

Homogeneous Liquid-Liquid Extraction of Metal Ions with a Functionalized Ionic Liquid

Supporting Information

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Experimental section

Lithium bis(trifluoromethylsulfonyl)imide (> 99%) and hydrogen bis(trifluoromethylsulfonyl)imide (80 wt.% aqueous solution) were purchased from Iolitec (Heilbronn, Germany). All other chemicals were obtained from Sigma-Aldrich or Acros. The ionic liquid betainium bis(trifluoromethylsulfonyl)imide was synthesized following a literature procedure, by reaction between betainium hydrochloride and lithium bis(trifluoromethylsulfonyl)imide.¹ The metal bis(trifluoromethylsulfonyl)imides were synthesized by reaction of hydrogen bis(trifluoromethylsulfonyl)imide, HTf₂N, with an excess of a metal oxide. After reaction, the excess of metal oxide was removed by filtration. Metal bis(trifluoromethylsulfonyl)imides were prepared for the following ions: La³⁺, Pr³⁺, Nd³⁺, Dy³⁺, Ho³⁺, Er³⁺, Y³⁺, Sc³⁺, In³⁺, Ga³⁺, Mn²⁺, Ni²⁺, Cu²⁺, Zn²⁺ and Ag⁺. Extraction experiments were performed with aqueous solutions with metal concentrations varying between 800 and 13100 mg/kg, with a concentration of 1500 mg/kg as the most often used one. To quantify the metal content, a benchtop total reflection X-ray fluorescence (TXRF) spectrometer (Picofox S2, Bruker) was used. The extraction experiments were performed with small vials in a temperature-controllable compact benchtop thermomixer (thermo-shaker). More information on the extraction conditions has been given in the main text.

(1) Nockemann, P.; Thijs, B.; Pittois, S.; Thoen, J.; Glorieux, C.; Van Hecke, K.; Van Meervelt, L.; Kirchner, B.; Binnemans, K. *J. Phys. Chem. B* **2006**, *110*, 20978.

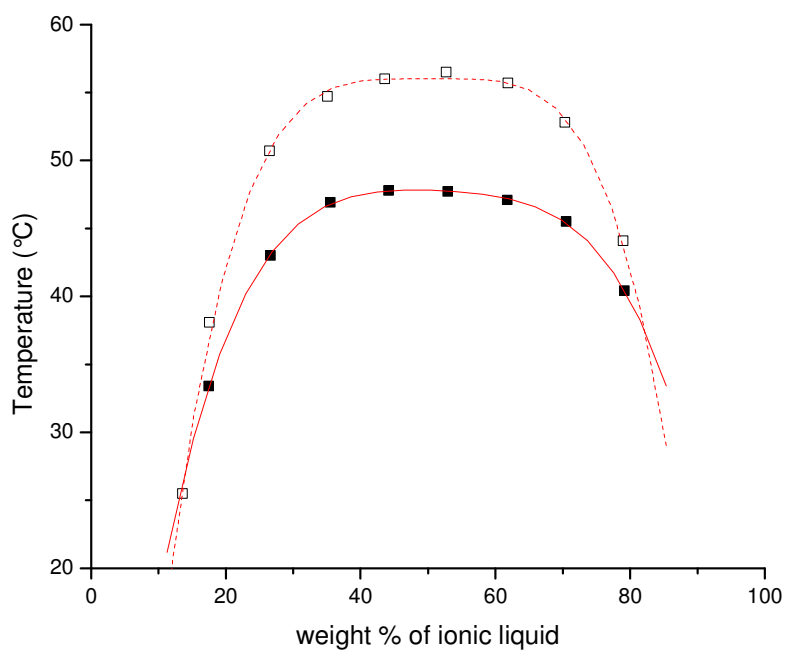


Figure S1. Phase diagram of the [Hbet][Tf₂N]-water solvent system: □ original system, ■ with 10 wt.% betaine in the aqueous phase.

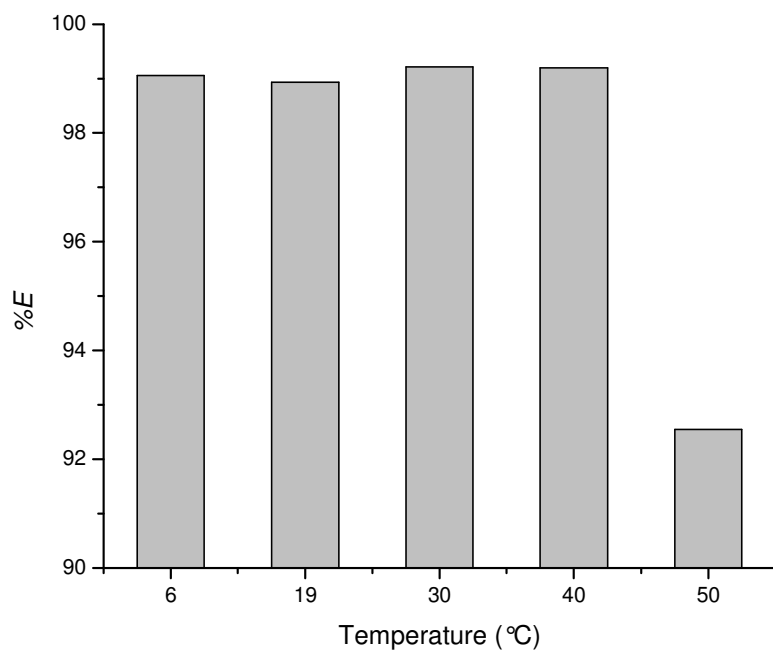


Figure S2. Extraction efficiency in function of the temperature to which the extraction mixture is cooled after the homogeneous stage of the extraction of Nd^{3+} from bis(trifluoromethylsulfonyl)imide medium in the $[\text{Hbet}][\text{Tf}_2\text{N}]\text{-H}_2\text{O}$ system, with zwitterionic betaine as an extraction agent.