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Performance Evaluation of Solid Waste at DPCOE'S Canteen for Biogas Production

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ABSTRACT: Now a days India is facing a massive problem of generation of solid waste. Urban areas in India generate approximately 55 million tons of municipal solid waste. This study consists of accessing feasibility of kitchen waste at DPCOE canteen for biogas production. Our institute's canteen (DPCOE) utilizes several LPG cylinders and also generate large amount of kitchen waste, so the aim is to tackle with this problem in environmental friendly manner. For this reactor, old cow dung is used. To find the variation in rate of biogas production setups are being prepared with and without inoculums such as sugary and starchy solutions in addition with kitchen slurry. Also an attempt is made by doing the experimentation at constant (37°C) and variable temperature conditions. It is being found that biogas production increased by about 150% by addition of inoculums. Also the rate of biogas production is 15% more at constant 37°C than variable room temperature.

KEYWORDS: Kitchen waste, Biogas, Food waste, Solid waste management.

I. INTRODUCTION

The biogas process is part of a biological waste treatment method used commonly. Solid waste (SW) means any garbage, refuse, sludge from a wastewater treatment plant, water supply treatment plant, or air waste management plays an important role. Pollution control facility and other discarded materials including solid, liquid, semi-solid, or contained gaseous material, resulting from industrial, commercial, mining and agricultural operations, and from community activities. Solid Waste Management (SWM) is a term that is used to refer to the process of collecting and treating solid wastes. It also offers solutions for recycling items that do not belong to garbage or trash.

To control different types of pollution, i.e., air pollution, soil pollution, water pollution, to stop the spreading of infectious diseases, to conserve all our environmental resources, including forest, minerals water and recycling of hazardous wastes for further production, SWM is very much important. The only difference is that instead of releasing the gases produced during the fermentation process, the gases are collected and utilized as a gaseous fuel product. In the biogas production system, liquid organic wastes, animal manure, and solid organic wastes are led into a digester where an anaerobic process using bacteria ferments the wastes and produces biogas as a gaseous by-product. The remaining non-digestible solids in the digester are collected as sludge that can later be returned back to the ground.

II. RELATED WORK

Feed preparation is done prior to feeding. The suitable quantity of food waste was grinded in a kitchen grinder to reduce its particle size such that it will be in the form of paste. Suitable quantity of DW is added to the paste to form a kitchen slurry such that kitchen slurry will be easily floodable.

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For Starchy solution preparation Line a colander with two layers of cheesecloth, and place the colander over the bowl. Grate the potato with the smallest set of holes on your grater into the cheesecloth. Fold the ends of the cheesecloth up and over the potatoes to cover. Press down on the cheesecloth until the starchy liquid from the potatoes drains into the bowl. Open the cheesecloth and pour ½ cup of water over the potatoes. Reclose the cheesecloth and squeeze the potatoes. Repeat above steps with the remaining ½ cup water. Place the two cans on top of the cheesecloth and leave them on top of the cheesecloth to squeeze more starch from the potatoes for 1 to 2 hours. Remove the colander and discard the cheesecloth with the potatoes. Carefully pour the liquid into the measuring cup from the the bowl without disturbing the starch that settled to the bottom. Discard the liquid in the cup and use the remaining potato starch in the bowl.

Sugary Solution preparation will be done in initially. Take about 5gm of sugar and dilute with 20 ml distilled water. Shake properly to dissolve sugar completely to obtain sugary solution.

III. METHODOLOGY

Survey is carried out in DPCOE canteen for approximate 500 students for 30 days.It is found that daily SW production is about 30-40 kg, out of which 2-4 kg waste is generated at morning, 20-25 kg in afternoon and 10-15 kg in evening and they dispose off the kitchen waste daily on backside of canteen without any treatment.

Sample is collected thrice a day in morning, afternoon and evening. Kitchen waste is then segregated manually by quartering method to categorize the content present in sample. Rotten tomato, Potato Waste, Spinach, Onion ,Pea peels , Bread, Pumpkin, Paper ,cooked Rice,and other vegetables are used. Separation of non bio-degradable materials such as glass, plastic,etc is done manual.

Experimental setup consist of four different setups namely A,B,C & D as shown above. In this setup A& B are kept at variable room temperature condition while setup C & D are kept at constant temperature of 37°C in water bath. Also setup A & C are added with sugary and starchy solutions. All the setups are provided with excess sludge disposal and excess slurry disposal valves.

