

EL724. Biodegradable Resin Products

[EL724-2002/5/2014-164]



1. Scope

The criteria shall apply to the product formed and manufactured mainly based on biodegradable resin of single quality or more than two types (hereafter referred to as "molded product") and to the raw material for formation to manufacture the product.

Note) As a general rule, the criteria for biodegradable resin products shall apply to "products that cannot be recovered through conventional methods."

2. Definitions

Note) The term used in the criteria shall be in accordance with the definition of KS M 3100-1 (measurement of aerobic biodegradation and disintegration of plastic in the composting condition - Part 1: quantitative method of carbon dioxide generated by titration) as long as there is no special definition.

2.1

"Biodegradable product" refers to the product whose resin consists only of biodegradable one. Types of resin can include plant-derived resins, natural organic material and synthetic resins that use chemical methods or microorganisms, etc.

2.2

"Biodegradable resin" refers to the resin that can be used as normal resin in the use stage of product, and be degraded by microbe existing in nature in the composting conditions such as landfill after use.

2.3

"Plant-derived resin" refers to a resin that is made of organic material produced by plants. There are biodegradable and non-biodegradable types of resin in this category.

2.4

“Natural organic material” refers to organic material that exists in nature, which can be biodegradable.

2.5

“Ultimate aerobic biodegradation” refers to that organic compounds including high polymers in the aerobic condition is finally converted into carbon dioxide, water, inorganic salt and new biomass by microbe.

2.6

“Biodegradability” refers to an average biodegradability value that is calculated in accordance with the test method by using an accumulated amount of carbon dioxide released by final aerobic biodegradation that is specified in ‘MS M IS 14855-1 (Determination of the ultimate aerobic biodegradability and disintegration of plastic materials under controlled composting conditions - Method by analysis of evolved carbon dioxide – Part 1: General Method) or 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).

2.7

“Standard material” refers to a positive control substance used in evaluating the biodegradation of biodegradable resin, in which a cellulose with less than 20 µm of particle size in TLC grade shall be used.

2.8

“Product that cannot be recovered through a conventional method” refers to the type of product that is installed in an outdoor environment with the intention to be used continuously for a certain period of time.

3. Certification Criteria

3.1 Environmental Criteria

3.1.1

With respect to the biodegradation of product at the disposal stage after use, the product shall satisfy the following requirements.

3.1.1.1

The product shall use more than 70 weight% resin of component materials of product, and the component materials except resin shall be readily separated from resin without using special tools by general users.

3.1.1.2

For resin of product component materials, only biodegradable resin shall be used. At this time, inorganic additives contained in resin and organic additives such as stabilizer, surfactant, pigments, etc. shall be regarded as biodegradable resin.

3.1.1.3

Final biodegradation value measured by culturing for not more than 180 days in accordance with the relevant criteria on the resin products shall be more than 90 % of the final biodegradability value on standard material. In the event that the biodegradability test is performed for each material, every material shall satisfy the above requirements independently. Alternatively, the criteria is considered as having been satisfied if the requirements in a) or b) below are met.

Note) Biodegradability test shall not be required for a material or inorganic additive if its total weight is equal to or less than 5% of the total weight of the product and the use of each individual material is less than 1%.

a) The biodegradability value measured by culturing for initial 45 days shall be more than 60 % of biodegradability value on standard material, and even at this point the period of biodegradation shall be continued so it can be confirmed that the biodegradation proceeds obviously.

b) The biodegradability value measured by culturing for 180 days shall be more than 60 % of the final biodegradability value on standard material, and at this point the period of biodegradation shall be continued so it can be confirmed that the biodegradation proceeds obviously. However, this method shall apply to film-type products such as bags and disposable food/apparatus/vessel packaging.

Note) Test substance for biodegradability shall be taken from formed product [in case of raw material, pellet or one made in the typical shape of expected final product]. After taking these frozen and smashed, it makes a rule to use powder type passing through a test sieve with the size measurement of 250 μm (60 mesh) in accordance with KS A 5101

(test sieve).

3.1.2

With respect to the use of chemical substance, the product shall satisfy the following requirements.

3.1.2.1

Lead or cadmium compounds shall not be used as an additive to resin, and harmful elements contained in resin shall satisfy the following requirements.

