Polymorphic Behavior vs. Kinetics in Triacylglycerols

Laura Bayés-García, Teresa Calvet, Miquel Àngel Cuevas-Diarte
Dept. de Cristal·lografia, Mineralogia i Dipòsits Minerals, Universitat de Barcelona
Barcelona, Spain

Triacylglycerols are the main components of alimentary fats and oils. They coexist with other minority components, like mono and diacylglycerols, fatty acids, cholesterol, phospholipids, waxes, etc. Depending on the kind of fatty acids that configure triacylglycerols (chain length, number of insaturations,…) and their relative distribution, the geometry obtained and, as a consequence, properties will become specific. Therefore, four different and general crystalline forms are known for the triacylglycerols [1]: α form, which crystallizes in the hexagonal system, β form (triclinic system), β' form (orthorhombic system) and sub-α form (also orthorhombic system). Each polymorphic form differs from another on their physical properties, like the melting point. Melting points follow the same correlation than stabilities: α form has the lowest melting point (less stable form) and β form has the highest melting point (more stable). Moreover, the size and shape of fat crystals are directly related to the polymorph.

There are many techniques capable of characterizing the triacylglycerols polymorphism, like X-Ray Diffraction, Thermal Analysis and Microscopy. These techniques were used in this study. By the way of thermal treatments, we have observed the influence of changing the heating and cooling rates on the results obtained by DSC and Thermo-optical Microscopy (TOM). As other studies [2], [3], we have found the important role that play kinetics. We have observed that, depending on the cooling rate, a different polymorphic form is obtained, so we are capable of characterizing each of them. By TOM, it has been possible to know the existence of a polymorphic form that hasn't been reported yet, whose crystalline habit becomes very uncommon (similar to hopper crystals). The samples studied were oil samples (being possible to differentiate between several categories) and pure triacylglycerols (triolein and 1,3-olein-2-palmitin).

[1] Widlak, N. (2000). *Physical Properties of Fats, Oils and Emulsifiers*. AOCS Press.

[2] Tan, C. P., Che Man, Y. B. (2002). *Phytochem. Anal.* **13**, 129-141.

[3] Che Man, Y. B., Tan, C. P. *Phytochem. Anal.* **13**, 142-151.