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Determination of Physico-Chemical Parameters in the Seman Basin Waters, In the Fieri City

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Abstract - This article presents the results of the study of water pollution of the Seman River basin, based on physico-chemical parameters. This study was conducted during the period April - June 2019. The selection of sampling stations was done in order to the results of the study provide, a complete information on the level of pollution of these waters and the main causes of this pollution. Water samples were analyzed for temperature, pH, conductivity, total suspended solids (TSS), total alkalinity, total hardness, dissolved oxygen (DO), chemical oxygen demand (COD). All analyzes were performed using standard analytical methods (APHA, DIN, ISO). The results were processed using descriptive statistics method and compared with international water quality standards. The results obtained showed that the values of some parameters were above the allowed or recommended norms. Since the main causes of pollution of these waters are discharges of untreated urban water and those from various economic activities, or discharges of wastewaters, it is recommended: Taking measures to minimize the causes of pollution, such as improving the sewerage network of the area, the provision of a completely special system, serious investments in the treatment of untreated urban waters and those from various economic activities as well as the information of the population on the importance of protecting these waters from pollution and the consequences of these pollutions.

***Keywords*:** physico-chemical parameters, international water quality standards, Descriptive Statistics method

Introduction

Of all the resources that we have on our planet water is undoubtedly the most precious. Without it, life on Earth would be non-existent: it is essential for everything on our planet to grow and prosper. Although we recognize this fact, we disregard it by pol-luting our rivers, lakes, and oceans. Subsequently, we are slowly but surely harming our planet to the point where organisms are dying at a very alarming rate. In addition to innocent organisms dying off, our drinking water has become greatly affected by pollution. In order to combat water pollution, we must understand the problems and become part of the solution. [1]

Seman River - The hydrography of Fier district consists of the Seman river, its branch Gjanica river and the downstream of Vjosa river. The Seman river flows with twists 61 km, in Fier, in the Myzeqe field. To the north of the town near the village of Mbrostar he takes Gjanica river with him, and flows into the sea forming a large delta. Gjanica is one of the branches of the Seman River. After crossing 42 km along Mallakastra, it enters to the Fier city and then joins the Seman river. The Vjosa river flows 75 km downstream, and serving as the border between Fier and Vlora city. [2, 3]

The Seman river is 281 km long, with a watershed of 5'649 km2 and an average altitude of 863 m above sea level.[4] Considering hydrometeorological conditions, the Seman catchment is the poorest of all rivers in Albania, in terms of groundwater. Also, rainfall is low, averaging 1'084 mm / year.

The average multi-year flow is 95.7 m^3 /s. About 60% of the water is provided by the Devoll catchment. 4][14] The Seman catchment consists of from the agricultural field with sparse vegetation that undergoes severe erosion. The amount of solids transported to the sea by the Seman river is approximately 31.2 million tons/year. The waters have a relatively high mineralization of 440 mg/L. Water temperatures range from 6.8ºC in January to 25.5ºC in August.[5]

The main sources of water pollution in Albania in the last decade are urban discharges. Urban wastewater and other industrial discharges discharge directly into catchments and go into rivers, lakes or the coast. [5]

One of the main polluters of the Seman river is the discharge of the Gjanica river, which serves the city of Fier as the recipient of untreated urban water, ranking it in one of the most polluted rivers in our country. Currently in Fier the separation of urban wastewater from other urban waters has not been realized yet, and a part of them, about 20%, is discharged into this river. Raw water of economic activities that take place in Fier is discharged into it. [6]

The purpose of this paper is to determine the physico-chemical parameters in the waters of the Seman River basin, as a very important indicator of pollution of these waters. The selection of sampling stations was done in order for the results of the study to provide complete information on the level of pollution of these waters and the main causes of this pollution.

Materials and Methods

A description of the sampling stations for monitoring is given below:

The M1station at "Lagjja e Re" (at the exit of the Fier city), also influenced by anthropogenic action.

The M2 station in the Hoxhara canal which flows into the Adriatic Sea (Seman beach). This canal brings all the spills of Ballsh industry, making this canal very polluted.

The M3 station belongs to the area after the union of Seman river with Gjanica river. In this area, there is a reduction of pollution and the river has a wide bed and considerable inflows.

The M4 station was taken to the city bridge also influenced by anthropogenic action.

The M5 station is taken to the Vija e Ngjales which flows into the Adriatic Sea (Seman beach). This canal like the M2 station, brings all the spills of Ballsh industry making this a very polluted canal.

The M6 station in Mbrostar at the Bridge at the entrance of Fier. The sampling place belongs to a relatively polluted area, as part of the urban waters of these areas are discharged into this river.

Figure 1 gives a map of the water sampling stations

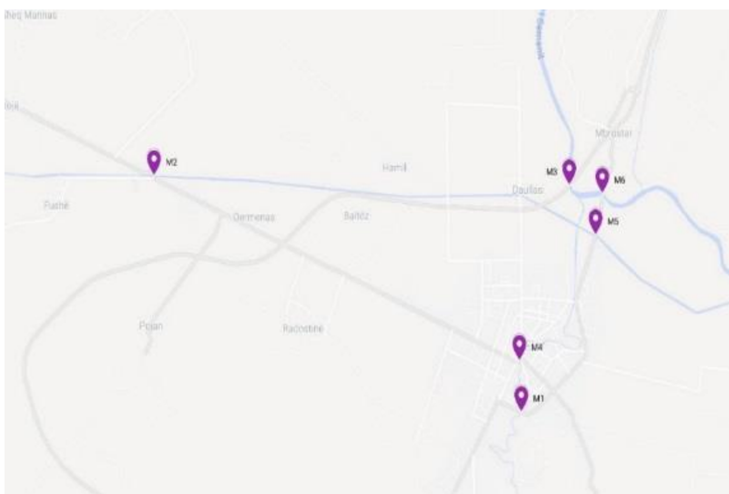

Fig 1. The water sampling stations

Sampling, preservation and conservation at river stations was carried out in accordance with the recommended standard methods. Water samples were collected using a polyethylene bottle of 1 L volume, at a depth of about 15 -20 cm below the water surface, prewashed and properly labeled.

They are transported to the laboratory in freezer boxes at about 4˚C for the analysis of physico-chemical parameters that determination in the lab. [7]

The chemical analysis methods that we have applied, are taken from APHA and DIN which are considered to be the official methods of water analysis in the US and Germany and are the same as the ISO / EN methods. The temperature, pH, electrical conductivity, and dissolved oxygen were measured at the point of collection with WTW Multimeter 3420 Set G apparatus. [8] Other parameters were determined in the laboratory using standard APHA methods [8,9,10,11,12,13]. TSS was determined after filtration through a 0.45 µm glass membrane filter, weighing to constant weight. [8,11] Alkalinity and total hardness were determined by the volumetric methods [12,13]. The COD measurements were performed using the Aqualytic Check it Direct COD VAR10 photometer, based on the relationship between absorption and concentration.

Results and Discussions

The mean values of physico-chemical parameters are shown in the table below.

Table 1. The mean values of physicochemical parameters of Seman River

Physico – chemical parameters	Stations					
	M1	M2	M3	M4	M5	M6
Temperature(°C)	19.03	20.20	19.87	19.63	20.47	19.47
pH	7.94	7.71	8.37	8.02	7.77	8.23
Electrical Conductivity (µS/cm)	777.7	707.7	614.7	766.7	927.7	472.7
DO (mg/L)	6.30	4.29	7.05	6.72	4.16	6.63
COD (mg/L)	27.5	231.7	30.3	269.1	252.5	30
TSS (mg/L)	367.93	10.083	60.5	414.4	8.93	78.2
Alkalinity (mg $CaCO_3$/L)	128.1	252.7	104.9	240.7	244.2	88.0
Total Hardness (mg $CaCO_3$/L)	355	434	347.5	354.7	431	242

Temperature

The higher the temperature, the greater the biological activity in the water.

The graph in the figure 2 show the temperature distribution measured in the field with portable multimeter the typeWTW Multimetër 3420 Set G.

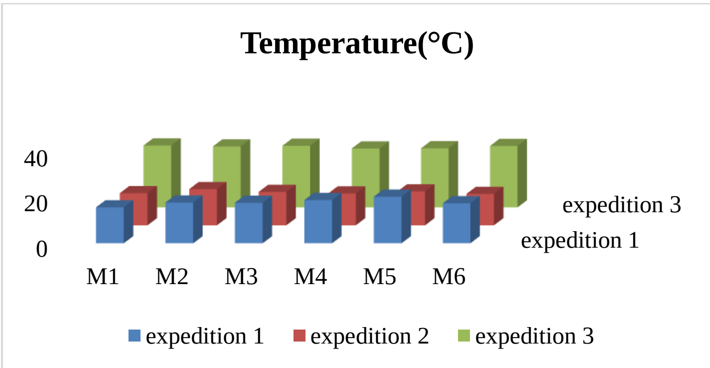

Figure 2. The distribution of temperature values (ºC)

Figure 3 shows the performance of the mean, median, minimum and maximum temperature values for each station. The waters of the analyzed samples of Seman and Gjanica rivers, had variable temperatures, depending on the air temperature. The lowest temperature was observed in May at the M6 station (Mbrostar Bridge), while the highest temperature was observed in the June at M1 station (Lagjja e Re). The highest mean temperature value was recorded at M5station (Vija e

Ngjales). Even the fluctuations in the maximum and minimum mean values are small from station to station giving an almost linear shape to the respective graphs.

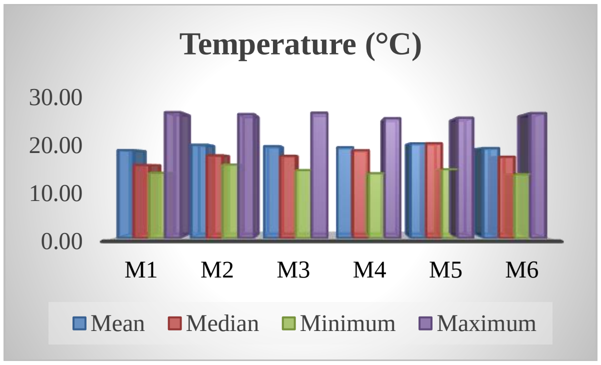

Figure 3. The mean, median, minimum, and maximum values of temperature

pH

The pH value is a parameter that express the acidic or basic natyre of water and this has an important impact in chemical and biological process occurring in aquatic ecosystems. usually have a pH value higher than 7. The results of the study for the pH of the waters of the Seman River are presented in Figure 4**.**

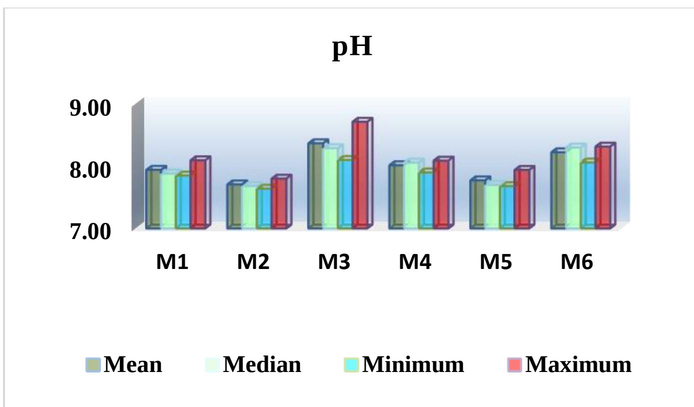

Figure 4. The mean, median, minimum, and maximum values of pH

The water samples that were analyzed resulted in mean pH values in the range from 7.71- 8.37. The lowest pH value was 7.64, in June, at the M2 station (Hoxhara canal), while the highest pH value was 8.7 in June at the M3 station. The mean pH values are within range that is considered suitable for the fish life (6.0-9.0) [14, 15]. and according to the NIVA norms and UNECE, are classified as water of the I class of environmental quality. [16, 17]

Electrical Conductivity

The electrical conductivity of water indicates the general presence of chemical compounds and is an indicator of water pollution.

The results of the mean electrical conductivity values in the study showed that the maximum value was recorded in M5 station and minimum value was recorded in the M6 station

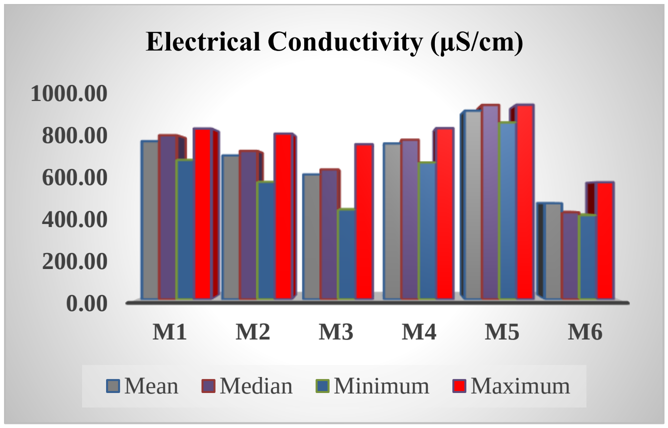

Figure 5. The mean, median, minimum, and maximum values of electrical conductivity

