

Session: Welcome and Opening
Presentation by: Marcel van Berkel, *VanBerkel Consultancy*

Title: **Update on BPM Polymerization pilot initiatives**

Author: **Marcel van Berkel**

Contact details:

Marcel van Berkel
VanBerkel Consultancy BVBA
Belgium
M +31 6 22203144
E marcel@vanberkelconsultancy.com
I vanberkelconsultancy.com



Curriculum:

Marcel is an accomplished, versatile and passionate Business Executive; driving product innovation in a global science-based market leader, and shaping/executing a successful growth strategy of a disruptive, entrepreneurial SME. Commercially agile, boasting an outstanding track record of propelling business operations forward via organic and acquisition activities; collaborating at board level with multiple shareholders, customers and external investors to enable businesses to reach their full potential on a truly global scale. Experience in Chemical Industry, Clean-tech, Renewables and Polymers & Materials, with the proven ability to inspire performance and deliver competitive advantage.

Marcel van Berkel studied Chemistry and Business Administration in Utrecht, The Netherlands. He worked for more than 20 years for corporate companies like Solvay and DSM. Marcel left DSM a few years back to expedite the growth of a start-up in the bio-based chemicals industry. After completing this successfully, he started his own consultancy firm VanBerkel Consultancy. With experience in business development, business strategy, marketing & branding and business management, VanBerkel Consultancy offers support in defining and executing your business development and market strategy and can help companies expand to overseas areas.

Abstract:

The Green Chemistry Campus (Bergen op Zoom) and REWIN West-Brabant (the regional development company), started a feasibility study to the attractiveness of a Polymerization Shared Facility pilot plant empowered and supported by the Biobased Performance Materials of the WUR and Synbra Technology. In the development of new or drop-in biobased polymers, a pilot plant is a crucial step to proof production beyond lab-scale and make large quantities for industrial trials.

The Polymerization Shared Facility has the mission to accelerate the development of innovative and drop-in (biobased) polymer-materials by enabling production on pilot scale for commercial-trials. It will contain State-of-the-art industrial equipment, experienced and flexible team serve customers in the field of: 1) Polymerization of (Bio)polymers, (bio)Polyesters and (bio)Polyamides and 2) Depolymerization of waste-plastics into monomers significant contribution to the Circular Economy. It will embrace both ring-opening as well as polycondensation technology; resp in continuous and batch operation. Focus is the merchant market. Construction is scheduled to start in Q4 2018 and operations to start end Q2 2019.



Polymerization Shared Facility

Empowered by WUR and GCC

14 June 2018

Content

- Introduction Biobased Delta
- Market trends of polymers
- Unmet needs
- Introduction Polymerization Shared Facility
- Summary

Biobased Delta is the first Public-Private Partnership developing an Ecosystem for the Circular Bioeconomy.



Mission:

Increasing the economic value of carbohydrates in the Biobased Delta.

Biobased Delta is connecting and promoting:

- SME's (start-ups, scale-ups and others)
- Large international companies
- Education

Key data:

- | | |
|-----------------|---|
| • Founded | 2012 |
| • Funding | 6 private, 3 governmental |
| • Partners | 4 Regional development agencies, 4 investment funds |
| • Team | 9 direct, 10 indirect |
| • Top locations | 17 of which 10 knowledge partners |
| • Stakeholders | > 200 with 100+ SME companies |



