University of Belgrade
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Ecological Truth

EcoIst '10

Edited by
Zoran S. Marković

Spa Junaković, Apatin
Serbia
01 - 04 June 2010

University of Belgrade – Technical faculty Bor

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SIGNIFICANCE OF THE ARBORETUM OF THE FACULTY OF FORESTRY IN BELGRADE IN PUBLIC PARTICIPATION IN ENVIRONMENTAL PROTECTION

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ABSTRACT

As a green area with a specific purpose, Arboretum Faculty of Forestry in Belgrade offers wide possibilities of education of the population to public involvement in improving environmental protection. Such activities allow the implementation of the basic provisions of the Aarhus Convention, and confirm the Multifunctional this important object. Research for this work, conducted in the period 2003-2009 year, are based on the implementation of numerous ecological and educational activities at the Arboretum. The paper defined global objectives in the aim public participation in the processes promotion and protection of the Arboretum: promotion of public awareness and public opinions on the issues of protection of local environment; defining of new human rights related to the environment; direct public participation in the creation of the local ecological action programs; assessment and categorization of ecological problems by the local public with regard to Arboretum; citizen's participation in the actions of enhancement of the local environment and creating the relationships of participants which can lead to new models of ecological actions.

Keywords: arboretum, environmental protection, Aarhus Convention

INTRODUCTION

During the period of intensive technological and informatic development of all aspects of the society and civilisation, when urban citizens spend very little time in the open space, each managed, maintained and tended anthropogenic ecosystem created in the difficult urban conditions, deserves special attention and care of the professionals, the leading city and state structures and the entire population [2,3]. The Arboretum of the Faculty of Forestry in Belgrade, as the valuable green space with a specific function within the system of the city green spaces [7], should get a wider multi-disciplinary character in the above processes of environmental protection and in the implementation of Conventions, agreements, contracts and regulations in these fields, as well as in the public participation [1,4].

MATERIAL AND METHOD

Arboretum, as a object of research in this paper, is a collection of tree and shrub species intended primarily to practical teaching, education and instruction of the Faculty of Forestry students, but also of other Departments and Faculties of Belgrade University. It was established in 1955 and today the Arboretum has 242 tree and shrub species and intra-specific taxa, and about eighty species of perennial herbaceous plants [6]. Research for this work, conducted in the period 2003-2009 year, are based on the implementation of numerous ecological and educational activities at the object of research. Method of work is a analytic-deductiv research of significance of the arboretum of the Faculty of Forestry in Belgrade, in the context of implementation of Aarhus Convention.

RESULTS AND DISCUSSION

In addition to its main functions, since its establishment the Arboretum (figure 1), together with Faculty's enclosure (*cca* 10 ha), also has a pronounced decorative-aesthetic function and the sanitation-hygienic significance as an urban green space. In interaction with the huge park area of the city forest Košutnjak[5], the Arboretum represents a very important green space in the centre of a large urban environment. Therefore, this archives of plants species, forms, varieties and cultivars has complex human and social aspects of utilisation of the designed open space.

Figure 1. Winter aspect of arboretum of Faculty of Forestry in Belgrade (2009)

In the framework of the implementation of Aarhus Convention (1998), the value and significance of the Arboretum of the Faculty of Forestry, University of Belgrade, indicate numerous concrete opportunities of promoting the basic principles of this Convention in the processes of public participation in environmental protection, and

spreading of information and raising public awareness of the value of this object at the local and wider city levels (figure 2). The UNECE Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters was adopted on 25th June 1998 in the Danish city of Aarhus [10] at the Fourth Ministerial Conference in the 'Environment for Europe' process. The fundamental question of the Aarhus Convention is to regulate the human rights to adequate environment and to live in the area that provides health and welfare and also requires that such environment preserves and promotes the interests the current and future generations. Convention this basic right build the right of citizens to access information, to participate in decision making and protection before the competent state bodies and above all the administrative bodies and the judiciary. So create a new human rights related to the environment and if it by itself not novelty. Exact, these are general human rights (the right to informed, the right to participate in decision-making, the right to judicial protection) which have long found a place in the most important international documents in the field of human rights. The novelty is that it is, on this occasion, link to the environment. The Arboretum potentially offers wide opportunities to the citizens of Belgrade city in the framework of the main decisions of Aarhus Conventions, such as human rights to the adequate environment and decision making regarding the environment, and, in this case, the participation in the procedure of legal protection of this valuable specific-purpose space, at the city level and wider [9].

The participation of the local public of the Municipality *Čukarica* and the Belgrade city will enable the realisation of a series of general-education and education functions related to environmental protection. As the special-purpose botanical garden, the Arboretum can enable the participation of school children (figure 3) and local citizens, students of other faculties of Belgrade University, in the free access to information related to the conservation of the local environment, public health, protection against many contaminants, etc. In this aim, various promotion actions can be organised (young Conservationists *'Gorani',* local ecological associations, etc.) on the reconstruction and maintenance of this space and its revitalisation, the introduction and planting of new plants which should enrich this collection of plant species, varieties, forms and cultivars.

The global objectives in the aim public participation in the processes protection of the Arboretum and implementation of global principle of Aarhus Convention are:

- Promotion of public awareness and public opinions on the issues of local environment, in the aim of raising the ecological awareness and ecological behaviour of citizens;
- Creation of new human rights related to the environment, and the models of public participation in the issues of environmental protection and highlighting the resulting advantages;
- direct public participation in the creation of the local ecological action programs which also include a special form of the Arboretum protection by the authorised institutions;
- assessment and categorization of ecological problems, aims and priorities related to Arboretum by the local public;

- citizen's participation in the actions of enhancement of the local environment;
- creating the relationships of participants which can lead to new models of ecological actions.

Figure 2. Opening of reconstruction of Arboretum and participation of scientific and professional public (2003)

Specific activities in the Arboretum need to organize in order to apply the provisions of the Aarhus Convention are:

1. organisation visits of elementary, secondary and technical schools and all the interested citizens of the Municipality *Čukarica* and other Belgrade Municipalities, education on the significance of Arboretum as the valuable resource within the system of green spaces in the Municipality *Čukarica* and the need to designate the Arboretum as protected nature;
2. increase the level of local public information on the value of the Arboretum – public debates, questionnaires, round tables, publications and brochures, leaflets with the accent on the protection of local environment and public participation in the procedures of the analysis of impacts on the environment and concrete strategic assessments;
3. submission of the Request to the authorised state organs to designate the Arboretum for protection;
4. organisation of multidisciplinary scientific work related to the implementation of the basic principles of Aarhus Convention;
5. organisation of cultural – artistic manifestations, performances, reviews and exhibitions of educational character;
6. participation in the tourist offer of Belgrade city.

Figure 3. 'What is the Arboretum?!'Visit to the youngest, Elementary school 'Đorđe Krstić' Belgrade (2005,2007) and Schools of agricultural Kovin (2008) (http:/www.sfb.rs//arboretum)

CONCLUSION

The Aarhus Convention is a new kind of environmental agreement. Applying the provisions of this Convention, a significant public participation in the decision-making related to the legal protection of natural and man-made botanical objects. Arboretum Faculty of Forestry in Belgrade, as well as future protected natural area, offers numerous opportunities implementation of the Aarhus Convention, particularly in the form of maintaining the ecological education of citizens and school youth and organizing visits, public forums, cultural events etc. In the above context, this important object, in addition to their basic educational-teaching, scientific-research, decorative-aesthetic and sanitogeno-hygienic functions, should take a special place within the system of urban greenery, as well as the tourist offer of the City.

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TOURISM AND REGIONAL DEVELOPMENT UNDER THE SIGN OF SUSTAINABILITY

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ABSTRACT

Romania concentrates at a continental scale "the natural and cultural interfaces of European size" of a large diversity, supported by a generous geographical frame: mountains, hills, fields, lakes, the Danube Delta, the Black Sea seaside etc. It is a well-known fact that the picturesque Romanian natural areas, completed by real cultural treasures - sometimes of universal interest - constitute as many motivations for tourism. Major changes in the models of economic growth take place at the same time, through directing the intensive types towards the fields of sustainable development, globalisation and integration. In this context, tourism is manifesting as a social component, with a significant participation in the general progress and, not least, as a promoter of globalisation and a factor of the sustainable development.

Keywords: tourism, sustainable development, sustainable tourist product, flow, motivation

INTRODUCTION

Very often there are situations - not isolated - in which some tourist products from countries with tradition in the field are "packaged" and presented much more consistent and sometimes even exaggerated compared to the real product value.

The majority of the Romanian providers do not lie even at a medium level from this point of view, thus the foreign visitors are still wondering that "such a beautiful country and with such a clean and generous nature is so little promoted for tourism". It is true that, objectively and subjectively, the providers and the salesmen of the Romanian tourist product are confronting with the lack of funds for promotion and advertising. Also this real is the fact that a part of them have great gaps in the chosen profession, much time without calling for tourism, which everybody knows (!). The complex of negative factors (the status of the infrastructure, the outdated mentalities, the poor professional training, the economic crisis etc.), to which we add a certain inertia and/or superficiality of some local public administrations which means and defines the local development of tourism, explain the difficulties through which this branch passes, so dependent on the general status of the national economy. That is why the existence of a national program of regional development of the sustainable tourism is of outmost importance, identifying for the beginning with the priority objectives of some less evolved areas.

Thus, in the conditions of a well directed regional development, I consider that the first thing to do is to carefully train the persons who are involved in the organisation of the local, county and regional development. There is not sufficient statistics from this point of view; it has to be completed with the exhaustive identification of the local resources. There are counties that have inventoried carefully for truth and value the entire natural and cultural endowment which they dispose of as tourist objectives, so that it is enough to revaluate the heritage of priorities for the promotion or promote again, in order to properly determine the necessary funds.

MATERIAL AND METHODS

It is known that from ignorance, indifference and lack of education, the important elements of the national, natural and cultural heritage are left drifting, with uncountable repercussions. In order to avoid this thing, I consider necessary to elaborate a regional development project of tourism, which consists of:

- the identification of all the tourist objectives;
- the evaluation or re-evaluation of the tourist objectives on the grounds of their real value;
- their categorising as an opportunity of economic support and protection;
- recommendations on the promotion or improvement of the current promotion;
- the appreciation of the economic influences from their properly organised revaluation through tourism;
- the number of persons working in tourism and their level of training.

The quality of the tourist product is influenced to the highest degree by the level of education and professional training of the personnel involved in tourism, which determines the quality of the direct services. From the contact with the providers and the careful analyses of the evolution of the quality of tourism services, it is revealed that the evolution is very slow, in general proportional with the privatisation [11]. Until the change of the aspects connected to heritage, in the sense that the scales incline towards the private property, we can count only on the regulation of real quality and on control actions, organised especially regionally.

The strategy of the regional development, especially for the regions that consist of real valuable tourist objective, must take into account the fact that the increase in tourist flow, of any origin, positively influences the regional economy:

- directly, through the total of the money cashed from the tourist consumption (housing, meals, fees, shopping);
- indirectly, through the contact and the local bilateral cultural influences, the knowledge of the local economic values and of the eventual business opportunity, the employment of the workforce in the services field, the creation of a favourable image, the civilisation of the infrastructure involved.

I needn't insist on the direct influence, because it is obvious that the local money cashed from tourism may represent an important income for the community and for the region. I present only the fact that the tourist are the best customers for the shops network, the fairs with different profiles, the exhibitions etc., fact that, besides the direct cashing, encourages the development of the organised trade, the increase of the number of shops and their quality. It is said that the best and most profitable advertisement for

tourism is the one made by the tourist after his/her return home. The effects of such an advertisement are pretty fast from a tourist point of view and very important regarding the image that it is created for a locality or/and an area.

The prosperity of a region as an effect of the tourism development is manifested in more stages:

- immediately, as a consequence of the direct consumption of the tourist product;
- on a short term, through the continuous absorption of workforce and the encouragement of the aggressive trading;
- on a long term, through the focus on capital for investments in the general infrastructure and in the tourism's one, in accommodation structures for tourism and in the development of urban services.

The regional development must correlated and must integrate tourism, necessarily, through the other components of the local economy, taking into account the fact that this clean industry does not affect the environment and, in general, does not involve large investments. A good project of tourism development, comprised by the "regional development program", means less costly investments in this activity the more harmoniously the integration is performed.

At last, I think that we must mention the influence - not at all negligible - that tourism has on the increase of the quality of life of the areas where it enjoys the attention of the public administration and it is treated with the proper professionalism [12].

Through its size and complex content, tourism engages a vast natural, material and human potential having profound implications on the dynamic of the economy and society, on the international relationships.

The sustainable tourism represents a distinct field of activity, a very important component of the economic and social life for a larger number of countries of the world. From an economic point of view, tourism constitutes as a main source of revival of the national economies of those countries which dispose of important tourist resources and exploit them properly. Its action is manifesting on a multitude of levels, from the stimulation of the economic development to the perfection of the social structure, from the superior revaluation of the resources to the improvement of the life conditions and last, but not least, as an important generator of work places. The unfolding of tourism means a specific request of goods and services, request that engages an increase in their production sphere.

The tourist demand determines an adaptation of the offer which materialises, among others, in the development of the material and technical basis of this sector, and indirectly, in the stimulation of the production of the branches involved: the construction and the equipment of the accommodation and catering spaces, the modernisation of the road network, means of transport, leisure installations etc. In this context, the main argument which determines the necessity of the tourism development results from the following aspects:

1. The tourist resources being practically inexhaustible, tourism represents one of the economic sectors with real perspectives of long term development;
2. The exploitation and the complex revaluation of the tourist resources accompanied by an efficient promotion on the external market, can constitute a source of income
3. Tourism represents a safe market of the work force and of the redistribution of the unemployed work force from other structured economic sectors.

4. Tourism, through its multiplication effect, acts as an dynamic element of the global economic system, generating a specific demand of goods and services which engage an increase in the production sphere, contributing thus to the diversification of the national economy sector structure.

a) The transport infrastructure:

- the rehabilitation and the modernisation of the national road infrastructure which could ease the traffic and the access to the areas of tourist interest;
- the relaunching and the development of the airports and of the harbours, the development of the combined transport systems;
- development programs of the naval fleet, with implications in the diversification of the tourist services offer and the revaluation of some elements of the tourist potential of the country into a reduced stage or even a non-existent stage of revaluation (the internal flow of the Danube, the cruise tourism, the Delta, tourist programs for the Black Sea etc.)

b) Telecommunications - the changes at the level of the digital economy are essential for the companies to became and maintain competitive.

The tourism and the trips, seen as an intensely technological industry, can help Romania obtain and apply the technological systems of information and telecommunication at a competitive level. A larger part of the operations in tourism and travels - as well as all the virtual operations of sales and distributions - communicate through the telecommunication systems. The development of the electronic businesses within the current network of information society offers multiple opportunities of elevation of the level of existing workplaces occupation, stimulates the economic development and the investments based on innovation, in the interest of the companies. E-business in tourism means only the promotion of the business on the internet and the on-line booking. By combining the traditional tourism activities with the modern approaches for e-business, the market share and the competitiveness can be increased, the costs can be reduced and the company's profit can be increased.

RESULTS

On a competitive global [13] and more and more developed market nowadays, there is a great need for a powerful national branding of tourism management which could optimize the resources, could concentrate within a nucleus the interests - the public and private sector, the national, local and regional sector - and capture the tourists' attention. This will need a certain type of interest for a coordinated approach on marketing and distribution through the internet in order to optimize the vision on Romania. The recommendation of the World Tourism and Travel Council (WTTC) is that the Romanian Government follows the policy of an open market of telecommunications, which will generate low costs and services of better quality for tourist and tourism companies. Its main task is to commercialise the region or the country as a tourist destination and to improve the image globally [14].

The harmonious development of tourism on the entire territory contributes to economic and social growth and to the mitigation of the unbalances occurred between various areas, constituting a very important source for increasing the incomes of the population. The policy of regional development aims mainly at: the reduction of the

existing regional unbalances, with the focus on the stimulation of a balanced development and on the revival of the unfavoured areas (with a slow development); meeting the production of new unbalances; fulfilling the criteria of integration into the structures of the European Union and of access to the financial instruments of assistance for the member countries. Thus the European Commission declared its availability to finance the development of tourism, between 2007 - 2013, through the structural funds (the European regional fund for development, the cohesion fund, the social fund, the European fund for agriculture and rural development, the European fund for fishing). For the period 2007 - 2013 Romania will benefit from a financial allowance of approx. 30 billions. The structural funds include the European Fund for Regional Development, the Cohesion Fund and the Social Fund. From the European Fund for Regional Development, tourism will benefit from a financial allowance for two operational programs: The Sectoral Operational Program Competitiveness and the Regional Program - Regional Development. Within the Sectoral Operational Program Competitiveness, the funds are destined to the promotion nationally, to the completion of a national network of tourist information centres and promotion of specific tourist products.

Within the Regional Operational Program - Regional Development, the funds are dedicated to the development of tourism regionally and locally through projects of the local public authority and projects of the private sector for the increase of the quality of the services and the development of the tourist entertainment.

There clearly results that:

- ✓ Tourism represents a mean of development of the rural areas, through the extension of the specific offer area and the creation of work places in the rural environment, other than the traditional ones, improving the life conditions and increasing the local population's incomes [15];
- ✓ The diversification of the local industry through the support for the constitution of SMEs;
- ✓ The development of the non-polluting industries connected to tourism and of consumption goods (craftsmanship, furniture, leather etc.);
- ✓ In the conditions of compliance with and promotion of the sustainable development, tourism constitutes a mean of protection, preservation and revaluation of the cultural, historic, folk and architectural potential of countries:
- ✓ Through the adoption of a strategy of tourist sustainable development and through imposing some measures of protection of the environment, of the fundamental values of the human existence (water, air, flora, fauna, eco-systems etc.), tourism has at the same time an ecologic vocation;
- ✓ On a social level, tourism manifests as an active mean of educating and elevating the level of training and civilisation of the people, having a special role in using the free time of the population, more specifically: Education and research
- ✓ The absence of the modern and competitive mechanisms of creation of the production factors is often one of the most determinant weaknesses of a destination. As a consequence, the start-up of the mechanisms for the creation of factors - education and research, investment programs in these fields - is the most important instrument in obtaining the sustainable competitive advantages. The use and the new revaluation of the abundant human capital can be a strategy for the passing from the prices competition to the quality competition.

- ✓ The promotion of the exports, conditioned by the strengthening of the Romanian industry capacity to export on the international markets.

In the field of tourism and of the Regional Development Policy aimed by the Romanian Government for the period 2007-2013 having as objectives:

- ➢ The reduction of the existing regional unbalances through the stimulation of the increase of competitiveness and through the revival of the unfavoured areas.
- ➢ The balanced regional development through the correlation of the national public policies of sectoral development with the public policies of local development: infrastructure and transportation, the increase of the work force employment, the rural development, education and health, environment and sustainable tourism [16].

CONCLUSIONS

Tourism has assumed a vital role in the development of destinations around the world. In most cases, culture is a major asset for tourism development as well as one of the major beneficiaries of this development. Sustainability is a major factor in the attractiveness of most destinations, not only in terms of tourism, but also in attracting residents and inward investment. In this section of the book, the growing relationship between tourism and culture, and the way in which they have together become major drivers of regional attractiveness and competitiveness, will be examine. During most of the 20th century, tourism and culture were viewed as largely separate aspects of destinations. Cultural resources were seen as part of the cultural heritage of destinations, largely related to the education of the local population and the underpinning of local or national cultural identities. Tourism, on the other hand, was largely viewed as a leisure-related activity separate from everyday life and the culture of the local population. This gradually changed towards the end of the century, as the role of cultural assets in attracting tourists and distinguishing detestations from one another become more obvious. The increasing use of culture and creativity to market destinations is also adding to the pressure of differentiating regional identities and images, and a growing range of cultural elements are being employed to brand and market regions. Partnership is essential. New policies are likely to feature new structures and projects involving public-private partnership and bringing together a wider range of stakeholders to use culture not only to make destinations attractive for visitors, but also to promote regions as destinations to live, work and invest in.

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LACK OF WASTE TREATMENTS IN PRINTING INDUSTRY IN SERBIA

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ABSTRACT

There are several environmental problems regarding printing and paper industry in Serbia but one of the main are insufficiency of waste water and solid waste treatments. Poor practiced legislation and almost free costs of landfill, does not force the paper and printing industry to place more emphasis on waste management. Given adequate investments and refreshed legislation the paper and printing industry in Serbia can gain adequate environmental status.

Keywords: paper industry, printing, waste management, wastewaters, solid waste

INTRODUCTION

The pulp and paper industry is a significant contributor of pollutant discharges to the environment and certainly a major consumer of natural resources (wood, water) and energy (fossil fuels, electricity). Urged by environmental and legislative pressure, together with advancing techniques and commitment from industry leaders, the pulp and paper industry has reduced its environmental impacts to water, land and air over recent decades by 80±90% in the world [1].

An idealistic approach is to treat the wastewater to such an extent that it can be reused within the mill. Indeed, the concept of "zero liquid effluent" has been suggested for mills making certain grades of paper. However, the recovery and reuse of water can increase the concentration of organic and inorganic species, which in turn can affect paper formation, increase bacterial loading or lead to corrosion and odours [2].

Paper and board mills raw wastewater can be, potentially, very polluting. The polluted water needs to be suitably treated before discharging, into river or running waters. Some survey within the industry has shown that chemical oxygen demand (COD) values can be as high as 11,000 mg/l [1]. Thus, wastewater from the industry needs to be treated to reduce any possible impacts on the aquatic environment. Effluents

from paper mills may contain many toxic substances such as chlorine, ammonia, heavy metal salts, acids, alkalies, etc. It is estimated that paper mill waste contains between 250 and 300 chemicals, including dissolved organics, methanol, terpenes, acetone, fatty acids, cellulose decomposition products, lignins and tannins, sulphides, mercaptans, resin-acids, soaps, chlorine, and caustic soda, among others [3]. It is obvious that the paper industry could be a major source of toxic chemical pollution. Many toxic chemicals are used in papermaking, especially toxic solvents and chlorine compounds used to bleach and delignify pulp. Additional toxins are used as biocides to prevent bacterial growth in the pulp and finished paper products [4, 5].

The aim of this paper is to point at the insufficiency of waste treatments as a basic environmental problems in paper and printing industry in Serbia, as well as to try to suggest the most economical solution, which will improve ecological status disturbed by poor respect of this branch of industry towards environmental protection safety.

DISCUSSIONS

Paper making generally produces a large amount of solid waste. Different processes in the paper industry result in the formation of different solid wastes and sludge. Solid waste is mainly generated from pulping, drinking unit operations and wastewater treatment. The amount and the composition of the solid waste depend on the paper grade produced, the raw materials used, the process techniques applied and the paper properties to be achieved. In terms of volume, most solids or liquids are those from the treatment of effluents, although waste from wood is also produced in large quantities. In general, solid wastes from pulp production and paper mill operations are humid, contain some organic compounds in the form of wood or recycled paper fibers, chlorinated organic compounds and pathogens, significant amounts of ash, and trace quantities of heavy metals [6].

The wastes can be reused and valorized in a safe and environmental way, so landfill is strongly being reduced as their final destination. In some countries such as Germany, Spain and The Netherlands, certain waste streams cannot be disposed at landfill sites. In addition, current legislation and increased taxes have resulted in research on non-conventional methods for the management or new uses of pulp and paper industry solid wastes. However, the difficult physical form of these wastes poses problems in waste handling and disposal, with the biosludge formed during biological effluent treatment being particularly problematic. These sludges have a low dry solid content requiring conditioning before they can be properly handled. Such sludges are usually thickened, and then burned in a bark-fired boiler together with bark from wood handling, or used for land filling. The problems associated with the land filling of sludges and other wastes are the large volumes involved and the possibility of hazardous substances leaking into the environment [6].

The share of residues disposed of in landfills has constantly decreased in Europe in recent years, in favour of the use as secondary raw material in other industries and other applications (e.g., soil improvers, in road construction, land reconstruction applications and for co-combustion in heat or power generating plants) and this could not be said for Serbia, since there is still a tendency of the landfill disposal of paper mill

sludge, but over the time it would be more difficult to implement land filling because of rapidly shrinking landfill space and leachate related issues. Paper is a biodegradable material. This means that when it goes to landfill, as it rots, it produces methane, which is a potent greenhouse gas (20 times more potent than carbon dioxide).

Incineration, which is second to landfill in popularity, suffers from its own drawbacks. Rising supplemental fuel costs, high capital costs and air pollution concerns have historically limited the use of this method. Public opposition to this disposition method has not limited the widespread use of this method as well. Due to the large quantities of waste generated, the high moisture content of the waste and the changing composition, some recovery methods, for example, conversion to fuel components, are simply too expensive and their environmental impact uncertain. The thermal processes, gasification and pyrolysis, seem to be interesting emerging options, although it is still necessary to improve the technologies for sludge application. Other applications, such as the hydrolysis to obtain ethanol, have several advantages (use of wet sludge and applicable technology to sludges) but these are not well developed for pulp and paper sludges. Therefore, at this moment, the minimization of waste generation still has the highest priority.

Several EU Member States have already implemented waste legislation and imposed higher taxes to restrict land filling and encourage the development of more sustainable waste management practices. Serbia does not have such an implemented policy. Measures for sludge waste reduction that should be realized in Serbia would contain: a new use of solid waste with maximum recycling of materials, separation on its resource, and if needed temporary warehousing and then recycling, reduction of fiber and filler deprivation in a production process, recycling of waste waters from process of paper priming, previous sludge treatment before its processement and disposal, its further use (soil and sediments remediation) or energy production.

In Serbia, there is also a deficiency in adequate treatments of wastewaters both in paper and cardboard industry as well as in small printing facilities. The share of industrial wastewaters is in constant increase in city's wastewaters, where the paper and printing industry is situated. Luckily, with economical development that is relatively visible from 2000 small companies are investing more in modern ecologically compatible technologies.

Raw waste waters from printing facilities are directly emitted in the municipal sewerage, without adequate treatments, threatening to endanger water quality due to possible increase concentrations of some metals and organic pollutants [7,8]. Praxis in Serbia is that every county regulates by its regulation for MPL (maximum permitted level) of dangerous substances. On territory of city districts, practically none of the printing facilites have adequate treatment for wastewaters. Sampling, as obligatory action, is done once a year, but penalties are so small that they can not improve awareness of printing houses leaders, nor demand waste waters treatment. But, as previously mentioned, with joining EU this will have to be changed.

Situation in factories is a little bit better but still far from developed countries and EU standards. From pulp and paper factories that are active in this moment, only 40% use water refinement, but only primary refinement [9]. Content of suspended particles is between 40 and 700 mg/dm^3, while in factories which produce packaging

paper and cardboard from 100% of old paper and content of suspended materials in wastewaters is from 1500 do 2000 mg/dm^3.

Primary treatment residue is mainly composed of fibers, fines and fillers lost because of incomplete solid/liquid separations at various stages of pulp and paper production. The lost materials, which vary from 3% to 4% for pulp mills to 15–30% for the waste paper mills, is captured through gravity settling in the primary clarifier and is referred to as primary sludge. The primary sludge generation rate mainly depends upon efficiency of the fiber recovery system installed at a mill. A very small percentage (5%) of paper mills in Serbia are currently optimizing their fiber recovery systems, which will increase their raw material yields and will reduce operating costs, and primary sludge production [9].

Recommended wastewater reduction methods include the recycling of wastewater with simultaneous recovery of fibers [10]. The most common technique for reclaiming fiber is to recycle primary sludge back into the fiber-processing system of the mill. Some recycled paperboard mills and some manufacturers of unbleached and bleached pulp and paper have reduced sludge volume by reclaiming the fiber, fillers, or both in sludge to be reused within their pulp and papermaking processes [11]. Effluents from paper machines bleach plants, and various cleaning and screening operations are targets for fiber reclamation. Other wastewaters such as those from wood handling or chemical recovery systems usually contain non-fibrous contaminants, which can become problematic in fiber-recovery systems unless cleaning systems are used. Bark, lime solids, dregs, grits, and dirt are some examples of contaminants, which should be avoided whenever possible.

Because the presence of sludge can decrease the quality of the final product, the reuse of sludge in pulp and papermaking processes is not always possible in the same company where it is generated, and consequently a management alternative is required. The most widely researched non-conventional management alternative has been the reuse of primary sludge as feedstock in the manufacture of hardboard, fiberboard [12], building materials such as cement [13], bricks [14], ceramics, concrete, and landfill cover material [15]. These management alternatives upgrade the high fiber content of some primary sludge's (e.g., in fiberboard), the high filler content of others (e.g., in building materials) or both (e.g., in landfill cover materials). Several methods to recover fiber and fillers from effluent streams and primary sludge have been patented and implemented (Thermo Fibergen Inc., Bedford, Massachusetts), making possible the reuse of particular sludge components instead of the sludge as a whole. The equipment used to separate fiber or fillers from sludge may be as conventional as screens and cleaners or may involve more elaborate methods such as wet-air oxidation. The selection of the most appropriate management alternative will depend on the availability of potential users of sludge near the pulp and paper mills, which in turn will determine the cost of the different options. An increase in the number of management alternatives will improve the feasibility of reusing sludge in a more sustainable manner.

The use of paper mill sludge's could be a good practice for soil and sediment remediation. Metal pollution of soils and sediments is a great environmental problem and can derive from different sources such as industrial waste disposal, river and harbor dredging, metal mining wastes, agriculture and atmospheric fallout. To remediate metal-

contaminated soils a lot of techniques were developed, some of which consist of treatments such as soil washing, acid cleaning, aching or soil replacement and electro kinetic techniques [16]. These can only be practiced ex situ, and are expensive and with a large negative ecological impact on the soil ecosystem. Other remediation techniques, defined ''mild'', consist of addition to soils of materials able to reduce the risk of the contaminants to enter the groundwater, surface water, etc. by immobilizing the mobile metal forms (adsorption) [16]. The paper mill sludge's could be effective because of their organic matter, silicate and carbonate content. The organic matter is able to form stable complexes with several metals; the silicates are materials of high caution exchange capacity (CEC) and the bicarbonate/carbonate system is able to increase the pH value of soil. These chemical features were able to reduce the harmful mobile metals in polluted soils when the paper mill sludge was added to them [17]. On the other hand, paper mill sludge is generated by various processes in the production of pulp and in the manufacture of paper, and increasing quantities produced make the disposal of this sludge a problem for the pulp and paper industry. Consequently, its utilization to ''remediate'' a contaminated soil could be an interesting proposal, taking into account that the paper mill sludge's do not have any toxic effect on the environment.

CONCLUSION

Every factory in Serbia, due to European integration and joining an EU will have to respect regulations and standards, which are assigned by EU. Government, competent ministries, labor and civil environment have to strongly include and professionally and financially help implementation of regulations about environmental protection. The first phase would certainly be the adequate implementation of waste treatments in factories.

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MEMBRANE FILTRATION TECHNOLOGY FOR MUNICIPAL WASTE WATER RECOVERY AND REUSE

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ABSTRACT

The classic method of communal wastewater treatment, is increasingly unable to meet the strict new condition of water and health laws making costly revisions necessary. Also, an increasing shortage on high quality drinking water is expected in the forthcoming century, what leads to intensive research on new quality acceptable water sources. One way of providing these resources is the use of membrane systems in the field of communal wastewater treatment. The wastewater treatment costs, makes both processes (conventional and membrane system) competitive, but long term advantages including universal applicability, guaranteed effluent purity, reduced excess sludge, modular expansion and presumably longer membrane lifetimes make membrane technology clearly profitable and adaptable to future socio-economic and ecological needs.

Keywords: Membrane Filtration, Municipal Waste Water, Water Reuse

INTRODUCTION

As only a one percent of water present on our planet is available for use, it is clear that the skill of managing this irreplaceable resource dictates the dynamics of development and causes the survival of civilization. Due to the pollution of natural water sources and almost daily reducing of the available amount of properly hygienic drinking water, thinking about getting drinking water treatment of waste water is flitting from the field of science fiction and absurd into the sphere of necessary and ethically acceptable. In cases of releasing purified water in sensitive areas (eg, protected waterways and national parks), in lakes or recipient with insufficient receiving capacity, there is no psychological barrier in which the nutrition source of ground water, or even the return of such water to water supply system arising at the average user of services of public utility companies for water supply.

Application membrane filtration process for wastewater treatment provide a better quality of water released into the natural waterways, than statutory. Although the membrane produced from nitrocellulose emerged early 20th century, only in the last

forty years are the full application in waters purification technology. Initially expensive, slow, unreliable and insufficiently selective, considered as technologically and economically uninteresting. Producing the first reliable, very thin membranes for reverse osmosis (Loeb and Sourirajan) that could make a big flow of water per unit area, all the advantages of membrane processes come into play. The high quality of treated water, ease the process, the ability of processing different types of water, reducing use of chemicals, reduction of plant size are just some of the technological features of standard membrane filtration [1].

PRINCIPLE AND CLASSIFICATION OF FILTRATION PROCESS

The membrane is a thin semipermeable film, selective barrier for the transfer of suspended and dissolved particles, which allows separation of matter from the liquid phase. Selective leakage through membrane depends on the physical - chemical, or electrical - chemical (electrodialysis) interaction between the membrane and dissolved substances, ie. of differences in size, shape, or chemical structure of particles and pore sizes. It is required entering energy into membrane filtration process, which is spent on the separation of particles whose in the mixture have less free enthalpy to carry over them into a state of more enthalpy. Driving force is, generally, the pressure difference between the two sides of the media with the membrane (called transmembrane pressure), but it can be the difference of electrical potential difference in temperature or concentration differences. Minimum energy required for separating mixtures must be larger than the free enthalpy of mixing. In practice, of course, require multiple higher energy. The most commonly used membrane processes classifying by the size of membrane pores. At the Table 1 are given pore size and transmembrane pressure for different processes [2].

Table 1. Pore size, transmembrane pressure and permeate flux

Process	Pore size (nm)	Pressure ($\cdot 10^5$ Pa)	Flux ($dm^3\ m^{-2}\ h^{-1}$)
Microfiltration	100	0.1-2	>50
Ultrafiltration	5-20	1-5	10-50
Nanofiltration	1-5	5-20	1.4-22
Reverse osmosis	<1	10-100	0.05-1.4

In Figure 1 are presented a kind of particle that can be separate with the different membrane processes, depending on the size of pores. There is no accurate boundaries between processes. Reverse osmosis and nanofiltration removes ions and salts dissolved in water, and in these processes need to overcome the osmotic pressure and the ions created in the membranes of different concentrations of the contact solution [3, 4].

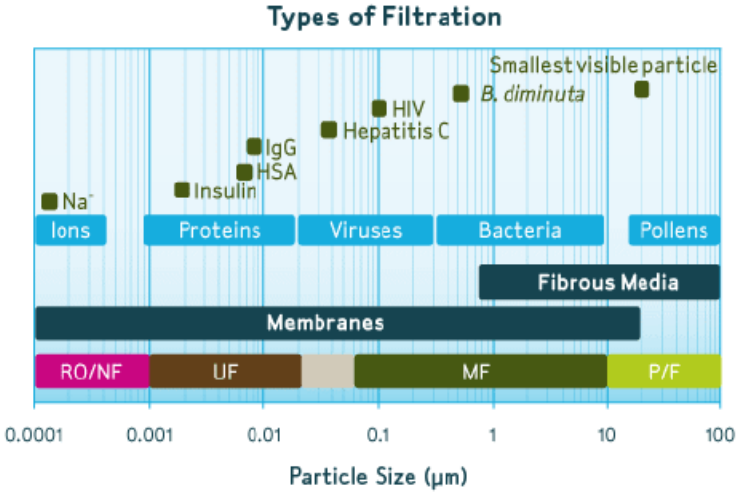


Figure 1. Particle types leeches by membrane filtration processes

In Table 2 are given, according to the type of membrane process, the possibility of separation and field of applications.

Table 2. Separation capability and membrane processes appliance

	Conventional Process	**Membrane Process**				
	Sand Filtration	MF	UF	NF	RO	ED
Gradient	Pressure					Electric Potential
Transport of the main species	Water					Ions
Removal of the smallest species	Suspended Matter	Colloids Bacteria	Large Organic Molecules, Viruses	Small Organic Molecules, Divalent Ions	All Dissolved Species	
Operating Pressure (bar)	0.1 to 2	0.2 to 2	1 to 5	5 to 20	20 to 80	1 to 3
Typical Flux (l/m 2/h)	2,000 to 10,000	100 to 1,000	50 to 200	20 to 50	10 to 50	
Water Treatment Applications	Clarification	Clarification	Clarification	Water softening,colour, natural organic matter, micro-pollutant removal	Desalination of seawater and brackish water	Desalination of brackish water, ion removal (NO_3)

TYPES OF MEMBRANES AND MEMBRANE MODULES

The material from which the products membranes are divided into: polymer (organic) and inorganic. Polymers, besides a large separation factor towards filtered matter, must be mechanically and chemically resistant, per the solvent and cleaning agents membranes. Most commonly, the inorganic material for making membranes used ceramics, glass and metal. At the same time, high temperatures resistance membranes are very resistant to chemical destruction, their lifetime is much longer, but are considerably more expensive.

In the Table 3 is given possible aplication of some construction materials.

Table 3. Construction material and polymer membrane possible application

Polymer	process
Polycarbonate	MF
Poly(vinylidene fluoride)	MF, UF
Polypropilen	MF
Polyamid	MF, UF, NF, RO
cellulose esters	MF, UF, NF, RO
Polysulphone	MF, UF, RO
polytetrafluoroethylene	MF
polyacrilonitril	UF

Membrane are packing in membrane modules, the basic membrane units which are consists of membrane cloth, constructive element (carrier membrane), connections to access the raw water inlet, outlet of concentrate and purified water (permeate).
There are several types of membrane elements (modules).

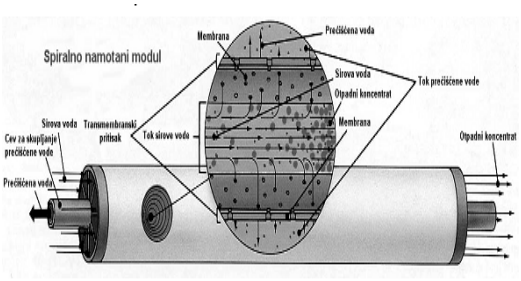
Plate - and - frame modules were one of the earliest types of membane system which provide good flow control on the permeate and feed side of the membrane, but side by side with high module costs.

Tubular modules are now mostly applied to ultrafiltration. The tubes consist of a porous paper or fiberglass support with the membrane formed on the inside of the tubes [5, 6].

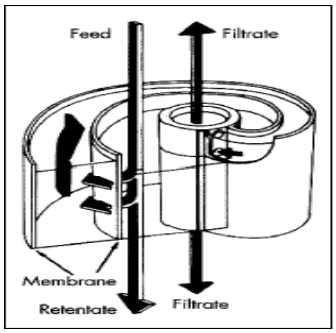
Spiral – wound modules built of a membrane envelope of spacer and membrane wound around a perforated central collection tube. The modul is placed inside a tubular pressure vessel.

One of the design is the **hollow fine fiber configuration**. Outstanding features of this cocncept is the extremely high membrane area that can be installed in a relatively small space.

In Figure 2 are illustrated a variety of membrane modules [7, 8, 9].



Spiral wound module



Spiral wound membrane module

Tubular membrane module

Tubular module

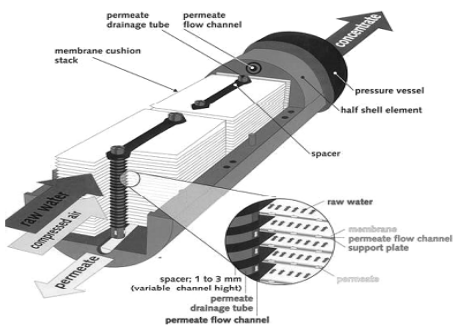


Plate and frame module

Hollow fibre module

Figure 2. Membrane module type

RECYCLING WASTE WATER UTILITY

The classic method of municipal waste water treatment, limited to the removal of solid phase by sedimentation and removal dissolved substances by microorganisms. Classic treatment are followed by many problems: increasing amount of waste water, multiplies the cost of reconstruction with insufficient impact on improving the process. The facilities for waste water processing techniques applied to microfiltration, ultrafiltration, nanofiltration and reverse osmosis. The various modules and different materials offer optimal treatment of different waste water composition, as defined by the quality of future intended use of recycled water.

Membrane bioreactor technology is a combination of conventional biological wastewater treatment and membrane filtration units. Often the membrane device is inserted in the existing space for nutrification bioreactor, thus, no significant investment cost effectively achieved refinement with a low cleaning and maintenance costs. Placing units for microfiltration made of polyethylene hollow fiber was a method for reconstruction plant for waste water in Thessaloniki. In conventional water treatment, after processing of purify water can go to subsequent treatment. In Figure 3 shows the flow chart of the process in a pilot plant in Weiz Austria, where the combined biological treatment (denitrification / nitrification) with microfiltration through a membrane with hollow fibers.

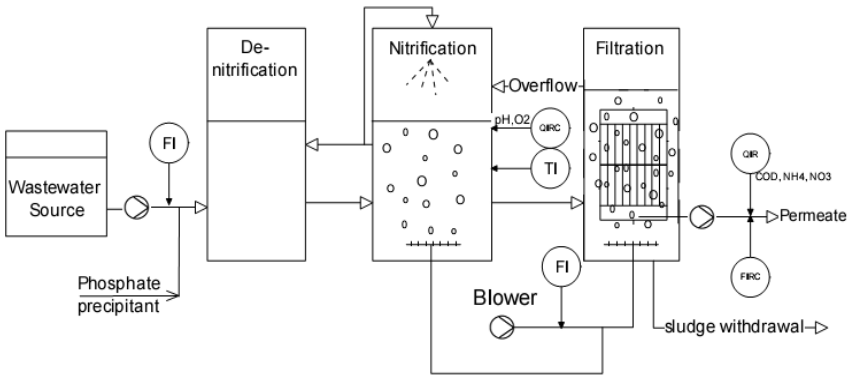


Figure 3. Process flow diagram of the pilot plant (PP), Weiz, Austria

The results obtained in several pilot plant show that the output concentration expressed as COD (indirectly measurement of the amount of organic compounds in water) and NH_4-N always below the sensitivity of photometric method, and the removal of nitrogen compounds on the basis of nearly complete. Purified water quality meets the European regulations (Regulations on water bath). In Figure 4 given comparison level of degradation of certain harmful substances in a plant in Weiz Austria, in the pilot plant and statutory value.

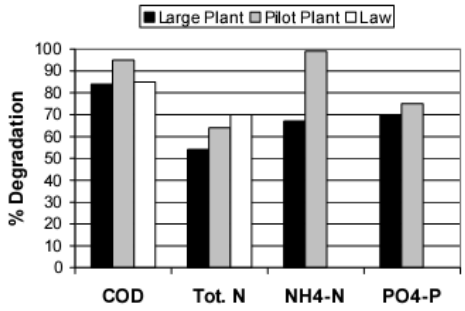


Figure 4. Comparison of degradation in both plants

Only in relation to the total amount of nitrogen removal pilot plant does not meet the law ordered values. Selectivity of membrane filtration, ensuring that pathogenic microorganisms (eg bacteria, yeasts mold, etc..) can not pass into the recipient, which significantly improves the hygienic and epidemiological picture recipient. That is why this type of device particularly suitable for karst areas and for areas of high sensitivity (mountain water, protected watercourses), and can serve as a first stage of processing in obtaining drinking water. The next filtration unit acts as another barrier to pathogenic organisms. It is often used nano-level filtration membrane modules made of Polyamide. During the sixty days experimental work of pilot plant proved a constant excellent quality permeata. The values of chemical and microbiological parameters of pure water thus produced meet EU legislation [10, 11, 12].

ECONOMIC SUSTAINABILITY

Investments in the (membrane bireactor) MBR plants are almost equal investment in facilities for waste water treatment (WWTP - waste water treatment plants), with primary (mechanical) and secondary (biological with the removal of nitrogen). Operating MBR costs are 0.2 € / m^3 higher than in WWPT. However, as a result of treatment permeat, which corresponds to the quality of drinking water (the price in the region 1 € / m^3), and we consider that the price of recycled water, 50% of drinking, it is clear that the profit that brings MBR solution is 0.30 € / m^3 for facility that meets the needs of 10 000 ES.

CONCLUSION

The advantages of membrane processes are very low consumption of chemicals, the possibility of processing large amounts of water and excellent permeate quality. Disadvantages are the necessary preprocessing, which would eliminate the rough and colloidal dispersed particles and a part of dissolved matter in order to prevent the creation of layers of membrane.

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ECOLOGICAL EDUCATION AS A PRECONDITION FOR SURVIVAL OF THE OLM IN TREBISNJICA RIVER VALLEY

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ABSTRACT

The object of this paper is to present the list of measures taken for the protection of the olm in Trebinje area. The project was started by the Speleological Society "Zelena Brda" Trebinje in cooperation with "Devon Karst Research Society" Plymouth, Devon, UK. Besides the identification and protection of the habitat locations of the olm and chemical examination of underground waters, one of the aims of this project was ecological education of local population in order to promote the importance of protecting nature, underground waters, and, therefore, the olm. A strong ecological awareness is a prerequisite for survival of the olm in this area. Local community must be more determined and engaged in strengthening the environmental awareness, and therefore to ensure the olm species preservation.

Keywords: the olm , ecological awareness, endemic species preservation

INTRODUCTION

Trebinje is situated on a karst terrain in the flow of Trebisnjica, the biggest sinking river in Europe. Characteristic feature of its flow is that it disappears more than once and reappears each time under a different name. The underground flow of Trebisnjica consists of a complex system of canals and basins that has a spread of almost whole East Herzegovina area. The underground canals and basins are a natural habitatfor a few endemic species. Best known endemic species of this area are the olm (*anguinus proteus*) and the Gaovica fish. "Zoological Society of London" placed the olm on a list of 10 most endangered species. Besides Trebinje its habitats have been found on the karst terrain of Slovenia, Croatia, Italy and France.

Up to the present day the researchers have identified a number of habitats of the olm. On most occasions it has appeared in the estavellas and sinking holes on the edge of Popovo Polje near Trebinje. Most recent research was carried out 40 years ago when the hydro-electrical power station Trebinje had been built and the river bed had been concreted from Trebinje to Popovo Polje where the river sinks in. The consequences of previously mentioned hydro-electrical system building are that the subterranean flowlines and flowpaths remained permanently altered, the flooding of Popovo Polje was prevented, and most of the estavellas and sinking holes remained permanently

deprived of their water input. A great number of identified habitats of the olm were devastated due to a town expanding process, and do not exist today.

METHODS AND RESULTS

Speleological society "Zelena brda" Trebinje in cooperation with "Devon Karst Research Society" from Plymouth, Devon, UK, started a project in order to research and preserve the natural habitat of the olm – "A joint strategy for the protection of the endangered underground endem Proteus anguinus and its natural karst habitat in the Trebisnjica river valley". The aim of the first phase of the project was to determine the current state of all previously identified habitats of the olm. This phase lasted for three, 2002 to 2005. All registered habitats underwent a trough speleological, hydrological, hydro-physico-chemical and biological assessment. When these assessments were done researchers located habitats with conditions necessary for the survival of the olm. These locations were subjected to further monitoring. The data were gathered periodically in different time-intervals and climate conditions (e.g. when the water level is high or when the water level is low, in the summer period when there is no rainfall). For processing the data and the field work they used GPS technology with a program for drawing topographical maps of speleological objects "Speleoliti" and a computer database. During the analysis the integration of the gathered data was performed using the GPS software for processing the results of topographical measurement of speleological objects and computer database of habitat condition. That is how a Geographical Information System- GIS was formed. Using the GIS they were able to compare the results from different places and come with the appropriate conclusion.

In three years of project realization the following was achieved:

- 64 chemical analyses of water on 34 localities were done and most of the habitats of the olm in Trebinje were identified
- The localities near the town are significantly devastated due to the city zone expansion and poor sewerage systems in suburban areas
- No heavy metals were found in underground waters
- Underground waters near human settlements are polluted with waste waters from the households
- Although the underground hydrology has been violated the olm is spotted on the most of the former localities
- The existence of the olm in the waters polluted by the household waste waters confirms the animal's ability to adapt to this kind of pollution

These results have shown that there is still a great number of olm habitats in Trebinje area. Those habitats are endangered by the underground water pollution which is the consequence of unorganized urbanization and lack of communal infrastructure.
During the data analysis and the field work the GPS technology with database made a great contribution.

The international project includes the restoration of confirmed habitats of the olm and other subterranean fauna, and a plan of preservation and conservation of proteus habitats, that will be carried out in phases.

A phase approach to the habitat restoration includes:

- Preliminary removal of vegetation that harms the structure of the objects
- Preliminary removal of waste material from the localities
- Conditioning and stabilization of the artificial building infrastructure and necessary reconstructions, to ensure the long-term safe structural condition
- The initial restoration of chemical and biological purity of water

DISCUSSION

Besides the identification and protection of habitats of the olm, it is also necessary to provide local population with ecological education. It is necessary to develop ecological awareness and conscience of the people since that is the basic precondition to the protection and conservation of nature, especially the rare and endangered species of plants and animals.

Ecological education includes new knowledge and action, which means that, while revealing that nature is damaged and endangered, it offers a strategy of different attitude towards environment in order to improve current situation.

Ecological awareness of contemporary man is not sufficiently developed. Anybody who has an insight into the ecological situation in the world will come to this conclusion. The important factors in forming the ecological awareness are: science, education and breeding, practical work on solving the negative ecological situations, etc.

We think that ecological knowledge acquiring is just one part of ecological awareness. For complete development of ecological awareness it is necessary to form a positive emotional attitude towards nature and its manifestations.

An important factor of people's attitude towards environment is the knowledge about that phenomenon, learning the basic ecological terms, ecological orientation, emotional and voluntary attitude towards that sphere and behaving in accordance with ecological values. It is necessary to establish the cooperation with schools, in order to familiarize students with this endangered endemic species. In order to reach ecological conscience, which is the final goal of ecological breeding and education, a person needs to have both ecological awareness and ecological culture, because awareness expresses the level of ecological education in its quantitative aspect, and the ecological culture expresses it in a voluntary, qualitative aspect. The level of person's ecological conscience is sufficiently high if the person possesses enough ecological knowledge and is willing to actively participate in environment protection. The attitude towards environment in everyday situations, like this endemic species protection, depends directly on the development of these personality qualities.

Ecological awareness is the basis for preservation and improvement of the environment, and it is formed under the influence of many factors of society, culture and education. In that aspect a great contribution may be provided by means of mass communication, schools and different forms of informal education of adults.

Trough mass communications society spreads certain information, facts, data, and therefore contributes to the person's system of knowledge, formation of values, attitudes, beliefs and convictions, view of the world.

Not just the information is spread trough mass media. The research has shown that mass media play a significant role in breeding of young people. Mass media often have more influence than many traditional means and ways of breeding and education.

Recognizing the significance of all means of communication in order to spread information and knowledge about the olm as endangered endemic species and the need for the species' preservation and conservation- we have decided to turn to local radio stations "Radio Trebinje" and "Korona", as well as daily newspapers "Euro Blic", "Glas Srpske", "Press" and local newspapers "Glas Trebinja" and supply them on regular basis with information about the current activities in this field. Also, we hold presentations and lectures in local communities where habitats of the olm exist.

Possibilities of solving the environmental problems, created owing to human recklessness, are various, but it is certain that each of them will take time. Anyway, environmental problems were not created in an instance, it was a step by step process of resource destruction.

The field work of speleologists made a great contribution in changing the community's attitude towards this natural treasure. One of the most polluted founts in urban zone was cleaned and after some time the olm reappeared on that location. Local people have stopped disposing waste in the fount and are proud to preserve this valuable find.

Maybe the olm will change human conscience with its charm, and help people to understand the significance of this unusual creature, so they would protect the survival of this rare species in this area. This location can also serve as an example of "demonstrational locality" for preservation and conservation of typical olm habitat. In this particular aspect, this location has a great educational and scientific potential.

At present some technological solutions are considered in order to present the olm in its natural environment to the public, but in a way that will not disturb the natural balance of the olm's habitat. Up to the present, more than 60 habitats of the olm have been located between Fatnicko and Popovo Polje. Herzegovina has a huge potential for development of ecological tourism. Slovenia successfully utilizes the image of the olm to promote eco-tourism and attract hundreds of tourists. Bosnia and Herzegovina is still undeveloped in that aspect although it has all the potentials.

Conservation status in Bosnia and Herzegovina has not yet been defined, and there are no protection measures. The law that would regulate the field of ecological protection does not exist.

The olm was first protected in Slovenia in 1922 along with all cave fauna, but that protection was not effective due to the growth of black market. It was placed on a list of rare and endangered species. After joining the EU, Slovenia had to establish mechanisms for protection of the species included in the EU Habitats Directive. The olm is included in a Slovenian red list of endangered species. In Croatia the olm is protected by the legislation designed to protect amphibians.

A conservation action plan for these species ought to be made and it should have a double strategy, to manage the terrain above the underground water systems as well as protection and conservation of underground habitats, preservation of caves, estavellas and underground water system. The plan should include monitoring of population and assessment of water quality in habitats.

CONCLUSION

Preservation of the olm and its habitat should be a permanent task for citizens of Trebinje. It is necessary to clean and protect all potential habitats with active participation of local community.

The local community should direct its activities on strengthening ecological awareness. Therefore, protection of the olm has to be a permanent and continuous process.

It is necessary to establish collaboration with elementary schools. That way the youngest pupils would gain appropriate knowledge about the olm and acquire an ecological behavior.

A great contribution to the ecological education can be made by means of mass media. Columns, radio programs, TV reportages, etc, are used to inform people about ecological problems, provide them with possible solutions to those problems and participate in forming ecological culture and awareness of the public.

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FUZZY COMPREHENSIVE EVALUATION OF LAND RECLAMATION SUITABILITY IN MINING SUBSIDENCE BASED ON GIS

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ABSTRACT

In order to make full use of mining subsidence area, we use fuzzy comprehensive evaluation method on the land reclamation suitability. According to the three directions of land reclamation of agriculture, forestry and pond, we choose proper evaluation elements and weights, and then obtain the structure of land reclamation suitability of this coal mining as a result which provides a basis for reclaiming the subsidence area appropriately. Combined with GIS, draw a land suitability evaluation result map of this coal mining subsidence.

Keywords: land suitability; fuzzy comprehensive evaluation; coal mining subsidence; GIS

INTRODUCTION

China is the largest coal-producing country, coal consumption accounts for about 70% of the total national energy consumption. No doubt, coal development and utilization for economics and social development have made outstanding contributions. Meanwhile, it has lead to the ecological environment damages in varying degrees. It's estimated that in China's major coal mines, mining collapse areas are about 10% of all coal mining areas in average. Coal mining subsidence cause houses fissures or collapsed, groundwater lowering, farmland destroyed, roads damage and so on, and the contradiction between human and land becomes intensified, so it's urgent for us to make land reclamation.

Land suitability evaluation is the assessment for the best use of land and land of special purpose combined with natural, social, economical and technology data. It not only reveals the production potential of land, but also for some type of land use, it reflects the degree of land suitability and possibility of land improvement which is the important content of overall plan of land utilization. Along With increasing development of computer technology, geographical information system, remote sensing technology,

global position satellite technology and other information processing technologies, land evaluation has become one of the important applications of GIS [1,2].

Under the support of GIS, land suitability evaluation is the process for user to use GIS system to interactively input, display, analyze relevant geographic objects (layer) and output the result. Spatial analysis and reasoning is the core of the issue and support decision is the ultimate goal.

This paper takes a mine of land subsidence in Shandong province as an example. In order to land reclamation with local conditions, this paper is base on GIS, according to the destruction land of the natural properties and conditions, multilevel fuzzy comprehensive evaluation on the suitability degree of subsidence land to agriculture, forestry and pond.

MULTILEVEL FUZZY COMPREHENSIVE EVALUATIO PRINCIPLE

Multilevel fuzzy comprehensive evaluation model can be considered comprehensively and widely adapted. It not only can objectively determine pros and cons of complicated problems with multi-attributes, multi-factors in which quantitative and qualitative theory co-existed, but also sort different programs based on the comprehensive evaluation values which is suitable to the problems with large amount of information, more evaluation indicators and more complicated programs[3,4]. We determine reclamation for three directions that is agriculture, forestry and pond.

A. Multilevel Fuzzy Comprehensive Evaluation Model

Set indicator factor X divides into s sub-sets according to attributes,

$$\mathrm{X} = \{\mathrm{X}_1, \mathrm{X}_2, \cdots, \mathrm{X}_s\}$$

And it contents that

$$\bigcup_{i=1}^{s} \mathrm{X}_i = \mathrm{X}, \quad \mathrm{X}_i \bigcap \mathrm{X}_j = \phi \quad (i \neq j)$$

$$\mathrm{X}_i = \{\mathrm{X}_{i1}, \mathrm{X}_{i2}, \cdots, \mathrm{X}_{in_i}\}\ , (i = 1 \sim s)\ , \sum_{i=1}^{s} n_i = n$$

As a result, establish evaluation set

$$V = \{V_1, V_2, \cdots, V_m\}\ ,$$

and determine the reviews according to different situations.

B. First-level fuzzy evaluation

A first-level fuzzy evaluation to each subset Xi, there is:

$$\mathrm{B}_i = W_i \circ R_i = (\omega_1, \omega_2, \cdots, \omega_n) = (b_1, b_2, \cdots, b_n)$$

The result shows that one property condition in the program is good or not.

C. Second-level fuzzy comprehensive evaluation

Set the results of first-level evaluation into second-level fuzzy subordinated evaluation matrix:

$$R = [B_1, B_2, \cdots B_s]^T$$

And

$$A = W \circ R = (a_1, a_2, \cdots, a_n),$$

where

$$W = (\omega_1, \omega_2, \cdots, \omega_s)$$

is the weight sets among subsets Xi.

The result shows that the comprehensive conditions of one program are good or not, and we can obtain improved information.

D. Computing comprehensive evaluation values

In order to easier to distinguish the advantages of each program, set values to evaluation set V, that is

$$E = A \bullet V^T,.$$

According to the value of E, we determine the pros and cons of various programs.

PRACTICE

This paper chooses one coal mine in Shan Dong province for analysis. It caused a total of 703.74 acres subsidence areas, of which there are 418.36 acres of arable land.

A. Selection of evaluation factors

According to the ecological status of the subsidence area, combined with the available data, constitute the following hierarchy structure diagram, see fig.1 and fig.2:

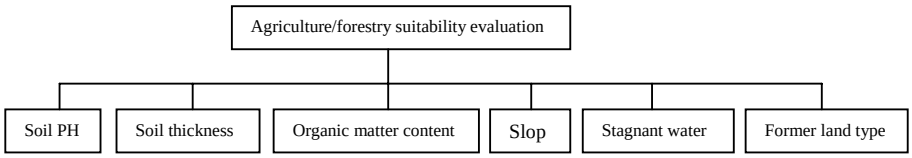

Figure 1. Agriculture and forestry suitability evaluation hierarchy structure diagram

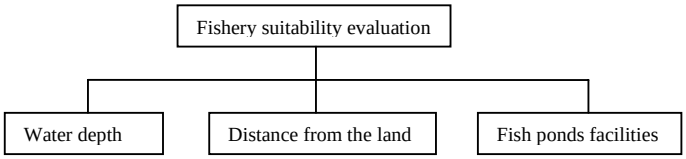

Figure 2. Fishery suitability evaluation diagram

B. Determination of grade values

The weights of evaluation factors are determined using the Delphi method, that is, multiple adjustments to be determined after scored by experts. See table.1 and table.2.

Table 1.Classification criteria of agriculture suitability and weights

Factors	Classification Conditions	Evaluation Degree	Weights
Soil Ph	6.5-7.5	Suitability	0.12
	7.5-8.0	Average suitability	
	8.0-8.5	Unsuitability	
Soil thickness (m)	>0.6	Suitability	0.19
	0.5-0.6	Average suitability	
	0.25-0.5	Unsuitability	
Organic matter content (%)	>1.3	Suitability	0.2
	1.2-1.3	Average suitability	
	1.0-1.2	Unsuitability	
Slope	<1°	Very suitability	0.07
	1-6°	Suitability	
	>6°	Unsuitability	
Stagnant water degree	No stagnant water area	No stagnant water	0.29
	Seasonal stagnant water area	Less serious	
	Stagnant water area	Serious	
Former land type	No stagnant water or seasonal stagnant water	Maintain former land type	0.13
	Large areas of stagnant water	Change land type	

Table2. Classification criteria of forestry suitability and weights

Factors	Classification Condition	Evaluation Degree	Weight
Soil Ph	6.5-7.5	Suitability	0.12
	7.5-8.0	Average suitability	
	8.0-8.5	Unsuitability	
Soil thickness(m)	>0.6	Suitability	0.27
	0.5-0.6	Average suitability	
	0.25-0.5	Unsuitability	
Organic matter content (%)	>1.3	Suitability	0.15
	1.2-1.3	Average suitability	
	1.0-1.2	Unsuitability	
Slope	<1°	Very suitability	0.03
	1-6°	Suitability	
	>6°	Unsuitability	
Stagnant water degree	No stagnant water area	No stagnant water	0.3
	Seasonal stagnant water area	Less serious	
	Stagnant water area	Serious	
Former land type	No stagnant water or seasonal stagnant water	Maintain former land type	0.13
	Large areas of stagnant water	Change land type	

Note: because of a large area of stagnant water caused by subsidence and perennial water depth to reach more than 3-5 m, according to the local conditions, no longer suitable for restoring the original state. It can be planned to be fishery areas or leisure water sites.

C. The result of suitability evaluation

Based on the actual situation of the project, according to the condition of the stagnant water, classify the land type into three types that is mild destruction, middle destruction and serious destruction. We only evaluate two kinds of land type that is mild destruction and middle destruction. For the serious destruction land, we don't give evaluation and make the plan for the pond or leisure water surface.

Through program calculation, the land-use structure areas of the suitability reclamation direction see in table.3 and table.4, combined with the priority principle of the arable land, choosing the appropriate direction.

Table 3. Land-use structure of suitability for agriculture and forestry

Evaluation Units		**Agriculture Evaluation**	**Forestry Evaluation**	**Suitability Direction**	**Selection Direction**	**Land Restriction**	**Area (acre)**
Land Type	**Destruction Degree**						
Arable Land	mild	484	528	agriculture suitability II, forestry suitability I	agriculture	Water restrictive	218.59
	middle	436	473	agriculture suitability II, forestry suitability I	agriculture	Comprehensive management	25.07
Forestry	mild	363	922	agriculture suitability III, forestry suitability I	agriculture	Soil restrictive	25.41
	middle	333	787	agriculture suitability III, forestry suitability II	forestry	Irrigation restrictive	34.73
Other Land Types	mild	439	449	agriculture suitability II, forestry suitability II	agriculture	Comprehensive management	54.02
	middle	338	325	agriculture suitability III, forestry suitability III	forestry	Comprehensive management	3.03
In Total	--	--	--	--	--		360.86

Table 4. Fishery planning land in subsidence water area

	Suitability	**Area (acre)**	**Measures**
Fishery Evaluation	First-rate	60.05	Build embankments and bottom of the pond, make the other irrigation and drainage equipments to form intensive fishing pond outside the stagnant water area and stereoscopic agriculture in the embankments
	Second-rate	13.67	Plant lotus, reeds and other aquatic plants to cage fishing
	Third-rate	155.60	Extensive fishing

After suitability evaluation, get 323.79 acres for arable land which reduces 90.07 acres less than before, mainly because due to serious stagnant water in the subsidence area, unable to restore to the use of arable land, in the comprehensive consideration of the various factors, reclaim to fishing ponds.

D. Generating suitability evaluation map

Based on all the analysis materials and fields survey, according to land-use map, we merge and class different land types according to the degree of suitability to agriculture, forestry with the indicators of soil PH, soil thickness, soil organic matter content, so that get the soil level diagram; in the support of GIS technology, with the project's DEM, extract slope and generate a slope grade distribution for the slope analysis; according to the different water depth and areas, form a class diagram of water level in the GIS technology for the water situation analysis; for the former land type, according to the different types of land and different damage degrees, form the classification whether or not maintain its original type. Ultimately form all the single-factor analysis diagrams.

The final map of suitability evaluation result sees in fig.3:

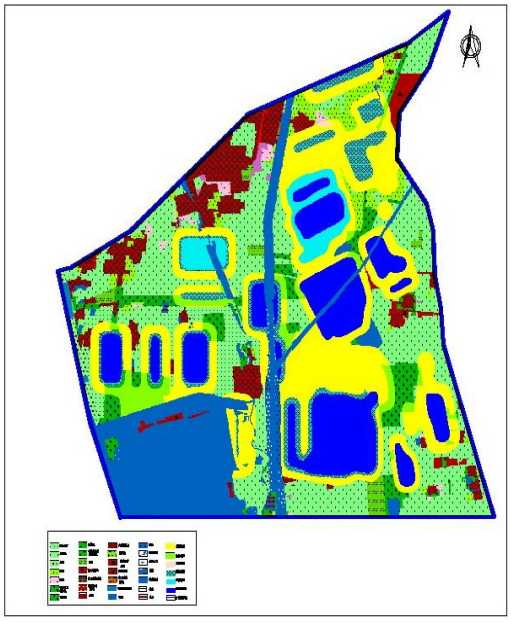

Figure 3. The map of suitability evaluation

CONCLUSION

The factors to influence the utilization direction of land reclamation are very complicated, and many factors have great ambiguity. Fuzzy comprehensive evaluation can deal with uncertainty among the elements properly and combined with kinds of factors, objectively reflect the actual situation so that maximize the effectiveness and efficiency of land reclamation.

GIS has powerful data processing and analysis capabilities and can generate a variety of thematic maps which can provide decision-making basis for land reclamation workers, thereby enabling them to conduct land reclamation more easily. Applied to the suitability evaluation of land reclamation, GIS can show suitability evaluation results intuitively and improve operability.

This paper not only evaluates the reclamation direction, but also proposes land-based restriction factors and their countermeasures. The fuzzy comprehensive evaluation with GIS is playing more and more important role in land reclamation. How to better achieve intelligence between them is the goal of future research.

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LITHOLOGICAL PROFILE, GROUNDWATER AND SOIL POLLUTANTS DETERMINATION WITH NONINVASIVE METHOD OF GEOCHEMICAL PROSPECTION

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ABSTRACT

A new geochemical prospecting method using a device "RADIJAN 2001 SF", used at Novi Sad territory, determines lithological profiles and pollutants in groundwater and soil. There were investigated pollutants whose presence could have been expected at the measure point, because of the pollution source closeness. Willing to define this method credibility, since it is not a standard one, there was done a control measuring. Ground water was sampled and analyzed with standard chemical methods. Thereby gathered results, indicated that there was a reasonable way to correlate results of the new method, with standard methods' results.

Keywords: geochemical propsecting, groundwater pollutants, lithological profile

INTRODUCTION

There are many different usage og groundwater – as drinking water, fresh water for technical purposes, water for industrial purposes etc. For water supply in Serbia, there are mostly used sources are groundwaters as a result of their significant capacity. Above all of them the most significant are sorces of alluvial that include more than a half of all groundwater sources [1]. Rapid decreasing of sources of water that could be used as drinking water, increasing demands of population for high quality water on the other hand, justify the requirement for qualitative and quantitative exploration of available groundwaters in Serbia. The results of previous prospectings, performed with standard methods, indicate that there is huge pollution of groundwaters in Serbia. Simplicity, expedition in results aquiring as well as ecological reasonableness of the method "RADIJAN 2001 SF", performed in this work, are of grate significance specially in those districts where the groundwater sources are main sources of drinking water.

NATURAL CONDITIONS OF INVESTIGATED AREA

Wider region of investigation includes the territory of Novi Sad. In geomorphologic meaning, the region belongs to the loess terrace of South Backa at the

junction of the DTD channel to the river Danube in the alluvial flat of Danube [2]. In the Danube alluvium, according to the hydro-geological criteria, there are assigned two basic hydro geological categories:

- water bearing layers of good filtration characteristics, consisted of sands and gravel that form the aquifer
- easy water permeable or water impermeable layers that represent all variations of silty-clayey or loess sediments [3]

According to lithological profiles along the river side of Danube, there could be distinguished three areas with different hydro-geological functions: hanging wall, water-bearing layer and lying wall. Sediments of hanging wall are easy water permeable, represented with diverse varieties of aleurits and loesides. Water-bearing layer, developed in river-bed facies is represented with grey silty to fine grained, sporadic gravel sands. The third lithological layer is water impermeable lying wall consisted of meager carbonated clays [4].

Chemical analyses of groundwater, sampled from piezometer during 1988. and 1989. year on the Ratno ostrvo measure points, during complex hydro geological explorations, there are determined improper concentrations or concentrations even a little bit above MAC of: H_2S, Fe, Mn, NH_4^+, As, phenols and mineral oils [5]. The monitoring results of some chemical parameters in collected raw water from three municipal drinking water sources in 2002. year, indicate that, in relation to defined value of MAC, there were determined improper concentrations of ferrous, phosphorus, manganese and ammonia [6].

MATERIALS AND WORKING METHODS

Main and only equipment used in this work is device named "RADIJAN 2001 SF". Implemented method, called by the used device, understands generation of electromagnetic waves at the ground surface [7]. Revelation the oscillation frequencies of elements in the Periodic table of elements, construction of device "RADIJAN 2001 SF" there was developed the method for horizontal and vertical electro-magnetic prospection, as well as the interferential method for determination of chemical composition of ores, minerals, water and compounds. Oscillation frequencies of the Periodic table elements are defined with a formula and depend on atomic weight of the element. The mentioned frequencies are implemented in the EPROM of device "RADIJAN-2001 SF".

The "RADIJAN-2001 SF"is device for precise determination ore position, location of minerals, water, hidden objects and explosives, as well as their depth determination in ground. There are two phases of the new device implementation. In the first phase with horizontal prospection there are explored ground water stream direction, presence of lythological elements and eventual presence of pollutants. In order to define the water table level and depth of the water bearing layer(s), the device is positioned just above the position where the object (mineral, water, pollutant) is detected in the previous phase of horizontal prospection. The whole process of measuring is done for each element of which the ore, mineral or compound is consisted of. Results obtained with the "RADIJAN 2001 SF" are expressed as strength of signal detected by the device and represent physical size without

units, since there is still not determined the correlation bitween the signal strength and some other relevant unit (for example concentration mg/dm^3) [8].

MEASURE POINT LOCATION

The measure point is situated on a farm in industrial area of Novi Sad, at the position of active shallow well that is used for drinking water supply of the nearby household. This measure point is placed in industrial area, surrounded with industrial plants of Neoplanta and Koteksprodukt, hence there is reasonable to expect theses pollution sources impact to ground water quality and soil quality as well [8].

RESULTS AND DISCUSSION

The first measuring at the mentioned measure point was done on 13th September 2007., and the second one was done on 22nd October 2008 (so called „control measuring"). Both measurings understood the device „RADIJAN 2001SF" implementation for determination of lythological profile at the measure point, water occurence and presence of pollutants in ground water. Comparative view of obtained results is shown in the picture number 1.

The first measuring was accomplished to 20,0 m in depth where the water table level was registered. There were determined two lythological elements – a layer of sandy clay (from ground surface to 16,5 m in depth), under which there was determined a layer of sand. The control measuring was accomplished to 22,0 m in depth. It is important to ephasize that the control measuring succeeded after the period of abounding precipitations. At the inspected depth there were determined same lythological elements as in the first measuring. Layers of clay and sand occure alternarly to the depth of 22,0 m where starts a layer of clay. Differences in lythological elements depth, determined in vertical profiles at the first and second measuring, could be the result of more detailed analysis of obtained results at the second measuring. First time, water table level was determined at the depth of 20,0 m and in ground water there were determined the following pollutants presence: ammonia (strength of the device signal 40); manganese (strength of the device signal 30); ferrum, nitrates and nitrites (strength of the device signal 25-30); arsenic, naphta, pyralen and phenols (strength of the device signal 10); and lead (strength of the device signal 5). In the first measuring there was not investigated presence of pollutants in soil.

The control measuring, that was done to the depth under 22,0 m, indicated that there were two water bearing layers (at depth of 12,5 – 14,5 m and 18,0 – 22,0 m), which was probably the consequence of abounding precipitations that marked the time period previous to the moment when the measuring was accomplished. There is no doubt that it was the same reason for pollutants occurence in shallower layers of soil. In the control measuring there was determined presence of pollutants in both water bearing layers. In the first water bearing layer there was determined presence of the following pollutants: manganese, nitrates, ammonia, arsenic and ferrum. In the second water bearing layer there was determined presence of nitrates and ferrum, manganese and lead. The pollutants – ammonia, nitrates, ferrum and manganese occur in both water bearing layers. Since during the second measuring there was investigated presence of pollutants

in soil as well as in ground water, the notification of lead and arsenic presence only in water bearing layers, indicates that these pollutants don't have geological origin from the layers of soil between two water bearing layers. Between two water bearing layers there was determined presence of nitrates, manganese and ferrum. In the most shallow layers there were registered nitrates and ammonia, which is probably the consequence of mineral manure implementation nearby the measuring point. At the depth 7,5 to 12,5 m there were determined ferrum and manganese present in soil. The control measuring understood more detailed exploration of specific pollutants presence, in layers of soil as well as in ground water, but then absented the determination of some pollutants that were determined in the first measuring. (naphta, phenols, pyralen).

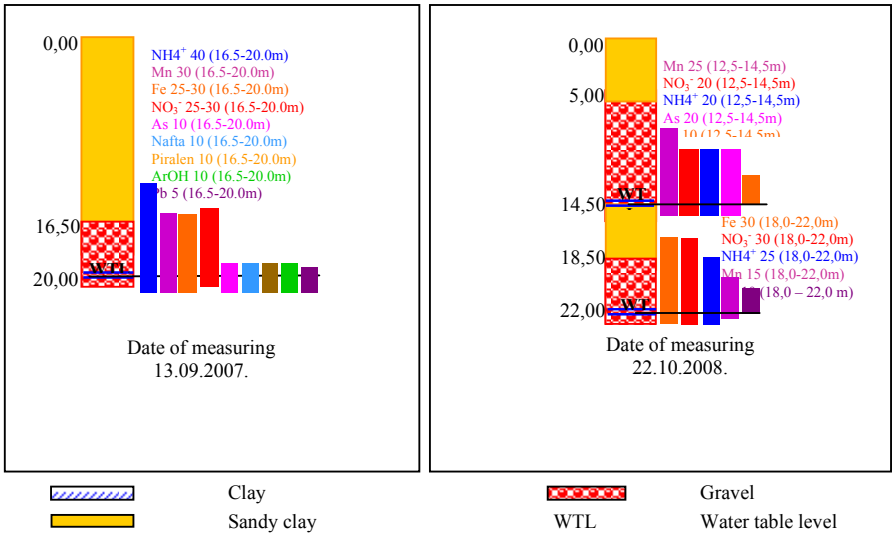

Figure 1. Lithological profile of vertical geochemical prospection at the measuring point on the farm in industrial area of Novi Sad (the first and the second measuring)

The same day when there was accomplished the control measuring with the device "RADIJAN 2001 SF", from the measure point at the farm in idustrial area of Novi Sad were taken samples of water from the digged well in purposes of quality testing. Samples were tested in the laboratory for public health in Vojvodina – center for hygiene and human ecology. Samples were tested for determination presence of the following pollutants: ammonia, arsenic, ferrum, manganese and lead, which are expected to be present in the samples, according to the previous measuring at the same measuring point with the new method of geochemical prospection.

The results obtained after laboratory testing are shown in the table 1. They indicate that in water samples there were confirmed the presence of ammonia in concentration of 0,62 mg/dm^3 and arsenic in concentraton of 0,02 mg/dm^3. The report

from the institute for public health of Vojvodina confirmed the presence of ferrum (in the concentration of 1,02 mg/dm^3), manganese in concentration of 0,192 mg/dm^3 and lead in concentration less than 0,01 mg/dm^3[9].

Starting from the fact that both results, after the first and the control measuring with the device "RADIJAN 2001 SF", determined presence of lead at the depth under 16,5 m (the first and the only water bearing horizon determined at the first measurng, respectively the second water horizon determined at the control measuring), the obtained laboratory results about pollutants concentration in water could be correlated with values of signal strength for each pollutant determined in the second water bearing horizon. While there aren't accomplished more measurings, while there aren't taken more samples of water, while so obtained results aren't statistically elaborated and define eventually deviation, the above mentioned claim can not be taken as a fact, but results obtained in this work can be used for orientation.

Table 1. Paralel views of chemical quality parameters of sampled water from the the measuring point on the farm in industrial area of Novi Sad [9]

Pollutant	Signal strength of RADIJAN 2001 SF	Laboratory analysis results [9]	MAC
$NH4^+$	25	0,62 mg/dm^3	1,0 mg/dm^3
As	20	0,02 mg/dm^3	0,01 mg/dm^3
Fe	30	1,02 mg/dm^3	0,30 mg/dm^3
Mn	15	0,192 mg/dm^3	0,05 mg/dm^3
Pb	10	<0,01 mg/dm^3	0,01 mg/dm^3

CONCLUSION

In this work there was used a new uninvasive method of electromagnetic prospection "RADIJAN-2001SF", which was used to determine ground water quality and lythological profile at the measure point. On the basis of preliminar electromagnetic prospection, without methodical montoring of ground water qaulity, there can not be with certainty defined pollutants origin in soil and ground water. There are needfull new, more detailed measurings, with greater number of measuring points and organisation of monitoring at the existing mesauring points.

In terms of qualitative determination of pollutants, there is high congruency in results obtained with the new method and those obtained in previous researching works with some standard methods. Control measuring results, parallel with results of chemical analysis, can be used as good guidelines in further terrain measuring. Those pollutants presence which were determined with the method "RADIJAN 2001 SF" were confirmed with laboratory analysis of sampled water. Hence, in qualitative meaning of pollutants determination, the new method provides the same results as standard laboratory methods for pollutants determination in water. Quantitative interpretation of results obtained with the new method, in the meaning of defining the concentration in which the pollutants are present in water, for now is not possible. By comparing results obtained with the new method and standard methods of sampling and examined, represents the basis for establishing the correlation between value of the signal strength obtained by "RADIJAN 2001 SF" and standard chemical sizes for expressing pollutants concentration.

Application of the new method "RADIJAN 2001 SF" excludes violation of the ecosystem in mechanical way, which can be objectively caused by classic monitoring as a consequence of building observing objects which are necessary for such purposes. The advantage of the new method is considerably simpler and faster process of water quality determination, as apposed to standard methods that understand sampling and sometimes very complicated methods of chemical analysis for samples quality determination.
The new method of geochemical prospection „RADIJAN 2001 SF" is cheap, fast, ecological terrain method that can be aplplied in creating and managing the cadastre of pollutants and to improve efficiency of the ecological inspection in quality control of soil and ground water. This new method "RADIJAN 2001 SF" purposefully till present represented results in work, can be a good basis for managing the quality of ground water and soil. Up to the extent to which is developed and verified, special relevancy the new method can have when there is neccessary to accomplish terrain measurings as soon as it is possible and provide the qualitative picture of present pollutants.

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INVESTIGATION OF INFLUENCE OF SODIUM SILIKATE ON STABILTY OF SMELTING SLAG SUSPENSION

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ABSTRACT

One of the main problems in the process of flotation smelting slag to maintain the pulp in a stable condition. The suspension formed of smelting slag, artificial creations of the characteristic physical and chemical composition, it differs from the suspension formed from natural materials in the water. In view of these problems in the flotation of slag to the fast deposition of large coarse particles to the bottom of the cell, in the first minutes of flotation, impairs its stability. The research has focused on determining the stability of the slag suspension and examination of influential factors-concentration of disperging agent on its stability.

The paper examined slag suspension stability in two ways. Determining the stability of suspension, the sedimentation rate or the length of the formation of sludge on the bottom of the glass gauge in certain time periods; and determination of stability of suspension by measuring of electrokinetic-zeta potential.

The experiments are based on the use of chemical compounds, sodium silicate Na_2SiO_3 (water glass), as disperging agent. Sodium-silicate, as one of chipest inorganic compounds, has great application in practice, where according to the present concentration in the suspension and the pH can increase or decrease the suspension stability.

On the basis of experimental results achieved in the glass gauge and measuring the zeta potential of slag with addition of chemical compounds, in this case, sodium silicate reached a certain stability of the suspension.

Keywords: smelting slag, stability of suspension, disperging agent, zeta potential

INTRODUCTION

Sedimentation experiments of slag were carried out in the glass gauge, where the impact of sodium silicate was tested on the stability slag suspension, observing the height of formation of solid deposits at the bottom of glass gauge. Relationship is represented graphically, the amount of sediment vs. forming time of deposition, with sodium silicate added in concentrations of 5, 10, 50 and 100 g / t, no other reagenats and pH regulators. Approximation of experimental curves obtained for the time interval from 0 to 1,4 min, (implied time of deposition of coarse particles), is determined depending on the studied mathematical influential factors on the stability of the slag suspension.

On the basis of experimental results achieved in the glass gauge, it was adopted for further testing by measuring the stability of suspension by zeta potential of the slag particles. These values present a measure of stability grade of suspension (pulp).

Potential values were measured in: pure slag particles without the addition of collector, in addition to collectors PAX (potassium amyl xanthate) and with the addition of collector and disperging agent sodium silicate, in order to provide comparative results.

Disperging agent was added in order to achieve greater stability of the suspension. For better stability of suspension, the zeta potential must have a higher value (positive or negative) of the ZPC (zero point of charge).

Graphics of zeta potential as a function of pH , with the addition of the collector, the collector and disperging agent, respectively, are shown in the figures 3 and 4.

EXPERIMENTAL

Figure 1 presents the experimental curves obtained as a result of the performance of laboratory experiments in the glass gauge, with the addition of sodium silicate as disperging agent in these concentrations, and without his addition.

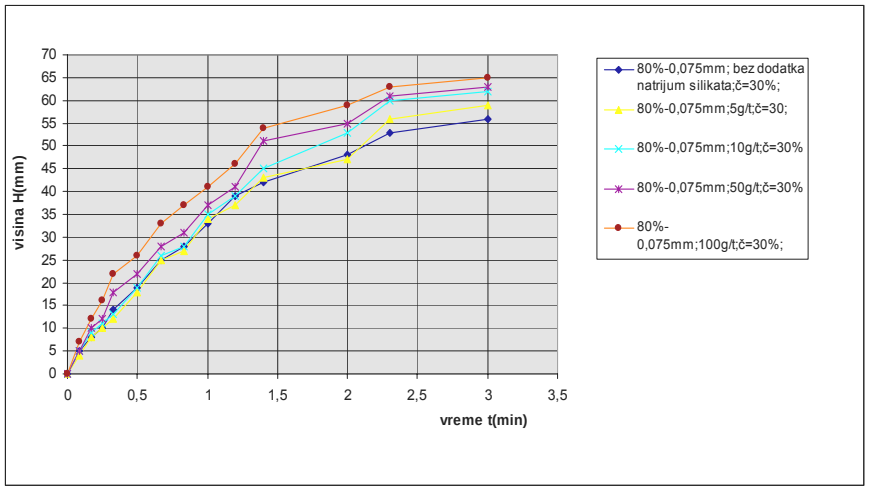

Figure 1. Comparative view of the formation of sediment level in function of time in addition to sodium silicate and without its addition

In order to define, depending on the direction of true coefficient *k* on the concentration of sodium silicate, the obtained experimental curves, the mathematical approximatively linear correlation was done (Table 1).

♦ Conditions of performance experiments are presented in tables (Table 1)

Table 1. Conditions of performance experiments

Solid content (%)	Sodium silicate g/t	Degree of particles liberation -0,075 mm	pH	Equation of first order	Degree of correlation
30	/	80	Natural	Y=29.814x+2.8369	R^2=0.9883
30	5	80		Y=29.465x+2.4046	R^2=0.9858
30	10	80		Y=30.934x+2.5456	R^2=0.9917
30	50	80		Y=33.872x+3.4637	R^2=0.986
30	100	80		Y=35.634x+5.8881	R^2=0.9702

Approximations of experimental curves in the interval from 0 to 1.4 min is shown in Figure 2.

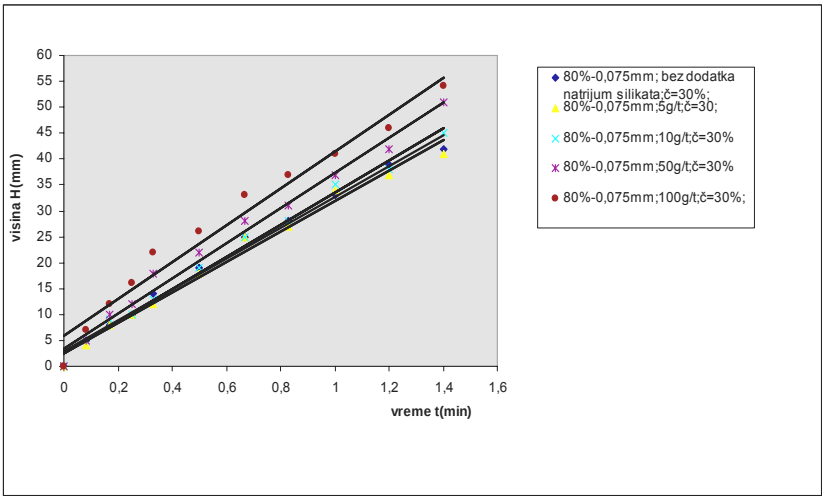

Figure 2. Amount of sludge formation in function of time withand without of addition of sodium silicate, fitting lines

Comparative analysis of the achieved experimental results (Figures 1 and 2), one can observe the effect achieved with the stability of the suspension with sodium silicate.

Clearer insight into the results achieved given the right direction coefficient k, (Table 1).

Negligible effect of increasing stability of slag suspension and the lower right direction coefficient k, was achieved with sodium silicate at a concentration of 5 g / t, compared to the true direction of the coefficient k, obtained by approximation of experimental curves of the experiments performed without addition thereof.

The increased concentration of sodium silicate in slag suspension, does not affect the increased stability of the suspension, but a negative effect was indicated by the

high value of the real direction of the coefficients k, table 1.

The highest value of coefficient k right direction, was obtained at a concentration of sodium silicate of 100g / t.

On the basis of experimental results achieved with sodium silicate, the concentration of 5g/ti 100g / t has been adopted for further investigation of slag suspension stability by measuring of zeta potential, in presence of the above mentioned disperging agent.

Note: The electrokinetic potential are measured on the surfaces of pure minerals. Bearing in mind that the tested materials smelting slag, the mixture of several mineral forms, uses the term medium value of zeta potential (average zeta potential).

Measured mean values of zeta potential of slag particles in function of pH with no reagents addition are shown in Figure 3 (basic curve).

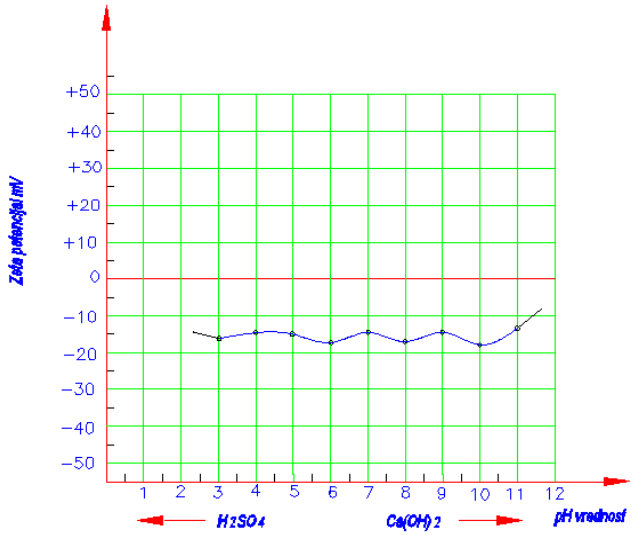

Figure 3. Mean zeta potential slag particles
(regulators of pH value are : H_2SO_4 and Ca $(OH)_2$)

The results give the relationship between stability vs. pulp pH, without adding reagents.

The figure 3 is observed measured negative mean zeta potential of pure slag in the entire pH range of scales of measurement. On the basis of measured values of zeta potential of suspension of slag particles with sulfuric acid and calcium hydroxide as pH regulators, is the upper limit of weak dispersity.

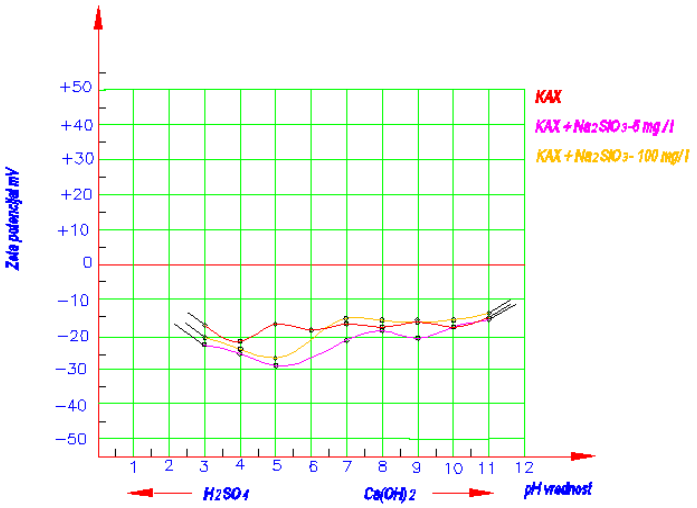

Figure 4. Comparative graphics of the mean zeta potential values of slag particles with the addition of collector PAX and dispergator sodium silicate in concentrations of 5 mg / l and 100 mg / l, and no added dispergatora; (pH regulators are H_2SO_4 and $Ca(OH)_2$)

Effect of suspension stability achieved by adding sodium silicate at a concentration of 5mg / l confirm the higher value of measured potential, compared with measurements from the potential with presence of sodium silicate in solution of 100mg/l and without it (Figures 3 and 4). On the basis of measured values higher zeta potential in the whole range of pH, the presence of sodium silicate at a concentration of 5mg / l, it can be said that the suspension of slag, has a moderate to high stability.

For technical reasons, measurements of mean values of zeta potential in the peripheral environmental pH values, pH = 2 and pH = 12, are absent.

CONCLUSION

Copper smelting slag suspension stability can be adequately modified in the implementation of appropriate inorganic compounds-sodium silicate.

The positive effect of increasing the stability of suspension, experiments in the glass gauge, was achieved with sodium silicate at a concentration of 5 g / t, while the same concentration of 100 g / t, obtained the highest value of coefficient k right direction (a negative impact on the stability of suspension).

Sodium silicate is present in concentrations of 10, 50 and 100 g / t, in suspension of slag, had no effect on increasing the stability of suspension, which is confirmed by mathematical coefficient k right direction (higher values) compared to the ratio k (lower value) , the experiments performed without addition of sodium silicate.

With the presence of sodium silicate at a concentration of 5mg / l, on the whole range of pH environment, the greater the measured zeta potential values ranging in the interval of (-17 to-28mV). Also notable are the higher potential values measured in acidic (interval pH 3 ÷ 5), which can be explained poly ions present in solution at lower pH values, the environment, ie. presence of colloidal particles of silica acid (H2SiO3).

Degree of dispesivity of applied dispersing agent depends on the pH of the solution, concentration of solution and some other factor.

Effect of suspension stability achieved by adding sodium silicate at a concentration of 5mg / l, measured values confirm the higher potential, compared with measurements from the potential presence of sodium silicate in solution without addition of 100mg/l.

On the basis of the measured zeta potential of greater value in the whole range of pH environment, we can say that the suspension made by slag particles has a moderate to high durability.

Acknowledgement

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GEOGRAPHICAL DISTRIBUTION OF CHLAMYDIA IN NIGERIA

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ABSTRACT

Chlamydia infections have been reported across the world. They have also been reported to lead to serious sequelae with relative frequencies in developing countries sparse. Due to rapid change climatically, there could also be change in microbial ecology. It has then become important to study the distribution of most infectious microorganisms like Chlamydia in order to enhance empirical treatment. Nigeria with a diverse population and different geographical lay out was sampled according to her geo-political zones. Samples were collected from the North East zone, North West zone, North Central zone, South South zone, South West zone and South East zone. Such samples included endocervical swabs, sputum, throat swabs, urethral swabs and semen. The samples were tested using different techniques for the three species of Chlamydia (*Chlamydia trachomatis*, *Chlamydia psittacci* and *Chlamydia pneumoniae*). Microbiological tests used included complement fixation test, Romanowsky-Giemsa technique, culture and polymerase chain reaction. It was revealed that the different Chlamydia species varies according to ecological zones with *Chlamydia pneumoniae* more in the Northern zones while *Chlamydia trachomatis* in the Southern zones. Variation within species were also discovered and this was suggested to be due to climatic change world wide.

Keywords: *Chlamydia trachomatis*, Nigeria, Climate, Distribution, *Chlamydia pneumoniae*

INTRODUCTION

Nigeria lies within latitude 4^{o} and 14^{o}N and longitude 3^{o}E and 15^{o}E of the Greenwich Meridian. Nigeria as a country in West Africa is bounded by Republic of Benin, to the east by Cameroon Republic, to the North by Niger Republic and to the south by Atlantic Ocean. In terms of size, the area of Nigeria is about 923,768 square kilometers. It is the 4th largest country in West Africa after Niger Republic, Mali and Mauritania in relation to land area but in terms of population her population stood at her population stood at 88,514,501 million as at 1991 according to the National Population Census [1], thus having the highest population in Africa. Although unofficial reports are that Nigeria is over 120 million in population as at 2007. This high population, coupled with the fact that her neighbours have free access across the Nigerian borders is actually a good factor for the spread of communicable diseases like chlamydia infections.

Relief simply refers to the surface features of the land above the sea level, which could also be a factor in transmission of infections due to Chlamydia. The general relief of Nigeria can be divided into two major categories; namely the highlands and

plateau and the low lands. The highland in Nigeria r refer to areas over 300m above the sea level and these can be grouped into four areas which included the Northern highlands, the

Geographical Distribution of Chlamydia

Western highlands, the Eastern scapelands, the Eastern highlands. Climate is the average weather condition of the atmosphere over a long period of time. Weather determines the survival of microorganisms. Though not all microorganism are weather sensitive, weather could be a determinant in the distribution of *Chlamydia* species especially *Chlamydia trachomatis* and *Chlamydia pneumoniae*. There has also been evidence of seasonal variation of *Chlamydia trachomatis* and *Chlamydia pneumoniae* in other countries [2]. Hence it is imperative to take a look at the climatic distribution in Nigeria. These climatic condition as well as the relief also contribute to interaction of microorganisms with their environment. It is also a major determinant of ecological distribution of *Chlamydia* spp in the said environment. The high population of Nigeria is also a major determinant of how *Chlamydia* will be distributed in the environment. All these put together becomes ecological factors. The current climatic change all over the world have made studies about the distribution of microorganism in the environment very important.

Chlamydiae were first cultured in the 1950s. The wide spread importance and frequencies of genital tract *Chlamydia* infections were first appreciated in the 1960s[3]. Chlamydiae were once thought to be viruses and were referred to as large viruses [4]. They look like bacteria by having cell wall, which lack muramunic acid and are like viruses by being filterable [3].

Chlamydia include organisms previously called the psittacosis – lymphogranuloma venereum - trachoma group (PLT organisms) or the (TRIC) group – Trachoma-inclusion conjunctivitis organism (TRIC) group. Chlamydia has three accepted species that includes *Chlamydia trachomatis*, *Chlamydia psittacci* and *Chlamydia pneumoniae*, which is on the basis of their antigenic composition, intracellular inclusions, sulphonamide susceptibility and disease production [5]. Recently a fourth member *Chlamydiia pecorium* was added to the family, which was isolated from ruminants as reported by Prescott *et al*., [4].

Chlamydia infections have been reported to be highly endemic worldwide and have been implicated in a wide range of disease sequelae. However there is paucity of reports on prevalence and distribution of *Chlamydia* infections in Nigeria. Hence this research sought the distribution of *Chlamydia* spp in Nigeria, their implication during treatment as well as in the ecosystem.

MATERIALS AND METHODS

Blood (4181 samples), endocervical (3627 samples), throat swabs and sputum (884) samples were collected based on geo-graphical zones in Nigeria which included North-East zone, North West zone, North Central zone, South-East zone, South-zone and South-south zone. Major hospitals which included teaching hospitals in each of the political zones served as stop stations for samples collection and sometimes processing

as the case may be. All samples were collected in sterile containers containing sterile 2SP sucrose [6] as transport medium and transported to the nearby laboratory for culture with the exception of blood samples which were only used for serology. The method of Black [6] was modified by the addition of phosphate buffered saline for samples to be transported over a long distance and were all transported in ice packs to the laboratory for final analysis. In the main laboratory all samples were stored in -20oC until used. All samples were collected by the help of a clinician. And all samples meant for culture had streptomycin incorporated in them to avoid bacterial growth [7]. Sample were also collected from apparently healthy individuals where necessary. Blood samples were tested using the complement fixation test, endocervical swabs (ECV) and sputum were tested bothe by culture as well as the immunochromatographic spot test kit (immunocomb) and the test carried out as directed by the manufacturer.

RESULTS

Of the 7442 sreened for *Chlamydia* spp. in Nigeria, 5750 (77.3%) were positive while 1692 (22.76%) were negative. Of the 5750 positive samples, the North East had 683 out of the total of 760 samples collected in that zone. The North Central zone had 863 of the 1100 samples collected from that zone. In the North West, where 1000 samples were collected 752 were positive. In the South East zone, 1400 samples were collected of which 1093 were positive while in the South West, 1533 of the 2000 samples collected were positive. The South South zone had 825 positive samples of the 1140 samples collected. There was also no significant difference in species distribution across the geographical zones except for *Chlamydia pneumoniae* which showed a significant difference in the two seasons (F=0.002, t=0.0679, 0.0997, 2.512, 0.101, CI=99%). The species distribution shows that *Chlamydia trachomatis* were more from the Northern zones down to the southern zones. *Chlamydia pneumoniae* was more in the northern zones than in the southern zones.

Table 1. Prevalence of *Chlamydia* according to age and sex in Nigeria during the wet and dry season

Age groups	**Total**	**Total number positive (%)**	
		Dry season	**Wet season**
6-10	479	109 (22.9)	186 (30.7)
11-15	528	209 (39.6)	186 (35.2)
16-20	929	354 (38.1)	337 (36.7)
21-25	1288	491 (38.1)	487 (37.8)
26-30	1385	568 (41)	559 (40.4)
31-35	1539	619 (40.2)	626 (40.1)
36-40	921	421 (45.7)	309 (33.5)
41-45	373	133 (35.7)	114 (30.6)
TOTAL	**7442**	**2985 (40.1)**	**2765 (37.2)**

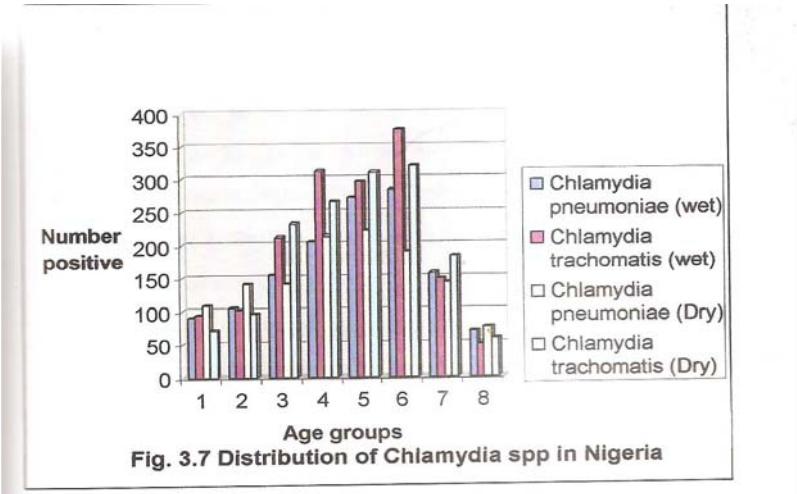

Fig. 3.7 Distribution of Chlamydia spp in Nigeria

Figure Keys: Dry= dry season

Wet=wet season Numbers 1,2,3,4,5,6,7,8 on x-axis represents different age groups 6-10, 11-15, 16-20, 21-25, 26-30, 31-35, 36-40, 41-45 respectively.

Figure 1. Distribution of Clamydia spp in Nigeria

DISCUSSION

Chlamydia spp. have long been reported to cause mild to chronic infections in humans with relative frequencies in developing countries [8]. Scanty reports have also revealed that infections could be higher in developing countries because paucity of reports may be due to lack of proper diagnostic techniques [8]. The general epidemiological survey for *Chlamydia* in this study is that the prevalence of *Chlamydia* infections in Nigeria is very high with an average positive result of 77.3%. This organism would be said to be highly endemic in the population. This study also revealed that *Chlamydia trachomatis* has the highest prevalence of 3114 positive samples (54.1%) as against 2567 (44.6%) for *Chlamydia pneumoniae* and 570 (71.6%) of the total of 800 poultry farmers tested for *Chlamydia psittaci.* This could be as a result of the fact that most of the populations sampled were very sexually active and hence very high amount of circulating antibodies. Another reason that might be responsible for the high position result for *Chlamydia trachomatis* could also be as a result of the fact that most of the patients reporting to the hospital are mainly those of the child bearing age and those with urinogenital problems that will general visit the hospitals. It has also been reported that most *Chlamydia pneumoniae* infection are self limiting [9], hence it is usually in the case of chronic infections that the individual reports to the hospital. The low positive result for *Chlamydia psittacci* in the general population is due to the fact that *Chlamydia psittacci* only infect a certain group of the population which makes up a very small

number of the populations. It has previously been reported to infect those handling and slaughtering poultry and owners of psittacine birds [10]. It is a zoonotic disease, one has to be close to the animal reservoir to be able to get infection and this greatly account for low incidence for *Chlamydia psittacci* in the population in general but high in the population of poultry farmers. Hence it is not expected that *Chlamydia psittacci* show any distribution as expected for both *Chlamydia trachomatis* and *Chlamydia pneumoniae.* The distribution shows that *Chlamydia pneumoniae* infections are more in the North than in the Southern zones.

CONCLUSION

This study hence concluded that there is even distribution in *Chlamydia trachomatis* across Nigeria as against *Chlamydia pneumoniae* which showed an uneven distribution and hence may tilt the ecosystem once that distribution is altered especially by the current climatic change.

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MOSS AS BIOMONITORS OF RADIO POLLUTION OF NP DJERDAP

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ABSTRACT

In this work activity levels of natural radionuclides ^{40}K, ^{226}Ra and ^{232}Th, and also artificial ^{137}Cs in moss and their substrate collected in July 2009 in NP Djerdap (Golubac city, Brnjica settlement and archeological site Lepenski vir) are presented. All samples contained the stated radionuclides making it necessary to monitor activity levels of these radionuclides in bioindicators in order to be able to evaluate whether there is radionuclide pollution on these territories.

Keywords: Moss, radionuclide pollution, Golubac city, Brnjica, Lepenski vir

INTRODUCTION

The National park (NP) Djerdap is located in the north-eastern part of the Republic of Serbia on the border with Romania. The total park area is 63.608 ha. It lies on about 100 km of the right bank of the Danube river from Golubac to Karataš near Kladovo and includes a narrow wooded hilly mountain region, about 2-8 km wide along the Danube, rising above the Danube about 50-800 meters above sea level [1]. The city of Golubac is part of NP Djerdap at the entrance to the Djerdap gorge, on the right bank of the Danube, 4 km downstream from the Golubac settlement that belongs to the Braničevo district. It is a medieval fortress, a cultural monument of exceptional importance, located on high cliffs. Brnjica is a settlement in the Golubac municipality, downstream of Golubac city and is one of the most significant Mesolithic and Neolithic archeological finds. This locality was the center of one of the most significant and complex prehistoric cultures. The area of NP Djerdap stands out as a unique European reservation of tertian flora, vegetation and fauna. Moss, considered to be one of the most significant bioindicators and biomonitors of environment pollution with radionuclides, pesticides and heavy metals, grow in the park [2-9]. Moss reacts to changes in the

chemical composition of the environment, contains information on its quality, indicates the presence of polluting substances from the atmosphere and enables information for quantitative characterization of the environment and changes in it. Their bioindication originates from their unique structure and feeding method: they have no root, cuticle and absorb polluting substances from the environment from dry and wet falls. Many factors influence the concentration of polluting substances in moss: microclimatic, plant age and morphology, amount of emitted and settled polluting substances, physico-chemical properties of polluting substances, regime and form of water supply, chemical composition and pH of the substrate on which they grow. Moss utilization is high, both in industry, medicine, pharmacy, and also for human and animal consumption and there is a danger of radiation load of organisms consuming it.

Sources of ionizing radiation by their genesis and occurrence in the environment can be divided into: natural, anthropogene and radioactive waste. Natural radionuclides formed before the creation of planet Earth and have remained to this day. They are the most common and significant sources of ionizing radiation in the environment. They have a long half life (10^5-10^{16} years) and differ by their physical and geochemical properties (^{238}U, ^{40}K, ^{226}Ra, ^{232}Th...). Anthropogene radionuclides were created by human activities. They have a different half life and origin. Pollution with these radionuclides has a mainly regional character, but it can be wider in the case of strong nuclear explosions. The Chernobyl accident released over 40 radionuclides into the atmosphere, with an activity of the order of 10^{18}Bq of which $3.7x10^{16}$ Bq ^{137}Cs. The physical half life of ^{137}Cs is 30.2 years and it actively ions the food chain of humans and animals through plants as it metabolically replaces potassium. Physical damage of an organism depends on the time the radionuclide remains in the organism and outside.

Purpose of this work: establishing the presence of natural (^{40}K, ^{226}Ra and ^{232}Th) and artifical (^{137}Cs) radionuclides in moss and its substrate sampled from localities: Golubac city, Brnjica and Lepenski vir.

MATERIAL AND METHODS

Moss and lichen samples were collected randomly on the territory of the National park Djerdap, more precisely on locations in Golubac city, Brnjica settlement and the archeological site Lepenski vir in July 2009.

All samples were homogenized, soaked in paraffin in Marinelli vessels with a volume of 1 L, left to stand for 30 days in order to establish radioactive balance between members of the series. Gamma spectrometric measurements were performed on an HPGe detector with 8192 channels and resolution of 1.65 keV and relative efficiency of 34% at 1.33 MeV for ^{60}Co. The measuring time for one sample was 60000s. The relative error for sample preparation and measurement was 10%. Spectral analysis was performed using the Gamma Vision 32 software package.

Activity of the ^{40}K radionuclide was measured at the energy of 1461 keV, ^{232}Th based on ^{228}Ac lines at energies of 338.4; 911.1 and 968.9 keV; and ^{226}Ra was measured at energies of 295; 352 and 609 keV. The activity of the artificially produced radionuclide ^{137}Cs was measured via the γ-line at the energy of 661.6 keV.

RESULTS AND DISCUSSION

Table 1 shows activity levels (in Bq/kg) of natural radionuclides ^{40}K, ^{226}Ra, ^{232}Th and the artificial radionuclide ^{137}Cs in moss samples and their substrate collected on the territory just before Golubac city and in Golubac city (samples 1-5), the Brnjica settlement (samples 6 and 6a) and the archeological site Lepenski vir (samples 7-9).

Analysis of the data presented in Table 1 shows that all radionuclides are present in all bioindicator and substrate samples. A comparison between radinuclide activity in moss and its substrate shows that lower activity levels were measured in samples from localities Golubac city and Brnjica than on the Lepenski vir locality.

The lowest activity levels of ^{137}Cs were measured in moss sample number 2 (5.43 Bq/kg) and the highest was measured in moss sample number 8 (111 Bq/kg). In moss samples collected a year earlier activity levels of radiocesium were from 7 Bq/kg (Brnjica) to 417 Bq/kg (Lepenski vir, entrance to the archeological site) [9]. Due to work on the archeological site Lepenski vir in July 2009 it was not possible to collect samples of moss from the entrance and thus further follow-up of activity levels of radiocesium in moss from this place was not possible.

Since 1996 activity levels of radiocesium have been followed in INEP in *Homalothecium sericeum* moss taken from a rock that is close to the archeological site Lepenski vir. In 1996 the measured activity levels of ^{137}Cs in moss were 724 Bq/kg and it was 1413 Bq/kg in its substrate. In samples collected in July 2009 (8 and 8a) from the same location the activity levels of ^{137}Cs were 111 Bq/kg in moss and 105 Bq/kg in its substrate. These results indicate that new contamination with radiocesium did not take place on this location but certain levels of radiocesium contamination are still present.

Table 1. Activity levels (Bq/kg) of artificial (^{137}Cs) and natural radionuclides (^{40}K, ^{226}Ra, ^{232}Th) in samples of moss and its substrate from the NP Djerdap territory collected in July 2009

Sample No.	Moss and substrate sampling location	^{137}Cs	^{40}K	^{226}Ra	^{232}Th
		(Bq/kg)			
1	Moss close to the notice board at the entrance to Golubac city, rock	7.95	184	7.40	11.0
2	Moss close to the notice board at the entrance to Golubac city, rock	5.43	142	9.16	9.11
3	Moss, stone quarry, before Golubac city, stone	14.5	189	11.7	8.65
3a	Substrate, quarry, before Golubac city	16.4	148	9.20	9.30
4	Moss, upper Golubac city, stone	19.2	192	5.84	7.56
5	Moss, Golubac city, stone behind tunnel	15.7	190	6.44	10.0
6	Moss, Brnjica, concrete	26.9	227	11.1	11.6
6a	Substrate, Brnjica, concrete	38.4	243	18.4	16.3
7	Moss, Lepenski vir, I rock close to the site	12.7	140	6.63	7.31
8	Moss, Lepenski vir, II rock close to the site	111	346	20.8	20.3
8a	Substrate, Lepenski vir, rock close to the site	105	356	23.5	22.8
9	Moss, Lepenski vir, koprivić notice board, earth	104	471	19.8	21.4

Activity levels of the natural radionuclide (homologue of ^{137}Cs) ^{40}K in moss and its substrate collected in 2009 in Lepenski vir (sample 8 and 8a) were 346 Bq/kg, i.e. 356 Bq/kg. In moss collected a year earlier from the same location, activity levels in moss were 332 Bq/kg.

The data given in Table 1 was used to determine the ratio between maximal and minimal activity level values of the observed isotopes both in moss and its substrate. The obtained data is given in Table 2. One can see that the activity ratio of ^{137}Cs in moss is 5-6 times higher than the ratio between the other three natural isotopes. Also, when considering the ratio between maximal and minimal activities in the substrate, it is 2.5 timers higher for ^{137}Cs than for the other three natural isotopes. Considering that one of the natural isotopes ^{40}K is chemically very similar, as an alkaline element of the ^{137}Cs isotope one can conclude that this is most probably the consequence of the fact that ^{137}Cs did not reach equilibrium state in the substrate, i.e. geochemical system that exists for ^{40}K. This should be taken into account when considering terrain pollution with this isotope as its adoption by organisms can be increased.

Table 2. Ratio between maximal (A_{max}) and minimal (A_{min}) isotope activity in moss and substrate samples stated in Table 1.

Isotope	**Moss**			**Substrate**		
	$\mathbf{A_{max}}$	$\mathbf{A_{min}}$	$\mathbf{A_{max}/A_{min}}$	$\mathbf{A_{max}}$	$\mathbf{A_{min}}$	$\mathbf{A_{max}/A_{min}}$
^{137}Cs	111	5.40	20.6	105	16.4	6.40
^{40}K	471	140	3.36	356	148	2.41
^{226}Ra	20.8	5.80	3.59	23.5	9.20	2.56
^{232}Th	21.4	7.30	2.93	22.8	9.30	2.45

CONCLUSION

^{40}K, ^{226}Ra, ^{232}Th and ^{137}Cs are present in all samples of moss and its substrate from the territory of NP Djerdap.

New contamination with radiocesium on the territory of NP Djerdap has not occurred, but certain levels of contamination by radiocesium from Chernobyl are still present.

Activity levels of all the stated radionuclides in moss and its substrate collected on the Lepenski vir location are higher than in samples collected on locations Golubac city and Brnjica.

An ecological system such as NP Djerdap represents a closed biogeocenosis in which levels of radioactive contamination with the ^{137}Cs isotope have been present for a long period of time.

Acknowledgement

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IMMOBILIZATION OF TOXIC SUBSTANCES BY VITRIFICATION OF WASTE FLY ASHES

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ABSTRACT

The results of laboratory scale experiments of vitrification of fly ash collected from the coal fired power plant are presented. Based on the analyzed characteristics of fly ash, the technological condition for its vitrification was determined. The final glassy material was obtained by malting a mixture of ash and limestone at T= 1480 ^{o}C and quenching the melt in air. To convert the waste into useful and environmentally acceptable material the crystallization of fly ash glass was performed by powder route processing. The properties of the resultant $CaO-Al_2O_3-SiO_2$ glass-ceramic indicate a potential various application such as building materials, ceramics tiles ,etc.

Keywords: vitrification, fly ash glass , $CaO-Al_2O_3-SiO_2$ glass-ceramic

INTRODUCTION

Most of industrial processes generate large amounts of toxic and hazardous wastes, which are disposed in open pits or landfills. Usually, such a wastes contain appreciable amounts of heavy metals (Pb, Hg, Cd, Cr, etc.) which can be accumulated in surrounding soil and water sources causing a huge environmental damage. Regarding to quantity of different waste materials the common disposal techniques for fly ashes generated from different combustion processes (power plants, incineration plants for municipal and medical waste) are not environmentally acceptable. Unfortunately, only small amount of fly ashes were recycled and reused and therefore, it is necessary to seek new options to solve this problem. As one of promising solution the vitrification of fly ashes could be considered. By this process the waste toxic components are bonded within the glass structure and the obtained durable material is environmentally stable for a long time. Also, the vitrification greatly reduces the volume of waste and by using appropriate technologies the waste can be converted to useful materials [1,2]. As reported earlier the different fly ashes without or with addition of other waste inorganic materials, can be transformed in glasses by melting technique. It has been demonstrated

that is possible to prepare a glass-ceramics with good chemical and mechanical durability by controlled crystallization of the parent waste fly ash glasses [3,6].

This paper reports the results of vitrfication of waste fly ash collected from the open pit near the TPS „Nikola Tesla" – Republic of Serbia . Also, the possibility of obtaining the glass-ceramics by sintering and crystallization of powder parent vitrified fly ash was presented.

MATERIALS AND METHODS

The raw sample of fly ash was dried and then analyzed. The grain size was determined using Warman cyclosizer M4. The phase composition was defined by the XRD - Philips PW-1710 automated diffractometer with a Cu K_α radiation tube operating at 40 kV and 32 mA. Microscopic analysis of the sample was performed by Jenapol microscope under magnification of 100 x. To determine chemical composition of fly ash a wet chemical method and AAS (Perkin Elmer 703) were employed. Vitrification procedure was realized by melting of the mixture of fly ash and powdered raw limestone (60:40) at T = 1450 °C for 2h in an electrical furnace Carbolite BLF 1700 using zirconate crucible. As confirmed by XRD the melt which was cooled in air on steel plate solidified as a homogenous black glass. For DTA measurement the powder glass was prepared by crushing and grinding the bulk glass in agate mortar, and then sieving it up to grain size of < 0,038 mm. Netsch STA 409 EP DTA device was used, and sample (100mg) was heated at v = 10 ^{o}C min^{-1} up to T = 1000 ^{o}C. For the crystallization experiments the glass powders (< 0.074 mm) were pressed at P = 50 MPa in the form of pellets (d = 5mm). The test samples were sintered in an electric furnace in the temperature range of 900-1100 $^{\circ}$C for 2h. The phase composition of the resultant glass-ceramics was examined by XRD using Philips PW- 1710 automated diffractometer. Density of the sintered sample was determined by Archimedes method and a Shimadzu Vickers micro hardness tester HMV 2000 and INSTRON 4206 testing machine were employed for determination of hardness and bending strength.

RESULTS AND DISCUSSION

The chemical composition of the fly ash sample is shown in Table 1.

Table 1. Chemical composition of the fly ash sample

oxides	SiO_2	Al_2O_3	CaO	MgO	Na_2O	K_2O	$(Fe_2O_3)_u$	TiO_2	P_2O_5	S	L.o.i
mass%	58.52	24.03	3.31	2.11	0.32	1.08	6.23	0.87	<0.02	0.33	3,16

Also, the sample contains a small concentration of different heavy metals (Table 2). The isotopes of Ra, Th and K were detected in the sample, but the index of radioactivity is below the limits prescribed for building materials, e.g., the fly ash can be used in such purpose.

Table 2. Contents of heavy metals in fly ash sample

metals	ppm
Zn	255
Cd	25
Bi	365
Cr	335
Cu	145
Pb	255

The XRD and microscopic analyses revealed a complex phase composition of fly ash.

The glassy phase (> 30 %) appears in the sample in a form of pearls of different colors with dimension up to 1mm. The large porous aggregates (> 40%) belong to the burned clay (chamotte) with inclusions of coal and iron oxides. As can be seen from the XRD patterns (Fig.1), the crystalline phases determined in the sample are: quartz, feldspar, mullite, melilite, crystoballite and anhydrite.

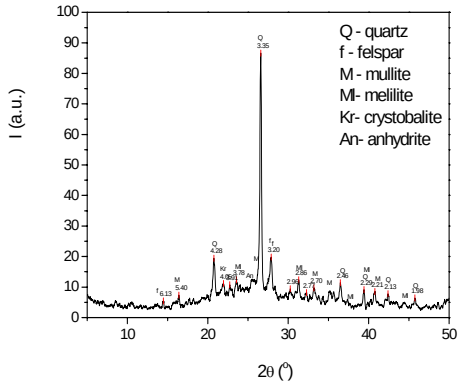

Figure 1. XRD patterns of the fly ash sample

The grain size of the fly ash is shown in Table 2.

Table 2. Grains size analysis of the fly ash sample

Grain size (mm)	wt (%)
- 0 + 0.6	1.37
- 0.6 + 0.5	0.81
- 0.5 + 0.4	1.73
- 0.4 + 0.3	4.32
- 0.3 + 0.2	12.23
- 0.2 + 0.1	28.51
- 0.1 + 0.075	17.13
- 0.075 + 0	33.90

The melting experiments have shown that is not possible to obtain an appropriate melt of the raw fly ash at temperatures $T \leq 1500\ ^{\circ}C$. At $T = 1500\ ^{\circ}C$, the melt remains highly viscous and could not be cast. To vitrify the fly ash properly, the mixture of limestone and fly ash was melted at $T = 1450\ ^{\circ}C$ for 2h. The parent homogenous black glass was obtained by melt casting on steel plate. The chemical composition of the glass sample is shown in Table 3, and DTA curve in Fig. 2.

Table 3. Chemical composition of the parent glass sample

oxides	SiO_2	Al_2O_3	CaO	MgO	Na_2O	K_2O	$(Fe_2O_3)_u$	TiO_2	l.o.i
mass%	46.83	18.97	26.33	1.49	0.29	0.67	4.18	0.68	0.58

The cations of heavy metal of fly ash were bonded into the parent glass network structure.

From the DTA curve (Fig.2), the glass transformation temperature $T_g = 740\ ^{\circ}C$ and the peak crystallization temperature $T_p = 966.2\ ^{\circ}C$ were determined.

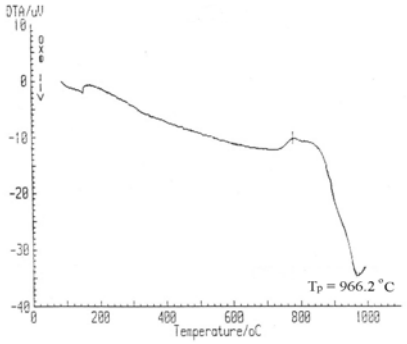

Figure 2. DTA curve of the parent glass sample

The results of sintering showed that the glass pellets shrink significantly during heating. The appearance of the untreated cold pressed sample and sintered at $T = 1000\ ^{\circ}C$ for 2h is present in Fig. 3.

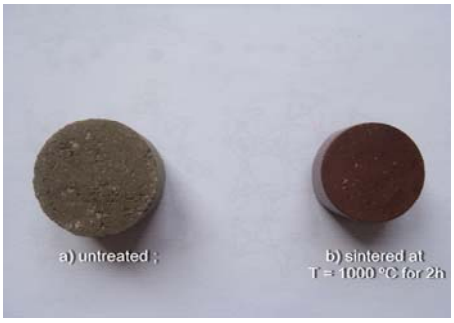

Figure 3. Appearance of glass pellets

By sintering process a dense dark-brown body with glassy appearance was obtained. The XRD analysis showed the crystallization of the sample. The extent of crystallization is small and only one crystalline phase (anorthite) was determined in the sintered sample (Fig. 4).

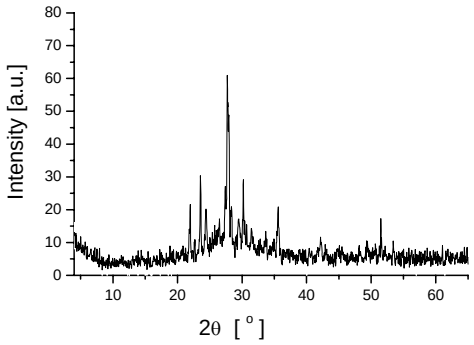

Figure 4. XRD patterns of the sample sintered at T = 1000 ºC for 2h

This result demonstrated that the sintering and crystallization processes take place simultaneously during heating of sample.

As shown in Table 4, the resultant $CaO\text{-}Al_2O_3\text{-}SiO_2$ glass-ceramic has good mechanical characteristics that indicate a wide industrial application.

Table 4. Properties of the glass-ceramic

Properties	Density ($g\ cm^{-3}$)	Bending strenght (MPa)	Hardness (GPa)
	2.58	116	7.2

CONCLUSIONS

The subject of this study was the vitrification of waste coal fly ash from thermo-power station. The results of laboratory experiments have shown that the vitrification process can be considered as promising solution for waste management. This process enables the conversion of toxic and environmentally dangerous waste material into a inert glass which can be used for production of useful glass-ceramics with potential wide application.

Acknowledgement

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ANALYSIS OF THE POSSIBILITY OF AGRO- ECOLODGE TOURISM DEVELOPMENT IN SREBRENICA MUNICIPALITY

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ABSTRACT

In line with the trends of development in the region and Bosnia and Herzegovina, based on available tourism potentials, development of eco-tourism is recognized as an extremely important component of integrated rural development and overall economic development of the municipality of Srebrenica and the region Birač.

In cooperation with the Tourist Organization of Srebrenica, a pilot project was carried out to develop agrotourism in accordance with the rules on the provision of services in rural households and available financial resources, the three households and a few individuals were selected for realisation of base education program, planning, equipping and promoting household in order to build settlement of „Ecolodge" and the organization of organic food production.

Keywords: ecological agriculture, rural-ecotourism, organic food

INTRODUCTION

According to Héctor Ceballos-Lascurén [1], ecotourism is environmentally responsible travel and visit in relatively preserved areas, in order to enjoy nature (and accompanying cultural features - both the past and the present) by improving the protection of nature, a small negative impact of visitors and good for active influence on the local population.

Marta [2] gives the clearest and simplest definition of ecotourism as a form of tourism that appeals to ecologically and socially conscious individuals. Generally speaking, ecotourism focuses on volunteering, personal growth, and learning new ways to live on the planet; typically involving travel to destinations where flora, fauna, and cultural heritage are the primary attractions. So, at this point, Srebrenica and BIRAC region definitely has all the necessary prerequisites.

If we concentrate on the definition given by the Food and Agriculture Organization of the United Nations (FAO) in a research conducted back in 2004, we will immediately get to the link between ecotourism and organic farming. The FAO views ecotourism as an opportunity for farmers and/or foresters to generate additional income,

and at the same time as one of the most effective ways of preserving biodiversity. FAO distinguishes ecotourism from agrotourism (i.e. holidays on farmland), pointing to the symbiotic relationship between tourism and agriculture as a key element of an environmentally and socially responsible tourism. FAO also mentions the term agro-ecotourism as a combination of nature-based ecotourism and farm-based agrotourism.

As another relevant term, the FAO report uses the term eco-organic tourism for agro-ecotourism evolving around an organic farm. As stressed in the report, conversion to organic management in agricultural areas and the development of connected activities such as tourism are increasing. The report points out that organically-managed farms increase the motivation for tourists' visits. It asserts that the expectations of new tourists have enhanced the quality of the supply such as diversified farm landscape, environmentally-sound farm-house architecture and local/typical gastronomy [3].

While opposed to ecotourism, tourism focused on destinations in nature is essentially a simple trip to the area with beautiful nature, ecotourism is realized for the benefit of local people in environmental, cultural and economic sense. For example, tourists can go into nature to observe birds. But ecotourist watching birds with a local guide, staying in local accommodation capacity („Ecolodge") and contributes to the local economy.

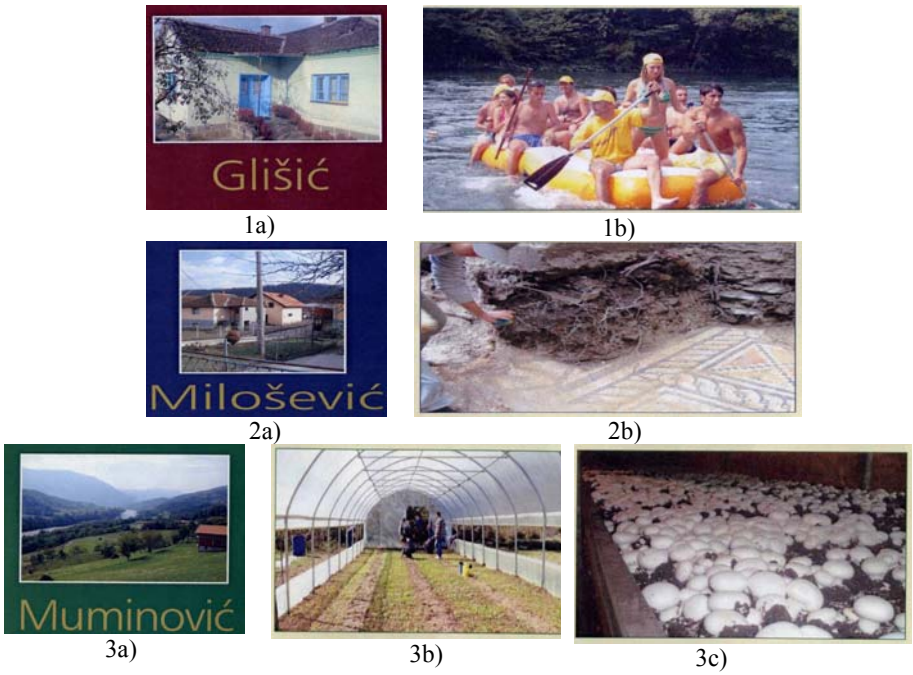
„Ecolodge" is a sort of tourist accommodation that: protecting natural and cultural components of their surroundings, during construction it has minimal impact on the environment, fits the specific context of environment, use alternative means of sustainable water consumption, ensure careful handling of garbage and waste waters, excellent working with local people, implemented environmental education, staff and visitors, contributing to sustainable community development through research programs.

