Energy Conservation in Tannery Effluent with Advanced Technology

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Abstract- **In India, tannery industry is the one of the major industries and characteristics of tannery waste water vary considerably from depending upon the size of tannery, chemicals used for specific purpose, amount of water used and type of final product produced by a Tannery. In tannery industries, tanning is a main process and making of leather from the skins of animals which does not easily decompose. Manufacturing of leather, leather goods, leather boards and fur produces numerous by-products, solid wastes, high amounts of wastewater containing different loads of pollutants and emissions into the air.**

This paper deals with collection of tannery waste from various leather factories and its characteristics are analyzed and to reduce the Chemical Oxygen Demand, Chromium content by advanced technology .During the treatment process biogas is produced and used for domestic purposes.

1. INTRODUCTION

Tanning industry also has one of the highest toxic intensity per unit of output. Tanneries generate wastewater in the range of 30 - 35 L/kg skin / hide processed with variable pH and high concentrations of suspended solids, BOD, COD, tannins including chromium. The uncontrolled release of tannery effluents to natural water bodies increases health risks for human beings and environmental pollution. Effluents from raw hide processing tanneries, which produce wet blue, crust leather or finished leather contain compounds of trivalent chromium (Cr) and sulphides.

The principal objective of wastewater treatment is generally to allow human and industrial effluents to be disposed of without danger to human health or unacceptable damage to the natural environment.

A major advantage of UASB treatment is the controlled, continuous production of valuable biogas. The biogas contains 60-85% methane and is a valuable energy source. The closed anaerobic process systems also prevent large quantities of methane (an important greenhouse gas) being emitted to atmosphere .Biogas is the ultimate waste product of the bacteria feeding off the input biodegradable feed stock and is mostly methane and carbon dioxide, with a small amount hydrogen and trace hydrogen sulphide. It will bring great economical social and environmental benefit.

2. LITERATURE STUDY

Yabfang NIU, Xingyuan MA, Rui WANG and Congzheng YU., (2006) studied about the treatment of high density tannery effluent with UASB reactor. The macro molecule organic compounds in tannery effluents were degraded into small molecule organic acids by the acid-producing bacteria at the bottom of UASB reactor.G. Durai and M.Rajasimman., (2001) found out that tannery waste water are highly complex are characterised by high contents of organic , inorganic and nitrogenous compound, chromium, sulphides, suspended solids and dissolved solids.

Lihui Huang, Baoyu Gao, Peng Guo, Bo Zhang., (2006) made a detailed study on combined system consisting of an up-flow anaerobic sludge blanket (UASB) and anoxic /aerobic bioreactor was introduced to treat a mature landfill leachate with a high ammonia concentration and low ratio of COD/TN..

Wang Bing, Han Hongjun, Tian Wende, Liu Shuo and Ma Wencheng., (2004) In this study, granule activated carbon was adopted as carrier to speed up the cultivation of granular sludge in a UASB reactor treating beer waste water.The results showed the granulation process of UASB was finished just on day 63rd and the COD removal efficiency reached as high.

Lihui Huang, Bo Zhang, Baoyu Gao and Lei Feng., (2009) An up-flow anaerobic sludge beds (UASB) reactor was fed with fishmeal industry wastewaters at different salinity levels in order to assess the effects on anaerobic granular sludge properties. The results show that fishmeal industry wastewater consists of abundant nutriment which are beneficial to the formation and activity of anaerobic granular sludge, and that the inhibition of granular sludge will occur when the wastewater sodium concentrations increase in steps.

Xinmei Fu, Nges Ivo Achu, Emma Kreuger and Lovisa Björnsson., (2007) made a study on process performances during anaerobic digestion of a mixture of energy crops (sugar beet, maize and triticale) in one stage CSTR reactors and batch two-stage leach bed-UASB reactors were investigated separately and compared each other.

