Monitoring water quality of Prishtevka River based on microbiological parameters

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Abstract

Prishtevka River Basin in the upper part is characterized by hilly - mountain terrain, while the side stretched towards the city of Pristina to the estuary of Sitnica River is characterized by field terrain. 1.5% of the catchment area is situated at an altitude above 1000 m, 33.9% from 1000 m to 800 m, 20.1% from 800 m to 700 m, 25.2% from 700 m to 600 m, and 19, 2% at an altitude below 600 m. Prishtevka River forms a partly deep ravine in the upper flow. The middle part of the Prishtavka River (down Makovc settlement) to Emshir is covered (into a concrete canal). The lower part of the river from Emshiri to its discharge into the river Sitnica delineates the field area.

Prishtevka River water is facing relatively high contamination by wastewater discharged without prior treatment. Water in the river upstream is mainly good quality, while the pollution in its middle and lower flow exceeds the permitted requirements based on microbiological parameters.

Keyword: Quality, Bacteria, River, Variation, Pollution, Parameter

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Introduction

Prishtevka River is left flow of Sitnica River basin. It is located between 21° 03' and 21° 19' longitude and 42 ° 44' and 42 ° 36' of latitude (Fig. 1.).

Surface water pollution is causing a serious problem not only in national level but also beyond. The increasing demand for the use of water for drinking, food preparation, irrigation, industry, etc., on one hand, the lack of infrastructure for collection and treatment of used water on the other hand is highly increasing the water pollution.

Prishtevka River is a water body with very bad ecological condition (P. De Guidici, 2006).

This paper aims to show the microbiological load. Specifically determination of the level of pollution respectively, load of the river, and eutrophication water improvement situation at a distance approximately 10 km to the Prishtevka River measured and analyzed at different time periods in 2011. The aim of this paper is also to advance the level of information about water quality in the river Prishtevka River which in recent years is in great pressure from wastewater discharges (household, industry, transport, etc.) Tests of biological parameters (microbiological) were conducted in two stations in achieving the purposes of this paper (Fig. 1), near the bus station in Prishtina (mid flow) and in Bresje village (downstream). The achievement of this goal was preceded by:

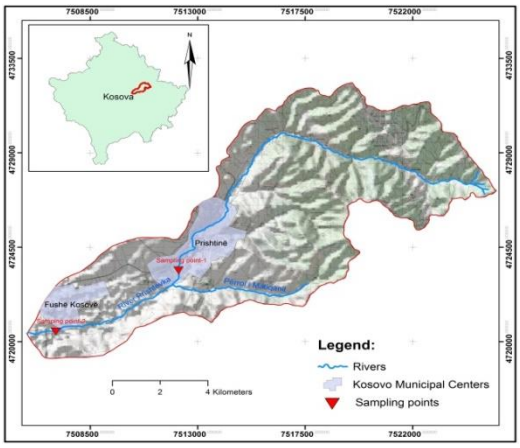

Figure:1 Location water sampling points in Prishtevka River

- Knowledge of the physical – geographic characteristics of Prishtevka River basin;
- Possession of knowledge in the field of Microbiology;
- Integration of the results and their systematization herein.

Material and methods

Working method used in this paper is a development method based on professional research and practical experience coupled with outreach activities, laboratory analysis, data processing and interpretation. The working method was also served by analog works carried out years ago in other areas of the country. The working method followed the following steps the material used for performing the research:

- Water/water samples;
- Laboratory equipment;
- Growth medium or culture medium/planting area;
- Incubating;
-The process of counting.

Indirect methods have been applied for microbiological examination such as agar method (according to Koch) through membrane filter method. Initially the samples were diluted with the dilution series of 10^1-10^6, in that case all dilutions were planted in order to determine which dilutions provide the required number of colonies, so in the case of Peter plate 10 cm diameter after planting and incubation as successful are considered dilutions in which there were 30 to 300 colonies and in the case of membrane filters after specific planting and incubation in Peter boxes, 6 cm are considered those plates or dilutions 10-60 respectively 20-80 colonies (Goldman, 2009).

The process of planting and incubation of Heterotrophic bacteria, Total coliform bacteria, as well as fecal streptococci have been tested at a temperature of 37°C. This process is conducted in the conditions of such temperature, and has given colonies of: different size, shape, color, consistency, abundance. Yeasts and molds after planting and incubation at room temperature 18-22°C provided colonies of: different size, shape, color, consistency, and abundant.

