

Supporting Information

Efficient Liquid-Phase Hydrogenolysis of Lignin Model Compound (Benzyl Phenyl Ether) Using a Ni/Carbon Catalyst

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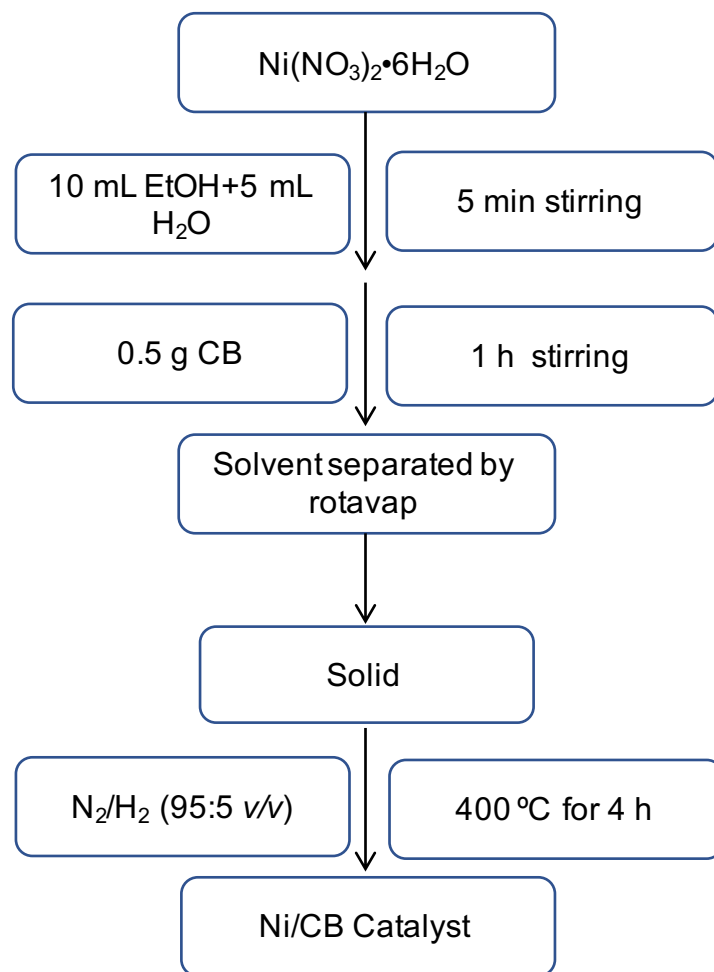


Figure S1. Illustration for the synthesis of Ni/CB catalyst.

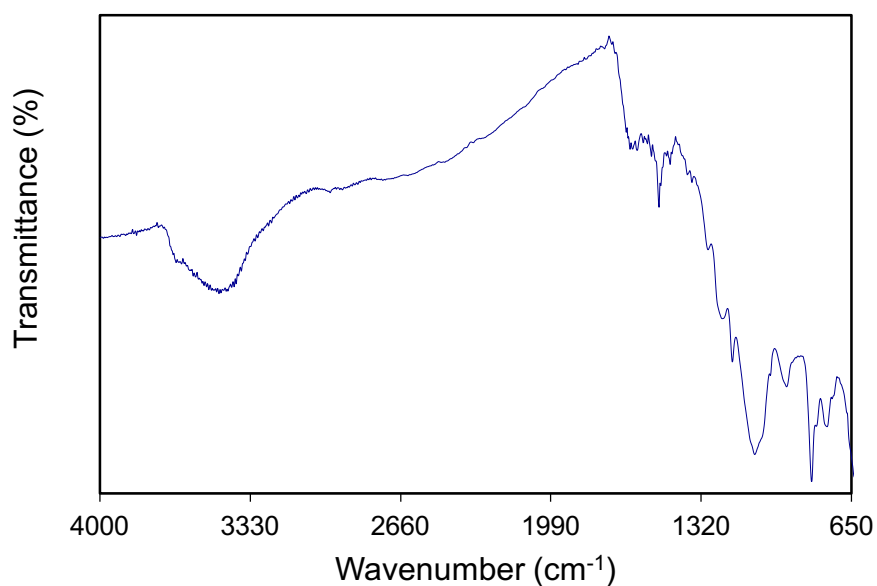


Figure S2. FT-IR spectra of Ni/CB catalyst.

