GRADUATE INDUSTRIAL RESEARCH SYMPOSIUM 2023

"Reshaping the Future through Science and Technology"

Yield Stress and flow behavior of enzyme liquefied slurries from Corn Cobs and Corn Stover Pellets

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ABSTRACT

With the increase in population, the world will depend on renewable sources to meet the increasing energy needs. The use of lignocellulosic biomass as a renewable source has been proven efficient for conversion to cellulosic ethanol and capable of contributing to thresholds for energy demand while reducing greenhouse gases by 90% when compared with fossil fuels. However, feeding and flow of biomass within biorefineries represent a constant challenge and needs to be addressed.

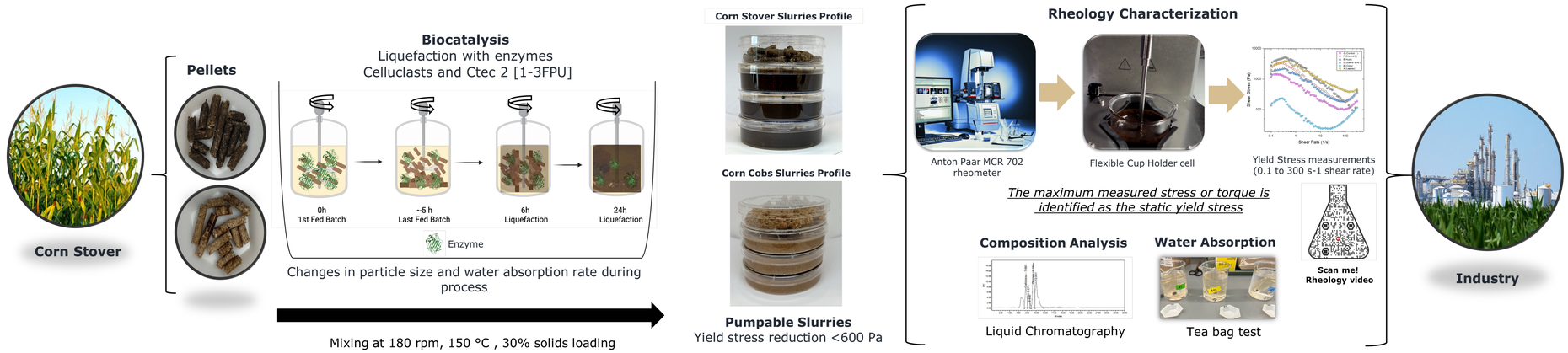
The purpose of this research is to understand the yield stress and flow behavior of enzyme liquefied slurries from Corn Cobs and Corn Stover Pellets and explore the effects of the differences in composition and physical characteristics of the material on the enzymatic liquefaction and rheology.

PRESENTER BIO INFORMATION

Diana M. Ramirez Gutierrez

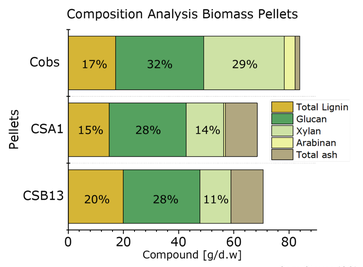
MS in Agricultural and Biological Engineering 2019. Diana is currently a PhD candidate at the LORRE lab in ABE. She is part of the diversity, equity and inclusion graduate committee and has a passion for renewable energies initiatives., like solar power and biofuels.

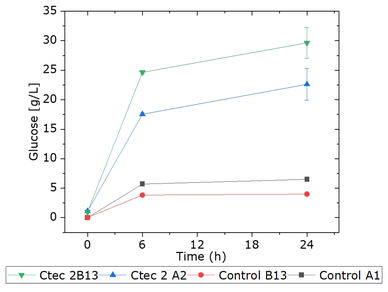
Materials & Methods



Results & Discussion

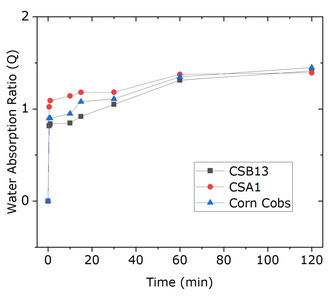
Chemical Characterization

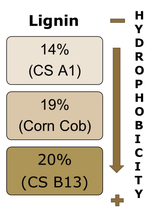


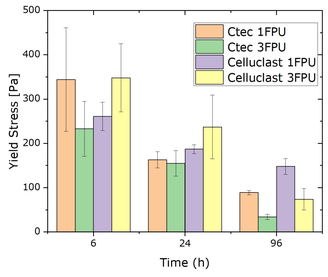


Yield conversion of sugars was higher for enzyme liquefied samples. Ranged between 24% to 35% based on the original glucan content.

Rheology Results



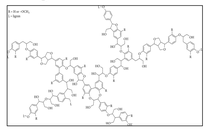




Sample	Control CS A1	Control Cobs	Control CS B13	CS A1	Cob	CS B13
Yield Stress [Pa]	--	4868	2197	1461	155	79

LIQUEFACTION

Lignin Molecule



Aliphatic and aromatic constituents make lignin hydrophobic.

Conclusions

- Flow behavior of enzyme liquefied slurries from corn cobs and corn stover pellets can be characterized by using the proposed rheology measuring method. Yield stress serves as a quantification for flowability and the success of liquefaction when reduced compared to the control.
- Lignin content can help to understand materials differences during the enzymatic liquefaction. Lignin hydrophobicity changes the physical characteristics of the pellets and affects the water absorption ratio and enzyme availability during the reaction.
- Yield stress reduction was successful for the three different residence times used for corn cobs and after 24h for corn stover pellets A1 and B13. Reduction of yield stress was prominent for samples treated with Ctec-2 at 3 FPU/g of dry sample.

References

[1] Dos Santos, Antonio C. Freitas, et al. "New strategy for liquefying corn stover pellets." Bioresource Technology 341 (2021): 125773.
[2] Serra, Luana Assis, et al. "Screening method for Enzyme-based liquefaction of corn stover pellets at high solids." Bioresource Technology 363 (2022): 127999.

Acknowledgements This research is possible by the support of the United States Department of Energy Bioenergy Technologies Office (DOE-BETO) under contract DE-EE0008256 & DE-EE0008910 .

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