Valorization of Lignin-derived Aromatics through Microbial Synthesis

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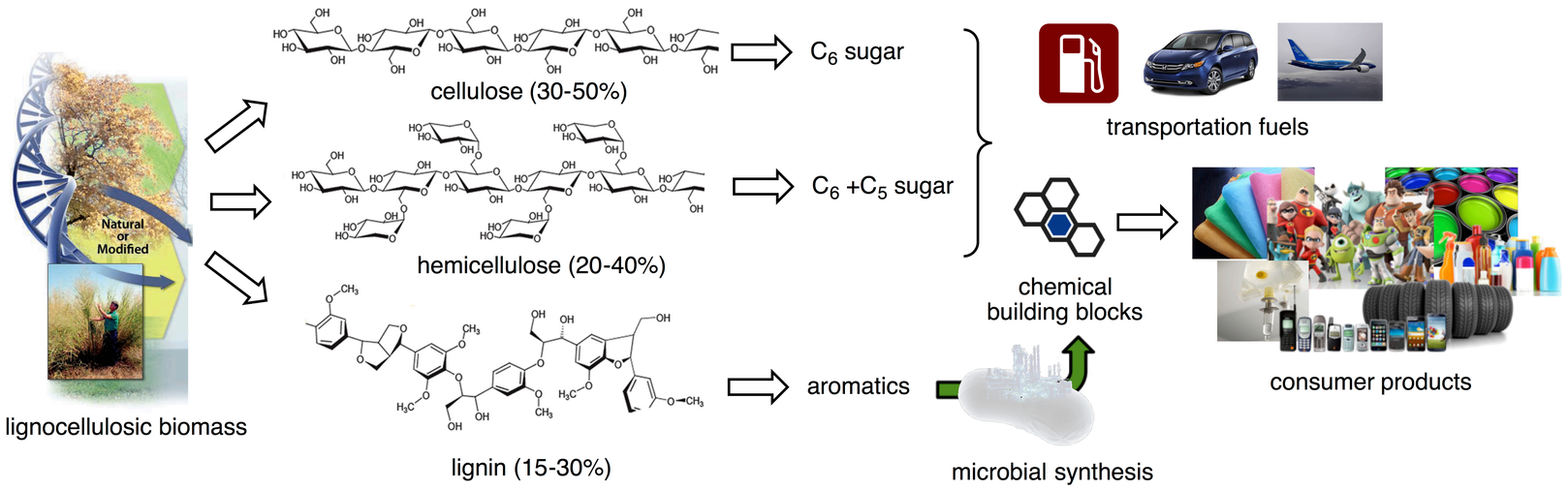
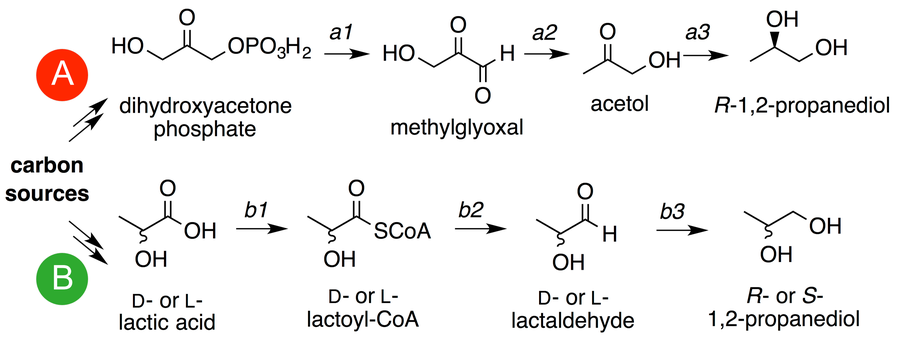


Abstract

Lignocellulosic biomass represents the primary feedstock in modern biorefineries for sustainable fuel and chemical production. Lignin, the aromatic polymer comprising 15-30% dry weight of the lignocellulosic biomass, has traditionally been viewed as a waste product and burned for heat and power. In this research, we seek to explore diverse microbial metabolic capacity of aromatic compounds that can be derived from lignin. We also focus on designing and constructing microbial strains that can convert the depolymerization products into value-added chemicals.

