SLOVENSKI STANDARD
SIST EN 17200:2024

01-april-2024

Nadomešča:
SIST-TS CEN/TS 17200:2019+AC:2019

Gradbeni proizvodi - Ocenjevanje sproščanja nevarnih snovi - Analiza anorganskih snovi po razklopu in v izlužkih - Analiza z masno spektrometrijo z induktivno sklopljeno plazmo (ICP-MS)

Construction products - Assessment of release of dangerous substances - Analysis of inorganic substances in eluates and digests - Analysis by inductively coupled plasma mass spectrometry (ICP-MS)

Bauprodukte - Bewertung der Freisetzung von gefährlichen Stoffen - Analyse von anorganischen Stoffen in Aufschlusslösungen und Eluaten - Analyse mit induktiv gekoppeltem Plasma - Massenspektrometrie (ICP-MS)

Produits de construction : Évaluation de l'émission de substances dangereuses - Analyse des substances inorganiques dans les digestats et les éluats - Analyse par spectrométrie de masse avec plasma à couplage inductif (ICP-MS)

Ta slovenski standard je istoveten z: EN 17200:2023

ICS:

13.020.99	Drugi standardi v zvezi z varstvom okolja	Other standards related to environmental protection
91.100.01	Gradbeni materiali na splošno	Construction materials in general

SIST EN 17200:2024 **en,fr,de**

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 17200

November 2023

ICS 91.100.01

Supersedes CEN/TS 17200:2018+AC:2018

English Version

Construction products: Assessment of release of dangerous substances - Analysis of inorganic substances in eluates and digests - Analysis by inductively coupled plasma mass spectrometry (ICP-MS)

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This European Standard was approved by CEN on 14 August 2023.

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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

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European foreword

This document (EN 17200:2023) 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 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of an identical text or by endorsement, at the latest by May 2024, and conflicting national standards shall be withdrawn at the latest by May 2024.

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 CEN/TS 17200:2018+AC:2018.

In comparison with the previous edition, the following technical modifications have been made:

— the addition of performance data and data from intercomparison validation;

— alignment of terms and definitions within the working groups of CEN/TC 351, i.e. through the revised version of EN 16687.

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

Any feedback and questions on this document should be directed to the users’ national standards body. A complete listing of these bodies can be found on the CEN website.

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

Introduction

Following an extended evaluation of available methods for content and eluate analysis in construction products (CEN/TR 16045) it was concluded that multi element analysis methods have preference over methods developed for single elements or small groups of elements. This implies that for inorganic substances ICP methods are preferred for the analysis of extracts obtained from digestion or eluates obtained from leaching.

This standard has been adopted from the work carried out in the context of CEN/TC 400 (project HORIZONTAL) and is very similar to EN 16171.

The outcome of the analysis of materials that due to considerations of reuse/recycling could fall under an evaluation as construction products would be considered to fall within the uncertainties as specified by the respective methods and as such would not require an additional analysis, thus avoiding double testing.

NOTE 1 A similar method has been validated for the determination of elements in *aqua regia* digests (EN ISO 54321) for the following matrices: municipal sludge, industrial sludge, sludge from electronic industry, ink waste sludge, sewage sludge, biowaste, compost, composted sludge, agricultural soil, sludge amended soil, waste, city waste incineration fly ash ("oxidised" matrix), city waste incineration bottom ash ("silicate" matrix), ink waste sludge (organic matrix), electronic industry sludge ("metallic" matrix), sewage sludge (BCR 146R), city waste incineration ash (BCR 176).

NOTE 2 A similar method has been validated for the determination of elements in hydrochloric (HCl), nitric (HNO_3) and tetrafluoroboric (HBF_4) or hydrofluoric (HF) acid mixture digests (EN 13656) for the following matrices: city waste incineration ash (BCR176/BCR176R), ink waste sludge (organic matrix), electronic industry sludge ("metallic" matrix), sediment, coal fly ash, steel slag, copper slag, city waste incineration fly ash ("oxidised" matrix), city waste incineration bottom ash ("silicate" matrix), sewage sludge (BCR 146R).

