



BSI Standards Publication

Paper, board and pulp — Determination of water-soluble sulfates

National foreword

This British Standard is the UK implementation of [ISO 9198:2020](#). It supersedes [BS ISO 9198:2001](#), which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee PAI/11, Methods of test for paper, board and pulps.

A list of organizations represented on this committee can be obtained on request to its committee manager.

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Paper, board and pulp — Determination of water- soluble sulfates

*Papier, carton et pâte — Détermination des sulfates
solubles dans l'eau*



Reference number
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Contents

Page

Foreword	iv
1 Scope	1
2 Normative references	1
3 Terms and definitions	1
4 Principle	1
5 Reagents	1
5.3 Sulfate intermediate solution.....	2
6 Apparatus	2
7 Sampling and preparation of sample	2
8 Procedure	2
9 Calculation	3
10 Precision	3
11 Test report	4

Foreword

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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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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 6, *Paper, board and pulps*.

This third edition cancels and replaces the second edition ([ISO 9198:2001](http://www.iso.org/iso/9198:2001)), which has been technically revised. The main changes compared to the previous edition are as follows:

- In [6.4](#), the addition of the option of filtering the suspension through a medium coarseness filter paper prior to withdrawing an aliquot with a syringe.

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.

Paper, board and pulp — Determination of water-soluble sulfates

1 Scope

This document specifies a method for the determination of water-soluble sulfates in all types of pulp, paper and board. The lower limit of the determination is 20 mg of sulfate ion per kilogram of dry sample.

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 186](#), *Paper and board — Sampling to determine average quality*

[ISO 287](#), *Paper and board — Determination of moisture content of a lot — Oven-drying method*

[ISO 638](#), *Paper, board and pulps — Determination of dry matter content — Oven-drying method*

[ISO 7213](#), *Pulps — Sampling for testing*

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

water-soluble sulfates

in pulp, paper and board, the amount of sulfate ion that is extracted with water at 23 °C and determined under the conditions specified

4 Principle

Pieces of the sample are extracted with water at 23 °C in a disintegrator. An aliquot of the resulting suspension is used for determination of the sulfate ion content by ion chromatography.

5 Reagents

Use only reagents of recognized analytical quality and only water as specified in [5.1](#).

5.1 Distilled water or deionized water, of conductivity less than 0,1 mS/m at 25 °C.

5.2 Sulfate stock solution, $r(\text{SO}_4^{2-}) = 1\,000$ mg/l.

Dry a portion of potassium sulfate (K_2SO_4) at 140 °C. Transfer $181,5 \text{ mg} \pm 2 \text{ mg}$ thereof to a 100 ml volumetric flask, dissolve the salt and make up to the mark with water ([5.1](#)).

material from clogging the syringe. Place the device over the fibres and withdraw the aliquot from the solution above this device. It is essential that the withdrawn aliquot be free from suspended material.

Since the operation of the ion chromatograph (6.2) depends on its design, no detailed instructions can be given in this document. Operate the apparatus as instructed by the manufacturer.

For calibration, prepare from the sulfate intermediate solution (5.3) a series of five calibration solutions, covering about one decade of concentrations, for example, from 1 mg/l to 10 mg/l.

Run the calibration solutions and the sample solution (the aliquot) on the chromatograph as instructed by the manufacturer of the apparatus.

Plot the readings for the calibration solutions against their sulfate ion concentrations. The five points for the calibration solutions should fall on a straight line. If they fail to do so, repeat the calibration with another set of calibration solutions, covering a lower concentration range. However, the range of calibration solutions shall always bracket the sulfate concentration obtained from the aliquot.

Check the calibration daily and whenever a new set of calibration solutions is taken into use.

Read the sulfate peak of the extract (the aliquot). From the calibration graph, read the sulfate ion concentration of the extract, r , and of the blank, r_0 .

9 Calculation

Calculate the mass fraction of water-soluble sulfates in the sample from the expression

$$\omega = 100 \frac{(\rho - \rho_0)V}{m\omega_d}$$

where

- ω is the mass fraction of sulfate ions in the sample, in milligrams per kilogram;
- ρ is the sulfate ion concentration of the filtered extract, in milligrams per litre;
- ρ_0 is the sulfate ion concentration of the blank solution, in milligrams per litre;
- V is the volume of water (5.1) used in the disintegration (the volume specified is 250 ml);
- m is the mass of sample taken, in grams;
- ω_d is the dry matter content of the sample, expressed as a percentage.

Calculate the mean and report the result to the nearest 10 mg/kg. Report values below 20 mg/kg as "less than 20 mg/kg".

10 Precision

Five pulp and paper samples were extracted several times in a laboratory. From every extract, two aliquots were analysed. The results are shown in [Table 1](#).

Table 1 — Results obtained when five samples were analysed several times, mg/kg

	Bleached pulp, soft wood	Unbleached wrapping paper	Writing paper	Bleached pulp, hard wood	Paper (40 g/m²)
1st extraction	36,5 37,0	65,5 68,2	155,0 155,3	335,5 336,0	840 833
2nd extraction	38,2 38,4	60,8 61,1	153,3 154,3	323,2 320,0	824 830
3rd extraction	36,9 37,8	69,6 67,1	— —	— —	— —
Mean value	37,5	65,4	154,5	328,7	832,0
Coefficient of variation (% of all values)	2,1	5,6	0,9	2,5	6,3

11 Test report

The test report shall include the following information:

- a) reference to this document, i.e. [ISO 9198:2020](#);
- b) date and place of testing;
- c) complete identification of the sample tested;
- d) the result, expressed as indicated in [Clause 9](#);
- e) any departure from the procedure described in this International Standard or any other circumstances which may have affected the result.

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