BRITISH STANDARD

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Plastics — Recycled Plastics — Characterization of polystyrene (PS) recyclates

ICS 13.030.50; 83.080.20

National foreword

This British Standard is the UK implementation of EN 15342:2007.

The UK participation in its preparation was entrusted to Technical Committee PRI/89, Plastics recycling.

A list of organizations represented on this committee can be obtained on request to its secretary.

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Kunststoffe - Kunststoff-Rezyklate - Charakterisierung von Polystyrol (PS)-Rezyklaten

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Foreword

This document (EN 15342:2007) has been prepared by Technical Committee CEN/TC 249 “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of an identical text or by endorsement, at the latest by June 2008, and conflicting national standards shall be withdrawn at the latest by June 2008.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This standard is one part of series of CEN publications on Plastics Recycling which is structured as follows:

— EN 15342 Plastics—Recycled Plastics—Characterization of polystyrene (PS) recyclates

— EN 15343 Plastics—Recycled Plastics—Plastics recycling traceability and assessment of conformity and recycled content

— EN 15344 Plastics—Recycled Plastics—Characterisation of Polyethylene (PE) recyclates

— EN 15345 Plastics—Recycled Plastics—Characterisation of Polypropylene (PP) recyclates

— EN 15346 Plastics—Recycled plastics—Characterisation of poly(vinyl chloride) (PVC) recyclates

— EN 15347 Plastics — Recycled Plastics — Characterisation of plastics wastes

— EN 15348 Plastics—Recycled plastics—Characterization of poly(ethylene terephthalate) (PET) recyclates

— CEN/TR 15353 Plastics — Recycled plastics — Guidelines for the development of standards for recycled plastics

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Introduction

Recycling of plastics waste is one type of material recovery process intended to save resources (virgin raw materials, water, and energy), while minimising harmful emissions into air, water and soil as well as any impacts on human health. The environmental impact of recycling has to be assessed over the whole life cycle of the recycling system (from the waste generation point to the disposal of final residues). To ensure that recycling constitutes the best environmental option for treating the available waste, some prerequisites should preferably be met:

— recycling scheme being contemplated should generate lower environmental impacts than alternative recovery options;

— existing or potential market outlets should be identified that will secure a sustainable industrial recycling operation;

— collection and sorting schemes should be properly designed to deliver recyclable plastics waste fractions fitting reasonably well with the available recycling technologies and with the (changing) needs of the identified market outlets, preferably at minimum costs to society.

This standard has been produced in accordance with the guidance produced by CEN on Environmental Aspects and in accordance with CEN/TR 15353, Plastics - Recycled plastics - Guidelines for the development of standards for recycled plastics.

NOTE CEN/TR 15353 considers the general environmental aspects which are specific to the recycling process.

It is often impossible to trace back each individual product at the end user stage and to check whether the product has been used correctly through its life. Consequently products are out of industrial control for a period of time. It is possible that during this period contamination with other materials may occur that could affect the product's suitability for recycling into the intended application.

1 Scope

This European Standard defines a method of specifying delivery condition characteristics for polystyrene (PS) recyclates.

It gives the most important characteristics and associated test methods for assessing a single batch of PS recyclates intended for use in the production of semi-finished/finished products.

It is intended to support parties involved in the use of recycled PS to agree on specifications for specific and general applications.

This standard does not cover the characterisation of plastics wastes. See EN 15347.

This standard is applicable without prejudice to any existing legislation.

2 Normative references

The following referenced documents are indispensable for the application 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 12099*, Plastics piping systems — Polyethylene piping materials and components — Determination of volatile content*

EN ISO 178, *Plastics — Determination of flexural properties (ISO 178:2001)*

EN ISO 179-1*, Plastics — Determination of Charpy impact properties — Part 1: Non-instrumented impact test (ISO 179-1:2000)*

EN ISO 179-2*, Plastics — Determination of Charpy impact properties — Part 2: Instrumented impact test (ISO 179-2:1997)*

EN ISO 180, *Plastics — Determination of Izod impact strength (ISO 180:2000)*

EN ISO 306, *Plastics — Thermoplastic materials — Determination of Vicat softening temperature (VST) (ISO 306:2004)*

EN ISO 472:2001*, Plastics — Vocabulary (ISO 472:1999)*

EN ISO 527-1, *Plastics — Determination of tensile properties — Part 1: General principles (ISO 527-1:1993 including Corr 1:1994)*

EN ISO 527-2, *Plastics — Determination of tensile properties — Part 2: Test conditions for moulding and extrusion plastics (ISO 527-2:1993 including Corr 1:1994)*

