IMPROVEMENT PROTEIN QUALITY OF CASSAVA PEEL BY SOLID SUBSTRATE FERMENTATION USING CELLULOLYTIC MICROBIAL CONSORTIUM

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Abstract

This study aims to determine the change in the composition of amino acids of cassava peel (Manihot esculenta Crantz) by SSF (Solid State Fementation) fermentation using cellulolytic microbial consortium Aspergillus tamarii, Bacillus megaterium and Bacillus mycoides. Usefulness of this research is to improve the quality of the nutritional value of cassava peel so it can be used as feed material herbivorous fish. The experiment was conducted at the Laboratory of Microbiology Department of Biology Padjadjaran University, while the analysis of amino acids in Bogor Agricultural University Integrated Laboratory. Research carried out by fermentation using the best treatment of microbial fermentation using consortium of Bacillus mycoides, Bacillus megaterium, Aspergillus tamarii 5% [2], while the data were analyzed using T Test. Fermentation is done for 7 days at a temperature of 28º C by the method of solid substrates. The parameters measured were total protein content by the method Kjeldhal (Titrimetry) and amino acids using HPLC method. While reducing sugar content was measured using the DNS (3,5-Dinitrosalisilat Acid) method. The results showed that the enzymatic activity of consortium of microbial in the fermentation process was improve the quality of the nutritional value of cassava peel. There was an increase in total protein and amino acid composition, both essential amino acids and non-essential, but there was no increase in the different amino acid lysine, and thyrosine methionin. In general, the fermentation products have better nutrition so it deserves to be used as feed material herbivorous fish.

Key words: Cassava tuber skin, fermentation, microbial, quality nutritional value, total protein, amino acids

INTRODUCTION

Tapioca is one of the important agro-industry in Indonesia. Tapioca production process produces cassava peel waste are abundant and should be utilized in order not to pollute the environment. Utilization of cassava peel waste can be used as fish feed ingredients. However, a low nutrient content, crude fiber and nutrients in the form of anti-hydrogen cyanide contained in the cassava peel, an obstacle in the direct utilization. One of the nutritional improvement of cassava peel waste is by using solid substrate fermentation.

Enzymatic processes that occur in the fermentation process proven to increase crude protein, crude fiber content as well as lower and antinutrition in various agricultural wastes. The use of microbial consortia will improve the efficiency of degradation of crude fiber and antinutrisi. Several studies have shown a decrease of crude fiber and crude protein increased higher when using microbial consortium as compared to a single microbe. But the increase in crude protein in the fermentation process has not been observed more in depth on the changes in the composition and amino acid content of the product. The use of microbial fermentation of *Trichoderma viridae* on cassava peel and the results showed a significant increase in amino acid composition [3]. The research of fermentation ability of *Aspergillus tamarii*, bacteria *Bacillus megaterium* and *Bacillus mycoides*, the results showed an increase in crude protein and crude fiber and reduction of cyanide in cassava peel substrate [2012]. However, further research needs to be done to

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determine the ability of the microbial consortium degradation in fermented cassava peel on the content and amino acid composition

MATERIAL AND METHODS

The study was conducted by fermenting cassava tuber skin waste using 5% microbial consortium of *Bacillus mycoides, Bacillus megaterium, Aspergillus tamarii*. Fermentation was carried out by the Solid Substrate Fermentation (SSF) method for 7 days. At the end of the study, measurements were carried out on several quality parameters of nutritional value, 1) using Kjehdajl crude protein analysis, and 2) Content and compotition of amino acids, using HPLC, 3) reducing sugar content, using the DNS (3,5-Dinitrosalisilat Acid) method.

Measurements on the same parameters were also conducted to non fermented cassava peel as control. Data were statistically tested with T test [4]. The results were an evaluation of the improvement amino acids of fermented products and reducing sugar using cellulolytic microbial consortium of *Bacillus mycoides, Bacillus megaterium,* and *Aspergillus tamarii*.

RESULT AND DISCUSSION

Quality feed ingredients is indicated by the content of protein, more specifically on the composition of amino acids contained. Fermentation using a microbial consortium *B. megaterium, B. mycoides* and *A. tamarii* with 5% dose increase amino acid content of cassava peel. Quantitative estimations of the amino-acid content of fermented cassava peel in comparison with unfermented cassava peel samples are presented in Table 1. As the table showed, amino acid content of cassava peel increased by an average of two to three times higher than before the fermentation, while the total amino acid content increased by 110%. The last research [3] showed the amino acid profile of cassava peel was greatly improved by fermentation with *T. viridae*. Total amino acid content was increased 4 times in the fermented cassava.

Changes in amino acid profile due activity of microbial enzymatic substrates used in cassava peel. Production of cellulolytic enzymes such as cellulase and amylase degrade crude fiber in cassava peel, and in turn increase the amino acid content in thesubstrate.

