Interreg North-West Europe
AgriWasteValue
European Regional Development Fund

celabor

PFI
Germany

# Bio-based chemicals and energy from agro-residues

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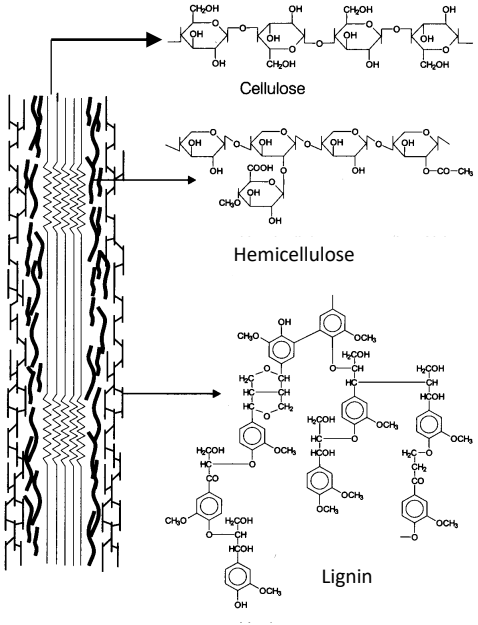
# What remains after extraction?

Extracted wooden biomass




Typical lignocellulosic structure

Transformation

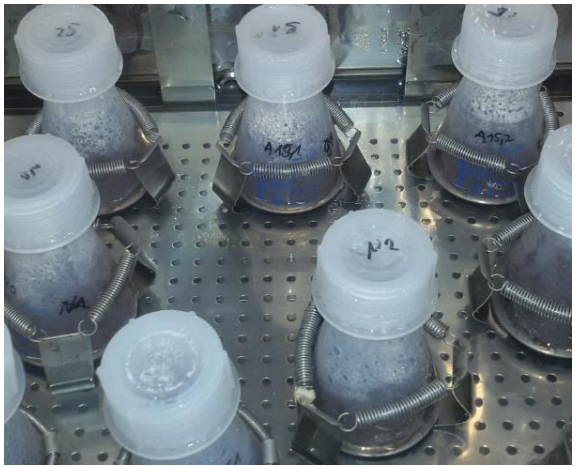
Fermentable sugar solution (Glucose, Xylose)

