Supplementary Materials: Solvothermal Conversion of Lignosulfonate Assisted by Ni Catalyst: Investigation of the Role of Ethanol and Ethylene Glycol as Solvents

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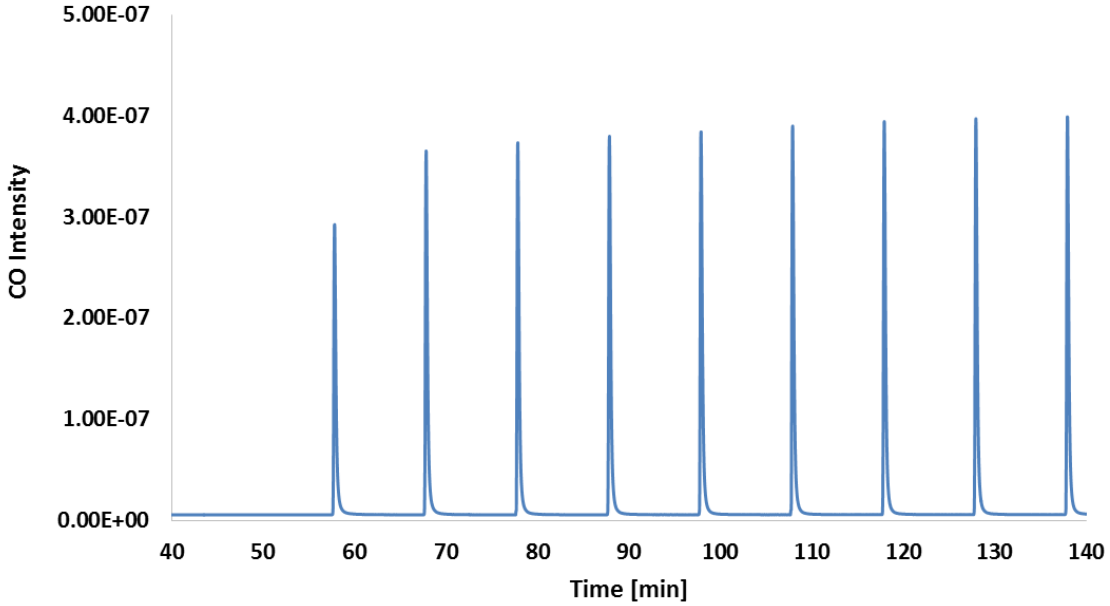

Figure S1. CO titration of Ni/γ-Al_2O_3 catalyst.

The CO titration over Ni/γ-Al_2O_3 catalyst is shown in Figure S1. It was assumed that titration takes place by chemisorption of 1 molecule of CO on 1 Ni atom. However, formation of nickel carbonyl was observed which destroyed the TCD detector filament. Therefore no further chemisorption tests, including particle size estimation of Ni/ZrO_2 were performed.

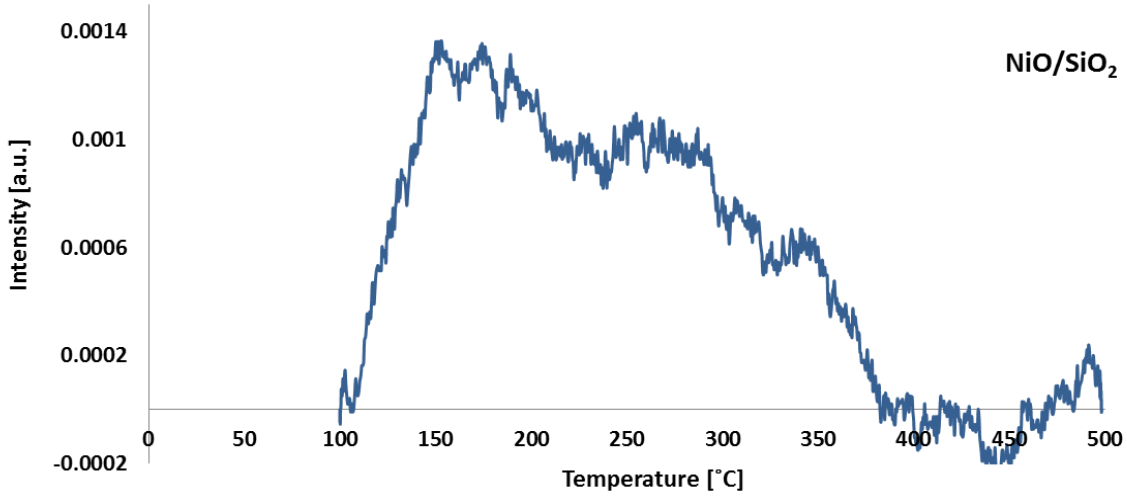

Figure S2. NH_3-TPD profile of NiO/SiO_2 catalyst.

