Experimental report

22/04/2025

Proposal: 9-12-684 **Council:** 10/2022

Title: Towards plant based dairy products

Research area: Other...

This proposal is a new proposal

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Samples: D20
H20
DOPC
DOPG
Beta Lactoglobulin
Middle chain triglyceride oil deuterated
rape seed protein
Middle chain triglyceride oil
DOPC deuterated
DOPG deuterated

Instrument	Requested days	Allocated days	From	To
D22	4	1	27/06/2023	28/06/2023

Abstract:

The importance of sustainable human nutrition is growing with increasing effects of climate change. Emulsions systems like milk are composed of unsustainable, animal derived milk proteins, phospholipids, oil and water. To increase the sustainability of emulsion systems, milk proteins are substituted with sustainable plant proteins, whereby the stabilization mechanisms, and the long-term stability of these sustainable emulsions are of interest.
A central role within the stabilization mechanisms of emulsions play proteins and phospholipids, since they stabilize the oil/water interface as interfacial active components. The interfacial stabilization is linked to reorganization of the molecular structure of proteins, interfacial arrangement and interactions of proteins with phospholipids. We aim to compare the interfacial characteristics in emulsions stabilized with two globular proteins: Cruciferin -as a sustainable protein source- and beta-lactoglobulin -as a main protein fraction in milk- with addition of the phospholipids: phosphatidylcholine and phosphatidylglycerol via SANS. The upcoming structural results systemize the general understanding of sustainable food emulsions.

Extract from current publication, which will be submitted soon. As soon as the manuscript is accepted, we are happy to provide the doi.

The most important SANS spectra measured for bulk, film and one intermediate contrast are depicted in Fig. 1. The bulk contrast was obtained by hydrogenous MCT oil (hMCT), hydrogenous protein and lipid and heavy water (D_2O). The film contrast was obtained by deuterated MCT oil (dMCT), hydrogenous protein and lipid and D_2O. One intermediate contrast was obtained with dMCT, hydrogenous protein and lipid and a 60/40 H_2O/D_2O mixture. Below we will also discuss other water mixing rations that aim at a zero contrast to either the protein or the lipid, because their natural contrast is different.

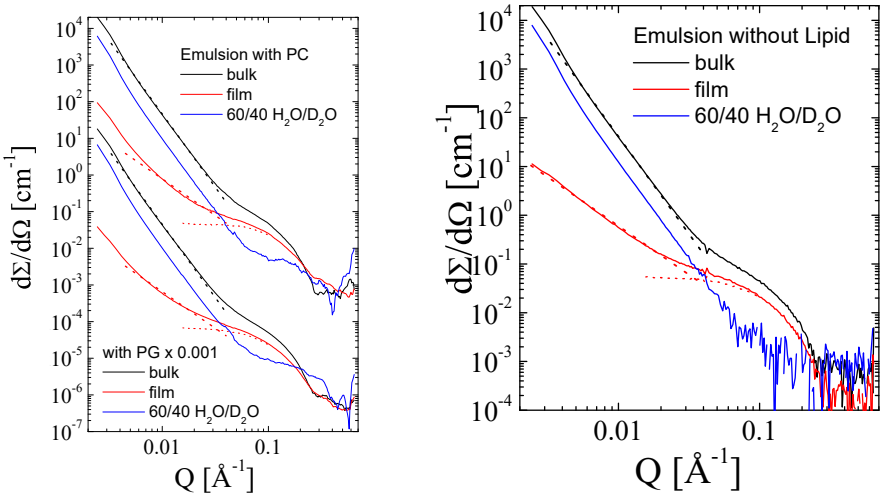

Figure 1A: The most relevant scattering contrasts of the SANS experiment on the emulsions with bLG protein and the two lipids PC and PG. The bulk contrast results from hMCT, hydrogenous protein and lipid and D_2O. The film contrast from dMCT, hydrogenous protein and lipid and D_2O. The intermediate contrast from dMCT, hydrogenous protein and lipid and a 60/40 H_2O/D_2O mixture. The power law scattering is indicated by dotted straight lines. The structure factor free protein Guinier scattering is also indicated by the dotted red line at $Q>0.01Å^{-1}$. The incoherent background was always subtracted.

Figure 1B: The most relevant scattering contrasts of the SANS experiment on the emulsions with bLG protein without any lipid. The colors and lines are identical to Fig. 1A.