

JAPANESE INDUSTRIAL STANDARD
JIS K 7223:1996
Testing method for water absorption capacity
of super absorbent polymers

December 1997

ERRATA

Page 2

Subclause 4.2

In lines 1 and 2, replace “0.900±0.001M/v %” with “0.9 mass %”.

Page 3

Subclause 5.1

In last line, replace “0.9M/v %” with “0.9 mass %”.

Clause 6 (1)

In line 2, replace “0.9M/v %” with “0.9 mass %”.

Clause 6 (3)

In line 5, replace “0.9M/v %” with “0.9 mass %”.

Remarks: This errata is for correcting the first edition of this Standard.

Japanese Standards Association

JIS

JAPANESE INDUSTRIAL STANDARD

Testing method for water absorption capacity of super absorbent polymers

JIS K 7223—1996

Translated and Published

by

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**Business Department,
Japanese Standards Association**
4-1-24, Akasaka, Minato-ku,
Tokyo, JAPAN 107
TEL. 03-3583-8002
FAX. 03-3583-0462

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JAPANESE INDUSTRIAL STANDARD

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Testing method for water absorption capacity
of super absorbent polymers

K 7223 1996

1. Scope This Japanese Industrial Standard specifies the testing method for water absorption capacity of super absorbent polymer which has 10 g/g or more water absorption capacity, using a tea-bag method.

Remarks 1. The grain size of the super absorbent polymer to be employed for this test shall be 60 μm or more. The grain size of the sample used in the measurement influences the dispersion of test results, therefore it is preferable to make the grain size distribution fall in as narrow range as possible so as to get measured values in less dispersion.

When grain size is less than 60 μm , it shall follow the agreement between the parties concerned with delivery.

2. The standards cited in this Standard are as follows.

JIS K 0069 Test methods for sieving of chemical products

JIS K 6900 Plastics – Vocabulary

JIS K 7100 Standard atmospheres for conditioning and testing of plastics

JIS K 8150 Sodium chloride

JIS R 3503 Glass apparatus for chemical analysis

JIS Z 8401 Rules for rounding off of numerical values

2. Definitions The definitions of terms mainly used in this Standard shall be as follows except those defined in JIS K 6900.

(1) super absorbent polymers The polymer which can highly absorb water and swells. Super absorbent polymer, hydrophilic material with crosslinking structure, absorbs water by contacting with water, and has a feature that it hardly dehydrates even when applying pressure after once absorbing water.

(2) water absorption capacity Mass of water absorbed by super absorbent polymers per its unit mass.

(3) deionized water Water from which almost all existing ions are removed. Its electric conductivity shall be 10 $\mu\text{S}/\text{cm}$ or less.

3. Conditioning of sample and testing liquid, and temperature and humidity for test

3.1 Conditioning of sample and testing liquid Sample and testing liquid shall be principally conditioned in standard temperature condition Grade 2 ($23 \pm 2^\circ\text{C}$) specified in JIS K 7100 for at least 24 hours prior to test.

Remarks: The conditioning of super absorbent polymers shall be carried out only by temperature as it is kept in a tightly sealed container.

And, if necessary, measure the drying loss of sample.

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3.2 Temperature and humidity for test Tests shall principally be carried out in the laboratory kept at standard temperature and humidity condition Grade 2 [temperature $23 \pm 2^\circ\text{C}$ and relative humidity $(50 \pm 5) \%$] specified in JIS K 7100.

