PALM MID FRACTION (PMF)-BASED BAKERY FAT

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Palm mid fraction (PMF), a co-product from fractionation has been established as a major confectionery fats, usually after modification process. Second fractionation process becomes a common activity in the refineries for producing palm olein with iodine value higher than 58. This is to ensure longer clarity life of palm olein on supermarket shelf and in temperate countries. PMF contains high percentage of sn-1, 3-dipalmitoyl-2-oleoyl-glycerol (POP), triacylglycerol (TAG) type. Such a TAG has beta tending properties, leading to big crystal formations in solid fat products, such as bakery fats. Using PMF in this product is a challenge as it requires the right formulation as well as proper crystallisation process during production (Mat Sahri *et al.*, 2005; Tanaka *et al.*, 2007). Thus, the use of PMF in bakery fat products is rather limited.

MPOB has successfully produced a bakery fat formulation based on PMF. The solid fat content (SFC) profile is comparable to the reference commercial sample F379 (*Figure 1*). The desired formulation was achieved by direct blending method. This is the most cost effective way of achieving desired formulation, although it is not the simplest method especially in avoiding tailing effect (Nor Aini and Noor Lida, 2005).

MPOB BAKERY FAT FORMULATION BASED ON PMF

The formulation F446 was selected from three prototype products, produced in margarine pilot plant (Gesternberg and Agger margarine pilot plant, Denmark). The products were evaluated for their stability during storage of 30 days at 25°C and 30°C, prior of which the products were tempered at 25°C for 48 hr.

The F446 exhibited stable and consistent bakery fat product during 30 days of storage at 25°C and 30°C. The selected formulation stabilised rapidly, while usually crystal stabilisation in palm-based margarine will take about 14 days (*Figure 2*). The consistency and plasticity of the product during 30 day storage were at the desired level indicated by the smooth texture profile curve (*Figure 3*).

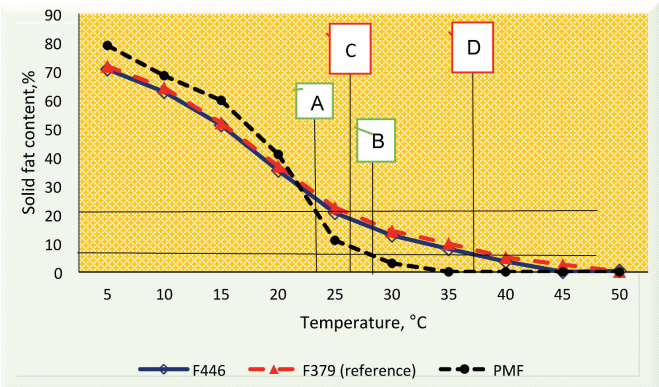

Figure 1. Solid fat content (%) as function of temperature (°C). Region A-B, indicates narrow plasticity profile of PMF. Region C – D, indicates improvement of plasticity profile in formulation F446 in comparison to the reference sample F379.

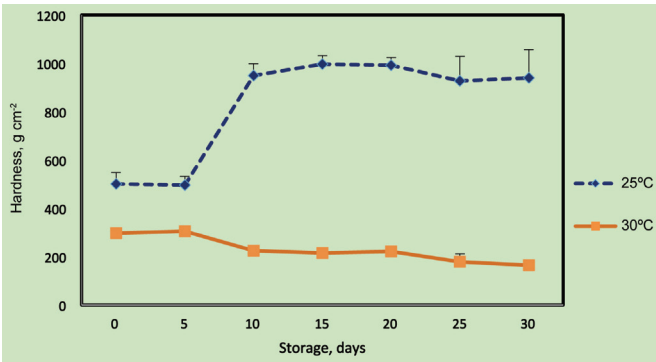

Figure 2. Hardness of bakery fat (F446) during storage at 25°C and 30°C for 30 days.

Based on *Figure 3*, the smooth line indicates product homogeneity at 30°C, as a result of the homogenous crystal size and distribution. Based on the hardening rate (Miskandar and Zaliha, 2014) and the equations, Y= 8.76X+987 for 25°C storage and Y=15.82X+248 for 30°C storage, the yield value of the product after a year would be 1442 g cm^{-2} and 1070 g cm^{-2}, respectively. It is expected that the products would still be acceptable during hot weather.

