

Session: Welcome and Opening
Presentation by: Christiaan Bolck, *Director CBPM*

Title: **Circularity of renewable materials**

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Curriculum:

Christiaan Bolck, is director of the Circular & Biobased Performance Materials research programme and as such is coordinating these activities within the Dutch topsectors. Christiaan has over 20 years of experience in product and market development regarding materials and products from biobased and recycled (re-)sources. As programme manager renewable materials within the applied research institute Wageningen Food and Biobased Research, he is currently responsible for the research and development activities at Wageningen Research in the field of biobased and circular materials, such as plastics, textile, paper& pulp, and building materials. In addition, he is Advisory Board member of the lectorate polymer technology at the Windesheim polytechnic, Paperfoam® and Vibers®.

Abstract:

The Circular & Biobased Performance Materials Program is a research program that has been running since 2009 and that initially focused on the development of high performance materials based on biomass. CBPM is a PPP within which industry and knowledge institutions collaborate and which also has a coordinating role within the Dutch top sectors in research and development in this field. Through a chain approach, technology is developed from various primary raw materials such as sugar beet and potatoes for the production and processing of new or substantially improved biobased polymers for applications in the packaging, electronics and automotive industries. The current CBPM program has come about through a "market-oriented" approach, based on the requirements of the materials and where the wishes of companies have been leading.

The research on renewable materials is influenced by "cyclic" societal issues. From a sourced focused '80-ties with major attention for the utilization of biomass for non food uses, to a end-of-life orientated '90-ties with society giving great emphasis on toxicity of chemicals and plastics and towards waste management including industrial composting and in the '00-s the climate change putting again emphasis on the renewability of the source. Now in the '10-s we again have this emphasis on end-of-life with a major focus on recycling and biodegradability. Therefore in the new research projects within CBPM, Wageningen Research wants to give more attention to both the techno- and biocycle of polymeric materials. In other words: the reuse of materials and the interaction of materials with the environment (litter, plastic soup). Hence the new name Circular and Biobased Performance Materials.

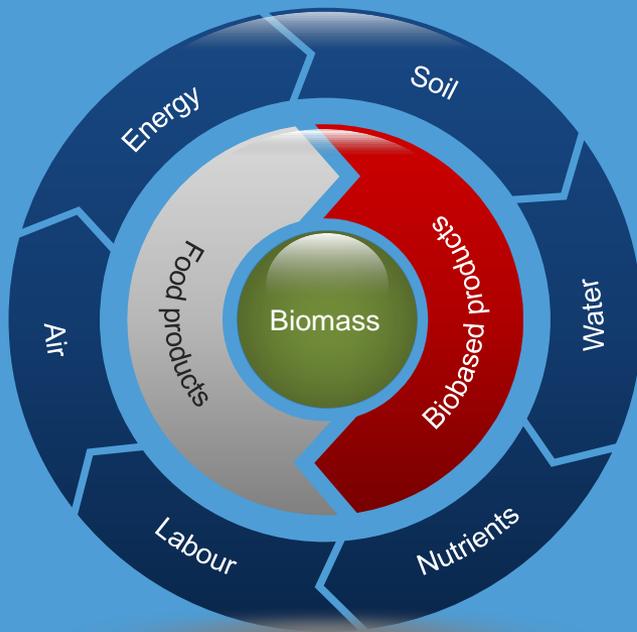
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For the 3rd tranche of (C)BPM an important research direction remains the creation of biobased materials based on new building blocks, with its own unique structure and associated unique properties. For this, on the one hand the available biomaterials will have to be improved and on the other hand completely new biopolymers have to be developed. Another research track is the direct use of available natural polymers such as cellulose, starch, chitin and lignin. This concerns both natural polymers that are currently being underutilized such as residual or secondary streams, as well as industrially produced natural polymers. The aim is, among others, to develop plastics by means of the functionalization of, for example, lignocellulose, and to develop processes by which these polymers can be extracted from waste without loss of functionality. A third research track is specifically aimed at reusing consumer waste.

