Feature Article

Investigations into Process Improvements

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INTRODUCTION

As we all know, improvement in process technology is not an one-off activity but a recurring one even though its frequency will not match that of the present day smart phones. However, we do not seem to have a special body wholly dedicated to the design, fabrication and conduction of field trials of new machinery. Whatever system we do have now is sadly inadequate for venturing into new territories with the result that much of talent is wasted due to lack of opportunities. This reminds me of *Thomas Gray, an Elegy Written in a Country Churchyard.*

"Full many a gem of purest ray serene the dark unfathom'd caves of ocean bear: full many a flower is born to blush unseen, and waste its sweetness on the desert air".

Now the question arises in my mind as to why we do not have a system to encourage our young engineers to be inventors. A university education is not good enough; it must be followed by creating an environment where the bottled up ideas of the young graduates can find expression. I used to ask the young engineers whether the palm oil processing techniques will remain stagnated the way it is in Malaysia if the industry was located in a western country or Japan. The answer would always be a big 'NO'.

A body, solely dedicated to promote palm oil milling innovations has to be created in Malaysia. This body must carry out some introspection and make genuine effort to continuously improve the milling technique so that the industry remains competitive. This is not a research project but modification of existing techniques but later its performance may be subjected to research-based scrutiny. It is a more sensible approach than the researchers trying to design machines.

To achieve the aforementioned objectives, it is necessary to have a moderate mechanical engineering workshop and at least two artisans and an experienced mechanical engineer in palm oil mill engineering. It will not cost much but the end results can be very rewarding. The facility can even be sponsored by the industry so that they can share the royalty.

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Currently, most of the research activities are centred around downstream products that may well be as high as 90% with hardly anything on the upstream end. This ratio has to be changed for processing techniques to improve.

Alternatively, MPOB should have its own facilities to manufacture prototype machinery designed by MPOB engineers or by anyone in the industry who comes up with a brilliant idea. The idea can be vetted and recommended by the head of the engineering division of a plantation company before submitting to MPOB and if MPOB finds it viable the fabrication work can be done at its facilities. By doing this, new concepts have an avenue for public exposure.

There are many areas where some changes would make a difference in improving processing techniques. The areas where changes will be required are as listed.

FRESH FRUIT BUNCH (FFB) UNLOADING AT THE RAMP TOGETHER WITH FRUIT QUALITY CHECK

The present system of dumping the crop on the hopper apron is a very primitive method for FFB quality check. This method promotes fruit bruising as well as crushing of fruits under the tractor wheels. In addition when FFB lorries are busy unloading, the tractor movement engaged in pushing the FFB from the hopper apron into the hopper is bound to cause unnecessary delay in FFB evacuation. This operation has to move back to the field where a much better FFB check can be carried out on every consignment without damaging the fruit. The estates have to undertake this task with mill checkers conducting counter-checks on suspected consignments at the mill by visual observation on the hopper.

FFB TRASH REMOVAL SYSTEM

The trash removal must be carried out before the consignment arrives at the mill. It is pointless to deliver crop plus trash to the mill as it will not only result in depressing the oil extraction ratio of the mill but also will encourage the FFB suppliers to add contaminants to the crop. The trash can be quite easily separated during the transportation of the crop to the mill. Most of the trash comes from the loose fruits and loading them into a side tray (fitted with a vibrating screen) of the FFB lorry will sieve out the trash if the consignment is dry. If this is not possible then the estate must have a hopper with vibrating screen to screen out trash. This problem is not new but had been in existence since the day we started processing oil palm fruits. Yet we continue to live with it. With all the sophiscated technology available today why we cannot solve a simple problem is indeed disheartening.

AUTOMATIC STERILISER DE-AERATION SYSTEM BASED ON TEMPERATURE

All the sterilisers used in palm oil mills are fitted with a pressure gauge as it is a requirement by the machinery department. But for processing the important gauge is a thermometer as its reading will tell us the efficiency of de-aeration and the actual cooking of the FFB. The sterilisers automation currently used in the mills automatically opens the inlet, exhaust de-aeration and condensate valves of the sterilisers based on time frame. As it does not have a specific target to aim for it is a blind system for operating valves.

