UNIVERSITY OF GEORGIA
New Materials Institute

The confusion around biodegradability

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Degradable plastic: A material that will undergo a substantial change in chemical structure under certain specific environmental conditions, resulting in a change in the material properties such as fragmentation, thermomechanical properties, and/or discoloration. Degradable plastics are not necessarily biodegradable or compostable. The process is better described as *micronization*.

Biodegradable: a degradable plastic in which the degradation results from the action of naturally occurring microorganisms such as bacteria, fungi, and algae. The process of biodegradation depends on the surrounding environment (moisture, temperature, inoculum, microbial load) and on the material itself.

Compostable: a plastic that undergoes degradation by biological processes during composting to yield CO_2, water, inorganic compounds, and biomass at a rate consistent with other known compostable materials and leaves no visible, distinguishable or toxic residue.

Oxodegradable or **Biooxodegradable:** substances added to conventional plastics with the intention of promoting oxidation. Oxidation brittles and fragments the material, accelerating the *micronization* process.

Compostability Certification

ASTM D6400 §6.1 – 6.4

6.3.1 Ninety percent (90 %) of the organic carbon in the whole item or for each organic constituent, which is present in the material at a concentration of more than 1 % (by dry mass), shall be converted to carbon dioxide by the end of the test period when compared to the positive control or in the absolute.

What is “Compostable”?

North America (ASTM D5338 and ASTM D6400)

BPI ®

COMPOSTABLE
IN INDUSTRIAL FACILITIES

Check locally, as these do not exist in many communities. **Not suitable for backyard composting.** CERT # SAMPLE

Australia (AS 4736 and AS 5810)

Compostable
AS 4736
ABAX 9999

Home Compostable
AS 5810
ABAX 9999

Germany (DIN EN 13432 and DIN EN 14995/14855)

INDUSTRIAL COMPOSTABLE DIN Geprüft

HOME COMPOSTABLE DIN Geprüft

UK (BS EN 13432 and BS EN 14995/14855)
France (NT T 51-800 and NF EN 13432)

compostable

Belgium (OK Compost Industrial and OK Compost Home)

OK compost TÜV AUSTRIA INDUSTRIAL

HOME OK compost TÜV AUSTRIA HOME

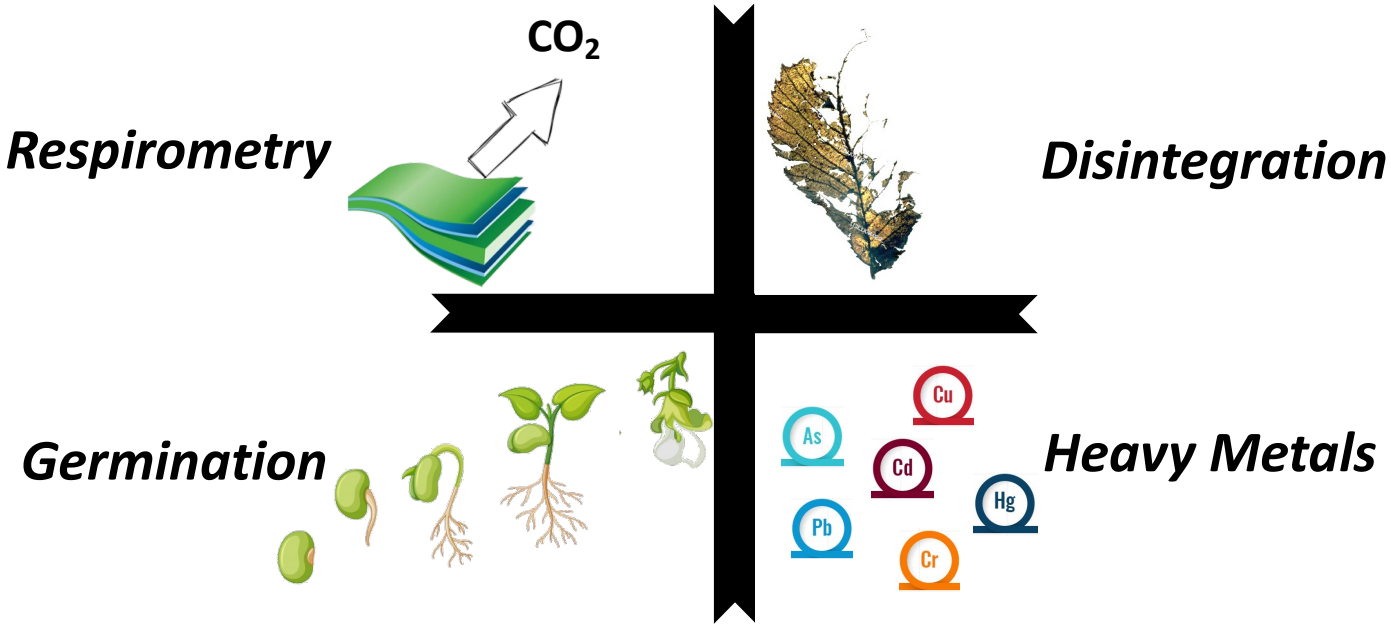
Japan

グリーンプラ®
生分解性プラスチック

How to Measure Biodegradability?

$$C + O_2 \rightarrow CO_2$$

Respirometry: a number of different techniques for obtaining estimates of the rates of metabolism of vertebrates, invertebrates, plants, tissues, cells, or microorganisms.



RESPIROMETRY AND DISENTIGRATION

Biodegradable Testing

Standard Test Method for Determining Aerobic Biodegradation of Plastic Materials

ASTM D6691: In the Marine Environment by Natural Sea Water Inoculum

ASTM D5271: In Municipal Sewage Sludge

ASTM D5338: Under Controlled Composting Conditions

ASTM D5988: In Soil

DISINTEGRATION PHOTOGRAPHY

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Multiple incubators allows for testing at different temperatures industrial, ”home”, soil, marine, wastewater, freshwater

For more information contact: Dr. Branson Ritchie (britchie@uga.edu) and Dr. Evan White (emwhite@uga.edu)

In 2019, we trademarked a Bioseniatic™ testing and service mark for the Bioseniatic℠ Laboratory

"Naturally-sourced or synthetically-derived polymers with no additives or chemical modifications to their structure that prevent them from being biologically converted into a non-polymeric form of naturally occurring, non-toxic compounds at a rate congruous with natural analogues."

The Bioseniatic℠ Laboratory is available to test any product currently in development or use, from any manufacturer or researcher.

We base our testing on ASTM and similar testing agency standards, but we require more: we ***encourage manufacturers to test their actual product or packaging, not just polymer powders or thin films***; we test in both laboratory and field settings, in cold and warm climates.

We do not set a specific time limit for degradation, what is more important is the outcome (degrades to its natural non-polymeric state leaving no toxic residues behind).

In addition to these requirements, after degradation is completed, we use advanced imaging technologies to examine the contents of the testing chamber for the ***presence of residual micro- and nano-sized plastic particles***.