Oxo-Biodegradable Plastics Association
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STANDARDS for TESTING OXO-BIODEGRADABLE PLASTICS

Oxo-biodegradation is officially defined by CEN[1] as "degradation resulting from oxidative and cell-mediated phenomena, either simultaneously or successively."

OXO-BIODEGRADABLE plastic can be tested according to:

- **American Standard** ASTM D6954-04 – "Standard Guide for Plastics that Degrade in the Environment by a Combination of Oxidation and Biodegradation"
- **British Standard 8472** Packaging – Method for determining the degradability, oxo-biodegradability and phyto-toxicity of plastics
- **French Accord T51-808** Plastics Assessment of oxobiodegradability of polyolefinic materials in the form of films
- **Swedish Standard SPCR 141** Polymeric waste degradable by abiotic and subsequent biological degradation – Requirements and test methods
- **UAE Standard 5009:2009** Standard & Specification for Oxo-biodegradation of Plastic bags and other disposable Plastic objects
- **ISO 17556** Plastics — Determination of the ultimate aerobic biodegradability in soil by measuring the oxygen demand in a respirometer or the amount of carbon dioxide evolved
- **There are also standards** in Singapore, Jordan, Iran, and other countries
- There is also a **French Standard XP_T_54-980__F** for oxo-biodegradable plastics in agriculture

These Standards measure:

- Tier 1 – Degradability
- Tier 2 - Biodegradability
- Tier 3 - Eco-toxicity

See also **OECD 201-208** (Eco-toxicity tests)

[1] the European Standards Organisation

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IRRELEVANT STANDARDS
(See below under "Tests for Compostable Plastic"

- EN 13432 (except for eco-toxicity test)
- ASTM D6400 (except for eco-toxicity test) D5338, 6002;
- AUSTRALIAN 4736
- ISO 17088

These are all standards for biodegradation in the special conditions found in industrial composting. They require short timescales and rapid CO_2 emissions

The standards for degradation in anaerobic conditions are also irrelevant, because oxo-biodegradation requires oxygen.

Oxo-biodegradable plastic products are bio-assimilated in the same way as nature's wastes after their molecular weight has reduced to 40,000 Daltons or less.

There are two types of Standards – Standard Guides and Standard Specifications ASTM 6954 is an acknowledged and respected Standard Guide for performing laboratory tests on oxo-biodegradable plastic. It has been developed and published by ASTM International – the American standards organisation,

ASTM D 6954 and BS 8472 have no less than six pass/fail criteria. 1 - for the abiotic phase of the test (6.3 - 5% e-o-b and 5,000DA) 2 - the tests for metal content and other elements (6.9.6), 3 - Gel content (6.6.1), 4 - Ecotoxicity (6.9.6 -6.9.10), 5 - PH value (6.9.6) and 6 - for the biodegradation phase, (for unless 60 % of the organic carbon is converted to carbon dioxide the test cannot be considered completed and has therefore failed)

The tests performed according to ASTM D6954-04 tell industry and consumers what they need to know – namely whether the plastic is (a) degradable (b) biodegradable and (c) non eco-toxic. It is not necessary to refer to a Standard Specification unless it is desired to use the material for a particular purpose such as composting for which a specification is available. Note 3 to ASTM D6954-04 provides that if composting is the designated disposal route, ASTM D6400 should be used.

Conditions in the laboratory are designed to simulate so far as possible conditions in the real world, but have to be accelerated in order that tests may be done in a reasonable time and at reasonable cost. This does not invalidate the results in relation to real-world conditions.

There is no requirement in ASTM D6954-04 for the plastic to be converted to $C0_2$ in 180 days because, while timescale is critical in an industrial composting process, it is not critical for biodegradation in the environment. Timescale in the natural environment depends on the amount of heat, light, and stress to which the material is subjected. Nature's wastes such as leaves twigs and straw may take ten years or more to biodegrade, but oxo-bio plastics will biodegrade more quickly than that, and much more quickly than ordinary plastic.

