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THE INFLUENCE OF WASTEWATER ON THE PHYSICAL AND CHEMICAL PARAMETERS OF THE RIVER BREGAVA

Dalila Ivanković¹, Merima Šahinagić – Išović¹, Fuad Čatović¹, Almir Šestan²

¹University Džemal Bijedić Mostar, Faculty of Civil Engineering, 88 000 Mostar, BiH

²University of Tuzla, Faculty of Natural Sciences and Mathematics, 75000 Tuzla, BiH

ABSTRACT:

Water is one of the most important raw materials on Earth. Without water life would not be possible. It is the most fluid raw material with great capability to receive and distribute a variety of substances including pollutants. Firstly, the source of the Bregava river in Stolac is important because of the living evolutions, which are not possible without water. Secondly, it is important because of the daily usages, where the most important ones are drinking water, domestic and agricultural usage. In this paper, the physico - chemical parameters of the water quality of the river Bregava are analysed as indicators of the impact of municipal wastewater. The samples of the water have been taken from three different sample - places throughout the flow of the river Bregava in the period of high and low water level of the river. The presented results of physical and chemical parameters of water indicate the degree of load of the Bregava river watercourse with pollutants.

Keywords: Stolac, Bregava, pollution, water quality, physico - chemical parameters

1. INTRODUCTION

The protection of the environment is becoming a bigger and bigger request for the survival of human civilization [1]. The water, H₂O is a chemical compound with extraordinary characteristics and with fundamental importance for the environment [2].

Stolac is a town in southeastern part of Herzegovina. 35km of the Bregava River to flow throughout Herzegovina until it joins the Neretva River as its left tributary. On its way to the Neretva River, Bregava passes Stolac, a quaint little town in Herzegovina with ancient history and beautiful cultural heritage.

Bregava is formed of permanent springs and Bitunja Hrgud and periodic springs Mali and Veliki Suhovića.

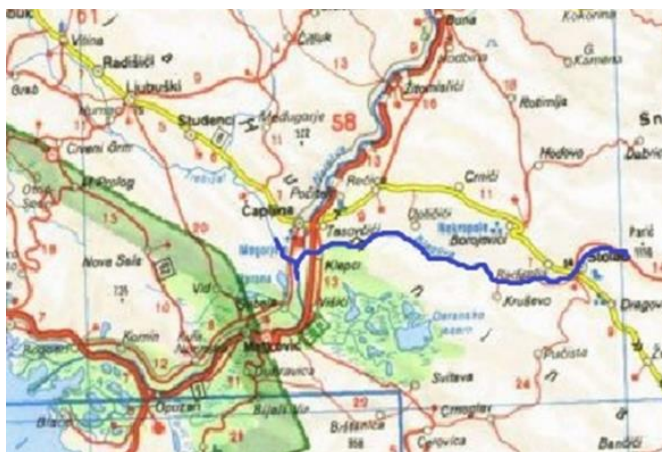


Fig. 1. Geographical position of the river Bregava [3]

Any use of water from numerous water supply systems for different usages leads to a change in its physical, chemical and biological properties [4]. Pollution threatens the biological balance of aquatic and terrestrial ecosystems and, depending on the quantities and types of pollution, even its survival can be questioned [5].

In this research, the physical and chemical parameters of water quality of the Bregava river are analysed. The samples of the water have been taken from three different sample - places throughout the flow of the river Bregava:

- Source of the river Bregava
- Behind restaurants
- Under the Slaughterhouse



Fig. 2. Sampling sites [3]

Sampling was performed in accordance with applicable regulations and good professional practice. The water was taken according to hygienic requirements because the results depend on the sampling method. One-liter glass bottles were used for sampling.

Laboratory analysis on all selected samples included the following physical and chemical parameters: Temperature, Electrical conductivity, pH, Dissolved oxygen, Turbidity, Ammonia, Nitrates, Chlorides, Biological consumption of oxygen (BOD), Chemical consumption of oxygen (COD).

