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Information and documentation — Papers and boards used for conservation — Measurement of impact of volatiles on cellulose in paper

Information et documentation — Papiers et cartons utilisés pour la conservation — Mesure de l'impact des substances volatiles sur la cellulose du papier

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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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This document was prepared by Technical Committee ISO/TC 46, *Information and documentation*, Subcommittee SC 10, *Requirements for document storage and conditions for preservation*.

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

According to ISO 16245[1], materials used for storage boxes and file covers in archives and libraries "*shall not contain or form any substances which may be harmful to the documents being stored*". Although ISO 16245 specifies important material properties as alkalinity and resistance to oxidation, as well as absence of, for example, optical brighteners and plasticizers, it does not provide a suitable method for evaluating potential effects of volatiles formed and emitted by the specific material which are the subject of this document.

This document can serve as a suitable tool for a completion of ISO 16245.

Information and documentation — Papers and boards used for conservation — Measurement of impact of volatiles on cellulose in paper

1 Scope

This document describes a test method for conservation materials which can evaluate their impact on cellulose as the main constituent of paper-based collections caused by emission of their volatile compounds.

NOTE This test can be extended to museum artefacts.

This document is applicable to papers and boards used for conservation and storage of cellulose based items.

It is not applicable to parchment-based items.

It does not evaluate the effects due to direct contact between the papers and boards used for conservation and the collections.

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 187, *Paper, board and pulps — Standard atmosphere for conditioning and testing and procedure for monitoring the atmosphere and conditioning of samples*

ISO 638, *Paper, board and pulps — Determination of dry matter content — Oven-drying method*

ISO 5351, *Pulps — Determination of limiting viscosity number in cupri-ethylenediamine (CED) solution*

ISO 14487, *Pulps — Standard water for physical 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
conservation
preservation measures and action applied to prevent, arrest or delay deterioration of a document or other material object

[SOURCE: ISO 5127:2017, 3.12.1.01]

3.2
reference paper
specified material used for the evaluation of the impact of boards and papers on cellulose

3.3
lot
aggregate of paper or board of a single kind with specified characteristics produced under conditions that are presumed uniform, and available for sampling at one time

Note 1 to entry: A lot comprises one or more nominally identical units. Where the material to be tested has already been incorporated into a manufactured article (for example a packing case), the lot is the aggregate of such articles of a single kind, of specified characteristics.

[SOURCE: ISO 186:2002, 3.1]

3.4
standard water
water purified to electrical conductivity ≤0,25 mS/m at 25 °C

[SOURCE: ISO 14487:1997, 3.1]

3.5
viscosity-average degree of polymerization
DP_v
average number of anhydroglucose units (monomers of cellulose) in the cellulose macromolecule, determined by measuring the viscosity of solutions in cupri-ethylenediamine (CED)

[SOURCE: ISO/TS 18344:2016, 3.3, modified — "Viscosity" has been added to the term, and the determination process has been added to the definition.]

3.6
limiting viscosity number

$[\eta]$
limiting value of the viscosity number at infinite dilution

$$[\eta] = \lim_{\rho \to 0} \left(\frac{\eta - \eta_0}{\eta_0 - \rho} \right)$$

Note 1 to entry: Limiting viscosity number is measured in millilitres per gram.

Note 2 to entry: In the literature, the term intrinsic viscosity is often used and is equal to the limiting viscosity number. There is no general conversion factor between the limiting viscosity number in ml/g and other viscosities, determined by other methods and expressed in millipascal seconds (mPa·s).

[SOURCE: ISO 5351:2010, 3.5]

3.7
loss of *DP*v
arithmetic mean of the *viscosity-average degree of polymerization* (3.5) of an exposed sample of reference paper against the viscosity-average degree of polymerization of an unexposed sample of same paper

4 Principle

Studies have shown that neutral or alkaline papers and boards can emit volatiles (such as acids, aldehydes, sulfur-containing compounds, etc.) that may depolymerize paper cellulose and therefore weaken it[2][3][4].

This test method consists of measuring the impact of volatile compounds emitted by the tested material on a reference paper made of pure cellulose. These volatile compounds are developed by exposure at elevated temperature in closed vessels[5][6].

The impact of the volatiles emitted by the test material on the reference paper is evaluated by comparing its degree of polymerization after a given exposure time in specific conditions to that of an unexposed control sample.

NOTE 1 The determining degree of polymerization has been proven to be a reliable analytical method for describing the condition of cellulose[7].

5 Apparatus

5.1 Vials.

The vials shall be of borosilicate glass. Each vial shall be equipped with a screw cap and a gasket which ensures an airtight sealing during the accelerated ageing.

The materials (such as glass, caps and gaskets) shall be stable. They shall not emit volatile compounds when heated at 105 °C and shall be resistant to acidic corrosion.

The internal height of the vials shall be high enough to contain the samples and their opening shall be wide enough to insert the microtube and additional vessel described in 5.2 and 5.7.

NOTE Caps of polybutylene terephthalate (PBT) and polytetrafluoroethylene (PTFE) linings were found to be most suitable[8].

All materials in contact with samples and reference papers shall be inert.

5.2 Vessels.

If an additional vessel is used in the vial, this shall be made of borosilicate glass.

5.3 Viscometer.

The viscometer used to determine the degree of polymerization of cellulose shall comply with the equipment described in ISO 5351.

5.4 Ageing chamber.

Fan forced air circulation ageing chamber, thermostatically controlled at (100,0 ± 1,0) °C.

5.5 Reference paper.

Cellulose filter paper manufactured from cotton linter. It shall contain a minimum of 98 % alpha cellulose, have grammage of (90,0 ± 0,9) g/m^2 and a thickness of (180 ± 18) µm[1)].

5.6 Wire, made of galvanized steel, 1 mm diameter.

5.7 Microtube, made of borosilicate glass, 0,5 ml.

5.8 Carded cotton.

1) Whatman© filter paper grade 1 is an example of a suitable product available commercially. This information is given for the convenience of users of this document and does not constitute an endorsement by ISO of this product.