Circularity of renewable materials

Christiaan Bolck – Director CBPM – 19 June 2019

8th CBPM symposium– De Wageningen Berg



Wageningen Campus inspires



University and research

- 9,000 BSc and MSc students
- 1,700 PhD students
- Over 100 nationalities
- 6,500 employees
- Extensive international network

Interaction with companies

- Contract research
- Stimulate & support entrepreneurship
- Incubators
- Sharing research facilities
- Lifelong learning
- Flexible business accommodation options
- Expat centre



Perfect base
for interaction
and innovation



To explore
the potential
of nature to
improve the
quality of life



Biobased Products Innovation Plant



Developed products



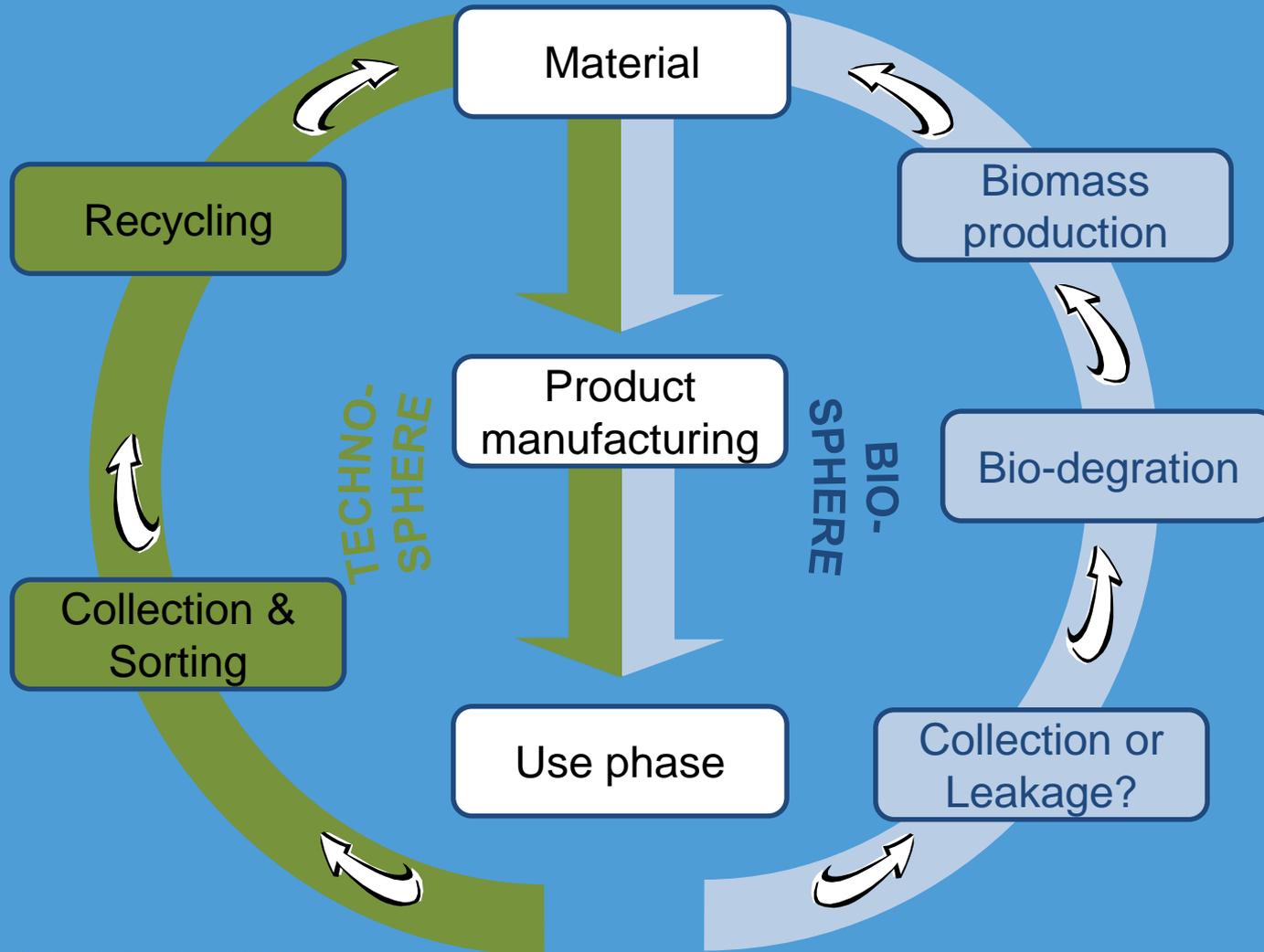
Evolution of renewable materials

Development is influenced by “cyclic” societal issues:

