Contribution ID: **56** Type: **Plenary talk (only invited speakers)**

Towards an improved understanding of food emulsions via neutron scattering and neutron spectroscopy

Thursday, 22 June 2023 09:00 (30 minutes)

The stability of food emulsions depends -beside other effects- on a complex interplay between proteins, phospholipids, oil and water. Preparing milk-based and sustainable plant-based emulsions requires good knowledge in interfacial and emulsion stabilization mechanisms, affected by the emulsion composition. To understand these mechanisms in detail different length scales from interatomic to macroscopic distances need to be investigated.
Neutron scattering techniques provide insight into such emulsions on these length scales depending on the technique used. Combining structural information on molecular length scales from small angle x-ray and neutron scattering (SAXS and SANS) with time dependent neutron spin echo spectroscopy (NSE) allows to expand our understanding towards intermolecular interactions within the interface. These interactions are linked to the emulsion stability –the elastic properties of the protein or protein/phospholipid stabilized oil/water interface on molecular length scales. NSE provides in this combination the time dependent correlation function in reciprocal space, S(q,t), on molecular length scales and time scales in the nanosecond range relevant for thermally driven motion of mesoscopic systems such as the emulsion interfaces.
This presentation introduces the neutron and x-ray scattering techniques which broadens the classical characterization of food emulsions. Results from emulsions stabilized with β-lactoglobulin as a representative milk protein, and different plant-based proteins, are presented and discussed. Contrast variation by deuteration of some components of the emulsions is applied to focus on the interfacial region, relying on the uniqueness of neutrons.
Connecting these emerging results with classical characterizations such as interfacial tension or viscoelasticity helps understanding the complex mechanisms of interfacial stability and may contribute to a knowledge driven development of sustainable food emulsions.

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Session Classification: Plenary 4