

Studies on Interactions of Bovine Serum Albumin with Cationic Gemini and Single-Chain Surfactants

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Protein-surfactant interactions have been a subject of extensive studies over the past few decades because they are of importance in a wide variety of industrial, biological, pharmaceutical, and cosmetic systems. Studies on the interactions of surfactants with proteins can contribute toward an understanding of the action of surfactants as denaturants and as solubilizing agents for proteins. Extensive studies on the interactions of surfactants with proteins have been reported and reviewed.

In the present work, the interactions of bovine serum albumin (BSA) with cationic gemini surfactants alkanediyl- α , ω -bis(dodecyldimethylammonium bromide) [C₁₂H₂₅(CH₃)₂N(CH₂)_SN(CH₃)₂C₁₂H₂₅]₂Br₂ (designated as C₁₂CSC₁₂Br₂, S = 3, 6, and 12) and single-chain surfactant dodecyltrimethylammonium bromide (DTAB) have been studied using isothermal titration microcalorimetry, turbidity, fluorescence spectroscopy, and circular dichroism at pH 7.0. Comparing with DTAB, C₁₂CSC₁₂Br₂ have much stronger binding ability with BSA to induce the denaturation of BSA at very low molar ratio of C₁₂CSC₁₂Br₂/BSA. Meanwhile, the strong hydrophobicity of C₁₂CSC₁₂Br₂ promotes the formation of the complexes with larger size. The binding of C₁₂CSC₁₂Br₂ to BSA generates larger endothermic peaks. The first endothermic peak is much stronger than that of the second endothermic peak. The double charges and strong hydrophobicity of the gemini surfactants are the main reasons for these observations. In addition, the spectra results show that the binding of DTAB to BSA only promotes BSA unfolding and aggregation, whereas the secondary structure of BSA is possible to be stabilized by a small amount of C₁₂CSC₁₂Br₂, even if the small amount of binding C₁₂CSC₁₂Br₂ could induce the lost of tertiary structure of BSA. This result may be related to the double tails of gemini surfactants, which may generate the hydrophobic linkages between the nonpolar residues of BSA.