



Demonstrating complete biodegradation with certified compostable materials

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Agenda

1. About BASF
2. Transitioning to a circular economy
3. What is biodegradability?
4. Microplastics and the benefits of compostable materials
5. Summary

Who We Are: BASF in North America – Snapshot

~150
Locations



\$20.5B
Sales

~16,000
Employees



NA HQ
Florham Park, NJ

+2,300
New hires



~28%
of worldwide BASF
Group sales

North American Biodegradation Laboratory

A Regional Lab Supporting a Global Vision



The new showcase facility in Wyandotte, MI grows our internal biodegradation testing network. Advanced analytics complement standard biodegradation methods to accelerate product development.



Ribbon Cutting in June 2023

Biodegradation Lab Tests

OECD 301F
Sludge

Detergents, Cleaning, & Cosmetics
+ biodegradation “screening”

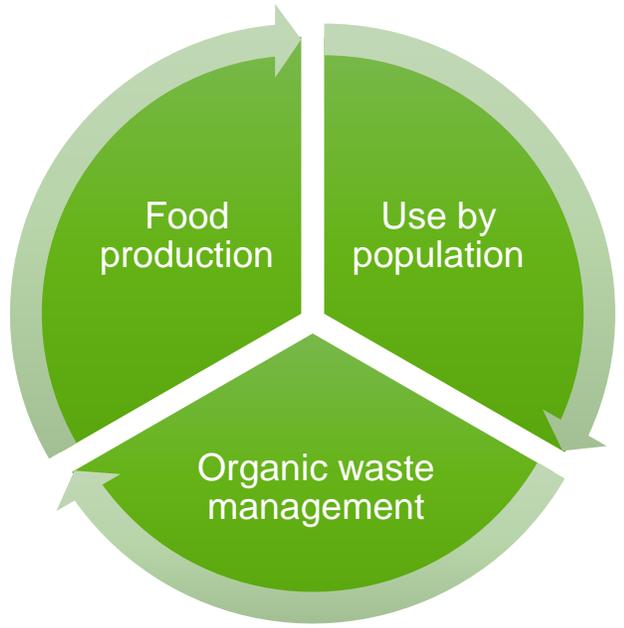
ISO 17556
Soil

Agriculture, Fertilizers & Seeds

ISO 20200
Compost

Food Products & Packaging

The circular economy vision – how to close the nutrient loop



Mulch Films



Compost



Packaging



Bags



Composting



Biogas

