Interfacial Layer Properties of Nonionic/Cationic Surfactants Mixtures

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Adsorption properties of aqueous solutions of 1:1 mixture of cationic hexadecyltrimethylammonium chloride and non-ionic tetraethylenglycol monododecyl ether are compared to the properties of the single surfactant solutions at the same total concentration. Dynamic interfacial tension and dilatational rheology is measured by pendant drop profile analysis tensitometry. A strong synergetic effect of mixed system was observed in both film and adsorption properties. Properties of the adsorption layers play a key role for stability and drainage kinetics of thin foam films. Most of the previous work focused on single surfactant systems and the systematic studies on the relationship between interfacial and foam film properties of mixed surfactant system are rare. However, commercial industrial and household products are mostly a mixture of surfactants. Here, we present a study on adsorption and foam film properties of aqueous solutions of 1:1 (mol:mol) mixture of cationic surfactant hexadecyltrimethylammonium chloride (CTAC) and nonionic surfactant pentaethyleneglycol-monododecyl ether ($C_{12}E_5$). The results are compared to the corresponding single surfactant system [1, 2]. All solutions are in presence of 0.1 mol/l sodium chloride (NaCl). The equilibrium interfacial tension isotherms for the mixed system (CTACl/$C_{12}E_5$) showed lower interfacial tension values for the same total concentration of surfactant as juxtaposed to those of single surfactant systems. The critical micelle concentration for mixed system was lower, 2.0×10^{-5} mol/l, compared to 7.0×10-5 mol/l for CTAC and 6.2×10^{-5} mol/l for $C_{12}E_5$. It was found that the dilatational elasticity of the adsorption layers correlates to drainage kinetics of foam films and corresponding film lifetimes. A profound increase in the magnitude of dilatational elasticity was observed for the mixed systems and the maximum was shifted to much lower concentrations in comparison with the single-surfactant case. The reported results underline the important role of adsorption layers and the surface dilatational properties in particular, for foam film drainage and stability. They suggest significant benefits of using mixed surfactant systems to achieve lower interfacial tension, higher dilatation elasticities and increased film stabilities for the same overall surfactant concentrations.

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References:

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