

# **Experimental Investigation on Biogas Production Using Industrial Waste (Press Mud) To Generate Renewable Energy**

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**ABSTRACT:** The present work investigates the biogas production was performed using sugarcane waste-Press mud. The laboratory experiment was conducted in floating drum type anaerobic digester capacity of 1m<sup>3</sup> made of fiber material at continues process. The cowdung used as an inoculum of the anaerobic digester. Then raw material feeded as a Pressmud in two state one wet and dry pressmud 1:1 waste/water equal ratio and fermentation process at 30°C to 35°C was maintained in mesophilic condition. The initial pH, biogas yield, Methane concentration, and HRT these parameters was studied in the experiments. The maximum biogas yield was 0.68m<sup>3</sup> and methane concentration was reached in 67%. The maximum biogas production reported as 30min in mesophilic condition using inflammable time. The pH maximum level of 7.1 and end of the digestion period pH (acid production) was decreased. HRT days calculated as 45 days.

**KEYWORDS:** Anaerobic digestion, Renewable energy, Industrial waste, wet pressmud, Dry pressmud, fermentation, HRT.

## **I. INTRODUCTION**

Anaerobic digestion (AD) is a biochemical and thermochemical process for the treating of organic matter such as sewage sludge and industrial effluents, animal wastes, agro wastes. The anaerobic digestion process producing biogas having four stages of digestion process it's like hydrolysis, acidogenesis, actogenesis, methanogenesis in this first stage hydrolysis process involves convert complex organics to sugars and amines. The second stage involves in Convert the sugar to organic acids to acetic acids. The End digestion period the conversion of acetic acid into methane and carbon dioxide the methanogenic phase [1]. Generally the biogas contains 50-70% methane CH<sub>4</sub> and 30-50% carbon dioxides CO<sub>2</sub> depending upon these substrates or organic and also some small amount of other gases like hydrogen sulphide.

The CH<sub>4</sub> is the component chiefly available for is general calorific value of 21-24MJ/M<sup>3</sup> [2]. The biogas technologies mostly apply natural anaerobic bacteria for microbes major communities form an intricate microbiological and cod for food chain mechanisms it's mainly population of dynamics of natural ecosystems [3]. Biogas as a fuel in any country for used in mainly heating purpose and cooking then purified biogas used in a gas engine to covert the electricity and heat[4].The gases methane, and hydrogen produced, can be combusted [5].These study of biogas production system having main advantages of eliminating greenhouse gas, betterment of fertilizer and production of power and heat [6].

Generally bio digester can be operated on their temperatures ranges (a)psychrophiles below 28°c (b)mesophilic medium temperature at 29 to 40°c (c)thermophilic at 50 to 55°c[7].The methanogenesis and microorganisms growth is mainly depend on various parameters like pH, temperature, C/N ratio, organic loading rate, reactor design, inoculums and HRT [8].The now a days anaerobic treatment plants of solid waste and sludge wastes are using merging of heat treatment leading to lower amounts and higher for sludge to biogas production in end of digestion process[9]. The dry fermentation process like dry pressmud is a very complex and more reliable for the biochemical process. It's very critical to produce CH<sub>4</sub> to adopt suitable digestion process with various factors [10]. AS a result, this study uses

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industrial waste like press mud in different state for fermentation to generate biogas and find optimum biogas production in wet and dry pressmud and different parameters temperature, pressure and acid production.

**II. MATERIAL AND METHODS**

The laboratory scale anaerobic digestion experiments were carried out with two phases, one dry and other wet pressmud. The two variable temperatures and pressures are monitored. Thermocouples were used to measure the temperature of digester slurry. Pressure gauge was used to pressure measurement. The pressmud was collected from sugar industry in sethiyathope. Gas flows were measured using with gas flow meter. Inoculums of cowdung were collected from dairy form and cow dung dried in sunlight then crushed mechanically. The inflammation time was measured using lab scale burner. The physical and chemical properties of pressmud shown in table .1.

