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Reseach Article

Evaluation of groundwater quality along al-abyar area, northeast libya

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Abstract

Worldwide, the stress on the freshwater resources is increasing due to population growth and rapid industrialization. Libya is considered as one of the countries which suffer from limited water resources availability. Groundwater is an important water resource in both the urban and rural areas of Libya. To evaluate the quality of groundwater for multiple purposes in the Abyar aera with regard to Physical, Chemical, Heavy Metals and Microbiological. The study conducted in Al-Abyar Regin on seven wells; duration from July 2018 to July 2019, for the following's parameters, Physical pH, Electrical Conductivity (EC), Temperature (^{0}C), Total dissolved Solids (TDS), Chemical Total Hardness (TH), Total Alkalinity (T. Alk), Sulphate (SO4), Nitrate (NO3), Chloride (Cl), Calcium (Ca), Magnesium (Mg), Potassium (K), Sodium (Na), Bicarbonate (HCO3), Heavy Metals Cadmium (Cd), Copper (Cr), Lead (Pb), Iron (Fe), and Microbiological total coliforms and Total Bacterial counts, and analysis of Results done with Excel as well as spss. Results showed that; Electrical Conductivity, Total Dissolved Solids, total hardness, Calcium, Chloride and total bacterial count were higher than WHO standard. Bicarbonate level was higher than WHO standard in most of the wells. Most of wells were higher than WHO standard with regard of Nitrate. all wells were higher than WHO as well as Libyan standard with regard cadmium, Iron and lead. While temperature, Ph, potassium was normal. All wells were very good for animal consumption, good for domestic purposes, and very acceptable for poultry, some wells may be used in paper industry, Textile, canning and drinks industry. Repair and maintain the wells should be one of the most priority to improve socioeconomic status in Al-Abyar region, and monitor the water quality periodically in essential.

Introduction

Worldwide, the stress on the freshwater resources is increasing due to population growth and rapid industrialization [1], water resources can play a vital role in various fields of the economy such as agriculture, livestock, forests, and in industry, such as power generation, fisheries and others [2], Water is vital for sustaining all existence life forms and access to clean and safe drinking water is an important for human need [3], Water of adequate quantity and quality is required to meet growing household, industrial, and agricultural needs [4], According to Tar et al, as cited in Atiku et al., [2017] studies have shown that over one billion people in the world lack access to safe drinking water and 2.5 billion people do not have access to adequate sanitation services [5], Groundwater is a most vital resource for millions of people for both drinking and irrigation uses [6]. In developing countries with arid climate, groundwater presents the main or unique source of drinking and agricultural waters, Water quality remains the main factor influencing its use for drinking, agricultural and industrial purposes [7], Groundwater supplies almost 95% of Libya's needs [8].

Libya is located in the north of Africa on the Mediterranean coast; it encompasses a geographical area estimated at [1,750,000 km^2] between [20° to 34º N] and [10° to 25º E]. Within which roughly 90.8% of the area is hyper-arid, 7.4% arid, 1.5% semiarid and 0.3% is classified as sub-humid [9]. Libya is considered as one of the countries which suffer from limited water resources availability. In Libya a large part of drinking water supply is by groundwater [10], Groundwater is generally considered as a safe source of fresh drinking water [11], Groundwater resource is one key factor that play important role in sustaining the socio-economic standards in any society [12]. Groundwater plays a vital role in the development of arid and semi-arid zones [13]. Groundwater is a preferred source of water because it is often unnecessary to treat it and because its temperature and relative density are almost constant throughout the year as it has helped to provide cheap water as major source of drinking [14].

Groundwater is the major source of water for domestic, agricultural, and industrial purposes in the world [15], The quality of water defined in terms of it's physical, chemical, and biological parameters [16], The quality of groundwater depends on various chemical constituents and their concentration [17], The quality of water influences the health status. analysis of water for physical, biological and chemical properties including trace element contents are very important for public health studies [10]. Water pollution been suggested that it is the leading worldwide cause of death and disease accounts for the death of more than 14,000 people daily [18]. Monitoring of groundwater quality is necessary to manage groundwater pollution, as well as to reduce pollution factors [19,20].