2. MATERIALS AND METHODS

For the purpose of achieving the best results for this paper, used various chemicals and instruments. The experimental part of this paper has been conducted in the laboratories of the Institute for Health Mostar, in the laboratories of the Chemical Department.

Parameters measured with modern methods of determination: spectrophotometric method, potentiometric stripping analysis and the classical standard methods of analysis.

In the experimental part used various and at the same time important chemicals for the determination of the parameters in the water of Bregava. Some chemicals have been of chemical purity “pro-analysis” (p.a.), whereas some others have been suprapur. The preparation of solutions has been done twice with distilled water.

For the determination of parameters, we have used these apparatus and instruments: the water temperature and the amount of dissolved oxygen were measured in situ using a portable digital Multiparameter Water Quality Meter HI 9828. We used Conductometer for measures of conductivity, pH meter for measures of pH, direct reading spectrophotometer for measures of concentrations of anions and volumetric titration for chlorides determinates.

3. RESULTS AND DISCUSSION

The results of this paper have been shown in table 1.

Table 1. Results of physico-chemical analysis of water in the Bregava river

The tested parameters	Sampling site						Drinking water standards
	Source of the river		Behind restaurants		Under the Slaughterhouse		
	High l.	Low l.	High l.	Low l.	High l.	Low l.	
Temperature (°C)	9,4	13,6	10,2	18,3	10	19	
Turbidity (NTU)	1,90	0,95	2,14	0,88	2,20	1,49	To 1 NTU
pH	7,49	6,88	7,64	7,48	7,70	7,49	6,5 – 9,5
Conductivity (μScm^{-1})	261	320	268	274	262	225	To 2500 μScm^{-1}
Chlorides Cl^- (mg/l)	9,86	10,12	12,78	12,06	12,07	13,41	To 200 mg/l
Dissolved oxygen(mgO_2/l)	9,98	9,15	8,80	7,12	9,23	6,83	< 20 mg/l
Ammonia (mg/l)	0,00	0,01	0,03	0,02	0,02	0,06	To 0,5mg/l
Nitrates (mg/l)	0,005	0,005	0,008	0,005	0,011	0,006	To 0,5 mg/l
COD (mgO_2/l)	30,42	31,76	44,70	53,81	38,18	57,11	
BOD (mgO_2/l)	4,08	4,11	7,66	8,16	4,75	10,5	

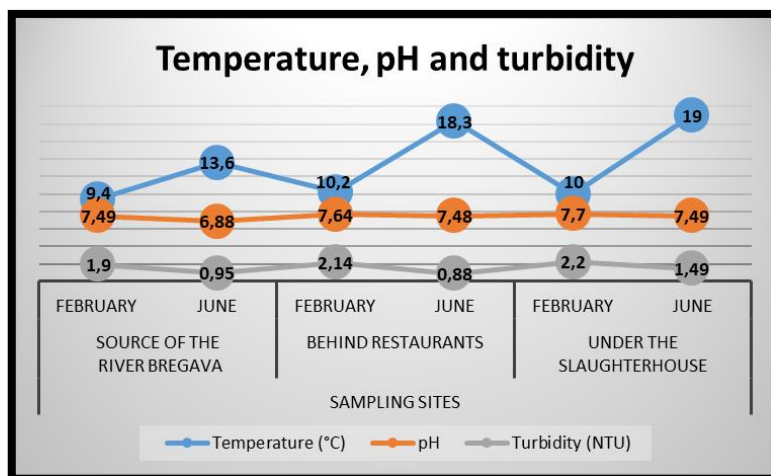


Fig. 3. Temperature, pH and turbidity in the month of February (high level water) and in the month of June (low level water)

Temperature is an important factor to consider when assessing water quality. Air temperature is one of the most important ecological factors which control the physiological behaviour of the aquatic system and distribution of the microorganisms. The temperature of the collected water samples varies in between 9,4 °C to 19°C.

pH is calculated by the number of hydrogen ions in solution. pH of aquatic ecosystems depends on chemical and biological activity of water [6]. The natural waters usually have their pH value higher than 7. The sampling of waters that we have analysed had various values of pH=6,88-7,70. The lowest value was 6,88 in the month of June on the Source of the river Bregava while the highest value of pH was 7,70 in the month of February in the sample - place under the Slaughterhouse.

