

Adsorption and aggregation activity of sodium dodecylsulfate and rhamnolipid mixture

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Recently rapid development of investigations aiming at reduction of consumption of synthetic surfactants, especially non-biodegradable and toxic ones and replacement them by new more safety for humans and the environment has been observed. Of special interest are highly biodegradable and biocompatible surface active agents including these produced by different microorganisms (biosurfactants). Besides the properties typical of synthetic surfactants, biosurfactants are characterized by high surface activity, very low critical micelle concentration, specificity of action and biological activities. Owing to such properties biosurfactants can be applied in various fields of industry, medicine and pharmacy as well as in environment protection [1,2]. However, the application of natural surfactants is limited by the high cost of their production [3]. From the economic point of view it seems that application of biosurfactants as the addition to the synthetic one is more proper. The mixture of biosurfactants with classical surfactants can show the synergetic effect in the reduction of water surface tension and micelle formation [4].

The purpose of this study was investigation of the adsorption and aggregation properties of the rhamnolipid mixture with classical anionic surfactant. Rhamnolipid is secondary metabolite of *Pseudomonas aeruginosa* and it belongs to the group of biosurfactants. It has very high surface activity, low value of critical micelle concentration and great emulsifying properties [1,3]. As a synthetic surfactants was chosen sodium dodecylsulfate due to the fact that it is used in many industries and it is also a component of large number of commonly used products e.g. cleaning and washing agents.

The surface and volumetric properties of aqueous solutions of rhamnolipid and sodium dodecylsulfate mixtures were determined on the basis of surface tension, density and viscosity measurements as well as on the thermodynamic analysis based on the size of these surfactants and their contactable area with water molecules. From obtained results, among other things, the activity of sodium dodecylsulfate and rhamnolipid in the surface layer and micelles, Gibbs standard free energy of adsorption and micellization as well as Gibbs free energy of the mixing of sodium dodecylsulfate and rhamnolipid in the surface layer and micelles were established. These parameters were discussed in the light of the independent adsorption of sodium dodecylsulfate and rhamnolipid and the size of their molecules and the contactable area with water ones. Obtained results indicate that there is correlation between the number of water molecules being with contact with surfactants ones and standard free energy of adsorption and micellization of these compounds as well as there is synergism in the reduction of water surface tension and the micelle formation by studied mixtures.

- [1] A.M. Abdel-Mawgoud, F. Lépine, E. Déziel, *Applied Microbiology and Biotechnology*, 2010, **86**, 1323.
- [2] I.M. Banat, R.S. Makkar, S.S. Cameotra, *Applied Microbiology and Biotechnology*, 2000, **53**, 495.
- [3] M.M. Müller, J.H. Kügler, M. Henkel, M. Gerlitzki, B. Hörmann, M. Pöhnlein, C. Syldatk, R. Hausmann, *Journal of Biotechnology*, 2012, **162**, 366.
- [4] M.L. Chen, J. Penfold, R.K. Thomas, T.J.P. Smyth, A. Perfumo, R. Marchant, I.M. Banat, P. Stevenson, A. Parry, I. Tucker, I. Grillo, *Langmuir*, 2010, **26**, 17958.