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Crystalline particles from fatty components as efficient non-aqueous foam stabilizer

Liquid foams are complex colloidal systems based on gas bubbles dispersed in a liquid continuous phase 1.Two different categories of liquid foams exist: aqueous or non-aqueous. In contrary to aqueous foams, which have been extensively studied, non-aqueous foams represent a new promising emerging field 1. Two types of non-aqueous foams are gaining interest: oil foams based on vegetable oil (oleofoams) and alcohol-based foams 2,3. Oleofoams are a promising option to develop new food products combining both a reduced fat content and new appealing textures and sensorial properties. Alcohol-based foams are gaining interest nowadays since the global pandemic due to COVID-19 and the frequent use of alcohol-based hand sanitizers as recommended by the World Health Organization. The main difference between aqueous and non-aqueous foams comes from the relatively large difference in the surface tension of the solvents 1. For non-aqueous systems, the low surface tension makes the adsorption of hydrocarbon-based surfactants energetically unfavourable. One way to produce and stabilize non-aqueous foams is to use surfactant crystalline particles, which can adsorb at the air-liquid surface 4.

In this talk, we will present how natural fatty acids crystalline particles can lead to the production and stabilization of both oleofoams and alcohol-based foams 2,5. We will illustrate how X-ray scattering techniques are useful to characterize these liquid foams. The formation and stabilization mechanisms of these two types of non-aqueous foams are the same and based on the adsorption of fatty acid crystalline particles at the air-liquid surface, which reduce the bare surface area by their presence rather than lowering the surface tension 4. The key parameter for fatty acid crystals to adsorb at the air-non-aqueous liquid surface is to exhibit a suitable three-phase contact angle below 90°. These foams are ultrastable due to the dense layer of adsorbed crystals at bubble surfaces that considerably reduce both disproportionation and coalescence.

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