4. Testing apparatus, testing liquid, and tea bag

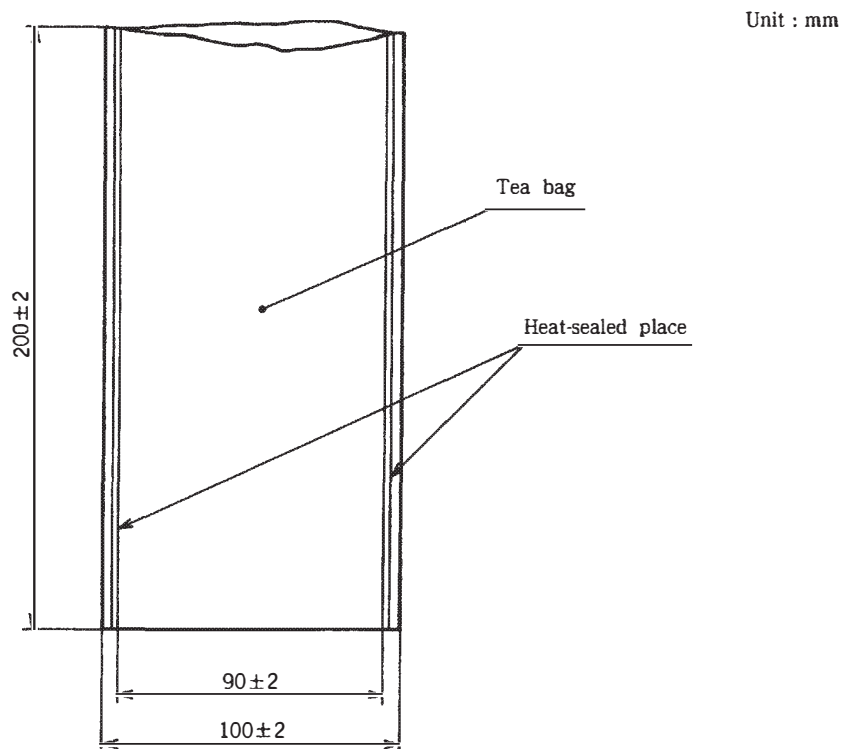
4.1 Testing apparatus

- (1) Beaker Beaker is for testing liquid in which the tea bag is immersed, keeping sample in it, and 1 l beaker specified in JIS R 3503.
- (2) Balance That for weighing the mass of sample, and capable of measuring to the nearest 1 mg.

4.2 Testing liquid Testing liquid is for being absorbed by sample, and $0.900 \pm 0.001 \text{ M/v\%}$ salt solution and deionized water which have been prepared using sodium chloride specified in JIS K 8150 and deionized water.

4.3 Tea bag Tea bag is for containing sample and then being immersed in testing solution, and principally prepared by cutting nylon fabrics, with sieve opening of $57 \mu\text{m}$ (255 mesh), to make $10 \text{ cm} \times 40 \text{ cm}$ oblong, then by folding it lengthway as shown in Fig. 1, and by heat sealing both ends to make it a bag shape.

Fig. 1 Shape and dimensions of tea bag



5. Sample

5.1 Grain size and mass of sample The grain size of sample shall be 60 μm or more. The mass of sample shall be about 0.20 g in case of deionized water as testing liquid, and about 1.00 g in case of 0.9 M/v % salt solution.

5.2 Sampling Sampling shall be as follows.

- (1) When sampling, make sampling as at random as possible so as to make particle size distribution represent its population.
- (2) When sample contains the particles less than 60 μm grain size, sieve off the particles less than 60 μm grain size according to 3.1 of JIS K 0069.

Remarks: When sieving, because the super absorbent polymers are hygroscopic, careful procedures are necessary as follows; either it shall be done in the room kept at standard temperature and humidity condition Grade 2 [temperature $23 \pm 2^\circ\text{C}$ and relative humidity $(50 \pm 5) \%$] specified in JIS K 7100, or the whole procedures be done under sealed condition.

The sieving procedure, which is needed when water absorption capacity of sample is measured under specified range of particle size distribution, shall follow the agreement between the parties concerned with delivery.

