Assessment of Ground Water Quality of Taluka Kazi Ahmed District Shaheed Benzirabad

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Abstract: The drinking water quality of ground water was investigated in suspected parts of Taluka Kazi Ahmed of district Shaheed Benzirabad, Sindh Pakistan, to ensure the continuous supply of clean and safe drinking water for the public health protection. In this regard, a detailed physical and chemical analysis of drinking water samples was carried out in different residential and commercial areas of Taluka Kazi Ahmed. 40 samples collected from different locations to check the total dissolved solids (TDS), electrical conductivity (EC), pH, Colour Taste, HCO₃, Cl(mg/l), SO₄, hardness, Ca, Mg, Na, K, ALK, F, Turbidity, NO₃, Fe, As, B.C of ground water. The obtained values of each parameter were compared with the standard values set by the World Health Organization (WHO). The results revealed that Ph, colour, HCO₃, SO₄, Mg, Na, K, ALK, F, Fe, NO₃, and As of all 40 samples were found within the permissible limit of WHO. 12.5% 15%, 5%, 7.5% and 10% samples of TDS, Taste, Cl, hardness and Ca were found above the permissible limit of WHO.

Keywords: Ground water quality, Physical and chemical parameters Kazi Ahmed, Shaheed Benzirabad

1. Introduction

Safe drinking water quality is very critical issue in developing countries like Pakistan. It is included in basic right and considered the fundamental need for good and sound health of human beings. Access to safe drinking water is already limited but its quantity and quality are reducing further due to rapid industrialization, urbanization, growth in population, land degradation and deforestation etc [1]. Unavailability of surface water turned the population towards the harnessing the ground water for meeting their various needs. Various studies have been conducted in different regions of Pakistan in order to analysis the ground water quality for drinking purpose. The study was carried out to weigh and match the parameters of ground water with WHO standards to calculate the water quality and its impact on human fitness, interrelated diseases in Bahawalpur City. Outcomes disclosed that quality of groundwater of Bahawalpur is deteriorating. Condition was much inferior in Islamic colony where 48%, 55% and 41% residents using diluted and brackish water with slight smell.

Laboratory investigation of ground water disclosed that pH, TDS, EC, hardness etc. were noticeably high from WHO permissible perimeters. Owing to deprived quality of water resulted severe diseases like diarrhea, cholera etc. 36% of Peoples of Islamic colony suffering from serious diseases [2]. Abdul Qayyum Khan Sulehria et al. examined the drinking water quality by analyzing the parameters i.e Coliforms particularly E.coli. In all ninety (90) samples were obtained from Data GunjBuksh, Islampura, from District Lahore. The laboratory outcomes indicated that there is no any Coliforms found in main reservoir (tube-well) and pipe-lines, whereas coliforms were found at end users area, which shows that the water provided at end users area is not potable. Owing to that the treatment/management of such water is to be needed to produce the safe and pure water for human intake [3]. InamUllah, E. and A. Alam assessed the water quality of 32 samples collected from different locations of Peshawar. While (84.35% of the samples) taken from the end users were unclean with coliform bacteria and cannot be considered fit for consumption of human. Results of samples which were taken directly from tube well also indicate that the water is not fit for human consumption. Defective delivery lines and storing arrangements and their dearth of maintenance are established core reasons behind the impurity of drinking water in Peshawar [4]. While physical & chemical parameters, SO₄²⁻, Na⁺, K⁺ and electrical conductivity, were detected to be greater in both sources i.e. surface and ground water, on other hand eminent levels of Cl⁻ & Ca²⁺ were pointed only in groundwater more than WHO approved limit [5]. It is fact that physiochemical parameters of drinking water in Pakistan are not to meet the requirements of WHO and Pakistan [6-7].

The objective of this study was to examine the quality of ground water of taluka Kazi Ahmed district Shaheed Benazir Abad for drinking purpose. The main source of drinking water in district is ground water where 98 percent of household use the groundwater for fulfilling their domestic needs [8].
2. Methodology

The forty groundwater samples were collected from the different locations of four union council of taluka Kazi Ahmed (Daulatpur, Ahmed Baghio, ShahpurJahnian and Thatt) of district Shaheed Benazir Abad. Ten water samples have been taken from each union council. Sterilized plastic bottles have been used for collecting the groundwater samples which were washed twice prior to taking samples with distilled water. The samples were collected by using standard methods suggested by Bartram et al [9] and WHO [10]. The collected water samples were brought to Pakistan Council of Research in Water Resources (PCRWR) regional laboratory Shaheed Benazir Abad for analyzing the following selected physical and chemical parameters of groundwater.

2.1. Physical parameters of water for study

These parameters of water are turbidity, Electrical Conductivity, pH, Taste and Colour.

