WIRE

Waste biorefinery technologies for accelerating sustainable energy processes

Production of optically pure lactic acid from waste wood via continuous fermentation with cell-recycle

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cost
EUROPEAN COOPERATION IN SCIENCE & TECHNOLOGY

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Green chemical building blocks

The 10 green chemicals driving a disruptive new biobased industry

July 9, 2018 | Jim Lane

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In the UK, a recent report identifies **10 specific bio-based chemicals**, in order to boost industrial growth, jobs, trade and investment in the UK. The report comes from LBNet, sponsored by the Biotechnology and Biological Sciences Research Council in consultation with leading biotechnology and chemistry experts from business, academia and the public sector.

And just now, the U.S. Department of Energy's Bioenergy Technologies Office (BETO) published a summary report for its workshop on **Moving Beyond Drop-In Replacements: Performance-Advantaged Biobased Chemicals,** that took place on June 1, 2017, in Denver, Colorado. At this workshop, BETO gathered stakeholder input on the research and development (R&D) necessary for novel biobased compounds and functional replacements. That summary report can be viewed via our Multi-Slide Guide here.

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1) **Lactic acid**

2) **2,5-Furandicarboxylic acid (FDCA)**

3) **Levoglucosenone**

4) **5 Hydroxymethyl furfural (HMF)**

5) **Muconic acid**

6) **Itaconic acid**

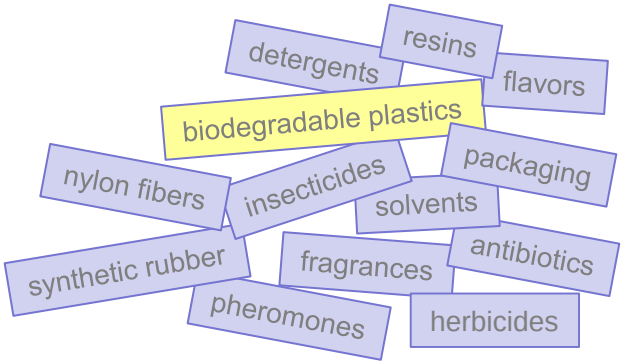
7) **1,3-Butanediol**

8) **Glucaric acid**

9) **Levulinic acid**

10) **n-Butanol**

applications…



Sources (last accessed on 19.10.2022):
http://www.biofuelsdigest.com/bdigest/2018/07/09/the-10-green-chemicals-driving-a-disruptive-new-biobased-industry/
https://www.total-corbion.com/news/low-carbon-footprint-of-pla-confirmed-by-peer-reviewed-life-cycle-assessment/
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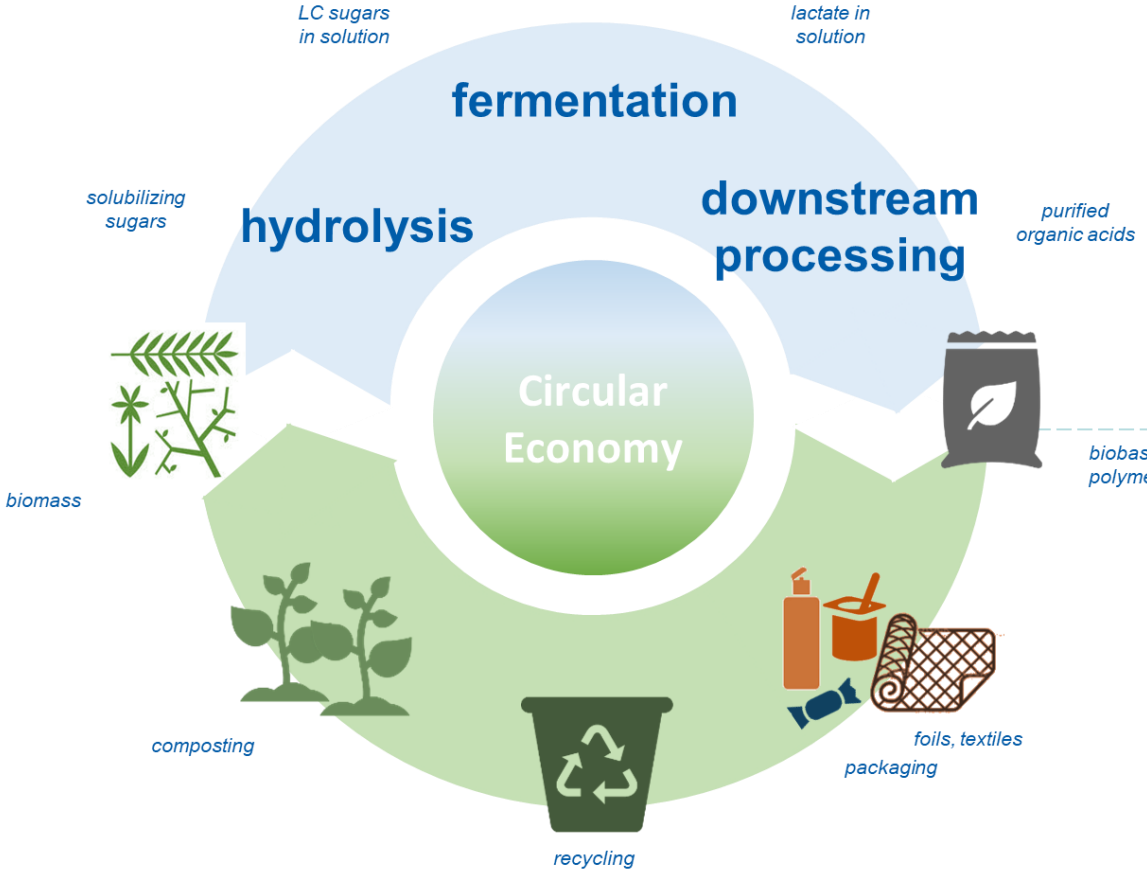
Circular Economy



