Influence of S/G Ratios on Product Distribution of Catalytic Fractionation of Grass Stover for Sustainable Fuel Production; Methodology Development

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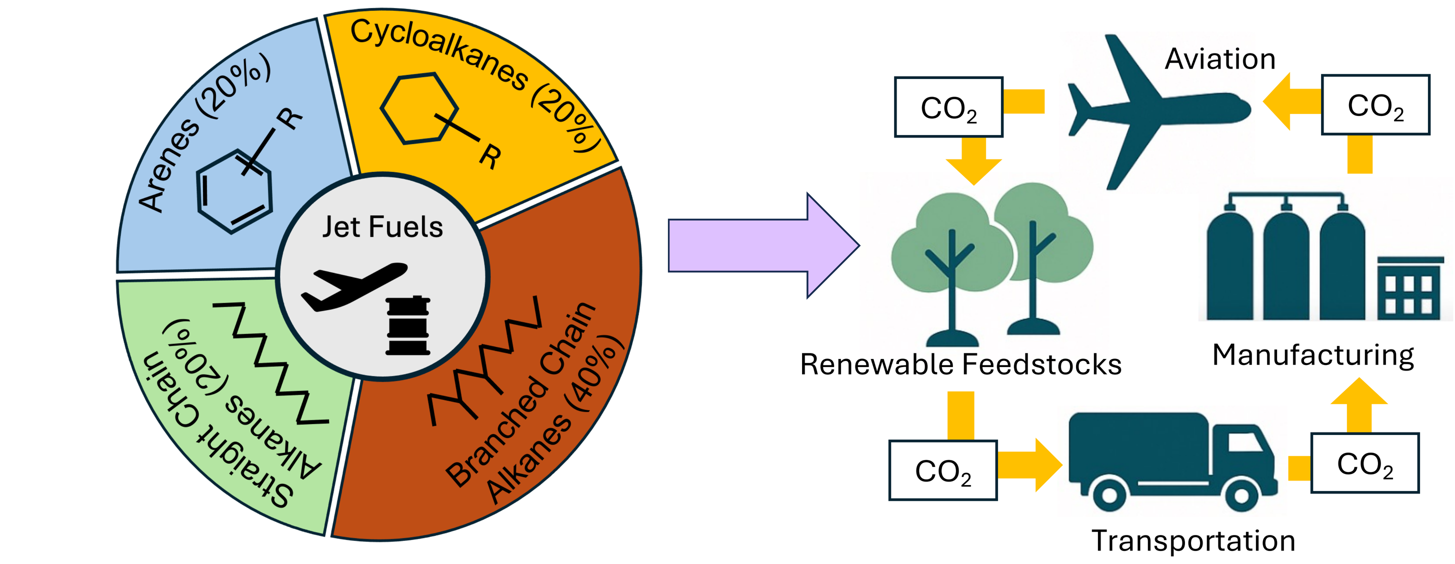
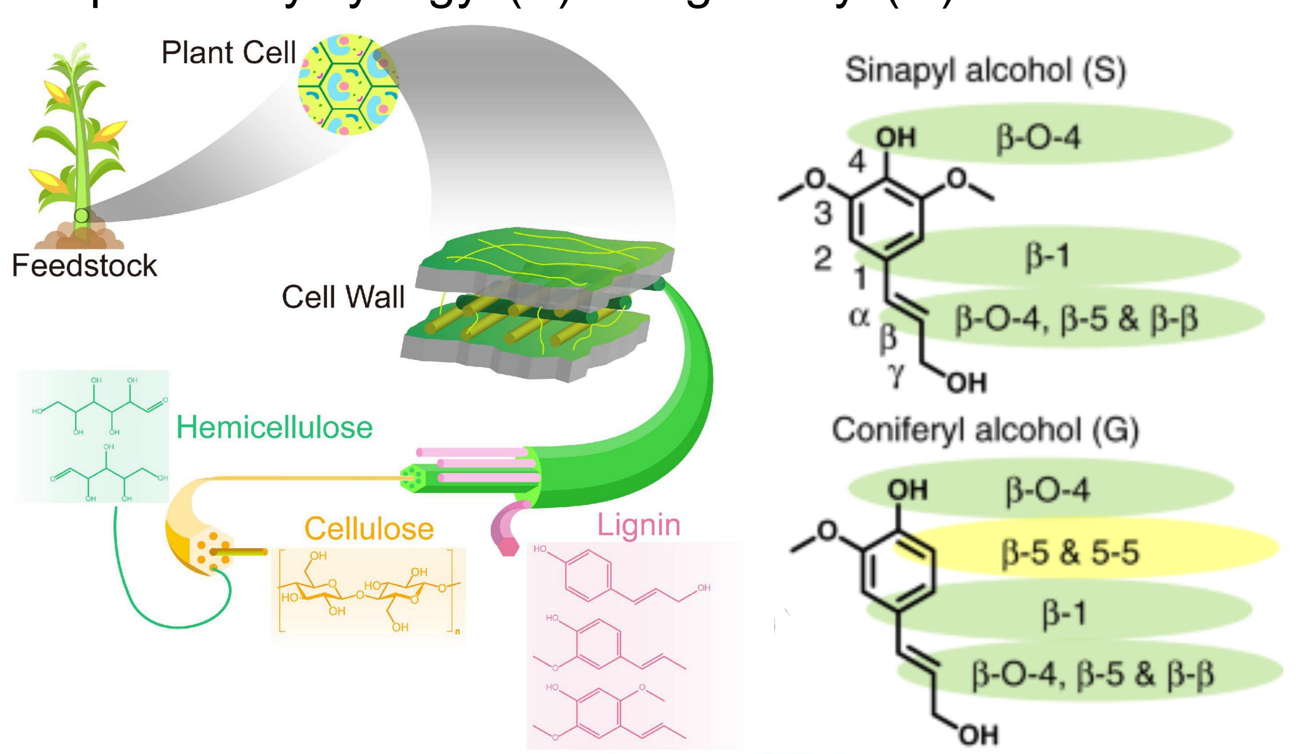
Motivation/Background

