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Water Quality Analysis, the Content of Minerals and Heavy Metals in the Drin I Bardh and Iber River

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ABSTRACT

Water resources management in Kosovo faces many problems such as economic, legal, lack of experts in the field of environment, and various factors for the management of water basins. The study is a special feature for presenting the current, important, situation of water resources in Kosovo. The results of the research show the current state of the rivers, especially the two largest basins such as the river Drin I Bardh and Iber. Water management is of particular importance for the health of flora and fauna. Drinking water quality monitoring, to be analyzed with compliance over 95%, compliance with microbiological water quality standards, and 97.0% with international chemical standards. Assessing the quality of rivers is finding the solution to the problem of water treatment to fully meet the needs of aquatic ecosystems. Determination of physico-chemical parameters such as: (pH, TDS, TH, EC, etc.), are necessary for water quality analysis. Water quality depends on the management of industrial waste, especially heavy metals such as (Pb, Hg, As, Zn, Fe, etc.), determination of parameters of other elements such as: (Na, K, Mg, Ca, etc.), indicate the hardness of the water. The study included different methodologies: qualitative, quantitative analysis, and statistics.

Keywords: water, ponds, environment, quality, and parameters.

INTRODUCTION

Water resources are important for all life processes. People need to be careful about conserving water resources (Ahmadpour et al. 2012). Maintaining the water quality of rivers, lakes, or basins in general, is recently deteriorating due to increased demand for goods (Jobbágy et al. 2017).

Sources of water pollution in reducing its quality are the result of the discharge of wastewater without prior treatment. Managing and protecting water quality requires rational use, not causing damage to natural ecosystems, which are necessary for our future generations (Dreshaj et al. 2022).

Water basins are more polluted as a result of wastewater discharge, industrial, urban runoff, mining activities, pollution from agriculture (Pesticides and Herbicides, Moraru et al. 2012).

Over 70% of freshwater is used in agriculture, 20% is used by industry and 10% is used by municipal bodies (Chai et al. 2020). The loss of water quality comes as a result of poor waste management causes water pollution known as "eutrophic" as a consequence of deteriorating (reduced), the amount of oxygen dissolved in water. Lack of oxygen in the water develops the anaerobic process, as a result of the release of H2S, NH3, and other gases (Kicińska et al. 2018). Algal blooms have a negative impact on aquatic systems, declining fish species, and a negative impact on human health (Łukowski et al. 2017). The presence of the element phosphorus in water limits the development of the process of photosynthesis, the source of pollution is the discharge of water with phosphate content (Bartkowska et al. 2015). The process continues with absorption by algae as a result they wither and insoluble compounds are formed with ions such as (Al_3^+, Ca_2^+, Fe_2^+, Fe_3^+) (Stefanowicz et al. 2014). Decomposition of organic matter which contains nitrogen, NH_4^+ ammonia is formed, assimilation is done by algae were as a result of microbial oxidation to NO_3 (Taszakowski et al. 2016).

METHODOLOGY

The study continues in sampling in the two rivers analyzed. These two ponds are the largest in the region. Conservation and monitoring of water quality also affects the economic development of the region. Agricultural development depends on the quality of water used for beverages, agriculture, and industrial development. Water quality analysis in these two riverside assigned sampling points. In the sampling sites, several measurements were performed, such as the measurement of temp. tthenwater, electrical conductivity, etc. After canning the samples were sent to the laboratory for analysis of heavy metals. Water hardness comes as a result of the presence of calcium and magnesium salts. Calcium and magnesium bicarbonates in water present instantaneous hardness, the presence of chlorides, phosphates, nitrates, and sulfates indicate the permanent hardness of the water.

Determination of calcium and magnesium was done by the EDTA method. Heavy metals are determined by analytical techniques: Inductively coupled plasma atomic emission spectroscopy (ICP-AES). The Ibar basin has major environmental impacts due to the mining activities "Trepça" Mitrovica.

RESULTS AND DISCUSSIONS

The solution of river sites for the analysis of water quality is done where it is thought that there are environmental impacts, the Drini I Bardh basin region is used for the cultivation of agricultural crops. The use of herbicides and pesticides in agriculture, poor management of urban and industrial waste increase the impact on the water quality of the Iber Basin. The Iber Basin region is notable for its sweet potato cultivation. Eight sampling sites have been set up in two rivers (Figure 1).

