

CHAPTER: XII

Concluding Remarks

Various interactions such as solute-solute, solute-solvent and solvent-solvent prevailing in aqueous, non-aqueous and mixed solvent systems in various concentration regions has been studied in our research work.

1, 4-dioxane (DO) and tetrahydrofuran (THF) are polar aprotic solvents of low permittivity, each with great present-day synthetic and industrial importance. They are frequently used in electrical conductance studies and in high-energy batteries has sound its application in organic syntheses as manifested from the physico-chemical studies in this medium.

Ethane-1, 2 diol have received increasing attention as a class of substance widely used in different applications. They find a variety of applications in pharmaceutical, cosmetics, food and textiles fields .

Methanol is used as solvent for paints and varnishes, antifreeze for automobile radiators, motor fuel, denaturant for ethanol, etc.

Tetraalkylammonium salts are bulky in nature and are known to orient water molecules around them depending on their alkyl chain. Salts like tetrabutylammonium iodide can give a better insight into the effect of electrostatic and hydrophobic interactions on the stability of vitamins.

Most of the present day knowledge on non-aqueous solutions have come from studies on various thermodynamics properties e.g. apparent molar volumes, adiabatic compressibilities, heat capacities etc. as well as on transport properties, e.g. conductance, viscosity and transference numbers.

The study of apparent molar volumes and apparent molal isentropic compressibilities of electrolyte solutions is very useful to obtain information on ion-ion, ion-solvent and solvent-solvent interactions. The relative magnitude of the limiting apparent molar volumes, and the limiting apparent

Concluding Remarks

molal isentropic compressibilities, would enable us to provide information about the strengths of interactions between ions and solvent molecules. Measurements of the apparent molar volumes as a function of temperature can give an indication of electrostriction or concentration of solvent molecules around an ion.

The excess molar volume (V^E), viscosity deviation ($\Delta\eta$), deviation in isentropic compressibility (ΔK_S), excess molar refraction (ΔR) and excess Gibbs free energy of activation (ΔG^E) of viscous flow have been investigated from the experimentally measured densities, viscosities, sound speeds and refractive indices for three binary mixtures

One of the most precise and direct technique available to determine the extent of the dissociation constants of electrolytes in aqueous, mixed and non-aqueous solvents is the "conductometric method." Conductance data in conjunction with viscosity measurements, gives much information regarding ion-ion and ion-solvent interaction.

The study of conductance measurements were pursued vigorously during the last five decades, both theoretically and experimentally and a number of important theoretical equations have been derived..

From chapter IV it was found that all tetraalkylammonium salts existed as triple ions due to low dielectric constant of the solvent mixtures. However, it was found that the smaller R_4N^+ cations tend to remain more as ion-pairs and exhibits higher tenency to form triple ions than larger ones.

Chapter VI revealed that the experimentally determined viscosities, η_{exp} of the ternary mixture of tetrahydrofuran (A) + methanol (B) + (cyclohexane, cyclohexanone, nitrobenzene) (C), are lower than those of its calculated values, η_{cal} which demonstrates viscous antagonism while for the ternary mixtures of tetrahydrofuran (A) + methanol (B) + (benzene, toluene, chlorobenzene, anisole) (C), the experimentally determined viscosities, η_{exp} are higher than those of its calculated values, η_{cal} which demonstrates viscous synergy.

Concluding Remarks

From the experimentally determined density and viscosity it was found from chapter VI that both sodium molybdate and sodium tungstate shows similar trend of ion-solvent and ion-ion interactions, which can be ascribed to the similar structure of tungstate and molybdate ions. From the values of apparent molar volume (V_{ϕ}^0) and viscosity B - coefficients it may be concluded that ion-solvent interaction increases with increasing temperature and decreases with increasing amount of ethane-1,2-diol in the aqueous mixture. Also the structure breaking tendencies of the two electrolytes were found to be similar.

In chapter VII conductivity studies of tetraalkyl ammonium salts were carried out in various molefractions of carbon tetrachloride and nitrobenzene and it was found that the tetraalkylammonium salts exists as ion-pairs upto 60 mass% of solvent mixture but as the dielectric constant of the solvent mixture decreases in 80 mass% , there is a tendency for triple ion pair formation.

Chapter VIII revealed that the values of apparent molar volume (V_{ϕ}^0) and viscosity B - coefficients for phosphomolybdic acid indicate the presence of strong solute-solvent interactions and these interactions are further strengthened at higher temperature and higher molarity of catechol in the ternary solutions. Also phosphomolybdic acid acts as a water-structure promoter due to hydrophobic hydration in the presence of catechol and catechol has a dehydration effect on the hydrated phosphomolybdic acid.

After a through study of the behavior of alkoxyethanols and iso-amyl alcohol in chapter IX we get a clear idea about the molecular interaction between the components and it was found that the interactions between the solvent molecules increases with the increase in chain length of alkoxyethanols.

It may be concluded from chapter X that in the low mole fraction region of D.C.M, intermolecular interaction between the two components (A.P+A.L), but as the mole fraction of D.C.M in the ternary mixture increases

Concluding Remarks

dispersion forces begins to operate. Thus, it can be said that the addition of D.C.M to binary mixture of A.L+A.P causes a decrease in intermolecular interaction between the mixing components.

Chapter XI dealt with conductivity studies of alkali metal salts in mixed solvents of ethane 1,2-diol and methanol and it was found that It can be concluded that Λ° of sodium salts of common cations follows the sequence $\text{SCN}^{-} > \text{I}^{-} > \text{CH}_3\text{COO}^{-}$ while Λ° of the studied electrolyte is enhanced in the following order: $\text{NaSCN} > \text{NaI} > \text{CH}_3\text{COONa}$.

To conclude, more extensive studies of the different thermodynamic, transport, refractometric and acoustic properties of the electrolytes will be of sufficient help in understanding the nature of the various molecular interactions and the role of solvents in different physico-chemical processes.

The proper understanding of ion-ion and ion-solvent interaction may form the basis of explaining quantitatively the influence of the solvent and the ions in solution and thus pave the way for understanding of different phenomena associated with solution chemistry.