Comparative study and physico-chemical analysis of kinnersani, palair and wyra reservoir waters of khammam, Telangana, India

Mohammad MJ1, Ravi Kumar T2, Hari Teja K3, Narsimharao T3, Premkumar B3, Sai Chand M3, Manikumar D1

ABSTRACT

In order to determine the water quality, samples of water collected from Kinnersani, Palair and Wyra reservoirs of Khammam district, it was collected in acid wash bottles in early hours. Physico-chemical analysis different parameters were analyzed like PH, Turbidity (NTU), Electrical Conductivity (micro mhos), Total dissolved Solids (mg/l) Chloride (mg/l), Sulphate (mg/l), Nitrate (mg/l), total Alkalinity (mg/l), total Hardness (mg/l), Calcium (mg/l), Fluoride (mg/l), Iron (mg/l). Each parameter was compared with the standard desirable limits of different agencies like BSI (Bureau of Indian standards), WHO (World Health Organization) standards. In this Kinnersani, Wyra, Palair reservoirs best and within the limitations of results are shown by Kinnersani reservoir.

Keywords: Physico chemical analysis, Kinnersani, Palair, Wyra Reservoirs.

1. INTRODUCTION

Water is life. No life can exist without water. Water resources are critical importance to both natural ecosystem and human development. Water is a most important renewable natural resource which plays an important role in the survival of living organisms. It is a vital factor of life and it is considered as precious compound on the earth (Mohammad et al., 2017).

Water is one of the most important natural resources available in abundant in nature which man has exploited more than any other resource for the sustenance of life. Basic feature of the earth is in abundance of water resources. It has been estimated that 0.00192% of the total water on the earth’s planet is available for human consumption (Trivedy and Goel, 1984). Fresh water is an important need to the human being and is considered as the “elixir of life”. The industrialization, urbanization, over population growth and consequent pollution let into the fresh water resources, are a challenge for the fragile fresh water ecosystem. The ability of fresh water bodies to clean themselves has affected by the major quantity of waste generated by ever growth of population (Ghosh, 1992).
The population in India is expected to stabilize around 1.64 billion by the year 2050, as a result, gross per capita water availability will decline from 1820 m³ in 2001 to as low as ~1140 m³/Year in 2050 thus the growing concern about water scarcity challenges us to think of alternative solutions to avoid the current problem of water scarcity (Mohammad et al., 2017). Water quality monitoring is of immense importance in conservation of water resources for fisheries, water supply and other activities; it involves the assessment of Physico-chemical parameters of water (John Mohammad and Krishna, 2014).

Review of literature
The Physico-chemical characteristics of water were studied by Jain and Dhamija, (2000); Bahura, (2001); Altaff & Muthupriya, (2002); Anitha and Kumar, (2003); Manna and Das, (2004); Mathew Koshey, (2005); Saritha et al., (2009); Mullar et al., (2010), Joshi and Patel, (2012).

2. MATERIALS & METHODS
Study area
To evaluate the water quality an effort was made to investigate the waters of Kinnersani, Palair and Wyra, reservoirs of Khammam district, Telangana, India. Description Kinnersani, Palair, Wyra reservoirs are given (Mohammad, 2015). Reservoirs the region gets much rain fall from south west monsoon. In generally the place gets most of rainfall from June to September during the monsoon highest rainfall observed in the months of June.

Description of Kinnersani Reservoir
Village : Yanamboil
Mandal : Palvancha
Distance from Khammam : 95Kms
Purpose of reservoir : Irrigation, fish culture, Electricity Generation, drinking water.
Latitudes : 17°–68’–41’ N
Longitudes : 80°–66’–11’ E
Water basin : Godavari
Full reservoir level : + 124.05 Metres
Maximum water level : +124.66 Metres
Maximum height of the Dam : 38 Metres
Catchment area : 1333.33 Sq. Mts.
Average rainfall : 863.55 mm

