Lignin Carbon–Carbon Bond Cleavage is Key to Increasing Aromatic Monomer Yields

Background

- Biological funneling of lignin to single products relies on the ability to convert lignin into bio-available aromatic monomers.
- Recalcitrant C–C bonds often limit the aromatic monomer yields from only the cleavage of C–O bonds to approximately 30 wt%.

Approach

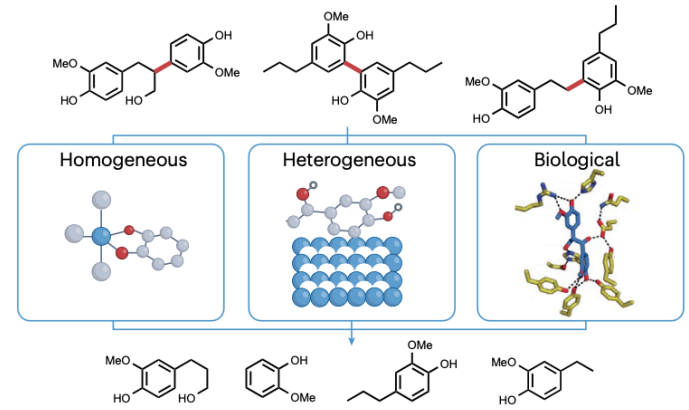
- We reviewed C–C bond cleavage from a catalytic perspective, focusing on homogeneous, heterogeneous, and biological catalysis.
- Our focus was on chemistry that was definitive for C–C bond cleavage, addressing challenges in lignin analytics and dearth of substrates wherein only C–C bonds remain.

Results

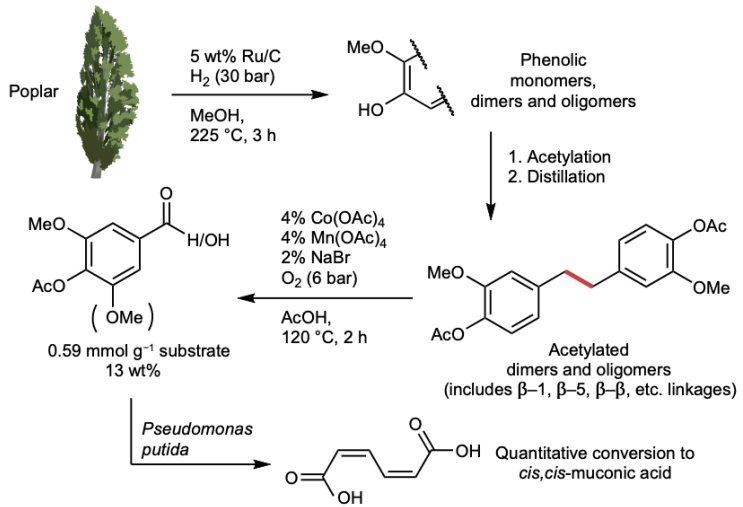
- Multiple potentially viable routes for chemo-catalytic C–C bond cleavage are demonstrated in the literature.
- There was a clear need for guidelines in the field for showing definitive C–C bond cleavage reactions in lignin; this review paper describes such guidelines.
- Significant further research is required to develop and optimize practical catalytic C–C bond cleavage methods.

Significance

- This review highlights the few robust methods that exist today for C–C bond cleavage in lignin.
- Despite the lack of studies today, it is imperative to find a realistic path to better C–C bond cleavage in order to maximize overall aromatic compound yields from lignin.



Our review covers homogeneous, heterogeneous, and biological C–C bond cleavage in the lignin polymer.



Example of lignin depolymerization via C–C bond cleavage in CBI-funded work (in collaboration with GLBRC)

Palumbo, Chad T. *et al*. *Nature Reviews Chemistry* (2024), doi.org/10.1038/s41570-024-00652-9