Water quality assessment can be evaluated for drinking by physico-chemical and biological aspects [21]. The term water quality was developed to give an indication of how suitable the water is for human consumption [22], The Water Quality Index [WQI] is one of the most effective ways of describing its quality. It uses water data and helps to modify policies developed by various environmental monitoring agencies [23].

Health problems faced by African countries are water related: typhoid, diarrhoea, cholera, dysentery [24], toxic effects of water pollution on man are related to dermal, lung and nasal sinus cancers [25]. In the developing world, 80% of all diseases are directly related to poor drinking water and unsanitary conditions [26], According to World Health Organization, about 80% of all the diseases in human beings are caused by water [27]. The presence of toxic metals such as lead [Pb] and cadmium [Cd] in the environment has been a source of fret to environmentalist, because of their hazardous and toxic impacts to man [28]. Heavy metals in groundwater are toxic even at low concentrations [29]. Groundwater gets contaminated with a variety of pollutants such as domestic, agriculture, and industrial due to utilization of fertilizers, pesticides, and other chemical products [30]. This study was conducted to evaluate the quality of groundwater in the Abyar aera with regard to: Physical, Chemical, Heavy Metals, Microbiological and Compare the finding with Libyan as well as WHO standard.

Materials And Methods

Study Area

Al-Abyar is considered one of the most important urban centers in the eastern region, and its geographical coordinates are longitude 20 34 29 and 20 40 37 and between the two latitudes 25 05 32 and 55 08 32 and its area is estimated at 6912.64 hectares approximately as in [Fig. 1]. And it's located east of Benghazi and far away about 62 km, but while it comes in the southwest of Marj, about 38 km, and a rocky area in the middle of an agricultural area at an altitude of 300 meters above the sea level, it enjoys a strategic location where in the north there are green forests and fertile land, and the south is underground wells, and Al-Abyar are named by this name because its contain a lot of Underground wells, which are the local pronunciation of the word wells, which is the collection of a well, which means wells preserved in depressions that formed valleys in that region. This site was mentioned in the modern era in the nineteenth century.

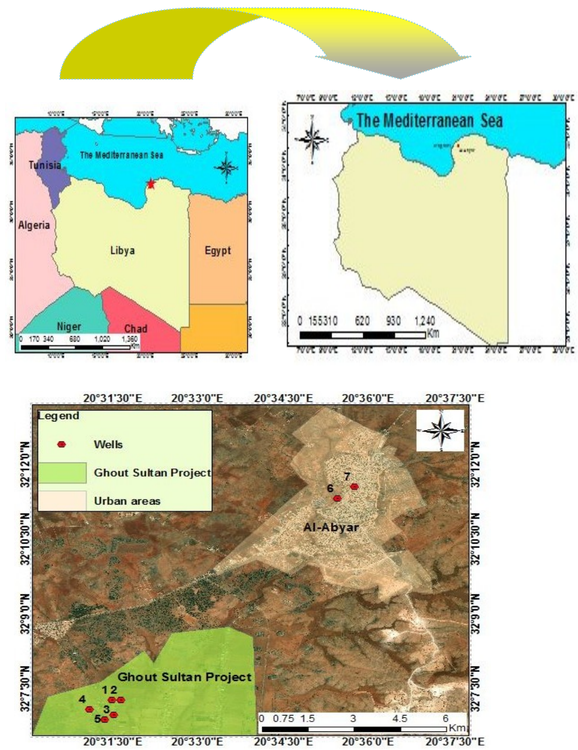

Fig. 1: Study Area Samples Location

Climate

The Libyan climate is characterized by hot and dry summers with high summer temperatures, Libya is one of the driest countries in the world, with mean annual rainfall along the Libyan coast ranging between 140 and 550 mm and rarely exceeds 50 mm in the interior region (1945- 2010), December and January are the wettest months, with the six months of October -March receiving 87.1% of the total annual precipitation [31].

