

Generation of Biogas from Different Proportion of Biodegradable Kitchen Waste and Cowdung Using Anaerobic Biodigester

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ABSTRACT: Deforestation is a very big problem in developing countries like India, most of the part depends on charcoal and fuel-wood for fuel supply which requires cutting of forest. Also, due to deforestation It leads to decrease the fertility of land by soil erosion. Use of dung , firewood as energy is also harmful for the health of the masses due to the smoke arising from them causing air pollution. Biogas production requires Anaerobic digestion. Anaerobic digestion is a microbial process for production of biogas, which consist of Primarily methane (CH₄) & carbon dioxide (CO₂). We need an ecofriendly substitute for energy. Kitchen waste is organic material having the high calorific value and nutritive value to microbes, that's why efficiency of methane production can be increased [1]. This study investigated the production of biogas using Biodegradable kitchen waste and cow dung from Kolagallu village, Ballari district. Maximum average biogas generation in reactor 1 is 0.89kg @ 21th day and reactor 2 is 1.3kg @ 21th day. a combustion test was also carried out for both reactors, which showed that for blue flames were produced without soot.

KEYWORDS: Anaerobic digestion, Biodegradable kitchen waste, Cow dung, Biogas.

I. INTRODUCTION

Global energy consumption has been increasing drastically in the past decade. The gradual depletion of fossil fuels, such as petroleum, coal and natural gas, and the environmental concerns of fossil fuel consumption have driven an intensive search for alternative energy sources. Such alternative energy sources should be hugely available, sustainable and eco-friendly. Kitchen waste has attracted considerable attention in recent years from the bio-energy recovery point of view, due to its high energy potential, biodegradability and inexhaustibility. Anaerobic digestion is a preferred method with several advantages, including volume reduction, waste stabilization, and biogas recovery. The whole reaction is run out with the help of microorganisms and the growth of microorganisms depends on various parameters like pH, temperature, organic loading rate, reactor designing, inoculums and HRT [2]. The first anaerobic digester was built by a leper colony in Bombay, India in 1859. In 1895, the technology was developed in Exeter, England, where a septic tank was used to generate gas for street lighting. Biogas production by anaerobic digestion has a tremendous potential in India. India is a pioneer in the field of anaerobic digestion of animal waste which is being practiced since 50 years. Over past 25 years, anaerobic digestion processes have been applied to wide array of industrial and agricultural wastes. Indiabeing an agricultural based country, it was estimated that there were about 330 thousand biogas plants by 1985-86. Most of the biogas plants are almost fed with cow dung, mixture of human night soil, pig dung, stacks of feed grasses, etc. "Biogas is produced by bacteria through the bio- degradation of organic material under anaerobic conditions. Natural generation of biogas is an important part of bio-geochemical carbon cycle. It can be used both in rural and urban areas"[3].Anaerobic digestion process has been used in order to decrease the use of fossil energy and it is a biological process converting organic matter into the main products methane (CH₄) and carbon dioxide (CO₂), usually referred to as biogas. A few percentages of nitrogen (N₂) and ppm levels of ammonia (NH₃) and hydrogen sulfide (H₂S) are also formed. The organic matter used come from sewage sludge, animal wastes, household wastes, industrial wastes and industrial wastewater. Biogas produced from manure, a commonly used source of organic

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matter, generates roughly 60-70% CH₄ and 30-40% CO₂[4]. We have tried to develop a anaerobic Biodigester for the generation of biogas using available Biodegradable Kitchen waste from Kolagallu village, Bellari district.

