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

Salah E.I1, O. A. Idam2, Musa A. M.3

1 Department of Biochemistry, Faculty of Medicine and Health Sciences, Managil University of science and Technology, Sudan.
2 Department of Fish Production and Technology, Faculty of Animal Production, University of Gezira, Madani, Sudan.
3 Department of Breeding Biology and Genetics, Faculty of Animal Production, University of Gezira, Madani, Sudan.

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 Almanagil 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, nitrate, nitrate) were determined. Results showed that EC between 440 -601 (ppm), GH 1000 (mg/L) all, NO3 and NO2 0.00 (mg/L), Cl 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≤ 0.01) with exception of (NO3) value zero so (NO3) 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 Almanagil 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.
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 aCO₃₂⁻), chloride (Cl⁻), nitrite (NO₂⁻) nitrate (NO₃⁻) 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:

<table>
<thead>
<tr>
<th>Ground water Well</th>
<th>Water Quality Parameters Means ± SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall</td>
<td>EC (ppm) ± 23.61</td>
</tr>
<tr>
<td>Block 49</td>
<td>601.00 ab</td>
</tr>
<tr>
<td>Block 34</td>
<td>563.66 ab</td>
</tr>
<tr>
<td>Block 3</td>
<td>556.66 ab</td>
</tr>
<tr>
<td>Albur</td>
<td>572.33 a</td>
</tr>
<tr>
<td>Almanagil University</td>
<td>474.33cd</td>
</tr>
<tr>
<td>Block 71</td>
<td>526.00 abc</td>
</tr>
<tr>
<td>Block 37</td>
<td>440.00 ab</td>
</tr>
<tr>
<td>Block 43</td>
<td>494.33bcd</td>
</tr>
<tr>
<td>Sig.</td>
<td>** NS NS NS</td>
</tr>
</tbody>
</table>

*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 to 440.00 (± 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 at 5% level.

Potassium Hydride (KH), in the study area 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].
Salts, varies in mean percentage from (20.00 % to 18.00 % (± 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 block 37.), whereas, the lowest concentration of TDS values appeared in the samples taken from (well of block 2). According to[14,15], samples taken from wells blocks in Almanagil area, classified as 100% 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 block 37.), whereas, the lowest concentration of TDS values appeared in the samples taken from (well of block 2) and the findings revealed highly significant difference at 1% level, this results on line with [14,15].

In the study (NO₃) and (NO₂) values were zero so they were not significant at 5% level.

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

ACKNOWLEDGEMENT
We wish to express our appreciation to all whose efforts made the this paper available for publication. We thank all the member of faculty of Animal production Gezira university and Sheikh Elzain Ahmed Hamed for his helping in collection of samples.

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.

REFERENCES