

# Vapor-Phase Pyrolysis Screening Links Feedstock Type to Performance in Catalytic Upgrading to Generate Renewable Aromatic Products

## Background

- Catalytic fast pyrolysis (CFP) uses catalysts to upgrade fast pyrolysis (FP) vapors from biomass to generate renewable chemicals or fuels. CFP research has focused on optimizing catalysts and process conditions, with less focus on the effect of feedstock properties on CFP product distributions.
- There are no known associations between raw, uncatalyzed pyrolysis products from specific feedstocks and their corresponding CFP products.
- The analysis of pyrolysis vapor composition and corresponding CFP products from a large variety of feedstocks with chemometrics and statistical analysis will help fill this gap in our understanding.

## Approach

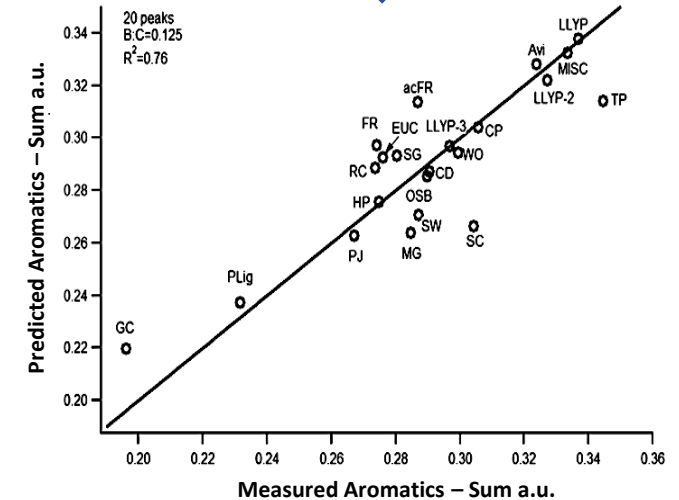
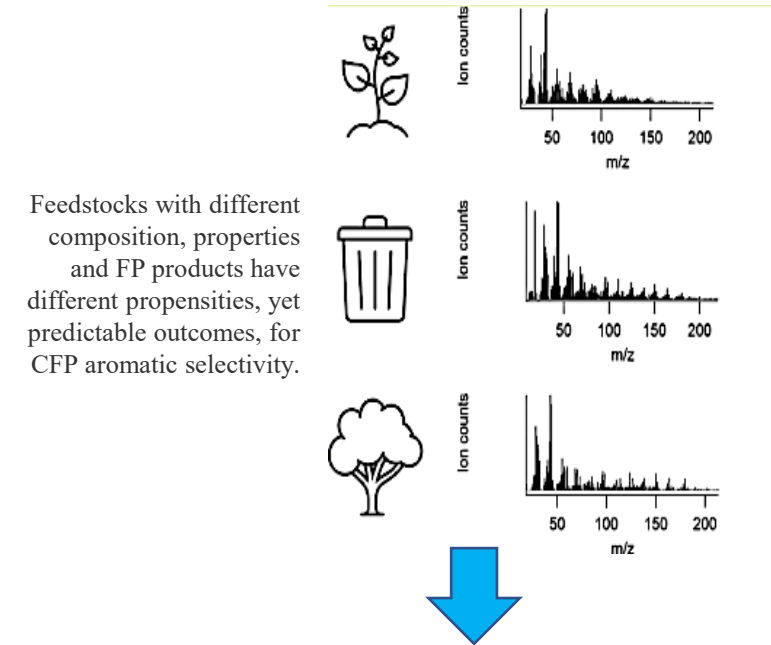
- Fast pyrolysis and catalytic fast pyrolysis behavior of 20 renewable feedstocks was studied in a microscale reactor with molecular beam mass spectral analysis of products generated.
- A partial least squared model was constructed based on the FP vapor spectra that predicts the aromatic selectivity when upgrading over a ZSM-5 catalyst. Principal component analysis of both FP and CFP spectra was performed.

## Results

- Aromatic selectivity of CFP of different feedstocks could be predicted from FP products; aromatic production was positively correlated with the carbohydrate-derived species and negatively correlated with lignin-derived species. Catalyst coking, a metric typically used to measure and understand catalyst deactivation in CFP processes, was not a reliable measure of catalyst deactivation when feedstock type was varied.

## Significance

- Feedstock type and properties impact CFP products and catalyst deactivation. Vapor phase mass spectral screening can be used to rapidly predict feedstock performance in CFP. Multiple variables and metrics need to be considered to understand catalyst deactivation when feedstock type is varied.



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