資 料

Current Research on Palm Oil Related to Quality in Malaysia*

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Quality of a high and consistent standard is the main objective and concern of the Malaysian palm oil industry. The quality deterioration of palm oil is mainly due to oxidation process between unsaturated fatty acids with oxygen which is enhanced by prooxidants such as trace metals and to excessive hydrolysis of the oil. These will result in poor bleachability and poor keepability of palm oil.

Comparison of normal palm oil mills constructed entirely with mild steel and a mill where stainless steel was used in pipework and selected parts of machinery, the latter mill showed significant decrease in iron content. Installation of magnetic trap at the end of milling process has been proved to be an effective means of removing particulate iron from crude palm oil. The effectiveness of such alternative milling procedures (iron content to below 2 ppm) and the effects of reduced iron levels on crude palm oil quality were established. Most of the iron contamination in crude palm oil is avoidable by suitable mill construction, and that if it does occur, most of the iron particles can be removed before dissolved in the oil.

It was noted that crude palm oil having a residual moisture content of 0.2~0.3% developed peroxides more slowly during storage than oil with lower moisture levels. Since these higher moisture content promote hydrolysis, a compromise is usually achieved by reducing to 0.15% moisture content in crude palm oil.

Total tocopherols and tocotrienols concentration in crude palm oil is in the range of 635~1000 ppm where about 80% are tocotrienols which have stronger antioxidant activities than tocopherols. Retention of such natural antioxidants is important in ensuring oil stability. In our survey, about 29~72% and 43~99% of the natural antioxidants remains in the refined palm

oil by alkali and physical refining respectively. A particular type of deodorizers involving relatively higher temperature (270°C) resulted in extensive loss of tocopherols and tocotrienols. Retention of these natural antioxidants thus depends on the processing condition such as temperature, plant design, etc.

Tertiary butylated hydroquinone, TBHQ (0.02%) was very effective and lasting antioxidant for palm oil and palm oil products in bulk storage. Together with citric acid, there was a synergistic enhancing effect. Addition of citric acid as metal complexing agent improve the bleachability and keepability of palm oil.

Our frying tests suggested that β -carotene might not be the sole cause for colour darkening of palm oil during heat treatment. The role of unsaponifiables and polar compounds in colour development is now under investigation.

There appear to be two major factors affecting the bleachability of crude palm oil. The first is a more dramatic effect caused by the accumulation of oxidation products due to deterioration of crude palm oil during storage and transport and the second is intrinsic in the composition of certain fresh crude palm oil in which their contents of trace constituents and impurities overloaded the bleaching capacity.

A new analytical procedure, DOBI (deterioration of bleachability index) was a useful indication for crude palm oil bleachability. DOBI is a measurement of content ratio of carotene (at 446 nm) and secondary oxidation products

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(at 269 nm). Malaysian commercial crude palm oil usually has DOBI values between 2 and 4. Crude palm oil with DOBI less than 2 will have difficulty in bleaching. Sludge or technical palm oils received from mill effluent have DOBI of less than 1 and are suitable for technical uses only.

There is a correlation between increasing free fatty acid content and decreasing bleachability. Maybe free fatty acids help to solubilize important trace components and impurities in crude oil. Commercial crude palm oil with high DOBI values sometimes shows differences in bleachability because of variation in other minor constituents. One can also relate bleachability with changes of phosphorus contents under conditions where oxidative deterioration is not the dominant factor.

There is definitely a strong correlation of both free fatty acids and colour development with the residual phosphorous content of the refined palm oil. Thus phosphoric acid "slip" during physical refining is considered an important criterion of quality and specification of less than 4 ppm of phosphorous has been proposed as a commercial standard. Therefore, instead of using activated earth to remove the

added phosphoric acid as in the present refinery practice alternative treatments were studied.

Hot water washing at laboratory scale was found to be very effective at removing not only all the added phosphoric acid but also in removal of the phosphorous containing and other gums initially present in the crude palm oil. Addition of calcium carbonate was not an effective means for the avoidance of phosphoric acid slip after degumming.

Our investigation on shipping of refined palm oil and palm olein demonstrated that oils with free fatty acid content at or below 0.05% were stable and developed fatty acids very slowly while those with higher fatty acids showed definite rapid increases. 0.05% of free fatty acids seems to be an empirical level and its significance is still being investigated.

Better awareness of effects of trace metals and minor components on the quality of palm oil during milling, processing and shipping is essential. In order to produce a better and more consistent refined palm oil, it is important also to understand the factors affecting bleachability and colour changes of palm oil and to improve or modify refining operations.

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