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Enhancing Basic CPO Quality

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The palm oil industry is currently facing unprecedented issues and challenges. Global climate change is caused by human activity such as deforestation and greenhouse gas emissions. Unfortunately, palm oil has been singled out as the perpetrator. While the industry has taken proactive steps to deal with the negative consumer image by producing certified sustainable palm oil (CSPO), improving crude palm oil (CPO) quality must go in tandem with CSPO; otherwise the onerous efforts will be negated. Surveys over a span of 25 years have shown that our CPO quality has, at best, remained status quo. Enhancing palm oil quality is not just a must but a prerequisite. This is because these are the very characteristics that affect consumer's perception of its value. The industry must produce CPO quality that refiners, and ultimately consumers, want and not the quality they think the refiners want. Refiners want CPO with low free fatty acid (FFA), low contamination, low oxidation, and high iodine value. Leaders of the industry must be committed to produce quality products, not just provide lip service. Formulating quality as a policy, and having effective control systems, do not in themselves, produce quality products. Such a task needs the commitment and the will of everyone within the organisation to set it in motion. In the long run, the most important factor affecting a business unit's performance is the quality of its products and services in relation to its competitors. To produce quality CPO, all that is needed is – reduce contaminants during collection of fruits, minimise fruit damage and process the fruits early. Good coordination and cooperation between estates and mills is a must.

Keywords*: Survey, quality, improvements, refinery, requirements.*

The palm oil industry is currently facing issues and challenges that are unprecedented. Globally, the climate has changed, and human activity is one of the main causes. Among the causative factors are deforestation and greenhouse gas emissions. Although some of these activities are related to palm oil, it is regrettable that palm oil has been singled out as the perpetrator. This has harmed the industry in a big way, so much so, that even the word "deforestation" is synonymous with palm oil.

While it is commendable that the industry is tackling the negative consumer image by producing certified sustainable palm oil (CSPO), the quality of palm oil produced, however, has left a lot to be desired. Surveys over a span of 25 years have shown that the Malaysian crude palm oil (CPO) quality has, at best, remained *status quo*. Improving CPO quality must go in tandem with CSPO; otherwise the efforts to produce CSPO will be negated. Enhancing palm oil quality is not just a must but a prerequisite. This is because quality is the very characteristics that affects consumer's perception of its value.

Leaders of the industry must be committed to producing quality products, not just providing lip service. Formulating quality as a policy,

Author's note:
This article is written in a non-technical manner to facilitate better understanding of palm oil quality from field practices, milling and refining.

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effective monitoring, and control systems, do not in themselves, produce quality products. Quality comes from the commitment, implementation, and the will of everyone within the organisation to set it in motion. In the final analysis, the hallmark of quality is product consistency, reliability, cost saving and customer satisfaction.

QUALITY, THE CRITICAL FACTOR

There are a lot of descriptions of quality and one that puts it neatly is:

> *Quality in a product or service is not what the supplier puts in. It is what the customer gets out and is willing to pay for. A product is not quality because it is hard to make and costs a lot of money, as manufacturers typically believe. This is incompetence. Customers pay only for what is of use to them and gives them value. Nothing else constitutes quality. (http://www.quotationspage.com/quote/4773.html). - Peter Drucker*

In a nutshell**,** one must produce CPO quality that refiners want, and not the quality one thinks the refiners want. To do that, the following need to be known:

- Refining – why does CPO need to be refined in the first place? And how is refining done?
- CPO – what are the quality parameters refiners look for in CPO? What needs to be done to meet their requirement?

CPO COMPOSITION

It is important to understand some of the basic characteristics and properties of CPO before they can be improved. A good start will be to look at the composition of CPO and see what it is made up of (*Table 1*).

CPO is mainly made up of triglycerides, and also free fatty acids (FFA), minor components, moisture, and impurities (M&I).

The good constituents: triglycerides, minor components such as vitamin E (tocopherols and tocotrienols) and carotene (pro-vitamin A) must be retained during refining.

The undesirable constituents: FFA, moisture and impurities, gums, coloured pigments, rancid (stale) products i.e. substances that affect taste and smell must be taken out during refining.

WHY DOES CPO NEED TO BE REFINED?

Refining is carried out to remove the undesirable constituents in CPO to make the oil more appealing to the consumers. This must

TABLE 1
COMPOSITION OF CRUDE PALM OIL

	Crude palm oil (CPO)	
Composition	*%*	*Comments*
Triglycerides (TG)	95.32#	Main constituent of oil
Free fatty acids (FFA)	3.44*	Fatty acid that has detached itself from TG
Minor components	1.00+	Vitamin E, provitamin A, gums, etc
Moisture and impurities (M&I)	0.24*	Impurities in CPO

* See *Table 2*; +*Source*: MPOB; # By difference

be done efficiently i.e. with minimum oil losses and with the least amount of damage to the valuable constituents.

