Production of High Carotene Palm Olein Using Moderate Deodorization Temperatures

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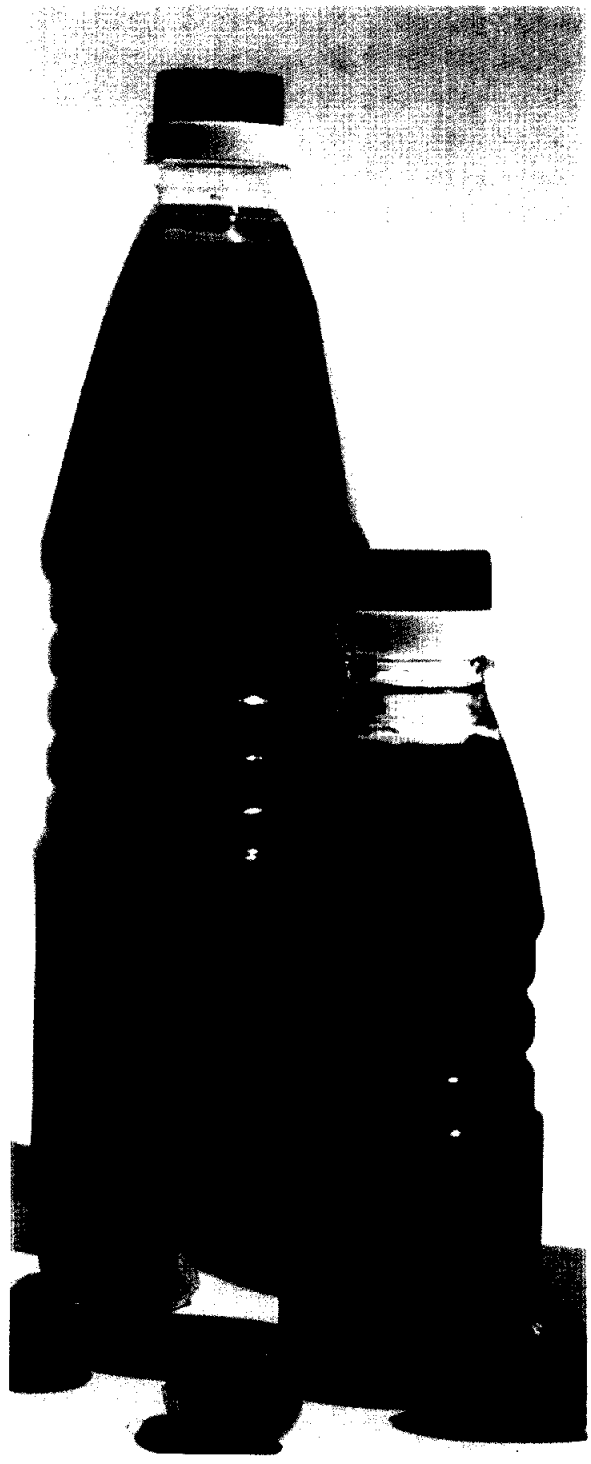

Crude palm oil is deep orange-red in colour owing to the presence of carotenes. In the production of edible oil, these carotenes are removed by the use of bleaching earth and thermal destruction at high temperatures. When the oil is light in colour, this usually signifies that the carotenes have been bleached by oxidation. The oxidized carotenes together with oxidized lipids, and the iron, copper and phosphorus generally present have detrimental effects on palm oil quality.

Malaysian crude palm oil contains about 500–700 ppm of carotenoids (Wong *et al.*, 1988; Jacobsberg, 1974), about 90% of which consists of α and β-carotenes in a ratio of about 1:1.5. Other components are ∂-carotene, lycopene and xanthophylls. Some carotenes possess provitamin A activity, with β-carotene having the highest.

There are a number of ways of extracting carotenes and other minor components in palm oil, such as saponification, transesterification, molecular distillation and ultrafiltration (Majid and Yusoff, 1993). The present paper describes a commercially viable method of preserving the carotenes in palm olein by the use of a modified chemical refining process.

