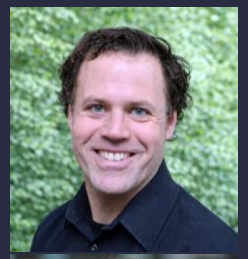


Short intro NTCP

Contacts:
Freek van Rhijn (Technical Director) email: fvanrhijn@ntcp.nl
Martine Brandsma (Founder/Director) email: mbrandsma@ntcp.nl

Scale up faster: leveraging open infrastructure in the Netherlands

Transition to Circularity, 29 October 2026



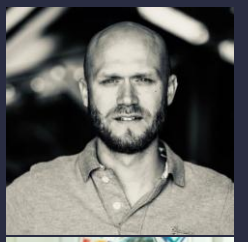


Tijs Lammens (BBC)

Edwin Keijsers (WFBR)

Freek van Rhijn (NTCP)

Lucie Wenmakers (BCS)





Agenda

11.15 - 11.20: Introduction (Tijs)

11.20 - 11.32: Wageningen Food & Biobased Research (Edwin)

11.32 - 11.44: Nationaal Testcentrum Circulaire Plastics (Freek)

11.44 - 11.56: Brightlands Circular Space (Lucie)

11.56 - 12.15: Q&A

BBC Open Access Facilities Platform

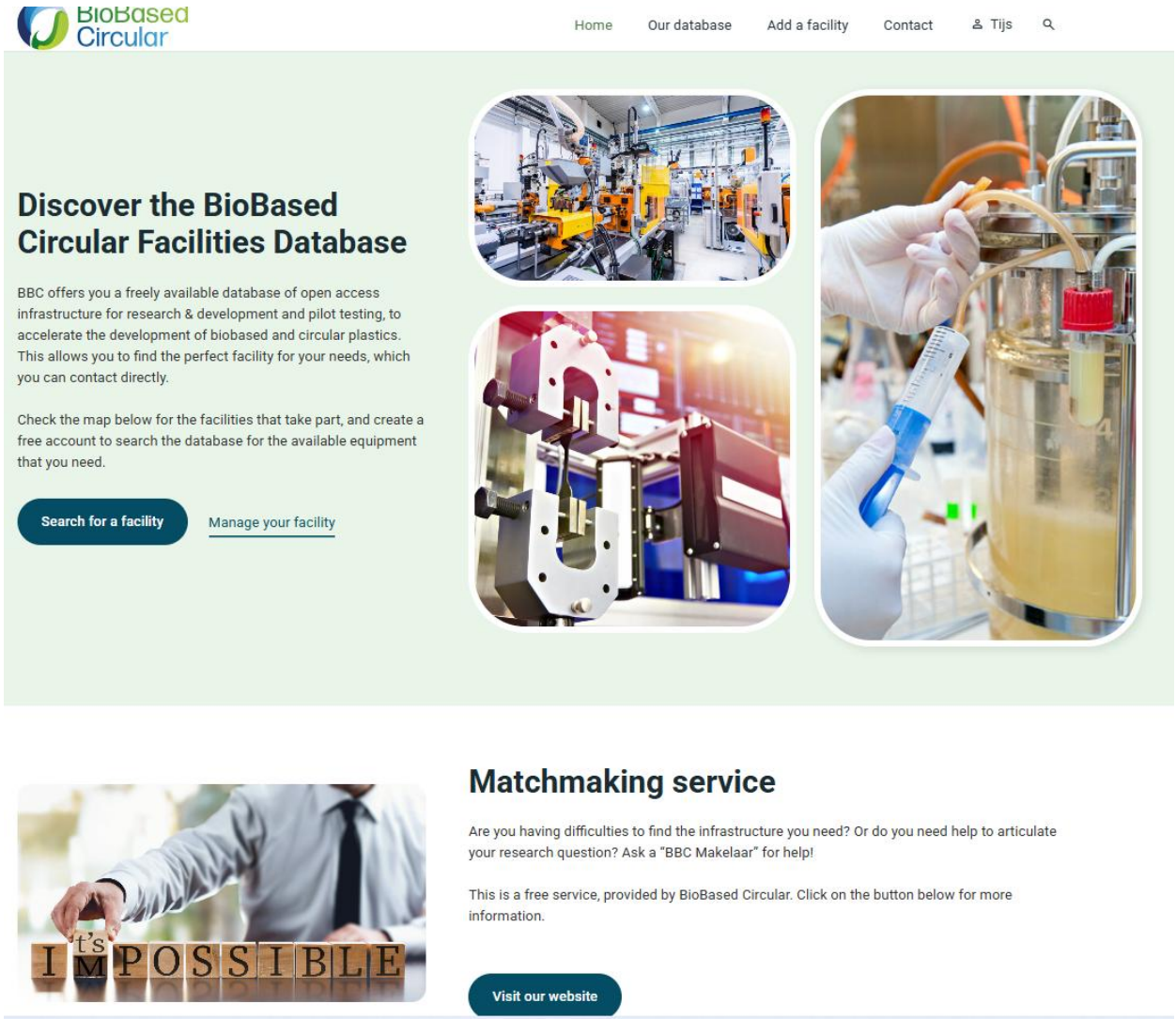
1. Infrastructure database

- Provides oversight and insight in open access R&D facilities
- Direct connection to facilities

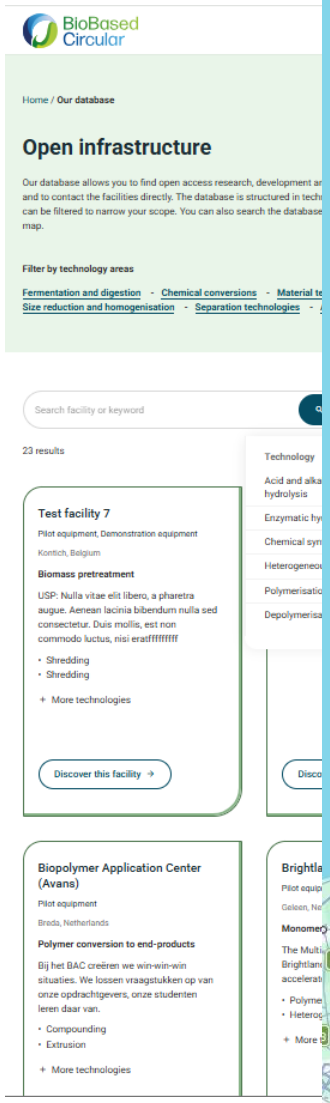
2. BBC Brokers

- Personal support of SME's with facility selection & connection
- Free service by BBC

