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Experimental Study on Biogas Production by Using Various Organic Wates

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Abstract: *A biogas is a modern energy source and is suitable to necessities of the future with the appropriate application of the digestion technology. The bulk of our work was performing the anaerobic digestion of wastes rich in organic matter in a laboratory prototype. Project was to create organic facility to create biogas which will be more cost effective, ecofriendly, cut down on organic wastes (cow dung, food waste, wood chips, komayam) generate high quality renewable fuel, and reduce carbon di-oxide and methane emission. Anaerobic digestion is a microbial process for production of biogas. Which consist of primarily methane (CH4) and carbon di-oxide (CO2). In this study the waste product, as a seeding material in the ratio of R1- CD 50% and water 50%, R2- CD 25% FW 25% water 50%, R3- FW 30% WC 20% water 50% R4-Komyam 50% FW 20% water 30%R5-komyam 65% water 35%. Replace in the 20 litres of reactor and is closed tightly to maintain anaerobic condition and evaluate their quantity of biogas production day by day by using of water displacement method. In the R2, R4, R5 ratio combinations gave the high yield of biogas and degraded the organic contaminants efficiently.*

Key words: *Seeding material, CW- cow dung, FW- Food waste, WC- Wood chips, komayam, anaerobic digester, organic pollutants, water displacement method*

I. Introduction

Million tons of solid waste are produced annually from municipal, industrial, and agricultural sources. The indiscriminate decomposition of these organic wastes results in large-scale contamination of land, water, and air. Biogas production is the best method to reduce this waste production and its effects. Under anaerobic conditions, organic contaminants in wastes are degraded by microorganisms generating methane and carbon dioxide. The degradation process is effective when compared to the more conventional aerobic processes. In our project we are planned to produce biogas by using waste materials like cow dung, food waste, woodchips, komayam.

II. Sample Collection And Seeding Material Preparation

The organic waste sample was collected from the surrounding villages. The required amount of sample for the experimental purpose was conserved in a incubator. The seeding materials like cow dung, food waste, wood chip, komayam was collected. The seeding materials are prepared for the various proportions. The water displacement method was used to calculate the quantity of biogas production from the various reactors in day by day.

III. Experimental study

3.1 Initial characteristics of sample

The organic wastes are collected and the initial characteristics are completed. The chemical characteristics were completed. There is pH, Total Solids, Total Dissolved Solids, Ammonia, Calcium,

Table .1 Initial characteristics of sample

Parameters	R1	R2	R3	R4	R5
PH	7.71	7	6.8	7.1	7.26
BOD	131.95	91.35	50.75	274.05	50.75
COD	6.92	9.92	6.64	3.93	7.58
TS	15000	20000	35000	40000	0
TSS	10000	12500	20000	10000	0
TDS	5000	7500	15000	20000	0
Calcium	100	175	180	600	875
Hardness	15	16.9	15.65	17.2	15.4
Ammonia	8164.56	6684.68	6879.9	6564.5	6842.3

Hardness, Total Suspended Solids, BOD, COD. The obtained results are shown in the Table1**.**

3.2 Bottling Process Test

The bottling process is used as a key of the anaerobic biodegradation. The capability of a biomass produce biogas can be evaluated by bottling process. It has been broadly used to determine the methane yield of organic substrate in definite situation. The span of the test varies depending on the biodegradation of organic substrate under study. This method can be used to determine the amount of organic carbon in a given substantial that can be an aerobically transformed to methane and to evaluate the biogas productivity of the anaerobic process on a given substantial. The data provided by bottling process is respected when evaluating anaerobic substrate and for enhancing the operation of an anaerobic reactor.

