A Study on Acid-Base Equilibria in (N-Butylamine + Acetic Acid) Systems in Binary (Dimethyl Sulfoxide + 1,4-Dioxane) Solvent Mixtures

L. Chmurzynski,[C,S] M. Czaja, and M. Makowski
Department of General Chemistry, University of Gdansk, Gdansk, Poland
lech@chem.univ.gda.pl

The importance of problems related to acid-base interactions rests on their widespread occurrence in both living and inanimate nature. The acid-base equilibria, together with ongoing processes of hydrogen bond formation, are crucial for the formation of structures of biomolecules and biochemical reactions, as shown by the rapidly increasing number of reports on this subject. Although research in this area has been conducted for many years now, no coherent picture of these interactions has been obtained to date. On the other hand, in analytical chemistry, there is an upsurge of interest in binary solvent systems in which solvent-solvent interactions are mostly responsible for modulating the properties of these mixtures.

In this study, the acidity constants of molecular and cationic acid, as well as the equilibrium constants of anionic homoconjugation, cationic homoconjugation, and molecular heteroconjugation have been determined in (n-butylamine + acetic acid) systems without proton transfer in binary [dimethyl sulfoxide (DMSO) + 1,4-dioxane (D)] solvent mixtures. Potentiometric measurements were carried out on the experimental molecular systems, the direct (B + HA) and the reverse (HA + B), where HA denotes acetic acid and B, n-butylamine, in mixed solvent systems of varying mole fractions of diluent (D) in the principal solvent (DMSO). The constants were determined using the potentiometric titration method at a fixed ionic strength. It has been concluded that the molecular heteroconjugation constants in the mixed solvent systems studied are linearly related to the 1,4-dioxane content. Furthermore, in the acid-base systems without proton transfer, the direction of titration (direct B + HA or reverse HA + B) has been found to affect the precision of the determination of the reliable values of molecular heteroconjugation constants.