Electronic Supplementary Information (ESI)

Extraction of gallium from simulated Bayer process liquor by Kelex 100 dissolved in ionic liquids

Stijn Raiguel[†], Wim Dehaen[†], Koen Binnemans[†]*

[†] KU Leuven, Department of Chemistry, Celestijnenlaan 200F, P.O. box 2404, B-3001 Leuven, Belgium.

*Corresponding author:
Email: Koen.Binnemans@kuleuven.be

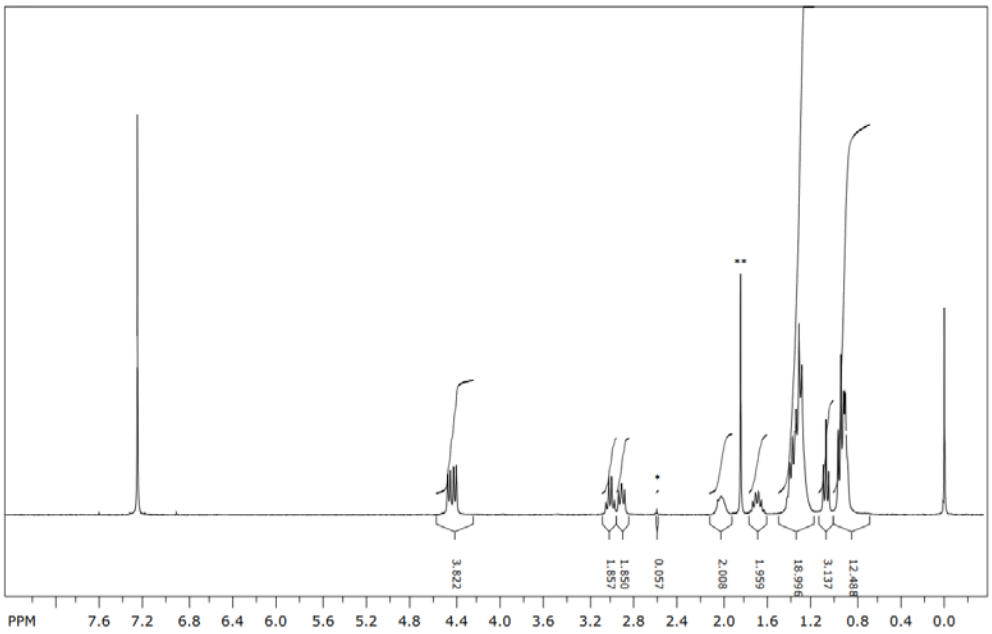

Fig. S1: [1]H NMR spectrum of 1,3-bis(2-ethylhexyl)-4-methyl-5-propyl-1,2,3-triazolium sulfate. Also visible: residual methanesulfonate (, 2 mol%) and water (**).*

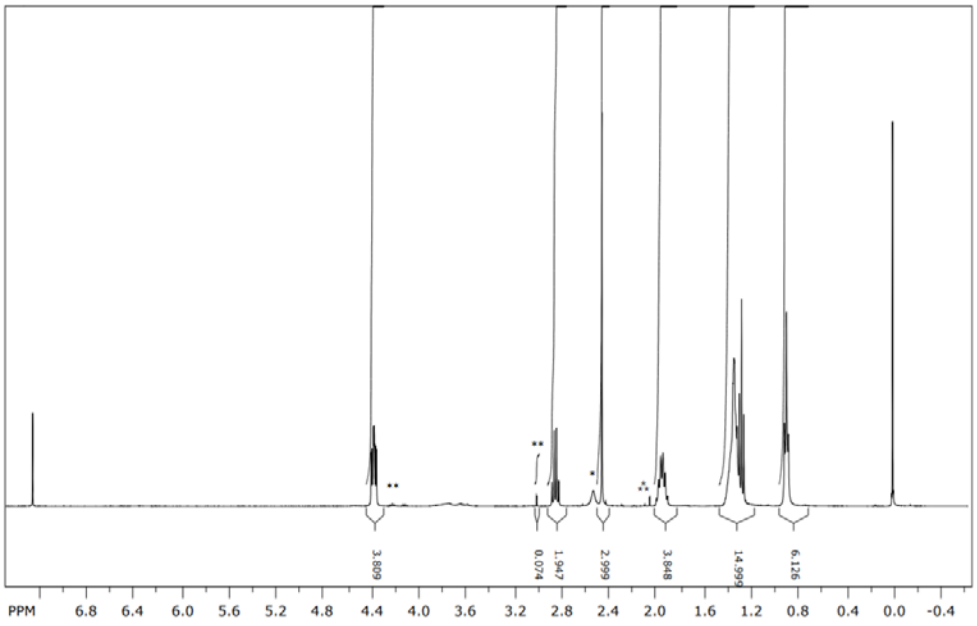

Fig. S2: [1]H NMR spectrum of 1,3-bis(2-ethylhexyl)-4-methyl-5-propyl-1,2,3-triazolium sulfate. Also visible: residual water (*), hexylmethanesulfonate (, 2 mol%) and residual acetone in sample tube (⁂)*

