Abstract

The leather industry is suffering from the negative impact generated by the pollution it causes to the environment. Nearly 70 percentage of the pollution of BOD, COD, and total dissolved solids are generated from soaking, liming, degreasing, pickling and tanning process the amount of pollution generated from the leather processing. The need for the use of alternative to chemical methods to combat pollution problem have become necessary to protect the industry and to comply with the environmental norms the physicochemical parameter of the tannery effluent viz., pH, alkalinity, COD, BOD, chlorides were determined. All the parameters included in this study are found to be higher than the prescribed discharge limits for tannery industries. The investigation of the tannery waste water from different tanning process gave a number of conclusions. The results indicate that the wastewater from the tanneries do not satisfy the legal ranges of selected parameters discharge to inland water and to sewer.

Keywords: Alkalinity, COD, BOD, Tannery wastewater, Chlorides.

I. INTRODUCTION

Tanning industry contributes significantly towards exports, employment generation and occupies an important role in Indian economy; on the other hand, tannery wastes are ranked as the highest pollutant among all the industrial wastes [1-6]. The damage to the environment by the hazardous tannery effluent is becoming an acute problem in the country.

The chrome tanning process results in toxic metals, especially chromium passing to wastewater and are not easily eliminated by ordinary treatment process. Tannery effluents are mainly characterized by high salinity, high organic loading and specific pollutants such as chromium. Various chemicals used in tanning are lime, sodium carbonate, sodium bicarbonate, common salt, sodium sulphate, chrome sulphate, fat liquors, vegetable oils and dyes. The tannery effluent was found to contain higher concentration of total dissolved solids, chromium, chloride, ammonia, nitrate and sulphates when the samples were collected from the outlets of the industry. Besides these, chemicals such as zinc chloride, mercuric chloride and formaldehyde are used as disinfectants, sodium chloride in curing and as bleaching powder and sodium fluoride to prevent putrefaction, lime in liming, sodium sulphate, ammonium chloride, borax and hydrochloric acid in DE liming, sodium for decreasing and basic or acidic dyes in leather finishing.

Hence, the tannery effluent is always characterized by its strong color (reddish dull brown), high BOD, high pH, and high dissolved solids. The other major chemical constituents of the waste from the tanning industry sulphide and chromium [7-12]. These chemicals mixed with water are discharged from the tanneries and pollute the ground water permanently and make it unfit for drinking, irrigation and general consumption. Therefore there lies an urgent need to determine the pollution levels in the effluent from these industries. Several studies have been carried out for the treatment of industrial effluents through coagulation and flocculation process (shouli et al., 1992).

II. METHODS

Determination of pH:

Adjust the manual temperature setting to room temperature. Wash the pH electrode with distilled water and wipe dry using filter paper. Insert the pH electrode into known buffer 7pH and adjust the reading to 7. Wash electrode with distilled water and wipe dry. Insert the electrode into known buffer 4 pH and adjust the reading to 4. Wash...
the electrode with distilled water and wipe dry. Repeat the procedure with 7 pH and 4pH until correct readings are obtained. Now pH meter has been calibrated. Insert the electrode into unknown sample and take the displayed reading.

**Determination of alkalinity:**
Add 20ml of water sample taken in conical flask. Add 2 drops of phenolphthalein indicator to the water sample turns to pink. Rundown 0.1N standard sulphuric acid till the solution turns to colorless. Note down the volume of H2So4 added (V1). Add two drops of methyl orange indicator to the water sample the colour turns to yellow. Resume titration till the colour of the solution turns to pink. Note down the total volume of H2So4 added (V2).
Calculation
Phenolphthalein (P) = (Volume of H2SO4(Vi)*normality*1000*50 ) / Volume of water sample.

**Determination of total hardness:**
Take 20ml of water sample in conical flask. Add 1-2ml of buffer solution. Add 2 drops of erio-chrome black t and titrate with standard EDTA (0.01m) till wine red colour changes to blue[13-19]. Note down the volume of EDTA required.
Calculation:
Total hardness (mg/l) has caco3 = ( Volume of EDTA*100 ) / Volume of sample

**Determination of Total solids:**
A clean porcelain dish is taken and weighed (B). A 10 ml of well mixed sample is taken in the dish and evaporated at 100 °C in heating mantle. Cool it to room temperature and weight it (A).
Calculation:
Total solids (mg/l) = (A-B.*10^6) / Volume of sample

**Determination of Total dissolved solids:**
A clean porcelain dish is taken and weighted (B). Then 10 ml of filtered sample is taken in dish and evaporated at 100°C in heating mantle. Cool to room temperature and find its weight (A).
Calculation:
Total dissolved solids (mg/l) = (A-B.*10^6) / Volume of sample

**Determination of chlorides:**
Take 20 ml of sample in conical flask. Add 5 drops of potassium chromate to get yellow colour. Titrate with standard silver nitrate solution till yellow colour change to brick red colour. Note the volume of silver nitrate added.
Calculation:
Chloride in (mg/l) = (Volume of AGNO3*normality of AGNO3*35.46*1000 ) / Volume of sample

