Comparison of Open Well Water Quality Parameter in Industrial Zone, Ariyalur District, Tamil Nadu, India

R. Geetha¹, A. Kistan¹, Dr. A. Thaminum Ansari²

¹Research & Development Centre, Bharathiar University, Coimbatore -641046, Tamil Nadu, India
²Assistant Professor, Muthurangam Government Arts and Science College, Vellore, India

Abstract: To assess the quality parameter of ground water in the Industrial area, Ariyalur district Tamil Nadu, water samples from 4 different locations were collected spreading over a period of three months in the year (2012-2013) namely December, January and February. The index of water quality was assess by measuring various physico-chemical parameter such as pH, Total Dissolved Solid(TDS), Total Hardness(TH), Total Alkalinity(TA), Calcium, Magnesium, Sodium, Potassium, Nitrate and Chloride content. After analysis of water quality, all the samples indicates that water of allocation is acceptable for consumption and is within the permissible limit. The Pump house water may be use for direct consumption which is nearly equal to the permissible limit. Other some samples were also can be used for drinking purpose after treatment.

Keywords: Water quality, Physico-chemical parameter, Ariyalur district, CHEEPO, Contamination, Open well, Ground water.

1. Introduction

Water is one of the most abundant commodities in nature but is also the most misused one. Although earth is a blue planet and four fifth of its surface is covered by water, the hard fact of life is that, about 97% of it is locked in the oceans which is too saline and not fit for drinking, agricultural, Laboratory and industrial purposes [1]. About 80% is trapped in polar ice caps and giant glaciers from which icebergs break off and slowly melt at sea[2]. Another 10% of it is locked in rock crevices and minerals lying as deep as 800m below the earth’s crust which is very expensive to pump out. This leaves only about 0.3% of the world’s water resource that man can tap for domestic, agricultural and industrial use. Indeed, more than two thirds of the earth’s surface is covered by water, the total volume representing almost 1,500 million cubic kilometers.

The use of water by man, plant and animal is universal. Without water there can be no life. Man can go nearly two months without food, but can live only 3 and 4 days without water. Water is the most priceless human commodity. It can be both priceless and worthless a blessing or curse depending on circumstances. Nothing can take place without water. Water serves more in fulfilling the human needs than does any other natural source [3]. In our homes whether in urban or in rural areas water is essential for cleanliness and health [4]. When humanity runs out of clean water everything stops. Though there are many liquids like alcohol, vegetable oil, mineral oil etc., they do not have the uniqueness of water, because they are composed of chemically different substances.

Water can be considered as the principal raw material from which most of our farm products are made. It is essential for the growth of crops and animals [5]. If there is a shortage of water there will be a decline in farm production. Water is only essential for the lives of animals and plants, but also occupies a unique position in industry [6]. Probably, its most important use as engineering material is in the ‘steam generation’. Moreover, ground water and soil moisture constituting 22% of the global fresh water resource cannot be exploited at present as it lies at a depth of more than 800m. The atmosphere and steam contain only 0.4% of fresh water of the earth[6]. Long and sustained industrial activity in any given area can often lead to soil and ground water contamination. Improper waste disposal practices might contaminate the soils and gradually the ground water in the area, impairing ground water quality for many applications including drinking. The study of underground contamination will be of immense help to researchers and environmental regulators working in the area to understand and evolve by initiating remedial measures. The determination alteration of the naturally occurring physical, thermal, chemical, or biological quality of groundwater is called ground water contamination.

2. Aim and Scope of the Present Work

The objective of the present work is to assess
- The quality of ground water in open wells.
- To study the Physico chemical properties of ground water in open wells.
- To know whether the open well water is suitable for drinking purposes.
- To compare the physic chemical properties of the four water samples.

3. Material and Methodology

Detailed survey was conducted to identify the four number of existing bore wells. The survey was conducted by each industrial plot and identifying the existence of bore wells.
3.1 Sample Areas

The area wise bore well locations are indicated in distribution of Bore well in study areas.

