PRODUCTION OF RED PALM OIL/ PALM OLEIN BY MODIFIED CHEMICAL REFINING ROUTE

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INTRODUCTION

The oil palm is the most productive of oil-bearing plant species. Commercial plantations in Malaysia are known to yield between 3-5 tonnes of crude palm oil/hectare/year which is about 10 times the yield of oil obtained from other oilseed crops.

Crude palm oil/olein is also known to contain a significant amount (0.05-0.07%) of carotenes which is responsible for the distinctive deep red-orange colouration of the oil. At that level of carotenes concentration, crude palm oil/olein is easily one of the richest sources of natural carotenes. Ironically, under the current practices of refining the crude oil *i.e.* by the chemical or the physical refining process, all the valuable and nutritionally important carotenes are destroyed. Since the potential availability of the carotenes from our 'golden-crop' is estimated at around 5000 tonnes by the year 2000, a modified chemical refining process has been developed to retain as much as possible the valuable carotenes while at the same time maintaining other aspects of a good quality refined oil.

Red palm olein by modified chemical refining route

PRODUCTION TECHNOLOGY-PILOT PLANT TRIAL

A batch type pilot plant refining facility capable of producing 25-75 kg of either refined, bleached and deodorized, or neutralized, bleached and deodorized palm oil/olein per batch is used without any additional facility. Basically the modified process involves pre-treatment of the crude palm oil/olein and deodorization of the pre-treated oil at low temperatures. The pretreatment is carried out using phosphoric acid, followed by neutralization with sodium hydroxide and water-washing. This excercise removes undesirable impurities such as phospholipids (gums), trace metals, soaps, free-fatty acids, *etc* from the crude oil. The neutralized oil is then brought to the deodorizer where it is subjected to a rather mild heat treatment under vacuum to remove moisture, free-fatty acids, oxidized materials, odours and off-flavours while at the same time retaining much of the carotenes and vitamin-E.

PRODUCT

Except for the colour, the red palm oil/olein produced by the modified method has been found to conform to the PORAM specifications. A typical example of the physical and chemical charateristics of the product is shown in *Table 1*. As can be seen the product also has a very good resistance against oxidation as reflected by a long induction period of 44 hours. Its low polymer content of about 0.5%, low free fatty acids of < 0.1% and high smoke point of over 200°C means that it is a good frying/cooking oil.

Its low contents of Cu, Fe and P is another indication of its quality and also reflects the effectiveness of the modified method. High presence of these elements is known to have detrimental effects on storage and oxidative stabilities of the oil. Most importantly the product retained about 70% and 90% of the original levels of carotenes and vitamin-E respectively. Its golden deep-red-orange colour is especially attractive and cannot be matched by any other oils. Last but not least, sensory evaluations carried over an extended period of time showed that the product is bland in taste, free from any rancid smell and off-flavour.

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TABLE 1. SOME CHARACTERISTICS OF RED PALM OLEIN OBTAINED BY MODIFIED CHEMICAL REFINING PROCESS

Parameter	FFA %	Carotene ppm	Vitamin-E ppm	M&I %	SMP °C	IV	PV	Smoke Pt °C	Polymer %	Fe ppm	P ppm	Cu ppm	LP ppm
Crude Palm Olein	4.52	623	1066	0.17	-	-	2.2	190	-	2.4	12.0	0.03	40
Red Palm Olein	0.08	434	959	0.06	22	57	Nil	220	0.5	0.3	1.87	0.01	44

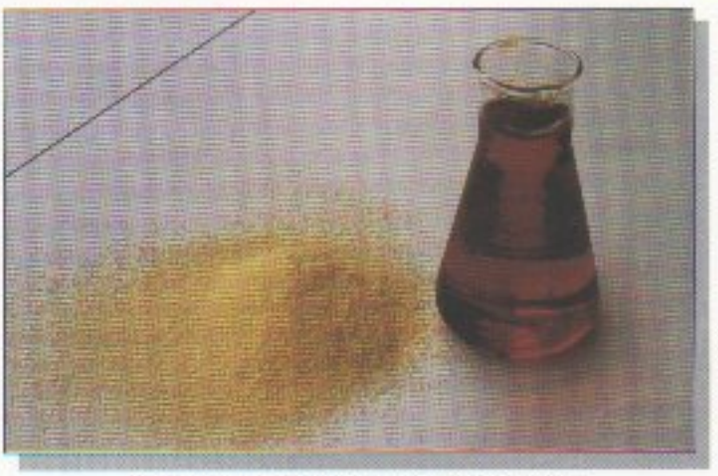
APPLICATIONS OF RED PALM OIL/OLEIN

The red palm olein is ideal to enhance the red colouration in certain dishes. This has been demonstrated in the preparation of satay sauce, curry and sambal. In household shallow/stir-frying activities where a small amount of oil is normally subjected to quick heating and almost all the oil is absorbed into the food, red palm oil/olein is definitely suitable since most of the carotenes remain intact and are absorbed by the food. This can easily be shown in the preparation of '*daging masak merah*' or chicken tandoori in which the dishes acquired an appealing red colouration.

At industrial scale, red palm oil/olein can be seen as a practical substitute to the synthetic β-carotene presently used as a colouring agent as well for as for the pro-vitamin A requirement in commercial production of light yellow margarines. Analyses by HPLC done in PORIM revealed that some 30%–35% of the natural carotenes in the red palm-olein are β-carotene. Thus by proportionately adding red palm oil/olein directly to the normal 'light-coloured' refined oil(s), margarines with the desired yellow colour and pro-vitamin A content can be produced.

A very fine, uniform, dried powdered material known as microencapsulated products in which red palm oil/olein is the core-material, has been successfully produced. These products besides having an attractive bright yellow colour, are also very stable, easily soluble and digested. Since they can act as carriers of the natural colouring agents, pro-vitamin A and vitamin-E, their potential uses are enormous; namely in food processing, pharmaceuticals, cosmetics, *etc.*

Pop corn, a favourite snack among children and adults, is normally 'popped' in either coconut, palm or hydrogenated corn oils. However, the colour of the product is dull and less appealing. To overcome the problem, some producers add synthetic colouring agent (β-carotene) so that their products appear shining yellow. This can also be achieved by popping pop-corn in either red palm oil/olein or its blends with the three



Microencapsulated product using red palm olein

oils. Most of the natural carotenes are not destroyed during the popping process but are absorbed into the snack food.

NUTRITIONAL IMPORTANCE OF CAROTENES

Red palm oil/olein is one of the richest sources of β-carotene, a precursor of vitamin A which is essential in the prevention of night blindness. A number of epidemiological studies have recently postulated its anti-cancer effects. β-carotene is also associated with the retardation of the aging process and cataract formation. In addition, α - carotene which is also found is red palm oil/olein, have lately been reported to be a more potent anti-cancer agent than β-carotene.

CONCLUSION

Carotene-rich red palm oil/olein of edible quality and long shelf- life can be produced using a modified chemical refining process. Because no bleaching earth is used, the processing cost is lower than the existing chemical refining practice. Existing chemical refining facilities can be used without any changes and with no additional installation needed.

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