Engineering and Technology Journal e-ISSN: 2456-3358

Volume 09 Issue 09 September-2024, Page No.- 5060-5064

DOI: 10.47191/etj/v9i09.09, I.F. – 8.227

The Used of Variuos Biomass Waste as Raw Material Biogass Production using Cow Dung as Source of Microbe by Continuously-Anaerobic Fermentation on the 15 Liter Reactor

Natalina[1], Hardoyo[2], Dede Ibnu[3], Veronica Situmorang[4], Cut Mutiawati[5], Softanur[6]

[1,2,3,4,5,6] Enviromental Engineering Department. Malahayati University, Bandarlampung, Indonesia

ABSTRACT: In Indonesia, there were some biomass wastes if there not treatment, will cause quality- environmental decreasing. It is need effort to minimalize negative effect of those biomass wastes by treating to higher value product. The organic materials in the biomass waste could be anaerobically fermentatation degradated to produce biogass. The anaerobic fermentation were depended on the use of raw materials and microorganism. The organic wastes that use as raw material on this research were (1) tapioca industrial wastewater,(2) tofu industrial wastewater, (3) fruits-peel wastes and (4) vegatable wastes. The source of microbe were found from cow dung

The reaserch purpose were to know the influence of the kind of raw materials on the biogas production using cow dung as source of microbe. The research were done at Engineering Faculty Laboratry, Malahayati University Bandarlampung on the 15 liter continuously-anaerobic bioreactor with 15 days retention time. The influen were added 2 liter/2days continuously. The tested variable were COD and biogas composition.

The research result showed that the COD in the tapioca industrial wastewater were reduced 71.00 – 89.5 %, in the tofu industrial wastewater reduced 70.00 – 75.00 %, in the fruit-peel waste reduced 7.00-86.00 % andin the vegetable waste reduced 65.00 – 67 %. The CH_4 concentration in the produced biogas were 57.63 % ; 40,75 %; 41,41 % and 40.64 %. The C/N ratio effluent between 7.94 – 14.08 could be used directly as liquid organic fertilizer

The research conclusion were the production biogas using tapioca industrial wastewater showed the best result . That cause tapioca industrial wasterawte contain high carbohydrate concentration. In the anaerobic digestion, the carbohydrate material were degradated to CH_4 (methane)

KEYWORDS : Tapioca wastewater, Tofu wastewater, fruit-peel waste, vegatable waste, biogas, cow dung,, COD, CH_4, C/N ratio.

INTRODUCTION

Indonesia is the one of country that have rich of source of potential renewable energy, but the not optimal utilization yet. The utilization renewable energy have some benefit, while competitive or comparative. The competitive benefit were the reduction of potential pollution biomass, to develop energy and find new energy with affordable price. The comparative benefit were there were abundant source waste that use as raw material to produce biogass, the process did not built pollution and there are appropriate technology at various region. The development of renewable energy like bioenergy were support to CDM (Clean Development Mechanism) technology on the sustainable development.. The treatment of solid waste and wastewater technology were the key to keep environment sustainable. One of the treatment technology that would be developed was biology treatment.

The anaerobic bioconvertion technology was one of simply, cheap biologis technology, that would be easy application on theindustry. Thus, it can dispel the notion that waste treatment is a very expensive burden for the industry. Anaerob microbiology decomposition was one process that the microorganism were used energy and growth by organic metabolis on the anaerobic condition and product the biogas. The biogas product could use as alternative energy, that could solve the energy problem.

The materials thet could use as raw materials to produce biogas were the organic containing materials, like tapioca wastewater, tafu wastewater, frueit waste and vegatable waste.