Rameshraja. D. and Suresh. S., (2001) Studied about general overview on the prospective of various oxidation and combined processes in the treatment of tannery industry effluent are reported. The tannery wastewater with sulphide as main sources of pollutant, electro-coagulation is the best removal efficiency process among the other oxidation processes, whereas for chromium, photo catalytic oxidation process using nano-TiO2 and wet air oxidation in the presence of manganese sulphate and activated carbon as a catalyst are more efficiency processes. The integrated combined processes described permit to meet disposal limits, health quality standards and the recovery of several chemicals utilized in the tanneries.

Yong Gao., (2008) found out that monosodium glutamate (MSG) wastewater is a very refractory case of High strength organic wastewater. Toinvestigate the effect of operating variables on treatment of MSGwastewater, a laboratory scale study was conducted. Thetreatment of MSG wastewater was studied in a continuous flowanaerobic fluidized blanket (UASB) reactor.

Lu WANG and Yong-feng Li., (2001) In order to discuss the ability of H2-production and wastewater treatment, a up-flow anaerobic sludge bed (UASB) using a synthesized substrate with brown sugar wastewater was conducted to investigate the hydrogen yield, hydrogen producing rate, fermentation type of biohydrogen production, and the chemical oxygen demand (COD) removal rate, respectively.

Yi Sun and Yu-wen Li., (2002) used kind of high efficient equipment of waste treatment, Up-flow Anaerobic sludge Blanket(UASB)has many advantages, such as effluent quality steady operation, broad application on treatment high concentration organic wastes.

2.1 Significance of the study

Major problems are due to tannery wastewater containing heavy metals, toxic chemicals, chloride, lime with high dissolved and suspended salts and other pollutants. Biodegradation of tannery wastewater using activated sludge process has been reported by many research workers. Several works have been carried out on tannery wastewater treatment using different methods has gained more and more importance in wastewater treatment plants. The main advantages of UASB technology is easy operation, low cost, handling hydraulic fluctuation, no need for settling tank and sludge recycling as well as organic load without any significant variation in removal efficiency.

3. TREATMENT PROCEDURE

3.1 Sample Collection

Samples from various tanneries where collected from in and around Erode city. Collection and characterization of tannery effluent target area water.

- Selection of the tannery industry.
- Selection of the target area.
- Collection of the tannery industry effluent.
- Characterization of the tannery industry effluent.

Fig: 1: Sample Collected From Tannery Industry

3.2 Materials

The waste water used in this study is collected from various tannery industries. The fresh Cow Dung Slurry was added to the above waste water to supplement the reaction process. It is used as a

seeding material for the reaction process in the UASB (Up flow Anaerobic Sludge Blanket Reactor.Effective micro-organism was collected from private company was used to accelerate the reaction process.

3.3 Up flow anaerobic sludge blanket (UASB) reactors.

The UASB is a high rate suspended growth in which a pre-treated raw influent is introduced into the reactor from the bottom and distributed evenly. “Flocs” of anaerobic bacteria will tend to settle against moderate flow velocities. The effluent passes upward through, and helps to suspend, a blanket of anaerobic sludge. Particular matters are trapped as it passes upward through the sludge blanket, where it is retained and digested.

Digestion of the particular matter retained in the sludge blanket and breakdown of soluble organic materials generate gas and relatively small amounts of new sludge. The rising gas bubbles help to mix the substrate with the anaerobic biomass.

The biogas, the liquid fraction and the sludge are separated in the gas/solid/liquids phase separator, consisting of the gas collector dome and a separate quiescent settling zone. The settling zone is relatively free of mixing effect of the gas, allowing the solid particles to fall back into the reactor; the clarified effluent is collected in gutters at the top of the reactor and removed. The biogas has methane content typically around 75% and may be collected and used as a fuel or flared.

