Water quality of ponds around Marthandam and Nagercoil town in Kanyakumari district, TamilNadu-India

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ABSTRACT

The present study assesses the water characteristics of five ponds around Marthandam and Nagercoil town in Kanyakumari district of Tamilnadu, India where ponds have been traditionally used for harvesting rainwater for drinking and irrigation purposes. Though several small and big ponds exist in this area, most of them are in a state of utter neglect and disuse. Agricultural and urbanization activities take place all round the year in this city of ponds influencing the water quality. The physico-chemical characteristics viz., temperature, pH, transparency, turbidity, D.O, nitrate, and total iron content are discussed in this paper over a period of one year. Water temperature broadly varied from 25.5 to 33°C respectively in monsoon and premonsoon seasons. Transparency fluctuated between 0.5 to 1.5m, the lowest in monsoon and the highest in premonsoon season with correspondingly turbidity between nil to 15NTU. Dissolved oxygen varied from 3.0 to 10mg/l where one pond showed low values in most of the months. Nitrate concentration ranged from 3.1 to 9.6mg/l the highest in premonsoon seasons. The findings indicate that there was much deterioration in water quality of these ponds in comparison to normal pond water possibly due to discarded condition, bank erosion and surface run off carrying chemical nutrients from farm application. Anthropogenic activities should be regulated, buffer zones maintained besides cleaning ponds for which a participatory action programme should be designed and implemented by the local self governments.

Keywords: Dissolved oxygen, urbanization, anthropogenic, physico-chemical, water temperature.

Introduction

Ponds can be defined as the smallest shallow bodies of standing water in which extensive plant and organisms are distributed. The quality of water is very important for many freshwater ecosystems, because any change in water has a direct impact on species composition abundance stability and productivity of aquatic organisms. (Bahura, 1998, Pendse et al., 2000, D as, 2002 and Radhika et al., 2004). Many of the water bodies in sound India are quite smaller in dimension. The geographic situation and the influence of climatic conditions play a major role in deciding the ecological status of water bodies (Jain et al., 1995; Bhatt et al., 1999; Harikrishnan and Abdul A zis, 2000; Padmavathy et al., 2003). Characteristics of water bodies influence the quality of water individually and in combination with various pollutants, thereby influencing the biota therein (Srivasta et al., 2003; Smitha et al., 2007). A pesticide is that compound which should be lethal to the targeted pests only and not to the non-target living organisms such as human and animals. Pesticides must be used with great care that the health of humans, animals and useful plants and the persistence of some of these chemical in the environment (Larson et al., 1988; Jones 1990; Ditoro et al., 1995).

In the modern agriculture large amount of pesticides are used and aquatic ecosystems such as ponds are sometimes contaminated directly or indirectly. Under
the specific background, current study is carried out for one year from January-December 2011 in five ponds around Kanyakumari District. Analysis of water quality and pesticide analysis is done in 2011. The main objectives of the study are to analyze the water samples for physiochemical parameters and primary productivity, to analyze the water for pesticide contamination and to find out the nature and sources of contamination and suggest management options needed for each pond under investigation.

Materials and Methods

The study was conducted across the eastern and western regions of Marthandam and Nagercoil town in Kanyakumari district, TamilNadu, India (Fig 1). Monthly samples were collected in pre-cleaned plastic and glass bottles. Physicochemical parameters such as water temperature, transparency, pH, conductivity, turbidity, total suspend solids, total dissolved salt, total alkalinity, total Hardness, Ca hardness, Mg hardness, Do, BOD, nitrite nitrogen, nitrate Nitrogen, inorganic phosphate, sulphate, and total iron and primary productivity were carried out by the standard methods (APHA 1995). Pesticides are organic pollutants which damage water quality and affect the health of organisms depending on aquatic systems. It was analyzed by taking external support from M/S Interfield laboratories, Kochi, Kerala, India. The method employed as per USEPA using gas chromatography.

Result and Discussion

Temperature varied from 25.5°C to 33°C. Because air temperature is one of the most important ecological factors which control the Physiological behavior of the aquatic system and distribution of the organism. In present study, water temperature was lower than air temperature. Relationship between air and water temperature, light penetration depends on transparency of water which affects the primary productivity of the system (Sharma, 2004). The values broadly varied between 0.5 to 1.0 m. The maximum was obtained in Theroor and Putheri (1.5m) that is in the monsoon period. While P<sub>H</sub> fluctuated from 6.8 to 7.9 which are considered as the optimum for fish cultures also turbidity values ranged from 5.0 to 15 NTU. Total dissolved salt values were ranged between 20 to 49.3mg/l. Table 1 shows the maximum value was attributed to run off water being in Theroor pond during pre monsoon period. Total alkalinity in five ponds fluctuated between 20 to 47mg/l. Excessive alkalinity may cause eye irritation in human and chlorosis in plants. Total hardness varied from 19 to 90 mg/l. Low value may be due to dilution of pond water and higher values due to high rate of evaporation of water and addition of calcium and magnesium salt from the pollutants. Mohananda and Behera (2010) stated the addition of sewage, detergents and large scale human use might be the cause of elevation of hardness in pond water. Ca hardness varied from 8.9 to 21.8mg/l and Mg hardness varied from 2.3 to 1.66mg/l fell below the acceptance limits (BIS, 1998).

