

تحديد بعض الأنيونات في المياه الجوفية لمناطق مختلفة بجنزور - ليبيا

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الملخص:

أحد العوامل التي تصف جودة المياه هو محتوى الأنيونات. كل من هذه الأنيونات أيونات كربونات الهيدروجين (HCO_3^-) ، أيونات الكبريتات (SO_4^{2-}) ، أيونات الفوسفات (PO_4^{3-}) ، أيونات الكلوريد (Cl^-) ، أيونات الفلوريد (F^-) ، أيونات النتريت (NO_2^-) ، أيونات النترات (NO_3^-) والسليكا (SiO_2) هي من الأنيونات الشائعة الموجودة في المياه الجوفية.

يمكن أن تكون بعض الأنيونات في المياه الجوفية في المنطقة مشكلة صحية كبيرة. لتحديد تركيز بعض الأنيونات (HCO_3^-) ، (SO_4^{2-}) ، (PO_4^{3-}) ، (Cl^-) ، (F^-) ، (NO_2^-) ، (NO_3^-) وكذلك تركيز السليكا (SiO_2) في المياه الجوفية بمناطق مختلفة بجنزور- ليبيا ، حيث أجريت هذه الدراسة.

في هذه الدراسة، تم استخدام أجهزة مختلفة مثل ASTM D-1067 و ASTM D-516 كطريقة اختبار قياسية وجهاز تحليل المياه Hach DR / 2500 لقياس تركيز الأنيونات المذكورة أعلاه بالإضافة إلى السليكا.

أظهرت النتائج أن مستوى تركيز جميع الأنيونات المختبرة باستثناء أيونات الفوسفات (PO_4^{3-}) تجاوز الحد المسموح به في بعض مناطق جنزور - ليبيا. حتى مستوى تركيز أيونات الكلوريد (Cl^-) والسليكا (SiO_2) موجود في جميع المناطق في جنزور- ليبيا فوق الحد.

Determination of some anions in ground water of different districts in Janzur-Libya

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Abstract:

One of the parameters that describe the quality of water is the content of anions. All of this anions Hydrogen carbonate ions (HCO_3^-), Sulfate ions (SO_4^{2-}), Phosphate ions (PO_4^{3-}), Chloride ions (Cl^-), Fluoride ions (F^-), Nitrite ions (NO_2^-), Nitrate ions (NO_3^-) and Silica (SiO_2) are common ions found in groundwater.

Some anions in the groundwater in the region can be of major health problem. To determine the concentration of some ions (HCO_3^- , SO_4^{2-} , PO_4^{3-} , Cl^- , F^- , NO_2^- , NO_3^-) as well as the concentration of Silica (SiO_2) in groundwater of different areas in Janzur-Libya, a study was carried out.

In this study, different instruments like ASTM D-1067 and ASTM D-516 as a Standard Test Method and water analysis instrument Hach DR/2500 were used to measure the concentration of the ions mentioned above in addition to silica.

The results showed that the level of the concentration of all examined ions with the exception of the Phosphate ions (PO_4^{3-}) is in some districts in Janzur-Libya over the limit. Even the level of the concentration of the Chloride ions (Cl^-) and the Silica (SiO_2) is in all districts in Janzur-Libya over the limit.

Keywords:

Water; Hydrogen carbonate, Sulfate, Phosphate, Chloride, Fluoride, Nitrite, Nitrate, Silica, Janzur, Libya

1. Introduction:

Water is very important for life. It is highly essential for all living beings everywhere. Water is not only a vital environmental factor to all forms of life, but also it has a great role to play in the socio-economic development of the human population [1].

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 [2]. Groundwater plays an important role as vital source of drinking water in Libya. Healthy and save drinking water is a basic need and it is an internationally accepted human right [3]. One of the parameters that describe the quality of water is the existing of anions. Some of this anions are essential elements for all organisms.

A study was carried out on the determination of the concentration of Hydrogen carbonate ions (HCO_3^-), Sulfate ions (SO_4^{2-}), Phosphate ions (PO_4^{3-}), Chloride ions (Cl^-), fluoride ions (F^-), Nitrite ions (NO_2^-), Nitrate ions (NO_3^-) and Silica (SiO_2) in ground water of different districts in Janzur-Libya.

2. Materials and Methods:

2.1. Sample collection

For this study, water samples were taken from ten (10) wells in different districts in the area of Janzur-Libya.

