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THE IMPACT OF URBAN AND INDUSTRIAL ACTIVITY IN THE POLLUTION OF SHKUMBINI RIVER

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Abstract - Demographic movements and increased industrial activity in the Elbasan area have affected the water quality of the Shkumbin River. River water pollution can be natural, as a result of the erosion of the soil formations that make up its catchment basin, but also of anthropogenic activity related to life and industrial activity.

In the study area, we have the urban influence on the pollution of the river, which is caused by the city of Elbasan, and the industrial one, which is caused by the activity of a large number of industrial activities.

Shkumbin River is one of the most important rivers in Albania. Its waters are widely used for the irrigation of the field of Elbasani and a part of Myzeqeja field. But it is also used for fishing and for various reasons.

Considering these facts, the study of river water pollution and the determination of the sources of its pollution assume great importance. In this paper, an assessment of the urban and industrial impact on river water pollution is made. Water quality monitoring of Shkumbini river water, was carried out based on the investigation of ten physical - chemical parameters: pH. EC, T, DO, TDS, salinity, nitrite, nitrate, ammonia, and PO_4^{3-}, in three water samples taken at three stations.

The water quality assessment is based on: NIVA classification and the European Community directive on "quality of fresh waters supporting fish life".

Key Words - Water Quality. Irrigation, Physical - Chemical Parameters, Anthropogenic Impact.

I. INTRODUCTION

Albania is a Mediterranean country with numerous water sources, which are represented by several important rivers, but also by lakes, reservoirs, etc.

Water has become essential for the development of industries and agriculture [1] and is absolutely essential not only for the survival of human beings but also for animals, plants and all other living things [2]

River flows are the main sources of fresh water. In addition to urban and industrial use, the demand for water is increasing in terms of personal hygiene, irrigation in agriculture, use in livestock, energy, for cooling in thermal energy and industry, as well as for fishing, navigation, etc.[3].

Industrial development and modern civilization have led to the formation of large inhabited areas, with intensively developed industry and agriculture. This caused the increase of water discharges without any preliminary treatment, beyond the possibility of self-purification of waters.

The intensive development of agriculture, as well as the large-scale use of pesticides, nitrogenous fertilizers, as well as waste from organic farms, are important pollutants of surface waters. Agricultural activities will contaminate the water with nitrates, phosphorus, pesticides, soil sediments, salts and pathogens [4].

Water quality parameters are divided into three categories; physical parameters, chemical parameters and biological parameters [5]. Some of the physicochemical parameters include

II. MATERIALS AND METHODS

Study area: The Shkumbin River is one of the important rivers is located in central Albania, crossing it from the east, the mountain of Valamare where it originates, to the west, flowing into the Adriatic Sea. The surface of the catchment basin of this river is 2445 km2, the average height of the basin is 753.2m, its length is 181.4km. About 60% of the annual flow of the river is surface water and only 40% is underground water. It follows that the effects of erosion play an important role in river pollution.

Urban pollution is related to the discharge of raw water from the cities of Librazhd, Elbasan, Peqin and Rrogozhine. Urban waste dumps near the river bed also have an impact.

Industrial pollution occurs as a result of industrial activity and the discharge of industrial waste without being treated beforehand in the river.

The study area includes a part of the Shkumbin river where it is considered to be highly polluted. The length of the river in the study area is 10 km, between Labinot (in the east) and Jagodina (in the west). Analyzing the physico-chemical parameters in three stations of the area (figure), we judge the contribution of urban and industrial activity in the waters of the Shkumbin River.

Table 1. Geographical position of the stations

No	Station	Latitude (φ)	Longitude (λ)
1	Labinot	41.14769	20.16605
2	Topçias	41.08471	20.05869
3	Jagodine	41.06942	20.01343

Most of the area is a plain area, with numerous agricultural and livestock farms.

Also, two small rivers that flow into the Shkumbin river are Kusha and Zaranika, which in the rainy season are very floodable and due to the clay formations they pass through, they bring a large amount of mainly clay sediments.

temperature, electrical conductivity (EC), total dissolved solids (TDS), pH, dissolved oxygen (DO), nitrates, nitrites, phosphates. Even in our study, these parameters were taken into consideration.

