

Toluene Methylation with Methanol Using Synthesized HZSM-5 Catalysts Modified by Silylation and Dealumination

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Abstract : Due to its abundance from catalytic reforming and thermal cracking of naphtha, toluene could become more value-added compound if it is converted into xylenes, particularly p-xylene, via toluene methylation. Attractively, toluene methylation with methanol is an alternative route to produce xylenes in the absence of other hydrocarbon by-products for which appropriate catalyst would be utilized. In this study, HZSM-5 catalysts with Si/Al molar ratio of 100 were synthesized via hydrothermal treatment and modified by either chemical liquid deposition using tetraethyl-orthosilicate or dealumination with steam. The modified catalysts were characterized by several techniques and tested for their catalytic activity in a continuous down-flow fixed bed reactor. Various operating conditions including WHSV's of 5 to 20 h⁻¹, reaction temperatures of 400 to 500 °C, and toluene-to-methanol molar ratios (T/M) of 1 to 4 were investigated for attaining possible highest p-xylene selectivity. As a result, the catalytic activity of parent HZSM-5 with temperature of 400 °C, T/M of 4 and WHSV of 24 h⁻¹ showed 65.36% in p-xylene selectivity and 11.90% in toluene conversion as demonstrated for 4 h on stream.

Keywords : toluene methylation, HZSM-5, silylation, dealumination

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