The level of dissolved oxygen acts as an indicator of the oxygen status of the water body. The presences of dissolved oxygen in water may be due to direct diffusion of oxygen from the atmosphere and by the phosynthetic activity. Dissolved oxygen varied from 3.0 to 1.0mg/l respectively from Nalloor and Theroor. Table 2 describes that the minimum values were obtained during monsoon period. The average Dissolved oxygen value of Nalloor pond (3.0mg/l) may be due to the organic pollution. BOD values fluctuated between 0.41 to 1.78mg/l, the highest BOD at Nalloor during pre monsoon period is indicative of the extent of pollution (Table 3).

Nutrients

Sulphate values were fluctuated between 0.31 to 0.78mg/l and found within the limit. Excess of sulphate imparts taste to water and has laxative effect causing adverse effect on the human health. Phosphate contents were varied from 1.2mg/l (Neduvali during post monsoon period) to 2.65mg/l (Chugankadai during pre monsoon period) which may be due to absorption and desorption of phosphorous and buffering sediments under prevailing environmental conditions (Sengupha and Upadhyaya, 1987).
### Table 1

**Physicochemical parameters of pond waters during pre monsoon period**

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Theroor</th>
<th>Putheri</th>
<th>Chungankadai</th>
<th>Neduvali</th>
<th>Nalloor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water Temperature ($^\circ$C)</td>
<td>33.0</td>
<td>30.0</td>
<td>33</td>
<td>30.5</td>
<td>32.5</td>
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<tr>
<td>Transparency (m)</td>
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<td>1.5</td>
<td>1.0</td>
<td>1.4</td>
<td>0.75</td>
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<td>7.8</td>
<td>7.4</td>
<td>6.9</td>
<td>7.4</td>
</tr>
<tr>
<td>Conductivity</td>
<td>61</td>
<td>53</td>
<td>71</td>
<td>67</td>
<td>61</td>
</tr>
<tr>
<td>Turbidity (NTU)</td>
<td>5.0</td>
<td>5.0</td>
<td>10</td>
<td>5.0</td>
<td>10</td>
</tr>
<tr>
<td>Total Suspended Solids (mg/l)</td>
<td>4.2</td>
<td>6.8</td>
<td>7.2</td>
<td>5.6</td>
<td>5.2</td>
</tr>
<tr>
<td>Total Dissolved Solids (mg/l)</td>
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<td>38.2</td>
<td>49.3</td>
<td>35.4</td>
<td>36.4</td>
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<tr>
<td>Total alkalinity (mg/l)</td>
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<td>39</td>
<td>28</td>
<td>24</td>
<td>23</td>
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<tr>
<td>Total hardness (mg/l)</td>
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<td>18</td>
<td>16</td>
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<td>Ca hardness (mg/l)</td>
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<td>8.9</td>
<td>11.5</td>
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<tr>
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<td>4.1</td>
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<td>DO (mg/l)</td>
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<td>7.9</td>
<td>5.8</td>
<td>6.4</td>
<td>4.6</td>
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<tr>
<td>BOD (mg/l)</td>
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<td>0.88</td>
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<td>Nitrite Nitrogen (mg/l)</td>
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<td>0.36</td>
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<td>0.56</td>
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<tr>
<td>Inorganic phosphate (mg/l)</td>
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<td>1.52</td>
<td>2.08</td>
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<tr>
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<td>0.78</td>
<td>1.10</td>
<td>0.87</td>
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<td>12.2</td>
<td>10.6</td>
<td>12.4</td>
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<td>284</td>
<td>214</td>
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<td>Parameters</td>
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<td>Chungankadai</td>
<td>Neduvali</td>
<td>Nalloor</td>
</tr>
<tr>
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<td>---------</td>
<td>---------</td>
<td>--------------</td>
<td>----------</td>
<td>---------</td>
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<td>29.0</td>
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<td>7.9</td>
<td>7.1</td>
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<td>40</td>
<td>47</td>
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<td>Turbidity (NTU)</td>
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<td>5.0</td>
<td>15</td>
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<tr>
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<td>9.7</td>
<td>13.7</td>
<td>10.3</td>
<td>12.6</td>
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<tr>
<td>Total Dissolved Solids (mg/l)</td>
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<td>Ca hardness (mg/l)</td>
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<td>11.2</td>
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<tr>
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<td>3.0</td>
<td>2.9</td>
<td>3.0</td>
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<tr>
<td>DO (mg/l)</td>
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<td>6.0</td>
<td>4.4</td>
<td>3.0</td>
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<td>Nitrite Nitrogen (mg/l)</td>
<td>0.19</td>
<td>0.22</td>
<td>0.34</td>
<td>0.43</td>
<td>1.74</td>
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<td>Nitrate nitrogen (mg/l)</td>
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<td>5.9</td>
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<td>3.1</td>
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<tr>
<td>Inorganic phosphate (mg/l)</td>
<td>1.87</td>
<td>2.87</td>
<td>1.97</td>
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<td>2.03</td>
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<td>Sulphate (mg/l)</td>
<td>0.33</td>
<td>0.62</td>
<td>0.51</td>
<td>0.59</td>
<td>0.64</td>
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<tr>
<td>Total Iron (mg/l)</td>
<td>20.3</td>
<td>34.7</td>
<td>29.6</td>
<td>21.4</td>
<td>20.2</td>
</tr>
<tr>
<td>Primary production (mg C/m³/day)</td>
<td>175</td>
<td>129</td>
<td>256</td>
<td>213</td>
<td>120</td>
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</table>
### Table 3

