WORKSHOP

2021

BIOBASED MATERIALS RESEARCH: ADVANCES FROM ECOFUNCO AND BIONTOP EUROPEAN PROJECTS

ecofunco

biontop

BBI JU

Bio-based Industries Consortium

Horizon 2020 European Union Funding for Research & Innovation

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End of life of materials: biodegradability and compostability assessment

Contents and objectives:

- Packaging waste and end of life
- Managed end of life scenarios and certifications
- Way to assess the behaviour
  - Biodegradability
  - Disintegration
  - Ecotoxicological impact
  - Overall compostability assessment
- Main conclusions

Plastic containers for convenience:

Food is mostly packaged in plastic:

Convenience Food:

- long shelf life
- availability at all times
- in all situations

Part of our life quality

Poisoning of nature and people:

- Accumulation of plastics in the environment
- Degradation to micro and nanoparticles
- Accumulation of toxic and carcinogenic chemicals (DDT, PCB) to the particles
- Accumulation of the particles in the food chain

particles and adhering toxins are ingested by humans

Waste management:

What is going to happen when a product is at its end-of-life phase?

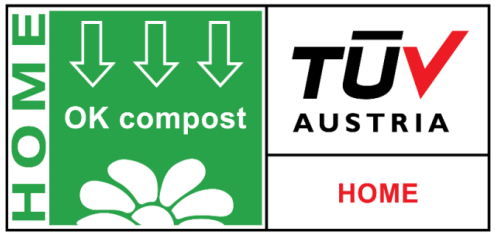
Biodegradation is the natural decomposition of organic waste made by micro-organisms.
Biodegradation has a great potential in reducing waste impact and amount.

Unfortunately, it is not simply disappearance of waste into the ground:

It depends on the specific biological environment!!

«Why environment is key for biodegradation»:
See video on https://www.tuv-at.be/green-marks/
https://www.youtube.com/watch?v=Yp5WA-PnFfs&t=36s

Packaging certification schemes (TÜV Austria – DIN CERTCO)



Managed end-of-life (controlled conditions)

In-situ biodegradation:
- **Biodegradation in soil**
- **Biodegradation in fresh water**
- **Biodegradation in marine conditions**

biobased %

Raw materials certifications

Laboratory compostability recognitions (**www.archa.it**)


REGISTRATION
TA8091802874
FOR TESTING ACCORDING TO
Laboratori ARCHA S.r.l.
Via di Tegulaia 10/a
56121 Pisa
Italy
Biodegradation
Disintegration
Ecotoxicity
Heavy Metals and Fluor


REGISTRATION
TA8091802876
FOR TESTING ACCORDING TO
Laboratori ARCHA S.r.l.
Via di Tegulaia 10/a
56121 Pisa
Italy
Biodegradation
Ecotoxicity
Heavy Metals and Fluor

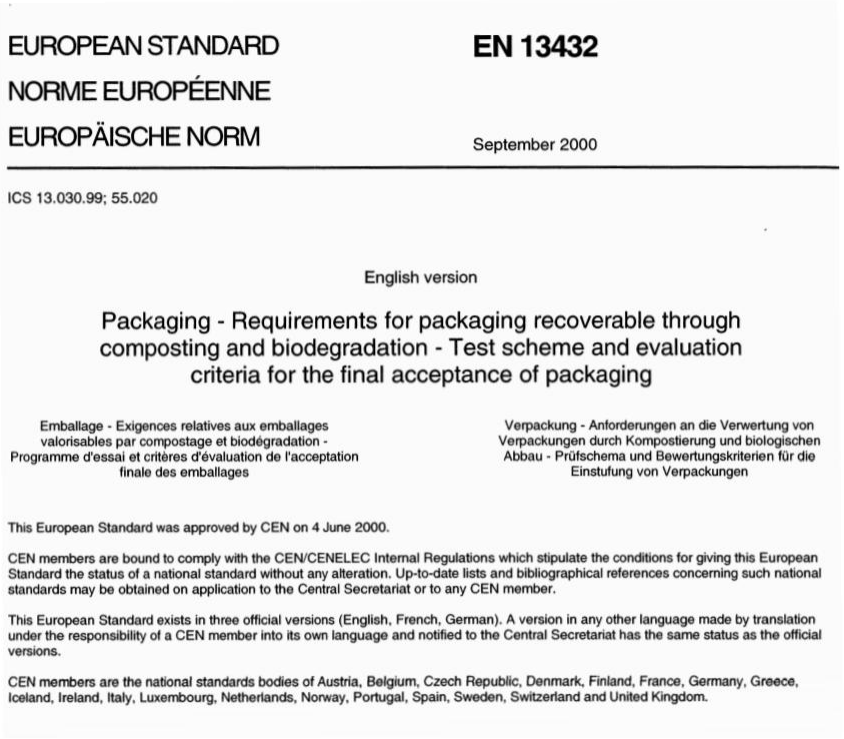

REGISTRATION
TA8091802875
FOR TESTING ACCORDING TO
Laboratori ARCHA S.r.l.
Via di Tegulaia 10/a
56121 Pisa
Italy
Biodegradation
Disintegration
Ecotoxicity
Heavy Metals and Fluor