- 80-ties : Source : Utilization biomass (4e gewas)
- 90-ties : EOL : compostability and non-toxic
- 00-s : Source : Renewable (climate change)
- 10-s : EOL : circularity (recycling & biodegradability)



Renewable materials in the techno- and biocycle



Major developments last 5 years

- Climate focus has led to the development of bio-based plastics (produced from biomass)
- At present bioplastics market is dominated by :
 - Drop-ins BioPE and Bio-PET (not biodegradable)
 - PLA, Starch-blends and Cellophane
- Further focus on efficiency and yields has led to development of novel polymers like PEF and PBS
- Widening of applications:
 - From packaging and single use towards durable products
 - Focus on properties and functionality



What can we expect the coming years?

Scale-up and maturing of current biobased plastics

Increased focus on:

- EOL : recycling & biodegradability
- USE : non-toxic and environmentally safe products
- Source : bio- and or post-use waste



Introduction CBPM



- Initiated by Wageningen Food and Biobased Research
- PPP coordinating R&D activities in the Netherlands on Circular and or Biobased Performance Materials
- Industrial partners participate actively from all parts of the value chain / circle
- Start in 2010, 2nd tranche in 2015, and 3rd tranche 2019/2020
- Sponsored by the Dutch Government

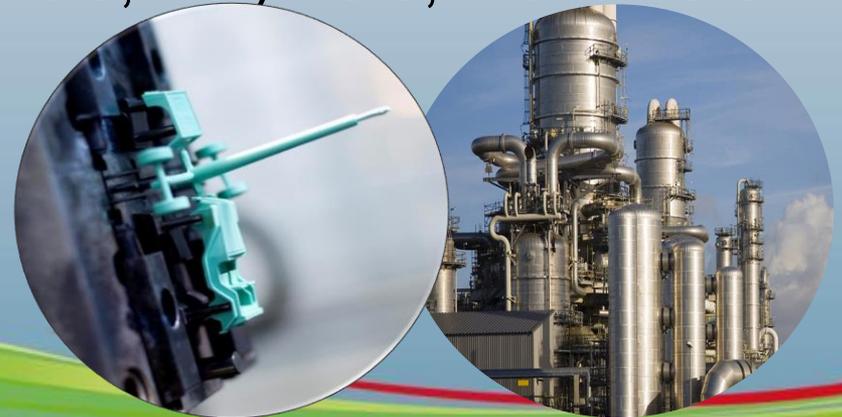


Goal & Scope



Cost competitive circular & biobased performance materials with substantially improved properties profile

- Using functionality in biomass & post use waste
- Using unique structures available in biomass
- Low temperature transformations (wherever possible)
- No back to crude routes : biocrude, syngas or pyrolysis oil
- With focus on Products, Materials, Polymers, Monomers
- Circular approach



