
Geosintetika - Metoda ugotavljanja mikrobiološke odpornosti s preskusom zakopavanja v zemljo

Geosynthetics - Method for determining the microbiological resistance by a soil burial test

Geokunststoffe - Prüfverfahren zur Bestimmung der mikrobiologischen Beständigkeit durch einen Erdeingrabungsversuch

Géosynthetics - Méthode pour la détermination de la résistance microbologique par un essai d'enfouissement

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résistance microbiologique par un essai
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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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European foreword

This document (prEN 12225:2019) has been prepared by Technical Committee CEN/TC 189 “Geosynthetics”, the secretariat of which is held by NBN.

This document is currently submitted to the CEN Enquiry.

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prEN 12225:2019 (E)

1 Scope

This document specifies a method for the determination of the microbiological resistance of geosynthetics by a soil burial test.

NOTE Experience and exhumation of geosynthetics which had performed successfully, in some cases for more than two decades, indicate that geosynthetics made out of synthetic materials are generally resistant against microbial initiated decay. It can therefore be expected that most of these products commercially available at the present time will pass the soil burial test successfully and it is probably not necessary to submit them all to this test independent of their function. However, if the requirements for appropriate functioning of the geosynthetics demand proof of microbiological resistance or if they are manufactured from newly developed polymers whose resistance is in any doubt, the soil burial test should be performed.

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.

EN 12226, *Geosynthetics - General tests for evaluation following durability testing*

EN ISO 291, *Plastics - Standard atmospheres for conditioning and testing (ISO 291)*

EN ISO 11721-1:2001, *Textiles - Determination of the resistance of cellulose-containing textiles to micro-organisms - Soil burial test - Part 1: Assessment of rot-retardant finishing (ISO 11721-1:2001)*

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)*

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:

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

3.1 microbiological resistance

resistance of a geotextile or geotextile-related product to attack by bacteria or fungi

Note 1 to entry: There are no limit values on evaluation criteria. Anything which exhibits statistically significant degradation in the laboratory under optimal conditions cannot be rot resistant in practice.

3.2 saturation moisture content SMC

water content of the soil at 100 % saturation

Note 1 to entry: EN ISO 11721-1:2001 uses the term “water holding capacity” (WHC).

3.3

water content

w

ratio of the mass of the water to the mass of the dry solid substances, expressed in per cent

$$w = \frac{m_w}{m_s} = \frac{\text{mass of soil as used} - \text{mass of oven dried soil}}{\text{mass of oven dried soil}} \times 100\%$$

where

m_w is the mass of water;

m_s is the mass of solids.

4 Principle

Tensile test specimens are exposed to microbiologically active soil for a specified test duration. After the specified test duration the test specimens are evaluated visually both before and after cleaning and tensile tests will be performed. The test results are compared with those obtained on unexposed specimens.

5 Reagents and apparatus

5.1 Test soil

The test soil shall contain a variety of microorganisms. To favour the optimum activity of the entire microbial population, the moisture content of the test soil shall be $(60 \pm 5)\%$ of SMC when determined according to method A.3 of EN ISO 11721-1:2001. Natural soil collected in the field shall be sieved and all particles greater than 4 mm diameter removed.

The water content is determined by drying 100 g of the soil in a thin layer at $(104 \pm 1)^\circ\text{C}$ until the mass remains constant to within 1 % (normally 24 h). If the water content of the test soil is too high, dry it in thin layers in laboratory atmosphere. Do not heat since this might affect the microflora. If the water content of the soil is too low the volume of solvent that is required for the wetting of soil can be determined according to EN ISO 11721-1:2001, Annex A, A.2. A solution of 1 g ammonium nitrate and 0,2 g dipotassium-hydrogen phosphate per 1 l of water shall be used to increase the water content.

To establish a constant microbial activity of the test soil, the soil shall be acclimatised prior to the soil burial test. The method consists of a preliminary incubation for at least 28 days at $\geq 90\%$ relative humidity and about 28°C for new soil sample. Alternatively, the soil can be acclimated for at least 56 days with the test climate of $\geq 90\%$ relative humidity and about 26°C . If the same soil material is used more than once, then for each new test set up half of the old material shall be replaced by new soil material in the manner described above.

NOTE Good experience has been obtained with soil type John Innes No.2, or with standard soil ED 73, a soil which contains 66 % of ashable substances and 0,24 % of nitrogen, the pH-value of the 10 % suspension is 5,2 and the SMC = 185 %.

prEN 12225:2019 (E)**5.2 Cotton fabric**

Strips, (100 ± 1) mm long and (25 ± 1) mm wide, of a bleached woven or knitted cotton fabric, mass per unit area about 230 g/m^2 , shall be used as a reference to test the biological activity of the soil.

