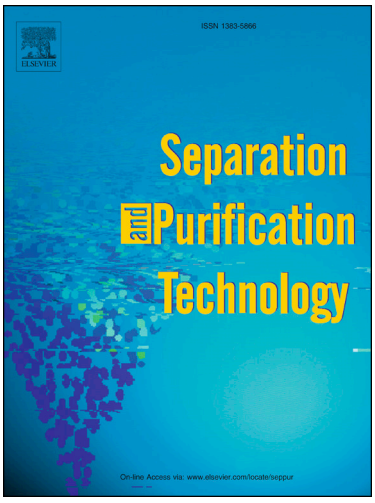

Evaluation of the effect of ionic liquids as adjuvants in polymer-based aqueous biphasic systems using biomolecules as molecular probes

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EVALUATION OF THE EFFECT OF IONIC LIQUIDS AS ADJUVANTS IN POLYMER-BASED AQUEOUS BIPHASIC SYSTEMS USING BIOMOLECULES AS MOLECULAR PROBES

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Abstract

Aqueous biphasic systems (ABS) have been largely investigated for the extraction, separation and/or purification of biomolecules. Recently, the use of ionic liquids (ILs) as additives in conventional polymer-based ABS was proposed to overcome the limited range of polarities of the coexisting phases. However, the impact of ILs on the partitioning of biomolecules on IL additivated ABS is not universal and is still poorly understood. Aiming at obtaining additional insights on this matter, the effects of the chemical structure of the IL, tie-line length (TLL) and biomolecule nature upon the partition of a series of model biomolecules were investigated. For this purpose, ternary ABS (composed of polyethylene glycol (PEG) 400, citrate buffer at pH 7.0, and water), and several quaternary ABS (composed of PEG 400, citrate buffer at pH 7.0, water and ILs at 5 wt%), were prepared using different chloride-based ILs ([C_4mim]Cl, [C_4mpyr]Cl, [C_4mpip]Cl, [P_{4444}]Cl and [N_{4444}]Cl). The partition of a wide range of biomolecules in these systems (gallic acid, vanillic acid, eugenol, nicotine, caffeine, L-tryptophan, L-phenylalanine and L-tyrosine), used here as molecular probes, was studied. These solutes were chosen due to their wide range of polarities. The results obtained support the concept that ILs, when used as adjuvants in polymer-based ABS, change the coexisting phases' characteristics and modify the partition behavior of biomolecules. In general, a positive effect derived from the use of ILs as adjuvants in PEG-salt systems is observed, particularly when dealing with more hydrophobic biomolecules, whereas IL + salt ABS perform better in the extraction of more hydrophilic biomolecules. The favourable partition of more hydrophilic biomolecules in IL + salt ABS seems to be ruled by specific interactions with the IL, while the favourable partition of more hydrophobic biomolecules in PEG + salt and PEG + salt + IL seems to be governed by the differences in the phases hydrophobicities. It is shown that ILs