Thermodynamic and Structural Effects in Mixed Surfactant Solutions

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It is well known that properties of surfactant solutions can change dramatically on addition of other surfactants or low molecular weight substances. In some mixtures synergetic effects are observed leading to a decrease of the surface tension and critical micelle concentration (CMC), increase of viscosity, growth of aggregates and peculiar features of phase behavior [1]. Mixed surfactant systems are paid much attention during last decades and find numerous applications in detergency and pharmacy, food, chemical and oil industries, etc.

This paper reports results of experimental measurements, molecular-thermodynamic modeling and computer simulations for mixed surfactant solutions, performed by the author and co-workers. Studied are aqueous solutions containing two surfactants or a surfactant and a low molecular weight additive. Special attention is paid to mixtures of alkyldimethylamine oxides with sodium dodecylsulphate and solutions of cetyltrimethylammonium bromide.
The following issues are discussed: effect of additives on the CMC and phase boundaries; concentration dependence of viscosity in solutions containing surfactants and additives; correlation between the viscosity and the hydrodynamic radius of aggregates; calculations of the size, shape and composition of mixed micelles by the quasi-chemical aggregation model that takes into account different contributions to the Gibbs energy of micellization; molecular dynamics simulations of spherical and cylindrical micelles of cetyltrimethylammonium chloride in aqueous solutions containing sodium benzoate and/or 2-propanol.

The results of experimental work and modeling contribute to understanding self-assembly phenomena in mixed surfactant solutions. In several systems we found quite pronounced synergetic effects.

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[1] N.A.Smirnova. *Phase behavior and self-assembly patterns of surfactant mixtures in solutions.* *Russian Chemical Reviews*, **74**, 129-144 (2005).