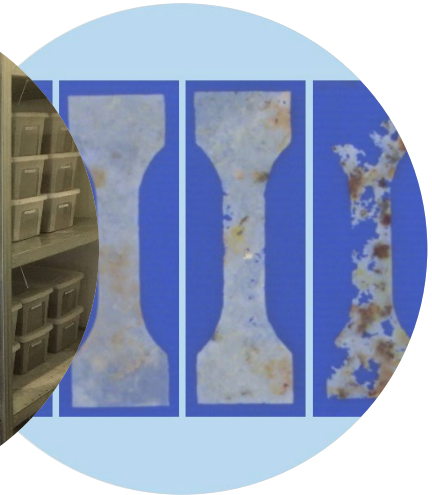


# Opties voor composteerbare plastics in de PPWR

Maarten van der Zee

10 maart 2025 – Wageningen Campus



# Opbouw presentatie

- Korte introductie WFBR
- Context: Composteerbare producten in de PPWR?
- Wat is composteerbaar?
- Hoe weet/meet je dat?
- Kansen voor composteerbare plastics

# Wageningen University & Research

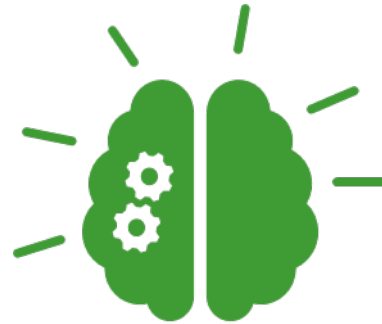


To explore  
the potential  
of nature to  
improve the  
quality of life

# The Wageningen approach

Unique union of expertise leading to scientific breakthroughs that can quickly be put into practical solutions and incorporated into education

## Wageningen University



3.415 employees (fte)  
fundamental and strategic research  
94 chair groups

## Wageningen Research



± 3.327 employees (fte)  
applied and pre-competitive research  
9 independent research institutes

# Wageningen Food & Biobased Research



Contract Research  
Organisation



Governments, NGO's,  
institutional funders,  
industrial companies



Highly engaged,  
proficient experts



World-class facilities  
and laboratories





# Sustainable Plastics Technology group

- >30 years of experience in biobased plastics and biodegradation research and >10 years of experience in (plastics) recycling
- Demonstrating the viability of alternative solutions for the current fossil based linear plastic products
- Developing plastic materials and products from sustainable sourcing to end-of-life
- Processing plastics from 1 kg scale up to 500 kg scale mimicking industrial scale
- Wide range of plastic analysis to support material and product development



# Sustainable plastic technology facilities



From waste plastics via sorting and mechanical recycling to granulates and products



