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Assessment of Physico-chemical Parameters of water quality of Ground Water, Almanagil town, Gezira State, Sudan

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ABSTRACT: The current study was conducted to evaluate physical and chemical parameters of water quality taken from some of ground wells in Almanagil town, Gezira State, Sudan. The efforts, in this work, included a collection of different groundwater samples from Managil town. Many groundwater samples were collected from different wells distributed throughout the area of study. From all these groundwater samples, only eight samples were selected, to exclude repetition, and subjected to physico-chemical analysis. The physical characteristics including: conductivity (EC) of the collected samples were determined. The values of different chemical parameters as: pH, total dissolved salts (TDS) were measured according to the standard methods of analysis. In addition, the concentration of many anions (chloride, nitrite, nitrate) were determined. Results showed that EC between 440 -601 (ppm), GH 1000 (mg/L) all, NO^3 and NO^2 0.00 (mg/L) , Cl_2 range between 0.7-3.58 (mg/L) ,KH 120- 362.667 (mg/L) ,salts 18.0-20.0 % , pH has values ranged from 8.0 - 8.5 while the Total Dissolved Solids (TDS (mg/L)) between 6.67 – 12.0 (mg/L) whereas (TDS (ppm)) between524.33- 653.67 . The results revealed significant different at ($P \leq 0.01$) with exception of (NO^3) value zero so (NO^2) *and* GH (1000mg/L) were not significant at $P > 0.05$). The findings show validity of certain samples for human uses.

KEY WORDS: ground water and water quality, physico-chemical.

INTRODUCTION

Groundwater is extensively used for agricultural, industrial, and drinking purposes in many arid and semi-arid regions (e.g., Western United States, Australia and China) where rainfall is infrequent and surface water is scarce [1,4]. Groundwater accounts about 29.9% of all worldwide freshwater resources [1,5], and water resource shortages have become one of the most important challenges to humankind [4,6]. In addition, groundwater resources have drastically declined not only in quality but also in quantity due to untreated effluents from industrial and agricultural development, expanding urbanization, population growth, inadequate sanitation, and pollutant run off in arid and semi-arid regions [2,7,8]. Hydrochemical characteristics are generally used to indicate the source of the main components of ions, types of groundwater, water–rock interactions, and groundwater reservoir environments [9]. Knowledge of hydrochemical characteristics is useful for evaluating groundwater quality because it provides an understanding of groundwater suitability for various purposes. Investigations have shown that exposure to potentially toxic chemicals, such as heavy metals, fluorides, and nitrate in groundwater can pose great risks to human health [10,11].

Groundwater pollution can affect human health and is the most widespread source of health problems in arid and semi-arid regions around the world [12,13].

OBJECTIVE

The objective of this study was to evaluate suitability of ground water taken from some wells in Al managil town for human use.

MATERIALS AND METHODS

Study Area: Almanagil town, Gezira State, Sudan. The capital of the locality, is 62 Km away from Wad Medani , the capital of Gezira State, and 156 km from Khartoum, the capital of the Sudan.

Sample Collection

In the study groundwater samples were collected from eight groundwater wells from Almanagil city, Gezira state, Sudan. The selected wells are represented all groundwater wells as they are distributed in the city as well. Three samples were taken from each well. Then subjected to analysis immediately using specific mobile portable Digital Electronic Devices.

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Water Samples Analysis

The collected samples were subjected to physico-chemical parameters analysis: which are pH, Total dissolved solids (TDS), Electrical conductivity (EC), Total hardness (TH, as aCO_3^-) ,chloride (Cl^-) nitrite (NO_2^-) nitrate (NO_3^-) General Hardness(GH) and potassium Hydride (KH).

Statistical analysis

The data were analysed using statistical package for Social Studies (SPSS version 22.0). One way analysis of variance (ANOVA) was used for means separation among wells. A P-value of ≤ 0.05 will be considered indicative of a statistically significant difference.

Table 1. Water Quality Parameters According to Almanagil Ground Water Wells:

Ground water Well	Water Quality Parameters Means ± SE									
	EC (ppm) ± 23.61	GH (mg/L) ±0.000	No_3 (mg/L) ± 0.00	No_2 (mg/L ± 0.00	Cl_2 (mg/L) ± 0.099	KH (mg/L) ± 20.00	pH ± 0.11	Salts (%) ± 0.204	TDS (mg/L) ± 0.79	TDS (ppm) ± 2.867
Overall	528.54	1000	nill	nill	0.208	240.50	8.25	18.92	9.063	591.21
Block 49	601.00 ^{a}	1000	nill	nill	0.700^{b}	362.66^{a}	8.13^{b}	19.00^{c}	10.000^{ab}	635.00^{b}
Block 34	563.66 ^{ab}	1000	nill	nill	0.700 ^{b}	361.33 ^{a}	8.23 ^{ab}	18.00^{d}	6.667^{c}	653.67^{a}
Block 2	556.66 ^{ab}	1000	nill	nill	0.001^{a}	280.00^{b}	8.27 ^{ab}	18.00^{d}	6.267^{c}	6.33.33^{b}
Albur	572.33 ^{a}	1000	nill	nill	0.267 ^{a}	240.00^{bc}	8.53 ^{a}	18.00^{d}	9.667^{ab}	626.67^{b}
Almanagil University	474.33^{cd}	1000	nill	nill	0.001 ^{a}	200.00^{c}	8.27 ^{ab}	19.33^{bc}	9.400^{ab}	524.33^{e}
Block 71	526.00 ^{abc}	1000	nill	nill	0.001 ^{a}	120.00^{d}	8.00^{b}	19.67^{ab}	7.833^{bc}	5,73,67^{c}
Block 37	440.00^{d}	1000	nill	nill	0.001 ^{a}	240.00^{bc}	8.57 ^{a}	20.00^{a}	12.00^{a}	539.67^{d}
Block 43	494.33^{bcd}	1000	nill	nill	0.001 ^{a}	120.00 ^{d}	8.00^{b}	19.33^{bc}	10.667^{a}	543.33^{d}
Sig.	**	NS	NS	NS	**	**	**	**	**	**

*Means with similar superscripts within the same column are not significant different.
* Sig≡ Significant Level.
**≡ Highly significant at (P ≤ 0.01)
SE ≡ Standard Error of means.

