ABSTRACT

The present study to determine the quality of well water sources in different villages of chintapalli mandal, Visakhapatnam, India. The results were compared with BSI and WHO standards for drinking water. The physic-chemical parameters include pH, Turbidity, Electric conductivity (EC), Total Dissolved Solids (TDS), Total Hardness, Calcium, Magnesium, Chloride, Sulphate, Phosphate, and Dissolved Oxygen (DO) were tested. It was found prescribed limits while that some parameters were higher than the prescribed limits while other parameters were lower than the limits. In the microbiological examination, all samples were found to be contaminated with coliforms. Although fecal coliforms were found to be contaminated with coliforms. These contaminated waters pose threats to the health of the tribal people. The results showed that, some of the parameters below and some of them above the limits. The water samples needed treatment before it is consumed.

KEY WORDS: Well water, Physico-chemical, coliforms, WHO.

INTRODUCTION

Water is the second essential factor for life. People acquire drinking water from surface and underground sources. The quality of water rapidly alters as a response to alteration in the surrounding environment. The quality of drinking water fall from physico-chemical and microbiological parameters. Potable water is free from disease producing microorganisms and chemical substances that are dangerous to health (1). The study area chintapalli is a tribal area, majority of the people live in hilly terrain. They depend on bore, spring and well water for drinking and domestic use. According to the report of Byragi reddy et al., in this area unsatisfactory with coliform counts far exceeding the level recommended by WHO (2). This poses a risk to human health. Bacteria are often responsible for water contamination and subsequent disease. Many infectious diseases are transmitted by water through the fecal-oral route. Diseases contacted through drinking water kill about 5 million children annually and make 1/6th of the world population sick (3). So the aim of the present study is to determine the well water quality in chintapalli area.
MATERIALS AND METHODS

Study Area

Chintapalli located at North Easter part of India between 17°42′22″ east to 82°38′04″. The temperature in the hill track village by deducting 2 to 30°C recorded at the local agriculture research station, chintapalli. Lambasingi area is referred to Andhra Kashmir by sightseers as temperature dip as low as 0°C during December and January (5).

Analysis of Water samples

The studies on physic-chemical and microbial analysis of well water samples were carried out during the period of 2010 to 2015. Ten well samples were examined for various physic-chemical parameters such as pH, Electric Conductivity (EC), Total Dissolve Solids (DS), Total Hardness (TH), Calcium (Ca), Magnesium (Mg), Chloride (Cl), Sulfate (SO₄), Phosphate (PO₄), Dissolved Oxygen (DO) and Microbial parameters Most Probable Number (MPN), Total Fecal coliform Count(TFC) were analyzed as per standard APHA 2005 (6).

RESULTS

The result of physic-chemical and microbial analysis of the well water samples were given in Table 1 and 2. These results were comparing with the drinking water quality standards lead by BIS and WHO.

pH of well water samples were found to range from 6.12 to 7.96. Low pH values 6.12 were recorded in well water samples of Lambasingi and Lingalagudi and high pH value 7.96 was recorded in well water sample of Parikalu. This indicates they were within desirable limits. The electric conductivity range from 37 to 360 µs/cm. The present study results show that all water samples EC below the limits of WHO standards.

The Total dissolved solid ranged from 98 to 186 mg/L, the low level of TDS indicates that the recharging of underground water through either rain water or by the water from nearby canals and still indicated the pollution (7,8). The maximum prescribed a limit (WHO) is 300-600mg/L.

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The highest value for Total hardness 80 mg/L and the lowest value 42.7 mg/L present in Kothapalem and Lambasingi water samples. Calcium of the sample ranged from 18.8 to 24 mg/L, the values were below permissible limit. In nature calcium obtain water through soil and rock containing large amounts of these elements in mineral deposits (9). The magnesium concentration is in 15to 18.2 mg/lit. When compared with WHO standards magnesium below the permissible limit, according to the WHO the limit is 30mg/L. The possibilities of dissolution of minerals are very low in the study area (7).

In the study chlorides contents in the samples is 10 to 18 mg/L which are below the WHO & BSI levels. The chloride concentrations above 0.5ppm in water considered as pollution hence the drinking water requires treatment before use (8).

The sulphates concentration ranged from 2 to 5mg/L values were present. The phosphate values range from 2.8 to 5.2 mg/Lin all water samples were above the prescribed limit. There are number of ways by which phosphates contaminate to ground water. These include anthropogenic input like chemical fertilizers household detergents, human and animal wastes while the major geological source is appetite, a principal rock mineral in which phosphorous is a chief component (10). The higher level of phosphate is indicative of eutrophication and pollution and water with high PO₄ contents causes health hazards’ (11). As 0.1mg/L is the recommended standard of phosphate for the drinking water.

Dissolve Oxygen is one of the most important aspects in evaluating water quality and signifies physical and biological process dealing with the water (12). In the study DO values found between 4 to 6.4 mg/L values, the DO concentration was higher than the prescribed standards laid by BIS.
### Table 1: Physico-chemical Analysis of Well water samples

