Anaerobic Treatment of Food Waste for Energy Recovery – A Floating Drum Anaerobic Digester

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Abstract.

The main objective of this study was to develop the anaerobic process for the treatment of canteen waste from the food waste. It is carried out in a one cubic meter floating drum anaerobic digester. The process includes inoculum of cow manure and start-up of the digester under mesophilic condition. This continues anaerobic digester is studied at different NaOH addition, agitation time, loading rate. The floating drum anaerobic digester is of 1 cubic meter capacity and it is observed continuously for 6 weeks (42 days). At steady state, the efficiency of the floating drum digester is produce biogas yield of 0.628m3 for loading rate of 15kg. The results showed that the biogas yield contained a maximum methane (CH4) content of 64.99% in mesophilic anaerobic digestion with temperature of 36°C.

Keywords. Anaerobic Digester, Biogas, Canteen waste, Food waste, NaOH

1. INTRODUCTION

Biogas is one of the renewable energy resources that are commonly obtained by the fermentation of rice straws, vegetable wastes, cotton waste, garbage waste, human waste, animal waste, food waste, dairy waste, industrial organic waste, used to produce bioenergy [1].The biogas price is very low and otherwise technical requirement is not very high. [2]Therefore biogas generation is very economical one and high value of market potential. Generally we know that renewable energy is says the important of wind, biomass, solar and tidal energy so this kind of energies developed and it is planned to enhance the energy generation on a priority needed. The biogas production mainly concentrate on of 50–60% of methane yield is obtained from the free oxygen - bio105 chosen of biomass like animal dung, plant residue, food waste, etc. Anaerobic digestion process is suggested that wide spread and well proved technology to create organic materials at waste technology. [3]AD (Anaerobic Digestion) method only controlled on some important parameters like as pH range slurry, temperature of digester, organic loading, some other ways to improve the digestion using some pretreatment types. Currently, the nanotechnology is developed in AD has shown excellent results and increased production rate in microbes in recent years.[4] In the many survey, it is suggested that the inclusion of nanoparticles (NPs) developed number of methane generation(CH4) from 21.5% to greater than 150%. Anaerobic bio digestion of organic matter (OM) has always important one due to the time-consuming in bio114 disintegration process. NPs have been proved as biodegradation enhanced due to their unique properties of physicochemical. [5] Therefore, Urea capped Fe3O4 nanoparticles (U–Fe3O4 NPs) are attractive materials to enhance Methane gas production. The various types of temperature used for biogas production in the anaerobic conditions example psychrophilic period above 30˚C maintained at digestion days,[6] mesophilic period above 30 to 45˚C and thermophilic period temperature around 46 to 60˚C but anaerobic bacteria's present in the thermophilic as well as mesophilic periods of digestion periods. Agitation is one of the main period for contact the bacteria as well as substrates with help the exit in liquid. Main role of the stirring is eliminate the scum generation its causes of capacity of the bio digester.

2. EXPERIMENTAL SETUP AND MATERIALS

The anaerobic digestion process a floating dome bio reactor at gas holder type is carried out the research work. The bio reactor makes from fiber material, size of 1m3and the cumulative volume of the bioreactor is 1000 Littreat overall all gas store is 700 liters. The bioreactor inner and outer slurry temperature is monitored

withheld by thermocouple probe type device. Waste slurry is stirred used agitator for the daily basis using the electric timer with compressor pneumatic type. Figure 1. shows the Floating dome anaerobic digester and In this experiments conducted using the catenae food waste 5 to 15 kg randomly and similarly added the NaOH solution of waste inlet slurry 2 to 8 %, the agitator device is used to stirrer slurry for every 5 to 20 mines it is used to enhanced the biogas and methane production.

