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Effect of emulsifiers on fat crystallization

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Food products are complex systems made of many ingredients and are structured in several phases, e.g., aqueous, lipidic, solid, liquid, gaseous. The lipidic phase is often present fully or partially crystalline and its crystallization needs to be controlled during the process to obtain the desired structure. For example, in cream or ice cream, fat is dispersed in an o/w emulsion. Emulsifiers are used to stabilize the emulsion, and therefore interact with the fat at the oil-water interface and in the fat if they are partially liposoluble. Control of the crystallization of the fat droplets is critical for the stabilization of the air bubbles by partial coalescence of the droplets at the water-air interface during processing or storage. In bulk fat, control of crystallization is relatively easy. In emulsions it is more complex as fat is dispersed under the form of small droplets and it interacts with molecules distributed between the continuous water phase, the oil droplets and the interface.

In this work, the effect of various emulsifiers on the crystallization in model bulk fat and oil-in-water emulsions are presented. Polymorphism and kinetics of crystallization were determined by DSC, Ultrasonic Velocimetry and low field p-NMR. In particular, Differential Scanning Micro-calorimetry at low cooling and heating rates was used to monitor the evolution of the different crystal types formed in bulk fat phases and in the corresponding oil-in-water emulsions. This allowed to understand the effect of emulsifiers on the crystallization and to relate it to their presence in the different parts of the system.