The importance of thermodynamic and physical properties in design calculations involving chemical separations, fluid flow and heat transfer has long being recognized in the chemical industry and though the development of sophisticated instrumentation like flow calorimeters, vibrating tube densimeters, continuous dilution dilatometers have considerably simplified the experimental determination of excess enthalpies, molar excess volumes and molar heat capacities, yet the experimental determination of thermodynamic properties have become progressively more difficult and time consuming with each additional component beyond binary mixtures. This has prompted researchers to turn to predictive methods and numerous equations have been derived\(^{1-10}\) for predicting the properties of ternary and higher order multicomponent systems from published binary and pure component experimental data.
The predictive methods do provide reasonably good estimate for non-complexing systems but there is need to develop better predictive expressions and models to describe the more non-ideal complexing systems.

The thermodynamic treatment of complexing systems can be traced back to the ideal associated solution (IAS) model that attributes all deviations from ideality not only to differences in molecular shapes, size, polarity but also to specific interactions between the components; it however, is assumed that the contribution due to chemical interactions far outway those that arise due to the differences in molecular shape, size and polarity. The neglect of non-specific physical interactions in the ideal associated model approach limits the applicability of this model to systems having very strong specific interactions and to a few select weaker associating systems.

Acree in a series of papers have addressed the problem associated with the incorporation of both specific and non-specific interactions into various associated solution model and has observed that these equations provide fairly reasonable estimates of excess molar enthalpies and excess volumes for acetone + chloroform + cyclohexane systems and significant deviations between calculated and observed values were noted at several of the ternary compositions studied. The failure of this approach could result from incorrect description of physical interactions...
or from the formation of the higher order molecular complex or from the configurational entropic contribution being expressed in terms of mole fraction (Raoult's Law) rather than volume fraction (Flory-Huggins model) composition. These concerns can be addressed partially by studying the influence of shape and size of inert hydrocarbon (that cover approximately a two-fold range in molar volumes) cosolvent on the calculated association parameters for complex formation. In this connection tribromomethane has recently been postulated\textsuperscript{18,19} to form 1:1 molecular complex with 2-propanone. It would therefore be interesting to develop an appropriate model for such ternary systems as 2-propanone + tribromomethane + cyclohexane, + n-hexane, + n-heptane and + n-decane and to examine how these expressions express the molar excess volumes and excess enthalpies data of these ternary systems.

Huggins\textsuperscript{22} in (1971) suggested that interaction between molecular surface of the components of binary mixtures should play an important role in determining the thermodynamic excess properties of binary mixtures of non-electrolytes. Since molar volume is a constitutional property of a molecule and as the constitutional formulae of a chemist is actually a special kind of graph\textsuperscript{23} and as very good correlation\textsuperscript{24-28} has been observed between the topological index of molecule and its physico-chemical properties, it appears topological index of a molecule and Huggins
concept for interactions between molecular surface can be synthesized to develop expressions that should reproduce reasonably well molar excess volumes and molar excess enthalpy data of binary and ternary mixtures of non-electrolytes.

Again though ion exchange is essentially a surface phenomenon, yet no account has been taken for surface effects similar to those used to measure adsorption from liquid mixtures on solids. Further, no predictive approach is available that predicts reasonably well, the separation of binary i/k ion exchange systems when the separation data of such binary ion systems as j/i and j/k are available. Again, very few studies have been made on thermodynamics of ternary ion exchange systems. Myers and Byington have suggested that there exists a correlation between isotherms for physical adsorption of gas mixture on heterogenous surface and ion exchange isotherms and that it is possible to predict separation of binary ion exchange i/k when separation for j/i and j/k binary ion systems are known. It would, therefore, be worthwhile to study the ion exchange of ternary (i+j+k) ion system and the five contributing sub-binary (i+j) mixtures on amberlite IR-120 (Na) and to analyse the data in terms of Myers and Byington approach and also to understand not only the role of energetics and heterogeneity of exchanger surfaces but also of film diffusion and particle diffusion in ion-exchange processes.
REFERENCES

25. A. Cayley, Phil. Mag., 67, 444 (1874).