II. RELATED WORK

A study on biogas production from different kitchen waste carried out at varying operating temperatures from 25°C to 36°C and pH ranged from 5.5 to 8.5 with constant feed of kitchen waste. The substrates were analysed at regular intervals for the biogas production. This study concluded that food waste/ kitchen waste as a potential sources for generation of methane [5]. The maximum methane gas was recorded as 65% and average maximum carbon dioxide was recorded as 58%. The daily temperature inside the digester was found in the range of (25-34°C) and pH value of the slurry was found in between (6.7-5.48). The average gas production was found to be 173 L/day. The maximum burning period of the gas was approximately 62 min/day and average burning period was 26 min/day. In the beginning, the proportion of methane is exceeded by carbon dioxide and then after gradually methane exceeded carbon dioxide and reached 56 on average. The amount of gas produced rate during July is low because of rainy season and increases respectively. Since the daily feeding of 5kg Dry chicken waste produce 173 L of gas per day, per kg of kitchen waste can produce 35 L of gas daily. The system will provide an appropriate and most efficient solution to the problem of kitchen waste enabling the recovery of energy from waste[6]. The study of innovations in generation of Biogas from kitchen food waste and cow dung was carried out and it has been found that the production of biogas can be increased with increasing proportion of cow dung [7]. Bio-methane generation from organic waste on different substrates and methods of improving gas production was carried out in a detailed manner and it has been recommended that production can be enhanced by co digestion method. A comparison between batch type and a continuous type digester system was also [8]. An experimental analysis of generation of biogas from kitchen waste was carried out with the comparison of biogas production using kitchen waste and cow dung. The kitchen waste and cow dung was taken in different proportions and the experiment was carried out. Then the measurement was done for each samples and analysed. The result concluded that the food waste samples were produced more biogas than the cow dung [9]. The biogas yields have been determined using batch anaerobic thermophilic digestion tests for a period of 90 days. Characteristic oscillation was observed in the rate of methane production, which may be due to the presence of methyloctroph population in the activated sludge, which uses methane as a carbon source for their growth. The total biogas generated in the system over the experimental period was the sum of methane and carbon dioxide. Biogas produced from the decomposition of food waste was a mixture of 76% methane and 24% carbon dioxide[10].

III. MATERIALS AND METHODOLOGY

MATERIALS :

Empty Water cans 20ltrs capacity: To be used as digester tank.

M-seal: M-seal is a multipurpose sealant with four main applications –Sealing, joining, fixing and building, it can be used to fill gaps, cracks and plug leaks in pipes and joints.

Gas collection pouch: To be used for collection of bio gas

PVC Pipes and Capes (Diameter-0.5'' and Length-1.5mtr): To be used as inlet and outlet for the digesters and to seal Inlet and outlet pipes, Capes (0.5'' diameter) were used.

T joints :Used for the purpose of diverting the biogas from gas pouch to burner.

Electronic weighing balance: Used for weighing the bio gas collected in the pouch.

METHODOLOGY:

A 20litres capacity of plastic cans will act as the digester unit. Inlet pipe was fixed at the top of reactor for feeding the mixed slurry and outlet chamber for discharging the unwanted slurry from the reactor. the whole set up is sealed and made air tight and allowed to check for water leakage. There are two digesters were fabricated, one digester was fed with 80% cow dung and 20% kitchen waste. The other digester was fed with 50% of cow dung and 50% of kitchen waste. Optimum pH range in an anaerobic digestion process is another important parameter that has a significant effect on the digestion process. the optimum ph range in an anaerobic digester is 6.8 to 7.0 however the process can tolerate a

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range of 6.5 to 8.0, In this study, Using Sodium bicarbonate (NaHCO_3), pH was maintained within the range. The daily variation in temperature and pH was measured in the lab. The study of biogas production was carried out for 28 days. The production of gas was made to collect in the pouch which was connected to the digester and the measurement of biogas production was carried out in the Environmental Engineering Laboratory of the Civil Engineering Department, Rao Bahadur Y. Mahabaleswarappa Engineering College Bellari.



Figure 1: Experimental set up

IV.RESULTS AND DISCUSSIONS

Table 1: Maximum average Biogas generation, Optimum pH, Optimum Temperature

Observation	Reactor 1	Reactor 2
Maximum average Biogas generation	890gms (0.89kg @ 21 th day)	1300gms (1.3kg @ 21 th day)
Optimum pH	6.9	7.2
Optimum Temperature	37°C	37°C

