

Circularity and end of life options.

Biobased & biodegradable products

Steven Verstichel

Topics

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

Normec OWS



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)



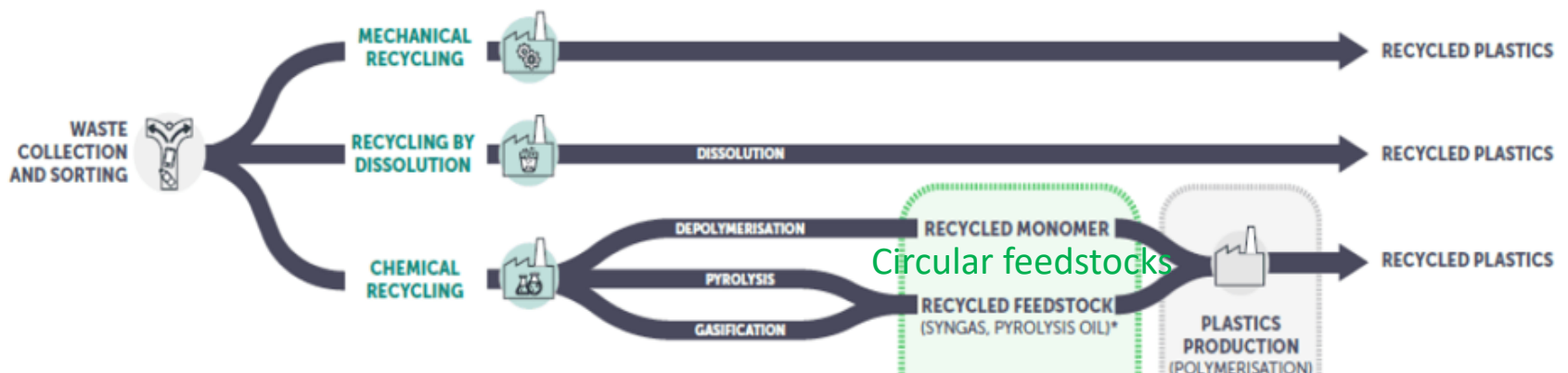
- Circular economy: model based inter alia on sharing, leasing, reuse, repair, refurbishment and recycling, in an (almost) closed loop, which aims to retain the highest utility (def. EU parliament)



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

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)

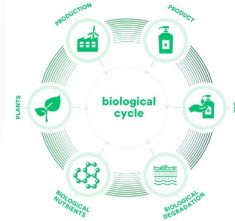
Additional organic recycling (composting, AD)

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)

