The Utilization of Fermented Palm Oil Sludge, Methyonine, Lysine and Triptophan on Layers Diet to Reduce Environment Pollution

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ABSTRACT

The aim of this study was to evaluate the effect of feeding fermented palm oil sludge and critical amino acid (CAA); methyonine, lysine and tryptophan supplementation on diet to reduce environment pollution. The research design used was completely randomized design with 4 treatment groups. The treatments were P0: control diet, P1: 50% CAA on diet, P2: 75% CAA on diet, P3: 100% CAA on diet. Parameters measured were nitrogen, amoniac, sulfide, phosphor, Biochemical Oxygen Demand (BOD) and Chemical Oxygen Demand (COD) feces. The results showed that there was a highly significant effect of feeding fermented palm oil sludge on nitrogen, ammoniac and sulfide in feces ($P<0.01$) and phosphor ($P<0.05$). However, the treatment insignificantly affected BOD in feces. In contrast, the COD was very significantly affected by the treatment ($P<0.01$). In conclusion, feeding fermented palm oil sludge with additional of CAA may have effect to reduce nitrogen, ammoniac, sulfide, phosphor and COD on layer feces; which resulted in a decrease on environment pollution. The best treatment was the diet contains 100% fermented palm oil sludge.

Keywords: critical amino acid, environment pollution, fermented palm oil sludge.

INTRODUCTION

Society awareness of environmental pollution has been improving significantly. Due to a rising in environmental pollution, many society elements, government and also non-government organization is discussing issue regarding environmental pollution. For example, Government of The Republic of Indonesia has issued Act No. 752/1994 on broiler farming which states that broiler farming of 15000 chickens and layer farming of 10.000 layers should be completed with waste management.

Poultry farming produces waste such as nitrogen and sulfide which are pollutions for the environment. Those gasses create unpleasant smells to the environment (Svensson, 1990; Pauzenga, 1991). A high concentration of ammonia in the poultry feces is an indication of an improper protein level on diet or a problem in digestion process (Pauzenga, 1991).

Palm oil sludge of palm oil processing has not utilized economically. In palm oil plantation area, palm oil sludge is pollutant that contaminates the area and problem for the society (Yeong, 1982). Data says that palm oil production in 2009 is 12.4 million tons which 2% of it is palm oil sludge. Palm oil sludge can be processed to make animal diet as it has similar nutritional value as rice brand even though it has a high concentration of crude fiber. Some research reported various results of palm oil sludge crude fiber content due to its different analysis methods. Limitations in palm oil sludge utilization as poultry diet are high crude fiber content (11-32.69%), ash content (9-25%) and low concentration of amino acid content (Hutagalung, 1978); therefore, fermentation process is required (Baeker *et al*., 1981; Pasaribu *et al*., 1998; Sinurat *et al*., 1998; Purwadaria *et al*., 1999; Bintang *et al*., 2000). Fermentation technology changes the an-organic nitrogen into cell protein as well as produces hydrolytic enzymes to increase diet digestibility (Purwadaria, 1998). It is reported that fermentation process increase the utilization level of palm oil sludge from 5 % to 10% in broiler diet (Sinurat *et al*., 2000). Moreover, Sonaiya (1995) stated that fermented palm oil sludge is able to mix into diet for up to 20-40%. Similarly, Fenita *et al*. (2009) revealed that feeding 15% of fermented palm oil sludge resulted in pale yolk color.

There are 22 kinds of amino acid to form body tissue. Barner *et al*. (1995) mentioned that quality of protein depends on the essential amino acid and the balance of the amino acids. Lysine, methionine and tryptophan are amino acids to complete on diet.

Animal nutritionists have been focusing on the use of amino acid on diet as supplement. It is beneficial to improve growth performance of poultry as well as reducing environment pollution such as ammonia. A reduce in total nitrogen excretion will minimize environment pollution (Gatel and Grosjean, 1992) and also reduce respiratory disorder on chicken (Chung, 1995).

MATERIAL AND METHOD

The Process of Making Fermented Palm Oil Sludge

The process of making fermented palm oil sludge is started by adding aquadest (70%) into dry palm oil sludge. Then it is mixed well and warmed for 30 minutes to sterilize the materials. At room temperature, the materials are inoculated with 9% *Neurospora crassa* by mixing them well and incubated for 7 days (aerobic process for 5 days and an aerobic process for two days). After that the product of the fermented palm oil sludge is harvested, dried and grinded (Figure 1).

