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Adsorption properties of binary mixtures containing quaternary derivatives of lysosomotropic substances

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ABSTRACT

The aim of presented work was to analyzed the adsorption properties of binary mixtures which containing quaternary derivatives of lysosomotropic substances (QDLS). The surfactants investigated were quaternary ammonium salts belong to the group of esterquats: fatty acids N,N-dimethylaminopropylesters methobromides (DMPM-*n*), fatty acids 1-dimethylamino-2-propyl methobromides (DMP_2M-*n*). Two types of mixed systems were considered: DMPM-9 + DMP_2M-9 and catanionic mixtures, as DMPM-9 + DBSNa. The equilibrium and dynamic surface tension data for these mixed systems were studied and interpreted. From dynamic surface tension data the micelle kinetics dissolution constant were determined. Moreover, the dynamic contact angle for investigated mixtures were measured at three model surfaces of different hydrophobocity: quartz, glass and paraffin. The obtained results indicated that the structure of monolayers formed in mixed systems is strongly affected by the composition of the bulk solution. Most of studied systems revealed synergistic effect in adsorption and wetting properties. Especially strong reduction of surface tension and value of cmc was observed for equimolar mixtures, in which the highly surface active complexes were probably created.

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1. Introduction

Surfactants are extensively used in a wide range of domestic, technological and industrial applications, which include detergents, conditioners, cosmetics, food, dyeing, mineral flotation, paints, other surface coatings, and a variety of other diverse applications that exploit their properties as colloid, emulsion or foam stabilizers [1,2]. Mixed surfactant systems are encountered in nearly all practical applications of surfactants. Commercial products containing surface active compounds usually consist of two or more amphiphilic chemicals. This is due to the fact that most of the binary mixtures of surfactants show synergistic effects in reduction of the surface tension and critical micellar concentration [3–8]. As result mixture of surfactants shows lower surface tension and/or lower value of cmc than single compounds at the same concentration. Synergistic behavior has also been observed in biological activity of some cationic-anionic mixtures of surfactants [2].

From the practical point of view it is important to understand the adsorption process from these mixtures. It is obvious that the adsorption processes in the systems of mixed surfactants is more complex than the adsorption of single surfactant because of some phenomena which may occur in binary systems, e.g. interactions between different surfactants, existence of mixed micelles, formation of association complexes, and some other ones [9–11].

Quaternary derivatives of lysosomotropic substances are compounds exhibiting both surface activity as well as fungicidal and bactericidal activities and have also antistatic and hemolytic properties. These features can be used as disinfectants, aids in the formation of plastic antistatic properties, or as substances that prevent the eutrophication of inland waters. However, the most interesting possibility of using these substances is believed to be in medicine. Lysosomotropic compounds show special biological properties. QDLS diffuse into the cellular lysosomal compartment where the low pH causes them to become protonated and trapped [12]. As a consequence membrane's permeability is changed what leads to release of hydrolytic enzymes and the destruction of the living cell. These action of QDLS can be use in the treatment of cancer, where QDLS could supporting cytostatic drugs. It seems to be very probable that the use of synergistic mixture of QDLS allows to decrease the concentration of a medicine without loss of its high surface and biological activity.

The paper presents our results of study on adsorption and wetting properties of binary mixtures containing *quaternary derivatives of lysosomotropic substances* (QDLS).

Two types of mixed systems were studied: mixtures containing two derivatives of *QDLS* as well as *catanionic mixtures* containing QDLS and sodium dodecylbenzenesulfonate (DBSNa) as an anionic compound.

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