In some cases, the results show exceeding the concentration of physico-chemical parameters by international standards such as pH, electrical conductivity, amount of minerals and some heavy metals as a result of agricultural, urban, and industrial activities (Table 1, Figure 2).

The amount of minerals in the water is useful e.g. magnesium has a role in the protection of kidneys, muscular system, calcium plays a functional role in the dental system, bicarbonates have a positive role in energy assimilation (Table 2, Figure 3).

Aqueous systems contain metal sulfides which are oxidized to sulfates or to sulfate ions which are present in water. Sodium sulfate is highly soluble in water as a result of the benefit of sodium sulfate. The same process takes place for nitrates and phosphates (Table 3, 4, Figure 4, 5).

Water hardness is the result of digestion of alkaline earth salts which are important which are estimated in mg. The analyzed results are Summer and Winter (Table 5).

Calcium and sodium are quite abundant in water, their salts are soluble in water and give water hardness. Plants absorb sodium and through these water systems reach the animal world. Magnesium is dissolved in water and transported through aquatic systems to animal cells, the

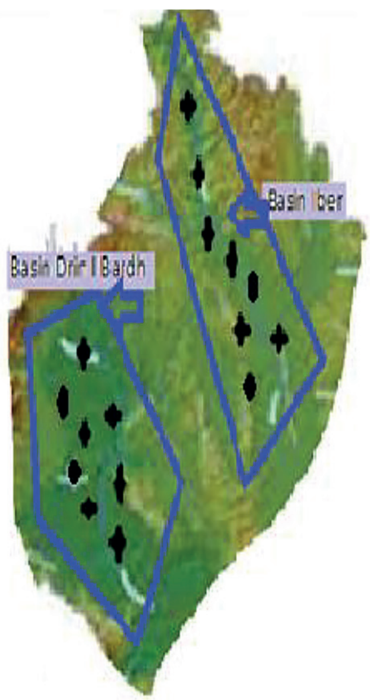

Figure 1. Sampling locations

Table 1. Results of physico-chemical analysis of Iber River water (Summer)

No	pH	TH (mg/l)	TDS (mg/l)	Cl (mg/l)	SO4 (mg/l)	N (mg/l)	F (mg/l)	Na (mg/l)	K (mg/l)	EC (µS/cm)
N1	7.71	245	1023	272	574	61	1.4	213	22.3	1942
N2	7.31	352	1013	279	582	58	1.8	218	27.4	2014
N3	8.11	251	1281	261	634	73	1.8	233	27.8	1384
N4	8.12	621	2251	538	668	64	1.7	274	27.1	2649
N5	8.25	510	2385	529	715	58	2.1	321	30.2	2728
N6	8.15	511	2051	461	644	67	1.6	275	26.3.	2416
N7	7.88	476	1852	472	654	60	1.3	264	20.1	2011
N8	7.51	473	1741	378	581	57	1.2	210	18.4	1642