Figure 1 Google map of Kinnersani Reservoir
Description of Palair Reservoir

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Village</td>
<td>Palair</td>
</tr>
<tr>
<td>Mandal</td>
<td>Kusmanchi</td>
</tr>
<tr>
<td>Distance from Khammam</td>
<td>23 Kms</td>
</tr>
<tr>
<td>Purpose of reservoir</td>
<td>Irrigation, fish culture, Electricity Generation</td>
</tr>
<tr>
<td>Latitudes</td>
<td>17°-12'-12' N</td>
</tr>
<tr>
<td>Longitudes</td>
<td>79°-54'-10' E</td>
</tr>
<tr>
<td>Water basin</td>
<td>Krishna</td>
</tr>
<tr>
<td>Full reservoir level</td>
<td>+ 439.310 Metres</td>
</tr>
<tr>
<td>Maximum water level</td>
<td>+444.310 Metres</td>
</tr>
<tr>
<td>Maximum height of the Dam</td>
<td>20.57 Metres</td>
</tr>
<tr>
<td>Catchment area</td>
<td>651.24 Sq. Mts.</td>
</tr>
<tr>
<td>Average rainfall</td>
<td>790 mm</td>
</tr>
</tbody>
</table>

Figure 2 Google map of Palair Reservoir

Description of Wyra Reservoir

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Village</td>
<td>Wyra</td>
</tr>
<tr>
<td>Mandal</td>
<td>Wyra</td>
</tr>
<tr>
<td>Distance from Khammam</td>
<td>25 Kms</td>
</tr>
<tr>
<td>Purpose of tank</td>
<td>Irrigation, fish culture, drinking, Recreation.</td>
</tr>
<tr>
<td>Latitudes</td>
<td>17°-11'-45&quot; N</td>
</tr>
<tr>
<td>Longitudes</td>
<td>80°-22'-30&quot; E</td>
</tr>
<tr>
<td>Water basin</td>
<td>Krishna</td>
</tr>
<tr>
<td>Full reservoir level</td>
<td>+314.20 Metres</td>
</tr>
<tr>
<td>Maximum water level</td>
<td>+320.20 Metres</td>
</tr>
<tr>
<td>Maximum height of the Dam</td>
<td>26.83 Metres</td>
</tr>
<tr>
<td>Catchment area</td>
<td>19.14 Sq. Meters</td>
</tr>
<tr>
<td>Average rainfall</td>
<td>793.06 mm</td>
</tr>
</tbody>
</table>
3. RESULTS & DISCUSSION

In order to determine the water quality, samples of water collected from Kinnerasani, Palair, and Wyra reservoirs of Khammam district was collected in acid wash bottles. Physico–chemical analysis different parameters were analyzed like PH, Turbidity (NTU), Electrical Conductivity(micro mhos), Total dissolved Solids (mg/l) Chloride (mg/l), Sulphate (mg/l), Nitrate(mg/l), Total Alkalinity (mg/l), Total Hardness (mg/l), Calcium (mg/l), Fluoride (mg/l), Iron (mg/l). Each parameter was compared with the standard desirable limits of different agencies like BSI, WHO standards.

Table 2 Water Parameters & Analysis Results

<table>
<thead>
<tr>
<th>S.No</th>
<th>Name of the sample</th>
<th>Place</th>
<th>PH</th>
<th>Turbidity</th>
<th>EC</th>
<th>TDS</th>
<th>Chlorides</th>
<th>Sulphates</th>
<th>Nitrates</th>
<th>Alkalinity</th>
<th>Total hardness</th>
<th>Calcium</th>
<th>Fluoride</th>
<th>Iron</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Sample R1</td>
<td>Kinner</td>
<td>8.38</td>
<td>5.2</td>
<td>542</td>
<td>350</td>
<td>57</td>
<td>71.8</td>
<td>2</td>
<td>200</td>
<td>132</td>
<td>80</td>
<td>0.21</td>
<td>0.21</td>
</tr>
</tbody>
</table>
Physico-chemical parameters assessment of ground water in urban area of Khammam, Telangana

