The Biogas Plant From Liquid Waste Of Tapioca

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Abstract— The Tapioca Plant has main product of Tapioca flour and Side Product Cassava Cellulose (onggok) and The Liquid Waste. The Biogas Plant is one of the best solution for Liquid Waste, The Liquid Waste of Tapioca plant needs integrated plant for waste application for us with circumstance friendly . There are two type of Biogas Reactor which one of the waste solution is CIGAR Type or Fixed Dome type. The Biogas yield collected in biogas tank which able to use for cooking stove and lamp for light. The liquid waste from Biogas Plant can be use for irrigation and the sludge able to use for fertilizer. The solid waste that has high content of cellulose and small amount of starch was dried several days and able to use for cattle or selling this solid waste to feed company. Key words : Liquid waste, Tapioca flour, Plant , digester, Biogas

I. Introduction

The more expensive price of fuel oil and limited petroleum reserves today, efforts should be made to find alternative energy sources from new and renewable raw materials. One of the new and renewable energy is biogas. Biogas is a gas produced from the process of decomposition of organic materials by microorganisms in conditions in the absence of oxygen (anaerobes). Organic materials of biogas sources include cattle dung, horses, buffaloes, pigs, chickens, goats; Tofu industry waste, tempe, soy sauce, oil palm and tapioca; Organic trash households, restaurants and markets. Biogas from livestock waste is one of the feasible alternatives to be applied in rural communities as well as in farm centers. Biogas contains about 60% CH_4 (methane gas), 38% CO_2 (carbon dioxide) gas and about 2% of N_2 gas (nitrogen) and other gases. Biogas equivalence with other gas fuels is 1 m^3 biogas equivalent to 0.46 kg of LPG gas, or 0.62 liters of kerosene, or 0.52 liters of diesel oil, or 0.80 liters of gasoline, and or 3.5 kg of wood Burn (anonimuous 2009). The Use of biogas on a small scale or household that is as fuel cooking and lighting. The use of biogas at medium and large scale is as fuel for power generation, heating, transportation, and injection to city gas channel.

Biogas production technology is not a new technology, because since the 1970s, Denmark has done research, development, and application of this technology. Recorded in Denmark has 20 centralized plant processing plants and 35 farming plant installations (Raven et al., 2005). China has also built 7 million units of biogas reactors in the 1980s, while India also launched no less than 400,000 biogas reactors at the same time (Rahman, 2005). Technology of small scale biogas, medium scale and large scale very potential to be applied by enthusiasts of energy made from new and renewable raw materials including biogas from cattle dung. Indonesia, which has the potential of livestock and the number of rural communities who have not received electricity supply, is very appropriate to apply biogas production technology. It is based on the technology of biogas production is not complicated or not high-tech data that is fully controlled by the general public and biogas enthusiasts.

Some of the goals to be achieved on the design and application of portable biogas technology are:

1. Get a biogas reactor that is easily moved from one place to another
   Elsewhere according to location of user needs.
2. Provision of fuel utilizing livestock waste
3. Helping rural communities in terms of daily energy needs.
4. Getting ready-made organic fertilizer as a by-product of the biogas reactor.

2. Liquid Waste Management of Tapioca

The Liquid waste of Tapioca Plant in Lampung ussualy used for biogas with CIGAR (Cover inthe Ground Anaerobic Reactor) type and Fixed dome Reactor type as ilustrated in fig.1 and fig2,