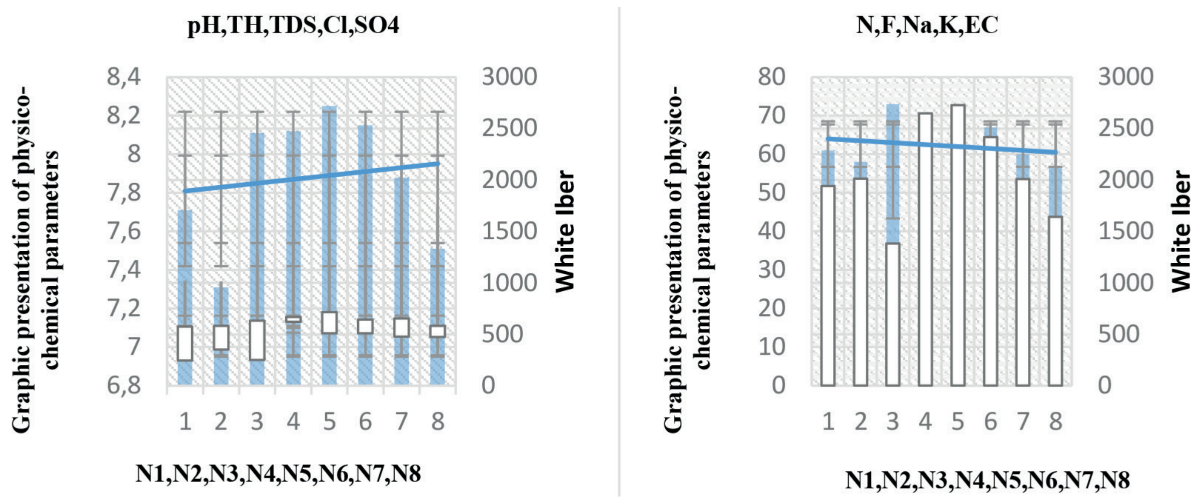

Figure 2. Graphic representation of physico-chemical parameters of the Iber river water

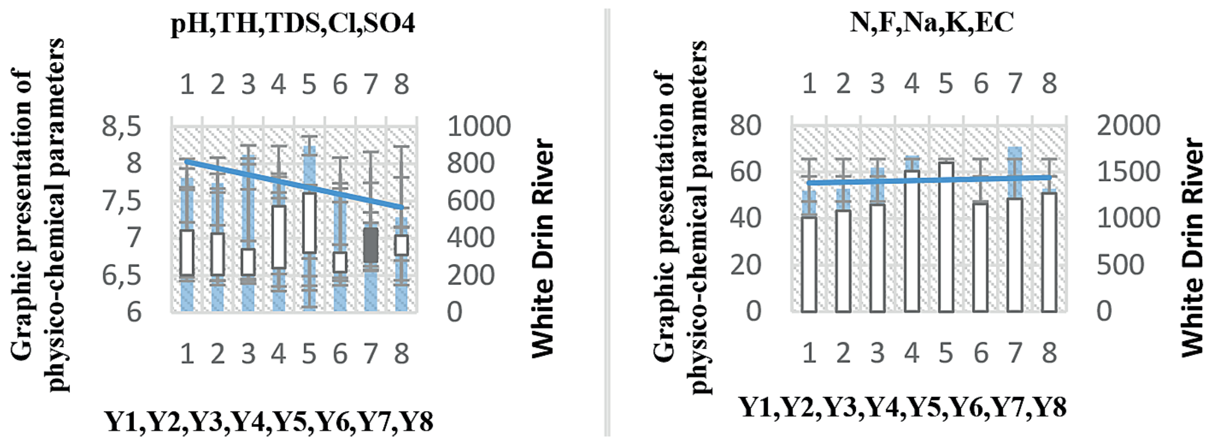

Figure 3. Graphic presentation of physico-chemical parameters of the White Drin River water

Table 2. Results of physico-chemical analysis of the Drin I Bardh river water (Summer)

	pH	TH (mg/l)	TDS (mg/l)	Cl (mg/l)	SO4 (mg/l)	N (mg/l)	F (mg/l)	Na (mg/l)	K (mg/l)	EC (µS/cm)
Y1	7.81	201	743	201	441	52	0.8	174	10.2	1012
Y2	7.74	202	749	161	425	53	0.9	189	13.1	1082
Y3	8.12	203	745	169	341	62	1.1	190	21.2	1147
Y4	7.74	239	812	128	571	67	1.6	210	15.2	1512
Y5	8.24	322	113	132	641	49	1.1	236	16.3	1601
Y6	7.61	218	750	159	321	45	2.2	177	11.4	1156
Y7	7.22	451	780	237	274	71	1.5	154	7.71	1212
Y8	7.28	311	810	161	413	53	0.4	165	9.23	1271

Table 3. Results of physico-chemical analysis of the waters of the Iber River (Winter)

No	pH	Turb.	TDS	Ca2+	Mg2+	SO42-	HCO3-	Al3+	NO3-	PO43-
K1	7.71	473.1	119	23.32	0.75	35.5	91.91	136.6	48.51	3.34
K2	7.79	9.612	123	53.41	0.59	2.23	27.33	19.52	67.11	2.46
K3	7.51	0.412	234	84.83	0.88	3.11	215.1	276.94	29.26	2.61
K4	7.73	44.76	114	38.29	0.72	2.32	136.2	183.77	38.66	3.52
K5	8.33	3.133	379	63.72	0.61	1.13	43.23	115.2	72.62	2.65
K6	8.45	2.242	111	97.81	0.69	1.18	282.1	124.44	45.95	2.84

