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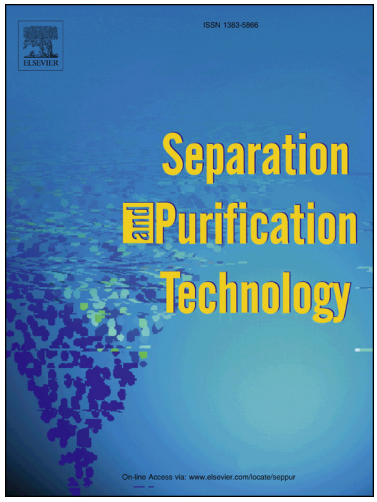

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Process Evaluation on the Separation of Ethyl acetate and Ethanol using Extractive Distillation with Ionic Liquid

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Abstract

This paper provides process design and simulation methodology for the separation of ethyl acetate and ethanol by extractive distillation using ionic liquids (ILs) as solvents and obtains the design parameters of extractive distillation process with solvent recovery system on the basis of a suitable IL solvent. The feasibility of IL-extractive distillation was examined via process simulation for the separation of ethyl acetate and ethanol in Aspen Plus. Four ILs [EMIM][$MeSO_3$], [EMIM][$MeSO_4$], [BMIM][CF_3SO_3] and [EMIM][BF_4] were created in Aspen Plus database with several thermodynamic and physical property parameters to allow the process to be simulated via the UNIFAC-Lei thermodynamic method. The results show that the separation process containing the hybrid regeneration system of flash tank and stripper with [EMIM][$MeSO_3$] as a suitable solvent is the best option in extractive distillation for the separation of ethyl acetate and ethanol compared with other ILs from the analysis of relative volatilities. The separation process was optimized by sensitivity analysis and the optimal design parameters were verified by economic evaluation based on the total annual cost (TAC).

Keywords: Extractive distillation; Ionic liquid; UNIFAC-Lei; VLE; Simulation

1. Introduction

In the history of chemical separations, conventional distillation has been applied to more commercial processes than all other techniques combined [1]. However, for systems with close boiling point or azeotropic systems, a separation by conventional distillation process becomes difficult or even impossible [2-4]. Nowadays, extractive distillation with ILs as solvents has become a promising alternative for these systems such as ethanol dehydration [5-7]. Extractive distillation is known as an efficient technology in the separation of complex mixtures by the

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