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Rubber latex, synthetic — Determination of mechanical stability —

Part 1: High-speed method

Latex de caoutchouc synthétique — Détermination de la stabilité mécanique —

Partie 1: Méthode à vitesse élevée

Reference number
ISO 2006-1:2009(E)

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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 2006-1 was prepared by Technical Committee ISO/TC 45, *Rubber and rubber products*, Subcommittee SC 3, *Raw materials (including latex) for use in the rubber industry*.

It cancels and replaces ISO 2006:1985, which has been technically revised.

ISO 2006 consists of the following parts, under the general title *Rubber latex, synthetic — Determination of mechanical stability*:

— *Part 1: High-speed method*

— *Part 2: Moderate-speed method under load*

Introduction

The mechanical stability of synthetic latices is important in a variety of manufacturing processes, and a number of empirical methods are used for testing. This part of ISO 2006 provides a method of determining the mechanical stability by stirring a test portion of latex at a high speed without applying pressure.

This part of ISO 2006 is a revision of ISO 2006:1985 which has been rewritten to bring it into line with ISO 2006-2, which provides an alternative method of measuring mechanical stability.

Rubber latex, synthetic — Determination of mechanical stability —

Part 1: High-speed method

WARNING — Persons using this part of ISO 2006 should be familiar with normal laboratory practice. This part of ISO 2006 does not purport to address all of the safety problems, if any, associated with its use. It is the responsibility of the user to establish appropriate safety and health practices and to ensure compliance with any national regulatory conditions.

1 Scope

This International Standard specifies a method for the determination of the high-speed mechanical stability of synthetic rubber latex. The method is not applicable to compounded synthetic rubber latices.

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 123, *Rubber latex — Sampling*

ISO 124, *Latex, rubber — Determination of total solids content*

ISO 1652, *Rubber latex — Determination of apparent viscosity by the Brookfield test method*

ISO 3310-1, *Test sieves — Technical requirements and testing — Part 1: Test sieves of metal wire cloth*

3 Terms and definitions

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

3.1
mechanical stability
resistance to coagulation of latex when subjected to mechanical shear under specified conditions

NOTE The greater the percentage of coagulum formed [w_c(A) and w_c(B) as defined in 9.2 and 9.3], the poorer the mechanical stability.

4 Principle

A test portion of latex is stirred at a high speed for a given time, and the coagulum formed is separated and weighed. The mass of coagulum formed is inversely proportional to the mechanical stability. Latices with a viscosity of over 200 mPa·s require dilution.

5 Reagents

During the analysis, use only carbonate-free distilled water or water of equivalent purity.

5.1 Surfactant solution: 5 % (by mass) solution of potassium oleate of pH value 10 ± 0,5 or, for use with a latex which is coagulated by potassium oleate solution, a 5 % (by mass) solution of a synthetic anionic or non-ionic surfactant.

6 Apparatus

Ordinary laboratory apparatus, plus the following:

6.1 Mechanical stability measuring apparatus, consisting of the items specified in 6.1.1 to 6.1.2.

6.1.1 Latex container, flat-bottomed, cylindrical, at least 100 mm high, with an internal diameter of 58 mm ± 2 mm and a wall thickness of about 2,5 mm. The inner surface shall be smooth, and a glass container is preferred.

6.1.2 Stirring apparatus, consisting of a vertical stainless-steel shaft of sufficient length to reach the bottom of the latex container (6.1.1) and tapering to approximately 6,3 mm diameter at its lower end. A horizontal, smooth, stainless-steel disc 36,12 mm ± 0,03 mm in diameter and 1,57 mm ± 0,05 mm thick is attached to the shaft by means of a threaded stud at the exact centre of the disc. The apparatus shall maintain a stirring speed of 14 000 min^{-1} ± 200 min^{-1} throughout a test, at which frequency the shaft shall not run out of true by more than 0,25 mm.

NOTE The stirring disc which is specified has a diameter greater than that specified for natural rubber latex concentrate in ISO 35.

