

**Karaktärisering av avfall – Laktest – Kontrolltest för utlakning från granulära material och slam –**  
Del 1: Enstegs skaktest vid L/S 2 l/kg för material med hög fastfashalt och med partikelstorlek mindre än 4 mm (utan eller med nedkrossning)

**Characterization of waste – Leaching – Compliance test for leaching of granular waste materials and sludges –**

Part 1: One stage batch test at a liquid to solid ratio of 2 l/kg for materials with high solid content and with particle size below 4 mm (without or with size reduction)

Denna standard utgörs av den engelska versionen av europastandarden EN 12457-1:2002, Characterization of waste – Leaching – Compliance test for leaching of granular waste materials and sludges – Part 1: One stage batch test at a liquid to solid ratio of 2 l/kg for materials with high solid content and with particle size below 4 mm (without or with size reduction).

Europastandarden utgörs av fyra delar som var och en beskriver ett kontrolltest vilka skiljer sig från varandra genom olika lakvatten till fastfasförhållanden (L/S) och kornstorlek. Ett kontrolltest fokuserar på att undersöka nyckelparametrar och utlakningsegenskaper som identifierats i den grundläggande karaktäriseringen av avfallet.

SS-EN 12457-1 Enstegs skaktest vid L/S 2 l/kg för material med hög fastfashalt och med partikelstorlek mindre än 4 mm (utan eller med nedkrossning).

SS-EN 12457-2 Enstegs skaktest vid L/S 10 l/kg för material med partikelstorlek mindre än 4 mm (utan eller med nedkrossning).

SS-EN 12457-3 Tvåstegs skaktest vid L/S 2 l/kg och L/S 8 l/kg för material med hög fastfashalt och med partikelstorlek mindre än 4 mm (utan eller med nedkrossning).

SS-EN 12457-4 Enstegs skaktest vid L/S 10 l/kg för material med partikelstorlek mindre än 10 mm (utan eller med nedkrossning).

Resultaten från enstegstestet vid L/S 10 kan skilja sig ifrån resultaten från tvåstegstestet vid ackumulerat L/S 10 genom att testprocedurerna kan ge upphov till olika kemiska jämvikter i lakvattnen. Vid enstegstestet kvarhålls alla utlakade ämnen i lakvattnet under hela proceduren och bidrar till den kemiska jämvikten i lakvattnet medan i tvåstegstestet avskiljs de först utlakade ämnena i det första steget och nya kemiska jämvikter kan inställa sig i det andra steget. Tvåstegstesten har därmed mer likheter med ett genomströmningstest än enstegstesten. Vad gäller kornstorleken kan den större kornstorleken i del 4 ge upphov till en sämre reproducerbarhet i resultaten från heterogena avfall än den mindre kornstorleken i del 1-3.

Metoderna är utvecklade för att undersöka i huvudsak utlakningen av oorganiska ämnen från avfall och tar inte hänsyn till de speciella egenskaperna hos opolära ämnen eller effekten av mikrobiologiska processer hos organiska, nedbrytbara avfall.

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This Swedish Standard consists of the English version of the International standard EN 12457-1:2002, Characterization of waste – Leaching – Compliance test for leaching of granular waste materials and sludges – Part 1: One stage batch test at a liquid to solid ratio of 2 l/kg for materials with high solid content and with particle size below 4 mm (without or with size reduction).

The European Standard consists of four parts each describing a compliance test but with differences in liquid to solid ratio (L/S) and grain size. A compliance test focuses on key variables and leaching behaviour as identified in the basic characterization of the waste material.

SS-EN 12457-1 One stage batch test at a liquid to solid ratio of 2 l/kg for materials with high solid content and with particle size below 4 mm (without or with size reduction).

SS-EN 12457-2 One stage batch test at a liquid to solid ratio of 10 l/kg for materials with particle size below 4 mm (without or with size reduction).

SS-EN 12457-3 Two-stage batch test at a liquid to solid ratio of 2 l/kg and 8 l/kg for materials with high solid content and with particle size below 4 mm (without or with size reduction).