From biodegradable plastics to compounds and products to biodegradation testing

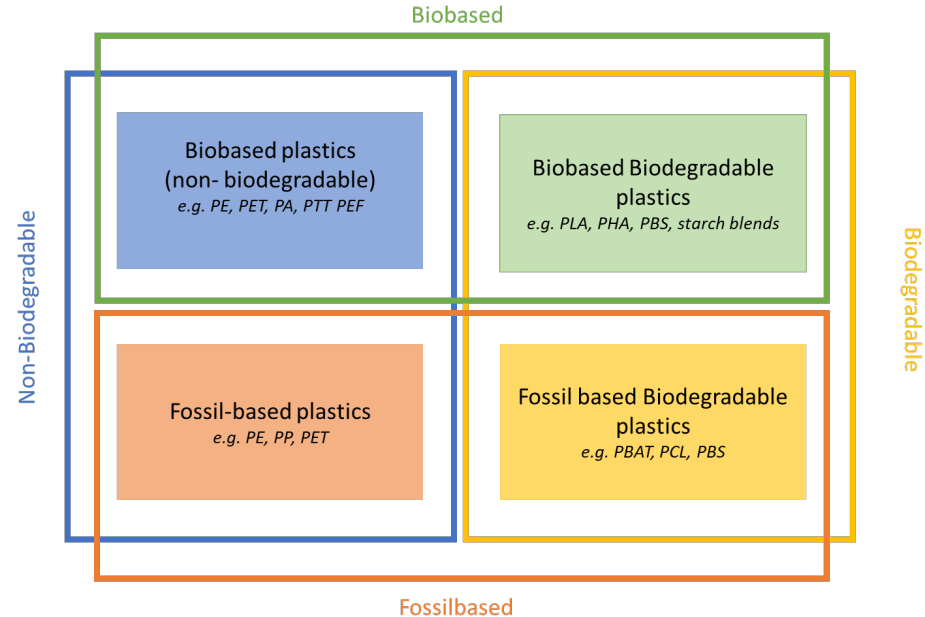






# Biobased en biodegradeerbare plastics

- Biobased ≠ biodegradeerbaar
  - Biobased gaat over **grondstoffen** en herkomst
  - Biodegradeerbaar (composteerbaar) gaat over de **afvalfase**



- Korte introductie WFBR
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# Composteerbare Verpakkingen in de PPWR

## Artikel 9 “Composteerbare Verpakkingen”

- Een paar specifiek genoemde verpakkingen moeten per 12 Feb 2028 (industrieel) composteerbaar zijn:

- Stickers voor groenten en fruit (Art 9, lid 1)
- Theezakjes en koffiepads (Art 3, lid 1, punt 1), f))



- Nederland heeft de keuze om een paar specifiek genoemde verpakkingen in Nederland verplicht composteerbaar te stellen:

- Koffiecapsules (Art 3, lid 1, punt 1), f))
- Lichte kunststof draagtassen (Art 9, lid 2, punt a))
- Zeer lichte kunststof draagtassen (Art 9, lid 2, punt a))





# Composteerbare Verpakkingen in de PPWR

## Artikel 9 “Composteerbare Verpakkingen”

- Ook andere verpakkingen kunnen in Nederland verplicht composteerbaar worden gesteld, mits voor 12 Aug 2026.
- De Europese Commissie kan bij voortschrijdend inzicht deze lijstjes nog aanvullen (mogelijke voorwaarden in Bijlage III).
- Uiterlijk 12 Feb 2028 moeten alle afbreekbare/composteerbare verpakkingen die niet op deze lijstjes staan “ontworpen zijn voor materiaalrecycling”.

# Composteerbare Verpakkingen in de PPWR

- Composteerbare kunststofverpakkingen zijn vrijgesteld van een minimum gehalte aan gerecycled materiaal (Art 7, lid 4, punt e))
- De hoeveelheid bio-afbreekbaar verpakkingsafval dat wordt gecomposteerd, mag als gerecycled worden meegeteld (Art 3, punt 7.)
- CEN wordt gevraagd om de methoden op te stellen waarmee aangetoond moet worden dat een verpakking (industriële) composteerbaar is.
  - Tot die tijd geldt: EN 13432:2000\*
  - Er wordt ook een norm voor “thuis-composteerbaar” gewenst

- Korte introductie WFBR
- Context: Composteerbare producten in PPWR?
- Wat is composteerbaar?
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- Kansen voor composteerbare plastics



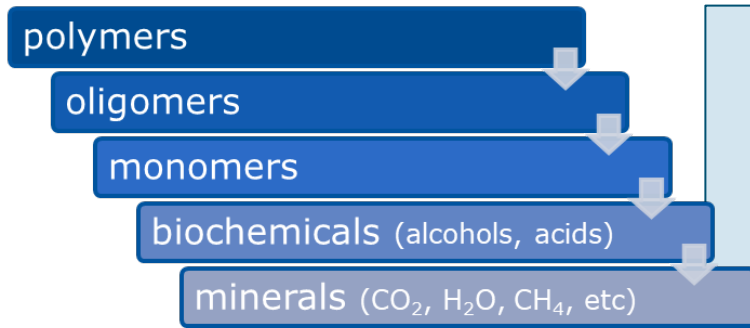
# Composteren

- Proces van recyclen van organisch materiaal door micro-organismen
- Compost bevat veel organische stof en verbetert de bodemstructuur
- Van nature een relatief traag verlopend proces
- Van belang: o.a. samenstelling organisch materiaal, temperatuur, vochtigheid, aanwezigheid zuurstof
- Geïndustrialiseerd om huishoudelijk gft-afval te verwerken

