

Biorefining research at Wageningen Food and Biobased Research

Circular Congres
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Our vision and ambition

- Resilient and sustainable food & biobased value chains
- co-production of food and non-food products from biomass, creating added value, new markets and businesses
- Reduced impact on natural resources and minimise losses

Circular thinking, beyond circular bioeconomy to create sustainable solutions beyond existing paths

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A new balance

kg + kJ $\xleftrightarrow{\text{Biorefinery}}$ k€

State of the art biorefinery

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Our Objective is to create impact

The most viable options bridging the gap between environmental sustainability and economic growth by

- Tailor made solutions also for challenging streams like recalcitrant or diluted feedstocks
- Mild processing for keeping the functionality intact
- Tecno-economical evaluation to identify the optimal routes
- New concepts, business models and value chains allowing for new value creation

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Technology toolbox


Biorefinery toolbox

<ul style="list-style-type: none"> Centrifugation Filtration Sedimentation Flocculation Centrifugation 	<ul style="list-style-type: none"> Dewatering Disruption Pressing Homogenizing Hydrolysis Concentration 	<ul style="list-style-type: none"> Extraction Centrifugation Precipitation Mild separation Desalting 	<ul style="list-style-type: none"> Drying Conditioning Preservation Purification
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- Conventional & mild technologies including use of microbial factories & enzymes as well

New and modified technology: Mild methods

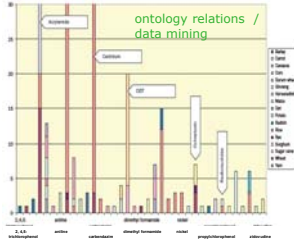
- Milling, air classification } 'dry'
- Electrostatic separation } 'dry'
- Membrane technologies } 'wet'
- Industrial chromatography } 'wet'
- Extraction technology } 'wet'
- Shear cell technology } 'semi-solid'
- Extrusion } 'semi-solid'
- Combined with mild disruption technologies (e.g., PEF, sonification, microwaves)



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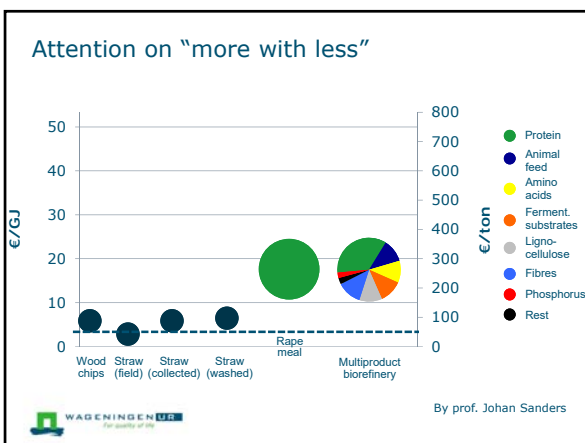
Focus 1: Identify – Value Mining

- Value from process streams
 - Potential products & markets
 - Potential functionality
 - Water and energy
- Smart search & selection tools
- Unique feedstock – product combinations




Risk & Issue management

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High added value components

- Value from side and rest streams
 - Functional/active compounds
 - Fibre and lignin fractions from cacao shells
 - Anti-oxidants from onion peels
 - Cellulose from EFB
 - Specific biorefining and separation technology



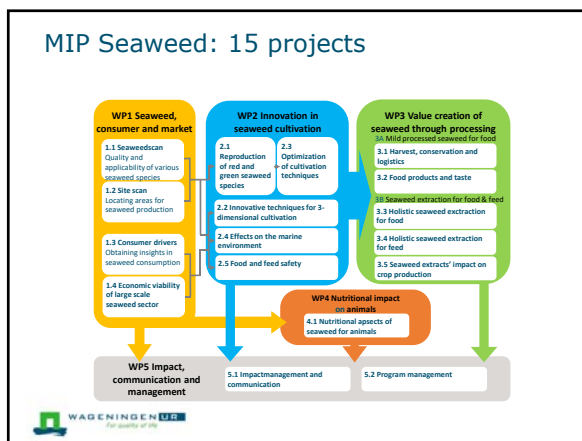
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Waste to plastics

Organic waste streams
Towards polymers via biotechnological routes



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Focus 2: Value Validation

- Infrastructure for scale-up and production runs
 - Relation product ↔ structure ↔ process

validated design/operation models

test cells (membranes) → lab cells (proof of principle) → lab modules (kinetics, mass/heat transfer)

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Value from process streams:

- De-lactosed permeate of whey (cheese, casein): more lactose, protein, minerals (phosphate)
- ED-brines, potato juice

Evaluation of various technologies

- NF, ED, IE-chromatography, MD, electrochemistry

Impact:

- Prevention of side stream
- Value to side stream
- Clean water

Lead, 3 MC, 3 year

Process stream including salt → Negative charged membrane → Positive charged membrane → Concentrated process stream with >50% lower salt load

product (A) salt (B) water

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Economically & Ecologically Efficient Water Management in European Chemical Industry

- 6 industrial cases: Dow, Solvay (2x), Procter & Gamble, TOTAL, Kalundborg

Lead (Dechema). 17 MC, 19 partners, 9 countries

Impact

- Water use: 40% ↓
- Waste water: 20% ↓
- Resource use: 20% ↓
- Energy use: 20% ↓
- Economic benefits (~30%)
- Policy compliance ensured

Water reuse for Dow case

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Focus 3: From lab to Pilot

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Example: Anti-solvent crystallisation

- New technology using a non-solvent approach
 - Location on site
 - Higher purity in fewer process steps;
- Feasibility demonstrated
- Scaled up to pilot scale (IPSS)

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Focus 4: Case Analysis & Benchmark


- Structured approach
- Business case analysis
- Bringing together required chain partners

Specific Product Costs vs. Production Capacity

value proposition

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Focus 5: Demonstration



- membrane distillation container
- pertraction container
- pure water factory
- membrane distillation
- water softening by Filtration-Assisted Crystallisation
- organics from water by pertraction
- Iron/zinc recovery by slug flow pertraction
- degradation of micro pollutants by UV/H₂O₂

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Processing Underutilised Low value sugarbeet Pulp into VALUE added products

www.pulp2value.eu

EUROPEAN UNION
EUROPEAN COMMISSION
BIO-BASED INDUSTRIES
CONSORTIUM



Targets: Produce MCF from sugar beet pulp on demo scale and show its application potential


Show and develop application potential of other sugars like arabinose and galacturonic acid (derivatives) on pilot scale

Lignin Applied

- Asphalt: substitution of bitumen (Infra project Zeeland)




- Bituminous roofing
- Substitution of UV-stabilizer (bilateral)
- Composites
- Phenolic resins



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To conclude

Circular approach in operation will continue to receive increasing attention

- Already much possible
 - Effective and complete use of biomass
 - Unique attributes, added value
- Evolving further from existing

Join us in our new initiatives!

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Thank you for your attention !



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