

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

Title: **Biobased performance materials in a circular economy**

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Curriculum:

Christiaan Bolck, is director of the Biobased Performance Materials research programme and as such is coordinating the Biobased Materials R&D activities within the Dutch topsectors. Christiaan has over 15 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 a member of the "Expert group Biobased Products" of the European commission (since 2008), Advisory Board member of the lectorate polymer technology at the Windesheim polytechnic (since 2008), member of the advisory committee on (green) taxation scheme of packaging waste (since 2008), and Consultant "governmental policy on the biobased economy" for the Dutch ministries of Economic Affairs and Agriculture (since 2004).

Abstract:

The Biobased Performance Materials Program is a research program that has been running since 2009 and focuses on the development of high performance materials based on biomass. BPM 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 BPM 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. In the new tranche Wageningen Research wants to give more attention to the reuse of materials and the interaction of materials with the environment (litter, plastic soup). Hence the new name Circular and Biobased Performance Materials.

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

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aimed at reusing consumer waste. The following research directions will be considered: (1) Design of materials that can be recycled using available collection and processing processes, (2) Consumer behaviour: for prevention of litter and collection of waste it is important to keep substances really well separated or to separate them afterwards (3) influence of so-called disturbances from residual and waste products. These must be separated as much as possible from the main product, so that new, qualitatively good new products can be made with clean recyclate and (4) each residual and waste stream has its own, unique functionalities that we must retain as well as possible in the reuse process.

Introduction BPM



- PPP coordinating R&D activities in the Netherlands on Biobased Performance Materials
- Initiated by Wageningen Food and Biobased Research
- Fills an important gap in research that catalyzes the biobased economy
- Is unique in its construction: industrial partners participate actively from all parts of the value chain
- Start in 2010 & 2nd tranche 2015
- Sponsored by the Dutch Government



Goal & Scope



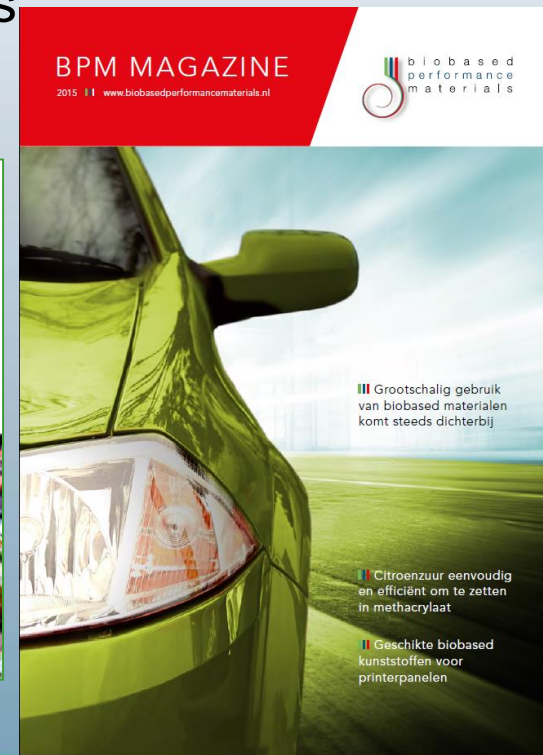
Cost competitive biobased performance materials with substantially improved properties profile

- Using functionality in biomass
- Using unique structures available in biomass
- Low temperature transformations (wherever possible)
- No biocrude or syngas
- With focus on Products, Materials, Polymers, Monomers
- Circular approach

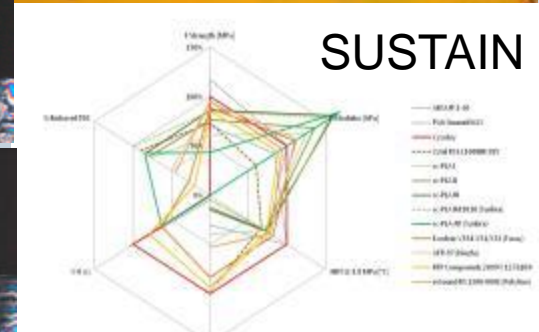
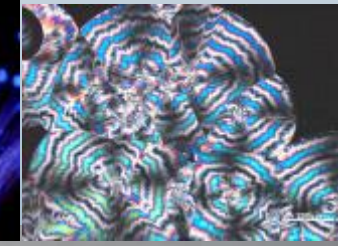
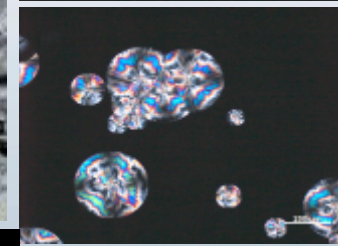
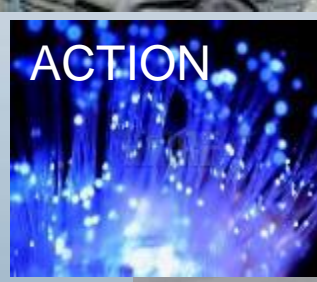


