Catalytic conversion of bioethanol to light olefins over hierarchical HZSM-5 nanosheets

Sirawit Shetsiri[1],Wannruedee Wannapakdee[1],Saros Salakhum[1],and Chularat Wattanakit[1*]
[1]*Department of Chemical and Biomolecular Engineering, School of Energy Science and Engineering, Vidyasirimedhi Institute of Science and Technology, Rayong 21210, Thailand.*

*e-mail: chularat.w@vistec.ac.th

The conversion of bioethanol to hydrocarbons is one of the most promising processes in the green industry[1,2]. Here we report the application of novel designed hierarchical HZSM-5 nanosheets in the light olefin production from bioethanol. The hierarchical HZSM-5 zeolites having various Si/Al ratios have been successfully prepared by a one-pot hydrothermal synthesis using a dual template, tetra(*n*-butyl) phosphonium hydroxide (TBPOH), as the structure-directing agent and the nanolayered porogen[3]. The designed hierarchical zeolites exhibit the superior physicochemical properties with an increasing of mesoporosity (~30 %) compared with a commercial one. To illustrate the beneficial effect of hierarchical structures on the catalytic performance of bioethanol conversion, the catalytic study was carried out using a fixed-bed reactor at 300-450 ºC under an atmospheric pressure. Interestingly, the hierarchical HZSM-5 exhibits the outstanding catalytic activity with the highest yielding light olefins (~90%) when compared with conventional HZSM-5(~80%) at the same Si/Al ratio and reaction conditions due to their hierarchical structure improving the mass transfer limitation and the thermal stability of catalysts. Furthermore, the effect of WHSV and Si/Al ratios of hierarchical zeolites on catalytic performances will be systematically discussed. This first example to demonstrate the application of hierarchical zeolites in biomass conversion is complementary to a wide range of catalytic applications from petrochemical reactions to green chemistry.

Keywords: Bioethanol; Hierarchical HZSM-5 nanosheet; Light olefins; Green chemistry

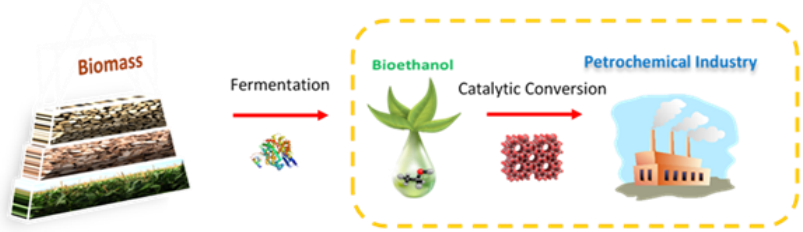

Figure 1. Schematic illustration of the petrochemical applications via the conversion of biomass-derived bioethanol over hierarchical zeolite nanosheets.

References

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