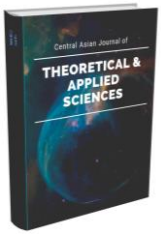

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Article

Study of Some Physical and Chemical Characteristics of Bottled Drinking Water Brands in Hilla City/ Iraq

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Abstract: The current study was conducted in Al-Hilla city on 10 factories that produce bottled water. Physical and chemical tests were conducted on the studied samples. the PH values ranged between (7.2-8). The electrical conductivity was (99-153) µS/cm and the nitrate values were (0.1-0.9) ppm. The values of Total hardness ranged between (20-84) ppm, while the elements of potassium and sodium ranged between (0.2-2.9) ppm, (1.2-13) ppm, respectively. The turbidity values ranged between (0.52-1.5) NTU and The TDS values ranged between (75-102) ppm, All physical and chemical tests were within the parameters recommended by the World Health Organization (WQI) and the Iraqi Ministry of Health.

Keywords: bottled drinking water, Hilla city, Al-Waha, Aquafina.

1. Introduction

Water is the elixir of life and an important resource for humans, as it constitutes a large percentage of the content of the living matter of the cell in all living organisms, plants and animals, and is a medium for vital reactions that cannot take place without its presence. In addition, it contains many salts of sodium, potassium, and magnesium that support the survival of the organism and its continuation of life [1]. Global water demand is largely influenced by population growth, urbanization, food and energy security policies, economic processes, changing food quantities and increasing consumption, mainly due to the increasing demand for water in industry, agriculture, electricity generation and domestic use. The misuse of water resources has increased the risks of pollution and severe water stress in many parts of the world over the past few decades, and the continued growing water crisis has serious repercussions on public health, environmental sustainability, food security, energy, and economic development [2]. Thus, drinking water is one of the basic and permanent requirements for all living organisms, including humans, and it cannot be dispensed with in any way. Therefore, it must conform to the physical, chemical, and biological quality specifications of water. Drinking water can be defined as water prepared for human consumption, and it is safe, whether for drinking or for uses. Other household water is also defined as water free of pathogens and chemical pollutants that harm human health. It must be colorless, tasteless, and odorless. In order for the water to be suitable for drinking, it must undergo treatment processes before using it [3]. As for bottled drinking water, it is defined as natural or treated drinking water suitable for human use, according to what is stated in the proposed Iraqi standard specifications for bottled drinking water. As for the US Food and Drug Administration (FDA), it considers that bottled water is sold in containers of different

sizes and is free of any substances. Added to the fact that it contains some antibiotics for biological pollutants, which must be safe and appropriate [4]. Bottled drinking water must conform to international standards used and followed when bottling drinking water. The source of this water in factories and desalination plants must be pure and unpolluted, in addition to being far from any source of environmental pollution and free of all microscopic organisms. Recently, health standards have been set for the specifications of drinking water suitable for human use to ensure the preservation of Human safety, health and protection. This is the result of increasing global interest in the quality of drinking water in recent years [5]. As a result of the possibility of water being polluted from liquefaction networks and changing its quality depending on the change in the quality of the source of that water, in addition to the possibility of it being contaminated by pipe networks during transportation, the production or industry of bottled water has recently flourished and the demand for it has increased in most parts of the world because this water is characterized by its uniform quality that varies. Seasons [6]. Thus, it has become necessary to pay attention to the characteristics of water when treating it and producing high-quality drinking water is extremely important. However, this matter did not achieve the required level in ideal drinking water treatment processes, as attention was focused only on the properties of color, taste and smell, after which interest increased in the physical specifications of water. and chemicals by specialists in the quality and quality of potable water and methods and methods for treating it [7]. Water exposure to direct and indirect pollution has increased as a result of the use of water moving from simple human and agricultural purposes to extensive industrial and civil uses. Because of this, the world has witnessed increasing interest in water resources and how to treat pollution in them [8].

The aim of our study:

The aim of the current study is to determine some physical and chemical characteristics of bottled drinking water brands in Hilla City/ Iraq

2. Materials and Methods

2.1. Description of the Study Area

Hilla city was chosen as a model for studying bottled water, as it is located in central Iraq and 100 km south of Baghdad. In the middle of the city of Hilla is the Shatt al-Hilla, which is one of the branches of the Euphrates River. It runs through it for a length of 10 km, and tributaries and streams extend from it. It is considered the main water resource for various uses. 10 Iraqi commercial companies for bottled water were selected: Seha, Rawd Al-Mueen, Afiyat, Aquafina, Durrat Al-Khaleej, Al-Waha, Oyoun Al-Basra, Granada, Al-Mas, and Wadi Mona.

