ABSTRACTS (MASTER THESIS)

Degradation of lignocellulosic biomass by activated manganese porphyrin complexes

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Lignin, a heterogeneous phenylpropanoid structural polymer of vascular plants, is the most abundant renewable material next to cellulose, but it hinders separation of cell wall polymers, cellulose and hemicelluloses. Therefore, extensive studies have been made to degrade lignin by chemical, enzymatic and microbial treatments of woody materials. Metalloporphyrins have been used as peroxidase models, and applied to lignin degradation. However, behavior of the biomimetic catalysts against natural woody biomass is not well understood. In this study, manganese porphyrin complexes with two different counter ions, Cl^- and AcO^- were synthesized and applied to degradation of a non-phenolic lignin dimer model compound and Japanese cedar wood. The Mn complexes with Cl^- did not efficiently decompose the model compound, but substitution of the counter ion to AcO^- significantly accelerated the degradation. This phenomenon can be explained by electron-donating properties of AcO^- which induced heterolysis of the peroxo complex of the manganese porphyrin complexes. Due to the high reactivity of the catalyst, softwood was degraded by the catalyst, and degradation of wood cell wall components were analyzed by 2D-NMR. The NMR spectra indicated that hemicelluloses and lignin were preferentially degraded at elevated temperatures.