Bulletin No. 96

By

INDIAN LAC RESEARCH INSTITUTE

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Namkum, Ranchi, Bihar, India

1959

Price Ten n.p. only

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It is well known that the effluent coming out of lac factories contains besides the lac dye, some proteinous matter derived from the body of the lac insect, some sugar, vegetable glue etc., which putrefy when the effluent accumulates. The place of accumulation thus becomes a breeding site for flies and a source of very obnoxious smell. As a result, the whole vicinity becomes very unhygienic. This poses rather a problem for the Public Health Department than for the Industries Department of the States where seedlac and shellac are manufactured and hence occasional attempts have been made by the former towards its solution, but without tangible results so far. According to a recent suggestion by Bhaskaran[1] the effluent from all the factories in the same locality should be collected at one place and there treated with lime. By this means the putrefiable matter will coagulate and hence could be removed by filtration; the suggested method is no doubt theoretically sound, but impracticable, since the capital investment required even for the smallest possible unit is large and therefore prohibitive to an average indigenous lac factory owner. What is really needed is a method which would not require much initial investment and could be run at a nominal expenditure. Such a method has been worked out at this Institute, and is reported here.

It has been shown in a separate communication[2] that the water-soluble dye along with other materials separates out on adding sulphuric acid to the effluent water. Obviously this fact may be utilized for separation of the putrefiable matter and hence for elimination of the possibility of putrefaction. Detailed studies show that if the residual water (i.e. water left after precipitation of the dye etc.) is allowed to attain a final concentration of 0.05 per cent sulphuric acid, it will not putrefy. The details of the study are given below.

Experimental

As an exploratory work the fresh effluent water collected from a lac factory was treated with various chemicals to judge their relative efficiencies in stopping putrefaction (which was noted by the formation of bad smell). Results of work with 500 c.c. effluent are given below in table I.

Table I

Reagents used.	Putrefaction (as judged by intensity of offensive smell) noted after					
	24 hrs.	48 hrs.	72 hrs.	96 hrs.	120 hrs.	Remarks.
1. Nil (Control)	Yes	--	--	--	--	
2. Formaldehyde 0.1% in total volume.	No	Yes	--	--	--	
3. Carbolic acid 0.1% in total volume.	Yes	--	--	--	--	
4. Lime 1% in total volume.	No	No	No	No	No	Slimy precipitate.
5. Bleaching powder 5 gms.	No	No	No	No	No	Smells of chlorine.

6. Sulphuric acid 0.1% of total volume.	No	No	No	No	No	Precipitates immediately.
7. Oil creosote	No	No	No	No	No	No precipitate.
8. "Phenyle"	Yes	--	--	--	--	
9. Copper sulphate 0.5 gms.	No	No	No	No	No	Precipitate.
10. Sodium Chloride	Yes	--	--	--	--	
11. Lime Water 5 c.c.	No	No	Yes	--	--	
12. Calcium chloride 0.5 gms.	No	No	Yes	--	--	
13. Hydrochloric acid 0.1% on the total volume.	No	Yes	No	No	No	Precipitate.
14. Potassium chloride 5 gms.	No	No	No	No	No	Precipitate.
15. Aluminium chloride	No	No	Yes	--	--	
16. Nitric acid 0.1% on the total volume.	No	No	No	No	No	Precipitate.
17. Ammonium sulphate 5 gms	No	No	Yes	--	--	
18. Boiling for 30 mins.	No	No	No	No	Yes	
19. Oxalic acid 0.1% on the total volume.	No	No	No	No	--	Precipitate.
20. Tartaric acid 0.1% on the total volume.	No	No	No	No	No	Precipitate.

The above table shows that acids, lime, bleaching powder, creosote oil and copper sulphate can stop putrefaction. Since acids in general were found effective, it was thought worthwhile to try for the purpose some vegetable leaves having acidic properties. A good variety of leaves was tried, of which the leaves of *ambuli* (*Oxalis repense*), tamarind and *amlika* were found to be effective. But the quantity of leaves required was nearly 50 gms for 500 c.c. of effluent water and this was considered too much to make their use a practical proposition. Furthermore, among the effective chemicals although lime would be the most economical to stop the obnoxious odour of the lac factory waste, it is not able to prevent putrefaction permanently which mineral acids are generally able to do. Of these, sulphuric acid is the cheapest and appeared to be most suitable. Hence a detailed study was made to determine the minimum quantity of this, required for maximum precipitation.

In this experiment also lots of 500 c.c. of effluent water were treated with different quantities of sulphuric acid. Results are given in table II.

Table II

Quantity of sulphuric acid in the total volume.	Observation.
1. 0.01%	Smells very badly after 72 hrs.
2. 0.025%	-do-
3. 0.05%	-do- 96 hrs.
4. 0.075%	No bad smell even after 120 hrs.
5. 0.10%	-do- 12 days.

Obviously, 0.1 per cent concentration of sulphuric acid in the total volume of wash water is sufficient to stop putrefaction and precipitate the dye and other matters. If the dye is to be recovered, the precipitate rich in dye may be filtered through cloth and the mother liquor allowed to flow out. In case it is not desired to separate the precipitate, it may be left in the solution. It has

however been observed that in presence of any chemicals other than sulphuric acid, the precipitate putrefies after 5 to 6 days and produces a bad smell. With sulphuric acid no putrefaction occurred even 12 days after precipitation. This fact also justifies the preference of sulphuric acid for treating the effluent water.

The residual water which is acidic and red in colour was re-used for preliminary washing of lac. By adding sulphuric acid again to this wash water the dye could be precipitated as before. In case the wash water is not re-used it may be allowed to flow through gutters made of cement or earth, which are not affected by it. If the effluent water is allowed to accumulate in a pool, the colour practically disappears and water becomes gradually neutral on 15 to 20 days' standing. Most probably this is due to the action of soil alkali. The treatment of effluent with sulphuric acid has been tried in batches or as a continuous process. In the batch process, the effluent was collected in a cistern 3' high, and treated with sulphuric acid with continuous stirring. The end point of the addition of acid was noted by a sudden appearance of curdling in the solution. After addition of the acid the mixture was allowed to stand for half an hour, after which the supernatant liquid was drained out. In the continuous process the acid was added at a certain point of the effluent stream so that the acid got intimately mixed with the water. Here also the quantity of acid was regulated by the appearance of curdling a few feet away from the point of addition of the acid. If the dye is to be collected there, the process suggested elsewhere[2] should be adopted.

As to the total quantity of acid required for the effective treatment of the effluent obtained from the waste water per one maund (40 kg.) of lac it is found to be very nearly one pound. Since commercial sulphuric acid costs three to four annas a pound, the expenditure, considering the service that would be done to public hygiene, should not be regarded as excessive. Indeed, if the dye is recovered as a bye-product—this is quite possible as shown elsewhere[2]—this process, far from being a source of expenditure, may well prove to be a source of profit.

Authors express their gratitude to Dr. S. V. Puntambekar, Director, Indian Lac Research Institute for his interest in the work.

References

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Printed at Beni Madhaw Press, Ranchi