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CHARACTERIZATION OF CHROME TANNERY WASTE WATER FROM GOAT SKIN PRODUCTION UNIT

ABDUL WADOOD QURESHI, NISHAT RIZVI AND MOHAMMAD IQBAL
Leather Research Centre, PCSIR, Karachi, Pakistan

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Mixed tannery effluent from goat skins production unit, was analysed Chemically and Microbiologically, to assess pollution load. Various treatments were also analysed to compare affectivity. Off all the studies, Chemical as well as Microbiological, it had been observed that aeration treatment brought the pollution down to some extent, while aeration with $FeCl_3$ addition indicated gradual increase in parameters of COD., total dissolved solids, as well as a marked increase in bacterial plate count.

Key words: Goat skin, Tannery waste water, Effluent analysis.

Introduction

Leather processing industry discharges very foul smelling effluents. The problem of these tannery effluents is becoming more and more acute with the establishment of the new as well as modernisation of the existing leather factories in the urban area.

Effluent at beam house stages, contains concentrated unhairing wastes. It also contains sulphide, and sulfide gases in pipes which is a source of corrosion, Lime in the beam house effluent is also highly undesirable as it clogs sewers and leaves an excess of aklalinity in Municipal plants. During bate, pickle and tannings operations, the effluent comprises of large quantities of ammonium salts, some soluble proteins, suspended solids and lime. Pickle liquors are seldom dumped, so it is not a factor in the effluent problem. Effluent at chrome tanning stage contributes approximately 5 lbs of chromium per 1000 lbs of hides and skins. The dyeing and fatliquoring wastes consist of dyes, vegetable tanning materials, synthetic and other specific chemicals and oils. In the finishing operation, the wastes contain suspended rasins and pigment, it may also contain some of the accumulated solvents. Concentration of the effluent may vary considerably from one tannery to another.

On an average 30 lbs. of water are needed for vegetable tanning while chrome tanning requires 48 lbs. of water per pound of hide/skins. Thus a tannery processing 10,000 skins (Average weight 5 lbs skin) will require about 2.4×10^3 lbs of water per day. Availability of this much amount of water poses problems in Karachi, therefore technique for recycling of waste water from tannery will be beneficial to the Leather Processing Industry.

As no work has been ever reported on tannery effluents in Pakistan, studies on tannery effluents from Pakistani skin processing units were taken in hand.

Experimental

A: Chemical Analysis:

Materials and methods. Chemicals used in all experiments were of A.R.grades. Raw materials (Tannery effluents) were collected in July, August, 1987 from a Leather production unit processing 4000 skins per day in SITE., Area, Karachi.

Procedure. Calibrated thermometers were used for direct temperature measurements of effluents.

The detailed methods of analysis would not be presented here. $BOD._5$, COD Total hardness, T.S., D.S., sulphide and chromium were determined by the methods [1-7].

Results and Discussion

The present investigation was carried out to establish the levels of pollution produced at different stages of the tannery processes in the mixed effluents and after different treatments.

Table I represents the pollution load values of Beam house process. In the processes of soaking, liming and deliming/bating, the lime liquor possesses the highest pollution load of BOD_5 in comparison to delime and soak while soak liquor has the lowest load. In the same way pollution load of COD in lime effluent is the highest than those of delime and soak. Deliming liquor possesses higher load than soak liquor. Total solids, dissolved solids and suspended solids have been found to possess the highest load in lime effluent than those of delime and soak liquors. It is also observed that maximum sulpide is available in the lime liquor. From the above study

TABLE 1. *SOAKING LIMING AND DELIMING/BATING:* ANALYTICAL RESULTS OF THE EFFLUENTS FROM BEAM HOUSEPROCESSE

	Soak:	Lime	Delime
pH	6.5	11-13	8.0
Water	42%	29%	9%
BOD 5	2374	10714	7143
COD	5352	23712	12488
T.S	38460	73630	28812
D.S	36812	66800	28280
S.S.	1648	6830	532
Sulphide	-	8780	637

All results are in mg/L except pH and water.

it is observed that amongst the beam house processes the lime concentrated liquor possesses the highest pollution load.

Table 2. shows the pollution values of the tan yard and finishing processes effluents indicating the highest COD value at pH 6 in tanning effluent in comparison to others. But the BOD_5 load is higher in retaining and neutralisation than those of fat-liquoring/dyeing and chrome effluents at pH 6 total solids are the highest in chrome effluent and lowest in fat-liquoring/dyeing effluents. In the same manner dissolved solids and suspended solids have been found with the maximum pollution load in the chrome tan liquors than those of neutralisation and finishing. The most toxic element like chromium (Cr_2O_3) is associated with the chrome liquors in large amount while some of the toxic element is also found in retan/neutralisation effluents.

