Circularity and end of life options.

Biobased & biodegradable products

Steven Verstichel

Topics

- Normec OWS
- Circularity - Recycling - Compostability
- Biodegradation: EOL
- CHAMPION results

Normec OWS

Normec OWS

normecows.com

Company profile

Founded in 1988 , 35 years of experience

Laboratory for biodegradability, compostability & ecotoxicity testing

Recognised by certification institutes world-wide

Other activities: LCSA, waste inspections, analytical lab

Export: 70%

105 employees

Head office: Gent, Belgium (https://normecows.com)

Affiliates: OWS Inc., Dayton, Ohio, USA

Partner: DJK International, Tokyo, Japan

CIRCULARITY

RECYCLING

COMPOSTABILITY

Circularity

- Current: linear economy
  (small part recycling)

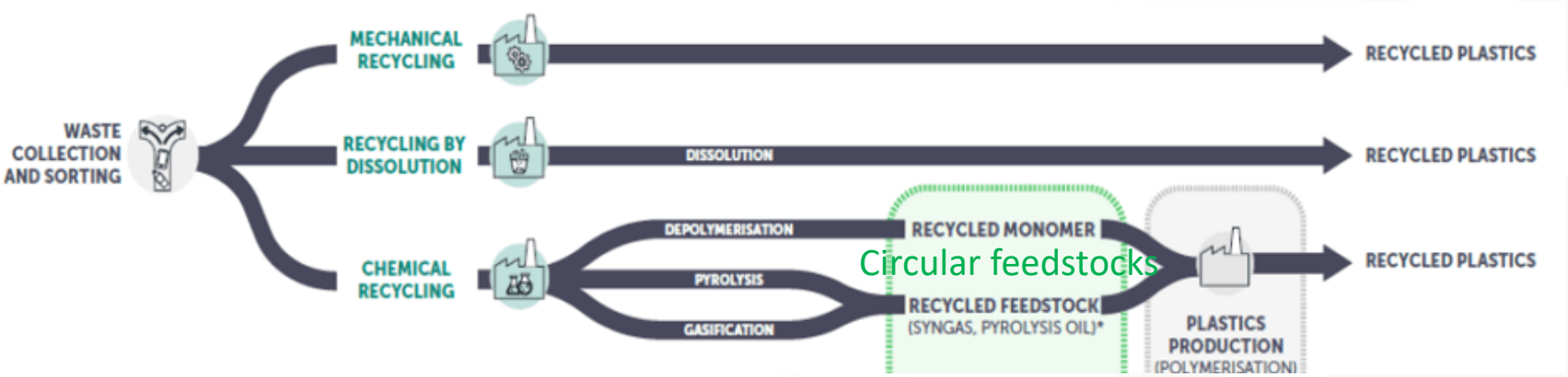
- Circular economy: model based inter alia on sharing, leasing, reuse, repair, refurbishment and recycling, in an (almost) closed loop, which aims to retain the highest utility (def. EU parliament)

- Less use natural resources
- Reduce landscape disruption
- Limit biodiversity loss
- Reduction greenhouse gases
- Reduce energy consumption
- Reduce waste
- Create jobs
- Save consumer money
- …

EU Parlement Research Service

Reality: we are a long way from

- **Europe = 10.1% of plastics is recycled** ***(Plastics Europe – The facts 2022)***
- **Only 14% of all plastic is recycled, whereas only 2% is optimally recycled; the remaining 12% is downcycled** ***(Williams, A.T.; The Past, Present, and Future of Plastic Pollution. Mar. Pollut. Bull. 2022, 176, 113429)***
- **Main recycling options:**



- **Plastic leakage: 2016 around 30% of all products leak into the open environment (Ellen McArthur foundation)**

Biodegradable and compostable products

Same recycling options (volumes)	Additional organic recycling (composting, AD)	Collection with organic municipal waste fraction	Composting facilities existing (variation; mature compost)

Biobased = 100% CIRCULAR	When biodegradable at mild conditions: less environmental impact when littering

EU PPWR

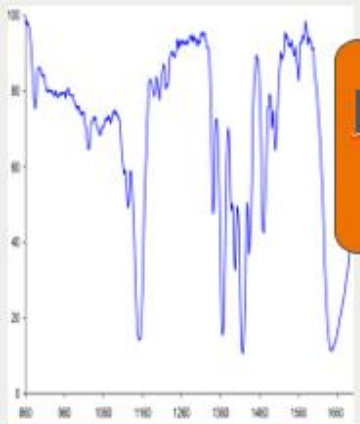
- Acknowledge compostability: 2 main benefits
  - * higher biowaste capture
  - * lower contamination of compost by non-biodegradable plastics.
- Specific applications:
  - * fruit &vegetable stickers; tea bags (filter coffee pods; very light plastic, carrier bags)