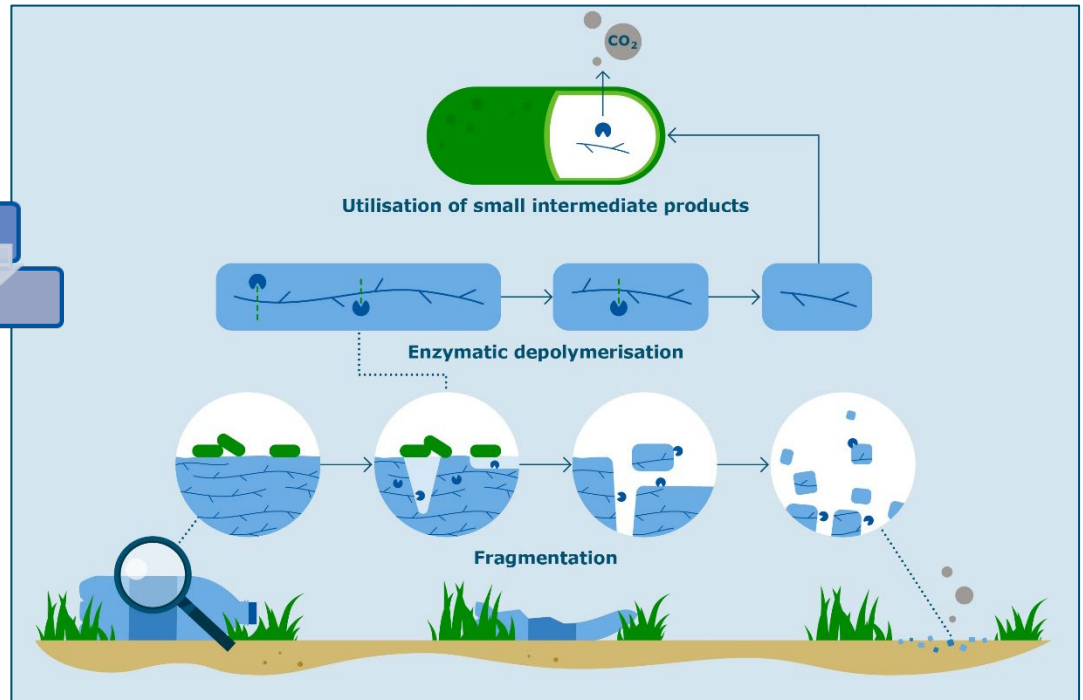


# Biodegradation of plastics

A complex process, comprising many different steps ...

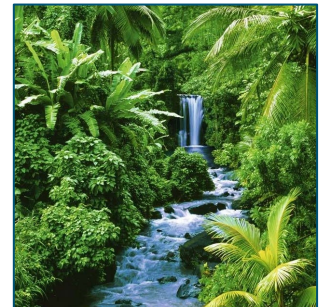
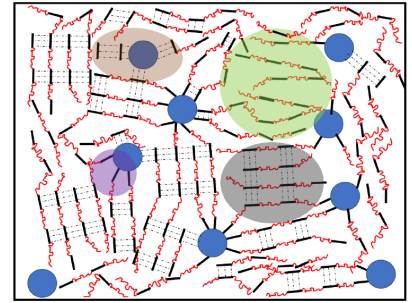


... that can be monitored in many ways.



