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Relationships between Physiochemical Properties in Water of Ain Kaam and Wadi Kaam in Zliten Libya.

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ABSTRACT

Background and Objective*: The water sources have been affected in Libya since the beginning of the revolution in February 2011, including the Kaam area, which contains Ain Kaam (spring) and Wadi Kaam (dam), so the objective of this study was to observe the effect of war on the water of Ain Kaam and Wadi Kaam in Zliten Libya, and to determine the relationships between each other in physiochemical properties.* ***Materials and Methods****: Water samples were collected from both study sites during January and February 2018. The physical and chemical properties of all samples were evaluated which included pH, Electrical conductivity (EC), Total dissolved solids (TDS), Total hardness (TH), Calcium (Ca2+), Magnesium (Mg+2), Chloride (Cl-1), Sodium (Na+1), Potassium (K+1), Sulphate (SO4-2), and Bicarbonate (HCO3-1). All parameters analyzed according to standard methods.* ***Results:*** *The findings showed that values of pH, Electrical conductivity, total dissolved solids, calcium and potassium in the water of both study sites were within the permitted limits of Libyan standards and World Health Organization (WHO) for drinking and irrigation water. On the other hand, values of sodium, sulphate and bicarbonate were exceeded the acceptable limit in both study sites. It was also noted that, total hardness, magnesium and chloride exceeding the allowable values in Ain Kaam, while in Wadi Kaam were within the allowable values****. Conclusion:*** *The results of this study showed the physiochemical properties of water in both study sites were accepted for irrigation and need treatment for drinking.*

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INTRODUCTION

Water is an essential for the establishment of cities, towns, villages, agricultural areas, because the progress and development of civilization and technology associated with the water. There are numerous water sources like groundwater and surface water, such as rivers, lakes, seas, oceans, and springs [1]. The aquatic environment study began over a century ago in Scandinavia and Europe [2] through the study of changes of the physical, chemical and biological of those sources. These factors can influence natural and human environment, whether directly or indirectly by creating conditions that limit water utilization for specific purposes [3].

In Libya, lakes, oases, valleys, and springs are the sources of the survival of life [4]. This study focus on

Kaam area which located in the west of Libya. Kaam area is a small village located 15 km northwest of the Zliten city in Libya, about 150 km east of the capital Tripoli [5]. In Kaam area the valley (Wadi), and spring (Ain) are the water sources. Kaam valley has a theoretical capacity of 111 million cubic meters. Most of the water comes from Wadis connecting into Wadi Kaam in the highland Tarhunah area. The second section of the valley is directly north and supplied from underground water, which comes closer and closer to the surface. Further north still, the water meets the surface, creating a wetland with spring (Ain Kaam) which surrounded by reeds. This section is about 2 kilometers long river and estuary, as reported by (GEFLI) [6]. The water is provided by the springs and the incoming tide. The estuary flows thorough a sandy beach of the Mediterranean Sea [4]. The Kaam area is an aquaculture site, and also are one of the importance of water availability for many agricultural, and industrial products [4], which is one of the requirements of life, so they recognized an agricultural project [4].

The water quality in any ecosystem provides significant information about the available resources for supporting life in that ecosystem [7]. Water quality of Ain Kaam and Wadi Kaam can be affected by different forms of contamination, especially after the revolution and war 2011 uprising. Furthermore, the contamination of this water due to the fertilization of chemical fertilizers or organic processes [8], and there are other contaminants extend to the Ain kaam with rainwater and runoff of Wadi Kaam.

Some contaminants can be easily known only by measuring the taste, odor and turbidity of the water. But most cannot be easily noticed and need testing to reveal whether or not water is contaminated [9], for this reason the study of physiochemical parameters of water is important to determine the quality of water as per WHO Criteria [10]. Furthermore, these parameters are determining factors for the survival of aquatic organisms [11].

Information on the relationships between physiochemical properties of the waters in Ain Kaam and Wadi Kaam is very limited generally after war 2011' upraising. Therefore, the objective of this study is to analyses the chemical and physical characteristics of water in order to determine the water quality of Ain Kaam and Wadi Kaam and the relationship between it.

In this analysis, we measure important parameters such as temperature, pH, electrical conductivity, total dissolved solids, total hardness, calcium, magnesium, chloride, sodium, potassium, sulphate, and bicarbonate as these parameters can determine the water quality for human consumption and irrigation.

MATERIALS AND METHODS

Study sites and sampling:

For the present study have chosen two study sites that are located in Kaam area, northwest of the Zliten city in Libya (Fig. 1). The first site was Wadi kaam located at south of Kaam area (32° 24′ 34″ N 14° 20′ 27″ E) while, the second site was Ain Kaam (32° 27′ 50″ N 14° 34′ 21″ E) located at the north of Kaam area nearby the beach of the Mediterranean Sea.

