SLOVENSKI STANDARD
SIST EN ISO 22940:2021

01-november-2021

Trdna alternativna goriva - Določevanje elementne sestave z rentgensko fluorescenco (ISO 22940:2021)

Solid recovered fuels - Determination of elemental composition by X-ray fluorescence (ISO 22940:2021)

Feste Sekundärbrennstoffe - Bestimmung der Elementzusammensetzung durch Röntgenfluoreszenz (ISO 22940:2021)

Combustibles solides de récupération - Détermination de la composition élémentaire par fluorescence de rayons X (ISO 22940:2021)

Ta slovenski standard je istoveten z: **EN ISO 22940:2021**

ICS:

75.160.10	Trda goriva	Solid fuels

SIST EN ISO 22940:2021 **en,fr,de**

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN ISO 22940

September 2021

ICS 75.160.10

English Version

Solid recovered fuels - Determination of elemental composition by X-ray fluorescence (ISO 22940:2021)

Combustibles solides de recupération - Détermination de la composition élémentaire par fluorescence de rayons X (ISO 22940:2021)

Feste Sekundärbrennstoffe - Bestimmung der Elementzusammensetzung durch Röntgenfluoreszenz (ISO 22940:2021)

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

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European foreword

This document (EN ISO 22940:2021) has been prepared by Technical Committee ISO/TC 300 "Solid recovered materials, including solid recovered fuels" in collaboration with Technical Committee CEN/TC 343 “Solid Recovered Fuels” the secretariat of which is held by SFS.

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of an identical text or by endorsement, at the latest by March 2022, and conflicting national standards shall be withdrawn at the latest by March 2022.

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The text of ISO 22940:2021 has been approved by CEN as EN ISO 22940:2021 without any modification.

INTERNATIONAL STANDARD

ISO 22940

First edition
2021-08

Solid recovered fuels — Determination of elemental composition by X-ray fluorescence

Combustibles solides de récupération — Détermination de la composition élémentaire par fluorescence de rayons X

Reference number
ISO 22940:2021(E)

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Published in Switzerland

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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This document was prepared by Technical Committee ISO/TC 300, *Solid recovered materials, including solid recovered fuels*, in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 343, *Solid Recovered Fuels*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

X-ray fluorescence spectrometry can be used as a fast method for a qualitative overview of ash forming elements and impurities. When calibration is based on reference materials or on matrix-matched homogeneous solid recovered fuel samples with known content, X-ray fluorescence spectrometry can be used for a quantitative analysis of the total content of the specified elements within different solid recovered fuels.

The quality of the results obtained depends very closely on the type of instrument used, e.g. bench top or high performance, energy-dispersive or wavelength-dispersive instruments. When selecting a specific instrument, several factors need to be considered, such as the matrices to be analysed, elements to be determined, detection limits required and the measuring time.

Due to the wide range of matrix compositions and the lack of suitable reference materials in the case of solid recovered fuels from various origin, it is generally difficult to set up a calibration with matrix-matched reference materials. Therefore, it is important to use several homogenized solid recovered fuel samples with properties that sufficiently match the matrices of interest and whose content has been derived by independent measurement techniques, for example total digestion of solid recovered fuels and characterization of major and minor elements by measurement of digestion solutions with ICP-MS or ICP-OES, or by other techniques such as elemental analysis using combustion technology on sulfur or by combustion and ion chromatographic determination for chlorine.

This document describes two different procedures:

1) Quantitative analytical procedure for major elements of solid recovered fuels. The calibration is based on different reference materials and solid recovered fuel samples with known content.

   The elements described as major elements of solid recovered fuels are in fact major elements of the fuel ashes more than of the fuels. The determination of these elements can be helpful to predict the melting behaviour and slagging of the ashes. Moreover, contamination of fuel with sand or soil is indicated by high values of several elements.

2) Total element characterization at a semiquantitative level for major and minor elements of solid recovered fuels. The calibration is based on matrix-independent calibration curves, previously set up by the manufacturer.

   In general, the sensitivity of X-ray fluorescence is not sufficient for a determination of the content of minor elements (trace metals) in solid recovered fuels. However, it is possible to use determination of minor elements after calibration with solid recovered fuel samples with known content or at a semiquantitative level based on matrix-independent calibration curves to collect data for higher sample numbers, taking into account lower achievable precision. Therefore, it may be used to reveal excessive contents of minor elements in solid recovered fuels.