The final refined oil must:

- be bland - without any strong taste,
- be stable - can be kept on the shelf for a long time, and
- have the desired appearance – that is visually appealing to the consumers.

HOW IS REFINING DONE?

In refining, CPO undergoes the following main processes - degumming, bleaching, deodorisation, and fractionation, as shown by the simplified flow diagram (*Figure 1*). We will focus on physical refining and fractionation has been included as part of refining.

It is best to discuss refining under four main headings, bearing in mind that there are equipment and process variations.

Degumming

Degumming is the first step in refining where the gummy substances, which are present in impurities are removed from CPO (*Figure 2*).

Why does CPO need degumming?

Gums are natural components found in oils. CPO has about 50 ppm, which is relatively low. These gums are unwanted because upon heating, they decompose and darken the oil which leads to discolouration of the refined oil and which can affect the flavour of the oil.

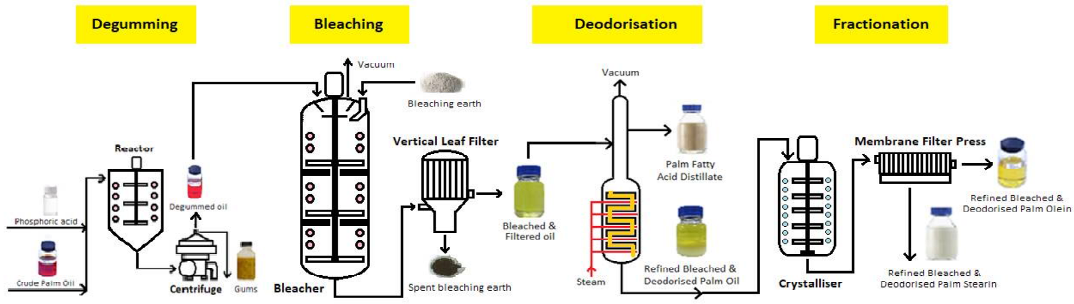


Figure 1 Simplified process flow diagram of refining

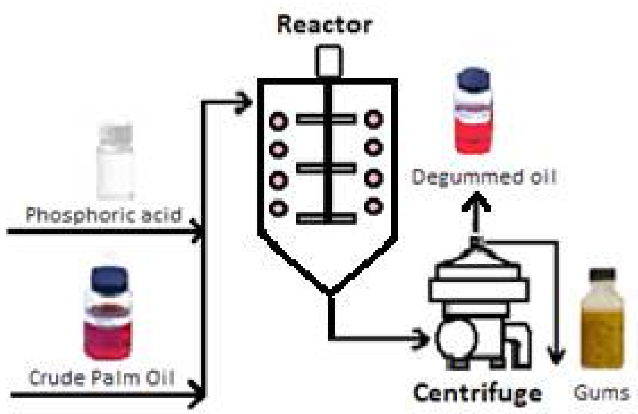


Figure 2 Degumming

How is degumming done?

Acid degumming is carried out by adding a small dose of concentrated phosphoric acid (less than 0.1%) to CPO at around 95^{0}C to precipitate out these gums, which are subsequently removed by centrifuging.

Bleaching

Bleaching is one of the most important processes in refining where unwanted substances in CPO are removed to ensure that the refined oil is stable, meets quality standards and visual appearance (*Figure 3*).

Why does CPO needs bleaching?

Bleaching removes rancid (stale) products, impurities, and coloured pigments from CPO. The term “bleaching” may sound like a harsh term of using hazardous chemicals to “whiten” a product. This is not the case for CPO. Bleaching of CPO is a mild process to produce a light-coloured oil, which also makes the oil more appealing to the consumers.

How is bleaching done?

In bleaching, 0.5 per cent activated bleaching earth (an adsorbent) is added to CPO at a temperature of 105^{0}C under vacuum while stirring. The mixture is then filtered and the “undesirable products” adhere to the surface of the bleaching earth and are retained by the filter media. The spent bleaching earth is discharged from the vertical leaf filter regularly. Activated bleaching earth is clayey material and is classified as non-dangerous goods and is labelled as a non-hazardous substance.

