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ASSESMENT OF BIOMETHANIZATION POTENTIAL OF DAIRY WASTEWATER

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ABSTRACT

Biogas produced by biomethanization of dairy wastewater, contributes to sustainable reliable and renewable energy. Due to the lack of proper treatment facilities; the waste undergo degradation naturally resulting in methane and other green house emissions into the atmosphere. An attempt was made to convert the waste into sustainable, reliable and renewable energy. In the present study biomethanization of dairy wastewater were studied in a 13lit biodigester with a HRT of (1.87, 2.08, 2.88, 3.74,5.34) days. The production of biogas was for 0.18 to 0.37 m3 of gas/kg COD removed.

INTRODUCTION

Anaerobic digestion system have been made with physiological interactions among different microbial species, effect of toxic compounds and biomass accumulation. The anaerobic process would be an economically alternative for the treatment of different types of industrial wastes including wastes of the collagenous (Lalitha *et al*. 1994).

The constant use of fossil fuels as primary energy source has lead to global climate, environmental degradation and human health problem (Budiyano *et al*. 2010). Renewable energies play an important role in the biomethanization process and in particular biomass could contribute in a significant way because it is a carbon neutral fuel(Francesco and Buratt, 2009).

Biomethanization has been employed in the developing countries. Bio gas production is a sustainable solution to treat waste and the cost of waste treatment is low (Verstraete *et al*. 2005). This is a cheap process that produces methane from biomass as well as fermentation sludge for fertilizer. The present study was undertaken to investigate the assessment of biomethanization potential of dairy wastewater by using fixed film fixed bed reactor. To evaluate the energy, environmental and economical view point.

MATERIALS AND METHODS

A laboratory scale model was fabricated with a working value of 13 litres of anaerobic bio film reactor. The reactor was made up of clear acrylic Plexiglas filled with fugino spirals and sealed to avoid any air entrapment. The physical features of the experimental model is shown in the Table 1 and the characteristics of Dairy Wastestream is shown in the Table 2.

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The materials were packed in the reactor to avoid flow tortousity and other physical factor at a height of 50cm.The digestor was continuously feed with diluted real time dairy wastewater at the flow rate of (0.43, 0.86, 1.20, 1.72, 2.16) l/d by means of a peristaltic pump with varies HRT of (1.87, 2.08, 2.88, 3.74 and 5.34) days. The schematic of the experimental setup is shown in the Fig. 1.

Table 1. Physical Feature and Process Parameters of Experimental Model

Reactor volume (liters)	13
Reactor height (cm)	125
Reactor diameter (cm)	12
Height of bio mass support media fill (cm)	50
Diameter of the influent and effluent pipes(cm)	0.6
Sample ports from the bottom of the reactor(cm)	
S1	20
S2	45
Influent average COD, (mg/L)	2072,2608,3024
Hydraulic Retention Time	1.87,2.08,2.88,3.74,5.34
Peristaltic pump (Miclin's make)	PP 10 model

The treatment process acclimation was achieved by operating the plant with screened sewage drawn from the treatment facilities of Annamalai University.

Table 2. Characteristics of Dairy Waste Stream

S. No.	Parameters	Sample -1	Sample - II	Average
1.	pH	6.62	6.75	6.68
2.	Total Suspended Solids, mg/L	560	590	575
3.	Total Dissolved Solids, mg/L	2380	2560	2470
4.	Total Volatile Solids, mg/L	2310	2160	2235
5.	Total Fixed Solids, mg/L	850	910	880
6.	Total Solids, mg/L	2940	3150	3045
7.	BOD_5 @ 20°C, mg/L	2180	1950	2065
8.	COD mg/L	2880	3160	3020
9.	Nitrogen (as N) mg/L	17	17.60	17.30
10.	Phosphorus (as P) mg/L	15	14.30	14.65

The dairy effluent was collected from M/S HATSUN AGRO INDUSTRIES SALEM, TN, India and physical characteristics of the parameter were analysed by Using procedure from standard methods APHA(1992) and tabulated in Table 2. The reactor was operated at five different influent COD (2076,2608,3024) mg/L of wastewater with vary HRT (1.87,2.08,2.88,3.74,5.34)days. biogas production was monitored throughout the period of study.

