First evidence of metal transfer into hydrophobic deep eutectic mixtures: Indium extraction from hydrochloric and oxalic acids

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The near-critical and strategic metal, indium, has been successfully extracted from hydrochloric and oxalic acid media into quaternary ammonium- and menthol-based eutectic mixtures with carboxylic acids. This is the first report on metallic species transfer from aqueous solution into hydrophobic deep eutectic mixtures.

Transfer of indium was carried out from hydrochloric and oxalic acid solutions. Three DESs composed of quaternary ammonium chloride and fatty acids, namely decanoic and oleic acids, and ibuprofen provide very quick and efficient metal extraction in the range of 0.01 – 10.2 M HCl (Fig. 1) and

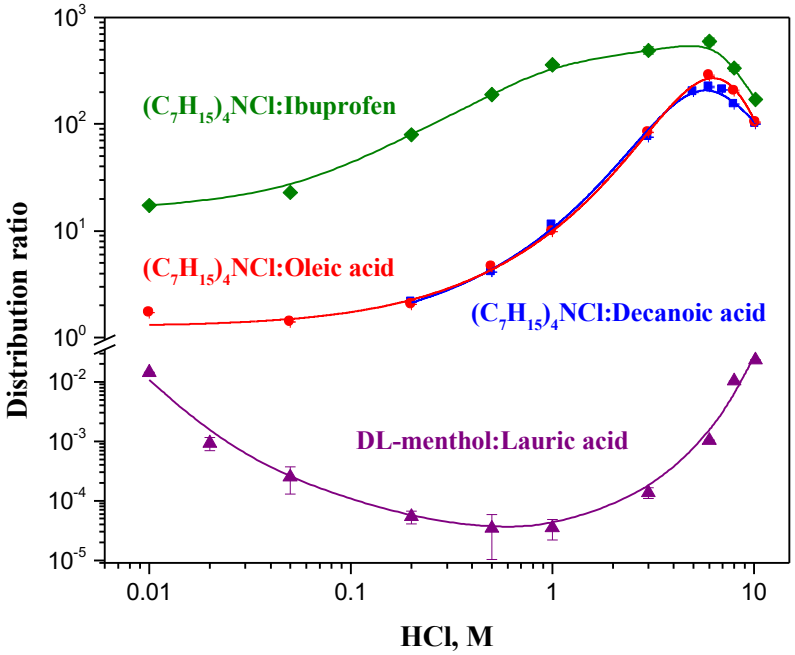

FIG. 1. Effect of aqueous hydrochloric acid concentration on the extraction efficiency of In into quaternary ammonium-based hydrophobic DESs. Lines are drawn to guide the eye.

10^{-7} – $8x10^{-1}$ M oxalic acid (Fig. 2) in the aqueous phase. The DES composed of DL-menthol and lauric acid extracts indium efficiently only from aqueous solutions with low acidity. Back-extraction of In from ammonium-based DESs has been performed using 0.1 M DTPA. The results provide an opportunity for valuable metallic species extraction from an aqueous phase by means of cheap and ecofriendly deep eutectic mixtures. A full publication on these results is currently under review.

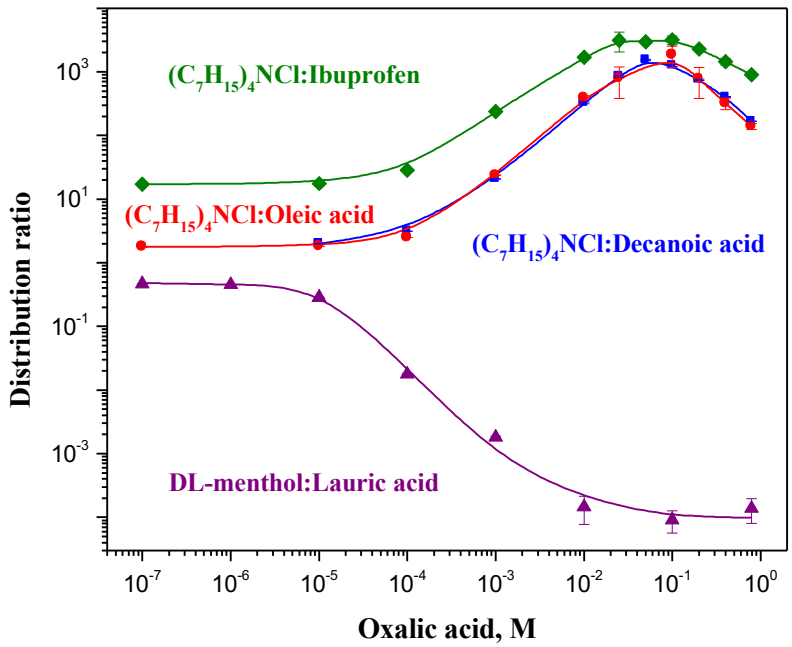

FIG. 2. Effect of oxalic acid concentration on the extraction of In into quaternary ammonium- and menthol-based hydrophobic DESs. The lines are drawn to guide the eye.