Physico-chemical Analysis of Uppanar River Water Samples Near an Industrial Area in Cuddalore, India

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Abstract: As the Uppanar River water is the major component of water system and contamination of this river results in pollution of various water bodies. In Cuddalore, at SIPCOT industrial areas such as Pachchyankuppam (Station 1), Kudikkadu (Station 2) and Sembankuppam (Station 3), have been reported to be contaminated by river water. Cuddalore is a well-known place for the production of many chemical fertilizers which pollute the water. Mostly, the pollutants are industrial chemicals, effluents and other wastes. In this study samples were taken from three different stations areas from Uppanar river water. Chemical parameters vary between Station 1, Station 2 and Station 3 depending upon quality and quality of effluent and river water with regard to pH, temperature, TDS, chloride, sulphate, DO, ammonia, calcium, magnesium, COD and total iron. The water in Cuddalore is being polluted therefore, we have to be aware of polluted water in Cuddalore district and precautions should be taken while using Uppanar river water for human use.

Keywords: Uppanar river, Pollution, Contamination, Cuddalore, Pollutants, Physico-chemical parameters

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Introduction
The SIPCOT chemical industrial estate in Cuddalore is one among many polluting industries in India. The needs of communities and workers in such areas are remarkably different from those of communities not living in polluted places. In unpolluted places, the health of communities would be the responsibility of the municipality and/or the health department. In pollution-impacted communities, the causes and sources of pollution are often within the jurisdiction of agencies such as the Pollution Control Board and the Factories Inspectorate, whereas the health of the workers outside the factory and residents comes under the purview of the District Administration and the public health system. Given the peculiarities of this situation, it is important that any approach to addressing health issues in such areas is done in coordination among these bodies (Rajarajan and Vetrivel, 2014). In the present study, an attempt has been made to evaluate the quality of Uppanar river water in the industrial areas [Station-1 (Pachchyankuppam), Station-2 (Kudikkadu), Station-3 (Sembankuppam)] and thereby to analyze correction and
regression study of various physico-chemical parameters.

**Materials and Methods**

*Study area and collection of sample:*

The water samples were collected from three different sampling stations from January to December 2020. The water samples were collected with the help of a glass sampler which consisted of a glass bottle and a cork tied to a lid. The sampling locations are S1 (Pachchyanuppam) (11°69’N latitude and 79°75’E longitude), S2 (Kudikkadu) (11°66’N latitude and 79°74’E longitude) and S3 (Sembankuppam) (11°64’N latitude and 79°73’E longitude) (Fig. 1). Samples were protected from direct sunlight and immediately transported to the laboratory of the Department of Zoology, Annamalai University, India.

**Physico-chemical analysis:**

Samples were analyzed for different physico-chemical parameters such as pH, TDS (Tamizhazhagan and Pugazhendy, 2015), chloride (Argentometric method) (APHA, 2005), DO (Winkler’s method), and calcium and magnesium (EDTA).

**Results and Discussion**

The physico-chemical parameters for samples collected from January to December 2020 from Uppanar river water are presented in Tables 1 to 4.

**Hydrogen ion concentration (pH):**

pH is a term used universally to express the intensity of the acid or alkaline condition of a solution. In S1 area followed by S2 and S3, the pH
value ranged from 6.8 to 8.8. Natural water has pH values between 6.5-8.5. The pH is the most important parameter of water quality. The normal drinking water pH range mentioned by WHO and NDWQS guidelines is between 6.8 and 8.5 (Kavitha et al., 2021).

**Total Dissolved Solids (TDS):**

TDS of Uppanar river water ranged from 157-458 mg/L. TDS less than 500 mg/L is not considered desirable for drinking water supplies, but in unwanted cases 2000 mg/L is allowed (Shrinivasa Rao and Venkateswaralu, 2000).

**Dissolved Oxygen (DO):**

DO is important parameter in water quality assessment. DO in water is replenished through photosynthesis, dissolution from the atmosphere and addition of oxygen-rich water such as through runoff. Simultaneously, DO is consumed during heterotrophic oxidation of organic matter and respiration by aquatic flora and fauna as well as oxidation of some naturally occurring constituents in water. In the present study DO values varied from 4.5 to 8.7 mg/L. Dissolved Oxygen (DO) is of considerable importance in water quality investigations as its concentration in water indicates ability of a water body to support a well-balanced aquatic life (Hynes and Greib, 1970).

