Imidazolium-based Ionic Liquids in Aqueous Biphasic Systems for Biomolecule Extraction

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Liquid-liquid extraction has often been a favored alternative in process engineering for separation issues. Nevertheless, environmental concerns around the use of volatile organic compounds have driven intensive research into finding "greener" extraction solvents. One promising approach is the employment of ionic liquids (ILs) [1] that exhibit negligible vapor pressures at atmospheric pressure. *Inter alias*, ILs are composed exclusively by ions, allowing the independent selection of both the cation and/or the anion and therefore the fine-tuning of their thermophysical properties and solvation/extraction performance.

Aqueous biphasic systems (ABS) containing ILs could be especially interesting in biotechnological applications for the separation and purification of vital biomolecules. Therefore, in this work, a systematic study involving a large number of imidazolium-based ILs was conducted to provide new information related to the ILs' ABS promoting capability and extraction ability. For that purpose, the influence of the anion nature, such as bromide, chloride, methylsulfate, ethylsulfate, trifluoromethanesulfonate (triflate), dicyanamide, trifluoroacetate, methylsulfonate and hydrogenosulfate, as well as the cation structure such as the number of substituted alkyl groups, the cation side alkyl chain length, and the presence of double bonds, aromatic rings and hydroxyl groups on this alkyl chain was evaluated. Phase diagrams of the ABS formed by these ILs and K_3PO_4, and the respective tie-lines, were measured and will be presented. The binodal data and respective tie-lines were further adjusted using an empirical mathematical approach [2]. In addition, the ABS here investigated were also characterized according to their extractive potential of amino acids, where L-tryptophan was selected as a model biomolecule. The partition coefficients obtained were shown to be substantially larger than those observed in conventional polyethylenoglycol-based ABS systems, demonstrating therefore the great potential of the IL-based ABS for biomolecule separation and purification in one single step procedure.

[1] Gutowski, K.E., Broker, G. A., Willauer, H. D., Huddleston, J. G., Swatloski, R. P., Holbrey, J. D., Rogers, R. D., *J. Am. Chem. Soc.* 125 (2003) 6632.
[2] Merchuk, J. C.; Andrews, B. A.; Asenjo, J. A. *J. Chromatogr. B* 711 (1998) 285.