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Effect of Emulsifier Type on Interfacial Crystallisation

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The study of interfacial crystallisation with SAXS/WAXS is commonly conducted using both water-in-oil and oil-in-water emulsions. The former case can be compared to that of a continuous lipid system, where impurities in the bulk lipid catalyse the formation of a lipid crystal network. In the latter case, the dispersion of the lipid phase into emulsion droplets means the division of crystal-promoting impurities amongst these droplets, with the number of droplets likely to exceed the number of impurities, hence lowering the temperature required to form crystals. The inability to distinguish bulk lipid crystals from those at an interface is also made challenging in an emulsion system due to the size of the droplets relative to the size of the x-ray beam. We have used a different approach to study interfacial crystallisation, whereby a model lipid layer (medium-chain triglyceride, MCT) containing a mono-diglyceride mixture was added on top of a water layer inside a capillary. Synchrotron SAXS/WAXS was then used to study crystallisation occurring at the oil-water interface. Surfactant molecules are present in emulsions as stabilising agents and they may also influence crystallisation and the lipid crystal structure. The effect of stabilising agents on the structure and properties of lipid crystals was also investigated. The interfacial activity of fat crystals was also assessed in a complementary series of experiments using Profile Analysis Tensiometry by monitoring the kinetics of interfacial tension in response to temperature changes. Both the addition of stabiliser and the stabiliser type alter the interfacial tension profiles for heating and cooling cycles compared to the lipid-water system in the absence of stabiliser.

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