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15th International Research/Expert Conference
”Trends in the Development of Machinery and Associated Technology”
TMT 2011, Prague, Czech Republic, 12-18 September 2011

CHEMICAL ANALYSIS OF WATER SAMPLES PUBLIC FOUNTAINS FROM TUZLA AND SURROUNDING AREA

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ABSTRACT
Although Bosnia and Herzegovina has significant water fountains, quality of drinking water in some parts of the country is not satisfactory. The population of the city of Tuzla and the surrounding area provides drinking water from central water supply conduit of Tuzla. The occurrence of occasional problems with the lack of (summer restrictions) and quality (accidental pollution) of water from central water supply system in the territory of the city, potentiates the importance of public sources of supply as alternative sources of water supply. For the determination of physico –chemical parameters of water were used standard methods. Concentrations of heavy metals Fe and Mn in samples of water fountains of public supply were determined on the spectrophotometer HACHDR/2000. The resulting measured parameters ranged as follows: t 12-24 °C, pH 6.44 to 8.34, electrical conductivity (EC) 139-757 µS/cm, carbonate hardness from 42.00-242.60 mgCaO/L, total hardness mgCaO/L 57.60-280, turbidity 0.12 to 0.59 NTU, ammonia (NH_3-N) 0.04-1.24 mg/L, nitrate (NO_3-N) from 1.1 to 6,1 mg/L, nitrite (NO_2-N) 0.004-0.006 mg/L, chloride 12-21 mg/L, Fe 0.01-0.05mg/L and Mn 0.01 mg/L. Concentrations of the investigated parameters in samples of drinking water alternative sources of public supply of Tuzla and its surroundings are within the allowed limits according to World.
Keywords: heavy metals, the standard method, drinking water, spectrophotometer, WHO

1. INTRODUCTION

Sanitary drinking water is an essential prerequisite for good health, because it is necessary to sustain life as well as personal and general hygiene. World Health Organization (WHO) ranked the quality of drinking water in the twelve indicators health status of the population of a country, which confirms its important role in protecting and improving health.[1] The importance of drinking water is reflected primarily in its physiological role in the body, or in maintaining the metabolic processes and the exchange of substances, toxicological-epidemiological importance, because through the water can develop and transmit bacterial, viral and parasitic diseases, and toxicological role, if they are in drinking water contaminants are present in higher concentrations than allowed. [2] Every year more than a billion people have no other choice but to use potentially dangerous, damaging the health of water sources. This causes the so-called. the silent humanitarian disaster which kills 3900 children every day worldwide. According to the World Health Organization (WHO) in 2005. in the humanitarian disaster caused by a deficiency of hygienic water that results in the following facts:[3] in developing countries die every year 1.8 million people due to intestinal infections and diarrhea, including cholera (90% of deaths are children under five years 88% of all intestinal infections and diarrhea caused by inadequate and unsanitary supply drinking water and poor sanitary hygienic conditions and it is estimated that 160 million people suffer from schistosomiasis - parazitnog diseases caused by trematodes - parasites of the genus Shistosoma to improve basic hygiene and sanitation can reduce the number of patients and by 77%. Population of Tuzla and the surrounding area provides drinking water from central water supply system in Tuzla water (water treatment plant for drinking-water factory "Cerik, water intake of drinking water in Stupari and related water supply systems, water intake Toplice and water intake Sprečko field with its water supply system).The occurrence of occasional problems with the lack of (summer restrictions) and quality (accidental pollution) of water from central water supply system in the territory of the city, emphasized the importance of public sources of supply as alternative sources of water supply. The problem is not a public fountain in the water which is abstracted, but they are objects that cannot control and which are not long-renovated, rehabilitated, etc. So in such facilities can reach secondary pollution. These waters are not subject to systematic quality control, and often does not control.Ta water is heavily influenced by anthropogenic factors, the effects of exposure to concentrated, and disperse pollutants. From the foregoing it is evident that in public fountains as well as alternative sources of water supply, there are very serious problems that must be solved, starting from the identification of sources, planning, protection, regular checks of all public fountains and the use of these waters. The aim of this paper is to explore and define the physical and chemical composition of water and the concentration of heavy metals (Fe and Mn) in water sources of public supply of Tuzla and its surroundings, and to emphasize the importance of these sources as alternative sources of supply.

