

Determination of some cations in groundwater of different districts in Janzur-Libya

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Abstract: One of the parameters that describes the quality of water is the content of cations. Calcium (Ca^{2+}) and Magnesium (Mg^{2+}) ions are both common in natural waters and both are essential elements for all organisms. Ammonia Gas (NH_3) is extremely soluble in water. It is the natural product of decay of organic nitrogen compounds. Ammonia can be both hazardous and caustic. A study has been carried out on the determination of the concentration of Calcium (Ca^{2+}) ions, Magnesium (Mg^{2+}) ions and Ammonia (NH_3) in ground water of different districts in Janzur-Libya. The conductivity and PH-Value were also measured. In this study the ASTM D-511 was used as a Standard Test Method for Calcium and Magnesium in Water. The Standard Test Methods ASTM D-1125 and ASTM D-1293 were used for the measurement of the conductivity and PH-Value. The concentration of Ammonia was measured with the water analysis instrument Hach DR/2500. The results showed that the level of the concentration of Calcium (Ca^{2+}) ions was from 76 mg/l to 184 mg/l and the level of the concentration of Magnesium (Mg^{2+}) ions was from 56 mg/l to 204 mg/l. The level of the concentration of Ammonia (NH_3) was maximum 0.07 mg/l. It is very low. The results also showed that the electrical conductivity was from 1059 $\mu\text{S}/\text{cm}$ to 2850 $\mu\text{S}/\text{cm}$ by 25 °C and the PH value was from 7.1 to 7.6. In all districts in Janzur-Libya the concentration of Calcium ions is under the limit and the concentration of Magnesium ions is very high. While the concentration of Ammonia is very low.

Keywords: Water; Calcium, Magnesium, Ammonia, Electrical Conductivity, Janzur, Libya

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I. Introduction:

Water is the key resource for human living, especially for drinking and irrigation. Water quality is very important to human healthy and the quantity and quality of grains by effecting on soils, crops and environment [1]-[2]. Kent and Spycher (1994) showed that the chemical character of groundwater is acquired primarily through chemical reactions between the water and the mineral assemblages that contact it [3]. Safe drinking water therefore is a basic need and hence, an internationally accepted human right [4]-[5]. One of the parameters that describes the quality of water is the content of cations. Calcium (Ca^{2+}) and Magnesium (Mg^{2+}) ions are both common in natural waters and both are essential elements for all organisms. Calcium and magnesium, when combined with bicarbonate, carbonate, sulphate and other species, contribute to the hardness of natural waters. In addition to being a component of chlorophyll, magnesium participates in enzymatic reactions. Calcium plays various structural roles in plant cell membranes, contributes to oxalate accumulation and regulates water transport as well as metabolic processes [6]. Ammonia Gas (NH_3) is extremely soluble in water. It is the natural product of decay of organic nitrogen compounds. Surface sources of groundwater nitrate contamination related to man's activities include domestic sewage, agricultural practices, and high-density animal confinement [7].

Ammonia can be both hazardous and caustic. Ammonia can be very corrosive to some copper plumbing systems [8]. Electrical conductivity is a measure of water capacity to convey electric current. It signifies the amount of total dissolved salts [9]. A study has been carried out on the determination of the concentration of Calcium (Ca^{2+}) ions, Magnesium (Mg^{2+}) ions and Ammonia (NH_3) in ground water of different districts in Janzur-Libya. The conductivity and PH-Value were also measured.

In this study the ASTM D-511 was used as a Standard Test Method for Calcium and Magnesium in Water. The Standard Test Methods ASTM D-1125 and ASTM D-1293 were used for the measurement of the conductivity and PH value. The concentration of Ammonia was measured with the water analysis instrument Hach DR/2500.

II. Materials and Methods:

Sample collection

For this study, water samples were taken from ten (10) wells in different districts in the area of Janzur-Libya. Before taking the samples the well was left operating for a while. Three (3) samples were taken from each well and put in containers which are cleaned with ultra pure water and rinsed with the water of the well before.