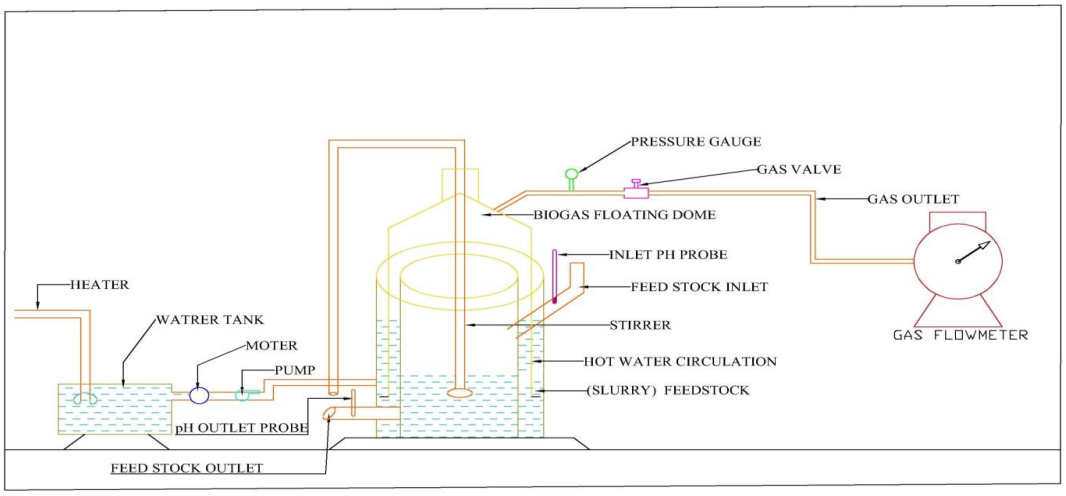

Figure 1. Line diagram of Floating dome anaerobic digester

The bioreactor temperature is monitored from inner also outer at time of digestion using the different thermocouples, it's measured digitally. The research work is initiated and then after methane are measured weekly bases by the help of Wet Type Bio Gas Flow Meter at duration of six weeks of bio digestion. Similarly another way of other method the gas production is monitor at 42 days. The pneumatic agitation unit is mainly used to stir the digested slurry day bases and digested slurry is obtained from the digester may be used as an organic bio fertilizer.

3. RESULT AND DISCUSSION

The Figure 2. result is indicated that the maximum biogas is achieved at the 5th week of digestion 0.63m3 at 6 % NaOH solution is added in the digester inlet slurry. The synergistic development is very important for biogas production higher balanced with nutrients also enhanced buffering capacity of co fermentation process. In this research alkalinity level is gradually declined because of NaOH solution added during the incubation periods.

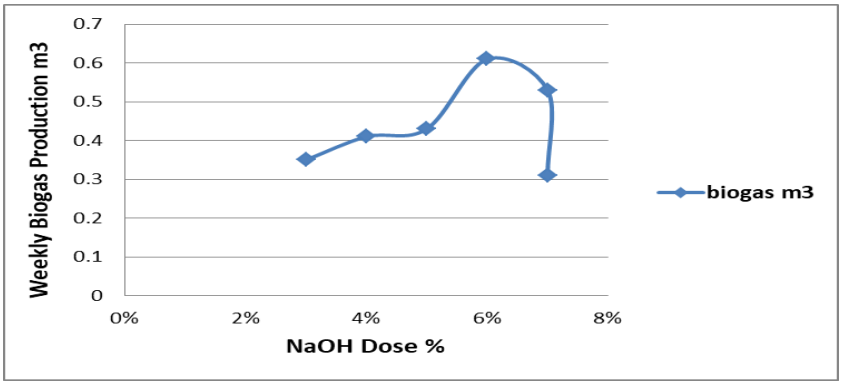

Figure 2. NaOH addition with Biogas production

Similarly Figure 3. Shows the quantity of methane content for the sample is maximum at 6% of NaOH addition; in this case the methane content is achieved at 42 % at last week of digestion. The [7] C/N ratio is one of the most important stages of methanogens production in this case the carbon as energy growth of microorganisms and nitrogen is one of the energy source for structural growth of microorganisms from the digestion.