<table>
<thead>
<tr>
<th>Sample No</th>
<th>Sample Station</th>
</tr>
</thead>
<tbody>
<tr>
<td>SAMPLE A</td>
<td>Asthinapuram</td>
</tr>
<tr>
<td>SAMPLE B</td>
<td>Kyralabath</td>
</tr>
<tr>
<td>SAMPLE C</td>
<td>Keelapaluvur, Annamalai Nagar</td>
</tr>
<tr>
<td>SAMPLE D</td>
<td>Chettinadu, Vetri Nagar</td>
</tr>
</tbody>
</table>

3.2 Sample Collection

Samples of ground water from sample stations were collected in glass containers and were labeled at the time of sampling to avoid misidentification. The information included while labeling the samples were the sample number, name of the person who collected the sample, date of collection and the place of collection. The samples were then refrigerated in the laboratory at 4°C and then taken for analysis.

3.3 Experimental Methodology

The examination made on the sample and the methods adopted are

3.4 Physical Examination

<table>
<thead>
<tr>
<th>S. No</th>
<th>Property Measured</th>
<th>Method Of Examination Of The Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Colour</td>
<td>-</td>
</tr>
<tr>
<td>2</td>
<td>Odour</td>
<td>-</td>
</tr>
<tr>
<td>3</td>
<td>Electrical Conductivity</td>
<td>Conductivity Meter</td>
</tr>
</tbody>
</table>

3.5 Chemical Examination

3.6 Result and Discussion

In the present investigation the following parameters were analyzed for using a standard method. The parameters such as water appearance odour, total dissolved solids, electrical conductivity, pH, alkalinity, ammonia, nitrate, chloride, fluoride, Sulphate, phosphate, tidy’s test, calcium. Magnesium, sodium and potassium were analyzed in four areas open well water and results are described below:

Open well ground water samples were collected from four places in Ariyalur District. The Physico – Chemical parameters were measured to assess the ground – water quality. The results were compared with the specification given by the Central Public Health Environmental Engineering Organization (CPHEEO).

5. Physical Examination of Open Well Water Samples

<table>
<thead>
<tr>
<th>Place of Collection</th>
<th>Asthinapuram</th>
<th>Kyralabath</th>
<th>Keelapaluvur, Annamalai Nagar</th>
<th>Chettinadu, Vetri Nagar</th>
<th>CPHEEO VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample No.</td>
<td>Sample A</td>
<td>Sample B</td>
<td>Sample C</td>
<td>Sample D</td>
<td>Minimum Limit</td>
</tr>
<tr>
<td>Appearance</td>
<td>Clear</td>
<td>Clear</td>
<td>Very slightly yellowish colour</td>
<td>Clear</td>
<td>Colourless</td>
</tr>
<tr>
<td>Odour</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>Unobjectionable</td>
</tr>
<tr>
<td>Turbidity NTU</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Electrical Conductivity mho/cm</td>
<td>1050</td>
<td>900</td>
<td>1180</td>
<td>1220</td>
<td>800</td>
</tr>
</tbody>
</table>

Table 4: Chemical Examination of Open Well Water Samples

<table>
<thead>
<tr>
<th>Sample No.</th>
<th>Place of Collection</th>
<th>Ammonia mg/L</th>
<th>Nitrite mg/L</th>
<th>BOD</th>
<th>COD</th>
<th>Fluoride mg/L</th>
<th>Sulphate mg/L</th>
<th>Phosphate mg/L</th>
<th>DO</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Asthinapuram</td>
<td>Sample A</td>
<td>0.01</td>
<td>0.7</td>
<td>13</td>
<td>0.4</td>
<td>60</td>
<td>0.2</td>
<td>6.2</td>
</tr>
<tr>
<td></td>
<td>Sample B</td>
<td>0.20</td>
<td>0.01</td>
<td>1.2</td>
<td>15</td>
<td>0.3</td>
<td>18</td>
<td>0.9</td>
<td>5.4</td>
</tr>
<tr>
<td></td>
<td>Sample C</td>
<td>0.01</td>
<td>2</td>
<td>11</td>
<td>128</td>
<td>0.06</td>
<td>18</td>
<td>0.07</td>
<td>6.8</td>
</tr>
<tr>
<td></td>
<td>Sample D</td>
<td>0.04</td>
<td>2.4</td>
<td>18</td>
<td>115</td>
<td>0.3</td>
<td>37</td>
<td>5.9</td>
<td>6</td>
</tr>
</tbody>
</table>

4. Result and Discussion

In the present investigation the following parameters were analyzed for using a standard method. The parameters such as water appearance odour, total dissolved solids, electrical conductivity, pH, alkalinity, ammonia, nitrate, chloride, fluoride, Sulphate, phosphate, tidy’s test, calcium. Magnesium, sodium and potassium were analyzed in four areas open well water and results are described below:

Open well ground water samples were collected from four places in Ariyalur District. The Physico – Chemical parameters were measured to assess the ground – water quality. The results were compared with the specification given by the Central Public Health Environmental Engineering Organization (CPHEEO).

