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Self-Assembly in Deep Eutectic Solvents

Tuesday, 27 September 2022 14:50 (25 minutes)

Deep eutectic solvents (DES) are promising novel solvents obtained through the complexation of a halide salt such as choline chloride with a hydrogen bond donor such as urea or glycerol, enabling them to be tuned for particular properties, including low toxicity and sustainability. They are of increasing interest to replace organic solvents in applications from synthesis to pharmaceutical formulations. We have found that polar DES will support amphiphile aggregation and so are undertaking a systematic study to correlate the unique hydrogen-bonded nanostructure of DES with surfactant phase behaviour in these solvents. We have used a range of scattering techniques, including small angle scattering and reflectivity as well as measurements of critical micelle concentration, rheology and thermal properties to study micellization in these media. These investigations have shown that DES can promote amphiphile self-assembly but alter surfactant phase behaviour significantly compared to that in water, offering control over micelle morphology, as the solvent components can be tuned to be interacting or non-interacting with the surfactant, altering the micelle shape. In ternary DES, containing both urea and glycerol as hydrogen bond donors, the interaction of cationic and anionic surfactant headgroups with these solvent components are strikingly different. In addition, despite the highly ionic nature of DES, surfactant counterion binding is also surprisingly important in controlling micelle shape, and the micelles appear to show electrostatic interactions as the surfactant concentration is increased. This presentation will discuss our results and try to draw conclusions on the important factors controlling amphiphile behaviour in these interesting novel solvents.

Primary author: EDLER, Karen (Lund University)

Presenter: EDLER, Karen (Lund University)

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