3.4 Effective Micro Organisms (EM)

Effective microorganisms is a group of organisms that has a reviving action on humans, animals, and the natural environment and has also been described as a multi–culture of coexisting anaerobic and aerobic beneficial microorganisms (EM Trading 2000). The main species involved in EM include:

- Lactic acid bacteria – Lactobacillus plantarum, L.casei, Streptoccus lactis.
- Photosynthesis bacteria – Rhodoseudomonas, Plaustrus, Rhodobacterspaeroides
- Yeast – Saccharomyces sereviside, S.griseus
- Fermenting Fungi – aspergillus oryaze, Mucor hiemalis(Diver 2001)

The basis for using these EM species of microorganisms is that they contain organic acids due to the presence of lactic acid bacteria, which secrete organic acids, enzymes, antioxidants and metallic chelates (China 1998).

One of the major benefits of the use of EM is the reduction in sludge volume. Theoretically, the beneficial organisms present in EM should decompose the organic matter by converging it to carbon dioxide (CO_2), methane (CH_4) or use it for growth and reproduction.

Studies have suggested that this is the case for both waste water treatment plants and also septic tanks. This is highlighted by Fertag (2000), who suggested that introduction EM into the anaerobic treatment facilities helped to reduce the unpleasant by-product of this decomposition and also reduce the production of residual sludge. The EM should assist in Treatment of waste water by improving the quality of water discharge the volume of sewage sludge produced.

SETUP OF ANAEROBIC REACTOR (UASB Reactor)

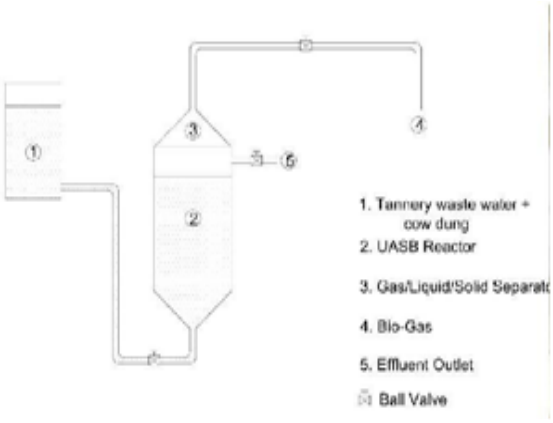

Fig: 2: Diagram of UASB Reactor

Fig: 3: UASB Reactor Before Production of Biogas

Fig: 4: UASB Reactor After Production Of Biogas

The chemical characteristics of tanner waste water are illustrated .The tests are carried out before the treatment.

4. RESULTS AND DISCUSSION

Table 1: Chemical characteristics of sample collected.

S.No	Parameters	Results
1	pH	8.70
2	T. Alkalinity mg/l	3400.00
3	T. Acidity mg/l	Nill
4	Chromium mg/l	1.80
5	COD mg/l	11680
6	BOD_5 mg/l	3410

Table 2: Operational Parameters and Treatment Efficiency of UASB

Days		pH
0	- 5	8.7
5 -	10	8.7
10	- 15	8.7
15	- 20	8.61
20	- 25	8.61
25	- 30	8.58
30	- 35	8.42
35	- 40	8.4
40	- 45	8.15
45 -	48	8

Table 3: Chemical Characteristics after UASB reactor.

S.No	Parameters	Results
1	pH	8.0
2	T. Alkalinity mg/l	135
3	T. Acidity mg/l	Nill
4	Chromium mg/l	0.6
5	COD mg/l	2300
6	BOD_5 mg/l	2906

5. CONCLUSION

Based on the performance evolution of UASB reactor the following collusion has been drawn.

1. UASB reactor can be started successfully in 48 days tannery effluent is treated.
2. This indicates that the tannery wastewater has better anaerobic biodegradability at the suitable COD.
3. Along the whole length of UASB reactor, methanogen gradually converts the organic acids into the methane gas and carbon dioxide, to achieve a waste of resource utilization.
4. The biogas has methane content typically around 75% and may be collected and used as a fuel and domestic purposes.
5. A considerable rate of decrease has been found out in the values of COD, BOD5, Chromium, pH, Acidity and Acidity.
6. As a result of the treatment of tannery effluent using USAB reactor, Bio-Gas production has been produced.

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