2.2 Chemical parameters of water for study

These parameters of water are Bicarbonate (HCO₃), Chloride (Cl), Sulfate (SO₄), Hardness, calcium (Ca), Magnesium (Mg), Sodium (Na), Potassium (K), Alkalinity (CaCO₃), Fluoride (F), Total Dissolved Solids (TDS), Nitrate (NO₃) and Arsenic (As).

2.3. Biological aspect of water for study

Presence-absence test kit was used to evaluate the water samples for microbiological contamination. American Public Health Association's guidelines were followed for examining the water samples and calibrating the equipments and instruments [11]. The methods of analysis and concerned instrument employed for each water quality parameter are summarized in Table 1.

Table No.1 water quality parameters and method of analysis

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Water Quality parameter</th>
<th>Method of analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>TDS</td>
<td>2540°C, Standard method(1992)</td>
</tr>
<tr>
<td>2</td>
<td>Conductivity (µS/cm)</td>
<td>E.C meter, Syber Scan CON 11 Singapore</td>
</tr>
<tr>
<td>3</td>
<td>PH</td>
<td>Jenco Handheld pH meter, Model 6230N</td>
</tr>
<tr>
<td>4</td>
<td>Colour(TCU)</td>
<td>Sensory Test</td>
</tr>
<tr>
<td>5</td>
<td>Taste</td>
<td>Sensory Test</td>
</tr>
<tr>
<td>6</td>
<td>Bicarbonate (mg/l)</td>
<td>2320, Standard method(1992)</td>
</tr>
<tr>
<td>7</td>
<td>Chloride(mg/l)</td>
<td>Titration Standard method (1992)</td>
</tr>
<tr>
<td>8</td>
<td>Sulfate</td>
<td>Spectrophotometer Optizen 2120UV plus Korea</td>
</tr>
<tr>
<td>9</td>
<td>Hardness(mg/l)</td>
<td>EDTA Titration Standard method (1992)</td>
</tr>
<tr>
<td>10</td>
<td>Calcium (mg/l)</td>
<td>3500-Ca-D, Standard method (1992)</td>
</tr>
<tr>
<td>11</td>
<td>Magnesium(mg/l)</td>
<td>234-C, Standard method (1992)</td>
</tr>
<tr>
<td>12</td>
<td>Sodium (mg/l)</td>
<td>Flame photometer Italy</td>
</tr>
<tr>
<td>13</td>
<td>Potassium</td>
<td>Flame photometer</td>
</tr>
<tr>
<td>14</td>
<td>Alkalinity</td>
<td>2320, Standard method(1992)</td>
</tr>
<tr>
<td>15</td>
<td>Fluoride</td>
<td>SPAND method</td>
</tr>
<tr>
<td>16</td>
<td>Turbidity</td>
<td>Turbidity meter Lovibond PC check kit Germany</td>
</tr>
<tr>
<td>17</td>
<td>Nitrate</td>
<td>Colorimeter, Hach- DR2800, USA</td>
</tr>
<tr>
<td>18</td>
<td>Arsenic(ppb)</td>
<td>Arsenic Test kit</td>
</tr>
</tbody>
</table>

Statistical methods were used to find out minimum, maximum, mean, range and linear regressions for analysis of all water quality parameters. The results of all parameters were compared and evaluated in the light of WHO guidelines for physical and chemical characteristics of water.

3. Result and Discussion

3.1 Physical Parameters

3.1.1. PH

The results of Ph of all 40 samples are highlighted in Fig.1.
Fig. 1 shows that the pH of all tested 40 samples are within the permissible limit given by WHO (i.e 6.5-8.5). The pH values of all the drinking water samples are found to be in the range between 6.9 and 7.5) and the average value of all 40 samples are calculated as 7.25.

### 3.1.2. Electrical Conductivity

The results of Electrical Conductivity of all 40 samples are shown in Fig. 2.

Fig. 2 indicates that only 11 sample of EC is within the permissible limit given by NDWQS (i.e 1000 μS/cm) while 72.5% samples are above the permissible limit of NDWQS [12]. The range of EC of all tested 40 samples was 750-3430 μS/cm and the average value was calculated as 1356.07 μS/cm.

### 3.1.3. Turbidity

The results of turbidity of all 40 samples are shown in Fig. 3.
3.1 Turbidity of the Water

The lowest turbidity values of 0 NTU and highest value of 3.1 NTU were found for samples and average value of all 40 samples are calculated as 1.47. the values of all tested 40 samples lies within the permissible limit of WHO (i.e., 5 NTU).

3.1.4 Colour of the Water

The colour of all the 40 samples were clear

3.1.5 Taste of the Water

There were six samples of ground water in Kazi Ahmed which were objectionable due to taste while the taste of 34 samples were un-objectionable out of 40 samples.

