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Study of physico- chemical parameters of surface waters in the Lana River, Albania

ABSTRACT

The water quality in the Lana River has been and currently is under the influence of a number of factors. However, we emphasize that the main impact comes from anthropogenic activities, exactly pollutation from discharges of urban wastewater.

This article presents the results of the study of the physical and chemical parameters of surface waters in the Lana River. The study report discusses about the analysis of river water quality.

The water samples for this study, taken were carried out on four expeditions in the months of May, June, July, September 2016, at five monitoring stations at: the upper part of the river flow (Lanabregas) , the middle stream of the river (New Maternity and Palace with Arrow), and downstream of the river, (Yrshek – ex Customs and Domje).

Collection, preservation and conservation of samples was carried out in accordance with the recommended standard methods. Parameters: temperature, electrical conductivity, pH, DO, and % DO were analyzed directly on the site using WTW Multimeter 3420 Set G apparatus. Other chemical parameters were analyzed in the Chemistry Laboratory of the Faculty of Mathematical Engineering and Physical Engineering based on recommended standard methods.

The obtained results showed high values of the quality parameters studied, and compared to international standards such as NIVA classification, UNECE, and EU standards, the Lane River waters are of very bad environmental quality.

At the conclusion of this study, we recommend, establishing a continuous monitoring system of water quality studied and strengthening the controls of urban waste-free discharge in the river.

***Keywords**: water pollution, Lana River, physico-chemical analysis.*

1. INTRODUCTION

Water pollution is often a local problem caused by the discharge of liquid waste into rivers or lakes. The study of water pollution poses an important environmental problem. There are many chemical substances that can cause water pollution, among the most common are: urban and industrial liquid wastes, chemical fertilizers, pesticides and other chemicals used in agriculture, synthetic wipes (detergents), petroleum and petroleum products her, heavy metals, etc. Anthropogenic chemical pollution is caused by urban activity that includes waste generated from everyday living in houses, work, traffic and by techno-business involving industrial production [1]. Mineral and chemical industries are the two most important sources of chemical pollution, though not least impact there are other industries such as pesticides, electrical, manufacturing and processing of leather, paper and urban wastes.

The urban wastewater sewerage system of the city of Tirana is a combined system that includes urban waste water of industry which is connected to the sewerage network as well as the rainwater that drains from the surfaces of roads, squares and all impermeable surfaces. The whole sewerage network is self-sealing and its discharge is done at the bottom of the Tirana river and Lana river. Urban waste are the main source of pollutant Very critical is the situation in the Lana River. It is estimated that the urban waste discharge in Lana is 1'640 l/s.

Lana River has suffered considerable damage within the territory of the Municipality of Tirana, in the last 20 years. The main sources of pollution are the dumping of urban solid waste on the banks of the Tirana River, the discharge of urban wastewater into these water bodies in the absence of appropriate wastewater treatment plants. At present, urban waters flow directly to the rivers Lana and Tirana.

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Lana is a small river, a branch of the Tirana River, which crosses Tirana from east to west. It originates in the western part of Priska; is 29 km long, the surface of the basin is 67 km², the average height is 179 m and a slope of 24 m / km. At the entrance to Tirana, Lana flows into a fixed concrete channel and then joins the Tirana River in the northeast of Berxulla, where the Ishmi River is formed.

The main goal of this study was determination of the physical and chemical parameters of surface waters in the Lana river, as well as the environmental quality analysis of this river. To achieve this goal water quality parameters (pH, electrical conductivity, dissolved matter, dissolved oxygen, total suspended solids and nutrients) were determination in 5 stations on four expeditions in the months of May, June, July, September 2016 and compared to international standards such as NIVA classification, UNECE, and EU standards [2-4].

2. EXPERIMENTAL

Sampling

The sampling stations are shoën in figure 1. The stations present various levels of human impact, from near river sources (the least polluted, Lanabregas), in rrjedhën e mesme të lumit (materniteti i ri, pallati me shigjeta), to near outfall (Yrshek - ish Dogana, Domje) (fig.1). Five sampling campaigns were carried out on four expeditions in the months of May, June, July, September 2016. Collection, preservation and conservation of samples was carried out in accordance with the recommended standard methods [5-7].

1.5 liters PET bottles are used for ëater sample analysis. The samples were transported to the lab ëithin the same day using cooling boxes to keep the temperature of +4°C. The samples were stored under standard conditions [5] till the analysis.

