

EL324. Baby Diapers

[EL324-2008/1/2008-137]



1. Scope

The criteria shall apply to diapers used for sanitation of baby's urine and feces but excludes cloth diapers which can be reused after laundering.

2. Definition

2.1

"Biodegradation Material" refers to materials of average biodegradability calculated with the method defined in the same standard using 180 days accumulation of carbon dioxide emitted by an aerobic final biodegradation which is 90% or above 90% when tested according to ISO 14855 or its relevant KS standard (KS M 3100-1). However, in a case where the value of biodegradation measured after cultivation during an initial 45 days is 60% or above 60% of standard material and it can be confirmed that obvious biodegradation is in progress in this condition, it may be regarded that it is a suitable biodegradation standard.

2.2

"Super Absorbent Polymer (SAP)" refers to powdered cross-linked components of aqueous solution having absorption and maintenance functions.

2.3

"Residual Pesticides" refers to pesticides defined in OEKO-TEX STANDARD Annexe 6 Compilation of individual substances.

3. Certification Criteria

3.1 Environmental Criteria

3.1.1

Product manufacture should not include the following materials:

3.1.1.1.

Chlorine gas (Cl₂) used for manufacturing pulp and cotton.

3.1.1.2

Pigment in which the sum of a lead (Pb), a cadmium (Cd), a hexavalent chromium (Cr⁶⁺) and an arsenic (As) is 100mg/kg or above 100mg/kg.

3.1.1.3.

Halogen synthetic resin including polyvinyl chloride (PVC)

3.1.2

To ensure paramount safety to the human body, the following requirements should be satisfied:

3.1.2.1

In cases where polyacrylat is the main component of the super absorbent polymer (SAP) the residual amount of acrylic acid monomer should be 1000 mg/kg or below 1000 mg/kg.

3.1.2.2

Absorption time, regurgitation and water permeability should satisfy the following requirements:

Item	Absorption Time [second]			Regurgitation[g]	Water permeability of waterproof film [g/m ² ·24h]
	First	Second	Third		
Criteria	≤35	≤55	≤60	≤3	≥2000

3.1.2.3.

Plasticizers contained in the product should satisfy the following requirements:

CAS No.	Item	Reference [mg/kg]
84-74-2	Di-butyl phthalate (DBP)	≤1000
85-68-7	Butyl benzyl phthalate (BBP)	≤1000
117-81-7	Di-(2-ethyltheyl) phthalate (DEHP)	≤1000

3.1.2.4

In a case where the product is lined with a natural fiber, the sum of residual pesticide should be 0.5mg/kg or below 0.5mg/kg.

3.1.3

When the product is disposed of, with regard to biodegradation, “biodegradation material” must be 15% or above 15% of its weight and should be made from synthetic resin materials. However, in a case where materials certified with “biodegradation resin product (EL724)” are used out of certifications per each environment mark-targeted product, the above should also be considered a suitable standard.

3.1.4

When the product is being manufactured or used, in regard to resources consumption, the packing material should satisfy the following requirements:

3.1.4.1

Halogen synthetic resin including PVC should not be used for packing materials.

3.1.4.2

The sum of a lead (Pb), a cadmium (Cd), a hexavalent chromium (Cr⁶⁺) and an arsenic (As), used in a packing materials, should be 100 mg/kg or below 100 mg/kg.

3.2 Quality Criteria

3.2.1

In regard to the quality of the product, the following requirements must be satisfied;

3.2.1.1.

The absorption of the product should be 10 or above 10.

3.2.1.2.

The leakage of the product should be 0.2g or below 0.2g.

3.2.2

The product should satisfy the standards of 「Voluntary safety confirm safety criterion」 in accordance with 「Quality Management and Safety Control of Industrial Product Act」 .

3.2.3

If Korean Industrial Standards are available as a national standard of the product in

question, it should satisfy the quality or performance criteria of the standard in question. However, items related to “3.1 Environmental Criteria” are excluded.

3.2.4

If no Korean Industrial Standards are available as a national standard of the product in question, it should satisfy the quality and performance standard according to the following sequence. However, the items related to “3.1 Environmental Criteria” are excluded. Also, if the E-Mark Certification Criteria Setting Committee determines that the applying criteria are not reasonable considering the characteristic of the product, it should satisfy the standards that were modified by the committee (test item, test method, standards, etc.).