Output

- 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 1st tranche



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

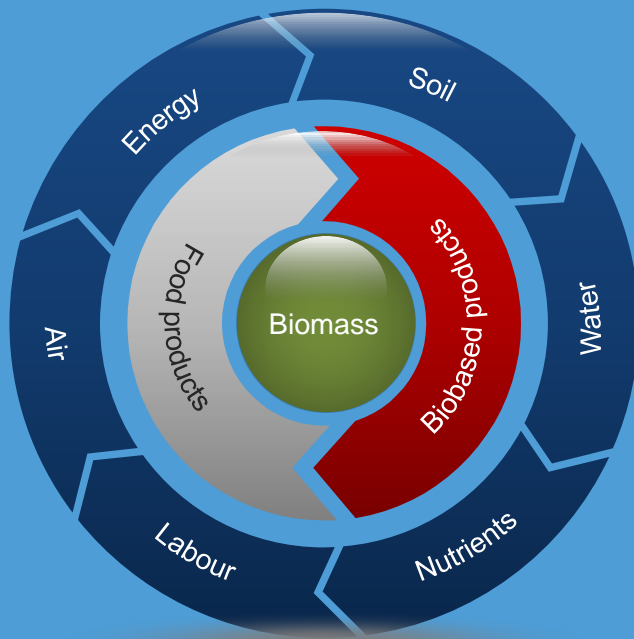
- Glue Reed : Renewable boards
DSM, Natuurmonumenten
- MethaForm : Biobased itaconic acid and methacrylic acid
ADM, EOC, Van Wijhe (Wydo)
- APPS : Applications for PBS
Reverdia, Promens, Teamplast
- FOAMEX : Extrusion foaming
Synbra (BEWi), Nomacorc, Sulzer Chemtech



Biobased performance materials in a circular economy

Christiaan Bolck – Director BPM

7th BPM symposium – 14 June 2018 – Campus Wageningen



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



WR Vision

Total use via (bio)refinery

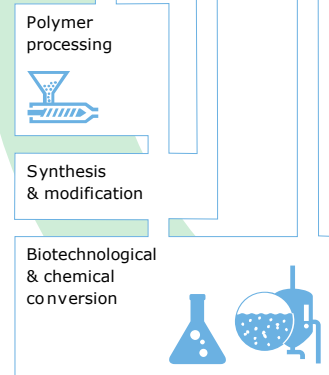
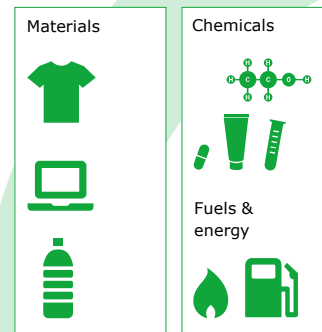
Strategic themes :

- Circular & Biobased Economy
- Resource Use Efficiency

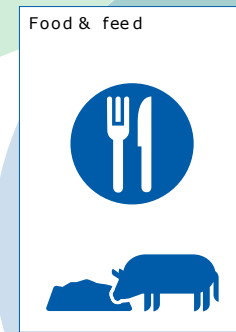
BIOMASS



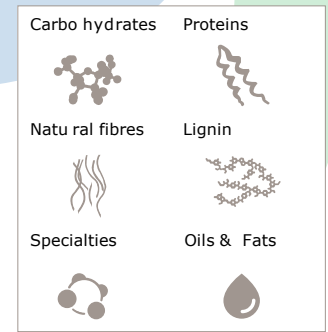
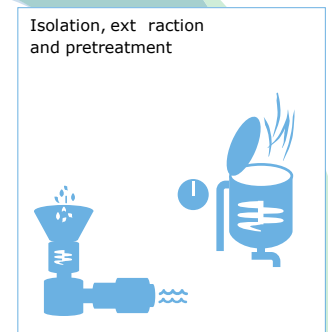
BIOBASED PRODUCTS



CONVERSION



BIOREFINERY



BIOMASS COMPONENTS

The Biobased Economy Value Chain

Waste: a valuable resource for materials

Preconditions:

1. Materials must be designed in such a way that they can be recycled with the available collection and processing methods.
2. When collecting waste, it is important that the components are properly separated, either by consumers themselves or at a later stage.
3. Contaminants in residual and waste products must be separated from the main product to enable the production of good-quality new products.
4. All residual and waste streams have their own unique functionalities which must be retained as best as possible in the recycling process.



