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Comparison of physic-chemical parameters of urban and industrial water discharges in the Lumbardh River

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Abstract. The purpose of this project is to assess the dynamics of pollution of the Lumbardh River from urban and industrial discharge water at intervals between April and September 2020. Urban discharge water and especially in the food production industries are one of the main surface water pollutants. The growth of inhabited centers and their industrialization has been associated with increased pollution in aquatic environments, discharge of urban, agricultural, and industrial liquid waste without any prior treatment are the main source of surface water pollution in our country. Rivers today have become collectors of all urban and industrial discharges. Controlling the degree of pollution and identifying the main pollutants that are caused is of particular importance for recognizing the situation and taking measures to protect or rehabilitate aquatic environments, and protect public health. April and September 2020 were taken as points of assessment of the physicochemical event in our work and the location of the source of Lumbardh L1 Prevallë was analyzed, then we have the monitoring point L_2, Sredska and L3, urban, food industrial area, and point L4 in Vlashnje. We have analyzed some physicochemical parameters such as Concentrations of total suspended materials, Chemical need for oxygen, Biochemical need for oxygen, and Total organic carbon. In this project, the evaluation is made of the above-mentioned parameters where it explains that from the results obtained from the analysis which were done at the Hydrometeorological Institute in Prishtina it presents that we have significant pollution of the river Lumbardh in these intervals and especially in September from these pollutants and in our opinion this comes as a result of minimizing surface water inflows.

Keywords: SDM (Suspended Dissolved Materials), CNO (Chemical Need for Oxygen), NBO5 (Biological Need for Oxygen), TOC (Total Organic Carbon)

1 Introduction

Prizren is a city in the southwestern part of Kosovo and the second largest in Kosovo in terms of size and population after Pristina.The city has a population of about 170,000, mostly Albanians.It is located near the Sharr Mountains in southern Kosovo. The Lumbardh River originates in the Sharr Mountains and flows into the White Drin (Drini i Bardhë) with a length of 35 km. It runs through several rural settlements and in the middle of the city of Prizren. In our city we already have installed collectors of urban and industrial wastewater which discharge their water into the wastewater plant where they are already treated with chemical and biological methods which is one of the largest investments that it is still in the testing phase but it should be noted that not all of the city is connected to the collector network and still half of the city discharges urban and industrial wastewater into the river without any prior treatment.

Urban and industrial food discharge water is created due to its use in households in technological processes, heating, cooling for hygienic purposes, washing from the process of production, processing, packaging, transport, which create waste of different quality and quantity and if not treated can lead to increased drainage and severe surface water pollution problems. Unlike municipal wastewater, the composition of which is known, discharge water from different industries e.g. It is difficult to know the composition of dairy products such as milk, ketchup, mayonnaise, canning vegetables and laundromats, from the great variety of pollutants.

The purpose of water quality control of the Lumbardh River from urban and industrial discharge waters is the assessment of water quality even after halved investments related to water treatment in our city. Based on this and the fact that water quality is an essential element for calculating the balance of physico - chemical parameters, water quality measurements in these specific conditions, are a much needed commitment.

2 Materials and methods

Analysis of physico-chemical parameters have been done at the Hydrometeorological Institute in Prishtina, in order to assess as realistically as possible the current state of the Lumbardh River, taking into account this research has been done at four locations, sampling sites: under one Lumbardh Source - Prevalla (L1); the second sampling site Sredska L2 and the urban, industrial area L3 and the fourth sampling site before the Lumbardh discharge in White Drin (Drini i Bardhë), Vlashnje which we have marked with L4. So during the research we monitored the

discharges, which come along the entire flow of Lumbardh, passing through the urban area and at the exit of the city. Lumbardhi of Prizren from the source to its meeting with the river White Drin (Drini i Bardhë). With this project we wanted to know how the pollution of the river stands as the testing phase of wastewater treatment, and industrial ones, has already begun. We have analyzed some physico-chemical parameters for the period April - and September 2020 such as: Total Suspended Materials (TSM), Chemical Need for Oxygen (CNO), Biological Need for Oxygen (NBO5) and Total Organic Carbon (TOC).
At each sampling site marked with L1, L2, L3 and L4, three laboratory analyzes were performed and the average value was found.

2.1 Sampling

Sampling was done at intervals of April-September 2020. Water sampling for laboratory analysis was done according to known standards. In this project we are dealing with the sampling of the river Lumbardh of Prizren and discharge waters, always respecting the standard methodologies and based on ISO 5667-5 of 2006, for the standard sampling rules. In this way we have tried to avoid the possibility of contamination of water samples for study. Sampling points for monitoring the dynamics of Lumbardh pollution for these intervals are presented in Figure 1.

