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Plastics — Vinyl chloride homopolymer and copolymer resins — Particle size determination by mechanical sieving

Plastiques — Résines d'homopolymères et de copolymères de chlorure de vinyle — Détermination de la taille des particules par tamisage mécanique

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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

ISO 22498 was prepared by Technical Committee ISO/TC 61, *Plastics*, Subcommittee SC 9, *Thermoplastic materials*.

Plastics — Vinyl chloride homopolymer and copolymer resins — Particle size determination by mechanical sieving

1 Scope

This International Standard specifies a method for the determination of the size distribution of particles of vinyl chloride homopolymer and copolymer resins by measuring the amounts retained on a selection of sieves having meshes of various aperture sizes.

The results can be expressed either in terms of the amount retained on the individual sieves or as the mean particle size for the whole test sample.

The method is not recommended for use with sieves having mesh sizes smaller than 0,038 mm.

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.

ISO 565, *Test sieves — Metal wire cloth, perforated metal plate and electroformed sheet — Nominal sizes of openings*

ISO 868, *Plastics and ebonite — Determination of indentation hardness by means of a durometer (Shore hardness)*

3 Terms and definitions

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

3.1
sieve retention
percentage, by mass, of the resin test sample retained on a given sieve at the end of the test procedure

3.2
pan retention
percentage, by mass, of the resin test sample retained in the pan at the bottom of the stack of sieves, or under a single sieve, at the end of the test procedure

3.3
mean particle size
single value, expressed to the nearest 0,001 mm, representing the dominant particle of the whole test sample

4 Principle

A test sample of resin is sieved through a single sieve, or through a stack of sieves of various mesh sizes, assisted by mechanical shaking. When several sieves are chosen to form a stack, the sieves are assembled in ascending order of mesh size so that the largest mesh size is at the top.

5 Materials

5.1 Antistatic agent: aluminium oxide powder, carbon black or equivalent.

5.2 Blocks of non-sticking rubber, with a Shore A hardness typically between 70 and 80, and with dimensions of approximately 40 mm × 10 mm × 15 mm.

6 Apparatus

6.1 Balance, accurate to ± 0,001 g.

6.2 Balance, accurate to ± 0,1 g, range and size sufficient to accommodate the individual sieves and the resin retained on them.

6.3 Sieves, nominally 200 mm in diameter, conforming to ISO 565, complete with lid and base pan receiver. It is recommended that sieves with mesh sizes of 0,425 mm, 0,250 mm, 0,150 mm, 0,106 mm, 0,075 mm and 0,063 mm are available as a minimum. In cases of dispute, the sieve mesh sizes to be used shall be agreed between the interested parties.

6.4 Sieve shaker: a mechanical device preferably fitted with an automatic time switch. The device shall be capable of subjecting the sieve, or stack of sieves, to a uniform vertical motion that is completed by a "tap" or "jerk" at the end of each stroke. The "tapping rate" shall be 150 ± 15 taps per minute.

6.5 Soft-bristle brush.

6.6 Vacuum cleaner, suitable for and electrically safe with very fine powders.

7 Procedure

7.1 Ensure that the sieve or sieves, the lid and the pan are free from resin particles by cleaning with the vacuum cleaner (6.6), releasing any stubborn remains by gentle use of the brush (6.5).

7.2 Examine the sieve or sieves for damage to the mesh or distortion of the mesh matrix. Replace any sieve found to show these defects.

7.3 Weigh the sieve, or each individual sieve, to the nearest 0,1 g.

7.4 Weigh the pan to the nearest 0,1 g.

7.5 Assemble the sieve or sieves and the pan, one on top of the other, adding two or three blocks of rubber (5.2) to each sieve. When assembling a stack of sieves, ensure that they are assembled in ascending order of mesh size so that the sieve with the largest apertures is at the top.

When using a stack of sieves to determine mean particle size (see 9.3), it is necessary to choose a selection of mesh aperture sizes such that the combined retentions on the top sieve and pan are < 4,0 % of the test sample. As many sieves as practical shall be used having a graded distribution of mesh sizes. A possible combination of sieves is given in 6.3.

7.6 Weigh out 20,0 g ± 0,1 g of the resin sample and add anti-static agent (5.1). The amount of anti-static agent used shall be just sufficient to facilitate the easy movement of the powder but in no case shall it be more than 0,1 % of the mass of the test sample.

7.7 Mix the weighed test sample and the anti-static agent with a spatula and transfer the mixture to the top sieve, avoiding spillage or the fomation of a dust cloud. Use the brush to complete the transfer if necessary.

7.8 Cover the sieve or stack of sieves with the lid and clamp into the mechanical sieve shaker.

7.9 Set the timer on the shaker for 13 min ± 2 min and switch on.

7.10 After shaking, carefully separate the sieve or sieves, beginning at the top. Carefully remove the rubber blocks, returning any adhering powder to the sieve concerned. Weigh the sieve, or each sieve, and the pan together with their contents.

8 Number of determinations

Make two determinations for each sample tested.

