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Treatment of Tannery Effluent by U.A.S.B Reactor Method

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Abstract— Tannery wastewaters are highly complex and are characterized by high contents of organic, inorganic and nitrogenous compounds, chromium, sulphides, suspended solids and dissolved solids. Treatment of tannery wastewater is carried out by physical or chemical or biological or combination of these methods. This study reviews various biological treatment methods applied for tannery wastewater. Characteristics of wastewaters from different tanneries and various methods for treating these tannery wastes are discussed. It was noted that the Chemical Oxygen Demand (COD) removal efficiencies and process capacities were affected by the variations in organic loading rates, presence of chromium and sulphides . The review shows that all aerobic processes have a similar level of COD removal, but the highest COD removal efficiency at a high organic loading rate was observed in anaerobic reactors. Up flow Anaerobic Sludge Blanket Reactor (UASB) exhibited better performance for treating high strength tannery wastewater effectively, compared with conventional reactors. Both aerobic and anaerobic processes are employed for the treatment of tannery wastewater.

I. INTRODUCTION

Next to air, the other important requirement of life to exist is water. It is an indispensable part of all life form and human civilization is very much controlled by the availability of water. Almost all-human settlements were flourished along the river course in the ancient days and disappeared when water was not available for reasons beyond man's control. On ocean and sea surface 450.000 km^3 of water falls every year and 502.800 km^3 evaporates. Of the freshwater on Earth, about 2.200 km^3 flows in the ground, mostly within half a mile from the surface. About 135.000 km^3 of water can be found in the atmosphere as water vapour, in lakes, soil moisture, marshes and wetlands, rivers, plant and animals. Generally, the leading tannery industries and dying industries releasing their waste water without proper treatment, it may cause several contaminations in surface water as well as ground water. For this problem we can use UASB Reactor for treatment process. By this method we can reduce the toxic nature of the waste water which gets release from the tannery industries.

A. Types of Waste Water Treatment

1) Mechanical Treatments: Screening
Sedimentation
Flotation
Filtration

2) Physical Treatments: Adsorption through solid absorbers
Flocculation / coagulation

3) Chemical Treatments: Precipitation
Wet Oxidation

4) Biological Treatments: Aerobic degradation
Anaerobic degradation

5)UASBR Treatment For Tannery Waste Water: One of the best and upcoming method of tannery waste treatment is "Treatment of tannery waste by using UASB Reactor". Wastewater discharged from tannery industries is highly complex, concentrated and toxic. In view of the varying nature of discharged wastewater and the numerous small industries in VELLORE, there is a need for highly efficient treatment processes that are simple to operate and have low/reasonable construction and operation costs.

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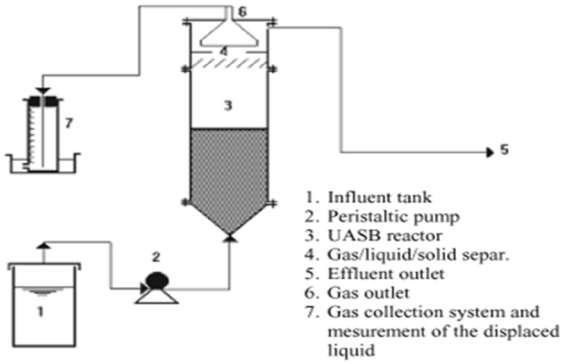
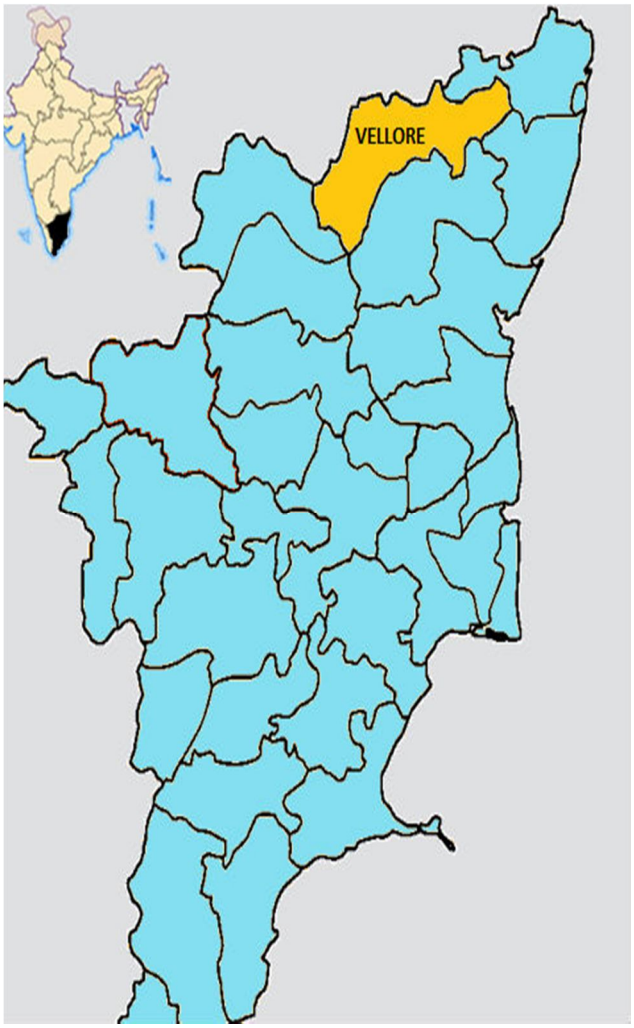