EN ISO 1133*, Plastics — Determination of the melt mass-flow rate (MFR) and the melt volume-flow rate (MVR) of thermoplastics (ISO 1133:2005)*

EN ISO 3451-1*, Plastics — Determination of ash — Part 1: General Methods (ISO 3451-1:1997)*

EN ISO 1183-1*, Plastics — Methods for determining the density of non-cellular plastics — Part 1: Immersion method, liquid pyknometer method and titration method (ISO 1183-1:2004)*

CEN/TR 15353:2007*, Plastics — Recycled plastics — Guidelines for the development of standards for recycled plastics*

3 Terms, definitions and abbreviated terms

For the purposes of this European Standard, the terms and definitions given in EN ISO 472:2001 and CEN/TR 15353:2007 apply. The abbreviated terms are given in EN ISO 1043-1:2001.

4 Characterisation of PS recyclates

A single batch is the quantity of recyclate that has homogeneous characteristics within the specified tolerances.

The characteristics of PS recyclates, which shall be determined for every batch of recyclate, are given in Table 1, and are divided into two types:

— Required characteristics, needed to define PS recyclates in general, and required for all recyclates.

— Optional characteristics, needed to define PS recyclates according to customer specifications and applications.

NOTE Polystyrene, or polystyrene-containing, plastics wastes for recycling may contain a variety of styrenic polymers, such as General Purpose (crystal or expanded) PS, and Impact-modified PS (usually containing grafted rubber particles). There may also be copolymers containing α-methyl styrene, butadiene, isoprene, acrylonitrile etc., and there may even be other non-styrenic polymers. The properties and performance of recyclates derived from such wastes will depend on the relative proportions of those polymers. Some of these copolymers (MBS, SAN for example) are not miscible with polystyrene, and can have adverse effects on the recyclate properties.

These characteristics shall be assessed using the test methods given in Table 1. Where possible, the supplier should provide information on the original application of the material.

A Certificate of Analysis, giving the test results for each batch of recyclate shall be provided by the supplier to the purchaser on request.

The polystyrene content of the recyclate may be measured by a method agreed between the parties, who will also agree the required level of polystyrene.

To secure the legal use of the recyclate, the supplier shall provide the necessary information about the material composition of the recyclate, as specified by the purchaser.

Table 1 — Characterisation of PS recyclates

Characteristic	Unit	Test method	PS	PS-I	Comment
Required					
Colour		Visual inspection	X	X	
Impact strength	kJ/m^2	EN ISO 179-1, EN ISO 179-2 or EN ISO 180		X	
Melt mass flow rate	g/10 min	EN ISO 1133 Condition H	X	X	
Particle size determination	mm		X	X	Using a method appropriate to the particle type and size range
Shape		Visual	X	X	For example, ground, micronized, pellets, flakes.
Vicat softening temperature	°C	EN ISO 306 Method A	X	X	
Optional					
Ash content	%	EN ISO 3451-1	O	O	
Bulk density	Kg/m^3	See Annex A	O	O	
Density	Kg/m^3	EN ISO 1183-1, Method A	O	O	
Filtration level	µm	Mesh size	O	O	
Flexural modulus	MPa	EN ISO 178	O	O	
Original application		Supplier to declare	O	O	
Presence of modifying additives		Supplier to declare	O	O	For example, fire retardants, fillers and reinforcements, heat and light stabilisers etc.
Residual Humidity	%	EN 12099	O	O	Although the scope of EN 12099 is limited, it is considered relevant
Tensile stress at yield	MPa	EN ISO 527-1 EN ISO 527-2	O	O	
Tensile strain at break	%	EN ISO 527-1 EN ISO 527-2	O	O	
Volatile Content	%	Weight loss at 200 °C	O	O	
X: required characteristic to be quantified. O: optional characteristic to be quantified.					
NOTE Other tests may be carried out by agreement between the purchaser and the supplier and the results reported.					

5 Quality assurance

To ensure the purchaser of the recyclate may have confidence in the quality of the product, the supplier shall maintain records of the quality control carried out, including incoming materials, processes and finished products.

NOTE 1 A quality management system certified to EN ISO 9001 may be a suitable guarantee of consistent recyclate quality.

The specification and the standard deviation or range of values within and between batches of material shall be agreed between the supplier and the purchaser.

Where a statement of recycled content, or the previous history of the material, is requested, documentary evidence shall be provided, where there is no analytical method available to supply such information. These records should be available to the purchaser on request.

Where a recyclate has been produced via a melt process, the supplier may choose to state the level of filtration applied during that process. This will determine the maximum size of any non-melting contaminants present in the recyclate. The statement of filtration level shall include details of the filter. Recyclates that have not passed through a melt process cannot be quantified in the same way, and the supplier may state this.