2.2. Collection Samples

Water samples were collected from ten selected water factories in different locations in Hilla Governorate, starting from October 2023 to December 2023, for the purpose of conducting physical and chemical tests. The water temperature was measured directly with a mercury thermometer. The pH was measured using a pH meter. Electrical conductivity (μS/cm) and water total dissolved solids (mg/L) were measured using an electrical conductivity meter[9]. Total hardness was also measured and the results were expressed in mg/L. Turbidity was measured and the results were expressed in NTU. Chlorides, potassium and sodium were measured and the results were expressed in mg/L. Nitrate concentration was also measured using an optical absorption spectrophotometer with a wavelength of 543 nm [10].

Figure (2). Bottled water samples collected (By researcher).

3. Result and Discussion

3.1. PH

The pH values ranged between (7.2-8), As in Figure 2, with the highest value at Rawd Al-Mueen, while the lowest value was at the Seha and Wadi Mona Factory. All values of the tested samples did not exceed the Iraqi and international limits for drinking water.

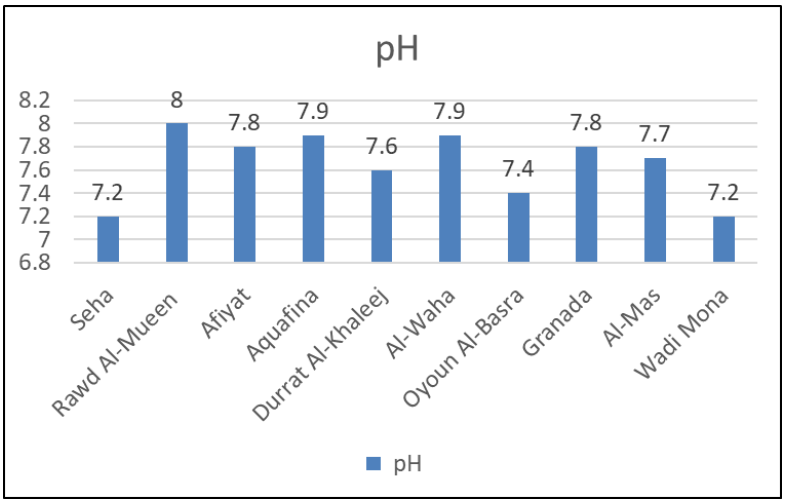

Figure (2). pH values.

3.2. Sodium (Na)

Figure 3 indicates that the sodium element values in the tested water samples ranged between (1.2-13) ppm, with the highest value reaching 13 ppm in the Al-mas factory and the lowest value at 1.2 ppm in the Afiyat factory. All sodium concentrations of the samples were within the permissible limits for drinking water.

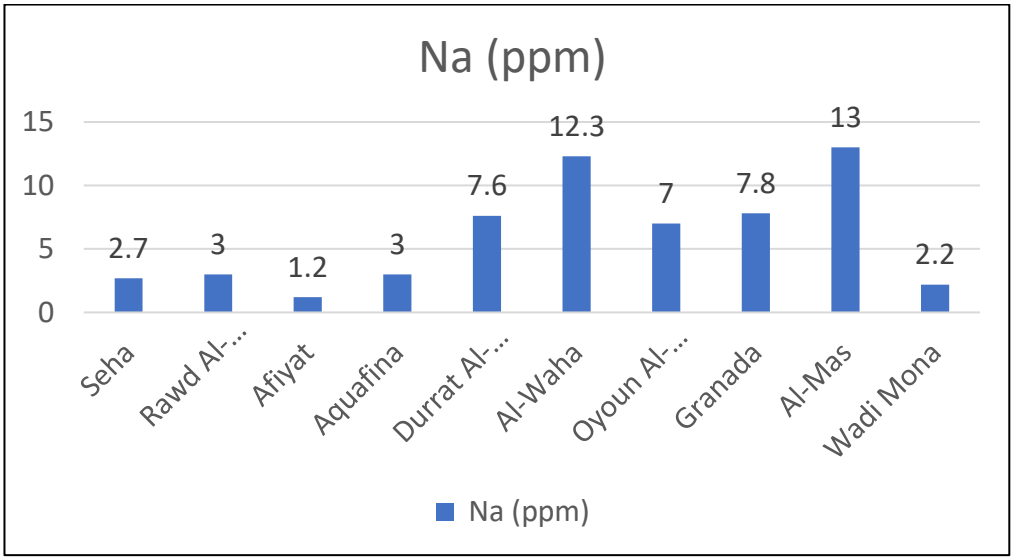

Figure (3). Na values (ppm)