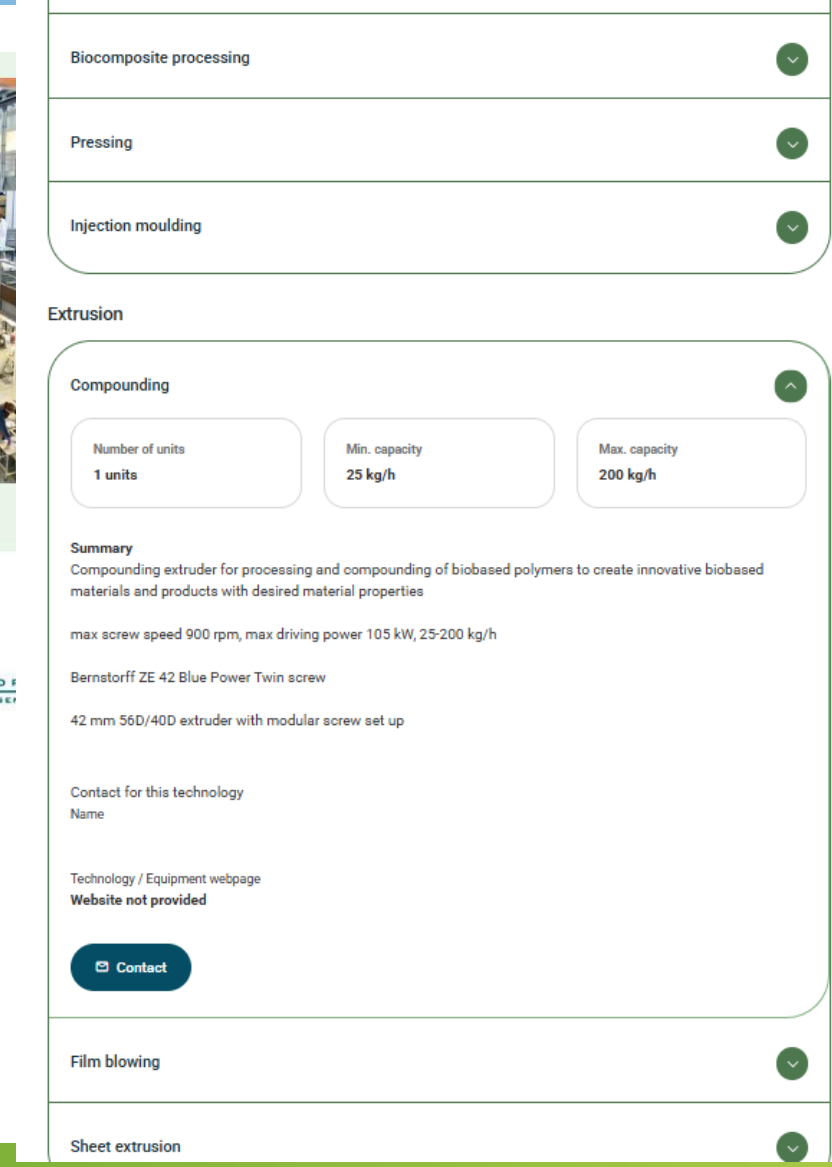
https://database.biobasedcircular.com



Database impression







Op de kaart

Heerenveen:
- Nationaal Testcentrum Circulaire Plastics

Lelystad:
- Acrres

Utrecht:
- Universiteit Utrecht

Delft:
- TU Delft
- TNO Green Chemistry Campus

Breda:
- Avans / MNEXT (Biopolymer Application Center)

Gent:
- Bio Based Europe Pilot Plant
- Centexbel



Groningen:
- Hanze Hogeschool
- Zernike Advanced Processing

Emmen:
- Senbis
- GETEC
- NHL Stenden

Enschede:
- Saxion Hogeschool
- Sulis Polymers
- CPL Triple Benefit
- Demcon QL Polymers

Arnhem:
- HAN: SPC
- Krimppp
- Bioplasticshop (Zevenaar)

Wageningen:
- Wageningen Food and Biobased Research

Nijmegen:
- HAN: Bio Centre

Geleen:
- Brightlands Chemelot Campus
- Brightlands Circular Space
- CHILL
- TNO: Brightlands Material Center
- AMIBM (Universiteit Maastricht)

https://database.biobasedcircular.com

Contact:
Tijs Lammens
T.Lammens@biobasedcircular.com

Testregeling:

Database:

Who?