3.2 Chemical parameters

3.2.1. Total Dissolved Solids (TDS)

The results of TDS of all 40 samples are shown in Fig 4.
There are 12.5% samples which are above the permissible limit of WHO (i.e., 1000 mg/l) as indicated in Fig. 4. While the remaining 35 samples of TDS are within the permissible limit given by WHO. The range of TDS of all tested 40 samples was 480-2195 and the average value was calculated as 866.87 mg/l.

3.2.2 Magnesium

The results of magnesium of all 40 samples are shown in Fig. 5.

![Figure 5. Comparison of the results of magnesium of all 40 samples](image)

The lowest magnesium values of 15 and highest value of 95 mg/l were found for samples and average values of all 40 samples are calculated as 34.77. The values of all tested 40 samples lies within the permissible limit of WHO.

3.2.3 Arsenic As

The results of arsenic of all 40 samples are shown in Fig. 6.

![Figure 6. Comparison of the results of As of all 40 samples](image)
The values of As are ranging from 0 to 5 ppb for samples and average value of all 40 samples are calculated as 1. The values of all tested 40 samples lies within the permissible limit of WHO (i.e 10 ppb).

3.2.4 Bicarbonates (HCO$_3$)

Fig.7 highlights the results of HCO$_3$ of all 40 samples. Figure 7 shows that the Bicarbonates (HCO$_3$) of all tested 40 samples are within the permissible limit given by WHO (i.e 1000). The range of HCO$_3$ of all tested 40 samples was 90-360 and the average value was calculated as 166.

3.2.5 Chloride (Cl)

Figure 8 highlights the results of chloride of all 40 samples.
Figure 8 indicates that the chlorine of 38 samples are within the permissible limit given by WHO (i.e 250 mg/l). 5% samples are above the permissible limit of WHO. The range of chlorine of all tested 40 samples was 57-289 and the average value was calculated as 113.52 mg/l.

### 3.2.6 Sulfate (SO₄)

Fig. 9 highlights the results of Sulfate (SO₄) of all 40 samples. Figure 9 indicates that the Sulfate (SO₄) of all samples are within the permissible limit given by WHO (i.e 250). The range of Sulfate (SO₄) of all tested 40 samples was 42-249 and the average value was calculated as 79.125.

### 3.2.7 Calcium (Ca)

Fig.10 highlights the results of calcium of all 40 samples. Figure 10 indicates that the Calcium (Ca) of all samples are within the permissible limit given by WHO (i.e 250). The range of Calcium (Ca) of all tested 40 samples was 42-249 and the average value was calculated as 79.125.
Figure 10 indicates that the calcium of 36 samples is within the permissible limit given by WHO (i.e. 75). 10% samples are above the permissible limit of WHO. The range of Sulfate calcium of all tested 40 samples was 16-100 and the average value was calculated as 41.4.

### 3.2.8 Hardness

Fig.11 highlights the results of calcium of all 40 samples.

![Hardness graph](image)

Figure 11. Comparison of the results of hardness of all 40 samples

Figure 11 indicates that the hardness of 37 samples is within the permissible limit given by WHO (i.e. 500). 7.5% samples are above the permissible limit of WHO. The range of hardness of all tested 40 samples was 100-640 and the average value was calculated as 246.25.

### 3.2.9 Sodium (Na)

Fig.12 highlights the results of calcium of all 40 samples.

![Sodium graph](image)

Figure 12. Comparison of the results of sodium of all 40 samples
Figure 12 indicates that the sodium of all samples is within the permissible limit given by WHO (i.e 200). The range of sodium of all tested 40 samples was 31-169 and the average value was calculated as 71.25.

3.2.10 Potassium (k)
Fig. 13 highlights the results of potassium of all 40 samples.

Fig.13 indicates that the potassium of all 40 samples is within the permissible limit given by WHO (i.e 12). The range of potassium of all tested 40 samples was 1.9-8 and the average value was calculated as 3.755.

3.2.11 Alkalinity
Fig.14 highlights the results of Alkalinity of all 40 samples.

Figure 14 shows that the alkalinity of all tested 40 samples are within the permissible limit given by WHO. The range of alkalinity of all tested 40 samples was 1.8 – 7.2 and the average value was calculated as 3.105.

3.2.12 Nitrate (NO₃)
Figure 15 highlights the results of nitrate of all 40 samples.
4. Conclusion

The values of water quality parameters of ground water of all 40 samples collected from different locations of taluka Kazi Ahmed district shaheedBenzir Abad such as Ph, colour, HCO₃, SO₄, Mg, Na, K, Alk, F, Fe, NO₃ and As were found within the permissible limit of WHO. While 12.5% 15%, 5%, 7.5% and 10% samples of TDS, Taste, Cl, hardness and Ca were found respectively above the permissible limit of WHO.

References


[10] World Health Organization, "Guidelines for Drinking Water Quality, Surveillance and Control of


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