Dissolved oxygen (DO)

DO frequently is the key substance in determining the extentand kinds of life in a body of water. Oxygen deficiency is fatal to many aquatic ani-mals such as fish. The presence of oxygen can be equally fatal to many kinds of anaerobic bacteria.[5]

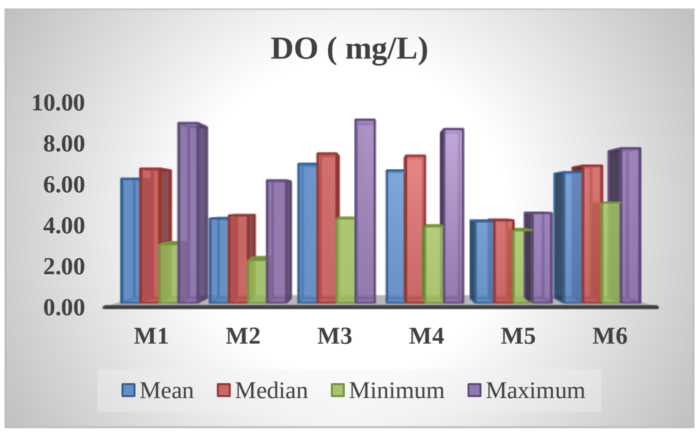

Figure 6. The mean, median, minimum, and maximum values of Dissolved oxygen

The results (Fig 6) showed that the mean values of the DO ranged from 4.16 mg/L in the M5 station to 7.05 mg/L in the M3 station. The minimum value of DO was recorded in the M2 station, while the maximum value was recorded in M3 station. The high values of dissolved oxygen at the M3station are explained by the fact that this station is outside the urbanization area, and still has no anthropogenic impact.

Based on the classifications according by the international standards (NIVA> 9 mg/L O_2, UNECE > 7mg/L O_2 and the EC Directive > 9 mg /L O_2), we can estimate that the waters of the M2 and M5 stations are classified in the IV class - "Bad" quality class, according to UNECE and NIVA clasiffication and according the Water Framework Directive are not suitable for growing fish. The waters of other stations, referring to the mean values of DO, recorded during the study, are classified in the II class - "good" quality class, according to UNECE and NIVA, but are not suitable for growing fish.[14, 15, 16, 17]

Chemical oxygen demand (COD)

Chemical oxygen demand (COD) is a critical parameter of determining water quality which represents the degree of organic contamination in water bodies.[4] This is an important issue for the characterization of water bodies, urban liquid and industrial discharge. [11] Figure 7 shows the mean, median, minimum, and maximum values of the COD values for each station studied.

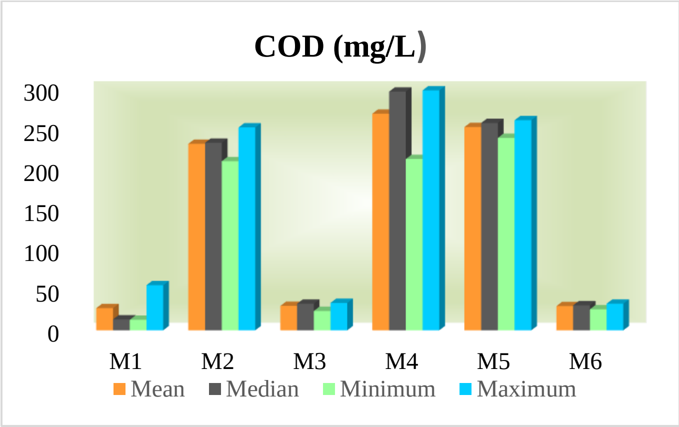

Figure 7. The mean, median, minimum, and maximum values of the COD values for each station

We see that COD values vary depending on the temperature. As the temperature rises, so do the chemical oxygen demand values. They range for April from 13.5mg/L at the M1 station to 296.5mg/L at M4 station, for May from 13mg/L to 239mg/L and for June range from 33 mg/L to 298mg/L. The highest COD mean values were recorded at M4, M5 and M2 stations. These values can be explained by the fact that in this segment of the river accumulates the most of the discharges of urban collectors of the city. The minimum COD value is recorded at station M1 and the maximum value at station M4. Comparing the mean values of the COD, with the values recommended by the international standards, we say that, according to the UNECE and according to the NIVA classification the studied waters belong to V class with a very bad environmental quality. [16,17]

