
**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*



This document is a preview generated by EKO



COPYRIGHT PROTECTED DOCUMENT

© ISO 2021

All rights reserved. Unless otherwise specified, or required in the context of its implementation, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

Contents

Page

Foreword	iv
Introduction	v
1 Scope	1
2 Normative references	1
3 Terms and definitions	1
4 Symbols and abbreviated terms	3
4.1 Symbols	3
4.2 Abbreviated terms	4
5 Safety remarks	4
6 Principle	4
7 Apparatus	4
8 Interferences and sources of error	5
9 Sample preparation	5
9.1 Preparation principles	5
9.2 Drying of general analysis sample material	5
9.3 Preparation of pressed pellet	6
10 Procedure	6
10.1 Analytical measurement conditions	6
10.1.1 Wavelength-dispersive instruments	6
10.1.2 Energy-dispersive instruments	7
10.1.3 Intensities and background corrections	7
10.2 Calibration	8
10.2.1 General	8
10.2.2 General calibration procedure	8
10.2.3 Calibration procedure using the pressed pellet method (recommended method)	9
10.3 Procedures for correcting matrix effects	10
10.3.1 General	10
10.3.2 Internal standard correction using Compton (incoherent) scattering method	10
10.3.3 Fundamental parameter approach	10
10.3.4 Fundamental or theoretical influence coefficient method	10
10.3.5 Empirical alpha correction	11
10.4 Analysis of the samples	11
11 Quality control	12
11.1 Drift correction procedure	12
11.2 Reference materials and quality control samples	12
12 Calculation of the result	12
13 Performance characteristics	13
14 Test report	13
Annex A (informative) Publicly available solid recovered fuel reference materials	14
Annex B (informative) Validation	15
Bibliography	38

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).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

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.