Quality and Characteristics of Malaysian Palm Kernel Cakes/Expellers

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INTRODUCTION

Palm kernel cake (PKC), sometimes referred to as palm kernel expeller (PKE), has long been known to be an important ingredient for the formulation of animal feeds (Collingwood, 1958). Though it is considered to be excellent for ruminants, PKC is also reported to be suitable for use in feed formulations for swine, poultry and horses (Hutagulung *et al*., 1982; Yeong *et al*., 1983; Collingwood, 1958). PKC is obtained as a by-product from the extraction of palm kernel oil via the mechanical process. The production of PKC involves the grinding of palm kernels followed by screw pressing with or without an intermediary flaking and cooking stages. During the screw pressing stage, the raw palm kernel oil is diverted for clarification and the residual PKC is cooled and stored in a warehouse. A simplified flow chart is shown in *Figure 1* (Tang and Teoh, 1985).

CHARACTERISTICS AND COMPOSITION

Malaysia produced 1.64 million tonnes of PKC in 2000 from about 40 crushing plants. Of this, 1.35 million tonnes were exported, mainly to Europe. As the cost of the solvent extraction process is high, it is not currently used in Malaysia. Thus, only PKE is produced. Besides oils and protein, PKC also has a high fibre content (about 16%) and a high phosphorus to calcium ratio,

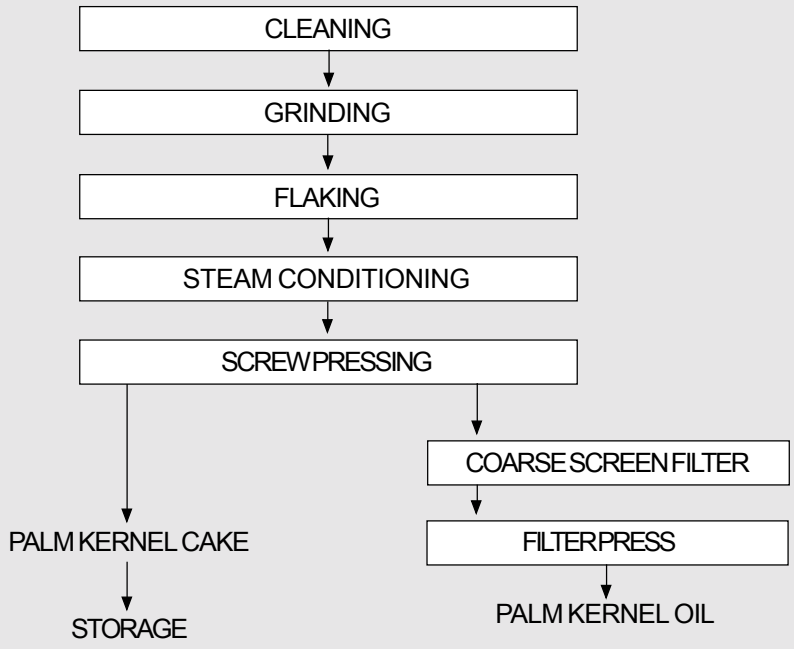

Figure 1. Mechanical extraction of palm kernel oil.

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which make it suitable as feed ingredient (Collingwood, 1958). Also present are essential elements such as magnesium, iron and zinc. A typical composition of PKC and its amino acid profile are shown in *Tables 1* and *2* respectively (Yeong *et al.,* 1983).

Survey of Malaysian PKC

A major survey to obtain data on the characteristics and composition PKC in Malaysia was carried out by Siew (1989). Seventy-eight samples from 23 palm kernel crushers, collected over a period of one year throughout Malaysia, including Sarawak and Sabah, were analysed for the common feed parameters. The data obtained in this survey are given in *Table 1*.

These results showed that PKC has a fairly high oil content averaging 10% *(Table 3)* which can be a good source of metabolizable energy for feed uses. The rather wide range of oil content, *i.e.* 4.5% to 17.3%, could be attributed to the different screw pressing conditions employed in the various crushing plants. With improvement in pressing technology, it might be envisaged that the oil content would be reduced to a slightly lower level. The ranges of the contents of the other constituents are generally within expectation for this product. It must be emphasized that no aflatoxin was detectable in all the samples in that survey. This was possibly due to the low moisture content of the cakes coupled with proper handling and storage conditions employed by the crushers.