SS-EN 12457-4 One stage batch test at a liquid to solid ratio of 10 l/kg for materials with particle size below 10 mm (without or with size reduction).

The results from the one stage batch test at L/S 10 may differ from the results from the two-stage batch test at accumulated L/S 10 since the differences in test procedure may lead to different chemical equilibriums in the eluates. In the one stage leaching tests all the leached constituents remain in the eluate during the entire leaching procedure. In the two stage leaching test the constituents leached in the first stage is withdrawn and new chemical equilibriums can develop in the second stage. The two-stage procedure can therefore be said to be more similar with the percolation test than what the case with the one-stage tests. In relation to differences in the grain size distribution between the parts, the larger allowed maximum grain size in part 4 may lead to less reproducibility of the results from heterogeneous wastes than the use of the smaller maximum grain size as in parts 1-3.

This European standard has been developed to investigate mainly inorganic constituents from wastes. It does not take into account the particular characteristics of non-polar constituents or the consequences of microbiological processes in organic degradable wastes

Swedish Standards corresponding to documents referred to in this Standard are listed in "Catalogue of Swedish Standards", issued by SIS.



EUROPEAN STANDARD  
NORME EUROPÉENNE  
EUROPÄISCHE NORM

**EN 12457-1**

September 2002

ICS 13.030.10; 13.030.20

English version

**Characterisation of waste - Leaching - Compliance test for leaching of granular waste materials and sludges - Part 1: One stage batch test at a liquid to solid ratio of 2 l/kg for materials with high solid content and with particle size below 4 mm (without or with size reduction)**

Caractérisation des déchets - Lixiviation - Essai de conformité pour la lixiviation des déchets fragmentés et des boues - Partie 1: Essai en bûchée unique avec un rapport liquide-solide de 2 l/kg et une granularité inférieure à 4mm (sans ou avec réduction de la granularité)

Charakterisierung von Abfällen - Auslaugung - Übereinstimmungsuntersuchung für die Auslaugung von körnigen Abfällen und Schlämmen - Teil 1: Einstufiges Schüttelverfahren mit einem Flüssigkeits-/Feststoffverhältnis von 2 l/kg für Materialien mit hohem Feststoffgehalt und mit einer Korngröße unter 4 mm (ohne oder mit Korngrößenreduzierung)

This European Standard was approved by CEN on 17 August 2002.

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 Management Centre 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 Management Centre has the same status as the official versions.

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COMITÉ EUROPÉEN DE NORMALISATION  
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## Foreword

This document (EN 12457-1:2002) has been prepared by Technical Committee CEN /TC 292, "Characterisation of waste", the secretariat of which is held by NEN.

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 June 2003, and conflicting national standards shall be withdrawn at the latest by June 2003.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

For relationship with EU Directive(s), see informative annex ZA, which is an integral part of this document.

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

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

This document was elaborated on the basis of :

DIN 38414-S4:1984

AFNOR X-31 210:1992

NEN 7343:1992

ÖNORM S 2072:1990

No existing European Standard is superseded by the publication of this European Standard.

Annexes A, B, C, D, E and ZA are informative.

This document includes a Bibliography.

## Introduction

In the different European countries, tests have been developed to characterise and assess the constituents which can be leached from waste materials. The release of soluble constituents upon contact with water is regarded as a main mechanism of release which results in a potential risk to the environment during the reuse or disposal of waste materials. 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 standard. Tests to characterise waste materials and their behaviour can generally be divided into three categories :

- (1) "Basic Characterisation" tests are used to obtain information on the short and long term leaching behaviour and characteristics properties of waste materials. Liquid/solid (L/S) ratios, leachant composition, factors controlling leachability such as pH, redox potential, complexing capacity and physical parameters are addressed in these tests ;
- (2) "Compliance" tests are used to determine whether the waste complies with specific reference values. The tests focus on key variables and leaching behaviour identified by basic characterisation tests ;
- (3) "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 the compliance test(s).