Solid recovered fuels — Determination of elemental composition by X-ray fluorescence

1 Scope

This document specifies the procedure for a determination of major and minor element concentrations in solid recovered fuel material by energy-dispersive X-ray fluorescence (EDXRF) spectrometry or wavelength-dispersive X-ray fluorescence (WDXRF) spectrometry using a calibration with solid recovered fuel reference materials or solid recovered fuel samples with known content. A semiquantitative determination can be carried out using matrix independent standards.

This document is applicable to the following elements: Na, Mg, Al, Si, P, S, Cl, K, Ca, Ti, V, Cr, Mn, Fe, Co, Ni, Cu, Zn, As, Br, Mo, Cd, Sb, Sn, Tl and Pb. Concentration levels between approximately 0,000 1 % and 100 % can be determined depending on the element, the calibration materials used and the instrument used.

NOTE X-ray fluorescence spectrometry can be used as a fast method for a qualitative overview of elements and impurities and after suitable calibration it is very useful for determining major elements or even minor elements (except Hg) in order to quickly identify increased concentrations of minor elements in solid recovered fuels (SRF), for example during SRF-production.

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.

ISO 21637, *Solid recovered fuels — Vocabulary*

ISO 21646,[1] *Solid recovered fuels — Sample preparation*

ISO 21660-3, *Solid recovered fuels — Determination of moisture content using the oven dry method — Part 3: Moisture in general analysis sample*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 21637 and the following 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
absorption edge
abrupt change in mass absorption coefficient at a specific wavelength or energy

3.2
absorption
loss of intensity of X-rays due to isotropic and homogenous material, as described by the Beer-Lambert law

1) Under preparation. Stage at the time of publication: ISO/DIS 21646:2021.

3.3
analytical line
specific characteristic X-ray spectral line of the atom or ion of the analyte used for determination of the analyte content

3.4
continuous radiation (Bremsstrahlung)
electromagnetic radiation produced by the acceleration of a charged particle, such as an electron, when deflected by another charged particle, such as an atomic nucleus

3.5
Compton line
spectral line due to incoherent scattering (Compton effect), occurring when the incident X-ray photon strikes an atom without promoting fluorescence

Note 1 to entry: Energy is lost in the collision and, therefore, the resulting scattered X-ray photon is of lower energy than the incident X-ray photon.

3.6
drift correction monitors
physically stable samples used to correct for instrumental drift

3.7
emitted radiation
emitted sample X-rays
radiation emitted by sample consisting of *X-ray fluorescence radiation* (3.13) and scattered *primary X-rays* (3.11)

3.8
mass absorption coefficient
constant describing the fractional decrease in the intensity of a beam of X-radiation as it passes through an absorbing medium

Note 1 to entry: It is expressed in cm^2/g.

Note 2 to entry: The mass absorption coefficient is a function of the wavelength of the absorbed radiation and the atomic number of the absorbing element.

3.9
powder sample
analyte sample submitted as a powder for direct measurement in the sample cup

3.10
pressed pellet
analyte sample prepared by pressing milled material into a disk

3.11
primary X-rays
X-rays by which the sample is radiated

3.12
quality control sample
stable sample with known contents, for example (certified) reference material (CRM) or homogenized solid recovered fuel samples from known origin whose contents have been derived by independent analysis used to monitor instrument and calibration performance

3.13
X-ray fluorescence radiation
emission of characteristic X-rays from a sample that has been bombarded by high-energy X-rays or gamma rays

4 Symbols and abbreviated terms

4.1 Symbols

Al	aluminium
As	arsenic
Br	bromine
Ca	calcium
Cd	cadmium
Cl	chlorine
Co	cobalt
Cr	chromium
Cu	copper
Fe	iron
K	potassium
Mg	magnesium
Mn	manganese
Mo	molybdenum
Na	sodium
Ni	nickel
P	phosphorus
Pb	lead
S	sulfur
Sb	antimony
Si	silicon
Sn	tin
Ti	titanium
Tl	thallium
V	vanadium
Zn	zinc