This document is part of a modular horizontal approach which was adopted in CEN/TC 351. "Horizontal" means that the methods can be used for a wide range of materials and products with certain properties. "Modular" means that a test standard developed in this approach concerns a specific step in assessing a property and not the whole chain of measurement (from sampling to analyses). Beneficial features of this approach are that modules can be replaced by better ones without jeopardizing the standard chain and duplication of work of in different Technical Committees for Products can be avoided as far as possible.

The modules that relate to the standards developed in CEN/TC 351 are specified in CEN/TR 16220, which distinguishes between the modules. This document belongs to the analytical step.

The use of modular horizontal standards implies the drawing of test schemes as well. Before executing a test on a certain construction product to determine certain characteristics, it is necessary to draw up a protocol in which the adequate modules are selected and together form the basis for the entire test procedure.

1 Scope

This document specifies the method for the determination of major, minor and trace elements in eluates and in *aqua regia* and nitric acid digests of construction products by inductively coupled plasma mass spectrometry (ICP-MS). It refers to the following 67 elements:

aluminium (Al), antimony (Sb), arsenic (As), barium (Ba), beryllium (Be), bismuth (Bi), boron (B), cadmium (Cd), calcium (Ca), cerium (Ce), caesium (Cs), chromium (Cr), cobalt (Co), copper (Cu), dysprosium (Dy), erbium (Er), europium (Eu), gadolinium (Gd), gallium (Ga), germanium (Ge), gold (Au), hafnium (Hf), holmium (Ho), indium (In), iridium (Ir), iron (Fe), lanthanum (La), lead (Pb), lithium (Li), lutetium (Lu), magnesium (Mg), manganese (Mn), mercury (Hg), molybdenum (Mo), neodymium (Nd), nickel (Ni), palladium (Pd), phosphorus (P), platinum (Pt), potassium (K), praseodymium (Pr), rubidium (Rb), rhenium (Re), rhodium (Rh), ruthenium (Ru), samarium (Sm), scandium (Sc), selenium (Se), silicon (Si), silver (Ag), sodium (Na), strontium (Sr), sulphur (S), tellurium (Te), terbium (Tb), thallium (Tl), thorium (Th), thulium (Tm), tin (Sn), titanium (Ti), tungsten (W), uranium (U), vanadium (V), ytterbium (Yb), yttrium (Y), zinc (Zn), and zirconium (Zr).

NOTE 1 Construction products include e.g. mineral-based products (S); bituminous products (B); metals (M); wood-based products (W); plastics and rubbers (P); sealants and adhesives (A); paints and coatings (C), see also CEN/TR 16045.

The working range depends on the matrix and the interferences encountered.

NOTE 2 The limit of detection of most elements will be affected by their natural abundance, ionization behaviour, on abundance of isotope(s) free from isobaric interferences and by contamination (e.g. handling and airborne). Handling contaminations are in many cases more important than airborne ones.

The limit of detection (MDL) will be higher in cases where the determination is likely to be interfered (see Clause 6) or in case of memory effects (see e.g. EN ISO 17294-1).

The method in this document is applicable to construction products and validated for the product types listed in Annex A (informative).

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 16637-2, *Construction products: Assessment of release of dangerous substances — Part 2: Horizontal dynamic surface leaching test*

EN 16637-3, *Construction products: Assessment of release of dangerous substances — Part 3: Horizontal up-flow percolation*

EN 16687:2023, *Construction products: Assessment of release of dangerous substances — Terminology*

EN 17196, *Construction products: Assessment of release of dangerous substances — Digestion by aqua regia for subsequent analysis of inorganic substances*

EN ISO 17294-1:2006, *Water quality — Application of inductively coupled plasma mass spectrometry (ICP-MS) — Part 1: General guidelines (ISO 17294-1:2004)*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 16687:2023 and the following apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1
analyte
determinant
element, ion or substance to be determined by an analytical method

[SOURCE: EN 16687:2023, 3.3.1.11]

3.2
aqua regia
solution obtained by mixing one volume of nitric acid and three volumes of hydrochloric acid

[SOURCE: EN 16687:2023, 3.2.2.10]

3.3
digest
solution resulting from acid digestion of a sample

[SOURCE: EN 16687:2023, 3.2.2.8]

3.4
eluate
solution obtained from a leaching test

[SOURCE: EN 16687:2023, 3.3.2.8]

3.5
instrument detection limit
IDL
smallest analyte concentration that can be detected with a defined statistical probability using a contaminant free instrument and a blank calibration solution