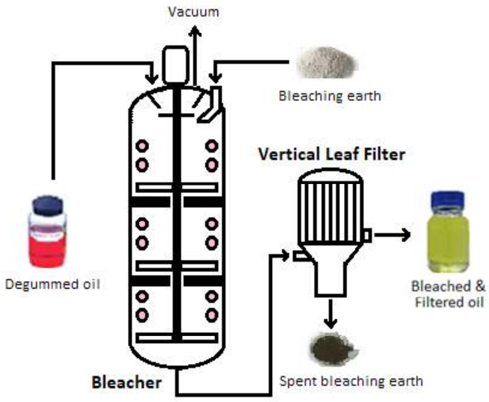


Figure 3 Bleaching

Deodoriser

This refining step is to remove the lower boiling point compounds and substances that cause odour (*Figure 4*).

Why does CPO needs deodorisation?

The deodoriser, as the name suggests, removes odour i.e. products that affect the aroma, taste, and colour of the oil. It also removes FFA as a lower value distillate because its presence imparts an unpleasant taste, lowers its stability, and leads to off-flavour of the final oil.

How is deodorising done?

Bleached and filtered oil enters the deodoriser and fills up a series of trays as it flows

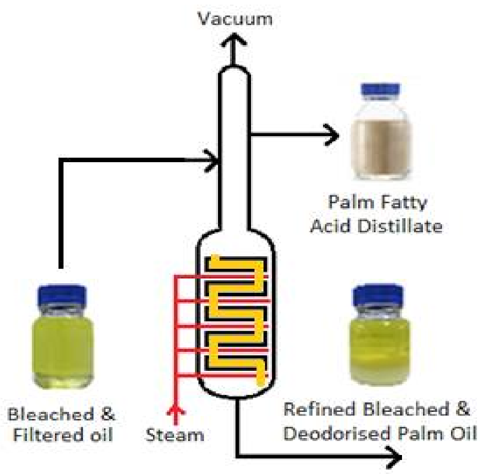


Figure 4 Deodorisation

downwards. Steam surges upward in the opposite direction and bubbles through the trays under vacuum at a temperature of 260°C. Substances with unpleasant odour and FFA and are distilled and discharged as palm fatty acid distillate (PFAD). The bland and stable oil that leaves the bottom of the deodoriser is called refined, bleached, and deodorised (RBD) palm oil.

Fractionation

This final refining step entails separating palm oil into its components based on their differences in physical properties (*Figure 5*).

Why does CPO need fractionation?

Palm oil has both solid and liquid fractions at room temperature. Both these fractions have different physical and chemical properties, and they are used for a wide range of different applications. This makes palm oil rather unique and versatile compared to other oils and fats.

How is fractionation done?

RBD palm oil is cooled under controlled conditions inside the crystalliser. This is achieved by circulating chilled water into the cooling coils while stirring to induce crystals to form and settle out from the oil. The chilled oil is then pumped into a membrane filter press where the solid fraction (RBD stearin) is retained while the liquid fraction (RBD olein) leaves the filter. RBD olein is commercially more valuable, and obviously a higher yield is desired. Iodine value is an important test to determine olein yield.

WHAT DO CPO REFINERS WANT?

From the preceding, it can be said that in general:

> "Refiners want CPO with low FFA, low contamination, low oxidation, and high iodine value."

Numbers will be added to the above-mentioned statement later. For now, one needs to take a critical look at the CPO quality that has been sold to the refiners.

WHAT IS THE CPO QUALITY THAT HAS BEEN PRODUCED ALL THESE YEARS?

A comprehensive survey carried out by Tan *et al*. (2000) of CPO quality, compared previous surveys over a span of 25 years as shown in *Table 2*. There were five major surveys, four