The procedures described in this European Standard fall in category 2 : compliance tests.

The four procedures described in the four following European Standards are based on different liquid to solid (L/S) ratios and different particle sizes because these parameters, among others, play an important role in the leaching process:

EN 12457-1, *One stage batch test at a liquid to solid ratio of 2 l/kg for materials with high solid content and with particle size below 4 mm (without or with size reduction).*

EN 12457-2, *One stage batch test at a liquid to solid ratio of 10 l/kg for materials with particle size below 4 mm (without or with size reduction).*

EN 12457-3, *Two stage batch test at a liquid to solid ratio of 2 l/kg and 8 l/kg for materials with high solid content and with particle size below 4 mm (without or with size reduction).*

EN 12457-4, *One stage batch test at a liquid to solid ratio of 10 l/kg for materials with particle size below 10 mm (without or with size reduction).*

Each part specifies a distinct procedure. The specific features of each part are described in the scope and principle of each part. For given wastes the results can be different for the different procedures. There are six annexes to this European Standard giving useful information on the selection of the appropriate procedure, reference documents and guidance on the limitations of these procedures.

The choice of the procedure depends on the degree and type of information required for compliance testing. This choice has to be made by the organisation establishing the compliance requirements.

This European Standard specifies a compliance test. For basic characterisation, a methodology for the determination of the leaching behaviour of waste has been developed within TC 292 and formulated in ENV 12920.



## 1 Scope

This part of four European Standards specifies a compliance test providing information on leaching of granular wastes and sludges under the experimental conditions specified hereafter, and particularly a liquid to solid ratio of 2 l/kg dry matter. It applies to waste which has a particle size below 4 mm without or with size reduction (as specified in 4.3.2)

This European Standard has been developed to investigate mainly inorganic constituents from wastes. It does not take into account the particular characteristics of non-polar organic constituents nor the consequences of microbiological processes in organic degradable wastes.

The test procedure specified in this European Standard produces an eluate which shall subsequently be characterised physically and chemically according to appropriate standard methods.

This procedure is only applicable to waste material and sludges having a high solid content : the dry matter content ratio shall be at least higher than 33%. In addition, the necessary quantity of eluate shall be obtained to perform the physical and chemical characterisation of the eluate. Furthermore, the minimum dry matter content ratio shall be high enough to allow a sufficient mixing of the leachant and the test portion.

NOTE 1 This procedure cannot be applicable to materials with a water content or such a water affinity that a good mixing of the solid with the predetermined quantity of liquid is not achievable.

NOTE 2 This procedure cannot be applicable to materials reacting with the leachant, leading, for example, to excessive gas emission, a solidifying effect or an excessive heat release.

NOTE 3 By crushing the material, new surfaces are exposed which may lead to a change in leaching properties.

NOTE 4 In relation with the minimum dry matter content ratio required for obtaining enough eluate, the test portion specified in this European Standard of 175 gram dry matter results in a maximum volume of eluate of 175 ml if its dry matter content ratio is 50 %.

When this part 1 is not applicable, the leaching test at L/S = 10 specified in part 2 can be performed.

This test cannot be used alone to determine the leaching behaviour of a waste, as specified in ENV 12920.

This European Standard does not address issues related to health and safety.

## 2 Normative references

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).

ENV 12506, *Characterization of waste - Analysis of eluates - Determination of pH, As, Cd, Cr VI, Cu, Ni, Pb, Zn, Cl, NO<sub>2</sub><sup>-</sup>, SO<sub>4</sub><sup>2-</sup>*.

ENV 13370, *Characterization of waste – Analysis of eluates – Determination of Ammonium–N, AOX, conductivity, Hg, phenol index, TOC, CN easily liberatable, F*

EN 12880, *Characterisation of sludges – Determination of dry residue and water content*.

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

EN ISO 5667-3, *Water Quality - Sampling - Part 3 : Guidance on the preservation and handling of samples (ISO 5667-3:1994)*.

