Available online at www.sciencedirect.com

ScienceDirect

Procedia Environmental Sciences 35 (2016) 795 – 800

Procedia Environmental Sciences

International Conference on Solid Waste Management, 5IconSWM 2015

Self - Circulating Biogas Generation for Swine Waste

M. Adam Mydeen[a], M. Venkateshwaran[a], S. Siva Sakthi Velan[a], C. Aarthy Vigneshwari[a], V. Kirubakaran [b,*]

[a] *M. Tech. Scholar, The Gandhigram Rural Institute – Deemed University, Gandhigram, Tamil Nadu, India*
[b] *Assistant Professor, The Gandhigram Rural Institute – Deemed University, Gandhigram, Tamil Nadu, India*

Abstract

Waste management plays key role in the development of a nation. There are many technologies to produce and extract energy. Several investigation has been made for generation of biogas from animal waste. A total of about 89,600 tons of Swine waste is produced per day in India. The characteristics of Swine waste is that it has a low C/N ratio, due to high nitrogen content. This will result in the production of ammonia and it destroys the micro-organisms which is responsible for Biogas production. In order to avoid more production of ammonia, swine manure is combined with cow dung, Food Waste each and water in the ratio of 1:1:4 and 1:1.5:4 at a temperature of 35^{o}C. This paper attempts to reduce the retention time by self – circulation of slurry by the gravity difference. Also experiment has been carried out in a thermophilic range for effective digestion. Experiments have been carried out in a fixed dome digester and the gas concentration has been continuously monitored by online biogas analyzer. Comparison study was carried out in two different combination of waste at normal methanogenic micro-organisms.

Peer-review under responsibility of the organizing committee of 5IconSWM 2015

Keywords: Swine manure, biogas, low C/N ratio, Self- circulating, pig waste;

1. Introduction

Waste management is one of the key issues faced by the urban and rural areas. Even though several methods are followed, the waste to energy conversion is a promising technology as it yields to be beneficial both economically and environmentally. As we know today there is a huge market for animals as they are used as food, petsand farming. The huge waste generated from this animal farming is subjected to the problem of disposal. For solving this

* Corresponding author.
E-mail address: kirbakaran@yahoo.com

Peer-review under responsibility of the organizing committee of 5IconSWM 2015
doi:10.1016/j.proenv.2016.07.095

disposal problem biogas plants come into picture. Here, the study of Swine waste disposal has been carried out. Swine's are primarily grown for their meat called pork. But the disposal of Swine waste is tedious due to its badodour and its compactness. It is notable that Swine manure is used as a fertilizer for agriculture and food for fish farms. So, if the waste is properly treated under self-circulating anaerobic digestion, then both biogas and manure can be produced.

2. Literature Review

Xiao Wu et al. (2010) evaluated the Codigestion process by combining Swine manure with three agricultural crop residues (Wheat Straw, Oat Straw and Corn Stalks) and concluded that the more methane generation is possible with Corn Stalks of about 68% followed by Oat Straw of about 57% and Wheat Straw of about 47%. In this study, the agricultural residues were sized to 0.422 mm and maintained temperature of $37 \pm 0.1\ ^{O}C$ for the whole process.

Xiao Wu et al. (2009) proposed an idea of producing Bio-Hydrogen by combining Liquid Swine Manure with Glucose (10g / L) using anaerobic sequencing Batch reactor at $37 \pm 1^{o}C$ with pH value of 5.0. The Bio-Hydrogen production rate and efficiency was high for HRT of 12hrs.

G.F. Huang et al. (2004) profound the impact of C/N ratio on the composting of pig manure with saw dust. In this paper, two piles were constructed which consists of mixture of pig manure with saw dust at different C/N ratios of 30 and 15. They observed that the pile with lower C/N ratio took longer time for composting than the other one and the lower C/N ratio composting pile has inhibited plant growth with lower Germination Index.

Nengwu Zhu (2007) proposed the impact of initial low C/N ratio on the aerobic composting of swine manure with rice straw. In this paper, swine manure were mixed with rice straw and took in two bins with different C/N proportions of 20 and 25 and concluded that the bin with lower C/N proportions could reduce 172 kg rice straw per ton fresh swine manure than a higher C/N ratio.

N. Stalin et al. (2007) developed a three stage methane fermentation system for digesting animal manure. Here burnt bricks were used at the center of the digester to increase the concentration of the microbes by immobilizing the bacteria near the surface of burnt bricks. Only 10 to 15% of the carrier material gave more gas generation. The operating temperature was from $30 - 50^{o}$ C. By using optimal temperature and auto catalyst the parameters were studied and increase in gas production was achieved.

M Murto et al. (2004) did a comparative study of anaerobic co-digestion of food waste with sewage sludge and pig manure each. The Biogas yield was high with pig manure compared to sewage sludge even though incomplete conversion of volatile fatty acids and production of ammonia.

N. Stalin et al. (2007) proposed a new concept for increasing the microbe concentration by immobilizing microbes on carriers. This has been done by inserting Central tube of one third of diameter and volume equal to 10.7% of total volume into the digestor. The Central tube is filled with bricks which acts as a bio filter for enhancing the biogas production by 60%.

T. T. T. Cu et al. (2015) carried out a detailed study and evaluated Biogas generation potential from Vietnamese biomasses such as Animal manure, Plant Residues and Organic Wastes.

The Biochemical Methane production and Biomass characteristics showed that piglet manure produced highest methane gas production compared to other animal manure, plant residues and organic wastes.

T. Forster-Carneiro et al. (2013) worked out the availability of agricultural residues, animal wastes in Brazil. The study has been carried out in order to integrate all the Bio refineries for more energy production. The Generation potential Index was also calculated. From the Study it has been observed that Sugar cane has the highest agronomic availability of 157 million tons and it has reuse potential of 19.6 million tons.