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Assessment The Ground Water Quality In The Southern Libyan Area Using Total Dissolved Solids And Ph Date

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تقييم جودة المياه الجوفية بالجنوب الليبي باستخدام الاملاح الذائبة والرقم الهيدروجيني

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الملخص

أجريت هذه الدراسة للتعرف علي بعض خواص المياه الجوفية لعدة مناطق ممتدة علي الساحل بين سبها و اوباري. وتمت الدراسة في شهر أكتوبر 2020 ، حيث جمعت 24 عينة لعدد ثمانية (8) أبار وبأعماق تتراوح بين (40– 300)م . وتتمثل هذه الخواص في الرقم الهيدروجيني (PH) و مجموع الأملاح الصلبة (TDS). وأظهرت النتائج أن متوسط الرقم الهيدروجيني يتراوح بين (6.53– 7.36) وهي ضمن الحدود المسموح بها طبقا للمواصفات الليبية ومنظمة الصحة العالمية. أما متوسط مجموع الأملاح الذائبة فتراوحت بين (38.6– 918) ملجم/لتر وهي كذلك ضمن الحدود ولم تتعدي 1000 ملجم حسب المواصفات الليبية و منظمة الصحة العالمية.

الكلمات المفتاحية: المياه الجوفية، الرقم الهيدروجيني، الأملاح الذائبة، المواصفات الليبية، منظمة الصحة العالمية.

Abstract

This study was conducted to identify some properties of underground water for several areas located in the south of Libya confined between the regions of Al-Fujeij and Al-Kharig in October 2020. Twenty-four samples were collected from eight wells, with depths ranging from 40-300meters.The investigated properties of the underground water are the pH, the total dissolved solids (TDS) and the electrical conductivity (E.C). The obtained results showed that the average pH ranged between (6.53-7.36), which is within the permissible limits according to the Libyan and the WHO standards, the average total dissolved salts ranged between (38.6-418) mg/L, which is also within the limits and did not exceed 500 mg/L according to the same standards and the electrical conductivity, which was calculated mathematically, it ranged between (60.31-653.13) µS /cm. Also, according to the Food and

Agriculture Organization, underground water is considered to be of good quality and can be used for irrigation.

Keywords: (Underground water; pH, total dissolved salts (TDS), electrical conductivity (E.C), Libyan standards and World Health Organization (WHO)).

1. Introduction

Water is natural resource. It is considered as an important and necessary wealth for the life of all beings. The availability of fresh water has become an important and worrying matter in the Arab countries [1]. The State of Libya is considered one of the poorest countries in the world in terms of water resources [2], as it is located in the arid or semi-arid regions [3]. The underground water in Libya is the main source of water [4], and it constitutes 96% of the water resources available for human consumption whether for drinking, agriculture or industry [5]. According to the United Nations reports, Libya is threatened by drought [6]. The underground water is found at different depths and gathered in the ground, forming two water layers. The first layer is known as the surface reservoir, which is called as the phreatic layer and its water is one of the most widely used. Its depth ranges from 10-100 m, sometimes up to 160 m. The second one is known as the semi-phreatic layer. It ranges from 20-50 m below the first one, and it is characterized by abundant amounts of water. It is considered one of the most important aquifers [4]. The southern region of Libya is rich of underground water, and it can supply the other regions of the country with water. So, the study of quality of this water has been conducted. Paper must be formatted according to this template. In order to safeguard the long-term sustainability of the groundwater resources, The main objective is to quality of underground water for in the south of Libya confined between the regions of Al-Fujeij and Al-Kharig for drinking and irrigation purposes, using Total Dissolved Solids and PH data.

METHODS

1.Study area

The study area is located in the south of Libya in the Murzuq basin [7], between longitudes of 14.427149o and 12.793976° and latitudes of 26.912733°, 26.580079° [16]. It includes (Al-Fujeij, Takerkebeh, Qaraqra, and Al-Kharig) as shown in (Fig .1), and (Table 1) shows the site of the studied wells.

Fig. 1: The general location and wells of the study area

Table 1:information about the groundwater wells.

Name of area	weight loss	Depth of the well (m)
Al-Fujeij	W1	125
	W2	125
Takerkebeh	W3	250
	W4	250
	W5	40
Qaraqra	W6	300
	W7	65
Al-Kharig	W8	90

2.Practical part and methodology

This study was carried out to find out some of the properties of underground water wells in the south of Libya, including the areas of (Al-Fujeij, Takerkebeh, Qaraqra, and Al-Kharig). Three samples were collected for each well.

Each sample was collected in a glass container of 500 mL for eight wells in October 2020. The samples were sent directly to the gas electrical station laboratory in Ubari. The tests were conducted there for the samples are the TDS and the PH.

RESULTS

The collected samples from eight wells were analyzed in the study area, and all the results are shown in (Table 2). It includes the average of both PH and TDS for three samples. The results were compared with the Libyan standards [13, 14] and the standards of WHO [15].

