

CHAPTER X

Concluding Remarks

Symmetrical tetraalkylammonium salts show numerous interesting properties that are now being actively investigated in many laboratories. Most of the present day knowledge on non-aqueous solutions has come from studies on various thermodynamic properties e.g., apparent molal volumes, adiabatic compressibilities, heat capacities etc. as well as on transport properties e.g., conductance, viscosity and transference numbers. We therefore determined the thermodynamic and transport properties of some tetraalkylammonium salts in methanol, acetone and its binary mixtures from the measurements of their viscosities, conductances, apparent molal volumes and adiabatic compressibilities since these are potentially capable of yielding more precise information on the nature of interactions taking place in solutions.

The viscosity B-coefficients give us quantitative values of the ion-solvent interactions, but still we have no unambiguous method of division of B-coefficients into ionic B values in all solvents. The use of Bu_4NBPh_4 appears to be sound, but we lack sufficient data measured in different solvents to arrive at a definite conclusion. It is desirable to use different methods of division of B values to have reasonably consistent ionic B values.

Accurate B_{ion} values would give the solvation number of ions. It is known that

$$B_{\text{ion}} = B_{\text{ion}}^{\text{Eint}} + B_{\text{ion}}^{\text{str}} + B_{\text{ion}}^{\text{Lind}}$$

but it is not possible to calculate the individual constituents like $B_{\text{ion}}^{\text{Eint}}$ etc. so that the effect of charges on the nature of solvation can be properly explored. Efforts should be made to know at least $B_{\text{ion}}^{\text{Eint}}$ values experimentally.

Similarly, different methods are to be used to find out the limiting conductances of the ions from the limiting equivalent conductances of electrolytes. Proper evaluation of the limiting equivalent conductance, Λ^0 , the single-ion conductance, λ_{\pm}^0 , the ionic association constant, K_A , and the ion-size parameter a^0 and their dependence on the relative permittivities would be of great help in determining ion-ion and ion-solvent interactions. However, the variation of λ_{\pm}^0 values for ions depend not only on their solvodynamic entity but also on their movement through different solvents. This aspect needs consideration and further study.

The determination of apparent molar volumes and adiabatic compressibilities of electrolyte solutions is useful as a guide to the structural properties of solutions, particularly in the study of ion-solvent, ion-ion and solvent-solvent interactions. The concentration dependence of these properties can be used to study ion-ion interactions. The relative magnitudes of the limiting apparent molar volumes ϕ_v^0 , and the limiting apparent molar adiabatic compressibilities K_ϕ^0 , 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 contraction of solvent molecules around an ion.

However, it is necessary to remember that ion-solvent interactions are very complex in nature. There are strong electrical forces between the ions and solvents, and it is not really possible to separate them all. Nevertheless, if careful judgement is used, valid conclusions can be drawn in many cases from viscosity, conductivity, apparent molar volume and apparent molar adiabatic compressibility measurements relating to degree of structure and order of the system.

More extensive studies of the different thermodynamic and transport properties of electrolytes will be of immense help in understanding the nature of ion-solvent interactions and the role of solvents in different chemical processes.