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Gradbeni proizvodi - Ocenjevanje sproščanja nevarnih snovi - 2. del: Horizontalni dinamični preskus izluževanja s površine

Construction products - Assessment of release of dangerous substances - Part 2: Horizontal dynamic surface leaching test

Bauprodukte - Bewertung der Freisetzung von gefährlichen Stoffen - Teil 2: Horizontale dynamische Oberflächenauslaugprüfung

Produits de construction - Evaluation de l'émission de substances dangereuses - Partie 2: Essais horizontaux et dynamiques de la lixivation des surfaces

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Construction products: Assessment of release of dangerous substances - Part 2: Horizontal dynamic surface leaching test

Bauprodukte - Bewertung der Freisetzung von
gefährlichen Stoffen - Teil 2: Horizontale dynamische
Oberflächenauslaugprüfung

This draft European Standard is submitted to CEN members for enquiry. It has been drawn up by the Technical Committee CEN/TC 351.

If this draft becomes a European Standard, 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.

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prEN 16637-2:2021 (E)

European foreword

This document (prEN 16637-2:2021) has been prepared by Technical Committee CEN/TC 351 “Construction Products: Assessment of release of dangerous substances”, the secretariat of which is held by NEN.

This document is currently submitted to the CEN Enquiry.

This document will supersede CEN/TS 16637-2:2014.

The main changes compared to the previous edition are as follows:

- Transfer of technical specification into European Standard (see Clause 12 and Annex E);
- Addition of requirements on the number of eluates (see 5.2);
- Addition of requirements on the determination of the geometric surface area for test pieces thinner than 40 mm (see 8.3.3);
- Addition of information on the determination of the geometric surface area for irregular test pieces (see Annex F);
- Updating of normative and informative cross-references.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association.

This document was elaborated on the basis of CEN/TS 15863 [2], which is based on NEN 7375 [3].

This document specifies a dynamic surface leaching test for determination of surface dependent release of substances from monolithic or plate-like or sheet-like construction products or granular construction products with low hydraulic conductivity under standardized conditions.

EN 16637, *Construction products: Assessment of release of dangerous substances*, consists of the following parts:

- Part 1: *Guidance for the determination of leaching tests and additional testing steps*,
- Part 2: *Horizontal dynamic surface leaching test*,
- Part 3: *Horizontal up-flow percolation test*.

prEN 16637-1 deals with the determination and use of test methods for leaching of construction products taking specific situations into account. prEN 16637-3 specifies an up-flow percolation test to determine the leaching behaviour of granular construction products under standardized percolation conditions.

Background information on characterization of leaching behaviour of construction products can be found in Technical Reports provided by CEN/TC 351 (i.e. CEN/TR 16098 [4], CEN/TR 16496 [5]).

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Introduction

The European Standards prEN 16637-1, prEN 16637-2 and prEN 16637-3 are developed to assess the release of regulated dangerous substances (RDS) from construction products into soil, surface water and groundwater in the framework of Mandate M/366. The horizontal test methods developed under the Mandate M/366 are intended to be used to show compliance with notified regulations. The tests cover the release of substances from construction products and in particular, those that are regulated in notified regulations in one or more EU Member States.

prEN 16637-1 specifies how the CEN Technical Product Committees and EOTA experts should determine the appropriate leaching test for the determination of the release of RDS from a construction product into soil, surface water and groundwater. prEN 16637-1 gives background information for CEN Technical Product Committees on the following aspects:

- a) description of the intended conditions of use of the construction product (e.g. above ground exposed to the precipitation, or shielded from direct infiltration, in surface or groundwater) with respect to the release of RDS into soil, surface water and groundwater;
- b) identification of main release mechanisms, and the appropriate leaching test for a given construction product.

prEN 16637-2 specifies a horizontal test to assess surface dependent release from monolithic, plate-like or sheet-like construction products (tank test).

prEN 16637-3 specifies a horizontal test to assess release from granular construction products.

