PD CEN/TS 16660:2015

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Characterization of waste — Leaching behaviour test — Determination of the reducing character and the reducing capacity

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Characterization of waste - Leaching behaviour test - Determination of the reducing character and the reducing capacity

Caractérisation des déchets - Essais de comportement à la lixiviation - Détermination des propriétés réductrices et de la capacité de réduction

Charakterisierung von Abfällen - Untersuchung des Elutionsverhaltens - Bestimmung der Reduktionseigenschaft und der Reduktionsfähigkeit

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Foreword

This document (CEN/TS 16660:2015) has been prepared by Technical Committee CEN/TC 292 “Characterization of waste”, the secretariat of which is held by NEN.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This document has been developed primarily to support the requirements for leaching behaviour testing within EU and EFTA countries.

This document was elaborated on the basis of NEN 7348:2006.

To determine the various aspects of the leaching behaviour (the leaching characteristics) of solid earthy and stony building and waste materials a series of steps should be followed, in particular sampling, sample pretreatment, characterization tests, digestion and chemical analysis of the solid substance or the eluates. An umbrella standard (EN 16457) is developed that gives general instructions. In here the relationship is given between all the standards in each step, each with a specific scope. To determine the leaching characteristics, the general instructions or the specific standards to which reference is made shall be followed with good consistency.

This Technical Specification describes a test that can be used to determine whether or not the material to be tested possesses reducing properties. If this is the case, a next test is used to quantify the reducing capacity of this material or its eluates. Based on the results of this Technical Specification, it can be established whether leaching under practical conditions can differ (considerably) from leaching under standard aerobic laboratory conditions and whether there is justification for testing leaching under low-oxygen conditions (see Annex A, [16]).

The standards that characterize the various aspects of the leaching behaviour are produced and published in phases. This means that upon the publication of this Technical Specification, reference is not yet made in all relevant standards. For the missing aspects, users of this Technical Specification will have to make their own choice of the methods to be used. Annex A gives information on the validation and materials used. Annex B gives a further explanatory note on the reducing capacity. In addition to specifications provided in EN 15002, Annex C gives further guidance on sampling, sample pretreatment and sample storage. For more information, the standards and other publications included in the bibliography that have been published in this respect can be used.

The numbered clauses are normative with the exception of the passages marked with the heading 'NOTE'; the annexes are informative.

According to the CEN-CENELEC Internal Regulations, the national standards organizations of the following countries are bound to announce this Technical Specification: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

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Introduction

This document specifies a set of three tests to assess if a material has reducing properties and subsequently to determine the reducing capacity of that material and the reducing capacity of an eluate produced at low liquid to solid ratio. For a proper performance special attention is given to minimize contact with the atmosphere before and during testing.

For the complete characterization of the leaching behaviour of waste under specified conditions the application of other test methods is required (see EN 12920).

Anyone dealing with waste and sludge analysis should be aware of the typical risks of that kind of material irrespective of the parameter to be determined. Waste and sludge samples can contain hazardous (e.g. toxic, reactive, flammable, infectious) substances, which can be liable to biological and/or chemical reaction.

Consequently these samples should be handled with special care. Gases which can be produced by microbiological or chemical activity are potentially flammable and will pressurize sealed bottles. Bursting bottles are likely to result in hazardous shrapnel, dust and/or aerosol. National regulations should be followed with respect to all hazards associated with this method.

In the different European countries, tests have been developed to characterize and assess the constituents which can be leached from waste materials. The release of soluble constituents upon contact with water is regarded as one of the main mechanism of release which results in a potential risk to the environment during life-cycle of waste materials (disposal or re-use scenario). The intent of these tests is to identify the leaching properties of waste materials. The complexity of the leaching process makes simplifications necessary. Not all of the relevant aspects of leaching behaviour can be addressed in one single standard. This Technical Specification addresses reducing properties of materials and the consequences to the test or test conditions to be applied in performing leaching tests.