The best ecotourism project is certainly one that includes the local community, preserves the local environment, aspires towards local ownership, showcases innovative environmental practices, and – last but not least – sources food and supplies from the local area. Accordingly, this paper refers to the local area of the municipality of Srebrenica.

ESTABLISHMENT OF EXPERIMENTAL MODEL OF HOUSEHOLDS

As experimental farms for the analysis of possibilities of ecotourism and organic food production we selected the three households: Glisić, Milošević and Muminović. All of the three households are for many years engaged in agricultural production.

Rural household Glišić has several rubber boats, which are used for floating and rafting by Drina. Agricultural and residential buildings were built in the traditional ethnic style of this region with preserved traditional tools for work. They own plantations for growing organic berries (raspberries and blackberries). In the immediate vicinity of the household Milošević is an archaeological site from the III and IV century, the necropolis of tombstones that are extremely interesting to visitors. Rural household Muminović has its own garden plot and cultivation of organic mushroom fruit and vegetables, medicinal plants and breeding of domestic animals.



1a) 1b) 2a) 2b) 3a) 3b) 3c)

Figure 1. Sample households, 1a, 1b - Glišić, 2a, 2b - Milošević, 3a, 3b, 3c - Muminović (4)

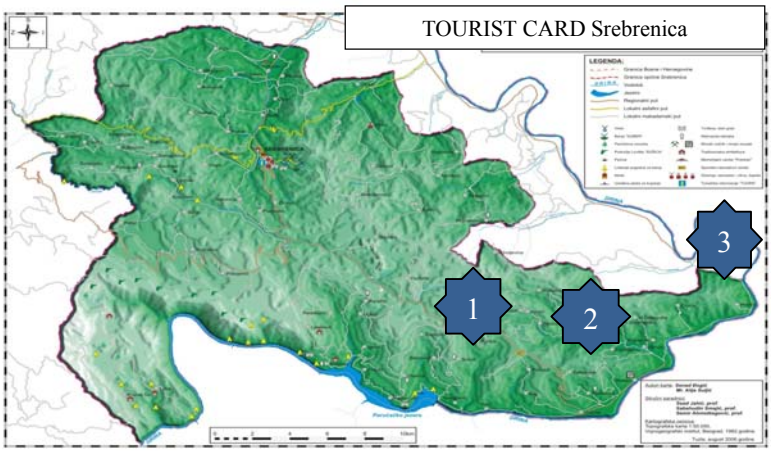


Figure 2. The geographical position of pilot households,
1 - Glišić,2 - Milošević, 3 - Muminović (5)

Since the wider region around the river Drina and lake Perućac are not polluted, nor does any kind of pollutants that could seriously contaminate the air, land or water, and with the commitment of the host and regular educational process, success in producing organic food in this area is warranted.

Like most other producers of large quantities in this region, there are products placement problem for this region of Srebrenica municipality, which can be extremely problematic because of a distance of other parts of Bosnia and Herzegovina and no existence of a customs crossing to Serbia. Listed households are mainly engaged in cultivation produce (tomatoes, peppers and other vegetables), producing fungus mushroom, and growing medicinal herbs. Orchards are also important areas, which will in the near future give a complete result.

In this area there is no serious buyers for organic food, cooperative or some other form of organizing the purchase, so the households remaining only to sell their products directly through its inn and visitors - tourists. What is also extremely important to note for the production of organic food in this area is the possibility of irrigation by the system drop by drop from the river Drina, and favourable climatic conditions in relation to other parts of the region.

STRATEGIC CONCEPT

The area of Srebrenica is a very interesting tourist destination, as a result of its European position, exceptional and unspoilt natural beauty, cultural and historical values, the river Drina which provides a unique natural capacity and ecological development of many tourist activities. The specified area is the intersection of different cultures, religions, traditions, natural resources and space which is not enough used for eco-tourism in rural areas, adventure tourism, health tourism, spa tourism and tourism which offers river Drina as a liaison between the two countries on the target area [6].

In order to enhance potential ecolodge Agro-tourism in the region and made clear the transformation of rural households in households with a potential ecotourism offer, it is necessary to carry out education of the population, organization, equipment, and promotion of households.

During the education of members of households they will become familiar with the concept of agro-ecolodge tourism, opportunities to provide services, relations with tourists (passenger- responsible ecotourist, ethical codes), and the terms of organic food production and marketing of traditional products, household equipment, cooperation with tourist organizations, scientific and educational institutions, agencies and the like.

The area of Srebrenica in was certified by KRAV in 2002 as environmentally sound area for the production of organic food.

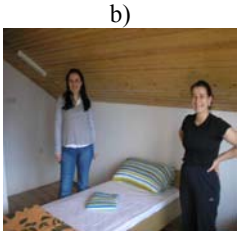
KRAV is a key player in the organic market in Sweden since 1985. They develop organic standards and promote the KRAV-label.The KRAV-label stands for:

- Sound, natural environment
- Solid care for animals
- Good health
- Social responsibility

a)

b)

c)



d)

Figure 3. a), b) -education activities, c)-set tourist signalization, d) -arrangement of households

KRAV has adapted the standards to IFOAM Basic Standards. The KRAV standards also fulfil the EU standards for organic production in the regulations (EC) No 834/2007, (EC) No 889/2008 and (EC) No 967/2008. In some cases the KRAV standards are stricter than the EU standards. The KRAV standards encompass more areas, such as certification of restaurants and industrial kitchens, fishing, and textiles [7].

RESULTS AND DISCUSSION

During activities with selected households the following advantages and disadvantages of the following subject areas were identified.

Advantages:

- The vicinity of the Drina river, with its natural and artificial wealth accumulation Perućac;
- Untouched nature;
- Natural beauty: forests, mountains - a unique landscape rich in contrasts;
- Environmentally sound area;
- The geographical position of Srebrenica provides integrated security development;
- Climate;
- Diverse cultural and historical heritage from the Roman, Ottoman, Slavic and Habsburg period;
- The existence of associations of fishermen, hunters, environmentalists and others who contribute to improving the environment in Srebrenica;

- Human Resources;
- Well known hospitality of the people;
- Local and international institutions support in the institutional development of the tourist region;
- Tourism increase and offer a variety of comparative advantage through integrated development of ecological tourism;
- Development of carriers in tourism (Tourism Organization, etc.);
- Established institutional structures for cooperation in the area of the region;
- Domestic local and state institutions increased participation in the planning, development and financing of tourism infrastructure;
- Area certified by the KRAV, as environmentally sound surrounding for the production of organic food.

Disadvantages:

- Limited access to all attractive destinations;
- Underdeveloped basic infrastructure by the municipality;
- Insufficient consideration of all structures and persons related to tourism and the dwelling in the region (for example, inadequate treatment of solid and liquid waste in the target region);
- Lack of municipal tourism brand;
- Local politics is strong dominating in the municipality;
- Lack of awareness and understanding of the importance of tourism experiences and the establishment of a complete value chain in the region;
- The lack of qualified tourism managers, skilled workers for specific types of tourism, catering services and carrier of cultural and entertainment events that could improve the tourism offer;
- Lack of waste management;
- Infrastructure failures, especially sewage and roads, that are spoil impressions of visitors and the surrounding natural;
- Lack of concern for the traffic relevant institutions infrastructure, such as road travel, tourism signalling and etc.;
- Inadequate application of different standards and service quality in tourism and manufacturing;
- Not enough attention paid to rural development planning linked to the tourism offer;
- Under-developed infrastructure for organic food production;
- Not sufficiently knowledgeable producers;
- Lack of quality standards and organized purchase of organically produced products;
- The lack of a database of tourist activity and limited market information about the visits to the area of the municipality of Srebrenica;
- Reliance on foreign aid-grants.

CONCLUSION

Based on the above analysis, it can be concluded, as follows:

- Municipality of Srebrenica and the region Birač is an area with a strong eco-tourism potential, but in the previous period have not been adequately exploited in terms of developing eco-tourism or tourism industry, and the main reasons are, among other things, bad roads and tourist infrastructure, especially the part that refers to the observed space Municipality.
- Potential visitors of rural households are: hunters, fishermen, families and individuals who want a holiday in nature, persons saturated urban lifestyle (anti-stress therapy), adventurers and Srebrenica Diaspora.
- The most suitable areas for the development of ecotourism and organic food production in the municipality are places along the river Drina, lake Perućac and southern highland parts (Krušev Do, Luke and Sućeska). These areas have great natural and environmental values and they are rich in flora, fauna and hydro potential. Population in these sites produces organic food, using natural fertilizers and traditional handicraft production and preservation of cultural heritage.
- Due to the increasing number of visitors from Srebrenica and other urban centres of the lake Perućac and the river Drina, pilot ecolodge households are given the opportunity to increase the number of nights.
- In Bosnia and Herzegovina tourism development was made at the local level through the strategic plans of municipalities, while there is no integrated version of the Development Strategy for Bosnia and Herzegovina tourism or for the region.

Some elements of potential in Municipality of Srebrenica and the region Birač the tourism value chain are significantly affected, so the population of these areas must be operational towards eco-tourism, healthy organic food and traditional values, as well as leading strategic economic development of border municipalities.

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EXPOSURE TO AIR POLLUTION AND HEALTH OF WOMEN DURING PREGNANCY

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ABSTRACT

Therapy application during pregnancy is conditioned by various pathological conditions and the pregnant woman's diseases. This research included the examination the application of therapeutical preparations in pregnant women who exposed to significantly different concentrations of sulphur dioxide, black smoke and lead in sediment matter.The measurement of air pollutants was carried out daily at two measuring locations, in Nis and Niska Banja. Subjects were 327 pregnant non smokers women, aged 20-40. Data on therapy application during pregnancy were obtained from the medical records of tested pregnant women. Research results have shown that the therapy application is significantly higher in pregnant women from exposed group.

Keywords: air pollution, pregnancy, therapy

INTRODUCTION

It is well known that all therapeutic substances penetrate the placental barrier, and that the only difference is in the rapidity of their transport. Numerous factors influence the penetrability of medicaments through the placenta: molecule size and configuration, liposolubility, polarity, concentration gradient.

Some drugs are especially harmful during pregnancy because it may cause fetal malformations, or even his death, and pregnant women may experience a variety of unpleasant side effects. Detection of unwanted drug effects depends on the period of pregnancy, the time when it is applied, the dose given, the duration of application, and genetic characteristics of pregnant women and fetus and the mother's health.

Indications for use of medications in pregnancy are the most common diseases that can lead to adverse outcomes for mother and fetus. Considering the structure of the placenta, all therapeutic preparations means faster or slower transport due to fetal blood [1].

Numerous epidemiological studies have proven that exposure to air pollutants can lead to the occurrence of anemia, high blood pressure, bleeding in pregnancy [2,3,4], which requires timely application of therapeutic preparations.

In the last couple of years increasing attention has been given to the study of the influence of air pollution on the reproductive system. These studies are carried out on the population layer most sensitive to reproductive effects of air pollution, such as pregnant women and infants.

AIM

The aim of this study was to examine the impact of exposure to polluted air on the application of therapy during pregnancy.

METHOD

Investigation of air pollution was done at the Institute of Public Health in Nis in 2005, the two measuring sites: Trg Knjeginje Ljubica (Nis) and Niska Banja. The air samples were determined by the concentration of sulfur dioxide, black smoke and lead in the sediment matter and commented the Regulation of Guideline Values of Immission (Official Register Republic of Serbia 54/92).

The research is performed in 2005 at the Health Center Nis and included 327 pregnant women, nonsmokers, aged 20-40, and professionaly nonexposed to polluted air. Examined pregnant women were divided into two groups: the exposed group (n=174) and control group (n=153). All pregnant women were examined lived near the place of measuring places of these pollutants and had been fully healthy before gravidity.

On the basis of medical documentation of pregnant women, obtained the data on used therapy during pregnancy, as well as information on indications that caused the application of therapy (anemia, hypertension and bleeding).

The remaining data were also processed in a PC, by the commercial software Microsoft Excel 2000. Levels of statistical significance of the measured pollutants were determined by Student's T-test, and differences at the level of $p<0.05$ were taken to be statistically significant.The occurence of a statistically significant difference between the frequency of therapy application was tested with Pearson's χ^2- test..

RESULTS

Average monthly concentrations of sulfur dioxide measuring the area of Nis ranged from 10.2 $\mu g/m^3$ to 60.2 $\mu g/m^3$, black smoke from 22.2 $\mu g/m^3$ to 70.1 $\mu g/m^3$ and lead in the sediment matter of 1.1 $\mu g/m^2$ to 24.7 $\mu g/m^2$. The measuring site in Niska Banja monthly average concentrations of measured pollutants had much lower values compared to the same measured in the measuring area of Nis (Table1).

Table 2 noticed that there was a statistically significant difference in the monthly average concentration of sulfur dioxide, black smoke and lead in sediment matter between the measuring places, which means that pregnant women from Nis were exposed to higher level of air pollution during pregnancy compared to pregnant women from Niska Banja.

Table 1. Average monthly concentrations of sulfur dioxide ($\mu g/m^3$), black smoke ($\mu g/m^3$) and lead in sediment matter ($\mu g/m^2$)

Measuring place	Polutant	Months											
		I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
Trg Knjeginje Ljubice	SO_2	46.1	60.2	50.3	24.1	12.2	10.2	11.3	14.2	18.2	27.1	29.1	48.1
	BS*	44.3	34.5	44.6	25.6	28.7	24.3	22.2	28.2	39.1	57.4	70.1	58.1
	Pb	16.3	4.1	1.5	1.1	1.2	15.9	16.5	3.1	9.2	2.1	24.7	22.5
Niška Banja	SO_2	6.4	6.8	1.4	1.3	1.2	1.4	2.1	1.9	1.8	2.4	1.5	2.3
	BS	2.1	1.6	1.1	2.1	1.9	1.7	1.8	1.8	1.9	1.2	1.9	2.1
	Pb	3.3	2.6	0.3	4.4	1.9	1.5	2.2	4.1	3.5	5.9	8.4	4.4

*black smoke

Table 2. Statistics significant difference between monthly concentration of air pollutants

Polutant	Measuring place		t	p
	Trg Knjeginje Ljubice ($\bar{X}$ ±SD)	Niška Banja ($\bar{X}$ ±SD)		
SO_2	29.13±8.23	2.54±4.42	18.02	p<0.01
BS	42.11±8.44	1.76±4.11	22.24	p<0.01
Pb	9.85±3.32	3.54±4.89	15.07	p<0.01

Of the total number of investigated pregnant women, 53%living in Nis and 47% live in Niska Banja. The average age of pregnant women from Nisa was 28.25 ± 5:07 and the average age of pregnant women from Niška Banja was 27.73 ± 4.76. Homogeneous group is satisfactory, because between the average age of pregnant women exposed to different concentrations of pollutants from the air there is no statistical significance (t = 0.968, p> 0.05)-table 3.

Table 3. The average age of pregnant women

Group	Number	$\bar{X}$	SD	t
Exposed	174	28.25	5.07	0,968, p> 0,05
Control	153	27.73	4.76	

Among pregnant women living in areas which diferent in the content of harmful substances in the air there is a statistically significant difference in the level of education (χ^2=58.13;p< 0.01). Neither woman was no education or incomplete elementary school (Table 4).

Table 4. Structure of pregnant women by education

Group	Education				
	Elementary school	Secandary school	College	Faculty	χ^2
Exposed	7 (4.02%)	90 (51.72%)	38 (21.84%)	39 (22.41%)	58.13 p < 0.01
Control	28 (18.30%)	106 (69.28%)	19 (12.42%)	0 (0.00%)	
Total	35 (10.70%)	196 (59.94%)	57 (17.43%)	39 (11.93%)	

Pregnant women who were exposed to significantly higher concentrations of air pollutants, 44.83% wete applied therapy during pregnancy. In pregnant women from the control group applying therapy was present in significantly lower percentage (25.49%). Among groups differences in the implementation of therapy was significant (Table 5).

Table 5. Application of therapy during pregnancy in relation to exposure to air

Group	Therapy during pregnancy			
	yes	no	χ^2	p
Exposed	78(44.83%)	96(55.17%)	13.25	p<0.01
Control	39(25.49%)	114(74.51%)		
Total	117(35.78%)	210(64.22%)		

Table 6 gives an overview of types of therapy used pregnant women.

Table 6. Kind of therapy applied during pregnancy

Kind of therapy	Exposed (n=174)	Control (n=153)	Total (n=327)	χ^2
Therapy of hypertension	10(5.75%)	7(4.58%)	17(5.20%)	4.06 p<0.05
Therapy of anemia	9(5.17%)	3(1.96%)	12(3.67%)	
Therapy of bleeding	33(18.97%)	13(8.50%)	46(14.07%)	
Therapy of hypertension and anemia	5(2.87%)	4(2.61%)	9(2.75%)	
Therapy of hypertension and bleeding	8(4.60%)	5(3.27%)	13(3.98%)	
Therapy of anemia and bleeding	10(5.75%)	7(4.58%)	17(5.20%)	
Therapy of hypertension, anemia and bleeding	3(1.72%)	0 (0.00%)	3(0.92%)	

Among pregnant women exposed to different concentrations of pollutants in the air there was statistically significant difference in the type of therapy applied during of pregnancy ($\chi 2$=4:06,p <0.05).

DISSCUSION

In our study found that pregnant women from Nis were exposed during pregnancy significantly higher concentrations of sulfur dioxide, black smoke and lead of sediment matter from the air in relation to pregnant women from Niška Banje.

Immission marginal value for sulphur dioxide and black smoke in the air for inhabited areas amounts to 50 $\mu g/m^3$, whereas allowed marginal values for sulphur dioxide and black smoke in the areas of rest and recreation, such as Niska Banja, are 30 $\mu g/m^3$ for both parametres. Concentrations of these polutants at both measuring locations do not show higher concentrations than allowed maximums. However, even as such they can significantly hinder human health.

In order to treat pregnancy as any rational, first to the diagnosis for the implementation of a medication. And if treatment is needed, it should use the most famous products, which were long in use, and which are known to be safe. However,

their application should be as short as possible (only if required), with mandatory state control pregnant women and babies.

Indications for application of the therapy of pregnant women investigated were anemia, hypertension and bleeding in pregnancy. The most common indication for use of therapy was bleeding in pregnancy for both groups of women. The therapy is applied in the rarest case of simultaneous presence of hypertension, anemia and bleeding.

Application therapy was significantly more common in exposed groups of pregnant women in relation to control group. Also it was found a statistically significant difference in the kind of therapy applied.

Studies done in the world [5,6] has shown a positive correlation between exposure and air pollution and occurrence of spontaneous abortion. Bleeding in pregnancy is a sign of the possible occurrence of spontaneous abortion. Hormonal therapy used with the aim to stop bleeding in tested pregnant women contributed to the preservation of pregnancy, and prevented possible miscarriages. The most commonly used hormonic substance was progesterone depot.

Other research suggests that some pollutants from the air can affect the intensity and flow of iron metabolism in the body, resulting in emergence of borrowers iron anemia [7,8]. The cause of anemia is the lack of iron, and it is treated by ferrous preparations per os, with mandatory monitoring pregnant woman's hematological reactions. Parenteral therapy has no advantages over oral therapy, since hemoglobin levels increase only 2-4 days later than after per os [9]. Since iron preparations are a bit harder to endure, most perinatologists suggest that this therapy, along with folic acid preparations, should be given during the second half of pregnancy [10].

Also, exposure to air pollution can cause increased blood pressure, especially systolic [11,12]. Antihypertension therapy during pregnancy usually consists of methyl dope, the medication in which after long research there have been found no harmful effects to the fetus. Other medicaments such as ACE Inhibitors, hydralazine, β blockers, are used only in sever hypertensive conditions, due to numerous side effects harming both the mother and the embryo [13].

More frequent use of therapy in exposed group may be associated with exposure to higher concentrations of pollutants from the air, but certainly that other factors (genetic predisposition, diet), that are not included in this study, contributed to the disease appears examined pregnant women indicated to implement appropriate therapy.

CONCLUSION

Our research results show that the exposure of pregnant women to air pollution has brought about more frequent therapy application during pregnancy. Manifestations that caused more frequent therapy were undoubtedly initiated by numerous integrated risk factors, and air pollution can quite clearly be one of the reasons for their occurence.

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MATHEMATICAL MODELING OF CONFLICT SITUATIONS IN ENVIRONMENTAL PROTECTION

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ABSTRACT

Any damage to any of environmental factors by human activities leads to conflict situations, because what is acceptable for the aggressor (the man) it can be very harmful for the environment and eco system in it. Therefore, the concept of optimal injury or damage in protection of people and nature is not acceptable. Among the processes of solutions selection, which are the subject of study of operational researches, special place gets those where obtained situation is a result of considering more options, that bring different profits, but also different damages in the environment. Such processes of solutions selection are called conflicts. This article gives the principles of conflicts modeling at mining impact on the environment.

Keywords: environment, conflict resolution, operations research

OPERATIONAL RESEARCHES APPLICATION ON THE CONFLICT RESOLUTION

Mathematical modeling of the conflict, which is essential of the mathematical game theory, achieves significant results in determine of minimax in the function of solution. In the framework of game theory is a marked and partially realized objective classification of conflict modeling as "game".

Relatively simple, well prepared games have the following properties:

The number of participants "players" in the conflict is two, one of them is a man, entrepreneur, or a joint-stock company, concessionaire, the second is environment, the people in it, and territorial social community, on whose territory activity takes place.

Number of strategies (effects) of each player is final and recognized.

Individual goals of players are diametrically opposed (i.e., gains and damages in the player's living environment at any outcome of the game are equal in size and opposite in sign). Games of mentioned types are interpreted by presenting the results in table, which in mathematics is called "matrix", in which the first column is the strategy of the first player (in the case of activities in living environment it represents the entrepreneur), and the first row of table is the corresponding total damage in the living environment with a corresponding probabilities, i.e. possible consequences for the territorial community. The gain (profit) that receives the first players from the other

players is equal to the number from the table (matrix) which is at the intersection of the column and row of the corresponding strategies chosen by players. In the game with matrix gains and damages, the first player by electing his i- column (strategy), may accounts to receive not less than the smallest profit gain, which belongs to this column:

$$\min_j a_{ij}$$

Interested in providing the largest profit for itself, the first player has to choose such strategy in which this minimum with deduction of damage of the living environment will be the biggest, i.e.:

$$\max_i \min_j a_{ij}$$

The first player, by electing i-row of matrix, provides itself gain in the amount of the smallest number that is contained in this row, and acting reasonable, he should choose the row with the highest minimum.

In the case when only one player can impact on the outcome of events, while the other player is without affection, the game is reduced to one person. Second player, in the aim to minimize the losses, should choose such a strategy - column, which minimizes

$$\max_i a_{ij} ,$$

And his loss is not be greater than

$$\min_j \max_i a_{ij}$$

That means that other player should select (or first, if it is about a game of one person) the column with the smallest maximum.

If both game participants act reasonable, then the gain of the first player is not less than the maximum (1) and it is not bigger than Minimax (2). If:

$$\max_i \min_j a_{ij} = \min_j \max_i a_{ij}$$

Then the gain of the first player is a full set number. The players can always provide this gain for him, but greater amount his opponent will not allow him to win. General values of two equal "Minimax"is called the value of the game.

If Minimax (1) and (2) are different, then it makes sense for players to use the random selection of their strategies x and y, in which all players is normal to attribute expected gain which is indicated with axy. And the first player than can provide gain not less than:

$$\max_x \min_y a_{xy}$$

and the other player can assure himself against loss greater than:

$$\min_y \max_x a_{xy} .$$

Reasonable player's choice and their mixed strategies (especially those which can be ordinary "clean" strategies) consist in choosing those strategies that achieves the external extremes.

The described approach to the player's behavior is called the "principle of Minimax". Minimax principle leads to a situation that has a very interesting property. If the

application of the principle of Minimax forced the player to perform a selection of (clean or mixed) strategies i^x and j^*, then the gain of the first player (or which is the same -the loss of another) will be equal to the $a_{ij,}$ for all ij should be fulfilled the un-equation:

$$a_{ij}{}^x < a_i{}^x j^* < a_i{}^x j .$$

The specified indicates that none of the players should be able to increase its gain on the account of the changes in their situation. Therefore, such strategies are called optimal, and situation balanced Finding of situation balance shows what kind of strategy players should choose and what are the consequences of such choice.

STRATEGY SELECTION FOR ENVIRONMENTAL PROTECTION IN MINING

The selection of ways and methods of mineral ores mining is treated in detail in the professional literature. Open stope mining method causes the largest endangering of the living environment in mine and even its surrounding areas. Stopes are used for the shallow layers. Underground mining of the mineral ores layers can be made by methods whose application reflect differently, with greater or less probability, on the environmental factors such as:

Stoping methods with block cutting and spontaneous or compulsory cave in and discharging of the ore, are used for stoping of the massive layers. These are methods with roof cave in where nothing is used for environmental protection, making the possibility of environment endangering very high (at massive layers, this possibility is greater than 0, 8). Endangering of living environment is similar as for open stope methods, due to the roof rocks breakdown occurrence.

For stoping methods with roof cave-in, depending of the cavity size, its depth and roof characteristics, breakdown of the roof rocks can occur and damage the terrain, object above layer, and also underground and surface waters. By investing in adequate way of roof management probability of living environment endangering could be decreased, and it could in range from 0, 5 to 0, and 8. Probability of living environment endangering can be very different (from 0, 2 to 0, and 8). Stoping methods with open stopes and protective pillars for roof protection from cave-in. Protective pillars of unstoped ore being left is a price of living environment protection, but, depending of rock's strength and stope depth, occurrence of roof cave-in is possible, making the probability of living environment at application of these stoping methods to be in the range of 0, 2 to 0, 5.

Stoping methods with subsequent stope fillings, by selection of stowage material of suitable strength and tightness to avoid roof deformations, are expensive stoping methods but by their application leads to avoiding of living environment endangering. Price for environmental protection is the production, transportation, and stowage installation. Probability and endangering the living environment at the application of these methods may be less than 0.2.

Depending on the selected stoping methods by entrepreneurs or designers (first player) and its endangering of living environment, it is possible to determine the damages in the environment, which, if the contractor does not invest in their elimination, are damages for the environment and territorial community (and other player). On the basis of these data may be defined by a simple matrix of the game, in

which the first player is the designer or contractor, the decision maker on the selection of mining methods and investment in the environmental protection and the other player is the environment or territorial communities of people in the area. They may by law, or the granting of concessions, to obligate an entrepreneur, which means to elect or to impose the alternative. Alternative cost matrix and damage is given in Table 1.

Table 1. Alternative cost matrix and damage in living environment

Options in choosing groups of underground stoping methods and amount of investments in living environment protection	Category, probabilities and damage values in living environment (second column in categories for damage probabilities)			
	I < 0,1 b_0	II 0,2 b_1	III 0,5 b_2	IV 0,8 b_3
1. with blocks a_1	0_1:0	0 :1	0 :2	0 :3
2. with cave-in a_2	1:0	1 :1	1 :2	1 :3
3. with pillars a_3	2:0	2 :1	2 ;2	2 :3
4. with fillings a_4	3:0	3 :1	3 :2	3 :3

A strategy for environmental protection from mining will be defined as the set of alternatives that a designer or contractor has in disposal when making decisions about the exploitation of a mineral ore layer. Depending on the value, depth and geometry of layer, the designer can make decisions (choose alternatives) on the way of mining in terms of profit and investment in the protection of the environment or the payment of community damage. The set of alternatives that a designer can choose are marked with A; A= (a_0, a_1, a_2, .a_m). Set of danger and damages exposition on environmental factors in dependence of exposition probability is marked with B; B = (b_0, b_1, b_2, b_m).

The strategy may be accounted or rigorously determined, and so each illogical decision excluded. Choosing these arguments, which are under the control of the projects (entrepreneurs) depend on the assessment, its logic and reasoning and experience. In this way, it is possible to adopt a strategy in relation to the estimated or actual way of manifesting of danger to the environment, be it dominant or not. The result of efficiency or dominance of particular strategy is learned only when the exploitation of layer or part of the layer , for which a project is designed, is completed or when the damage in living environment occurs , so the company must compensate the damage, but on the damage volume can not be affected.

For the strategy that was chosen, is said to be the zero-sum game price, if at the end of the game player who win the game, is equal to a loss value of player who lost the game. The value of gain is equal to the risk. None of the players can fully, but only partial, affect on the outcome of events. In the case when only one of the players can impact on the outcome of events (designer), while the other player is without affecting on the game, such game is reduced on one-player game. If the designer of stoping methods has a number of alternatives, which are indicated with A (a_0 , a_1 , a_2 , … a_n) with resulting investing in security, for safety and environmental protection (0 , 1 , 2 ,3) C(a). Then we can look for the optimal alternative a_i making C (a_i) > C (a_i) for all values of a_i.

Territorial community, the other player in the concession agreement, sets the requirements (and will issued the account for the damage) in terms of risk to the environment, and shall run its alternative.

If both players have selected the optimal alternatives, then the price for the first player is C (a_i; b_j), and for the second player is C ′(a_i; b_j), where:

$$C(ai; b_j) = - C'(a_i; b_j)$$

Among the profit of the selected alternative for layer stoping, which can be expressed in (din/t) or in cumulative (din), for mined ore quantity (values 0, 1, 2, 3, are nominal values of investments in protection a_i) and damage values in living environment b_j (if optimal alternative is not chosen), there is a difference (R): $R = (a_i - b_j)$.

It represents savings on the protection of the environment or risk to which is strategy selection executed. Value of damage which would be created due to damage on environmental factors can be greater than risk (already the biggest), if possibility of its occurrence is great.

Matrix of strategy of safety prices and risk on living environment with conditional values R_I ($a_i - b_j$); (a_i = 0, 1, 2, 3) and (bj = 0 - 1 - 2 -3) are given in Table 2.

Table 2. Matrix of prices groups for safety and risk

a_i / b_j	b_0	b_1	b_2	b_3
a_0=0	0	-1	-2	-3
a_1=1	1	0	-1	-2
a_2=2	2	1	0	-1
a_3=3	3	2	1	0

If there is small probability that at layer exploitation by any of mentioned methods occurs endangering of living environment b_j=0, than it is logical that risk is R=0, which means that for designer (or entrepreneur) reply is a_i=a_0, which means alternative with the smallest investment in living environment protection and possible the greatest gain. When possibility of living environment endangering exist $b_i > 0$, 1 than the application of some alternative will lead to the living environment endangering. In that case, designer can chose alternative (strategies) a1; a_2; a_3. If strategy a_2 (price for investments in other groups) is selected, and probability if danger occurrence b_1, than designer is estimated possible environmental damages and invested more (2), and gain (1). If the risk is manifested with b2, then the selected strategy is with a zero value, making that an optimal strategy.

If the risk of underground layer's exploitation is manifested with danger possibility b_3 , than selected alternative a_2 brings risk which price group is R= (2 - 3) = -1. The appearance of risk to the environment shows that the selected alternative is risky. Is it worth risking depends of if damage (damage payment) on living environment and objects endangering would be smaller or bigger than risk. If the damage would be less than the risk, then the entrepreneur gain profit from the risk. But, when the living environment is in question, than for the people living on mine territory, for the community, that damage is irreparable, so any risk is impermissible, which means that the damage must be multiply charged, making that entrepreneur has no interest to risk.

LINEAR PROGRAMMING APPLICATION FOR THE STRATEGY SELECTION

Together with ways of danger expressions b_j could be joined probabilities of their frequencies $q_i > 0$, known from experience (for example: if in Z mine of some mining company, zero, first, second and third way of danger manifestation appear z_0 ; z_1; z_2 ;z_3 times, and : $q_0 = z_0/Z$; $q_1= z_1/Z$; $q_2= z_2/Z$; $q_3 = z_3/Z$, than n-dimensional vector Q (q_0, q_1, q_2, q_3) can be determined, layout of appearance probability, where is $\Sigma q_i=1$. The frequency of designer choice of individual strategies, (protection system), so it can be represented with m - dimensional vector P = (p_0; p_1; p_2; … p_m), where is $p_i > 0$, and $\Sigma p_i = 1$.

Strategy price (i=0; 1; 2… m) is than given with C (pQ) =$\Sigma p_i q_i a_{ij}$. The expression shows that there are optimal strategies $P_x q_x$ such as that:

C(Pxqx) =min max C(PQ) =max min C′(PQ).
P Q Q P

Choosing a strategy may be in the form of a procedure, and can be a series of procedures, with new information at each new step. The procedure of strategy selection which means protection system is made on the basis of the matrix given in Table 3.3.10. Represents normal form of simple matrix game, and positional and dynamic game will include the new information at each subsequent step (for example: change of the law on the environmental protection or market value of mineral ores).

The choice of strategy by the matrix can be transformed into a linear programming problem. The general formula of linear programming task, which is the most suitable for this purpose, consists of the following: to minimize or maximize the objective function, strategy:

$$F(x) = C_1x_1+C_2x_2+ \quad C_nx_n,$$

$A_{ij}=R > 0$ the respective restrictions, inequalities given by columns, with elements aij

$$a_{11}x_1\_a_{12}x_2+ \quad a_{1n}x_n>b_1$$
$$a_{21}x1+a_{22}x_2+ \quad a_{2n}x_n>b_2$$
$$a_{m1}x_1+a_{m2}x_2+ \quad a_{mn}x_n>b_n$$

It is always possible to find such constant value d which would, when it is added to each matrix element, give new matrix having all positive elements. At the same time matrix structure remains unchanged but its value varies for a constant size d compared to the original. Pair of optimal strategies in the original matrix is the same as a pair of optimal strategies in the new matrix.

If P=(p_0, p_1 .. p_m) is optimal designer's strategy, Than for any pure strategy, depending of manifestation of danger probability on living environment, which is marked by price b_j,, is relevant known relation:

$$C (p^v bj) >V,$$

Where is: V-variant value (j=0, 1, 2, n)

The developed relation with inequalities obtained by columns is:

$$a_{11}p_1+a_{21}p_2+ \ldots \quad +a_{m1}p_m>V$$
$$a_{12}p_1+a_{22}p_2+ \ldots \quad +a_{m2}p_m>V$$

$a_{1n}p_1+a_{2n}p_2+ \ldots \quad +a_{mn}p_m>V$

Based on these relations solutions p_1; p2; pm can be obtained, and given system of inequalities could be expressed as:

$a_{11}p_1/V+a_{21}p_2/V+ \ a_{m1}p_m/V>1$
$a_{12}p_1/V+a_{22}p_2/V+ \ a_{m2}p_m/V>1$
$a_{1n}p_1/V+a_{2n}p_2/V+ \ a_{mn}p_m/V>1$
$x_i=p_i/V \ , \ i=(1 \ 2 \ m)$

Since the $p_1+p_2+p_m=1$, x_1+x_2+ xm = 1/V is obtained.

Designer wishes to choose that set of values ($p_1 \ p_2 \ \ldots \ p_m$) and V (variant value) which would satisfy previous inequalities on p_i, while V to be less. This is identical to the claim that designer wishes to determine set of values ($x_1;x_2;x_m$) which satisfy the set of inequalities given by the columns of matrix 1.

$a_{11}x_1+a_{21}x_2+ \quad a_{m1}x_m>1$
$a_{12}x_1+a_{22}x_2+ \quad a_{m2}x_m>1$
$a_{1n}x_1+a_{2n}x_2+ \quad a_{mn}x_m>1$

Inequalities provide that $F(x) =1/V=x_1+x_2+ \quad x_m$ obtain maximal value. In given example it is possible to form four inequalities with four unknown x_i, whose solution is easy to find using a computer.

Based on the analysis of possible influence of particular underground mining methods on the living environment factors, can be determined amount of damages and possibilities of their occurrence. Territorial communities in the mine areas are interested in preservation of ecological factors of living environment, and will require multiple amounts for compensation. Therefore, the entrepreneur has to choose the layer's stoping method with the lower risk for the environment. Selecting the stoping method that in itself includes the environmental protection, reduce the risk to the environment. Including the environmental protection reduces profit but also a risk from damages which could highly exceed the protection price.

CONCLUSION

When environmental protection is in question than it is unacceptable to turn the damage risk in living environment into a profit for entrepreneur or confessor, because damages could not be noticed immediately but after many years, but even when mine is already closed.

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WATER RESOURCES, PROTECTION AND FINANCING

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ABSTRACT

Water management is an organized activity of the water which proves the protection against harmful effects of water, planned utilization of water resources and their adequate protection. Water management includes all economic activities, also.

Activities comprise the field, according the Water Law ("Official Gazette RS" No 46/91).

- Water use
- Protection against water
- Water protection
- Financing
- Supervision

Keywords: Water management, financing

INTRODUCTION

The Water Law (Official Gazette of the Republic of Serbia N^{o} 46/91). regulate the water protection, protection from the floods, the exploitation of the water and the water management.

Theme of this paper has to show the relations of issue of water management agreements and financing facilities and objects, among other documents as defined by the Water law and regulations which regulates allocation of financial resources.

First of all, we have to clarify the way that investors have to prepare needed documents to be submitted in the process of issuing water management regulations. The Water Law (Official Gazette of the Republic of Serbia N^{o} 46/91). regulate the water protection, protection from the floods, the exploitation of the water and the water management. (In the meantime, The New Water Law is in the process of its adoption).

In the legal framework, for the objects that in some way affects the water regime, qualitatively or quantitatively, it is necessary to avoid any disruption of the natural regime, and if it does, the impact have to be minimized.

WATER DOCUMENTS

Before any usage, investors have to fulfill the preconditions issued by the Ministry of Agriculture, Forestry and Water, Republic directorate for Water, and mast respect the following procedure:

1. Provision of Water management conditions for the preparation of technical documentation (for abstraction of water, water transportation, using, treatment, discharging,…) with respect to be evidenced in Urban Planning documents for the relevant activities that are planned, which also should be in accordance with Master plan of water management of Serbia (Official Gazette RS No 11/02).

Technical documentation has to be done at the level of Main Project with the technical control done by another relevant project office.

Water management agreement, **which in fact represents the core document in this issue related to the financing of appropriate facilities**, can be given to the technical documentation.

Water Management agreement confirms that the technical documentation prepared in accordance with the water conditions, and is therefore very important to know that the technical solutions given in the technical documentation must be seriously dealt with measures that are precisely defined.

Water management permit is issued for use and use water from natural and artificial watercourses, lakes and ground water, discharge water and other substances in natural and artificial watercourses, lakes, ground water and public sewers, increasing the amount of affected and discharged water, changed the nature and quality of discharged water.

Water management agreement

As we noted in this paper, the document which we stress is Water management agreement.

Water management agreement grantee approval to water management issues on the technical documentation that is adopted for the construction of the relevant facility and that the technical documentation is done at the level of the main project with the makings adopted precisely defining objects that affect the water regime.

For example, the abstraction of water for industrial facilities, as defined Art.15. p.4. it is necessary to show the abstraction of water sources (groundwater, surface water, public water supply ..) method of abstraction, the abstraction of quantity, water transportation, the length of the transport-pipeline, for which purpose the procedure, the possible need for preparation of water for specified purposes (whether drinking water, technical water, ..).

Figure 1.

Second example (fig. 2.) is Waste Water treatment. Project for Waste Water treatment have to define capacity of treatment plant, water quality which have to be treated, to guarantee quality of water after treatment, the final recipient,…

Figure 2. Waste Water Treatment in Subotica

FINANCING

Ministry of Agriculture, Forestry and Water Management – Republic Directorate for Water, based on the annual Program for construction, reconstruction and maintenance of water management facilities, finance the works on construction, reconstruction and maintenance of water management facilities, such as:

- multipurpose dams and reservoirs,

- water supply systems (water intake, pumping stations, tanks for water supply, the pipeline facilities, facilities for preparation of drinking water),
- systems for collecting, removal and treatment of waste water (main collectors for waste water which will waste water transfer to waste water facilities, waste water facilities and objects which will transfer refined water),
- facilities to protect against the harmful effects of water…

As already mentioned, all water management facilities must have the appropriate technical documentation (main project) for which is issued adequate **Water management agreement**

Of course, these objects must have approval for the construction or building permit, issued by the competent authority. Only such objects may participate in financing from the Republic.

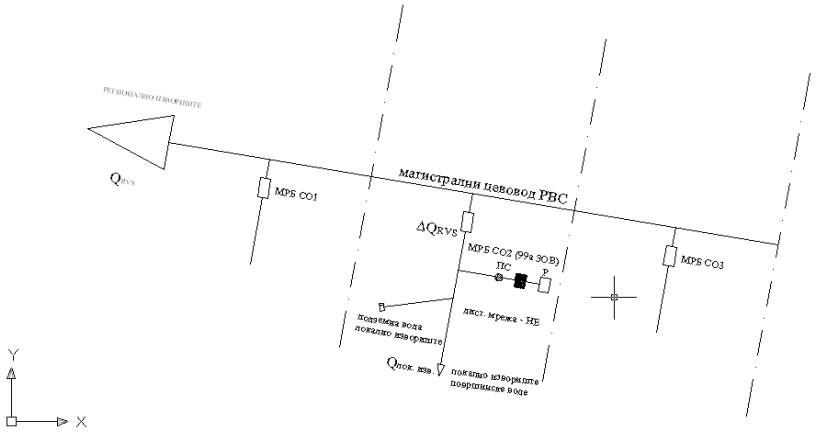

Figure 3. Regional water management system

Also, the Ministry of Agriculture, Forestry and Water Management - Republic Directorate for Water, as part of an annual program of construction, reconstruction and maintenance of water management facilities finance further projects:

General Project, Preliminary Project and Main Design Projects for the items which are covered by the area of water supply, water protection, protection of water, projects that have aimed at solving problems with water supply, as well as resolving problems of waste water.

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THE MOST COMMON DISEASES ON TREES IN MUNICIPAL GARDEN IN VRŠAC

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ABSTRACT

Over the last few years the investigation of pathogenic changes in the trees in the garden in Vrsac municipality which has found that the majority of horse chestnuts was attacked by Guignardia blotch (Guignardia aesculi) and Inonotus hispidus (Fr.) Karst, the most maples and Tulip Trees have been infected by Verticillium wilt (Verticillium albo-atrum) and birches and firs by „honey fungus" (Armillaria mellea). In this paper is analised these three dangerous diseases which occur on urban greenery in this region.

Keywords: Guignardia, Verticilliym-albo atrum, „honey fungus"

INTRODUCTION

The Municipal Garden in Vršac is one of only a few preserved historical public gardens in Serbia, built in a mixed style, which was a characteristic feature of Europe in 18th century. This garden embraces some important representatives of rare trees and bushes that, with the course of time, have reached the imposing proportions and age. During the field investigations, in the period from March to September 2008, 107 plant species were identified and divided into 4 large groups: plants with a form of trees and bushes, vines and herbaceous plants [1].

Among 107 identified species there are 54 in living forms of trees. These trees are infected by numerous plant diseases, about 90 species of fungus have been determined [2].

MATERIAL AND METHODS

Carpophores, leaves and other material were collected and observed throughout this study. All available printed materials were collected and unexplored.

RESULTS AND DISCUSSION

The most frequently diseases on trees in Municipal garden in Vršac, which are also the most dangerous are Guignardia blotch, Verticillium wilt, "honey fungus" and Inonotus decomposition.

Guignardia aesculi (Peck) Stewart

Guignardia blotch occurs on horse chestnut trees and results in large, brown blotches appearing on the upper leaf surface at the leaf margins. On the infected areas also appear small black spots-pycnidia. When the lesions merged together the results are the leaves curling upwards.

Spores are released in mid spring and are dispersed to growing leaves mainly by water splash. The reddish-brown blotches appear 10-20 days after infection and the pycnidia appear from June onwards. Fallen leaves should be collected and removed from the area to reduce the amount of inoculums available for the following spring [3].

Fungicide application must begin as buds open to protect leaves from extensive primary infections. If there are extended periods of cold and wet in early summer weather then repeated additional treatments will be necessary to control the secondary infection cycle. Gugnardia blotch causes little harm to the health of vigorous trees but it decreases aesthetic value of town's greenery.

Figure 1. A chestnut alley in Municipal garden in Vršac (Štrbac O.2000)

Verticillium albo-atrum Reinke et Berthol

Verticillium albo-atrum was found to be the cause of a lethal xylem infection of maples and Tulip Trees. Symptoms of this serious pathogen are browning of the vascular tissue and wilting of the entire plant. Most of the xylem of wilting plants showed brownish discoloration from below the ground into the small, leaf-bearing twigs, suggesting that a systemic infection may have responsible for the mortality. The disease spread through the ground using root injuries. Due the lack of effective fungicides, the

only way of reduction the disease is planting resistant varieties of trees [4]. Unfortunately, the most significant and precious species are also the most vulnerable.

Figure 2. An air view on parterre with geometric shaped flower plots (Lazarević D. 2000)

Armillaria mellea (Vahl. Ex Fr.) Karst

Armillaria mellea is „honey fungus" or "boot lace fungus" after the boot-lace-like threads that are found in the soil and which means it can travel incredible distances to strike at perfectly healthy specimens without warning [5]. This root-infecting hymenomycete has ability to remain in a saprotrophic stage within woody material in the soil, before attacking new host trees through rhizomorph production, or when the root systems of the trees contact the colonised material.

Honey fungus is called a secondary organism because it usually attacks stressed trees. Among some species it also can attack and kill healthy trees.

The most successive technique for controlling this fungal infection of trees is the use of resistant selections. Till then, a sensitive plant species in Municipal garden in Vršac, such as birches will disappear.

Figure 3. A Plane Tree in Municipal garden in Vršac (Štrbac O.2003)

Inonotus hispidus (Bull.) P. Karst.

This fungus occurs on different angiosperms, oaks, Pagoda Trees, maples, horse chestnut, Plane Trees and others. Infections penetrate trough injuries and causes white coloured wood decomposition. At the first phase of this process white or yellow blotches are occur rimmed with brown. The manifestation of the last stage of decomposition is sponged woody substance. It is a very serious problem when the tree is large and old and could be unsafe and source of infection.

Figure 4. A White Oak in Municipal garden in Vršac (Štrbac O.2003)

CONCLUSION

The Municipal Garden in Vršac has lost a significant part of its former beauty and attractiveness. Trees are old and physiologically weakened. In addition, in the period between 1999 and 2001, the phenomenon of drastic drying of conifers was observed and reported, as well as a mass occurrence of pests and plant diseases as the „parasites of weakness". Many rare plants were lost during that period. In October 2001, the sanitary cut of completely dry and rotten trees was performed [1]. The most common disease are at the same time the most dangerous ones and effective measures still doesn't exist in our country.

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QUALITY MONITORING OF NISAVA RIVER IN the REGION OF NIS

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ABSTRACT

Nis Waterworks laboratory performs systematic sanitary-hygienic status monitoring of the water of Nisava river, with a special emphasis on water quality in Mediana water catchment area, where a plant for water treatment, based on slow infiltration, is located and supplies the city of Nis with water.

Results of the physical-chemical and microbiological analysis of the river water sampled at two checkpoints during 2009 were shown. The results point out that water river quality is deteriorating after waste waters inflows, especially from a microbiological aspect. This situation emphasizes the need to dedicate special attention to this river with an aim of preserving its natural water quality.

Keywords: river Nisava, city of Nis, quality monitoring

INTRODUCTION

River Nisava springs in neighboring Bulgaria, on Old mountain, below Kom peak. With its flow from the state border to Nis, in lenght of 144 km, it represents an important hidrological artery of Ponisavlje region. It passes through Dimitrovgrad, Pirot, Bela Palanka, Niska Banja and Nis. After about 10 km of passing through Nis, it flows into South Morava river. The surface area of the river basin is approximately 4000 km^2. River basin of Nisava is in a highland-mountainous region, with a continental and mountainous climate [1]. On its water current, Nisava receives a great number of trubutaries and streams. According to cadastre it has in total 87 tributaries (Jerma, Temstica, Gradasnicka river, Mokranjska, Malcanska, Kutinska, Knezselska, Gabrovacka and others) and flooded streams. According to the norms of the Decision of water classification (Official Journal of SR Serbia 5/68) it is classified into 2nd class during its entire water current from bulgarian border up to the mouth to South Morava, and from the mouth of river Temstica to Nis falls into the 2nd class of water currents [2].

City of Nis, as the largest urban centre of Ponisavlje was forced first to orient itself to Nisava as a spring. Today Nisava has special importance, because it provides fresh water to the city. Namely, in line with its objective to provide a long-term and optimal exploatation of the only spring of underground water Mediana, a system for artificial groundwater was built through the plant for pretreatment and preparation of river water. The desired quality for pouring into underground, where additional treatment

is taking place under anaerobic conditions of up to 40 days, is achieved using coagulation, sedimentation and filtration. Then, it reaches two stations by a system of pipes and pumps where water is being chlorinated and distributed to consumers, after all the criteria of hygienic suitability have been satisfied.

According to the Cadastre of pollutants from the end of the eighties and the begining of the nineties, 38 pollutants were registred in the upstream river basin of Nisava. Although factories are not in operation or operate with reduced capacity, along with autopurification strenght of the river, level of pollution, content of some pollutants and water quality change are important elements for succesful treatment of river water to drinking water quality.

Degradation of water quality of Nisava river begins before flowing into South Morava, because all types of municipal waste waters of Nis are released untreated directly or by sewage by two main outlets into the river.

The aim of this paper is to present the quality of the water of river Nisava on Mediana spring at the altitude of Mediana water catchment area with an emphasis on water quality degradation following inflows of waste waters. In order to observe the quality of Nisava water, the data collected during 2009 were statistically processed and presented**.**

MATERIALS AND METHODS

Sanitary control sector laboratories of Public Utility Company Naissus perform everyday sistematic water quality monitoring of river Nisava in Mediana water catchment area on many physical-chemical and microbiological parameters. Sampling is carried out according to the yearly Sampling plan and programme of the Department of Hygiene with Humane Ecology and in accordance with the Instructions on sampling of surface water based on the guidlines for Water Quality Sampling - Part 6: Guidance on sampling of rivers and streams (JUS ISO 5667-6). Samples are taken at about 2 m from the bank and at depth of 30 - 50 cm. Water and air temperatures are measured *in situ*.

Laboratory documentation shows the status of the sanitary condition of the control point Mediana on the basis of following parameters:

1. On a daily basis: water temperature, visible colour, turbidity, pH value, electrical conductivity, dissolved oxugen, oxygen saturation, biochemical oxygen demand, free carbon dioxide, potassium permanganate consuption, ammonia, nitrate, nitrite, chloride, sulfate, orto and total phosphates, total hardness, potassium, magnesium, alkalinity, suspended matter, iron, manganese, trivalent and hexavalent chromium, aluminium, anionic surfactants, phenols and series of eaisily volatile organohalogen compounds (chloroform, dichlorbrommethane, dibromchlormethane, bromoform, 1,1,1-trichloroethane, carbontetrachloride, trichloroethylene and tetrachloroethylene).
2. Additional physical-chemical parameters, on a monthly basis: Kjeldahl nitrogen, chemical oxygen demand, sulfides, cyanides, fluorides, silica, seattable matter, total oil and grease, sodium, potassium, mercury, zinc, copper, lead and cadmium.
3. Microbiological parameters: total number of aerobic vital bacteria in 1 ml TCV (at 22°C and 37°C), total coliforms (MPN-TC/1000 ml), fecal coliforms (MPN-FC/1000 ml), fecal streptococcus (MPN-SF/1000 ml), sporogen sulphite reducing anaerobic

bacillus (SSA/1000 ml), proteus species (MPN-Pv/1000 ml) and pseudomonas aeruginosa (MPN-PA/1000 ml).

Once a month, the scope of analysis is increased and the quality of Nisava at about 150 m downstream from left main wastewater outlet is examined, in the mixing zone with wastewater before flowing into South Morava.

Quality appraisal is performed based on current legislation: Decision of water classification (Official Journal of SR Serbia 5/68), Regulation of water classification (Official Journal of SR Serbia 6/78), Code of hazardous matters in water (Official Journal of SR Serbia 31/82) and Decision of maximaly allowed concentrations of radionucleides and hazardous matter (Official Journal of SFRJ 8/78).

Quality of river Nisava is represented by the advanced numerical system Water Quality Index on which basis selected physical-chemical and microbiological parameters are grouped into one composite indicator of surface water quality. The grouped sampled data were yearly averaged and then employed to create WQI for the observed period.

RESULTS AND DISCUSSION

Results of physical-chemical analysis

Comparing the average concentrations of the individual parameters of the two mentioned measuring profiles, the following could be inferred:

Water of river Nisava is slightly alkaline. Measured values range from 7,75 to 8,24 on both profiles. Electrical conductivity values range from 300 to 470 on the watercapture and 340 to 640 μS/cm after wastewater discharge.

Mineralization of water, dry residue of filtered water, amounts 270 mg/l on water catchment up to 370 mg/l downsteram. It belongs to middle hard waters, and total hardness values range from 9,60 to 13,60 °dH.

A variation in suspended matter content was observed, the most frequent one being during rainy periods from flooded deposits, by rinsing out river basin area. According to suspended matter values in the water catchment area exceeded 2nd class values in 9,1% of the examined samples, and on downstream in 66,7%.

According to amonnia salts, nitrates and nitrites concentrations, Nisava in the water catchment area does not exceed regulated values, and amonnia ion for 2nd class is detected in less than 1% of samples. After the inlfow of waste waters, the situation changes, so high concentrations of nitrites and amonnia ion are present in a great number of samples. Nitrite nitrogen values ranges from 0,01 to 1,5 mg/l, and amonnia ion ranges from 0,05 to 15 mg/l.

Total nitrogen concentrations ranges from 0,02 to 0,5 mg/l at water catchment and from 0,27 to 14,5 mg/l at downstream.

Phosphates are followed by analysis on orto and total phophorus. Ortophosphates in the water catchment area has been found trace to 0,220 with average concentration of 0,060 mg/l, and total phosphorus ranges from trace to 0,560 with average concentration of 0,110 mg/l. In downstream water, after the inflow of waste waters, concentrations are increased, so the quantity of ortophosphates ranges from 0.020 to 2.470, with average value of 0.310 and total phosphorus ranges from 0.020 to 2.490 mg/l, with average value of 0.440 mg/l.

Among ions, sulfate are present with maximal recorded value of 52,6 mg/l in the water catchment area and 51,2 mg/l downstream, followed by low concentrations of chlorides and silica. Among kations, calcium is dominant, lesser followed by magnesium, potassium and sodium.

Dissolved oxygen concentrations, even during rainless periods, were not lower than 6,47 mg/l in Mediana water catchment area, while concentration of 4,0 mg/l was recorded downstream.

According to biochemical oxygen consumption values, it is concluded that river water in the water catchment area was not charged with organic content (BOD_5 values ranges from 1,00 to 2,48 mg/l O_2), what shows that water is classified to I-II class at this checkpoint. Higher BOD_5 values than 12,56 mg/l O_2 are obtained downstream.

COD values from potassium permanganate and potassium dichromate haven't exceeded 8.7 mg O_2/l i 3.9 mg O_2/l respectively for samples in the water catchment area. The situation is much different in the downstream river samples. COD values from potassium permanganate are relatively low compared to COD values from potassium dichromate which range from 10 to 150 mg/l. It is evident that the river is charged with organic content that originates from waste waters, because COD values from potassium dichromate as a strong oxidant are more reliable regarding real quantity of oxygen for organic matter decomposition. It was noticed that the relationship between COD and BOD was often larger than 2, which indicates that river water at downstream checkpoint does not have satisfying decomposition of organic matter which uses oxygen for its decomposition.

The average content of manganese at both checkpoints is 0.001 mg/l, and iron concentration exceeded the nominal value in only 4,1% of samples at Mediana checkpoint. Other heavy metals (Cu, Cd, Pb, Zn, Hg, Al i Ni) were not detected, except ocassionaly present concentrations of copper and zinc at micro levels.

Measured values of organic micropollutants (phenols, anionic surfactants and total oil and grease) at water catchment were extremly low and very near to limits of detection of methods. Easily volatile organohalogen compounds were not detected.

Phenol concentration in river water downstream ranges from 0.020 mg/l, total oil and grease ranges up to 20 mg/l, and anionic surfactants ranges up to 3,250 mg/l. Certain detected concentration of organohalogen compounds is originated from waste water.

Taking into account the mentioned physical-chemical parameters of river Nisava in the water catchment Mediana, it is obvious that there is not a particular variation in quality, except occasionally present suspended matter. Values of the other examined parameters are far below maximum acceptable concentrations (MAC) for 2nd class of water.

Results of microbiological analysis

Results of microbiological analysis during 2009 show that the most likely number of total coliform bacteria (MPN-TC/1000ml) and fecal coliform bacteria (MPN-FC/1000ml) amounted to 240000 (during winter months) or >240000 during the rest of the year. Escherichia coli, Enterobacter sp and Citrobacter sp are proven most often. Values of Fecal Streptococus (MPN-SF/1000ml) are identical with the previous ones, except during winter months, following 38000 in February and above 240000 during January and March. Number of Sulfite reducing clostridia (SSA/1000ml) ranges from 200 to 185000, and Pseudomonas aeruginosa (MPN-PA/1000ml) values and Proteus species (MPN-Pv/1000ml) values are

higher than 2000 in all of the examined samples. Given that the classification of river water on the basis of microbiological parameters is only carried out in terms of the most likely number of coliforms, river Nisava at water catchment Mediana is classified as 4th class considering that the proven values are above maximal 200000 for 3rd class.

Degradation of river water based on microbiological analysis is evident after city waste water outlet inflow regarding that the values of all microbiological parameters are ten times higher during all year regardless of it is still 4th class river (table 1). This statment is in accordance with above mentioned results for COD and BOD which points out to weak autopurification capability of the river and it points to the need of treatment plant construction for waste water treatment before flowing into the river.

Water Quality Index

Water quality index represents unsigned number, from 1 to 100, established as mathematical tool for reduction of large number of data into simple form. The on-line calculator of Wilkes University, Center for Environmental Quality which includes 9 parameters of quality is used in WQI calculation [3]. Nine selected parameters (oxygen saturation, fecal coliform, pH value, BOD, temperature change, total phosphorus, nitrates, turbidity and total solids) with its quality q_i represent characteristic of surface water reducing them to one index number. Each parameter has an appropriate weight w_i and the number of points according to contribution in quality reduction. By summarizing the products $q_i \cdot w_i$ index 100 is created, as ideal 100, in regard to maximal sum of quality portions of all parameters (table 2).

Table 1. Microbiological quality parameters

date	sample	MPN-TC/1000ml	MPN-FC/1000ml	MPN-SF/1000ml	class
29.01.09.	Nisava	240 000 E.coli	240 000 E.coli	> 240 000	IV
29.01.09.	NN*	2 400 000 E.coli, Esch.sp	2 400 000 E.coli, Esch.sp	> 2 400 000	IV
26.02.09.	Nisava	240 000 E.coli	240 000 E.coli	38 000	IV
26.02.09.	NN*	380 000 E.coli	380 000 E.coli	380 000	IV
26.03.09.	Nisava	240 000 E.coli, Enterob.sp	240 000 E.coli, Enterob.sp	> 240 000	IV
26.03.09.	NN*	> 2 400 000 E.coli, Enterob.sp	> 2 400 000 E.coli, Enterob.sp	> 2 400 000	IV
23.04.09.	Nisava	> 240 000 E.coli	> 240 000 E.coli	240 000	IV
23.04.09.	NN*	> 2 400 000 E.coli	> 2 400 000 E.coli	> 2 400 000	IV
28.05.09.	Nisava	240 000 E.coli	240 000 E.coli	240 000	IV
28.05.09.	NN*	> 2 400 000 E.coli,Esch.sp.,Enterob.sp	> 2 400 000 E.coli	2 400 000	IV
25.06.09.	Nisava	240 000 E.coli	240 000 E.coli	> 240 000	IV
25.06.09.	NN*	> 2 400 000 E.coli	> 2 400 000 E.coli	> 2 400 000	IV
30.07.09.	Nisava	240 000 E.coli, Esch.sp.	240 000 E.coli	240 000	IV
30.07.09.	NN*	> 2 400 000 E.coli	> 2 400 000 E.coli	> 2 400 000	IV
27.08.09.	Nisava	> 240 000 E.coli	> 240 000 E.coli	> 240 000	IV
27.08.09.	NN*	2 400 000 E.coli	2 400 000 E.coli	> 2 400 000	IV
24.09.09.	Nisava	240 000 E.coli, Esch.sp., Enterobac.sp.	240 000 E.coli, Esch.sp., Enterobac.sp.	240 000	IV
24.09.09.	NN*	> 2 400 000 E.coli, Enterob.sp.	2 400 000 E.coli	> 2 400 000	IV
29.10.09.	Nisava	> 240 000 E.coli	> 240 000 E.coli	> 240 000	IV
29.10.09.	NN*	>2 400000 E.coli, Ent.sp.,Citrobacter sp.	>2 400 000 E.coli,Ent.sp.,Citrobacter sp.	> 2 400 000	IV
26.11.09.	Nisava	> 240 000 E.coli	> 240 000 E.coli	> 240 000	IV
26.11.09.	NN*	> 2 400 000 E.coli, Enterob.sp	> 2 400 000 E.coli, Enterob.sp	> 2 400 000	IV
24.12.09.	Nisava	> 240 000 E.col, Esch.sp.	> 240 000 E.coli, Esch.sp.	> 240 000	IV
24.12.09.	NN*	2 400 000 E.coli, Esch.sp.	2 400 000 E.coli, Esch.sp.	2 400 000	IV

*Nisava downstream of left outlet waste water discharge

Table2. Water Quality Index

Parameter	Nisava at water catchment Mediana	Nisava downstream of left outlet discharge	$q_i \cdot w_i$
Oxygen saturation	97.2 %	82 %	17
Fecal Coliform	240000	2400000	16
pH	7.90	8.01	11
BOD	1.7 mg/l	5.3 mg/l	11
Temperature change	0	0.2	10
Total phosphates, P	0.110 mg/l	0.440 mg/l	10
Nitrate, N	1.53 mg/l	1.73 mg/l	10
Turbidity	13.0 NTU	14.5 NTU	8
Total suspended solids	15 mg/l	145 mg/l	7
	$\Sigma q_i \cdot w_i$ =WQI		100
	WQI = 76	WQI = 67	
	Quality rating = Good	Quality rating = Medium	

CONCLUSION

Based on physical-chemical results of analysis, it can be concluded that Nisava river at Mediana water catchment belongs to 2nd class in more than 95% of examined samples by almost all parameters, except for the occasionaly present suspended matter. It is not charged with organic content, neither with toxic nature organic substances which would reduce autopurification ability of the river or with hardly decomposable synthetic matter. Results of the analysis show mostly presence of mainly inorganic substances originating from the soil of the river basin and represent natural quality of water. Nevertheless, there is a disagreement with microbiological characteristics, what shows that there is a continuous municipal pollution. Based on water quality index, river Nisava shows descriptive indicator good.

Based on water analysis at downstream checkpoints, fall of integrity is evident and even 45% of examined samples can not be classified by physical-chemical characteristics, mostly because of unpleasant odor, suspended matter and excessive concentartions of amonnia and nitrites, and high content of organic matter is present associated with extremly high number of fecal Coliform bacteria. The situation gets worse during summer months, in bad hydrological conditions, when water level falls multiple times. It is clear that this state of the water downstream is unsustainable and that waste water treatment solution is necessary as a problem logically intruded to one urban region as city of Nis is.

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STRUCTURAL AND ELECTROCHEMICAL CHARACTERIZATION OF AU-IN-SB ECO ALLOYS

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ABSTRACT

Alloys from ternary system Au-In-Sb are one of the potecijalnih material, which can be used in electrical engineering, like new, ecological lead-free solder. For this reason it is necessary to understand the different characteristics of these alloys. This paper presents results of structural and electrochemical characterization of some alloys from Au-In-Sb system. The following tests was performed: DTA analysis, optical microscopy, SEM-EDX analysis, hardness and micro hardness measurements, cyclic voltammetry and electrical conductivity measurements.

Keywords: Au-In-Sb, structural characterization, electrochemical characterization

INTRODUCTION

World electronic industry is using large amounts of lead-based solders. However, because of its high toxicity, lead is a threat to the environment. At the beginning of the last decade of the century, the U.S. Congress has launched an initiative to replace lead with other, less harmful metals [1]. In Europe and Japan, this idea was not only accepted, but also expanded. According to the WEEE directive [2], in Europe is needed to remove from use lead, cadmium and other toxic substances no later than 2008. year. Therefore, it has been started with developing of new solder materials which do not contain toxic elements, and also meets many requirements in terms of mechanical and electrical properties, corrosion sustainability and economic profitability. Electronics industry is currently the largest user of gold and gold alloys. Gold alloys are known for good mechanical and thermal properties, as well as corrosion consistency. Owing to the formation of low temperature eutectic with other elements, gold alloys are often used as soldering alloys in electronics [3]. Indium-based lead-free solders are considered as a possible alternative to conventional Pb-bearing solders in step soldering, which are required for high density packaging of multi-chip modules demanding a number of solders with melting points over a wide temperature range [4]. System Au-In-Sb is the subject of different investigations lately. Phase equilibria of this system have been

investigated by different researchers [5-9], also its thermodynamics [10-27], while electrochemical investigations have not yet been done.

EXPERIMENTAL

DTA measurements have been carried out on the Derivatograph 1500 (MOM Budapest) apparatus under following conditions: air atmosphere, heating rate 10 ^{o}C/min, T_{max}=1073 K. As a referent material during measurements was used Al_2O_3. The precision of the measurement in the investigated temperature interval was ±5 ^{o}C. Microstructure analysis of investigated samples was performed by optical microscopy, using a Reichert MeF2 microscope (magnification 500x). Solution of 1:1 HNO_3 was applied for structure development. SEM analysis was performed on Philips microscope XL-300 type with EDX of resolution of 1 nm on 30 kV and 5 nm on 1 kV, extinction voltage of 0.2-30 kV and magnification of 2000x. Hardness measurements were done using standard procedure according to Vickers. Micro hardness is measured using instrument PTM-3, with 20g load. Electrical conductivity of investigated materials was measured using the standard apparatus -SIGMATEST 2.069 (Foerster) eddy current instrument for measurements of electrical conductivity of non-ferromagnetic metals based on complex impedance of the measuring probe with diameter of 8mm. Corrosion behavior of chosen alloys was investigated by means of cyclic voltammetry. Experimental system was composed of electrochemical cell with three electrodes: working, reference (saturated calomel electrode, SCE) and counter (Pt sheet A=2 cm^2); hardware (PC, AD/Da converter PCI-20428 W produced by BURR-BROWN and analogue interface developed on Technical Faculty in Bor[28]) and software for excitation and measurement (LABVIEW 7.1 platform and originally developed application software for electrochemical measurements[28]). Scheme equipment display is given on Fig. 1.

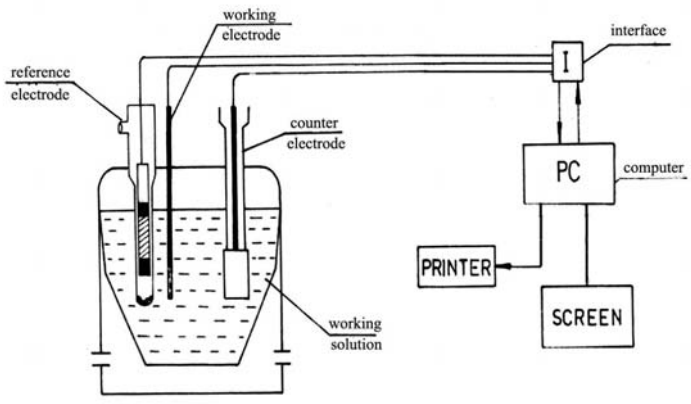


Figure 1. Apparature for cyclic voltammetry

RESULTS AND DISCUSSION

The samples for all experiments were prepared using metals - gold, indium and antimony, of 99.99% purity. The composition and masses of samples are given in Table 1.

Table 1. Composition and masses (in g) of the investigated samples

Alloy	x_{Sb}	x_{Au}	x_{In}	m_{Sb}	m_{Au}	m_{In}
A1	0	0.5	0.5	0	3.8032	2.2145
A2	0.05	0.475	0.475	0.2304	3.5396	2.0623
A3	0.2	0.4	0.4	0.8693	2.8122	1.6386
A4	0.28	0.36	0.36	1.1813	2.4569	1.4317
A5	0.4	0.3	0.3	1.6169	1.9610	1.1429
A6	0.65	0.175	0.175	2.4158	1.0520	0.6129
A7	0.85	0.075	0.075	2.9678	0.4326	0.2468

The results of the DTA heating measurements are presented in Fig. 2.

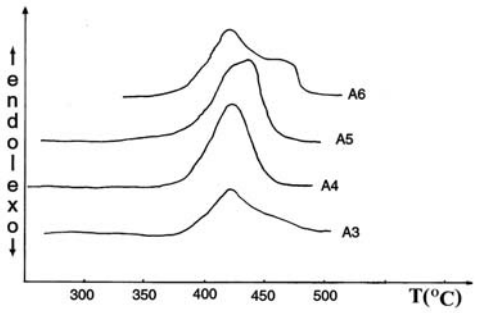


Figure 2. DTA curves for samples with x_{Sb} = 0.2, 0.28, 0.4 and 0.65

The quasibinary eutectic reaction L↔AuIn+Sb occurs at 420 °C in this system. The eutectic concentration was found to be 28 at% Sb. Graphical representation of the obtained phase diagram for AuIn-Sb system, compared with literature data [29], is given in Fig. 3. It could be noticed that the phase diagram boundaries from DTA measurements in this work are in good agreement with existing literature data.

Characteristic microphotographs recorded by optical microscopy are given in Fig. 4. The quasibinary hypoeutectic alloys, presented in the widest part of the concentration range, solidify with the primary crystallization of the intermetallic compound AuIn (light regions) and the /Sb/-based phase (dark regions). SEM image for sample A6 is given in Fig. 5, and also the results of experimental determination of composition by EDX.

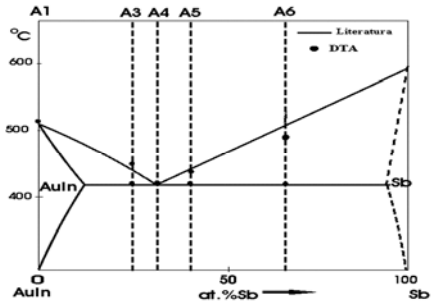


Figure 3. Phase diagram of AuIn-Sb section[29]

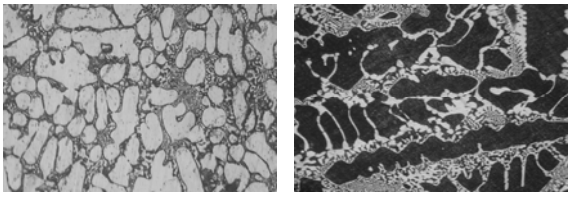


Figure 4. Characteristic optical microphotographs for A3 and A6 sample

alloy A6 – light phase *alloy A6 – dark phase*

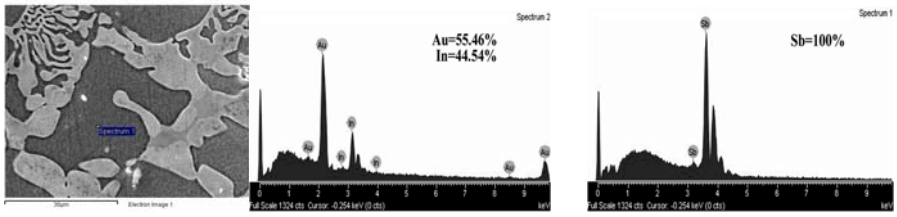


Figure 5. SEM image of the investigated sample A4 (enlargement 2000x) and results of EDX analysis (composition in atomic percents)

The results of EDX analysis confirmed that the dark phase is Sb based and light phase is consisted from intermetallic compound AuIn. The values of micro hardness for investigated samples are presented in Table 2.

Table 2. Results of micro hardness measurements

Alloy	x_{Sb}	H_μ		
		light phase	*dark phase*	*borders*
A2	0.05	137.7		152.04
A4	0.28	119		92.5
A5	0.4		132.6	111.2
A6	0.65	105.9	100.7	138.3
A7	0.85		106.8	93.2

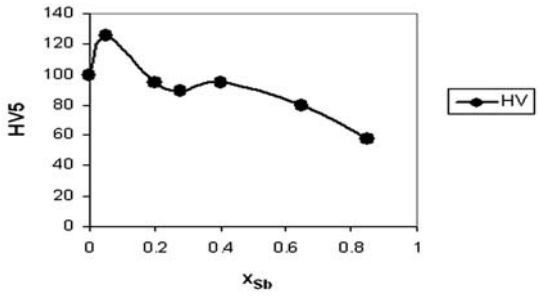


Figure 6. Hardness vs. composition for chosen alloys in the AuIn-Sb section

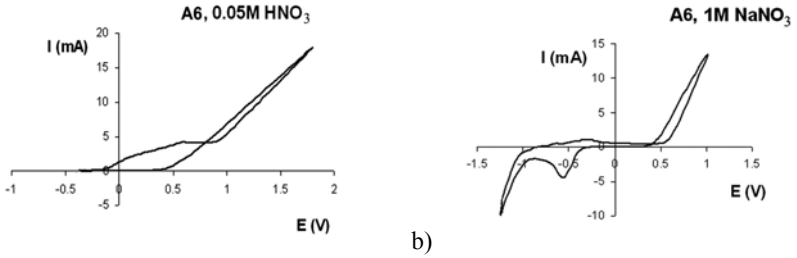
The results of hardness measurements are shown in Fig. 6, in the form of hardness dependence on antimony composition. It may be noticed that in concentration range over x_{Sb}> 0.05 hardness decreases.

The results of electrical conductivity measurements are presented in Table 3. (three series of measurements), where electrical conductivity dependence on composition is showed. As can be seen, the electrical conductivity decreases rapidly with antimony concentration increase in the investigated alloys.

Table 3. Measured values of electrical conductivity for investigated Au-In-Sb alloys

Alloy	Electrical conductivity (MS/m)		
A1	12.94	12.77	12.99
A2	7.396	7.546	7.339
A3	5.660	5.664	5.572
A4	5.533	5.522	5.536
A5	4.287	4.283	4.268
A6	2.667	2.633	2.644
A7	0.5475	0.6700	0.4948

The analysis and interpretation of curves obtained by cyclic voltammetry method, was carried out taking referent data about equilibria E-pH diagrams[29] into account.



a) b)

Figure 7. Curve obtained by cyclic voltammetry for A6 in a) 0.05 M HNO_3 and b) 1 M $NaNO_3$

On the anodic potential curve, weak anodic peak is detected firstly, at about 0.15V, which corresponds to indium oxidation process reaction:

$In = In^+ + e^-$ ... (1)

and antimony oxidation process by reaction

$2Sb + 3\ H_2O = Sb_2O_3 + 6\ H^+ + 6e^-$ ...(2).

Last anodic peak, in wide potential range from 0.25 to 0.8V, corresponds to the formation of Sb_2O_5. Above the potential of 0.8V, oxygen separation occurs. The voltammogram for alloy A6 in 1M $NaNO_3$ shows weak anodic peak at E = -0.6V, firstly, and this peak correspond to indium oxidation process. Next, more defined anodic peak at E = -0.25V represents reaction (2), while above the potential of 0.4V, oxygen separation occurs. The peak at E = -0.55V, noticed in cathodic potential curve, represents the process of reduction to metallic indium.

CONCLUSION

Characterization of the investigated Au-In-Sb eco alloys carried out using different experimental methods: DTA, SEM-EDX, optical microscopy, hardness and micro hardness measurements, cyclic voltametry and electrical conductivity measurements. Temperatures from DTA curves show good agreement with available literature data. Results of optical microscopy and SEM-EDX analysis has confirmed that the microstructure of the studied samples consists of two phases, a light phase on the basis of intermetallic compounds AuIn and dark phases based on antimony. With increasing antimony content, measured values of hardness and electrical conductivity show a rapid decline. The results obtained using cyclic voltammetry indicate that in the acid and in the alkali environment will occur antimony and indium oxidation, but in the alkali area oxidation of indium will be reversible, contrary to the acidic environment where this is not the case. Obtained results contribute to a better understanding of structural and electrochemical characteristics of investigated alloys, thus opening the perspective that the selected Au-In-Sb alloys can be used as an alternative alloys for production of lead-free solders.

Acknowledgement

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NEW DATA ON THE PRESENCE INSECTIVOROUS PLANTS ON THE TERRITORY OF FLAT SREM AND MAČVA

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ABSTRACT

So far, field research has established presence of three insectivorous plants: two species from the bladderwort genus and a monotypic genus of aldrovanda. Presence of bladderwort, depending on the species, indicates ecological characteristics of the habitat conditions. In the past period, *U. vulgaris* was recorded in 50 new locations in Srem and 14 in Mačva, with canals as the dominant type of habitat. Continuation of this research will be directed towards locating new habitats of bladderwort in Srem and Mačva, especially for the *U.australis R.Br.* species. Certain locations, particularly the ones examined in the 1990s, should be searched again in order to confirm whether bladderwort is still present there, because many canals are periodically cleaned from mud and vegetation so as to maintain hydrological functionality. A special segment in the research of bladderwort will be done in cooperation with hydrobiologists, as a continuation of the research on mutual dependence of zooplankton and bladderwort. Globally, bladderwort as a specific form of adaptation is in the stage of withdrawal from water ecosystems. As a rare species, *U.australis R.Br* was suggested for the Red Book of Serbian flora, whereas the status of *U.vulgaris L.* has not yet been decided. In any case, both species are considered for the working list of Red Book of Serbian flora. A special segment in the flora research will be tracking the appearance and presence of aldrovanda on the territory of Srem and Mačva. Its almost accidental discovery after 80 years gives new hope that aldrovanda lives in other similar habitats, since this is no longer only the result of systematic research, but a realistic situation in the field.

Keywords: Srem, Mačva, insectivor plants, *Aldrovanda,Utricularia*

INRODUCTION

The Srem plain emerged through piling up and deposition of wattle in the past. Prior to the regulation of the flow of the Sava River (1972) there were far more swamp areas, as well as internal wetland areas. The first meliorations were carried out by the ancient Romans as early as III-IV century (Jarčina Canal). The absolute height of the lower Srem decreases going from the west towards the east, and the river Sava flows in that direction, 72-88 meters above sea level. The terrain is mildly corrugated with ridges and depressions, the pools are filled with atmospheric water, but when the water of the Sava. On the territory of the flat Srem, there are two rivers: the Sava and the Bosut, the latter being merely a canal nowadays with a dam and pumping station at the mouth. There are numerous streams that flow downhill from Fruška gora: Šarkudin, Vrtič, Manđeloški, Čikac, Gat, Kudoš, Jarčina, Vranj and Krivaja which were later transformed

into canals. Redistribution of agricultural land in the period between 1955 and 1985 in flat Srem reduced the level of underground and overground water by 3-6 m, and so now there is no water where it used to be a wetland. Inside this region is also the famous Obedska bara, which is the abandoned fossil bed of the river Sava, and today it is a reserve under a special protection regime. Caverns with hot water were discovered underneath the quaternary layer, with the temperature of 70ºC. The climate of this area is characterized by the steppe-panonian modification of the continental climate with very hot and often dry summers and fierce winters (Gajić & Karadžić, 1991).

Mačva is a plain in the far northwest of Serbia. Its west boundary is the river Drina, in the north and the east by the river Sava, and in the south there is no distinct natural boundary. Geographically, Mačva lies between 44^0 40' and 44^0 58' of the north latitude and between 19^0 16' and 19^0 43' of the east Greenwich longitude. The area of Mačva is 86.280 ha. Its largest part lies between 78 and 90 meters above sea level. The terrain in Mačva is characterized by alternating depressions and alluvial ridges. Near the end of the Tertiary, 10-15 million years ago, in the territory of present-day Mačva, there were large complexes of subtropical marshes when indicate remain layers of coal as deep. Analysis of rings on carbonated tree trunks from the Mačva basin from 12 millions years ago has indicated removal of the width of rings as a result of moderate and rainy periods extremely slow and slight changes in the climate. The upcoming glacial period was followed by depositing of a large quantity of wattle in the territory of entire Panonia. In several profiles on the bank of the Zasavica, presence of a wattle layer can be noticed, at points even a couple of meters thick, and under it non-porous blue-green clay. (Erdeši&Janjatović, 2001) According to Cvijić, the largest part of the Mačva plain was formed from the Drina deposits in the Atlantic phase of the Holocene, that is, at the time when its water mass was much more voluminous. A narrow stretch of Mačva along the Sava was formed from the deposits brought by the Sava or, which is most likely, cut off from the Srem wattle plateau, after the river had changed its course. It should be emphasized that this deposit from the Drina created comparative pressure on the course of the Sava, which, caused by this, moved more and more towards the north, cutting in the Srem plateau until it took its present-day course. This is what led to the formation of the prominent bend in the Sava's flow that today surrounds Mačva from the north. The remnant of the former riverbeds of the rivers Sava and Drina is the present-day Zasavica(Petrović&Radaković,1996).

In the area of Mačva when accumulated thermal waters in karstificated limestone of the Triassic age were discovered. This accumulation has the minimum area of 100 km ² with temperature of up to 100ºC. The age of this thermal water is estimated to between 15,000-26,000 years. (Milivojević, et.al, 1996) Mačva also has moderately-continental climate. (Lakić, 1958) According to Matvejev & Punicer (1989) the region of Mačva belongs to the biome of South European predominantly deciduous forests and European deciduous forests with steppe elements. This type of biome is also indicated by the characteristic forest communities present: *Salici-Populetum, Alneto glutinosae, Carpino-Quercetum roboris*. Within this biome, there are also some fragmentary Mediterranean elements which usually appear on inundation terrains such as Široka bara and Ribnjača with fragments of characteristic communities: *Fraxino-Quercetum roboris* and *Leucoio-Fraxinetum angustifoliae Glov*. The biome of European, predominantly

floodable deciduous forests together with steppe elements comprise forest-steppe areas. They also have an ecotone character, and typically they feature the following community: *Genisto-Quercetum roboris, Fraxino-Quercetum roboris, Ulmo-Quercetum roboris Issler.1931*, *Leucoio-Fraxinetum angustifoliae Glov.1959*.

According to the type of nutrition, all organisms can be divided into three groups: autotrophic, heterotrophic and mixotrophic organisms**.** The group of autotrophic (*gr. auto=by oneself; trophe= food)* encompasses they are capable of producing inorganic matter from organic. Green plants and red algae use the sunlight in the process of photosynthesis, and the organic compounds that result from this process matter represent the food source for all living organisms, directly or indirectly. Cruel environmental conditions and soil poor in nutritive matter have conditioned in some plants a so-called "additional nutrition". (Glumac, et.al., 1982). Carnivorous plants have particular metamorphoses of leaves, which are transformed into organs for catching and digesting insects and similar animals, and they take on the widest variety of shapes (chalice, bladder, etc). In the world he lives about 450 species insectivor plants in several families. Insectivorous, plants, mostly live in the tropical belt (rainforests of Asia, Africa and America). The Balkan Peninsula, as well as the whole of Europe, is rather scarcely inhabited by insectivorous species. On the territory of Srem and Mačva there are several species and varieties of insectivorous plants; the following genera: *Utricularia* and *Aldrovanda*. All insectivorous species in Serbia are found on the preliminary list of species for the Red Book of the Serbian flora as endangered species (Stevanović,2002).

MATERIAL AND METHODS OF WORK

Field search was conducted by boat across larger open areas where submersible plants were taken out of water with rakes in order to confirm the presence of insectivorous plants, then by looking around reed beds and other areas such as canals, wetlands, watering places, etc. Apart from insectivorous plants, other present species were also recorded if they were dominant and found in their surrounding. Determination was performed according to: Gajić, Karadžić, (1991), Jávorka & Csapodi (1975), Janković & Stevanović (1999), Kojić, (1986), Obradović (1974; 1986) .

RESULTS AND DISCUSSION

Over the past fifteen years, floristic researches of wetland habitats in Srema and Mačva, including the Zasavica Special Nature Reserve, presence of three insectivorous representatives was confirmed; two from the *Utricularia* genus and one from the *Aldrovanda* genus. *Utricularia* genus is represented in Mačvi by two species: *U.vulgaris* and *U.neglecta,* while in Srem, apart from these two basic species, there is also an intraspecies: *form. platiloba* (*Meister, 1910*). (Obradović,et.al., 1979) The presence of U.vulgaris in Macva have previously published data for Zasavica (Stanković, 2000; Stanković, 2007a; 2007b)

The type of Utricularia vulgaris L. in Srem and Mačva register at the following locations:

Srbija, Vojvodina, Srem (Ruma, Kudoš, 21.07 1993., canal ; Subotište, Krivaja, 14.08 1993., canal; Pećinci for Subotište, Galovica, 20.04 1993., canal; Deč, Kuvalov, 11.05 1993., canal; Batrovci (near highway), Bosut, 11.05 1993., river; Progar, Živača, 19.05 1993., swamp; Ašanja, Jarčina, 11.05 1994., canal; Hrtkovci, Vranj, 17.06 1994., 28.04 1995., canal; Jakovo, Galovica, 09.06 1994 swaping ground.; Kuzmin, Gat, 07.06 1994., canal; Šid for Berkasovu, 10.05 1994., swaping ground; Manđelos, Vranjaš, 16.06 1994., lake; Jarak, Kudoš,12.04 1995., canal; Jarčina, 16.05 1996., canal ; D.Petrovci, Jarčina, 21.05 1995., canal; Grabovci, Vranj, 18.09 1995., canal; GJ. GVO depression in the forest department 81,88,101, 01.06 1995.,; Platičevo, Vranj, 14.051995., canal; Lovište Karakuša, 29.06 1995., 19.09 1996., water trough; 09.05 1995.; 11.05 1996., swamp Trskovača; Vitojevci, Krivaja,28.05 1995., canal; Morović, Studva, 22.06 1995., rver- fouling.; Bosut, 11.05 1996., river; Klenak, GJ. Senajske bare-Krstac department 8,10,11, 05.05 1995.;19.09 1996., depression of water in the forest,; Dobrinjci, Jarčina, 07.06 1996., canal; Nikinci, Vranj, 04.06 1996., canal; Sremska Mitrovica, Čikas, 10.06 1997., canal; Martinci, Generalni, 10.05 1997., canal; Inđija for Beški, 06.06 1997., depression of water; place Bosut, Bosut,02.06 1997., river; 11.06 1998.; Surčin, Galovica, 05.06 1998., canal; Veliki Radinci, Čikas, 21.05 1998., canal; 29.05 2002.; Kukujevci, Generalni, 14.05 1998., canal; Višnjićevo, Grčanski,14.09 1998., canal; 19.05 1999.; Manđelos, Manđeloški, 18.06 1998., 09.06 2002, canal; Nova Pazova for Batajnici, ,15.05 1998., depression of water; Šimanovci, Kuvalov, 02.06 2000. canal; Laćarak, Generalni,14.05 2001., canal; Manđeloški,14.05 2001., canal; Kupinovo, ,14.05 2002. reclamation canal; 05.06 2006.; Irig, Jelence,03.06 2003., canal;

NW. Srbija, Mačva, Šabac (Belotić, Bitva, 14.07 1995., canal; Jerez, 17.07 1995., canal; Drenovac for Majuru, Kalovica, 10.09 1995., canal; Drenovac, 04.09 2001., reclamation canal; Noćaj, Bitva, 05.07 2002., canal; Kojšanski, 05.05 2007.; 09.05 2006., canal), **Bogatić (**Dublje, Bitva, 21.07 1997., canal; Dublje for Duvaništu, Jerez, 19.09 1997., canal; Metković, ,06.07 2003., reclamation canal; Sovljak, 05.07 2004.; 07.07 2005, reclamation canal; Salaš Crnobarski, 05.09 2005. reclamation canal; Glušci Bitva, 05.05 2008., canal**)**

According to Obradović, et.al (1979) *Utricularia vulgaris* is a widely spread species in Vojvodina, in Macva present. Bladderwort in waters in Srem and Mačva, inhabits the immersive belt with shallow waters as well as other parts with slow water flow due to either natural material or artificial barriers or small overpasses. Bladderwort appears together with of other macrophyte species in the association *Lemno-Utricularietum vulgaris* relation (*Soó (1928),1938)* (all. *Utricularion vulgaris* Pasarge 1964). as edification species or as a companion species in a number of other aquatic communities. According to our to the records from the last ten years, the *U. vulgaris L.* species in the Srem and Mačva is found in expansion stage so that it becomes more frequent in active and abandoned irrigation canals and other hydro-technical facilities.

Utricularia neglecta (=syn. U.australis) - is far more rare than the previos one which according to literature data redorded in very few localities in Srem, and so far, the only known habitat in Mačva is the Zasavica Nature Reserve.

Presence of both species of bladderwort is directly connected with water chemistry because *U. vulgaris L.* is a species of meso-eutrophic character, while *U.*

australis R.Br is also of mesomorphic character and goes into somewhat more acidic waters (Stojšić, 1995). It has been noticed that bladderworts do not like colder waters with reason is the increased flow of water. (Stanković, 2000) Qualitative and quantitative composition zooplanktons which play an important role in the elements of additional nutrition, also have an effect on the presence of bladderwort. Experiments have found a positive correlation between the number of *Utricularia vulgaris* and zooplankton and zooplankton diversity and abundance is five times larger in area than in the bladderwort part of the *Stratiotes aloides* L. An obvious example of the connection was in the Sadžak stretch in the Zasavica Reserve, where the experiment was conducted. In the place of the monotypical bladderwort community, a water sample was taken with plankton net, and as a control method, a sample was taken ten meters downstream In melioration canals bladderworts *Utricularia vulgaris* are usually sporadically present in individual samples (water holes in the Karakuša hunting) or smaller groups. After the Sava withdrew into its bed, depressions and coves filled with water remained in GJ "Senajske bare I - Krstac" at Klenak, where presence of the *Utricularia vulgaris* species was recorded in five places, out of which two were in bloom. Bladderwort presence was recorded in Bosut, in the part around the pumping station, and it was in bloom, and then upstream from the pumping station it was sporadically present in 300-500 m of the stream. To Kupinovo, next to the Obedska bara, bladderwort (*Utricularia vulgaris*) was recorded in the canal at the entrance in the village on the right side with 3-5 specimen. Melioration canals in Mačva, is a habitat of *U. vulgaris*. Out of all the mentioned canals, Kojšan only had a regular presence registered bladderworts with solid abundance over many years was the only one with a regular presence of bladderwort several years in a row and with a satisfactory number of specimens of this species; Noted that the bladderwort has been noticed to appear in 90% of the cases where there is an immersive belt of *Typha sp.* and *Phragmites communis*, probably because it requires such a habitat where there is a gradual filtration of water through the belt coastal and other vegetation. Thus, in the coastal belt in the Srem and Mačva except species *Utricularia vulgaris* L. recorded and solder *L. minor, L. trisulca L., Ceratophyllum demersum L.,* and occasionally occur: *Spirodela polyrhiza* (L.) Schleid., *Hydrocharis morsus-rane* L., *Nymphoides peltata* (S.S Gmel.) Kuntze, *Stratiotes aloides L., Myriophyllum spicatum L., Nymphaea alba L.* and *Nuphar lutea* Sm.

Aldrovanda (*Aldrovanda vesiculosa* L) has been sought by many a botanist. It was not even listed by the famous botanist Josif Pančić in his field diary when in mid-August of 1879 while touring Mačva, and as he states in his diary: "*I took 9 students to Obrenovac, and from there to Ratari, where we looked around the nearby marshes, and then continued our trip to Skela and explore the bank of the Sava there*. From there we went on to *Šabac, and further across Lešnica along Drina towards M. Zvornik, and then down the Drina turn around towards Rača, where we looked around the mouth of the Drina and went across Mačva to Šabac, and from there we headed home to Belgrade on the Sava River*. *Except for several new plants, there were no significant discoveries for flora.* (Tatić & Diklić, 1997)

Throughout more than 90 years of studying flora in Serbia there has been no new data about aldrovanda because it is in the Red Book of the Serbian flora. This had been the state up to 2005 when specimens of aldrovanda were discovered in the blue

zone Zasavica. This date is very significant because it was then shown that Serbia had not forever lost a plant species. The following year (2006) more detailed research was carried out on the Zasavica stream and the surrounding melioration canals where the established presence. aldrovanda at the 7th km of the Zasavica. It was also noted that aldrovanda quite often goes to habitats where there is bladderwort experiments we found a link between the number and size aldrovande and the number of zooplanktons in the water as well as bladderwort The examination of specimens shows that there is a link between the number and size of aldrovanda and the concentration of zooplankton in the water. Current research into the nutrition of aldrovanda shows that it is dominated by *Brachiopods, Copepods* and *Ostracods* with sporadic presence of other representatives of microfauna. (Breckpot, 1997) In 90% of the cases, Aldrovanda inhabits the water, up to 1.5 of depth. It is not present only in reed beds but at the contact of the immersion zone with free water. Macrophytes present indicate slower water flow, somewhat higher water temperature and, therefore, increased sedimentation of the floral detritus.

According to literature data (Lloyd, 1942; Kamiński, 1987) the optimal physical-chemical parameters of waters inhabited by aldrovanda are temperatures of 25^{0}C, pH 5.8-6.8, and depth of 1 m, which suggests that it inhabits waters at the transition from oligotrophic to mesotrophic. Many authors (Saito,1972, Haldi, 1974, Mazrimas, 1978) give minimal water temperature than is 16^{0}C, and the ideal is between 23 and 30^{0}C. This corresponds to the pH and temperature values measured on the Zasavica. We've noticed that does not like aldrovanda colder waters, with water temperature which does not exceed 16-18°C in the summer, which most certainly confirms that it belongs to the Tertiary, ie subtropical flora swamping. When the speaking of the presence of aldrovanda in Srem, and still possess only referring to old literature data by Jankovic & Stevanović,(1999) (Obedska bara, Kupinovo (Moesz,1916; Javorka,1924; Simonović,1959; Obradović,et.al., 1977); at Save (anonim.) Odubašića pane (Gjurašin, 1913). Our field research canals, Wetlands or Marshes inundation in the past 15 years.along the river Sava that have not had confirmed presence of aldrovanda. **So the only proven Zasavica plantation habitat aldrovande in Serbia.**

Endangerment factors for insectivorous plants are common for Srem and Mačva, and they are as follows: a) destruction of habitat due to draining of swamps and marshes and change the existing water regime, b) the removal of water and coastal vegetation during cleaning of drainage network; c) pollution of surface and ground water with toxic and nitrogen and phosphorus rich substances from agricultural areas which ultimately leads to the inevitable process eutrofisation and vegetation succession. Due to these changes coming to the withdrawal or loss of sensitive insektivor plants.

CONCLUSION

So far, field research has established presence of three insectivorous plants: two species from the bladderwort genus and a monotypic genus of aldrovanda. Presence of bladderwort, depending on the species, indicates ecological characteristics of the habitat conditions. In the past period, *U. vulgaris* was recorded in 50 "new" locations in Srem and 14 in Mačva, with canals as the dominant type of habitat. Continuation of this research will be directed towards locating new habitats of bladderwort in Srem and

Mačva, especially for the *U. australis R.Br.* species. Certain locations, particularly the ones examined in the 1990s, should be searched again in order to confirm whether bladderwort is still present there, because many canals are periodically cleaned from mud and vegetation so as to maintain hydrological functionality. A special segment in the research of bladderwort will be done in cooperation with hydrobiologists, as a continuation of the research on mutual dependence of zooplankton and bladderwort. Globally, bladderwort as a specific form of adaptation is in the stage of withdrawal from water ecosystemsIts almost accidental discovery after 80 years gives new hope that aldrovanda lives in other similar habitats, since this is no longer only the result of systematic research, but a realistic situation in the field.

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PHYTOREMEDIATION OF URANIUM CONTAMINATED SOILS

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ABSTRACT

Environmental uranium contamination based on human activity is a serious problem worldwide. This paper displays reviews of the process and modern technology for the remediation of soil contaminated with uranium, with special emphasis on phytoremediation. Phytoremediation technology takes advantage of plant to extract, sequester pollutants with an aim of pollutants removal and transformation into harmless forms. Well-organized use of phytotechnology means integrated management strategy for contaminated site which includes: proper selection of plants, improving mobility of uranium with amendments and application sequestering agents for immobilization and transformation of excess uranium, which plant didn't accept.

Keywords: Uranium, Phytoremediation, hyperaccumulators plants, soil amendments

INTRODUCTION

Uranium in the environment – characteristics, occurrence and consequences

Sources of uranium in the environmental originate from natural geological – geochemical processes and human *(*anthropogenic*)* activities. Widespread use of nuclear energy, application of weapons with depleted uranium, nuclear testing, coal combustion, oil and gas production, production and application of phosphoric fertilizer, mineral processing and formation radioactive waste landfill, improper waste storage practices and uranium tailings are the main anthropogenic sources of uranium entering the environment [1].

Methods and techniques for uranium removal

The objective of any remedial action is to reduce the risks to human health, the environment and property to acceptable levels by removing or reducing the source of contamination or by preventing exposure to it. Once the decision has been made that remedial action is necessary, there are various options possible for achieving the objective. Various strategies have been proposed for the remediation of contaminated environments in order to reduce the detrimental effects of uranium on ecosystems and local communities. These strategies include physical, chemical and biological technologies.

Clearly, there are both advantages and disadvantages with any remediation technology, and each technology may be applicable in certain circumstances only, determined from data gathered during the phase of site characterization. Such data are used to determine the initial need for site remediation, plans for further remediation and implementation of remedial actions as well as to ensure that there is compliance regarding the residual concentrations of radionuclides in the environment post-remediation.

Radionuclides and heavy metals are retained by soil in three ways:

- adsorption onto the surface of mineral particles;
- complexation by humic substances in organic particles;
- precipitation reaction.

The mobility of uranium in soil is mainly controlled by complexation and redox reactions:

- complexation leads to mobile species or precipitation of U bearing minerals;
- redox reactions change the solubility between the two major oxidation states: U(IV)–U(VI):
  - reduction of U(VI) to U(IV) immobilizes uranium;
  - oxidation of U(IV) to U(VI) mobilizes uranium because of the dissolution of U(IV)bearing minerals.

Remediation technologies available for treating uranium contaminated soils and groundwater could be applied as either *ex situ* or ***in situ*** techniques [2]. Methods and techniques for uranium removal could be classify as: Natural attenuation, Physical processes, Chemical methods, Biological methods and Electrokinetic methods [3]. These processes and techniques for uranium removal are presented on Figure 1.

Phytoremediation

Phytoremediation involves the use of plants to extract, sequester and/or detoxify the pollutants present in soil, water and air. For long-time projects and adequate pollutants, phytoremediation is considered as the cheaper and simplest option available for soil cleanup [4].This technique, takes advantage of the natural abilities of plants to take up (absorb) and accumulate metals and radionuclides [5]. These plants could be used in an efficient way if they are adapted to a wide range of environmental conditions. Plants for phytoremediation are tolerant plants, having heavy metal hyper accumulation potential [3].

Plants for phytoremediation of U-contaminated soils could be selected by using a mathematical model related to plant characteristics (e.g. biomass and planting density) to predict a long-term U-removal rate from the soil [6].

Plant-assisted remediation of soil can generally occur through one or more of the following mechanisms [7,3]:

• *phytostabilization*: involves the use of plants to contain or immobilize contaminants in the soil by:

- absorption and accumulation by roots;
- adsorption onto root surface;
- precipitation within the root zone.

• *phytodegradation/phytotransformation*: involves the breakdown of contaminants through:

- metabolic processes(internally);
- release of enzymes into the soil.

- *phytovolatilization*: the uptake and transpiration into the atmosphere of a contaminant by a plant;
- *rhisodegradation*: involves the breakdown of the contaminants in the soil due to microbial/root/soil interaction;
- *phytohydraulics*: involves the use of plants to control the migration of contaminants.

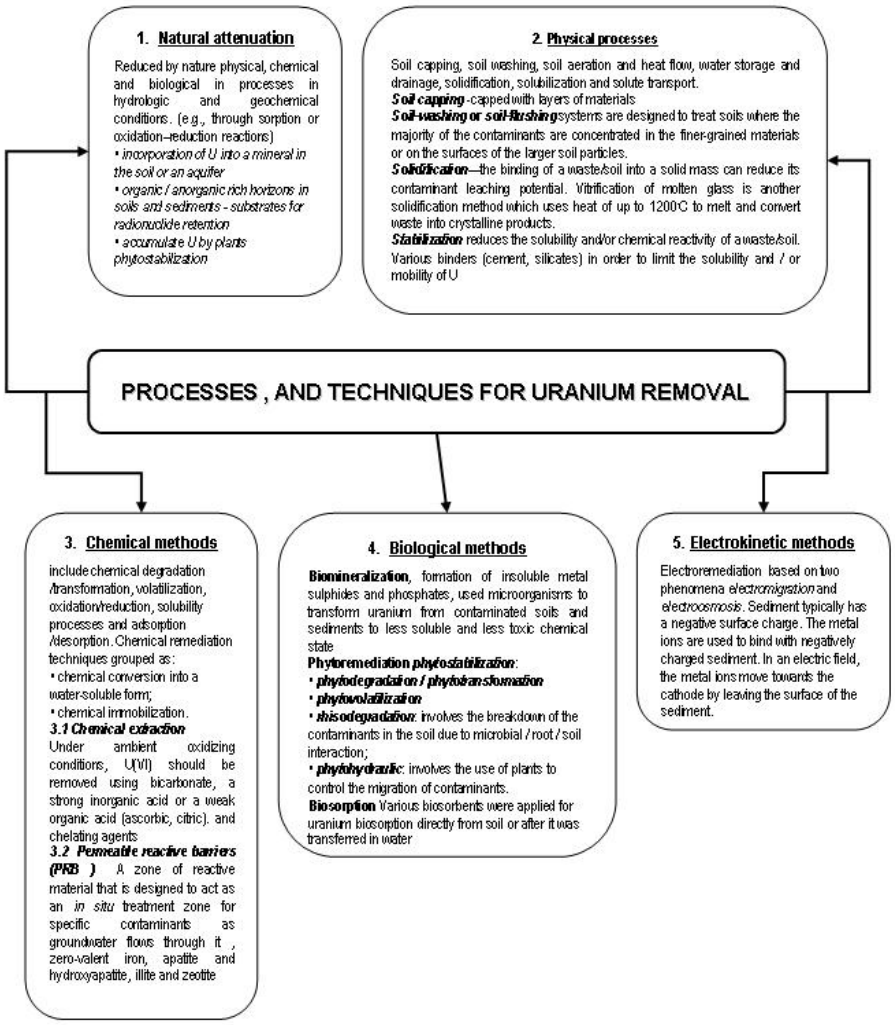

Figure 1. Processes and techniques for uranium removal

Radionuclide bioavailability mostly depends on [7]:

- type of radionuclide deposition;
- time of deposition;
- soil characteristics

Hyperaccumulators plants are those plants that adopt the pollutants from the soil at a much higher rate than other plants (100 to 1000 times). The transfer of radionuclides from soils to plants is dependent on three classes of factors [3]:

- quantity factor (that is the total amount of potentially available elements);
- intensity factor (the activity, the ionic ratios of elements in the soil solution, presence of other species (nitrogen, phosphorous));
- reaction kinetics (the rate of element transfer from solid to liquid phases and to plant roots).

There are several attributes ascribed to the ideal candidate plant species for phytoremediation of metals. First, the plants should have either a low biomass with a high metal capacity or a high biomass plant with an enhanced metal uptake potential. Specifically, the plant should have a sufficient plant capacity to accumulate the metal of concern within the harvestable biomass at a level greater than 1% (for some metals, greater than 1000 mg kg^{-1}). Furthermore, the plant should have a sufficient capacity to tolerate the site conditions and accumulate multiple metal contaminants. Finally, the species should be fast growing and have a suitable plant phenotype for easy harvest, treatment, and disposal [5].

According to the PHYTOREM data base sunflower is recognized as hyperaccumulator of uranium. PHYTOREM was developed by Environment of Canada and this database consist of 775 plants with capabilities to accumulate or hyperaccumulate one or several of 19 key metallic elements. Species were considered as hyperaccumulators if they took up greater than 1000 mg/kg dry weight of most metals. Sunflower had content of uranium more than 15000 mg kg^{-1} dry weight. Plants hyperaccumulators like sunflower (*Helianthus annuus)* have highest phytoremediation potentials since there are also crop plants with well established cultivation methods [5]

Shahandeh and Hosssner evaluated the influence of specific soil fractions on U bioavailability from contaminated soils. Plant species, Sunflower and Indian mustard, were selected to compare the degree of U removal from different soil types utilizing different sources, forms, and rates of U. Uranium concentration in shoots or roots of sunflower varied with soil type, regardless of soil U (VI) contamination rate. According to the uranium concentration in shoots and roots they conclude that sunflower plants grown on calcareous soils can accumulate more uranium then one grown on acid soils. Calcareous soils containing free carbonate and uranyl ion is complexed with the carbonate radical, forming highly mobile, anionic complexes. Uranium solubility and mobility were probably limited in some acid (clay) soils due to the presence of highly adsorptive Fe and Mn oxides [8].

There are two general approaches to phytoextraction: continuous and chemically enhanced phytoextraction. The first approach uses naturally hyperaccumulating plants with the ability to accumulate an exceptionally high metal content in the shoots. Another method is the application of synthetic and nature organic agents as a means of improving the

mobilization of uranium and increase efficiency phytoextraction. A key to the success of U phytoextraction is to increase soil U availability to plants [9].

Amendments could be organic compounds: synthetic chelating agents (ethylenediaminetetraacetic acid (EDTA), N-hydroxyethyl-ethylenediamine-N,N',N'-triacetic acid (HEDTA), diethylenetrinitrilopentacetic acid (DTPA)), natural fulvic acid, humic acid and more natural low molecular weight organic acids (citric, malic, oxalic, and acetic acid). The most frequently used is EDTA, which has been reported as more effective than other synthetic chelators for several heavy metals [10].

Role of amendments in uranium phytoremediation

Addition of chelating agents in order to enhance phytoextraction may promote leaching of the pollutants (uranium) into groundwater. Therefore, there is a need for application of sequestering agents (apatite, zeolite, clay, zerovalent iron, etc.), that will enable hydrological control, immobilization and transformation of excess uranium, which plant didn't accept. Furthermore, sequestering agents can be used as ground cover in perennial phytoremediation, for adsorption of uranium, which can leach from fallen leaves in autumn. Schematic phytoremediation technique is presented on Figure 2.

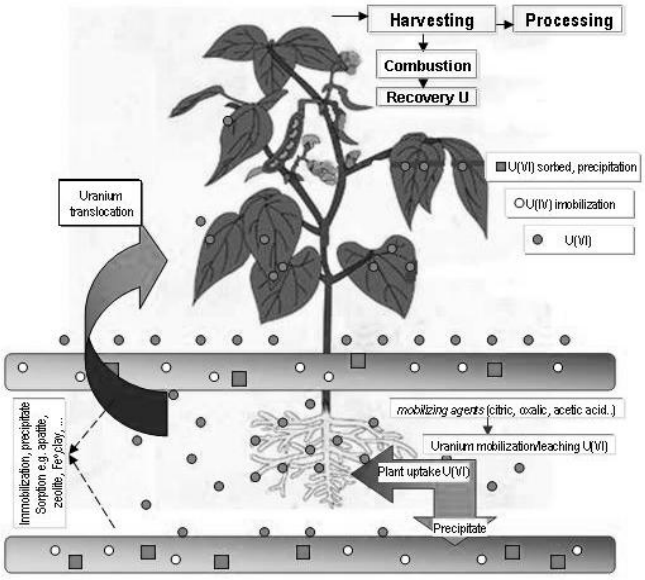

Figure 2. Schematic phytoremediation technique

CONCLUSION

Solving global problem such as uranium contamination requires the appropriate management and strategic for uranium contaminated soils and that include the application of currently innovative available remediation technologies. Phytoremediation

is expected, in certain situations, to demonstrate superior economic, technical, and environmental advantages over other remediation techniques. Application of plants for remediation of soil contaminated with uranium is the subject of this paper.

Therefore, a great deal of research focus and investment can be expected into management of the soil–plant system in the next 50 years [11]. Under the direction of present research in the world it is considered that in the future an important role in remediation of contaminated soils will have hybrid technologies. These technologies combine: chemical, physical, and/or other biological processes with phytoremediation.

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ECOLOGYCAL ASSPECT OF SUPERCONDUCTING MATERIALS

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Superconductors, materials that have no resistance to the flow of electricity, are one of the last great frontiers of scientific discovery. Not only have the limits of superconductivity not yet been reached, but the theories that explain superconductor behavior seem to be constantly under review. In 1911 superconductivity was first observed in mercury by Dutch physicist Heike Kamerlingh Onnes [1] of Leiden University. When he cooled it to the temperature of liquid helium, 4 degrees Kelvin (-452F, -269C), its resistance suddenly disappeared. Thus, it was necessary for Onnes to come within 4 degrees of the coldest temperature that is theoretically attainable to witness the phenomenon of superconductivity. Later, in 1913, he won a Nobel Prize in physics for his research in this area.

The next great milestone in understanding how matter behaves at extreme cold temperatures occurred in 1933. German researchers Walter Meissner (above) and Robert Ochsenfeld2 discovered that a superconducting material will repel a magnetic field. A magnet moving by a conductor induces currents in the conductor. This is the principle on which the electric generator operates. But, in a superconductor the induced currents exactly mirror the field that would have otherwise penetrated the superconducting material - causing the magnet to be repulsed. This phenomenon is known as strong diamagnetism and is today often referred to as the "Meissner effect" (an eponym). The Meissner effect is so strong that a magnet can actually be levitated over a superconductive material.

In subsequent decades other superconducting metals, alloys and compounds were discovered. In 1941 niobium-nitride was found to superconduct at 16 K. In 1953 vanadium-silicon displayed superconductive properties at 17.5 K. And, in 1962 scientists at Westinghouse developed the first commercial superconducting wire, an alloy of niobium and titanium (NbTi). High-energy, particle-accelerator electromagnets made of copper-clad niobium-titanium were then developed in the 1960s at the Rutherford-Appleton Laboratory in the UK, and were first employed in a superconducting accelerator at the Fermilab Tevatron in the US in 1987.

The first widely-accepted theoretical understanding of superconductivity was advanced in 1957 by American physicists John Bardeen, Leon Cooper, and John Schrieffer. Their *Theories of Superconductivity* became know as the BCS theory [2] -

derived from the first letter of each man's last name - and won them a Nobel prize in 1972. The mathematically-complex BCS theory explained superconductivity at temperatures close to absolute zero for elements and simple alloys. However, at higher temperatures and with different superconductor systems, the BCS theory has subsequently become inadequate to fully explain how superconductivity is occurring.

Then, in 1986, a truly breakthrough discovery was made in the field of superconductivity. Alex Müller and Georg Bednorz [3], researchers at the IBM Research Laboratory in Rüschlikon, Switzerland, created a brittle ceramic compound that superconducted at the highest temperature then known: 30 K. What made this discovery so remarkable was that ceramics are normally insulators. They don't conduct electricity well at all. So, researchers had not considered them as possible high-temperature superconductor candidates. The Lanthanum, Barium, Copper and Oxygen compound that Müller and Bednorz synthesized, behaved in a not-as-yet-understood way. The discovery of this first of the superconducting copper-oxides (cuprates) won the 2 men a Nobel Prize the following year. It was later found that tiny amounts of this material were actually superconducting at 58 K, due to a small amount of lead having been added as a calibration standard - making the discovery even more noteworthy.

Müller and Bednorz' discovery triggered a flurry of activity in the field of superconductivity. Researchers around the world began "cooking" up ceramics of every imaginable combination in a quest for higher and higher Tc's. In January of 1987 a research team at the University of Alabama-Huntsville [4,5] substituted Yttrium for Lanthanum in the Müller and Bednorz molecule and achieved an incredible 92 K Tc. For the first time a material (today referred to as YBCO) had been found that would superconduct at temperatures warmer than liquid nitrogen - a commonly available coolant. Additional milestones have since been achieved using exotic - and often toxic - elements in the base perovskite ceramic. The current class (or "system") of ceramic superconductors with the highest transition temperatures are the mercuric-cuprates. The first synthesis of one of these compounds was achieved in 1993 at the University of Colorado and by the team of A. Schilling, M. Cantoni, J. D. Guo, and H. R. Ott of Zurich, Switzerland. The world record Tc of 138 K is now held by a thallium-doped, mercuric-cuprate comprised of the elements Mercury, Thallium, Barium, Calcium, Copper and Oxygen. The Tc of this ceramic superconductor was confirmed by Dr. Ron Goldfarb at the National Institute of Standards and Technology-Colorado in February of 1994. Under extreme pressure its Tc can be coaxed up even higher - approximately 25 to 30 degrees more at 300,000 atmospheres.

The biggest application right now for superconductivity is in producing the large volume, stable magnetic fields required for MRI and NMR. This represents a multi-billion US$ market for companies such as Oxford Instruments, Siemens etc. The magnets typically use Conventional superconductor|low temperature superconductors (LTS) because high-temperature superconductors are not yet cheap enough to cost effectively deliver the high, stable and large volume fields required, notwithstanding the need to cool LTS instruments to liquid helium temperatures. Superconductors are also used in high field scientific magnets "because copper has a limit to the field strength it can produce.

The commercial applications so far for high-temperature superconductors (HTS) have been limited.

HTS superconduct at temperatures up to the boiling point of liquid nitrogen which makes them cheaper to cool than low temperature superconductors (LTS). However the problem with HTS technology is that the currently known high-temperature superconductors are brittle ceramics which are expensive to manufacture and not easily turned into wires or other useful shapes.

Large-scale applications of superconductivity comprise medical, energy, transportation, high-energy physics, and other miscellaneous applications such as high-gradient magnetic separation. When strong magnetic fields are needed, superconducting magnets offer several advantages over conventional copper or aluminum electromagnets. Most important is lower electric power costs because once the system is energized only the refrigeration requires power input, generally only 5–10% that of an equivalent-field resistive magnet. Relatively high magnetic fields achievable in unusual configurations and in smaller total volumes reduce the costs of expensive force-containment structures.

MRI dominates superconducting magnet systems applications. Most of the MRI systems are in use in hospitals and clinics, and incorporate superconducting magnets.

Some of the largest-scale superconducting magnet systems are those considered for energy-related applications. These include magnetic confinement fusion, superconducting magnetic energy storage, magnetohydrodynamic electrical power generation, and superconducting generators.

Though fusion is common in the sun and other stars, it is difficult to produce artificially and is very difficult to control. If controlled nuclear fusion is achieved, it might provide an inexpensive energy source because the primary fuel, deuterium, can be extracted from ordinary water, and eight gallons of water could provide the energy equivalent to 2,500 gallons of gasoline.

Interest in the nuclear fusion reaction arises from the expectation that it may someday be used to produce useful power, from its role in energy generation in stars, and from its use in the fusion bomb. Since a primary fusion fuel, deuterium, occurs naturally and is therefore obtainable in virtually inexhaustible supply, solution of the fusion power problem would permanently solve the problem of the present rapid depletion of chemically valuable fossil fuels. As a power source, the lack of radioactive waste products from the fusion reaction is another argument in its favor as opposed to the fission of uranium.

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THE SPECTROCHEMICAL ANALYSIS OF WASTE PRINTING INKS

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ABSTRACT

This work presents the possibility of application the spectrochemical methods in analysis of waste printing inks (conventional and eco-solvent). The metals were determined by Inductively Coupled Plasma-Optical Emission Spectrometry (ICP-OES). All the ink samples were prepared according to the EPA method 3050B. The concentration levels of the target metals, except the copper, were below the maximum allowed concentrations (MACs) prescribed by the Center of Excellence for Environmental Chemistry and Risk Assessment (CECRA). The copper concentrations in conventional waste inks are almost 120 - 225 times higher then the MAC value and 300 – 560 times higher then in eco-solvent waste inks.

Keywords: waste inks, heavy metals, ICP-OES method, printing

INTRODUCTION

The liquid wastes of printing industry are a very serious problem and require the coordinated work of graphic experts and manufacturers of raw materials, because they influence the further spreading of the contaminants in the environment, especially in the natural recipient. One of the most important resources in the entire printing production process are printing inks. Depending on the process and end use, printing inks are classified into letterpress, lithographic, flexography, rotogravure, digital, ink-jet and others. Printing inks mainly contain the following components:

- Pigments (5-30%), which give the ink shade;
- Solvents (20-70%), which contain volatile organic compounds and are often highly carcinogenic and harmful to organisms;
- Binders (15-60%), i.e. resins in various forms;
- Additives (1-10%), which determine the ink properties in many ways.

One of the most hazard pollutants of the printing process is the waste printing ink, which contains elevated metal concentrations. Heavy metal ions such as copper, silver, lead, chromium and zinc are particularly common in waste solutions of the printing industry. They are harmful to humans and other biological systems if their

presence exceeds the corresponding tolerance levels. Heavy metals are not biodegradable, and they tend to accumulate in the organisms, causing numerous diseases and disorders [1-6].

The widely used analytical technique for the determination of metals and certain non-metals in solution is the Inductively Coupled Plasma-Optical Emission Spectrometry (ICP-OES). The versatility of ICP-OES makes it a good analytical technique for a wide variety of applications. This versatility is due not only to the large number of elements that can be determined rapidly at trace levels but also to the wide variety of sample types that can be analyzed using the ICP-OES technique [7-8]. Equipment for ICP optical emission spectrometry consists of a light source unit, a spectrometer, a detector and a data processing unit. There are several types of equipment based on differences in the spectrometer and the detector [9].

The goals of the present work were to confirm the presence of target heavy metals (copper, cadmium, iron, silver, chromium and zinc) in waste printing inks and to determine their concentration levels, using the spectrochemical method of ICP-OES.

MATERIALS AND METHODS

Ink samples. In this work four samples of waste printing inks (three conventional and one eco-solvent ink), from four different printing machines (Mimaki JV 3 – 250 SPF, Vutek Ultra VU II 3360, HPScitex XP 5300 and Roland SOL JET PRO III XC-540 MT) are analyzed. All the ink samples are from one of the printing houses in Novi Sad. Three conventional ink samples have the same chemical composition, but they are from different ink manufacturers. The chemical composition of conventional and eco-solvent ink samples is presented in Table 1.

Table 1. Chemical composition of ink samples

Conventional ink sample		**Eco-solvent ink sample**	
Composition	%	Composition	%
Carbon black	2 – 8	Carbon black	1 – 5
N-butyl acetate	2 – 4	Synthetic polymer	1 – 5
Propylene glycol, mono-methyl ester acetate	1 – 20	Dietylene glycol, diethyl ether	55 – 65
Xylene	0.01– 0.1	Gamma-butyrolacetone	10 – 20
Trimethylbenzene – 1, 3, 5	0.1 – 0.5	Tetraethylene glycol, dimethyl ether	10 – 20
Phthalocyanine blue	2 – 8	Tetraethylene glycol, monobutyl ether	1 – 5
Nickel compound	2 – 8	Additives	1 – 5
Organic pigment	2 – 8		

Sample preparation method. The sample introduction for ICP environmental applications requires that samples be in a liquid form so as to be aspirated through a nebulizer and that suspended solids are removed to prevent clogging of the nebulizer. Therefore, solid samples such as soils and sludge must first be acid digested to extract the metals of interest from the solids, and the resulting solution must be filtered, centrifuged or allowed to sit to remove the suspended solids prior to analysis.

The standard method of sample preparation is used for metal analysis in waste printing inks. The DM N15 is a method for sample preparations by dry digestion and

acid digestion according to the EPA standard 3050B. This methods includes the following steps:

1. The sample must be throughly mixed to achieve homogeneity. All equipment used for homogenization should be cleaned to minimize the potential cross-contamination. For digestion procedure, weigh 1-2 g sample (wet weight) or 1 g sample (dry weight) to a digestion vessel.
2. For the digestion of samples using the method DM N15, add 10 ml of 1:1 HNO_3. The created emulsion is covered with a watch glass or vapor recovery device. Heat the sample to 95°C ± 5°C and reflux for 10 to 15 minutes without boiling. Allow the sample to cool, add 5 ml of concentrated HNO_3, replace the cover, and reflux for 30 minutes. If brown fumes are generated, it indicates oxidation of the sample by HNO_3. This step should be repeated by addition of 5 ml of conc. HNO_3 over and over until no brown fumes are given off by the sample which indicates the complete reaction with HNO_3. Using a ribbed watch glass or vapor recovery system, either allows the solution to evaporate to approximately 5 ml without boiling or heat at 95°C ± 5°C without boiling for two hours. Maintain the vessel covered at all times.
3. After the step 2 has been completed and the sample has cooled, add 2 ml of water and 3 ml of 30% H_2O_2. Cover the vessel with a watch glass or vapor recovery device and return the covered vessel to the heat source for warming and to start the peroxide reaction. Care must be taken to ensure that losses do not occur due to excessively vigorous effervescence. Heats until effervescence subside and cool the vessel.
4. Continue to add 30% H_2O_2 in 1-ml aliquots with warming until the effervescence is minimal or until the general sample appearance is unchanged.
5. Cover the sample with a ribbed watch glass or vapor recovery device and continue heating the acid-peroxide digestate until the volume has been reduced to approximately 5 ml or heat at 95ºC ± 5ºC without boiling for two hours.
6. Add 10 ml conc. HCl to the sample digest and cover with a watch glass or vapor recovery device. Place the sample on/in the heating source and reflux at 95ºC ± 5ºC for 15 minutes.
7. Filter the digestate through Whatman No. 41 filter paper and collect the filtrate in a 100-ml volumetric flask.
8. The samples are put into plastic or glass vessels which must be protected from contamination. The sample prepared in this way is ready for further analysis by Inductively Coupled Plasma-Optical Emission Spectrometry [10].

Method. Inductively Coupled Plasma-Optical Emission Spectrometry is an analytical technique used for the detection of trace metals with linear-dynamic range (measurement range of 0.2-100 ppb). ICP-OES is a type of emission spectroscopy that uses the inductively coupled plasma to produce excited atoms and ions that emit electromagnetic radiation at wavelengths characteristic of a particular element. The intensity of the radiation is proportional to the concentration of element within the solution and so can be used for quantitative purposes. While, the frequency of this

radiation is characteristic of the element that emits it and as such can be used for identification purposes.

The analyzed metals were determined by Inductively Coupled Plasma-Optical Emission Spectrometry on a Thermo Scientific, Thermo ICAP 6500 Duo instrument, after applying the extraction procedure according to EPA 3050B.

RESULTS AND DISCUSSION

Most printing inks contain certain toxic metals, which originated form of metal-based pigments, driers or through impurities and contaminants. In recent years, ink manufacturers have developed printing inks based on organic solvents, which are not difficult to recycle, as it was the case with inorganic inks. Printing inks based on alcohol and petroleum which used different solvents was the main carriers of pollution. Table 2 presents alternative replacements for conventional printing inks.

Although the new "eco friendly" printing inks satisfy the appropriate criteria of print quality, the conventional inks provide high-speed printing and better ink transfer on various substrates. A disadvantage for all alternative replacements is their higher cost, which is compensated through the protection and conservation of living and working environment. When the employee's work with less toxic inks, they are protected from the harmful evaporation. On the other hand, workers may be exposed to other harmful influences, because some alternative inks contain higher concentration of heavy metals [11,12].

Table 2. Alternative replacements for conventional printing inks

Alternative	Benefits	Disadvantages	Product Quality
Vegetable Oil Heatset Inks	Reduced VOC* emissions and worker exposure to petroleum oils, less amount of printing ink used	Slower drying time; poor drying can result in set-off, marking and poor rub resistance	Similar print quality, as in conventional inks
Vegetable Oil Non heat-set Inks	Reduced VOC* emissions and worker exposure to petroleum oils	Slower drying time	Similar quality; brighter colors and improved clarity compared with conventional inks
Vegetable Oil Form Inks	Reduced VOC* emissions and worker exposure to petroleum oils	Slower drying time	Higher print quality compared with conventional inks
UV Curable Inks	No ink-derived VOC* emissions or worker exposure to petroleum oil; reduced process waste	Not found	Good gloss and durability; print quality may be less clear; possible adhesion problems on some materials (aluminum, steel, some plastic)
EB Curable Inks	No ink-derived VOC* emissions or worker exposure to petroleum oil; reduced waste	Not found	Print quality less clear than conventional
Water-based Inks	Water is solvent; safer for the environment; reduced disposal costs	Slower drying time, require different types of dryers; limited range of colors	The best printing quality on absorbent materials

* Volatile organic compound

The main difference of the analyzed conventional and eco-solvent inks is in their composition (Table 1) and the application of low hazardous solvents. Metals in printing inks should be reduced, because they accumulate in living and working environment and represent a harmful to employee's health. Therefore, the application of eco-solvent inks is more useful and profitable for the living and working environment protection.

The analysis of waste inks using ICP-OES confirmed the presence of copper, cadmium, iron, silver, chromium, and zinc in all the ink samples (Figures 1-2).

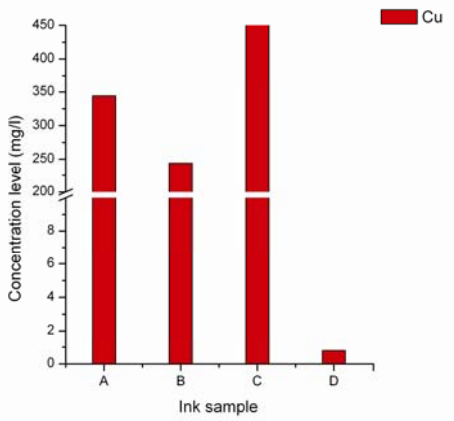

Figure 1. Concentration levels of Cu in waste printing inks

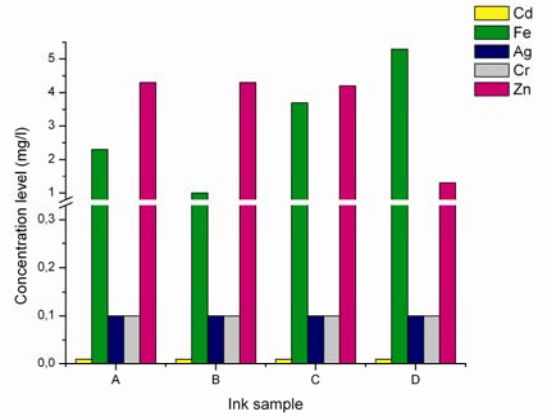

Figure 2. Concentration levels of Cd, Fe, Ag, Cr and Zn in waste printing inks

The variations of the metal concentrations in waste printing inks are in the following range: 0.8 – 450 mg/l for Cu, 0.001 mg/l for Cd, 1 – 5.3 mg/l for Fe, 0.1 mg/l for Ag, 0.1 mg/l for Cr and 1.3 – 4.3 mg/l for Zn. As seen from the Figure 1, copper has

the highest variation of the concentration levels (in the range of 0.8 to 450 mg/l) in dependence on the type of the waste printing ink. The maximum allowed concentrations (MACs) to drainage of hazardous matters in the city sewage system according to the Center of Excellence for Environmental Chemistry and Risk Assessment (CECRA) for Cu, Cd, Fe, Ag, Cr and Zn are: 2 mg/l, 0.5 mg/l, without limitation, 2 mg/l, 3.5 mg/l and 5 mg/l, respectively [13].

