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Determination of Heavy Metals Concentration of Olt River Water from Valcea Area by Atomic Absorption Spectrometry

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Heavy metals represent one of the most important categories of polluants of natural waters and wastewaters. Small amounts of metallic polluants can cause extreme damages on environment quality. This paper presents a study of few heavy metals of Olt river water. The Olt river is one the most important rivers of Romania which length is 670 km. It flows through Romania counties Harghita, Covasna, Brasov, Sibiu, Valcea and Olt. The concentration of cations was determined by atomic absorption spectrometry.

Key Words: Heavy metals, Wastewaters, Atomic absorption spectrometry, Environment.

INTRODUCTION

Olt river is one the most important rivers from Romania which length is 670 km. Its source is in the Hasmasul Mare mountains of the eastern Carpathians mountains, Orientali Carpathians. It flows through Romania counties Harghita, Covasna, Brasov, Sibiu, Valcea and Olt.

The towns Miercurea Ciuc, Sfantu Gheorghe, Fagaras, Ramnicu Valcea and Slatina are situated on the Olt river side. The Olt river flows into the river Danube in Izlaz near Turnu Magurele.

The main stationary sources of pollution within this hydrographical basin are the following:

• Communal economy activities: Miercurea Ciuc, Sf. Gheorghe, Covasna, Tg. Secuiesc, Baraolt, Brasov, Codlea, Fagaras, Zarnesti, Victoria, Sibiu, Cisnadie, Agnita, Avrig, Talmaciu, Rm. Valcea, Dragasani, Slatina, Bals, Draganesti, Caracal, Corabia.

• Industrial units: Sector Minier Balan, Nitramonia Fagaras, Viromet Victoria, Roman Brasov, IAR Ghimbav Brasov, Metrom Brasov, Colorom

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Codlea, Ecopaper Zarnesti, Romarm Tohan Zarnesti, Vinilacril Rasnov, Mecanica Marsa, Oltchim Rm. Valcea, Uzinele Sodice Govora, Alro Slatina, Electrocarbon Slatina.

• Agricoles units: Suinprod Let, Europig Sercaita, Luca Suinprod Codlea, Avicola Codlea, Ventureli Sibiu, Italtrust Racovita, Suinprod Babeni, Avicola Babeni, Carmolimp Vestem.

The pollution of waters, more and less, is very difficult to avoid it. The statistics showed that the main stationary sources, from the towns and factories are evacuated in emissary through evacuated sources, represent only *ca.* 35 % from all pollution sources, during the another sources without evacuated sources represent *ca.* 65 %. For the main stationary sources, which are controlled, can take measures for their purification, for another sources it is impossible[1].

Generally, the polluting sources cause pollution both surface water and the underground water. The impact and the purification measures of environment, of a quality of water are practically same. Toxic substances discharged from the industrial processes, in the atmosphere or in the water, are numerous and varied like effect. For example, the emissaries of industrial substances have a toxic character.

In the category of the heavy metals exist *ca.* 60 metals which have the density more than 4.5 mg/cm^3. Few heavy metals are important for human beings, animals and plants, *e.g.*, iron, nickel, zinc, copper in controlled amount, while cadmium, mercury, chromium and lead are highly toxic.

Also, heavy metals have toxic action on aquatic organisms, to inhibit in same time the self purification processes. Although, few of these substances are essential elements, even very small doses can affect, in serious way, the health, if its are ingurgitated a long period of time.

Frequently, chronic effects of toxic metals appear under the untypical symptomatic forms and often can not be find out the causes and the substances which are provoked this. For this, the analysis of heavy metals concentration is necessary. For the analysis of the content of heavy metals from the water samples from many points of Olt river used like analytical method, the atomic absorption spectrometry.

EXPERIMENTAL

The samples were collected during 3 months, its are represented 3 seasons: winter, spring and summer, from 7 points of Olt river long ways of Valcea county. The places of collected were: (1) Boita (2) Cornet (3) Ramnicu Valcea (4) Tatarani (5) Cremenari (6) Dragasani and (7) Strejesti. Weather report and the river aspects were different at time when the water samples were collected.

The sampling of the water samples represents a important step in the analysis process of heavy metals, because the samples must to be representative and to not introduce the changes in the composition and quality of the water[2]. These changes can be influenced by the defective techniques for the sampling or the incorrect conditions for preparing of the sample. The distance from the river side was, for the majority places where the samples were collected, 2.00-2.50 meters and the depth is between 0.20-0.50 meters.

