SLOVENSKI STANDARD
SIST EN 14119:2003

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Preskušanje tekstilij - Ocenjevanje delovanja mikrogliv

Testing of textiles - Evaluation of the action of microfungi

Prüfung von Textilien - Bestimmung der Einwirkung mikroskopischer Pilze (Mikrofungi)

Essais sur les textiles - Evaluation de l'action des champignons microscopiques

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English version

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EUROPEAN COMMITTEE FOR STANDARDIZATION
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Foreword

This document (EN 14119:2003) has been prepared by Technical Committee CEN/TC 248 “Textiles and textile products”, the secretariat of which is held by BSI.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by March 2004, and conflicting national standards shall be withdrawn at the latest by March 2004.

Annexes A and B are informative.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Slovakia, Spain, Sweden, Switzerland and the United Kingdom.

Introduction

Under certain climatic and environmental conditions microfungi can settle on and colonise the surface of textile products and can possibly deteriorate them.

The tests and test conditions specified in this standard are empirical and cover most - but not all - potential applications.

The actions of microfungi on textiles are quite different:

a) Direct action: deterioration of the textile product which serve as a nutritive substance for the growth of the microfungi;

b) Indirect action: influence of metabolic products of the microfungi, e.g. discolouration or biochemical deterioration.

This standard deals also with the combined action of these two processes.

This standard is based on a part of ISO 846:1997 "Plastics - Evaluation of the action of microorganisms" and IEC 68-2-10:1988 "Basic environmental testing procedures, Part 2: Test J, Mould growth".

1 Scope

This European Standard specifies methods for determining the resistance of textiles to the action of microfungi. The results of the tests are evaluated by visual examination and by measuring the physical properties of the textiles. These tests are applicable to all textile products, including cellulosic or man-made fibre textiles (see annex A).

2 Normative references

This European Standard incorporates, by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text, and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

EN ISO 13934-1, *Textiles - Tensile properties of fabrics - Part 1: Determination of maximum force and elongation at maximum force using the strip method (ISO 13934-1:1999).*

3 Terms and definitions

For the purposes of this European Standard the following terms and definitions apply.

3.1
biodeterioration
change of chemical or physical properties of materials due to the action of (micro-) organisms

3.2
fungistatic effect
antimycotic effect of an antimicrobial treatment which prevents a given material from being overgrown by fungi under moist conditions

3.3
biodegradation
ultimate degradation / mineralization of organic matter under aerobic conditions into CO_2, water and microbial biomass

3.4
rotting
microbiogenous deterioration under moist or wet conditions, in contact with a microbiological active soil

4 Safety

Handling of microorganisms which are potentially hazardous requires a high degree of technical competence and can be subject to current national legislation and regulations. Only personnel trained in microbiological techniques should carry out such tests. Codes of practice for disinfection, sterilisation and personal hygiene shall be strictly observed.

NOTE It is recommended that workers should consult appendix A "Danger to personnel" of IEC 68-2-10 and ISO 7218 "Microbiology - General guidance for microbiological examinations".

5 Principle

5.1 General

The tests involve exposing test specimens of textiles to the action of selected test strains of microfungi for specified or agreed periods under specified temperature and humidity.

At the end of the exposure, the test specimens are assessed before and/or after cleaning by visual examination and/or change in physical properties, e.g. tensile strength.

The results of the test specimens exposed to biological attack are compared with unexposed specimens.

Brief descriptions of each method are given in 5.2 to 5.5.

5.2 Method A1: Fungal growth test on incomplete agar medium

The test specimens are exposed on an incomplete nutritive medium (agar medium without a carbon source) to a standardized mixed spore suspension of the test fungi. The test fungi can only grow at the expense of the material. The standard contains fungi for testing cellulose or cellulose containing textiles. The influence of the test fungi is evaluated by growth rating and tensile strength evaluation.

5.3 Method A2: Fungal growth test in a moist chamber

The test specimens are inoculated with a standardized mixed spore suspension and exposed in a near to the practice test (moist chamber test) to determine the influence of the test fungi. Test fungi are proposed for cellulose or cellulose containing textiles. The influence of the fungi is evaluated by growth rating and by tensile strength evaluation.

5.4 Method B1: Fungal growth test on a complete agar medium

The test specimens are exposed on a complete nutritive medium (agar medium with a carbon source) to a standardized mixed spore suspension of the test fungi. The test fungi can grow on the agar medium and on the textile, if the textile is not protected against fungal growth. The standard contains fungi for testing cellulose or cellulose containing textiles. The influence of the test fungi is evaluated by growth rating (determination of the antimycotic effect) and by tensile strength evaluation (determination of the resistance of the textile against biodeterioration).

5.5 Antimycotic effect of a textile material

5.5.1 Method B1: Fungal growth test on complete agar medium; antimycotic effect

See 5.4

5.5.2 Method B2: Antimycotic activity

The test specimens are laid on an inoculated complete nutritive medium (agar with carbon source and incorporated fungal spores (single cultures). The test fungus can grow in and on the agar near the textile specimen, if the textile is not protected against fungal growth. The standard test is using Aspergillus niger and Chaetomium globosum for testing. The test germ spectrum can be adapted. The antimycotic effect against the test strain is evaluated by growth rating (determination of the antimycotic effect) and measuring of a possibly zone without fungal growth around the specimen.

NOTE 1 Method A allows the determination of the fungal resistance of cellulose or cellulose containing textiles or other susceptible textiles and the evaluation of an antimicrobial finishing.

NOTE 2 Method B allows the determination of the action of a textile finishing against selected test strains. It allows the in vitro comparison of different finishings.

