Physical and chemical properties of dealuminated Indonesian natural mordenite and evaluation as a cracking catalyst

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Abstrak

There is an abundant source of naturally occurring mordenitein the Bayah region of Indonesia. In this work we studied how acid dealumination of this indigenous zeolite affected its physical, chemical and catalytic properties. The results are compared to those obtained with another natural mordenite and a commercially available synthetic mordenite. Acid dealumination of mordenites is known to affect the pore structure and therefore enhance the adsorption-properties of the zeolite and the accessibility to its acidic sites. A series of dealuminated mordenite samples were prepared. They were refluxed in constant boiling HCl as a function of time. The samples were each subsequently exchanged with IN ammonium nitrate. The Si/Al ratio was determined by X-Ray Fluorescence. The presence of other metals was detected with Atomic Adsorption Spectroscopy and Inductively Coupled Plasma Spectroscopy. Nitrogen Adsorption was used to determine the surface area and the pore size distribution. Crystallinity and unit cell size were determined via X-Ray Diffraction. The surface morphology was probed with Scanning Electron Microscopy. An n-hexane cracking test was utilized to probe catalytic activity and selectivity.

The results of this study indicate that up to and including sixteen hours of reflux, dealumination of this natural Indonesian mordenite increases the crystallinity and the average pore size, however the surface area and the unit cell size remain constant. Additional reflux, beyond sixteen hours, destroyed a portion 'of the zeolitic framework, indicated by a loss in crystallinity. Cracking activity increased through sixteen hours .of ref lux and was found to be constant thereafter. Total' C2, C3 and C4 {including isobutene) selectivity improved through sixteen hours of reflux and then also remained constant. In comparison to a commercially available sample of synthetic mordenite, the modified Indonesian mordenite ,is less active, but has comparable selectivity. However, compared to the naturally occuring U.S. mordenite, the modified Indonesian mordenite has improved physical and catalytic properties.