SLOVENSKI STANDARD
SIST-TS CEN/TS 17627:2021

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Polimerni materiali - Reciklirani polimerni materiali - Ugotavljanje deleža trdnih onesnaževal

Plastics - Recycled plastics - Determination of solid contaminants content

Kunststoffe - Rezyklate - Bestimmung des Gehaltes an Feststoffverunreinigungen

Plastiques - Plastiques recyclés - Détermination de la teneur en contaminants solides

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83.080.20	Plastomeri	Thermoplastic materials

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English Version

Plastics - Recycled plastics - Determination of solid contaminants content

Plastiques - Plastiques recyclés - Détermination de la teneur en contaminants solides

Kunststoffe - Rezyklate - Bestimmung des Gehaltes an Feststoffverunreinigungen

This Technical Specification (CEN/TS) was approved by CEN on 1 March 2021 for provisional application.

The period of validity of this CEN/TS is limited initially to three years. After two years the members of CEN will be requested to submit their comments, particularly on the question whether the CEN/TS can be converted into a European Standard.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
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European foreword

This document (CEN/TS 17627:2021) has been prepared by Technical Committee CEN/TC 249 “Plastics”, the secretariat of which is held by NBN.

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Introduction

The use of recycled materials in production of plastics products is widely accepted nowadays throughout the industry. Those recycled materials are mostly prepared from post-industrial or post-consumer sources, which always contain more or less contamination by foreign bodies. Most of this contamination is removed during the recycling process, either by washing and/or by melt filtration. However, this removal is never perfect, leaving some small amounts of foreign bodies in the material pellets.

For many applications that use recycled materials this little residue of contaminants is not posing any problem. But for other, more demanding or more sensitive products (e.g. having thin wall sections) the use of a recycled material is not an option, unless the number and size of those solid contaminants could accurately be determined and controlled.

While some recyclers do have the means to determine and report a limited number of properties of their material, like density, MFI etc., none of them is able to measure or specify anything regarding the amount and size of foreign bodies left in the material that they supply.

This document describes a test method that enables the determination of the number, the size and the substance (material) of solid contaminants in a sample of recycled material, using a small extruder and a microscope. This test method, known as **SCF** (for **Solid Contaminants Filtration**), was developed by a major user of recycled polyethylene and has since been in use almost daily for more than 10 years.

Although the experience gained so far with this test method is mainly with polyethylene materials, it is believed that this method can be adapted and used for testing other thermoplastic materials.

1 Scope

This document specifies a method for determination by melt filtration of solid contaminants content in a sample of recycled thermoplastic material, evaluating their number and, optionally, their size and substance (material).

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.

CEN/TS 16010, *Plastics — Recycled plastics — Sampling procedures for testing plastics waste and recyclates*

CEN/TS 16011, *Plastics — Recycled plastics — Sample preparation*

ISO 9044:2016, *Industrial woven wire cloth — Technical requirements and tests*

ISO 9045, *Industrial screens and screening — Vocabulary*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 9045 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 https://www.iso.org/obp

4 Principle

The material sample, normally in pellet form, is passed through an extruder fitted with a screen pack, followed by clear, uncoloured virgin material. Then the extruder is stopped, the screen pack is taken out and pressed flat. The screen pack is examined under a microscope for presence and evaluation of any solid contaminants embedded in a thin layer of transparent material on the screen surface.

5 Apparatus and consumables

5.1 Extruder

A small, single-screw extruder, having screw diameter preferably between 18 mm and 30 mm, with a breaker plate dimensioned to contain, and to enable tight clamping and complete sealing of, the screen pack specified in 5.5.

Recommended: a convenient clamping/unclamping arrangement for the breaker plate that enables quick and easy change of the screen pack.

NOTE Optional: a melt pressure sensor located just in front of the screen pack. A sharp and steady increase in melt pressure while passing the tested material in the extruder is a pre-warning sign of high contamination in the sample.

5.2 Press

A device capable of squeezing the screen pack between two parallel horizontal flat metallic surfaces, using very low pressure, just enough to make the top layer of the hot purging material flat.

A laboratory hot press may be used for this purpose, as well as a simple manual cold press (see Annex A, Figure A.1 for an illustration).

5.3 Microscope

A stereo (3D) zoom microscope with the following properties:

— zoom ratio: at least 5:1;

— magnification range: including 10x–50x;

— object field-of-view: at least 25 mm diameter at lowest magnification;

— millimetric measuring graticule;

— top incident cold illumination, preferably annular LED ring.

Optional: a microscope camera, linked to a measuring software.

5.4 Pointed metal rod

A sharp point metal rod (see Annex A, Figure A.2 for an illustration).

5.5 Screen pack

A two-layer screen pack, comprising two square-mesh plain-weave metal wire screens held together by a peripheral aluminium frame: a **filtering screen** with aperture size 200 µm (0,2 mm), supported on a **backing screen** with significantly larger aperture size, e.g. 800 µm (0,8 mm). (See Annex A, Figure A.3 for an illustration). Aperture sizes shall comply with ISO 9044:2016, Table 1.

