POLYMORPHIC DETERMINATION OF CRYSTALS OF PALM OIL AND ITS PRODUCTS USING TTRAX III ROTATING ANODE DIFFRACTOMETER

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Palm oil is a semi-solid oil at ambient temperature (~25°C). This enables palm oil to be easily separated into a liquid (olein) and solid (stearin) fractions. Both the liquid and solid fractions have their own niche applications, *e.g.* as cooking oil and hard stock in food formulations respectively.

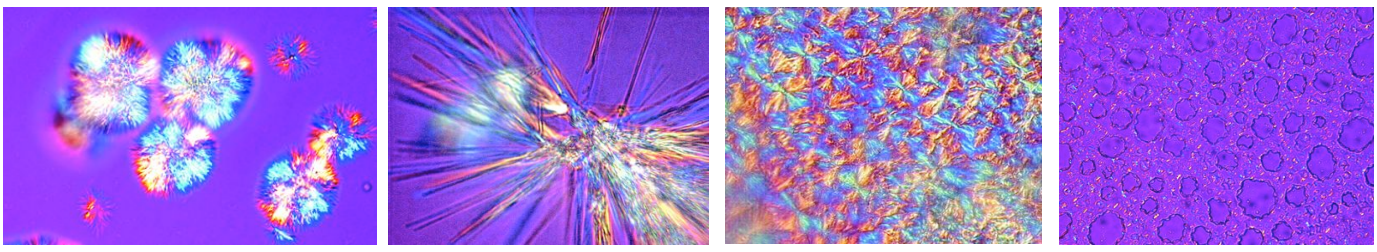
The efficient separation of the solid from the liquid fraction and the application of the solid fraction in food formulations as well as palm oil itself in food formulations are dependent on its polymorphic behaviour.

Polymorphism is defined as the ability of a chemical compound to form different crystalline structures. The three basic polymorphic forms of fats are α, β′ and β. The α-form is the least stable and has the lowest melting temperature and the β-form the most stable with the highest melting temperature. The β′ has intermediate characteristics (Sato, 1999).

Palm oil crystals can be expressed in three polymorphic forms, namely, α, β′ and β, depending on the conditions under which they are crystallized from melt or solution. Usage of the correct polymorphic form in food is important as it affects the texture and taste of the food product. For example, the crystals may need to either melt very quickly or very slowly in order to give a cool sensation in the mouth without any waxy after-taste or to enable slow flavour release, respectively. Also the texture of food products are affected by the polymorphic form of the crystals. For example, margarine has to be in the β′ form for a smooth texture while some consumers may prefer their vegetable ghee to be course and granular (β-form). Hence, it is important that the right polymorphic form be achieved in the food products (deMan, 1994).

SERVICES OFFERED

The TTRAX III is the most versatile X-ray diffractometer which can be used for both wide angle X-ray diffraction (WAXS) and small angle X-ray diffraction (SAXS) measurement for the identification of polymorphic form (α, β′ and β) and their longitudinal packing (2L, 3L, *etc.*). The measurement is rapid (< 5 min) and only a small amount of sample is required (< 1 g). The polymorphism of palm oil crystals can be measured in the food products *in situ* without any prior sample preparation according to AOCS method (1990).



β′ crystals of RBD palm oil | β crystals of RBD palm oil | β′ crystals of fully saturated RBD palm oil | β′ crystals of palm-based margarine

Figure 1.

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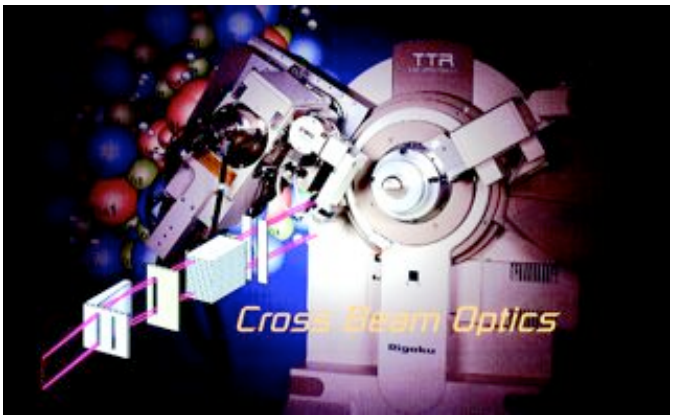

NOVELTY OF THE SERVICE

- Proper assignment of polymorphic form as a function of thermal events of the crystallizing slurries. This will assist in the processing/ formulation work.
- Accurate determination of longitudinal molecular packing of palm oil crystals.
- Enables the problems associated with crystal packing of palm oil triacylglycerols (TAG) to be elucidated.
- Optimizing of processes involving crystallization of palm oil.

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