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Anaerobic Co-Digestion of Mixed Kitchen Wastes and Buffalo Dung

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ABSTRACT

Kitchen is the important part of house which take cares about the health of family members. It also generates organic wastes which are generally dumped. On the other hand many people felt shortage of animal dung for biogas production. This study is an attempt to find out the way between these situations by finding the suitability of kitchen wastes addition for biogas production. The experiment was performed in 5L glass bottles with two treatments i.e. buffalo dung alone and mixture of dung with kitchen wastes. The bottles were filled on daily feeding basis by the feeding material at 5.3% total solids for the experimentation period of 80 days. On first day 12mL fresh digested biogas slurry from running biogas plant was also added in all the digesters as inoculum. Daily biogas production was measured by water displacement method. Results show that co-digestion of dung and kitchen wastes produces 85.71 to 195.12% higher biogas than dung alone. Overall it produces 2.69 % higher total biogas than buffalo dung alone for the experimentation period of 80 days.

Key words: Biogas production, Supplementation, Waste management.

INTRODUCTION

A huge amount of plant and animal origin organic wastes are being generated daily throughout the world whose management is very difficult because improper management will produces foul odor and pollutants which causes an ill effect on health of living beings. Nature put microorganisms in almost everywhere which has potential to degrade them and utilize for their growth. Some microorganisms are aerobic whereas some are anaerobic and it was found by research that anaerobic digestion is superior to aerobic process because it requires low input cost, easy in operation and produces biogas also.[1-4] The process was initially used to digest animal dung because it was available in huge amount. Slowly many plant and industrial wastes were tried successfully.[5-7] Kitchen wastes can be used for biogas production.[8] Present laboratory study was undertaken to find out the suitability of co-digestion of mixed kitchen wastes with buffalo dung for biogas production.

MATERIALS AND METHODS

Buffalo dung was procured locally and mixed kitchen waste was collected from mess of our centre. This mixed kitchen wastes contains *Bhakhri*, cooked rice and boiled potato and they were mixed in the amount of 2.5g, 5.0g and 5.0g. This mixed kitchen waste was mixed with 20.0g dung to maintain 5.3% total solids concentration. A total of six digester sets of 5L were prepared each connected with one gas holder and water displacement bottle of 2L. All the joints were made airtight and to fill the digesters upto 4.8L in 40 days (Hydraulic Retention Time for Gujarat) 120mL mixture of 40g dung and 80mL water was added daily. After 40 days when the digesters were filled upto the mark then biogas production was measured by water displacement method. The feeding remains continue for next 10 days. From 51st day when the biogas production becomes stable, three digesters were fed with mixture containing 20g dung, 12.5g mixed kitchen wastes and 87.5mL water to maintain its total solids concentration to

5.3%. Remaining three digesters were fed by usual practice of 120mL containing 40g dung and 80 mL water. To maintain the level of feeding material inside the bottle 120mL digested slurry was taken out daily. Now the experiment was run for next 30 days and biogas production was measured daily.

Table. 1: Daily average biogas production (mL per day) in both the treatments receiving dung alone and co-digestion of dung with kitchen wastes

Days	Biogas production (mL per day)	
	Dung only	Co-digestion
Average biogas production during 41-50 days (stable condition)	2100	2100
51	2100	3900
52	2100	4400
53	2100	4850
54	2050	5150
55	2100	5400
56	2000	5600
57	2050	5750
58	2100	5850
59	2100	5950
60	2100	6000
61	2100	6000
62	2100	6000
63	2150	5950
64	2100	6000
65	2100	6000
66	2050	6050
67	2100	6050
68	2100	6000
69	2100	6000
70	2100	6000
71	2150	6000
72	2100	6000
73	2100	5950
74	2100	5950
75	2150	6000
76	2100	6000
77	2100	6000
78	2100	6000
79	2100	6000
80	2100	6000
Total	65000	174900

RESULTS AND DISCUSSION

Biogas production by dung alone in the digesters was 2100mL per day on majority of days and fluctuates between 2050 and 2150mL. During the whole experimental period of 80 days a total of 65000mL biogas was produced in it (Table 1). When a portion of dung was replaced by mixed kitchen wastes on 51st day then from the first day itself its positive effect on biogas production was observed which increased by 85.71% (Table 1, 2). With time this difference in biogas production between two treatments increased further and reached to a

Table. 2: Percent increase in biogas production in co-digestion over dung alone

Sr no.	Days	% increase in biogas production
1	51	85.71
2	52	109.71
3	53	130.95
4	54	151.22
5	55	157.14
6	56	180.00
7	57	180.49
8	58	178.57
9	59	183.33
10	60	185.71
11	61	185.71
12	62	185.71
13	63	176.74
14	64	185.71
15	65	185.71
16	66	195.12
17	67	188.09
18	68	185.71
19	69	185.71
20	70	185.71
21	71	179.07
22	72	185.71
23	73	183.33
24	74	183.33
25	75	179.07
26	76	185.71
27	77	185.71
28	78	185.71
29	79	185.71
30	80	185.71

maximum of 195.12% in favor of co-digestion. During the whole experimental period a total of 174900mL of biogas was produced in co-digestion treatment which was 2.69% higher than that of dung alone (Table 1). Since in this experiment all other conditions were kept same for both the treatments, hence the increase in biogas production in co-digestion may be due to increased bacterial activity only. We know that bacterial activity increased due to increased nutrients supply. Kitchen wastes contain more nutrients than dung and hence its addition supplied more nutrients to microorganisms. Higher biogas production in co-digestion of feeding materials was also reported previously. [9-11]

CONCLUSION

Results of the study show that kitchen wastes can be used along with buffalo dung for biogas production and their addition in said proportion resulted in 2.69% higher biogas.

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