Experimental report

11/11/2016

Proposal: 9-10-1450 **Council:** 4/2015

Title: Effect of temperature and concentration on the self-aggregation of a novel alkylglycoside

Research area: Soft condensed matter

This proposal is a new proposal

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Samples: C16G8

Instrument	Requested days	Allocated days	From	To
D33	0	2	23/11/2015	25/11/2015
D11	0	0		
D22	2	0		

Abstract:

The increased effort to preserve the environment among industry and consumers has driven extensive research toward the identification of surfactants that are nontoxic, biodegradable, and synthetized from renewable resources. Alkylglycosides with alkyl chain length from 8 to 14 and glucose head group from 1 to 3 were characterised in several studies. A novel enzymatic synthesis allows the production of a surfactant with a long alkyl chain, 16 carbons, and a long glucose chain, 8 glucose (C16G8); we are focusing on its characterisation. Since the functionalities and possible applications of C16G8 can compete with the widely used Polysorbate 80, we want to investigate further the self-aggregation mechanism with SANS and complement it with SAXS experiments. This understanding will lead to further development of liposome carriers containing C16G8 as a trigger for controlled release in the framework of the BIBAFOODS project (Initial Training Network (ITN) funded by the FP7-PEOPLE-2013 programme).

Report on Experiment #9-10-1450

In this experiment we investigated the effect of temperature and concentration on the self-aggregation of an alkylglycosides with 8 glucose headgroups and 16 carbons alkyl chain (C16G8).
The surfactant is produced by enzymatic synthesis and depending on the substrate used the resulting surfactant presents different ratio of alpha and beta isomer. We investigate two samples: A, 100% beta isomer; B, 1:1 alpha and beta. Both samples were dissolved in D2O at 7 different concentrations: 0.1, 0.5, 1, 5, 10, 20 and 50 mg ml^{-1}. Three temperature were studied: 25, 45 and 65 °C.
Sample B forms bigger structure than sample A (Fig. 3, right). The overall shape is similar. The initial model chosen to fit them is a cylinder, with a radius greater than the length. This basic model has been fitted to all the data collecte, and example of the fitted is shown in Fig. 3. The SLD of the solvent and the cylinder were both fixed, respectively 6.35×10^{-6} $Å^{-2}$ and 1.76×10^{-6} $Å^{-2}$. The background level was fixed to 5×10^{-4}. All the other parameters were left free: length, radius and scale factor. Since the fitting was not conclusive, we send the sample for cryo-TEM analysis, and together with flat aggregates, small particles of about 5 nm were found. Based on the cryo-TEM analysis, we combined a cylinder model with a sphere model and the fit quality improved drastically, as it is shown in Fig.3.
Considering the concentration shown in Fig.3, for sample B the cylinder has larger radius and length than sample A, radius 200 compared to 120 nm, and length 9 compared to 3 nm, while the particle is much smaller for sample B compared to sample A, 1 to 6 nm.
The analysis with the combination of the two models is in progress and we are willing to publish a paper early 2017.

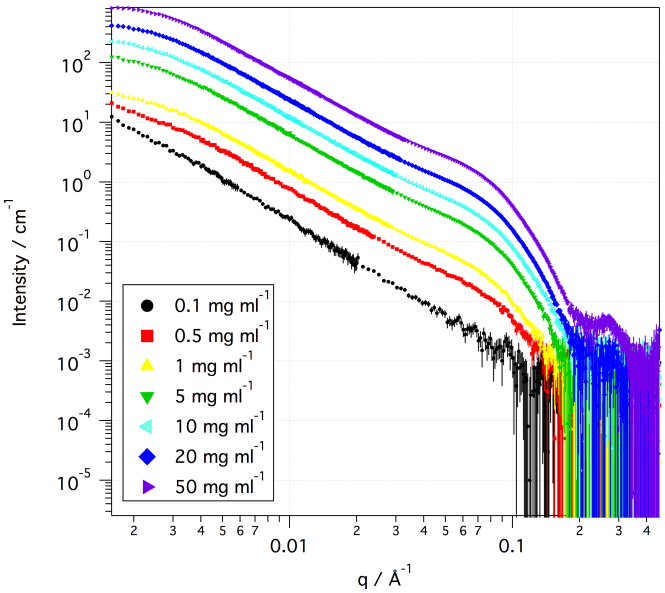

Figure 1 SANS profiles recorded for sample A at 25°C. Intensity scales with concentration.

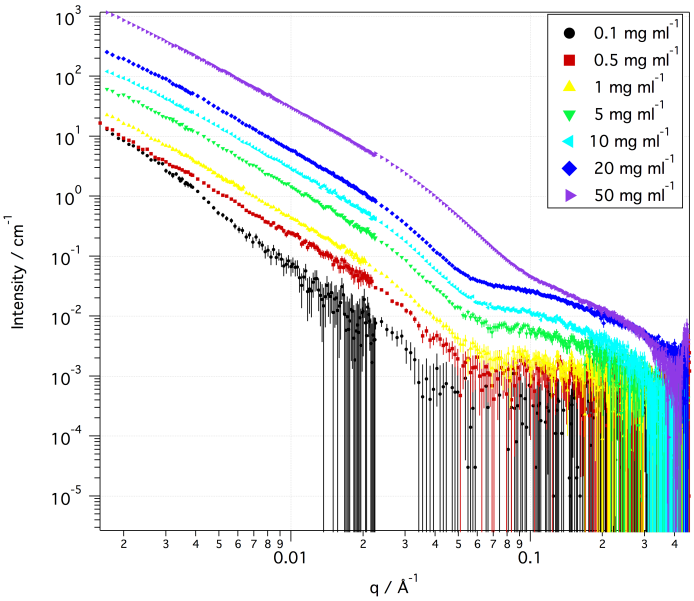

Figure 2 SANS profiles recorded for sample B at 25°C. Intensity scales with concentration, except for highest concentration.

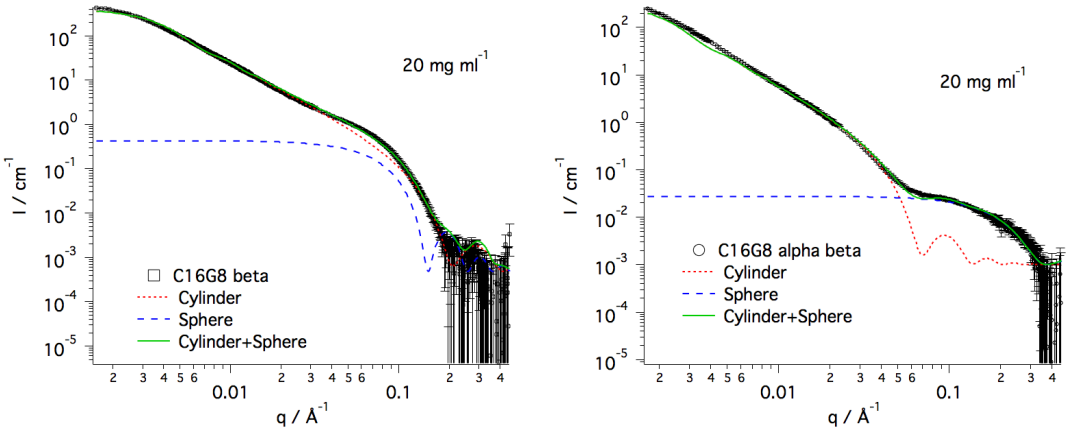

Figure 3 Examples of model fitted to the sample A (left) and sample B (right). Temperature is 25°C.