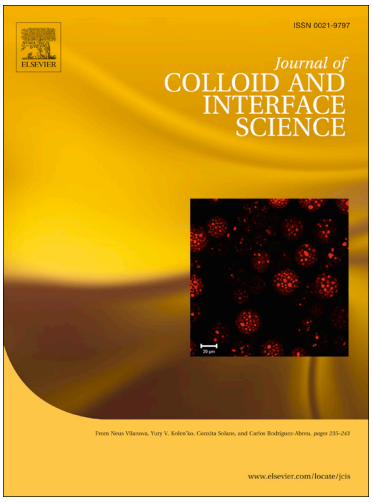

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The effects of small molecule organic additives on the self-assembly and rheology of betaine wormlike micellar fluids

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Abstract

A model zwitterionic surfactant, oleyl amidopropyl betaine (OAPB), that spontaneously forms viscoelastic wormlike micelles in aqueous solution is mixed with a variety of structurally diverse organic additives. By systematically varying the nature of these additives, insight into the effects of their aromaticity and polarity on the bulk assembly and fluid behaviour of these micelles is gained by the complementary use of small-angle neutron scattering and viscosity measurements. Inclusion of non-polar additives causes the wormlike aggregates to transition into microemulsions above a critical additive concentration; the precise partitioning within the micelle is determined using contrast variation. Alternatively, polar additives do not appear to cause evolution from the wormlike structure, but instead influence the fluid rheology, with some serving to significantly increase viscosity above that of the pure surfactant solution. Addition of these molecules is accompanied by an increase in fluid viscosity when the oxygenated group of the additive is resonance stabilised or acidic. This effect is thought to be a result of surfactant–additive synergism, in which charge screening of the surfactant head-groups causes stronger attractions between molecules, increasing the scission energy of the micelles (*i.e.* reducing their ability to break apart and reform). Further doping of acidic additives past a critical concentration causes phase separation of