5.3 Number of sample tests The number of sample tests shall be 5.

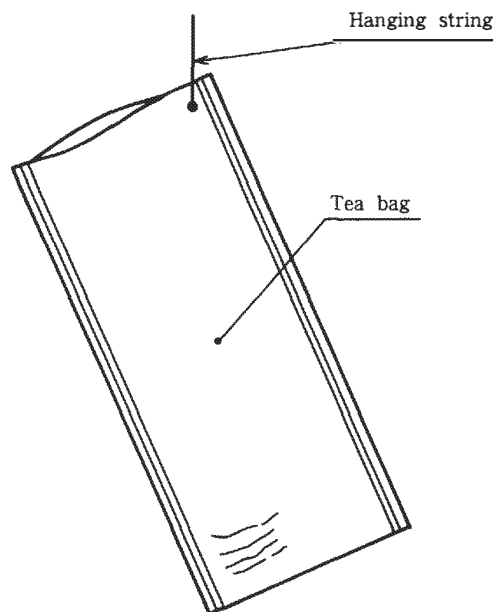
6. Operations Operations shall be carried out as follows.

- (1) In case of adopting deionized water as testing liquid, weigh quickly about 0.20 g of sample to the nearest 0.001 g to make it "a". In case of 0.9 M/v % salt solution, weigh quickly about 1.00 g of sample to the nearest 0.001 g to make it "a".
- (2) Place 1 l of testing liquid whose pH and conductivity have been measured beforehand into a beaker.
- (3) Put uniformly the sample in the bottom of a tea bag, and immerse gently the tea bag by about 150 mm its lower part into the testing liquid ⁽¹⁾, so as not to produce undissolved lump of flour, for specified period. The immersed period shall be 3 hours and 24 hours in case of deionized water, and one hour, 3 hours and 24 hours in case of 0.9 M/v % salt water.

Note ⁽¹⁾ Immerse one tea bag in 1 l of testing liquid.

- (4) When immersion for specified period has finished, as shown in Fig. 2 suspend the tea bag in a laboratory making its bottom line get oblique for 10 minutes to drops off water, and immediately weigh its mass to the nearest 0.001 g to make it "b".

Fig. 2 Example of suspending tea bag



- (5) Immerse the tea bag ⁽²⁾ not containing sample in testing liquid for specified period ⁽³⁾, carry out the procedures in (4), and measure the mass of the tea bag to make it "c".

Notes ⁽²⁾ Use 2 tea bags for blank test.

⁽³⁾ It is permissible to immerse 2 tea bags in 1 l testing liquid.

- (6) Repeat the procedures (1) to (4) 5 times. Then, observe for the presence of leakage of sample which absorbed water through a tea bag. If the leakage was found, retest the tea bag containing sample leaked.

7. Calculation

7.1 Water absorption capacity Water absorption capacity shall be calculated according to the following formula (1).

$$W = \frac{b - c - a}{a} \dots\dots\dots (1)$$

where, W : water absorption capacity (g/g)

a : mass of sample (g)

b : mass of tea bag containing sample which was immersed for specified period and whose water was dropped off (g)

c : averaged mass of tea bags containing no sample which were immersed for specified period and whose water was dropped off (g)

7.2 Rounding off of test results Calculate individually the test results, and round off the averaged value of 5 measured values according to JIS Z 8401 to get 2 significant figures.

7.3 Standard deviation and variation coefficient When standard deviation and variation coefficient are needed, calculate them according to the following formulas (2) and (3), and round them off according to JIS Z 8401 to get 2 significant figures.

$$s = \sqrt{\frac{\sum (x - \bar{x})^2}{n - 1}} \dots\dots\dots (2)$$

$$CV = \frac{s}{\bar{x}} \times 100 \dots\dots\dots (3)$$

where, s : standard deviation

CV : variation coefficient (%)

x : each measured value

$\bar{x}$: average of measured values

n : number of measured values

8. Report In report, the following items shall be recorded as occasion demands.

- (1) Kind, constitution, shape, manufacturing method and name of manufacturer of sample
- (2) Sampling method, particle size distribution and average particle size of sample
- (3) Drying loss of sample
- (4) Temperature and period for conditioning sample
- (5) Temperature and humidity for test
- (6) Type of testing liquid
- (7) Mass of sample taken
- (8) pH and conductivity ($\mu\text{S}/\text{cm}$) of testing liquid before test
- (9) Test results (water absorption capacity, averaged value, standard deviation and variation coefficient of each sample)
- (10) Date of test
- (11) Other items to be specially mentioned

K 7223-1996
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