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Anaerobic digestion of cooked rice along with buffalo dung for biogas production

Pradip B. Acharya* and Prateek Shilpkar

Biogas Research and Extension Centre and Department of Microbiology, Gujarat Vidyapith, Sadara, Dist.- Gandhinagar, Gujarat- 382320, India
Corresponding author

KEYWORDS

Kitchen wastes, Anaerobic digestion, Eco-friendly technique

A B S T R A C T

A laboratory study was conducted in 5L capacity glass digester bottles. One bottle was filled with buffalo dung mixed with water in 5.3% total solids concentration whereas in another bottle half of the portion of dung added to first bottle was replaced by cooked rice after steady gas production. On first day 12mL fresh digested biogas slurry from running biogas plant was also added in all the digesters as inoculum. Both the bottles were kept in natural environmental conditions and biogas production was recorded daily by water displacement method till a total of 80 days. On comparison of amount of biogas produced in both the digesters it is clear that addition of cooked rice gives almost triple biogas production (2.74 times higher). The study concludes that buffalo dung and cooked rice should be added in equal proportion to get higher biogas yield compared to buffalo dung alone.

Introduction

Waste management is an essential practice to save our environment. Wastes are being generated in a numerous ways. Wastes may be two types- degradable and non-degradable. Degradable wastes can be managed easily. The most common place of degradable waste generation is kitchen. The peels of vegetables and left over meal are a degradable waste which can be managed to produce an economic product. Biogas is a technique to degrade wastes anaerobically and convert them into fuel gas and also produces organic manure.

In anaerobic digestion biological wastes are being degraded by bacteria in anaerobic environment and produces methane, carbon dioxide gases and stable residues (Garba and Atiku, 1992; Cassidy *et al.*, 2008). In this study a laboratory experiment was conducted at Biogas Research and Extension Centre, Sadara to find out the suitability of cooked rice addition for biogas generation. This biogas production was compared with the biogas production from buffalo dung.

Materials and Methods

The experiment was conducted in glass digester bottles. Six digester bottles of 5L capacity each were taken and labelled three as control and three as test. All were joined with 2L capacity gas holder bottle separately which were already joined with a second 2L capacity water displacement bottles. All the joints were made air tight using vacuum grease. Experiment was laid down in daily feeding manner and hence 120mL mixture was added daily in all the bottles up to 40 days since 40 days is the hydraulic retention time of biogas production in environmental conditions of Gujarat.

This mixture contains 40g buffalo dung and 80mL water (to obtain 5.3% total solids). On first day 12mL fresh digested biogas slurry from running biogas plant was also added in all the digesters. After 40 days this feeding of raw materials remains continue in all the bottles and biogas production was recorded daily. To maintain the fixed level of material in digester bottle 120mL slurry was taken out daily. When the biogas production becomes stable in all the digesters, control digesters were fed as such whereas test digesters were fed with 120mL mixture containing 20g dung, 20g cooked rice and 80mL water.

Now these feeding remain continue for next 40 days and biogas production was recorded daily. Average values of biogas production in control and test digesters are presented here.

Result and Discussion

A close examination of data presented in Figure 1 reveal that during 40 to 50 days the biogas production remains same in all the digesters but from 51st day onward as the addition of cooked rice started the biogas production jumped by 88.09% in test digesters compared to control (Table 1). Data presented in Table 1 further show that with time the biogas production in test digesters increases continuously and reached to a maximum of 197.56% (Table 1).

Figure.1 Average daily biogas production in control and test digesters

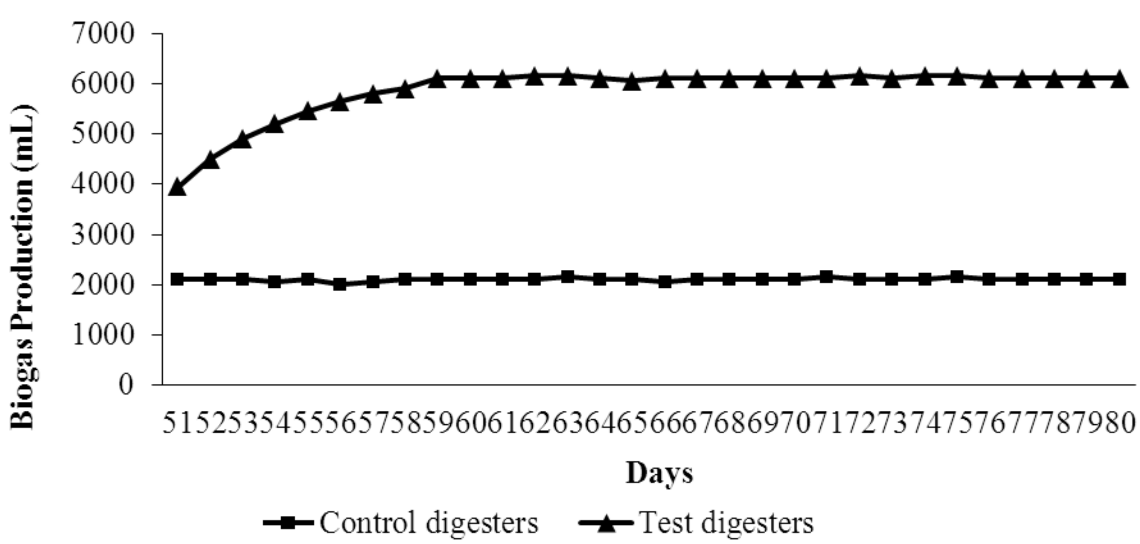

Table.1 Percentage increase in biogas production in test digesters over control digesters

Sr no.	Days	% increase in biogas production
1	51	88.09
2	52	114.29
3	53	133.33
4	54	153.66
5	55	159.52
6	56	182.50
7	57	182.93
8	58	180.95
9	59	190.48
10	60	190.48
11	61	190.48
12	62	192.86
13	63	186.05
14	64	190.48
15	65	188.09
16	66	197.56
17	67	190.48
18	68	190.48
19	69	190.48
20	70	190.48
21	71	183.72
22	72	192.86
23	73	190.48
24	74	192.86
25	75	186.05
26	76	190.48
27	77	190.48
28	78	190.48
29	79	190.48
30	80	190.48

This continues rise reveals that anaerobic bacteria of digester takes some acclimatization time when the feeding material changed and cooked rice addition started. As bacteria become acclimatized their activity increased sharply. The long term continue increase in biogas production over control digesters show that this rise is due to fundamental change in feed composition. As a portion of digested dung is being replaced by undigested and cooked rice the nutrients supply to microorganisms increased immediately.

It helps in higher microbial activity and hence biogas production increased. Advantages of co-digestion were also reported by Elijah *et al.* (2009) and Amirhossein and Sharom (2004), Chellapandi *et al.* (2008). Biogas production from kitchen waste was also reported by Beno et al (2009).

Conclusion

Based on the results of study it can be concluded that left over cooked rice in our kitchen can be successfully added along with buffalo dung in equal proportion for biogas production and this mixture gives almost tripled biogas amount compared to buffalo dung alone. The effect remians longer time which shows that their is no harmful effect of any component of feeding material on other.

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