

CHEAP AND ABUNDANT CATALYSTS FOR BIOMASS CONVERSION INCLUDING LIGNIN

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Biomass is a renewable source that can be used for the production of liquid fuels and valuable chemicals. Development of chemical catalysis for the fractionation of sugar and lignin components of biomass and their subsequent conversion has attracted intense attention over the past few years. The use of organic acids enables solubilization of the hemicellulose fraction of the biomass and dehydration of xylose to furfural. We discovered the combination of organic acids with Lewis acids such as aluminum enables the extraction of both C-5 (hemicellulose) and C-6 (cellulose) sugars and their dehydration to furfural and hydroxymethylfurfural, respectively. Cheap and abundant transition metals have also been used successfully to obtain levulinic acid and H₂ directly from biomass variants. We will report on examples with corn stover, switch grass, poplar, and pinewood. Even though lignin is a minor component of the total biomass, it represents a significant portion of the energy content. A robust and recyclable catalyst system based on palladium and zinc has been developed in our laboratory for the cleavage of ether bonds that are prevalent in lignin. The same catalyst can also affect the hydrodeoxygenation (HDO) of the resulting monomeric units of lignin to substituted phenols. Application of this new catalytic technology to engineered biomass will be briefly described.