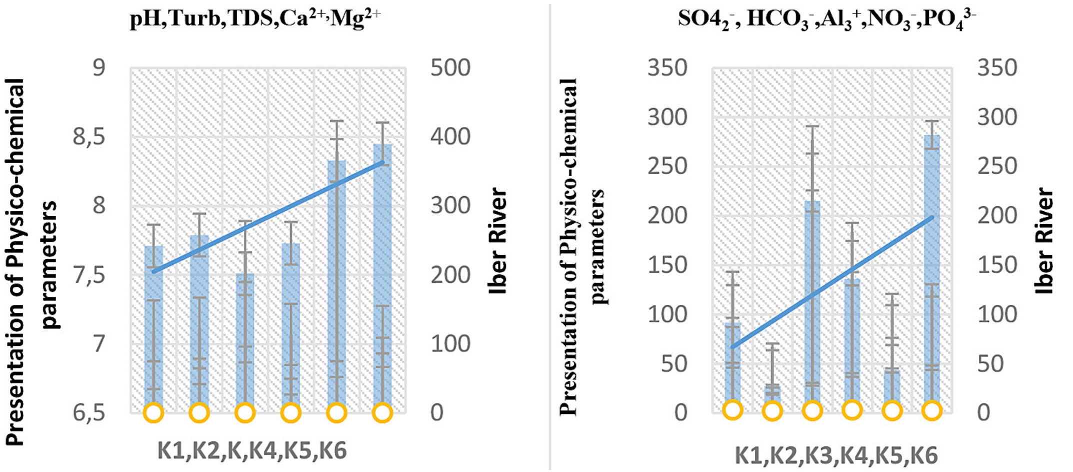

Figure 4. Graphic presentation of Physico-chemical parameters of the Iber River water

Table 4. Results of physico-chemical analysis of the waters of the river Drin I Bardh (Winter)

No	Turb.	pH	TDS	Ca2+	Mg2+	SO42-	HCO3-	Al3+	NO3-	PO43-
E1	806.5	7.43	114	325.5	46.72	0.54	0.90	0.061	0.45	0.354
E2	13.45	7.75	145	13.86	4.212	0.16	0.52	0.052	0.04	0.235
E3	11.12	7.51	212	234.1	65.14	0.29	0.51	2.194	0.01	0.401
E4	2.952	8.73	111	133.2	21.73	0.27	1.95	1.177	0.02	0.438
E5	5.354	8.69	372	82.52	22.32	0.38	0.15	1.159	0.05	1.145
E6	1.754	8.48	119	139.72	41.32	0.56	0.05	0.144	0.02	1.108