[SOURCE: EN 16687:2023, 3.3.1.13 – modified, Note 1 to entry removed]

3.6
laboratory sample
sample or sub-sample(s) sent to or received by the laboratory

[SOURCE: EN 16687:2023, 3.2.2.1 – modified, Notes to entry removed]

3.7
method detection limit
MDL
lowest analyte concentration that can be detected with a specified analytical method including sample preparation with a defined statistical probability

[SOURCE: EN 16687:2023, 3.3.1.12; modified – Note 1 to entry removed]

3.8
sample
portion of material selected from a larger quantity of material

[SOURCE: EN 16687:2023, 3.2.1.5 – modified, Notes to entry removed]

3.9
test portion
analytical portion
amount of the test sample taken for testing/analysis purposes, usually of known dimension, mass or volume

[SOURCE: EN 16687:2023, 3.2.2.3 – modified, Examples removed]

3.10
test sample
analytical sample
sample, prepared from the laboratory sample, from which test portions are removed for testing or for analysis

[SOURCE: EN 16687:2023, 3.2.2.2]

4 Abbreviations

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

FEP	Hexafluoroethene propene
HDPE	High-density polyethylene
ICP	Inductively coupled plasma
ICS	Interference check solution
IDL	Instrumental detection limit
IEC	Inter-element correction
LOD	Limit of detection
MS	Mass spectrometry
OES	Optical emission spectrometry
PFA	Perfluoroalkoxy alkane
PTFE	Polytetrafluoroethylene
PVC	Polyvinylchloride
QC	Quality control

5 Principle

This method describes the multi-elemental determination of analytes by ICP-MS in (diluted) nitric acid or *aqua regia* digests. The method measures ions produced by a radio-frequency inductively coupled plasma. Analyte species originating in a liquid are nebulised and the resulting aerosol is transported by argon gas into the plasma. The ions produced by high temperatures of the plasma are entrained in the plasma gas and introduced, by means of an interface, into a mass spectrometer, sorted according to their mass-to-charge ratios and quantified with a detector (e.g. channel electron multiplier). Interferences shall be assessed and valid corrections applied. Interference correction shall include compensation for background ions contributed by the plasma gas, reagents, and constituents of the sample matrix.

6 Interferences

6.1 General

Non-spectral interferences shall be in accordance with 6.1 of EN ISO 17294-1:2006.

6.2 Spectral interferences

6.2.1 Isobaric elemental interferences

Isobaric elemental interferences are caused by isotopes of different elements of closely matched nominal mass-to-charge ratio and which cannot be separated due to an insufficient resolution of the mass spectrometer in use (e.g. ^{114}Cd and ^{114}Sn).

Element interferences from isobars may be corrected for taking into account the influence from the interfering element. The isotopes used for correction shall be free of interference if possible. Correction options are often included in the instrument software.

6.2.2 Isobaric molecular and doubly charged ion interferences

Isobaric molecular and doubly-charged ion interferences in ICP-MS are caused by ions consisting of more than one atom or charge, respectively. Examples include $^{40}Ar^{35}Cl^{+}$ and $^{40}Ca^{35}Cl^{+}$ ion on the ^{75}As signal and $^{98}Mo^{16}O^{+}$ ions on the $^{114}Cd^{+}$ signal. Natural isotope abundances are available from the literature. However, the most precise coefficients for an instrument will be determined from the ratio of the net isotope signals observed for a standard solution.

The accuracy of these types of equations is based upon the constancy of the observed isotopic ratios for the interfering species. Corrections that presume a constant fraction of a molecular ion relative to the "parent" ion have not been found to be reliable, e.g. oxide levels can vary with operating conditions. If a correction for an oxide ion is based upon the ratio of parent-to-oxide ion intensities, the correction shall be adjusted for the degree of oxide formation by the use of an appropriate oxide internal standard previously demonstrated to form a similar level of oxide as the interferent.

Other possibilities to correct for isobaric and doubly charged ion interferences are the use of an instrument with collision/reaction cell technology or high resolution ICP-MS.

The response of the analyte of interest shall be corrected for the contribution of isobaric molecular and doubly charged interferences if their impact can be higher than three times the IDL or higher than half the lowest concentration to be reported.