AN OVERVIEW OF DOBI AND THE USE OF DISCRIMINANT FUNCTIONS ANALYSIS FOR QUALITY OF CRUDE PALM OIL

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INTRODUCTION

Many parameters have been used to indicate oil quality. These are free fatty acids (FFA), moisture, impurities, peroxide value, anisidine value, UV-visible measurements of dienes and trienes, etc. Crude palm oil trade is based on FFA, moisture and impurities. However, these parameters alone do not give an adequate indication of its quality with respect to its oxidative status and its bleachability (*i.e* ability to be refined to less than 3R on a 5 1/4 inch Lovibond cell). In some instances, oils with low FFA values have high oxidative characteristics.

It is therefore essential that new parameter(s) must be found in order that the palm oil quality can be better defined. In our investigation, we have found that the measurement of DOBI gives a good indication of quality of crude palm oil.

Definition of DOBI
Deterioration of Bleachability Index. It indicates the oxidative status of crude palm oil and relates to the refinability of the oil.

Definition of DF
The use of discriminant functions to distinguish quality of crude palm oil based on oxidative characteristics.

Measurement of DOBI
DOBI is measured by using UV-visible spectrophotometer and is the ratio of the absorbances at the wavelength at 446 to 269 nm.

$$DOBI = \frac{Abs\ 446}{Abs\ 269}\ \text{in a 10mm quartz cell}$$

The measurement is carried out on a 1 % concentration solution of palm oil in isooctane.

Measurement of DF
DF is a set of three equations used to define the quality and categories of palm oils:-

$$Y_1 = 47.67X_1 + 0.18X_2 + 17.74X_3 - 0.17X_4 - 86.69$$

$$Y_2 = 30.89X_1 + 0.11X_2 + 3.23X_3 - 0.10X_4 - 29.96$$

$$Y_3 = 47.76X_1 + 0.18X_2 + 1.74X_3 - 0.30X_4 - 59.40$$

Where Y_1 = crude palm oil category

Y_2 = sludge palm oil as exported

Y_3 = sludge palm oil from mills/dealers

$X_1 = E_{c269}$

X_2 = Carotene

X_3 = DOBI

X_4 = PV (meq/kg)

The equation $Y_1 - Y_3 = Y$ relates to quality of crude palm oil and is given as

$$Y = 0.3X_1 + 16X_3 + 0.13X_4 - 27.29$$

An arbitrary scale for the quality of crude palm oil had been set based on the relationship between Y and refinability of palm oil. This is shown in *Table 1*.

TABLE 1. REFINABILITY OF CRUDE PALM OIL ACCORDING TO DOBI VALUES

Y	DOBI	Grade
<0	<1.7	poor
1-10	1.8-2.3	fair
11-20	2.4-2.9	good
21-25	3.0-3.2	very good
>25	>3.3	excellent

ACCURACY OF DETERMINATIONS

The DOBI test being a very simple procedure and can give the lowest variation between laboratories is thus a suitable parameter for assessing crude palm oil quality. Some results are given in *Table 2*.

TABLE 2. ACCURACY OF DETERMINATIONS

Tests	Mean	Standard Deviation	Coefficient of Variation
E_{C269}	0.186	0.004	2.6
Carotene	652.6	7.06	1.1
DOBI	3.46	0.026	0.8
PV	0.78	0.094	12.0
Y	28.39	0.429	1.5