3.2.4.1

National standards other than Korean Industrial Standards.

3.2.4.2

Overseas national standards or international standards regarding the product quality in question.

3.2.4.3

Standards of the organizations at home and abroad that are referred by the current E-mark target product and certification standard.

3.2.4.4

A private standard that is recognized as higher than the national standard in the industry of the product in question.

3.3 Information for Consumers

Marking of items that contribute to product certification (high biodegradability, less harmful substances)

4. Test Methods

Certification Criteria		Test method and verification method
	3.1.1	Verification of submitted documents and actual location.

Environmental Criteria	3.1.2	3.1.2.1	Submitted documents or authorized test institution test reports pursuant to “4.1 and 4.2 confirmation and test methods”
		3.1.2.2	Authorized test institution test reports pursuant to the following testing method. <ul style="list-style-type: none"> ▪ Absorption time: confirmation and testing method in accordance with 4.1 and 4.3. ▪ Regurgitation: confirmation and testing method in accordance with 4.1 and 4.3. ▪ Water permeability of waterproof film: confirmation and testing method in accordance with 4.1 and 4.4.
		3.1.2.3	Authorized test institution test reports pursuant to KS M 1991 (Determination of phthalates in plastic materials)
		3.1.2.4	KS K 0732 (Test method for the determination of pesticides in textiles)
	3.1.3	Verification of submitted documents and test report conducted by an authorized test institution the following test methods ^{note)} or certificates for the same or higher criteria: <ul style="list-style-type: none"> ▪ KS M ISO 14855-1 (Determination of the ultimate aerobic biodegradability of plastic materials under controlled composting condition — Method by analysis of evolved carbon dioxide — Part 1: General method) ▪ KS M 3100-1(Determination of the ultimate aerobic biodegradability and disintegration of plastic materials under controlled composting conditions –Part 1 : Analysis of evolved carbon dioxide by titration method) 	
	3.1.4	3.1.4.1	Verification of submitted documents
		3.1.4.2	Test report conducted by an accredited testing laboratory in accordance with announcement 2006-143 (announcement concerning recommended standard of heavy metal content in packing material and its test method) by Ministry of Environment.
	Quality	3.2.1	▪ Test report conducted by an accredited testing

Criteria		laboratory in accordance with the following test method: <ul style="list-style-type: none"> ▪ Absorption: verification and testing method in accordance with 4.1 and 4.5. ▪ Leakage: verification and testing method in accordance with 4.1 and 4.3
	3.2.2	Test reports of authorized institutions pursuant to the relevant standards or certificates for the same or higher criteria with the relevant voluntary verification safety criterion.
	3.2.3~3.2.4	Test report conducted by an accredited testing laboratory or certificates for the same or higher criteria
Consumer Information		Verification of submitted documents

Note1) Sample collection method: The entire weight of the product and the weight of the portion constructed with biodegradation resin is firstly measured and then, the biodegradation-used rate is confirmed. According to this method, a biodegradation material with confirmed finished product weight is used as a sample, thereby requiring the biodegradation test.

Note2) The test materials for biodegradation should be collected from a molded component and then frozen and disintegrated. Thereafter, powdered materials are passed through a test sieve being a nominal dimension of 20 μ m in accordance with KS A 5101-1(Test sieves-part 1: Test sieves of metal wire cloth).

4.1 General Matters

4.1.1

Make it a principle to take one test sample per product under application. However, where one or more than one test is required, additional products shall be provided for testing.

4.1.2 Test Samples

4.1.2.1

Environmental labeling certification institutions shall conduct random sampling of test samples among the products commercially available or kept in production locations.

4.1.2.2

In a case where certification should be executed on various types of standards having

the same component construction as a straight type, a tape type and a panty type, the product type based on difference of function such as a small, medium and large size, the tape type product with the large size (including baby's weight ranging from 10kg to 13kg) can be used as a representative sample for determining appropriateness in certification standards.

4.1.3

Test result shall be numerically set according to KS Q 5002 (Statistical interpretation method of the data – Part 1: Statistical description of the data).

4.2. Measuring Method of Acrylic Acid Monomer Residues

Note1) This method modifies and arranges EDANA (the European Disposables and Nonwovens Association) Recommended Test methods ERT 410.2-02 (Superabsorbent materials – Polyacrylate super absorbent powders – Determination of the amount of residual monomers) in order to apply to the certification standard.

