

The Use of Ionic Liquids as Solvents in Separating Organic Liquids and the Importance of Solubility in these Separations

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Ionic Liquids offer a new and exciting range of solvents for both extractive distillation and solvent extraction processes for separating organic liquid mixtures. In this work a number of ionic liquids are used to investigate the separation of organic liquid mixtures such as aromatic compounds from aliphatic compounds. The ionic liquids include: [HMIM] BF₄⁻, [HMIM] PF₆⁻, [BMIM] PF₆⁻, [OMIM] Cl⁻, [BMPY] BF₄⁻, [EMIM] I₃⁻, [BMIM] I₃⁻, [EMIM] C₈H₁₇SO₄⁻, [BMIM] CH₃(OC₂H₄)₂SO₄⁻ and phosphonium ionic liquids - trihexyl-tetradecyl phosphonium chloride or tris(pentafluoroethyl)trifluorophosphate. The tie-lines of ternary phase diagrams are used to determine the selectivity of each ionic liquid for a particular separation process and the efficacy of each ionic liquid is then predicted. Although these selectivity values are important they must be looked at with other phase diagram properties in mind, such as the magnitude of the partially miscible region and their solubility, when considering commercial separation. The ternary phase diagrams are dependent on the mutual solubilities of the three components involved. These solubilities can be used to predict crude phase diagrams and tie-line data for any ionic liquid – organic liquid mixtures. The phase equilibria and solubility data, discussed in this work, have been obtained in the author's laboratory and from data reported in the literature. The results in this work have also been extrapolated to predict the molecular structures of potentially more effective ionic liquids for the separation processes discussed here. These selectivities also have a bearing on the efficacy of ionic liquids in separating liquids using extractive distillation. Activity coefficients at infinite dilution of organic liquid solutes in Ionic Liquid solvents have also been measured in order to predict the possibility of using these Ionic Liquids as solvents in extractive distillation processes. The results of our work and those of other workers are discussed in this work and related to the conclusions obtained from the phase equilibria work. The importance of the solubility of the ionic liquids is stressed in this work.