The majority of rainfall occurs in the winter season (DJF), with the rainy season beginning in September-October and ends in March-April, Readings from Libyan Meteorological Center, Benina Station (It is 35 km from the study area) include years 2001 to 2010, reveal that: temperature Lowest mean Minimum temperature 8.9 0C during February, while highest mean Maximum temperature recorded was 32.3 0C during August.

Relative humidity from same station (Benina), record that lowest mean relative humidity 52.9 % during May, while highest relative humidity 71.4 % during January, the lowest mean monthly wind speed was observed was 10.5 during October and highest wind speed was 13.4 during May and April.

Regarding Evaporation, lowest reading was recorded 3.9 during January, while highest Evaporation observed 9.5 during May, duration of Sunshine was varied, lowest duration recoded 5.6 during December while the longest duration 12.3 in July, and rainfall was highest during December 54.7 and lowest in July 0.1, while August was no rainfall, as shown (Table. 1).

Table. 1: Climatic date of the study provided by

Mean in year 2001 – 2010	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Minimum Temperature	9.3	8.9	10.7	13.4	17.1	19.6	21.7	22.3	20.9	18.0	13.9	11.0
Maximum Temperature	17.1	17.4	21.3	24.4	28.4	30.8	31.9	32.3	31.3	27.9	23.2	18.6
Relative Humidity %	71.4	70.4	63.4	55.7	52.9	56.4	63.5	64.1	59.2	62	63.5	68.6
Monthly Wind Speed	10.9	11.6	11.9	13.4	13.4	12.3	12.5	11.9	11.3	10.5	10.9	12.1
Monthly Of Evaporation	3.9	4.5	6.2	8.6	9.5	8.5	6.8	7.0	7.8	7.3	5.9	4. 7
Monthly Duration Of Sunshine	6.01	6.7	8.6	9.2	10.8	11.6	12.3	11.8	10.2	8.8	7.5	5.6
Monthly Total Rainfall	52.4	47.2	23	1.9	4.8	0.7	0.1	0	5.4	16.7	28.3	54.7

Geology

The geological structure of Al-Abyar, is divided into the following:

1. Darnah Formation.
2. Al Abraq Formation.
3. Al Faidiyah Formation.
4. Ar Rajmah Formation.

Ar Rajmah Formation served as a basis for subdividing it into two members:

1. Benghazi Member.
2. Wadi al Qattarah Formation as Shown (fig. 2) (Industrial Research Center, 1977) [32]

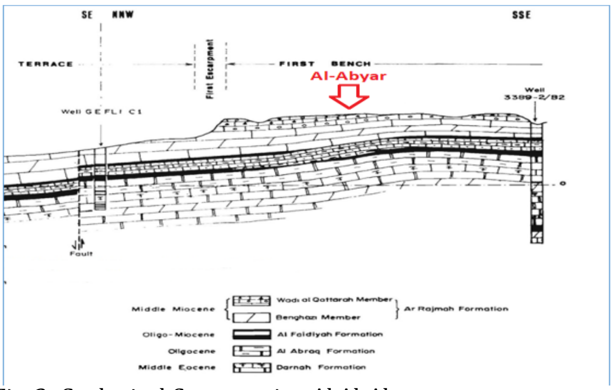

Fig. 2: Geological Cross section Al Al-Abyar

Table 2: Sites Description

Wells No.	Description	Coordinates	Used
1	The well located in the Ghout Sultan Project, was drilled in 1980 and depth about 230 meters, it is assembled in large tank and then enriched to Al-Abyar.	N 32° 7'15.55" E 20°31'29.96"	Drinking, Domestic, Irrigation, Industrial, Animal and Poultry
2	The well located in the Ghout Sultan Project, was drilled in 1972 and depth about 210 meters, it is assembled in large tank and then enriched to Al-Abyar.	N 32° 7'15.62" E 20°31'38.92"	Drinking, Domestic, Irrigation, Industrial, Animal and Poultry
3	The well located in the Ghout Sultan Project, was drilled in 1972 and depth about 210	N 32° 6'57.30" E 20°31'31.6	Drinking, Domestic, Irrigatio