NOTE The following cotton fabrics have proved themselves as suitable:

— Woven cotton fabric (bleached and de-sized) M.0428 (available from TESTEX GmbH and Co. KG, Bad Münstereifel, Germany), nominal mass per unit area 235 g/m^2 .

— Control fabric, defined as follows: cotton American type, good middling; warp: 18,5 tex Z 886 x 2S 748; weft: 30 tex Z 630 x 2S 748; plain weave 34 ends/cm by 17 picks/cm, with brown and green threads at 0,5 cm and 1,0 cm intervals so that strips with identical numbers of threads can be prepared; mass per unit area 230 g/m^2 ; finish: scoured only (available from British Textile Technology Group, Manchester, UK).

5.3 Microbicides

An ethanol-water mixture 70:30 shall be used as a cleaning and disinfectant fluid after the soil burial test.

5.4 Container

The size and shape of the container shall be such that the test specimens can be buried in a 100 mm to 150 mm depth of test soil. The dimensions of the container should facilitate easy handling and placement in the test environment. If the container is covered, it is necessary to provide the cover with ventilation openings for the access of oxygen to the test soil.

6 Specimens

Prepare five specimens according to EN 12226 concerning each direction (machine direction and cross machine direction) to be tested and concerning each set of conditions. Store the control specimens in standard atmosphere according to EN ISO 291, class 1 at $(23 \pm 1) \text{ }^\circ\text{C}$ and $(50 \pm 5) \%$ relative humidity.

7 Test climate

The container with the test soil shall be stored at room temperature $(26 \pm 1) \text{ }^\circ\text{C}$ with admission of fresh air. The soil as well as the test specimens shall be stored in absence of direct or indirect sunlight. To ensure uniform and constant moisture content of $(60 \pm 5) \%$ SMC, relative humidity $\geq 90 \%$ shall be controlled in the gaseous phase in the container above the test soil. Ensure that neither drying nor addition of water to the test soil during a test time of several weeks influences the performance of the microbes. The container shall allow air exchange with the environment and therefore it shall not be closed tightly.

8 Procedure**8.1 Biological activity**

Bury five strip specimens of the cotton fabric described in 5.2 and keep them in the test soil for seven days. Five control strip specimens shall be stored at temperature $(23 \pm 1) \text{ }^\circ\text{C}$ and relative humidity $(50 \pm 5) \%$. Both – the buried strip specimens and the control strip specimens – shall be cleaned according to 8.2.3 before tensile tests are performed. The tensile strength in original state (= control strip specimens) and after exposure (= buried strip specimens) shall be determined according to EN ISO 13934-1 with the following modification: distance between the clamps: 50 mm.

After exposure for 7 days the tensile strength of the cotton strips shall be $\leq 25\%$ of the original tensile strength. If this criterion is not met, the soil shall be replaced by a biologically more active soil. The biological activity of the test soil shall be checked during the soil burial test according to 8.2 by adding a cotton strip to the test. On completion of the exposure, this strip shall have been destroyed.

NOTE The biological activity of the soil can be increased by adding well rotted garden compost to the test soil.

8.2 Testing of specimens

8.2.1 Active test

The duration of the test shall be 16 weeks. Bury the specimens approximately 100 mm deep in the soil and ensure good contact between them and the test soil. The container shall permit oxygen exchange, and shall therefore not be closed tightly.

8.2.2 Incubation

Place the test container prepared according to 8.2.1 in an incubator for 16 weeks at the climatic conditions specified under Clause 7.

NOTE For index tests, the test duration is 16 weeks. During the development of new geosynthetics a prolonged test of 32 weeks may be used.

Control the moisture content to $(60 \pm 5)\%$ by verifying the mass of the soil in the vessels every four weeks. If necessary, ammonium nitrate - dipotassium hydrogen phosphate solution shall be added.

8.2.3 Cleaning of specimens

Recover the test specimens from the soil, strip off the soil, and submerge all specimens, including the control specimens, in an ethanol-water solution (70:30) for 300 s. Then clean the specimens under running water, wipe with absorbent paper and dry for at least 72 h in standard atmosphere according to EN ISO 291, class 1 at $(23 \pm 1)^\circ\text{C}$ and $(50 \pm 5)\%$ relative humidity.

To ensure comparability the cleaning shall be performed on the buried as well as on the control specimens.

Products for which the above given method is not suitable for cleaning (e.g. products from coir, esparto or jute) and in case a washing liquid may affect the tensile properties, the specimens shall be taken from the soil, the soil shall be wiped off, and the specimens shall be tapped with caution. Then the specimens are dried for at least 72 h in standard atmosphere according to EN ISO 291, class 1 at $(23 \pm 1)^\circ\text{C}$ and $(50 \pm 5)\%$ relative humidity.

8.2.4 Evaluation tests

Determine the tensile strength of test and control specimens in accordance with EN 12226.