ATB

partners

Project HyAlt4Chem

„Säurebasierte Hydrolyse von unbehandelten Altholzrecyclaten zur Bereitstellung von Biochemikalien“

“Acid-based hydrolysis of untreated waste wood recyclates for the provision of biochemical”

ORmatiC

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BioEconomy Cluster

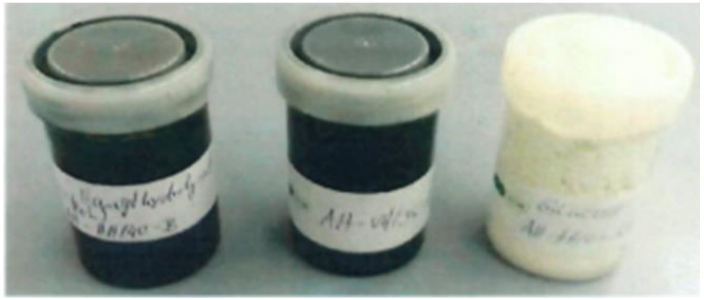
WIRE

Reiling Unternehmensgruppe

KAHL

waste wood (cat. A1)

GREEN SUGAR



Project HyAlt4Chem

➢ *Process Overview*

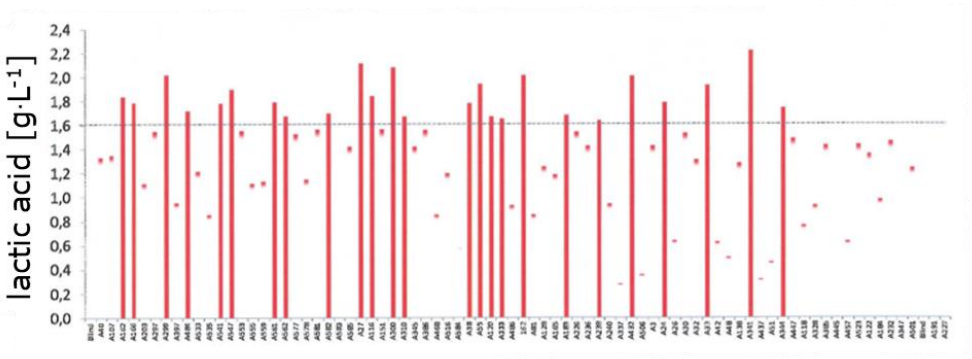
continuous fermentation
with cell recycle

