

PROTEIN FORTIFIED TRANS-FREE SOFT MARGARINE

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JUNE 2001

136

MPOB TT NO. 124

MPOB INFORMATION SERIES (formerly known as PORIM Information Series)

ISSN 1511-7871

Margarine is formulated to meet the desired consistency for different uses (Looney, 1975). It contains ingredients that are regulated by local food regulations or other standards. However, there are manufacturers who enrich their products with vitamins other than A and D for special functionalities (Anon, 1975). Fortifying margarine with protein is not common in margarine manufacturing despite the nutritional needs for essential amino acids which vary with the age and physiological conditions of individuals (pregnancy, lactation, etc.) (Cheffel *et al.*, 1985). Unfortunately, the deficit in protein intake is still very large in some segments of the population, especially in developing countries. In Europe and the United States, adding milk in the aqueous phase for flavouring purposes is common and at the same time enhances the protein content of the margarine. Most margarine manufacturers replace milk with water, which is cheaper and requires less stringent hygienic handling during manufacture. Since margarine is used extensively as a result of urbanization and changing lifestyles, fortification with protein in the recipe would help to increase the protein availability in the diet of those consuming the product.

RECIPE

In addition to ingredients commonly used in margarine, protein was fortified into the recipe. Non-hydrogenated oils and fats were formulated to enhance certain nutritional requirements, while at the same time fulfilling the desired melting profile. Such a formulation is able to retain the original *cis* form of the fatty acid, thus maintaining a high degree of the desired polyunsaturated fatty acids. The formulation contains linoleic acid (an essential fatty acid) at 46% (Table 1). Other ingredients are water (filtered and ultraviolet treated), protein base, vacuum dried salt, emulsifier (distilled monoglycerides, 90% monoester and lecithin), flavouring agent, beta-carotene, vitamins A, D3, E, B1 and B2, preservatives and antioxidants.

PRODUCTION OF MARGARINE

The ingredients were mixed and emulsified in a blending tank. Since protein will denature at high temperature, special attention was given during the emulsification process (Fleet, 1978). The emulsion was processed in a normal margarine plant to the desired product consistency (Haighton, 1976). The product was tempered at low temperature prior to shipment.

TABLE 1. CUMULATIVE FATTY ACID COMPOSITION (%) OF COMMERCIAL AND EXPERIMENTAL MARGARINES

Code	Saturated	Monounsaturated		Polyunsaturated		Total	
		<i>cis</i>	<i>trans</i>	Linoleic	Linolenic		
				<i>cis</i>	<i>trans</i>		
COMM	17	23.7	8.4	48.5	1.3	1.1	100
MPOB591	21.0	31.8		46.8		0.2	100

ISSN 1511-7871



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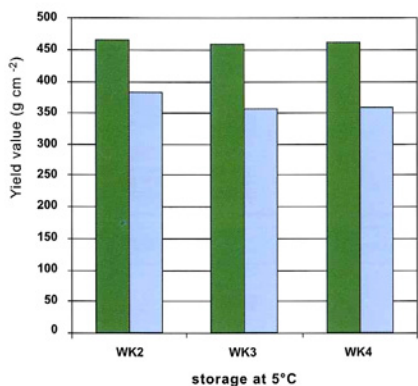


Figure 1. Consistency yield value (g cm^{-2}) of commercial and experimental sample.

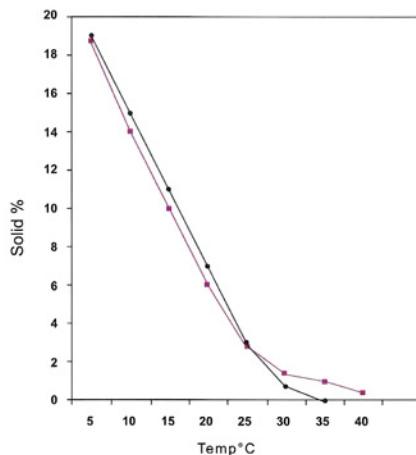


Figure 2. Solid fat content of commercial and experimental blend.

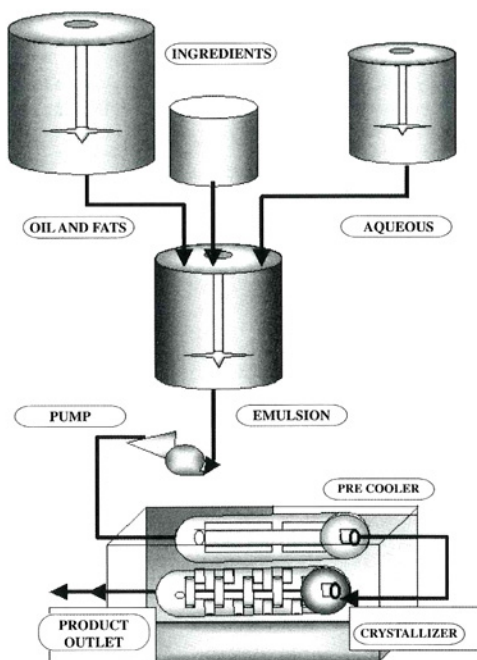
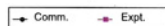


Figure 3. Process flow diagram of protein fortified trans-free margarine.

THE PRODUCT

The margarine sample 591 was soft and spreadable straight from the refrigerator (5°C). It had good stability at room temperature and was comparable to most margarines in its class. The consistency of the margarine during storage at 5°C is shown in *Figures 1 and 2*.

ECONOMIC FEASIBILITY

Trans-free soft margarine fortified with protein is only economically feasible for manufacturers who already have a commercial plant (*Figure 3*). No additional capital cost is required for such a product.

ACKNOWLEDGEMENT

The authors would like to thank the following: MPOB for the kind support and facilities and Mohd Radzuan H, Ahmad Hisham Z, Suid A, Ramlah A, Hanirah H, Maimun C H and Zukarimah K for their technical assistance.

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