6.1.3 Holder, for the latex container (6.1.1). The holding arrangement shall ensure that the axis of the rotating shaft is concentric with the axis of the latex container and that the bottom of the stirring disc is at 13 mm ± 1 mm from the inner surface of the bottom of the latex container.

6.2 Preliminary filter, of stainless-steel wire cloth with an average aperture width of 180 µm ± 10 µm, complying with ISO 3310-1.

6.3 Test filter, consisting of a disc of stainless-steel wire cloth with an average aperture width of 180 µm ± 10 µm, complying with ISO 3310-1, dried to constant mass and weighed to the nearest 1 mg, firmly clamped between two stainless-steel rings of equal internal diameter between 25 mm and 50 mm.

7 Sampling

Carry out sampling in accordance with one of the methods specified in ISO 123.

8 Procedure

8.1 If the total solids content of the latex is not known, determine it in accordance with ISO 124.

8.2 If the viscosity of the latex, determined with the L instrument as specified in ISO 1652, exceeds 200 mPa·s (200 cP), dilute it to this or a lower value with an amount of water (see Clause 5) which reduces the concentration of the latex by no more than 10 % (by mass) total solids content.

NOTE Dilution of the latex may decrease its stability since the balance of free and absorbed soap is changed.

8.3 Adjust the temperature of the latex to 25 °C ± 3 °C by means of a suitable heating device, then pass it through the preliminary filter (6.2) into a beaker and accurately transfer 50 g ± 0,5 g to the latex container (6.1.1), recording the mass m.

8.4 Secure the latex container in the holder (6.1.3) of the apparatus and start the stirrer, ensuring that the stirring speed (see 6.1.2) is 14 000 min^{-1} ± 200 min^{-1}. Stir the latex for a time between 1 min and 30 min, as agreed between the interested parties, but of duration such that the latex does not increase in temperature to more than 60 °C and does not rise to a height exceeding 100 mm in the container. In the case of a latex which contains ammonia, the duration of stirring shall be limited since loss of ammonia by evaporation during the test may cause additional destabilization. If it is necessary to control foaming, a paste of a silicone defoamer shall be smeared around the upper part of the inner surface of the container.

8.5 Immediately after the termination of stirring, remove the latex container and wash the stirrer shaft and disc free from latex deposits with surfactant solution (5.1) or water (see Clause 5). Collect the washings in a beaker.

8.6 Wet the test filter (6.3) with surfactant solution or water and pour the latex and washings onto the test filter. Use surfactant solution or water to ensure quantitative transfer of all latex and deposits of coagulum, including skin.

8.7 Wash the residue on the test filter with surfactant solution or water until it is free from latex and no longer cloudy, then with water until the washings are clear.

8.8 Carefully remove the test filter containing the wet solid matter and blot the underside with filter paper. Place the filter on a watch glass.

8.9 Dry the watch glass with the test filter containing the coagulum at 100 °C ± 5 °C. After 15 min of drying, transfer to a desiccator and allow to cool to ambient temperature. Then carefully remove the filter from the watch glass and weigh. Repeat the drying procedure for periods of 15 min until the loss in mass between two successive weighings is less than 1 mg.

8.10 Carry out the procedure described in 8.3 to 8.9 in duplicate.

9 Expression of results

9.1 General

There are two methods of expressing the test result, as described in 9.2 and 9.3.

9.2 Method A

The mechanical stability of the latex is expressed as the percentage by mass of coagulum formed, w_c(A), relative to the mass of the test portion of latex, calculated using the following equation:

$$w_c(\mathrm{A}) = \frac{m_c \times 100}{m}$$

where

m_c is the mass of coagulum formed, in grams;

m is the mass of the test portion, in grams.

NOTE The greater the percentage of coagulum formed, the poorer the mechanical stability.