More opportunities

- Food contact products: increase organic waste to composting (sauce sachets,…)
- Laminates (barriers), blend of plastics,….: hard to recycle

Compostable materials

Requirements: EN 13432 (harmonized standard)



Environmental safety

- **Chemical characteristics**
- **Ecotoxicity** (plants, worms)

Degradation

- **Biodegradation** (chemical level)
- **Disintegration** (physical level)

OK compost TÜV AUSTRIA INDUSTRIAL

industrially compostable

INDUSTRIAL COMPOSTABLE DIN Geprüft

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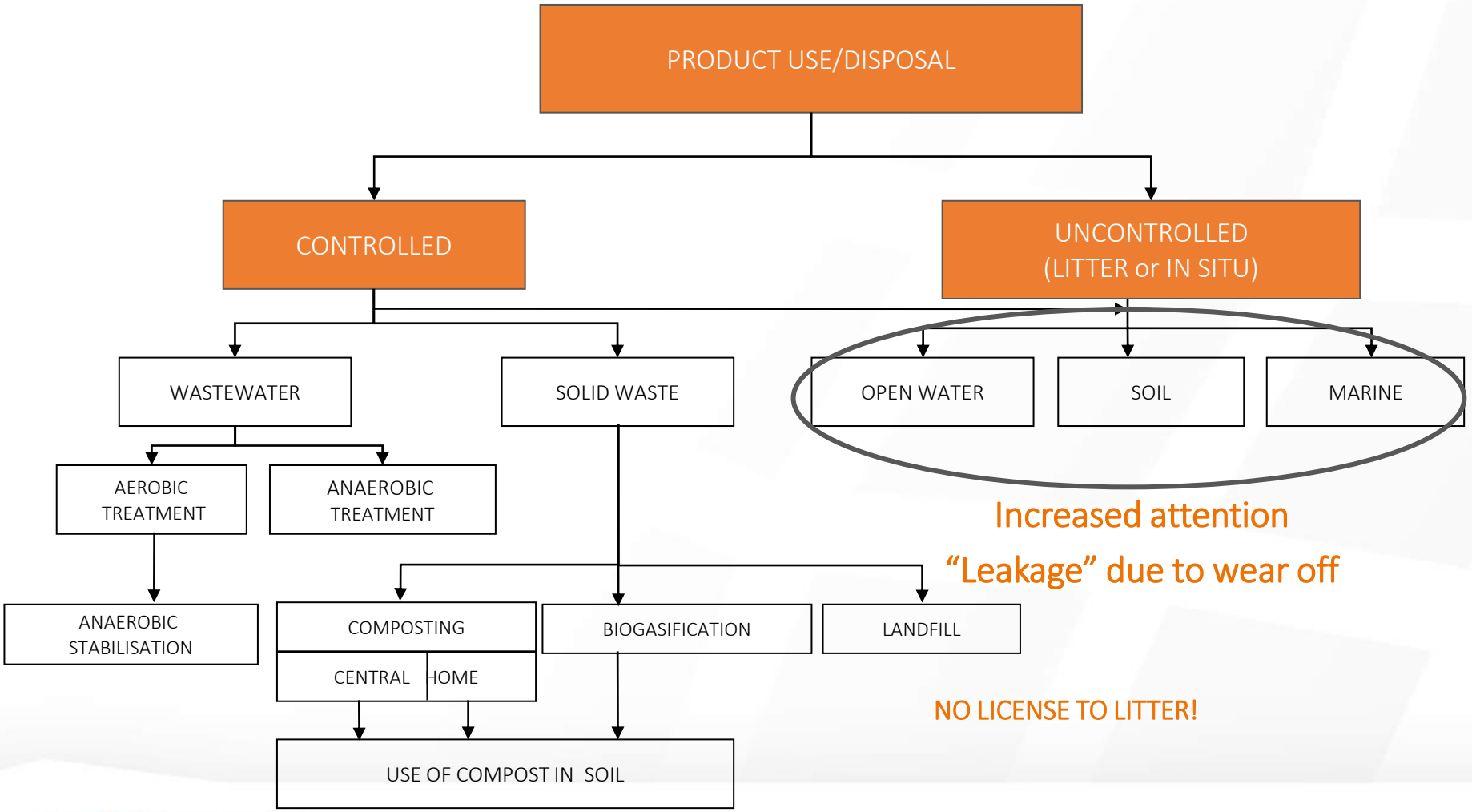
Biodegradation