Water turbidity consists from suspense inorganic substances, dispersioned organic substances, microscopic microorganisms etc. The values of turbidity hover from 0,88 units NTU up to 2,20 units NTU.

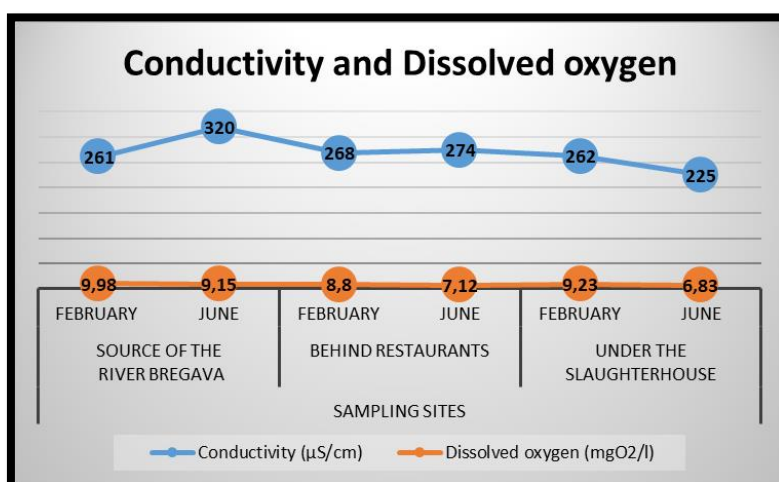


Fig. 4. Conductivity and Dissolved oxygen in the month of February (high level water) and in the month of June (low level water)

Conductivity of river water expresses the capacity of aqua system for conduct of current. This depends on presence of ions, from their common concentration and the water temperature. How bigger is the conductivity of current, so bigger it will be its pollution [6]. If the conductivity of the natural water is higher, so will be its pollution, as well. This parameter in the three existing sampling places has been different, but not that much accentuated. Therefore, the values have been from 225-320 $\mu\text{S}/\text{cm}$.

Dissolved Oxygen (DO) in waters is the vital gas for many animal organisms. DO in waters depends from water temperature, partial pressure of oxygen in atmosphere and from contents of salts in waters. If water is too warm, it will not hold enough oxygen for aquatic organisms to survive [7]. A good quality water should have the solubility of oxygen 7.0 mg/L at 30 °C. The DO of the river Bregava is about 6,83 mg/L to 9.98 mg/L. It is quite close to the prescribed values.

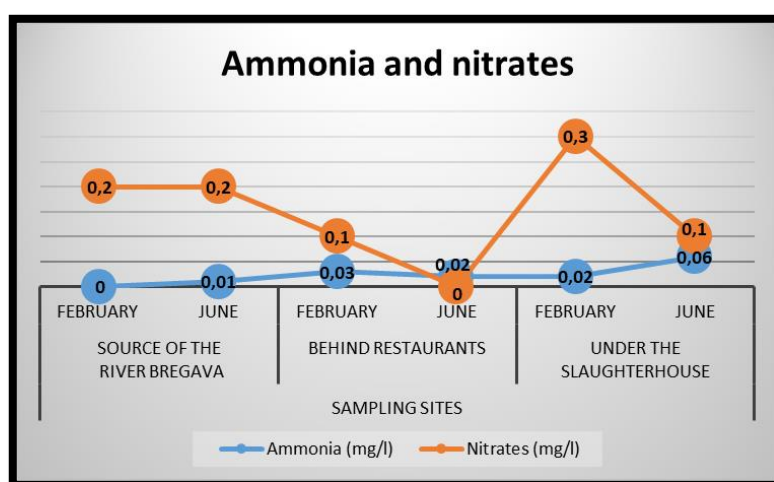


Fig.5. Ammonia and nitrates in the month of February (high level water) and in the month of June (Low level water)

Ammonia is one of the several forms of nitrogen that exist in aquatic environments. The lowest values have been measured in the month of February on the Source of the river and were 0,00 mg/L, the highest value has been measured in the month of June and it was 0,06mg/L.