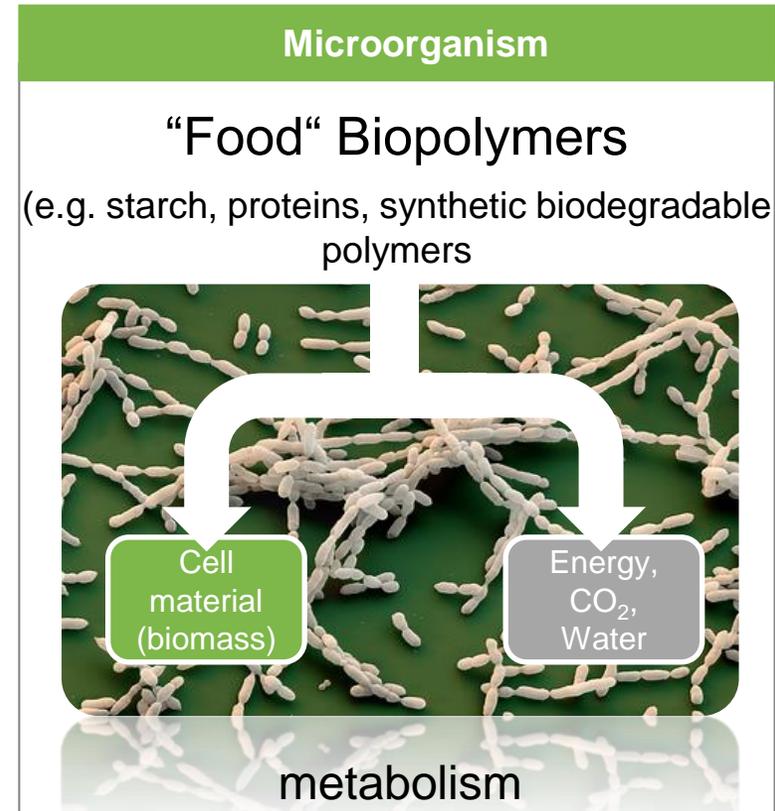
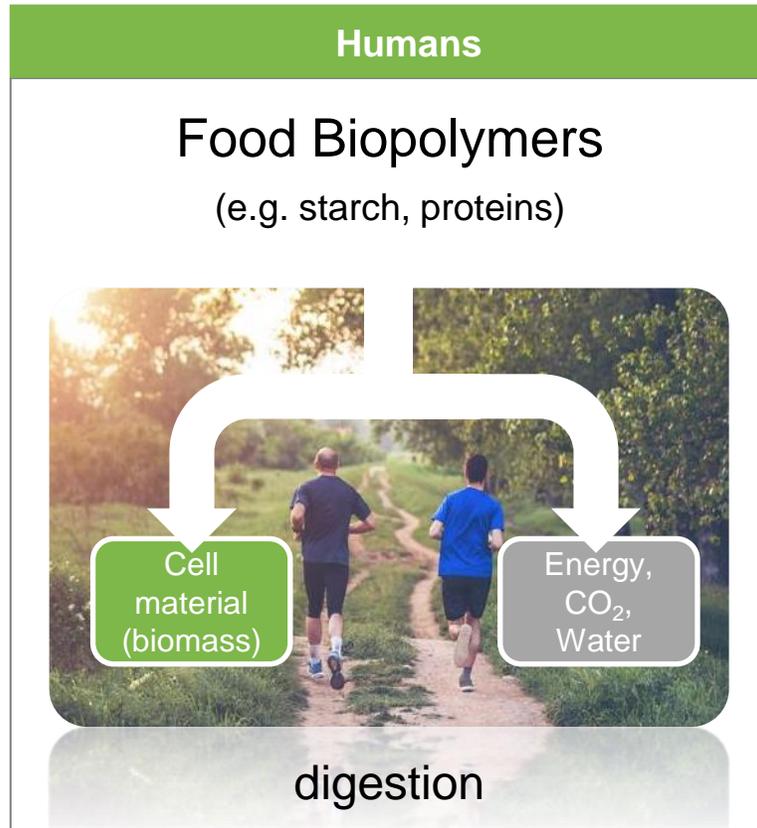
BASF's global circularity goals

- 1 We aim at **doubling** our **circular sales** to reach **€17 billion** by 2030
- 2 We commit to use **250,000 metric tons** of **recycled feedstock** by 2025 globally
- 3 We run a **Circular Economy Program** to accelerate the transition

Compostable products are an enabler for organic waste recycling and closing the loop

What is biodegradability?

The breakdown of organic matter by microorganisms into CO₂, energy, water and biomass (aerobic process)



In biodegradation processes, microorganisms recognize the polymeric material as a food source and metabolize it completely to CO₂, water and microbial biomass.

What are microplastics?

Microplastics are plastic particles which are less than 5 mm in size. There are 2 types of microplastic:

Primary Microplastic

< 1%*



- **Primary Microplastics** intentionally introduced into the product for a specific function

Secondary Microplastic

> 99%*



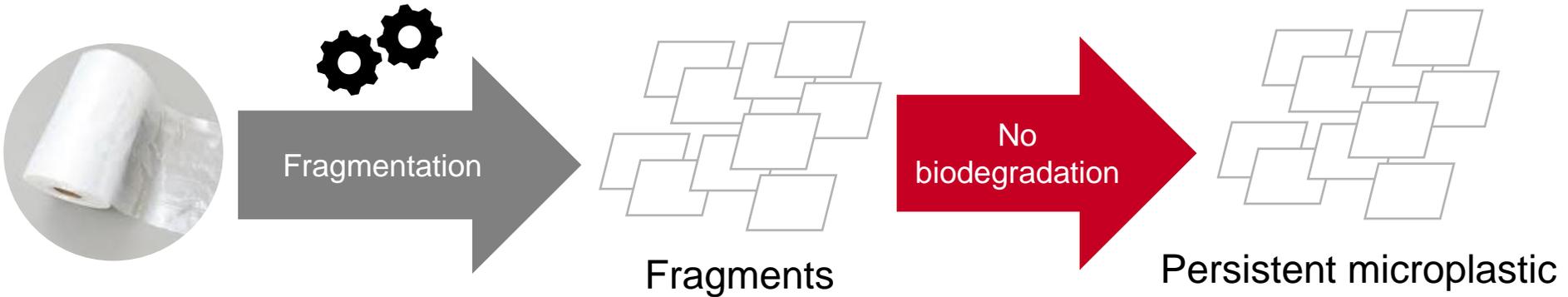
- **Secondary microplastics** are released by **degradation** and **fragmentation** of larger plastic pieces

