REMOVAL OF DYE FROM LEATHER INDUSTRY

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ABSTRACT

Environmental pollution by dye due to rapid industrialization is a challenging problem faced now-a-days for maintaining good quality of water bodies. The contaminated water discharged into the water bodies causes adverse effects to aquatic life as well as human health by consuming polluted water. Techniques were developed to remove dye by physical, chemical and biological treatment. Thus, removal of dye from industries is environmentally a significant costly process. In this present situation, the use of low cost coagulant is economically beneficial. The main objective is to study the coagulation of dye using Lime and Alum which are cheap and eco-friendly. The various parameters such as initial pH, adsorption concentration, temperature and adsorbent dose for these parameters are evaluated experimentally. The coagulant process has many advantages while comparing with other processes. The above-mentioned adsorbents are easily available in the market and are highly cost effective. This process is used to obtain waste free water.

Key words: Coagulation, Coagulant-Lime and alum.

INTRODUCTION

Leather industry is one of the most water consuming industries after the thermal, engineering pulp and paper industries. Water pollution by untreated synthetic dye effluent released from industries has been identified as one of the consequences of worsening situation of water scarcity. As the leather industry is one of the most water consuming industries, water treatment system plays a major role. In every stage of industry various types of dyes are used to colour their products. Dyes are chemicals, which on binding with a material will give colour to them. Dyes are ionic, aromatic organic compounds with structures including aryl rings, which have delocalized electron systems. The dye containing wastewater is usually released directly into the nearby drains, rivers, stagnant, ponds or lagoons. Dyes absorb and reflect sunlight entering water and so can interfere with the growth of bacteria and hinder photosynthesis in aquatic plants.

COAGULATION

Coagulation is a process that occurs when a coagulant is added to water to "destabilize" colloidal suspensions. Conversely, flocculation involves the addition of polymers that clump the small, destabilized particles together into larger aggregates so that they can be more easily separated from the water. Coagulation is a chemical process that involves neutralization of charge whereas flocculation is a physical process and does not involve neutralization of charge. The coagulation-flocculation process can be used as a preliminary or intermediary step between other water or wastewater treatment processes like filtration and sedimentation.

Coagulation is affected by the type of coagulant used, its dose and mass; pH and initial turbidity of the water that is being treated; and properties of the pollutants present. The effectiveness of the coagulation process is also affected by pre-treatments like oxidation.

In a colloidal suspension, particles will settle very slowly or not at all because the colloidal particles carry surface electrical charges that mutually repel each other. A coagulant with the opposite charge is added to the water to overcome the repulsive charge and "destabilize" the suspension.

OBJECTIVE OF THE STUDY

The objective is achieved through,

- Identifying initial parameters in the waste water.
- Treating a sample of waste water by different coagulant.
- Recommend the effective coagulant.
- Comparing and recommend the effective method of treatment.
- Comparison between the treated waste water samples to the standard values.

Table 1.1 Initial parameters of wastewater

pH	5.9
Temperature	23°C
TDS	8 ppt
Turbidity	34 NTU
BOD	1124 mg/l
COD	745 mg/l
Chloride	568 mg/l
Sulphate	534.9mg/l

2. MATERIALS AND METHODS

2.1 LIME AND ALUM

Lime and alum were used as a coagulant and both coagulant is taken in an equal amount. Then, it was washed with distilled water and dried at a temperature of 60-800°C in an oven.

2.2 COLLECTION OF SAMPLES

The wastewater samples were collected at the end of unit operation in dying unit which contains the waste water of process as dyeing in acid washed cans.

2.3 ANALYSIS OF SAMPLES

The effluent samples which contain several metals and organic compounds were analysed to measure their pH, temperature, total dissolved solids, dissolved oxygen, turbidity and chemical oxygen demand (COD), using standard methods.

2.4 EXPERIMENTAL SETUP

The dye waste is taken in a clean, dry 250 ml flask and its initial pH value is fixed. Coagulant which is pre-prepared is added into this with a dosage rate of 1g, 2g, 5g,7 g, and 10 g per 250ml. The flask is initially stirred with a glass rod for mixing, it's shaken in shaker for 24 hours. Samples were drawn at regular intervals and checked for pH, conductivity, TDS, turbidity, absorbance, BOD, COD, chloride, sulfate. All the tests are done and the concordant values were taken for the results comparison.

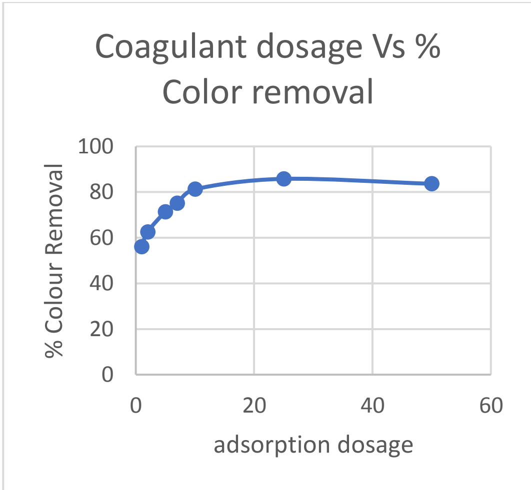
3. RESULTS AND DISCUSSION

3.1 EFFECT OF ADSORBENT DOSAGE

Several investigations were carried out by varying the amount of lime and alum from 1 g to 50g at the fixed initial dye concentration of 250ml, pH of 5.9 and room temperature of 23 °C. These studies showed an increase in coagulation with the increase in the dose of coagulant. Optimum coagulant dose was found to be 10 g/l. It was found that turbidity 7 NTU.