REGISTRATION
TA8092105340
FOR TESTING ACCORDING TO
Issued by TÜV AUSTRIA Belgium NV to
Laboratori ARCHA S.r.l.
Via di Tegulaia 10/a
56121 Pisa
Italy
for the following tests
Biodegradation
Disintegration
Ecotoxicity
Heavy Metals and Fluorine
The tests comply with the requirements described in:
Certification Scheme
Home compostability of products (OK 2 Edition 0)
Validity of the certificate from 28 January 2021 till 28 January 2026
Brussels, 28 January 2021
For the Certification Committee
Ph. DEWOLFS
President of the Committee

Official standard – Industrial compostability

EN 13432-2000

Packaging—Requirements for packaging recoverable through composting and biodegradation—Test scheme and evaluation criteria for the final acceptance of packaging



EUROPEAN STANDARD **EN 13432**

NORME EUROPÉENNE

EUROPÄISCHE NORM September 2000

ICS 13.030.99; 55.020

English version

Packaging - Requirements for packaging recoverable through composting and biodegradation - Test scheme and evaluation criteria for the final acceptance of packaging

Emballage - Exigences relatives aux emballages valorisables par compostage et biodégradation - Programme d'essai et critères d'évaluation de l'acceptation finale des emballages

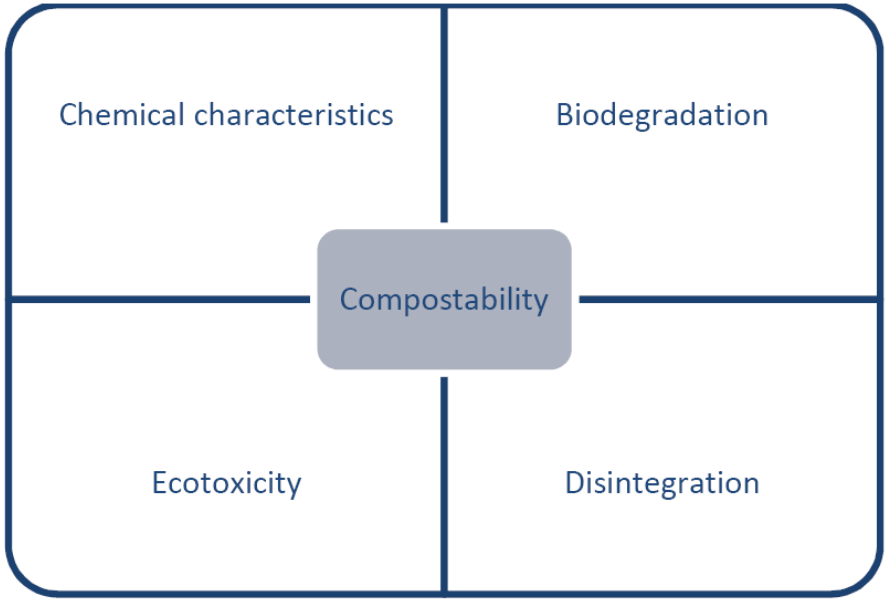
Verpackung - Anforderungen an die Verwertung von Verpackungen durch Kompostierung und biologischen Abbau - Prüfschema und Bewertungskriterien für die Einstufung von Verpackungen

This European Standard was approved by CEN on 4 June 2000.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Central Secretariat has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.