The high concentrations of copper, which are above the MAC value, were observed in the conventional waste inks (A, B and C, respectively), due to the presence of the phthalocyanine blue pigment. The lowest concentration of copper, which is below the MAC value, was observed in eco-solvent waste inks (D), due to the absence of mentioned blue pigment.

CONCLUSIONS

Based on the experimental data it can be concluded that the concentration levels of all the target metals, except the copper (240, 344 and 450 mg/l in conventional waste printing inks B, A and C, respectively), were within the instrumental detection limits (LOD) and below the MAC values prescribed by the Center of Excellence for Environmental Chemistry and Risk Assessment (CECRA).

By analyzing the data, we concluded that the reduced concentration levels of heavy metals in eco-solvent waste printing ink are the result of ever present trend for use water-based inks and vegetable oils based inks. Also, applying the eco-friendly inks in printing process will reduce the emission of volatile organic compounds (VOC) and other pollutants into the printing environment. That will preserve the employee's health and keep the ecological balance of the printing environment.

The usage of alternative inks is observed through reduced metals concentration, less consumption of printing inks, similar print quality as with conventional printing inks, but a longer drying time and a limited range of colors. Also, the application of alternative inks requires more expensive materials investments, but the high price is compensated for the working environment protection.

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NATIVE VEGETATION AS A BASIS FOR SUCCESSFUL LANDSCAPED ROADS

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ABSTRACT

This is a review of principles of the use and benefits of native vegetation, primarily through the assessment of ecologic species which can be used in landscaping roads.

Keywords: native woody plants, roadside landscaping

INTRODUCTION

Functionality, as well as the age of living tree species and the basic elements of green areas, is diverse and depends on the type and characteristics of the specifics of a small area which may have many variable environmental conditions [1]. The dynamics of growth and achievement of certain developmental stages and longevity, depends on the conditions in which some plants develop. During the construction of roads, it is standard practice to use inert construction materials (concrete, metal, asphalt), which cause poor and difficult conditions to the environment. This is manifested in terms of effects on woody plant individuals, mostly indirectly, more or less modifying microclimates and health conditions in the environment. The influence of generally dry and warmer habitats in which specific landscapes are developed along roads, is often very unfavourable for individuals of certain species, so that some of them, even when they are indigenous, they must be totally excluded from the landscape, unless they can be provided with very complex and expensive care [2].

This review aims to show the importance of the use and function of native vegetation in the process of landscaping of roads. The paper provides a review of woody plant species for landscaping roads in our climatic conditions.

THE FUNCTION OF NATIVE VEGETATION IN LANDSCAPING ROADS

Landscaping along roads should fulfil several functions: sanitary - hygienic, engineering - technical and aesthetic functions.

The volume of physiological activity of the individual is mostly directly related to the sanitary - hygienic function. The intensity of physiological processes depend primarily on the processes which create a new plant mass [1]. Only during the conduct of the process of photosynthesis, respiration and the construction of new plant tissue, the tree as an organism achieves environmentally desirable and necessary (intense) absorption of harmful substances, that is binding and removing pollutants from the air. Trees, as an element, that actively contribute to the improvement of environmental conditions have an even greater environmental impact if their growth is more intensive in height as well as in thickness. Use of native plant species, and therefore potentially most resistant species of trees for the landscaping of roads, which are already acclimatized to the conditions in the microclimate of a site, this effect is manifold and achievable.

Native vegetation, in addition to sanitary functions, are also of protective importance, protecting soil from further degradation and erosion on steep slopes, especially along roads. As well as being a sanitary function, it is also the most important engineering and technical function. In addition to stabilizing and strengthening soil slopes, engineering functions of landscaping alongside roads is reflected in the protection from wind and snow drift. The construction of wind and snow barrier belts has a special purpose in the process of landscaping roads.

Figure 1. The current native vegetation as a basis for road landscaping.

Many native plants have attractive flowers, leaves, winter twigs, autumn colour and produce a unique landscape. Creating a beautiful and pleasant landscape with native plants achieves an aesthetic function.

Travel by car through bleak, lifeless, difficult and monotonous sites is a tedious and uninspiring task. Greater passenger satisfaction can be achieved if the view is of landscaping, woodlands or fields [3]. Therefore, it is apparent that landscaping along roads for passengers presents an important attribute of a pleasant journey.

NATIVE WOODY TREES IMPORTANT FOR LANDSCAPING OUR ROADS

Along with longevity and resistance of plant species to different pollutants in air and soil, native woody trees only require minimum from soils. These conditions are more extreme alongside roads and are one of the most important biological criteria for landscaping of green spaces along our roads.

Exposure, steepness of terrain and shallow soils alongside roads often generate warm pedological and microclimates in which thermophilic native vegetation dominates.

The most important native woody plant species for the landscaping of our roads is as follows:

Acer campestre L. (family: Aceraceae Juss.) – Field Maple is a deciduous tree with a height of up to 20m and a wide ecological amplitude. It grows naturally in lowlands and hillsides, in the zone of oak. The flowers are light green in erect clusters, honey bearing. It is suitable for landscaping of roads, because it is not particular about soil conditions and tolerates shade of other trees.

Acer platanoides L. (family: Aceraceae Juss.) – Norway Maple is a tall tree that grows in height up to 30m, and naturally grows in beech regions. When grown in groups a thick egg-shaped treetop is established and a round tree top is formed when free standing. Norway Maple is one of the most important tree species for landscaping roadsides as well as for tree rows and for landscaping with other vegetation. It is ornamental in the fall because of intense yellow leaves and is resistant to pollutants.

Acer pseudoplatanus L. (family: Aceraceae Juss.) – Sycamore is one of the most important species for the landscaping of our roads. The Sycamore is a tall tree, which can reach up to 30m in height. It can be found in beech zones as well as in a fir and beech zone. Sycamores seek deep and moist habitats. They can be used for landscaping roads with a northern exposure and shady sites. It is resistant to frost and cold so can be planted by roadside areas characterised by frost belts, cold winds and etc. It is a fast-growing species.

Figure 2. Aesculus hippocastanum L. in a tree row

Aesculus hippocastanum L. (family: Hippocastanaceae DC.) - Horse-Chestnut is our endemic and relict species, very important for the landscaping of roads, for planting as tree rows, compositions with other landscaping or as solitary planting. It is resistant to harmful gases and pollutants in the air or in the soil. Horse chestnut trees reach a height of up to 30m and form a wide or a wide oval crown. It is most ornamental in the flowering period, which lasts from April to May. The flower is white or pale pink in large, upright clusters.

Carpinus betulus L. (family: Corylaceae Mirb.) – Hornbeam is a high deciduous tree, which grows as the majority species in stands in lowlands and mountain belts. The Hornbeam has a meliorate function for soil and improves it. It is resistant to frost and can be planted in frosted areas. It sprouts strongly from the stump, so it is good as a pioneer species in degraded areas. The leaves in the fall have a golden colour.

Carpinus orientalis Mill. (familija: Corylaceae Mirb.) – The Oriental Hornbeam is a small deciduous tree which grows up to 10m high with a dense, branchy crown. It grows naturally on steep slopes and shallow, skeletal erosion rendzine, where it forms stands of Carpinetum orientalis. Oriental Hornbeam is suitable for the landscaping of wastelands and rocky terrain. It is an extreme heliophyte.

Corylus colurna L. (family: Corylaceae Mirb.)– Turkish Hazel is a high deciduous tree which grows up to 25m and can have a trunk 1m in diameter, a conical or wide oval crown. It develops well in lime soil, and occurs in a range from mesophilic beech stands to thermophilic lilac stands. In nature, it can be found on steep terrain, on sunny side of ravines and rocky terrain, on deep brown forest soils and it can also be found on gentler slopes. It is a fast growing species and is resistant to frost. It binds terrains and is suitable for planting in windbreak belts along roads. The dark green colour of leaves is retained well into the fall.

Corylus avellana L. (family: Corylaceae Mirb.) – Hazel is a deciduous shrub or sometimes a small tree which can grow up to 7m. In Serbia, this species is widespread in all regions, often in stands of Oak, but mainly in deep and fresh soil. It is often formed as coppices so it is suitable for planting along roadside slopes. There are many ornamental forms of this species, and the purple variety is especially suitable for landscaping slopes along roads.

Figure 3. Cotinus coggygria Scop. – The smoke tree used for landscaping highways.

Cotinus coggygria Scop. (family: Anacardiaceae Lindl.) – The smoke tree is a shrub 2-3m high, decorative during flowering. Naturally grows in the thermophilic forests on the rocky terrain.

Forsythia europaea Deg. Et Bald. (family: Oleaceae Hoffmgg. Et Link) – The European Forsythia is a dense, upright, branchy shrub with a height up to 5m and is an endemic to the Balkan Peninsula. It is a suitable species for the landscaping of roads, particularly in compositions because it blooms before foliating and has a very yellow flower. It is very decorative and is a good binder of soil.

Fraxinus ornus L. (family: Oleaceae Hoffmgg. Et Link) – The Flowering Ash is a deciduous tree with a height of up to 10m. It grows throughout continental territories of Serbia in thermophilic forests. It is suitable for landscaping roads and stabilizing slopes because it is a good binder of soil and is a bio-meliorative species. Flowering Ash is most ornamental during the period of flowering and in the fall because of the purple colour of leaves.

Syringa vulgaris L. (family: Oleaceae Hoffmgg. Et Link) – Common Lilac is a high deciduous shrub, which naturally occurs in forest and shrub stands and is also of a particular vegetation type - coppice. The species is particularly significant because it represents an endemic and relic species found in a narrow geographic area of the Balkan Peninsula. Lilac is an excellent pioneering species, which will be one of the first to spread on erosion degraded soils and often with other pioneering species (Cotinus coggygria Scop., Prunus mahaleb L., Fraxinus ornus L., Acer monspessulanum L., Carpinus orientalis Milli ect.). Lilac easily spreads throughout thermophilic degraded forests on exposed steep slopes, due to large amounts of light and lack of competition from other species. Lilac is characterized by a large aboveground mass as well as an underground mass and has great capacity of vegetative reproduction and formation of dense clumps.

Cornus mas L. (family: Cornaceae Dum.) – Cornelian Cherry is a deciduous shrub that grows in hot and dry habitats. It is suitable for landscaping roads because it creates dense coverage and binds the soil. It is decorative in the early spring because of yellow flowers and red fruits in August.

Crataegus oxyacantha L. (family: Rosaceae Juss.) – Midland Thorn is a shrub or small tree of wide ecological amplitude, which grow in various habitats. It is a very suitable species for landscaping of roads, as it requires minimal conditions from the environment. It is decorative during blooming in May and in time of fruiting. The flowers are a whitish pink and its fruits are red.

Crataegus monogyna L. (family: Rosaceae Juss.) – The Common Hawthorn is a bush or low tree that is found in oak belts. It can be used for the landscaping of roads as a second level of trees.

Prunus laurocerasus L. (family: Rosaceae Juss.) – The Cherry Laurel is an evergreen shrub with a height up to 3m. It is a fast-growing species which tolerates shade and frost and therefore is suitable for the landscaping of roads. It is conducive to a moist habitat.

Figure 4. Prunus laurocerasus L. used as landscaping of highway in second levels.

Prunus spinosa L. (family: Rosaceae Juss.) – The Blackthorn is found in bright and warm habitats, frequently in oak belts. Often grows in hedges and as such is suitable for landscaping roads. It is a shrub up to 4m high and it is decorative during flowering and in time of fruiting.

Sambucus nigra L. (family: Caprifoliaceae Juss.) – The Edler is a bush or smaller tree which grows to 6m high. It is found in oak belts mainly on plains and hill sides. It seeks light and requires deep and moist soil. It is decorative during blooming in May and June and while fruiting.

Tilia argentea DC. (family: Tiliaceae Moench.) – The Silver Lime is an indigenous species that is present in thermophilic stands in Oak belts. It is a tall tree and very suitable for solitary planting, with an extensive, dense, wide pyramidal crown. It tolerates shade, drought and increased air pollution.

CONCLUSION

For landscaping roads, environmentally relevant species should be used, primarily native species, because they are adapted to specific environmental conditions. Growing almost wild, they are simple to plant, cultivate and maintain in good condition. Their distinctive morphological and psychological character makes for a good basis for preserving the local environment. When choosing species for the landscaping of roads, if there is existing vegetation its floristic composition and bio indicators should be analyzed and on that basis the recommendation of introducing new species should be given. Analysis of existing species can give us a clear and accurate picture of the existing environmental conditions prevailing in a given area.

When planning indigenous species of plants for landscaping roads, one should choose plants for their form, colour, structure, and other visual features leaving the viewer with a pleasant and beautiful impression. Although the planting of trees along

side roads is the major element of a composition, it is also recommended to plant shrubs and ground coverage. It should be noted that native plants are the most important part of local natural ecosystems. They are a critical link for the movement of species, such as insects, birds and other species that live together. They also provide food and protection to wild animals.

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USE OF NATIVE WOODEN VEGETATION FOR STABILIZATION OF ROADSIDE SLOPES

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ABSTRACT

Modern road construction operations in addition to standard construction (earthworks, building of bridges and roads) devotes considerable attention to the passive protection of landscapes, aesthetics and the shaping of the surrounding terrain and special techniques of landscaping slops along roads. This paper presents a view of the implementation of woody vegetation to fortify slopes along roads for the protection of soil and the environment.

Keywords: native woody vegetation, slope stabilization, roadside slopes

INTRODUCTION

The problem of fortification and stabilization of slopes alongside roads was, till recently, solved by using artificial materials and traditional construction methods, neglecting possibilities of the application of natural materials, especially vegetation. Although the development of geotextiles and geomembranes is used to improve soil structure, vegetation is used as a secondary component which encourages interest in the use of vegetation as the main factor of stabilization.

Soil slopes along the road landscaped with trees and bushes were almost completely protected from erosive damage of water and wind. Precipitation reaches soil partially with a reduced rate, because the water is divided into very small flows, as encountered on the leaves and ground floor vegetation. The water absorbed by the earth slowly descends through the root system, so there is no erosive damage.

This review is an introduction to the principles of using woody vegetation as well as its advantage in the stabilization and binding of slopes alongside roads.

THE SHAPING OF SLOPES ALONGSIDE ROADS AND PROSPECTIVE LANDSCAPING WITH WOODY PLANTS

The gradient of soil slopes of both gully-cuts and embankments are usually constructed at sharp angles in order to reduce both cost and soil excavation. For gully-

cuts, as well as the top of embankments, the usual gradient is 1:1.5 or sometimes gentler, 1:2. The lower the height of the embankment, that is the depth of the gully-cut, the gradients are 1:4 or less. Thus, it reduces the impression of technical operations on the site.

From the aspect of landscape practices during construction of soil facilities (embankments and gully-cuts) it is desirable to encourage naturally designed slopes, with continuous gentle transitions (fig. 1.), depending on local conditions. Glacises and slopes in the surrounding landscape should be formed so as not to give the impression of technical intervention on the site. In addition, these slopes are easier to landscape. Glacises allow the use of woody vegetation that encourages visual quality of an entire site.

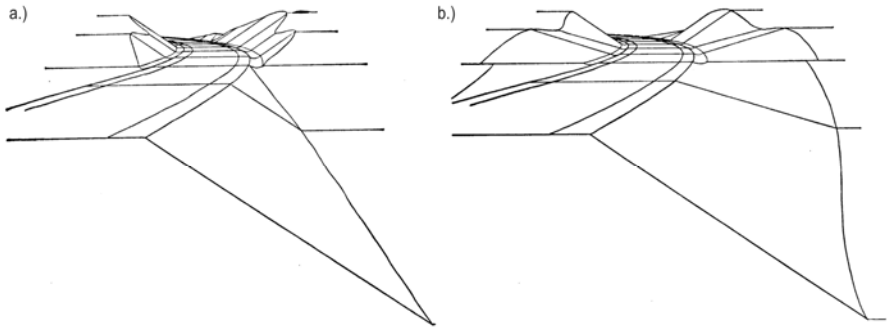

Figure 1. Design of slopes along roads; a) a sharp shaped slope on a site appears unnatural; b) a free shaped slope with a continuous gentle transition.

LANDSCAPING SLOPES ALONG ROADS WITH TREES AND SHRUBS

Landscape sites are almost completely protected from erosive water or wind damage. Precipitation reaches soil partially with a reduced rate, because the water is divided into very small flows, as encountered on the leaves and ground floor vegetation. Precipitation only partially reaches the soil and with a reduced rate falls due to the water being divided into very small flows, as encountered in the leaves and ground floor vegetation. The water absorbed by the soil, slowly descends through the root system, so no erosion damage occurs.

Strong cross-winds, which are very dangerous for drivers, are much less at roads which have high level trees as protective vegetation.

In the technique of landscaping slopes along roads, each plant has an aim to protect the upper surface of the slope from erosion caused by water and wind. This is best achieved by trees and bushes. Landscaping needs to serve, apart form the aforementioned primary purpose, an aesthetic, visual impression which presents another aspect of forming vegetation along roadsides.

On sharp gradients, moist soil slopes, decomposed rocky layers, and so on, erosion would be destructive however, planted grass, roots and planted trees would keep

and protect the soil [1]. What, then, can make the construction of landscape features remain intact?

The answer can be reduced to a single sentence: On the affected sites, vegetation must be selected to achieve, for at least a while, to act as a mechanical fixture, until their roots develop and achieve permanent protection. When it comes to trees, there are mainly two steps: strengthening slopes with twine using willow wattle and landscaping slopes with decorative trees and shrubs.

The technique of working with willow wattle

Wattle and branches of willows which are taken during dormant periods of vegetation that is, in the state without leaves, just before foliage, are either speared into or laid on the soil. In the beginning of the vegetative period, they will spread roots into the soil or foliate above ground. Different species of willows have different needs for climate, water, soil etc. for normal growth and development. Because of this, a willow taxon should be selected appropriately for the conditions of a site. For example, sallow (*Salix caprea*) because of its poor ability to sprout, it is not suitable for this purpose. Other species of trees like black poplar or white lilac also sprout roots from cut wattle and branches, but they do not have the ability to twine as well as willows and cannot be found in a sufficient quantity.

The best installation is if the majority of wattle is speared in the ground and above ground only a small protrusion remains. The protruding part should be thinner. Willows need a lot of light and will not thrive in a shady site. The willow is very sensitive during the period of root formation, especially towards other plant roots, it is even more sensitive to advanced root systems of other plants. Actually, willows are only suitable in the first faze. It is only a temporary solution for stabilizing the slopes (gully-cuts or embankments) because the other species will outgrow it, overshadow it and in turn destroy it. On installation, the willow is more or less alone, and will prosper with plenty of air, light and underground water. Constructed slopes, using willow, in time will become vegetative which will develop almost ten years. Later, other species of trees will sprout and develop which will eventually suppress the willow. The suppression of one plant, by trees and shrubs, which man has planted for technical-constructual reasons, is more effective as stabilization so the defence from erosion is better than the willow alone.

If the willows are not desired for a longer period, then between them other trees should be grown, and the willows should be pruned every year until they become just roots, which will continue to protect the slope from erosion.

Twine of willow wattle is built as follows: in a soil slope impeach strong wooden stakes, and leave them sticking out the same size as the amount of the twine. Distance of stakes in a row is determined by the strength of available wattles of willow. Between the stakes, the wattle is laid in a zigzag fashion, one on top of each other, so that a woven wall is formed at a height of 20-25cm. In interspaces, thinner stakes are speared. For twine, foliating willows are mainly selected, due to root systems that strengthen the twine. Wickers are placed on the slope obliquely to each other at a distance of 2m or more, in order of crossing (fig. 2.).

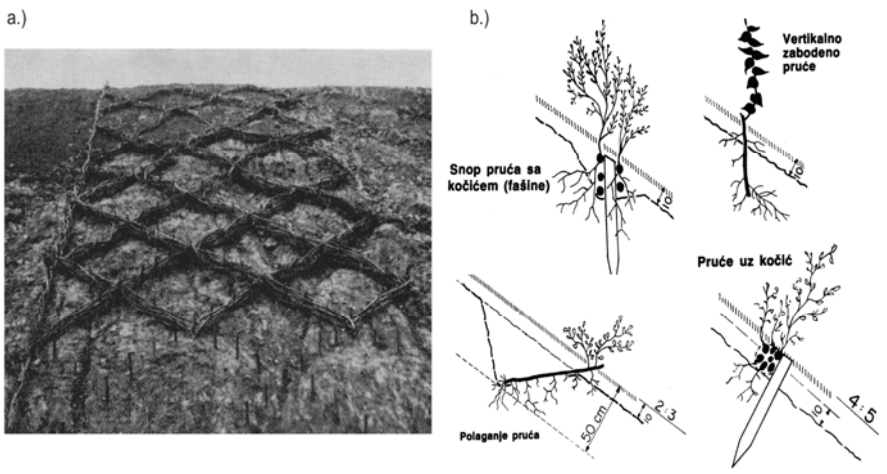

Figure 2. a) Twine made before filling with fertile layers of soil. b) Spear wattle, weave of wattle (staked wattle, laden wattle and their rooting).

When the end of the living structures on infertile soil is completed, the same is filled with fertile soil, so that it barely covers the wicker. This way, the willow wattle will not dry out, will grow roots into the soil and foliage will emerge from the buds.

Classic landscaped slopes with decorative species of trees and shrubs

During landscaping of slopes alongside roads, the new vegetation should primarily supplement the old, which is retained after construction, so there is a new visual formation in the landscape.

This requires careful establishment between the relationship of the new landscaping and existing vegetation, which often consists of a group of shrubs and trees or forests. Sometimes, even remaining bushes have to be removed. For users of the road, vegetation makes the surrounding driving area often more pleasant than the roadway itself. This space should not, however, turn into a thick green continuous channel or tunnel. It is desirable to form open views, as well as the possibility of creating a feeling of different aspects during driving.

The aim of planning landscaped roads is spatial designing of sites with full retention of old vegetation, as well as forming new. Construction and landscape plans of sites during construction must be coordinated (fig. 3.).

When choosing a new species for landscaping slopes alongside roads, they should primarily be native vegetation and have decorative characteristics such as flower colour, length of flowering and flowering phases. Ornamentality can be seen through the colour of leaves, their size, texture and so on. It is very important to consider technical regulations on the permitted distance of trees and shrubs from the road during planting (fig. 4).

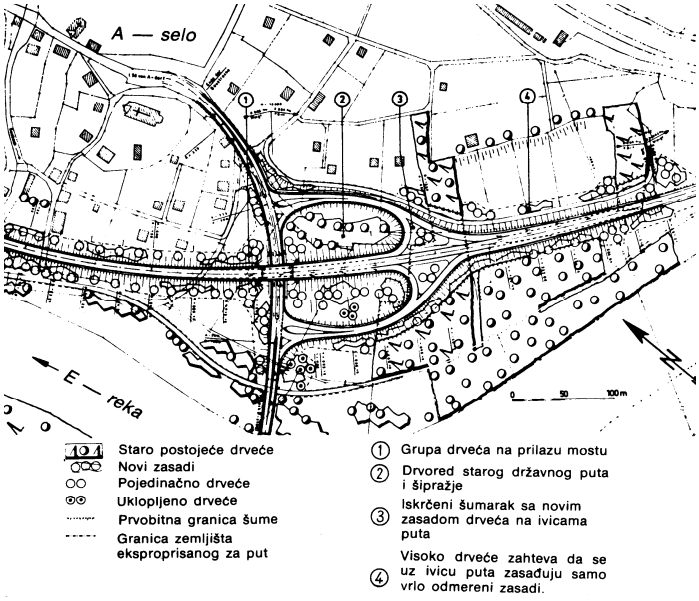

Figure 3. A segment from a plan of a road site which practically fits the existing vegetation with new.

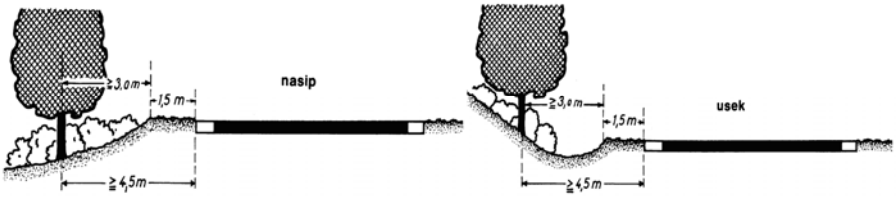

Figure 4. Distance of trees from the road.

ADVANTAGES OF WOODY VEGETATION IN STABILIZING SLOPES ALONG ROADS

The effects of stabilizing soil slopes are much higher with the use of woody species because they have a much more developed root system.

A large part of the root system of woody plants is permanent. That means that the efficiency with which the roots of trees and shrubs bind and strengthen the soil is

only slightly decreased during winter and gradually increase over time, along with the growth of the plants. This is an obvious contrast to seasonal periodical herbaceous vegetation.

The depth of the root system of woody plants is larger than herbaceous vegetation and because of that they have a greater impact in the prevention of slope instability deeper in soil. Of course, there are differences between plant species and vegetation types. Tensional forces and root pressure of woody plants are greater than that of herbaceous species.

Measurements carried out in the first year of development of the root system did not show significant differences [2], but the root diameter of woody species increase each year.

The relationship between the root diameter and its strength is not proportional. The strength of the root is not the only important parameter, other important factors to be taken into account in determining the quality of stabilization with woody plants are root growth rate, direction, diameter and density; soil conditions also have a huge impact. But the strength of thicker roots (which only exist with woody species), provide relatively high resistance. In some root systems, there was a noticeable decline in strength after cutting the wood, which shows that dead lignified roots have strength which is 50% the strength of healthy trees [3].

During the winter, crowns of evergreen woody vegetation prevent snow covering from rapid melting. Snow on the slopes acts as an insulator that prevents freezing of the soil. It is a known fact that frost has a negative effect on the stability of slopes [4].

The root systems of vegetation coverage not only strengthens the soil but also supplies soil with water and air as well as some organic matter or mineral salts even to layers which would be completely inert parts of the soil without the vegetation [5].

For water, we can say that it is the main problem because it leads to instability of slopes. Effects of vegetation on the increase and decrease of soil moisture are manifold. Roots increase soil porosity, which improves the absorption of water.

Trees draw moisture from the soil, draining it, leading to an increased capacity to receive water. Foliage retains rain drops and some of them immediately evaporate without penetrating the soil.

Roots draw moisture from the soil which is then lost through transpiration, causing reduction in water pressure in the pores of soil, increasing the speed at which the soil dries.

By reducing the water pressure in the pores of soil (moisture content) increases the binding of the soil and thus the stability of slopes. High water pressure in soil pores reduces the binding of the soil particles.

Mechanical influence of plant roots on the soil is generally known, but it is very difficult to express numerically. Today, geo-mechanics is trying to include stability analysis as a factor of influence of plant roots on the binding of soil slopes. The latest project related to this issue launched CIRIA in 2001, which set a mathematical formula for calculating the stability factor of the existing slopes, including the effect and influence of vegetation.

When selecting the species of trees with deep and branched root systems, it is recommended to use shrub species because they do not burden the slopes too much, and perform as a very useful natural drainage and partly reinforce sliding masses [6].

CONCLUSION

Today, throughout the world, it is taken into account when constructing roads that they not threaten the structure and sustainability of the environment through which they pass. When planning the route of a road, all natural conditions, including existing vegetation, should be taken into consideration. If a road divides or disrupts a natural structure, it is necessary to change its direction in order to preserve the immediate environment.

Landscape that remains after the road passes through is also very important. For this purpose, in modern road construction, it is mandatory to incorporate landscaping projects.

Modern roads must be adjusted to the psychological needs of the driver. The passengers always want to see the road with a nice and quiet environment, rich with vegetation.

When designing a landscape it must be interesting and dynamic for the passenger, and this is achieved by alternating rhythmic curves, straight lines and routing the road through preserved and interesting landscapes.

The road should be built so that the passengers have an impression of safety, satisfaction and mental relaxation. Roads that do not leave such an impression on passengers, cannot be considered as first class roads. The use of woody species in aesthetics as well as engineering and technical aspects is extremely significant.

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ECO-TOURISM AND SUSTAINABLE DEVELOPMENT IN THE DANUBE DELTA

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ABSTRACT

The sustainable development could be considered a chance to the human race. Tourism is enrolled between polluting activities but it can develop respecting the principles of durability. Eco-tourism is an alternative to mass tourism, able to protect nature and to develop local communities.

The protected areas could be enrolled in the projects of implementation and eco-tourism practicing.

In the Danube Delta, Reservation of the Biosphere internationally acknowledged, eco-tourism is practiced through various forms. The tourist circulation in this area shows us that just a few tourists choose to spend their free time here.

Keywords: development, durability, tourism, eco-tourism, protected area, the Danube Delta

INTRODUCTION

The environment is the main factor for the survival of the human kind to continue and the protection of the environment and the economic development must be contemporary preoccupations.

In this way we must focus on sustainable development which answers to the current necessities of the society without jeopardizing its future.

The protection of the environment was given a complex status within the European policies when the Treaty of Maastricht was signed. Thus, The Committee of the European Community has established the fundamental criteria of the sustainable development, namely:

- the maintaining of life quality;
- continue access to natural resources;
- avoiding permanent deterioration of the environment.

Tourism, as any other economical activity depends on the environment and its quality can cause important degradation to it.

The sustainable development of tourism would mean:

- the increasing of the level of ressource exploitation and capitalization, without altering their value;
- the increasing of working places;
- the development and the preservation of crafts;
- the access of population to tourist facilities;
- the extension of the life expectancy;
- the avoidance of the environmental deterioration;
- the decrease of the withdrawal of land from the agricultural circuit.

This type of tourism development is based on some principles such as:

- the environment, being the main element which supports tourism, must remain to the next generations;
- practicing tourism to create benefits to the environment, local communities and tourists;
- the existence of a long term relation between the environment and the tourist;
- the preserving of the place's characteristics;
- the preserving of a balance between the participants' needs (tourists, hosts and destination);
- respecting principles of all the involved ones in the tourist activity and their responsibility.

The sustainable tourism develops the idea of satisfying the needs of the present tourists and the tourist industry and, in the same time, the needs of protection the environment and future opportunities. The focus is on satisfying all the economical, social, aesthetic needs of the tourism ''actors'', maintaining the cultural, ecological integrity, biological density and all the systems which support life [1].

ECO-TOURISM – A FORM OF TOURISM SUSTAINABLE DEVELOPMENT

Compared to the mass tourism which developed between 1970 and 1980, the lasting development of tourism drew attention upon some more flexible and reduced tourism forms. Within these new "tourism forms" we include rural tourism, eco-tourism and agro-tourism.

Also known under the name of "green tourism", these tourism-forms are generated by the tourist space of a "green" kind.

Eco-tourism is known as an alternative form of tourism meant to support the preservation of nature and the local development of the settlements.

This kind of tourism assumes the following directions, namely:

- the preservation of the quality of the natural environment;
- a restructuring based on reshaping the resources management;
- practicing some types of individual or group tourism which acknowledges the pollution problems.

The definition most often used by the specialists shows that "eco-tourism is a tourism practiced in natural wild areas and traditional cultural areas less modified by the people and which must constitute the sanctuary of the protection of nature and of the ancestral forms of civilizations to develop the economical development of the local communities"[2].

For its implementation in an area some steps are necessary to take:

- the inventory of resources , the assessment of their condition and the valorification modality;
- the identification of the tourist products which could be created and the target markets;
- the elaboration of some realization plans for this products;
- putting them in practice;
- to attract in some shared actions of all the involved factors;
- the realization of some legal structures necessary to sustain these plans;
- collecting after-project data.

The ecological positive effects that are possible to produce after practicing this form of tourism are considered to be:

- limiting the destructive effects resulted from the economical activity or the uncontrolled tourist circulation on tourist potential;
- limiting the access for mass tourism in the sensitive ecological areas;
- increasing the activity of tourist resources;
- a better cohabitation on Earth.

According to the definitions given to tourism, we appreciate that the protected areas could constitute the starting point to develop eco-tourism. From a tourist point of view these protected areas present a special attractiveness and could be characterized through:

- position and accessibility;
- surface and structure of the existent species.

At an international level, at the moment, the categories of the WCU management (The World Conservation Union) are:

- Strict Natural Reservation;
- Wild Natural Area;
- National Park;
- Natural Monument;
- The area of Management of the habitats/species;
- Protected Area with controlled resources.

It is considered that the main purposes for which an area is protected are the following:

- scientific research;
- the protection of the wildness and the diversity of species;
- maintaining the services;
- the protection of some natural and cultural characteristics;

- tourism and recreation;
- education;
- the sustainable use of the eco-systems;
- preserving the traditional and cultural characteristics.

According to the present legislation, at the Romanian standards, the protected areas are grouped in two categories as it follows:

- reservations of the biosphere, national or natural parks;
- reservations and natural monuments.

THE ECO-TOURISM IN THE DANUBE DELTA

From 1990, the Danube Delta was declared Reservation of the Biosphere, accordingly to the decision of the Romanian Government, this being certified also internationally through the UNESCO decision.

The Danube Delta is being situated in the Eastern side of the country, in the North-East of the Danube to the Black Sea. The Northern limit is given by the state border with Ukraine, in the South by the Dobrogea massive mountain and in the East by the sea shore. More exactly the geographical coordinates of the deltaic space are between 44 47'25'' (the peak of Perişor grind) and 45 37'30'' (the bank of the Sasic lake-Ukraine) Eastern longitude. It is divided in natural subdivisions as follows:

- the fluvial Delta;
- the river-maritime Delta;
- the Lagoon complex Razelm- Sinoe.

The termical aspect from the Danube Delta is obviously influenced by the closeness of the sea and the presence of big stretches of interior water which have a moderate effect. The annual average temperature (normal) in the Delta varies around the value of 11 Celsius degrees, increasing to the seaside.

The total surface of the Biosphere Reservation of the Danube Delta is of 5800 squared km from which:

- 3510 sq km the basic Delta- the Romanian sector;
- 1145 sq km the lacustrine Complex Razim- Sinoe;
- 1030 sq km the maritime waters until the Isobath of 20m;
- 13 sq km the Danube bed between cotul Pisicii and Isaccea (on Romania's teritory);
- 102 sq km the floating meadow of the Danube between Isaccea and Tulcea.

The developed habitats in the reservation are various hosting 5380 of types of plants and animal communities, as it follows:

- -30 types of eco-systems;
- 5380 of species from which:
  - 1839 species of flora
    - planctonic seaweeds (678 species)
    - lichens (107 species)
    - macromycetes (38 species)
    - vascular plants (1016 species)
  - 3451 species of wildlife

- -mollusks (91 species)
- -insects (2244 species)
- -fish (86 species)
- -amphibians (10 species)
- -reptiles (11 species)
- -birds (331 species)
- -mammals (42 species)

Within the reservation the following areas were delimitated:

- strictly protected (18 areas representing 8, 7 % from the reservation surface);
- buffer (13 areas representing 38, 5 % from the reservation surface);
- economical (52, 8 % from the surface of the reservation).

The access to the reservation is possible only by navigable means leaving from the Tulcea city, which is reachable by plane, train or other vehicles. There are everyday departures, regular, towards the Sulina, Sfântu Gheorghe and Periprava cities. For this purpose there are also:

- small classical ships;
- catamaran;
- fast ships;
- fast ships on carriers.

The Administration of the Reservation Biosphere of the Danube Delta tries the use of the natural resources by a sustainable means.

For tourist purposes the access is made on the exchange of a permit received in Tulcea, which costs 2.5 euros/ person/day.

There are also opened 19 navigable tracks which give to the tourists the possibility of a better discovery of the Delta and of its potential.

The main forms of tourism which could be developed on the territory of these reservations are:

- for rest and recreation;
- of knowledge (discovery), practiced either individually or by the intermediary of organized trips;
- specialized – scientific;
- for young people (the goal being the knowledge, the understanding and the treasuring of the nature);
- rural;
- for the nautical sports practice;
- safari-photo;
- for the practice of sport fishing and hunting.

The tourist activity takes place only 168 days per year (15^{th} May – 31^{st} December) because of the natural conditions.

The tourist circulation towards this destination has known a fluctuant within the centuries, this fact being obviously from the following data.

The number of accommodation settlements has raised from 76 in 2000 (considered a reference year) up to 144 in 2006 and 43 of them have closed afterwards

because of the legislative changes. In 2009 we notice again, within the analyzed area, 141 accommodation settlements. Moreover, we may notice that the number of the accommodation places has risen annually due to the improvements brought to these settlements.

Table 1. The evolution of the indicators of tourist circulation

Indicator	**2000**	**2005**	**2006**	**2007**	**2008**	**2009**
N° of accommodation settlements	76	122	144	101	103	141
N° of accommodation places	2540	3171	3269	3266	3761	4650
The current accomodation capacity	426658	532763	549171	548880	554298	688200
N° of coming tourists	34462	76961	54624	73767	96090	104213
N° of over-night tourists	84816	151162	139798	145978	174355	218848
The booking degree (%)	19,88	28,37	25,46	26,6	31,5	31,8
Average staying (days)	2,5	1,96	2,6	2	1,8	2,1

Source: The Romanian Institute for Statistics, 2010 data[3]

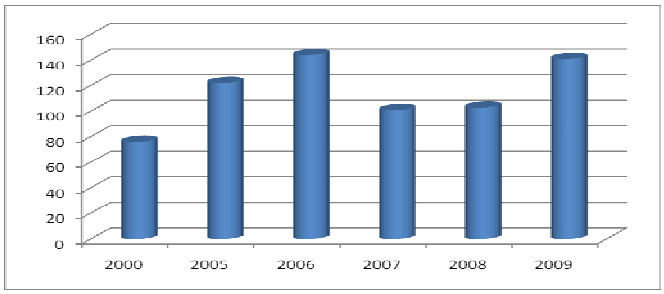


Figure1. The Evolution of the number of accommodation settlements

The beauty of the Danube Delta raised the number of tourists, with a minor exception in 2006 when there was a reduction because of the N1H5 flu, signaled from the 2005 autumn. Accordingly with the number of tourists the over-night staying decreased in 2006.

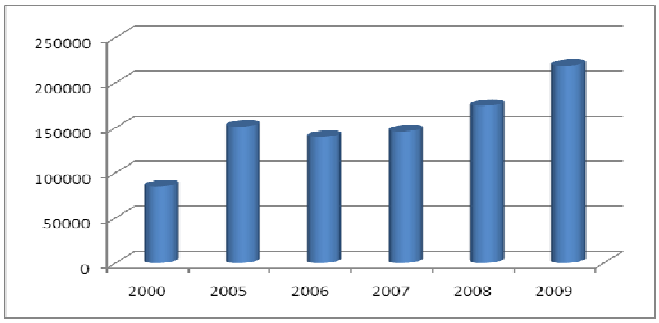
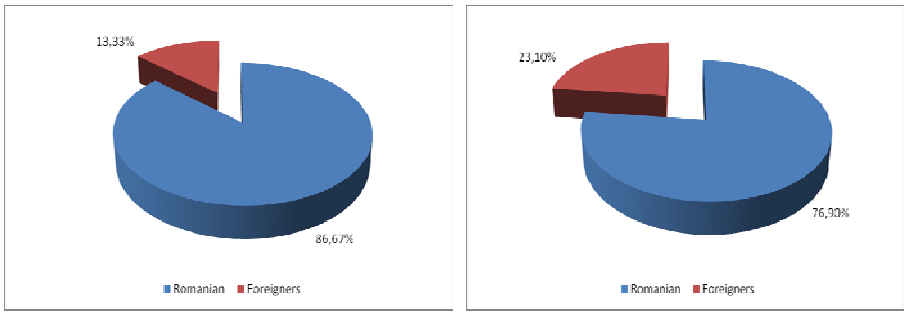


Figure 2. The evolution of over-night register

The booking degree had an uprising direction but the values are still moderate and we cannot talk about economical rentability.

From the average staying of 2.6 days we may conclude that the majority of tourists prefer the short staying or week-end holidays.



2000 2009

Figure 3. The weight of the Romanian and foreign tourist who have booked in

From the total of tourists arrived in the Danube Delta, the majority are Romanians, internal tourists and we may notice that during the last nine years the percentage of foreign tourists has changed in a positive way by ten percentual points. Taking into account the period the growth was minor.

CONCLUSIONS

Eco-turism is the type of tourism practiced in the Reservation Biosphere of the Danube Delta and there are several preoccupations in this sector. We notice that the number of the accommodation places and of tourists is increasing; however the occupation degree remains low.

The Delta tourism could evolve with a better promotion and a significant evolution of the tourist service quality. Eco-tourism offers the possibility of the maintaining of natural wealth from this part of the world and the limitation of pollution.

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SEWAGE TREATMENT USING DESULFOTOMACULUM RUMINIS IN BREWING INDUSTRY

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ABSTRACT

The paper presents a typology and review of the most popular sewage treatment methods used in brewing industry. Author distinguished three groups of methods which are currently applied in industries and especially in brewing industry. Results of reasearch on using *Desulfotomaculum ruminis* to reduce sulphur content in brewery liquide wastes are presented.

Keywords: biological methods, *Desulfotomaculum ruminis,* sewage treatment, brewing industry

INTRODUCTION

Brewery sewage induce deficit in oxygen content of receiving ponds as a result of high BOT_5. This leads to fast concrement expansion of *Filamentous bacteriae* and *Sphaerotilus natans*. Prompt decay processes in bottom sediments cause exhaust of reek gases, which contaminate atmospheric air in surroundings. Influence of brewery sewage on receiving ponds is seen in: sedimentation of slurry, fungi expansion, strong oxygen absorption, distribution of hydrogen sulphide and others accompanying undesirable and harmful phenomena [1]. Brewery sewage treatment can be classified into three main groups of methods:

- Mechanical treatment (grills, sieves and molecular sieves, sand separators and tanks)
- Physical and chemical treatment (neutralization,coagulation,filtration, sedimentation)
- Biological treatment (active sediment, trickling filter, sewage ponds)

All methods are exploited, however individual conditions create preferences as well as experience, being a tool of selection.

MECHANICAL TREATMENT

Methods of mechanical treatment of slurry and sewage from brewing industry is based upon removal of insoluble particles, namely impurities suspended in water. In

course of mechanical treatment of sewage the following particles are deposed: bigger solid particles, grain fraction, slope down suspension (preliminary sludge),floating suspensions (oils and fats), majority of parasites and eggs,part of micro-organisms and in this number also pathogenic microbes. In correctly operating mechanical treatment installations there should be attained the following results: removal of 90 – 100% of easily dropping suspensions, 60 – 70 % of overall suspensions, 25 – 40% of BOT_5, 20 - 40,% of COD, 70 - 95% parasites' eggs and 25 – 75% of bacteria. Grills, sieves, sand tanks and receiving ponds are used to treat sewage mechanically [2]. Sieves and molecular sieves are used to strain all impurities and, similarly at it was with grills, they can be classified based upon dimensions as *runny*, aperture size more than 1,5 mm, *medium*, aperture size 0,1-1,5 mm, *dense,* aperture size below 0,1 mm [3]. **Sand separators and tanks** are next mechanical method of brewery sewage treatment. They are used to remove and dispose sand, which consists of slug, coke breeze, coal different grains and other particles. Exploitation of sand separators is connected with sedimentation process.In settling ponds there is possibility of separation of solid particles with diameter over 0,03 mm. Sewage which undergone treatment in sand separators has considerably reduced BOT_5. In double chamber Imhoff tanks occurs release of methane and carbon dioxide, apart from separation of precipitate from sewage. Time and intensity of fermentation depends on temperature. In temperature between 10 - 15 ^{o} C, overall decomposition of residue follows after 2 - 4 months. Sand separators reduce BOT_5 about 40%, and suspension approximately 70%. Slope down precipitate is skimmed and removed outsider separator, in turn – purified sewage is directed to other water treatment factories or to receiving ponds [4].

PHYSICAL AND CHEMICAL TREATMENT

Physical and chemical methods are exploited more frequent when density of pollution is increasing. Usually pollutions can't be removed by biological method, so chemical and physical methods are necessity [5]. **Neutralization** is chemical reaction whereby an acid and a base react to form water and a salt. It is used as one of preliminary decontamination of brewery sewage before direct disposal to receiver, before draining to communal sewage system, before other chemical methods of decontamination and at repeat of pH correction used to standardize sewage to other treatment processes [6].The following reagents are used: **to neutralize acid sewage** NaOH, solution concentration of 20- 30 %, Ca $(OH)_2$ solution concentration of 5-15 %, Na_2CO_3 as solution, $CaCO_3$ as grain bed, MgO as granulate bed; **to neutralize base sewage:** H_3PO_4 as solution, HCl as solution, H_2SO_4 as solution,CO_2 as pure or flue (exhaust) gas [7].

BIOLOGICAL TREATMENT

Crucial aim of biological sewage treatment is removal from the sewage all biologically decomposed impurities. Decomposition of organic pollutants comes up from natural colonies of micro organisms suspended in fluid, which initiate and carry out the process naturally (method of active sediment) or microorganism creating harden biomass (trickling filter method). Organic pollutants are exploited by microorganisms due to

biochemical changes as pasture inducing increase of bacterial biomass. Remaining part of decomposed pollutants are discharged in oxygen conditions as carbon dioxide and water. In case of anaerobic processes gaseous products of organic mass decomposition are methane and carbon dioxide [8]. **Active sediment.** Sewage treatment, in which active sediment was applied, is based upon creation in fluid flocks with 50 - 100 mm diameter and extremely well developed surface. Flocks are built of mineral, brown, grainy nucleus placed in mucosal envelope and consisting of numerous heterofites bacteria species such as *Acinetebacterium, Pseudomonas, Zoogloea, Enterobacteriae, Aeromonas, Flavobacterium, Achromobacter* and *Micrococus*. Metabolism of microorganism results in mineralization of organic pollutants and absorption on outer surface of flocks. Active sediment method need to deliver oxygen as bio oxidation substrate of organic impurities [9]. Advantage of sewage treatment using active sediment method is high effectiveness of disposal sedimentation up to 95% and liquidation of pathogenic microbes up to 98% with relatively low demand for oxygen (BOT_5). In turn disadvantage is high vulnerability of micro organisms to toxic complexes and other factors affecting their expansion. High performance of active sediment method in brewing industry is proved by decreasing BOT_5 between 85 – 95 % [10].

THE MATERIALS AND METHODS OF THE RESEARCH

The aims of research were to isolate SRB bacteria of *Desulfotomaculum ruminis* strain, testing rate of reducing COD by using *Desulfotomaculum ruminis* in brewery waste treatment, researching catabolitic activity of isolated *Desulfotomaculum ruminis* raised on nutritionally rich medium containing brewery waste as the only source of carbon and energy and testing multiplication of bacteria on standard base, Brewery wastes (COD = 5412 mg O_2/dm^3)were taken at Cornelius Brewery owned by Sulimar company based in Piotrków Trybunalski in Central Poland.Sulphur reducing bacteria were isolated from peat bog soil in the vicinity of Poznan (Poland) and identified as *Desulfotomaculum ruminis* strain [11]. Multiplication and colonization of bacteria was performed at 37^OC, pH = 6.8 (with tolerance between 6.6 – 7.2) in anaerobic conditions (argon), in tightly closed sterilized glass reactors of 50 cm^3 in capacity containing a modified Starkey medium (without lactate). Brewery wastes were added to the bed as a source of carbon and energy in proportions reported below. Reference (blank) sample was conducted on Starkey medium with lactate. Tested samples, after degasifying, were inoculated by 4% inoculum taken from logarytmic phase of development (after 24 hours). Measure of reaction speed was sulphates to sulphides reduction rate checked in precisely defined intervals. Reactors were vemtilated with argon, while hydrogen sulphide exhales were absorbed in rinser containing 0.02M cadmium acetale. Laboratory equipement as well as Bed were etery time sterilized in 120°C. Sulphides were indicated in precipitated cadmium sulphide – iodometric method [12].

RESULTS AND DISCUSSION

There were study carried out to research first activity of bacteria on standard Starkey's bed, where sodium was a prime source of carbon and energy for

microorganisms. Activity of bacteria in experiment haven't showed difference comparing with results of other researches like Domka et consortes [13]. Reduction of sulfates was accompanied by considerable decrease of bed's (medium) COD, which reached 76,17% after 31,5 hours (fig. 1)

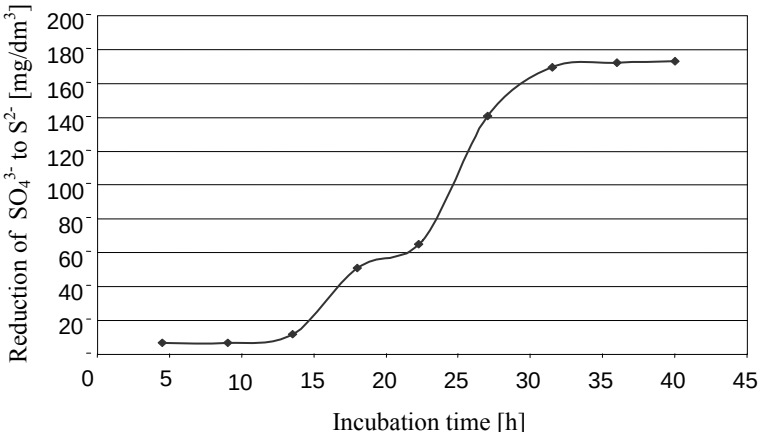

Figure 1. Kinetic curve of sulphate reduction process (sulphate respiration) of Desulfotomaculum ruminis on standard bed (Starkey medium) in 37°C

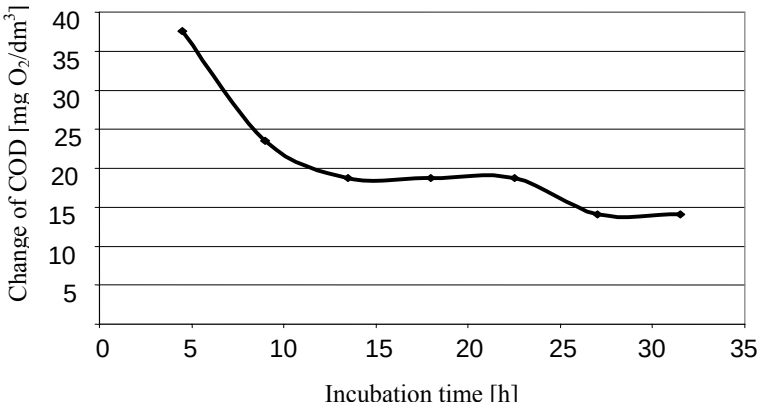

Figure 2. COD changes of organic pollutants reduction process of Desulfotomaculum ruminis on standard bed (Starkey medium) in 37°C

Changes in pollution indicators (SO_4^{2-}, COD) observed during sulphate respiration on Starkey bed depend on relation of COD to SO_4^{2-} and are similar in presented case to results of other authors [14]. Curves of sulphate respiration kinetic process occuring in modified, lactate less Starkey bed are presented on fig. 3 and fig. 4. Bed was modified with 10% and 14% brewery wastes respectively. As a result relation of COD to SO_4^{2-} has been diversified consequently resulting in changes of pollution rates. Research shows that after 25 – 30 hours rate of SO_4^{2-} reduction was slowering from 72% through 60% (Fig. 3) and 59% (Fig. 4) depending on pollutant solution of 10% and 14% respectively.

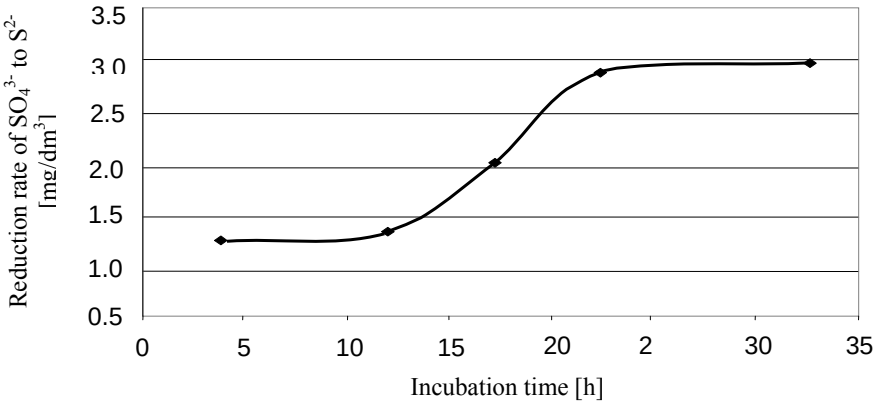

Figure 3. Kinetic curve of sulphate reduction process (sulphate respiration) of Desulfotomaculum ruminis on modified bed (Starkey medium) in 37°C with 10% brewer waste solution

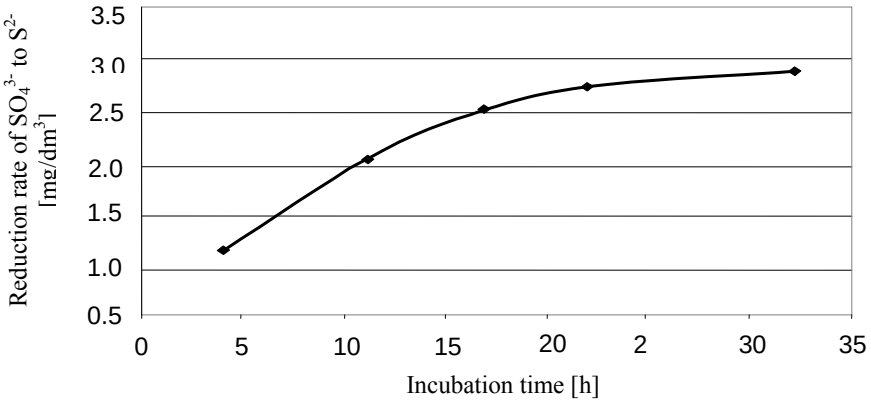

Figure 4. Kinetic curve of sulphate reduction process (sulphate respiration) of Desulfotomaculum ruminis on modified bed (Starkey medium) in 37°C with 14% brewer waste solution

Slowering of sulphates reductiuon process is especially clear in the latest case. Further continuation of the process didn't induce any significant changes in parameters of reaction, especially in sulphates reduction rate. Organic pollutants reduction rate, which accompany decrease of SO_4^{2-} in tested samples containg 10% and 14% solvent of brewery effluent was presented on fig. 5 and 6 respectively.

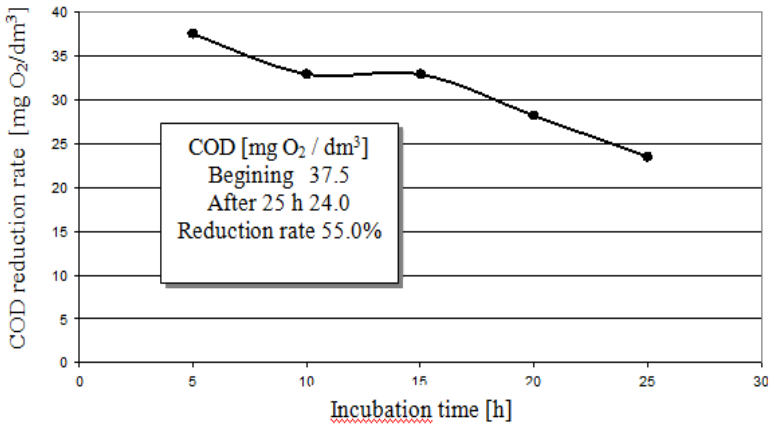

Figure 5. Changes of COD in medium containing brewery 10% effluent solution

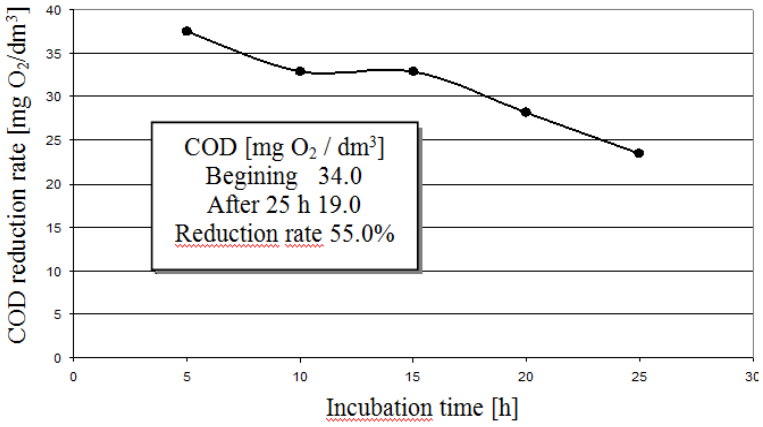

Figure 6. Changes of COD in medium containing brewery 14% effluent solution

Reduction of COD reached around 55% in both cases. Research concludes that at such a level of reduction rate of COD / SO_4^{2-} there were simultaneously occuring reduction processes of SO_4^{2-} as well as organic pollutants without a sheer dominance of one of this forms. It was proved earlier that excessive concentration of SO_4^{2-} in sewage and sewage sediments decreases metabolism leading to methane production, it means – inhibits methane fermentation [11].

When relation of COD to SO_4^{2-} is $\leq$ 1.6g/g the dominating process is reduction of sulphates to sulphides. Results of this preliminary researches on changes of pollution indicators (SO_4^{2-}, COD) cannot be compared with other studies because researched sewages are not chemically defined.

Aim of the research was also different focused on checking possibilities of using SRB to effluent treatment originated in brewery industry. This caused that rates of reducing SO_4^{2-} and COD resulting from activities of *Desulfotomaculum ruminis* (SRB) were the most important observations.

CONCLUSIONS

Sulphates respiration of *Desulfotomaculum ruminis* can be utilized in effluent treatment of brewing industry. Depending on SO_4^{2-} content and other pollutants concentration, it means relation of COD to SO_4, there is possibility to reduce considerably both pollution indicators.

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FREQUENCY ANALYSIS AT 1/1 OCTAVE BANDS FOR DIFFERENT TYPES OF PRINTING MACHINES

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ABSTRACT

The extent of noise in five printing companies in Novi Sad, Serbia, was determined using TES-1358A Sound Analyser with RS-232 Interface. The data on equivalent A-level (dBA), as well as, maximum and minimum sound pressure levels (SPL) of digital colour presses and offset printing machines, were collected. It was found that offset printing units are the predominant noise sources, with the average L_{eq} level of 82.7 dBA and the maximum L_{eq} level at 4000Hz. For these type of machines the means of L_{eq} levels exceeded the permissible levels given by NR-80 curve at higher frequencies. For digital colour presses the highest noise level was in the frequency range of 400-630 Hz, but the means of L_{eq} levels were bellow the acceptable values given by NR-80 curve, at all frequencies.

Keywords: Noise level, frequency analysis, printing machines

INTRODUCTION

Noise, or unwanted sound, is one of the most ubiquitous pollutants which permeates many of aspects of life throughout inhabited world. Man is exposed to unpleasant and distracting sounds at work and outside of work, which adversely affects his health and working ability. Noise pollution as a kind of physical pollution is not fatal, but it can directly influence sense organs. The impact of noise will primarily be localised on hearing damage called noise induced hearing loss (NIHL), which has profound social and occupational impact on affected individuals and substantially reduces quality of life.

In industrial settings, in most machines, there is a continual and sometimes also intermittent type of noise. The noise may contain predominantly low or high frequencies, tonal components, be impulsive or have unpleasant and disruptive temporal sounds patterns. The mechanism of noise generation depends on the particular noise operations and equipment including: electromechanical devices, pumps, compressors, cutters, presses, etc. [1]. For a given machine the effect of SPL generated depends on the type of noise source, the distance between the source and the receiver and the nature of working environment .

In printing industry, noise occurs during printing, binding, folding and cutting processes. The sources of noise are all moving parts of the machines and the elements of the

machinery drive such as motors, compressors and vacuum pumps, which supply mechanical energy, air under pressure or vacuum. Printing presses are one of the major sources of high noise levels [2]. The dominant noise source from a printing press came from the second print head air drum. Secondary noise sources included drying fans and suction systems. In printing facilities where noise measurements for this study were conducted, there were two types of printing presses: digital color presses and sheet-fed offset lithographic presses. This kind of offset technology is normally used for short-run orders.

In many countries noise has been ranked among the top occupational risk factors in printing manufactures. In printing industry in Portugal, as reported in Arezes and Miguel [3], the estimated percentage of noise exposed workers, with daily exposure level equal to 85 dBA, or greater, was 33.5 %. In the department of rotogravure printing in Brazil the noise measurement revealed continuous noise levels in the range of 71–93 dBA [4]. The means of L_{eq} varied from 76.5 to 93.3 dBA in 14 companies involved in printing, publishing and paper products industry in Saudi Arabia [5]. Mokhtar et al. [6] reported L_{eq} noise levels in the range of 78-94 dBA at different sections in publication and printing industry in Malaysia. Boateng and Amedofu [7] found that total average noise level on selected printing machines in six factories in Ghana was 85.3 dBA.

Noise in the work environment is the major cause of concern for safety and health of the industrial workers. Internationally accepted noise level which does not cause temporary or permanent hearing loss is 75 dBA. However, sound levels of 85 dBA and above, for duration of 8 hours per day cause damage to the hearing after many years. Damage risk criteria for noise vary in different countries mostly between 85-90 dBA [8]. Today, more and more employers notice the hearing damage and physiological non-auditory effects. The manifestation, progress and degree of occupational hearing impairment depend on several factors: sound intensity, duration of exposure, frequency of interfering sound, age, physical conditions of workers and individual sensitivity [9]. Non-auditory effects of noise may include lack of concentration, headache, sleep disturbance, depression, cardiovascular disorders, increased breathing rate, social isolation and greater risk of accidents [10, 11].

MATERIALS AND METHODS

In Serbia, there has been no detailed investigation about the magnitude of occupational noise exposure in printing industries. Therefore the objectives of this paper may be listed as:

- Determining noise levels and noise spectrum in relation to different types of printing machines.
- Examining compliance with the standards for industrial noise exposure and providing recommendations for noise reduction and health protection of the employees.

The study was conducted in five printing companies in Novi Sad, Serbia. The noise level of two different types of printing machines: digital color presses and offset printing presses, was measured using TES-1358A Sound Level Meter (SLM), with RS-232 Interface. The calibration procedure of the instrument was performed before the actual measurements using standard acoustic calibrator recommended by SLM manufacturer (TES Electrical). The

desired response of SLM was set at "fast". When the measurements were made, the microphone was located in such a way as not to be in the acoustic shadow of any obstacle in appreciable field of reflected waves. Noise levels were measured about 1.5 m above the floor, at the position of the employees' head. For conducting the noise survey, Serbian Guidelines for noise measuring were followed [12]. The A-weighted levels on L_{eq}, L_{max} and L_{min} Sound Pressure Level (SPL) in dBA were collected. The measurements were taken over a period of 30 s. At the end of experiment the data were downloaded to a personal computer. With the help of utility software, the equivalent SPL and noise spectrum at each reading was obtained. The data were statistically analysed using Microsoft Excel. For each types of machines, the means of L_{eq}, L_{max} and L_{min} SPL levels with variances were computed. This was followed by a graphic representation of the means of L_{eq} SPL-s at different octave bands, and its comparison with NR-curves given by International Organisation for Standardization (ISO).

RESULTS AND DISCUSSION

Noise measurements were conducted for 5 digital colour presses and 11 offset printing machines. The mean levels of L_{eq}, L_{min} and L_{max}(in dBA) with their variances are given in Table 1. The measured L_{eq} values for all machines generally varied between 70-90 dBA. This is in agreement with the results of Morata et al. [4], Noweir and Jamil [5] and Mokhtar et al. [6].

Table1. Noise levels of printing machines with average levels and variances

Type of machine	L_{min} [dBA]	L_{max} [dBA]	L_{eq} [dBA]
Digital printing presses			
Mimak	65.9	71.8	69
Ultra VU II 3360 EC	64	70.9	68
Teleios	62.1	69.7	65.4
HP Invent Scitex XP 5300	71.2	79.8	74.1
Press VUTEK VU 200/600 FC	74.2	79.2	76.8
AverageSD)	67.48 (4.53)	74.28 (4.32)	70.66 (4.17)
Offset printing presses			
Heidelberg B2	78.9	85.7	81.8
Heidelberg SORM B2	66.5	85.8	77.9
Heidelberg GTO (B3)	71.6	79.7	75.3
Heidelberg, cylinder	79.7	87.8	84.3
Heidelberg 74 PERFECTOR	80.7	85.2	83
Heidelberg 74 PERFECTOR [1]	84.5	87.1	85.6
Heidelberg SPEED MASTER 74-4XL)	76.6	83.2	81.3
KBA Rapida 74	81	84	82.8
Rapida 74	81.5	86.3	88.1
Rapida 74 [1]	87.1	90.5	93.5
Rapida 74	74.2	80.9	85.4
AverageSD)	78.39 (5.60)	85.95 (3.27)	82.7 (3.92)

For offset printing machines and digital colour presses the mean values of L_{eq} were 82.7 (3.92) and 70.66 (4.17) dBA, respectively. The noise levels produced by 4 of 16 machines exceed the limiting threshold level of 85 dBA, tolerated by law. It was found that the noise level increased as a function of faster mode of working (higher productivity) for

the offset printing machines.The dBA means of L_{eq} (SPL) at 1/1 octave bands for each type of the machines in comparison with NR-80 curve[1] at 1/1 octave bands, as a histogram, are presented in Figures 1-3. It reveals that the highest noise for digital colour presses is in the frequency range of 500-1000 Hz, and the noise level decreases above these frequencies. Maximum noise levels for the offset printing machines appeared at different frequencies. For Heidelberg printing presses the maximum L_{eq} levels were at higher frequencies with the most dominant noise at 4000 Hz, whereas for Rapida printing presses the most dominant noise was observed at 500 Hz, 2000 Hz and 4000 Hz.

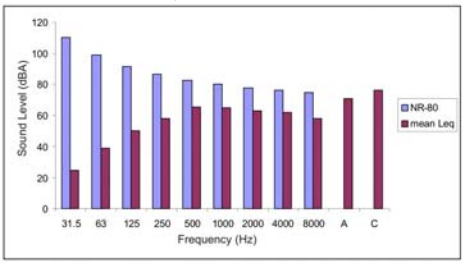

Figure 1, Digital colour presses: Means of L_{eq} in dBA at 1/1 octave bands in comparison with NR-80 curve

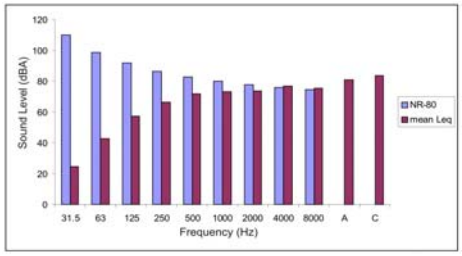

Figure 2, Heidelberg printing presses: Means of L_{eq} in dBA at 1/1 octave bands in comparison with NR-80 curve

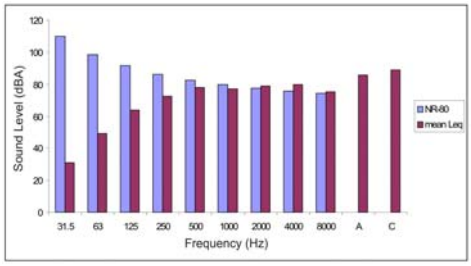

Figure 3, Rapida printing presses: Means of L_{eq} in dBA at 1/1 octave bands in comparison with NR-80 curve

[1] The noise rating - NR - curves are developed by International Organisation for Standardization (ISO) to determine the acceptable indoor environment for hearing preservation, speech communication and annoyance. The Noise Rating level for industrial noise should not exceed the levels of NR-80 curve.

High noise levels at frequencies below 1 kHz produced interference with workers communication, since much of the human speech is between 300 and 700 Hz. Hearing damage from excessive noise usually occurs at high frequencies (3, 4, 6 kHz) and then spreads to lower frequencies (0.5, 1, 2 kHz) which limits the working capacity and social adequacy of workers [13]. For effective noise induced hearing loss prevention, it is important to consider the spectral content of noise as the personal protective equipment is often designed according to the noise spectrum.

For digital colour presses the means of L_{eq} levels were bellow the acceptable values given by NR-80 curve at all frequencies. For both types of offset printing machines (Heidelberg and Rapida) the means of L_{eq} levels exceeded the NR-80 curve levels at higher frequencies. For Heidelberg printing presses the L_{eq} levels were slightly over the permissible values at 4 kHz and 8 kHz, whereas for Rapida printing machines the levels exceeded permissible values at 2 kHz and above.

CONCLUSIONS

The frequency analysis of the means of SPL revealed, for both types of machines, that the noise in the printing companies was dominated by higher frequency noise, and the maximum level mostly appeared at 4 kHz. It was also observed that, for offset printing machines the means of L_{eq} levels exceeded the permissible levels given by NR-80 curve at higher frequencies.

Many examples of noise control methods are described in literature [14]. Basic recommendation regarding hearing conservation programme include: occupational noise assessment, technical and organizational measures in order to control noise and prevent noise exposure, workers hearing evaluation and monitoring, and hearing protection.

More extensive studies are necessary in order to determine the exact impact of noise on the workers. The present investigation of surveyed printing companies showed that most of the facilities are not located in workspace standardized to adequate acoustic criteria and the workers do not wear hearing protectors. The high levels of noise obtained in this study suggest that a hearing conservation programme (HCP) to protect workers from the effects of hazardous noise exposure in the workplace should be integrated into printing companies. In the application of noise reduction techniques special care should be concentrated on higher frequencies (2 kHz and above), since it was at those frequencies that the maximum of noise level was found. This study has shown that some workers in printing companies are at risk of developing noise induced hearing loss due to excessive occupational exposure to noise. In further investigation, performing a questionnaire about the noise in printing facilities and audiometric tests to check hearing impairment of the workers should be carried out.

Acknowledgment

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TREATMENT OF INDUSTRIAL WASTE

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ABSTRACT

As a result of rapid industrialization leads to a permanent increase of the amount and type of waste, which may occur in different phases, with different characteristics that make it more or less dangerous. This paper presents a summary of the state of waste that occurs as a result of various activities in the industry and the possibility of their use as secondary raw materials. It is particularly emphasized the use of industrial waste materials in the building ceramics industry. In the end, a short overview of the means of storing waste material in the storage drive and the need for recycling or permanent deposit of the same.

Keywords: environment, industry, waste, treatment, recycling, landfills

INTRODUCTION

Industrial waste means any waste material generated during an industrial process, and its properties can be harmless, hazardous or inert. Development of science and technical inventions is a key condition of balance in the environment and seriously threaten the basic parameters of living [2]. It is practically impossible to give a decisive answer to the question of whether recycling is more important in the field of industrial waste or municipal solid waste, since in both cases, thus, realize a very significant technical, environmental and economic effects. Certainly most important effects of them are drastically reduce the amount of industrial waste that ultimately must defer to sanitary landfill, which use existing landfill life practically doubled, and significantly slow down the process of exhaustion of natural raw material resources[1,2].

Inert industrial waste is waste that is not accessible to any physical, chemical or biological changes; insoluble, do not burn or otherwise physically or chemically react, not a biological biodegradable or adversely affect other matter with which it comes into contact in a way that can lead to pollution of the environment or endanger public health. Dangerous (hazardous) industrial waste is any waste material created during the industrial process, which because of its quantity, concentration, physical, chemical, or infectious characteristics may pose a threat to life or health or the environment when improperly treated, stored, transported with him or improperly managed. Harmless waste is waste that has not the characteristics of hazardous waste[3].

In industrial plants produced in accordance with technological processes and operations, as well as the raw materials used, different amounts of waste material, different in structure and chemical characteristics, with a variety of potential beneficial and unusable components. Such industrial waste includes all types of waste and quoted one of the classification according to (1) is shown in Table 1.

Table 1. The classification of industrial waste

Industrial waste	**Specially controlled industrial waste**
Ashes	Waste oil (except hard fuel gases)
Sludge	Waste acid (pH = 2 or less)
Waste oil	Waste alkali (pH = 12.5 or more)
Waste acid	Infectious industrial waste: - waste PCB - materials contaminated with PCB - the sewage sludge - cinder - asbestos waste materials - soot and dust, ash, waste oil, sludge, waste acid and waste alkali which contain mercury, cadmium or other waste substance and do not meet appropriate regulations.
Waste alkali metal salts	
Waste plastics	
Waste paper	
Waste wood	
Waste fiber	
Solid waste from the flora and fauna	
Hard pieces of rubber	
Solid pieces of metal	
Solid pieces of glass and ceramics	
Cinder	
Construction waste	
Animal waste organic	
Soot and dust from waste gases and plants that produce carbon black	

Large quantities of waste material produced in mining production and technological preparation of ore for metallurgical and chemical processing. That caused large areas of degraded land which according to the environmental and economic standards represent the waste land. It also creates large quantities of primary tailing and overburden from the ore preparation process technology, which is represent unchanged mineral raw materials, mostly in the form of fine suspension which are difficult to separate.Liquid phase of the suspension often contains highly toxic organic and inorganic components[3].

Some industrial wastes that result in the production process can be re-used in the same or a different technological process as a secondary raw material, if they meet certain technical standards necessary for their implementation.

Secondary raw materials has a great importance for the economic development of a country. An important step towards their better utilization is the quality of waste characterization performed. Efficiency performance of characterization depends largely on the balance of generators of waste according to the manner of addition, classification and storage. Method of sampling and testing, as well as adequate implementation of legislation will significantly contribute to the properly executed waste characterization[4].

An example the part of the waste characterization from industrial surface protection of zinc coatings is shown in Table 2.

Table 2. Chemical composition of the waste material from plants for the hot galvanizing

	Parameter	Sludge from the neutralization process [Mg / kg]	Zinc ash [Mg / kg]	Zinc cinder [Mg / kg]
1	Cadmium, Cd	< 0,1	< 0,1	< 0,1
2	Lead, Pb	< 0,1	1660	118500
3	Arsenic, As	70	100	< 0,1
4	Total chromium, Cr	251	50	20
5	Nickel, Ni	260	220	1450
6	Copper, Cu	200	25	230
7	Zinc, Zn	27700	348200	865100
8	Antimony, Sb	< 0,1	< 0,1	< 0, 1
9	Mercury, Hg	< 0,1	< 0, 1	< 0, 1
10	Aluminum, Al	28	4800	3700
11	Iron, Fe	279100	2000	3800
12	Barium, Ba	1800	350	350
13	Chlorides, Cl^-	56400	65800	-

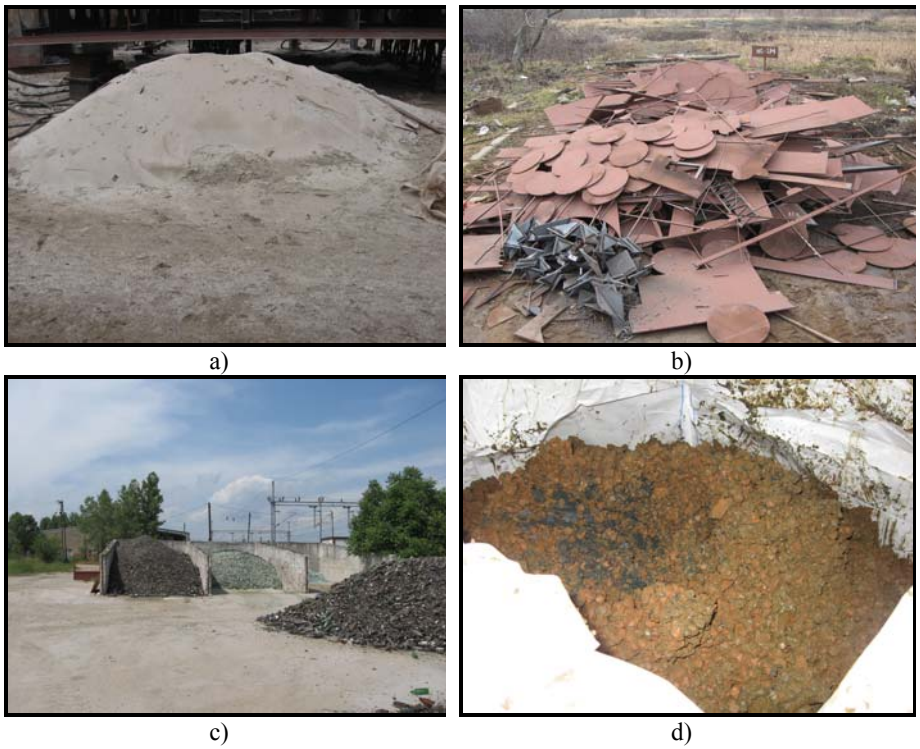
According to the results shown in Table 2 observed that each side product or waste material has a different chemical composition, but it is evident that each has a metal content of zinc, so that it can serve as raw material for recycling the metal zinc.

TREATMENT OF INDUSTRIAL WASTE

In the industrial production of wastes resulting from the changed physical and chemical properties compared to the initial raw materials and primary products (waste materials: clay, dust, ash, waste water, etc.), and with unchanged physical and chemical properties (secondary raw materials: spon, flanges and of cutting sheets metal and profiles, metal dust, etc.).

Figure 1a shows a waste of sand casting, which has not undergone physical changes but there was chemical contamination, which is seen in the characterization analysis. Figure 1b shows the flanges of cutting sheets metal and profiles that have suffered in the industrial processing physical changes but the chemical composition remained unchanged, namely there was no chemical treatment. Figure 1c shows the landfill of recycled generated glass that was broken in the recycling (changed form), but there was no pollution or some chemical changes and it has held the status of inert waste. Figure 1d shows the sludge from neutralization of waste water, which is well filtered and whose humidity is 22% and as such is delay in large bags. Such bags are kept at the premises of its kind dedicated to the deposit of waste (hazardous) until further treatment.

Table 3 shows the percentage of waste matter (organic, inorganic, metal, etc.) in different states of industrial waste.



a) b) c) d)

Figure 1. Disposal of various types of industrial waste

Table 3. The structure and chemical characteristics of waste materials in the industry

	Type of waste	Waste matter,%
Solid waste	- organic	11.80
	- inorganic	28.00
	- special mixed waste	60.20
Liquid waste	- Halogen (Cl, Br, J), organic	1.00
	- nonhalogenic organic	8.60
	- acid	34.80
	- bases	18.80
	- dissolved metals	11.40
	- oil and oily waste	7.60
	- mixed liquids	17.80
Sludge	- organic	41.80
	- inorganic	33.50
	- metal	24.70

Industrial systems in order to function in ecological terms, it is necessary, in addition to remediation of degraded land and barren, recycle all waste materials.Recycling, generally speaking, has its main task in the technological processing of waste materials, selectively listed:

- material components that can be return to the production,
- hazardous components (toxic, explosive, etc..), which must be stored in special procedure,
- remains to be returning to the ecosystem (purified water, gas),
- components that are certainly stored under standard conditions.

Selective recycling of all types of waste material is often complex technical and technological solution that includes many of the processes, operations, procedures and complex equipment.

In Table 4 provides an overview of the technological processes and operations, as well as part of equipment that are commonly used in the recycling of solid industrial waste.

Table 4. Technological processes and operations for the recycling of solid wastes

A. The most common approach to recycling of solid wastes	**B. The main technological processes and operations for the recycling of solid wastes**	
	Operations	**Processes**
Characterization of materials: - physical - chemical - physical-chemical - mineral **Selection of useful components:** - defining - possible ways of appropriation - assessment application	- disintegration - fragmentation - grinding - milling - micronization - classification - wet - dry - solid-solid separation - solid-liquid separation - liquid-liquid separation - flotation and agglomeration - homogenization - recrystallisation - chlorine treated - concentration and deposition - filtering, etc.	- ion exchange - electrolysis - cementation - leaching - roasting, calcination, gas reduction, etc. - reducing melting - oxidant melting - thermal dissociation

Rough ceramic industry may decrease natural raw materials consumption while using waste materials, decrease CO_2 emission, so it can contribute to sustainable development. These products must fulfill a number of quality demands, in the first place constructive ones including ecological and economical aspects, so in order to have a good product, multidisciplinary exploration approach must be applied. European Technological Platform defines several research priorities in the case of rough ceramic industry: user requests satisfaction, sustainable development, as well as civil engineering sector transformation[5].

DISPOSAL OF INDUSTRIAL WASTE

According to its characteristics, industrial landfill waste are usually much simpler in chemical terms of utility, but can contain many dangerous substances and can not be studied in bulk. Each industry has specific types of waste that can not be compared or processed in the same way. In addition to inorganic ingredients in industrial landfills can be found and natural and synthetic organic compounds, whose origin is complicated to talk in general[6].

The predominantly method of treatment of industrial waste is a temporary storage inside the generator or disposal. Industrial waste is disposed at locations within the plant, and the rest is disposed with municipal solid waste in urban landfills. There are no facilities to treat hazardous waste. A large number of small companies that generate hazardous waste have serious problems due to lack of regional or national infrastructure for its treatment. Analyses show that most such places exceeded their capacity and does not meet the requirements of national legislation on waste or EU directives[7].

CONCLUSION

Different technological processes and processing or generally speaking activities in the industry created by-products that are declared as waste. Important is the analysis and characterization of waste and finding opportunities in recycling and regeneration, and the possibility of using in other industries, with additional treatment. A particular problem is disposal this kind of waste. In the Republic of Serbia is now reduced to depositing waste at the location of the company in a specially equipped warehouses. This delay is temporary but committed to developing the technology of recycling and regeneration as a way to the final solution.

Acknowledgements

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ECOLOGICAL ASPECTS OF CHROMIUM ELECTRODEPOSITION FROM DILUTE SOLUTIONS

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ABSTRACT

Electrolytic deposition of chromium coating is usually carry on from chromium-sulphate electrolytes of high concentration. The process of chromium coatings deposition is harmful to the environment. Research has focused on the introduction of electrolytes with low chromium content, electrolytes based on trivalent chrome with various additions or introduction of alternative coatings. In fact, research of process chromium coating deposition from electrolytes with low chromium content showed that they can get a functional chromium.

Keywords: electrodeposition, chromium, ecological aspect, dilute solution

INTRODUCTION

Electrolytic deposition of chromium has a wide and varied application, which is conditional characteristic properties of these coatings. Electrolytic chromium coatings has high hardness and good wear resistance, low coefficient of friction, resistant to atmospheric corrosion at normal and high temperatures. The obtained coatings are brightness without additional processing. The main factors which influence the quality of chromic coatings are: types and treatment of basic material, electrolyte composition, electrolyte temperature, cathode current density and subsequent treatment after chrome plating. Agitation of the bath is required to equalize the bath temperature and promote uniform brightness on the part. Preheating the parts to be plated by placing them in the solution without current applied, may be necessary to obtain a uniform deposit [1,2,3].

Transport of chromium particles occurs during plating because a number of by-products are generated, such as hydrogen and oxygen gases, water vapor and chromic acid mist. Hydrogen and oxygen gases are generated due to the inefficiency of electrolytic reaction during chrome plating. Unfortunately, hexavalent chromium is highly toxic and a known carcinogen, especially when carried through the air as a vapor. On the other hand, the main component of the electrolyte, chromium (VI) oxide, it is expensive. Researchers are forced to find alternative solutions applying chromium

coatings from baths with low chromium content, because the specified environmental and economic disadvantages of conventional chromium deposition bath.

These electrolytes are known as electrolytes for the deposition of chromium coatings resistant to wear. Diluted electrolytes are very favorable for the deposition of wear resistant coatings on cylindrical shapes with small distances between electrodes (10 to 25 mm). These electrolytes are less aggressive than the conventional concentrated and less damage to the insulation parts and tools and equipment with which to contact [4,5]. Malinin [6,7,8] and Konishi [9] were investigated application of diluted electrolyte for deposition of chromium. Content of chromium (VI) oxide in diluted electrolyte is from 50 to 150 g dm^{-3}. These electrolytes are used to protect steel, nickel, copper and brass. Chromium coatings are used for corrosion protection, protection against wear, as well as decorative purposes. They are very effective for deposition in both the stationary and in flow systems.

THEORY OF ELECTROLYTIC CHROMIUM PLATING PROCESS

Electrolytic chromium coatings deposited from the aqueous solution of chromium (VI) oxide. Chromium (VI) and chromic oxide building with polychrome acid (chromic acid, H_2CrO_4-yellow color, dihromna $H_2Cr_2O_7$-orange, red trihromna $H_2Cr_3O_{10}$, tetrahromna $H_2Cr_4O_{13}$-brown). Chrome coating is deposited from aqueous solution of chromium (VI) oxide, only in the presence of anions added in small quantities, usually sulfate anion SO_4^{2-}. It also can add the following anions: F^-, SiF_6^{2-}, Cl^-, etc. [10].

The electrolyte for deposition of chromium coating is-simple, but the process of deposition is very complex and has many specificity in comparison with the processes of deposition of other metals. Chromium deposit process specifity is: high reduction potential of the negative chromate ions, high density, easier to extract hydrogen than chrome on the cathode, low electricity usage (from 15 to 30%, depending on the temperature of the electrolyte and current density), the influence of current density and electrolyte temperature on the properties of coatings, catalysts required the presence of anions in the electrolyte, applicatuion of inert anodes [11].

The content of conventional chromium bath is chromium (VI) oxide and sulfuric acid. The concentration of chromium (VI) oxide in the bath can be from 75 to 500 g dm^{-3}. Content of chromium (VI) oxide in diluted electrolytes is from 75 to 150 g dm^{-3}. The relationship between the concentration of chromic and sulfuric acid in the electrolyte determines the productivity of the process, structure and properties of coatings. The value of this number can range from 75 to 250, and the best results in the chromium plating is achieved if the ratio of 100:1 [12,13].

Compared concentrated electrolytes with diluted, spending chromium (VI) oxide during the deposition of chromium coatings to a lesser extent reflects the change in relationship to the concentration CrO_3/H_2SO_4. For this change affects the presentation of electrolyte with gas in the ventilation systems, as well as the removal of electrolytes in the parts of the flushing. Using diluted electrolyte flow system of compensation in chromium (VI) oxide is much simpler, because the central tank, where correction is made, it can establish a continuous control of the electrolyte density and programmed automatic correction of the concentration of basic components.

According to research, the content of hydrogen in dilute electrolyte is 1.5 to 2 times higher than in conventional electrolyte. Higher content of hydrogen in the coatings deposit from diluted electrolytes caused by the inclusion compounds of Cr (III) due to higher pH in layer near the cathode and the formation of more compact colloidal layer. Reduction of absorption of hydrogen by 15 to 25% can be achieved by adding the molybdate ion in electrolyte in range of 3 to 7 g dm^{-3}. Adding molybdate ion affects the formation of solid solution of chromium coating.

Further development of the electrolyte for chromium plating leads to the use of different catalysts in order to increase efficiency and improve the current properties of coatings. On the environmental point of development goes in terms of electrolyte application of electrolyte with loww content of chromium (VI) ion and electrolytes based on chromium (III) ion. Further significant progress in the development of technology electrolytic deposition of chromium coat is to implement a programmed deposition [14].

REVIEW OF TECHOLOGICAL PROCEDURE OF ELECTROLYTIC CHROME PLATING

Preparation for the electrolytic deposition of chromium coatings include: mechanical polishing, degreasing, protection surface that is not deposited chromium coatings, electrochemical degreasing, chemical etching and anodic etching. Electrochemical degreasing is carried out in a hot alkaline solution composition:

- Sodium hydroxide, NaOH ..... 30 g/l,
- Sodium phosphate, Na_3PO_4 ..... 35 g/l,
- Sodium carbonate, Na_2CO_3 ..... 30 g/l.

Parameters of electrochemical degreasing the samples are:
- Anode current density 20 A dm
- Working temperarura 65 ^{o} C,
- Electrochemical degreasing time of 3 to 5 minutes.

After degreasing followed by rinsing in water. Chemical etching carred out in 20% sulfuric acid solution, followed by rising, anodic etching and deposition of chromium coatings. According to the work program, anodic etching and deposition of coatings, carried out successively in the electrolyte composition shown in Table 1.

Table 1. Chromium-sulphate electrolyte

No	Electrolyte	Content of electrolyte,g/l	
		CrO_3	H_2SO_4
1	dilute	from150 to 175	from 1.5 to 1.75
2	universal	from 220 to 250	from 2.2 to 2.5
3	convencional	from 275 to 300	from 2.75 to 3.0

Studies has included examining programmed deposition of chromium diluted hromatno-sulfate electrolytes with or without addition molybdenum acid concentration shown in Table 2.

Table 2. Diluted chromium-sulphate electrolytes with and without molybdate acid

Content [g dm^{-3}]	Electrolyte 1	Electrolyte 2
Chromium(VI)oxide, CrO_3	100 - 110	100 - 110
Sulphuric acid, H_2SO_4	0,5 - 1,1	1 - 1,16
Molybdenum acid,H_2MoO_4	-	5

Chrome plating is deposited in programmed mode and reverse DC current, in a given field experiment. During the deposition process parameters are controlled electricity and regulated in the given limits. Current efficiency during depositing chrome coating is relatively low, due to simultaneous hydrogen evolution at the cathode. Current efficiency change with changing electrolyte concentration is shown in Figure 1.

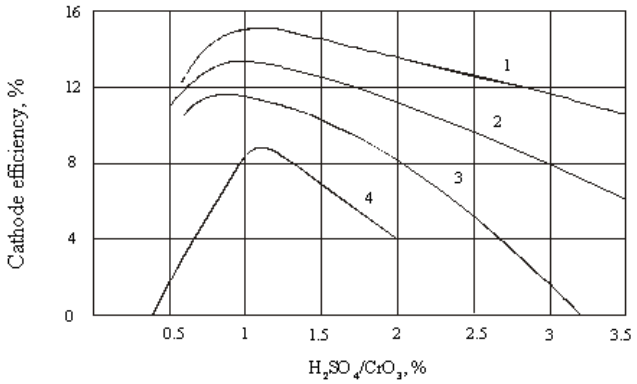

Figure 1. Dependence of cathodic current efficiency by concentration of CrO_3 in electrolyte 1 - 75 g dm^{-3}, 2 – 150 g dm^{-3}, 3 - 250 g dm^{-3}, 4 – 500 g dm^{-3}

Current efficiency in the chrome coating deposition from diluted electrolyte with and without the addition of molybdenum acid changed with the change of temperature, but there are no significant differences in comparison with current efficiency in the chrome coating deposition from concentrated electrolyte which is presented at Figure.2.

Chrome coating deposition from diluted electrolyte with direct current at temperatures from 50 to 60 ^oC at current density of 55 A dm^{-2} are very bright, smooth and without boundary effect. Deposition of chrome with reverse current at temperatures from 50 to 60 ^oC were obtained semibright or matt coating, depending on the parameters of reverse current, the smooth and without boundary effect.

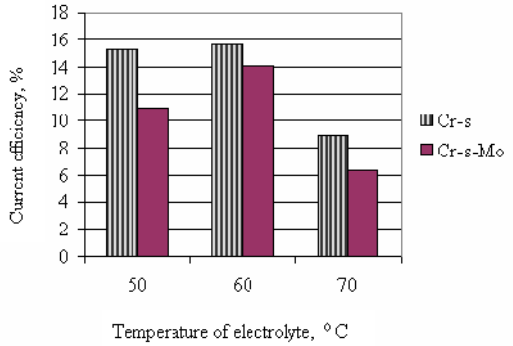

Figure 2. Change the current efficiency with increasing temperature of the electrolyte in the chrome coating deposition from the dilute electrolyte on i_K=55 Adm^{-2} in a period of 1 hour: Cr-chromium - sulphate electrolyte; Cr-s-Mo chromium-sulphate electrolyte with molybdenum acid

Application diluted electrolytes does not require a change in the preparation of samples, primarily refers to the work of lighting for degreasing and chemical etching. By using a programmed deposition anodic etching is also carried out in diluted electrolyte, which is considerably more favorable than the environment of the electrolyte with higher concentration.

CONCLUSION

Surface preparation before deposition chromium coatings involves the same technological process whether coatings deposited from highly diluted or concentrated electrolytes. Programs deposition studies conducted in electrolytic deposition of chromium in diluted electrolytes showed that they can get a coating that can meet the functional and environmental conditions that are much better.

Chromium coating deposited from diluted chromium-sulfate electrolytes with and without the addition of molibdenum acids, programmed and reverse DC current, at high current density of 55 A dm^{-2} to 100 A dm^{-2}, at temperatures from 50 to 70 ^{o}C, have functional properties that can satisfy many requirements. It is important that the coating adhesion to base metal is satisfactory.

When chrome is deposited from diluted chromium-sulfate electrolyte, curent efficiency not significantly changes whith change of temperature the electrolyte, as the current regime changes and time of electrolysis.

From the ecological point of view chromium deposition from dilute electrolyte is more favorable compared to the deposition of chromium coating from conventional electrolytes. This is primarily related to: the impact on the working environment (removal hexavalent chrome Cr^{6+} with hydrogen bubbles, which distinguished), the impact on the environment (removal of hexavalent chromium Cr^{6+}in waste water) and the possibility of solving the solution of the chromium plating waste and waste water.

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EFFECTS OF NORTHERN SOLAR PROTON WIND ON OCCURRENCE OF VIRUS H1N1 AND PREVENTIVE PROTECTION WITH SILVER IONS

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ABSTRACT

This paper presents the influence of north proton solar wind, its chemical composition, electric charge of particles, X and UV radiation and their role in the disinfection of the Earth's atmosphere. The origin and occurring of the virus, way of penetration, the spread of the virus, as well as preventive and destruction of thevirus.

Keywords: solar wind, ionized particles, the virus

INTRODUCTION

Corpuscular radiation of the sun in the form of particles whose dimensions are among atoms or even smaller various energy particles, present the forms of the world beyond, which determines the cosmic interplanetary space. In fact, Sun releases with its daily blasts into space millions of tons of material, this flow is called solar wind. Density of energy particles and flow through a square centimeter per second, ster radian value can reach up to tens of millions. Particles near the magnetic field and carry the free electrical load and their moving produces electric convection current. Solar wind particles are containing of 95% protons, 4% alpha particles, electrons, in cases of strong explosions nucleons, and ions of many elements, such as carbon, nitrogen, oxygen, neon, magnesium, silicon, iron, etc... Strong convection currents from the Sun have great influences on events on Earth.

Each proton solar wind penetration with a large convection current and low UV and X radiation, which doesn't disinfect Earth's atmosphere enough causes the appearance of viruses. Viruses neither have cells, nor structure that living beings need to supply nourishment, create energy, and grow. etc. All the viruses do, that remains on life is reproduction. They are lifeless, fixed chemical particles - as long as they live outside the cells, but when they find get into a living organism, viruses are changing and fully occupying the organism just as they had been programmed.

DISCUSSION

In the early 24th solar cycle the Sun has reduced activity, and with such activities occurres also the weakening of the magnetic defense in the entire solar system. The Earth defends passively against strokes of energies from the other side. In the period of reduced magnetic active defense, there are developed conditions for the energy of the Milky Way to reach the Earth. This effect is especially strong in April and October, when it comes to the largest number of adverse physiological manifestations. The Earth, in its rotation around the sun during a calendar year, intersects twice the magnetic field lines the Milky Way, where all the time energies from the other side travel.

Collision of energies from the other side with Earth is the period when viral respiratory infection or flu outbreak is occurring. When the same form of adverse physiological events occur on the same day in various remote locations, hundreds or thousands kilometers away from each other, we cannot talk about transferring the virus from one person to another. Respiratory infections are not related to the temperature drops, because sometimes there is no infection, although there were several frequent fluctuations in the temperature regime.

However, large-scale outbreak of viral infections occur by penetration of strong solar proton winds that carry a great convection current, and whose chemical composition contains particles which are moving along the earth's magnetic field lines and under the influence of gravity coming down to the surface of the Earth. Distance of penetration of particles from the composition of the solar wind is directly dependent on the strength of the explosion on the sun, the type of particles and convection currents. Proton solar wind penetration creates also a occurring of strong cloudiness as well as a large amount of precipitation. So caused cloudiness protects Earth's surface from penetrating UV and X radiation, and when it is reduced, and insufficient amount is coming from the sun, disinfection of Earth's atmosphere, soil is reduced, contributing to the development of viruses, bacteria, protozoa, and so on.

VIRAL IDENTITY

Nucleic acid in viruses may be DNA or RNA, but never both. DNA viruses can create their own copy of the RNA, using the cellular material. In order to build new viruses, the viral copy takes up the cellular mechanisms for the creation of proteins. RNA viruses such as influenza virus may use its own RNA to build viruses directly. In almost all forms of life, and even in most viruses, DNA is always copied to generate RNA, should not be reversed, although so-called retroviruses refute this. Those viruses replicate its RNA to DNA. Therefore, when the virus enters the cell, it takes its mechanisms to create countless new viruses. Although basically always stays the same type of virus, influenza virus is RNA virus, which means that it is very unstable and changeable. When DNA is copied, a copy is perfect, RNA is less reliable and it is copied with series of errors. When viruses multiply, each individual particle has its own series of mistakes and this can be a big problem for the immune system, which tries to defend itself from them. The immune system identifies the virus via its envelope-antigen, which

corresponds to a particular antibody. If an error in RNA significantly changes the envelope, the virus could become unrecognizable. A protein and enzyme extensions are extremely important for the identity of the virus. Protein is the hemaglutinin (HA), and enzyme raminidase (NA), the envelope has always the same type of H and one type of N, because H is a protein that binds to host cells and takes them and the virus escapes using the NA. When the virus inside the cells multiplies, NA extensions degrade chemical substances that retain viruses in the cell. These chemical substances are neuraminidases. H1N1 may have the same extensions as the Spanish flu, but has different HA extensions. Since these HA extensions allow the virus to penetrate into a cell, this difference prevents virus to be transferred to humans, although small changes in the HA extensions may allow it. This is an antigenic offspring, and the reason why the flu occurs, because antibodies that have been created, following year do not recognize the same flu. If these changes involve the genes that constitute the viral envelope, that process is an antigenic change and it can cause dramatic consequences. Virus that had the same kind of envelope, suitable for penetration in pig cells only, in this way can get the genes for envelope that can unlock human cells, too. So the virus jumps the species barrier and causes a pandemic. Viruses are also the main participants in the evolution of species, DNA is a remnant of past viral infections that infiltrate their genetic material in the genetic material of infected species and the particles of proton solar wind are only trigger for the emergence and further spread of viral infections.

PREVENTIVE CARE

Since the human body contains a large number of chemical elements, one of them is silver. The main role of silver in our body is to strengthen the immune system. The mere presence of positive silver ions (Ag +) enable the body to produce more immunoglobulins, phagocytes and T-lymphocytes. Silver acts as a catalyst by blocking certain enzymes which viruses, bacteria, fungi use in their metabolism. In contact with silver, these germs quickly lose their oxygen, food, and fall apart. This process is very fast and effective that no one microorganism can mutate and acquire resistance to colloidal silver. However, some of them are still resistant, the microorganisms that are necessary for the functioning of the digestive tract. An additional role of colloidal silver in the body is that the silver particles are so small that they easily pass through the cell membrane and within cells to neutralize viruses that are reproducing there. Significant is also the fact that colloidal silver destroys not only the cause, but also the excreted toxins. Colloidal silver acts as an active anti-oxidant, so that silver particles in the blood are very easy to bind to molecules of free radicals, which are mainly electronegative, and neutralize them.

Amounts of silver in our body are taken through food, so that amount of silver in the tissues of our body normally reaches the 0.002 mg per 100g of dry matter. Most silver contain tissues of cerebrum, nuclei of nerve cells, glands of the endocrine system, the outer part of the eye and bones. As a structural element of tissue in our body and a catalyst for participating in the process of exchange of goods, silver is being wasted, and the average daily requirements for this element are 0.88 mg. Development of industrial methods of agricultural production, cultivation of ground with mineral fertilizer in the soil and water, contributes to even greater reduction of silver (0.007 mg).

CONCLUSION

Metrology data obtained from the SOHO and ACE satellites are daily processed and scrutinized. The period from 2009 to 2010 is a period of reduced solar activity in the eleven-year period of 24thSolar cycle. Through mere reducing the sun's activity, UV and X radiation, which is necessary for the sterilization of the Earth's atmosphere and its surface, is also decreased. Through reduced activity, magnetic defense of entire solar system is reduced too, and therefore comes to decreasing the Earth's magnetic defense, and explosions, which are common in the period of minimum of solar activity have little impact on the Earth itself, as well as the penetration of other cosmic energies. The Earth is then almost without protection. Earth's transition through the magnetic field lines of the Milky Way, in late March and early April and late September and early October, has caused the occurring of viral activity. Also is noted the coincidence of the occurring of viral infection during the periods of the reduced activity in the years of minimum solar activity as in the human population and in animals that live in the outdoors.

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NEOCORTICAL EFFECTS OF ELF ON HUMANS AS A FACTORS OF THE TARGET GROUP

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ABSTRACT

Extremely low frequency (ELF) exists in our environment since the creation of the planet and the man was able from its beginning to adjust to this effect. These natural ELF waves could be explained as natural resources which represent natural electric and magnetic fields. Natural electric fields we divided into stationary and variable while the natural magnetic fields is divided into internal and external, as well as the human body. No doubt, it is equally interesting to study natural and artificial sources of electric and magnetic fields of Elf. The paper is based on the research of artificial influence of ELF on the entire population and on the humans, as an important factor of the target group. With effects aimed at awareness, central nervous system, subconscious, cortex, nerve tissue in the solar plexus, which is also called the heart of the human soul, where ideas are transformed into expirencies and become part of the experience. Through ELF broadcast by using Earth's magnetic field lines as a virtual antenna, density of free electrons in spiral paths that circle the Earth's magnetic field lines, traveling from the northern to the southern pole are being modulated through electromagnetic waves from the Earth and in this way is the virtual antenna powered by a sinusoidal currents with desired wave length. This process causes the adverse effects, while ELF waves are disrupting the work of the human brain and the behavior of people itself takes the most unexpected forms.

Keywords: Extremely low frequency, a virtual antenna

INTRODUCTION

One of the significant artificial influences of ELF on the human population has been researced over a longer period of time. ELF impact methods and can not be properly understood without additional knowledge about the functioning of the human brain (mind and body). As far as it concerns the brain, there are six transmitters of nerve stimuli, which have a strong influence: acetylcholine, norepinephrine, dopamine, noradrenaline, serotonin, phenolphatein. So far, many studies proved that the human body, if exposed to certain frequencies, produces a greater magnitude of neurotransmitters than ussualy. If the delicate natural balance at a specific person or the entire population is changet, they will become unstable. This relationship is shown in table 1.

The brain has two systems: adrenergic and holinergic, which provide the correct level of serotonin and acetylcholine in the brain. They work so, that when one is turned

on the other is turned off, both systems should not operate simultaneously. The environment of the human body is electromagnetic field. In the interior of the brain is the electric field. The brain has a characteristic of measurable polarity, this polarity is switched off during sleep. Through external electromagnetic stimulating of the cerebral cortex, the person will either fall asleep or wake up, it is a matter of manipulation, in this case, of the effects of external magnetic field of ELF. Scientific findings regarding the frequency of the human brain and its connections with different stages of awareness, shows Table 2.

Table 1.

Brainwaves / Hz	Gamma >21Hz	Alpha 20-8Hz	Theta 4-7Hz	Delta 1-3Hz
Type effects of energy	agressive	calm	agressive	calm
Nerve transmitter	Noradrenalin	Serotonin	Dopamine	Acetylcholine
Excited nerve fibers	Sympaticus	Parasympaticus	Sympaticus	Parasympaticus
Cardiac activity	Accelerated	Slow	Accelerated	Slow
Genetical nukl.	Timin	Gvanin	Adonin	Citozin

Table 2.

Frequency/Hz	Description of the state of uconsciousness
Delta waves 0-4	Coma, deep sleep, extreme state of hypnosis
Theta waves 4-8	Sleeping, the state of hypnosis, nap, creative penetration of the thinking process
Alpha waves 8-13	Half-dreaming state, a state between dream and awareness, complete relaxation and tranquility, creative thoughts
Beta waves 13-30	Condition funkcionality of an adult per day
Gamma vawes 30-70	Start of mania, agitation
70-90	State of psychosis

Adjusting the amplitude of the frequency of artificial ELF on the frequency of brain emissions of man, pergormances of the brain could be changed and thus cause changes in behavior and abilities for a longer period.

Applied artificial ELF's impact can be also called using of neocorticalnih methods. After applying of the so-called. neocortical methods the state of mind changes, and it is known that changed states of consciousness are: REM sleep, hypnosis, meditation, hallucinatory state, a state psychopatological clinical death ...

I do not doubt that in the longer period ELF is used in the field of neocortical impact on the population with the reason of –experimental nature

WORKING METHOD

Presence ELF waves was done by using electric and magnetic receivers in the range of continuous frequency and amplitude level results were followed by PC and spectrum analyzers. Registrovani signali imali su najčešću amplitudu od 1-3Hz. The most common amplitude of registered signals were 1-3Hz. To a large extent during the period of monitorin, almost always was present electrical discharge in the form of spherex, which is a characteristic for distribution of the ELF in one part of so-called Schuman cavity, which part is also used for modulation and broadcasting using virtual antenna. In order to avoid interference from the low voltage network 50Hz, measurements were carried out of urban areas as well as away from air high-power lines. Also is the average amplitude obtained, measured in Hz for a period which is given in Table 3:

Table 3.

Month/2009.	Average amplitude in Hz
March	2,8
April	2,5
May	3
June	1

THE RESULTS

Through comparing and analysis of the data obtained, it was found out that the amplitude of the signal was in the range of Delta waves (1-3Hz), which points to the influence of extreme states of consciousness, as a state of hypnoses, nap and impact on the creative decisions in the process of thinking, which gives a picture neocortical ELF impact on the individual, and thus the whole target group.

Such an electromagnetic wave induces responses, and response in humans occurs when a part or the entire nervous system of a particular person is placed in the modulated field of electromagnetic waves This message affects the subconsciousness of man, and he does not hear it , because those are not the waves with a frequency above human hearing range. In addition to these influences, the purpose of these electromagnetic waves is to cause chronic fatigue, function disorder of the nervous or immune system, accelerated aging, stimulate cell growth that is cancer. All that can lead to disorder or even the end of normal life functions. These signals with variable amplitude cause mismatched behavior at the most vulnerable residents. According to the World Health Organization, by the end of 2020th even a quarter of the world population will become ill from similar symptoms.

CONCLUSION

When ELF waves concerns, with amplitudes in the range of human subconscious, influence on the nervous system, especially on the human brain, they contribute to neocorticaln managing the human mind.Što se jedino može zaštititi

zabranom upotrebe istog u svim zemljama, bez najave, da su pojedini eksperimenti ove vrste nešto grublji. Which can only be protected by prohibiting the use of them in all countries, without notice, since some experiments of this kind had become somewhat rougher.I blaži oblici uticaja ELF-a u smanjenom obliku, mogu da budu primenjeni na pojedine institucije ili ličnosti, što se lakše može registrovati, nego kod globalne primene. The impact of milder forms of Elf in reduced form, can be applied to individual institutions or personalities, what are easier to be registered, than in case of global application.

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THE ANALYSIS OF THE EXTERIOR DESIGN OF THE ZEMUN MEDICAL CENTRE IN TERMS OF ITS PHYSICAL ACCESSIBILITY FOR THE PEOPLE WITH REDUCED MOBILITY

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ABSTRACT

The exterior design of the Zemun Medical Centre was analyzed in terms of its physical accessibility for the disabled, the elderly, visually impaired, children…Checklists were used for the analysis of the surroundings. The results showed that the analyzed elements were partially accessible or inaccessible for these groups of people. The results were compared to the standards regulatet by the law, those dealing with the design of the accessible environment. It has been concluded that it is necessary to adapt the inaccessible surroundings, implementing legal regulations, so that all users have equal opportunities and rights to move freely and easily, without barriers.

Keywords: accessibility, open spaces, barriers, the disabled

INTRODUCTION

The accessible environment designed with regard to the needs of the users should be the most important part of the planning and designing process of open spaces. Being one of the fundamental human rights, the right to move freely, without impediments and barriers, it is necessary to design spaces in the way that they are accessible for all users – the disabled, the elderly, children, pregnant women and all other people who have permanent or temporary physical impairments.

There are numerous problems surrounding the constructed areas that influence reduced mobility and disable some basic human activities. The quality and the types of surfacing, pedestrian paths, the size and the shape of the pavements, inappropriately parked cars, inadequate ramps and many other impediments make the life more difficult for the disabled and other physically challenged people [1]. The barriers incapacitate these people, especially those in wheelchairs to cross the streets alone, use the adjacent stepped access, enter the schools and study, enter the working places and work and enter other facilities such as theatres, cinemas, art galleries, hospitals and other public buildings in general. In that way they are prevented from walking freely and alone, as well as communicating, going to school or university, working, enjoying cultural events, practising sports…[2].

Creating of accessible open spaces must be the result of the work of the team of experts with different skills – urban planners, open spaces planners, architects, landscape architects. Landscape architects' skills and knowledge, together with the skills of other experts on the relevant subjects, can be very useful for finding the best solutions for overcoming the problems of the disabled people, the problems that have to do with their mobility and moving around, as well as the better quality of their life [3].

Urban areas, including all their elements and components, should be designed in the way that they provide access to everyone and to everything these buildings and areas offer. As it is necessary for all spaces to be accessible, that gives a big task for the authorities to make efforts to complete the process of inclusion. The arrangement and the design of the spaces should be done in accordance with the principles of universal design, and it is also necessary to adapt and reconstruct the existing facilities and their surroundings to make them accessible for everyone. One of the main priorities are the hospitals and other health institutions, because they are frequently visited by the people with limited mobility.

The aim of this thesis is to identify and analyze the open spaces surrounding a medical centre in terms of its accessibility – the physical accessibility for the people with limited mobility.

METHOD

The research has been carried out at the end of the year 2009. in the Zemun Medical Centre. The research included the analysis of the open spaces of the medical centre in terms of its accessibility – the physical accessibility for the users who have problems with mobility (the disabled, patients, the elderly, children, pregnant women). The main building of the Zemun Medical centar, in Vukova Street, has been analyzed. A number of chosen positions are shown in the thesis: the analysis of the pedestrian areas – the pavements that connect the entrance to the centre with the main entrance to the building; the analysis of the entrances to the building and the entrance to the centre from Vrtlarska Street; the analysis of the parking lots: the analysis of the green area between the parking lots and the main entrance to the building; the analysis of the urban movables set across the pedestrian area.

In the first phase the field research was carried out, and it included the analysis of the location with regard to the formerly given criteria. The checklists were produced in order to analyze in detail different elements of the open spaces – pedestrian areas (pavements and paths), the entrances to the buildings, parking lots, urban movables and equipment and green areas. Each checklist consisted of different questions relevant for the analysis of the accessibility. During the site tour the checklists were filled in by answering the previously prepared questions. They were answered with impartial and competent consideration of specific problems, as well as the direct measuring of the different elements in the analysis (the dimensions of the pedestrian areas, parking lots, determining the slope of the pedestrian area etc.). The analyzed locations were evaluated according to their accessibility using three categories of grades: accessible, partially accessible and inaccessible.

- The grade "accessible" means that easy and unobstructed mobility is fully available, with minimal effort and difficulties, for all users regardless of whether they are disabled or not.

- The grade "partially accessible" means that the space is accessible to all users, but certain effort is necessary for the use of it.
- The grade "inaccessible" describes a space that is impossible to be used without someone else's help

(Notice: if one category of users can't use a certain location, and all the others can, the space is marked as being inaccessible as well).

In the second phase of the research, the collected data were systematized, and then through the comparative method the positions were analyzed in terms of to the requirements set forth by the Book of regulations about the requirements for the planning and designing of buildings that deal with the unobstructed mobility of children, the elderly, the handicapped and the disabled („Official Gazette RS, No. 18/97) which, among other things, sets forth the laws that deal with the designing of the open spaces.

In the last phase, the conclusions of the thesis were given through the synthesis of the results.

RESULTS

Having analyzed the pedestrian areas the following results were obtained: the width of the pavement is not adequate for the use by the people in wheelchairs, there are bumps, holes and hollows at the road surface, the grass area is not divided from the pavement by a kerb, the kerbs of the pavements are not adjacent to the roadway crossings, there are many obstacles across the pathways (posts, flower containers, benches, rubbish bins). The pedestrian area arranged in this way prevents users from using it freely, therefore it was marked "partially accessible", taking into account that certain effort is needed for using it.

Figure 1. Pedestrian area

Having analyzed the main entrance to the building, as well as having analyzed the entrance to the centre from Vrtlarska Street, it was established that the entrances are inaccessible for the users of wheelchairs, because the difference in the level between the

path that leads to the entrance and the entrance is bridged by stairs, which is an insuperable obstacle for the users of wheelchairs. In addition, the existing stairs are not built in accordance with the standards, because they do not have non skid treads on each stair. The recommendation that the top of the stairs should be in a colour in contrast with the stairs was not applied. There are no information boards or any markings at the entrances that would give the basic information about the centre. These entrances were assessed as "inaccessible", because the users of wheelchairs are prevented from entering them.

Figure 2. The entrances to the buildings

Having analyzed the parking lots it was established that the parking places for the disabled were not provided. In addition, there is no safe path available from the parking lot to the entrances to the building. The existing access can be approached by stairs, which are not built in accordance with the standards (without handrails and of inappropriate width), while the accessing path also has an inappropriate width, without the protecting kerbs, and with a surfacing of bad quality. Along the accessing path there is a change in level that prevents the access of wheelchirs users to the building. Having all these facts in mind the parking lots were marked as "inaccessible".

Figure 3. Parking lots

The green areas that go along the pedestrian areas, and also between the parking lots and the main entrance to the building, are not taken care of properly. The branches of the bushes that line the pavement stick out and reach the pedestrian area, therefore, they reduce the pedestrian area and prevent the pedestrians from walking freely. The grass area extends to the paths and pavements due to irregular taking care of them and obstruct the mobility of the users. The green spaces are "partially accessible", because they complicate the mobility of the users.

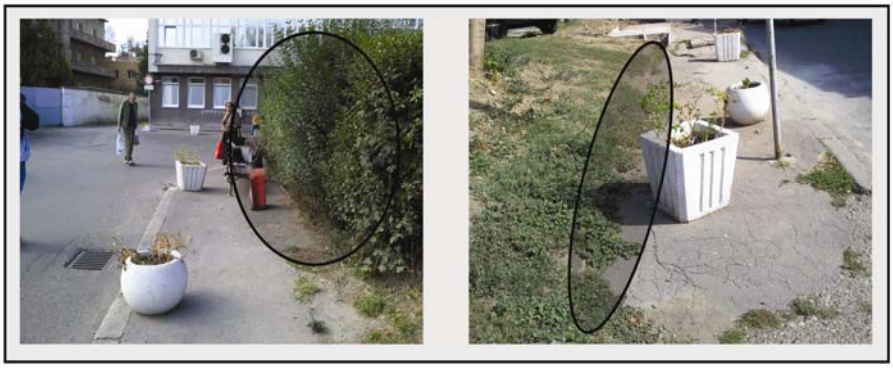

Figure 4. The green spaces

It was established that the urban movables and equipment (the benches, flower containers, rubbish bins, small posts) were inadequately set in the spaces. The flower containers were set on the main paths, therefore they obstruct walking freely along them. The benches that line the green areas are not at appropriate distances from each other. In addition there is no enough space beside the benches for the wheelchairs. The small posts that line the paths were not marked adequately in order to be noticed by the visually impaired people. The space where the urban movables were set was graded as "inaccessible", because their positions prevent pedestrians from walking freely.

Figure 5. Urban movables and equipment

DISCUSSION

It can be seen from the shown results that Zemun Medical Centre open spaces were not constructed according to the standards regulated by the law. The pedestrian areas cannot be used freely by all users, especially by the people in wheelchairs. When the construction of these spaces is concerned, the requirements from the article number 4 from the Book of regulations were not met – the requirements have to do with the width of the pavements and pedestrian paths, the passages between the immobile impediments, the quality of the surfacing, as well as markings of the main routes (4). Comparing these to the requirements from the article 5 from the Book of regulations, it is established that the pedestrian mobility is obstructed by the unplanned setting of the urban movables, the position of which reduces the area intended for the moving of pedestrians. This article also states that the main passageways should not be impeded, and that the existing impediments should be clearly marked. The same article states that the lower parts of the treetops should be at least at the 250-cm-distance above the pedestrian areas. This requirement has not been met as well. The level difference between the path leading to the entrance and the entrance prevents the access for the users of wheelchairs to the building. In addition, the design of the stairs themselves is not in accordance with the standards, because the article 11 states that the surface in front of the stairs should have a different tactile and visual quality when compared to the quality of the landing. When the parking lots are concerned the article 7 states that hospitals must have at least 10% of the parking places for the disabled people. There are no parking places for the disabled people in this medical centre.

CONCLUSION

By analyzing the results it can be concluded that the open spaces of the Zemun Medical Centre were not constructed according to the standards of accessibility. The analyzed elements have been evaluated as partially or fully inaccessible. The technical standards for planning and constructing of the public places have not been met fully and consistently. Taking care of the greenery (plants) is inadequate, as well, which contributes additionally to the inaccessibility of the medical centre to the users.

As the health institutions are very important for all people, it is necessary to reconstruct and adapt the open spaces, so that all users, no matter what their abilities are, could have equal opportunities to approach the health institutions. The planning of the spaces in accordance with the standards required by the laws will bring one of the main human rights to all users – the right to move freely and easily, without impediments and barriers.

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AMBROSIA-ENVIRONMENTAL PROBLEM NOWADAYS

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ABSTRACT

Serbia is facing a serious problem, Ambrosia artemisifolia (fazanusha or partzanka), which has health and economic repercussions. Ragweed pollen production is increasing from year to year. Ambrosia is wide spread in Serbia in Vojvodina. The main habitat of her fallow and abandoned land. The state is not able to give financial help in order to destruct of this weed, although it is expected of it, but the indisputable role in the legal part of the problem. In the world we have plenty of examples of how to manage this problem and that we would experience welcome. In all the rest are local individual thinking individual local initiatives and experiences are presented in the local region. Ambrosia is destroyed agro-technical measures, mechanical and chemical, each measure is important in its field. The overall method of struggle against ragweed, do not forget educational and promotional flyers public appearances, TV spots, television shows and even the very public social action in order to develop awareness among the population that is a problem all of us and tomorrow we can be themselves victims of this evil.

Keywords: ambrosia, weeds, district

INTRODUCTION

About ambrosia

"Ambrosia called temptation"

Serbia is facing a serious problem and it is Ambrosia artemisifolia, one of the 40 representatives of the genus Ambrosia. Weed plant contains 6 species alergenata. Flowers from July to late frosts. One plant makes and ambrosia to 150,000 grains. Plant that provides from 1 to 8 million pollen during flowering, which can be transmitted by wind up to 100 km around. And we know that 20 -30 cubic feet of pollen in the air are sensitive enough to respond to a person allergic manifestation (runny nose, sneezing, tingling eyes, coughing or difficulty breathing), Figure 1. This overproduction ragweed allergens makes it number one in the world.

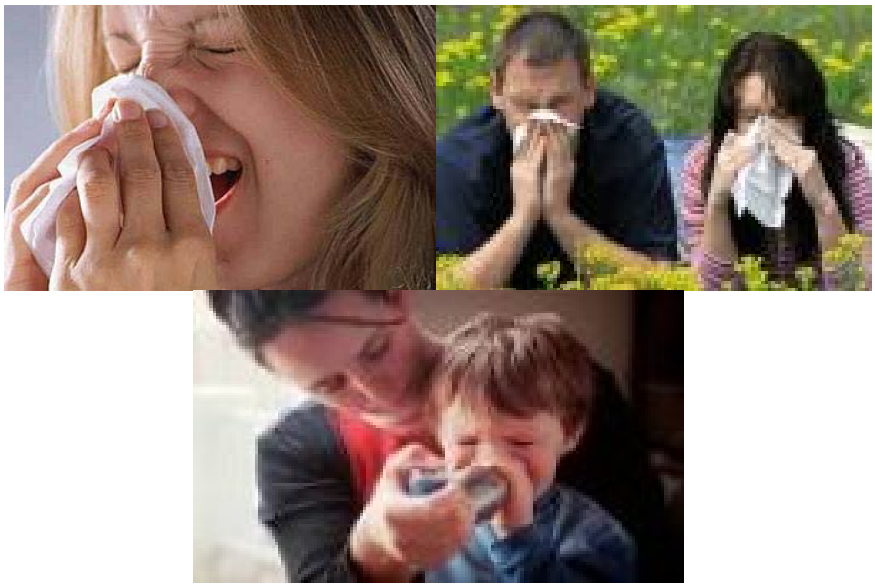

Figure 1. Allergic manifestation caused by ambrosia pollen

Ambrosia pollen production has been increasing from year to year. Global warming, increased levels of carbon dioxide, sulfur dioxide emissions with enhanced UV radiation in each case is in direct impact on the production of ragweed pollen. This suggests an association between air-pollution and the increasing number of allergic respiratory disease. They have statistics and facts into account and recognize that today is the amount of allergen is much greater than a thirty or forty years. With this we wish to point out that predisposition itself is not at all equal. They where the lesser degree of hypersensitivity, and if the longer part of life presents cumulative allergen, in the process can be desensitivated. If the concentration of allergens in the air increases, as the means to make ambrosia, then quickly comes to overlapping-balance will be disturbed, allergens will prevail and the body will react. What we need to mention is that ambrosia pollen but also contains other allergens. So not only those who are in the pollen that we know what causes, as well as protein allergens that are in flower, stem, leaf, stem and other parts of the plant. They belong to the so-called group of terpen allergens. They may cause the skin eczema and conjunctivitis. Do we see the true significance of this problem is the fact that of every 10th resident has some of the above problems.

In Serbia, the 24 allergens ambrosia weed species has the most allergenic properties. Ambrosia is wide spread in Serbia, in Vojvodina. The main habitat of her fallow and abandoned land, figure 2. One of the main reasons for the impoverishment of society, which are created raw surfaces and effective way of combating failure. Last year the ambrosia spread on large agricultural estates, which makes us particular concern, figure 3.

Figure 2.The main habitat of ambrosia are fallow and abandoned land

Figure 3. Last year the ambrosia spread on large agricultural estates

METHOD

Ambrosia is so much to us to develop estimates of its expansion in each of our citizens get 5 to 10 trees of this weed. And what should concern us is that many people do not know what it is like ambrosia. Working group to combat ragweed in the West District in all four of its municipalities organized setting of "Info-Stand" on the city streets in order to survey citizens about recognizing ragweed. The markets are set tents with different age ambrosia in pots. Citizens have been tested with a test question, "Do you know Ambrose"? To the question "What is the ambrosia from the

set of plants", with data taken at the test papers at the count came up to the tested data of 55%, do not know or are not sure which is the ambrosia. It is depressing that 65% of youth do not know ambrosia.

Figure 4. Sample of ambrosia

When talking about the ragweed we must be aware about the terms we use. We can not use term destruction but suppression that refers to the presence in our controlled environments. Also we must not pass by in the way of its combat and grading importance. Ambrosia is destroyed by agro-technical measures, mechanical and chemical, each measure is important in its field.

Optimal suppression of ragweed deadlines do not exist, ambrosia in favorable conditions, pollen can be cast in May, which is seen.

Figure 5. Ambrosia flower

It is important to highlight the problem of ragweed as weeds in agricultural crops that can significantly reduce the yields of agricultural crops figure 6. This kind of thinking to be forgotten in the common ragweed suppression system. We are witnesses to our large systems on large tables can be found but a number of ragweed in the Guard.

This is another reason for the decision-making strategies in the fight against this weed in the organized performance.

Figure 6. Ragweed as weeds in agricultural crops

The overall method of struggle against ragweed should not be forgotten and media appearances, all possible flyers, TV spots, TV appearances and actions, and therefore in order to develop awareness among our people that this is a problem all of us and tomorrow we can be themselves victims of evil.

RESULTS AND DISCUSSION

In the overall activity in the suppression of ragweed in the West District (Town and municipality of Sombor, Kula, Odzaci and Apatin). Control suppression of ragweed has been done by mechanical and chemical means in the following areas, in the year 2009, table 1.

Table 1. Control suppression of ragweed in the year 2009

Town/ Municipality	Mechanical means	Chemical means	Total means
Sombor	306.784	10.000	316.784
Odzaci	150.000	180.000	330.000
Apatin	255.000	610.000	865.000
Kula in the resort	106.000	436.000	542.000
Kula settlements	330.000	150.000	480.000
Total :	436.000	586.000	1.022.000
Total	1.583.784	1.972.000	3.555.784

Working Group to combat ragweed in the West District has drawn up a spot on the ambrosia which he played from April to September in all the local TV West Bachka administrative district. Was also paid to the terms of local television appearances. The tours are part TV top experts in medicine and agriculture inspections in the interpretation of legal regulations.

Organized fighting ragweed are the complete program consisting of the suppression of ragweed. This project is also financed from the budget of local self-

government. The main display web application for the Geographic Information System Spatial documented follow-up, development and treatment of sites covered by ambrosia, all citizens of West bachka administrative district can see and to include the web address http:www.geo.rs. This application is available to the general public and specialized agencies, which monitor the growth, development, spread and treatment of affected sites ragweed. Instructions on how to use this application to the training of representatives of the municipal West Bachka district done in the period March and April 2009.

Often the public challenge the use of chemical suppression of ragweed. It must be pointed out that chemical control of ragweed is not harmful if you act professionally, and that means accountability requirements with respect to legal regulations in the implementation. With the implemented precaution measures still comes to the most economical way to fight, certainly with the use of products based on 2,4 D funds. Applying these drugs should be used in the evening, and the effects are quickly visible. Plant herbicide that this hormone acts through a leaf, approved in the period of 92 hours and it stops growth. We must admit to themselves faced with a skeptical looking at the use of chemistry in the suppression of weeds plants, but hard to be responsible with respect to the given expert advice and the performance of this treatment by authorized service no fear or adverse effects. What hinders us in this measure is that it is unfortunately used to it pretty much all that is most non capable persons.

Well-driven campaign to suppress ragweed is still recognized by the Faculty of Agriculture, Osijek and Novi Sad, partners in the IPA cross-border project in which the applicant is for the district, FC.

