Palm Kernel Cake: Increased Global Feed Opportunities Assisted By Its Inherent Properties

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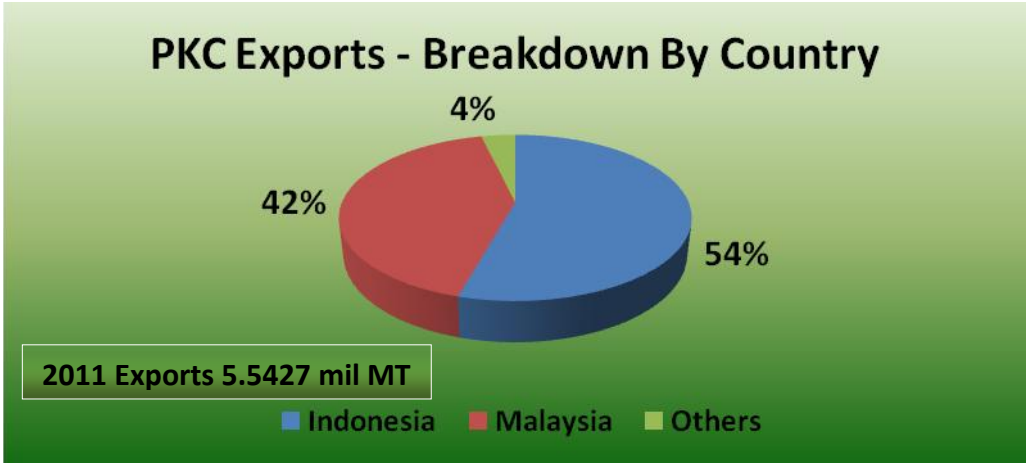
1.0 INTRODUCTION

Malaysia is one of the major exporters of Palm Kernel Cake (PKC). In 2011, Malaysia exported 2.3 million MT of PKC. The PKC produced in Malaysia is along the lines of balancing the 3Ps – which are People, Planet and Profit. *(Refer to Tan Sri Datuk Dr Yusof Basiron's paper at POTS China 2012 found in website www.mpoc.org.my for more details and discussion.)*



The PKC industry is working hard to establish maximum inclusion level of the product into the global feed market. There are commercial justifications for this effort. From the business angle, PKC is the most competitive oilmeal currently traded. At the end of December 2012, PKC traded at US$212/MT, is a steep discount of US$315/MT against soymeal, which is priced at US$563/MT. Users of PKC are guaranteed availability of supply throughout the year because it is obtained from a perennial crop and PKC is also environmentally greener if compared with other

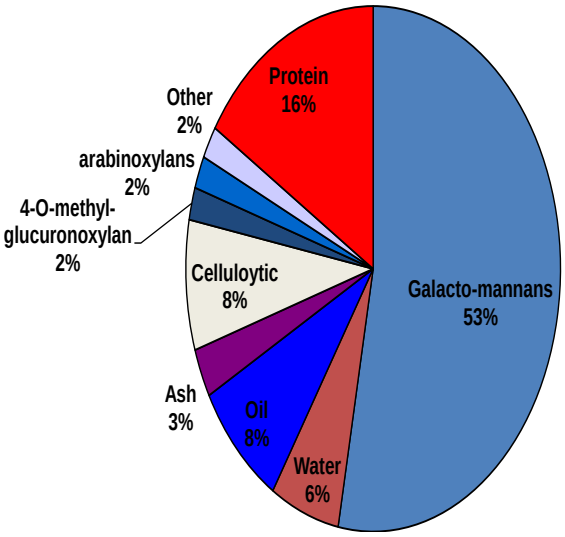
major oilmeals that are derived from seasonal crops. As such, PKC is a good choice ingredient among green animal feed product marketers.

From traditional use in the biomass sector, the application of PKC has expanded and is now popularly accepted by feed millers for the production of compound feeds. This development has enabled PKC to be sold at a better value, with the average international price of PKC increasing from US$50/MT in 1999 to US$212/MT at the end of December 2012. Supporting this price improvement is the expanding animal husbandry sector. Increased livestock breeding, attributed to the world's growing population and affluence, has resulted in the higher consumption of protein-based diet, with growing affluence leading to higher meat consumption. This is because meat is more desirable to the consumer than the relatively dull and bland vegetable-based food.

