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Study of some Chemical Indicators of Water Quality in Ain Kaam Zliten City

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Abstract

Water quality and availability are most important indicators of sustainable development that have a significant role in realizing the reaching in the field of economic and social development. The biggest value of the surface water in the Libyan coast comes from using them for irrigation and sometimes as a source of potable water. This study aimed to assessment of some chemical indicators of water quality in Ain Kaam (spring) at Zliten city which including calcium, magnesium, sodium, potassium, chloride, sulphate, bicarbonate and silicon dioxide. The analytical results indicated that most of the chemical ions values have exceeded the acceptable limit for drinking water in Libyan standard and internationally (WHO) for calcium, sodium, chloride, sulphate and bicarbonate, while values of magnesium and potassium ions did not exceed the allowed range for drinking water. According to the chemical indicator results, the water can only use for irrigation and need treatment for drinking.

Keywords: Chemical Indicators, Ain Kaam, Zliten, Water Quality

1. Introduction

Many regions all over the world are entirely depending on surface freshwater and groundwater resources for the various uses. Surface freshwater represents the smallest amount of water on the earth (about three percent) and represented mainly by lakes and it also includes springs and swamps which account for a mere 0.29 percent of the earth's freshwater [1]. The increase in population and growing needs, increasing the use of water has led to growing consumed water on the one hand [2], and effected surface water of different human activities associated with the presence of laboratories and increasing population growth in the surrounding areas and this effect negatively on surface water properties on the other hand [3]. Moreover, the surface waters exposed to all elements and picks up something from anything, it touches lead to many sources of contamination its [4]. For instance, the agricultural production used, the quality and quantity of fertilizers and pesticides randomly and excessive may contribute to contaminate a surface water body [3]. The scientific studies indicated a strong correlation between the use of agricultural lands and the decline in the quality of groundwater and surface water in the surrounding areas. The contamination of this water due to the source of the fertilization of chemical fertilizers or organic operations [5]. A wide variety of materials has been identified as contaminants found in surface waters. These include synthetic organic chemicals, hydrocarbons, inorganic cations, inorganic anions, and pathogens [6]. In Libya, the lakes, valleys (Wadi), and springs (Ain) are the sources of the survival of life in coastal areas, and also are importance of water availability for many agricultural and industrial products [7]. Use the waters of Ain Kaam currently in the used up irrigate the agriculture project in the west of Zliten city and used the most of the land in planting of vegetables and fruit trees. Currently, the lake suffers from high contamination indicators due to the discharge of solid waste from residential areas, fertilizers, pesticides in the agriculture areas and man-made activities, which affects the water qual-

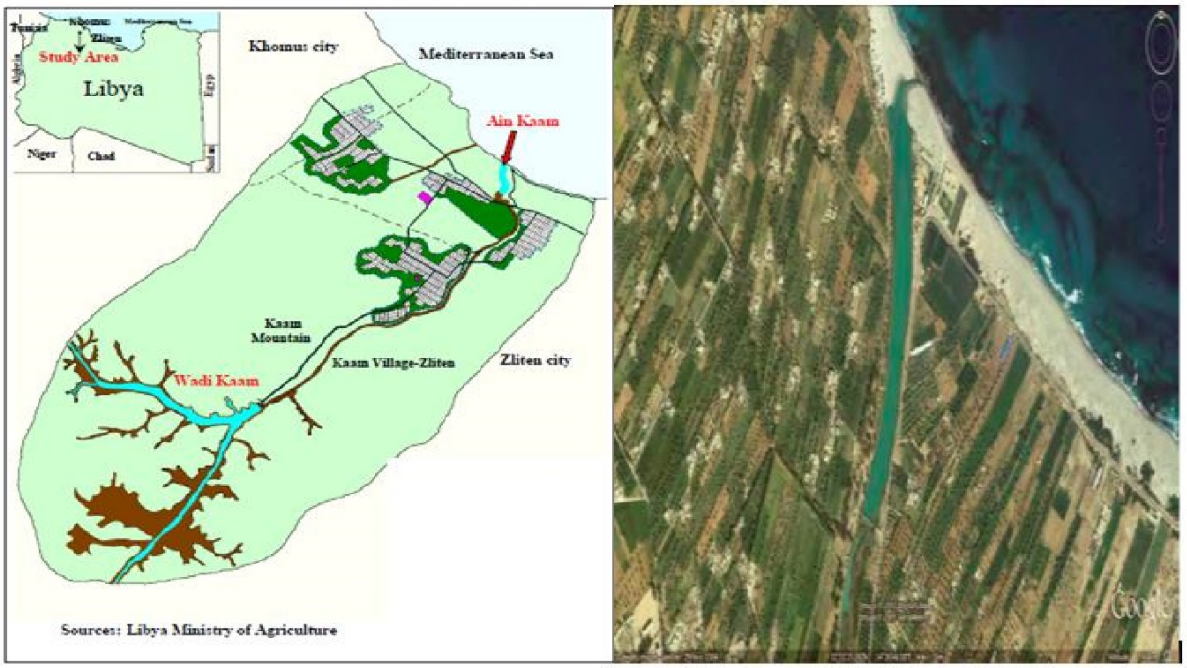

Figure 1.1: Showing map of sampling location in the study areas

ity negatively.

1.1. Significance and objectives of study

Due to the importance of the water resources in Libya and the growing urgent need for fresh water, these sources are focused on the control of the quantity and quality of water, so to reduce at least partly from the peril of pollution, therefore, make check the water periodically and find out their suitability for all users in order to protect and only examine, but slightly the establishment of area protection of these sources on the basis of development of scientific studies. Although local people are dependent on lake Ain Kaam for their livelihoods, but they are not aware of the pollution of the lake water. So, it is needed to know the water quality status of this lake. Keeping these points in thinking this study was provided additional information to existing data on water quality assessments of this lake [7]. The objective of this study to determine some chemical important indicators of water quality such as calcium, magnesium, sodium, potassium, chloride, sulphate, bicarbonate, and silicon dioxide to investigate the status of aquatic environment of the lake, develop public awareness and help in formulating guidelines regarding this problem.

