

Salting-Out Effects in Aqueous Solutions of [Bmim][BF₄]

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Salts are widely used in aqueous 2-phase partitioning processes as they possess high water-structuring ability that might provoke phase separation that has various chemical, biochemical and biological applications [ref.1-3 and references therein]. On the other hand, ionic liquids have gained importance as useful alternatives to volatile organic solvents (VOCs).

Aqueous solutions of [bmim][BF₄] were the subject matter of a detailed thermodynamic research in our laboratory [4]. As a natural continuation of this program, in the present work the effects of several inorganic salts, namely NaCl, Na₂SO₄, and Na₃PO₄ on the liquid-liquid (L-L) phase diagram of aqueous solutions of [bmim][BF₄] were studied. In the case of all three aforementioned salts, a salting-out effect leading to an upward UCST shift was observed. This effect mainly depends on the kosmotropic nature of the salt. For the same initial binary ([bmim][BF₄]+water) solution of near-critical composition the comparison of salting-out effects showed that the hydration ability of the salts increases following the order NaCl, Na₂SO₄, Na₃PO₄; the effect is commensurate with the ionic strength increase and, consequently, with the Gibbs free energies of hydration of these salts. The latter were calculated using published [5] molar Gibbs free energies of hydration of related cations and anions and also took into consideration the pH values measured for the studied solutions. NMR analyses showed that, even in the case of high pH values of the solutions (Na₃PO₄ as the inorganic salt in the solvent), the imidazolium-ring of the ionic liquid did not lose its acidic proton.

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