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Assessment of water quality of Buna River using microbiological analysis

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Abstract:

The Buna River is situated near Shkodra town, between the hill of Rozafa castle and Taraboshi Mountain. It is the only emissary of the Shkodra Lake. Buna River is exposed to different sources of pollution related to urban pollution, sewerage discharge, agricultural activity, and climate change which are associated with an increase in water levels, erosion and floods. This research assesses the quality of water in Buna River, based on the microbiological and physical-chemical analysis. Samples were taken at three different points during years 2013-2014. The analysis will stress out data about *heterotrophic* and *fecal coliform* general characteristics, figures, and the role as indicators of water pollution and also information about PH, conductibility and the temperature of water. Microbiological contamination tests show relatively large water contamination, especially in the first sample point where Buna River begins. The high level presence of these microorganisms indicates that the water quality of the river is bad according to standards, presenting a risk to health for all the organisms that inhabit the sweet waters of Buna River.

Keywords: Buna River, fecal coliform, heterotrophic, urban pollution, contaminate, water quality.

Introduction

The Buna River is the only river that flows off Shkodra Lake, and after 1.5 kilometers it joins the Drini River. After running across some villages in the suburbs of Shkodra, Buna River serves as a border between Albania and Montenegro [8]. Buna River has got regional importance and scientific interest. During the last decades the human activity has greatly damaged this ecosystem. Unfortunately, Buna River waters are being used for the discharge of the waste waters, industrial and urban waste and other urban activities contributing to the pollution of this ecosystem [3]. For this reason, the monitoring and the studying of the microbic pollution of Buna river waters show special research interest. Water quality is mainly determined by the monitoring of the presence of pathogenic microbes, based on the identification of fecal contamination indicators. The quality of Buna river water is typically determined by monitoring microbial presence, especially *fecal coliform* bacteria (FC), *heterotrophic etc.*[1]. Meteorological events and pollution are a few of the external factors which affect physico-chemical parameters such as temperature, pH and dissolved oxygen (DO) on the water. These parameters have major influences on biochemical reactions that occur within the water. Internal factors, on the other hand, include events, which occur between and within bacterial populations in the water body. Standard Methods shows that the number of *faecal coliform* and *heteterotrophic* indicates the origin of water pollution[1;5].

Aquatic environments are usually polluted along the length of the rivers from direct and indirect discharges. Through the use of microbial indicators for the quality of surface waters, mainly for fecal contamination, we receive information for determining the amount of the presence of pollutants *in general* and the presence of fecal contaminants of serious impact on the health of the population that uses these waters for irrigation, fish growing or in some cases even for swimming or washing.

Through the determination of the presence of fecal bacteria, as a reliable indicator of fecal pollution, importance should be placed on the measures for their reduction. The higher level of bacterial indicators in river waters, the greater the risk of diseases, which speaks of a high level of its fecal contamination [4].

2. Material and Methods

Monthly water samples were taken in three points in Buna River from September 2013 till February 2014. The choice of the stations was made to better represent the quality of the Buna River water. The first station coincides with the emergence of the Buna River from Shkodra Lake, the coordination of this point are 42°.05´4N; 19°.48´89E. The second station is located 60m away from the new bridge, left, its coordination are 42°.04´6N;19°.48´65E. The third

station is located near Zusi village where Drini joins Buna river, the coordination of this point are 42°03´5N;19°47´9E. Transport and storage of samples before the testing was done with boxing freezer temperature 4-7°C. Samples are analyzed on the same day. In the laboratory we considered: hygiene, labeling each item or preparation, preparations, storage conditions, accurate results.

Two analyses for FC and HET were performed for each sample according to standard European methods. Samples and analyzing of samples are carried out according EU Standard ISO 7899-1[7].

Table 1. Microbial standards (ISO 7899-1) for fecal and total coliforms of water quality in river and stream

Microbiology	**EU Standard ISO 7899-1**			
	Very good	Good	Bad	Very Bad
Fecal Coliforms, CFU/100ml	250-500	500-1000	1000-2000	Over 2000
Total Coliforms, CFU/100ml	1250	2500	5000	10000

*Fecal coliforms***:** Multiple tube fermentation technique was used, 3 tubes for each dilution and the tables (MPN index) served for the determination of the number of bacterial cells. Fecal coliforms were determined by inoculating 10ml, 1ml, 0.1ml water samples, first in LTB (Lauryl Tryptose Broth) at 35°C for 24-48 hours and then in EC-medium at 44.5°C for 24 hours. Positive reaction is indicated by turbidity and gas presence in the Durham pipes. The Most Probable Coliform Number was determined using the MPN index [1;6].

Figure 1. The Stations of the sample points.

Heterotrophic determination of the total number of bacteria that are in an ml of water is made using the terrain and planting YEA coverage in dishes petri. For this purpose are planted 1 ml and 0.1 ml (two parallel) for each water sample dilutions relationships of samples. Incubation was at 37 ° C in a biological thermostat for 48 hours. Readings after 48 hours and the average calculated for all plates colonies of microorganisms. Counting was done with the naked eye and through a loupe. In the cases where the number of microorganisms was large, the counting was done dividing the Petri plates into 4 or 8 pieces and counting only one of these pieces multiplied for the pieces in which were divided . The number of the colonies gives the number of bacterial cells that are in a given moment in the sample CFU per 1 ml. Calculations are made for 1m water and reported CFU/100ml[6;2] .

Sampling points. S1. Buna River; S2. At the Buna Brigde; S3. The node, where Buna joins Drini

3. Results and Discussion

The observation of the Buna river water in all three points, represent normal conditions regarding the color and odor. The temperature was ranking from 7,2°C to 20°C, and it is a biologically significant factor, which plays an important role in the metabolic activities of the organism. The pH values of water varied from 7.36 to 8.19.

