Fuel Processing Technology 159 (2017) 96–110

Contents lists available at ScienceDirect

Fuel Processing Technology

journal homepage: www.elsevier.com/locate/fuproc

Extraction of aromatic hydrocarbons from pyrolysis gasoline using tetrathiocyanatocobaltate-based ionic liquids: Experimental study and simulation

Marcos Larriba [a], Pablo Navarro [a], Noemí Delgado-Mellado [a], Victor Stanisci [b], Julián García [a,*], Francisco Rodríguez [a]

[a] Department of Chemical Engineering, Complutense University of Madrid, E–28040 Madrid, Spain
[b] Centro de Ciências Naturais e Humanas, Universidade Federal do ABC, Santo André, SP, Brazil

ARTICLE INFO

Article history:
Received 7 December 2016
Received in revised form 18 January 2017
Accepted 18 January 2017
Available online 24 January 2017

Keywords:
Aromatic/aliphatic separation
Ionic liquids
Liquid–liquid extraction
Vapor-liquid separation
Thermophysical characterization
Process simulation

ABSTRACT

The pyrolysis gasoline is one of the main sources of aromatic hydrocarbons as a result of their high content in these compounds. Organic solvents such as sulfolane are currently employed in the extraction of aromatic but the ionic liquids (ILs) have been recently proposed as potential replacement. In this work, we have studied the use of the bis(1-ethyl-3-methylimidazolium) tetrathiocyanatocobaltate ($[emim]_2[Co(SCN)_4]$) and bis(1-butyl-3-methylimidazolium) tetrathiocyanatocobaltate ($[bmim]_2[Co(SCN)_4]$) ILs in the extraction of aromatic hydrocarbons from pyrolysis gasoline. The extractive properties of both tetrathiocyanatocobaltate-based ILs were compared to those of other promising ILs and sulfolane, showing the highest values. To perform the simulation of the whole process, we have experimentally studied the liquid-liquid extraction of aromatics from pyrolysis gasoline and the recovery of the extracted hydrocarbons from the ILs. In addition, a thermophysical characterization of the ionic solvents was performed measuring their densities, viscosities, thermal stabilities, maximum operation temperatures, and specific heats. Employing the experimental data, the extractor was simulated using the Kremser equation whereas the recovery section formed by flash distillation units was simulated using a new algorithm specifically design to the case of a high concentration of non-volatile compounds.

* Corresponding author.
E-mail address: jgarcia@quim.ucm.es (J. García).

http://dx.doi.org/10.1016/j.fuproc.2017.01.027
0378-3820/