The samples were collected in the polyethylene vessels and before the analysis, the samples were filtered. The measurements of the heavy metals concentration were realized using the atomic absorption spectrometry. The apparatus used was the spectrometer NOVAA 300 - Analytic Jena.

The spectrometer NOVAA 300 is available in two models:

- With an external PC
- As stand-alone version with integral PC.

The environmental conditions for working with spectrometer NOVAA 300 are:

- Corrosion protection: the device is corrosion-proof for the samples used in the analysis.
- Working temperature: 10-35 ºC
- Humidity: max 90 % at 30 ºC
- Storage temperature (drying agent): -40 to + 50 ºC.

The spectrometer NOVAA 300 analyzes the samples with a concentration in heavy metals between 0.01 to 10 mg/L. This method has been widely applied to biological, agricultural, metallurgical, geological and environmental samples. The atomic absorption spectrometry technique was used for the analysis of Fe, Mn, Cu, Cr and Zn.

RESULTS AND DISCUSSION

Table-1 represents the concentrations of heavy metals from the Romanian standard.

TABLE-1
CONCENTRATIONS (mg/L) OF HEAVY METALS FROM THE ROMANIAN STANDARD

Metals (mg/L)	Values regulated by the Romanian standards				
	I	II	III	IV	V
Cr	0.025	0.05	0.10	0.25	> 0.25
Cu	0.010	0.02	0.04	0.10	> 0.10
Fe	0.200	0.50	0.70	1.00	> 1.00
Mn	0.050	0.10	0.30	0.50	> 0.50
Zn	0.050	0.10	0.20	0.50	> 0.50

In terms of water quality, Romanian river waters are classified as follows: Class I: very good, Class II: good, Class III: moderate, Class IV: satisfactory, Class V: low.

The results of researchers presented that many metals with toxic character like arsenic, mercury, selenium and silver have a level of concentration situated under the admissible limits of methods[3]. Also, many heavy metals presented the values in the admissible limits of environment or in the concentrations of heavy metals from the Romanian standard. The toxic action of chromium is conditioned in a big measure by the oxidation form of it[4].

In the water, the concentration of chromium must to be under 0.05 ppm Cr^{6+}. In Fig. 1 the concentrations of chromium in Olt river water during 3 months are presented. In Fig. 1 we can observe a high concentration of chromium in January month, in area of towns Ramnicu Valcea and Dragasani, in (3) and (6) points. In March and June months, the concentration of chromium was between 0.01-0.04 mg/L. The values of concentration didn't exceed the admissible limits.

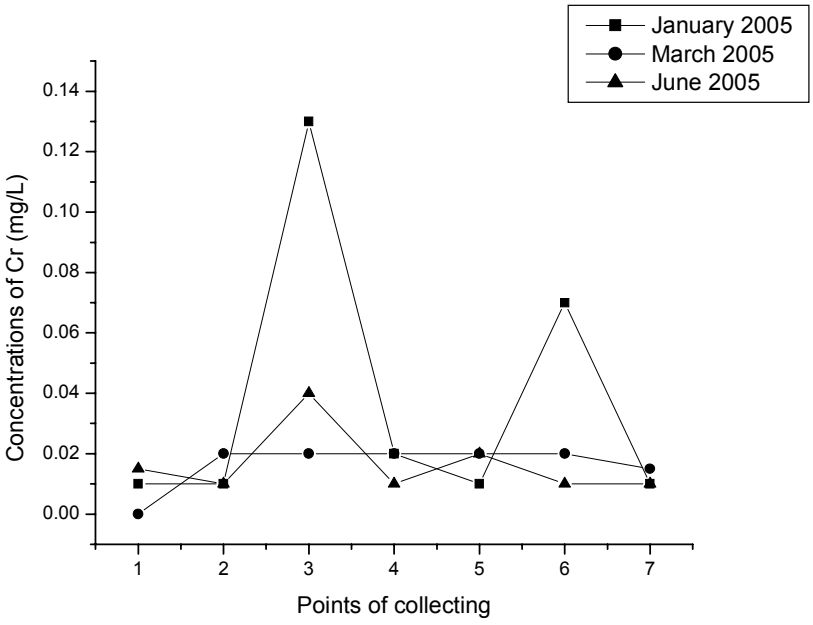

Fig. 1. Concentrations of chromium in Olt river water-January, March, June 2005

The maximum concentration in the water must to be 1 ppm. In Fig. 2 the concentrations of copper in Olt river water during 3 months are