The test methods can be used for both steps in the hierarchy (type testing (TT) and factory production control (FPC)) and form the reference tests for the intended uses and conditions specified in prEN 16637-1. In this hierarchy of testing conditions “indirect tests” can be used, but are not specified.

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The release of substances upon contact with water results in a potential risk to the environment during the intended use of construction products. The intent of these tests is to identify the leaching behaviour of construction products and thereby allow assessments of the release of RDS from such products to soil, surface water and groundwater under intended conditions of use in relation to CE marking and assessment and verification of constancy of performance.

This document does not address impact assessment. However, since the test methods described in the document may be used in the context of impact assessments and regulation based on impact assessments, some guidance on this issue is provided in prEN 16637-1:—¹, Annex A (informative).

In addition to existing validation results, in 2011 CEN/TC 351 began an extensive research program on robustness validation of the existing tank leaching and percolation tests. This was carried out by a consortium of European experts on 20 construction products to unify differences from the protocols of the different CEN Members and to check the influence of testing conditions on the test result (e.g. temperature, flow rate, renewal scheme). The results ([6]) of the research program confirmed the robustness of the horizontal tests known from former works. Conclusions from the program have been implemented into the Technical Specifications for the test methods. The performance of the leaching tests regarding repeatability and reproducibility was deduced from a second validation step and respective data ([7], [8]) are included in this document and in prEN 16637-3:—².

1 Scope

(1) This document specifies a dynamic surface leaching test (DSL_T) which is aimed at determining the release per unit surface area as a function of time of inorganic and/or non-volatile organic substances from a monolithic, plate- or sheet-like product, when it is put into contact with an aqueous solution (leachant). The test method is not suitable for substances that are volatile under ambient conditions.

(2) This test is a parameter specific test focusing on identifying and specifying parameter specific properties tested under specified conditions. It is not aimed at simulating real situations. The application of results to specific intended conditions of use may be established by means of modelling (not included in this document).

(3) The test method applies to more or less regularly shaped test portions consisting of monolithic test pieces with minimum dimensions of 40 mm in all directions (volume > 64 000 mm³ (64 cm³)). It also applies to plate- or sheet-like products with surface areas of minimum 10 000 mm² (100 cm²) exposed to the leachant. Products designed to drain water (e.g. draining tiles, porous asphalt) and monolithic granular products according to prEN 16637-1:—¹, Table 1, are also tested by this test method. All products to be tested are assumed to maintain their integrity over a time frame relevant for the considered intended use.

(4) The modification for granular construction products with low hydraulic conductivity (Annex A) applies for granular particles with so little drainage capacity between the grains that percolation in percolation tests and in practice is nearly impossible.

(5) Metals, metallic coatings and organic coatings on metals are excluded from the scope of this document because the principles of this test (diffusion) are not obeyed by these products. Guidance on the need for testing of these products is under consideration.

(6) For some coatings (e.g. some renders with organic binders according to EN 15824 [9]) in intermittent contact to water, physical and chemical properties might be changed in permanent contact with water. For these products this document is not appropriate.

(7) Guidance on the applicability of the test method to a given product is outlined in prEN 16637-1.

NOTE 1 This test method is only applicable if the product is chemically stable and the matrix does not dissolve. For construction products that are possibly used in contact with water this is usually not the case as construction products are then supposed to be dimensionally stable. If a product possibly wears substantially in its intended use, the test cannot provide proper information. If the product contains a substantial amount of water-soluble compounds, e.g. gypsum or anhydrite, the matrix could (partially) dissolve and lead to dimensional instability of the test piece. In this case the test standard also cannot be used.

NOTE 2 Volatile organic substances include the low molecular weight substances in mixtures such as mineral oil.

NOTE 3 It is not always possible to optimize test conditions simultaneously for inorganic and organic substances. Optimum test conditions can also vary between different groups of organic substances. Test requirements for organic substances are generally more stringent than those for inorganic substances. The test conditions suitable for measuring the release of organic substances will generally also be applicable to inorganic substances.