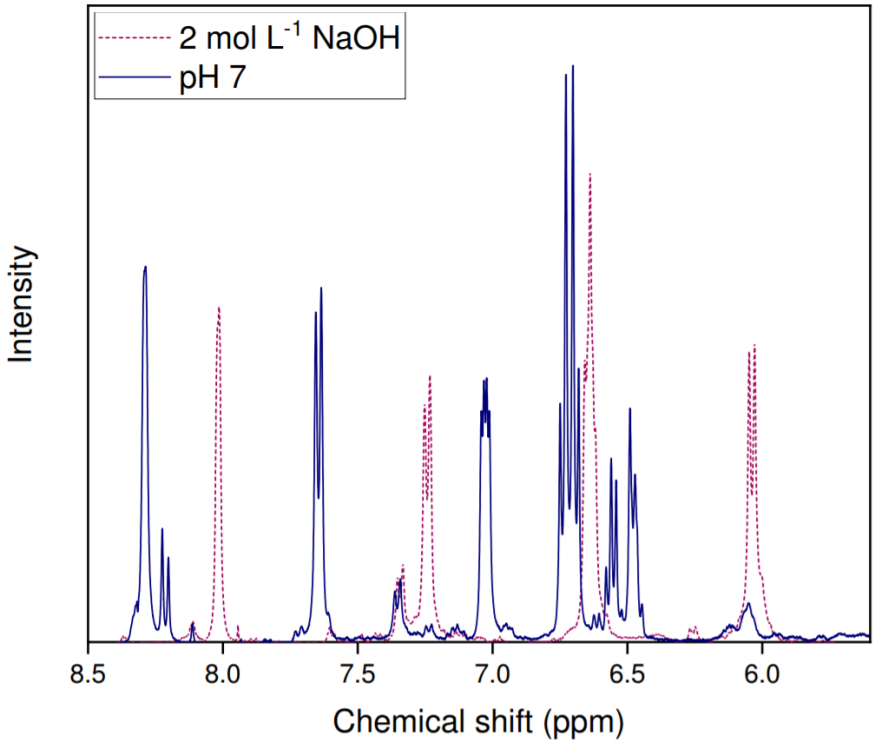

Fig. S3: ^{1}H NMR spectra of Kelex 100 (aromatic region) in $[EhEhT_{23}]_2[SO_4]$ after contact with demineralized water (pH 7) and 2 mol L^{-1} sodium hydroxide,. showing the broadening and upfield shift caused by saponification.