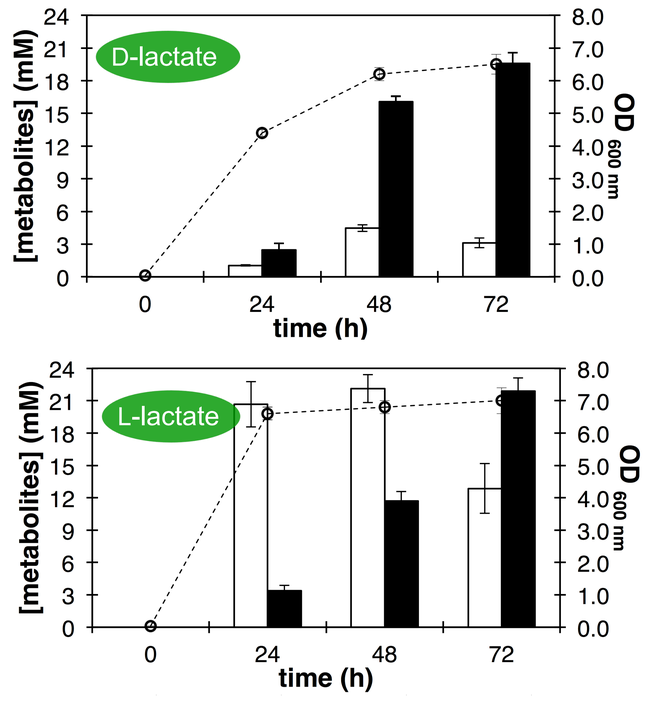
Preliminary Results

Figure 1. Biosynthetic pathways of 1,2-propanediol.



Preliminary Results

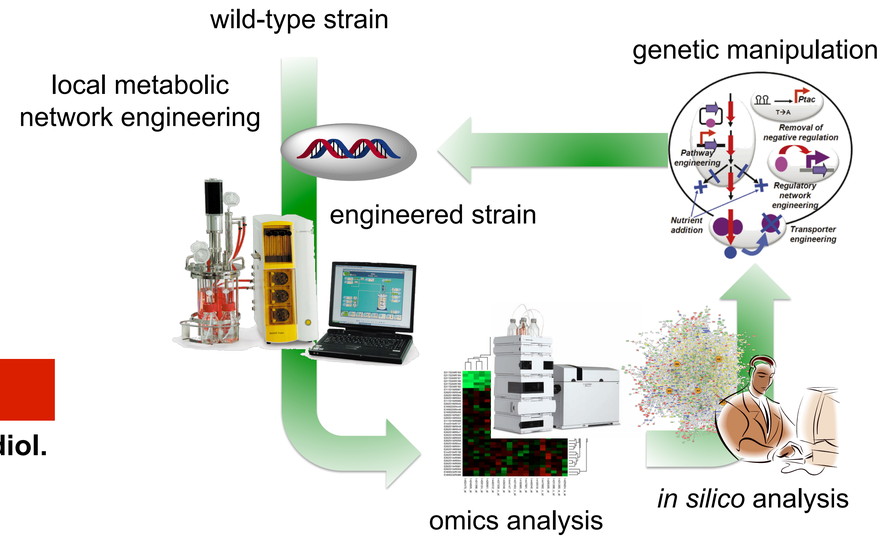
Figure 2. Bioconversion of lactic acid into 1,2-propanediol.



Experiments used an *E. coli* host that was incapable of lactate metabolism and ethanol synthesis. Molar yields of 35.3% and 39.4% were achieved for D- and L- lactate conversions. Analysis showed 99% *ee* and 98% *ee* for the *R*- and the *S*- isomer.

Preliminary Results

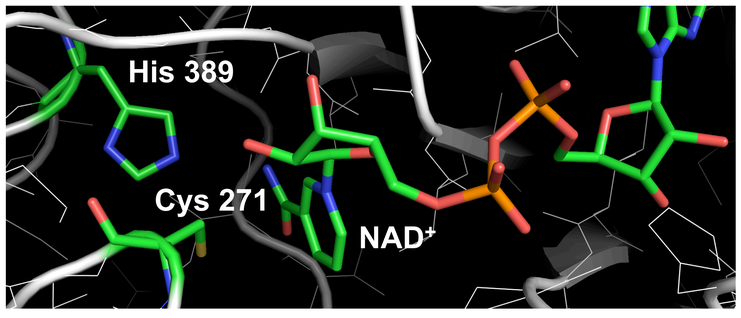
Figure 3. Systems metabolic engineering of *E. coli* host for *de novo* biosynthesis.



The *S*- and *R*- stereoisomers were synthesized at molar yields of 24.9% (97% *ee*) and 22.4% (99% *ee*) from glucose under the fermenter-controlled conditions.

Future Works

1. Protein engineering of rate-limiting enzyme.



2. Engineer the pathway into aromatics-utilizing hosts.

Acknowledgement

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