Note2) Other detailed matters not suggested in the present test method should be in accord with EDANA ERT 410.2-02.

4.2.1

Principle: The absorbent (SAP + pulp) of test pieces is to be separately from a diaper and then, the pulp and super absorbent polymer (hereinafter referred to as a SAP) is divided based on the difference of specific gravity. Thereafter, the residues of acrylic acid monomer in the SAP shall be measured using HPLC (high performance liquid chromatography).

4.2.2

Test Equipments and Materials

4.2.2.1. Waring blender or Mixer

4.2.2.2. Dust mask

4.2.2.3. Balance

4.2.2.4. Fan

4.2.2.5. Two A3 papers

4.2.2.6. Test Solution

a) 0.9% sodium chloride solution, $c(\text{NaCl})$: Water of 1L, in which 9g sodium chloride and ion are removed, is poured into a flask and then, its weight is measured (tolerance field $\pm 0.1\text{g}$). Thereafter, it should be stirred until melted.

b) 85% concentrated phosphoric acid, $c(\text{H}_3\text{PO}_4)$

c) 0.1% phosphoric acid solution, $c(\text{H}_3\text{PO}_4)$: 1 g/L or 0.0087 mol/L: concentrated H_3PO_4 is diluted with water in which ion is removed. Thereafter, it should be stirred until melted.

d) Acetonitrile

e) Acrylic acid(>99.5%): Since the acrylic acid will be decomposed with time it should be prepared after its purity is measured using HPLC.

f) Solution S1 1000 mg/L: 0.1g acrylic acid is put into 100mL flask labelled S1 and then, its weight measured (tolerance field $\pm 0.0005\text{g}$). It should be prepared after the acrylic acid is put into UPW (ultrapure water).

g) Solution S1 10mg/L, 1mg/L, 2mg/L, 3mg/L and 4mg/L: Using a pipette, S1 10mg/L, 1mg/L, 2mg/L, 3mg/L and 4mg/L should be moved into each 100mL flask and labelled S2, S3, S4, S5 and S6.

4.2.3. Preprocessing of Test Pieces

4.2.3.1

The entire diaper is used for a test piece and 5 test pieces or above 5 test pieces should be prepared. Since a lot of pulps are generated upon executing this test, separation work should be executed within a fume hood.

4.2.3.2

The test piece should be let to stand for 2 hours or above 2 hours according to ISO 187 (Paper, board and pulps – Standard atmosphere for conditioning and testing procedure

for monitoring the atmosphere and condition of samples)

4.2.3.3

The absorbent (SAP + pulp) of the test piece is made separately from the test piece and is then disintegrated after putting into a Waring Blender or Mixer.

4.2.3.4

The pulp remaining on the upper portion of a Waring Blender or Mixer is cleaned so that the mixed SAP is totally removed from the bottom and then all of the pulp should be set on A3 paper (1).

4.2.3.5

In regard to the said pulp, the process of re-dividing the SAP using a mixer should be repeated twice. The pulp is then set on A3 paper (1) and the Waring Blender tube is reversed so that the sample in which the divided SAP and the minute pulp are mixed shall be collected on A3 Paper (2).

4.2.3.6

The disintegrated absorbent material shall be filtered using a test sieve of 10 mesh [the number of network/inch²]. More particularly, the pulp remains on the test sieve and the SAP and minute pulp pass through the test sieve. At this time, the test sieve should be slapped by hands so that the absorbent material tangled in the pulp can settle. In order to increase the purity of the filtered SAP, filtering can be executed several times.

4.2.3.7

The samples in which the SAP and minute pulps are mixed shall be spread equally area: 5_{cm}x10_{cm}), and the minute pulps shall be gently removed using a fan.

4.2.3.8

The remaining divided SAP is inserted into a 3 g or above 3 g weighing bottle and sealed - thus creating a sealed vessel. It will then be dried for one hour at 105°C,

4.2.3.9

The weight of the SAP obtained by the above section 4.2.3.8 shall be measured and recorded with a standard deviation of 5%.