5.6 Choice of properties for assessment

A visual examination of the biological attack, the fungal growth or formation of an inhibition zone against the test fungi should always be made as the first stage in assessing the resistance of a textile.

Tensile strength evaluation allows the determination of the resistance of a textile against microfungi. Tensile strength tests are necessary for testing the resistance of cellulosic textiles.

Further evaluations can be agreed. The choice depends on the aim of the testing.

6 Apparatus

6.1 *Microbiological incubators*, capable of controlling temperature to (29 ± 1) °C.

6.2 *Oven* capable of controlling temperature at (45 ± 1) °C for drying the test specimens.

6.3 *Ambient* conditioning to attain standard temperature and humidity conditions (20 °C and 65 % relative humidity (r.h.)) for conditioning the specimens for tensile strength tests.

NOTE Ambient conditions 23 °C and 50 % r.h. are optional and should be agreed between the partners.

6.4 A*utoclave* capable of attaining a temperature and pressure of 121 °C and 2 bar respectively.

6.5 *Analytical balance* (graduation of 1 mg) for preparing media.

6.6 *Laboratory centrifuge.*

6.7 *Stereoscopic microscope* (magnification 50 X).

6.8 *Test containers*: glass or plastic Petri dishes of approximately 90 mm diameter.

6.9 *Glass or plastic containers*, e.g. with a volume of about 1 l (height, 16 cm; diameter, 11 cm), for example preserving jars with covers or another humid chamber facility.

7 Reagents

7.1 *Distilled or deionised water* with a conductivity of <1 µS/cm. for the preparation of solutions, nutritive media and the tests.

7.2 *Microbicidal solutions* for cleaning the textile before and after the biotest, ethanol-water mixture at a mass ratio of 70:30.

7.3 *Test fungi - Test strains.* The test fungi shall be obtained when ever possible from national culture collections. The strains to be used are listed in table 1 and shall be stated in the test report.

Table 1 — Test strains

Name	Strain		
Aspergillus niger van Tieghem	ATCC 6275	DSM 1957	IMI 45551
Chaetomium globosum Kunze:Fries	ATCC 6205	DSM 1962	IMI 45550
Gliocladium virens Miller et al.	ATCC 9645	DSM 1963	IMI 45553
Paecilomyces variotii Bainier	ATCC 18502	DSM 1961	IMI 40025
Penicillium pinophilum Thom	ATCC 36839	DSM 1944	IMI 114933

If there are technical reasons, and by agreement between the interested parties, additional species may be used (see annex B). The strains used shall be stated in the test report.

7.4 *Stock strains*

The test fungi can be cultured in tubes on agar slants of the following composition:

— oatmeal 20 g

— malt extract 10 g

— agar 20 g

— distilled or deionized water 1 000 ml

Sterilize at 121 °C for 15 min to 20 min in an autoclave with saturated water vapour.

After incubation at (29 ± 1) °C well-sporulating cultures may be used. They should not be stored for more than 4 weeks at this temperature.

Because of the possibility of genetic and physiological changes in the test fungi during culturing on artificial media the intervals between subculturing should be reduced to a minimum by suitable measures (lyophilised cultures, storage at +4 °C or in liquid nitrogen).

7.5 *Solutions and media*

7.5.1 *Stock mineral salts solution* (use substances of analytical or equivalent purity)

— $NaNO_3$ 2,0 g

— KH_2PO_4 0,7 g

— K_2HPO_4 0,3 g

— KCl 0,5 g

— $MgSO_4 \times 7H_2O$ 0,5 g

— $FeSO_4 \times 7H_2O$ 0,01 g

— H_2O 1 000 ml

Adjust the pH to 6.0 to 6.5 by adding 0,01 mol/l sterile NaOH solution.

The following sterile solutions are prepared *from the stock mineral salts solution.*

7.5.2 *Mineral salts solution with wetting agent.* Add to 1 l of the stock mineral salts solution (7.5.1) 0,1 g of a non-toxic wetting agent, such as*N*-methyltauride or polyglycol ether.Sterilize in an autoclave at 121 °C for 15 min to 20 min.

7.5.3 *Mineral salts solution with glucose.* Add to the mineral salts solution (7.5.1) glucose to obtain a concentration of (30 ± 1) g/l. Sterilize in an autoclave at 115 °C for 30 min.

NOTE In autoclaves with integrated cooling procedure it is possible to sterilize sugar containing media at 121 °C for 15 min.

7.5.4 *Incomplete agar medium.* Add to the mineral salts solution (7.5.1) agar to obtain a concentration of 20 g/l. Dissolve the agar by boiling the solutions whilst stirring.

Sterilize in an autoclave at 121 °C for 15 to 20 min.

7.5.5 *Complete agar medium.* Use the incomplete agar medium (7.5.4) and add glucose to obtain a concentration of (20 ± 1) g/l.

Sterilize in an autoclave at 115 °C for 30 min.

Adjust the pH to between 6,0 and 6,5 at 20 °C after sterilisation with a 0,01 mol/l NaOH solution.

NOTE In autoclaves with integrated cooling procedure it is possible to sterilize sugar-containing media at 121 °C for 15 min.

8 Test specimens

8.1 Dimensions

The shape and dimensions of the specimens will depend on tests to be carried out, see the following procedures.

8.2 Numbers of specimens

At least 4 test specimens shall be taken from the same batch for visual examination.

At least 6 test specimens shall be taken from the same batch for the determination of tensile strength.

8.3 Batches of specimens

For each sample, each stage of ageing and each test method two batches of specimens should be prepared:

— **batch 0**: control specimens, stored under standard temperature and moisture conditions;

— **batch I**: specimens used for the biotest.