INTERNATIONAL STANDARD

ISO 10251

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Copper, lead, zinc and nickel concentrates — Determination of mass loss of bulk material on drying

Concentrés de cuivre, de plomb, de zinc et de nickel — Détermination de la perte de masse au séchage du matériau en vrac

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Foreword

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International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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.

ISO 10251 was prepared by Technical Committee ISO/TC 183, *Copper, lead, zinc and nickel ores and concentrates*.

This second edition cancels and replaces the first edition (ISO 10251:1997), which has been technically revised.

Introduction

Reference to the percentage mass loss as moisture content is appropriate because, although oxidation, decomposition or sublimation of elemental sulfur may contribute, most of the mass loss on drying is due to loss of moisture.

When oxidation, decomposition or sublimation of elemental sulfur has been shown to occur or volatile organic flotation reagents such as kerosene are present, the chemical analysis test sample should be prepared from the dried moisture test portions. Under these circumstances, the sampling scheme established in accordance with ISO 12743 must ensure that moisture samples and test portions are sufficiently representative for subsequent chemical analysis. Where oxidation is a problem, an inert atmosphere may also be used during the drying stage. Annex A provides a procedure by which it can be determined whether or not a concentrate is susceptible to oxidation, decomposition or sublimation.

Copper, lead, zinc and nickel concentrates — Determination of mass loss of bulk material on drying

WARNING — This International Standard may involve hazardous materials, operations and equipment. This International Standard does not purport to address all of the safety issues associated with its use. It is the responsibility of the user to establish appropriate health and safety practices and determine the applicability of regulatory limitations prior to use.

1 Scope

This International Standard specifies methods for the determination of moisture content of a lot of copper, lead, zinc or nickel concentrate, defined as the percentage mass loss of the moisture test portion under the conditions of drying specified in this document.

In order to obtain an unbiased estimate of the metal content of the lot, it is important that the same drying conditions are used for the determination of bulk and hygroscopic moisture or for preparing a predried test portion.

This International Standard is not applicable to drying samples used for determination of volatile elements such as mercury and sulfur. Such samples are allowed to dry at ambient temperature, and a hygroscopic moisture determination is carried out according to ISO 9599 at the time of chemical analysis.

2 Normative references

The following referenced documents are indispensable for the application 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 12743, *Copper, lead, zinc and nickel concentrates — Sampling procedures for determination of metal and moisture content*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
representative sample
quantity of concentrate representing a larger mass of concentrate with both precision and bias within acceptable limits

3.2
lot
quantity of concentrate to be sampled

3.3
lot sample
quantity of concentrate that is representative of the lot

3.4

sub-lot

subdivided parts of a lot that are processed separately, each of them producing a subsample which is analysed separately, e.g. for moisture determination

3.5

subsample

quantity of concentrate that is representative of the sub-lot

3.6

increment

quantity of concentrate selected by a sampling device in one operation

3.7

moisture sample

representative quantity of concentrate from which test portions are taken for moisture determination

NOTE Alternatively, the whole moisture sample may be dried to determine its moisture content.

3.8

laboratory sample

sample that is processed so that it can be sent to the laboratory and used for further processing and selection of one or more test samples for chemical analysis

3.9

common sample

representative quantity of concentrate that is dried to determine its mass loss and subsequently used for further processing and selection of one or more test samples for chemical analysis

3.10

test sample

representative quantity of concentrate obtained for a laboratory sample when additional preparation, such as drying or hygroscopic moisture determination, is needed prior to selection of one or more test portions

3.11

test portion

representative quantity of concentrate taken from a moisture sample, a laboratory sample or a test sample that is submitted to moisture determination or analysis in its entirety

4 Drying method

4.1 General

Test portions are dried at 105 °C ± 5 °C until constant mass is obtained and the moisture content determined as the percentage mass loss on drying. However, drying to constant mass can be difficult or impossible if the concentrate is susceptible to oxidation, decomposition or sublimation of elemental sulfur, or volatile organic flotation reagents such as kerosene are present (see Annex A). Under these circumstances, using a common sample for moisture determination and chemical analysis, drying in an inert atmosphere, or interrupting the drying is applied. Of these alternatives, the use of a common sample is the best approach, although care needs to be taken to ensure that the moisture samples and test portions are sufficiently representative for subsequent chemical analysis.

One of the following drying methods is selected to suit the particular concentrate. A flow chart for selecting the correct drying method is given in Figure 1, noting that use of a common sample is applicable in all cases.

