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**NATIONAL STANDARD OF THE
PEOPLE'S REPUBLIC OF CHINA**

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**Plastics - Determination of specific aerobic biodegradation rate
of solid plastic materials and disappearance time (DT50) under
mesophilic laboratory test conditions**

塑料 中温实验室试验条件下固体塑料材料的特定需氧生物分解率和消失时间 (DT50) 的测定

(English Translation)

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Foreword

This document complies with the provisions of GB/T 1.1-2020 "Standardization Work Guidelines Part 1: Structure and Drafting Rules of Standardization Documents".

Drafting.

This document is equivalent to ISO 5148:2022 "Plastics - Solid plastic materials under

intermediate temperature laboratory conditions - Specific aerobic biodegradation".

Determination of resolution and disappearance time (DT50).

Please note that some content in this document may involve patents. The issuing organization of this document assumes no responsibility for identifying patents.

This document was proposed and is under the jurisdiction of the National Technical Committee on Standardization of Bio-based Materials and Degradable Products (SAC/TC380).

Introduction

ISO (International Organization for Standardization) has established various methods for determining the degree of biodegradability of plastics. Under aerobic conditions, the biodegradability of materials...

The solution reaction is as follows.

CM O₂ → CCO₂ H₂O CB

In the formula.

CM --- Organic carbon present in the test material (such as polymer or plastic material);

CCO₂ --- Carbon released in the form of carbon dioxide;

CB --- Carbon that is absorbed by microorganisms and incorporated into microbial biochemistry.

The testing method tracks biodegradation reactions by measuring oxygen consumption (disappearance of reactants) or CO₂ release (formation of products).

The experimental method can yield the percentage of biodegradation (strictly speaking, the percentage of "mineralization"). This value is the reaction yield percentage, i.e., the percentage of biodegradation during the reaction process.

The ratio of the mass of carbon oxidized to CO₂ (actual yield) to the maximum possible yield (theoretical yield). This is expressed as escaped CO₂/theoretical yield.

CO₂, the latter value is the CO₂ obtained when the initial carbon present in the test substance is completely oxidized.

As of the date of publication, there is no reliable method for determining CB (i.e., the amount of carbon in CM that has been assimilated into biomass carbon).

This test method is suitable for determining the final degree of biodegradation, but not for determining the rate of biodegradation, because it does not take into account the sample being tested.

The surface area. This article provides guidance on how to determine biodegradation rates using existing testing methods.

The biodegradation of solid, water-insoluble polymers and plastics is a heterogeneous reaction because the polymers are in a solid state, while microorganisms and enzymes...

Located in the liquid phase. Even when the test material is exposed to a solid matrix (such as compost, soil, marine sediments, etc.), the microorganisms remain in the solid matrix (such as...

The liquid phase exists within micropores and macropores. Therefore, biodegradation reactions occur at the liquid/solid interface, where the effective surface area can be used as a limiting factor.

It is well known that grinding plastic samples can increase their biodegradation rate. The biodegradation rate (i.e., CO₂ release rate and O₂ absorption rate) of the tested samples...

The surface area constraint of the test sample. Therefore, the biodegradation rate should be expressed as a function of the effective surface area; otherwise, this information is meaningless and will...

The result is contradictory.

Increasing attention is being paid to determining biodegradation rates and related parameters, such as time to disappearance (DT₅₀), which is the rate at which the initial concentration of the test substance decreases.

[50% less time required] to assess the risk in the event of accidental or intentional spillage of biodegradable plastics into the environment.

The degradation of substances can affect exposure, making it a key parameter for assessing the risk of long-term adverse effects on biota.

This document is capable of determining the specific aerobic biodegradation rate, that is, the mineralization per unit time and unit area under the conditions specified by the applied test method.

This represents the carbon content of CO₂.

The method described in this document aims to determine the mineralization rate. It is consistent with the method described in ISO 23832 for determining the physical decomposition rate and disintegration of plastic materials.

The testing methods for different degrees of exposure vary. On the other hand, ISO 22403 confirms the effectiveness of exposing plastic materials to seawater under mesophilic aerobic laboratory conditions.

The intrinsic biodegradability of marine inoculants.

Solid plastics under medium-temperature laboratory test conditions Specific aerobic biodegradation rate and disappearance time of materials (DT50) determination

1 Scope

This document specifies a method for measuring the specific aerobic biodegradability of solid, water-insoluble plastic materials under intermediate temperature conditions.

Note 1: Specific aerobic biodegradation rate (strictly speaking, specific mineralization rate, meaning assessing the conversion of organic carbon to CO₂, but ignoring biomass formation) is expressed as...

The amount of carbon mineralized into CO₂ per unit area per unit time.

The methods described in this document do not provide information regarding the final aerobic biodegradability of the test samples. Regarding plastic materials under intermediate temperature conditions...

Test methods for assessing the biodegradability of feedstock can be found in relevant standards such as ISO 23517 and ISO 22403. Only when appropriate standards (such as...) are used...

The methods described in this document may be used to determine the biodegradability of plastic materials only when ISO 23517 and ISO 22403 demonstrate that the materials are inherently biodegradable.

DT50. Furthermore, for plastic materials that have not yet been proven to be ultimately biodegradable, the measured specific biodegradation rate should not be considered as the material's intrinsic biodegradability.

Overall characteristics.

This document only considers CO₂ release as a direct measure of mineralization in test samples.

The methods described in this article can also be applied to solid materials used as a reference.

This document does not apply to the "Marine, Soil and Freshwater Biodegradability" claim for biodegradable plastic materials. Please refer to the relevant product for details.

Standards (if any).

Note 2: Although the results may indicate that the tested plastic materials and polymers will degrade at a certain specific aerobic biodegradability or DT50 under specified test conditions.

Biodegradation is performed, but any laboratory results are not directly applicable to actual use sites or leaks, including soil, marine environments, and lakes.