External Factors affecting Lipid Crystallization

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Many physical properties such as hardness, texture, rheology, spread ability etc. of lipid-based products largely depend on the extent of crystallization and transformation of lipids, and their network formation. Therefore, plenty of studies have focused on controlling the lipid crystallization processes, as one of the keys to reveal the functionality of lipid crystal. There are two factors, internal and external, which greatly affect the processes of lipid crystallization. The most important internal factors are polymorphism, which basically depends on the variation in fatty acid moieties, and the composition/blending of different lipid materials. Important external factors are thermal treatment, additives, application of shear, pressure and sonication, interfacial structures between lipid and water or air phases in dispersed systems, etc.

This talk tries to make a brief review on recent advances in the research on the above external factors. A particular attention will be paid to the effects of temperature variation, since kinetic properties of polymorphic crystallization and transformation of the lipids are largely influenced by the rates of cooling and heating. This is because the influences of dynamic temperature variations are revealed in different manners for metastable and more stable polymorphic forms. Our recent work on 1, 3-dipalmitoyl-2-oleoy-glycerol (POP), 1, 3-dioleoyl-2-palmotoy-glycerol (OPO), trioleoyl-glycerol (OOO) and 1, 2-dioleoyl-3-linoeoyl-*rac*-glycerol (OOLi) will be presented. The results, which were commonly observed for these lipids, indicated that more stable forms were formed in a higher quantity when molten samples were slowly cooled and heated, whereas less stable forms occurred at higher rates of cooling and heating. The polymorphic transformations occurred either in solid-state or melt-mediation and were largely influenced by the heating rates. We discuss the results by considering the differences in activation free energies for the transformations, which may determine the heating-rate-dependent transformation pathways.