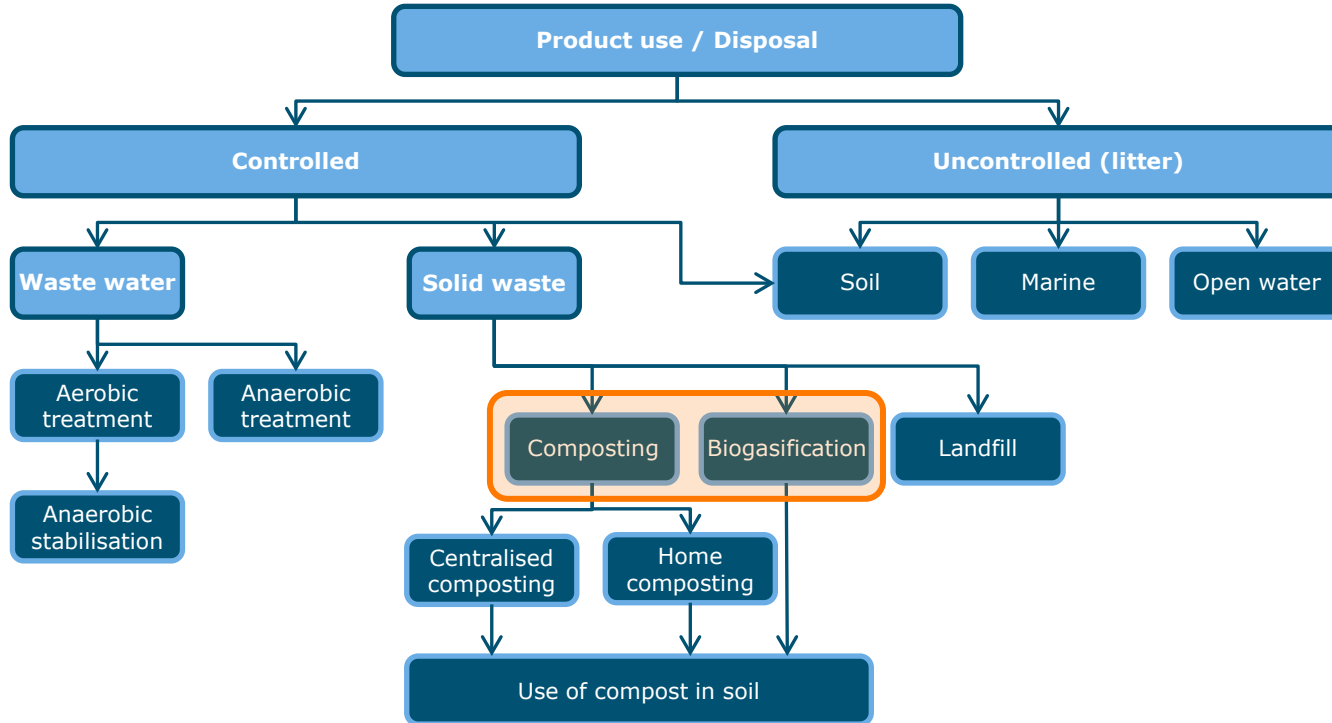
# Biodegradability: a system property

- Chemical structure of the plastic/packaging
- Activity of biological systems
  - the presence of micro-organisms
  - the availability of oxygen
  - the amount of available water
  - the temperature
  - the chemical environment (pH, electrolytes, etc.)





# Relevant environments for biodegradable plastics

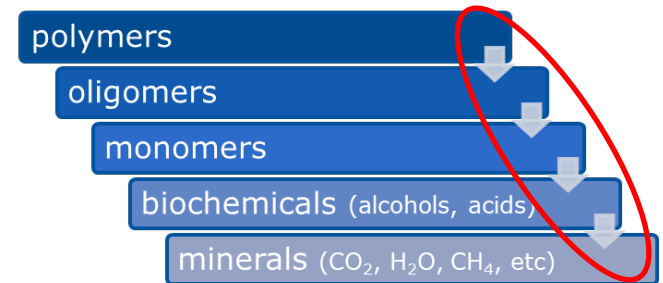


# Measuring biodegradation

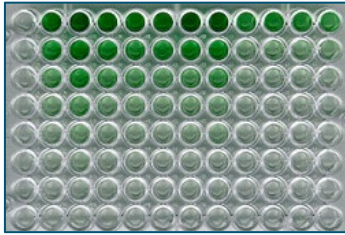


## Common approaches:

- Monitoring the depletion of substrates
- Monitoring changes in substrate properties
- Monitoring reaction products
- Monitoring accumulation of biomass