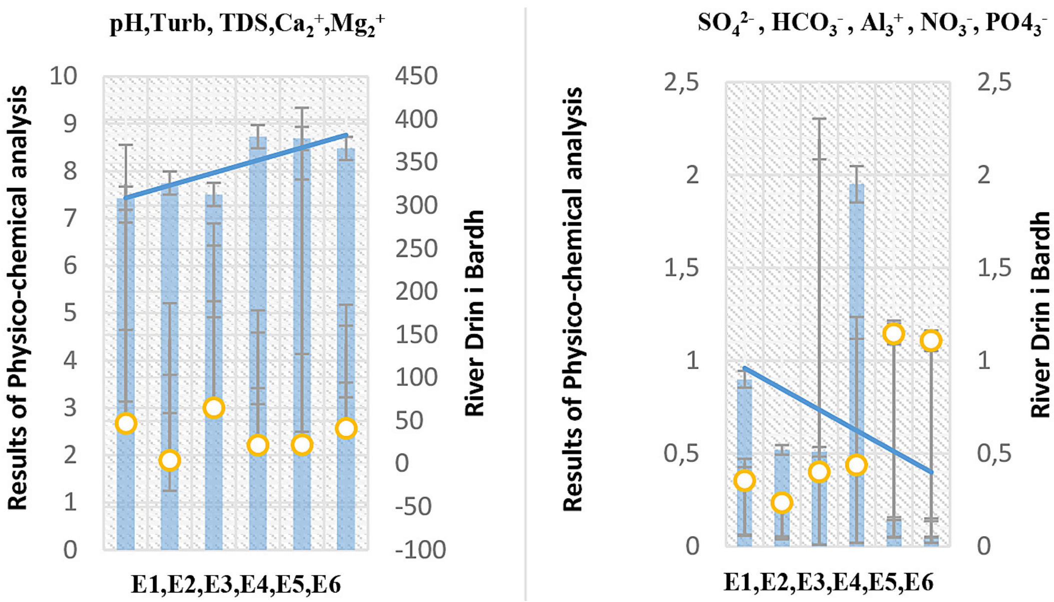

Figure 5. Graphic presentation of physico-chemical parameters of the Drin I Bardh River water

Table 5. Results of the analysis, content of calcium, magnesium, sodium, and potassium in the water of the Iber River and the White Drin

	Iber		Drin I Bardh	
	Summer	Winter	Summer	Winter
Calcium	36.23	41.11	19.44	10.66
	35.61	31.35	18.16	10.83
	33.37	22.35	24.89	12.01
Magnesium	25.22	1.561	11.51	5.223
	23.34	2.233	8.724	6.661
	24.16	8.861	12.12	8.331
Sodium	34.16	24.64	24.34	12.011
	33.37	31.38	22.23	13.66
	29.32	26.62	21.31	17.61
Potassium	3.231	3.021	2.612	2.126
	2.211	3.612	2.851	1.262
	3.013	2.234	2.344	2.361

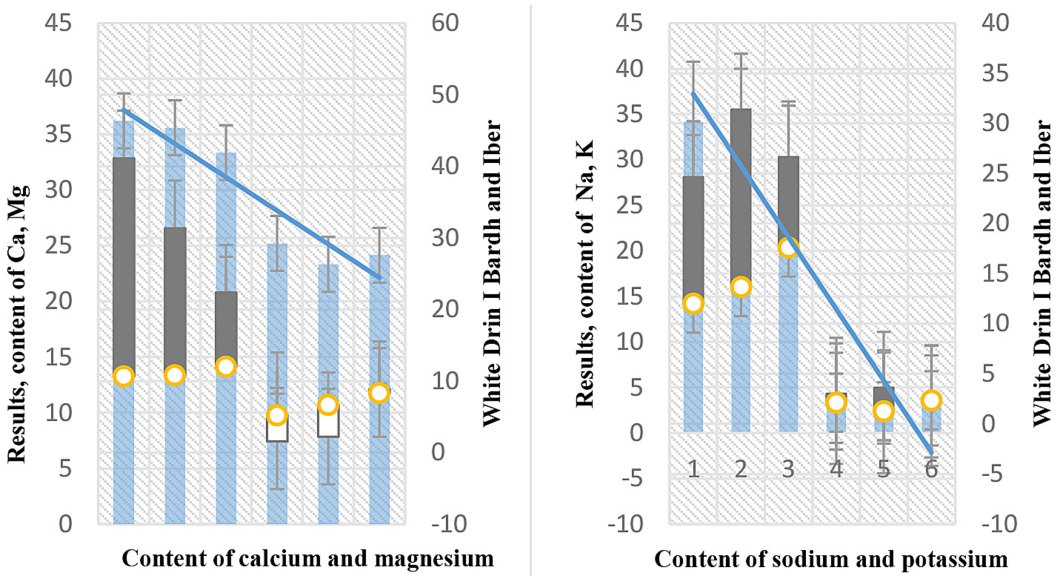

Figure 6. Graphic presentation, the content of calcium, magnesium, sodium and potassium in the water of the Iber River and the White Drin

values of minerals in water are presented in Tables 4, 5, and Figure 6.

Mercury is found in nature, its amount is increased by mining and urban activities, the amount above international parameters is toxic, and is easily obtained by animals. It happens in certain cases that the amount of mercury exceeds 500% above the allowed norms as a result of the combustion of solid fuels such as the process of electricity generation, incineration of urban waste, etc., the presentation of Hg values (Table 6, Figure 7).

