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Urine-absorbing aids for incontinence — Test methods for characterizing polymer-based absorbent materials —

Part 6: Gravimetric determination of fluid retention capacity in saline solution after centrifugation

Aides pour absorption d'urine — Méthodes d'essai pour caractériser les matériaux absorbants à base de polymères —

Partie 6: Détermination gravimétrique de la capacité de rétention de fluides en solution saline après centrifugation

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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 3.

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 part of ISO 17190 may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

International Standard ISO 17190-6 was prepared by Technical Committee ISO/TC 173, *Technical systems and aids for disabled or handicapped persons*, Subcommittee SC 3, *Aids for ostomy and incontinence*.

ISO 17190 consists of the following parts, under the general title *Urine-absorbing aids for incontinence — Test methods for characterizing polymer-based absorbent materials*:

— *Part 1: Determination of pH*

— *Part 2: Determination of amount of residual monomers*

— *Part 3: Determination of particle size distribution by sieve fractionation*

— *Part 4: Determination of moisture content by mass loss upon heating*

— *Part 5: Gravimetric determination of free swell capacity in saline solution*

— *Part 6: Gravimetric determination of fluid retention capacity in saline solution after centrifugation*

— *Part 7: Gravimetric determination of absorption under pressure*

— *Part 8: Gravimetric determination of flowrate*

— *Part 9: Gravimetric determination of density*

— *Part 10: Determination of extractable polymer content by potentiometric titration*

— *Part 11: Determination of content of respirable particles*

ISO 17190 is intended to be used in conjunction with ISO 17191, *Urine-absorbing aids for incontinence — Airborne polyacrylate superabsorbent material in the workplace — Determination of the content in respirable dust by sodium atomic absorption spectrometry*.

Annexes A and B of this part of ISO 17190 are given for information only.

Introduction

ISO 17190 consists of a series of test methods originally developed by *European Disposables and Nonwovens Association (EDANA)*. These test methods have been incorporated without technical changes into one International Standard consisting of eleven parts.

These test methods have been in practical use for several years, and have proven to be reliable with respect to common criteria of quality of test methods (validity, repeatability, etc.). They are applicable to polyacrylate superabsorbent materials, which occur in hygiene products, including urine-absorbing aids for incontinent persons. The test methods are addressed to the *material* exclusively. They are not intended to be used, and are not applicable for use with finished manufactured urine-absorbing aids.

Urine-absorbing aids for incontinence — Test methods for characterizing polymer-based absorbent materials —

Part 6: Gravimetric determination of fluid retention capacity in saline solution after centrifugation

1 Scope

This part of ISO 17190 specifies a method for determining the fluid retention capacity of polyacrylate (PA) superabsorbent powders in saline solution, following centrifugation.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of ISO 17190. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of ISO 17190 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO 187, *Paper, board and pulps — Standard atmosphere for conditioning and testing and procedure for monitoring the atmosphere and conditioning of samples*

ISO 3696, *Water for analytical laboratory use — Specification and test methods*

ISO 5725-2, *Accuracy (trueness and precision) of measurement methods and results — Part 2: Basic method for the determination of repeatability and reproducibility of a standard measurement method*

3 Terms and definitions

For the purposes of this part of ISO 17190, the following terms and definitions apply.

3.1
nonwoven
manufactured sheet, web or batt of directionally or randomly orientated fibres, bonded by friction, and/or cohesion and/or adhesion, excluding paper and products which are woven, knitted, tufted, stitch-bonded incorporating binding yarns or filaments, or felted by wet-milling, whether or not additionally needled

NOTE 1 The fibres may be of natural or man-made origin. They may be staple or continuous filaments or be formed *in situ*.

NOTE 2 Adapted from ISO 9092 (see reference [1] in the Bibliography).

NOTE 3 See ISO 9092 for further details about the definition of nonwoven.

3.2
bag
bag of nonwoven (3.1)

4 Principle

The sample is weighed and placed in a bag. The bag is submerged in the fluid to be absorbed and afterwards centrifuged for a specified time, at a specified centrifugal force, to determine the amount of fluid retained.

5 Reagents

Use only reagents of recognized analytical grade, unless otherwise specified.