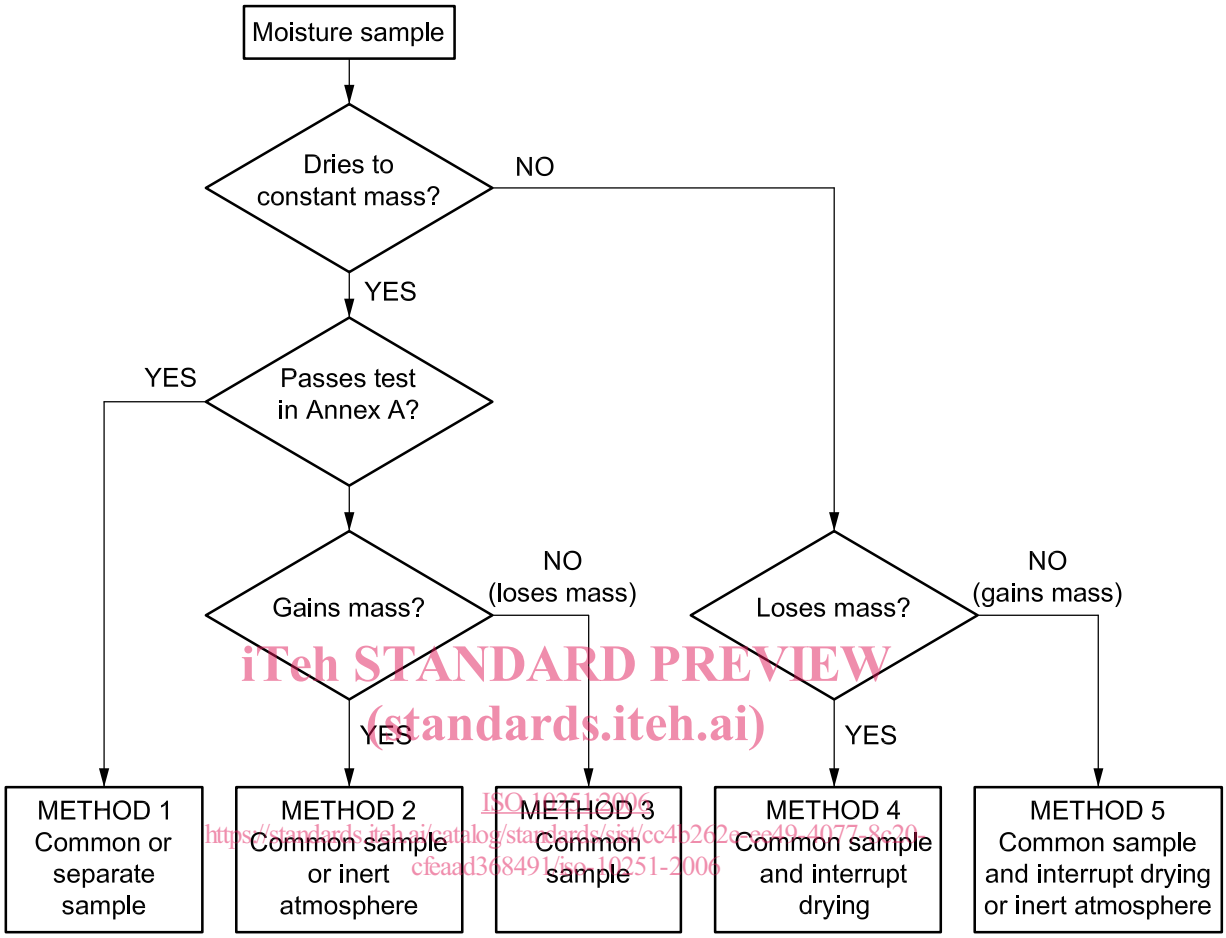

Figure 1 — Procedure for selection of appropriate drying method

4.2 Method 1

Where the test portion can be dried to constant mass and the concentrate passes the test in Annex A, a separate sample for moisture determination or a common sample is dried to constant mass.

4.3 Method 2

Where the test portion can be dried to constant mass but the test in Annex A results in a higher mass (indicating that the concentrate is susceptible to oxidation) moisture and chemical analysis samples are dried to constant mass in an inert atmosphere, or a common sample is dried to constant mass.

