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Study of the process of micellization in aqueous solutions of alkylpolyglucosides and surfactant mixtures based on it

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Abstract

The behavior of aqueous solutions of surfactants of various nature, nonionic surfactants such as alkylpolyglucosides (APG), anionic (sodium lauryl sulfate) and amphoteric (cocamidopropylbetaine) surfactants, as well as their binary and ternary mixtures, has been studied using the tensiometric method. Surface tension isotherms are obtained and the experimental values of the critical micelle formation (CMC) concentrations of all the systems are determined. The aggregation numbers of alkylpolyglucosides with different lengths of hydrocarbon radical were received using the approach of A.I. Rusanov. It is shown that with the increase of the length of the alkyl radical of APG the solubility of the surfactant decreases, which leads to a strong decrease of the critical micelle concentration and an increase of the aggregation number. The parameters of intermolecular interaction of surfactant molecules in binary mixtures are determined according to Rubin's thermodynamic approach. Negative values of the interaction parameters were obtained, indicating a mutual attraction of various types of surfactants, and in the case of mixtures of alkylpolyglucosides with sodium lauryl sulfate, there is a tendency to growth the absolute value of the interaction parameter with increasing hydrocarbon radical APG. The theoretical values of the CMC of the ternary mixture are calculated using the Lange-Beck approaches (assuming perfect mixing) and Rubin-Holland (taking into account the non-identity of mixing). The experimental values of the CMC of all ternary mixtures are below the values calculated from the Lange-Beck equation. A deviation from the ideal behavior is observed. The nonideality of mixing is taken into account by the Rubin-Holland theory: the calculated values agree well with the experimental values. A phenomenon of synergism was established for all investigated multicomponent mixtures of surfactants of different composition.

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