PREPARATION OF RED PALM OLEIN

Crude palm olein was homogenized in the reaction vessel. Then the gums and other undesirable materials were conditioned, that is to condition these compound ready for the next stage of treatment, with 0.1% phosphoric acid, (Yusoff *et al.* 1984). The degummed oil was then neutralized with 4 N sodium hydroxide solution. The neutralized oil, which contained very little free fatty acid was subjected to deodorization by mild heat treatment under vacuum at 130°C, 150°C and 170°C.

PRODUCT EVALUATION

Table 1 shows the free fatty acid content of neutralized bleached palm olein sampled at intervals during deodorization at different temperatures. Significant changes were observed when the samples were subjected to 170°C. At this temperature, the amount of free fatty acid detected in the oil after 1.5 hours was 0.08%, which is below the permitted level in the processed oil. Larger amounts of free fatty acid, that is 0.23% and 0.21%, were observed with the samples treated for 1.5 hours at 130°C and 150°C respectively. The free fatty acid content in these samples tended to stabilize i.e. did not drop significantly, after further deodorization at 130°C or 150°C.

Table 2 shows the effect of different deodorization temperatures on the retention of carotene in the palm olein. There was a significant drop in the amount of carotenes during deodorization at 170°C. At the lower temperatures of 130°C and 150°C retention of carotenes in the olein was considerably higher. Deodorization at 130°C and 150°C for 3.5 hours still left 84.8% and 69.7% of the carotenes, respectively.

The amount of vitamin E retained in palm olein at all deodorization tempera-

TABLE 1. EFFECT OF DEODORIZATION ON FREE FATTY ACID CONTENT OF PALM OLEIN

Deodorization Temperature (°C)	130	150	170
Sampling Time (hours)	FFA Content %		
0	4.52	4.52	4.52
0.5	0.30	0.26	0.15
1.0	0.25	0.24	0.13
1.5	0.23	0.21	0.08
2.0	0.23	0.20	0.07
2.5	0.22	0.20	0.05
3.0	0.20	0.20	0.03
3.5	0.20	0.08	0.02

TABLE 2. EFFECT OF DEODORIZATION ON CAROTENE CONTENT OF PALM OLEIN

Deodorization Temperature (°C)	130	150	170
Sampling Time (hours)	Carotene		ppm
0	623.1	623.1	623.1
0.5	619.7	541.9	416.7
1.0	553.3	509.2	329.3
1.5	544.2	486.6	283.2
2.0	543.0	467.7	220.6
2.5	537.1	465.8	171.3
3.0	528.3	449.6	143.9
3.5	511.6	434.1	114.5

TABLE 3. EFFECT OF DEODORIZATION (for 3.5 hours) ON VITAMIN E CONTENT OF PALM OLEIN.

Temperature	130°C	150°C	170°C
Vitamin E (% of original content)	95	90	84

TABLE 4. SOME OTHER CHARACTERISTICS OF RED PALM OLEIN OBTAINED BY THE MODIFIED CHEMICAL REFINING PROSCESS

Parameter	M&I %	SPM °C	IV	PV	Smoke Point (°C)	Polymer %	Fe ppm	P ppm	Cu ppm	Induction Period hours
Crude Palm Olein	0.17	–	–	2.2	190	–	2.4	12	0.03	40
Red Palm Olein	0.06	22	57	Nil	220	0.5	0.3	1.87	0.01	44

Source: Palm Information Series No. 37, PORIM

tures was very high, between 84 and 95%. *Table 3* shows the vitamin E content in palm olein deodorized at various temperatures for 3.5 hours.

Other parameters were monitored in the deodorized olein. It was noted that the peroxide value was nil after deodorization at all the temperatures used. This means that at the selected temperatures primary oxidation in the final product was controlled. The pretreatment and deodorization process also play an important role in removing breakdown products in the oil. It was noted that the phosphorus content measured after 3 hours of deodorization at 130°C, 150°C and 170°C dropped significantly from 12 ppm to less than 2 ppm.

Some other physical and chemical characteristics of the red palm olein are given in *Table 4*. The product has a very strong resistance against oxidation as reflected by a long induction period of 44 hours. Its low polymer content of about 0.5% and high smoke point of over 200°C mean that it is a good cooking or frying oil.

CONCLUSION

Important minor components such as carotenes and vitamin E in palm olein can be preserved using a modified refining process. The refined palm olein contains a high level of desirable minor components but its free fatty acid and phosphorus content are low. This special food product is now ready for edible uses.

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