



**SLOVENSKI STANDARD
SIST-TP CEN/TR 16192:2020**

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**Nadomešča:
SIST EN 16192:2012**

Odpadki - Navodilo za analizo izlužkov

Waste - Guidance on analysis of eluates

Abfällen - Anleitung zur analyse von Eluaten

Déchets - Lignes directives pour analyse des éluats

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ICS:

13.030.20 Tekoči odpadki. Blato Liquid wastes. Sludge

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CEN/TR 16192

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English Version

Waste - Guidance on analysis of eluates

Déchets - Lignes directrices pour analyse des éluats

Abfällen - Anleitung zur analyse von Eluaten

This Technical Report was approved by CEN on 2 March 2020. It has been drawn up by the Technical Committee CEN/TC 444.

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

CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

Contents	Page
European foreword.....	3
Introduction	4
1 Scope.....	5
2 Normative references.....	5
3 Terms and definitions	5
4 Sample pretreatment.....	6
5 Blank determination.....	6
6 Interference	6
7 Selection of the suitable test method.....	7
8 Expression of results.....	10
9 Test report.....	11
Annex A (informative) Validation of EN 12506:2003 and EN 13370:2003	12
A.1 General.....	12
A.2 Interlaboratory study.....	12
A.3 Selection of laboratories.....	12
A.4 Selection of samples.....	12
A.5 Validation scope	13
A.6 Results and statistics	15
A.7 Conclusion.....	24
Annex B (informative) Additional validation data.....	25
B.1 Round robin test for the determination of Ba, Cd, Cr, Mo, Sb and Se in eluates	25
B.1.1 General.....	25
B.1.2 Round robin samples.....	25
B.1.3 Results of the round robin test.....	25
B.1.4 Conclusion from the round robin test	30
B.2 Round robin tests in the framework of acceptability of waste at landfills	30
Bibliography.....	34

European foreword

This document (CEN/TR 16192:2020) has been prepared by Technical Committee CEN/TC 444 "Test methods for environmental characterization of solid matrices", 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 shall not be held responsible for identifying any or all such patent rights.

This document supersedes EN 16192:2011.

The changes between this document and the previous edition involve updating the relevant EN and ISO standards or removing them if withdrawn, and adding new relevant standards. Furthermore, the document has changed from a normative standard into an informative report.

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CEN/TR 16192:2020**Introduction**

This document is intended to be used for the characterization of waste as defined in the Council Directive 75/442/EEC on waste, as amended by Council Directive 91/156/EEC of 18th March 1991, and national regulations, whose final destination for disposal is landfill. In the Council Decision of 19 December 2002 establishing criteria and procedures for the acceptance of waste at landfills pursuant to Article 16 of and Annex II to Directive 1999/31/EC, the test methods are described for determining the acceptability of waste at landfills. In section 3 of the Annex of this Decision, the European standards EN 12506 and EN 13370 are included which are replaced by this document.

This document deals with the determination of chemical constituents, electrical conductivity, pH and total dissolved solids (TDS) in eluates which have been obtained by leaching of waste samples, for example using EN 12457-1 to EN 12457-4: "Characterization of waste - Leaching - Compliance test for leaching of granular waste materials and sludges". In principle, it can be used for the analysis of every kind of eluate as long as the performance characteristics of the applied analytical method fulfil the specific requirements.

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1 Scope

This document summarizes methods for the determination of the parameters pH, ammonium, AOX, As, Ba, Cd, Cl⁻, easily liberatable cyanide, Co, Cr, Cr(VI), Cu, DOC/TOC, electrical conductivity, F⁻, Hg, Mo, Ni, NO₂⁻, Pb, phenol index, total S, Sb, Se, SO₄²⁻, TDS, V and Zn in aqueous eluates for the characterization of waste.

2 Normative references

There are no normative references in this document.

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:

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <https://www.iso.org/obp/ui>

3.1

eluante

solution obtained by a defined leaching test

3.2

laboratory sample

sample or subsample(s) sent to or received by a laboratory

3.3

leachant

aqueous solution used in a leaching test

3.4

leaching test

laboratory test for the determination of the release of matter from a waste into water or an aqueous solution

3.5

sample

portion of material selected from a larger quantity of material

3.6

test portion

analytical portion

quantity of material of proper size for measurement of the concentration or other properties of interest, removed from the test sample

Note 1 to entry: The test portion can be taken from the laboratory sample directly if no preparation of sample is required (e.g. with liquids), but usually it is taken from the prepared test sample.

