EVALUATION OF COPPER CONCENTRATION IN PALM KERNEL MEAL BASED ON SAMPLES SUBMITTED TO IVM FROM YEAR 2006 TO 2011

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Abstract: Palm Kernel Meal (PKM) is a protein feed with high fibre content. It is suitable for feeding of ruminants. Unfortunately the copper content in this feedstuff is associated with copper poisoning. Continuous monitoring of copper content in PKM samples were analyzed in the Animal Feed Laboratory, Malaysia Veterinary Institute. It was conducted to obtain data for ruminant livestock, especially sheep and goats at risk of copper poisoning. The aim of this study was to evaluate copper concentration in PKM used as ruminant feedstuff during 2006 to 2011 period. Results showed that the copper concentration has decreased through the years of evaluation. Copper concentration ranged from the highest value of 37.13 mg/kg to the lowest of 9.00 mg/kg.

***Keyword**: Copper, Palm Kernel Meal, Atomic Absorption Spectrophotometer*

INTRODUCTION

Palm kernel meal is an important by-product of the oil palm industry and is obtained after the extraction of oil from the kernel of the oil palm fruit. There are two types of PKM, the mechanically pressed palm kernel expeller (PKE) and the solvent extracted palm kernel cake (PKC) (Mardhati, *et al.*, 2011). In this study PKM refers to PKC and PKE. Both by-product has a high nutritive value and is widely used as feed ingredients in ruminants, although its usage in excess in sheep can cause chronic toxicity (Abdul Rahman *et al.,* 1989; Wan Mohamed *et al.,* 1989). Copper is an essential element for animals, it plays an important role in growth of bone and cartilage, in immune cell function, as an anti-oxidant, in blood formation and it plays many roles in cattle fertility (Murphy, 2012). However, the level of copper in PKC was found to be relatively high which was about 11 to 55 mg/kg dry weight (Abdul Rahman *et al.,* 1989; Jalaludin *et al.,* 1991).

Like most nutrient, excessive concentrations can cause toxicity to livestock. Generally, sheep require about 5 mg/kg (mg/kg or parts per million) of copper in their total diet. Toxicity can occur at levels above 10 mg/kg. In contrast, cattle require about 10 mg/kg of copper in their diet and can tolerate copper levels ten times higher than sheep (Church and Pond, 1988). However, copper toxicity in ruminant usually results from the accumulation of copper in the liver over a period of time (Berger, 1991; Bradley, 1993). The aim of this study is to evaluate copper concentration and to ensure that the concentration in PKM is safe to use for animal feed. Copper concentration of PKM that were used as livestock feed in Malaysia was analyzed from samples submitted to Animal Feed Laboratory, Malaysia Veterinary Institute. Data collection is made for four years to observe the trend in copper levels.

MATERIALS AND METHODS

Palm Kernel Meal samples: A total of 72 PKM samples were submitted to Animal Feed Laboratory, IVM from 2006 to 2011. Received samples were recorded, analyzed and the results are collected in PROX system. PROX system can be used to produce the laboratory report, check the analytical results quickly and accurately developed by Animal Feed Laboratory, IVM using Lotus 123 program.

Wet Ashing and Atomic Absorption Spectrophotometer: An analysis of copper content by wet ashing methods was refers to the reference methods performed AOAC International (2000). The quantitative determination in samples was assessed using a Perkin-Elmer Analyst 300 Atomic Absorption Spectrometer equipped with deuterium arc background corrector, an air-acetylene burner and controlled by personal computer.