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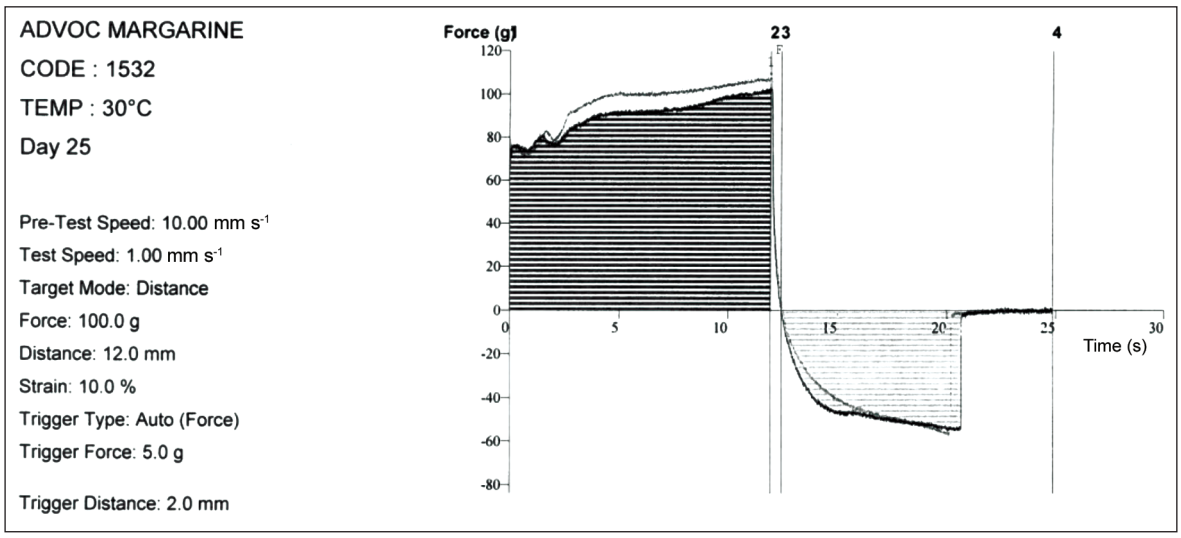

Figure 3. Texture of bakery fat during storage at 30°C for 25 days.

TECHNOLOGY OFFERRED

The technology offered is formula F446 as well as the process condition, based on pilot scale plant production, for producing PMF-based bakery fat. The product sample as well as the application of the fat using the formula is shown in *Figure 4*.

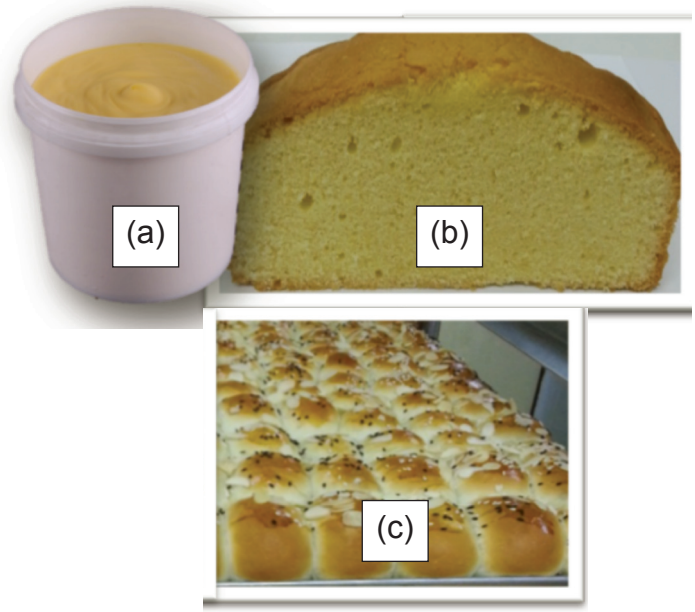

Figure 4. (a) PMF-based bakery fat sample developed using the formula F446 and (b) cake and (c) buns, baked using the PMF-bakery fat.

BENEFITS

The formulation has several benefits such as:

- stable to high storage temperature, up to 35°C;
- good plasticity, suitable for bread; and
- producing cakes with good texture and volume.

NOVELTY

The technology is a formulation of a bakery fat using PMF as one of the major ingredients using direct blending method with no hydrogenated fat.

ECONOMIC EVALUATION

Commercialisation of PMF-bakery fat formulation is viable based on 40% production capacity in the first year with gradual increase to 95% in the fourth year. The parameters as shown below were evaluated based on the price of bakery margarine at RM 3.40 per kg (The price is about 30% of the retail bakery margarine).

Parameters	Value
Payback period	year 4
Benefit:cost (B:C) ratio	1:1.06
Internal rate of return (IRR)	20%
Net present value (NPV)	RM 3 500 000
Return on investment (ROI)	50.6

POTENTIAL MARKET AND COMMERCIALISATION

Current lifestyle has changed our diet and preference for food. Fast-food restaurant industry is growing rapidly and bakery product is one of the favoured foods by the younger generation. This could reflect to the growing demand of bakery fat. Thus, margarine manufacturers could use the formulated PMF-based bakery fat formulation to cater for consumers' demands.

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