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Urine-absorbing aids for incontinence — Polyacrylate superabsorbent powders —

Part 5: Test method for determination of the free swell capacity in saline by gravimetric measurement

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

Partie 5: Détermination gravimétrique de la capacité de gonflement en solution saline

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Foreword

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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).

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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 *[or Project Committee]* ISO/TC *[or ISO/PC]* ###, *[name of committee]*, Subcommittee SC ##, *[name of subcommittee]*.

This second/third/... edition cancels and replaces the first/second/... edition (ISO #####:####), which has been technically revised.

The main changes compared to the previous edition are as follows:

— xxx xxxxxxx xxx xxxx

A list of all parts in the ISO ##### 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 5:
Test method for determination of the free swell capacity in saline by gravimetric measurement

1 Scope

This test method determines the free swell capacity of polyacrylate superabsorbent powders in saline solution.

NOTE - This standard 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 standard 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.

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 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 allowed to soak for a defined soaking period, after which the bag is removed. Excess fluid is allowed to drip away and the sample is weighed to determine the amount of fluid absorbed.

5 Reagents and Materials

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

5.1 Water

Grade 3 water according to 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% by mass (m/m) Weigh 9.00 ± 0.01 g of sodium chloride into a 1 l beaker and add 991.0 ± 0.1 g of deionised 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 16mS/cm at 25 °C. Each testing lab must 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.

5.3 Nonwoven Bag

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

— 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 tested): 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 must 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 highly 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, approximately 5 to 15 cm deep and large enough to hold several bags

6.4 **Analytical balance**, capable of weighing a mass of between 0.180 and 0.220 g ± 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 1000.00 ±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 **Drying rack or line** with clips

6.11 **Volumetric flask** of 1 l capacity and Grade "A" quality

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

SAFETY WARNING Power Handling – The German MAK 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, move the container five to ten times in a figure of eight motion, so as to obtain a homogeneous product. For that matter, sample bottles should not be filled more than 80% of their nominal capacity.

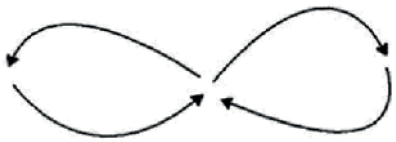

Figure 1 — Sense of motion of the container

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

9 Procedure

9.1 If necessary, prepare the teabags. Each bag must 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 and 0.220 g of superabsorbent test sample into the teabag.

NOTE 1 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 ms1.

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 ms2.

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.

NOTE 2 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. However, regular (daily) checking of the blank teabags is advised for QC checking.

9.9 Fill the pan with 0.9% saline solution, using at least 1 litre of saline per 10 teabags.

NOTE 3 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. Otherwise gives wrong answer.

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 At the end of the immersion period, remove each bag from the tray of saline solution and hang diagonally on a line from one of the double-sealed corners for 10 minutes, so as to remove excess saline solution by dripping.

9.16 Discard the saline solution.

9.17 Weigh each bag and record the mass of the two blank bags mb1 and mb2, and the mass of the bags containing polyacrylate superabsorbent gel mw1 and mw2.

10 Calculation

Calculate the average of the 2 blank values

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

For each sample, (i = 1 or 2), calculate the free swell capacity, $w_{i,}$ expressed as a mass fraction ($g.g^{-1}$):

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

where

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

m_b is the average mass, expressed in grams, of the 2 wet blank bags

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

11 Report

In addition to the precise test results, the report shall include the following information:

a) Reference the test method used

b) Complete identification of all materials tested and method of sampling

c) Name and address of testing institution

d) Make and model of testing equipment

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

f) The results of the free swell capacity in saline solution for each test portion, expressed as mass fraction in grams per gram ($g.g^{-1}$) to the nearest 0.1 $g.g^{-1}$, and the average for duplicate determinations

g) Laboratory testing conditions

h) Number of specimens tested

i) For computer processed data, identify the software used and the version

j) Deviation from the standard test procedure, if any

k) When calculated, the standard deviation or the coefficient of variation

l) Whether or not samples were conditioned prior to testing and, if so, for how long

m) Anything unusual noted during the testing

SI values are regarded as the official standard system of measurement for this standard test method. If other systems of measurement are used in place of SI units (including inch-pound) their values must be reported independently. Systems of measurement must not be combined in any way, but shall be regarded and reported separately.