4.2.4. Measurement of Acrylic Acid Monomer Residues

4.2.4.1. Preprocessing of Test Pieces

a) The test should be executed according to ISO 187 (Paper, board and pulps— Standard atmosphere for conditioning and testing and procedure for monitoring the atmosphere and conditioning of samples).

b) Within 3 minutes of collecting the sample the divided SAP (according to the section 4.2.3) shall be placed on paper of appropriate size.

c) Before taking the sample from the sealed vessel, the vessel containing the sample shall be rotated three times or five times so that a uniform sample can be obtained. The material in the rotated vessel should be let to settle for five minutes before opening.

d) As a sample, polyacrylate (PA) superabsorbent powders being $1g \pm 0.005g$ is placed in a clean weighing vessel to determine the quantity of mass.

4.2.4.2. Test Method

a) All the samples for testing are inserted in a beaker or in a flask.

b) 0.9% saline solution of 200mL measured by a measuring cylinder is added to the beaker or flask.

c) The said solution shall be rotated in the condition of $(500 \pm 50)r/min$ for 60 minutes.

d) The rotation period is followed by a 5 minute waiting time.

e) The monomers shall be filtered with a filter of $0.45\mu m$. In addition, the analysis should be executed with the following requirements of HPLC.

Injection	20uL - 100uL
Mobile phase (capacity unit)	10% acetonitrile: 90% phosphoric acid solution
Flowing speed	1 mL/min
Analysis column	C18 column (7.11)
Guard column	C18 (7.12)

Detection	UV (7.13) in 210mm
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Note) Peak area should be obtained using an integrator, a data station or a computer. In such a condition, the acrylic acid will be melted and divided within 5 to 6 minutes.

4.2.4.3. Verification

a) The standard solution S3 to S6 should be analyzed repeatedly. The peak areas obtained in each level should be averaged (A1).

b) In a case where the difference of two peak areas repeatedly analyzed is beyond 5% of the average, quantitative analysis should be duplicated. In a case where the difference is below 5% of the average, the average value of duplicated quantitative analysis shall be used for a calibration curve.

4.2.4.4

Quantitative analysis: The test portion obtained in 4.3.4.4. should be analyzed repeatedly. In addition, the obtained peak areas shall be averaged.

4.2.4.5. Calculation

a) In order to acquire a calibration curve, the mass concentration of an acrylic acid and pcal should be constructed in regard to the average peak area A1. While it is assumed that this relationship is a straight line, the equation on the regression line of mass concentration p in an average peak area should be determined as follows.

$P_{cal} = aA + b \quad \textcircled{1}$
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p_{cal}: mass concentration of analyzed material represented by milligram per a liter.

A: peak area of analyzed material

a: gradient of a straight line

b: intercept of Y axis (p_{cal})

note) The coefficient of correlation of the regression line obtained by the equation ① should be determined and the obtained coefficient of correlation should be beyond 0.99.

b) Amount of Residual Monomer: By using the dispersion formula ① obtained by the above calibration curve, mass concentration on the extraction solution is executed on the test quantity (9.3) and the p_{sam} should be calculated. The p_{sam} is the peak area obtained in regard to the sample. The amount of residual monomer in the PA super

absorbent powder is the massfraction of the quantified residual acrylic acid (W_{acr}), which shall be obtained by the following equation.

$$W_{acr} [\text{mg/kg}] = \text{psam} [200/\text{msam}]$$

psam: mass concentration of extraction solution represented by milligram per liter.

Msam[g]: mass of polymer used for test quantity

200: capacity of extraction solution represented by milliliter

4.2.4.6. Precision

Note) The critical data on repeatability and reproducibility of this test method is the result of interlaboratory testing executed by EDANA in 1997, which has been published in appendix 2 of EDANA Residual Monomers 410.2-02.

a) The absolute difference between two single test results obtained under a condition of repeatability test in accordance with ISO 5725-2 should not be extended beyond a critical value of repeatability r in a case of 5% or above 5%.

$$r = 55 \text{ mg/kg}$$

b) The absolute difference between two single test results obtained under a condition of reproducibility test in accordance with ISO 5725-2 should not be extended beyond a critical value of reproducibility R in a case of 5% or above 5%.

$$R = 416 \text{ mg/kg}$$

c) It is estimated that a higher critical value of reproducibility is due to a verification problem caused by the maturation of acrylic acid. If the test standards of repeatability and reproducibility are not satisfactory, the original sample is remixed and then, the test should be repeated twice. The said operation should be executed in duplicate. If this standard is not satisfactory, it is reported as an abnormal state and causes on the error are diagnosed.

