

Partial coalescence induced by the addition of low molecular weight surfactants in O/W emulsions stabilized by sodium caseinate: the role of interfacial crystallisation

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In emulsified dairy products as milk, yogurts and ice-creams, both size and state of dispersion of fat droplets are known to influence the creaminess mouthfeel [1]. Partial coalescence is ubiquitous in emulsions whose dispersed phase is partially crystallized [2]. Upon cooling, fat crystals formed nearby the interface can protrude into the continuous phase and pierce the film between adjacent droplets. This phenomenon is termed as partial coalescence since the shape relaxation (merging) process is frustrated by the intrinsic rigidity of the partially solidified droplets. In the case of dairy emulsions stabilized with proteins like sodium caseinate, the strong interactions between them induce interfacial stiffness likely to impede partial coalescence. When a low molecular weight surfactant is added, its adsorption weakens the interactions between proteins and the gain in interfacial fluidity allows protruding crystals to pierce the interfacial films [3-5]. In the present work, different types of added surfactants were examined for their ability to induce sensitivity towards partial coalescence and to control the emulsion texture. A model oil-in-water emulsion based on anhydrous milk fat stabilized with a mixture of sodium caseinate and surfactant was prepared and submitted to a tempering cycle, as a simple and efficient way to induce partial coalescence [3,5]. We could probe the influence of several parameters (surfactant nature, surfactant concentration, oil volume fraction, fat droplet size and emulsification process) on partial coalescence. The extent of partial coalescence was quantified by rheological analysis, measuring the storage modulus, while polarized microscopy, DSC, and surface tension measurements were performed in order to characterize the crystallized state. Interestingly, in the explored temperature range, partial coalescence was rather marginal in presence of crystallizable surfactants and very pronounced in presence of liquid surfactants. The phenomena underlying this result, especially interfacial crystallization, were discussed.

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