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GROUND WATER EVALUATION OF SELECTED TAZERBO WELLS, SE LIBYA

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ABSTRACT

In this work, we evaluate ground water quality of nine Tazerbo wells southeast Libya for drinking and irrigation uses. Nine ground water samples were subjected to Atomic absorption for major ions. The results showed the parameters of water samples are below the acceptable limit except (Fe). The plot of EC vs. Na % classified the water samples as excellent quality for irrigation uses. The source of major ions are originated mainly from silicate rocks. The iron level in the studied water samples are seriously affected on human health. The techniques that use to remove the iron from drinking water such as oxidation with chlorine, ozone, green sand filter and reverse osmosis.

Introduction

Throughout the 1970s, the Great Man- Made River project (GMRP) allowed the development of large desert agricultural schemes. However, the location were remote, the climate harsh, and they were unsuitable for population settlements. Therefore, during the late 1970s and early 1980s, an investigation into feasibility of using water from the southern basins to supply coastal towns and farmlands was started. Great Man- Made River project transports about 6milion m^3 of water daily to the northern coast where 90 % of the Libya population lives (Lenghi *et al*.,2008).

. The GMRP was launched in 1983 and has established important water supply well fields, which include:

1-Sarir-Sirt/ Tazerbo-Benghazi System (SS/TB).
2-Kufra/Tazerbo System.
3-Hasouna-Jeffara System.
4-Sirt/Assdada System.
5-Ghadamis/Zwara System.

The aim of this study is to assess the suitability of ground water of Tazerbo wells for drinking and irrigation uses.

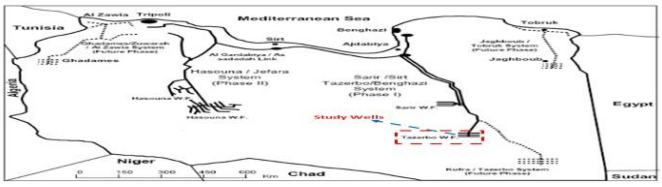

Fig.1: Schematic of the Great Man-Made River Pipeline (Lenghi *et al*.,2008).

2. Methodology

The data that used in this work were obtained from Great Man-Made River Authority. Nine ground water samples were collected from different wells. The electrical conductivity (EC), pH and Total Dissolved Solids (TDS) were determined by means of Denver Instrument, Model 50. Titrimetric methods were used for the determination of Cl, whereas SO_4 was determined gravimetrically. AAS Hitachi-5000 measured Ca, Mg, Na and K. The analysis was done in the laboratory of Great Man-Made River Authority.

Table 6.1: Chemical analysis data of the studied ground water

Parameters	Well 101	Well 102	Well 103	Well 104	Well 105	Well 106	Well 107	Well 108	Well 109	WHO (2108)
Tempearture(T)	29.8	30	30	30.3	31.1	32	28.7	29.9	29	_
PH	6.43	6.23	6.37	6.3	6.4	6.17	6.33	6.18	6.29	8
EC	314	350	350	321	313	320	302	317	312	_
TDS	204	228	228	209	203	208	196	206	203	500
TH	75	72	73	76	77	78	74	72	77	500
Na	16	25	31	18	16	22	17	19	17	200
K	30	30	30	29	38	30	25	29	30	150
Ca	8	8.4	11.6	8.8	8.4	12	20.8	9.2	10.4	200
Mg	13.4	12.4	10.7	13.1	13.6	11.7	5.3	11.9	12.4	150
Fe	1.2	1.73	1.87	1.9	1.4	2.2	2.42	2.59	2.68	0.3
Cl	25	30	25	25	25	20	20	25	25	250
SO_4	20	26	24	24	22	25	27	26	24	600
NO_3	0.4	0.4	0	0	0.4	0.4	0	0	0	10

3. Results and discussion

The chemical analysis of the studied water samples includes a group of major ions and physical parameters such as Ca, Na, K, Fe, Mg, Cl, NO_3, TDS, SO4, pH, T and EC.

3.1. Drinking and irrigation water quality

Table (1) shows a comparison between the chemical analysis of the studied ground water and the permissible limits of WHO (2018) for drinking water. All the parameters of the studied ground water are below the allowed limit except (Fe). Caerio *et al*., (2005) classified the metal index into six categories as following:

1) Class I: very pure (MI<0.3).
2) Class II: pure (MI ranges from 0.3 to 1).
3) Class III: slightly affected (MI ranges from 1 to 2).
4) Class IV: moderately affected (MI ranges from 2 to 4).
5) Class V: strongly affected (MI ranges from 4 to 6).
6) Class VI: seriously affected (MI>6).

The MI is calculated as MI = C / MAC Where, C is the metal concentration (mg/l) in water sample and MAC (mg/l) is the maximum allowable concentration (WHO, 2018). The MI value of Fe is more than 6 mg/l, which classified as seriously affected (Class VI). The irrigation parameter plot between (EC) vs. Na % showed the ground water of the studied samples are excellent quality for irrigation uses (Fig.2).

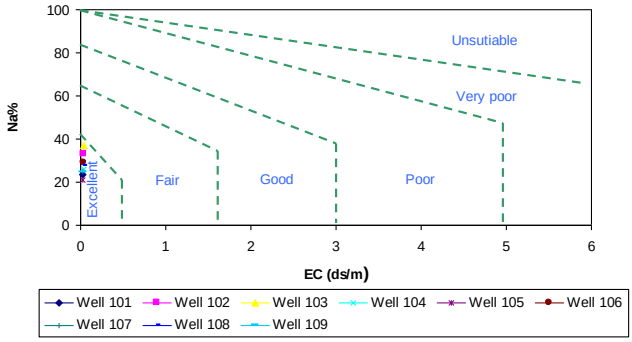

Fig.2: Classification of irrigation water on EC vs. Na % and its suitability for agriculture (fields after Johnson and Zhang, 1990).

