Effect of textile effluent on chemical characteristics of Wunna river of Wardha District (M.S.)

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Abstract

The paper describes the chemical characteristics of Wunna River at Hinganghat, Wardha district of Maharashtra State. Various chemical characteristics such as BOD, COD, total alkalinity, total hardness, total dissolved solids, chloride, sodium, nitrate, chromium and iron were studied at 3 different station of Wunna River viz. upstream region (S₁), effluent mixed region (S₂) and 700 m away from effluent mixed region (S₃). Marginal variations in chemical characteristics were noticed at station 1 and 3. However, higher values were recorded at station 2 i.e. effluent mixed region. Data analysis indicates heavy pollution of eco system of the river at the site of release of textile industry waste water i.e. S₂.

Keywords: Analysis, BOD, COD, Chemical characteristics, Eco-system, Textile industry Waste water, Wunna river

Introduction

Water is one of the most precious gifts of nature. It occupies over 71% of the earth surface of which about 97% is saline in nature while 2.14% water is trapped in the giant glaciers and polar ice caps. This means that not even 1% quantity of water is available for drinking, agriculture, domestic and industrial consumption. There are 14 major rivers in India that share 83% of the total drainage basin and contribute 85% of the total surface flow (Chaudhari, 1982). Water used by the consumers must be free from microbial contamination, toxic substance and excessive amount of minerals and organic matter (Godi et al., 2003). Anthropogenic activities like rapid industrialization, urbanization and improper waste management techniques lead to heavy pollution of water. The effluents of one of the textile industries involved in fabric dyeing are being released in Wunna River. Hence, the present investigation was undertaken to assess the changes in chemical characteristics of the river due to release of industrial effluents.

Materials and Method

Wunna River

It originates from Pilkarpur rows of Mahargarh valley in Tahsil Katol, District Nagpur of Maharashtra State. The latitude of the river is 20°32′58″, the longitude is 78°49′00″, and altitude is 214.2 metre. It is the main tributary of river Wardha that joins the Pranhita river which ultimately flows into the Godavari river. People residing in the vicinity of Wunna river heavily depend on it for drinking and other domestic purposes.

Study stations

Water samples from three stations of the Wunna river were collected monthly from Station-1 (upstream region), Station-2 (effluent mixed region) and Station-3 (700m away from effluent mixed region) during June 2007 to March 2008 between 10

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A.M. to 11 A.M. The samples were collected 2 meter away from the bank and 0.3 meter below surface to prevent the surface micro layer.

Sample collection and analysis
The samples were collected in pre-cleaned plastic bottles. The samples were brought to the laboratory and stored at 4 °C till the analytical work was carried out. The chemical analysis of samples were undertaken as per American Public Health Association (APHA, 1989) and Bureau of Indian Standards (IS-3025).

Results and Discussion
The chemical analysis of samples of three different locations distribution of these parameters for the three stations of the river was analyzed using descriptive statistics and the results are given in the Table 1 and 2.

Alkalinity: The estimated levels of alkalinity at different stations along the course of the river were presented in table 1-2. At station 1, maximum value of alkalinity recorded was 303 mg/l, while minimum value was found to be 105 mg/l. For station 2, the maximum value was 696.6 mg/l and minimum value was found to be 309 mg/l. For station 3, the maximum value was 397 mg/l and minimum value was found to be 132 mg/l.

Hardness: At station 1, maximum value of hardness was found to be 332.8 mg/l, while minimum value was 109 mg/l. For station 2, the maximum value was found to be 450 mg/l. For station 3, the maximum value was found to be 327 mg/l and minimum value 128 mg/l (Table 1-2).

BOD: In the present study, the estimated levels of BOD at station 1, maximum value of BOD recorded was 4.9 mg/l, while minimum value observed was 2 mg/l. For station 2, maximum value was 112 mg/l in October 2007 which indicated heavy organic load. While minimum value was 69 mg/l. For station 3, maximum value of BOD recorded was 19 mg/l and minimum value was 13 mg/l (Table 1-2).

Chemical Oxygen Demand (COD): The estimated levels of COD at station I had ranged from 23-54 mg/l (Table 1). Station II were recorded with minimum level of 240 mg/l and the maximum levels of COD recorded were 289 mg/l. At station 3 recorded levels ranged from 55-119 mg/l (Table 2). Variations in the estimated levels of COD at all the stations studied during the period of investigation, station II shows estimated COD levels more than 10 folds increased than the reference site (Station I) due to the influx of industrial waste water (Table 1 and 2).