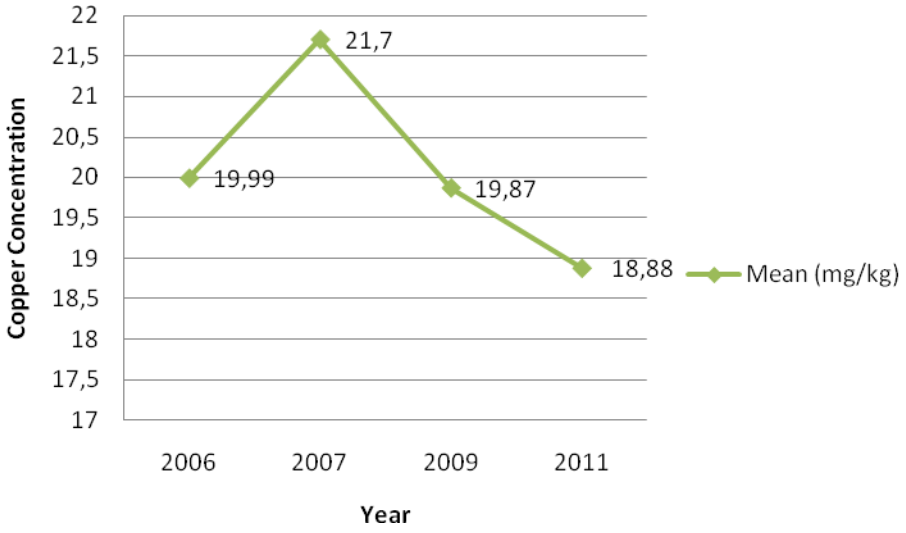
RESULTS AND DISCUSSION

Average concentrations of copper in 72 samples of PKM analyzed are presented in Table 1.

Table 1: Average, highest and lowest of copper concentration from 2006 to 2011

Year	**n**	**Mean (**mg/kg**)**	**Highest (**mg/kg**)**	**Lowest (**mg/kg**)**
2006	13	19.99	37.13	11.74
2007	14	21.70	30.83	9.00
2009	5	19.87	23.10	9.46
2011	40	18.88	23.70	11.10

Figure 1: Average concentration of copper in PKM, mg/kg dry matter



Detectable amounts of copper were found in all samples analyzed using atomic absorption spectrometer. In 2006 until 2011, the mean value of copper concentration ranged from 18.88 mg/kg to 21.70 mg/kg. Figure 1 show that the copper concentration has declined since 2007 to 2011. The highest copper concentration is 37.13 mg/kg in 2006 and the lowest is 9.00 mg/kg in 2007. There are two methods of palm oil extraction process being used; solvent extracted and expeller pressed. Article from Chin (2001) shows that copper concentration in PKC from solvent extracted is higher than expeller pressed. Maybe these two processes influence the copper concentration in PKM.

Advisory Committee on Animal Feeding stuffs on their 22nd meeting has agreed that the maximum level of element copper permitted for cattle is 40 mg/kg of total diet dry matter. However, to satisfy nutritional requirement the formulation level in normal situations should be based on 18 mg/kg dry matter. Although the results showed the copper concentration is higher than nutritional requirement but PKM is still a preferred feed for cattle because of its energy content, aflatoxin free, good palatability, readily available and also cost effective.

Results also shows that the value of copper concentration has declined but the amount (more than 10 mg/kg) is still higher than that recommended for sheep. Some studies had shown that copper toxicity can be control with certain chelating mineral elements. Yusoff *et al.* (1995) proved that sheep can take up to 100% PKC in their diet, by incorporating chelating agent into the feed to ensure protection against toxicity. Sodium molybdate, Molybdate and Zinc are chelating agents that can render the copper safe when it was incorporated into the feed mixture (Rahman *et al.*, 1989; Hair Bejo and Alimon, 1992; Yusoff *et al.*, 1992 and Yusoff *et al.*, 1995).

CONCLUSION

Analysis results for four years found that the level of copper in the PKM has decreased compared to study done by Abdul Rahman *et al.*, (1989) which is 11 to 55 mg/kg dry weights. Copper concentration ranged from the highest value of 37.13 mg/kg to the lowest of 9.00 mg/kg. From the results obtained, strategies for the analysis of copper concentration levels in the PKM must be diversified, such as soil sampling to detect copper content in the soil and also the different processes of palm oil extraction. In the future, this analysis will be continued to obtain more complete data to help farmers on the issue of copper poisoning.

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