<table>
<thead>
<tr>
<th>S. No</th>
<th>Well water sample (Village name)</th>
<th>pH</th>
<th>EC</th>
<th>TDS</th>
<th>TH</th>
<th>Ca</th>
<th>Mg</th>
<th>Cl</th>
<th>SO$_4$</th>
<th>PO$_4$</th>
<th>DO</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Anthrala I</td>
<td>6.89</td>
<td>178</td>
<td>182</td>
<td>74.5</td>
<td>22</td>
<td>16</td>
<td>8</td>
<td>5</td>
<td>3.5</td>
<td>5</td>
</tr>
<tr>
<td>2</td>
<td>Anthrala II</td>
<td>7.02</td>
<td>182</td>
<td>152</td>
<td>72.3</td>
<td>20</td>
<td>18</td>
<td>8</td>
<td>5</td>
<td>4</td>
<td>4.9</td>
</tr>
<tr>
<td>3</td>
<td>Chowdupalli</td>
<td>6.89</td>
<td>171</td>
<td>183</td>
<td>48.2</td>
<td>20</td>
<td>15</td>
<td>17</td>
<td>2.5</td>
<td>4.2</td>
<td>5.2</td>
</tr>
<tr>
<td>4</td>
<td>Bailukinchangi</td>
<td>6.88</td>
<td>163</td>
<td>146</td>
<td>57</td>
<td>24</td>
<td>18.2</td>
<td>18</td>
<td>2.7</td>
<td>2.8</td>
<td>4</td>
</tr>
<tr>
<td>5</td>
<td>Lambasingi</td>
<td>6.12</td>
<td>137</td>
<td>183</td>
<td>42.7</td>
<td>18.8</td>
<td>16</td>
<td>12</td>
<td>2.5</td>
<td>3.2</td>
<td>4.9</td>
</tr>
<tr>
<td>6</td>
<td>Parikalu</td>
<td>7.96</td>
<td>360</td>
<td>186</td>
<td>78.3</td>
<td>19.8</td>
<td>16</td>
<td>10</td>
<td>5</td>
<td>4</td>
<td>5.9</td>
</tr>
<tr>
<td>7</td>
<td>Kothapalem</td>
<td>6.42</td>
<td>187</td>
<td>106</td>
<td>80</td>
<td>22</td>
<td>16</td>
<td>12</td>
<td>2</td>
<td>5.2</td>
<td>6.4</td>
</tr>
<tr>
<td>8</td>
<td>Kinnerla</td>
<td>6.22</td>
<td>143</td>
<td>98</td>
<td>74.6</td>
<td>24</td>
<td>15</td>
<td>10</td>
<td>2</td>
<td>4.2</td>
<td>6.2</td>
</tr>
<tr>
<td>9</td>
<td>Mamidipalli</td>
<td>6.49</td>
<td>186</td>
<td>180</td>
<td>74.2</td>
<td>26</td>
<td>18</td>
<td>11.9</td>
<td>2.9</td>
<td>3</td>
<td>5.2</td>
</tr>
<tr>
<td>10</td>
<td>Lingalagudi</td>
<td>6.12</td>
<td>182</td>
<td>178</td>
<td>57</td>
<td>20</td>
<td>15</td>
<td>12.6</td>
<td>2</td>
<td>3.6</td>
<td>5.4</td>
</tr>
</tbody>
</table>

### Table 2: MPN Count and Total Fecal Coliform Counts in Well Water Samples

<table>
<thead>
<tr>
<th>S. No</th>
<th>Well water sample (Village name)</th>
<th>MPN Index /100ml</th>
<th>TCF(CFU) /100ml</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Anthrala Well I</td>
<td>2400</td>
<td>4.24X10$^2$</td>
</tr>
<tr>
<td>2</td>
<td>Anthrala Well II</td>
<td>93</td>
<td>0.56X10$^2$</td>
</tr>
<tr>
<td>3</td>
<td>Chowdupalli Well</td>
<td>120</td>
<td>1.56X10$^2$</td>
</tr>
<tr>
<td>4</td>
<td>Bailukinchangi Well</td>
<td>1100</td>
<td>3.68X10$^2$</td>
</tr>
<tr>
<td>5</td>
<td>Lambasingi Well</td>
<td>240</td>
<td>2.56X10$^2$</td>
</tr>
<tr>
<td>6</td>
<td>Parikalu Well</td>
<td>460</td>
<td>2.16X10$^2$</td>
</tr>
<tr>
<td>7</td>
<td>Kothapalem Well</td>
<td>1100</td>
<td>3.46X10$^2$</td>
</tr>
<tr>
<td>8</td>
<td>Kinnerla Well</td>
<td>2400</td>
<td>4.65X10$^2$</td>
</tr>
<tr>
<td>9</td>
<td>Mamidipalli</td>
<td>1110</td>
<td>4.08X10$^2$</td>
</tr>
<tr>
<td>10</td>
<td>Lingalagudi</td>
<td>2400</td>
<td>4.55X10$^2$</td>
</tr>
</tbody>
</table>
The coliform population in the range of 93 to 2400 MPN/100 ml. Minimum coliform population 93MPN/100ml was
detected in Anthrala Well Il sample, whereas, a maximum coliform population was found in Anthrala Well I, Kinnerla Well
and Lingalagudi 2400 MPN/100ml followed by the Bailukinchangi, Kothapalem and Mamidipalli Wells having 1100
MPN/100ml (Fig.1). WHO permissible limits for coliform, and E.coli is 0MPN/100ml. in present study well water samples
cross the permissible limits of WHO (13). The presence of coliforms shows the danger of faecal pollution and consequent
hazard of contracting diseases through pathogenic organisms. None the less, the disease- causing organisms (pathogens)
mostly transmitted via drinking water are predominantly of faecal origin (14). The fecal coliform counts on EMB agar plat
ranged between 0.56X10^2 and 4.55X10^2 CFU/100ml, which also exceeds the standard limit for water. This result compared
favorably with the report of Banwo 2006(15) which indicates that the presence of bushes and shrubs makes likely possible
that smaller mammals may have been coming around these water bodies to drinking water, thereby passing out feces into
the water.

CONCLUSION

The well water quality of the study area showed that mostly physio-chemical and microbiological parameters of
drinking water were found above the permissible limits of WHO. Presence of coliform indicates that drinking water is
focally polluted. The poor sanitary condition in tribal area is mainly responsible for change in water quality. Hence
there is a need of treatment of drinking water before it is used for consumption.

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