Table 3

<table>
<thead>
<tr>
<th>S.No</th>
<th>Parameters</th>
<th>Range</th>
<th>BIS</th>
<th>WHO</th>
<th>MEAN</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>PH</td>
<td>7.53-8.38</td>
<td>6.5-8.5</td>
<td>6.5-8.5</td>
<td>8.06</td>
</tr>
<tr>
<td>2</td>
<td>Turbidity</td>
<td>0.1-20.5</td>
<td>5-10 NTU</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Electrical Conductivity</td>
<td>542-1850</td>
<td>1500 mmhos</td>
<td>1500 mmhos</td>
<td>1014</td>
</tr>
<tr>
<td>4</td>
<td>TDS</td>
<td>350-1193</td>
<td>500 mg/l</td>
<td>500</td>
<td>654.33</td>
</tr>
<tr>
<td>5</td>
<td>Chloride</td>
<td>57-359</td>
<td>250 mg/l</td>
<td>250 mg/l</td>
<td>175.67</td>
</tr>
<tr>
<td>6</td>
<td>Sulphate</td>
<td>32.4-71.8</td>
<td>200-400 mg/l</td>
<td>500 mg/l</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Nitrate</td>
<td>0.3-7.2</td>
<td>45-100 mg/l</td>
<td>500 mg/l</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Total Alkalinity</td>
<td>200-368</td>
<td>200 mg/l</td>
<td>200 mg/l</td>
<td>277.33</td>
</tr>
<tr>
<td>9</td>
<td>Total Hardness</td>
<td>132-432</td>
<td>300-600 mg/l</td>
<td>----</td>
<td>118.67</td>
</tr>
<tr>
<td>10</td>
<td>Calcium</td>
<td>80-172</td>
<td>75-200</td>
<td>----</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Fluoride</td>
<td>0.1-0.41</td>
<td>1-1.5 mg/l</td>
<td>1.5 mg/l</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Iron</td>
<td>0.21-0.24</td>
<td>0.3-1.0 mg/l</td>
<td>----</td>
<td></td>
</tr>
</tbody>
</table>

Source: BIS, WHO Standards, Mohammad et al., (2015), Physico-chemical parameters assessment of ground water in urban area of Khammam, Telangana.

Physico-chemical analysis of Water

The Physico-chemical analysis of water is the prime considerations to access the water quality for its best utilization like drinking, irrigation (Mohammad et al., 2017). In the present study from Kinnersani, Palair, Wyra reservoirs total 12 parameters were assessed and its comparison of variations individual parameters was showed in (Figure 4-Figure 15).

\( \text{PH} \)

The \( \text{PH} \) is defined as the intensity of the acidic or basic character of solution at given temperature. It is a most important chemical factor of water, it is considered as important ecological factor of aquatic ecosystem (Mohammad and Srujan, 2016). In the present study \( \text{PH} \) range is in 7.53-8.38, in all reservoirs \( \text{PH} \) is in within the limits.

\( \text{Turbidity} \)

Turbidity is an expression of light scattering and light absorbing property of water and is caused by the presence of suspended particles such as clay, silt and colloidal organic particles. Higher turbidity is known to affect the primary productivity by restricting the light penetration and photosynthesis (Kodarkar and Chandrasekhar, 1995). In the present study three reservoirs turbidity range is 0.1-20.5 (NTU), in this highest turbidity was shown by Wyra reservoir it may due to low density and runoff water from paddy fields.

\( \text{Electrical Conductivity} \)

The electrical conductivity of water depends up on ions present in water. It reflects the nutrient status of water and distribution of macrophytes (Gupte, 1996). In present study three reservoirs water analysis of Electrical conductivity results are in the range of 542-1850 (mg/l), in this present study high range of Electrical conductivity is shown by Palair reservoir.

\( \text{TDS (Total Dissolved Solids)} \)

Total dissolved solids do not contain gases or the colloids, but consist of molecules and ions that are present as true solution in water. In natural waters, total dissolved solids are normally composed of salts of carbonates, bicarbonates, chlorides, sulphates and elements like silica, calcium, magnesium, sodium and potassium which confirm degree of hardness in water (Toran, 1987). In present study three reservoirs water analysis of Total dissolved Solids results are in the range of 350-1193 (mg/l); in this present study high range of Total dissolved solids are shown by Palair reservoir.
Chloride
Chloride is one of the most important anion, which determines the total salinity of water. High chloride content in freshwater can be due to excessive evaporation and non-replenishment of the water loss through rainfall (Dwivedi and Pandey, 2002). In present study water analysis of three reservoirs chlorides results are in the range of 57-359 (mg/l), in this present study high range of Chlorides’ are shown by Palair reservoir.

Sulphate
Sulphide oxidation in a carbonate environment produces ground water contamination with high sulphate making the water unsuitable for drinking supplies (Tebbut, 1974). In present study reservoir water analysis of three reservoirs Sulphates results are in the range of 32.4-71.8 (mg/l), all the reservoirs are within the standards.

Nitrate
Higher concentration of nitrate is an indicator of organic pollution and eutrophication (Dass and Mohammad, 2015). In present study three reservoir water analyses of Nitrates results are in the range of 0.3-7.2 (mg/l), all the reservoirs Nitrate results are within the standards.