# Methods for evaluating biodegradation



Enzyme assays



Plate tests



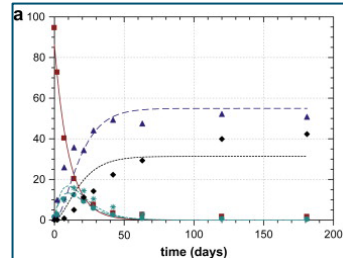
Respiration tests



Gas evolution tests  
(CO<sub>2</sub> or CH<sub>4</sub>)



Natural environments,  
field tests

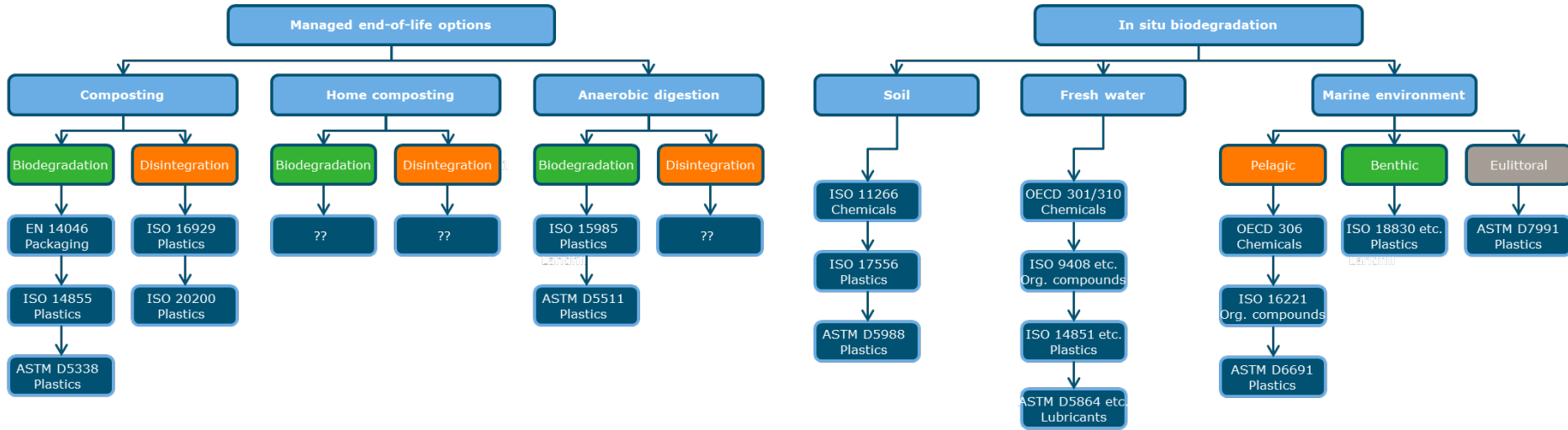



Isotope labelled  
polymers



Laboratory-scale simulated  
accelerating environments

# Standard testing methods



Worldwide: 

Europe: 

USA: 

# Claiming 'Biodegradable'

- The term **BIODEGRADABLE** has no meaning unless it defines the:
  - Degradation environment
  - Time/rate of degradation
  - Extent of degradation
    - = *Conversion to CO<sub>2</sub>?*
    - = *Remaining visible particles?*
    - = *Change of properties?*

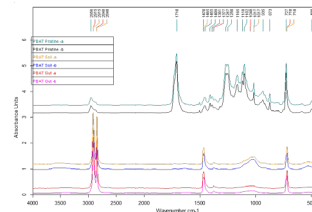
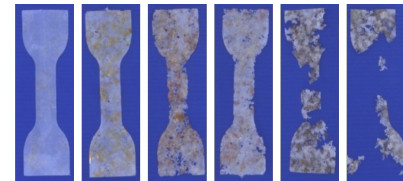
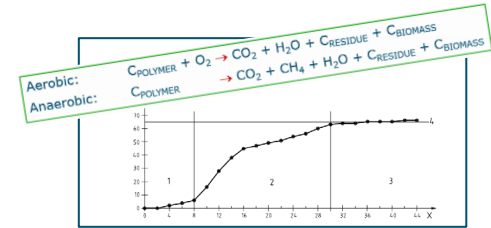


# Product normen (product standards)

Bijvoorbeeld voor: “Compostable packaging”, “Home compostable products”, “Biodegradable mulch film”, etc.