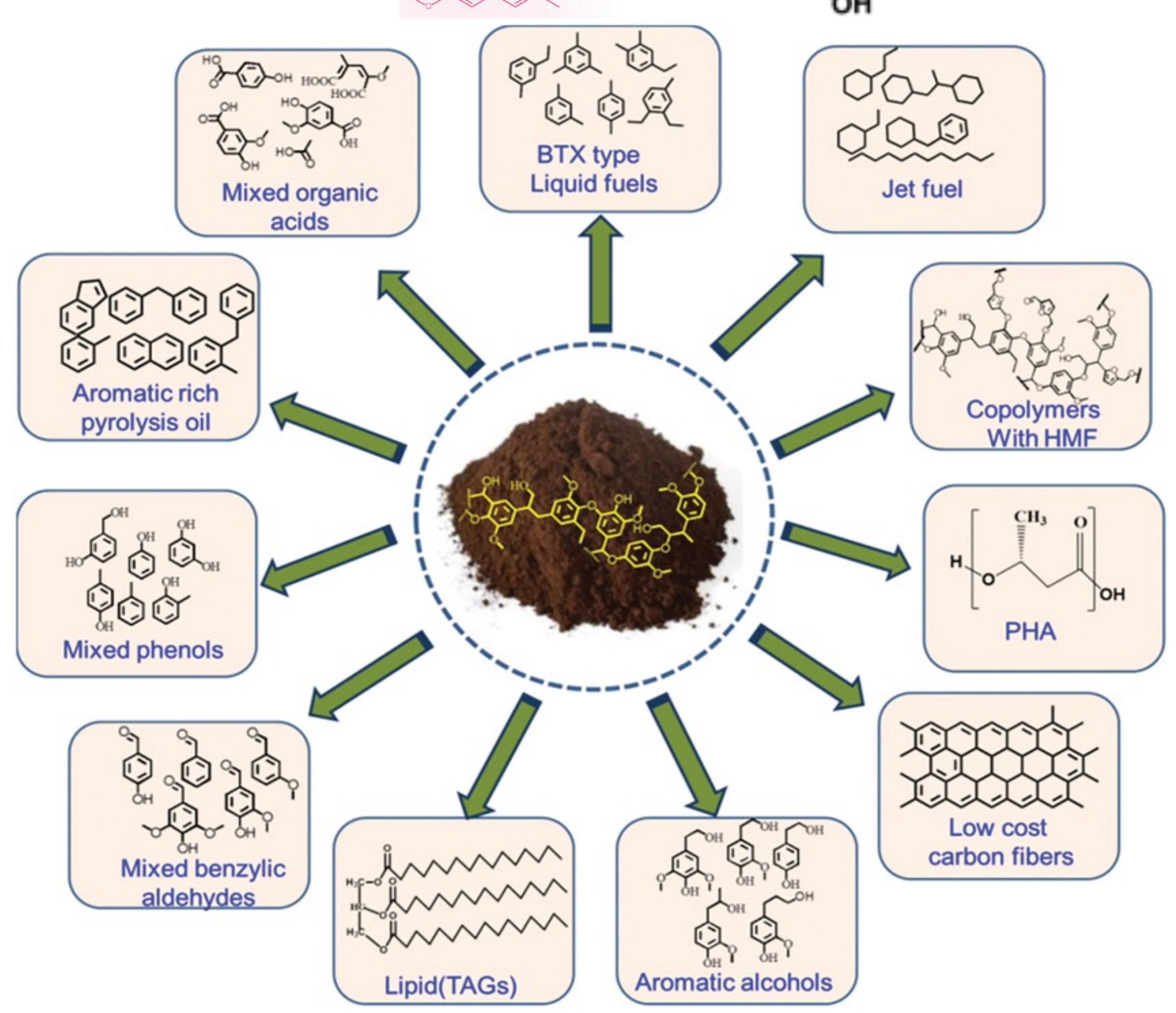
- Aviation industry contributes 2-3.5% of CO_2 emissions[1]
- Goal: produce sustainable aviation fuels (SAF's)