NTCP is leading research center for recycling in Europe



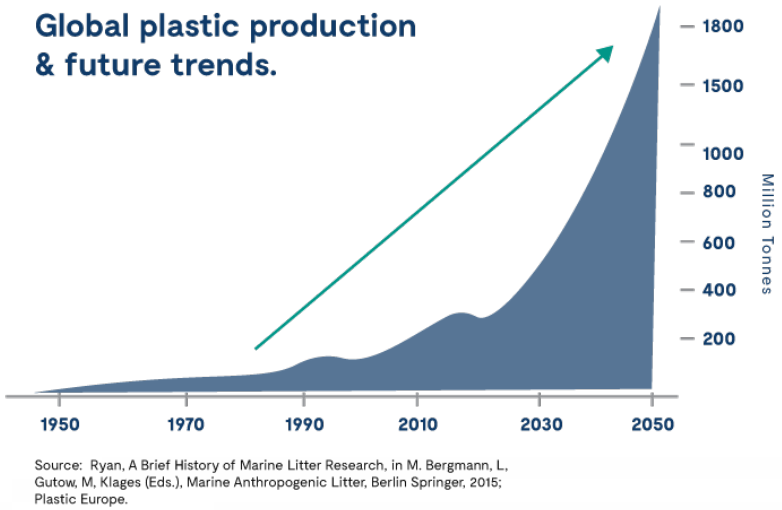
NTCP is not-for-profit



NTCP is independent – open to all players in the recycling chain

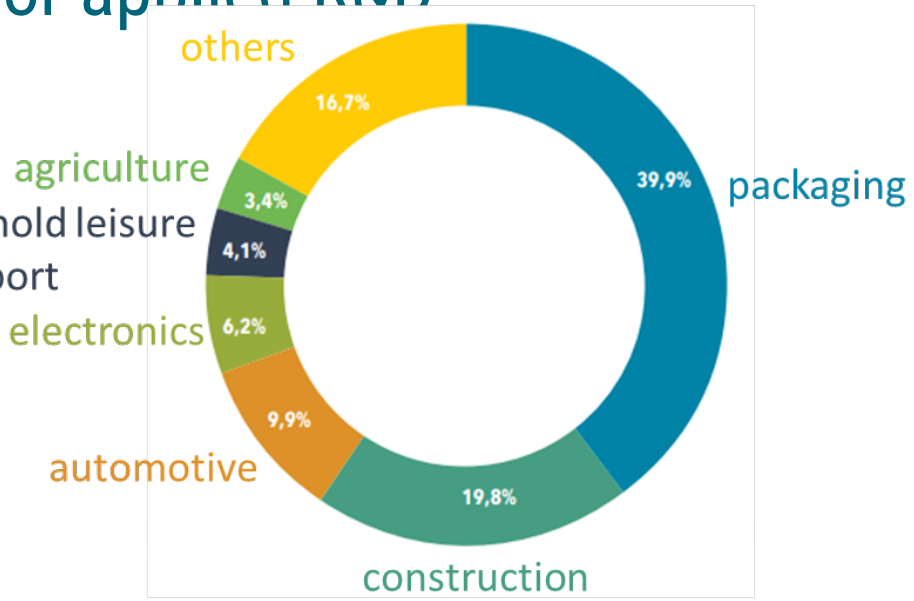
applications

NTCP: Industrial scale R&D facilities for applied R&D



Source: Ryan, A Brief History of Marine Litter Research, in M. Bergmann, L. Gutow, M. Klages (Eds.), Marine Anthropogenic Litter, Berlin Springer, 2015; Plastic Europe.





accelerating plastic circularity

NTCP

The leading, independent research center for recycling in Europe

- Unique combination of relevant (industrial) scale R&D facilities and knowledge position
- **The business model is driven by delivering world class knowledge and solutions based on experimental research at industrial scale**
- Open to all stakeholders in the circular plastic chain
- Collaboration and partnerships with relevant European knowledge institutes and universities

NTCP's timeline

Feasibility & business case
Aug 2018 – Dec 2018

Founding of NTCP
Oct 2018

Signing of contracts funding secured
Jan 2019



Start building of the facility
Sep 2019

Start building sorting line
Jan 2020

Commissioning & testing sorting line
Mar 2020

Fully operational sorting line
May 2020

First sorting trials
May 2020



Funding for washing line
Jul 2021

Tender phase washing line
Sep 2021

Start building washing line
Jul 2022

Fully operational washing line
Nov 2022



Third phase development GROEIFONDS
Mar 2024

Extension of Sorting and washing capabilities
~12 Meur CAPEX investment
Mar 2024 – Mar 26

Extension of Building
Jan 2025 – Oct 25



New building Oct 25
Extended facilities Apr 26

accelerating plastic circularity

What: research and development from waste collection to recycling



Methods & standards development



Technology evaluation



Process development & optimisation



Packaging assessment



Waste stream characterisation



R&D & demonstrator development

Contract Research | Testing | Research programmes

accelerating plastic circularity

NTCP Development themes



Advanced sorting and separation



Reprocessing towards Mechanical Recycling



Pre-treatment for chemical recycling technologies



Quality control across the value chain (From waste to recyclate)



Monitoring and Control of micro plastics, losses & emissions

"License to operate in recycling"
AI and advanced Data analysis

accelerating plastic circularity

Track record

- R&D project organization with an **unique proposition** and **leading in Europe** on Characterisation, Sorting and Washing



~50 projects per year (tests, contract research)



>70% of project portfolio is international



several multiple year research programmes running to further develop unique knowledge position



Team of ~30 experts



15 Meur investment in R&D facilities

Experimental Capabilities



4900 m² state-of-the art R&D facilities

Waste stream characterisation

Data-driven

Unique capabilities (knowledge + facilities)

Spare capacity in facility, utilities and offices to host your technology development

NTCP accelerating plastic circularity

State-of-the art modular sorting facility

- Multiple stream analyzers (NIR and RGB)
- Automated characterization of waste streams
- Integrated NTCP-owned data platform
- Sampling points and sensoring (connected to NTCP data platform)
- 3 types of optical sorters including AI
- Representative sample size in sorting line
- Automated mass balance assessment
- Film sorting on smaller grain sizes
- Connected to pre-treatment chemical recycling and washing installations
- Shredder and dry-wash testbed connected for pre-treatment chemical recycling routes



accelerating plastic circularity



State-of-the art modular washing facility

- Suitable for all polymer types, fully modular to build different processes
- Includes experimental setups for pre-wettening & density separation
- Hotwash testbed to isolate, investigate and optimize critical parameters in hotwashing
- Stream analyzer for flakes, connected to NTCP Data platform
- Sampling points and sensoring included, connected to NTCP data platform
- Flake sorting tower for 2T material (eddy current, color, two-sided sorting color and NIR)
- Different dryer technologies
- Integrated waterloops
- Complete mechanical and chemical water treatment facilities for research on residue streams, process emissions and losses

Output for quality control

- Erema single-screw extruder for film and rigids
- Degassing and melt filtration incl. contaminant assessment
- Under-water pelletizer

- Small scale pyrolysis unit
  - Yield and contaminant assessments
- Solid-liquid-gas sampling in pyrolysis
- Lab-scale shredder &pelletizer for plastics and biomass





Monitoring & Control

NTCP Data landscape



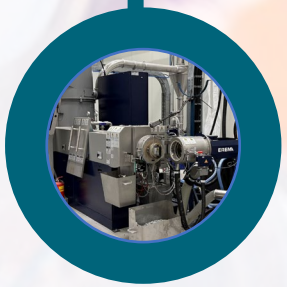
Sorting



Washing



Water Treatment



QC (Extrusion)



QC Pyrolyse

- All relevant data generating aggregates are implemented in the NTCP Data landscape;
- Optical sorters, stream analyzers in sorting and washing, equipment process parameters etc.