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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.

EN 15934, *Sludge, treated biowaste, soil and waste - Calculation of dry matter fraction after determination of dry residue or water content*

prEN 16637-1:—¹⁾, *Construction products: Assessment of release of dangerous substances - Part 1: Guidance for the determination of leaching tests and additional testing steps*

EN 17087, *Construction products: Assessment of release of dangerous substances - Preparation of test portions from the laboratory sample for testing of release and analysis of content*

CEN/TS 17195, *Construction products: Assessment of release of dangerous substances - Analysis of inorganic substances in eluates*

EN ISO 3696:1995, *Water for analytical laboratory use - Specification and test methods (ISO 3696:1987)*

EN ISO 5667-3, *Water quality - Sampling - Part 3: Preservation and handling of water samples (ISO 5667-3)*

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

eluate

solution obtained from a leaching test

[SOURCE: EN 16687:2015 [10], 4.2.7]

3.2

laboratory sample

sample or sub-sample(s) sent to or received by the laboratory

Note 1 to entry: When the laboratory sample is further prepared by subdividing, cutting, sawing, coring, drying, grinding, mixing, curing or by combinations of these operations, the result is the test sample. When no preparation of the laboratory sample is required, the laboratory sample is the test sample. A test portion is removed from the test sample for the performance of the test or for analysis.

Note 2 to entry: The laboratory sample is the final sample from the point of view of sample collection but it is the initial sample from the point of view of the laboratory.

[SOURCE: IUPAC 1990 [11], 2.5.5]

¹⁾ Under preparation. Stage at the time of publication: prEN 16637-1:2021.

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3.3

leachant

liquid that is brought into contact with the test portion in the leaching procedure

Note 1 to entry: Usually demineralized water is used as leachant for laboratory leaching tests.

[SOURCE: EN 16687:2015 [10], 4.2.6]

3.4

leaching behaviour

release and change with time in release from a solid product in contact with a leachant as a function of major release controlling factors

Note 1 to entry: Such factors are diffusion, pH, L/S or time.

[SOURCE: EN 16687:2015 [10], 4.2.9]

3.5

release mechanism

physical-chemical processes that control the release of substances from a solid construction product into a leachant

Note 1 to entry: In the case of monolithic products, the main release mechanisms for substances are diffusion, dissolution, initial surface wash-off and depletion. Additional factors like pH or DOC also have influence on the magnitude of the release.

Note 2 to entry: The release mechanism for every substance can be determined using the results of the release test (tank leaching test). Determination of the release mechanism is relevant for modelling of the source term and so for determination of the effects on soil and water over a time period.

[SOURCE: EN 16687:2015 [10], 4.2.17]

3.6

liquid to surface area ratio

L/A

ratio between the volume of liquid (L) which in a given step of the test is in contact with the exposed surface area (A) of the test portion

Note 1 to entry: L/A is expressed in l/m^2 .

[SOURCE: EN 16687:2015 [10], 4.2.12]

3.7

monolithic product

product which has certain minimum dimensions and physical and mechanical properties that ensure its integrity over a certain period of time in the intended conditions of use

Note 1 to entry: Monolithic products are usually tested by a dynamic surface leaching test.

[SOURCE: EN 16687:2015 [10], 2.2.4]

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3.8

plate-like product

product formed as a semi-rigid or rigid plate, which has certain minimum dimensions and physical and mechanical properties that ensure its integrity over a certain period of time in the intended conditions of use

Note 1 to entry: Plate-like products are usually tested by a dynamic surface leaching test.

[SOURCE: EN 16687:2015 [10], 2.2.5]

3.9

release

emission

<leaching> liberation of chemical substances (e.g. non-volatile organic compounds, heavy metals, salts) from a construction product into soil, surface water or ground water or into the leachant of a test facility

Note 1 to entry: Release to soil, surface and groundwater can be expressed in terms of area related release (tank leaching test, e.g. mg/m²) or in terms of mass related release (percolation test, e.g. mg/kg).