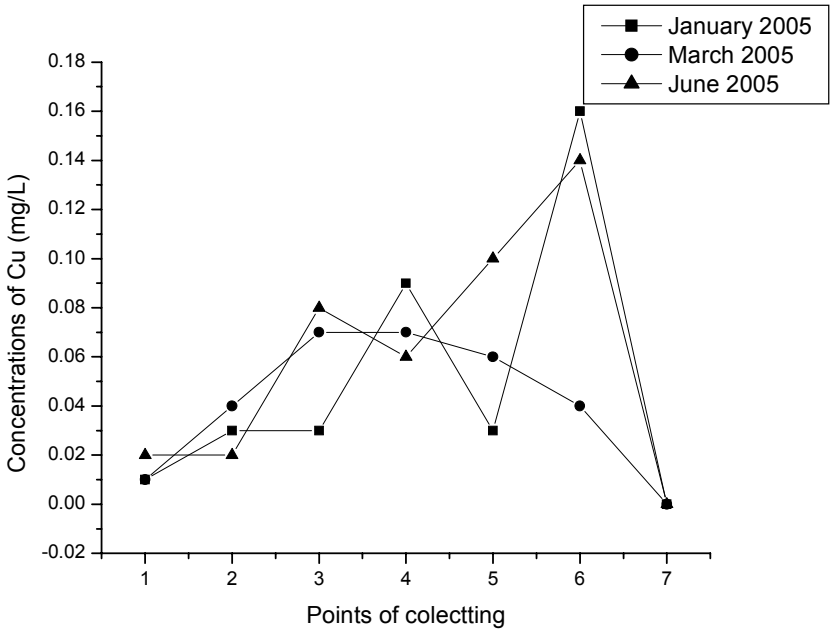

Fig. 2. Concentrations of copper in Olt river water-January, March, June 2005

presented. In January and June months (winter, summer temps), the concentration of copper is bigger than the admissible limits by the Romanian Standard in (6) Dragasani point. In (7) Strejesti point, the concentration of copper is under the detection limit of it. In January month, the concentration of copper in (2) Cornet and (3) Ramnicu Valcea points are stabilized 0.03 mg/L and in (4) Tatarani point, the concentration of copper is 0.09 mg/L.

In Fig. 3 the concentrations of iron in Olt river water during 3 months are presented. The concentration of iron in January, March and June in all points is in the admissible limits by the Romanian standard. In domestic and industrial area, in (3) RamnicuValcea and (6) Dragasani points, we observed a small increase of iron concentration.

In Fig. 4 the concentrations of manganese in Olt river water during 3 months are presented.

In month of March , the concentration of manganese in (3) Ramnicu Valcea point is 0.51mg/L Mn. This value of concentration is higher than the admissible limits by the Romanian standard. In another months, in all points, except (7) Strejesti point, the concentration of manganese is in the admissible limits of it.

In Fig. 5 the concentrations of zinc in Olt river water during 3 months are presented. The concentration of zinc in all points is in the admissible limits by the Romanian standard. In January month, the concentration of

