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Moving from Oxo-Degradable to Certified Compostable:

The Case for PLA



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Executive Summary

Oxo-degradable plastics are conventional plastics, typically polyolefins such as polyethylene (PE) or polypropylene (PP), with additives that make the material break into small pieces[3][5]. They are often marketed as "oxo-biodegradable" or "degradable", but the evidence shows they fragment, and there is no evidence that they fully biodegrade[2][3]. This paper sets out what oxo-degradable plastics are, what the evidence says about them and where regulators and industry stand, and compares them with certified compostable polymers such as PLA.

Key Findings

- **No evidence of full biodegradation:** the European Commission found no evidence that oxo-degradable plastic fully biodegrades in a reasonable time, and flagged a risk of accumulating microplastics[2].
- **Not compostable, a risk to recycling:** oxo-degradable plastic is not compostable, and in conventional recycling it can lead to poor quality recyclate[1][2].
- **No standard behind the claim:** there is no internationally established standard or certification that proves oxo-degradation[3].
- **Banned in the EU:** EU law has required Member States to ban products made from oxo-degradable plastic since 3 July 2021, and over 150 organizations back a worldwide ban on oxo-degradable plastic packaging[1][4].
- **Deceptive under US guidance:** under the US Federal Trade Commission's Green Guides, unqualified degradable claims are deceptive for items that usually end up in landfill, incineration or recycling[12].
- **Certified compostable products break down quickly:** in a full-scale industrial composting trial, EN 13432 certified items, including PLA, broke down within 22 days at most, well inside the 12-week limit set by EN 13432[10][11].

1. Introduction

Products labelled "oxo-degradable" or "oxo-biodegradable" are often presented as a more sustainable version of conventional plastic[3]. For anyone choosing materials for single-use products and packaging, or planning how that packaging is collected and treated at end of life, it matters whether that claim holds.

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This paper reviews the findings of the European Commission, independent research and industry, summarizes how regulators have responded, and compares oxo-degradable plastics with certified compostable polymers such as PLA. It is written for customers, partners and regulators in the GCC.

2. What oxo-degradable plastics are, and what they are not

Oxo-degradable plastics are conventional plastics, typically polyolefins such as polyethylene (PE) or polypropylene (PP), with additives mixed in[5]. The EU defines them as "plastic materials that include additives which, through oxidation, lead to the fragmentation of the plastic material into micro-fragments or to chemical decomposition"[1].

They are not bioplastics. European Bioplastics states that "oxo-biodegradables" and other additive-mediated plastics "are not bioplastics", and that the additives only facilitate fragmentation, while the material does not fully degrade[3].

There is also no accepted way to prove the claim. According to European Bioplastics, "there is currently no internationally established and acknowledged standard or certification process" for oxo-degradation, which makes "oxo-degradable" "just an appealing marketing term"[3]. Figure 1 shows how the end of life of oxo-degradable plastic differs from that of certified compostable PLA.

