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COLOR REDUCTION OF EFFLUENTS --- A STUDY

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Abstract

A study on pretreatment of effluents generated in the Paper mill complex was taken up for color reduction. Several laboratory scale trials were conducted using various other wastes available in the mills and some common coagulants. However, only the waste sludge from calcium hypochlorite plant appeared to be effective. The paper deals with the study carried out.

The effluent discharged from Mysore Paper Mills Ltd., is pale yellow in color and joins the river Bhadra. However, the water flowing in the river appers to be brown, due to its depth and appears to be aesthetically disagreeable. The effluent treatment system incorporated in Mysore Paper Mills Ltd., consists of a two stage clarification with an intermediate activated sludge treatment. The system is efficient in reducing the parameters like BOD5, COD and suspended solids. The color reduction presently happening is due to mixed treatment of effluents in ETP.

The characteristics of effluents from each individual unit were studied and it was found that the dilute, weak, brown stock washer filtrate as the m ain source of color even though its contribution towards total flow was very less. Requirement of enormous steam in evaporators for boiling is the other factor under consideration. Hence it was decided to study the possibility of pretreating this effluent separately.

Several laboratory scale trials were conducted using various other wastes available in the m ills and some common coagulants. Hwever only the waste sludge from calcium hypochlorite plant appeared to be effective. Hence this was studied in detail on a larger scale in laboratory. It was found that this method was satisfactory with a color removal of more than 97%.

The paper consists of the following:

1. Effluent streams under study & their propeties.
2. Treatment with carbon di-oxide.
3. Treatment with carbon dio-oxide followed by alum.
4. Treatment with calcium hypochlorite plant sludge.
5. comparison of the various treatments adopted.

1. The two streams of effluents taken for pretreatment are the Cold Soda refined mechanical pulp plant's brown stock washer (CSRMP)(BSW) filtrate and the calcium hypo chlorite plant (hypo) sludge.

The characteristics of the two effluent streams are given in Apendix I.

2. As it is a known fact that lignin coagulates in acidic medium and captive lime kiln flue gases can be a source of carbon dioxide, acidification of the CSRMP BSW filtrate with carbon di-oxide was tried. Commercial carbon di-oxide was passed through the filtrate. The pH of the medium was monitored and it dropped down to 6.4 and tended to remain constant on passing of further carbon di-oxide. No appreciable color reduction was observed.

3. Treatment with carbon di-oxide followed by Alum:

The above trial was modified and alum was added to lower the pH further after it reached an equilibrium with carbon di-oxide Floculation was observed at pH 5. But the settling rate of the floc was very poor.

4. Treatment with hypo sludge: Literature states that a massive dosage of lime can effectively coagulate lignin bringing down the color. However, the cost of treatment makes the process prohibitive.

The waste sludge from hypo plant contains plenty of calcium chloride alongwith free calcium hydroxide. This is being presently stored in lagoons and disposed after natural evaporation as a land fill.

Since the preliminary trials by mixing this with CSRMP BSW filtrate were encouraging a thorough study was taken up. The characteristics are as tabulated in Annexure I.

A 150 litre container made of acrylic sheets on two sides to facilitate view was used for these experiments.

The ratio of hypo sludge to CSRMP BSW filtrate was fixed at 1:10 on volume basis. The CSRMP BSW filtrate was taken and the required quantity of hypo sludge was added. It was agitated thoroughly for a few minutes and allowed to settle. It was observed that the coagulation of coloring matter was fast and the settling rate of the sludge was good. The observations of settling are tabulated in Annexure II.

The supernatant clear liquid was tested for color and other characteristics. (Annexure III). It can be seen that the color removal is more than 97% with appreciable reduction in other effluent parametres like BOD5 and COD. The total possible reduction in pollution load is given in Annexure IV.

The filtration characteristics of the sludge:

The sludge obtained from the above trial was filtered through a synthetic paper machine wire on a buchner funnel under suction. The cake formed was observed to peel off easily.

The possibility of the wire mesh getting clogged by the sludge was studied as follows:

500 ml of sludge was filtered as above and the filtrate collected at the end of 5 minutes was measured. The cake formed was peeled off and the experiment was repeated with same wire mesh without cleaning it. This was repeated five times in succession and the filtrate volume was observed, to remain unchaned. It was also observed that small particles entrained in the wire can be easily removed by a back wash. The characteristics of the sludge and the cake formed during these experiments are tabulated in Annexure V.

5. To sum up, only carbon di-oxide pretreatment of the stream does not give any appreciable color reduction. The carbon di-oxide and alum treatment poses the problem of settling of floc generated due to coagulation. the in-plant pretreatment of hypo sludge and the brown stock washer filtrate of CSRMP can be an effective measure for color reduction and an indepth study in this field is necessary.

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ANNEXURE I

SL. NO.	CHARACTERISTICS	CSRMP BSW FILTRATE	HYPO SLUDGE
1.	PH	9.15	12.0
2.	Total Solids (mg/l)	10,880	$3x10^5$
3.	Suspended Solids (mg/l)	40	--
4.	Color (Platinum Cobalt Units)	$1x10^5$	--
5.	BOD 5 (mg/l)	4750	--
6.	COD (mg/l)	6226	--

ANNEXURE II

SETTLING RATES OF SLUDGE

Total Height = 37 cm

TIME	SETTLED HEIGHT
0	0
5 min.	2.8 cm.
10 min.	4.0 cm.
15 min.	5.3 cm.
20 min.	6.6 cm.
30 min.	9.6 cm.
70 min.	16.8 cm.
90 min.	17.7 cm.
120 min	18.6 cm.
150 min.	19.5 cm.
	23.0 cm.

SLUDGE VOLUME = 37.8% ON TOTAL.
= 41.8% ON CSRMP BSW FILTRATE

ANNEXURES III

CHARACTERISTICS:

Supernatant clear liquid got after treatment with CSRMP BSW filtrate and Hypo Sludge.

PH	: 11.75
TOTAL SOLIDS ppm	: 7360
SUSPENDED SOLIDS	: —
COLOR (PLATI. COBALT UNITS)	: 600
BOD5 (ppm)	: 550
COD (ppm)	: 1125

ANNEXURE IV

POSSIBLE POLLUTION LOAD:

	CSRMP BSW FILTRATE	AFTER PRETREATMENT THE SUPERNATNANT LIQUID
TS (T)	10.88	7.36
SS (T)	0.04	DEPENDS ON FILTER EFFICIENCY
COLOR (T)	100	0.6
BOD5 (T)	4.75	0.55
COD (T)	6.226	1.125

ANNEXURE V

CHARACTERISTICS OF SLUDGE SETTLED:

CONSISTANCY OF SLUDGE SETTLED (SETTLED)	= 8.59 %
(UNSETTLED)	= 3.5 %

CAKE FORMATION USING PAPER MACHINE
WIRE ON BUCHNER FUNNEL (APPLYING SUCTION)

CONSISTENCY OF CAKE	= 25 %
ASH (ON DRY BASIS)	79.5 %