Functional Fat Blends of Specific Mixture Systems of Saturated-Oleic Mixed Acid Triacylglycerols: Impact of Molecular Compound Crystal Formation

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Critically increasing high demands for trans-free and reduction of saturated fats have been asking lipid researchers to develop novel ideas of materials designs of hard stocks for various edible fats. The uses of edible oleogels and interesterification of natural fats are highly promising candidates. In addition, fat blending technology based on natural fat resources containing monounsaturated fatty acid moieties has also been developed. Among three typical fat mixture phases of miscible, eutectic and molecular compound (MC) crystal forming systems, recent studies have shown the high potential of the application of the MC-crystal forming mixture systems in fat spread and confectionery fats. This is because MC crystals are formed by specific molecular interactions among cis-monounsaturated fatty acids moieties. The MC-crystals-based fat blends, therefore, can increase the relative concentrations of unsaturated fatty acids at the expense of saturated ones, possibly making important physical properties such as poly-morphism, melting and hardness suitable for edible applications. The present paper first discusses key molecular interactions forming the MC crystals, particularly oleic-oleic aliphatic interactions and steric hindrance between glycerol group and methyl end stacking, which are the main drivers for the formation of MC crystals having double chain length structures and stable polymorphic forms. Then, the kinetics of polymorphic transformation and crystallization of stable form of the MC crystals with saturated-oleic

mixed acid triacylglycerols (POP/OPO and POP/PPO) are shown by using synchrotron X-ray diffraction and DSC methods.