

Study of Heavy Metals Concentration on the Main Rivers from Valcea Area, Romania

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This paper presents a study of a few heavy metals *e.g.*, iron, manganese, copper, chromium and zinc from 5 rivers (Olt, Lotru, Oltet and Topolog river) of hydrographic Valcea area. The concentration of cations was determined by atomic absorption spectrometry.

Key Words: Valcea County, Heavy metals, AAS.

INTRODUCTION

The Valcea County is situated in the central-Southern part of Romania. This surface is 2.4 % of Romania, of which about a half is covered by forests and forestry flora. The Valcea County, bordered to the North by the Meridional Carpathians has all formations of relief: mountains up to 2,200 m above sea level, plateaus and hills, valleys which are proper for agriculture. The hydrographic network is rich; the Olt river crosses the Valcea County on a length of 130 km, gathering in its basin numerous other courses.

Toxic metals can be present in industrial, municipal and urban runoff, which can be harmful to humans and aquatic life. Increased urbanization and industrialization are to blame for an increased level of trace metals, especially heavy metals, in our waterways. As trace elements, some heavy metals (copper, selenium, zinc) are essential to maintain the metabolism of the human body. However, at higher concentrations they can lead to toxicity.

Heavy metals are dangerous because they tend to bioaccumulate *i.e.*, an increase of the concentration of a chemical in a biological organism in time, compared to the chemical's concentration in the environment¹. Heavy metals can enter a water supply by industrial and consumer waste or even from acidic rain breaking down soils and releasing heavy metals into streams, lakes, rivers and groundwater.

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EXPERIMENTAL

The analyses were performed during the month of January, March, June and September 2006 and these months represent four seasons: winter, spring, summer and autumn from points of Olt river, Lotru river, Oltet river and Topolog river long ways of Valcea County.

The sampling places of Olt river were: (1) Cornet; (2) Valea Caldararilor; (3) Ramnicu Valcea; (4) Cremenari; (5) Dragasani. While the collection places for Lotru River were: (1) Valea lui Stan; (2) Gura Latoritei.

The place of collecting for Oltet river was Nistoresti and for Topolog river was Milcoiu.

Three rivers Lotru, Oltet and Topolog flow into the Olt river. The weather report and the river aspects were different at the time when the water samples were collected. The collection of the water samples represents an important step in the analysis process of heavy metals, because the samples must be representative and not to introduce the changes in the composition and quality of the water². These changes can be influenced by the defective techniques for the gathering or the incorrect conditions for preparing 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 was between 0.20-0.50 meters. The samples were collected in the polyethylene vessels and before the analysis the samples were filtered³.

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 environmental conditions for working with spectrometer NOVAA 300 are the device is corrosion-proof for the samples used in the analysis. The working temperature is ranged from +10 to 35 °C. The humidity is max. 90 % at +30 °C and the storage temperature (drying agent) is ranged from -40 to +50 °C.

RESULTS AND DISCUSSION

In this studies, the results obtained are compared with the concentration from the Romanian Standard⁴. Table-1 presented the concentrations of heavy metals from the Romanian Standard.

TABLE-1
HIGHEST CONCENTRATIONS (mg/L) SPECIFIED BY ROMANIAN STANDARD

Metals	Concentrations values-Romanian standard				
	I	II	III	IV	V
Copper	0.010	0.02	0.04	0.10	> 0.10
Chromium	0.025	0.05	0.10	0.25	> 0.25
Iron	0.200	0.50	0.70	1.00	> 1.00
Manganese	0.050	0.10	0.30	0.50	> 0.50
Zinc	0.050	0.10	0.20	0.50	> 0.50

Table-2 presented the concentration of copper in the collecting points of Olt river water. The concentration of copper during four months at 5 sampling points is between the next limits 0.01-0.16 mg/L.

TABLE-2
CONCENTRATIONS OF HEAVY METALS (mg/L) AT
FIVE SAMPLING POINTS OF OLT RIVER

Sampling point	Metals	January	March	June	September
Cornet	Copper	0.030	0.040	0.020	0.0100
	Chromium	0.010	0.020	0.010	0.0100
	Iron	0.150	0.010	0.190	0.4500
	Manganese	0.020	0.015	0.300	0.2350
	Zinc	0.010	0.030	0.100	0.0100
Valea Caldararilor	Copper	0.090	0.070	0.060	-
	Chromium	0.020	0.020	0.010	0.0100
	Iron	0.227	0.260	0.110	0.0830
	Manganese	0.030	0.036	0.265	0.6800
	Zinc	0.060	0.040	0.040	-
Ramnicu Valcea	Copper	0.030	0.070	0.080	0.0800
	Chromium	0.130	0.020	0.040	0.0300
	Iron	0.215	0.490	0.302	0.3000
	Manganese	0.078	0.051	0.120	0.3000
	Zinc	-	0.010	0.060	0.0600
Cremenari	Copper	0.030	0.060	0.100	0.0600
	Chromium	0.010	0.020	0.020	-
	Iron	0.210	0.380	0.102	0.0200
	Manganese	0.080	0.265	0.153	0.1318
	Zinc	0.050	0.040	0.040	0.0500
Dragasani	Copper	0.160	0.040	0.140	0.0600
	Chromium	0.070	0.020	0.010	-
	Iron	0.430	0.365	0.080	0.1500
	Manganese	0.091	0.190	0.075	0.6320
	Zinc	-	0.030	0.020	-

In January and June months, the concentration of copper is higher than the prescribed limits of the Romanian Standard at Dragasani.