Harmful Elements	arsenic	lead	cadmium	mercury	chromium	copper	nickel	zinc
Contents [mg/kg]	≥ 25	≥ 50	≥ 0.5	≥ 0.5	≥ 150	≥ 200	≥ 25	≥ 500

3.1.2.2

Vessel-apparatus-packaging product touching food or food raw material, or the product used by touching directly human body shall not use the following compound as the raw material of resin.

a) Chemicals belonging to the following class according to the UN Globally Harmonized System of Classification and Labeling of Chemicals

Note) EU Regulation (EC) No. 1272/2008 Annex VI Part 3, (Harmonized Classification and Labeling Tables) will be tentatively applied to the material list.

- H330 : fatal if inhaled (gas, vapour, dust/mist)
- H310 : fatal in contact with skin
- H351 : suspected of causing cancer
- H334 : may cause allergy or asthma symptoms or breathing difficulties if inhaled
- H350 : may cause cancer
- H340 : may cause genetic defects
- H350i : may cause cancer by inhalation
- H360F : may damage fertility
- H360D : may damage the unborn child
- H361f : suspected of damaging fertility
- H361d : suspected of damaging the unborn child
- H362 : may cause harm to breast-fed children

- b) Substance corresponding to the 'Group 1', 'Group 2A' and 'Group 2B' of carcinogenic classification mark of IARC (International Agency for Research on Cancer). However, carbon black and titanium dioxide (TiO₂) shall be excluded.
- c) Substance that may require all products to bear a designated hazard symbol in accordance with the Annex V of the EU Regulation (EC) No. 1272/2008.
- d) Substance that may require all products to bear a H317 label in accordance with Annex V of the EU Regulation (EC) No. 1272/2008.

3.2 Quality Criteria

3.2.1

The quality of the molding material of biodegradable resin products shall exceed the criteria specified by the manufacturer. Requirements of the purchaser shall also be considered if needed.

3.2.2

The quality of disposable tablecloths shall meet the following criteria.

3.2.2.1

The thickness, tensile strength and tearing strength shall meet the following criteria.

Test Item	Criteria
Average thickness	90% of the presented value or higher
Tensile strength [N/mm ²]	10 or higher
Tearing strength [N/mm]	20 or higher

3.2.2.2

The elution volume of the product shall meet the following criteria.

Test Item	Criteria [mg/L]	
Not containing starch	Lead	1 or lower
	Consumption of potassium permanganate	10 or lower
	Evaporation residue	30 or lower
Starch containing	Arsenic	0.1 or lower
	Lead	1 or lower

	Formaldehyde	4 or lower
	Fluorescent whitening agent	Not detected

3.2.3

The quality of biodegradable bags (excluding volume rate garbage disposal bags) shall meet the following criteria.

3.2.3.1

The tensile strength and tearing strength of the product shall meet the following criteria. Assessment shall be performed for each direction of width and height of the unfolded or unglued part.

Test items		Criteria
Tensile strength [N/mm ²]	Vertical	22 or higher
	Horizontal	18 or higher
Elongation rate [%]	Vertical	100 or higher
	Horizontal	100 or higher

3.2.3.2

The average thickness of the product shall be 90% of the value specified by the manufacturer or higher.

3.2.3.3

The capacity and durability of the product shall satisfy the following criteria.

Test items	Criteria
Capacity	Within $\pm 3\%$ of the presented value
Durability for static load	No failure such as product damage
Durability for dynamic load	

3.2.4

The product shall meet the quality and performance criteria specified in the Korean Industrial Standards that are applicable to the corresponding product. However, the products corresponding to '3.2.1 ~ 3.2.3' shall be excluded.

3.2.5

If there is no Korean Industrial Standard that is applicable to this target product, then the quality and performance requirements shall be satisfied based on various standards, in the order listed below. However, the products corresponding to 3.2.1 ~ 3.2.4 shall be excluded. Furthermore, if objective changes in physical properties caused by storage effects are specified for the corresponding product, these can be considered when applying the criteria.

3.2.5.1

Any national standards other than Korean Industrial Standards

3.2.5.2

National standards of other countries or international standards that are applicable to the quality requirements of the target product.

3.2.5.3

Domestic and overseas organization standards that are recognized in the E-mark certification criteria for the target product.

