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Urine-absorbing aids for incontinence — Polyacrylate superabsorbent powders —

Part 6: Test method for determination of the fluid retention capacity in saline solution by gravimetric measurement following 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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 173, *Assistive products*, Subcommittee SC 3, *Aids for ostomy and incontinence*.

This second edition cancels and replaces the first edition (ISO 17190-6:2001), which has been technically revised. The main changes compared to the previous edition are as follows:

— full text review and new laboratory analysis with statistical evaluation;

— sample weighing simplified;

— request for duplication removed.

A list of all parts in the ISO 17190 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user’s national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Urine-absorbing aids for incontinence — Polyacrylate superabsorbent powders —

Part 6:
Test method for determination of the fluid retention capacity in saline solution by gravimetric measurement following centrifugation

WARNING — - This document does not claim to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this document to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use. It is expected that the person performing this test has been fully trained in all aspects of this procedure.

1 Scope

This document provides a test method for the determination of the fluid retention capacity of polyacrylate superabsorbent powders in saline solution, following centrifugation.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 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*

3 Terms and definitions

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

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

3.1
sample
product or portion of a product taken from a production lot for testing purposes and identifiable and traceable back to its origin

3.2
specimen
specific portion of the identified *sample* (3.1) upon which a test is performed

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 and materials

5.1 Water.

Grade 1 water in accordance with ISO 3696, with the exception that the conductivity can be as high as 30 µS/cm.

5.2 Sodium chloride solution.

5.2.1 0,9 % mass fraction of sodium chloride solution in water. Weigh (9,00 ± 0,01) g of sodium chloride into a 1 l beaker and add (991,0 ± 0,1) g of deionized water (grade 3). Stir until dissolved.

5.2.2 The conductivity of the solution should be checked prior to each use using properly calibrated measuring equipment. The expected conductivity of a 0,9 % saline solution is of the order of 1600 S/m at 25 °C. Each testing lab shall determine the correct conductivity for the conditions obtaining in the lab.

It is also recommended that the temperature of the solution be maintained at (23 ± 2) °C for the duration of the test. As this matches the required laboratory temperature it is not necessary to record the solution temperature.

5.3 Nonwoven bag.

NOTE Bags described in this document are often referred to as "teabags".

The bag has the external dimensions of (60 x 40) mm^2 to (60 x 85) mm^2 and made of non-apertured heat-sealable nonwoven. One example of a suitable specification for the nonwoven is the following:

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

— Thermoplastic fibre content: (4,0 ± 0,8) g/m^2;

— Web tensile strength in cross direction: (70 ± 12) N/m;

— Air permeability (4 plies) – 2,30 ± 0,50 $l.min^{-1}.cm^{-2}$ at a pressure drop of 124 Pa.

Normally the teabag paper is supplied as a roll, for example 120 mm wide. This shall be stored flat as storing in an upright position (as a wheel) will compress the paper at bottom of the roll and affect its characteristics.

The teabag is made by cutting sections, for example 60 mm wide, which will provide teabags 60 x 60 mm^2 when folded and sealed. In this example, the paper may be folded in half and sealed along two sides ready for the addition of superabsorbent powder and the sealing of the final side prior to running the test.

It is recommended to have teabags made in bulk and delivered ready-made for use in the lab.

In any case, teabags should be stored in cool, dry conditions. For best practice storing teabags in a desiccator prior to use is also recommended.

6 Apparatus

6.1 Bag, having dimensions of (60 x 40) mm^2 to (60 x 85) mm^2 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.

6.2 Heat sealer, capable of bonding nonwoven.

6.3 Large pan with cover, >5 cm internal depth and large enough to hold several bags. A compartmentalized tray is recommended to keep each teabag separate from the others, but the compartments shall be large enough to allow the teabag to be properly submerged and where swelling is not restricted by the volume of the compartment.

6.4 Analytical balance, capable of weighing a mass of between (0,180 ± 0,001) g and (0,220 ± 0,001) g of polymer powder in combination with the mass of the teabag (if weighed directly) or weighing vessel or laboratory paper employed.

6.5 Analytical balance, capable of weighing a mass of (9,00 ± 0,01) g of sodium chloride in combination with the mass of the weighing vessel or laboratory paper employed.

6.6 Analytical balance, capable of weighing a mass of (1 000,00 ± 1,00) g of sodium chloride solution in combination with the mass of the vessel employed.

6.7 Weighing vessel or laboratory paper.

6.8 Metal spatula, to accommodate 0,2 g of superabsorbent powder.

6.9 Timer, accurate to 1 second in 30 minutes.

6.10 Volumetric flask, of 1 l capacity and Grade "A" quality.

6.11 Centrifuge equipped with basket or rotor system, capable of delivering a centrifugal acceleration of 2 452 $m.s^{-2}$ (250 g) applied to a mass placed on the internal wall of the basket or rotor mesh (e.g. 1 400 $r.min^{-1}$ for a centrifuge with an internal diameter of 225 mm).

