The Influence Of Fermentation Time On Physical And Proximate Characteristics On Palm Kernel Meat Using Bacillus Licheniformis

Siti Lestari, Eddy Suprayitno, Anik M. Hariati

Abstract: Palm kernel meal is waste produced from the extraction of palm oil. The main problem in the use of palm kernel meal in fish feed ingredients is the high crude fiber content making it difficult for fish to digest. The purpose of this study was to observe palm kernel meal fermented with Bacillus lichemiformis to improve the quality of feed raw materials. The research was carried out with the length of fermentation treatment 0,24,48,72, and 96 hours with 3 replications. The results showed that the fermentation of palm kernel meal at the 48th hour using Bacillus lichemiformis gave the best results on increasing protein levels by 30, 22 and the results of physical characteristics test of aroma, texture, lumps, and colors also gave the best results. Then the crude fiber decreases for 96 hours after fermentation.

Index Terms: Fermentation, Palm kernel meal, Bacillus licheniformis.

1. INTRODUCTION

Palm kernel meal, very potential to be used as an alternative feed source of protein and energy. The nutritional content of the palm kernel meal is crude protein at 15.32%, crude fiber 14.39%, crude fat 1.75%, Ca 0.49% and P 0.68%, with a metabolic energy content of 1892 Kcal / kg [1]. (Shakila and Reddy, 2014). Palm kernel meal is included in the type of concentrate feed or reinforcement feed. Which has benefits as a source of energy, protein, vitamins, and minerals [2] (Ketaren, 2008). Pranata (2015) [3] the content of crude fiber of palm kernel meal ranges between 10-17%. In order to be used as a raw material in making fish feed, technology is needed to reduce the fiber content of the palm kernel meal. The use of palm kernel meal as fish feed is not optimal because of the low biological value of protein and high crude fiber which can inhibit the process of nutrient absorption. Bacillus species are well suited for the production of protease enzymes. Bacillus microbes do not produce toxins, are easily grown, do not require expensive substrates, are able to withstand high temperatures, lack metabolic byproducts and their ability to produce large amounts of extracellular protein. One of the thermostable proteases can be produced from thermophilic microorganisms, namely Bacillus licheniformis [4] (Soeka et al., 2011). then Bacillus licheniformis is able to produce cellulose, hemicellulose, and manannase [5] (Seo et al., 2014).According to the ultimate (2011) [6] Fermentation is the process of breaking down organic compounds into simpler compounds by involving microorganisms. In general, all fermented end products usually contain compounds that are simpler and easier to digest than the original ingredients. Overcoming this problem needs to be studied about the processing of palm kernel meal which can reduce levels of crude fiber and increase the efficiency of its protein so that its utilization in feed is maximum. One way to increase the effectiveness of protein and the value of the benefits of palm kernel meal with a biotechnological approach through fermentation with Bacillus licheniformis.

2 METHODOLOGY

2.1 Fermentation

The process of fermentation of palm kernel meal refers to the solid phase fermentation method. The initial procedure for the process of fermentation of palm kernel meal flour is to make an inoculum. B. licherniformis isolates obtained from LIPI were first rejuvenated in Nutrient Agar (NA) and incubated for 24 hours at 37°C. After being cultured on the media so that it is then cultured on a liquid media (Nutrient Broth), then incubated in an incubator at 37°C for 24 hours with a bacterial density of 10^8, then the bacteria are ready to use. The next procedure is solid-phase B. licherniformis fermentation. Each treatment was fermented for 0, 24, 48, 72 and 96 hours, repeated 3 times then the fermentation product was harvested.

2.2 Physical Characteristics

Observations made at this stage of the fermentation process are changes in texture, aroma, lumps, and color on the surface of the fermented palm kernel meal media, then made in the form of scoring [7] to indicate the success of the fermentation process in each treatment 0, 24, 48, 72 and 96 days long fermentation time. Scoring 1-4 with criteria not good, poor, good and very good where the greater the score indicates the better the fermentation.

2.3 Proximate Analysis

Proximate analysis was carried out on palm kernel meal before fermentation and after fermentation at 24 hours, 48 hours, 72 hours and 96 hours. The proximate analysis consists of water content, crude protein content, crude fat content, ash content and crude fiber [8].

2.4 Statistical Analysis

The data obtained were analyzed using variance analysis (ANOVA) using SPSS software ver. 20.

3 RESULT AND DISCUSSION

Physical Characteristics of Fermented ResultsBased on the results of fermentation, the best time is at 48 hours. The results were observed through changes in texture, aroma, lumps, and color on the surface of the palm kernel meal media.