2. Materials and Methods

2.1. Study Area

The area investigated in this study is situated in Ain kaam spring in Libya Figure (1.1) and located 15 km northwest of Zliten city, or about 150 km east of the capital Tripoli [8]. It is the largest in area comparing with other springs in west of Libya (about 2 kilometres long) according reported by [9].

2.2. Sampling

The water samples were collected from three points using plastic bottles, and before sample collection all the plastic bottles were properly cleaned with distilled water. Bottles were immersed below the water surface, filled brought out of the water and properly closed. Then they were labelled properly and preserved in a refrigerator.

2.3. Chemical analysis

The collected samples were analyzed for different chemical ions such calcium, magnesium, sodium, potassium, chloride, sulphate, bicarbonate and silicon dioxide (Silica) were carried out referring the ‘standard methods.

2.4. Statistical analysis

All data are presented as means ±SD and were analysed by one-way ANOVA. Pearson correlation in SPSS 16.0 was used to evaluate any significant ($P<0.01$ and $P < 0.05$) positive or negative correlation among parameters

3. Results and discussion

The average water temperature in the study site was 22 ° C and a tend to surface temperature of the water more often to the compatibility with the air temperature [10], and remains the effect of temperature associated with the physical factors in the water, as well as the impact on the chemical properties and their interaction [11], there is nothing as an isolated factor for other factors in the aquatic environment. From the chemical analysis results, the concentrations of major cations and anions water samples are shown in Table (3.1). The numbers shown are the average measurements of three replicates. Results were compared with Libyan standard specifications and World Health Organization (WHO) standard limits are shown in the Table (3.1). It is found that the chemical indicators such calcium concentration was (292 mg/L) these results high compare with the Libyan standards for drinking water. and WHO but lower than the result of a similar work by Shaikh and Mandre [12] High value of Ca^{2+} in this study may be due to a dissolution of limestone and other minerals. Calcium is one of the major elements responsible for water hardness. Water containing less than 60 mg/L of calcium is considered as soft water [13]. Also Magnesium (Mg^{+2}) concentration in the water samples was analysed as an expression of hardness. Magnesium concentration value was (147 mg/L), this result within Libyan standards and WHO. Magnesium is usually less abundant in waters than calcium, which is easy to understand since magnesium is found in the Earth's crust in much lower amounts as compared with calcium [14]. In common surface water the weight concentration of Ca^{+2} is commonly several times higher compared to that of Mg^{2+}, the Ca to Mg ratio reaching up to 10 [14]. However, a common Ca^{2+} to Mg^{+2} ratio is about 4, which corresponds to a substance ratio of 2.4 [15] The average potassium values of water samples were (23ppm). It was slightly basic, may be attributable to basic ions [16], and also, these values were found to be within the permissible level. The highest value of Chloride ion (Cl^{-}) concentration was recorded (925 mg/L). This value which recorded in this study were more than the presumably values for drinking water (250mg/L) in Libya. The higher level of chloride recorded in the present study may be related to the flow of inorganic materials such as effluents from the surrounding area [17]. Large concentrations of chloride increase the corrosiveness of water and, in combination with sodium, give the water a salty taste [18]. In addition, the sodium concentration value in current study was (494 ppm), this result higher than Libyan standards and WHO for drinking water (200 mg/L). This is due to, the Ain Kaam spring is directly connected to the sea in some season, so it has higher Na^{+} and Cl^{-} content. Sulphates salts ($SO4^{-2}$) have been mostly soluble in water and impart hardness. Waters with about 500 mg/ L sulphates are having a bitter taste and those with 1000 mg/L or more sulphates may bring about intestinal disorders [13] . Experimental values (864 mg/L) show that all the samples are higher the values than of the WHO and Libya of drinking water standard limits. Sulphate is one of the least toxic anions and the major physiological effects resulting from the ingestion of large quantities of sulphate are catharsis, dehydration, and gastrointestinal irritation [13]. Bicarbonate was observed 297 mg/L during the study. This value was more than the presumably values for drinking water (200 mg/L) in WHO, may be due to action of CO_2 upon the basic material of soil and rocks [19]. The relative amount of the anions depends on the pH of the water and other factors. Bicarbonate increase as the pH decreases [20]. Bicarbonate ion served as the main buffer in aqueous freshwater systems and provides CO_2 for photosynthesis [19]. The higher concentration of bicarbonate in the water infers a dominance of mineral dissolution and irrigation activities in that area.

4. Conclusion

The results presented in this study suggest that the Ain kaam waters in Zliten have chemical ions well within the permissible limit sets by Libyan and international standard specifications for irrigation water. Whereas, the most of ions showed significant difference in concentrations in drinking water. The increase related to characteristics of spring (location, capacity, the activities located around the spring.

Table 3.1: Comparison of average concentration ions (mg/L) from this study with Libyan standard and WHO

Ions	Ain Kaam	Libyan standard*	WHO**
Calcium (Ca^{2+})	292	200	500
Magnesium ($Mg)^{+2}$	147	150	50
Sodium (Na^{+1})	494	200	200
Potassium (K^{+1})	23	40	20
Chloride (Cl^{-1})	925	250	250
Sulphate $(SO4)^{-2}$	864	400	250
Bicarbonate	297	-	200
Silicon Dioxide	24	-	-

* 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, volume 2, 2nd ed, Geneva, 1997

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