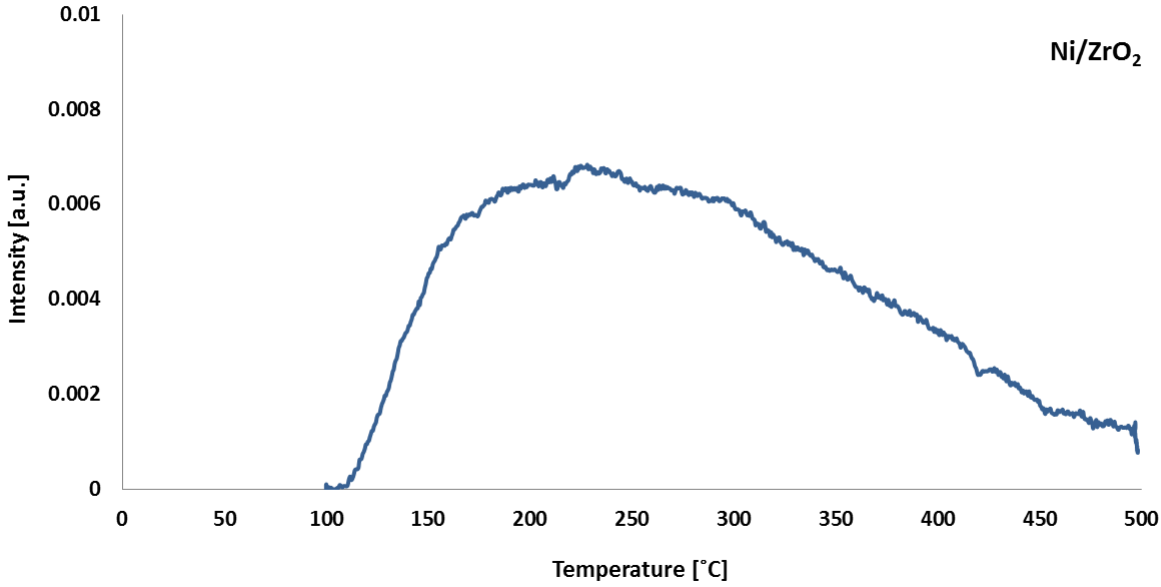

Figure S3. NH_3-TPD profile of NiO/ZrO_2 catalyst.

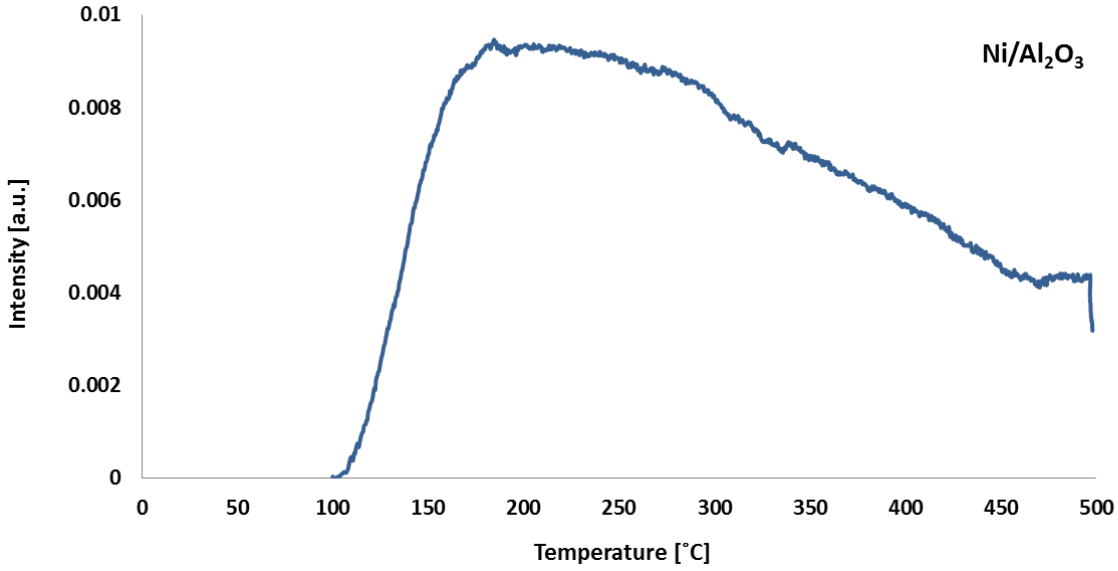

Figure S4. NH_3-TPD profile of NiO/Al_2O_3 catalyst.

