

The Effect of a Local Biotechnological Approach on Rumen Fluid Characteristics (pH, NH₃, VFA) of the Oil Palm Fronds as Ruminant Feed

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Abstract – Oil Palm is the most widespread the plantation commodities compared with the other in Indonesia. Utilization of agricultural waste is constrained by the bonding lignocelluloses that influence digestibility of nutrients from the waste product if used as animal feed. This study aimed to improve the quality of oil palm fronds through biotechnological with Local microorganisms base on livestock waste (rumen content, feces and urine of cow) and commercial microorganisms of EM4 and Tempe yeast as ruminant feed. The randomized completely design with 6 treatments and 3 time replicated. The parameters observed were the characteristics of rumen fluid (pH, VFA and NH₃). The result of this study showed that fermentation with local microorganisms rumen contents that it could increase the VFA content of 48,09mM be 83.09mM.

Keyword – Biotechnological, Oil Palm Frond, Ruminant Feed.

I. INTRODUCTION

The Forage is a main resource of animal feed and as a source of energy to ruminants. The increasing of population growth and the rise of infrastructure development affect to availability of forage those resources with grass field. So, it needs to find feed alternative that be substitution grass field as resources forage. The feeding should be available in large quantities at low prices, and one of the alternative feeding are potential to be used as ruminant feed is waste from the oil palm plantations, the availability in areas of oil palm plantations.

Palm is available all year in conjunction with fresh fruit bunches. The area of oil palm plantations in Indonesia was 5.4069 million hectares [1]. Cutting of cycle of oil palm frond in 14 days, where every cutting about 3 oil palm frond that weight up to 10 kg 1. One hectare of land planted about 148 trees that will be generated every 14 days ± 4,440 kg or 8,880 kg / month. [2]. The chemical composition of oil palm frond containing dry matter 48.78%, crude protein 5.33%, 78.05% Neutral Detergent Fiber, Acid Detergent Fiber 56.93%, hemicelluloses 21.12%, cellulose 27.94%, lignin 16.94% and silica 0.6% .[3]

The utilization of oil palm frond as a feeding was very limited because of the high content of the lignin which causes low digestibility; therefore it needs to be done the treatment before given as fodder. The biotechnological treatment with fermentation approach has been done but is hampered by the high cost of the material, difficult to get

it, and complex mechanism of preparation treatment. Fermentation with water had increased the crude protein content and degradability of the feedstuffs and would therefore improve intake and utilization by ruminant livestock [4]. Local microorganisms is a solution that a result of fermentation of many resources available. [5] said the advantages using of local microorganisms was the ultimate low-cost and easy production in the manufacturing process, it used from waste. The identification of several solutions of local microorganisms that get identified of banana weevil; *Bacillus* sp., *Aeromonas* sp. and *Aspergillus niger*. In local microorganisms snails identified *Staphylococcus* sp. and *Aspergillus niger*, whereas in rabbit urine local microorganisms identified *Bacillus* sp., *Rhizobium* sp., *Pseudomonas* sp., *Aspergillus niger* and *Verticillium* sp. [6] said The Microbes *Rhizopus*, *Lactobacillus* and yeast were belong to local microorganisms. [7] the treatment of bioprocess banana peel with fermentation by Local microorganisms could increase the NH₃ and VFA (18.525 – 68.52%).

Fermentation by local microorganisms simpler when compared with fermentation by specific bacteria or fungi that commonly being used, the fermentation by local microorganisms solution does not need to be done rejuvenation and media preparation. Local microorganisms can be used as inoculums in the substrate directly.[2].[8]

So hopefully, the fermentation technology by local microorganisms can improve the quality of sustainable local feed and replace the commercial material of fermentation such as Tempe yeast and EM4. The rumen ingest containing alpha-amylase enzyme, galactosidase, hemicelluloses and cellulose The rumen is a large tube for storing and mixing ingest for microbial fermentation.

Feces of cattle containing hemicelluloses 18.6%, 25.2% cellulose, the lignin 20.2%, 1.67% nitrogen, phosphate and potassium 1.11% 0.56% (Sitohang, 2010). Urine of cattle consists of 92% water, 1.00% N, 0.2% P, and K 1.35%, a pH of 7, which means that urine of cattle is neutral, [9]. EM4 is a mixture of beneficial microorganisms which consists of five groups, 10 Genus 80 species and after the land into 125 species. [10]. *Tempe* is a food made from the fermentation of soy beans or some other material that uses some kind of *Rhizopus*, such as *Rhizopus oligosporus*, *Rh. oryzae*, *Rh. stolonifer* (bread Local microorganisms), or *Rh. arrhizus*, thus forming a compact solid white. The white color in *Tempe* due to fungal mycelia growing on

the surface of soybean seeds. Compact texture is also caused by fungus mycelia linking the soybean seeds [11].