Figure 1: Schematic diagram of the laboratory UASB reaction system.

II. STUDY AREA

We selected Vellore area covered by river Palar. Because most of the Tannery industry will present there due to the presence of those industries there are more land get polluted by disposing the waste water on the land. The untreated effluent of these tanneries and industries were finally discharged in the river Palar which was the main source of water supply to the residents of the area. The State Government also informed the Court about the 59 villages that were affected by the tanneries. The NEERI, the Tamil Nadu Board and Central Board visited the tanning units and other industries in the Tamil Nadu and submitted their reports.



STUDY AREA IN TAMILNADU MAP

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III. HISTORY OF UASBR – RESEARCH AND DEVELOPMENT

The first application of anaerobic digestion for wastewater treatment is presumably the air-tight chamber developed by the end of last century in France by M. Mouras. According to McCarty, 1981, in this so-called 'mouras automatic scavanger' settleable solids from wastewater are 'liquefied'. Septic tank was developed by Cameron in England and the Imhoff tank by Imhoff in Germany. In the above systems the wastewater flows through the system in the upper part, while the anaerobic sludge rests at the bottom of the tank. The settleable solids present in the wastewater will sediment and are degraded by in the septic tank may be hampered to considerable extent by floating matter rising up from the bottom, or due to the agitation of decomposing solids by biogas bubbles. The Upflow Anaerobic Sludge Blanket (UASB) Reactor was developed in the 1970's byLettinga and his group at the University of Wageningen in the Netherlands.

IV. EXPERIMENTAL METHODOLOGY

A. General

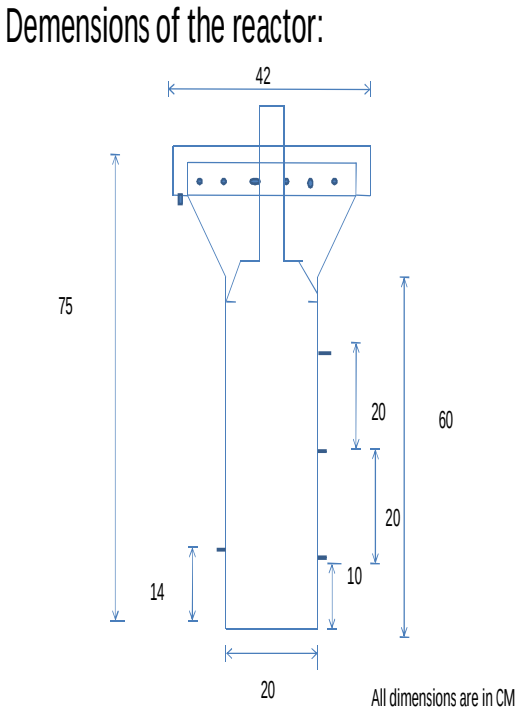
A laboratory model of the Up flow Anaerobic Sludge Blanket Reactor (UASBR) with necessary, having an effective capacity of 18 liters was fabricated and used for this study. Synthetic tannery wastewater, simulating the typical characteristics of tannery wastewater, was daily prepared with necessary chemicals and nutrients for conducting the experimental study. Experiments were conducted at different prefixed but varying and operating conditions. Experiments was conducted for seven different influent substrate concentrations (COD), at five different hydraulic loading rates by adjusting the speed of the peristaltic pump after required calibration of the pump.

B. Experimental Setup

The experimental setup consists of a UASB reactor, made of acrylic material with a cylindrical portion having 60 cm height and diameter of 20cm, whose top widens to accommodate a gas liquid solid separator (GLSS).

The physical dimensions of the reactor model were assessed using a empirical approach for an effective reactor volume of 18.3 liters with an overall volume of 21 liters. The design approach is made on the basis of influent flow rate, hydraulic retention time, upward velocity, influent COD and Organic Loading Rates.