## EN 12457-1:2002 (E)

ISO 5725-5:1998, *Accuracy (trueness and precision) of measurement methods and results – Part 5: Alternative methods for the determination of the precision of a standard measurement method.*

ISO 11465, *Soil Quality - Determination of dry matter and water content on a mass basis - Gravimetric method.*

### 3 Terms and definitions

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

#### 3.1 leaching test

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

#### 3.2 leachant

liquid used in a leaching test

NOTE For the purpose of this European Standard the leachant is water as specified in 4.2.15

#### 3.3 eluate

solution recovered from a leaching test

#### 3.4 single batch leaching test

leaching test in which a fixed amount of material is leached in one step with a fixed amount of leachant

#### 3.5 serial batch leaching test

leaching test for two or more subsequent extractions of the same portion of material with a fresh amount of leachant

#### 3.6 liquid to solid ratio L/S (abbreviation : L/S)

ratio between the total amount of liquid (L in litre), which in a leaching test is in contact with the waste, and the dry mass of the sample (S in kg of dry matter) abbreviated L/S and expressed in l/kg

#### 3.7 liquid waste

waste that completely flows out of a calibrated opening, down to the upper level of the opening within a limited period of time less than 8 h (annex B informative)

#### 3.8 sludge

mixture of liquid and solids separated from various types of liquids as a result of natural or artificial processes

NOTE In the field of water treatment, the prevailing standards (EN 1085 and EN 12880) use the word water instead of the word liquid.

#### 3.9 monolithic waste

material which has certain minimum dimensions and physical and mechanical properties that ensure its integrity over a certain period of time

#### 3.10 granular waste

waste that is neither monolithic, liquid, gas nor sludge

### 3.11

#### **dry matter content ratio** (abbreviation : DR)

ratio expressed in percent between the mass of the dry residue, determined according to ISO 11465, or EN 12880 for sludges, and the corresponding raw mass

### 3.12

#### **moisture content ratio** (abbreviation MC)

ratio expressed in percent between the mass of water contained in the material and the corresponding dry mass of the material

NOTE The basis for the calculation of the moisture content is the mass of the dry residue in this European Standard, as specified in ISO 11465 (for the determination of the water content of soil). It is to be noted that in EN 12880 (for the determination of water content of sludges), the water content is calculated on the basis of the raw mass.

### 3.13

#### **laboratory sample**

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

NOTE 1 When the laboratory sample is further prepared (reduced) by subdividing, mixing, grinding 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 sample collection but it is the initial sample from the point of view of the laboratory.

NOTE 2 Several laboratory samples can 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.

### 3.14

#### **test sample**

sample, prepared from the *laboratory sample*, from which *test portions* are removed for testing or for analysis ( IUPAC definition )

### 3.15

#### **test portion**

amount or volume of the *test sample* taken for analysis, usually of known weight or volume ( IUPAC definition )

## 4 Compliance test

### 4.1 Principle

The sample material, which originally or after pre-treatment has a particle size below 4 mm as defined in 4.3.2, is brought into contact with water (4.2.15) under defined conditions. This European Standard is based on the assumption that equilibrium or near-equilibrium is achieved between the liquid and solid phases during the test duration (see 5.2.1). The solid residue is separated by filtration. The properties of the eluate are measured using methods developed for water analysis adapted to meet criteria for analysis of eluates (ENV 12506, ENV 13370 and others under development).

After the test the leaching conditions in terms of pH, conductivity and optionally redox potential dictated by the waste are recorded.

NOTE These parameters often control the leaching behaviour of wastes and are therefore important for checking the leaching test.

### 4.2 Equipment and reagents

**4.2.1** Glass or high density polyethylene (HDPE)/polypropylene (PP) bottles in accordance with EN ISO 5667-3, with a nominal volume of 500 ml, glass bottles having caps of inert material, for example PTFE (polytetrafluoroethylene). Rinsing is compulsory.

NOTE 1 For inorganic constituents HDPE/PP bottles are preferred, except for samples analysed for mercury.