# How do we get there?

**Thermochemical pretreatment (TP)**


Solid fraction

**Enzymatic hydrolysis**

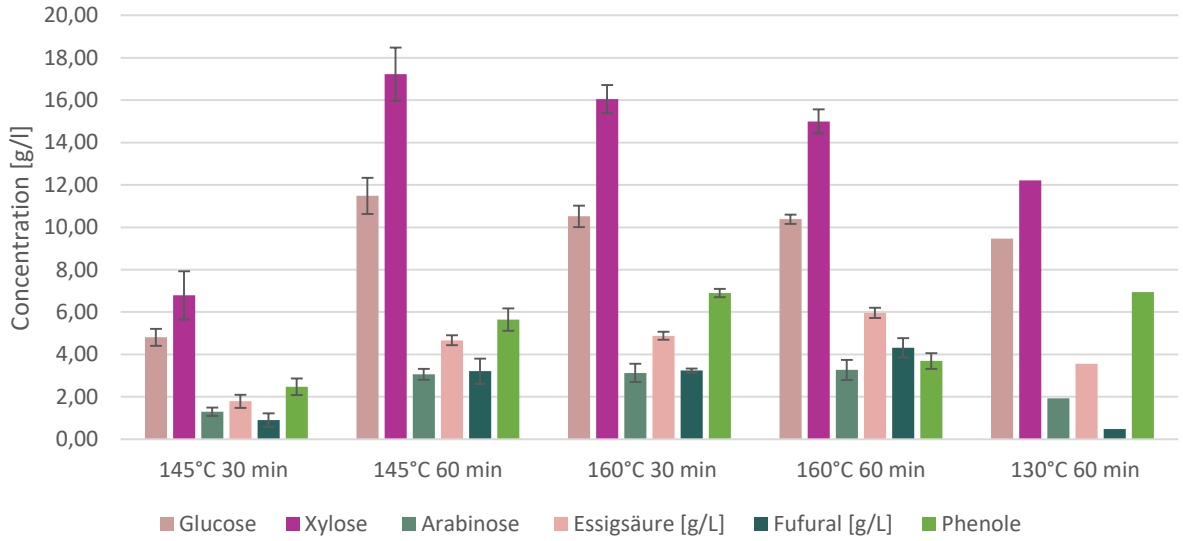


→ Removed hemicellulose,
Enhance accessibility for cellulase

→Degradation of cellulose to glucose

# Optimization TP

**Three temperatures (130, 145, 160 °C) and two duration times (30, 60 min)**




Optimal temperature and duration time: 145 °C and 60 min

# How successful are?

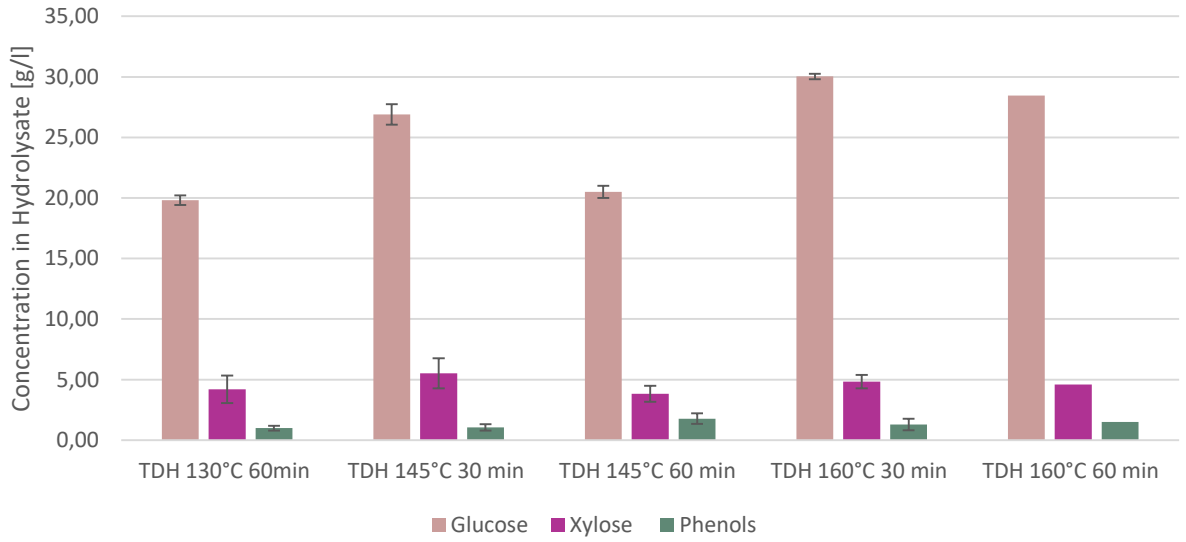
Sugar yields after pretreatment

| Pretreatment conditions | Glucose yield [%] | Xylose yield [%] | Arabinose yield [%] |
|---|---|---|---|
| 130 °C; 60 min | 24, 1 | 63,3 | 100 |
| 145 °C, 30 min | 12,3 | 35,2 | 90,1 |
| 145 °C, 60 min | 29,3 | 89,3 | 100 |
| 160 °C, 30 min | 26,8 | 83,3 | 100 |
| 160 °C, 60 min | 26,5 | 77,7 | 100 |

Best yields with 145 °C temperature and 60 min duration time

# Next step enzymatic hydrolysis

Parameters: 50 °C, 72 h, pH 5.0, Dry matter content 10 %, Enzyme dosage: 20 FPU/g
Enzyme: CellicCTec 2© (Novozymes)