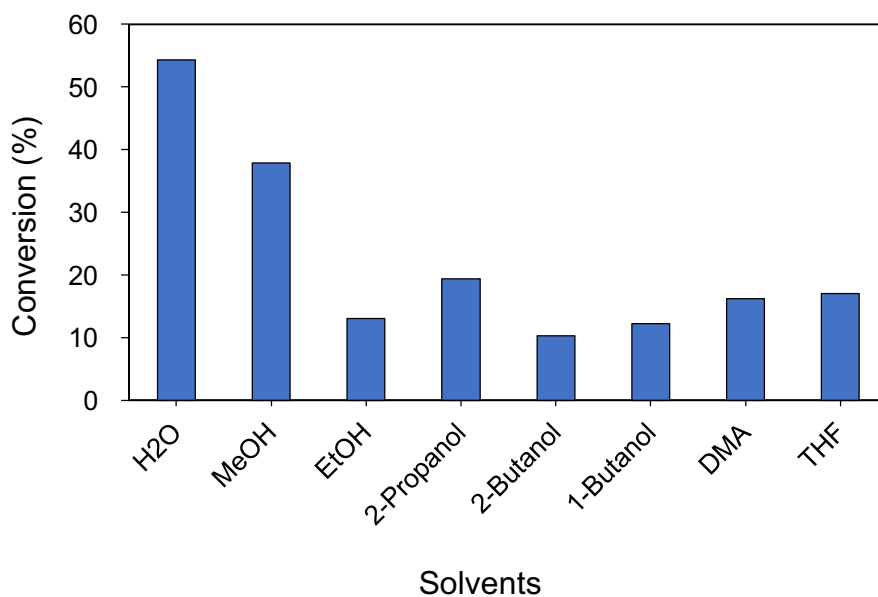


Figure S3. Effects of solvents for the BPE hydrogenolysis.

Reaction condition: BPE 0.0368 g, NaBH₄ 0.05 g, Ni/CB 0.04 g, solvent 10 mL, 70 °C, 1 h.

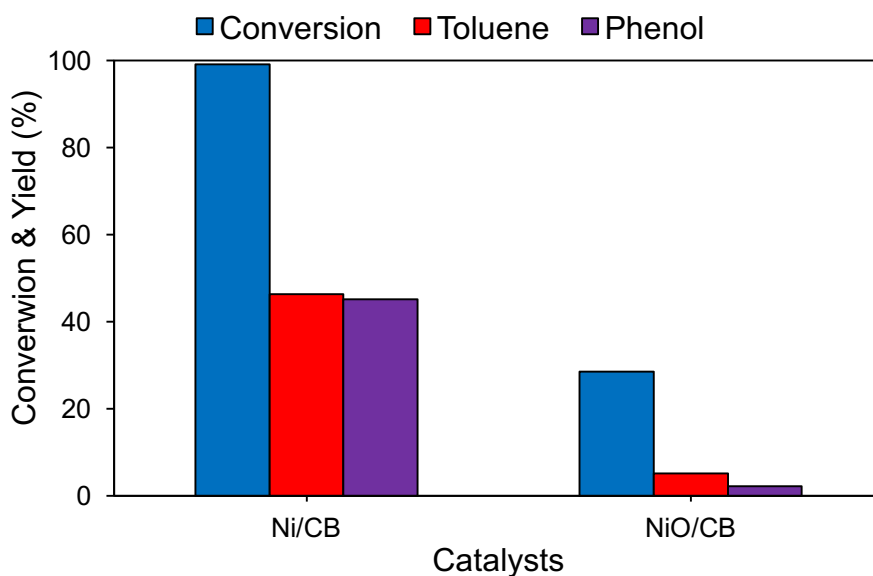


Figure S4. Effects of Ni catalysts for the BPE hydrogenolysis.

