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Effectiveness of paper deacidification processes

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Ch. de Blandonnet 8 • CP 401
CH-1214 Vernier, Geneva, Switzerland
Tel. +41 22 749 01 11
Fax +41 22 749 09 47
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Foreword

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The committee responsible for this document is ISO/TC 46, *Information and documentation*, Subcommittee SC 10, *Requirements for document storage and conditions for preservation*.

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Introduction

Archives, libraries and similar institutions store written and printed documents which they are obliged to retain on a permanent basis for cultural reasons and, in some cases, in order to meet legal requirements.

Often, the condition of these documents is endangered for a number of reasons. One of these is related to the manufacturing process used for more modern types of paper.

In the industrial age, paper-making processes underwent significant changes. One of the processes affected was sizing, which, in industrial processes, was achieved by mixing additives into the fibre suspension before shaping the sheets. These additives included acidic substances like aluminium sulfate. The reaction of the sizing agent eventually leads to formation of free acids. The acids act as a catalyst for the hydrolysis of cellulose, making the material brittle. Climatic influences aggravate this process, air pollution and cellulose degradation processes are a further source of acid in paper.

Another factor for paper stability is the raw material itself. For centuries, paper was made of textile fibres like linen, hemp or cotton rags which rather deliver stable, long-chain cellulose. The search for a more abundant raw material led to the invention to produce pulp out of wood by a grinding process. The resulting ground wood paper still contains most of the lignin and hemicelluloses, in addition to cellulose. The low pulp purity and the mechanical process causing a partial cutting of fibres lead to a much weaker paper. Compared to the older rag papers, ground wood paper is also less stable on the long run.

The problem of paper degradation due to acid has developed into a tremendous problem for archives and libraries. In addition to the processes for deacidifying single sheets, such processes having been used in conservation for a long time, the past few decades have seen new developments in technical processes which can be used on a large scale to retard the further decay of cultural assets as bound volumes and single sheets (“mass deacidification”).

The aim of deacidification is to appreciably improve the life expectancy of paper. This is achieved by adding an alkaline substance to neutralize existing acid and slow down future acidic degradation for at least some time (buffering, alkaline reserve). Deacidification cannot improve the actual physical properties of the paper, but in combination with proper storage, it can slow down further decay.

Without validated analytical methods, it is not possible to assess whether a paper has been deacidified, or to what degree deacidification has been successful. This Technical Specification compiles the suitable measurements.

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Effectiveness of paper deacidification processes

1 Scope

This Technical Specification defines test methods and minimum requirements for paper deacidification processes regarding their effectiveness and consistency.

It is applicable for all large scale processes which offer deacidification of acid documents made of printed or hand-written paper.

Possible negative side effects of deacidification processes on the treated objects are not the subject of this Technical Specification. However, some general recommendations for how to cope with these side effects are given in Annex A.

It is not specified either, which types of paper objects can be treated by large scale deacidification methods. Whatever currently available deacidification method is used, some objects might be excluded from treatment to avoid mechanical damage to paper and bindings or other unwanted side effects. The provider of the deacidification treatment should inform the customer about the limitations of the chosen method.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 535, *Paper and board — Determination of water absorptiveness — Cobb method*

ISO 536, *Paper and board — Determination of grammage*

ISO 776, *Pulps — Determination of acid-insoluble ash*

ISO 5351:2010, *Pulps — Determination of limiting viscosity number in cupri-ethylenediamine (CED) solution*

ISO 5626, *Paper — Determination of folding endurance*

ISO 5630-5:2008, *Paper and board — Accelerated ageing — Part 5: Exposure to elevated temperature at 100 degrees C*

ISO 6588-1, *Paper, board and pulps — Determination of pH of aqueous extracts — Part 1: Cold extraction*

ISO 9184-1, *Paper, board and pulps — Fibre furnish analysis — Part 1: General method*

ISO 9184-4, *Paper, board and pulps — Fibre furnish analysis — Part 4: Graff "C" staining test*

ISO 10716, *Paper and board — Determination of alkali reserve*

3 Terms and definitions

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

3.1
accelerated ageing
artificially induced ageing under laboratory condition by increasing temperature and sometimes changing humidity or exposure to light in order to accelerate chemical reactions in paper like hydrolysis or oxidation to simulate processes usually occurring under natural condition but at a much slower speed

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