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STUDY OF EFFLUENT TREATMENT SYSTEMS OF LATEX CENTRIFUGING PLANTS

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A. INTRODUCTION

Effluent generated from a latex centrifuguging factory consists of serum after acid coagulation of skim latex, washings from various process tanks, washings from barrels and floor, bowl washings, washings during milling of skim coagulum etc. Out of these, coagulation of skim latex is the major contributor of effluent. The quantity of effluent generated from a latex centrifuging factory is of the order of about 4 litres for every litre of concentrated latex produced. This effluent has high Biochemical Oxygen Demand (BOD) and Chemical Oxygen Demand (COD). Hence a considerable reduction in BOD and COD is essential to avoid pollution due to this effluent.

Discharge of this effluent into streams and rivers without proper treatment will, therefore, result in serious depletion of oxygen in the water. To protect the environment from this destabilising condition, statutory regulations have been introduced by the Government for the discharge of effluents.

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As per the regulations, the effluent should be treated before discharge and it should conform to the standards prescribed in IS 2490 (Part 10 - 1985). The various parameters and their limits for discharge into inland water/ land application is given in Table -1. The land requirement for on land application is estimated at one hectare for every 140,000 to 160,000 litres of effluent per day.

Table - 1

Parameters and Limits for Discharge

Parameter	Limit for discharge into inland surface water	Limit for Discharge into land for irrigation
pH	6.0 - 8.0	6.0 - 8.0
BOD (max)	50	100
COD (max)	250	250
Suspended Solids (max)	100	200
Phosphates (max)	5	-
Total Nitrogen	100	-
Total Dissolved Solids (max)	2100	2100
Sulphides	2	-
Oil and Grease (max)	10	10

Note: All parameters except pH are in mg / litre

A study was conducted among the existing latex centrifuging units for the evaluation of various methods

practised by them for the treatment of effluent. A questionnaire was prepared and sent to each unit for the collection data. Out of the 52 units under operation, 29 units responded to the study. The units responded have up to five latex centrifuging machines under operation. The results are discussed below:

B. OBSERVATIONS

(a) Quantity of Effluent

The quantity of effluent generated is found to vary widely from unit to unit. In fact it depends on processing capacity of the unit. Table - 2 gives the relation between the number of machines under operation and the corresponding effluent generation.

Table - 2

Number of Machines Vs Effluent Generation

No. of Machines	Effluent Generated in litres per day
1	2,000 - 50,000
2	6,500 - 85,000
3	6,000 - 65,00
4	18,580 - 52,000
5	40,000

It may be noted that the processing capacity of the individual machines installed are not identical. They include both old model machines with low capacity and new machines with larger capacities. If a milling facility for skim rubber is attached with the unit, it will naturally increase the quantity of effluent.

The total number of machines under operation by the 29 units is 59 and the total effluent generated per day is repoted to be 7,43,500 litres. Thus the average effluent generation by each machine is around 12,600 litres per day.

(b) Characteristics of Effluent Before Treatment

The effluent coming out from the processing factory is found to vary widely in its properties. The different parameters and their range before treatment is given in Table - 3.

Table - 3

Characteristics of Effluent Before Treatment

Parameter	Range
pH	2.6 - 8.0
BOD	50 - 5500
COD	230 - 7800
Suspended Solids	64 - 2000
Phosphates	1.2- 50
Total Nitrogen	100 - 800
Total Dissolved Solids	400 - 10950

Sulphides	2 - 30
Oil & Grease	Nil - 300

Note: All parameters except pH are in mg / litre

The higher values of pH reported is due to the addition of lime for neutralisation of the effluent.

(c) - Types of Treatment

Although there are some variations in the method of treatment given to the effluent, most of the units make use of the principle of biological oxidation of effluent under controlled conditions. The effluent coming out of the processing factory is acidic in nature due to the acid coagulation of the skim latex to recover skim rubber. This effluent is first sent to a rubber trap to remove suspended rubber particles. It is then neutralised and allowed to settle by the addition of flocculating agents in the primary settling tank.

The overflow from the primary settling tank is fed to the aeration tank where bacterial population is maintained. Aeration is given by surface aerators. Required nutrients are added to assist bacterial growth in the aeration tank. Oxidation brings down the BOD and COD values. The overflow from the aeration tank is collected in a secondary settling tank where sludge settles.

The clear liquid from the secondary settling tank

is sent to the polishing tank for further purification by aeration. The treated effluent is then pumped out for land application. Part of the sludge from settling tanks is returned to the aeration tank to maintain the bacterial population and the rest to the sludge drying bed.

