INDUSTRIAL PILOT PROJECT

Natural care products through understanding both bulk and surface behaviour, using SAXS and Neutron reflectometry

THE INDUSTRIAL CHALLENGE

Formulated products such as for example shampoos need to be reformulated with more sustainable ingredients. However, it is not known if the theories built over the years using synthetic systems can be translated to the less defined natural materials.

In particular, information on coacervate formation and deposition is of high value for CR Competence as a company, guiding producers to greener alternatives using this technology. Learning how to use the combination of methods to study these systems in more detail was our goal.

More specifically, using an oppositely charged polymer-surfactant pair we studied the formation of coacervates and its subsequent deposition on model surfaces.

WHY USING A LARGE SCALE FACILITY

Using neutron reflectometry can provide information on what molecules are on the surface, complementing ellipsometry data that only give thickness and adsorbed mass. Compared to laboratory small angle X-ray scattering (SAXS), using synchrotron SAXS can provide the resolution often required to analyse poorly structured aggregates, such as coacervates.

Figure 1. Experimental set-up at the INTER instrument of ISIS, UK.

HOW THE WORK WAS DONE

The samples studied were aqueous polymer-surfactant formulations: a cationic biopolymer with inulin backbone and ca 70% cationic substitution (Quatin®) and the oppositely charged sodium decanoate. Neutron reflectometry was run at the INTER instrument of ISIS Neutron and Nuon Source, England, with the help of Max Skoda, using a syringe pump setup for sample dilution. SAXS with a microfluidic chip setup was run at the CoSAXS beamline of MAX IV laboratory, with help of Antara Pal and Ann Terry.

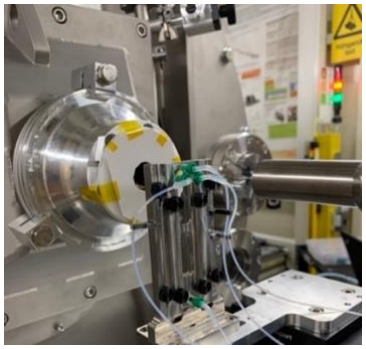

Figure 2. Experimental set-up at the CoSAXS beamline, MAX IV.

THE RESULTS AND EXPECTED IMPACT

As a company CR Competence gained increased experience working with large scale instruments and the resulting data. This will help position us as the main advisor for developing industry in the field.

We have two major learnings. First, it has been shown that traditional theories can be used to control coacervate formation also with less characterized systems. Second, the complexity of the often kinetically dependent coacervate formation is observed in comparing reflectometry and ellipsometry results. For many other systems, these two techniques are more straight forward to use in combination. Here, our interpretation is that we do not observe the same phenomena with the two set-ups. This is of importance, for us and others to understand and take into consideration.

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