Research topics waste2materials

Identifying valuable components :

Use the raw materials concealed in the waste in applications of the highest achievable quality and seek opportunities to use the waste stream as a whole wherever possible.

Recycling processes :

Simulate existing recycling processes in detail and test new recycling processes and pilot setups.

Recycled materials :

Properties and standards : To what extent are recyclates suitable for specific applications and determine which components most affect the quality of the material.

Chemical recycling :

Technology to separate and enable the reuse of waste streams which are difficult or impossible to separate mechanically. Partially or fully break down or dissolve polymers to their original building blocks.

New circular value chains :

How can new circular value chains best be organized? How does the quality and costs from recycling compare to the raw material demand?



Current societal drivers

- Scientific

- > functionality from nature

- Environmental

- > Climate / no fossil carbon

- > Circular

- Social

- > Economy

- > Jobs

Plasticdeskundigen uit hele wereld komen twee dagen bijeen om antwoord te vinden op groeiend probleem

Hans Verbraeken
Amsterdam

De wereld raakt overspoeld met plastic. Sinds medio jaren zestig is de productie van plastic vertwintvoudigd en tot 2050 wordt nog eens een ruime verdrievoudiging van het plasticgebruik voorzien. Er is dan 1,1 miljard ton plastic op aarde. Alarmerender uitgedrukt: 1.100.000.000.000 kilo plastic. Van koffiebekertjes voor de consument tot hit-

kunst- wordt gewoon verbrand, waardoor fossiele CO₂ de lucht ingaat.

Donderdag en vrijdag komen plastic-experts uit bedrijfsleven, overheden en onderzoeksinstituten bijeen in Rotterdam om te praten over dit wereldwijde probleem. De organisatoren van de 'European Conference on Plastic' hopen dat er na twee dagen ideeën en initiatieven op tafel liggen om het probleem aan te pakken.

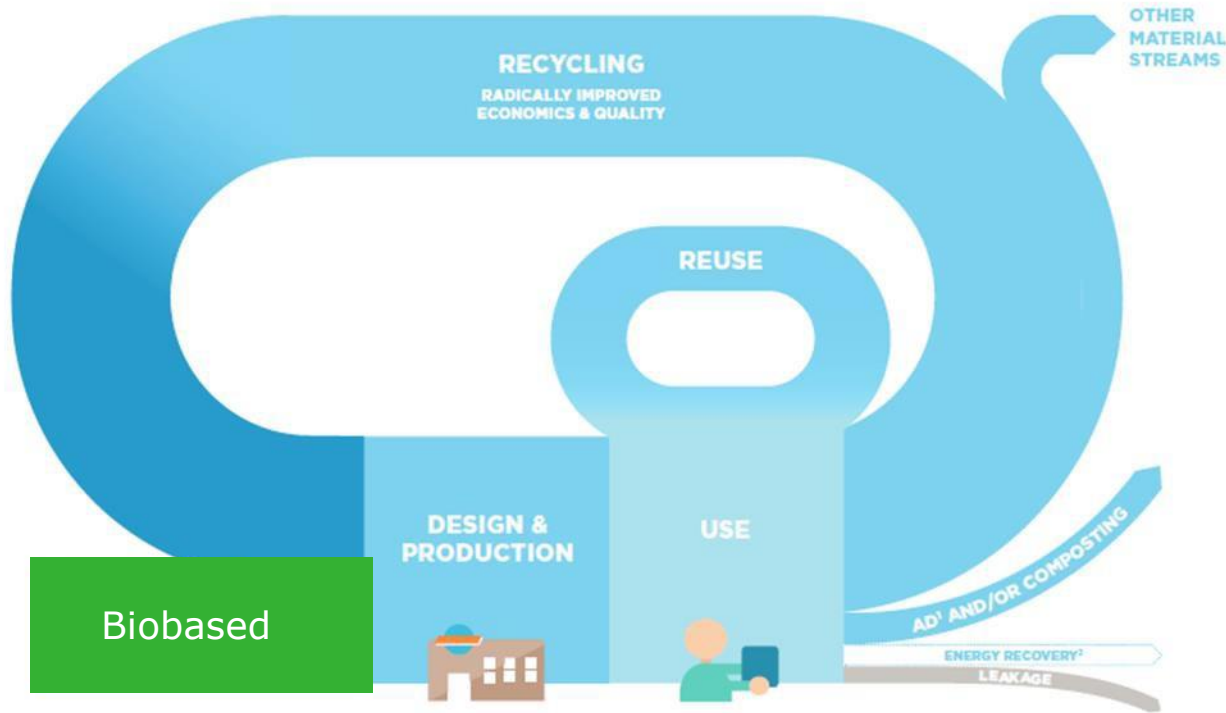
'Hoe kunnen we meer circulair omgaan met ons plastic? Hoe kunnen we plastic weer als grondstof gebruiken, hoe zorgen we ervoor dat geen plastic meer in de oceanen terecht komt?', zegt Christiaan Bolek, expert duurzame materialen aan Wageningen University & Research. Hij formuleert een aantal dwingende vragen waarop het het antwoord gevonden moet worden. 'Wat is de goede, duurzame grondstof voor plastic in plaats van fossiele grondstoffen?'

