Hydrothermal pretreatment and fractionation of agricultural lignocellulosic waste biomass towards furanics and lignin based chemicals

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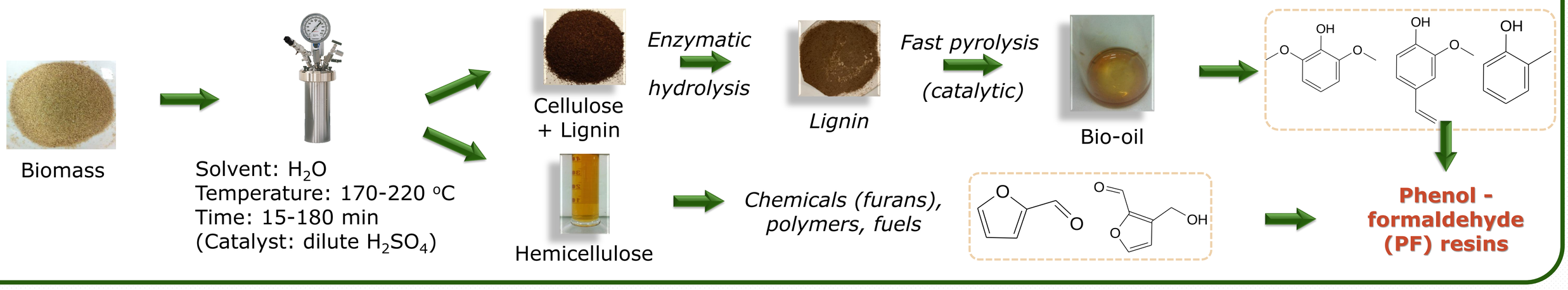
Introduction

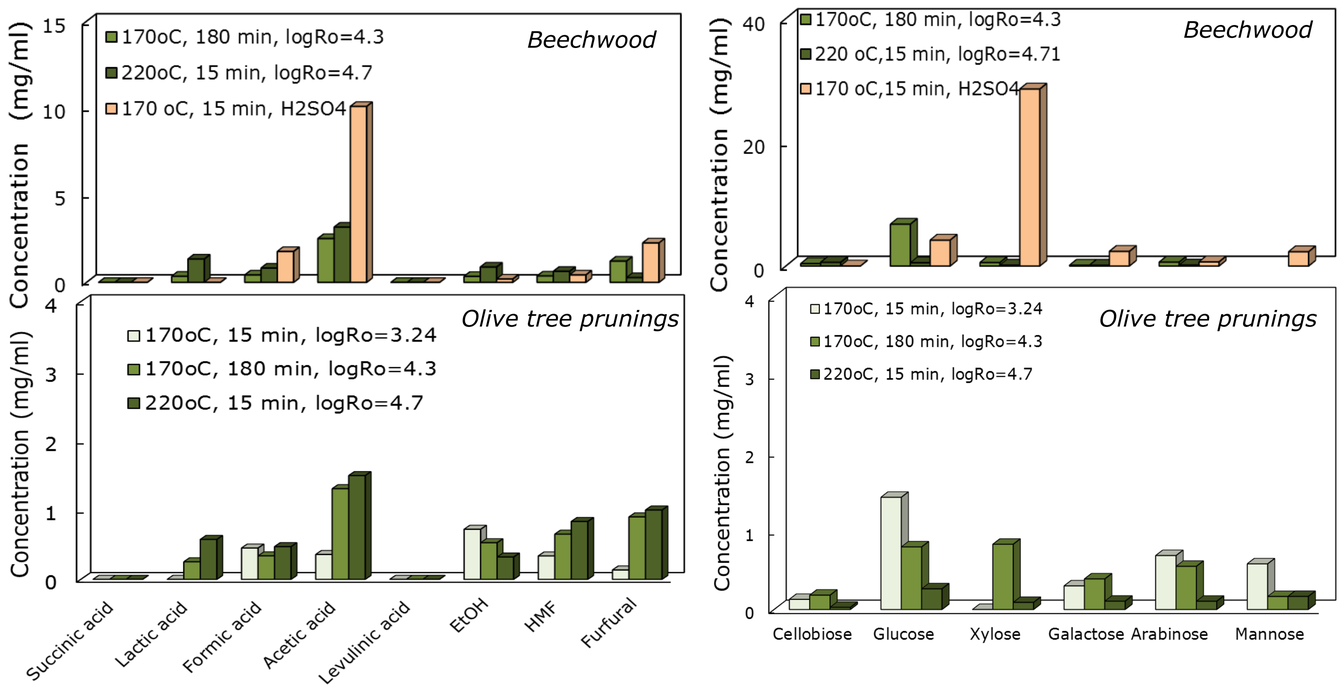
- The depletion of fossil raw materials and the effort to replace the petroleum derived products, fostered research towards alternative sources of fuels and chemicals.
- Within an integrated "biorefinery" context, lignocellulosic biomass can be converted into platform chemicals with many industrial applications via (bio) catalytic processes[1-3].
- The aim of this study, is the selective fractionation of lignocellulosic biomass feedstocks (agricultural and food industry wastes), towards liquid (hemicellulose/furanics) and solid (lignin/bio-oil) streams that could be utilized in the production of phenol formaldehyde (PF) resins.