Table.1. physical and chemical properties of Pressmud

Crude wax	5-14%
Fiber	15-30%
Sugar	5-15%
SiO	4-10%
Mgo	0.5-1.5%
pH	6 to 8
Crude protein	5-15%
Moisture	75%

**III. EXPERIMENTAL SETUP**

The bioreactor with a capacity of 1m<sup>3</sup> made up of fiber material. A batch study was carried out in floating drum anaerobic bioreactor. The effective volume of the bioreactor was maintained at 700 liters. This reactor was properly provided with suitable arrangements for feeding, gas collection and draining of residues. In this experiments were carried out in the mesophilic temperature range. The bioreactor was initially inoculated with 40kgs cowdung and same quantity of water was added. Then feedstock selected for the experiment was wet pressmud and dry pressmud were collected form sugar cane industry. The bioreactor was charged separately for wet and dry pressmud at 30kgs for each and water was added. The final slurry of reactor used as a bio-fertilizer. Daily biogas production was measured by using gas flow meter (GI).

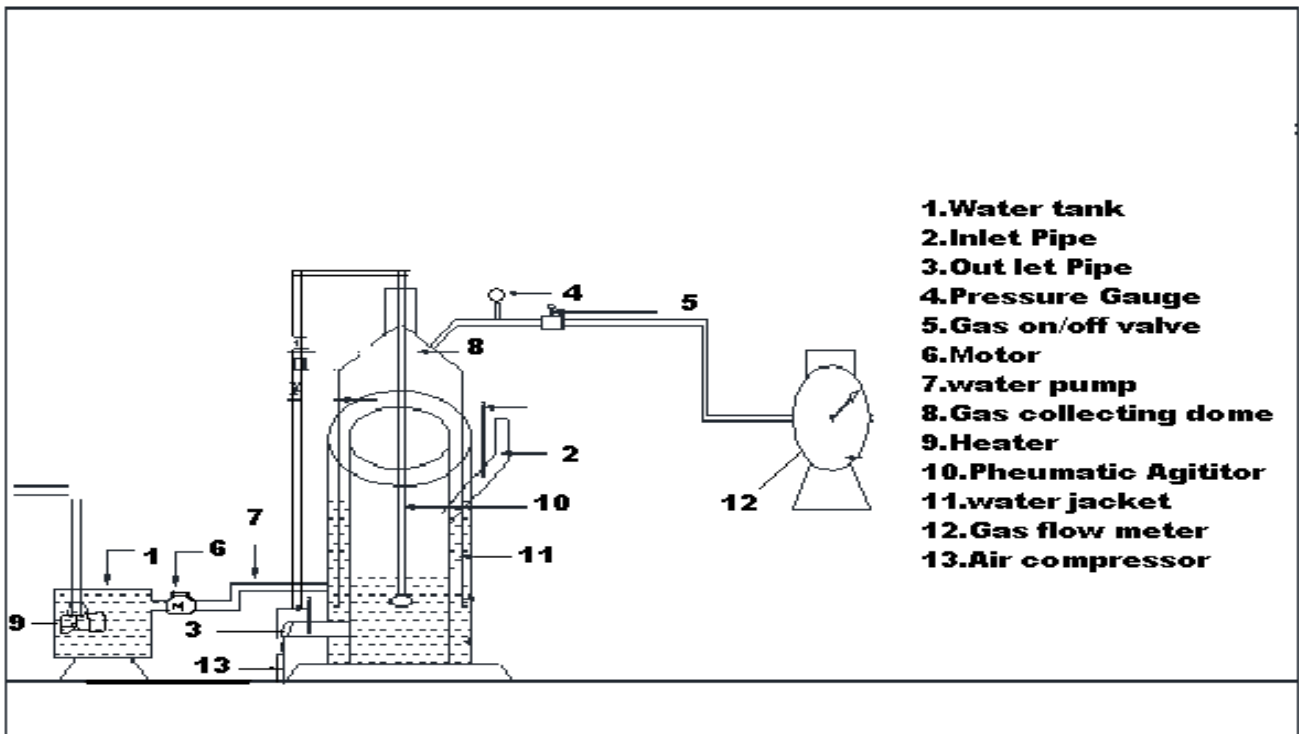


Fig.1 schematic view of the Experimental Setup

The above fig.1. Shows that schematic view of this experimental setup. The bioreactor was mixed by pneumatic stirrer with agitated the digester slurry with help of air compressor for swirling twice in a day. The pH was measured using digital pH redox meter. These daily and cumulative methane generations monitored and analyzed in AVL DI gas analyzer 444 used as a gas chromatography. It was done in department of chemical environmental laboratory at Annamalai University.