3.3. Potassium (K)

Figure 4 indicates that the values of potassium in the tested water samples ranged between (0.2-2.9) ppm, with the highest value reaching 2.9 ppm in the rawd al-mueen factory and the lowest value at 0.2 ppm in the Afiyat and wadi mona factory. All potassium concentrations in the samples were within the permissible limits for drinking water.

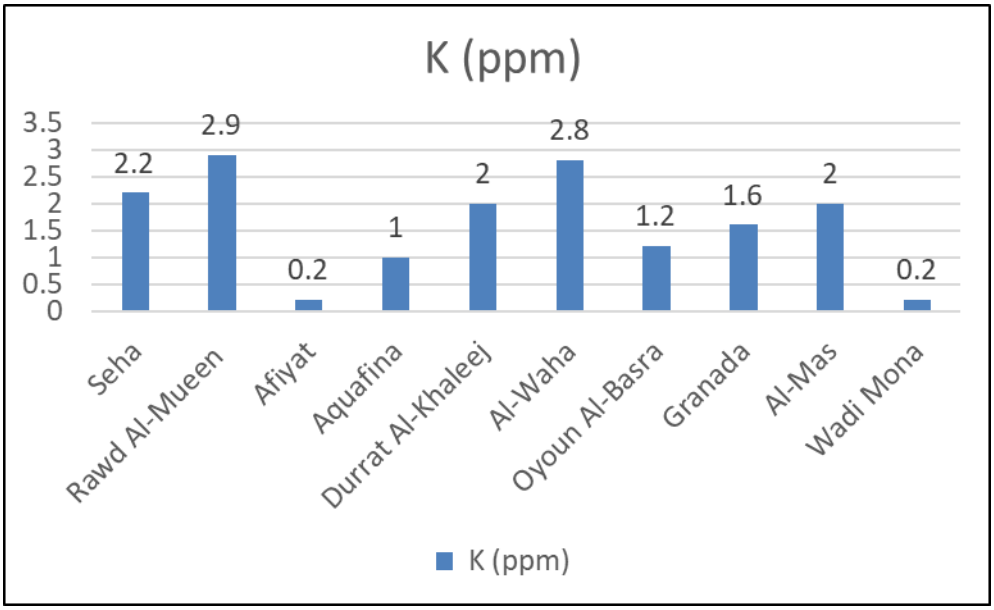

Figure (4). Potassium values (ppm).

3.4. Total Dissolved Solids (TDS)

The TDS values in the tested water samples ranged between (75-102) ppm, As shown in Figure 5, with the highest value reaching 102 ppm in the durrat AL-khaleej Factory, and the lowest value was 75 ppm in the oyoun Al-basra Factory. All TDS values for the tested samples were within the Iraqi and international limits allowed for drinking water.