If there not treatment and direct discharged to environtment, the tapioca and the tofu wastewaters contain high BOD (6.000 – 10.000 mg/l)were potentially would give an negative effect on environment equilibrium (Subekti, 2011) Fruit-peel waste contains high enough vitamins and sufficient carbohydrates (Sugiharto ,1994). Fruit-peel waste contains COD around 11,000 – 13,500. According to Hadiwiyoto (1983) Vegetable waste is part of vegetables or vegetables that can no longer be used and are thrown away. The vegetable waste COD araoud 11.00=12500

Cow dung were one of farm waste that contain some microorganisms. Like rumenansis animals, in the intestine of the cow, the anaerobic fermentation process were occured, so

cow dung often used as biogass process starter, because contain some anaerobic microorganism. The microorganisms that contain in the cow dung were selulolitic bacteria, hemiselulose digestion bacteria, sugar digestion bacteria, Acid digestion bacteria, ammonia producing bacteria, methane producing bacteria, lipolitic bacteria and vitamin synthesize bacteria (Suwandi, 1997)

The research porpuse were to know the effect raw materials (tapioca wastewater, tofu wastewater, fruit-peel waste, and vegetable waste) on the anaerobic process to produce biogass using cow dug a anaerobic microbe source.

MATRIALS AND METHODS

Materials

- The biogas production raw materials were tapioca industrial wastewater, tofu industrial wastewater, fruit-peel waste, vegetable waste
- Anaerobic-microorganism stater were cow dug

Methods

- The process were anaerobic-continuously on the 15 liters reactor (Figure-1)
- The testedvariables were COD, C/N ratio and biogas composition (CH4, CO2, N2)
- Influen debit were 2 liter/2 days with 15 days retentation time

Apparatus scheme

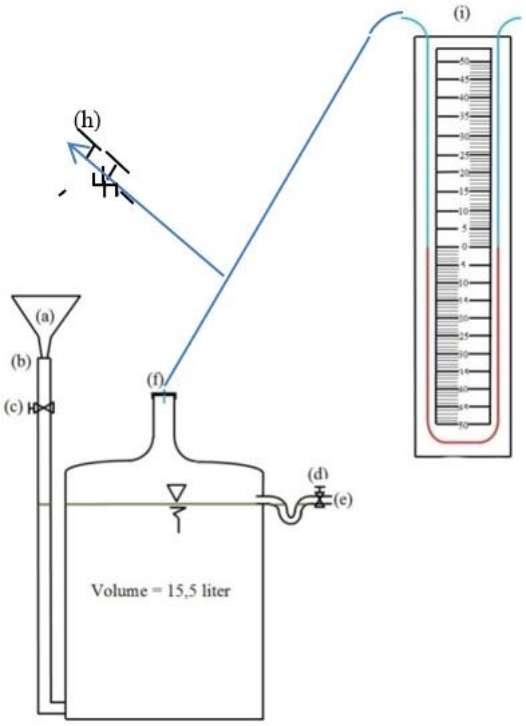


Figure 1.The research apparute scheme

Note :

a. Funnel
b. Inlet pipe
c. ¾ in PVC valve
d. ½ inch PVC valve
e. Outlet pipe
f. The produced biogas oulet
g. Closed valve when the biogas were produced
h. Flame test valve
i. Manometer

RESULT AND DISCUSSION

COD and Produced Biogas

The 15-days retention time was used in this resesearch. The influent flowrate 1 liter/day was used in to the 15 liter bioreactor. The influens were input to the bioreactor in the 2 days interval time or with 2 liter/2days flowrate. The input were done at the day of 0, 2, 4, and 6. With the retention time 15 days, the COD concentration were tested at the days of 0, 2, 4 and 6 for influent sample and at the days of 15, 17, 19 and 21 for effluent sample.

The relation COD versus fermentation time on the continuously biogas production process from tapioca industrial wastewater, tofu industrial wastewater, fruit-peel waste and vegetable waste, using cow dung stater were illustrated on Figure 2

