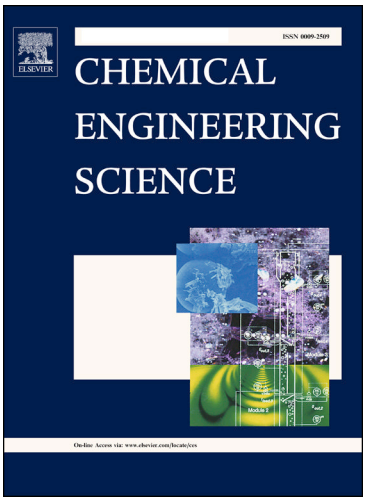

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Flow Distribution in a Novel Fixed Bed Bionic Reactor

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Abstract

The concept of a novel Fixed Bed Bionic Reactor (FBBR) is presented in this work. The core idea is to use distributed input and output network, compact channel structure and small scale packed beds. In the FBBR, fine catalyst particles with high effectiveness can be used while the pressure drop stays at a rather low level, which breaks through the limitations of the existing fixed-bed reactors. The flow distribution uniformity is the key to the design of the FBBR. A general mathematical model is established for the FBBR elementary unit, and concise analytic solutions are obtained to describe the profile of the distribution. Characteristic parameters are extracted from the model and uniformity criteria can be set up as theoretical instructions for the design of the FBBR. To demonstrate the practical value, two application cases are presented. A large scale multilayer radial FBBR is designed for Methanol to Propylene reaction, having the advantages of higher propylene selectivity and productivity. Then a small scale modular FBBR is designed for catalytic combustion of lean methane, having the advantages of being nearly isothermal with auto-thermal function and being miniaturized and modularized with better flexibility in satisfying different scale of productions.

Keywords: fixed bed bionic reactor; flow distribution uniformity; analytic analysis; methanol to propylene; catalytic combustion of lean methane

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