#### IV. RESULT AND DISCUSSIONS

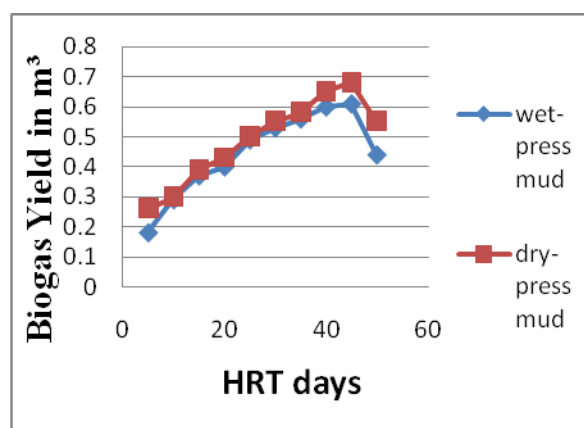


Fig.2. Biogas yield in HRT days.

In this research biogas generation was calculated from biogas yield producing in the bio reactor during the Hydro retention time (HRT) in days. Fig.1 shows the biogas yield from bioreactor wet pressmud gave very low percentage of gas production compare to dry pressmud because of wet pressmud having C/N ratio is less than 18. The microorganisms are deceased reason for this lowest source of nutrition and Carbon/Nitrogen ratio. The dry pressmud having higher daily gas production compare to wet pressmud in hydro retention time.

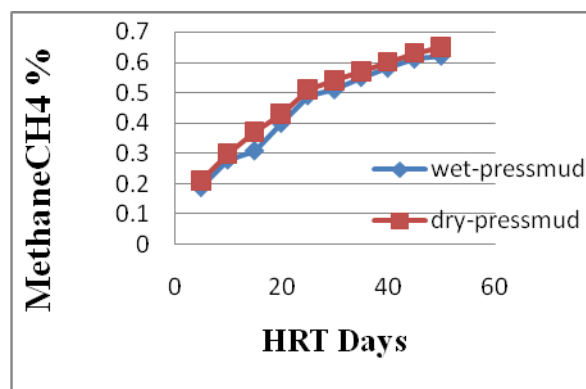


Fig.3. Methane (CH<sub>4</sub>) in HRT days.

The wet pressmud having low carbon content and acid formation pH level was 5.8 so methane formation is very low compare to dry pressmud. The microbes present in mine water with dry pressmud because higher methane production 67% was achieved. This methane (CH<sub>4</sub>) was obtained at 30°C in mesophilic condition.

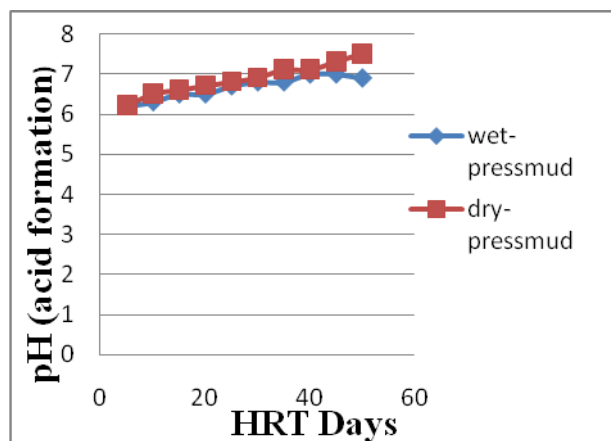


Fig.4. Acid formation (pH)

The acid production (pH) in these stage acetogenic bacteria is converting to organic material to organic acids so slowly increased for pH and also reducing the methane concentration were pH stable for dry pressmud and gradually increasing at 6 to 7.4 which is optimum range for pH and methanogenic stage. Mainly pH based on acetogenesis and acetogenesis stages.

## V. CONCLUSION

Anaerobic digestion of industrial waste (pressmud) has been carried out in a laboratory large scale floating drum biodigester with two different conditions. The maximum biogas yield was obtained 0.68 m<sup>3</sup> from dry pressmud and

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methane concentration (CH<sub>4</sub>) was reached in 67% compare to wet pressmud. The acid production pH level was 7.1 end of digestion at observed in dry pressmud in 45days. Hence industrial waste (pressmud) was potential source for energy production. The conversion of industrial waste to biogas using anaerobic digestion process represents a viable and commercial one.

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