Infrared study of structural changes of water encapsulated in AOT reverse micelles

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Reverse micelles have been the subject of a large number of experimental and theoretical investigations during the last two decades. They are powerful models for complex biological water cavities and wall pores in solid media. The surfactant sodium bis (2-ethylhexyl) sulfosuccinate (AOT) forms spherical nanometer-sized molecular aggregates in nonpolar solvents. The hydrocarbon part of the AOT molecules are oriented toward the exterior of the aggregate, while the sulfonate headgroups with the sodium counterion are localized in the interior of the reverse micelle. Infrared spectroscopy is a suitable method to characterize microstructures in the AOT microemulsions [1-2].

The goal of the preposed work was investigation of structural changes of water pools of reverse micelles depending from AOT concentration in the presence or absence of structure-making and structure-breaking ions by IR-Spectroscopy. Since any structural change will be revealed in a variation of the bound and bulk water fractions, we selected the O-H stretching region for our IR investigations. An analysis of the IR spectra in this spectral region of AOT reverse micelles as a function of W was carried out.

Microemulsions were prepared on the basis of AOT, hexane, water, water solutions of sodium acetate and potassium perchlorate. IR absorption spectra were recorded in a IR spectrophotometer Specord - 75.

Results show, that the shape of water band in O-H streching region (3000-3800) varies with increasing of W within 1-10. IR investigations of water-AOT-hexane reverse micellar systems show that three types of water are presented in the water pockets if the reverse micelle. Addition of salts into the water core results in the changes of ratio of the bound, free and trapped water fractions, viz. the bound and free fractions of water is higher, but trapped water fraction is lower in the presence of acetate ions in the water core of reverse micelle in comparison with with additives of potassium perchlorate; fraction of trapped water increases significantly under the influence of perchlorates ions as compared to pure water.

Results may be useful in investigation of the interface features of AOT reverse micelle with unique properties as models for biomembranes and templates for nanoparticles.

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