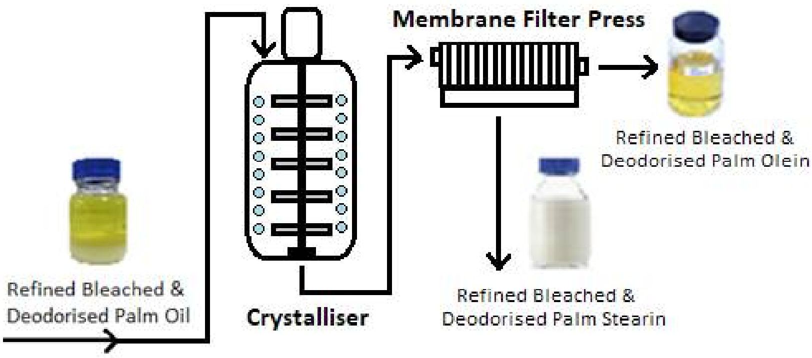


Figure 5 Fractionation

TABLE 2
COMPARISON OF SURVEY DATA

Test parameter	*CPO Survey*					
	1973	*1979/80*	*1986/87*	*1991/92*	*1997/98*	*Average*
FFA (%)	3.15	3.66	3.57	3.64	3.18	3.44
Moisture and impurities (%)	-	0.22	0.30	-	0.21	0.24
DOBI value	-	-	2.67	2.70	2.70	2.69
Peroxide value (meq/kg)	3.92	2.70	2.43	-	0.72	2.44
Anisidine value	4.61	4.55	2.90		4.70	4.19
Totox	12.44	-			6.15	9.30
E_{233}	1.680	-	1.44		1.31	1.48
E_{269}	0.291	-	0.290		0.30	0.29
Iodine value	-	53.17	-	52.50	52.10	52.59
Carotene (ppm)	567	587	579		582	579
Moisture (%)	0.09	0.18	0.168		0.181	0.15
Impurities (%)	-	0.04	0.129		0.029	0.07
Discriminant function			11.3		15.69	13.50
Phosphorous (ppm)			13.5		14.05	13.78
Fe (ppm)	3.76		5.6		4.85	4.74
Total chlorophyll (ppb)					1879	1879

Source: Tan *et. al.* (2000)

by PORIM [now Malaysian Palm Oil Board (MPOB)] and one by Palm Oil Refiners Association of Malaysia (PORAM). The 25-year arithmetic average (1973 to 1997/98) has been added by the authors.

Some salient points from the report were:

- A 12 per cent improvement in the mean FFA value,
- No change in moisture and impurities,
- A substantial improvement in peroxide value (PV),
- A slight increase in anisidine value (AV),
- A significant decrease in total oxidation (Totox) value.
- A steady improvement in E_{233}, but no change in E_{269}, and
- No change in carotene content and deterioration of bleachability index (DOBI).

CPO QUALITY THE MILLS CAN PRODUCE

In 2002, the main author of this article chaired a team of very experienced palm oil quality personnel comprising of Technical Research Committee of Malaysian Palm Oil Association (MPOA) and MPOB.

The Committee's objective was to determine the quality parameters in the survey that mills can achieve and thereafter to make recommendations.

Data from PORIM's 97/98 survey over a 12-month period from 127 mills and refineries covering 1379 samples were analysed.

The analyses highlighted the percentage of palm oil mills in the survey that could meet each of the quality parameters. The Committee recommended two types of CPO that the industry should focus on in achieving over a

2-year period (*Table 3*).

Based on the intensive analyses, the Technical Committee then recommended two types of CPO to be produced, Type 1 immediate and Type 2 within 2 years. Although the data above was evaluated in 2002, it is still applicable today.

The Committee's recommendations were:

- Type 1. Overall, 34 per cent of the mills can achieve Type 1. If some of the mills improve their moisture and impurities, then 55 per cent of those mills can produce Type 1 CPO straight away, and
- Type 2. This type of oil can be produced by 2 per cent of the mills. Again, with improved moisture and impurities, 9 per cent of those mills will qualify to produce Type 2 CPO.

Tabulated below is 25-year average quality data to compare with PORAM/MPOA CPO contract and Malaysian Standard MS814:2007 (*Table 4*).

WHAT DO REFINERS WANT?

A long route has been taken to explain what the refiners want. The rationale being – one needs to look at what can be produced and compare that with what the refiners want to home in on what needs to be done.

The MPOA Technical Research Committee's proposal is shown in *Table 5* which is believed to be still valid today. This is also our recommendation.

By lumping moisture and impurities as 0.25 per cent in the CPO contract, it means the refineries are obligated to accept, say 0.15 per cent impurities and 0.09 per cent moisture. Surely this level of impurities is not acceptable to the refineries. This clearly shows that moisture and impurities must have separate limits.

> "The bottom-line is that the quality of our CPO especially FFA, DOBI and impurities needs to be improved."

This leads to the next question.

IS THERE ANY ADVANTAGE IN PRODUCING QUALITY CPO?

This is very well summed up by a whitepaper issued by the American Society for Quality (ASQ) which carries the title "Making the

TABLE 3
1997/98 PORIM SURVEY: % OF MILLS THAT CAN MEET EACH OF THE QUALITY PARAMETERS

Type 1			*Type 2*		
Requirement	*Limits*	*Samples (%)*	*Requirement*	*Limits*	*Samples (%)*
Free fatty acids (%)	<3.5	68	Free fatty acids (%)	<2.5	19
Moisture and impurities (M&I) (%)	<0.25	75	Moisture (%) (M)	<0.2	65
Carotene (ppm) (antioxidant)	>500	94	Impurities (%) (I)	<0.02	30
Extinction 269nm (oxidation)	<0.4	97	Carotene (ppm) (antioxidant)	>550	73
DOBI (overall oxidative state)	>2.5	73	Extinction 269 nm (oxidation)	<0.3	53
Meet all requirements		34	DOBI (overall oxidative state)	>2.8	33
Meet all except M&I		55	Meet all requirements		2
			Meet all except M&I		9

