

***Solanum tuberosum* Supplementation for Biogas Production**

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ABSTRACT

Production of biogas using animal dung is well documented. Nutritional supplement enhances microbial activity and ultimately results in increase biogas production. *Solanum tuberosum* (potato) is a vegetable crop grown in most parts of world. It is a rich source of carbohydrate starch and many minerals. Present experiment was conducted in 5L capacity glass digester bottles filled with mixture of buffalo dung and water at 5.3% total solids. A total of six sets were prepared, three as control and three as test. Control sets were fed daily with buffalo dung water mixture throughout the period of experimentation, i.e. 80 days, whereas in test, from 51st day onward digesters were filled with mixture of dung and boiled potato with water. Feed was added daily in the amount of 120mL upto 80 days from beginning. On first day 12mL fresh digested biogas slurry from running biogas plant was also added in all the digesters as inoculum. From 41th day onward biogas production was recorded by water displacement method and compared. Results reveal that in test digesters addition of potato shows an immediate and long lasting effect and increases biogas production between 90.48 and 192.86% higher than control sets.

Key words: Potato, Pre-treatment, Anaerobic digestion.

INTRODUCTION

Biogas technology is well known in the world for waste utilization. Wastes are being converted in biogas digester anaerobically by different groups of bacteria into valuable manure and gas is generated. The gas is used for a number of purposes. Factors affecting microbial activity governs the amount of biogas generated. Rate of microbial activity fluctuates with change in pH, temperature, nutrients supply, mineral contents etc. In India since the population of cattle is very large so biogas is being generated mainly by animal dung but the fact is that being a digested product it supplies lower amount of nutrients to microorganisms than any undigested one. Fruit and vegetable wastes can be used for biogas production.¹ Potato (*Solanum tuberosum*) is king of vegetables and remains present in almost each and every house, restaurants, hotels etc. A

lab study was undertaken with objective to find out the suitability of potato addition with dung for biogas production.

MATERIALS AND METHODS

Six sets were prepared each containing one 5L capacity glass digester bottle, one 2L capacity gas holder glass bottles and one 2L water displacement glass bottle, all remains connected with each other without any leakage. Digester has an outlet for discharge of digested slurry to maintain the level of feeding material in it. All the digesters were filled with mixture of 40g buffalo dung with 80mL water added daily. After 40th day when the digesters filled with outlet level this feeding remains continue for next 10 days with an equal amount of slurry discharge to maintain the level of feeding material inside digesters and with a recording of biogas

produced daily by water displacement method. When the gas production becomes stable from 51th day this feeding remains continue in three control digesters whereas in remaining three test digesters feeding of 20g dung, 20g boiled potato and 80mL water started till next 30 days. The biogas production was recorded daily.

Table 1: Average biogas production obtained by addition of boiled potato at the rate of 5.3% along with dung (mL/days)

Days	Biogas production (mL/day)	
	Control digesters	Test digesters
Average biogas production during 41-50 days (stable condition)	2100	2100
51	2100	4000
52	2100	4500
53	2100	4950
54	2050	5250
55	2100	5500
56	2000	5700
57	2050	5850
58	2100	5950
59	2100	6150
60	2100	6150
61	2100	6150
62	2100	6150
63	2150	6150
64	2100	6150
65	2100	6150
66	2050	6150
67	2100	6100
68	2100	6150
69	2100	6150
70	2100	6150
71	2150	6150
72	2100	6150
73	2100	6100
74	2100	6150
75	2150	6150
76	2100	6150
77	2100	6150
78	2100	6150
79	2100	6150
80	2100	6150
Total	65000	179000

RESULTS AND DISCUSSION

Data about daily biogas production from 51th to 80 days of experimentation show that in control digesters the average biogas production varies between 2000 and 2150mL per day and in test digesters its average value was between 4000 and 6150mL per day (Table 1). The total biogas production in control digesters during 80 days was 65000 mL but in test digesters total biogas production was almost 2.75 times higher i.e. 179000 mL. A close examination of data presented in Table 1

Table 2: Percentage increase in biogas production in test digesters over control digesters

Sr no.	Days	% increase in biogas production
1	51	90.48
2	52	114.29
3	53	135.71
4	54	156.09
5	55	161.90
6	56	185.00
7	57	185.37
8	58	183.33
9	59	192.86
10	60	192.86
11	61	192.86
12	62	192.86
13	63	186.05
14	64	192.86
15	65	192.86
16	66	200.00
17	67	190.48
18	68	192.86
19	69	192.86
20	70	192.86
21	71	186.05
22	72	192.86
23	73	190.48
24	74	192.86
25	75	186.05
26	76	192.86
27	77	192.86
28	78	192.86
29	79	192.76
30	80	192.86

show that in test digesters biogas production ranged between 4000 and 5000mL per day during 51st to 53rd day which increases with time and ranged between 5000 and 6000mL per day during 54th and 58th day and then remains higher than 6000mL per day till 80 days. Near the end of experimentation period the biogas production in control and test digesters remains constant. When this increased biogas production in test digesters over control digesters was converted in terms of percentage then it ranged between a minimum of 90.48 and a maximum of 192.86% (Table 2). As stated earlier that potato is a rich source of carbohydrate starch. After boiling this carbohydrate becomes available to microorganisms. When this boiled potato was added in digesters the ready supply of carbohydrates to microorganisms causes a burst in microbial activity and at first day of addition it shows 90.48% higher biogas production than control. With time the supply of nutrients continuous to increase with a simultaneous increase

in microbial activity and biogas production too. Our results are in tune with previous work reported pre-treatment of waste increases biogas production.²⁻⁴

CONCLUSION

The study concludes that addition of boiled potato in equal proportion of dung after initial filling of digester with dung resulted in continuous and sustainable increase in biogas production and produces 2.75 times higher biogas.

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REFERENCES

1. Mataalvarez J, Mtzvituria, A., Llabresluengo P. and Cecchi, F. *Biomass Bioenergy*, **5** (6): 481–488. (1993).
2. Chandra, R, Takeuchi, H., Hasegawa, T and Kumar, R. *Energy*, **43** (1): 273-282 (2012)
3. Ma, J., Duong TH, Smits M, Verstraete W, and Carballa M. *Bioresource Technol*, **102** (2): 592-599, (2011)
4. Zheng, Yi, Zhao, J., Xu F., Li Yebo. *Progress in Energy and Combustion Science*, **42**: 35-53 (2014)