3.2.6

If no standards in 3.2.1 ~ 3.2.5 above are applicable, the applicant may apply the quality and performance criteria specified in private standards that are acknowledged as equivalent to the national standards in the corresponding industry for the specific product. However, the recommendation of the deliberation committee shall be followed if the certification deliberation committee determines that the application of the proposed standard is not appropriate.

3.2.7

Items corresponding to '3.1 Environmental Criteria' shall be excluded from 3.2.1 ~ 3.2.6.

3.3 Information for Consumers

3.3.1

Indication on the items that the product contributes to the reason for certification (well degradable in nature, reduction of ecosystem toxin or excellent biodegradable capability and reduction of ecosystem toxin) during its consumption stage

3.3.2

Attentions to disposal after use: Not release the product together with synthetic resin to

be recycled.

3.3.3

Methods to store and use the product: Each of the following items shall be included in the user's manual or other relevant documents.

3.3.3.1

A label stating that "the product is made of biodegradable resin, and the material will biodegrade if the instructions in '㉓' below are followed."

3.3.3.2

The shortest period for which the intended performance of the product can be maintained if used properly.

3.3.3.3

The correct method and place for the use of the product (including the installation method if the product is materials for landscaping or greening). If its physical properties are changed while the product is in the distribution channel, the corresponding rationale and conditions should be specified.

4. Test Methods

Certification Criteria		Test and Verification Methods	
Environmental Criteria	3.1.1	3.1.1.1~ 3.1.1.2	Verification of submitted documents
		3.1.1.3	<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) or• KS M 3100-1 (measurement of aerobic biodegradation and disintegration of plastic in the composting condition - Part 1: quantitative method of carbon dioxide generated by titration) or certificate of equivalent

	3.1.2	3.1.2.1	Verification of submitted documents and test report by an accredited testing laboratory in accordance with KS M 0016 (general rules of analyzing atomic absorption), KS M 0032 (general rule for way of analyzing high-frequency inductively coupled plasma emission)
		3.1.2.2	Verification of submitted documents
Quality Criteria	3.2.1		Test report by the relevant accredited testing laboratory in accordance with the relevant standards, or certificate of equivalent standards or higher.
	3.2.2	3.2.2.1	Test report by the relevant accredited testing laboratory in accordance with the test method in '4.1 and 4.2.'
		3.2.2.2	Test report by the relevant accredited testing laboratory in accordance with the "Standards for Apparatuses, Containers and Packages" of the "Food Sanitation Act".
	3.2.3		Test report by the relevant accredited testing laboratory in accordance with the test method in '4.1 and 4.3.'
	3.2.4 ~ 3.2.5		Test report by the relevant accredited testing laboratory in accordance with the relevant standards, or certificate of equivalent standards or higher.
Consumer Information			Verification of submitted documents

Note) Formed products shall be regarded to satisfy the 3.1.1.3 and 3.1.2.1 of environmental criteria through the review by the deliberation committee of eco-label certification in case of trying to prove that the products are manufactured by using raw materials for formation certified with eco-label. However, this may not be met in case of requiring the test report of biodegradation in accordance with the methods specified by the deliberation committee of eco-label certification.

4.1 General Matters

4.1.1

One test sample shall be required for each applied product. However, if more than one test sample is needed, the former requirement may not be met.

4.1.2

Test samples shall be collected at random by a certification institute from products in

market or those in storage at the production site.

4.1.3

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

4.2 Method for Testing Thickness, Tensile Strength and Tearing Strength of Biodegradable Tablecloth

4.2.1

Take five pieces of test samples in total, one from the approximate center of the tablecloth and the rest from each corner at least 5 mm from the cut surface in the width direction.

4.2.2

Tensile strength and tearing strength shall be measured with a separate tablecloth, and test results shall be represented by the arithmetic mean. If required, the standard deviation of the mean values and 95% confidence interval shall be calculated in accordance with KS I ISO 2602.