Note) For example, it should be confirmed whether or not the instrument is operating normally and the base value of the portion of the material tested, thereby executing the diagnosis. If precision and accuracy in a fixed quantity is the same or better than those above as well as the peak separation, breakaway by chromatography will be allowed.

4.2.4.7. Information Required in Test Report

a) References on ERT

b) Results on the residual monomer quantity for each test (10.2) (represented by massfraction (mg/kg) of residual acrylic acid monomer in PA) and the average of the duplicated quantity.

c) Investigation of abnormal characteristics when quantifying or reproducibility and repeatability are not satisfied.

d) Selective matters and all abnormal separation.

4.3. Test Method for Absorption Time, Regurgitation and Leakage

4.3.1. Principle

4.3.1.1

Absorption time: The time that artificial urine (test solution) is absorbed in a diaper shall be observed with the naked eye and then measured with a stopwatch.

4.3.1.2

Regurgitation: After the fixed amount of artificial urine (test solution) is absorbed in a diaper, the regurgitation should be measured in the direction of skin through a lining of the diaper from an absorbent material according to fixed compression applied to a test piece.

4.3.1.3

Leakage: After the fixed amount of the artificial urine (test solution) is absorbed in a diaper, the leakage should be measured through a waterproof film according to fixed compression applied to a test piece.

4.3.2. Test Equipment and Materials

4.3.2.1

Funnel: The same standard as shown in Figure 1.

4.3.2.2

Ring: Stainless steel material having an inside diameter 60mm, a height 40mm and

weight $550\text{g}\pm 8\text{g}$.

4.3.2.3

Stand for fixing a funnel

4.3.2.4

Bottom measuring board: It is an acrylic board 490mm X 290mm in size

4.3.2.5

Measuring cylinder: Its capacity is 100mL with scales indicated in 1mL intervals.

4.3.2.6

Cylinder-type weight of balance: ($2\text{kg}\pm 3\text{g}$ and a diameter of 100mm)

4.3.2.7

Balance precision of $\pm 0.01\text{g}$

4.3.2.8

Stopwatch: Measured in 0.01s units.

4.3.2.9 Filter paper

a) Materials: 5 type C (for small particle) out of KS M 7602 (Filter paper (for chemical analysis)) or equivalents.

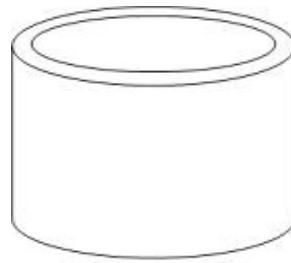
b) Size and shape: Circle having a diameter of 11mm (leakage) and 10mm (regurgitation), respectively.

4.3.2.10

Test solution: Physiological salt solution in which reagent-level salts (95% NaCl) are added to the distilled water in a concentration of $0.9\pm 0.005\%$.



<Figure 1> Funnel



<Figure 2> Ring

4.3.3. Preprocessing of Test Piece

4.3.3.1

The entire diaper is used for a test piece and five 2 pieces or above 2 pieces should be prepared.

4.3.3.2

The test piece should be left to stand for 2 hours or more according to ISO 187 (Paper, board and pulps – Standard atmosphere for conditioning and testing and procedure for monitoring the atmosphere and conditioning of samples)

4.3.4. Test Method



<Figure 3> Test Apparatus for Absorption Time, Leakage and Regurgitation

4.3.4.1

The weight of one filter paper (110mm) for measuring leakage and the weight of 30 filter papers (100mm) for measuring regurgitation shall be measured in a unit of 0.01g using a balance and a glass vessel for weighing.

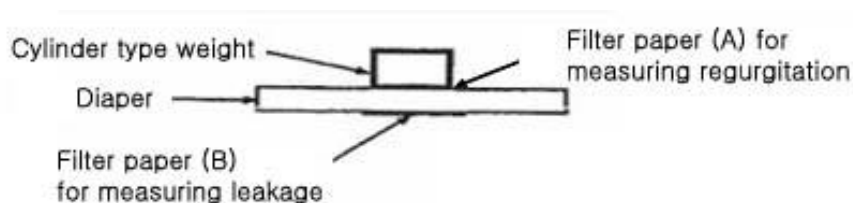
4.3.4.2

A diaper is spread on the central portion of an acrylic board so that the outside of texture of the diaper is close to the acrylic board and then is fixed by a tape on the waist band. The front end portion of the diaper is stretched and fixed by a tape to prevent creases in the diaper. The leakage-prevent band is pummeled in the left, the right and in the front and rear while not affecting the establishment of ring.

