URBAN ENVIRONMENT INFLUENCE ON THE SURFACE WATER QUALITY IN THE CITY OF IASI

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This paper aims mainly to monitor surface water in the municipality of Iasi (Bahlui and Nicolina rivers), following several chemical indicators (pH, conductivity, copper, nickel, zinc, lead and chromium). Research to consist of sampling of water in rivers Nicolina and Bahlui of 11 points (locations) from entering the city of Iasi in to leave town. Monitoring was conducted in June 2009, sampling the weekly samples of the 11 points of interest. The values obtained were related to norm of 10/12/2002 published in the Official Monitor, on the reference for classifying the quality of surface waters that complement Water Law no. 107/1996.

***Key words**: surface water, monitoring, heavy metals*

This paper aims mainly to monitor surface water in the municipality of Iasi (Bahlui and Nicolina rivers), following several chemical indicators (pH, conductivity, copper, nickel, zinc, lead and chromium).

As the city Iasi be supplied with water for the rivers Prut and Timisesti, our research not proposes a bacteriological analysis of these rivers only heavy metal analysis to highlight the influence of urban and industrial on the surface water that crosses the city.

The river Nicolina springs from Codrii Iasi, near the hill Rotunda (common Barnova), from an altitude of over 350 meters below the structural forested plateaus in the southern village Barnova. It has a length of 20 km and the river basin area of 117 km ². Multi-flow environment is 0.477 m³/s, which is determined at hydrometric station in the area Nicolina Nicolina II district of the city of Iasi. It is considered to be the only river in Romania which flows from south to north and not vice versa [1, 2].

On the Iasi, Nicolina River riverbed is regularized as controlled waste flows, the necessary water to meet the requirement of domestic and industrial consumers or flood. Dams were built to protect the fence to elude the consequences of city floods.

Since 2009, Nicolina River was included in the national water quality monitoring of river basin of the river Prut. Section of the sampling required to carry out physicochemical analysis was set at about 50 meters upstream of confluence with the river Bahlui, the frequency of the sampling was quarterly.

As the main sources of pollution in the Nicolina river were identified: industrial units SC Moldoforest S.A. Iasi (located on the territory of Ciurea), SC Fortus S.A. Iasi (discharging into the river waters nickel, cadmium and lead) [5] and halt the scum of SC Fortus SA monitored by laboratory tests conducted by specialist of the Directorate of Water Prut Iasi.

Bahlui is a river in central Moldova, a tributary of Jijia. It springs in Botosani county at an altitude of 500 metres and flows south through the county of Iasi, flowing into Jijia nearby Chiperesti town. It has a length of 119 km and a catchment area of 2007 km ^{2}.

Bahlui is flowing through the lower plain Jijia NW-SE direction, passing through towns Harlau and Iasi. Iasi City is crossed by Bahlui over a distance of 14 km and it is virtually half divided. Neighborhoods that are passed by Bahlui, from NW to SE: Dacia, Alexandru cel Bun, Mircea cel Batran, Podul de Piatra, Podul Ros, Tudor Vladimirescu, Gradinari, Dancu.

Also, the population of the coastal city of Iasi is an important source of pollution of surface water storage in the river riverbed of different categories of waste or by direct discharge of sewage waste.

MATERIAL AND METHOD

The research consist of sampling of water in rivers Nicolina and Bahlui in 11 points (locations) from the entering the city of Iasi to the leaving point of the town. Monitoring was conducted in June 2009, sampling the weekly samples of the 11 points of interest.

Samples were performed according to SR ISO 5667-1/1998 from the bridges of the city.

Between sampling points 4 and 5, the Bahlui river receives the waters of the Nicolina river. First two sampling points are situated on the Nicolina river from entering the city of Iasi and until flowing in Bahlui River.

pH and conductivity measurements were made by potentiometric methods with pH and conductivity sensors of a multiparameter kit produced by ORION company in Germany.

Determination of traces of heavy metals was made by spectrometric of atomic absorption method with graphite furnace according to SR EN ISO 15586/2004 using atomic absorption spectrometer ZEENIT 700 product AnalytikJena Germany.

RESULTS AND DISCUSSIONS

The values obtained were related to norm of 10/12/2002 published in the Official Monitor, on the reference for classifying the quality of surface waters that complement Water Law no. 107/1996.

Changes in pH are achieved according to the measurements presented in *table 1.*

It can be observed pH variation within the limits set by legislation (6,5-9,5 pH units), depending on the activity water ecosystem.

Samples taken from the last point (11), after cesspool Iasi shows a slight decrease in pH.