TABLE 4
CPO QUALITY SURVEY FOR COMPARISON AGAINST MALAYSIAN STANDARD AND REFINER'S NEEDS

Test parameter	*25 years average*	*PORAM /MPOA contract*	*MS814:2007*		*Refiner's needs*	
			Premium	*Standard*	*Type 2*	*Type 1*
FFA (%)	3.44	5.0	2.5	5.0	2.5 max	< 3.5%
Moisture (%)	0.15				0.20 max	
Impurities (%)	0.07				0.02 max	
Iodine value (IV)	52.59				52 min	
Carotene (ppm)	579				500 min	> 500
DOBI value	2.69	2.31	2.8	2.3	2.8 min	> 2.5
E_{269}	0.29				0.3 max	< 0.4
E_{233}	1.48					
Peroxide value (meq/kg)	2.44		1.0	2.0		
Anisidine value (AV)	4.19		4.0	5.0		
Totox (2PV+AV)	9.30		6.0	9.0		
Moisture and impurities (%)	0.24	0.25	0.25	0.25		< 0.25%

TABLE 5
REFINER'S CPO QUALITY NEEDS

Requirement	*Refinery wants*	*Industry 25 years average*
Free fatty acids	< 2.5 %	3.44
Moisture (M)	< 0.2 %	0.15
Impurities (I)	< 0.02	0.07
Carotene (Vit A) (antioxidant)	> 550 ppm	579
Extinction 269 nm (oxidation)	< 0.3	0.29
DOBI (overall oxidative state)	> 2.8	2.69

economic case for quality" (http://www.asq.org/economic_case/index.html). In it, John Ryan describes the earliest solid piece of evidence linking quality and business results, which was the ground-breaking research by Bradley T Gale and Robert D Buzzell in 1987. They studied 450 companies and nearly 3 000 business units and one linkage between strategy and performance that stood out above the rest was "Quality".

> *In the long run, the most important factor affecting a business unit's performance is the quality of its products and services in relation to those of competitors.*

To stay ahead of competition, quality CPO must be produced.

WHAT DO THE PLANTATIONS NEED TO DO TO PRODUCE GOOD QUALITY CPO?

The refiner's requirement can be narrowed down into four main categories (*Table 6*).

The identity characteristics (inherent physical

TABLE 6
GROUPING REFINER'S NEED

Test parameters	*Category*
FFA	Hydrolysis
E_{269}, DOBI	Oxidation
Iodine value, carotene	Identity characteristics
Moisture, impurities	Contamination

and chemical properties that can be used to differentiate palm oil from other oils) are predetermined during breeding. The level of carotene, however, increases as the bunch ripens. Harvesting black bunches, for example, will give rise to low DOBI readings due to the absence of carotene. Moisture and impurities on the other hand are a process problem and can be controlled in the mills. Two aspects need to be focused on i.e. hydrolysis and oxidation.

Hydrolysis: FFA and fruit damage

Hydrolysis is the breaking down of oil due to its reaction with water in the presence of the enzyme lipase. When palm fruits are damaged, oil is exposed to water and enzymes present in the fruits hydrolyse the oil to FFA and diglycerides (*Figure 6*).

Hydrolysis is a fast reaction; FFA can reach 30 per cent in five minutes after the fruits are damaged. In a bunch, only the outer fruits are bruised (damaged), the rest of the fruits are still intact. The overall FFA is still low. However, to prevent the FFA from building up, it is important to de-activate the enzyme by heating the bunches in the mill's steriliser within 48 hours (*Figure 7*).

The more the bunches are handled when transferred from one point to another, the more the fruits will be damaged, and the longer the delay before sterilisation, the higher will be the FFA.

FFA and ripeness

It is a known fact that harvesting is a compromise between oil yield and oil quality. It is governed by two main factors - harvesting intervals (HI) and minimum ripeness standard (MRS).