9.3 Method B

The mechanical stability of the latex is expressed as the percentage by mass of coagulum formed, w_c(B), relative to the total solids content of the latex, calculated using the following equation:

$$w_c(\mathrm{B}) = \frac{m_c}{\left(\frac{m \times \mathrm{TSC}}{100}\right)} \times 100$$

where

m_c is the mass of the dried coagulum, in grams;

m is the mass of the test portion, in grams;

TSC is the total solids content of the latex sample, as a percentage by mass (see 8.1).

NOTE The greater the percentage of coagulum formed, the poorer the mechanical stability.

10 Test report

The test report shall include the following:

a) a reference to this part of ISO 2006;

b) all details necessary for the identification of the sample;

c) the method used for the calculation of the mechanical stability;

d) whether the latex required dilution (and, if so, by how much), the total solids content at which the latex was tested and the name of the silicone defoamer used, if any;

e) the duration of the test, in minutes;

f) the test result, i.e. the percentage by mass of coagulum formed, rounded up to the second decimal place;

g) any unusual features noted during the test;

h) details of any operation not included in this part of ISO 2006 or in the International Standards to which reference is made, as well as details of any operation regarded as optional;

i) the date of the test.

Annex A
(informative)

Precision

A.1 General

An interlaboratory test programme (ITP) to determine the precision of this test method was conducted in 2006 in accordance with ISO/TR 9272, using three synthetic latices and one natural latex (see Table A.1). A type 1 precision was determined, measuring the percentage by mass of coagulum formed relative to the total solids content of the sample, i.e. w_c(B).

Six laboratories from four countries participated in the programme.

The test result was the mean value from determinations on two test portions of each latex material (i.e. $n = 2$). Test results were obtained on two different days, at intervals of 7 days between each of the two tests.

The test conditions used are given in Table A.2.

In this ITP, only two laboratories succeeded in measuring the percentage of coagulum for natural rubber latex due to clogging of the filter. This shows that this high-speed method is not suitable for natural rubber latex.

The precision results as determined by this ITP may not be applied to acceptance or rejection testing of any group of materials or products without documentation that the results of this precision determination actually apply to the materials or products tested.

Table A.1 — Samples provided for testing

Sample	Concentration %	Viscosity mPa·s
NBR	51	50
X-SBR-1	50	100
X-SBR-2	51	100
NR	61	30

Table A.2 — Test conditions

Item	Conditions
Total solids content	As specified in ISO 124
Mechanical stability tester: 1) stirring speed 2) stirring time	 14 000 $min^{-1} \pm 200$ min^{-1} 30 min
Expression of results	In accordance with 9.3

A.2 Precision results

A.2.1 General

The results of the ITP are given in Table A.3. These results were obtained using the outlier deletion procedures described in Clauses 8, 9 and 10 of ISO/TR 9272:2005.

A.2.2 Repeatability

The repeatability, r, of the test method has been established as the appropriate value tabulated in Table A.3 for each material. Two single test results that differ by more than this value should be considered suspect and suggest that some appropriate investigative action be taken.

A.2.3 Reproducibility

The reproducibility, R, of the test method has been established as the appropriate value tabulated in Table A.3 for each material. Two single test results that differ by more than this value should be considered suspect and suggest that some appropriate investigative action be taken.

Table A.3 — Precision data

Material	Mean value	Within-laboratory			Between laboratories		
	%	s_r	r	(r)	s_R	R	(R)
NBR	0,142	0,006	0,001 6	12	0,146	0,41	291
X-SBR-1	0,088	0,014	0,040	45	0,013	0,04	43
X-SBR-2	0,003	0,001	0,002	88	0,002	0,01	271
NR [a]	42,171	6,350	17,970	43	10,979	31,07	74

s_r is the repeatability standard deviation;

r is the repeatability, in measurement units;

(r) is the repeatability, in percent (relative);

s_R is the reproducibility standard deviation;

R is the reproducibility, in measurement units;

(R) is the reproducibility, in percent (relative).

[a] Calculated from data from only two laboratories.

Bibliography

[1] ISO 35, *Natural rubber latex concentrate — Determination of mechanical stability*

[2] ISO/TR 9272:2005, *Rubber and rubber products — Determination of precision for test method standards*

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