

Premium Oil Segregation using Near-Infrared (NIR) Online System

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The importance of monitoring crude palm oil (CPO) quality cannot be overemphasised when we consider the fact that good-quality refined oils must be produced from high quality CPO. Commonly the quality of crude palm oil is determined by several parameters such as the deterioration of bleach ability index (DOBI), iodine value (IV), moisture content, free fatty acid (FFA) and carotene content. The FFA content in crude palm oil is the most important because it affects the market price. Arising from the high demand in the palm oil industry market nowadays, the trend to produce crude palm oil with low (<1.5%) FFA has increased among the millers as it commands a premium price being recognised as a high quality food grade product. Great effort has been put up to improve the quality of palm oil including the determination and reduction of free fatty acids in palm oil.

Crude palm oil normally contains FFA, which has to be removed as part of the refining process. The FFA levels can vary from the time of harvesting to the milling processing and storage. Lipase activities cause increment in FFA levels in crude palm oil. FFA is formed when the bound fatty acid in triglyceride molecules are split either by chemical or enzymatic hydrolysis. The Palm Oil Refiners Association of Malaysia standard specifications for the FFA content (as palmitic acid) is 5% maximum in CPO and 0.1% maximum in refined-bleached-deodorised (RBD) oils, respectively. Currently, the premium oil at the mill is manually segregated every 30 minutes after analysing for the FFA content and switching the flow of CPO into the clarifier tank. The common practice to determine the FFA content in crude palm oil is the wet chemical method. To meet this demand, it will be of great advantage to

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use the near infrared (NIR) system, which is more efficient, much faster and solvent free compared to the titration method. With the NIR system, the FFA of the CPO can be analysed instantaneously where the result is conveyed as an electrical signal to operate a two-way valve that switches the CPO flow into separate tanks. As a result, mills can segregate automatically the low and from high FFA CPO. The objective of the paper is to introduce an automatic segregation system for producing low FFA premium oil.

NIR CALIBRATION

Near infrared (NIR) spectroscopy is a fast analytical technique using non-destructive wavelengths of 800 nm to 2500 nm and no sample preparation is required. The system is calibrated using similar product samples. The values obtained using standard laboratory method and the calibration are tested for goodness of fit based on R^2 , standard error coefficient (SEC) and standard error of prediction (SEP) *Figure 1*. Calibration models are downloaded into the analyser for sample analyses. The NIR-Online system is used to monitor free fatty acid content during the palm oil milling process.

PROCESS DESCRIPTION OF NIR ONLINE SYSTEM

- The NIR sensor detects the FFA content in crude palm oil and send a signal to the Programmable Logic Control (PLC) (*Figure 3*).
- The signal is amplified and interfaced to give an indication on the computer monitor; and also operate the control valves located on the pipeline to the clarifier tank.
- The clarifier valve (*Figure 2*) opening is dependent on the signal given by the controller. The threshold value is set to a maximum of 1.5% FFA for premium oil (clarifier A) and above 1.51% FFA for standard quality oil (clarifier B).
- The system is linked to a computer for continuous monitoring of FFA.

By increasing the quality of the crude palm oil, the Malaysian palm oil industry is able to compete in the world oil market and bid better prices.

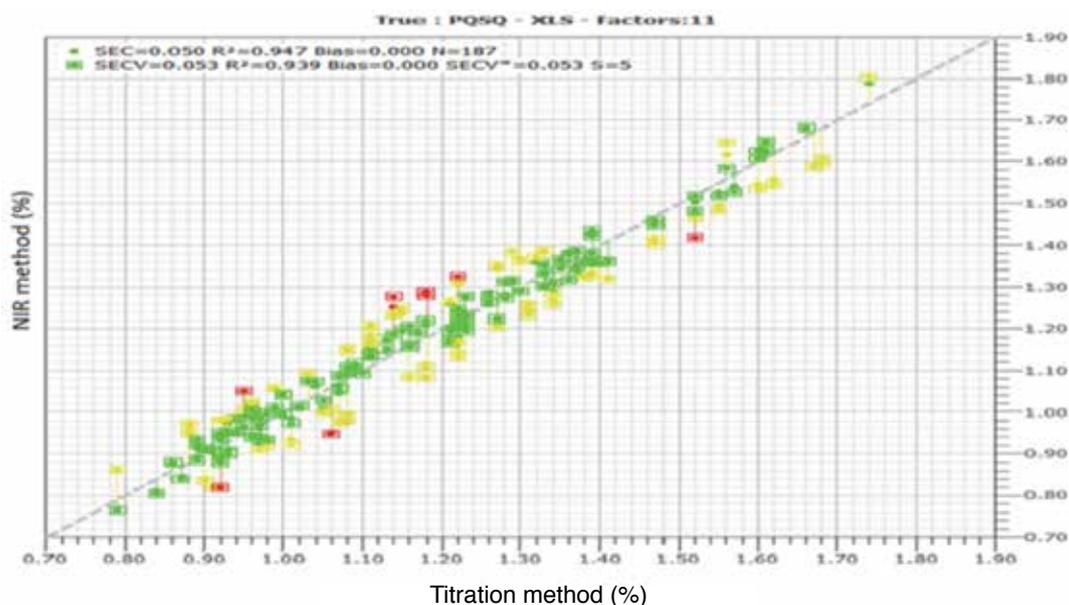


Figure 1. NIR calibration curves for free fatty acid (FFA) content.



Figure 2. NIR Online System in the mill.

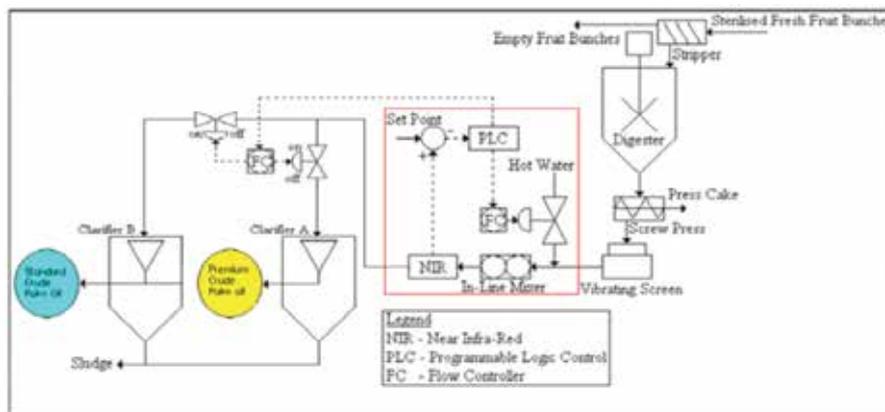


Figure 3. Schematic diagram of automatic premium oil segregation using the NIR system.

BENEFITS

The FFA content of crude palm oil is always used as an indicator of quality by palm oil refiners. Higher prices are paid for better grade crude palm oil.

Advantages of low FFA content:

- lower refining losses of oil;
- lower usage of bleaching earth;
- the low dosage of phosphori; and
- increased income.