Reaction condition: BPE 0.0368 g, NaBH₄ 0.05 g, catalyst 0.05 g, solvent 10 mL, 80 °C, 1 h.

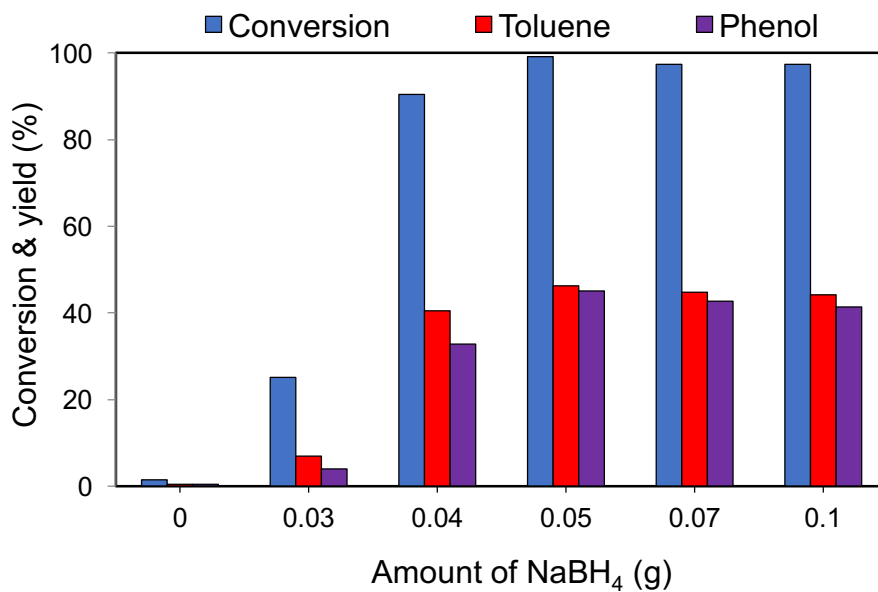


Figure S5. Effects of NaBH₄ concentration for the BPE hydrogenolysis.

Reaction condition: BPE 0.0368 g, Ni/CB 0.05 g, EtOH/H₂O 10 mL (3/7 v/v), 80 °C, 1 h.

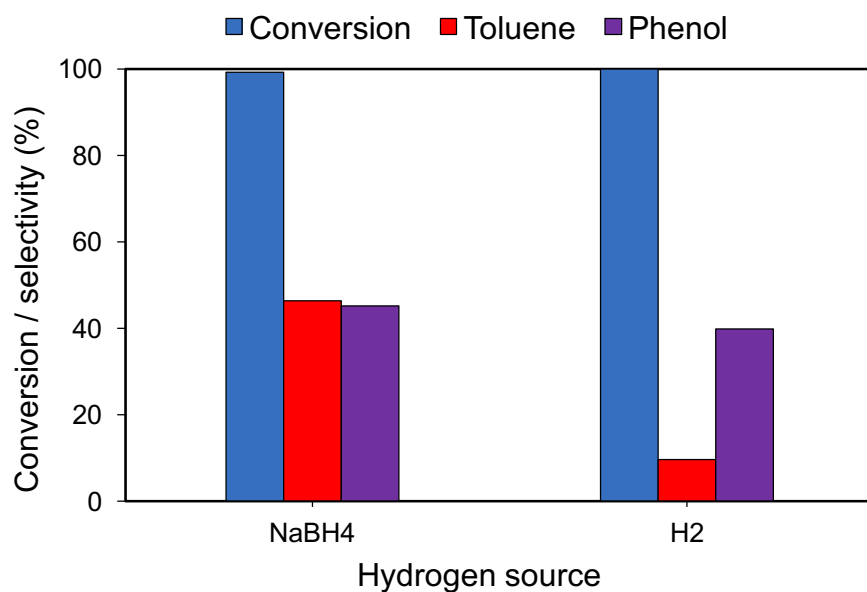


Figure S6. Effects of hydrogen source for the BPE hydrogenolysis.