1 Lactic Acid

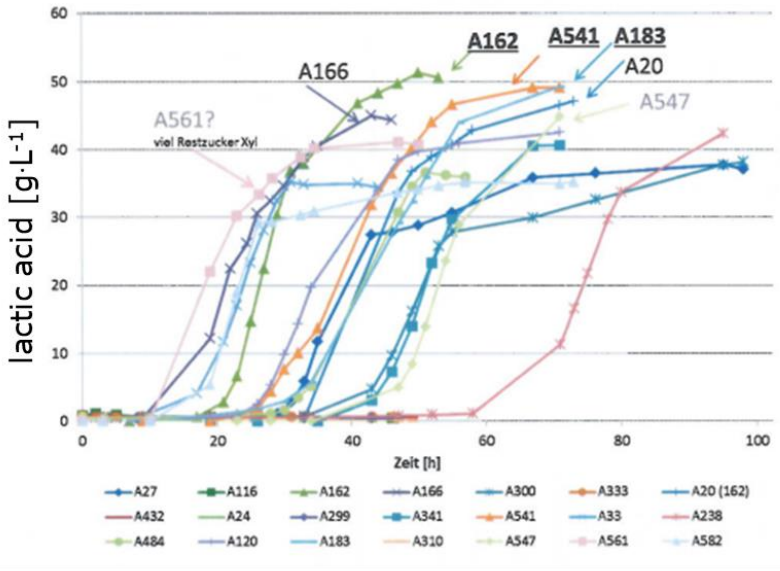
educt → upstream processing → fermentation → downstream processing → product

pelletizing
chemical hydrolysis
thermal pretreatment
strain screening

various steps, e.g.
electrodialysis
vaccum destillation



❖ test tube inoculation (5 mL scale)
❖ 10% hydrolysate, 2.5 g·L^{-1} yeast extract (YE)

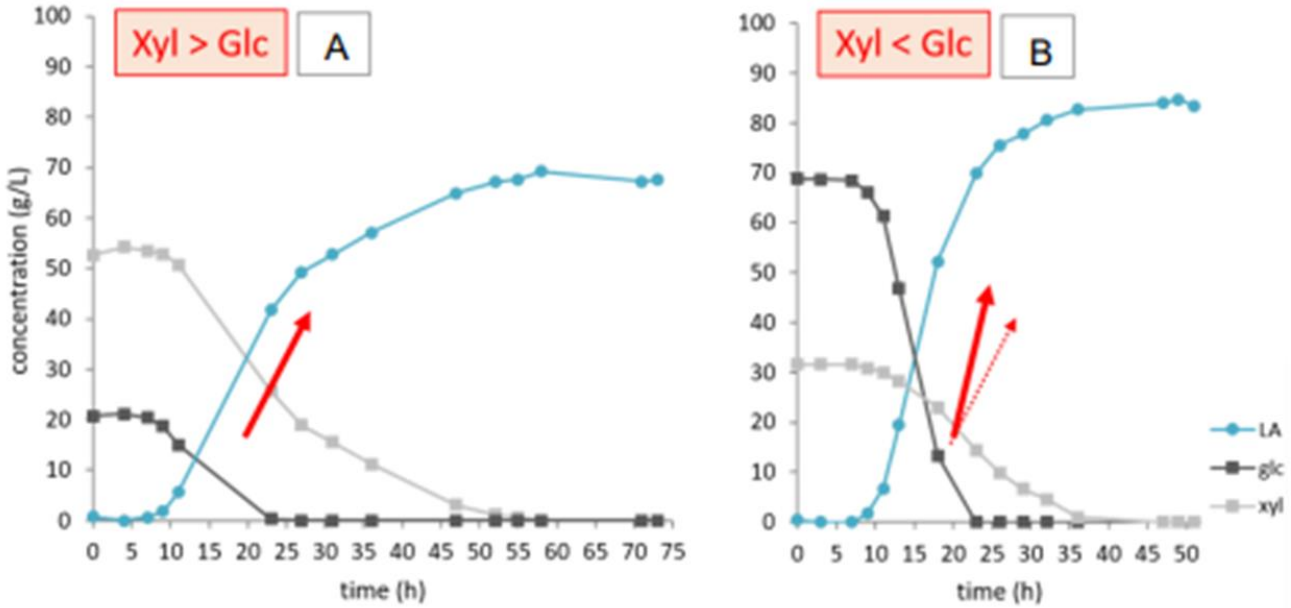


➢ Challenge: Hydrolysate variation
➢ Composition, volume, glucose ratio

❖ Lab scale (0.25 L working volume)
❖ 20% hydrolysate, 2.5 g·L^{-1} YE

Published 1st Author Papers:
❖ Schroedter *et al.* (2020). L-(+)-lactic acid from reed: Comparing various resources for the nutrient provision of *B. coagulans*. *Resources*, 9:89
❖ Schroedter *et al.* (2021). Biorefinery Concept Employing *Bacillus coagulans*: LX-Lignin and L-(+)-Lactic Acid from Lignocellulose. *Microorganisms*, 9:1810