Lab facilities (will be further extended)

- FTIR, NIR
- Conductivity, pH
- COD and BOD measurements and analysis
- Flake analyser
- Lab hotwash reactors
- Flake size distribution
- Contaminant characterization

Application driven recycling

Challenge:

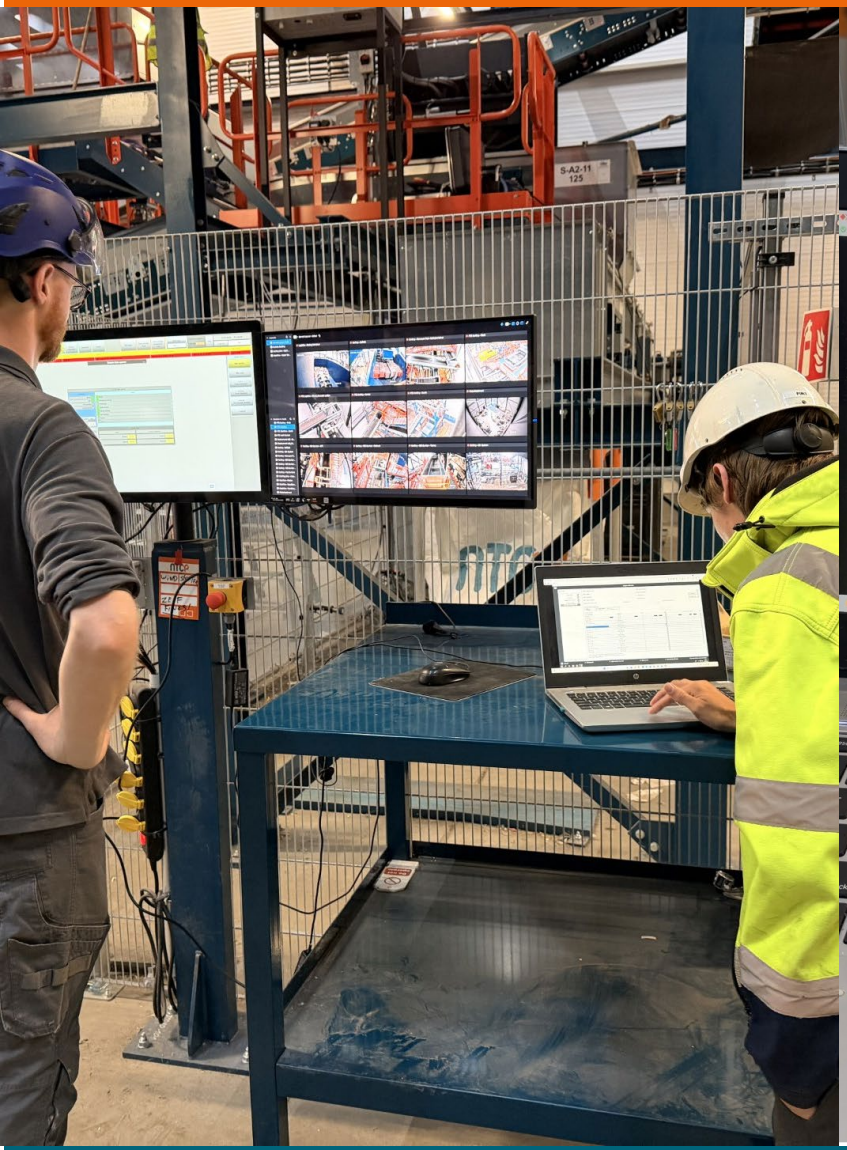
Waste compositions are constantly changing due to the introduction of “new” packaging of alternative polymers (intro of biobased), new art work, seasonality factors, and others. Meanwhile, the demand for PCR (both in terms of quantity and ‘fit-for-purpose’ quality) is increasing, driven by upcoming legislation, technological advancements, and economic shifts.

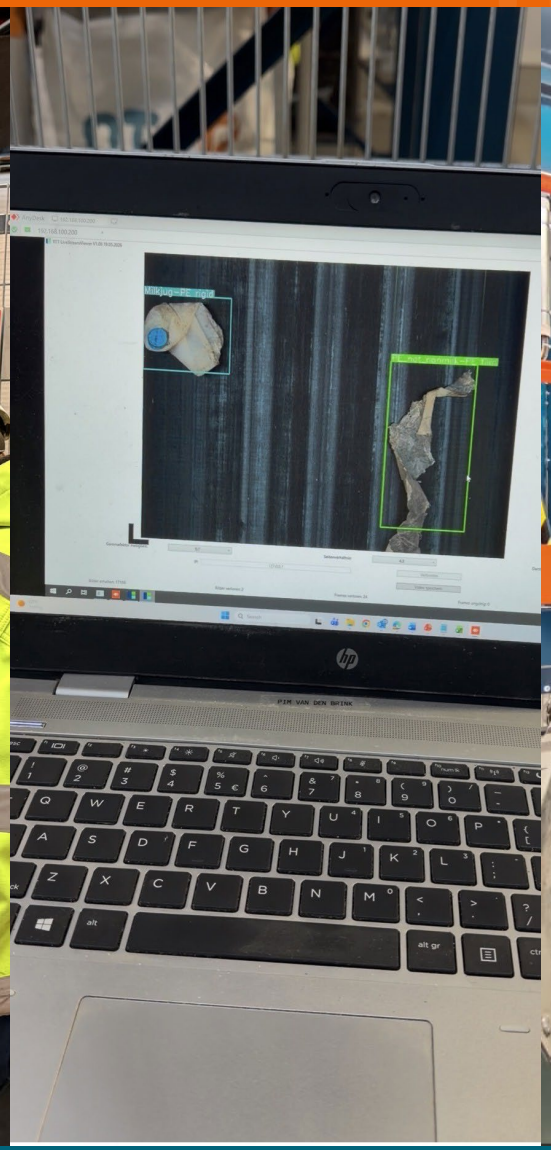
‘Fit-for-purpose’ PCR implies that different levels of end-product quality are acceptable depending on the final application- ranging from food contact sensitive packaging to outdoor applications like park benches.