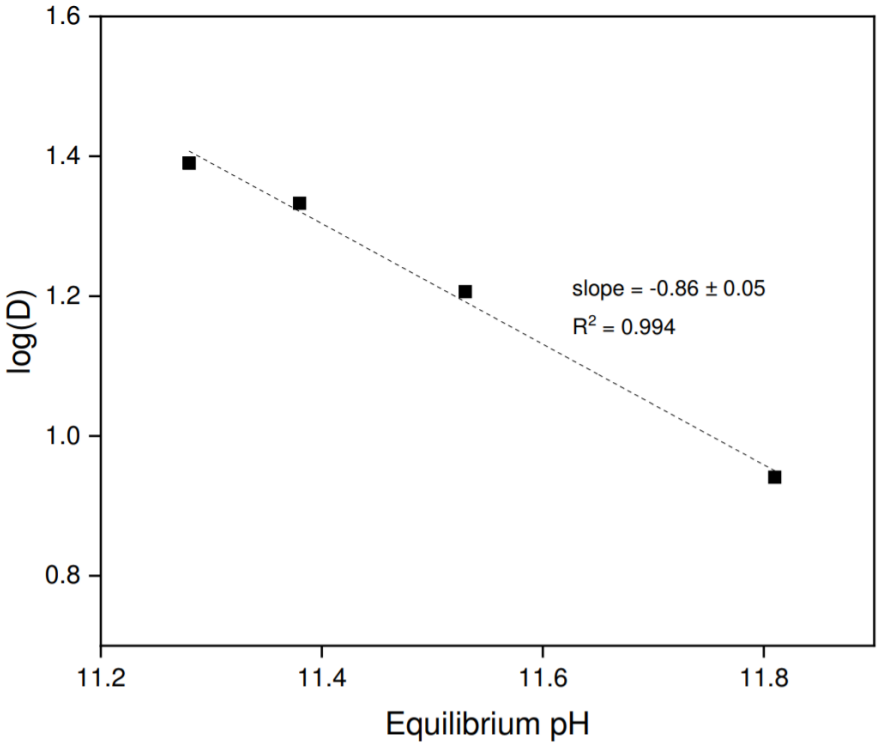

Fig. S4: Variation of the logarithmic distribution ratio of gallium with the equilibrium pH value for 200 ppm solutions extracted from 1.700 mol L^{-1} sodium carbonate by 0.124 mol/mol Kelex® 100 in $[EhEhT_{23}]_2[SO_4]$. Phase ratio: 1:2 organic to aqueous. The HLLE procedure was followed.

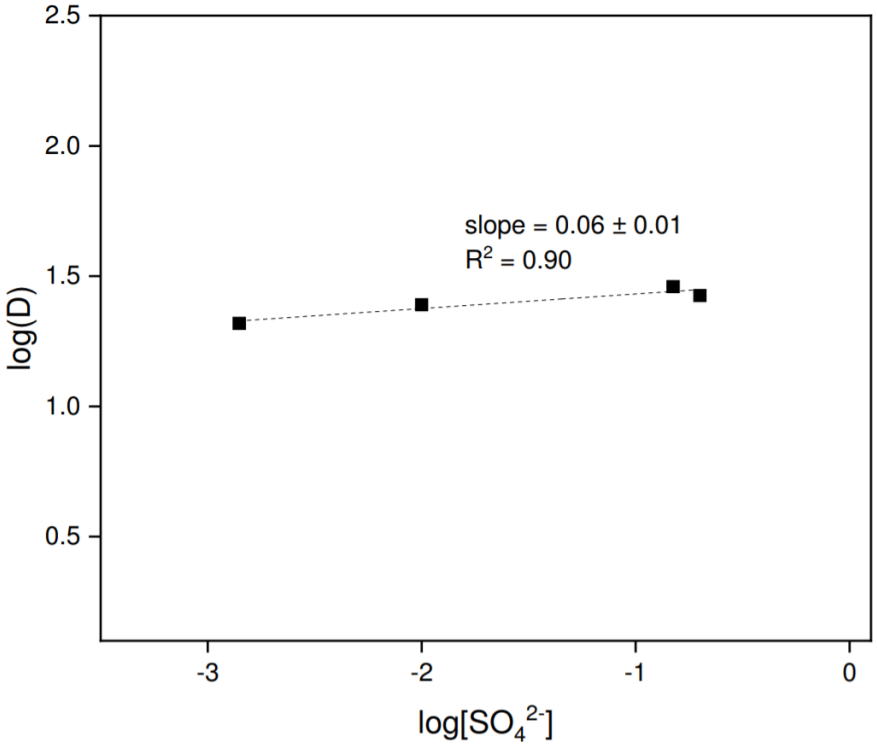

Fig. S5: Variation of the logarithmic distribution ratio of gallium with the logarithmic sulfate concentration for 200 ppm solutions extracted from 1.700 mol L^{-1} sodium carbonate by 0.124 mol/mol Kelex® 100 in $[EhEhT_{23}]_2[SO_4]$. Phase ratio: 1:2 organic to aqueous. The HLLE procedure was followed.

