pH-Driven Reversible Aqueous Biphasic Systems Composed of Ionic Liquids

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Recently, a large interest has been devoted to the exploitation of dynamic and reversible biphasic systems constituted by ionic liquids (ILs) [1]. It was previously demonstrated that mixtures involving ILs and other solvents can be switched between the homogeneous regime and a two-phase system either by a temperature-driven phenomenon or by adding CO_2/N_2 [1]. These systems have shown to be remarkable in the selective separation of several value-added compounds, such as proteins [1]. Amongst the liquid-liquid extraction techniques, aqueous biphasic systems (ABS) constitute a "greener" and more benign and biocompatible option since they are mainly composed of water (ca. 50 wt%). Furthermore, these systems can lead to the complete extraction of a wide variety of compounds and to high concentration factors [2]. In addition to all the advantages and enhanced performance of IL-based ABS, their switchable character between a two-phase and a homogeneous regime was not previously attempted. The major goal of this work consists on the exploitation of switchable IL-based ABS triggered by a pH-dependent phenomenon. A large array of ABS, obtained by the combination of potassium citrate with different ILs, was initially investigated by the determination of their ternary phase diagrams at different pH values. The first set of reversible IL-based ABS was ascertained by the addition of citric acid or potassium hydroxide and through the organic salt speciation. Their reversibility behaviour was demonstrated for at least 3 times. In addition to IL-salt mixtures, polymer-IL-based ABS were also investigated while reaching their switchable behaviour through the IL anion speciation. Finally, these ABS were explored as fractionation techniques for amino acids and peptides.

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