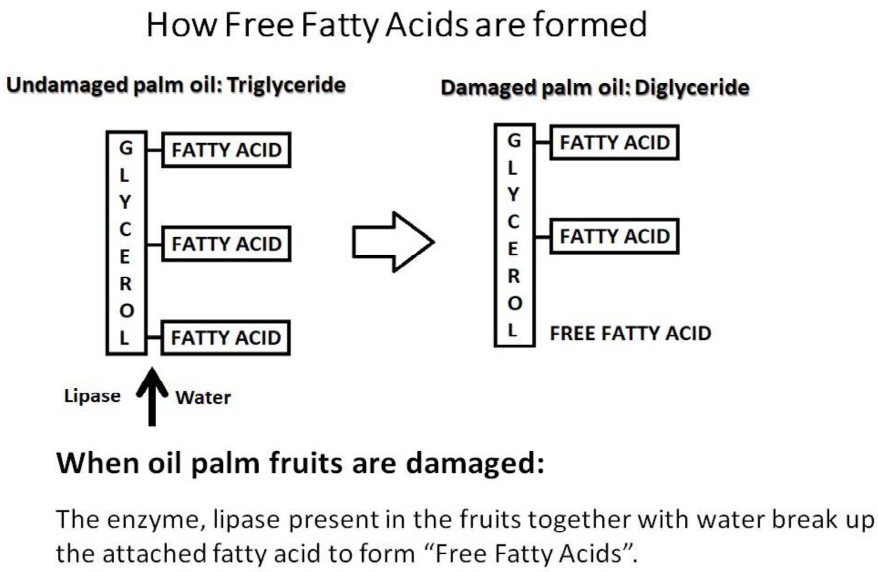
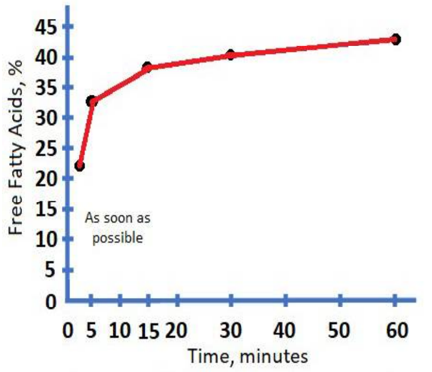
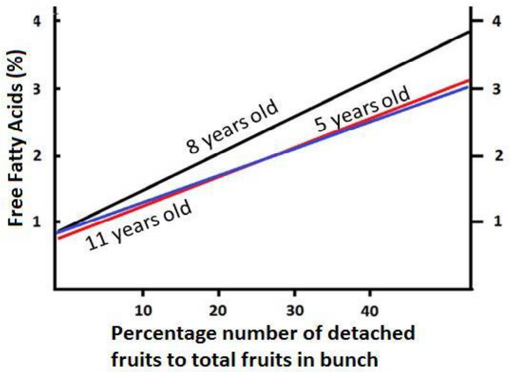


Figure 6 How free fatty acid is formed



Source: Olie and Tjeng (1974)

Figure 7 The speed of the fat splitting process (graphical form)



Source: Ng and Southworth (1973)

Figure 8 The relationship between bunch ripeness and FFA

> "The objective of harvesting is to optimise oil yield and oil quality by maintaining a low HI (<15 days) and a tolerable MRS (up to 10 detached fruits per bunch) after harvesting."

Research on ripeness was carried out based on percent detached fruits to total fruits. For example, if the bunch has 1000 fruits in total, the chart (*Figure 8*) plotted FFA of 10 per cent (100 fruits) to 40 per cent (400 fruits) detached after harvesting for three different age groups of planting. In a normal harvest, there is a range of ripeness i.e. some bunches with less than 10 per cent detached fruits to total fruits and some above 40 per cent detached fruits to total fruits. FFA is generally still low but delays and bruising of fruits from the time of harvest to sterilisation causes FFA to increase.

HI

HI is the interval (days) between two harvests in the same field. Usually this is maintained between 10 to 15 days and in acute situation, it can go up to as high as 30 days, may be more.

> "HI has a significant impact on harvesting as it is solely dependent on the availability of harvesters."

A 30-day HI, for example, gives higher levels of over-ripeness i.e. the same harvest will have a high percentage of over-ripe and empty bunches, which lead to poorer oil quality. A 10-day HI, on the other hand, will result in a higher percentage of ripe bunches.

MRS

MRS is the minimum number of fruits that have been detached from a bunch before that bunch is considered ripe for harvesting. MRS is decided by management. With the current scenario, MRS ranges from 1 to 10 detached fruits per bunch after harvesting.

In *Figure 8*, it can be seen that as more fruits detach from the bunch, the bunch becomes riper. The riper the bunch, the higher will be the FFA.

FFA – storage

Below are some factors considered for good storage conditions.

- Oil storage is part of milling and there are times when the oil must be stored for prolonged periods. The storage conditions - temperature, level of impurities and moisture can increase FFA due to microbial activities.