(d) Characteristics of Effluent After Treatment

The characteristics of effluent and their range of values obtained after treatment is given in Table - 4. The limit prescribed for various parameters for discharge into land for irrigation is also included.

Table - 4

Characteristics of Effluent After Treatment

Parameter	Range	Limit for land application
pH	4.4 - 9.0	6.0 - 8.0
BOD	3 - 326	100
COD	13 - 1850	250
Suspended Solids	4 - 200	200
Total Nitrogen	30 - 314	-
Total Dissolved Solids	200 - 1780	2100
Sulphides	2.6	-
Oil & Grease	1 - 10	10

Note: All parameters except pH are in mg / litre

(e) Effectiveness of Treatment of Effluent

Among the 29 units which responded to the study, there are some units which have very efficient effluent treatment sytems in terms of the chacteristics of treated effluent. Properties of effluent before and after treatment from three such units are given in Table - 5, Table - 6 and Table -7. The units have been so selected that the characteristics of treated effluent from these units fall within the limits specified by IS 2490 as given in Table - 1 above for land application.

Table - 5

Characteristics of Effluent Before and After Treatment

(Unit A)

Parameter	Before Treatment	After Treatment
pH	6.4	6.1
BOD	2780	24
COD	4800	100
Dissolved Solids	2290	480
Suspended Solids	190	100
Total Nitrogen	550	260

The effluent treatment system employed by unit 'A' is very much similar to the method already discussed. This unit has five latex centrifuging machines. The quantity of effluent is about 40,000 litres per day. The operating cost

of the unit is around Rs.600/ per day or 1.5 paise per litre of effluent.

Table - 6

Characteristics of Effluent Before and After Treatment

(Unit B)

Parameter	Before Treatment	After Treatment
pH	6 - 8	7.4
BOD	50	3
COD	250	13
Dissolved Solids	2100	399
Suspended Solids	100	9
Total Nitrogen	100	30
Oil & Grease	10	7

Unit 'B' has one latex centrifuging machine. Effluent generated by unit 'B' is comparatively less in quantity and it is around 4,500 litres per day. Here, the effluent is first diluted with equal volume of water and mixed with one third its volume of lime water. It is then allowed to settle and the overflow is aerated. Further treatment is similar to that already explained. The operating cost of the unit is Rs.80/ per day which is about 1.75 paise per litre of effluent.

Table - 7

Characteristics of Effluent Before and After Treatment

(Unit C)

Parameter	Before Treatment	After Treatment
pH	5	7
BOD	5500	60
COD	7800	120
Dissolved Solids	2500	240
Suspended Solids	2000	160
Sulphides	30	Trace
Phosphates	50	..
Total Nitrogen	800	200
Oil & Grease	3	2

Unit 'C' has four latex centrifuging machines. The method followed by unit 'C' is the usual method of chemical treatment followed by aeration and settling. The quantity of effluent handled by the unit is about 52,000 litres per day. The operating cost of effluent treatment plant is reported to be around Rs.1300/ per day or 2.5 paise per litre of effluent.

(e) Operating cost for Treatment of Effluent

Various factors contributing to the operating cost of Effluent Treatment plant are

(1) Cost of Chemicals

(2) Cost of Labour

(3) Cost of Electricity

(4) Cost of Maintenance

The operating cost of effluent treatment plant incurred by some of the latex centrifuging units responded to the study are given in Table - 8.

Table - 8

Operating Cost of Effluent Treatment Plant (Daily Basis)

Quantity of Effluent (Litres)	Operating Cost (Rs.)				
	Chemicals	Labour	Power	Maint	Total
25,000	369	100	130	--	599
30,000	--	--	--	--	1000
15,000	--	--	--	--	500
40,000	101	165	350	--	616
40,000	1174	304	306	--	1784
30,000	--	--	--	--	616
37,000	--	--	--	--	200
4,500	--	--	--	--	80
2,000	--	--	--	--	240
30,000	112	50	250	98	510
8,000	596	120	--	--	716
22,000	225	150	500	--	875
65,000	--	--	--	--	1000
6,000	--	--	--	--	200
9,000	185	90	48	--	323

70,000	1215	400	--	--	1615
483,500					10874

The above table shows that the average operating cost of effluent treatment plant is around 2.25 paise per litre of effluent.

C. CONCLUSION

Latex centrifuging factory is considered the most polluting among the different rubber processing factories. It is seen that a treatment system combining flocculation, sedimentation and biological oxidation with mechanical aeration can be employed to treat the effluent to the limits prescribed for onland application. The operating cost will be around 2.25 paise per litre of effluent or 9 paise per litre of cenex produced.

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