Biodegradation: Environmental niches



Biodegradation

$C_{polymer} + O_2 \Rightarrow CO_2 + H_2O + C_{residual} + C_{biomass}$

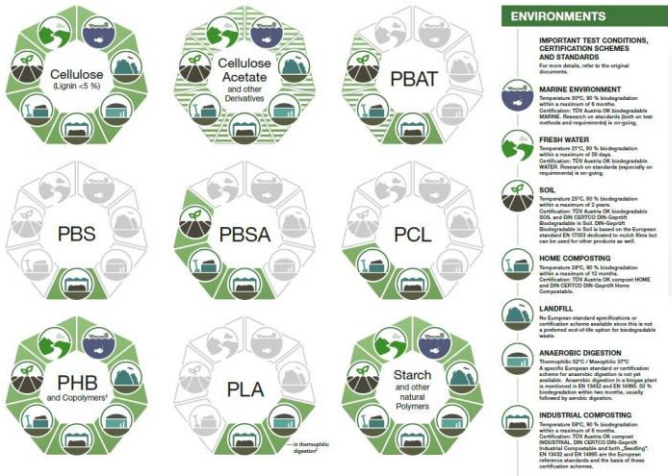
Intermediate degradation products

Biomass growth

Biodegradation varies from one environment to the other

	Industrial compost	Home compost	Soil	Fresh water	Marine water	Anaerobic digestion
Standard	ISO 14855	ISO 14855	ISO 17556	ISO 14851	ISO 23977	ASTM D5511
Temperature	High (60–70°C)	Low (21–30°C)				High/low
Species	Fungi + Bacteria + Actinomycetes			Only bacteria (some filamentous fungi)		Multiple Bacteria

Decreasing aggressivity



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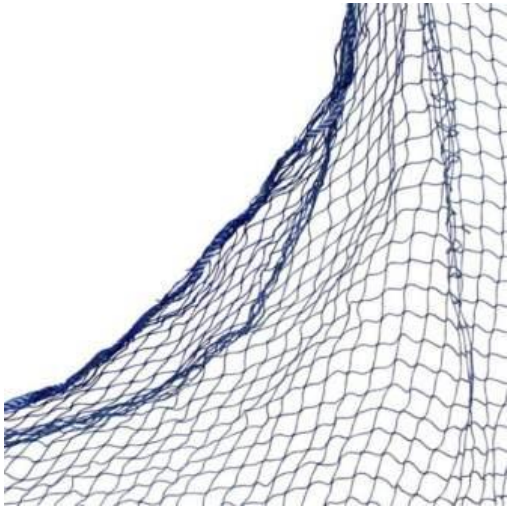
Biodegradation: in situ applications



In situ biodegradation: Soil, freshwater and seawater

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Biodegradation: wear

Non-persistent:
Soil, freshwater
and seawater

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Biodegradation: Recognised in EU policy & legislation

- **PPWR: voted soon (April 2024)**

- **EU Fertilizers products regulation 2019/1009**
  - By July 2024: assess biodegradability criteria
  - 90% of organic carbon converted into CO_2 within 48 months

- **EU restriction intentionally added microplastics (< 5 mm, > 0.01% w/w, ECHA)**
  - Used in glitter products, rinse-off cosmetics (2027), detergents (2028), agricultural use (2028), infill on artificial sport pitches (2031),…

  - TIER approach biodegradation testing (5 Group)
  - Screening biodegradation tests: OECD (Aquatic, short period; hard to reach for bioplastics)
  - ISO biodegradation standards (soil, marine (interface/sediment), freshwater)

CHAMPION

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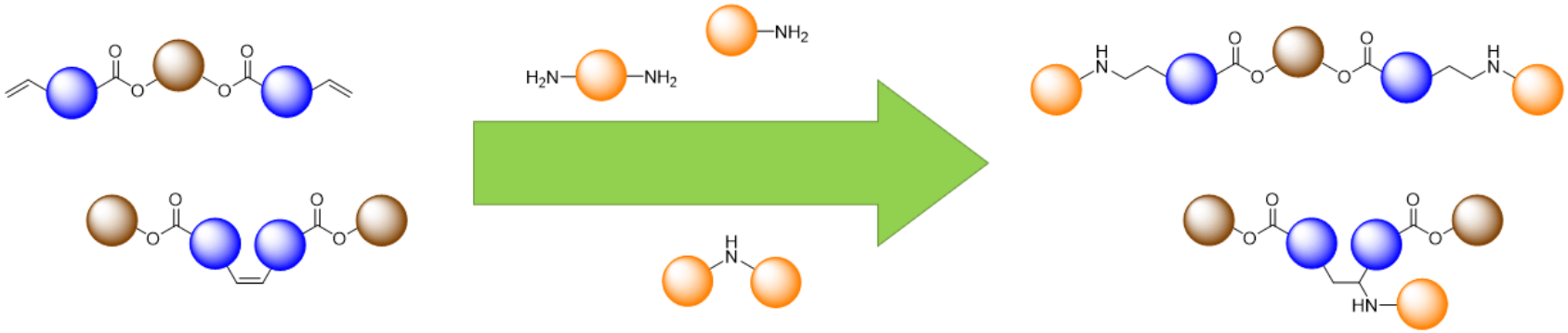
CHAMPION