## 3 Essential requirements

- Sufficient biodegradation (chemical level)
- Sufficient disintegration (physical level)
- Environmentally safe
  - Chemical composition
  - Ecotoxicity (after exposure)



# EN 13432 – Composteerbare verpakkingen

EN 13432: Packaging – Requirements for packaging recoverable through composting and biodegradation – Test scheme and evaluation criteria for the final acceptance of packaging

Characteristic	Requirements and evaluation criteria
Chemical characteristics	Organic matter: <b>&gt;50%</b> of volatile solids Limits for heavy metals and other toxic hazardous substances
Biodegradation (for each constituent present in >1%)	Methods: Preferably ISO 14855 (at test temperature: <b>58°C</b> ) Max. test duration: <b>6</b> months Required level: <b>&gt;90%</b> (or 90% of max degradation of a ref. material) Alternative methods allowed when necessary (ISO 14851, ISO 14852, etc.)
Disintegration (on product level)	Methods: not specified, but normally: ISO 20200 Max. test duration: <b>12</b> weeks Required level: <b>&lt;10%</b> recovered as particles <b>&gt;2</b> mm
Ecotoxicity	Methods: based on OECD 208 'Terrestrial plants, growth test' On compost obtained at test conc.: >10% Current alternatives: ISO 16929, EN 14045 Required level: <b>&gt;90%</b> germination and plant biomass

# Voorbeelden van certificering

## ■ Industrial compostable

- EN 13432:2000 (Packaging – organic recovery)
- EN 14995:2007 (Plastics – compostability)
- ISO 18606:2013 (Packaging – organic recycling)
- ISO 17088:2021 (Plastics – organic recycling)
- ASTM D6400-12, ASTM D6868-17 (Compostable products)



## ■ Home compostable

- No European standard for packaging
- National standards: AS 5810:2010, NF 51-800:2015
- ISO 17427:2022 (Packaging - home compostable carrier bags)



# Voorbeelden van certificering



## INDUSTRIAL compostable

## HOME compostable

Biodegradation	Max. test duration: <b>6</b> months Required level: 90% Methods: All tests mentioned in EN 13432 Test temperature: <b>58°C</b>	Max. test duration: <b>1</b> year Required level: idem Methods: All tests mentioned in EN 13432 Test temperature: <b>20-30°C</b>
Disintegration	Max. test duration: <b>12</b> weeks Methods: ISO 20200, ISO 16929, EN 14045 and all tests in EN 13432 Test temperature: <b>40-75°C</b> (natural)	Max. test duration: <b>6</b> months Methods: ISO 20200, ISO 16929, EN 14045 and all tests in EN 13432 Test temperature: <b>20-30°C</b>
Ecotoxicity	ISO 16929, EN 14045 Test conc.: >10%	idem
Chemical characteristics	Limits for heavy metals etc. No SVHC (REACH Annex XIV)	idem

# Biodegradable Polymers in Various Environments

According to Established Standards & Certification Schemes



## NOTES

- proven biodegradability
- proven biodegradability for certain grades
- biodegradability not proven

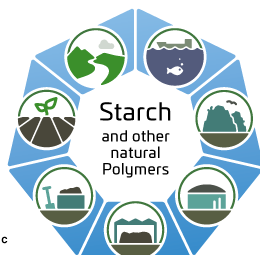
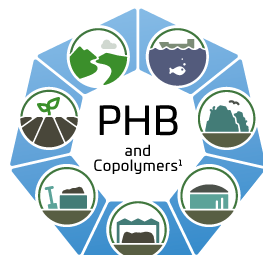
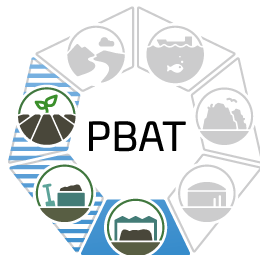
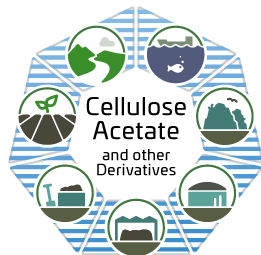
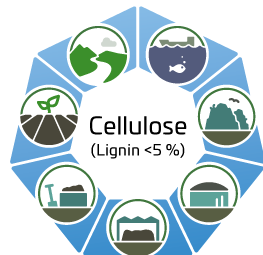
The biodegradability of plastics derived from these biodegradable polymers can only be guaranteed if all additives and (organic) fillers are biodegradable, too. Dying and finishing of cellulosic fibres, for example, may prevent their biodegradation in the environment.

Biodegradation depends on the complex biogeochemical conditions at each testing site (e.g. temperature, available nutrients and oxygen, microbial activity, etc.). Therefore, these generalised claims about biodegradability can only serve as approximations and need to be confirmed by standardised testing under lab conditions. In-situ behaviour can vary, depending on the mentioned conditions, size of the plastic, grade of the polymer and other factors. For instance, biodegradation testing is often performed after milling, slowing the inherent nature of the material to biodegrade. In reality, the same level of biodegradation will be obtained, be it possibly within a different timeframe.

## SLOWER BIODEGRADING POLYMERS

The polymers shown in the poster are rapidly biodegraded in the labelled environments, within the time frame of the corresponding standards or certificates. Some biopolymers, such as PBS or PLA in soil and also lignin/wood for virtually all environments, also biodegrade, but (much) more slowly. Full biodegradation can take several years to decades to be achieved. In addition, for some applications with a use phase in a certain environment (e.g. geotextiles), too rapid biodegradation is not desired, as their function should first be given for a few years. However, for these cases no standards exist so far.

- 1 incl. P3HB, P4HB, P3HB4HB, P3HB3HV, P3HB3HV4HV, P3HB3HX, P3HB3HO, P3HB3HD
- 2 PLA is likely to be biodegradable in thermophilic anaerobic digestion at temperatures of 52°C within the time frame mentioned in standards. This does not apply to mesophilic digestion.



## ENVIRONMENTS

### IMPORTANT TEST CONDITIONS, CERTIFICATION SCHEMES AND STANDARDS

For more details, refer to the original documents.



#### MARINE ENVIRONMENT

Temperature 30°C, 90% biodegradation within a maximum of 6 months. Certification: TÜV AUSTRIA OK biodegradable MARINE and DIN CERTCO DINplus biodegradable in marine environment, the latter is based on ISO 22403, the standard giving requirements for marine biodegradability.



#### FRESH WATER

Temperature 21°C, 90% biodegradation within a maximum of 56 days. Certification: TÜV AUSTRIA OK biodegradable WATER. Research on standards (especially on requirements) is on-going.



#### SOIL

Temperature 25°C, 90% biodegradation within a maximum of 2 years. Certification: TÜV AUSTRIA OK biodegradable SOIL and DIN CERTCO DIN-Geprüft Biodegradable in Soil. DIN-Geprüft Biodegradable in Soil is based on the European standard EN 17033 dedicated to mulch films but can be used for other products as well.



#### HOME COMPOSTING

Temperature 28°C, 90% biodegradation within a maximum of 12 months. Certification: TÜV AUSTRIA OK compost HOME and DIN CERTCO DIN-Geprüft Home Compostable.



#### LANDFILL

No European standard specifications or certification scheme available since this is not a preferred end-of-life option for biodegradable waste.



#### ANAEROBIC DIGESTION

Thermophilic 52°C / Mesophilic 37°C  
A specific European standard or certification scheme for anaerobic digestion is not yet available. Anaerobic digestion in a biogas plant is mentioned in EN 13432 and EN 14995: 50% biodegradation within two months, usually followed by aerobic digestion.



#### INDUSTRIAL COMPOSTING

Temperature 58°C, 90% biodegradation within a maximum of 6 months. Certification: TÜV AUSTRIA OK compost INDUSTRIAL, DIN CERTCO DIN-Geprüft Industrial Compostable and both "Seedling". EN 13432 and EN 14995 are the European reference standards and the basis of these certification schemes.



