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Understanding Surfactant-Stabilized Oil Foams via X-Ray Scattering

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Oil foams can be used in food, cosmetics, and pharmaceutical formulations, for enhancing textures, improving product application, and delivering active ingredients. Traditionally, they have been stabilized with a high concentration of surfactants that form crystalline particles [1]. Recently, oil foams were produced with hydrocarbon-based surfactants, but without the presence of crystalline particles [1]. However, the mechanisms of oil foam formation and stabilization remain underexplored, which is crucial for expanding the relevance of these systems to industrial applications. Here, we used several commercially available surfactants, such as fluid soybean lecithin and formed stable, edible, oil foams, at room temperature. We used a multi-scale approach, to investigate the system from the bulk phase to the air/oil interface by using SAXS/GISAXS and X-ray reflectivity experiments and discovered that the key requirement to promote and stabilize the bubbles was the formation of dense surfactant multilayers, leading to a highly elastic layer [2]. This study offers new insights into oil foam formulation with surfactants already used widely in emulsion formulation, which can facilitate their use in various applications.

References
[1] A.-L. Fameau, and B. P. Binks. Aqueous and oil foams stabilized by surfactant crystals: New concepts and perspectives. Langmuir 2021, 37.15: 4411-4418.
[2] S.-M. Argyri, C. Ugarte Pereyra, R. Bordes, E. Schneck, and A.-L. Fameau. Unravelling the mechanisms of stabilization of edible oil foams using lecithin as a model surfactant, In preparation, 2025.

Abstract Title

Surfactant-Stabilized Oil Foams from X-Ray Scattering understanding

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