The sampling stations are shown in figure 1. Labinot station is located far from the influence of urban and industrial pollution, station 2 has the influence of urban pollution and is located at the exit of the city of Elbasan.

Fig 1. Location of the stations

This station gives the effect of two large discharges of raw water in Bejrelbe and Ura e Shkumbini. It should be noted that rainwater and sewage, due to the lack of a separate network for each, mix with each other, adding to urban pollution and other pollution such as road pollution or accidental discharges into the environment. Station 3 Jagodine is located behind the metallurgical plant and this station also provides information on the contribution of industrial pollution to the river waters.

Sampling: 1.5 liters PET bottles are used for water sample analysis. The samples were transported to the lab within the same day using cooling boxes to keep the temperature of +4°C. The samples were stored under standard conditions till the analysis. Temperature, pH, conductivity (CE), dissolved solids (TDS), salinity and dissolved oxygen (DO) was measured directly with camera multimeter Hach (Sension 156). The concentration of nutrients (NO_2^-, NO_3^-, NH_4^+, PO_4^{3-}) was performed with UV–VIS spectrophotometer PYE UNICAM SP6 - 550, respectively at 543nm, 220 - 270nm, 630nmand 880nm.

All phyzical – chemical parameters were analyzed in the Laboratory of the Depatment of Chemistry of University of Elbasan.

III. RESULTS

The conclusions of the analyzes carried out on the water samples are presented in table 2. To have an accurate reflection on the results, they are also reflected in fig 2, fig 3, fig 4 and fig 5. From the figures we understand how the parameters change between stations.

Table 2. Values of measured parameters.

Parameters	St 1	St 2	St 3
	Labinot	Topçias	Jagodine
T ^{0}C	19.6	20.4	20.7
pH	7.74	7.79	8.13
DO mg/L	9.2	8.4	8.3
Salinity mg/L	0.057	0.064	0.091
TDSmg/L	140.8	148.4	168.6
NH_4^+ mg/L	0.29	0.41	1.32
NO_2^- mg/L	0.031	0.034	0.014
NO_3^- mg/L	1.8	1.2	1.6
PO_4^{3-} mg/L	0.06	0.42	0.48
EC µS/cm	281	280	336

Table 3. Descriptive Statistics of the data obtained.

Variable	Mean	Stan Dev	Co Var	Min	Med	Max
pH	7,89	0.21	2.69	7.74	7.79	8.10
DO	8.63	0.49	5.71	8.30	8.40	9.20
Salin	0.07	0.02	25.4	0.06	0.06	0.09
TDS	153	14.4	9.42	141	148	169
NH_4^+	0.67	0.56	83.7	0.29	0.41	1.32
NO_2^-	0.03	0.01	41.0	0.01	0.03	0.03
NO_3^-	1.53	0.31	20.0	1.20	1.60	1.80
PO_4^{3-}	0.32	0.23	71.0	0.06	0.42	0.48
EC	299	32.0	10.7	280	281	336

From the analysis of the statistical processing data, it can be seen that the parameters NH4, NO2, NO3, PO4 have the highest variance. which are also the main causes of pollution and these pollutions come mainly as a result of urban and agricultural and livestock activity.

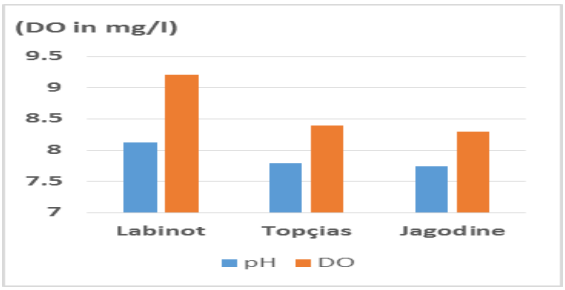


Fig 3. Graphic presentation of EC, TDS values.

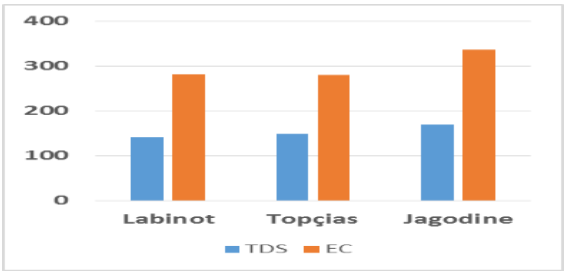


Fig 4. Graphic presentation of salinity, NO_2^- values.