Table 2:Results of tests for underground water wells.

Well No	PH average	TDS average mg/L	EC average µS/cm
W1	7.3	166.9	260.78
W2	7.36	70.50	110.15
W3	7.5	38.6	60.31
W4	7.0	74.47	116.3
W5	6.53	271	423.43
W6	7.12	43.9	68.59
W7	6.7	147.6	230.62
W8	6.83	418	653.13

1.PH

A total It is a number that expresses the level of acidity or alkalinity of a pure solution at a temperature of 25 CO. The range of pH extends from zero to 14. It gives a neutral pH when it is equal to 7, and the acidic solution is less than 7, while the basic one is more than 7. It is of great importance in evaluating quality of water and its suitability for drinking or other uses. The obtained results are shown in (Table 3). It was found that the pH values of the studied samples ranged between (6.53-7.5).It was noted that the well of Al-Kharig has acidic water due to its concentration of less than 7, while the well in the Qaraqara area it is between acidic and alkaline, and in The Al-Fujeij region is alkaline, and in the Takerkebeh region, it is between acidic, neutral and alkaline.(Fig .2) shows the PH of all samples is within the permissible limits according to the Libyan and the WHO standards (6.5 - 8.5) [13, 15], and the water is considered good and fit to drink.

Table 3:The quality of underground water according to PH

PH Value	No. of wells	Water type
< 7	3	acidic
= 7	1	Neutral
> 7	4	alkalic

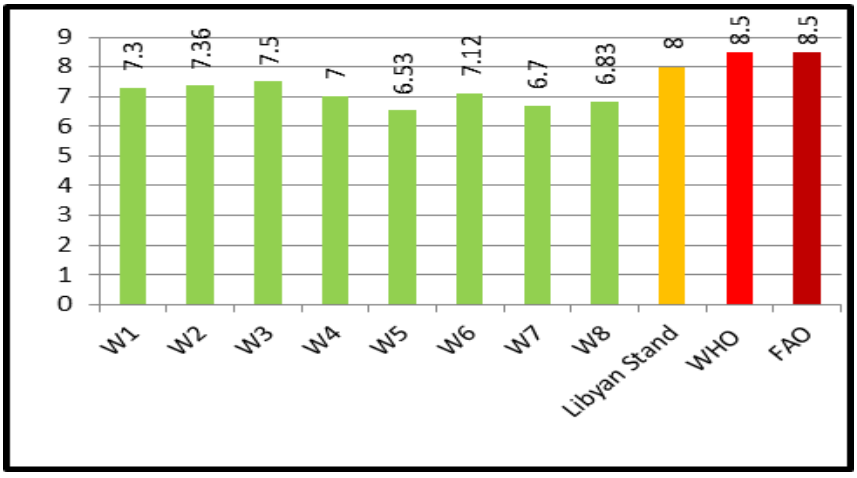

Fig. 1: The pH of wells' water

Likewise, according to the Food and Agriculture Organization (FAO, 2006), the pH is considered within the permissible limits (6-8.5), [8].and also within the classification (Ayers and Westcot, 1999), which stipulates the permissible limit in irrigation water (6.5 – 8.4) [10]. According to the Don classification, water is considered well-used and reliable for irrigation, as shown in (Table 4) [11].

Table 4:Water quality for irrigation according to Don 1995 classification

PH	Water quality
< 6.5	super
6.5 – 6.8	Good
6.8 – 7	Allowed
7 - 8	invalid

2.Total Dissolved salts ((TDS)

The obtained results for TDS ranged between (38.6-418) mg/L. The lowest concentration was of Takerkebeh well while the highest concentration was of Al-Kharig well. (Fig. 3) shows the concentrations of total dissolved salts in the study area. With reference to the standards, all samples are the same within the limits of the Libyan standards (100 -500 mg/L). It is considered good and potable water according to Libyan National Center for Standardization and Metrology 2020[13] Also, through the results shown in (Table 1), which indicate that its concentration should not exceed the maximum limit (FAO, 2006) allowed in irrigation water (2000) mg/liter, which was mentioned by the Food and Agriculture Organization [8], which is (Fig. 3) shows underground water salinity concentrations.