If required, the **contaminants detection threshold** in this test method can be lowered or increased by using a filtering screen with larger or smaller aperture size, respectively. Aperture sizes should be selected in ISO 9044:2016, Table 1.

The screen pack dimensions: outer diameter (33,8 ± 0,1) mm, inner diameter (inside frame) (28,0 ± 0,1) mm, height (thickness) at frame 1,5 mm to 1,8 mm.

NOTE These dimensions are based on EN ISO 23900-5 and fit available commercial equipment.

5.6 Plastic foil

A plastic foil that does not stick to, and does not deform when touching, the hot layer of purging material on top of the screen pack immediately after being taken out of the extruder.

NOTE A clear polyester foil, 125 µm thick, was found to be suitable when testing polyethylene materials.

5.7 Purging material

Natural, uncoloured, transparent polymer, preferably of the same polymer family as the tested material. For best visibility of the embedded contaminants in the layer of purging material select a material grade with the highest transparency possible.

NOTE When testing recycled polyethylene materials, LDPE with MFI 0,2 to 0,3 was found to be suitable as the purging material.

6 Sample preparation

A representative sample of (1 000 ± 50) g of the tested material, in pellet form, prepared in accordance with CEN/TS 16010 and CEN/TS 16011. To be truly representative of the bulk, it should preferably be taken from pre-homogenized material.

NOTE 1 Material in agglomerate form or in flake (regrind) form can also be tested. If necessary, some purging material can be added and mixed with the sample to ease material flow through the extruder hopper.

NOTE 2 The development work on this test method was carried out with recycled polyethylene; yet it is believed that it can be adapted and used with other thermoplastic materials.

7 Procedure

7.1 Extrusion

7.1.1 If the extruder contains initially a polymer different from the material to be tested, or the same polymer but not a virgin, natural material — purge and replace it completely with the purging material mentioned in 5.7.

7.1.2 Adjust and heat up the extruder, including its head and die area, to achieve a normal operating temperature profile suitable for the tested material.

7.1.3 Fit a new screen pack in the extruder head, with the filtering screen side facing the screw, and clamp it tightly. Screen packs may be reused provided they are clean and free of any foreign matter.

7.1.4 Feed purging material into the hopper and start screw rotation. Set the screw speed as you prefer.

7.1.5 When the extrudate stream emerging from the die appears entirely clear and uniform wait until the hopper is emptied (or empty it manually), then feed into it the sample of the tested material.

7.1.6 Continue running the screw. When the hopper becomes empty add purging material into it.

7.1.7 When the extrudate stream emerging from the die appears clear again stop the screw rotation.

7.1.8 Unclamp and take out the screen pack, while hot, gripping it only at the frame, using long-nose pliers (or another suitable tool).

7.2 Flattening

NOTE The following instructions apply to the use of a manual cold press.

7.2.1 While still hot, move the screen pack quickly and place it centrally on the lower plate of the press, with the filtering screen side facing upwards.

7.2.2 Hold a piece of plastic foil (5.6) horizontally over, but without touching, the screen pack.

7.2.3 Move the upper plate of the press down quickly, pressing firmly the foil and the screen pack together. Hold and keep the pressure manually for about 10 seconds.

Steps 7.2.1 to 7.2.3 shall be done rapidly in succession and completed within a few seconds, before the purging material layer gets cold and solidifies.

7.2.4 Release the pressure and wait for about 1 minute until the screen pack cools down.

7.2.5 Open the press, take out the screen pack and remove the plastic foil.

NOTE It is beneficial to mark the sample data on the screen pack frame, using a fine-point permanent marker pen.

7.3 Visual examination

Place the screen pack under the microscope, adjust for best focus and look for any foreign bodies embedded in the transparent layer of purging material on top of the screen pack.

8 Evaluation

8.1 Amount of solid contaminants

Count, or estimate as closely as possible, the number of foreign bodies seen on the screen pack. Rate the **Level of Contaminants** (**LC**x) of the sample according to Table 1.

Table 1 — Level of Contaminants

Rating the Level of Contaminants	Amount of contaminants observed	
LCx	Number of foreign bodies	Percentage of screen area blocked
LC0	0	–
LC1	1–10	< 20 %
LC2	11–50	< 20 %
LC3	51–200	< 20 %
LC4	–	20 %–50 %
LC5	–	> 50 %

8.2 **Largest contaminant size** (optional)

If required, the length and width of the largest foreign body observed on the screen pack may be measured, using the microscope's measuring graticule (or the camera software), to the nearest 0,1 mm and reported in the format **S *length* x *width***.

EXAMPLE **S** 1,6x0,4

8.3 **Identification of the types (substance) of contaminants** (optional)

Contaminants made from different materials (e.g. metal, paper, wood, elastomer etc.) may have different impact on a product's production process, hence they may require different criteria for acceptance/rejection.

With some experience gained it may be possible to identify the substance of most types of contaminants, by their appearance (shape, colour, transparency, dimension ratio etc.) under the microscope and by their reaction (hard/soft, elastic/plastic, brittle etc.) to touching or poking using a pointed metal rod.

See Annex B, Table B.1 for help and guidance on identification of contaminant types.

If required, contaminant types may be reported using the designation in Table 2, in either of the following formats: