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EVALUATION OF WATER QUALITY IN LAKES FROM BUCHAREST

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Abstract

The aims of the present study conducted during May and June of 2012 were to investigate the microbiological level of pollution of some lakes from Bucharest and to determine the concentration of nutrients in order to evaluate the pollution degree. Results indicated that the level of nitrogen species and phosphate pose no danger meanwhile the pH values of the water samples revealed a slightly alkaline reaction. The variety and complexity of water composition is defined not only by the variety of the chemical species but also by the different forms and concentrations of each of them. Microbiological analyses indicated the presence of fungal strains and yeasts.

***Key words*:** *lake, nitrate, nitrite, phosphate, pollution*

INTRODUCTION

Monitoring and maintaining the quality of ecosystems is very important from economic and environmental point of view. Water is an important receiver of the environmental issues that appear as consequence of human activities. Also, is an environmental component essential of human settlements sustainable development. Degradation of water quality means an increased risk of eutrophication that is a main cause the destruction of lake ecosystems around the world and decreases the value of its use in various urban purposes.

The quality of lake's water is under considerable threat due to rapid increase of population number, developing technology but also due to domestic and agricultural pollutants. Water pollution is defined as a change in the chemical, physical and biological parameters of a water course due to human activity.

In Bucharest an essential part of the urban ecosystem is represented by the lakes along Colentina River and Dambovita River. Morii Lake is the most extended lake from Bucharest (246 ha) and is a reservoir on the Dambovita River that assure water supply in critical situations and is suitable for leisure activities. Herastrau Lake is part of Colentina River. It has an area of 74 ha and is used for sport and recreation.

The aim of this study was to evaluate the water quality from Herastrau and Morii lakes, taking into account the eutrophization risk. As consequence, we determined the concentration of nitrogen pollutants (nitrite, nitrate, ammonium) and phosphate. It is widely known that increased levels of phosphates and nitrates often indirectly harm the environment by causing bacterial growth and huge algae blooms [1].

Because these lakes are used for recreation also, the presence of microbiological species that could affect human health was considered in this study withal.

Water degradation sources for Morii Lake is represented by dwellings situated on the lake borders non-connected to the sewage network [2].

MATERIAL AND METHOD

1. Sampling

Sampling campaign was performed between May and June 2012, periods of time characterized by similar climatic and hydrological conditions. Water samples were

collected from Herastrau Lake (four randomly poits, figure 1) and Morii Lake (three randomly points, figure 2). Water samples were taken at about 30 cm below surface layer in plastic bottles. The samples were subsequently stored at 4°C for as short a time as possible before analysis to minimize physical and chemical changes.
The samples were allowed to stay until they reached room temperature before analysis.

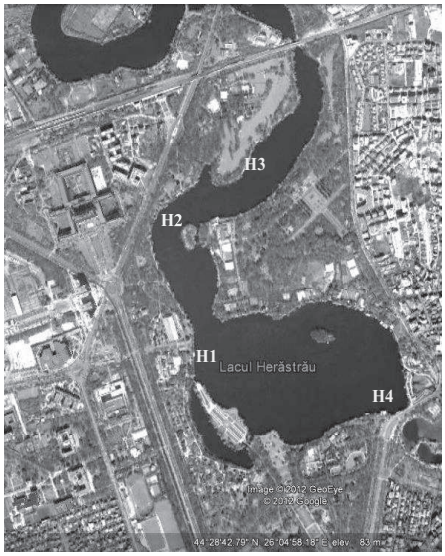


Fig.1. Sampling points from Herastrau Lake

2. Analyses

The chemical analysis of lake water samples was performed by using methods similar to those recommended for drinking water [3]. The assessment of all species was performed in triplicates and the presented results are the average of three similar values of each sample determinations.
Prior to the analysis, all instruments were calibrated according to manufacturer's recommendations.
The concentrations of phosphate, nitrate, ammonium and nitrite species were determined by the spectrophotometric means. Phosphate was quantified as molybdenum blue, for nitrate was used phenoldisulphonic method and for ammonium determination was used Nessler reagent.
Nitrite was quantified by the Griess reaction (sample was treated with sulphanilic acid and naphthyl-1-amine in acidic medium).
pH was determined potentiometrically, after the water samples reached room temperature.
For microbiological analyses was used a PDA medium (potato-dextrose-agar) sterilized at 121^{o}C, 1.2 atm for 15 minutes. Samples were incubated at dark for five days at 22-25^{o}C.

Fig. 2. Sampling points from Morii Lake

RESULTS AND DISCUSSIONS

The analytical results obtained for lake water samples are presented in table 1.

Table 1. Analytical results for water samples

Sample	pH	NO_2^-, mg/L	NO_3^-, mg/L	NH_4^+, mg/L	PO_4^{3-}, mg/L
H1	7.68	0.052	5.23	2.35	0.38
H2	7.92	0.043	6.29	1.71	0.44
H3	7.96	0.023	4.38	2.85	0.28
H4	8.00	0.066	2.27	1.84	0.49
M1	8.38	0.154	<DL	0.85	<DL
M2	7.84	0.162	<DL	1.34	<DL
M3	8.29	0.157	<DL	1.66	<DL

H1, H2, H3, H4 - sampling points from Herastrau Lake
M1, M2, M3 - sampling points from Morii Lake
(<DL-below limit of detection of the method)

Lake waters are belonging to 2nd quality class category because are used for water sports, recreation, leisure [3]. Quality parameters for surface waters are presented in table 2. The pH values for all water samples indicate a slightly alkaline reaction, but the values are within recommended range.