Reaction condition: BPE 0.0368 g, NaBH₄ 0.05 g/H₂ 0.2 MPa, catalyst 0.05 g, solvent 10 mL, 80 °C, 1 h.

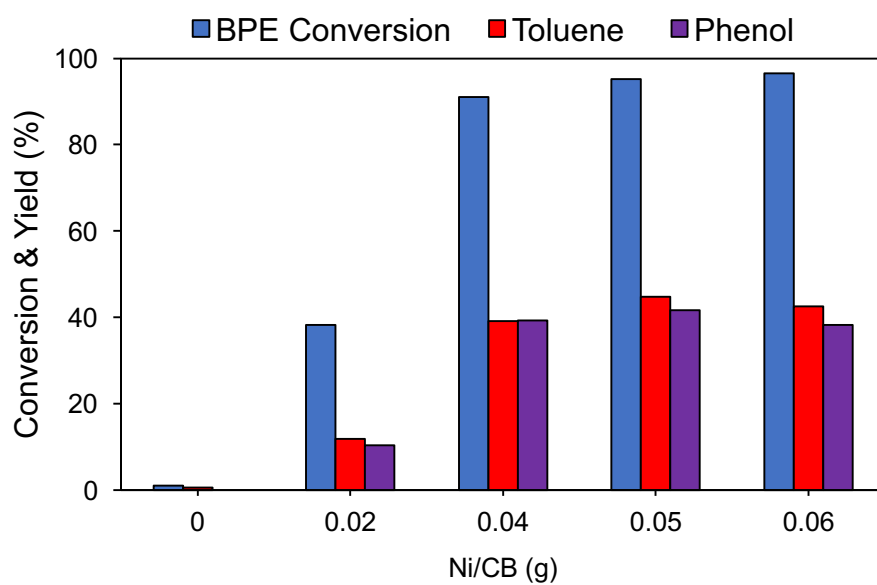


Figure S7. Effects of Ni/CB catalyst concentration for the BPE hydrogenolysis.
Reaction condition: BPE 0.0368 g, NaBH₄ 0.05 g, EtOH/H₂O 10 mL (3/7 v/v), 70 °C, 1 h.

Hydrolysis of NaBH₄ in water and in mixed solvent (EtOH/H₂O) system:

Preparation of HPLC sample: After hydrolysis reaction of NaBH₄ in the mixed solvent in presence of Ni/CB catalyst. The solvent was evaporated using a rotary evaporator and the obtained solid dried in an oven at 105 °C for 16 h. Next, the dried solid was added in 10 mL of H₂O. Further, the sample was filtered through a 0.22-micron syringe filter to remove catalyst and then it was injected in HPLC (For this analysis HPLC equipped with Pb²⁺ column was used).