TABLE 1. TYPICAL CHEMICAL COMPOSITION AND ENERGY CONTENT OF PKC

Constituents	Composition
Dry matter[1], %	91
Proximate chemical composition (as % of cakes)[1]	
Crude protein (N x 6.25)	14
Ether extract	8
Crude fibre	23
Total ash	6
N-free extracts (by difference)	49
Mineral nutrients[2]	
Calcium, %	0.29
Phosphorous, %	0.79
Magnesium, %	0.27
Iron, mg kg^{-1}	4.05
Copper, mg kg^{-1}	28.5
Zinc, mg kg^{-1}	77.0
Manganese, mg kg^{-1}	225.0
Energy content[2]	
Metabolizable energy, MJ kg^{-1}	6.2
Metabolizable energy, Kcal kg^{-1}	1 480.0
True metabolizable energy, MJ kg^{-1}	7.4
True metabolizable energy, Kcal kg^{-1}	1 760.0

Sources: [1]Extracted from Mustaffa *et al.* (1991).
[2]Extracted from Yeong *et al* (1983).

TABLE 2. AMINO ACID PROFILE OF PALM KERNEL CAKES

Protein/amino acid	Composition (%)
Total protein (as % of PKC), consisting mostly of the following amino acid:	16.06
Alanine	0.92
Arginine	2.18
Aspartic acid	1.55
Cystine	0.20
Glutamic acid	3.15
Glycine	0.82
Histidine	0.29
Isoleucine	0.62
Leucine	1.11
Lysine	0.59
Methionine	0.30
Phenylalanine	0.73
Proline	0.62
Serine	0.69
Threonine	0.55
Tryptophan	0.17
Tyrosine	0.38
Valine	0.93

Source: Yeong *et al.* (1983).

TABLE 3. QUALITY CHARACTERISTICS OF PKC SURVEYED IN 1989

Item	Property	Content by weight (%)	
		Range	Mean
a.	Moisture content	3.3- 9.5	7.1
b.	Oil content	4.5-17.3	10.0
c.	Protein content	11.3-17.0	14.4
d.	Ash content	2.9- 8.1	3.9
e.	Shell & dirt content	3.6-21.4	11.9
f.	Aflatoxin	Not detectable	-

Source: Siew (1989).

TRADE SPECIFICATION AND STANDARD

The export specification for PKC stipulated by the Malaysian Edible Oil Manufacturers' Association (MEOMA) is shown in *Table 4*. The Malaysian Standard (MS) for PKC has additional parameter which provide useful information to reflect its nutritive values (*Table 5*).

As protein and fats are the most important nutrient components in a

feed ingredient, it is thus a common practice to combine these two components as the *Profat Content* in the trade specification of PKC. The current MEOMA's specification for profat content is 21%. This allows some flexibility as a product with lower protein content could be compensated for by a higher fat content and *vice-versa*.

The MS for PKC, on the other hand, is more stringent in that it stipulates additional parameters such as crude fibre, total ash and aflatoxin content to specify the quality of the product. *Ether extract* in the MS specification is the same as the fat content. As fibre is a natural component in all feed ingredients, its content usually varies within a narrow range. The ash content measures indirectly the total content of trace metals and silica, as all these will be reduced to ash after carbonization and incineration. The inclusion of aflatoxin content helps to promote proper storage practices to minimize fungal infestation.

TABLE 5. MALAYSIAN STANDARD FOR PKC AS ANIMAL FEEDSTUFFS MS 607:1987 (first revision)

Item	Property	PKC	
		'as is'	dry basis
a.	Moisture, % by weight, max.	12.0	0.0
b.	Crude protein, % by weight, min.	13.0	14.8
c.	Ether extract, % by weight, max.	10.0	11.4
d.	Crude fibre, % by weight, max.	18.0	20.4
e.	Total ash, % by weight, max.	5.0	5.7
f.	Aflatoxin, max.	N.D.*	N.D.*

Note: *N.D. - means not detectable at 50 ng kg^{-1} (ppb).

TABLE 4. MEOMA SPECIFICATION FOR PKC

Parameters	Specification
Profat*, % min. by weight	21
Moisture, % max. by weight	10 at time of shipment

Note: *profat = protein (N x 6.25) + fat content.
Source: MEOMA (2000).

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