Correlation between DOBI and Y
The linear correlation of $r^2 = 0.972$ indicates that Y is very highly dependent on the DOBI factor (*Figure 1*).
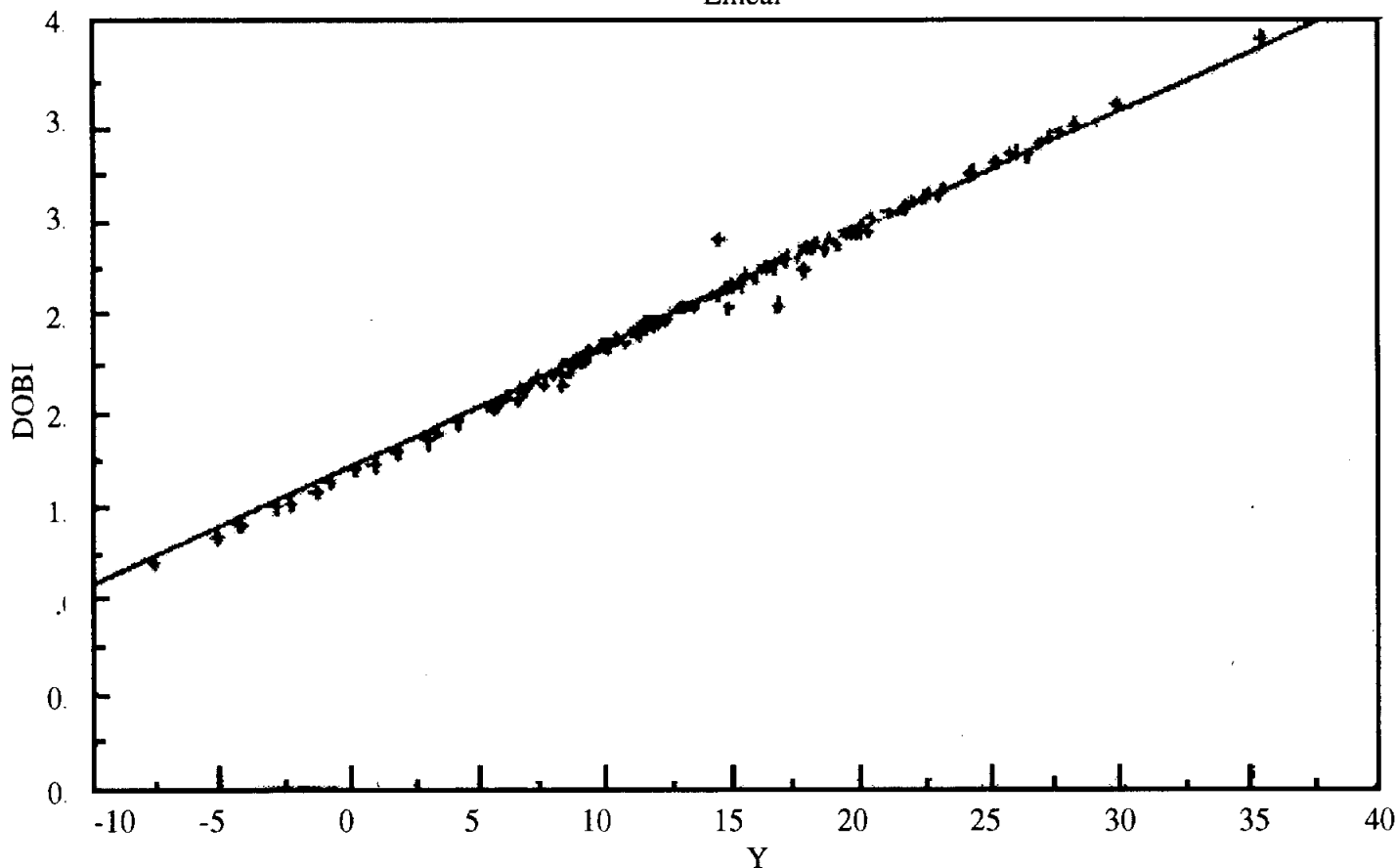
Linear

Figure 1. Correlation between Y and DOBI

QUALITY OF CRUDE PALM OIL

The mean DOBI value of CPO from 812 samples surveyed in 1987 was found to be 2.67 with a range from 1.12 to 3.90 and standard deviation of 0.391. The latest survey carried out jointly by PORLA and PORIM in September 1991 to February 1992 indicated similar trends (Table 3). East Malaysia produces crude palm oil with higher DOBI values. The DOBI value is highest for oil from production lines in the mill and some deterioration occurs during storage as indicated from DOBI of oils in storage and despatch tanks.

TABLE 3. DOBI VALUES OF CRUDE PALM OIL FROM DIFFERENT SOURCES

	Production Line	Storage Tank	Despatch Tank	Refinery
Mean*	2.73	2.68	2.59	2.52
Max	4.05	4.03	4.05	4.82
Min	1.37	1.12	1.63	1.38
s.d.	0.340	0.327	0.395	0.248
CV (%)	12.4	12.2	15.2	9.8

* For oils $\leq 5\%$ FFA.
Source: PORLA/PORIM Survey, Sept. 1991 - Feb 1992

FACTORS AFFECTING DOBI

- **Quality of Fresh Fruit Bunches (FFB)**

DOBI is significantly affected by freshness of FFB (Table 4) where storage of oil palm bunches over four days shows significant reduction in the DOBI values. Bruising of fruits also affects the DOBI values.

Under-ripe and over-ripe fruits affect the DOBI values as well (Table 5) and this is indicated in the Y values and the rancimat stability. The highest stability is obtained from oils of optimal ripeness and freshly harvested fruits.

TABLE 5. QUALITY OF OIL FROM OIL PALM FRUITS

	Y	Rancimat
Fresh, under-ripe	16.1	18.4
Ripe	51.5	26.2
Under-ripe, stored, not bruised	21.2	19.2
Under-ripe, stored,* bruised	6.2	9.1

* 4 days

- **Storage of crude palm oil**

Figure 2 shows the effect of storage of crude palm oil over a period of 21 months in 225 litre drums.

