SLOVENSKI STANDARD
SIST EN 17033:2018

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Polimerni materiali - Biorazgradljive folije za mulčenje za uporabo v kmetijstvu in vrtnarstvu - Zahteve in preskusne metode

Plastics - Biodegradable mulch films for use in agriculture and horticulture - Requirements and test methods

Kunststoffe - Biologisch abbaubare thermoplastische Mulchfolien für den Einsatz in Landwirtschaft und Gartenbau - Anforderungen und Prüfverfahren

Plastiques - Films de paillage biodégradables pour utilisation en agriculture et horticulture - Exigences et méthodes d'essai

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Plastics - Biodegradable mulch films for use in agriculture and horticulture - Requirements and test methods

Plastiques - Films de paillage biodégradables thermoplastiques pour utilisation en agriculture et horticulture - Exigences et méthodes d'essai

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

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European foreword

This document (EN 17033:2018) has been prepared by Technical Committee CEN/TC249 “Plastics”, the secretariat of which is held by NBN.

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of an identical text or by endorsement, at the latest by July 2018, and conflicting national standards shall be withdrawn at the latest by July 2018.

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1 Scope

This document specifies the requirements for biodegradable films, manufactured from thermoplastic materials, to be used for mulch applications in agriculture and horticulture.

This document is applicable to films intended to biodegrade in soil without creating any adverse impact on the environment.

It also specifies the test methods to assess these requirements as well as requirements for the packaging, identification and marking of films.

For information, it defines a classification of biodegradable mulch films according to their service life on soil and gives a good practice guide for the use of the films.

NOTE Films intended to be removed after use and not incorporated in the soil are not in the scope of this standard. They are in the scope of EN 13655 [1].

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 ISO 472, *Plastics - Vocabulary (ISO 472)*

EN ISO 527-1, *Plastics - Determination of tensile properties - Part 1: General principles (ISO 527-1)*

EN ISO 527-3, *Plastics - Determination of tensile properties - Part 3: Test conditions for films and sheets (ISO 527-3)*

EN ISO 7765-1:2004, *Plastics film and sheeting - Determination of impact resistance by the free-falling dart method - Part 1: Staircase methods (ISO 7765-1:1988)*

EN ISO 11268-1, *Soil quality - Effects of pollutants on earthworms - Part 1: Determination of acute toxicity to Eisenia fetida/Eisenia andrei (ISO 11268-1)*

EN ISO 11268-2, *Soil quality - Effects of pollutants on earthworms - Part 2: Determination of effects on reproduction of Eisenia fetida/Eisenia andrei (ISO 11268-2)*

EN ISO 11274, *Soil quality - Determination of the water-retention characteristic - Laboratory methods (ISO 11274)*

EN ISO 12846, *Water quality - Determination of mercury - Method using atomic absorption spectrometry (AAS) with and without enrichment (ISO 12846)*

EN ISO 17294-2, *Water quality - Application of inductively coupled plasma mass spectrometry (ICP-MS) - Part 2: Determination of selected elements including uranium isotopes (ISO 17294-2)*

EN ISO 17556:2012, *Plastics - Determination of the ultimate aerobic biodegradability of plastic materials in soil by measuring the oxygen demand in a respirometer or the amount of carbon dioxide evolved (ISO 17556:2012)*

ISO 4591, *Plastics — Film and sheeting — Determination of average thickness of a sample, and average thickness and yield of a roll, by gravimetric techniques (gravimetric thickness)*

ISO 4592, *Plastics — Film and sheeting — Determination of length and width*

ISO 4593, *Plastics — Film and sheeting — Determination of thickness by mechanical scanning*

ISO 10390, *Soil quality — Determination of pH*

ISO 15685, *Soil quality — Determination of potential nitrification and inhibition of nitrification — Rapid test by ammonium oxidation*

OECD 208, *OECD Guidelines for the Testing of Chemicals, Section 2, Effects on Biotic Systems — Test No. 208: Terrestrial Plant Test: Seedling Emergence and Seedling Growth Test*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN ISO 472 and the following 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 Definitions related to films

3.1.1
mulch film
film made from thermoplastic material intended to be used in agriculture and horticulture to cover the ground in order to improve growing conditions of crops and depending on the colour to control weeds

Note 1 to entry: It is assumed that a transparent mulch film does not allow to control weeds.

3.1.2
material
homogenous preparation of biodegradable polymer and additives, as necessary, such as carbon black and colour pigments

Note 1 to entry: Additives are usually introduced under the form of masterbatches using as carrier resin a biodegradable polymer.

