J Pet Environ Biotechnol 2017, 8:5 (Suppl)
DOI: 10.4172/2157-7463-C1-038

Heat transfer in adiabatic and non-adiabatic packed bed with a low dt/dp ratio: Steady state and transient evaluation

Alejandro Romero Limones
Universidad Autónoma Metropolitana, Mexico

In our research group we are interested in describing the performance of packed bed reactors, where highly exothermic reactions occur, namely the partial oxidation of o-xylene to phtalic anhydride, ethylene to oxide ethylene and recently the oxidative dehydrogenation of ethane to ethylene. This type of reactors present a tube to particle diameter ratio (dt/dp) lower than 8, which generates appreciable velocity profiles that strongly interact with kinetic and heat and mass transfer mechanisms. Literature have tried to develop models which are able to describe observations on this reactors, however they have failed, which has been attributed to a non-adequate characterization of heat transfer mechanisms in absence of reaction. Although several works have studied heat transfer in absence of reaction in packed beds it is yet not clear the role of hydrodynamics, transient experimentation, temperature gradient, anisotropy and solid contribution. This work aims at characterizing axial and radial heat transfer mechanisms in a packed bed with dt/dp<8. First, the classical quasi-adiabatic packed bed system is studied to characterize axial heat transfer through the determination of the axial effective thermal conductivity. Second, the well-known non-isothermal packed bed system is studied to characterize radial heat transfer through the estimation of the radial effective conductivity and the wall heat transfer coefficient. The role of hydrodynamics and temperature gradients are also evaluated. In both packed beds, temperature observations are described accounting or not for solid contribution at steady and transient states. Main contribution of this work can be summarized as follows: The importance of the solid (static) contribution on heat transfer is elucidated, essentially when the adiabatic or non-adiabatic packed bed is operated in transient state; hydrodynamics is crucial to properly describe radial heat transfer mechanisms. Finally, correlations are developed to evaluate heat transfer parameters accounting for static and local dynamic contributions.

romero1992@hotmail.com