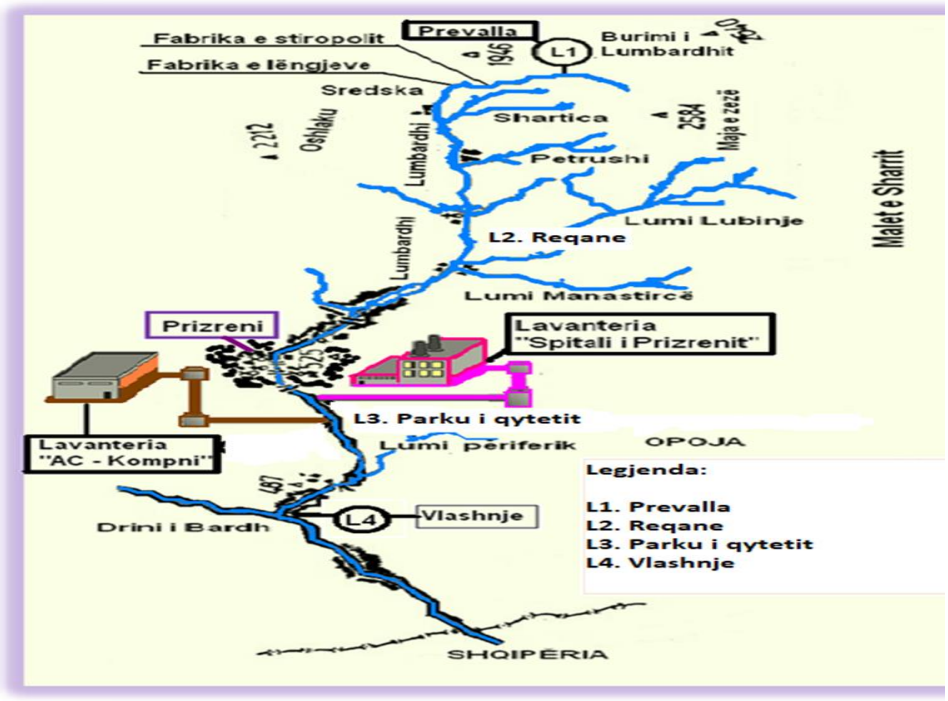

Fig. 1. Map of sampling sites (Veseli S2011)

Measurement of parameters on-site and in the laboratory

Physical parameters.

These physical parameters are usually defined as Temperature, turbidity, and conductivity

Temperature - in the sample to be analyzed is determined in the field, at the place and moment of sampling, which is measured with a digital thermometer.

Turbidity: The measurement of water clarity was performed with NTU (Nephelometric turbidity unit) Turbidimeter.

Electrical conductivity in our work is made with the equipment of the firm WTW model 340i. The results are usually read directly in the apparatus and expressed in units of µS / cm,

Chemical parameters

The pH value was determined at the sampling site with the CONSORT C830 multimeter instrument

Determination of dissolved oxygen was determined in the field with a digital thermometer, at the same time as pH and temperature, to arrive at a more accurate result due to the expenditure of oxygen in the sample which oxidized organic matter. Chemical oxygen consumption, Biochemical oxygen consumption for 5 days, Total organic carbon, and Total suspended matter are determined with the SECOMAM PASTEL UV apparatus which equipment possesses the ultra-violet photometric measuring technique with a wavelength range of 190-1100m.

3. Results and discussions

Tabele 1: Some general physico-chemical characteristics of surface water in the lumbardhë river of Prizren. Month: April and September 2020

Parameters		Sampling period of 24.04.2020, Lumbardhi i Prizrenit, cloudy weather				Sampling period of 24.09.2020, Lumbardhi i Prizrenit, sunny weather			
Physical-chemical Parametrs	Allowed values	value	value	value	value	value	value	value	value
Sampling place	8	L_1	L_2	L_3	L_4	L_1	L_2	L_3	L_4
Water Temp.	^{0}C 5 -15	5.3	6.6	9.1	11.2	8.4	13.7	14,8	15.3
Turbitdity NTU	1,2 - 2,4	0.15	22.8	32.4	13.4	0.00	13.0	26.2	10.93
Electrical conductivity	600-1500 µScm-1	130	168	182	232	118	161	232	355
Water soluble substances	300-10 mg/L	65	84	91	150	64	130	216	120
H-ion contraction	pH 0-14	7.93	7.88	7.84	7.56	7.50	7.94	7.66	7.27
Dissolved oxyge	0 mg/L	10.22	8.68	10.6	9.91	9.22	10.6	11.1	13.8
Suspended solids	mg/L	0.0	10.5	28.2	21.4	0.0	12.0	29.9	23.1
CNO	125 mg/L	0.0	0.79	10.4	13.0	0.0	3.8	22.6	16.6
CBO5	25 mg/L	0.0	0.7	8.1	7.03	0.0	2.1	15.8	7.3
TOC	mg/L	0.0	0.11	3.8	2.38	0.0	0.21	5.17	4.0