9 Calculation and expression of results

9.1 Calculation of the average mass of resin retained on each sieve and in the pan

For each sieve and for the pan, calculate the mass, in grams, of resin retained in the first determination [Equation (1)] and in the second determination [Equation (2)]:

$$m_1 - m_2 = m_3 \quad (1)$$

$$m_4 - m_5 = m_6 \quad (2)$$

where

m_1 and m_4 are the masses, in the first and second determinations, respectively, of the sieve or pan plus retained resin;

m_2 and m_5 are the masses, in the first and second determinations, respectively, of the sieve or pan alone;

m_3 and m_6 are the masses, in the first and second determinations, respectively, of resin retained by the sieve or pan;

Then calculate, for each sieve and for the pan, the average mass m_r, in grams, of resin retained, i.e. the average of the two determinations, as follows:

$$m_r = \frac{m_3 + m_6}{2} \quad (3)$$

9.2 Calculation of the percentage of the test sample retained on each sieve and in the pan

For each sieve and for the pan, calculate the percentage R of the test sample retained, as follows:

$$R = \frac{m_r \times 100}{m_s} \quad (4)$$

where m_s is the average mass, in grams, of the two test samples taken.

9.3 Calculation of mean particle size

9.3.1 Calculate the percentage R of the test sample retained by each sieve and the pan in accordance with 9.1 and 9.2. The cumulative total of the values for the whole stack of sieves, together with the pan, shall amount to > 99 %.

If this is not the case, the test procedure shall be repeated.

9.3.2 Starting from the top of the stack of sieves, divide the stack into adjacent pairs and calculate the mean size of the resin particles retained on the lower sieve in each pair (that with the smaller mesh size) as follows:

$$D = \frac{d_1 + d_2}{2} \tag{5}$$

where

D is the average size, in mm, of the resin particles retained on the sieve with the smaller mesh size;

d_1 is the mesh size, in mm, of the sieve with the larger mesh size;

d_2 is the mesh size, in mm, of the sieve with the smaller mesh size.

9.3.3 Calculate the mean particle size for the test sample as follows:

$$\text{Mean particle size} = (D_1 \times R_1) + (D_2 \times R_2) + \ldots\ldots + (D_n \times R_n) \tag{6}$$

where

$D_1, D_2, \ldots D_n$ are the average particle sizes, in mm, for each of the pairs of sieves forming the stack, calculated using Equation (5);

$R_1, R_2, \ldots R_n$ are the percentages of resin retained on the sieve with the smaller mesh aperture in each pair.

For the purposes of the calculation of the mean particle size, the resin retained on the sieve with the biggest mesh size and in the pan shall be ignored.

10 Precision

The precision of this method is not known as interlaboratory data are not available.

11 Test report

The test report shall contain the following particulars:

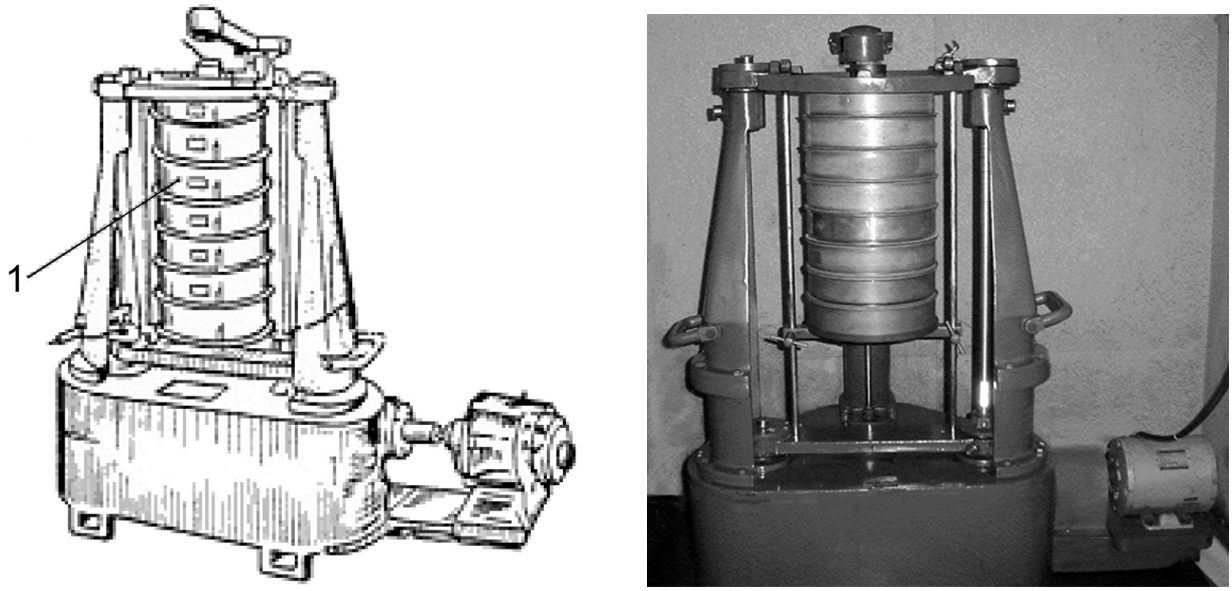
a) a reference to this International Standard;

b) all details necessary to identify the resin tested;

c) the anti-static agent used;

d) the values of the properties determined, i.e. the percentage of the test sample retained on the sieves of various mesh sizes and/or the mean particle size for the whole test sample;

e) the date of the test.



Key

1 wire cloth sieve

Figure 1 — Typical mechanical sieve-shaking device