Table 2. Quality parameters for surface waters (STAS 4706-74)

Parameters	Water 1st class category	Water 2nd class category	Water 3rd class category
pH	6,5-8,5	6,5-8,5	6,5-9,0
NH_4^+ (mg/L)	1	3	10
NO_2^- (mg/L)	1	3	-
NO_3^- (mg/L)	10	30	-

According to already published data, pH value of lakes was observed to be into the range 7.3-9.2 (table 3) [4,5].

Table 3. pH values of different natural waters

Water characteristics	pH
Waters of volcanic exhalation	>2
Mine waters	3-4
Swamps	4-6
Groundwaters	5-7
Rivers	6.8-7.8
Fresh lakes	7.3-9.2
Ocean	7.8-8.3
Salt (soda) lakes	up to 10.5

Phosphates and nitrogen species occur in small amounts in all aquatic environments and are required to maintain the growth and metabolism of plants and animals. In excess these species are quite harmful.

It is widely known that the increasing phosphorus concentrations in the surface waters raise the growth of phosphate-dependent organisms, prevent sunlight from entering the water and appear a phenomenon commonly known as eutrophication [1,6,7].

Phosphate concentration was found very low in samples from Herastrau Lake and for samples collected from Morii Lake the levels were below detection limit of the method. The results were much lower than those reported elsewhere [8].

Nitrate and nitrite concentrations for analyzed samples are below admitted levels for all samples. Similar results in the case of Morii Lake were reported by Ghervase et al. [2].

Ammonium was found closer to the maximum level in the case of Herastrau Lake. Instead, for water samples from Morii Lake, the ammonium levels were found lower than those reported by Ghervase et al. [2].

Phosphates, nitrates, and ammonium could be nutrients for different microorganisms and aquatic plants, for example algae. These sometimes are unwanted because of their possible effects in inhibiting water aeration, which can lead to death various aquatic species. Anyway, the values found in our research indicate that these nutrients pose no environmental danger from this point of view.

Microbiological analyses of water samples collected from Herastrau Lake indicated the presence of yeasts and fungal strains (*Aspergillus*, *Penicillium*) (figure 3). The microbiological results obtained for water samples from Morii Lake showed as well, the presence of yeasts and fungal strains (*Fusarium*, *Penicillium*) (figure 4).

Moulds are found in all natural habitats due to their remarkable ability to adapt to the different ambient conditions. In water, the presence of mould is occasional. Mould growth is dependent of organic compounds found in water and can take place only under conditions of aeration. Fungal strains or moulds are vital for the maintenance of ecosystems. By breaking down dead organic material, they continue the cycle of nutrients through ecosystems. Water fungi can play a vital role in the decomposition of some organic materials.

In the meantime, a higher quantity of moulds than it is normally in proper water poses a risk to water quality and aquatic species. Therefore, *Aspergillus* species are found in oxygen-rich environments and could produce infections of respiratory system. *Penicillium* and *Fusarium* species lead to mycotoxins [9,10].

Literature survey reveals that *Penicillium* and *Aspergillus* specied were found in microflora of Dal Lake to be widespread in the water samples, this indicating that the spores of this genus are most widespread in nature [11].

CONCLUSIONS

The aim of this study was to evaluate the water quality from Herastrau and Morii lakes having in view eutrophization danger and microbiological species that could affect human health. The results allowed us to conclude:

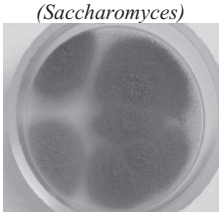
1. the ammonium and nitrite found concentrations are below limits set for surface waters 2nd quality class category;

2. for samples from Morii Lake, the nitrate was below detection limit of the method, situation found for phosphate ions, as well;

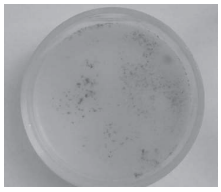
3. the pH values indicated a slightly alkaline reaction (7.68-8.38);
4. lower concentrations of nutrients indicate that there is no danger regarding eutrophication process;
5. microbiological analyses evidenced the presence in water samples of yeasts and fungal strains (*Aspergillus*, *Penicillium, Fusarium*).

H1 - yeasts *(Saccharomyces)*

H2 - fungus *(Aspergillus)*

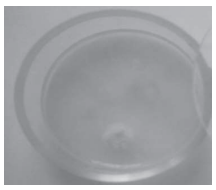


H3 - fungus *(Aspergillus.)*

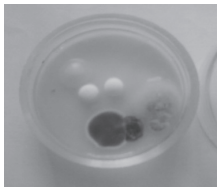


H4-fungus *(Penicillium)*

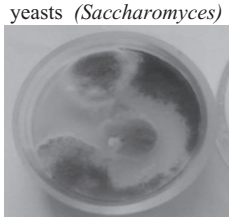
Fig. 3. Results of microbiological analyses - Herastrau Lake water samples (H1-H4)



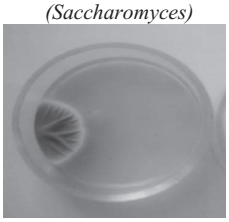
M1 - fungus (*Fusarium)* yeasts *(Saccharomyces)*



M2 - yeasts *(Saccharomyces)*



M2 - fungus *(Penicillium, Fusarium)*



M3 - yeasts *(Saccharomyces)*

Fig. 4. Results of microbiological analyses - Morii Lake water samples (M1-M3)

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