Quality Management in the Malaysian Palm Oil Mills

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INTRODUCTION

In the early days the main factor governing the quality of palm oil was the free fatty acid (FFA) content, normally expressed as palmitic, although occasionally checks were made of the percentages of dirt and water. The FFA was in the regions of 2% to 7% and the palm oil was used mainly for the manufacture of soap, as well as for the manufacture of tin plate.

The Malayan Department of Agriculture (Arnolt 1963) carried out some 1500 analyses of the palm oil produced during the period between 1949 and 1962 and the results of these analyses are shown by the histogram - *Figure 1*. The oils were categorized as follows:

FACTOR	FFA %	MOISTURE %	DIRT %
Very low	less than 2.0	less than 0.10	less than 0.005
Low	2.0 to 2.7	0.10 to 0.19	0.005 to 0.010
Medium	2.8 to 3.7	0.20 to 0.39	0.011 to 0.025
High	3.8 to 5.0	0.40 to 0.60	0.026 to 0.050
Very high	5.0 and above	greater than 0.60	greater than 0.050

It was reported that most of the high and very high categories were obtained during 1949 to 1954 and after 1954 almost all samples were in the medium to low categories.

Some of the larger Malaysian producers have for many years been producing "special" oils of low FFA contents, sometimes as low as 1.5%, but this demands good harvesting and transportation systems.

Today nearly all the Malaysian palm oil mills carry-out the following basic quality tests:

FFA %
Water %
Dirt %
Peroxide Value

Whilst some of the larger companies also include more sophisticated tests such as:

a) DOBI (Deterioration of Bleachability Index)

$$= \frac{\text{Absorbance at 446 nm}}{\text{Absorbance at 269 nm}}$$

b) TOTOX = 2 Peroxide Value + Anisidine Value

c) Discriminant Function = $0.3X_1 + 16X_3 + 0.13X_4 - 27.29$

where X_1 = UV absorption at 269nm
X_3 = DOBI
X_4 = Peroxide Value

d) Trace Metals - copper and iron

Today the Malaysian crude palm oil very rarely exceeds 3.5% FFA with water at 0.15% max, dirt 0.01% max and P.V. between 2 and 6.5 (m.equiv/kg).

MILLING CERTIFICATE OF COMPETENCY

With a view of ensuring the Malaysian Palm Oil Millers would be given every help in striving for the production of the highest quality oil and kernel, PORIM inaugurated early in 1984, a voluntary scheme for the awarding of "Certificate of Competency" for the Malaysian palm oil mills.

The main objective of the scheme was to certify that the mill was capable of producing crude palm oil and palm kernel, of the highest quality and that all the mill operations were carried-out efficiently. The following elements were included in the assessment:

1. *General* - Mill facilities and layout, hygienic

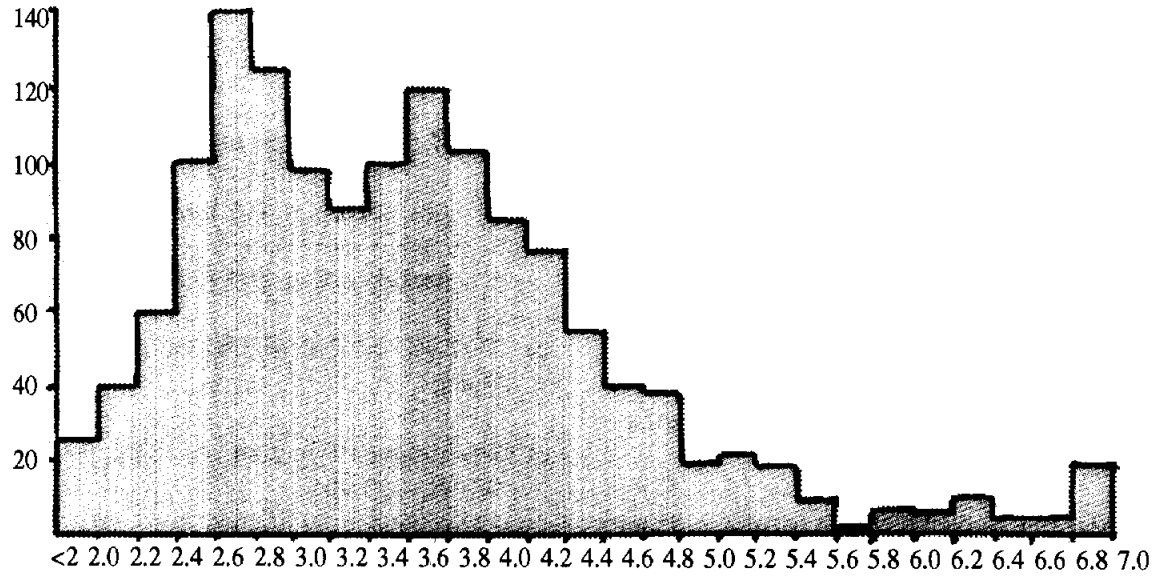

Figure 1. Percentage Free Fatty Acids in Palm Oil

conditions of the mill. Operators efficiency - punctuality in completing log sheets, reports and knowledge of process.

2. *Milling operations* - Systematic and relevant logging of operations; maintaining proper processing conditions in both the oil line and kernel lines; adequate instrumentation and proper services.

3. *Quality control* - Laboratory facilities and levels of staff, type of test carried out. Utilization of the laboratory information for process and quality control.

4. *Storage conditions* - Storage and handling systems for crude palm oil and palm kernel.

5. *Treatment and utilization of wastes* - Disposal method for empty bunch, type of treatment for effluent, disposal of surplus fibre and shell and how they compare with the minimum legal requirements.

6. *Maintenance* - State of maintenance of the mill, maintenance schedules and facilities - planned maintenance.

As at September, 1993, 175 mills have been awarded certificates which is about 65 percent of all the Malaysian palm mills.

IMPLEMENTATION OF ISO 9002

Following the introduction of the ISO 9000 Quality Assurance Systems in Malaysia, many of the larger plantation companies decided to transform their traditional, quality control systems to conform with the stringent requirements of ISO 9002 Quality Assurance System.

The ISO 9002 Quality System is the model for quality assurance in production and specifies the requirements to demonstrate a supplier's capability to control the processes that determine the acceptability of his products. The requirements specified are aimed at detecting and preventing any non-conformity during production and implementing means to prevent its recurrence. The requirements of ISO 9002 are briefly explained by *Table 1.*

DETAILS OF THE MILLING OPERATIONS CARRIED OUT TO ENSURE THE PRODUCTION OF QUALITY PRODUCTS

Fruit Reception

On delivery to the mill the bunches are subjected to ripeness tests and any rotten bunches and foreign matter discarded. The operations of discharging the vehicles carrying the FFB and the loading of the FFB into the sterilizer cages is carefully carried out to keep to a minimum the damage or bruising of the fruitlets.

Sterilization

Every effort is made to ensure that the FFB "first-in" are the "first-sterilized" and the sterilizing cycle is adjusted according to the ripeness

TABLE 1. ISO 9002 REQUIREMENTS

Requirements	Brief Description of Requirements
1. Management responsibility	Defining and documenting policy and objectives.
2. Quality system	Establishing and maintaining a documented quality system.
3. Contract review	Establishing and maintaining procedures for coordinating contract activities
4. Document control	Establishing and maintaining procedures to control all documents and data relating to the requirements of ISO.
5. Purchasing	To ensure that all purchased products conform to the specifications called for.
6. Purchasing supplied	Establishing and maintaining product procedures for identifying products during all stages of production.
7. Product identification and traceability	Establishing and maintaining procedures for identifying products during all stages of production.
8. Process control	Identification and planning production processes which directly affect quality.
9. Inspection and testing	Inspection of raw material input to ensure it is not used or processed until it has been checked.
10. Inspection, measuring and test equipment	Controlling, calibrating and maintaining inspection and measuring equipment used to check the conformance of products.
11. Inspection and test status	Identifying inspection and test status by authorized marking and the keeping of inspection records.
12. Control of nonconforming	Establishing and maintaining procedures to ensure that all non-conforming products are prevented from despatch.
13. Corrective action	Establishing, documenting and maintaining procedures for investigating causes of non-conformance and corrective action to prevent recurrence.
14. Handling, storage, packaging and delivery	Estabilishing and documenting procedures for handling, storage and delivery of products.
15. Quality records	Establishing and maintaining procedures for identification, indexing and storage of quality records.
16. Internal quality	To perform in-house quality audits to verify that quality activities comply with the planned system.
17. Training	Establishing and maintaining procedures for indentifying training needs and providing such needs.
18. Statistical	Establishing procedures for techniques identifying and verifying the acceptability of product characteristics.