The results of the research for both time periods April and September 2020 have shown that the surface waters of the Lumbardh River have been polluted. According to the results of this research, water pollution is manifested in the physical parameters as well as in the chemical parameters and is the highest in September.

Temperature heat is considered to be a water pollutant because it reduces the capacity of water to retain dissolved oxygen in the solution and increases the rate of fish metabolism (Nathanson, 2022). Our research has shown a significant increase in water temperature along with the Lumbardh River flow. Thus, during April the temperature in Prevalla L1 was 5.4 ° C while in the fourth Vlashnjee sampling site (L4) the water temperature reached 11.2 ° C. During September, the situation was even worse in the first sampling site: L1 - 8.4 °, while L3 - 15.3 ° C this comes as a result of climate change wherein the sampling site L1 we have very high altitude which goes down along the river where the city reaches a height of 420 m as the river has a length of 35km.

pH-value fluctuate from 6.86 to 7.27 table 1 which is normal for European norms and according to norms (pH> 6.5). The lowest average value was recorded at the sampling L4 = 7.27 September we think that this value comes as a result of the accumulation of urban liquid discharges however this low pH value does not pose any risk to the environment (Bode Aida 2012).

Turbidity is caused by water-soluble particles that scatter light making the water appear turbid. It can harm fish and other aquatic life by reducing food supply and degrading egg beds (Minnesota Pollution Control Agency, 2008). Unfortunately, the ideal values of source turbulence (L1) of 0.15NTU, did not exceed the allowed values of water turbulence (1.2-2.4 NTU) while in the City Park (L3) they reached the values of 32.4 NTU in April and 26.23 NTU in the L3 sampling site in September thus exceeded the allowed values.

The electrical conductivity of water estimates the total amount of solids in the water. Therefore, it can be used to determine water quality (Choubey, 2008). Fortunately, even against the increase in electrical conductivity along the Lumbardh River, the conductivity parameters are within acceptable limits regarding water quality. Thus, the minimum value of 118.26 μScm-1 was recorded in L1 during September, while the maximum value of 355 μScm-1 was recorded in L4 during September where we also have greater pollution.

Dissolved oxygen The content of dissolved oxygen is a very important quality parameter, which determines the health status of the watershed because its content determines the amount and types of living things in an aquatic environment. The presence of dissolved oxygen is also related to the temperature of the water. Our research has shown that oxygen values ranged from the highest at 13.22 mg / l at 5.3 ° C to the lowest at 9.20 mg / l recorded at 18.8 ° C. In addition to the negative impact of temperature rise, oxygen levels dissolved can also be reduced by the biochemical decomposition of materials that are present in water (Qullaj Alqi 2010). Our research has shown higher values of dissolved oxygen concentration at source locations for both surface water time periods at, location L1 in April and September as we are dealing with surface water source sampling and at an altitude above 1946 meters where the sample was taken, the lowest value of oxygen is observed at location L3 in the area Park of the city in the month of September that we have presented in table 1. This is due to urban waste and discharges industrial activities that have their activity

in this area and their waters cause deoxygenation of waters leading to the extinction of life in them (Gregova, Takacova D, Mojzisova J, Papajova I, Venglovsky J, S Zaboova T, Kovacova S 2018).

Suspended solids

Turbidity is the reduction of clarity in water due to the presence of suspended or colloidal particles. Blur is measured by the amount of light reflected by the particles. Turbidity in water is caused by suspended solids such as clay, sludge, and organic matter, and by plankton and other microscopic organisms that interfere with the passage of light through water. Turbidity is closely related to total suspended solids (TSS), but also includes plankton and other organisms. Natural water turbidity tends to increase during flow events as a result of increased ground flow, turbulent streamflow, and erosion. The values of suspended solids in our work vary from 0.00 mg / l at the first sampling site for the two time periods up to the highest ones at location L3 29.9 mg / l in September 2020 within the allowed values, Because according to the standards of wastewater treatment plants the values are 35 mg / l - 60mg / l

Suspended or colloidal particles, commonly referred to as total suspended solids (TSS), are all extremely small suspended solids suspended in water. (Kinyua E M, Isaac W. Mwangi, Ruth N. Wanjau, and J. C. Ngila 2015)

Sedimentation processes are very effective in removing suspended solids in industrial wastewater. The efficiency of sedimentation tanks depends on the following factors: stopping period, wastewater characteristics, reservoir depth, floor area and degree of overfilling, operation, temperature, particle size, and inlet and outlet design.

