Synthesis of Aviation-Fuel from Bio-oil over Pt/Mesoporous Aluminosilicate Catalysts

Jongjin Kim[1], Seong Hun Jeon[1], Choul-Ho Lee[1], Dong Sun Kim[1], Jungho Cho[1], Chul-Ung Kim[2], and Jong-Ki Jeon[1,*]

[1] *Department of Chemical Engineering, Kongju National University, Cheonan 31080, Korea*

[2]*Center for Convergent Chemical Process, Korea Research Institute of Chemical Technology, Daejeon, Korea*

*E-mail: jkjeon@kongju.ac.kr

The aircraft seems the most fossil fuel consumption among the transport means. Therefore, it is urgently necessary to replace the aviation-fuel by an alternative fuel such as a biomass-derived oil [1, 2]. Palm oil, carmela oil, and jatropha oil can be used as a biomass-derived oil. They can be utilized after the hydro-deoxygenation (HDO) and/or the hydro-decarboxylation (HDC). The majority of biomass-derived oil obtained from palm oil in a patent consisted of C_{15}~C_{18} hydrocarbon [3]

The general aviation fuel can be produced from the refining of crude oil. This component has contained such as n-, iso- and cyclo-paraffin. In addition, because it has the low freezing point due to a branched hydrocarbon isomers having low temperature fluidity. Because the biomass-derived oil consists of linear alkane in the range of C_{15}~C_{18}, it is necessary to isomerize to the branched alkane as well as to convert to lower hydrocarbon in the range of jet-fuel range (C_8~C_{17}).

In this study, a simulated bio-oil (C_{15}~C_{18} linear hydrocarbon mixture) and a bio-oil prepared from palm oil were used as a model compound to evaluate the catalytic performance of PtMg/Al-KIT-6 catalysts in hydro-upgrading (hydrocracking and hydroisomerization) of bio-oil. The catalyst was characterized by N_2-adsorption, ammonia-TPD, X-ray diffraction and pyridine FT-IR. Effect of reaction condition on catalytic activity and selectivity to jet-fuel was elucidated in a fixed-bed reactor.

Figure 1 shows the isomer selectivity over the catalysts. The catalyst manufactured through alumination has shown more than 50% isomer selectivity. Thus, it was confirmed that the effect of alumination of KIT-6 on isomer selectivity was very effective in hydroupgrading of the simulated bio-oil. Consequently, PtMg/Al-Kit-6 catalysts can be one of candidates of hydroupgrading catalysts for the conversion of biomass-derived oil to aviation-fuel.

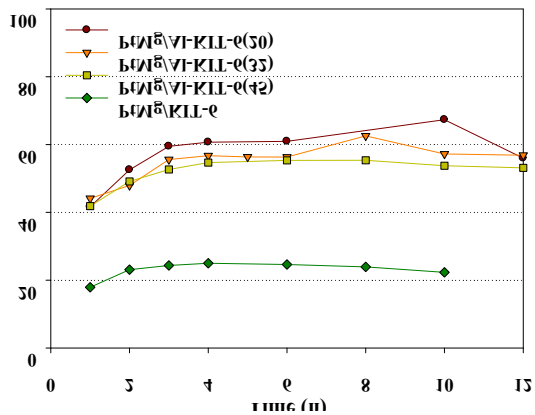

Figure 1. Isomer selectivity over various catalysts [Temp. : 400℃, WHSV : $1h^{-1}$].

Acknowledgment

We would like to acknowledge the financial support from the R&D Convergence Program of the MSIP (Ministry of Science, ICT and Future Planning) and ISTK (Korea Research Council for Industrial Science and Technology) of the Republic of Korea (Grant 13-6-KIER).

REFERENCES

[1] J. Han, A. Elgowainy, H. Cai, M.Q. Wang, Bioresour. Technol., 150 (2013) 447.

[2] G. Liu, B. Yan, G. Chen, Renew. Sust. Energ. Rev., 25 (2013) 59.

[3] D.W. Kim, D.K. Kim, S.I. Lee, H.J. Jeon, S.Y. Kang, J.Y. Yoo, S.H. Oh, Korea Patent, 10-1234121 (2013).