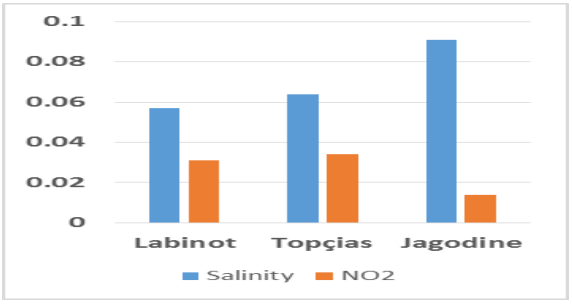
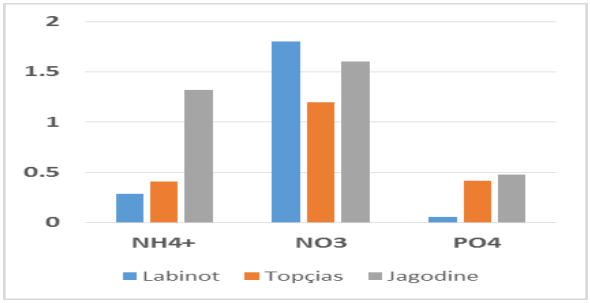


Fig5.Graphic presentation of NH_4^+ NO_3^- PO_4^{3-} values.



IV. DISCUSSION

As can be seen from Fig. 2, the pH and DO values decrease after passing St 1 to St 2 and St 3. The high

pH value in St 1 comes as a result of the dissolution of carbonate rocks, which are the main geological formations of the Shkumbin river watershed. While the increase in the other two stations is related to urban discharges but more to industrial ones (value 8.31 in St 3). The DO values decrease passing St 1 to St 2 and St 3, this is due to urban pollution which causes a decrease in the amount of DO, due to the oxidation reactions of nitrogen and phosphorus that come into the river from the discharge of raw water from the city. From fig 3 we have the graphs of EC and TDS, two parameters which together with salinity are increasing. At station 1, which is far from the city, the water is almost free of pollution. Pollution comes to station 2 from two discharges of black water from the city of Elbasan, but also from the surrounding villages. The study area has a population of 200,000 inhabitants and the water used by them is discharged into the raw river. this leads to increase in TDS. The increased values of TDS are related to the industrial activity of the metallurgical combine, from the use of water in the steel plating processes, but also from the activity of the two plastic recycling factories that operate in the area. The water used for washing the collected plastic materials. Plastics collected as waste in the city are cleaned by washing food or solid waste, and the water used for washing them is discharged into the river without prior treatment. While in fig 4 and 5, we have an increase in the content of nitrites, nitrates, ammonia and phosphates. The high content of nitrogen compounds is related to the discharge of cleaning water from livestock farms, which are the majority in the area. The origin of phosphates is related to city water discharges (soaps and different detergents used) but also from the use of phosphate fertilizers by farmers.

Table 4. Parameter values for drinking water according to WHO and classification according to NIVA(Norwegian Institute for Water Research) [5].

Parameters	Units	WHO	NIVA sclassification				
			I	II	III	IV	V
PH		6.0-8.5	6.0-8.5	6.0-8.5	6.0-8.5	5.5-9.0	<5.5 ->9.0
Conductivity	(µS/cm)	400	200	300	400	-500	-600
DO	(mg/L)	5-7	>7	>6	>5	>3	<3
TDS (mg/L)	(mg/L)	500-1000	<300	<500	<800	<1200	<1200
Chloride	(mg/L)	250	<50	<200	<300	<400	>400
Nitrate	(mg/L)	< 50	<1	<3.4	<7	<11	>11
Nitrite	(µg/L)	3	<2	<5	<20	<50	>50

V. CONCLUSION

By comparing the values of the physico-chemical parameters with those according to the NIVA classification, we find that the water of the Shkumbin River is slightly to moderately polluted, so it is suitable for irrigation but also for other purposes. The establishment of city water treatment plants and the treatment of water from industrial entities before discharge into the river will contribute to the improvement of the physico-chemical parameters, that is, to the reduction of pollution.

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