3.1.3
masterbatch
well-dispersed mixture of a polymer and high percentages of one or more components (colorants and/or other additives) in known proportions for use in blending in appropriate amounts with the basic polymer in the preparation of a compound

[SOURCE: EN ISO 472:2013, definition 2.574]

3.1.4
width
overall width of a film when lying flat

Note 1 to entry: It is expressed in millimetres (mm).

3.1.5
nominal width
width of a film, as declared by the manufacturer

Note 1 to entry: It is expressed in millimetres (mm).

3.1.6
thickness
thickness at any point of a film

Note 1 to entry: It is expressed in micrometres (µm).

3.1.7
nominal thickness
thickness of a film, as declared by the manufacturer

Note 1 to entry: It is expressed in micrometres (µm).

3.1.8
roll length
largest dimension of the film corresponding to the length of the unwinded roll

Note 1 to entry: It is expressed in metres (m).

3.1.9
nominal roll length
roll length, as declared by the manufacturer

Note 1 to entry: It is expressed in metres (m).

3.1.10
longitudinal direction
MD
direction parallel to the roll length, corresponding to the extrusion direction

3.1.11
transverse direction
TD
direction parallel to the width (at a right angle to the roll length)

3.1.12
radiant exposure
H
time integral of irradiance, measured in joules per square metre ($J \cdot m^{-2}$)

Note 1 to entry: measured in joules per square metre ($J\ m^{-2}$)

[SOURCE: ISO 9370:2017, definition 3.27]

3.2 Definitions related to biodegradation and disintegration

3.2.1
ultimate aerobic biodegradation
breakdown of an organic compound by microorganisms in the presence of oxygen into carbon dioxide, water and mineral salts of any other elements present (mineralization) plus new biomass

[SOURCE: ISO 17088:2012, 3.10]

3.2.2
mineralization
decomposition of organic matter or organic substances into carbon dioxide, water and the hydrides, oxides or other mineral salts

[SOURCE: ISO 11074:2005, definition 3.3.11]

3.2.3
disintegration
physical breakdown of a material into very small fragments

[SOURCE: ISO 17088:2012, definition 3.6]

3.2.4
degradation
irreversible process leading to a significant change in the structure of a material, typically characterized by a change of properties (e.g. integrity, molecular mass or structure, mechanical strength) and/or by fragmentation, affected by environmental conditions, proceeding over a period of time and comprising one or more steps

[SOURCE: EN ISO 472:2013, definition 2.262]

3.2.5
photodegradation
degradation identified as resulting from the action of the light

3.2.6
total dry solids
amount of solids obtained by taking a known volume of test material or compost and drying at about 105 °C to constant mass

[SOURCE: ISO 17088:2012, definition 3.9]

3.2.7
volatile solids
amount of solids obtained by subtracting the residue of a known volume of test material or compost after incineration at about 550 °C from the total dry solids of the same sample

Note 1 to entry: The volatile-solids content is an indication of the amount of organic matter present.

[SOURCE: ISO 17088:2012, definition 3.11]

3.2.8
constituent
every pure chemical material or substance of which a thermoplastic material is composed

3.3 Definitions related to test soil

3.3.1
natural soil
soil collected from the surface layer of fields and/or forests

3.3.2
standard soil
soil made from a defined mixture of industrial quartz sand, clay, natural soil and mature compost, as defined in EN ISO 17556:2012, 8.3.2

3.4 Definitions related to ecotoxicity and control of constituents

3.4.1
microbial activity
metabolic performance of microorganisms

[SOURCE: EN ISO 16072:2011, definition 3.3]

3.4.2
substances of very high concern
SVHC
substances covered by legal provisions laid down in Regulation (EC) No 1907/2006 [2]

4 General requirements

In order to meet the requirements of this document, the mulch film under investigation or its plastic base material in the primary form (pellets, powder, etc.), without the additive(s) and or the masterbatch(es) which are added during the extrusion of the film, shall fulfil all the requirements given in Clause 5. The mulch film shall fulfil all the requirements given in Clause 6. If not, no reference to this document shall be made.

A mulch film, made from the plastic base material that comply with the requirements specified in Clause 5, is considered to fulfil this document, provided that the addition of any masterbatch or additive during the manufacture of the mulch film does not result in a mulch film in conflict with the requirements specified in Clause 5.

5 Requirements for materials, testing schemes and evaluation criteria for biodegradation and ecotoxicity

5.1 Control of constituents

5.1.1 Regulated metals and other substances

The concentrations of regulated metals and other substances in the material under investigation shall not exceed the limits as described in Table 1.