The number of bacteria in all aquatic ecosystems represents one of the most important indices of the intensity of decomposition of organic matter

Heterotrophic bacteria as an important component of biocenosis which actively participate in metabolic conversions of various substrates and, therefore, are a basic link in the trophic chain. Heterotrophic bacteria performing the processes of organic matter decomposition are the most numerous group microorganisms in aquatic ecosystems [9].

For station 1, according to the lab analyzes we can see that during September, October and November the values for heterotrophic are higher than during winter, this fact might be due to the rains and low temperatures. The values of heterotrophic are lower in station 2 and even lower in station 3. The statistical difference between the stations is due to the fact: station 2 and 3 are distant from station 1 which is near the place where the untreated waste water of the city is discharged.

At Station 3 Buna River joins Drini River, and the value of heterotrophic are lower.

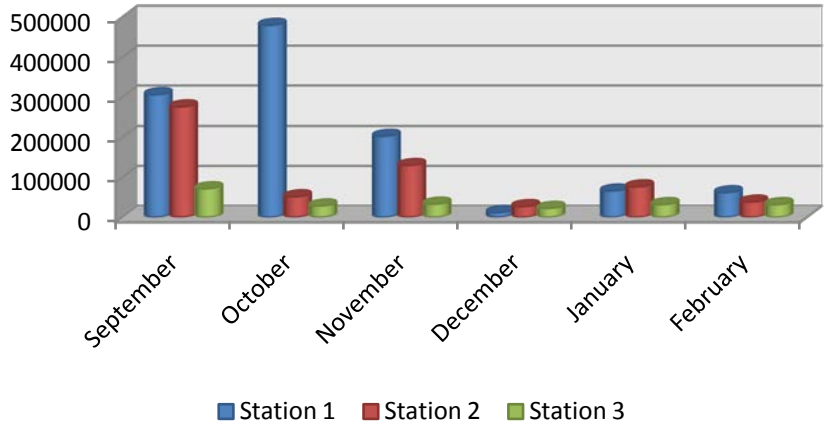

Figure 2. Heterotrophs of Buna river water at three sites of monitoring

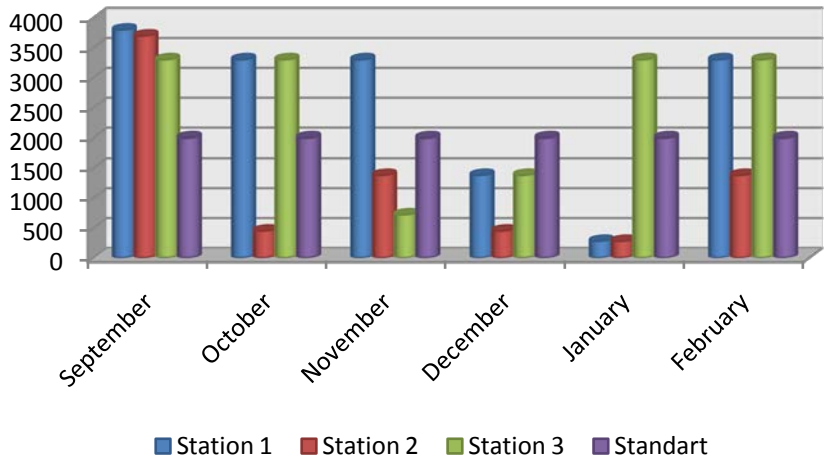

Figure 3. Fecal coliforms of Buna River water at three sites of monitoring

From the microbiological data reported in the figures above, if compared with EU Standard ISO 7899-1, the situation of Buna River seems bad. The values of fecal coliform during the reporting period ranks from 279 to 3800 CFU/100ml. The evaluation of microbiological parameters for surface waters shows that the sampling stations like: At the Buna Bridge and The node where Buna joins Drini have microbial loading from 279-3300 CFU/100ml and the highest values were registered in the station Buna River, where Buna begins and the nearest point where the untreated waste water of the city is discharged. The quality of the water is considered good for the station Buna River only in the month of January and during the other monitoring months the quality of the water is considered bad and very bad. For the second station At the Buna Bridge, the quality of the water is considered good in October, December and January, and bad or very bad during September, November and February. For the third station The node where Buna joins Drini, the quality of the water is considered good only in November, and bad or very bad during the other monitoring months.

At station 1 (Buna River) and Station 3 (The node) the mean value is above the EU standard 2000 CFU/100ml, which means that the water quality is

bad. The minimum values are at Buna River and Buna Bridge and the maximum value is at station 1 (Buna River) which confirms the high level of pollution at this point. Buna River has the highest standard deviation, which means that this sampling point has the largest value difference between the months.

4. Conclusions

According to the microbiological parameters analyzed and EU Standard ISO 7899-1, Buna River results polluted. The main parameters used to evaluate the level of contamination are heterotrophic and Fecal Coliform: the values of the heterotrophic in the different stations vary from 22500-480000 in 100ml water, the highest values of heterotrophic result during September and October which belong to Autumn, and the lowest values result during November, December, January and February. The values of the fecal Coliform vary from 279-3800 CFU/100ml, the highest values of Fecal Coliform result during September, October, November, December and February, and the lowest value result during January. The most problematic point regarding microbiological parameters was the station *Buna River*.

From the results taken during this study we can resume that the quality of Buna River is bad according to the European standards. As long as the untreated waste water of the city will be discharged in the Buna River, the quality of the water is compromised. There is a need to continuously monitoring the quality of water of Buna River, in order to reduce the risk for the flora and fauna that populates Buna River and for the human as well.

5. References

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