	meters, it is assembled in large tank and then enriched to Al-Abyar.	0"	n, Industrial, Animal and Poultry
4	The well located in the Ghout Sultan Project, was drilled in 1974 and depth about 230 meters, it is assembled in large tank and then enriched to Al-Abyar.	N 32° 7'30.87" E 20°31'06.11"	Drinking, Domestic, Irrigation, Industrial, Animal and Poultry
5	The well located in the Ghout Sultan Project, was drilled in 1974 and depth about 300 meters, it is assembled in large tank and then enriched to Al-Abyar.	N 32° 6'51.62" E 20°31'21.84"	Drinking, Domestic, Irrigation, Industrial, Animal and Poultry
6	The well located in the Al-Abyar, was drilled in 2014 and depth about 500 meters, used for drinking and home purposes in lamis district.	N 32°11'18.69" E 20°35'26.98"	Drinking and Domestic
7	The well located in the Al-Abyar hospital, was drilled in 2014 and depth about 450 meters.	N 32°11'32.31" E 20°35'45.00"	Dialysis Unit

Sampling And Analysis

A total number of seven wells were collected Quarterly including 7 groundwater (wells 1 to 7) and total samples were 28. The study duration from July 2018 to July 2019. The collected water samples were analyzed for various physio-chemical parameters such as (pH), Temperature (^{0}C), Electrical Conductivity (EC), Total Dissolved Solids (TDS), Total Alkalinity (T.Alk), Chloride (Cl^-), Sulphate (SO_4^{--}), Bicarbonate (HCO_3), Nitrate (NO_3^-), Sodium (Na^+), Potassium (K^+), Magnesium (Mg^{++}), and Calcium (Ca^{++}), water temperatures were recorded in the field and pH and EC values were measured by using pH-meter and electric conductivity meter respectively, Also samples were analyzed for Heavy Metal (Cd, Cu, Pb, Zn, Fe) by solvent extraction method (standard Method, 2017) , and Microbiological.

Results And Discussions

This study investigates different parameter; Physical, chemical (including heavy metals), and microbiological.

1-Phisical Parameter: The physiochemical characteristic of eater important determinant of the aquatic system. Various Physical parameters influence the characteristic features and usefulness of water.

1-1- pH: PH is classed as one of the most important water quality parameters Measurement of pH relates to the acidity or alkalinity of the water, The annual pH value of the collected groundwater range between 7.16 and 7.42, In our wells the groundwater in slightly alkaline, the pH changes in different seasons and shows that, water in Summer has nearly relatively higher Ph. The pH study was within the standard of Libya as well as WHO 2011.

1-2- Electrical Conductivity (µS/cm): EC values ranging between 1754 and 2915 µS/cm, the EC values are mostly high in the Summer.

1-3- Temperate (^{o}C): The temperature, value ragin between 24.4 ^{0}C to 24.8 ^{0}C

TDS (mg/L): all samples in the study were Slightly Saline (1000-3000) except the well number four (was fresh, 975.67 mg/L).

2-Chemical Parameter: Selection of parameters for testing of water is solely depends upon for what purpose we going to use that water and what extent we need its quality and purity.

2-1- Carbonate(mg/L): Below pH 8.3 the carbonates are converted into equivalent amount of bicarbonates.

2-2- Bicarbonate(mg/L): Bicarbonate concentration range between 105.012 mg/L and 190.961 mg/L, most of samples were low in Bicarbonate during winter and Autumn (6 wells out 7), more than half of wells (4, 57.1%) were exceed WHO standard (more than 120 mg/L), while two wells (28.6%) were exceed Libyan standard (more than 150 mg/L).

2-3- Chloride (mg/L): all Samples taken were exceeding WHO and Libya standard for potable water (250 mg/L).

2-4- Sulphate(mg/L): in our study, Sulphates varies in content between 163.55 mg/L and 477.29 mg/L, two wells show exceed WHO and Libya standard (more than 250 mg/L), which represent 28.6 % from the total.