3.2.1 Experimental Setup for the Bottling Process

Test The experiment was executed in 500 ml serum bottles. The actual volume of the reactor was maintained as 300 ml rest of 200 ml space was left free for gas collection. Anaerobic seed samples and the water was mixed at different proportion and added to the bottles. Then the bottles are sealed with rubber cork throughout the experiment. The reactor was stirred by daily shaking and swirling. A retention time of minimum 30 days was maintained for the reactors or till the end of the biogas production. A tube is put in through the cork such a way that one ends a needle. This needle was connected to the rubber cork of the serum bottle to measure the gas production by water displacement method. This setup is done to reduce the interaction of oxygen. The representation bottling process is shown in the Figure 1.

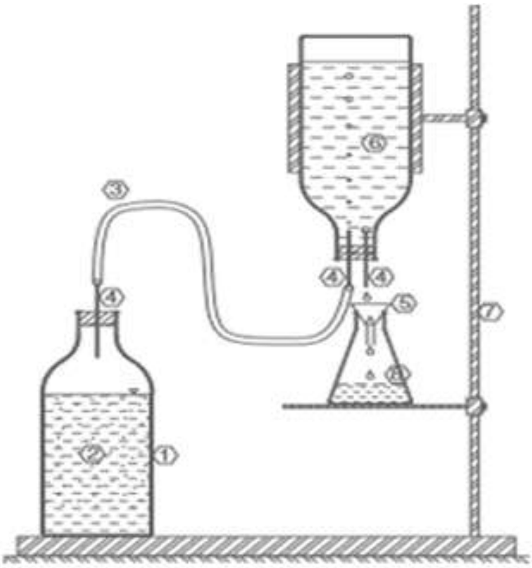

Figure1. Schematic Diagram of bottling process

3.2.2 Ratio of reactor by waste water and activated sludge

In this process 500ml reactor named as R1, R2, R3, R4, and R5 was completed in the various proportions with the volume of 500ml. The samples are placed in reactor respectively. The respective percentage of seeding material is added. The proportion ratio of samples is shown in the Table 2. The ratio of the reactor R1 by 50% of cow dung & 50% water are to be done. In the 500 ml of bottle the 150 ml of sample and 150 ml of water is poured in to the bottle and their gas production by the ratio is collected by the conical flask by the water through a water displacement method. The ratio of the reactor R2 by 25% of cow dung & 25% food waste and 50% water are to be done. In the 500 ml of bottle the 75 ml of cow dung and 75 ml of food waste and 150 ml of water are poured in to the bottle and their gas production by the ratio is collected by the conical flask by the water through a water displacement method. The ratio of the reactor R3 by 37% of food waste & 13% wood chips and 50% water are to be done. In the 500 ml of bottle the 100 ml of food waste and 50 ml of wood chips and 150 ml water are poured in to the bottle and their gas production by the ratio is collected by the conical flask by the water through a water displacement method. The ratio of the reactor R4 by 50% of komayam& 25% food waste and 25% water are to be done. In the 500 ml of bottle the 150 ml of komayam and 75 ml of food waste and 75 ml of water are poured in to the bottle and their gas production by the ratio is collected by the conical flask by the water through a water displacement method. The ratio of the reactor R5 by 65% of komayam& 35% water are to be done. In the 500 ml of bottle the 200 ml of komayam and 100 ml of water are poured in to the bottle and their gas production by the ratio is collected by the conical flask by the water through a water displacement method. The characteristics are done and the range of the parameter of samples with seeding material by various ratio are shown in the Table 3. The percentage removal of Total Solids, Calcium, Hardness, BOD, COD of wastewater with seeding material VS water are shown in the Figure 2.

Table 2. Ratio of samples (S) and water (W)

Symbol	% of sample	% of water
R1	50c.d	50
R2	25 c. d+25f.w	50
R3	30f.w+20w.c	50
R4	50k+25f.w	25
R5	65k	35

Table 3. Characteristic result of samples and water

Parameters	R1	R2	R3	R4	R5
PH	6.55	5.95	5.78	6.03	6.17
BOD	79.17	77.64	43.13	164.43	42.63
COD	5.88	8.53	5.57	3.34	6.92
TS	10500	13000	29050	24000	0
TSS	8500	10250	13000	8400	0
TDS	4100	6375	12000	15000	0
Calcium	75	129.5	140.4	420	568.7
Hardness	12.75	14.54	13.14	14.1	12.3
Ammonia	6123.42	4345.04	4471.9	6564.5	6842.3