2.0 PKC – THE PRODUCT PROFILE

The nutritive profile as illustrated below is obtained by researchers after fresh PKC has been dried in the oven at 100^0C until a constant weight is achieved. The chart shows that 16% of PKC comprises protein-based materials. Other major components, namely galacto-mannans, arabinoxylans, celluloytic and 4-O methyl glucuronoxylan, are carbohydrates. Most of these sugar-based compounds are not easily digestible and PKC is normally treated further to break these energy-based compounds so that it is easily digestable. Since PKC is rich in protein and glucose-based compounds, it is generally classified as an energy- and protein-based feed ingredient.

NUTRITIVE PROFILE OF PKC



Source: Dr Wan Zahari Mohamed

Ash is dry matter devoid of organic matter. It resembles the inorganic component of PKC, which is basically mineral. *(See table below for the PKC mineral content)*

Mineral content of PKC

	Proportion
Calcium	0.21-0.34%
Phosphorus	0.49-0.71%
Magnesium	0.16-0.33%
Potassium	0.76 – 0.93%
Sulphur	0.19-0.23%
Copper	21.0 – 28.9 ppm
Zinc	40.5 – 50.0 ppm
Selenuim	0.23 – 0.30 ppm
Ca : P	0.36 : 1

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The mineral content of PKC is not sufficient for the requirements of livestock. PKC's phosphorus composition is very high, while its calcium content is low. The ideal Ca:P ratio is 2:1. With a low Ca:P ratio of 0.36:1, more calcium is normally added to PKC when it is used as an ingredient in diet for livestock. Otherwise, the bone growth and fertility of the livestock will be reduced. The other deficiency is that the concentration of copper can cause copper toxicity, especially in sheep, as this species of animal is highly susceptible to copper toxicity, resulting in the animal suffering from jaundice or even death. Therefore, in the preparation of feed compounds for sheep using PKC as an ingredient, precaution is needed to avoid copper toxicity. The maximum level of PKC that can be included in formulating compound feed for sheep is 50%.

Other valuable qualities of PKC are its beta-carotene content of 4.3-11.8 mg/kg and 0.35 mg /kg of Vitamin E. PKC is free from aflatoxin and therefore it is safe for animal feeds. It is also free from toxic metals, heavy metals, pesticides and dioxins. The high dry matter content of 93% inherent in PKC discourages growth of micro-organisms and mould and this will optimise animal feed intake and improve overall growth for livestock.

Based on the market price traded in Rotterdam on Dec 27, 2012, PKC is ranked high in energy content. *(Refer to table below)* For a US dollar spent on PKC, the energy value feed millers obtain is 0.50 MJ, which is 40%-50% higher than soymeal, rapeseed meal and sunflower meal. For crude protein, PKC has between 15%-22% lower protein content. PKC crude fibre content is high at 17%. The high crude fibre content is said to make the product more suitable for ruminants than non-ruminants. The amount of nutrient that is easily digestible, measured in terms of total digestible nutrient (TDN) per US dollar, is high for PKC. It ranks higher than soymeal, rapeseed meal and sunflower meal at 3.3 kg per US dollar. With 1.7 to 2.2 times higher nutrient absorption, technically, PKC should rank higher in terms of availability of crude protein to livestock although PKC's crude protein availability is between 15%-22% lower compared to soymeal, rapeseed and sunflower meal.

Comparative composition of ingredients in different meals

	CP (%)	ME (MJ/kg)	CF (%)	TDN (%)
PKC	**16.0**	**10.5**	**17**	**70**
Soymeal	**48.0**	**14.9**	**6.2**	**84**
Rapeseed meal	**36-38**	**10-12**	**10-12**	**72**
Sunflower meal	**30.0**	**8.3**	**25.5**	**65**

CP : Crude protein, ME : Metabolisable energy,
CF – Crude Protein TDN : Total Digestable Nutrients
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Estimated cost of nutrients per USD of selected feed resources

	CP Kg/US$	ME (MJ/US$)	TDN (Kg/US$)
PKC	0.76	0.50	3.3
Soymeal	0.84	0.26	1.5
Rapeseed meal	0.92-0.97	0.25-0.30	1.8
Sunflower meal	0.89	0.25	1.9

Based on cif Rotterdam price on 27/12/2012
Price: PKC –US$212/MT, Soymeal – US$565/MT
Rapeseed meal – US$390/MT, Corn-US$320/MT,
Sunflower meal – US$335/MT

Fresh PKC has on average 10% palm kernel oil. PKC exported is occasionally extracted for kernel oil. For every MT of fresh PKC imported, approximately 100gm of palm kernel oil can be extracted. On protein, PKC total amino acid content has a high by pass value of 65-75%, implying a high protein absorption rate.