Note 2 to entry: The terms “emission” and “release” have fundamentally the same meaning. However it is often a tradition to use the term “emission” when describing liberation of chemical substances or radiation into air and to use the term “release” when describing the liberation of chemical substances into soil or water.

[SOURCE: EN 16687:2015 [10], 4.2.15]

3.10

release rate

product specific rate describing the mass of a substance released from a product at a given time interval in a laboratory leaching test

Note 1 to entry: The release rate is expressed in (mg/m²)/d (tank leaching test) or in (mg/kg)/d (percolation test). The first, area related release rate is also called “flux”.

[SOURCE: EN 16687:2015 [10], 4.2.18]

3.11

leachant renewal scheme

selection of time intervals after which the leachant is renewed

[SOURCE: EN 16687:2015 [10], 4.2.10]

3.12

sample

portion of material selected from a larger quantity of material

Note 1 to entry: The manner of selection of the sample is usually prescribed in a sampling plan (x, y, z).

Note 2 to entry: The term “sample” is often accompanied by a prefix (e.g. laboratory sample, test sample) specifying the type of sample and/or the specific step in the sampling process to which the obtained material relates.

[SOURCE: IUPAC 1990 [11], 2.1.1]

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3.13

sheet-like product

product formed as a flexible or semi-flexible sheet, which has certain minimum dimensions and physical and mechanical properties that ensure its integrity over a certain period of time in the intended conditions of use

Note 1 to entry: Sheet-like products are usually tested by the dynamic surface leaching test.

[SOURCE: EN 16687:2015 [10], 2.2.6]

3.14

test piece

single monolithic, plate- or sheet-like piece as part of the test portion

[SOURCE: EN 16687:2015 [10], 3.2.5]

3.15

test portion

analytical portion

amount or volume of the test sample taken for analysis, usually of known weight or volume

Note 1 to entry: The test portion might consist of more than one test piece.

[SOURCE: IUPAC 1990 [11], 2.5.7]

3.16

test sample

analytical sample

sample, prepared from the laboratory sample, from which test portions are removed for testing or for analysis

[SOURCE: IUPAC 1990 [11], 2.5.6]

3.17

exposed surface

A

<leaching> part of the total surface of the test portion exposed to the leachant

[SOURCE: EN 16687:2015 [10], 4.2.11]

3.18

compacted granular product

granular product with a low permeability, due to very small pores between the particles

Note 1 to entry: Compacted granular products are usually tested by the method for granular construction products with low hydraulic conductivity, because the percolation test is not applicable due to the low permeability of the products.

[SOURCE: EN 16687:2015 [10], 2.2.2]

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3.19

monolithic granular product

granular product with specific requirements on the grain size distribution to be tested in the dynamic surface leaching test (DSLTL)

[SOURCE: EN 16687:2015 [10], 2.2.3]

3.20

test method for granular construction products with low hydraulic conductivity

GLHC

release test method in which a construction product with low hydraulic conductivity is exposed with one defined surface to a leachant renewed at subsequent time intervals

[SOURCE: EN 16687:2015 [10], 4.2.3]

3.21

dynamic surface leaching test

DSLTL

release test method in which a monolithic, sheet-like or plate-like product is immersed in a leachant renewed at subsequent time intervals

[SOURCE: EN 16687:2015 [10], 4.2.2]

3.22

limit of quantification

LOQ

lowest value of an analyte (determinant) that can be determined with an acceptable level of accuracy and precision

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Note 1 to entry The LOQ is the lowest concentration of an analyte that can be quantified within defined limits of certainty after replicate measurements. As a “rule of thumb”, this is usually taken as three times the limit of detection of the analytical method.