Solution:

A clear need for flexible, modular process setups that incorporate easily adjustable classification systems for monitoring and control. This enables operations to adapt and respond effectively to specific end-application requirements.

Application driven recycling process in action









accelerating plastic circularity

Application driven recycling process in action



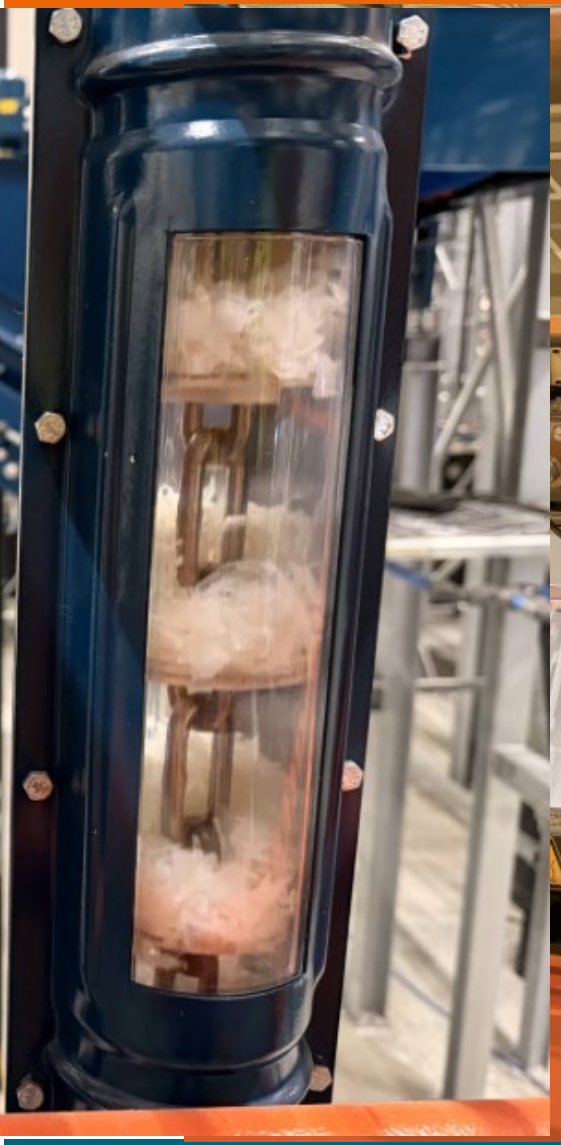






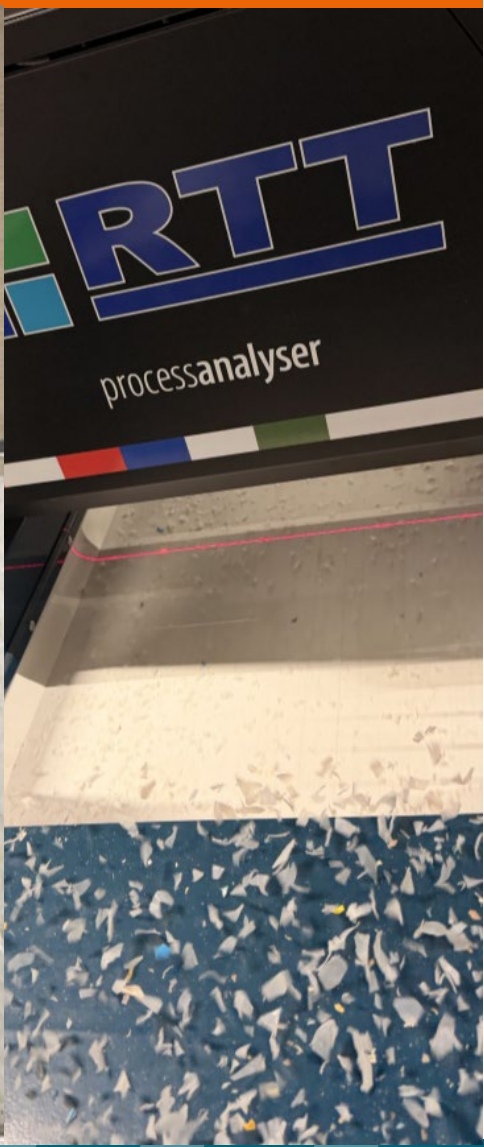
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Application driven recycling process in action










ANTICPATE
NTCP
accelerating plastic circularity

Biobased Products Innovation Plant



29-10-2026

Edwin Keijsers

Wageningen Food & Biobased Research

WAGENINGEN
UNIVERSITY & RESEARCH

Wageningen University & Research

at a glance



2,500 PhD and EngD candidates



1 faculty



7,800 employees (6,900 FTE)



8 research institutes

Around 23 locations across the Netherlands & worldwide





12,000 students



1,000+ participants in lifelong learning

Wageningen Campus: an innovation hotspot

Wageningen ecosystem

240

research institutes, R&D
of (international) companies,
NGO's, start-ups and SME's

societal
dialogue

open
innovation

shared
facilities





Wageningen Food & Biobased Research

World class facilities and laboratories



FACILITY

FreshTech Facility - Sensing, storage & robotics

We combine advanced sensing technologies, smarter storage & transport, packaging and robotics in order...