Table 3.1 Effect of coagulant dosage

S.NO	Lime and Alum Dosage (g)	% Colour Removal
1	1g	56.02
2	2g	62.57
3	5g	71.36
4	7g	75.12
5	10g	81.23
6	**25g**	**85.79**
7	50g	83.62



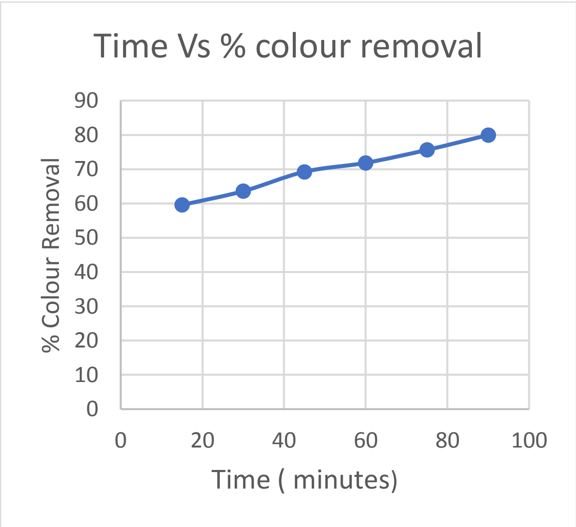
Graph 3.1 Coagulant dosage Vs %Colour Removal

3.2 EFFECT OF CONTACT TIME

To study the effect of time on efficient removal of colour from leather waste the study was carried out. The wastewater sample was taken in a 250-ml conical flask and kept in an orbital shaker at temperature 25±1 °C at 120 rpm. The sample was withdrawn from the conical flask and results are compared with original colour concentration of waste water to know the colour removal efficiency of adsorbents. It is clear from the results that time plays an important role in colour removal of dye waste. It is concluded that dye and adsorbent should be in contact for 90 minutes to get maximum removal percentage.

Table 3.2 Effect of contact time

S.NO	Time (in minutes)	% Colour Removal
1	15	59.56
2	30	63.58
3	45	69.25
4	60	71.85
5	75	75.62
6	**90**	**79.95**



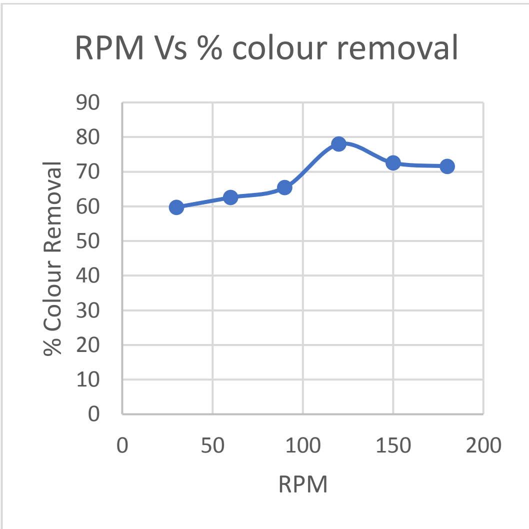
Graph 3.2 Time Vs % Colour Removal

3.3 EFFECT OF RPM ON % COLOUR REMOVAL

Maximum colour removal of 77.98% with lime as an adsorbent occurs at optimum RPM of 120.

Table 3.3 Effect of RPM

S. No	RPM	% Colour Removal
1	30	59.75
2	60	62.56
3	90	65.42
4	**120**	**77.98**
5	150	72.56
6	180	71.56



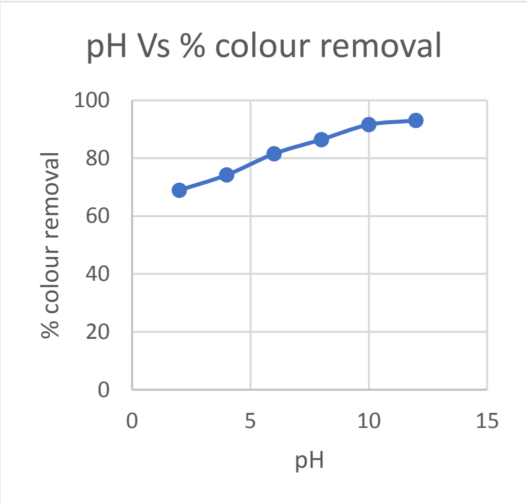
Graph 3.3 RPM Vs % Colour Removal

3.4 EFFECT OF pH

Variation of colour removal with pH at optimum RPM of 120, optimum time of 90 min and at optimum dosage of 25g for dye effluent. Maximum colour removal of 93.001 occurs at optimum pH of 12.

Table 3.4 Effect of pH

S.NO	pH	% Colour Removal
1	2	68.95
2	4	74.21
3	6	81.52
4	8	86.45
5	10	91.56
6	**12**	**93.001**



Graph 3.4 pH Vs% Colour Removal

CONCLUSION

From this study, it may be concluded that the removal of various dyes from wastewater by coagulation on lime and alum has been found to be useful for controlling water pollution due to dyes. From this experiment, the coagulation of dyes using lime and alum is influenced by pH values, number of adsorbents and contact time. Therefore, Maximum percentage of colour removal for the leather dyeing industry effluent using lime and alum and optimum values of variables is given in the following table.

Variable	Optimum value	% Colour removal
RPM	120 rpm	77.98
Time	90 minutes	79.95
Dosage	25g	85.79
Ph	12	93.001

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