Original Research Article

**Water Quality Status of Kokisare-Nadhwade Ponds in Vaibhavwadi Taluka, District Sindhudurg, India**

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**Abstract**

Water quality status of Kokisare-Nadhwade Ponds in Vaibhavwadi Taluka was analyzed during March 2011 to February 2012. Different parameters like Temperature, Conductivity, Hydrogen Ion Concentration, Total Acidity, Total Alkalinity, Dissolved Oxygen, Biochemical Oxygen Demand, Free Carbon dioxide, Chlorides, Total Hardness, Calcium Hardness, Magnesium Hardness, Phosphates, Sulphates, Nitrates and Nitrites were analyzed during the course of study. The study revealed that all the parameters except pH were within the permissible limits as per IS standards indicating potability of water.

**Keywords**

Kokisare-Nadhwade Ponds, Water quality

**Introduction**

Water is most precious commodity of life. It is one of the basic needs for sustaining human life. But all kinds of human activities have adversely affected water qualitatively and quantitatively. The dynamic and heterogeneous relationship gains varied physical, chemical and biological elements in the aquatic ecosystem, which can be recorded by regular monitoring to maintain the integrity and conserve the ecosystem (Ramachandran et al., 2002). Hence, an attempt was made to analyze the water quality status of Kokisare-Nadhwade Ponds in Vaibhavwadi Taluka. Kokisare-Nadhwade Ponds is an artificial water body of Vaibhavwadi situated at a distance of just 7 km from Talere village. The water body is surrounded by rich vegetation (figure 1). The daily water requirements of people in Vaibhavwadi Taluka are met by Kokisare-Nadhwade Ponds. The district experiences heavy rainfall every year in monsoon and the water body Kokisare-Nadhwade Ponds remains filled with water throughout the year. Regular environmental monitoring allows detection, assessment and management of the negative effects on fresh ecosystems (Karthick, 2010). No such study was done to assess the water quality of Kokisare-Nadhwade Ponds in Vaibhavwadi. The present findings may serve to create awareness among people in the Taluka and will be helpful to the scientific community in general and government in particular as a database for future investigations.

**Materials and Methods**

Water samples were collected from study site during March 2011 to February 2012.
once in every month between 7.30 am to 10.30 am. Keeping in view the accessible area of the water body three different sampling sites viz; K1, K2, K3 were selected and are presented in figure 2, 3, 4 respectively. Parameters like Temperature, Conductivity, Hydrogen Ion Concentration were recorded on the spot, while other water parameters like Total Acidity, Total Alkalinity, Dissolved Oxygen, Biochemical Oxygen Demand, Free Carbon dioxide, Chlorides, Total Hardness, Calcium Hardness, Magnesium Hardness, Phosphates, Sulphates, Nitrates and Nitrites were analyzed in laboratory as per the standard methods of APHA (1985), Trivedy and Goel (1986), Pande and Despande (2012).

**Result and Discussion**

The results of the physico-chemical analysis of Kokisare-Nadhwaide Ponds are presented in Table 1. The values of some parameters did not show variation but fluctuated unevenly. Temperature is one of the most important ecological factors, which controls the physiological behavior and distribution of organisms (Moundiotiya et al., 2004). Temperature values were recorded in between 25°C to 32°C of which high values (32°C) were recorded in month of June, August and October, while minimum temperature values (25°C) were recorded in month of December. Jain et al (1996) has also made similar recordings in temperature variation of Halai Reservoir of Vidisha District, India. Similar findings were also recorded by Shastri and Pendse (2001) of the Dahikhura Reservoirs. Conductivity values of Kokisare-Nadhwaide Ponds ranged in between 1.009 Scm⁻¹ to 1.092 Scm⁻¹. Higher values (1.092 Scm⁻¹) were found in month of September while minimum values (1.009 Scm⁻¹) were recorded in month of February.

pH values ranged between 7.1 to 10.6 showing alkaline nature of water. Higher pH values (10.6) were recorded in winter season. Higher pH of water body is due to presence of sufficient amount of carbonates because of photosynthesis activity which increases the pH as a result of consumption of CO₂ in the process (Trivedy and Goel, 1986). Minimum pH (7.1) was recorded in monsoon, in month of September. Previous studies have indicated that pH of most of the freshwater lakes, reservoirs ponds range between 6 to 9Wetzel (1975). Khan and Khan (1988) have reported similar findings at SeikhaJheel in Aligarh. Ghose and Sharma (1988) have shown relation of high pH in winter months with increased primary productivity at River Ganga in Patna, Bihar.

In natural waters, most of the acidity is present due to the dissolution of carbon dioxide which forms carbonic acid (Trivedy and Goel, 1986). In present findings the total acidity ranged in between 1mg/L to 2mg/L. the maximum values (2mg/L) were recorded in month of October while minimum values (1mg/L) in February. Alkalinity and pH are the factors responsible for determining the amenability of water to biological treatment (Manivasakam, 1980). The recorded values ranged in between 41 mg/L to 47 mg/L. the values were fairly uniform throughout the year showing no seasonal and periodic variation.