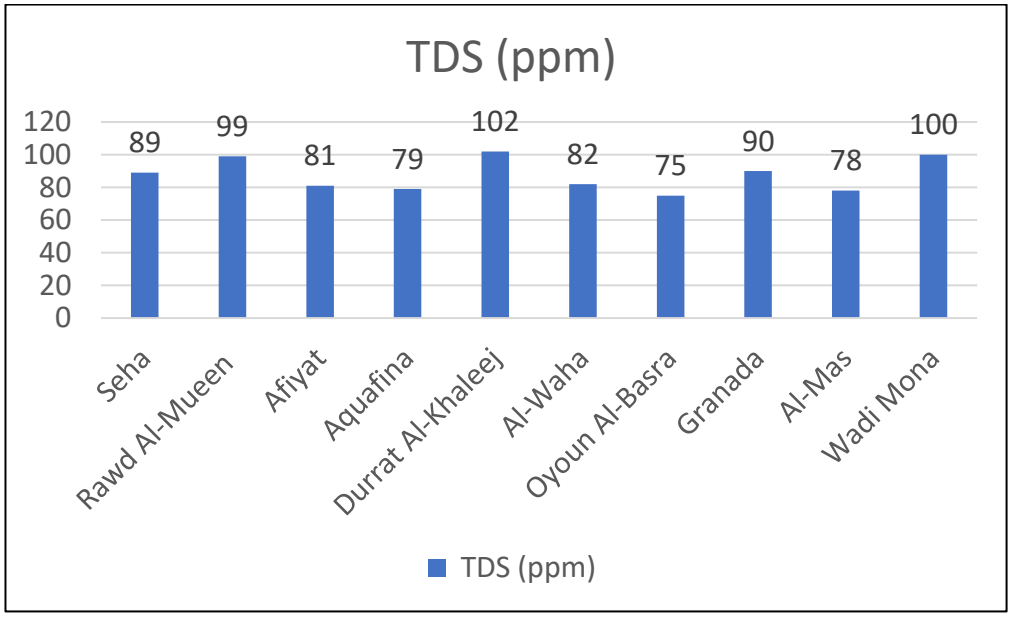

Figure (5). TDS values (ppm).

3.5. Total hardness (TH)

The total hardness values in the tested water samples ranged between (20-84) ppm as in Figure 6, where the highest value was 84ppm in the seha factory and the lowest value was 20ppm in the aquafina factory. All total hardness values of the tested samples were within the Iraqi and international limits allowed for drinking water.

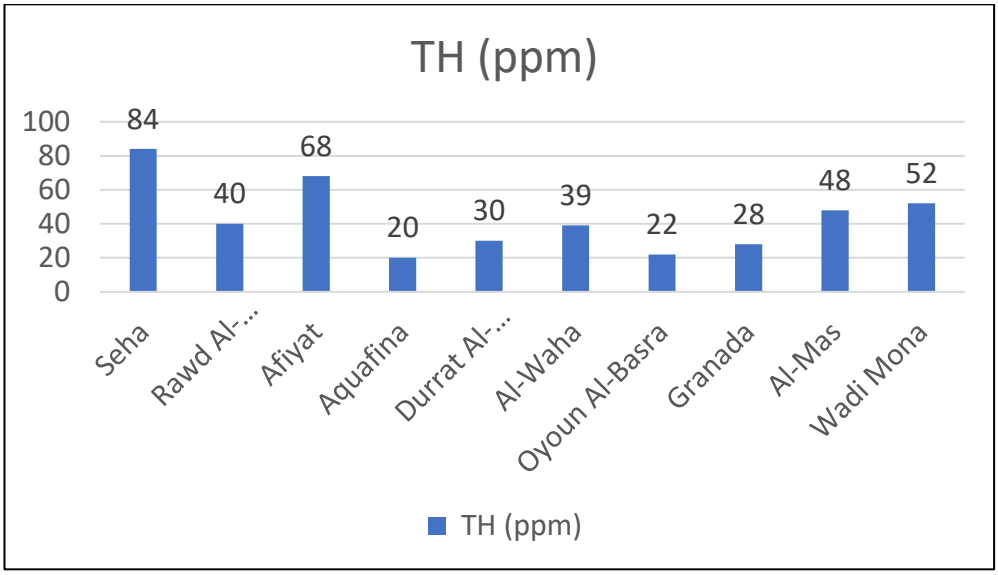

Figure (6). TH values (ppm).

3.6. Turbidity

The turbidity values ranged between (0.52-1.5) NTU, as shown in Figure 7. The lowest turbidity value was in the seha Factory and the highest value was in the Granada and durrat Al-khaleej Factory. All values were within the standard parameters for drinking water.

