

## Liquid-Liquid Extraction of Ethanol and 1-Butanol from Water using Imidazolium Based Ionic Liquids

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Separation of organics from aqueous solutions, as is frequently encountered in recovery of products from fermentation, usually requires energy intensive distillation. Here we explore the potential use of ionic liquids 1-hexyl-3-methylimidazolium bis-(trifluoromethylsulfonyl)imide, 1-(6-hydroxyhexyl)-3-methylimidazolium bis-(trifluoromethylsulfonyl)imide, and 1-hexyl-3-methylimidazolium tris(pentafluoroethyl)trifluoro-phosphate to remove alcohols from aqueous solutions using ionic liquids. Ionic liquids are low melting salts that exhibit negligible volatility at ambient conditions. Therefore, the recovered alcohol could be removed from the ionic liquid extraction solvent in a single evaporation stage. The general feasibility of separating water and alcohols using ionic liquids has been shown previously (Fadeev 2001). Ternary diagrams are necessary in order to optimize the design liquid-liquid separations. Ternary diagrams of systems with water and alcohols for various ionic liquids were developed, measuring all three components of each phase. Further the Hunter-Nash method was used to determine the number of stages that would be required in order to separate water and alcohols using a liquid-liquid extractor. Replacing distillation with liquid-liquid extraction could reduce energy consumption and make the production of alcohols cheaper and more environmentally sound. To that end, this study also measured enthalpies of mixing for mixtures of these ionic liquids and alcohols. With this data, we use a thermodynamic cycle to calculate the energy required to evaporate the alcohol from the ionic liquid and compare this to energy requirements for conventional distillation.

Fadeev, A. G.; Meagher, M. M., Opportunities for Ionic Liquids in Recovery of Biofuels. *Chem. Comm.* **2001**, 295-296