Sun Grant Western Regional Center
Oregon State University

# Synergies Between Heme Peroxidases and Cellulases in the Bioconversion of Lignocellulosic Feedstocks to Ethanol

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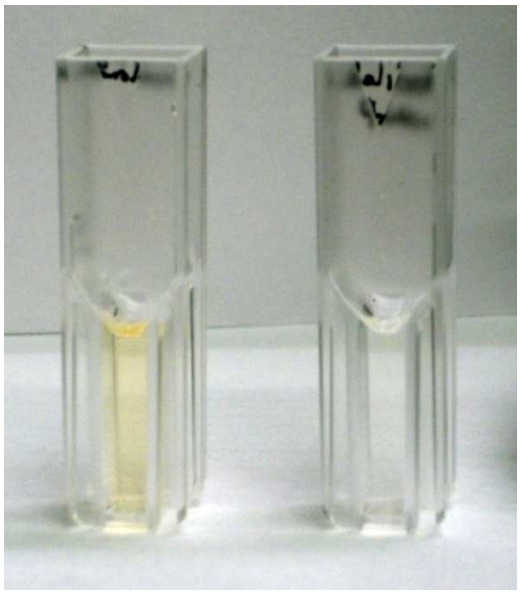
## Overview

Forest thinning, particularly forestry wastes composed of softwoods, in the Western region are a major potential source of biomass for biofuel production. However, softwoods, such as Douglas fir, tend to be more resistant to conversion processes due to the high presence of lignin. Dr. Kelly, along with her co-PIs, proposes to develop a new enzyme-mediated bioconversion process technology for more efficient separation of Lignocellulosic biomass into its component parts for bioconversion to ethanol. The team will examine fungal heme peroxidases to discover new "accessory" enzymes that function synergistically with the latest generation of commercially available cellulases to increase the rate and extent of conversion of softwoods to ethanol.

## Progress to Date

- Bioreactor runs and analyses: Dr. Kelly and her collaborators have run bioreactor experiments, analyzed bioreactor experimental data for publication and developed and solved a mathematical model describing bioreactor cultivation of manganese peroxidase (MnP) producing yeast. To analyze the effect of air low rate on MnP biosynthesis and degradation in the bioreactor broth, experiments were performed to determine the oxygen transfer coefficient at different air flow rates and different impellor speeds.
- Lignin degradation experiments: Experiments were performed to investigate the enzymatic degradation of partially purified lignin. The effect of H2O2 on rMnP enzymatic lignin degradation was investigated in shake flask reactors with periodic H2O2 addition. Researchers observed variability in the color development of the supernatant over 24 hours. The lignin was prepared from milled wheat straw using the NREL procedure for determining acid insoluble lignin in biomass.



*Color development in supernatant due to degradation of lignin.*

- Enzyme purification: The purification of nMmP through a pure final enzyme preparation process using spin filtration as a concentration step before purification has been described by various researchers. Dr, Kelly's laboratory investigated the use of four alternative concentration steps in the process. The team is continuing to produce and optimize the purification of rMnP for use in conversion experiments.

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## Collaborators

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