Procedures to characterize the behaviour of waste materials can generally be divided into three steps, using different tests in relation to the objective. The following test hierarchy is taken from the Landfill Directive [1)] and the Decision on Annex II of this Directive [2)] for disposal of waste.

a) Basic characterization constitutes a full characterization of the waste by gathering all the necessary information for a safe management of the waste in the short and long term. Basic characterization may provide information on the waste (type and origin, composition, consistency, leachability, etc.), information for understanding the behaviour of waste in the considered management scenario, comparison of waste properties against limit values, and detection of key variables (critical parameters as liquid/solid (L/S) ratios, leachant composition, factors controlling leachability such as pH, redox potential, complexing capacity and physical parameters) for compliance testing and options for simplification of compliance testing. Characterization may deliver ratios between test results from basic characterization and results from simplified test procedures as well as information on a suitable frequency for compliance testing. In addition to the leaching behaviour, the composition of the waste should be known or determined by testing. The tests used for basic characterization should always include those to be used for compliance testing.

b) Compliance testing is used to demonstrate that the sample of today fits the population of samples tested before by basic characterization and through that, is used to carry out compliance with regulatory limit values. The compliance test should therefore always be part of the basic characterization program. The compliance test focuses on key variables and leaching behaviour identified by basic characterization tests. Parts of basic characterization tests can also be used for compliance purposes.

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1) Council Directive 1999/31/EC of 26 April 1999 on the landfill of waste.

2) Council Decision 2003/33/EC of 19 December 2002.

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c) On-site verification tests are used as a rapid check to confirm that the waste is the same as that which has been subjected to characterization or compliance tests. On-site verification tests are not necessarily leaching tests.

The test procedure described in this document is a basic characterization test and falls in category a).

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1 Scope

This Technical Specification specifies three laboratory tests to determine the reducing character and the reducing capacity of construction products, waste materials and the eluate resulting from exposure of these solids to a leachant. Reducing species released from the product are titrated to quantify the reducing capacity.

For a specification of the materials with which experience has been acquired with the execution of the tests according to this Technical Specification see Annex A and [16].

NOTE Materials with reducing properties can in practice under both oxidizing and anoxic (isolated) conditions show completely different leaching behaviour than obtained with the leaching tests specified in EN 16457. This may seriously hamper the interpretation of the leaching tests, if this condition is not taken into consideration.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 14346, *Characterization of waste - Calculation of dry matter by determination of dry residue or water content*

EN 15002, *Characterization of waste - Preparation of test portions from the laboratory sample*

EN ISO 10523, *Water quality - Determination of pH (ISO 10523)*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply. Additional terms and definitions are given in EN 13965-2.

3.1
eluate
solution obtained by a leaching test

3.2
laboratory sample
sample or sub-sample(s) sent to or received by the laboratory

[SOURCE: IUPAC, 1990]

Note 1 to entry: When the laboratory sample is further prepared (reduced) by subdividing, cutting, sawing, coring, 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. The laboratory sample is the final sample from the point of view of sampling but it is the initial sample from the point of view of the laboratory.

Note 2 to entry: Several laboratory samples may be prepared and sent to different laboratories or to the same laboratory for different purposes. When sent to the same laboratory, the set is generally considered as a single laboratory sample and is documented as a single sample.

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3.3
leaching test
test during which a material is put into contact with a leachant and some constituents of the material are extracted

[SOURCE: EN 12457-1:2002]

3.4
liquid to solid-ratio
L*/*S
ratio between the amount of liquid (*L*) and of solid (*S*) in the test

Note 1 to entry: *L*/*S* is expressed in l/kg dry matter.

3.5
reducing capacity
potential for a material to impose reducing conditions

Note 1 to entry: Reducing capacity is expressed in mmol O_2/kg.

3.6
redox potential
value that indicates reducing or oxidized state of a material

Note 1 to entry: Redox potential is expressed in mV.

3.7
sample
portion of material selected from a larger quantity of material

3.8
test portion
amount or volume of the test sample taken for analysis, usually of known weight or volume

[SOURCE: IUPAC, 1990]

3.9
test sample
sample, prepared from the laboratory sample, from which test portions are removed for testing or for analysis

[SOURCE: IUPAC, 1990]

4 Principle

The purpose of the tests described in this Technical Specification is to:

— establish whether or not a material has reducing properties;

— establish where necessary the reducing capacity of this material or its eluates in quantitative terms.

The reducing character of a material is determined by bringing the material into contact with demineralized water at a low L/S value in an airtight sealed vessel (24 h contact time) and then measuring the redox potential with respect to the redox potential in water with the same pH.

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