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Imidazolium and pyridinium-based ionic liquids for the cyclohexane/cyclohexene separation by liquid-liquid extraction

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ABSTRACT

The separation of olefins/paraffins is a challenge for the petrochemical industry due to the close boiling points of these hydrocarbons. In this work we have studied the feasibility of different imidazolium and pyridinium-based ionic liquids (ILs) as alternative solvents in the cyclohexane/cyclohexene separation. Five ILs have been studied, namely 1-butyl-4-methylpyridinium tricyanomethanide ([4bmpy][TCM]), bis(1-ethyl-3-methylimidazolium) tetrathiocyanatocobaltate ($[emim]_2[Co(SCN)_4]$), bis(1-butyl-3-methylimidazolium) tetrathiocyanatocobaltate ($[bmim]_2[Co(SCN)_4]$), 1-ethyl-4-methylpyridinium bis(trifluoromethylsulfonyl)imide ([4empy][Tf_2N]), and 1-butyl-4-methylpyridinium bis(trifluoromethylsulfonyl)imide ([4bmpy][Tf_2N]). Experimental liquid-liquid equilibrium (LLE) data were obtained for the equimolar ternary mixtures {cyclohexane (1) + cyclohexene (2) + IL (3)} at T = (298.2, 313.2 and 328.2) K and atmospheric pressure in order to study the effect of the temperature on the extractive properties. Afterwards, LLE data for every ternary system was determined at the best temperature and for the whole cyclohexane/cyclohexene composition range. These ILs have shown promising results in terms of distribution ratio and selectivity, showing the [4bmpy][TCM] IL the best extractive properties at 298.2 K and atmospheric pressure. The Non-Random Two Liquids (NRTL) model was used to successfully correlate the experimental LLE data.

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