Breakdown of Jet Fuel Components[5]

- Lignin catalytic depolymerization can produce aromatic components needed for SAF's
- Lignin from varying sources has a different structure, specifically syringyl (S) and guaiacyl (G)

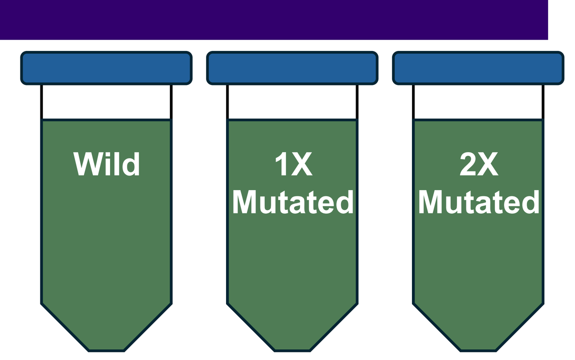




Different potential pathways of lignin to diverse products[4]

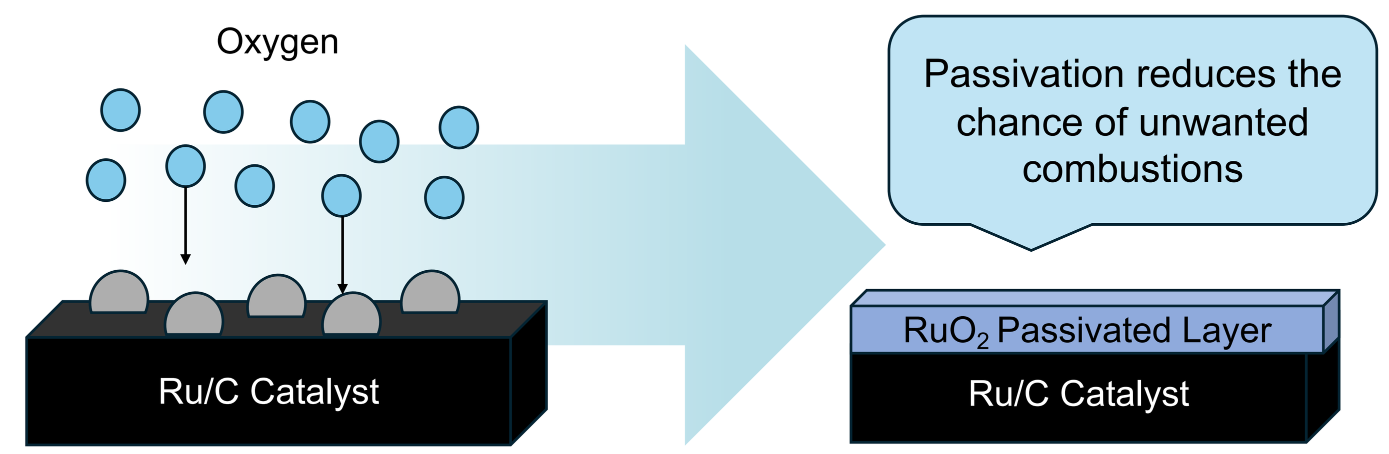
Goal

Investigate how the S/G ratio in lignin comprising grass stover affects the distribution of products formed during reductive catalytic fractionation (RCF)
2,3

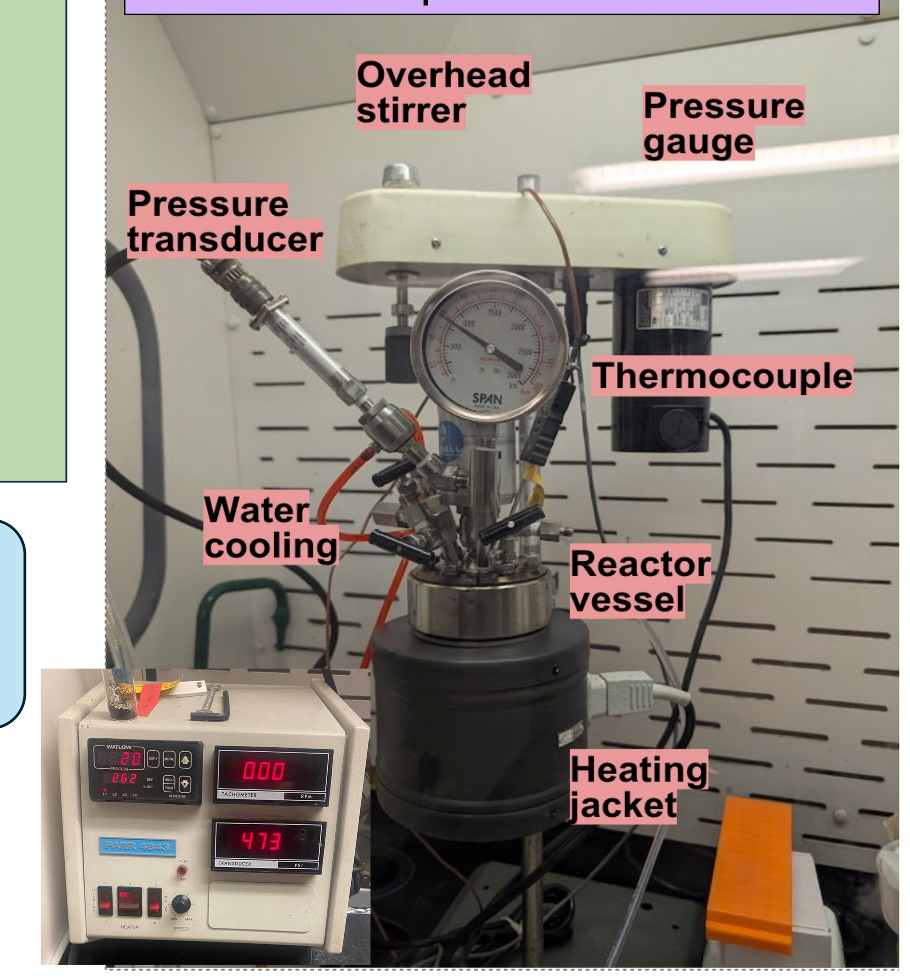


Methodology

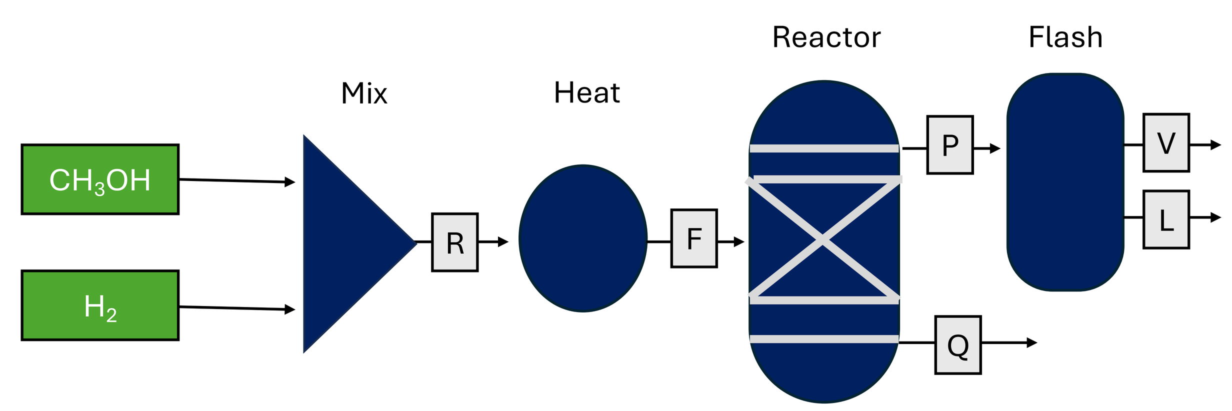
Key Challenges



SOP Development Parr Reactor

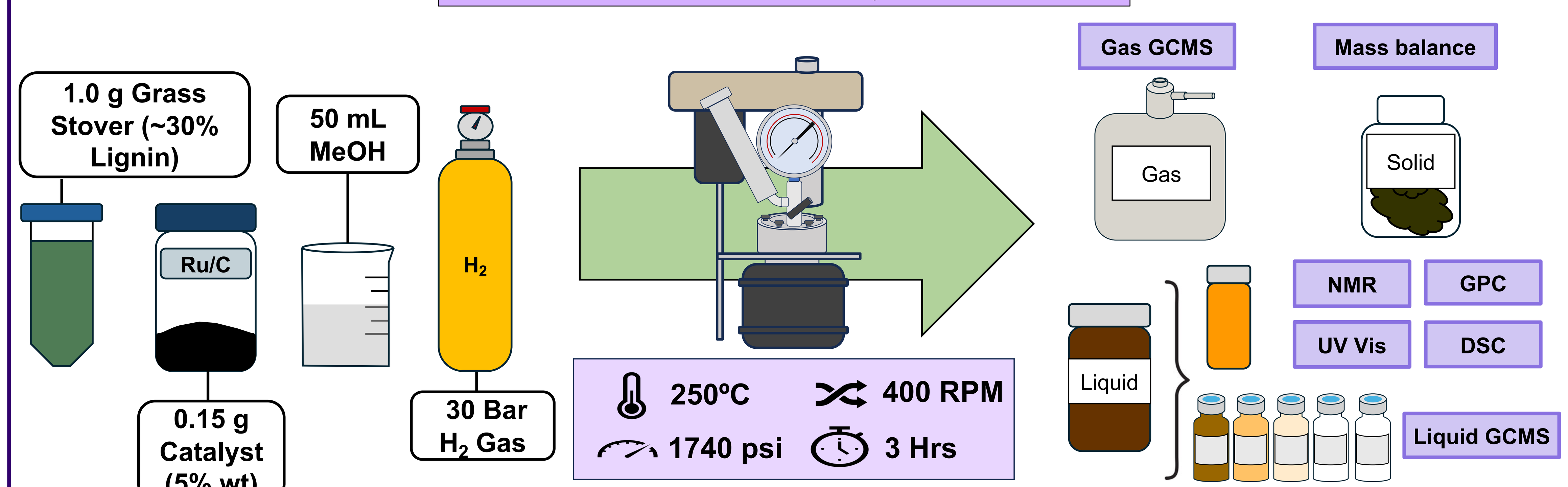


Safety Calculations



Case	Assumptions	Predicted Pressure and Temp
Isothermal	Constant 250°C, 100% MeOH Conversion	PR: 224 Bar NRTL: 212 Bar SRK: 228
Adiabatic	No heat exchange	>700°C, > 400 Bar