Note 2 to entry: A unit or increment of suitable homogeneity, size and fineness, needing no further preparation, can be a test portion.

CEN/TR 16192:2020

3.7

test sample

analytical sample

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

4 Sample pretreatment

The eluate should be analysed for the total content of its constituents. If precipitation occurs between the preparation of the eluate and the analysis it is necessary to ensure by appropriate methods (e.g. re-dissolution, separate analysis of solution and precipitate) that the total content of the parameters of interest is determined. If the eluate results from a procedure including a 0,45 µm membrane filtration process, then the analytical results refer to the content dissolved by the leaching process.

Eluates are susceptible to change to different extents as a result of physical, chemical or biological reactions which could take place between the time of leaching and the analysis. pH should be determined immediately after preparation of the eluates and prior to sample pretreatment and this should be recorded.

It is therefore recommended to take the necessary precautions to minimize these reactions and in the case of many parameters to analyse the eluate sample with a minimum of delay. The recommended maximum delay is given in EN ISO 5667-3 or in the respective analytical standards.

Precautions should be taken before and during transport as well as during the time in which the samples are preserved in the laboratory before being analysed, to avoid alteration of the test portion.

The eluate should be split in an adequate number of test portions for different chemical analyses and they should be preserved according to the requirements in the analytical standards or EN ISO 5667-3.

One specific test portion may be an untreated aliquot of the laboratory sample for the analysis of substances such as chloride, fluoride, sulfate, nitrite and chromium(VI) as well as for the determination of electrical conductivity.

For trace metal analysis test portions usually need to be acidified to $\text{pH} \leq 2$ with nitric acid.

For safety reasons, it is recommended to acidify the test portion under an extraction hood or in a fume cupboard as volatile toxic substances could be generated.

NOTE In cases where high contents of soluble solids are leached, acidification of the eluates can lead to precipitation of salts. This can be avoided by using a suitable dilution prior to acidification.

5 Blank determination

The blank contribution of the applied analytical procedures should be determined as described in the analytical standards and allowed for in the calculation of the results when appropriate.

6 Interference

A large number of compounds can interfere with the determination of the parameters concerned. These potential interferences are listed in the individual standards in question.

Several types of interference effects can contribute to inaccuracies in the determination of the various parameters, especially at low concentrations. These potential interference effects are listed in the individual standards and should be considered separately for each analytical technique.

Chemical interferences are characterized by molecular compound formation, ionization effects, solute vaporization, precipitation and effects of degradation of organic matter. Addition of a pH buffer and/or other preservation methods could reduce these effects.

Physical interferences can be caused by changes of viscosity and surface tension. They can cause significant inaccuracies especially in eluate samples containing high concentrations of acids and/or dissolved components. The colour or turbidity of eluates can cause interference in spectrophotometric determination.

7 Selection of the suitable test method

The appropriate standardized test method listed in Table 1 can be selected according to the type of waste eluate, the concentration range of the parameter of interest and the expected interferences.

For analytical quality control purposes ISO/TS 13530 and EN ISO/IEC 17025 should be considered.

It is pointed out that the standardized test methods listed in Table 1 have primarily been developed for the analysis of water samples. Most of them were validated in an interlaboratory trial for a limited number of waste eluate matrices (see Annex A). Their suitability for other waste eluates should be checked in the laboratory performing the analysis. Additional validation data obtained in the evaluation of the analytical performance of laboratories are given in Annex B.

Those standards cited in Table 1 that have not been validated in the CEN/TC 292 interlaboratory trial in 1999 - 2001 (Annex A), including revised or newly developed standards since this trial, have the matrix waste water and/or leachates included in their scope, and they proved to be applicable for the analysis of eluates in routine analyses.

If the methods referred to in Table 1 are found to be inappropriate by reason of, for example, detection limits, repeatability or interferences, other methods validated for water analysis can be used. Their suitability for waste eluates should be checked in the laboratory performing the analysis. The reason for the deviation should be stated in the test report.

