Dynamics of adsorption of polyallylamine hydrochloride/ sodium dodecyl sulfate at water/air and water/hexane interfaces

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Understanding of the behavior of polymer / surfactant mixtures in the solution bulk and at different interfaces is important for a wide range of industrial, technological and domestic applications. In this regard study of polymer / surfactants mixtures is an intensively studied topic of present research. The interaction between oppositely charged polyelectrolytes and surfactants in aqueous solution and at the water/air interface were frequently studied while only few investigations were devoted to these mixed interfacial layers at water/oil interfaces.

The aim of this work is the study of the adsorption behavior of a cationic polyelectrolyte mixed with anionic surfactants in aqueous solution at water/air and water/hexane interfaces. For this purpose surface and interfacial tensions of polyallyl amine hydrochloride (PAH) / sodium dodecylsulphate (SDS) were studied by Drop Profile Analysis Tensiometry (PAT-1, SINTERFACE Technologies, Germany). Two minima are obtained from isotherms of PAH/SDS complex which correspond to the critical aggregation concentration and critical micelle concentration, respectively. The observed features of the dynamic surface/interfacial tensions of PAH/SDS solutions are explained by the association of the oppositely charged polyelectrolyte/surfactant molecules to form complexes in aqueous solutions, caused by electrostatic interactions which lead to a significant hydrophobisation of the polyelectrolyte chains and the reduction of the electrostatic free energy of polyions. This can be the reason for the accelerated surface and interfacial tensions reduction in the initial part of the dynamic curves because an increase of the compaction in accordance to the Einstein-Smoluchowski equation leads to increasing diffusion coefficients. The data are analyzed with available thermodynamic and kinetic models in order to determine molecular characteristics of the surfactants and the complex at the respective interfaces.