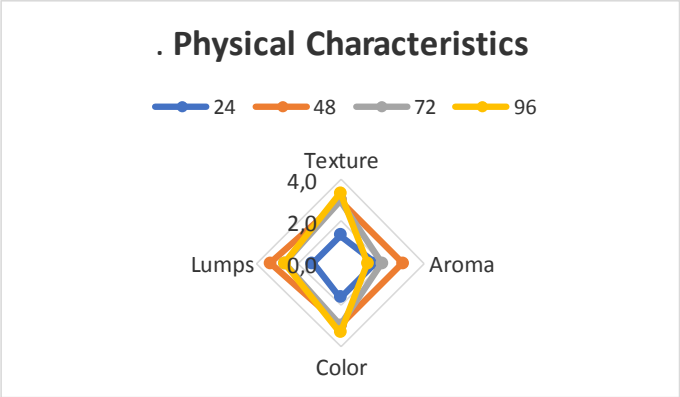

Figure 1. *Physical Characteristics of Fermented Results*

The observation results in Figure 1 above can be seen visually by the presence of lumps, the number of lumps in the fermented palm kernel meal media is also one of the indications of the best treatment. The scoring results based on blobs obtained at the 48th hour are the best results. lumps formed in fermentation with Bacillus licheniformis as a result of the exothermic reaction during the process of breaking down organic matter. Based on the results of the study, the aroma of the cemented palm kernel meal showed the best aroma, which is a little acidic and a typical fermented fragrance at the 48th hour. This is in accordance with the opinion (Abdelhadi et al., 2005) [9] which states that good fermentation is to have a sour aroma and smell good. According to Mulia et al. (2010) [10] hydrolysis time effect on increasing levels of NH_3 (ammonia). Based on the results of studies on the texture and lumps of fermented palm kernel meal at 48 hours showed the best texture and lumps compared to other hours. Texture formation is also influenced by water content, fat content, and type of substrate (Fellows, 1992) [11]. Deliani (2008) [12] states that fermentation causes changes in the nature of feed ingredients including texture as a result of the breakdown of food content by microorganisms that are in it.

Proximate Palm Kernel Meal

The proximate yield of palm kernel meal which has been fermented at the highest fermentation time of protein value at 48 hours. The use of fermentation is intended to reduce levels of crude fiber and improve protein quality. The results can be seen in Table 2.

Table 1. Criteria for Assessment of Physical Test Results of Fermentation Scoring

Scoring value	Number of lumps	Aroma	Color	Texture
1 (Not Good)	No lumps <10%	Rancid or fragrant >10%	Black <10%	Very rude <10%
2 (Poor)	Slight clumps <10 - <25%	Somewhat missing >10 - <25%	Blackish Brown <10 - <25%	Rough <10 - <25%
3 (Good)	There are lumps >25 - <40%	Many missing >25 - <40%	Chocolate >25 - <40%	Slightly soft >25 - <40%
4 (Very Good)	Blobs >40%	Odorless <40%	Light Brown >40%	Soft >40%

Table 2. Proximate Result of Fermented Palm Kernel Meal

Long-time fermentation	Protein (%)	Fat (%)	Water (%)	Ash (%)	Crude Fiber (%)	Carbohydrates(%)
0 hours	20,01 ± 0,86^{a}	8,81 ± 0,47^{c}	89,84 ± 1,12^{d}	7,16 ± 0,18^{a}	27,78 ± 0,53^{d}	32,57 ± 2,16^{c}
24 hours	26,30 ± 1,06^{b}	5,88 ± 0,32^{b}	63,54 ± 3,14^{a}	8,42 ± 0,27^{b}	24,98 ± 2,05^{c}	21,92 ± 0,57^{a}
48 hours	30,22 ± 0,90^{c}	6,20 ± 0,27^{b}	67,73 ± 2, 25^{ab}	6,99 ± 0,11^{a}	18,30 ± 0,44^{b}	25,92 ± 0,57^{b}
72 hours	26,71 ± 0,65^{b}	4,08 ± 0,03^{a}	71,98 ± 2,29^{b}	6,99 ± 0,10^{a}	17,41 ± 0,58^{b}	32,26 ± 1,13^{c}
96 hours	25,01 ± 1,24^{b}	4,65 ± 0,57^{a}	83,46 ± 2,94^{c}	7,33 ± 0,12^{a}	14,23 ± 0,65^{a}	40,75 ± 2,75^{d}