2. MATERIALS AND METHODS

The subject of this study, six public water sources supplying the city of Tuzla and its surroundings at six different sites. For all sites was recorded using a GPS unit accurate position and altitude. Location of measuring points is indicated on the situational map of Tuzla and the surrounding area in Figure 1. and Table 1.

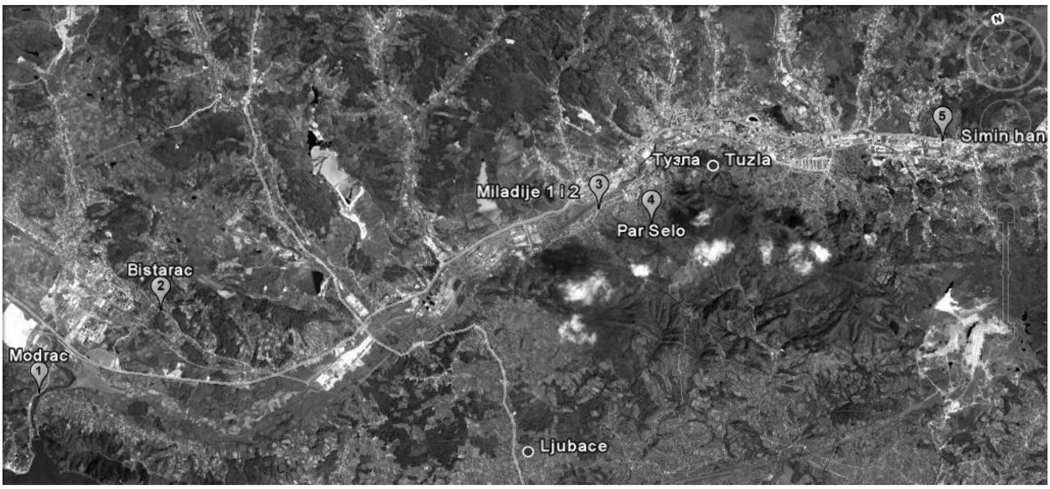

Figure 1. Situational Map of Tuzla and its surroundings with the exact positions of public fountain

Table 1. The names of localities with coordinates and elevations

Locality	Sample	x	y	elevation
1	Modrac	4 930 529	6 541 178	149
2	Bistarac	4 931 486	6 543 703	153
3	Miladije 1, sulphurous waters	4 931 882	6 551 563	191
3	Miladije 2 , fresh water	4 931 884	6 551 562	191
4	Par Selo	4 931 916	6 557 767	215
5	Simin Han	4 929 846	6 553 778	270

Samples were taken for physico-chemical analysis of water from all six sites in chemically clean and dry plastic containers (PVC bottles) volume of 1.5 L. Before sampling, bottles were at least three times in rinse water that is sampled, then to the top filled and sealed plastic cups. Done required labeling of samples and their dispatch to the laboratory. Before analysis, all instruments are calibrated according to manufacturer's instructions. Precise determination of pH was made potentiometrically to pH-meter WTW InoLab. Electrical conductivity was determined by conductometric the meter WTW LF 318th Determination of nitrate (NO_3-N) was performed on spectrophotometer DR/2000 HACH spectrophotometer, with the cadmium reduction method using pads NitraVer 5th Quantitative determination of ammonia (NH_3-N) was carried out by the method of Nessler. Analyses were performed on the spectrophotometer HACH DR/2000, with maximum absorbance at 425 nm. Total iron was determined spectrophotometrically by the method already mentioned spectrophotometer with Fero Ver-oom. Manganese was determined by periodate oxidation on the spectrophotometer HACH DR/2000, with maximum absorbance at wavelength of 525 nm.