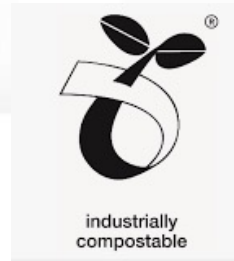
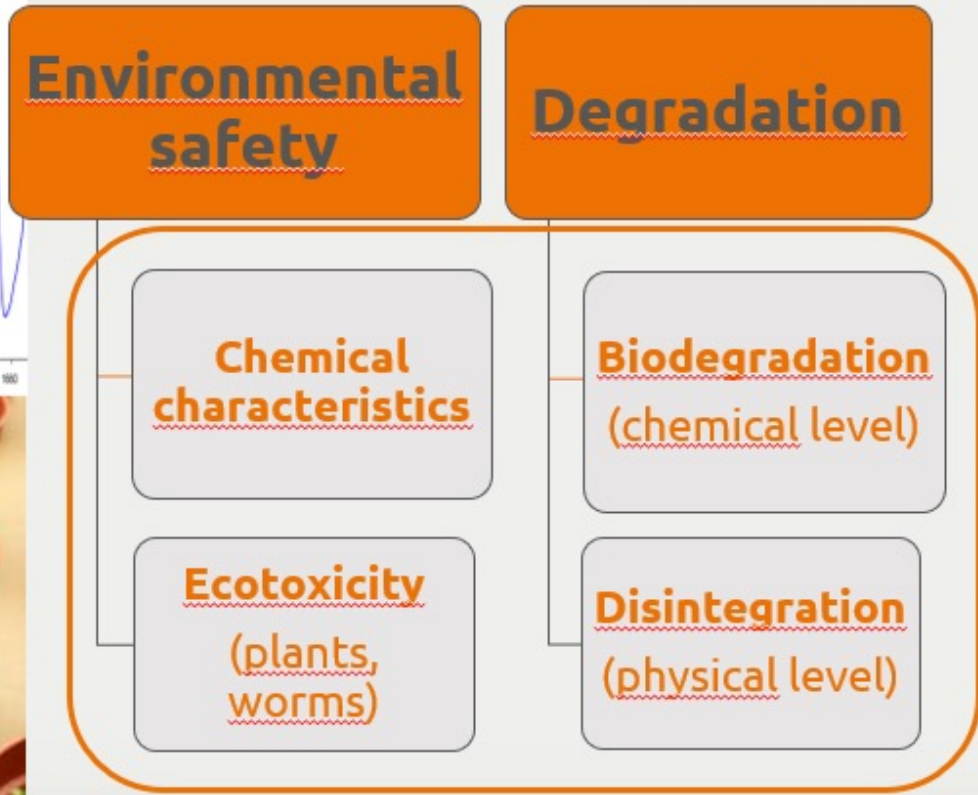
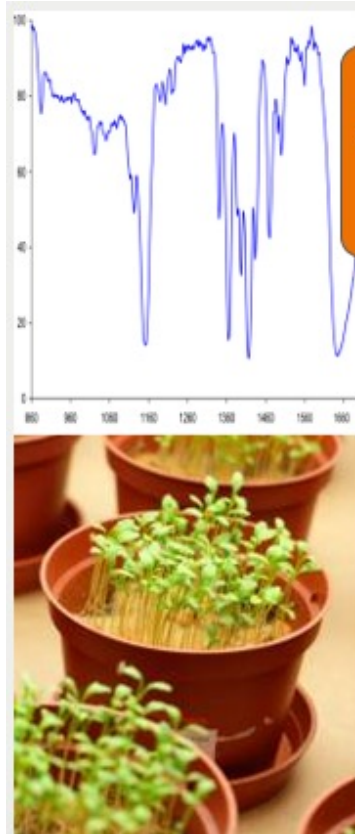


More opportunities

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

Compostable materials

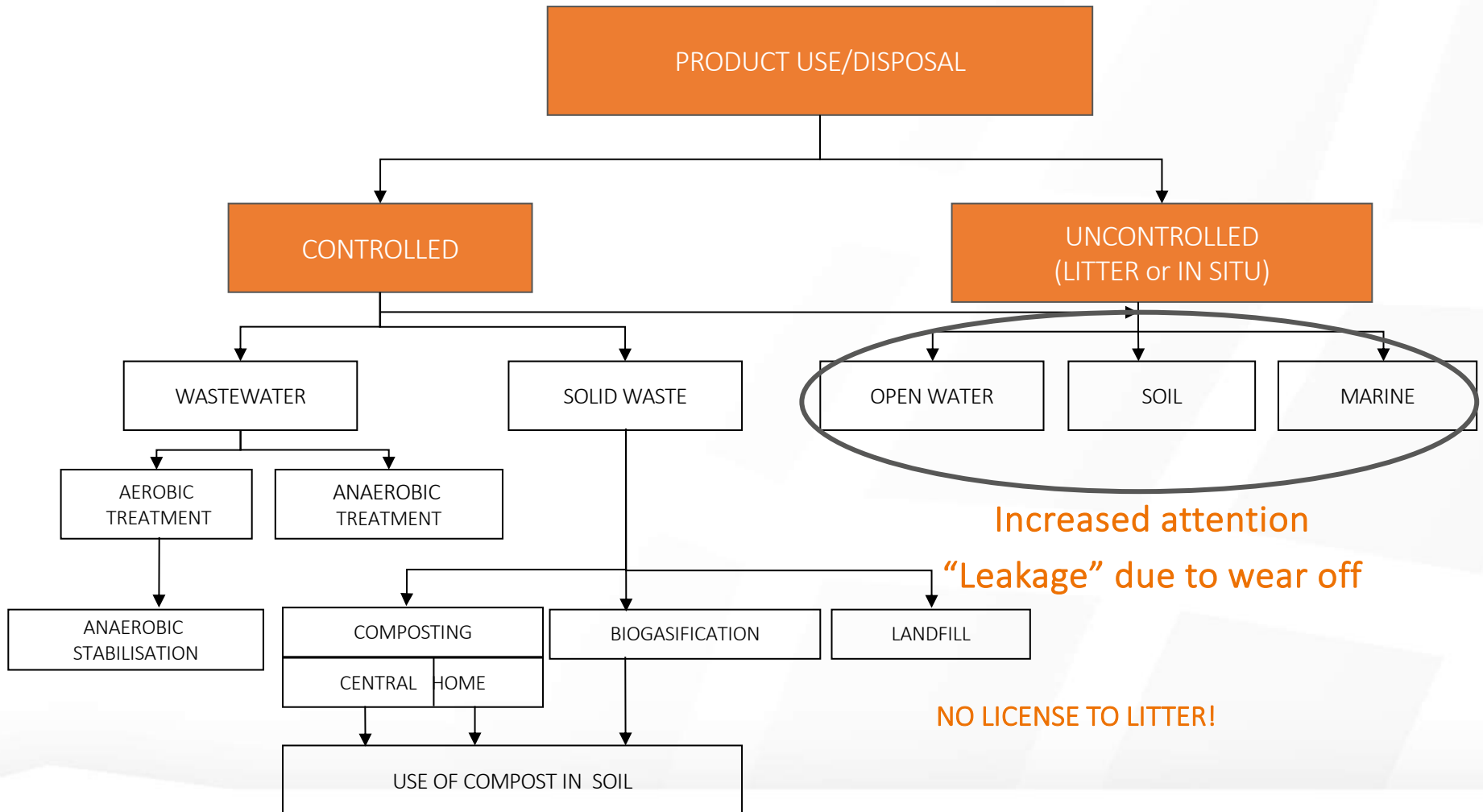
Requirements: EN 13432 (harmonized standard)



Biodegradation



Biodegradation: Environmental niches



Biodegradation



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

ENVIRONMENTS

IMPORTANT TEST CONDITIONS, CERTIFICATION SCHEMES AND STANDARDS:
For more details, refer to the original documents.

MARINE ENVIRONMENT
Temperature 20°C, 5% biodegradation within a maximum of 18 months.
Certification: ISO 14851 OK biodegradable MARINE. Research on microplastic DPM on test material and monitoring in progress.

FRESH WATER
Temperature 20°C, 5% biodegradation within a maximum of 18 days.
Certification: ISO 14851 OK biodegradable WATER. Research on microplastic DPM on test material in progress.

SOIL
Temperature 20°C, 5% biodegradation within a maximum of 18 months.
Certification: ISO 14851 OK biodegradable SOIL and ISO 17556 OK biodegradable SOIL.
Biodegradability in Soil is based on the European Standard EN 13432 and should be used as well as can be used for other products as well.

HOME COMPOSTING
Temperature 20°C, 5% biodegradation within a maximum of 12 months.
Certification: ISO 14855 OK biodegradable HOME and ISO 17556 OK biodegradable HOME Compostable.

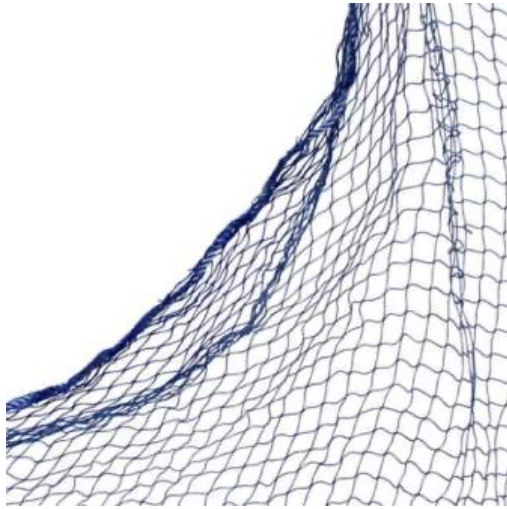
LANDFILL
An European standard specification or certification scheme exists since this is not a preferred end-of-use option for biodegradable waste.

ANAEROBIC DIGESTION
Temperature 35°C, 60 days/10°C.
A specific European standard or certification scheme for anaerobic digestion is not available. Anaerobic digestion is a biological process that is mentioned in EN 13432 and EN 13436. 50% biodegradability refers to the results, usually followed by aerobic digestion.

INDUSTRIAL COMPOSTING
Temperature 50°C, 18% biodegradation within a maximum of 1 month.
Certification: ISO 14855 OK biodegradable INDUSTRIAL, ISO 17556 OK biodegradable INDUSTRIAL Compostable and fully "Seedling".
EN 13432 and EN 13436 are the European reference standards and the base of these certification schemes.



Biodegradation: in situ applications



In situ
biodegradation:
Soil, freshwater
and seawater



Biodegradation: wear



Non-persistent:
Soil, freshwater
and seawater



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 CO₂ 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)

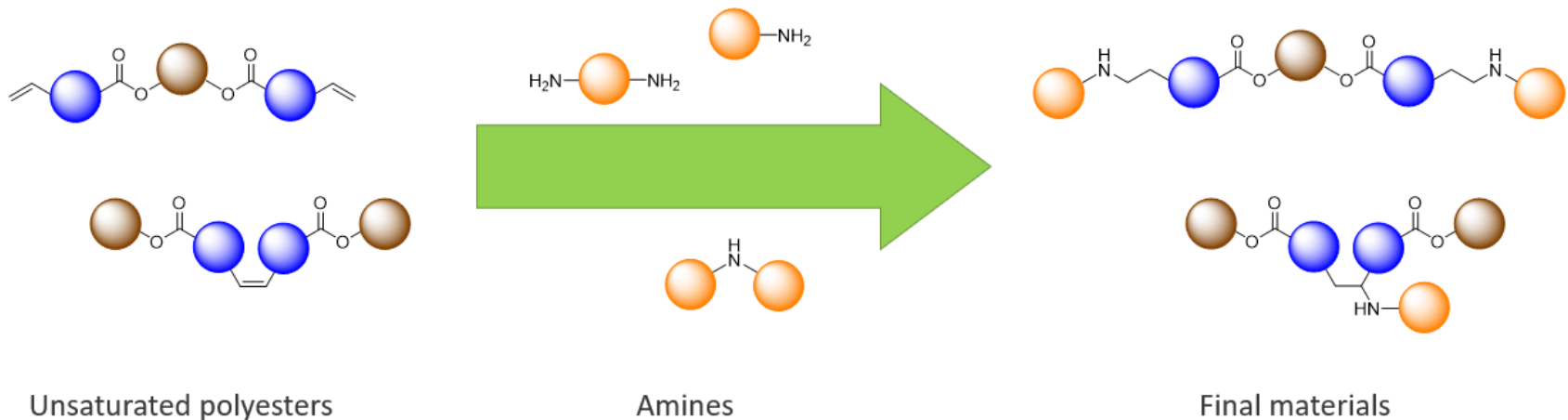


CHAMPION

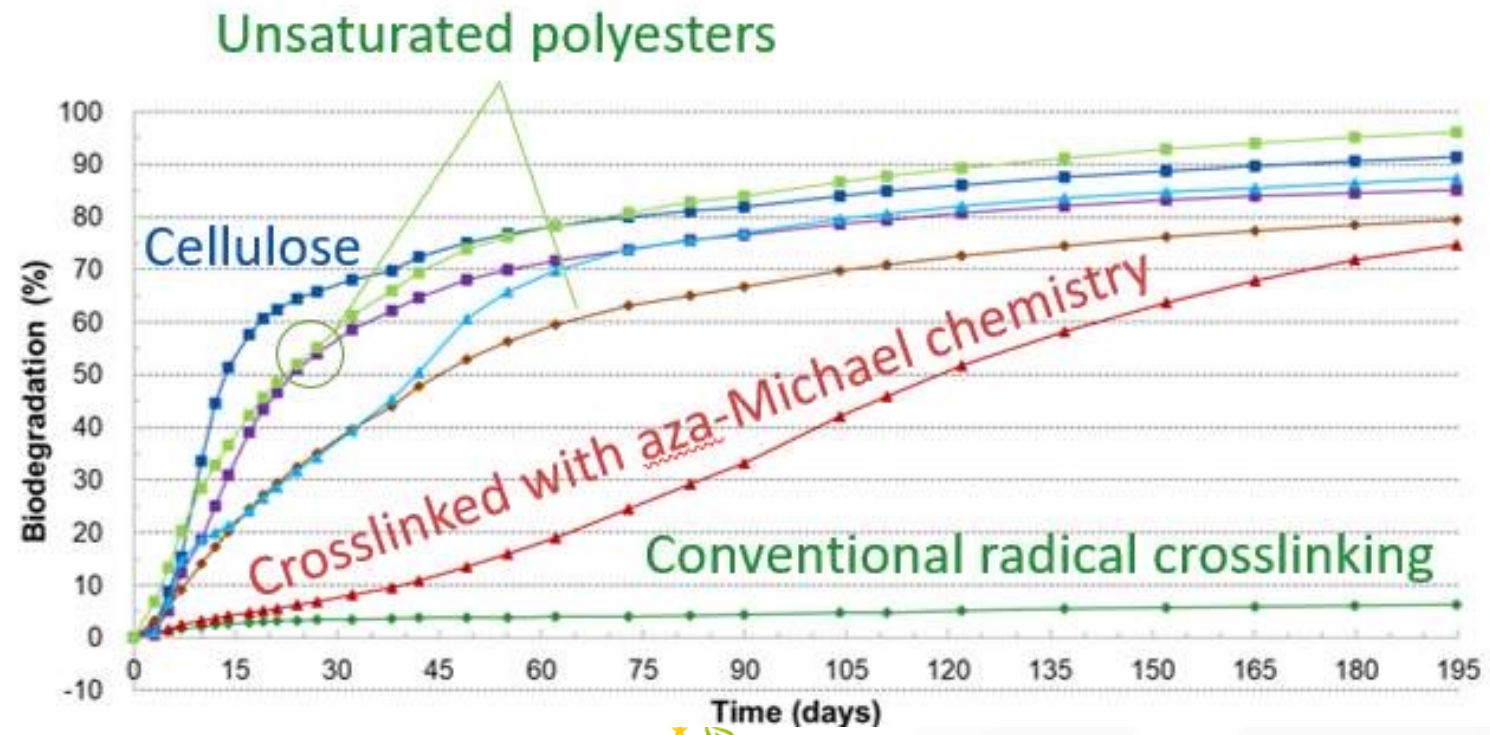


CHAMPION

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



- Improved biodegradation compared to conventional radical crosslinking: soil



Bio-based Industries Consortium  Horizon 2020 European Union Funding For Research & Innovation

THANK YOU

FOR YOUR ATTENTION