7 Conditioning

Samples shall be delivered in a closed container, to prevent absorption of atmospheric moisture. Allow the closed container to equilibrate to the laboratory conditions. The preferred test conditions are (23 ± 2) °C and (45 ± 15) % 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.

8 Sampling

WARNING — Powder Handling – The German Commission for the Investigation of Health Hazards of Chemical Compounds in the Work Area (MAK Commission) has provided a guideline value for long-term exposure to the respirable portion of superabsorbent polyacrylate dust of 0,05 $mg.m^{-3}$. The respirable portion is defined as those particles of less than 10 µm diameter. Commercial superabsorbent polymers typically contain less than 0,1 % of such particles. Precautions should be taken to avoid routine exposure to atmospheric respirable particles above this guideline MAK value.

8.1 Before taking a test portion out of the container to run the test, rotate the container five to ten times in a three-dimensional figure of eight motion (see Figure 1), to obtain a homogeneous product. For that matter, sample bottles should not be filled more than 80 % of their nominal capacity.

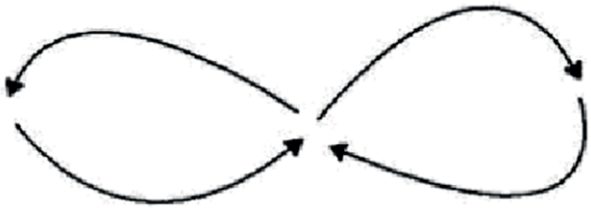

Figure 1 — Sense of motion of the container

8.2 Make sure the test portion is substantially free of lumps of size greater than 1 mm in diameter before proceeding with testing. Lumps can pierce the screen and disqualify the equipment and the test.

9 Procedure

9.1 If necessary, prepare the teabags. Each bag shall have the dimensions of (60 x 40) mm^2 to (60 x 85) mm^2 and be made from 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. Each experimental set comprises two bags per test sample.

9.2 Place a teabag onto the balance pan and tare the balance.

9.3 Add between 0,180 g and 0,220 g of superabsorbent test sample into the teabag.

Transfer the sample portion from the sample bottle to the weighing vessel or laboratory paper in one spatula portion. Discard any excess material on the spatula. Do not return it to the sample bottle. Keep the sample container closed as much as possible during this process.

9.4 Record the weight of the dry polymer as m_{s1}.

9.5 Seal the teabag (the seam should be about 5 mm from open side of the teabag).

9.6 Use the same procedure to prepare a second test portion and record the mass as m_{s2}.

9.7 If it takes longer than 5 minutes to weigh and seal the bags before starting the test, place the bags in a desiccator.

9.8 Prepare 2 blank bags and test alongside the bags containing polymer.

As long as bag materials and sealing conditions are unchanged, the use of historical data on the blanks may be used. In this case, the tests on the two blanks need not be carried out. However, regular checking of the blank teabags is advised for quality control checking.

9.9 Fill the pan with 0,9 % saline solution, using at least 1 litre of saline per 10 teabags.

Use fresh saline for each batch of teabags tested as the saline may become more concentrated owing to water evaporation during the test and contaminated by water soluble extractables from the polymer samples.

9.10 Hold each bag containing the test portion by its opposite edges and carefully distribute the test portion horizontally throughout the bag.

9.11 Lay each bag on the surface of the saline solution.

9.12 After each tea bag has become fully wet for (typically about one minute), gently push it under the liquid surface.

9.13 Carefully eliminate any entrapped air bubbles by manipulating the bag.

9.14 Allow the test portion to absorb the saline solution for a period of 30 minutes.

9.15 After the immersion period, remove each bag from the tray of saline solution.

9.16 Position the bags such that the blanks are opposite each other, and the bags containing the samples are opposite each other for proper balancing.

9.17 Discard the saline solution.

9.18 Set the centrifuge controls to obtain a centrifugal acceleration of 2 452 ± 50 m.s^{-2} (250 g) (see Annex A).

9.19 Switch off the centrifuge after centrifuging for 3 minutes.

9.20 For scientific centrifuges, the brake should be applied to bring the centrifuge to a halt.

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

9.22 Remove the teabags and place them individually onto a tray. Do not allow the bags to touch one another during this operation.

9.23 Immediately, weigh each bag and record the mass of the two blank bags m_{b1}, and m_{b2}, and the mass of the bags containing polyacrylate superabsorbent gel m_{w1} and m_{w2}.

10 Calculation

Calculate the average of the two blank values:

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

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

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

where