FOOD & BIOBASED

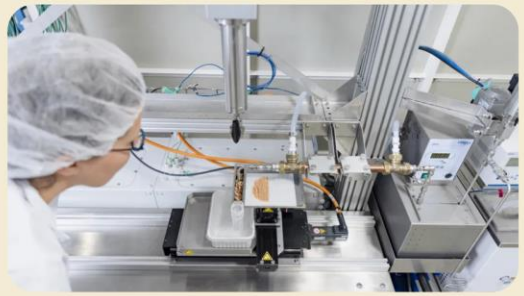


FACILITY

Biobased Products Innovation Plant

We design processes to convert green raw materials into biobased products, shaping the transition from...

FOOD & BIOBASED



FACILITY

Cibia FoodTech Facility - advanced Food-Tech Research Center

Cibia (completed in 2026) is a leading facility for innovative research into food processing, product devel-...

FOOD & BIOBASED



FACILITY

Health Research Unit – Clinical research on nutrition

We offer unique opportunities for clinical trials of various foods and supplements. This allows for thor-...

FOOD & BIOBASED

Biobased Products Innovation Plant (BPIP)

Expansion and upgrade

- Infrastructure/Facilities: Growfund BBC (ORIBI)
- Building/Plant upgrade

Scope:

- Biorefinery Tech Facility
- Conversion Tech Facility
- Biobased Plastics Tech Facility

- Labscale research and analytics



Open-access Research Infrastructure for Biobased Innovations (ORIBI)

An integrated research infrastructure connecting key technologies across the full value circle, from biomass feedstock to applications and end-of-life scenarios:

1. Storageability and quality of biomass
2. Pretreatment and fractionation of biomass
3. Conversion technology for bio-based building blocks (monomers) production
4. Polymer synthesis
5. Plastics processing
6. Recycling / end-of-life scenarios
7. Analytical capabilities



BBC: From biomass to polyesters

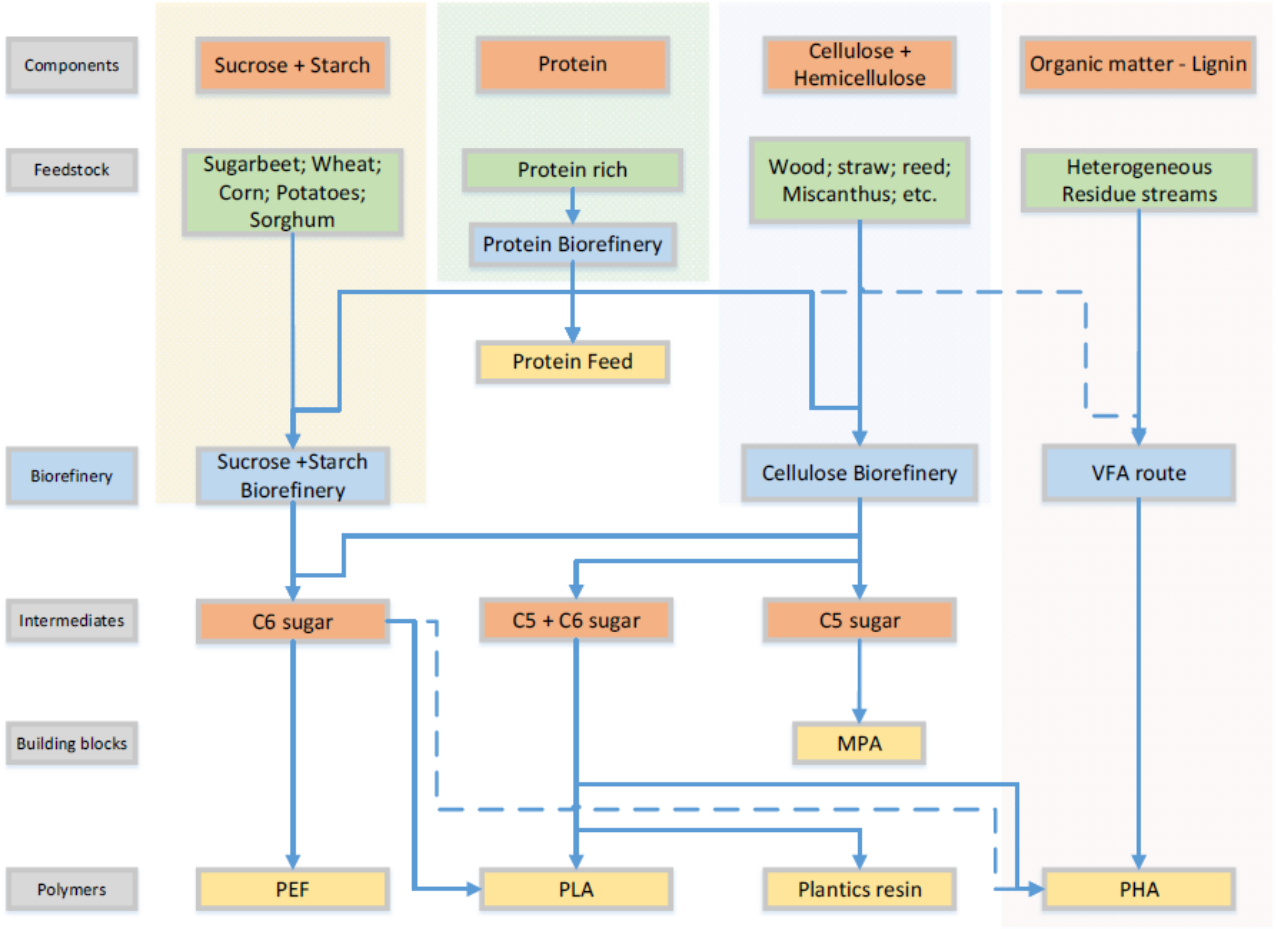


Figure 11 Schematic overview of routes to convert different biomass feedstock into biobased polymers and building blocks

BBC study: Kampen, 2026

BBC scope and BPIP activities

Biomass sourcing
Quality assessment
Storage and logistics
Pretreatment
Biorefinery and DSP

Fermentation
Electrochemistry
Organic chemistry

Polymer synthesis
(reversible) thermosets

Compounding
Polymer additives

Product development
Plastic testing
Plastic processing

Recyclability
Biodegradability

1 2 3 4 5 6

Sustainability analysis

Standardisation

Analysis (chemical, physical,.....)