[SOURCE: EN 16687:2015 [10], 4.1.14]

3.23

method detection limit

MDL

smallest analyte concentration that can be detected with a specified analytical method including sample preparation with a defined statistical probability

[SOURCE: EN 16687:2015 [10], 4.1.12]

4 Symbols and abbreviations

4.1 Symbols

For the purposes of this document, the following symbols apply:

A	geometric area of the test portion exposed surface of test piece(s), in m^2 ;
c_i	concentration of the substance in eluate i , in $\mu\text{g/l}$;
L	volume of liquid in contact with the test portion, in l ;
m_a	loss of weight, in g/m^2 ;
m_s	mass of the solid matter that has fallen off during the test, in g ;
R_n	cumulative area release of the substance for period n including fraction $i = 1$ to n , in mg/m^2 ;
r_i	area release of the substance in fraction i , in mg/m^2 ;
P	test piece;
V_p	volume of the test portion, in l ;
V_l	volume of the leachant, in l .

4.2 Abbreviations

For the purposes of this document, the following abbreviations apply:

DL	detection limit
DOC	dissolved organic carbon
DSL _T	dynamic surface leaching test
GLHC	test for granular construction products with low hydraulic conductivity
FEP	fluorinated ethylene propylene
FPC	factory production control
HDPE	high-density polyethylene
LOQ	limit of quantification
MDL	method detection limit
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
PE	polyethylene
PET	polyethylene terephthalate
PMMA	polymethyl methacrylate
PP	polypropylene
PTFE	polytetrafluorethylene
RDS	regulated dangerous substances
TPH	total petroleum hydrocarbons

5 Principle

5.1 General principle

(1) This document describes a method to determine as a function of time the release of substances from a monolithic, plate-like or sheet-like product with a leachant in contact with its surface.

(2) The test portion of the product is placed in a reactor/leaching vessel and the exposed surface is completely submerged in a leachant. The leachant is introduced in the reactor up to a given volume of liquid to surface area ratio (L/A ratio), at a given temperature and renewed at predetermined time intervals.

(3) The following test conditions are fixed:

- a) the type of leachant (standard leachant pH-neutral demineralized water as specified in 6.2);
- b) the temperature (see 9.1);
- c) the L/A ratio (l/m^2) (see 9.2);
- d) the total duration of the test (see 9.3);
- e) the number of eluates to be collected at fixed time intervals (see 9.3).

(4) This test method produces eluates, which shall subsequently be characterized by physical, chemical and ecotoxicological methods according to existing standard methods. Special precautions may be necessary with respect to the choice of equipment design and materials, handling of eluates and prevention of biodegradation when the leaching of non-volatile organic substances is of interest.

(5) For those products that have a too low hydraulic conductivity to perform a regular percolation test according to prEN 16637-3:—² (e.g. clay or paste-like products), a modified “Method for granular construction products with low hydraulic conductivity (GLHC)” is given in Annex A. This method is different from the DSLT with respect to the test equipment and sample preparation in order to ensure the exposure of a well-defined surface. All other conditions (e.g. liquid to area ratio, renewal times, leachant and data handling) are the same as for the regular DSLT.

(6) The eluate fractions are characterized physically and chemically according to existing standards.

(7) Loss of solid material from the test piece during testing is an indication of limited long term stability.

(8) The results of the test are expressed as a function of time, in terms of both milligrams of substances released cumulatively per m^2 of geometric surface area of the product exposed to leaching, and milligrams of the substances released per litre of eluate, each after 64 days.

NOTE The results can be additionally expressed and reported in terms of the flux (milligrams of substances released per m^2 per second) for each eluate fraction as a function of time.

(9) The test conditions (L/A ratio, leachant renewal scheme) have been designed such that the identification of leaching mechanisms and their relative importance is enabled. The main leaching mechanisms that can be distinguished and identified are:

- a) diffusion (through the pores and / or from the surface to the bulk of the leachant);
- b) initial surface wash-off;
- c) other processes (e.g. solubility control, changes in speciation, depletion).