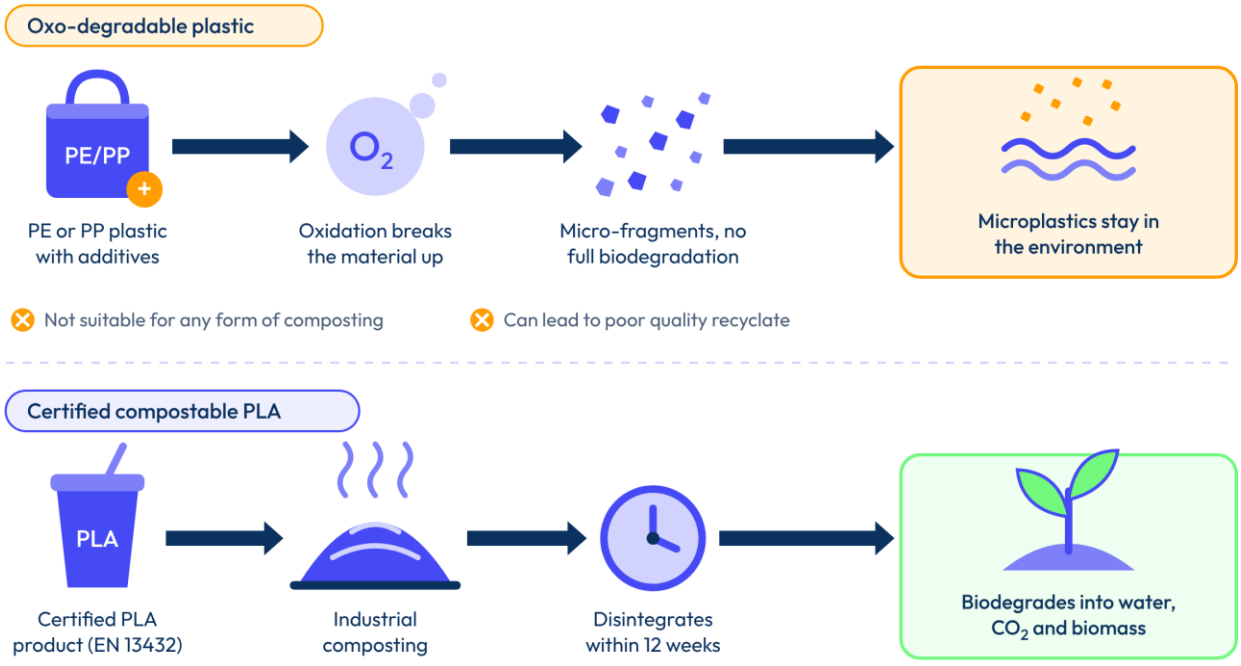


Figure 1: End of life of oxo-degradable plastic and certified compostable PLA[1][2][3][5][10]

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3. The evidence: fragments, not biodegradation

The European Commission reviewed the evidence in its January 2018 report to the European Parliament and the Council, and found problems on four fronts, summarized in Figure 2[2]:

- **Biodegradation.** "There is no evidence that oxo-degradable plastic will subsequently fully biodegrade in a reasonable time in the open environment, on landfills or in the marine environment." For none of the environments reviewed had a full biodegradation process been documented.
- **Microplastics.** Fragmentation brings "a subsequent risk of an accelerated and accumulating amount of microplastics in the environment."
- **Composting.** The evidence suggests oxo-degradable plastic is "not suitable for any form of composting or anaerobic digestion."
- **Recycling.** Its presence in a conventional plastic recycling system "can lead to poor quality recycle."



Figure 2: Findings of the European Commission's 2018 report on oxo-degradable plastic[2]

These findings match earlier research. A 2010 study by Loughborough University for the UK Department for Environment, Food and Rural Affairs (Defra) found that oxo-degradable plastics were not suitable for composting or mechanical recycling, and did not deliver the environmental benefits often claimed for them[5].

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4. Where regulators and industry stand

Table 1 summarizes the key regulatory and industry milestones, which are described below.

Date	Who	Milestone
Oct 2012	United States	FTC revises its Green Guides, under which unqualified degradable claims are deceptive for items that usually go to landfill, incineration or recycling[12]
Oct 2016	Saudi Arabia	SASO issues regulation M.A-156-16-03-03, requiring a list of disposable PE and PP products up to 250 microns to be oxo-biodegradable[6][7]
Apr 2017	Saudi Arabia	Phase 1 of the SASO regulation starts, with enforcement at import from December 2017[6][9]
Nov 2017	Industry and NGOs	Ellen MacArthur Foundation calls for a worldwide ban on oxo-degradable plastic packaging, now backed by over 150 organizations[4]
Jan 2018	European Union	European Commission report: no evidence of full biodegradation; evidence suggests it is not suitable for composting[2]
Jun 2019	European Union	Directive (EU) 2019/904 adopted, requiring Member States to ban products made from oxo-degradable plastic[1]
Feb 2020	Saudi Arabia	SASO suspends phases 2 and 3 of the regulation[8]
Jul 2021	European Union	Member State bans on products made from oxo-degradable plastic apply from 3 July 2021[1]