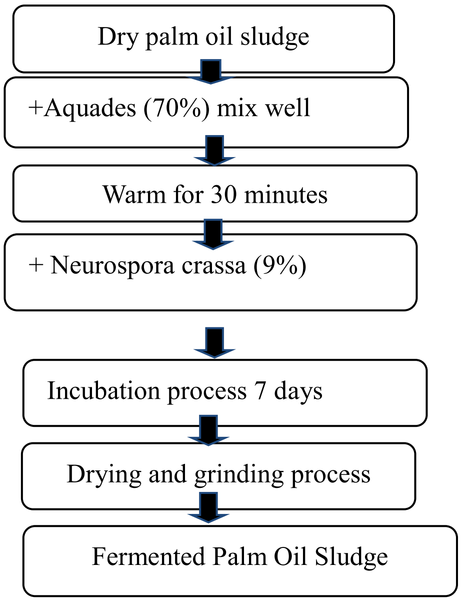

Figure 1. The Process of Making Fermented Palm Oil Sludge

Object of the Research

The objects of the research were forty layers aged 9 months which were distributed into four treatments. The treatments were fermented palm oil sludge with critical amino acid (lysine, methionin and thryptophan) 50%, 75% and 100%, as recommended by Bell and Weaver (2002). The layers were fed ad libitum for 60 days. The diet composition is shown on Table 1.

Table 1. Composition and nutritional content of diet on treatment groups

Diet	Treatment ration				
	P0	P1	P2	P3	P4
Yellow Corn meal (%)	38	38	38	38	38
Fish meal (%)	8	7	7	7	7
Soybean meal (%)	19.5	16	16	16	16
Fermented palm oil sludge(%)	0	15	15	15	15
Rice brand meal(%)	24.5	14	14	14	14
Oil (%)	3	3	3	3	3
Mineral mix	3	2	2	2	2
$CaPO_4$	4	5	5	5	5

Total(%)	100	100	100	100	100
EDK	0	0	6	9	12
Nutritional content					
Crude Protein(%)	18.05	18.07	18.07	18.07	18.07
ME (kkal/kg)	2733.42	2701.90	2701.90	2701.90	2701.90
Crude Fiber(%)	3.77	5.57	5.57	5.57	5.57
Calsium(%)	3.24	3.04	3.04	3.04	3.04
Phospor(%)	1.41	1.55	1.55	1.55	1.55
Fat(%)	4.92	5.16	5.16	5.16	5.16

Parameters measured were feces nitrogen (Kjedahl method), phosphor and sulfide measurement (AOAC, 1980), ammoniac (Nessler method), BOD and COD on feces were collected 4 days before the end of the research as well as lung histology. The research design used was completely randomized design (CRD). The collected data were analyzed by using analysis of variance (ANOVA); any significant results will be tested by Duncan's Multiple Range Test (DMRT).

RESULTS AND DISCUSSION

Feces production of a layer is 0.06 kg/day with dry matter of 26% (Fontenot *et al*., 1983). Chicken feces consists of undigested cellulose and diet which contains protein, fat, carbohydrate and other organic compounds. Protein in feces is a source of nitrogen, even though nitrogen is also supplied from an-organic sources. The feces composition of chickens depends on type, age and diet. Critical amino acid supplementation contributes varied levels on nitrogen, ammoniac, phosphor, sulfide, BOD and COD.

Feces Nitrogen of Layer

Statistical analysis on feces nitrogen data showed a highly significant decrease (P<0.01) see Tabel 2. DMRT results revealed that the treatment groups data were very different from the control group (P<0.01); however, there was no significant difference among the treatment groups (P>0.05). The lowest feces nitrogen level was at P3 of 100% critical amino acid supplementation (1.59% nitrogen) which was decreasing by 39.57% compared to control group. Methionin is a critical amino acid that contributes the highest effect to decrease feces nitrogen. This effect may be due to the utilization level of synthetic methionin can be up to 100%; in contrast, the lysine and tryptophan utilizations are limited to 80-90% (Lesson and Summer, 1990). Methionin, as sulfur supplier is useful in particular metabolism; such as choline, carbohydrate and protein metabolism (Amrullah, 2004). A significant decrease on feces nitrogen may be due to an efficient protein metabolism process in the layer body that resulted in a decrease in environment pollution (Gatel and Grosjean, 1992) as well as a decrease in respiratory disorder cases. Observation on lung histology showed that the layers were healthy with no specific abnormality. It means that the layers environment during the experiment was healthy for the layers growth.

Table 2. Nitrogen content (%), ammoniac (ppm), phospor (%), sulfide (%), BOD (mg/l) dan COD (mg/l) on layer feces fed with fermented pal oil sludge and critical amino acid.