V. SPECIFICATION AND DIMENSIONS OF REACTOR



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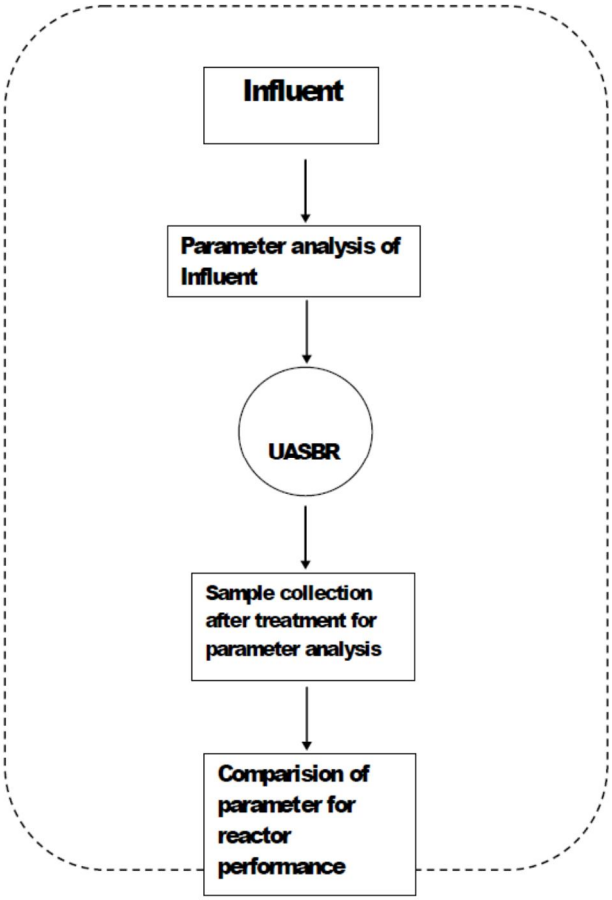
Total volume of the Reactor, lit	18.3lits
Height of the Reactor, cm	75
Effective height of the Reactor, cm	52
Effective diameter of the Reactor, cm	20
Diameter of the Reactor at Top, cm	42
Diameter of the GLSS as Top, cm	10
Diameter of the GLSS at Bottom, cm	18
Total height of the GLSS, cm	12
Diameter of the Influent & Effluent Pipes, cm	0.8
Effective volume of the Reactor	18.3
Sample 1 height from bottom	14
Sample 2 height from bottom	30
Sample 3 height from bottom	50
Height of the inlet from bottom level	10
No of sample ports	3

VI. TERATMENT PARAMETERS AND PROCESS

The characterization of the Tannery Wastewater and the experiment on the laboratory scale UASB model was conducted using different pollutant parameters namely pH, Solids estimation, Biochemical Oxygen Demand [BOD], Chemical Oxygen Demand [COD], total Nitrogen and total Phosphorus were measured during the experiment for the purpose of monitoring the treatment process.

A. Process in Flow Chart



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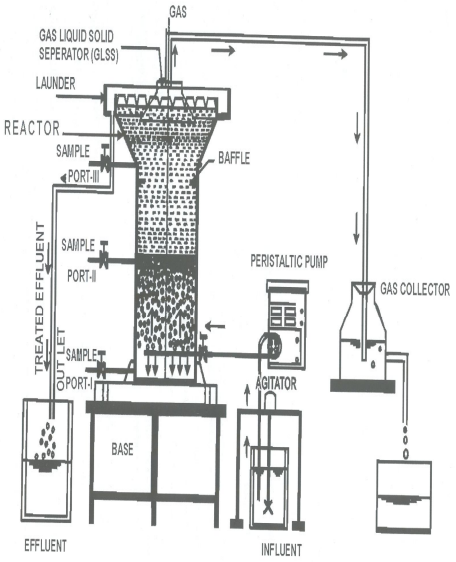

Figure 3.1. LABORATORY EXPERIMENTAL SETUP FOR UASBR - 25 LITRES

VII. RESULTS AND DISCUSSION

The sample was collected and the treatment process was done.

A. Sample Analysis Report For Tannery Effluent

Industry : TANNERY
Sample drawn from : ANNAI FATHIMA TANNERY
RANIPET, VELLORE.
Date of Collection : 25-02-2016
Sample Quality : 5lits

B. Our Parameter Analysis Of The Tannery Effluent Before Treatment

S. No	Parameters	Sample
1.	Ph	7.8
2.	Total suspended Solids, mg/l	1728
3.	Total Dissolved Solids, mg/l	38192
4.	Total Solids, mg/l	6450
5.	BOD mg/l	3700
6	COD mg/l	8853
7.	Colour	Dark grey

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C. RESULT FOR THE TANNERY WASTE WITH UASB REACTOR

PARAMETERS	OUR SAMPLE LEVEL (Before treatment) (mg/l)	OUR SAMPLE LEVEL (AFTER TREATMENT) (mg/l)
PH	7.8	7.3
Total Solids	6450	3210
BOD	3700	1200
COD	8853	1750
TSS	1728	458
TDS	38192	15780
COLOUR	DARK GREY	LIGHT ORANGE