CONCLUSION

Suppression of ragweed is made exclusively from the budget of local self-government. The working group addressed the province and in writing and direct talks to help, but unfortunately failed to get any help.

When the deal for another legal lever to U.S. HEALTHY ENVIRONMENT BE EXCEED THE RIGHT TO PRIVATE OWNERSHIP, then we may hope that in the control of ragweed make substantial progress. Ambrosia weeds can not be addressed or partially in the state district alone nor in the localities of a country.

State in situation which is not much help in the financial area, although this is expected from it. What she could have the legal section. We have many examples in the world as it is done and the experience we would welcome.

As part of the state are substantial and its ministries, which would have to initiate and announce to us in the 21st century facing the biggest allergen, so we organized and provided guidance on the basis of collected experience.

In all the rest are local individual thinking, individual local experiences that are presented in the local region and the pollen of ragweed in one day exceed the 3 more region.

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MARKET OF HIGHER ENVIRONMENTAL EDUCATION IN SERBIA

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ABSTRACT

Inclusion of contents related to environmental protection at faculties in the Republic of Serbia was started years ago, and it is a continuous process within the general educational reforms. Ecology as a broad science has a number of areas in which student's knowledge can be improved. The market of environmental education in Serbian gives a wide range of offers.

Keywords: environmental education, faculties, market

INTRODUCTION

Environmental education is the process of recognizing values and clarifying concepts in order to develop skills and attitudes necessary to understand and appreciate the inter-relatedness among man, his culture, and his biophysical surroundings. Environmental education also entails practice in decision-making and self-formulation of a code of behaviour about issues concerning environmental quality[1].

Blenkin, Edwards and Kelly (1997) note the following possible perspectives in education[2]:

- *Technological*. Desired learning results can be achieved through efficient and effective instrumental action.
- *Cultural*. Learning can best be achieved where practitioners and others defer to cultural norms which are deep-rooted and, for the most part, intuitive and implicit.
- *Micropolitical*. Learning is contingent on micropolitical power struggles within educational institutions.
- *Biographical*. Practitioners' views of learning depend on where they are in their careers, and what is happening in the rest of their lives.
- *Structural*. Practitioners' views of learning are influenced significantly by broad social trends.

The Constitution of the Republic of Serbia provides for the right to a healthy environment as one of the basic rights and freedoms of every citizen. The Parliament has proclaimed environmental education to be a priority for the country. Strategies have been developed jointly between the ministries in charge of education and of environment. The formal education system is currently being reformed to incorporate the environment and sustainable development into the curriculum at all levels of education [3].

RESULTS

Inclusion of contents related to environmental protection in school curricula in the Republic of Serbia was started 15 years ago, and it is a continuous process within the general educational reforms. Contents of environmental education has been implemented in various subject matters in elementary and secondary schools: World Around Us, Guards of Nature, Civic Education, Biology (with Ecology), Chemistry, Geography, Physics, but also in social sciences subject matters, such as: History, Philosophy, Sociology and various project activities and experiments in schools [4].Universities in Serbia have also introduced Environmental Education as basic studies by establishing departments for Environmental Education as well as postgraduate studies.Although education as a whole, and in the case of environmental education, is not public good, but there is much evidence that it has positive external effects [5]. This means that the benefits of that type of knowledge are not reserved only to its holders, but also to other members of society. For example, the expert who has knowledge of environment protecting can use this knowledge so the other members of society and should enjoy better environmental conditions that he enabled.

It is important to notice that environmental education provided by the individual may not give good results in practice and positive external effects. In order to achieve the desired goals this often requires a team of experts to solve environmental problems. Therefore, today's ecology appears in the area of management, economics, law, agriculture, energy, mining, etc. This is confirmed by data on the introduction of this subject at universities where the primary research area is not ecology. We are talking about the majority of the faculties of Belgrade and Novi Sad Universities, and private universities: Megatrend, University Union, University of Novi Pazar, Alpha University and European university. Environmental protection, as a primary research area, is studying at four universities in Serbia founded by the Republic (Belgrade, Nis, Novi Sad and Kragujevac), as well as faculty in Bor, Zrenjanin and Kosovska Mitrovica (Tab.1). From private faculties we can underline the Faculty of Applied Ecology FUTURA and Faculty of Environmental Protection at Educons University.

Table 1. Educational profiles (departments,study groups,direction)related to environmental protection

Faculty	**City**	**Educational profile**
Faculty of Technology and Metalurgy	Belgrade	Enviromental Engeneering
Faculty of Mining and Geology	Belgrade	Enviromental Engeneering and Occupational Safety
Technical Faculty	Bor	Enviromental Engeneering
Faculty of Forestry	Belgrade	Protection of Erosion and Flooding
Faculty of Chemistry	Belgrade	Environmental Chemist
Faculty of Biology	Belgrade	Ecologist – Environmental Protection
Faculty of Geography	Belgrade	Geospatial base of Environmental
Faculty of Security studies	Belgrade	Civil protection and protection of nature
Faculty of Technical sciences	Novi Sad	Enviromental Engeneering
Faculty of Science and Mathematic	Novi Sad	Ecologist – Environmental Protection
Faculty of Science and Mathematic	Novi Sad	Chemist of Quality Control Science and Environmental Management
Faculty of Agriculture	Novi Sad	Agroecology and Environmental Protection
Technical Faculty «Mihajlo Pupin»	Zrenjanin	Enviromental Engeneering
Faculty of Science and Mathematic	Niš	Ecologist – Environmental Protection
Fakultet zaštite na radu	Niš	Environmental Protection
Faculty of Science and Mathematic	Kragujevac	Biologist-ecologist
Faculty of Technical sciences	Kosovska Mitrovica	Departman of Mining: Environmental Protection
Faculty of Technical sciences	Kosovska Mitrovica	Departman of Technology: Environmental Protection

DISCUSSION

In addition to being an outstanding example of the use of instruments of public finance, education is also interesting because of the amount of money that is continually spending on it. In America and most European countries providing of public education on faculties and schools is below the below the average level characteristic for them [6]. This fact emphasizes the importance of detailed evaluation of educational policy and when it comes to environment education.

Ecology is a broad science and has a number of areas in which student's knowledge can be improved (ecology of plants, animals, ecotoxicology, soil protection, water protection etc). With the knowledge from the offered areas students need to develop cooperation between people, in order to improve the quality of life from both social and economic aspects. All of these would be hardly to quantify and even harder to express by some precise measures [7]. Therefore, for future students of ecology it is difficult to decide which decision is right when they are choosing their faculty among all faculties from the education market of this specific area of science.

On the other hand, this analysis should include all material costs of education, because candidates could always ask: "Whether the higher expenses provide more knowledge?". Apart from self-financed students, at the state universities subsidies to studies are transfers from resident taxpayers to students. While the policy on private colleges is based only on the principle of self-financing. It is difficult to answer on this question as well as on previous one, for the same reason.

Costs of environmental education are high in both cases, whether they are subsidized by the state or paid by individuals. At this level we can ask another question: "Whether education increases future earnings?". If expenditure on higher education has no influence on future earnings, we can say that whole money is spent irrationally on it, which conditionally implies a failure to positive external effects. The assumption that higher expenditure on education increases the productivity of workers in solving environmental problems, which reflects in their higher earnings, in Serbia cannot be certain. In such a situation it is more likely that they will remain on secondary education. In addition to this fact, from 2000's environmental protection has been introduced through secondary education. That can be identified as the way for minimizing the costs of education, because there are no expenditures for higher levels of education. However, the high school level of education of technicians for environmental protection is relatively young, and there is no clear picture of the employment possibilities for this profile, and therefore there is no information about their earnings.

The concerned data have been taken from the report of the National Employment Service which states the number of registered and unemployed graduate ecologists, engineers for environmental protection and graduate ecologists - masters. At the end of March 2010, in the Republic of Serbia, in records of National Employment Service were 250 persons of this occupation that is not too much on the state level. But, from the official statements of the service, needs for these profile do not occur often (they are extremely rare), which means that ecologists and engineers for environmental protection are forced to seek job out of their profession. In part, this problem occurs because of poor communication between educational institutions and the labor market. It

should be mentioned that work place for environmentalists are usually filled by experts from other areas.

CONCLUSION

It can be concluded that the market of environmental education in Serbian gives a wide range of offers. From the future students perspective we can say that their first question can be: "Which offer to choose?". This question is difficult to answer because it is not entirely clear how to determine which option can give "better education". Everyone should be aware that this great amount of offers brings broad spectrum of costs and that supply and demand are not always harmonized.

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PROJECT OF RECULTIVATION OF THE DESERTED QUARRY SREBRO

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ABSTRACT

The deserted quarry Srebro is located in the national park of Fruska Gora. The recultivation of this abandoned space could transfer it into swimming lake and the rearrangement of its edges would return its former natural and ecological value. The application of landscape design on this space would enrich Fruska Gora with another tourist and natural resort.

Keywords: national park, quarry, lake

INTRODUCTION

Fruska Gora is located in northeast Serbia, and in the south part of the plain. The mountain range is edged by the river Danube on the east and north, by Telek hill on the west where it turns into loess plateau which continues in Croatia. In the south, mountain gradually flattens into tectonic depression. The quarry is located on the northeast slopes of Fruska Gora at the altitude of around 300 m above the sea level. The nearest village is Ledinci, distanced around 3,5 km from the quarry.

Within the project of recultivation of degraded spaces in Fruska Gora, we proposed a solution for former quarry Srebro, commonly known as the Silver Lake. On the basis of the analyses of climatic, geologic and geomorphologic conditions and the history of degradation process the conceptual design for the recultivation of quarry was made [1,2,3].

GEOGRAPHIC POSITION

Trachytes of Fruska Gora were the subject of many geologic researches because of their low dispersal, specific natural phenomenon and economic potentials. They constitute 4,5 km long zone from the village Veliki Gradec over the Lišnjev`s Peak and Kamenjar to Ikonica. They appear as sills with east-west orientation and are embedded between serpentinite in the south and flysch in the north. Trachytes have a thickness of 165m and are between sandstone and siltstone layer. They have a 60° declension towards

north. After embedding, the rock mass was tectonically triturated and hydrothermally changed. Latite concretion is step-like to irregular. The explotation of trachyte begun on the crosspoint of two streams, Lukin svetac and Srebrni potok, in the middle of last century. The altitude of the pit was initialy 300masl, now it is 250masl.

HISTORY OF THE LAKE

In1960 The National park of Fruska Gora was established and the quarry became a part of it. The excavation of trachyte was degrading and violating the balance in the environment. During 1999, the works in the quarry stopped and 50 m deep pit started filling with surface water and groundwater. Around 400 m long and 100 m wide lake of irregular shape was formed. Its average depth is 15m. The lake was used for swimming until 2006 when a rockfall took place, after which it was closed for public.

CLIMATIC AND GEOLOGIC ANALYSES OF THE AREA

At the weather bureau of Iriški Venac, the measurements of climatic conditions were stopped in 1989, therefore, the following analyses are based on data taken from the weather bureau of Sremski Karlovci in the period from 1979 until 2004.

In the given period of time average annual amount of precipitation was 606,10 mm. Concerning the average annual amounts of rainfall there were 11 years with the average amount of rainfall of 500 to 600 mm, 6 dry years with low amount of rainfall under 500 mm, and 9 wet years with high amount of rainfall over 600 mm. The wettest year was the year of 2001 with the amount of rainfall of 882,6 mm, and the driest was the year of 2000 with the amount of rainfall of 274,3 mm.

The primary temperature maximum was 11,09 C. The hottest year was the year of 2000 with the annual amount of 166,00 C, and the average annual temperature of 13,80 C. The coldest year was the year of 1980 with the average temperature of 10,40 C. In the analyzed period there were 11 average years, 3 extremely cold years and 10 warm years. The average annual temperatures for the given period vary from 0,8 to 22,00 C. Absolute monthly maximum temperature of 26,70 C is measured in August in 1992 and absolute monthly minimum temperature in January in 1985 and it was -3,80 C. Average temperatures oscillate seasonally, the maximum is always in July with the air temperature of 21,40 C and the amplitude of extreme monthly temperatures in July is 4,4C. In the analyzed period, August was hotter than July from 0,4-2,9 C on the average. Monthly minimum temperatures were -3,8 C in January. Its amplitude of extreme monthly average temperatures was 9,3 C.

The average annual amount of relative humidity was 857,9 %. Maximum annual amount of relative humidity of 958,00 % was measured in 1996 and the minimum amount of 747,00 % in 1992, 17 years were averagely humid, 1 was with low humidity while 8 were extremely humid.

Absolute monthly minimum of relative humidity was noted in August 1992 and was 48 % and absolute monthly maximum of 94 % in January 1997. Average annual relative humidity for 26 years was 71,5 %. Humidity is of a seasonal nature, it is the

highest in winter time, in December, with average of 81,2 % and the lowest in summer, in July and August with 65,1 %.

In the analyzed period of time, dominating winds were the southeast with the speed of 4,4 m/s, the northwest, west and south with the speed of around 3 m/s and the west with the speed of 2,6 m/s. The fastest is the wind from southeast direction and the slowest is the east wind. The average amount of wind speeds is 41,2 m/s. Winds were the most frequent in 1991 with the maximum amount of wind speed of 45,5 m/s and the opposite was 1982 with the minimum amount of wind speed of 3,4 m/s. The highest wind speed was in March 1996 with the average speed of 5,5 m/s and the lowest in July, August and September 1982 with the speed of 1,8 m/s. Average monthly wind speeds are the highest in March, 4,1 m/s, and the lowest in July and August, 2,8 m/s.

CONCEPTUAL DESIGN

Landscape rehabilitation of the damaged, exploited area had an aim of bringing back the environmental balance and expansion of tourist facilities. Nature restoration in these areas should be done by methods of biological stabilization such as: applying layers of humus, stabilization of seismic areas, selection and planting of various plant species in order to stimulate further succession and establishment of plant and animal species. There are different methods and techniques of biological recultivation. Before it is done, it is necessary to do technical repair of the terrain which consists of making terraces, ensuring stability, arranging and ensuring quarry edges etc. Biologic rehabilitation includes depositing layer of humus on the terraces, its recultivation with grasses and planting of indigenous trees and shrubs. Biological stabilization arose from the detailed analysis of the quarry and has its purpose in the cultivation with new vegetation, blending into environment, and speeding up the process of successive greening of bare spaces. The future uses of the space are based on the expansion of tourist facilities.

The conceptual design assumes walking, recreation and staying in the open as basic uses of the space. For that reason, it proposes the reconstruction of a motel and observation decks as resting points where people can gather and enjoy views, have pick-nicks or do sporting activities. These points are connected with pedestrian paths across the beach and terraces.

The access to the repaired area is from existing driveway in the north. That path expands into a parking area at the right, which has 50 parking spaces including places for invalids and buses. The driveway continues as pedestrian path to the hotel, along the beach and terraces, to the viewpoints as the endpoints for walkers. Paths are designed in the way to provide beautiful views on the lake and surrounding area of woods. Lower terraces are covered with grasses around paved paths, while higher are planted with indigenous trees and shrubs. Walls of terraces are covered with vertical greenery, so the whole impression of the cascades is natural and green with balance between vertical and horizontal plains.

The selection of vegetation that is introduced in the space of former quarry is dependant on specific conditions of space, climate and soil. Most of broadleaved trees and shrubs are indigenous; conifers are selected on the basis of their adaptability to

shallow soil layer. Its function is greening bare ground, shading and blocking undesired views.

The aim of this conceptual design is to meliorate space on several levels: in returning ecological balance, expansion of tourist facilities and upgrading esthetic values.

CONCLUSION

The aim of this project is to meliorate space on several levels: the returning of ecological balance, expansion of tourist facilities which build people's awareness of natural values and the significance of its preservation and upgrading esthetic values of deteriorated space.

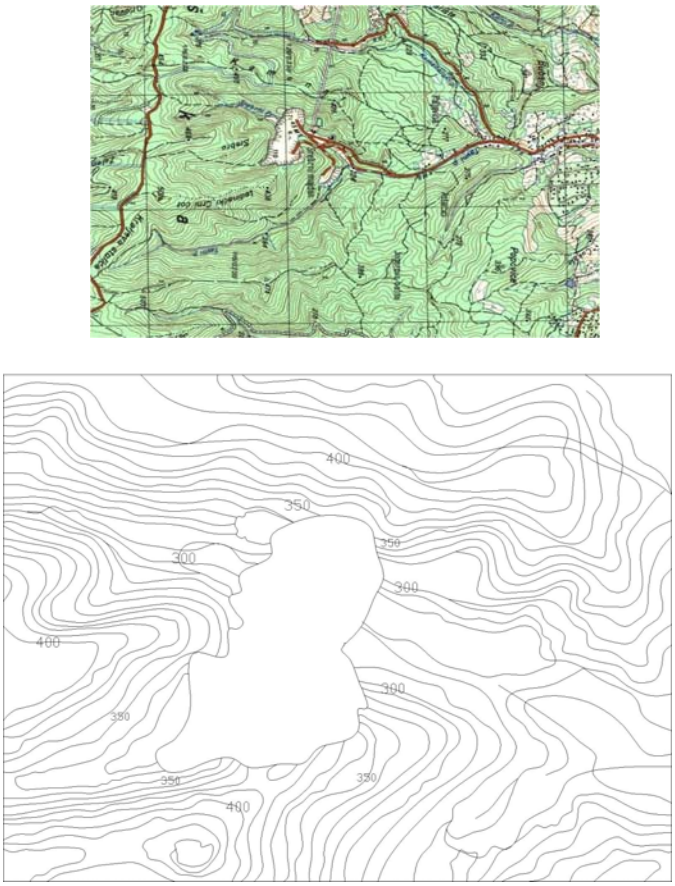

Figure 1. Map of the area

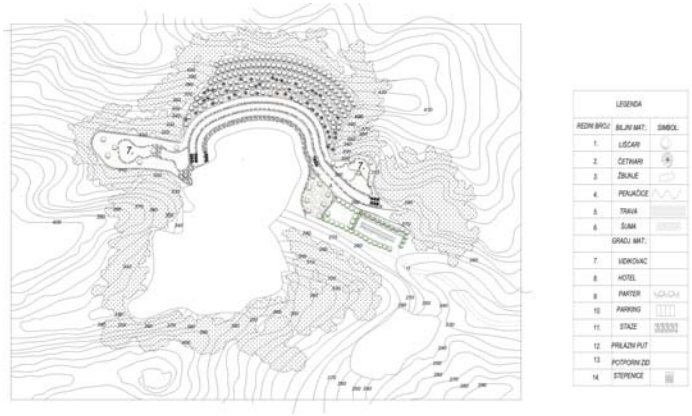

Figure 2. Conceptual design

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WATER BALANCE REGIME OF SOILS IN THE REGION OF ČAČAK AS DEPENDENT UPON CLIMATIC PARAMETERS

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ABSTRACT

The objective of this study was to evaluate soil water balance as affected by air temperature and precipitation in the region of Čačak (43°53'N; 20°21'E).

The obtained results revealed soil water deficit during May-October (ranging from 1.0 mm to 70.0 mm) to be satisfied by irrigation. The surplus of water to be eliminated from the soil occurred from September through April, ranging from 3.0 mm to 38.0 mm.

Minimum and maximum total precipitation (on an annual basis and during the growing season) and monthly potential evapotranspiration (1984-2003) were analysed. The ensuing results suggest deviations from the long-term average.

Keywords: climatic parameters, water balance regime, soil

INTRODUCTION

The irrigation of soils planted to crops is dependent upon a multitude of factors, the most crucial being climate, apart from soil properties and plant water requirements.

The region of Čačak (Western Serbia) has a temperate continental climate with cold winters, warm summers and changeable spring and autumn weather. The effect of air temperature as a climate element is reflected, primarily, in the level of water consumption i.e. crop water requirement, being potential evapotranspiration (PET). Potential evapotranspiration as an output component of soil water balance has been defined for some regions in Serbia, such as the region of Sombor, with mean monthly evapotranspiration increasing from January through July and declining from July through December [6]. A similar PET tendency has been recorded for the regions of Šabac, Loznica and Valjevo [4]. The mean annual PET for the region of Priština is 656 mm, with the highest value being measured in July [1]. Precipitation is the source of water inflow for the soil and an input water balance component. There is an increasing tendency in mean annual air temperature and PET in the region of Čačak and a decreasing tendency in total annual precipitation [7].

The main objective of this study was to use potential evapotranspiration and precipitation data to evaluate water balance in order to define quantitative changes in the amount of soil water in the region of Čačak. The effect of climatic elements on the inflow and outflow of soil water in this region resulted in the determination of soil water deficit and surplus.

MATERIAL AND METHOD

The analysis of air temperature and precipitation as the two major climatic elements was based on the data recorded for Čačak [5].

The PET values for each month over a long-term period (1984-2003) for Čačak were identified by the calculation method described by Thornthwaite [8]. Mean monthly air temperatures were used to compute monthly corrected PET values during each year of the study.

The soil water balance for the region of Čačak was calculated by the Thornthwaite method [8].

RESULTS AND DISCUSSION

The environmental conditions of Čačak during the period of analysis were characterised by a regular annual air temperature pattern (Tab. 1).

Table 1. Mean monthly, annual and growing season air temperatures for Čačak, t°C (1984-2003)

Months												Mean air temperature	
												Annual	Growing season
I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	11.6	18.6
0.1	2.3	6.9	11.3	17.5	20.6	22.4	22.2	17.3	11.8	6.1	1.2		

The warmest months were July, August and June, their mean monthly air temperatures being 22.4°C, 22.2°C, and 20.6°C, respectively. The lowest air temperature was in January (0.1°C), followed by December (1.2°C) and February (2.3°C). The measured mean annual and mean growing season air temperatures were 11.6^0C and 18.6°C, respectively (Tab. 1).

Mean monthly precipitation (P, mm) and mean monthly potential evapotranspiration (PET, mm), as soil water balance elements, for the region of Čačak, are given in Graph 1.

The precipitation analysis shows that the highest mean monthly precipitation occurred in June (84.0 mm), July (73.0 mm) and May (68.0 mm), Graph 1. The lowest total precipitation was recorded in January (33.0 mm), February (35.0 mm) and December (41.0 mm).

The measured mean total annual precipitation was 638.0 mm. The mean total precipitation over the growing season was 380.0 mm.

The highest mean monthly PET was during July (144.0 mm), followed by August (130.0 mm) and June (126.0 mm), as induced by air temperatures. The lowest mean monthly PET values were recorded in January (1.0 mm), December (3.0 mm) and February (7.0 mm) (Fig. 1.)

The measured mean annual PET was 725.0 mm. The average PET value during the growing season was 630.0 mm.

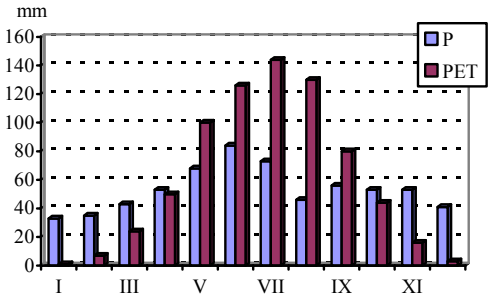

Figure 1. Mean monthly precipitation (P, mm) and PET (mm) in the region of Čačak (1984-2003)

The analysis of the soil water balance in the region of Čačak resulted in the clear definition of monthly soil water deficit and surplus over the long-term period (Fig. 2).

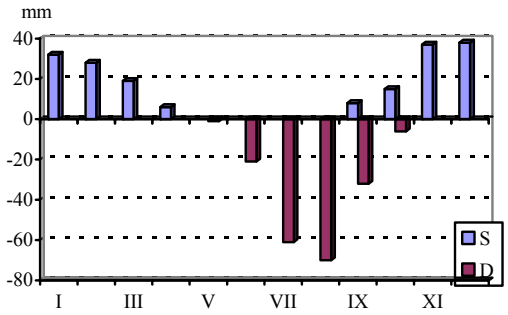

Figure 2. Mean monthly soil water surplus (S, mm) and deficit (D, mm) in the region of Čačak (1984-2003)

Soil water deficit was observed from May through October. The highest water deficit was recorded in August (70.0 mm), followed by July (61.0 mm), September (32.0 mm) and June (21.0 mm), Graph 2. The soil water deficit in October and May was 6.0

mm and 1.0 mm, respectively. The average annual water deficit was 191.0 mm, corresponding to the level recorded for the growing season (191.0 mm). No soil water deficit was determined in April (in terms of the growing season).

The surplus of soil water in Čačak was observed from September through April (Graph 2). The water surplus was highest during December, November, January and February (38.0 mm; 37.0 mm; 32.0 mm; 28.0 mm, respectively). It amounted to 19.0 mm in March, 15.0 mm in October, 8.0 mm in September and 6.0 mm in April (Graph 2). The mean annual water surplus was 183.0 mm.

In terms of the growing season, the soil water surplus of 8.00 mm and 6.00 mm occurred in September and April, respectively.

Water deficit (32.0 mm; 6 mm) and water surplus (8.0 mm; 15 mm) simultaneously occurred in September and October (respective values).

The relationship between the analysed elements of soil water balance, including precipitation and PET (mm), during the aridest and highest rainfall years of the study is presented in Fig. 3 and 4.

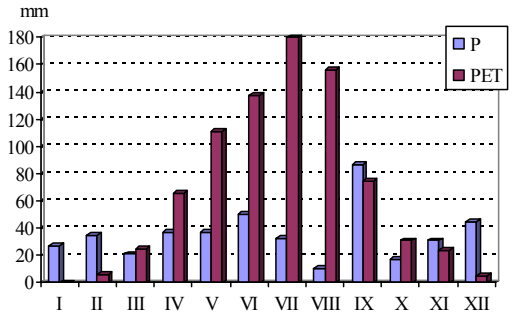

Figure 3. Mean monthly precipitation (P, mm) and PET (mm) during the aridest year of the study (2000)

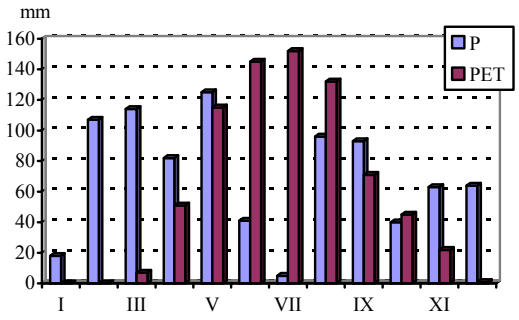

Figure 4. Mean monthly precipitation (P, mm) and PET (mm) during the highest rainfall year of the study (1996)

During the period of analysis, the year 2000 was the aridest, the total annual precipitation being 431.0 mm (67.5% of the average annual precipitation during the period of observation) and PET – 816.0 mm (exceeding the mean annual PET by 12.5%), Fig. 3.

During the growing season, the values measured in 2000 were 255.0 mm for total precipitation (67.1% of average growing season precipitation during the period of study), and 725.0 mm for PET, which was identical to the mean annual value of PET (725.0 mm) during the long-term period of analysis (Fig. 3).

The highest rainfall over the long-term period occurred in 1996, the total annual precipitation being 848.0 mm (32.9% higher than the average annual precipitation during the period of analysis) and PET – 741.0 mm (exceeding the mean annual PET over the long-term period by 2.2%), Fig. 4.

During the growing season, the year 1996 measured 442.0 mm precipitation (16.3% higher than the average growing season precipitation over the period of analysis), and 666.0 mm PET, which was 5.7% higher than the mean value of PET recorded during the growing season (630.0 mm) over the long-term period (Fig 4).

Similar results on water balance under the climatic conditions in BH and Vojvodina were reported by a number of authors [2, 3].

CONCLUSION

The results of the above analysis showed that the soil water deficit occurred from May through October, ranging from 1.0 mm to 70.0 mm. Water surplus was recorded during September-April and fell within a range of 3.0 mm to 38.0 mm.

The measured values of total annual and growing season precipitation and evapotranspiration under the environmental conditions of the region of Čačak deviated from the average values, the deviations of precipitation being higher than those of evapotranspiration.

During the arid year, total precipitation showed similar deviations from the average values on an annual basis and during the growing season – being 67.5% and 67.1%, respectively. During the humid year, the deviations of precipitation from the average annual value on an annual basis were higher than those of growing season precipitation from the average growing season totals.

During the arid year, annual PET deviated from mean annual PET. Characteristically, the growing season PET in the dry year was identical to the mean value measured over the period of the study. During the moist year, PET deviations during the growing season were higher than those during the year, relative to the average values for the respective time periods.

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RECULTIVATION OF MINE WASTE DUMP IN THE NATIONAL PARK

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ABSTRACT

In 1931 coal mine was flooded and thermal water started springing from mine shaft over the waste dump. In 1970s sports rehabilitation center was built right under the mine shaft, between the road to the old colony, waste dump and the cemetery. Even today mine shaft is a thermal spring with neglected space of waste dump at the eastern part of hotel complex.

Keywords: mine, thermal water, waste dump

INTRODUCTION

Vrdnik is an old mining village on south slopes of Fruška Gora . It is located in natural tectonic depression with the altitude of 181-260 masl. Vrdnik is mentioned for the first time in 1315 as the Vrdnik fortress and the second time in 1702 as a village. The most important event for the development of Vrdnik was the discovery of brown coal deposit and the beginning of its exploitation. The mine was active from 1804 till 1968 and was one of the oldest mines in former Federal Republic of Yugoslavia. Thanks to the mine, Vrdnik had a power plant and electric lighting system at the beginning of twentieth century. Village still contains the old street of mine controllers' houses, Old and New colony with miners' houses, but it is all deteriorating over time. From the Dobra voda shaft, which is now concreted, used to be a railroad that transported coal to the power plant. After the mine was closed, all attempts of preserving the old shaft and village or turning it into tourist attraction failed. All iron constructions, railroad, mining wagons and other equipment were sold out. In the 1970s the sport and recreation center was established between the Dobra voda stream, the cemetery and waste dump.

This project represents a technical solution of the environment of recreation center with the accent on waste dump rehabilitation. All necessary analyses concerning relief, hydrology, geologic characteristics, and historic development of the mine had to be made for the general plan.

CLIMATIC AND GEOLOGIC CONDITIONS OF THE AREA AND HISTORY OF MINE EXPLOITATION

Even though Fruška Gora is a low mountain in relatively dry area where the average annual amount of precipitation is from 631-658 mm, it receives substantial amounts of precipitation, from 650 to 800 mm. Weather bureau of Iriški venac (444 masl) measured average annual amount of precipitation from 748 to 755 mm for the period from 1950 to 1979, after which it was closed. If we take average amounts of precipitation in Vojvodina, monthly and annual, as a standard to compare analog values of rainfall, Fruška gora has a water surplus in all seasons and throughout the year, in comparison to Vojvodina`s average over 50% higher. For the period from 1950 to 1979 average monthly maximums are: primary in June and secondary in December. Primary minimum is in November and secondary in March. Detailed analysis of rainfall regime indicates that:

- the primary maximum is in July, measures 90 mm which is 8 mm above average,
- the primary minimum is in November , measures 38 mm which is 14 mm below average
- secondary maximum is in December and is 15 mm above average
- secondary minimum is in March and is 13 mm above average.

There is a significant surplus of rainfall during the year compared to norm. Relatively staggering amount of rainfall in this agro-climatic region is R = 6.2% and indicates that the annual distribution of rainfall compared to average conditions in Vojvodina is more balanced.

Coal mine was opened in 1804 and first exploratory drillings for determining coal reserves took place in 1901. With occasional interruptions, explorations lasted until 1917, and in that time 134 wells were drilled with depth of 24.00 m to 260.00 m. A number of boreholes were drilled to the underlaying formation of coal layer, and a less number of them were affected by the surface of neogene basin. South mine shaft was designed at the Obrazac field to the depth of 270,00m and was based on the exploratory drill B-12. During 1931 miners entered the fault by under mining, there was a rapid penetration of the mineral water and underground rooms sank. Other mines closed in time and mineral water poured out from shaft.

Vrdnik basin was created during a long period from the end of upper cretaceous till the beginning of lower Miocene under influence of radial tectonics and erosion. In its development, it is possible to single out four main phases, each of which gave a specific genetic type of sediment. The first phase was the state before the lake, when torrential sediments of heterogeneous composition deposed the tectonic depression. Its thickness varies from 5,00 to 15,00 m. In the second phase basin was closed towards south, forming a lake. The deposing of lake sediments takes place: gravel, sand and clay from which are later formed conglomerates and sandstones. The thickness of sediments of this phase varies from 10,00 to 60,00 m. In the third stage several coalbaring layers appear, separated by betonite or coal clays. The thickness of this complex in the central part of

basin is 10-12 m. The fourth phase is the final stadium in the development of Vrdnik basin. It begins with the renewal of tectonic movements along major dislocations: Sremska and Fruškogorska , by rhythmic rising and lowering of the bottom of basin. Sediments were deposed over the thick layer of coal and they later transform to marly and clay sandstones, clays, marls, gravels, sands with several phases of tuffs.

The northern border of the Vrdnik basin is a dislocation of east-west direction up to 150.00 m. Southern border of the basin makes a great southern fault, with direction southwest-northeast , with the northern block dropped from 100.00 m to 175.00 m. Several transverse faults divide coalbaring series on south and north field, with an increase of 10.00 - 50.00 m. Within the basin, local faults are separated: two ways with northeast-southwest direction, and one that cuts them with direction northwest-southeast (along the fault there was a penetration of thermal waters and the flooding of the mine. Along the eastern borders of the basin faults were not confirmed).

Coalbaring horizon consists of four layers of total thickness of coal 8,00 to 12,00 m, separated by three layers of bentonite, whose thickness varies from 0,12 m to 1,20 m. In the field of Oborac, the first and second layer of coal have an average thickness of 4,33 m, the third layer 1.92 m, while the fourth 2.61 m (1.2)). The first layer of bentonite is 0,14 m thick, the second 1,03 m and the third 0,36 m.

GENERAL PLAN

The area intended for landscaping includes the slope on the left bank of the Dobra voda stream east from Fruškogorska street, hotel Thermal entrance and the old mining dump behind the hotel. Whole area is around 18000 $m^{2,}$ which is divided into four sections:

- The first unit is in the northern part of the field. This area has a sporting and recreational function and is designed for users of all ages. On the eastern slopes of this area cascades are planed with supporting walls and trails that follow the terrain. Paths would have incline of 1% by length and 0.1% in width. The altitude difference is overcome by 2 steps. The width of the paths is 150 cm. The paths are paved with roughly processed stone. Fence is placed along the terraces.
- The second section includes an existing swimming pool and the area around it. This section occupies approximately 8500 meters. Paved portion around the pool is an area of 1608 m² and contains deck chairs and umbrellas. The altitude of this plateau is 223m, and the dimensions of the pool are 50x20m. In addition, there is a smaller pool with the area of 88 m. Next to the pool area, there is a slope with the incline of 8% which is conected with the first section wth similar greenery and a path.
- The third section is the slope, the mine dump behind the pool and the hotel, which occupies an area of about 12,500 m². The incline is mastered by three cascades with supporting walls 2 m high. There are two kinds of paths with a gentle fall that follows the slope. The first are paved with roughly processed stone, with width of 2m and are distanced 2 m from the supporting walls. Longitudinal slope is 1%, cross 0.1%. The other type of path is 1.5 m wide. Terraces provide five plateaus, 3 x 70 m², 2 x 85 m²,

1 x 130 m. Supporting walls consist of three levels. A plateau with woody species and movables is predicted by the South shaft from which the thermal water drains.

- The fourth section is the area of the Orthodox cemetery and the slopes that are located in the east of the cemetery. Terrain in this area has not been altered, so it has two slopes (terraces) that follow the incline of the natural terrain. These terraces would be planted with indigenous vegetation. This area would not contain any paths, or other facilities. In the fourth section, there is a parking space. A part of that space is reserved for buses and invalids. The species characteristic for the sacred places are planted at the border of the cemetery. They provide the isolation of this space.
- The entrance of the hotel is emphasized with short avenue, lawn and cascades of thermal water which flows to the Dobra voda stream.

CONCLUSION

The main goal of this project is the restoration of depleted area caused by exploitation of raw materials, its revival,the return of ecological and biological values and involvement in the commercial complex. The appearance of the mineral water contributed to the return of the lost and simultaneously enriched the area. By subtle interventions in the space we strived to bring it closer to users for whom this is the most significant natural value.

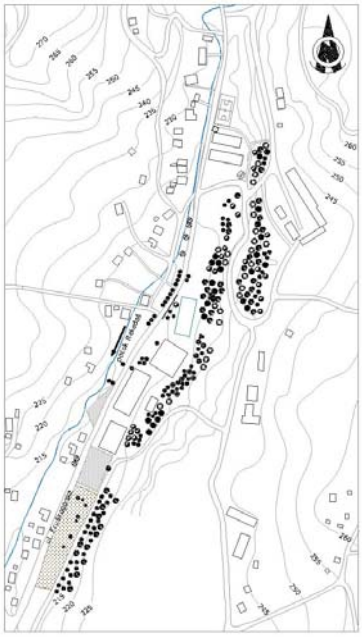

Figure 1. Existing state of the area

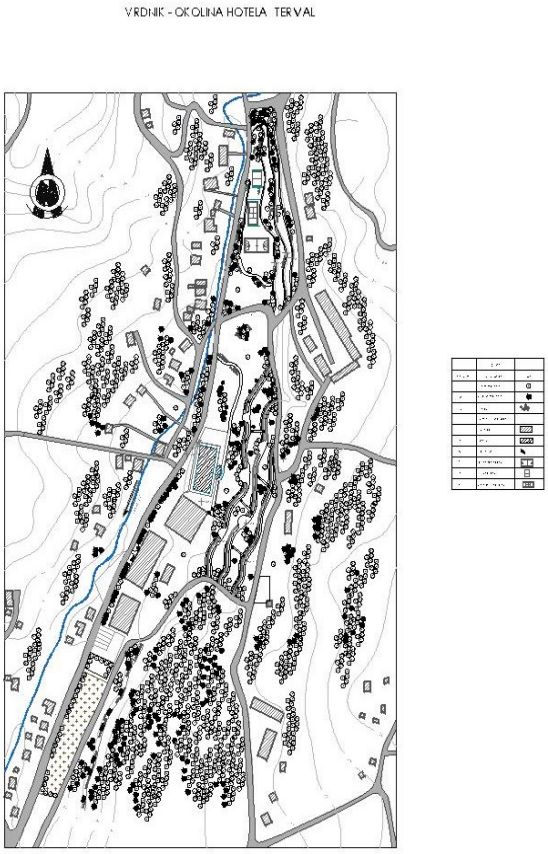

Figure 2. General plan

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$(La_{0.85}Sr_{0.15})_{0.92}MnO_3$ and $Ba_{0.5}Sr_{0.5}Co_{0.8}Fe_{0.2}O_{3-\delta}$ PEROVSKITES AS ADSORBENTS OF AMMONIA FROM AQUEOUS SOLUTION

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ABSTRACT

The characteristics of $(La_{0.85}Sr_{0.15})_{0.92}MnO_3$ and $Ba_{0.5}Sr_{0.5}Co_{0.8}Fe_{0.2}O_{3-\delta}$ perovskites as adsorbents were tested in the process of adsorption of ammonia from the aquatic environment. The adsorption of ammonia on $(La_{0.85}Sr_{0.15})_{0.92}MnO_3$ and $Ba_{0.5}Sr_{0.5}Co_{0.8}Fe_{0.2}O_{3-\delta}$ perovskites is explained by the characteristic structure of the perovskite-type ceramics, i.e. by the presence of non-stoichiometric ratio of oxygen in a crystal lattice, which can explain occurence of the dipole and the locations deficient in electrons. The registered adsorption is defined as physical, and the obtained adsorption curves are characteristic of a multilayer adsorption, and for all samples, according to the form, belong to the group VI based on the IUPAC classification.

Keywords: LSM, BSCF, perovskites, ammonia, adsorption

INTRODUCTION

$(La_{0.85}Sr_{0.15})_{0.92}MnO_3$ and $Ba_{0.5}Sr_{0.5}Co_{0.8}Fe_{0.2}O_{3-\delta}$ perovskites, as mixed ionic – electronic conductors, have been for quite some time present in the technology of ceramic membranes for oxygen [1,2,3] and as the materials of electrodes in solid oxide fuel cells [4,5,6,7]. Because of the present chemical reactivity on the surface of these oxides [8,9], there exists the interest in their application in other technologies as well. The above mentioned perovskites, as mixed oxides which in their structure in place of a cation have the elements occurring in several valence states, impose upon the application in the scientific field of chemistry on surfaces, especially because of the defect in the crystal lattice and present non-stoichiometric ratio of oxygen (in case of $Ba_{0.5}Sr_{0.5}Co_{0.8}Fe_{0.2}O_{3-\delta}$ perovskite). The removal of ammonia from aqueous solutions as the problem arising in real systems is currently most frequently solved by adsorption on zeolites, reverse osmosis, but also biological filtration. The need for a bigger profitability of the process of elimination of ammonia imposes a constant work devising new scientific – technological solutions. The adsorption of ammonia from the aqueous

solution was in the previous papers conducted on $BaCe_{0.9}Gd_{0.1}O_3$ perovskite, with the presented results indicating a big adsorption capacity of the given perovskite compared with the selected zeolites and aluminum(III) – oxide [10]. This paper presents the first results of the adsorption of ammonia from the aquatic environment on $(La_{0.85}Sr_{0.15})_{0.92}MnO_3$ and $Ba_{0.5}Sr_{0.5}Co_{0.8}Fe_{0.2}O_{3-\delta}$ oxides with the perovskite structure by using the data of the adsorption of ammonia from the aquatic environment on the active coal as reference values for comparison.

EXPERIMENTAL PART

The study used $(La_{0.85}Sr_{0.15})_{0.92}MnO_3$ and $Ba_{0.5}Sr_{0.5}Co_{0.8}Fe_{0.2}O_{3-\delta}$ perovskites of 99.9% purity, of the Praxair producer. The conducted XRD analyses for both materials confirmed the presence of peaks characteristic of the perovskite structure (Figure 1). XRD analyses were conducted on the SIEMENS D5000 diffractometer with the copper (λ=154 nm) anode and Θ-2Θ configuration. The range of measurement was from 20° to 100° 2 theta with the 0,05° step.

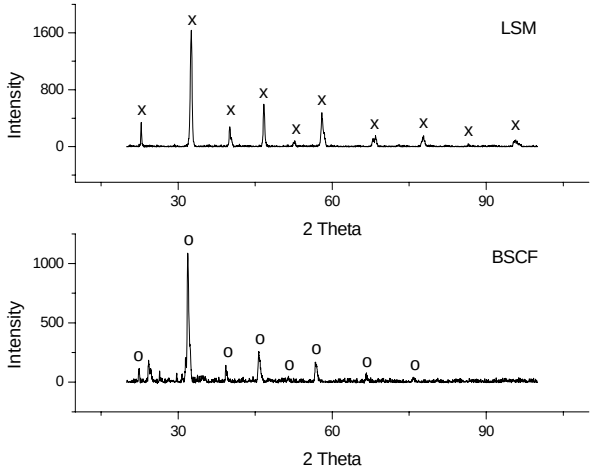

Figure 1. XRD analysis of used adsorbents with marked peaks $(La_{0.85}Sr_{0.15})_{0.92}MnO_3$ (x) and $Ba_{0.5}Sr_{0.5}Co_{0.8}Fe_{0.2}O_{3-\delta}$ (o) perovskite.

The BET method was used to determine the specific surface of the samples of $(La_{0.85}Sr_{0.15})_{0.92}MnO_3$ and $Ba_{0.5}Sr_{0.5}Co_{0.8}Fe_{0.2}O_{3-\delta}$ perovskites. The samples were annealed for four hours at 400°C, and the specific surface was 1.87 m^2/g for the sample of $Ba_{0.5}Sr_{0.5}Co_{0.8}Fe_{0.2}O_{3-\delta}$ perovskite and 4.02 m^2/g for the sample of $(La_{0.85}Sr_{0.15})_{0.92}MnO_3$ perovskite. The approximate pH of the samples (0.1 g $(La_{0.85}Sr_{0.15})_{0.92}MnO_3$ in 1 mL of water and 0.1 g $Ba_{0.5}Sr_{0.5}Co_{0.8}Fe_{0.2}O_{3-\delta}$ in 1 mL of water) was determined by the universal indicator paper and was around pH 5.5 for both samples. Six different

concentrations of aqueous solutions of ammonia were prepared for the experiments, with approximately the following values: 0.07, 0.14, 0.18, 0.30, 0.35 and 0.45 mol/L (accurate concentrations were detrmined by titration with the standard HCl solution). Six samples of each $(La_{0.85}Sr_{0.15})_{0.92}MnO_3$ and $Ba_{0.5}Sr_{0.5}Co_{0.8}Fe_{0.2}O_{3-\delta}$ perovskite of approximate 0.5 g were weighed on the analytical balance, and then 50 mL of aqueous solution of ammonia was added to each. The exact time of adsorption was previously determined at the temperature of 20°C in the time interval of 7h, where it was established that the optimal time of adsorption of these samples was 3h (Figure 2). The blank determination was conducted in order to correct a potential error due to the adsorption of ammonia on the glassware and filter paper, as well as vaporization while filtering the sample. The suspensions were agitated and placed for thermostatting at three different temperatures (0°C, 15°C and 25°C) for the period of 3h. Because of a distinct evaporation of ammonia, the samples were treated with a special attention during the titration. The aliquots of 10 cm^3 were titrated with the standard solution of hydrochloric acid solution of 0.1 mol/L concentration with the methyl orange as indicator.

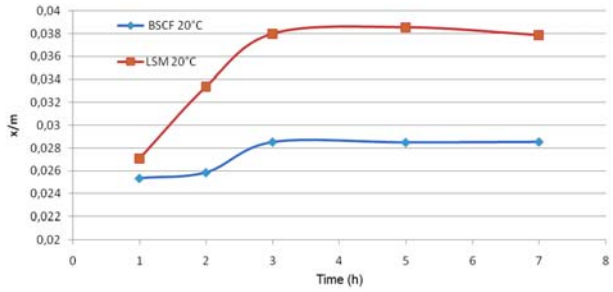

Figure 2. Diagram of establishing optimal time for adsorption of NH_3 on LSM and BSCF at 20°C

RESULTS AND DISCUSSION

The results of three series of measurement of ammonia adsorption from aqueous solutions on BSCF and LSM perovskite and active coal, as reference adsorbent, can be seen in tables 1-9. The characteristic of the adsorbate/adsorbent system was described by the Freundlich isotherm. The adsorption isotherms obtained on BSCF perovskite indicate a multilayer adsorption (Figure 3). Since the quantity of adsorbed ammonia gets reduced with temperature (at the first plateau from 0.0116 mol/g at 0°C to 0.0081 mol/g at 25°C), it is the case of physical adsorption. On LSM perovskite adsorption isotherms are of the same type as on BSCF perovskite (Figure 4). The quantities of tied ammonia on the first plateau are approximately equal, but the number of molecules of tied ammonia on the second plateau on LSM perovskite is significantly bigger, especially in the adsorption at 0°C. (0.0287 mol/g of ammonia on BSCF and 0.0368 mol/g on LSM). The obtained results for the adsorption of ammonia on perovskites were compared with the results of the adsorption of ammonia on active coal

(Figure 5), which is a largely applicable and used adsorbent, of a crystal structure, big specific surface (cca 1000 m^2/g) with the pores whose size does not exceed 0.1 nm. Figure 6 presents the isotherms for adsorption systems of ammonia/active coal, ammonia/BSCF perovskite and ammonia/LSM perovskite at given temperatures as comparative diagrams. At 0°C the adsorption of ammonia on active coal is incomparably bigger than on perovskites, while at a bigger (room temperature) the adsorption capacities of LSM and BSCF perovskites get closer to the values of active coal. At the temperature of 15°C, LSM and BSCF perovskites are almost equally active adsorbents for ammonia in aquatic environment. With the increase of temperature, the most distinct fall is of the adssorption capacity of BSCF perovskite. Since ammonia is the adsorbent of base characteristics, we assume that the active centers on the surface of perovskite, responisble for adsorption, are of acid character. The change of temperature obviously affects the factors determining acidity power of the centers which because of non-stoichiometric ratio of oxygen in perovskites most probably represent electron-deficient locations of the Lewis acid type. The presence of iron ions in BSCF perovskite and ions of manganese in LSM perovskite, which are prone to change of oxidation state, and especially manganese with the changeable electrostatic field (e/r) obviously significantly affects the activity of the centers responsible for the adsorption of ammonia from the aqueous solution.

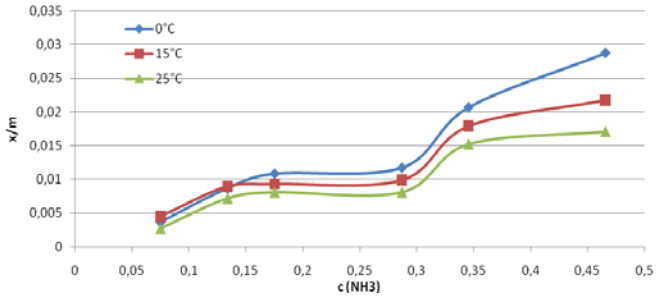

Figure 3. Adsorption isotherms for the system NH_3 – BSCF for 0, 15, 25 °C

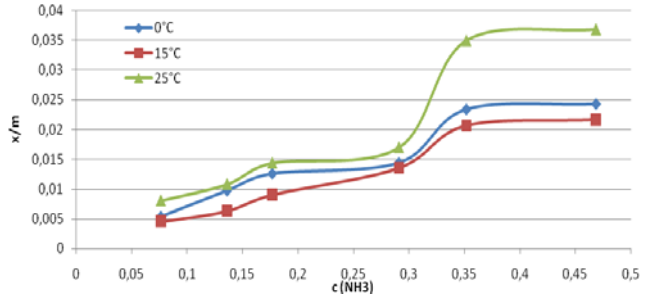

Figure 4. Adsorption isotherms for the system NH_3 – LSM for 0, 15, 25 °C

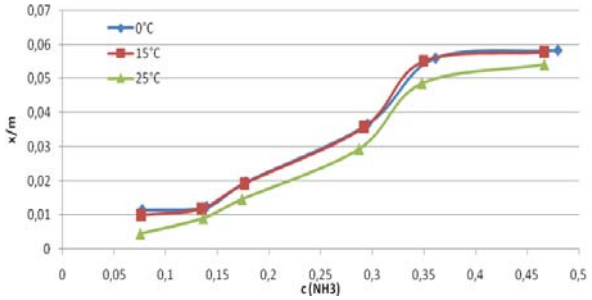

Figure 5. Adsorption isotherms for the system NH_3 – active coal for 0, 15, 25 °C

Table 1. Adsorption of ammonia at 0 °C on active coal.

$c_0(NH_3)$	$c(NH_3)$	x/m
0,07732	0,07053	0,011496
0,13978	0,13245	0,012384
0,17747	0,16584	0,019599
0,29560	0,27407	0,036583
0,3613	0,32845	0,055934
0,47975	0,44529	0,058232

Table 2. Adsorption of ammonia at 15 °C on active coal.

$c_0(NH_3)$	$c(NH_3)$	x/m
0,07592	0,06999	0,01008
0,13461	0,12761	0,01191
0,17607	0,16476	0,01926
0,29184	0,27084	0,03580
0,34945	0,31714	0,05507
0,46629	0,43237	0,05776

Table 3. Adsorption of ammonia at 25 °C on active coal.

$c_0(NH_3)$	$c(NH_3)$	x/m
0,07538	0,07269	0,00459
0,13622	0,13084	0,00918
0,17391	0,16530	0,01468
0,28699	0,26976	0,02937
0,34783	0,31930	0,04856
0,46629	0,43452	0,05411

Table 4. Adsorption of ammonia at 0 °C on BSCF perovskite.

$c_0(NH_3)$	$c(NH_3)$	x/m
0,07494	0,07282	0,00359
0,13383	0,12877	0,00863
0,17521	0,16888	0,01079
0,28709	0,28023	0,01168
0,34567	0,33353	0,02067
0,46600	0,44911	0,02874

Table 5. Adsorption of ammonia at 15 °C on BSCF perovskite.

$c_0(NH_3)$	$c(NH_3)$	x/m
0,07546	0,07283	0,004491
0,13668	0,13141	0,008977
0,17278	0,16729	0,009330
0,28498	0,27918	0,009894
0,34989	0,33934	0,017942
0,45967	0,44542	0,021791

Table 6. Adsorption of ammonia at 25 °C on BSCF perovskite.

$c_0(NH_3)$	$c(NH_3)$	x/m
0,07658	0,07499	0,00269
0,13626	0,13203	0,00718
0,1769	0,17217	0,00810
0,29101	0,28625	0,00810
0,35174	0,34276	0,01523
0,46846	0,45843	0,01709

Table 7. Adsorption of ammonia at 0 °C on LSM perovskite.

$c_0(NH_3)$	$c(NH_3)$	x/m
0,07658	0,07341	0,00540
0,13626	0,13045	0,00975
0,17693	0,16953	0,01259
0,29101	0,28256	0,01440
0,35174	0,33801	0,02335
0,46846	0,45420	0,02424

Table 8. Adsorption of ammonia at 15 °C on LSM perovskite.

$c_0(NH_3)$	$c(NH_3)$	x/m
0,07658	0,07394	0,00449
0,13626	0,13256	0,00628
0,17745	0,17217	0,00900
0,29101	0,28308	0,01350
0,35174	0,33960	0,02060
0,46846	0,45579	0,02159

Table 9. Adsorption of ammonia at 25 °C on LSM perovskite.

$c_0(NH_3)$	$c(NH_3)$	x/m
0,07658	0,07182	0,00805
0,13626	0,12992	0,01079
0,17693	0,16848	0,01437
0,29101	0,28097	0,01697
0,35174	0,33115	0,03491
0,46846	0,44681	0,03681

The active coal was a good choice for reference adsorbent in examining the adsorption characteristics of perovskite, because the adsorption of ammonia on active coal is physical adsorption and because the obtained isotherms on active coal are of the

same class according to the IUPAC classification. Examining of adsorption on BSCF and LSM perovskites gives the information that with the increase of temperature the tendency of ions towards the transfer to higher valence states is more intensive, which increases the effect of electrostatic field of the introduced cation and causes a bigger activity of the centers responsible for adsorption of ammonia and that is why LSM perovskite with the temperature increase is a better adsorbent, and because of the tendency of manganese to change valence states from Mn(II)-ion potentially to even Mn(VII)-ion, opposite to iron which has an easy transforamtion from Fe(II)-ion to Fe(III)-ion even at the lower temperatures.

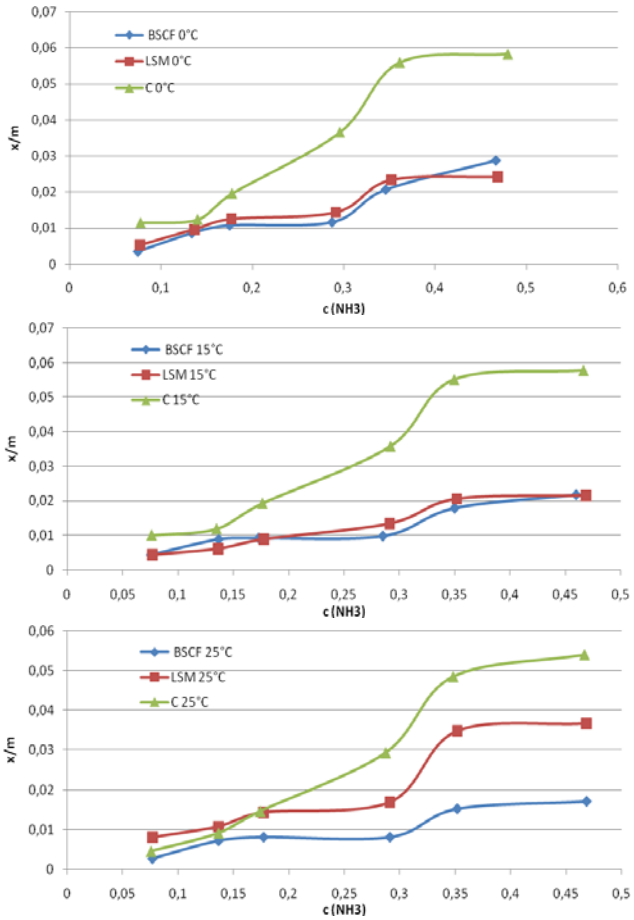

Figure 6. Comparison of adsorption of ammonia on active coal, BSCF and LSM perovskite at 0, 15, 25 °C

CONCLUSION

$(La_{0.85}Sr_{0.15})_{0.92}MnO_3$ and $Ba_{0.5}Sr_{0.5}Co_{0.8}Fe_{0.2}O_{3-\delta}$ perovskites were tested as adsorbents in the process of adsorption of ammonia from the acquatic environment. Based on the analysis of Freundlich adsorption isotherms for the systems NH_3 – LSM and NH_3 – BSCF, it can be concluded that it is the case of a multilayer physical adsorption, and the isotherms based on their form belong to group VI according to the IUPAC classification. The adsorption capacities of LSM and BSCF perovskites with the increase of temperature get closer to the values of adsorption capacity of active coal used as a reference adsorbent. The structure of $(La_{0.85}Sr_{0.15})_{0.92}MnO_3$ and $Ba_{0.5}Sr_{0.5}Co_{0.8}Fe_{0.2}O_{3-\delta}$ perovskites, i.e. previously known characteristics of non-stoichiometric ratio of oxygen and changes of oxidation state of the present Fe- and Mn-ions, are a possible explanation of the present changeable activity of centers with the temperature, which is important for the adsorption of ammonia from the aqueous solution.

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DIETARY SUPPLEMENTS MEET REGULATIONS

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ABSTRACT

Dietary supplements are foods that supplement the normal diet and which are concentrated sources of nutrients (vitamins, minerals and other substances with a nutritional or physiological effect). They are marketed in dose forms (capsules, tablets, drops, etc.). The oldest and most complete regulation on dietary supplements is a U.S. regulation. The basic law regulating the manufacture, sale, labeling and marketing of dietary supplements is the Dietary Supplement Health and Education Act (DSHEA) from 1994.

The EU regulation on food supplements is only partially harmonized. Directive 2002/46/EC on the approximation of legislation of the Member States relating to food supplements is determined list of permitted vitamins and minerals, substances that are used as their sources, marking units and permitted forms of dietary supplements. Maximum allowable amounts for vitamins and minerals, herbal supplements and health statements are not yet harmonized and apply national regulations that differ as a barrier to trade dietary supplements in the EU. Checking declared content gets the confidence in the quality of supplements, as well as the content of additives applied in accordance with nationallegislation.

Keywords: dietary supplements, vitamins, minerales, aditives

INTRODUCTION

In our country there is no regulation on food supplements. Dietary supplements are usually classified in dietetic foods by the Regulation on requirements in terms of health safety of dietary ingredients that can be placed on the market that is outdated and not consistent with the standards of Codex Alimentarius and EU regulations. Nutrition declaration of foods is regulated by the labeling and marking packaged foods rule book . There are 24 prescribed nutritional statements, declaration of vitamins and minerals and RDAvalues.

AIM

Our goal was to determine content in supplements, as wall as aditives. Their content is declared, by using HPLC and UPLC methods, to assess the quality of these foods.

MATERIAL

A large number of dietary products have a high content of vitamins and minerals. Depending on usage, the amount of nutrients entered can significantly exceed recommended daily intake. Also, if the content does not match the declared quantity, consumers can be misleaded. In our market, there is a more diverse supply of dietary products in pharmaceutical forms, as well as foods fortified with declared content of vitamins and minerals. by the proper use of these foods, it is possible to substantially meet the daily needs.

Dietary supplements often contain substances with a nutritional or physiological effect that mitigated the problem with sleep (such as melatonin - a hormone naturally present in some foods), facilitate menopause (phytoestrogens), which are used in the nutrition of athletes and people with specific needs (based on individual amino acids, or their mixtures with immunoglobulin, various "growth factors" and herbal extracts, and even alkaloids). Only the application of modern instrumental techniques, certified standard reference materials and substances, an experienced expert-analyst can determine the content of declared components. It is often necessary to confirm the absence of unwanted substances or supplement name when the declaration reminiscent of intoxicating drugs. Using RP-HPLC method with the library spectra we can verify the presence of substances with strong effect by the screening method. Dietary supplements are used to change the composition, and retain the generally accepted name. Thus, herbal syrups often contain ethanol (up to 13%) and are traditionally used to support the treatment of children. By using HPLC method with refractive detector to verify the contents of sugar, sugar alcohol, and ethanol. It is necessary to specify in the declaration, the presence of ethanol, because for a big part of the population its use is not allowed.

Zeolite is a suitable adsorbent and is characterized by poor ability to accept or interchange water and some of their constitutional cations. Zeolite is more and more applied in veterinary medicine, pharmacy and human medicine. As a dietetic supplement it has been present on European market since 1998. Zeolite based preparations are used for aflatoxin adsorption, prevention of aflatoxicosis and presence of aflatoxins in eggs and poultry, cattle, pigs and sheep meat. Zeolites are of volcanic origin and radiometric analysis, as well as checking the contents of toxic metals are required. Dietary supplements contain additives that are always declared and are subject to analysis in accordance with the regulations. The use of certain additives is permitted *quantum satis*, sometimes restricted by legislation. Very frequently used colors for pleasing look that reminds of the foods and flavors. Sweeteners are often used and the content is clearly regulated. Checking their content is possible using liquid chromatography with appropriate detectors, depending on the nature of the analyte.

RESULTS

Using modern instrumental techniques (HPLC, UPLC) with different detection systems there were 127 samples of dietary supplements analyzed in the past year. In terms of vitamin content, 81% met the conditions of the declaration, 15% had lower and

4% higher content than the declared. Supplements based on minerals were present in a small number (3) and they all meet the requirements of the declaration. Foods that are based on herbal extracts were analyzed in terms of confirmation of certain components (such as caffeine, theobromine, theophylline) or absence (ephedrine). In only three cases it was possible to confirm the content of the extract, when the caffeine content was standardized, in other cases the content of active principles could not correlate with the plant extract. In terms of applied additives, maximum deviation was increased in terms of color content of foods when it comes to capsuled forms. All samples had the opinion of the Drugs agency that in respect of the declared content they does not belong to a group of drugs, because the current national legislation has defined the maximum permitted content of vitamins, minerals and herbal drugs.

CONCLUSION

Adoption of regulations on food suplements based on the new Law on Food and harmonized with EU regulations and international standards is the basis for introduction of making order in the production and distribution of this specific group of foods and for health protection and other consumers interests.

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PHYTOSANITARY STATE OF VEGETATION IN THE ZEMUN CENTRAL CITY PARK

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ABSTRACT

Health condition of the vegetation in Zemun Central City Park was analyzed. Entomological and phytopathological agents were found in various categories of vegetation. Deciduous trees are in a somewhat better state of health than conifer trees. The median values of the health condition of shrubs are fairly equal between the various categories, but, just as in trees, the deciduous species stand out as the most vital. Of a total 1140 plants, only the species *Juglans nigra* was evaluated as having the highest median health condition grade. Lowest median health condition grades were evaluated on 22 species (89 plants).

Keywords: state of health of vegetation, insect pests, mites, pathogenic fungi

INTRODUCTION

On the land of the former Kontumac, a small park was established in 1880 later growing into the large complex which is today's City Park. The park is organized well and within it can be seen examples of rare trees such as: American Douglas-fir, plane trees, ginkgo, Kentucky coffeetree, Japanese black locust, honey locust, yew, pine, cedar, Judas tree and others. Within the park itself are Kontumac chapels, built in baroque style, which once served the religious needs of travelers who were held in quarantine [1].

The Orthodox Church of St. Archangel Gabriel was built in 1786 using funds from the renowned Zemun businessman Teodor Toša Apostolović and the icons where painted in 1830/31 by Zemun artists Dimitrije Bratolglić and Konstantin Lekić. In 1993 a monument was placed in front of the church honoring the work of Armenian author Rumen Nalbadjan.

The Catholic Church St. Rok was built by Zemun builder Jozef Felber 1836/7 over the location of the old chapel from the XVIII century. Behind the church is a memorial column discovered in 1933 marking the 100-year anniversary of the stay of renowned French poet Alphonse de Lamartine in Zemun.

In the middle section of the park are two more monument sculptures: "Bombas" sculpted by Vanja Radauš and "Talac" sculpted by Boris Kalin.

MATERIAL AND METHODS

Through direct field research, conducted during June of 2007, the vegetation of Zemun Park was recorded and valorized. Through the recording of the state of vegetation, all species which form the green surfaces of Zemun Park were recorded. The health condition of each tree in the park was established. The valuation of the health condition of each plant entailed the establishment of entomological damage and phytopathological disease. The health condition of trees was evaluated using values which were divided into five categories: grade 5 - excellent, grade 4 - very good, grade 3 - good, grade 2 - bad, grade 1 - very bad. An excellent health condition entails the lack of noticeably visible symptoms of pests and diseases of assimilation organs, trunk and branches. A grade of 2 was given to trees and shrubs with a poor health condition which can be rehabilitated using standard protection technologies for the health and care of plants. A grade of 1 was given to trees and shrubs which cannot be rehabilitated using standard methods. Such trees are considered dangerous for the safety of park visitors.

Based on the collected data, the health condition grades were analyzed according to category (deciduous trees, conifer trees, deciduous shrubs, evergreen shrubs and conifer shrubs) and the presence of entomological and phytopathological damage. Additionally, a proposal of measures for rehabilitation of the vegetation in Zemun Park is provided.

Data obtained through a separate analysis of each category of vegetation was compared, i.e. the comparative method was used, in order to, through synthesis consideration, reach the research results and conclusions which indicate the phytosanitary condition of various categories of vegetation in Zemun Park. The identification of pests was established according to [2, 3].

RESULTS AND DISCUSSION

Within the park 111 species of trees and shrubs were established. 70 tree species were recorded with a total of 945 trees. Leaf bearing trees make up the majority according to both species diversity and quantitative state. 46 leaf bearing tree species were recorded with a total of 579 trees (61.27%). 24 conifer tree species were established with a total of 366 trees (38.73%).

Furthermore, within the park there were 41 shrub species recorded and of that 5 (12.19%) were conifer, 13 (31.7%) evergreen and 23 (56.1%) deciduous. The total number of seedlings amounts to 195, of which the most are leaf bearing - 127 (65.13%) and then evergreen - 61 (31.28%) and conifer - 7 (3.59%).

Tables 1 and 2 provide an overview of conifer and leaf bearing trees which had the greatest number of seedlings. The tables provide an overview of the species, number of trees for each species and median health condition grade. The remaining types which are not shown in the tables are represented by less than ten trees.

Table 1. Overview of most common d trees according to species, number of trees and median health condition grade

№	Botanical name and variety	Number of trees	Phytosanitary condition (median health condition grade)
1	*Betula alba*	27	2,92
2	*Cercis siliquastrum*	24	1,96
3	*Acer platanoides*	67	2,72
4	*Tilia cordata*	19	2,74
5	*Tilia grandifolia*	53	2,96
6	*Aesculus hippocastaneum*	60	3,2
7	*Acer pseudoplatanus*	63	2,6
8	*Tilia tomentosa*	32	2,84
9	*Carpinus betulus*	13	2,92
10	*Quercus robur*	26	3,0
11	*Fagus moesiaca*	25	3,2
12	*Sophora japonica*	23	2,27
13	*Platanus x acerifolia*	20	3,0

The median health condition grade of leaf bearing trees amounts to 2.7. By analyzing the obtained results it was established that the lowest median health condition grade was found in the species *Sambucus nigra* and *Acer dasycarpum*. Additionally, low health condition grades were recording in the following species: *Gymnocladus canadensis, Catalpa bignonioides, Morus alba, Maclura aurantiaca, Prunus cerasifera, Cercis siliquastrum* and *Buxus sempervirens.* The only species which was given the highest median grade was *Juglans nigra*. A very good health condition was evaluated in *Corylus colurna, Ulmus effusa* and *Acer obtusatum*. All other species were given a median health condition grade from 2 to 4.

Table 2. Overview of most common conifer trees according to species, number of trees and median health condition grade

№	Botanical name and variety	Number of trees	Phytosanitary condition (median health condition grade)
1	*Thuja occidentalis*	16	3,12
2	*Pinus nigra*	174	2,0
3	*Thuja orientalis*	31	2,13
4	*Abies nordmanniana*	15	1,93
5	*Picea abies*	22	1,95
6	*Taxus baccata*	25	2,7
7	*Picea pungens*	24	1,95

The median health condition grade of conifer trees amounts to 2.23, which is somewhat lower in relation to deciduous trees. Of the 24 species, a total of 14 (58.33%) were evaluated as having the lowest grades (1 and 2). The best health condition was recorded in the species *Ginkgo biloba*, with a median grade of 4.71.

The median health condition grade of all 945 trees in Zemun Park is 2.46. By analyzing individual trees it was established that a grade of 1 was given to 89 trees and

of that were 13 species of conifer and 25 leaf bearing tree species. The species with the largest number of trees which received the lowest grade were: *Pinus nigra* (12 trees), *Cercis siliquastrum* (8 trees), *Acer platanoides* (7 trees), *Prunus cerasifera* (6 trees) and *Acer pseudoplatanus* (5 trees). The remaining species with the lowest grade are represented by less than 5 trees. The highest grade was given to 14 trees and that being 4 species of leaf bearing tree and 2 species of conifer. *Ginkgo biloba* was the species with the highest number of trees with a grade of 5 (6 trees), then comes *Juglans nigra* (3 trees) and *Fraxinus excelsior* (2 trees). The remaining types in this category are each represented by one tree.

The most common diseases of assimilation organs of the trees in Zemun Park are *Sphaeropsis sapinea*, power mildew on *Acer* spp., *Quercus* spp., *Guignardia aesculi*, decay of root or trunck (figure 1).

Figure 1. Trunk decay caused by wrong maintenance

The most significant species of harmful insects are aphids, coccids, *Cameraria ohridella, Physokermes piceae* and *Corythuca ciliata*.

For the first phase, the removal of 92 trees (9.73% of the total number of leaf bearing and conifer trees) has been envisaged.

Table 3. Overview of most common shrubs according to species, number of trees and median health condition grade[1]

№	Botanical name and variety	№ of plants	Median health condition grade
	Deciduous shrubs		
1	*Spiraea x vanhouttei (Briot.) Zbl.*	17	2.53
2	*Symphoricarpus albus L.*	10	2.6
3	*Syringa vulgaris L.*	15	3.0
4	*Phyladelphus coronarius L.*	23	2.52
5	*Forsythia x intermedia Zab*	20	3.3
6	*Hibiscus syriacus L.*	8	3.5
7	*Rosa sp.*	6	3.0
	Evergreen shrubs		
1	*Prunus laurocerasus L.*	7	2.71
2	*Mahonia aquifolium (Pursh) Nutt.*	12	2.83
3	*Ilex aquifolium L.*	5	2.6
4	*Buxus sempervirens L*	9	4.0
5	*Ligustrum ovalifolium Hassk.*	14	3.57
	Coniferous shrubs		
1	*Thuja occidentalis L.*	1	3.0
2	*Juniperus chinensis L.*	1	2.0
3	*Juniperus fitzeriana*	1	3.0
4	*Juniperus horisontalis* Moench	3	3.0
5	*Chamaecyparis pisifera 'Plumosa'*	1	4.0

The median health condition of all shrub seedlings in Zemun Park is 2.48. The best health condition was recorded in deciduous species of shrubs (median health condition grade of 3.28), then conifer (median health condition grade of 3.0 and then evergreen (median health condition grade of 2.98). The species which stand out as the most vital according to the median health condition grade are: *Wisteria sinensis (Sims.) Sweet, Viburnum rhytidophyllum Raf., Sambucus nigra L., Kerria japonica (L.) DC, Koelreuteria paniculata Laxm., Celtis australis L., Chanomeles japonica (Thunb.) Lindl., Buddleia davidii Franch., Chamaecyparis pisifera 'Plumosa', Buxus sempervirens L., Berberis vulgaris L.* and *Lonicera nitida Wils.* Not a single shrub species received a median grade of less than 2, as opposed to leaf bearing and conifer trees where such grades were recorded in a total of 15 species.

By analyzing individual seedlings it was established that the lowest health condition grade was given to just 6 shrub seedlings (3.08% of the total number of shrub seedlings). All species with a grade of 1 are each represented by one seedling. Just one seedling Yucca *filamentosa* received the highest health condition grade of 5.

The most common diseases of assimilation organs of the shrub species in Zemun Park are: powdery mildews on various host plants (*Mahonia*, *Syringa*). The most significant species of harmful pests are aphids, coccids an especially *Pseudaulacaspis pentagona, Carulaspis juniper*i. Commons pests are also *Dendrothrips ornatus* mites and snails.

[1] Considering that only 5 conifer species are represented, all species are displayed within the tables regardless of the number of plants

For the first phase, the removal of 6 shrub seedlings has been envisaged (3.08% of the total number of shrubs).

PROTECTED TREES

In Zemun Park there are 7 species which are protected, that being 4 species of leaf bearing tree and 3 species of conifer (a total of 18 trees, 10 leaf bearing and 8 conifer). The highest health condition grades were recorded in the species *Ginkgo biloba* (grade of 4), while the poorest health condition was recorded in *Gymnocladus dioicus* with a grade of 1. Table 4 provides an overview of the protected trees according to species, number of trees and median health condition grade. The damage, as well as rehabilitation measures which are necessary to undertake, are also described.

Table 4. Legally protected species

№	Botanical name	№ of trees	Med. health condit. grade	Damage	Measures of rehabilitation
1	*Cercis siliquastrum*	4	2,25	Wood decay	Dendrosurgery
2	*Sophora japonica*	1	3.0	Central decay	Dendrosurgery
3	*Gymnocladus canadensis*	1	1.0	- Central decay - decay of main branches	- dendrosurgery
4	*Pterocarya pterocarpa*	4	3.0		- dendrohirurgija
5	*Picea pungens*	1	2.0	-spider mites, coccids, very strong infestation - *S. sapinea* – weak infestacion	Control measures
6	*Ginkgo biloba*	2	4.0		
7	*Taxus baccata*	5	2,8	-decay in the base of tree - central decay -škoccids, Tenuipalpidae and spider mites.	- dendrosurgery - control measures
total		18	2,57		

CONCLUSION

Zemun Park is a very significant green area with a valuable vegetation reserve according to both species diversity and quantitative state. It can be concluded that the overall health condition of vegetation is good, but damages were noted. In order to improve and protect this valuable natural resource it is necessary to undertake the following measures:

- constant monitoring, professinal and regular maintenance, application of rehabilitation measures.e.g. dendrosurgery

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REVIEW SPECIES DIVERSITY SPECIAL NATURE RESERVE GROMIŽELJ (Velino selo, Bijeljina, RS-BiH)

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INTRODUCTION

Gromiželj wetlands located in the area Semberije, (North East BiH) in the territory of the Municipality of Bijeljina, Velino village. Alone swamp Gromiželj by all characters is a Lowland moorland, affecting a total area of 67.39 hectares of which will be established and the level of protection, and protection regime II covers an area of 763.61 hectares. The central place of the vortex surface Laketic 1000-1200 m^2, 4-5 m depth. (Sl.gl.RS. 118/08*) Lowland moorland are usually formed in the vast Pannonian Plain, whose bottom is located mainly within the absolute height of 60-100 m. At the bottom and the rim of the Pannonian Basin tresave occur within neotectonic depression, alluvial plains and others. Neotectonic depression formed after swelling at the bottom of the lake paludin Pannonian Basin was performed when the differential scroll blocks, and whose bottom is affected by continuous and intermittent formation of moorland. As it is known at the bottom of the Pannonian Basin are concentrated some of the great rivers like the lower part of the Sava and Drina River which flows in the alluvial plains in various ways to build a bed, in the form of a backwater, and Meander, which over time grow in still water from the peat bog. (Tešić, et.al., 1979) The site Gromiželj geomorphological point of view can be classified into inudacionu even the Drina river alluvium.

MATERIALS AND METHODS

As information about the presence of botanical and zoological species material was collected by standard methods applied in field studies for certain groups of organisms. Part of the zoological material was fixed immediately in the field and part of his return, while the plant material to herbarium. Determination was performed using the following references: Gajic & Karadzic, (1991), Javorka & Csapody, (1975), Obratov, et.al. (1990), Bechyně, (1988), Garms & Born, (1981), Keroves, (1986), Tanasijević & Tosic, (1987), Hardy, (2000), Djurovic, et.al, (1979), März, (1987), Simonovic, (2001), Bertel (2006), Radovanovic & Martino (1950), Bruno (1998), Toman & Felix, (2000).

RESULTS WITH DISCUSSION

Previous research specijskog diversity of flora marshes Gromiželj showed the following: Linchensis 3 types; Bryophyta 8 species, 240 species of vascular plants. As a separate group of the fungi with 33 species.

Flora and Vegetation

On the Lowland moorland shows us present vegetation. Featured are two forest communities that characterized this moorland as follows: *Alnetum glutinosae* Vuk.1956 and *Salicetum cinereae* Zol.1931. Depression which was formed moorland surrounded by a community clean hygrophil *Alnetum glutinosae* Wolf. 1956, which is relict and originates from the cooler and wetter climate during the Holocene and Pleistocene interglacial periods, which are sporadically builds *Salicetum cinereae* Zol.1931 community. Community *Salicetum cinereae* Zol.1931. sindinamic is associated with herbaceous vegetation, reed, rush and high sedge, and eventually to go to wooden vegetation community *Alnetum glutinosae* Vuk.1956. These communities are established on land Bar, which has long been flooded and permanently under the influence of underground water. By physiognomy community *Salicetum cinereae* Zol.1931. is low, bushy often very dense communities, where the associated indicator species occurring hydrophilic species: *Caltha palustris* and *Glyceria fluitans*. (Jovanovic & Cvijetićanin, 2008) Directly in contact with water or black alder trees and ash sporadically Polish community appears *Urtica kioviensis-Salicetum cinereae* V.Jov. 1979. Land makes various versions of the swampy, extremely wet (clay soil) substrate, which has long been flooded and permanently affected by high groundwater. As a species, which differentiates this community I've taken the Bar *Urtica kioviensis*, which belongs to ponto-Pannonian floristic element. (Jovanovic, et.al, 1997) These are usually clay soil and marshy- clay soil land, which most of the saturated water. Characteristic and differential species community *Alnetum glutinosae* Vuk.1956 legally appear in asonal disunction of these communities in a wider area. The most characteristic species of this community are diagnosed in the field: *Thelypteris palustris, Caltha palustris*. (Stefanovic, 1986) Fern *Thelypteris palustris* is very important for the association, fiziognomic and environmentally friendly. It is being developed in shallow water and in open places in the community, which makes the whole facies, ie. form a "chair" (turf) with earth and mud that accumulates around them, in the lower part of the stem, where, along with wetland fern, sporadically present *Rumex hydrolapatum*. At the site of the note Gromiželj turf form, which is next to ferns, as subdomination *Carex riparia* species occurs. (Jovanovic, et.al, 1997) Sporadic presence of small groups of *Quercus robur* in the ash forests in the wider area shows us that the current clean community *Alnetum glutinosae* Vuk.1956 secondary origin, ie. derived from hydrophilic fresh *Alno-Quercion roboris* Horv.1938, long-term recall of the main species (*Quercus robur* and *Fraxinus angustifolia*). Black alder is present in the depressions around the Semberije in the form of small groups where they could form a pit bog and usually some of them were complexes of oak-forest that ash cutting and are depressed with a black alder others with very individual units / areas.

An emerged belt was built by *Typha angustifolia* in touch where the pit bog forests and notes Patches appearance *Phragmites communis*, which indicates that the

succession of vegetation initiated in accordance with the mineralization pit bog. Reed bed the habitat of relict species *Urtica kioviensis* glacial period, which is the Pannonian endemic species whose southern border area ends in Peri region. This nettle is the indicator species for the lowland moorland made in the fossil river bed. The flood zone is noticeable throughout the area covered terrestrial form *Hottonia palustris* or marsh vegetation indicator species within the forest class *Alnatea glutinosae*. Fitogeographic and its taxonomic significance in the flora of the Balkans is that it belongs to oligotip *Hottonia* relict genus, which includes also the Vicar North American type *H.inflata* These remote connections fitogeographic indicate relicts types ie. its background elements arkto-terciary aquatic flora. Today is hotonia element azonal temperate aquatic vegetation in the mid-European climate, avoiding the extreme north end and the Mediterranean. Hotonia in Bulgaria has disappeared species category (EX), and the author Butorac, (1999) hotonia in BiH, in the category of vulnerable species (VU) by IUCN-in. On the habitat along with hotoniom grow more kinds such as *Caltha palustris, Sium lapatifolium, Sparganium erectum, Mentha aquatica, Alisma plantago aquatica, Heleocharis palustris, Juncus articulatus, Butomus umbelatus* et al. The coastal strip has been developed emerged vegetation dominated by *Typha angustifolia*, and sporadically appear *Oenanthe aquatica, Iris pseudacoris, Schaenoplectus lacuster*, and in small groups *Phragmites communis*. On the muddy areas after the withdrawal of water between emerged belt and the free water notice individual specimens often small plant species *Bolboschenus maritimus*, *Cyperus fuscus, Pycreus rotundus, Sagitaria saggitifolia, Myosoton aquaticus* particular stands out where the presence of rare species of *Carex michelianus.*

Aquatic represented part of the flotant species are *Lemna minor, L. gibba, Spirodella polyrrhiza, Salvinia natans and Nuphar luteum,* a kind of submerged plant *Myriophyllum spicatum*, *Utricularia vulgaris* and *Lemna trisulca*. Aquatic community can be characterized as *Myriophyllo-Nuphaeretum* W. Koch 1926th According to review the list of vascular plants for the Red Book H (Silica, 1992-96) to endangered species classified as: *Thelypteris palustris, Nuphar luteum and Hottonia palustris,* the status of endangered vulnerable species (VU) by IUCN in the BH, given that *Thelypteris palustris* and *Hottonia palustris* listed plant species with a proposal for the Red List of Bosnia and Herzegovina, whose presence in the Republic of Srbsca uncertain, which confirms the importance of this habitat. The aquatic flora and hygrophil pit bog Gromiželj diagnosed are 32 plant species.

Fauna

Inventory of the total fauna by the number of wetlands Gromiželj recorded species appears as follows: Invertebrate fauna is represented by the Filum *Porifera, Cnidaria, Mollusca* and *Arthropoda*. Filum *Porifera* represented class *Hexactinellidae Fam. Spongillidae* while Filum *Cnidaria* class *Hydrozoa* represented Fam. *Hydridae*. Certainly the largest number of species belonging recorded Filum *Arthropoda*. Filum *Arthropoda* is represented with the following classes and number of registered species: 26 species of *Arachnida,* 1 species *Crustacea (Isopoda)*, 4 species *Myriapoda* and *Hexapoda* largest class. Class *Hexapoda* has 235 species. According to a representative with the following lines: *Collembola, Symphypleona, Mantoide, Neuroptera, Mecoptera* and *Dermoptera*, while among the Coleoptera to the family: *Antribidae, Oedemeridae,*

Bostrychidae, Myceto phagidae, Colymbetidae, Histeridae, Staphyllionidae, Lampyridae, Malachiidae, Pyrochro idae, Mordellidae and *Lagriidae*. With more than one representative of the class *Hexapoda* following rows: 12 types of *Odonata, Orthoptera* 20 species, 20 kinds of *Hemiptera (Homoptera - Cicadelidae* 4, *Heteroptera* 16), 28 species of *Lepidoptera, Hymenoptera* 14 species (*Formicida* 4, *Vespida* 6, *Apida* 4) and 16 kinds of *Diptera*. Order *Coleoptera*, whose family have more than one representative are the two species have families *Lucanidae, Buprestidae, Cleridae, Hygrobidae, Cantharidae, Meloidae* and *Tenebrioidae*, with three species is present Familia *Elateridae*, four species have Fam. *Scolytidae* and *Dytiscidae*, five species have Fam. *Silphidae* and *Coccinellidae*, followed by families with 8 species of *Curculionidae, Chrysomelidae* with 12 species, 17 species of the families have *Scarabidae* and *Carabidae*, and Family *Cerambycidae* has recorded 20 species. Filum *Mollusca* represented the class *Gastropoda* of 25 species of *Bivalvia* from the present one species.

Depression is supplied fresh water from underground sources, and measured the physical - chemical parameters indicate that: 9,5-10,8^{o}C water temperature, oxygen 10,7-11,4 mg / L; saturation from 104.4 to 108.7 % O_2. Cold water rich in oxygen caused the sunken branches rare colony of freshwater sponges *Spongilla lacustris*. submerged vegetation found in the presence of Cnidaria, species Chlorohydra viridis, as well as large numbers of larvae with dominant species of *Odonata Anax imperator*, and there was found the larva species *Libellula depresa*. The underwater vegetation types were established: *Nepa cinerea, Iiyocoris cimicoides, Notonecta glauca, Sigara dorsalis, Ranatra linearis, Dytiscus margimalis, Acilius sulcatus* as well as many other coleoptera. Of *Gastropoda* were found in vegetation types: *Valvata piscinalis, Lymnaea stagnalis, Succinea putris, Eulota gruticum, Radix sp*. as well as many other types of small gastropoda one Bivalvia *Musculium lacustre*, and many amphipodae and Trichoptera larvae.

On the surface waters are present: *Gerris najas, Hydrometra stagnorum* and *Hygrobia tarda* characterized by rapid circular motion on the water and colembola *Podura aquatica*. Above the water flying Odone: *Sympetrum sanguineum, Lestes parvidens, Ischnura elegans*, etc. At the touch of forests and emerged vegetation note of the following types of cicada: *Cicadella viridis, Epiptera europaea, Cercopis sanguinolenta* and *Stictocephalus bisonia*. The forests have been established snails *Helix pomatia, Cepea nemoralis* and *C.hortensis* and snail without homes (*Limax maximus, Arion rufus* and *Tandonia kusceris*). From snails to single out the type of *Helix pomatia* as a consumer type and significant species *Tandonia kusceris* as Balkan endemic. (Telebek & Stankovic, 2007)

Certainly the most significant finding of the fish *Umbra krameri* for which this is the only proven habitat in BiH. There is evidence that is stated in the document "Strategy for Nature Conservation in the Republic of Srpska" from December 2007 - January 2008. where the umbra alleged presence in the territory of Brcko District, but the new certificate with the court no. In addition umber of fish have been recorded following types: *Tinca tinca, Esox lucius, Cobitis taenia, Missgurnus fosilis* and *Carassius auratus carrasius* that a few years ago anthropogenically created. Of the other vertebrata diagnosed are 9 species of Amphibia, Reptilia 10 species, 71 species of Aves, Mammalia 14 species. Amfibie are represented with 2 types of Caudata (*Triturus vulgaris, Triturus dobrogicus*) and 7 species of Anura (*Rana dalmatina, R. ridibunda, R.esc.complex, Bufo bufo, Hyla arborea, Bombina bombina* and *Pelobates fuscus*). Of these 10 species of reptiles, one species of the

turtles (*Emys orbicularis*), 4 types of lizards (*Lacerta agilis, Lacerta viridis, Podarcis muralis* and *Anguis fragilis*) and 5 species of the snake (*Natrix natrix, Natrix natrix persa, Natrix tessellata, Elaphe longissima* and *Coronella austriaca*). From 71 species of birds, 16 species are directly related to aquatic habitats from which *Fulica atra, Anas platyrhynchos* and *Gallinula chloropus* nesting in emerged belt, while others use it as a marsh feeding area. There was some over-flight globally endangered species in the world of ducks *Aythya nyroca* while the nearest meeting place for ducks brunette Drina coast with its backwaters. The flight record more *Larus ridibundus, Vanellus vanellus, Sterna hirundo* and *Ciconia nigra, Ciconia ciconia* while nesting in the surrounding areas. Heron Gromiželj used only as a feeding area. I Laketic vortex has a strong Drina sources who caused a rich and diverse composition of the ichthyofauns and batrahofauns so this is an excellent feeding grounds for birds, especially ihtiofage heron, stork, kingfisher, etc.. The withdrawal of water from the fields around Laketic Vir muddy grounds remained where they were observed *Charadrius dubius* and *Limosa limosa*. It was found 7 types of predator birds (*Accipiter gentilis, Accipiter nisus, Circus aeruginosus, Falco tinunculus, Pandion heliacus, Buteo buteo* and *Haliaetus albicila*), among which is the most common *Buteo buteo* who certainly know that the nests on the ground Gromiželja. On a wider area Gromiželja recorded regular flight eagle *Haliaetus albicila* which nests along the river Drina. For the nearby area IBA "Bottom Podrinje in Serbia is estimated that there are two nest money, so they probably recorded in the area Gromiželja. (Puzović, et. Al., 2009) Significantly higher number of species of birds inhabit the surrounding forest and prohibitions surrounding Laketic vortex, which are certainly the highest percentage of singers. From the total of 71 registered species of birds, 6 species or 8.4% of the closed hunting season on the list of protected species, while 36 species or 51% are considered useful for agricultural and forestry under Article 24, paragraph 1 of the Hunting Rules of the time hunting wild animals protected by closed hunting season and a list of species of birds and mammals that are considered useful for agricultural and forestry. (Sl.novine Federation 4 / 06). On the migration of the flight are recorded *Merops apiastri* clusters. During the fall and later winter there are flocks *Sturnus vulgaris* and *Fringilla montifringilla* presence as well as individual specimens and *Pyrrhula pyrrhula Galerida cristata. Hirundo rustica*, *Delchion urbica* and *Streptopelia decaocta* safe nest in the nearby village of origin Velino. Presence of illegal dumps by fields gathers oportuniostics species such as *Pica pica, Corvus corone, Corvus fragilegus* and *Corvus cornix*. In an interview with the residents of the village Velinog we learned that the no housing buildings (sheds, barns, stables, room for hay etc.). *Tyto alba* individual happiness, while in winter the alleys in the streets and sometimes in the forest villages in the district bans *Asio otus*. Among the real silvicol species can be distinguished presence *Dendrocopus major, Upupa epops, Remiz pendulinus, Picus viridis,* and others. Community *Salicetum cinereae* bushy habitat is of particular species of birds like *Ixobrichus minutus, Nycticorax nycticorax, Rallus aquatilis* et al. Great proximity to the Special Nature Reserve Gromiželj, IBA area "Lower Podrinje (IBAcod: RS023IBA) as a place of international importance for birds of course increases the importance of the need to protect Gromiželja internationally. (Puzović,et.al., 2009). Out of 25 selected species of birds with the IBA criteria, 13 species were present in Gromiželju. In the area of Special Nature Reserve Gromiželj criterion for identifying species of birds that require coordinated action to preserve the level of Europe

(Species of European Conservation Concern-SPEC) diagnosed are 2 types of SPEC 1 (*Haliaetus albicila, Aythya nyroca*) and 5 species of SPEC 2nd Konstatovanih 14 species of mammals are related to the cosmopolitan species near the water (*Ondatra zibethica, Arvicola terestris*) or a shift of forest and agricultural land (*Talpa europea, Erinaceus europeus, Lepus europeus, Talpa europea, Meles meles, Apodemus agrarius, Apodemus flavicolis, Felis silvestris, Rattus norvegicus, Vulpes vulpes, Mustela nivalis i Mustela puturis*)

CONCLUSION

After leaving the field it can be concluded that this rare, preserved lowland moorland deserves the protection of its biodiversity, especially when it comes to the types of international importance, endemic and relic species. The total species diversity in wetlands Gromiželj looks as follows: Fungi 33 species, 3 species Linchensis, Briophytha 8 species, vascular flora, 240 species. Invertebrate fauna is represented with one representative Filum Porifera and Cnidaria, 26 species of Filum Mollusca, and Arthropoda is the largest Filum with 266 species of which 235 species or 88.3% makes a class of insects. Of the other vertebrata diagnosed as: Pisces 6 species, 9 species of Amphibia, Reptilia 10 species, 71 species of Aves, Mammalia 14 species. Diagnosed four endemic species, two species from the realm of plants (*Urtica kioviensis* and *Hottonia palustris*) and two species of the animal kingdom that is. belongs to a kind of Invertebrate (*Tandonia kusceris*) and other vertebrata (*Triturus dobrogicus*) and both species are endemic Balkan. A large number of plant and animal species is a threat to the status of the IUCN, where specifically allocated critically endangered species (*Aythya nyroca*), which together with *Haliaetus albicilla* belongs SPEC 1 category. Three representatives of the flora found in the Red List of flora of BiH.

Umbra krameri finding fish at the site of the only proven Gromiželj habitat of this species in the Republic of Serbian as well as in Bosnia and Herzegovina, greatly increases the importance of protecting these habitats.

On the basis of Article 37 Law on the Protection of Nature (Sl.gl.RS No. 113/08) and the Republican administration (Sl.gl.RS No. 118/08) the Ministry of Urban Planning, Construction and Environmental Protection has made a decision on the protection of the previous "Special Nature Reserve Gromiželj , the total area of 831 ha, of which 763.61 ha in the II degree of protection and space Laketic vortex is in the first level of protection. Adequate measures could save this small but significant surface tresavu at the edge of the Pannonian Basin as it undoubtedly deserves.

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ECO- TIMOK

UNSUCCESSFUL ATTEMPT OF REGULATION OF TIMOK IN ORDER TO PREVENT DESTRUCTION OF LAND FROM INDUSTRIAL WASTE FROM BOR COPPER MINE

A contribution to the history of ecology of Timocka krajina

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I

Industrial development in the area of Timocka krajna became the main preoccupation of the society. Old industrial plants were expanded and new were built particularly in Bor and Majdanpek, which were accompanied by multiple increases in production of copper and precious metals by the end of the first decade after the war, and thus also increased the amount of industrial waste materials that were dropped in rivers without purification. In seventies, Timok became a big collector of waste waters from Bor copper mine. There was a serious consequence because of the devastation of plant and animal life in them, when industrial flood from Bor mine occurred, after the spill of Borska River and Timok covered fertile fields in the area, there was an irreparable poisoning of land and serious damage in agriculture. Many years later there is the question: „Was this unavoidable?"

At a time when so-called "first phase of development of mining and industry in Bor" took place, such a question was not asked because the development of industry and mining was considered as a reflection of patriotism and moral power in society, especially of prominent politicians and those who directed the development and organized production. As Božin Jovanovic writes in one of his books, for development of mining and industry of decisive importance were the "strong will and patriotism." The issue of protecting people health and environment spawned only institutionalized service for people health protection, and when it comes to the environment and its pollution, what happened could barely perceive in the mist of industrial smoke from industrial facilities in Bor. When it comes to environmental pollution with solid, liquid and gaseous poisonous substances from the industrial complex in Bor, because of relationship to all this, and the ways in which protective measures have been undertaken there is the impression that people in the Timocka krajna are industrial uneducated.

The notion of "industrial uneducated" I met for the first time in mid-seventies of the twentieth century, at a meeting in Bor council, scheduled to representatives of Bor municipalities and mines on the occasion of measuring air pollution in this city. In the early seventies, the environmental awareness in Bor changes, and it was seen by all serious interest in the application of positive legal regulations in the field of environmental protection in this case concerning the protection of air pollution in the environment. At that time, Bor, pressed with smog from industrial facilities, with an average of 23 days per month above allowed limit which caused serious health troubles to residents and the environment of Bor, was depopulated to "the fourth kilometer" and further to Brestovacka Spa. For some of us present at that meeting it was strange why the city was not built at these areas, away from the smelter, earlier, at the begining of intensive industrial development of the Bor, the answer was that the most responsible for development wanted to be as close to work so "they could go to work in their slippers" and large residential buildings were built as closely as possible to the working places. So the large number of buildings was built near the smelter chimney whose residents had to close the windows at the time of highest air pollution. Almost below the smelter chimney was also built green market, children playgrounds, also schools and football fields of ambitious football club FK Bor. What was the treatment of gaseous toxic fumes from mining-industrial complex, such was the treatment to solid and liquid waste materials that for decades flow trough Borska River and Timok and poisoned fertile land at the time of spillage and in case of flooding. It must be taken into consideration when it comes to "industrial uneducated", that at the time, the highest educated in Bor were not in a position to manage the development of industry and the city, but this fact can serve as justification. A number of educated experts, were servants to politics and they listened and did everything that was requested. There were those who wanted to make a nice career or continue to work in Belgrade, provided they achieve the main goal - more excavated ore and valorization of copper and other precious metals from it by any cost. Other experts have behaved naively and without experience of the harmful consequences of such development of mining and industry in Bor in the environment, which was typical for other underdeveloped countries at the start of industrialization.

Bearing in mind all mentioned above, over several decades of post-war development of Bor mining and industrial complex in Bor river valley in district of village Vražogrnac and in the valley of the Timok, in the district of villages Trnavac, Brusnik, Braćevac, Crnomsnica, Zlokuće, Kovilovo, Rogljevo and Veljkov, there was a poisoning of several thousand acres of land on which they cultivated corn, wheat, alfalfa, barley and oats. During this time the Timok turned into a collector of waste water from the Bor mine in which pyrite and sulfuric acid destroyed flora and fauna. Land in the valley of the Timok, between the hills on the right bank of the railway embankment Nis - Prahovo port was buried layers of pyrite that in some places were deep and several meters.

After the construction of hydroelectric power „Sokolovica", in the spring, when water of Timok multiple grows, and hydropower „Sokolovica" open the dam and causes pyrite to go over the dam with water and flood fertile fields. So the reason for poisoning fertile soil with pyrite layers below the dam of hydroelectric power „Sokolovica" sought and found in it, as well as the remains of gaps in the mills along the Timok. But either

way, bearing in mind initiatives raised by the villagers, and municipalities of Zaječar and Negotin, looks that such poisonings and destruction of fertile lands would not happen, if environmental awareness and enlightenment of the people most responsible for the development of the Bor mining-industrial complex was strongly developed.

II

In the fifties of the twentieth century the anxiety of peasants from the valley of Borska River and Timok, has increased, due to the appearance of pollution and poisoning the fields with industrial waste waters from Bor mine. In year 1953, during the so-called "The first phase" waste water carried waste from the flotation of copper and pyrite, waste water from electrolyses of coppe,r wire factory and other plants that have made a great damage to crops in the fields in villages, Vražogrnac, Trnavac, Braćevca, Rajac, Rogljeva, Veljko, Kovilovo, Zlokuća, Crnomasnice and Mokranja that have been raised, at most, wheat, maize, oats and clover. Such pollution of mentioned rivers with waste waters did them unusable for watering livestock and thus damage was made not only to husbandry but also to animal husbandry.

Fish were destroyed too: catfish, carp, chub, barbell, roach, dace, pike, and thus prevented a significant number of fishermen engaged in these sports for rest, recreation and health. The aquifer is melted in Timok hemp, as rural households produced a small amount for their own needs. In it, the peasant washed wool blankets and wool. After harvest, the villagers performed the bathing season to the St.. Elijah is considered the first day of autumn for all, except for children and young people who regularly bathed in the river and learn to swim, so that the villages near the Timok rare that he does not know swimming.

Significant flooding with industrial waste waters was observed for the first time in 1948 and then again in 1951, 1955 and 1956, and then the next year. Research of Institute of Agriculture in Zajecar in sixties of the twentieth century proved that in the territory of the municipality of Negotin 3905 hectares were damaged with pyrite sludge of which 465 hectares has been permanently destroyed.

Anxiety at some point turned into open discontent of peasants who have begun to require their municipalities to solve this problem and put an end to further destruction of agricultural land. Some farmers went to leadership of the Bor mine, coming back without understanding, with the promises that were never performed, and sometimes with negative political label, because it all happened during the great expansion of mining and industry in Bor . In sight was the ecological disaster where the ecological crisis caused poisoning of land with pyrite and other industrial waste waters was just a prelude of what will happen only until the end of the twentieth century.

Farmers from these villages in municipality of Zajecar have initiated this issue in 1951, so the the land was reclassified in one part of the affected areas and also some funds were received from the Bor mine for compensation for rural households whose lands were destroyed and the regulation of Borska River. In year 1953 the management of Bor mine decided to pay compensation as 45 million dinars, 3 million dinars to the owners of damaged property, which was more than the annual compensation. In year 1954 the management of the Bor mine almost doubled investments in melioration fund,

and also increased payments to the owners of damaged property to the six million but that has not solved the existing problem that became bigger and more complex. That's what best speaks Engineer Zdravko Todorovic from Braćevac in his report to the Municipality of Negotin, stating what is Bor copper mine doing to prevent further destruction of land, when he says that "the measures taken by the RTB are insignificant and inefficient because Borska river still runs day and night fuzzy due to the strong concentration of pyritic sludge and other particles from the flotation in Bor. Comparing the allegations in the act of RTB Bor no. 951 of 24.I 1955th and the actual situation on the ground gets the impression that the management of RTB is taking some measures that might serve as a justification, and to calm those who have rebelled against such a powerful polluters. The management of Bor mine, instead of effectively solving the issue of leakage of harmful industrial waste into water streams, sought other culprits for the environmental crisis. Thus, the attempt of the National Board of the municipality of Negotin to resolve the issue of protection of agricultural land by buiding dam that would protect from flooding during high water level of Timok, they refused to fund her withdrawal, believing that it is all fault of "Timok" electric company because they let the water from the lake, above the dam of hydroelectric power „Sokolovica" allowing drift of pyrite on agricultural land downstream from it. That is why the president of the National Board of the municipality of Negotin Jovan Žikić took it upon himself to organize a meeting attended by representatives of RTB Bor, the National Committee of the district Zaječar and national committee Negotin, "Timok" electric companies and Negotin Water Board.

In year 1954 appeared the idea that "offender" for pollution of soil with pyrite mud in the valley of Timok is hydroelectric dam „Sokolovica". In regard of that, the expert committee was formed in order to establish the facts and when it comes to destroying fertile land the Department of Agriculture in Zajecar was involved to give their expert opinion and to propose measures to be taken for its recovery. In the period from year 1954 to year 1962 great efforts to resolve the issue of destruction of agricultural land with pyrite mud were done but they have remained without result. From year to year, from decade to decade, until the end of the twentieth century, after each spill of Timok, the situation has deteriorated to the point that the land is permanently destroyed for cultivation of wheat, corn, oats and alfalfa. Deposits of pyrite mud in some places reached few meters, and their toxic effect on plant life reflected so that the areas under pyrite mud turned to deserts: the vegetation dried up including trees. From some areas, when the wind blow north-west, toxic clouds of dust raised polluting other unpolluted soils and in Zalokuća gardens and residential buildings. In the rivers disappeared every form of life. It is interesting that quartz sand mines in Rgotinia and Donja Bela Reka were never blamed for the situation, although they also discharge large amounts of waste from flushing of sand into watercourses. It is also inherent to the emergence from "industrial uneducated" where one problem could not be noticed another because of the other one.

III

Ecological crisis in the area of Timocka Krajna took place in three phases. A phenomenon concerned in this article occurs in the first phase, the phase of euphoria and "industrial uneducation". This phase began after the war, in 1945 and lasted until 1972 when the world environmental conference was held in Stockholm. In this phase of intensive development mining-industrial complex in Bor, were used mainly so-called dirty technologies that destroy the environment. Then the first adverse effects appeared including poisoning and destruction of agricultural land with pyrite deposits and other industrial waste. While farmers reacted with complains, petitions and lawsuits pollutants acted euphorically because of great results in the development of industry and mining. This development is the main goal and interest and everything else is secondary. Over time, with the support of policy and the state, privileged social class of employees was formed in Bor, whose members have higher wages and stronger purchasing power, better standard of living and social status.

At this stage, almost as a rule, during the construction of new factories and industrial plants are not constructed devices for treatment of waste waters, but they are freely discharges into rivers causing large, often irreparable damage. Companies have for years paid penalties for environmental protection, and they didn't care about construction equipment for treatment of waste waters. When first residential buildings, children's playground, green market and other were constructed below smelter chimney in Bor, underestimation of hazards of industrial development to health and the environment similar phenomena occurred as a result of euphoria and "industrial uneducation".

Open rebellion of peasants from villages Rgotina, Vražogrnac and Trnavac, and further downstream in the valley of Timok caused the municipalities Zajecar and Negotin to seriously address this phenomenon. Developing regulatory plan of Borska River was taken under consideration. Farmers from Vražogrnac were trying to build their own insulation in order to prevent Borska River spills and pollution of fertile fields and gardens with mud pyrite mud. Much more serious effort was made in Negotin municipality, which if it was realized would prevent ecological disaster in the valley of Timok.

In 21.10.1961 in the Assembly of Negotin municipality important meeting dedicated to the poisoning and destruction of agricultural land with pyrite and other toxic industrial waste, took place and it was attended by representatives of the villages Braćevac and Rajac and Mining and Metallurgical Complex Bor. At that meeting it was concluded that 460 hectares of the best agricultural land was damaged, worth 40 million dinars, and in order to repair the existing situation that the following should be done:

- To accurately identify damaged area and indicate the percentage of damage,
- To obtain the opinion of the Water Board Negotin in which way can regulation of Timok protect the land and what are estimated costs for such work,
- To prepare a study on the possibility of redemption and replacement of damaged land, as well as elaborate on the value of damages that must be compensated each year.

- To obtain expert opinion from the Institute for Improvement of Agriculture in Zajecar on the possibility of regeneration of poisoned land, and what are the measures and resources required for such activities,
- To obtain opinion from the expert committee on the work of Hydropower, „Sokolovica", and its role in the poisoning of land and how big water flow must be when the water from the lake above the dam is being released so as not to damage agricultural areas with pyrite,
- And, NOO Negotin to use the experience of villages Tranavac and Gradskovo and raise the question for reclassification of land and exemption from taxes.

In connection with the agreement at this meeting in 1962, many actions were taken that could prevent an environmental disaster in the valley of Timok. National Board of Negotin Municipality, on November 15th 1961, addressed to the Department of Agriculture in Zaječer, and then the expert committees were formed and they began its work on March 16th 1962. National Board of Negotin Municipality, addressed the legal department of Mining and Metallurgical Basin Bor and reported that the Water Board and the hydraulics section of Negotin estimated the costs concerning the building construction system for the prevention of flooding and damaging the soil with waters polluted with pyrite particles that are destroying crops in fields near Timok, in villages: Rajac, Rogljevo, Tamnič, and others. Estimate cost was also made for the work of the Institute of Agriculture in Zajecar and all that was sent to Workers Council of RTB Bor, to approve funds for the purchase of destroyed land and construction of building systems.

IV

The role of the Institute of Agriculture has been important in providing expert opinions on possibilities to engage both the review of agricultural fields and assess their poisoning, to assess to what extent the damage inflicted on the dominant crops (wheat, corn, alfalfa), to determine whether some measures (agro, fertilizer, mechanical) can establish earlier productivity, the extent to which productivity can be improved, and as it says in one document, all measures that can be taken to be taken after the construction of appropriate construction system to prevent further flooding of this area.

Najdan Miladinovic informed the National Board of Negotin Municipality that he is ready to be professionally engaged for the sum of 3.375 million dinars until December 1th 1962. The document in question has no detailed proposals of measures, but the idea occurred that the land can be cured by rinsing, collecting and removing pyrite sediments from poisoning areas, by extracting iron and precious metals from the sediment. Department seeded some cultures along the road Rajac - Zlokuće, on the contaminated soil and watched its progress. There was also an opinion that it takes 80 years for weed to grow on poisoned fields so they can regenerate themselves..

At the proposal of Mining and Metallurgical Complex Bor and company "Elektrotimok" from Zajecar People's Committee of Negotin Municipality formed on December 8th 1961 a commission composed of: Councillor Krčić Vlajko from Negotin, engineers Aleksandar and Petrovic Karaferović Desimir from Negotin, Zarko Avramovic

representative of RTB Bor and Flipović Ljuba, representative of "Elektrotimok" Zajecar, which was assigned to investigate on-site at hydroelectric power plant „Sokolovica" how big should be a water drain on the dam during its discharging from accumulation lake in order to prevent damage to the soil in the basin of Timok.

On December 15th 1962 the commission met on site at hydro plant "Sokolovica" but as there was contradictory opinions Commission decided that all members give their opinion about the harmful effects of hydroelectric power plant in the poisoning of land in the valley of Timok. After a detailed analysis hydroelectric committee has determined that there is no justification for finding justification and culprit for this situation on the other side. The only cause of pollution of agricultural land in downstream of river Timok is RTB Bor. The report was signed by three members of the Commission: Krčić Vlajko, and engineers Pertović Aleksandar and Karaferović Desimir. Engineer Ljubomir Filipovic wrote more about this problem in his repor. In his opinion the dam of hydroelectric power plant "Sokolovica" had no influence on fertility of flooded land, on the contrary it has a positive effect because it slows catastrophic waters. The dam had positive influence even in the period of her construction through to its completion, because the toxic particles were deposited in that area. If the opinion of this commission is not unanimous ... I propose that the task of this commission should be entrusted to Hydro Technical Institute "Jaroslav Černi" - Belgrade.

On January 12th 1962 in the small hall of Negotin National Board held a very important meeting in terms of solving the problem of damaging fields with pyrite sediment in the area of villages Braćevac, Tamnič, Rajac, Rogljevo and other villages in the Timok basin. At the meeting were invited: representatives of RTB Bor, "Elektrotimoka" and Agricultural Chamber of Zajecar, representatives of local People's Committee of endangered villages and hydraulics department of Negotin. At the meeting, reports of Commissions responsible for solving this problem were submitted, some of which are shown in the previous sections of the article. It seems to me that is related to the purpose of this study, that the most important was the opinion of representatives of the hydropower section of Negotin, Zdravko Todorovic, where in addition to the analysis of condition is also given a proposal of measures for the rehabilitation of poisoned land in the valley of Timok.

In this part of the report were proposed measures to be taken by Mining and Smelting Complex Bor, and also they were committed to promise that they will prevent removal of all kinds of toxic substances either by water or wind, to the measure that water in Borska river has all the features needed for irrigation and propagation of plant and animal life.

Engineer Zdravko Todorovic advocated for full control of Timok from Brusnik to Rogljevo, in length of 12 kilometers dissociating himself with the proposal to investigate its viability. Such regulation of Timok according to his calculations would cost 1.3622 billion dinars. It was in fact the main proposition of Hydropower Department in Negotin. In a document dated March 5th 1962, it is clear that the cost of damage caused by pyrite, in just six years were slightly smaller and amounted was 1,236,495,000 dinars, but if a complete control of Timok is not done they would be increasing in the following years continuously and they would overcome the cost of such solutions for protection of agricultural land from poisoning with pyrite and other industrial wastes.

The report mentioned in the section "Restoration of poisoned land in Timok Valley," there is a proposal made by Negotin Water Board for partial resolution of defenending the fields near Timok, from the railway station Rogljevo to railway station Tamnič with calculations of all costs. Total cost of designing, previous works, materials and securing fields was 198.2 million dinars.

Of all the possibilities for protecting the fields from pyrite sediments and other industrial wastes, the best were those related to the control of Timok. Unfortunately they have not been realized. In the early seventies of the twentieth century, yet it was time to do something, because there was still living beings in Timok, peasants were tilling the fields, but soon because more industrial waters were discharged from Bor mine into rivers, so much pyrite was deposited by flooding waters that the fertile fields were damaged irreparably. The significance of all that happened was that the conflicts between polluters and the public were deepened and the issue of environmental protection was pointed to the fore, which will further come into play in the seventh decade of the twentieth century, after global environmental conference held in Stockholm in 1972.

CONCLUSION

At the time this paper was written the damages to agricultural land in the villages Vražogrnac and Trnavac still exist in the form of pyrite desert and in the valley of Timok that is overgrown with weeds. The layers of pyrite jackals use to dig pits in which they multiply and hide from people, harassing them with unpleasant howling every night. Many generations that have cultivated the land and that were bothered because Bor mine is spoiling their land have disappeared. Bor mine is also not what it once was, but fuzzy Borska River is still flowing into Timok. In this situation, this work has only historical significance and the opportunity to highlight the emergence of "industrial uneducation" in the age of industrialization of Tomočka Krajina and to preserve the memory of individuals, such as the engineer Zdravko Todorovic, and the president of the National Board of the Municipality of Negotin Jovan Žikić that were sincere and committed in trying to prevent an ecological disaster in question.

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DYNAMIC OF THE MOST COMMON SPECIES OF ENDOHELMINTES IN OHRID TROUT - SALMO LETNICA (KARAMAN) FROM OHRID LAKE DURING 1991/92

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ABSTRACT

Two species of endohelmintes are common and permanent parasites in ohrid trout from the Ohrid Lake. These are: *Eubothrium crassum* Bloch, 1779 and *Cyatocephalus truncatus* (Pallas, 1781). Therefore, in this paper is made and processed, in particular, their dynamic, in terms of relations between conditional factor of the host and these two parasites - cestodes and relation between conditional factor of the host and cestode frequency during the research period of 1991/92. The objective of this research is to gain knowledge about the dynamic of these two cestodes and their relation to host conditional factor.

Keywords: parasites, endohelmintes, ohrid trout, Ohrid Lake

INTRODUCTION

Many authors were studying the endohelmintes in ohrid trout *Salmo letnica* (Karaman), from Ohrid Lake (Šinžar, 1956, 1958; Hristovski, 1983, 1983a, 1984, 1984a, 1984b, 1985, 1986) and they established the following types of endohelmintes: *Nicolla testiobliqua* (Wish., 1933); *Sphaerostomum globiporum* (Rud., 1982); *Eubothrium crassum* Bloch, 1779; *Cyatocephalus truncatus* (Pallas, 1781); *Diphyllobothrium latum* L., 1758; *Rhabdochona denudata* (Duj., 1845); *Metechinorhynchus salmonis* (Müller, 1780); *Metechinorhynchus truttae* (Schrank, 1788); *Acanthocephalus anguillae* (Müller, 1780) and *Pomphorhyncus bosniacus* Kiškarolj et Čanković 1967.

Only two of these species of endohelmintes are common and permanent parasites in ohrid trout from the Ohrid Lake. These are: *Eubothrium crassum* Bloch, 1779 and *Cyatocephalus truncatus* (Pallas, 1781). Therefore, in this paper is made and processed, in particular, their dynamic, in terms of relations between conditional factor of the host and these two parasites - cestodes and relation between conditional factor of the host and cestode frequency during the research period of 1991/92. The other endohelmintes species are rare and are not specific to this host and are represented in small numbers, particularly the plerocerkoid from cestode *Diphyllobothrium latum* L., 1758. This cestode is not found in these studies, while, in previous studies, is found in

three samples of trout, which means that this parasite in Ohrid Lake is very rare and its found may apply one of the following assumptions:

- It may be a glacial relict and it is in dying in this lake, or
- May be a alohtone kind in the lake, transferred from the tourists which are infected with adults cestode.

Moreover, then, regarding the fact that faecal waste waters were flowing in the lake, these cestode eggs came in the Lake`s water. From these, then, miracidies were developed, which approached in the body of the Copepoda representatives (*Cyclops ochridanus* etc.) through food chain, where it developed in procerkoides. This infested plankton crayfish served as food for the ohrid trout, where they developed in plerocerkoides, which we found (Hristovski 1983, 1986, 1987; Spirkovska 1991, 1992).

Man, dogs and their relatives, cats, otters etc. occur as definitive host for this parasite. Therefore, in this lake there are conditions for completing the life cycle of this cestode. That, in turn, presents an opportunity for its further survival in this lake and its surroundings. The species *Diphyllobothrium latum* L., 1758, parasite in salmonid fishes and pikes in boreal areas of Europe, Asia and North America. In Central Europe it is located in Lake Geneva, and in Eastern Europe, in the Danube Delta. According to the literature data this is the southeast occurrence of this parasite in the northern hemisphere (Hristovski, 1986). The objective of this research is to gain knowledge about the dynamic of these two cestodes and their relation to host conditional factor.

MATERIALS AND METHODS

Ohrid trout samples, hunted in Lake Ohrid, were used in this investigation. Trout hunted in sexual stage (in winter) carried out by standing fishnet, and in July with fibers - when is hunting the summer form of trout, in which period, it is naturally reproducing, while in the vegetative stage that is performed with blinker by dragging. Samples were taken from the following fishing sites of Lake Ohrid: Trpejca, Peštani and Ohrid. Studies were carried out during 1991/92, and in collected samples were dominated those from fishing site Ohrid - Gorica – Metropol hotel, through experimental fishing - performed by a team of Hydrobiological Institute - Ohrid, while in the other two sites, samples were taken during the hunting in sexual stage of the trout, which is performed by professional fishermen from AD „Ohrid trout - Ohrid. Typically, for such systematic studies ten samples of trout and this equally of both sexes have been used, and certain deviations from this were directly dependent on the catch and mainly in vegetative stage.

Fishes that were used for this study were carefully opened with standard routine method for helminthological investigations (Dogel, 1936). Moreover, all internal organs were carefully examined separately, and helmintes were ejected with needle or pipette under binokular. Separated parasites were firstly tested in a live condition, then, after a natural death, in physiological solution at room temperature. The death parasites were fixed in 2% formalin or 70% ethyl alcohol. Determination of helmintes was made under binokular as native preparations or fixed preparations dyed with acid carmine. Photographing was carried out in the Hydrobiological Institute by Reichert microscope or by binokular. Some of the preparations were photographed at Biotehnnological

Faculty in Ljubljana, R. Slovenia. Some of the fixed material is situated in the Hydrobiological Institute, and the other part in the Natural History Museum of Macedonia - Skopje.

RESULTS AND DISCUSSION

According to all previous studies of endohelmintfauna of ohrid trout - *Salmo letnica* (Karaman), (Šinžar, 1956, 1958; Hristovski, 1983, 1983a, 1984, 1985, 1986), nine species of endohelmintes are established: *Nicolla testiobliqua* (Wish.,1933), *Sphaerostomum globiporum* (Rud., 1982), *Eubothrium crassum* Bloch, 1779, *Cyatocephalus truncatus* (Pallas, 1781), *Diphyllobothrium latum* L., 1758, *Rhabdochona denudata* (Duj., 1845), *Metechinorhynchus salmonis* (Müller, 1780), *Metechinorhynchus truttae* (Schrank, 1788), *Acanthocephalus anguillae* (Müller, 1780) and *Pomphorhyncus bosniacus* Kiškarolj et Čanković 1967. From these, two cestode species *Eubothrium crassum* Bloch, 1779 and *Cyatocephalus truncatus* (Pallas, 1781) are almost permanently represented in greater percentage than others, that are rare, and most of them are optional for host species.

The cestode *Eubothrium crassum* Bloch, 1779, is established in the Europe countries, North America and Asia. According to Kažić (1970, 1979), it occurs rarely on the Balkan Peninsula, but it is present in all Balkan countries. Main hosts are fishes: salmons and trouts. These are long cestodes with almost yellow color. The main part is elongated, with simple and small botrides. The neck was poorly expressed, the strobil is long up to 1000 mm and there are cases when its length reaches up to 1200 mm. Breadth of cestode is different and is closely related to the length. Over - hosts of this parasite are plankton's crayfish from the genus Cyclops. Because of the fact that in Ohrid Lake, representatives of the genus Cyclops are present in more species, the cycle of this cestode can be closed. This parasite is parasited in see and freshwater fishes and can be considered as a glacial relict in Lake Ohrid.

Second widespread cestode is *Cyatocephalus truncatus* (Pallas, 1781), which parasites in salmonid fishes in boreal parts of the northern hemisphere. It is present in Central Europe and in the three plum in the Balkans Peninsula. Parasites in the intestinal tract of these fishes. It is a small cestode, with length of 10 mm and width of 2 mm. Poles are alternately opened and almost always incorrectly located on both sides of the body of parasites. Testikuls are large and are located on the sides of ovarium. Ovarium consists of two interconnected parts of a bridge. The eggs are yellowish brown, found in the uterus which is located between the two ovariums, ovarium bridge and cirus bag.

According to Wisnievski (1933) transitional hosts for this parasite species are crayfish of genus Gammarus, Rivologammarus, Pontogammarus and others. They develop procerkoid that entered in the body of the trout together with the host, as food, and it is transform in adults of this parasite. Other species of endohelmints are found in smaller percentages, so they do not have a significant population of fish parasitism, especially as most of them parasite optional in ohrid trout, while they are regular parasites in ciprinid fish in Lake Ohrid. According Spirkovski (1992) and the results obtained of Fulton`s number (fatness coefficient) of the tested samples of trout and the presence of parasites that are dominant (*Eubothrium crassum* Bloch, 1779 and

Cyatocephalus truncatus (Pallas, 1781)), there are not major differences. In parts in which there are differences between Fulton`s number and infestation degree with cestodes, they are gravid female individuals of the host (trout), which provide greater than usual Fulton`s number for these length - weight classes. It also means that the infestation of endohelmints which parasite in ohrid trout from the Ohrid Lake, have not a significant impact on host condition.

Also, it must have in mind the life cycle of over - hosts, as well as, host nutrition with them. Thus, according Hadzishche (1967) plankton crayfish from the genus Cyclops and its relatives, who over – hosts of cestode *Eubothrium crassum* Bloch, 1779, have two maximums in year (Bauer, 1959). This is a period in which young cestodes appear in ohrid trout, which increase the total number of parasites per host. Regarding the gender structure of the host and the degree of parasitism, we can conclude that the male individuals are more parasited, because in female individuals, estrogen hormones are predominant, and act on reducing parasitism degree (Hristovski, 1983, 1984).

As the temperature of the environment has adequate influence on the number and development of over - host, so it affects on the development of the procerkoid in over - host (Protasova, 1977). Normally, in the aquatic environment, temperature amplitudes are smaller than the air, but in over – host, at the stage of kopepodit, there is a mutual dependency between environment and over – host development (Ratajac, 1978, 1981).

The dynamic of *Cyatocephalus truncatus* (Pallas, 1781) depends from the time of the ohrid trout nutrition with Amphipoda, whose representatives are transitional hosts for this parasite. For other akantocefals who rarely meet, transitional hosts are amfipods and izopods, while for trematods transitional host are molluscs (Bauer et al. 1987, Быховская - Павловская et al. 1962), which are rarely included in the diet of the ohrid trout (Stefanović,1948).

Regarding a patogenic action of the two most common species of parasites in the ohrid trout, *Eubothrium crassum* Bloch, 1779 and *Cyatocephalus truncatus* (Pallas, 1781), we can conclude that they cause certain anatomical - pathological changes in the host. They are manifested by mechanical damage of host tissue, opturation in the site of attachment to the host tissue (Bauer, 1958), various types of poisoning and blood changes (Догеы et al. 1962), inflammation of various tissues and degenerative changes (Freeman, 1964) and immunity changes (Reichenbach, 1965).

Also, they affect on the young fishes, which is especially pronounced in cestode *Cyatocephalus truncatus* (Pallas, 1781) (Wisniewski, 1932). According Senkl (1956) this cestode affect on the development of the trout sexual system, particularly on the ovaries, which was actually recorded in our cases with greater invasion by this parasite. During investigation we noted damages to the intestine, especially with greater invasion of these parasites, which is found in other species of trout (Sekutović, 1934). Especially marked damage was determined by the invasion with cestode *Eubothrium crassum* Bloch, 1779.

CONCLUSION

1. Two species of endohelmintes (*Eubothrium crassum* Bloch, 1779 and *Cyatocephalus truncatus* (Pallas, 1781)) are common and permanent parasites in ohrid trout from the Ohrid Lake.
2. The cestode *Eubothrium crassum* Bloch, 1779, which is established in the Europe countries, North America and Asia, occurs rarely on the Balkan Peninsula, but it is present in all Balkan countries.
3. Main hosts for *Eubothrium crassum* Bloch, 1779 are fishes: salmons and trouts.
4. Second widespread cestode is *Cyatocephalus truncatus* (Pallas, 1781).
5. *Cyatocephalus truncatus* (Pallas, 1781) parasites in salmonid fishes in boreal parts of the northern hemisphere. It is present in Central Europe and in the three plum in the Balkans Peninsula. Parasites in the intestinal tract of these fishes.

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POSSIBILITY OF REUSING DISCARDED FOUNDRY SAND

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ABSTRACT

Large quantities of discarded sand are generated in the foundry production. One possibility of reusing discarded sand is to make artificial soil.

In company Termit, which is the main supplier of foundry sands for all slovenian foundry industry and foreign countrys. We are aware that one of the main concern for foundry industry is environment and reducing cost for deposition discarded sand.

In cooperation with university we find one of possibility to use discarded foundry sand in making artificial soil. The work carried out so far also indicates that discarded foundry sand can be successfully used in agriculture as well as in civil engineering applications. In our company we use discarded foundry sand in combination with others materials to remidiate our open mining pits.

Keywords: discarded foundry sand, artificial soil, remediation

INTRODUCTION

The discarded foundry sand is the »waste material« of the foundry industry, that appears in the great amonuts. It is typical, that in the casting process we get from 230 to more than 2000 kg of the sand/tone of the castings. One of the main concern of the foundry induistry is to protect the environment and to lower the costs of the deposition. These costs will be in a future more and more bigger.

The reuse of the sands for casting is the highest challenge and possibility for the development of foundry science. One of the possibility is the use of that sand in the building industry and industry of the materials for buildings, where we can see various recycling opportunities. The »waste« materials, generating in building industry, can replace materials from nature sources as a component.

COMPANY TERMIT

Termit is the main producer for the production of the foundry sands and auxiliary materials. Termit has two plants: Peskokopi in Moravče and Ilpos Ihan.

The production capacity of the sand in Moravče is about 350.000 tons/year. Silica sands are: washed, classed, dried, precoated and oil sands. The use is in the foundry industry, iron and steel industry, building industry and sport activities. The quantity of the SiO2 is more than 98%.

Figure 1. Plant Moravče, sand production

It is normally that such a production causes a »changes« in the nature (350.000 tons/year) and because ot that we have to recover the »holes« with the sanitation. The solving of these problems was the project with the cooperation of the university in Ljubljana. We allready reported the results of the project – the recultivation was very successfull.

DIFFERENT FOUNDRY MIXTURES

Foundry sand mixtures – the most of them are the mixture of the silica sand grains and clay. When we add water we get the wanted properties: hardness, permeability .. Foundry sands can allready have clay, the most use of sands is the washed sand, than we add the binding agents directly in the foundry. Beside bentonite we can use also the other binders – organic and inorganic.

THE COMPOSITION OF THE FOUNDRY SANDS

The »waste« sands have the composition from refractory material, mostly silica grains. We can say, the »waste« sand is the sand, which can not be used for the »new« mixtures because of the properties the sand has. On the surface of the sand we get the sintered particles of the auxiliary materials. So we get on the surface of sands the layers

we name the oolits. Oolits are composed of the rests we get from the decomposition of the lubricants and dead burned bentonite, that has no binding function.

THE POSSIBILITIES OF THE USE OF »WASTE« FOUNDRY SANDS

The word regeneration has not the meaning for the foundry sands reuse but also the all other mineral components, used in various foundry processes. In everyday praxis is known thermal and mechanical regeneration, but the costs ot these processes are very high. Companies go into such technologies because of the high costs for the deposit of the materials.