5. Physical Examination of Open Well Water Samples
Sample A: Asthinapuram, Sample B: Kyrulabath Sample, Sample C: Keelapaluvur Annamalai Nagar Sample, Sample D: Chettinadu Vetrinagar.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Sample A</th>
<th>Sample B</th>
<th>Sample C</th>
<th>Sample D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chloride mg/L</td>
<td>112</td>
<td>102</td>
<td>144</td>
<td>92</td>
</tr>
<tr>
<td>pH</td>
<td>7.38</td>
<td>7.20</td>
<td>8.2</td>
<td>8.3</td>
</tr>
<tr>
<td>Alkalinity mg/L</td>
<td>300</td>
<td>272</td>
<td>380</td>
<td>260</td>
</tr>
<tr>
<td>Total Hardness mg/L</td>
<td>216</td>
<td>280</td>
<td>420</td>
<td>260</td>
</tr>
<tr>
<td>Calcium mg/L</td>
<td>64</td>
<td>65</td>
<td>68</td>
<td>67</td>
</tr>
<tr>
<td>Magnesium mg/L</td>
<td>16</td>
<td>22</td>
<td>22</td>
<td>22</td>
</tr>
<tr>
<td>Sodium mg/L</td>
<td>90</td>
<td>110</td>
<td>112</td>
<td>85</td>
</tr>
<tr>
<td>Potassium mg/L</td>
<td>0.9</td>
<td>1.8</td>
<td>0.6</td>
<td>1.4</td>
</tr>
<tr>
<td>Total dissolved solids</td>
<td>438</td>
<td>488</td>
<td>730</td>
<td>630</td>
</tr>
</tbody>
</table>

Water Quality Parameters:

**Chloride**
- Sample A: 112 mg/L
- Sample B: 102 mg/L
- Sample C: 144 mg/L
- Sample D: 92 mg/L

**pH**
- Sample A: 7.38
- Sample B: 7.20
- Sample C: 8.2
- Sample D: 8.3

**Total Hardness**
- Sample A: 216 mg/L
- Sample B: 280 mg/L
- Sample C: 420 mg/L
- Sample D: 260 mg/L

**Calcium**
- Sample A: 64 mg/L
- Sample B: 65 mg/L
- Sample C: 68 mg/L
- Sample D: 67 mg/L

**Magnesium**
- Sample A: 16 mg/L
- Sample B: 22 mg/L
- Sample C: 22 mg/L
- Sample D: 22 mg/L

**Sodium**
- Sample A: 90 mg/L
- Sample B: 110 mg/L
- Sample C: 112 mg/L
- Sample D: 85 mg/L

**Potassium**
- Sample A: 0.9 mg/L
- Sample B: 1.8 mg/L
- Sample C: 0.6 mg/L
- Sample D: 1.4 mg/L

**Total dissolved solids**
- Sample A: 438 mg/L
- Sample B: 488 mg/L
- Sample C: 730 mg/L
- Sample D: 630 mg/L

**Fluoride**
- Fluoride concentration of 1 ppm in drinking water is suitable for dental health. Fluoride is found in 4 bore wells ranging from 0.1 mg/L to 1.5 mg/L. None of the samples indicated fluoride concentration exceeding the permissible limit of 1.5 mg/L (Table -4).

**Alkalinity, Hardness and Chloride**
- The alkalinity and total hardness detections show the vulnerability of shallow ground water to contamination in four samples. The values are higher than the desirable limit specified (Table 4). These waters if used for drinking may cause gastrointestinal discomforts [8]. Higher concentration of calcium magnesium, bicarbonate and carbonate in these samples indicates the reason for the elevated total hardness of the samples.