standard of the FFB. This is to avoid unnecessary exposure of the FFB to high temperatures. The sterilization is normally carried out using saturated steam at 40 psig (140°C).

Digestion

The temperature of the digested mash is carefully controlled at 95°C, again to avoid over-heating. The heat is applied by "steam injection" to avoid any localized over-heating which may occur if steam jackets were used.

Clarification of Oil Ex-press

The temperature of the oil at all stages of this section are carefully controlled and every effort is made to keep the contact of the oil with air to a minimum. The oil to storage is controlled at a moisture content between 0.10% to 0.15% and impurities at less than 0.02%.

Oil Storage

Before the oil is pumped to the storage tanks it passes through a magnetic trap to remove any particulate iron. Then to a cooler to reduce its temperature to 45°C - this helps to reduce primary oxidation.

During storage the oil temperature is controlled between 35°C to 40°C and before shipment is heated-up slowly at a maximum rate of 5°C per 24 hours until the unloading temperature of 50°C to 55°C is reached. All storage tanks are subjected to a rigorous cleaning programme.

Kernel Drying

The drying of kernels is carefully controlled with air temperatures not exceeding 75°C to avoid oil exudation from over heated kernels. The quality specification for kernels "as shipped" is 7.0%

moisture maximum and 4.0% impurities maximum.

Instrumentation

Indicating and recording instruments, for temperature and pressure, are installed at all stages of the production of oil and kernels to provide accurate information for process control.

Plant Design Factors

Iron and copper are pro-oxidants and when present in palm oil decrease its oxidative stability. Copper, and copper alloys, are completely banned for the use of any equipment in the mill coming into contact with palm oil. Also iron pick-up is limited by using stainless steel for oil piping, and tanks etc. Normally oil to storage rarely exceeds 0.5 ppm of copper and 2 to 5 ppm of iron. The use of mercury-in-glass thermometers are also banned.

CONCLUSION

The practice of quality control in the Malaysian palm oil mill sector is now being geared to meet the demands of the 21st century. Quality is no more the function of the laboratory alone but the responsibility of every mill employee from the top management to the workers on the mill floor.

It can be seen that the quality control operations in the Malaysian palm oil mills have made significant progress since the early 1900's.

REFERENCES

ARNOLT, C W (1963). The Malayan Oil Palm and the Analysis of its Products.

Quality Assurance System in a Palm Oil Refinery –Jomalina Experience

*Lim Jew Yeok, Chia Chok Sia, Ahmad Jaril Asis and Sally Chan**

ISO 9002 Quality Assurance (QA) system is a well structured quality management system which documents and implements the objectives of a company's quality policies.

The QA system will help prevent quality deficiencies and enhance continuous improvements. This will not only meet the organization's interests, but also customers' needs and expectations. The implementation of the QA system in Jomalina has helped improve quality, reduce reworks and instil quality awareness and culture among all employees.

IMPLEMENTING ISO 9002

Golden Hope Plantations Berhad and its subsidiaries have always encouraged quality consciousness in all departments. With the advent of the internationally recognized QA system under ISO 9002, and its well structured quality management systems, Golden Hope wasted no time in adopting the principle in total.

In the palm oil refining industry, consistencies in quality prove to be the chief selling point in a highly competitive palm oil market. Golden Hope is one of the first plantation group of companies to recognize this need to adopt and implement the ISO 9002 standard.

In 1990, Golden Hope commenced implementation of the ISO 9002 QA system in stages, starting with a selection of palm oil mills and factories within the Group. The second stage of implementation took into consideration the subsidiaries of Golden Hope, which included the palm

* *Golden Hope Plantations Berhad*