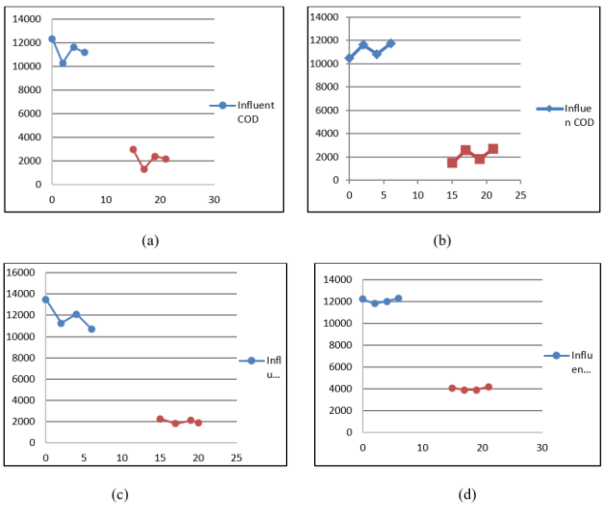


Figure 2 . The relation COD versus fermentation time on the continuously biogas production process used : (a) tapioca wastewater (b) tofu wastewater, (c) fruit-peel wasre and (d) vegetable waste

The Figure 2a shown the research use the tapioca industrial wastewater as raw material. The COD concentration of the tapioca industrial wastewater were reduce from 10.300 – 12.300 mg/l in the influent to 1.300-3.000 mg/l in the effluent. The COD reduction about 71.0-89.5%. The Figure 2b. shown the research use the tofu industrial wastewater as raw material. The COD concentration of the tofu industrial wastewater were reduce from 10.400 – 10.700 mg/l in the influent to 2.400 – 2.700 mg/l in the effluent. The COD reduction about 70-75 %. The Figure 2c. shown the research use the fruit-peel waste as raw material. The COD concentration of the fruit-peel waste were

reduce from 10.700 – 13.500 mg/l in the influent to 1.800 – 2.250 mg/l in the effluent. The COD reduction about 78-86 %. The Figure 2d. shown the research use the vegatable waste as raw material. The COD concentration of the vegatable waste were reduce from reduce from 11.800 – 12.300 mg/l in the influent to 3.900 – 4.200 mg/l in the effluent. The COD reduction about 65-67 %. There were difference on the COD reduction using the four raw materials. Those result indicated that COD reduction were depended on the compotion of raw material. The tapioca industrial wastewater gave the highest COD reduction, that cause the tapioca industrial wastewater was a materials that contain high carbohydrate. The tofu industrial wastewater contain high protein and the fruit-peel contain high vitamin

Biogas Compotition

To prove that the producted biogas could be used as energy, it have to done analized of the biogas compotition . Table 1 shown the the producted biogas compotition

Table.1. The producted biogas compotition

Component	Tapioca wastewater	Tofu wastewater	Fruit-peel waste	Vegatable waste
N_2 (%)	4.37	11.99	2.34	2.15
CH_4 (%)	**57.63**	**40.73**	**41,41**	**40.64**
CO_2 (%)	37.90	47.76	56.24	57.20

Source : Primer data

From the produced biogas analyzed, the CO_2 concentration were high enough, while the methane (CH_4) concentration abaut 40,00 - 57.00 % .. The flame test shown the fire flame, but the color was less blue. To be flameable gas, the CH_4 concentration in the biogas must be 60-90 %. The degradation of organic matter in the wastewater to produced biogas not perfect yet if used 15 days retention time. Expexted by addition retention time, the CH_4 concentration in the biogas would be increased..

The analyzed produced biogas shown that CH_4 concentration on producted biogas using tapioca industrial wastewater (57.63 %) was highest than CH4 contain using another raw materials. The tapioca industrial wastewater was a materials that contain high carbohydrate. The carbohydrate materials were degradated to CH_4 by anaerobic microorganism that contain in the cow dung

C/N Ratio

In the anaerobic process the carbohydrate matter would be degraded to produced CH_4. Those process caused C (carbon) concentration in the effluent would be smaller than C concentration in the influent. The decreasing Carbon caused C/N ratio in the effluent smaller than C/N ratio in the influent. The Nitrogen (N) component could be increased, that caused by the dead microorganism. The C/N ratio could be used as indicator for the anaerobic digestion effluent to used as a organic fertilizer. Organic fertilizer usually contain C/N <20 Table 2 shown the C and N concentration in the influent or efluent