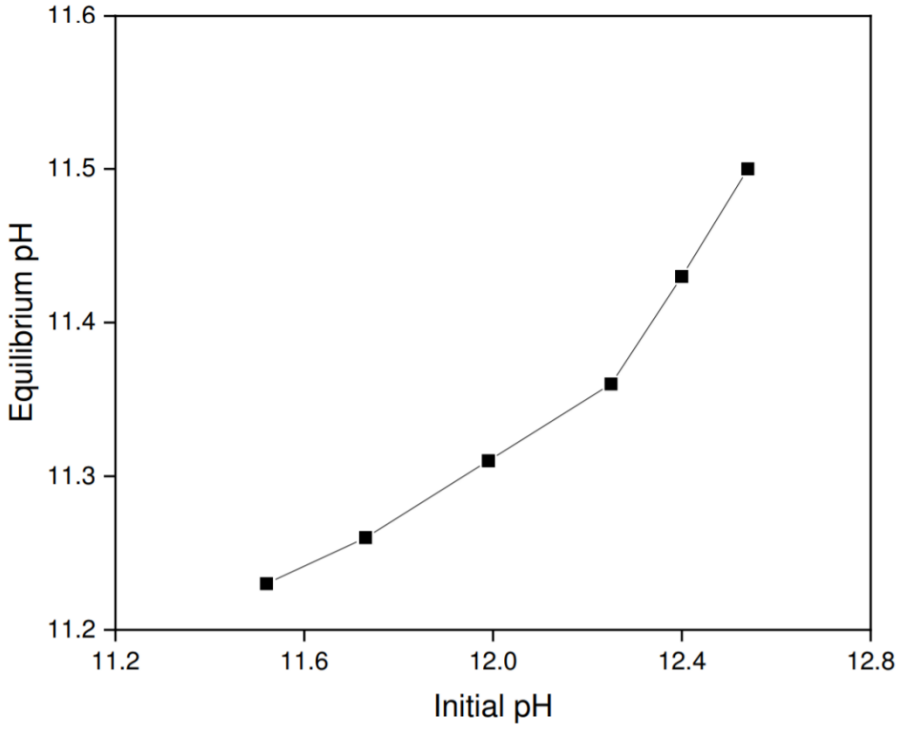

Fig. S6: Variation of the aqueous phase pH upon extraction of gallium and aluminum (200 ppm each) from carbonate solutions (1.700 mol L^{-1}) by 5 vol% Kelex 100 in $[EhEhT_{23}]_2[SO_4]$.

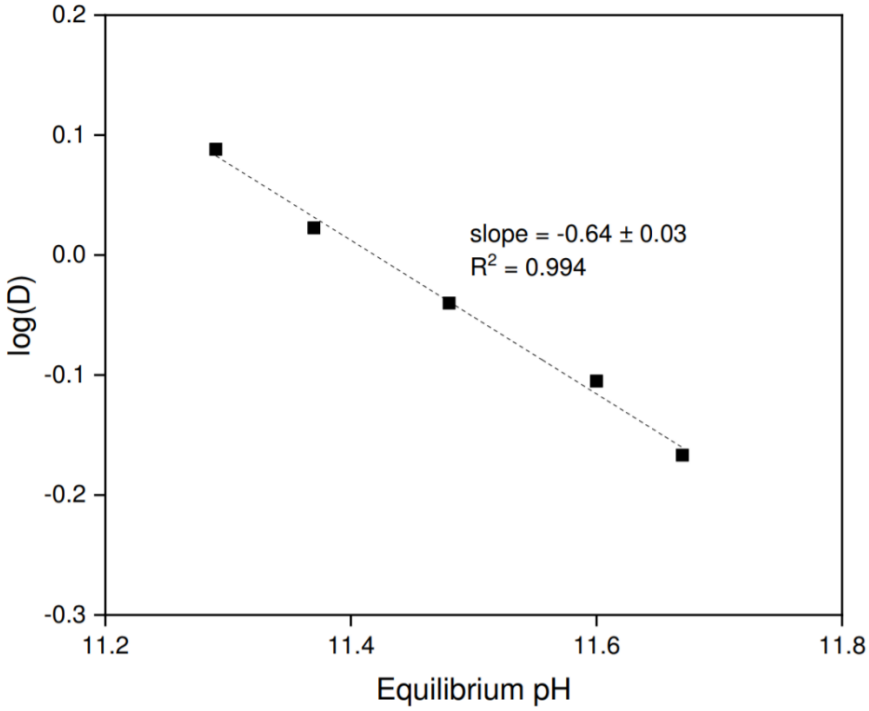

Fig. S7: Variation of the logarithmic distribution ratio of aluminum with the equilibrium pH value for 200 ppm solutions extracted from 1.700 mol L^{-1} sodium carbonate by 0.124 mol/mol Kelex® 100 in $[EhEhT_{23}]_2[SO_4]$. Phase ratio: 1:1. The HLLE procedure was followed.