- FFA *vs* time (days) graph serves to demonstrate this point. FFA increases more rapidly if stored at 60°C compared to at 50°C over a period of 25 days (*Figure 9*). It has been shown that DOBI will also deteriorate if stored at higher temperatures.
- There are other intangible benefits with good quality CPO. One such example is oil dispatches. When oil prices are unfavourable, mills that produce average quality CPO face problems with buyers delaying CPO collection because they prefer to collect better quality oil. These mills will be under pressure because of high CPO stocks and limited storage tank space. Mills with good quality oil rarely face such problems.

OXIDATION

Oxidation is a measure of the degree of oil rancidity (staleness) and is of great importance to refiners.

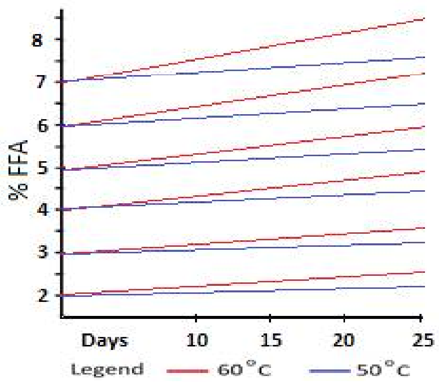
Palm oil oxidation occurs in two stages, primary oxidation (measured by PV) and secondary oxidation (measured by AV). A good way to tell the overall oxidative state is to use Totox which is the sum of AV + 2PV. See example in *Table 7*.

Newer and faster test methods have been developed which use absorbance of light wavelengths E_{233} and E_{269}. These correspond to PV and AV, respectively. E_{269} alone will give a good indication of the overall oxidative state of the oil.

Although PV and AV are not in the palm oil contract, it is measured indirectly by DOBI. This test was initially developed to determine how easily a sample of CPO can be bleached and serves to complement the long and tedious laboratory bleaching test. DOBI test has evolved into a useful tool to differentiate between good and bad quality oil.

The importance of DOBI

DOBI is the ratio of carotene at light absorbance of E_{446}, an antioxidant parameter and E_{269}, an oxidation parameter. When oil is oxidised, the amount of carotene decreases and there will be a corresponding increase in E_{269}.



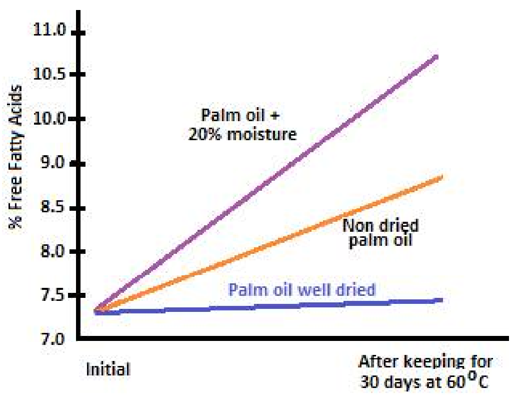


Figure 9 Effect of temperatures and length of storage on FFA

TABLE 7
TOTOX VALUES GIVEN IN MALAYSIAN STANDARD, MS814:2007

Malaysian Standard, MS814:2007	*AV + 2PV*	*TOTOX value*
Special quality (SQ) grade	4.0 + 1.0 x 2	6
Standard quality (STD) grade	5.0 + 2.0 x 2	9

The net result is that DOBI value is amplified. CPO is segregated into five grades based on DOBI values (*Table 8*).

TABLE 8
CATEGORISATION OF OIL BASED ON DOBI VALUES

DOBI	*Grade*
< 1.68	Sludge palm oil or its equivalent
1.68 – 2.30	Poor
2.31 – 2.92	Fair
2.93 – 3.24	Good
> 3.24	Excellent

Iodine value, another important parameter

Iodine value is a measure of the degree of unsaturation or a measure of the total number of double bonds present in the oil. The higher the iodine value the higher will be the olein yield or the liquid fraction.

FACTORS CAUSING POOR OIL QUALITY

Below is a guide of the severity of fruit damage from the time of harvesting until sterilisation (*Table 9*). The numbers are arbitrary and are based on the authors' experience.

FFA

- There are twelve transfer points from harvesting to sterilisation and in each transfer, some fruits are damaged resulting in oil quality deterioration.
- The most significant damage to fruits is at the mill's hopper top where the front-end loader shovels the bunches and loose fruits into the hopper causing excessive fruit damage. The oil-laden condensate that is seen discharging from the steriliser is evidence of such a practice.
- The use of non-tipper lorries, which need front-end loaders to assist in unloading the fruits will only serve to compound the problem. Such lorries will have to run over loose fruits and FFB under the lorry once unloading is done.
- The more the transfer points and the more severe the damage, the poorer will be the oil quality.

DOBI

- Avoid overheating during processing in the mill. If prolonged storage of CPO is needed, reduce the storage temperature to 55^0C.
- Recycling of steriliser condensate, sludge oil or empty bunch oil is strongly discouraged.