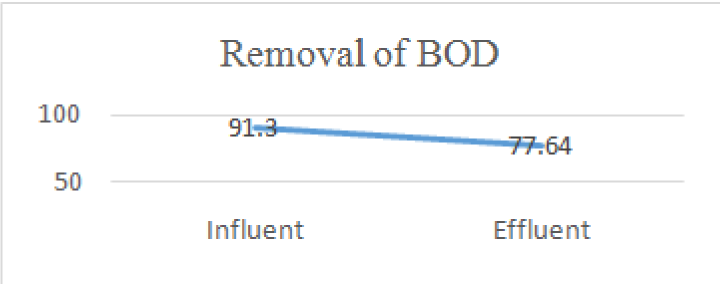

Figure 2. (a) Removal of BOD (mg/l) in R2

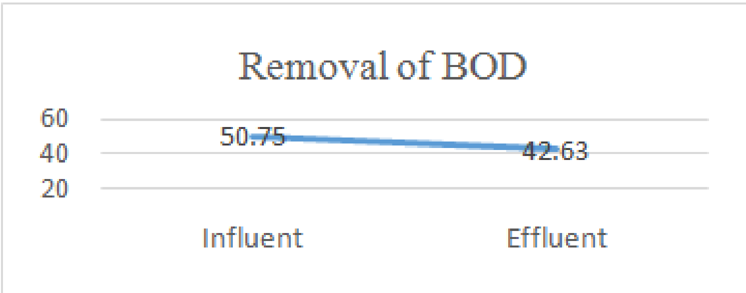

Figure 2. (b) Removal of BOD (mg/l) in R5

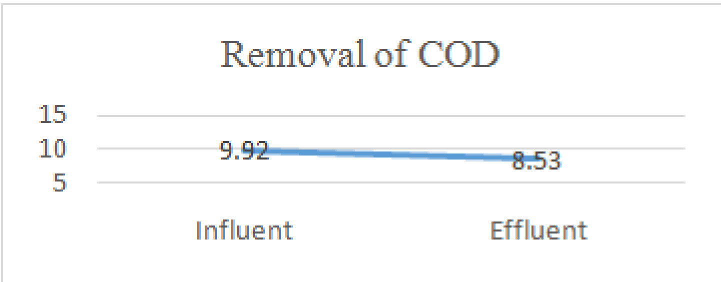

Figure 2. (c) Removal of COD (mg/l) in R2

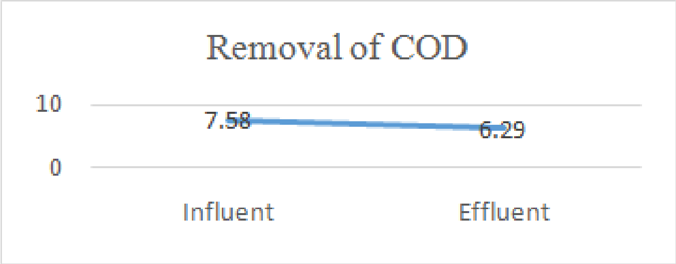

Figure 2. (d) Removal of COD (mg/l) in R5

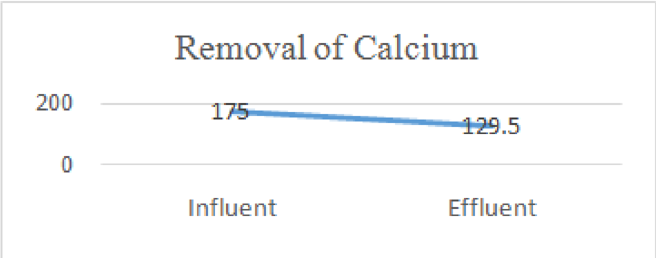

Figure 2. (e) Removal of Calcium (mg/l) in R2

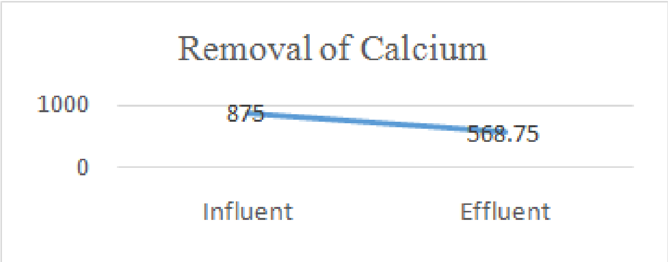

Figure 2. (f) Removal of Calcium (mg/l) in R5

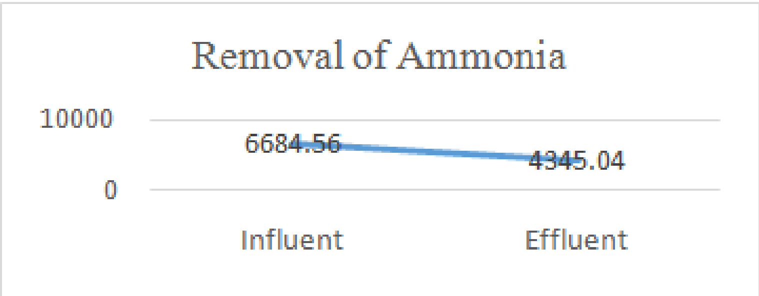

Figure 2. (g) Removal of Ammonia (mg/l) in R2

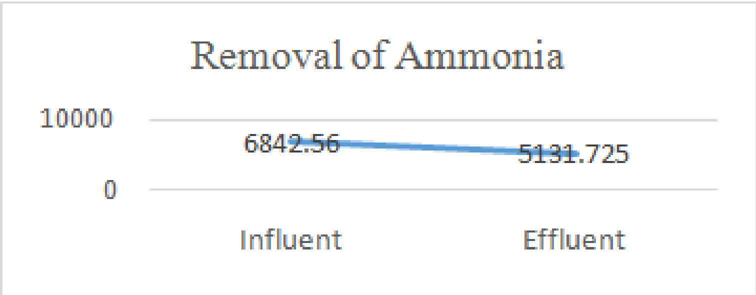

Figure 2. (h) Removal of Ammonia (mg/l) in R5

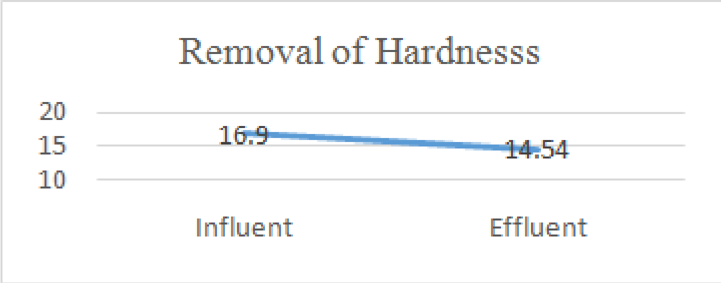

Figure 2. (i) Removal of Hardness (mg/l) in R2