THE ARTIFICIAL SOIL

In our investigations we found out, that the most simple way and also the nature way is to try to get the used foundry sand back in our plant and to »inbuild« such sand into pits. Normaly the sand is after casting driven on deposit places. Our work is to get back the high quantity of foundry sand into our plant, where we are going to renovate it to make a good sanitation.

For an successful sanitation it is not enough to have only sand, we need also organic components and also additives. We can also add all material from sand washing and also over grains and undersize grains.

The goal for the project was:

- The use of the primary materials, we get at the process of the separation
- To refine the primary clays
- To enable of such artificial soil for sanation of all degraded places.

This was a complete new procedure and we allready showed some results of the investigations (figure 2)

Figure 2. The artificial soil

With such a processing ot the waste material we enabled to lower the depositions of the materials. It is the positive result for mostly »degraded« places in Slovenia, we lower the number of illegal depositions and it is an inovative accession for the sanation and recultivation.

Figure 3. the recultivated place

CONCLUSIONS

Our method is the original accession for the recultivation of the various degradated surfaces. To use the sand, we mean the used sand, special from foundries, will be the good future environmental protection. Of course, we will have to improve our method with the use of various kinds of »waste« sands. We see the possibilities for building industry and for other kinds of industries.

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TESTING OF GLYCOSIDE HEMOGLOBIN AND INFLUENCE OF GLYCEMIA ON POPULATION`S HEALTH STATUS

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ABSTRACT

Today's modern and dynamic way of living increasingly requires and enables a rapid increase of degenerative diseases such as diabetes and cardiovascular diseases and especially in young individuals. According to the analysis of the transcriptions in which are noted patients suffering from Diabetes mellitus, in the territory of the municipality of Prilep, in 2003, 950 were suffering from diabetes, in 2004 there were 1090 new patients, in 2005, 1200 were infected and in 2006 there were 1380 new patients from diabetes. Food is the only way through which people can reach nutrients they need to maintain vital functions and construction of tissues and organs, for which an inseparable and integral part of life. The report explains that it is a key factor for the metabolic effects of CSG and can become a powerful tool in helping patients to make appropriate choice of CSG food.

Keywords: Diabetes mellitus, glucose, glycemia

INTRODUCTION

Today's modern and dynamic way of living increasingly requires and enables a rapid increase of degenerative diseases such as diabetes and cardiovascular diseases and especially in young individuals. Fast food and such a lifestyle are big risk factor for disturbances to the normal function of human organism. It is believed that such a lifestyle play a decisive role in matching chronic diseases. Dieted habits can be modified in a positive direction with the prevention and treatment of chronic diseases.

In recent twenty years it has been suggested careful selecting of carbohydrate food (CHO) with low glycemic index (GI), which potentially can lead to significant improvement of conditions related to poor glycemical control. Numerous tests were conducted, that are committed to glycemic food index. It has been proven that food with low glycemic index can improve the diversity of psychophysical functions in the body and positively affecton humans diseases.
GI is a value that describes the increase of glucose in the blood followed by introduction of CSG food, compared with 2 hours hyperglycemia caused by the equivalent standard CSGfood.

The great importance is the display of selected CSG food, which affect on human psychology and metabolism, i.e. affect on the psychological and mental performances and contributes to the prevention of certain chronic diseases.

Changes in environmental conditions are responsible for the increase of risk factors for occurrence of heart disease and diabetes mellitus, which can be caused by several factors including improper nutrition. Pathological changes occurring in heart muscle and blood vessels. These diseases occur in all ages, but mostly among older people who suffer from fatness.

Prevention and treatment recommend low calories diets with high CSG, which would protect the receiving weight in people with normal weight. It has been proven that food with a high % of fat may decrease HDL cholesterol and increase the triglycerides in the blood and therefore have a negative effect on cardiovascular risk.

Besides the basic methodology for GI, there are other criteria that should be included, as a measurement of glucose and insulin. Insulin index (II) shows a high degree of correlation with them, when two types of food with same portion CHO are tested. Factors that modulated GI -glycemic index are: individual factors (sensitive of insulin, beta cell function, physical activity, etc.) and nutritional factors (amount of CHO, biological source and starch digestivity, the nature of sugars, presence of fats and proteins, fibber, etc.) Glycemic index, quantity of carbohydrate food, insulin index, glycemic accumulation, the amount of glucose in the blood and HbA1c are important parameters that should be given serious attention because they are an important factor for healthy psychophysical condition of the people.

RESULTS AND DISCUSSION

According to the analysis of the transcriptions in which are noted patients suffering from Diabetes mellitus, in the territory of the municipality of Prilep in 2003, 950 were suffering from diabetes, in 2004 there were 1090 new patients, in 2005, 1200 were infected and in 2006 there were 1380 new patients from diabetes. Their number is growing rapidly so from the records of specialists from the city hospital, the number of new suffering from diabetes increases of 15-20 new patients each month. Diabetics registered are at an average age of 40 to 65 years. Diabetes as a endocrinology disease not even bypassed our area.

All the previously mentioned conditions: genetic predisposition, the wrong way of nutrition, pathological disorders of the pancreas as a gland with endo and egzo secretions, are responsible for the occurrence of this disease. The tests are taken in Prilep hospital, on patients diabetics, who are examining for the level of glucose in the blood, four times a day, before breakfast, then before lunch, two hours after lunch and before the evening dose. Analysis are taken capillary blood, which is then examined in the biochemical laboratory. Ekstences are read on the apparatus designed for that purposes. For this purpose can be used colorimeter and spectrophotometer, and there are other devices for measuring glucose in the blood. It is also used polarimeter that is intended for measuring the level of glucose in capillary blood.

One of the methods that being used to carry out this analysis is Kit method. It is

calorimetrical enzyme method with glucose oxidise, and it is performed by the following principles:

$$\text{Glucose} + H_2O + O_2 \rightarrow \text{gluconic acid} + H_2O$$
$$2H_2O + \text{phenol} + 4 - \text{aminoantipirine} \rightarrow 4 - (p - \text{benzochinonomonoimino}) - \text{phenazone} + 4H_2O$$

- GOD - glucose oxidise
- POD – peroxidise

The following tables show results from multiple daily examination of blood glucose in diabetics patients.

The intensity of the color showed the amount of glucose in the blood.
Reagents:
1.Glukose
2.Standard (standard solution of glucose: 5,5 mmol/l)

Table 1. Results from the analysis of glucose level in the blood in female patiens, first day of hospitalisation, when it is not khown the consumed food

Women	Before breakfast	Before lunch	2 ours after lunch	Before evening dose
1	9.1	12.0	16.7	5.39
2	10.6	12.0	17.3	13.6
3	12.29	13.0	17.3	12.5
4	12.74	13.0	15.4	11.8
5	15.9	15.0	19.3	11.1
6	16.8	17.0	21.0	14.3
7	11.2	16.0	26.5	15.4
8	16.2	18.0	19.9	15.8
9	15.65	14.0	16.1	15.0
10	12.3	16.0	17.7	14.4
Σ 10	**13.2**	**14.6**	**18.7**	**12.9**

Table 2. Results from the same female patiens one day after introducing properly diet nutrition

Women	Before breakfast	Before lunch	2 ours after lunch	Before evening dose
1	5.8	3.7	6.5	4.4
2	8.5	11.2	15.1	7.7
3	8.0	6.4	9.7	8.3
4	11.3	11.2	18.7	16.0
5	8.61	10.0	14.7	9.0
6	11.4	9.7	13.4	15.4
7	7.9	6.5	7.5	3.4
8	11.4	8.9	9.9	4.1
9	7.6	9.0	8.5	11.1
10	10.4	9.1	16.1	14.3
Σ 10	**9.1**	**8.5**	**12.0**	**9.7**

Table 3. Results of the third day of hospitalisation with same diet resume

Women	Before breakfast	Before lunch	2 ours after lunch	Before evening dose
1	8.36	10.5	13.9	6.7
2	14.5	8.5	11.9	12.0
3	6.1	6.5	8.9	6.8
4	8.9	11.5	11.4	11.0
5	5.1	6.6	10.7	8.2
6	8.5	9.5	12.0	8.0
7	5.6	7.7	8.6	4.3
8	9.1	6.8	8.0	5.4
9	6.5	7.0	8.0	6.9
10	5.4	7.4	8.3	7.3
Σ 10	**7.8**	**8.2**	**10.1**	**7.6**

Table 4. Results of the fifth day of hospitalisation with same diet resume

Women	Before breakfast	Before lunch	2 ours after lunch	Before evening dose
1	7.3	3.5	11.8	4
2	6.95	4.9	10.1	5.5
3	8.5	13.3	13.4	7.7
4	9.2	8.8	14.7	8.9
5	6.2	8.1	9.8	4.1
6	10.9	9.5	11.3	5.6
7	5.1	6.2	8.6	6.4
8	9.3	7.4	9.5	6.0
9	6.7	5.4	7.8	6.3
10	5.9	6.4	9.0	7.0
Σ 10	**7.5**	**7.35**	**10.6**	**6.15**

Based on the same surveys conducted among male patients suffering from diabetes, we received the following average values for the level of glucose in the blood:

Table 5. Average values of glycemia in men, measured by hours

Men	Before breakfast	Before lunch	2 ours after lunch	Before evening dose
0 day	13,6	15,1	16,3	11,9
1 day	9,24	8,78	11,5	8,8
2 day	7,68	8,39	10,9	8,3
3 day	7,5	8,7	10	7,4

The following table presents the values of haemoglobin HbA1c and glucose in the blood from 10 male patients and 10 female patients who are on average age of 40 - 60 years. Analyses were performed in the biochemical laboratory of „Poliklinika Althea - Prilep.

Table 6. Values of HbA1c and glucose in the blood in women

	HbA1c	Glucose in blood
1	8,86	6,3
2	7,87	11,37
3	8,31	9,41
4	6,67	9,92
5	8,9	9,53
6	7,38	11,43
7	6,1	7,58
8	5,98	7,73
9	5,96	7,64
10	5,78	7,29

Table 7. Values of HbA1c and glucose in the blood in women

	HbA1c	Glucose in blood
1	8,32	12,3
2	8,52	10,16
3	5,65	7,78
4	5,65	6,97
5	9,36	15,08
6	7,45	9,25
7	8,13	13,44
8	9,6	8,12
9	5,95	6,91
10	10,1	16,5

Some of the sick persons were asking the question of what comprises their therapy, they responded that except medical therapy, major impact on the regulation of glikemia in blood had recommendations from specialists in terms of nutrition, in which is conducted appropriate diet that primarily consists of the restriction of carbohydrate intake. The introduction of this kind of diet has shown positive results on the course of the disease. Beside daily therapy that patients receive, a great influence on the regulation of blood glucose among them has a food. Here's an example of how food has led to regulation of glycemia in patient with Diabetes mellitus type 2. The patient is 64 years old and suffering from this disease for 18 years. Due to the inability to regulate glycemia with tablet therapy, which was treated for many years, she has been suggested to take the regulation with insulin by parenteral application. The patient's own risk denied such treatment, but she taken nutritional diet, which, for surprise, made glycemia of 6-6,5 mmol /l, which still maintains in the same way, using tablet therapy and nutrition.

This example shows effect of the food on the human organism and its relation to the prevention of diseases and their treatment. Diabetic specialists recommended the following regime for the diet of patients with diabetes: carbohydrate should be reduced and to be 40-50% of daily energy needs, but not under 120 gram a day, which prevents the use of spare fats and proteins in energy goals. Part of carbohydrate should come from fruits and vegetables that has great biological value for the diabetic patients. Protein should be imported in quantities of 1.5 g/kg/ tt, while in the younger's 2g/kg/tt and 70% of them should be from animal origin, i.e. milk and dairy products, lean meat, fish and eggs (no more than one per day). Fat should contribute with 35-40% of total daily energy

needs and should be from plant or mixed origin. Vitamins should be optimally represented, and for minerals have no restrictions.

CONCLUSION

From the previous results shown in tables and schedules can be concluded that diabetes as a endokrinological disease not bypassed and municipality of Prilep. Surveys made in Prilep hospital show rapid growth of the disease on average of new 15-20 patients each month. The record shows that they were in average aged of 40-60 years.

The table shows the results of the level of glucose in the blood in women and men hospitalized in the Prilep hospital at high glycemia when it is not known what kind of meals they consumed. On the first day of hospitalization the level of glucose in blood was approximately 14 mmol/l. The measurements were made four times a day: before breakfast, before lunch, two hours after lunch and before dinner.

It is noted reduced level of glucose in the blood after the first day, when it is introduced a diet food. The same situation is noted after the third and fifth day of hospitalization. It is concludes that except the medical therapy, major impact on the regulation of glikemia in blood has the nutrition which consist of adequate diet primarily, with restriction of carbohydrates.

It is shown tables with values of glicolised haemoglobin HbA1c and glucose in the blood of 10 male patients and 10 female patients of average age of 40-60 years. These tests were performed in biochemical laboratory of the "Polyclinic Althea" Prilep. HbA1c gives us information about the treatment of patients with diabetes, the effects of oral diet, the duration of the hyperglycemia for new patients etc. We have noticed the increased value at no adequately treated diabetes and in patients with newly detected value of HbA1c ranges from 8-12%.

There is a weekly schedule of meals that patients with diabetes have to receive more times during the day. Diet must contain carbohydrate derived from fruit and vegetables, proteins of animal origin (milk and dairy products, lean meats, fish end eggs) and fats which be included should be from vegetable or mixed origin, optimalrepresented vitamin and mineral intake not to be limited.

So, food is the only way through which people can reach nutrients they need to maintain vital functions and construction of tissues and organs, for which an inseparable and integral part of life.The report explains that it is a key factor for the metabolic effects of CSG and can become a powerful tool in helping patients to make appropriate choice of CSG food.

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MICROBIOLOGICAL PROPERTIES OF DEPOSOL IN THE LOCATION OF BANATSKO KARADJORDJEVO

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ABSTRACT

Disposal of drilling mud is a considerable problem in the process of crude oil pumping and transportation. Microorganisms are the most important component of the soil biological phase as their enzymatic systems take part in degradation and synthesis of soil compounds. Soil samples were taken from the location of Banatsko Karadjordjevo. The results show high values of total numbers of microorganisms and azotobacters in indigenous soil than in deposol.

The numbers of ammonifiers, oligonitrophiles, actinomycetes and fungi were higher in deposols than in the local soil. The density of the studied groups of microorganisms and DHA decreased with depth, with the exception of actinomycetes.

Keywords: microorganisms, soil, deposol, dehydrogenase

INTRODUCTION

Presence of contaminants in the soil, depending on their chemical properties and amounts, causes stress in soil organisms. Microorganisms as the most numerous group of soil organisms [3] provide preliminary information on soil health/quality [6] and the presence of ecotoxic substances [7, 2].

During the pumping and transport of crude oil, a serious problem arises regarding the storage/disposal of drilling fluid and mud. Construction of permanent dumps causes significant changes the physical, chemical and biological properties of indigenous soils.

A legal obligation of drilling contractors is to keep operative wells filled with drilling fluid while a corresponding volume of drilling fluid must be kept nearby in open pools, for backup purposes. On completion of works, drilling fluid in the well is replaced by another fluid and the drilling mud, as technological waste, is temporarily deposited in the abovementioned open pools, wherefrom it is transported to the nearest permanent dump.

Microorganisms as the most important component of the soil biological phase are an important indicator of soil degradation processes (reduction of biodiversity,

accumulation of pollutants, disruption of food cycles and redox state). Microbial activity is influenced by the physical and chemical soil properties, climatic conditions, pesticides level, heavy metals and other pollutants as well as mutual relations in the microbial population [7]. Studies of microbial activity conducted within a project of soil reclamation at oil drilling dumps from several locations in the Vojvodina Province have shown that the number of microorganisms and dehydrogenase activity are reliable indicators of soil quality/health status [6]. In the location of Mokrin [5], chemical properties of deposol (at a depth of 50 cm) reduced the total number of microorganisms, but significantly increased the numbers of actinomycetes and fungi as well as dehydrogenase activity.

Considering the importance of preservation of soil as the most important natural resource of any country, the objective of our research was to monitor microbial numbers and dehydrogenase activity in the soil of the oil drilling dump in the location of Banatsko Karadjordjevo and the soils surrounding the dump.

MATERIAL AND METHODS

Samples for chemical and microbiological analyses were taken from the indigenous hydromorphic black soil and from the oil drilling dump (deposol). Samples were taken from several depths of the soil profile in the location of Banatsko Karadjordjevo.

Soil biological activity was estimated on the basis of microbial numbers (total number of microorganisms, azotobacters, oligonitrophiles, ammonifiers, actinomycetes and fungi) by the method of dilution on appropriate mediums. Total number of microorganisms was determined in agarized soil extract. Ammonifiers were determined on MPA [8]. Oligonitrophiles and azotobacters were determined on a N-free medium. Actinomycetes were determined on a synthetic medium, fungi on Chapek's medium. Dehydrogenase activity (DHA) was determined by a modified method of Thalmann [9], which is based on the measurement of extinction of triphenylformazan (TPF), formed by the reduction of 2,3,5-triphenyltetrazolium chloride (TTC).

RESULTS AND DISCUSSION

Soil is an ecological system and it is the habitat for diverse and numerous microorganisms whose enzymes play a key role in the metabolic activity of soil. Microorganisms are important for the development and maintenance of fertility and they may serve as indicators of the adverse impact of heavy metals and pollutants, as well as of changes in physical and chemical soil properties. Carbon, hydrogen and nitrogen are constituent elements that allow the growth and development of microorganisms. Certain groups of microorganisms have high requirements ($l0^{-3}$ to $l0^{-4}$ M) for phosphorus, potassium, sulphur, magnesium and iron, and the requirement for microelements (Mn, Cu, Co, Zn, and Mo) ranging from $l0^{-6}$ do $l0^{-8}$ M [7].

Disturbances of physical and chemical soil properties of, high concentrations of heavy metals, pesticides and other pollutants are stress factors that may inhibit the activity of microorganisms. On the other hand, microorganisms have the ability to

survive unfavorable soil conditions in the quiescent state, while resuming their activity when good conditions are restored. Poor and/or degraded soils host a narrow range of microbial genera and species.

By storing drilling fluid (lignosulfonic type, basic reaction) in permanent dumps, there develops a tehnogenic soil of deposol type, with has horizons I, II, III (Table 1).

The indigenous soil was a humogley type (Table 1), which is pH neutral to slightly acidic. The content of available phosphorus in the surface horizon is extremely high, even toxic (75.00 mg/100g), while the content of available potassium is high (23.5 mg/100g). The soil in the dump is alkaline and with heterogeneous properties along the profile, which is a consequence of the origin and composition of the deposited waste. The conducted analyses [4] indicates that the content of heavy metals was within the MAC, except for high amounts of chromium (117-218 mg/kg soil, profile 3) and nickel (54-58 mg/kg soil, profil 2).

Physical and chemical characteristics are most important soil features that affect the activity of microorganisms [7].

Table 1. Main chemical properties of humogley and deposol

Soil type	Horizon	Depth (cm)	pH		$CaCO_3$ (%)	Total N (%)	Total C (%)	AL-P_2O_5 mg/100g	AL-K_2O mg/100g
			in KCl	in H_2O					
Indigenous soil (profile 1)	Aor	0-21	6.09	6.84	0.00	0.367	4.116	23.5	75.0
	A	21-70	6.33	7.23	0.17	0.287	3.243	13.3	34.5
	ACGso	70-108	7.64	8.33	35.95	0.043	4.890	7.2	22.7
	CGso,r	108-180	7.92	8.39	41.18	0.038	4.928	8.3	18.2
Deposol (profile 2)	(A)	0-15	7.32	7.88	14.16	0.231	3.921	28.3	102.5
	I	15-62	7.40	8.23	10.72	0.077	1.871	9.1	82.0
	II	62-90	7.43	8.54	9.44	0.064	1.339	6.7	36.4
	III	90-145	7.35	8.22	6.86	0.059	1.171	5.5	30.0
	G,r	145-170	7.17	8.24	11.15	0.066	0.462	10.5	32.3
Deposol (profile 3)	(A)	0-14	7.44	8.10	17.16	0.137	4.381	8.2	50.0
	I	14-132	7.52	8.54	20.59	0.092	2.967	23.6	26.4
	Gr	132-180	7.53	8.53	10.30	0.063	1.530	7.1	29.1

Microbial activity is a good indicator of the presence of pollutants in the soil [1,7].

The microbiological analysis showed high biological values of the surface layers of the soil profiles; however, the number and diversity of microorganisms change significantly with depth (Tables 2 and 3). The surface layers of both indigenous soil (humogley) and deposol contained high numbers of all examined groups of microorganisms. Table 2 shows that in the surface layer of deposols had higher numbers of ammonifiers than the indigenous soil, which is probably influenced by the presence other waste materials in the dumps. Actinomyces were found in all three profiles in the densities of x 10^4 g^{-1} soil. It was observed (Table 2) that the number of actinomycetes was high in the deep layers of the deposol (with the exception of the Gr layers of deposol). The highest number of fungi was registered in the surface layer of the dump. Fungi were not found at a depth below 15 cm in profile 2, while profile 3 had a large number of fungi, up to 16 x10^4 per gram of soil on average.

Azotobacter, an indicator of N fixation balance in the soil, was not observed at greater depths in any of the profiles (Table 3). The oligonitrophilous bacteria are a heterogeneous group of microorganisms and their number was higher in deposol than in the indigenous soil. Although the numbers of this group of microorganisms decreased with depth, they were found in all soil layers. According to Wyszkowska and Kucharski [10] soil contamination with crude oil increased the numbers of oligotrophs, copiotrophs and actimonycetes but inhibited the numbers of azotobacters and cellulolytic bacteria.

Dehydrogenase activity (DHA), as an indicator oxidoreduction processes, was highest in the surface layer of the indigenous soil. The lowest dehidrogenazne activity was observed in deposol, profile 3. DHA decreased with depth in all profiles. In profile 1, DHA was registered in all layers. In deposols, oksidoreduction processes were not observed at greater depths - below 62 cm in profile 2, and below 132 cm in profile 3.

Table 2. The occurrence of microorganisms

Sample	Depth (cm)	Total no. (x $10^7 g^{-1}$ soil)	Ammonifiers (x $10^7 g^{-1}$ soil)	Actinomycetes (x $10^4 g^{-1}$ soil)	Fungi (x $10^4 g^{-1}$ soil)
Indigenous soil (profile 1)	0-21	63.41	9.70	3.32	4.08
	21-70	61.72	4.78	2.23	2.09
	70-108	12.52	2.09	4.78	1.25
	108-180	0.00	0.00	5.00	0.00
Deposol (profile 2)	0-15	43.95	33.68	5.10	6.77
	15-62	7.90	2.29	4.80	0.00
	62-90	8.92	5.58	9.05	0.00
	90-145	12.86	5.51	9.87	0.00
	145-170	10.88	0.00	0.00	0.00
Deposol (profile 3)	0-14	42.07	39.00	7.37	15.81
	14-132	23.73	18.17	15.85	13.25
	132-180	37.92	7.60	2.80	0.67

The presence of microorganisms in large numbers, their large diversity and high activity are indications of good soil properties. Low values of these indicators hint at unfavorable physical, chemical and toxicological soil properties. Poor soils have a narrow range of microbial species and strains. There are cases when there is a numerous and diverse microbial population which is inactive [2]. Namely, a number of microbial species can survive adverse soil conditions in the quiescent state and resume their activity when conditions improve. Enzymatic activity is a better indicator of soil biological activity than the number of microorganisms.

Table 3. The occurrence of N-fixing bacteria and dehydrogenase activity

Sample	Depth (cm)	*Azotobacter spp.* (x $10^2 g^{-1}$ soil)	Oligonitrofili (x $10^6 g^{-1}$ soil)	DHA (ug TPFg^{-1} soil)
Indigenous soil (profile 1)	0-21	27.98	35.75	271
	21-70	3.12	21.78	51
	70-108	0.00	10.02	42
	108-180	0.00	4.05	17
Deposol (profile 2)	0-15	24.23	62.23	171
	15-62	12.00	12.75	28
	62-90	1.80	4.65	0
	90-145	0.00	8.76	0
	145-170	0.00	3.89	0
Deposol (profile 3)	0-14	18.01	75.89	137
	14-132	3.67	12.33	143
	132-180	0.00	3.78	0

Fungi are efficient decomposers of resistant components, and their small numbers indicate a low rate of biodegradation of cellulose, starch, glutens and lignin. As they take part in the forming of macroaggregates, fungi affect the soil structure which is a key to high soil fertility.

The density of microorganisms, their relationships and enzymatic activity reflect the rate of biological activity of a particular ecosystem. Considering the important role of microbes in the overall soil metabolism, biological activity is an indicator of potential and effective soil fertility. Microbiological studies confirm that the number of microorganisms and dehydrogenase activity are important indicators of soil quality.

CONCLUSION

The study showed that the total number of microorganisms and the number of azotobacters were higher in the indigenous soil than in deposol. The numbers of ammonifiers, oligonitrophiles, actinomycetes and fungi were higher in deposols than in the indigenous soil. The density of the studied groups of microorganisms and DHA decreased with depth, with the exception of actinomycetes.

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EU EXPERIENCE IN USING OF WASTE MATERIALS IN CERAMIC INDUSTRY - CONTRIBUTION TO ENVIRONMENTAL PROTECTION

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ABSTRACT

The paper presents experience of countries from European Union in using of different secondary raw materials into ceramic industry. Transformation of waste materials embedded in the basic clay mass, improves its performance and reduces bad impact on the environment. Since the secondary raw materials are mainly kept in operating inappropriate warehouses, the reuse of these by-products has significant environmental impact (water, soil and air protection).

Keywords: waste materials, ceramic industry, treatment, environmental protection

INTRODUCTION

The growing consumption and the consequent increasing of industrial production have led to a fast decrease of the available natural resources (raw materials and energy). The high production of rejects or sub-products is generated, most of them not directly reusable[1].

The ceramic industry, particularly the structural sector, might constitute an interesting alternative to cement-making plants for incorporation or reuse of different waste materials. In fact, actual production levels involve the consumption of huge amounts of mineral resources (e.g., 500 ton. /day of clays in a medium-sized brick making unit), and the heterogeneous character of natural raw materials, the use of several formulations and, not less important, the firing process might ensure the desired inertness of final waste-containing products with respect to the ceramic matrix[2,3].

The countries from EU have experience in the incorporation of wastes in structural ceramics, such as usage of sludge generated from natural granite cutting processes as raw material in brick type and floor tile-type ceramic formulations, sludge from plating or surface treatments (AL-anodizing), sludge from potable water filtration, foundry sand, glass containers, etc[4].

A careful characterization of each residue and a detailed identification of possible pre-treatment needs for their correct use are always necessary, as usually happens for each raw material. Moreover, correct prediction of their effects on

processing conditions and/or on changes of typical final characteristics are also evaluated.

TREATMENT

Generally, samples are prepared according to the scheme shown in Figure 1, as close as possible to real experimental conditions. The origin of the wastes might be divided in two categories: (a) arising from the own ceramic sector (fired glazed crock, sludge's, etc); (b) generated by different sectors (e.g., sludge's from plating or surface treatments (Al-anodizing), sludge from potable water filtration, foundry sand, glass containers, etc).

This paper reviews two representative cases from reference [5] - Al-rich sludge from aluminium anodizing industry and sludge collected in the wastewater treatment plant of a sanitary ware industry.

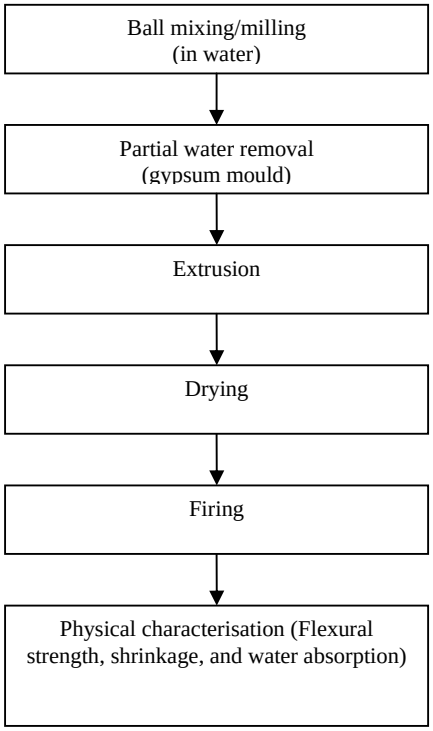

Figure 1. Scheme for relevant steps for sample preparation.

Case study 1 - Al-rich sludge from aluminium anodizing industry

Table 1 gives the average chemical composition of the dried sludge, confirming its aluminous character. After calcining above 1100°C the aluminium content might reach levels higher than 30%, corresponding to alumina levels higher than 90 wt.%. Calcium, sodium, iron and chromium are the main impurities, being the last one responsible for the light pink colouring effect.

The leaching behaviour of the dried sludge confirms its non-toxic character. XRD shows the amorphous nature of the dried sludge, with aluminium hydroxide and sulphide being the main constituents. The appearance of crystalline phases (mainly alumina) is only detected above 1100°C, after the occurrence of sulphate decomposition at about 800°C, as confirmed by DTA/TGA. Any reusing alternative of the as-received sludge as a raw material for traditional or new products is seriously affected by excessive moisture levels that will cause high shrinkage upon drying and firing and require high energy consumption for its decomposition (strong endothermic reactions). This problem is strongly minimized by assuring a previous drying step, preferably in the producer's. Vacuum and pressure drying methods should be explored by the anodizing industries, whenever thermal processes are not currently used.

Table 1. Chemical composition (XRF) of the dried and calcined (at 1600°C) sludge, with respect to the relevant elements

Element (Wt. %)	Fe	Cl	Na	P	S	Mg	Sn	Al	Ca	Si	Cr
Dried	0.4	0.15	0.6	0.2	4.5	0.07	0.3	23.0	0.6	0.4	0.25
Calcined 1600^0C	0.5	n.d.*	0.9	n.d.*	n.d.*	0.12	n.d.*	30.5	1.1	0.7	0.18

*Notice * not detected*

Table 2 summarizes the effects of sludge addition on tile and brick ceramic formulations. Generally, it can be observed that small additions (up to 5 wt. %) of pre-treated sludge do not induce significant deleterious effects on physical and mechanical characteristics of ceramic samples. Some remaining problems that deserve a complementary study might be related with higher shrinkage values shown by residue-containing samples upon firing, certainly related with the aforementioned late decomposition reactions of the sludge. Those reactions tend to open the microstructure, especially if the resulting main phase is not reactive (as happens with alumina formation). Those problems are more evident in as-received sludge-containing samples.

Table 2. Effect of sludge addition (wt. %) on typical ceramic formulations used for the production of bricks and tiles

Composition	Shrinkage on drying (%)	Shrinkage on firing (%)	Apparent porosity (%)	Water absorption (%)	Flexural strength (kgf/cm^2)
Pure ceramic	7.6	8.1	27.9	15.8	280
+5 % wet sludge	10.5	12.9	35.2	20.9	228
+15 % wet sludge	15.0	20.0	41.5	26.9	174
+2 % dried sludge	7.5	8.3	28.1	16.0	274
+5 % dried sludge	7.5	9.8	31.3	18.2	245

Case study 2 - Sludge collected in the wastewater treatment plant of a sanitary ware industry

The current waste is a non-toxic sludge collected in the wastewater treatment plant of a sanitary ware industry[6]. It is generated in several routine processing operations: (i) washing of the mills; (ii) collected rejects from the glaze applying cabins or in-line application tests, etc. Its average chemical composition is given in Table 3.

Table 3. Chemical composition (XRF) of the dried sludge, with respect to the relevant elements.

Element	Si	Zr	Ca	Al	Ba	K	Zn	S	Fe	Na	Sr
(Wt %)	29.5	9.5	8.8	8.1	7.1	6.0	3.4	0.78	0.42	0.40	0.15

As it happens with other several sludge's grain size is very small and permits its direct incorporation in ceramic formulations. Table 4 shows results of several stoneware formulations.

Table 4. Effect of sludge addition (wt. %) on typical stoneware formulations.

Property	Pure	5 wt % sludge	10 wt % sludge	10 wt % dried sludge
Shrinkage on drying (%)	2.32	2.06	2.30	2.10
Shrinkage on firing (%)	9.15	9.61	9.69	10.36
Loss of ignition (%)	6.29	6.66	6.97	6.92
Flexural strength (kgf/cm^2)	757	681	629	533
Water absorption (%)	0.18	0.18	0.24	0.30

During our project activities, sludge from industrial wastewater neutralization where incorporated in basic clay mass [7]. Chemical composition of sludge showed in Table 5.

Table 5. Chemical composition (XRF) of the dried sludge, with respect to the relevant elements, (wt. %)

Compounds	Fe_2O_3	ZnO	MnO	Cr	CaO	SiO_2
Sludge	29.3	1.18	0.250	0.0095	27.55	0.29

DISCUSSION

The incorporation of Al-rich anodizing sludge in common ceramic products seems to be functionally viable, and interesting for environmental and economical viewpoints. The addition of small amounts (2-3 wt. %) of dried and milled sludge only causes slight changes in the normal processing conditions and in the final properties of the material. The formation of mullite-based refractory ceramics incorporating Al-rich anodizing sludge up to levels of 70- wt% might be an alternative and more valuable way to reuse this residue.

In general, the addition of sludge up to levels of 5 wt-percent does not induce significant changes in the relevant functional characteristics and is enough to consume the total amount generated in each industry. However, one can notice a tendency for a general degradation of properties (lower mechanical resistance) with sludge additions, due to its refractory nature.

Despite careful sorting and mixing requirements, undesirable coloring effects might be also promoted.

During our project activities, sludge from industrial wastewater neutralization where incorporated in basic clay mass

Our project researching results are shown in reference [7].

CONCLUSION

Presented experimental results from the EU countries, as well as in Serbia indicate that incorporation of sludge in ceramic products:

1. improves some of product properties
2. reduce the consumption of natural resources
3. prevent sludge negative impact on the environment.

Acknowledgements

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THE STATE OF AIR EMISSIONS IN THE REPUBLIC OF SERBIA ACCORDING TO THE LCP DIRECTION –DATA ORIGINATED AT THE ENVIRONMENTAL PROTECTION AGENCY

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ABSTRACT

Air pollution problems are growing deeper and increasingly important at a global level, but at the same time awareness on this issue has also been raised. The sources of air pollution are both natural and anthropogenic, including for instance fossil fuel combustion, intensive growth of industry and agriculture, waste generation and so forth. The Environmental Protection Agency (hereinafter referred to as the Agency), being the competent authority for management of the environmental information system of the Republic of Serbia, collects and processes data on air emissions. The paper shows the data collected during 2008 and 2009 related to big combustion plants that are most often the biggest sources of air emmissions, and the operation of which is in accordance with the sustainable development principles, defined by the Directive on Large Combustion Plants - LCP Directive 2001/80/EC.

Keywords: air emissions, large combustion plants

INTRODUCTION

Pollutant emissions have a negative effect both on the territory of the country where they originate and on the transboundary areas.

The Directive on Large Combustion Plants (hereinafter referred to as: LCP Directive) lays down boundary conditions of air pollutant emissions during the oxidation of fuel from energy production plants with heat output exceeding 50 MW. The boundary values of the emissions have been established for plants with the heat output ranging from 50 to 100 MW, from 100 to 300 MW and over 300 MW.

In accordance with the Rulebook on the Methodology of Producing an Integral Cadaster of Pollutants ("Official Gazette of RS", no 94/2007), data is collected and a data base is managed on air and water pollution, as well as on waste generation and management both from point sources and from a diffuse source, thus enabling the process of monitoring of the state of the environment in the Republic of Serbia.

METHODOLOGY

As laid down by the Law on Amendments of the Law of Environmental Protection ("Official Gazette of RS", no 36/09), the Integral Cadastre of Pollutants has been harmonized with the term from the PRTR Protocol and is now called the Register of Environment Pollution Sources. The Register contains the data on the sources, types, quantities, method and the site of release of pollutants in the air and water, as well as on the quantities, type, composition and the manner of waste disposal.

The Register is produced on the basis of data duly submitted to the Agency by the polluters, i.e. on the basis of activity, capacity and a total number of employees.
The forms containing data on emissions generated from air combustion include the following:

1) Data on the source;
2) Data on fuel used;
3) Data about the system of filtration of emitted gases;
4) Data about the types and quantities of emitted gases.

The reported data on the quantities of emitted pollutants may be obtained by measurement, calculation or engineering assessment. The measurements, or else mathematical methods and engineering assessment must be in accordance with the relevant national, European and international guidelines and standards. If the polluter does not use the measurement method for establishing the quantities of released pollutants, he must submit detailed methodology used for the calculation or assessment of emissions.

Based on the collected data, the Environmental Protection Agency drafted a Register of combustion plants in the territory of the Republic of Serbia, with heat output exceeding 50 MW for 2007 and 2008, while data processing for 2009 is in progress.

Spatial distribution of large combustion plants, based on the submitted data for 2008, has been shown in Figure 1.

Out of a total of forty LCP plants in 2007, 6 plants have heat output ranging from 50 to 100 MW, 25 plants from 100 to 300 MW, and 8 plants have heat output exceeding 300 MW. For 2008, we have data on a higher number of plants (Fig. 2). By virtue of the Draft Regulation on the Boundary Values of Pollutant Emissions in the Air, what is meant by "plants" are those plants for which a construction permit has been issued after the entry in force of the Regulation. We do not have such new plants, so the data item on increased number of LCP plants can only be explained by improving of data collection in local communities.

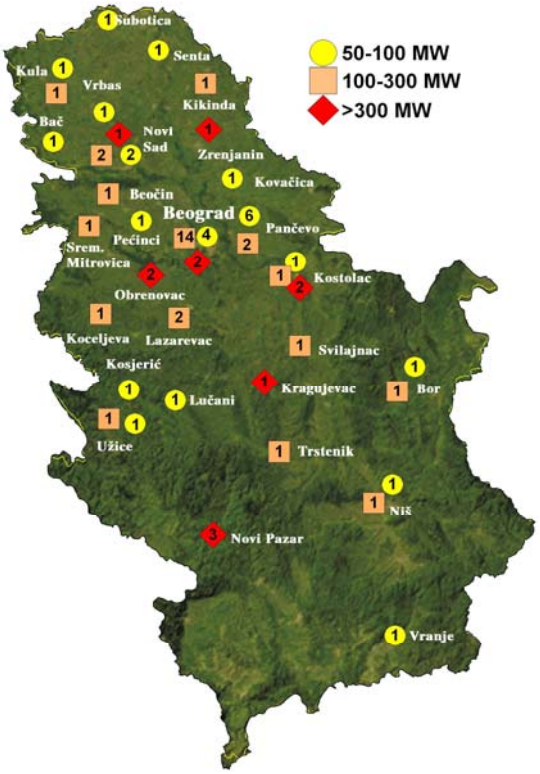

Figure 1. Spatial distribution of combustion plants with heat output exceeding 50 MW in the territory of the Republic of Serbia in 2008 (numbers denote the number of plants)

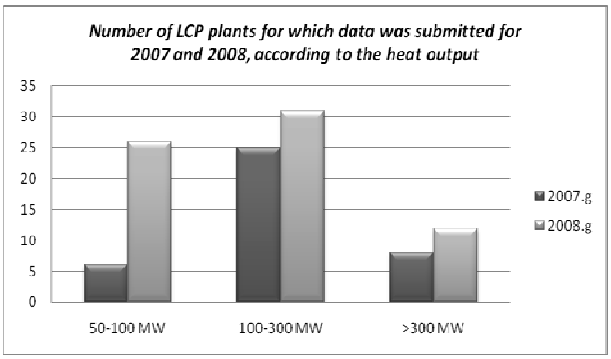

Figure 2. Number of LCP plants for which data was submitted for 2007 and 2008, according to the heat output

In the course of 2008, over 25,000 pages of material were submitted by 500 companies, and in 2009 the number increased to about 35,000 pages received by 800 companies. The data verification is carried out by the expert team of the Agency, and what remains to be done in the forthcoming period is the improvement of the received data. At the moment the Agency is working on the installation of a software for the establishment of data base in which operators will be able to enter data on their companies by themselves. The data base will be available on the website of the Agency www.sepa.gov.rs. With the establishment of the information system the Agency will be able to submit the missing data and indicators, whereby the responsibilities towards the European Environmental Agency would be completed.

By analyzing biannual data it has been found out that the largest air emissions originate from the sector of electrical energy generation, which in 2007 amounted to over 22% of all LCP plants, and to 12.8% in 2008 (Fig. 3 and 4).

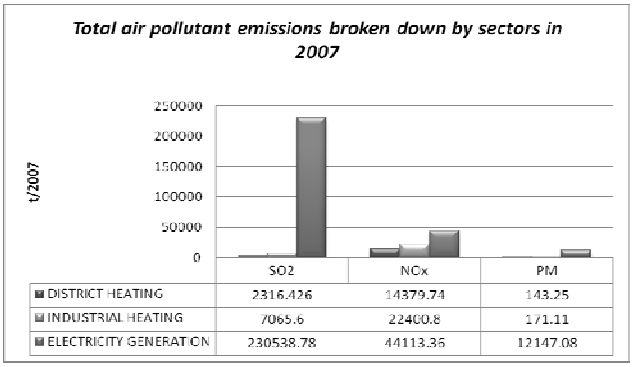

Figure 3. Total air pollutant emissions broken down by sectors in 2007

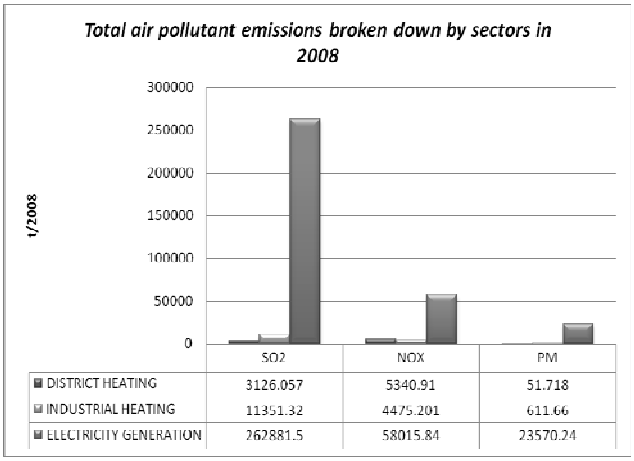

Figure 4. Total air pollutant emissions broken down by sectors in 2008

Filtration systems are made of electro-filters, cyclones and bag filters. Around 30% plants submitted data regarding the possession of one of filtration systems.

Based on processed data, there are three distinct sources with the largest total annual emissions:

1. Thermo-electrical power plant (TE) Nikola Tesla A and B in Obrenovac
2. TE Kostolac A and B in Kostolac
3. TE Kolubara in Veliki Crljeni, Lazarevac.

The total pollutant emissions from these sources in 2008 have been shown on the Fig. 5.

In comparison with 2007, total emissions increased in 2008 from these sources. The thermo/electrical power plants Nikola Tesla A and B reported larger coal consumption in 2008 by 1.5 mil. ton. In the course of 2008, the public enterprise Elektroprivreda Srbije continued with the activities of introducing a new technology of ash transport and disposal at the dump of the TE Nikola Tesla B and TE Kostolac B.

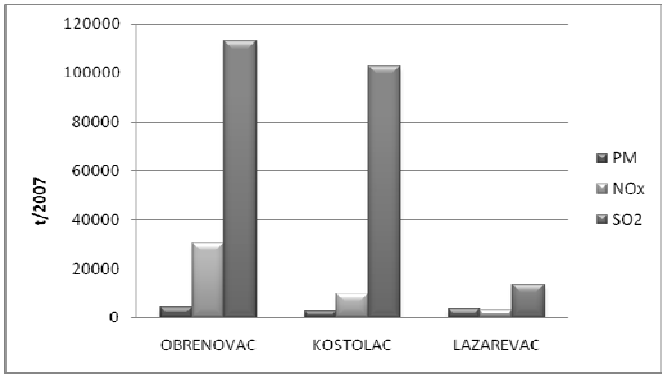

Figure 5. Total emissions of SO_2, NO_x and PM in 2008 from TENT A and B-Obrenovac, TE A and B-Kostolac and TE Kolubara-Lazarevac

It is worth mentioning that the Environmental Protection Agency has received some irregularly filled forms that could not be used in this analysis. One of the most common problems is failure to give emissions in the respective measurement units, or else their incorrect conversion. Also, in the submitted forms data on the characteristics of plants and air emissions is lacking, in spite of the indication that they exist. Still, since the establishment of the Integral Cadastre of Polluters, reporting progress has been observed, both as regards the response and data quality.

CONCLUSION

By collecting and managing a data base on air pollutant emissions, foundations are laid for the application of international standards and requirements related to the establishment of the Register of Greenhouse gases (UNFCCC GHG Register), the implementation of the Directive on Integral Pollution (IPPC Directive), PRTR Protocols and E-PRTR Directive, LPTAP Convention, as well as the earlier mentioned LCP Directive.

The new responsibilities and commitments of the Agency have been defined by the new Law on Air Protection ("Official Gazette of RS", no. 36/2009) and by the Draft Regulation on the Boundary Values of Air Pollutant Emissions. As laid down by Article 46 of this Regulation, operators are required to report on the measured air pollutant emissions. The content of each element of the Report has been given in Annex *VII The Content of Elements of Report on the Measured Air Pollutant Emissions* of the Regulation.

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MANAGEMENT OF PLASTIC WASTE

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ABSTRACT

Every year all over the world more than 100 million tons of plastics are produced. It should be pointed out that conventional plastics can be sustained in the human environment and its inappropriate disposal represents a significant source of human environment pollution. Because of that, the investigations have been started with aim to develop ecologically acceptable products which would replace conventional plastics in ecologic and economic point of view and help in solving the problem of plastics pollution. Also, establishment of the system for management of packing and packing waste, and its functioning in practice, is a great challenge for the state, and concerns the widest social community and all citizens.

Keywords: human environment, plastics, packing waste

INTRODUCTION

Plastics or plastic materials started to be used in production engineering with discovery of bakelite at the end of the 19th century. However, mass application of plastic materials dates back the second half of the 20th century. These materials are divided into two groups, to thermoplasts and thermoactive plastics. Thermoplasts are plastic materials which are characterized by a simple recycling. Namely, the old parts of this material can be simply used as a raw material for manufacture of new products. If they are heated for shaping, they do not change the properties of this material. Examples for these materials are: polyethylene (PE), polyvinyl chloride (PVC), polypropylene, polystyrene, polyamide, thermoplastic polyester, etc. These materials are known in general application, but very often they are used in agricultural technique. Examples of these materials are: greenhouses, tanks, dishes, plastic hoses, etc. Thermo-active kinds of plastics are characterized by a chemical reaction which is created during manufacture (forming), and is caused by heating. That means that the raw material and manufactured

part are not identical according to their composition. This feature prevents a simple repeated processing of the old parts. Examples of thermo-active kinds of plastics are: bakelite (phenol resins), polyester, epoxy resins, etc. These materials are used for different purposes: electric isolators, basis of composite materials, tanks, anticorrosive coatings, etc.

Recycling of plastic materials is relatively new industrial procedure, which shows the tendency to permanent development. One of the first examples of recycling of plastic materials, was the process of polyethylene foils (PE) production, in which, apart from pure polymers as a raw material, the treated waste was used. For plastic materials recycling a considerable use of electric energy is needed. In collecting of plastic waste, some problems may appear, arising from different physical-chemical properties of individual kinds of plastic materials, and all that may have a considerable influence on technological process of recycling.

Polymers are often used in pharmaceutical industry as packing materials. They can be used as primary packing materials which in contact with a medicine has a task to protect the medicine against negative influences of temperature, humidity, light, oxygen and other gases and microorganisms, and yet, they can be used as secondary packing materials. Today, for these purposes are used different kinds of plastics such as : PVC, PE, PP, PS, PET. Fig. 1. presents some kinds of polymer packing materials which is used in pharmaceutical industry and medicine.

Figure 1. Some sorts of plastic packing used in pharmaceutical industry and medicine

A great number of polymers are used in medicine as biomaterials. They have various applications: from facial prosthesis, trachea pipes, parts for kidneys and liver, parts for heart including also dental prosthesis and artificial knees and hips, table 1.

Table 1. Examples of polymers and biomaterial use

Uses	Polymers
Finger joints	Silicon
Sewing up of surgical cuts	Polyalkilated and polyglycogenicc acid, nylon
Trachea pipes	Silicon, acryl, nylon
Pacemaker for heart	Acetal, polyethylene, polyurethane
Blood vessels	Polyester, polytetratetrafluorethylene
Gastrointestinal parts	Nylon, PVC, silicon
Dental prosthesis	Polymethyl, siloxane, polyurethane, PVC
Cement for bones	Polymethylmetacrilat

When is thought about the use of polymer materials for manufacture of packing, it must be pointed out that most kinds of packing are used only once and, after a short time, such kinds of packing are found in dumps for disposing of communal waste. Large quantities of such waste have already been deposited, and significant place is taken by packing made of polymer materials.

A phenomenon called "plastic soup" can be taken as an example of a great ecologic problem. "Plastic soup" is the name for garbage dump, about 1.4 millions km^2 in size, which is floating on the Pacific Ocean. Wastes, consisting of plastic things, are together because of underwater currents. Undesirable isle is situated at about 500 nautical miles from the coast of California, and spreads as far as Japan, across the north Pacific and Hawaii. Floating garbage, which is called "plastic soup", is half-transparent and lies just under the water surface, so it is impossible to be seen on satellite photographs. In Fig. 2 is given the satellite photograph of a part of the territory where the "plastic soup" is located, with indicated direction of underwater currents streaming.

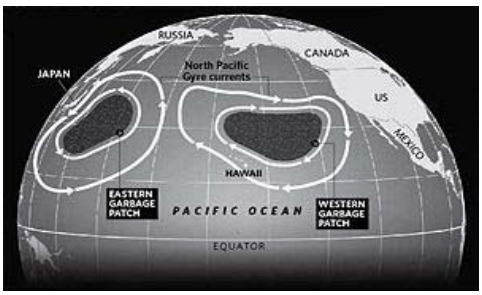

Figure 2. Satellite photograph of a part of the territory where the "plastic soup" is located

As a consequence of human unconcern, the packing made of polymer materials can be found very often on land outside dumps. For a long period of time, the possibility of synthesis of such polymers has been investigating, which would be decomposed in natural conditions into the products which are to be included into a circular flow of matters in nature (CO_2, H_2O). From the time when the ecological balance for polymer materials for production of packing started to be made, it has been concluded that biodegradation is not profitable for synthetic polymers, because the total energy, contained in polymers, is wasted in that way, as well as the energy used for their synthesis. This is the reason why today, a special attention is paid to manufacture of biodegradable thermoplastic polymers by modification of natural polymers, for example starch or cellulose, because in such cases, ecological balance does not take into account raw materials and used energy for polymer synthesis. Now and in near future, limited usage of biodegradable polymers for packing production can be expected.

In great number of developed countries in the last fifteen years significant means and scientific potential are engaged with aim to solve the problem of polymer

waste. According to present considerations, solution of the problem of polymer waste, and consequently the problem of protection of human environment can be found in :

- synthesis and use of biodegradable polymers,
- reduction of waste
- repeated use of polymer materials from wastes – recycling of polymer waste with aim to produce new materials, raw materials ad energy, and
- disposal of polymer waste and appropriate dump organization.

All suggested ways of solving the problem of polymer waste are used and supplemented at the same time, and so far, none of them has shown any advantage.

COLLECTION OF PLASTIC WASTE

Organization of activities for collection of plastic materials represents one of the most important problems. Degree of dirtiness is defined by the contact of one kind of plastic mass with the other. Experience form many countries show that there is a great difference in collecting the waste from households and from industrial objects. Plastic waste, which comes from households, is usually collected with other residual waste, which results in its damage. In the last years different systems of collection were introduced for making collection of waste materials of greater cleanness economical. Two systems are commonly used: integrated collection system and additional collection system.

Figure 3. Containers for collection of plastic packing

Integrated system for waste collection includes placing of two or five containers (sometimes even more); some of them are intended for particular kinds of waste. Plastic materials are collected with paper, glass or metal, but they can be separated in separate bags. Additional system of collecting includes placing of containers in the centre of inhabited area, so that consumers have to bring the material themselves. Problem of this system is necessary motivation of the public together with a corresponding company.

Plastic waste found in solid communal waste (which is very heterogeneous according to its content) is dirty and mixed with other kinds of materials. In order to use such a waste, it is necessary to collect if first and prepare. Within the preparation for

recycling, plastic waste must be separated from other kinds of wastes, then identified and separated according to the types, chopped up, washed, dried and regranulated, i.e., processed again into the packing or some other products. To carry out these operations, a specific equipment is necessary, and then the price of recycled materials is high. It is established, that by separated collection in containers, the whole process of manufacture would be cheaper and simpler.

PLASTIC WASTE CLASSIFICATION

In the recycling procedure identical materials have a central importance. The same kind of materials can be collected by previous relatively expensive process of sorting. In order to get high quality plastic masses, the same kinds of plastic masses should only be processed. Separation of plastic materials can be divided into identification and separation. Recognition of used polymer packing is simplest, if it carries the designation for recycling with given kind of polymer material from which it is made. In the process of separation of plastic masses, chopped up plastic material is sorted according to its physical properties such as the density, networking and electrical conductivity.

PROCEDURES FOR PROCESSING OF PLASTIC WASTE

Used plastic products can be re-used or remanufacture by different procedures, depending on the set aim, in order to reduce the mass for deposition. Plastic waste can be treated in different ways:

- melting, without changing or with very small changes of macromolecular structure.
- Chemically, by hydrolysis or alcoholysis is possible to get monomers, or by hydrogenate from starting material can be obtained organic raw materials such as gases and oils,
- By controlled burning, which produces energy as a burning product of carbon dioxide (CO_2) and water (H_2O).

Possibilities of plastic waste treatment are shown in the Fig. 4.

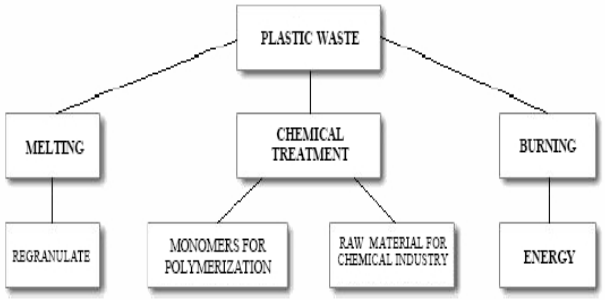

Figure 4. Possibilities of plastic waste treatment

Regranulation of thermoplast is one of the oldest and the commonest recycling procedures. Basis of such way of recycling is ability for repeated melting which is possible with thermoplast. After chopping up and pressing of plastic waste by use of special devices and final separation and washing, output material is regranulated, stored and is further used for different purposes. Procedures of chemical processing can be divided into two groups: first is processing procedures where macromolecules (polymers) are converted into low-molecular substance and second is processing procedures, where from macromolecules which contain plastic waste, can produce carbon hydrides in the form of gases or oils, which can further be treated by petrochemical procedures in refineries. Nowadays, for chemical recycling of mixed polymeric waste in industrial proportions, are used the procedures of pyrolysis, combined pyrolysis and hydrogenate and high-temperature gasification. Unfortunately, the price of chemical recycling is still high and does not cover recycling costs.

Burning of plastic waste – Aim of this way of plastic waste use is production of energy. Direct use of naphtha for production of energy, from the point of view of "sustainable development" in longer period of time, would not have any sense. Taking into account that in plastic products is preserved almost the total energy of naphtha, it would be very good to use the energy accumulated in plastic products, for the purpose of, but only at the end of their useful cycle. Such way of usage of plastic waste should be applied only in the case when the waste is not possible to be recycled in some other way. All modern plants for burning both communal and separated polymeric waste, are equipped with efficient devices for treatment of waste gases.

CONCLUSION

In difference from materials whose recycling have been done from a long time ago, due to economic reasons, recycling of plastic materials is technological and economic problem and in some fields is still the subject of intensive research.

Which procedure is to be applied, depends on the degree of impurities, i.e. sorting of waste and desirable quality of the final product. Processing of materials (by melting), from the same and pure plastic waste can be get high-quality recycling materials, which could be used as a replacement for original raw materials, of the same or similar quality. Such a waste is produces in manufacture of plastic materials and in production of packing.

The waste from household make problems , especially if it is heterogeneous, and if it contains mixed, and depending on the kind of collection, different dirty plastic materials. Costs of processing of such a waste, for manufacture of high quality products usually surpass the costs of new materials.

Because of the fact that plastic waste is not usually sorted (due to difficult and expensive process of sorting and insufficient separation by the consumers), the solution for processing of mixed plastic waste has been found. However, such way of processing results in recycling materials of lower quality. Such materials cannot be competitive to new materials. Because of that production plants are not ready to expand their production programme based on recycling. Above considered procedures of

manufacture represent only on way which could be used for considerable reduction of ecological problems, but it can and must be a profitable industrial activity.

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DETERMINATION OF PHENOL AND COD IN DANUBE WATER : RESULTS OF THE REGIONAL INTERLABORATORY STUDIES

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ABSTRACT

Interlaboratory studies are important for the improvement of the quality of chemical analyses, accreditation of laboratories and the introduction of quality system based on the ISO 9000 standards in chemical laboratories. In order to improve the quality of chemical analyses of water in South-Eastern Europe four interlaboratory studies were organised in the period 2003-2008. About sixty laboratories from Greece, Republic of Srpska - Bosnia and Herzegovina, Romania, Serbia and Montenegro took part in them. In this paper the results for determination of phenol and chemical oxygen demand (COD) were discussed.

Keywords: Phenol, COD, Chemical oxygen demand, Interlaboratory study, Intercomparison, Danube water

INTRODUCTION

There is a great demand for accurate and precise chemical analyses in modern society. The environmental analyses as well as the globalization of trade require even higher quality of analyses. In order to achieve such goal, the principal solutions are wide use of reference materials and the introduction of quality system based on the ISO 9000 standards in chemical laboratories [1]. In our country these standards were adopted as JUS ISO 9000 standards. Laboratory accreditation (at national, regional or international level) is one of the activities within this general framework. The criteria for accreditation cover all aspects of laboratory's operations. It includes also the obligation for applying laboratory to participate in interlaboratory studies. As the consequence, the number of interlaboratory studies increased considerably, mostly in developed countries [1]. The interlaboratory studies could be organised at national, regional or international level. Consultations among several scientists and the Round Table Discussion on Interlaboratory Measurements organised within the 2nd International Conference of the Chemical Societies of the South-Eastern European Countries "Chemical Sciences for Sustainable Development" [2] stressed the need for permanent long-term activities in the region as well as the organization of the regional interlaboratory studies.

Therefore, in the period 2003-2008 four interlaboratory studies were organised in order to improve the quality of water analyses in South-Eastern Europe. The International Scientific Committee with professor dr. Anastasios Voulgaropoulos as the Chairperson organised and evaluated regional interlaboratory studies. In all regional interlaboratory studies the task for participants was to determine some or all trace elements (Al, As, Cd, Cu, Mn, Fe, Pb and Zn) in the samples. Furthermore, in the 2nd, 3rd and 4th regional interlaboratory studies the participants had also to determine choride, sulphate, phosphate, nitate, nitrite, ammonium ion, phenol and chemical oxygen demand (COD).

About sixty laboratories took part in four interlaboratory studies organized in the period 2003-2008. Three laboratories were from Greece (Department of Analytical Chemistry, Aristotle University of Thessaloniki; Department of Chemistry, University of Ioannina, Ioannina; Thessaloniki Water Supply and Sewerage Organisation, Thessaloniki). Two laboratories were from the Republic of Srpska - Bosnia and Herzegovina (Institute for health protection of the Republic of Srpska, Banja Luka; Water supply and sewerage organisation, Bijeljina) and 11 from Romania (Administratia Nationala Apele Romane - Directia Apelor Prut Iasi; ICIA CLUJ NAPOCA, Cluj Napoca; Institute for Energy Research and Development – ICEMENERG, LAICA, Faculty of Chemistry, AI.I. Cusa University of Iasi, Iasi, Bucharest; National Research and Development Institute for Industrial Ecology (ECOIND), Bucharest; R.A. APA - CANAL "Aquatim", Timisoara; RA AQUASERV, Tg. Mures, Jud Mures; S.C. APA CANAL 2000 S.A., Pitesti; SC APA NOVA, Comuna Chiajna, Jud Ilfov; S.C. ROMPETROL REFINING, Navodari; S.C. RULMENTUL S.A., Brasov).

Other laboratories were from Serbia and Montenegro (A.D. Bio-ecological Center, Zrenjanin; Copper Mill, Sevojno; DP HIP Azotara – Pančevo, (Nitrogen fertilizer plant), Pančevo; DP HIP Petrohemija – Pančevo (Petrochemical plant), Pančevo; Faculty of Chemistry, University of Belgrade, Belgrade; Faculty of Technology and Metallurgy, Belgrade; Faculty of Technology, Novi Sad; Geoinstitute, Belgrade; Holding Institute of General and Physical Chemistry, Belgrade; IChTM – Center of Chemistry, Belgrade; Institute for Technology of Nuclear and Other Mineral Raw Materials, Belgrade; Institute for Water Development "Jaroslav Černi", Belgrade; Institute of Public Health (Belgrade, Čačak, Kosovska Mitrovica, Kraljevo, Leskovac, Niš, Novi Sad, Pančevo, Podgorica, Požarevac, Subotica, Šabac, Užice, Vranje, Zaječar, Zrenjanin); Institute of Public Health of Serbia, Belgrade; "Knjaz Miloš" - Laboratory, Arandjelovac; "MOL", Joint Stock Company for Chemistry, Biotechnology and Consulting, Belgrade; NIS – Naftagas, Central Laboratory, Novi Sad; NIS – Oil Refinery Pančevo, Pančevo; Petnica Science Center, Valjevo; Sojaprotein A.D., Bečej; "ZORKA" – Chemical Industry, Research Center, Šabac; "ŽUPA" – Chemical Industry, Kruševac; Veterinary institute, Belgrade; Veterinary institute, Kraljevo; Water Supply and Sewage, Belgrade; Water Works "NAISSUS", Niš; Water Works, Kruševac; Water Works, Novi Sad; Water Works, Pančevo).

The results for determination of cadmium, lead, copper and manganese were presented earlier [3, 4]. In this paper the results for determination of phenol and chemical oxygen demand (COD) were discussed.

MATERIALS AND METHODS

The samples for all regional interlaboratory studies were prepared from filtered water of the river Danube near Belgrade by addition of corresponding substances. The task for participants was to determine some or all trace elements (Al, As, Cd, Cu, Mn, Fe, Pb and Zn) in two samples (A and B) and some other parameters (in samples C, D, E and F). In this paper the results for determination of phenol and COD were discussed. Participants could freely select the elements for analysis and the analytical methods. Full confidentiality was guaranteed with the respect the link between results and participants' identity. All participants who submited their results in time received the certificate of participation. All participants also received CD with several scientific papers and other literature relevant for interlaboratory studies of water and traceability in chemical analyses.

All results were analysed using the same methods as in the interlaboratory studies organised by IRMM-JRC (Institute for Reference Materials and Measurements: EU-Joint Research Centre, Geel, Belgium) within IMEP (International Measurements Evaluation Programme) [5, 6, 7, 8]. In addition to graphic presentation and analysis of results using the Youden method [9], Cochran and Grubbs tests were also used. Reproducibility (R) and repeatability (r) were calculated according to the British standard BS 5497: Part I: 1987 (ISO 5725: 1986) [10].

RESULTS AND DISCUSSION

Interlaboratory studies are important for the improvement of the quality of determination of various chemical parameters. Accurate chemical analyses are neccessary for the investigation of the quality of natural or wastewater as well as for the monitoring of wastewater treatment. In this paper the resuls for determination of phenol and chemical oxygen demand (COD) in regional interlaboratory studies were presented. Phenol is dangerous pollutant which sometimes appeared in the river Ibar. Chemical oxygen demand provide information of the amount of total organic pollutants in water.

Eighteen participants in the 4th Regional Interlaboratory Study ″WATER ANALYSIS-2008″ took part in the determination of phenol in water. Different methods were used: gas chromatography, liquid chromatography and spectroscopy. It is convenient to present results in the ascending order (Fig, 1) as in IMEP studies [5, 6].

Then the results which were obviously too low or too high were discarded. The remaining results were subjected to Cochran and Grubbs test which also eliminated some results. The results which were not eliminated in such way became the accepted results and they were used for calculation of the median, mean and standard deviation (Table 1) as well as for further analysis.

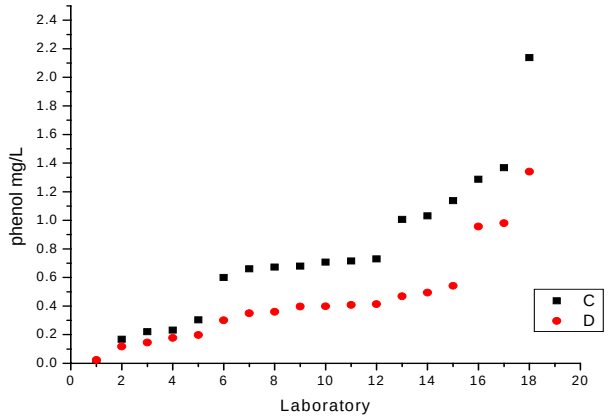

Figure 1. Results of phenol determination (mg/L) in samples C and D

Table 1. Results of phenol and COD determination

	PHENOL (mg/L)		COD (mg O_2/L)	
Sample	C	D	C	D
Number of results	18	18	26	26
Number of accepted results	13	15	20	21
Median	0.677	0.397	135.3	177.0
Mean	0.680	0.381	134.8	176.8
Standard deviation	0.311	0.205	9.9	20.2
Repeatability (r)	0.054	0.042	15.9	30.2
Reproducibility (R)	0.872	0.575	18.0	58.5

Better information on the quality of results could be obtained by the use of Youden graphical method [9]. The same method was applied for evaluation of international interlaboratory studies of water (IMEP-3, IMEP-6 and IMEP-9) organised by experts of the European Commission – Institute for Reference Material and Measurements [5, 6]. Results for phenol determination were presented in Figure 2.

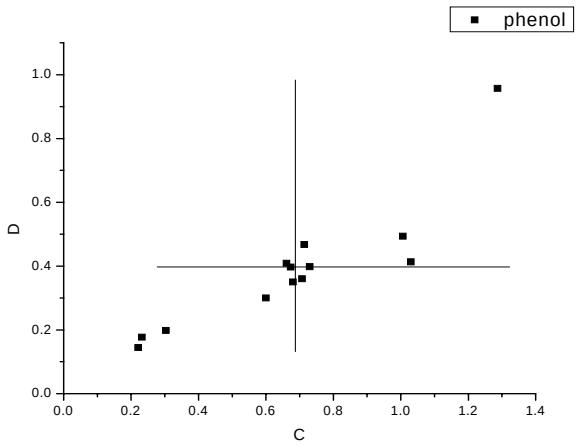

Figure 2. Youden diagram for phenol determination (mg/L) in samples C an D

This graph was prepared by drawing the x-axis at the bottom and laying off on this scale the results for sample C. Similarly, the y-axis corresponded to the scale with the results obtained for sample D. In such diagram each laboratory was represented with one point (its results for sample C and D were the coordinates). New coordinate system was made by adding two lines: one, parallel with y-axis was made to go through the median of the results for sample C and another, parallel with x-axis, was made to go through the median of the results for sample D. The best laboratories had the position close to the crossing of median lines. Diagonal grouping of results indicated that some laboratories made systematic errors, i.e. they found too low or too high values for both samples (Figure 2).

Every participant had to perform three analyses for each sample so that the repeatability value (r) could be calculated as well as the reproducibility value (R). These values were calculated (Table 1) and interpreted in accordance with IUPAC protocol [7, 8] and the British standard BS 5497: Part 1: 1987 [10]. Repeatability referred to the agreement of results from the same operator/laboratory while the reproducibility corresponded to the agreement among different operators/laboratories. Both values were related to standard deviations of corresponding results – if values of r and R were smaller the agreement was better.

The total of 26 participants determined COD within the 3rd Regional Interlaboratory Study ″WATER ANALYSIS-2006″. About 80% of results were accepted (Table 1). Almost all participants used the international standard method ISO 6060:1989 for determination of chemical oxygen demand. The Youden diagram with these results was presented in Fig. 3

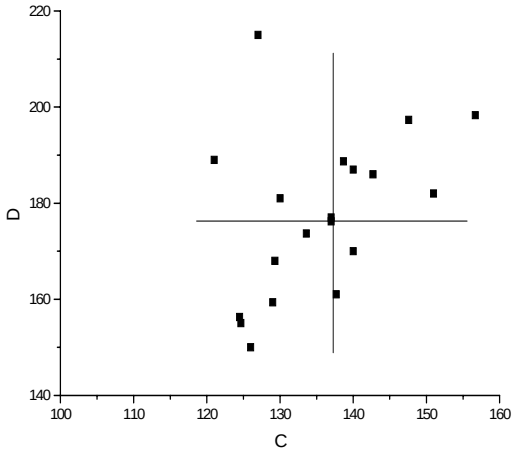

Figure 3. Youden diagram for COD determination (mg O_2 / L) in samples C an D

Radial distribution of results for COD indicated better overall results than for determination of phenol. Corresponding values for the repeatability (r) and reproducibility (R) were calculated for determination of COD (Table 1). The lower value of the reproducibility for sample C indicated better agreement than for the sample D.

CONCLUSIONS

Regional interlaboratory studies, which included determination of phenol and chemical oxygen demand (COD) in Danube water as the sample matrix, was generally successful and useful for all participants. There was a good agreement between the results of most laboratories. Systematic errors were observed in some cases and these laboratories need to improve their performance. Results obtained for COD determination were better than those for phenol. Participants found the interlaboratory study useful and expressed the need to continue with this kind of regional co-operation in the future.

Acknowledgements

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MORE THAN 25 YEARS OF ENVIRONMENTAL EDUCATION IN PETNICA SCIENCE CENTER - SERBIA

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ABSTRACT

Petnica Science Center (PSC) is operating more than 25 years in Serbia. It is a unique non-governmental, non-profit and independent educational institution working with young people who demonstrate an inclination and interest in science beyond regular school curricula. The emphasis was on experimental work: problem solving and students research projects. Most of PSC's educational activities are designed for upper secondary school students (age 15-19), but there are also a variety of programs for younger students and college undergraduates as well as for teacher training. Results of environmental education were presented in this paper.

Keywords: Petnica Science Center, Environmental education, Secondary school students, Student research project, Water analysis

INTRODUCTION

Petnica Science Center (PSC) was founded in Petnica near Valjevo (Serbia, Yugoslavia) in 1982 by a group of young teachers, scientists and university students [1,2]. It is a unique non-governmental, non-profit and independent educational institution working with young people who demonstrate an inclination and interest in science beyond regular school curricula. Contrary to traditional and rigid system, which was dominating in the schools, new styles and teaching/learning methods were introduced in Petnica Science Center. The emphasis is on experimental work; problem solving and students research projects. The equipment and instruments in laboratories of PSC are considerably better than those in the schools (often similar like in the university laboratories for undergraduate students). Members of teaching staff are also better qualified and more capable than average school teachers.

PSC is consisted of several departments with equipment suitable for the research and teaching/learning in various sciences: Anthropology, Archaeology, Astronomy, Biology, Chemistry, Computer science, Geology, Geography, History, Electronics, Linguistics, Mathematics, Psychology and Physics. It also has Computer

centre (over 30 Pentiums) and the Library with 13000 books, 2000 international scientific journals, many databases on CD-ROM. Free access to Intranet and Internet was also provided for all participants in PSC. Accommodation and meals could be provided for about 100 persons. Participation in educational programmes (including accommodation and meals) is practically free of charge for students. The gender ratio was usually well balanced. Up to 1995 there was a tiny majority of boys (never over 52%). Later the girls prevailed (51% in 1996, 56% in 2009).

The importance of PSC could be envisaged from the data for the year 2009. Over 110 science camps, workshops and courses were organised for over 2169 participants (including 113 school teachers). Beside permanently employed staff from PSC, nearly 600 scientists and lecturers from about 150 institutions (faculties, research institutes, medical institutions, and industrial companies) were also engaged. Furthermore, about 150 young assistants (Petnica alumni and usually university students) were also helping their younger colleagues.

In this paper environmental project realised by students in Chemistry Department of PSC will be discussed. Environmental projects were also realised in other departments of PSC (Biology, Geography, Geology) and there were also several interdepartmental projects. Chemistry was among the first disciplines, which started in 1982 in Petnica Science Center. The share of environmental projects was usually very high. In some periods it was up to 64% of all projects realised in Chemistry department of PSC.

METHODS

Department of chemistry in PSC has two large laboratories suitable for qualitative and quantitative analyses (gravimetric and volumetric) as well as several smaller rooms for instrumental analyses (gas chromatograph, spectrophotometer, AAS).

Within environmental projects most of them were concerned with the analyses of water. During the first seven years (1982-1989), projects were usually realised in a form of summer schools. They included field studies and lasted 2-4 weeks. The teams very relatively large: 20 to 30 participants, mostly secondary school students. Within one typical project water resources in the region of river Jadar (Serbia) were studied. The aim was to make evidence of all wells and springs, to take samples and finally to estimate the quality of water on the basis of physical, chemical and microbiological investigation. Participants usually collected 50 to 400 water samples [3,4].

Later when individual student projects started (1990-2010) about 10 to 40 water samples were studied by each student. In most projects students analysed water samples collected near PSC: different sites of Petnica Lake, river Banja and Pocibrava spring. Some students brought water samples from their home towns [3,4].

Most of projects realised at the beginning were relatively simple, e.g. they included determination of only one parameter in few samples. Later the number of chemical parameters increased up to 15. The quality and complexity of student projects on water analysis were considerably increased. More parameters were determined as well as their changes with location and time (daily and during summer seminars). Chemical and biological oxygen demand (COD and BOD), pH, the content of calcium,

magnesium, nitrate, nitrite, carbonate, bicarbonate, sulphate, phosphate and dissolved oxygen were often determined. Some microbiological parameters of water quality were also included.

In Petnica Science Center the emphasis was on experimental work, problem solving and students research projects. In spite of their interest for science and environment, many secondary school students did not have enough knowledge and practical experience to define and perform their projects. There were also similar findings in the literature [5]. Therefore, the annual cycle of seminars was designed in order to provide students with theoretical and practical knowledge necessary for research project. Students applied for PSC in September-October each year. Those who passed the screening procedure were invited to winter and spring seminars (4-7 days each) where they could acquire theoretical and practical knowledge on analytical techniques (gravimetric, volumetric, optical and electrochemical methods), methodology of scientific research, data handling and statistics, use of chemical literature, etc. Beside the staff from PSC, volunteers mostly from faculties and research institutes gave lectures and provided training for students. Young assistants (Petnica alumni and usually university students of chemistry, technology, medicine, etc.) were also engaged. Usually, about 6-10 volunteers and 2-4 young assistants were engaged for each seminar. At the end of spring seminar students alone or together with older colleagues had to design their project. After individual preparation (2-3 months) students realized practical parts of their projects in Petnica Science Center during the summer seminars (12-15 days). At the end of seminar students had to present the results of their projects to others and to write the draft version of the report. In consultation with mentors, the reports were later improved and published in PSC publications in different form. Earlier, abstracts of papers in English and Serbian were published and later complete versions of papers were published in Serbian with English abstract. The best papers (from all departments of PSC) were also presented at the annual conferences of young researchers (since 2002).

Although most of PSC's educational activities are designed for upper secondary school students (age 15-19) there are also a variety of programs for younger students and college undergraduates. Teacher training was envisaged as the important activity from the beginning of Petnica Science Center and some courses were occasionally made. However, after 1998 additional and systematic efforts were undertaken in this direction. Teacher Resource Center (TRC) was founded in PSC with collection of carefully selected books, textbooks, manuals, software, videotapes, etc.

RESULTS AND DISCUSSION

The individual student projects started in 1990 as most of necessary equipment was collected and installed in chemical laboratories of PSC. In comparison with large team projects done earlier, this type of projects demanded much more from students, but it was also more important for their development.

The share of environmental projects was usually very high (Table 1). In average, it was 64% of all projects realized in Chemistry department of PSC (the total number of projects was 206 in the period 1990-2001). Among them, project on water analysis were very popular, especially in the early nineties [3,4]. Later the interest of

students was shifted towards food analysis (Table 1). The share of projects on water analysis increased to some extent during the last five years (Table 2). In fact, water analyses and the interest of students for them were all the time much higher than it could be deduced from Tables 1 and 2. Beside the mentioned projects, several seminars with a lot of laboratory work were also organised each year, especially for the youngest students (age 15 and 16) who came to PSC for the first time. During these seminars they analysed many water samples by different methods.

Table 1. Student projects in chemistry and environmental chemistry during 1990-2001.

YEAR	CHEMISTRY	ENVIRONM.	WATER	SOIL	FOOD
1990	24	22	13	8	1
1991	27	21	9	5	7
1992	17	9	2	1	6
1993	16	9	6	0	3
1994	17	5	0	2	3
1995	10	7	2	1	4
1996	12	9	1	2	6
1997	17	11	0	2	9
1998	20	7	1	1	5
1999	9	9	1	1	7
2000	17	11	1	1	9
2001	20	12	0	0	12
TOTAL →	206	132	36	24	72

During the last ten years, projects became more complex and their quality was considerably improved. Project usually involved several substrates (two or three), for example food and soil, or water and soil. So, it was difficult to assign projects from this period with one (main) substrate. One of the best projects had the title "The influence of acid rains on the quality of soil and wheat".

Table 2. Student projects in environmental chemistry during 2002-2006.

YEAR	ENVIRONM.	WATER	SOIL	FOOD	MISCL.
2002	5	1	1	2	1
2003	8	1	0	6	1
2004	4	2	1	1	0
2005	6	1	1	4	0
2006	4	3	0	0	1
TOTAL →	27	8	3	13	3

Within the water analyses, several parameters were often determined by students: COD (chemical oxygen demand), nitrate, pH, calcium, magnesium, etc. (Fig. 1).

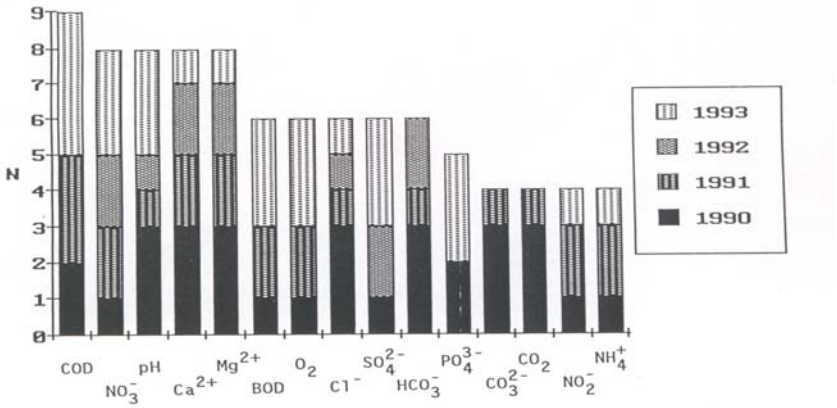

Figure 1. The number of student projects (N) studying specific parameters of water quality

Students from Petnica Science Center participated successfully several times at various international events such as London International Youth Science Fortnight. Students from Chemistry and Biology departments of PSC also got several awards for their environmental projects presented at "Bios-Olympiad". Well known scientist from Greece, Dr. Agni Vlavianos-Aravanitis, initiated this important international event which was organised annually near Sankt-Petersburg (Russian Federation) by professor Shishkin and Ladoga environmental club. Miss Danica Galonic (as the secondary school student, age 18) got the first prize in 1996 for the project "The influence of acid rains on the quality of soil and wheat". She later finished with excellent marks her studies at the Faculty of Chemistry of Belgrade University and got Ph.D. in USA. Students from Yugoslavia also participated several times at other international events such as International Competition "Young Europeans' Environmental Research". Some of their papers (e.g. paper of Miss Marta Kamenjicki) were published in Young Researcher - The European Journal of Science and Technology [6].

Foreign visitors (students and/or educators/researchers) were coming each year to Petnica Science Center even in the period of international sanctions. Usually they were coming mostly from neighboring country but also from Australia, Canada, Japan or USA. The purposes of these visits were realisation of projects (for students), the exchange of views or sharing the experience (for researchers/educators).

International activities were always important in Petnica Science center. They included participation of the best students from PSC (and their projects) at various international youth events (science fairs, exhibitions, competitions), short study visits to foreign research institutes (usually on the occasion of some international summer course), hosting of visitors from foreign countries in PSC (students and/or educators/researchers).

Teacher training courses were organised occasionally in the period 1982-1997. After 1998 additional and systematic efforts were undertaken in this direction. Teacher

Resource Center (TRC) was founded in PSC with collection of carefully selected books, textbooks, manuals, software, videotapes, etc. The number of courses for various teachers was considerably increased. For example, 34 courses with 775 participants were organised in Chemistry department of PSC in the period of 1998-2010. Each course lasted about one week. The emphasis was on active teaching methods, problem solving, project method, role-playing, organisation of out-of-school activity, how to achieve scientific and technological literacy of students, etc. Teachers were encouraged to use computers, multimedia and Internet. Examples of software suitable for use in schools were demonstrated. Attention was also given for teaching about chemistry and environment (global warming, ozone layer, new formulations for detergents, etc.) as well as chemistry and health/medicine.

Educational activities in Petnica Science Center were highly appreciated by students teachers, schools and universities. Dr. Aleksandar Despic, Vice-president of the Serbian Academy of Sciences and Arts, wrote [7]: "On the occasion of the tenth anniversary of Petnica Science Center, one very successful fulfillment of an extremely high-minded idea should gain recognition and appreciation which it has deserved; those dedicated, determined and highly able people who made that idea come true, should also be commended……Petnica represents a precious point of interchange between the world of young and the world of those who have a great experience. The PSC spreads out a peculiar spirit – the one we miss so much at our present situation. That is its remarkable mission….. Petnica distinguished itself through its results and gained right of being indisputable and irreplaceable today. The Serbian Academy of Sciences highly appreciates the work of PSC… That's why it became the founder of PSC.…".

It is also very interesting to find how students, participants in the educational programmes realised in Petnica Science Center, evaluate various aspects of their activity in PSC. Each year students are asked to fill out anonymous questionnaires about their impressions and estimation of educational programs and their personal experience in Petnica Science Center. They had to estimate several elements of the program with the marks 1-5 (5 being best). In 2000, the program, teaching methods and individual student activities got the average marks 4.27, 4.33 and 4.34, respectively. The quality of lecturers was marked with somewhat higher score (4.61) as well as for the program leaders (4.58). The living facilities got average score of 4.00, while the value for food was the lowest (3.12). The total number of participants was 801 and they gave the average mark 4.43 for the entire program including boarding, accommodation and extracurricular activities.

CONCLUSIONS

In the period of 1982-2010, Petnica Science Center (PSC) gave significant contribution to science education, chemical education and environmental education. Many students realised successfully their projects in PSC.

The share of environmental projects was usually very high. In some periods it was up to 64% of all projects realised in Chemistry department of PSC. Among them the project of water analyses always had important share. During the last few years

environmental projects became gradually more complex and their quality was considerably improved.

Methodology for preparation of students and realisation of projects was continuously improved, from large team projects to individual student projects of high quality. The best student projects produced in PSC were on a level with similar achievements in other European countries.

Teacher training courses and international activities were always important for Petnica Science Center.

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INDUSTRIAL HAZARDOUS WASTE SAMPLING – PART I

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ABSTRACT

Testing and characterization of waste are key elements of waste management. The paper presents some of the sampling methods, sampling procedures, which may adversely affect the outcome of measurements. The sampling methods in terms of impact on the representative sample and reliability of measurement are shown.

Keywords: industrial waste, sampling, method

INTRODUCTION

One of the key stage in testing of industrial waste is a sampling. Procedures, methods, personnel, equipment and environmental factors may significantly affect on the sampling operation, which results in obtaining the results of measurements that do not correspond to reality.

"Representative sample - a sample resulting from a sampling plan that can be expected to adequately reflect the properties of interest of the parent population. A representative sample may be a random sample or, for example, a stratified sample, depending upon the objective of sampling and the characteristics of the population. The degree of representativeness of the sample may be limited by cost or convenience"[1].

Sampling is the physical collection of a representative portion of the universe or whole of a waste or waste treatment residual. For a sample to provide meaningful data, it is imperative that it reflect the average properties of the universe from which it was obtained, that its physical and chemical integrity be maintained, and that it be analyzed within a dedicated quality assurance program. Sampling and analysis often is employed to make a hazardous waste determination, to determine if a waste is subject to treatment or, if so, has been adequately treated, or for routine monitoring.

A hazardous waste is defined as a solid waste, or a combination of solid wastes which, because of its quantity, concentration, or physical, chemical, or infectious characteristics, may cause, or significantly contribute to an increase in mortality or an increase in serious irreversible or incapacitating reversible illness, or pose a substantial

present or potential hazard to human health or the environment when improperly treated, stored, transported, disposed, or otherwise managed.

There are different approaches to waste sampling and determination of its features and classification in a group of hazardous waste or non-hazardous waste. The most important step in sampling is to provide a representative sample. The regulations only say a "representative sampling" should be collected. Because of the physical form of this waste, composite samples may be difficult to test, so individual grab samples should be used. If some of the waste proves to be characteristically hazardous, we will need to consult a statistician on an appropriate design to assure the level of confidence you need to make a decision on the hazard posed by the entire waste. As an initial step, use judgmental sampling of the different types of filter waste.

If a representative sample of each component of the waste is collected and tested, this addresses the representativeness, comparability, and completeness criteria for the entire waste. If each of these components is non-hazardous, then the entire waste is non-hazardous.

Solid wastes are defined by regulation as hazardous wastes in two ways. First, solid wastes are hazardous wastes if are in the lists them as hazardous wastes. The lists of hazardous wastes are found in wastes listed in Annex VIII LIST A Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal.

Solid wastes are hazardous if they exhibit any of the following four characteristics of a hazardous waste:

- ✓ -ignitability,
- ✓ -corrosivity,
- ✓ -reactivity, or
- ✓ -toxicity (based on the results of the Toxicity Characteristic Leaching Procedure, or TCLP).

Persons who generate a solid waste first must determine if the solid waste is excluded from the definition of hazardous waste, use of Annex III to demonstrate that a waste is not hazardous pursuant to Article 1, paragraph 1 (a), of Basel Convention. The generator determines that a solid waste is not excluded, then generator must determine if the waste meets one or more of the hazardous waste listing descriptions and determine whether the waste is mixed with a hazardous waste, is derived from a listed hazardous waste, or contains a hazardous waste, exhibits a characteristic of a hazardous waste.

This evaluation involves testing the waste or using knowledge of the process or materials used to produce the waste.

When testing a solid waste to determine if it should be characterized as a hazardous waste or to determine if the waste is restricted from land disposal, such a determination must be made at the **point of waste generation**.

METHODS OF SAMPLING MATERIAL FROM A MOVING STREAM, STATIONARY BATCH AND UNIT OF MATERIAL

Obtaining the Correct Shape and Orientation of a Sample

When sampling materials, particularly heterogeneous, which is a common case when it comes to waste, the shape and orientation of the sampling device can affect the

composition of the resulting samples and facilitate or impede achievement of data quality objectives.

The following two subsections provide guidance on selecting the appropriate shape and orientation of samples obtained from a moving stream of material and a stationary batch or unit of material.

Sampling of a Moving Stream of Material

In sampling a moving stream of material, such as solids, liquids, and multi-phase mixtures moving through a pipe, on a conveyor, etc., the material can be treated as a one-dimensional mass. That is, the material is assumed to be linear in time or space.
The correct or "ideal" sample is an undisturbed cross section delimited by two parallel planes. The approach is depicted in Figure 1 in which all of the flow is collected for part of the time. In practice, the condition can be met by using "cross-stream" sampling devices positioned at the discharge of a conveyor, hose, duct, etc.

Alternatively, in sampling solids from a conveyor belt, a transverse cutter or flat scoop (with vertical sides) can be used to obtain a sample, preferably with the conveyor stopped (though this condition may not be practical for large industrial conveyors).
For sampling of liquids, if the entire stream cannot be obtained for a fraction of the time (e.g., at the discharge point), then it may be necessary to introduce turbulence in the stream using baffles and to obtain a portion of the mixed stream part of the time [2].

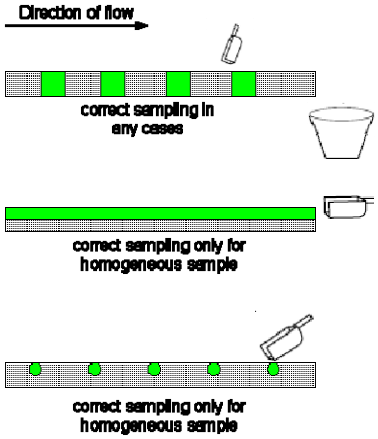

Figure 1. Three ways of obtaining a sample from a moving stream.

Sampling of a Stationary Batch of Material

Sampling of a stationary batch of material, such as filter cake in a roll-off bin, soil in a drum, or liquid in a tank can be approached by viewing the three-dimensional space as a series of overlapping two-dimensional (i.e., relatively flat) masses in a

horizontal plane. The correct or "ideal" sample is a core that obtains the full thickness of the material of interest.

Figure 2 shows a bin of granular waste with fine grain material in the upper layer and larger fragments in the bottom layer. Coring device "A" is correct: it is wide enough and long enough to include the largest fragments in the waste. Coring device "B" is too narrow. It either fails to capture the larger particles or simply pushes them out of the way (causing *increment delimitation error*). Device "C," a trowel or small shovel, can collect an adequate volume of sample, but it preferentially selects only the finer grained material near the top of the bin. Device "D" is the correct shape, but it is not in the correct orientation. Devices "B," "C," and "D" yield incorrect sample support.

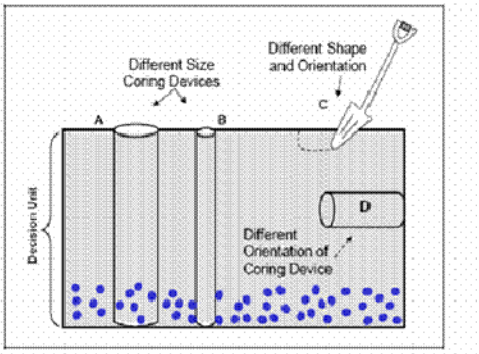

Figure 2. Sampling a three-dimensional waste by treating the sampling problems as a series of overlapping two-dimensional wastes.

Simple Random Sampling

This is the most important principle behind reliable sampling. Only a random sample will guarantee an unbiased result. The definition of a random (or probability) sample is that every member of the population concerned should stand an equal chance of ending up in the sample, hence no bias. This method is recommended for small sample sizes but to randomly select each member of a large sample from those remaining on the list would be very time consuming. To save time it is perfectly acceptable to use a systematic random sample.

Random sampling (without replacement) is sampling, in which every possible sampling unit in the target population has an equal chance of being selected. Random samples, like the other samples, can be either samples in space or in time and are often appropriate at an early stage of an investigation in which little is known about nonrandom variation within the waste generation process or the site. All of the sampling units should have equal volume or mass, and ideally be of the same shape and orientation if applicable. With a random sample, the term "random" should not be interpreted to mean haphazard; rather, it has the explicit meaning of equiprobable selection. One possible disadvantage of pure random sampling is that localized clustering of sample points can occur. If this occurs, one option is to select a new random time or location for

the sample. Spatial or temporal biases could result if unknown trends, patterns, or correlations are present. In such situations, stratified random sampling or systematic sampling are better options.

Stratified Random Sampling

In stratified random sampling, a heterogeneous unit, site, or process is divided into nonoverlapping groups called strata. Each stratum should be defined so that internally it is relatively homogeneous (that is, the variability within each stratum is less than the variability observed over the entire population).

After each stratum is defined, then simple random sampling is used within each stratum. For very heterogeneous wastes, stratified random sampling can be used to obtain a more efficient estimate of the parameter of interest (such as the mean) than can be obtained from simple random sampling. It is important to note that stratified random sampling, can be used when the objective is to make a decision about the whole population or decision unit.

If the objective is to determine of a solid waste is a hazardous waste or to measure attainment of a treatment standard for a hazardous waste, then any obvious "hot spots" or high concentration wastes should be characterized separately from low concentration wastes to minimize mixing of hazardous waste with nonhazardous wastes and to prevent impermissible dilution. If the objective of the sampling effort is to identify nonrandom spatial patterns (for example, to create a map of contamination in shallow soils), then consider the use of a geostatistical technique to evaluate the site. In stratified random sampling it is usually necessary to incorporate prior knowledge and professional judgment into a probabilistic sampling design. Generally, wastes or units that are "alike" or anticipated to be "alike" are placed together in the same stratum. Units that are contiguous in space (e.g., similar depths) or time are often grouped together into the same stratum, but characteristics other than spatial or temporal proximity can be employed. For example, you could stratify a waste based on particle size (such that relatively large pieces of contaminated debris are assigned to one stratum and unconsolidated fines assigned to a separate stratum). This is called stratification by component. In stratified random sampling a decision must be made regarding the allocation of samples among strata. When chemical variation within each stratum is known, samples can be allocated among strata using optimum allocation in which more samples are allocated to strata that are large, more variable internally, or cheaper to sample. An alternative is to use proportional allocation. In proportional allocation, the sampling effort in each stratum is directly proportional to the size (for example, the mass) of the stratum. There are several advantages to stratified random sampling. Stratified random sampling:

- ✓ Ensures more uniform coverage of the entire target population.
- ✓ Ensures that subareas that contribute to overall variability are included in the sample
- ✓ Achieves greater precision in certain estimation problems
- ✓ Generally will be more cost-effective than simple random sampling even when imperfect information is used to form the strata.

There are also some disadvantages to stratified random sampling. Stratified random sampling is slightly more difficult to implement in the field and statistical calculations for stratified sampling are more complex than for simple random sampling (e.g., due to the use of weighting factors and more complex equations for the appropriate number of samples) [3, 4, 5].

Systematic Sampling

Systematic sampling over space involves establishing a two-dimensional grid of the unit or waste under investigation. The orientation of the grid is sometimes chosen randomly and various types of systematic samples are possible. For example, points may be arranged in a pattern of squares (rectangular grid sampling) or a pattern of equilateral triangles (triangular grid sampling). The result of either approach is a simple pattern of equally spaced points at which sampling is to be performed. As shown in systematic sampling also can be conducted along a transect (every five feet, for example), along time intervals (every hour, for example), or by flow or batches (every 10,000 gallons, for example). The systematic sampling approach is attractive because it can be easily implemented in the field, but it has some limitations such as not being truly random. We can improve on this sampling design by using random sampling within each grid block or within each time interval. This approach maintains the condition of equiprobability during the sampling event and can be considered a form of stratified random sampling in which each of the boundaries of the strata are arbitrarily defined (rather than using prior information) and only one random sample is taken per stratum. This approach is advantageous because it avoids potential problems caused by cycles or trends.

Systematic sampling also is preferred when one of the objectives is to locate "hot spots" within a site or otherwise map the pattern of concentrations over an area (e.g., using geostatistical techniques). Even without using geostatistical methods, "hot spots" or other patterns could be identified by using a systematic design. On the other hand, the systematic sampling design should be used with caution whenever there is a possibility of some type of cyclical pattern in the waste unit or process that might match the sampling frequency, especially processes being measured over time (such as discharges from a pipe or material on a conveyor) [6-10].

CONCLUSION

Before the selection of sampling methods, it is important to know the purpose of sampling, and the information we need as a result of the whole process of measurement. When it is known to us, with knowledge of the opportunities that each sampling method provides, it is easy to make a selection of method.

Random sampe method is recommended for small sample sizes but to randomly select each member of a large sample from those remaining on the list would be very time consuming. To save time it is perfectly acceptable to use a systematic random sample.

Stratified random sampling, can be used when the objective is to make a decision about the whole population or decision unit.

Person who perform sampling procedure must always be guided by the basic principle, namely that the resulting sample is representative, ie a sample resulting from a sampling plan can be expected to adequately reflect the properties of interest of the parent population.

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INDUSTRIAL HAZARDOUS WASTE SAMPLING – PART II

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ABSTRACT

Using information from a set of samples (such as measurements of chemical concentrations) and the tools of inductive statistics, inferences can be made about the population. The validity of the inferences depends on how closely the samples represent the physical and chemical properties of the population of interest. For these reasons it is equally important role of sampling and analysis processes that follow. The sampling methods such as: ranked set sampling, sequential sampling, authoritative sampling, composite sampling, transect sampling and background sampling are shown, in terms of impact on the representative sample and reliability of measurement.

Keywords: industrial waste, sampling, method

INTRODUCTION

Some method shown in literarure has shown convenience of application of certain methods of sampling: Random sample method is recommended for small sample sizes but to randomly select each member of a large sample from those remaining on the list would be very time consuming. To save time it is perfectly acceptable to use a systematic random sample.

Stratified random sampling, can be used when the objective is to make a decision about the whole population or decision unit.

The paper presents other methods of sampling, which are suitable or recommended for other cases of sampling of solid materials, when there are different requirements of sampling or different purpose.

When testing a solid waste to determine if it should be characterized as a hazardous waste or to determine if the waste is restricted from land disposal, such a determination must be made at the **point of waste generation** [1].

METHODS OF SAMPLING MATERIAL

Ranked Set Sampling

Ranked set sampling (RSS) can create a set of samples that at a minimum is equivalent to a simple random sample, but can be as much as two to three times more

efficient than simple random sampling. This is because RSS uses the availability of expert knowledge or an inexpensive surrogate measurement or auxiliary variable that is correlated with the more expensive measurement of interest. The auxiliary variable can be a qualitative measure, such as visual inspection for color or an inexpensive quantitative (or semi-quantitative) measure that can be obtained from a field instrument such as a photoionization detector for volatile organics or an X-ray fluorescence analyzer for elemental analysis. RSS exploits this correlation to obtain a sample that is more representative of the population than would be obtained by random sampling, thereby leading to more precise estimates of the population parameters than random sampling. RSS is similar to other probabilistic sampling designs such as simple random sampling in that sampling points are identified and samples are collected.

In RSS, however, only a subset of the samples are selected for analysis. RSS consists of creating m groups, each of size m (for a total of "m x m" initial samples), then ranking the surrogate from largest to smallest within each group. One sample from each group is then selected according to a specified procedure and these m samples are analyzed for the more expensive measurement of interest (Figure 1). The true mean concentration of the characteristic of interest is estimated by the arithmetic sample mean of the measured samplesby

Equation 1 [2,3]:

$$\bar{x} = \frac{1}{n}\sum_{i=1}^{n} x_i \qquad (1)$$

The population variance and standard deviation also are estimated by Equations 2 and 3:

$$s^2 = \frac{1}{n-1}\sum_{i=1}^{n} (x_i - \bar{x})^2 \qquad (2)$$

$$s = \sqrt{s^2} \qquad (3)$$

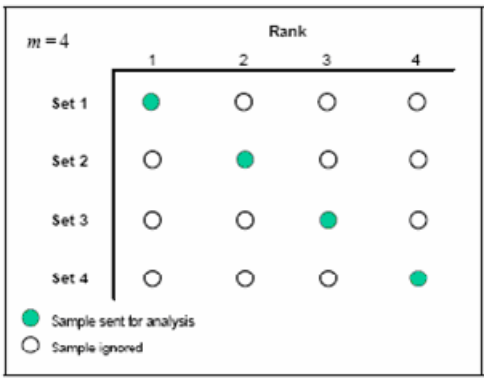

Figure 1. Ranked set sampling

Sequential Sampling

➢ In sequential testing procedures, sampling is performed by analyzing one (or more) sample(s) at a time until enough data have been collected to meet the statistical confidence level that the material does not exceed the critical level. The expected sample size, using this sequential procedure, can be approximately 30- 60-percent lower than a corresponding fixed sample size test with the same power. The sequential procedure is especially helpful in situations in which the contamination is very high or very low relative to the action level. In these situations, the sequential procedure will quickly accumulate enough evidence to conclude that the waste or site either meets or fails to meet the standard. Figure 2 shows how the procedure operates in a simple example for determining the mean concentration of a constituent of concern in soil.

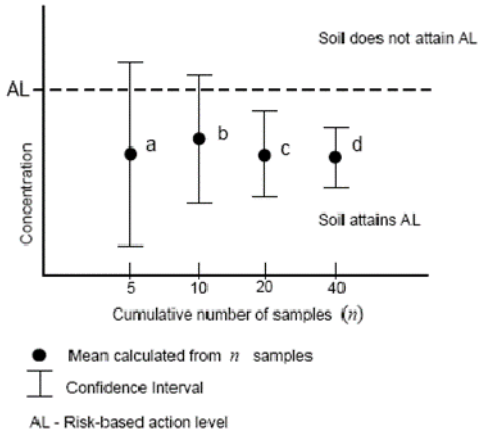

Figure 2. Example of sequential testing for determining if concentrations of a constituent of concern in soil at a closed waste management unit are below a risk-based action level (AL)

This particular example involves clean closure of a waste management unit, however, the approach could be used for other situations in which the mean is the parameter of interest. The procedure consists of analyzing groups of samples and calculating the mean and 80-percent confidence interval (or upper 90-percent confidence limit) for the mean after analysis of each group of samples. The horizontal axis represents the number of sample units evaluated.

The vertical axis represents the concentration of the contaminant; plotted are the mean and 80-percent confidence interval after analysis of **n** samples. The Action Level , against which the sample is to be judged, is shown as a horizontal line. The sampled units are analyzed first in a small lot (e.g., five samples).

After each evaluation the mean and confidence interval on the mean are determined (point "a"). If the 90-percent upper confidence limit on the mean value stays above the critical value, Action Level , after successive increments are analyzed, the soil in the unit cannot be judged to attain the action level (point "b"). If the upper confidence limit goes below that the soil attains the standard. In the figure, the total number of samples is successively increased until the 90-percent upper confidence limit falls below the critical level (points "c" and "d"). A sequential sampling approach also can be used to test a percentile against a standard. In sequential sampling, the number of samples is not fixed a priori; rather, a statistical test is performed after each analysis to arrive at one of three possible decisions:

- reject the hypothesis,
- accept the hypothesis, or
- perform another analysis.

This strategy is applicable when sampling and/or analyses are quite expensive, when information concerning sampling and/or measurement variability is lacking, when the waste and site characteristics of interest are stable over the time frame of the sampling effort, or when the objective of the sampling effort is to test a specific hypothesis. It may not be especially useful if multiple waste characteristics are of interest or if rapid decision making is necessary. In planning for a sequential sampling program, the following considerations are important:

- ✓ Pre-planning the effort between the field and laboratory, including developing a system of pre-planned paperwork and sample containers
- ✓ Arranging for a system of rapid delivery of samples to the laboratory
- ✓ Providing rapid turnaround in the laboratory
- ✓ Rapidly returning data to the planners, supervisors, and others responsible for decision making.

If the sequential sampling program is carried out using field methods (e.g., portable detectors), much of the inconvenience involved with shipping and return of results can be avoided [4, 5].

Authoritative Sampling

Authoritative sampling is a nonstatistical sampling design because it does not assign an equal probability of being sampled to all portions of the population. This type of sampling should be considered only when the objectives of the investigation do not include the estimation of a population parameter. For example, authoritative sampling might be appropriate when the objective of a study is to identify specific locations of leaks, or when the study is focused solely on the sampling locations themselves. The validity of the data gathered with authoritative sampling is dependent on the knowledge of the sampler and, although valid data sometimes can be obtained, it is not recommended for the chemical characterization of wastes when the parameter of interest (such as the mean) is near the action level.

Authoritative sampling (also known as judgmental sampling, biased sampling, nonprobability sampling, nonstatistical sampling, purposive sampling, or subjective sampling) may be appropriate under circumstances such as the following:

- ✓ We need preliminary information about a waste stream or site to facilitate planning or to gain familiarity with the waste matrix for analytical purposes.
- ✓ We need to identify a potential or actual release to the environment.
- ✓ We have encountered a spill of an unknown chemical and need to determine the chemical makeup of the spilled material.
- ✓ We have access to only small portions of the population and judgment is applied
  to assess the usefulness of samples drawn from the small portion.
- ✓ We are screening samples in the field, using an appropriate field method, to identify "hot" samples for subsequent analysis in a laboratory.
- ✓ We are sampling to support case development for an enforcement agency or to "prove the positive".

With authoritative sampling, it is not possible to accurately estimate the population variance. Also, due to its subjective nature, the use of authoritative sampling by the regulated community to demonstrate compliance with regulatory standards generally is not advisable except in those cases in which a small volume of waste is in question or where the concentration is either well above or well below the regulatory threshold. According to standards two types of authoritative sampling are recognize: judgmental sampling and biased sampling (ASTM D 6311).

Judgmental Sampling

The goal of judgmental sampling is to use process or site knowledge to choose one or more sampling locations to represent the "average" concentration or "typical" property. Judgmental sampling designs can be cost-effective if the people choosing the sampling locations have sufficient knowledge of the waste. If the people choosing the sampling locations intentionally distort the sampling by a prejudiced selection, or if their knowledge is wanting, judgmental sampling can lead to incorrect and sometimes very costly decisions. Accurate and useful data can be generated from judgmental sampling more easily if the population is relatively homogeneous and the existence of any strata and their boundaries is known. The judgmental sampling is known, because of his disadvantages also in term "discrete sample" to refer to an individual sample that is used to form a composite sample. or "grab sample."

Disadvantages of judgmental sampling are:

- ❖ It can be difficult to demonstrate that prejudice was not employed in sampling location selection
- ❖ Variances calculated from judgmental samples may be poor estimates of the actual population variance
- ❖ Population statistics cannot be generated from the data due to the lack of randomness.

Biased Sampling

Biased sampling is the type of authoritative sampling that intends not to estimate average concentrations or typical properties, but to estimate "worst" or "best" cases (ASTM D 6051-96). The term "biased," as used here, refers to the collection of samples with expected very high or very low concentrations. For example, a sample taken at the source of a release could serve as an estimate of the "worst-case" concentration found in the affected media. This information would be useful in identifying the constituent of concern and estimating the maximum level of contamination likely to be encountered during a cleanup.

At times, it may be helpful to employ a "best case" or both a "best-case" and "worst-case" biased sampling approach. If there is a range of wastes and process knowledge can be used to identify the wastes likely to have the lowest and highest contamination levels, then these two extremes could be sampled to help define the extent of the problem. Biased sampling has similar disadvantages to that of judgmental sampling.

Composite Sampling

Composite sampling is a strategy in which multiple individual or "grab" samples (from different locations or times) are physically combined and mixed into a single sample so that a physical, rather than a mathematical, averaging takes place. Figure 3 illustrates the concept of composite samples. For a well-formed composite, a single measured value should be similar to the mean of measurements of the individual components of the composite. Collection of multiple composite samples can provide improved sampling precision and reduce the total number of analyses required compared to noncomposite sampling. This strategy is sometimes employed to reduce analysis costs when analysis costs are large relative to sampling costs. To realize the full benefits of composite sampling, field and laboratory personnel must carefully follow correct procedures for sample collection, mixing, and subsampling [6-10].

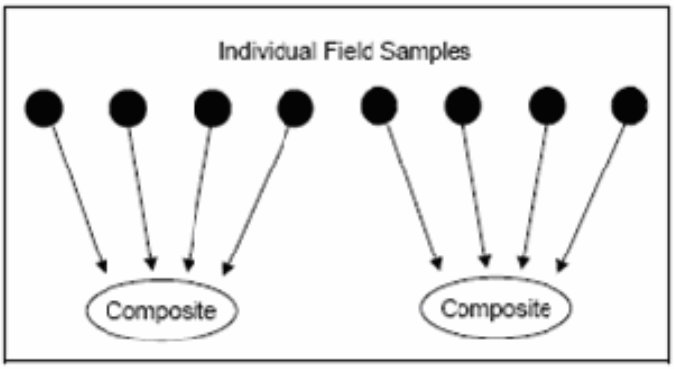

Figure 3. *Forming composite samples from individual samples*

Point-quarter sampling

Point-quarter sampling is complex sampling and concept is in an attempt to reduce the amount of intensive labor involved in sampling procedure. Point-quarter sampling involves generating a random number of points in an area and then for each point, the nearest population of waste in each of the four quadrants surrounding the point is noted. The distance from each random point to the nearest population can also be measured and used as an indicator of the dispersion of the sample (Figure 4). Replicate samples (points) are also necessary for the point-quarter sampling method [11].

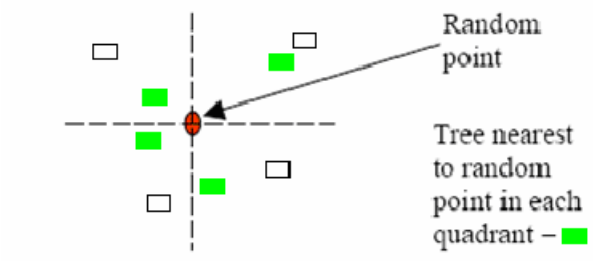

Figure 4. Point-quarter sampling

Transect sampling

To implement this technique, the investigator establishes a line (i.e. the transect line) between two points. There are several ways to conduct a transect sample. All individuals on the transect line may be counted and their position along the transect recorded, or, all individuals may be counted within a given distance of the transect line and their distances along and to the side of the line recorded. It is also common to place quadrats at specific distances along the transect and collect data within each quadrat. As with plot and point-quarter samples, it is usually important to have replicate transects within the same area. The line transect technique is used primarily to collect data along a gradient of some sort. For example, a line transect may be placed running from the shore of a lake, extending out into the lake to see changes with distance from the shore (Figure 5).

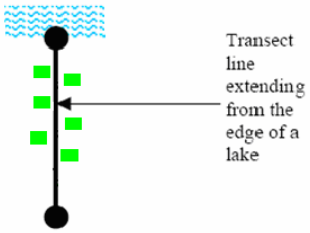

Figure 5. Transect sampling

Background sampling

In special cases, when is necessary to determine the impact of an object on the environment or continuous monitoring is applied Background sampling. Background samples are samples collected at or near the waste site in areas not influenced by site contamination. It demonstrates the ambient concentrations of a substance from both naturally occurring and anthropogenic non-site sources.

Background samples are collected from each media of concern: soil, sediment, surface water, groundwater, and air. The sample locations should have the same basic characteristics as the medium at the site. The number of background samples is site specific and dependent on the media sampled, the type of contaminant, and the availability of background sample locations. The number of samples should, however, be sufficient enough to reduce or eliminate the potential determination that concentrations of a constituent at the site are higher than background when in they in fact fall within the range. It should be understood that a difference in the concentration of background samples and site samples should not, in itself, trigger a cleanup action at the site. It indicates that further evaluation of the data must be completed [12].

CONCLUSION

Before the selection of sampling methods, it is important to know the purpose of sampling, and the information we need as a result of the whole process of measurement. When it is known to us, with knowledge of the opportunities that each sampling method provides, it is easy to make a selection of method.

The sequential procedure is especially helpful in situations in which the contamination is very high or very low relative to the action level. In these situations, the sequential procedure will quickly accumulate enough evidence to conclude that the waste or site either meets or fails to meet the standard

When we need preliminary information about a waste stream or site to facilitate planning or to gain familiarity with the waste matrix for analytical purposes, then we supplied authoritative sampling.

In special cases, when is necessary to determine the impact of an object on the environment or continuous monitoring is applied Background sampling.

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INTERACTIVE TEACHING ENVIRONMENTAL EDUCATION IN THE NATURAL SCIENCES IN RELATION TO PRESERVATION OF THE GREATEST NATURAL TREASURES IN YOUR CITY

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ABSTRACT

Ginko biloba, as well as teaching units, can be used for a broader study of eco-dendrological status of a region or environment. As part of regular teaching and non-teaching activities, the theme of environmental education and environmental monitoring is education depending biological balance. Therefore, teaching chemistry and biology should be focused on studying the facts, which explain the appearance of variable factors interact in nature. It achieve selection of useful and interesting topics. Ginko biloba is one of those topics and can be used in the implementation of active and interactive teaching, using the latest teaching aids and methods. Traditional teaching is the basis of knowledge of facts applicable in today's pharmacy, which is based on natural products chemistry and biology. Environmental factors influence the growth of Ginko trees bilobe, extracts of certain plant parts (leaf and fruit) contain alkaloids, which are under strict eating regime. To master such a sensitive subject, it is necessary in teaching a unit of study Ginko biloba, to introduce education about chemical and physiological properties of compounds based on extracts of Ginko biloba. Classes start locating the place where the Ginko biloba cultivated or growing wild, and description of properties of Ginko tree, and at the end of the students themselves to study compounds on the basis of Ginko, under the strict supervision of professors and instructors.

Keywords: Interactive Teaching, Enviromental Education, Preservation, Greatest Natural Treasures

INTRODUCTION

Natural Treasure is designed to enhance young people's outdoor experiences. All that is needed is a map and a sense of adventure. To begin, participants will simply pick up an entry form and map at the respective park. They will then set off to locate special Get to Know hieroglyph stations hidden on or near a designated trail.

Once the participant has taken impressions of each hieroglyph on their entry form, they will be able to go online and access the next stage of the adventure on the

Natural Treasure website. Each hieroglyph unlocks a series of challenges that provide insight into the natural world, and each challenge brings the participant closer to solving the final riddle, and unlocking the natural treasure. Along the way, participants will be able to earn rewards and incentives that they will later be able to use in a number of creative ways – but only after they have solved the final challenge.

By discovering their wild neighbors through exploration and adventure, young people will be better equipped to appreciate and respect their natural surroundings, leading to a deeper desire to preserve the environment.

In Novi Sad there are specialized sports and Science Club "Skaut", which deals with drawing and printing maps, orientation running, organizing lectures about reference in nature. Since Novi Sad, especially around his narrow abundant natural resources, this program is a rich and international in character. In the organizational sense, the most valuable cooperation between the Novi Sad "Skaut", Novi Sad Marathon, Mountaineering Society "Željezničar" and several environmental organizations and initiatives. Attention is paid to the hidden natural treasures, which can be found in Novi Sad parks, National Park Fruška gora, Petrovaradin-Kaćki rit and in the surrounding farms, dealing with traditional agriculture. In the Novi Sad parks can be found various kinds of trees, of which the most respected ones that have medicinal fruits or leaves, and the wild.

In particular, the price of Ginko-biloba, Acacia and Mulberry. Ginko has been cultivated in East Asia for hundreds of years. Numerous reports mention the existence of large specimens, some more than a thousand years old, at ancient temples in Japan and China. For most specimens do not know when and who planted them, and it is possible to spread naturally. In Traditional China Medicine (TCM), Ginko seeds are more widely used. In Western botany, the tree was first observed in 1690 then described in 1712 by Englebert Kaempfer (*Figure 1.*), a German surgeon working for the Dutch East India Company. Kaempfer stayed two years in Japan, during which time he twice visited Edo, today Tokio and the Shogun Tokogawa Tsunayoshi there. When he visited Buddhistmonks in Nagasaki in February 1691, he was the first western scientist to describe the tree Ginko biloba- scientists at the time thought that all Ginkgo species were extinct. He brought some Ginko seeds back that were planted in the botanical garden in Utrecht and can still be seen today. During his stay in Japan, his tact, diplomacy and medical skill overcame the cultural reserve of the Japanese, and enabled him to elicit much valuable information. In November 1692 he left Japan for Jawa. After twelve years abroad, Kaemfper returned to Europe in 1695, landing at Amsterdam. He was awarded a medical degree at the University of Leiden in the Netherlands. Kaempfer settled down in his native city of Lemgo, where he became the physician of the Count of Lippe (Gramany, Nort Rhine Westphylia). In Germany he published the book *Amoenitatum exoticarum* (Lemgo 1712) which showed an illustration of a camelliaand introduced 23 varieties. Notable for its description of theelectric eel, acupuncture, and moxibustion. His systematic description of tea (as well as his other work on Japanese plants) was praised by Carl Linnaeus (1707-1778), who adopted the Kaempfer-devised nomenclature.

Figure 1. Englebert Kaempfer (1651-1716)

In Novi Sad there are two conflicting opinions, to save the untouched nature, should be done by urbanization, improved transportation and the whole city infrastructure. The aim of this paper is to find a compromise between these two extremes, in which environmental education has a significant role. That is why, in particular, proposed cooperation of teaching physical education, ecology, botany, hygiene, chemistry, physics and technical education.

MECHANISMS AND STRUCTURES OF COOPERATION WITH SPORTS ASSOCIATIONS TO INSTITUTIONS WHERE ENVIRONMENTAL EDUCATION IS DONE

The most important mechanism is an interactive teaching and active teaching, which is changing the layout, location and composition of the teaching staff. Provide the most important role the school doctor or dispensary, which thoroughly prepares students for leading a healthy life to maintain hygiene and to recognize the almighty risk factors that compromise, in particular, the urban population.

Secondly, a professor of physical education engage co-workers, if possible, from sports clubs, who organize sports events, day programs: cross-country competition, approximately running and movement in nature.

Only a third, engage teachers, and experts from the natural sciences. First, engage the botanist, who are well understood in the dendrological, and other wild plants, and zoologist, who have a great understanding of Ornithology, especially in indigenous species and beneficial insects that perform pollination and maintain biological balance.

It is also engaged professors of chemistry and physics, to detect and predict air pollution, water and soil and propose measures to remove result of pollution. Given that this is a higher grade Elementary School "Prva vojvođanska brigada", they are paying attention to such pollutants that cause acid rain, drying green area and causing respiratory allergies, especially the upper parts, nose, throat, eyes, and allergy the whole body, in extreme cases. Urban structure of Novi Sad is that landscape architecture, and deep ecology, received a special role. This refers to the part of Novi Sad, which is located on the left and right bank of the Danube, located between the city of Novi Sad and area Futog village, between the city of Novi Sad area Kać and villages, and especially Rome moats, which are experimental farm of the Agricultural University of Novi Sad.

The structure of education of the group, in which the particular distributed problem-solving tasks. All students have the same form, teaching certificate, but their problems are strictly different, and their cooperation is occasional, just in case the exchange of relevant data or samples for testing. In the group are professional and responsible person, who after the preparatory activities, training and testing of theoretical knowledge, it is only an observer and, ultimately, has the right to intervene. According to the note indicated at the opening test, is elected leader of the group, which is responsible for successful execution of tasks. Its function is to coordinate movement, control of execution of tasks according to established schedule and to maintain discipline. In the event that there are such leaders, this role provide teacher, but it is regarded as the failure of interactive teaching.

Determines the number of groups specializing in sports team "Skaut", which prepares students for approximately movement in the city, urban and suburban environment. Scouts who are from among students or are attached to school teaching, are strictly uniform in the international association of "Skaut," but have other signs of recognition and signal devices: firecrackers, whistles, special lamps, talk-talkie, mobile phone. Scouts are not responsible for the physical safety of students, but they are required to coordinate the movement of students, so that they can not find in an emergency: a traffic accident, fall, drowning in water or loss of orientation in space, especially in the underground galleries Petrovaradin.

IDENTIFICATION OF GINKO BILOBA IN NATURE

Identification is necessary, before going to the countryside, look for the herbarium, as well as the collection of illustrations and photographs Ginko biloba leaf (*Figures* 2,3). It is necessary to make several measurements of the dimension leaf that irregular shape, has two varieties, with uninterrupted contour and a wedge-shaped notch in the outline leaf (*Figures* 2, 3, 5 and 6). In the event that the group has a laptop, it is easier to identify because it is possible to enter the full gallery of various parts of Ginko biloba. In the case of Ginko biloba tree characteristic features leaf is the best for identification.

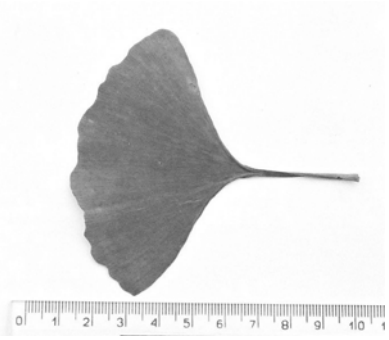

Figure 2. Ginkgo leaf

Figure 3. Ginkgo leaf

Figure 4. Alternaria sp. From Ginko leaf

Figure 5. Ginkos leaf in herbarium

Figure 6. Illustration of Ginko

The second step is the registration of Ginko biloba any locations where there is a park, like the arboretum (*Figure* 7-13). In all four seasons is necessary to record the look of the whole tree, while winter is mostly a leaf and therefore more attention should focus on the damaged trees. It is expected that this kind of suffering damage resistant only in urban neighborhoods where air pollution is the biggest. Ginko biloba leaf, especially in the summer and autumn, a good ecological Valers for diagnosis plant diseases (*Figures* 4). The appearance of a healthy leaf shows the *Figures* 4, shows the plant disease that occurs in places where air and soil pollution is obvious. Any plant diseases is necessary to study a long time, because of soil contamination at the Novi Sad's parks.

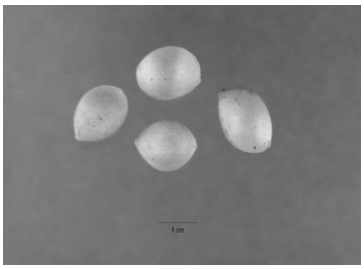

Figure 7. Ginkos seeds

Figure 8. Ginko biloba at autumn

Figure 9. Ginko biloba tree

Figure 10. Ginkos flower

Figure 11. Ginkos white berry

Figure 12. Ginkos yellow berry

Figure 13. Ginkos fruit

The next step is to measure the height and size of trees that need to be performed in summer at the stage of exuberant vegetation, and in winter with stripped branches. So you get the answer that the ecological environment, outside the city, where the pollution of water, air and soil less, affect the size, the growth of wood. This experiment must be long-lasting. Finally, a professor of chemistry, has in detail informed

about the composition chemical extract leaves, and fruits can Ginko biloba. This explanation is only possible at higher grades of secondary schools, which are different formulas of organic compounds and have information on the alkaloids (*Figures* 14).

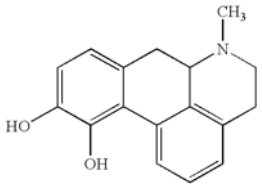

Figure 14. Apomorphin, as component of Ginkos extract

Lower grades should be emphasized only the kinds of alkaloids found in extracts of Ginko biloba and whose consumption is allowed only under medical supervision. In this case, you should pay attention to the commercial, semi-pharmaceutical and pharmaceutical preparations, such at Figures 15, 16, and Table 1. In this case, can achieve excellent cooperation between the professor of ecology, biology, school dispensaries and professor of chemistry. This should be the project assets of natural science in school, extended with a professor of physical education and school teachers. i Bilobas extracts from falling into the category of dopamine, which have specific physiological, psychological effects of their consumption can be a serious problem. Such an approach organize continue to achieve the goal of environmental education and education has a broader social significance.

Figure 15. Ginkos preparate as pills

Figure 16. Ginkos tictores

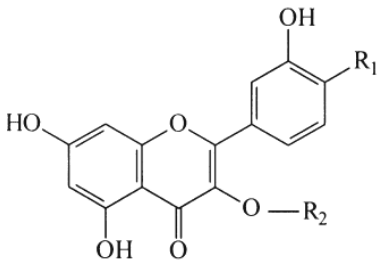

Table 1. Chemical content of Ginkos extract Flavonols

Flavonol	R_1	R_2
Rutin	OH	Rutinose
Quercitrin	OH	Rhamnose
Quercetin	OH	H
Kaempferol	H	H
Isorhamnetin	OCH_3	H

CONCLUSION

Ginko biloba is a topic that may time to time multidisciplinary and interdisciplinary approaches to students the importance of natural resources in everyday life, but also in science and education. In order to achieve the goal of multi-disciplinary education is necessary, with assets of natural science and related social organizations, to organize an active and interactive teaching, when it comes to such sensitive topics, such as alkaloids and medicinal herbs, including Ginko biloba is stressed.

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THE INFLUENCE OF THE TECHNICAL AND BIOLOGICAL WORKS ON THE INTENSITY OF EROSION PROCESSES IN DRAINAGE BASIN OF MELO TORRENTS

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ABSTRACT

This paper is aimed at the determination of the influence of biological and technological works on the mitigation of the intensity of the erosion processes in drainage basin of Melo torrent based on the analysis of the condition of the intensity of the erosion processes and sediment yield after the erosion control works were performed.

The study results showed that the current condition of the erosion processes in the drainage area are much different from the previous ones and that it is characterized by the considerable mitigation of the intensity of erosion and the sediment yield and transport.

Keywords: land use, erosion control works, erosion processes, sediment yield

INTRODUCTION

The system of the erosion control methods and works is the complex of the protective measures and methods aimed the control of the erosion processes and defense from the torrents. In the control of the soil erosion and defense from the torrents, several systems are applied, and each one refers to the combination of the erosion control measures and works, by which certain drainage basin is affected.

The oldest system which is applied is the classical European system based on the establishment of the transversal facilities in the bed of the torrents and the creation of the protective vegetation cover in all parts of the torrents, affected by the intensive erosion.

The impact of the technical activities in the bed is reflected in the decrease of the longitudinal bed slope and retained quantity of the sediment behind the transversal facilities, whereas the influence of the works conducted in the drainage basin is reflected by the change of the intensity of erosion, as well as by the change of the sediment yield.

This paper is aimed at the determination of the biological and technological works on the mitigation of the intensity of the erosion processes in drainage basin of Melo torrents based on the analysis of the condition of the intensity of the erosion processes and sediment yield after the erosion control works were performed. The

current condition of the erosion processes and the determined sediment yield (2009) were compared to the suitable parameters before the erosion control works were performed.

STUDY AREA AND METHOD

Melo is the third downstream tributary of the Trgoviski Timok River, which flows into it near Gornja Kamenica. The drainage basin of this torrent is located in the territory of the inhabited places Gornja Kamenica and Sesti Gabar. The source of it is located above Sesti Gabar and Srezovica hills, at 650 meters above the sea level. The direction of flow is southeast-northwest. The drainage basin area is 5.25 km^2. The main course is 4.8 km long, and the relative channel slope is 7.5%. In regard to the configuration, the drainage basin is very hilly, and the average slope gradient is 40%.

The researches presented in this paper included the following phases:

1) Collection and analysis of the existing documents and data on the condition of erosion before the beginning of erosion control works in the drainage basin of Melo torrent
2) Study of the natural characteristics of the drainage basin
3) Collection of data on the type and scope of implemented works
4) Assessment of condition and erosion intensity before the beginning of works
5) Assessment of condition and erosion intensity in 2009
6) Calculation of sediment yield before the beginning of works and in 2009

The natural characteristics of the drainage basin were studied based on the digital cartographic material and field studies.