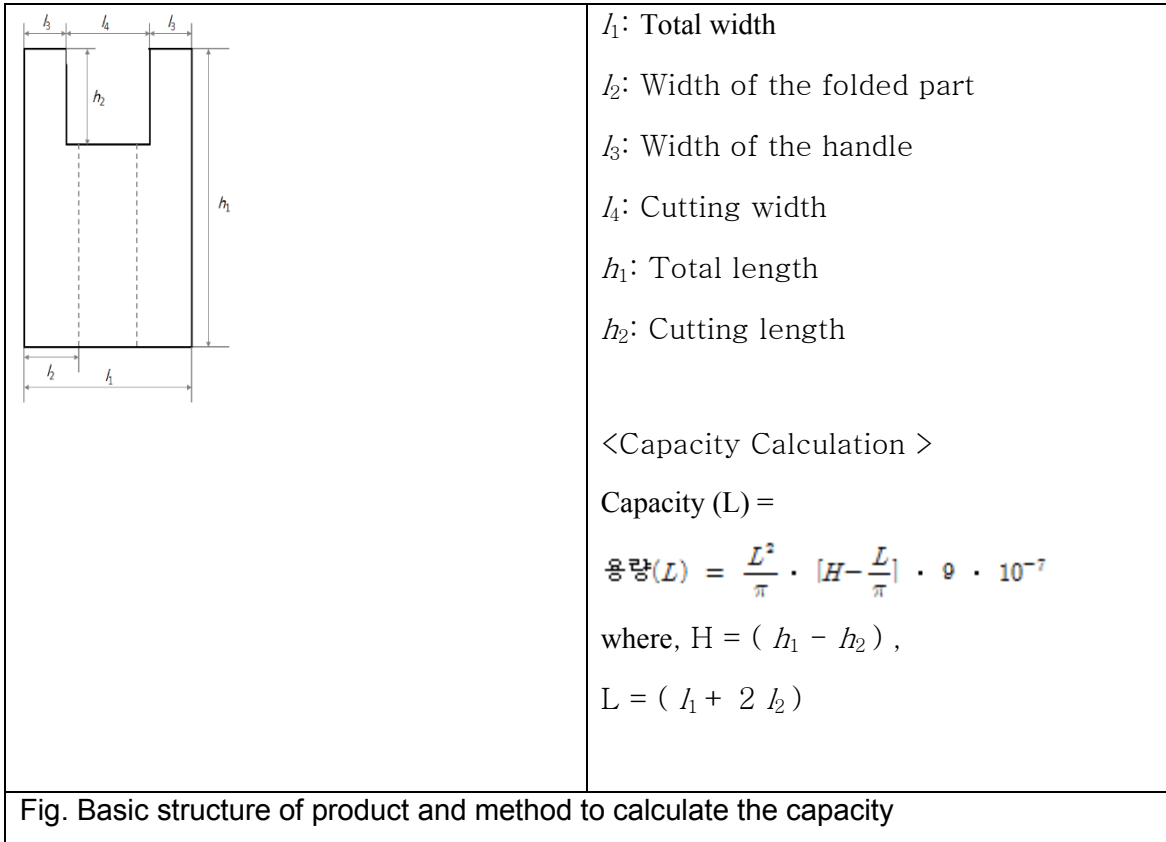
4.2.3

The dimensions shall be measured at the center of the sample and within 5 mm from each end of the gauge length, and cross-sectional area shall be represented as the mean of the measured value. However, the thickness shall be represented as the arithmetic mean of the values taken from all test samples on which the strength tests are performed.

4.3 Method for Test of Biodegradable Bag (excluding volume-rate garbage disposal bag)

4.3.1

The basic shape of the bag should be as shown in the following picture, and the bag carrying handles shall be mandatorily designed and be part of the bag as a configuration.



4.3.2

Capacity-based product classification shall use the following table, and the error tolerance shall be within $\pm 3\%$ of the value specified by the manufacturer.

Symbol	Name	Capacity, V(liter)
A	Large	$V \geq 23$
B	Medium	$17 \leq V \leq 22$
C	Small	$9 \leq V \leq 16$
D	Micro	$V < 9$

4.3.3

The products shall satisfy the requirements of durability against dynamic load and static load under the following test conditions. The test shall be performed with five bags, and the test is considered as having been failed if two or more of the bags are damaged during the test. If only one bag is damaged, an additional test shall be

performed, and the test is considered as having been passed if there is no additional damage.

4.3.3.1 Durability test method for static load

After filling the bag with dry sand in the amount specified for the durability test for static load in the following table, hold the bag still at the center of the handle using a round stick with a diameter of (40 ± 5) mm for six hours, and then visually inspect any damage done to the bag.

