Sim Yee Chin*, Anwaruddin Hisyam and Haniif Prasetiawan

Modeling and Simulation Study of an Industrial Radial Moving Bed Reactor for Propane Dehydrogenation Process

DOI 10.1515/ijcre-2014-0148

Abstract: An accurate model is required to optimize the propane dehydrogenation reaction carried out in the radial moving bed reactors (RMBR). The present study modeled the RMBR using a plug flow reactor model incorporated with kinetic models expressed in simple power-law model. Catalyst activity and coke formation were also considered. The model was solved numerically by discretizing the RMBR in axial and radial directions. The optimized kinetic parameters were then used to predict the trends of propane conversion, temperature, catalyst activity and coke content in the RMBR along axial and radial directions. It was found that the predicted activation energies of the propane dehydrogenation, propane cracking and ethylene hydrogenation were in reasonable agreement with the experimental values reported in the literature. The model developed has accurately predicted the reaction temperature profile, conversion profile and catalyst coke content. The deviations of these simulated results from the plant data were less than 5%.

Keywords: radial moving bed reactor, propane dehydrogenation, simulation, modelling, kinetic

***Corresponding author: Sim Yee Chin,** Department of Chemical and Natural Resources Engineering, Universiti Malaysia Pahang, Lebuhraya Tun Razak, Gambang, 26300 Kuantan, Pahang, Malaysia, E-mail: chin@ump.edu.my

Anwaruddin Hisyam, Department of Chemical and Natural Resources Engineering, Universiti Malaysia Pahang, Lebuhraya Tun Razak, Gambang, 26300 Kuantan, Pahang, Malaysia

Haniif Prasetiawan, Chemical Engineering Department, Semarang State University, Gd. E1 Kampus Sekaran Gunungpati, Semarang, Indonesia, 50229