Microplastics generated from conventional plastics are typically not biodegradable and accumulate and persist in the environment

*Figure 2, Eunomia report: <https://www.eunomia.co.uk/reports-tools/investigating-options-for-reducing-releases-in-the-aquatic-environment-of-microplastics-emitted-by-products/>

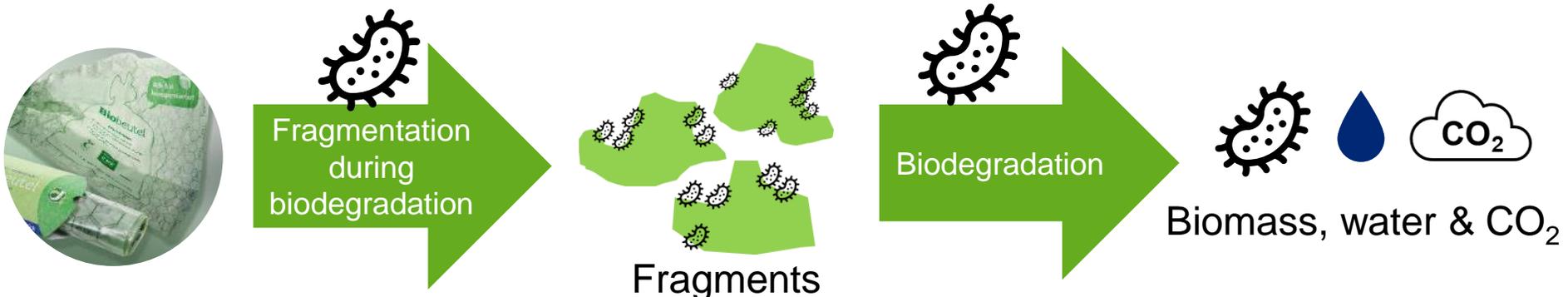
Breakdown of conventional vs. certified compostable plastics during composting

Conventional Plastics – e.g. LDPE



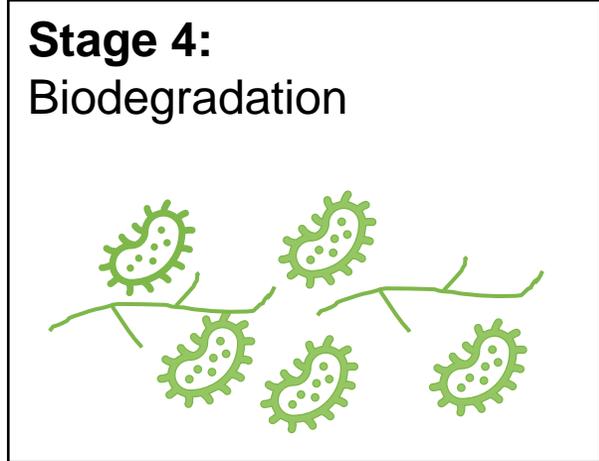
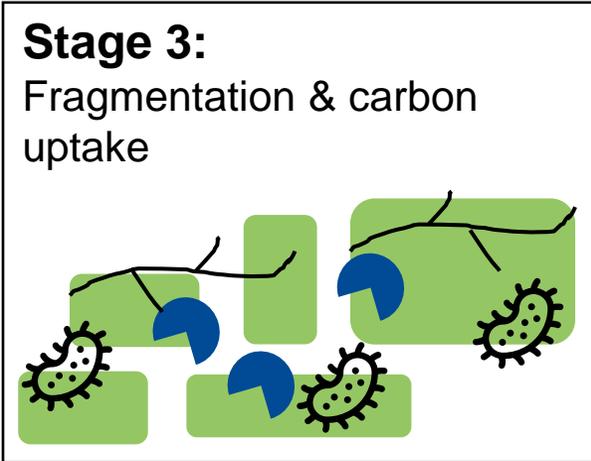
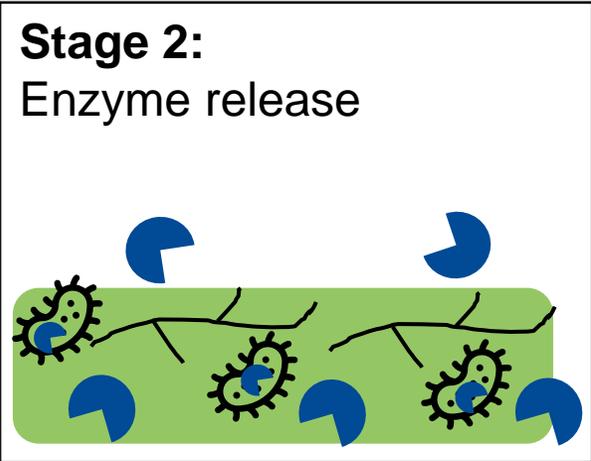
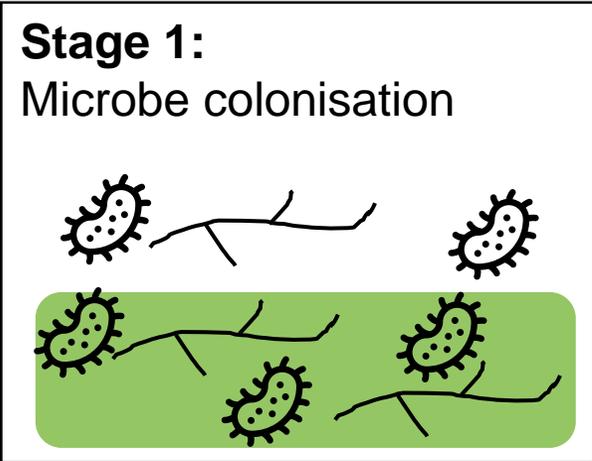
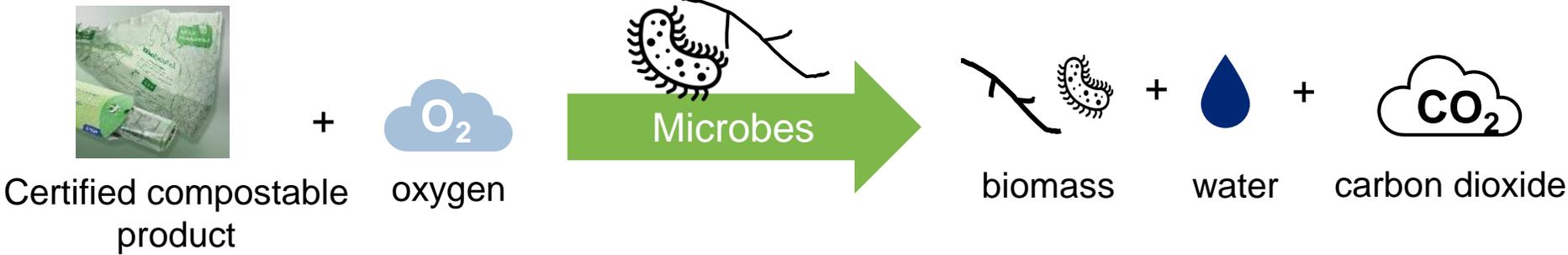
Fragmentation occurs via external processes such as mechanical treatment and creates persistent microplastic

Certified compostable plastics – e.g. ecovio®



Certified compostable plastics also fragment during composting, but the fragments are then completely biodegraded by microbes