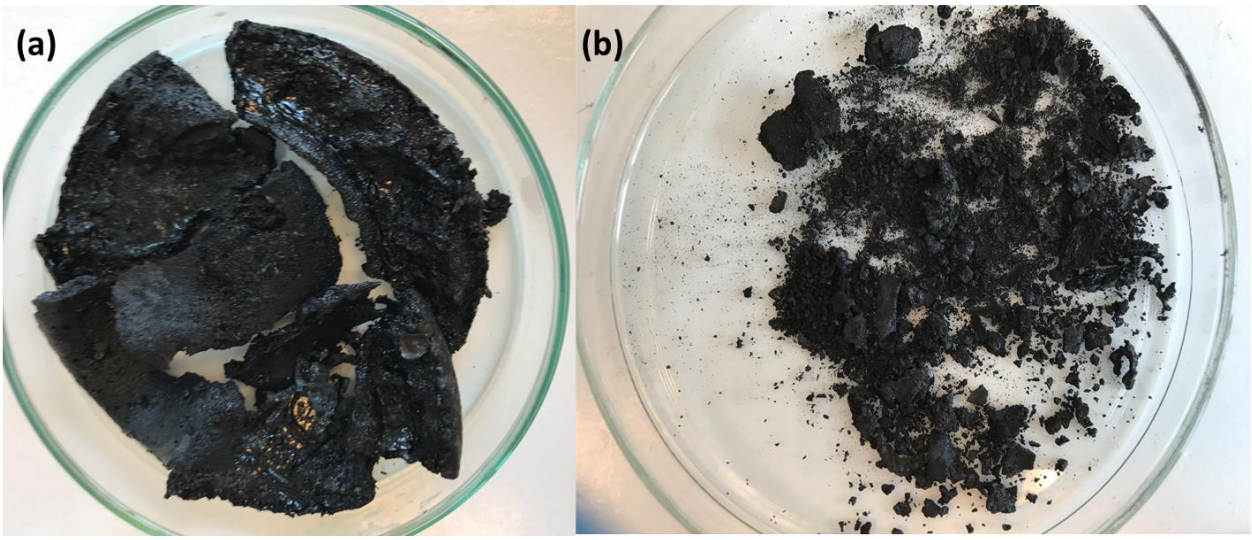

Figure S5. Physical appearances of the solid fractions from reaction of H-LS. (**a**) non-catalytic conversion, (**b**) catalytic conversion over Ni/SiO_2 catalyst. Reaction condition: 0/0.75 g catalyst, 7.5 g H-LS, 75 mL solvent, initial H_2 loading of 50 bar at RT, reaction temperature of 250 °C, 3 h reaction time.