All aquatic living organisms require oxygen for their survival. Oxygen gets in water as a waste product of photosynthesis or by diffusion from the surrounding air. In present study, Dissolved Oxygen ranged from 5.82mg/L to 7.89mg/L. The maximum values (7.89mg/L) were obtained in winter season while decreasing values were recorded during summer and rainy season. This was because of increase in temperature which further decreases oxygen holding
capacity of water body. Such type of an inverse relationship of Dissolved Oxygen with temperature was recorded by Bahura (1998) at Bikaner Temple Tank, Rajasthan. Similar findings are also done by Joshi (1992) at Bhagirathi River System in Gurhwal Himalayas and Shanthi et al (2002) at Singanallur Lake.

Aquatic aerobic living organisms require dissolved oxygen to breakdown organic material in water at certain temperature over specific period is called Biochemical Oxygen Demand. The Biochemical Oxygen Demand values recorded in present study ranged in between 0.79mg/L to 4.94mg/L. Minimum values (0.79mg/L) were recorded in winter while maximum values (4.94mg/L) in summer.

Carbon dioxide did not show any seasonal variation. The recorded values showed uniformity with little fluctuation. The values ranged in between 0.18 mg/L to 0.22 mg/L. The higher concentration of chlorides is considered to be an indicator of higher pollution due to higher organic waste of animal origin (Moundiotiya et al., 2004). The chloride values ranged in between 31.93 mg/L to 50.30 mg/L. Higher values were recorded in summer because of higher temperature which enhances evaporation and concentration of salts while minimum values were recorded in winter. Similar findings were also recorded by Jana (1973) at West Bengal and Sehgal (1980) at Surinsar Lake, Jammu.

**Table 1** Physico-Chemical parameters in Kokisare-Nadhwaide Ponds of Vaibhavwadi Taluka

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
<th>Jun</th>
<th>Jul</th>
<th>Aug</th>
<th>Sept</th>
<th>Oct</th>
<th>Nov</th>
<th>Dec</th>
<th>Jan</th>
<th>Feb</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature °C</td>
<td>28</td>
<td>28</td>
<td>31</td>
<td>32</td>
<td>30</td>
<td>32</td>
<td>30</td>
<td>32</td>
<td>32</td>
<td>28</td>
<td>25</td>
<td>26</td>
</tr>
<tr>
<td>Conductivity Scm⁻¹</td>
<td>1.011</td>
<td>1.024</td>
<td>1.076</td>
<td>1.077</td>
<td>1.076</td>
<td>1.081</td>
<td>1.092</td>
<td>1.087</td>
<td>1.084</td>
<td>1.080</td>
<td>1.050</td>
<td>1.009</td>
</tr>
<tr>
<td>pH</td>
<td>9.8</td>
<td>8.9</td>
<td>7.8</td>
<td>7.5</td>
<td>7.5</td>
<td>7.2</td>
<td>7.1</td>
<td>7.8</td>
<td>8.3</td>
<td>8.6</td>
<td>9.4</td>
<td>10.6</td>
</tr>
<tr>
<td>Total Acidity mg/L</td>
<td>1.3</td>
<td>1.8</td>
<td>1.1</td>
<td>0.8</td>
<td>1.3</td>
<td>1.6</td>
<td>1.2</td>
<td>2.0</td>
<td>1.4</td>
<td>1.7</td>
<td>1.2</td>
<td>1.0</td>
</tr>
<tr>
<td>Total Alkalinity mg/L</td>
<td>44</td>
<td>45</td>
<td>45</td>
<td>47</td>
<td>45</td>
<td>47</td>
<td>47</td>
<td>44</td>
<td>42</td>
<td>42</td>
<td>41</td>
<td>44</td>
</tr>
<tr>
<td>DO mg/L</td>
<td>6.84</td>
<td>6.47</td>
<td>6.09</td>
<td>6.09</td>
<td>5.91</td>
<td>5.90</td>
<td>5.82</td>
<td>6.030</td>
<td>6.234</td>
<td>7.025</td>
<td>7.899</td>
<td>6.84</td>
</tr>
<tr>
<td>BOD mg/L</td>
<td>4.91</td>
<td>4.94</td>
<td>4.88</td>
<td>4.93</td>
<td>4.91</td>
<td>3.74</td>
<td>3.26</td>
<td>0.811</td>
<td>0.88</td>
<td>0.79</td>
<td>1.13</td>
<td>5.24</td>
</tr>
<tr>
<td>CO₂ mg/L</td>
<td>0.21</td>
<td>0.22</td>
<td>0.18</td>
<td>0.22</td>
<td>0.22</td>
<td>0.20</td>
<td>0.20</td>
<td>0.22</td>
<td>0.20</td>
<td>0.22</td>
<td>0.22</td>
<td>0.22</td>
</tr>
<tr>
<td>Chlorides mg/L</td>
<td>50.10</td>
<td>50.24</td>
<td>50.30</td>
<td>48.7</td>
<td>48</td>
<td>43.78</td>
<td>40.10</td>
<td>39.98</td>
<td>39.38</td>
<td>36.94</td>
<td>31.93</td>
<td>49.98</td>
</tr>
<tr>
<td>Total hardness mg/L</td>
<td>21</td>
<td>23</td>
<td>23</td>
<td>26</td>
<td>22</td>
<td>21</td>
<td>21</td>
<td>32</td>
<td>29</td>
<td>23</td>
<td>23</td>
<td>18</td>
</tr>
<tr>
<td>Ca hardness mg/L</td>
<td>19</td>
<td>21</td>
<td>21</td>
<td>23</td>
<td>20</td>
<td>22</td>
<td>22</td>
<td>24</td>
<td>24</td>
<td>20</td>
<td>20</td>
<td>16</td>
</tr>
<tr>
<td>Mg hardness mg/L</td>
<td>0.934</td>
<td>1.098</td>
<td>1.178</td>
<td>1.387</td>
<td>1.624</td>
<td>1.693</td>
<td>1.816</td>
<td>1.944</td>
<td>1.978</td>
<td>1.741</td>
<td>1.298</td>
<td>0.486</td>
</tr>
<tr>
<td>Phosphates µgatoms/L</td>
<td>200</td>
<td>201</td>
<td>196</td>
<td>198</td>
<td>200</td>
<td>201</td>
<td>198</td>
<td>200</td>
<td>197</td>
<td>196</td>
<td>199</td>
<td>200</td>
</tr>
<tr>
<td>Sulphates mg/L</td>
<td>0.19</td>
<td>0.33</td>
<td>0.41</td>
<td>0.57</td>
<td>0.55</td>
<td>0.63</td>
<td>0.73</td>
<td>0.72</td>
<td>0.69</td>
<td>0.52</td>
<td>0.41</td>
<td>0.12</td>
</tr>
<tr>
<td>Nitrates µgatoms/L</td>
<td>2.13</td>
<td>2.14</td>
<td>2.16</td>
<td>2.21</td>
<td>2.23</td>
<td>2.21</td>
<td>2.17</td>
<td>2.14</td>
<td>2.24</td>
<td>2.29</td>
<td>2.21</td>
<td>2.16</td>
</tr>
<tr>
<td>Nitrites µgatoms/L</td>
<td>211.0</td>
<td>209.98</td>
<td>209.75</td>
<td>207.97</td>
<td>207.48</td>
<td>203.02</td>
<td>204.99</td>
<td>200</td>
<td>200.87</td>
<td>203.09</td>
<td>205.89</td>
<td>210.74</td>
</tr>
</tbody>
</table>
The total hardness of water is due to the total concentration of Ca and Mg ions, expressed in calcium carbonates. Total hardness values ranged from 18 mg/L to 32 mg/L. Maximum values recorded in winter. Values for Calcium hardness recorded ranged between 16 mg/L to 24 mg/L while values for Magnesium hardness ranged between 0.486 mg/L to 1.944 mg/L. Similar results were observed by Koshy and Nayar (1999) at River Pamba.

