



bioenergy2020+



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Thermo-chemical pretreatment of brewery residuals to improve biogas process



Competence Centers for
Excellent Technologies



Feedstock for Biogas-production

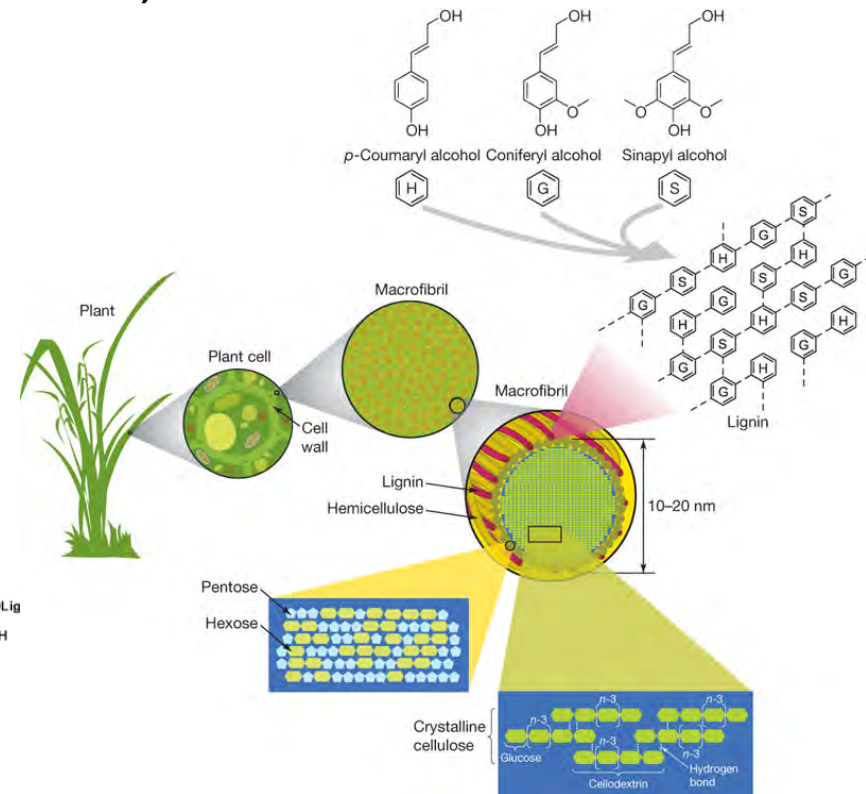
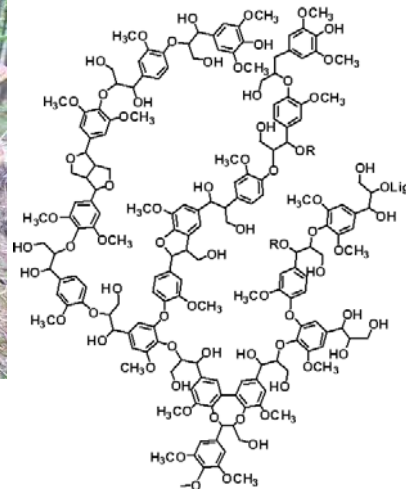
- Conventional feedstock
 - Maize silage, energy crops
 - Costs
- Alternatives
 - Organic residues from industrial processes
 - Whey, abattoir waste, brewery residues
- Brewery residues
 - Co-substrate in Biogas process
 - Medium gas yields
 - Potential





Why is biogas yield only medium?