**Determination of biological oxygen demand (B.O.D):**
Place the desired volume of distilled water in a five litre flask (usually about 3 litres of distilled water will be needed for each sample). Add 1 ml each of phosphate buffer, magnesium sulphate solution, calcium chloride solution and ferric chloride solution for every litre of distilled water. Seed the sample with 1-2 ml of settled domestic sewage. Saturate the dilution water in the flask by aerating with a supply of clean compressed air for at

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least 30 minutes. Highly alkaline or acidic samples should be neutralized to pH 7. Destroy the chlorine residual in the samples by keeping the sample exposed to air for 1 and 2 hours or by adding a few ml of sodium sulphite solution. Take the sample in the required concentrations. Add the required quantity of sample (calculate for 650 ml dilution water the required quantity of sample for a particular concentration) into a 1000 ml measuring cylinder. Add the dilution water up to the 650 ml mark. Mix the contents in the measuring cylinder. Add this solution into two B.O.D. bottles, one for incubation and the other for determination of initial dissolved oxygen in the mixture. Determination of B.O.D. of wastewater sample. Prepare in the same manner for other concentrations and for all the other samples. Lastly fill the dilution water alone into two B.O.D. bottles. Keep one for incubation and the other for determination of initial dissolved oxygen. Place the set of bottles to be incubated in a B.O.D. incubator for 5 days at 20 degrees Celsius. Care should be taken to maintain the water seal over the bottles throughout the period of incubation. Determine the initial dissolved oxygen contents in the other set of bottles and note down the results. Calculate the B.O.D of the given sample [20-25].

Calculation:

\[ D_1 = \text{Initial dissolved oxygen} = \ldots \ldots \text{mg/l} \]
\[ D_2 = \text{Dissolved oxygen at the end of 5 days} = \ldots \ldots \text{mg/l} \]

Therefore, \text{mg/l of B.O.D.} = \frac{(D_1 - D_2)}{P}

Determination of chemical oxygen demand:

Wash culture tubes and caps with 20% H2SO4 before first use to prevent contamination. Make volumetric measurements and place sample in culture tube or ampules and add digestion solution. Carefully run sulfuric acid reagent down inside of vessel so an acid layer is formed under the sample—digestion solution layer. Tightly cap tubes or seal ampules [46-50], and invert each several times to mix completely [34-40]. Place tubes or ampules in block digester preheated to 150 degrees Celsius and reflux for 2 hrs behind a protective shield. Remove culture tube caps and add 0.05 to 0.10 ml (1-2 drops) ferroin indicator and stir rapidly on magnetic stirrer while titrating with standardized 0.10M FAS. The end point is a sharp color change from blue—green to reddish brown. Although the blue—green may reappear within minutes [26-33]. In the same manner reflux and titrates a blank containing the reagents and the volume of distilled water equal to that of the sample.

Calculation:

\[ \text{COD (mg/l)} = (A - B) \times m \times 8000 / \text{ml sample} \]

Where,

\[ A = \text{ml FAS used for blank} \]
\[ B = \text{ml FAS used for sample} \]
\[ M = \text{molarity of FAS} \]
\[ 8000 = \text{milliequivalent weight of oxygen} \times 1000 \text{ml/l} \]

III. RESULTS AND DISCUSSION

Characteristics of tannery wastewater

Wastewater of tanning process consists of pollution of varying parameter values. And also variation exists in every parameter BOD, COD, Chloride, Hardness etc [41-45]. Discharge of these chemicals into wastewater is hazardous for the environment. Analysis of physico-chemical characteristics of the tannery wastewater
collected from different tanning processes viz. soaking, liming and unhairing, deliming and bating pickling, chrome tanning and retanning are shown in Table 1.

**TABLE.1. ANALYSIS OF TANNERY WASTEWATER**

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<tbody>
<tr>
<td>1</td>
<td>Colour</td>
<td>Reddish brown</td>
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<tr>
<td></td>
<td></td>
<td>(dull)</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>pH</td>
<td>6.5</td>
<td>5.5-9.0</td>
</tr>
<tr>
<td>3</td>
<td>Temperature</td>
<td>35°C</td>
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<tr>
<td>4</td>
<td>Total solids</td>
<td>3125mg/l</td>
<td>800</td>
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<tr>
<td>5</td>
<td>Total dissolved</td>
<td>2920mg/l</td>
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<tr>
<td></td>
<td>Solids</td>
<td></td>
<td></td>
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<tr>
<td>6</td>
<td>Chlorides</td>
<td>1300mg/l</td>
<td>600</td>
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<tr>
<td>7</td>
<td>Hardness</td>
<td>1075mg/l</td>
<td>1000</td>
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<td>8</td>
<td>Alkalinity</td>
<td>950mg/l</td>
<td>500</td>
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<tr>
<td>9</td>
<td>BOD</td>
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<tr>
<td>10</td>
<td>COD</td>
<td>743mg/l</td>
<td>250</td>
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**IV. CONCLUSION**

The processing water of raw hides and skins into leather contains several highly toxic. Results of the analysis showed that the tannery wastewater from different tanning processes is highly with a disagreeable alkalinity, total solids, total dissolved solids, chemical oxygen demand, biochemical oxygen demand, chlorides and hardness. The results of the analysis indicate that the wastewater from different units of the tannery do not satisfy the Standards for Industrial Effluent Discharge.

**REFERENCES**