Ecosystem Circular Bioeconomy: 17 top locations



Seaports, Industry-parks and Pilot-Service plants



5 Port of Rotterdam



6 Port of Moerdijk



7 Nieuw Prinsenland



12 Biopark Terneuzen



11 North Sea Port



1 Bio Pilot Facility



13a Biobase Europe Training Center



13b Biobase Europe Pilot plant



Application, Innovation & Knowledge Centers



2. Biotech Campus Delft



3 Yes! Delft Incubator



4 Veenweide – Dairy Innovation center



8 Green Chemistry Campus



9a Natural Fibre Appl. Center



9b Colour Appl Center



9c Biopolymer Appl. Center

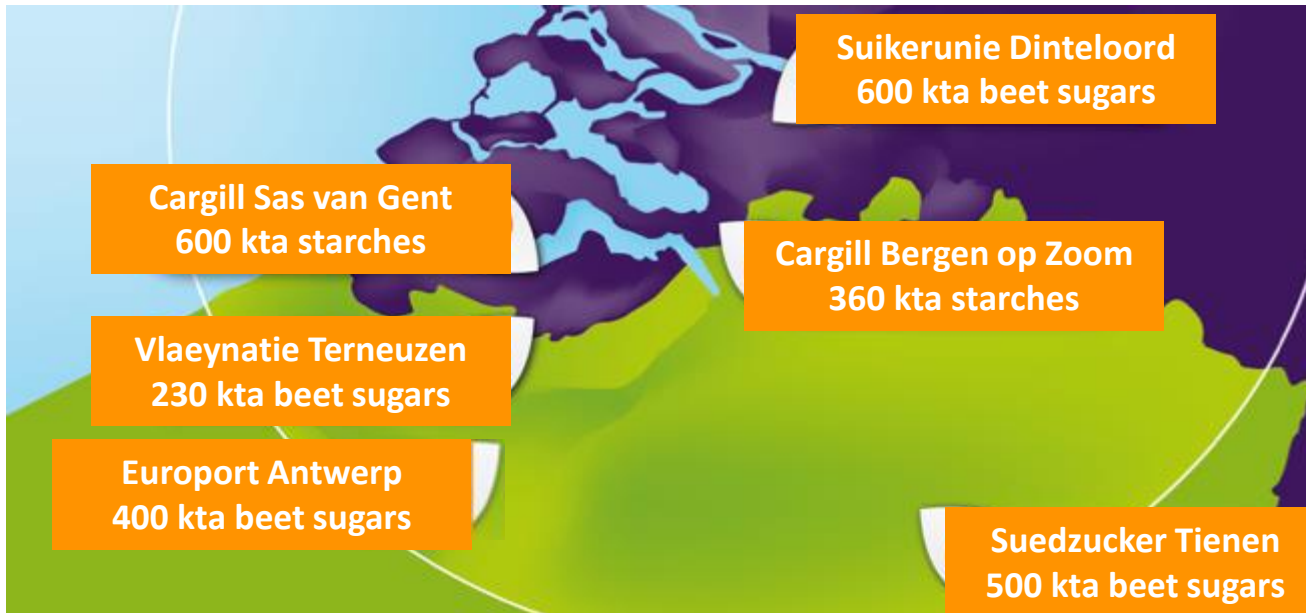


10 Biobased Innovation Center



14abc Centres of Expertise Biobased Economy (CoE BBE)

Business Opportunity: Europe's sugar hub

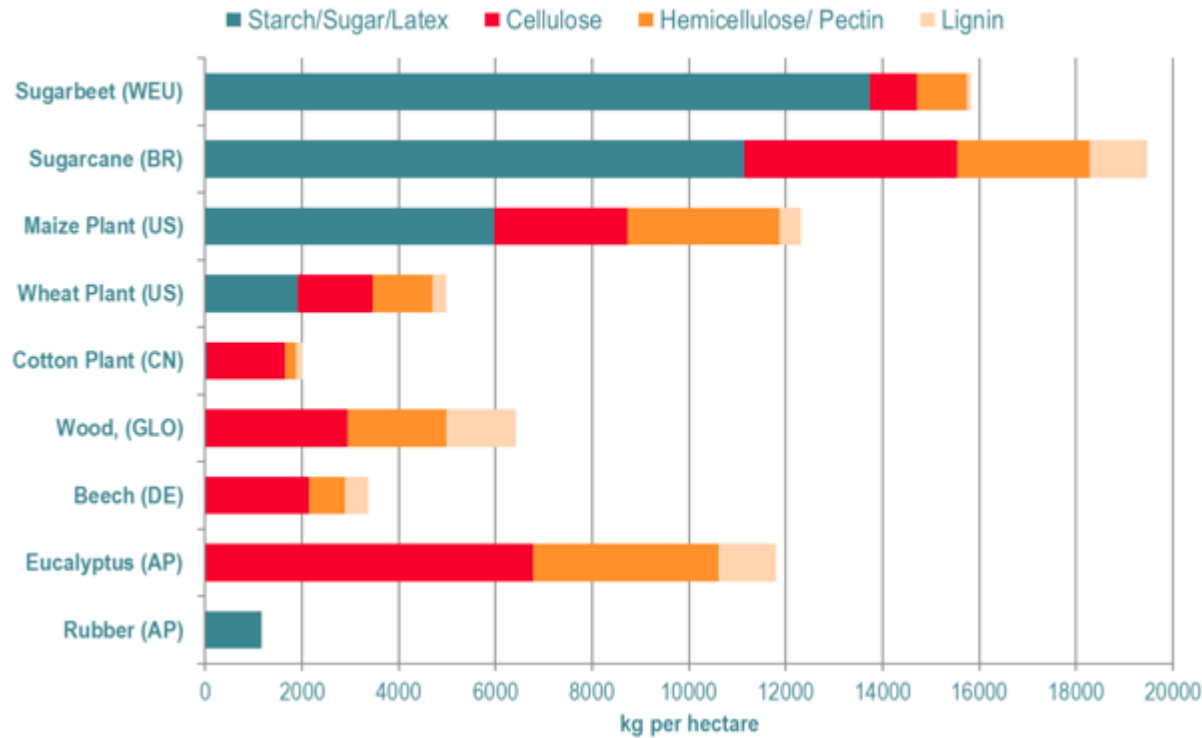


- 5 companies producing and trading close to 3m tons sugar annually
- Secures raw material supply at favorable cost