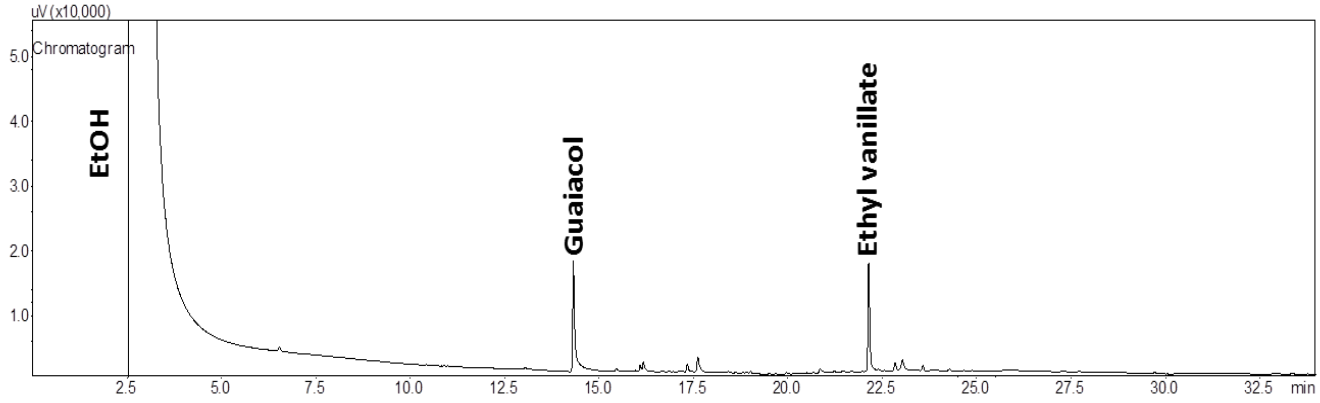

Figure S6. GC-MS analysis of the oil fraction from conversion of H-LS over Ni/SiO_2 catalyst in ethanol medium. Reaction condition: 0.75 g catalyst, 7.5 g H-LS, 75 ml solvent, initial H_2 loading of 50 bar at RT, reaction temperature of 250 °C, 3 h reaction time.

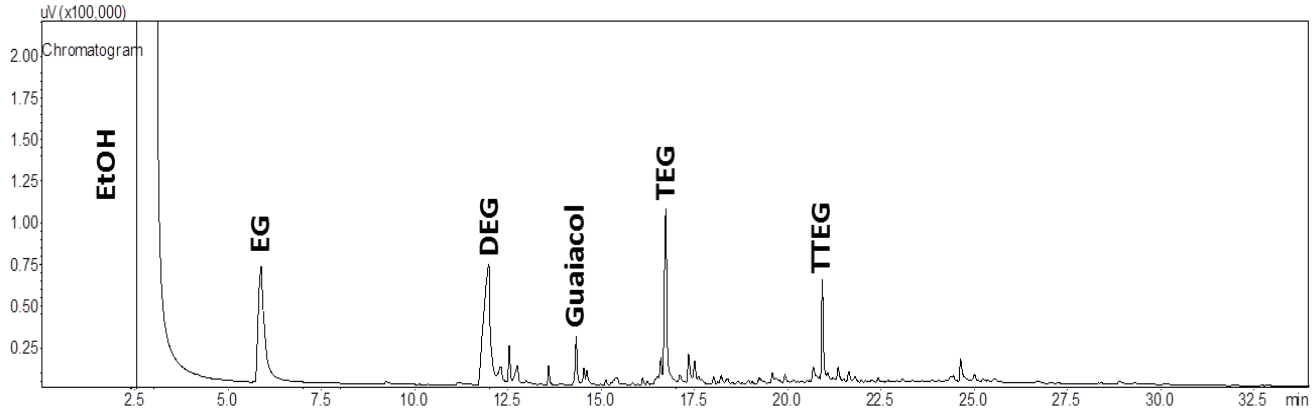

Figure S7. GC-MS analysis of the oil fraction from conversion of H-LS over Ni/SiO_2 catalyst in ethylene glycol medium. Reaction condition: 0.75 g catalyst, 7.5 g H-LS, 75 ml solvent, initial H_2 loading of 50 bar at RT, reaction temperature of 250 °C, 3 h reaction time.