Treatment	Nitrogen	Ammoniac	Phosphor	Sulfide	BOD	COD
P0	2.810 [a]	1.1648[a]	1.956[a]	0.124[a]	11.274	23.428[a]
P1	2.232 [b]	0.5056[b]	1.554[ab]	0.104[ab]	10.234	22.344[ab]
P2	1.956 [b]	0.3008[b]	1.224[b]	0.086[b]	10.002	20.936[ab]
P3	1.590 [b]	0.3008[b]	1.310[b]	0.076[b]	10.032	19.772[b]

Feces Ammoniac of Layers

The poultry farming pollutant is related to feces which containing nitrogen and sulfur. These compounds are biodegradable. Unfortunately, the process by microorganism produces ammoniac, nitric and sulfide. Those gases create unpleasant smell to the environment.

Results of ANOVA showed that feces ammoniac of control group was very significantly different from treatment groups (P<0.01). However, there was no significant difference among treatment groups ($P>0.05$). The lowest feces ammoniac level was 0.3008 ppm of P2 and P3. According to Setiawan (1996), ammonia level of 5 ppm will affect human and animal health. A supplementation of critical amino acid of 75% and 100% contributes the lowest feces ammoniac. There was 74.20% decrease of feces ammoniac. Pauzenga (1991) mentioned that a high level of ammoniac in feces is because of bad digestion process or over protein on diet. Instead of absorbed as amino acid, some nitrogen is excreted as feces ammoniac. There is evidence that the treatment of fermented palm oil sludge and critical amino acid supplementation on diet had resulted in good efficiency protein in digestive tract of layers.

In general, the feces ammoniac during experiment was ranged from 0.3008 ppm to 1.1648 ppm. The low level of ammoniac is good for the environment and causes no lung abnormality.

Feces Phosphor of Layers

Results of ANOVA and DMRT showed that feces phosphor of control group was significantly different from P2 and P3 treatment groups ($P<0.05$). The lowest phosphor was in P3 treatment group (1.224%). Rachmawati (2000) reported that normal feces phosphor on broiler chicken is 3.22%. This figure is much higher than the feces phosphor in our research which ranging from 1.224% to 1.956%. This result showed that critical amino acid supplementation is able to increase the phosphor utilization efficiency during egg formation (Amrullah, 2004) as more phosphor may be used for egg formation metabolism.

Feces Sulfide of Layers

Level of sulfide in this research was ranged from 0.076 to 0.124 ppm. Results of ANOVA and DMRT showed that feces sulfide of control group was highly significantly different from P2 and P3 treatment groups ($P<0.01$). The lowest sulfide was in P3 treatment group (1.224 ppm). According to Pauzenga (1991), a level hydrogen sulfide of 10 ppm/hour may cause human eyes irritation. Rahmawati (2000) reported that feces sulfide in broiler chicken was 0.52 ppm.

Sulfide gas creates unpleasant smell in a poultry house. Efforts to decrease sulfide level in poultry house are by using 5% zeolit and critical amino acid that are effective to reduce sulfide in the environment. The treatment of critical amino acid on diet is able to decrease sulfide level by 38.71%.

Biochemical Oxygen Demand

BOD is defined as bio-oxygen demand of microorganism to decompose poultry feces. In a poultry house, BOD is a great concern as it causes unpleasant smell around the poultry house. This research revealed that there was insignificant effect of feeding fermented Palm oil sludge and critical amino acid supplementation on BOD level. BOD levels are ranged from 10.002 to 10.274 mg/l. Rachmawati (2000) stated that BOD level in jungle fowl is in average of 15.39 mg/l.

Chemical Oxygen Demand (COD)

Analysis of variance results of COD showed that treatments had very significantly affected COD ($P<0.01$). According to Duncan's Multiple Range Test, it is evident that control group had significant differences compared to P3 group (19.77). COD levels in this research are ranged from 19.77 to 23.42 mg/l. The figures are lower than COD levels measured in Rachmawati's research (2000), which stated that average COD level of layers is 35.12 mg/l. A low COD in this research might be due to a healthy poultry house environment and also critical amino acid supplementation which resulted in a decrease in organic matter decomposition and organic matter oxidation such as ammoniac and nitric.

CONCLUSION

In conclusion, the utilization of fermented palm oil sludge and critical amino acid on layers diet are able to reduce environment pollution as the treatments decrease nitrogen, ammoniac, sulfide, BOD and COD feces of layers.

REFERENCES

A O A C. 1980. Official methods of analysis. 11 ed. Association of Official Analytical Chemist, Washintong, D. C.

Barnes, D.M. C.C Calvert and K.C. Klasing. 1995. Methionin deficiences protein and system but not tRNA acylation in muscles of chick. J. Nutr. 125 : 2623-2630.