Physicochemical parameters of pond waters during post monsoon period

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Theroor</th>
<th>Putheri</th>
<th>Ch.Kadai</th>
<th>Neduvai</th>
<th>Nalloor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water Temperature (°C)</td>
<td>29.0</td>
<td>30.0</td>
<td>31.0</td>
<td>32.0</td>
<td>31.5</td>
</tr>
<tr>
<td>Transparency (m)</td>
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<td>0.75</td>
<td>0.50</td>
</tr>
<tr>
<td>pH</td>
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<td>7.7</td>
<td>7.6</td>
<td>7.2</td>
<td>7.3</td>
</tr>
<tr>
<td>Conductivity</td>
<td>63</td>
<td>70</td>
<td>70</td>
<td>67</td>
<td>79</td>
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<tr>
<td>Turbidity (NTU)</td>
<td>10.0</td>
<td>15.0</td>
<td>10</td>
<td>5.0</td>
<td>15</td>
</tr>
<tr>
<td>Total Suspended Solids (mg/l)</td>
<td>12.2</td>
<td>26.9</td>
<td>17.1</td>
<td>9.3</td>
<td>13.7</td>
</tr>
<tr>
<td>TDS (mg/l)</td>
<td>23</td>
<td>29</td>
<td>26</td>
<td>20</td>
<td>29</td>
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<tr>
<td>Total alkalinity (mg/l)</td>
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<td>37</td>
<td>44</td>
<td>35</td>
<td>32</td>
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<tr>
<td>Total hardness (mg/l)</td>
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<td>52</td>
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<td>15.4</td>
<td>21.8</td>
</tr>
<tr>
<td>Mg hardness (mg/l)</td>
<td>10.4</td>
<td>10.3</td>
<td>9.3</td>
<td>7.7</td>
<td>16.6</td>
</tr>
<tr>
<td>DO (mg/l)</td>
<td>6.1</td>
<td>4.3</td>
<td>5.7</td>
<td>6.9</td>
<td>3.9</td>
</tr>
<tr>
<td>BOD (mg/l)</td>
<td>0.43</td>
<td>0.70</td>
<td>0.47</td>
<td>0.21</td>
<td>1.03</td>
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<tr>
<td>Nitrite Nitrogen (mg/l)</td>
<td>0.23</td>
<td>0.39</td>
<td>0.32</td>
<td>0.47</td>
<td>0.81</td>
</tr>
<tr>
<td>Nitrate nitrogen (mg/l)</td>
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<td>6.2</td>
<td>4.6</td>
<td>4.7</td>
<td>6.1</td>
</tr>
<tr>
<td>Inorganic phosphate (mg/l)</td>
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<td>2.51</td>
<td>1.47</td>
<td>1.12</td>
<td>1.78</td>
</tr>
<tr>
<td>Sulphate (mg/l)</td>
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<td>0.23</td>
<td>0.31</td>
<td>0.47</td>
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<tr>
<td>Total Iron (mg/l)</td>
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<td>18.1</td>
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<tr>
<td>Primary production (mgC/m³/day)</td>
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<td>172</td>
<td>197</td>
<td>223</td>
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### Table 4 Pesticide Analysis of five ponds during pre monsoon period