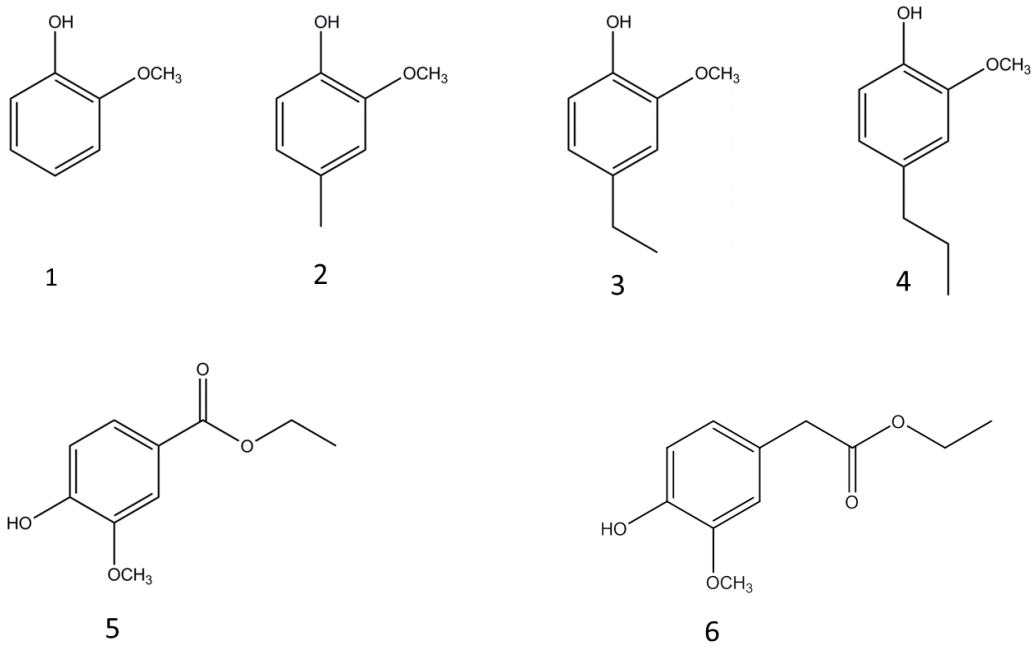

Figure S8. The main identified compounds in the oil fractions by GC-MS analysis: (1) Guaiacol, (2) Methyl guaiacol, (3) Ethyl guaiacol, (4) Propyl guaiacol, (5) Ethyl vanillate, (6) Ethyl homovanillate.

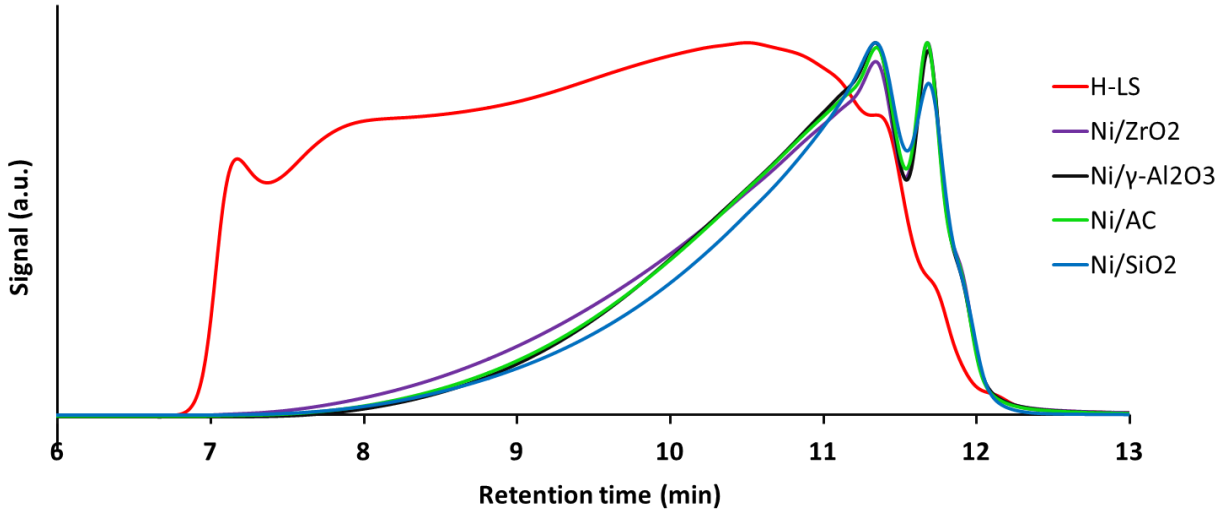

Figure S9. SEC of H-LS and the catalytic oils produced from conversion of H-LS in EtOH over Ni supported on SiO_2, AC, ZrO_2 and γ-Al_2O_3. Reaction condition: 0.75 g catalyst, 7.5 g H-LS, 75 ml solvent, initial H_2 loading of 50 bar at RT, reaction temperature of 250 °C, 3 h reaction time.

