State of Oregon
Department of Environmental Quality

White Paper – Effectively Composted Definition

Background and context

Food serviceware and packaging, advertised as compostable, has the potential of presenting a number of challenges to composting facilities if not "effectively composted," including: 1) introducing contamination into compost if the item does not compost, 2) increasing contamination resulting from user confusion and "look-alike" non compostable plastic materials, 3) increasing composting facility operating costs to remove contamination, and 4) hurting compost sales because of contamination. More detail on the impacts of contamination is found in A Message from Composters Serving Oregon.

The term "effectively composted" appears in **ORS 459A.965 Prohibition on promoting acceptance of certain materials for composting; pilot programs.** This statute was adopted in 2021 with other statutes that resulted from Oregon's Plastic Pollution and Recycling Modernization Act. The statute prohibits local governments, haulers, composters and others from promoting the acceptance of certain materials for composting that cannot be "effectively composted."

> **459A.965 Prohibition on promoting acceptance of certain materials for composting; pilot programs.** (1) A person that operates or controls a collection program for yard debris or food waste or that operates or controls a compost facility may not promote for acceptance any material that cannot or will not be effectively composted.
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> (2) The Department of Environmental Quality, or entities approved by the department, may conduct research or pilot projects to examine the collection and compostability of materials and to identify materials that can and cannot be effectively composted. A pilot or research project may not exceed two years in duration.
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> (3) Nothing in this section prevents a compositing facility from accepting materials that are not readily compostable and are incidentally collected as part of a collection program. [2021 c.681 §41]

The term "effectively composted" is not defined in statute or rule. For DEQ to administer this prohibition, DEQ staff and regulated entities must understand what the term "effectively composted" means.

DEQ staff considerations

DEQ staff identified several considerations for interpreting the term "effectively composted," including how to address: 1) the potential for and type of benefit a material presents, 2) the potential for and type of harm a material presents, and 3) whether to include life cycle impacts (beyond impacts at the compost site or through use of compost) of the material.

In considering what effectively composted means, DEQ staff used state policy, identified in ORS 459.015, as a basis of understanding. That policy identifies a preference for composting as a management method above incineration and landfilling and indicates that "composting or digestion results in net reductions in impacts on human well-being and environmental health…"

Additionally, DEQ staff considered that the primary purpose of composting facilities is to break down or decompose organic matter (yard debris, manures, food waste, crop residues, etc.). The compost produced by a composting facility contains decomposed plant and animal material, also called humus, and is intended to improve soil condition/productivity to enhance plant growth, conserve water and reduce the need for pesticides, among other benefits.

Maintaining the environmental benefits of composting

Composting facilities are also businesses that need to be profitable to operate. The compost they produce should be free of plastic and other contamination to maximize sales (from a business perspective). Contamination hurts the usefulness and benefits of compost and increases the environmental, energy and monetary costs to remove it. Commercial compost sales are hurt when the public won't buy contaminated compost. Farmers and gardeners won't place contaminated compost on their soil. It's important to determine if a material can "effectively compost" or whether it leaves contamination or causes some other negative impact that would impair the economic (and reputational) viability of Oregon composters and the environmental benefits that their products offer.

Type of composting system effects whether a material can be effectively composted

The type of composting system used to process a material can influence whether a material can be "effectively composted." Aerobic composting facilities may be able to fully decompose compostable products, if operated in a certain manner, while anaerobic digestion systems may find this more challenging. Even within the narrow universe of aerobic composting sites, differences in operational conditions (residence time, temperature, rainfall, etc.) between facilities may impact the ability of a facility to "effectively compost" a given material. Compost facilities are not controlled laboratories all following the exact same procedures under identical and replicated conditions; the composting process is not consistent across all facilities serving Oregon.

Research and experience have shown that, with appropriate feedstock preparation and careful attention to composting facility operations (maintaining adequate compost pile parameters and longer composting time), aerobic composting processes are capable of completely decomposing many manufactured materials that are certified as "compostable." Proper feedstock preparation and composting conditions are important. For example, shredding compostable products such as food service ware and mixing well with plant-based feedstocks may aid in decomposition. Oxygen and moisture levels within the composting piles must be monitored and maintained throughout the process. However, some compostable products generally take longer to break down in compost piles than the residence time some Oregon composting facilities have found to be economically viable, raising the question whether they can be "effectively composted."

Anaerobic digestion equipment can generally be lumped into two categories used for digestion: 1) "dry" digesters (high solids content) and 2) "wet" digesters (low solids content). All Oregon anaerobic digesters currently in operation are wet digesters. Regardless of the type of digester, compostable products cannot be decomposed in an anaerobic environment and typically the compostable products and all other contamination are separated from food waste feedstocks and disposed. The reason - anaerobic microorganisms are incapable of breaking down compostable packaging and food serviceware and in the case of wet anaerobic digestion, cause operational problems. Wet anaerobic digesters typically remove all plastics (compostable or non-compostable) and discard the plastic in a landfill prior to food waste slurry incorporation into the digester. Dry digesters may screen out and dispose all plastics (compostable or non-compostable) after the digestion process or may aerobically compost the digestate and screen and dispose what doesn't compost. Consequently, for Oregon digesters, no compostable food serviceware or other compostable products can be "effectively composted."