**Chloride (Cl⁻), Sulphate (SO₄²⁻), Calcium (Ca²⁺) and Magnesium ( Mg²⁺):**

In the present analysis, chloride concentration was found in range of 136 mg/L to 418 mg/L at

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**Table 1: Physico-chemical analysis of Uppanar river water at selected stations at January to March 2020**

<table>
<thead>
<tr>
<th>Parameters</th>
<th>January 2020 Sampling Stations</th>
<th>February 2020 Sampling Stations</th>
<th>March 2020 Sampling Stations</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>S1</td>
<td>S2</td>
<td>S3</td>
</tr>
<tr>
<td>pH</td>
<td>8.2</td>
<td>7.6</td>
<td>6.0</td>
</tr>
<tr>
<td>TDS mg/L</td>
<td>233</td>
<td>321</td>
<td>289</td>
</tr>
<tr>
<td>Chloride mg/L</td>
<td>30</td>
<td>53</td>
<td>31</td>
</tr>
<tr>
<td>Sulphate mg/L</td>
<td>5.2</td>
<td>9.3</td>
<td>4.2</td>
</tr>
<tr>
<td>D.O mg/L</td>
<td>7.8</td>
<td>8.2</td>
<td>7.5</td>
</tr>
<tr>
<td>Calcium mg/L</td>
<td>29</td>
<td>38</td>
<td>34</td>
</tr>
<tr>
<td>Magnesium mg/L</td>
<td>16</td>
<td>20</td>
<td>25</td>
</tr>
</tbody>
</table>

**Table 2: Physico-chemical analysis of Uppanar river water at selected stations at April to June 2020**

<table>
<thead>
<tr>
<th>Parameters</th>
<th>April 2020 Sampling Stations</th>
<th>May 2020 Sampling Stations</th>
<th>June 2020 Sampling Stations</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>S1</td>
<td>S2</td>
<td>S3</td>
</tr>
<tr>
<td>pH</td>
<td>7.4</td>
<td>7.6</td>
<td>7.71</td>
</tr>
<tr>
<td>TDS mg/L</td>
<td>271</td>
<td>280</td>
<td>356</td>
</tr>
<tr>
<td>Chloride mg/L</td>
<td>31</td>
<td>30</td>
<td>58</td>
</tr>
<tr>
<td>Sulphate mg/L</td>
<td>20</td>
<td>7</td>
<td>17</td>
</tr>
<tr>
<td>D.O mg/L</td>
<td>5.15</td>
<td>7.3</td>
<td>6.6</td>
</tr>
<tr>
<td>Calcium mg/L</td>
<td>25</td>
<td>31</td>
<td>19</td>
</tr>
<tr>
<td>Magnesium mg/L</td>
<td>21</td>
<td>15</td>
<td>20</td>
</tr>
</tbody>
</table>
the S1, S2 and S3 areas. All the values are within the limit, except at S3. The highest calcium values were observed during the study at station 2 (Bhavani) (Shrinivasa Rao and Venkateswaralu, 2000). $SO_4^{2-}$ concentration ranged from 3.5 to 25 mg/L and found within the prescribed limit. $SO_4^{2-}$ occurs naturally in water as a result of leaching from gypsum and other common minerals (Manivaskam, 2005). Ca$^{2+}$ and Mg$^{2+}$ are directly related to water hardness. Ca$^{2+}$ concentrations ranged between 22 mg/L to 98 mg/L, and found below permissible limit. Mg$^{2+}$ content in the Uppanar river water samples ranged from 25 mg/L to 101 mg/L. Calcium concentration ranged between 0.1 mg/L to 42.4 mg/L and found below permissible limit. Devi and Premkumar (2018) reported magnesium content in the investigated water samples which ranged from 0.8 mg/L to 6.4 mg/L. The physico-chemical parameters studied showed values significantly higher than the standard limits on account of pollution of the river water by industrials activities (Hema et al., 2010).

**Conclusion**

The study showed that the Uppanar river water in the investigated areas is not fit for drinking purpose. This experimental analysis may give sufficient information about the contamination in Cuddalore district Uppanar river water.

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References