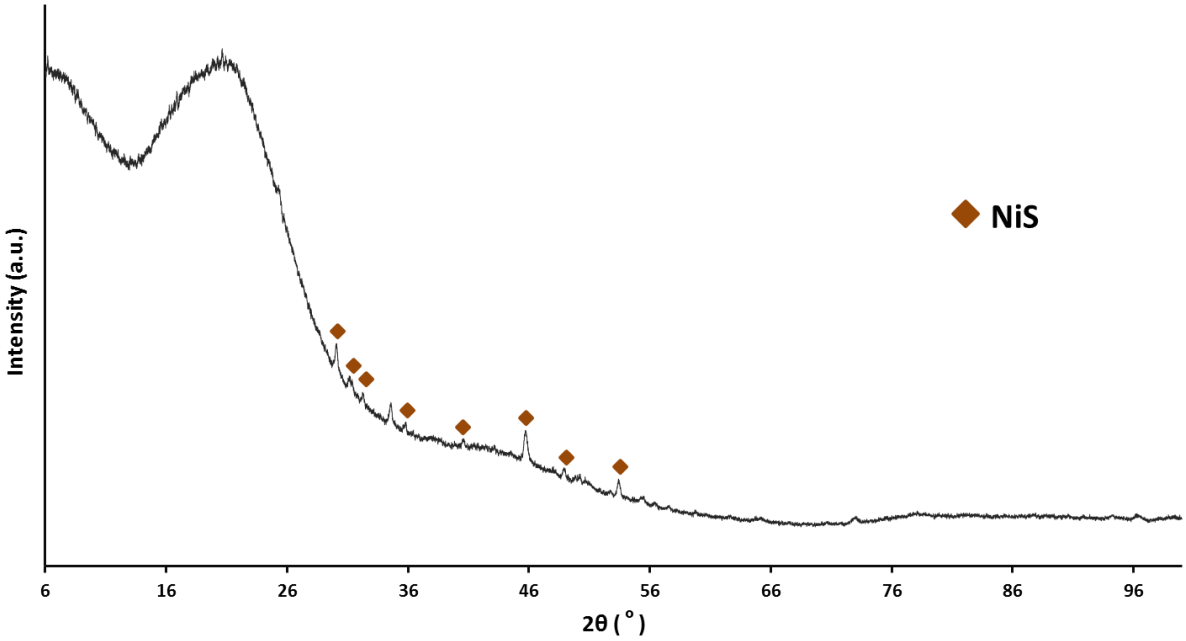

Figure S10. XRD pattern of the solid residue from conversion of H-LS over Ni/SiO_2 catalyst. The peaks for NiS are specified. Reaction condition: 0.75 g catalyst, 7.5 g lignin, 75 ml solvent, initial H_2 loading of 50 bar at RT, reaction temperature of 250 °C, 3 h reaction time.

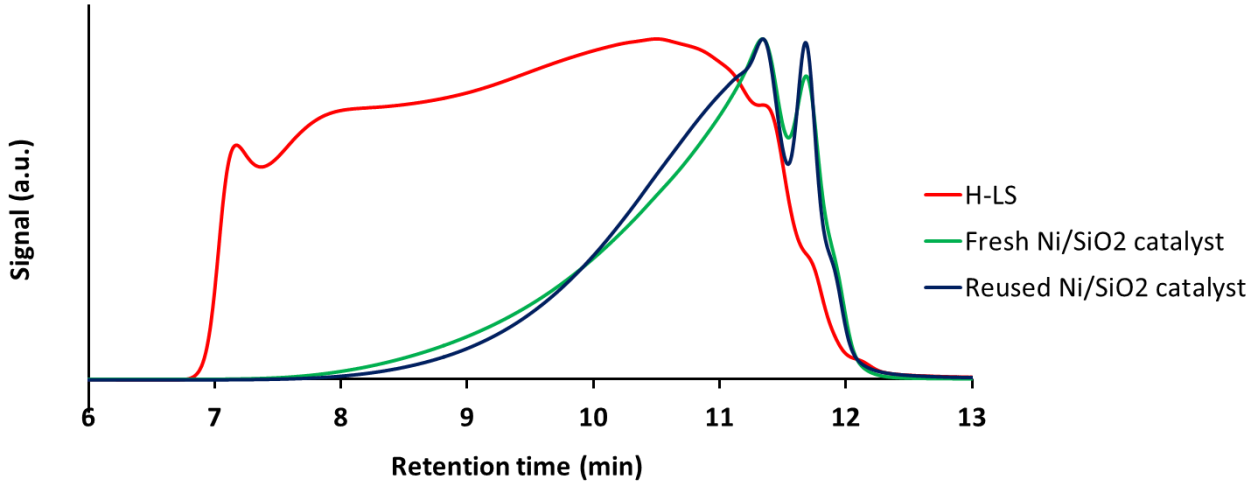

Figure S11. SEC of H-LS and catalytic oil products from conversion of H-LS in EtOH over fresh and reused Ni/SiO_2 catalyst. Reaction condition: 0.75 g catalyst, 7.5 g H-LS, 75 ml solvent, initial H_2 loading of 50 bar at RT, reaction temperature of 250 °C, 3 h reaction time.