Table 2 shows that protein levels based on proximate results increase in protein values with increasing fermentation time. The highest crude protein fermented palm kernel meal testing with a duration of 48 hours was 30.22%, then followed by a treatment of 72 hours (26.71%), 24 hours (26.30%), 96 hours (25.01 %) and the lowest treatment is 0 hours of unfermented palm kernel meal (20.01%). [13] The development of microorganisms with NH_3 and carbon substrate sources, so that by itself will increase protein levels in line with the increase of storage time in the biodegradation process and in the process makes protein levels can be maintained and easily absorbed by microbes because crude protein compounds have been decomposed to be simplified. Seen on crude fiber along with the length of fermentation the value of crude fiber decreases while the lowest crude fiber value at 96 hours fermentation is equal to 14.23%. The faster the enzyme activity will accelerate in breaking down the fiber in proportion to the formation of microbes. Bacillus lincheniformis is able to produce enzymes mananase and cellulose enzymes (Sigres and Sutrisno, 2015) [14]

4 CONCLUSION

It can be concluded from the results of the study showing that the fermentation of palm kernel meal at the 48th hour using Bacillus lichemiformis gave the best results in increasing protein levels by 30, 22 and the results of physical characteristics test of aroma, texture, lumps, and colors also gave the best results. Then the crude fiber decreases to 96 hours fermentation time.

REFERENCES

[1] Shakila, S. and P.S. Reddy. 2014. Certain observations on nutritive value of palm kernel meal in comparison to deoiled rice bran. International Journal of Science, Environment and Technology, Vol. 3:1071 – 1075.

[2] Ketaren, S. 2008. Pengantar Teknologi Minyak dan Lemak Pangan. Jakarta: Universitas Indonesia.

[3] Pranata, A. 2015. Pengaruh ‘’pemberian bungkil inti kelapa sawit yang difermentasi menggunakanisolat selulolitik dari belalang kembara pada pakan terhadap penampilan produksi puyuh jantan. Buletin Peternakan. 39:49-56.

[4] Seo, J., T. S. Park., J. N. Kim., Jong K. Ha., and S. Seo. 2014. Production of Endoglucanase, Beta-glucosidase and Xylanase by Bacillus licheniformis Grown on Minimal Nutrient Medium Containing Agriculture Residues. Asian Australas. J. Anim. Sci. 27(7):946-950

[5] Soeka, Yati Sudaryati. Sri Hartin Rahayu. Ninu Setianingrum Dan Elidar Naiola. Kemampuan Bacillus Licheniformis Dalam Memproduksi Enzim Protease Yang Bersifat Alkalin Dan Termofilik. Media Litbang Kesehatan 21(2):89-95.

[6] Pamungkas Wahyu. 2011. Teknologi fermentasi, alternatif solusi dalam pemanfaatan bahan lokal. Loka Riset Pemuliaan dan Teknologi Budidaya Perikanan Air Tawar. Media akuakultur Vol 6(1).

[7] Ihtifazhuddin, M. I., Nursyam, H., and Ekawati, A. W. 2016. The Influence of Fermentation Time in the Physical and Chemical Composition of Fermented Soybean Husk by Using Aspergillus niger on the Quality of Raw Feed Materials. J.Exp. Life Sci. 6(1):52-57.

[8] AOAC (Association of Official Analytical Chemists). 1995. Official methods of analy-sis, 12th Ed. Washington DC.

[9] Abdelhadi, L.O., F.J. Santini, and G.A. Gagliostro. 2005. Corn fermentasi of high moisture corn supplements for beef heifers grazing temperate pasture; effects on performance ruminal fermentation and in situ pasture digestion. Anim. Feed Sci. Technol. 118 : 63-78.

[10] Mulia, D.S., M. Mudah., H. Maryanto. and C. Purbomartono. 2010. Fermentasi Ampas Tahu Dengan Aspergillus niger Untuk Meningkatkan Kualitas Bahan Baku Pakan Ikan. Prosiding Seminar Nasional Hasil - Hasil Penelitian dan Pengabdian LPPM UM. Universitas Muhammadiyah Purwokerto, Purwokerto. p : 336 – 345.

[11] Fellows, P.J. 1992. Food Processing Technology; Principles and Practice. Ellis Horwood Limited, England. 206 p.

[12] Deliani. 2008. Pengaruh lama fermentasi terhadap kadar protein, lemak, komposisi asam lemak, dan asam fitat pada pembuatan tempe. Journal Agriculture.3 (1) : 17-23.

[13] Jaelani, Achmad., Widaningsih, N. and Mindarto, E. 2015. Pengaruh Lama Penyimpanan Hasil Fermentasi Pelepah Sawit Oleh Trichoderma Sp Terhadap Derajat Keasaman (Ph), Kandungan Protein Kasar Dan Serat Kasar. Ziraa’ah, 40 (3):232-240 .

[14] Sigres, Divan Probo and Sutrisno, Aji. 2015. Enzim Mananase Dan Aplikasi Di Bidang Industri. Pangan dan Agroindustri. 3(3):899-908.