Analytical procedure

In this study the ASTM D-511 was used as a Standard Test Method for Calcium and Magnesium in Water. The Standard Test Methods ASTM D-1125 and ASTM D-1293 were used for the measurement of the conductivity and PH value [10]-[11]-[12]. The concentration of Ammonia was measured with the water analysis instrument Hach DR/2500 Spectrophotometer.

III. Results and Discussion:

Table 1 presents the results of the determination of the concentration of Calcium (Ca^{2+}) ions, Magnesium (Mg^{2+}) ions, the electrical conductivity (EC) and PH values in ground water of different districts in Janzur-Libya. The results showed that the level of the concentration of Calcium (Ca^{2+}) ions was from 76 mg/l to 184 mg/l and the level of the concentration of Magnesium (Mg^{2+}) ions was from 56 mg/l to 204 mg/l. The level of the concentration of Ammonia (NH_3) was maximum 0.07 mg/l. It was very low.

The results also showed that the electrical conductivity was from 1059 $\mu\text{S}/\text{cm}$ to 2850 $\mu\text{S}/\text{cm}$ by 25 °C and the PH-Value was from 7.1 to 7.6. The highest level of the concentration of Calcium and Magnesium ions was found in Alnjila district, and the lowest level was found in Algiran district. In all districts the concentration of Calcium ions is still under the limit which is 200 mg/l [13]. While the concentration of Magnesium ions is very high and it is in all districts above the maximum permissible amount which is 50 mg/l [13]. The concentration of Ammonia was very low. The high level of the concentration of Calcium and Magnesium ions in water in the study area is due to its geology. The calcium and magnesium salts get into the water when streams and rivers pass through ground with a high level of chalk or limestone, or when subsurface water occurs in limestone or chalk hills. The results also showed that the highest PH value was found in Hia Alkuwait district and the lowest in Alrshah district. The pH values in all districts are in the permissible range which is 6.5 – 8.5 [13]. The highest level of the electrical conductivity was found in Alnjila district, and the lowest level was found in Algiran district. The electrical conductivity values in all districts except of Hia Alkuwait, Alnjila and Janzur Alsharqiya district are under the permissible limits of WHO standards which is 2300 $\mu\text{S}/\text{cm}$ by 25 °C [13]. This excessive conductivity in Hia Alkuwait, Alnjila and Janzur Alsharqiya district is due to large excess of dissolved ions in water.

Table1: Mean value concentration (STDEV value) for Calcium Ca^{2+} ions, Magnesium (Mg^{2+}) ions, the electrical conductivity and PH in in water sample from different district.

District	Ca^{2+} (mg/l)		Mg^{2+} (mg/l)		EC ($\mu\text{S}/\text{cm}$) by 25°C		PH	
	Mean	STDEV	Mean	STDEV	Mean	STDEV	Mean	STDEV
Janzur Alsharqiya	120	0.67	92	0.55	2730	1.22	7.42	0.97
Janzur Alsouq	112	0.45	107	0.33	1846	1.61	7.40	0.81
Awlad Abu Garara	132	0.84	73	0.21	1735	0.72	7.22	0.79
Hia Alkuwait	104	0.38	122	0.59	2500	0.26	7.60	0.51
Algiran	76	0.26	56	0.11	1059	0.95	7.45	0.48
Almshashta	176	0.52	87	0.42	2020	0.88	7.45	0.22
Alnjila	184	0.87	204	0.89	2850	0.48	7.42	1.56
Sayad	164	0.61	80	0.36	2210	0.22	7.39	0.61
Alhishan	96	0.62	73	0.41	1604	0.89	7.36	0.85
Alrshah	136	0.86	66	0.19	1675	0.74	7.15	0.80

IV. Conclusions

It is concluded that the samples collected from the different districts in Janzur-Libya have a high level of some quality parameters. Some of these parameters are above the permissible limits of WHO standards. The main contributors for these results are higher values of the concentration of Magnesium ions and the electrical conductivity. Hence the water is not suitable either for drinking purposes.

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