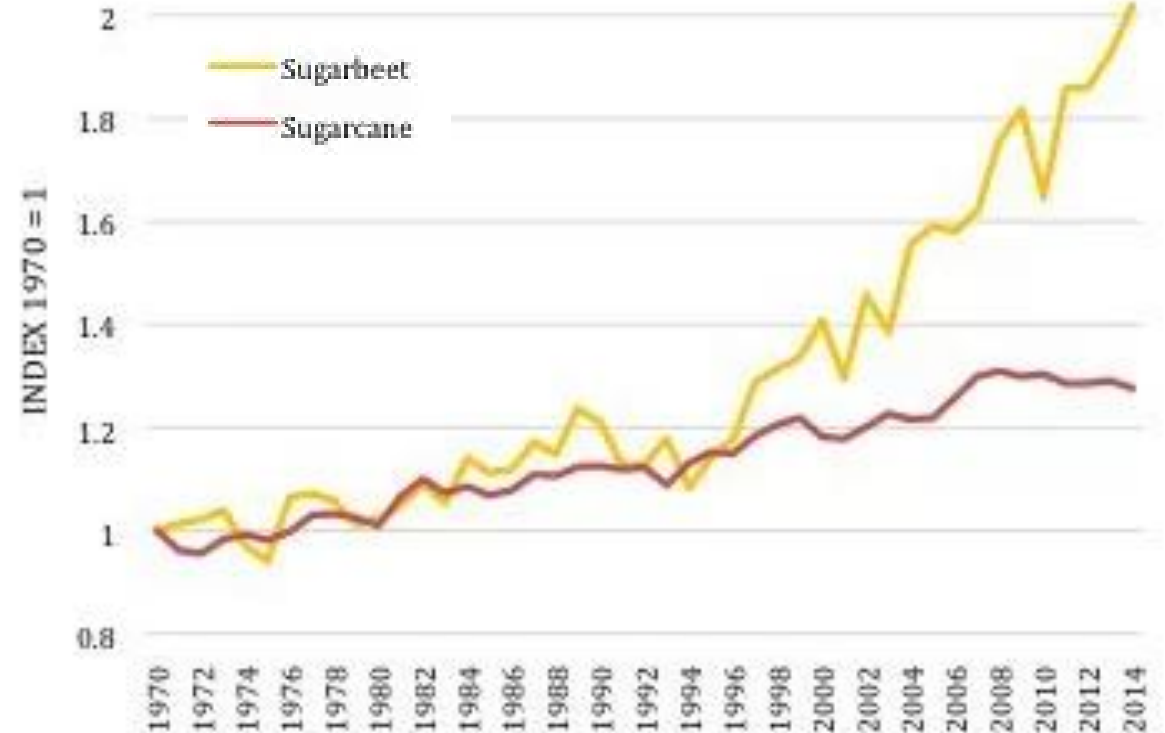
Beet sugars are a preferred feedstock for biobased products



Crop Efficiency



Gains in Field Productivity (tons beat or cane/ha)



Key data beets, 2017: 90 t/ha, resulting in 16.2 t/ha sucrose and 6 t/ha pulp

Sources: Dupont, Nova Institute, <http://jonathankingsman.com/wordpress1/2016/11/15/trends-that-are-changing-the-world-of-sugar/>

Biobased Delta added value



- Value proposition:
 - Ecosystem Sustainability, infra-structure and support
 - Carbohydrate availability Favorable cost position
 - Market Within 200km to 40% of European Customers
 - Innovation & knowledge Yield, conversion and down-stream processing
 - Trade 2nd exporter of agro & food worldwide (€94bn, 2017)

**Biobased Delta is ideally situated to welcome the
Polymerization Shared Facility.**

Megatrends in & materials: there is a great need for innovative materials for technical as well as economic reasons.