4.3.4.3

Marking should be at a point on the absorbent ring in a central position between the left and right portion being between 1/3 and 1/2 from the front portion of the absorbent material in order that the portion does not form creases and is included in a ring while containing absorbent supplying layer of the product. The inside diameter of the ring should be represented by four directions so that the point is placed on the central portion of the ring. When a balance weight is placed on the centre for the purpose of measuring regurgitation, the diameter of the balance weight should indicate the four directions.

4.3.4.4. A leakage filter paper is inserted down to the ring-set portion of the test piece.



<Figure 4> Sectional view showing establishment of filter paper and balance weight for regurgitation and leakage test

4.3.4.5.

The ring is to be placed at the marked point of the absorbent material and positioned on the central portion. In addition, it should be adjusted so that the interval between the

end of a funnel and the test piece is 20mm. Once the position of the ring is determined, it should be secured by slightly pressing the ring.

4.3.4.6

The test solution of 100 ± 1 mL is measured using a cylinder for capacity measurement on a basis of a large-size product and then, poured into a funnel. In addition, a small-size product is 50mL and a medium-size product is 70mL.

4.3.4.7

A stopwatch should start when the test solution is poured while taking care not to overflow. The funnel is removed after the test solution is poured and then the absorption state of the test solution should be observed.

4.3.4.8

If the test solution is absorbed and disappears from the surface of the test piece, the stopwatch shall be stopped and the first absorption time measured. The time should be recorded by units of 0.1 second.

4.3.4.9

After measuring the first absorption time, it should be left to stand for 3 minutes i.e., in the condition that the ring is set on. And then, the above-mentioned operations from 4.3.4.6 to 4.3.4.8 are repeated and then, the second absorption time is measured.

4.3.4.10

After measuring the second absorption time, it should be left to stand for 3 minutes. And then the above-mentioned operations from 4.3.4.6 to 4.3.4.8 are repeated and then, the third absorption time is measured. However, in a case where leakage is extremely prolific due to the imbalance expansion of the left and right sides, the absorption point can be moved to the lesser leakage portion between the left and right sections.

4.3.4.11

After measuring the third absorption time, the measured ring is removed and a 2kg weight applied for a period of 10 minutes. Thereafter, the 2kg weight is reapplied and left for one minute. Then, 30 filter papers (100mm) are applied to the lining in the central portion of the test solution..

4.3.4.12. The stopwatch should be started at the same of setting the 2kg weight.

4.3.4.13

After 2 minutes, the weight is removed and then the weight of the leakage and regurgitation filter papers is quickly measured in a unit of 0.01g, respectively (W2).

4.3.4.14

The procedure from 4.3.4.1 to 4.3.4.13 should be repeated five times and then, the average value in which the biggest value and the smallest value out of the measured first, second and third absorption times, regurgitations and leakages are excluded should be determined as the first, second and third absorption time, regurgitation and leakage of the diaper. Herein, the absorption time should be calculated by a unit per 0.1 second and regurgitation and leakage should be calculated by units of 0.01g. However, in a case where at the time of testing the absorption time, the test solution leaks, an additional test should be executed within 5 times and the obtained data can be used.

Regurgitation[g] = weight [g] of upper filter paper (A) after testing - weight [g] of upper filter paper (A) before testing

Leakage [g] = weight [g] of bottom filter paper (B) after testing - weight [g] of bottom filter paper (B) before testing

4.3.5

The test report should include the following:

4.3.5.1

Test method and reference standards

4.3.5.2

Detailed matters on the test piece (leakage, absorption characteristics, irregularity of the surface (embossing) and uniformity)

4.3.5.3

Individual test data and standard deviation

4.4. Water Permeability of Waterproof Film

Note) This method modifies and arranges the water method of section 5.2. in accordance with KS K 0594 (Testing method for permeability of textile goods) to be applicable to this certification standard.

4.4.1

Principle: The permeability area of waterproof film should be regular using a humidity cup containing test solution, and the amount of air movement should be determined based on the amount of test solution passing through a waterproof film after the test solution in the humidity cup is evaporated.

4.4.2

Test Equipments and Materials

4.4.2.1

Humidity cup: There should be no water vapor and according to test conditions, there should be no decay and no change in the permeability area.