2-5- Calcium (mg/L): all Samples Regarding Calcium content exceed WHO 2011 standard (75 mg/L), while consider as normal when comparing with Libyan standard (200 mg/L).

2-6- Sodium (mg/L): Four wells (57.14 %) from our study exceed WHO as well as Libya standard (200 mg/L).

2-7- Potassium (mg/L): All samples were within WHO and Libyan standard.

2-8- Magnesium (mg/L): The annual values for magnesium in our study were ranged between 88.3 mg/L and 32.1 mg/L, more than half (57.1 %) of samples exceed WHO standard (50 mg/L), While all samples consider within normal when compare with Libyan standard (150 mg/L)

2-9- Total Hardness (mg/L): all samples were considered very hard (>180 mg/L), and some of them (57.1%) exceed the maximum, the values were ranged between 289.4 mg/L in well number 2, and 835.1 mg/L in well number 7, and all readings were higher during summer

2-10- Nitrate (mg/L): all wells were exceeding WHO and Libya stander (45 mg/L) except well number 6 (20.62 mg/L), Seasonal variation shown that most of wells (5 out of 7 wells) were higher in during summer.

2-11- Alkalinity (mg/L): Regarding Alkalinity samples were within WHO standard (180 mg/L) except well number 6, the highest values were observed in summer.

2-12- Water Quality Index (WQI): Regarding WQI (Water Quality Index) the well Number 4 was poor water (109.52), while one well Number (2) very poor water (207.97), and lastly wells Number (1,3,5,6,7) were unsuitable (522.97, 2505.06, 423.19, 527.32, 428.01 respectively).

3- Heavy Metals: Heavy metals in groundwater are toxic even at low concentrations [29], Human activities have increased the concentrations of heavy metals in the environment, for example, industry, agriculture, and solid waste disposal increase the contents of heavy metals in water, soil, etc [33].

3-1-Concentration of Cadmium (mg/L): Cadmium is a contaminant that has been found in waters that could be used as drinking water sources in Minnesota. New information suggests that too much cadmium from drinking water may not be good for our health. This information sheet discusses the Minnesota Department of Health (MDH) health-based guidance value for cadmium in drinking water and its possible health effects.

Cadmium is an element found naturally in the earth's crust and soil. It is used in batteries, paints, pigments, coatings and some types of inexpensive jewelry, eating a well-balanced diet with adequate iron intake can help to protect from exposure to cadmium because iron can block absorption of cadmium into the body [34]. Cadmium and cadmium compounds have been classified as Group 1, "carcinogenic to humans," by the International Agency for Research on Cancer [35].

The cadmium concentration in our study exceed WHO as well Libya standard (0.003 mg/L) in all samples.

3-2- Concentration of Lead (mg/L): Lead is a poison whose effects are cumulative, high level of lead in water case health problem such as cancer. lead has never been essential for life; on the contrary, it is considered toxic. presence of lead in groundwater can have a risk for consumers since it can cause disorders in the body such as lead poisoning, seizures or even nervous and mental disorders [36].

All Samples were exceeded with WHO as well as well Libya standard (0.01 mg/L), Seasonal variation indicates higher reading during summer in all samples except well number 2.

3-3- Concentration of Iron (mg/L): Appreciable amounts of iron may therefore be present in ground waters, problems are primarily aesthetic, as the soluble (reduced) ferrous (Fe^{2+}) iron is oxidized in air to the insoluble ferric (Fe^{3+}) form, resulting in color or turbidity (or, in severe cases, precipitate formation). washed in water with excessive iron, and vegetables likewise become discolored on cooking. Taste problems may water rich in iron is used to make tea (in which tannins are present) there may be a reaction giving rise to off-color which may in severe cases resemble that of ink. So, to avoid this problem WHO stated the maximum permissible limit to be 0.3 mg/L **(Environmental Protection Agency. 2001).**

Regarding Iron, the values were ranged between 0.116 mg/L in well number 5, and 0.759 in well number 4, all reading were higher during winter, more than one quarter of samples were exceeded Libya standard (0.3 mg/L).

