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This measurement has far reaching consequences if applied in the right places. With the advent of near infra red (NIR) analyser a whole world of opportunities are available to the industry which was not possible before. The NIR analyser has the capability to analyse about 100 analyses per minute and with the possibility of inter-phasing with computer the applications are limitless. MPOB has already successfully tested the analyser for accurate measurement of oil in crude and incorporated it in an automatic dilution control system with feedback loop to operate a pneumatically operated water injection valve. The capability of rapid analysis of the NIR analyser make it ideal for use in control systems with feedback control loop and servomechanisms.

As an example, if the production oil has varying values of free fatty acid (FFA) against a time-frame, it is difficult to segregate manually the low FFA crude palm oil (CPO) from the high FFA oil as the oil flows through the production oil line to a storage tank. As the analyser conducts the analysis so rapidly when it detects low FFA CPO, it triggers a special two-way valve to channel the CPO to another tank and back again to the original tank when the FFA readings become high again. Figure 1 shows the concept of flow channeling to three destinations.

OIL EXTRACTION RATE (OER)

Measurement in Real Time

This can be considered the best offer MPOB can give to the smallholders who are about 18 000 in Malaysia and most of them are settlers in well organised government schemes. The current practice of allocating the same OER to all settlers irrespective of the quality of crop they bring to the mill in terms of its oil content has been frowned upon by many sympathisers. The system fails to give incentives to the smallholders whose motivation to improve productivity is practically non-existent.

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These factors encouraged MPOB to develop a system for on-line measurement of OER in real time so that the settlers get what they deserve. The heart of the system is the NIR analyser and its amazing prowess. In this exercise, the measurement is only one of the many components of the system. There are many other associated research to complement it.

The first component is the basic address entry into magnetic disc followed by the gross weight of transport vehicle. The driver carries the disc with him and pass it over to the hopper attendant who in turn places it in a recess at the hopper control switchboard. Later, when loading the FFB into steriliser cages this will be transferred into the designated pocket on the steriliser cage. The cage will undergo sterilisation cycle accompanied by the magnetic disc. As cages emerge out of the steriliser at the end of the cycle, a disc reader placed in front of the steriliser will capture the data on the disc simultaneously initiating and activating the timer.

The disc reader after a set time (previously arrived at by conducting a series of trials) will start writing data from the NIR analyser as at that point in time the data is related to the FFB data written in the magnetic disc at the weighbridge. As the analytic data is spread over a whole FFB pressing time and the graph representing the oil content in the press liquor comprises multiple analysis, their average value calculated by the computer should give a reasonably accurate value. A counter-check by manual analysis over a period of the trial can dispel fears of inaccurate computation and this can be done during commissioning time.

The set time must be as error free as possible because of the high dependency of the measurement on the set time. Here again a number of trials will be needed to arrive at the exact time required for the sterilised bunches to start their journey from the point in front of the steriliser where the clock started ticking. A number of readings must be made when there was no breakdown along the flow line with all presses in operation. Automatic data should be fed into the computer on the number of presses in operation, fruit to digester return conveyor electric load (proportional to mass of fruits returned). The breakdown of the conveyors or fruit elevators will affect the relationship of the oil analysed and the owner of the crop. In order to avoid such errors it is logical to trim out the two ends of the graph band as shown in Figure 2.

Figure 1. The flow channelled to three destinations.
The selected band need not necessarily be in the middle of the band. It can also commence from one end if the selected stretch had no defects arising from breakdowns of fruit recycling or similar occurrences. If the middle of the band is defective it will not be logical to use that stretch of the band for obtaining average readings.

**The Sampling Point**

This can pose some problems as the press liquor will contain a large quantity of tailings that is likely to choke the NIR meter. There are many places the sample may be selected. As free oil drains off from the digester bottom and it is relatively free from tailings, the sample here should be able to give a good representative sample. The oil content of this sample should be representative of the oil content in the crop. This can be verified before finalising and this will also fall under a different research activity and the trail may have to be conducted a number of times by counter-checking using manual analysis. If not consistent the trials will have to be repeated by getting samples directly from the crude oil ex-vibrating screen. Both these trials can be conducted concurrently and the best one selected. After getting the analysis using the manual analytical data a correction factor has to be established so that the oil in crude is converted to read as OER.

**Interfacing**

This operation needs the expertise of a system designer aided by a hands-on programmer who has ventured into similar systems. Initial teething problems can be expected but once perfected the whole system will be a much sought-after system that is original in nature. The captured information from the different sources has to be integrated with a provision to present data in different ways needed by the management at different levels and also make it available on-line to top management at Head Office. In this system, there are unlimited possibilities and features for scientific explorations hitherto unavailable to research institutions. Some of them, apart from the measurement of OER, are segregation of CPO having different FFA content so that premium oil can be stored in different tanks for sale at premium prices. Likewise segregation of CPO based on other parameters also can be pursued with ease and the development and commercialisation of each one of the selected system can be a topic for a Ph.D research activity that is inexpensive. The time is ripe now for pursuing research along this direction as the equipment for accurate measurement of the controlled parameter is available for the first time now.

Some top mill management may not like to have this system implemented in
their group fearing this may trigger labour unrest. Nevertheless, we have to take a chance and see how the ensuing problems can be addressed when it present itself. An anticipated calamity should not block or be a hindrance to scientific research because the anticipated calamity may not present itself in which case we would have lost an opportunity for developing something new to another country. This is indeed negative perception. If by mechanisation people may lose jobs and we adopt a policy of pursuing non-mechanisation policy we will not move away from stone age.

In the early 1970s, some of the management staff in the plantation industry wanted to know whether it was possible to source some kind of meter that could detect the oil content in the FFB delivered to the mill. At that point, it was not ripe for introducing such equipment as there were no analysers to do the job even to obtain an approximate value. But now there are accurate NIR spectrometers that can analyse the oil content in the crude oil as explained in this article.

The interesting aspect associated with the current industrial response is pure lack of interest by some of the plantation companies who will certainly benefit from such an analyser. If a mill receives crop from say 20 suppliers would not be a boon for the mill if an analyser computes the OER of every consignment and chart a graph to represent the data so that the mill can allocate the exact OER of the crop delivered rather than an average figure that will not do justice to the suppliers of good crop but will benefit those whose crop is of poor quality?

If a supplier X supplies crop from a small plantation which has been badly managed with no regular fertiliser application and poor harvesting systems that can hardly contribute 17% OER. Another supplier Y has managed his plantation well with regular application of fertiliser and well established field maintenance and whose OER could reach about 24% based on the fruit mesocarp development. If the mill offers a blanket OER of 19% to both of them it is obvious that Y got a bad deal and where is the incentive for X or anyone else to improve field performance. In this case, the supplier Y is a big loser because he has to fork out money for his fertiliser purchases whereas supplier X is on the gaining side.

The resistance to quantify oil and compute OER will not last long as petty prejudices by some mill management should not stand in the way of modernisation of the industry especially when justice is denied to the good crop suppliers. I sincerely hope that the Malaysian industry will move in the right direction. If it does not, other palm oil producers are ready to take it up and we may lose a great opportunity to keep abreast of others.