3.0 PALM KERNEL CAKE FORMULATION IN ANIMAL FEED – SOME EXAMPLES OF GLOBAL FORMULATION

PKC has been used in many countries for many types of animals. A compilation of feeding trials and feed formulation used in the market globally shows that PKC ration has been successfully used as a ration to feed fresh water fish, beef cattle, dairy cattle, sheep, swine, broiler and layer chicken. Due to its high fibre content, ruminants digest the PKC feed formulations better. As such, generally, lower PKC rations in compound feeds are used for monogastric animals, while ruminants are fed with a higher amount of feed originating from PKC.

For beef cattle, in Malaysia, PKC can be fed up to 90% of the total ration without any adverse effect. Daily Live Weight Gain (LWG) of Kedah Kelantan steers fed with 50% PKC and 50% palm oil mill effluent (POME) was about 0.6kg/day. Brahman crossbred steers fed with 70% PKC for a period of 120 days gained 0.8kg per day. *(America Palm Oil Council, APOC 2006)*

Beef Cattle Formulation – An example of the formulation used in Malaysia Farm

	%
PKC	80
Grass/hay	17.5
Limestone	1.5
*Premix	1

* Vitamins and minerals
Source: APOC, 2006

For dairy cattle, PKC is used as a source of energy and fibre. In China, a feeding trial was carried out the Mengniu Dairy Group on 24 Australia-Holstein dairy cows by feeding the animals with a different content of PKC. The results show that at 18% inclusion level in their PKC formulation, milk yield was 41.3% higher than the controlled group. The result may be interesting for feed millers in India, where cattle are bred for milk and beef export and for the major Western diary producing countries.

EFFECTS OF PKC SUBSTITUTION ON MILK PRODUCTION OF AUSTRALIAN HOLSTEIN DAIRY COWS

	Control	**Diet 1**	**Diet 2**	**Diet 3**
PKC (%)	0	10	15	18
Milk Yield (kg)	13.8	15.3	16.5	19.5
% increase in milk yield		10.9	19.6	41.3

Source: Mengniu Dairy Group, China study

David Pooch of the NZ Institute of Food Science & Technology reported at the recently concluded POTS KL seminar that cows in New Zealand fed up to 6 kg/day of PKC recorded a Live Weight Gain (LWG) of 2kg to 3 kg per day.

In Kerala, India, the feeding of meal at a level of 20 percent has been found suitable for calves and lactating cows (Rajan et al (1990).

For swine, feeding trials on 144 pigs conducted by Xiangda Company of the Tangrenshen Group, China, showed that PKC used in the diet of swine resulted in increased growth performance at 5% inclusion level. (*Refer to table below)*

EFFECTS OF PKC SUBSTITUTION ON GROWTH PERFORMANCE OF PIGS

	Control	Diet 1	Diet 2
PKC (%)		5.0	10.0
Corn (%)	64.45	58.7	52.8
Soymeal (%)	14.5	13.8	13.18
LWG* (g)/day	679	709	610

* LWG- Live Weight gain
Source: Xiangda Company of Tangrenshen Group, China

Palm kernel meal contains 20-30ppm of copper (APOC, 2006). Sheeps are very sensitive to copper and levels as low as 25ppm in the diet can be toxic to them (Schoenian, 2009); *(American Palm Oil Council, APOC America*). Precaution is needed when PKC is used as a feed ingredient for sheep in order to prevent copper toxicity. Among others, one of the formulations recommended by scientists for sheep rearing is illustrated as follows:

Ingredient	%
PKC	50
Grass/Hay	30
Soymeal	9.0
Rice Bran	10.0
Pre-mix*	1.0

* Vitamin & Minerals
Source: APOC 2006

In China, Wuxi Freshwater Fish Research Institute conducted a research on effects of PKC substitution on grass carp. It was found that PKC inclusion at 5% to 10% reduced the feeding cost without affecting the growth performance of the fish.

