Physicochemical study of PaperMill Effluent: To assess pollutant release to Environment
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ABSTRACT

Rapid industrialization affects the environment in different ways by discharging large amount of effluent as waste water in the surrounding water bodies causing the serious problems to environment. This paper presents the physiochemical characteristics of waste water from the paper industry which is using hosiery cotton and waste paper as a raw material. The waste water from the paper industry is characterized by colour, temperature, turbidity, pH, conductivity, acidity, alkalinity, TDS, total hardness and chloride. The waste water samples were collected from the inlet and outlet of paper mill. The samples were analysed and compared with the Indian standards of effluent discharge. The results show that the temperature, turbidity, pH, alkalinity, total hardness and chlorides are within the permissible limit while conductivity, TDS and acidity do not meet the standards set by Central pollution control board, India. The selected physiochemical parameters are the indicator of pollution load and provides clues about the further use and recycling of effluent.

Keywords: paper industry, physicochemical parameter, pulp paper mill effluent.

1. Introduction

Nature, now a days is suffering from a serious problem of environmental pollution, increased industrialization has resulted in indiscriminate release of toxic waste in to the surrounding environment. Industrial effluent non point pollution sources, as well as atmospheric precipitation, also be responsible for water pollution. Though water is continuously purified by evaporation and precipitation yet pollution of water has emerged as one of the most significant environmental problem of the recent times.

The pulp and paper industry is the largest industry in India (Medhi et.al., 2011), among world it ranks 20th paper producing country (Malaviya and Rathore, 2007). The paper making process requires large amount of water for the production processes, hence it is a water intensive process. The natural raw material are used for the processes are wood, cellulose, vegetables, rice husk, fibres and also waste-paper. This creates a high level of waste water. The dark colour of the waste paper exhibits the toxic effects on the biota and inhibits the photosynthetic activity by reducing the sunlight (Swamy et.al., 2011).

For the environmental protection & pollution abatement, It is necessary to assess the quality of effluent in term of physiochemical parameter so we can judiciously use the valuable resources for irrigation, industries, wild life etc.
2. Material and methods

2.1 - Collection of samples

The waste water samples of paper mill from four selected sites were collected in triplicate to analyse the various physiochemical parameter in presterilized glass bottles.

2.2 - Study area

Jhansi is a well known district of Bundelkhand region of Uttar Pradesh in India. The climate condition of Jhansi city are varies due to similar topographic factors. The average rainfall is 800-900 mm. Taragram paper mill is one of the paper mill of Jhansi city. It is located between Jhansi-orchha road. Jhansi and orchha both are the famous historical places of Bundelkhand region. Taragram paper mill is far from Jhansi about a km, and from orchha about 8km. It is widely sphered paper mill and it’s annual production is about 120 tonnes. The paper mill required lots of water for the manufacturing of paper and the effluent of ‘TARAGRAM’ paper mill meet to the ‘Betwa river’ through a small stream ‘Bebdie nala’.

3. Experimental

All the experimental method is described as per method suggested by APHA (1998), for water testing and the results are compared with permissible limit given by IS (1982), and CPCB (1995).

4. Results and discussion

The properties of waste water & well water (control), are presented in table-1 In the present investigation the sample was observed black and dirty black in colour due to the effluent contamination, remaining of lignin which is a by-product of manufacturing process. Klien (1973), had reported that black colour is due to accumulation of lignin. According to CPCB (1995), the temperature of effluent were under 40⁰c, all the samples are in permissible range. Turbidity is considered as a good measure of the quality of water. Duggle (1996), had
reported turbidity was caused by presence of suspended particles. Electrical conductivity is a measure of water capacity to convey electric current, the value of EC suggested that significant amount of total dissolves salts are in effluent. Hazarika et.al.(2007), reported that acidity and alkalinity of paper mill effluent is depends upon the various chemical used in paper manufacturing and also evaluate that the alkaline reaction of effluent is due to extensive use of sodium hydroxide in pulp and paper industry. The pH of the effluent rises slightly from control (8.1), to 8.7(effluent), due to presence of NaOH used in processing. pH of water is the important for the biotic compound because most of the plant and animal species can survive between narrow pH from slightly acidic to slightly alkaline. The TDS value of effluent increases three times as compare to control water suggested excessive use of chemicals during process but is in limit as prescribe by CPCB. Hardness of water does not compare to control and suggested that Ca, Mg as well as carbonates are not present in effluent, the value of hardness also not exceed to CPCB.

The high turbidity in effluent was found to result into very high biological demand (BOD). Although the BOD of effluent is also greater as compare to CPCB range of effluent. Similarly the COD of the effluent was found very high (630), as compare to 346 in control water where as CPCB value is 250. Thus COD & E.coli shows high organic pollution load in effluent.

The population of coliform bacteria exhibited positive trends with BOD, and TDS. In other words population was very high were pollution load was high coliform represent a negative trends with oxygen, probably because the absence of oxygen leaves the waste untreated which is favourable for bacterial growth (Verma et. al 1978). For finding corrosive or incrusting nature we use langlier index and concluded that paper mill effluent are slightly incrusting in nature.

**Acknowledgement**

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**Table 1:** Characteristics of paper mill effluents and adjoining well water (control).

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Properties</th>
<th>Control</th>
<th>Effluents</th>
<th>CPCB(permissible),</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Temp(°c)</td>
<td>29.9</td>
<td>31.2</td>
<td>40</td>
</tr>
<tr>
<td>2</td>
<td>Turbidity</td>
<td>2.3</td>
<td>3.5</td>
<td>5</td>
</tr>
<tr>
<td>3</td>
<td>pH</td>
<td>8.1</td>
<td>8.7</td>
<td>5.5-9.0</td>
</tr>
<tr>
<td>4</td>
<td>EC(ds/m)</td>
<td>992</td>
<td>1148</td>
<td>2250</td>
</tr>
<tr>
<td>5</td>
<td>DO(mg/l)</td>
<td>2.6</td>
<td>0.5</td>
<td>4-6</td>
</tr>
<tr>
<td>6</td>
<td>BOD(mg/l)</td>
<td>54</td>
<td>92.1</td>
<td>30</td>
</tr>
<tr>
<td>7</td>
<td>COD(mg/l)</td>
<td>346</td>
<td>630</td>
<td>250</td>
</tr>
<tr>
<td>8</td>
<td>Chloride</td>
<td>85</td>
<td>100</td>
<td>1000</td>
</tr>
<tr>
<td>9</td>
<td>TDS</td>
<td>431</td>
<td>1121</td>
<td>2000</td>
</tr>
<tr>
<td>10</td>
<td>Hardness</td>
<td>214</td>
<td>275</td>
<td>600</td>
</tr>
<tr>
<td>11</td>
<td>Acidity</td>
<td>70</td>
<td>40</td>
<td>-</td>
</tr>
<tr>
<td>12</td>
<td>Alkalinity</td>
<td>110</td>
<td>165</td>
<td>600</td>
</tr>
<tr>
<td>13</td>
<td>MPN</td>
<td>13000</td>
<td>15072</td>
<td>2000</td>
</tr>
</tbody>
</table>
5. Conclusion

From the results obtained in the foregoing study the following conclusion have been drawn

1. In physical parameters of paper mill effluents temperature, turbidity and pH are in acceptable limit as prescribed by CPCB & I.S. while conductivity is beyond permissible limit.
2. The chemical characteristics such as alkalinity, total hardness and chloride value are in acceptable limit where as acidity & TDS value are above the permissible limit of effluent.
3. The results revealed the pollution load in paper mill effluent was not very severe.

6. References


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