Iodine value

- Plant breeders must select high iodine value palms during breeding. Iodine value cannot be increased in the estates or mill.

TABLE 9
NUMBER OF TRANSFER POINTS FOR FFB FROM HARVESTING TO STERILISATION

Step	*Action*	*Severity of fruit damage*
1	Harvesting FFB	2
2	Collecting harvested FFB and loose fruits	1
3	Transferring FFB to collecting point	1
4	Piling FFB at collecting point	1
5	Manual in-field FFB loading	2
6	Unloading FFB into estate hopper	4
7	Loading FFB from hopper into lorry	4
8	Unloading FFB in the mill	7
9	Mill FFB ripeness check	6
10	Loading FFB into hopper with front-end loader	9
11	Unloading FFB from hopper into conveyor	4
12	Loading from conveyor into cages	4
13	Sterilisation of FFB	-

Severity of fruit damage: 1 = least severe; 10 = most severe

WHAT WILL BE THE ADDITIONAL COST TO THE PLANTATION TO IMPROVE CPO QUALITY?

The objective of harvesting by the estates is to cut only ripe bunches, collect all the loose fruits and transport them to the mill as soon as possible.

The objective of processing in the mill is to extract the maximum amount of good quality palm oil from the bunches without delay and at the lowest cost.

The objectives of both the estates and mill are clear, and they are already doing that or are supposed to be doing that. There are no additional activities required or extra steps needed to produce good quality CPO. The estates and mills need to adhere carefully and systematically to established operating procedures to achieve their respective objectives.

Poor quality is caused by excessive fruit damage because of too many transfer points, handling of fruits and undue delays in processing – all of these are operational problems. Apart from rising cost of labour and materials in the day to day running of the estates and mills, which will increase the overall cost, there is minimal direct cost associated with improving CPO quality.

It is imperative for estates and mills to have good communication, close rapport, and a well-coordinated procedure to tackle logistics problems from harvesting to sterilisation. The setting up of an estate/mill liaison committee to address localised issues is a must. From experience, this committee is best confined to only operational personnel from participating estates and mills. Other parties will only be invited as and when required to help clarify matters relevant to their area of expertise.

COST BENEFITS IN PRODUCING QUALITY CPO TO THE REFINERY

The financial difference between producing quality CPO is as in *Table 10.*

TABLE 10
PRODUCING QUALITY CPO - COST BENEFITS

Type of CPO	*FFA < 3 %*		*FFA 3.5-5 %*
Phosphoric acid dosage (%)	0.08		0.10
Bleaching earth dosage (%)	0.6		1.0
	RM		*RM*
Cost of phosphoric acid, RM3 789/tonne (2020)	3.03		3.79
Cost of bleaching earth, RM1 244/tonne (2020)	7.46		12.44
25% oil* trapped in spent earth, CPO RM2 265/tonne	3.40		5.66
Material, chemical and oil loss	13.89		21.89
Overall savings		*RM*	
Material, chemical and oil loss		8.00	
1.2% higher RBD olein@RM2 367 instead of PFAD@RM1 910		5.48	
Total savings per tonne CPO		13.48	

* Normally ranges from 20% to 40% oil trapped in spent earth.

There is, without doubt, financial savings for the refinery if the plantation sends in good quality CPO. The calculations above do not include savings from increased throughput, savings in having less spent bleaching earth to dispose of and better DOBI values which lead to better shelf life of the final oil. For an average 300 000 tonnes refinery, the gain is RM4 million a year*. (*Some of the numbers used are obtained from the internet, and as such, the calculations only serve as a guide. The true values must come from the refineries).

RECOMMENDATIONS FOR PLANTATIONS

i. Under present scenario, 15 days HI coupled with MRS of five detached fruits per bunch before harvesting is recommended.
ii. If HI cannot be maintained, MRS must be reduced to one or two detached fruits per bunch. Bunches should not be harvested based on colour or gauged from cut mesocarp colour. They are very subjective.
iii. Reward harvesters for consistently cutting ripe bunches rather than punish them for harvesting black bunches. Of course, such a scheme must be carefully implemented as the system can be abused.
iv. Reduce the number of transfer points of fresh fruit bunches (FFB) from harvesting to sterilisation.
v. All FFB must be processed within 48 hours.
vi. Ensure loose fruits collection is free of debris.

Recommendation for mills

i. Avoid using hopper top for FFB storage except during emergency.
ii. From a quality standpoint, the use of non-tipper lorries is discouraged.
iii. For preventing oil losses and quality deterioration, FFB checks should be done in the field to lessen fruit damage at the hopper top.

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