2.2. Sample preparation

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 were cleaned with ultra pure water and rinsed with the water of the well before.

2.3. Analytical procedure

In this study, the ASTM D-1067 was used as a Standard Test Method for Hydrogen carbonate ions (HCO_3^-) in water and the ASTM D-516 was used as a Standard Test Method for Chloride ions (Cl^-) [4]. The concentration of rest ions (SO_4^{2-}), (PO_4^{3-}), (F^-), (NO_2^-), (NO_3^-) and Silica (SiO_2) was measured with the water analysis instrument Hach DR/2500.

3. Results and Discussion:

Table 1 and Table 2, present the determined concentrations for some anions and Silica in groundwater of different districts in Janzur-Libya.

Table 1: The concentration of the anions of Hydrogencarbonate, Chloride, Sulfat and Phosphate in water samples

District	Hydrogencarbonate		Chloride		Sulfat		Phosphate	
	Mean	STDEV	Mean	STDEV	Mean	STDEV	Mean	STDEV
	[mg/l]	[%]	[mg/l]	[%]	[mg/l]	[%]	[mg/l]	[%]
Janzur Alsharqiya	232	0,65	622	0,45	180	0,66	0,08	0,23
Janzur Alsouq	183	0,44	505	0,23	180	0,69	0,06	0,66
Awlad Abu Garara	232	0,75	437	0,87	61	0,77	0,10	0,89
Hia Alkuwait	207	0,42	660	0,47	120	0,34	0,03	0,58
Algiran	323	0,33	252	0,10	55	0,87	3,00	0,66
Almshashta	293	0,32	408	0,26	380	0,55	0,04	0,51
Alnjila	165	0,72	719	0,88	550	0,23	0,03	0,56
Sayad	214	0,56	583	0,51	200	0,89	0,01	0,79
Alhishan	207	0,67	233	0,89	410	0,31	1,32	0,52
Alrshah	214	0,34	340	0,56	250	0,86	0,01	0,52

Table 2: The concentration of the anions of Floride, Nitrite, Nitrate and Silica in water samples

District	Floride		Nitrite		Nitrate		Silica	
	Mean	STDEV	Mean	STDEV	Mean	STDEV	Mean	STDEV
	[mg/l]	[%]	[mg/l]	[%]	[mg/l]	[%]	[mg/l]	[%]
Janzur Alsharqiya	1,11	0,65	0,019	0,87	48,25	0,71	8,6	0,91
Janzur Alsouq	1,10	0,33	0,007	0,34	69,10	0,98	16,9	0,28
Awlad Abu Garara	0,95	0,58	0,007	0,59	31,80	0,38	18,1	0,92
Hia Alkuwait	0,95	0,41	0,033	0,82	56,18	0,45	18,2	0,87
Algiran	1,19	0,78	0,007	0,22	31,40	0,63	17,3	0,41
Almshashta	1,58	0,21	0,118	0,21	43,38	0,79	17,0	0,46
Alnjila	1,54	0,11	0,007	0,95	17,70	0,32	15,0	0,67
Sayad	1,00	0,98	0,030	0,29	69,50	0,58	16,7	0,27
Alhishan	3,00	0,82	0,003	0,38	49,50	0,21	15,5	0,12
Alrshah	1,88	0,75	0,010	0,55	51,30	0,11	17,5	0,49

Hydrogen carbonate ions (HCO_3^-)

The concentrations of the Hydrogen carbonate ions (HCO_3^-) in the study area were found to be in the range of 165 mg/l and 293 mg/l.

The highest and the lowest levels of the concentration of Hydrogen carbonate ions (HCO_3^-) were found in Almshashta and in Alnjila district, respectively.

In all districts, the concentration of the Hydrogen carbonate ions (HCO_3^-) was very high and it was in all districts except in Janzur Alsouq and Alnjila districts above the maximum permissible amount, which is 200 mg/l (W.H.O. DRINKING WATER STANDARDS) [5].

Chloride ions (Cl^-)

The concentration of the Chloride ions (Cl^-) in the study area was found between 233 mg/l and 719 mg/l. The highest level of the concentration of the Chloride ions (Cl^-) was found in Alnjila district, and the lowest one in Alhishan district.

