The Result of Biotechnology by Local Microorganisms to Banana Peel on Rumen Fluid Characteristics as Ruminant Feed

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***Abstract*—The purpose of this research was to improve the nutritive value waste of banana peel as ruminant feed through biotecnology process to using of variaty sources of local microorganisms (MOL) as inoculum fermentation with different incubation lenght. Mol is a liquid containing microorganisms such as fungi, bacteria, based on waste. This research done to evaluate rumen characteristics banana peel that have fermented with Mol as ruminant feed in- vitro methode. The factorial randomized block design used in this research, 3 x 2 with 3 replications for each treatment. Factor A was the source of MOL (rument contents, banana peels, vegetable waste). Factor B was incubation lenght on a banana peel 7 days and 14 days. Parameters measured were pH, Ammonia (NH3) dan VFA. The best results of the research contained in the banana peel that has been fermented with Mol source of rumen contents and incubation for 7 days.**

***Index Terms*—lokal microorganism, banana peel, ruminant feed**

I. Introduction

Banana is not seasonal fruit and available a long time as the highest production in Indonesia compared to other not seasonal fruits as avocado, oranges, pineapple, and papaya (Table I.).

TABLE I. Production Some of Fruits in Indonesia (Ton/Year) [1].

Year	Avocados	Orange	Pineapple	Papaya	Banana
2012	294 200	161174	1781 899	906 312	6189052
2011	275 953	1818 949	958 251	1540626	6132695
2010	224 278	2 028 904	675 801	1406445	5755073
2009	257 642	2 131 768	772 844	1558196	6373533

The industry of banana processing in Indonesia as a food, It's many kind of delicious products, such as: kripik (like a crackers), ledre, getuk juice, jam, and banana fried / grilled [2]. Processing of banana will be resulted many waste of banana peel that is approximately one-third of an unpeeled banana [3].

Evaluation of the nutritional value of a banana peel that has been done by previous researchers shown that banana peel a potential as source of carbohydrate (energy) for all phases of livestock. The content of crude fiber of banana peel 13% [4]. Dry matter = 12.6%; Organic matter = 80.36%; crude protein = 8.36% [5]. Seeing the potential banana peel based on the availability of waste and nutrition value, banana peels can be used as ruminant feed material, but is hampered by the presence of anti-nutritional content. The green bananas peel have content of tannin (7.36 % - 1.99 %), [6] so it needs the treatment before being used a feed. [7] The processing of banana peel (*Musa brachyarpa*) with steam, ammoniation, and silage fermentation can reduce the content of NDF, ADF, cellulose, hemicelluloses, lignin, and silica and the best result by fermentation processing.

One of method to processing of feed with biotechnology by fermentation. The fermentation was of metabolic processes with the help of enzymes that have resulted of microbes (microorganisms) to do the oxidation, reduction, hydrolysis and other chemical reactions, resulting in chemical changes in the organic substrate to produce a particular product. Fermentation was a biochemical process that can cause material properties change as a result of the breakdown of ingredients [8]. [9] The fermentation should be considered was the substrate as fermentation media, the growth of microorganisms and the physical conditions, inoculum dose, fermentation time, temperature, pH and sugar content. The fermentation can improve the quality of the material , such as increasing the crude protein content, amino acids and vitamins, as well as reduce the content crude fiber, and increases the value of the digestibility. [10] The Batu banana peels the content of crude protein increased about 54.02%, there was 9.2% up to 14.17% after fermented with Rhyzopus oligosporus [11]. The crude protein Kepok banana peels fermented with Rhyzopus oligosporus an increase of 3.63 becomes 22.15% [12].

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Local Microorganisms (MOL) get from the result of fermented a various resources available . There are many microorganisms containing potentially as decomposer of organic matter. The advantages of the use of MOL was the ultimate low-cost and easy production in the manufacturing process, it uses from waste. The identification of several solutions of Mol that get identified of banana weevil; Bacillus sp., Aeromonas sp. and Aspergillus niger. In Mol snails identified Staphylococcus sp. and Aspergillus niger, whereas in rabbit urine MOL identified Bacillus sp., Rhizobium sp., Pseudomonas sp., Aspergillus niger and Verticillium sp[13]. [14]The Microbes Rhizopus, lactobacillus and yeast are belong to mol . The content of dry matter and organic matter banana peels were 96.11% and 81.92% that becomes 95.53% and 80.89% after fermentation with MOL resources of rumen fluid [15]

II. Materials and Methods

This research was conducted in two stages

A. Preparation of MOL as Media Inoculum

At this stage of the preparation of media will be experiment. Three kinds of media in this research are the contents of rumen, banana peels, and vegetables waste. All of these materials are available in nature and easy to get it. The vegetables used were the waste of vegetable on the tradisional market, the same case with banana peels. Content of rumen was slaughterhouse waste is often problematic due to damage the environment and pollute water hue due discarded in to the sewer.