Table 1

Changes in pH measured in points (units of pH)

Nr. Crt.	Point sampling	03.06.2009	10.06.2009	17.06.2009	24.06.2009
1	Ciurea bridge (Nicolina)	7,73	7,25	8,03	7,2
2	Strand bridge (Nicolina)	8,21	8,14	8,55	8,01
3	Dacia bridge (Bahlui)	7,48	7,2	8,57	8,2
4	Strand bridge (Bahlui)	7,37	7,86	8,25	8,06
5	Stone bridge (Bahlui)	7,76	7,95	8,37	8,18
6	Red bridge (Bahlui)	7,78	8,14	8,38	8,12
7	T. Vladimirescu bridge (Bahlui)	8,07	8,04	8,36	7,4
8	Metalurgie bridge (Bahlui)	7,83	8,21	8,36	7,6
9	Gradinari bridge (Bahlui)	7,42	7,59	8,16	7,56
10	After city cleaning station (Bahlui)	7,63	7,2	8,04	7,46
11	Tomesti bridge after cesspool (Bahlui)	7,48	6,84	7,86	7,4

Changes in conductivity of samples taken are presented in *table 2*.

Table 2

Changes in the measured conductivity (µS/cm)

Nr. Crt.	Sampling points	03.06.2009	10.06.2009	17.06.2009	24.06.2009
1	Ciurea bridge (Nicolina)	1043	1143	1432	1276
2	Strand bridge (Nicolina)	1136	1124	1173	1135
3	Dacia bridge (Bahlui)	1247	1454	1649	1640
4	Strand bridge (Bahlui)	1234	1384	1644	1610
5	Stone bridge (Bahlui)	1191	1347	1555	1487
6	Red bridge (Bahlui)	1186	1344	1554	1420
7	T. Vladimirescu bridge (Bahlui)	1162	1348	1556	1335
8	Metalurgie bridge (Bahlui)	1158	1352	1576	1308
9	Gradinari bridge (Bahlui)	1227	1157	1346	1243
10	After city cleaning station (Bahlui)	1025	984	1120	1032
11	Tomesti bridge after cesspool (Bahlui)	1125	1148	1240	1126

The average conductivity is 1295 µS/cm with a minimum of 984 µS/cm and a maximum of 1649 µS/cm.

Common values of conductivity for various types of water are presented in *table 3.*

Table 3

Common values of conductivity for some water

Nr. Crt.	Water Type	Conductivity (µS/cm)
1	Ultrapure water	0
2	Distilled water	2-7
3	Water tap	150-300
4	Mineral water	500-1000
5	Groundwater water	850-1700
6	Surface water	1000-1800
7	Waste water	1500-3000

It may be said that the conductivity of samples analyzed are within normal limits for surface waters.

Determination of concentrations of heavy metals showed the absence of nickel and zinc in samples taken. Copper, lead and chromium are found in surprisingly low concentrations (eg Cu <10 µg/L, Pb <3 µg/L, Cr <1µg / L).

The average values for copper, lead and chromium are presented graphically in Figures 1, 2 and 3. In graphs, sampling points 3 and 4 coincide with the sampling points 1 and 2 to show the differences between the two rivers.

Although values for these metals are very low, there is still a difference of metal concentrations between the two rivers before shedding. Of analysis revealed that the Nicolina river has greater quantities of metals from the Bahlui river.

Variation of copper on the two rivers can be seen in *figure 1*.

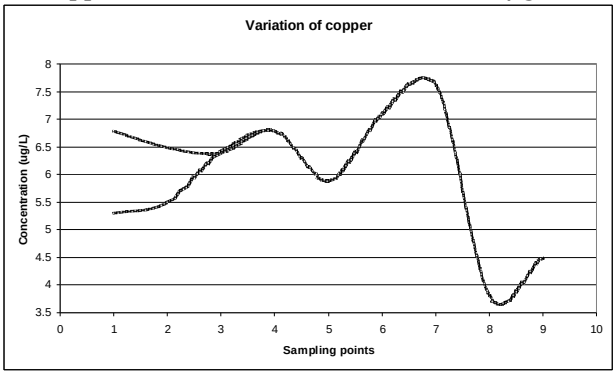

Figure 1 **Variation of copper concentration on the courses of Nicolina and Bahlui rivers**

Nicolina enter the Iasi territory with a copper concentration of 6.8 µg/L while Bahlui has a copper concentration of only 5.3 µg/L. Observed slight increases in the right areas Podul Ros' (6.8 µg/L) and Gradinari (7.6 µg/L) due most likely activities that disrupt the aquatic ecosystem of the banks.

A significant decrease is observed after taking water discharged from the city water purification station, due to dilution water (1.5 µg/L). Analysis of samples taken after the landfill site, indicate a slight increase in the concentration of copper (2.8 µg/L) due to pluvial and agricultural land water infiltrations in the area.