4.3.3.2 Durability test method for dynamic load

After filling the bag with dry sand in the amount specified for the durability test for dynamic load in the following table, hang the bag using a rope, and provide 300 mm clearance between the bottom of the bag and the floor so that the bag can move freely without interruption. The rope to hold the bag shall be made of cloth or leather and have a length of over 1 meter and width of (100 ± 5) mm, and the entire width of the rope should support the center part of the handle naturally. While the sample stands still with no motion, pull the rope to lift up the bag by 200 mm from its original position and let it fall free, and then perform a visual inspection.

Symbol	Standard Test Load [kg]	
	Static load durability	Dynamic load durability
A	15	7.5
B	10	5.0
C	6	3.0
D	Weight corresponding to 40% of the contents	Weight that corresponds to 20% of the contents

Note) Numbers with a decimal point shall be rounded up to the next whole number (example: 5.3 L = 6 L) and the load shall be specified to the first digit below the decimal point.

4.3.4

Average thickness, tensile strength and elongation rate shall be tested in accordance with the method specified in 'KS M 3001(Testing Methods for Mechanical Characteristics of Polyethylene Film)', except for the following.

4.3.4.1

Take two test samples, one from each direction of width and height from the approximate center of one bag.

4.3.4.2

Take 10 test samples in total, including five samples from each direction of width and height. The test results shall be represented as an arithmetic mean. If required, the standard deviation of the mean values and a 95% confidence interval shall be calculated in accordance with KS I ISO 2602.

4.3.4.3

The dimensions shall be measured at the center of the sample and within 5 mm from each corner of gauge distance, and the mean value obtained for the cross-sectional area. However, the thickness shall be represented as the arithmetic mean of the values for ten test samples.

5. Reasons for Certification

“High biodegradability, less ecological toxicity”

<Annex> Simple Test Methods on Material Properties of Biodegradable Resin
(related to '4. Test Methods')

1. Overview

The specification describes the test methods and procedure to prove that the formed product consists of biodegradable materials which is the same as raw materials for biodegradable resin product formation. Here, as the method to prove this, the fact that the biodegradation of formed products satisfy the eco-label certification criteria is indirectly proven by demonstrating that not more than 4 type test analysis results are the same as those of raw materials for formation registered in advance. The four type test methods described here are not sufficient conditions needed to prove that the biodegradation of formed products is the same as raw materials for formation.

2. Test methods to confirm whether it is the same quality or not

2.1. Test using TGA (thermogravimetric analyzer)

Note) The method shall be applied to aliphatic polyester resin containing starch.

2.1.1

Test samples shall be collected from the product same as the product used for biodegradation test or the formed product manufactured by this product. Collect them from each part of more than 5 places by the certain size of 5 ~ 10mg, conduct packing of them evenly, and remove moisture inside the test sample by maintaining for 5 minutes after increasing the temperature to 105 °C under the nitrogen atmosphere.

2.1.2

Get heat weight curve by raising the temperature of dry test sample up to 600 °C at the speed of 10 °C/min in the nitrogen atmosphere.

Ex) In case of aliphatic polyester resin containing starch, the content ratio of starch shall be calculated in counting number place after taking by the first decimal place, by using the following equation.

$$\text{Content Amount of Amylum[Weight\%]} = \frac{\text{Degradation Amount of Amylum}}{\text{Total Amount} - \text{Remnant Amount}} \times 100$$

At this time, the degradation amount of starch shall be calculated from initial degradation point (W_i) of derivative curve get by differentiating the heat weight curve and the middle point (W_f) of baseline where AP degradation starts.

2.2 Content analysis of aliphatic polyester by extraction method

Note) The method shall be applied to aliphatic polyester resin.

2.2.1

Test samples shall be collected from the product same as the product used for biodegradability test or the formed product manufactured by this product. Cut the collected test samples by the size of less than 0.5 cm × 0.5 cm or the size equal to the former and dry them in heated wind type dryer (appropriate temperature) for 1 hour.

2.2.2

Collect the dry test samples respectively by 5 g, weigh them precisely, put them into the cellulose filter (thimble for abstraction), put 200 mL chloroform in a 250 mL broad-floor flask (W1) that is weighed in advance, and set up soxhlet extractor and condenser.