4.4 Method 3

Where the test portion can be dried to constant mass but the test in Annex A results in a lower mass (indicating that the concentrate may be losing organics over an extended period) a common sample is dried to constant mass.

4.5 Method 4

Where the test portion cannot be dried to constant mass and continues to lose mass over long periods (indicating that the concentrate may be losing hydrated water, decomposing or subliming) a common sample is used, with interruption of drying after a period determined in accordance with Clause 8 for each concentrate type, and no further drying prior to analysis.

4.6 Method 5

Where the test portion cannot be dried to constant mass and after the initial drying period continues to gain mass (indicating that the concentrate may be oxidizing even when dry) moisture and chemical analysis samples are dried to constant mass in an inert atmosphere, or a common sample is used with interruption of drying after a period determined in accordance with Clause 8 for each concentrate type, and no further drying prior to analysis.

5 Apparatus

5.1 Drying oven, ventilated, with forced circulation of air or inert gas, regulated at a temperature of 105 °C ± 5 °C.

5.2 Top-loading balance, having a minimum precision of 0,01 % as specified in Table 1.

5.3 Drying trays, having dimensions that permit the sample to be spread to a thickness of less than 30 mm. The trays shall be made of corrosion-resistant and heat-resistant material such as stainless steel, glass or enamel plate.

Table 1 — Mass of sample and minimum precision of balance and weighing

Mass of sample kg	Minimum precision of balance and weighing g
1	0,1
2	0,2
5	0,5
10	1
20	2
50	5

The weighing platform should be protected from heat transfer material, e.g. by a 13 mm layer of polystyrene.

6 Processing of samples

Moisture samples shall be taken and processed in accordance with ISO 12743.

If the concentrate is cohesive or excessively wet, the sample may be predried until sample preparation can be conducted without difficulty. The predried moisture content and the total moisture content of the sample shall be determined by the procedure specified in Annex B.

7 Moisture samples

7.1 General

Moisture samples shall be taken as close to the point (position and time) of mass determination as practicable. Samples shall then be prepared and the test portions weighed immediately to minimize bias.

Breaking up of agglomerates by screening is not permitted, because this will result in a change in moisture content.

NOTE If agglomerates are present, the minimum mass of the test portion specified in 7.2, 7.3 and 7.4 or the number of moisture determinations may have to be increased to obtain the required precision.

7.2 From a single lot sample

Where a single lot sample is obtained from a lot, four test portions of not less than 1 kg shall be taken as specified in Table 2 and two of these shall be submitted initially for the determination of moisture content. The two reserve test portions shall be weighed in accordance with the procedure specified in Clause 8 and set aside on a covered tray.

Table 2 — Minimum number of test portions for moisture determination

Type of sample	Number of test portions	Number of subsamples per lot
Lot sample	4	—
Subsample	2	2 to 3
	1	$\geqslant 4$
Increment	1	—

7.3 From subsamples

Where subsamples from a lot are not combined into a single lot sample, the minimum number of test portions specified in Table 2 shall be taken from each subsample and submitted for the determination of moisture content. Each test portion shall be not less than 1 kg in mass.

Where a subsample is prepared from each sub-lot, the mass of each sub-lot shall be recorded at the same time for calculation of the moisture content of the lot.

7.4 From increments

Where moisture determination is conducted on each increment, one test portion of not less than 1 kg shall be taken from each increment as specified in Table 2 and submitted for the determination of moisture content.

The mass of each stratum shall be recorded at the same time for calculation of the moisture content of the lot.

8 Procedure for drying samples to constant mass

Weigh the drying tray and record the mass (m_1) to the precision specified in Table 1. Transfer the test portion (not less than 1 kg) to the drying tray, spreading it evenly using a suitable implement, and weigh immediately. Record the mass (m_2) to the precision specified in Table 1.

Place the tray and test portion in the drying oven and dry at 105 °C ± 5 °C for a predetermined time.

The initial drying time has to be determined empirically. Sixteen hours is sufficient for most cases and can be taken as a guide.

Once the drying period has commenced, no other wet samples should be placed in the same drying oven.

Remove the tray and test portion from the oven and weigh while still hot. Dry the tray and test portion at 105 °C ± 5 °C for an additional 4 h. Remove from the oven and, while still hot, weigh again. Repeat this step as necessary until two successive determinations of the mass of the tray plus dried test portion agree to within 0,05 % of the initial mass of the test portion. Record the mass of the dried test portion plus tray (m_3) to the precision specified in Table 1.