Specification of the number of cells is to ascertain the number of colonies, so because it starts from the premise that a cell has made a colony and specification of cells in certain amount of sample is done according to the formula (Plakolli, 2011).

$$\text{No of cells}/100 = \frac{\text{CFU}\times\text{SD}\times 100}{\text{VS (volume of sample)}}$$

Where:

No of cells/100 - Total number in 100 mL.

CFU= Colony forming unit.

SD= Serial of dilution.

100= Volume (mass) in which the number of microorganisms is required.

VS= Volume of sample.

Figure 2. Microscopic examination.

Water microbiological analysis aimed at specifying the total number of bacteria: Heterotrophic bacteria (HT), Total Coliforms (TC), Enterococci (FS), Salmonella and Shigella (SSH), and Yeast (Y) and Molds (M). Preparation of food, their planting-incubation, manipulation through device and all action in the Laboratory of Microbiology in University of Pristina has been conducted in standard conditions. The incubation time for Heterotrophic Bacteria, Total Coliforms, Enterococci, Salmonella and Shigella bacteria lasted 48 hours at a temperature of 37°C. On the other hand molds and yeasts have been incubated at the time interval from 5 days course

up to 8 days at room temperature (20-22°C).

At the end, each dilution was planted three (3) times parallelly and was supposed to obtain more accurate.

Results and discussion

The microbiological parameters analyzed (Fig. 3) in Samplings points 1 (SP-1) and (Fig. 4) Samplings points 2 (SP-2), in spring season have shown these variations.

The tests resulted that Heterotrophic bacteria at the sampling point SP-1 are of high quantity about 68 million or 53% in 100 ml of water. This indicated that Prishtevka River water at the sampling point SP-1 is loaded by pollution resulting from organic pollutants (proteins, carbohydrates, fats, etc.) (Ginsburg, 1973), (Fetoshi, 2016) Type of Coliform bacteria at the sampling point SP-1 marks the second place of 54 million or 42% of the cells in 100 ml of water, compared to the total number of microflora tested in the river water. Enterococci coliforms (Fecal streptococci) in 100 ml of water they participate with 3.2 million or 1 %. Pathogenic Coliform bacteria: Salmonella and Shigella participate with 1,8 million cells per 100 ml of water, and fungus, yeast and mold respectively indicated little participation; 720,000 respectively 250,000 per 100 ml of water. The number of yeasts and molds turns out to be normal for the fact that they attack mainly fruits, vegetables, foods of organic nature, mainly in aerobic conditions. This statement was argued by the fact that Prishtevka River from the segment called Fusha e Pajtimeve up to the sampling point SP-1 flows through the closed concrete canal that enables the transfer of yeasts and molds to the sampling point SP-1.

Heterotrophic bacteria at the sampling point SP-2 have proved to be 39,000,000 or 82.44% in 100 ml of water. This shows that the water of Prishtevka River at this point is loaded with pollutants, especially with organic ones which create conditions for growth and development of heterotrophic bacteria (proteins, carbohydrates, fats, water, temperature, etc.).

Total coliforms as indicator of fecal contaminated water (Coyne, 1994). These bacteria take the second place for the number of bacteria at the sampling point SP-2 with: 3,500,000 cells or 7 %. At this point, Fecal streptococci take the first place (900,000 cells or 2%) within enterococci coliforms is applied to determine whether fecal pollution is originating from human or animal based on the ratio FC / FS (Coyne, 1994).

Pathogenic Coliform bacteria represented by Salmonella and Shigella participate with 3,400,000 cells per 100 ml water of analyzed sample. Fungi represented yeasts and molds show a relatively high participation from 500,000 to 290,000 in 100 ml water of tested sample. This large number of participation of molds and yeasts is within normal conditions because they attack mainly fruits, vegetables, foods of organic nature.

In general, the results indicate that the microbiological parameters are higher at the sampling point SP-1, and such growth is reduced in the course of water flow, respectively at the sampling point SP-2. Since the purpose of the research was to define the level of pollution, the river load respectively, eutrophication and self-improvement of the water situation at a distance 10 km near the river, also the number of bacteria have the impact to make the bioremediation (Barraga, 2006), (Rumky, 2013) The results have shown that the microbiological parameters from the sampling point SP-1 towards the sampling point SP-2 ranged as follows:

Comparing the results obtained by two sampling point SP-1 and SP-2 have shown that Heterotrophic bacteria have a significant difference between the first point SP-1 to the point SP-2, which turns out to be 29 million Heterotrophic bacteria more at the sampling point SP-2. In terms of Total coliform bacteria also at the point SP-1, the number is higher than the point SP-2 with a difference between them of 54 million cells in 100 ml of water.