Table 1 Amino Acid Composition of unfermented and fermented cassava peel

No	Amino Acid	Amount of amino acid (% b/b)								Significancy
		Non-fermented				Fermented				
		1	2	3	Average	1	2	3	Average	
1	Crude protein	4,93	4,21	4,75	**4,63 ^{A}**	9,96	10,61	12,16	**10,91 ^{B}**	**hs**
2	Aspartic acid	0,36	0,42	0,36	**0,38 ^{A}**	0,69	0,77	0,82	**0,76 ^{B}**	**hs**
3	Glutamic acid	0,61	0,53	0,45	**0,53 ^{A}**	1,29	1,12	1,31	**1,24 ^{B}**	**hs**
4	Serine	0	0	0	**0 ^{A}**	0,57	0,39	0,3	**0,42^{B}**	**hs**
5	Histidine	0,12	0,09	0,09	**0,1^{A}**	0,21	0,15	0,15	**0,17 ^{B}**	**hs**
6	Glysine	0,19	0,22	0,19	**0,2 ^{A}**	0,45	0,42	0,3	**0,39 ^{B}**	**s**
7	Threonin	0,16	0,17	0,21	**0,18 ^{A}**	0,41	0,39	0,31	**0,37 ^{B}**	**s**
8	Arginine	0,19	0,2	0,27	**0,22 ^{A}**	0,45	0,41	0,55	**0,47 ^{B}**	**hs**
9	Alanine	0,21	0,19	0,29	**0,23 ^{A}**	0,36	0,49	0,62	**0,49 ^{B}**	**s**
10	Tyrosine	0,12	0,16	0,14	**0,14 ^{A}**	0,19	0,2	0,39	**0,26 ^{B}**	**ns**
11	Methionin	0,06	0,07	0,08	**0,07 ^{A}**	0,16	0,09	0,08	**0,11 ^{A}**	**ns**
12	Valine	0,18	0,21	0,33	**0,24 ^{A}**	0,35	0,41	0,74	**0,5 ^{B}**	**s**
13	Phenylalanine	0,22	0,24	0,26	**0,24 ^{A}**	0,41	0,42	0,34	**0,39 ^{B}**	**s**
14	Isoleucin	0,22	0,18	0,17	**0,19 ^{A}**	0,39	0,42	0,36	**0,39 ^{B}**	**hs**
15	Leucin	0,3	0,34	0,32	**0,32 ^{A}**	0,59	0,66	0,61	**0,62 ^{B}**	**hs**
16	Lysine	0,25	0,3	0,26	**0,27 ^{A}**	0,35	0,29	0,26	**0,3 ^{A}**	**ns**
17	Triphtophane	0,01	0,01	0,01	**0,01 ^{A}**	0,07	0,05	0,12	**0,08 ^{B}**	**s**
	Total amino acids	**3,02**	**3,34**	**3,6**	**3,32 ^{A}**	**6,45**	**7,21**	**7,22**	**6,96 ^{B}**	**hs**

*Means followed by the same superscript in the same row are not significantly different ($p \leq 0.05$).

Bacillus megaterium, Bacillus mycoides and *Aspergillus tamarii* known to have selullase and amylase activity so as to parse the crude fiber into simpler components, such as glucose [1]. Increased level of reduction sugar during fermentation is presented in Figure 1.

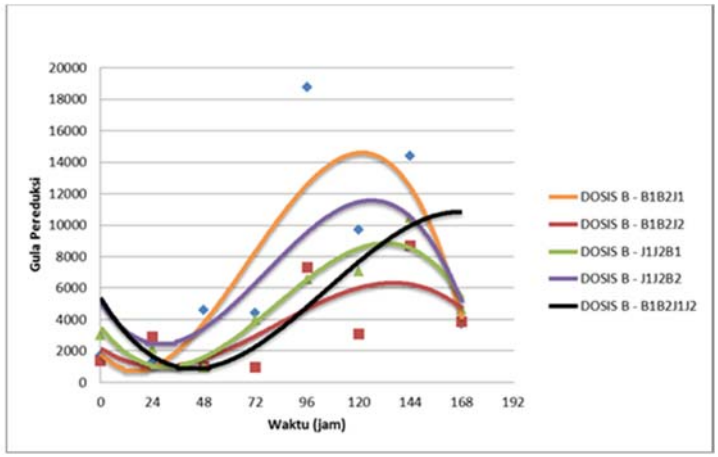

Figure 1. Reducing sugar Formed During the Fermentation

T test results showed a significant difference in the increase in total amino acids and other amino acid components, except for the three types of amino acids thyrosine, methionin and lysine. The third type of amino acid is a kind of indispensable amino acids that is essential for the growth of fish. Deficiency of dietary amino acids in fishes generally include reduces growth, poor feed convertion and reduce appetite [7]. Lysine is the major component to promoting growth, prevented diseases and mortality, meanwhile less methionine on feed cause cataract lens, suffer poor growth and survival [5]. Methionin lysine deficiency and is often found in vegetable products, and fermented plant products. Methionin deficiency, histidine and lysine are also found in the SBM (Soybean Meal), and peel fermented cassava, or corn meal [5,3,6]. This deficiency can be overcome by supplementation of animal and vegetable sources in fish feed formulations.

CONCLUSION

The fermentation using consortium of *B. megaterium, B. mycoides* and *A. tamarii* in solid stated fermentation methods increase the amino acid content of cassava peel, but not significantly increase thyrosine, methionin and lysine.

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