Biomass pretreatment/fractionation and production of phenolic and furanic monomers



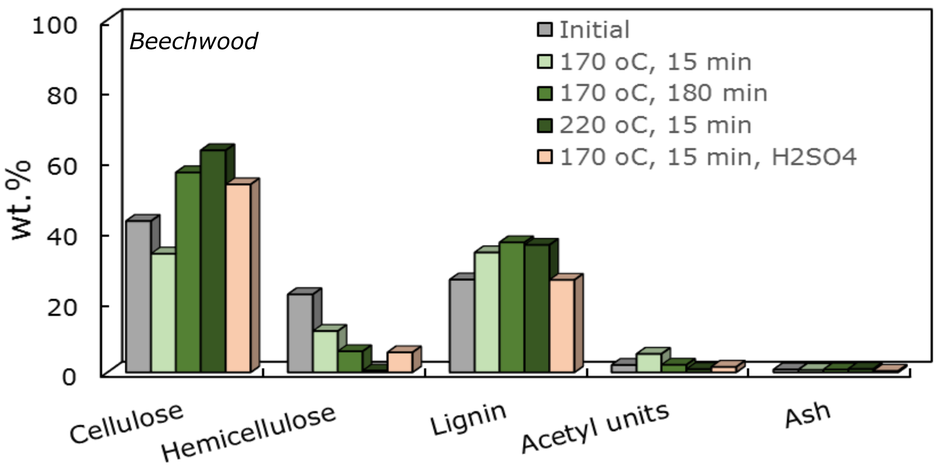
Composition of liquid and solid fractions – Enzymatic hydrolysis of cellulose

Composition of liquid fractions



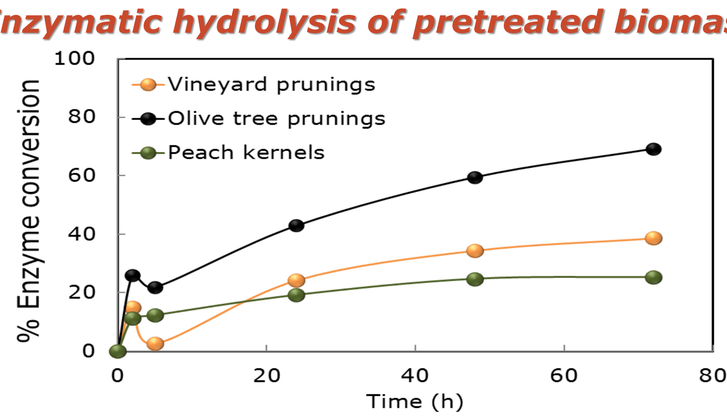
- Composition of liquid fractions can be tuned according to the targeted downstream valorization
- Increase of pretreatment severity, increases the solubilization of biomass and decrease the pH due to the formation of organic acids
- At low severities, hemicellulose is recovered as xylose while at higher severities, furanic compounds (furfural, HMF) are formed
- Addition of H_2SO_4 as catalyst, enhanced the solubilization and the formation of xylose monomer in liquid fraction