Fecal streptococci at the sampling point SP-1 indicated growth about 2.5 times more than at the sampling point SP-2. Salmonella and Shigella bacteria proved to be about twice higher at the sampling point SP-2 when compared to sampling point SP-1, because near the sampling

SP-2, have some chicken farm that justifies this growth. By this rule of slight decreasing bacterial microflora from sampling point SP-1 to sampling point SP-2, for yeasts, and slight increasing molds at the sampling point SP-2, than SP-1 per 100 ml of water sample (Figs. 3 and 4).

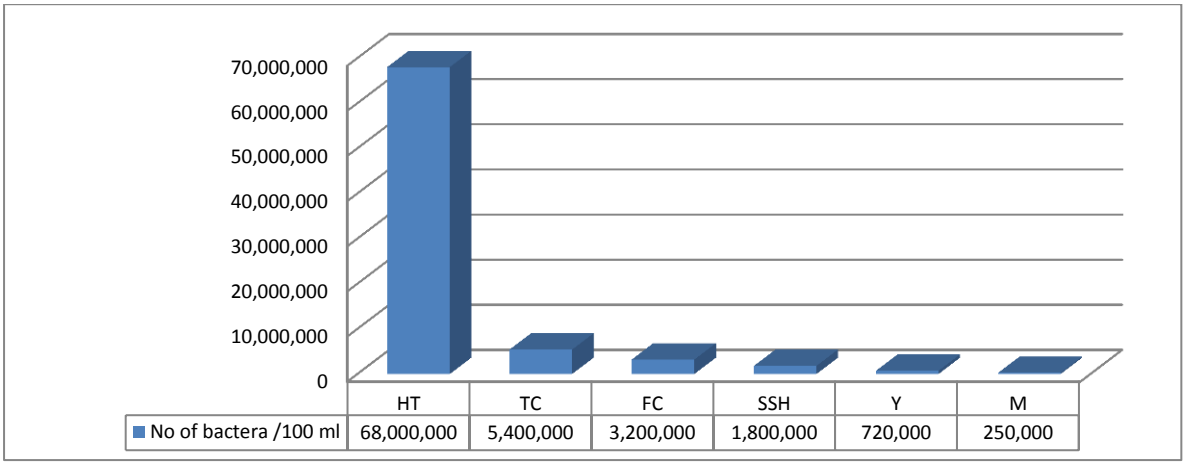

Figure 3: Results of microbiological parameters, sample point SP-1.

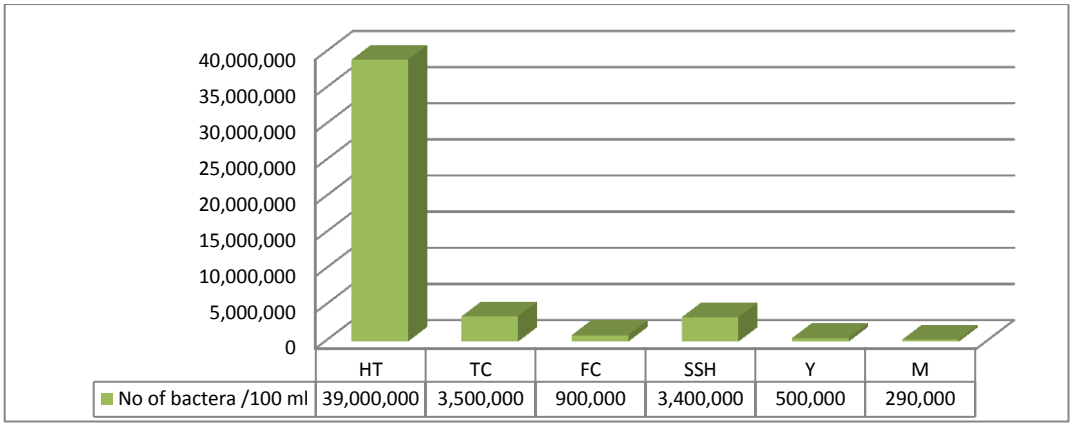

Figure 4: Resulsts of microbiological parameters, sample point SP-2.

Conclusions

In this study work, by using the biological monitoring, clearly indicates that quality of water based on microbiological parameters indicate very bad quality, that is outside of water standards for surface water classification. The water quality it is improved in 10 km distances from sampling point SP-1 to sampling point SP-1 point, from natural processes as auto purification that happen in Prishtevka river basin. Also during our study we found the high number of Oligochaete in simple SP-1, in contrast we could not recorded any fish species due to large water pollution and low oxygen in SP-1.

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