Lignin: It’s Degrading

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53%

130,000,000

*2005, Environmental Protection Agency
The Problem:

Cellulose

Lignin

Hemicellulose
Lignin

R = C – C – C
\[ R' \quad \text{R' \quad \text{R'}} \]

Lignin "monomer"

\[ R' = -H, -OH, \text{ or } =O \quad \text{4-alkylcatechol} \]

Sample Lignin Polymer Structure
Phanerochaete Chrysosporium
Our Idea:

LipA Yeast

Mixture of cellulose & hemicellulose

Wood Sample
Products = Fuel

Mixture of cellulose & hemicellulose

Cellulolysis

Sugar Compound

Fermentation
Goals

• Isolate Genes for Lignin Degradation

• Contribute Biodegradation Parts

• Make it easier to engineer Biodegradation system

• Experiment with degrading other materials
Limitations
Phase I: Summer 08

Lignin

Peroxidase
Step 1:
Isolate LipA Gene

Phanerochate Chrysosporium cDNA grown on Aspen Wood
Step 1:
Isolate LipA Gene

Specific for Coding Region

Lignin Peroxidase
Step 2:
Make Lignin Peroxidase BioBrick
Step 3:
Test For LipA production
Strategy

cDNA RP-78 Strain of Phanerochaete Chrysosporium

Lignin Peroxidase

~200 bp Upstream

~80 bp Downstream

pPIC6α Expression Vector

BioBrick Standard Assembly
Accomplishments

- Isolated Lignin Peroxidase from Highly Homologous Gene Family
- Cloned into Yeast Expression Vector for Testing
- Submitted Biodegradation Part to Registry
- Helped make it easier to engineer a biodegradation system.
Future

• Further test and fully characterize our part
• Develop genetic system around our part for lignin degradation
• Isolate and standardize other genes involved in lignin degradation
• Test our enzyme’s ability to degrade synthetic polymers
Thanks

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