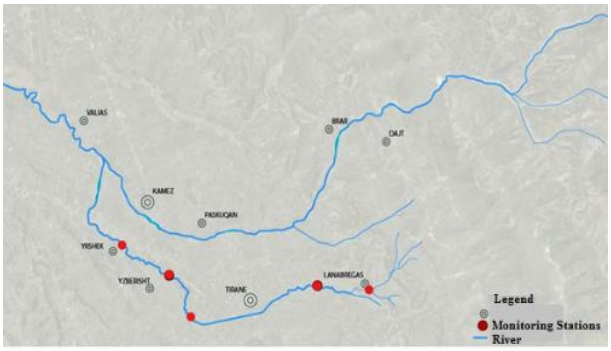

Figure 1. The sampling stations
Slika 1. Mesta za uzorkovanje

2. METHODS OF CHEMICAL ANALYSIS

The parameters that were determined during this study are:

- Temperature, pH, conductivity, DO, % DO, TSS, TDS, turbidity, Alkalinity, Total hardness. b) Concentrations of nutrients: $P\text{-}PO_4^{3-}$, $N\text{-}NO_2$.

All analytical methods used are standard ones, recommended by APHA [8], DIN [8-12] and EN/ ISO standard methods[4] Temperature, pH, conductivity, TDS and DO were measured directly using WTW Multimeter 3420 Set G apparatus, TSS was determined after filtering through a 0.45 µm glass membrane filter. Alkalinity [13,14], total hardness[4] were determined by the volumetric method. All nutrients were determined by spectrophotometry using SP – 2100 UV Spectrophotometer

3. RESULTS AND DISCUSSION

The mean values of each chemical parameter that were determined in this study are summarized in Table 1 and are discussed separately.

Physical - chemical parameters

Table 1. The mean values of each physical -chemical parameters
Tabela 1. Srednje vrednosti pojedinačnih fizičko-hemijskih parametara

Parameters	Stations				
	L1	L2	L3	L4	L5
Temperatura (°C)	18.1	19.8	20.8	20.8	22.6
pH	7.7	8.3	7.8	7.6	7.8
Conductivity (µS/cm)	574	600	657	662	573
DO (mg/L)	3.99	3.93	3.04	2.65	4.07
BOD (mg/L)	23.50	19.25	80.75	99.50	118.50
COD (mg/L)	35.00	35.50	128.50	138.50	149.00
TSS (mg/L)	23	35	453	519	88
TDS (mg/L)	573	610.25	668.75	667.25	572.75
Hardnnes (mg $CaCO_3$/L)	3.2	3.45	1.7	1.45	2.45
Alkalinity (mg$CaCO_3$/L)	3.25	3.35	3.5	4.65	4.95