Biogas production in reactor 1 and reactor 2

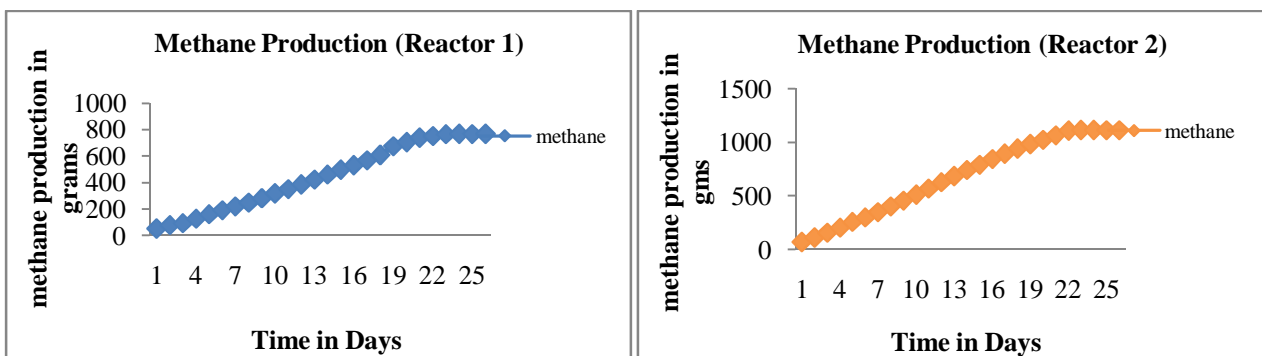


Figure 1:Biogas production in reactor 1 and reactor 2

Above figure shows the graph of Number of days v/s methane gas production in both reactor 1 & 2. The generation of biogas will increase day by day, Microorganisms will break down the organic matter, they can utilize it as a food source under anaerobic condition and produce the methane gas. After 21 days, the generation of methane gas will

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shows consistence results in both reactor 1 and reactor 2. The maximum average methane gas generation in reactor 1 was 890 grams and 1300 grams in reactor 2.

pH in reactor 1 and reactor 2

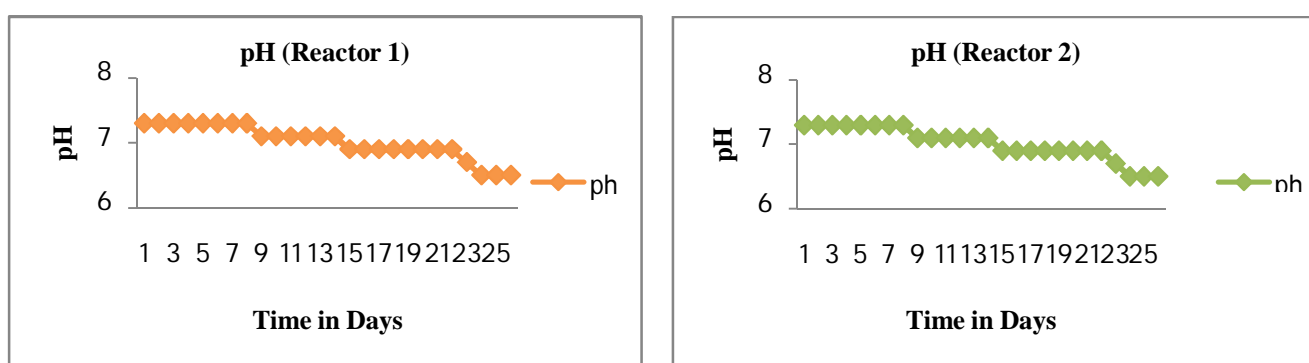


Figure 2:pH in reactor 1 and reactor 2

Above figure shows the graph of Number of days v/s pH in both reactor 1 & 2. Optimum pH range in an anaerobic digestion process is another important parameter that has a significant effect on the digestion process. the optimum pH range in an anaerobic digester is 6.8 to 7.0 however the process can tolerate a range of 6.5 to 8.0. In this study, Using Sodium bicarbonate (NaHCO_3), pH was maintained within the range. The daily variation in temperature and pH was measured in the lab. pH was goes on changing from 7.3 to 6.6 , it will shows decreasing the pH from day 1 to day 26, this is Because of microorganisms will utilize the organic matter. After 21 days, the generation of methane gas will shows consistence results in both reactor 1 and reactor 2. In reactor 1, @ pH 6.9, maximum average methane gas was 890 grams @ the end of 21 days. Similarly reactor 2, @ pH 7.2, maximum average methane gas was 1300 grams @ the end of 21 days.

V.CONCLUSION

1. Maximum average Biogas generation in reactor 1 was 0.89kg @ 21th day and reactor 2 was 1.3kg @ 21th day. By comparing reactor 1 and reactor 2 , reactor 2 gives more Biogas yield. this is because of presence of more number of anaerobic microorganisms.
2. Optimum pH for the generation of Biogas was 7.2 @ temperature 37°C
3. Utilization of Biodegradable kitchen waste and cow dung in generation of Biogas leads to maximum generation of Biogas because cow dung has more number of anaerobic microorganisms and kitchen waste has the high calorific value, nutritive value to microbes.
4. Generation of Biogas from Kitchen waste and Cow dung using Biodigester is also one of the best alternative technology for the generation of waste to Energy. .

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