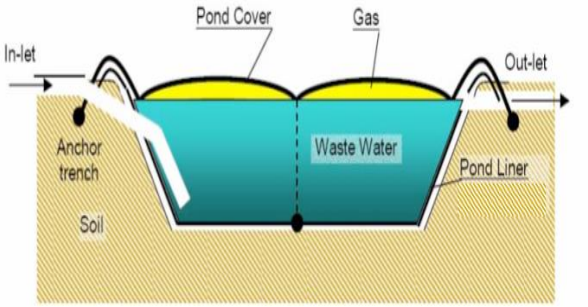

Figure 1. The Biodigester of CIGAR type

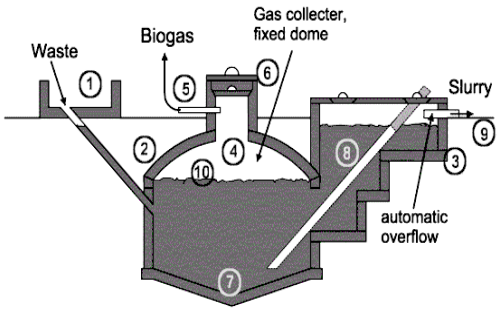

Figure 2 . Fixed-dome anaerobic reaktor

The Cigar Type suitable for large amount of liquid waste. The fixed dome type able to use for small until large scale amount of waste. Both type has Biogas as the main yield and fertilizer as side yield. In the digester, bacteria decompose organic materials in the absence of air with the release of methane and carbon dioxide. This process is shown in Figure 3. Acid-forming bacteria break down or liquefy the volatile solids, changing them in to simple fatty acids. The methane-forming bacteria then convert these volatile acids to methane and carbon dioxide. These bacteria are sensitive to changes in their environment. Rapid disgestion and efficient biogas production occur within limited ranges of temperature and are influenced by the composition of the raw material.

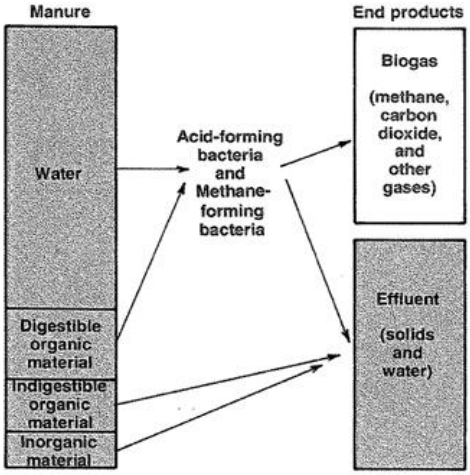

Figure 3. The breakdown of manure in an anerobic digester

The Biogas Production by fixed dome as following in table 1 , table 2 and table 3. The composition of produced biogas showed at Tabel .

Table 1. The composition of Biogas

Component	*%*
CH4	53,8
N2	11,5
CO2	34,7

The concentration of feed (influent) and slurry (effluent) of anaerobic reactor showed at Table 2

Table 2. The COD of Influent and Efluent

Unit	COD (mg/l)
Influent	90.150
Efluent	30.850

The C/N ratio of the feed (influent) and slurry (effluent) of anaerobic reactor showed at Table 3

Table 3. The C/N retio of the feed (influent) and slurry (effluent

Unit	*C-org.*	*Ntotal*	*C/N*
Influent	69.2	1,98	35,0
Efluent	52,4	2.18	24.0

The main products of the biogas production process are generally used as fuel (cooking), although today it is being used as a generator power generator. Biogas can only burn if the methane content in it reaches 57% or more (Hammad, 1996). According to Hessami et.al., (1996) biogas can burn if the methane content is at least 60%. The by-products in the form of a mixture of sludge or biological fluid can be used as organic fertilizer for plants (Li and Ho, 2006).

3. The Waste Water Treatment Plant (WWTP)

The Waste Water Treatment Plant consist of two pieces aeration pool, one fixed dome anaerobic digester, one liquid aeration, one biogas tank and one channel for field irrigation. This WWTP able to collect 700 m^3 of liquid waste from tapioca plant. The yield of Biogas has calorific value of about 2 kWh / m^3, so it has the potential to be utilized as an alternative energy source. Biogas is mainly used as fuel, as does natural gas, and is being used as a raw material for power generation, heating and water heating. If compressed, biogas can replace compressed natural gas used in vehicles. Biogas can only burn if the methane content in it reaches 45% or more (Garcelon and Clark, 2001). In Indonesia, the potential value of biogas utilization is predicted to increase due to the abundant amount of biogas feedstock and the ratio between biogas energy and promising petroleum energy.

Usefulness of biogas include:

- Substitute kerosene for cooking purposes
- Used oil fuel substitutes in power plants or generators
- Motor vehicle fuel
- Used in ovens and greenhouse lights, increasing CO2 concentrations in greenhouses used in photosynthesis processes
- As an ingredient for producing methanol

The flow of utilization and the anaerobic biogas production cycle circular system is illustrated in Figure 4 below.