End of life behaviour

Ind. Compostability

Packaging Composition	**Thickness**	**Heavy metals and Fluorine concentrations**	**Volatile solids (> 50%)**
Biodegradability	**> 90% within 6 months**		
Disintegration	**< 10% above 2 mm**		
Compost quality	**Chemical-physical composition (pH, Volatile solids, C org, N, …)**	**Heavy metals concentrations**	**Eco and phytotoxicity tests**

HIGH TEMPERATURE (aprox. 58°C)

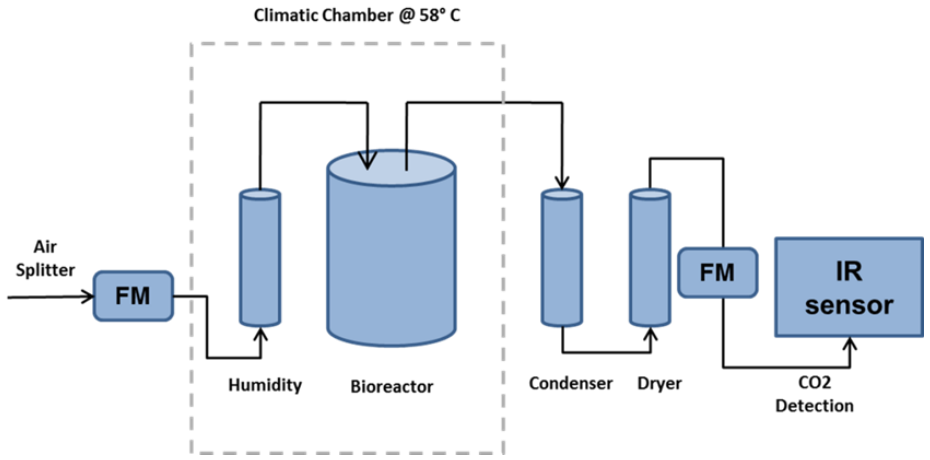
Biodegradability assessment

Biodegradability **> 90% within 6 months**

Biodegradability tests are carried according to official method ISO 14855-1
Test methods determine the degree and the rate of aerobic biodegradation of plastic materials on exposure to a controlled-composting environment

DESCRIPTION:

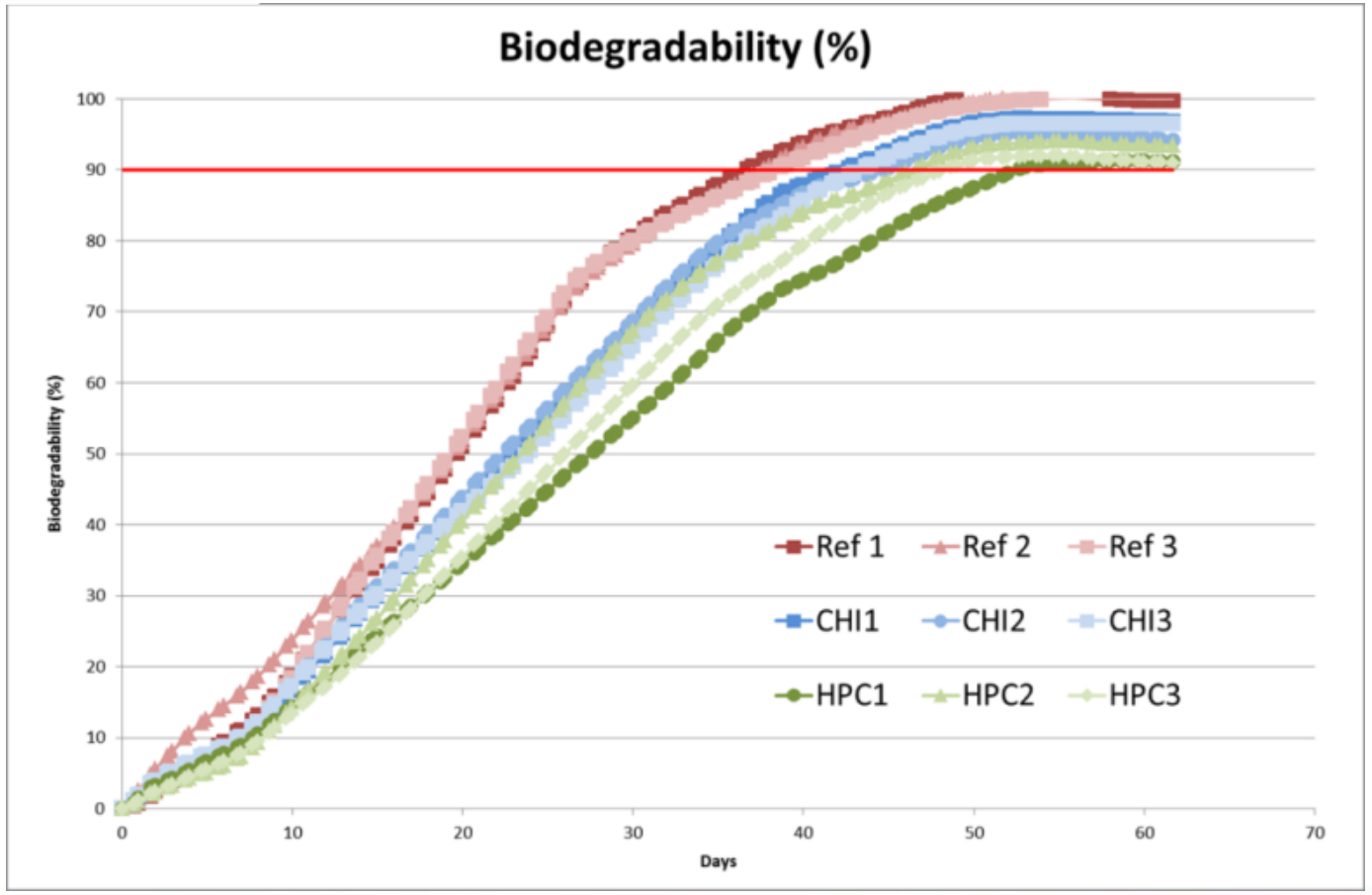
- Test is performed on 3 replicates for every specimen and employs a cellulose as biodegradability positive control, a blank control containing only the inoculum and the test material;
- Test material can be defined "biodegradable under composting conditions" if its degradation results at least 90% in less than 6 months.