- Ligno-cellulose content (50-75%)
- Non-accessible to bacteria



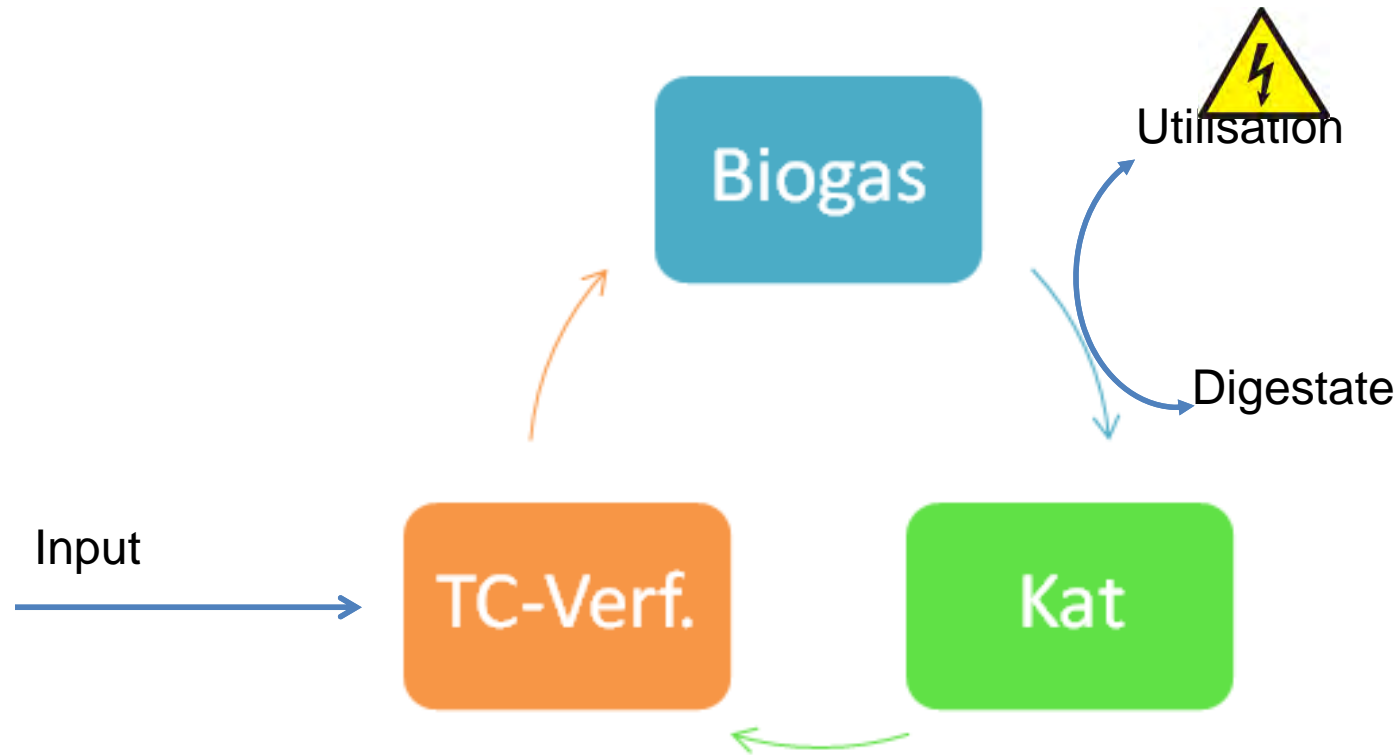


How can biogas yield be improved?

- Feedstock pre-treatment
- Different methods
 - Biological (Enzymes)
 - Mechanical (Milling)
 - Physical (Steam explosion)
- Thermo-chemical (diluted acid)

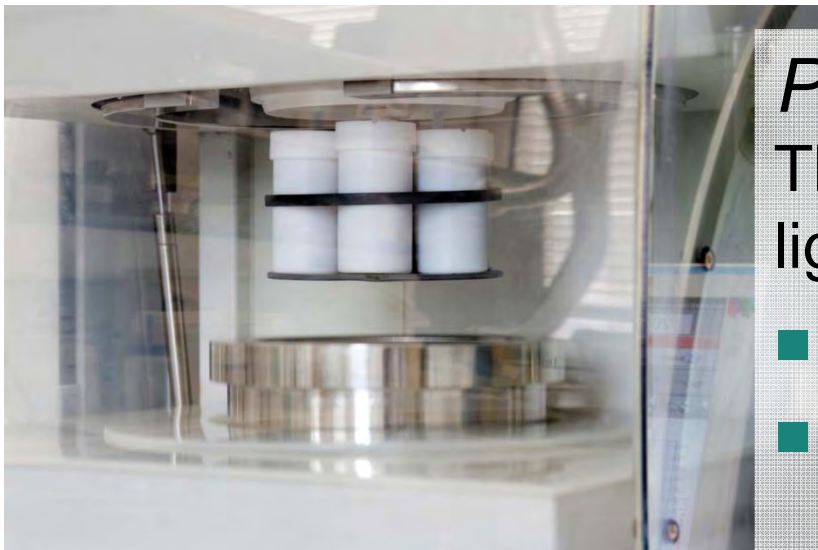
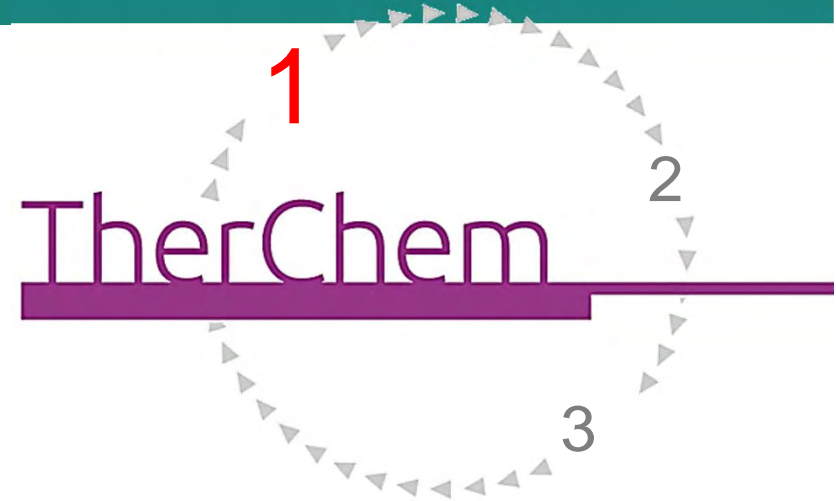