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Table 1 — Parameters and test methods

Parameter	Test method
pH	EN ISO 10523:2012
Ammonium	EN ISO 11732:2005 EN ISO 14911:1999 ISO 7150-1:1984 ISO 15923-1:2013
AOX	EN ISO 9562:2004
As	EN ISO 11885:2009 EN ISO 15586:2003 EN ISO 17294-1:2006 EN ISO 17294-2:2016 ISO 17378-1:2014 ISO 17378-2:2014
Ba	EN ISO 11885:2009 EN ISO 17294-1:2006 EN ISO 17294-2:2016
Cd	ISO 8288:1986 EN ISO 11885:2009 EN ISO 15586:2003 EN ISO 17294-1:2006 EN ISO 17294-2:2016
Cl ⁻	ISO 9297:1989 EN ISO 10304-1:2009 EN ISO 15682:2001
CN ⁻ easily liberatable	EN ISO 14403-1:2012 ^a EN ISO 14403-2:2012 ^a ISO 6703-2:1984
Co	EN ISO 11885:2009 EN ISO 15586:2003 EN ISO 17294-1:2006 EN ISO 17294-2:2016
Cr	EN ISO 11885:2009 EN ISO 15586:2003 EN ISO 17294-1:2006 EN ISO 17294-2:2016
Cr(VI)	ISO 11083:1994 EN ISO 10304-3:1997 EN ISO 23913:2009

Parameter	Test method
Cu	ISO 8288:1986 EN ISO 11885:2009 EN ISO 15586:2003 EN ISO 17294-1:2006 EN ISO 17294-2:2016
DOC/TOC	EN 1484:1997
Electrical conductivity	EN 27888:1993
F ⁻	EN ISO 10304-1:2009 ^b ISO 10359-1:1992
Hg	EN ISO 12846:2012 EN ISO 17852:2008
Mo	EN ISO 11885:2009 EN ISO 15586:2003 EN ISO 17294-1:2006 EN ISO 17294-2:2016
Ni	ISO 8288:1986 EN ISO 11885:2009 EN ISO 15586:2003 EN ISO 17294-1:2006 EN ISO 17294-2:2016
NO ₂ ⁻	EN 26777:1993 EN ISO 10304-1:2009 EN ISO 13395:1996 ISO 15923-1:2013
Pb	ISO 8288:1986 EN ISO 11885:2009 EN ISO 15586:2003 EN ISO 17294-1:2006 EN ISO 17294-2:2016
Phenol index	EN ISO 14402:1999 ^c ISO 6439:1990
Total S	EN ISO 11885:2009
Sb	EN ISO 11885:2009 EN ISO 15586:2003 EN ISO 17294-1:2006 EN ISO 17294-2:2016 ISO 17378-1:2014 ISO 17378-2:2014

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Parameter	Test method
Se	EN ISO 11885:2009 EN ISO 15586:2003 EN ISO 17294-1:2006 EN ISO 17294-2:2016 ISO/TS 17379-1:2013 ISO/TS 17379-2:2013
SO ₄ ²⁻	EN ISO 10304-1:2009 ISO 15923-1:2013 ISO 22743:2006
TDS	EN 15216:2007
V	EN ISO 11885:2009 EN ISO 15586:2003 EN ISO 17294-1:2006 EN ISO 17294-2:2016
Zn	ISO 8288:1986 EN ISO 11885:2009 EN ISO 15586:2003 EN ISO 17294-1:2006 EN ISO 17294-2:2016
a	free cyanide is equivalent to easily liberatable cyanide for eluates with low organic content after distillation.
b	for eluates with low organic content.
c	after distillation.

NOTE Some parameters as described in Table 1 can be analysed simultaneously with the same technique. For instance, ISO 15923-1:2013 specifies methods with a discrete analysis system, allowing the simultaneous determination of ammonium, nitrate and sulfate. ISO 17294-2:2016 and EN ISO 11885:2009 specify an ICP-MS method and ICP-AES method, respectively, allowing the simultaneous determination of the above elements As, Ba, Cd, Co, Cr, Cu Mo, Ni, Pb, Sb, Se, V and Zn.

8 Expression of results

Specific instructions for the calculation of the results given in the individual analytical standards should be strictly observed.

The results of the tests except for pH and electrical conductivity should be expressed as a concentration of the constituents in the eluate, expressed in µg/l or mg/l. The amount of constituent leached relative to the total mass of the sample, in mg/kg of dry matter, can be calculated using the liquid to solid ratio of the leaching test.