3-4- Concentration of Cupper (mg/L): the values were ranged between 0.016 mg/L in wells number 3,5, and 0.020 in well number 7, all reading below WHO and Libya standard.

3-5- Concentration of Zinc (mg/L): the values were ranged between 0.165 mg/L in well number 6, and 0.205 in well number 4, the higher reading mostly (71.4 %) in summer, all samples were below WHO as well as Libyan standard.

3-5- Metal Index: Our samples from all selected wells were Seriously affected by Lead (Pb), two wells (4,7) were Seriously affected and remainder wells moderately affected, when consider samples that water affected, they represent about two-third (60%) of all samples.

4- Bicategorical: Water-borne disease could be contracted and spread through drinking and use of contaminated water, according to the WHO, the lack of safe water supply and of adequate means of sanitation is blamed for as much as 80 % of all diseases in developing countries.

4-1- TOTAL COLIFORM: The coliform was found only in well number 3 (40cell/ 100ml) as shown table 46, this exceed WHO as well as Libyan standard (zero per 100ml).

4-**2- TOTAL BACTERIAL COUNT:** Regarding total bacterial count, the values were ranged between 20 in well number 4 and 968 cell/1ml, in well number 3, mostly higher during summer, all reading was exceeding WHO (Zero cell/1ml), When compare with Libyan standard, only two wells were acceptable (wells 2,4).

5- Irrigation: Classification of groundwater quality for irrigation show that, the wells (3,4,5,6) were Permissible with regard of Electrical Conductivity, while wells (1,2,7) consider as Doubtful. Study of Chloride reveals that, wells number (4,5,6) were Permissible, while wells (1,2,3,7) were Doubtful, all wells were Permissible with regard of Percent Sodium (Na%), and Also, all wells had low Sodium Absorption Ratio (SAR). Regarding permeability.

All wells were within Permeability (PI) level, all wells were Suitable with regard of Magnesium Absorption Ratio (MAR) except well number 5 was Unsuitable, and all wells were Suitable with Kelly's ratio, except well number 4 was Unsuitable.

6- Domestics: All wells were good for Domestics purpose with Classification Kamensky.

7- Animal: all wells considered good and acceptable for animals
8- poultry: all wells not acceptable for poultry.
9- Industry: wells were considered as acceptable for paper as well as textile industry and most of industries cannot established in Al-Abyar area according water quality at present time.

10- Correlation Coefficient:

10-1- Correlation Coefficient for different physical, chemical parameters:

pH: showed highly significant correlation ($p<0.01$) with T. Hard (r=-0.555), HCO_3 (r=-0.483), and Ca (r=-0.552); While pH showed significant with T. Alk (r=-0.534) and
NO_3 (r=0.404), **EC:** showed highly significant correlation ($p<0.01$) with TDS (r=0.991), T. Hard (r=0.779) Cl (r=0.845), SO_4 (r=0.915), Na (r=0.866), Mg (r=0.821) and Ca (r=0.623), **TDS:** showed highly significant correlation ($p<0.01$) with T. Hard (r=0.0.807) Cl (r=0.834), SO_4(r=0.917), Ca (r=0.854), Mg (r=0.814) and Ca (r=0.665), **T. Alk:** showed highly significant correlation ($p<0.01$) with Ca (r=0.624), NO_3 (r=-0.731) and Total Hard (r=0.0.473), **T. Hard:** showed highly significant correlation ($p<0.01$) with SO_4 (r=0.815), Mg (r=0.753), Ca (r=0.818), and Cl (r=0.489). While showed significant correlation ($p<0.05$) with Na (r=0.413), **Cl:** showed highly significant correlation ($p<0.01$) with SO_4 (r=0.575), Na (r=0.883), Mg (r=0.544), Ca (r=0.640) and NO_3 (r=0.500), **SO_4:** showed highly significant correlation ($p<0.01$) with Na (r=0.693), Mg (r=0.855), and Ca (r=0.639), **HCO_3:** showed highly significant correlation ($p<0.01$) with NO_3 (r=-0.502), and significant with K (r=0.422), **NO_3:** showed highly significant correlation ($p<0.01$) with Na (r=0.607), and significant with Ca (r=-0.405), **Na:** showed highly significant correlation ($p<0.01$) with Mg (r=0.572), and significant with K (r=0.389), **Mg:** showed significant correlation ($p<0.01$) with Ca (r=0.401), **Pb:** showed highly significant correlation ($p<0.01$) with Cd (r=0.671), and significant with Fe (r=0.548) as shown tables. 3,4