Total Suspended Solids (TSS)

The concentration of total dissolved solids affects the water balance in the cells of aquatic organisms. Higher concentrations of suspended solids can serve as carriers of toxics, which readily cling to suspended particles. This is particularly a concern where pesticides are being used on irrigated crops. Total solids also affect water clarity. Higher solids decrease the passage of light through water, thereby slowing photosynthesis by aquatic plants. Sources of total suspended solids, include industrial discharges, sewage, fertilizers, road runoff, and soil erosion. [1, 9] The figure 8 shows the mean, median, minimum, and maximum values of the TSS. From the graph shown in this figure it can be seen that the mean values range from 8.93 mg/L at M5 station to 414 mg/L at M4 station.

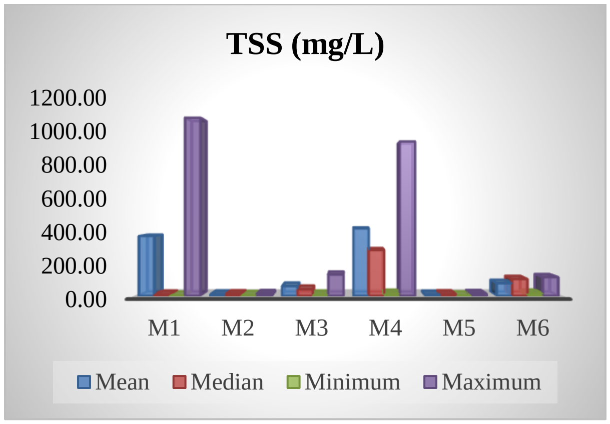

Figure 8. The mean, median, minimum, and maximum values of the TSS

The minimum value of TSS was recorded at M1station during the first expedition and the maximum value of TSS was recorded at M1station during the second expedition. This is explained by the fact that this expedition was carried out in May during which there was heavy rainfall and the river inflows in the study were large, and influenced by anthropogenic actions. If we compare the results, referring to the mean values of TSS (mg/L), with European standards we say that:

According to the NIVA classification, for the V class of quality, the TSS limit is 10 mg/L. The TSS mean values for the M1, M2, M3, M4 and M6 stations resulted > 10mg / L, so the waters are classified in the V class of environmental quality, hence of very poor quality. The mean TSS value for the M5 station is 8.93mg/L classifying it as class IV environmental quality. [17]

According to the EU Directive the recommended level for TSS is below 25 mg/L. Thus, this indicates that the waters of M1, M3, M4 and M6 stations, are not suitable for fish farming. [14,15]

Alkalinity

The capacity of water to accept H^+ ions (protons) is called alkalinity. Alkalinity is important in water treatment and in the chemistry and biology of natural waters. Frequently, the alkalinity of water must be known to calculate the quantities of chemicals to be added in treating the water. Natural water typically has an alkalinity, designated here as “[alk],” of 1.00 ´ 10- 3 equivalents per liter (eq/L), meaning that the alkaline solutes in 1 liter of the water will neutralize 1.00 ´ 10-3 moles of acid. The contributions made by different species to alkalinity depend upon pH. Highly alkaline water often has a high pH and generally contains elevated levels of dissolved solids. [18] Mean alkalinity values in this study range from 88mg / L to 252.7 mg $CaCO_3$/Lor from 0.88 to 2,527 mmol / L (fig. 9). These values are recommended from 100 - 200 mg / L of class "good" and > 200 mg/L, of class "very good", according to UNECE norms, so the buffering capacity of the water is very good.[16] or in the range > 0.2 mmol/L of water quality class "very good", according to NIVA norms, classifying them as good waters.[17]

