WETTING PROPERTIES OF A SURFACTANT CONTAINING SHORT PERFLUOROALKYL CHAINS COMBINED WITH CONVENTIONAL BRANCHED SURFACTANTS

Sayfutdinova A.R., Pokidko B.V., Pletnev M.Y.

Department of Colloid Chemistry, Institute of Fine Chemical Technologies, Russian Technological University (MIREA), Vernadsky Avenue, 86, Moscow, 119454, Russia; e-mail: sayadeliya@gmail.com

Fluorinated surfactants are known as unsurpassed surface-active agents for reducing the surface tension of water and various solvents up to ultra-low values. However, disadvantages of the surfactants containing long C_6F_{13}-C_8F_{17}-chains are related to their environmental impact, associated with their worth biodegradation, bioaccumulation, and toxicity [1]. A proper alternative to such surfactants is a new type of amphiphiles containing several short perfluoroalkyl chains. These surfactants are not subject to restrictions on marketing and use whereas their effectiveness is almost the same as of long-chain fluorinated surfactants [2-4].

Our study focuses on the wetting properties of Tivida FL 2300 (TFL), new fluorosurfactant kindly provided by Merck KGaA. This eco-neutral anionic surfactant contains three perfluoropropyl chains connected via a spacer to hydrophilic group. Surprisingly, aqueous solutions of this fluorosurfactant in a certain range of concentrations exhibit synergistic wetting of Parafilm M with ethoxylated (×5 EO and ×6 EO) wetting agents, derivatives of branched decanol (Guerbet alcohol). The wetting rate and contact angles on the Parafilm surface were examined for solutions ofthe surfactants and their mixtures using a digital camera in video mode at 25°C.

It was shown that the even small additives of TFL to ethoxylated alcohols significantly accelerate the spreading of water drops on the hydrophobic Parafilm surface. Probably, this nonideal behaviour is essentially of the same kind as the known cases of "fluorophobic effect", which is typical for other mixtures of a fluorinated surfactant and hydrocarbon molecules. On the other hand, the attractive interaction of hydrophilic moieties can take place. Associative behaviour of TFL and branched alcohol ethoxylate in mixed solutions is examined by various methods. Anyway, anionic TFL and ethoxylated alcohols show a certain independence of their action at the liquid/air surface and the liquid/solid interface. As it was proposed before [5], the comparison of isotherms $\gamma = f(\log C)$ and $\gamma \cdot \cos\theta = f((\log C)$ offer the suggestion on the concentration ranges of surfactant adsorption on these surfaces. TFL adsorption at the Parafilm/air surface is possible as revealed by Zisman's plot. The obtained data allow us to conclude that the synergistic mixtures of short-chain fluorinated surfactant and branched decanol ethoxylates represent a promising eco-friendly and cost-effective alternative to other wetting agents, particularly with regard to the high adsorption rate and proper wetting in such compositions as sprayable coatings, inks, and surface cleaners.

References
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