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Self-Assembly of Long-Chain Betaine Surfactants: Effect of Tailgroup Structure on Wormlike Micelle Formation

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Amidopropyl betaines are zwitterionic surfactants that exhibit viscoelastic properties, due to their ability to self-assemble into wormlike micelles and other extended micellar geometries. A range of amidopropyl betaine surfactant molecules containing C18 hydrocarbon tails, with differing levels of unsaturation and branching, were synthesised and analysed. The fatty acids used as targets for surfactant tail groups were stearic, oleic, isostearic, linoleic and linolenic acids. Small-angle neutron scattering (SANS), ultra-small angle neutron scattering (USANS) and rheology coupled to small angled neutron scattering (rheo-SANS) were employed to determine self-assembly in solution, micellar geometries and alignment of wormlike micelles under shear. Optimum wormlike micelle formation was achieved for the oleyl tailed surfactant. The more highly unsaturated molecules formed rodlike micelles, whereas the stearic-tailed molecule showed a pronounced Krafft point, and the isostearic-chained surfactant was entirely water-insoluble. These properties indicate that the oleyl-tailed betaine has the most potential to be exploited in applications, particularly where fluid control is imperative. This research has offered new insight into the micellar processes associated with amidopropyl betaines. It is evident that a subtle change in the tail group of amidopropyl betaines can modify the behaviour and solubility of these surfactants.

Speakers Gender

Female

Travel Funding

No

Level of Expertise

Student

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Yes

Primary author(s) : KELLEPPAN, Veena (Monash University); MOORE, Jackson (Monash University); MCCOY, Thomas (Monash University); SOKOLOVA, Anna (Dr); Dr DE CAMPO, Liliana (Australian Centre for Neutron Scattering, Australian Nuclear Science and Technology Organization (ANSTO)); Dr WILKINSON, Brendan (The University of New England); TABOR, Rico (Monash University)

Presenter(s) : KELLEPPAN, Veena (Monash University)

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