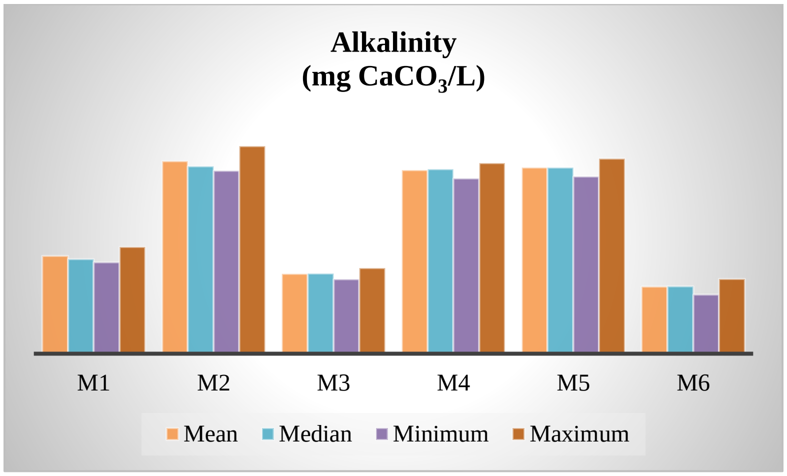

Figure 9. The mean, median, minimum, and maximum values of the alkalinity

Total Hardness

The total hardness water is a very important parameter of water quality that affects its use in many branches of industry and production. Water hardness is the total calcium and magnesium ion concentration in a water sample and is expressed as the concentration of calcium carbonate. [19]

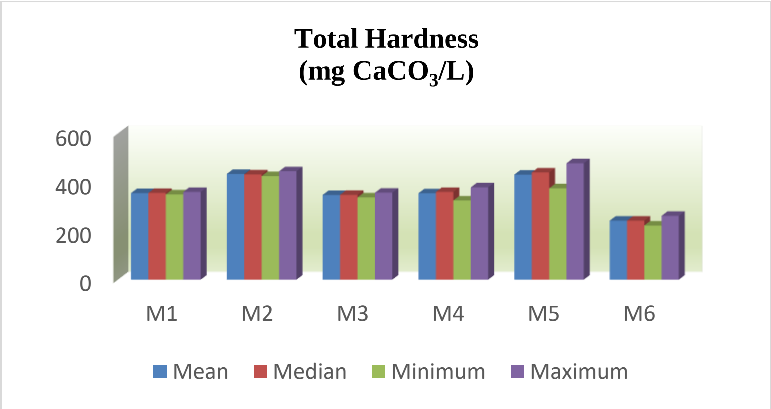

Figure 10. The mean, median, minimum, and maximum values of the total hardness

From the graph given in Figure 10 it is noticed that the mean values of total hardness in the studied waters ranges from 242 mg$CaCO_3$/L for the M6 station to 434 mg$CaCO_3$/L for the M2.station The minimum value of the total hardness resulted in the M6 station and the maximum values resulted in M5 station of 478mg/L $CaCO_3$. Based on these results it can be said that these waters are classified relatively as hard and very strong waters. [11]

Conclusions

The mean results of the study indicate a significant and sustained impact of urban and industrial discharges on the water quality of the basin studied. The Gjanica River significantly affects the quality of this basin, as a result of the impact and pressure of urban and industrial discharges.
The waters of the analyzed samples of Seman and Gjanica rivers, had variable temperatures, depending on the air temperature. Even the fluctuations in the maximum and minimum mean values are small from station to station giving an almost linear shape to the respective graphs.

The mean pH values are within range that is considered suitable for growing fish (6.0-9.0), and according to the NIVA norms and UNECE, are classified as water of the I class of environmental quality.

In terms of DO mean values, based on the classifications according by the international standards (NIVA> 9 mg/L O_2, UNECE > 7mg/L O_2 and the EC Directive > 9 mg /L O_2), we can estimate that the waters of the M2 and M5 stations are classified in the IV class - "Bad" quality class, according to UNECE and NIVA clasiffication and according the Water Framework Directive are not suitable for growing fish.

The waters of other stations, referring to the mean values of DO, recorded during the study, are classified in the II class - "good" quality class, according to UNECE and NIVA, but are not suitable for growing fish.

Comparing the COD mean values and the TSS mean values, with the values recommended by the international standards, we say that, according to the UNECE and according to the NIVA classification the studied waters belong to V class with a very bad environmental quality and are not suitable for fish farming.

Based on the results for the tola hardness, it can be said that these waters are classified relatively as hard and very strong waters.

Based on the above results, we understand, that the waters of the Seman River are very polluted waters and do not meet the conditions according to international standards, more emphasis on mean values of parameters such as DO, COD, TSS, parameters that are mainly related to anthropogenic factors. Since the main causes of pollution of these waters are discharges of untreated urban water and those from various economic activities, or discharges of wastewater, it is recommended: Taking measures to minimize the causes of pollution, such as improving the sewerage network of the area, the provision of a completely special system, serious investments in the treatment of untreated urban waters and those from various economic activities, separation of urban wastewater from other urban waters as well as the information of the population on the importance of protecting these waters from pollution and the consequences of these pollutions.

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