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Date	Who	Milestone
Jan 2022	Industry	U.S. Plastics Pact lists oxo-degradable additives as problematic and unnecessary materials to eliminate by 2025[13]

Table 1: Key regulatory and industry milestones

European Union. Directive (EU) 2019/904 requires Member States to "prohibit the placing on the market" of products made from oxo-degradable plastic, from 3 July 2021[1]. The ban followed the Commission's 2018 report, which concluded that "EU wide measures should be considered"[2].

Industry. Over 150 organizations back the Ellen MacArthur Foundation's call to ban oxo-degradable plastic packaging worldwide, first published in November 2017[4]. They include PepsiCo, Unilever, Veolia and the Gulf Petrochemicals and Chemicals Association (GPCA)[4]. The statement says "compelling evidence suggests that oxo-degradable plastics take longer than claimed to degrade and that they fragment into small pieces which contribute to microplastics pollution"[4].

United States. The Federal Trade Commission's Green Guides, its guidance on environmental marketing claims, state that it is deceptive to misrepresent that a product or package is "degradable, biodegradable, oxo-degradable, oxo-biodegradable, or photodegradable"[12]. Unqualified degradable claims for items that are usually disposed of in landfills, incinerators and recycling facilities are deceptive, because these locations do not present conditions in which complete decomposition will occur within one year[12]. In January 2022, the U.S. Plastics Pact also listed "oxo-degradable additives, including oxo-biodegradable additives" among the problematic and unnecessary materials its members aimed to eliminate by 2025[13].

Saudi Arabia. The technical regulation M.A-156-16-03-03 of the Saudi Standards, Metrology and Quality Organization (SASO), issued in 2016, required a list of disposable PE and PP products, such as bags and films up to 250 microns thick, to be oxo-biodegradable and to carry a SASO logo[6][7]. It was to be rolled out in three phases covering 16 product groups[6]. The first phase started in April 2017[9], and from December 2017 non-compliant first-phase products could no longer be imported, produced or offered for sale in Saudi Arabia[6]. The second phase was to extend the rule to more packaging, such as stretch, shrink and cling films, bubble wrap, flower wraps, and courier and mail-order bags[16]. The third phase was to add items such as carton liners and bags used for soil remediation[17]. In June 2019, SASO postponed both phases for the second time, to April 2020[18]. In

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February 2020, SASO suspended them[8]. Its board limited the regulation to the first-phase products and agreed to form a working group with the Ministry of Environment, Water and Agriculture to evaluate it[9].

5. The compostable alternative

Certified compostable polymers such as PLA are designed for the opposite outcome. In industrial composting they biodegrade into water, CO_2 and biomass, and this can be proven against a recognized standard[10][20].

EN 13432, the European standard for compostable packaging, requires the material to disintegrate within 12 weeks and at least 90% of its carbon to be converted to CO_2 within six months[10][15]. It also includes tests on ecotoxicity and heavy metal content[10].

The US standard, ASTM D6400, sets the requirements for "plastics and products made from plastics" that are designed to be composted in municipal or industrial facilities[14]. According to the certification body TÜV AUSTRIA, the two standards are broadly the same, though not identical: both require 90% of the material's carbon to be converted to CO_2 within six months, and both include a plant growth test and limits on heavy metals[15]. Products that meet the EN 13432 limits on heavy metals also meet those of ASTM D6400 in the US[15]. Figure 3 compares the core requirements of the two standards.