In oxo-biodegradable plastics there are anti-oxidants mixed with the resins, and they must be consumed before degradation starts. People sometimes do not understand this sequence. An induction period must therefore elapse before degradation starts, due to the presence of the anti-oxidants, which have been included to give the product a pre-determined service-life.

Packaging made from oxo-biodegradable plastic complies with paras. 1, 2 3(a), (b) and (d) of Annex II of the European Parliament and Council Directive 94/62/EC (as amended) on Packaging and Packaging Waste. This Annex specifies the essential requirements for the composition and the reusable and recoverable, including recyclable, nature of packaging.

Oxo-biodegradable plastic satisfies para. 3(a) because it can be recycled. It satisfies para. 3(b) because it can be incinerated. It satisfies para. 3(d) because it is capable of undergoing physical, chemical, thermal or biological decomposition such that most of the finished compost ultimately decomposes into carbon dioxide, biomass and water. It can even satisfy para. 3(c) if composted in an "in-vessel" process.[2]

STANDARDS FOR COMPOSTABLE PLASTICS

Biodegradation in the environment is NOT the same thing as composting.

Composting is an artificial process operated to a much shorter timescale than the processes of nature. Standards (such as ASTM D6400, D6868; EN13432, and Australian Standard 4736 see below) designed for compostable plastic are not therefore appropriate for plastic which is designed to self-destruct if it gets into the environment.

EN13432, ASTM D6400, D6868, ISO 14855, 17088 and Australian Standard 4736-06 are designed for compostable plastic and are NOT appropriate for plastic which is designed to degrade then biodegrade if it gets into the open environment. Composting is an artificial process operated according to a much shorter timescale than the processes of nature, and EN13432 itself says that is not appropriate for waste which may end up in the environment through uncontrolled means.

The requirement in EN13432 and similar standards for 90% conversion to CO_2 gas within 180 days is not useful even for composting, because it contributes to climate change instead of contributing to the improvement of the soil. "Compostable" plastic, 90% of which has been converted to CO_2 gas, is therefore virtually useless in compost. Nature's lignocellulosic wastes, such as leaves and straw do not behave in this way.

"Compostable" plastic is compliant with EN13432 and similar standards precisely because it emits CO_2 (a greenhouse gas) at a high rate.

The Note to paragraph 5 of EN 13432 says: "It is important to recognise that it is not necessary that biodegradation of packaging material or packaging be fully completed by the end of biological treatment in technical plants but that it can subsequently be completed during the use of the compost produced." This is what oxo-biodegradable plastic does, and it is consistent with the behaviour of nature's waste products such as twigs, leaves and straw, which take years to biodegrade fully. Oxo-biodegradable plastics will biodegrade much more quickly than these natural materials.

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[2] EU law does not require compliance with EN13432 even for compostable plastics

If a leaf were subjected to the CO_2 emission tests included in EN13432 it would not pass! Leaves are not of course required to pass any such test, but it shows how artificial the standard is.

Conversion of organic materials to CO_2 at a rapid rate during the composting process is not "recovery" as required[3] by the European Directive on Packaging and Packaging Waste (94/62/EC as amended),[4] and should not really be part of a standard for composting. Nature's lignocellulosic wastes do not behave in this way, and if they did they would have little value as soil improvers and fertilisers, having lost most of their carbon.

The EU Directive does NOT require that when a packaging product is marketed as "degradable" or "compostable" conformity with the Directive must be assessed by reference to EN13432. The Directive[5] provides that conformity with its essential requirements may be presumed if EN 13432 is complied with, but it does not exclude proof of conformity by other evidence. Indeed Annex Z of EN13432 itself says that it provides only **one means of conforming** with the essential requirements.

[3] Annex II para. 3

[4] http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:1994L0062:20050405:EN:PDF

[5] Article 9(2)