Variation of chromium along the rivers is shown in *Figure 2*.

Concentrations of chromium in Iasi at the entrance of the two rivers are: Nicolina 0.75 µg/L and Bahlui 0.68 µg/L. Maximum recorded next point Pod Metalurgie (0.95 µg/L) and the minimum is 0.34 µg/L after purification station.

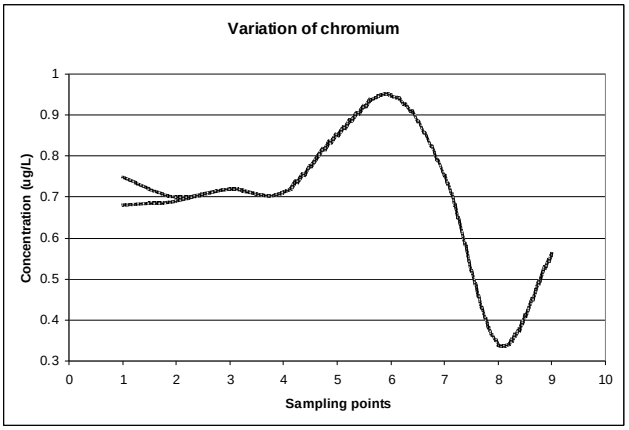

Figure 2 **Changes in concentrations of chromium in courses Nicolina and Bahlui rivers**

Lead Changes in rivers within the city of Iasi is shown in *Figure 3.*

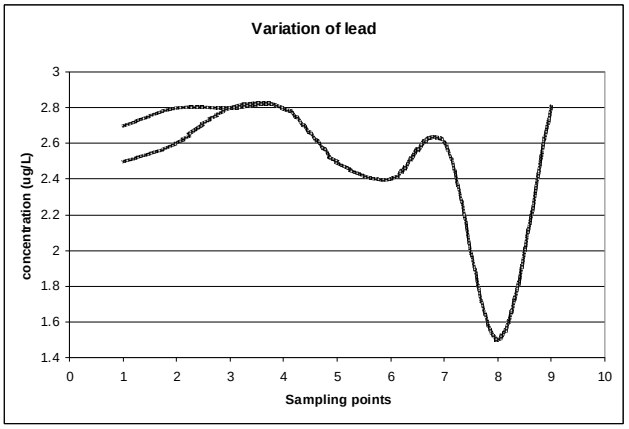

Figure 3 **Changes in the concentration of lead in river courses and Nicolina Bahlui**

Concentrations of lead in Iasi at the entrance of the two rivers are: Nicolina 2.7 µg/L and Bahlui 2.5 µg/L. The maximum recorded next Podul Ros' (2.8 µg/L) and the landfill site (2.8 µg/L) and the minimum value is 1.5 µg/L after purification station.

CONCLUSIONS

Nicolina river enter the Iasi territory with a greater concentration of metals than Bahlui river. Generally, increases in concentrations of metals in the right areas Podul Ros' and Podul Gradinari are most likely due to activities that disrupt the aquatic ecosystem of the river banks, and less likely urban and industrial activities.

A significant decrease is observed after taking water discharged from the city water purification station, due to dilution water. Analysis of samples taken after the landfill site, indicate a slight increase in metal concentration due to pluvial water infiltrations and agricultural land in the area.

Main sources of industrial pollution of the river and Nicolina Bahlui identified (industrial units Moldoforest SC SA Iasi, SC Fortus SA Iasi, halt the scum of SC Fortus SA, all companies in the industrial area of Iasi) have substantially restricted activity or were closed on the current economic crisis.

Following this study, we conclude that the urban area of Iasi do not significantly affect the quality of surface waters of the rivers studied indicators analyzed.

BIBLIOGRAPHY

1. Amigoni, F., Brandolini, A., 2006 - *Agencies for Perception in Environmental Monitoring*, IEEE Transaction on Instrumentation and Measurement, Vol. 55, No.4, pp. 1039-1050.
2. Angelescu, A., Ponoran, I., Ciobotaru, V., 1999 - *Mediul ambiant şi dezvoltarea durabilă*, Ed. A.S.E., Bucureşti.
3. Rojanschi, V., Bran, F., Diaconu, Gh., 1997 - *"Protecţia şi ingineria mediului"*, Ed.Economică, Bucureşti.
4. Vişan, S., Angelescu, A., Alpopi, C., 2000 - *"Mediul înconjurător-poluare şi protecţie"*, Ed.Economică, Bucureşti.
5. ***, 1980 - Administraţia Naţională Apelor Române - Cadastrul Apelor – Bucureşti.
6. ***, 1971 - Institutul de Meteorologie şi Hidrologie - *Rîurile României* – Bucureşti.