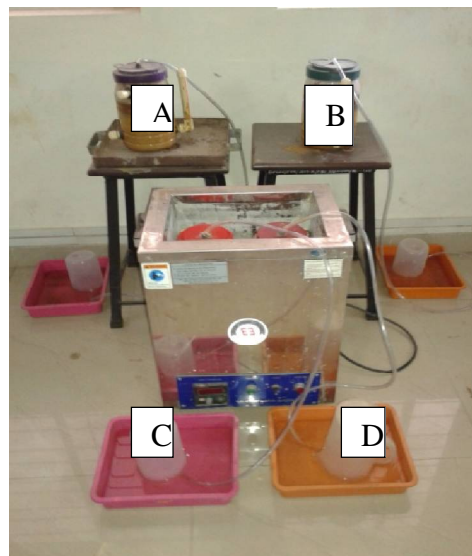
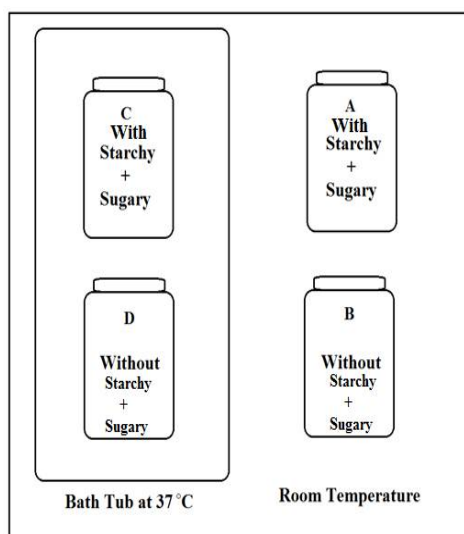


Fig.1 Schematic view of experimental setup Fig.2 Photographic view of experimental setup

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Operational Procedure consist of following steps:

1. Four set ups are prepared A, B,C and D (capacity 2 lit. each)
2. 500ml old cow dung slurry is prepared for each setup of ratio 1:1 and filled in each setup.
3. Temperature of 37°C is maintained for two setups C and D. A and B are kept at room temperature.
4. On next day 50ml kitchen slurry is added in each setup.
5. Initially 0.5 ml sugary and starchy solutions are added in setup A and C.
6. Concentration of kitchen slurry, starch and sugary solution increased based on rate of biogas production.
7. Temperature and pH of substrate is checked at interval of two days for 22 days.

IV. EXPERIMENTAL RESULTS

Fig. 3 below indicates variation of biogas production with no. of days. Fig.3 clearly indicate that setup A produce 163.63% more biogas as compare to setup B. Also Setup C produce 151.85% more biogas as compare to setup D. This is due to addition of sugary and starchy solution. The amount of biogas produced in setup C is 14.705% more than setup A due to change in temperature conditions. So it is clear that addition of sugary and starchy solution at constant temperature of 37°C is most favourable for biogas production.

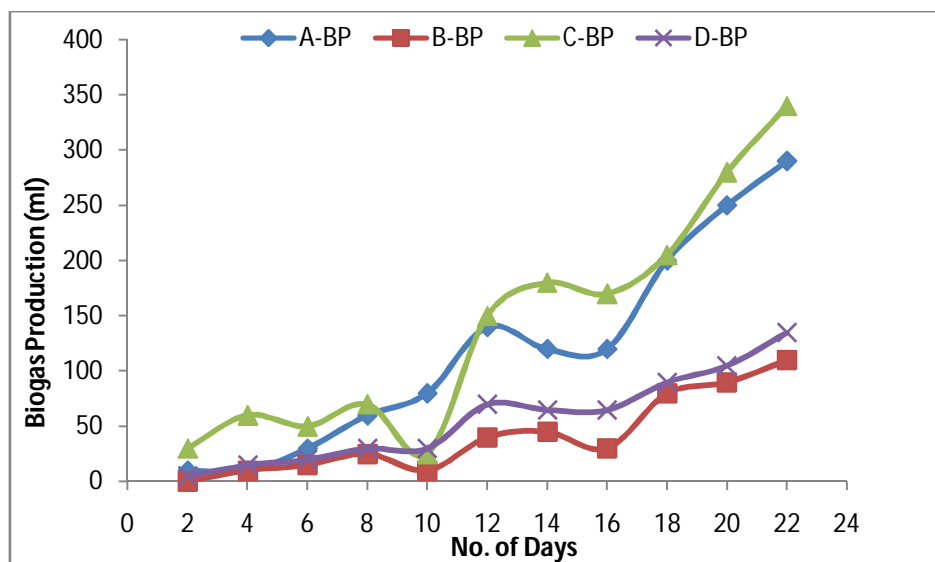


Fig.3 Variation of biogas production with respect to no. of days.

Fig.4 shows the variation of pH with no of days. From the figure 4 it is clear that on 10th day there was reduction in pH value. This is due to acidogenesis bacteria convert the system into acidic condition. The pH was neutralised by addition of lime. So on the 12th day pH becomes neutral. It is being observed that there is considerable reduction in pH value in setup C as there is more biogas production. From figure 3 & figure 4 it is clear that biogas production is directly proportional to pH value.