Compostable product testing

Testing for the compostability of food serviceware and packaging can be generally categorized as 1) laboratory studies and 2) field studies. Laboratory studies are conducted in a controlled environment to evaluate the rate of decomposition of compostable products and microbial growth. Laboratory studies follow standardized methods, for example ASTM D6400, to assess the biodegradation and the disintegration of compostable materials. Field studies are conducted in a real-world setting to evaluate the disintegration of compostable products inside a composting facility. They assess the disintegration only. Field studies use laboratory studies to confirm a product is biodegrading, that is, being converted by microbes at a molecular level.

There is a difference between lab-based compostability tests and real-world disintegration performance. Laboratory tests can verify that a product will biodegrade and disintegrate under composting conditions, but the conditions for lab tests, like feedstock, moisture, and temperature, are kept constant through the test, and the test duration is up to 180 days. Oregon composting facilities do not operate at conditions maintained in laboratories.

In contrast, composting piles experience daily fluctuations in temperature and moisture, and retention times vary widely across facilities, with many sites completing active composting within six weeks or less. As a result, materials certified as "compostable" via lab tests may not break down as effectively in a real composting environment. Field testing is used to assess how compostable products tested in the lab actually behave in a facility's composting piles.

Compostable product certification

Several third-party organizations administer certifications for products marketed as "compostable," including the Biodegradable Products Institute and the Compost Manufacturing Alliance. These certifications are intended to indicate that a product has been evaluated against defined compostability criteria, generally using standardized testing approaches.

BPI certification is based on laboratory testing to applicable ASTM compostability standards and evaluates whether a product meets specified criteria for biodegradation, disintegration, and certain chemical characteristics under controlled conditions. CMA certification also references laboratory compostability standards but incorporates additional field testing to observe disintegration performance at participating composting facilities. The certifications differ in scope, with laboratory-based testing intended to assess performance under standardized conditions and field-based testing intended to observe performance under selected real-world operating conditions.

DEQ staff conclusions and definition

After research, consideration and discussion, DEQ staff reached the following conclusions:

- The analysis of whether a material is effectively composted should be approached as a facility-specific concept, since how a facility is designed and operated determines if a material can be "effectively composted".
- To be "effectively composted," a material should both provide benefit to the finished compost product and avoid harm to the composting facility (contamination).
- Whether a compostable product fully disintegrates in a composting process may be an inadequate measure of "effectively composted," particularly from a chemical and a material life cycle perspective.
- Due to the level of complexity involved, the determination of whether a material can be "effectively composted" should not include assessing the material's life cycle impacts.

DEQ staff propose the following draft definition:

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Effectively composted is a material and facility-specific concept and means a material, allowed by law and accepted for composting at a composting facility, that, when composted at the facility:

1. **Contributes to the beneficial soil properties of the final compost, and**
2. **Leaves an amount and type of biological, chemical or physical residue that does not harm the environment or public health or cause nuisance when the compost is used properly at agronomic application rates.**

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The purpose of DEQ's Technical Workgroup on defining "effectively composted" is to consider and provide feedback on this draft definition.

Important definitions

OAR 340-093-0030 definitions

(5) **"Agronomic application rate"** means land application of no more than the optimum quantity per acre of compost, sludge or other materials. In no case may such application adversely impact the waters of the state. Such application must be designed to:

(a) Provide the amount of nutrient, usually nitrogen, needed by crops or other plantings, to prevent controllable loss of nutrients to the environment;

(b) Condition and improve the soil comparable to that attained by commonly used soil amendments; or

(c) Adjust soil pH to desired levels.

(26) "**Composted material**" or "**compost"** is the solid material resulting from the composting process. It includes both the material produced from aerobic composting and the solid digestate produced by anaerobic digestion, although the solid digestate may require additional composting in order to be suitable for certain applications.

(27) "**Composting**" means the managed process of controlled biological decomposition of feedstocks. A managed process includes, but is not limited to, reducing feedstock particle size, adding moisture, mixing feedstocks, manipulating composting piles, and performing procedures to achieve human pathogen reduction. "composting" includes both aerobic composting and anaerobic digestion. Other examples of composting include bokashi, fermentation, and vermiculture.

(28) "**Composting facility**" means a site or facility composting feedstocks to produce a useful product through a managed process of controlled biological decomposition. Examples of composting facilities include sites used for composting windrows and piles, anaerobic digestion, vermiculture, vermicomposting and agricultural composting.

459A.863 definitions. As used in ORS 459A.860 to 459A.975:

(4) "**Contaminant**" means:

(a) A material set out for recycling collection that is not properly prepared and on the list of materials accepted for recycling collection by a recycling collection program; or

(b) A material shipped to a recycling end market that is not accepted or desired by that end market.

(5) "**Contamination**" means the presence of one or more contaminants in a recycling collection or commodity stream in an amount or concentration that negatively impacts the value of the material or negatively impacts a processor's ability to sort that material.

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