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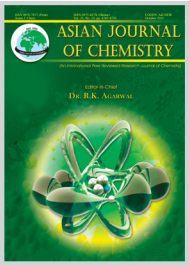

Physico-chemical and Bacteriological Water Quality Assessment to the Rivers Iber and Sitnica

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Investigation of the water pollution for the Iber and Sitnica rivers related to the heavy metals, some physico-chemical and bacteriological indicators is presented in this study. Application of analytical techniques, ICP-MS and ICP-OES, were used to determine levels of present chemical elements, including mercury. These techniques offer a more complete multi elementary analysis than other techniques related to the environmental studies. Multi elementary analysis of the samples by ICP-MS and ICP-OES was conducted in the laboratory "ACTLABS" in Ontario, Canada. Microbiological-bacteriological analyses are conducted in the Institute of Public Health, Prizreni Division. Geographical position of samples is determined by the geographic positioning system (GIS). The results show that environmental pollution of surface waters from the studied rivers is considered moderately high. Regarding to the microbiological contamination of the surface waters it depends on residential areas.

Key Words: Sitnica, Iber, Surface water, Physico-chemical parameters, Microbiological indication.

INTRODUCTION

The environmental pollution by heavy metals in the surface water of Iber and Sitnica rivers is the first time that is being to analyze. By applying ICP techniques the concentration of nine chemical elements, including mercury were determined. Due to the benefits, such as: lowlimit of detection for many elements, very good selection and high accuracy, the ICP (copulated plasmatic induction-mass spectroscopy) and ICP (copulated plasmatic induction-optical emitting spectroscopy), offer a multi-elementary analysis compared to other analytical techniques.

The multi-elementary analysis with ICP-MS and ICP-OES techniques was realized in the laboratory "ACTLABS" in Ontario, Canada. Microbiological-bacteriological analysis determined at the Institute of Public Health-Prizren branch. The geographical position of the demonstration location was determined by the geographical positioning system (GIS). Water commodity is very important to meet the needs in many vital activities as well it is crucial to the industry. On going development of industry continuously has used the natural resources by creating environmental problems, such as lack of potable water and other resources[1,2].

The water demands are increased continuously. WHO has alerted the stakeholders around the globe related to the shortening of water resources in many areas of the planet. Although the amount of water on earth is approximately the same, it is increasingly polluted[3]. Operating systems in some regions of natural water: rivers, lakes and seas, especially near large concentrations of urban and industrial areas are subject to pollution as a result of processing systems, lack adequate sewage, industrial emissions and waste disposal direct industrial natural water systems.

In Kosova, the main sources of industrial pollution have as a starting point of various industrial units *viz.*, trepça accumulator plant, fertilizer plant, ferronickel plant drenas, power plants Kosovo A and B in Obiliq. Many pollutants that in the main water arteries of Kosovo solid waste disposal, technical water, turn into a public landfill environment increasingly threatened. This problem requires to deal with this issue and have continued monitoring of water quality[4].

One of the prerequisites for successful study by the quality of the environment is organizing a special system of surveillance and alarm, to monitor the qualityof the water. There are several variants of monitoring, but we will stick to biological monitoring, which provides a tracking system state in the ecosystem through biological characteristics of those types of microorganisms that are sensitive to pollutants and serve as an indicator of environmental pollution.

The monitoring is based on the fact that living beings with the absence or presence of its or their behaviour indicate long-term action of toxic materials. Biological indication expresses the cumulative effect of pollution. This means that even without precise measurements, but due to qualitative and

TABLE-1
PHYSICO-CHEMICAL PARAMETERS OF WATER SAMPLES FROM SITNICA AND IBER RIVERS

Sampling site	Location	Water Temp. (ºC)	Elelect conductivity (μs cm^{-1})	pH	Alkalinyty (mA)	Alkalinyty (pA)	Total hardness (ºD)	γ(CO_3^{-2}) (mg dm^{-3})	γ(HCO_3^-) (mg dm^{-3})
S_1	Sitnicë (Lipjan)	14.7	11.31	7.36	53.52	0.25	13.8	2.3	340.30
S_2	Sitnicë (Fush- kosovë)	15.4	16.32	7.89	47.32	0.24	18.32	2.1	280.30
S_3	Sitnicë (Obiliq)	15.0	14.3	7.36	38.32	1.2	16.32	12.30	220.21
S_4	Sitnicë (Vushtrri)	16.0	13.32	7.65	32.30	1.3	14.12	15.02	212.52
F_1	Iber (Mitrovicë)	15.3	12.42	7.52	35.00	1.5	15.30	18.06	203.01

