PHYSICO-CHEMICAL PARAMETERS AND THEIR SIGNIFICANCE:

Apparent molar volume (ϕ_V^0) from experimental density values is estimated, the sign and magnitude of apparent molar volume (ϕ_V^0) also provides information about the nature and magnitude of solute-solvent interaction while the experimental slope (S_V^*) provides information about solute-solute interactions. Viscosity Deviation($\Delta\eta$), viscosity B -coefficients are estimated from experimental viscosity values. From experimental speed of sound values, Deviation in Isentropic Compressibility (ΔK_S), limiting apparent molal isentropic compressibility (ϕ°_K) and the experimental slope S_k^* were estimated. These parameters along with many other parameters estimated from Refractometric, conductometric measurements helps to establish the results obtained from density and viscosity measurements.

WORK SUMMARY

CHAPTER I

This chapter contains the objective and applications of the research work.

CHAPTER II

This chapter contains the general introduction of the thesis and forms the background of the present work. A brief review of notable works in the field of solute-solvent interaction has been given.

CHAPTER III

This chapter contains the experimental section which mainly involves the structure, source, purification and application of the solutes and solvents used in the research work and the details of the instruments used for the study.

CHAPTER IV

In this chapter molecular interaction prevailing in α-amino acids (glycine, L-alanine, L-valine) and aqueous solution of Folic acid (FA) have been reported by physico-chemical properties as density (ρ), viscosity (η), refractive index (n_D) and ultrasonic speed (u) at 298.15 K. The extent of interaction (solute-solvent interaction) is expressed in terms of the limiting apparent molar volume (ϕ_V°), viscosity B-coefficient, molar refraction (R_M) and limiting apparent molar adiabatic compressibility (ϕ_K°). The trends in transfer volumes, $\Delta\phi_V^\circ$, have been interpreted in terms of solute-cosolute interactions on the basis of a cosphere overlap model. The role of the cosolute (FA), and the contribution of solute-solute and solute-solvent interactions to the solution complexes, has also been analyzed through the derived properties.

CHAPTER V

This chapter contains precise electrical conductance measurements are reported for some ethanoates, viz. ammonium, lithium, sodium and potassium in pure tetrahydrofuran (THF) and dimethyl sulphoxide (DMSO) and their binary mixtures at 298.15 K. The conductance data have been analyzed by the Fuoss conductance-concentration equation in terms of the limiting molar conductance (Λ_0), the thermodynamic association constant (K_A) and the association diameter (R). The limiting ionic conductances have been estimated from the appropriate division of the limiting molar conductivity value of the "reference electrolyte" Bu_4NBPh_4. Furthermore, the conductance data for pure THF have been analyzed by the Fuoss–Kraus theory of triple ions and the values of the ion-pair and triple-ion formation constants (K_P and K_T) were made and the results have been discussed in terms of molecular scale model.

CHAPTER VI

The apparent molar volume (ϕ_V), viscosity B-coefficient and molal refraction (R) of some carbohydrates (D-Glucose, D-Sucrose, and D-Maltose monohydrate) have been determined in 0.01, 0.03, 0.05 mol·dm^{-3} aqueous ascorbic acid solutions at 298.15 K from the experimental density (ρ), viscosity (η) and refractive index (n_D) values respectively. The limiting apparent molar volumes (ϕ_V^0), experimental slopes (S_V^*) have been derived from the Masson equation and they have been interpreted in terms of solute-solvent and solute-solute interactions respectively.

The viscosity data have been analysed using the Jones-Dole equation and the derived parameters viscosity-A and B coefficient obtained have also been interpreted in terms of solute-solute and solute-solvent interactions respectively in the solutions. Molal refractions (R) have been calculated using the Lorentz-Lorenz equation and discussed.

CHAPTER VII

In this chapter apparent molar volumes (V_ϕ), viscosity B-coefficients for Nicotinamide (NA) in (0.03, 0.05, 0.07 and 0.10) mol·dm^{-3} aqueous Citric Acid monohydrate (CA) solutions have been determined from solution density and viscosity measurements at (298.15, 308.15 and 318.15) K as function of concentration of NA. In the investigated temperature range, the relation: $V_\phi^0 = a_0 + a_1 + a_2 T^2$, have been used to describe the temperature dependence of standard partial molar volume V_ϕ^0. This results have, in conjunction with the results obtained in pure water, been used to calculate the standard volumes of transfer ΔV_ϕ^0 and viscosity B-coefficients of transfer for NA from water to aqueous CA solutions for rationalizing various interactions in the ternary solutions. The structure making or breaking ability of NA has been discussed in terms of the sign of $\left[\frac{\partial^2 V_\phi^0}{\partial T^2}\right]_p$ and *dB/dT*. An increase in the transfer volume of NA with increasing CA concentration has been explained by Friedman-Krishnan co-sphere model. The activation parameters of viscous flow for the ternary solutions studied have also been calculated and explained by the application of transition state theory.

CHAPTER VIII

Here, apparent molar volume (ϕ_V), viscosity B-coefficient, molal refraction (R) and adiabatic compressibility (ϕ_K) of Nicotinic Acid, Ascorbic Acid, and Folic Acid have been determined in 0.01, 0.03, 0.05 mol·dm^{-3} aqueous Cysteine solutions at 298.15 K from density (ρ), viscosity (η), refractive index (n_D) and speed of sound (u) respectively. The limiting apparent molar volumes (ϕ_V^0) and experimental slopes (S_V^*), derived from the Masson equation, have been interpreted in terms of solute-solvent and solute-solute interactions respectively. The viscosity data were analyzed using the Jones-Dole equation and the derived parameters A and B have also been interpreted in terms of solute-solute and solute-solvent interactions respectively in the solutions. Using the Lorentz-Lorenz equation, molal refractions (R) have been calculated. At infinite dilution, limiting apparent molar adiabatic compressibilities (ϕ_K^0) of these vitamins were evaluated and discussed.

CHAPTER IX

In this chapter molecular interaction in terms of apparent molar volume (ϕ_V), viscosity B-coefficient, apparent molar adiabatic compressibility (ϕ_K) and molal refraction (R) of Glycine, L-Alanine, L-Valine have been structured in 0.01, 0.03, 0.05 mass fraction of aqueous nicotinic acid solutions at 298.15 K. Using the density data to Masson equation, the limiting apparent molar volumes (ϕ_V^0) and experimental slopes (S_V^*) have been obtained at the infinite dilution by extrapolated to zero concentration, which interpreted the solute-solvent and solute-solute interactions, respectively. Similarly, using the Jones-Dole equation the viscosity data were analyzed to determine the viscosity A and B- coefficient, which have also been interpreted the solute-solute and solute-solvent interaction respectively in the solutions. Molar refractions (R) also signify the solute-solvent interaction; have been calculated from refractive indices by the Lorentz-Lorenz equation. From the ultrasonic speeds, the limiting apparent molar adiabatic compressibilities (ϕ_K^0) of the amino acids at infinite dilution have been evaluated and discussed for the same.

CHAPTER X

This chapter contains the concluding remarks of the works about this thesis.