

UNIVERSITI TEKNOLOGI MARA

**EFFECTS OF CHEMICAL
INTERESTERIFICATION AND FRACTIONATION
ON THE PHYSICOCHEMICAL PROPERTIES AND
CRYSTALLISATION KINETICS OF PALM
STEARIN AND PALM KERNEL OLEIN BLENDS**

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ABSTRACT

Palm stearin and palm kernel olein have limited applications due to the high melting point and excessive foaming during heating, respectively. In view of their limited application, this research looks into the possibility of diversifying their usage through a combination of 3 modifying processes, namely blending, chemical interesterification and dry fractionation. The three modification methods were chosen due to their simplicity and for economical reasons.

Blends of medium-hard palm stearin-palm kernel olein and hard palm stearin-palm kernel olein were formulated by mixing each stearin with 20 to 80% palm kernel olein (w/w) in 20% increments. These binary blends were subjected to chemical interesterification using sodium methoxide as catalyst. The effects of blending and subsequent chemical interesterification on the physicochemical, thermal, microstructural and rheological properties were investigated. The kinetics of isothermal crystallisation of the blends was studied using DSC and laser light anisotropy methods by applying the Avrami and Fisher-Turnbull equations, respectively. The interesterified medium-hard palm stearin-palm kernel olein blends was subjected to a single stage dry fractionation at 20 or 25°C and the physicochemical properties of the fractions were determined.

Chemical interesterification of palm stearin and palm kernel olein (PSPKOo) produced β' oils with lower slip melting points (SMP) and solid fat contents (SFC) due to changes in the triacylglycerol (TAG) profiles. Rheological studies showed that the hardness, fractal dimension, storage (G') and loss (G'') moduli of chemically interesterified (CIE) PSPKOo blends were lower than that of their non-interesterified (NIE) counterparts. Chemical interesterification altered the mechanism of crystallisation of the PSPKOo blends from plate-like ($n = 2$) to spherulitic growth ($n = 3$) or vice-versa depending on the composition and the crystallisation temperatures. The induction times of crystallisation and the activation energies of nucleation of the NIE 60:40 PSPKOo blends also increased after chemical interesterification. The crystal morphology of PSPKOo blends was altered by chemical interesterification and the growth rate of CIE blend was lower than that of the NIE blend as determined by PLM.

Single stage dry fractionation of the interesterified blends at 20 and 25°C yield β' tending oleins and stearin fractions containing 10 to 40% medium chain fatty acids. Fractionation induced changes in the TAGs composition and the physical properties of both solid and liquid fractions with those fractionated at 25°C having the greater effects. Based on SFC and SMP, some of these interesterified fractions could be utilised for reduced-calorie and reduced-fat formulations such as baked goods, confectionery products, margarines or shortening.

Candidate's Declaration

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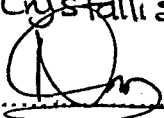
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