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Utilization of *Euphorbia nivulia* for Biogas Production

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Thor (*Euphorbia nivulia*) plant was co-digested with buffalo dung at 6 % total solids for biogas production in laboratory scale experiment on daily feeding basis. The experiment was run for a total of 120 d and data regarding quality as well as quality of biogas and fertilizer value of biogas slurry were recorded. Results show that co-digestion of thor with buffalo dung gives 101.36 per cent increased biogas production with methane content of 66.84 per cent. Biogas slurry from co-digestion also contains 55.36, 0.69 and 3682.35 % higher nitrogen, phosphorous and potassium compared to that of buffalo dung alone.

Key Words: *Euphorbia nivulia*, Biogas production, Anaerobic degradation.

INTRODUCTION

Biogas, an age old technology, touches new horizons today by utilizing a number of wastes for biogas production. Actually any degradable carbonaceous material can be added in biogas plant. Hand and mechanically sorted municipal solid wastes and nearly one hundred genera of fruit and vegetable solids wastes, leaves, grasses, woods, weeds, marine and fresh water biomass have been utilized successfully for biomethanation[1]. Thor (*Euphorbia nivulia*) is a hedge and has some medicinal, like healing of wounds and industrial uses like in preparations of soft drinks and candy etc. It is generally grown in lawns for its purple flowers and is also used for fencing. Its latex content attracts us to utilize it for biomethanation.

EXPERIMENTAL

The plant was first dried and powdered and analyzed for its organic carbon[2], total nitrogen[3], available phosphorous[4], available potassium[5] and total solids and total volatile solids contents[6]. It was co-digested with buffalo dung whose chemical composition is shown in Table-1. The experiment was done in 5 L capacity glass digester bottles connected with water

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displacement bottles in triplicate. Digester bottles were filled up to 4.8 L working volume. For this 120 mL feeding material was added daily from the very first day of experimentation. Initially, for 40 d hydraulic retention time for Gujarat region[7] all the six sets were run on feeding of 36 g buffalo dung mixed with 84 mL water at 24 h interval, to obtain 6 % total solids content. Inoculum from running biogas plant was also added in all the digesters @ 10 % (v/v) bases. From 41st day onwards three digesters (control) were fed with same feeding material but remaining three digesters (test) were fed with mixture of 30 g buffalo dung, 6 g powdered *Euphorbia nivulia* and 84 mL water (to maintain 6 % total solids). This feeding remains continue for next 120 d. Care was taken to maintain the 4.8 L level in the digester bottle so the extra material comes outside from the exit tube of bottle at this level. The experiment was aimed to study the effect of co-digestion of *Euphorbia nivulia* with buffalo dung on quantity and quality of biogas production and on fertilizer value of produced slurry. Amount of biogas production was measured daily, from 41st day onwards, by water displacement method and its quality, in terms of proportion of methane, was checked frequently by orset apparatus.

RESULTS AND DISCUSSION

Biogas production is a microbial process and includes three types of microorganisms *viz.*, hydrolytic, acid former and methanogens bacteria. These microorganisms hydrolyze the feeding material added to plant and obtain nutrients. Since dung is a digested product hence contains lower nutrients than that of undigested one like *Euphorbia nivulia* (Table-1). This lower nutrients supply to microorganisms through dung results in lower biogas production in control digesters compared to test (Fig. 1). Per cent increase in biogas production in test digesters compared to control ranged between 10.06 (88 d) to 266.66 % (106 d age of digester). Fluctuation in biogas production may be due to changes in nutrients content of feeding material added daily because composition of dung depends on a many factors like cattle feed, health of cattle, season *etc*. To check the stability in biogas production the experiment was run for a longer duration of 120 d. In terms of quality, the biogas produced in test digesters has some what lower (66.84 %) methane content compared to control (72.68 %) (data not shown). It is because the methane content depends on chemical composition of feeding material like degradation of sugars gives a mixture of equal volume of carbon di oxide and methane, whereas degradation of lipids gives a greater percentage of methane[8].

Next to biogas the second important product of biomethanation is digested slurry because it has fertilizer value[9]. Result show (Table-2) that the slurry obtained from test digester has 55.36, 0.69 and 3682.35 % higher

TABLE-1
CHEMICAL CONSTITUENTS OF RAW MATERIALS USED (per cent)

Parameters	Buffalo dung	*Euphorbia nivulia*
Organic carbon	16.25	35.67
Total nitrogen	0.56	0.87
Available phosphorous	0.08	0.12
Available potassium	0.02	0.75
Total solids	20.50	98.00
Total volatile solids	17.45	78.40

TABLE-2
NUTRIENTS CONTENT IN EFFLUENT SLURRIES (per cent)

Nutrients	Contents	
	Control	Test
Available nitrogen	0.056	0.087
Available phosphorous	0.144	0.145
Available potassium	0.017	0.643

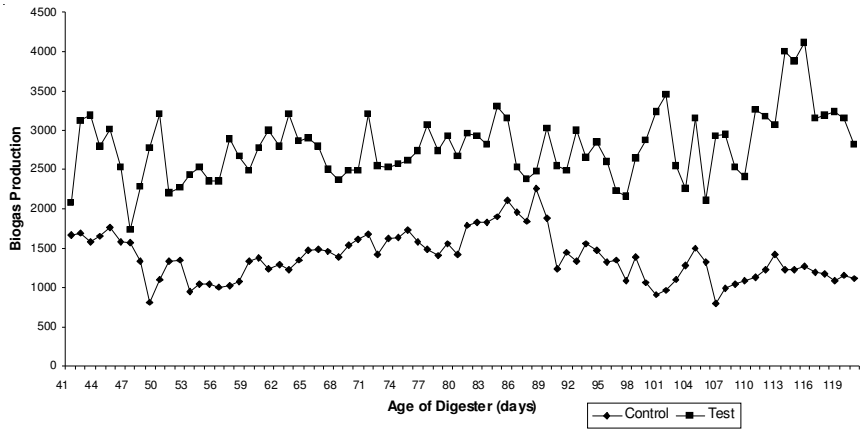

Fig. 1. Amount of biogas produced (mL per day)

available nitrogen, phosphorous and potassium content, respectively than that of control digester. As stated above that microorganism in biogas plant utilizes nutrients of feeding material for their growth and mineralize them thus the content of available nutrients increased in effluent slurry. Increased nitrogen, phosphorus and potassium content in digested slurry of biogas plant were also reported previously[10].

Conclusion

Experimental results show that *Euphorbia nivulia* can be successfully co-digested with buffalo dung at 6 % total solids and produces higher biogas compared to buffalo dung alone.

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