Effect of Beef Cattle and Horses Feces Mixture of Biogas Formation Process on Sludge Quality

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Abstract

This study aims to determine the influence of a mixture of feces of beef cattle and horse feces on the formation of biogas to the quality of sludge. The method used in this study is the experimental method in the laboratory using a completely randomized design with three treatments and six repetitions, ie P1 = C / N ratio of 25, P2 = C / N ratio of 30 and P3 = C / N ratio of 35. To determine the effect of treatments, data were analyzed with ANOVA and Duncan test. The results showed that the mixture of feces of beef cattle and horse feces significantly affected the content of N, P_2O_5 and K_2O. Treatment of C / N ratio of 35 (P3) produced the highest N content (0.4817%), P_2O_5 (0.4383% and K_2O (0.3253%).

Keywords: beef cattle feces, feces of horses, anaerobic digestion, sludge, N, P_2O_5, K_2O

Introduction

Faeces is organic waste that could potentially cause environmental pollution, it is necessary to do the processing on the stool. Organic waste includes feces of horses and cattle feces, with feces as the feces of horses and cattle are also potentially causing environmental pollution. One of the processing that can be done is to process into biogas. Formation process in addition to producing methane biogas as an energy source, produce sludge that can be used as organic fertilizer.

The process of biogas formation is influenced by several factors, namely the C / N ratio, moisture content, temperature, acidity (pH), without oxygen and the activity of microorganisms. C / N ratio is used to meet the needs of nutrients for the microorganisms to break down their activities in the substrate. Carbon is used as a source of energy and nitrogen for building cell structure of microorganisms. C and N content differences will determine the viability of biogas formation process and the quality of sludge produced. Horse feces contain elements high carbon© and nitrogen (N) is low. Meanwhile, the feces of beef cattle fed concentrates, have C / N ratio is low. Mixing between the feces of horses and cattle feces would produce the C / N ratio that can meet the needs of the process of biogas formation. According to Markel, JA (1981) C / N ratio of the process of biogas formation between 26 - 35.

Research Quality of sludge as organic fertilizer ingredients produced reflected the content of nitrogen (N), phosphorus (P), potassium (K), as in the compost. Standard quality of sludge as organic fertilizer material is assumed to equal standards of quality compost. Compost quality standards based on SNI 19-7030-2004 minimum contain nitrogen (N) 0.40%, Phosphorus (P_2O_5) 0.1% and potassium (K_2O) 0.20% (Eulis TM, 2009). The content of N in compost derived from organic materials are degraded by microorganisms substrate, so that the process of degradation greatly affects the content of N in compost (Yuli AH, *et al* 2008a). The content (P_2O_5) in substrat allegedly associated with the content of N in substrate. Potassium (K_2O) are not found in proteins, these elements are not direct

elements in the formation of organic material, potassium only play a role in assisting the formation of protein and carbohydrates. Potassium is used by microorganisms in the substrate material as a catalyst in the presence of bacteria and its activity was highly influential on potassium content. Balance of beef cattle feces and organic waste 25: 75 (P1) produces the best quality compost (N = 2.18%, P = 1.17% and K = 0.95%) (Yuli AH, *et al* 2010d).

Materials and Methods

Research material used is a horse feces, cattle feces, chemicals to analyze the content of nitrogen (N), Phosphorus (P_2O_5) and potassium (K_2O). The method used in this study was an experimental method in the laboratory. The design used was Completely Randomized Design (CRD) with three kinds of treatment, ie P1 = C / N ratio of 25, P2 = C / N ratios of 30 and P3 = C / N ratio of 35 and was repeated six times. Observed variable is the content of nitrogen (N), Phosphorus (P_2O_5) and potassium (K_2O). To determine the effect of treatment, data were analyzed with analysis of variance and Duncan test.

Biogas formation procedure:

1. Analyzing Dry Material, Carbon, Nitrogen and water content of the feces of horses and cattle feces to be used, then determine the C/N ratio of each treatment.
2. Considering the feces of horses and cattle feces according to the C/N ratio of each treatment and add water until the water content of the mixture 90% (10% dry material)
3. Incubating a mixture of horse feces and the feces of beef cattle in the digester for 30 days
4. After the process of biogas formation was completed, a content analysis of nitrogen (N), Phosphorus (P_2O_5) and potassium (K_2O) in the sludge produced.

Results and Discussion

Effect of treatment of the nutrient content of nitrogen (N).

Based on observations and measurements during the study obtained data on average nutrient content of nitrogen (N) sludge is presented in Table 1. Based on Table 1, shows that there are differences in the average content of N. P1 treatment on average produces the lowest, ie 0.4252% followed by P2 (0.4393%) and P3 highest of 0.4817%. To determine the magnitude of treatment effect, an analysis of variance and Duncan test. The results showed that a mixture of feces of horses and cattle feces significantly influenced the content of nitrogen (N) in the sludge, the content of nitrogen (N) obtained at the highest treatment of P3 (C / N ratio 35), it is believed the process of biogas formation is influenced by C / N ratio of the biogas-forming material and activities of microorganisms which will outline the material. In the study of microorganisms that plays a indigenus microorganisms in the feces of beef cattle and is suspected of nutrients for the microorganisms forming the corresponding biogas and sludge, contained in the treatment of P3 (C / N ratio of 35) so that the process of establishing optimum biogas running high and produce biogas and sludge quality. The quality of sludge formed from the basic materials used and the smooth process of formation. Sludge quality indicators reflected in the content of the elements nitrogen (N), phosphorus (P_2O_5) and potash (K_2O) as the quality of compost. This is in line

with the opinion Yuli AH, *et al* (2008a) stating that the content of N in compost derived from organic materials subtrate are degraded by microorganisms, so that the process of degradation greatly affects the content of N in the compost. This is in line with the opinion Markel, JA (1981) and Lin, Chitsan. (2008) which states that the composting process required ratio C / N 25-35. All treatments in this study produces nutrient content N between 0.4252 to 0.4817%, this is still determined in accordance with SNI standards which require that the compost contains a minimal element N 0.40%.