Table 6. Concentration Hg, in Iber and Drin I Bardh river water samples (mg/L)

Sampling Sites	Hg (mg/L) / Iber		Hg (mg/L) / Drin I Bardh	
	Summer	Winter	Summer	Winter
1	0.321	0.171	0.137	0.108
2	0.291	0.194	0.040	0.096
3	0.498	0.259	0.132	0.116

Poor waste management, emissions from vehicles, industrial development, increase the concentration of lead in the environment. Lead has a negative role in nature for both flora and fauna. Lead from the 80s, used for welding or joining copper pipes used for water pipes. The amount of lead in the environment is also increased by the fumes that are released into the air and then very easily pass into water systems, Pb values are presented in point (Table 7, Figure 8).

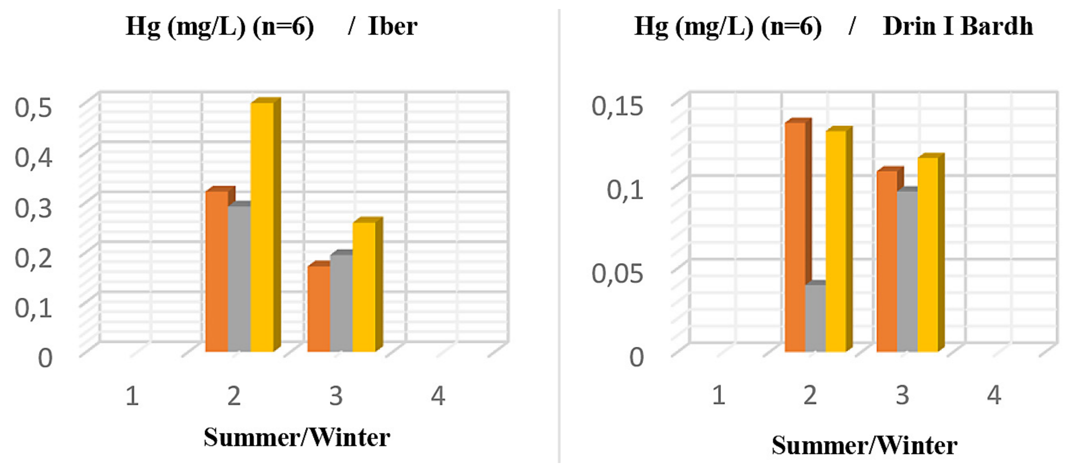

Figure 7. Graphic representation of Hg concentration in Iber and Drin I Bardh river water samples

Table 7. Concentration Pb, in Iber and Drin I Bardh river water samples (mg/L)

Sampling Sites	Pb (mg/L) / Iber		Pb (mg/L) / Drin i Bardh	
	Summer	Winter	Summer	Winter
1	0.295	0.124	0.022	0.025
2	0.272	0.121	0.031	0.031
3	0.219	0.129	0.034	0.022

Table 8. Fluoride concentration in Iber and Drin I Bardh river water samples (mg /L)

Sampling Sites	Fluoride (mg/L) / Iber		Fluoride (mg/L) / Drin I Bardh	
	Summer	Winter	Summer	Winter
1	0.23	0.22	0.19	0.12
2	0.29	0.32	0.11	0.17
3	0.19	0.18	0.22	0.12

