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Development of facilitated transport membranes with silver nano-particle and the process design for separation of propylene from propane in petrochemical industry

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In petrochemical process, catalytic cracking of naphtha (NCC) process requires extremely high energy consumption for separation of ethylene from ethane or propylene from propane mixtures by low-temperature distillation. Membrane-based gas separation enables these separation processes to be low-energy consuming and environment friendly, if high olefin selective membrane materials. Facilitated transport membranes (FTM) have been known to show very high olefin selectivity over paraffin. This study is aimed to develop the membrane materials and show their separation properties for propylene and propane. We prepared FTM module using PVP/AgBF₄/TCNQ composite membrane on top of hollow fiber membrane. Pure gases and mixed gas permeation test were performed in various operational conditions. We developed simulation program predicting the membrane separation properties under operation conditions. Separation properties of FTM module for propylene and propane were obtained from the simulation program based on the pure gas permeation data. The FTM showed high propylene/propane selectivity and propylene permeabilities. It is predicted that one-stage or two-stage membrane process provides over 99.5% of propylene at permeate side at high propylene recovery from a binary gas mixture of 95 vol% C₃H₆/5 vol% C₃H₈ supplied as a feed gas. The results showed FT membranes could be effectively used in C3 separation process instead of typical NCC (Naphtha Cracking Center) C3 splitter.

Biography

Jeon Hoon Kim has completed his PhD in KAIST, Korea in 1999 and Post-doctoral studies from Department of Chemical Engineering from Waterloo University, Canada in 2000. He is the Head of Greenhouse Gas Separation and Recovery Group in KRICT, Korea. He has published more than 90 papers in reputed journals and has been serving as an Executive Director in The Membrane Society of Korea.

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