4.4.2.2

Balance: It should have the sensitivity of 0.001g or above 0.001g.

4.4.2.3

Test Solution: Physiological salt solution in which reagent-level salts (95% NaCl) are made to a distilled water of concentration of $0.9\pm 0.005\%$.

4.4.2.4.

Constant temperature and constant-humidity equipment: The air having the temperature of $40\pm 1^\circ\text{C}$ and relative humidity of $50\pm 5\%$ is circulated at the speed of approximately 0.5 to 2.5m/s in the sample.

4.4.3

Preprocessing of Test Piece

4.4.3.1

Three original materials of waterproof film used for the outer-most surface of a diaper, for which a circle of 8 cm in diameter should be prepared.

4.4.3.2.

The test piece should stand for 2 hours or more according to ISO 187 (Paper, board and pulps – Standard atmosphere for conditioning and testing and procedure for monitoring the atmosphere and conditioning of samples).

4.4.4

Test Method

4.4.4.1

The test piece is inserted into a humidity cup preprocessed at 40°C with a test solution of 40°C at a height of 42mm with the distance between the water and the bottom surface of the test piece approximately 10mm.

4.4.4.2.

Silicon adhesives for glass should be slightly rubbed on the packing of a humidity cup cover with a swab.

4.4.4.3

The unprinted internal surface concentric circles of the test piece is set toward water to be in a humidity cup and then, the packing and ring are added sequentially, and secured with fly nuts.

4.4.4.4

This test specimen is inserted into constant temperature and constant-humidity equipment in which the air has a temperature of $40\pm 2^\circ\text{C}$ and a relative humidity of $50\pm 5\%$ which is circulated and then, weighed (A1) after 24 hours.

4.4.4.5

This test specimen is again inserted into the constant temperature and constant-humidity equipment and then, its weight (A2) should be measured after 24 hours.

4.4.4.6

The procedure from 4.4.4.1 to 4.4.4.5 should be repeated five times and then, the average value in which the biggest value and the smallest value out of the measured values are excluded should be determined as the permeability by calculating down to one decimal place.

$$\text{Permeability}(g / m^2 \cdot 24h) = \frac{A2(g) - A1(g)}{\text{permeabilityarea}(m^2)}$$

4.4.5

The test report should include the following:

4.4.5.1

Test method and reference standards

4.4.5.2

Detailed matters on the test piece (leakage, absorption characteristics, irregularity of the surface (embossing) and uniformity)

4.4.5.3

Individual test data and standard deviation

4.5 Test Method of Absorption

4.5.1

Principle: The entire diaper is placed in an artificial urine (test solution) for three minutes and then, taken out of the artificial urine. After leaving for one minute, the weight of the absorbed test solution should be measured.

4.5.2

Test Equipment and Materials

4.5.2.1

Water tank: It should be of sufficient size to contain the fully spread diaper.

4.5.2.2

Balance: It should be able to measure the weight of precision of $\pm 0.01g$.

4.5.2.3

Vessel for weighing: It should be of sufficient size to contain the diaper.

4.5.2.4

Wire mesh for supporting the test piece: It is a sieve for the stainless steel test being 2mm or equivalent in accordance with ISO 565 (Test sieves – Metal wire cloth, perforated metal plate and electroformed sheet – Nominal sizes of openings). In addition, it should be of sufficient size to contain a diaper and a have a weight so that the diaper is not floating.

4.5.2.5

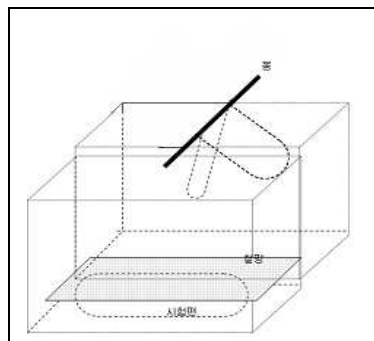
Stopwatch: It is able to measure in a unit of 0.01s.

4.5.2.6

Test solution: Physiological salt solution in which reagent-level salts (95% NaCl) are made to the distilled water of concentration of $0.9\pm 0.005\%$.

4.5.2.7

Horizontal bar: It is a circular-type bar having a diameter of 1cm, on which the diaper can be hung.



<Figure 5> Test Equipment for Absorption

4.5.3

Preprocessing of Test Piece

4.5.3.1

The entire diaper is used as a test piece and five test pieces should be prepared.

