BRITISH STANDARD

BS EN
14987:2006

Plastics — Evaluation of disposability in waste water treatment plants — Test scheme for final acceptance and specifications

The European Standard EN 14987:2006 has the status of a British Standard

ICS 13.060.30; 83.080.01

BSI
British Standards

National foreword

This British Standard was published by BSI. It is the UK implementation of EN 14987:2006.

The UK participation in its preparation was entrusted to Technical Committee PRI/21, Testing of plastics.

A list of organizations represented on PRI/21 can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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This British Standard was published under the authority of the Standards Policy and Strategy Committee on 29 December 2006

ISBN 0 580 49792 5

Amendments issued since publication

Amd. No.	Date	Comments

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 14987

November 2006

ICS 13.060.30; 83.080.01

English Version

Plastics - Evaluation of disposability in waste water treatment plants - Test scheme for final acceptance and specifications

Plastiques - Evaluation de l'aptitude des plastiques à être éliminés dans des stations de traitement des eaux usées - Plan d'essai pour acceptation finale et spécifications

Kunststoffe - Bewertung der Entsorgbarkeit in Kläranlagen - Prüfplan für Endabnahme und Spezifikationen

This European Standard was approved by CEN on 6 October 2006.

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

Management Centre: rue de Stassart, 36 B-1050 Brussels

Ref. No. EN 14987:2006: E

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Foreword

This document (EN 14987:2006) has been prepared by Technical Committee CEN/TC 249 "Plastics", the secretariat of which is held by IBN/BIN.

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of an identical text or by endorsement, at the latest by May 2007, and conflicting national standards shall be withdrawn at the latest by May 2007.

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

1 Scope

This European Standard specifies test methods and criteria which are to be applied in order to verify if a solid plastic material can be considered as disposable in waste water treatment plants, i.e. it does not create problems for the environment and for the drainage systems. In order to reach this conclusion it needs be verified that the plastic material under evaluation is biodegradable under aerobic conditions (i.e. susceptible to mineralization) and water soluble or water dispersible.

NOTE Plastic materials which are shown to be in compliance with this European Standard can be used to produce items which, for their characteristics of water solubility or water dispersibility and biodegradability, can be eventually disposed of in municipal or industrial waste water treatment plants, through the sewage.

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 ISO 14851, *Determination of the ultimate aerobic biodegradability of plastic materials in an aqueous medium — Method by measuring the oxygen demand in a closed respirometer (ISO 14851:1999)*

EN ISO 14852, *Determination of the ultimate aerobic biodegradability of plastic materials in an aqueous medium — Method by analysis of evolved carbon dioxide (ISO 14852:1999)*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
water soluble plastic
plastic item that is able to readily produce water solutions capable to pass throughout a membrane with pore size of 0,45 μm

3.2
cold water
water at a temperature ≤ 25 °C

3.2
hot water
water at a temperature ≥ 60 °C

3.3
cold water soluble plastic
water soluble plastic which can be solubilized in cold water

3.4
hot water soluble plastic
water soluble plastic which can be solubilized in hot water

3.5
water dispersible plastic
plastic item that is able to readily fragments in water in particles lower than 10 mm size

3.6
cold water dispersible plastic
water dispersible plastic which can be dispersed in cold water

3.7
hot water dispersible plastic
water dispersible plastic which can be dispersed in hot water

4 Principle

The biodegradability of the plastic material is determined by performing a standard respirometric test method under aqueous and aerobic conditions. The water dispersibility or the water solubility is then assessed performing specific tests, as described in the following.

5 Test methods

5.1 Determination of biodegradability

The biodegradability of the water soluble or water dispersible plastic is evaluated by using the EN ISO 14852 standard test method.

Biodegradability can also be determined by evaluating the biochemical consumption of oxygen following the EN ISO 14851 standard test method.

5.2 Determination of solubility/dispersibility

5.2.1 Apparatus

5.2.1.1 Magnetic stirrer

A magnetic stirrer with the speed control, which can reach 150 rpm.

5.2.1.2 Filter

Glass sintered funnel for holding a filtering membrane with 0,45 µm pore size in poly(vinylidenefloride) (PVDF), or in cellulose acetate (CA) or in nylon, or in regenerated cellulose (RC (size 4,7 cm diameter).

5.2.1.3 Sieve

Inox steel sieve, mesh of 10 mm (see ISO 3310) with maximum diameter 10 cm.

5.2.1.4 Set up for under pressure or under vacuum filtration

5.2.1.5 Analytical balance with mg precision

5.2.2 Specimens

Specimen dimension shall be not lower than 25 mm $\times$ 25 mm, the specimen thickness will set the maximum thickness of the final product. In any case the density of the final product shall be equal or lower than the density of the specimen. The total mass of specimens shall be of at least 1 g.

In the case of multilayer products, the specimen shall have the same multilayer structure (number, type, sequence and thickness of layers) of the final product, and dimensions as above.

