LIGNIN CONTENT IN FERMENTATION OF COCOA POD HUSK (Theobroma cocoa) USED Phanerochaete chrysosporium

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Abstract

The study was aimed to determine the lignin degradation in fermentation of cocoa pod husk (CPH) when fermented by *Phanerochaete chrysosporium*. The purpose of this research was to examine the lignin degradation in fermentation of cocoa pod husk (CPH) when fermented by P*hanerochaete chrysosporium.* The research methods was performed using three treatments and four replications. To = fermentation of CPH in 10 days, T1 = fermentation of CPH in 15 days, and T2 = fermentation of CPH in 20 days. The mixture was put into a container aerobically. The variables observed were covering Dry Matter (DM), Crude Protein (CP), Crude Fiber (CF), Crude Fat (CFt), ash and lignin content. This study was designed using the completely randomized research design with a unidirectional pattern analysis of variance (oneway ANOVA). Significant variables went through Duncan's Multiple Range Test (DMRT). The result showed that the lower lignin content was T2 = fermentation of CPH in 20 days = 6.40 ± 0.12%. It could be concluded that the addition of fungus *Phanerochaete chrysosporium* on fermented CPH during 20 days was the lower lignin content in fermentation of CPH.

Keywords : lignin, fermentation, cocoa pod husk, *Phanerochaete chrysosporium*

1. Introductions

The main barriers to livestock farmers, especially in the livestock population increase is limited feed. The expansion of areas for planting grass as ruminant feed is very difficult, because the land use is very high. Considering the inadequacy of grazing land, then any efforts to re-use agricultural waste as the farm feed need to be combined with other materials that until now have not been commonly used as feed.

The waste of crops and plantation has an important role and high potential in providing forage for ruminants such as cattle, goats, sheep and buffalo, especially in the dry season. In the dry season forage grasses are stunted, resulting in less available forage in terms of both quantity and quality. Even in certain areas fodder grass will dry up and die, causing a crisis of forage. In addition, ruminants maintenance system is still largely dependent on the form of forage grasses and other forage with little or no additional feed.

CPH has an important role and potential in ruminant feed supply, especially for goats, moreover during the dry season. Utilization of CPH as animal feed can be given in the form of raw material or in the form of flour after being processed. Research findings showed that the fresh CPH with sun-dried and then milled can be used as animal feed.

CPH is an agroindustrial waste produced by cocoa plant (Theobroma cacao L.). Cocoa fruit has result of CPH about 74%, cocoa bean about 2 % and 24 % fruit flacent. The proximate analysis results showed that it contains 88.98% dry matter (DM), 79.89% organic matter (OM), 9.14 crude protein (CP), 35.74% crude fiber (CF) (Alemawor *et al.*, 2009). Another expert stated nutritional content of CPH consists of DM 91.80%, OM 88.90%, CP 6.20%, and CF 45.90% and 50.8 % (Aregheore, 2002). Lateef *et al.* (2008) report that content of CPH consist OM 88.70%, CP 8.20%, CFt 4.70 and CF 18.30%. Suparjo *et al.* (2009) report that content of CPH consist DM 48.17% and OM 93.93%.

From the results of research conducted on sheep, that the use of CPH can be used as a substitute supplement as much as 15% or 5% of the ration. Preferably before used as animal feed, CPH waste needs to be fermented prior to degrade the indigestible lignin content consumed by animals and to increase the protein content of 6-8% to 12-15%.

The specific objective to be achieved in this research was to examine the nutrient content and a decrease in lignin content in fermented CPH. It was expected that this research would produce a

proper referential method in the processing of agricultural CPH waste using the services of molds so that they can be used for further studies when given to ruminants.

2. Materials and Methods

The material used is cocoa pod husk (CPH), isolates of Phanerochaete chrysosporium. The tools used are test tubes, petri disk, ose, autoclave, aluminum foil, cotton and a set of laboratory equipment for proximate analysis. CPH fermentation was using Phanerochaete chrysosporium and used three treatments and four replications, namely : To = fermentation of CPH in 10 days, T1 = fermentation of CPH in 15 days, and T2 = fermentation of CPH in 20 days.

Data were analyzed with analysis of variance analysis (ANOVA) and a unidirectional pattern followed by Duncan 's Multiple Range Test Test (DMRT) (Christensen, 1996) in case there was any difference.

The fermentation was carried out in aerobic fermentation on CPH fermentation treatment. Fresh CPH was chopped and dried. 100 g of CPH with water content of 61.23% was placed on a plastic container inoculated with Phanerochaete chrysosporium and mixed thoroughly. CPH before and after fermentation were examined for the nutrient and lignin content analysis by using proximate analysis (AOAC, 2005). Parameters observed were Dry Matter (DM), Crude Protein (CP), Crude Fiber (CF), Crude Fat (CFt), Ash and lignin.

