Comparison of Notable Microbial Platforms Toward Optimizing Biological Funneling of Lignin Streams

Background

- Bioconversion of lignin to produce chemicals requires harnessing the metabolism and tolerance mechanisms of microbes. Several strains have been promoted for their catabolic capacity to utilize lignin-derived aromatic compounds, necessitating a comparison of these strains as hosts and genetic reservoirs for lignin bioconversion.

Approach

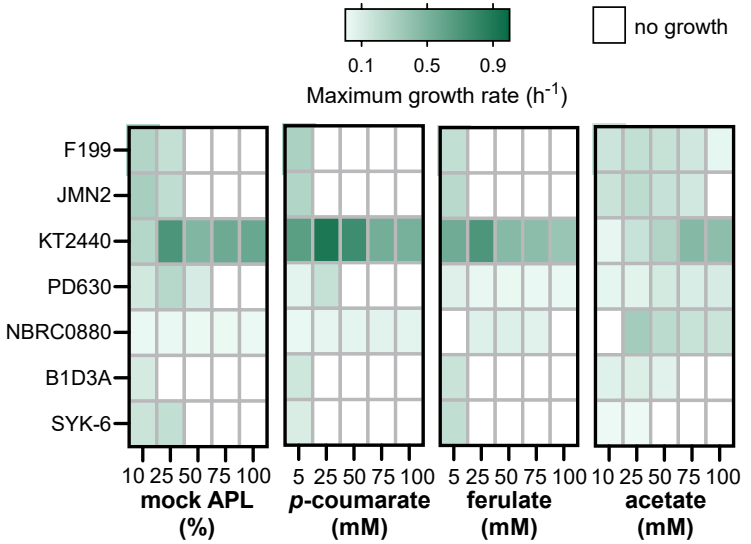
- With GLBRC and JBEI, we assessed 7 strains by 1) identifying a common minimal media, 2) determining growth and tolerance to 9 compounds and alkaline pretreated liquor (APL), and 3) evaluating the catabolism of corn-stover APL. Several analytical techniques were utilized to characterize the lignin bioconversion.

Results

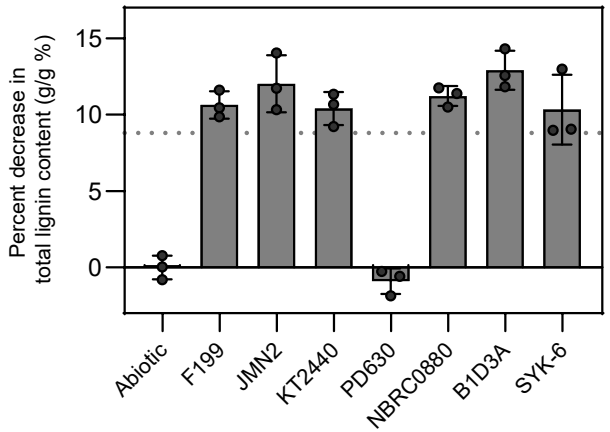
- *Pseudomonas putida* KT2440 had the fastest growth and greatest tolerance when grown on *p*-hydroxyphenyl-type compounds, guaiacyl-type compounds, aliphatic acids, a model chemical mixture, and corn stover APL, whereas the *S. lignivorans* strains (B1D3A and SYK-6) had the fastest growth on the syringyl-type compounds and were the only strains to appreciably modify β-ether units in the corn stover APL.
- Six strains depleted the lignin content 10-12% after 120 h, which represented almost exclusively free aromatic and aliphatic acids in the corn stover APL; *Rhodococcus opacus* PD630 was the exception.

Significance

- The comparisons in this work provide a basis for the selection of microbial hosts and unique metabolic capabilities for lignin bioconversion. This work also highlights the tolerance and catabolic capacity of *P. putida* KT2440 for most lignin-related compounds, the syringyl catabolism in the *Sphingobium* spp., and the need for improvements in catalytic lignin deconstruction to obtain a higher percentage of monomeric content.



Maximum growth rates and tolerance of microbial strains to model chemical constituents of lignin streams.



Percent decrease in lignin content including free aromatic compounds after 120 h of incubation with the 7 strains or no inoculum (abiotic control).

Novosphingobium aromaticivorans F199 | *Novosphingobium aromaticivorans* JMN2 | *Pseudomonas putida* KT2440 | *Rhodococcus opacus* PD630 | *Rhodosporidium toruloides* NBRC0880 | *Sphingobium lignivorans* B1D3A | *Sphingobium lignivorans* SYK-6

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