Fermentation in the rumen produce VFA and NH₃, gases (CO₂, H₂, and CH₄) through the process eructation . Volatile Fatty Acid (VFA) is the end product of fermentation of carbohydrates and main energy source for ruminants [12].

II. MATERIALS AND METHOD

This study was conducted using wasted materials that obtained from rumen contents slaughterhouse waste, feces and urine from livestock waste. Oil palm fronds to be tested as a feed ingredient derived from farm waste. yeast Tempeh and EM4 can be bought in commercially market.

Procedures

1. Manufacture of local microorganisms

Rumen contents, feces, and urine each of them mixed with sugar and coconut water with ratio 1: 2, than incubated for 10 days in anaerobic.

2. Prepared the oil palm frond

- a. Collecting the oil palm frond
- b. Chopping the oil palm frond

3. Fermentation

The fermentation process done for 7 days and incubated an aerobically, than the oil palm frond must In-Vitro analyzed.

The treatments:

A: Oil Palm Fronds without fermentation

B: Oil Palm fronds fermentation with local microorganisms base on Rumen fluid

C: Oil Palm fronds fermentation with local microorganisms base on feces

D: Oil palm fronds fermentation with local microorganisms base on urine

E: Oil palm fronds fermentation with EM4

F: Oil Palm fronds fermentation with Yeast Tempe

The parameters observed in this study were the characteristics of rumen fluid consisting of pH, NH₃, VFA of oil palm frond treatment.

III. RESULT AND DISCUSSION

The average of rumen characteristics (pH, VFA and NH₃) of oil palm frond that fermented by many kind of sources of microorganisms found in Table 1.

Table 1. The Average Of Rumen Characteristics of Palm Frond Fermentation

Treatment	pH	VFA	NH ₃
A	6.90 ^a	48.09 ^d	6,24
B	6.88 ^a	83.09 ^a	5,91
C	6.84 ^b	53.02 ^b	5,36
D	6.90 ^a	61.77 ^c	4,44
E	6.87 ^c	78.97 ^a	6,70
F	6.91 ^a	52.60 ^b	5,88

Note: The different Superscript (a,b,c) in the same column show different effect (P<0,01).

The analysis statistic showed (Table 1) the treatment fermentation of oil palm fronds provide a significant effect (p <0.01) for treatment of pH and VFA, but the no significant effect (p>0.01) on the content of NH₃. The average of rumen fluid pH about 6.84 to 6.91, where the condition has been qualified to growth of cellulolytic microbial. When the pH less than 6, the consequences proteolysis and deamination process will be interrupted and will decrease the digestibility of crude fiber. [13] said that when the ruminal pH is less than 6, it will be cause inhibit proteolysis , deamination process, and the growth of rumen bacteria. The high ph on oil palm frond that fermentation by Tempe yeast (6.91), and different than other treatments. The content of the pH in all treatments still in the normal conditions required by rumen microorganisms.

The Fermentation treatment of oil palm fronds provide a significant effect (p <0.01) on production of VFA ,there were about 48.09 to 83.09 mM. Base on the table 1 shows that there was an increase in the VFA content of fermented palm fronds compared the control, and the highest VFA contained in the fermented palm frond with local microorganisms base on rumen fluid (83.09), and this was suitable for optimal growth of microbial rumen. [14] The levels of VFA needed to support optimal growth of rumen microbes 80-160 mm. The results of this study was lower than research of [6]who did biotechnological fermentation with local microorganisms source of rumen contents, vegetable waste and waste banana peel which has VFA content 106.67 -151.67mM.

Oil Palm frond fermentation showed no significant effect on the production of NH₃. The highest NH₃ contained in the fermented with EM4. 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[15]. The microbe of rumen needs ammonia about 4-12mM.[12] This research showed that the fermentation with EM4 as commercial microbial sources can be replaced by using local microorganisms solution rumen contents, cow urine, cow feces.

IV. CONCLUSION

Base on the results of this research concluded that fermentation of oil palm frond with kind of sources - conventional (local microorganisms rumen content, urine and feces) and commercial (yeast temped an EM4) provides pH, NH₃ and VFA content in accordance with the needs of livestock in synthesis of microbial protein, so the utilization of local microorganisms solution replaces the using of EM4 as inoculums fermentation to improve the quality of animal feeding.

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