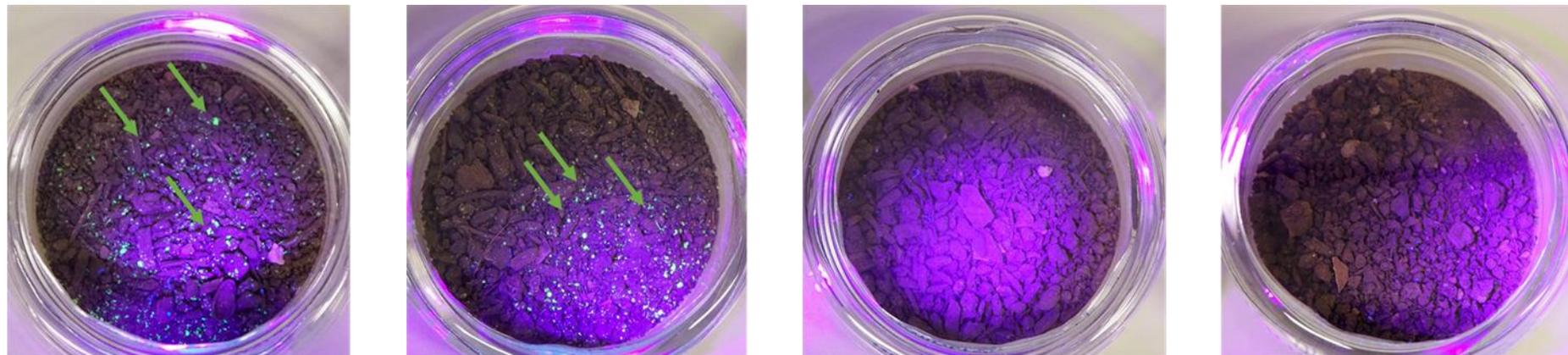
Key aspects in plastics biodegradation



Certified compostable product biodegrade in compost like any natural organic material

How to develop microplastic analytics

Challenge: complex compost matrix contains organics, inorganics, larger pieces of wood...



time point 0

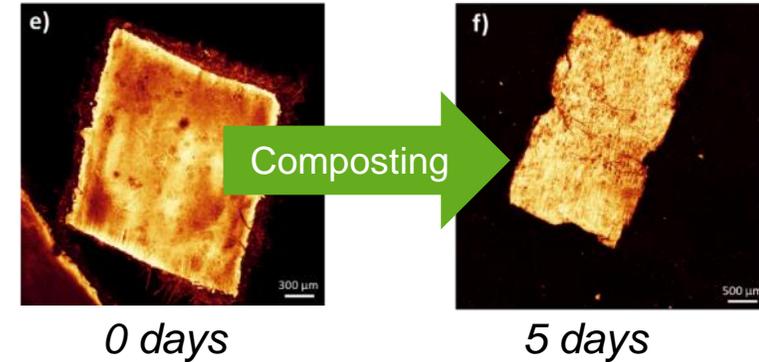
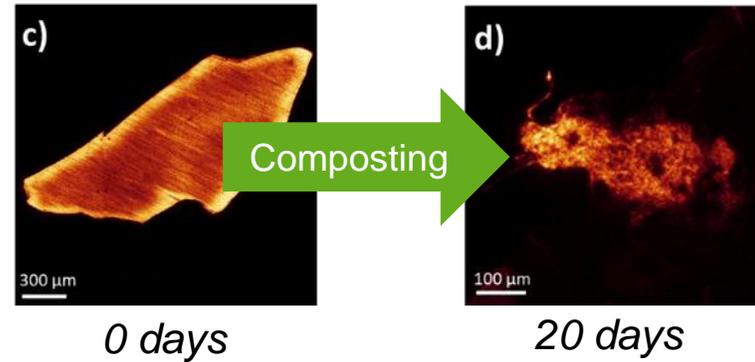
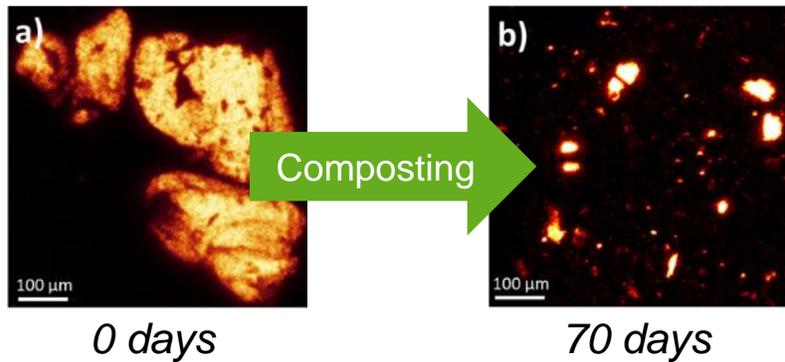
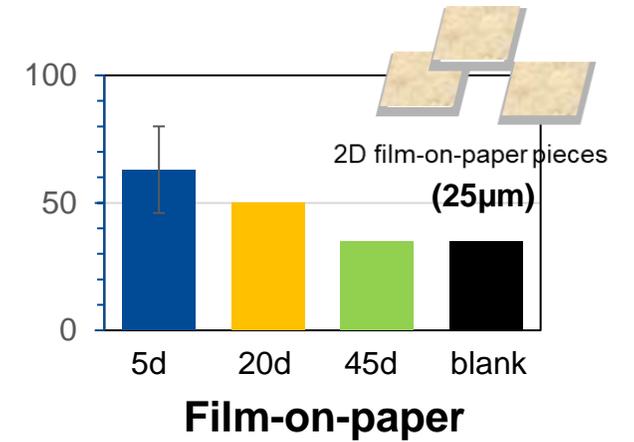
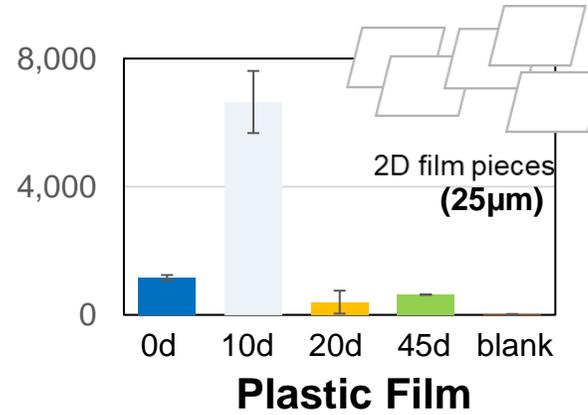
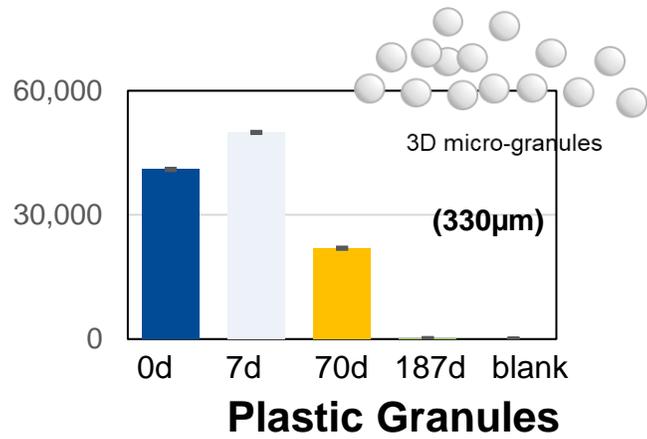
6 % mineralization