Water samples were collected randomly from Ain Kaam and Wadi kaam over a depth of about 10 cm below the water surface in the upper layers of the water using plastic water bottles (1.5 litters) according to standard methods by American Public Health Association (APHA) [12]. Water samples were collected from both study sites during January and February 2018.

Measurement of Water Quality Parameters

Twelve water quality parameters have been tested in this study. All these parameters were carried out

referring the 'standard methods. Water temperature was measured using mercury-in glass thermometer. Hydrogen-ion concentration (pH) and conductivity were measured in the laboratory with pH meter and conductivity meter 4310, respectively. Total dissolved solids (TDS) were determined by evaporation a known amount of water sample and weighing the residue. The calcium, magnesium, total hardness and chloride were estimated by the titrimetric method. Chloride (Cl-1), sodium (Na+1), potassium (K+1), sulphate (SO4-2), bicarbonate was done according to standard specifications presented by APHA [12]. One-way ANOVA was used to test for statistical differences between the means of the physical and chemical parameters of both study sites using SPSS software.

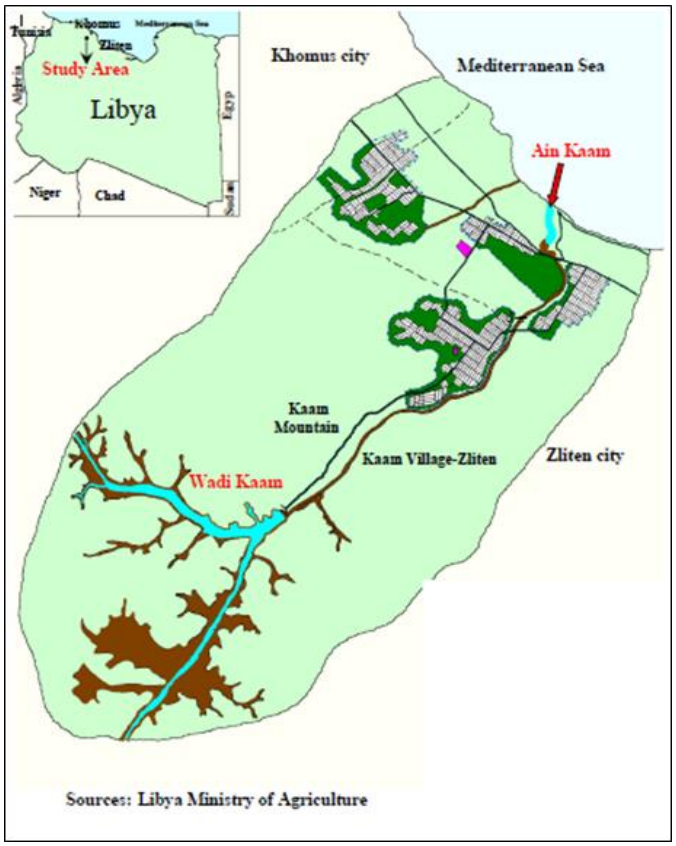

Figure (1) Showing map of sampling location in the study sites (Sources: Libyan Ministry of Agriculture).

RESULTS

The results of the physicochemical parameters of water samples collected from Ain Kaam and Wadi Kaam and compared it with values of Libyan standards and World Health Organization (WHO) quality parameters and are presented in Table 1. The average pH, electrical conductivity, calcium and potassium of both study sites were within the Libyan and WHO standards. While the average of sodium, sulphate, and bicarbonate of both study sites was higher than Libyan and WHO standards. The highest values of total hardness and chloride in Ain Kaam were recorded 1110 mg/L and 610 mg/L respectively. These values were more than two times the presumably values for drinking water in Libya. Moreover, the value of magnesium (1050 mg/L) also recorded about seven times Libyan standards (150 mg/L).

DISCUSSION

The quality of water depends on the location and the natural physicochemical properties and management of water sources. The results of physicochemical analysis of water samples are discussed as below.

The pH provides important information in many types of chemical equilibrium and considered an important ecological factor [13]. In the current study, no significant difference was recorded between both study sites, and within the normal range and was toward alkalinity, due to may be attributable to basic ions [14].

