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Paper, board and pulps — Determination of conductivity of aqueous extracts

Papier, carton et pâtes — Détermination de la conductivité des extraits aqueux

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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).

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 6, *Paper, board and pulps*.

This third edition cancels and replaces the second edition (ISO 6587:1992), which has been technically revised.

The main changes are as follows:

— editorial updates;

— requirement added to 7.1;

— bibliography update.

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

Conductivity measurement provides an indication of the level of residual ionic impurities in pulp. It can thus be used, for example, to assess the effectiveness of washing in the pulp and paper manufacturing process.

Paper, board and pulps — Determination of conductivity of aqueous extracts

1 Scope

This document specifies a method for the determination of the conductivity of aqueous extracts of paper, board or pulp, these extracts having been prepared by a hot or cold method.

The method is applicable to all kinds of paper, board and pulps, except for papers used for electrical purposes. For high purity papers used for electrical purposes, see method given in EN 60554-2.

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 638-1, *Paper, board, pulps and cellulosic nanomaterials — Determination of dry matter content by oven-drying method — Part 1: Materials in solid form*

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 terminology databases for use in standardization at the following addresses:

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

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

3.1
conductivity
measure of the effect of the presence of dissolved substances in a solution to conduct electricity

Note 1 to entry: Conductivity does not measure the same solution properties as either osmolality or osmolarity and does not produce equivalent results. Conductivity only measures those substances that produce ions and does not measure dissolved substances that do not produce ions.

[SOURCE: ISO 18369-1:2017, 3.1.6.7]

4 Principle

A 2 g sample is extracted for 1 h with 100 ml of boiling or cold, distilled or deionized water. Measurement of the conductivity of the extract at 25 °C by means of a conductivity meter or resistance bridge, using alternating current.

5 Reagents

5.1 Distilled or deionized water

Distilled or deionized water shall be used throughout the test. The conductivity of the water shall not exceed 0,2 mS/m after boiling and cooling as specified in 8.2.2.

NOTE Usually, both distillation and deionization are required. Unless great care is exercised when distilling, and with the materials employed in the condenser and subsequent surfaces with which the condensed vapour would possibly come in contact, the distillate can fail to reach the required level of conductivity.

When it is not possible to obtain water of the specified purity, water with a higher conductivity may be used, but the conductivity of the water used should be stated in the test report.

5.2 Potassium chloride, standard solutions

Use potassium chloride (KCl) of recognized analytical reagent grade, powdered, or fine crystals. Dry for 2 h at 105 °C ± 2 °C and immediately prepare the following two solutions.

5.2.1 0,01 mol/l solution

Dissolve 0,745 g of the potassium chloride in water having a conductivity not greater than 0,2 mS/m, and dilute to 1 000 ml.

5.2.2 0,001 mol/l solution

Dilute 100 ml of the 0,01 mol/l solution (5.2.1) to 1 000 ml.

Store the solutions in waxed glass bottles with ground glass stoppers. The conductivity values, in millisiemens per meter, of the two solutions, are given in Table 1.

Table 1 — Conductivity of potassium chloride standard solutions

Concentration	Temperature	Conductivity
mol/l	°C	mS/m
0,01	18	122,05
	20	127,80
	25	140,88
0,001	25	14,693

6 Apparatus

The usual laboratory apparatus and, in particular, the following shall be used.

6.1 Flasks of chemically resistant glass, with ground glass joints, stoppers and efficient water-cooled reflux condensers made of the same quality of glass. All glassware shall be carefully rinsed with boiling distilled or deionized water (5.1).

6.2 Electric heater, adjustable at least to 200 W.

6.3 Conductivity meter or **resistance bridge,** with measuring cells provided with black platinum electrodes of area approximately 1 cm^2, and capable of indicating the conductance of an aqueous extract with an error of less than ±5 % in the frequency range of 50 Hz to 3 000 Hz.