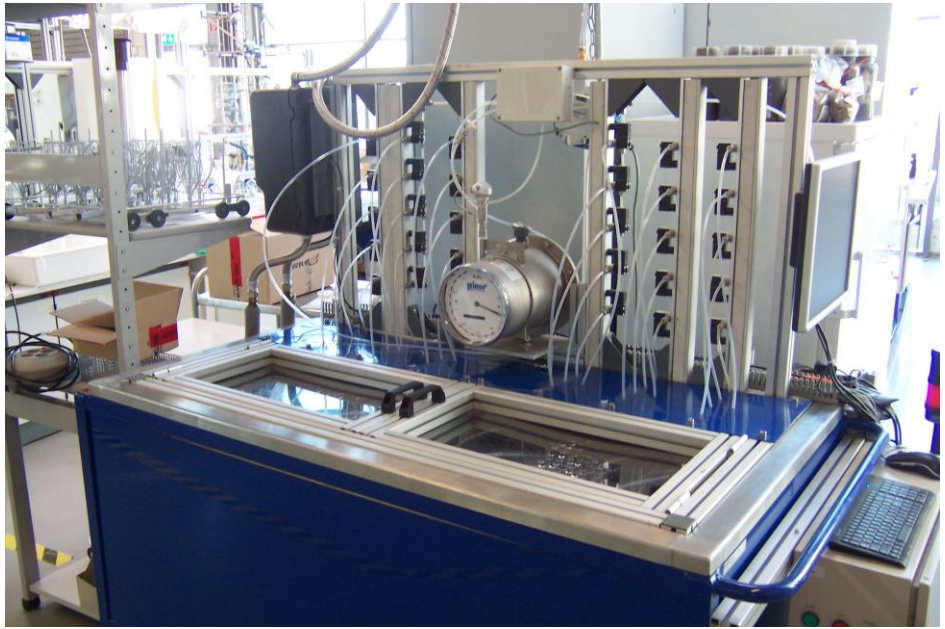



Composition after enzymatic hydrolysis: Around 20 % cellulose remained!

# What is the energetic potential?

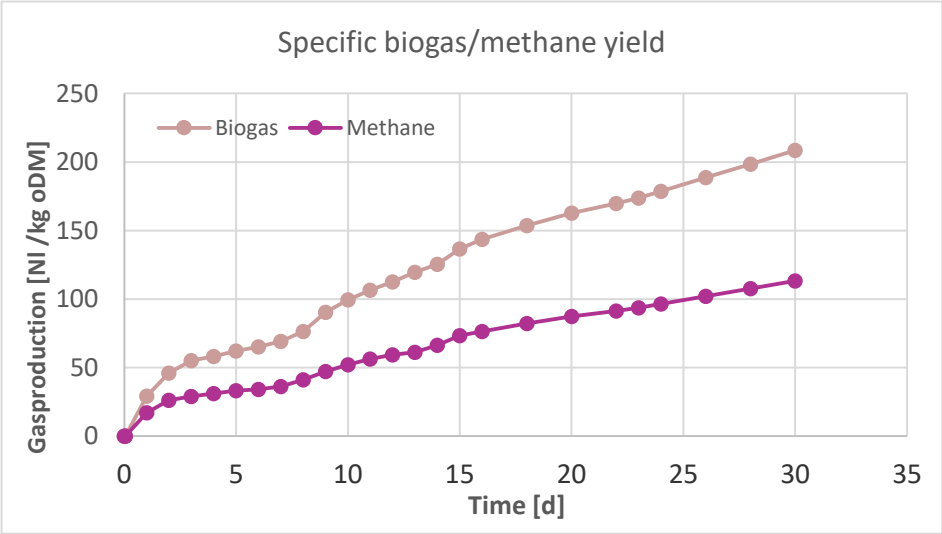
## Looking for the biogas production

Residues after enzymatic hydrolysis mixing with seed sludge → 4 weeks



# What happens after 4 weeks?!

## Biogas production of 200 NL/ kg DM with 50 % methane




→ Less than maize silage (650 NL/kg DM) but some potential!

# Last but not least: fertilizer potential

## Nutrient composition (solid residue):

| Nutrient | Concentration [mg/kg DM] |
|---|---|
| Total nitrogen | 16182 |
| Ammonium | 707 |
| Sodium | 939 |
| Potassium | 13300 |
| Phosphorus | 4212 |
| Sulfur | 3397 |
| Magnesium | 3092 |

→ Sending the residues to DELPHY for fertilizer tests!

# What is next?

Up-Scaling of
the pretreatment

Fermentation to bio-based
chemicals