Current focus



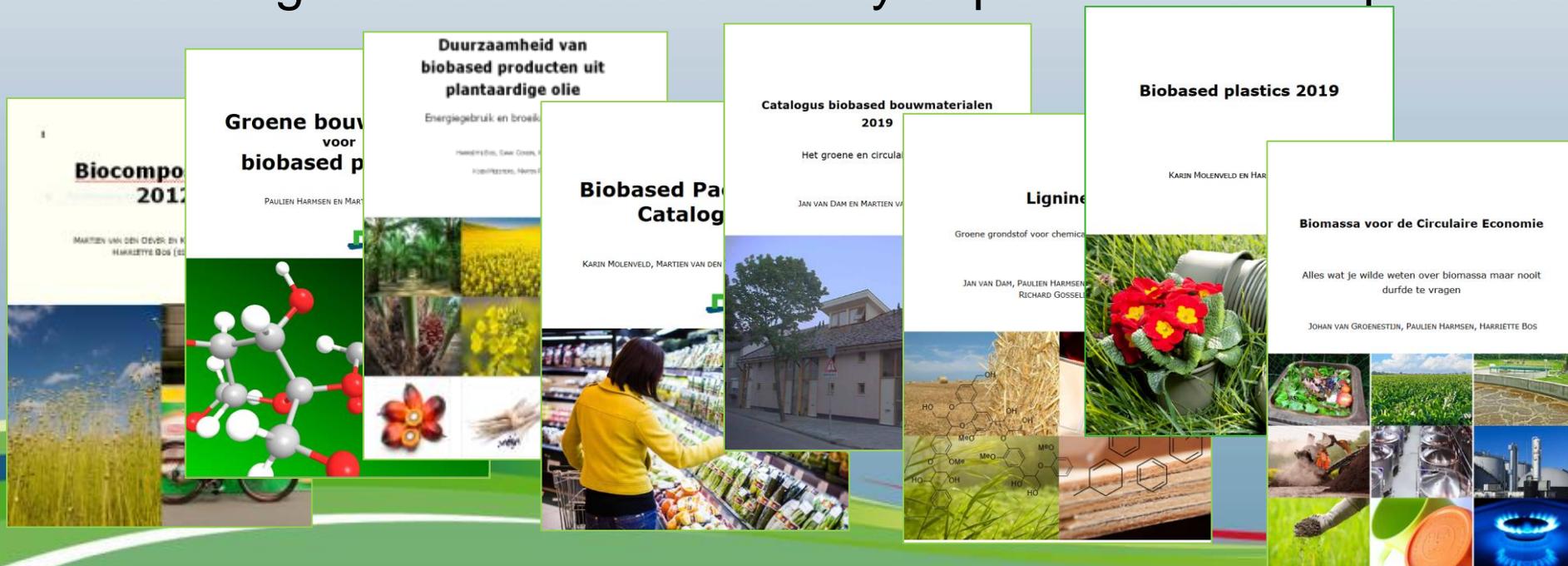
Polymeric materials :

- A. Produced by and extracted from plants and post use waste
- B. Produced via biotechnology or chemical catalysis and synthesis
- C. Using available biobased polymers for new materials and products

Output



- New building blocks, polymers, compounds and end products
- Patents, scientific publications, posters, etc.
- Books on plastics, composites, building materials, chemical building blocks and sustainability of plant derived oil products



Projects 2nd tranche



- **MAGIC** : Rail fastening systems :
Edilon Sedra, Croda
- **HIPPIE** : High performance polymers
from isoidide : ADM, DuPont, HCA
- **SPECIFIC** : Starch PE films with
Improved barrier : AVEBE, Sabic
- **DISCOVER** : Covering materials for
Roofing : Icopal, Stichting DAKlabel



Projects 2nd tranche



- Glue Reed : Renewable boards :
DSM, Natuurmonumenten
- MethaForm : Biobased itaconic acid
and methacrylic acid :
ADM, EOC, Van Wijhe (Wydo)
- APPS : Applications for PBS :
Reverdia, Promens, Teamplast
- FOAMEX : Extrusion foaming :
Synbra (BEWi), Nomacor, Sulzer
Chemtech



3rd tranche



- Financed by government and industry
 - Industry 50% cash + in kind (of which >50% cash)
 - Government : DFI and/or TKI-AF
- 2 follow up projects started : Foamex & Discover
- 9 Preproposals submitted : options for new partners
- New proposals : still open for discussion

A. From plants and post-use waste



Preproposals:

- Biodegradable alternatives for anionic poly acrylates
- Sustainable Binderless Product Technology
- Pre-pulp production from agri residues

New idea's:

- PEF recycling
- Denim recycling
- Biotechnological routes for polyester recycling
- Polyolefin recycling

B. Via (bio)-chemical routes



Preproposals:

- Biobased glycolic acid and polyglycolic acid
- PHA latex for carpets and coatings
- Starch in adhesives

New idea's:

- 100% Bitumen from lignin
- New routes to thermoplastic cellulose
- Biobased alternative for styrene

C. Using available biobased polymers



Preproposals:

- Paper-based food packaging
- Home compostable and soil degradable PLA
- Biodegradable disposables

New idea's:

- Plastics from seaweed
- More natural artificial grass

Thank you for your attention



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www.wageningenur.nl/en/fbr

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