7

Regulation

Phenomea

Biorefinery Tech Facility

Conversion Tech Facility

Biobased Plastics Tech Facility









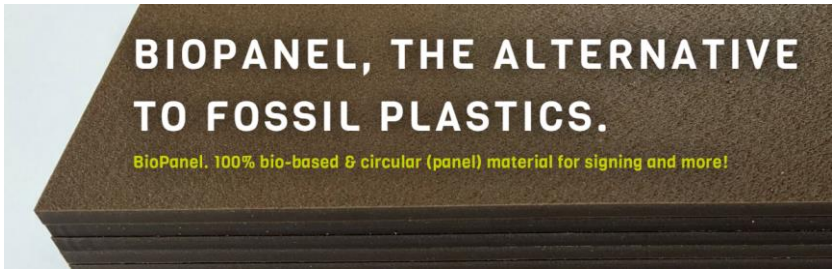

Customer Experiences

Building on over 15 years of successful collaboration with WFBR, **Corbion Biomaterials** looks forward to future cooperation through the open-access Biobased Products Innovation Plant.

Biobased Products Innovation plant allowed **Biopanel** to efficiently test a range of processing technologies, accelerating the selection of the best method for our product development.



BIOPANEL®



Test & validate your innovation

29.10.2026, Zwolle
Transition to Circularity



Brightlands
Circular
Space

Brightlands Circular Space

We are a circular plastic **innovation center**, bringing together players along the value chain for **co-creation,** and offering **semi-industrial R&D facilities for scaling up innovations**.

We focus on circular solutions for plastic packaging, textiles, electronic & electrical components, and automotive plastic parts.

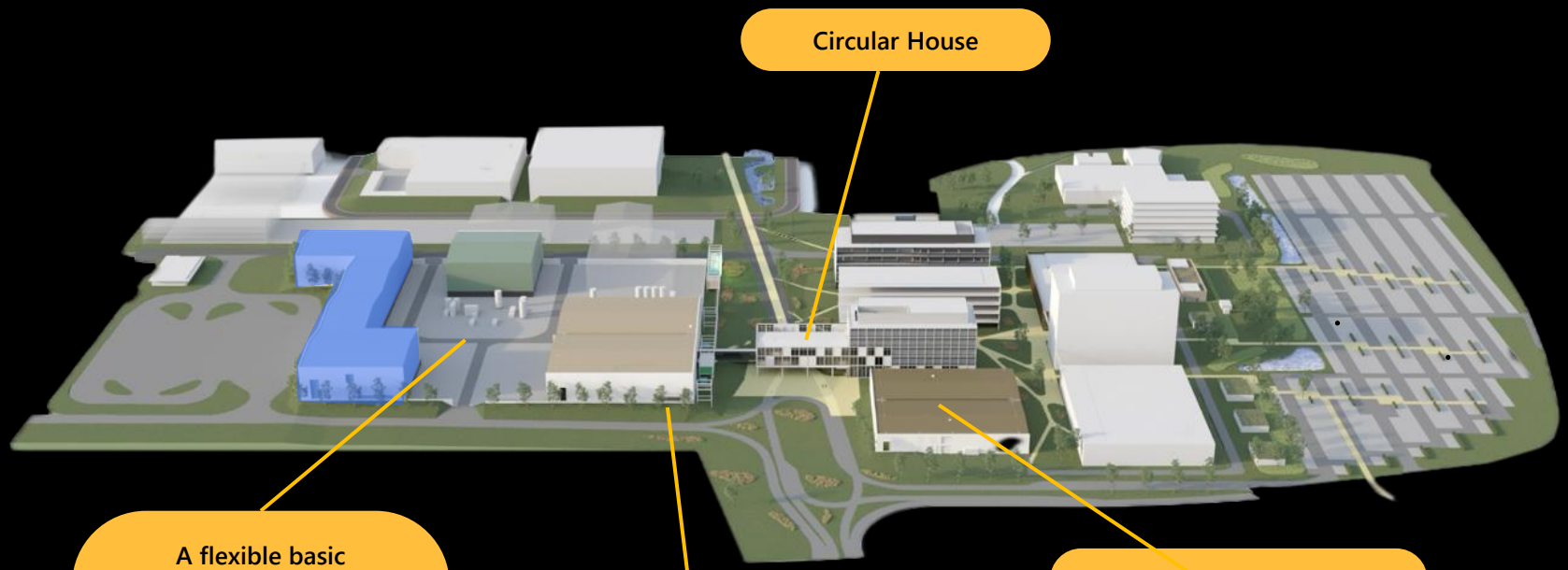
TNO innovation for life

Maastricht University

Brightlands



An ecosystem for developing & testing, all at one location



Officially opened
7 October 2026

Advanced feedstock preparation
5.000 m2: equipment, operators, R&D support

Polymer processing
4.000 m2: equipment, operators, R&D support

Plots for pilots & demos
25.000 m2 with plot infra

Circular House
7.000 m2: material characterisation, experience center, co-creation and event spaces, labs, offices

Brightlands Circular Space Facilities

Processing of plastic

- Agglomeration
- Extrusion
- Compounding
- Injection molding
- 3D printing
- Film blowing
- Sheet extrusion
- MDO and bi-axial stretching of film and sheet

.



Kahl 33-390 pellet press

Compacting of low-density plastic materials

Capacity: appr. 100 kg/hr
Input density: 20-50 kg/m3
Big-bag operation
Belt feeder

Preparation of low-density plastic materials for extrusion or chemical recycling.





Pellets from foil residues
Source: www.akahl.com



KraussMaffei recycling & compounding line

In-line melt filtration, devolatilization, reactive extrusion, twin-screw compounding

General:

- Recyclate: LLDPE, LDPE, HDPE, PP, PET
- Throughput: up to 100kg/hr (average 30-50 kg/hr)
- Max temperature: 350°C

Extruder 1: Cleaning the melt phase

- Feeding of polymer granules, pellets, flakes with metal separator
- Continuous melt filter
- Vacuum vents and liquid injection point (stripping agent)
- Equipped with adapters for additional injection points or in-line sensors

Extruder 2: Compounding

- Feeders for polymer granules & flakes with metal separator, for powder and for liquid dosing for reactive extrusion, stripping agent or liquid additives
- 3x atmospheric vents + 1x vacuum vent
- Equipped with adapters for additional injection points or in-line sensors

Strand pelletizer (movable for both extruders)

Extruders can be connected with a melt pipe or operated separately.



