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Palm Kernel Cake Fermented with *Candida utilis* for Mannose-Enriched Local Feed Supply

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Abstract— Nutritional value evaluation on palm kernel cake (PKC) was conducted using *Candida utilis*. Experiment was assigned to Completely Randomized Design with two treatments, with fermentation and non-fermentation. Fermentation was carried on at 36°C for two days. Result showed that fermentation increased crude protein level of palm kernel cake from 22.18% to 26.07%, while NFE level diminished from 15.82% to 6.36%. Crude fiber increased not significantly in PKC and Fermented PKC namely 37.43% and 37.,84%, respectively. Crude fat decreased insignificantly, in that crude fiber of PKC and fermented PKC was 9.13% and 8.89%, respectively. Ash was 9.13% and 8.89%, respectively, and mannose increased insignificantly as much as 2.19% and 3.56%. Fiber volume fraction undergoing significant increase was hemicellulose, from 21.12% to 22.93%, while cellulose insignificantly increased from 38.9% to 41.13%, lignin insignificantly decreased from 21.12% to 19.18%. It was concluded that fermented Palm Kernel Cake product provided essential nutritional values for poultry (hemicellulose, mannane and mannose) that potentially improved poultry health.

Index Terms—*Candida utilis*, Mannose, Palm Kernel Cake.

1 Introduction

Oil palm is a promising prospect in Indonesia. Expansions on oil palm plantation are under constant improvement, particularly those recently developed in Kalimantan and Irian. This area expansion supports the prospective Palm Kernel Cake (PKC) despite the intake constraints namely high fiber (43%), low palatability, low protein (4%)/essential amino acid, and anti-nutrient such as mannan, galactomannan, xylan, and Arabinoxylan. If Indonesia produced 16.9 million tons of CPO [1], the potential byproducts were 2 million tons of palm kernel cake, 2 tons dry palm oil sludge and 4 tons dry solid heavy phase [2]. Low palatability of palm kernel cake on non ruminants made it necessary to supply other palatable feed. Nutritional content of PKC is varied, depending on the assigned oil extraction, storage and shredded palm kernel shell [3]; [4]. Crude fiber of PKC was 21,97% and the crude protein was 13,53%[5]. PKC contained 14,49% [6] crude fiber, while) reported 24% [7]. One alternative to improve feed quality was solid substrate fermentation using mold that enabled degradability of indigestible material to be more available and eventually increased nutritional value. The quality of fermented product depended on the type of microbes and solid media used. Most microbes including bacteria, fungi and yeast could produce various enzyme. Products of yeast metabolism were ethanol, citric acid, acetone, butanol, glutamate acid, lysine, nucleotides, polysaccharide and vitamins [8].

Protein component of yeast's cell wall partly consisted of enzymes like invertase, melibiose, phosphatase, glucanase, ariel-beta glucosidase, phospholipase and protease [9]. PKC fermentation using *Candida utilis* could improve nutritional value by increasing crude protein and nitrogen free extract, and decreasing fiber [5]. This fermentation caused crude fat decrease, lowered gross energy on PKC (4733,5) and FPKC (4245,5 kcal/kg) also metabolic energy of PKC (2672,54) and FPKC (1807,76 kcal/kg). Utilizing *Aspergillus niger*-fermented PKC at 15% level, 6% hydrolyzed chicken feather meal and supplementing 120 ppm Zn in ration could lower ration consumption and body weight gain, improve feed conversion ratio, increased carcass weight percentage and nutrition absorption, and lessen intestines length [10]. Palm kernel cake supplemented with cellulase enzyme could be given 15% in broiler ration [11]. Fermentation of palm oil sludge was the most effective using *Aspergillus niger* at 38°C for 3 days, following 2-day enzymatic process [12]; [13]. PKC cell wall components consisted of 56.4% mannose, 11.6% cellulose, 3.7% xylose and 91.4% galactose [14]. Mannose sugar in PKC cell wall reached 45-50% [15]. It was explainable that almost 40% component in palm kernel cake was beta-mannane. Although enzymatically beta-mannane was indigestible by poultry because of the absence of mannanase enzyme, physical digestion occurred through beta-mannane degradation into minor form namely *mannan oligosaccharide* (MOS) or even manose. These substances were in charge of improving poultry body immune. As prebiotic, MOS can bind with *Salmonella sp* bacteria to reduce the population of pathogenic bacteria and increase commensal bacteria like *Lactobacillus sp*. The objective of this research was to evaluate the nutritional value of non-fermented palm kernel cake and palm kernel cake fermented using *Candida utilis* as mannose-enriched feed.

2 Materials and Method

Research was conducted from May to June 2014 in Chemical Laboratory and Microbiology Laboratory Mercu Buana University Yogyakarta. Dry palm kernel cake (PKC) was obtained from by-product of oil palm processing in Bangka Belitung. Mold used was *Candida utilis* FNCC from PAU UGM. Research apparatus included laminar, autoclave, *Memmert*

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