De bijeenkomst moet volgens Bolek 'handen en voeten geven aan het EU-beleid'. De resultaten van twee dagen Rotterdam moeten een toevoeging vormen voor de 'EU Strategy on Plastics', een aanvalsplan voor het plasticprobleem.



Ambitions of the New Plastics Economy

1 CREATE AN EFFECTIVE AFTER-USE PLASTICS ECONOMY



3 DECOUPLE PLASTICS FROM FOSSIL FEEDSTOCKS

2 DRASTICALLY REDUCE THE LEAKAGE OF PLASTICS INTO NATURAL SYSTEMS & OTHER NEGATIVE EXTERNALITIES

1 Closed-loop recycling: Recycling of plastics into the same or similar-quality application

2 Cascaded recycling: Recycling of plastics into other, lower-value applications

Source: Project Mainstream analysis – for details please refer to the extended version of the report available on the website of the Ellen MacArthur Foundation:
www.ellenmacarthurfoundation.org



Current market drivers

- New unique functional properties: T_g , T_m , gas barrier, UV-stability, water sensitivity, targeted biodegradability, strength, impact
- Non toxic additives and functional ingredients such as plasticizers, fire retardants, anti-fouling, water binders
- Recycling of thermosets, post consumer plastics, textiles, diapers, packaging and foodwaste
- Added value for industrial organic waste like leaves for packaging and sewer sludge for plastics or foodwaste
- Regulation support at NL and EU level: normalization, standardization, certification

Research tracks Circular and Biobased Performance Materials

1 Sustainable packaging

2 New Biobased Polymers

3 Materials from underutilized biomass

4 Closing the loop of consumer waste

5 Plastics in the environment



biobased performance materials

Bekijk hoe de tomatendoos wordt gemaakt

Kunststofindustrie roept op tot recyclingrevolutie

Het recyclingsysteem van kunststoffen in Nederland functioneert onvoldoende. Dat stelt de Federatie Nederlandse Rubber- en Kunststofindustrie (NRK) in het Masterplan Kunststof Kringloop, dat deze week gepubliceerd wordt. De gerecyclede kunststof- recyclaat - komt terecht in slechts een beperkt aantal producten. Vooral omdat de kwaliteit van de gerecyclede grondstoffen te gering is of de hoeveelheden te klein. Daardoor worden grondstoffen nu vooral hergebruikt in laagwaardige toepassingen als pallets, drainagebuizen, tuinmeubelen, kratten en haspels. Dat is doodzonde. Het recyclaat kan en moet ook worden verwerkt in hoogwaardiger producten, zoals in verpakkingen, goed voor 40% van alle geproduceerde kunststoffen, zo meldt het Masterplan Kunststof Kringloop.