Baeker, T.W., N.J. Drouliscos and J.T. Worgan. 1981. Composition And Nutritional Evaluation of *Aspergillus onzae* Biomas Grown On Palm Oil Processing Effluents, J.Sci. Food Agric.32:1014-1020.

Bell, D.D and Weafer. Jr. 2002. Comerercial Chicken Meat And Egg Production Poultry Specialist Univercity Of California Reverside California.

Bintang, I.A. K, A. P. Sinurat, T. Purwadaria dan T.Pasaribu. 2000. Nilai Gizi Lumpur Sawit Hasil Permentasi Pada Berbagai Proses Inkubasi. JITV 5 : 7-11.

Bps. 2000. Statistik Indonesia 2000. Badan Pusat Statistik. Jakarta.

Charles, R.T. dan Hariono. 1991. Pencemaran Lingkungan Oleh Limbah Peternakan Dan Pengolahannya. Bull Fkh – Ugm X (2) 71-75.

Fenita, Y. 2002. Suplementasi Lisin dan Metionin serta Minyak Lamuru kedalam Ransum Berbasis Hidrolisa Bulu Ayam ,Ayam Ras Pedaging, Disertasi Program Pasca Sarjana IPB.

Fontenot, J.P., W. Smith and A.L. Sutton. 1983. Alternatif Utilization Of Animal Waste.

Gatel, F and F. Grosjean. 1992. Effect Of Protein Content Of Diet Nitrogen Excretion By Pigs.J.Livest.Prod.Sci 31: 109-120.

Hutagalung, R.I. 1978. Non Tradisional Feedingstuffs For Liverstock In Feeding stuffs Livestock Insouteast Asia (Devendra.C and R. Hutagalung) Malaysia Society of Animal Production. Serdang, Malaysia.

Lesson, S and J.D. Summers. 2001. Nutritional of The Chicken. 4 th Ed. University Books Guelph, Ontario, Canada.

Moran, E.T.R., D. Bushong and S.F. Bilgilli. 1992. Reducing Dietary Crude Protein for Briler While Statisfying Amino Acids Requirements by Least Cost Formolation Life Peformance, Litter Compotition and Yield of Fast Food Cuts Ax Six Wels Poult. Sci: 71(10) : 1687-1994.

Pasaribu, T., A.P. Sinurat., T. Purwadaria, Supriyati, J. Rosida dan H. Hamid. 1998. Meningkatkan Nilai Gizi Lumpur Sawit Melalui Fermentasi. Pengaruh Jenis Kapang, Suhu dan Lama Proses Enzimatis. JITV 3: 237-242.

Pauzenga, 1991 Animal P Introduction in The 90s in Harmony with Nature, A Case Study in The Nederlands. In Biotechnology in the Feed Industry. Proc. Alltech. Seven Annual Symp. Nicholasvile. Kentucky.

Purwadaria, T., A.P. Sinurat, Supriyati, H. Hamid dan I.A.K. Bintang.1999. Evaluasi Nilai Gizi Lumpur Sawit Fermentasi Dengan Aspergillus Niger Setelah Proses Pengeringan Dan Pemanasan. JITV 4 : 257-279.

Rachmawati, S. 2000. Upaya Pengendalian Lingkungan Usaha Peternakan Ayam. Wartazoa. Vol 9 No 2 Thn 2000. Balai Penelitian Veteriner Pusat Penelitian Dan Pengembangan Peternakan Bogor.

Setiawan, H. 1996. Amonia Sumber Pencemar Yang Meresahkan. Infovet (Informasi Dunia Kesahatan Hewan) Edisi 037. Agustus 1996, Hal 12.

Sinurat, A.P., T. Purwadaria, H. Surachman, H. Hamid Dan I.P. Kompaing 1998. Pengaruh Suhu Ruangan Fermentasi Dan Kadar Air Substat Terhadap Nilai Gizi Produk Fermentasi Lumpur Sawit. Jitv 3:225-279.

Sinurat, A.P., T. Purwadaria, T. Pasaribu, P. Ketaren, D. Zainudin dan I.P. Kompiang 2000. Pemanfaatan Lumpur Sawit untuk Ransum Unggas. (1) Lumpur Sawit Kering Dan Produk Fermentasinya sebagai Bahan Pakan Ayam Brpiler. Jitv 6: 107-112.

Yeong, S.W. 1982. The Nutritive Value of Palm Oil the Products for Poultry in Animal Prod and Health in the Tropics (Jainudin and Ar. Omar, Eds). Penerbit University Malaysia, Selangor 217-232.