**Total Dissolved Salt**
- On the basis of sample analysis from four open wells less than 100 feet deep, two ground water samples (Sample A and Sample D) in the uppermost zone of the aquifer did not exceed drinking water standards for the analyzed constituents but have higher than desirable dissolved solid concentration in water samples from two wells (Table -4).

**Colour**
- Out of the four samples analyzed three samples are colourless and clear. One sample is very slightly yellowish Sample:C.
Nitrates
Nitrates in potable water are one of the important environmental problems, as intake of excessive nitrates presents a potential risk to public health [9]. All the samples are found to have nitrates concentration much less than the desirable limit.

Chloride
Range between 36 mg/L and 900 mg/L. All the samples are well within the permissible limit of 900 mg/L (Table 4).

Electrical Conductivity
The samples collected from Keelapaluvur Annamalai Nagar and Chettinadu Vetri Nagar has having higher concentration of total dissolved solids (Table 4). This is indicated also by the higher electrical conductance values for the samples.

Micro Nutrients
Sodium, Potassium, Calcium, Magnesium and Fluoride contents are secondary nutrients which are essential for plants and used for crops yield development and also essential for animals and human. There are comparatively low micro nutrients in the samples collected from Keelapaluvur Annamalai Nagar (Table-4).

Sulphate and Phosphate
The assessment was reported that the concentration of Sulphates and Phosphate also not exceeded the permissible limits range from (Table-1). High level of Sulphates in water can cause dehydration and diarrhea and may also cause corrosion effect on plumbing. So in the present study area there is no problems due to Sulphate content present the water (Table 4).

pH
The observed pH value ranging from 7.2 to 8.3 shows that quality of water samples were slightly alkaline (Table-4) which may be used for domestic purposes directly. These values are maximum permissible limit prescribed by CPHEEO standards. If pH increases the permissible level it may promote corrosion of plumbing systems and fixtures. If pH decrease the permissible level it may cause for health issues which is not fit for domestic purposes.

BOD and COD
As per the study report it was observed that BOD and COD not exceeded the limit which is very much essential for aquatic species (Table-1).

A correlation analysis has been carried out among the various parameters. There is a wide variation in the quality of water, from place to place which is reflected by the related parameters. All these four open well water samples found that may suitable for drinking purpose after condoning (such as boiling, Chlorination etc.) The parameters measured are within the desirable limit of drinking water standards.

The sample have permissible limit of hydrological parameters from the results. As urbanization increase around the world, many of these open wells are being created to assist in controlling runoff. There is considerable need for additional quantitative data and a better understanding of these small impoundments so they may be managed more effectively.

Four water samples were collected from different locations in Ariyalur District and the Physico Chemical parameters were measured. The experimental results were compared with the Central Public Health Environmental Engineering Organization (CPHEEO) specification.

The ground water which was taken from the various places in Ariyalur district (Keelapaluvur Annamalai Nagar, Chettinadu Vetri Naga, Asthinapuram, and Kyralabath) was analyzed for the various water quality parameters like pH, EC, Potassium, Calcium, Magnesium, Chloride, Alkalinity, Hardness, Nitrates, Phosphates, Nitrates, Ammonia, Total dissolved salt and physical parameters. The content of the substance lies above the maximum permissible limit prescribed by Central Public Health Environmental Engineering Organization (CPHEEO). Especially the analysis report shows that the contamination slightly takes place in Keelapaluvur Annamalai Nagar. The reason for this slight variation of Physico-chemical parameters at certain sampling location may be due to unscientific disposal of wastes, industrial effluents may affect the quality water. So from this research study, it can be concluded that there are no major impacts due to water pollution in the study areas.

6. Conclusion

In the present study the following significant findings were made. After the analyses of water quality parameters it is clearly found that, the value of two sampling station of the study areas are permissible rating of pollution and other two of the sampling station of the water rating is very slightly polluted and slightly permissible rating of pollution. So, proper treatment is essential before using it for various purposes mainly drinking and domestic purposes. Some techniques that can be used to raise the quality of the water that are Activated Carbon Filtration, Distillation, Ion Exchange, Reverse Osmosis, Ultraviolet Radiation, Fish bone Charcoal etc.

References

[9] Environmental Pollution, common wealth publisher, New Delhi, M.S. Sethi and S.A. Iqbal.

www.ijsr.net
Licensed Under Creative Commons Attribution CC BY