Correlation between the adsorption of the surface active agents mixtures at water-air and polymer-water interfaces in the polymer-solution-air system

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In most practical applications, rather mixtures of surface active agents, than those of individual ones, are used intentionally or unavoidably in the case of some commercial surfactants. The surface active agents adsorbed in the mixed monolayer at water-air interface decrease the water surface tension, but at polymer-water interface they can decrease, increase or not affect the tension of this interface. In most cases mixtures of surface active agents being classical surfactants contain additives which improve their ability to modify the interfacial properties even at a low bulk concentration. Among a very large number of additives, alcohols hold a special place because they are the most common co-surfactants and co-solvents at their low and high concentration, respectively [1]. Addition of alcohols to surfactants influences the density and structure of mixed films at different interfaces and micelles in the bulk phase by changing their properties [1]. In the literature it is possible to find many studies dealing with adsorption of classical surfactants and alcohols mixtures at water-air and polymer-water interface [1,2]. It is found that surface excess concentration of classical surfactant and alcohol mixtures is nearly the same at water-air and polytetrafluoroethylene (PTFE)-water interfaces, but for polymethylmethacrylate (PMMA) at the PMMA-water interface it is considerably lower than that at water-air one. However, the relationship between real concentration of surfactants and alcohols in the monolayer at water-air and PTFE (PMMA)-water interfaces was not analyzed. Therefore, we considered the composition of the mixtures of cetyltrimethylammonium bromide (CTAB), cetylpyridinium bromide (CPyB), sodium dodecyl sulphate (SDDS) and hexadecyl sulphonate (SHS) with methanol, ethanol and propanol in the monolayer at water-air, PTFE-water and PMMA-water interface. Based on the surface tension and contact angle data the surface concentration of alcohols and surfactants at water-air, PTFE-water and PMMA-water interface was determined. For this determination the polymer-solution interface tension was calculated from Young equation by using the literature data of the polymers surface tension [2,3]. Taking into account the Gibbs and Guggenheim-Adam adsorption isotherms of surfactants and alcohols their molar fractions and activity coefficients were determined. From the calculation of the adsorption of the surfactants and alcohols it results that the surface excess concentration of the mixture and its individual components at PTFE-solution and solution-air interface is nearly the same, but the surface excess concentration at PMMA-solution interface is considerably lower than at solution-air one, and the composition of the mixtures at both interfaces is different. It can be also stated that the activity coefficients of surfactants and alcohols in the surface region at solution-air and polymer-solution interface are different.