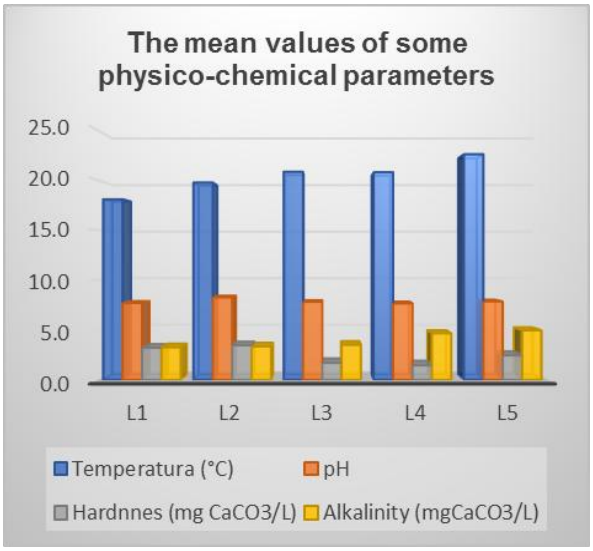

Figure 2. The mean values of some physico-chemical parameters

Slika 2. Srednje vrednosti nekih fizičko-hemijskih parametara

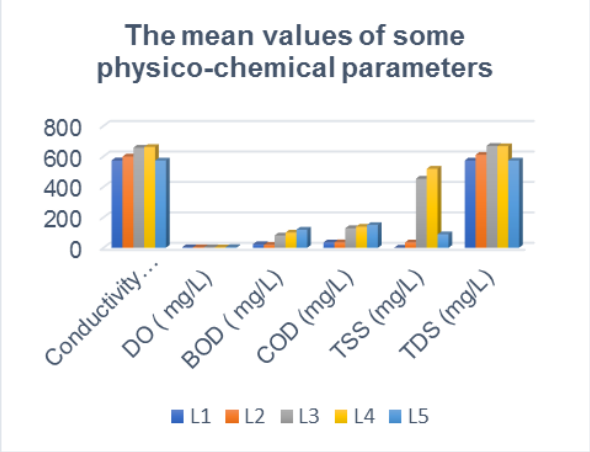

Figure 3. The mean values of some physico-chemical parameters

Slika 3. Srednje vrednosti nekih fizičko-hemijskih parametara

Temperature of water is basically important because it effects biochemical reactions in aquatic organisms. As is apparent from the average temperature values and the graph in figure 2, the mean temperature value range from 18.1ºC to L1 station at 22.6ºC at L5 station. Thus, the mean temperature rises markedly along the course, towards the west, this increase is due to the overall climatic conditions of the area. By comparing the resulting temperature values at the stations taken for study with the EU Directives, these waters are not suitable for fish growth.

pH measurement is among the important measurements carried out in natural waters. The The graphs in Figures 2 and 3 represent the mean values of physico-chemical parameters studied, while the graph in Figure 4 shows the average values of the nutrients concentration, that were determined in this study.

pH value is a parameter that expresses the acidic or basic nature of a liquid sample and it has a significant impakt on the chemical and biological processes occurring in aquatic environments.

The mean pH values range from 7.6 for station L4 to 8.3 at station L2. These values are normal values for European norms (pH> 6), [4,14] and according to NIVA Classification (pH> 6.5)[2].

In European standards do not provide water quality limits for electrical conductivity, but generally there is increased flowability along the river flow, indicating the highest content of dissolved substances in the water.

Based on the mean values of solid matter (TSS) it is noted that the mean values range from 23 mg / l for station - L1 to 519 mg / l at station L4. By comparing the results with the European standards, we have: according to NIVA classification, the class V quality limit is 10 mg/l. The mean values of TSS of stations, are> 10 mg/L, so the waters are classified very bad quality. According to the EU Directive the recommended level for TSS is below 25 mg / l. This indicates that these waters are not suitable for fish growth.

Based on the mean values of Dissolved oxygen (DO) noted maximum value is recorded at station L1, and the minimum value at station L4. The high values of dissolved oxygen at station L1 are explained by the fact that this station is outside the urbanization area and still has no anthropogenic impact. These results show that according to the NIVA classification, the quality of Lana river waters belongs to the bad pollution class. (class IV). Regarding EU norms, the Lana river waters are outside the permissible norms for fish growth. Regarding the classification of UNECE all stations belong to Class IV and V.

The mean values of BOD range from 19.25 mg/L in station L2 to 118.5mg/L in station L5. There is a trend in the mean values of BOD.

The sources of these organic matter in surface water can be the excrements of aquatic biota, soluble compounds in humus water and urban and industrial liquid discharges.Compared with international standards: according to the EU Directives, the recommended level for BOD for salmonid waters is <3 and for Cypriot waters is <6, indicating that the waters of the river Tirana are not suitable and are outside the allowed values. According to UNICEF, all station belongs to class V.

The mean value of COD varies from 35 mg / L to L1 at 149mg / L at L5 station. There is a

noticeable increase in the average COD values along the river flow. There is also an immediate increase in the average values of COD for L2 and L3 stations. This immediate increase can be explained by the fact that in this segment Lana waters accumulate most of the urban collector discharge of the city of Tirana.

Compared with international standards: According to the NIVA classification, all stations belong to the environmental class V - very bad. According to UNECE classification of urban discharges all stations belong to class V.

Based on the results obtained for the total hardness, we say that the river ëaters studied are classified as soft waters.

Nutrients

Nutrient parameters analyzed for nitrogen are nitrite and for phosphorus are total phosphates and orthophosphates (Table 2).

Table 2: The mean values of each nutrient

Tabela 2. Srednje vrednosti svakog sastojka

Stations	Parameters		
	NO_2- N (mg/L)	Orthophosphate PO_4 - P (mg/L)	Total phosphorus PO_4 - P (mg/L)
L1	0.1744	0.451	0.540
L2	0.1915	0.532	0.673
L3	0.5828	1.093	1.637
L4	0.6722	1.564	2.044
L5	0.1271	1.009	1.559