RESULT AND DISCUSSIONS

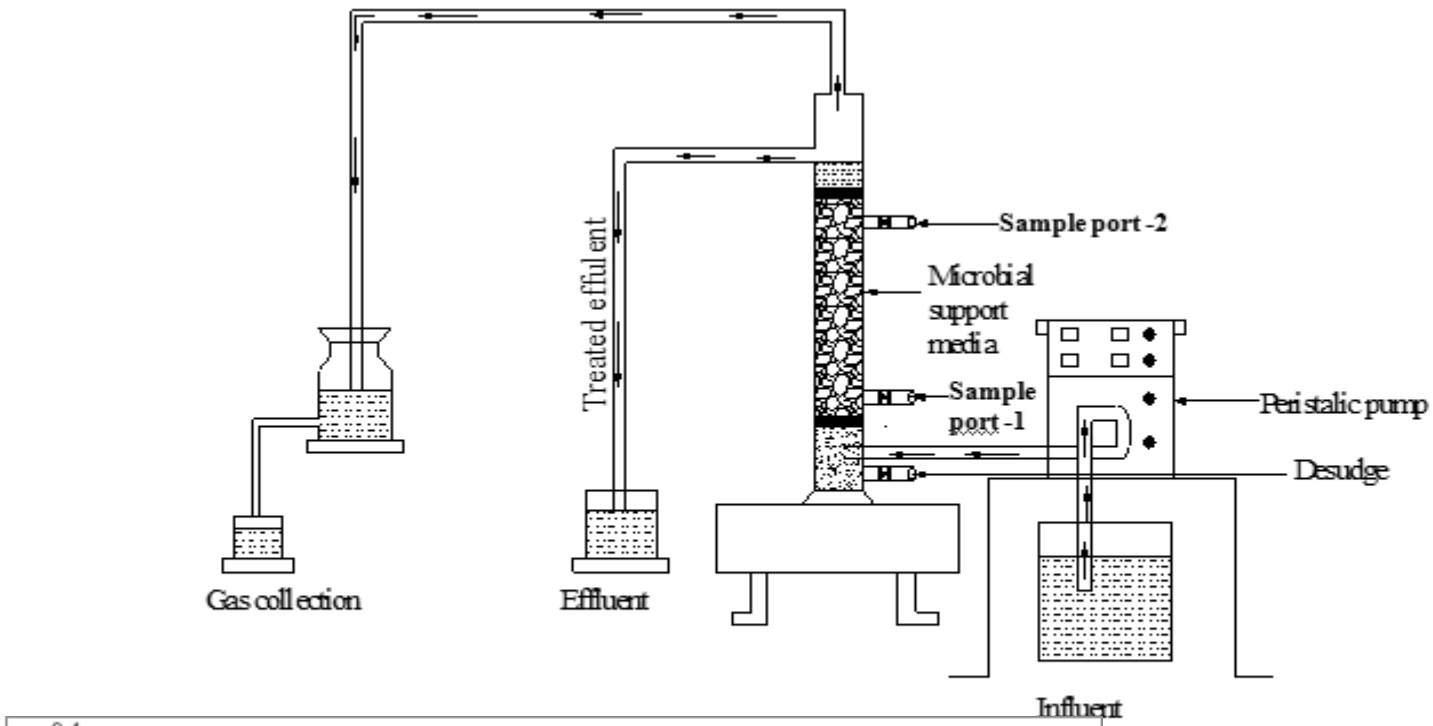
Biomethanization process involves hydrolysis, acidogenesis, and methanogenesis. This process is characterized by a series of biochemical transformation brought on by different consortia of bacteria.

The trend of biogas production with respect to HRT is shown in the Fig. 2. The maximum COD removal effluent was achieved at 82%.The rate of biomethanization was highest for 5.34 days of HRT at 3020 mg/L influent COD. Biomethanization of the digestor was caused at the mesophilic range. The profiles of cumulative biogas yield with respect to HRT is shown in Fig. 1.

