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Determination of the ultimate aerobic biodegradability and disintegration of plastic materials under controlled composting conditions - Method by analysis of evolved carbon dioxide (ISO 14855:1999)

iTeh STANDARD PREVIEW

Bestimmung der vollständigen aeroben Bioabbaubarkeit und Zersetzung von Kunststoff-Materialien unter den Bedingungen kontrollierter Kompostierung - Verfahren mittels Analyse des freigesetzten Kohlenstoffdioxides (ISO 14855:1999)

[SIST EN ISO 14855:2004](https://standards.iteh.ai/catalog/standards/sist/ed2cd47a-0e8b-4731-a25f-3ca601a11e1e/iso-14855-2004)

<https://standards.iteh.ai/catalog/standards/sist/ed2cd47a-0e8b-4731-a25f-3ca601a11e1e/iso-14855-2004>

Evaluation de la biodégradabilité aérobie ultime et de la désintégration des matériaux plastiques dans des conditions contrôlées de compostage - Méthode par analyse du dioxyde de carbone libéré (ISO 14855:1999)

Ta slovenski standard je istoveten z: EN ISO 14855:2004

ICS:

83.080.01	Polimerni materiali na splošno	Plastics in general
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SIST EN ISO 14855:2004

en,fr,de

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EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

EN ISO 14855

July 2004

ICS 83.080.01

English version

**Determination of the ultimate aerobic biodegradability and
disintegration of plastic materials under controlled composting
conditions - Method by analysis of evolved carbon dioxide (ISO
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Evaluation de la biodégradabilité aérobie ultime et de la
désintégration des matériaux plastiques dans des
conditions contrôlées de compostage - Méthode par
analyse du dioxyde de carbone libéré (ISO 14855:1999)

This European Standard was approved by CEN on 21 June 2004.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Central Secretariat has the same status as the official versions.

[SIST EN ISO 14855:2004](https://standards.iteh.ai/catalog/standards/sist/ed2cd47a-0e8b-4731-e25f-1d1518875b1a/iso-14855-2004)

CEN members are the national standards bodies of Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.



EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

Management Centre: rue de Stassart, 36 B-1050 Brussels

EN ISO 14855:2004 (E)**Foreword**

The text of ISO 14855:1999 has been prepared by Technical Committee ISO/TC 61 "Plastics" of the International Organization for Standardization (ISO) and has been taken over as EN ISO 14855:2004 by Technical Committee CEN/TC 249 "Plastics", the secretariat of which is held by IBN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by January 2005, and conflicting national standards shall be withdrawn at the latest by January 2005.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

Endorsement notice

The text of ISO 14855:1999 has been approved by CEN as EN ISO 14855:2004 without any modifications.

NOTE Normative references to International Standards are listed in Annex ZA (normative).

<https://standards.iteh.ai/catalog/standards/sist/ed2cd47a-0e8b-4731-a25f-ec8d151887fb/sist-en-iso-14855-2004>

Annex ZA (normative)

Normative references to international publications with their relevant European publications

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

NOTE Where an International Publication has been modified by common modifications, indicated by (mod.), the relevant EN/HD applies.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN</u>	<u>Year</u>
ISO 5663	1984	Water quality - Determination of Kjeldahl nitrogen - Method after mineralization with selenium	EN 25663	1993

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INTERNATIONAL STANDARD

ISO
14855

First edition
1999-05-15

Determination of the ultimate aerobic biodegradability and disintegration of plastic materials under controlled composting conditions — Method by analysis of evolved carbon dioxide

iTeh STANDARD PREVIEW
*Évaluation de la biodégradabilité aérobie ultime et de désintégration des
matériaux plastiques dans des conditions contrôlées de compostage —
Méthode par analyse du dioxyde de carbone libéré*

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[https://standards.iteh.ai/catalog/standards/sist/ed2cd47a-0e8b-4731-a25f-
ec8d151887fb/sist-en-iso-14855-2004](https://standards.iteh.ai/catalog/standards/sist/ed2cd47a-0e8b-4731-a25f-ec8d151887fb/sist-en-iso-14855-2004)



Reference number
ISO 14855:1999(E)

ISO 14855:1999(E)**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.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

International Standard ISO 14855 was prepared by Technical Committee ISO/TC 61, *Plastics*, Subcommittee SC 5, *Physical-chemical properties*.

Annexes A to E of this International Standard are for information only.

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[SIST EN ISO 14855:2004](#)

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Printed in Switzerland

Determination of the ultimate aerobic biodegradability and disintegration of plastic materials under controlled composting conditions — Method by analysis of evolved carbon dioxide

WARNING — Sewage, activated sludge, soil and compost may contain potentially pathogenic organisms. Therefore appropriate precautions should be taken when handling them. Toxic test compounds and those whose properties are unknown should be handled with care.

1 Scope

This International Standard specifies a method for the determination of the ultimate aerobic biodegradability of plastics, based on organic compounds, under controlled composting conditions by measurement of the amount of carbon dioxide evolved and the degree of disintegration of the plastic at the end of the test. This method is designed to simulate typical aerobic composting conditions for the organic fraction of solid mixed municipal waste. The test material is exposed to an inoculum which is derived from compost. The composting takes place in an environment wherein temperature, aeration and humidity are closely monitored and controlled. The test method is designed to yield the percentage conversion of the carbon in the test material to evolved carbon dioxide as well as the rate of conversion.

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The conditions described in this International Standard may not always correspond to the optimum conditions for the maximum degree of biodegradation to occur.