Total Alkalinity
Alkalinity in natural waters is formed due to dissolution of CO$_2$ in water or HCO$_3$ produced by the action of ground water on limestone or chalk. Alkalinity provides buffering to resist change in pH (Mahajan and Billore, 2014). In present study three reservoir water analysis of Total alkalinity results are in the range of 200-368 (mg/l), In the present study Palair, Wyra reservoirs Total alkalinity ranges are more than the standards of BIS, WHO.

Total Hardness
The total hardness of water causing ions in water is mainly calcium and magnesium is the measure of the capacity of water to react with soap (Mohammad, 2015). In present study three reservoirs water analysis of Total hardness results are in the range of 132-432 (mg/l), in present study all the reservoirs Total hardness results are within the standards of BIS, WHO.

Calcium
Calcium is exacerbated through leaching lime stone, Dolomite, Gypsum and Gypsiferous state WHO, 1996. The presence of calcium and magnesium along with their carbonates, sulphates and chlorides make the water hard. In present study water analysis of three reservoirs Calcium results are in the range of 80-172 (mg/l), in present study all the reservoirs Calcium results are within the standards of BIS, WHO.

Fluoride
Traces of fluorides occur in many waters and higher concentration often associated with underground sources. Most of the waters contain below 1 mg/l. It effectively reduces dental caries without any adverse effect on health. Fluorosis may occur when fluoride level exceed the recommended limits. In present study three reservoirs water analysis of fluoride results are in the range of in present study all the reservoirs Fluoride results are within the standards of BIS, WHO.

Iron
Iron is the second most abundant metal in the earth’s crust, of which it accounts for about 55 elemental Iron is rarely found in nature, as the iron Fe$^{2+}$ and Fe $^{3+}$. The common source of Iron in ground water naturally occurring from weathering of iron bearing minerals and rocks, industrial effluent, acid mine drainage, Sewage. In present study three reservoirs water analysis Iron results are in the range of 0.21-0.24 (mg/l), in this present study Iron results are within the limitations standards of BIS, WHO.
Figure 4 Comparison of variations of $P^H$ in three study reservoirs

Figure 5 Comparison of variations of Turbidity (NTU) in three study reservoirs

Figure 6 Comparison of variations of Electrical Conductivity (micro mhos) in three study reservoirs

Figure 7 Comparison of variations of Total Dissolved Solids (mg/l) in three study reservoirs
Figure 8 Comparison of variations of Chlorides (mg/l) in three study reservoirs

Figure 9 Comparison of variations of Sulphates (mg/l) in three study reservoirs

Figure 10 Comparison of variations of Nitrates (mg/l) in three study reservoirs

Figure 11 Comparison of variations of Alkalinity (mg/l) in three study reservoirs
**Figure 12** Comparison of variations of Total dissolved solids (mg/l) in three study reservoirs

**Figure 13** Comparison of variations of Calcium (mg/l) in three study reservoirs.

**Figure 14** Comparison of variations of Fluorides (mg/l) in three study reservoirs

**Figure 15** Comparison of variations of Iron (mg/l) in three study reservoirs.
4. CONCLUSION

The present study shows detailed report of Physico-chemical characteristics assessment of Kinnersani, Palair, Wyra reservoirs of Khammam. The study is analyzed 12 parameters of three reservoirs water which are essential to identify water quality of reservoirs, the water parameter results are compared with the standards of BIS, WHO. In overall Three reservoirs PH, Sulphates, Nitrates, Alkalinity, Total Hardness and Fluorides are within the limitations of BIS, WHO, but in this study Palair reservoir shows high ranges of results in Electrical Conductivity, Chlorides and Total dissolved solids these are more than standards of BIS, WHO. Wyra reservoir having high density in turbidity and both of Wyra and Palair reservoirs are having high ranges in Alkalinity, finally it was concluded that The Kinnersani reservoir results good and all are within the limitations of BIS and WHO.

Abbreviations
JETL (Jeedimetla effluent treatment plant),
BSI (Bureau of Indian standards),
WHO (World Health Organization)

Ethical approval
Not applicable.

Informed consent
Not applicable.

Conflicts of interests
The authors declare that there are no conflicts of interests.

Funding
The study has not received any external funding.

Data and materials availability
All data associated with this study are present in the paper.

REFERENCES AND NOTES

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