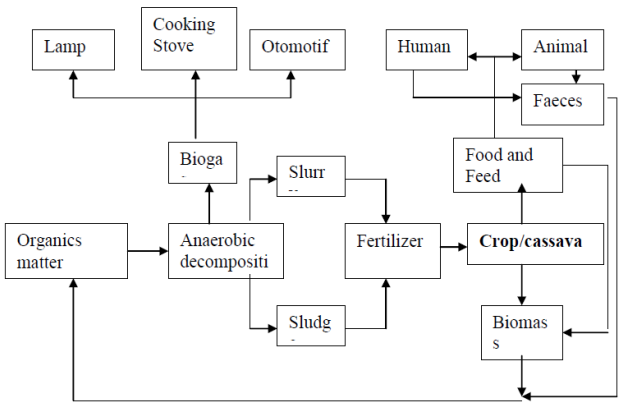

Figure 4. Flow utilization and biogas production cycle system

The biogas produced can be used for cooking purposes, generators for power generation and forwards can be used in automotive. Liquid and sludge from the biogas production process can be used as a fertilizer plant, from which the plant can be obtained food and feed. Food and feed subsequently consumed by humans and livestock. From the plant will be obtained biomass waste that can be used as

raw material biogas production. Manure and livestock can also be used as raw material for biogas production.

4. Conclussion

1. Waste Water Treatment Plant with Biogas reactor is one of the energy technology solutions to overcome the society's difficulties due to the spike in fuel prices in the country. This technology can be applied immediately; Especially for urban with tapioca plant and rural people who raise livestock (cattle, buffalo, or goat).
2.Technology of this WWTP has been developed long enough in various countries, either developed or developing country, with good result. For the user community, this biogas reactor will produce two advantages simultaneously, namely in the form of gas fuel (for cooking) and high quality fertilizer.
3.The Profit and benefit will increasing significantly for Tapioca plant which use Waste Water Treatment Plant and also will be Circumstances Friendly.

Reference

[1] Anonim, 2008, *Dasar-Dasar Teknologi Biogas*. http://www.google.com/teknologi biogas [pdf diakses 11 Nov 2014 jam 10 Wib.

[2] Biogas Support Program (BSP), (2003), *Construction option for RABR Remote Area Biogas Reactor*, SNV-Nepal

[3] Dadang dan Cahyono, 2012. *Pembangunan Instalasi Biogas dari air limbah domestik di Pondok Pesantren Al Ashriyyah Nurul Iman*, Parung, Bogor**.**

[4] Garcelon, J. and Clark, J., 2001, *Waste Digester Design, Civil Engineering laboratory Agenda*, University of Florida, http://www.ce.ufl/activities/waste/wddndx.html

[5]Haryati, Tuti; 2006 : Biogas *: Limbah Peternakan Yang Menjadi Sumber Energi Alternatif*, Journal Wartazoa, **volume 16** no 4

[6] Hammad S.M.D., 1999, *Integrated Environmental and Sanitary Engineering Project at Mirzapur*, Journal of Indian Water Work Association 28 : 231-236

[7] Hendroko, R., Liwang, T. dan Saefudin, 2008, *Sinergi Bio-metana Berbahan baku Limbah Jatropa curcass.L dan Pangan Dalam Penerapan Program Kawasan Rumah Pangan lestari*, Pasca sarjana Universitas Darma persada, Jakarta.

[8] Kadarwati, Sri, 2003, *Studi Pembuatan Biogas Dari Kotoran Kuda dan Sampah Organik Skala Laboratorium*, Journal P3TEK II

[9] Khori Ex Indarto, 2010, *Produksi Biogas Limbah Cair Industri Tapiokas Melalui Peningkatan Suhu dan Penambahan Urea Pada Perombakan Anaerrob*; Skripsi, Jurusan Biologi, FMIPA, Universitas Sebelas Maret, Surakarta

[10] Karim, K., Hoffmann, R., Klasson, T., Al-Dahhan, MH., (2005), *Anaerobic digestion of animal waste: Waste strength versus impact of mixing, Bioresource Technology*, 96, 1771-1791

[11] Metcaff dan Eddy, 2003, *Wastewater Engineering Treatment, Disposal, and Reuse*, 4th ed, McGraw-Hill, Singapore

[12] Moog, FA., Avilla, HF., Agpaoa, EV., Valenzuela, FG., Concepcion, FC., (1997), *Promotion and utilization of polyethylene biodigester in smallhold farming systems in the Philippines*, Livestock Research for Rural Development, **Volume 9**, Number 2.

[13] Nurhasanah, Ana.,Teguh W.W., Ahmad A., dan Elita R., 2006, *Perkembangan Digester Biogas di Indonesia (Studi Kasus di Jawa Barat dan Jawa Tengah)*, Balai Besar Pengembangan Mekanisasi Pertanian, Serpong