- Concept: biobased, safe and biodegradable polymers via Aza-Michael Chemistry
  - home care products (laundry detergents)
  - textile coating
  - hard surface coating
  - structural adhesives



Unsaturated polyesters | Amines | Final materials

Champion project has received funding from the BioBased Industries Joint Undertaking under the European Union's Horizon 2020 research and innovation programme under grant agreement No 887398

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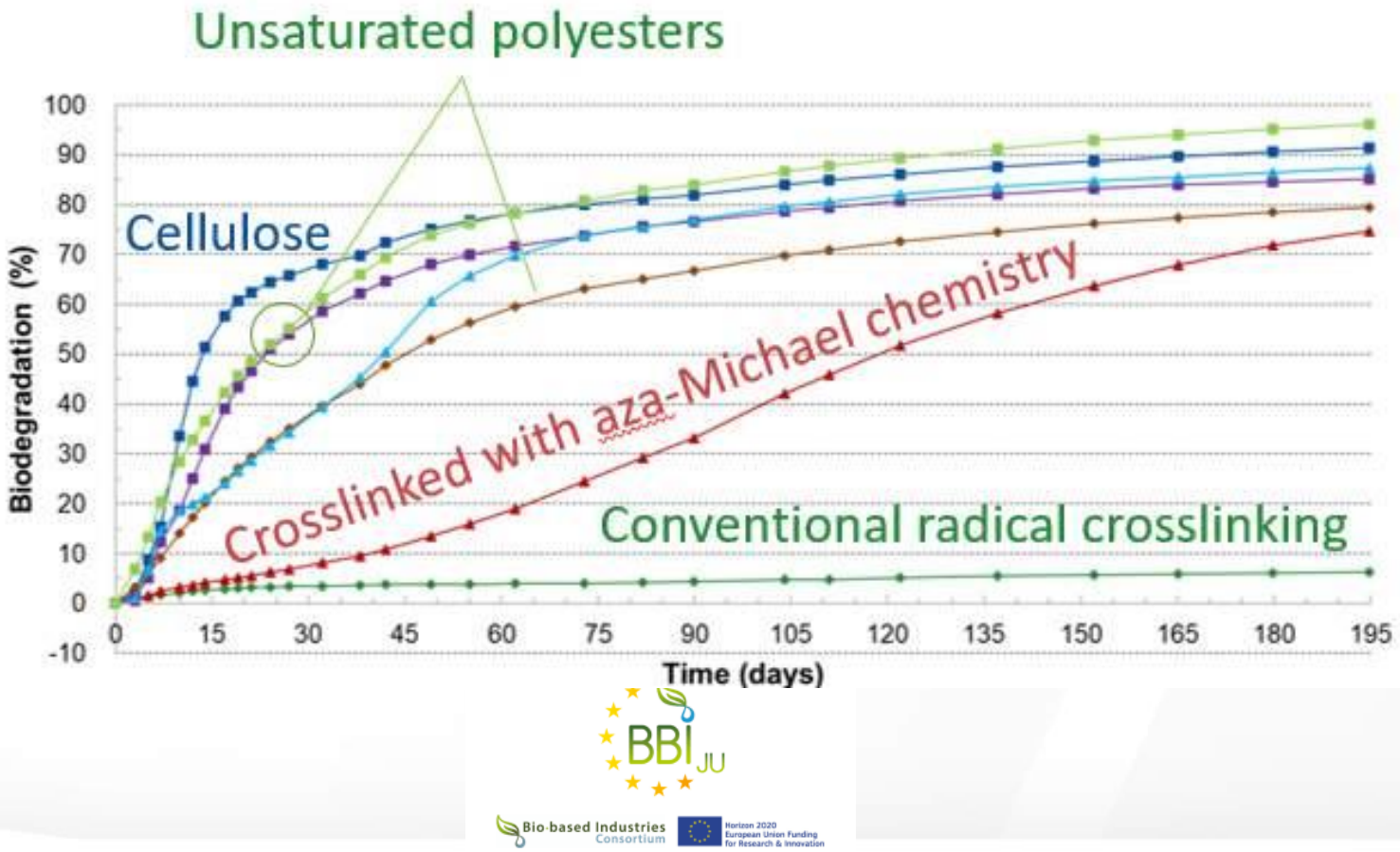
CHAMPION

- Improved biodegradation compared to conventional radical crosslinking: soil



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THANK YOU

FOR YOUR ATTENTION

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