CATALYTIC PREPARATION OF CYCLOPENTYL ETHYL ETHER FROM PRIMARY ALCOHOLS

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Attempts at achieving carbon neutrality in production of value-added chemicals may include using biomass as a source of said chemicals. Alcohols derived from biomass can be utilized in many such syntheses, among others the production of ethers. Etherification of two different primary alcohols catalyzed by solid acids leads to three possible ethers. Therefore, preparation of unsymmetric ethers, such as cyclopentyl ethyl ether (CPEE), must focus mainly on catalyst selectivity.

The aim of this study is to test the performance of a large-pore aluminosilicate zeolite USY on gas-phase etherification of ethanol and cyclopentanol under varying technological conditions. We studied the effects of temperature, WHSV, mass ratio of reactants and Si/Al ratio of USY zeolite on CPEE selectivity.

The initial rise in reaction temperature up to 120 °C caused an increase of CPEE yield and cyclopentanol conversion. Further increase in temperature resulted in CPEE yield decline, as well as rise in cyclopentanol conversion, cyclopentene yield and coke deposition. Both WHSV and mass ratio of reactants did not have any significant effect on the result of the reaction. With increasing Si/Al ratio of USY zeolite, both conversion of cyclopentanol and cyclopentene yield steadily decreased. CPEE yield peaked and declined after an initial increase.

In conclusion, gas-phase etherification of biomass-derived cyclopentanol and ethanol catalyzed by USY zeolite is a promising method for CPEE preparation thanks to its mild technological conditions. To improve its feasibility, however, further increases in catalyst selectivity is needed.

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References:

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