6.4 Constant-temperature bath, capable of maintaining a temperature of 25 °C ± 0,5 °C.

7 Sampling and sample preparation

7.1 Sampling

Sampling of paper or board shall be carried out in accordance with ISO 186. If the testing is done on another type of sample, report the origin of the sample, and if possible, the sampling procedure.

Sampling of pulp shall be carried out in accordance with ISO 7213. If the testing is done on another type of sample, report the origin of the sample, and if possible, the sampling procedure.

7.2 Sample preparation

Cut or tear the sample into pieces approximately 5 mm x 5 mm in size from portions that have not been touched by bare hands. Mix the pieces thoroughly. The sample shall not be touched at any time with bare hands. Clean protective gloves shall be worn at all times to protect the sample and the pieces prepared from it. Store the prepared samples in clean, covered containers.

7.3 Determination of dry matter content

Determine the dry matter content in accordance with ISO 287 for paper or board and ISO 638-1 for pulp.

8 Procedure

8.1 Determination of cell constant

Wash the measuring cell (see 6.3) several times with water (5.1), and then at least twice with the potassium chloride standard solution (5.2.1 or 5.2.2) the conductivity of which is nearest to that of the extract being measured.

Measure the conductance or resistance of the cell by means of the conductivity meter or resistance bridge (6.3), with a fresh portion of the same potassium chloride standard solution.

Calculate the cell constant using the appropriate formula between Formula (1) and (2):

$$J = \frac{\gamma_{KCl}}{G_{KCl}} \tag{1}$$

or

$$J = \frac{R_{KCl} \cdot \gamma_{KCl}}{1\,000} \tag{2}$$

where

J is the cell constant

G_{KCl} is the conductance, in millisiemens, of the potassium chloride standard solution;

R_{KCl} is the resistance, in ohms, of the potassium chloride standard solution;

γ_{KCl} is the conductivity, in millisiemens per meter, of the potassium chloride standard (see Table 1).

NOTE The conductance G (in siemens) is equal to $1/R$, where R is the resistance (in ohms).

8.2 Preparation of the aqueous extract

8.2.1 Weighing of sample

Weigh 2 g ± 0,002 g (oven-dry basis) of the sample (7.2) into a flask of suitable size (6.1) that has been carefully washed with boiling water (5.1).

8.2.2 Hot extraction method

With the aid of a pipette, measure 100 ml of water (5.1) into a separate flask (6.1). Attach the reflux condenser (see 6.1) and heat the water to almost boiling. Remove the condenser and add the water to the flask containing the sample (8.2.1). Replace the reflux condenser then boil gently for 1 h on the electric heater (6.2). Cool rapidly, with the condenser still fitted, to about 25 °C. Let the fibres settle and then decant the extract. Prepare the extract in duplicate.

Using the constant temperature bath (6.4), adjust the temperature of the extract to 25 °C ± 0,5 °C and maintain that temperature throughout the test.

8.2.3 Cold extraction method

With the aid of a pipette, measure 100 ml of water (5.1) into the flask containing the sample (8.2.1). Seal the flask with a ground glass stopper and leave to stand at room temperature (20 °C to 25 °C) for 1 h. Shake the flask at least once during this time. Decant the extract. Prepare the extract in duplicate.

Using the constant temperature bath (6.4), adjust the temperature of the extract to 25 °C ± 0,5 °C and maintain that temperature throughout the test.

8.3 Determination of conductivity

Rinse the measuring cell (see 6.3) carefully, several times with the water (5.1), and then twice more with the extract from 8.2.2 or 8.2.3. Measure the conductance or resistance with fresh portions of the extract until a constant value is obtained.

Repeat the determination with the duplicate extract.

8.4 Blank test

Carry out a blank test following the same procedure as for the determination, but omitting the sample.

9 Calculation and expression of results

9.1 If the meter gives conductance

The conductivity, γ, of the extract is given, in millisiemens per metre, by Formula (3):

$$\gamma = J(G_x - G_o) \quad (3)$$

where

J is the cell constant, determined as specified in 8.1;

G_x is the conductance, in millisiemens, of the extract;

G_o is the conductance, in millisiemens, corresponding to the blank test.

