Petrochemistry-2013

OMICS Group Conferences
Accelerating Scientific Discovery

World Congress on
Petrochemistry and Chemical Engineering

November 18-20, 2013 Hilton San Antonio Airport, USA

Separation of benzene and cyclohexane by extractive distillation using task specific ionic liquids

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Abstract

Cyclohexane is an important bulk chemical for production of adipic acid and ε-caprolactam, which are feedstock for Nylon 6 and Nylon 6,6 production. Cyclohexane is mainly produced by catalytic hydrogenation of benzene in the presence of hydrogen and catalyst. Therefore, the removal of the remaining benzene from the reactor's effluent stream is a very important process. However, the separation of benzene and cyclohexane mixtures has been proved one of the most difficult tasks in petrochemical industry because of their close boiling points and formation of an azeotropic. Since conventional distillation cannot be used for this separation process, extractive distillation is the main technology presently available to separate benzene and cyclohexane mixtures. In extractive distillation, higher boiling point and relatively stable solvents are used to change the phase equilibrium of the system in such a way that the relative volatility of the interest component is increased. However, extractive distillation with these solvents suffers from process complexity and high-energy consumption due to their low extractive capacity, considerable volatility and high mutual solubility with both benzene and cyclohexane. Recently, ionic liquids have attracted attention in replacement of the conventional solvents in extractive distillation. The aim of the present work is to investigate the applicability task-specific ionic liquids with thiocyanate and dicyanamide anions for separation of benzene and cyclohexane mixtures. The ionic liquids selected contain nitrile, allyl, hydroxyl and benzyl functional groups in imidazolium alkyl chain. The performances of the ionic liquids were investigated by measuring the relative volatility cyclohexane to benzene.

Biography

Girma Gonfa is a Ph.D. at Univeristi Teknologi PETRONAS, Chemical Engineering Department. He has completed his M.Sc, and M.Sc from Bahir Dar University and Addis Ababa University in 2003 and 2009. Starting July 2009, he is working PETRONAS ionic liquid laboratory on application of ionic liquids in separation. His work is mainly on selection and application of task-specific ionic liquids in separation of aromatic and non-aromatic hydrocarbons.