

Comparison of standards for industrial compostability (*)



Information Document 415 (EN) – 24.07

1. Introduction

There are many standards dealing with industrial compostability, but we will focus on the ISO, EN and ASTM standards.

Their main criteria and tests are broadly the same: biodegradation, disintegration, ecotoxicity and regulated elements; but there are a few differences which may, in some cases, be significant.

Historically, the harmonised standard EN 13432:2000 can be considered as the mother of all standards dealing with this subject. Never revised since its publication, it will finally be revised shortly.

Let's begin our analysis with their scope of application. There are two main groups :

- packaging and packaging materials
- plastics and products made from plastics

2. Scope

	 Europe	 North America	 International
packaging	EN 13432		ISO 18606
plastics	EN 14995	ASTM D 6400	ISO 17088

Table 1

Strictly speaking, compliance with a specific standard can only be assessed for products that fall within its scope.

Certification schemes such as OK compost INDUSTRIAL and the Seedling logo are based on the EN 13432 standard (for packaging), but extend its scope to other products, such as disposable tableware, whether made from plastic, coated paper or sugarcane pulp ...

(*) : situation on 1 July 2024

3. Regulated elements

Maximum permissible levels of regulated elements (expressed in ppm, mg/kg of dry material) are part of the criteria specified in all compostability standards but vary considerably from one region to another.

- In Europe, the limit values are based on ecological criteria for the award of the Community eco-label to soil improvers and are set at 50 % of the maximum concentration of those requirements.
- In North America, the concentrations of regulated metals shall be less than 50 % of those prescribed for sludges or composts in the country where the product is sold, with different values for US / Canada.
- The ISO standards do not impose single values but list all values from the main standards for US, Canada, Europe & EFTA countries, but also those applicable in Japan and China.
- The values quoted for China are broadly in line with European values, while Japanese limits are generally 20% higher.




			
ppm	EN 13432 EN 14995	ISO 17088 ISO 18606	ASTM D6400 Canada / US
As	5	5 - 20,5	19 / 20,5
Cd	0,5	0,5 - 17	5 / 17
Cr	50	50 - 265	265 / na
Cu	50	50 - 750	189 / 750
F	100	na	na
Hg	0,5	0,5 - 8,5	1 / 8,5
Mo	1	1 - 5	5 / na
Ni	25	25 - 210	45 / 210
Pb	50	50 - 150	125 / 150
Se	0,75	0,75 - 50	4 / 50
Zn	150	150 - 1400	463 / 1400
Co	na	38	38 - na

Table 2

It is immediately apparent that, except for cobalt (38 ppm, only mandatory in Canada and China) and lead (50 ppm in the EU but only 10 ppm in Japan), the limits imposed in European standards are systematically the lowest. It should also be noted that Brazilian standard NBR 15448-2 (not referenced in ISO) sets limits identical to European standards, but with the addition of a 10 ppm limit for cobalt.

Compliance with EN 13432 / EN 14995 for regulated components therefore implies de facto compliance with ASTM D6400 in the US.

To avoid any inconvenience in the event of additional standards being applied later, TÜV AUSTRIA systematically requires the measurement of Cobalt during assessments for **OK compost INDUSTRIAL** certification.

4. Biodegradation




					
	EN 13432 2000	EN 14995 2006	ISO 18606 2013	ISO 17088 2021	ASTM D6400 2023
applicable standards for biodegradation	ISO 14855 (1)	ISO 14855 (1)	ISO 14855-1 ISO 14855-2	ISO 14855-1 ISO 14855-2	ISO 14855-1 ISO 14855-2 ASTM D5338
constituents to be tested individually	(2)	-	between 1% and 10%	between 1% and 15%	between 1% and 10%
exemption for material of natural origin	yes	na	yes	na	(3)

Table 3

Measuring biodegradation requires specific skills and facilities and can therefore only be carried out by laboratories with proven expertise.

All the standards are based on the same concept : 90% of the carbon in the tested material must be converted into CO₂ by the micro-organisms within a maximum of 6 months in compost at 58 ± 2°C. The tests are carried out in 3 test reactors, as well as 3 reactors containing cellulose as a reference (to validate the activity of the compost) and 3 reactors containing only compost (to quantify the background noise from the activity of the compost itself).

There are, however, some differences/evolutions between the standards, mainly linked to their date of publication.

(1) Standards for measuring biodegradation

The oldest standards still refer to ISO 14855, which was replaced by ISO 14855-1 which we, as a certifier, adopted as soon as it was published.

(2) Constituents

The standard specifies that the biodegradation of each packaging material OR each significant organic constituent must be tested individually.

The most recent standards (ISO and ASTM) add that the biodegradability of components between 1% and 10% - or even 15% - must also be verified by testing.

Standard EN 13432, currently under revision, will adopt a similar approach.

For our part, we do not accept any intentional addition of structural polymers deemed to be non-biodegradable, regardless of their concentration.

(3) Exemptions

Materials of natural origin are deemed biodegradable by default (in reality, they would not reach 90% biodegradation within the timeframe prescribed by the standards).

The ASTM D6400 standard specifies that lignocellulosic substrates are qualified by showing that more than 95% of their carbon comes from biobased resources.

