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Interaction of hexadecyltrimethylammonium bromide with glycine in aqueous medium using the Walff-Zangwill-Ruhemann conductivity measurement

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ABSTRACT

Conductivity measurements were employed to investigate the interactions of cationic surfactant hexadecyltrimethylammonium bromide (CTAB) with glycine (Gly) in aqueous medium at different temperatures. The critical micelle concentration (CMC) of CTAB increases with the increase in temperature. The CMC of CTAB decreases with the increase in concentration of Gly and the CMC values of CTAB in the presence of Gly are lower than the CMC values of CTAB in pure water. The micellization process of CTAB in the presence of Gly is found to be spontaneous. The thermodynamic parameters of micellization such as Gibbs free energy of micellization (ΔG_m°), enthalpy of micellization (ΔH_m°), and entropy of micellization (ΔS_m°) have been calculated. The micellization process is found to be entropy controlled and endothermic in nature. The interaction parameters such as the micellization parameter (β), the interaction parameter (α), the activity coefficient (f_1), and the Gibbs free energy of interaction (ΔG_{int}°) have been calculated using the Walff-Zangwill-Ruhemann (WZR) model. The interaction parameter (α) and the activity coefficient (f_1) have been found to be negative and less than unity, respectively, which indicates that the interaction between CTAB and Gly is more favorable than the ideal mixing. The negative value of ΔG_{int}° indicates that the interaction between CTAB and Gly is more favorable than the micellization of CTAB in pure water. The interaction between CTAB and Gly is found to be more favorable at higher temperature. The interaction between CTAB and Gly is more favorable than the micellization of CTAB in pure water. The interaction between CTAB and Gly is found to be more favorable at higher temperature.

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1. Introduction

The amphiphilic molecules particularly surfactants have been a vital subject of research since the last decade. Surfactants have been the subject of interest in the field of pharmaceutics, food industry, and medicine [1–3]. The amphiphilic molecules have been used as well as interactive with biological macromolecules such as proteins and DNA [4–6]. The interactions between surfactants and biomolecules are quite strong and both are in biological membranes. The interaction of proteins with surfactants has been studied extensively using various techniques such as fluorescence [7,8], circular dichroism (CD) [9,10], isothermal titration calorimetry (ITC) [11], fluorescence [12–14], and electrical conductivity [15–18]. These interactions are important in a wide variety of biological, medicinal, and industrial processes such as food, cosmetics, and drugs. The changes in protein structure due to surfactant binding are of great importance in the study of protein stability, folding, and interaction with other biomolecules. Any data can be obtained if one finds that the surfactant binding causes a change in protein structure [19–21]. Thus, to understand the non-covalent intermolecular interactions of surfactants with proteins, it is of vital importance to understand the origin of the forces that are involved in these interactions both qualitatively and quantitatively [22].

In general, the surfactants interacted as a polymer between the CMC and the critical micelle concentration (CMC) [23]. Cromwell et al. [24] reported the WZR computer or CLU is employed to a comprehensive range of colloidal temperature range. WZR. They have reported that WZR increases by increasing the monomer solubility of the surfactants and the micelle solubility of the surfactants. The WZR model also provides consistent data. The first process indicates that the size of micelle increases with the increase in temperature. The second process is the addition of salt with counterions to an ionic surfactant solution increases the micelle size and decreases the CMC. The third process is the ionic number of micelle. Adding salt also increases the solubility of surfactant in water the WZR is an in contrast a constant solubility of surfactant in water. The WZR model is used to study the micelle in CLU. As WZR CLU with ions caused by ionic surfactant concentration of medium. Clement et al. [25,26] have reported that the WZR model is used to study the micelle in CLU. The WZR model is used to study the micelle in CLU. The WZR model is used to study the micelle in CLU. The