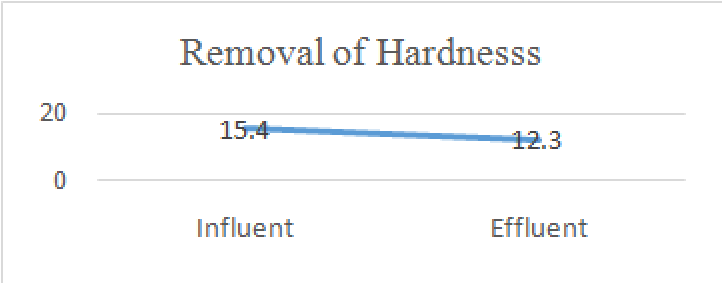

Figure 2. (j) Removal of Hardness (mg/l) in R5

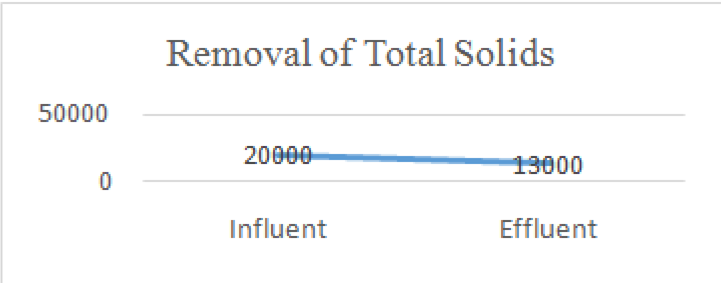

Figure 2. (k) Removal of Total solids (mg/l) in R2
Figure 2. Graphical Representation of various chemical characteristics removal.

IV. Result And Discussion

From this study, the reactor by 65% of komayam and 35% of water produces the more bio gas among the various proportions of reactors. In the bottling process the amount of gas produced by the small quantity which was collected over the conical flask by the water in the mean of water displacement method. The value of biogas by water displacement method is given in Table 4.

Table 4. Evaluation of biogas production samples with water

Day	R1	R2	R3	R4	R5
1	0	0	0	0	0