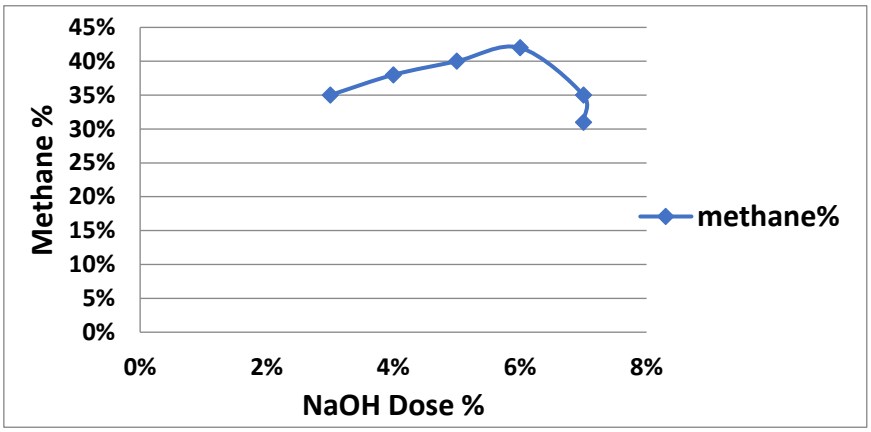

Figure 3. NaOH addition with Biogas production

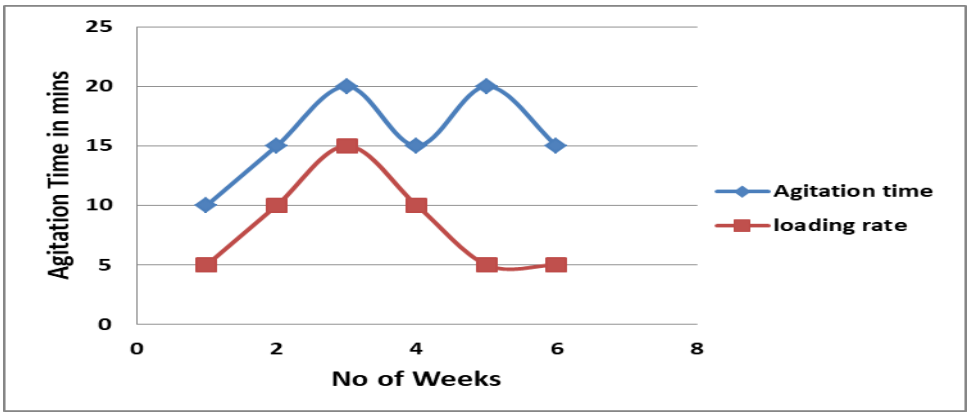

Figure 4. Agitation time with Different loading rate

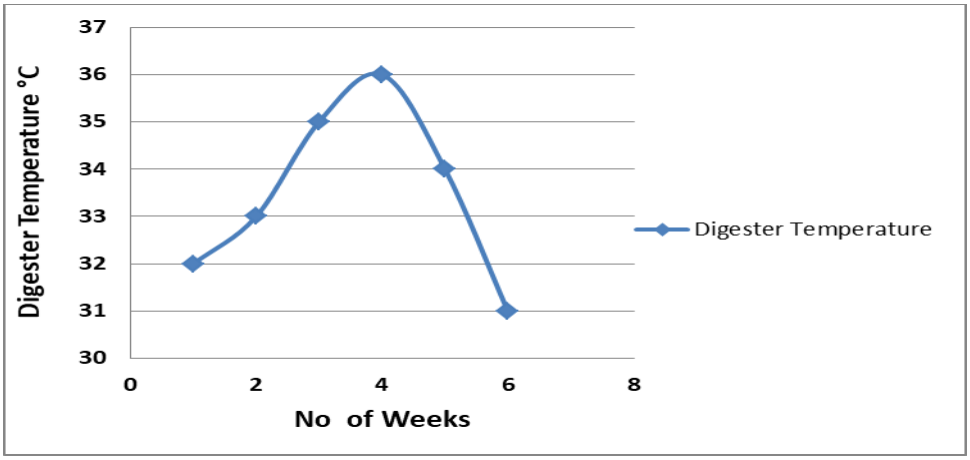

Figure 5. Digester temperature with respect to weeks

From graph figure 4 and 5 shows the Agitation time with different loading rate and digester inlet temperature of slurry. In the graph represented that the 20 minutes with 15 kg is received the maximum biogas and methane yield. Agitation is most developed stage in anaerobic digestion to enhance the adequate contact with bacteria also substrates and it is one of the cause of out of the gases from digester. A further increase the loading rate then plant achieves a maximum gas production. [8-10] The importance of biogas cleaning and upgrading methods is including product purity as well as impurities, biogas recovery and loss, development efficiency and the investment with operating cost.

4. CONCLUSION

The research studies conclude that the canteen waste might be one of the best way of produce the efficient biogas with NaOH chemical pretreatment under anaerobic bio digestion process. The digester working in mesophilic condition is concluded with high amount of biogas yield and quicker reaction rate at the NaOH addition with agitation. In this research conclude that the food waste is used to bio methane production is create pollution less also eco-friendly environment in the region. Present day's biogas production provides more environmental with social benefits, but still adopted at minor rate when transferred to rural households at developing countries.

5. REFERENCE

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