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<https://standards.iteh.ai/catalog/standards/sist/ed2cd47a-0e8b-4731-a25f-ec8d151887fb/sist-en-iso-14855-2004>

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 5663:1984, *Water quality — Determination of Kjeldahl nitrogen — Method after mineralization with selenium*.

ISO 8245:1999, *Water quality — Guidelines for the determination of total organic carbon (TOC) and dissolved organic carbon (DOC)*.

3 Definitions

For the purposes of this International Standard, the following definitions apply:

3.1

ultimate aerobic biodegradation

the breakdown of an organic compound by microorganisms in the presence of oxygen into carbon dioxide, water and mineral salts of any other elements present (mineralization) plus new biomass

3.2

composting

an aerobic process designed to produce compost

NOTE Compost is an organic soil conditioner obtained by biodegradation of a mixture consisting principally of vegetable residues, occasionally with other organic material, and having a limited mineral content.

3.3 disintegration

the physical breakdown of a material into very small fragments

3.4 total dry solids

the amount of solids obtained by taking a known volume of test material or compost and drying at about 105 °C to constant mass

3.5 volatile solids

the amount of solids obtained by subtracting the residue of a known volume of test material or compost after incineration at about 550 °C from the total dry solids of the same sample

NOTE The volatile-solids content is an indication of the amount of organic matter present.

3.6 theoretical amount of evolved carbon dioxide

ThCO_2

the maximum theoretical amount of carbon dioxide evolved after completely oxidizing a chemical compound, calculated from the molecular formula and expressed as milligrams of carbon dioxide evolved per milligram or gram of test compound

3.7 lag phase

the time, measured in days, from the start of a test until adaptation and/or selection of the degrading microorganisms is achieved and the degree of biodegradation of a chemical compound or organic matter has increased to about 10 % of the maximum level of biodegradation

3.8 maximum level of biodegradation

the degree of biodegradation, measured in per cent, of a chemical compound or organic matter in a test, above which no further biodegradation takes place during the test

3.9 biodegradation phase

the time, measured in days, from the end of the lag phase of a test until about 90 % of the maximum level of biodegradation has been reached

3.10 plateau phase

the time, measured in days, from the end of the biodegradation phase until the end of a test

4 Principle

The test method determines the ultimate biodegradability and degree of disintegration of test material under conditions simulating an intensive aerobic composting process. The inoculum used consists of stabilized, mature compost derived, if possible, from composting the organic fraction of solid municipal waste.

The test material is mixed with the inoculum and introduced into a static composting vessel where it is intensively composted under optimum oxygen, temperature and moisture conditions for a test period not exceeding 6 months.

During the aerobic biodegradation of the test material, carbon dioxide, water, mineral salts and new microbial cellular constituents (biomass) are the ultimate biodegradation products. The carbon dioxide produced is continuously monitored, or measured at regular intervals, in test and blank vessels to determine the cumulative carbon dioxide production. The percentage biodegradation is given by the ratio of the carbon dioxide produced from the test material to the maximum theoretical amount of carbon dioxide that can be produced from the test material.

The maximum theoretical amount of carbon dioxide produced is calculated from the measured total organic carbon (TOC) content. The percentage biodegradation does not include that amount of carbon converted to new cell biomass which is not metabolized in turn to carbon dioxide during the course of the test.

Additionally, the degree of disintegration of the test material is determined at the end of the test, and the loss in mass of the test material may also be determined.

5 Test environment

Incubation shall be in the dark or in diffused light, in an enclosure or room maintained at a constant temperature of $58\text{ °C} \pm 2\text{ °C}$ and free from vapours inhibitory to microorganisms.

In special cases, e.g. when the melting point of the test material is low, another temperature may be chosen. This temperature shall be kept constant during the test to within $\pm 2\text{ °C}$. Any change in temperature shall be justified and clearly indicated in the test report.

6 Reagents

Use only analytical-grade reagents.

Use TLC (thin-layer chromatography) grade cellulose with a particle size of less than $20\text{ }\mu\text{m}$ as the positive-control reference material.

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7 Apparatus

Ensure that all glassware is thoroughly cleaned and, in particular, free from organic or toxic matter.

7.1 Composting vessels: Glass flasks or bottles that allow an even gas purge in an upward direction.

A minimum volume of 2 litres is required to meet the requirements specified in 8.2 and 8.3. Depending on the test material, a smaller volume may be used for screening purposes. If the loss in mass of the test material is to be determined, weigh each composting vessel empty.

7.2 Air-supply system, capable of supplying each composting vessel with dry or water-saturated, if required carbon-dioxide-free, air at a pre-set flow rate which shall be high enough to provide truly aerobic conditions during the test (see example given in annex A).

7.3 Apparatus for the determination of carbon dioxide, designed to determine carbon dioxide directly or by complete absorption in a basic solution and determination of the dissolved inorganic carbon (DIC) (see example given in annex A). If the carbon dioxide in the exhaust air is measured directly, for example with a continuous infrared analyser or a gas chromatograph, exact control or measurement of the air-flow rate is required.

7.4 Gas-tight tubes, to connect the composting vessels with the air supply and the carbon dioxide measurement system.

7.5 pH meter.

7.6 Analytical equipment, for the determination of dry solids (at 105 °C), volatile solids (at 550 °C) and total organic carbon (TOC), for elemental analysis of the test material and, if required, for the determination of dissolved inorganic carbon (DIC).

7.7 Balance (optional), to measure the mass of test vessels containing compost and test material, which is normally in the range between 3 kg and 5 kg.

7.8 Analytical equipment (optional), for the determination of oxygen in the air, moisture, volatile fatty acids and total nitrogen (e.g. by the Kjeldahl method as specified in ISO 5663).