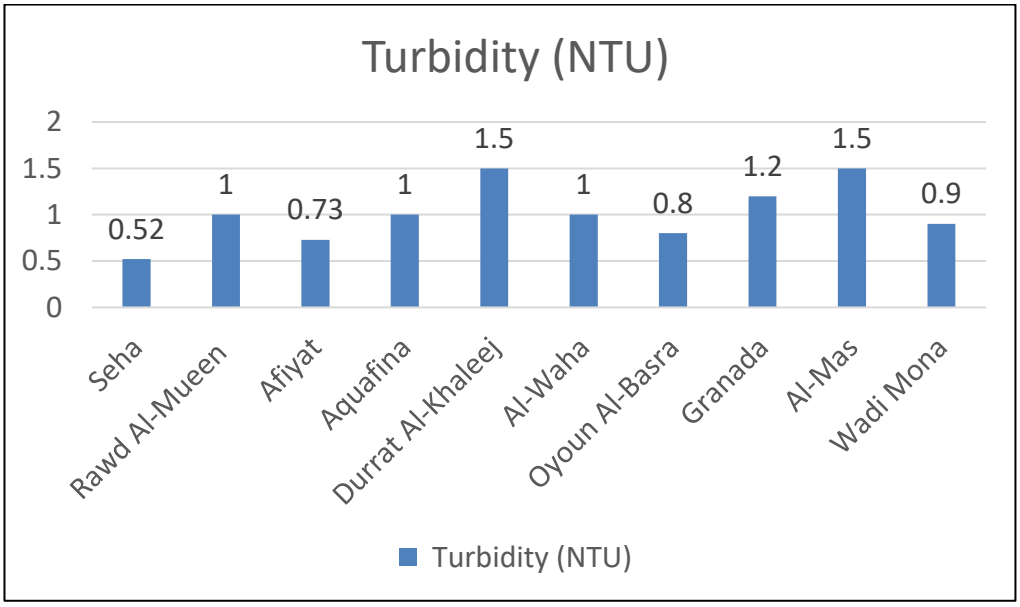

Figure (7). Turbidity values (NTU).

3.7. Electrical conductivity (EC)

All EC values were within the limits permitted by Iraqi Health and the World Health Organization, where EC values ranged between (99-153) µS/cm as in Figure 8. The highest value was in the afiyat Factory and the lowest value was in the Al-waha Factory.

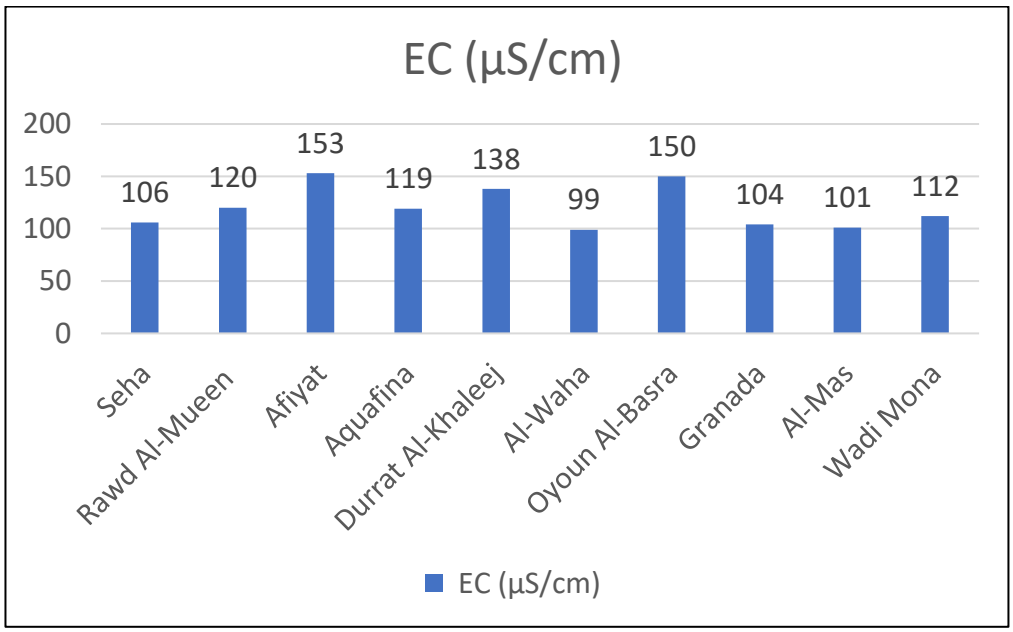

Figure (8). EC values (µs/cm).

3.8. Chloride (Cl)

Figure 9 indicates that the chloride values in the tested water samples ranged between (17-58) ppm, with the highest value reaching 58 ppm in the oyoun Al-basra Factory and the lowest value being 17 ppm in the seha Factory. All total hardness values of the tested samples were within the Iraqi and international limits allowed for drinking water.