publication in progress

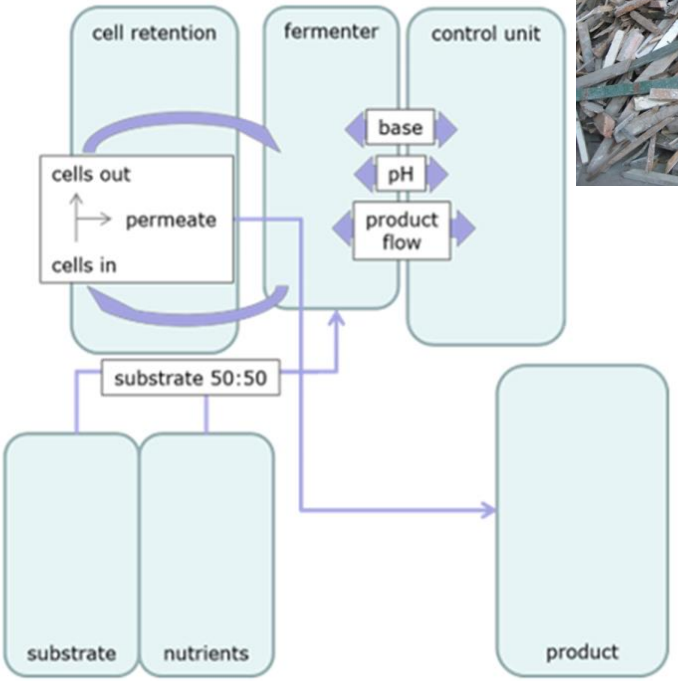


ring batch fermentations of two waste wood hydrolysates with varying xyl:glc ratio (*B. coagulans* A166, 52 °C, pH 6, 10 g/L yeast extract, 0.25 L working volume).