2	0	0	0	0	0
3	0	0	0	5	5
4	0	0	5	5	5
5	0	0	5	6	10
6	0	0	5	8	5
7	0	1	7.5	10	10
8	0	0	0	0	3
9	0	0	0	0	2
10	0	0	0	0	5
11	0	0	0	0	2
12	0	0	1	1	2
13	0	0	1	1	2
14	0	459	0	0	2
15	5	0	2	5	5
16	10	0	5	10	10

17	10	0	7	15	15
18	12	0	10	10	20
19	15	0	15	17	25
20	17	0	20	20	30

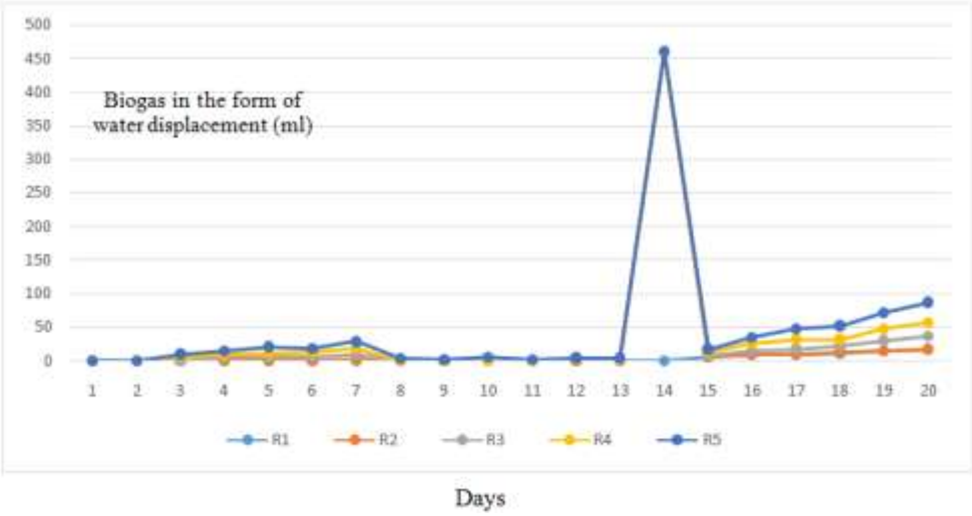

Figure 3. Evaluation of biogas production of samples

V. Conclusion

The biogas was obtained in various ratio especially 65% ofkomayam and 35% of water as well as in case of food waste with cow dung the biogas production is more after 2 weeks.The biodegradation was also found in this investigation where we done. From this analysis we conclude that komayam could produce Biogas more than other materials.

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