Highly-efficient and magnetically-separable ZnO/Co@N-CNTs catalyst for hydrodeoxygenation of lignin and its derived species under mild conditions

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Conversion of technical lignin into liquid biofuel and value-added aromatic chemicals has been considered a crucial pathway for realizing an economically-viable lignocellulose-based biorefinery concept. Most of the undesirable properties originate from the presence of a large amount of oxygenated compounds (oxygen content of 20–60 wt%). In search for the non-noble metal-based catalysts, conventional hydrotreating catalysts have been widely studied for the upgrading of bio-oil as well as its model species and only a few HDO tests over non-noble metal-based catalysts have been performed. Herein, we developed non-noble metal-based catalyst, which consisted of amorphous ZnO and crystalline Co nanoparticles (NPs) embedded on nitrogen-doped carbon nanotubes. The ZnO/Co@N-CNT catalyst completely removed the C=O group in vanillin to form creosol with a 100% yield under mild reaction conditions (150 °C, 0.7 MPa H2, 2 h) in an aqueous medium. In addition, kraft lignin and bio-oil derived from concentrated strong acid hydrolysis lignin were converted over ZnO/Co@N-CNTs.