EFFECTS OF PKC SUBSTITUTION ON GRASS CARP

	Control	Diet 1	Diet 2	Diet 3
PKC (%)	0	5	10	20
Wheat	10	10	9	6
SBM (%)	30	29	28	26
LWG (g)/ day	2.72	2.80	2.83	2.66
Total Feed Cost (Yuan/kg)	2,262	2,236	2,194	2,130

Source: Wuxi Freshwater Fish Research Institute , China's study

In Malaysia, effects of PKC on broiler growth carried out by a local scientist have established that daily weight gain is highest at 10% PKC inclusion level.

BROILER GROWTH PERFORMANCE ON THE EFFECTS OF PKC IN DIETS

PKC level (%)	Daily feed intake (g)	Daily weight gain (g)
0	54.7	26.5
10	58.3	28.7
15	58.7	28.4
20	59.5	27.8
25	60.8	27.7
30	60.2	27.4

Source: Yeong (1985)

Feeding trial carried out by a group of animal nutritionists from Eco-agricultural Chicken Feedlots in the Tangrenshen Group, China, shows that PKC inclusion at 6% to10% improved the egg laying rate, individual egg weight and the feed-to-egg ratio. Further improvements were observed when Heimei enzyme was added, at 10% PKC inclusion rate.

EFFECTS OF PKC SUBSTITUTION ON LAYER CHICKEN PRODUCTION

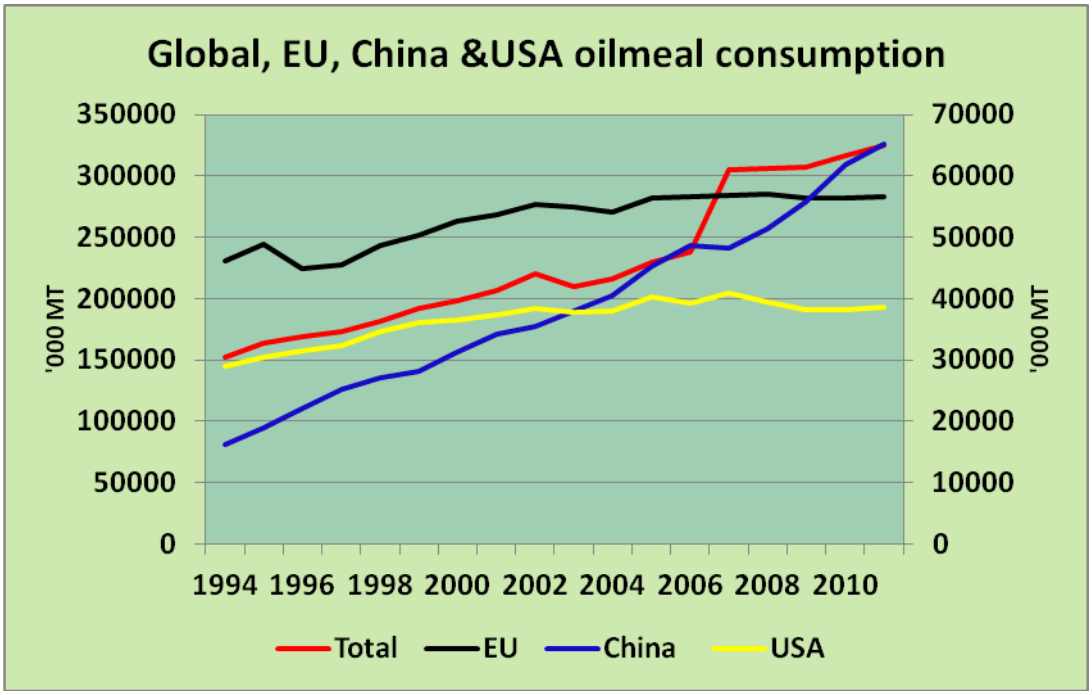
	Control	Diet 1	Diet 2	Diet 3	Diet 4
PKC (%)	0	6	10	6	10
Corn (%)	61.84	55.59	51.43	55.59	51.43
SBM (%)	27.40	26.27	25.53	26.27	25.53
Heimei Enzyme (500 g/t)	0	0	0	0.05	0.05
Total Feed Cost (Yuan/kg)	2,084	2,071	2,062	2,106	2,097
Feed:Egg ratio	2.16	1.80	2.05	2.25	1.88