Total Dissolved Solids: At station I TDS levels ranged form 180-290 mg/l during the period of study;
the minimum levels were recorded during the November 2007 and March 2008; the maximum level during the month of January 2008 (Table 1). A station II values ranged from 1600-2050 mg/l (Table 2) And 410-650mg/l respectively at station III (Table 2) Among the stations studied station II was recorded with highest levels of TDS during the period (June 07-March08) of study.

### Table 1: The ranges of values obtained for different parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>WHO/India Standards</th>
<th>Station 1</th>
<th>Station 2</th>
<th>Station 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alkalinity (mg/l)</td>
<td>200</td>
<td>105-303</td>
<td>399-996</td>
<td>112-397</td>
</tr>
<tr>
<td>Hardness (mg/l)</td>
<td>200-300</td>
<td>108-332</td>
<td>266-2450</td>
<td>128-327</td>
</tr>
<tr>
<td>BOD (mg/l)</td>
<td>1.2</td>
<td>2.4-9</td>
<td>69-112</td>
<td>13-19</td>
</tr>
<tr>
<td>COD (mg/l)</td>
<td>0.5</td>
<td>25-54</td>
<td>240-289</td>
<td>55-119</td>
</tr>
<tr>
<td>Total Dissolved solids (mg/l)</td>
<td>500</td>
<td>180-209</td>
<td>1600-2050</td>
<td>410-550</td>
</tr>
<tr>
<td>Chloride (mg/l)</td>
<td>200-300</td>
<td>11.1-19.7</td>
<td>7.9-86.1</td>
<td>30-48</td>
</tr>
<tr>
<td>Sodium (mg/l)</td>
<td>11-19</td>
<td>61-88</td>
<td>28-58</td>
<td></td>
</tr>
<tr>
<td>Nitrate (mg/l)</td>
<td>45</td>
<td>1.1-3.1</td>
<td>35-62</td>
<td>40-80</td>
</tr>
<tr>
<td>Chromium (mg/l)</td>
<td>0.05</td>
<td>0.02-0.05</td>
<td>0.08-0.10</td>
<td>0.04-0.07</td>
</tr>
<tr>
<td>Iron (mg/l)</td>
<td>0.3</td>
<td>0.1-0.2</td>
<td>0.15-0.29</td>
<td>0.12-0.27</td>
</tr>
</tbody>
</table>

January and March 2008 and minimum was 30 mg/l recorded in August 2007. (Table 1-2).

**Sodium:** Sodium was recorded maximum value of 19 mg/l in August 2007 and February 2008 and minimum was 11 mg/l in November 2007. For station 2, maximum value was 938 mg/l in October 2007 and minimum 611 mg/l in February 2008. At station 3, maximum value was 58 mg/l in December 2007 and minimum 29 mg/l in July 2007. (Table 1 and 2).

**Nitrate:** Table 1-2 provided the data on variations in the nitrate levels at different stations along the course of Wunna river. At station 1, maximum value was found to be 301 mg/l in July 2007 and minimum was 1.1 mg/l in February 2008. For station 2, maximum value was 620 mg/l in December 2007 and minimum value was 540 mg/l in November 2007. For station 3, maximum value recorded was 80 mg/l in September 2007 and minimum value was 40 mg/l in the month of March 2008.

**Chromium:** At station 1, maximum value recorded was 0.05 mg/l in the month of October 2007 and February 2008 and minimum was 0.02 mg/l recorded in June 2007. For station 2, minimum value was 0.1 mg/l in the month of August 2007, while minimum value was 0.08 mg/l in December 2007. For station 3, maximum value was 0.07 mg/l in July 2007, while minimum value was 0.04 mg/l in June 2007 (Table 1 and 2).

**Iron:** The estimated levels of iron content at different stations during the period of study were presented in the tables 1-2, maximum value observed was 0.20 mg/l in March 2008, while minimum value was 0.10 mg/l.
mg/l in August 2007. Station 2, maximum value was 0.29 mg/l in March 2008 while minimum value was 0.15 mg/l in January and February 2008. For station 3, maximum value was 0.27 mg/l in January 2008 while minimum value was 0.12 mg/l in August 2007.

Conclusion

From the exceptionally higher values of BOD, COD, TDS, Hardness, Alkalinity, Sodium, Chloride and Nitrates at station 2 i.e. effluent mixed region, it may be concluded that the water of station 2 is unsuitable for drinking and other domestic purposes.

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