Composition of solid fractions



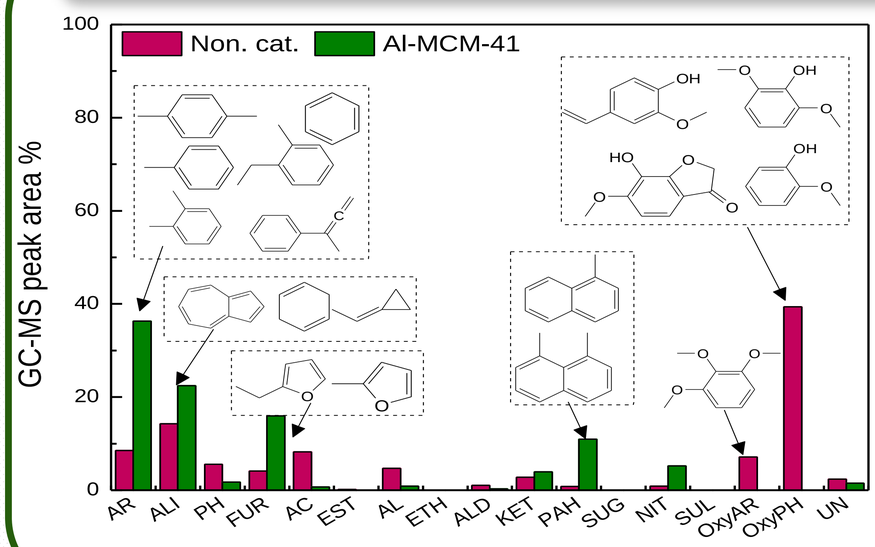
- Increase of pretreatment severity, increase the cellulose and lignin content in the solid fraction.

Enzymatic hydrolysis of pretreated biomass

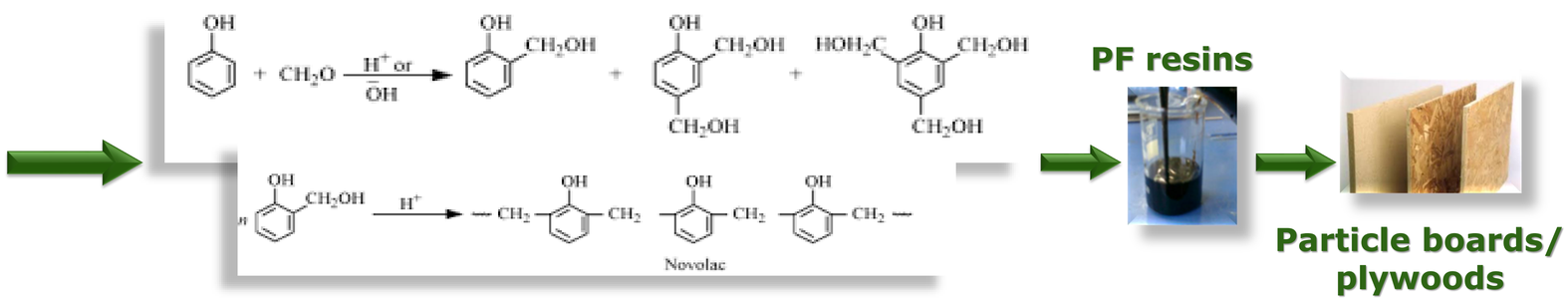


- Enhanced cellulose digestibility even at low enzyme dose (25 FPU/g cellulose)

Phenolic bio-oil from Lignin fast (catalytic) pyrolysis



Valorization of phenolic bio-oils towards resins production



- Fast (non-catalytic) pyrolysis of isolated lignins produced bio-oils rich in alkoxy-phenols
- Alkoxy-phenols conversion into alkyl-phenols/BTX aromatics can be tuned by appropriate catalysts

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BIO RES COM

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