Preparation Media procedure was:

1) *Materials were:*

- The contents of the rumen, banana peels and vegetable waste @ 5 kg
- Coconut water is 3 x 10 Litre
- Sugar 3 x 1000 grams

2) *Procedure*: Rumen contents, banana peels and vegetable waste each component ground into powder, then put into 3 buckets that have containing coconut water 10 liters each buckets, then added sugar 1000 grams, to be mixed and then closed bucket until an aerob. Incubation for 10 days [16].

The process of incubation to get the mol is shown in Fig. 1.

Figure 1. Figure about process to get the mol solution.

B. To Purpose. The Potency and Effectiveness MOL Test to Get The Best Kind of MOL In Bioprocess Banana Peel.

Mol solution to be inoculum of fermentation banana peels that have been a powder and incubated for 7 days and 14 days. Then the banana peel which has been in fermented with Mol be analysis to look at the characteristics of rumen fluid by in – vitro method [17]. Consisting of pH (ph Meter digital), NH3 (Microdifusi Conway methode) and VFA (with gas distillation).

The experimental design used was factorial randomized block design 3X2 with 3 replicates for each treatment [18].

Mathematics model:

$$Yijk = \mu + \alpha i + \beta j + (\alpha\beta)ij + \sum ijk$$

In this research, Factor A was source of Mol :

A1 : Content of rumen

A2 : Banana peel

A3 : Vegetable waste

Factor B was incubation lenght :

B1 : 7 days

B2 : 14 days

III. Results and Discussion

Rumen fluid characteristics are essential to ensure the activity of rumen microorgasm. Caracteristics of rumen fluid include pH, production of VFA and NH3 [19]. The data in Table II are characteristics of rumen fluid of banana peel before bioprocess by Mol, and Table III were characteristics banana peel rumen fluid after fermented by Mol.

TABLE II. The Data Characteristics of Rumen Fluid of Banana Peel before Bioprocess with MOL

characteristic of rumen	Content
Ph	6.88
NH3	5.25
VFA	90

TABEL III. The Data Characteristic of Rumen Fluid of Banana Peel After Bioprocess with MOL

Incubation		FACTORB		Average
Length	B1	B2	B3	
	6.90	6.94	7.03	6.96
Ph	6.88	6.90	6.87	6.88
	6.89	6.92	6.95	
NH3	10.22	7.27	6.42	7.96^{A}
	5.95	5.48	5.95	5.79^{A}
	8.09	6.37	6.18	
VFA	111.67^{aA}	101.67^{aA}	111.67^{aA}	108.33
	191.67^{bB}	111.67^{aA}	100.67^{aA}	134.67
	151.67	106.67	106.17	

Note: The average with defferent superscrip (A,B) in the same colom and (a,b,c) rows that show was different effect (p<0,05)

Based on the analysis variance there was no interaction between the length incubation with source of Mol, and it was not significant effect (p> 0.05) on the pH of fermented banana peels. Table 3, shown that pH of the rumen fluid fermentation banana skin with Mol was normal conditions (6.89 - 6.95).

The mean ruminal pH in this study was in normal range.Ideal ruminal pH for keeping normal rumen metabolism was 6.0-7.0. Fiber digestion decreases at low rumen pH, especially below pH 6.0 [20]. The ruminal pH generally was higher than 5.5 and often in the range from 5.8 to 6.5 in grain adapted cattle [21]. Therefore the pH obtained in this study indicated the occurrence of cellulose fermentation process optimally. Fermentation with mole as inoculum to maintain conditions normal pH banana peel.

NH3 content of banana peel fermented by mol source of rumen contents, banana peel and vegetable waste ranges from 6.18 to 8.09 mM. There was an increasing about 17.8% - 54% the NH3 content when compared it with controls (5.25mM) . Analysis of variance showed there was no interaction (P> 0.05) between the source of Mol and the incubation time, but the lenght incubation treatment on banana peel shown the real effect (P <0.05). The highest content of NH3 in banana peel fermentation by mol of rumen contents with incubation lenght 7 days (10.22 mM). NH3 content in this research was lower than the results of research about Coffee Husk Fermented with *Pleurotus ostreatus* as Ruminant Feed. There was about 11.84-13.41mM, but still in normal limits [22]. The microbe of rumen needs ammonia about 4-12mM [23].

There was interaction (p<0.05) between the incubation length and source of mol on VFA banana peel fermented. After DMRT there was no different effect of the treatment except source of rumen fluid and incubation of 7 and 14 days. The VFA content of banana peel fermented with Mol ranged between 106.67 - 151.67 mM. The increasing of VFA about 18.52% - 68.52% compared with no fermented. Levels of VFA needed to support optimal growth of rumen microbes 80-160 mM [23]. VFA in ruminant have a dual role as a source of energy for livestock and carbon source for microbial protein synthesis [24]. Volatile fatty acids were the end products of biofermentation in the rumen which was the source of energy for ruminants, because 70-80% meet the needs of ruminants [25]. Carbohydrates in a banana peel that is generally in the form of cellulose and hemicellulose into monosaccharides and subsequently digested by microbes fermented into VFA. Based on this research, VFA production from fermented banana peel have sufficient need for microbes.

IV. Conclusion

The treatment of biproses with fermentation banana peel by Mol could increase the NH3 and VFA (18.525 – 68.52%) but there are no differences in ruminal pH.

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