Phosphate is generally recognized as the key nutrient in the productivity of water. The main source of phosphorous in natural waters comes from weathering of phosphate bearing rocks and leading of soils in the catchment (Jhingran, 1982). Phosphorous is an important element required for growth of plants and animals. Phosphates in fewer amounts are helpful for growth of planktons and aquatic plants but in high concentration cause eutrophication. The phosphate values recorded during the study ranged in between 196 µgatoms/L to 201µgatoms/L. No significant seasonal change was seen in the values obtained.
Sulphate is another key nutrient factor in the aquatic environment and also supplies oxygen in anaerobic conditions (Nath, 1998). The sulphate values fluctuated in between 0.12 mg/L to 0.73 mg/L. High values were obtained in rainy season which was because of the input of surface water while lower values were recorded in summer season. Similar findings were recorded by (Dad, 1981) on Chambal River.

Nitrate and nitrites are very important nutrient factor in aquatic ecosystems, generally, water bodies polluted by organic matter exhibit higher values of nitrates (Shanthi et al., 2002). In present findings, showed very low nitrate values ranging in between 2.13µgatoms/L to 2.29µgatoms/L. This prevented algal growth and kept water body free of eutrophication. Similar observations are done by (Salaskar et al., 1997). Unpolluted natural waters contain only minute amounts of nitrates (Jajiet al., 2007). The nitrite profile of the water samples varied from 200µgatoms/L to 211.07µgatoms/L throughout the study period. If the nitrite levels exceed the regulatory limits then it may pose harm to communities when the receiving water bodies are used for domestic purposes. This may give rise to disease called methaemoglobinemia (Fatoki et al., 2003).

The present study gave a detailed account on physic-chemical parameters and water quality status of Kokisare-Nadhwade Ponds in Vaibhavwadi Taluka, of District Sindhudurg, Maharashtra. All the parameters analyzed were within permissible limits of IS Specifications and hence water is safe as far as its potability is concerned.

Acknowledgement

The authors are grateful to Principal and Head, Dept. of Zoology, S. P. K. M. Sawantwadi, Sindhudurg (M.S.) for providing laboratory facilities in connection with this work and for encouragement during the completion of the work.

References


