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The state of a paramagnetic probe in solutions containing mixed micelles of anionic and nonionic surfactants from data on nuclear magnetic relaxation

Amirov R., Saprykova Z.

Kazan Federal University, 420008, Kremlevskaya 18, Kazan, Russia

Abstract

The state of Mn2+ ions in solutions of binary mixtures of anionic (sodium decyl, dodecyl, and tetradecyl sulfates) and nonionic (Tween 40 and Triton X-100) surfactants at 298 K was studied by the nuclear magnetic relaxation method. It was found that an increased spin-lattice relaxation rate of water protons is caused by formation of mixed surfactant aggregates. The method proposed previously for describing the micellization of anionic surfactants was extended to mixed aggregates containing a nonionic surfactant. A mathematical simulation revealed the formation of mixed micelles of alkyl sulfates and nonionic surfactants of two types: with 1 : 1 and 1 : 2 ratios. In the latter case, the mixed micelles are incapable of binding counterions, which is probably caused by the blocking of head sulfate groups by the ethylene oxide chains of the nonionic surfactants. The adequacy of the used approach was supported by the method of competing reactions between iminodiacetic acid and mixed micelles of sodium dodecyl sulfate and Tween 40 for binding with Mn2+ cations.