Title: Processing underutilised low value sugarbeet pulp into value added products

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Curriculum:
Ad de Laat studied cell biology and got his PhD degree in plant physiology in 1982 both at the Agricultural University Wageningen. After 5 years in science in one of the Wageningen Institutes (ITAL) he took responsibility for the biotech activities in the breeding company VanderHave (part of Cosun).
After a short period as secretary of the executive Board of Cosun (1997-1999) he became director of the Cosun Food Technology Centre in Roosendaal. As from 2014 he is Innovation manager Agro and New Business, and responsible for scouting and early selection of new business opportunities for the Cosun companies.

Abstract:
Cosun is Coordinating a BBI project titled Pulp2Value. The objective is to develop an integrated processing concept for sugar beet pulp, delivering high value products for food and non-food markets for each of the major pulp constituents.
A powerful consortium of committed stakeholders succeeded in the successful development of desired products from the cellulosic (Betafib being a potent rheology modifier), the pectic (galacturonic acid and its derivatives as building block for e.g. surfactants and polymers) as well as the hemicellulosic fraction (Arabinose as a health promoting food ingredient or chemical intermediate).
The integrated process is designed for sustainability and economic performance, and has been scaled up to the demo level. Market pull will be the driving force for further upscaling to a full industrial scale.

http://pulp2value.eu/
Processing Underutilised Low value sugarbeet Pulp into VALUE added products

www.pulp2value.eu

The project has received funding from the Bio-Based Industries Joint Undertaking under the European Union’s Horizon 2020 research and innovation programme under grant agreement No 669105.
Sugarbeet pulp is a major residual stream from the sugar beet industry, which is currently valorised as low value feed and/or green gas. In Europe sugarbeet pulp accounts for a production volume of approx. 13 million tonnes per year.
**Raw material**

- Beet pulp (dry)
  - 25% Pectin
  - 25% hemi cellulose
  - 25% cellulose
  - 15% other organic
  - 10% ash

**Primary Products**

- Special Sugars
  - Arabinose
  - Rhamnose
  - Mannose
  - Galactose
  - other
- Micro Fiber
- Galacturonic acid
- Oligo’s

**Derivatives**

- Plasticizers
- Surfactants
  - Galactaric acid
  - Gal X
  - “CBB”
- Adipic acid
- Furans

**Markets**

- feed
- biogas
- powder/tablets
- paper
- food
- pharma
- leather
- coatings
- composites
- flavors
- cosmetics
- detergents
- chemicals
- feed
- polymers
- cosmetics
- chemicals
- coatings
- leather
- plastics
Main objectives:

- To optimize, scale up and integrate processes.
- To build long lasting value chains.

- The ultimate goal is to set up a demonstration plant which refines sugarbeet pulp in an integrated and cost-effective cascading biorefinery.
Innovation = Endurance!

Idea → Lab → Pilot → Demo → Industrial

- 2007
- 2010
- 2015 - 2019
- 2020 – 2021?

"Endurance is not just the ability to bear a hard thing, but to turn it into glory." - William Barclay
Lab: Grams - 20 kg
Pilot: 1 - 500 kg
Demo: 1 - 5 ton
“Our dream”
The PULP2VALUE consortium

7 participating organisations from the EU countries:
Belgium, Germany, the Netherlands and United Kingdom

Coordination: Royal Cosun
Gerald van Engelen, gerald.van.engelen@cosun.com

- Complementary expertise along the whole value chain
- Strong industrial participation
Project data

- PULP2VALUE receives funding from the **Bio-based Industries Joint Undertaking** under the European Union’s **Horizon 2020** research and innovation programme under grant agreement No 669105.

- PULP2VALUE is one of the two **demonstration** projects in the **Bio-based Industries Joint Undertaking (BBI JU) Call 2014**.
  - PULP2VALUE relates to the BBI annual work plan topic BBI VC3.D4 2014: “Functional additives from residues from the agro-food industry”.
  - BBI JU Project Manager:

- **Budget:**
  - Total cost: 11.4 million Euro
  - Funding: 6.6 million Euro

- **Duration:** July 1, 2015 – June 30, 2019
Approach and main activities

Figure 2: Value chain approach for optimal SBP valorisation in a range of new value chains
Evolution of sugarbeet biorefinery

Grow
Harvest
Logistics
Process
Logistics

Sugar
Storage Biomass
Biorefinery
Digester
Green gas
Side streams

Fibers
Arabinose
Green chemicals
Other
Evolution of sugar beet biorefinery

**Grow**
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**Harvest**
- Special Sugars
  - Arabinose
  - Rhamnose
  - Mannose
  - Galactose
  - Other

**Process**
- Micro Fiber
- Galacturonic acid
- Oligo’s
- Galactaric acid

**Logistics**
- Plasticizers
- Surfactants
- “CBB”
- Adipic acid
- Furans
- Gal X

**Markets**
- Feed
- Biogas
- Food
- Pharma
- Oil
- Coatings
- Feed
- Flavors
- Cosmetics
- Detergents
- Chemicals
- Composite
- Polymers
- Chemicals
- Leather
- Cosmetics
- Coatings
- Plastics
Value chain developments

From biomass... ...to end-users
Basic properties

- Rheology profile
  - Shear thinning
  - High yield point
- Structurant (particles).
Betafibr: Applications

- Liquid detergents
- Paints & Coatings
- Drilling muds
- Cement / concrete
- Food
L-Arabinose

- Sweetness: 60% of sucrose.
- Available as syrup or high purity crystalline powder
- No adverse health effects in digestive system up to single dosages of 20 grams.
L-Arabinose

Health benefits (WUR):
- Lowering glycemic index
- Reduction insulin response
- Prolonged feeling of satiety

Add 10 wt% of arabinose

Arabinose inhibits sucrase enzyme in small intestine
L-Arabinose: Applications

- Flavour
- Food products icw sucrose
  - Sports drinks, supplements, cereal bars, muffins
Galacturonic acid

- Anionic surfactants based on D-galacturonic acid
- Sulphate free
- Mild (non-irritant)
- Good foaming properties
- Personal care
Galactaric acid

- Chelating agent (cosmetics)
- Corrosion inhibition
- Rigid building blocks for polymers (Gal X, cross-linker)
Orineo: Betabind® in composites

Flooring panels and table tops
For more information, please visit our website:
www.pulp2value.eu

For questions, please contact the project coordinator:
Gerald van Engelen, gerald.van.engelen@cosun.com

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