5.1 Water, complying with ISO 3696.

5.2 Sodium chloride solution, c(NaCl) = 0,9 % by mass.

Weigh, to the nearest 0,1 g, 9 g of sodium chloride into a 1 l volumetric flask (6.7) and make up to the mark with deionized water (grade 3, see 5.1). Stir until dissolved.

6 Apparatus

6.1 Bag, having dimensions of (60 mm × 40 mm) to (60 mm × 85 mm) and made of non-apertured heat-sealable nonwoven.

Fold the nonwoven and heat-seal two of three open sides about 3 mm to 5 mm from the open edges to obtain the bag. The characteristics of the nonwoven shall be as follows:

— mass per unit area: (16,5 ± 1,5) g/m^2

— thermoplastic fibres content: (4 ± 0,8) g/m^2

— wet tensile strength in cross-direction: (70 ± 12) N/m

— air permeability (4 plies tested): (230 ± 50) l/min/100 cm^2 at a pressure drop of 124 Pa

6.2 Heat sealer, capable of bonding nonwoven.

6.3 Large pan, approximately 5 cm to 15 cm deep and large enough to hold several bags.

6.4 Analytical balance, capable of weighing, to the nearest 0,001 g, masses up to 100 g.

6.5 Weighing boats or **weighing paper**.

6.6 Timer, accurate to 1 s over 30 min.

6.7 Volumetric flask, Grade A of 1 l capacity.

6.8 Centrifuge, equipped with basket rotor, capable of delivering a force F equal to a centrifugal acceleration of (250 ± 5) g applied to a mass placed on the internal wall of the basket (e.g. 1 400 r/min for a basket internal diameter of 225 mm).

For calculation of the centrifugal acceleration see annex A.

7 Sampling

CAUTION — Use respiratory protection, dust mask or fume hood, when handling sample amounts greater than 10 g.

In order to guarantee that a representative sample is taken from the bulk material contained in a large bag or a silo truck, remove the top layer (approximately 20 cm). Take the test sample with a scoop. Place it in an airtight container of adequate size within 3 min after sampling.

Keep the test samples in a closed container and allow them to equilibrate to the ambient laboratory temperature before removing a test portion to run the test. The preferred test conditions are (23 ± 2) °C and (50 ± 10) % relative humidity. If these conditions are not available, test at ambient conditions and report the temperature and relative humidity. Measure these laboratory conditions in accordance with ISO 187.

Before taking a test portion out of the container to run the test, rotate the container three to five times so as to obtain a homogeneous product. Allow the container to sit 5 min before opening the lid and removing the test portion.

Make sure the test portion is substantially free of lumps of size greater than 1 mm in diameter before proceeding with testing.

8 Procedure

8.1 Prepare bags as specified in 6.1. Each experimental set comprises two bags per test sample and two blanks.

8.2 Weigh, to the nearest 0,005 g, a 0,200 g test portion of PA superabsorbent powder test sample and record the mass, m_{s1}.

Test portions prepared for ISO 17190-5 can be continued to be tested in this test. If this is the case, proceed to 8.10.

8.3 Place this test portion in the bag and seal the bag.

8.4 Use the same procedure to prepare a second test portion and record the mass, m_{s2}. If it takes longer than 5 min to weigh and seal the bags before starting the test, place the bags in a desiccator.

8.5 Prepare two blank bags and test alongside the bags containing PA superabsorbent powder.

As long as bag materials and sealing conditions are unchanged, the use of historical data on the blanks may be considered. In this case, the tests on the two blanks need not be carried out.

8.6 Fill the pan with 0,9 % saline solution (5.2). Change the solution after a maximum of 10 bags per litre of saline solution used.

8.7 Hold the bags containing the test portion by opposite edges, and equally distribute the test portion horizontally throughout the bags.

8.8 Lay the bags on the surface of the saline solution. Allow the bag to become wet for 1 min before pushing it under the liquid surface. Eliminate entrapped air bubbles by manipulating the bag.