From the values obtained from laboratory the comparison graphs for the samples before treatment and after treatment is done with an interval of 5days

VIII. CONCLUSION

After 30days the growth of microbial organism get occurred after that we injected the tannery waste water of 50ml in the inlet then waited for 5days for proper treatment and after that the parameters of the outlet water get checked to refer the previous analysis.
The comparison of parameters table explain that the reduction of parameters and also shows that our treatment get success in our reactor.At last the parameters get checked with before and after treatment shows that our reactor is working well with reduction of the parameters. By comparing the parameters reduction we can say that the process we did is going on in a positive manner and our reactor is performing well.
Finally the treatment of Tannery effluent was achieved by using U.A.S.B reactor process.

IX. ACKNOWLEDGMENT

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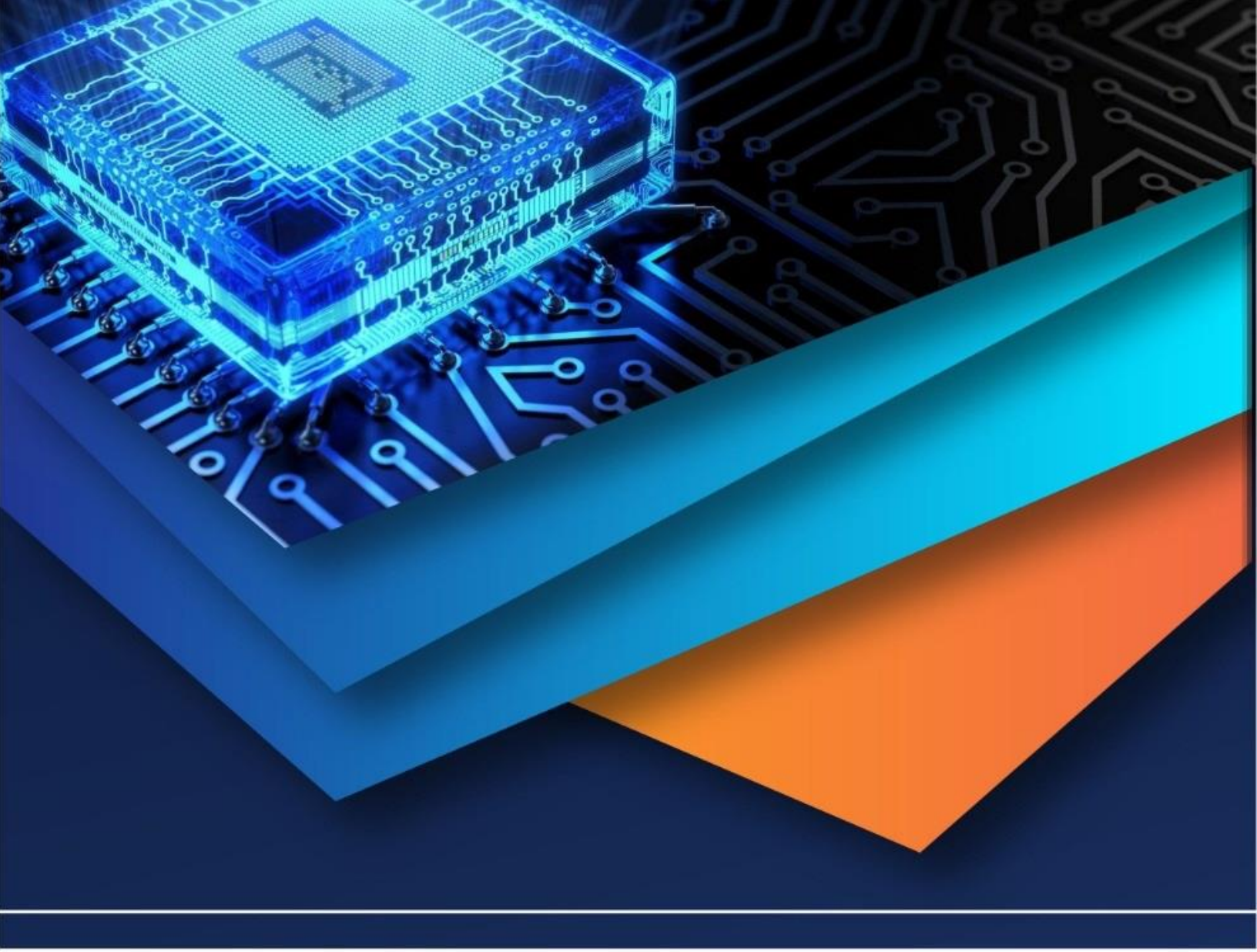

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