Electrical Conductivity (EC) mean varies from (601.00 to440.00 (± 23.61) µS/cm), the result indicate highly significant difference at 1% level. Since EC is direct indicator of salinity. The distribution of EC reflects that, high value was at (well of block 49.). These may be attributed to leaching processes along the flow of surface water, high rates of evaporation and anthropogenic activities prevailing in the area.

General Hardness GH (mg/L) in the study area stable (1000.00 mg/l) , The results are not significant at5% level .

Potassium Hydride(KH) , in the study area the mean varies (362.00-120.00 (± 20.00) mg/l) (Table 1), The distribution of KH values in the study area decreasing in (well of blocks 43 and 72), whereas, increasing at (well of block 34 and 49). The results revealed highly significant difference at 1% level.

Chloride (Cl^-) chloride ion usually present in natural water, concentration in the study area varies from (3.58 to 0.27 (± 0.099) mg/l) in a mean (Table 1) , The results revealed highly significant difference at 1% level. The spatial distribution of Cl^- values in the study area decreasing in(well of block Albur), whereas, increasing at (well of block 43).

(pH) value in the study area varies from (8.00 to 8.57 (± 0.11)) in a mean (Table 1). The distribution of pH reflects that, high value was observed at the (well of block 37)., whereas, decreasing in (well of block 71 and 43) the result indicate highly significant difference at 1% level. The pH values indicates alkaline nature of groundwater of Almanagil town. , the results indicate highly significant difference and agree with [14–15].

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Salts, varies in mean percentage from (20.00 %to18.00% (± 0.204)) (Table 1), The spatial distribution of salts values in the study area decreasing in (well of block Albur), whereas, increasing at (well of block 43). The results revealed highly significant difference at 1% level.

Total Dissolved Solids (TDS mg/l), in the study area varies from (12.00 to 6.26 (± 0.79) mg/l in a mean (Table 1) , the result indicate highly significant difference at 1% level . The distribution of TDS visualized increasing (well of block37.), whereas, the lowest concentration of TDS values appeared in the samples taken from (well of block2). According to[14,15], samples taken from wells blocks in Almanagil area, classified as100% drinkable water beside using for other purposes.

Total Dissolved Solids (TDS ppm), in the study area the mean varies from (653.67 to 524.33 (± 2.867) ppm) (Table 1). The spatial distribution of TDS visualized increasing (well of block37.) , whereas, the lowest concentration of TDS values appeared in the samples taken from (well of block2) and the findings revealed highly significant difference at 1% level , this results on line with [14,15] .

In the study ***(NO^3)and (NO^3)*** values were zero so *they were* not significant at 5% level .

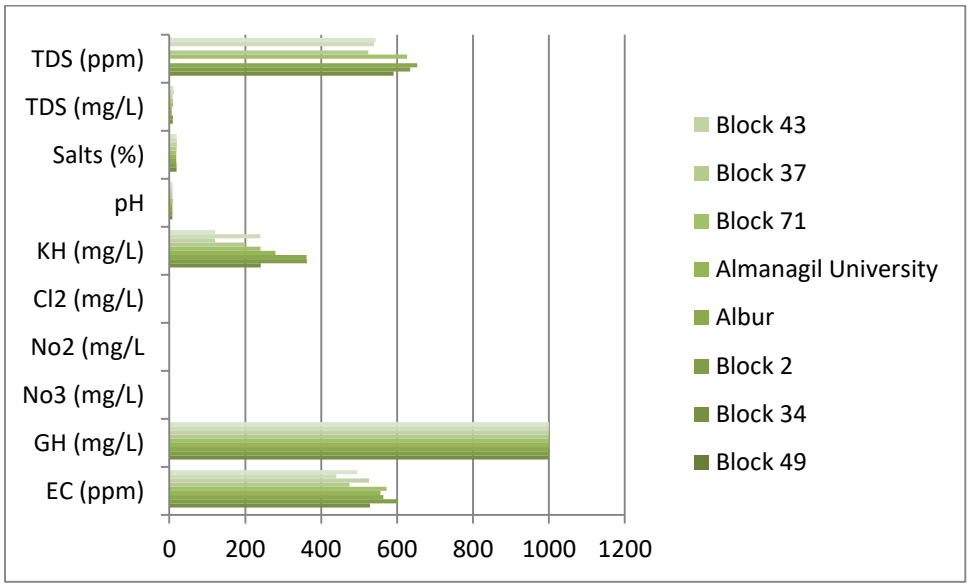

Figure 1. Water Quality Parameters According to Almanagil Ground Water Wells

Statistically there where many difference among many parameters m but The results show that groundwater in the study area suitable in nature and good for domestics uses , according to [14–15].

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RECOMMENDATIONS

According to our findings we recommend to use Almanagil water safely and we need further study by testing all elements alone to determine the toxicity .

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