NOTE 2 EN 15343 describes a qualified recycling process and gives details of traceability and the assessment of recycled content.

Annex A
(normative)

Test Method for the determination of bulk density

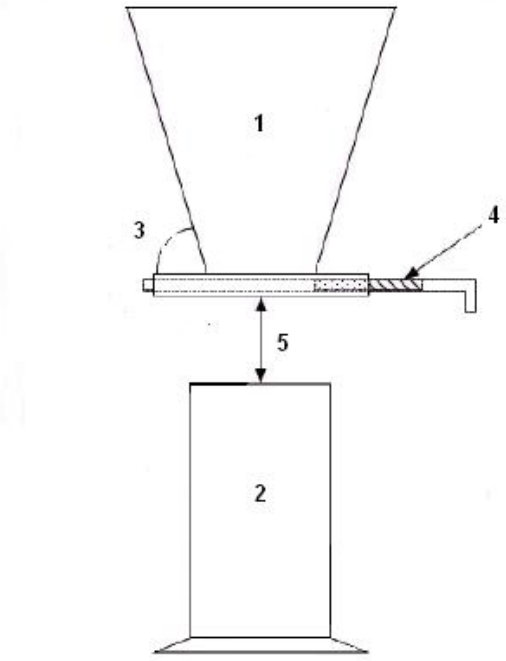
A.1 Scope

This test method specifies a method of determining the bulk density, i.e. the mass per unit of volume, of loose material (powder or granular material) that can be poured from a funnel of specific design.

When the method is applied to relatively coarse materials rather variable results may be obtained, owing to the error introduced when a straightedge blade is drawn across the top of the cylinder.

Knowledge of bulk density is of limited value in estimating the relative fluffiness or bulk of moulding materials, unless their densities in the moulded condition are approximately the same.

It therefore gives a fairly good idea of stability of mixing, presence of humidity and stability between batches (consistency).



Key

1 Volume of approximately 2 500 ml, diameter of hole at base 55 mm ± 0,25 mm

2 Inner height: 200 mm ± 0,2 mm, Inner diameter: 113 mm ± 0,2 mm, Volume: 2 000 ml

3 Angle approximately 65 °

4 Diameter of hole approximately 60 mm

5 Distance of 100 mm ± 0,5mm

Figure A.1 — Typical apparatus

A.2 Material

Powder or granular material.

A.3 Apparatus

A.3.1 *Balance*, accurate to 0,1 g.

A.3.2 *Measuring cylinder*, smoothly finished inside, which shall be constructed of metal, of a capacity of 2 000 ml (Inner height of 200 mm and inner diameter of 113 mm).

A.3.3 *Conical funnel*, of the form and dimensions shown in Figure A.1, of a capacity of 2 500 ml, internal diameter at base 55 mm, equipped with a metal trap plate for the lower orifice. Diameter of orifice in a trap plate of 60 mm.

A.4 Preparation of test sample

Mix the sample well before the test.

A.5 Procedure

A.5.1 Support the funnel (A.3.3) vertically with its lower orifice 100 mm above the measuring cylinder (A.3.2) and coaxial with it. Mix the sample of the powder or granular material well before testing. With the lower orifice of the funnel closed by means of the trap, place 2 200 ml to 2 400 ml of the sample material in the funnel.

A.5.2 Open the trap quickly and allow the sample to flow into the measuring cylinder.

When the measuring cylinder is full, draw a straightedge blade across the top of the measuring cylinder to remove any excess of the sample. Weigh the contents of the measuring cylinder to the nearest 0,1 g, using the balance (A.3.1).

A.5.3 Repeat procedure A.5.1 and A.5.2 to complete at least two determinations of the sample under test.

A.6 Expression of results

The bulk density of the material under test is given, in grams per millilitre, by the formula:

$$\frac{m}{V} \qquad \text{(A.1)}$$

where

m is the mass, in grams, of the contents of the measuring cylinder;

V is the volume, in millilitres, of the measuring cylinder.

Take as the result the arithmetic mean of the results of the determinations obtained by following the procedure A.5.

A.7 Test report

The test report shall include the following information:

a) reference to this European Standard (EN 15342:2007);

b) all details necessary for complete identification of the material tested;

c) individual results determined following the procedure A.5 and the arithmetic mean of the results;

d) details of any deviation from the test method, as well as any incident which may have influenced the results;

e) date of the test.

Bibliography

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[12] EN ISO 9001, Quality management systems — Requirements (ISO 9001:2000)

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