# Update van EN 13432 nodig?

Volgens de PPWR is er herziening nodig van EN 13432:2000 m.b.t.

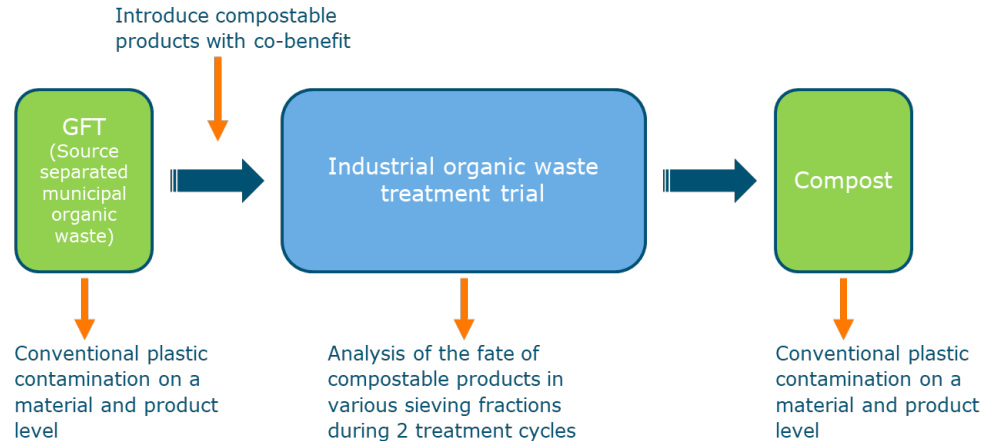
- composteertijden
- de toegestane niveaus van verontreiniging
- beperkingen op de hoeveelheden microplastics die vrijkomen

*"(...) moeten een afspiegeling vormen van de reële omstandigheden in installaties voor de verwerking van bioafval, waaronder anaerobe vergistingsprocessen."*

Daarnaast moet er een vergelijkbare norm voor thuiscompostering worden vastgesteld.

# Composteerbaarheid van plastics in de praktijk

- Determine the fate of (compostable) packaging products in the current organic waste treatment process
  - How fast do they disintegrate in current common practice?
  - Determine composition of current contamination by conventional plastics in biowaste and compost produced from biowaste



# Composteerbaarheid van plastics in de praktijk

- Composteercyclus van 11 dagen: ~20% is compost (<10 mm)
- Geen composteerbare plastics gevonden in de compost
- Één composteercyclus (11 dagen) voldoende om PLA plantpot volledig te laten verdwijnen (sneller dan banaan of sinaasappelschil)
- Ook de andere composteerbare producten desintegreerden minstens net zo snel als 'normaal' gft-afval
- Onwaarschijnlijk dat de onderzochte producten bijdragen aan toename van het 'residu' bij de gft-afvalverwerking



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- **Kansen voor composteerbare plastics**

# Kansen voor composteerbare plastics

Zie PPWR Bijlage III: Mogelijke voorwaarden om het gebruik van composteerbare verpakking verplicht te stellen of in te voeren:

- het gebruik van de verpakking leidt tot een aanzienlijke **toename van de inzameling van organisch afval** in vergelijking met het gebruik van niet-composteerbare verpakkingsmaterialen;
- het gebruik van de verpakking leidt tot aanzienlijk **minder verontreiniging van compost** met niet-composteerbare verpakkingen en veroorzaakt geen problemen bij de verwerking van bioafval;



# Kansen voor composteerbare plastics

... en ook nog:

- Toepassingen waar recycleerbare materialen niet gerecycled (kunnen) worden vanwege samenstelling en/of afmeting.

# Een paar voorbeelden...

Voorwaarde	Voorbeelden
Bevordert inzameling van GFT	GFT inzamelzakken Theezakjes, koffiepads, koffiecapsules ...
Minder niet-composteerbare verpakkingen in GFT	Stickers voor groente en fruit Plantpotten voor keukenkruiden, kamerplanten Verpakking van gesneden groenten ...
Moeilijk recycleerbare toepassingen	Meerlaags barrière folies Koffiecapsules ...

# Vragen?

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



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