CONCLUSIONS

DOBI is a simple parameter indicating the oxidative status of crude palm oil, its shelf life and its refinability. It is affected by quality of oil palm fruits, ripeness of fruits, post harvest storage period of fruits, and storage of palm oil. It is clear that stringent quality control and management of fruits and oil processing result in high quality crude palm oil.
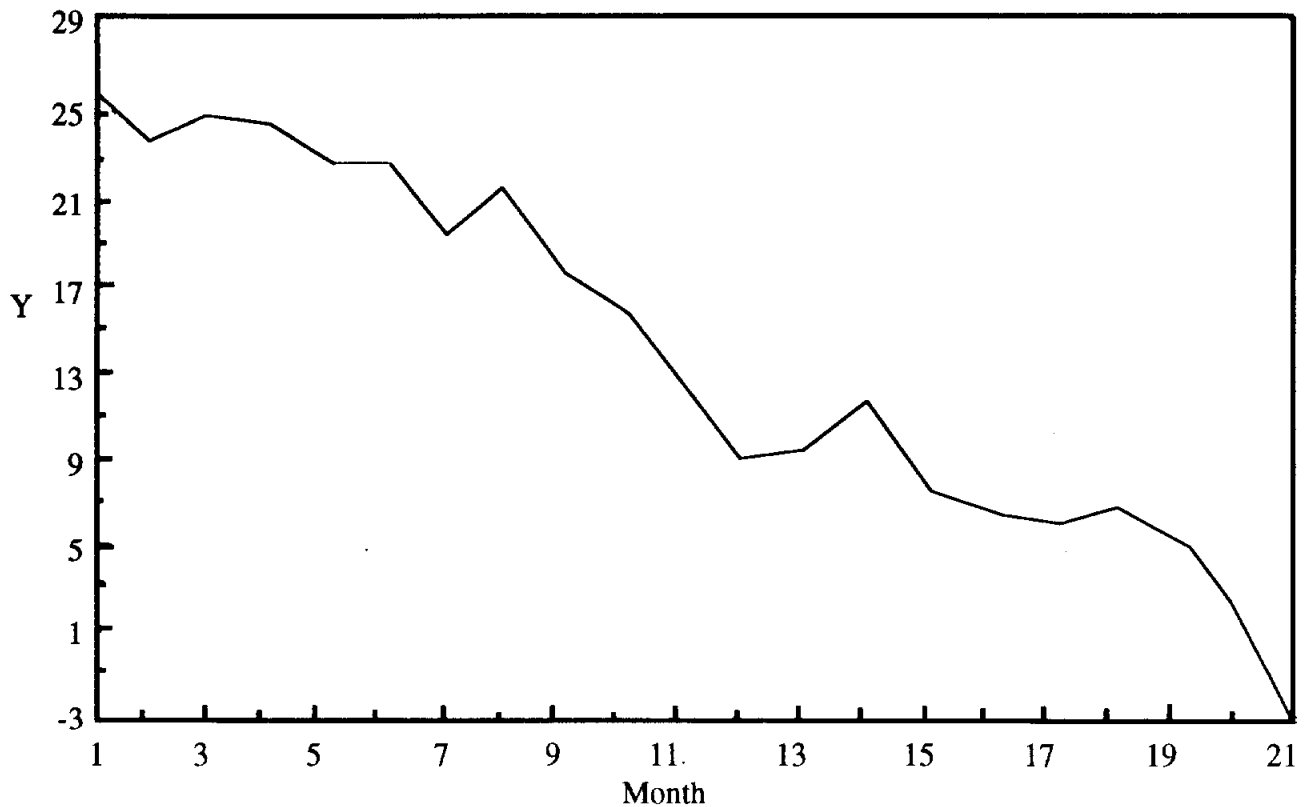
TABLE 4. EFFECT OF FRUIT CONDITION ON THE KEEPABILITY OF OIL PALM FRUITS

Fruit Condition	PV meq/kg	FFA(%)	E_{233}	E_{269}	Carotene (ppm)	DOBI	Bleachability (5.25 inch cell)	
							(R	Y)
FF	0.3	0.31	0.99	0.09	962	4.6	1.1	20
SO(NB)	0.3	0.46	0.96	0.10	810	4.4	1.0	13
SO(B)	0.8	8.13	1.14	0.18	867	3.9	2.2	31
SS(NB)	0.3	0.24	1.00	0.12	862	4.3	0.9	10
SS(B)	0.7	4.56	1.05	0.14	845	4.2	1.5	18

Abbreviations

FF : Fresh fruits, processed immediately after harvest.
SO(B) : Damaged fruits kept in field for 4 days.
SS(B) : Damaged fruits kept in shade for 4 days.

SO(NB) : Undamaged fruits kept in field for 4 days.
SS(NB) : Undamaged fruits kept in shade for 4 days.

Figure 2. Quality of CPO upon storage

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