The digital geological map of the drainage basin was made based on OGK scale 1:100,000.

The soil map is also digital, and it is based on the soil map of Serbia, scale 1:50,000.

The land use map representing the condition before the control works was constructed based on the collected technical documents, whereas the condition in 2009 was based on the topographic maps scale 1:25,000, satellite imagery, and direct field reconnaissance.

The analysis of climate data was based on the data collected by the Hydrometeorological Service of Serbia at the weather station Knjazevac and rain gauge stations Donja Kamenica and Kalna.

The condition of erosion in the drainage basin before the beginning of control works was taken from the existing documents.

The intensity and distribution of erosion processes in the drainage basin in 2009 were defined based on the digital erosion map which was constructed by Professor Gavrilovic's method using the satellite imagery and the reconnaissance of the field.

Sediment yield and sediment transport over the period before the beginning of control works and in 2009 were calculated by Gavrilovic's method.

RESULTS

The main drainage basin parameters which influence the development of erosion processes and sediment yield are presented in the Table 1

Table 1. Analysis of the natural characteristics of the study drainage basin

Parameter	Symbol	Melo torrent
Drainage basin area	F (km^2)	5.25
Drainage basin perimeter	O (km)	12.93
Drainage basin lenght	L (km)	4.8
Gavrilovic's coefficient of drainage basin shape	A	0.525
Module of drainage basin divide development	E	1.580
Morphological coefficient	n	0.228
Density of hydrographic network	G (km km^{-2})	1.863
Coefficient of drainage basin asymmetry	a	0.187
Coefficient of sinuosity	K	1.105
Drainage basin mean altitude	N_{sr} (m)	575.63
Mean altitudinal difference	D (m)	285.63
Mean slope of the drainage basin	I_{sr}	35.18%
Relative bed slope	I_t	9.8%
Equilibrium bed slope	I_{urt}	9.0%
Drainage basin potential during torrential water	P_{sl}(m km s^{-1})	171.53
Coefficient of erosion energy after Silvestrov	E_r(m $km^{-1/2}$)	102.42
Geomorphologic coefficient	M (m $km^{-2/3}$)	190.793

The presented parameters of the drainage basin point to the fact that the intensive erosion processes and sediment transport can be expected.

The parent rock in the drainage basin consists of sandstones, limestones and clayey rocks. Out of the types of soil in the drainage basin in the upper part the dystric cambisols are present, in the middle parts calcocambisols, and in the lower part fluvisols.

The mean air temperature over the multi-annual period at the climate station Knjazevac is 10.2^0C. The coldest month is January, with the mean monthly air temperature -1.2°C, whereas July is warmest with the mean monthly air temperature 20.5°C. Based on the mean annual precipitation for two rain gauge stations (Donja Kameica and Kalna) and the maps of the rain gauge coverage, the mean annual precipitation for the observed drainage basin is H_{sr} = 661.18 mm.

The drainage pattern in this is very well-developed. The main course receives 12 tributaries – 7 left and 5 right ones. The left tributaries are the following: Mrkonjin

do, Jaruga I, Jaruga II, Jevremov do, Suskin do, Strasno Bucje II i Strasno Bucje I, and right tributuares are the following: Srezavica, Kaskavi do I, Kaskavi do II, Jazanski do and Krsanski do. The bed is deeply carved into the limestones, sandstones and clayey rocks.

Before the erosion control works started, 33.52 % of the area in the drainage basin was devoid of the vegetation, 28.56% was covered by forests, whereas ploughland accounted for 37.92% of the total drainage basin area.

Table 2. Land use structure in 1955 and 2009

Year	Forests	Agricultural land	Bare land	Total
	%	%		%
1955	28.56	37.92	33.52	100.0
2009	38.81	58.52	2.67	100.0

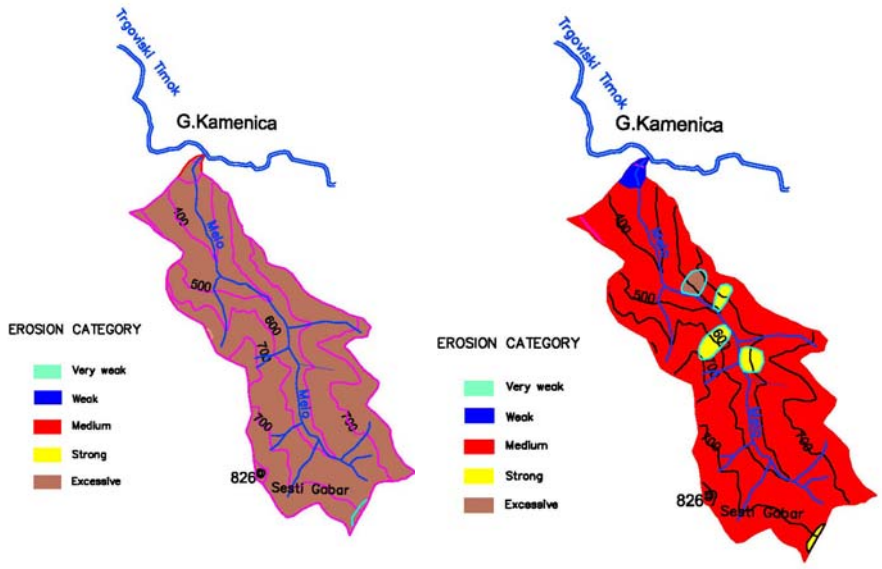
The current condition of land use indicates that the vegetation cover consists of the oak, hornbeam, linden, hazel, ash and beech forests, Austrian pine and black locust plantations (38.81%), agricultural land (mainly pastures and meadows and very small areas occupied by orchards and ploughland account for 58.52%), and the bare land accounts for 2.67% of the drainage basin.

The whole area of the drainage basin of Melo flood was subject to the processes of the excessive erosion over the previous period (in 1955). The mean coefficient erosion of the whole drainage basin was Z=1.25, which implies that it belonged to the first I category of erosion.

Table 3. The erosion condition and sediment yield in the drainage basin of Melo torrent in 1955 and 2009

Year	**Category of erosion**					Total	Z_{sr}	W_{year}
	Excessive	Intensive	Medium	Weak	Very weak			
	%	%	%	%	%	%		$m^3 year^{-1}$
1955	100.0	0.0	0.0	0.0	0.0	100.00	1.25	14 034.37
2009	2.67	4.95	91.24	1.14	0.0	100.00	0.58	5 098.47

The current condition of the erosion processes in the drainage basin is very different from the previous one and it is characterized by the considerable decrease of the intensity of erosion. Only 7.62% of the drainage basin area was subject to the processes of the I and II categories of erosion in 2009. The processes of the III category of erosion are dominant (medium erosion), since they cover 91.24% of the drainage basin area. The mean coefficient of erosion for the whole drainage basin is $Z_{sr} = 0.58$, which implies that the processes of the medium erosion, i.e. III category of erosion, are present in the drainage basin.



Erosion map for 1955 *Erosion map for 2009*

The works aimed at the reclamation of the erosion processes in Melo flood were performed over the period from 1955 to 1966. Over this period the works in the drainage basin and bed were performed.

The works performed in the drainage basin refers to the afforestation of the 137 hectares, out of which 65 hectares was afforested by the establishment of Austrian pine, and 72 hectares was afforested by the establishment of black locust.

Along with the afforestation, 25 hectares was covered by grass, and 14 hectares was covered by orchards, which implies the planting of walnut, pear and cherry seedlings. The afforestation and establishment of orchards were partly performed by using bench terraces, the total lenght of which is 44.7 km.

The works performed in the main course refer to the setting of 12 partitions, out of which 11 were made of cement mortar, and 1 from dry stone. In the tributaries 14 partitions and small stone partitions made of cement mortar, and 1 partition made of the dry stone, as well as 14 rustic stone partitions were set.

The works performed in the drainage basin and bed of Melo torrent had the favourable effect on the control of erosion in the drainage basin. The effect of the biological works is reflected in the mitigation of the intensity of the erosion processes and sediment yield in the drainage basin, which to a great extent improved the water regime in the Trgoviski Timok River.

The transversal facilities which were set in the main bed and tributaries prevented the degradation of the bed and run-off of the sides of the bed. The condition of the facilities is good and the great damages of the partitions have not been observed so

far. The floodplains are filled by the sediment which underpinned the banks, raised the bed and prevented the further sliding of the banks. The processes of the erosion of the bed sides was stopped, which also implies the stopping of the sediment yield from the bed. The volumes of the floodplans near some partitions are different and range from 350.32 – 33,610.34m^3.

The estimation of the sediment yield over the period before the erosion control works were performed in the bed and drainage basin of Melo torrent, and in 2009 the results show that the sediment yield after the works were performed decreased almost by third of the initial value, which proves that the technical and biological works performed in the drainage basin considerably contributed to the mitigation of the intensity of erosion, sediment yield and transport in the drainage basin of Melo torrent.

Along with the control erosion works, the mitigation of the intensity of erosion and sediment yield, is also the result of the demographic processes of the rural population in the region of the drainage basin of the Trgoviski Timok River, which is characterized by the permanent decrease of population and number of households, as well as by the decrease of the number of the members of households. All rural inhabited places are subject to the processes of aging, which is the result of the decreased population growth rate and negative migration balance, i.e. migration of the working age population. This continued depopulation and considerable aggravation of the age structure of the rural population disturbed the demographic vitality and work potential of the rural population. Many areas which used to be arable are now turned into the bemired ploughland, meadows and forest areas. This change of the way in which soil is used led to the mitigation of the intensity of erosion and sediment yield.

CONLUSION

The study results showed that the technical and biological works contributed to the considerable mitigation of the intensity of erosion, as well as to sediment yield and transport in the drainage area of Melo torrent.

Over the period before the erosion control works were performed, the whole drainage basin area was subject to the processes of the excessive erosion, and the coefficient of erosion was Z=1.25, whereas the sediment yield was Wyear=14,034.37 $m^3 year^{-1}$.

The researches showed that the current condition of the erosion processes in the drainage basin greatly differs from the previous one, and that the parameters which indicate the intensity of erosion considerably decreased in 2009. The mean coefficient of erosion for the whole drainage basin is now Z_{sr} = 0.58, which means that the processes of the medium erosion, i.e. of the III category of erosion, are dominant in the drainage basin, whereas the annual sediment yield decreased to Wyear=5098.47 $m^3 year^{-1}$.

Along with the erosion control works, the mitigation of the intensity of erosion and sediment yield is also the result of the large-scale migration trends, which contributed to the conversion of the previous ploughland which are turned into pastures due to the non-cultivation.

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SPECIFIC OF CRT RECYCLING

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ABSTRACT

Cathode ray tubes (CRTs) from used televisions and computer monitors represent a major e-waste problem as they consist of glass with different compositions.
The front panel is a lead-free barium-strontium glass whereas parts such as the funnel hidden inside are composed of glass with lead oxides. Closed-loop recycling and openloop recycling are two principal ways of recycling CRT glass. The aim of this paper is to examine the technical characteristics and composition of the CRTs, its generation, environmental impacts and related regulatory requirements and to review the current technologies and their limitations for recycling CRT glass and its end use.

Keywords: Cathode ray tube; CRT recycling; Electronic waste; Glass

INTRODUCTION

The demand for consumer electrical and electronic equipment (EEE) has been on the increase since the 1980s and a countless number of EEEs, especially computers and televisions, has been sold to consumers around the world. Rapid advances in technology and ready availability of newer designs at cheap prices have motivated customers to discard old EEEs even before their useful life is over. This has resulted in mountains of old EEEs, referred to as electronic waste or e-waste, to be managed by the relevant authorities.

With number of televisions and computers reaching their EOL, the electronic industry is confronted with a major problem of dealing with the used CRTs. It is estimated that CRT glass accounts for approximately 47% by weight of commercial electronics and 30% by weight of data processing equipment and also contains metals such as lead, strontium, antimony and barium [1]. Dismantling the CRTs in used EEE and removing the metal coatings in the CRT glass are major challenges faced by the electronics recycling industry.

CHARACTERISTICS AND COMPOSITION OF CRTs

There are two types of CRTs: black and white (monochrome) and color. The monochrome CRT consists of a front panel used as the screen, a neck which envelopes

the electron gun and a funnel which connects the panel and the neck. The panel and the funnel are manufactured by pressing and sealing together. A color CRT consists of a panel, a shadow mask, a glass funnel and an electronic gun. The shadow mask is the thin sheet metal located immediately behind the glass panel. The glass funnel in a shape of a funnel is attached to the back of the glass panel, both connected together using a glass frit solder. At the back end (neck), the glass funnel holds the electron gun which produces electrons that strike the glass panel and produce the images in televisions and monitors. It is estimated that CRT constitutes around 65% of the weight of a television or a computer monitor and is composed of 85% glass of which the front panel contributes 65%, the funnel 30% and the neck glass 5% [2].

The front panel of the CRT is made of very homogenous bariumstrontium glass (up to 12% barium oxide and up to 12% strontium oxide) whose weight is about two thirds of the whole CRT while the funnel is a lead glass (up to 25% lead oxide) whose weight is around one third of the whole CRT. The neck of the CRT which envelopes the electron gun consists of a glass with very high lead content (up to 40% lead oxide) while the frit consists of a low melting lead glass (up to 85% lead) [3].

Table 1. Components in 14" Philips color monitor

Components	Materials	Kg	%
Chassis Monitor	Plastics	2.032	17.38
Protective ring	Fe	0.213	1.82
Cathode ray tube	Fe, Glass, Cu, Plastics	5.638	48.23
Deflectore winding	Cu, Plastics, Fe	0.589	5.04
Metal plate	Fe	0.542	4.64
Motherboard	IC, gum arabic, Cu, Fe	1.676	14.34
Cables	Cu, Plastics	0.661	5.65
Rubber parts	Gum	0.048	0.41
Plastic parts	Plastics	0.291	2.49
Σ		11.690	100.00

Table 2. Average five typical faceplate, funnel and neck glass compositions, % [4]

Oxide	Faceplate glass	Funnel glass	Neck glass
SiO_2	63,87	58,00	53,59
Na_2O	8,06	7,03	3,02
K_2O	9,35	8,57	13,01
CaO	2,18	3,64	1,32
MgO	1,04	2,18	0,52
BaO	7,99	3,47	4,05
SrO	3,89		
Al_2O_3	3,26	4,12	2,04
TiO_2	0,20		
PbO		12,99	21,34
CeO_2	0,16		
B_2O_3			1,11

The amount of lead oxide present in CRTs varies from 0.5 kg to 3 kg. Apart from lead, barium and strontium oxides, the CRT glass also contain oxides of silicon, sodium, potassium, aluminium and calcium. These are also common in commercial glass applications. In addition, the inside of the CRT panel is coated with layers of phosphor which may also contain cadmium and other metals. The outer section of the funnel section is coated with graphite and inner section with iron oxide.

TECHNOLOGY OF RECYCLING CRT

When recycling waste CRTs, recovered glass can be used in further manufacture of CRTs (closed-loop recycling) or into other products (open-loop recycling). Recycling of waste CRTs consists of two broad technologies: Glass-to-Glass and Glass-to-Lead recycling.

Glass-to-Glass recycling is a closed-loop process where waste CRTs are sent to CRT manufacturers to obtain the leaded and unleaded glass required for manufacturing new CRTs. The process involves the following steps [5]:

- Removing the CRT from plastic casing;
- Releasing the vacuum in the tube;
- Removing various metals and non-glass metals including the electron gun;
- Separating panel glass from funnel glass; and
- Removing the phosphor coatings from the panel glass.

Although glass-to-glass recycling of CRT glass enables to replace the virgin materials with recycled cullet at equal or lower cost and improve the quality of output glass as a result of using high quality recycled glass, the difficulty of identifying glass composition (different manufacturers use different compositions), high cost of collection and significant labor involvement form barriers to the process.

SEPARATING PANEL GLASS FROM THE FUNNEL

As noted above it is very important to separate the panel glass (nonleaded glass) of a CRT from funnel glass (leaded glass) to avoid contamination and improve the efficiency of recycling.

Electric wire heating method uses a special electrical wire (e. g. NiChrome wire) wound around the interface between the panel and the funnel glass. An electric current is passed through the wire to heat the wire for a designated period and then cooled using cool air. As a result of the thermal shock, the CRT brakes along the interface separating the two glasses. The potential problems associated with this method include the formation of sharp edges on separated fractions, difficulty in getting a clean separation if the wire is incorrectly placed and the glass not always breaking along the wire line. This method is more appropriate for processing small to medium quantities of CRT glass, and requiring low investment capital.

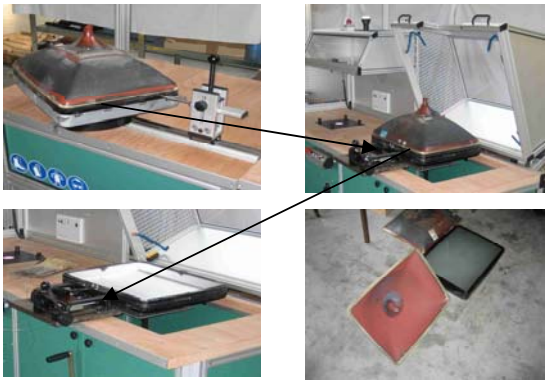

Figure 2. Tube separation and cleaning facility [6]

Various methods are available to separate the panel glass from funnel glass as described below [7, 8]

Gravitational-fall Method. In this method the CRT is lifted to a designated elevation and allowed to drop while the funnel glass is facing downwards. The panel glass can be manually separated from the funnel glass when the funnel glass breaks on the impact with a surface. Although this is a simple and low cost procedure a clearer separation may be difficult to achieve.

Thermal Shock and Laser Cutting Methods. In this method CRT is subjected to localized heat and followed by cold air to induce a thermal stress at the frit line where the funnel glass and panel glass are joined. The laser method is similar to the above where the thermal shock is created by a laser beam which is focused inside the CRT and followed by a cold water spray. The problems associated with this process include reformation of the glass after the laser beam has passed through and the difficulty of cutting thick glass. The laser process is energy intensive and requires significant investment capital. However, the process can be utilized for large scale operations.

Diamond Saw Method. This process can be undertaken under wet or dry conditions. The wet saw method involves rotating the CRT in an enclosure while diamond saw blades cut through the CRT around the interface of the two glasses. Coolant water is sprayed to CRT during the process. In this process a clean separation can be achieved providing the CRT is correctly aligned with the saw blades and can be used for large scale operations although it requires high capital investments.

Water Jet Separation. This method uses a high-pressure spray of water containing abrasive materials and directed at the surface where the separation is needed

REMOVAL OF COATINGS FROM PANEL GLASS

The following four coatings are applied to the inner surface of the panel glass in a CRT [9]:

- Mixture of carbon slurry and other surfactants as the first layer to produce carbon black and clear stripes on the interior;
- Three fluorescent colors (green, blue and red) are filled into clear areas as the second coating;
- Lacquer is applied on the surface of the second coating to smooth and seal the inner surface of the glass panel;
- Fourth coating layer is an aluminium film applied to the inner surface to enhance brightness.

The coating of fluorescent colors contains several metals which are of concern hence needed to be removed prior to recycling. There are various technologies for the removal of the coatings which include technologies such as the vacuum suction method (a vacuum- suction device is used to suck loose coatings from the panel glass surface), ultrasonic-cleaning method (broken CRT glass is immersed into a cleaning fluid containing water and acid and placed in an ultrasonic device for a period of time), wet-scrubbing method (broken CRT glass is placed in a tumbling mill with water and coatings scrubbed off), and sandblasting method (small steel balls are blasted onto the glass surface by a high-pressure air jet) [8, 9].

RECYCLING PLANT FOR AUTOMATIC CATHODE REZ TUBE

Example of Sims Recycling Solutions' specialist businesses is Cathode Ray Tube (CRT) treatment facilities, figure 4. CRT's from televisions and monitors are processed and converted into raw material for different applications. Sims Recycling Solutions breaks these visual display units and televisions down into their constituent materials, separating the CRT first, before processing the other metal, plastic and electronic materials.

The CRT is then sent down dedicated lines that break the tube down and separate leaded and unleaded glass cullet free from metallic and organic contaminants. Together with CRT Glass producers, Sims Recycling Solutions has developed this raw material so that it is suitable as feedstock for the production of new CRTs in a completely closed loop solution.

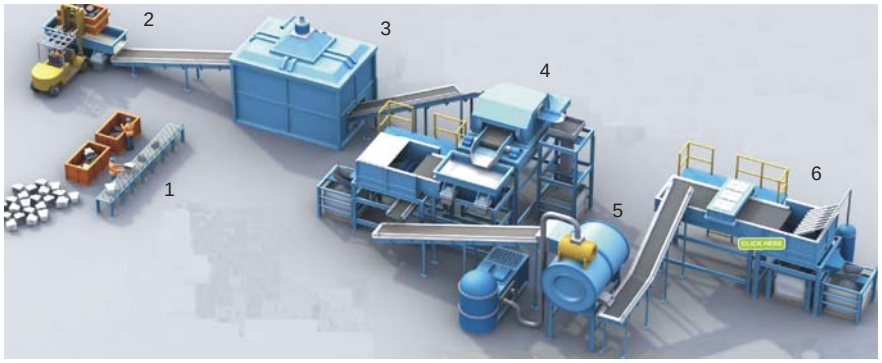

Figure 4. Recycling plant for automatic cathode rey tube [10]

CRT recoveri process from television and computer monitors containt next parts:

1. Separation of monitor body and cathode ray
2. Hopper separation
3. Controlled size reduction process (this process reduces the complete tube and screen down into smaller pieces)
4. Metal removal
5. Washing line
6. Glass sorting line

Figure 5. Recycling glass before and after recycling in washing line

APPLICATION OF RECYCLING CRT GLASS

The two major industries that have potential to use recycling CRT glass (open-loop recycling) are the glass industry and the ceramic industry. Some examples of end use of CRT glass in these industries and other industries are described in this section..

Foam glass or cellular glass is mainly used for thermal and sound insulation purposes and for ground stabilization. Foam glass is manufactured by generating a gas in glass at a temperature between 700 and 900^{o}C. As a result the gas expands producing a structure of cells within the glass to form a porous body. The present day foam glass industries are using up to 98% post consumer waste glass in their products.

Ceramic Products. It is difficult to use funnel glass in many open-recycling systems due to its lead content. In glass products such as container glass and tableware, raw materials with high lead content are not allowed. However, in the ceramic industry, it is possible to use both panel and funnel glass from CRTs as the restrictions are much lower. A case study by Andreola et al. [2, 11] investigated the used CRT glass (panel and funnel) as secondary raw material substitutes for common ‚ceramic frits' used in the manufacture of commercial glazes.

CONCLUSION

Generation of waste from EEEs is increasing at a rapid rate worldwide surpassing the rate of generation of normal municipal waste. Used televisions and

computer monitors form a significant portion of this waste stream. CRT is the largest component of both of these devices. Replacement of standard-definition television with highdefinition television (without CRT) and the increasing popularity of LCD monitors (without CRT) in computers will have major impact on the generation of waste CRTs. Recycling CRT glass is not easy because it is composed of four different types of glasses – panel, funnel, neck, and frit – with varying material compositions. Closedloop recycling and open-loop recycling are two principal ways of recycling the CRT glass.

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POSSIBLE REASONS OF POORNESS OF BUTTERFLY FAUNA (HESPERIOIDEA & PAPILIONOIDEA) IN BOJČIN FOREST

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ABSTRACT

Bojčin forest is located in SE Srem in the Republic of Serbia. It is a part of forests which used to cover big part SE Srem. Forest comprises small territory and uniform habitats. The field examination was done during 2008-2009-2010. There has been established 21 butterfly species. All species are in boundaries of their areal. Such a small number of species found here is very conspicuous and suspicious, in particular the absence of all Serbian Papilionidae. Factors of butterfly fauna poorness are summarized.

Keywords: butterflies, Bojčin forest

INTRODUCTION

Butterflies (Lepidoptera: Hesperioidea and Papilionoidea) are very sensitive to various habitat change and represent good indicator species of environmental conditions. From these reasons the butterflies are one of the target group in EPA (European Environmental Protection Agency) biomonitoring programme. The data concerning butterflies of Bojčin forest are not available in literature.

Bojčin forest is situated in South-East Srem in the Repuplic of Serbia (UTM 10x10 km grid DQ 35). It is part of forest which used to be two times biger than today [1]. Decreasing of area nearby forests, Bojčin became isolated with tendency of becoming real patch habitat. It covers 619,41 ha.

The geological basis is composed of alluvial deposit. The most present type of soil is brown forest soil on loes with huge compound of brown soil.

Whole area has temperate continental climate. The general characteristics of temperature regime of the area are: average air temperature is 10,3 °C, in the growing season 17,6 °C. Average annual quantity of precipitation is more then 580 mm, of which 60% occurs during growing season. There are no days with frost during growing season, and huge cloudiness in winter period mitigate daily temperature fluctuations. Relative air humidity is the highest in winter period, and the the lowest in spring [2].

According to CORINE classification habitat types in this territory is Riparian mixed forests of *Quercus robur*, *Ulmis laevis* and *Ulmus minor*, *Fraxinus excelsior* or *Fraxinus angustifolia*, along the great rivers (*Ulmenion rivers*), more or less degraded [3]. Cleared land is located in central part of forest and has occasionally been threated by pesticides, during 2010. that cleared land has been ploughted up.

The next plant associations can be recognised in Bojčin territory:
Carpino-Quercetum roboris on brown forest soil to brown forest soil on loes at unflooded area; *Quercetum Farnetto cerris quecetosum ropori* on brown forest soil [4].

Forest manager authority is enterprise "JP Srbijašume". Present forest condition is not satisfactory and far away from potential vegetation possibilities of habitat [5]. Local pig race named "lasasta mangulica" (Wollschwein) is raised in enterprise "Agrar" for a few years. Bojčin forest is protected as cultural heritage. This place is has sport an cultural importance.

Air pollution monitoring data in surrounding of thermal plant power "Nikola Tesla" (TENT) A and B shows that values of SO_2 imision for the period October 2009. to Januar 2010. – took as illustration - 100% in range AQSd (150 mg/m^3). For the same period record of average monthly values of total suspended particles imision was in range from 92, 3 % results below AQSd, to 100% below AQSd (450mg/m^2/day) [6].

MATERIAL AND METHODS

The collecting of butterfly material was done in a conventional way by entomological net. Almost all samples were released after identification. Taxonomical order and nomenclature corresponds to Karsholt and Razowsky (1996) [7]. The field examination was done during 2008-2009-2010, from Mart to September, all together 12 field visits.

RESULTS

There has been established 21 species of butterflies of which Hesperidae: 1. *Ochlodes venata* (Bremer & Grey, 1853); Pieridae: 2. *Antocharis cardamines* (Linnaeus, 1758), 3. *Pieris rapae* (Linnaeus, 1758), 4. *Pieris napi* (Linnaeus, 1758), 5. *Pieris brassicae* (Linnaeus, 1758), 6. *Gonepteryx rhamni* (Linnaeus, 1758); Lycaenidae: 7. *Hamearis lucina* (Linnaeus, 1758), 8. *Lycaena phlaeas* (Linnaeus, 1761), 9. *Satyrium ilicis* (Esper, 1779), 10. *Celastrina argiolus* (Linnaeus,1758), 11. *Glaucopsyche alexis* (Poda, 1761); Nymphalidae: 12. *Argynnis paphia* (Linnaeus, 1758), 13. *Issoria lathonia* (Linnaeus, 1758), 14. *Vanessa atalanta* (Linnaeus, 1758), 15. *Vanessa cardui* (Linnaeus, 1758), 16. *Inachis io* (Linnaeus, 1758), 17. *Polygonia c-album* (Linnaeus, 1758), 18. *Neptis sappho* (Pallas, 1771), 19. *Pararge aegeria* (Linnaeus, 1758), 20. *Lasiommata megera* (Linnaeus, 1767) and 21. *Maniola jurtina* (Linnaeus, 1758). They are most seen at the sunny woodland margins forest next to clered land made by wood crearing in the center of Bojčin.

DISCUSSION

Quantitative composition of 21 established butterfly species is determinate as poor abundance, following the scale for the selection of Prime Butterfly Areas in Serbia [8]. According to scale Pannonian basin and Peripannonian region is extreme abundance if comprises more than 60 species, abundance if comprises 50-60 species, moderate abundance if comprises 40-50 species and poor abundance if comprises less than 40 species. Such a small number of species found here is very conspicuous and suspicious, in particular the absence of all Serbian Papilionidae.

All species are in boundaries of their areal [9].

Only one target species in PBA in Serbia is registered here *Glaucopsyche alexis* wich is widespread in Balkan Peninsula. In Serbia, the species is not considered threatened [8].

Pieris brassicae is listed us vulnerable in the Red Data Book of Serbian Butterflies (Jakšić, 2003). It is average sensitive species [10].

Zoogeographical composition: Middle-European fauna elements 30% and Sub-Mediterranean fauna elements 30%, European-Mountain 9,52 % and Pontic-Mediterranean 9,52 %, Subpontic 4,76%, Pontic-Centr.-Asian 4,76%, Central-American 4,76%. Zoogeographical fauna composition is unificated in conformity with geographical position and habitat type.

In comparation with Zasavica [8] which belongs to the same, Continental-Pannonian biogeographical region, relation between both area and number of species is the same about 3, but this interpretation (coincidence) isn't major factor having an impact on biodiversity. In Bojčin there are at least 5 different micro habitats for butterflies, and even 62% are seen at sunny woodland margins made by wood clearing a few years ago, which comprises less than 1% of whole territory.

All species registered at this locality are normal or hiposensitive, but these hiposensitive or normal sensitive and the most widely distributed and common species in nearby are not present here [9,11]. If this is not coincidence, we can never say that butterfly fauna is unificated and the whole ecosystem and convenient for butterflies and other species. We have confirmation in small number of butterfly species and bad present forest condition which is far from it's potential. If composition is realy unificated, maybe that is the last level which is unificeted or one of the last sustainable compositions butterfly fauna in this forest.

This situation could be a result of small territory, uniform habitats, isolation, pollution (pesticides and air pollution) and as the most important reason intensive agriculture around this area and declining of forest territory in order to provide more agricultural land. Small territory and uniform habitats aren't the most significant factors for poorness, sunny margins which comprise 1% of territory are visited by 62 % butterfly species of Bojčin (1, 2, 3, 4, 5, 6, 9, 10, 11, 14, 15, 16, 17). Logging, local grazing and tourism do not significantly affect biodiversity, for now but shows a tendency to grow.

CONCLUSION

During three years of fieldwork there is 21 registered butterfly species in Bojčin forest. Following this elementary fact we concluded that butterfly fauna in Bojčin is poor. Analysing aspects of poorness we revealed that the most important threats to butterflies are increasing habitat fragmentation (low habitat connectivity), conversion of natural habitats (more and more agricultural land), and air pollution effect (TENT "Nikola Tesla") and land pollution (use of chemical substances in agriculture).

At the end, level of fauna knowledge can be considered as insufficient so the further research is needed. This locality should be more detailed investigated because fragmentation, isolation and low habitat quality the most impotrtant threats to butterflies in Europe very expressive here. Supposition is that increase of any negative influence would probably affect butterflies.

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THE "ECOLOGICAL TAX" AS A MEAN FOR DEVELOPMENT AND IMPROVEMENT OF ENVIRONMENT PROTECTION

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ABSTRACT

Modern business is based on accomplishment of two major groups of goals – economical and ecological goals. Until recently, most of attention has been focused on economical outputs, but with increase of understanding for ecology, the activities started to spread in that direction. Today, economical and ecological goals are considered as complementary.

Rapid economic development, along with preservation of healthy environment should be a priority for any community. In order to encourage such ideas, government has many activities, mainly from economic aspect.

Introduction of ecological tax in our country is mean of achieving these complementary goals. At the same time, it is a new step in bringing our country closer to countries with developed economies, such as members of European Union.

Keywords: ecological tax, economic development, environment quality

INTRODUCTION

Today, economy and ecology are two inter-linked, conditional and highly dependent areas. Namely, there is no economic progress without the preservation and improvement of business and living environment. But also, the quality of the environment depends on the level of economic development, and application of modern techniques and technologies in the process of labor and business.

Coordinated relationship between economy and ecology is an important prerequisite for achieving sustainable development, which, in essence, assumes that the current economic development is based on available resources, without prejudice about the settlement needs of future generations. This can be achieved only with rational use of natural resources, replacing non-renewable to renewable resources, including substitutes, and recycling of secondary raw materials and etc [1].

Special emphasis is given to recycling, as an important segment of the concept of sustainable development. The effects of this approach are manifold.

„Ecological tax" that was introduced in many countries or it is in process of introducing, among other things, aim at improving the process of recycling waste materials. In our country such activity is almost at the very beginning and this could represent an important impetus to the improvement and development of this process, both the economic and wider social importance. They shall be discussed more in this paper.

GOALS OF INTRODUCING THE „ECOLOGICAL TAX"

There are many reasons that have influenced our country to opt-in the introduction of environmental taxes. These are, primarily:

- Harmonizing our legislation with European regulation,
- Appreciation of ecological principle that "polluter pays"and
- Improvment of the recycling process.

Under the overall activity of creating the conditions for admission of our country's full membership of the European Union, particular obligations referring to the harmonization of our legislation with EU regulations. It is about the numerous legal and other regulations that governing specific fields of economic and social life. Big part of this has already been done but bigger part remains to be done in the future.

Particularly sensitive area is ecology. In the European Union it is regulated by many Directives, especially when it has to do with waste substances.

Our country has adopted a some of legal regulations in the field of ecology. Among them is the regulation of so-called "ecology tax" or compensation for the management of specific waste streams.

The principle that „polluter pays" environmental damage caused by himself is one of the basic ecological principles. Namely, the „polluter pays" compensation for pollution of the environment that their activities cause or may cause, or if he produce, use or place on the market raw material, semi-product or a product that contains substances harmful to the environment.

Pollutant, in accordance with the regulations, shall bear the total cost of measures to prevent and reduce pollution, which includes the cost of risk to the environment and the cost of removing the damage done to the environment [8].

This means that the costs of repairing incurred damage to the environment are included in the cost or selling price of products and thus directly affect the business result of the economic entity. In this regard, economic entities, which activities do not contribute to the emergence of damage or they are on a smaller scale, will be advantaged. And the opposite, those who harm the environment more have increased environmental costs and higher prices of their products and services.

Finally, the third goal of introducing „ecological tax" is the promotion of the recycling process in our country. It is a manufacturing process that involves re-aligning the same raw material in production. These are raw materials that were already in use, or have a specific function in the process of reproduction. Recycling allows them to obtain appropriate re-use value.

These are all reasons why the economic development is increasingly based on the use of secondary raw materials, in order to ensure sustainable development. Until recently, useless and worthless materials become useful substances and became factor of economic development.

Today, within the industry is developing special economic sector that deals with processing of secondary raw materials. There is also a market where trades in recycled raw materials and commodity exchanges where the exchange of waste products takes place.

Collection and processing of secondary raw materials have multiple benefits. These are:

- Protection and preservation of primary resources,
- Production of useful utility property,
- Maintaining a healthy environment, and
- Achieving more favorable economic effects.

Recycling of secondary raw materials in the world has an impressive development. It is estimated that the annual turnover of goods is around 160 billion U.S. dollars. This sector employs more than 1.5 million people, which allow that it can be recycled and offered the market more than 600 million tons of waste paper, nonferrous metals, plastics, textiles, glass, electronic waste and others per year.

In our country, the collection and disposal, and especially the processing of waste, not given away a special significance. Municipal waste is stored in landfills and only in small quantity was used as industrial waste. A breakthrough in this field carried out in recent years.

Today we still can not speak with certainty about the quantity and structure of the waste generated in our country. The reason is the lack of appropriate data. According to some estimates in Serbia, is annually collect about 2.5 million tons of various wastes. In addition, half of it remain in the yards, or along the roads, however, in the river beds [10].

Collecting waste from the relevant utility companies on the territory of central Serbia and Vojvodina covers about 5 million people or 60-70%. This means that about 2.5 million inhabitants do not have organized waste collection, but uncontrolled, mostly placed in illegal dumps.

It is estimated that in our country daily occur occur an average of nearly 0.8 kg per capita municipal waste. In addition, this waste is much higher in urban than in rural areas. The amount of waste per capita in our country is in a more favorable position in relation to the countries of Central and Eastern Europe.

The largest share has organic waste, 30%. With slightly smaller percentage has the waste paper 28%, followed by glass and 7%, 5% plastics, textiles, iron and other metals 4%, 2% non-ferrous metals, rubber 1% and 21% is other waste.

Collection of municipal waste in the current circumstances is followed with numerous of difficulties, such as large fluctuations of the daily quantities, volume and composition of waste, the lack of containers and their inadequate layout, improper use of containers, lack of special vehicles for transportation of waste, poor management of waste at source by its creators.

These are the reasons that creates need for changing situation in this area in the future. This includes full implementation of legislation in this field.

ECONOMIC AND ECOLOGICAL ASPECTS OF INTRODUCTING OF „ECOLOGICAL TAX"

Republic of Serbia is committed to the introduction of „ecological tax" in order to achieve the foregoing objectives, primarily to raise funds for the development of waste collection and recycling industry. A special regulation is anticipated that after using the products become special waste flows, and the amount, method of calculation and payment of compensation. These are the following products: tires of motor vehicles, agricultural and construction machinery, trailer, traction engine and other machines and appliances, and other related products, products that contain asbestos, batteries, accumulators, oil, electric and electronic products [9].

Table 1. The amount of compensation for products that after use become special waste streams

Product Name	***Unit of issue***	***The amount of compensation in dinars***
I Tires - Tires of motor vehicles, agricultural and construction machinery, trailers, aircraft, drawn machinery, other machinery and appliances, and other similar products from rubber	t	17.000
- Tires that are an integral part of the imported or manufactured cars, buses, freight vehicles, work machines, working vehicles and tractors, aircraft and other aircraft and kit costs (tires and rims) for the:		
1) Automobile and car trailer	Tire	110
2) Vans carrying up to 3.5 and tractors	Tire	170
3) Trucks, buses and forklifts	Tire	950
4) Construction machinery	Tire	30
5) Agricultural machinery	Tire	20
6) Cargo trailers and traction machines	Tire	20
7) Other vehicles, transport equipment, aircraft	Tire	30
II Products that contain asbestos	kg	100
III Batteries and accumulators		
- Starters	kg	15
- Portable batteries and accumulators	kg	150
- Industry batteries and accumulators	kg	15
IV Waste oil	l	10
V Electric and electronic products		
1st Class Large household appliances	kg	30
Thermo-accumulation furnace	kg	10
2nd Class Small household appliances	kg	60
3rd Class Information technology equipment (IT) and telecomunications	kg	60
Monitors	kg	90
4th Class Equipment for entertainment	kg	60
5th Class Lighting equipment: Lighting	kg	40
6th Class Electrical and electronic tools (except large stationary ind. tools)	kg	50
7th Class Toys, equipment for recreation (leisure) and sport	kg	40
8th Class Medical auxiliary equipment (except inplantiranih and infectious products)	kg	75
9th Class Instruments for monitoring the supervision	kg	100
10th Class Automata	kg	100

Taxpayers which pay compensation for the management of specific waste streams are manufacturers and importers of products that after use become special waste streams. Otherwise, the compensation is calculated and paid during the first placing on the market and the import of these products.

The compensation is calculated on this basis shall be paid to the Fund for Environmental Protection. Funds in the form of the loan can be used to purchase equipment and devices aimed at encouraging waste management programs in order to protect the environment, encouraging waste treatment useful for the purpose of exploiting the properties of waste, and promote use of renewable energy sources.

Fixed compensation for products that after use become special waste flows among the lowest in the region and the European Union. But it, in some extent, increases the retail price.

For example, when certain electronic and electrical devices costs are increased by 0.31% to almost 15%.

Table 2. The increase in retail prices due to the introduction of „ecological tax"

Product Name	***Unit of issue***	***The amount of compensation***	**Previous price**	**New price**	***Increase***	
					Iznos	%
Elektrolux microwave oven EMS 2100 S	14	60	5.699	6.539	840	14,74
Range ''Milan Blagojević'' E 50 W1 White	44	30	17.999	19.319	1.320	7,33
Elektrolux range EME 500100 W	44	30	20.199	21.519	1.320	6,53
Elektrolux vacZAM 6100	5,75	60	5.299	5.644	345	6,51
Elektrolux washing machine EWT 10115	67	30	3.999	33.009	2.010	6,48
Elektrolux fridge ENB 34000W	72	30	39.999	42.159	2.160	5,40
Elektrolux range EKS 513502W	53	30	30.699	32.289	1.590	5,18
Grunding LCD TV VISION/106cm	14	60	20.699	21.539	840	4,06
LG 18,5'' monitor W 1941SPF	3	90	8.999	9.269	270	3.00
LG LCD TV 42LG2100/1096 cm	21,5	60	64.999	66.289	1.290	1.98
Philips iron GC 1705	1	60	3.399	3.459	60	1,77
Ariete hair dryer 8105	0,47	60	1.699	1.727	28	1,66
Philips hair dryer NP 4829	0,65	60	2.999	3.038	39	1,30
Aser Aspire laptop ONE D 250 OBb blue	1,33	60	25.499	25.578	79	0,31

According to the evaluation of the Ministry of Environment and Spatial Planning, the average amount of compensation does not exceed five percent of the price of the product. Otherwise, the fee is variable, given each year to coordinate with the rate of growth of retail prices.

The prescribed fee for the products that after use become special waste streams are included in the cost or the cost of the purchase price over the shift to consumers.

CONCLUSION

„Ecological tax" in modern economic conditions should be regarded as an important factor in accelerating economic development and improve environmental quality. Funds raised in this way are used for organized collection and disposal or recycling of products after use become waste.

In this way it can be realized many economic and environmental benefits. First of all, it reduces the need for appropriate natural resource, creates a useful utility goods, develops the industry for the processing of secondary raw materials, and in this regard and a number of economic benefits – profit, new jobs, increase of living standards and general social welfare. At the same time, the collection and recycling of waste materials ensure the preserving and improving the quality of the natural environment.

The Republic of Serbia in a lengthy period, faced with constant increasing amount of waste. Problems in collecting, processing and disposal of waste materials are bigger and bigger. Introducting „ecological tax"create the conditions to start with solving the many difficulties in this vital area of our economic and social development.

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THE AGRICULTURE IN ECONOMIC DEVELOPMENT BOR DISTRICT

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ABSTRACT

Agriculture takes the traditional leading role in the economic structure of Serbia. However, decades of stagnation in this field is more evident. Obsolete agriculture machinery, fragmented plots and lack of affordable credit funds have given an unfavorable position and limit the further development of this area.

For the development of this industry in Bor district there are natural and human resources that enable normal circulation process of agricultural production especially in the field of animal husbandry, fruit-growing and crop farming. Therefore, the development of agriculture in the future should be a development priority for the district.

However, indicators of development, especially in the transitional phase in which our economy is, show that there are severe restrictions on the development of this activity. The biggest limitation is the wrong economic and agricultural policy of the state, which in the long period of neglect the development of this activity, under-invest in it, which has negative effects on agriculture. No strategic documents adopted by the state and coordinated strategy for the development of agriculture at the local level, it can not expect good results.

Keywords: agriculture,crop farming, fruit growing, animal husbandry, development, land

POTENTIALS OF BOR DISTRICT FOR ENGAGING IN AGRICULTURE

Human resources are an important factor in agricultural development. In Serbia, the percentage of active agricultural population is traditionally above the average in developed countries. The last ten years the permanent migration of people from villages to the city have greatly influenced the decline in the number of active population in agriculture. However, this process is somewhat slowed by demographic aging in rural areas, and increasing the participation of the late years of working population engaged in agriculture.

Table 1. Agricultural population according to census in 2002.

Community	Active	Supported	Total
Bor	1774	324	2098
Kladovo	1441	672	2113
Majdanpek	1673	439	2112
Negotin	6734	2872	9606
Total	11622	4307	15929

From publication "The municipalities in Serbia," SIS

According to the 2002 census, in the territory of Bor District live 163 229 inhabitants. Agricultural population participates with 9.76% in the total population of district. In the agricultural population 72.96% is the active population, which is engaged in this activity. At the district level, the majority of the rural population has Negotin municipality.

Another important precondition for engaging in agriculture is the existence of adequate agricultural land, in both the quality and the volume sence. The agricultural sector is characterized by the dual structure of ownership: corporate farms (agrocombine and agricultural cooperatives), and family farms.

Table 2. Agricultural land by ownership in 2007.

Land ownership	Community				Total on the district level
	Bor	Kladovo	Majdanpek	Negotin	
Companies and cooperatives	49751	28804	20085	70363	**169003**
Family farms	35929	22027	18717	61154	**137827**
Total	**85670**	**50831**	**38802**	**131517**	**306830**

From publication "The municipalities in Serbia," SIS

Bor district has 306,830 ha of agricultural land which is 48.1% of the total area of the district. The majority of agricultural land makes land used by so-called agrocombines and agricultural cooperatives owned by the state (55.1%).

TREND OF AGRICULTURAL PRODUCTION IN THE PERIOD 2003.-2007.

Each region carries some of its specific characteristics. In this sense, agricultural production should be adjusted to present specifics of the region. The territory of Bor district is predominantly mountainous and especially suitable for the development of farming, fruit growing, viticulture and animal husbandry.

The total yield of field crops at the district level is in 2007. year significantly decreased compared to 2003. year. In the case of wheat this fall is 22.5%, corn 54% and 28.56% of sunflower. From this table we can see that the most pronounced decline in total yield is in 2007th year which is mostly a result of the global economic crisis that had spreaded from developed markets and in our country. The average yield of wheat in the Bor district is 4500 kg / ha, maize is also 4500 kg / ha, while in sunflower is 2250t[2].

Table 3. Production of main agricultural crops in the period 2003-2007. by each community

Community	Agricultural crops	The total output in tons				
		Year				
		2003.	2004.	2005.	2006.	2007.
Bor	Wheat	5494	9985	9717	8842	5920
	Corn	8588	16585	16794	15863	5517
	Sunflower	6	14	14	10	10
Kladovo	Wheat	7491	12770	10688	7619	6072
	Corn	9066	17694	18812	15534	3730
	Sunflower	367	463	100	75	562
Majdanpek	Wheat	2414	3711	3423	2721	2232
	Corn	4247	6051	7289	6487	2679
	Sunflower	-	-	-	-	-
Negotin	Wheat	18994	38439	32702	25738	12429
	Corn	20891	28243	39433	33557	7761
	Sunflower	3646	4848	5154	6232	2299
Total at the district level	Wheat	**34393**	**64905**	**56530**	**44920**	**26653**
	Corn	**42792**	**68573**	**82328**	**71441**	**19690**
	Sunflower	**4019**	**5325**	**5268**	**6317**	**2871**

From publication "The municipalities in Serbia," SIS

Table 4. Production of fruit and grapes in the period 2003rd - 2007. by each community

Community	Fruit	The total output in tons				
		Year				
		2003.	2004.	2005.	2006.	2007.
Bor	Apple	666	382	1027	918	566
	Plum	808	702	836	952	485
	Grapes	2429	1908	2214	2897	1523
Kladovo	Apple	291	279	265	340	396
	Plum	1127	1737	1118	1331	1195
	Grapes	5328	6835	3478	5657	5925
Majdanpek	Apple	301	201	193	172	228
	Plum	1838	1498	1245	909	1043
	Grapes	168	85	108	53	54
Negotin	Apple	2650	1118	1650	1936	1661
	Plum	1818	1612	1790	2277	1584
	Grapes	39236	28454	15436	31095	28869
Total at the district level	Apple	**3908**	**1980**	**3135**	**3366**	**2851**
	Plum	**5591**	**5549**	**4989**	**5469**	**4307**
	Grapes	**47161**	**37282**	**21236**	**39702**	**36371**

From publication "The municipalities in Serbia," SIS

Production of ruit and grapes in the Bor district is reduced 2007th compared to 2003. year, so the total yield of apples decreased by 27.05%, plum 22, 97% and 22.8% for grapes.

Table 5. Number of livestock in the period 2003rd - 2007. by each community

Community	Animals	Number of livestock				
		Year				
		2003.	2004.	2005.	2006.	2007.
Bor	Cattle	6453	6462	6510	6549	6369
	Pigs	7800	9284	9470	10389	8626
	Sheep	11238	12098	10367	11297	11092
Kladovo	Cattle	1803	1740	1635	1829	1779
	Pigs	4624	4622	4020	6159	5113
	Sheep	3845	3834	3847	3865	3795
Majdanpek	Cattle	3961	3647	3611	4020	3910
	Pigs	4126	4704	4480	5495	4562
	Sheep	6345	6292	5853	6378	6262
Negotin	Cattle	5131	4126	4938	5207	5065
	Pigs	11617	13492	12596	15461	12848
	Sheep	12503	12502	11232	12568	12338
Total at the district level	Cattle	**17347**	**15975**	**16694**	**17605**	**17123**
	Pigs	**28167**	**32102**	**30566**	**37504**	**31149**
	Sheep	**33931**	**34726**	**31299**	**34108**	**33487**

From publication "The municipalities in Serbia," SIS

Favorable natural conditions in the Bor district are especially suitable for animal husbandry , and because of that in the reporting period the number of heads of cattle, pigs and sheep was not significantly reduced. The number of cattle in the period decreased by only 1.29% and 1,31% of sheep while the number of pigs increased by 10.59%.

THE PROBLEMS OF AGRICULTURAL DEVELOPMENT IN THE BOR DISTRICT

Unfavorable situation in agriculture and in rural areas in our country is a consequence of many factors: the long-term disadvantage of agriculture in the primary and secondary distribution of national income (depressed prices and price disparities), wrong agricultural policies, uncontrolled and rapid deagrarization, relatively small investments in agriculture and village , unfavorable credit terms, and the like.

Special problems of agricultural development in the Bor district are:

1. Under-developed market of agricultural products;
2. Uncertain placement;
3. The bad promotion and the lack of brands of agricultural products from Bor district;

4. The lack of processing capacity to absorb market surpluses of agricultural products;
5. The lack of more active arrangements for the development of agriculture in particular for the purchase price for certain agricultural products;
6. Unfavourable age structure of population;
7. Distance of market, which affects the price and thus the competitiveness of farmers from the Bor district.

If in the future there is no significant change, large number of farmers in the Bor district would not be able to compete with domestic competitors and especially with the foreign competition after the opening of the borders with the EU.

OPPORTUNITIES FOR FURTHER DEVELOPMENT OF AGRICULTURE IN THE BOR DISTRICT

Although significantly distressed with problems of underdeveloped markets (credit and land market) and the lack of proper market infrastructure, Bor District certainly has the producers and proper conditions to be recognized and competitive in production of certain agricultural products. Without adequate assistance to the state and the introduction of appropriate institutional arrangements it would be impossible to improve the conditions for agricultural production and facilitate its further development. In the Regional Development Strategy of Serbia for the period between 2007.-2012. the agricultural policy has a special place. This strategy identified the main problems of this industry and the necessary measures for their resolution.

The basic goals of agricultural policy in this period are:

1. Improve the structure of farms;
2. Regulate the functioning of land markets and the possibility of renting;
3. Providing high quality and safe food for consumers;
4. Improve credit policy in this area;
5. Provide support for sustainable rural development;
6. Apply modern technology and techniques of production;
7. Improving the institutional and legal framework [3].

Realization of these measures will certainly lead to a significant improvement of agricultural production and thereby to increase the produced quantity and quality of agricultural products both at the republican level and the level of the Bor district.

CONCLUSION

Agriculture is a vital sector of our country. It is one of the rare sectors in Serbian economy that have a surplus in foreign trade. Serbia exported agricultural products worth even $ 1.7 billion, and imports only 1.1 billion dollars, so the trade surplus was about $ 600 million (2007.) [4]. According to its importance, both at the macro level and at the regional level, it is necessary to pay much attention to its further development.

In Bor district, there are favorable conditions for agricultural development but because of the poor state of the economy in our country and the lack of state support, this sector suffered significant losses. Production of main agricultural crops is in constant decline. A similar situation is in the fruit growing and viticulture while the state of animal husbandry remained almost unchanged as a result of highly favorable natural conditions for cattle in Bor county area.

Appropriate measures that should be implemented in the future, nationwide and at the district level, will contribute improving engage this activity. In addition to significant financial resources in the form of investments, loans and financial support of the state, it is necessary to implement the appropriate institutional change and improve the quality of agricultural products, through application of appropriate techniques and technology and education of farmers.

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WASTE MANAGEMENT - BELGRADE CASE

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ABSTRACT

The production of waste is increasing worldwide. Waste management, its treatment in an environmentally and economically responsible as well as energy efficient manner is a problem that consumes significant technological and intellectual resources of a modern society. The pilot project titled "Readiness of Belgrade citizens for acceptance of implementation of new waste management methods" has been realized by the Belgrade Polytechnic. Some of the results of this research are presented in this paper.

Keywords: waste management, poll, recycling, incineration, composting

INTRODUCTION

In general term *waste management* refer to the collection, transportation, processing, recycling or disposal of waste materials [1]. Waste management practices differ for developed and developing nations, for urban and rural areas, and for residential and industrial, producers.

The National Waste Management Strategy was adopted by the Serbian Government in 2003. The Strategy is being revised in 2009, as a result of the recently adopted Law on Waste Management, and should be completed in the next few months. The Strategy requires the Government to prepare and adopt national waste management plans, which should address issues associated with different waste streams, as well as implementing the requirements of the Basel and Stockholm Conventions [2]. The strategy encourages waste minimization, and recycling, it also prohibits the import of hazardous waste. In addition Ministry of Environment and Spatial Planning is preparing strategic investment plans to identify how to prioritize future investments for landfills, possible incinerators and other forms of waste treatment and recycling.

Will people in urban areas accept new approach towards waste management? How well the citizens understand the importance of waste separation and could they follow this principle?

METHODOLOGY

The pilot project "Readiness of Belgrade citizens to acceptance of implementation of new waste management methods", tried to establish how well are citizens in the Belgrade's municipality of Zvezdara informed on issues related to the protection of their environment from inadequate waste management as well as potential for their own involvement in projects aimed at improving conditions in this area. It was also important to determine how well they are informed of different waste management methods.

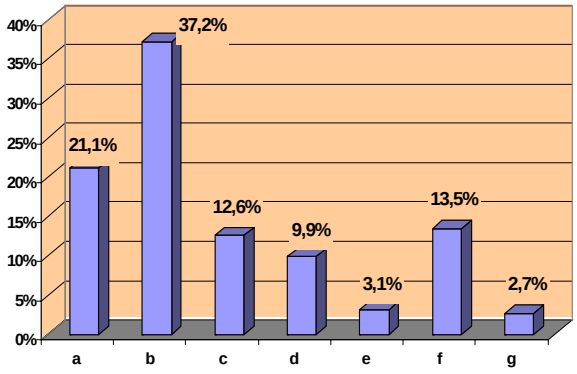
Citizens from Belgrade municipality Zvezdara, 120 of them, have been asked to answer the questionnaires dealing with waste problems and their environmental impact. They gave their answers to 64 questions in total.

The main aim of the poll was to determine how well are respondents informed about different waste management problems and methods.

Some of the most interesting results regarding waste management are presented here.

RESULTS AND DISCUSSION

It is important to notice that on question *What would you set to be an environment preservation priority?*, which aim was to define environment preservation priorities among respondents, implementing new waste management practice get only 13,5 %, of all the answers, the same percent as the recovery of ecologically vulnerable areas (Figure 1), while at first place respondents put maximum reduction of pollution of air, water and soil.



a. Rational use of natural resources,
b. Maximum reduction of pollution of air, water and soil,
c. Work on the recovery of ecologically vulnerable areas,
d. Transition to usage of renewable energy and raw materials for production
e. Strict application of sustainable development model in local and wider community
f. Implementing ***new waste management practice***
h. I don`t know

Figure 1. Question: What would you set to be an environment preservation priority? (two priorities)

What the poll has shown is that 90 % of all respondents understand importance of recycling for economy and as potential for improvement of life standard of the individual, and even 97 % of all respondents are willing to perform the waste separation.

When the problem of illegal landfilling was the issue, 81 % respondents gave opinion that this is very serious problem. Throwing trash out of appropriate place would punish 97 % of respondents. 98 % support the introduction of municipal police, while 88 % of respondents would cooperate with municipal police work.

Such high percentages indicate that the citizens have developed awareness towards necessity of taking certain steps in order to obtain cleaner environment.

Despite of previously given answers, only 54 % of respondents have concerns about the amount of waste going to landfills (Figure 2). It is important to notice that in Belgrade landfilling is still dominant waste management method.

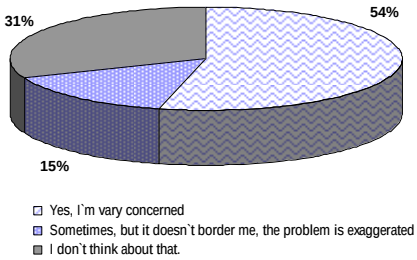
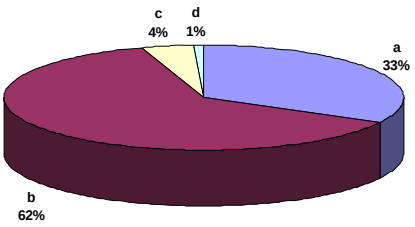


Figure 2. Question: Are you concern about the amount of waste going to landfills?

When asked *What is recycling*, only 62 % of respondents have given correct answer (Figure 3), although significantly higher percentage was expected.



a. Termical treatment of waste
b. Conversion of material goods from consumption stage into production stage
c. Landfilling of waste
d. I don`t know/something else.

Figure 3. Question: What is recycling?

What is interesting is that even the term *recycling* became very common in everyday news, the number of respondents that gave correct answer to the question *What is recycling* is smaller than number of them which know what is composting - 73,5 gave correct answer (Figure 4).

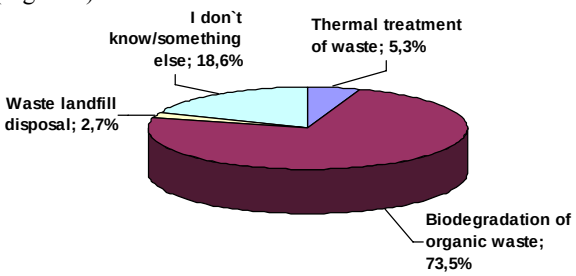
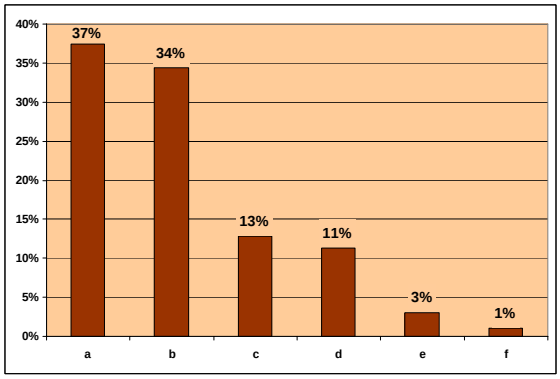


Figure 4. Question: What is composting?

84 % of answers of the respondents who know what is composting, know what waste can be composted (answers a., b. and c. are correct - Figure 5).



a. grass clippings, leaves, withered flowers, weeds, branches;
b. remains of raw vegetables, potatoes peel, remains of fruit;
c. dregs of coffee, remains of tea, egg shells;
d. newspaper, magazines, diapers;
e. old medicines, oil, plastic packaging;
f. stained wood, Styrofoam.

Figure 5. Question: What waste can be composted?

Concerning incineration of waste, 32 % of respondents are against this method, 30 % would accept incineration as a way of waste management, and 38 % hasn't opinion about this issue (Figure 6).

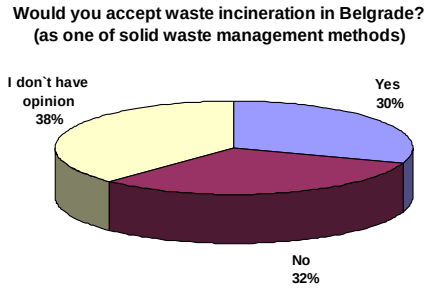


Figure 6. Question: Would you accept waste incineration in Belgrade?

The explanation for this division of answers can be obtained in relation to the answers to next two questions that are also related to waste incineration (Figure 7).

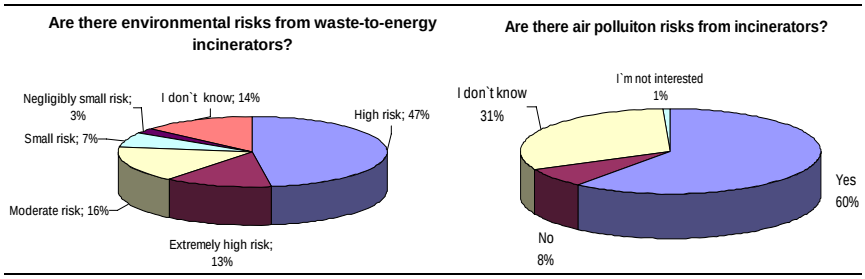


Figure 7. Division of answers to poll questions connected with waste incineration.

These results should be kept in mind in order to more adequately inform population in both positive and negative sides that incineration as a method of waste management has.

The results discussed here represent just a small proportion data collected.

CONCLUSION

The results of survey pointed out that citizens need more information for some of the methods of waste management. Data collected in the pilot poll should serve as a basis for modeling future actions aimed at improving waste management in Belgrade.

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ELECTROPLATING PLANTS RINSE WATERS TREATMENT BY COLUMN ADSORPTION ONTO WHEAT STRAW

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ABSTRACT

Metal finishing plants produce significant amounts of waste/rinse waters which contains heavy metal ions usually in a concentration far above the maximum allowed one.
In this paper we present some results of the research of metal ions adsorption (Cu^{2+}, Zn^{2+} and Ni^{2+}) from very dilute solutions (concentration up to 200 mg/dm^3) on wheat straw. Column adsorption was used as a mode of operation.

Presented results have shown that the column adsorption of considered ions onto wheat straw can be successfully applied for the treatment of wastewater from electroplating plants achieving a very high adsorption degree - higher than 99%.

Keywords: wastewater; column adsorption; wheat straw; heavy metal ions

INTRODUCTION

Metal working plants, particularly metal finishing (electroplating) plants produce large amounts of waste water containing higher or lower concentrations of corresponding metal ions in outlet streams. Such water streams are, in the practice from our country, huge polluters of surface waters due to their releasing into environment either without any treatment prior their discharge or employing old or inappropriate purification technologies. Rinse and waste water from electroplating plants, water from copper and brass rolling plants as well as waste water and solutions from electronic industry are particularly harmful for environment containing various heavy metal cations, in some cases cyanides and chromate anions; organic additives also used in surface finishing processes. The amounts of these wastewaters and the metal ions content are usually insufficient to be treated in an economically sustainable way but is still high enough to contaminate surrounding surface water flows if they would be released from a plant with no previous removal of metal ions. Different techniques are in use for the wastewaters treatment in order to remove heavy metals from. By them, chemical precipitation technology is the most frequently used way of wastewaters purification

when the present metal ions are being precipitated in the form of corresponding hydroxides or insoluble salts. Precipitation is a reasonably efficient technology but it comprises an irreversible loss of metal ions precipitated from wastewaters through sludge produced at precipitation. The sludge needs to be stored on an especial dump what makes a reasonably high investment costs. Dump servicing for preventing further scattering of accumulated metal bearing sludge needs operating expenses. Moreover, the dumps are always potentially dangereous objects due to any accident that may cause uncontrolled sludge discharge. Novel technologies for heavy metal removal from wastewaters as adsorption and ion exchange processes are used mainly for the treatment of those effluents containing precious metal ions. Recent research of new separation and purification processes involves investigation of different sorption processes. Among other things a lot of attention has been paid to bio-sorption processes in which by- or waste products from farming, wood- or food industry are used as adsorbents [1-7]. These products, as being available everywhere and are very cheap, have exhibited a certain adsorption potential to adsorb metal ions from weekly acidic solutions as usually wastewaters are. The aim of this work was to investigate the adsorption ability of wheat straw as a potential adsorbent for the adsorption of heavy metal ions (Zn^{2+}, Ni^{2+}, Cu^{2+}) most frequently present in rinse waters from electroplating plants. Through this study it should be determine the adsorption capacity of wheat straw against mentioned ions, as well as to determine the other adsorption features of it, as: adsorption degree, selectivity, adsorption kinetics and possible mechanism of adsorption and the other relevant data characterising an adsorbent and parameters affecting them. Batch and column study were employed through the experimental part of this study.

EXPERIMENTAL

Chemicals

A series of experiments were performed using synthetic, single ion solutions (Zn^{2+}, Ni^{2+}, Cu^{2+}), as well as a synthetic mixture of mentioned ions which should simulate a real wastewater from a plating plant. All chemicals used for preparation of working solutions were of p.a. purity. Stock solutions of each of the considered ions were prepared by dissolving of corresponding metal salt in distilled water.
Wheat straw provided from a local farm was used as an adsorbent. It was only grinded, than sieved through a set of laboratory sieves and two sieve fractions (- 0.4 + 0 mm and – 1+ 0.4 mm) were used for the adsorption experiments. Finer fraction was used in the batch experiments while the coarser one in the column experiments in order to provide better flow distribution through the column and lower pressure–drop in. Prior the adsorption wheat straw was rinsed with distilled water then dried in a laboratory drier. No chemical pretreatment of wheat straw has been performed.

Methods of measurements

The pH of synthetic solutions was measured/monitored by WTW inoLab-720 pH-meter, while the concentration of considered heavy metal ions was determined by

sampling periodically the treated solutions and analyzing samples by means of Perkin-Elmer 403AAS atomic absorption spectrophotometer.

Experimental procedure

The first series of the adsorption experiments was carried out in a batch mode by using a series of beakers each equipped with magnetic stirrer. All batch experiments were performed at constant stirring rate of 300 rpm in order to keep the solid and aqueous phase in a suspension. The experiments were performed by adding 1g of wheat straw in 50 ml of metal ion solution with previously determined the initial pH and concentration of considered metal ion. Both phases were kept in contact for a suitable time intervals. Time intervals were in the range from 1 min to 90 min. After that, the suspension was filtered and the filtrate was sampled and analyzed on the remaining concentration of metal ions. The pH value for each period was also measured.
In the second series, column adsorption experiments were carried out in a column (inner diameter 32mm and height 500 mm). At the bottom of the column was mounted a glass tap for adjusting the flow rate through the column. Above the tap was placed a layer of glass wool in order to prevent straw particles to leave the column and above it the amount of 50g of wheat straw formed a fixed bed. Bed height varied depending on the packaging. Above the straw bed was another layer of glass wool to preserve uniform distribution of the aqueous phase across the whole cross section area of the column, preventing the formation of channels inside the bed.

Prior the adsorption a portion of distilled water passed through the bed rinsing the straw, from very fine particles. After rinsing and drainage the column, the adsorption experiment performing was continued with the aqueous phase containing considered metal ion.

Volume of the aqueous phase passed through the column was an independent variable.

After passing a certain volume of the aqueous phase through the column, samples were taken for analysis on the metal content and measuring the current pH value. After completing the adsorption, the loaded straw was taken out from the column then dried on air and burned. The obtained ash was annealed at 800^{o}C to complete the combustion of residual carbon. After that, the ash was cooled and leached with a small volume of 0.5 M H_2SO_4. Leach solution was filtered and analyzed on the content of metal ions.

RESULTS AND DISCUSION

Adsorption degree and selectivity

The adsorption degree (AD) is defined by the following equation:

$$AD\% = (1 - \frac{C(t)}{C_i}) \cdot 100 \qquad (1)$$

Change of AD with the process time is presented in Fig.1 for all three considered ions. It is clear that AD increases sharply with time achieving a constant value after 15 to 20 minutes for each ion. The plateau values are different showing different adsorption abilities for different ions: the highist for Zn (more than 60%) and the lowist for Ni (only 25%). It comes out that wheat straw is weak adsorbent for nickel ions comparingly to zinc ions.

The adsorption of copper ions can be considered a modest in this case.
It could be pointed out that wheat straw adsorption ability may be ranked as: zinc, copper and nickel.

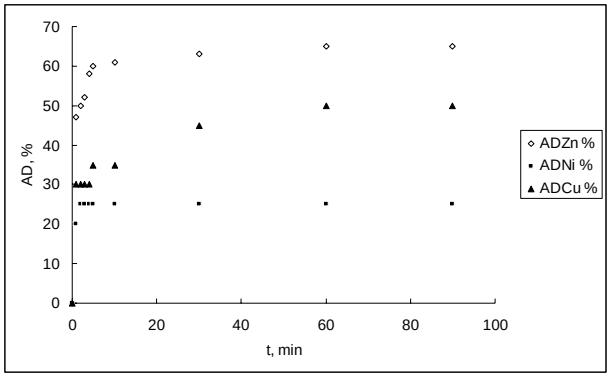

Figure 1. Adsorption degree vs. process time for the considered ions:
Particle size +0 – 0.4mm;Initial concentration of metal ions 0.2g/dm^3

Adsorption kinetics

From the batch experiments data about the adsorption kinetics were also evaluated allowing to get the maximum adsorption capacity that could be achieved at equilibrium.

It comes out that the adsorption kinetics can be described by a pseudo-second order kinetic equation [1]:

$$q(t) = \frac{q_e{}^2 k_a t}{(1 + q_e k_a t} \tag{2}$$

Where: q_e- is mass of adsorbed metal per unit mass of adsorbent (mg/g) at equilibrium; k_a – is the rate constant (gmg^{-1}min^{-1}).

Rearranging the equation [2] the following linearized form is obtained

$$\frac{t}{q(t)} = \frac{1}{k_a q_e{}^2} + \frac{t}{q_e} \tag{3}$$

By plotting t/q against time very good fitting is obtained as is presented in Fig. 2. The regression coefficients are close to unity for all three considered metals.

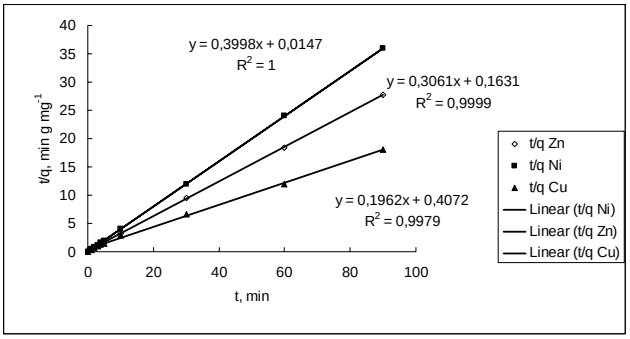

Figure 2. Plots of linearized kinetic curves: Particle size +0 – 0.4mm; Initial concentration of metal ions 0.2g/dm^3

Column adsorption data

Column adsorption data are presented in Fig. 3 in the form of breakthrough curves by plotting a dimensionless concentration against the volume of solution passed through the column.

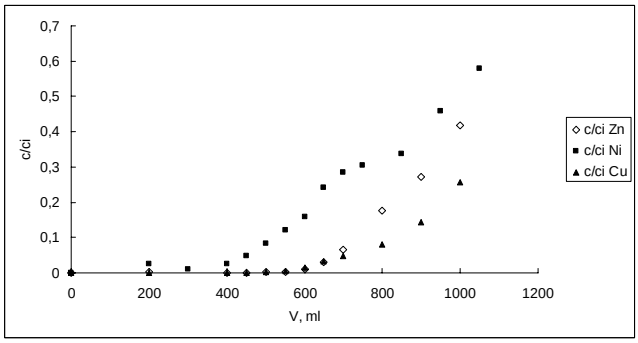

Figure 3. Breakthrough curves: Particle size + 0.4mm – 1mm; Initial concentration of metal ions 0.2g/dm^3, Mass of wheat straw 50g; Flow rate 10 cm^3/min

From Fig. 3 one can see that the breakthrough points are almost equal for zinc and copper, while it is smaller for nickel due to its lower capacity what we already discussed in the previous text.

The appearance of the breakthrough points for copper and zinc occurs at volumes higher than 600 cm^3 what corresponds that almost 66% of wheat straw is loaded by adsorbed metal.

CONCLUSIONS

Obtained results clearly show that wheat straw can be used as an adsorbent for successful removal of copper and zinc ions from wastewaters. Nickel will be adsorbed only in a small extent meaning that wheat straw shows a certain selectivity in adsorption this ion in the presence of the other two considered heavy metals.
Column adsorption mode of operation followed by burning the loaded adsorbent and leaching the obtained ash could be employed as a good way for wastewater purification from electroplating plants and for recycling heavy metal ions containing in.

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CLEANER PRODUCTION IN THE ELECTROWINNING OF ALUMINUM: GENERAL STRATEGIES AND RECENT DEVELOPMENTS

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ABSTRACT

Molten salt electrowinning represents an important part of commercial metallurgical processes, mainly due to the aluminum industry. On the other hand, primary aluminum production is energy intensive. The last stage in the overall process of aluminum recovery – electrolysis – is the largest consumer of energy. Yet, aluminum has a potential to meet the criteria for sustainable development such as the reduction in energy consumption, reducing the gases evolving during the electrolysis, especially those (perfluorinated carbon compounds) tied to the so-called anode-effect, etc. Thus, from this perspective, the following paper reviews studies of current efficency of the electrolysis process in the Hall-Héroult cell.

Keywords: alumina; aluminum; the Hall-Héroult cell; the anode-effect; curent efficiency; cell voltage

INTRODUCTION

Molten salt electowinning represents an important part of comercial metallurgical processes, mainly due to the aluminum industry. Over the years, production of aluminum constantly increased, and aluminum is today the most widely used non-ferrous metal [1-3].

The initial source for recovery of aluminum in the electrolytic process is its oxide, alumina (Al_2O_3), produced previously using hydrometallurgical (Bayer process) and pyrometallurgical processes. The main objective of the Bayer process is production of a pure alumina, while pyrometallurgical treatment by evaporation provides removal water from alumina and needed components for electrolysis in molten salt solution (fluorides).

Tle last stage in the overall process of aluminum recovery – electrolysis – is the largest consumer of energy. In the overall process of aluminum recovery, electrolysis is the major part of cost and design of a process requires careful optimization in order to lower these high costs. This paper considers fundamentals of aluminum electrowinning and factors of importance for the efficiency (in terms of the energy consumption) of this process. The enviornomental aspects of the electrowinning of aluminum are considered as well.

CONCEPT OF THE ELECTROLYTIC RECOVERY OF ALUMINUM

The process includes dissolving of alumina, most often, in a molten mixture of synthetic cryolite (Na_3AlF_6, AlF_3 and CaF_2) at 970 ^oC and electrolysis between a consumable carbon anode and a carbon cathode which is the lining of the cell [4]. In the cells or ''pots'' the molten salt solution is covered with a crust and a deep layer of fine alumina which acts as a reservoir of feed and also insulation over the bath. Gases evolved must be vented away, scrubbed to remove fluorine compounds and oxidized fully to CO_2 prior to discharge. The percentage of alumina dissolved varies between 8 and 1.5%. If the content of alumina falls to extremely low value, a high voltage develops (up to 40 to 50V) as the result of high resistance at the anode. When this happens, the alumina in solution must be replenished by breaking the crust over the cell and stirring in fresh calcined solid. During this process, the carbon anode reacts with oxygen. Due to this process, a very intensive consumption of carbon occurs. The metal is collected at the bottom of the cell, and is withdrawn at intervals by suction.

Typical modern aluminum reduction cells consist of rectangular steel shells (9-12 m long; by 3-4 m high), lined with refractory thermal insulation that surrounds an inner lining of carbon to contain the highly corrosive fluoride electrolyte and molten aluminum. Thermal insulation is adjusted to provide sufficient heat loss to form a large frozen electrolyte of the inner walls but not on the bottom of the cell cavity, which must remain bare under anodes to provide electrical contact with the molten aluminum cathode. Electric current enters cells through 18 to 30 prebaked carbon anodes or through a single continuous self-baking Södeberg anode. The anode-to-cathode spacing ranges from 3 to 6 cm. Prebaked anodes are typically 70 cm wide, 125 cm long and 50 cm high. The cells operate at about 6 to 7 V, at current densities up to about 10000 A m^{-2}, and at current efficiencies between 90 and 94 percent.

Over the years, many different types of cells have been applied. Nowadays, there may be about 180 smelters in operation over the world, with possibly 200-300 different cell designs and constructions operating in the range of 30-300 kA, with a large variation in characteristics. The oldest line still working is likely the Volkov smelter, built 1932 near St. Petersburg in Russia.

BASIC REACTIONS IN THE HALL-HÉROULT PROCESS

During electrowinning aluminum is deposited on the cathode and oxygen, evolved at the anode, reacts with the carbon to produce carbon dioxide by the exothermal reaction ($\Delta H^o = -397$ kJ):

$$O_2 + C \rightarrow CO_2 \qquad (1)$$

This is benefit in terms of the controlling of the electrolyte temperature but reaction (1) consumes the carbon anode as well. Different impurities such as iron and silicon, which are more noble than aluminum, will also deposit at the cathode unless removed from the alumina in the Bayer process.[1] The mechansm of cells reactions is not completely understood, but a simplified presentation of the overall process (for the sake

of the energy consumption) is given below. Dissociation of alumina present in electrolyte produces charged particles, aluminate anion and alumunum cation:

$$2Al_2O_3 \rightarrow 3AlO_2^- + Al^{3+} \quad (2)$$

thus, allowing the cathodic reaction:

$$Al^{3+} + 3e \rightarrow Al \quad (3)$$

and the anodic reaction:

$$3AlO_2^- \rightarrow 3Al + 3O_2 + 3e \quad (4)$$

Also, at the cathode the following reaction occurs:

$$3C(\text{electrode}) + 3O_2 \rightarrow 3CO_2 \quad (5)$$

Therefore, the summation of the cathodic and anodic reactions gives the overall cell reaction:

$$Al^{3+} + 3AlO_2^- + 3C \rightarrow 4Al + 3CO_2 \quad (6)$$

or, mor shortly,

$$2Al_2O_3 + 3C \rightarrow 4Al + CO_2 \quad (7)$$

By knowing the standard free energy change ($\Delta G^{o}_{(1273\ K)}$ = +1362 kJ) of reaction (7), one can determine the standard theoretical decomposition potential of alumina at the temperature of 1000 ^{o}C:

$$E^{o}_{(1273\ K)} = -(1362200/nF) = -1.176\ V$$

where n = 3, F = 96500 J.

In practice the cell voltage varies in the range of 4 to 6 V. This potential difference is the result of overpotentials at the anode and cathode and also of potentials required to drive the very high current against the resistances in bus-bars and electrolytes. The last is of great importance because the energy (I^2R) dissipated that is required to maintain the temperature of the solution. As the current is determined by the total resistance of the line of pots in series, it is essential that the resistance in any pot should not deviate far from its prescribed value.

On the anode electrode of the Hall-Héroult cell, a carbon monoxide (CO) gas evolves as well. The reaction:

$$Al_2O_3 + 3C \rightarrow 2Al + 3CO \quad (8)$$

is favoured by the low value of the standard free energy change which at 1243 K, for instance, is equal to ΔG^{o} = +616.7 kJ and E^{o} = –1.07 V. This implies that overall reaction may be written as follows:

$$Al_2O_3 + (\alpha + \beta)C \rightarrow Al + \alpha CO + \beta CO_2 \quad (9)$$

The α : β ratio is a function of the operating conditions and carbon quality. In practice, the gases leaving the cells contain between 20 and 30% of CO. Despite this fact, it is commonly to consider CO_2 as the main reaction product at the anode. The reason for this is that carbon monoxide may be formed in side reactions between the CO_2 and metallic aluminum and sodium dissolved in the electrolyte. In the case of aluminum, the following reaction occurs:

$$2/3Al + CO_2 \rightarrow 1/3Al_2O_3 + CO \qquad (10)$$

On the basis of thermodynamic data, one can determine the minimum energy needed for recovery of 1 kg of Al from Al_2O_3. For example, for the reaction:

$$Al_2O_3 + 1.5C \rightarrow 2Al + 1.5CO_2 \qquad (11)$$

which occurs at 970 ^oC ($\Delta G^o_{(1243\ K)} = +616.7$ kJ; $E^o_{(1243\ K)} = -1.18$ V), it is necessary to provide 6.70 kWh per kilogram of a metal. If half of this is provided by oxidation of the anodic carbon, about 3.35 kWh remains to be supplied by electrical energy, and, if the cell voltage is 5 times of the reversible potential for the effective reaction (11), the total demand for electrical power is 16.75 kWh per kg Al. In addition, about 0.5 kg of anodic carbon is used. Obviously, the electrolytic production of aluminum in Hall-Héroult cells is an energy-intensive process, accounting for almost four percent of the electrical energy produced in the United States. Consequently, in order to be supplied with as cheap as possible electricity, most smelters are located close to hydroelectric power plants.

In recent years, there have some cases of smelters being built along side conventional and nuclear power plants. Thus, if the source of electricity is coal-fired plant, combustion of about 7.5 kg of coal is required to provide 16.75 kWh of electrical energy. However, just in specific conditions the cost of this coal may be low enough to allow the process to be conducted profitably.

An ''anode-effect'' occurs when alumina content becomes too low to provide normal electrolysis process [5]. From the electrochemical standpoint, anode-effect corresponds to the onset of concentration polarization with respect to the variability of dissolved alumina at the anode-electrolyte interface. During anode-effect, the surface of the carbon anode in the melt becomes covered with an electrically insulating and non-wetting gas film that causes a considerable increase in cell resistance. The maximum cell voltage obtained during this effect provides the cell operator information regarding the particular conditions that exist in industrial cell.

The anode-effect voltage depends on the surface condition of the anodes, bath depth of cell, etc. The sides of the anodes conduct significantly more electrical current during anode effects due to the lower resistance of the thinner, less stable gas film on the sides as compared with the thicker, more stable film on the bottom surface of the anodes. This is evident from the higher voltages (50-100 V) experienced due to low bath levels, particularly in Södeberg cells where there is less side area available compared to prebake cells.

During this effect, perfluorinated carbon compounds (PFCs) are formed. These carbon compounds are fully fluorinated (i.e., the hydrogen atoms of the base hydrocarbon are entirely substituted by fluorine atoms), and they contributed to global warming. When certain anode effect-influencing condition exists, the formation of tetrafluoromethane (CF_4), according to reaction (13):

$$4Na_3AlF_6 + 3C \rightarrow 4Al + 12NaF + 3CF_4 \qquad (12)$$

is possible, and hexafluoromethane (C_2F_6) as well.

Perfluorinated carbon compounds are not emitted during the normal electrolysis in industrial reduction cells. The reason for this is the cell potential, E^o, which is low enough to provide the discharge of fluoride ions. The standard potentials needed for the decomposition of cryolite and the formation of CF_4 and C_2F_6 are 1.37 and 1.70 V higher, respectively, than the potential required for the formation and discharge of CO_2 during normal electrolysis conditions ($E^o = -1.18$ V).

Anode effect is undesirable because of extra energy consumption, over-heating of the cells and the generation of environmentally unwanted fluorine-containing anode gases. Thus, real-time monitoring and improved control of dissolved alumina concentration in the molten cryolite-alumina bath are ever-present needs throughout the alumina smelter industry. Recently, electroanalytical sensors for monitoring alumina concentration have been developed.

As mentioned before, process of electrolysis of alumina is characterized by evaluation of gases at the anode: CO_2 and CO (reactions 9 and 10). Its ratio depends on the amount of re-oxidation of aluminum metal, or current efficiency, occurring in the electrolyte. For prebake and Södeberg cells during normal electrolysis the major anode gas constituents emitted from reduction cells are CO_2 (90-95%) and CO (5-10%). However, when the cell approaches an anode-effect, the CO/CO_2 ratio becomes greater. The CO_2 content may decrease to about 20%, and the CO content may increase to about 65% of the total anode gas composition. The rates of formation of CF_4 and C_2F_6 differ significantly. The CF_4 evaluation changes markedly (from 1 to 20%) with time (during the first minute) when anode-effect occurs in prebake and Södeberg cells. On the other hand, C_2F_6 evolves at a much lower rate than CF_4, and it increases to a maximum level of only 1-2% of the total anode gas composition.

Measurements of the CF_4/C_2F_6 emission ration from aluminum reduction cells has significance since it can provide a method for identifying the source of these gases in the atmosphere. It is believed that these two gases would be emitted in the same ration from other natural or anthropogenic sources. The CF_4/C_2F_6 (mass) ratio in the atmosphere is reported to be between 12 and 25.

CONCLUSION

High electrical energy prices is the significant factor in research efforts to minimaze this energy consumption in the aluminum electrolysis proces. In general, reduction in energy consumption can be realized in two ways: (1) increase in current efficiency, and (2) reduction in cell votage [6,7]. The latter has greater potential, since

efficiencies in modern cells exceed 94 percent while actual cell voltages exceed the themodynamic minimum of 1.75 V by a factor of over 2.

Current efficiency

It has been known for a long time that the loss of current efficiency is directly proportional to evolved anode gases. From the technological point of view, establishment of the reaction between the electrolyte composition and current efficiency is of great importance. Namely, if the cell design is fixed, the question which a plant worker often arises may be: If the electrolyte composition is changed, what will happen to the current efficiency? A number of plant experiments have been carried out in order to give as much as possible precisely answer, and a huge body of literature on loss current efficiency in aluminum industry has been published.

There is a difficulty in this type of determination. In order to obtain real dependence between the current efficiency and the presence of different components in the melt, it is necessary to distinguish the effect of changing cell temperature at constant electrolyte composition and the temperature change which is inevitable in a properly operating cell when the composition is changed.

There are many side cathodic reactions that lower the current efficiency: (1) *reactions tied to primary formation of aluminum* (e.g., dissolution of aluminum into the bath, reaction of aluminum with the carbon, reduction of the melt by aluminum that yields sodium metal); (2) *reactions with imuprities present in the melt* (e.g., sodium, lithium, or magnesium); (3) *reaction of aluminum metal with carbon*, yilding aluminum carbide (Al_4C_3); and (4) *aluminum metal dissolution reactions into the electrolyte*. The last group of side cathodic reaction is the main reason for the loss of the current efficiency. Namely, the solubility of aluminum, which is obout 0.1%, increases when th emelt gets more basic, when the temperature increases, and when the proportion of aditives such as Al_2O_3, MgF_2, CaF_2 and LiF decreases.

In addition to already mentioned impurities, some other impurities may play significant role as well. Phosphorous oxide (P_2O_2), for instance, is often introduced to the bath of the Hall-Héroult cell together with row materials. In the conditions of the electrolysis its content may attain up to 250 ppm. Every 100 ppm of P_2O_2 decreases the current efficiency by 1%. During the process, phosphorous and its compounds react with the bath components, mainly cryolite and with alumina oxide.

Cell voltage

The distribution of the cell voltage (4.64 V) in a typical Hall-Héroult cell looks as follows: (1) *external* (0.16 V or 3.4% of total voltage); (2) *anode* (0.32 V; 6.9%); (3) *polarizations* (0.60 V; 12.9%); (4) *bath* (1.76 V; 38%); (5) *decomposition* (1.20V; 25.9%); (6) *cathod*e (0.47 V; 10.1%) and *other* (0.13 V; 2.8%). As can be seen from these data, only 25.% of the energy entering the cell could be electrically reversibly extracted from aluminum recovered. The value of 1.2 V is fixed, since the decomposition potential expresses the free energy of the reaction. Therefore, the other components could be reduced:

(1) External anode and cathode resistances;
(2) Polarization which includes:
- the rate of the reaction of oxygen with anode carbon;
- the rate of diffusion of the aluminum oxyfluorides to the anode for discharge;
- resistance of the bubble layer leaving the anodic surface;
(3) Resistance of bath.

Tha last is the most promising because 38% of energy entering the cell is converted to heat by resistance of electrolyte. Reduction of the anode-to-cathode distance (ACD), therefore, may be solution. This anode-to-cathode distance is 4 to 5 cm in present-day cells. Further reducing this ACD value, in order to lower energy consumption, is not desirable since there is danger of shorting the cell contacts between the anodes and the metal pool.

In modern aluminum reduction cells the overall cell voltages are most often about 4.5 V. These values are significantly lower than those obtained several decades ago. The need to reduce anode-to-cathode distance has led to the concept of advanced Hall-Héroult cells that use inert anodes and wettable refractory cathodes (on which a thin film of aluminum will form rather than the pool of aluminum in existingcells). The greatest attention is devoted to development of materials for the inert anode (e.g., TB_2) and refractory cathode. Single cell lives greater than 4000 days have been reported at a number of smelters. The use of graphitic and graphitized blocks for lower cathode resistances has also become more widespread, resulting in energy saving.

Undoubtedly, developing a nonconsumable anode for smelting is one of the highest research priorities among primary aluminum producers. It is a research area that is sufficiently complex and risk. There are many properties that should be collected in an ideal non-carbon electrode.

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THE ROLE OF MICROORGANISMS FOR DETOXIFICATION OF AGRICULTURAL SOIL

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ABSTRACT

The aim of experiment was to study the influence of herbicides, used in soybean cropping, on soil microbiological activity. The observed effect depended on herbicide type, microorganism species and reactional period. The most inhibitory effect vas noted in klomazon (Command) and imezetapira (Pivot) treatments. The most sensitive group of microorganisms to herbicides were nitrogen fixators - *Azotobacter*. Dehydrogenase activity of soil was significantly reduced by herbicides, too. Meanwhile, the number of fungus and *Actinomycetes* was enlarged.

Keywords: soil, herbicides, microorganisms

INTRODUCTION

The contemporary development of agriculture in 20th century creates technology production with high speciality for all crops, including utilization of mineral fertilizers and synthetic pesticides. There is well-known harmful influence of such production, provided on gradual declination of ecosystem (humus decrease, soil degradation, lower microbiological activity, consuming of food with toxic residues etc.). There is accent on reducing of such production in western countries, together with lower usage of chemicals amount (Milošević et al. 2006).

The herbicides circulate in environment. The conventional agro-technique includes herbicides utilization and their retention in soil depends on degradation speed. In soil, herbicide arrives many physical, chemical and biological processes: it binds to colloid fractions and submits to chemical and the most important - microbiological decomposition (Cvijanović et al. 2004).

Taking into consideration the sensitivity of microorganisms and their fast response to herbicides (above their quantity and biochemical activity) they could give approach of herbicide influence. The aim of this experiment was to observe the herbicides influence on soil biogenity.

MATERIALS AND METHODS

In this experiment the herbicides were used: H_1- kvizalofop-p-tefuril (Pantera) 48 g a.i. ha^{-1}; H_2 - oksasulfuron (Dynam) 60 g a.i. ha^{-1}; H_3 - imezetapir (Pivot) 80 g a.i. ha^{-1} and H_4 - klomazon (Command) 75 g a.i. ha^{-1} H_5-acetochrol (Acenit) 2 $l.ha^{-1}$ and K - control (without herbicide applications). The herbicides were used after phase of third leaf.

The trial with soybean was set up on poorly carbonated chernozem of Maize Research Institute "Zemun Polje". The samples for microbiological analysis were germ-free practiced from soybean rizosphere, after 5; 10 and 30 days, from moment of herbicide treatment.

Standard microbiological methods on selective mediums (Pochon and Tardieux 1962; Krasiljnikov 1965) were used to determine basic parameters of all alterations in soil. Dehydrogenase activity was realized by modificated method of Thalman (1968).

RESULTS AND DISCUSSION

The applied herbicides influenced differences in amount of microorganisms and their enzymatic activity, depended on microorganism variety and reactional persistence.

The differences in reactional array of herbicide treatment were estimated by microorganisms' number (Tab. 1). The increased physiological activity and mortality of microorganisms (Cervelli et al., 1978) was noted as reaction on the majority of herbicides. Some microorganisms species could reduce the toxic effect of herbicides, what depend on constituents of microbiological population; physical and chemical soil properties (Govedarica, et. al., 1999).

Results confirmed in Table 1 approve herbicide influence in examined periods, i.e. they decreased total quantity of microorganisms, in general. However, after 30 days of herbicide application imezetapir (Pivot) and klomazon (Command) reduce their amount, opposite to other herbicide treatments, in which amount was increased to 5.9 do 14.2%.

Table 1. Total number of microorganisms (log numbers)

Herbicides	after 5 days		after 10 days		after 30 days	
	Log numbers	Index Level	Log numbers	Index Level	Log numbers	Index Level
Control	1.36	100	1.32	100	1.34	100
Pantera g a.i. ha^{-1}	1.22	98.7	1.45	109.8	1.42	105.9
Dynam 60 g a.i. ha^{-1}	1.28	94.1	1.42	107.5	1.53	114.2
Pivot 80 g a.i. ha^{-1}	1.08	79.4	1.31	100.0	1.33	99.2
Command 75 g a.i. ha^{-1}	0.91	66.9	1.30	98.5	1.31	97.8
Acenit 2 $l.ha^{-1}$	1.27	93.9	1.36	103.0	1.46	108.9

Herbicide application decreased *Azotobacter* amount (Tab. 2). Hence, this bacteria is very sensitive and reacts with quantity on inhabit shift, it is good prove of all soil alterations

Table 2. Number of Azotobacter (log numbers)

Herbicides	after 5 days		after 10 days		after 30 days	
	Log numbers	Index Level	Log numbers	Index level	Log numbers	Index level
Control	1.02	100	1.04	100	1.23	100
Pantera g a.i. ha^{-1}	1.25	122.5	1.22	117.3	1.15	93.5
Dynam 60 g a.i. ha^{-1}	1.40	137.2	1.03	99.0	1.07	86.9
Pivot 80 g a.i. ha^{-1}	0.93	91.7	0.99	95.2	1.04	84.5
Command 75 g a.i. ha^{-1}	0.85	83.3	0.81	77.8	0.90	73.2
Acenit 2 $l.ha^{-1}$	5.02	68.6	0.93	89.4	1.16	94.3

It could be recognised that high amount of this nitrogen-fixator was decreased, especially after klomazon (Command) and imezatapir (Pivot) application. The results of Milošević et. al., (1995; 2000) also prove that imezatapir appliance had negative influence on noticed group of bacteria, particularly after 14 days; klomazon in combination with bentazonom reduced amount of this group to 53-80%.

The presence of amynoheterotrophs, as microorganisms which apart in degradation of organic soil substance - transforming proteins and other nitrogen compounds to ammonium, vas significant in soil.

Table 3. Numbers of ammonificators (log numbers)

Herbicides	after 5 days		after 10 days		after 30 days	
	Log numbers	Index Level	Log numbers	Index level	Log numbers	Index level
Control	1.04	100	1.13	100	1.22	100
Pantera g a.i. ha^{-1}	0.93	89.4	1.09	96.5	1.21	99.1
Dynam 60 g a.i. ha^{-1}	1.08	103.8	1.00	98.5	1.25	102.5
Pivot 80 g a.i. ha^{-1}	1.01	97.1	1.24	109.7	1.26	103.3
Command 75 g a.i. ha^{-1}	0.98	94.2	0.91	80.5	1.01	82.8
Acenit 2 $l.ha^{-1}$	1.02	95.2	1.09	96.5	1.13	92.6

Applied herbicides reduced quantity of ammonificators in different percent. After 30 days of oksasulfuron (Dynam) and imezatapir (Pivot) application, their amount was increased to 2.5 and3.3%, respectively, while klomazon (Command) reduced their number to17.2%.

In general, the herbicide treatment did not disturb fungus amount (Tab. 4), with exception in 5^{th}, when number was decreased. Mainly depression of number was observed after klomazona and acetohlora application: 23.7 and 14.0%, respectively.

Meanwhile, in 30^{th} day the all applied herbicides increased fungus quantity in different percent: from 5.6%, in kvizalofop-p-tefuril (Pantera) treatment to 19.6%, in acetohlor (Acenit) treatment. In could be connected to fungus taking account in processes of herbicide decomposition. Whereas, the fungi are heterotrophic organisms, with developed enzymatic system and pronounced amount dynamism, they are participants in numerous decomposition processes of inorganic and organic substances, even and herbicides.

Table 4. Number of fungi (log numbers)

Herbicides	after 5 days		after 10 days		after 30 days	
	Log numbers	Index Level	Log numbers	Index level	Log numbers	Index level
Control	0.93	100	1.04	100	1.07	100
Pantera g a.i. ha^{-1}	0.84	90.3	1.08	105.8	1.13	105.6
Dynam 60 g a.i. ha^{-1}	0.88	94.6	1.07	102.8	1.20	112.1
Pivot 80 g a.i. ha^{-1}	0.89	91.4	0.89	85.9	1.23	114.9
Command 75 g a.i. ha^{-1}	0.71	76.3	1.10	105.7	1.20	112.1
Acenit 2 $l.ha^{-1}$	0.80	86.0	0.91	87.5	1.28	119.6

Additionally, the herbicides stimulated *Actinomycetes* number: already, after 5 days the number was increased (except in kvizalofop-p-tefuril (Pantera) and acetohlora (Acenit) treatment), continually to 30th day, with values higher to13.7 and 20.9% in kvizalofop-p-tefuril, and klomazon treatment. It is important to determine dynamism of Actinomycetes amount in soil, since they produce vitamins of B group and could participate in activation of physiological processes of other microorganisms. In accordance to Grossbard and Davies (1976), Cvijanović et al. (2006) fungi and *Actinomycetes* are resistant to pesticide influence.

Table 5. Number of Actinoyicetes (log numbers)

Herbicides	after 5 days		after 10 days		After 30 days	
	Log numbers	Index Level	Log numbers	Index level	Log numbers	Index level
Control	1.42	100	1.28	100	1.24	100
Pantera g a.i. ha^{-1}	1.22	85.9	1.42	110.9	1.41	113.7
Dynam 60 g a.i. ha^{-1}	1.44	101.5	1.32	103.1	1.47	118.5
Pivot 80 g a.i. ha^{-1}	1.43	100.7	1.45	113.2	1.43	115.4
Command 75 g a.i. ha^{-1}	1..43	100.7	1.50	117.1	1.50	120.9
Acenit 2 $l.ha^{-1}$	1.33	93.1	1.33	103.9	1.42	114.6

The herbicides generate decease of sensitive microorganisms (Cervelli et. al., 1978), reverse to herbicide decomposition, supported by enzymes of microbiological population, who yielded on noted compounds and their metabolites as resources of biogenic elements. It could be recognised, that primary group of microorganisms decay herbicides even after few days, while the secondary group produce adequate enzymes to rot co-products after period of adaptation.

The significan decrease of dehydrogenase activity was observed in30th day after herbicide use (Tab. 6).

Table 6. Dehydrogenase activity (µTPF.10 g $soil^{-1}$)

Herbicides	after 30 days	
	µTPF.10 g $soil^{-1}$	Index level
Control	916	100
Pantera g a.i. ha^{-1}	589	64.30
Dynam 60 g a.i. ha^{-1}	626	68.34
Pivot 80 g a.i. ha^{-1}	823	89.84
Command 75 g a.i. ha^{-1}	686	74.89
Acenit 2 $l.ha^{-1}$	758	82.75

Our investigations indicate that irregular and uncontrolled herbicide application affect soil biological activity.

CONCLUSIONS

The herbicide effect on soil biogenity depended on herbicide type, microorganism species and reactional period. In general, they decreased examined parameters, with exception of *Actinomycetes* and fungi quantity. The inhibitoriest effect was observed in klomazona and imezetapira treatment.

There is emergency to investigate the influence of herbicides on soil microbiological activity before theirs majority exercise in agricultural production in aim of soil ability preservation.

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MANAGEMENT OF THE SLOVAK-HUNGARIAN WATER CONFLICT OVER THE DANUBE RIVER

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ABSTRACT

The purpose of this chapter is to explore the dynamics of environmental conflict and cooperation under the conditions of relative power symmetry and involvement of various actors (not predominantly state-actors); especially, environmental groups. This paper analyzes the highly-contested water issue in the Danube River Basin that refers to the multi-purpose "Gabcikovo-Nagymaros" project and its alleged detrimental impact to the environment. The conflict analysis shows that the water dispute between Hungary and Slovakia involves dynamics that include a complex network of interactions between a number of domestic and international policy actors. It also indicates the conditions under which a voluntary mode of cooperation can produce not satisfying results.

Keywords: the Danube River, conflict, cooperation, environmental groups

INTRODUCTION

The conflict between Hungary and Slovakia over the Danube intensified in 1992 when Hungary definitely abrogated (primarily on the basis of environmental concerns) the 1977 treaty with Czechoslovakia concerning construction of the Gabcikovo/Nagymaros hydro-power project. Benefits claimed for it by its Hungarian-Czechoslovak designers were hydroelectric power, improved flood control, and navigability [1]. Slovakia, following the withdrawal by Hungary in the early 1990s, continued construction unilaterally, completed the dam, and diverted the Danube into a canal inside the Slovak territory. This diverting of the Danube River (so-called "Variant C") was the result of Hungarian termination of the agreement signed in 1977.

The Hungarian government has pointed out three environmentally related issues resulting from the Slovakian continuation of the project. These are: (1) the irreparable damage of an ecologically and agriculturally rich region of Hungary; (2) a threat to the water table underlying parts of Hungary, Slovakia, and Eastern Austria; and, (3) pollution of the waters of millions of people. Kurland and co-workers have offered a similar identification of environmental concerns: "The dam will result in lowering of the water table, the destruction of woodlands and wetlands, and the contamination of water

supplies" [2]. Apparently, this conflict entails both the quantity and quality attributes of an environmental conflict. In addition, Hungarian officials have expressed concern that water supplies to some ethnic Hungarian Danube villages will be cut off, while other would be flooded. Finally, the Hungarian side is very sensitive to the changed character of international border with its northern neighbor; on the other hand, the Slovak government tends to dismiss the environmental reports as alarmist and focuses on the benefits of the dam.

THE HUNGARIAN CONCERNS OVER THE''GABCIKOVO-NAGYMAROS'' ISSUE

The Slovakian-Hungarian water conflict has environmental as well as other aspects such as economic, social, and political. Hungary, in terms of fresh water resources, has faced an extremely high level of vulnerability interdependence. Almost all the rivers of significance to Hungary have their springs abroad. For example, three quarters of Hungary's surface water resources are found in the channels of the Danube, Tisza, and Drava Rivers, while almost ninety percent of the total drinking water demand is being met from sub-surface water resources. Signs of the excessive use of these resources have been recognized in some regions, where sixty-five percent of the water authorities now extract water from hydro-geologically vulnerable environments [3].

Given these natural constraints, it is not surprising that, particularly in Hungary, the "Gabcikovo-Nagymaros" project engendered widespread protests against its potentially adverse impact on the environment. In numerous public forums since the 1980s, including demonstrations involving thousands of individuals, environmentalists have protested that the project will: (1) flood huge areas of fertile agricultural and forest lands, (2) reduce the water table and endanger the water supply for millions of residents of nearby localities, and, (3) increase pollution in an already heavily contaminated Danube River [4]. Environmentalists also questioned allocating such large resources to Nagymaros when the "Paks NPS" (a nuclear electric power plant) was supposed to provide a surplus of electricity by the year 2000.

Critics of the hydro-project also received unexpected assistance from the Soviet House of Culture in Budapest. This institution attempted to organize the presentation of a Soviet film on why barrage systems should not be built on flat land. The invitation announcement asserted:

> No single other enemy out to destroy our planet earth has ever done so much damage as the constructors of (these) barrage systems. The barrage systems are the product of shortsighted, tunnel-visioned technocrats out to overpower everything; they stand in opposition to … environmental protection [4].

Yet, for publicly unexplained reasons, the House of Culture canceled the film on the day of its planned showing. Subsequently, however, Radio Budapest (October 12, 1988) reported that the president of the "Soviet Society for the Protection of Nature" called construction of huge flatland barrage systems an "ecological sin" [4].

The controversy culminated in an unprecendeted debate (October 1988) in the Hungarian Parliament on the future status of the project. The final vote ─ 317 deputies in favored the project, 190 opposed it, and 31 abstained ─ reflected neither the acrimonious nature of, nor the depth of opposition expressed in, the debate that ensued. Opponents

criticized the project as both economically and environmentally unsound. One deputy asserted that "if there had been democracy in Hungary in 1977, then we would not be here debating the barrage system today" [4].

As these several illustrations indicate, the "Gabcikovo-Nagymaros" dispute has a dominant symbolic character, and, more importantly, this conflict cannot be explained without considering environmental pressure groups (EPGs). The fact that local EPGs in Hungary were deeply embedded in the process of democratic transition makes explanations of this case very interesting and challenging. The fall of communism and rise of new democratic institutions in Hungary and Czechoslovakia/ Slovakia, therefore, offer a valuable opportunity to develop the arguments in this study. The dynamics of democratization influenced both the dynamics of EPGs and the gradual polarization of the "Gabcikovo-Nagymaros" issue that began in both countries on the eve of first free elections (in 1990). Consequently, EPGs that acted from early the 1980s, particularly in Hungary, saw many changes dependent on what Kitschelt calls existing "political opportunity structure" (POS) [5]. The difference in political opportunity structure, as we will show later, may explain the difference in the scope of activities and outcomes of EPG' in Hungary and Czechoslovakia/Slovakia.

Therefore, the remainder of this paper will be organized as follows: First, we will describe the most relevant developments in environmental movements regarding the "Gabcikovo-Nagymaros" dispute, analyzing strategies adopted by various environmental pressure groups; second, we will analyze constraints and inducements for activities of environmental pressure groups in the context of the specific political opportunity structures in Hungary and Slovakia; and, finally, we will pay attention to the issue of politicization of the "Gabcikovo-Nagymaros" project.

THE "GABCIKOVO-NAGYMAROS" ISSUE AND ENVIRONMENTAL PRESSURE GROUPS

It is a truism to say that the environmental movement is extraordinarily diverse. However, for the sake of analytical precision in treatment of the "Gabcikovo-Nagymaros" water dispute, it seems plausible to adopt a three-fold typology of EPGs suggested by Carter [6]. It coincides with three historical waves and encompasses: (1) the conservation movement, (2) modern mainstream environmentalism, and, (3) grassroots environmentalism. Two key aspects of any environmental pressure group are also important ─ *resource mobilization* and *political efficacy*. While resource mobilization refers to the choice between a professional and a participatory organization, political efficacy refers to the choice of strategy and tactics. The core dilemmas in EPGs activities are presented in Table 1. We will begin with analyzing the EPGs that were involved in the conflict.

Table 1. A Typology of Non-Partisan Political Organizations.

	Forms of Action	
	Conventional pressure	Disruption
Professional resources	Public interest lobby	Professional protest organization
Participatory resources	Participatory pressure group	Participatory protest organization

ENVIRONMENTAL GROUPS IN HUNGARY, CZECHOSLOVAKIA/SLOVAKIA, AND AUSTRIA

The very beginning of an environmental movement in this region was in Hungary in the early 1980s. In line with Table 1, one can identify two distinct periods – the early 1980s and late 1980s. The first period was characterized by the use of professional resources through public interest lobbying. This stage was followed by using disruption as a form of action relying on both professional and participatory resources.

Table 2 illustrates the main moments in the development of an environmental movement in Hungary. Unlike Hungary, there was virtually no opposition to the project in Czechoslovakia. The response of local EPGs was "passive" and "immobile" [7].

Table 2. The Rise Opposition to the Dams in the 1980s.

Date	Event/Process(Outcomes)
the early 1980s	The initial technical critiques of the project. (No wide discussion)
1981	Janos Vargha, a biologist and journalist, opens the debate in Buvar (Diver), a nature protection monthly.
1981	Some limited international criticism of the project and a temporary construction halt.
1981 November	Janos Vargha publishes a dramatic critique of the project in VALOSAG (a social science monthly). (Vargha asked to participate in an advisory committee of the Academy of Sciences)
1982-84	Further expert debates and critiques come from official and semi-official bodies such as government economists ─ the Hungarian Hydrological Society, the Scientific Institute of Water Management, the Association of Technical, and Natural Sciences Societies, the National Environmental and Nature Protection Office.
1984 January 27	Janos Vargha is invited by the Embankment Club in Budapest to a debate with a Deputy Chairman of the Water Management Authority. (open debate for a short time; the Government re-imposes censorship restrictions)
1984	A newly created "Danube Circle", an umbrella environmental movement, launches a campaign for postponement of the project.
1985-1986	The Danube Circle becomes more structured and develops foreign links.
1986	Hungarian intellectuals participate in the movement through advertising campaigns against dam and against Austrian financial involvement.
1986 January 30	A 2,500 signature petition calls for a referendum.
1988 September 4	A joint Danube-Circle-WWF Conference is held and a mass demonstration of 30,000 people in front of the Parliament. (The Project is again confirmed.)
1989	A campaign of demonstrations and collection of signatures continues and intensifies.
1989 December	The reformist Miklos Nemth becomes Prime Minister.
1989 February	A 140,000 signature petition is presented to Parliament.
1989 March	The Government asks the Academy of Economic Sciences to prepare an opinion, which later leads to the Committee of Independent Experts, chaired by Professor Hardi.
1990 October	The Hungarian Parliament accepts the conclusions of the Hardi Report, that is, cancellation of Nagymaros.

THE WORLD WIDE FUND FOR NATURE INVOLVEMENT

The *World Wide Fund for Nature* (WWF) lies somewhere between the conservationist and mainstream environmentalism, that is, between first and second environmental waves. Carter states that the founding in 1961 of the *World Wildlife Fund* (WWF) (now World Wide Fund for Nature) "represented a bridge to a new type of international organization", that reflects the international nature of modern environmentalism and increased membership [6].

The role of the WWF in the Hungarian-Slovakian conflict was extraordinarily important in terms of both its influence on *world-wide publicity* of the issue itself, and, surprisingly, its subsequent role in *conflict diffusion*. The former was achieved through the help of local environmental groups in organizing a massive protest. The latter goal was achieved by an independent expert study, within the WWF, of alleged detrimental environmental effects.

Thus, in the early summer of 1988, when the process of liberalization and reform was in motion, the local environmental groups kept pressure on the Hungarian Parliament. On September 4, a joint Danube Circle-WWF Conference was held and almost 30,000 people demonstrated in front of the Parliament in Budapest. Later, when the reformists took over the Government in Hungary, the newly elected officials, with support from the WWF, claimed that Gabickovo would dry out large forested wetlands beside a narrow stretch of the Danube and "either empty or pollute important underground water sources fed by the River" [8]. This water source supplies 1.4 million people ─ mostly within Hungary. At the same time, Slovakian authorities and experts accused the WWF of being politically motivated in backing Hungarian opposition to the diversion.

However, the year of 1994 saw a twist in the WWF stance regarding the Gabcikovo conflict. The organization's director, Claud Martin, halted WWF's campaign against the diversion after receiving detailed scientific refutation of the claim that the dam would cause an ecological disaster. In June 1994, Magnus Sylven, European director of the WWF, apologized to Slovakian scientists, saying "how embarrassed I personally feel about WWF's past involvement in the campaign against the dam" [9]. The WWF officials, after a scrutinized analysis, praised the scientific evidence given by Igor Mucha, a leading Slovakian hydrologist. The project, in fact, has some positive environmental effects. Since May 1993, the Slovakian side has regularly fed part of the diverted water back into the wetland, reviving branches of the Danube that have been largely dry for thirty years.

This clearly indicates the power of the scientific (epistemic) community in opening the doors for cooperation. It also shows a shift in policy of the most influential global environmental groups, such as the WWF, towards a more cautious assessment of each particular controversy. Nevertheless, in this particular case, the WWF had both negative and positive effects on cooperation between Hungary and Czechoslovakia. (The WWF's missing point was the symbolic meaning of this conflict.) In Hungary, during the 1980s, hostility to the dams at Nagymaros and Gabcikovo became the focus for opposition to the Communist government.

THE OUTCOMES OF EPGS ACTIVITIES AND COOPERATION

The local environmental movement in Hungary, as we have seen, achieved its ultimate goal ─ the cancellation of the project by Hungary. Simultaneously, it contributed to the deterioration of relations between Hungary and Czechslovakia/Slovakia. The movement significantly shaped the preferences of a new reformist Government (since 1989) in Hungary. Unwilling to risk a massive loss of public support, the reformist Government took into account almost all objections of the environmentalists, and, thus, deprived itself of a certain freedom in coming negotiations with Czechoslovakia and Slovakia (since January 1, 1993).

Thus, although mobilization strengthens the ability of challengers and elites to make claims, it also limits the range of acceptable outcomes because of the conditional nature of popular support [10]. Therefore, this case fits very well in the Putnam "double-level game". Yet, at the end of the day the expert knowledge helps to encourage prospects for cooperation. That occurs, as the case of the exchange of data between the WWF and the Slovak scientists shows, when the data are interchanged or produced by common experts teams.

CONCLUSION

The difference in opposition to the dams in Hungary and Czechoslovakia may be explained by differences in their openness to the influx of new ideas within the political opportunity structure. Although Communist leaderships ruled the two countries, Hungary's government was more eager to enter into a dialogue with society and to begin the process of political and other reforms. Simultaneously, after 1968, Czechoslovakia remained quiescent, ruled by a very conservative Slovak-dominated leadership. There, the main objective of the leadership was the post-Spring 1968 normalization. Thus, unlike Hungary, as Fitzmaurice observes, "dissidence in Czechoslovakia was at a very narrow intellectual, even Prague-based, phenomenon" [7]. On the other hand, the Hungarian dissident movement linked up with the environmentalists in the Danube Circle in opposition to the Gabcikovo-Nagymaros project. Apparently, there was in Hungary a comparative advantage for the emergence of a strong environmental movement.

Another event that created a "space" for environmental movements in both countries was the Chernobyl NPS accident on April 16, 1986. The event itself acted as a catalyst for general environmental mobilization throughout Europe. In Hungary, protests were limited primarily to the issue of the disposal of nuclear wastes. In Czechoslovakia, on the other hand, the prominent dissident group Charter 77 criticized the Temelin project (NPS). "*Nahlas*", a group of environmental activists in Slovakia, circulated a petition with 1,400 signatories that demanded a "public discussion" of environmental problems [4]. This indicates a certain level of asymmetry in perception of risks originated from nuclear energy facilities (stronger in Slovakia, lower in Hungary) and from hydro power stations (stronger in Hungary, lower in Slovakia).

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MICROBIAL ABUNDANCE IN SUGARBEET RHIZOSPHERE IN DEPENDENCE OF INOCULATION AND LOCATION

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ABSTRACT

The objective of the study was to investigate the microbial abundance in sugarbeet rhizosphere depending on location and different types of application of *Azotobacter chroococcum*. Field trials were established in the locations of Rimski Šančevi and Pančevo, in 2008. Five strains of *Azotobacter chroococcum* were used for inoculation. The experiment included three variants of inoculation. The results of the study for the five strains of *Azotobacter chroococcum* and the three application methods showed that inoculation increased total number of microorganisms and number of azotobacters in sugarbeet rhizosphere.

Keywords: *Azotobacter chroococcum*, PGPR, rhizosphere, sugarbeet

INTRODUCTION

The rhizosphere is a complex environment in which the effect of the plant on soil microorganisms and effects of microorganisms on the plant are interacting and interdependent. Some rhizosphere microorganisms may be neutral or deleterious in regard to plant growth, whereas others support plant growth (Welbaum et al., 2004; Raaijmakers et al., 2008).

Rhizobacteria, also called plant–growth–promoting rhizobacteria (PGPR) (Kloepper and Schrot, 1978), are a heterogeneous group of bacteria that can be found in rhizosphere, on root surfaces and in association with roots, which can improve the extent and/or quality of plant growth directly or indirectly. PGPR strains can exert a beneficial effect on plant nutrition as a result of a combination of N_2 fixation, mobilization of nutrients (N, P, Fe) in the soil and excretion of plant hormones (Picard and Bosco, 2003; Johansson et al., 2004). Such plant-growth promoting rhizobacteria can stimulate plant growth, increase yield, reduce pathogen infection, as well as reduce biotic or abiotic stresses (Welbaum et al., 2004, Lugtenberg and Kamilova, 2009). In recent decades, a large number of bacteria including the species of *Azotobacter*, *Pseudomonas*, *Bacillus*, *Azospirillum*, *Klebsiella*, *Enterobacter*, *Alcaligens*, *Arthobacter*, *Burkholderia* and *Serratia* have been reported to enhance plant growth (Ahmad et al., 2008). PGPRs are used as inoculants for biofertilization, phytostimulation and biocontrol (Okon and

Itzigsohn, 1995; Rodelas et al., 1999; Bloemberg and Lugtenberg, 2001; Milošević et al., 2003).

The objective of this study was to determine the abundance of azotobacters and the total number of microorganisms in sugarbeet rhizosphere depending of different variants of inoculation with *Azotobacter chroococcum*.

MATERIAL AND METHODS

Field trials were established on a chernozem soil at Rimski Šančevi experimental field of Institute of Field and Vegetable Crops in Novi Sad and at experimental field of PDS Institute " Tamiš" in Pančevo. The experimental object was the sugarbeet hybrid variety Drena developed at the Institute. The trial included three variants: (I) application and simultaneous incorporation of a liquid culture of *Azotobacter chrooccocum* strains before sugarbeet sowing, (II) the second was same as first, only with inoculation before the first inter-row cultivation, and (III) seed treatment before sowing. Inoculation was performed with five strains of *Azotobacter* [1, 5, 8, 10, 14] isolated from the sugarbeet rhizosphere at Rimski Šančevi. The mentioned strains were chosen because they demonstrated best association with sugarbeet varieties in former tests. Cell density of the inoculum was 10^9 per ml of culture. The rhizosphere soil was sampled three times in the course of growing season (May, July and September).

Total number of microorganisms was determined on soil agar (dilution 10^6). Azotobacters were determined on Fiodor substrate (dilution 10^2) (Jarak and Đurić, 2004).

RESULTS AND DISCUSSION

Effects of the different types of sugarbeet inoculation are presented in Tables 1 and 2. Table 1 shows the total number of microorganisms and Table 2 the number of azotobacters in sugarbeet rhizosphere. Mrkovački et al. (2001, 2003, 2009) showed that the application of *Azotobacter chroococcum* strains to sugarbeet may not only increase the bacterial density in the rhizosphere and surrounding soil, but may also increase the yield and technological quality of sugarbeet roots.

Table 1. Total microbial number in sugarbeet rhizosphere

Location	Variant of inoculation	Control	S1	S5	S8	S10	S14	Mean of strains	Increase %
	I	214.17	226.88	249.25	218.16	212.27	233.68	228.05	6.48
Rimski	II	179.04	258.94	168.7	227.13	239.83	226.47	224.21	25.22
Šančevi	III	205.49	191.42	246.58	238.79	224.87	235.05	227.34	10.63
	Average	199.57	225.75	221.51	228.03	225.66	231.73	226.53	13.51
	I	131.7	171.53	113.92	151.14	113.08	233.43	156.62	18.92
Pančevo	II	77.09	135.57	205.43	89.82	85.59	116.33	126.55	64.16
	III	126.15	127.76	198.44	142.95	202.36	256.46	185.59	47.12
	Average	111.65	144.95	172.6	127.97	133.68	202.07	156.25	43.4

At Rimski Šančevi, the highest total microbial number for all strains was recorded with soil treatment applying inoculation method I. In Pančevo, best results were obtained with inoculation method III. Best effects of inoculation on the total number of microorganisms, in both locations, were obtained with strain 14. In a study of Mrkovački et al. (2010), best effects of inoculation on the total number of microorganisms were obtained with strain 1 (average for two years) at Rimski Šančevi.

On average for both locations, the highest percentage increases of total microbial abundance were obtained in the variant of soil treatment with inoculation before the first inter-row cultivation by 25,22% and 64,16% respectively (Table 1). These results are in agreement with earlier investigation for two years (Mrkovački et al., 2010).

Table 2. Number of azotobacters in sugarbeet rhizosphere

Location	Variant of inoculation	Control	S1	S5	S8	S10	S14	Mean of strains	Increase %
Rimski Šančevi	I	22.03	33.75	31.32	40.70	41.12	28.97	35.16	59.6
	II	27.96	40.30	45.24	40.06	40.97	46.65	42.64	52.5
	III	22.29	34.24	47.16	37.55	28.52	55.17	40.52	81.78
	Average	24.09	36.10	41.24	39.44	36.87	43.60	39.44	63.7
Pančevo	I	32.94	39.27	63.08	53.19	49.58	45.34	50.09	52.1
	II	51.43	64.24	62.72	61.28	58.14	57.01	60.67	17.96
	III	38.96	50.76	39.50	39.90	43.20	46.71	44.01	12.96
	Average	41.11	51.42	55.1	51.46	50.31	49.69	51.59	25.5

On average for both locations, the highest azotobacter abundance for all strains was obtained in the second variant of soil treatment, i.e., with inoculation before the first inter-row cultivation.

In this study, largest numbers of azotobacters were obtained with strain 14 at Rimski Šančevi and with strain 5 in Pančevo.

On average, the highest percentage increase in number of azotobacter at Rimski Šančevi was obtained in the third variant of inoculation with seed treatment (81.78%) and in the soil treatment on first variant (52.1%) in Pančevo (Table 2). The same results were obtained (Mrkovački et al., 2010) on average for two years.

On average, all the investigated strains increased total number of microorganisms and number of azotobacters in relation to the non-inoculated treatments. The results of the study, for both locations and the three variants of application, showed that inoculation increased total number of microorganisms and number of azotobacters in sugarbeet rhizosphere.

The inoculation with *Azotobacter chroococcum* produced a higher positive effect on the number of azotobacters at Rimski Šančevi than in Pančevo. The inoculation with *Azotobacter chroococcum* had a higher positive effect on total number of microorganisms in Pančevo than at Rimski Šančevi.

CONCLUSION

The inoculation with *Azotobacter chroococcum* increased the total number of microorganisms and the number of azotobacters in sugarbeet rhizosphere in both test locations.

The highest increase (%) in the total microbial abundance, in both locations, was obtained in the variant of soil treatment with inoculation before the first inter-row cultivation (II).

The highest increase (%) of azotobacters at Rimski Šančevi was obtained in the third variant with seed treatment (III) and in the first variant (I) of soil treatment in Pančevo.

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IMPLEMENTATION OF CORPORATE SOCIAL RESPONSIBILITY INTO THE PROCESS OF COMPANY MANAGEMENT

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ABSTRACT

One of the currently actual economic issues is social responsibility of companies. Corporate social responsibility is a constant ambition of the business sector to behave ethically and to contribute to the economic development, while at the same time it improves the lives of their employees, their families, the community and society with proactive elimination of potential negative impacts on the environment. This paper will emphasize the importance of introducing the concept of social responsibility in the process of company management. The means and ways of implementing this concept, as well as its costs, benefits and opportunities will be also analyzed.

Keywords: enterprise, social responsibility, economic development, management

INTRODUCTION

The concept of Corporate Social Responsibility (CSR) is still insufficiently present in our companies as well as the term itself is not yet clearly defined. This is a typical situation for the countries in transition. The former period left as its legacy the notion that donations, voluntary giving and the like make socially responsible businesses. These are, however, only elements of such behaviour and are insufficient if a company is to be defined as a socially responsible one. Corporate social responsibility is an attempt to engage all aspects of a business to function toward social welfare generally. Besides the profit, companies also take care of the employees, their families, the environment, local community and society in general. Nowadays, companies are usually more worth than their accounts books show. This difference comes from the intangible property, such as copyright, patents, licences or professional staff, as well as good practices and corporate social responsibility which has become a current issue in the last couple of years. This is the crucial factor that differentiates one company from other players in the market and makes it a desirable workplace – it ensures higher quality workforce and greater loyalty on the part of the employed and clients, and greater competitiveness along with all this. This concept enables the link between the company's own economic and braoder social goals and building up the value system and management which will bring both profitability and growth to the company in the long

run, while ensuring the development of society as a whole. It should be emphasised that the concept of social responsibility is not obligatory, it is a matter of free choice and good will of every company.

THE COMPONENTS OF SOCIAL RESPONSIBILITY

Social responsibility is derived from the approach according to which a company in its doing business starts with social needs and social benefits. We will see its main functions through the dimensions of social responsibility.

There are four main dimensions of social responsibility and these are: economic, legal, ethical and philanthropic. [1]

Economic responsibilities make the essence of all business activities. The economic dimension of social responsibility refers to the distribution of production means within a social system and the company's orientation to ensure employment, profit and return of investments.

Legal dimensions of social responsibility refer to the laws and regulations brought by the government in order to ensure the minimum of behavioural standards. The laws which deal with doing business are brought because society, including customers, interest groups, competitors and lawmakers, believes that doing business has to be carried out according to the socially determined standards.

Ethical dimension of social responsibility refers to the behaviour and acts which all interested, above-mentioned, participants expect of a business organisation even if not clearly stated by the law. In order for ethics to be implemented in social responsibility, business strategies have to depict the understanding of values shared by the members of the organisation and stakeholders, as well as understanding the ethical nature of choosing a strategy.

Philanthropic dimension of social responsibility refers to the structure and dynamics of a society, as well as to the questions regarding the quality of life. Businesses are expected to contribute to the community and society. Companies help education, culture, solving the environmental problems and those who are not capable of taking care of themeselves.Social responsibility means the awareness of the fact that business activities have a great impact on society, and social responsibility costs a lot of money. It may not be so obvious, except in particular cases, that social responsibility is a good business. Eventually, clients will know which firms behave in a socially responsible way and which do not. In the same way in which they give their value (in the form of money) votes for the company's products, they vote against the firm which pollutes the air or water, food products which are ecologically unfriendly or the companies that survive on corruption – their vote is seen in their refusal to use the products and services of such companies.

THE IMPORTANCE AND GOALS OF SOCIALLY RESPONSIBLE BUSINESS

The main pillar of sustainable development is the dynamic development and economic growth while remaining just, with the accent on hiring and increasing personal

income within a very competitive private sector. Socially responsible business is important for achieving sustainable development; in other words, it is the awareness of the new position and of the importance that companies have in modern global society and of the responsibilities which come out of the new situation. The practice of socially responsible business refers to the overall activities of a company: what it produces, how it buys and sells, whether it is law-abiding, how it treats its employees, whether it invests in the local community and in which way it contributes to the protection of the environment. [2]

Socially responsible business may bring the following business advantages [3]*:*

- protecting and improving the existing resources (human resources and the environment), on which the company's business depends;
- anticipating, avoiding and minimising business risks and the relevant operating costs;
- increasing the financial capacities of the company through the reduction of operating costs;
- opening new business possibilities and new markets;
- protection, creation and improvement of the company's reputation, especially its relation to customers;
- the company becomes attractive to investors and to qualified and motivated workers.

There are many arguments speaking in favour of the fact that there is a real business interest that companies should behave in a socially responsible manner; therefore, there is a more or less direct interest behind the company's every activity, even that which means incorporating social responsibility into its business. The first thing is certainly reputation, which is no longer an intangible category but a direct link to how much a particular company is worth. The other argument, which also refers to the employees, is their better motivation and loyalty, as well as a possibility of hiring higher qualified staff. [4]

Being socially responsible means not only meeting legal obligations, but also (and even more importantly) investing in human capital, the environment and relations to other stakeholders. [5].