2.2.3

Maintain the temperature of water bath at 80 °C and extract from them for 24 hours.

2.2.4

After extracting for 24 hours, detach the flat bottom flask and evaporate chloroform of internal solution by using a revolving concentration evaporator.

2.2.5

Dry the evaporated flask content again in heated air dryer at the temperature of 105 °C for 1 hours.

2.2.6

After measuring the weight (W2) of each dried flask, calculate and record the weight of only internal content.

2.2.7

The content of aliphatic polyester (AP) shall be calculated by the following equation.

$$\text{AP Content [Weight\%]} = \frac{W2[\text{g}] - W1[\text{g}]}{\text{Weight of Original Test Sample}[\text{g}]} \times 100$$

2.3 Test using FTIR spectrometer (Fourier transform infrared spectrometer)

2.3.1

Test samples shall be collected from the product same as the product used for biodegradability test or the formed product manufactured by this product. Collect them from each part of more than 5 places by the size of 3 cm × 3 cm (width × length), dry three test samples collected at random among these in heated air dryer (appropriate temperature) for 1 hour and cool them off slowly in desiccator.

Note) In case that the additive interrupting FTIR spectrum such as pigment is contained in the product or the product is not in the shape of film, the test sample shall be manufactured by the following method.

1. Test sample which is not film shape and does not contain the additive interrupting FTIR spectrum: Compress the test sample at the temperature of more than second transition point on the metal board plating with chromium to make it the shape of film, or dissolve it with solvent and plaster it on the metal board, NaCl board or KCl board to fly the solvent off. After this, it shall be the test sample.
2. Test sample that contains the additive interrupting FTIR spectrum: Dissolve the test sample with solvent and remove the solid part by centrifuging it. Here, add appropriate solvent again to dissolve the additive, add precipitants to separate polymer as pure as possible, and make film in the method specified in 1 above to use it as test sample.

2.3.2

After stabilizing FTIR spectrometer in the nitrogen atmosphere, tune the baseline in the wave number 4 000~400 cm^{-1} .

2.3.3

After getting FTIR absorption spectrum on each dry test sample, compare it with standard absorption spectrum by resin type.

2.4 Test using NMR (nuclear magnetic resonance spectrometer)

2.4.1

Test samples shall be collected from the product same as the product used for biodegradability test or the formed product manufactured by this product. Collect them from each part of more than 5 places by the certain size of 5~10mg to make the total aggregate of collected test samples about 40 mg, conduct packing of them evenly, and

dry them in the heated air dryer (appropriate temperature) for 1 hour, and cool them off slowly in the desiccator.

2.4.2

After melting the dry test sample in the solvent of deuterated trichloromethane (CDCl_3), get NMR spectrum by using hydrogen NMR with the frequency of more than 250 MHz from this solution. In case that the test sample is not melted well in deuterated trichloromethane, proper solution among other deuterated solution may be used.

2.4.3

Analyze NMR spectrum, presume the chemical structural equation of the test sample, and distinguish whether the test sample consists of single element or is compound. In case that it is judged as compound, review whether characteristic signal of non-degradable resin shows, presume the ratio of non-degradable resin based on the comparable appropriate signal.

3. Procedure to confirm whether it has the same quality or not

3.1 Registration of biodegradable resin raw material for the manufacture of formed product

When manufacturers of formed products try to receive the eco-label certification, manufacturers who received eco-label of 'EL724. biodegradable resin product' shall submit the test result data related to quality by 2.1 and 2.4 of this annex to the president of eco-label certification institute in order to prove that the products fit into 3.1.1.3 and 3.1.2.1 of environmental criteria of 'EL724. biodegradable resin product', and register them as raw materials for manufacture of biodegradable formed products.

3.2 Use of raw material of formed product manufacturer

Manufacturer of formed product shall manufacture the formed product by using only raw materials for formation that is certified by environmental mark.

3.3 Confirmation whether it has the same quality or not

3.3.1

Submit more than 2 test result data of tests related to the quality by 2.1 or 2.4 of this annex regarding manufactured formed products to the president of eco-label certification institute.

3.3.2

Test items related to quality in the 3.3.1 above, shall be selected by the president of eco-label certification institute, and the test result on these items shall be accorded with the test result data of the relevant raw material registered in eco-label certification institute with the error range.