

## PALM MID FRACTION-BASED HARDSTOCK FOR COLD-SPREADABLE TABLE MARGARINES

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In the production of table margarine, it is important that the oil blend has the right solid fat content (SFC) profile,  $\beta'$  crystal stability as well as possesses manageable crystallisation rate in order to obtain a good quality table margarine with the desired physical and organoleptic properties, *e.g.*, good spreadability and firmness at refrigeration and usage temperature, glossy appearance, and good mouth feel and flavour-release (www.walterrauag; www.unimills.com). All these attributes are ascertained by the solid phase or hardstock of the oil blend. It is essential that the hardstock is able to provide blend with SFC of less than 40% at 5°C to ensure that the table margarine has good spreadability at refrigeration temperature, and SFC of less than 3% at 35°C to ensure that table margarine has a clean melt in the mouth (De Greyt and Huyghebaert, 1995; Charteris and Keogh, 1991). It is also important that fat crystals of the blend remain in  $\beta'$  form during storage in order to maintain the textural and functional qualities of the table margarine. The  $\beta'$  crystals are relatively small and can incorporate a large amount of liquid oil in their crystal network. The table margarine, therefore, confer a glossy surface. Rapid crystallisation of the blends upon processing is important to prevent the margarine from

post-hardening and crystals granulation problem upon storage.

Palm products, *e.g.*, palm oil (PO) and palm stearin or blends thereof are frequently used as hardstock for table margarine (Miskandar and Nor Aini, 2010; Miskandar and Noor Lida, 2011; Pederson, 1998). However, another important solid fraction of PO *i.e.*, soft palm mid fraction (PMF) with iodine value (IV) of 40-45 and melting point of 28°C -30°C, has limited application in table margarine formulations due to its triacylglycerol (TAG) composition. PMF is the by-product from fractionation of palm olein (IV56-58) into super palm olein (IV >62), a common practice in palm olein exporting countries *e.g.*, West Asian countries, India, China and Pakistan. It is high in disaturated-monounsaturated ( $S_2U$ ) symmetrical TAG *i.e.*, the POP (39.2%) and PLP (12.7%), where 'P' is palmitic, 'O' is oleic and 'L' is linoleic acids. The  $S_2U$  symmetrical TAG stabilise in  $\beta$ -triple chain packing and have slow crystallisation. Formulation of table margarine with fats high in such TAG may results in post-hardening and granular crystals (30-140  $\mu$ m) upon storage (Timms, 1984; Lumor *et al.*, 2008; Watanabe *et al.*, 1992). Restructuring of the fatty acid (FA) distribution in the TAG molecules



of PMF substantially reduces its symmetrical S<sub>2</sub>U TAG content, expedites its crystallisation rate and stabilises the blend in β' crystals. Thus, the PMF is more suitable to be used as the hardstock for table margarine formulation.

### THE HARDSTOCKS

The PMF-based hardstocks have the right SFC profile at 5°C and 35°C, rapid crystallisation upon processing and stabilise in mixture of β' and β crystals with β' crystals dominating at usage and storage temperatures as required for good table margarine blend formulations. The SFC and crystallisation profiles of the hardstock are shown in *Figure 1* and *Figure 2*, respectively.

### PRODUCT'S APPLICATION

The PMF-based hardstock is suitable to produce good quality table margarine. Successfully formulated blends that are able to mimic the SFC profile of commercial cold-spreadable block and tub table margarine blends are shown in *Figure 3*. Table margarine blends having a reduced saturated FA or balance saturated, monounsaturated and polyunsaturated FA could also be formulated using the PMF-based hardstocks. Post-hardening and crystals granulation, are frequent phenomena in table margarine formulated with high amounts

of PMF if not carefully processed, especially after refrigerated storage. The problem can be averted/reduced by using PMF-based hardstocks in the formulations.