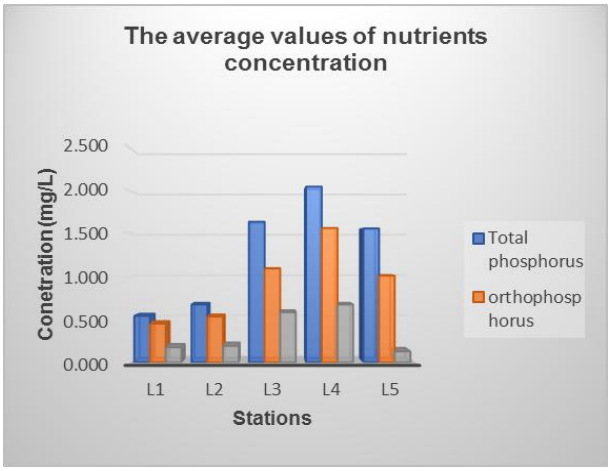

Figure 4. The average values of nutrients concentration

Slika 4. Prosečne vrednosti koncentracije sastojka

Based on the mean nitrite values, it is noted that they range from 0.127mg / L to L5 to 0.672mg / L at L4 station. This condition is caused by the wastewater discharges of the city of Tirana and the municipalities around it. According to the European Directive, the level of nitrite, recommended for salmonid waters is <0.01 mg / l, while for cyprinid waters <0.03 mg / l. Compared with the European Directive, all stations of Lana river do not fulfill these conditions.

Based on the mean values that resulted for the concentration of orthophosphates in the studied stations, it is noted that the values ranged from 0.451 mg/L phosphate to the station L1 to 1.564 mg/L phosphate for the station L4. Compared with the international standards "Quality of natural waters to allow fish growth", the mandatory level of phosphates for salmonid waters is 0.2 mg/L and for cyprinid waters is 0.4 mg/L.

In all stations taken in the study phosphate concentrations are higher than the norms allowed by the European Directive, so these waters are not suitable for the growth of fish.

As shown in the chart of mean values of nutrient concentrations, the mean values of total phosphorus range from 0. 0.540 mg / L for station L1 to 2.044 mg / L for station L4.

Compared to European standards:

- Based on the NIVA classification, all the stations in the study belong class - V very bad) environmental class, resulting in very polluted.
- According to UNECE all stations belong to class V.

4. CONCLUSIONS

The figure 5 shows schematic the pollution scale from one station to another.

Figure 5. The pollution scale

Slika 5. Skala zagađenja

It is concluded from the present study that:

- The physico - chemical parameters studied at the Lana river stations are problematic. Except pH and electrical conductivity, other physical-chemical parameters exceed the limit allowed by international standards. So, these waters are classified as waters of very bed environmental quality
- The nutrient levels are very high, especially near residential areas, caused mainly by urban

and agricultural waste. All stations taken in the study, belong class - V very bad) environmental class, based on the NIVA classification. Compared with the European Directive, all stations of Lana river do not fulfill these conditions.

- At the conclusion of this study, we recommend, establishing a continuous monitoring system of water quality studied and strengthening the controls of urban waste-free discharge in the river.

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IZVOD

FIZIČKO-HEMIJSKI PARAMETRI POVRŠINSKIH VODA REKE LANA, ALBANIJA

Kvalitet vode u reci Lani je pod uticajem više faktora. Međutim, glavni uticaj na kvalitet vode dolazi od antropogenih aktivnosti, tačnije od zagađenja usled ispuštanja urbanih otpadnih voda. U ovom članku prikazani su rezultati istraživanja fizičkih i hemijskih parametara površinskih voda u reci Lani. Izveštaj u radu govori o analizi kvaliteta rečne vode.

Uzorci vode za ovu studiju izvedeni su u toku četiri meseca: maj, juni, juli i septembar 2016. godine, na pet stanica za monitoring: gornji deo rečnog toka (Lanabregas), srednji tok reke (New Maternity and Palace with Arrow), i nizvodno od reke, (Yrshek – ex Customs and Domje). Sakupljanje, čuvanje i konzerviranje uzoraka vršeno je u skladu sa preporučenim standardnim metodama. Parametri: temperatura, električna provodljivost, pH, DO i %DO su analizirani direktno na lokaciji pomoću uređaja VTV Multimeter 3420 Set G. Drugi hemijski parametri analizirani su u hemijskoj laboratoriji Fakulteta za matematičko inženjerstvo i fizičko inženjerstvo, Tirana, na osnovu preporučenih standardnih metoda.

Dobijeni rezultati pokazuju visoke vrednosti ispitivanih parametara kvaliteta vode i upoređeni sa međunarodnim standardima, kao što su NIVA klasifikacija, UNECE i EU standardi, vode reke Lane su veoma lošeg kvaliteta. Na osnovu ovih ispitivanja preporučuje se uspostavljanje sistema kontinuiranog monitoringa kvaliteta vode i jača kontrola izlivanja urbanih otpadaka u reci.

Ključne reči: *zagađenje voda, reka Lana, fizičko-hemijska analiza.*

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