8.9 After (30 ± 1) min, remove the bags from the saline solution.

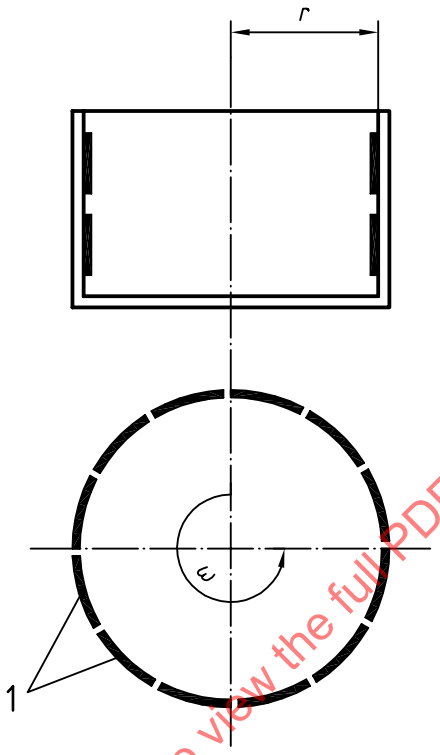
8.10 Place the samples and the blanks in the centrifuge basket (6.8). Position the bags so that the blanks are opposite each other, and the bags containing the samples are opposite each other for proper balancing. See Figure 1.

8.11 Set the centrifuge control to obtain 250 g centrifugal acceleration (see 6.8 and annex A).

8.12 Switch off the centrifuge after 3 min ± 10 s.

8.13 Wait for the centrifuge basket to come to a complete stop before opening the lid.

8.14 Remove the bags, weigh each bag and record the mass of the two blank bags, m_{b1} and m_{b2}, and the mass of the bags containing PA superabsorbent powder m_{w1} and m_{w2}.



Key

1 Bags

Figure 1 — Positioning of the bags in the centrifuge basket

9 Calculation

Calculate the average of the two wet blank bag masses after centrifugation:

$$m_b = \frac{(m_{b1} + m_{b2})}{2} \quad (1)$$

For each sample (i = 1 and 2), calculate the centrifuge retention capacity, w_i, expressed as a mass fraction (g/g):

$$w_i = \frac{(m_{wi} - m_b) - m_{si}}{m_{si}} \quad (2)$$

where

m_{si} is the mass, expressed in grams, of dry test portion.

m_b is the average mass, expressed in grams, of the two wet blank bags.

m_{wi} is the mass, expressed in grams, of the wet bag containing PA superabsorbent powder.

Take the average of the two calculated values and round it to the nearest 0,1 unit.

10 Precision

The data for the repeatability and reproducibility limits of this method are the result of interlaboratory tests carried out in 1997 by EDANA and are given in annex B.

The absolute difference between two single test results obtained under repeatability test conditions in accordance with ISO 5725-2 shall not exceed the repeatability limit r in more than 5 % of cases:

r = 1,53 (g/g)

The absolute difference between two single test results obtained under reproducibility test conditions in accordance with ISO 5725-2 shall not exceed the reproducibility limit R in more than 5 % of cases:

R = 3,28 (g/g)

If the repeatability and reproducibility test criteria are not met, the test shall be repeated twice, each in duplicate, after ensuring that the original sample is thoroughly mixed. If these criteria are still not met, report the results as unusual, then diagnose the source of error for example by verifying correct operation of the instruments and testing a portion of a material with a known value.

11 Test report

The test report shall include the following information:

a) the name and address of the testing institution;

b) the type of polymer-based absorbent materials, including all technical details and source information required for the complete identification of the sample;

c) a reference to this part of ISO 17190, i.e. ISO 17190-6;

d) the results of the centrifuge retention capacity for each test portion, expressed as a mass fraction in grams per gram (g/g) to the nearest to 0,1 g/g, and the average for duplicate determinations;

e) any unusual features noted during the determination or if the reproducibility and/or repeatability criteria were not met (see clause 10);

f) any deviation from the procedure, or any operations regarded as optional.

Annex A
(informative)

Centrifugal acceleration

The centrifugal force (F) applied to a mass (m) placed on the internal face of the cylindrical basket of the centrifuge is defined by:

$$F = m\omega^2 r \quad \text{(A.1)}$$

where

m is the mass, expressed in grams;

ω is the angular velocity, expressed in radians per second;

r is the basket radius, expressed in metres.

For this procedure, the specified centrifugal force applied to the mass corresponds to 250 g acceleration (see 8.11), i.e.

$$m\omega^2 r = m \times 250\ g \quad \text{(A.2)}$$

where g is the acceleration due to gravity (= 9,81 m/s^2).

The characteristics of the centrifuge are then defined by:

$$\omega^2 r = 250\ g \quad \text{(A.3)}$$