Approach: Multistep process





- Step 1:* TC-pretreatment
- Step 2:* Biogas production
- Step 3:* Catalyst recovery

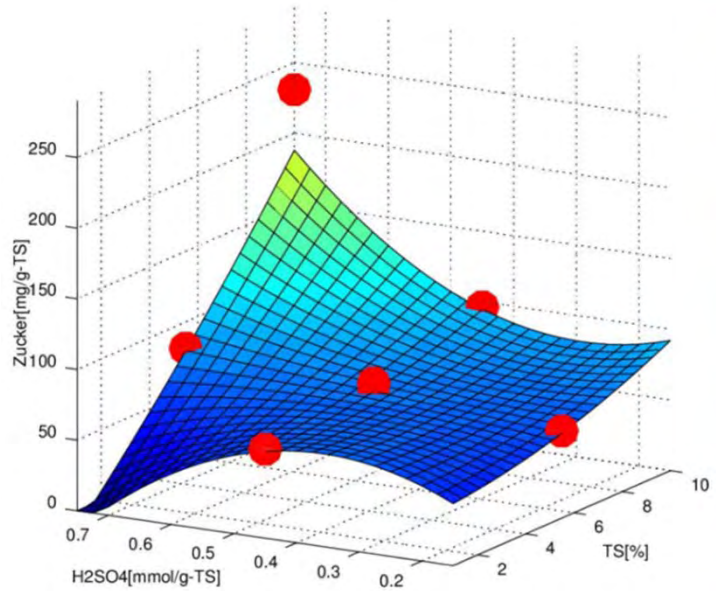


Process step 1:
Thermo-chemical pre-treatment of
lignocellulosic substrate

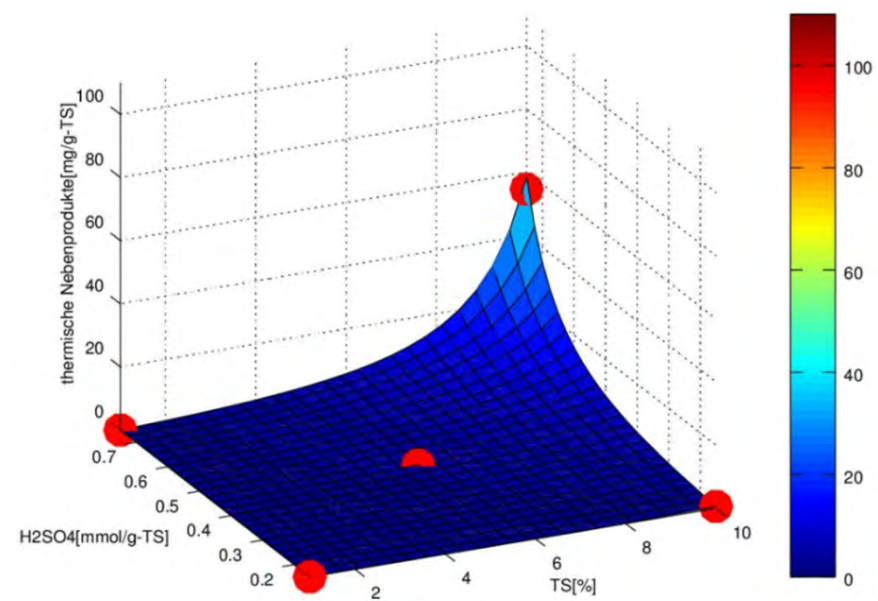
- Formation of monomeric sugars
- Prevention of Maillard products
(HMF, Furfural)