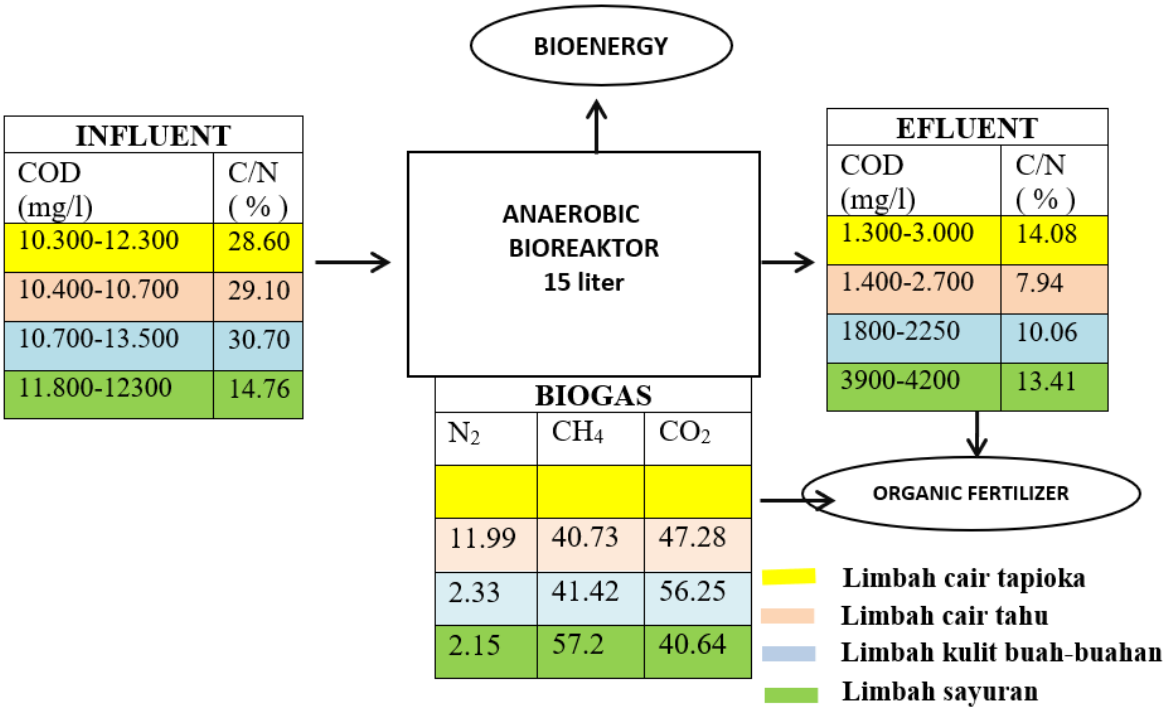
Table 2. C , N Compotition and C/N ratio

Component	Tapioca wastewater		Tofu wastewater		Fruir-peel waste		Vegatable waste	
	Influen	Efluen	Influen	Efluen	Influen	Efluen	Influen	Efluen
C (%)	1.46	0.97	1.659	0.098	1.075	0.050	1.26	1.14
N (%)	0.05	0.07	0.057	0.777	0.035	0.503	0.045	0.085
C/N	**28.6**	**14,1**	**29.10**	**7.94**	**30.7**	**10.06**	**28.00**	**13.41**

Source : Primer data

The research result shown that C/N ratio would be decreased on the all raw materials used. The all of efluents could be used as organic fertilizer.

SCHEME OF ANAEROBIC DEGRADATION



Gambar 4.. Skema proses anaerobic yang digunakan.

