Regeneration of mesoporous aluminosilicate catalysts for DCPD oligomerization

Yongin You[1], Won Jun Choi[1], Soo Hyun Chae[1], Jeongsik Han[2], Byung-Hun Jeong[2], and Jong-Ki Jeon[1,*]

[1]*Department of Chemical Engineering, Kongju National University, Cheonan 31080, Korea*
[2] *Agency for Defense Development, Daejeon 34186, Korea*
`*e-mail: jkjeon@kongju.ac.kr

Tricyclopentadiene (TCPD) has been used as a fuel having a high energy density [1,2]. TCPD can be prepared through dicyclopentadiene (DCPD) oligomerization. Because freezing point and viscosity of endo-type TCPD are higher than those of exo-type TCPD, it is need to convert to exo-type by isomerization [3,4]. Today, exo-type TCPD has been produced from DCPD through oligomerization and isomerization by using homogeneous catalysts.

In this study, oligomerization and isomerization was conducted using heterogeneous catalysts in a single reactor. DCPD oligomerization and isomerization was carried out over pellet-type zeolites and mesoporous aluminosilicate catalysts. To investigate the lifetime of the catalyst, the pellet-type catalyst was reused five times. The used catalyst was regenerated by the removal of the oligomer via calcination at 500 ˚C under an air flow and was recycled in the next run. Physical and chemical properties of the regenerated catalysts were analyzed by N_2 adsorption, XRD, FTIR spectra of pyridine adsorption and NH_3-TPD.

Among various catalysts, a mesoporous material prepared from commercial Y zeolite shows the highest reaction activity and selectivity to endo-TCPD isomer, which can be attributed to the large pore size of the catalysts which is favorable for the diffusion of reactant, intermediate, and product. As shown in Fig. 1, the catalyst shows stable activity after five recycling trials. No significant difference was observed in the BET surface area and the NH_3-TPD profiles for the fresh catalyst and the regenerate catalyst, indicating that the catalytic property of the regenerated catalysts is similar to that of the fresh catalyst. This indicates that the catalyst can easily be regenerated by calcination.

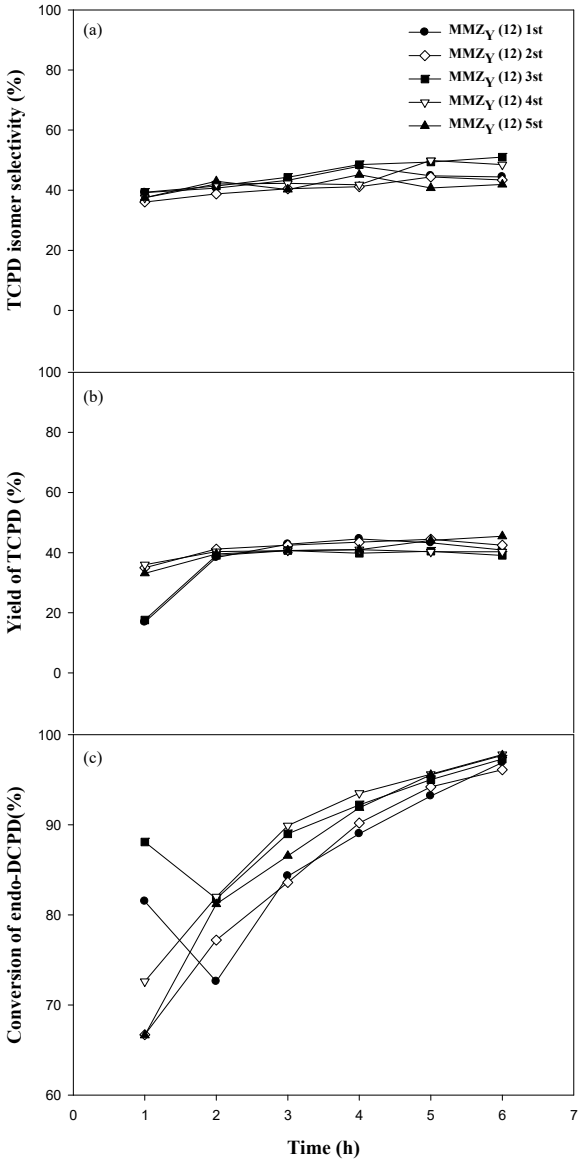

Figure 1. DCPD conversion, TCPD yield and isomer selectivity over reused MMZ_Y catalyst

REFERENCES

[1] J. Zou, Y. Xu, X. Zhang, L. Wang, Appl. Catal. A, General 421-422 (2012), 79.
[2] H. Han, J. Zou, X. Zhang, L. Wang, Appl. Catal. A, General 367 (2009) 84.
[3] T. Ma, R. Feng, J.J. Zou, X. Zhang, and L. Wang, Ind. Eng. Chem. Res. 52 (2013) 2486
[4] J. Kim, J. Han, T. S. Kwon, Y. K. Park, J. K. Jeon, Catal. Today, 232 (2014) 69.