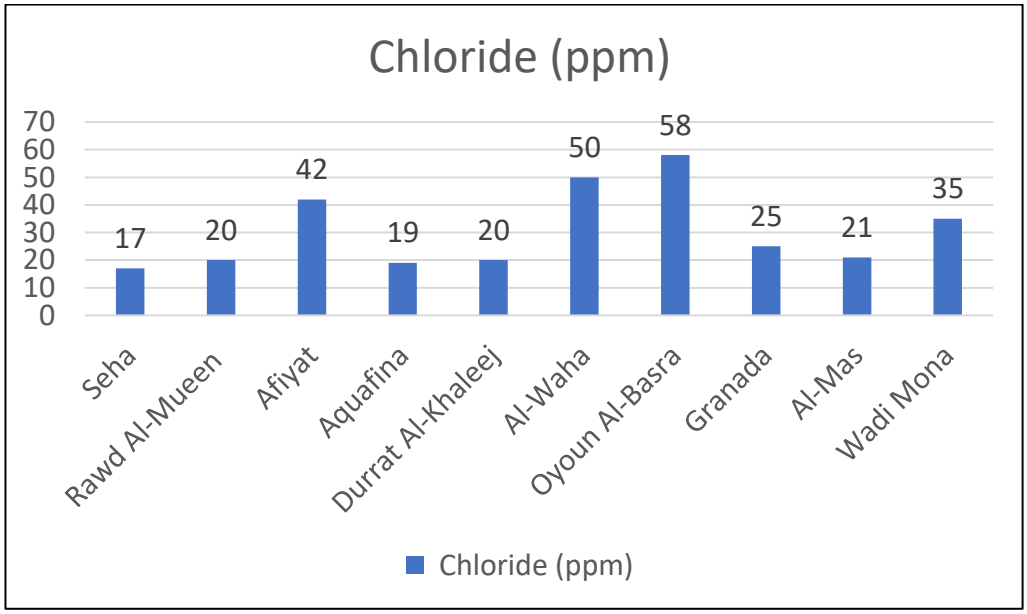

Figure (9). Cl values (ppm).

3.9. Nitrate(NO3)

All nitrate values were within the limits permitted by Iraqi Health and the World Health Organization, where nitrate values ranged between (0.1-0.9) ppm as in Figure 10. The highest value was in the durrat AL-khaleej factory and the lowest value was in the Al-waha factory.

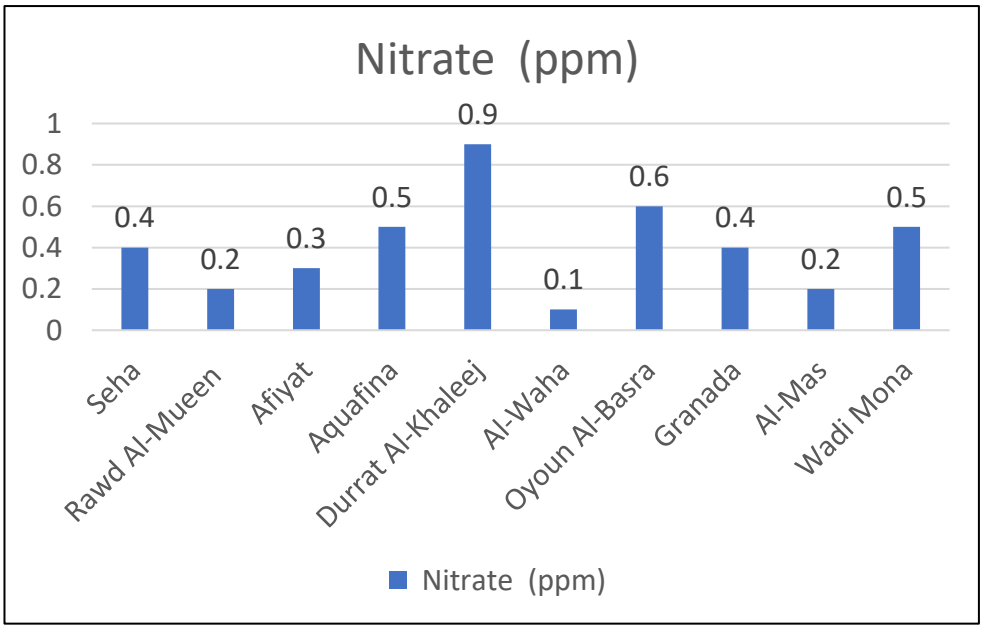

Figure (10). No3 values (ppm)

Conclusion

The current study showed that all physical and chemical tests conducted on the study samples did not exceed international specifications for drinking water. The difference in the results of most of the chemical tests for the water studied is due to the storage, transportation process, the difference in methods and techniques used in the water treatment process and the source of treated water.

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