<table>
<thead>
<tr>
<th>Pesticides</th>
<th>Theroor</th>
<th>Putheri</th>
<th>Chungankadai</th>
<th>Neduvali</th>
<th>Nalloor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organo chlorine pesticides</td>
<td>Not Detected</td>
<td>Not Detected</td>
<td>Not Detected</td>
<td>Not Detected</td>
<td>Not Detected</td>
</tr>
<tr>
<td>Organo phosphorous pesticides</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(a) Phorate sulphone</td>
<td>Not Detected</td>
<td>Not Detected</td>
<td>Not Detected</td>
<td>&lt;0.05µg/l</td>
<td>&lt;0.05µg/l</td>
</tr>
<tr>
<td>(b) Iprobenfos</td>
<td>Not Detected</td>
<td>Not Detected</td>
<td>Not Detected</td>
<td>&lt;0.05µg/l</td>
<td>Nalloor</td>
</tr>
<tr>
<td>(c) Other Organo phosphorous pesticides</td>
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<td>Not Detected</td>
<td>Not Detected</td>
<td>Not Detected</td>
<td>Not Detected</td>
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<tr>
<td>Pyrethroids</td>
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<td>Not Detected</td>
<td>Not Detected</td>
<td>Not Detected</td>
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</table>

### Table 5 Pesticide Analysis of five ponds during monsoon period

<table>
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<tr>
<th>Pesticides</th>
<th>Theroor</th>
<th>Putheri</th>
<th>Chungankadai</th>
<th>Neduvali</th>
<th>Nalloor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organo chlorine pesticides</td>
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<td>Not Detected</td>
<td>Not Detected</td>
<td>Not Detected</td>
<td>Nalloor</td>
</tr>
<tr>
<td>Organo phosphorous pesticides</td>
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<td></td>
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<td>Pyrethroids</td>
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<td>Not Detected</td>
<td>Not Detected</td>
<td>Not Detected</td>
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### Table 6 Pesticide Analysis of five ponds during post monsoon period

<table>
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<tr>
<th>Pesticides</th>
<th>Theroor</th>
<th>Putheri</th>
<th>Chungankadai</th>
<th>Neduvali</th>
<th>Nalloor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organo chlorine pesticides</td>
<td>Not Detected</td>
<td>Not Detected</td>
<td>Not Detected</td>
<td>Not Detected</td>
<td>Nalloor</td>
</tr>
<tr>
<td>Organo phosphorous pesticides</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(a) Phorate sulphone</td>
<td>Not Detected</td>
<td>Not Detected</td>
<td>Not Detected</td>
<td>Nalloor</td>
<td></td>
</tr>
<tr>
<td>(b) Other Organo phosphorous pesticides</td>
<td>Not Detected</td>
<td>Not Detected</td>
<td>Not Detected</td>
<td>Nalloor</td>
<td></td>
</tr>
<tr>
<td>Pyrethroids</td>
<td>Not Detected</td>
<td>Not Detected</td>
<td>Not Detected</td>
<td>Not Detected</td>
<td>Nalloor</td>
</tr>
</tbody>
</table>
Nitrate an important limiting factor in fresh water varied from 3.1 to 9.6mg/l, the higher values may be due to the influx of nitrogen rich flood water. Nitrite nitrogen in natural water occurs in lower concentration than Nitrate, it covers between 0.19 to 0.5mg/l. The maximum iron content (34.7mg/l) was reported in Putheri and minimum (10.3mg/l) in T heroor. Most of the samples have iron higher desirable limit (0/3mg/l) for drinking purpose. Trivedy and G oel (1994) reported that iron has got litter concerns as a health hazard but it is still considered as a nuisance in extensive quantities.

**Primary Production:**

Primary productivity fluctuated from 120 to 84(µg/cm²/day) which is reflective of the distribution of physicochemical characteristics of water bodies.

**Pesticide analysis:**

Pesticides are those chemicals which have been widely used throughout the world to increase crop yield and to kill insect pests responsible for various diseases to human and animals. Table 4 shows During pre monsoon period organophosphorous pesticides was detected in Neduvali and Nalloor ponds that is phorate sulphone and iprobenfos. It initiates that during the monsoon period (Table 5), there was no pesticide concentration in five ponds. Table 6 indicates that during post monsoon period, phorate sulphone organophosphorous pesticide was detected in Chungankadai (0.248µg/l) and Nalloor (0.312ug/l). In most of the technological advanced countries organochlorine pesticide have been banned or restricted. While considering the organo chloro pesticides it was not detected in the ponds.

**References**


