

Enthalpic Discrimination of Chiral Compounds of Electrolytes and Non-Electrolytes in Solution

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Enantiomers are unique molecules that have extensive effects throughout several aspects of organic chemistry, biology and pharmacology. The human body being amazingly chiral selective, will interact with each racemic drug differently and metabolize each enantiomer by a separate pathway to produce different pharmacological activity. Thus, one isomer may produce the desired therapeutic activities, while the other may be inactive or, in worst cases, produce unwanted effects. As a result, chiral drugs have generated considerable interest in recent times. Hence physicochemical studies of model compounds in solutions are of fundamental importance in understanding the different aspects of chiral compounds. In order to understand the mechanisms of molecular discrimination and molecular behaviors of biological and biomimic systems on the bases of intermolecular interactions and conformations of stereo specific molecules, model compounds have been studied by calorimetry. The study can be divided into two categories; (I) study with chiral compounds, which are in liquid state, and (II) chiral compounds, which are solids. Mixing of liquid enantiomers gives the opportunity to study direct interaction between them. On the other hand interaction of solution of solid enantiomers provides the opportunity to take account the effect of solvent on the structure of enantiomers. All observed systems showed a very small enthalpy change for 33 liquid systems and 5 solids systems at 298.15K. Five liquid systems were slightly exothermic showing slight enthalpic stabilization, whereas the other 25 systems were endothermic, showing a small enthalpic destabilization on mixing at 298.15K. The intermolecular interactions between heterochiral compounds were discussed. There is very little literature on the mixing enthalpies in solution. In order to understand enthalpic chiral discrimination in the solution, excess enthalpies of mixing of carboxylic acids have been measured in aqueous and ethanol solution over the whole range of composition. All enthalpies of mixing were exothermic over the whole mole fraction. Enthalpic stabilization on mixing of two heterochiral solutions decreased with increasing the concentration of the carboxylic acids. Concentration dependence of the excess enthalpies of mixing and sequence of stability on mixing at different concentrations will be discussed.