Requirement	EN 13432 Europe	ASTM D6400 United States
Biodegradation	90% of carbon converted to CO_2 within 6 months	90% of carbon converted to CO_2 within 6 months
Disintegration	At least 90% passes a 2 mm sieve after 12 weeks	At least 90% passes a 2 mm sieve after 12 weeks
Plant growth	At least 90% germination and biomass vs reference compost	At least 90% germination and biomass vs reference compost
Heavy metals	Below 50% of the EU Ecolabel limits for soil improvers	Below 50% of the limits for sludges or composts where sold

Figure 3: Core requirements of EN 13432 and ASTM D6400[14][15]

In practice, disintegration can be much faster than the EN 13432 maximum. In a full-scale trial at an industrial composting facility in the Netherlands, Wageningen University & Research found that EN 13432 certified products broke down within 22 days at most, and a PLA plant pot disintegrated after the first 11-day cycle[11]. Figure 4 sets these results against the EN 13432 maximum.

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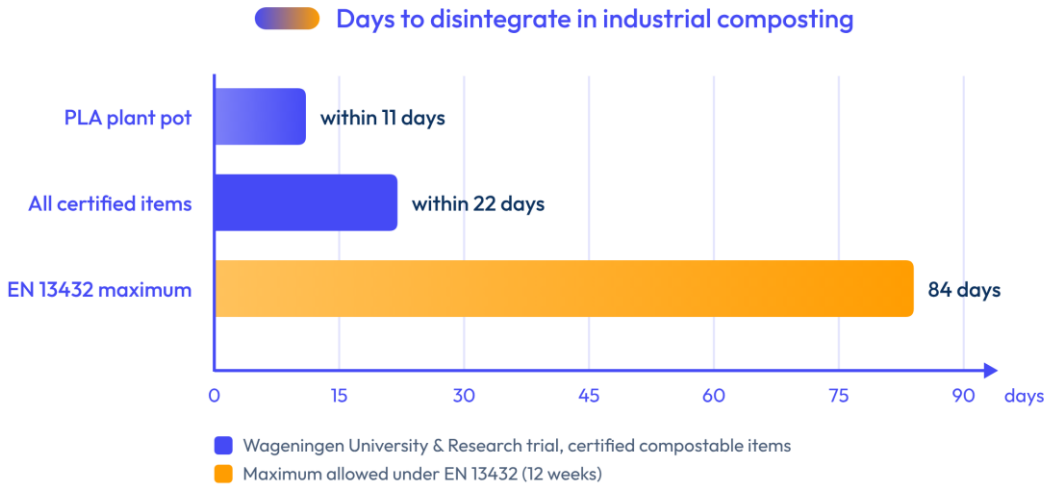


Figure 4: Wageningen composting trial results against the EN 13432 maximum[10][11]

Table 2 compares the two materials side by side.

	Oxo-degradable plastic	Certified compostable PLA
What it is	Conventional polyolefin, such as PE or PP, with additives[3][5]	Bio-based polymer certified to a composting standard such as EN 13432 or ASTM D6400[10][14][19]
What happens to it	Fragments into micro-fragments[1][2]	Biodegrades into water, CO_2 and biomass in industrial composting[10][20]
Proof	No accepted standard or certification[3]	EN 13432 or ASTM D6400 certification[10][14]
Composting	Not compostable[1][2]	Certified items, including PLA, broke down within 22 days in a full-scale industrial trial[11]

Table 2: Oxo-degradable plastic compared with certified compostable PLA

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6. Conclusion and recommendation

Oxo-degradable plastics do not solve plastic waste: they break down into fragments that remain in the environment, they are not compostable, and they can lower the quality of recycled plastic[1][2][3]. Where single-use products and packaging are likely to end up with food or garden waste, we recommend:

1. Specify certified compostable polymers such as PLA, certified to EN 13432 or ASTM D6400, instead of oxo-degradable plastics, where the waste is collected for industrial composting.
2. Do not accept "oxo-biodegradable" claims as proof of biodegradability or compostability; ask for certification to a recognized standard[3].
3. Keep oxo-degradable materials out of composting and recycling streams[2].

Embio Biotech supplies PLA polymers for compostable products and can support customers and authorities with material selection and compostability documentation.

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