Table-3 presented the concentration of copper in Lotru river water at Valea lui Stan and Gura Latoritei. The concentration of copper during four months in these places were found to be in the range of 0.01-0.04 mg/L.

Table-4 presented the concentration of copper found in Oltet river water. In June, the concentration of copper is higher and in the month of September, the concentration of copper is under the admissible limits.

Table-5 presented the concentration of copper found in Topolog river water. During the months of January and September, the concentration of copper is under the admissible limits.

TABLE-3
CONCENTRATIONS OF HEAVY METALS (mg/L) FOUND IN LOTRU RIVER

Sampling point	Metals	January	March	June	September
Valea lui Stan	Copper	0.040	0.030	0.0400	0.010
	Chromium	0.010	0.010	0.0200	0.020
	Iron	0.109	0.103	0.0080	0.090
	Manganese	0.010	-	0.1150	0.045
	Zinc	-	0.020	0.0900	-
Gura Latoritei	Copper	0.010	0.010	0.0200	0.010
	Chromium	0.020	0.030	0.0500	0.010
	Iron	0.085	0.020	0.0390	0.060
	Manganese	0.010	0.030	0.0755	0.028
	Zinc	-	0.030	0.0700	-

TABLE-4
CONCENTRATIONS OF HEAVY METALS (mg/L) FOUND IN OLTET RIVER

Sampling point	Metals	January	March	June	September
Nistoresti	Copper	0.01	0.020	0.070	-
	Chromium	0.01	0.010	0.030	-
	Iron	0.10	0.110	0.130	0.012
	Manganese	0.23	0.445	0.165	0.093
	Zinc	0.01	0.020	0.080	-

TABLE-5
CONCENTRATIONS OF HEAVY METALS (mg/L) FOUND IN TOPOLOG RIVER

Sampling point	Metals	January	March	June	September
Milcoiu	Copper	-	0.030	0.020	-
	Chromium	-	0.040	0.020	-
	Iron	0.88	6.680	0.415	0.022
	Manganese	-	0.381	0.199	0.756
	Zinc	-	0.230	0.030	-

The concentration of chromium in Olt river water is high in January at Ramnicu Valcea and Dragasani points. In March, June and September, the concentration of chromium is between 0.01 and 0.04 mg/L. The values of concentration did not exceed the permissible limits. The concentration of chromium in Lotru river water is ranged between 0.01 and 0.05 mg/L. The concentration of chromium is below the permissible limits of the Romanian standard. The concentration of chromium in Oltet river water is 0.01 mg/L during the month of January and March, 0.03 mg/L in June and in September it is under the permissible limits. For Topolog river water, the concentration of chromium is under the permissible limits in the month of January and September.

In Olt river water, the concentration of iron is found, during all the four months, below the permissible limits of the Romanian Standard. Similarly, both in Lotru and Oltet rivers water, the concentration of iron is far below the permissible limits of the Romanian Standard.

For Topolog river water, the concentration of iron in January, June and September months is below the permissible limits of the Romanian Standard, however, the concentration of iron during the month of March is high, which exceed the value of Romanian Standard.

Olt river water, in September, the concentration of manganese in Valea Caldararilor (2) point and in Dragasani (5) point is over 0.6 mg/L. This value of concentration is higher than the admissible limits of the Romanian Standard. In the other months, in all points, the concentration of manganese is below the admissible limits.

In Lotru river water, the concentration of manganese is below the accepted limits, except Valea lui Stan (1) point during March, when the concentration is under the admissible limits. While in Oltet river water, the concentration of manganese in all four months is below the admissible limits of the Romanian Standard.

In Topolog river water, the concentration of manganese in January, March and June months is below the admissible limits. However, in September the concentration is higher than the admissible limits of the Romanian Standard.

The concentration of zinc in Olt river water at all points and in all months is below the admissible limits of the Romanian Standard, except the concentration of zinc in September at Valea Caldararilor (2) point and January and September at Dragasani (5) point when the limit is below the admissible limits. The concentration of zinc in Lotru, Oltet and Topolog river waters, in all points during the four seasons is below the accepted limits of the Romanian Standard.

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