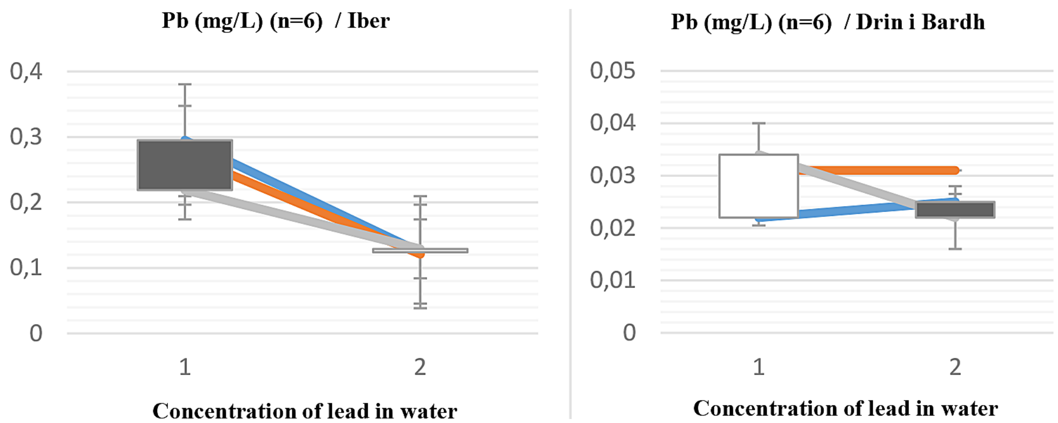

Figure 8. Graphic representation of Pb concentration in Iber and Drin I Bardh river water samples

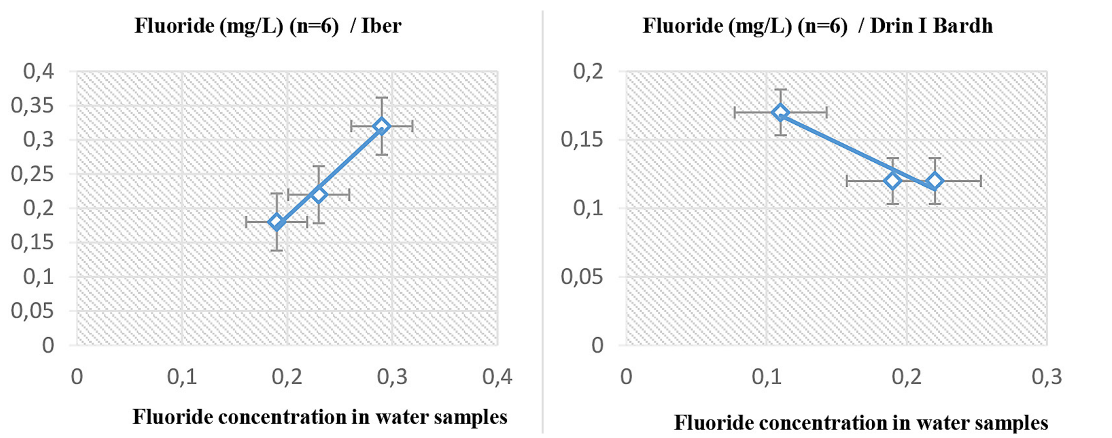

Figure 9. Graphical representation of Fluoride concentration in Iber and Drin I Bardh river water samples

Water systems contain fluoride in water, depending on atmospheric conditions, soil geological mining activity, and poor management of municipal waste, which increases the amount of fluoride in water systems. The amount of fluoride in water should be 7 mg/L, higher values in water are harmful to animal health (Table 8, Figure 9).

CONCLUSIONS

Water basins are constantly polluted due to poor waste management. The purpose of this study was to obtain qualitative analytical results to analyze the concentration of heavy elements in the water. The results of physico-chemical analyzes show in some cases a slight decrease in pH, in some samples in the Ibar basin river, due to the influence of free metal ions in water.

The value of chlorides and sulfates in the Iber River is higher in relation to the White Drin (chloride 71 mg/L, sulfate 133 mg/L. Analytical results also show changes in sampling periods and seasons. The value of calcium in winter in the Iber River is smaller compared to the value of calcium in the Drin I Bardh River for 302.2 mg/L. The value of magnesium in the Iber River is very high in winter 8836 mg/L in comparison with the water of the Drini I Bardh River 8318, mg/L. Potassium in these two water basins has a value of 2.77 mg/L.

Kosovo state institutions should have priority in preserving water quality, strict monitoring, implementation of environmental legislation, awareness of citizens about the harmful effects on the environment, affects the preservation of water systems. Economic development of industry, agriculture depends heavily on the storage and use of water for agricultural activities. The high presence of heavy metals such as lead, zinc, cadmium, arsenic in aquatic ecosystems negatively affects agricultural crops. The average values in the international parameters of chlorides, sulfates, nitrates, etc., show the hardness and quality of water in these rivers, it is mostly used for irrigation of agricultural products.

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