

RESEARCH ARTICLE

STUDY OF SOME PHYSICAL AND CHEMICAL PROPERTIES OF WATER THAT GOES IN, THEN OUT OF THE DESALINATION PLANT AT AL-KHUMS CITY

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Abstract

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Key words:-

Entering Water, Yielded Water, Desalination Plant

The analysis of entering water samples, gave an average value for pH (7.98), but yielded water samples show a slight change in the pH (8.06), while the value of conductivity EC for sea water was (53501us/cm), then, significant decrease has been recorded in vielded water samples to become (32.032µs/cm). The chemical analysis also showed a major difference in the measurement for both of total dissolved salts TDS, and salts causing hardness TH, between entering and yielded water samples, as same as for sodium and potassium, where the average value of their concentrations in water samples that goes in the desalination plant were (10380ppm)&(444ppm), to become (5.358ppm)&(0.24ppm)in water that goes outof desalination plant, respectively. A big difference was also observed in the average concentration of chloride and sulfate anions, in which the amount of chlorine was (19644ppm)and for sulfate (2752ppm)insea water, however at yielded water bothof them were (2.292ppm)and (1.389ppm)respectively.

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Introduction:-

Arab countries are among the driest regions in the world, almost 75% of arab population live under the water scarcity level, and half of them nearly lives under extreme water scarcity level of 500 m^3 per capita a year.Libya is considered to be one of those countries that exceeds water poverty line, according to the world water development report issued in 2015¹.

Due to the nature of the desert climate, the lack of rainfall and the lack of running water sources^{2, 3}, Libya depends mainly on groundwater that can be confined to five major basins, as in the next table ⁴:

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NO.	Basin Name	Area (Km ²)	Basin Type
1	Jiffarah plain	18000	Renewable
2	Al HamadaSirte and Souf Al Jene	215000	Renewable
3	Murzuq	350000	Non- Renewable
4	Kufra and Sarir	700000	Non- Renewable
5	Al Jabal A Akhdar	145000	Renewable

Table (1):- Shows Main underground basins in Libya.

Corresponding Author:- Agab M. Hewas Address:- Department of Chemistry, Elemergib University Al-Khomes. Libya is characterized by a long coastal strip, estimated at about 1950km, where the population density is concentrated, and thus the need was to exploit sea water as a non-traditional source of water, by constructing desalination plants for it, so a number of 30 desalination plants have been established, With a total capacity of 157 million m^3 of treated water annually. Yet, the actual product does not exceed 70 million m^3 at the present time, as the number of operating stations does not exceed 8 only, and they are as follows:

The Bomba bay desalination plant, Tobruk, Derna, Szessa, Abu Traba, Zliten, and Al-Zawiya, in addition to the desalination units in the steam station east of ______. Al-Khums city, which was established in the eighties of the last century, and is one of the largest desalination plantin Libya⁴.



Figure (1):- Seawater desalination plant, east of Al-Khums.

In such desalination plants, there are two types of treatment for water, a primary treatment, and the final one. The primary treatment targets the removal of suspended matters, sand, silt⁴, as well as dissolved gases and microorganisms such as fungi, bacteria and algae. This treatment is necessary for the produced water, and it's also important to protect production units from the formation of sediments, corrosion and rust. While, at the final treatment, physical and chemical properties of produced water are adjusted to make it suitable for human use.

Methodology:-

In this research, 10 samples of seawater have been collected before desalination process and 10 after this process (desalinated water), along a month (two samples each three days) at numbered polyethylene test tubes.

All required tests were carried out directly, using some simple devices such as the spectrophotometer, conductivity meter and pH meter, in addition to volumetric analysis methods.

Results and Discussion:-

All measurements gained for pH values, conductivity (EC), total dissolved salts (TDS), hardness (TH), and the concentration of some common cations and anions, for water samples are presented in the next tables.

Table (2):- Shows the values of pH, EC, TDS, TH, concentrations of some common cations& anions, in seawater samples.