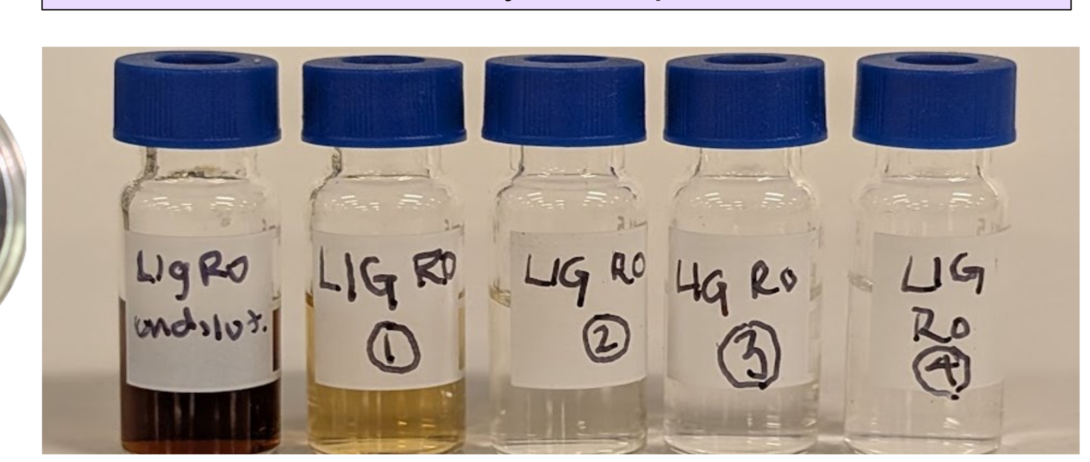
Reaction Workflow & Analytical Methods



Results

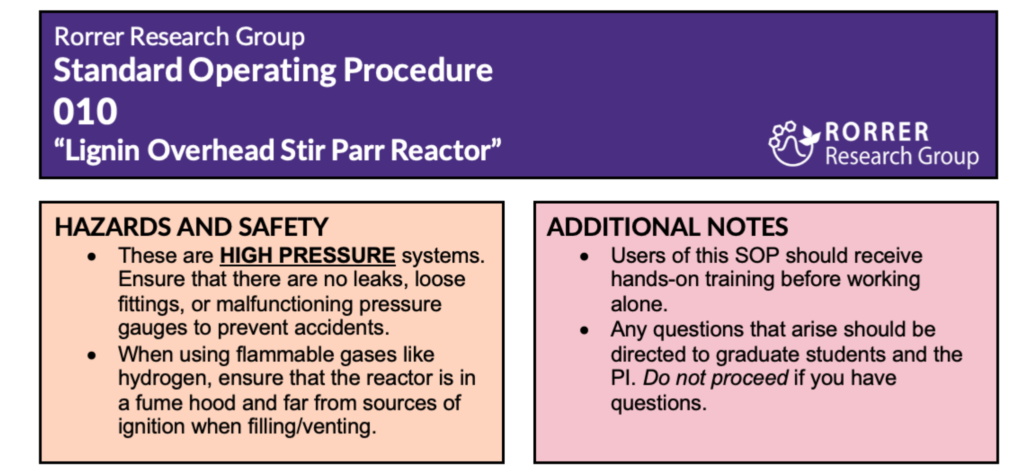
Uncatalyzed Trial Reaction

Diluted Uncatalyzed Liquid Products



Conclusion

Developed a standard operating procedure (SOP) for lignin RCF rxns to ensure reproducible results and consistent comparison between samples. Details replacement parts, cleaning procedures, and safety concerns



Rorrer Research Group
Standard Operating Procedure
010
"Lignin Overhead Stir Parr Reactor"

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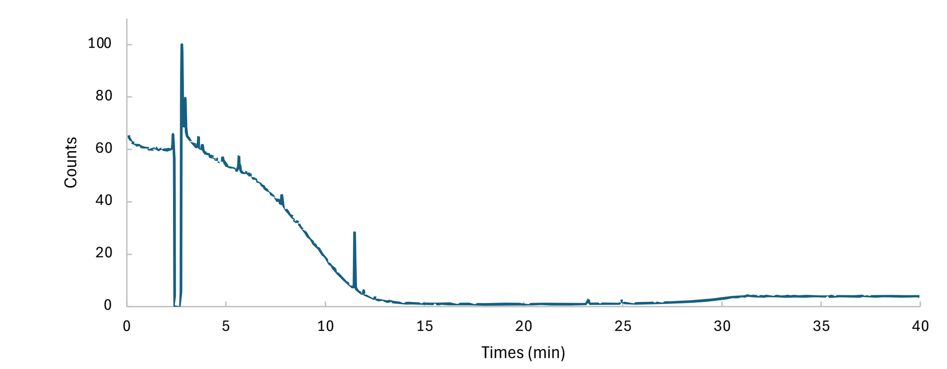
HAZARDS AND SAFETY
- These are **HIGH PRESSURE** systems. Ensure that there are no leaks, loose fittings, or malfunctioning pressure gauges to prevent accidents.
- When using flammable gases like hydrogen, ensure that the reactor is in a fume hood and far from sources of ignition when filling/venting.

ADDITIONAL NOTES
- Users of this SOP should receive hands-on training before working alone.
- Any questions that arise should be directed to graduate students and the PI. *Do not proceed* if you have questions.

Future Work

- Conduct RCF rxns using the mutated lignin samples
- Characterize the reaction products (solid, liquid, and gas) from all three lignin types to compare compositional trends and identify potential fuel precursors



- Quantify a S/G ratio is needed to make a difference in product distribution.
- Collaborators engineer lignin that can produce desired aromatics ($C_6 – C_{16}$)

Acknowledgments

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