Finding the right parameter set-up



Forming of CH-monomers



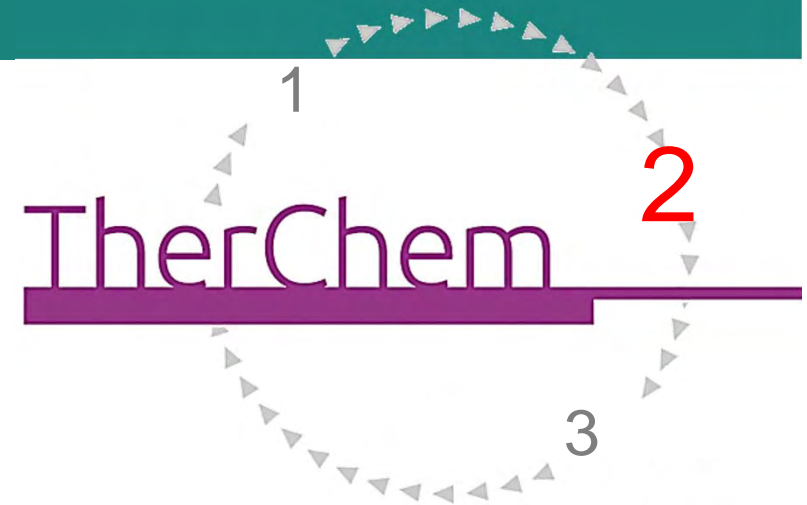
Forming of thermal by-products



COMET



- Step 1:* TC-pretreatment
- Step 2:* **Biogas production**
- Step 3:* Catalyst recovery