Sample	pН	EC	TDS	TH	Ca ⁺²	Mg ⁺²	Na ⁺	\mathbf{K}^+	Cl ⁻ ppm	$(SO_4)^-$
number		µs/cm	ppm	ppm	ppm	ppm	ppm	ppm		ppm
1	7.99	53500	34240	4839	431	1175	10380	446	19644	2753

2	7.98	53502	43242	4841	432	1176	10378	446	19642	2752
3	7.99	53501	34240	4842	427	1177	10382	444	19646	2751
4	7.97	53500	34243	4839	431	1175	10378	442	19644	2750
5	7.99	53503	34245	4837	430	1174	10383	445	19646	2755
6	7.99	53502	34238	4839	432	1175	10381	446	19645	2754
7	7.99	53500	43242	4839	431	1175	10379	443	19644	2753
8	8.00	53504	34240	4836	429	1172	10378	445	19640	2749
9	7.98	53498	34237	4833	430	1172	10384	441	19645	2755
10	7.95	53503	34244	4835	428	1169	10380	443	19644	2749
Average	7.98	53501	35141	4838	430	1174	10380	444	19644	2752
values										

Table (3):- Shows the values of pH, EC, TDS, TH, concentrations of some common cations& anions, in desalinated water samples.

Sample	pН	EC	TDS	TH	Ca ⁺²	Mg^{+2}	Na ⁺	K ⁺	Cl	$(SO_4)^-$
number		µs/cm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
1	8.06	32.02	17.60	2.47	0.27	0.60	5.34	0.23	2.28	1.39
2	8.05	32.00	17.59	2.47	0.27	0.60	5.34	0.23	2.28	1.39
3	8.06	32.00	17.59	2.48	0.27	0.61	5.40	0.26	2.33	1.38
4	8.06	32.05	17.63	2.49	0.28	0.62	5.35	0.24	2.28	1.36
5	8.06	32.03	17c.61	2.48	0.28	0.61	5.34	0.23	2.27	1.40
6	8.10	32.00	17.59	2.47	0.27	0.60	5.33	0.22	2.28	1.39
7	8.11	32.09	17.63	2.47	0.27	0.60	5.35	0.24	2.28	1.38
8	8.00	32.05	17.62	2.50	0.28	0.63	5.34	0.23	2.27	1.41
9	8.01	32.02	17.60	2.47	0.27	0.60	5.38	0.25	2.30	1.39
10	8.00	32.06	17.62	2.47	0.28	0.60	5.41	0.27	2.35	1.40
Average	8.058	32.032	17.608	2.477	0.273	0.607	5.358	0.24	2.292	1.389
values										

From obtained results in previous tables, we note that the value of pH has slightly increased after water treatment, as it was in the range of (7.90 - 8.00) and became (8.00 - 8.11).

In contrast to this, the rest of measured values of water samples before and after treatment showed a very large difference, where conductivity was in the range of $(53498-53504\mu s/cm)$ and became $(32.00-32.09\mu s/cm)$, as well as, a large quantity of dissolved salts were removed to become (17.63-17.59ppm), instead of (34245-34237ppm).

Similarly, total hardness, it was (34245-34237ppm) to become (2.50-2.47ppm), and the same is true for cations $(Ca^{+2}, Mg^{+2}, Na^{+}, K^{+})$ and anions $(CI^{-}, (SO_{4})^{-})$, where it witnessed a huge decrease in its concentrations.

Parameter	pН	EC	TDS	TH	Ca ⁺²	Mg^{+2}	Na ⁺	K ⁺	Cl	$(SO_4)^{-}$
		µs/cm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
seawater	7.98	53501	35141	4838	430	1174	10380	444	19644	2752
(Average values)										
Desalinated	8.058	32.032	17.608	2.477	0.273	0.607	5.358	0.24	2.292	1.389
water(Average										
values)										
WHO	6.5-8.5	-	500-	100-	75-	30-	<175	<12	200-	200-
(Standard values)			1000	500	200	150			600	400

Table (4):- Comparison of all parameters with WHO standard values.

Comparing the average values for water samples before and after the treatment, in tables 2 & 3, with international standard values for drinking water^{5, 6}, proved that desalinated water was in a good convergence with WHO guideline⁷, basically they are even less than the permissible, which means good control of an increase concentrations of some important minerals in well-studied way.

Conclusion:-

It was observed that desalinated water samples were found qualitatively okay, and this water is suitable for drinking purposes. Finally these are some recommendations:

- 1. Desalinations of seawater should be strongly adopted in each of coastal Libyan city.
- 2. Responsible authorities should urgently create professional inspection team to investigate the out of service desalination plants and write reports describing the technical status of these plants.
- 3. Government should encourage research in water reuse field, which can be conducted by research centers and universities.

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