ANAEROBIC CO-DIGESTION OF PRESS MUD WITH POULTRY WASTE

K. Sandhya[1], P. Raja Rao[2]

[1]Department of Chemical Engineering, University College of Technology, Osmania University, Hyderabad 500 007, Telangana, India.
Email id: Sandhya.mittu@gmail.com; Mobile No: 9676461165

ABSTRACT

In this study, Lab scale experiments on co-digestion were organised at mesophilic range. Here, one substrate (poultry litter) having low C/N ratio is co-digested with another substrate (Press mud) having high C/N ratio. Different batch experimental setups were conducted with different ratios of cow dung and poultry litter for a retention period of 60 days to evaluate the best possible ratio of these two substrates at which gas yield is high and process is stable in terms of pH change, nutrients requirements, biomass growth etc. Parameters like Total solids, Volatile solids, C.O.D, Alkalinity, VFA, PH were analysed at equal time intervals by using standard methods. Gas produced is collected and measured daily by using water displacement method and the purity of the gas is analysed by Gas Chromatography (GC).

Keywords: *Anaerobic co-digestion, Press mud, Poultry litter, Biogas, Methane.*

1.Introduction

A common sight in cities these days is the pile-up of garbage at every street corner. This is one of the consequences of the process of urbanization, coupled with increased industrial activities. Naturally, unless and until the garbage is properly disposed off, there is a risk of environmental degradation and health hazards to the public. Such a situation opens new area of researches and technologies that are now available to treat the municipal solid waste to meet the required pollution control standards, besides generating energy as in the form of biogas. Anaerobic digestion is a series of processes in which microorganisms break down biodegradable material in the absence of oxygen to release energy. The reactor design has also a strong effect on digester performance. The anaerobic digesters are broadly classified into two distinct categories, such as conventional digesters and high rate digesters. High rate digesters are designed to minimize hydraulic retention time and increase rate of biogas production. BIMA digester, The Dranco process, Valogra process, etc. are to name a few of recent technologies that have emerged as response to this deal. The main advantage of this process is the production of biogas, which can be used to produce electricity. A valuable effluent is also obtained, which eventually can be used as an excellent soil conditioner after minor treatments. An interesting option for improving yields of anaerobic digestion of solid wastes is co-digestion. The benefits of co-digestion include: dilution of potential toxic compounds, improved balance of nutrients, synergistic effect of microorganisms, increased load of biodegradable organic matter and better biogas yield. Additional advantages include hygienic stabilization and increased digestion rate. In anaerobic digestion, co-digestion is the term used to describe the combined treatment of several wastes with complementary characteristics, being one of the main advantages of anaerobic technology.

Furthermore, successful mixing of different wastes results in better digestion performance by improving the content of the nutrients and even reduces the negative effect of toxic compounds on the digestion process.

2.Materials and Methods

2.1 Substrates

Poultry litter was collected from a poultry farm near Hyderabad, India. The poultry litter was brought to the laboratory and stored under dry conditions. Pressmud is brought from

near by sugar factory. Poultry litter and Press mud were mixed in three different ratios at 25% total solids ratio and was made into slurry and fed in three different digesters.

2.2 Experiment set up

A batch set-up of 3 glass bio-digesters (aspirator bottles) with a capacity of 1 L was used and the digestion of poultry litter with press mud in three different Proportions of A:- 1:1, B:-1:2, C:-1:3 respectively were taken and fed into three different digesters, one digester for each experiment. Thus, the biogas produced in the digester by the fermentation slurry passed through the connecting tube, passed through water and collected by water displacement method.

2.3 Experimental procedure and Operation

The 3 bio-digesters were fed with the slurry as stated above and was operated for a retention period of 60 days. The biogas produced is collected through collecting tube by using water displacement method and is measured every day.

2.4 Analytical methods

Poultry litter and press mud were characterized for pH, Total Solids, Volatile solids. During the course of the experiment, poultry litter and press mud mixed slurries i.e., co-digested material in three cases were characterised for pH, Total Solids, Volatile Solids, Moisture content, Alkalinity, C.O.D for every ten days as per standard methods (APHA, 1998). The volume of the biogas produced was measured daily and its composition was determined with GC for every 20 days.

3.Results and Discussions

3.1 Performance of bio-digesters

The three Bio-digesters were operated for a period of 60 days and its performance is evaluated. The characteristics of the slurry like pH, Total Solids, Volatile Solids, Moisture content, Alkalinity, VFA, C.O.D is determined for every 12 days in all the cases.

3.2 Gas analysis

Biogas produced daily is collected by using water displacement method and its quantity is measured daily. Its composition is determined by using GC and it has observed the

presence of 60% percentage of methane. The amount of biogas produced is tabulated and is shown below.

Table 1: The quantity of Biogas produced in all the three cases:

Reactor	A	B	C
Total gas produced (cu.cm)	5200	4175	4740

From the table 1, we can say that in case A, the co-digestion of poultry litter with press mud in 1:1 ratio is having more syntrophic effect and it is completely biodegraded by the microorganisms and has produced more biogas than the rest of the two cases. It is followed by case B and case C. The physico-chemical properties such as pH, Total solids, volatile solids and C/ N ratio are known to favour biogas production. The amount of carbon and nitrogen nutrient source affects the growth of microorganisms and the biogas production. It has observed that the quantity of biogas production is maximum in case A i.e., 5,200 cu.cm from all the three cases and next it is observed in case C i.e., 4740 cu.cm and then by case B (4175 cu.cm).

4. Conclusions

The importance of Anaerobic co-digestion in improving biogas yield is better shown from this experiment.

References

1. APHA- AWWA- WPCF, 1998. Standard Methods for the Examination of Water and Wastewater. American Public Health Association, Washington, DC.
2. P. Panichnumsin, A. Nopharatana, B. Ahring, and P. Chaiprasert, (2012). Enhanced Biomethanation in Co-Digestion of Cassava Pulp and Pig Manure Using A Two-Phase Anaerobic System.
3. Gangagni Rao, A., Surya Prakash, S., Joseph, Johny, Rajashekhara Reddy, A., Sarma, P.N., 2011. Multi stage high rate biomethanation of poultry litter with self mixed anaerobic digester. Bioresour. Technol. 102 (2), 729–735.
4. Kelleher, B.P., Leahy, J.J., Henihan, A.M., O'Dwyer, T.F., Sutton, D., Leahy, M.J., 2002.Advances in poultry litter disposal technology – a review. Bioresour. Technol. 83, 27–36.
5. Peter Ciborowski., 2001. Anaerobic digestion of livestock manure for pollution

control and energy production: a feasibility assessment. Minnesota Pollution Control Agency.http://www.pca.state.mn.us/publications/p-gen4-02.pdf>, 2013.

6. Salminen, E.A., Rintala, J.A., 2002a. Anaerobic digestion of organic solid poultry slaughter waste – a review. Bioresour. Technol. 83, 13–26.