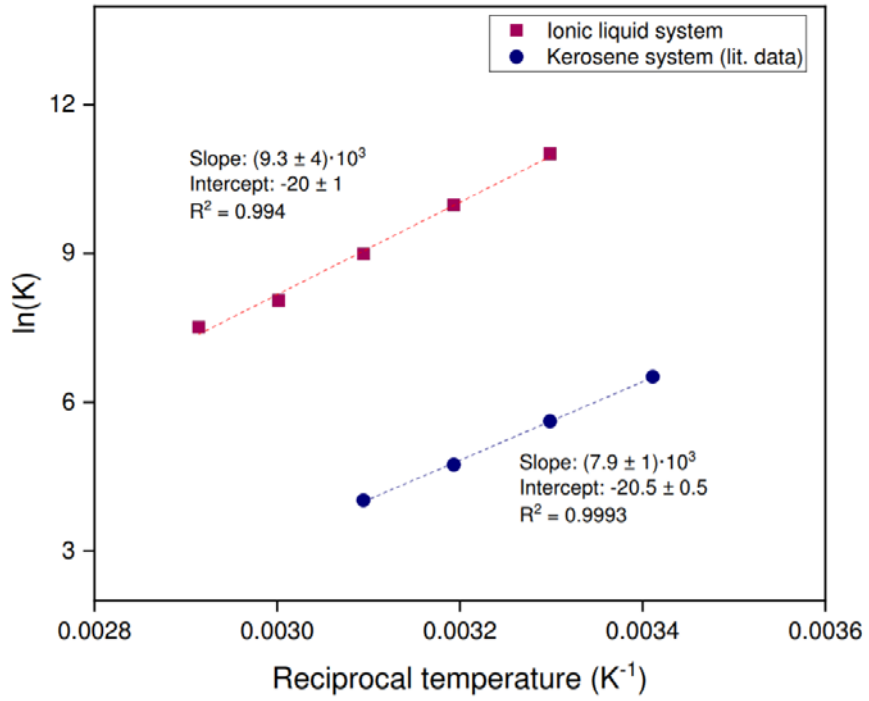

Fig. 11: Variation of the natural logarithm of the equilibrium constant of gallium extraction reciprocal temperature for 200 ppm solutions extracted from 2.000 mol L^{-1} sodium hydroxide by 5 vol% Kelex® 100 in $[HHT_{12}][Tf_2N]$ modified with 10 vol% 1-decanol. Phase ratio: 1:2 (organic to aqueous). Also shown are literature data for extraction of gallium by 5 vol% Kelex® 100 in kerosene modified with 10 vol% 1-decanol from 2 mol L^{-1} sodium hydroxide, collected from Sato and Oishi.[1]

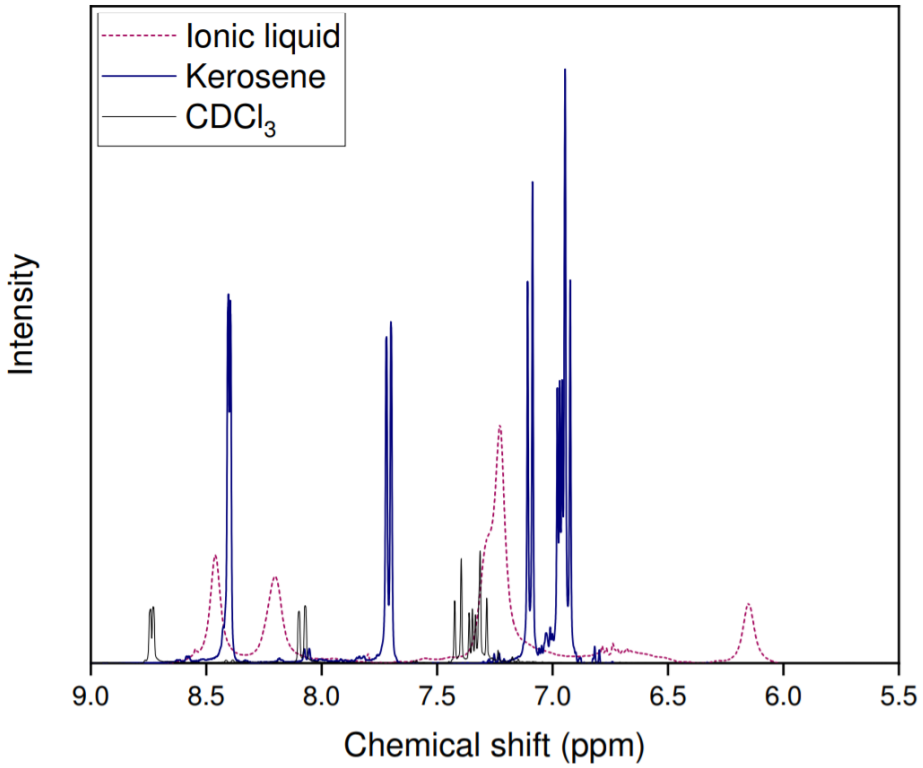

Fig. S9: ^{1}H NMR spectra of Kelex 100 (aromatic region) in [HHT$_{12}$][Tf$_2$N] modified with 10 vol% 1-decanol (ionic liquid), in kerosene modified with 10 vol% 1-decanol and in chloroform-d. Broadening of the signals in the ionic liquid is a result of the viscosity of the medium.

Reference

1 T. Sato and H. Oishi, *Hydrometallurgy*, 1986, 16, 315–324.