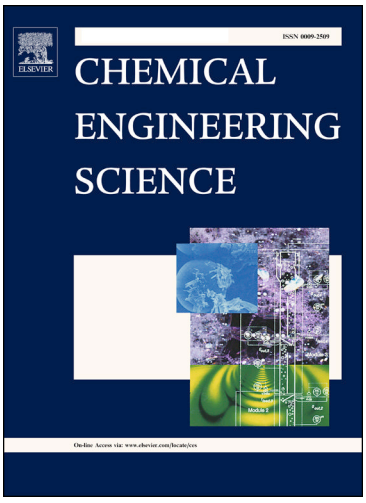

Heterogeneous catalysis in microreactors with nanofluids for fine chemicals syntheses: Benzylation of toluene with benzyl chloride over silica-immobilized $FeCl_3$ catalyst

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Heterogeneous catalysis in microreactors with nanofluids for fine chemicals syntheses: Benzylation of toluene with benzyl chloride over silica-immobilized $FeCl_3$ catalyst

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Abstract

A novel strategy for a heterogeneous benzylation reaction conducted in a capillary microreactor was proposed. Silica-immobilized $FeCl_3$ nanocatalysts were dispersed in benzyl chloride to form a nanofluid, and then were applied for the benzylation of toluene with benzyl chloride to produce monobenzyl toluene and dibenzyl toluene. The effects of various factors, such as reaction temperature, catalyst composition and residence time on the reaction performance were systematically evaluated. The benzyl chloride conversion could reach 99.2% with the 10%$FeCl_3$-SiO_2 catalyst under optimal conditions. Both internal effectiveness factor and external effectiveness factor were estimated to explore the influence of internal diffusion and external diffusion on the reaction performance and to reveal the rate-controlling step during the continuous-flow synthesis. Furthermore, the carbenium ions mechanism was applied to elaborate this heterogeneous benzylation reaction. The nanocatalysts could be

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