Evaluation of Ru_xNi_{1-x}/SBA-15 catalysts for depolymerization features of lignin macromolecule into monomeric phenols

Jae-Young Kim, Shin Young Park, In Gyu Choi, Joon Weon Choi

PII: S1385-8947(17)32040-5
DOI: https://doi.org/10.1016/j.cej.2017.11.118
Reference: CEJ 18089

To appear in: *Chemical Engineering Journal*

Received Date: 10 August 2017
Revised Date: 23 October 2017
Accepted Date: 21 November 2017

Please cite this article as: J-Y. Kim, S.Y. Park, I.G. Choi, J.W. Choi, Evaluation of Ru_xNi_{1-x}/SBA-15 catalysts for depolymerization features of lignin macromolecule into monomeric phenols, *Chemical Engineering Journal* (2017), doi: https://doi.org/10.1016/j.cej.2017.11.118

Chemical Engineering Journal

Evaluation of Ru_xNi_{1-x}/SBA-15 catalysts for depolymerization features of lignin macromolecule into monomeric phenols

ABSTRACT

The bimetallic catalysts were prepared by a wetness impregnation method with different molar ratios of Ru and Ni (Ru_xNi_{1-x}, x = 0.2, 0.4, 0.6, 0.8, and 1.0) on mesoporous silica SBA-15. Soda lignin (SL) was directly depolymerized to phenol-rich oil fraction (lignin-oil) over bimetallic catalysts under supercritical ethanol. 2D-HSQC-NMR demonstrated that representative interunit linkages such as β-O-4, β-5, and β-β were considerably degraded during depolymerization process by thermal reaction. Phenol was mainly produced from SL with other phenolic compounds such as guaiacol, 4-ethylphenol, 4-methylguaiacol, 4-ethylguaiacol, and syringol. This study revealed that the chemical properties of lignin-oil were clearly affected by the physicochemical properties of bimetallic catalysts. By increasing the amount of hydrogen binding sites and the acidity of the catalyst, the yields of lignin-oil, total phenols, and phenol increased while that of char decreased. In particular, acidic sites in bimetallic catalysts have a significant effect on the formation of phenol. The yields of total monomeric phenols and phenol were largest with the $Ru_{0.6}Ni_{0.4}$ catalyst (12.7 wt%, and 4.7 wt%, respectively).

Keywords: Lignin depolymerization, Bimetallic catalyst, Ruthenium, Nickel, GC/MS,