The average electrical conductivity (E.C) of the both sites were 1745.66 and 241.67 ms/cm for Ain Kaam and Wadi Kaam respectively. These values are within the Libyan acceptable limit (2000 ms/cm) for drinking water. In addition, the EC value of Ain Kaam was higher than Wadi Kaam (about seven times). These result in agreement with Mehdi, [15] in his study measuring the water quality in baqubah city. EC in the water ecology is considered a good indicator for estimating total dissolved solid materials in water and

nature of the purity of water [12]. The total dissolved solid materials (TDS) values in Ain Kaam (1047.40 mg/L) were found to be higher than the Wadi Kaam (143.50 mg/L). These high values of EC and TDS may be due to the high amount of dissolved inorganic substances present in the water surface [16], and also due to that, Ain Kaam spring is directly connected to the sea in some season, so it has higher Na+ and Cl^- contents [17].

The magnesium (Mg+2) and calcium (Ca+2) concentrations in the water samples were analyzed as an expression of the hardness of water. Calcium concentration values recorded 60.17 and 112.4 mg/L at study sites of Ain Kaam and Wadi Kaam respectively. These values give us an indication that all samples of the waters within the Libyan and WHO acceptable limit (200 mg/L) for drinking water. Calcium is one of the major elements responsible for water hardness [4]. Water containing less than 60 mg/L of calcium is considered as soft water [10]. On the other hand, the magnesium concentration values recorded 1050.66 and 15.6 mg/L at study sites of Ain Kaam and Wadi Kaam respectively. These values of the Wadi Kaam site are within the Libyan acceptable limit (150 mg/L), while the values of the Ain Kaam site exceeding the allowable values. The high values of magnesium in the Ain Kaam site may due to be magnesium is washed from rocks (dolomite, magnetite, etc.) and then ends up in Ain Kaam waters, being responsible for water hardness [18]. In addition, the magnesium level noted lower than calcium in the Wadi Kaam site may due to being magnesium is usually less abundant in fresh waters than calcium, and easy to understand since magnesium is found in the Earth's crust in much lower amounts as compared with calcium [19]. Furthermore, important of magnesium intake in drinking water is correlated with multiple health problems such as heart diseases [20].

The Chloride is a good indicator to identify sources of contamination from authpogentic actions [3]. The chloride ion present in this study has a very high amount in Ain Kaam (610.93 mg/L) and higher than Libyan and WHO acceptable limit (250 mg/L), while the study site of Wadi Kaam was (62.75 mg/L) and agree with acceptable limit of Libyan and WHO to drinking water. Other research shows the same result with high chloride ion in the Alshati District of Libya [21]. The sodium concentration in the water samples of both sites had sodium levels exceeding the drinking water aesthetic objective of 200 mg/L. Moreover, the sodium concentration of Ain Kaam (494 mg/l) higher than Wadi Kaam (286 mg/L). But the potassium concentration of the water samples was approximately within the acceptable limit of Libyan standard (40 mg/L), and no significant difference was recorded between both study sites.

The sulphate (SO4-2) values recorded 864 and 687 mg/L for both locations of Ain Kaam and Wadi Kaam respectively, and higher than Libyan and WHO standards for drinking water. The bicarbonate values more than Libyan and WHO acceptable limit (200 mg/L) at the both study sites,

CONCLUSION

The results presented in this study suggested that the chemical and physical parameters like electrical conductivity, total dissolved solids and calcium (Ca2+) and potassium within the within the Libyan standard. However, total hardness, magnesium and chloride in Wadi Kaam were within the acceptable limit. Whereas, the values of sodium (Na+1), sulphate (SO4-2) and bicarbonate were within the normal values in both study sites.

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Conflicts of interest

There are no conflicts of interest.

Table (1): Physicochemical parameters of water in Ain Kaam and Wadi Kaam

Parameters	Units	Study sites		Libyan standard*	WHO**
		Ain Kaam	Wadi Kaam		
pH	——	7.23	7.92	6.5-8.5	6.5-8.5
Electrical conductivity (E.C)	(ms/cm)	1745.66	241.67	2000	2000
Total Dissolved Solids (T.D.S)	(mg/L)	1047.40	143.50	1000	1000
Total Hardness (T.H)	(mg/L)	1110.83	128	500	500
Calcium (Ca^{2+})	(mg/L)	60.17	112.4	200	200
Magnesium (Mg^{+2})	(mg/L)	1050.66	15.6	150	50
Chloride (Cl^{-1})	(mg/L)	610.93	62.75	250	250
Sodium (Na^{+1})	(mg/L)	494	286	200	200
Potassium (K^{+1})	(mg/L)	23	22	40	20
Sulphate (SO_4^{-2})	(mg/L)	864	687	400	250
Bicarbonate (HCO_3^{-1})	(mg/L)	297	271	200	200

* Libyan National Center for specifications and standards, Drinking water standards. No. 82, 1992.

** WHO (World Health Organization), Guidelines for drinking water quality health criteria and other supporting information, Geneva, 2011.

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