Investigation of the confined water by chromatographic and spectroscopic methods on the basis of reverse micelles as models

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Micelles are often used as model colloids due to simplicity of both structure and surface of micelles. The biological processes occurring in a reverse micellar system mimic the membranous environment in vivo [1]. Complexity of water structure becomes enormous when it is confined to nanometer-scale cavities. Ionic reverse micelles represent a good model to study the properties of water aggregates close to the ionic center.The additives of ionic kosmotropes (sulfate, phosphate, chloride) and chaotropes (bromide, thiocyanate, perchlorate) because of ion-water interactions influence the water structure in water pockets of reverse micelles [2-3]. The added salts have a great influence on the solubilisation ability of the microemulsion system.

The goal of the proposed work was to study the influence of different ionic additives introduced in the water nanocages of reverse micelles by using water-in-oil microemulsion chromatography, infrared and ultraviolet-visible spectroscopy in order to reveal the changes in: i) chromatographic retention factor of model compounds; ii) binding of a molecular probe to AOT reverse micelles; iii) structural changes of water pools of reverse micelles.

The different influence of kosmotropic and chaotropic anions on the binding of constant o-NA with reverse micelles of Brij-30 and AOT was revealed. The results were compared with chromatographic data. An interesting regularity is observed between changes of retention factors and values of binding constants in different microemulsion systems in the presence of the same anions. The changes in ratio of bound, free and trapped water are revealed under the influence of kosmotropic and chaotropic anions.

Additionally an interesting observation, concerning the maximal upload of aqueous phase in the oil phase, until turbidity occurs, is made. Water with addition of chaotropic perchlorate is absorbed by the mixture of oil and nonionic surfactant in quantity of 0.56% (v/v), whereas the maximum value of absorbed water with additives of kosmotropic acetate at the same salt concentrations reaches only 0.37%. These data are reversed in case of oil and anionic surfactant. These different values of maximum water content in microemulsion may be explained by the dissimilar influence of kosmotropic and chaotropic anions on the water structure.

References

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