

Biorefinery – processing and separation technologies for side/waste streams in forest industries

Roy Nitzsche, Jakob Köchermann



We offer expertise and search for project partners

Processing technology



side/waste streams in forest industries

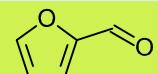
hydrothermal processing

green platform chemicals

C5/C6 sugars

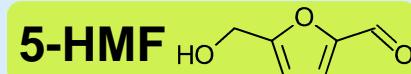
ethanol | lactic acid

furfural



THF | PolyTHF | PFA

5-HMF



2,5- FDCA | PEF

green carbon

activated carbons
catalyst carrier
filling material

Experimental equipment for hydrothermal processing:



continuously tube reactor

$T_{max} = 350 \text{ } ^\circ\text{C}$ | $p_{max} = 200 \text{ bar}$



500 mL stirred-tank reactors

$T_{max} = 300 \text{ } ^\circ\text{C}$ | $p_{max} = 200 \text{ bar}$

Analytics:

- GC-MS
(phenols)
- GC-FID
(org. acids/ethanol)
- HPLC
(sugars/furans)
- ICP-OES
- elemental analysis

Separation and purification of side/waste streams in forest industries

Products → green chemicals and fuels

Organic acids

Cellulose/Hemicellulose

Lignin

Alcohols

Furans

Sugars

Phenols

...

➤ Experimental separation equipment

- Membrane filtration (MF, UF, NF, RO)
 - Flat sheet, spiral and ceramic membranes
- Decanter centrifuge
 - $g_{\max} = 4,400$, $u_{\max} = 10,000$ rpm, $\dot{V} = 5-50$ l/h
- Extraction column
 - $T_{\max} = 120$ °C, $\dot{V} = 0,6-7$ l/h, Stirred column
- Preparative chromatography / Adsorption
 - $\dot{V} = 0,1-100$ ml/min, $p_{\max} = 400$ bar, $T_{\max} = 85$ °C



Membrane filtration



Decanter centrifuge



Preparative chromatography 3

➤ Process simulation and overall system assessment

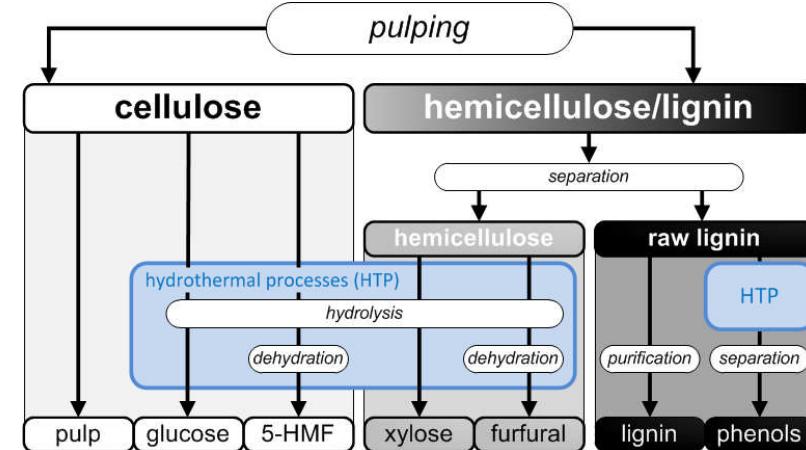
Experience



➤ KomBiChem^{PRO}



- Fine- and platform chemicals from wood by chemical-biotechnological process combinations
- Purification and separation of hydrothermal produced green platform chemicals
- Process simulation and assessment of developed single and overall process chains



➤ FEBio@H2O



- Green chemicals by an integrated hydrothermal conversion of lignocellulosic biomass
- Production of levulinic acid and γ -valerolactone (GVL)

➤ NachBar (Excellence cluster BioEconomy)



- Development and up-scaling of biorefinery concepts from laboratory and pilot scale experiments → Process simulation via Aspen Plus
- Development of an assessment methodology considering economic and environmental parameters already during process design → Process optimization



Contacts

Dipl.-Ing. Jakob Köchermann
Tel. +49 (0)341 2434 – 359
E-Mail: Jakob.Koechermann@dbfz.de

Dipl.-Ing. Roy Nitzsche
Tel. +49 (0)341 2434 – 574
E-Mail: Roy.Nitzsche@dbfz.de

**DBFZ Deutsches
Biomasseforschungszentrum
gemeinnützige GmbH**

Torgauer Straße 116
D-04347 Leipzig
Phone: +49 (0)341 2434 – 112
E-Mail: info@dbfz.de
www.dbfz.de