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Hydroprocessing of lignin for the production of liquid fuels and chemicals

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Forestry biomass and residues (such as harvesting residues, sawdust, and bark) and lignin–a byproduct from pulping processes can be promising bio-renewable sources for the production of liquid fuels and chemicals. The lignin component of woody biomass is of particular interest as it comprises the world's largest natural source of aromatic compounds and is produced in large quantities as a by-product of pulp and paper processing. The main challenge in lignin utilization for fuels and chemicals is that it is composed of very large molecules with low heating values (due to high oxygen content) and low reactivity. Accordingly, the overall objective of this work is the production of chemicals and fuels by the catalytic hydroprocessing of lignin and lignin-derived bio-oils aiming to reduce their molecular weights and oxygen contents. This work investigated the catalytic hydroprocessing of a number of different lignins for the production of fuels and chemicals. Several supported metal hydrogenation catalysts were investigated for the depolymerization, deoxygenation, and desulfurization of Kraft lignin (KL) organosolv lignin (OL) and hydrolysis lignin (HL) under hydrogen atmospheres to produce depolymerized lignins or lignin-derived bio-oils. Screening of catalysts was performed using guaiacol as a model compound. The most effective catalyst under the conditions tested was found to be 1wt.% Mo-doped 5wt.% Ru supported on activated charcoal (MoRu/AC). The selected catalyst proved to be very effective for hydroprocessing of organosolv lignin, hydrolysis lignin (HL) and depolymerized hydrolysis lignin (DHL).

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