Het plan is mede ondertekend door onder meer onderzoekers van

1. Sustainable Packaging



Example project :

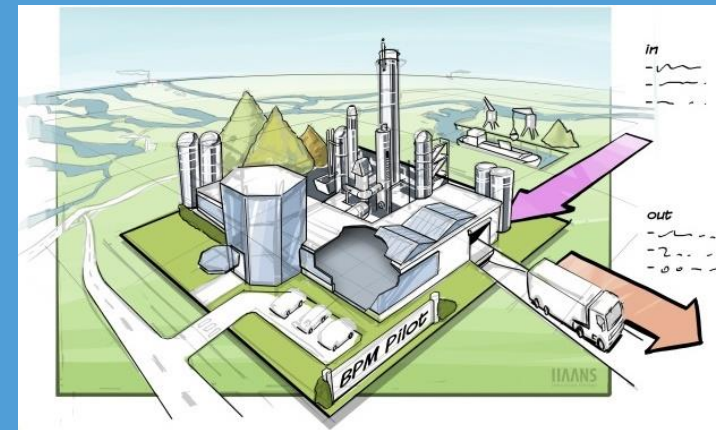
Alternatives for multilayer gas and watervapour barrier materials

2. New Biobased Polymers

- Using biobased building blocs for new non polluting and circular materials
- Taking polymers 2 market : Polymerisation pilot plant initiatives

Example projects :

- Recyclable thermosets en resins
- Biobased Elastomers



3. Materials from under utilized biomass

- Fuelled by the circular economy
- Refinery and materials sciences

Example projects :

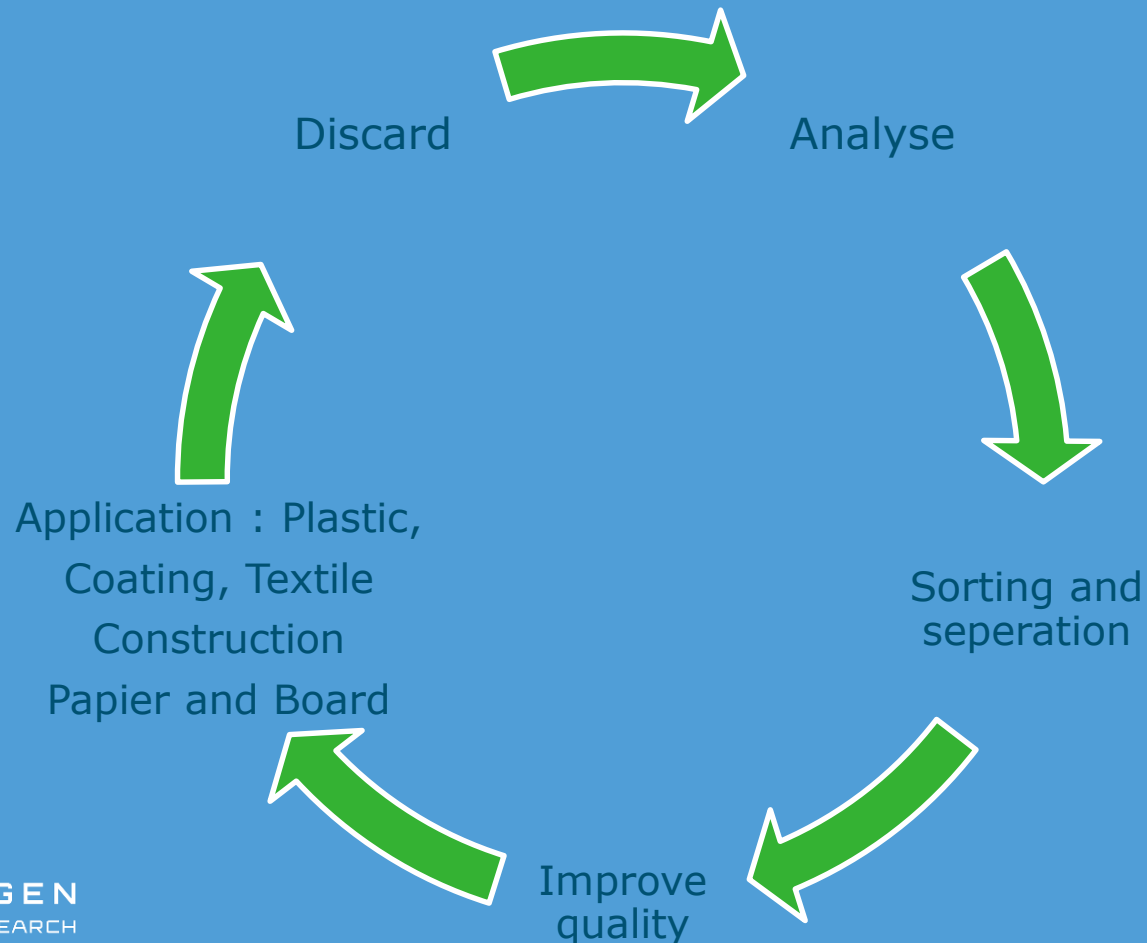
- Thermoplastic lignocellulose : thermoplastic materials from naturally abundant biopolymers and its derivatives
- Sea2plastics : production of plastics materials based on seaweed and chitin
- Fibrewaste4paper&construction : valorising waste fibres like tomato leaves and reed