As far as the social sphere is concerned, investing in education, work conditions and adopting good relations with employees can also increase productivity. Socially responsible behaviour directly influences the following groups [2]:

Consumers and clients – socially responsible business affects the consumers' behaviour in such a way that it increases their loyalty and strengthens the relationships. The impact is usually exerted through the production and sale of safe and high quality products at reasonable prices.

The employed and the partners – the loyalty of the workers is increased not only by improving work conditions and standards but also by encouraging their active participation in charity projects. Socially responsible business can be one of the reasons why some high qualified professionals decide on accepting a job in a particular company.

The public and local communities – a well formulated strategy as part of the concept of the general company's behaviour can strengthen its position at the regional and local level through the following:

- Environmental protection– for example, use of safe production processes;

- Taking part in improving the position and protecting marginalised groups;
- Taking care of sustainable development and responsibility in using natural resources.

The point of the social responsibility concept is precisely in accomplishing the company's interests while preserving the interests of the mentioned groups (stakeholders). [6].

THE DIMENSIONS OF SOCIALLY RESPONSIBLE BUSINESS

Socially responsible behaviour has two dimensions, the internal and the external one.

The Internal Dimension

Within a company, socially responsible behaviour includes the employed and refers to the areas such as investing in human capital, health care, safety and change management. Responsible practice in the field of the environmental protection mainly refers to the management of natural resources used in the production. [7].

Managing human resources. One of the great challenges companies face today is how to attract and keep workers who possess adequate knowledge and skills. Responsible behaviour at the hiring stage includes hiring the members of minority groups, older workers, women, people who have been unemployed for a longer period and people with special needs.

Health care and safety at workplace. Health care and safety at workplace is traditionally solved through regulations and obligatory measures. Enterprises, business organisations and associations are trying to find additional ways to promote health care and safety, as a marketing element or taking care when buying products of other companies.

Adjusting to changes. A modern trend nowadays is restrucring with the aim of reducing costs, increasing productivity and the quality of products and services. Conducting the restructuring in a socially resonsible way means finding the balance and taking into account the interests of those who are influenced by these decisions and changes.

Managing the influences that affect the environment and natural resources. The influence on the environment can be reduced by the rational use of resources, by the reduction of emissions into the air, soil and water, and by waste reduction through separate waste gathering and recycling. Such practices reduce operating costs at the same time. [8].

The External Dimension

Socially responsible business stretches even outside the enterprise itself and includes the local community and different stakeholders: business partners and suppliers, consumers, public administration etc.

Local communities. Socially responsible business encompasses the process of integration of a company into its surrounding. Companies contribute to local communities through the supply of available positions or tax paying, and on the other side they depend on the health condition of the workforce as well as on the stability and prosperity of the community in which they operate.

Relationships with partners, suppliers and consumers. Relationships are built through gaining someone's trust, fair relationships and respecting the wishes and needs of partners, suppliers and customers as well as high quality products.

Global care for the environmental protection. A number of enterprises are subjects at the international and global plan and thus have influence on the global level. The role of the business sector in achieving sustainable development has become a very frequent issue lately.

The impact of shareholders. Shareholders very often use their influence to affect the company business and behaviour. When investors unite their interests with other relevant stakeholders such as local communities, workers and consumers, a very strong coalition can be made which can change the behaviour of the company. [9]

THE POSSIBILITIES AND LIMITATIONS IN IMPLEMENTING THE SOCIAL RESPONSIBILITY CONCEPT

The need for implementing the social responsibility concept into the process of company management appears due to the ever increasing pressure exerted by the state, consumers, workers, and other interest groups and with the aim of protecting the environment, workers, human rights and the like.The key limitations to the broader implementation of the social responsibility concept in enterprises with regard to domestic conditions are the following:

- Unstable political conditions
- Inadequate legislative regulations
- Insufficient number of people who are informed about the benefits and possibilities of the application
- Insufficient support of the state and other institutional infrastructure
- Resistance on the part of the management and the employed
- Insufficient support of financial institutions. [10].

In order for social responsibility to be more present in the management system, it is primarily necessary to give all the required support to the development of this concept. In the former period, entrepreneurs were literally left with and to their own skills and personal finances. They faced unfavorable ambience in which they operated without counseling, financial, organizational or any other support in the process of starting-up their business or its further development. As long as there are limitations of this kind, it is hard to expect of the company to see all the benefits which socially responsible business offers.In order for the social responsibility practice to be more present, a number of steps is necessary:

- Tax reduction
- Interest rate reduction with banks and other financial insitutions
- Gaining support from the government and non-government institutions
- Carrying out the reform of legislative regulations dealing with the environmental protection, protection at workplace, etc.
- Enabling information exchange with other interest groups . [7].

The enterprises which decide to implement the social responsibility concept into their business systems, face the need to introduce certain means and procedures ("CSR tool") for implementation. In some cases, these are written instructions; in more ambitious enterprises they refer to the whole management system. Some enterprises in their desire to

formalize their dedication to this concept, issue certificates or report in some other way on the activities underatken regarding this plan.The means and procedures for the implementation of the social responsibility concept used most often are the quality standards, reporting systems, management systems, documents and instructions, etc.

The success of the concept implementation primarily depends on the following:

- Costs - the management system which is expensive can be implemented only in medium and large enterprises, although it is frequently a problem even for medium enterprises. Therefore, the possibility of subventions is to be taken into account.
- Simplicity – the best management system is the one which is clear and which does not require a lot of time to be incorporated.
- Degree of integration in other existing systems - the management system ought to be related to or integrated into the existing systems depending on the company's sphere of business; in most cases it is the quality system or ecological management. [11].

Besides the unstable political situation, the factors such as high unemployment rate, low living standards, weak competitiveness of the economy, insufficient support of the banking system, that is, a number of economic factors also make it more difficult to apply the concept of social responsibility more broadly. The awareness that the environment needs to be protected is not on a high level while the technological conditions, meaning technical and technological support to enterprises or cooperation with universities, does not offer sufficient support for the introduction of this concept.

Serbian economy still functions on the basis of unfavourable economic structure, with the given natural and financial resources, technology and people. All of these resources are relatively scarse, partly due to the relatively weak natural, technological or financial sources.

In order to develop socially responsible behaviour in Serbia, it is necessary to create legislative regulations in this sphere (e.g. tax allowances, sanctions and fines for irresponsible behaviour) and to put pressure on the media and the public to point out the importance of this issue. It is also necessary for all the sectors and elements of the society to be mutually related and to engage the sector of education in this process. [2]

Due to the greater importance given to the consequences of economic activities on society and ecology, this issue has become quite frequent in Serbia. All sectors are beginning to think about and speak of the concepts such as sustainable development, corporate social responsibility or engaging resources from all social sectors in contributing to the general welfare.

CONCLUSION

In global economy, business has to be directed at social responsibility and adjusted to the demands for the preservation and advancement of the environment. Guidelines with referrence to sustainable development are defined at the global level, a sustainable development which is to create balance between the goals of the economic development on one hand and the social development on the other, taking into account the need to advance and protect the environment. All this has its effect on business subjects to dedicate their time and resources to satisfying the goals of a number of

interest groups in their surrounding. The near future points to the necessity of incorporating the social responsibility concept into the company business practice.

A lot of companies do not understand the long-term benefits that are the result of the social responsibility approach, and a lot of entrepreneurs think they do not have enough resources or knowledge necessary for engaging in different strategies. The challenge is the following: to develop a market which rewards socially responsible practice and to create a government that would in turn generate that kind of practice which helps, encourages and enables responsible business practices and competition.

The main obstacles to the broader adoption of these practices are various: the relationship between the state and the legislative regulations, the non-existence of adequate institutions, the human factor (no awareness or understanding of the social responsibility concept, lack of knowledge, resistence on the part of the employees or the management), as well as the financial factors such as high costs and no direct link to the financial success.

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THE SPECIES POPULATIONS OF GENUS CROCUS L. IN THE RIVER BASIN OF NIŠAVA

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ABSTRACT

The synopsis of distribution and population state of the species of the genus Crocus L. in the river basin of Nišava, the confluent of the river South Morava, in the west part of E Serbia, is given in this paper.

Keywords: Nišava, species of the Genus Crocus L

INTRODUCTION

Habitat Nišavska valley (Ponišavlje) and the mountains surrounding it, are rich in plant species, especially endemics and relics, as well as plant species that appear in early spring and soon wither and disappear, such as early spring plants (ephemers) of which are the best known and most beautiful, species of the genus *Crocus* L. from the iris-family, Iridaceae. On warmer habitats in the hilly region they appear more during the winter months: January, February, especially in the first half of March, wither and continue to vegetate and fructificate already in the end of April and soon end their life cycle. Blooming then takes place on the peaks of the mountains, where spring comes much later, so that on the peaks of Stara Planina crocus bloom in May and June. It often happens that flowered crocus snow cover, but they have adapted to such conditions and survive them successfully, living and reproducing. This is achieved by making their ovary and egg cells located below ground, where winter frosts can not harm them. When the warmer days come, seed capsules come out to the surface land, dividing fruit handle, shoot and throw a large number of seeds in the biotope. Round seeds rolling disperse, and are transferred by the ants and animals, on whose legs they attach and so disseminate. That is why crocuses are often met at the tracks in the range of domestic animals and near the old specimens where they germinate in bunches. Except from the seeds, saffron can survive from vegetative bulb (Geoff) that contain accumulated

substances in the middle of the bulb germ from which in the spring grows one or more offsprings. Old bulb serves for the development of spring plant, and below it, creating new, this year's bulb that stores and transmits the flame of life in the next year.

Saffron or kaćunke as called by some nations of the Balkan peninsula and residents of Ponišavlje have a very beautiful and delicate flowers that are coloured differently, with different patterns on the petals of the perigon (floral envelope). The most common are yellow, white, blue, purple, with a variety of patterns. Perianth they composed of 6 leaves (petals), arranged by 3 in 2 cycles. However, in the Nišava valley, we encountered the specimen that had twice as many petals. Those are anomalies that look very cute. Besides the good kind in the valley there are some Nišava's hybrids. For example, the most famous botanist of Niš, Sava Petrović (1882.1885) in his book Flora of neighbour regions of Niš and the Appendix, described a kind of hybrid that was created by hybridization of species *C. chrysanthus* and *C. adamii*. The first one is yellow and the other is purple with a pattern in the form of lines. This new taxon that has a yellow and purple spots, the author of Flora of the neighbour regions of Niš named as *C. hybridus*. Otherwise, saffrons of the Nišava valley studied our great botanists also Joseph Pančić (1874, 1884) and Lujo Adamović (1901, 1908), whom worked in Pirot and was a professor of botany in local high school in Pirot. Beside them, the saffrons have studied and today they still do, the members of Southserbian botanical school, led by the Spas Sotirov: N. Randjelović, V. Stamenković, DA Hill, M. Ruzić, V. Jovanović and botanists of the younger generation: V. Randjelović, B. Zlatković, V. Milosavljević, D. Avramović, I. Gajević, Ana Lilić, J. Randjelović, S. Cvetković, I. Blagojević, V. Velicković et al.

THE DESCRIPTION OF BIOTOPE

Nišava is the river, whose sources are located in the mountains of Balkanian Serbia, which originates in the Republic of Bulgaria in Stara mountain. After, it comes to Serbia at Dimitrovgrad near the village Sukovo is already receiving its largest tributary, river Jerma, which springs below the Rhodope Mountains, and penetrates Ruj-mountain and Balkan mountains Greben and Vlašku mountain and empties into the Nišava. Of the major tributaries, Nišava near village Staničenje receives Temska, the second largest tributary, and from smaller there are: Mokranska, Jelašnica, Gadžinhanska and Gabrovačka river. Right side of Ponišavlje valey build these mountains: Vidlič, Stara and Svrljiške mountains, and left side: Greben, Vlaška, Sto, Belava, Crni vrh, Sedlar, Šljivovički vis, Suva mountain and Seličevica.

A SYSTEMATIC OVERVIEW OF THE GENUS CROCUS L. IN THE RIVER BASIN OF NIŠAVA

I Subgenus *Crocus* Mathew 1982nd
- A. Section *Crocus* Mathew 1982nd
  - a. Series *Verni* Mathew 1982nd
    - 1st *Crocus tommasinianus* Herbert 2n = 16

B. Section *Nudiscapus* Mathew 1982nd
b. Series *Reticulati* Mathew 1982nd
2nd *Crocus veluchensis* Herbert 2n = 26
c. Series *Biflori* Mathew 1982nd
3rd *Crocus chrysanthus* Herbert 2n = 8
4th *Crocus adamii* Gay 2n = 18
5th *Crocus hybridus* Petrovic 2n = 13
6th *Crocus alexandri* Ničić 2n = 8
d. Series *Flavi* Mathew 1982nd
7th *Crocus flavus* (L.) Hill 2n = 8

SERIES *VERNI* B, Mathew 1982nd

1. *CROCUS TOMMASINIANUS* Herbert 1847

State of population: the numerous populations of this species are represented on Vidlič (Basara), Belava (Staničenje) and Sedlar. They have been in good condition and very numerous, flourishing and fructificating.

Flowering and fruit ripening: they flower from March to May, fruit ripens from May to June.

Habitat: in oak and beech forests and scrub.

General distribution: Balkan peninsula (Bu, Mac, Sb, Montenegro, Bosnia-Herzegovina), Hungary.

Genotype: 2n = 16

SERIES *RETICULATI* Mathew 1982nd

2. *CROCUS VELUCHENSIS* Herbert 1845th.

State of population: the studied species is growing by the river of Temska, by it's spring parts on the Stara mountain. It is also found on the mountains: Plane, Klinčarnica, Ruj, in the Jerma river valley. Populations are large and preserved.

Flowering and fruit ripening: from April to June.

Habitat: in sub-alpine and alpine pastures.

General distribution: Balkan peninsula (Bu, Sr, Mac, Al, Gr.)

Genotype: 2n = 26

SERIES *BIFLORI* Mathew 1982nd

3. *CROCUS CHRYSANTHUS* Herbert 1843.

State of population: Very common in fields of Ponišavlje, and populations are very well preserved, seen at the Suva Mountain (Koritnik, Niška Banja), Svrljiške mountains (Kamenički vis-Brenica), near Niš (Petrovic, 1882:821), around Pirot and Niš (Pančić 1884:221); around Gradašnica, Suvodol, Kostur, Belava, Sedlar, Babušnica (Adamović 1908:207); around Jelašnica (Hill, D, A, 1985:190), Sićevo (SRS Flora 10:327) ; Ostrovica (N. Ranđ. et V. Stam. 1986:407); near Jelašnica, Kunovica, Gabrovačko hill (Ranđ. 1990:32), Sićevo (N. Ranđ. Sotirov et S. 1992); Gradac-Svrljiške mountains (N. Ranđ. Djordjevic et Danijel Đorđević 1998) ...

Flowering and fruit ripening: flowers from February to March, fruit ripens from April to May.

Habitat: in hilly meadows and rocky places.

General distribution: Balkan peninsula and Asia Minor (Middle East).

Genotype: 2n = 8

4. *CROCUS ADAMII* Gay 1831.

State of population: this calciphylous species has its population on limestone terrains of Ponišavlje valley and is present in the following locations: in the vicinity of Niš and Pirot (Pačić 1847:666), (Stejap.-Veseličić: Flora SRS 8:11, 1976), on Suva Mountain (Petrovic 1882:820-821) in the vicinity of Pirot (Adamović, 1908:207, 1892:232; Ničić 1892), Basar, Vidliča, Sto, Rasnice 1908:207): the Suva Mountain (R.Jov.-Dunjić 1955: N. Ranđ. 2009), on Basara-Vidlič (Randj. et I.Blagojević2009, 2010), in Sićevo Gorge (S. Cvetkovic, 2010; Zlatković B., 1999); N.Ranđ.et S. Sotirov (1993); N. Ranđ. et D.Đorđević (1998), on Belava, Sićevo, Kunovica, Suva mt., Brenica (Ranđ.et al. 1990:37): Stara mt. (B, Zlatković. 1997) ...

Flowering and fruit ripening: from February to April and from April to June.

Habitat: in hilly and mountain meadows and pastures.

General distribution: Serbia, Macedonia, Bulgaria, Turkey, Iran, Russia.

Genotype: 2n = 18

5. *CROCUS HYBRIDUS* S. Petrovic, 1885.

State of population: it spreads on the limestone mountain terrain of Svrljiške mountains: Brenica, Sićevo and Suva mountains (Ranđ. et al.1990: 33), Petrović (1882:821, 1885:168), individuals of this species are developed earlier than the typical species of which was created (C.adamii C. Chrysanthus) and the colour of flowers is yellow with patterns on leaves of perigon.

Flowering and fruit ripening: January, February. It doesn't give fruits.

Habitat: in hilly and mountainous pastures.

General distribution: Serbia, Macedonia.

Genotype: 2n = 13

6. *CROCUS ALEXANDRI* Ničić 1894.

State of population: in the valley Nišava small populations of this kind can be found on the mountain Seličevica, south of Niš (Gabrovac): Petrovic, 1882 Sat *Crocus biflorus*); Seličevica-Crno jezero (Ranđ.N. et V. 1984). Since this part of the hill Gabrovačko Seličečecice-Niš is rapidly urbanized, habitate of this species is very endangered, and populations are reduced. Seličevica around the village of Vlas: B. Zlatk., oral report ...

Flowering and fruit ripening: flowering from January to April, fruit ripening from April to May.

Habitat: mountain forests of oak and submountain region.

General distribution: Serbia, Macedonia (?).

Genotype: 2n = 8

SERIES *FLAVI* Mathew 1982nd

7. *CROCUS FLAVUS* (L.) Hill.

State of population: Belava-Pirot (Adamović 1908:207); around Pirot (Stepanović-Veselič ić, L.-Flora SRS 8-5), the entrance to the gorge Jerma (Ranđ.). Populations of this species in Ponišavlje valley are much smaller compared to those in the valley spa, but they are relatively well preserved.

Flowering and fruit ripening: flowers from March to May, fruit ripens from May to June.

Habitat: grows on hills and mountain meadows.

General distribution: Balkan Peninsula (Bu, Gr, Mac, Sb), Romania and Turkey.

Genotype: 2n = 6

CONCLUSION

1. Ponišavlje is wide area that stretches from Stara Mountain to Nišava's confluence with the South Morava, west of the city of Niš, and flows through the following centers: Dimitrovgrad, Bela Palanka and Niš.
2. In the river basin of Nišava there are the following mountains: Stara, Vidlič and Svrljiške, comprising the northern edge and Greben, Vlaška, Sto, Belava, Crni vrh, Sedlar, Šljivovički vis, Suva mt. and Seličevica, of which consists the southern edge of Ponišavlje.
3. In the river basin of Nišava grow 7 species of genus Crocus L., as follows: Crocus tommasinianus, C. veluchensis, C. chrysanthus, C. adamii, C. hybridus, C. alexandrii and C. flavus.
4. C. alexandri is Serbian, C. flavus moesian, while C. tommasinianus and C. veluchensis are Balkan endemics.
5. The most endangered populations in the river basin of Nišava are those of the species C .alexandri and C. hybridus, while bigger populations are those of C. adamii and C. flavus, and very numerous and well preserved populations have species: C. tommasinianus, C. veluchensis and C. hybridus.

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RARE PLANT SPECIES OF DELIBLATO SANDS

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ABSTRACT

Deliblato sands is located on southeastern border of Panonian lowland in south Banat between three rivers Danube, Tamiš and Karaš, as wide sand plateau which has eolian origin. It now has the status of a special nature reserve first category of protection - Natural resource of great importance, protected areas listed as IUCN Category IV (Habitat/Species Management Area) by the World Conservation Union**.**

Keywords: Deliblato sand, rare species of plants

INTRODUCTION

Geographic position of Deliblato sands has greatly contributed specific combination of biotopes on this area. Karpatian mountains are rising on its eastern and northeastern side, Banatian clay plateau is on its western side, and on its southern side Danube flows. Because of this specific location, climate of Deliblato has a particular character of continental moderate climate in which the impact of extremely continental climate from the east, atlanse climate from the west and moderate climate in the south Adriatic. Relief of Deliblato has a very dunal character and it has height of 70 to 193 meters. In his creation most important significance had winds that still dominate this space doing deflation sandy substrate. These are the southeastern and northwestern wind, of which the first -kosava, its role as the decisive factor in climate. The Hydrographic terms of the area is without water streams, but occasionally emerge to the surface of ground water forming swamps.

In this area is clearly visible correlative link between the genesis, evolution of land and the succession of plant communities (fitocenosis) that in these processes directly affect. Predominant minerals in the sand: limestone, quartzite, alumo-silicates, clay, humus, feldspats, and heavy fraction minerals: magnetite, hornblende, granite and others. Soil shows the base reaction, which causes the appearance of basophilic species. At Deliblato biotopes, two opposite directed processes occur at the same time:

progressive in terms of growing and bonding of sand, humus formation during pedogenesis, from sirozem through the brown steppe chernozem soil, and thus all complex fitocenosis and regressive, fitocenosis degradation caused by disturbances in the balance of the cenosis whose cause is usually exogenous (anthropogenic) factor. Dualism of these processes is related to environmental factors that guide the direction of successive changes, and thus the specificity of this floristic region because there is already a certain number of species in Flora Red book Republic of Serbia.

MATERIAL AND METHODS

Flora studies conducted personal tours of the location by authors of this paper in different time periods and in different habitats. Affiliation of species to floristic elements was carried out on the basis of available literature and knowledge of the area of individual species. Endangered species specific research was done on the basis of personal knowledge of the status of their population distribution area. On that occasion were used categories of endangered species by IUCN: **EW** (Extinct in the Wild**), CR** (Critically Endangered), **EN** (Endangered), **VU** (Vulnerable). The paper presents only rare species of Deliblato sands.

FLORISTICAL AND VEGETATIONAL DIVERSITY OF DELIBLATO SANDS

Lowland flora and vegetation are characterized by significant involvement of steppe plants and fragments of steppe vegetation, with specific lowland forests, temperate continental character. According to its vegetation, Deliblato belongs to forest-steppe sub-zone, and according to its fitogeography to the southern part of the Pannonian province, since it is located on the intersection of continental steppes, Black Sea-Mediterranean and Carpathian modify continental climate. Characteristic soil is formed in thick clay layers as the geological background. Precisely for this type of soil and boreal continental climate (which dominated at the time of vegetation on Deliblato sands) was related to autochthonous steppe vegetation that their dominant effect is weakened by hydrogeographical and geomorphological local factors contribute to increased humidity microclimatic habitats on which a dominant native forest vegetation appeared. Area of Deliblato belongs to potential leaf fall forest vegetation. From this it follows that the current forms of meadow steppe, pasture and sand-vegetation are secondary and soil conditioned. If the successive shift left to spontaneous developments, raise the question of what would happen to those plants that are already vulnerable and fall under the protection regime. Flora of Deliblato, as our research showed, is very specific and diverse, which contributes the specificity of the biotope. In this region is 891 native, 16 dibbled and 22 advent species, or a total of 928 species, distributed in different types of vegetation, and various associations and their sub associations.

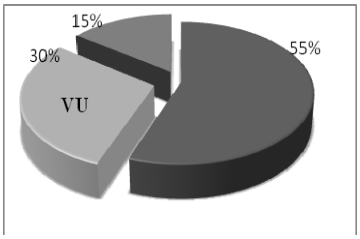
ANALYSIS OF RARE SPECIES

In fitogeographical terms, we can distinguish three groups of floral elements. We have analyzed over 90 rare species, of which 27 belong to the cold regions, 30 plants

belonging to warm regions and 32 are elements of eastern regions, while one taxon is cosmopolitan.

Table 1. Plant species of northern - cold geographic regions

Floristic element	Plant species	Degree of vulnerability by IUCN
Euroasian	*Ranunculus pedatus* W.K.	EN
	Gymnadenia conopsea R.Br.	EN
	Neottia nidus-avis (L.) Rchb.	EN
	Gentiana pneumonanthae L.	EN
	Helichrysum arenarium (L.) DC	CR
	Aconitum vulparia Rchb	VU
	Cephalanthera rubra (L.) Rich	CR
	Listera ovata (L.) R.Br.	EN
	Gypsophyla paniculata L.	VU
	Leucojum aestivum L.	EN
	Salvia aethiopis L.	VU
European	*Onosma arenarium* W.K.	EN
	Ophris apifera Huds.	EN
	Petasites hybridus (L.) Gaertn.	VU
	Astragalus asper Jacq.	VU
Eurasian-Siberian	*Anemone sylvestris* L.	CR
	Hypericum elegans Stef.	EN
	Allium angulosum L.	EN
	Orchis macula L.	EN
	Centaurea banatica Roch	VU
	Cerastium semidecandrum L.	VU
	Prunus tenella Batsch.	CR
	Orchis ustulata L.	EN
	Centaurea sadleriana Janka	VU
Subboreal	*Parnassia palustris* L.	EN
	Acorus calamus L.	EN
Arkto-alpine	*Dactylorhiza incarnata* (L.) Soo	EN

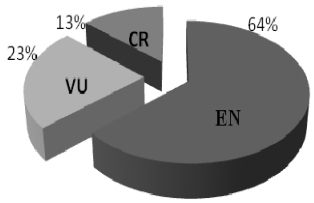


%	∑	IUCN
55	15	EN
30	8	VU
15	4	CR

Figure 1. Percentage of IUCN categories of rare species of the northern geographic regions

Table 2. Southern- warm geographical regions plant species

Floristic element	Plant species	Degree of vulnerability by IUCN
Mediterranean	*Scorzonera parviflora* Jacq.	CR
Euromediterranean	*Vinca herbacea* W.K.	VU
Submediterranean	*Dianthus giganteus* D' Urv.	EN
	Paeonia banatica	CR
	Fritillaria orientalis Huds.	EN
	Orchis simia Lam.	EN
	Anacaptis piramidalis (L.) Rich	EN
	Spiranthes spiralis (L.) Koch.	EN
	Orchis palustris Jacq.	VU
	Paeonia tenuifolia L.	CR
	Astragalus dasyanthus Pall.	CR
	Glycyrhiza echinata L.	VU
	Orchis laxiflora Lam.	VU
	Epipactis palustris (L.) Rich.	EN
	Spiranthes aestivalis (Lam) Rich	EN
	Lathyrus panonicus (Jacq) Garcke	EN
	Alkana tinctoria (L.) Tausch.	EN
	Asperula tenella Heuff.	EN
	Astragalus austriacus L.	EN
	Sideritis montana L.	VU
	Echinops banaticus Roch	EN
	Linaria angustissima (Lois) Barbas	EN
Eurosubmediterranean	*Prunus mahaleb* L.	VU
	Orchis morio L.	EN
	Ranunculus illyricus L.	EN
	Galatella lynosiris (L.) Reich.	EN
	Orchis tridentata Scop.	EN
	Orchis coriophora L.	EN
Balkanian	*Campanula lingulata* W.K.	VU
	Comandra elegans Reich	EN

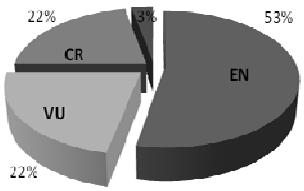


%	∑	IUCN
64	19	EN
23	7	VU
13	4	CR

Figure 2. Percentage of IUCN categories of rare species of the southern geographic regions

Table 3. Plant species of eastern-steppe geographic regions

Floristic element	Plant species	Degree of vulnerability by IUCN
Pont	*Rindera umbellata* W.K. Bunge	CR
	Colchicum arenarium W.K.	EN
	Agropyrum cristatum (L.) Gaertn.	EN
	Gagea pusilla (Schm.) Sch. et Sch.	VU
	Melampyrum barbatum W.K.	CR
	Centaurea atropurpurea W.K.	EN
	Festuca vaginata W.K.	VU
	Allium tropurpureum L.	EN
	Ruscus aculeatus L.	VU
Pont-Mediterranean	*Trifolium rubens* L.	EN
	Orchis militaris L.	EN
	Epipactis latifolia (L.) All.	EN
	Crocus reticulatus M.B.	CR
	Ophris sphaegoides Mill.	EN
	Stipa pulcherrima Koch.	VU
Pont-sub-Mediterranean	Silene buplerioides Chultes.	EN
Pont-Pannonian	*Iris variegata* L.	EN
	Achillea asplenifolia Vent.	EN
	Campanula macrostachya W.K.	EN
	Pulsatilla grandis Wen	CR
Pont-Central Asian	*Adonis vernalis* L.	EN
	Allium flavescens Bess.	EN
	Iris pumila L.	EN
	Stipa joanis Čel.	VU
	Veronica spuria L.	VU
Pont south sibirian	*Veronica bachofenii* Heuff.	EW
	Artemisia pancicii (Janka) Ronn.	CR
	Iris sibirica L.	EN
	Sedum sertorianum Boiss.	EN
	Ajuga laxmanii (L.) Benth.	VU
	Crambe tataria Sebeok.	CR
	Chorispora tenella (Poll.) DC	CR



%	∑	IUCN
53	17	EN
22	7	VU
22	7	CR
3	**1**	**EW**

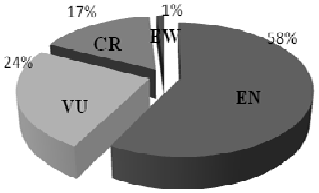
Figure 3. Percentage of IUCN categories of rare species of the eastern geographic regions

Table 4. Plant species of Cosmopolitan

Floristic element	Plant species	Degree of vulnerability by IUCN
Cosmopolitan	*Schaenoplectus mucronatus* (L.) Jalla	VU

CONCLUSION

A Deliblato sand is a unique biotope in Serbia and Europe as well. It inhabited the interesting flora and vegetation and therefore declared as a special nature reserve and protected by law. In our list there is 90 different species by the IUCN categories of protection which numerical and percentage representation is shown in the following table and cycle diagram. Of the rare and protected plant species so far in the Red Book of Flora Serbia handled the following taxons: *Paeonia banatica, Helichrysum arenarium, Crembe tataria,* and we suggest the same status type for *Anemone sylvestris, Prunus tenella, Rindera umbellata, Crocus reticulatus, Paeonia tenuifolia* and *Astragalus dasyanthus* as well as those species that have IUCN categry CR (Critically Endangered). Rare taxons from our list that we propose for the protection, give this area a specific seal, and among them are the species of family Orchidaceae, which are protected in all European countries because they are the ornaments of nature.



IUCN	EN	VU	CR	EW
∑	51	22	15	1

Figure 4. Percentage of IUCN categories of rare species of Deliblato sands

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MICROBIOLOGICAL PROPERTIES OF SOIL IN OIL REFINERIES

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ABSTRACT

Certain microbial groups have the ability to utilize the components of petroleum as a source of energy and carbon, which enables them to live in contaminated soils. The objective of this investigation was to assess microbiological properties of soils in the vicinity of Pančevo and Novi Sad oil refineries. Microbiological analyses included the determination of the total microbial number, copiotrophic and oligotrophic bacteria number, azotobacters number and dehydrogenase activity. High concentrations of total hydrocarbons and polycyclic aromatic hydrocarbons adversely affected the microbiological properties of the tested soils. Low concentrations of total hydrocarbons and polycyclic aromatic hydrocarbons tended to stimulate the number and activity of microorganisms in the contaminated soils. The obtained results indicated the importance of monitoring the microbiological properties of soil contaminated with petroleum.

Keywords: microbial activity, petroleum, soil

INTRODUCTION

The expansion of oil and petrochemical industries in the course of the 20th century resulted in an intense contamination of the environment (air, water and land) with petroleum and petroleum products. Contamination with petroleum causes significant changes in the physical, chemical and biological properties of soil [1]. In the process of production and processing of petroleum and petroleum products, various byproducts such as hydrocarbons and other toxic substances are produced, which have a deleterious effect on the biota, while soils contaminated with petroleum lose its fertility. Soil microorganisms, which are a heterogeneous group of organisms, and their enzymatic systems comprise up to 90% of the overall metabolic activity of soil [2]. Petroleum refining products affect the microbial soil activity and cause changes in the quantitative and qualitative composition of the microbial population [3]. Certain microbial groups have the ability to utilize the components of petroleum as a source of energy and carbon, which enables them to live in contaminated soils. High microbial activity in contaminated soils is primarily a result of the activity of indigenous microbial populations adapted to living in areas with high concentrations of hydrocarbons originating from petroleum [4]. Certain groups of microorganisms can break down only some petroleum compounds and petroleum products, but combined microbial

populations can achieve a high level of oil degradation, since some oil compounds can only be decomposed by cometabolic activity.

The objective of this investigation was to assess microbiological properties of soils in the vicinity of Pančevo and Novi Sad oil refineries.

MATERIAL AND METHODS

Sampling of contaminated soils was carried out in the yards of Pančevo and Novi Sad oil refineries in the course of January 2009. Simultaneously, samples were taken of non-contaminated soils from sites in the vicinity of the refineries. The collected samples were analyzed for basic chemical properties and the contents of total hydrocarbons and polycyclic aromatic hydrocarbons (PAHs). Microbiological analyses included the determination of the total microbial number, copiotrophic bacteria number, oligotrophic bacteria number, azotobakters number and dehydrogenase activity. The microbial number was determined by the indirect method of dilution on appropriate nutritive media. The total microbial number was determined in agarized soil extract. The number of azotobacters determined on a N-free surface, by the fertile drops method [5]. The numbers of copiotrophic and oligotrophic bacteria was determined by a media with different carbon concentrations [6]. Dehydrogenase activity in the soil was determined spectrophotometrically, by a modified method of Thalmann [7], which is based on the measurement of 2,3,5-triphenyltetrazolium chloride (TTC) reduction in triphenylformazan (TPF).

RESULTS AND DISCUSSION

Microbial distribution and activity in a soil contaminated with petroleum are affected by physical and chemical soil properties, environmental conditions, chemical structure of petroleum products, their concentration and composition of the microbial population in the soil [8] (Milošević et al., 2010).

Table 1. Basic chemical soil properties and contents of total hydrocarbons and polycyclic aromatic hydrocarbons (PAHs) in the location of Pančevo oil refinery

Sample description	pH		$CaCO_3$	N%	AL-P_2O_5 mg/100g	AL-K_2O mg/100g	Total hydrocarbons (g/kg)	PAH (mg/kg na a.s.z.)
	u KCl	u H_2O						
Pančevo-non-contaminated	6.73	7.86	9.22	0.223	119.50	57.00	0.181	0.0027
Pančevo-contaminated	6.86	7.73	11.32	0.183	17.20	25.90	2.101	0.1751

Soil contamination by byproducts of Pančevo oil refinery, (total hydrocarbon content - 2.101 g/kg, Table 1), stimulated the soil microbial activity as compared with the surrounding (non-contaminated) soil. The total number of microorganisms and the number of oligotrophic bacteria were higher in the contaminated soil than in the surrounding non-contaminated soil (Table 2). The increased hydrocarbon content

promoted the development copiotrophic bacteria whose numbers increased by 121%. However, the contamination had a negative impact on the number of azotobacters, which were not found at this site at all. The increased numbers of microorganisms and the resulting higher microbial activity brought about a higher dehydrogenase activity in the contaminated soil (Table 2).

In a study of Tynybaeva [9], which dealt with soil contaminated with petroleum (100-600 mg/kg of total hydrocarbons), the numbers of oligotrophic and copiotrophic bacteria were higher in the contaminated than in non-contaminated soil. Results of Xu and Johansson [10] showed that increased concentrations of hydrocarbons tended to increase the numbers of soil microorganisms and their enzymatic activity. A research of Wyszkowska [11] showed that the numbers of azotobacters, oligotrophic and copiotrophic bacteria, as well as dehydrogenase activity were increased in soils contaminated with petroleum.

Table 2. Mikrobiological properties of the soil at the site of Pančevo oil refinery

Sample description	Total no. of microorganisms ($x10^6$)	Oligotrophic bacteria ($x10^5$)	Copiotrophic bakteria ($x10^5$)	*Azotobacter spp.* ($x10^1$)	DHA mg TPF g^{-1} soil
	In g^{-1} of absolutely dry soil				
Pančevo-contaminated	312.56	313.78	356.34	0.00	1647
Pančevo-non-contaminated	278.20	279.51	161.41	19.68	838

In the contaminated soil in Novi Sad oil refinery (Table3), high concentrations of total hydrocarbons (4,244 g/kg) and polycyclic aromatic hydrocarbons (0.9322 mg/kg), which are most difficult for microorganisms to decompose, reduced the numbers of the investigated microbial groups. The low contents of nitrogen (0.042%), phosphorus (5.6 mg/100g) and potassium (4.50 mg/100g) in the contaminated soil definitely contributed to the reduction in the number of microorganisms. Nitrogen and phosphorus deficits in the soil may be limiting factors in the microbial degradation of petroleum, as indicated by results of numerous authors [12,13,14,15].

Table 3. Basic chemical soil properties and contents of total hydrocarbons and polycyclic aromatic hydrocarbons (PAHs) in the location of Novi Sad oil refinery

Sample description	pH		$CaCO_3$	N%	AL-P_2O_5 mg/100g	AL-K_2O mg/100g	Total hydrocarbons (g/kg)	PAH (mg/kg a.d.s.)
	in KCl	in H_2O						
Novi Sad - non-contaminated	7.11	7.92	9.22	0.139	18.40	9.50	1.055	0.6788
Novi Sad - contaminated	7.79	8.08	11.32	0.042	5.60	4.50	4.244	0.9322

In the contaminated soil at the site of Novi Sad oil refinery, the total number of microorganisms and the number of copiotrophic bacteria were six times lower than in non-contaminated soil (Table 4). The number of oligotrophic bacteria in the contaminated soil was also lower, but the difference in favor of the non-contaminated

soil was not large (Table 4). Results of Wyszkowska and Kucharski [3] showed that oligotrophic bacteria are more resistant to soil contamination with petroleum byproducts than the copiotrophic bacteria. Azotobacters were found in the contaminated soil, but their number was low (2.81×10^1) when compared with that in the non-contaminated soil (112.98×10^1) (Table 4).

Studies of Iwanow [16] have shown that azotobakter and other N-fixing bacteria are extremely sensitive to soil contamination with petroleum and its products. In contrast to these results, Bieszkiewicz [17] and Wyszkowska and Kucharski [3] claimed that oil refinery products of stimulated the development of azotobacters in the soil. Reduced numbers of all examined microbial groups caused a lower microbiological activity in the soil and so was lower the dehydrogenase activity in contaminated soil. Results of Garcia [18] and Sorensen [19] showed that the increased concentration of hydrocarbons reduced the microbial number and enzymatic activity in the soil.

Table 4. Mikrobiological properties of the soil at the site of Novi Sad oil refinery

Sample description	Total no. of microorganisms ($x10^6$)	Oligotrophic bacteria ($x10^5$)	Copiotrophic bakteria ($x10^5$)	*Azotobacter spp.* ($x10^1$)	DHA mg TPF g^{-1} soil
	In g^{-1} of absolutely dry soil				
Novi Sad - contaminated	56.94	137.32	68.10	2.81	753
Novi Sad - non-contaminated	299.24	299.24	357.66	112.98	2079

The results of our experiments showed that the contamination of soil with petroleum products affected differently the number and enzymatic activity of microorganisms in the oil refineries in Pančevo and Novi Sad. The contradictory results may be explained by the fact that microbial activity is significantly affected by chemical structure of the components of diverse petroleum products. Results of numerous authors [20-24] indicated that the gasoline components released during petroleum processing reduce the microbial number and inactivate the enzymatic activity of soil, while petroleum may stimulate microbial development and the activities of dehydrogenase, urease and phosphatase. Studies of Bosset and Bartha [25] indicated that the microbial number in petroleum-polluted soil was also influenced by the degree of contamination.

CONCLUSION

High concentrations of total hydrocarbons and polycyclic aromatic hydrocarbons adversely affected the microbiological properties of the tested soils.

Low concentrations of total hydrocarbons and polycyclic aromatic hydrocarbons tended to stimulate the number and activity of microorganisms in the contaminated soils.

The obtained results indicated the importance of monitoring the microbiological properties of soil contaminated with petroleum.

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CLIMATE CHANGE AND URBAN PLANNING – PREMISES FOR LOW CARBON FUTURE IN THE CITIES

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ABSTRACT

Climate change is recognized as one of the defining problems of the 21st century. Emissions of carbon dioxide (CO_2) and other greenhouse gases (GHGs) from anthropogenic activities are the root cause of global warming [1]. Carbon emission comes from energy consumption, production and transport. The vast majority of climate impacts, it is believed, will be negative and will severely affect those most vulnerable and less able to adapt, especially in cities.

Despite all the international conventions, carbon dioxide emissions from developing countries are showing little sign of abating. Kyoto protocol, signed by over 180 countries, is to cut CO_2 emissions by 5.2 % globally, based on 1990 levels. UN IPCC scientists calculated that 60% cut worldwide would be necessary to halt global warming.

Cities are responsible for two thirds of global energy use and are thus the major contributor to the emission of GHG and climate change, although occupying only 2% of the planet's surface. Urban energy use is set to increase significantly through 2030, by which time 73% of the world's energy will be consumed in cities [2].

Therefore, cities and towns have an important role in overall energy consumption and they are responsible for climate change and energy security. The question is whether current urbanization trends are a threat or an opportunity for a low carbon society in the future.

Keywords: low carbon city, urban planning, climate change, renewable energy, sustainable development

INTRODUCTION

The role of cities in tackling climate change, same as relation between urbanization and climate change are of essential importance. CO_2 is mainly emitted in urban areas and it is urban and inter-urban activities that lead to the emission of significant amounts of other GHGs. Together, energy for electricity, heating and cooling, transport and industry generates more than 60 % of greenhouse gas emissions [3].

Climate change is a global challenge and must be addressed through United Nations, EU and national governments, so the action taken by cities also depend on national actions and actions by other cities and regions worldwide. One of the global strategies to limit and decelerate climate change had been agreed under the United Nations Framework Convention on Climate Change (UNFCC) [4]. The degree to which

the actions are implemented will ultimately determine the range and implementation of strategies that will be necessary.

It is expected that, within the next two decades, 60% of world population will be living in the cities; therefore growing urbanization trend, especially in developing countries makes the search for these formulation and implementation of rational adaptation strategies and policy solutions urgent [5].

Climate change is since recently in the focus of urban planners faced with practical problems of making cities work, by combining natural and human environment, in a healthy and livable setting with economic opportunities. A variety of social needs in the city generally lead to consuming green resources and degrading natural processes, unless the city intervenes resolutely through rational urban planning and smart environmental management. Natural resources in a city have factual limits associated with their use. The major challenge for urban planning process is to find ways in which cities can both respect natural environment and satisfy human growth aspirations.

CLIMATE CHANGE STRATEGY AND THE CITY

Contemporary climate change challenges are colossal, but acting locally, on a city scale, can have effect. Cities and local authorities have the potential to influence both the causes and consequences of climate change, and they contribute to national and international strategies to prevent deplorable forces of climate change.

The cities can offer opportunities to reduce emissions through economies of scale interventions and the numbers of communities involved in reduction strategies. Some cities are already carrying out vast range of activities related to energy efficiency, renewable energy, cleaner production and the application of regulations to control industrial emissions and to improve architectural design for energy efficiency.

Considering the role played by the cities in the climate change, by analyzing good practices of many leading cities and towns on EU level, it is important to recognize the relation between rapid urbanization and climate change. Urban sprawl and increase in energy use is reciprocal. Therefore, it is needed that the cities and other levels of local authorities once again take a strategic and pioneering role to plan future energy needs of communities. To accomplish this, it is important to create the energy plan of a city. This plan should be developed in two directions, one is the transformation to decentralized energy production, and the other is the climate change strategy for reduction of GHGs. (Figure 1.) Also, this plan can be divided in six different strategic components:

1. *Creating policies* – Promoting the crucial role of cities in climate change strategies from global, national and local level, down to the level of individual building or property;
2. *Institutional strengthening* – Creating institutional framework which provides needed planning and financial support;
3. *Urban planning* – Establishing planning according to previously created climate change strategy and sustainable development principles. Promoting innovative approaches to urban planning and management in order to support national and local authorities in addressing climate change by providing support to the building design and construction sector aiming at mitigating climate change;

4. *Establishing leadership in the communities* – Creating new leaders able to take action and do needed networking, promoting and applying climate change strategy and other sustainable development principles;
5. *New business opportunities* – Promoting and establishing partnerships to demonstrate and invest in new green technologies; Creating new jobs (green jobs);
6. *Creating new competence* – Raising public awareness, developing education strategies targeting general public, creating new experts.

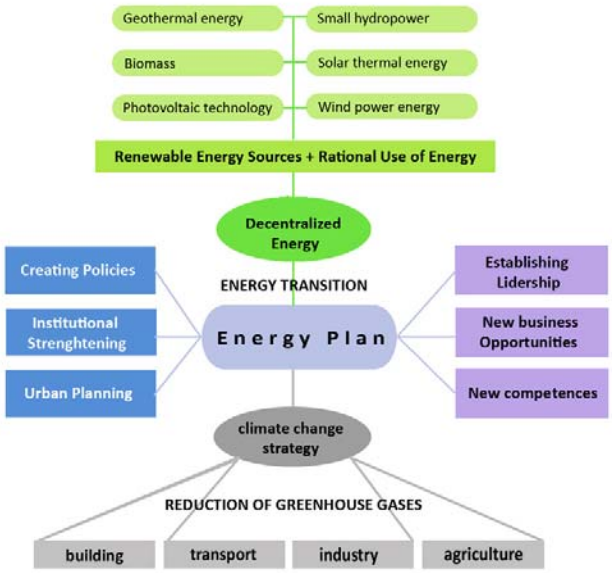

Figure 1. Sustainable energy plan for the low carbon city

Furthermore, this energy plan emphasizes rational use of renewable energy sources by shifting from centralized to decentralized energy production. In this way, it is possible to achieve main goals of climate change strategy to reduce emission of GHGs produced by buildings, transport, industry and agriculture.

Pioneer cities using renewable energy sources like Barcelona, Malmö, Freiburg and other, known for their rational use of energy and energy efficiency, have indicated that a balanced approach is needed. There are different approaches of using renewable energy sources according to local energy potentials. This requires an improved focus by the energy industry and local government on localized solutions. Local leadership and the engagement of communities are needed in order to overcome possible barriers.

Considering pioneer cities and their effect on global change, it can be concluded that a local initiative is much more efficient than the national one. A good

example of the demonstration of city power is the European initiative platform "Covenant of Mayors" [6]. More than five hundred European cities have joined this initiative, sharing experiences and information, learning from each other on the planning and management implications of climate change, also by formally committing to reduce CO_2 emission by at least 20% by 2020, and implement Sustainable Energy Action Plans. This initiative emphasizes the potential of the cities to reduce CO_2, energy sustainability and the consequences of climate change, and thus creating the path for low carbon future. However, local authorities are in need of further support related to capacity building, information exchange, technology transfer, technical support and establishing an enabling environment.

TRANSITION TO DECENTRALIZED FORMS OF PRODUCING ENERGY – DEVELOPINGTHE USE OF RENEWABLE ENERGY SOURCES

After policy changes, next important issue is the reduction of reliance on fossil fuels and making a fundamental change in the way the energy is being generated and supplied. This means that there is a need for rapid transition from traditional centralized forms of energy production to more decentralized ones. Decentralized energy production is independent as it uses renewable energy sources, and economically more reliable than the traditional one. Advantage of this system is that the losses occurred in energy infrastructure and transfer is minimized by producing the energy near the end consumers [7]. Local, decentralized production of renewable energy is therefore an efficient and rational model of energy production.

Renewable sources of energy are: biomass, geothermal energy, photovoltaic technology, small hydropower, solar thermal and wind power. They are in line with overall strategic goals of sustainable development as they do not create dependence of energy imports, therefore ensuring the security of supply. Renewable energy sources do not produce GHGs and they do not make any environmental damage. Furthermore, they can help improve the competitiveness of industries in the long run and have a positive impact on regional development and employment.

The use of renewable energy sources in the city creates sustainable, low carbon, healthy and eco-environment, and reduces the use of fossil fuels. A number of urban areas are now partly powered by renewable energy techniques and technologies, and there are noteworthy opportunities to harness solar, wind, hydro and geothermal power for urban use. These examples of decentralized energy sources for the use in the cities show how a certain degree of energy independence can be achieved. To make this happen, it is considered necessary that the changes are delivered at regional and local level, creating new and challenging roles for local authorities, their communities and their stakeholders. It will also result in the need to locate decentralized, community-scale energy technologies in everyone's 'backyard' and create energy sustainable communities [8]. This will fundamentally change our relationship to the way the energy we use is generated.

RETHINKING URBAN PLANNING MODELS

Dealing with challenges caused by climate change, it is very important to start rethinking the role of urban planning. Existing urban planning models and plans may be completely inappropriate to respond to climate change; as some of them have directly and greatly contributed to the climate calamities. It is therefore crucial that urban planners start seeing in the climate change a real opportunity to reexamine and reconsider their postulates by developing new models for future urban development.

Some of the developed countries have already initiated and developed processes and plans that are more strategic, participatory, flexible, and action oriented, realizing the weakness of traditional master planning approach of the 20^{th} century. Still, some countries in the developing world continue to promote obsolete master planning models, out-of-date land use zoning, regardless the sustainability aspect.

It is necessary to measure the quantity of energy consumption by all social actors and the exact quantity of CO_2 produced. Spatial planning and the choice of locations for functions and buildings must be geared to a far more intensive and intelligent use of residual heat and geothermic conditions in urban areas for the buildings, industry, transportation and agriculture.

Integrating climate change concerns in the urban planning process must take into consideration past experiences, like Agenda 21 Programme, other spatial planning initiatives and other various technical cooperation activities. Practical and appropriate urban planning systems are needed for introducing strategies for responding to climate change in the cities. Key ingredient for ensuring effective responses to climate change is strengthening of urban governance structures and their preparedness and responsiveness. Also, it is important to define a clear role for urban planning that goes beyond the promotion and implementation of carbon reduction measures. Local authorities should seek to create the strategic framework for CO_2 reduction including planning obligations and requirements. Local government planning capacities are essential in establishing framework for the location, form and specification of new property developments as well as utility infrastructure and low carbon energy generation.

Sustainable urban planning is a long term planning process requiring governance that goes beyond market forces and helps create widely accessible infrastructure and community services. This new, invigorated and regenerated urban planning requires great investment in order to improve human health and livability in the city whilst simultaneously reducing ecological footprints and improving the natural environment.

CONCLUSION

The role of the cities and towns in overall energy consumption and their respective responsibilities for climate change and energy security is significant. Therefore, acting towards low-carbon future is necessary. Commitment to a low carbon economy, together with high energy efficiency and use of sustainable renewable energy sources is essential for energy security and tackling climate change. Prior to that, it is

needed to introduce new policies, strengthened institutions, followed by urban planning, established leadership and economic responses.

Cities have enormous responsibilities and potentials to reduce energy consumption, carbon dependency and climate change, but they alone cannot solve the challenges and need supplementing measures from national governments and supra-national level, same as multi- level approach. Urban growth and growth of energy use are not necessarily a threat to low carbon future. If city planners succeed in reversing current unsustainable urbanization trends by designing energy sustainable cities, these solutions can serve as role models for a sustainable world.

Spatial and urban planning can contribute significantly to climate-proof cities and CO_2 neutral built environment. Through urban restructuring, the use of intelligent links in the local generation of sustainable energy, the utilization of residual heat and drastic improvements in public transport, it is possible to effectively reduce greenhouse gas emission and achieve low carbon future.

The perspective of low carbon future is certainly attractive, but it will have to include many social actors. Available knowledge, speed of action and degree of enthusiasm are all areas that require attention; not only from administrators, managers, designers, engineers and builders but also from consumers.

Transition to decentralized energy production and the rational use of renewable energy sources are the pillars of the new model that should be developed on a much bigger scale within the next decade, so that we can dynamically respond to climate change and thus create a path to sustainable, low carbon future.

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MANGANESE TECHNOLOGICAL WASTE – AN EFFORT TOWARDS PROTECTION OF ENVIRONMENT

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ABSTRACT

Manganese is one of the principal deoxidizers and alloying elements used in the production of steels and alloys. However, the decrease in the reserves of high-grade manganese ores is making necessary to consider the processing of lower-grade manganese ores. The paper presents the investigation results about the possibility to obtain the qualitative manganese concentrates from technological waste. The product particle size distributions, chemical and mineralogical compositions were determined. The data from laboratory and pilot test scale clearly illustrate that there are the possibilities to produced manganese concentrates with up 31.0% Mn content from technological waste. On the basis of test results a technology for manganese technological waste treatment was developed.

Keywords: Environmental impacts, manganese technological waste treatment

INTRODUCTION

Great amount of wasted materials are generated by industries and has caused tremendous harm to both the environment and ecology. The development of science and technology has made it possible to transform the waste into new resources to benefit human beings. In fact, zero discharge of waste materials in many industries becomes true. The construction of pollution free and recycling plants is the target of sustainable development in all countries of the world.

Manganese is used as a processing and alloying agent of steel and an alloying agent in non-ferrous materials. Manganese ores are classified as metallurgical grade, chemical or battery grades. For metallurgical grade the iron, silica and especially phosphorus content are important. In battery grades the manganese content is expressed in terms of manganese dioxide and these ores typically contain from 70 to 85 percent MnO_2 (44 to 53 % manganese).

Manganese consumption is related to the increasing production of raw steel and upgrading ferroalloys. Nonferrous applications of manganese include production of dry-cell batteries, plant fertilizer components, animal feed and colorant for bricks. The manganese ore (high grade 35% manganese) production world wide is about 6 million

ton/year and electrolytic manganese metal demand is about 0.7 million ton/year. The total manganese demand is consumed globally by industries including construction (23%), machinery (14%), and transportation (11%) [1].

Environmentally sustainable management choices include identifying raw material chemistry, utilizing clean production processes, minimizing waste generation, recycling materials, controlling occupational exposures, and collecting representative environmental data [2].

As result of manganese ore processing, during the long period of manganese deposit exploitation in Bosna and Herzegovina were accumulated significant quantities technological waste. Manganese ore industrial production from the deposit was made since 1959. Washing mineral processing was used. The annual productions of manganese concentrate with content of Mn 35.0% for 1959-1973 was 15 000 – 20 000 t. Washing factory was made since 1973 with manganese concentrate capacity 30 000 t. per year. Ancillary facilities – tailings and technological water lake were made. This construction described as "Old separation" was been working since 1990. Since 1891 was started building of new dressing plant – "Italian installation", which included washing process, sizing, heavy media separation, dewatering process and waste water purify. This installation was been working since 1993.

Large amounts of manganese technological waste was accumulated during the different installations mineral processing activities of dressing plant.

Based on representatives a sample analysis of drill core was established available from 100 000 t. technological wastes proved reserves sustainable for processing and manganese concentrate production. Manganese concentrate could be produced currently from 50 000 tones. The rest quantities could be mining after relevant treatment on the ground [4].

This paper will discuss a new technology for manganese concentrate production from technological waste.

LABORATORY AND PILOT TESTS

In a laboratory and pilot scale it was studied the possibility to obtain the qualitative manganese concentrates from technological waste. The technological waste samples were characterized. In previous studies including the characterization of manganese technological waste from "Italian installation" and "Old separation" are investigated by complex methods of research [3]. Optical microscopy, X-ray diffraction, chemical analysis and other methods has been used. It was found that the wastes have a high content of manganese and they interest potential row materials for manganese concentrates produced.

Laboratory and pilot scale testing included "Attrition process" and hydroclassification. The attrition process is used for destruction of manganese – clay aggregates.

It was established that destruction of manganese – clay aggregates depends on pulp density. Using reagent dispersant leads to high efficiently of the process. The optimal parameters of "Attrition process" are presented in Table 1.

Table 1. Optimal technological parameters

Technological parameters	Optimal values
Pulp density, %	70
Time to attrition, min	8
Reagent consumptions Clercal PA 660, g/t	30

In laboratory test it was used a laboratory hydrocyclone and laboratory spiral classifier. In pilot test it was used a battery hydrocyclones with diameter D = 350 mm. The chemical and the mineralogical compositions of manganese concentrates were determined using AES-ICP and Diffractometer Siemens D 500 respectively. The granulometric composition of obtained manganese concentrates was determined using vibratory sieve shaker Analysete 3, FRITSCH. The chemical analysis and granulometric composition of manganese concentrates are presented in Tables 2, 3 and 4.

Table 2. Chemical content of manganese concentrates from "Italian installation" and "Old separation" technological waste

Compound, %,								
Manganese concentrate produced from "Italian installation" waste	Al_2O_3	BaO	CaO	Fe_2O_3	K_2O	MgO	MnO_2	Mn
	5.63	0.18	1.32	8.49	2.11	1.33	51.64	**32.65**
	Na_2O	P_2O_5	SO_3^-	SiO_2	TiO_2	ZN	Moisture	
	0.05	0.24	0.74	26.04	0.24	10.93	3.16	
Manganese concentrate produced from "Old separation" waste	Al_2O_3	BaO	CaO	Fe_2O_3	K_2O	MgO	MnO_2	Mn
	6.16	0.17	1.61	8.77	2.10	1.58	47.61	**30.11**
	Na_2O	P_2O_5	SO_3^-	SiO_2	TiO_2	ZN	Moisture	
	<0.05	0.21	1.24	28.06	0.26	10.65	3.55	

Table 2 shows that manganese concentrate from "Italian installation" technological waste contains 32.65 % Mn, respectively manganese concentrate from "Old separation" – 30.11%.

Table 3. Granulometric composition of manganese concentrates from "Old separation" technological waste

Particle size, mm	Yield, %
+ 0.8	2.37
- 0.8 + 0.4	5.30
- 0.4 + 0.25	11.78
- 0.25 + 0.1	53.43
- 0.1 + 0.074	12.35
- 0.074	14.77
	100.00

The data from laboratory and pilot test scale clearly illustrate that there are the possibilities to produced manganese concentrates with up 31.0% Mn content from technological waste after separation of fine clay fraction.

Table 4. Granulometric composition of manganese concentrates from "Italian installation" technological waste

Particle size, mm	Yield, %
+ 2.5	2.50
- 2.5 + 1.6	3.25
- 1.6 + 0.8	17.75
- 0.8 + 0.4	32.58
- 0.4 + 0.25	20.00
- 0.25 + 0.1	21.75
- 0.1 + 0.074	1.95
- 0.074	0.22
	100.00

Difractograms of manganese concentrate sample from "Italian installation" and "Old separation" technological waste are presented in Fig. 1 and 2.

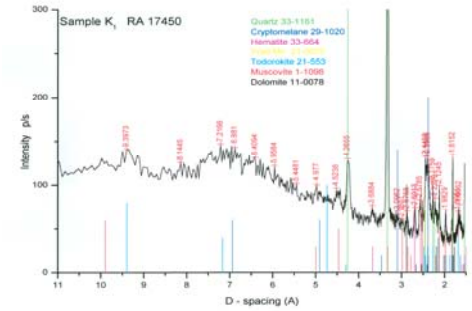

Figure 1. Difractogram of manganese concentrate from "Italian installation" technological waste

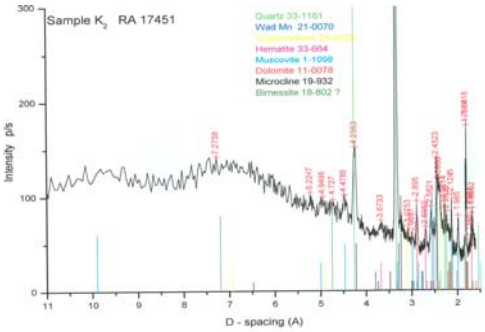

Figure 2. Difractogram of manganese concentrate from "Old separation" technological waste

There were established mineral structures of waste from manganese ore, including textural and structural features of main minerals and mineral complexes. The main

components in manganese concentrate are cryptomelane, roentgen-amorphous manganese hydroxides ("wad"), birnessite, hematite, quartz, illite (hydromuscovite) and dolomite [3].

Manganese concentrates that has mineral contains cryptomelane, birnessite and todorokite expanded their use.

Cryptomelane has a great potential in use of ion-exchange material, battery material, radioactive waste immobilization material, catalytic material and remediation materials used for environmental pollution. It is known that the natural cryptomelane is a great sorbent of Cd and As. Natural samples containing mainly manganese hydroxides (cryptomelane, birnessite, todorokite), iron oxides and hydroxides (hematite, goethite) are cheap and effective material for removing of As from mining and industrial polluted waters. Cryptomelane is a great sorbent of Ra from acidic aqueous solutions. In addition, the amorphous manganese hydroxides could be use for removal of Sr from polluted waters. Because a better tunnel constructed by active Mn-O octahedron in cryptomelane crystals is similar to that of tetragonal molecular sieve in zeolite, cryptomelane has the function of active octahedral molecular sieve. As compared with natural zeolite, the aperture of cryptomelane is close to that zeloite and the K^+ in tunnels of cryptomelane with the feature of ion exchange is similar to Na^+ and Ca^+ in the tunnel of zeolite [5].

APPLICATION RANGE

The world rapidly growing demand for manganese has made it increasingly important to develop processes for economical recovery of manganese from low grade manganese ores and other secondary sources.

Based on the tails characterization data, the laboratory experiments and pilot scale results a technology for manganese waste treatment was developed. The schematic flow sheet of manganese concentrate production from technological waste is given in Fig. 3.

Technological wastes from old tailings pool are transported to the dressing plant with dump-truck and dumped over fixed screen. For easier transport, sieving and wetting the fresh water Q_1 is used. After passing through fixed screen technological waste entered in feed tank (1) and under chain feeder passed to belt conveyor (7). To remove large pieces of dolomite and hematite the hand separation is used.

From belt conveyor manganese waste passes to intermediary hopper (9), where is feed fresh water Q_6. After that the waste is subjected to "attrition process" in attrition machine (32), with a high content of solid phase. The presence of reagent dispersant supports the destroying of manganese-clay aggregates. After the disintegration the pulp is diluted with fresh water Q_7 and put it on slurry tank (21). The slurry pump (22) transports diluted pulp. Separation of heavy manganese large fraction from light fine clay fraction takes in battery hydrocyclones (23). Overflow fraction is a final technological waste. The underflow fraction is deslimed in spiral classifier (26) for additional purification of manganese fraction. The spiral classifier overflow and the hydrocyclone underflow are transported to the tailings pool using waste pipeline. Sand fraction (manganese concentrate) from spiral classifier is stored in a storage house for finished product. The final technological waste processing is precipitates in tailing pond. The clarify water through water pump (31) is transferred to a fresh water lake. The fresh water is pumped at different points in technological flow sheet using water pumps (29) and (30).

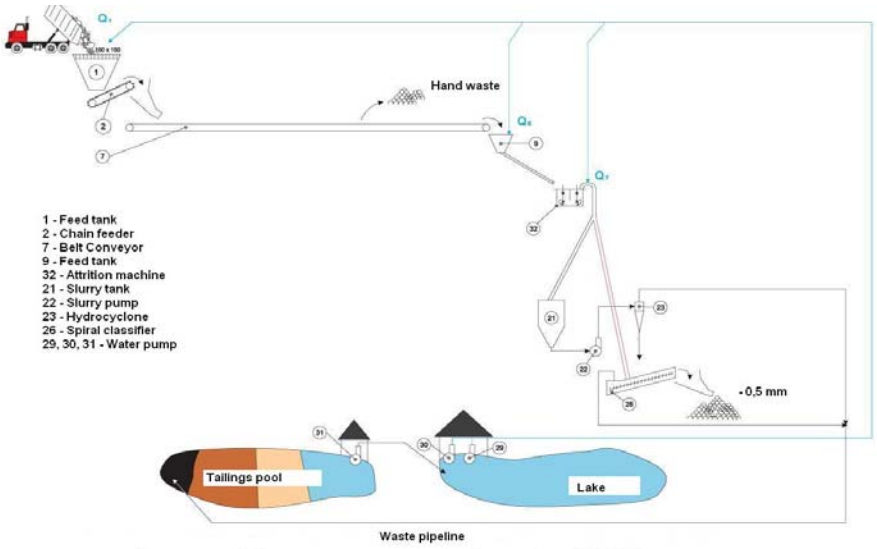

Figure 3. Flow sheet of manganese concentrates production

CONCLUSIONS

The performed test work shows that there are possibilities to obtain the quality manganese concentrate from technological waste. The pilot test data clearly demonstrate that the new manganese waste treatment technology is suitable for manganese waste material. A new technology for production of manganese concentrates was developed. Increasing the economic efficiency of processing manganese technological waste ensures complex use of raw material and reduces volumes of waste.

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ON THE POSSIBILITY OF WASTE UTILIZATION FROM SRBOKVARC SILICA SAND PRODUCTION

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ABSTRACT

Research and development program has started to improve the silica sand recovery of SRBOKVARC processing plant. The program has undertaken of decreasing the losses in the processing tails and to provide production of new products. The technological tails from SRBOKVARC processing plant was characterized. The pilot test work was performed on hydrocyclione installation. The research was realized using Laboratory & Test Complex and Complex for Semi-industrial Testing and Experimental Ceramics Laboratory facilities of KAOLIN AD. The data clearly illustrate that the technological tails could be transform in two new secondary products for ceramics industry and could be increase the production of fine silica sand. The new production will improve the silica sand recovery of SRBOKVARC d.o.o.

Keywords: technological tails, kaolinite-silica-feldspar product, fine quartz-feldspar sand

INTRODUCTION

KAOLIN AD is a company which main line of business is mining of sands and non-metallic minerals. The company is a leader in industrial minerals production in Bulgaria. The main manufactured products are: kaolin, silica sand, chamotte, limestone, dolomite, feldspar, carbonate fillers and ceramic read body. KAOLIN AD is the first sand producer in Eastern Europe and the forth largest producer of sand in Europe. The company controls 1 % of the world's kaolin reserves and is the first kaolin producer in South-Easter Europe and the second chamotte producer in Europe. The grades kaolin produced by KAOLIN AD are: kaolin filler for paper, kaolin for coating of paper, kaolin for ceramic and porcelain-faience industries, ground kaolin for rubber and chemical industries and kaolin for refractory industry. The grades of silica sand produced by the company are: silica sand for glass industry, ground sand for sanitary ware, silica sand for moulding, dry silica sand and gladded sand. KAILIN AD exploits almost 40 deposits and processes raw materials in 18 company's plants in Bulgaria, Serbia, Ukraine and Albany [1].

SRBOKVARC d.o.o. is subsidiary company of KAOLIN AD and produces different grades silica sands. The raw material mined in the open pit and processed in the

company's plant is quartz – feldspar sand. The primary crushing is realized in the quarry. The flowsheet of quartz–feldspar sand treatment is given in Fig. 1. Processing of the raw material is carried out in a complex gravity circuit. The run of quarry sand is fed to a 4 mm vibrating screen from which the oversize goes to a jaw crusher. The crushed product is returned in the technological process. Then the screen undersize minus 4 mm is conveyed to a rotary drum scrubber, the product from which is screened on a double deck vibrating screen. The screen oversize is a final sand product for cement industry. The screen undersize is classified in 600 mm cyclones, overflow ("-0.100 mm) passing to lamella thickener. Cyclone underflows are processed on monosizers for additional cleaning of fraction minus 0.100 mm. Monosizer underflows are further classified in hydrosizers. On this stage is produced the second final sand product for building industry and water filters and the third final sand product for dry mixtures and self-leveling flowers. Hydrosizer overflows ("-0.100 mm) are thickened in a lamella thickener. The fine hydrosizer product (fraction "-0.600 + 0.100 mm" is thickened in hydrocyclone and underflow is treated in an attrition machine. Then the sand is dewatered in a spiral classifier and plane filter. This final sand product is used in glass and foundry industries. The technological waste is formed from overflows of cyclones, hydrozisers and dewatering classifier and filtrate from plane filter. The tails is ticked in lamella thickener and then is passed to tailing pond. About 20 % of the treated raw material is turned into waste and is disposed in the tailing pool.

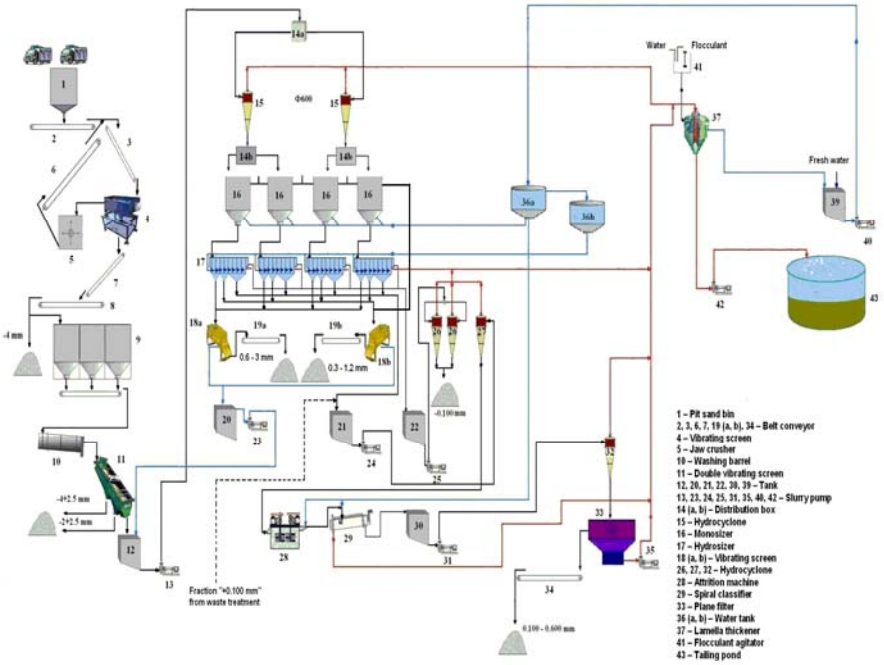

Figure 1. Flowsheet of quartz-feldspar sand treatment in SRBOKVARC processing plant

Research and development program has started to improve the silica sand recovery. The program has undertaken of decreasing the losses in the processing tails and to provide production of new products. This paper describes some of the results on an experimental work in the frame of the research program.The purpose of this study is to establish the possibility of the transformation the sand processing tails in new secondary products.

EXPERIMENTAL

Tails characterization

A number of samplings in SRBOKVARC processing plant were performed. Sampling and performance evaluation was applied to final technological tails from yellow raw material (deposit "Oblazite"). The following characteristics of the representative tails sample were determined: particle size distribution and chemical composition.

Pilot tests

The pilot tests using the KAOLIN AD Complex for Semi-industrial Testing and Experimental Ceramics Laboratory facilities were conducted (2). The representative sample of final technological tails of SRBOKVARC processing plant was tested. The sample was sized by wet screening (0.1 mm screen) into two fractions. The undersized fraction "-0.1 mm" was treated at the hydrocyclone installation. It was tested 125 mm hydrocyclone and 100 mm hydrocyclone with different overflow pipe diameter and sand end piece diameter. The pilot hydrocyclone installation is given in Figure 2.

The following characteristics of the sampling products were determined in Laboratory & Test Complex: particle size distribution; chemical composition and mineralogical composition.

Particle size distribution of samples was determined by wet sieving: fractions "+ 45 μm" using vibratory sieve shaker Analysete 3, FRITSCH and fractions "- 45 μm" using SediGraph 5100. The chemical and the mineralogical compositions were determined using AES-ICP and Diffractometer Siemens D 500 respectively.

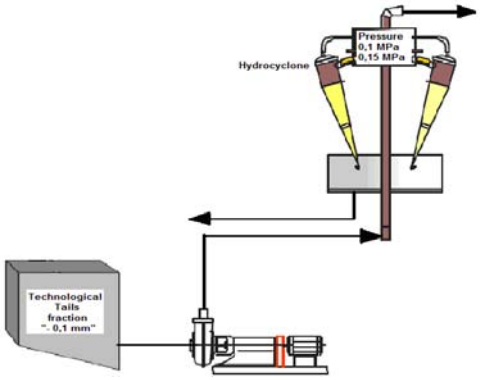

Figure 2. Pilot hydrocyclone installation

RESULT AND DISCUSSION

Tails characterization

The data from particle size distribution and chemical analysis of final technological tails from SRBOKVARC processing plant are shown in Tables 1 and 2 respectively.

Table 1. Particle size distribution of technological tails

Size fraction, mm	Yield , wt. %	Size fraction, mm	Yield , wt. %
> 0.800	0.01	< 0.200	91.25
< 0.800	99.99	< 0.160	88.86
< 0.630	99.94	< 0.100	83.40
< 0.500	99.68	< 0.063	70.14
< 0.400	99.09	< 0.056	67.43
< 0.315	97.35	-	-

Table 2. Chemical composition of technological tails

SiO_2 %	Al_2O_3 %	Fe_2O_3 %	TiO_2 %	CaO %	MgO %	K_2O %	Na_2O %	L.o.i., %
79.57	9.51	1.28	0.36	0.16	0.11	4.96	2.05	1.91

The performed analyses show that the final technological waste is kaolinite-silica-feldspar product. The contents of SiO_2, Al_2O_3 and K_2O in the tails are respectively 79.57 %, 9.51 % and 4.95 %. The fraction "- 0.100 mm" is 83.40 % from processing tails. Therefore there are some losses of the fraction over 0.100 mm in the final tails. The results clearly demonstrate that there are possibilities to improve silica sand recovery increasing the yield of silica sand "0.100 – 0.600 mm" and transforming the final technological tails in new secondary products.

Pilot tests

The pilot test final data of technological tails hydrocyclone classification are presented in Tables 3 and 4.

The performed analyses demonstrate that the waste fraction minus 0.100 mm is kaolinite-silica-feldspar-mica product with content of SiO_2 – 77.18%, Al_2O_3 – 11.90 %, Fe_2O_3 – 1.40 % and K_2O - 5.85 %. The pilot test data clearly show that there are possibilities to obtain two new products after technological tails hydrocyclone classification. The cyclone overflow is kaolinite-silica-feldspar product with high content of mica and hydromica. The yield of this product is high – 32.9 %. The physical characteristics show that this product could be used like component in ceramics mass for floor tiles and building ceramics production. The product has high plasticity – 30.5 %, good strength of bending at 110^0C – 41.53 kg/cm^2, good linear shrinkage – below 5 %. The maximum linear shrinkage (17%) and the minimum water absorbtion (0.093%) the kaolin-silica-feldspar product realizes at 1150^0C. About casting data – maximum concentration for 5 pS – 52,5 %. The cyclone underflow is fine quartz-feldspar sand with 60 % silica and yield – 67.1 %. This product could be used like component in ceramics mass for tiles production.

Table 3. Pilot test – product chemical and mineralogical composition and particle size distribution

Characteristics	Tails fraction "-0.100 mm"	Cyclone overflow	Cyclone underflow
Chemical content, %			
SiO_2	77.18	61.54	85.76
Al_2O_3	11.9	20.94	7.19
Fe_2O_3	1.40	3.32	0.36
TiO_2	0.42	0.62	0.26
CaO	0.12	0.24	0.10
MgO	0.38	0.87	0.079
K_2O	5.85	6.35	5.44
Na_2O	0.30	0.22	0.25
L.o.i.	2.32	5.76	0.52
Particle size distribution, %			
> 250 μm	0.4	-	0.3
< 250 μm	99.6	-	99.7
< 160 μm	98.9	-	98.8
< 100 μm	97.7	-	97.2
< 63 μm	74.5	-	58.0
< 56 μm	66.6	-	44.7
< 45 μm	63.6	99.2	39.8
< 32 μm	60.4	99.1	35.5
< 20 μm	52.8	96.5	21.4
< 10 μm	40.3	84.8	7.3
< 5 μm	29.9	65.5	3.8
< 2 μm	19.8	43.4	2.1
< 1 μm	14.4	31.7	1.2
< 0.5 μm	10.3	32.2	0.7
Yield, wt.%	100.00	32.9	67.1
Mineralogical composition	-	Quartz ~ 23% K feldspar ~ 23% Kaolinite ~ 30% Mica/Hydromica ~ 20% Fe – oxide, hydroxide ~ 4 %	Quartz ~ 60% K feldspar ~ 36% Kaolinite ~ 2% Mica/Hydromica ~ 2%

Table 4. Pilot test – cyclone overflow product physical characteristics

Physical characteristics		Cyclone overflow
Plasticity – Pfeferkorn test, %		30.5
Strength of bending, (110^0C), kg/cm^2		41.53
Linear shrinkage, %	- 110^0 C - 950^0 C - 1050^0 C - 1150^0 C	4.2 5.3 8.6 17.0
Water absorbtion, %	- 950^0 C - 1050^0 C - 1150^0 C	26.0 18.6 0.093
Color after firing	- 950^0 C - 1050^0 C - 1150^0 C	Slightly pale orange/RAL 2007 Slightly pale orange/RAL 2007 Cooper brown/RAL 8004
Maximum concentration for 5 pS viscosity, %		52.5
Optimum amount of peptizer, % - 10 pS - 5 pS		 0.25 0.50

Application range

On the basis of the pilot test results a technology for sand treatment waste was developed. A schematic flow sheet of waste treatment is proposed in Figure 3.

The final technological waste from SRBOKVARC processing plant is mixed with water and is fed to a vibrating screen sizing at 0.100 mm. The oversize waste material is returned to the processing plant. Undersize fraction (-0.100 mm) is pumped to a cyclone for hydrocyclone classification. The cyclone overflow (-0.040 mm) is dewatered in filter press and the cyclone underflow (0.040-0.100 mm) passes to dewatering screen. This technology could be realizes the waste transformation into two new secondary product for ceramics industry and could be increase the production of fine silica sand 0.100-0.600 mm.

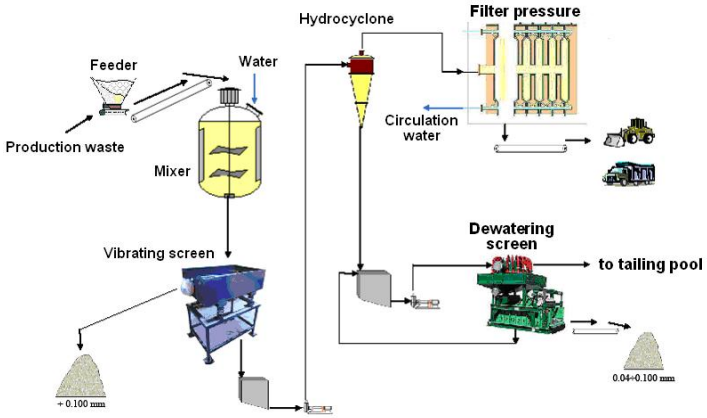

Figure 3. Waste treatment flowsheet

CONCLUSIONS

The tails characterization and performed pilot test indicate the possibility for waste utilization from SRBOKVARC silica sand production. The data clearly illustrate that the technological tails could be transform in two new secondary products for ceramics industry. The new production will improve the silica sand recovery of SRBOKVARC d.o.o.

Acknowledgements

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INNOVATION POSSIBILITIES OF ECOLOGY EDUCATION IN THE PARTNERSHIP OF THE SCHOOL AND THE LOCAL COMMUNITY INSTITUTIONS

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ABSTRACT

Actual level of common awareness of natural environment protection and the level of ecology culture in the Republic of Serbia are not as they should be, among the others due to unsufficient ammount of input of ecology curriculum in schools. An innovative approach to ecology content is necessary. It is possible to maintain such kind of education through the partnership between schools and particular institutions from the local community which obtains double effect: pupils gain a possibility to improve their knowledge from many resources, whereas they get involved in activities while creating ecological awareness of their parents and further on the whole community through events in the community. An experience from the Primary school" Dušan Radović" in Bor during realization of innovative model of ecology education of pupils and other citizens in the local community along with the great support of the NGO-s, cultural and public institutions that gives an important issue to ecology endangered environments such as Bor is.

Keywords: ecology education, environmental protection

INTRODUCTION

Ecological awareness and ecology education are of a great importance to improvement of the environmental protection. Nevertheless, according to the most important nationl documents, such as the National programme of the environment protection [1] is, common level of awareness on environmental protection as well as the level of ecology culture in Republic of Serbia are not sattisffactory, due to, among other reasons insufficient presence of ecology education in the curriculum of both Primary and Secondary Technical, Economy and Grammar schools. It is rather necessery for ecology education to be included and present more in the school curriculum. On the other hand, an innovative approach to presenting ecology content is also of great importance, which requires achieving international standards and experience at cology education.

Educational reforms that started in 2003. found out that Primary and Secondary school pupils did not have clear picture of environmental problems although it had been one of the listed educational objectives[2]. Nothing has changed ever since. Pupils in

schools are not stimulated to think about their environment by different school activities, while mainly transmissive methods dominate in the educational system. The curriculum being used at the moment in Primary schools in the field of envioment show that the content is not in the function of applying their knowledge, nor there is correlation among school subjects which cover the problems of environmental protection (World around us, Nature and Society, Biology, Geography, Chemistry, Physics, Technical Education, Art, Civic education and the optional subject Natural keepers). Educational institutions do not often get appropriate support from authorities such as Ministries of Education and Enviroment and the local community, while promoting environmental protection and including sustainability into their every day functioning. Ministry of environment recognized this problem and enlisted those measures into their future activities [1].

Some subjects such as Biology cover general scientific facts, but the the teaching concept does not allow classes in nature that is in the field (class lasts 45 minutes, and the pupils are overladen by the number of the classes). The role of Biology excursions aiming to achieving educational objectives has been neglected although some researches [3] show that the level of adopted knowledge in most of the cases is the highest when adopting required knowledge of curriculum. Reason to this is mainly due to the lack of the support, particularly financial one, when creative programmes schools created can not be realized. There is also need to introduce systematically improved informal ecology education through different educational programmes and projects of professional institutions and associations which allow schools to act as partners.

Along with the educational reforms teachers are able to achieve their programme content and furthermore be initiators and acivities organizers in order to contribute developing ecology awareness and culture of the pupils. There are also great possibilities to develop knowledge and positive attitudes of pupils through their personal experience by organizing out-door activities in the field [2].

Local community such as Bor is, having rather devastated environment on one side and pretty preserved environment with its geomorphological and biodiversity specific features and wealth on the other side, take particular interest for larger extent of ecology education in schools, as well as educating citizens through informal education. There is at the same time possibility realize education through transparent education which allows more detailed and expert knowledge in order to appreciate essential features of the relationship between the man and the environment, which makes the basic of education on sustainable development.

MODEL OF ECOLOGICAL EDUCATION INTRODUCED IN PRIMARY SCHOOL "DUŠAN RADOVIĆ" IN BOR

A survey on ecology education among pupils and teachers in Primary school "Dušan Radović"in Bor, conducted in 2006. proved that teachers (73%), thought how curriculum had little ecology content. 100% thought that ecology education was necessary. They agreed that it was possible to include ecology education in most of the school subjects, and that it was necessary to improve ecology education by introducing new teaching methods and out-door activities. Teachers believed that it was possible to involve parents and local institutions into ecology programmes the school had created

thus building partnership while organizing civic actions, donations and open discussions. Junior pupils stated that they studied about their environment and how to keep it safe. But 89% of them would prefer to learn more by going out into the nature, watching educational programmes, reading ecology magazines and lectures. Senior pupils agreed that they should learn more and that they could best acquire knowledge during trips, thematic excursions, additional activities and multimedia presentations. 92% of pupils expressed their wish for school to organize trips in Bor surrounding where they could learn more about its specific features.

The survey done among pupils and teachers made grounds for creating the Project „Enviroment and we – ecology education for environmental protection"[4]. The objective of the Project was contextual and methodological improvement of ecology education by observing the relations between urbane and industrial influence and traditional living culture on the environment, and strengthening the cooperation with different society structures in the local community and with the parents on joint action of protecting, revitalizing and improving the environment. The school together with other organizations and institutions from the local community offered 200 pupils of different age a possibility to find out about relatios between urbane and industrial culture of living in Bor towards environment which resulted in degradation of the same through direct observation. On the other hand they could observe traditional culture of living in the rural area in Bor surrounding which tended to preserve the nature.

Figure 1. Trips to Bor surrounding

Simultaniously one of the objectives was to make pupils become aware of overtaking initiative and responsibility for their own development. Building knowledge on different ways how people relate towards nature, as well as different attitudes of the pupils towards nature would create new generation of pupils with high level of ecology awareness who would treat the nature in ecology sustainable way. Objective is to have pupils who think ecocentrically that is, biocentrically, according to *deep ecology* approach, not anthropocentrically, which is, at the moment, governing principle of thinking [5].

Main concern of the Project was to introduce the pupils with the relationship man had with the nature in their surrounding. At first through in-door and out-door school activities, whereas they themselves would later become acters promoting

ecocentrical attitude towards nature in school and in their community. Thus, they could get a chance to be active participants in protection of their environment. Those activities of the Project were designed and realized together with the Society of young researchers from Bor in the frames of complex programme "Bor days of ecology".

Main objective of the Project was to improve ecology education in schools both contextually and methodologically, and to strengthen cooperation among different levels in the local community and pupils` parents. The Project itself included realization of particular activities and actions:

- **EDUCATION of pupils, teachers, parents and other citizens towards their relationship to their enviroment** : workshops where topics on environment as one of the basic resource were worked out as well as on the relationship our culture of living – enviroment, open discussions during different International ecology days such as (World Water Day, Health Day, Biodiversity Day, Enviromental Protection Day; European Parks Day), lectures on working methods in the field (observing, taking photos, making collections of biological material, collecting medicinal herbs), out-door classes, a visit to the fair of medicinal herbs

Figure 2. Out-door classes

- **ACTION PLAN**: preparing and realizing a trip to an area under an extremely negative anthropogenic influence (tailing which was part of the complex of Mining-Melting Company in Bor, town depony, town parks)and trips to Bor surrounding (2 villages with mainly traditional living styles, one river eco-sistem, two areas suggested to become protected and natural monument Lazarus canyon), creating collections of natural materials, taking photos, making films, collecting medicinal herbs, literary and art competitions, creating new ecology games (like society games with „hot fields" and question cards), redecorating schoolyard with the greenery, trees planting actions in the town, thematic literary evenings, participating the International youth working-researching campus in the organization of NGO Society of young researchers from Bor on the topic „Customs and Nature", creating and publishing the ecology magazine, literary and art contest (on the topic „Our enviroment",

„What can we do to make our environment more beautiful and healthier", „Medicinal herbs"), making school yards more ecologically functional

- **PRESENTATION AND PROMOTIONS:** presentation of the project and the realiation phases , posters and literary works presentations of the pupils, photo presentations, art and biology collection presentations

Figure 3. Art and literary works presentations

- **COMPETITIONS**: choosing the best poster, drawing, literary work, quiz of knowledge, competition in a newly created ecological game
- **PROMO MATERIAL** posters and fliers that promote protective relationship towards enviroment
- **CREATION OF THE WEB-SITE** where the project activities and results are published
- **COOPERATION WITH THE LOCAL MEDIA**: TV broadcasts and newspaper reports

The model was created in the frames of School Development Plan, which was, due to lack of financial means, partly realized. Printing of ecology game, organization of the pupils competition, publishing promotional material, trees planting were delayed. The Web site, which was created, lasted only one year. However, many activities were conducted thanks to the Society of young researchers from Bor, Mountaniars Society, and the Society of medicinal herbs fans, the Municipalaty Enviromental Department and the Public library, which offered organizational and financial support. All of which gave good results, offering possibility for 200 pupils, their parents and local population to get acknowledged with the problem of relating the men towards the environment in innovative way. The pupils got introduced to their environment and the people`s towards it, they created their attitude on the need of natural protection getting at the same time ecology knowledge, which could be seen at school during regular classes, as well as through optional and out-door activities. Turning pupils into the role of promoters of sustainable relationship towards nature made them understand that personal contribution even a child was very important when protecting environment, and at the same time made place for ecology education possible in the frames of relarionship between parents and children.

Figure 4. Pupils creation – „Ecological tree"

CONCLUSION

A need for ecology education has been more and more stated, especially in very degraded environments, both in formal and informal education. Educational institutions do not have sufficiently applied ecological context in their curriculum. Those that exist at presence, are not sufficiently correlated and synchronized and the pupils acquire partial knowledge from some school subjects at different levels of their educational cycles, which are neither functional nor applicable. Innovative teaching methods, which would point to problems regarding anthropocentrical attitude men have towards the environment and the possibilities of acting in order to protect, revitalize and improve it, are also missing. Such kind of education is possible through a partnership between schools and particular institutions from the local community (NGO-s, Cultural center, the Municipality) which has double impact: pupils being partners with other institutions have a possibility of getting new knowledge, whereas they are at the same time involved in the activities of creating ecology awareness at their parents and other citizens through different events which take place in the local community, as promoters of healthy and functional attitude towards the environment.

The Project „Enviroment and We" in the Primary school „Dušan Radović" in Bor implemented into the School Development Plan, but it was realized in the frames of broader programme of ecology education in the local community as a segment of wide partnership which proved to be main condition for its succesful realization. It also proved to be innovative approach to improving ecology education in schools as well as wider education of the citizens.

However, in order to maintain such programms of good quality in schools it is necessery to obtain financial support not only from the local community but also from appropriate Ministries, especially in those areas where the antropogenic influence on the environment is highly present. Implementation of creative programmes and projects of ecology education into school programmes should be an imperative in areas such as Bor

is. Such areas should be involved into wider programmes of ecology education, at the level of local community and at the level of state. It is also very important to educate more teachers who will be able to create and conduct active model of teaching in the field of ecology education.

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INVASIVE WEED SPECIES IN URBAN ENVIRONMENTS AND PREVENTION POSSIBILITIES OF THEIR SPREAD

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ABSTRACT

Ruderal weed species comprehend also adventive ones that if adapted to the conditions on arable areas may become more problematic than weed species in unchanged conditions of weed control. They are result of significant ecological changes caused by globalization and human activities, and consequences are mainly significant losses in economy, biological diversity and function of invaded ecosystems. These species primarily occupy urban settlements and rural habitats, spreading later also on other areas. Invasive weeds are problematic, for they grow rapidly in new areas and spread aggressively, endangering other plants, violating existing water and soil ecosystems by changing their structure and function.

Keywords: invasive weeds, *Ambrosia artemisiifolia, Iva xanthifolia, Asclepyas syriaca*, adaptation, spread

INTRODUCTION

Nowadays it is evident that species that occur on non-agricultural areas have very significant role in agro-ecosystems. They are important for the application of pesticides, allow dynamics of weeds, represent a habitat for displaces species or species that extinct and contribute to the flexibility of ecosystems [1]. Ruderal vegetation is mainly described phytocenologically, by Braun-Blanquet methodology through ecological parameters such as vegetation diversity, life forms and fenological diversity that by complex action point to the relation between dynamics of ruderal weeds and dynamics of crop weed community [2]. Depending upon habitats, two huge groups of ruderal plants can be distinguished, i.e. those that occur on soils such as boundaries, weeded land, economic yards, along roads and railways, historic buildings, monuments and in water ecosystems such as drainage channels, rivers, ponds, swamps, lakes, ponds [3]. Each year thousands of seeds of exotic species are accidentally introduced into new regions [4,5], and only few of them will develop population with possibility to became domesticated. Intentional introduction of new species in agriculture, horticulture and forestry for commercial purposes can also lead to occurrence of invasion. Weber [6] established that of the total number of determined species in the review Flora Europea,

5% are exotic species of European florae. In France majority of exotic plants has invaded crops, places along roads, sandy areas and riverbanks. Degraded areas are otherwise prone to invasion, in contrast to the stable, natural vegetation [7]. Many countries reduce risk from spreading of these species by application of the quarantine measures, prohibiting entry of seed through the impure seed for sowing [8]. In the frame of International Plant Protection Conference and the European strategy, European Plant Protection Organization (EPPO) has developed strategy on invasive alien species (Bern Convention), joint European strategy on protection of EPPO countries region from invasive weeds. Since 2002 program for identification of invasive plant species that could represent problem for EPPO region has been developed, as strategy for their control. As the number of plants that could be considered as possible harmful species is very high, priority estimations of kinds of potential invasive species of EPPO region have been made [8].

INVASIVE WEED SPECIES – PROBLEM IN URBAN ENVIRONMENTS

Ruderal plant communities have great impact to weediness of field areas, especially of row crops. According to their floristic composition they are the closest related to the weed communities of agrobiotopes. Their division is narrowly related to the specific conditions of habitats, and they are considered as real ruderal such as *Datura stramonium, Hyosciamus niger, Solanum nigrum, Urtica dioica, Urtica urens,* and *Xanthium strumarium* or facultative occurring such as *Convolvulus arvensis, Cynodon dactylon, Polygonum aviculare,* and *Eragrostis minor* [9]. Among ruderal weed species adventive ones can be also found; if they adapt to the conditions on arable areas, they may become huger problem than weed species in unchanged conditions of weed control. In our conditions, the most problematic adventive species belong mainly to the fam. *Asteraceae* (*Ambrosia artemisiifolia, Iva xanthifolia, Xanthium strumarium,* and *Erigeron canadensis*). In our country, from fam. *Asclepiadaceae* is present invasive species *Asclepias syriaca*, known as common milkweed, and in the world problem arises Cynanchum *rossicum* - syn. *Vincetoxicum rossicum* that also belongs to this botanic family. As all invasive species, they are also of huge biological potential, highly competitive, adaptive and aggressive. They result from significant ecological changes accompanied by globalization and human activities, and consequences are mainly significant losses in economy, biological diversity and function of invaded ecosystms [10].

The most frequently invasive species spread as accidental companion of different human activities. These species primarily occupy urban settlements and rural habitats, spreading later also on other areas. Invasive weeds are problematic, for they grow rapidly in new areas and spread aggressively, endangering other plants, violating existing water and soil ecosystems by changing their structure and function. In recent years, the problem of invasive weed species is gaining increasing importance, due to their rapid expansion worldwide, primarily due to the globalization of markets, increased trade, transport and tourism. Given such an unfavorable trend, introduced invasive species now represent one of the major threats to biological diversity.

Each year, great number of invasive plant is introduced into new areas. However, only limited number of them is able to develop population while inhabiting new habitats [4]. There is no way to prevent completely introduction of such species, which initially colonize the most unstable ecosystems such as ruderal sites and agrophytocenozis. Risk evaluation from the introduced (adventive) plant species is performed by monitoring of its spread and prediction of time it needs to become an invasive weed species. The main characteristics of invasive plants are their ability to grow rapidly and spread aggressively. Another important characteristic of invasive plants is their high reproductive ability, which involves production of large quantities of seeds per plant that usually easily and quickly spread to the larger areas and have low requirements in terms of conditions for germination and emergence. In addition to seeds, these plants often reproducing vegetatively, by rhizomes and adventive buds on the root. Additional important characteristic of invasive weeds is their ability to adapt to different environmental conditions, as well as the ability of exploitation by which they cause disturbance in the existing environmental conditions [11].

In September 2007 invasive species were by EPPO Council-a included into EPPO A1/A2 list of harmful quarantine organisms, presented in Table 1.

Table 1. Invasive species included into the list of EPPO quarantine list

Invasive weed species	EPPO list	Year
Crassula helmsii	A2/340	2006
Eichhornia crassipes	A2/351	2008
Heracleum persicum	A2/354	2009
Heracleum sosnowskyi	A2/355	2009
*Hydrocotyle ranunculoides**	A2/334	2005
Polygonum perfoliatum	A2/352	2008
Pueraria lobata	A2/341	2006
Solanum elaeagnifolium	A2/342	2006

* Aquatic species

Plants assessed as significant threat to plant health, protection of environment and biodiversity in EPPO region are grouped in special category. As great number of invasive species is already present in EPPO region, priority lists with plant species that represent the highest threat to the ecosystem of EPPO region are made. In such a manner, countries are warned of danger and possibility of timely implementation of preventive measures of their introduction and spread, or to management of undesirable populations, i.e. limited sale of planting, as well as control. From EPPO list of invasive species, for our country of special significance are: *Ambrosia artemisiifolia, Amorpha fruticosa, Azolla filiculoides, Cyperus esculentus, Helianthus tuberosus, Heracleum mantegazzianum, Myriophyllum aquticum, Reynutria (Fallopia) japonica* and *Solidago gigantea.*

Specially extracted EPPO list of warning provides EPPO member countries insight into the risk from plant species for the region. Majority of these species are still of limited distribution or are not present in the EPPO region. Risk from entering of invasive weed species through the aquatic environment has been analyzed also by the following 10 EPPO member countries: Austria, Czech Republic, Estonia, France, Hungary, Germany, Israel, Netherlands, Latvia, Swiss and Turkey. Of 247 studied species, only 10 is

considered as threat to the EPPO region which represents 4% of the total number of introduced species. Despite measures applied by some countries, species: *Crassula helmsii, Eichhornia crassipes, Azolla filiculoides, Egeria densa, Elodea nuttalli, Lagarosiphon major, Ludwigia grandiflora* and *Myriophyllum aquaticum,* still spread, as well as *Hydrilla verticillata* and *Pistia statiotes*, that are in some countries on lists of quarantine weed species. Only one species, *Hydrilla verticillata,* is used for aquariums, and due to this, it represents great threat to natural ecosystems [8]. From the very beginning of crop breeding, agricultural producers have problems with weeds and pests, but the impact of invasive weed species on native ones, environmental communities and ecosystem has attracted attention of international experts only recently. Invasive species, also known as environmental weeds represent insidious biological pollution [12].

Ren and Zhang [13] have examined invasive mechanisms in order to predict the occurrence of invasive species in the future. By analysis of general mechanisms of invasion in plants, guided by ecological processes that were behind the invasion, eight of them they categorized into three classes: physical environment mechanisms (phenotypic plasticity in environmental tolerance and evolutionary adaptation to physical environment), resource use mechanisms (resource competition, resource utilization and allelopathy) and enemy release mechanisms (high growth/reproduction rate, evolutionary increased competitive ability and phenotypic plasticity in resource allocation).

INVASIVE WEED SPECIES IN OUR COUNTRY

As the problem of adventive and invasive weed species is not of the local character, and that spreading of such species is usually perceived late, when they already become troublesome, terrain studies, as well as information exchange between extensions that monitor these processes are important. Such activities are regularly conducted in countries such as Great Britain, France, Switzerland, Germany, Czech Republic, USA and Australia [14]. However, in our country to this problem is not paid enough attention. It is necessary to actualize this issue at the state level. With development of transport and trade in last thousand years, humans accidentally or purposely introduced different plant species in new ecosystems [15].

Spreading of species that are not native in certain area, i.e. habitat became global problem that occurred also in Serbia. Among them dominant are *Ambrosia artemisiifolia*, *Iva xanthifolia* and *Asclepyas syriaca*.

Ambrosia artemisiifolia L., known as ragweed is weedy-ruderal species of fast and intensive spread. It has been introduced from neighboring European countries. It belongs to adventive floristic element and in 1800 it was introduced from North and Middle America into Europe together with clover seed. In USA and Canada, it is considered as one of the most important weeds and its control is regulated by numerous legal acts. Concerning damages caused by its spread, in Hungary its control is mandatory and regulated by the Ministry of Agriculture in the frame of Agricultural Land Law from 1994. In its spread, ragweed began to adapt also to open vegetation on uncultivated terrains, usually of ruderal type, and on degraded pastures. It weeds almost all crops and plantations; it is spreading fast and becomes cosmopolitan. Due to its wide ecological valence, it easily becomes dominant weed in differing conditions [16].

First data on allergenic weed species *Iva xanthifolia* Nutt. originate from 1966. In 1978 presence of this allergenic weed species was established near roads and other non-arable land [17]. *I. xanthifolia* is ruderal weed species, but in last ten years, its presence was established in field crops such as maize, sugar beet, sunflower and soybean [18]. In the period 2002-2006, *I. xanthifolia* was found on 24 localities on the territory of Banat, Backa and Srem [19].

Asclepyas syriaca L. was introduced in Europe from North America as bee plant, and first written data on its presence in our country are from the beginning of the last century. After this the species spreads slowly, and nowadays it is distributed all over Serbia, especially in the northern part of Vojvodina. It is the most frequently found near riverbanks and on the edges of woods, as well as near banks of the rivers Danube, Sava and Tisa and some smaller rivers in Vojvodina. It occurs on sandy soil (Deliblato and Subotica-Horgos desert). Due its small seed that has hairy, web-like extensions, it is easily transferred by wind, and today this species is completely domesticated in the region of Vojvodina [20].

POSSIBILITIES OF NEW INVASIVE WEEDS SPREAD IN URBAN ENVIRONMENTS

Invasive weed species, introduced accidentally or deliberately into the territory of some country represent huge treat to biodiversity, and other potential economic and social consequences may also arise. In order to prevent damages, EPPO countries have adapted standard and guide for management of invasive organisms, especially measures of control and reduction of risk to the minimum during import of these species [8]. International management measures, that are applied with the aim of management by imported invasive plants within endangered region include the following: information of public (existing regulations and lists of invasive or potentially invasive plants; raising the consciousness of the people in the field of horticulture, botanical gardens and parks);labeling and marking of plants, monitoring, control of plans, limitations or rules of conduct in the sale and maintenance, limitations or rules for importers, imports restricted to certain varieties or clones; obligation to report new occurrences outside the intended habitat, informing the public about the life cycle, mode of reproduction and propagation, the competitiveness of some kind, allelophatic characteristics, experiences in other areas, possibility of hybridization and possibility of control. Unavoidable preventive measure of against spread of new invasive weeds in urban environments is certainly check of seed material to the presence of seed of plants from the list of quarantine organisms.

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STRATEGIC ASPECTS OF THE ECOLOGICAL MANAGEMENT

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ABSTRACT

From the beginning of human society up to the present day, man has sought to meet their environment and understand the basic laws of natural phenomena that occur in it, to master the same. In earlier times, business companies were focused on achieving growth in the volume of production whose result was the increase in profits. In the past times, imerative task manager has been achieving so colled „economy of scale", so the success of the company was measure by the quantity produced and sold products and services. With the emergence of the first environmental problems 70th of the last century, and who have acquired a global character, gradually developed the awareness of the necessity of implementation of a new systematic and strategic approach to managing the problems in the field of ecology. Ecological management is a new concept for solving environmental problems. Companies that want to work successfully must respect the presumption of sustainable development and environmental standards in planning their business activities and defining the goals. In addition to responsibility for the successful operations of the company led by managers also have some social responsibility. In order to reduce the harmful effects of production processes on the environment, and in response to the social responsibility of companies, are defined and specific environmental standards ISO 14000 which must adhere to managers.

Keywords: sustainable development, environment, environmental standards, ecology, ecological management, corporate social responsibility

INTRODUCTION

From the beginning of human society up to the present day, man has sought to meet their environment and understand the basic laws of natural phenomena that occur in it, to master the same. This human characteristic confirms the fact that the man in the whole development of human society, trying to formation of various forms of association and mutual organization, gradually develop and improve their ability to reduce the stress of work and also achieve higher performance and a result of their work.

In earlier times, business companies were focused on achieving growth in the volume of production whose result was the increase in profits. In the past times, imerative task manager has been achieving so colled „economy of scale", so the success of the company was measure by the quantity produced and sold products and services. However, rapid economic growth and irrational use of natural resources 70th of the last

century have influenced the emergence of global structural crisis in energy and raw materials. Disproportion in the development of individual countries and regions, caused shortages of certain products on the world market, which is its immediate consequence the sudden jump in the prices of scarce products, growth, unemployment and the decline in income - only confirmed the necessity of practical implementation of strategic management as a new management concept of management in everyday life companies. Strategic management can be defined in different ways;

Strategic management is "the process of top management activities of the organization in the process of formulating its strategy." [1] "Strategic management is a continuous process of constant adaptation to changes in business environment, in which the environment is a permanent impact on the company and the company itself also made some impact on the environment in which exists and which is adjusted." [2]

Regardless of the different ways in which the authors define the concept of strategic management, the common denominator in all of them, is the unanimous view that the main task of strategic management of a comprehensive understanding of changes in the environment and creating the preconditions for the successful adjustment of enterprises to these changes. The essence of the application of strategic management is to ensure the necessary conditions for the effective planning and operation of companies with the factors in the environment.

GENESIS CREATION AND DEVELOPMENT OF ECOLOGICAL MANAGEMENT

Technical and technological progress was accompanied by demands for increased productivity and quality of products and services. On the other hand, these phenomena and processes in the global economy and society, have influenced the changes in the environmental sphere and to specific environmental problems are gradually gaining multiply growing, global dimension. Increase the physical volume of production in response to the growing needs of consumers and society, caused a disturbance of the environment by increasing pollution of the environment. That is the reason of the creation so-called ecological paradox as a new concept in the ecological literature, which means "a discrepancy between what we demand from the planet Earth and what she is capable to give us, or between unrestricted and limited aspects of human life." [3] These problems might be solved by sustainable development. "The bridge between ecology and economy is sustainable growth and development. The essence of sustainable growth is responsible for growth or growth that meets the current needs a way to rationally use natural resources to ensure meeting the needs of future generations."[4] Decisive role in solving the problems of modern society has a management company, that is, "special duties and responsibilities in establishing harmonious relations between economy and ecology is the management of business entities ... which includes the rational use of natural resources, less environmental pollution of waste reduction, recycling of secondary raw materials, substitution of primary resources, etc." [5]

With the emergence of the first environmental problems 70th of the last century, and who have acquired a global character, gradually developed the awareness of

the necessity of implementation of a new systematic and strategic approach to managing the problems in the field of ecology. "Awakening of ecological consciousness" influenced the decision-Business Charter of Sustainable Development 1991st year in which the ecological management marked a key determinant for sustainable development and the priority task of the modern enterprise. This Charter was proclaimed that ecology must be integrated into the management of the company and that its promotion must be a continuous process, to ensure that employees are required to motivate and educate environmentally, that we must make a constant assessment of environmental consequences of any new processes and products, the company must assume responsibility for the behavior of their subcontractors and suppliers, that the company must be open to dialogue on environmental risks and engaged in joint efforts to promote environmental awareness and regularly informing all interested parties. A year later, 1992. in Rio de Janeru held the first global environmental summit which adopted Agenda 21. Starting from the Business Charter of Sustainable Development to elaborate further principles for strengthening the role of business entities in the environment. The Agenda 21 explicitly defined category of ecological management as one of the priorities of each business entity.

ECOLOGICAL MANAGEMENT OF THE ENTERPRISE

Ecological management is a new concept for solving environmental problems, and it "includes organizational structure, processes, procedures, resources for the implementation of environmental policy and accountability in the region."[6] Model ecological management system shows the five phases of the cycle repeated:

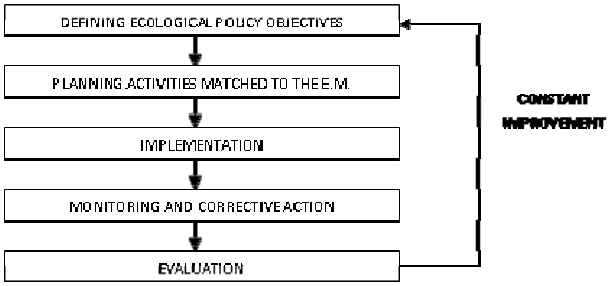

Figure 1. Model ecological management system [6]

Dynamic and complex changes are caused by technological, economic, political and social factors and there are constant of the time. During the XX century, changes have become significantly faster and more complex. Accelerate the pace of change is related to the increase in the frequency of change and the increase in the rate of diffusion changes. As such, the changes are permanent and challenges for strategic management for the purpose of training and development of appropriate approaches that will successfully manage change.

Change in requirements environments, caused changes in the very businesses, primarily through perceived the necessity of acquiring and implementing new, first of all ecological knowledge in all organizational functional areas. The production and technological revolution, the whole society is being called management revolution that is, as Drucker points out, the third change in the dynamics of the application of knowledge, where science is applied directly to the science - knowledge is applied to knowledge. Management revolution emphasizes the importance of the intellectual capital and the necessity of its implementation as a precondition for the creation of value and effective organizational management. While it is important to point out that: "(a) knowledge is the basis for the modern business enterprise and was efficiently and effectively through management, and that (b) the human factor in their dual participation in the management process...only able to generate, use and valorize the knowledge." [7]
"Ecological management is entirely anthropocentric concept of business management, making it significantly different from all other management approaches. Also, it is not just standard science, skills, effective and efficient conduct and achieving the goals the right way, but true knowledge and practice to achieve real goals, then those related to human survival and quality of his life. Ecological management, according to professor Vujic, is already involved into each business practices and sustainable management and so turns into a sort of global management. In no area of application management is not confirmed anywhere so strong and convincing performance of the dominance of the principle of the effectiveness under the principle of efficiency, or the inability to a lack of effectiveness (bad, so inhuman and unecological selected targets) compensate even the highest efficiency. In that sense, ecological management can (and must, in the future) become kind of a management infrastructure and pilot test performance each management practices, without exception." [8]

Companies that want to work successfully must respect the presumption of sustainable development and environmental standards in planning their business activities and defining the goals. Recognition of basic environmental requirements and to integrate environmental objectives into specific business objectives of the company, must not be an exception and an example of only the best companies and the company today, but it represents a kind of imperative for all participants in the global market.
Modern managers must be able to recognize and understand the basic trends of changes to their management of the enterprise was successful. Adaptation becomes a condition of growth and development of modern enterprises, and above all, its survival. The existence of the company in today's market environment, is thus determined, its ability to adapt to their environment and/or adapt to the environment itself, with the necessary existence of some kind of feed-back between enterprises and the environment. At the beginning of the creation of ecological management, basic moves are undertaken in the direction of remedy and mitigate the problems caused by different types of pollution and environmental disruption. Acting Manager was reactive to the changing external environment. However, bearing in mind that strategic management emphasizes proactive attitude toward change, the basic task of ecological management as an important segment of strategic management is an active, positive attitude toward ecological change, and the main task of managers is to go to meet the changes in order to act preventively. So, not only will the company be ready to respond promptly and ready to

welcome the creation of specific changes, but then environmental costs will be much lower, which will enable successful business and achieving competitive advantage. Knowledge, skills and experience as the main elements of "classical" management skills are increasingly measured not only the ability of managers to effectively do their jobs, but their ability to recognize the strategic goals of treir organization and strive to achieve them. And in the strategic goals of contemporary companies certainly are, and ecological goals. In this respect we follow the development of preventive measures for organizational actions to reduce environmental pollution, which are a consequence of applying the concept of ecological management in enterprises. In fact, some measures such as installation of treatment represented a significant corrective action on the emergence of ecological management, but they are now superseded by preventive measures, precisely as a result of the development of environmental awareness, ecological education and management.

THE ROLE OF MANAGERS IN THE IMPLEMENTATION PROCESS OF ECOLOGICAL MANAGEMENT

In making many business decisions, modern managers need to analyze not only economic, but also the ecological dimension in the determination of cost-effectiveness of a particular job. In addition to responsibility for the successful operations of the company led by managers also have some social responsibility.

"The concept of sustainable growth of a new born, so. CSR concept - the concept of corporate social responsibility. Corporate social responsibility is assumed the involvement of the business entity in the social and community development programs in the field of health, environment, sports, culture, assisting vulnerable people, implementation of health (clean) technology, prudent use of resources, training employees on environmental protection, public reporting on success and its consequences, funding research projects of a wider social significance that are not strictly related to the activity of the company. Therefore, the socially responsible companies overcome once the primary target acquisition and distribution of profits by integrating into the process of solving social problems." [9]

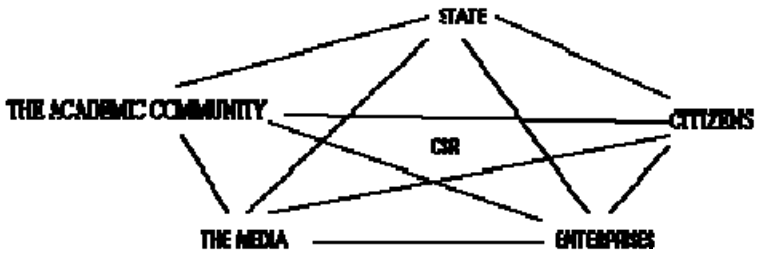

Figure 2. CSR network of stakeholders [9]

In carrying out organizational activities managers must take into account the impact of internal and stakeholder interests or insiders, but the external stakeholder's called outsiders.

Certo and Peter listed four specific areas of social responsibility of managers:

1. concern for consumers,
2. concern for employees,
3. concern for the environment,
4. concern for society in whole." [10]

"Social responsibility refers to the task or duty manager to make decisions that respect, protect, strengthen and promote the welfare of the stakeholders of the organization and society as a whole. Corporate social responsibility is a moral responsibility to the stakeholders that influence the activities of the organization." [11]
In order to reduce the harmful effects of production processes on the environment, and in response to the social responsibility of companies, are defined and specific environmental standards ISO 14000 which must adhere to managers.

„The ISO 14000 Standards are a set of environmental standards designed by the International Organization for Standardization 1994. to assure that businesses are environmentally responsible. The ISO 14000 Standards were created to help meet the objective of "sustainable development" outlined at the United Nations Conference on Environment and Development in Rio De Janeiro in 1992. The ISO 14000 Standards include guidelines for waste disposal, use of natural resources, pollution control and environmental responsibility. The ISO 14000 Standards also include sets of tests and measures that help organizations and businesses measure the impact they are having on the environment. ISO 14001 is the corner stone standard of the ISO 14000 series. It specifies a framework of control for an Environmental Management System against which an organization can be certified by a third party. Other standards in the series are actually guidelines, many to help you achieve registration to ISO 14001. These include the following:

- ISO 14004 provides guidance on the development and implementation of environmental management systems,
- ISO 14010 provides general principles of environmental auditing (now superseded by ISO 19011),
- ISO 14011 provides specific guidance on audit an environmental management system (now superseded by ISO 19011),
- ISO 14012 provides guidance on qualification criteria for environmental auditors and lead uditors (now superseded by ISO 19011),
- ISO 14013/5 provides audit program review and assessment material,
- ISO 14020+ labeling issues,
- ISO 14030+ provides guidance on performance targets and monitoring within an Environmental Management System,
- ISO 14040+ covers life cycle issues.

Of all these, ISO14001 is not only the most well known, but is the only ISO 14000 standard against which it is currently possible to be certified by an external certification authority." [12]

CONCLUSION

Modern business society is constantly exposed to the influence of numerous, dynamic and complex changes that are caused by technological, economic, political and social factors. Increase the physical volume of production, as a response of the growing needs of consumers and society, on the one hand, caused a disturbance of the environment and the emergence of the so-called ecological paradox, on the other side. Emerging problems of the entire human society can be solved by applying the concept of sustainable growth and development and raising awareness about the necessity of implementation of basic environmental standards in business. Increasing awareness of environmental protection in the framework of sustainable development, contributing to the need to integrate ecological management in the context of strategic management. Socially responsible business, modern business the right way meet the requirements of its customers and society at large. However, recognition of basic ecological requirements and to integrate ecological objectives into specific business objectives of the company, must not be an exception and an example of best practice a company and the company today, but it should be a kind of imperative task to all participants in the global market. In implementing these tasks, the role and importance of management is great, but also, we should not neglect the impact and importance of all professional and corporative public in whole, which was the main catalyst of change in this area.

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SYNTHESIS OF THERMAL EXPANDED LIGHTWEIGHT GRANULATES INCORPORATING WASTES AS RAW MATERIALS

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ABSTRACT

This work focuses on the synthesis of thermal expanded lightweight granulates replacing part of some natural resources (schist, clay) by wastes generated during the treatment of sewage water. Other materials such as harbor sludge sediments as well as incineration flying ashes were also used in the formulation of such granulates. Several mixtures containing various proportions of natural and waste materials were prepared and their expansion was tested under different conditions. Attempts were also made to specify heavy metals (Cr, Cu, Zn, Pb) in the solid and the condensable fraction of smokes. Granulates obtained at about 1100 °C show a real density close to unity and a compressive strength of 49 MPa which indicates a mechanical performance allowing their use in building light concrete.

Keywords: Sewage sludge, waste, schist, clay, granulates

INTRODUCTION

Industrial treatment of wastewater at different steps of their plants' flow-sheets generates a vast amount of sewage sludge. The amount of sewage sludge produced during the last decades in European countries has been increasing steadily, and this tendency is pertinent to all countries worldwide. About 6.2 million dry tons per year of sludge are produced in the United States [1]. Land application of sewage sludge related to their capacity as fertilizers (organics and phosphates) could be their major end-use ; however, this cannot be a real solution due to their content in harmful heavy metal compounds. Various recycling methods and processes are emerging for the sewage sludge treatment as alternatives of their landfill disposal. An overview of these methods is given by Fytili and Zabaniotou [2]. Recent works were devoted to the use of the sludge incineration ashes for ceramic products [3] and utilization of dried sludge as raw materials in brick manufacturing [4].

This work mainly focused on the possible use of wastewater purification

sludges in the synthesis of lightweight solids by thermal process. The fundamental idea is that the Na, K and P content of the sludge act as fluxes and promote the formation of a continuous silicated liquid at temperatures where the volatile compounds are not completely expelled, what leads to the formation of gas bubbles to the origin of an expansion that will stay stable under the form of an alveolar glass when cooling. The sludge also contains an appreciable amount of organic matter and carbon improving the energetic balance of the envisaged thermic process. The here described results are part of those obtained in the frame of the 'EXPANTHERM' project belonging to the "PRECODD" program supported by the French National Research Agency (FNRA). Two French companies (vBc 3000 & GEM) and INPL joined their efforts for synthesizing lightweight granulates incorporating wastes such as sewage sludge in the raw natural materials (clay, schist). Research was conducted from laboratory scale up to pilot trials. An industrial plant is expected to be built in a near future.

MATERIALS AND EXPERIMENTAL PROCEDURES

A good number of samples coming from wastewater treatment plants as well as clayey natural materials were used for this investigation. They were mixed in different weight proportions and the obtained mixtures were conditioned as cylindrical and /or spherical shape of average size roughly equal to one centimeter. Only the composition of four selected mixtures is given in Table 1. Raw mixtures were dried in an oven at 60 °C in order to evaporate the free water before expansion and different analysis tests.

Table 1. Composition of several prepared mixtures (weight pct).

Mixtures	Clay	Schist	Sediment	Ashes	Sludge 1	Sludge 2
M1			65		35	
M2	50			23	27	
M3		60				40
M4		75				25

The thermal behavior of the mixtures was studied by using a Cahn balance type TG 2171 able to make simultaneous thermo-gravimetric (TG) and differential thermal (DT) measurements. Tests of the thermal expansion were conducted in horizontal experimental set-up including a static electrical furnace. Air was used as flow gas and it also assured the combustion of the organic matter contained in the mixtures. The outlet gases were cooled at room temperature leading to the condensation of the vapor phase and the recovery of a solid condensate mixed with the soot.

Raw mixtures and thermally expanded granulates were examined by visible microscopy, scanning electron microscopy-energy dispersive analysis (SEM-EDX), X-ray diffraction (XRD) and infrared (DRIFTS) spectroscopy. Condensates were subjected to SEM-EDX analysis.

RESULTS

Figure 1(a) is an example of TG analysis giving the weight loss (% WL) as a function of temperature during the treatment of the mixtures M1 and M2 from room temperature up to 1000 °C. The WL for M1 is close to 38 %, while that of M2 doesn't exceed 20 %. This is in good agreement with the composition of these mixtures. The presence of high amount of sediment in M1 explains the difference between the WL obtained at the end of the treatment. However, the behavior of both samples is somewhat similar. Weight losses observed up to 200 °C could be related to the evaporation of free and/or absorbed water. The TG curves between 200 and 600 °C represent an overlapping of different phenomena such as: decomposition or combustion of organic matter and dehydration of the clay minerals contained in the schist and in the mineral part of the sewage sludge. The WL observed at higher temperatures can be attributed to the decomposition of metal sulfates and / or carbonates.

Derivative of WL with respect to temperature and the results of DT analysis for the thermal treatment of M1 are depicted in Figure 1(b). The maximum reaction rate (dWL/dT) peaks were observed at about 64, 265 and 705 °C. Similarly, the DT peaks were observed at nearly the same temperatures where the TG analysis peaks occurred. Moreover, the exothermic peak revealed at about 265 °C suggests the possible oxidation of the organic matter. Minor peaks were also observed at 300-600 °C but are difficult to interpret due to the complexity of the chemical and thermal phenomena occurring there.

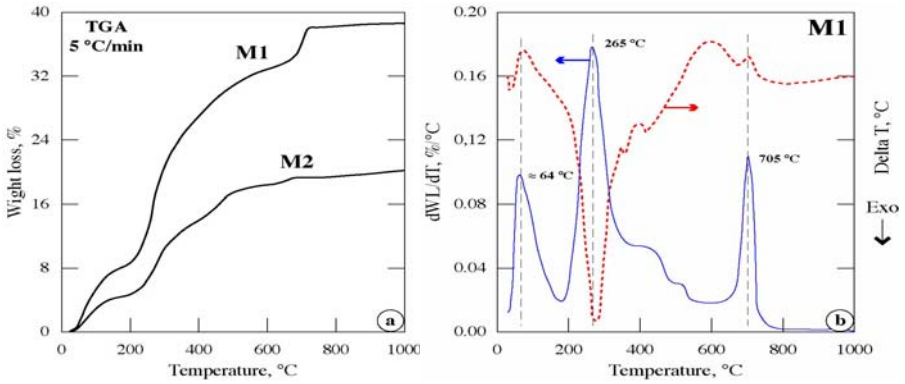

Figure 1. TG analysis of M1 and M2 treatment up to 1000 °C (a) and comparison of TG-DT results for M1 (b).

Several expansion tests for M1 and M2 were conducted at different temperatures and residence times. Experimental results showed that the first mixture was poorly expanded at any temperature between 1050 and 1200 °C. The obtained granulates were mostly melted and sintered. To the contrary, M2 was well expanded around 1150 °C and for a 15 minutes residence time. Figure 2 shows a comparison view of M2 (raw and expanded). The granulates initially of cylindrical shapes were clearly expanded into sub-spherical gravels. Similar results were obtained when expanding this mixture in a rotary kiln pilot plant.

Figure 2. General view of raw granulates M2 and after expansion at 1150 °C for 15 min.

Both mixtures (M1 and M2) at two levels (initial and expanded) were subjected to DRIFTS, Figures 3 and 4. As shown in Figure 3, the initial mixture M1 is an highly hydrated material mainly composed of silicates (quartz patterns in the Figure), calcite and small amounts of kaolinite. Alkyl chains are also clearly identified by their C-H stretching vibrations. The presence of calcite in the expanded M1 sample is probably due to the high partial pressure of CO_2 in the porous solid leading to the decrease of the calcite decomposition extent at a given temperature. Furthermore, the detection threshold of the IR spectrometry with respect to calcite is very sharp. Almost similar observations (Figure 4) are valid for the analysis of raw and expanded M2 samples by IR spectrometry.

Results of IR spectrometry were confirmed by XRD analysis for the major crystallized phases in the solid fractions.

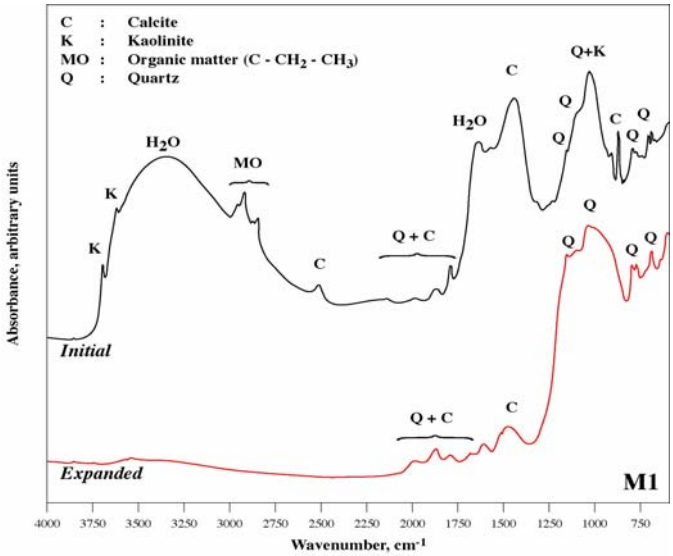

Figure 3. DRIFTS spectroscopy results for M1.

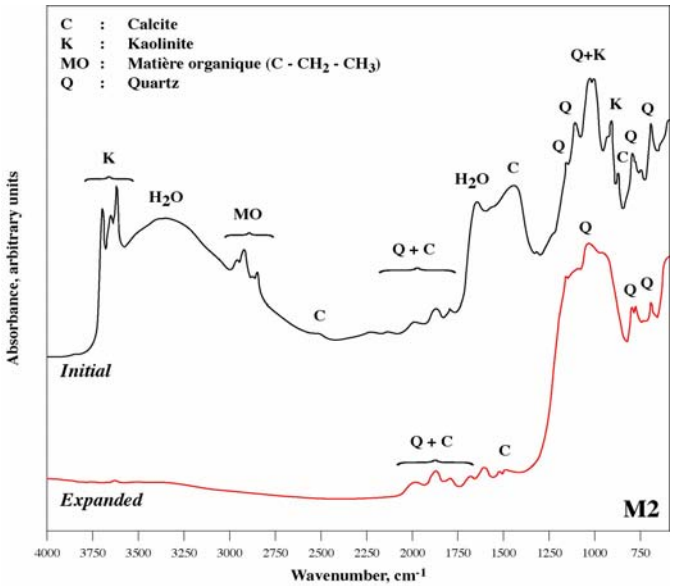

Figure 4. DRIFTS spectroscopy results for M2.

To understand the expansion mechanism and give an insight into the heavy metals speciation, the solids issued from the expansion tests of M3 at 1150 °C were systematically analyzed by SEM-EDX. Results suggested that copper is detected as copper-iron sulfide in the expanded granulates. Chromium, nickel and manganese are often found coexisting with iron in the fine particles of stainless steel coming from the sewage sludge [5].

Figure 5 gives a typical example of SEM-EDX results indicating that some so-called "spinels" form during thermal expansion, one must note that Cr and Zn are retained in their lattices. This is a possible way to stabilize heavy metals by their incorporation into highly stable chemical compounds.

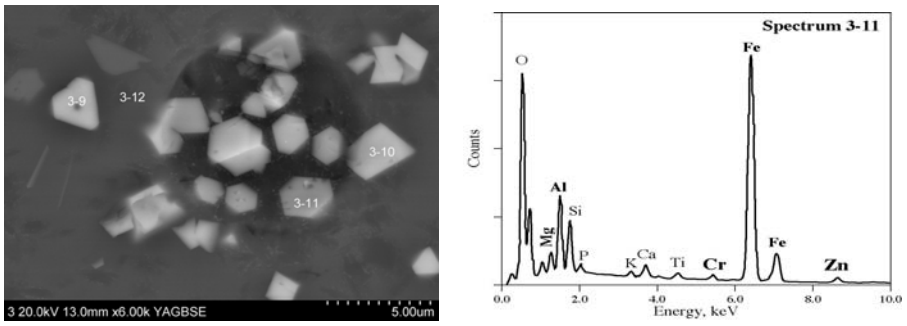

Figure 5. Morphological aspect and SEM-EDX spectra of spinels containing Cr^{3+} and Zn^{2+}.