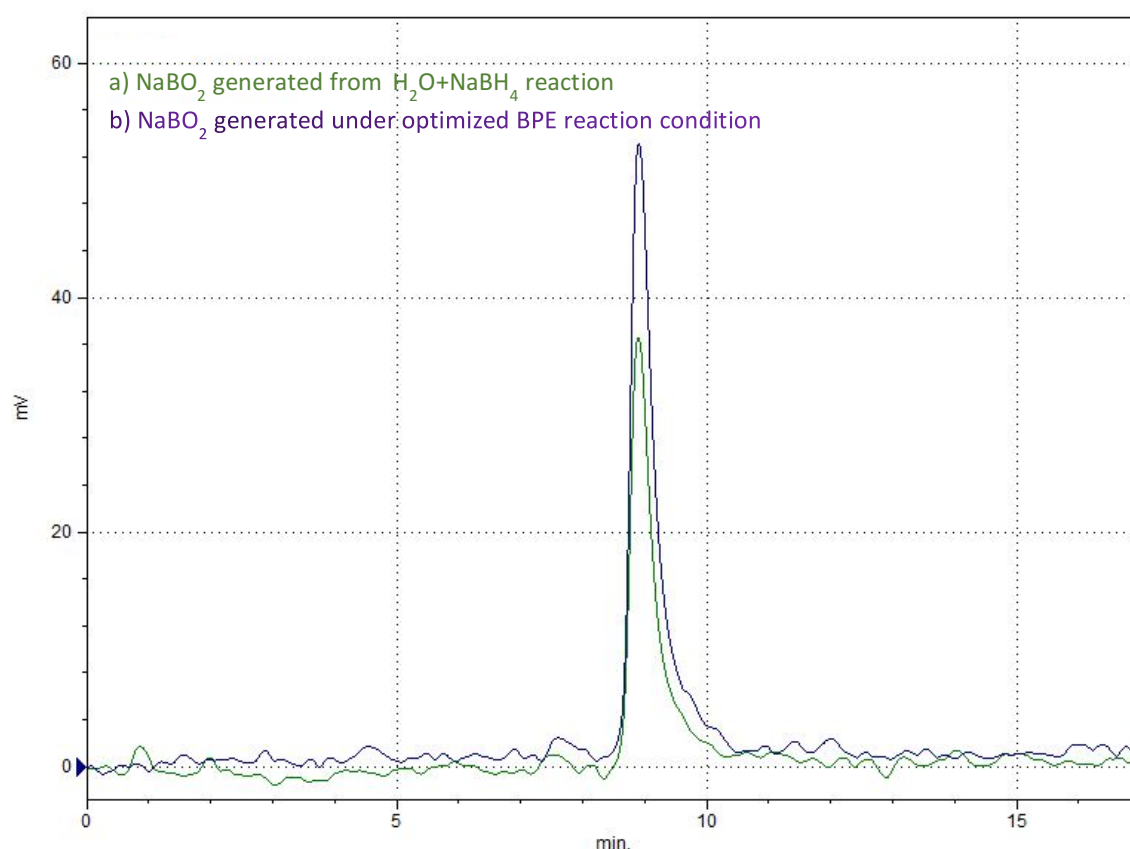


Fig S8. HPLC chromatogram of a) NaBO₂ generated by hydrolysis of NaBH₄ in water and b) hydrolysis of NaBH₄ in mixed solvent (EtOH/H₂O).

Reaction condition: NaBH₄ 0.05 g, EtOH/H₂O 10 mL (3/7 v/v), Ni/CB 0.05 g, 80 °C, 1 h.

The NaBH₄ is hydrolyzed and converted into hydrated or anhydrous sodium metaborate (NaBO₂). The formation of NaBO₂ from NaBH₄ hydrolysis was reported and, in our experiment, also we have found the formation of NaBO₂ (Fig. S8).

Table S1 Results of BET analysis for adsorption of various solvents on the support*

Support	Surface area (m ² /g)	Relative volume (%)			Resistance (Ω)
		H ₂ O	EtOH	Benzene	
Carbon black (CB)	97.0	0.60	0.74	0.3	1.8
Activated carbon (AC)	998.3	0.18	0.63	0.44	1913.3

