Binary Mixing Behavior of Mixed-acid Triacylglycerols Including Omega-3 Polyunsaturated Fatty Acids and POP

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In our previous study (1), we investigated physical properties of mixed-acid triacylglyceroles (TAGs) including omega-3 polyunsaturated fatty acids at the *sn*-2 position and stearic acid at the *sn*-1 and *sn*-3 positions, which are called S-PUFA-S TAGs. The S-PUFA-S we have examined were1,3-distearoyl-2-alpha-linolenoyl-glycerol: S-ALA-S, 1,3-distearoyl-2-eicosapentanoyl-glycerol: S-EPA-S, and 1,3-distearoyl-2-docosahexanoyl-glycerol: S-DHA-S. We also investigated binary mixing behavior of S-ALA-S and S-DHA-S with SOS (1,3-distearoyl-2-oleoyl-glycerol) (2).

In the present study, we investigated binary mixing behavior of the S-PUFA-S TAGs with POP (1, 3-dipalmitoyl-2-oleoyl-glycerol) by using simultaneous measurements of DSC and synchrotron radiation X-ray diffraction (SAXS-WAXS-XRD). It was found that the mixtures of S-ALA-S/POP and S-DHA-S/POP were eutectic based on DSC heating measurements, since melting peaks of gamma forms of S-PUFA-S and POP were split at the all concentration ratios. The long spacing patterns of SAXS-XRD of the mixtures did not split clearly, but the diffraction intensity of either fraction of the mixtures decreased at the temperatures where the DSC melting peaks appeared. These results indicate that the binary mixtures of S-PUFA-S TAGs and POP are not miscible, making a clear contrast to the miscible mixtures of S-PUFA-S TAGs and SOS. We think that this difference may be caused by the mismatching of the chain length of the saturated fatty acid moieties at the sn-1 and sn-3 positions: stearic acid in S-PUFA-S TAGs and palmitic acid in POP.

1) K. Sato et al., J. Am. Oil Chem. Soc., 86 (2009) 297-300.

2) K. Sato et al., The 6th Euro Fed Lipid Congress, 7-10 September 2008, Athens