Chemical oxygen demand (CNO) The results of the analysis according to the monitoring are presented in Table 1. According to this table, the results of the analysis vary from o.oo mg / l in the L1 sampling site for the period April 2020 to 58.4 mg / l in L3 for the period April. According to Table 1, we see that the minimum values are in L1 0.00 mg / l for both time periods, while the maximum values in the Sampling locations L3 downstream of the river Lumbardhë (urban area) with 58.4 mg / l. Average values vary from 16 mg / l L2 to 58.4 mg / l at the L3 sampling site Table 1. It is observed that as with dissolved oxygen at the two Locations L1 For both time periods during the upstream river, the value of NKO's is very low, this is always for the reason that the water flow of the Lumbardhë river has not yet entered the inhabited area, so even the anthropogenic impact is smaller, even negligible (Bode A 2012). We notice an immediate increase in average values in stations L3 and L4, which is explained by the fact that in this segment the surface waters of Lumbardh accumulate most of the urban discharges of the city of Prizren.

The biological need for oxygen (CBO5)

From the table of results and according to graph 1 it is noticed that the values vary from 0.00 mg / l L1 for both time periods April and September 2020 while the highest L3 for the period September in location L3 up to 37.8 mg / l. Average values range from 17 mg / l L2 to 30.4 mg / l at the Vlashnje L4 site. It is generally noticed that in both locations and in L1 both NKO and NBO5 values are low. In relation to EU norms, the surface waters of the Lumbardhë River are outside the permitted norms for fish survival (Bode A 2012). The environmental impact of anthropogenic factors in the Lumbardh basin has been increasing for years from large discharges of rural, urban and industrial waste. Regarding the classification according to WHO, these

waters according to Locations are classified as L1 for both time periods belonging to Class I, Location L2 belongs to class II slightly polluted, and can be treated and used for irrigation and in the cooling industry of facilities and as steam, while location L3 and L4 belong to class III and IV where polluted surface waters belong. Higher COD levels in surface waters mean a greater amount of oxidizable organic matter, which will reduce dissolved oxygen (DO) levels (Sasakova N, Gregova G, Takacova, Mojzisova J, Papajova I, Venglovsky J, Szaboova T and Kovacova S 2018).

Total Organic Carbon.

The concentration of organic matter in water can be described as total organic carbon TOC which consists of different fractions e.g., dissolved or biodegradable forms. Particularly biodegradable dissolved organic carbon can be important when considering surface water because of its impact on the bacteriological quality of water. It can be a useful source of energy for microorganisms and can be an essential parameter considering the distribution of surface water (Sobczak P and Rosińska A 2020). The main difference between Chemical Oxygen Need and Biological Oxygen Need is that through Biological Need determines organic substances that can be oxidized biologically, while the Chemical Need for Oxygen determines the substances that can be oxidized chemically (Qullaj A 2012).

Conclusion

Changes in physicochemical parameters of water quality along the Lumbardh River and discharge water in this study period for the same time intervals in April and September 2020 had pollution, smaller in April the reason was that in this period in our region we have higher water inflows as a result of atmospheric precipitation. While in the period September 2020 in almost all parameters analyzed in our paper there was an increase, this comes as a result that in this period the water inflows are smaller. The condition of the Lumbardh River is satisfactory recently as a result of these factors investments have been made in the construction of the wastewater treatment plant but still, our whole city does not have access: Low level of maintenance of the Lumbardh River infrastrcture. The current situation is more satisfactory as a result of the start of the discharge water treatment process which is the testing phase. The concentration of the population in the city and especially in the urban area. Failure to define the competencies of regional water companies and local governments. Illegal connections to sewerage systems, serious distribution network damage, and maintenance problems. The main way to increase water quality is to eliminate pollutants and control them, and this can be achieved based on the following recommendations. Ecology and the environment should be taught in primary, secondary, and universities, our institutions need to deal more with wastewater and industrial and household services, to think about sustainable development. There should be cooperation of local government with companies and institutions, in order to minimize pollution at the source of the environment.

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