Source: Eco-agricultural Chicken Feedlots in Tangrenshen Group, China

4.0 GLOBAL OILMEALS DISAPPEARANCE - TRENDs AND PROSPECTs

The annual growth of oilmeals disappearance, from 1994 to 2011, has been approximately 3.5%. Major oilmeals used are soymeal, rapeseed meal, corngluten feed and PKC, accounting for 61%, 12%, 5.2% and 2.3% of the global oilmeals consumed respectively in 2011. Major consuming countries are the EU27, China and USA. These three countries account for 22%, 21% and 15% of the global oilmeal consumption of 324.9 million MT in 2011. On average, the EU27 oilmeal consumption registered slow growth from 2007 to 2011 amidst a stable population and lifestyle. As such, the EU27 oilmeal consumption growth pattern is within expectations, for there is no expanding husbandry sector to support growing feedmeal usage. A similar situation occurs in the US market. However, China's oilmeals consumption grew at an average annual rate of 8.6% between 1994 and 2011, registering 65.2 million MT in 2011. Supporting China's oilmeals consumption are the country's growing prosperity as a result of the country's continuous GDP

growth and the changing lifestyle brought about by rapid urbanisation, averaging at a rate of 2.3% a year on a population base of 1.37 billion people.



A common market feature in the global major feed market is that PKC consumption is relatively low. In China, PKC consumption is currently around 245,000 MT, which is only 0.2% of the total country's compound feed production of 120 million in 2011. In the EU27, the PKC usage of 2.2 million MT in 2011 was 1.5% of the country's compound feed formulation. In the USA, usage of PKC is negligible, although the country produces 121.2 million MT of compound feed.

Among the other countries, New Zealand has registered phenomenon growth in PKC usage. New Zealand's preference for PKC has increased following severe droughts in 2005 and 2007, which led farmers to believe that the grassland is not a reliable source of animal feed. The country's import of PKC from Malaysia rose from 32,506 MT in 2003 to 702,880 MT in 2012.

The subcontinent, mainly India and Pakistan, could also be potential areas for PKC feed usage in view of the large cattle industries of the two countries. Both India and Pakistan are producing large amounts of meat and milk products from their livestock industry. India has also topped the list of beef and veal exporters in 2012 and due to strong export demands, India's beef production is expected to increase to 14% in 2013. Pakistan's production of beef is also significant, but it is mainly for domestic consumption.

At present, the consumption of PKC by India is not very significant as the country is also producing large amount of soymeal. On the other hand, Pakistan's import of PKC is on the rising trend, with imports shooting up from just 19,871 MT to 72,510 MT in 2011.

5.0 CONCLUSION

Animal diet made up of PKC has been found to be consumed by many types of animals and in many countries. Samples of global feed formulation provided in this report shows that it is used as feed blends for fresh water fish, beef cattle, dairy cattle, sheep, swine, broiler and layer chicken. There are good commercial values that provide PKC this buying support. From the business angle, PKC offers feed producers a competitively priced feed ingredient. This is because PKC is the most competitive oilmeal currently traded in the market. At end of December 2012, PKC traded at US$212/MT, which is a steep discount of US$315/MT off soymeal, which is priced at US$563/MT.

Since PKC is obtained from a perennial crop, the product is produced everyday. Thus, PKC can sustainably meet the daily requirements of compound feed producers. With PKC appearing to be greener, since it is derived from a perennial crop compared with other major oilmeals that are derived from crops that are seasonal in nature, PKC is a good choice ingredient for the green animal feed product marketers. From the nutritive angle, PKC is rich in protein and carbohydrate content.

PKC is generally classified as an energy- and protein-based feed ingredient. Other valuable qualities of PKC are that it has a beta-carotene content of 4.3-11.8mg/kg, 0.35mg/kg of Vitamin E and is free from aflatoxin, toxic metals, heavy metals, pesticides and dioxins. Fresh PKC has on average 10% palm kernel oil. PKC is occasionally extracted to yield kernel oil to increase its product value. Protein-wise, PKC total amino acid content has a high by pass rate of 65% to 75%, implying high protein absorption. The future prospects for PKC are bright, for there should be a much bigger market for the product alongside growing global feedmeal requirements to meet growing animal-based protein requirements. The commercial reasoning is that it is tied up with the growing feed demand in that the consumption of meat will rise as a result of growing populations and consumer affluence, particularly rising incomes.

The EU is currently the biggest PKC importer, but the volume is not significant in view of the total compound feed utilisation by the livestock industry in the region. The strength of PKC, which has proven to improve milk production in dairy cattle, could be the main reason why New Zealand is importing a substantial amount of PKC for its livestock industry. While Pakistan’s import of PKC is rising, there is still room for much improvement, in view of the sizeable dairy industry of the country.