Mobility Efficiency & Energy



Weight, cost reduction
and fuel efficiency

**Polymers for
metal replacement**

Communications & Security



Energy, thermal management
and miniaturization

**High durability,
thin film technology**

Environment and Climate



New feedstock and
environmentally friendly
products

**Biobased,
biodegradable/recy
clable polymers**

Health



Joint replacement
and pain management

**High performance
polymers for device
innovation**

https://additive-fertigung-2018.dgm.de/fileadmin/Tagungen/2017/2017-09_Werkstoffwoche/02-Dateien/2016-11-11-WW2017-Exhibition-Information.pdf; <http://www.victrexplc.com/sites/default/files/2018-01/Victrex%20plc%20Annual%20Report%202017.pdf>

There is an urgent need for new biobased polymers

	Petroleum-derived polymers	Biobased polymers	
	Industry	Industrial approach	Scientific approach
Super-engineering applications	since 1960 PEEK, PSU, PES, PPS, PEI, PAI, LCP	not yet	since 2010 bio-LCP, bio-PEEK (new generation)
Engineering/semi-engineering applications	since 1950 Polyamide, POM, PC, PPO, PET, PTT, PBT, ultra-high MW PE, HIPS	since 2010 bio-PET, bio-PTT, bio-PBT, bio-polyamide (analogous to petroleum-derived ones)	since 2000 polyterpenes, PEF, bio-polyamide, sc-PLA (high T_m), sb-PLA (high T_m) (new generation)
General applications	since 1930 PE, PP, PS, PMMA, PVC, ABS	since 2000 PLLA (high-L content) reinforced PHAs, PHAs blends, succinate polymers, bio-PE/PP	since 1990 sc-PLA (low T_m), PHAs (super high MW), succinate polymers (upgrading from biodegradable polymers)
Biodegradable/biocompatible applications	since 1970 PCL, PEG	since 1990 PLLA (low-L content) PBS, PHAs, PGA, polysaccharides	since 1970 PLA, PHAs, succinate polymers

New and drop-in polymer development is a process with hurdles

- Development of new or drop-in polymers involves high cost due to long product development cycles:
 - Need for acceleration and higher efficiency.
 - Reduction of the product cycle development time.
- Companies lack the resources and the infrastructure :
 - Companies to perform in-house R&D and outsource process development.



First Commercial Shared Service Pilot Plant

- To accelerate the development of innovative (biobased) and drop-in polymer-materials
- Filling the gap between lab and commercial volume by enabling production on commercial-trial scale
- Filling the gap after monomer-pilot plants like the Biobase Europe Pilot Plant (Gent) and Bioprocess Pilot Facility (Delft)
- Besides polycondensation also ring-opening polymerization a.o. for biobased Lactic Acid polymers
- Special focus on depolymerization of waste-plastics into monomers: significant contribution to the Circular Economy



Polymerization Shared Facility is the first multipurpose pilot facility for the development and scale-up of new innovative (bio based) polymers.

- State-of-the-art industrial equipment, experienced and flexible team serve customers in the field of:
 - Polymerization of (Bio)polymers, (bio)Polyesters and (bio)Polyamides
 - Depolymerization of waste-plastics into monomers enabling significant contribution to the Circular Economy

Mission:

To accelerate the development of innovative (biobased) and drop-in polymer-materials by enabling production on pilot scale for commercial-trials.



Drawing of the Polymerization Shared Facility



Potential location at Synbra, Etten-Leur (NLD)



Potential location at GCC, Bergen op Zoom (NLD)

Polymerization Shared Facility is the missing link for companies to bridge the gap in the innovation chain.

A new company on initiative of WUR; Biobased performance materials program, Synbra, Green Chemistry Campus and facilitated by REWIN



The **Green Chemistry Campus** offers unique facilities in one location for development of the Bio-Economy.



The **Biobased Performance Materials** program develops biobased materials.



Synbra Technology bv is the producer of world's first Poly-Lactic Acid (PLA) based BioFoam[®].



REWIN West-Brabant is the regional development company.

Scope of the plant: focus on innovative polymers and materials, biobased polymers

- 2 lines: continuous ring-opening and batch-polycondensation
- 25 kg/hr resp 80 - 100 L reactor size
- Temperature range: up to 350°C
- Pressure: 30 bar to 0.1 mbar
- Solid-State post-condensation, Vacuum distillation equipment
- Process Monitoring, Control and Data Acquisition components and systems for monitoring and control of process parameters, DEVO unit.
- Sampling and analytical instruments for end-point determination
- Etc

Service-oriented business model

- Landlord-renting principle:
 - Operation of the plant by the owner; customer present
 - Clear position (customer – contractor), simple IP-sharing rules
 - No interface problems: access to all relevant resources in-house
 - Customer: no complication from obligation to publish results in bridging function between academic research and industrial application
 - Customers benefit from results (patents); PSF benefits from financial support
 - Setting up resources (labs, teams, plants, networks) through projects
 - Incremental scale up

100% merchant market focus

Summary

- Part of an Circular Bio-Economy ecosystem
- Technology scope designed; in dialogue with vendors
- Market need proven: written commitments
- Financially sound and attractive for investors
- Realistic project planning





Many thanks for your attention

Contact: VanBerkel Consultancy BVBA
Marcel van Berkel
Belgium.
M +31 6222 03144
W VanBerkelConsultancy.com
E Marcel@VanBerkelConsultancy.com