The specimen is dried in an oven up to constant weight at (50 ± 2) °C under vacuum before weighing.

5.2.3 Water quality

The initial pH of the water should be neutral, and shall be measured after the sample dissolution. Any pH changes have to be mentioned in the report.

5.2.4 Temperature

Temperature should be monitored during the test to detect any effect of the heat of specimen dissolution. If a significant temperature rise is observed, the sample shall be introduced progressively in water.

5.2.5 Carrying out of the test

5.2.5.1 Water treatment

1 litre of tap water is kept under stirring at 150 rpm in a 2 litres beaker. The specimen is released into the stirring water and the suspension maintained under stirring for 16 h either at (25 ± 2) °C to evaluate cold water solubility and dispersibility, or at (60 ± 2) °C to evaluate hot water solubility and dispersibility. After this period the suspension can be subjected either to the determination of the water soluble fraction "S" or to the determination of the water dispersible fraction (D), depending on the dissolution level reached after this period by the specimen.

5.2.5.2 Determination of the water soluble fraction "S"

The solution obtained as described in 5.2.5.1 is cooled to room temperature, if necessary, and immediately filtered on a 0,45 µm filter, preferably applying a light pressure, otherwise by vacuum pump aspiration. The fraction "S" will be obtained by determining the dry mass of the filter before and after filtration, drying in the oven under vacuum at (50 ± 2) °C up to constant mass. The determination of the water soluble fraction S shall be the result of at least three tests performed independently. The water soluble fraction S, is calculated as an average of the single test values, as reported in the following equation:

$$S = \frac{1}{3}\sum_{i=1}^{3}\left[1-\frac{PLi-PTi}{Ci}\right] \qquad (1)$$

where

S is the water soluble fraction;

P_{Li} is the dry mass of the filter after filtration;

P_{Ti} is the dry mass of the filter before filtration;

C_i is the dry mass of the specimen at the start of the experiment.

5.2.5.3 Determination of the water dispersible fraction "D"

The water dispersion obtained as described in 5.2.5.1 is cooled to room temperature, if necessary, and immediately sieved by gravity on a 10 mm mesh pre-weighed sieve. The fraction D will be obtained by determination of the dry weight of the sieve before and after sieving, dried in the oven under vacuum at (50 ± 2) °C up to constant weight. The determination of the water dispersible fraction D shall be the result of at least three tests performed independently. The water dispersible fraction D is evaluated as the average of the values obtained by the single tests, as reported in the following equation:

$$D = \frac{1}{3}\sum_{i=1}^{3}\left[1-\frac{QLi-QTi}{Ci}\right] \quad (2)$$

where

D is the water dispersible fraction;

Q_{Li} is the dry weight of the sieve after sieving;

Q_{Ti} is the dry weight of the sieve before sieving;

C_i is the dry weight of the specimen at the start of the experiment.

6 Requirements

6.1 Biodegradability

For the purposes of this European Standard, a plastic material is considered as biodegradable if after 56 days of testing it reaches a mineralization degree which is at least 90 % or the 90 % of the mineralization degree reached in the same time by the reference material, tested in parallel (relative biodegradation ≥ 90 %). The reference material is soluble starch or microcrystalline cellulose.

For the purposes of this European Standard the standard test methods applied to verify biodegradability, EN ISO 14851 and EN ISO 14852, shall be performed with the following restrictions. The microbial inocula shall be obtained only from municipal or industrial sewage sludge. Soil or compost inocula are excluded. The test temperature shall be room temperature (from 20 °C to 25 °C). It is excluded to run the tests under thermophilic temperature condition.

6.2 Water solubility and water dispersibility

For the purpose of this European Standard a plastic item is considered to be a cold water soluble plastic or a hot water soluble plastic if it produces a soluble fraction $S \geq 0{,}9$ after dissolution in cold or hot water, respectively.

For the purpose of this European Standard a plastic item is considered to be a cold water dispersible plastic or a hot water dispersible plastic if it produces a dispersible fraction $D \geq 0{,}9$ after dissolution in cold or hot water, respectively.

7 Classification and designation

A plastic item which is shown to be biodegradable and water soluble/dispersible can be indicated as suitable to be disposed of in a waste water treatment plant. A further classification is between the cold water and the hot water soluble/dispersible plastics. The second class can be disposed of through the sewage only after exposition to hot water. A further classification is between the soluble and dispersible plastics. The second class is not suitable for application where the final solution shall pass through small diameter pipes or orifices, i.e. laundry bags for washing machines.

8 Test report

The test report shall include the following information:

a) reference at this European Standard, i.e. EN 14987;

b) every information necessary to identify and describe the material under examination;

c) extent of the soluble fraction (S) or of the dispersible fraction (D);

d) results of the biodegradation experiment, including the inoculum characteristics and its preparation, the reference material used, and all the other information which is required by EN ISO 14851 or EN ISO 14852 to be explicitly quoted in the test report.

Bibliography

[1] ISO 3310 (all parts), *Test sieves — Technical requirements and testing*

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