4.5.3.2

The leg elastic cords of the test piece shall be removed and the elastic cords of the

leak-preventage band shall be cut in at 2cm intervals. Thus, it should be spread levelly to prevent creases on the absorption portion of the lining close to skin. In this regard, it should be cut carefully in order to prevent leakage to the absorbent material.

4.5.3.3

The test piece should stand for 2 hours or more according to ISO 187 (Paper, board and pulps – Standard atmosphere for conditioning and testing and procedure for monitoring the atmosphere and conditioning of samples)

4.5.4

Test Method

4.5.4.1

The NaCl (physiological salt solution) solution of $0.9\pm 0.005\%$ with a water level of 10cm should be prepared in a vessel with the capacity to accommodate the test piece fully spread. The water level should be constantly maintained.

4.5.4.2

After selecting the test piece, the weight of the test piece should be measured in a unit of 0.01g using a balance and a glass vessel for weighing.

4.5.4.3

The test piece should be floated on the test solution so that the lining is upward and at the time of placing it on the wire mesh, the stopwatch should be started. And then, it is left standing for 3 minutes so that the diaper is digested naturally by the wire mesh.

4.5.4.4

After removing the wire mesh when the 3 minutes have passed, the test piece in its levelly spread state should be taken out of the test solution by the waist bands positioned on longitudinal both sides of the test piece.

4.5.4.5

The lining of the test piece should be hung on the horizontal bar having a diameter of 1 cm, with the lining of the test piece upward, and at the same time, the stopwatch should be started.

4.5.4.6

After the test piece has been hung on the horizontal bar for one minute, it should be placed in a vessel for weighing in order to prevent dehydration due to careless handling. The weight of the test piece should be measured in a unit of 0.01g.

4.5.4.7

The procedure from 4.5.4.1 to 4.5.4.6 should be repeated five times and then, the average value in which the biggest value and the smallest values out of the measured values are excluded should be determined as the absorption by calculating by a unit of 0.1g.

$$Absorption(g / g) = \frac{WeightofTestPieceaftertesting[g] - WeightofTestPiecebeforetesting[g]}{WeightofTestPiecebeforetesting[g]}$$

4.5.5

The test report should include the following:

4.5.5.1

Test method and reference standards

4.5.5.2

Detailed matters on the test piece

4.5.5.3

Individual test data and standard deviation

5. Reasons for Certification

“High biodegradability, Less harmful substances”

Common Criteria, Notice No. 2012-36, the Ministry of Environment

1. Eco-label products must follow the following provisions with regard to the proper treatment of environmental pollution substances, such as air and water wastes and noxious chemical substances emitted in the process of manufacturing or service operation.

A. When first applying for certification, the product manufacturer should observe the environment related laws and agreements pertaining to the region where the production factory or the place of service operation is located for a period of one year prior to the date of application. Any case of violation of the penalty clause will be verified by confirming documents involved during a period of one year to the date of application. Regarding any violation not related to the penalty clause, confirmation will be made on the completion of appropriate measures.

B. A person who has received a certification of eco-labeling shall observe the environment related laws and agreements pertaining to the region where the production factory or the place of service operation is located during the period of certification. However, regarding any violation besides a penalty, confirmation will be made on the completion of appropriate measures.

2. As a general rule, information for consumers shall be indicated on the surface of the product in such a way not to be easily erased. However, in case that indication on the surface of the product is impossible or undesirable, it can be indicated on the appropriate part such as product packaging, product guidebook and user's manual that consumers can recognize. However, the service information should be indicated inside and outside of the place of service operation. In case that indication inside and outside of the place of service operation is impossible or undesirable, it can be indicated on the appropriate part such as an agreement, letter of delivery, letter of guarantee, and PR materials that consumers can recognize.

3. In order to establish fair trade and to protect consumer, the applicant for eco-label and the holder of eco-label license shall observe the Act on the Fairness of

Indication and Advertisement with respect to the environmental aspects of the product.

4. For Various standards referred in the certification criteria by target product, the latest revised edition applies at the date of application, if not specified otherwise.

5. In applying the quality related criteria for each target product, if no standard is available that can be applied as the quality criteria, the president of Korea Environmental Industry & Technology Institute (KEITI) (hereafter referred to as "president of KEITI") may establish and operate the quality criteria for the product involved after review by a competent committee.