INFLUENCE OF SURFACTANTS OF DIFFERENT TYPES ON THE LUMINESCENT PROPERTIES OF FLUORESCEIN, EOSIN, AND ERYTHROSINE

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Surfactant-based systems are widely used in the pharmaceutical and food industries, medicine, analytical practice, and many other fields. Several aspects of use characterize surfactant solutions in the analysis. Thus, surfactants can be used as reagents, the object of analysis, and surfactant solutions are often used as a medium for analytical reactions. The use of surfactants in luminescent methods of analysis leads to an increase in the sensitivity of the developed methods for determining various analytes. This is due to the unique properties of surfactants to change the photophysical characteristics of phosphor solutions and the nature of their microenvironment.

The study of the effect of surfactants of different types on the fluorescence characteristics of anionic dyes in aqueous solutions and Triton X-100 (TX-100) systems was the aim of the work. Fluorescent reagents of the anionic type – fluorescein, eosin, and erythrosine were used as fluorescent dyes. Sodium dodecyl sulfate (SDS) was used as an anionic surfactant. 1 alkylpyridinium chlorides with a hydrocarbon chain length of n=11-18 were used as cationic surfactants.

The study of the acidity effect on the fluorescence intensity of dye solutions in the presence of surfactants was carried out in the work. It was found that increasing the pH of the solution leads to the increase in the intensity of the fluorescence signal with subsequent exit to the «plateau». The maximum fluorescence intensity of dye solutions is achieved in the pH=9-12 range for the fluorescein-surfactant system and at pH=7-12 for the eosin-surfactant and erythrosine-surfactant systems. Surfactant-concentration dependences of changes in the fluorescence intensity of reagents in aqueous solutions and micellar solutions of the nonionic surfactant were also investigated. Thus, the addition of the anionic SDS to solutions of anionic dyes has little effect on the signal intensity. This can be explained by the lack of electrostatic attraction between the reagent particle and the surfactant. The increase in the content of the nonionic surfactant in solutions of fluorescein and its derivatives leads to a gradual decrease in the fluorescence intensity in the fluorescein–TX-100 system and to a slight increase in the signal in the eosin–TX-100 system. The increase in signal intensity of approximately 4 times was registered for the erythrosine–TX-100 system. This effect can be explained by the strengthening of hydrophobic properties and changes in the protolytic properties of the reagent particle in the presence of TX-100. The addition of minimal amounts of cationic cetylpyridinium chloride (CPC) leads to a sharp decrease in the signal intensity of fluorescein-CPC associates solutions with subsequent access to the «plateau», in contrast to the anionic and nonionic surfactants. A decrease in fluorescence intensity at the CPC concentration less than the critical micelle concentration (CMC) is observed for fluorescein derivatives that are more hydrophobic. The signal intensity increases with the subsequent exit to the «plateau» at CCPC>CMC. The change in the hydrophobicity of the cationic surfactants (n=11-18) has practically no effect on the fluorescence intensity of fluorescein solutions.

However, the study of similar dependences for eosin and erythrosine in the presence of the nonionic surfactant showed the leveling of the inhibitory effect of the cationic surfactants on their analytical signal in association with dyes.

Thus, the data obtained in the work make it possible to formulate a rational basis for the search and design of analytical systems for the determination of organic cations by the fluorescent method.