Nitrates are the product of the final mineralization of organic matter. This signifies that in the most time water was polluted. The lowest value has been measured behind Restaurants in the month of June and was 0,00 mg/L, the highest value has been at the Source of the river Bregava in the months of February and June and it was 0,20 mg/L

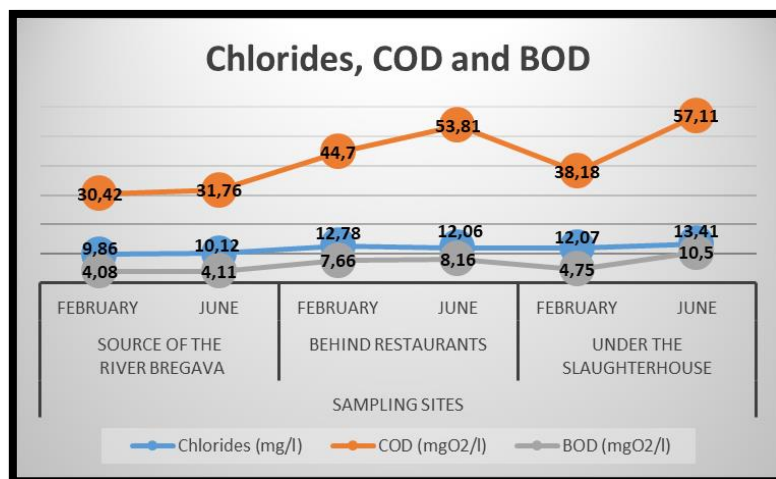


Fig. 5. Chlorides, COD and BOD in the period of high (February) and low (June) water level of the river Bregava

Chlorides have constituted the greatest amount of anions of natural waters which may come as pollution in sanitary and industrial waters [8]. Concentration of chlorides in the natural waters is varies. High chloride ion concentration indicates organic pollution in the water. The chloride concentration on fresh natural water is quite low, generally less than that of sulphate and bicarbonates. Chloride is a natural substance present in all portable water as well as sewage effluents as metallic salt. Many researchers reported that rainfall directly adds chloride [9]. The chloride concentrations of the river Bregava varies between 9,86 mg/l up to 13,41mg/l.

Chemical consumption of oxygen (COD) is biochemical parameter of analysis of natural waters. In this analysis it is chemical oxidation that is used for dispatch of identical reaction with organic matters which proceed from bacteria in reaction of biochemical consumption of oxygen [10]. The value of COD is almost the same theoretical mass of O₂ consumption and depends on water content [11]. The results of COD in general are higher than the value of BOD. The lowest value has been measured at source of the river in the month of February and was 30,42 mg/l, the highest value has been at under the slaughterhouse in the month of June and was 57,11 mg/l..

Biological consumption of oxygen (BOD) refers to amount of used oxygen for biochemical decomposition of organic matter in water. BOD is used for determination of relative demand of oxygen for effluents and discard waters because it is indicator of pollution level of waters [12]. The lowest value of BOD was 4,08 mg/L at Source of river in February and the highest value was 8,16 mg/L behind restaurants in June.

4. CONCLUSION

Physico chemical parameter indicate the amount of pollutants in the watercourse and their potential impact on water usage for different purposes. Samples of the water from the first sample place are less polluted with different contaminants. Samples of the water from the second and third sample places are more polluted than the ones from the first sample places. Some parameters are: Temperature, pH, electrical conductivity, chloride, dissolved oxygen, amount of ammonia and nitrate satisfies the quality of drinking water. Water turbidity is above the value for drinking water and suggests high content of suspended matter. The effects of water pollution can be seen in the values of COD and BOD. According to the values of COD and BOD, the water of the river Bregava belongs to the IV class of waters. This refers to chemicals and waste from Restaurants and Slaughterhouses chemicals, wastes and polluted waters of the dwellings, which as they flow towards the last flowing of the river they huddle more, and as well as to the general pollution of the environment in the region of the Stolac. and economy.

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