Biodegradability assessment

Biodegradability

> 90% within 6 months



Disintegration assessment

Disintegration → **< 10% above 2 mm**

ISO 16929 “Plastics - Determination of the degree of disintegration of plastic materials under defined composting conditions in a pilot-scale test”

DESCRIPTION:

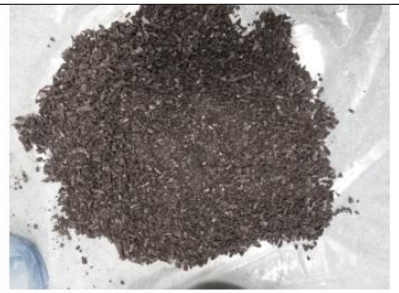
- Pieces of the plastic test material are mixed with a prepared solid matrix (synthetic solid waste and mature compost). Test is performed on 2 replicates for every specimen.
- Each reactor is placed in an air-circulation oven for 12 weeks.
- The degree of disintegration is determined after a composting cycle, by sieving the final matrix through a 2 mm sieve in order to recover the non-disintegrated residues.
- The disintegration test occurs efficiently if less than 10% of the original mass of loaded samples is above 2 mm sieve after 12 weeks.

Disintegration assessment

Disintegration | **< 10% above 2 mm**

Final compost

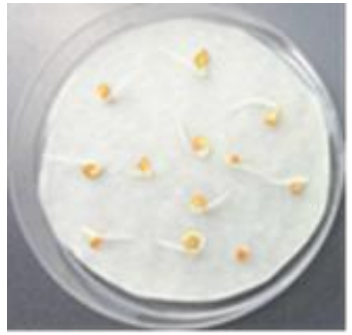
Final packaging residues



Final compost residue after disintegration

Starting of test		 INSIDE THE VESSEL
AFTER 8 days		
AFTER 37 days		
AFTER 51 days		
AFTER 84 days		

Ecotoxicity assessment



OECD 208 (July 2006) "Terrestrial Plant Test: Seedling Emergence and Seedling Growth Test"

DESCRIPTION:

- Tests evaluate the differences in toxic or phytotoxic potency between control compost (blank sample) and final compost obtained from the degradation of the developed materials.
- According to EN 13432, the determination of phytotoxic effects can be performed:
  - germination test
  - plant growth test on barley and cress

If GROWTH INDEX (Gm) for the doses 25% and 50% is greater or equal to 90% the sample is not-toxic

Ecotoxicity assessment

Ecotoxicity test → **GROWTH INDEX (Gm) ≥ 90%**

OECD 208 (July 2006) "Terrestrial Plant Test: Seedling Emergence and Seedling Growth Test"

BARLEY	Added conc.	Germination rate (%)
FILM sample	25%	96.1
	50%	101.8

CRESS	Added conc.	Germination rate (%)
FILM sample	25%	96.1
	50%	97.9

End of life behaviour - ongoing

Home Compostability

Biodegradability

> 90% within
12 months
at ambient temperature

Disintegration (qualitative)

< 10%
above 2 mm within
6 months
at ambient temperature

Conclusions

1. Preliminary validation for OK compost INDUSTRIAL certification
2. Further validation for final labelling of the products
3. Further assessment for OK compost HOME behaviour
4. Further assessment for Ok biodegradable environments (SOIL, WATER, MARINE)

Thank you!

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