CONCLUSION

The COD reduction on the anaerobic fermentation of tapioca industrial wastewater, tofu industrial wastewater, fruit-peel waste and vegetable waste were 71- 89 %, 70-75 %, 78-86 % and 65-67 % respectively.The CH4 concentration were 57.63 %, 40.73 %, 41,41 % and 40.64 %

tofu industry wastewater using cow dung stater and chicken manure stater were 74-76 % and 70-75 % , methane concentration 40.731 % and 25.707 %, respectively The COD reduction and CH4 concentration on the research using tapioca industrial wastewater showed the best result . That cause tapioca industrial wasterawte contain high carbohydrate concentration. In the anaerobic digestion, the carbohydrate material were degradated to CH4 (methane)

The effluent with the C/N ratio between7.94- 14.08 could be used directly as liquid organic fertilizer

REFERENCES

1. Astuti, Ariani Dwi, 2007, Pengolahan Air Limbah Tahu Menggunakan Bioreaktor Anaerob-Aerob Dengan Variasi Waktu Tinggal
2. Dadang dan Cahyono, 2012. Pengembangan Instalasi Biogas Dari Limbah Domestik Pondok Pesantren Al Ashriyyah Nurul Iman, Parung, Bogor
3. Hardoyo dkk, 2014, Panduan Praktis Membuat Biogas Portable Skala Rumah Tangga Dan Industri, Penerbit Andi, Yogyakarta
4. Hermawan,B. dkk, 2007, Pemanfaatan Sampah Organik Sebagai Sumber Energi Biogas Untuk Mengatasi Krisis Energi Dalam Negeri, Karya Tulis Ilmiah Mahasiswa Universitas Lampung, Bandarlampung.
5. K. Christ Obileke et.al, 2021, Anaerobic Digestion ; technology for Biogas Production as a Source of Renewable Energy; Energy and Environment, vol 32
6. Kaswinarni, Febria, 2007, Kajian Teknis Pengolahan Limbah Padat Dan Cair Industri Tahu
7. Mathias Heicher et.al., 2021, Biogas plants in Renewables Energy Systems – A Systematic Review of Modeling Approaches of Biogas Production; Applied Science, 11 (8), 3361-
8. Muljatiningrum,A.,2007, Pemanfaatan Kotoran Sapi Menjadi Sumber Bahan Bakar, PT Agro Media Pustaka, Jakarta
9. Pohan, Nurhasmawaty, 2008, Pengolahan Limbah Cair Industri Tahu Dengan Proses Biofilter Anaerobik
10. Rimika Kapoor et.al;2019; Evaluation of Biogas Upghrading Technology and future Perspective : A Review; Environmental Science Pollution Research. 26, 11631 -11661,
11. S.Mirmohamadsadeghi, K. karimi, M. Tabatabei; 2019 : Biogas Production from food wasten: A review on recent development and future perpective; Bioresources Technology Reports, Vol 7,
12. Said, E. G., 2006, Membuat Biogas Pengganti Bahan Bakar Minyak Dan gas Dari Kotoran Ternak
13. Setiawan Denny, 2015, Pengaruh Komposisi Campuran Limbah Cair Tapioka Dan Kotoran Sapi

Terhadap Produktivitas Biogas Pada Proses Anaerobik Secara Batch, Skripsi, Prodi Teknik Lingkungan, Universitas Malahayati, Bandarlampung.

14. Subekti, Sri, 2011, Pengolahan Limbah Cair Tahu Menjadi Biogas Sebagai Bahan Bakar Alternatif.
15. Sukmana Widya, 2011, Biogas Dari Limbah Ternak, Penerbit Nuansa, Ujung Berung, Bandung
16. Suwandi, 1997, Peranan Mikroba Rumen Pada Ternak Rumenasia, Lokakarya Fungsional Non Peneliti, 1997
17. Tri Minarto, 2017, Pemanfaatan Limbah Cair Industri Tahu dan Kotoran Ayam Terhadap Produksi Biogas Pada Proses Anaerobik Secara Kontinyu, Skripsi, Fakultas Teknik Universitas Malahayati, Bandarlampung.
18. Wahyuni Sri, 2010, Menghasilkan Biogass Dari Aneka Limbah, Penerbit PT. Agro Media Pustaka, Jakarta Selatan
19. Widarti, Budi Nining, dkk, 2012, Produksi Biogas Dari Limbah Pembuatan Tahu Dan Kotoran Sapi, Journal Rekayasa Proses.