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Self-assembly of surfactants in protic ionic liquids

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Protic ionic liquids (PILs) are the largest known solvent class capable of promoting surfactant self-assembly. However, PILs are increasingly used as mixtures with molecular solvents, such as water, to reduce their cost, viscosity and melting point, and the self-assembly promoting properties of these mixtures are largely unknown. Here we investigated the critical micelle concentration (CMC) of ionic and non-ionic amphiphiles in two ionic liquids, ethylammonium nitrate (EAN) and ethanolammonium nitrate (EtAN), to gain insight into the role of solvent species, and effect of solvent ionicity on the self-assembly process. The amphiphiles used were the cationic cetyltrimethylammonium bromide (CTAB), anionic sodium octanoate sulfate (SOS), and the non-ionic surfactant tetraethylene glycol monododecyl ether (C12E4). Surface tensiometry was used to obtain the CMCs and free energy parameters of micelle formation, and Small angle x-ray scattering (SAXS) was used to characterise the micelle shape and size. For CTAB, the trend in the CMC observed indicated that at low concentrations of the PIL, the ionic liquids acted as free ions, decreasing the CMC due to charge screening effects. This effect was not observed in C12E4 due to its neutral overall charge. Micelle formation of the anionic amphiphile was found to be more complex than initially hypothesised in ionic liquids. It was discovered that EtAN, the less cationic ionic liquid was able to facilitate self-assembly of SOS, whereas in EAN mixtures micelles could not be confirmed. The findings from this study gives insight into how solvent interactions are modified from solvents rich in water to rich in a PIL.

Level of Expertise

Student

Presenter Gender

Woman

Pronouns

She/Her

Which facility did you use for your research

Australian Synchrotron

Students Only - Are you interested in AINSE student funding

Yes

Do you wish to take part in the Student Poster Slam

Yes

Condition of submission

Yes

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