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Title of thesis: Thermophysical and Thermoacoustical Behaviour of Binary Liquid Mixtures and Mixtures of Amino Acids in Aqueous Surfactants

ABSTRACT

This Ph.D. thesis has been divided into seven chapters.

CHAPTER I This is an introductory chapter which embodies the scope and objective of the proposed work. An upto date literature survey has been presented to illustrate the work being carried out in this field. At the end of this introductory chapter, brief outlines of the work presented in subsequent chapters are given. It comprises the statement of the problem, importance of the work and an exhaustive and systematic review of the most recent literature on the volumetric, viscometric, ultrasonic, surface tension and conductometric studies of the binary non – aqueous and ternary aqueous liquid mixtures containing biomolecules.

CHAPTER II deals with the standard methods of purification of the chemicals and details of the instruments and techniques used in the present study. Techniques described in this chapter are density, viscosity, ultrasonic speed, surface tension, conductivity, fluorescence spectroscopy and dynamic light scattering.

CHAPTER III In this chapter the densities, viscosities, and ultrasonic speeds, of pure N, N-dimethylformamide (DMF), 1- propanol, 1-butanol, 1-pentanol, and those of their binary mixtures, with DMF as common component, covering the whole composition range have been measured at different temperatures. Partial molar volumes, $\overline{V}^{0}_{\phi,2}$, and partial molar compressibilities, $\overline{K}^{0}_{\phi,2}$, of 1- propanol, 1-butanol and 1-pentanol in DMF have also been evaluated. Moreover, V^{E} values were theoretically evaluated by using the Flory's statistical theory and by using the viscosity data. The variations of derived parameters mentioned above with composition offer a convenient method to study the nature and extent of interactions between the component molecules of the liquid mixtures.

CHAPTER IV presents surface tension, volumetric and compressibility behaviours of Triton X-100 in aqueous mixture of glycine have been studied at different temperatures below and above the micellar composition range. Critical micelle concentration (cmc) of the surfactant TX-100

was obtained by surface tension, density, and ultrasonic velocity measurements at different temperatures. From surface tension data, the surface excess concentration, the minimum area per molecule, the surface pressure at the cmc, Gibbs free energy, enthalpy, and entropy of micelle formation have been evaluated. The values of apparent molar volumes and compressibilities at infinite dilution in the pre-micellar region and those of apparent molar quantities in the micellar range were obtained and studied as a function of temperature. The effect of glycine on micellar size of nonionic surfactant in water has been investigated by dynamic light scattering (DLS) technique.

CHAPTER V presents the thermodynamic and micellar properties of sodium dodecyl sulfate (SDS) in aqueous solutions of L-serine and L-threonine were determined employing conductivity, fluorescence spectroscopy and dynamic light scattering techniques. Changes in cmc of SDS with the addition of amino acids were examined by both conductivity and pyrene I_1/I_3 ratio methods at different temperatures. The pyrene fluorescence spectra were used to study the change of micropolarity produced by the interaction of SDS with amino acids, and the aggregation behaviour of SDS and the results have been interpreted in terms of structural changes in mixed solutions.

CHAPTER VI Apparent molar volume and apparent molar compressibility of glycine, L-alanine, and L-valine in binary aqueous solutions of $4 \cdot 10^{-4}$ and $12 \cdot 10^{-4}$ m ($mol \cdot kg^{-1}$) cetyltrimethylammonium bromide (CTAB) have been determined at 298.15, 303.15, 308.15, and 313.15 K from density and ultrasonic speed measurements. The structure-making /-breaking ability of solutes were discussed using Hepler's criterion. Transfer parameters were interpreted in terms of solute-cosolute interactions on the basis of cosphere overlap model. The obtained data were discussed in the light of various interactions operating in ternary systems of amino acids, water and CTAB.

CHAPTER VII Apparent molar volume and apparent molar compressibility of L-Glutamine and L-Asparagine in binary aqueous solutions of cetylpyridinium chloride (2×10^{-4} and 10×10^{-4} mol dm^{-3}) have been determined at different temperatures from density and sound speed measurements. Experimental values of viscosity were used to calculate Falkenhagen coefficients, *A*, Jones – Dole coefficients, *B*, free energies per mole of solute, and per mole of solvent, enthalpies, and entropies of activation of viscous flow. Various interactions operating in ternary system of amino acids, water and CPyCl have been discussed.