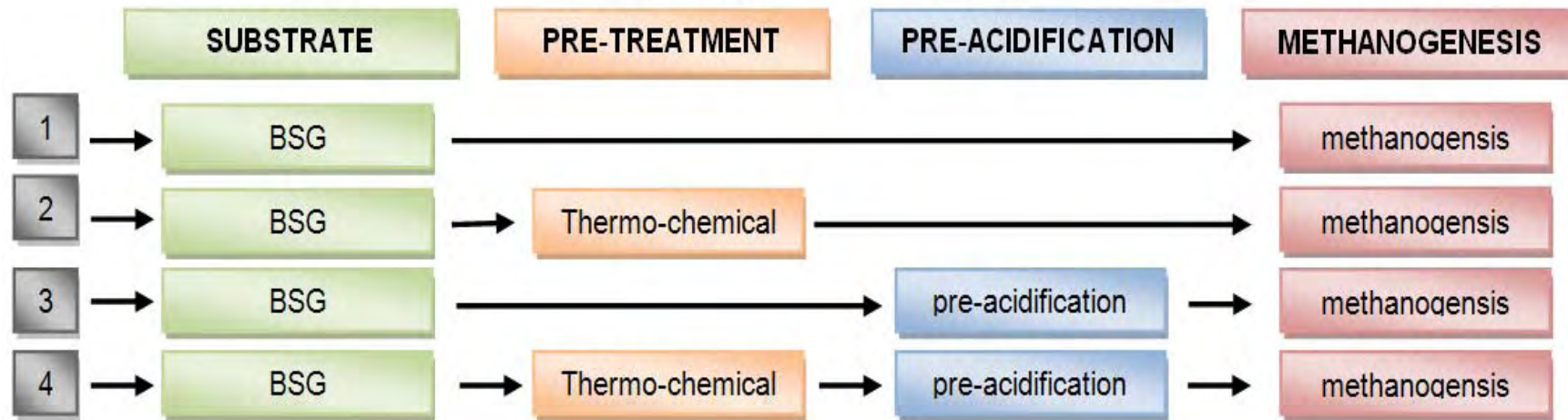


Process step 2: Multistage digestion

- Increasing efficiency by using preacidification
- Optimising process



Biogas production: Comparing different set-ups

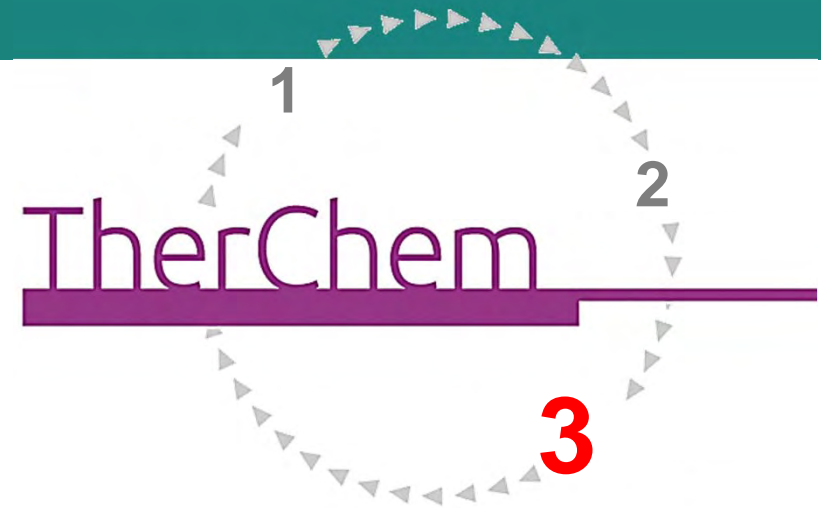


Gas yield	BSG	+H ₂ SO ₄	MW140 (+)	MW140 (++)	MW160 (+)	MW160 (+++)
Nm ³ /t VSS	277	237	402	429	458	511
	100 %	- 14.5 %	+ 44.7 %	+ 54.7 %	+ 65.1 %	+ 84.2 %



The THERCHEM project

- Step 1:* TC-pretreatment
Step 2: Biogas production
Step 3: Catalyst recovery



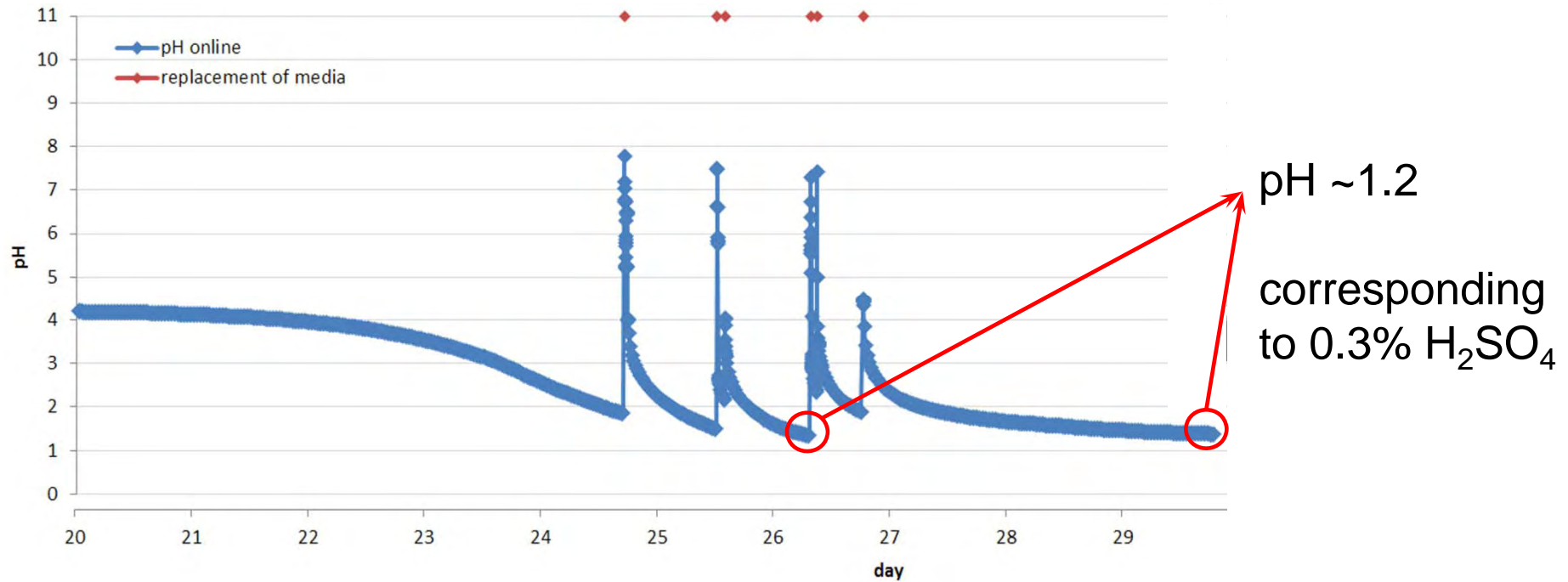
Process step 3:

Recovery of catalyst (=H₂SO₄)

- H₂S converted in a biotrickling filter to gain sulphuric acid
- Reused for substrate pre-treatment



Sulphuric acid generation by sulphur reducing bacteria



→ sufficient for substrate pre-treatment



From lab scale to demo scale

PRE-TREATMENT



PRE-ACIDIFICATION



METHANOGENESIS





Demoplant





Onsite Integration of this technology into Breweries

- Waste to energy concept
- Integration of energy into the process
- Reduction of use of fossil fuels



Video





Thank you for attention

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