Experimental report

26/08/2022

Proposal: **INTER-383** **Council:** 4/2018

Title: Structure of alkylethoxycarboxylate/cyclodextrin complexes in water

Research area:

This proposal is a new proposal

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Samples: Surfactant (ethoxylated fatty acids) and cyclodextrins in D2O

Instrument	Requested days	Allocated days	From	To
D11	1	1	20/03/2018	21/03/2018

Abstract:

Experimental report for experiment: INTER-383 -- Structure of alkylethoxycarboxylate/cyclodextrin complexes in water

Aim of the experiment was to probe the supramolecular assembly of inclusion complexes formed by cyclodextrins and alkyl ether carboxylic acids. Alkyl ethyleneoxide carboxylic acids (AECs) are a particular class of surfactants (Figure 1). The structures of AECs are very similar to fatty acids more commonly known as soaps, in their salt form but with the addition of ethoxylate (EO) units. Fatty acids possess a low solubility and a high Krafft point (i.e. the minimum temperature at which a surfactant is more stable in a crystal than as a single molecule in solution) which limits their applicability in the consumer market. The addition of EO units overcomes these issues, resulting in an alternative class of surfactants with considerable benefits. The carboxylic acid termination group has a pH-dependent degree of ionization. As expected from the name, AECs are weakly acidic. Cyclodextrins (CDs) are cyclic oligosaccharides with a cone-like structure and have the ability to link to other cyclodextrin molecules (covalently or intermolecularly) and can therefore be used as a foundation for supramolecular complexes. Before SANS experiments are performed on D11, light scattering experiments were carried out. Experiments were conducted on the D11 diffractometer and an exemplary set of data is shown in Figure 2. When Y = 0 (pure surfactant), the scattering curve follows a q−2 scattering power law which is characteristic of a locally-flat and undefined structure (such as polydisperse vesicles or bilayers). When Y = 1.1, the scattering curve features a plateau in the low-q region and oscillations in the scattering intensity which signify a well-defined structure. The oscillation minimum corresponds to a cross-section 2π/q ≈ 105 nm. At Y values higher than this, the plateau in the low-q range is seen to gradually disappear and the gradient increases to a value of -4 in the mid-q range at Y = 2.8. At this high Y value, the scattering curve shape could be due to phase separation.

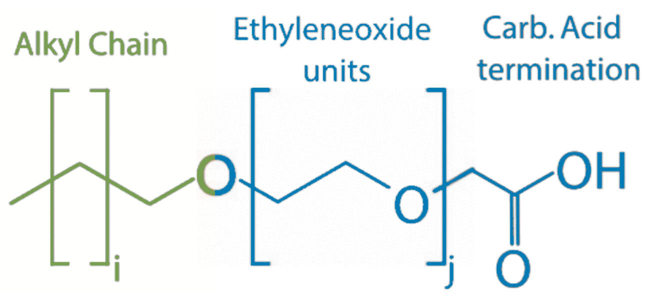
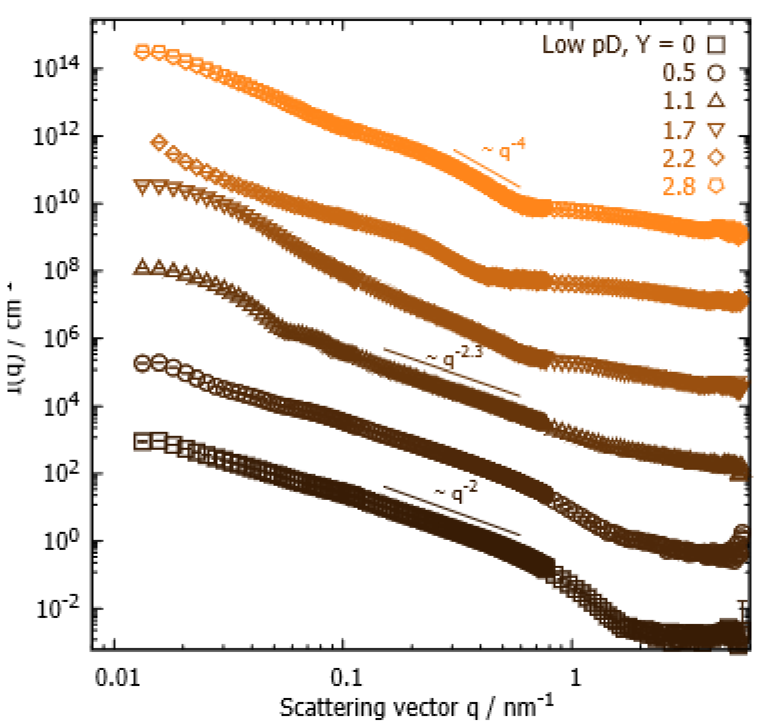


Figure 1: Chemical structrue of alkyl ether carboxylic acids.



This work was preparatory for the beamtime 9-12-664 which resulted in a recent publication in Soft Matter.