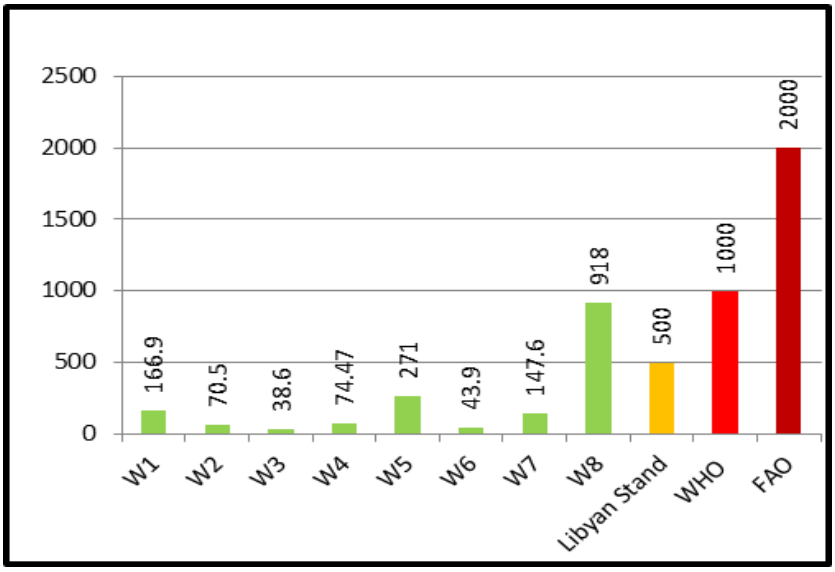

Fig. 3: Average dissolved salts of wells' water

3.Electrical Conductivity

The electrical conductivity of water depends on the number of ions of substances dissolved in water that carry positive and negative ions. The conductivity increases directly with the amount of these ions. Electrical conductivity is considered one of the basic and important tests. It is used to figure out the amount of salinity and its suitability for irrigation according to classifications. There are multiple systems for classifying water for irrigation according to the concentration of conductivity. It has been calculated from the equation below [14], and it is shown in (Table 1) [14,15], and illustrated in (Fig.4).The conductivity values were in the range. It is considered to have low conductivity due to the lack of dissolved salts. (Table 5) shows the quality of water based on electrical conductivity. To determine its suitability [14]:

$$\mathrm{E.C} = \frac{\mathrm{TDS}}{0.64}$$

Where;
(TDS): salinity(mg/L) and, E.C: electrical conductivity µS/cm.

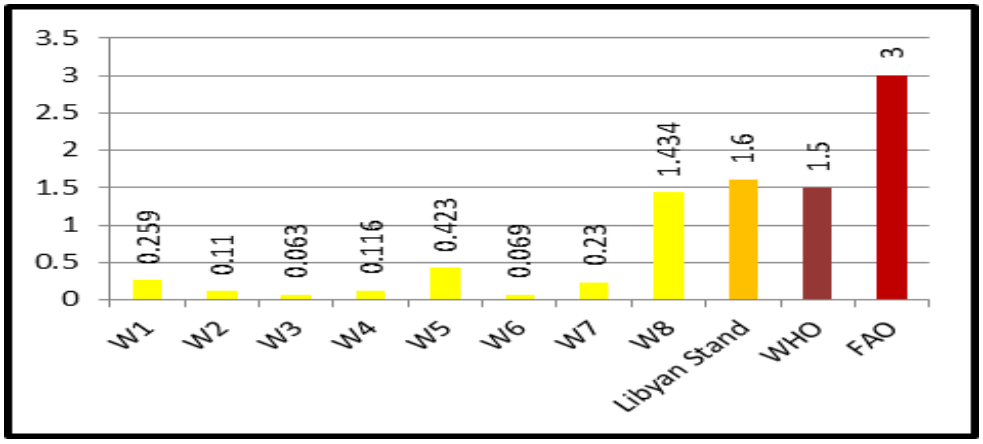

Fig. 4: Electrical conductivity of underground water in the study area

Table 5:Irrigation water quality based on electrical conductivity [9]

Water salinity	E.C µS/cm	Water quality	Evaluating of targeted wells
Low	0-0.25	super	5
Moderate	0.25-0.75	good	2
Medium	0.75-2.25	allowed	1
High	2.25-4.0	doubtful	-
Very high	4-6	Invalid	-

The results were compared to the system most widely used for irrigation water, which is the salinity laboratory system in the United States of America. (C1, C2, C3). The results can be classified as shown in (Table 6) [11].

Table 6:Classification of water conductivity according to the US Salinity Laboratory System (USSL)

Damage caused by salts	Classification	E.C µS/cm
Low	C1	< 250
Medium	C2	750 - 250
High	C3	2250 - 750
Very high	C4	> 2250

The results can also be compared with the Don classification, and their quality can be classified between allowed and super [12]. (Table 7) shows the quality of irrigation water for electrical conductivity according to the Don classification.

Table 7:shows the quality of irrigation water for the electrical conductivity, according to the Don classification

Water quality	E.C µcm/S
Super	< 250
Good	750 - 250
Allowed	2000 - 750
Doubtful	3000-2000
Inappropriate	> 3000

Conclusion

Depending on the obtained results of water analysis in the study area in the south of Libya at Ubarig as electrical station laboratory and according to the Libyan and the WHO standards, the study recommends preserving water resources as well as:

1- Conducting more chemical, microbial and physical analyses of underground water basin in the study area.

2- Finding alternatives of underground water to meet domestic, agricultural and commercial consumption of water, such as treatment and purification of wastewater and sewage water and desalination of seawater

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