10-2-Correlation Coefficient related to Irrigation:

EC: showed highly significant correlation ($p<0.01$) with Cl (r=0.835), and SAR (r=0.494), **Cl:** showed highly significant correlation ($p<0.01$) with SAR (r=0.652), **Na%:** showed highly significant correlation ($p<0.01$) with SAR (r=0.894), PI (r=0.961), and KR (r=0.991), **SAR:** showed highly significant correlation ($p<0.01$) with PI (r=0.755), and KR (r=0.869), PI: showed highly significant correlation ($p<0.01$) with KR (r=0.973) as shown (Table 3,4 and 5).

Table 3: Correlation Coefficient related to Irrigatio

Correlations		Temp	pH	EC	TDS	T-Alk	T.Hard	Cl	SO4	HCO3	NO3	Na	K	Mg	Ca
Temp	Pearson Correlation	1													
	Sig. (2-tailed)														
pH	Pearson Correlation	0.14	1												
	Sig. (2-tailed)	0.48													
EC	Pearson Correlation	0	-0.310	1											
	Sig. (2-tailed)	0.99	**0.11**												
TDS	Pearson Correlation	0.05	-0.349	0.991**	1										
	Sig. (2-tailed)	0.82	**0.07**	**0**											
T-Alk	Pearson Correlation	0.02	-0.534**	0.16	0.16	1									
	Sig. (2-tailed)	0.92	**0**	**0.42**	**0.43**										
T.Hard	Pearson Correlati	0.06	-0.555	0.779**	0.807**	0.473*	1								

	on		**												
	Sig. (2-tailed)	0.76	0	0	0	0.01									
Cl	Pearson Correlation	0.03	-.172	0.845**	0.834**	-0.002	0.489**	1							
	Sig. (2-tailed)	0.9	0.38	0	0	0.99	0.01								
SO4	Pearson Correlation	0	-0.325	0.915**	0.917**	0.22	0.815**	0.575**	1						
	Sig. (2-tailed)	0.99	0.09	0	0	0.26	0	0							
HCO3	Pearson Correlation	0.07	-0.483**	-0.061	0.03	0.21	0.3	-0.285	0.08	1					
	Sig. (2-tailed)	0.72	0.01	0.76	0.89	0.29	0.13	0.14	0.69						
NO3	Pearson Correlation	0.05	0.404*	0.3	0.26	-0.731**	-0.238	0.500**	0.11	-0.502**	1				
	Sig. (2-tailed)	0.82	0.03	0.12	0.18	0	0.22	0.01	0.57	0.01					
Na	Pearson Correlation	0.01	-0.078	0.866**	0.854**	-0.167	0.413*	0.883**	0.693**	-0.220	0.607**	1			
	Sig. (2-tailed)	0.96	0.69	0	0	0.4	0.03	0	0	0.26	0				
K	Pearson Correlation	0.18	-0.365	0.35	0.394*	0.27	0.34	0.31	0.28	0.422*	-0.078	0.389*	1		
	Sig. (2-tailed)	0.36	0.06	0.07	0.04	0.16	0.08	0.11	0.15	0.03	0.69	0.04			
Mg	Pearson Correlation	-.035	-0.289	0.821**	0.814**	0.1	0.753**	0.544**	0.855**	0.18	0.22	0.572**	0.25	1	
	Sig. (2-tailed)	0.86	0.14	0	0	0.61	0	0	0	0.37	0.26	0	0.19		
Ca	Pearson Correlation	0.12	-0.552**	0.623**	0.665**	0.624**	0.818**	0.460*	0.639**	0.2	-0.405*	0.29	0.23	0.401*	1
	Sig. (2-tailed)	0.56	0	0	0	0	0	0.01	0	0.31	0.03	0.13	0.24	0.03	
	**Correlation is significant at the 0.01 level (2-tailed). *Correlation is significant at the 0.05 level (2-tailed).														