4. Closing the loop of consumer waste

Example project

Sustainable chains for supplying sustainable plastic packaging & textiles



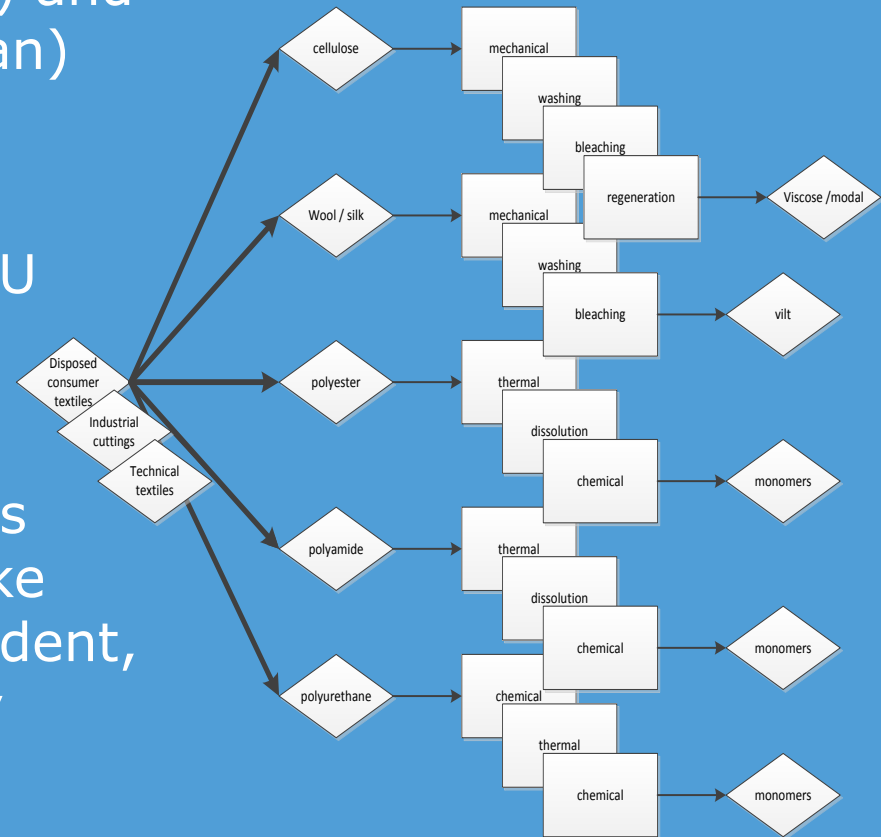
Plastic recycling

- Improving the properties and value of post-consumer recycled plastics
- Which contaminations have the largest detrimental effect on plastic recyclates
 - Sorting errors
 - Packaging design
 - Packaging content
- Blueprint recycled plastics
 - Standards post use recycled plastics
 - Scope : all applications including packaging
 - Focus large volumes: PP, PE, PET, PS, PVC



Wastexcel : recycling mixed textile

- Recovery of mixed textile from basic natural (cellulose/cotton) and synthetic (polyester and elasthan) raw materials
- 6 million tons/y discarded in EU
- Reuse of the cellulosic fractions from mixed textiles would make the EU more resource independent, and makes the textile industry overall more sustainable



5. Plastics in the environment

- CSI Plastics
 - Where are plastics found in the marine environment?
 - How to prevent ...
 - Are biodegradable plastics THE solution?
- Closing the biocycle : triggered biodegradation in soil and sea



Research tracks 3rd tranche (C) BPM

1 Sustainable packaging

2 New Biobased Polymers

3 Materials from under utilized biomass

4 Closing the loop of consumer waste

5 Plastics in the environment



Bekijk hoe de tomatendoos wordt gemaakt



fti. Home Mij nieuws Laatste nieuws Krant Beurs Meer v

Hans Verbraeken - Ondernemen

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Thank you for your attention

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