Table 1. Data elements of the average content of nitrogen (N) sludge Horse Feces and Cattle Feces.

Treatment	Content Nitrogen (N)	Significance 0,05
	.....%.....	
P1	0.4252	a
P2	0.4393	a
P3	0.4817	b

Description: The same letter in the vertical direction of the column indicates no significance significantly different

Effect of treatment of the nutrient content of phosphorus (P_2O_5).

Based on observations and measurements during the study obtained data on average nutrient content of the elements phosphorus (P_2O_5) sludge is presented in Table 2.

Table 2. Data elements of the average content of phosphorus (P_2O_5) sludge Horse Feces and Cattle Feces.

Treatment	Content Phosphorus (P_2O_5)	Significance 0,05
	.....%.....	
P1	0.3463	a
P2	0.4225	b
P3	0.4383	b

Description: The same letter in the vertical direction of the column indicates no significance significantly different

Based on table 2, shows that there are differences in the average content of P_2O_5. The treatment produced an average of P1 tertendah, ie 0.3463% followed by P2 (0.4225%) and P3 of the highest 0.4383%. To determine the magnitude of treatment effect, an analysis of variance and Duncan test. P2 and P3 treatment produces different P_2O_5 nutrient content is higher than P1 treatment, it is allegedly in line with the content of P_2O_5 content of N in the sludge as well as in the compost. This is in line with the opinion Yuli AH, *et al* (2008c) and Stofella, PJ and Brian A. Kahn, (2001) which stated content (P_2O_5) in the compost allegedly associated with the content of N in substrate. The greater the nitrogen contained in the multiplication of microorganisms that break down phosphorus will increase, so that the content of phosphorus in substrate materials also increased. The content of phosphorus in substrate material will be used by most microorganisms to build the cell. Overhaul of organic matter and phosphorus assimilation process occurs because of the phosphatase enzyme produced by microorganisms.

Effect of treatment on nutrient element content of potassium (K_2O).

Based on observations and measurements during the study obtained data on average nutrient content of element potassium (K_2O) sludge is presented in Table 3.

Table 3. Data elements of the average content of potassium (K_2O) and horse feces sludge cattle Feces

Treatment	Content Potassium (K_2O)	Significance 0,05
	.....%.....	
P1	0.2822	a
P2	0.2897	ab
P3	0.3253	b

Description: The same letter towards the vertical column indicates no significance significantly different

Based on Table 3, shows that there are differences in the average content of K_2O. P1 treatment on average produces the lowest, ie 0.2822% 0.2897% followed by P2 and P3 highest of 0.3253%. To determine the magnitude of treatment effect, an analysis of variance and Duncan test, P3 treatment produces the highest K_2O nutrient content, it is alleged K_2O content of sludge derived from the raw materials are used that contain a lot of greenery in which there are many elements of K_2O is in the process of biogas formation will be utilized by bacteria for its activity. K_2O content of the sludge as contained in the compost. K_2O content of the research is still in accordance with the standards prescribed SNI which requires that the compost contains elements of at least 0.20% K_2O.

Conclusions

1. Mixture of horse feces and the feces of beef cattle with different C/N ratio (25-35) significantly affect the quality of sludge.
2. Mixture of horse feces and the feces of beef cattle with the C/N ratio of 35 produces the highest sludge that is Nitrogen (N) 0.4817%, Phosphorus (P_2O_5) 0.4383% and potassium (K_2O) 0.3253%.

References

Eulis T.M., 2009. *Biokonversi Limbah Industri Peternakan*.UNPAD PRESS.Bandung.

Lin, Chitsan. 2008. *A negative-pressure aeration system for composting food wastes*. Bioresource Technology. Vol 99 Issue 16. P7651-7656,6p.

K.Y.Chan, C Dorahy, T Wells, D Fahey, N Dowoan, F Saleh, and I Barchia. 2008. *Use of Garden Organic Compost in vegetable Production Under Contrasting Soil P Status*. Australian Journal of Agricultural Research, 59, 374 – 382.

Markel,J.A.1981. *Managing Livestock Wastes*. AVI Publishing Company, INC, Westport, Connecticut.

Stofella,P.J. dan Brian A. Kahn, 2001. *Compost Utilization in Holticultural Cropping Systems*. Lewis Publishers.USA

Yuli A.H., Ellin H., dan Eulis T.M., 2008a, *Analisis Kandungan N, P dan K Pada Lumpur Hasil Ikutan Gasbio (Sludge) Yang Terbuat Dari Feses Sapi Perah*, Semnas Puslitbangnak – Bogor,

Yuli A.H., Ellin H., dan Eulis T.M., 2008b, *Analisis Kualitas Kompos Dari Limbah Organik Pasar Tradisional Tanjungsari Sumedang*, PATPI – Palembang

Yuli A.H., Ellin H., dan Eulis T.M., 2010d, *Pengaruh Imbangan Feses Sapi Potong dan Sampah Organik pada Proses Pengomposan terhadap Kualitas Kompos*, Jurnal Penelitian Universitas Jambi Seri Sains Vol 12, No 3 Bulan Agustus.