Sustainable Process Engineering
Chemical Reactor Engineering

TU/e EINDHOVEN UNIVERSITY OF TECHNOLOGY

Chemical reactor design for lignocellulose reductive catalytic fractionation

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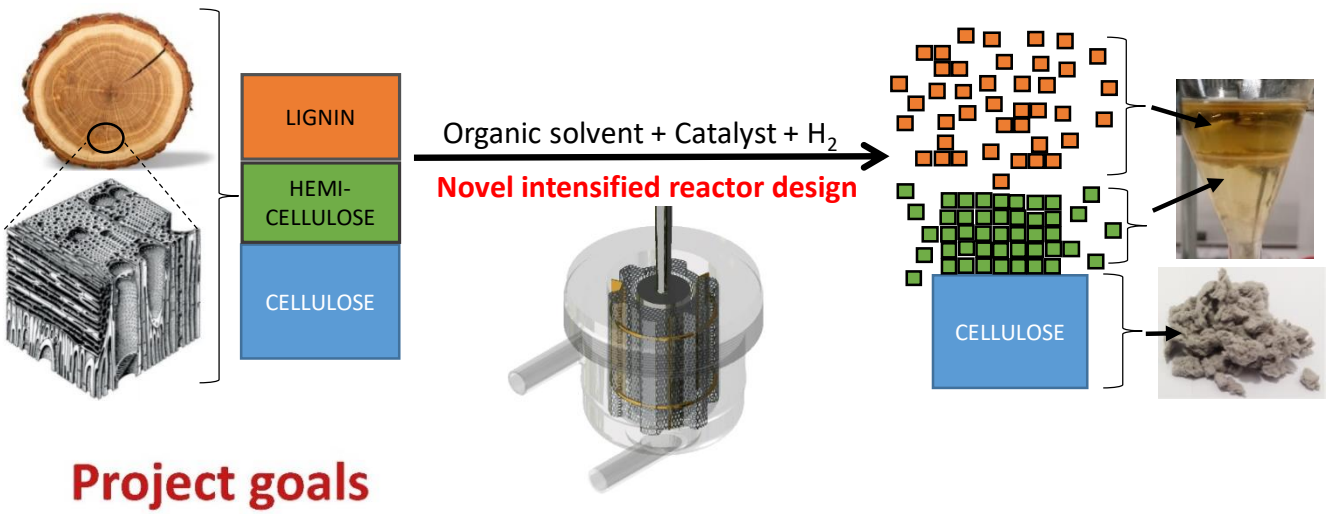
Introduction

Lignin is one of the main polymeric components of biomass, together with cellulose and hemicellulose. It is a highly functionalized polyaromatic amorphous material. Lignin is traditionally separated from (hemi)cellulose through chemically aggressive processes that disruptively modifies its structure, decreasing dramatically its potential for valorization and making it by far the most underutilized biomass fraction. Reductive catalytic fractionation (RCF) is a one-step novel approach, capable of separating lignin from (hemi)cellulose under mild conditions, hence avoiding degradation.

Project summary

In RCF, lignin is detached from (hemi)cellulose and depolymerized through solvolysis in an organic solvent (liquid-solid process). The detached lignin fragments are then stabilized through hydrogenation by using a metallic catalyst (gas-liquid-solid process), hence avoiding undesirable recondensation reactions and reaching high monomer yields. This multiphase complexity makes reactor design for RCF process specially interesting and challenging, requiring a novel (intensified) approach.



Project goals

- Measurement and comparison of reaction kinetics for different biomass feedstocks through experiments in (intensified) batch and/or flow through reactor. Reactor modeling (kinetics and mass transfer) in MATLAB
- Advanced characterization of reactants/products through GC-MS/FID, HPLC, GPC and 1D/2D HSQC NMR

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