### TECHNOLOGY OFFERED

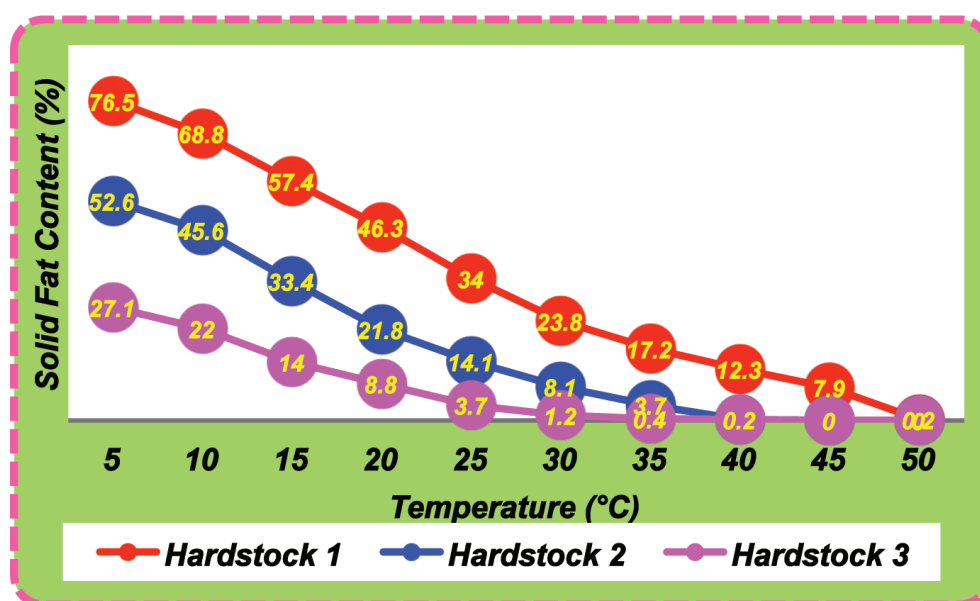
MPOB offers the formulations of PMF-based hardstocks suitable for cold-spreadable table margarine formulations.

### PRODUCT'S NOVELTY

- Free of *trans* FA.
- Rapid crystallisation.
- Stable in mixture of β' and β crystals, with β' crystals dominating.
- Provide the right SFC for good mouth feel and good spreadability at refrigeration and usage temperature.
- Do not develop post-hardening and granulation of products upon storage.

### ECONOMIC FEASIBILITY

Production of PMF-based hardstock is economically feasible to manufacturers who have abundance of PMF from fractionation of palm oil products.



*Figure 1.* SFC profile of the PMF-based hardstocks.

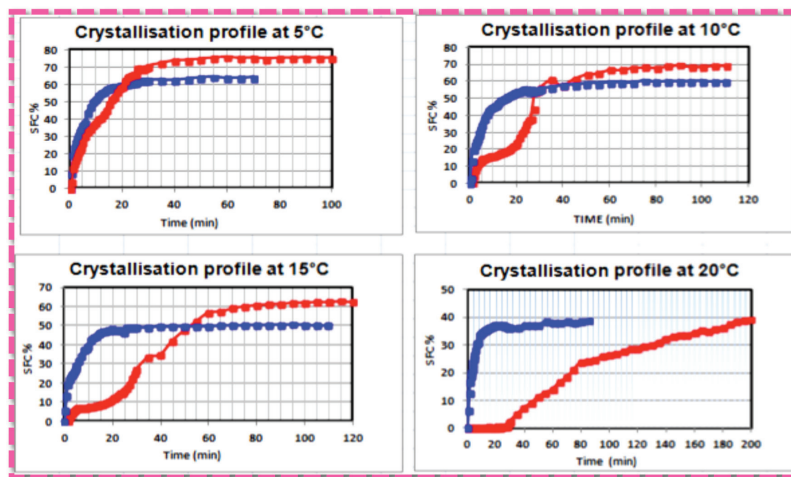


Figure 2. Crystallisation profile of PMF-based hardstock (blue) as compared to that of PMF (red).

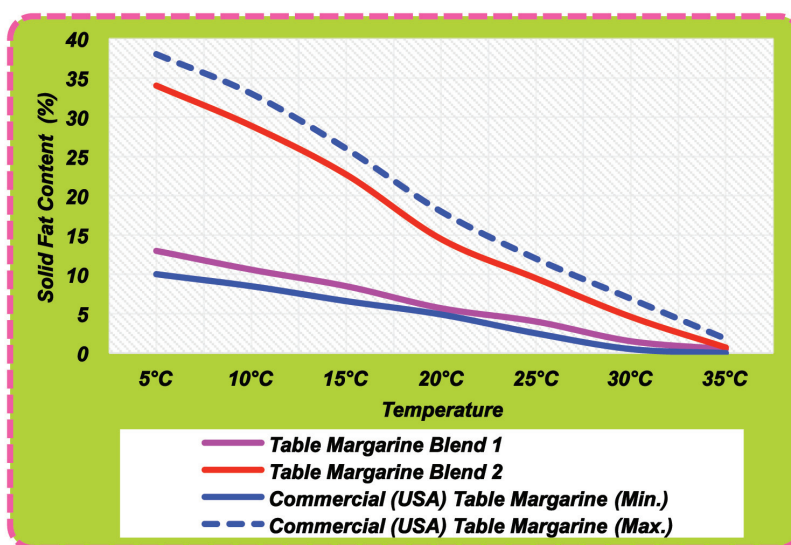


Figure 3. SFC profile of cold-spreadable table margarine blends formulated using PMF-based hardstock.

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