5. Disintegration




					
	EN 13432 2000	EN 14995 2006	ISO 18606 2013	ISO 17088 2021	ASTM D6400 2023
applicable standards for disintegration	no standard specified (1)	ISO 16929	ISO 16929 (ISO 20200)	ISO 16929 (ISO 20200)	ISO 16929 ISO 20200
rule for reduce delay	no	no	no	yes (2)	no
rules for equivalent form	same or a smaller mass to surface ratio or wall thickness	same or a smaller mass to outer surface ratio and maximum wall thickness	same or a smaller mass to surface ratio or wall thickness	no	thinner gages and lower densities will also compost satisfactorily
restriction of use of produced compost for ecotoxicity tests (3)	-	-	compost from test ISO 20200 is not suitable for ecotoxicity tests	compost to be used for plant toxicity tests shall be prepared according to ISO 16929	compost from test ISO 20200 is suitable for ecotoxicity tests under restrictions

Table 4

(1) Standards for measuring disintegration

The determination of disintegration is carried out in accordance with the international ISO 16929, sometimes with ISO 20200 as an alternative method.

At the time EN 13432 was published, there was no specific standard for disintegration, an anomaly which will be corrected in the next revision, but which has the consequence that some laboratories used, or still use, biodegradation standards to quantify disintegration. Something we find rather inappropriate.

As an EN 13432 certification body, we refer to ISO 16929 since its publication in 2002, or to the European standard EN 14045 published a year later.

The time limits (12 weeks = 84 days) and requirements are identical : after this time, a maximum of 10% (dry weight) of the test material may not pass through a 2 mm mesh sieve.

(2) Extrapolations

Only ISO 17088 provides for the possibility of extrapolating results when time is reduced : if disintegration is achieved for the maximum thickness (X) in 12 weeks, it is taken for granted that a thickness of X x 0.45 will achieve sufficient disintegration in half the time (6 weeks / 42 days). And most standards logically specify that thicknesses, densities or mass/surface lower than those tested are automatically compliant.

(3) Later use of compost for ecotoxicity

Finally, note that if the ISO 20200 standard is used, the compost obtained cannot be used for subsequent ecotoxicity tests.

6. Ecotoxicity




					
	EN 13432 2000	EN 14995 2006	ISO 18606 2013	ISO 17088 2021	ASTM D6400 2023
applicable standard (1)	OECD 208 modified according to EN 13432 annex E	OECD 208 modified according to EN 13432 annex E	OECD 208 modified according to ISO 18606 annex B	OECD 208 OR ISO 11269-2	OECD 208 modified according to EN 13432 annex E
criteria	germination & biomass > 90% on minimum 100 seeds	germination & biomass > 90% on minimum 100 seeds	germination & biomass > 90% on minimum 100 seeds	germination & biomass > 90% on minimum 50 seeds	germination & biomass > 90% on minimum 100 seeds
compost prepared according to	-	-	only ISO 16929	only ISO 16929	not ISO 20200
worm test (2)	-	-	-	ISO 11268-1 ISO 11268-2 (ASTM E1676)	-
criteria	-	-	-	> 90%	-
nitrification (3)	-	-	-	ISO 15685	-
criteria	-	-	-	< 80%	-

Table 5

Ecotoxicity criteria have evolved the most in recent years and are set to become more generalised.

(1) Plant growth test

The approach is the same for all the standards covered by this comparative study: compost resulting from the disintegration tests, mixed at different concentrations with reference/blank compost, is used to check the potential effects on the emergence and mass of different plants (selected from a choice proposed in OECD308 with some variations specified in the appendix to the said standards) : « *a minimum of 90% emergence and mass must be achieved in the test compost compared with a reference compost (without bioplastic)* ».

(2) Earthworm test

In the selection of standards covered by this comparative study, only the latest revision (2021) of ISO 17088 includes verification of the absence of ecotoxicity on earthworms : « *the difference in the morbidity or mean weight of surviving worms must be < 10%* ».

However, these tests are likely to become more generalised with the revisions of other standards over the coming years.

(3) Nitrification inhibition test

Similarly, nitrification tests as specified in the latest revision of ISO 17088 (as well as EN 17427 for home compostable bags) will become more widespread in the future : « *nitrite formation in compost exposed to the test material shall be > 80 % of those from the corresponding blank compost* » .

Standard EN 13432, which is due to be revised soon, should incorporate these additional ecotoxicity tests.

7. Conclusion

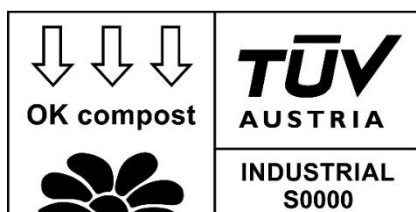
It is clear that the criteria for all these standards are quite similar, but not identical. However, the main criteria have converged over time and with the periodic revisions of the standards.

We strongly advise companies having their products tested as part of the certification process to contact us before carrying out the tests, so that we can assess their current and future needs and establish a relevant and complete test protocol.

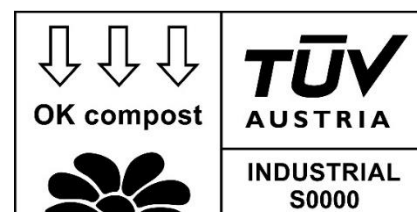
EN 13432, the mother of all standards in this field, will be no exception, and its forthcoming revision will incorporate certain criteria already provided for in the most recent standards, such as earthworm tests and nitrification tests, or biodegradation requirements for constituents between 1 and 10% or even 15%.

We advise all companies with certified raw materials to be proactive and to test the biodegradability of their used components between 1 and 15% as soon as possible, so as to avoid being trapped by time.

And finally, as a reminder, all these standards can be combined with the **OK compost INDUSTRIAL** certification to cover local requirements imposing a particular standard, which can be integrated into our logos.



ASTM D6400



ABNT NBR 15448-2