Ultra-stable and cost-efficient protic ionic liquid based facilitated transport membranes for highly selective olefin/paraffin separation

Haozhen Dou, Bin Jiang, Xiaoming Xiao, Mi Xu, Baoyu Wang, Li Hao, Yongli Sun, Luhong Zhang

www.elsevier.com/locate/memsci

PII: S0376-7388(17)33524-X
DOI: https://doi.org/10.1016/j.memsci.2018.04.015
Reference: MEMSCI16099

To appear in: *Journal of Membrane Science*

Received date: 16 December 2017
Revised date: 6 April 2018
Accepted date: 10 April 2018

Cite this article as: Haozhen Dou, Bin Jiang, Xiaoming Xiao, Mi Xu, Baoyu Wang, Li Hao, Yongli Sun and Luhong Zhang, Ultra-stable and cost-efficient protic ionic liquid based facilitated transport membranes for highly selective olefin/paraffin separation, *Journal of Membrane Science,* https://doi.org/10.1016/j.memsci.2018.04.015

Ultra-stable and cost-efficient protic ionic liquid based facilitated transport membranes for highly selective olefin/paraffin separation

Haozhen Dou[a1], Bin Jiang[a], Xiaoming Xiao[a], Mi Xu[a1], Baoyu Wang[b], Li Hao[a], Yongli Sun[a], Luhong Zhang[a*]

[a]School of Chemical Engineering and Technology, Tianjin University, Tianjin 300072, China

[b]School of Chemical Engineering and Food Science, Zhengzhou Institute of Technology, Zhengzhou 450000, China

[*]Corresponding author at: School of Chemical Engineering and Technology, Tianjin University, Tianjin 300072, China. Tel./fax: +86 2227400199. zhanglvh@tju.edu.cn (L. Zhang).

Abstract

Facilitated transport membranes (FTMs) for olefin/paraffin separations have failed to achieve commercial success due to the instability of carriers although great efforts have been made. In this work, ultra-stable and cost-efficient protic ionic liquid based FTMs (PIL-FTMs) were firstly prepared by utilizing the Bro□nsted acidic property of PILs to stabilize the carrier. The gas solubility in the carrier/PILs was measured and the separation performances of PIL-FTMs were evaluated systemically. The results indicated that the structure of PILs affected the C_2H_4 permeability and the presence of ether group and hydroxyl group in PILs significantly enhanced the C_2H_4/C_2H_6 selectivity. The carrier concentration led to structural variation of PIL-FTMs, thus manipulating the gas separation performances of PIL-FTMs. The increase of transmembrane pressure decreased C_2H_4 permeability and C_2H_4/C_2H_6 selectivity, indicating a typical feature of FTMs. The increase of temperature increased the C_2H_4 permeability but decreased C_2H_4/C_2H_6 selectivity. The separation performances of PIL-FTMs were much higher than other results in the literature. Furthermore, the PIL-FTMs exhibited excellent stability during the long-term experiments carried out for six months. Finally, the investigation of separation mechanism revealed that the hydrogen-bonding and coordinative interactions between PILs and carrier accounted for the high separation efficiency of PIL-FTMs. In all, the excellent long-term stability, outstanding separation performances and economic feasibility of PIL-FTMs could play an important role in moving these membranes toward industrial application.

[1] contributed equally to this work.