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Ionic Liquid-Based Green Emulsion Liquid Membrane for the Extraction of the Poorly Soluble Drug Ibuprofen

Khan, Huma Warsi^a; Elgharbawy, Amal A. M.^b; Bustam, Mohamed Azmi^{a, c}; Goto, Masahiro^d;

Moniruzzaman, Muhammad^{a, c} ✉

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^a Department of Chemical Engineering, Universiti Teknologi PETRONAS, Seri Iskandar, 32610, Malaysia

^b International Institute for Halal Research and Training (INHART), International Islamic University Malaysia, Kuala Lumpur, 53100, Malaysia

^c Center of Research in Ionic Liquids, Universiti Teknologi PETRONAS, Seri Iskandar, 32610, Malaysia

^d Department of Applied Chemistry, Graduate School of Engineering, Kyushu University, 744, Moto-oka, Fukuoka, 819-0395, Japan

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Screening of ionic liquids as green entrainers for ethanol water separation by extractive distillation: COSMO-RS prediction and aspen plus simulation

Abstract

Ibuprofen (Ibf) is a biologically active drug (BADs) and an emerging contaminant of concern (CECs) in aqueous streams. Due to its adverse effects upon aquatic organisms and humans, the removal and recovery of Ibf are essential. Usually, conventional solvents are employed for the separation and recovery of ibuprofen. Due to environmental limitations, alternative green extracting agents need to be explored. Ionic liquids (ILs), emerging and greener alternatives, can also serve this purpose. It is essential to explore ILs that are effective for recovering ibuprofen, among millions of ILs. The conductor-like screening model for real solvents (COSMO-RS) is an efficient tool that can be used to screen ILs specifically for ibuprofen extraction. The main objective of this work was to identify the best IL for the extraction of ibuprofen. A total of 152 different cation–anion combinations consisting of eight aromatic and non-aromatic cations and nineteen anions were screened. The evaluation was based upon activity coefficients, capacity, and selectivity values. Furthermore, the effect of alkyl chain length was studied. The results suggest that quaternary ammonium (cation) and sulfate (anion) have better extraction ability for ibuprofen than the other combinations tested. An ionic liquid-based green emulsion liquid membrane (ILGELM) was developed using the selected ionic liquid as the extractant, sunflower oil as the diluent, Span 80 as the surfactant, and NaOH as the stripping agent. Experimental verification was carried out using the ILGELM. The experimental results indicated that the predicted COSMO-RS and the experimental results were in good agreement. The proposed IL-based GELM is highly effective for the removal and recovery of ibuprofen. © 2023 by the authors.

Author keywords

biologically active drug; COSMO-RS; emulsion liquid membrane; extractant; green process; ionic liquids

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 Moniruzzaman, M.; Department of Chemical Engineering, Universiti Teknologi PETRONAS, Seri Iskandar, Malaysia; email:m.moniruzzaman@utp.edu.my

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