Table 4: Correlation Coefficient related to Heavy metal

CORRELATIONS		Zn	Cd	Pb	Cu	Fe
Zn	Pearson Correlation	1				
	Sig. (2-tailed)					
Cd	Pearson Correlation	0.516	1			

	Sig. (2-tailed)	0.059				
Pb	Pearson Correlation	0.436	0.671**	1		
	Sig. (2-tailed)	0.119	0.009			
Cu	Pearson Correlation	0.337	0.046	0.128	1	
	Sig. (2-tailed)	0.239	0.875	0.664		
Fe	Pearson Correlation	0.011	0.211	0.548*	0.371	1
	Sig. (2-tailed)	0.971	0.47	0.042	0.191	
	**Correlation is significant at the 0.01 level (2-tailed) *Correlation is significant at the 0.05 level (2-tailed).					

Table 5: Correlation Coefficient related to Irrigation

Correlations		EC	CI	Na %	SAR	PI	MAR	KR
EC	Pearson Correlation	1						
	Sig. (2-tailed)							
CI	Pearson Correlation	0.835**	1					
	Sig. (2-tailed)	0						
Na %	Pearson Correlation	0.094	0.311	1				
	Sig. (2-tailed)	0.635	0.107					
SAR	Pearson Correlation	0.494**	0.652**	0.894**	1			
	Sig. (2-tailed)	0.008	0.00	0.00				
PI	Pearson Correlation	-0.117-	0.067	0.961**	0.755**	1		
	Sig. (2-tailed)	0.553	0.736	0.00	0.00			
MAR	Pearson Correlation	0.11	0.245	0.037	0.161	-0.033-	1	
	Sig. (2-tailed)	0.579	0.209	0.85	0.414	0.866		
KR	Pearson Correlation	0.069	0.254	0.991**	0.869**	0.973**	-0.036	1
	Sig. (2-tailed)	0.726	0.193	0.00	0.00	0.00	0.855	
	**Correlation is significant at the 0.01 level (2-tailed) *Correlation is significant at the 0.05 level (2-tailed).							

Conclusion

In this study, we concluded that; Electrical Conductivity, Total Dissolved Solids, Bicarbonate, Chloride, Calcium, total hardness, cadmium, lead, Iron and total bacterial count were higher than WHO standard. The PH were slightly alkaline and within WHO standard. Regarding the Libyan Standard; The values of Electrical Conductivity, Chloride, Nitrate, total hardness, cadmium, lead and total bacterial count were higher in all wells. Total Dissolved Solids in less than half of wells were higher than Libyan standard. More than one third of wells were higher than Libyan standard with regard of Bicarbonate. Most of the wells were higher than WHO as well as Libyan standard with regard of Nitrate. Most of wells were suitable for irrigation with regard of magnesium absorption, as well as Kelly's ratio. All wells were good for domestic purposes, very good for animal consumption, very acceptable for animal and poultry, but may cause potential diarrhea in livestock. Leather, frozen fruits, Petroleum and plastic industry cannot be established in AL-Abyar area unless water management done.

Recommend

1. WHO as well as Libyan Standard for water quality should be used in assessment for different purpose.
2.Monitor periodically of lead as well as cadmium should be a priority in assessing water quality from Groundwater wells in Al-abair.
3.Groundwater wells should be isolated from sanitation and awareness of the local people regarding the effect of wastewater on human health.
4. Patient with renal, heart as high blood pressure need to take care when drinking water, with high sodium.

5.Advise for long term repair and maintain for wells in Al-Abyar as groundwater represent the main water supply in that aera.

6.Textile as well as paper industry may initiated in Al-Abyar aera according to quality of water.

7.Monitoring of quality of water supply in poultry farms should be done periodically.

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