Waste Wood Hydrolysates - Project HyAlt4Chem

➢ Continuous fermentation with cell-recycle

publication in progress

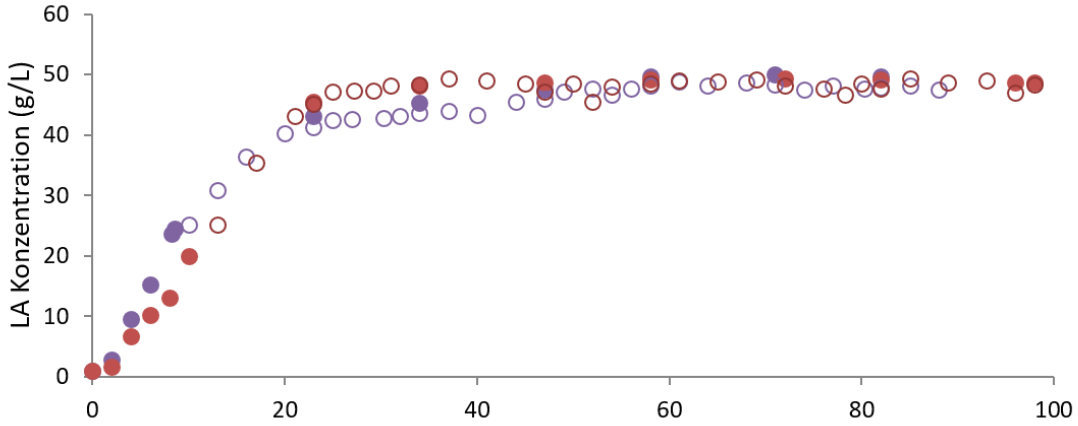


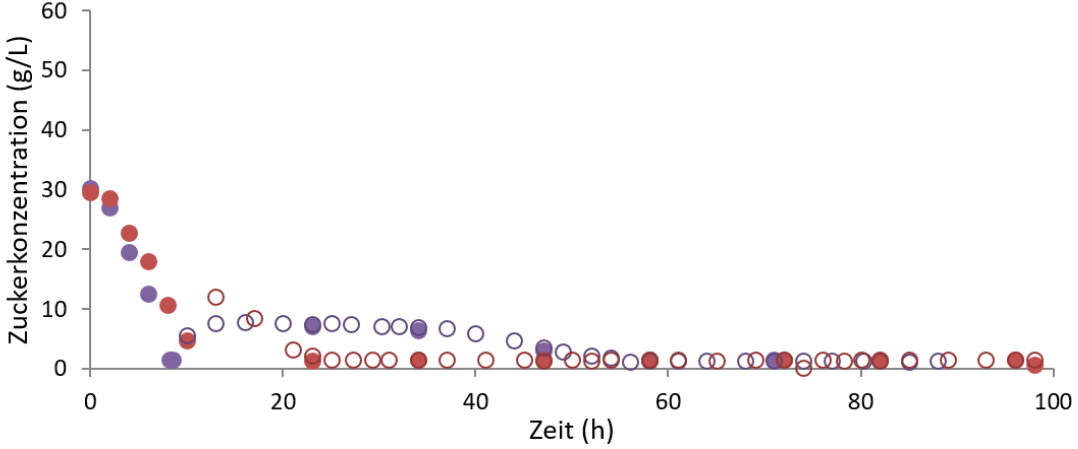
Olszewska-Widdrat, A.; Alexandri, M.; López-Gómez, J.P.; Schneider, R.; Venus, J.: Batch and Continuous Lactic Acid Fermentation Based on A Multi-Substrate Approach. *Microorganisms* 8 (2020) 7, 1084. https://www.mdpi.com/2076-2607/8/7/1084

Waste Wood Hydrolysates - Project HyAlt4Chem

➢ *Continuous fermentation with cell-recycle (3 L scale)*

publication in progress

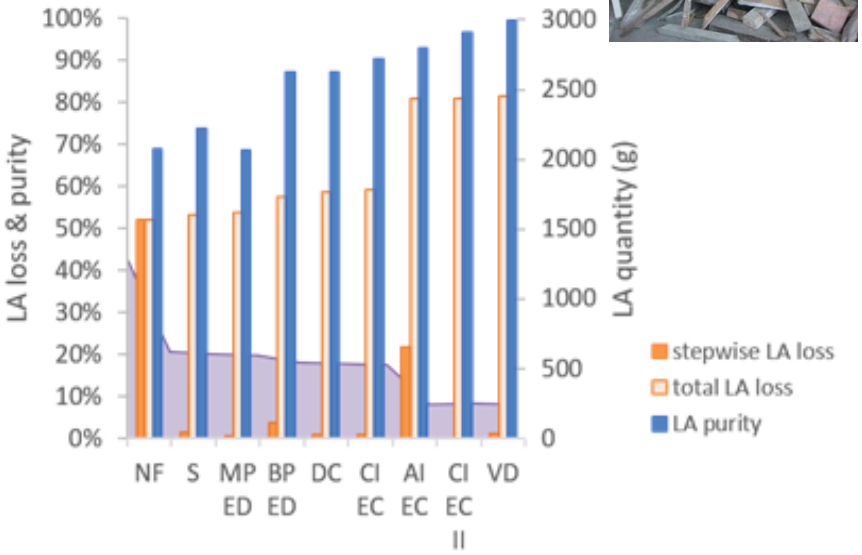




publication in progress

- ~ 80% conversion
- 9.6 $g \cdot L^{-1} \cdot h^{-1}$ productivity
- 48.1 $g \cdot L^{-1}$ LA after microfiltration
- defined synth. media: > 180 h LA production

- successful downstream of 26.7 L
- 843 $g \cdot L^{-1}$ LA from waste wood
- optical purity: 99.1%, chemical purity: 99.5%
- losses**: Nanofiltration, Anion-Exchange**



NF = Nanofiltration, S = Softening, ED = Electrodialysis, MP = Monopolar, BP = Bipolar, DC = Decolorization, CI EC= Cation Exchange, AI EC= Anion Exchange, VD = Vacuumdistillation)

Thank you for your attention!

Bundesministerium
für Bildung
und Forschung

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BioEconomy Cluster