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Abstract. One of the main ingredients of soft drinks is water, which makes up about 86%-94% of the volume of drinks. Soft drink manufacturers face unique challenges in the field of water treatment. Water sources, water treatment processes and treatment wastes can affect the quality and (microbiological) safety of the final product. The aim of this paper is to analyse some qualitative and bacteriological safety parameters of untreated and treated water in one of the non-alcoholic beverage production industries in our country. Water samples were taken at the water plant before treatment, and after treatment, where the following physical and chemical parameters were analysed: pH scale, electrical conductivity, water hardness, residual chlorine, and some bacteriological parameters were also analysed, such as total bacteria and E. Coli. The obtained results of the physical, chemical, and bacteriological analyses are compared with the standards of waters intended as auxiliary raw material in the production process of non-alcoholic beverages.

Keywords: water, analysis, physical, chemical, bacteriological, standards.

1. Introduction

Water quality is a term used to describe the chemical, physical, and biological characteristics of water. The chemical constituents of water are substances that dissolve in water, including gases (e.g., oxygen and carbon dioxide), metals (e.g., iron and lead), nutrients (e.g., nitrogen and phosphorus), pesticides (e.g., atrazine and endosulfan), and other organic compounds (e.g., polychlorinated biphenyls). The most common physical characteristics of water are color, odor, temperature, taste, and turbidity, while biological constituents of water are living organisms including bacteria (e.g., Escherichia coli), viruses, protozoans (e.g., Cryptosporidiosis), phytoplankton (i.e., microscopic algae) [1]. Water, as the main component of a soft drink, usually accounts for between 85% and 95% of the product and acts as a carrier for the other ingredients [2]. The water used is normally separately pretreated to remove impurities, microorganisms, and other undesirable attributes, such as off-tastes, odors, and turbidity. It is also treated to regulate alkalinity and hardness [3]. Water should comply with the following quality requirements. It should be free from: high levels of elements and mineral salts; objectionable tastes and odours; organic material. It should also be clear and colourless; free from dissolved oxygen; sterile, that is, free from micro-organisms [2]. The constituents in water can have a profound impact on the overall quality and shelf life of beverage products. For example, if alkalinity is not controlled, the acidic profile of the beverage formulas will be compromised, making the beverage more susceptible to microbial growth and spoilage [4].

The major considerations for the design of the system that will result in high-quality treated water at the lowest possible cost for the final beverage are as follows:

- The quality of the raw water
- The treatment process for microorganisms
- The treatment process for removal of or reduction in suspended and dissolved materials
- The treatment process to eliminate off-tastes and off-odours
- The treatment to ensure high-quality product appearance
- The overall effective treatment for all water used in all the company's product types [3].

2. Materials and methods

During this research, several water samples were analysed, which were taken at the water treatment plant in one of the factories producing non-alcoholic beverages in the Republic of Kosovo. In the water treatment plant, where we carried out the research, the untreated water goes through several stages, such as potassium permanganate, sediment filtration, filter media for removing iron, manganese, and hydrogen sulphide from water, chlorination, active carbon filters, reverse osmosis, bacteriological filters, UV-lamps. Microbiological water samples were taken at the water plant before treatment (natural water) and final water (treated) where the following microbiological parameters were analysed: total number of bacteria and E. Coli. Also, in the water treatment plant, several samples were taken, of untreated water (natural water) and treated water (final water), where the following parameters were analysed: pH level, electrical conductivity, water hardness, and residual chlorine.

The methods used to analyse some microbiological water samples are standard methods used in the factory's accredited microbiological laboratory. For the determination of the total number of bacteria, the nutrient medium Plate count agar (PCA) was used, while for the determination of Escherichia Coli, the nutrient medium was used: Endo Agar (EA). We planted the water samples in petri dishes, where we took 3-4 mL of the sample and then we placed the corresponding nutrient grounds. After the nutrient grounds have hardened, we have placed them in incubators. We placed the samples for determining the total number of bacteria in the incubator at a temperature of 37°C, the samples for the determination of Escherichia coli, we also placed them in the incubator at a temperature of 37°C. For the total number of bacteria, the result is read after 24 hours, for Escherichia coli, the result was read after 4 days.

The determination of the pH was done with a digital pH meter, where initially the calibration was done with a standard buffer with pH 4.01, 7.01 and 10, after the calibration the water samples were analysed. The determination of electrical conductivity in water was carried out with a conductometer, where the probe of the conductometer was first rinsed with deionized water, then the water samples were analysed. Determining water hardness: water samples are placed in a 100 mL Erlenmeyer flask, we added a little black Eriochrome indicator and to the same, we added 5 mL buffer with pH 10, where in untreated water (natural water) it turns pink while in the treated water it turns blue when the indicator is added. The sample is titrated with 0.05M EDTA. The spent value of EDTA is multiplied by 2.8. Water hardness is expressed in the German scale °dH. In the treated (final) water, we did a quick test to determine the presence of chlorine in the water. For the quick test we used the special palin pill, where they are placed in a special container and if the water does not change color, it means that there is no presence of chlorine.

3. Results and discussion

The results obtained during the following experimental work are presented in tabular form.

Results of microbiological analyses in water

Table 1. Results of microbiological analyses in water

Samples/Parameters	**Total number of bacteria**	**E. Coli**
Before treatment (natural water)	20 cfu/mL	0 cfu/mL
Final water (treated)	0 cfu/mL	0 cfu/mL

The results obtained and illustrated in Table 1 in the sample, the untreated water: the total number of bacteria 20 cfu/mL, Escherichia Coli 0 cfu/mL, while in the final treated water the total number of bacteria 0 cfu/mL while Escherichia Coli 0 cfu/mL. So, the results show that the technological influences used for water treatment have had a positive effect on reducing the total number of bacteria, the samples for the analysed parameters are safe from the microbiological point of view.

Results of physical and chemical analyses in water

Table 2. Results of physical and chemical analyses in water

Samples/Parameters	pH scale	Electrical conductivity (µS/cm)	Overall hardness (dH°)	Palin Test
Before treatment (natural water)	7.30	453	12	Positive
Final water (treated)	6.86	70	0	Negative

In table 2, the results obtained in average values from three measurements for the pH scale resulted with changes, in the untreated water sample the pH value was 7.30, while in the treated water the value was smaller 6.86. The electrical conductivity in the untreated water sample resulted in higher values of 453 (µS/cm) while in the treated water the values were lower 70 (µS/cm), the overall hardness in the untreated water was 12 dH ° while in treated water 0 dH°. The presence of chlorine in the untreated water sample was positive, while the treated water was negative. So, the application of water treatment processes has had a positive effect according to the values obtained.

4. Conclusion

Based on the results of this study we can conclude that:

- Untreated water resulted in the highest content of total bacteria count at 20 cfu/mL.
- In untreated water and treated (final) water, Escherichia coli resulted with a value of 0 cfu/mL, so the water is considered safe for the analyzed parameter.
- The electrical conductivity in the untreated water sample resulted in higher values of 453 (µS/cm), while in the treated water the values were lower, 70 (µS/cm).
- The overall hardness in the untreated water was 12 dH° while in the treated water it was 0 dH°.
- The average value from the three measurements for the pH scale resulted in changes, in the untreated water sample the pH value was 7.30, while in the treated water the value was smaller 6.86.
- The presence of chlorine in the untreated water sample was positive, while the treated water was negative.
- The application of water treatment processes has had a positive effect according to the values obtained.
- From the results obtained, the treated water is suitable for use in non-alcoholic beverages, cleaning production lines, and other applications.

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