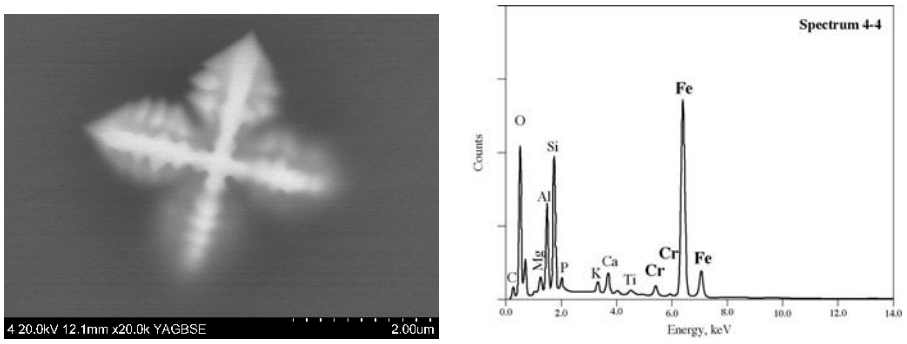

Figure 6. Morphological aspect and SEM-EDX spectra of spinels containing Cr^{3+}.

Figure 6 gives (SEM-EDX results) also a significant example of Cr-Fe spinel formation by heating M3 mixture at 1150 °C, and as mentioned above, the synthesis of chromium spinel seems to be a promising process for its immobilization.

Figure 7. View of M4 raw granulates and their expansion product at 1110 °C for 15 min.

After a detailed analysis of the parameters affecting the whole expansion process, some nominal conditions were determined for the expansion of M4 (75 % schist + 25% sludge) in order to produce about 2.5 kg of expanded granulates at laboratory scale for recovering a sufficient amount of condensates resulting from the cooling of the smokes produced by the expansion tests. The expansion was performed at 1110 °C and for a residence time of 15 minutes. One may note that temperatures approaching 1200 °C were necessary for the schist expansion in absence of sewage sludge. Figure 7 displays a general view of the raw mixture M4 and of the granulates obtained under aforementioned experimental conditions. Two important indices, i.e. the real density and compressive strength were measured for the expanded granulates. They show a real density close to unity and a compressive strength of 49 MPa such a value is comparable with those obtained for natural granulates based on schist and allows their use as building materials.

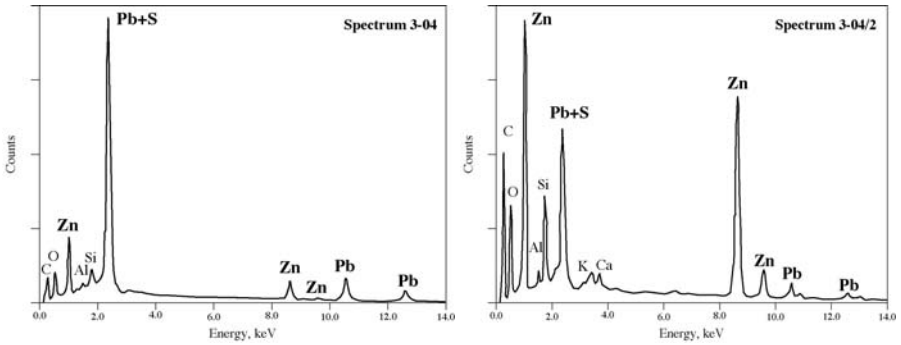

Figure 8. SEM-EDX spectra of condensed particles.

Analysis by SEM-EDX of the condensates obtained during expansion of M4 showed that they contain Zn and Pb as shown by Figure 8. Further analyses are to be performed in order to characterize the vapor carrier phases of these two metals.

CONCLUSIONS

1. Sewage sludge and incinerator ashes could be used as alternative material, among other industrial solid wastes, in the formulation of lightweight clay and schist based granulates.
2. Sludge incorporation in granulates, within certain limits, allows the decrease of the expansion temperature and leads to natural resources and energy savings.
3. Best results were obtained by using a mixture of 75 % schist and 25 % sewage sludge and expanded at about 1100 °C. The resulting granulates are lightweight and they have a good mechanical strength meeting the conditions for their use as construction materials.
4. Copper remains essentially in the expanded granulates, mostly as metal sulfides. Other heavy metals (Cr, Zn) are partially stabilized in the spinel phase of the granulates. Part of Pb and Zn were also found in solid condensates.
5. This work meets the principles of sustainable development from the environmental and resource conservation points of view.

Acknowledgments

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CONTRIBUTION TO CLEANER ENVIRONMENT – RECYCLING OF ZINC FROM THE WASTE OF HOT DIP GALVANIZING PLANT

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ABSTRACT

Keeping the environment clean is a priority task of the modern society, which is accompanied by intensive industrial development. Technologies of surface protection, including hot galvanizing, produce an array of by-products in addition to the main product, which are in the group of hazardous waste. This paper focuses on one of the directions to preserve a clean environment. Zinc recycling from hazardous waste is a large contribution to maintaining a clean environment. Through the proposed environmental technologies, hazardous waste is tranformed to metal zinc or zinc compounds that are commercially useful, and waste from those processes is transformed into harmless waste and in minimized amounts.

Keywords: environment, hot dip galvanizing, zinc, recycling, waste

INTRODUCTION

Pollution in our world effects three essential aspects of our planet: air, water and soil. Although their pollutants are emitted in completely different ways, they both harm living organisms. Water pollution is the result of industrial waste and environmental accidents.

Our society knows that pollution is harmful and a serious problem for Earth but generally people don't care. Nevertheless everybody needs to contribute to prevention and pay attention to government control in the amount of material large industries can emit into the air, soil and/or water. Industry gives off a good share of the waste that is polluting our planet, but it is every person is contributes as well. Government involvement is key to regulating toxins, building waste systems and protecting air, soil and waters.

"Pollution is the introduction of contaminants into the environment that cause harm or discomfort to humans or other living organisms, or that damage the environment" which can come "in the form of chemical substances, or energy such as noise, heat or light". "Pollutants can be naturally occurring substances or energies, but are considered contaminants when in excess of natural levels." By-products derived by

industrial processes represent waste. Troubleshooting the deposit of waste and development of recycling technology will be reflected positively on the environment [1]. The process of hot galvanizing is a corrosion protection method for iron and steel, which has many advantages over other corrosion protect methods [2].

Zinc is the primary raw material for hot dip galvanizing. Zinc can be recycled an unlimited number of times, and that in fact there is no change in physical or chemical properties. This is a great advantage for hot dip galvanizing, providing continuity and economic efficiency. About 30% (2 million tons) of world zinc consumption comes from recycled sources. This number increases by increasing the awareness of people about environmental protection and improvements in recycling technology.

Steel coated with zinc is recycled with other steel waste, which occurred in the manufacturing process, quickly evaporate and thus collect for re-processing [3].

DESCRIPTION OF THE HOT GALVANIZING PROCESS

The process of hot galvanizing can be continual or discontinual. The process of hot dip galvanizing proceed in several stages, preparatory phase which includes degreasing, etching, and fluxing and secondary phase deposition of zinc coating. This process has a specific procedure because that is very important to be well-prepared coating derived [4].

Applying the coating is performed on the cleaned object which is sinks in the melted zinc at a temperature 430 ^{o}C to 460 ^{o}C with a total quantity of allowances to 1.5% by weight. Zinc coating is the result of metallurgical diffusion reactions, in which zinc and iron, create iron-zinc intermetallic phases with different contents of iron, as shown in Fig. 1.

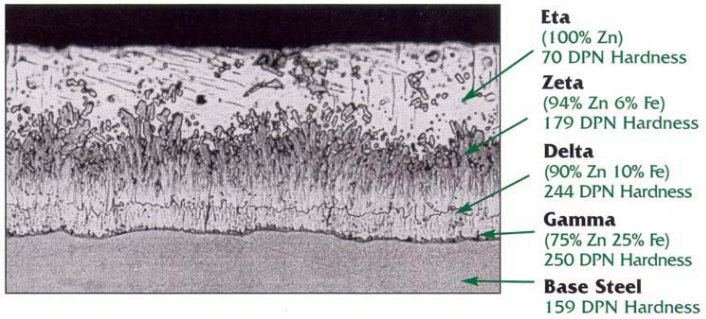

Figure 1. Cross section of hot zinc coating

Iron-zinc intermetallic layer allows mutual connection and good adhesion of zinc coating on steel base. High content of iron that diffund of the layer of zinc, by melting steel base in much worse corrosive resistance of such coatings. Immersion courses in melted zinc is about 4-5 min., and may be longer for heavier elements, which have high thermal resistance, or where the zinc slowly diffund into the interior.

A few by-products are formed in the galvanic process of hot galvanizing. Among them are solid materials composed of different components made in galvanise

bath. Proved that the slag from the bottom of the crystallite is composed of (-phase of Fe-Zn phase diagram dispersed in a matrix of pure zinc Zn), while the waste from the ventilation system in the form of granules, whose core is made of pure zinc Zn, covered with a layer of ZnO. Mixture of Fe-Zn oxide was also detected in the slag from the bottom. Therefore, these side products are mainly composed of pure zinc and various zinc components, while larger amounts of iron in the form of Fe-Zn intermetallic compounds and iron oxide present in the clay from the bottom of the tub. In any case these composites are considered to be suitable materials for recycling zinc [5].

Due to continuous contact melted zinc with the air, on the surface of the bath will appear in the so-called zinc ash, which is another type of solid waste generated in the process of hot galvanizing. The chemical composition and quantity of metal that are removed in the form of solid waste slag and ash on an annual basis are shown in Table 1 and refer to the quantities that arise in the capacity of plants for the hot galvanizing of 10 000 tons of goods per year. The average amount of slag that comes in hot galvanizing plant with a capacity mentioned.

Table 1. The chemical composition of slag and metal which lost through slag

Chemical composition	Content of metal (%)	Metal which lost through slag	
		Min (kg/year)	Max (kg/year)
Zn	95-98	9 500	9 800
Fe	0,5-0,88	50	88

Waste rinsed water are treated continuously or discontinuously in the pools for neutralization. Zinc appears in rinsing water after the etching of basic metals and no quality coating. Such water after collecting in pools of plants for water rinse treatment are neutralized, sludge from the neutralization are settling, and after filtration such filter cake are treated. The amount and composition of sludge formed by hot galvanizing plants depends on the first line of, whether the process leading discontinuously or continuously, the capacity of working time, the monitor the technological process from the standpoint of concentration of basic components in solution and rinsing water as given in Table 2. Some plants send them for further processing, while others stored in specially designed facilities for their disposal.

Management other types of waste and sludge, in the plant includes monitoring from appear to solve the problem of waste, and this is one part of the main proposition in the interest of protecting the environment. Consideration of this problems have two positive effect, one economic and the other in terms of technological process control, primarily the execution of legal obligations regarding waste. Solving the sludge from the neutralization waste solution and waste water from the hot galvanizing plant, through recycling and use as raw materials in industry is a very good approach, as the economy enterprise, and environmental protect [5, 6].

An important step in defining the treatment of waste is characterization. This procedure, defines the physical-chemical, chemical, and biological properties. Testing results shows whether the waste contains or does not contain one or more hazardous characteristics. That waste are classified as hazardous or not hazardous waste.

Table 2. Chemical composition of sludge from the process of hot galvanizing

Parameter	Diskontinual process I- sample 1 concentration (mg/kg)	Continual process sample 2 concentration (mg/kg)
Cd	< 0,1	< 0,1
Pb	< 0,1	604
As	70	23
Cr	251	49
Cu	200	33
Zn	27700	116600
Fe	279100	111800
Cl^-	56400	44400

ZINC RECOVERY FROM HOT DIP GALVANIZING WASTE

The analysis of the waste from different hot dip galvanizing plants were showed that all wastes has high concentrations of metals, primarily zinc and iron, which makes them very suitable for recycling and regeneration.

According to the recommendation for treatment of hazardous waste, generators of this type of waste emphasized that the zinc dross and zinc ash are registered as a recycling waste.

Currently, only producers of zinc oxide are used dross as a secondary raw material in its production. The zinc ashes or spent acid pickling solution not yet involved in the recycling technology of zinc-oxides producers [7].

Spent etching solutions containing significant amounts of iron and less amounts of zinc oposit of spent pickling solution, which containing significant amounts of zinc and less amount of iron. The researshers aim is to regenerate and recycle the entire amountof both spent solutions and solid waste. In this way adverse environmental impact will be minimized. Recycling of metal ions from waste is very important in order to protect the environment, as well as from the economic point of view. If dross contains 70% metallic zinc, then it is over US$40,000 per month in lost zinc. A nominal buyback rate may be recouped from a zinc recycling company, but, in general, a significant financial loss is being incurred by the discarded zinc [8, 9].

Many different methods developed for recycle and recovery of waste from the hot dip galvanizing plant. Some of them are: various chemical and heat treatments, followed by application of solvent extraction, membrane processes and others [10, 11].
Process of solvent extraction of iron and zinc from the spent solution of hydrochloric acid involves several phases shown in figure 2. Reaction extraction can be shown through the following equations:

$$2\,H^+_w + ZnCl_4^{2-}{}_w + 2\,S_o \rightarrow H_2ZnCl_4 \cdot 2S_o \quad (1)$$

$$H^+_w + Cl_w^- + FeCl_{3w} + 2\,S_o \rightarrow HFeCl_4 \cdot 2S_o \quad (2)$$

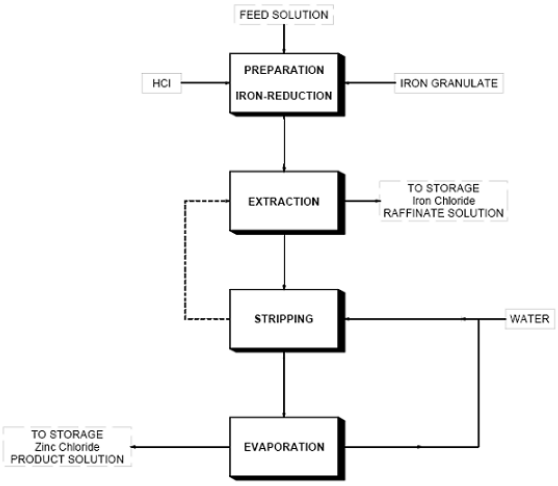

Figure 2. Flow sheet of processing hot dip galvanizing spent pickling solution

Method of zinc recycle from solid wastes starts by leaching with sodium hydroxide. Solid waste load into the reactor as raw material. Reactor with the material put down into the tank with hot water solution of sodium hydroxide concentration of 250-440 g/dm^3 . Working temperature is 70-90 C.

The dissolution of zinc from solid waste by sodium hydroxide can be represented by the following equations:

$$Zn_{(s)}+2NaOH_{(aq)}\rightarrow Na_2ZnO_2+ H_2 \quad (3)$$

$$ZnO_{(s)}+2NaOH_{(aq)}+H_2O\rightarrow Na_2Zn(OH)_4 \quad (4)$$

Load zinc solution is then treated in electrolytic cells. Cells are equipped with steel cathode alloyed with magnesium. The electric charge of 1 000 Ah is needed to obtain 1 kg of zinc powder. Average power consumption is about 4.4 kWh per kilogram of zinc powder. After the electrowining process, sodium hydroxide solution returns to the waste leaching process. The method is applied in industry.

Another method of zinc recycle from solid wastes starts by leaching wastes with diluted sulfuric acid (or hydrochloric acid). Major impurities such as Fe, Cd, Cu and organic components are removed by precipitation, which mean the control of leaching pH value. Zinc oxide (or zinc powder) is added as a neutralization agent. Further purification and removal of organic matter involved treatment of solution through activated carbon bed. At the end of the process zinc hydroxy-carbonate is precipitate.The process of zinc recycling from hot dip galvanizing ash and sludge is shown in Figure 3and 4 [12].

Method for processing of zinc ash formed during hot dip galvanizing is possible. The reason is a relatively simple preparation of a very pure chloride-free basic

zinc carbonate. This intermediate product is a suitable raw material for the preparation of zinc sulphate electrolytes. The main advantage of leaching the ash in HCl is the possibility of recovering NaCl from waste solutions after zinc carbonate precipitation. This is in contrast to the similar waste solutions, but originated from leaching the ash in H_2SO_4, which contain, a part from Na_2SO_4, a certain concentration of NaCl.

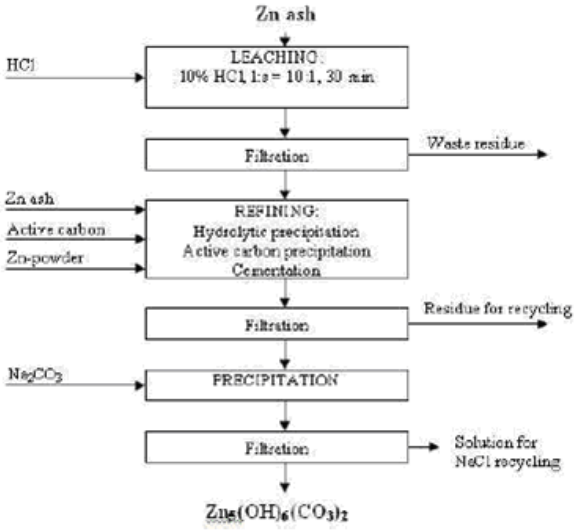

Figure 3. Flow sheet of processing hot dip galvanizing ash

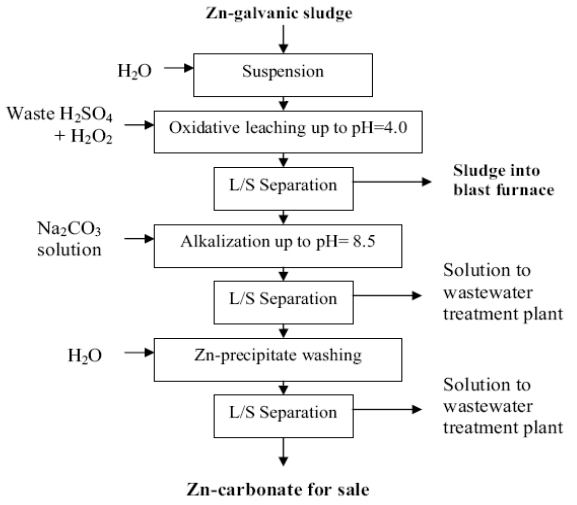

Figure 4. Flow sheet of processing hot dip galvanizing sludge

Metallic zinc obtained by electrowinning process from sulphate electrolyte, which is prepare by disolving of zinc hydroxy-carbonat by diluted sulfuric acid.

All methods of recycling zinc from solid waste, as the final process involves electrowinning deposition of metallic zinc. Elementary reactions describe the events at the electrodes during the electrowinning of zinc are shown in the following equations.

Reactions to the cathode:

$$2\ Zn^{2+} + 4e^- \rightarrow 2\ Zn \qquad (5)$$

Reaction to the anode:

$$4\ H_2O \rightarrow 4\ H^+ + 4\ OH^- \qquad (6)$$
$$4\ OH^- \rightarrow O_2 + 2\ H_2O + 4\ e^- \qquad (7)$$

Overall reaction:

$$2\ Zn^{2+} + 2\ H_2O \rightarrow 2\ Zn\ +\ 4\ H^+ + O_2 \quad ili \qquad (8)$$
$$2\ ZnSO_4 + 2\ H_2O \rightarrow 2\ Zn\ + H_2SO_4 + O_2 \qquad (9)$$

Cathodic deposit is metallic zinc, in the electrolyte at the same time generate the equivalent amount of sulfuric acid, and at the positively charged anode, an oxidation reaction occurs, generating oxygen gas.

Because of the inability to work with dilute electrolyte can not be extracted all amount of zinc from solution. Depending on the density and other conditions of work, the lower limit concentration of zinc in electrolyte is between 30 to 40 g/l. On the other hand, if the electrolyte concentration is above 165 g/l zinc, zinc sulfate solution is saturated, which causes interference in the deposition of zinc.

CONCLUSION

During the process of hot galvanizing than primary products, zinc coating on iron or steel, formed and by-products mainly hazardous wastes that contain greater amounts of zinc.

Recycling of zinc from the hazardous waste makes great contribution to the preservation of clean environment. Zinc compounds or metalic zinc were obtained as commercial products, also regenerated hydrochloric acid was obdtained and returns to the process, which is useful in order to protect the environment, as well as from economic point of view. This approach to treatment of hazardous waste is of great importance both for the individual hot galvanizing plants and for the Republic of Serbia as a whole.

Acknowledgements

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M-BANKING NEW ECO-TEHNOLOGY

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ABSTRACT

The market of the mobile finances has still been developing. Many services which are being used at the moment represent a simple expansion of Web service. Companies have shown few innovations relating to the services such as paying of bills and trade. Although, these services are used in a mobile environment they do not use completely the possibilities of mobile dealing: to have available transactions in whatever time and at whatever place. In order to use completely the advantage of mobile dealing, financial institutions must more profoundly understand key strategies and technologies of the mobile market.

This study gives a solution to mobile banking which is based on the usage of PDA device with latest version operating system and Internet explorer, the infrastructure of banking information system and an adequate protective system. It improves protection of environment because it does not use paper documentation.

Keywords: Internet, M-banking, PDA, Windows cetnet, Internet explorer, Windows server 2003, SQL server, IIS

INTRODUCTION

With fast development of Internet from one side and mobile communications from the other side there is an open possibility for integration of two scientifical disciplines that are new. With their convergention the mobile internet has been found. Mobile internet, as the name says, presents a begining approach to the Internet and using of Internet service.

This idea is present in the world of computers for a long time, but only in the last few years the conditions for reliable application in different science and disciplines are ripen. For the most of ordinary users this is one more miracle of new age technic. But, we can certainly say that financial institutions have been waiting the development of modern technology for a long time, so they could improve their business and enable to their clients comfortable, but at the same time safe way for financial transactions. Different mobile financial services have been found.

Beside the development of Internet and mobile communications for finding a mobile financial services the whole industry of hardware and software components is meritorious, such as also the education of clients and emploees in financial institutions,

and also working of high qualified professionals from different areas of integration of all mentioned in financial institutions.

Financial institutions now have possibility to offer banking, stock exchange and insurance services by using mobile phones, smartphones and personal digital assistantes (PDA). They give us applications for chacking of bank accounts, stock trade or transfer of funds from one account to the other. The mentioned transactions you can do from whatever place in whatever time.

Financial services are materialized with realization of key requests which are realaiyed by financial institutyiones through the implementation of modern technical solutions. On that way banks can do their business in mobile world.

Nowadays, we have different kinds of mobile financial services and we can divide them on: mobile banking services, mobile stock exchange services, mobile services of investition banking the other mobile financial services. In this partician special retrospection will be on M-banking services. The architecture of banking system is presented and it is designed for m-banking, using of personal digital assistants (PDA) and system protection.

MOBILE BANKING (M-BANKING)

Bank is a company which is taking a big part in financial business. The basic acivities of a bank are taking credits and giving the same, and also funds transactions. They work on centralization of capital, gethering and giving of funds. The basic principles of banking are:

- safety
- effectivity of investment of funds
- liquidancy
- rentability

There is a wide range of services that users of mobile services can get by mobile arrangement from the simple checking of state on their banking account to the executing of some complicate transactiones.

Nowadays, banks all over the world offer a wide range of banking services, such as:

- checking of bank account state by using mobile channels
- paying
- checking of the last paying in
- checking of course papers
- checking of stock value at the market
- transfer of important financial information to their users stocks trade
- paying by cards

The automatisation of banking business can be seen particulary in next activities:

1. The automatisation of funds transfer on a large scale

- transfers between banks

- cliring between banks

2. The automatisation of funds transfer on a small scale:

- paying cards
- E-checks
- Charges

The main characteristics of banks on the Internet can be described on the next way:

The main assignment of a bank as a profitable institution is gethering of free financial funds from people and their further plasman. If a bank wants to do that and to have more clients that are going to economize their funds it has to make conventient image about itself. On that way bank is attractive for clients and it can make funds larger.

- **The main characteristics of E-banking service are:**

- individuality
- mobility
- independence of time and place
- flexibility
- interactive work

- **The areas of using of Internet are:**

- Internet as a support to internal business processes in banking
- Externet as a process of gethering of business partners in banking
- Globalisation of business processes in banking
- Banking transactions by using of Internet service
- Electronical checks
- Electronical or digital money
- Paying cards
- Paying by attestation from the third side

- **Usual activities of banks on Internet are:**

- Approach and checking of state on users account
- Evidention of all transactions
- Payings
- Transfer funds from one account to the other
- Changing of information
- Ordering cheks
- Contacts

- **Internet transactions:**

- The identification between the actors
- Cripting of personal data
- The transaction cannot be overmeeted or overdirected
- The digital signature is bound
- The guarantee that the acters have the same intention is needed

THE USING OF PORTABLE DIGITAL ASSISTANTES (PDA) DEVICES

The portable digital assistantes (PDA) for M-banking are mobile devices which have their operative system and Internet browser, the possibility of communication by WIFI 802.11G network and they can read cards with chip. One of this devices is shown on the Fig. 1.

Figure 1. PDA device

This mobile device has operative system Windows cetnet and with instalation of this operative system also Internet browser is instaled. The other components are also integrated in this instrument, but the most important is integration of next two services:

- mobile communication
- card service

The image 2 shows the integrated components on PDA device.

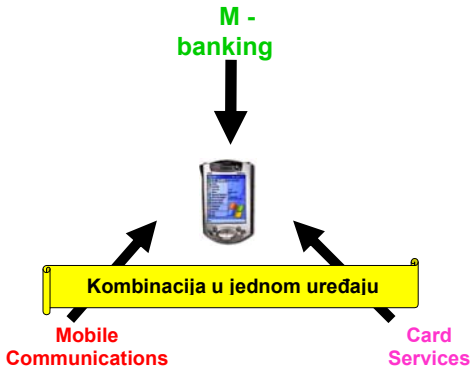

Figure 2. Integrated components on PDA device

THE SYSTEM ARCHITECTURE

The tipical development of applications includes next options:

1. Intelligent server – Intelligent server (2-tier) – business logic is accomplished on server and client is just presentation service
2. Intelligent client – Intelligent client (2-tier) – business logic is accomplished on client, and services that are in relation with information are accomplished on server
3. N-tier business process is divided between information base server, applicative server and client
4. Internet business process is divided at three levels. Business logic and presentation level are on WEB server, and client is using only Internet browser. For presentation level and Internet browser SQL server is using XML back up. SQL server gives back up to any client who has Internet browser. There is no other software that client needs

You can have an approach to SQL server by HTTP protocol by using URL. On that way you can have the possibility of direct approach to the objects of data base and to executive files (applications). It is recommended that the environment has very high level of protection and high performances.

The project of M-banking use the solution at number 4 called Internet. This solution is simple as much for users as for professionals who are maintaining the system. The biggest effort must be invest for protection system at all levels.

Internet information server is a part of the latest operative systems. Here is recommended a version of operative system Windows server 2003 or Windows server 2005. On this systems it is possible to instal Internet information server very successfully. It is recommended to have 6.0 version of Internet information server. Just behind the Internet information server there is asp.net and it provides communication with SQL server.

The logic architecture of complete system with all components and their relation is presented on the Fig. 3

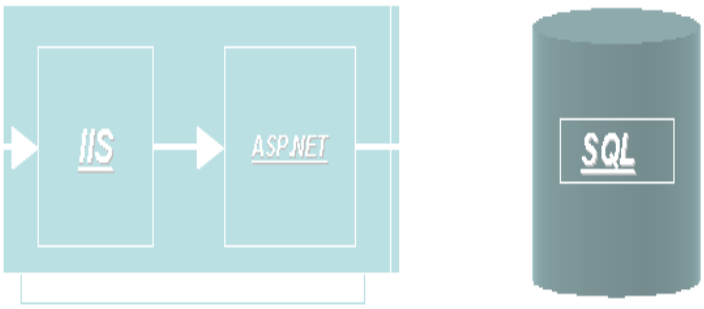

Figure 3. The logic architecture

On the next figure we have shown software components divided by levels.

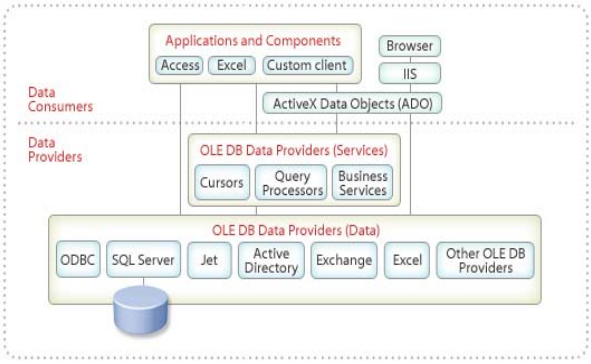

Figure 4. Software components

Applications that are on Internet information server are developig in visual studio net development environment.

Most of codes is written od CS program language. CS is objectively oriented program language of very high level and big possibility. For applications developed in this program language it is valid the same what is valid for every NET applications and that is primary working over NET framework class library.

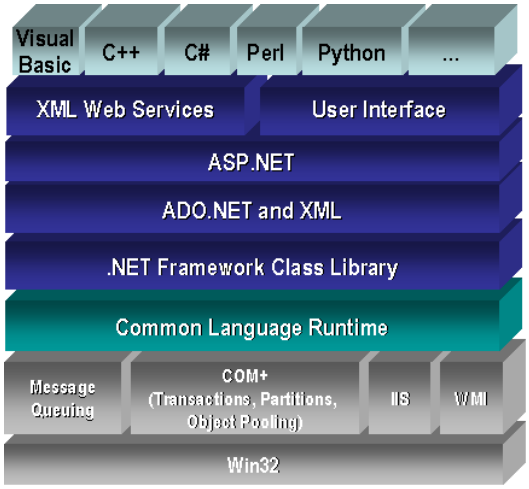

Figure 5. Net sistem architecture and their relation

Global architecture of banking system is shown on image 6. Here can be seen four levels of architecture and the way of banking system organization. This are:

1. back up businesses
2. managing with risk
3. available services
4. communication chanels

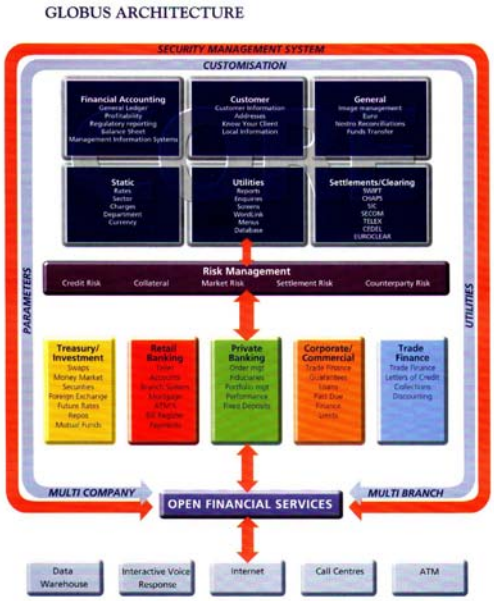

Figure 6. Global architecture

THE PROTECTIONE SYSTEMS

The identification system of users on Internet is based on:

- identification based on something we already know
- identification based on something that we have
- place where we can find GPS information

Generally there are two existing ways of coding and these are simetrical and asimetrical criptography.

The basic characteristics of simetrical criptography are:

- the key for coding and the key for decoding are the same
- the privacy is based on the privacy of a key
- the distribution of keys is a problem
- for more users there must exist many keys
- it is not convenient for Internet

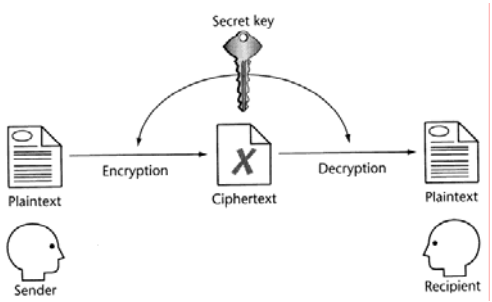

Figure 7. Simetrical cryptography

The basic characteristics of asimetrical criptography are:

- two keys exist and these are public and private
- they are connected with definite transformation
- public key is sent further through network
- private key must be used just for decoding
- the process of working. Public key is sent to the other user who can cript on that way the message which should be sent to you. But with it the message cannot be decripted. Only the owner of private key can decript the message.

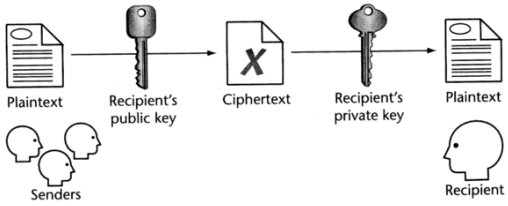

Figure 8. Asimetrical cryptography

The examples for algoritams of public keys are:

- RSA (Ronald Rivest, Adi Shamir and Leonid Adelman)
- patented
- it is the base for all protected e-mail messages
- key is variable from 512-1024 bayts
- El Gamal (Tahir El Gamal)
- variable lenghth of a kay from 512-1024 bayts

Digital signature

The purpose of digital signature is to confirm the authentic of message content. From the message with free content is can be made device of fixed length (512 bits) by using the algoritam. The device shows the content of a message completely. Every change of message is registered immediately. At the other side the recipient is checking the message with algoritam for verification.

Digital certificate

Digital certificate is like a personal identification card in syber space. If we want to send a cripted message to someone then we have to get from him a public key first so we can be sure that we have a right one. Certificate autoritets prove your identity. Servers and clients are recognizing with them. Every server which enables paying with cards has to work as secure web server, and that means that it has to have CA.

Digital certificate of banking server which comes from CA has to have next information:

- the name of organization
- additional information for identification
- public key
- validity data of public key
- the name of CA who have publish digital certificate
- the unique serial number

All this data together form certificate which can be coded with private key. For safety of banking system it is necessary to implement FIREWALL SYSTEM with ruther and applicative gateway.

CONCLUSION

The market of the mobile finances has still been developing. Many services which are being used at the moment represent a simple expansion of Web service. Companies have shown few innovations relating to the services such as paying of bills and trade. Although, these services are used in a mobile environment they do not use completely the possibilities of mobile dealing: to have available transactions in whatever time and at whatever place. In order to use completely the advantage of mobile dealing, financial institutions must more profoundly understand key strategies and technologies of the mobile market.

The leading principles for mobile financial services are:

- the loyality of users is more important than returning of investitiones
- avoiding of similarity with others and from begining ofering different services
- personalization is a key for loyality of users
- partnership with mobile operaters
- M-banking has to be integrated with other user services
- If the applications are adapted to ext users

- Correct protection requieres correct planning
- The caution from the middle coat
- The strategy for starting of application
- M-banking is not only for the clients
- Using the mobile financial services it is eliminated from the use tons of papers as contributing to environmental protection.

The development of financial business is in fact further development and implementation of mobile financial services. It is reality to expect the fast development of M-banking because of very fast development of Internet and user's needs.

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MEDICAL WASTE MANAGEMENT IN REPUBLIC OF SRPSKA – AWARNES AND PRACTICE

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ABSTRACT

Hospital sector in RS produces 33 tons of hazardous medical waste yearly. In order to minimize environmental adverse effects and to achieve premises for hospital accreditations and ISO certification, sustainable waste management system needed. Creation of such a system is not easy but it is essential for quality of health care. Particular problem is fact that system needs to be developed from the zero stage, without previous experiences, lacking of resources, and awareness of medical personnel, patients, policy makers, and general population. Constant education and control of medical personnel is needed along with evaluation through continuity of waste weight and number of injuries in the process of handling.

Keywords: medical waste, infectious waste, sharps, management, Republic of Srpska

INTRODUCTION

In both developed and underdeveloped world accumulation of waste as a consequence of various industrial processes is important problem. In the nature, matter and energy is constantly recycled, maintaining the equilibrium. On the other hand humans have created the variety of synthetic materials that can not reenter the process of recovery and in that way create environmental, health and economic problems.

Medical or health care waste is a product of various health care procedures and services and by its characteristics it can be inert (like communal waste) or hazardous [1]. Major sources of generation are hospitals, health care centers, diagnostic laboratories, autopsy centers, transfusion and hemodialysis centers, nursing homes. Beside health care facilities scientific institutions produce waste similar to health care waste. Smaller producers are dentist offices, home patient care, „harm reduction“ programs for intravenous addicts and some services like cosmetic parlors. Hazardous medical waste is divided into several categories: pathological, infectious, sharps, pharmaceutical, chemical, containers under the pressure and radioactive waste [1,2].

Hazardous effects of improper waste management can be observed at multiple levels. At the level of health care services both medical personnel and patients can be exposed within, and outside the facilities. On the level of technical facility management medical waste handlers could be critically exposed same as waste handlers at the community level due to the landfilling without pre-treatment. In the end at the environmental level deposit of hazardous medical waste could become permanent source of adverse effects on all eco systems [3]. Hazardous medical waste creates negative psychological effect of continuous fear of unknown and illness, and ethical and emotional problem due to the fact that medical waste could comprise body parts. Health care workers professional injuries are divided into six categories, and risk comprising hazardous medical waste is described in category of contact with objects and equipment and exposure to infectious and toxic agents. Estimated mortality as professional exposure consequence is 17-57 cases per million employed in USA [4]. In England [5] estimated that 34 out of 40 needle stick injuries are consequence of improper disposal. Among health care workers most exposed are nurses and waste handlers [6,7], while the risk of blood transmitted infectious diseases such as hepatitis B and C and HIV are most prominent. It is followed by gastroenterological, respiratory and skin infections [2,8]. Beside that is recorded appearance of stress and anxiety attacks in individuals who suffered needle stick injury which lead to prolonged leave of absence or work resignation [9]. Data reports that probability of infection after needle stick injury for HIV is 0,3%, for hepatitis B 3% and for Hepatitis C 3-5% [2,10]. In Republic of Srpska (RS), there is no official evidence keeping, of occupational injuries in medical services according to the Public Health Institute of RS. Also Institute for occupational health and sport of RS is not keeping such records which combined discourages reporting from primary health. As for immunization, it is obligatory against hepatitis B since year 2006 for all medical workers and employees in companies handling communal waste [11].

The aim of this article is to explore the quantities of hazardous medical waste generated in health care system of RS and modus it is presently managed. Estimation of the present state would facilitate development of basis for overall and technically and financially sustainable management of healthcare waste. Beside that, in the processes of hospital accreditation and ISO 14001:2004 certification this segment must be determined and harmonized with required norms.

MATERIALS AND METHODS

In order to obtain precise information on quantities of hazardous medical waste we conducted direct weighing combined with questionnaire in all medical facilities regardless the ownership. In first round we interviewed all facilities in region of Banja Luka as the most populated and with advanced health care procedures and region of Trebinje as the south and unevenly populated region of RS with Mediterranean climate. In second round, we interviewed all general hospitals in RS, including Clinical center in region East Sarajevo, Psychiatric clinic Sokolac, and 4 Institutes. The response rate was 95%. We obtained following information:

- Quantity (kg) of hazardous medical waste according to the categories where possible
- Number of beds per hospital, number of medical doctors and nurses

- Existence of appropriate containers for sorting of various categories of medical waste
- Existence of unclean passages within the facilities for waste transport
- Waste management after collection
- Where direct data were not obtainable, quantities were estimated according to the stock supply (gauze, injections, needles etc), and according to the number of beds and mean quantity of generated waste per bed and day in kg.

When results are delivered as total quantity of produced waste meaning communal waste such as cardboards, glass, food remains together with infectious, chemical and pharmaceutical waste, we calculated proportion of hazardous medical waste according to the formula 14% hazardous waste: 86% communal (inert) waste [12,13]. Factor for calculation of waste generated per bed is comprised of quantity in kg per hospital type (3.5 per clinical centers, 2.5 per general hospitals and 1.5 per psychiatric wards and sanatoriums), factor of reserve and standard rise which is 1.2 and estimation of percentage of hazardous waste within total waste which is 14%. Calculated factor is 0.546 for clinical hospital, 0.42 for general hospital and 0.252 for psychiatric wards and sanatoriums [1,2,12,13].

RESULTS

Results have shown that around 910 tons of total medical waste is produced per year in RS and revealed chaotic situation regarding awareness and practice in health care waste management. That is visible in all stages from the place of generation to the place of disposal. Main problems are lack of knowledge what medical waste is, what hazardous medical waste is, and that is on all levels, particularly at the level of waste handlers. There are no appropriate containers in terms of materials, color coding and safety and as a consequence any separation of medical waste. Finally, there is no treatment of hazardous medical waste.

Pharmacies mostly did not perceived pharmaceutical waste as hazardous, particularly small private facilities. Bigger pharmacies owned by state partially sort waste and either have contract with company that is intermediate between them and company that finally manage waste or they are bunkering that waste in deposit area of questionable quality. Clinical center Banja Luka incinerate pathological and infectious waste, but in the facility without permission and certificates on emission in environment. In Clinical centers East Sarajevo, Kasindo and Foča infectious waste is chemically or thermally processed, while pathological waste is buried at the cemetery. Laboratory cultures are treated by autoclaving and landfilled with communal waste. Only general hospital (GH) Doboj has licensed equipment for sterilization and reduction of hazardous medical waste. According to the Law on waste management [14] all institutions in region Doboj that produce hazardous medical waste should transport their waste to GH Doboj for processing. This is not the praxis due to the technical obstacles and high price (2 Euro/kg). Some of the facilities have false contracts in the case of sanitary inspection, but in reality they do not use this service. These are the "off the record" findings that we are not judging, rather citing them as the indicator of the inadequate way of managing. Companies that manage communal waste and take infectious waste in some regions

neutralize it with quicklime (CaO), but without written and approved protocol. Liquid chemical waste is mainly without neutralization disposed in sewage system. In most cases all medical waste is disposed in inappropriate containers and as such landfilled.

Table 1. Quantities of hazardous medical waste by examined regions

	Region Banja Luka		*Region Trebinje*	
	By day/kg	**By week/kg**	**By day/kg**	**By week/kg**
State owned institutions (1)	528.8	3701.59	69.88	492.4
Private institutions (2)	22	154.03	0.38	2.66
Total (1+2)	**550.8**	**3855.62**	**70.26**	**495.06**
Pharmacies (3)	1.41	9.87	-	-
Total (1+2+3)	**552.21**	**3865.49**	-	-

Table 2. Quantities of hazardous medical waste obtained by weighing and estimation based on number of beds all expressed in kg

			By bed/by day	
Hospital	***By day***	***By week***	***Number of beds***	***Calculated quantity (kg)***
CC Banja Luka	253	1771	1117	609.8
CC East Sarajevo clincs and hospital services Kasindo	N/A		220	120
CC East Sarajevo clinics and hospital services Foča	N/A		250	136.5
Psychiatric clinic Sokolac	N/A		200	50.4
GH Prijedor	186	1302	480	201.6
GH Gradiška	95	665	177	74.4
GH Doboj	212	1485	480	202
GH Bijeljina	N/A		310	130.2
GH Trebinje	52.2	365.4	193	81.1
GH Nevesinje	4.86	34.02	43	18.06
GH Zvornik	72.8	509,6	207	86.94
Institute for physical medicine and rehabilitation „Dr M. Zotović"	35.7	249.9	501	126.25
Institute for rehabilitation of chronic psychiatric patients „Jakeš"	N/A		259	65.27
Institute for physical medicine and rehabilitation and balneology Mlječanica	3	21	144	36.29
Public Health Institute of RS	15.28	106.96	-	-
TOTAL	**929.84**	**6509.88**	**4581**	**1938.81**

CC – clinical center
GH – general hospital
N/A – not available

DISCUSSION

During recent years RS has ratified a number of laws and directives that define and regulate waste management in general and medical waste management in particular. However it is important to mention that numbers of these laws are formally old laws taken from former Republic of Yugoslavia, without substantial adaptation and modernization. Main laws are Law on waste management [14], Directive on categories of waste and its catalogization [15] and Directive on medical waste management [16]. Ratification of these laws and directives is a platform for development of medical waste managing system, with the definition of responsibilities of all stakeholders in that process. All subjects that

produce medical waste are responsible for its sanitation in environmentally safe and sustainable way. At the moment RS only has long term plan for harmonization of present laws with EU legislative.

Main problem regarding efficient hazardous medical waste managing is fact that until present it was not managed at all or it was managed without plan and according to the personal preference. In order to establish efficient and sustainable system all medical institutions will have to systematically educate its staff, create teams, implement protocols and in the end find financial resources for this activity. At the moment hospitals are public and they are funded through Health Insurance Fund of Republic of Srpska (RS HIF) and patient's participation. Their budget is prospective annual budget, established upon the proposal of the annual work plan that institutions deliver to the RS HIF, thus the question is if this budget will be enlarged or each hospital will have to do a rebalance of existing budget and learn how to fit another item in it. Proposal of the hazardous medical waste management system should be evidence based and taking into account experiences from the other states particularly states in the region [17,18].

System needs to define sites of waste generation, separation, packing, labeling and short term and long term storage conditions, along with paths for in hospital transportation. Further it has to comprise educational programs for all participants in the process of health care service with evaluation strategies. In the end it must be clear who the responsible persons are and what is the chain of subsidiary and responsibility.

Obtained results on quantities and type of hazardous medical waste imply that intersectorial collaboration is a must in such a complex problem. Quantities of chemical waste and containers under the pressure are small and it should be treated along with other chemical waste produced in industrial settings. Radioactive waste is under the authority of state agency as in the most states in the world. Pharmaceutical waste in terms of management could be treated as chemical and so far the most efficient way is incineration.

Medical institutions produce mostly pathological, infectious waste and sharps that are treated as infectious waste as well and it would be most cost effective that medical sector under the authority of Ministry of Health and Social Welfare of RS is responsible only for these categories. Pathological waste consisting of amputated parts, fetuses and various tissues should be where possible cremated or buried at appropriate cemeteries. Infectious waste that consists of various parts of equipment, materials that were in contact with blood or other body fluids, diagnostic material or other materials containing pathogenic agents should be conveyed into inert form and than landfilled. After sterilization metal sharp objects could be recovered and recycled. The best possible way of final processing is incarnation but this is financially unsustainable for most of the transitional countries. Therefore, the applied technology should be in sync with financial, ethical, environmental and health principles that are long term cost effective for RS.

CONCLUSION

Due to the small amounts produced per regions most suitable management scheme would be small units for waste processing that would serve, both primary care sector and hospitals, strategically placed in GHs' regardless region boundaries. Poor roads and geographically scattered territory of RS would be serious obstacle for transportation

to possible one or two bigger facilities for hazardous medical waste processing. Hazardous waste management in terms of in situ separating should become integral part of every health care service, while on the institution level it must become a part of regular business activity. System must be constantly controlled even subject to sanctions.

Lack of proper hazardous medical waste management could be considered as important public health problem. Direct landfilling is the most expensive method in both terms of finance and future environmental capacity.

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CLIMATE VARIATION AND ENVIRONMENTAL CONDITIONS FOR VEGETATION DEVELOPMENT IN THE BOR AREA

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ABSTRACT

This paper presents analysis of past, present and predicted values of most important climatic elements: air temperature, rainfall, relative air humidity of town Bor with special attention to the main air pollutant presence, and discusses their influence on existing and future vegetation development.

Keywords: Climate variation, vegetation, pollution

INTRODUCTION

Modern climatological and environmental researches are leading to expectation of global warming and other climate changes to occur within the next few decades. While term 'climate change' has not reached its scientific consensus, there is a fact that climate variations are present on global, regional and local level. There are many researches who are aming to predict trends in those variability patterns.

However, climate variability even on short time scale can have significant, sometimes crucial effect on plant and vegetation growth and development.

Climatic changes projected over the next century are also to occur in an environment already affected by other environmental stress such as air pollution. This is specially the case with industrial and urban areas, such as Bor.

One of the main pollutants in the Bor area is sulfur dioxide, which is generated as a by-product of copper ore melting and refining. Concentration of SO_2 in Bor`s air is high and often exceeds prescript limits. This gas has been detected as one of the main limiting factors for vegetation development in Bor area (Ranđelović, 2010). Climate parameters tend to modify influence of this air pollutant.

Bor and its surroundings are characterized by the continental climate. The features of such climate are warm and sunny summers and cold winters with a lot of snow. The seasons are clearly recognized. Climate data for the Bor area have been collected since 1931. From 1949 untill 1979 climate mesurements were carried out by Republic Hydro meteorological Service of Serbia, and afterwards Institute for Mining and Metalurgy in Bor has been continued with the measurements. Summarized climate

data from Republic Hydrometeorological Service of Serbia measuremets were given, while newer climate data and folowing were analyzed more detaily. Some climate and air polution data comparations, specially those regarding the conditions for vegetation growth and development in Bor area were shown.

VARIATION OF IMPORTANT CLIMATIC PARAMETERS IN BOR AREA

This chapter presents both annual and seasonal values of the most important climate elements, significant for the vegetation development: temperature conditions, pluviometric and hygric regime.

Air temperature - Average monthly air temperatures have mostly regular annual course in Bor area, with values increasing from January to July and decreasing from August to December.

Table 1. Average monthly temperatures in ºC for different time periods

Year	J	F	M	A	M	J	J	A	S	O	N	D	average
1931/60.	- 2.4	- 0.5	4.1	10.4	15.7	19.3	21.7	21.0	17.0	10.6	4.6	0.4	10.2
1965/85.	0	- 1.5	3.6	10.7	15.8	19.1	21.3	21.2	17.4	10.6	4.2	0.0	10.3
1980/07.	-0.2	1.0	4.5	10.5	15.7	19.2	21.4	20.6	15.9	10.3	3.9	0.2	10.3

* Sources: Stanković, 1993 and Annual report on meteorological measurements in Bor from 1980-2007

Average annual air temperature has been increased for only 0,1 ºC since the beginning of measurement period, but the changes have occured in average monthly temperature values. Table 1. shows increasing of average spring temperatures and decreasing of autumn average temperatures tor period from 1980-2007. These changes are followed by decreasing of average annual temperature amplitude, which had values of 24,1 ºC for period from 1931-1960, 22,8 ºC for period from 1965-1985 and 21,6 ºC for period from 1980-2007.

Number of tropical days is still high comparing to alititude – average 29 C per year.

Under high temperature influence, disturbances in cell metabolism occur: synthetic processes are slowing down, while decomposition processes are getting intensified, as well as cell breathing. Frosts can be present in this area from October to May. Low winter temperatures and frosts are slowing down main physiological processes in plants. Water absorption by root gets slower, but transpiration continues, so the plant tends to dry.

Air humidity - Average air humidity influences plants and vegetation. Higher humidity intensifies transpiration, as well as evapotranspirstion process, impacting plant water regime. There is decreasing in average air humidity level during time. However, high average annual humidity amplitude is still present.

Table 2. Average relative air humidity in Bor area.

Air humidity (%)	J	F	M	A	M	J	J	A	S	O	N	D	average
1965/85.	84	79	75	69	69	71	63	62	66	77	85	83	74
1980/07.	80	75	67	63	65	64	62	66	72	79	81	83	70

* Sources: :Stanković, 1993 and Annual report on meteorological measurements in Bor from 1980-2007

It can be noticed significant decrease of average humidity values in spring for period from 1980-2007.

Precipitation - Precipitation is one of the most important climate elements for plant development. Majority of rains fall in May, showing elements of continental pluviometric regime. Major precipitation minimum is in January. Monthly and annual precipitation quantities varies significnatly by years, which makes it one of the climatic parameters with highest amplitude.

Table 3. Average monthly precipitation values in mm

Precipitation (mm)	J	F	M	A	M	J	J	A	S	O	N	D	sum
1951/70.	56	46	40	59	73	78	51	38	32	67	86	62	688
1980/07.	34	41	38	51	57	54	52	39	42	43	48	49	547

*Sources: Stanković, 1993 and Annual report on meteorological measurements in Bor from 1980-2007

During vegetation period from 1951-1970 76,2% percent of average precipitation sum was delivered, while in vegetation period from 1980-2007 this amount increases up to 77,6%. Some changes in precipitation regime also occures: during 1951-1970 interval average precipitation sum from March to May was 172 mm and from September to November was 185 mm. For the interval of 1980-2007 situation has changed: average precipitation sum from March to May was 146 mm and from September to November was 134 mm.

Majority of days with snow cover is in January, while snow cover occurrence is characteristic from November to March. Average annual number of days with snow is 58.

Urban habitats, degraded suburban ecosystems, mine wastes and flotation tailings in Bor have their specific microclimate. Temperature extremes are more expressed, and ground surfaces gets very dry and hot during summer months. Air pollutants from urban and industrial areas are also modifying local climate creating a more specific microclimate in these areas. These changes are reflecting on air temperature rising and decreasing of air humidity.

CLIMATIC FACTORS

For climate characteristic evaluation its important to have not only main climate data, but also to present certain important climatic factors which are base for climatic-vegetation classification.

Lang's rain factor and drought index after De Marton are among the most important indices of climate and vegetation relations and are calculated for the period from 1980-2007.

Lang's rain factor relates annual sum of precipitation and annual air temperature and it`s value for Bor area is 53.4. According to bioclimatic classification after Lang, this area belongs to arid bioclimatic type, which implies the conclusion that optimal climatic conditions for development of deciduous vegetation have been changed. Drought index by De Martonne for the Bor area has value of 27,01, which according to De Martones clasification means that vegetation is exposed to drought during the warmer half of the

year. This value of drought index is characteristic for grasslands or areas with steppe climate.

Potential evapotranspiration value is calculated after Ivanov (1949) .Values are shown in table 4, where it van be seen that highest potential evaporation values are in period from April to August. Main contrast between potential evaporation and precipitation is in June and July.

Table 4. Potential evapotranspiration (PET) in Bor area for period from 1980 -2007.

Month	J	F	M	A	M	J	J	A	S	O	N	D
PET (mm/mmonth)	21,03	49,74	84,05	113,16	126,79	156,01	153,68	130,05	75,94	40,30	23,56	25,15

CLIMATE DIAGRAMS

Climate diagrams are brief summaries of average climatic variables and their time course. The climate diagrams after Walter display monthly averages for temperature and precipitation over a year, showing seasonal variations and extremes as well as mean values and therefore provides summary of a local climate.

Walter climate diagrams for the Bor area have been made for periods from 1931.-1960. and 1980.-2006, where it can be noticed general increasing of total average annual temperature and decreasing of total average annual precipitation in the second interval. Comparing both diagrams significantly lower amounts of precipitation during May and November in later years can be seen, as well as apperance of drought period in August.

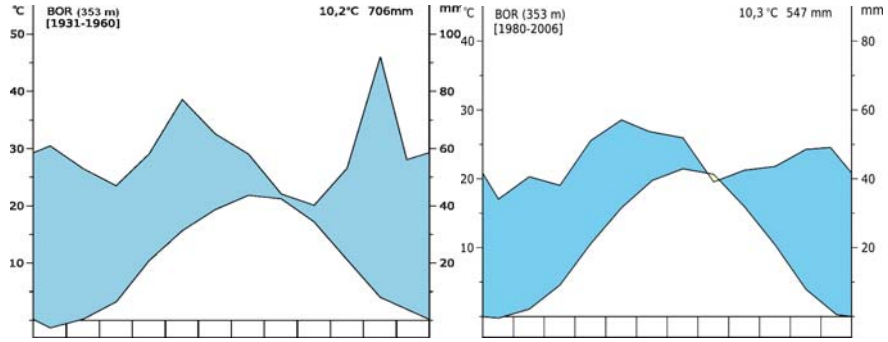

Figure 1. Walter Climate Diagrams for Bor area
for period from 1931-1960 and 1980-2006

Walter climate diagram for period from 1931-1960 is characteristic for temperature decidous forest biome, while climadiagram for period from 1980-2006 indicates characteristic of temperate grassland (steppe) biome.

MAIN CLIMATIC AND ENVIRONMENTAL FACTORS INFLUENCE ON VEGETATION DEVELOPMENT

In addition to any direct consequences of climatic change, the deterioration of existing environmental problems is an important indirect consequence.

Some of these interactions are synergistic, with climate enhancing and accelerating change due to other environmental stresses.

Climatic variations can modify effect of sulfur-dioxide to plants. Generally, same conditions that are usually suitable for plant growth are also favorable for SO_2 apsorption. Increasing of air humidity enhances apsorption rate influencing resistance of stoma, while temperature variations intensifies plant susceptibility to SO_2. This significantly refers to temperatures lower then 5°C and higher then 30°C, where synergistic effects of temperature and SO_2 are present (Jablanović, 2003).

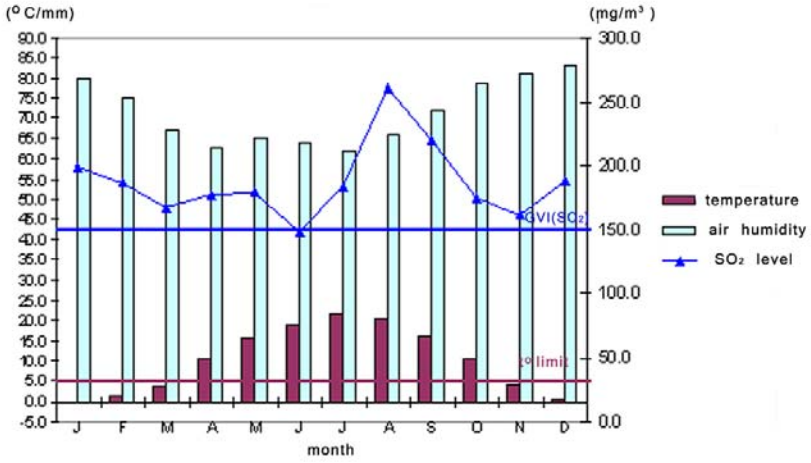

Figure 2. Composite display of temperature, air humidity and SO_2 level in Bor ('Elektroistok' measurement station data) for period of 1985-2000 (GVI (SO_2) – limited imission value for SO2 , t° limit - begining of negative temperature and SO_2 effect on plants)

Analysis of average monthly temperature, humidity and concentration of SO_2 in air shows that synergistic effects of low teperature, high humidity and increased levels of SO_2 in atmosphere on the vegetation in Bor are present from November to March, but also in August, where there are extremely high concentration of SO2 in the air associated with high average monthly temperature and moderate air humidity.

The strongest negative effect of combined effect of climate variation and SO_2 on plant development therefore occurres for the very early spring phases such as buds bursting, sprouting and initiation plant growth. Another synergistic negative influence

on plant development in Bor area occurs in August, where plants are entering summer phenology phases under drought stress and increased air pollution conditions.

CLIMATE VARIATION TRENDS, PREDICTIONS AND INFLUENCES

Prognoses of International Panel for Climate Change (IPCC Report, 2007) are that the global climate tends to change in the direction of increasing air temperature and decreasing of precipitation. According to descriptive maps of Agency for Environmental Protection (2007) in Serbia intensity of temperature increasing and precipitation decreasing in period from year 1951. – 2000. is highest on the territory of East Serbia. In Bor area these variations are in interval of 1-1,4 ºC for temperature rises and 15 to 30 mm for precipitation decreasing value.

Consequently, vegetation periods in this area gets longer, warmer and dryer. Radičević et al. (2008) calculates that in period from 1949-2005 vegetation period beginning trend for this area shows negative values, and effective temperature amount is higher up to 0,5-1,5 ° C. Potential evapotranspiration values are higher than growth of precipitation amount, which indicates dryer vegetation periods.

If this trend continues, existing and future vegetation in Bor area will develop in warmer climate conditions with decreased precipitation comparing to hiderto conditiones. This trend indicates further straightening of local microclimatic extremes, thus harshing the condition for future vegetation development. These conditions are likely to cause the prolongation of the growing season and the modification of the phenological phases of individual plants. Predicted variation trend tends to favorize development and spreading of xerotermic and thermophylic plant species, specially among short-lived and ruderal plant species,which react quickly to climate changes.

CONCLUSION

Climatic variation in Bor area are showing changes in temperature and precipitation pattern, causing warmer and drier periods during calendar year. Observed and predicted warmer local climate effects the vegetation mostly by prolonging the growing season and causing a shift in phenological phases. The intensification of the existing pollution effect on plants is one of it`s important indirect consequence.

The strongest influence on plant development, according to collected climatologically and environmental data, so far has occurred for the very early spring phases. But further climate changes will probably increase existing synergistic negative effect of pollution and climate variation on plants, so that in the future stronger impacts are most likely to happen, getting a form of prolonged drought stresses and enhanced SO_2-caused plant injuries during cold and warm seasonal temperature extremes. Changes in vegetation composition are also likely to occur, since the present climatic conditions are favorable for development of xerotermic and termophylic plant species.

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THE SANITATION OF EXISTING ENVIRONMENTAL PROBLEM BY PROFITABLE PROCESSING OF SMELER SLAG FROM RTB BOR

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ABSTRACT

Unplanned depositing of technological wastes, such as smelter slag, flotation tailing, mines tailing, etc. is causing high environmental pollution. One possible solution to this problem is processing of these waste materials and their dislocation.

Smelter slag from RTB Bor is being processed, by flotation, in existing industrial process and copper and precious metals are being recovered. Due to specific characteristics of smelter slag, physical and chemical, technological processes of milling and classification, as well as process of flotation are working inefficiently.

The results of research for optimization of flotation process flow sheet and increasing recovery of useful components are being presented in this paper. On the basis of research results, the proposed flow sheet is a new technological process of flotation, with parallel flotation on hydrocyclone overflow and underflow. The new technological solution creates the ability to reduce processing costs and increase recovery of copper.

Keywords: ecological problem, smelter slag, copper, flotation

INTRODUCTION

During the centennial production of copper and precious metals in the RTB Bor, waste materials such as: mines and flotation tailings, smelter slag, etc. are being created as by-products of various processes. All of these technological waste materials are being unplanned deposited, close to urban settlements. Inadequately secured, subject to atmospheric influences, wind and precipitation, these waste materials pollute air, soil, groundwater and surface water for decades.

However, as in the past few years demand for copper in the world is increasing, while on the other side the content of this metal in the primary ore deposits is very low, the interest in investigating the economic possibilities for processing various waste materials has appeared

Particularly interesting are smelter slag, which were made over the years in various technologies and stages of metallurgical processes, as well as from different basic raw materials. All this is conditioned by their heterogeneity, and thus complexity. Reserves of smelter slag are estimated at approximately 16 million tons on the landfill, as well as 700-1000 tons, which are being made during the daily production of copper.

The contents of copper from 0.65 to 0.8%, gold 0.4 g/t and silver 7.5 g/t, as well as estimated reserves of slag indicate the necessity of investigating possibilities for valorization of these basic useful components from this waste material. The value of this waste material is very high, due to its reserves, copper and precious metals contents and their values on world markets, and its processing is both an economic interest and environmental need.

Accordingly, in the Bor flotation plant in year 2001 began with the processing of this waste material. The process of slag processing, carries a lot of technical and technological problems, whose solution requires extensive research.

ECOLOGICAL PROBLEM

As a result of exploitation and processing of copper ore in RTB Bor dozens of different technological wastes are being produced daily. All of these wastes, due to unplanned and inadequate depositing are exposed to atmospheric influences, wind and precipitation, and pollute air, soil, groundwater and surface water, for decades.
Typical examples are smelter slag and old flotation tailing landfills, holding about a hundred hectares located near the urban areas of the city, Figure 1.

Figure 1. The position of smelter slag and flotation tailing landfills in relation to the urban zone of the city

Because these areas are not secured and recultivated, in the summer, mineral dust of high concentration (1-45 g/s) rises, which according to its chemical and mineralogical composition, with dominant share of fine silicate dust and toxic compounds occurred under the influence of external and internal atmospheric factors, is polluting urban environment of the city and surrounding villages, as well as agricultural land in the near and distant surroundings.

Since the creation of these landfills, rain is passing through the waste material, dissolving the components contained in it, first of all heavy metals and is carrying in the form of aqueous solutions polluting both surface and underground water. Effects of leaching these technological wastes, the best can be seen in chemical composition of

Borska and Kriveljska rivers waters. The contents of heavy metals ions, as well as major pollutants in the waters of Borska and Kriveljska rivers are presented in Table 1.

Table 1. The contents of heavy metals ions in waters of Borska and Kriveljska rivers

Heavy metals ions (mg/L)	Borska river	Kriveljska river	Maximum allowed concentration of heavy metals ions by the classes of water (mg/L)[8]	
			I i II	III i IV
Copper	15,7	16,2	0,1	0,1
Zinc	2,1	0,26	0,2	1,0
Lead	0,100	<0,010	0,05	0,1
Cadmium	0,009	0,003	0,005	0,01
Nickel	0,270	0,020	0,05	0,1
Chromium	<0,010	<0,010	0,1	0,1
Arsenic	0,008	<0,002	0,05	0,05
Mercury	$<5x10^{-3}$	$<5x10^{-3}$	0,001	0,001

The obvious example of pollution with waste waters from mines are Kriveljska and Borska rivers, which waters does not have any wildlife, not even microorganisms. Coasts of these rivers are completely sterile, with no plants and animals, Figure 2, and water from wells in the near and distant surroundings of the rivers, in the area of the villages, Krivelj, Slatina, Oštrelj, etc. are unsuitable for use in homes, it is not even recommended for use in agriculture.

Figure 2. The appearance of coastal areas of Borska river

In accordance with previous statements, removing and processing deposited material from smelter slag and old flotation tailing landfills, as well as planned disposal on the secured flotation tailing landfill, would greatly solve existing environmental problems and made significant contribution to environmental protection.

NEW TECHNOLOGICAL PROCESS AS A POSSIBLE SOLUTION OF EXISTING ECOLOGICAL PROBLEM

One of possible solutions to this ecological problem is investigating cost-effective options for processing as many technological wastes as possible, including smelter slag.

Characteristics of smelter slag grinding and classification products

Processing of smelter slag is being done in Bor flotation plant from year 2001. Due to specific characteristics of this technological waste material, its processing is associated with a reduced efficiency of milling and grading processes, and reduced recovery of copper in the process of flotation.

In order to determine the cause of the problem and possible solutions to overcome it, in the first phase of research industrial processes of milling and grading were observed, with the aim of determining the efficiency of this phase of the process. Grain size composition of grinding and classification products is shown in Table 2.

Table 2. Grain size composition of grinding and classification products

Grain size classes, (mm)	Hydrocyclone feed (F)	Hydrocyclone overflow (O)	Hydrocyclone underflow (U)
	D (%)	D (%)	D (%)
+1,651	100,00	100,00	100,00
-1,651+1,168	98,47	100,00	98,44
-1,168+0,833	95,64	100,00	95,37
-0,833+0,589	89,72	100,00	89,09
-0,589+0.417	82,13	100,00	77,52
-0.417+0.295	69,42	100,00	64,61
-0.295+0.149	51,46	97,34	44,04
-0.149+0.106	20,47	76,78	14,11
-0.106+0.075	13,25	63,86	8,31
-0.075+0.053	9,46	53,66	5,34
-0.053+0.000	7,21	46,38	3,90

As it can be seen, process of classification of this complex metallic material is inefficient. In addition to this statement is the fact that only approximately 10% of material goes to hydrocyclone overflow, while even 90% of the total mass goes to hydrocyclone underflow. Circulative charge of over 700%, is confirming that milling process is inefficient too.

Also, from Table 2, it can be seen that the share of optimally liberated particles in hydrocyclone underflow is approximately 14%. Detailed analysis confirms that application of flotation of copper and precious metals from hydrocyclone underflow can improve technological indicators of smelter slag processing.

Flotation of copper from hydrocyclone overflow

In this phase of research a large number of laboratory experiments of copper flotation from hydrocyclone overflow were performed. After a detailed characterization of material, technological parameters that have the most influence on efficiency of the flotation process were determined.
In figure 3 is given the optimal flow sheet of flotation of copper from hydrocyclone overflow, defined on bases of results of a large number of experiments.

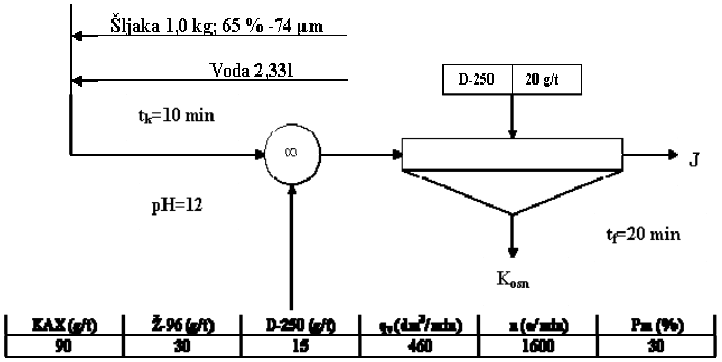

Figure 3. Optimal flow sheet of flotation of copper from hydrocyclone overflow

Results of laboratory studies show that by optimization of flotation process and selection of appropriate reagents can be achieved recovery of basic useful component, copper, of approximately 50%, with 3-4% of Cu in concentrate. Compared to the results of industrial flotation process, where recovery of copper is approximately 30%, it can be noted that the efficiency of the flotation process is increase greatly, and thus adequate economic effects.

Flotation of copper from hydrocyclone underflow

Experiments of copper flotation from hydrocyclone underflow were conducted in laboratory flotation machine, type Denver. On that occasion, the impact of certain technological parameters on the flotation process indicators was examined.
In figure 4 the optimal flow sheet of flotation of copper from hydrocyclone underflow, is given based on results of a large number of experiments.

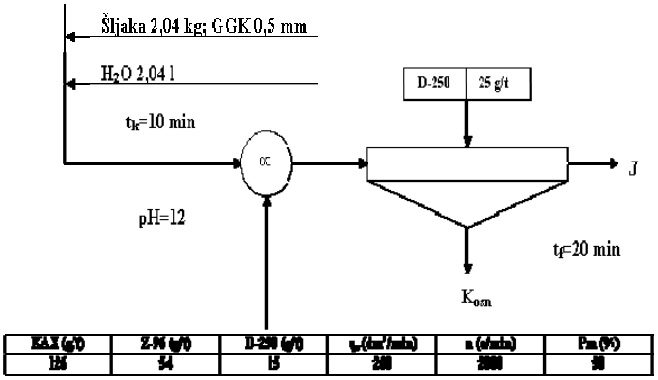

Figure 4. Optimal flow sheet of flotation of copper from hydrocyclone underflow

Results of laboratory studies show that by application of flotation from hydrocyclone underflow, approximately 72% of basic useful component, copper, can be recovered, with content of copper in the concentrate of 4.85%. Mass recovery gain by flotation of copper from hydrocyclone underflow is 10%. Given the mass distribution of classification products and recovery rates received by flotation of copper from hydrocyclone overflow and underflow, it can be seen that the efficiency of process is greatly increased, which is accompanied by adequate economic effects.

Based on the results of preliminary researches, in Figure 5, is given technological flow sheet for processing smelter slag, with flotation from hydrocyclone overflow and underflow.

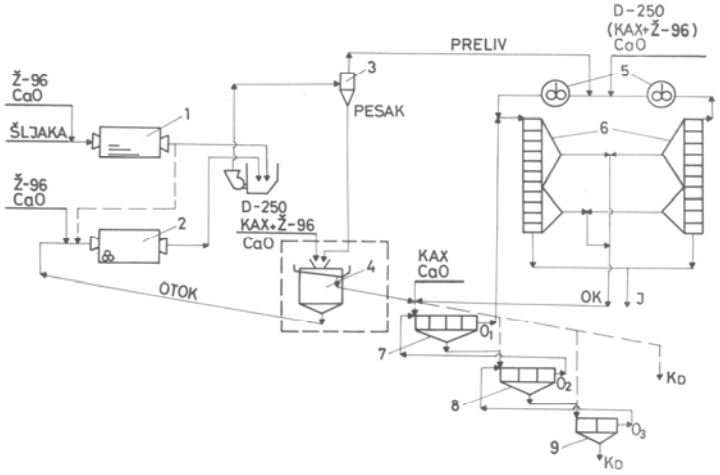

Figure 5. Technological flow sheet for processing smelter slag with flotation from hydrocyclone overflow and underflow.

CONCLUSION

Landfills of various technological wastes, made as a result of the centennial exploitation and processing of copper ore in the RTB Bor, are major polluters of the environment. Their processing would partially solve existing environmental problems.
Processing of smelter slag in RTB Bor is done since year 2001. Observing industrial processes of milling and grinding of smelter slag we came to the conclusion that certain disorders occur that negatively affect processing of smelter slag. Namely, the distribution of material by products of classification is about 90% of the mass distributed in the hydrocyclone underflow and only about 10% in hydrocyclone overflow.

One of possible solutions to overcome this problem is flotation of copper from hydrocyclone underflow, which has proven to be effective. Performed laboratory tests have shown that the application of this model of flotation can get a copper recovery of 72%. By introducing additional flotation of copper from hydrocyclone underflow several times higher recovery of copper could be achieved, comparing to the recovery of the same component from hydrocyclone overflow.

Analysis of the results of laboratory research of smelter slag flotation process show that by applying the proposed flow sheet and technological regime of the process can increase the flotation recovery of copper by about 20%, reduce energy consumption in the process of milling for about 15% and reduce consumption of grinding charge about 20%.

Therefore, the final conclusion is that smelter slag processing by using flotation of copper from hydrocyclone underflow is a great development opportunity in the production of copper and precious metals in the RTB Bor.

Acknowledgements

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THE INCIDENCE OF OBSTRUCTIVE PULMONARY DISEASES IN YOUNG CHILDREN OF SARAJEVO CANTON, IN VARIOUS CONDITIONS OF AIR POLLUTION

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ABSTRACT

During this research, it has been established that in Sarajevo area, there is a high prevalence of children suffering from bronchitis and asthma. The number of diseased children has tripled in the period of ten years. Though there is no clear evidence, it is indicative that there is a correlation between air quality and the number of diseased.

Keywords: Obstructice pulmonary diseases, asthma, bronchitis, air pollution

INTRODUCTION

For a long time, diseases of respiratory system are considered to be the leading in general framework of diseases among world population, affecting children of different parts of the world. The proportion of this disease relates to the quality of environment, the state, trends and examples of industrial and energetic growth. Many studies have inquired into this issue, based on the samples of population living in urban area, where a factor of emission (including immision) of various polluters is identified. The high-risk group of patients, affected by different respiratory diseases are those who live and work in ecologically unsafe work area, as well as in the area of polluted air caused by active and passive smoking, pollution by inflammation of SO2 and NO2, smoke and other parameters which emphasize the high sensitivity of respiratory systems (Mendell et al, 2007). Studies on Epidemiology have shown that a significant growth in prevalence of obstructive diseases among children population happened in the last 300 years. According to data of White Book on Allergies in Europe (1997), in the last two decades the percentage of children and teenagers suffering from asthma has doubled or even trippled . Similar case was registered in other industrial countries of the world (USA, Australia, Japan) In the majority of countries with high economic standard, prevalence rate of children with asthma is between 5 and 15%.

Causes of such a high and sudden growth of incidence of children with asthma are not yet clear. Considering the short time line of these changes, we can not state that a genetic factors bare a dominant role, eventhough there are many reports on polygenic basis for asthma (Ivković-Jureković, 2006). Lately, more attention has been given to risk factors that are present in surrounding areas and the so called "western life style". These factors are numerous and it is difficult to indentify their individual role, because their impacts are constantly mixed and summed up. However, among the most important are the allergens, other polluters, respiratory and virus infections. (Viegi, Scognamiglio, Baldacci et al. 2001).

MATERIALS AND METHODS

For the preparation of this work, data from Pediatric Clinic at the University Clinical Center in Sarajevo have been used. The data have been collected out from the protocol books where all patients who seeked medical help have been registered. There is a clear information about the date, place, permanent adress and sex of each patient in the protocol. This research includes only patients born and residing in Sarajevo. The age bracket of patients include patients from 3 days to 15 years of age.

Data on air quality has been taken from the Federal Hidrometeorological Institute of FBIH, where, since 1974, the actions of measuring the level of sulphur dioxide concentration and the level of dust in the air are being measured, and since 2003 these measurings include the concentration of CO2, O3, NO2 and NOx. The method which was used in collecting the data on chronical pulmonary diseases is a retrospective analysis for a twelve-year period (1997-2008). The following forms of Chronic Diseases were discussed: (i) *Bronhitis chronica simplex* (ii) *Bronhitis chronica obstructiva* i (iii) *Bronhitis chronica mukopurulenta*, and (iv) *Asthma bronhalae*.

Collected data were used on the basis of statistical methods.

The aim of this research is to prove the incidence of asthma and bronchitis prevalence in young children, and to try to relate this issue to the increase of air pollution.

RESULTS AND DISCUSSION

Table 1 shows the overall results of research of the number of diseased in terms of asthma bronchale and bronchitis, following the age bracket and sex. This research covers the period of twelve years; however, due to insufficient data, only information covering the eight-year period has been found, that sums up to 23,054 patients. The number of people suffering from bronchitis is 17,503, average number per year is 21,879, while the number of patients suffering from asthma bronchale is 5,551 or approximately per year 693,9 people.

It has been confirmed that, in childhood, boys are more affected by pulmonary diseases than girls. In the sample taken out from 17,503 children affected by bronchitis, 10,937 of them are boys, and 6,566 are girls, which is 62% to 38%. Similar case is in terms of asthma: the total of 5,551 diseased, includes 3,673 (66%) , of male and 1,878 (34%) of female sex.

Table 1. Incidence of bronchitis and asthma in children according to age and sex structure

Age	Bronchitis	Bronchial asthma	Bronchitis		Bronchial asthma	
			♂	♀	♂	♀
1997	1196	568	750	446	344	224
2000	1282	821	788	494	584	237
2001	1460	551	936	524	370	181
2002	2515	408	1616	899	270	138
2005	1288	290	787	501	187	103
2006	3118	1235	2004	1114	824	411
2007	2848	1270	1741	1107	848	422
2008	3796	408	2315	1481	246	162
total	**17503**	**5551**	**10937**	**6566**	**3673**	**1878**
average	**2187.9**	**693.9**	**1367.1**	**820.8**	**459.1**	**234.8**

This data shows that the most exposed population of children suffering from bronchitis are those between the age of 1 to 10. In each age group, which have been the subject of this research,the dominant age group is that between the age of 1 to 10.

In terms of bronchitis and asthma, a statistically significant difference in the number of diseased, without including the age and sex structure, has been established. It is indicative that there are differencies and various trends in terms of other factors that might point to the presence of statistically significant differences in conditions where major air changes of air quality happen, including changes of other ecological parameters within the area of living.

It can be concluded, on the basis of this research, that the greatest number of people suffering from obstructive pulmonary diseases happens in Spring and Winter time. In Spring period, starting in March to June there are many people suffering from this disease, and the reason is the high concentration of pollen in the air which causes problems among people with allergies. From June till October the number of diseased rises, and the cause is the rising concentration of air pollution, fog and smog, which is characteristic for Sarajevo during Winter period.

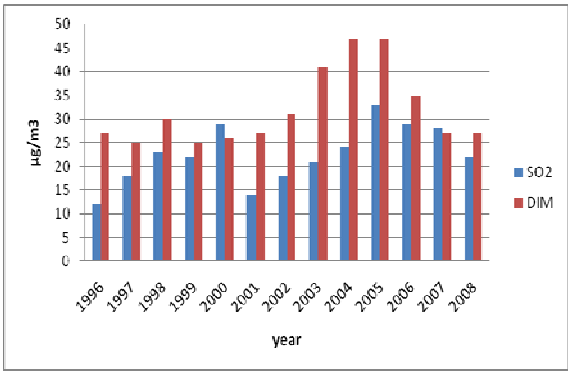

Figure 1. Average annual concentration of sulphur-dioxide and smoke.

Air polluters are connected with asthma symptoms and the state of asthma being worsened, but it seems that a chronic exposure to polluted air creates a predisposition for a respiratory system diseases in a more complex way than a simple sensitivity. Polluters can cause a bronchospasm, temporary risen the BHR and the allergy outcome, producing asthma egzacerbation. Eventhough asthma is more present in industrialized countries, there is little or no evidence of air pollution being directly responsible for the growth in prevalence of asthma in these countries (Renzetti 2009, Houssaini et al 2007, Wilhelm, Qian, Ritz 2009). Sometimes it is considered that there is no real connection between the air pollution and respiratory diseases such as emphysema and chronic bronchitis. However, the symptoms of these diseases are similar to those responsible for inhaling the air polluters which suggests that these diseases can, at least, worsen by the effect of air pollution. Furthermore, the incidence of respiratory diseases is the greatest in cities with the highest level of air pollution. But the direct line that connects the high level of specific air polluter with certain respiratory disease is not ordinary. It is very difficult to prove the presence of this connection, because the urban and industrial atmosphere contains gasses and substances whose relevant concentration fluctuates continuously, and whose interactions are very complex. The age, the level of physical vitality and general state of health, along with the quantity and frequency of exposure, affect a person's reaction to polluted air (Ko et al. 2006, Pauwels, Buist, Calverley et al. 2001, O'Connor et al, 2008, Moshammer H, 2006, Man et al, 2003).

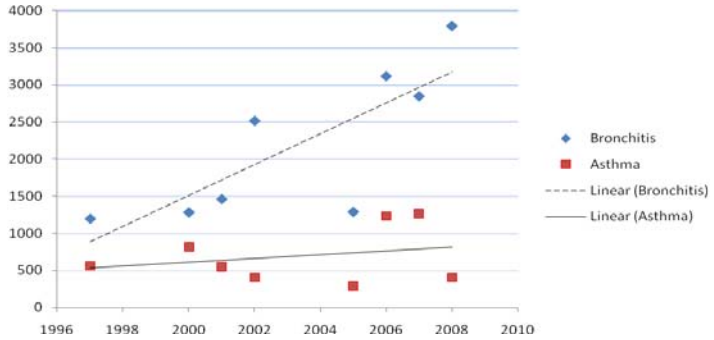

Figure 2. Bronchitis and Asthma trends since 1997 until 2008

A number of diseased children increases from year to year, which is especially visible in bronchitis. The real cause of such a trend is hard to mark, but one of the main causes is, certainly, the ever growing concentration of polluters in the atmosphere-biosphere of Sarajevo, mainly the gasses coming out of old and over-used cars with no appropriate clensing systems. The geographical position of the city, surrounded by high mountains adds to that, which again causes slow air circulation. Apart from this, the erecting of high and large buildings, without previous analysis of factors preventing air circulation, will lead to even worse situation. This is especially visible in winter months when the fog is highly present and when air pollution is intensified by the smoke coming out from boiler rooms and independent heating systems, which results in increased

number of diseased-more emphasized in this period of the year. Considering the fact that air polluters spread cummulatively, depending on an individual`s genetic predisposition and many other factors, it is very difficult to decide on one specific polluter as being responsible for the obstructive pulmonary diseases. This is the reason why there is no clear evidence on this issue .

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ECONOMIC VALUE OF MINING, PROCESSING AND METALLURGICAL WASTES IN COPPER MINE BOR

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ABSTRACT

Historically RTB Bor (the Copper Mining and Smelting Basin Bor) was one of the largest copper producers in Europe. The ore production in Bor started at the beginning of the last century (1903) and was operated by a French company that opened the first pit mine in Bor.

The development and economic progress was significant from 1960 to 1990, when copper production reached its peak (e.g. 151,395 t of copper cathode representing 1.5% of world production, 344,655 t of sulphur acid, 4703 t of gold). At present, the production capacity is some 12,000 metric tons per year, which represents 10% of the peak production [4].

The process of copper ore treatment has produced large amounts of ore waste and flotation tailing heaps, located in the vicinity of the towns of Bor. So far, as a result of mining and metallurgy activities, an estimated 450 x 10^6 tones of waste materials, 207 x 10^6 flottaion tailings, and 23 x 10^6 tones of smelting slag have been stored on the territory of Bor municipality, or 99,95% of its total waste stored.

This paper a short review of probable dangers of environment pollution during the mining and processing ore special attention on the quantity and economic value of mining and metallurgical wastes and alternative propositions for re-utilization of valuable materials contained in massive wastes, with an especial attention to final copper slag produced during pyro metallurgical copper processing.

Keywords: Mining waste; processing waste; smelter slag; RTB Bor; Serbia

INTRODUCTION

The active Copper mine Bor is the oldest copper ore mine, with exploitation in modern times dating back to the beginning of 20th century. The mining production in Bor started in 1903 with the exploitation of the only underground mine, followed by exploitation of 3 other open pits in Bor area: the Bor open pit started from 1912, at Veliki Krivelj (opened in 1979) and Cerovo (opened in 1990) [7].

The mine is located on the north-eastern rim of the town so that the open pit, metallurgical smelting complex and the flotation tailings pond make a boundary between the urban and the industrial zone. Owing to the fact that the town was built in the near vicinity of the mine, as well as the location of the copper smelting plant and two more mines nearby, which are comprised by RTB Bor (the Copper Mining and Smelting

Complex Bor), the town itself represents a serious environmental hot spot of Serbia and Europe [7].

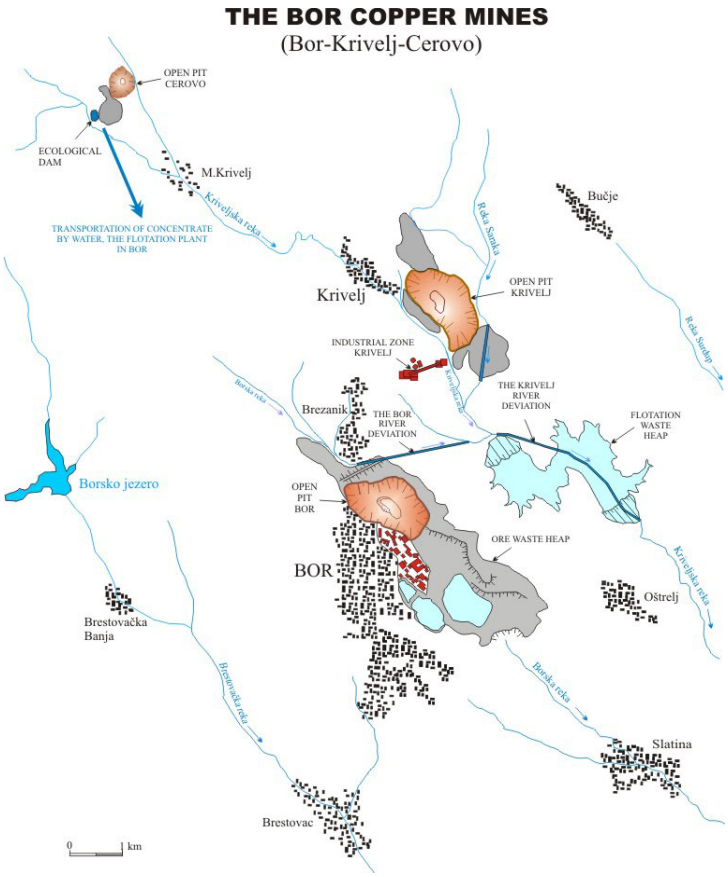

Figure 1. The Bor industrial area [4]

BOR MINING COMPLEX

Bor Open Pit Mine

Bor open mine is located on the northern boundary of the Bor town [7]. The mine is approximately 300 m deep and is large 1 km at the widest point. The mine intercepts the Borska River, which is diverted eastwards via a 7 km tunnel to the Krivelj River, south of the Veliki Krivelj mine.

The exploitation of the surface copper deposits started in 1924 and ended in 1993. Total ore production from the mine is as follows [4]:

- Total excavated ore: 96,108,468 t;
- Copper content in the ore: 1.40%;
- Copper exploited: 1,346,258 t;
- Overburden: 170,278,511 m^3.

Tailing Ponds

Three tailing ponds are present within the mining complex for disposal of tailing materials resulted from the flotation process. Two ponds, called Field 1 and Field 2, developed in the valley of the Bor River, were used between 1933 and 1987 and contain approximately 27 million tonnes of tailings, covering an area of approximately 57 ha, of which about 30 ha were recultivated. The dam of the uncultivated pond failed in the 1960's, following heavy rain, resulting in tailings pollution of agricultural land along the Borska and Timok valley. Tailing are still present along the Borska river banks between Bor and Slatina [4].

The third pond called "RTH", started in 1985 and is based on an old open pit mine, designated "H" pit, and is retained on one side by the slopes of a waste rock storage area. The dump is situated to the east of the flotation facilities, is elliptical in shape and stretches from the old open-pit Bor to the main railroad and the road leading to the industrial complex RTB Bor. Tailings slurry, 28 % solids, is upon thickening in thickeners pumped to the pond and clarified water returned to the floatation plant. At present production level and dam height, the pond has an estimated lifetime of 4 - 5 years. The present depth of tailings is approximately 150 meters [4].

VELIKI KRIVELJ MINING COMPLEX

Mines Activities

The ore exploitation started in 1983. Since 1998, when the transportation system was built, overburden from the mine Veliki Krivelj is transported to the old open pit of Bor. The mining complex covers a total area of about
87254 ha, of which [4]:

- Open pit mining = 129 ha
- Dump for waste from the mine = 124 ha
- Facilities = 0.62 ha.

The planned capacity is as 10,6 million tons/year and 10 million tons/year for ore extraction and overburden, respectively. The level of the current production is about 50% of the planned capacities.

Flotation Process

The flotation facility occupies a total area of 358 ha, of which [4]:

- Flotation tailings ponds (total area) = 334 ha
- Flotation facilities = 24 ha.

Tailing Ponds

The tailings from the Veliki Krivelj flotation plant, as a 25 – 30 % slurry, is transported by gravity by means of a concrete canal to the tailings ponds of Veliki Krivelj. The tailings dump is formed in the Kriveljska River valley and it consists of two fields (Field 1 and Field 2) situated between three dams (1A, 2A and 3A): Field 1 is located between dams 1A and 2A; Field 2 between dams 2A and 3A. Dam 2A is 1,300 m downstream of Dam 1A and Dam 3A is 1,500 meters downstream of Dam 2A [4].

The flow of Kriveljska River is deviated near the first field, across the sound rock mass, while beneath the second field it passes through the collector.

Field 1 (containing at present about 94 million m^3 tailings) was used from 1983 until 1989 and is currently closed. The dump covers an area of 81 ha. Field 2 (at present about 130 million m^3 tailings) started operations in 1989 and is currently in operation. The pond covers an area of 127 ha [4].

CEROVO MINING COMPLEX

Mining facilities at Cerovo include an open pit mine and crushing unit. The exploitation started in 1991 and ended in 2001.

The complex occupies a total area of approximately 54 ha, of which [4]:

- open pit = 31 ha
- mining wastes dump = 23 ha.

SOURCE OF ENVIRONMENTAL POLLUTION IN BOR

The prodution of large volumes of waste, including solids, liquid effluents, and air emissions, is a fact of life for mining and mineral processing operations. A hundred years of mining has left polluted air, lifeless rivers, damaged and destroyed agricultural soil, with over 11,000 tons of waste per citizen.[1]

The main source of environmental pollution in the Bor consists of the Mining & Smelter Basin, and in particular the following activities:

- underground mining (water pollution),
- the open cast pits and surrounding waste heaps (air- and water pollution),
- the flotation process (water pollution) and
- the smelting process (air-, water-, and soil pollution).

The mining activities have left a strong mark on the surrounding landscape. Based on available information mining of copper degraded an area of 1,110 ha in Bor and 12,060 ha in Majdanpek. Total degraded area by mining of non-ferrous metals in Serbia is 13,479 ha and represents 53% of total areas degraded by this activity in Serbia [4].

The process of copper ore treatment has produced large amounts of ore waste and flotation tailing heaps, on the order of the tens of thousands to hundreds of thousands of tonnes a day, located in the vicinity of the towns of Bor. So far, as a result of mining and metallurgy activities, an estimated 450 x 10^6 tones of waste materials, 207 x 10^6 flotation tailings, and 23 x 10^6 tones of smelting slag have been stored on the territory of Bor municipality, or 99,95% of its total waste stored [1].

The mining waste contains high levels of heavy metals, which poses a particular risk to water resources, the soils and through plants also the food chain. Toxic pollutants that are commonly found in tailings include: cyanide, mercury, copper, lead, arsenic, cadmium, selenium, zinc and nickel. The waste and tailing heaps pollute the environment in a number of ways, sometimes to the extent of ecological catastrophes.

Mining and flotation waste waters are being let out into rivers: Borska and Kriveljska rivers, Timok, Danube and even Black Sea. About 300 to 500 tons of sulphuric acid is discharged yearly into the water flow of Borska river (further into the Timok and Danube), as well as the following amount of heavy metals: 300 to 350 tons of Arsenic, 30 to 100 tons of Lead and 10 to 35 tons of Zinc [1, 4].

Smelting of ore copper produces SO_2 emissions which lead to soil acidity, dust with high contents of heavy metals and arsenic, destroying vegetation and consequently caused soil erosion. Emission of sulphur dioxide into atmosphere from the smelter is 170000 to 250000 tons per year [1, 7].

Knowing the value of 238 μg/m3 for the annual average concentration of SO_2 in the most polluted part of the Bor town ("Town Park") it could be evaluated the dimension of air pollution in Bor town [7].

It could be concluded that Bor is one of the most polluted town in Europe in accordance to the data that 5.3–19.6 kg of As per citizen were emitted during past years [7].

WASTE QUANTITY PER TONE OF COPPER

Many decades of exploitation and ore processing in the Copper Mining and Smelting Complex Bor, last years characterized by poor production efficiency, questionable process reliability and inadequate environmental controls, have produced huge quanitites of waste, which have not been treated and stored safely.

Waste quantities in Bor primarily depend on the scope of ore exploitation and on capacities of metallurgical aggregates. With regards to production efficiency, up to 320-450 tons of ore are dug and some 224-315 tons of tailings materials removed to produce 1 ton of cathode copper. During 1991 some 3,315 tons per day/per citizen of waste was created. Due to recent production decreases, in 2001 amount reduced to 0,795 tons per citizen [1].

Figure 2. Waste quantity per tone of copper [1]

Because of the large volume of wastes generated at mine sites, and their potential for negative environmental impacts, managing waste rock and tailings can be one of the greatest challenges in responsibly operating a mine. Historically mine wastes were simply dumped in a convenient location including lakes and rivers with little regard for the environment.

MINING AND PROCESSING WASTES

Mining waste

Amounts of mining waste ponds and copper contents in them are shown in table 1.

Table 1. Amounts of mining waste ponds and copper contents

	Mining waste ponds					
	Visoki planir	**Severni planir**	**Planir RTH**	**Unutrašnji planir**	**Planir Veliki Krivelj**	**Planir Cerovo**
Quantity (Mt)	150	20	60	28	170	22
Cu (%)	0,15	>0,3	< 0,1	0,2	< 0,1	0,18
Cu (t)	225.000	60.000	60.000	56.000	170.000	39.600
Value (US $)	900.000.000	240.000.000	240.000.000	224.000.000	680.000.000	158.400.000
Total value (US$)	**2.442.400.000.**					

If there are sulphide and oxide minerals of copper in ores, like in mine Cerovo, acidic leaching in the presence of bacteria, which fermentation mechanism accelerates the oxidation of sulphide copper minerals and enhances their leaching, can be successfully applied,

For receiving copper from leaching solutions, two processes are applied today in the world:

- precipitation (cementation),
- solvent extraction.

More prospective and with wider application is solvent extraction, which is in the practice usually combined with the electrowinning of copper from solution, making the technology, known as the SX-EW (SOLVENT EXTRACTION ELECTROWINNING).

Flotation tailing

There is about 700 million tons of waste materials in flotation tailings of RTB Bor. All flotation tailing ponds are big polluters to underground and surface waters, as well as soil and air.

Amounts of flotation tailing ponds and copper contents in them are shown in table 2.

Table 2. Amounts of flotation tailing ponds and copper contents

	Flotation tailing ponds		
	Old flotation tailing	**RTH**	**Veliki Krivelj**
Quantity (Mt)	27	50	130
Cu (%)	0,2 – 0,41	< 0,2	0,15
Cu (t)	54.000	100.000	200.000
Value (US $)	216.000.000	400.000.000	800.000.000
Total value (US $)	**1.416.000.000**		

In order to solve problems that flotation tailing causes to the environment there is a possibility for additional recovery of useful components and reclamation.

METALLURGICAL WASTES

Smelter slag

During pyro metallurgical production of copper from copper ores originated significant amounts of smelter slag, which may contain copper and precious metal also. Smelting slag contain 0,5 – 0,8 % copper, 0,4 g/t gold and 7,57 g/t silver. The existing of these ore deposit designates on processing loss with minimal production costs. The slag reserve is rated on 15 to 18 million tones.

All amounts of slag, which are formed in different period of copper producing, can be reprocessed also for both base components and accessory elements. The efficient recovery of metals from slag requires effort for them suitable recycle.

The content of basic useful components in slag, that is about 2 times higher than the one in the primary ores of RTB Bor, as well as the availability of this technological waste, makes it a significant resource for production of these metals.

Smelter slag quantity of 16.500.000 tons, and the prices of copper and precious metals on the world markets, determine the value of the basic useful components in this technological waste of about **700.000.000** US $**.**

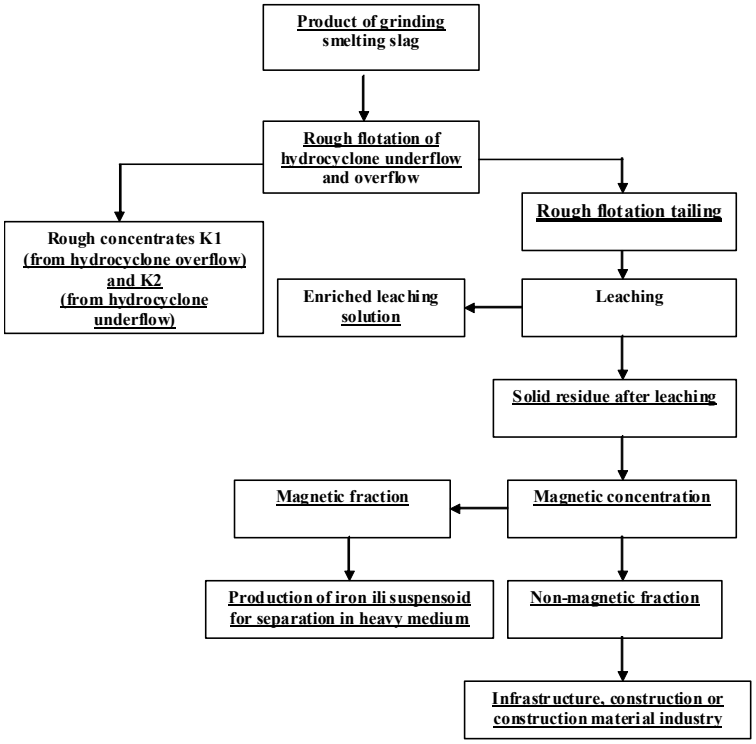

Figure 2. Technological flow sheet of the possibility for processing smelter slag without residue

CONCLUSIONS

Over 100 years the Copper and Smelting Basin Bor (RTB Bor), as an integrated mining and metallurgical company, produced large amounts of waste materials, whose storing, keeping and utilization become now the most important and an urgent ecological task in Bor and surrounding [5].

On the basis of a large number of information available, as well as the results of numerous research, on the primary raw materials and wastes from RTB Bor, we can conclude with certainty that the introduction of the latest hydrometallurgical technologies is the one of the most realistic possibility for contribution to sustainable survival and development, of RTB Bor and the wider community.

Application of the latest procedures of copper leaching, with or without the presence of bacteria, and its valorization by SX-EW is a sure way to increase economy of operations and to give a significant contribution to environmental protection.

By leaching of copper from poor ores, non balance reserves, parts of deposits that are not mined, mining waste ponds, flotation tailings and other wastes, we could achieve profit that could be measured in hundreds of millions of dollars, and also contribution to environmental protection would be immeasurable.

According to previous statements, it could be concluded that the application of modern science and technology is the one of the most important, but insufficiently used, factor of sustainable development, as well as education in this area.

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THE PRESENCE OF INVASIVE PLANT SPECIES IN TRIM TRACKS IN BELGRADE

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ABSTRACT

Invasive species primarily occupy unstable ecosystems and later on spread through the surrounding area causing homogenization of the regional flora. Beside their negative impact on biodiversity, invasive species can have a negative impact on the health and living of people and they can seriously harm human development. Trim tracks are parts of preserved and "healthy"landscapes, in which recreational function is dependent upon the ecological influence of plants. However, they are places intensively exploited by users, which leads to easy formation of unstable ecosystems, which can further transform them into the hotspots of the spread of invasive species especially those introduced in the aim of arrangement of the recreational areas.

Trim tracks in the most frequented recreational areas of Belgrade near the river Sava were chosen for this research in order to investigate the presence and the share of these invasive species in them and determine future tendencies. Standard floristic method was used in the determination of species, whereas the registration of the invasive species was performed according to the defined list of invasive and potentially invasive species composed as the summary of data collected by Serbian, Bosnian and Croatian authors.

Keywords: invasive species, trim tracks, recreation, invasion

INTRODUCTION

Antropogenous influence made significant changes in almost all the existing ecosystems and it caused the withdrawal or extinction of plant species. Another significant reason for reduced biodiversity is the introduction of invasive allochthonous plant species. Trim tracks of sports and recreational areas are places marked by the prominence of both and for that reason they were chosen as the research object.

Trim tracks are commonly a part of the sports and recreational areas which belong to the category of public green areas. They provide an opportunity for passive and active recreation of the population. The arrangement of trim tracks implies the maintenance of autochthonous vegetation but often the introduction and spreading of the alien (allochthonous) one. In that way, man makes the first step in the invasion process by unintentional or more often intentional introduction of alien species. In that way, trim tracks and the entire recreational areas can become the focal points for the introduced species, but also the hotspots for further spread in the surrounding landscapes. There is

an ever growing number of invasive species which pose a serious threat to human health and consequently their presence in trim tracks which should be places of a "healthy" landscape is unwanted and inadmissible.

The performed floristic researches enable defining of the state in the trim tracks and the determination of the extent to which the invasive species are present in order to enable future monitoring of their state and tendencies. The results of the research should provide the foundation for the development of a strategy for monitoring of the state and planning of measures for the control of unwanted species in the aim of protection of the autochthonous vegetation and especially the health of the users of trim tracks.

METHOD

The floristic researches included a total of five trim tracks in the following recreational areas of Belgrade: Bojčinska forest, Obrenovački reserve and Ada Ciganlija. The criteria for the choice of these very areas were their attractiveness i.e. their business and their closeness to the river Sava.

The researches were performed during 2009 by phytocenological surveying in 1-10 meter wide belt by the trim tracks. Phytocenological records were made regularly i.e. a record was made at every second station of the track and additional records were made outside these areas if needed.

In the locality Bojčinska forest the researches were performed in nine areas of the existing trim track. In the locality Obrenovački reserve the researches were performed in 12 areas of two trim tracks (the red trim track and the track along the embankment). At the location of Ada Ciganlija 10 records were made in two trim tracks (the old and the new trim track).

The determination of plant species was performed on the basis of the available floristic literature: Flora SR Srbije I-X [1,2] and Stavretović, N. [3].

The analysis of the structure and floristic composition of plants was performed using the standard phytocenological method of the central European school of Brown Blanquet[4]. The structural parameters which were analyzed were the number and cover. In order to determine the presence and the number of the invasive plant species the list of invasive species was composed, using the data obtained from Serbian, Bosnian and Croatian authors. The list included 80 invasisve or potentially invasive species according to the authors Vrbničanin, S. et al. [5], Boršić, I. et al.[6] and the data published on the website of the Federal Ministry of the Environment and Tourism of Bosnia and Herzegovina [7].

According to the determined list and on the basis of the results of the research, conclusions regarding the presence of invasive species and the prevailing families in the investigated trim tracks were reached. The following was determined: the percentage of the present invasive species, the ratio of the invasive and other species and the location characterized by the highest percentage of the invasive species.

RESULTS AND DISCUSSION

In the locality Bojčinska forest near the restaurant "Bojčinska koleba" starts the trim track which passes through the forest with the length of 2 km and 16 stations. The track is 2 m wide, and built from loose brick chips [8].

The total number of species determined in the investigated areas of the trim track in this locality is 46. The greatest number and cover were recorded for the species *Hedera helix* and *Glechoma hederacea* which can be explained for by the fact that the trim track passes through a forest canopy.

From the total number of registered plants 13.04% (6 species) are characterized as invasive and potentially invasive: *Aster lanceolatus, Urtica dioica, Rubus caesius, Stenactis annua, Erigeron canadensis* and *Artemisia vulgaris.* The woody invasive species *Amorpha fruticosa, Ailanthus altissima* and *Acer negundo* were spotted on the field not far from the tracks but they were not marked using the measured parameters. The species *Aster lanceolatus* stands out with the greatest number and cover among the registered invasive species. The second place, in terms of the values of the measured parameters, belongs to the species *Stenactis annua,* followed by the species *Urtica dioica and Erigeron canadensis*.

The species *Aster lanceolatus* was registered in the largest number of records (7 records) and its absence in other records can be explained for by somewhat denser canopy of the storey of trees, shrubs and the ground vegetation as well as the drier and more shadowed microconditions in these areas. The second place regarding their share in the records belongs to the species *Stenactis annua* and *Erigeron canadensis* (6 records), *followed* by *Urtica dioica* (5 records), further *Rubus caesius* (3 records) and finally the species *Artemisia vulgaris* (1 record).

In the records made in the areas near tables 4 and 14 the largest number of invasive species (5 species) was spotted, while the lowest number of invasive species was registered in the record made near table 16 (1 species). A phytocenological record without invasive species was not found.

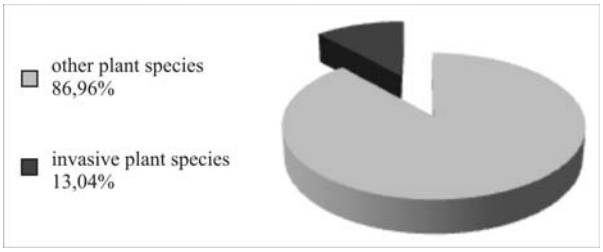

Figure 1. The presence of invasive species in the trim track in the locality Bojčinska forest.

In the locality Obrenovački reserve the investigations were performed on two trim tracks. The red trim track with a finish made of loose brick chips, passes through the reserve forest, with a length of 1480 m, and 14 stations at 100 m spacing intervals. The

embankment popularly called "Dolma"is used as a grass-covered, 1970 m long trim track [9].

The total number of species in the investigated areas of the trim tracks in this locality is 37. The following species stand out with their number and cover: *Urtica dioica* and *Glechoma hederacea*. The species *Glechoma hederacea, Plantago media* and *Potentilla reptans* were found in each phytocenological record made in the red trim track, whereas they were not noticed along the embankment track. The reason for such findings are the microconditions of the environment in the forest canopy at the location of the red trim track, which are favourable for the development of these species.

From the total number of recorded plants 24.32% (9 species) are characterized as invasive and potentially invasive: *Aster lanceolatus, Polygonum aviculare , Helminthia echioides, Urtica dioica, Rubus caesius, Stenactis annua, Erigeron canadensis, Asclepias syriaca* and the woody invasive species *Amorpha fruticosa and Acer negundo.* The most prominent of the invasive species in the phytocenological records are the species *Urtica dioica* (found in 9 records, in 5 records with the number and cover mark 4.5 and 3.5) and *Aster lanceolatus* registered in 7 records, two records marked 4.5 and 3.5 for number and cover). In two records neither of the two species was recorded (the records were made in the area at the end of the red trim track and in the middle of the embankment track) whereas in all others one of these two species is dominant. It can be assumed that the reason for the above mentioned is intensive and low mowing, as well as somewhat drier conditions in the embankment area and the dense canopy of the tree storey at the end of the trim track. In a large number of records there are findings of the species *Rubus caesius* (7 records) and *Stenactis annua* (6 records), but with low values of the measured parameters. The area by the edge of the forest was noticed (in the direction from the end of the trim track along the embankment towards the river) where the *Ambrosia artemisifolia* and *Artemisia vulgaris* were spotted in a larger number.

The largest number of invasive and potentially invasive species was registered in the record made on the red trim track near table number 3 (6 species), whereas there is no presence of invasive species in the record made at the end of the red trim track. The reasons for the absence of invasive species in this record can be somewhat drier environmental conditions and a denser canopy of the storey.

Along the whole embankment track (in the record areas and among them) the species *Asclepias syriaca* and *Amorpha fruticosa* were registered with a high value of the measured parameters.

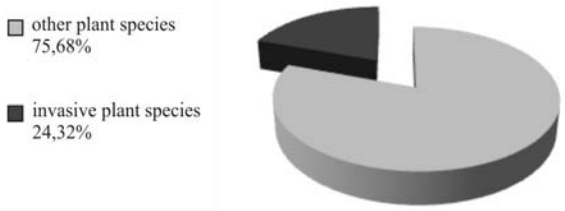

Figure 2.The presence of invasive species in trim tracks in the locality Obrenovački reserve.

Two trim tracks (the new and the old one) were investigated in the area of Ada Ciganlija. The old trim track consists of 16 stations and its finish is a mixture of ground and gravel. The other (the new trim track) was built in 2009 and it is 2 m wide, from loose brick chips and it has 14 stations [10]. It passes through the forest between the embankment and the beach which makes it more isolated than the old one. It is intended for the users who want to be away from the beach during recreation.

The total number of species determined in the investigated areas of this locality is 36. The species *Stenactis annua* and *Taraxacum officinale* are present in each record in most cases with high values of the measured parameters (marks 3.4 and 3.3). So, it can be said, with some reserve, that they are dominant in trim tracks. After these species the prominent ones are *Glechoma hederacea, Urtica dioica* and *Rubus caesius.*

From the total number of the recorded species 25% (9 species) are characterized as invasive and potentially invasive: *Aster lanceolatus, Polygonum aviculare, Eleusine indica, Ambrosia artemisifolia, Xanthium strumarium var italicum, Urtica dioica, Rubus caesius, Stenactis annua* and *Erigeron canadensis.* The species *Stenactis annua* is the prevailing species, the second one regarding presence is the species *Urtica dioica* (7 records*),* followed by the species *Aster lanceolatus* (4 records), followed by *Rubus caesius* and *Polygonum aviculare* (3 records). The other invasive and potentially invasive species were registered in 1 record each.

The largest number of invasive species was recorded in the area of the new trim track near table number 10. In each record made in the new trim track, three invasive woody species were registered (*Acer negundo, Ailanthus altissima, Amorpha fruticosa).*

It is important to mention numerous pathways which intersect with the investigated trim tracks, made by the visitors and workers of JKP Ada, who work on the maintenance and arrangement of beaches. The pathways are irregular in shape, 0.5-1.5 m wide, composed of ground. They are present in a large number spreading in all directions. The ground vegetation along these pathways is characterized by a great percentage of species such as *Stenactis annua, Glechoma hederacea* and to a lesser extent *Aster lanceolatus,* as well as woody species *Ailanthus altissima* and *Acer negundo.* The creation of such pathways enables favourable conditions for the invasion and spread of unwanted species which can be the assumed reason for their dominance along these paths and the potential for further space occupation.

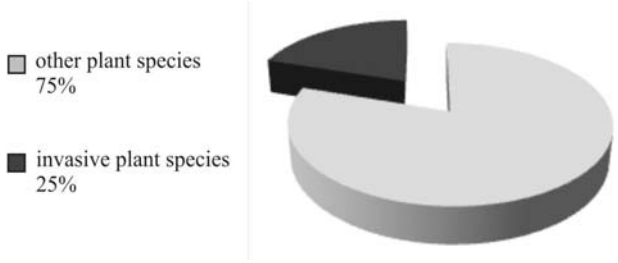

Figure 3. The presence of invasive species in trim tracks in the locality Ada Ciganlija

Table 1. The review of the present invasive species in the investigated trim tracks.

SPECIES	FAMILY	LOCALITY
Asclepias syriaca	*Asclepidaceae*	Obrenovački reserve
Erigeron canadensis	*Asteraceae*	Bojčinska forest Obrenovački reserve Ada Ciganlija
Ambrosia artemisifolia	*Asteraceae*	Obrenovački reserve Ada Ciganlija
Stenactis annua	*Asteraceae*	Bojčinska forest Obrenovački reserve Ada Ciganlija
Xanthium strumarium var italicum	*Asteraceae*	Ada Ciganlija
Picris (Helminthia) echioides	*Asteraceae*	Obrenovački reserve
Aster lanceolatus	*Asteraceae*	Bojčinska forest Obrenovački reserve Ada Ciganlija
Artemisia vulgaris	*Asteraceae*	Bojčinska forest Obrenovački reserve Ada Ciganlija
Eleusine indica	*Poaceae*	Ada Ciganlija
Polygonum aviculare	*Polygonaceae*	Obrenovački reserve Ada Ciganlija
Rubus caesius	*Rosaceae*	Bojčinska forest Obrenovački reserve Ada Ciganlija
Urtica dioica	*Urticaceae*	Bojčinska forest Obrenovački reserve Ada Ciganlija
Acer negundo	*Aceraceae*	Bojčinska forest Obrenovački reserve Ada Ciganlija
Ailanthus altissima	*Simaroubaceae*	Ada Ciganlija Bojčinska forest
Amorpha fruticosa	*Fabaceae*	Bojčinska forest Obrenovački reserve Ada Ciganlija

CONCLUSION

In the above listed analyses it was determined that a total of 15 invasive species and potentially invasive species are present in the investigated trim tracks. The presence of 9 invasive species was recorded in the locality Bojčinska forest which accounts for an eighth part of the total number of the registered species. A total of 13 invasive species was recorded in the locality Obrenovački reserve which is a fourth part of the total number of the determined species. The presence of 15 invasive species was determined in the trim tracks of Ada Ciganlija which is one fourth of the total number of species in the records.

The largest number of the determined invasive species belongs to the family *Asteraceae* (7 species), whereas other species participate with one species each.

In the determined number of present invasive species the largest number was found in trim tracks of all three investigated localities and it is 8 species, 3 species were

present in two localities, and two species were found only in trim tracks of Ada Ciganlija, and those were *Eleusine indica* and *Xanthium strumarium var italicum*. Also, two species were found only in trim tracks of Obrenovački reserve, and those were *Helminthia echioides* and *Asclepias syriaca.* It can be assumed that the reason for the presence of the largest number of invasive species in Ada Ciganlija is the heterogeneity of the site, site size and the exposure of trim tracks to users.

Tending and maintenance are marked by low intensity in all localities. If they were totally excluded, we could claim with certainty that the ratio of autochthonous and invasive plants would change, and that there would be a tendency of increase in the number of plants and the invasive plant species number. That would diminish the value of these sports and recreational areas, as well as the quality of the urban environment.

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VALORISATION HARVEST REST WITH SIGNIFICANT POSITIVE EFFECTS ON THE ENVIRONMENT

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ABSTRACT

This study derived from practical use of valorisation of harvest rests into quality new ecological products.

Energy making products, animal food and organic fertilizers are made thanks to development of biomass briquetting and pelleting technology.

Parameters of gas emissions and contents of organic and mineral materia are shown in the tables, and biomass pelleting procedure is shown on the pictures.

Keywords: Harvest rest, briquette, polluting, biomass

INTRODUCTION

On fields where different cultures are grown in purpose of producing food for human, significant quantity of harvest rests remain. The most of these rests, as product of photosynthesis, are lignocellulose materials, hemicellulose and lignins with certain content of mineral materias.

In Vojvodina, for example, annually over 4.000.000 tones of harvest rests remain on the fields.In past times these rests have been used as a heating fuel in rural households, or as a sort of food and flooring in facilities builded for domestic animals. In those times, valorisation of harvest rests was significant, with a lots of positive effects on the enviroment. Production of heat energy out of harvest rests represented sort of regenerative energy, and with burning these rests there was no any gas emission problems. Using of manure in agruculture, organic matter was given back to the soil without using mineral fertilizers and negative mineralization effects.

All this leads to one conclusion: In the past times, the natural resources had been used much better with significant positive ecological effects.

Ecological aspects

With the development of contemporary agriculture, but also with unnecessary urbanisation of villages (making earth gas as fuel in rural households), building „ contemporary" facilities for catle keeping, harvest rests became an important problem for agricultural manufacturing.

Heavy surplus of harvest rests was sorted out in the most unacceptable and ecologically problematic way- by burning on the arable lands. This procedure led to big and spontaneous CO_2 and ashes emission in the atmosphere, which caused destruction of surface layer's microflora. In this big fires, caused by random burning of harvest rests, great damage was made to the wilderness, but often the human lifes were at stake.

With the concept of industrial reproducing of harvest rests, an effort has been made to make this problem significantly smaller and to adjust it to modern way of life and to contemporary technological-technical solutions. This concept also provide 3 tipes of finale products:

- Energetic briquets and pellets made of harvest rests, as source of regenerative eco fuel, which can be used in new heating systems as well as in big industrial systems. Burning of harvest rests made positive gas emission effects, which is ilustrated by a data about quality analysis of gases during the burning process of wheat straw.

Table 1. Biomass combustion products

Emission	Average emission g/kWh srtaw	Variation of emission g/kWh straw
Solid particles	0.14	0.01 – 0.3
CO	2.2	0.4 – 4
NO_x	0.32	0.14 – 0.5
SO_2	0.47	0.4 – 0.6
HCl	0.14	0.05 – 0.3
PAH*	0.6	0.4 – 1
Dioxin**		1 – 10 ng

*PAH = Polyaromatic Hydro – Carbons, this is cancerogenic part of VOC-a (vapourising organic ingredients in biomass)
**Emission of Dioxin-a is based on 2 messurements and expressed in nanograms.

- Out of different hays soy straw and ammonised straw, can be made briqueted and pelleted cattle food for winter feeding of wild animals wich is very important condition for keeping fund of wild animals that live on our fields (dears, rabbits, etc.).
- Third way of valorisation of harvest rests is the procedure which is made of 2 phases:

a) Directed microbiological composting of rests, with adding of nitrogen and phosphorus (different kind of manure) and manufacturing of high quality organic fertilizer-biocompost with high content of humus materia.
b) Turning biocompost into the pellets, which are used as organic manure for fertilizing lawns (golf courses), and also in producing processs in

greenhouses and on fields with intensive production where restauration of organic fertilize wants to be made in a similar manner as with mineral ones. All accros the Europe pelleted organic fertilizers are been used, in thousands tones, in organic production related with fertilizing vineyards and orchards. In this kind of production it's possible to produce combination of mineral and organic fertilize, depends on soil and vegetable culture requirements.

Table 2. Biocompost content

Dry matter (%)	60,00
Ahs (%)	69,20
Organic matter (%)	30,80
PNJ (H_2O) (%)	6,88
KCl (%)	6,60
Salts, total (%)	2,00 or less
Humus (%)	29,10
N (%)	1,28
P (%)	0,47
K (%)	2,00
Na (%)	0,49
Mg (%)	0,90
C (%)	17,90
C : N	14 : 1
Mikrobiological ananlysis	
Useful soil microorganisms	$1{,}23 \times 10^{10}$ /g
Coli	0.20 g
Fecal coli	0.20 g
Fecal streptococus	0.20 g

In realisation of this inovation, numerous analysis and probe manufacturing were made. Numerous of large project, which should be realised in Serbia, are in preparation. These inovations could be implemented even for recultivation of different dums and barren soils.

Biomass pelleting-briqueting procedure

The procedure of making pellets and briquets isn't simple to define at all. because there is many elementa that influence on a choice of procedure.

Key elements are : type of material, moisture (in and outtgoing), granulation 2-8mm, temperature (in and outtgoing), drying and cooling, tool which combine all the elements mention before. Tool presser must have a certain velocity, height-quantity of material in front of matrix. There must be an adequate pressure and clearance between tool presser and matrix (Figure 1).

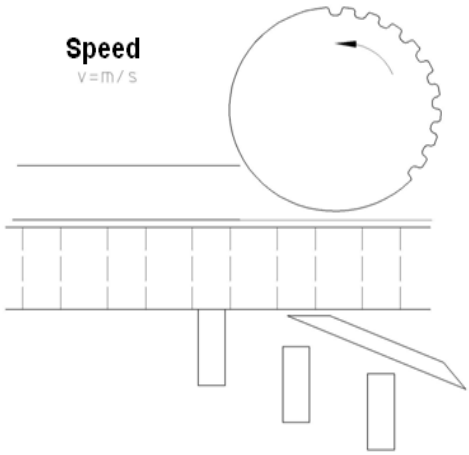

Figure 1. Biomass pelleting illustration

After this comes the key moment in choosing the matrix which will homogenize and shape material. Dimensionig of the matrix is shown on picture 2. Dimension of the matrix depends on previously mentioned parameters. Diameters of energy requirements pellets are between 6-10 mm, and length is between 15-30mm.

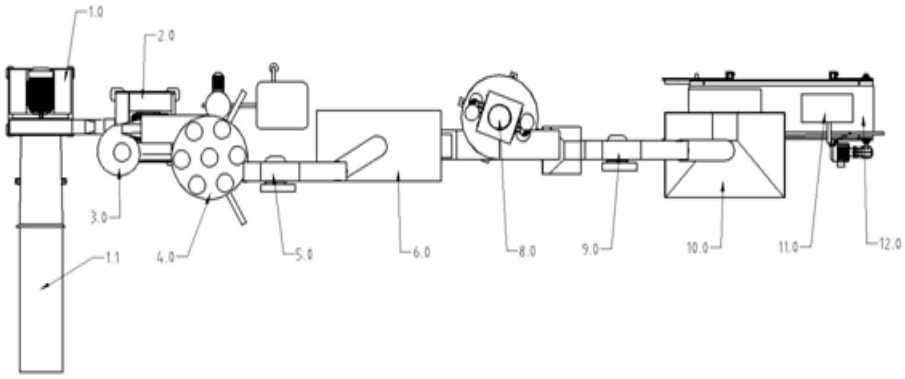

Figure 2. Biomass pelleting producing line,
(1.0 Chopper with feeding conveyor, 2.0 Mill for fine grinding, 3.0 Fan, 4.0 Cyclone with filter bags, 5.0 Bucket elevator, 6.0 Metal box, 7.0 Pellet press with dosing device, 8.0 Ash cooler, 9.0 Bucket elevator, 10.0 Semi scale - Packaging Machine, 11.0 Plastic bags welder, 12.0 Conveyor belt, 13.0 Device for moistening)

CONCLUSION

Biomass, as renewable source of energy with previously explained technical-technological procedure, allows making of eco products in form of energents, animal food and organic fertilizer.

With the importance of using clean energy, radical moves in realising project like this one, finansing equipment manufacturer and users, are nessecary. Fiscal politics needs to stimulate production and products and gave some subventions on it, as some countries in our neighbourhood are allready doing.

One act solves the problem of the enviroment, employments in rural regions and makes a quality and clean newmade energy.

It is our responsability to the future generations to make and use renewable sources of energy. That is not just economical or ecological matter, but a crucial matter for saving planet earth and all people on it.

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SUSTAINABLE DEVELOPMENT STRATEGY APATIN IN TERMS OF PROTECTION AND IMPROVEMENT OF ENVIRONMENT

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ABSTRACT

Vision, strategic priorities and goals for development of Apatin

VISION COMMUNITY APATIN

Apatin municipality, located in the region of Vojvodina, the local communities of high social and economic welfare of the population, that its development is based on developed institutions and infrastructure, human resources, knowledge, innovation, "clean" technologies, unique strategies for competitiveness and preserved and enhanced environmental sredini.Opština foster multiculturalism and traditional values, continuously strengthen inter-regional and inter-cooperation and allows all of full inclusion in the social and economic life of the community..

MUNICIPAL STRATEGIC GOAL APATIN:

Competitive and unique position in the region, which is based on well-developed social infrastructure, continued economic growth, preserved environment and high environmental awareness of all people. The council will constantly invest in institutions, social and physical infrastructure, economic capacity, innovation, environmental protection programs, with strong inter-and intra-regional cooperation to create conditions for the creation of entrepreneurial spirit, the growth of living standards of the population and many social and economic inclusion of all citizens in Municipal Life.

A prerequisite for achieving the strategic goal is the realization of the Municipality of general and specific goals and measures and projects - which are given for each of the following three distinctive developmental priorities (the direction of development). Defined development priorities essentially determined by way of realization of strategic objectives, and the instruments of the strategic objectives Municipalities:

AND DEVELOPMENT PRIORITY:
I DEVELOPMENT AND PROMOTION OF SOCIAL SERVICES, with emphasis on environmental ethics and environmental education
II DEVELOPMENT PRIORITY:
Competitive and sustainable economic development, establishment of environmental marketing
III DEVELOPMENT PRIORITY:
Preservation, protection and improvement of environmental quality.
PRIORITY OF PRIORITIES
REGINALNI ASPECT

Keywords: Sustainable Development Strategy, the vision, strategic priorities and objectives of municipal development, environmental programs, regional aspects, environmental ethics and environmental education, establishing environmental marketing, development priorities

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GUIDING PRINCIPLES ON THE DEVELOPMENT OF INLAND NAVIGATION AND ENVIRONMENTAL PROTECTION IN THE DANUBE RIVER BASIN

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ABSTRACT

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1. Background of the process to develop the Joint Statement on Inland Navigation, Water Management and Environmental Sustainability in the Danube River Basin initiated by the International Commission for the Protection of the Danube River (ICPDR), Danube Commission (DC) and the International Sava River Basin Commission (SRBC)
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   1.2. The current situation of navigation in the Danube river basin
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Keywords: internal navigation, protection of water, sustainable development of the environment, coastal ecology in the Danube River basin, environmental interests, sustainable planning of waterways, integrated planning principles

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MANAGEMENT OF INFECTIOUS MEDICAL WASTE IN THE HEALTH CENTER IN ZAJEČAR

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ABSTRACT

Medical waste is defined as "all the hazardous waste, dangerous or not, which is generated by the provision of health services (diagnosis, prevention, treatment and research in the field of human medicine)". From 10-25% of medical waste seems risky for hazardous waste human health and the environment.

In accordance with the World Health Organization it is estimated that all hospitals in Serbia are produced an average of 1.8 kg of medical waste per hospital bed per day, also it is estimated that all health institutions in Serbia produce about 48 tons of waste per year.

Many health centers in Serbia are involved in Project "Management of medical waste", which supports the Ministry of Health, funded by the European Agency for Reconstruction.

This paper has shown a way of management and treatment of the medical waste on the example of the Health center in Zajecar.

Within the project "Medical Waste Management" in the Health Center in Zajecar is provided autoclave, crusher, packaging waste collection and vehicle designed for transport of infectious medical waste.

The central place for the collection and treatment of waste is in the technical area of Hospital center in Zajecar. Medical waste is brought from RC Gamzigradska spa, ZZJZ Zajecar, Health center in Boljevac, Health center in Zajecar and all private office in the municipality.

On the basis of available information, in the Health center in Zajecar is generated daily 150 kg of medical waste, or 2.5 tons per month.

Keywords: medical waste, infectious waste, waste management

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