Table 1 — Maximum concentrations of regulated metals and other substances

Element	Maximum concentration[a] mg/kg of dry matter	Test method
Cadmium (Cd)	0,5	EN ISO 17294-2
Chromium total (Cr)	50	EN ISO 17294-2
Copper (Cu)	50	EN ISO 17294-2
Mercury (Hg)	0,5	EN ISO 12846
Nickel (Ni)	25	EN ISO 17294-2
Lead (Pb)	50	EN ISO 17294-2
Zinc (Zn)	150	EN ISO 17294-2

[a] The maximum metal concentrations are 50 % of those prescribed in ecological criteria for the award of the Community eco-label to soil improvers [COMMISSION DECISION (EU) 2015/2099 of 18 November 2015 establishing the ecological criteria for the award of the EU Ecolabel for growing media, soil improvers and mulch (notified under document C(2015) 7891].

5.1.2 Substances of very high concern (SVHC)

From a precautionary perspective the material of the mulch film under investigation shall not contain substances of very high concern (SVHC)

a) that exceed a concentration limit of 0,1 % (by weight) in the material of the mulch film,

and

b) which appear on the Candidate List of substances of very high concern for Authorization [3].

5.1.3 Volatile solids

Materials used for the manufacture of mulching products shall contain not less than 60 % by mass of volatile solids, which largely excludes inert products.

5.1.4 Identifying characteristics

The material of the mulch film shall be identified as follows:

a) information regarding the constituents of the material of the mulch film shall be obtained or declared and recorded;

b) regulated metals and other substances (5.1.1) shall be determined and reported;

c) information on the use of substances of very high concern (SVHC) (5.1.2) shall be recorded based on a self-declaration;

d) volatile solids (5.1.3) shall be determined and reported.

5.2 Biodegradation

5.2.1 Evaluation criteria

Test samples shall not be subjected to conditions or procedures, such as a pretreatment by heat and or an exposure to radiation exposure, designed to accelerate biodegradation prior to testing according to EN ISO 17556.

The material of the mulch film is considered to have demonstrated a satisfactory rate and level of biodegradation in soil if:

a) when tested in accordance with EN ISO 17556, it achieves a minimum biodegradation percentage as specified hereunder within a test period no longer than 24 months;

b) 90 % of the organic carbon shall have been converted to CO_2 by the end of the test period (relative to a reference material). Both the reference material and the test item shall be tested for the same length of time and the results compared at the same point in time after the activity of both has reached a plateau;

c) as an alternative, 90 % (in absolute terms) of the organic carbon shall have been converted to carbon dioxide by the end of the test period.

Test environment: temperature constant to within ± 2 °C in the range between 20 °C and 28 °C, preferably 25 °C.

Use as reference material a well-defined biodegradable polymer [microcrystalline-cellulose powder, ashless cellulose filters or poly(3-hydroxybutyrate)]. If possible, the physical form and size of the reference material should be comparable to that of the test material.

The validity criteria of the results as stated in EN ISO 17556 shall be fulfilled.

5.2.2 Requirements regarding constituents

The ultimate aerobic biodegradability shall be determined for the whole material or for each organic constituent.

Organic constituents which are present at concentrations of less than 1 % do not need to demonstrate biodegradability. However, the sum of such constituents shall not exceed 5 %.

Carbon black is an inert solid. Therefore, it is not considered as an organic constituent and shall not be accounted in the calculation of the degree of biodegradation.

Inorganic carbon coming from black masterbatches, if any, or from mineral fillers, e.g. calcium carbonate, if any, shall not be accounted in the calculation of the degree of biodegradation.

5.3 Ecotoxicity

5.3.1 Rationale

Ecotoxicity tests are performed in order to investigate possible adverse effects caused by the material of the mulch film and residues as intermediates (degradation products) resulting from the degradation of the material of the mulch film in soil at the end of the intended service life.

The test scheme takes into account:

a) all relevant organism groups as plants, invertebrates (e.g. earthworm) and microorganisms;

b) important ecological processes critical due to their role in maintaining soil functions as breakdown of organic matter, formulation of soil structure and cycling of materials;

c) all relevant exposure pathways as soil pore water, soil pore air and soil material.

The link between soil organism groups of major ecological importance covering all significant soil exposure pathways and suitable test methods for the evaluation of ecotoxicity of the materials of mulch films and their degradation products is shown in Table 2.