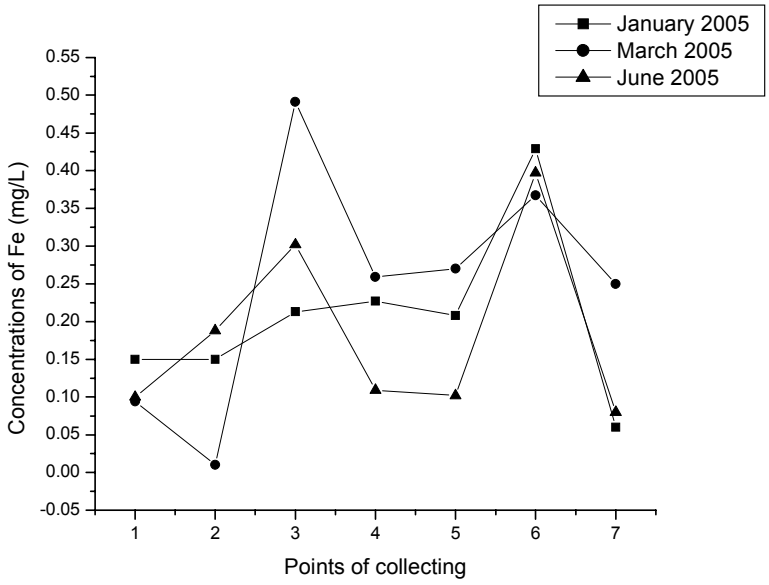

Fig. 3. Concentrations of iron in Olt river water-January, March, June 2005

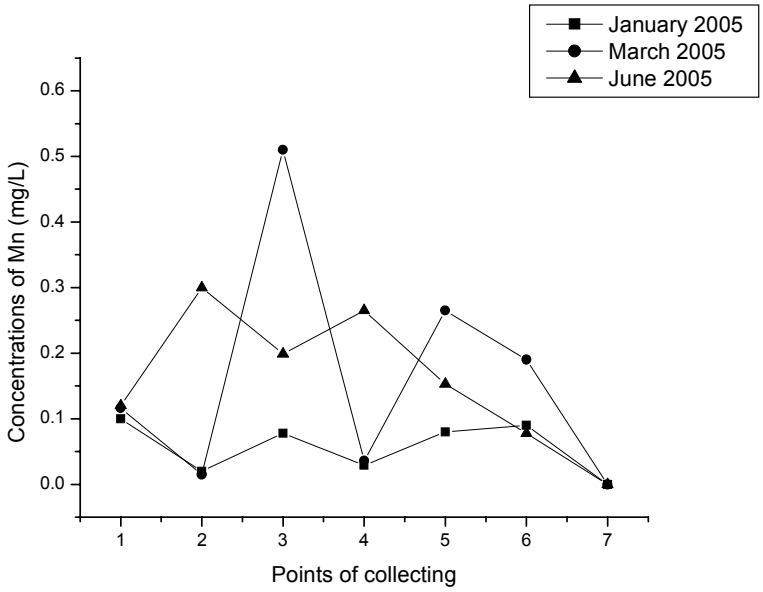

Fig. 4. Concentrations of manganese in Olt river water-January, March, June 2005

zinc is 0.06 mg/L Zn in the (4) Tatarani point. This point is situated after domestic and industrial Ramnicu Valcea area. In June month, the concentration of zinc in the (3) Ramnicu Valcea point is 0.06 mg/L Zn.

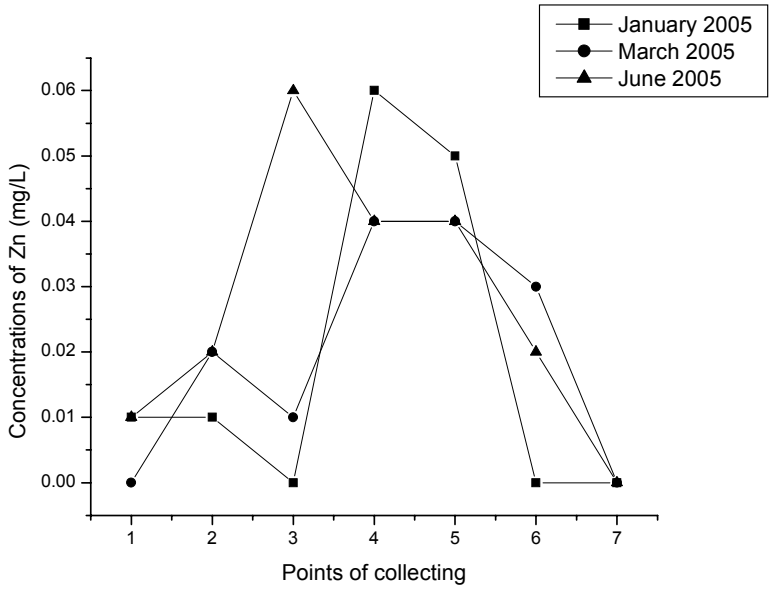

Fig. 5. Concentrations of zinc Olt river water-January, March, June 2005

Conclusion

The results obtained enable to conclude that the concentration of these heavy metals is situated in normal range, only with some exceptions-copper and manganese. In the end of the analysis of Olt river water on Valcea county area, we observed that the Olt river water is polluted in few regions and depend on the temperatures, the chemical and domestic activities. For environmental and biological samples it is important to know the real concentration of some heavy metals, because it exists a very narrow 'concentration window' between the essential and toxic levels and it is necessary to understand their biochemical cycle, mobility and toxicity.

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