TABLE-2
MAXIMUM ALLOWED VALUES (MAV) FOR SOME ELEMENTS STANDARDS

Metal (ppm)	S_1	S_2	S_3	S_4	F_1	WHO Standard (mg/L)	EU Standard, 1998 (mg/L)	Metadata setting
Zn	143	618	133	162	2450	3.0	-	ICP-MS
Ni	195	339	254	140	121	0.02	0.02	ICP-MS
Mn	2309	3090	2060	1523	3220	0.5	0.05	ICP-MS
Pb	220	453	85.3	142	2163	0.01	0.01	ICP-MS
Cu	60.40	67.4	54.9	64.7	1693	2.0	2.0	ICP-MS
As	32.10	142	18.4	24.1	292	0.01	0.01	ICP-MS
Sb	2.42	5.33	1.27	1.39	41.8	0.005	0.005	ICP-MS
Cd	0.42	2.82	1.41	0.88	89.2	0.003	0.005	ICP-MS
Hg	2.02	3.64	3.04	1.43	21.2	0.001	0.001	ICP-MS

quantitative composition of living things can convincingly be proven a level of environmental pollution. As pollution bioindicators to the land are used some annelid, nematodes, arthropod species, related to microorganisms can be mentioned-agobacters species. Some of the good bio indicator air pollution are several types of lichens. The bio indicator water pollution can be used fish, rye cambered, worms, microorganisms, *etc.*[5,6].

In passive bio monitoring is investigated natural populations of organisms in the contaminated region. Active bio monitoring includes monitoring of exposure of bio indicators species in the contaminated region, *e.g.*, exposure jiggles with lichens, mice, snails, pigeons, *etc.*, in the courts of the TCA and TCB in Obiliq where exposed to a certain time. Treatment may also be done with any of the organisms present in the environment contaminative *in vitro*. The rat's intoxication and snails by Cd and Pb or their presence in raw foods the TCA and TCB is common in Kosovo 1 and Kosovo 2 power plants[2].

EXPERIMENTAL

Water samples from Sitnica and Iber rivers were taken during the summer (August 2010). Fig. 1 represents the sampling sites, while in the Table-1 are drawn characteristic locations where contamination is expected, such as: in the vicinity of industries, traffic, habitats *etc.*[5].

The water volume for each sample was 2 dm^3. Sampling sites' geographic position is set by GPS, Extrax model, "Garmin", 12 channels. The water temperatures are recorded as date and time of sampling. Samples were filtered with the letter "Selekcta" no. 589, (Germany) and subsequently evaluated the pH, electrical conductivity, alkalinity, hardness, the concentration of HCO_3^-, CO_3^{2-} (Table-1). During experimentation purity chemicals are used by manufacturers "Merck" and "Kemika". Water samples placed in plastic packaging (1 dm^3), are divided into packages of 100 cm^3 and then treated with 0.1 M HNO_3 to pH 1-2,[8-10]. Concentrations of elements were determined by ICP-MS technique (model "Per kin Elmer SCIEX ELAN 6100) (Table-2 and Fig. 2) and microbiological parameters are presented in Table-3 according to the previous report[10].

Fig. 1. Map of Kosovo hydrological major rivers

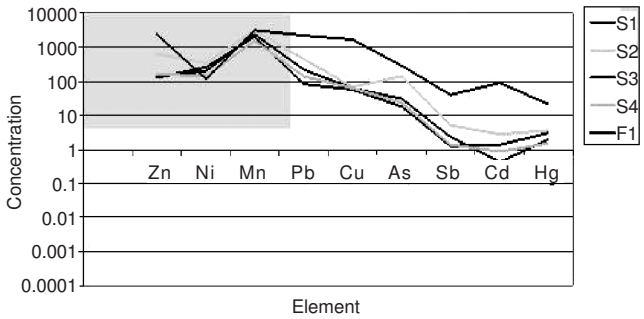

Fig. 2. Concentration of elements in the water of the river Iber in Sitnica and all Sampling sites

The rivers' water quality in certain segments of the criterion, "the amount of the chemical element" to the natural waters of rivers is used Norwegian standards (Table-4).

TABLE-3
AMOUNT OF *COLIFORM* BACTERIA, ANAEROBIC AND VIVID IN ALL SAMPLING SITES OF THE SITNICA AND IBER RIVERS

Examination bacteriology	General Numeric bacteria resultant *E. coli* to 100 cm^3	*Coliforme* bacteria with fecal archer prey 100 cm^3 (Cfu/cm^3)	General Numeric bacteria to Galle 1cm^3 net result Cfu/cm^3 at 37 °C	Anaerobic numeric sporogene sulfido-reduction in 100 cm^3 (Cfu/cm^3)	Fecal streptococci originating in 100 cm^3 (Cfu/cm^3)
Open Source Norms	10 – 100	0.00	300	10.0	0.00
S_1	0.00	0.00	0.00	0.00	0.00
S_2	>300	>300	>300	5.00	>300
S_3	>300	300	>300	10.0	300
S_4	>300	>300	>300	>25.0	>300
F_1	>300	>300	>300	>50.0	>300

TABLE-4
CLASSIFICATION OF RIVER WATER AND IBER AND SITNICA NORWEGIAN STANDARDS (µg/dm^3)

