

Catalyst screening for conversion of glycerol to light olefins

Abstract

Screening of modified ZSM-5 catalysts for conversion of glycerol to light olefins has been investigated. In this study HZSM-5, Al/ZSM-5, Ca/ZSM-5, Cr/ZSM-5, Cu/ZSM-5, Li/ZSM-5, Mg/ZSM-5 and Ni/ZSM-5 zeolite catalysts were prepared, tested and screened. The catalysts were characterized to relate their properties with catalyst activity. XRD and FTIR characterization results demonstrated that the structure of the catalysts remained intact while BET revealed the surface and micropore areas decreased after metal loading. TPR data exhibited the reduction phenomenon of the catalysts. NH₃-TPD analysis indicated that Cu/ZSM-5 catalyst has relatively more moderate and strong active acid sites compared to others. GC TCD/FID analysis detected light olefins and paraffins; methane, CO and CO₂ in the gaseous product stream. The acidity of the catalyst affected olefin production, but no direct correlation between surface area and olefin yield was observed. The turnover frequency (TOF) for Cu/ZSM-5 and Cr/ZSM-5 catalysts were significantly high comparatively. Cu/ZSM-5 produced the highest light olefins selectivity and yield due to the synergistic effect of the physico-chemical properties between the parent ZSM-5 and the metals.