Short Communication (NS-6)

AN EVALUATION OF TURBIDITY REMOVAL FROM INDUSTRIAL WASTE BY NATURAL COAGULENTS OBTAINED FROM SOME PLANTS

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ABSTRACT

All the aquatic system carries some suspended solids under natural conditions. There are numerous direct and indirect impacts of silt, suspended solids etc. associated with turbidity in natural as well as in wastewaters. This leads to changes in the water quality, reduced light penetration and aesthetics as well as adverse effects on fish, invertebrates and aquatic plants. At industrial level the major contributes towards turbidity are effluents from paper-pulp industries, dairy industries etc. Therefore, there is an utmost need to lower the turbidity level of natural and wastewater. The plant polymers are effective in reducing suspended particles from the wastewater and hence are useful as natural coagulants, for example Coccinia indica, Abelmoschus esculentus, Plantago ovata etc. Therefore, the present study aimed at reducing turbidity level of dairy waste using natural coagulants. The wastewater samples were collected from Baroda dairy and Amul dairy and analyzed as per standard methods for pH, Temperature, EC, Turbidity, BOD, COD, TS and TDS etc. The performance of fruit mucilages of Coccinia indica and Abelmoschus esculentus and the dry seed powder of Moringa concensensi and Trapa natans at different doses i.e. 20 mg/l, 30 mg/l, 40 mg/l towards the turbidity removal from wastewater were evaluated. The results of raised value of physico-chemical parameters indicated the presence of pollutants in the collected dairy samples. The initial turbidity of the sample was reported to be quite high (784 NTU) against normal turbidity of 40 NTU. Treatment with 30 mg/l dose proved more effective as compared to other experimental doses for all the tested coagulants. C.indica gives highest turbidity reduction of 77.67% among four selected plants, while M. concensensis, T. natans and A. esculentus give turbidity reduction up to 72.95%, 64.79% and 60.33% respectively.

Key Words: Turbidity, Industrial waste, Natural coagulants, Mucilage, Temperature

INTRODUCTION

Pollution of water from industrial effluents poorly treated or untreated domestic and industrial sewage, runoff of agricultural chemicals and mining wastes is growing problems. Chemicals can enter waterways from point source or a nonpoint source, such as an industrial site. Non-point source pollution involves many small scales that combine to cause significant pollution. One of the booming problems of our industrial society is the high consumption of water and high demand for clean drinking water. Numerous approaches have been taken to reduce water consumption but in the long run it seen only possible to recycle waste water in to high quality water. Turbidity refers to how clear water is the greater the amount Total Suspended Solids (TSS) in the water, the murkier it appears and the higher the measured turbidity. High concentrations of particulate matter can modify light penetration, shallowing of lakes and days to fill faster. By addition of some chemicals, the surface property of colloidal particles can be changed or dissolved material can be precipitated so as to facilitate the separation of solids by gravity of filtration. Chemical coagulants such as Alum, Ferric sulphate, Ferrous sulphate, Ferric chloride etc. were used since past to lower the turbidity values in the wastewater. Disadvantages of these
synthetic coagulants are that they are mostly non-biodegradable, highly expensive and may be toxic. Historical records of using different parts of plants such as root, stem and seed for making clear water are well documented. Related to Sanskrit book which says more than 4000 years ago Indian used seed of Nirmali tree (*Strychnos potatorum* Linn.) for making clear water from turbid water of the river. Principal advantages of natural polymers are that they are non-toxic and readily available from renewable natural resources.  

AIMS AND OBJECTIVES  
To remove turbidity from two dairy wastes, i.e. Amul and Baroda dairy.