The chips are programmed only to operate valves and nothing else. It was started like that in the 1980s and remains almost the same after three decades. Sterilisation can be grossly inadequate but in the absence of a feedback loop to change the programme to correct the situation, no automatic correction is made and the millers as well as the steriliser automation vendors appear to be comfortable with the situation. The desired automation is to cook the bunch for which the target is the tempera-

ture of the steam within the sterilisers. A low temperature indicates poor de-aeration that will lead to poor cooking. So until the target temperature is obtained the de-aeration may have to be repeated. Prolonged duration of sterilisation may not promote steam penetration into bunches and as such the aim should be efficient de-aeration.

CONSTANT THRESHER FEED SYSTEM TO REDUCE OIL LOSS IN EFB

Uneven feeding caused by manual operation of the overhead hoist is an on-going issue that had been in existence from the beginning of the oil palm industry. The recent change to tipper feed system in new mills have reduced the issue to some extent but the mills using overhead hoist continue to live with the issue that results in excessive oil absorption by the empty fruit bunches (EFB) sometimes reaching even 0.65% oil loss as a percentage to FFB. This loss is seldom highlighted in private mills as most of them do not analyse oil loss in EFB and as such this loss is mistakenly assigned a zero value! Overloading or uneven feeding of the thresher hopper could raise this oil loss. Continuous automatic feeding could reduce this loss but no mills have taken the initiative to automate this operation.

SHAFT-LESS SCREW DIGESTERS

The use of shaft-less screw conveyors is a concept not yet done by any mill. With the advent of shaft-less conveyors a new digester system can be evolved with specially designed blades attached to the scroll or the casing or both. After some trial and error, a perfect system capable of good digestion can be perfected. This digesting conveyor can replace the digester and the fruit conveyors and oil can be tapped from many points along the stretch of the conveyor. This system is very much simpler than conventional digester/conveyor system.

STORD-TYPE SCREW PRESSES

Figure 1 shows a Stord press. Stord has a wide range of presses. Some of them can go even up to 10 m or longer. These presses come in big sizes used for dewatering a multitude of products. For palm oil industry probably a custom-made unit would be the best choice to give a specified throughput like 30 t hr^{-1}, 45 t hr^{-1}, 60 t hr^{-1} *etc*. so that a single unit would suffice to give the required mill throughput. The important feature is self-adjusting inter-screw gap so that the oil loss will remain constant when the screws wear off. In the current screw presses only the front ends of the screw wear off with the rear ones almost intact making the whole design inefficient and under-utilised. The desired targets are least oil loss in mesocarp fibre, least nut breakage and least moisture content.

Figure 1. One of the small Stord presses.

DECANTERS FOR CRUDE OIL

After the pressing water is added to the crude oil at the receptacle of the crude oil known as the gutter before it is screened using a double deck vibrating screen to remove the tailings from the crude oil. In the proposed system, water addition is avoided

and the crude is processed by the decanter for separating out as much solid as possible leaving oil and heavy phase.

LONG (30 m) CHANNEL FLOW SAND SEPARATORS

The solid free liquid phase is now allowed to flow slowly along a long channel with ridges or partitions placed along the whole stretch of the channel to trap as much fine sand as possible. The length of the channel is important here as the aim is to slow down the flow rate to attain a laminar flow.

COALESCENCE PLATE SEPARATOR

After the removal of the sand, the crude oil is subjected to separation of oil and sludge using a coalescence plate separator. This operation will separate most of the oil from the sludge. The oil may be channelled to the pure oil tank and the sludge into the clarifier from which the oil in the underflow can be separated.

The system developed here is not the only possible one. A number of such systems can be drawn up and trials run to establish their efficient operation. Once we have established a facility to fabricate the system new ideas can be tried out for the benefit of the industry.