INTERNATIONAL STANDARD

**ISO 23832**

First edition
2021-06

# Plastics — Test methods for determination of degradation rate and disintegration degree of plastic materials exposed to marine environmental matrices under laboratory conditions

*Plastiques — Méthodes d'essai pour l'évaluation de la vitesse de dégradation et du degré de désintégration des matériaux plastiques exposés aux matrices environnementales marines dans des conditions de laboratoire*

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Reference number
ISO 23832:2021(E)

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Published in Switzerland

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# Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 61, *Plastics*, Subcommittee SC 14, *Environmental aspects*.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

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# Introduction

Plastics are potentially susceptible to ultimate biodegradation, i.e. to be decomposed by the actions of microorganisms under aerobic conditions into $CO_2$, water and biomass as can be proven with specific test methods. In most cases, biodegradation occurs at the surface of the plastics materials, i.e. at the solid-liquid interface. Microbes and enzymes cannot penetrate the solid plastic item, thus only the exposed surface is generally available to biodegradation. The physical effect of biodegradation on a solid plastic item is erosion leading to a thinning and weakening of the item. This process leads the item to lose mass, physical properties, and ultimately physical integrity by fragmentation into biodegradable particles whose ultimate fate is to be biodegraded. The term disintegration is used when the degradation process is extended until a total fragmentation of the original item into particles below a defined size is reached. When microorganisms cause degradation processes *bio*degradation, *bio*fragmentation, *bio*disintegration are the proper terms, etc. as suggested by CEN/TR 15351. However, when the physical breakdown rather than the chemical breakdown is measured, the generic term "degradation" is preferably used, reserving the term "biodegradation" to the assessment of the ultimate biodegradation, i.e. the conversion into $CO_2$, $H_2O$ and biomass.

The assessment of specific degradation rates occurring when plastics materials are exposed to marine matrices is needed for designing products intended for marine applications (e.g. biodegradable plastic fish and mussel farming, floating devices) and for assessment of the risk caused by leakage of products into the sea.

In this document three test methods for testing degradation are described. Plastics samples can be exposed to three different test conditions and different marine matrices:

— buried into a wet sandy marine sediment;

— at the interface between a marine sandy sediment and the water column;

— to seawater.

The conditions applied in these test methods are designed to determine the degradation rates of plastics materials and give an indication of their propensity to physical degradation and disintegration in natural environments.

Degradation rates considered in this document are mass loss rate, erosion rate, and mechanical properties loss. Disintegration, i.e. physical breakdown of a sample into very small fragments (<2mm), can also be assessed.

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# Plastics — Test methods for determination of degradation rate and disintegration degree of plastic materials exposed to marine environmental matrices under laboratory conditions

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## 1 Scope

This document specifies test methods for the measurement of the physical degradation of samples made with plastics materials when exposed to marine environmental matrices under aerobic conditions at laboratory scale.

This document is not suitable for the assessment of degradation caused by heat (thermo-degradation) or light exposure (photo-degradation).

## 2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 527-1, *Plastics — Determination of tensile properties — Part 1: General principles*

ISO 527-2, *Plastics — Determination of tensile properties — Part 2: Test conditions for moulding and extrusion plastics*

ISO 527-3, *Plastics — Determination of tensile properties — Part 3: Test conditions for films and sheets*

ISO 4593, *Plastics — Film and sheeting — Determination of thickness by mechanical scanning*

ISO 16012, *Plastics — Determination of linear dimensions of test specimens*

ASTM D 638-14, *Standard Test Method for Tensile Properties of Plastics*

## 3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

**3.1**
**biodegradation**
degradation caused by biological activity, especially by enzymatic action, leading to a significant change in the chemical structure of a material

[SOURCE: ISO 472:2013, 2.1680]

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