Biogas production was slow at the beginning COD high rate at the end period of observation. This is predicted due to the biogas production corresponding to the COD removal efficiency. The initial slow production of biogas clearly indicates that the digestor does not have essential microbes for early evaluation of gas and neccerate enriched seeding to enhance biomethanization, The slow to higher production of biogas is due to the fact that the HRT period for attaining maximum product rate 0.084 kg COD/m^3.d.

CONCLUSIONS

The present study revealed that the dairy wastewater is a very good biogas production needing specific growth of methanogenic bacteria in the biodigestor. The use of dairy wastewater for biogas generation will be a good energy source. The results of this study shown that the maximum COD removal was achieved at 82% with a HRT of 5.34 days. The maximum biogas yield was attained at an organic loading rate of 0.084 kg COD/m^3.day.The reactor efficiency of treating dairy wastewater at an OLR was studied and its performance was accessed by monitoring COD and bio gas production. The reactor achieved COD removal efficiency was observed from 61% to 82% and the biogas yield was from 0.18 to 0.37m^3 of gas/kg COD removed.The use of dairy wastewater for bio gas generation therefore, will be a good energy source for the industry and those residing areas.



reactor

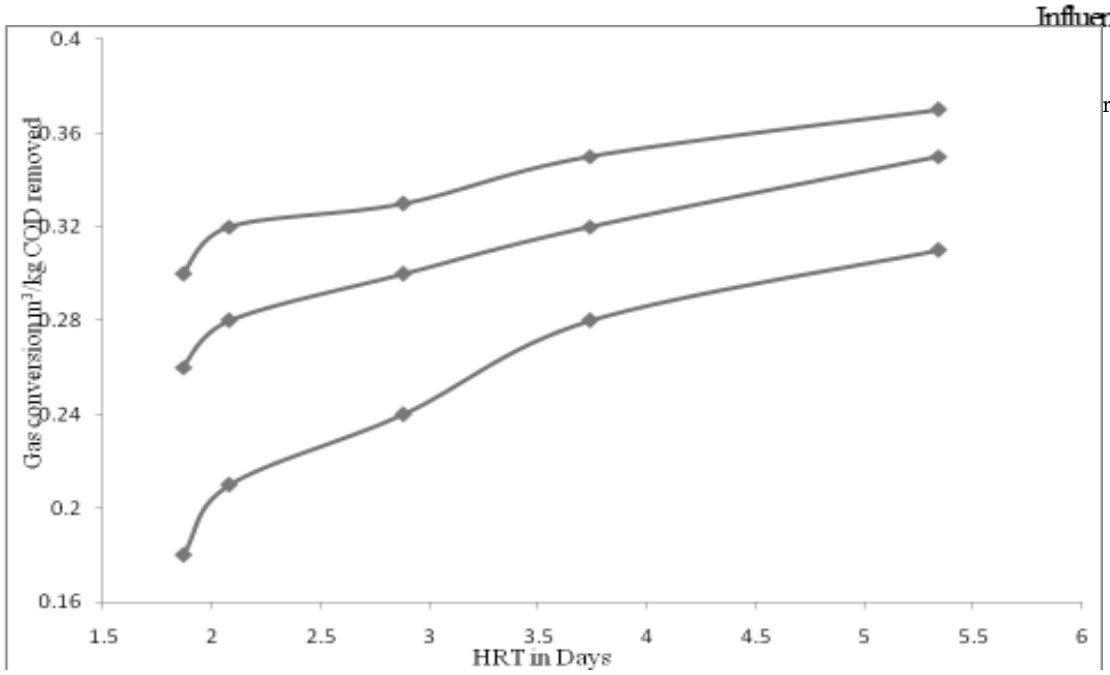


Fig. 2 HRT in Days Vs Gas conversion m3/kg COD removed for an average COD of 2072mg/l,2608mg/l,3024mg/L.

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