Offer for Technology Adoption of MPOB Modified Fractionation Programme for Increased Olein Yield

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INTRODUCTION

Are the fractionation plants in your organisation looking for ways to further improve your organization's profit and operational efficiency from your fractionation process? If the answer is yes, then read on. It is a well known fact that palm oil, being a semi-solid oil at ambient temperature, can be fractionated to produce palm olein and palm stearin. Palm olein is used as a cooking oil while palm stearin finds uses in a number of edible applications which require a solid fat.

Normally, refined, bleached and deodorised (RBD) palm oil is fractionated as it is easier to control the fractionation process when the oil is in the refined form. The yield of olein obtained for a single stage fractionation of RBD palm oil is usually in the range of about 78%-82% for olein of IV 56, depending on the fractionation process and crystalliser type used. For crude palm oil fractionation, to obtain crude olein of IV 56, the yield of olein obtained is in the range of 68%-78%, again depending on the type of conditions and equipment used. Here, the yield is lower than that of RBD palm oil due to the larger amounts of impurities present in crude palm oil (CPO). The impurities affect the crystallisation process by acting as seeds for the crystallisation process, thus making the fractionation process more difficult to control in crude palm oil fractionation. This is further exacerbated by the variation in the quantities of impurities that are present in different CPO consignments. These impurities will have a great effect on the morphology of the stearin crystals which will, to a certain extent, affect the separation of olein from stearin during press filtration.

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MPOB Fractionation Process for Increased Olein Yields from Crude and Refined Palm Oil Fractionation

Over the last 10 years, a number of fundamental studies were carried out in MPOB on crystallisation of palm oil products (Chong *et al*., 2007; Chen *et al*., 2004; Zaliha *et al*., 2005; Norizzah *et al*., 2012), the understanding of which can be applied to the fractionation of palm oil. From these fundamental studies, it was realised that the fractionation process could be better controlled by incorporating additional steps mid-way during the fractionation process.

Consequently, in March 2013, two process patents were filed, one for CPO and the other for RBD palm oil fractionation. These processes are termed MPOB modified fractionation programmes for CPO

and RBD palm oil fractionation, respectively.

The patented processes produce a smaller mean diameter crystals compared to the conventional cooling programme, but the crystal size is more homogeneous. This is equivalent to a forced Ostwald ripening of the crystal slurry. The consequence is easier filtration with less olein entrainment in the stearin.

Laboratory Scale Trial of MPOB Fractionation Process for Increased Olein Yield

Experiments in the laboratory showed that for RBD palm oil fractionation, an increase in olein yield of 3% was obtained when the modified RBD palm oil fractionation programme was applied. The modified CPO fractionation programme, when applied to the laboratory fractionation of CPO, gave olein yields of about 78%, *i.e.,* a very significant increase in yield when compared to the yields of crude olein obtained from the present commercial fractionation of CPO.

Refinery Plant Trial of MPOB Fractionation Process for Increased Olein Yield

In order to evaluate the effectiveness of the patented process at the plant scale, a plant trial was carried out using the modified fractionation programme for RBD palm oil fractionation for the production of olein of IV 58.5 with a cloud point of 6°C. This was compared to the normal programme used by the refinery. In the plant trial, two generations of crystallisers were used in order to evaluate whether differences in the crystalliser design will affect the modified process. The size of the crystallise used was of 40 t capacity.

From the results of *Table 1*, it can be seen that the olein yield has been increased with a corresponding decrease in the stearin yield. The IV and cloud point of the olein remained unchanged at 58.5 wijs and below 6°C, respectively while the IV of the stearin was decreased by 1-2 wijs units. This shows that the olein entrainment in the stearin has been reduced.

In summary:

1. The results showed that the modified fractionation profile patented by MPOB is effective in increasing olein yield as compared to the normal cooling profile used by the refinery.
2. The crystal size in the slurry is larger.
3. The increase in olein yield was observed to be between 4%-5% without affecting the physico-chemical properties of the olein, *i.e.,* no change to the cloud point of the olein.
4. This increase is due to the reduction in olein entrainment in the stearin.
5. Quantum of olein yield increase could be additionally improved with further optimisation of the process.

Visual observations during plant trial

The MPOB Modified Fractionation Programme for Increased Olein Yield for the fractionation of crude and refined palm oil is now available for adoption by the palm

TABLE 1. RESULT OF REFINERY FRACTIONATION PLANT TRIAL

Tank No.	Refinery cooling recipe		MPOB patented modified cooling recipe	
	Olein yield (%)	Stearin yield (%)	Olein yield (%)	Stearin yield (%)
001	69.7	30.3	73.0	27.0
004	68.0	32.0	72.2	27.8
015*	59.0	41.0	----	----
014*	----	----	65.9	34.1

Note: *First generation crystallisers (Physico-chemical properties of oleins obtained are the same in all cases as measured by the refinery laboratory. All data are determined by the refinery).

Note: Crystal size with a smaller mean.

Figure 1. Slurry using refinery recipe.

Note: Crystal size with a larger mean size.

Figure 2. Slurry using MPOB modified recipe.

oil industry both nationally and internationally.

Economic Benefits of Adoption of this MPOB Technology

A glance at the prices of RBD palm olein and palm stearin reported to MPOB showed an average price differential between olein and stearin of about RM 100-RM 150/t. Assuming the lower price differential of RM 100/t and assuming an increase of 4% in olein yield when using the new MPOB technology, this would result in an additional income of RM 4/t of RBD palm oil fractionated. This will almost ensure that the refinery will earn an additional income of at least RM 3/t of oil fractionated.

It must be borne in mind that this is pure additional income from the fractionation process as no capital investment is required for the adoption as explained in the next section.

No Risk Adoption of MPOB Modified Fractionation Programme for Increased Olein Yield

In adopting the MPOB Modified Fractionation Programme for Increased Olein Yield process technology, no investment is involved as the technology does not require new equipment for the fractionation process, except as a mean to ascertain the increase olein yield during the commissioning phase. The increase in olein yield is totally achieved through alteration of the fractionation cooling profile used by the refinery.

Pros and Cons for the Adoption of MPOB's New Modified Fractionation Technology

Some refineries are reluctant to pay royalty for adoption of the technology. This is fine as long as the refinery is happy with the status quo. However, if the refinery is to adopt the technology with no capital cost involved, then the refinery would earn additional income from the fractionation process after deducting the royalty payment to MPOB.

It must be realised that the royalty payment to MPOB does not come from the refinery budget, but from the extra money earned from the olein stearin price differential and the increase in olein yield.

Process stability will be monitored and rates reviewed periodically when requested. For more information on the process or adoption of the technology, kindly contact:

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