Innovations from MPOB on Analytical Techniques

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INTRODUCTION

Palm oil is one of the export earners of Malaysia. In the palm oil trade, quality parameters are important to ensure that the quality is not compromised. Once quality is compromised, it will affect the image of Malaysian palm oil and may lead to lost of credibility of the suppliers. With the emphasis on quality, the Malaysian Palm Oil Board developed test methods to assist the industry to monitor the quality of its palm oil produced.

In developing these methods, MPOB wanted to use less solvent in line with the current demand for green technology. MPOB had developed and fabricated instruments for the industry. These instruments are the *Laser Spectrofluorimeter System, Transparency Meter, Slip Melting Point Meter* and *Automatic Colorimeter* for palm oil.

LASER SPECTROFLUORIMETER SYSTEM

This instrument determines the chlorophyll content in both crude and refined vegetable oils. The system, Laser Induced Fluorescence Spectrofluorimeter (LIFmeter), is more sensitive than the conventional spectrophotometer (*Figure 1*). The instrument is simple to operate with only a cuvette of the test sample inserted into the cuvette chamber and the measurement taken by pressing the *measure* button. The minimum detection level is 10 µg kg^{-1} of chlorophyll with ultra high linearity throughout the measurement range achieved through the use of proprietary modified dual slope measurement techniques. It is a compact, portable instrument with high throughput of less than 5 s per measurement.

Figure 1. Laser Induced Fluorescence Spectrofluorimeter (LIFmeter).

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TRANSPARENCY METER

The transparency of a product is important in the soap and cosmetics industries. Transparent soaps and gel products need to be determined for their clarity to reflect the purity of the products. Transparency is normally measured by subjective means and therefore is dependent on the vagaries of the operators' eye sight. A more objective method is necessary to ensure consistency of the results. MPOB developed this instrument aiming for objective results.

The Transparency Meter was developed by MPOB for measuring the transparency, translucency and clarity of solids, liquids and gels (*Figure 2*). Measurement is based on a new method which is superior to the subjective visual observation or direct transmission methods. The method is based on light from a laser scattering through various media. The more particles present in the medium, the more scattered is the incident light. This phenomenon is used to differentiate the degree of transparency, translucency or clarity of materials.

The instrument gives a rapid and accurate quantitative measurement of transparency independent of the colour of the material and operator's eye sight. The system uses laser-based technology with computerised data acquisition and report generation. The method is applicable for food and non-food products such as bar/liquid soap, liquid oil, shampoo, hair gels/ tonics and beverages.

Figure 2. Transparency Meter.

SLIP MELTING POINT METER

One of the important parameters widely used in the trade is the slip melting point. It is normally determined by visual observation of a thermometer placed along the sample immersed in a water bath. The system works using optical liquid level detection to determine the temperature at which the oil slips (*Figure 3*). Capillary tubes containing columns of frozen and tempered palm oil are inserted in the detection disk immersed in a water bath/beaker. The water bath is then heated at a certain rate and starting temperature. As the oil columns melt and slip, they will pass through the detection point and induce a change in the light signal. This signal will be sent to a micro controller-based circuit and the slip melting point temperature displayed on the computer screen. At the detection point, a pair of light emitting diodes (LED) and photodiode is placed in front of another set

Figure 3. Slip Melting Point Meter.

and a capillary tube containing an oil column placed in between. When the oil passes through the detection point after the slip melting point is reached, it will induce a change in the light signal received by the photodetector.

The software is designed to provide an interface between the operator and system. The operator can control several parameters, namely, the heating rate of the water bath and the temperature around which the slip melting point is expected to occur. The heating rate can be set from 0°C to 5°C per minute. The parameters displayed by the computer are the slip melting point of the palm oil, the real time temperature of the water bath and the heating rate of water bath. The software also allows the operator to store the slip melting point in a data file with the operator only required to key in the sample name.

AUTOMATIC COLORIMETER FOR PALM OIL

Colour is an important indication of a product composition, purity and degree of deterioration. It is a quick check on degradation and the suitability and stability of the product for a particular use. In the case of vegetable oils, it is necessary to monitor each stage of the refining process to determine whether the correct colour has been obtained, as each type of oil will have its own sell-by or commercial colour specification. Hence, colour measurement is used for quality checks, production control and inspection of the final product for conformance to pre-determined colour tolerances and compliance with customer specifications.

The colorimeter is specially designed for colour analysis of palm oil according to the Lovibond scale (*Figure 4*). It replaces the conventional visual grading with an instrument that is user-friendly, speedy and consistent. The instrument operates by passing the light from three LEDs (red, green and blue) through a 2.54 cm (1 inch) glass cell containing the oil sample. The transmitted light is detected by a photodiode and the intensity correlated to the Lovibond colour scale of red and yellow units. The measurement of colour involves three short steps of inserting the glass cell with the sample into the sample chamber, pressing a button to initiate the measurement and taking the results in Lovibond Red and Yellow units displayed on the LCD.

It is a more efficient instrument for routine colour measurement and paves the way for online monitoring of colour to check the progress in refining and processing. The instrument also offers a ready and relatively inexpensive solution to the problem of colour matching based on approximations or intelligent guesswork.

Figure 4. Automatic colorimeter for palm oil.

CONCLUSION

All these instruments have been well tested to ensure good precision and accuracy as well as stability in rough environments. They were presented at the Transfer of Technology Seminars in 1999 and 2002. These instruments are available to the industry and can be purchased from MPOB.