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PERFORMANCE STUDY ON MODIFIED USABR FOR TREATING DAIRY EFFLUENT

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Key words : UASBR, COD, HRT, OLR, VSS and Biogas

ABSTRACT

Dairy effluent is the most dynamic and varying in its characteristics, as all effluent streams are only from cleaning and washing activities. It is a high COD waste stream with certain inhibitory factors like cream of milk and residues of milk products like gee, butter etc., Anaerobic techniques like UAS-BR do require specific pre treatment operations for its effective operation and hence they are not widely used. The typical dairy effluents are synthetically prepared for varying COD values [1563.28, 2559.00, 3560.16, 4043.17 and 4571.15 mg/L] and an UASB model was studied. The study was repeated for varying Hydraulic Retention Time [6, 10, 12, 18 & 24 hrs] and performance of model was evaluated in term of % COD removal, VSS in the reactor and biogas generation.

INTRODUCTION

Dairy plants in India, Seldom incorporated UASBR in their effluent treatment facilities while only Aerobic Reactors are in popular use. Applications of Anaerobic digester to remove COD at first stage for effective Aerobic Oxidation subsequently are recently introduced. In this study, UASBR which is a time-tested, Proven technology to remove COD up to 80 % for biodegradable waste stream (BOD/COD: 0.4 to 0.6) is evaluated with an experimental model for its performance and a detailed experimental study was conducted.

EXPERIMENTAL SET UP

The experimental setup consists of an UASB Reactor having 25 litres of effec-

tive volume. The features and process parameters are listed in Table-1 the schematics of the experimental setup is presented in Fig. 1.

Table 1	
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Process parameters of the experimental model (UASBR- 25 Lit.)

:	25
:	69
:	60
:	20
:	36
:	7.2
:	17
:	9
:	1
:	2.5
:	1563.28, 2559.00, 3560.16,
	4043.17, 4571.15
:	6, 10, 12, 18, 24
:	PP-20 Model

Table 2 Report of analysis (average values)					
1.	pН	6.69			
2.	Total Suspended Solids, mg/L	600.00			
3.	Total Dissolved Solids, mg/L	2350.00			
4.	Total Volatile Solids, mg/L	550.00			
5.	Total Fixed Solids, mg/L	1800.00			
6.	Total Solids, mg/L	2950.00			
7.	$BOD_{5} @ 20^{\circ}C, mg/L$	2050.00			
8.	COD, mg/L	4200.50			
9.	Nitrogen [as N], mg/L	16.80			
10.	Phosphorus [as P], mg/L	15.15			
Table 2					

Table 3 Chemical composition of the synthetic dairy wastewater						
: Va	aried					
: Va	aried					
: 50	mg/L					
: 3 r	ng/L					
: 0.4	4 mg/L					
: 60	mg/L					
: Va	aried					
	ble 3 ne synthetic da : Va : 50 : 31 : 0.4 : 60 : Va					

EXPERIMENTAL METHODOLOGY

The model was commissioned with domestic wastewater collected from the sewage treatment facility of our University. The model is found to acclaim the process stabilization with an average COD Removal of 74 % in 80 days.









At least three random samples were drawn from M/s. Hatsun Agro Industries Pvt. Ltd., Karipatti, Salem Dist., T.N., analyzed for critical parameters. The report of analysis, as their average values, is presented in Table 2.

The real time wastewater was introduced in the reactor with an average OLR of 0.54 Kg COD/m³/day and in stages, mixed with domestic wastewater in proportion with 20 %, 40 %, 60 %, 80 % and 100 %. The process stabilization and acclimatization was get achieved with an average of 74 % COD removal in 30 days.

The synthetic dairy plant effluent is prepared by using milk powder considered for the experiment and introduced after the process stabilization. The chemical composition of the synthetic dairy plant effluent is presented in Table The model was 3. run under different Organic Loading Rates (OLR) ranges from 0.29 to 4.43 Kg COD/m³/day for an average influent COD values of 1563.28, 2559.00, 3560.16, 4043.17 and 4571.15 mg/L and for different Hydraulic Retention Times (HRT) of 6, 10, 12, 18 and 24 hrs respectively.



RESULTS AND DISCUSSION

Fig. 2 shows the maximum COD removal at 77.68 % for $3.55 \text{ Kg COD/m}^3/$ day of Organic Loading Rate (OLR).

Fig. 3 shows the maximum COD removal at 77.68 % for Hydraulic Retention Time (HRT) of 24 hrs.

The Volatile Suspended Solids (VSS) and Biogas conversion correlation with the % of COD removal efficiency are shown in the Fig. 4 & 5.

CONCLUSION

The modified UASBR is found to treat diary plant wastewater for a maximum of % COD removal efficiency at 77.68 % and 0.318 m³ of gas/kg COD removed. Hence, UASBR can be recommended for removing up to 77.68 % of COD in Dairy effluent and the rest can be removed in the down stream aerobic systems.

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