Study of Vegetable Oil Phase Transitions by Coupling Time-resolved Synchrotron X-ray Diffraction and DSC Analysis

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Among natural lipids the physical properties of vegetable oils has been studied to a smaller extend probably due to their characteristics to be liquid at room temperature. However, the storage at low temperatures of many chilled and frozen food formulations, such as ready-to-eat meals, can cause the crystallization of the oil fraction. Consequently, at refrigerated and sub-zero temperature, oils are frequently presents as a mixture of a liquid entrapped in a solid made of triglyceride crystals. It should be noted that the presence of partially crystallized oil could greatly affect the food stability. In fact, as crystallisation proceeds, the oxidation reactions develop at considerably higher rate probably due to the relative increase of the concentration of oxidation reactants (i.e. unsaturated fatty acids, oxygen, pro-oxidants) in the liquid phase surrounding the fat crystals (Calligaris et al., 2006 and 2007).

The physical properties of extra virgin olive oil, sunflower oil and palm oil, three widely used lipid matrices in food formulations, was systematically investigated by differential scanning calorimetry (DSC) and time-resolved synchrotron X-ray diffraction (XRDT). In particular, the polymorphism and phase transitions of vegetables oils were evaluated by cooling and then heating the samples at 2 °C/min from 60 °C to -80 °C and *viceversa*. By comparing results obtained from XRDT with those of DSC analysis a set of detailed information of oil phase transition was obtained.

Calligaris, S., Sovrano, S., Manzocco, L., Nicoli, MC. Influence of Crystallisation on the oxidative stability of extra virgin olive oil. Journal of Agricultural and Food Chemistry, 54, 2, 529-535, 2006.

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