In all districts, the concentration of the Chloride ions (Cl^-) was very high and it was above the maximum permissible amount, which is 250 mg/l (W.H.O. DRINKING WATER STANDARDS) [5]. This may be due to the intrusion of seawater. Excessive chlorides give an irritating smell and taste to the water

Sulfate ions (SO_4^{2-})

The determined concentration of the Sulfate ions (SO_4^{2-}) in the study area was in the range of 61 mg/l to 550 mg/l. The highest level of the concentration of the Sulfate ions (SO_4^{2-}) was found in Alnjila district, and the lowest level was found in Algiran district.

The level of the concentration of the Sulfate ions (SO_4^{2-}) was very high and it was in Almshashta, Alnjila, Alhishan and Alrshah districts above the maximum permissible amount, which is 200 mg/l (W.H.O. DRINKING WATER STANDARDS) [5]. In the rest of the districts, the level of the concentration of the Sulfate ions (SO_4^{2-}) was still under the limit.

The higher values of Sulfate in water reveal, that the discharge in the form of Sulfate fertilizers by man made activities in the location.

Phosphate ions (PO_4^{3-})

The determined concentration of the Phosphate ions (PO_4^{3-}) in the study area was between 0.01 mg/l and 3.0 mg/l.

The highest level of the concentration of the Phosphate ions (PO_4^{3-}) was found in Algiran district, and the lowest level in Sayad and Alrshah districts.

In the whole area, the concentration of the Phosphate ions (PO_4^{3-}) was low and still under the limit, which is 5 mg/l. (W.H.O. DRINKING WATER STANDARDS) [5].

The higher values of Phosphate in water indicates the discharge of phosphate fertilizer into the groundwater.

Fluoride ions (F^-)

The concentration of the fluoride ions (F^-) in the study area was found between 0,95 mg/l and 3,00 mg/l. The highest level of the concentration of the fluoride ions (F^-) was found in Alhishan district and the lowest in Awlad Abu Garara and Hia Alkuwait districts.

The level of the concentration of the fluoride ions (F^-) was very high and was above the maximum permissible amount, which is 1,5 mg/l (W.H.O. DRINKING WATER STANDARDS) [5], in Almshashta, Alnjila, Alhishan and Alrshah districts.

In the rest of the districts, the level of the concentration of the fluoride ions (F^-) was still under the limit.

Nitrite ions (NO_2^-)

Concentration values between 0,007 mg/l and 0,118 mg/l of Nitrite ions (NO_2^-) were found in the study area. While the highest concentration of Nitrite ions (NO_2^-) was measured in Almshashta district, the lower was measured in Janzur Alsouq and Awlad Abu Garara districts.

Compared with WHO standards the concentration of the Nitrite ions (NO_2^-) were low in all districts except in Almshashta district

In the whole area, the concentration of Nitrite ions (NO_2^-) was low and under the permissible limits of WHO standards which is 0,1 mg/l except in Almshashta district. (W.H.O. DRINKING WATER STANDARDS) [5].

Nitrate ions (NO_3^-)

The measured concentrations of Nitrate ions (NO_3^-) was found between 17,7 mg/l to 69,5 mg/l.

The highest and lowest levels of the concentration of Nitrate ions (NO_3^-) were found in Sayad and Alnjila districts, respectively

The level of the concentration of the Nitrate ions (NO_3^-) was in Janzur Alsouq, Hia Alkuwait, Sayad and Alrshah districts above the maximum permissible amount, which is 50 mg/l (W.H.O. DRINKING WATER STANDARDS) [5].

In the rest of the districts, the level was still under the limit. The high nitrogen content is an indicator of organic pollution. It results from the added nitrogenous fertilizer, decay of dead plants and animals and their residues. Low nitrate levels may be due to the less usage of nitrogenous fertilizers and fewer disposals of other wastes around the locations or it may be due to denitrification.

Silica (SiO₂)

The concentration of the Silica (SiO₂) in the study area was found to be from 8,6 mg/l to 18,2 mg/l.

The highest level of the concentration of the Silica (SiO₂) was found in Hia Alkuwait district and the lowest in Janzur Alsharqiya district.

In all districts, the concentration of the Silica (SiO₂) was very high and above the maximum permissible amount, which is 2 mg/l (W.H.O. DRINKING WATER STANDARDS) [5].

4. Conclusions

The water samples collected from the different districts in Janzur-Libya have a poor water quality. The results showed that in all districts the concentrations of all studied anions are very high except Phosphate ions (PO₄³⁻).

The measured values are above the permissible limits of WHO standards. The water samples from all districts are highly polluted and unfit for drinking purposes. Therefore it is very necessary to establish a water treatment system by the people or the authorities in this area before use.

5. References:

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