

Investigation of the effect of PTHC on the phase behavior of SDS

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Amphiphilic molecules self-assemble in water to form micellar aggregates above the critical micellar concentration (CMC). At much higher amphiphile concentrations (Φ_s) these solutions exhibit a variety of thermodynamic phases, characterized by varying degrees of translational and orientational order of the micelles. The phase diagrams of single chain amphiphiles is in general dominated by the hexagonal (H_I) phase, consisting of cylindrical micelles arranged on a two-dimensional (2D) hexagonal lattice, which occurs over a wide range of Φ_s . At still higher Φ_s a lamellar (L_α) phase is observed, made up of a periodic stack of planar amphiphile bilayers separated by water. Further increase in Φ_s results in inverse structures, where water-filled regions surrounded by the hydrophilic head groups of the amphiphilic molecules are dispersed in the hydrocarbon matrix. These inverse micellar morphologies are referred to as type II, whereas the direct micellar morphologies are called type I.

The generic phase behavior of amphiphile-water systems, outlined above, can be rationalized in terms of a gradual decrease in the spontaneous mean curvature of the micelle-water interface with increasing Φ_s , from being positive at low values of Φ_s to being negative for high values of Φ_s .

Organic salts, such as p-toluidine hydrochloride (PTHC), can be considered as an extreme limit of an ionic amphiphile. While they do not self-assemble in water to form micelles, they have a preference to sit at the surface of the micelle and hence affect the properties of the micelle-water interface. Such molecules, often called hydrotropes, decrease the spontaneous curvature of the micellar surface leading to the formation of long worm-like micelles (WLM) in many amphiphiles. In some cases, the decrease in the spontaneous curvature is large enough to stabilize bilayers.

Here, we describe the influence of a hydrotropes p-toluidine hydrochloride (PTHC), on the phase behavior of the anionic surfactant sodium dodecyl sulfate (SDS), at various molar ratio (α) of PTHC to SDS and at fixed $\Phi_s \sim 50$. This SDS - PTHC-water system is found to exhibit- Hexagonal (type I), Lamellar and Isotropic phase of bilayer with increasing the value of α at $\Phi_s \sim 50$.