Heterogeneous Catalyst Design Principles for the Conversion of Lignin into High-Value Commodity Fuels and Chemicals

U.S. DEPARTMENT OF ENERGY | Office of Science

Background

- Tremendous effort has been invested in elucidating the factors for valorizing lignin components using heterogeneous catalysts, with efforts to explore robust methods for processing raw lignin.
- Current progress in lignin conversion has fostered many empirical advances; but understanding the key catalyst design principles is important for advancing the field.

Approach

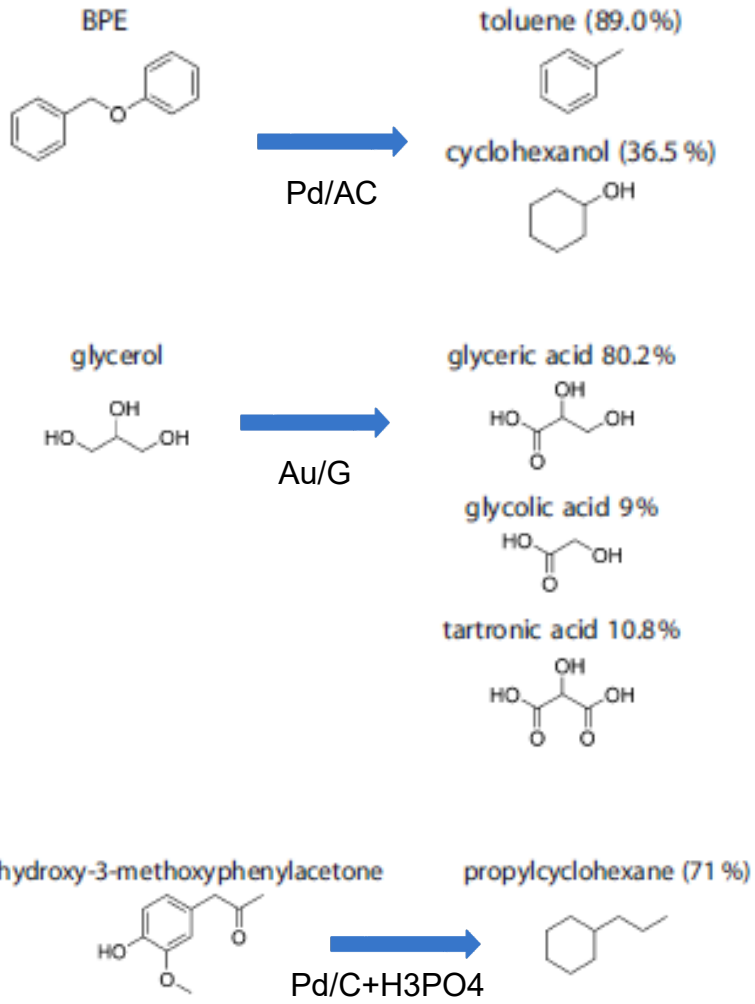
- This review aims to provide a summary on the fundamental design principles for the selective conversion of lignin by using heterogeneous catalysts, including the pairing of catalyst metals, supports, and solvents.

Outcome

- Depolymerization and polymerization through heterogeneous catalytic pathways require further development before lignin valorization is commercially viable.
- Most studies rely on the optimization of catalyst processes based on model lignin compounds making it easier to observe specific reactions and mechanisms.
- Catalyst optimization with real lignin samples will require co-optimization with biomass pretreatment technologies that can extract or fractionate natural lignin.

Significance

- This review brings a holistic view of the optimization of material and solvent properties needed for biomass upgrading.
- Efforts made to characterize lignin polymeric structure from different biomass sources will help develop pathways for improving the catalytic environment.



M. Gale, C. M. Cai, K. L. Gilliard-Abdul-Aziz, "Heterogeneous Catalyst Design Principles for the Conversion of Lignin into High-Value Commodity Fuels and Chemicals," *ChemSusChem* **2020**, *13*, 1947.. doi.org/10.1002/cssc.202000002.

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