Cosolvent Enhanced Lignocellulosic Fractionation Tailoring Lignin Chemistry to Enhance Lignin Bioconversion

Background

- Lignin bioconversion is a promising green approach for lignin valorization of biomass. The structural heterogeneity of low-quality lignin and the underdeveloped fermentation technology significantly hinder efficient lignin bioconversion. Cosolvent Enhanced Lignocellulosic Fractionation (CELF) produces a clean lignin steam (i.e., CELF lignin). The effects of CELF on lignin bioconversion have not yet been evaluated.

Approach

- We isolated lignin from poplar via CELF pretreatment and examined the bioconversion performance of CELF lignin by applying recently developed alkali sterilization to enhance lignin dispersion within aqueous media.
- Chemical and structural properties of alkaline sterilized CELF lignin were elucidated and compared with conventional ethanol organosolv lignin (EOL) and kraft lignin (KL) to understand mechanisms of enhanced bioconversion performance of CELF lignin using the aromatic-consuming, lipid-producing microbe, *Rhodococcus opacus*.

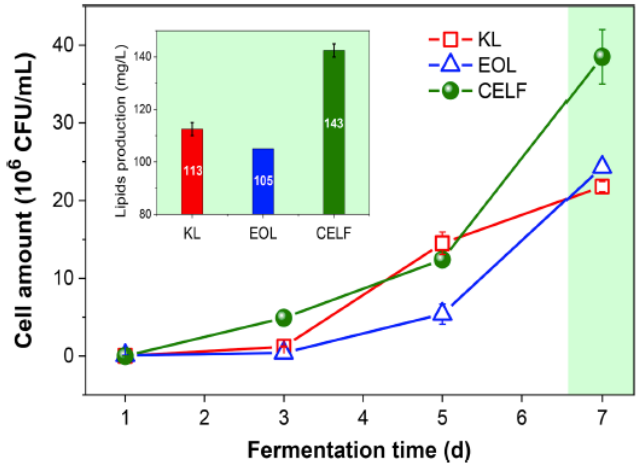
Results

- *R. opacus* PD630 cell amounts was highest in CELF media compared to EOL, and KL media (see figure).
- The lipids production at the end of fermentation followed the order of CELF > KL > EOL.
- Principal component analysis suggested that more carboxylic acid groups and lower molecular weight in the pretreated fractionated lignin contributed to the enhanced bioconversion performance of CELF lignin.

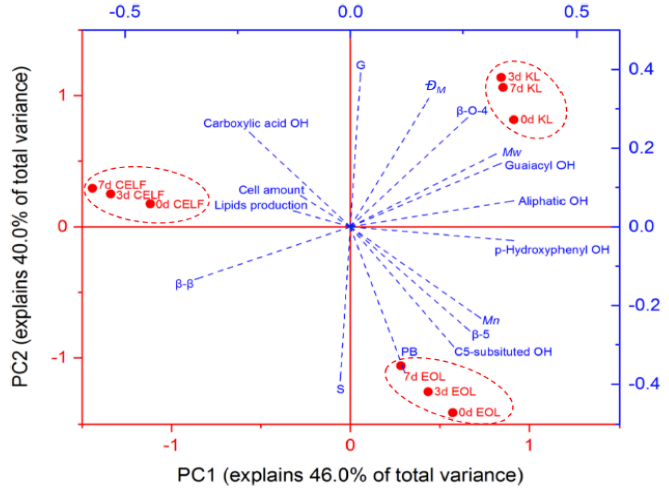
Significance

- CELF pretreatment combined with alkali sterilization strategy provides an effective strategy to improve the bioconversion of lignin into lipids, facilitating lignin biological valorization in biorefineries.
- Biolipids cany be directly upgraded into biofuels (e.g., biodiesel).

Zhao et al. Bioresource Technology. (2022) 347, 126367. doi.org/10.1016/j.biortech.2021.126367



Comparison of *R. opacus PD630* growth and lipids production using different pretreated lignin substrates.



Plots of the first two principal components from a PCA analysis of lignin molecular properties on conversion.