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Separation of aromatics from *n*-alkanes using tricyanomethanide-based ionic liquids: Liquid-liquid extraction, vapor-liquid separation, and thermophysical characterization

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ABSTRACT

Ionic liquids (ILs) have been extensively studied as replacements to sulfolane in the separation of aromatics from alkanes. The employment of ILs could reduce energy requirements and operating costs of the aromatic extraction unit as a result of their nonvolatile character. However, the ILs studied so far have shown mass-based aromatic distribution ratios lower than the sulfolane values, which would increase the solvent-to-feed ratio in the extractor. To overcome this drawback, we tested the performance of the 1-butyl-3-methylimidazolium tricyanomethanide ([bmim][TCM]) and the 1-butyl-4-methylpyridinium tricyanomethanide ([4bmpy][TCM]) in the separation of toluene from *n*-heptane, exhibiting the [4bmpy][TCM] mass-based toluene distribution ratios and toluene/*n*-heptane selectivities higher than those of sulfolane. We also studied the vapor-liquid recovery of the extracted hydrocarbons from the ILs, obtaining relative volatilities of *n*-heptane from toluene substantially higher in the presence ILs than those without ILs. A thermophysical characterization of the ILs was also made by measuring their densities, viscosities, thermal stabilities, and estimating their maximum operation temperatures. Finally, the regeneration and reuse of the ILs was studied on successive recovery cycles. After five recovery cycles, ILs have shown the same extractive capacity.

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