3.2. Ground water classification

Fetter (1994), classifies the water based on TDS as shown in Table (2). The studied ground water samples, which have TDS value between from 196 mg/l to 228 mg/l, which classified as fresh water type. The bivariate plot of TDS vs. TH (Fig.3) shows the studied ground water samples found to be soft fresh water. The PH corrosive water is classified into three categories:

1) If the pH is below 6.0, the water is considered highly corrosive.
2) If the pH is between 6.0 and 6.9, the water is somewhat corrosive.
3) If the pH is between 7.0 and 7.5, the water is probably not excessively corrosive.

The pH in the studied ground water samples from 6.13 to 6.43 indicating that the water is somewhat corrosive (Swistock *et al*., 2001). The bivariate plot of pH vs. Al kalinity is supported the above result, the samples are classified as corrosive water, this process is natural occurs when the metals react with oxygen and form oxygen oxides (Fig.4).

Table 2:Classification of water based on Total Dissolved Solids (TDS) (after Fetter, 1994).

Class	TDS (mg/l)
Fresh	0 - 1000
Barkish	1000 - 10000
Saline	10000 - 100000
Brine	> 100000

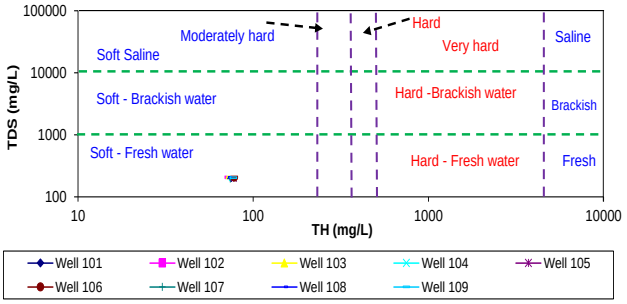

Fig.3: Plot of total dissolved solids (TDS) versus total hardness (TH) of the water springs (fields after Todd D., 1989).

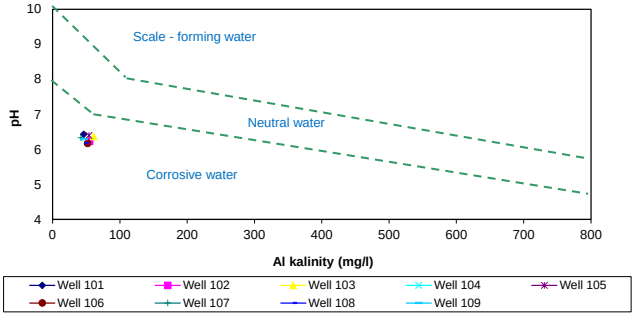

Fig.4: Relationship between pH, alkalinity and water stability standard in studied water samples (fields after Singh and Hussian, 2016).

3.3. Rock – water interaction

Han and Liu (2004) have used the variations in the composition of water (Mg/Ca vs. Na/Ca) to distinguish limestone, dolomite and silicate rock sources of ions. The studied samples are mainly sourced from silicate rocks (Fig.5). The discrimination diagrams based on Na/Na+Ca vs. TDS indicate the dominance of rock the study area (Fig.6).

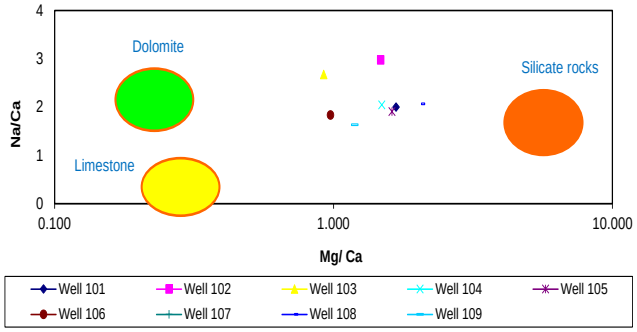

Fig.5: Plot of Mg/Ca vs. Na/Ca ratios of the studied water samples (modified after Han and Liu, 2004).

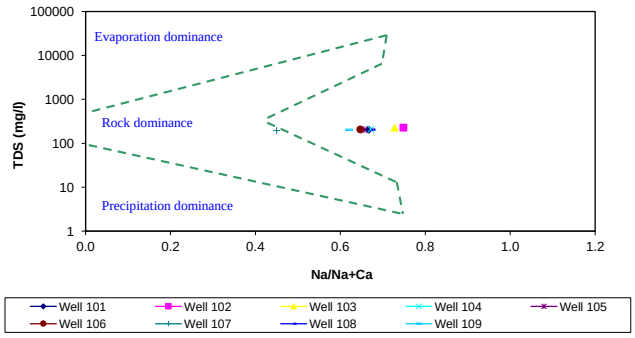

Fig.6: Dominance of precipitation, rock and evaporation on Na/Na+Ca vs. TDS of the study area (fields after Gibbs, 1970).

4. Conclusions

In general, the ground water in the study area is suitable for drinking and irrigation proposes but should be noted that highly increase in Fe values should be treated. The studied ground water samples are classified as soft fresh water. The pH in the studied ground water samples from 6.13 to 6.43 indicating that the water is somewhat corrosive. The major ions of the studied water are mainly came from silicate rocks.

5. Recommendation

The iron levels in drinking water are found to have deleterious effects on human health. The techniques that use to remove the iron from drinking water including, oxidation with chlorine, ozone and green sand filter.

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