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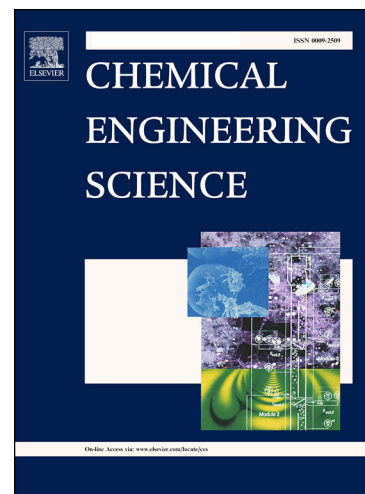
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Transformation of 2,3-butanediol in a dual bed catalyst system

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Abstract

The catalytic dehydration of 2,3-butanediol (BDO) was investigated over a dual bed catalyst system comprised of Sc_2O_3 as the first bed and Al_2O_3 , silica-alumina, and zirconia doped with calcium and ceria as the second bed at temperatures between 300 °C and 400 °C. A dual bed reactor concept was chosen to productively couple two different chemistries to direct reaction towards specific products. Both Sc_2O_3 +alumina and Sc_2O_3 +silica alumina gave 1,3-butadiene (BD) selectivity of about 61%, while Sc_2O_3 +zirconia gave lower BD selectivities. Sc_2O_3 +zirconia produced 2,5-dimethylphenol with selectivity reaching 12% at a maximum. The BDO dehydration over a single bed of zirconia catalyst was studied at various residence times. 2,5-dimethylphenol concentration increased as the residence time increased. Possible intermediates to form 2,5-dimethylphenol from BDO are methyl vinyl ketone (MVK), 3-buten-2-ol (3B2OL) and acetoin. The first bed Sc_2O_3 selectively converted BDO to 3B2OL, while the second bed catalyst greatly affected the product distribution. Acidic oxides such as alumina oxide and silica alumina were better catalysts to convert 3B2OL to BD, while catalysts with basic sites, such as zirconia doped with ceria and calcium, catalyzed condensation reactions that ultimately lead to phenols like 2,5-dimethylphenol.

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