Metals	Class I	Class II	Class III	Class IV
Zn	<30	30-60	60-300	>300
			S_1, S_3,S_4	S_2, F_1
Cd	<0.2	0.2-0.5	0.5-1	>1
		S_1	S_4	S_2, F_1 S_3
Pb	<1	1-5	5-15	15 - 40
				S_1, S_2, S_3, S_4, F_1
Cu	<3	3-15	15-60	>60
			S_2	S_1, S_3, S_4, F_1

Since Kosovo does not have criteria and guidelines on the quality of surface and potable waters, we have taken as reference standards Norwegian estimate water quality. Iber river water samples related to the Zn, Cd, Pb and Cu levels is the extent in the Class IV. For Sitnica river water: Zn is classified according to Class II and III, regarding to Cd it belongs to Class IV, Pb in class in class III and Cu Class IV.

RESULTS AND DISCUSSION

The water analyses of the Iber and Sitnica rivers show increased levels related to the chemical and physical parameters, water conductivity and increased hardness of water.

Heavy metals in water of the Iber and Sitnica rivers determined by ICP-MS techniques showed increased levels. Large concentrations of heavy metals are present in the water.

The Zn concentration values range from 133-2450 ppm, for Pb the range was 85.3-2163 ppm, the Cu range of 54.9-1693 ppm, the Mn levels of 1523-3220 ppm, the Cd from 0.42-89.2 ppm, the Hg from 1.43-21.2 ppm, the As range 24.1-292 ppm.

The results from sampling site F1 give higher increased levels, which is obviously the main factor of the high presence of these metals that are connected in the form of various minerals in the Iber River, part of the Trepça area. The microbiological analysis-bacteriological results in high scales of pollution in Sitnica river flow S1. But water samples did not show the presence of bacteria.

Based on the results, we can conclude that the spring river bacterial load is zero. While in the analyzed samples: S1, S2, S3, S4 and F1 the *coliform* bacteria vary > 300 per 100 cm^3. The living cells bacteria in all the studied sites: S2, S3, S4 and F1 resulted > 300 Cfu/cm^3. The number of anaerobic bacteria ranges > 300 per 100 cm^3. The fecal streptococci bacteria in sites: S2, S3, S4 and F1 > 300 in 100 cm^3. In conclusion, the microbiological load of the Sitnica and Iber rivers must be considered high and the contamination sources come mainly from the urban wastewaters. Actually the urban wastewaters discharged to this ecosystem are not treated, because no wastewater treatment plant is constructed.

Conclusion

This research outcome aims to be notified to the scientific bodies and wider public with, regarding to the actual situation to the pollution of rivers' water mainly hydrographic network of Kosovo and measures to be undertaken in this regard. Ensuring of the quality and maintaining the water ecosystems can be achieved through the: prevention, control and reduction of water dischargers. Emergency steps that need to implement is early investments in wastewater plants, treatment of the industrial wastewater. In present study, it is verified that the polluted water basins are mainly conditioned by the presence industries.

The seizure of the industrial and urban wastewaters into the Iber and Sitnica rivers is required with immediate effect. One controlled release of technical gases and waters from the power plants in Kosovo in surface waters and finally applying of the seasonal regimes, by controlling the extreme situations with environmental pollution outcomes.

REFERENCES

1. S.G. Misra and D. Mani, Pollution soil, Efficient Offset Printers, ABC, New Delhi, India, edn. 1st, pp. 6-42 (1991).
2. Ministry of Environment and Spatial Planning. Kosovo State of the Environment Report, pp. 21-24 (2003).
3. B. Lester, *State of the World*, **7**, 18 (2001).
4. D. Rozaje and M. Jablanovic, Pollution and Environmental Protection, University of Kosovo in Pristina, Faculty of Natural and Mathematical Sciences, Institute of texts and learning tools, Pristina, pp. 182-186 (1983).
5. Environmental state of same rivers of Albanian Adriatic Lowland, A. Miho, A. Cullaj, A. Hasko, P. Lazo, L. Kupe, R. Bachofen, H. Brandl, F. Schanz and B. Baraj, Tirana, Albania. p. 335 (2005).
6. M. Voiculsecu, N. Kochkov, N. Akhmatova and N. Weinmeister, *J. Environ. Protect. Ecol.,* **12**, 16 (2011).
7. A. Çullaj, Environmental Chemistry, Tirana, Albania (2005).
8. B. Korça, Chemical Analysis of Water, Donation MASHTK and Östreich, Pristina, pp. 71-121 (2003); R. Thomas, Beginner's Guide to ICP-MS. Parts I-XI. URL http:/www.spectroscopyma.
9. L. Clesceri, A. Grenberg and A. Eaton, Standard Methods for the Examination of Water and Wastewater, Washington DC, USA, edn. 20, pp. 4-129-4-139 (1998).
10. N. Kuzmanov and A. Tomov, *J. Environ. Protect. Ecol.*, **1**, 324 (2000).