50 % mineralization

end of the experiment

The use of a fluorescently labelled materials allow the training of analytical methods

Impact of shape and structure on fragmentation behavior



Fragmentation into smaller particles before complete biodegradation

No significant fragmentation before complete biodegradation

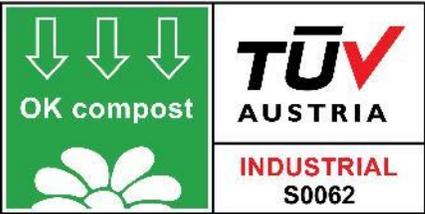
Despite different fragmentation pathways, ecovio® PS1606 showed in all three scenarios complete biodegradation in industrial composting conditions

Certification ensures compostability performance

Certifications address the following:



Europe
EN 13432,



Europe
EN 13432



Canada
ISO 17088 and ISO
18606



North America
ASTM D6400, ASTM
D6868, ASTM D8410



Japan
GreenPla

Certification to internationally recognized standard specifications ensure all requirements are met.

Key elements that result in successful programs



Policy

- Thorough engagement of waste generators with built-in feedback loops throughout the value chain

Education and outreach

- Definition and enforcement re: appropriate
- product claims, markings & diversion requirements

Commercial and economic considerations

- Organized effort to connect all stakeholders & ensure economic success for participants

Summary

- Science based studies confirm that microbes recognize and digest the special polymers used in certified compostable products as food. These polymers are **different** from conventional plastics.
- Certified compostable products do not leave microplastics after composting and that they are safe for the soil.
- In aerobic conditions microbes mineralize them exhaling CO₂ as well as taking up the carbon of the polymer into their bodies (biomass).
- The globally recognized performance criterias for biodegradation in compost, such as third party certification by independent and recognized bodies, ensures a product meeting these requirements will fully biodegrade in the same manner as organic waste.
- Certified compostable products DO compost same as the organic waste that they help to divert from landfill.

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We create chemistry