3. Result and Discussion

The results of the proximate analysis and calculation of lignin fermentation of cocoa pod husk using Phanerochaete chrysosporyum that have been implemented are listed in the table 1.

Table 1. Mean chemical composition of fermented CPH using *Phanerochaete chrysosporyum* (% DM)

Variable	Matterial (%)		
	To	T1	T2
Lignin	$8.05^{c} \pm 0.19$	$7.41^{b} \pm 0.23$	$6.40^{a} \pm 0.12$
Dry Matter	$77.52^{a} \pm 0.42$	$81.42^{ab} \pm 0.09$	$84.35^{b} \pm 5.16$
Crude Protein	$2.11^{a} \pm 0.06$	$2.44^{b} \pm 0.21$	$1.94^{a} \pm 0.11$
Crude Fiber	$11.72^{c} \pm 0.19$	$9.65^{b} \pm 0.28$	$8.47^{a} \pm 0.32$
Crude Fat	-	-	-
Ash	$2.76^{b} \pm 0.05$	$2.75^{b} \pm 0.17$	$2.32^{a} \pm 0.13$

[abc] Superscript different on the same line indicate a very significant (P < 0.01).
To = Fermented CPH for 10 days .
T1 = Fermented CPH for 15 days .
T2 = Fermented CPH for 20 days.

3.1 Lignin

The mean of the chemical composition of lignin are listed in table. The mean of the three consecutive treatments were To = 8.05 ± 0.19%, T1 = 7.41 ± 0.23%, and T2 = 6.40 ± 0.12%. It showed highly significant results (P<0.01).

The fermentation using Phanerochaete chrysosporyum showed that fermentation for 20 days was a treatment with the lower lignin content which was 6.40 ± 0.12% . This happenned because the lignin contained in the CPH is high and there should be a special treatment to reduce the lignin content. With the longer days of fermentation it was seen that the reduction in lignin content also decreased.

3.2 Dry Matter

The mean of the chemical composition of water are listed in table. The mean of the three consecutive treatments were To = 77.52 ± 0.42%, T1 = 81.42 ± 0.09%, and T2 = 84.35 ± 5.16%. It showed highly significant results (P<0,01).

The fermentation using Phanerochaete chrysosporyum showed that fermentation for 20 days is the treatment with the highest water content which was 84.35 ± 5.16%. This is due to the activity of microbes in the fermentation activity in the cocoa pods husk can produce CO_2 resulting in increasing water content.

3.3 Crude Protein

The mean of the chemical composition of the proteins are listed in table. The mean of the three consecutive treatments were To = 2.11 ± 0.06%, T1 = 2.44 ± 0.21%, and T2 = 1.94 ± 0.11%. It showed highly significant results (P< 0,01).

The fermentation using Phanerochaete chrysosporyum showed that fermentation for 10 and 20 days showed better protein value compared to the fermentation for 15 days.

This is due to the activity of microbes in the fermentation activity in the CPH are expected to increase the protein content not as expected.

Although it seemed to be different but the proteins that were produced from the fermentation of the CPH was still relatively very low in protein content increase. Therefore if we want it to be used as ruminant rations it needs to be added with certain feed ingredients

which can raise the protein content of feed.

3.4 Crude Fiber

The mean of the chemical composition of crude fiber are listed in table. The mean of the three consecutive treatments were To = 11.72 ± 0.19%, T1 = 9.65 ± 0.28%, and T2 = 8.47 ± 0.32%. It showed highly significant results (P<0,01).

The fermentation using Phanerochaete chrysosporyum showed that fermentation for 20 days was the lowest crude fiber content which was 8.47 ± 0.32%.

This was due to the microbial activity in the activity in the fermentation process of CPH. This suggests that the addition of microbial types Phanerochaete chrysosporyum the fermentation process of CPH can lower crude fiber content in the CPH, so that when used as animal feed it can be more efficient in the process of digestion.

3.5 Crude Fat

The results of the proximate analysis that has been carried out to determine the crude fat content contained in the CPH with cocoa fermentation for 10, 15 and 20 days were not able to show the number or not detected because the fat content was very small.

3.6 Ash

The mean of the chemical composition of the ash are listed in table. The mean of the three consecutive treatments were To = 2.76 ± 0.05%, T1 = 2.75 ± 0.17%, and T2 = 2.32 ± 0.13%. It showed highly significant results (P<0,01).

The fermentation using Phanerochaete chrysosporyum 20 days was the treatment with the lowest ash content of 2.75 ± 0.17%. This was due to the microbial activity in the activity in the fermentation process of CPH.

This suggests that the addition of microbial types Phanerochaete chrysosporyum the fermentation process of CPH can reduce the ash content of the CPH.

4. Conclusion

It could be concluded that the addition of fungus Phanerochaete chrysosporium on fermented CPH during 20 days was the lower lignin content in fermentation of CPH.

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