

**DEVELOPMENT OF NOVEL NITROGENOUS BASE-TETHERED COBALT-SCHIFF BASE
COMPLEXES FOR THE SELECTIVE CATALYTIC CLEAVAGE OF LIGNIN**

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Lignin comprises up to 25% of biomass and is thus the second most abundant renewable carbon source after cellulose. Biorefining processes for converting biomass into its respective individual components introduces drastic changes into the native structure. For example, as native lignin is cleaved, the amount of free phenols found in dissolved lignin substantially increases. Therefore, developing catalysts that focus on the conversion of substituted phenols would best model the lignin structures as an isolated renewable carbon source. Because the substituted aromatics present in lignin are electron-rich, they should be susceptible to selective oxidation. Therefore, catalysts that target lignin-like phenol oxidation would be a viable approach for determining the applicability of lignin as a chemical feedstock. Co-Schiff base compounds are known to catalyze the oxidation of phenols under aerobic conditions. Recently, our group developed a homogeneous asymmetric Co-Schiff base catalyst (i.e., “second-generation” catalyst) that incorporates a benzylpiperazine unit onto one of the salicylaldehyde moieties; this catalyst effectively oxidizes both S- and G-type phenolic lignin models to 2,6-dimethoxybenzoquinone (DMBQ) and methoxybenzoquinone (MBQ), respectively, demonstrating significantly higher reactivity than conventional Co-Schiff base catalysts. Building upon this work, we seek to expand the scope of second-generation catalysts by designing both symmetric and asymmetric systems with differing nitrogenous base tethers (pyrrolidine, dimethylamine, and 1,5,7-triazabicyclo[4.4.0]dec-5-ene (TBD)) to be examined for catalytic oxidative activity relative to our current lead catalyst. Thus far, Co-Schiff base catalysts with pyrrolidine and dimethylamine tethers have been synthesized and characterized. Preliminary results indicate that these catalysts are not as active toward the oxidation of S-type phenolic lignin models to DMBQ as our current lead catalyst. Interestingly, the catalyst with a single pyrrolidine moiety gave the highest yield of syringaldehyde relative to the previously synthesized catalysts from our group. Based on these preliminary results, efforts toward the syntheses of catalysts with TBD units, as well as novel catalysts with differing arylpiperazine and arylimidazolidine units, are underway. Once these catalysts are synthesized, activity toward phenolic oxidation of lignin models will be examined. If these catalysts are active, then they will be evaluated for the catalytic deconstruction of lignin. If successful, our library of nitrogenous base-tethered Co-Schiff base catalysts for phenolic oxidation will be expanded and will lead to new methodology for conversion of biorefinery lignin, which will streamline biorefinery operation and offer new catalytic routes to biobased chemicals and fuels from renewable carbon sources.