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Solid mineral fuels — Guidelines for the validation of alternative methods of analysis

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ISO copyright office
Ch. de Blandonnet 8 • CP 401
CH-1214 Vernier, Geneva, Switzerland
Tel. +41 22 749 01 11
Fax +41 22 749 09 47
copyright@iso.org
www.iso.org

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Contents

Page

Foreword ... **iv**

1 Scope ... **1**

2 Normative references ... **1**

3 Terms and definitions ... **1**

4 General ... **2**

5 Preliminary work on the alternative method ... **3**
5.1 General ... 3
5.2 Selectivity and specificity ... 3
5.3 Range and linearity ... 3
5.4 Sensitivity ... 3
5.5 Limit of detection ... 3
5.6 Limit of quantitation ... 4
5.7 Ruggedness ... 4
5.8 Accuracy ... 4
5.9 Precision ... 4

6 Defining the alternative method to be validated ... **4**

7 Procedure ... **5**
7.1 Measurement of precision and trueness ... 5
7.1.1 Precision ... 5
7.1.2 Trueness ... 5
7.2 Comparison with reference materials ... 6
7.2.1 Sources of reference materials ... 6
7.2.2 Estimation of trueness ... 6
7.2.3 Estimation of precision ... 9
7.3 Comparison with International Standard method within a laboratory — Single fuel ... 10
7.3.1 General ... 10
7.3.2 Estimation of trueness ... 10
7.3.3 Estimation of precision ... 12
7.4 Comparison using the International Standard method within a laboratory — Range of fuels ... 13
7.5 Comparison using the International Standard Method, between laboratories ... 13

8 Validation report ... **13**

Annex A (informative) **Explanation of rationale of method A** ... **14**

Annex B (informative) **Example of calculations** ... **16**

Bibliography ... **23**

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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.

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This document was prepared by Technical Committee ISO/TC 27, *Solid mineral fuels*, Subcommittee SC 5, *Methods of analysis*.

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Solid mineral fuels — Guidelines for the validation of alternative methods of analysis

1 Scope

This document describes procedures for validating alternative methods of analysis for coal and coke either directly by comparison with the relevant International Standard method or indirectly by comparison with reference materials that have been exhaustively analysed using the relevant International Standard method.

The statistical analysis methods used are parametric, i.e. their use is possible only when the characteristic is expressed as a simple number on an approximately linear scale. The results from some methods, for example the Gray-King coke type, are not so expressed and the methods given here need to be used only if the data are converted to a parametric scale.

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 5725-6:1994, *Accuracy (trueness and precision) of measurement methods and results — Part 6: Use in practice of accuracy values*

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:

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

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

3.1
accuracy
closeness of agreement between a test result and the acceptable reference value

Note 1 to entry: The term accuracy, when applied to a set of results, describes a combination of random components and a common systematic error or bias component.

3.2
bias
difference between the expectation of the test results and an accepted reference value

Note 1 to entry: Bias is a systematic error as contrasted to random error. There may be one or more systematic error components contributing to the bias. A larger systematic difference from the accepted reference value is reflected by a larger bias value.

3.3
precision
closeness of agreement between independent test results obtained under prescribed conditions

Note 1 to entry: Precision depends only on distribution of random errors and does not relate to the accepted reference value.

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Note 2 to entry: The measure of precision is usually expressed in terms of imprecision and computed as a standard deviation of the test results. Higher imprecision is reflected by a larger standard deviation.

Note 3 to entry: "Independent test results" means results obtained in a manner not influenced by any previous result on the same or similar material.

3.4
trueness
closeness of agreement between the average value obtained from a large series of test results and an accepted reference value

Note 1 to entry: The measure of trueness is usually expressed in terms of bias.

4 General

An International Standard method is a measurement method that has been subjected to a standardization process to satisfy various requirements. Among these requirements, taken from ISO 5725-6:1994, Clause 8, are the following:

— The method shall be applicable to a wide range of levels of characteristics to cover most materials that are internationally traded.

EXAMPLE A method for the determination of sulfur content in coal is applicable to as many internationally traded coals as possible.

— Equipment, reagents and personnel shall be available on an international basis.

— The costs of performing the tests shall be acceptable.

— The precision and trueness of the measurement method shall be acceptable for the users of the results.

Many analytical methods for coal and coke are based on traditional combustion or wet-chemical analysis and the results are highly dependent on the test conditions. They are frequently time-consuming, labour- and skill-intensive and unsuited to automation. However, they meet the requirements of International Standard measurement methods, both in being internationally available and in providing acceptable levels of trueness and precision in international coal trade.

Other, non-standard methods of analysis are in use when

a) most of the material tested comes from the same source and the variation of its characteristics is relatively small. In such cases a simpler, less expensive method may be adequate;

b) an instrumental or automated version of the standard method provides much cheaper analysis of large numbers of samples. Such equipment may be much more expensive than the standard equipment or of a highly proprietary nature;

c) an instrumental method based on an analytical principle different from that of the standard method is available. Such methods have similar characteristics to 4 b) above.

In some cases, if it is possible to write a generic description of the method and the equipment is widely available, methods of types 4 b) and 4 c) above can be developed as International Standards. If an International Standard method already exists for analysis of a particular parameter, the new alternative method should be tested against the established method to ensure that it provides results that are comparable for trueness and accuracy. This is part of the process of issuing the alternative method as an International Standard.

Even if the equipment is widely available, it might not be possible to convert the method into an International Standard because of the proprietary nature of the equipment, speed of development and rapid obsolescence of such equipment.

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