*N₂ was used as reference

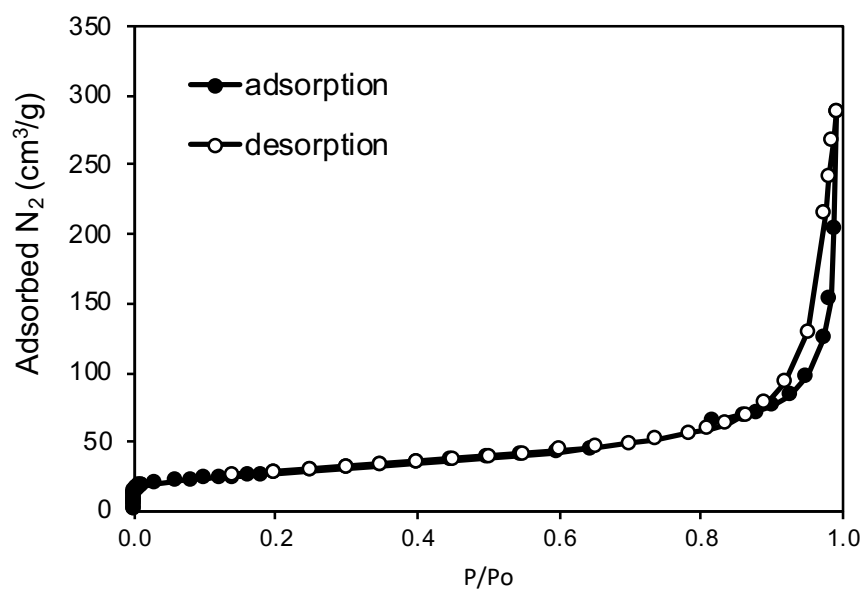


Figure S9. N₂ adsorption / desorption isotherm of carbon black (BC).

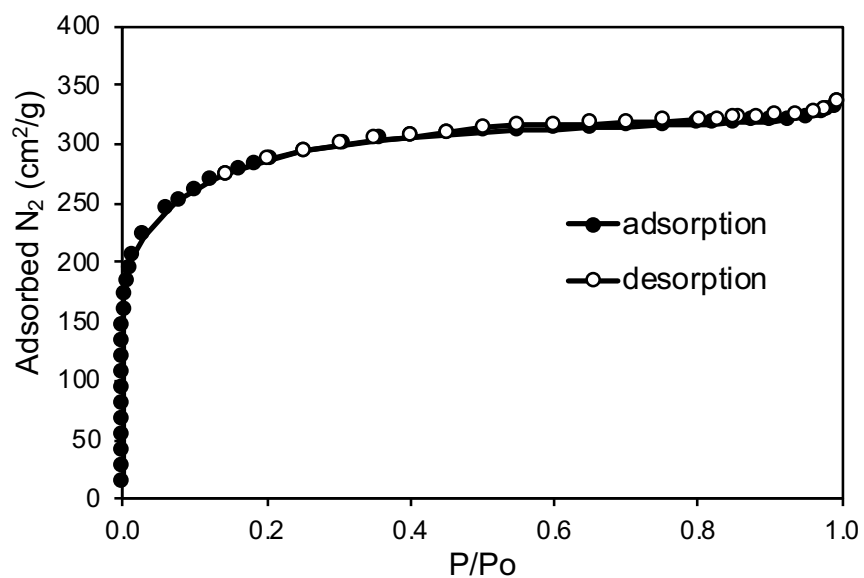


Figure S10. N₂ adsorption / desorption isotherm of active carbon (AC).

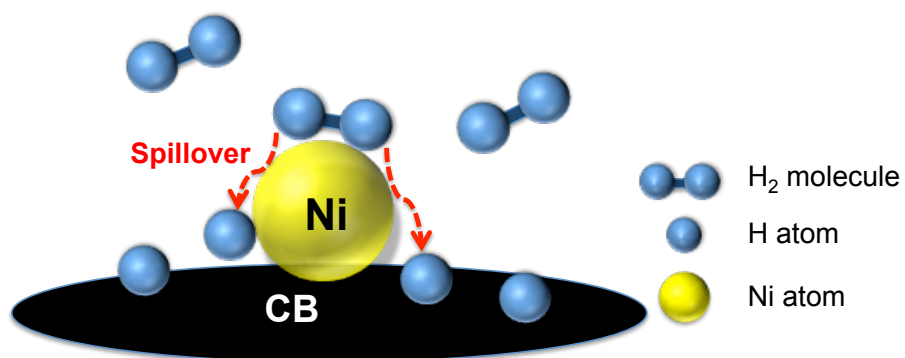


Figure S11. Proposed mechanism for hydrogen spillover on Ni/CB catalyst.