TABLE 2. ANALYTICAL RESULTS OF THE EFFLUENTS FROM TAN YARD AND FINISHING PROCESS.

	Chrome tan	Retan + Neutra Lisation	Fat-liquoring and dyeing
pH.	3.0	6.0	6.0
Water	9%	5%	5%
BOD_5	834	1756	1105
COD	6718	2087	3059
T.S.	91742	21788	4808
D.S.	88882	20352	4790
S.S.	2860	1436	1800
Sulphides.	720	480	–
Chromium (Cr_2O_3)	4700	1163	–

Table 3. shows the pollution values of different parameter of the composite tannery effluents obtained after the processing of wet salted goat skins. pH value at 260° indicates that the concentrated liquor is neutral. Total solids are the highest source of pollution which indicates the presence of suspended and dissolved solids. It is also detected that sulphides are absent. Chromium having more toxicity than sulphide has been found in the liquor. COD Value indicated the poresence of heavy pollution load.

TABLE 3. ANALYTICAL RESULTS OF MIXED TANNERY EFFLUENTS AFTER SEDIMENTATION (GOAT SKINS)

Parameters	Values
pH	7.5
Cr_2O_3	0.0311%
Total hardness.	1760 mg/L
Choloride.	3098 mg/L
Total solid.	9398 mg/L
Dissolved solid.	8642 mg/L
Sulphide.	Nil.
COD	4385 mg/L
Temp.	26°C.

From the above investigation it is apparent that each stream of a tannery has specific nature of pollution. They differ with each other not only in pH value, as shown in Tables 1 and 2 but also in the type of their constituents. Beam house effluents having high float of water possess the highest pollution load of BOD_5, COD TS and sulphides while highest toxic material like chromium is found with low float of water in tan liquors, COD and TS values are also high in this liquor. Therefore, the separate discharge of each stream is more dangerous for environment i.e. common practice in Karachi., than the effluent which is being discharged after mixing and settling. In this case pH value becomes neutral, as shown in Table 2, due to the neutralization of lime liquor by the acid, delming, pickling or tanning. More over some of the liquors react with each other often resulting in the formation of insoluble precipitate which settles down as a sediment in the tank thus lime could precipitate chrome salts, dye stuff or can split fat dispersion. It is concluded that the tannery effluents being drained off possess the maximum load of pollution which must be treated before it is drained off.

B: Microbial Analysis.

Materials and methods. Effluent sample details are shown in Table 4 and 5. All the samples were diluted to 1:100 with autoclaved distilled water, out of this 1:100 diluted effluent sample - 0.1ml was inoculated in petri plates using

TABLE 4. MICROBIAL LOAD OF EFFLUENT SAMPLES FROM VARIOUS PROCESSING STAGES.

	Samples	Colony count
A	Mix effluent	768
B	liming effluent - 20 days old	61

All readings are in 1:10000 ratio.
Plating media = Nutrient agar.

TABLE 5. MICROBIAL ANALYSIS OF EFFLUENT SAMPLES

Samples at IV mixed effluent after settling 400

All readings are in 1:10000 ratio.
Plating media = Nutrient agar.

10ml of autoclaved media. The medium used for study was nutrient agar. Mode of study was pour plate technique. All Plates after inoculation using above mentioned technique, were incubated at 35°C for 24 hrs. The results were taken, using plate count method.

Composition of nutrient agar. (Planting media):

Polypepton	5 gms
Beef extract	3 gms
Agar	15 gms
Distilled H_2O	1 liter

Cross section of microbial population is determined by the plate count technique in which the sample is diluted

quantitatively and measured quantities of the dilutions are cultured in petri dishes

Dilution of the inoculum used in each experiment. 10 ml autoclaved distilled H_2O, efflent sample 0.1 ml., dilution of the inculum (Effluent sample = 0.1 =(1:100) out of this diluted sample 0.1 ml in 10 ml media (Plating) dilution = 0.001 = 1:10000

Conclusion

Maximum number of bacterial colonies have been obtained in case of freshly mixed effluent sample as shown in Table 4A, while liming effluent indicates lower colony count, as it does not encourge bacterial growth.

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