MATERIAL AND METHODS  
Collection of untreated industrial waste water sample from each industry was collected using standard methods described in APHA-1998. Physico-chemical parameters i.e. pH, temperature, turbidity, EC, BOD, COD, TS, TDS, sulphate, Na⁺, K⁺ and TSS of collected water samples were also analyzed. To obtain the mucilage extract of *Coccinia indica* and *Ablemous esculentus*, they were thoroughly washed with water and cut them into small pieces and soaked in distilled water overnight. The mucilagenous extract was filtered through muslin cloth. The precipitate was washed with acetone 2-3 times and finally dried by keeping in oven at 40°C for 24 hours. The dried precipitates were found to be easily soluble in water. The filtered extracted was then used as biofloculant in the experiment. The Jar test method on flocculator was carried out on experimental turbid water samples with 20, 30 and 40 mg/l dose of each flocculants. After the treatment, the final turbidity of each test sample was measured by Nephelometric turbidity meter.

RESULTS AND DISCUSSION  
The results of physico-chemical analysis of untreated water sample under investigation are shown in Table 1. It is evident that the values of Turbidity, BOD and COD are many times higher than that of permissible limit prescribed by ISI (1981). The waste water from all the industries did not suit to discharge in any kind of water bodies. By extension it is also a potential for harmful effects on the residents of the area who depends on the river for life substance. So, it must be treated before discharge into water bodies. It was observed that the turbidity of the untreated waste water collected from Baroda dairy gradually decreased when optimized dosage of coagulants were incorporated. After five hours of the treatment, *Trapa natans* and *Coccinia indica* gave the best turbidity reduction up to 71.84% (Fig. 1) whereas *Coccinia indica* gave the best turbidity reduction up to 77.67% among four selected plants for Amul dairy waste water (Fig. 2).  

Table 1: Physical-chemical analysis of untreated water sample

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Permissible limit (ISI 1981)</th>
<th>Baroda dairy</th>
<th>Amul dairy</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH</td>
<td>6.00-8.00</td>
<td>4.7</td>
<td>6.5</td>
</tr>
<tr>
<td>Temperature (°C)</td>
<td>Less than 40</td>
<td>29</td>
<td>31</td>
</tr>
<tr>
<td>EC (ms)</td>
<td>2.30</td>
<td>1.77</td>
<td>1.45</td>
</tr>
<tr>
<td>Turbidity (NTU)</td>
<td>40</td>
<td>760</td>
<td>784</td>
</tr>
<tr>
<td>BOD (mg/l)</td>
<td>30</td>
<td>2984</td>
<td>2402</td>
</tr>
<tr>
<td>COD (mg/l)</td>
<td>500</td>
<td>1684.2</td>
<td>2216.0</td>
</tr>
<tr>
<td>TS (mg/l)</td>
<td>-</td>
<td>1830</td>
<td>1771</td>
</tr>
<tr>
<td>TDS (mg/l)</td>
<td>2100</td>
<td>766</td>
<td>700</td>
</tr>
<tr>
<td>Chloride (mg/l)</td>
<td>1000</td>
<td>1260</td>
<td>1100</td>
</tr>
<tr>
<td>Sulphate (mg/l)</td>
<td>400</td>
<td>120</td>
<td>118</td>
</tr>
<tr>
<td>Na⁺ (mg/l)</td>
<td>250 (WHO)</td>
<td>295</td>
<td>312</td>
</tr>
<tr>
<td>K⁺ (mg/l)</td>
<td>12 (WHO)</td>
<td>11</td>
<td>18</td>
</tr>
</tbody>
</table>
The earlier study recommended the use of Moringa olifera seed extract which act as a natural coagulant for water treatment in African and South Asian countries. They reported 80 to 90% turbidity removal from raw water. The role of Plantago ovata in the elimination of water turbidity was studied using coagulant-flocculation process. Starch and its derivatives, cationic proteins and polymeric molecules present in natural flocculants are responsible for lowering down the turbidity in the wastewater. The active component of Moringa olifera seeds was found to be soluble cationic proteins having molecular weight 13 kDa which binds with suspended particles in the. The mucilage of Abelmoschus esculentus fruit contains polymer molecules also help in removing turbidity. Various researchers have described the flocculating activity of natural coagulants that is due to chemical reaction or a complex formation.

CONCLUSION

Therefore, the reported turbidity removal by the tested coagulants in the current study might be due to above mentioned active components present in the natural coagulants.

ACKNOWLEDGEMENT

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