3. RESULTS AND DISCUSSION

This section presents the results of the physico-chemical analysis of water from public supply sources that are placed at selected locations. The results of physical-chemical analysis are shown in Table 2. for the month of July 2009. Physical and chemical parameters of water samples including pH, $KMnO_4$ consumption, content of ammonia, nitrate, nitrite content, chloride, EC, total hardness, iron and manganese, and their values are shown in Table 2. pH values were in the 6,80-8,34, with the exception of of water at the source Miladije fresh water, where the pH value was below the allowed (6,5-9,5)4 and was 6,44 . Such a pH value of the source in Miladije (fresh water) can be partly attributed to the lower value of the carbonate hardness (42,00 mgCaO / L), or a small amount of carbonate and bicarbonate, which act as buffer systems and pH are held constant in the natural waters. The highest pH value in the sample water from springs Miladije (so. sulfuric water) and partly a consequence of the high concentration of ammonia (1,24 mg / L) in this water, as well as higher values of carbonate (92,40 mgCao / L) of the total (57,60 mgCao / L) of hardness. In waters where the larger value of the total carbonate hardness, in addition to magnesium and calcium carbonate and bicarbonate significantly present Bicarbonates and carbonates of other alkali and alkaline earth metals (K and Na), which affects the pH value. Based on the results of the total and carbonate water hardness test can be characterized as follows:[6]

Soft water (5-10 degrees German hardness) corresponds to the quality of water sources Bistarac (80,02 mg CaO / L), Miladije 1 (57,60 mg CaO / L) and Miladije 2 (57,80 mg CaO / L). Moderately hard water (10-15 degrees German hardness) corresponds to the quality of water sources in Par Selo (117,60 mg CaO / L). Very hard water (over 25 degrees German hardness) corresponds to the quality of water sources Modrac (280 mg CaO / L) and Simin Han (280 mg CaO / L).

Table 2. The results of physical-chemical analysis of water samples

Analysis	Locality 1	Locality 2	Locality 3	Locality 4	Locality 5	Locality 6	**BiH MAV**	**EU MAV**
pH	7,92	7,77	8,34	6,44	6,80	7,47	6,5-9,5	6,5-9,5
EC [µS/cm]	757	221	304	139	307	747	2500	2500
$KMnO_4$ [mg/L]	3,79	1,90	2,21	1,90	2,84	3,16	5	5
NH_3-N [mg/L]	0,04	0,06	1,24	0,04	0,03	0,07	0,5	0,5
NO_3-N [mg/L]	6,1	4,9	1,1	1,2	3,6	1,4	50	50
NO_2-N [mg/L]	0,006	0,006	0,004	0,005	0,005	0,006	0,5	0,5
Hloridi [mg/L]	18	14	14	12	15	21	250	250
Total hardness [mgCaO/L]	280,00	80,02	57,60	57,80	117,60	280,00	-	-
Fe [mg/L]	0,01	0,01	0,05	0,02	0,03	0,01	0,2	0,2
Mn [mg/L]	0,01	BDL*	0,01	0,01	0,01	0,01	0,05	0,05

*- below the detection limit; **BiH** - the maximum allowed by the Regulations BiH [4]; **EU-** the maximum allowed concentrations under Council Directive 98/83/EZ [5]

From the presented results show that the nitrate content in the range of 1,1 to 6,1 mg / L and is seen not to exceed MAV.[4] European Union (EU) and the World Health Organization (WHO) allow concentration nitrate of 50 mg / L in water and chloramination provided that Member States must ensure compliance with the condition that:

$$\{[\text{nitrate}] / 50 + [\text{nitrite}] / 3\} \leq 1,$$

where square brackets indicate concentration in mg/L for nitrate (NO_3^-) and nitrite (NO_2^-), and the value of 0.10 mg / l for nitrite meets water from plants treatment.[1,5] Manganese concentration is constant and amounted to 0.01 mg / L in five out of six samples (80%), where manganese detected. The highest concentration of iron was the source Miladije-sulfuric water 0.05 mg / L, and lowest at the sources Bistarac, Modrac and Simin Han of 0.01 mg /L.

4. CONCLUSION

Concentrations of heavy metals (Fe and Mn) were below the MAV values according to the applicable regulations of BiH, the EU directive (Directive 98-83-quality of water intended for human consumption) and the WHO recommended values. Concentrations of heavy metals within the limits of which are characteristic of natural waters of several micrograms to a few nanograms, indicated that the metals mostly of mineral origin. According to the values of the investigated physico-chemical parameters in relation to water from the source MAV Miladije-sulfur (ammonia content of 1,17 mg / L) and Malta Miladije-fresh (pH 6,44) are invalid for a drink.

5. REFERENCES

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