COLLIN 7-layer cast/blown film & sheet line

General:
- Materials: polyolefins, polyesters, polyamides, tie-layers, polymer barrier materials
- Throughput: up to 100-150kg/hr (avg.30-50 kg/hr)

Extruder section:
- 7x extruders ø30mm x 30D
- Cloeren feedblock for automatic layer control – for cast film/sheet
- Max temperature: 350°C

Blown-film section:
- Roll width: 800mm (max. lay-flat width: appr. 750mm)
- Die diameter: 80-200mm
- Max. blow-up ratio (BUR): 2.5-3.0
- Cooled-air blower
- Web-speed: 1-50m/min

Cast film/sheet section:
- Extrusion gap: 0.2-2.0mm
- Roll width: 800mm
- Take-off speed: 1-100m/min

Edge trimming:
- Bubble slitting
- 1 or 2 sided trimming

MDO-section (blown and cast):
- Single gap
- Corona treatment (1-side)
- In- & off-line operation

Winder-section:
- Speed: 1-100 m/min
- In-line film/sheet inspection system for determining gels and agglomerates



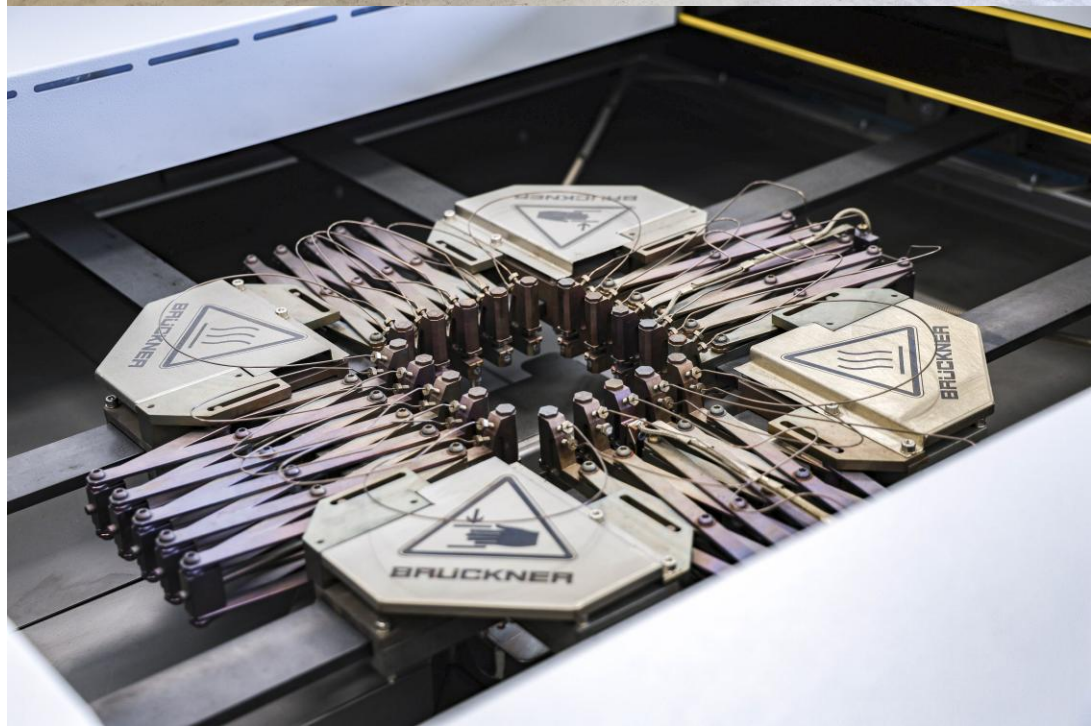
Karo 5.0 bi-axial stretching
Brückner 3-oven system

Purpose:
- Development of new functional barrier films
- Evaluation of different polymers to produce oriented films

Unique features:
- High-temperature package (400°C), fit for high-temperature engineering polymers for high-tech functional polymer membranes
- 3-oven system allowing staged stretching in one test

Examples:
- Development of packaging substrates for new nano-layer barrier materials
- Non-packaging: Development of PTFE-free membranes





Enabling circular material routes with credible analytical data



Recycled materials introduce challenges that virgin grades rarely present:

- batch-to-batch variation
- unknown contaminant loads
- additive depletion and degradation history that affects downstream processability

Wonder Analytics helps with analytical know-how, material expertise and evidence-driven workflows — characterising materials at every stage of the recycling chain, not just after the fact.

Choose how to work with us

- As a customer
  - R&D and scale-up facilities
  - Material characterization services
  - Support in building a consortium
  - Event and workshop facilities
- As a consortium partner
  - Technical expertise & validation
  - Partner scouting
  - Access to facilities
  - Stakeholder engagement & impact
- Become part of our community
  - Attend our events
  - Visit the Experience Center
  - Book our event & workshop facilities
  - Stay informed through our newsletters





Invitation

You’re welcome to ask your circular question, upscale and apply your research or join us in one of our collaborative projects!



What our customers say about us

- Purtiso: R&D infrastructure is unique in Europe and allows us, as a small company, to compete.
- Itero: Research, start-ups, and industry are collaborating on advancing necessary solutions for full circularity, making Brightlands ideal for advancing our technology within a circular ecosystem.
- Alkyl Recycling: Brightlands is crucial because it provides the expertise, facilities, ecosystem connections, and scale-up support needed to accelerate the commercialisation of our energy-efficient diaper recycling technology.
- RWM: Brightlands Circular Space is an important partner for us for knowledge sharing, eg on waste streams that we (intend to) collect such as plastic packaging waste and diapers.

Let’s find solutions together!

Lucie Wenmakers

Lucie.wenmakers@brightlands.com



Brightlands
Circular
Space