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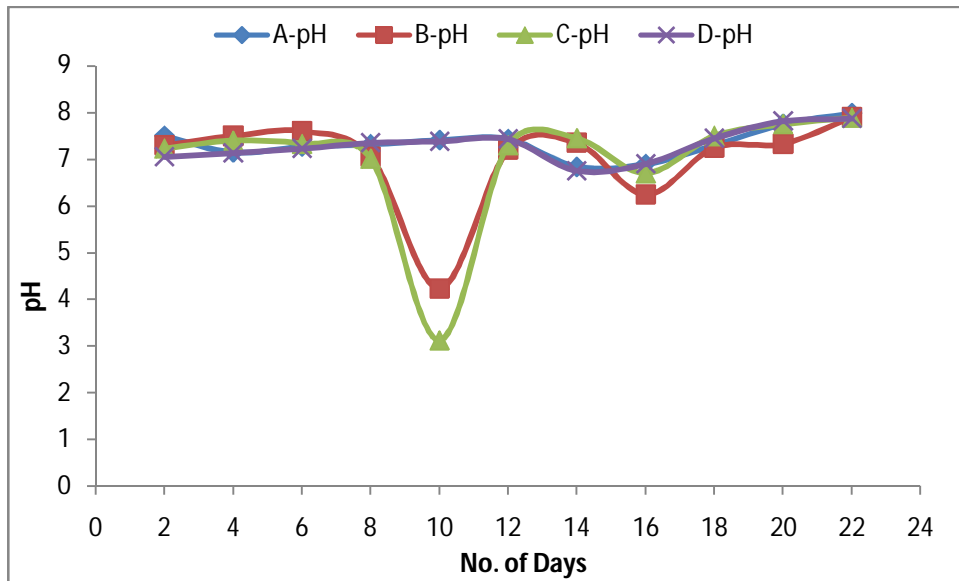


Fig. 4: Variation of pH with no of days

Fig. 5 shows variation of temperature with no. of days for setup A& B. From the figure it is clear that temperature goes on increasing as no. of days of experimentation increases. This is due to continuous fermentation process going on into the reactor. Also from figure 3 and figure 5 it is clear that biogas production varies with temperature inside the setup A and setup B.

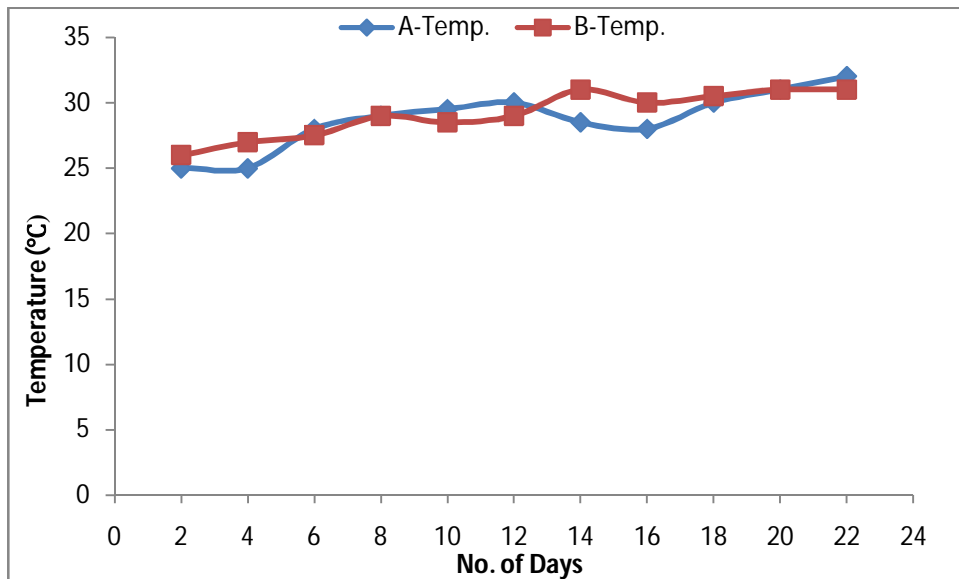


Fig.5 Variation of temperature with no of days for setup A& B with respect to no. of days.

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V. CONCLUSION

Setup A produce 163.63% more biogas as compare to setup B due to addition of sugary and starchy solution. Setup C produce 151.85% more biogas as compare to setup D due to addition of sugary and starchy solution. The amount of biogas produced in setup C is 14.705% more than setup A due to change in temperature conditions. In variable temperature condition rate of biogas production is directly proportional to temperature. The amount of biogas produced is directly proportional to pH.

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