

EL724. Biodegradable Resin Products [EL724-2002/2/2003-114]



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 "moulded product") and to the raw material for formation to manufacture the product.

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. 'Natural high polymer' such as starch-cellulose-wood powder as well as 'synthetic resin' synthesized by using chemical method or microbe can be used for the "resin".

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

"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.

2.4

"Biodegradability" refers to ISO 14855 (Determination of the ultimate aerobic biodegradability and disintegration of plastic materials under controlled composting conditions - Method by analysis of evolved carbon dioxide), or to the average biodegradability value calculated in the method specified in the same standard by using the accumulated carbon dioxide released by final aerobic biodegradation when testing in accordance with the KS standard (KS M 3100-1)

equivalent to the former.

2.5

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

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.

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 consisting the product shall be more than 90% of the final biodegradability value on standard material. However, the following case shall be regarded to satisfy the criteria of biodegradability.

3.1.1.3.1

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.

3.1.1.3.2

The biodegradability value measured by culturing for 80 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 (excluding film-type product such as envelope, 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 μ m (60mesh) 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.

3.1.2.2.1

Substance that indicates the following R number obligatorily in accordance with the annex 1 of EU EC board committee instruction 67/548/EEC

- R 26 : very toxic when inhaled
- R 27 : very toxic upon contact with the skin
- R 40 : possible irreversible damage
- R 42 : possible sensitization by inhalation
- R 45 : may cause cancer
- R 46 : may cause genetic damage
- R 49 : may cause cancer when inhaled
- R 60 : may impair the reproductiveness
- R 61 : may be harmful to the reproductiveness
- R 62 : may possibly impair the reproductiveness
- R 63 : may possibly be harmful to the embryo
- R 64 : may be harmful to the infant via mothers milk

3.1.2.2.2

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 shall be excluded.

3.1.2.2.3

Substance that may have necessity to mark danger symbol designated in accordance with the annex II of EU EC board committee instruction 67/548/EEC all over the product.

3.1.2.2.4

Substance that may have necessity to mark R43 in accordance with the annex III of EU EC board committee instruction 67/548/EEC all over the product

3.2 Quality Criteria

3.2.1

If the Korean Industrial Standards for the concerned product is available, the quality criteria of the KS shall be satisfied.

3.2.2

If the Korean Industrial Standards for the concerned product is not available, the quality criteria of the KS or the relevant quality standards and certification standards set for products which are subject to preferential purchase according to 'Enforcement Decree of the Act on Contract to Which the State is a Party', serving the same or similar function, shall be satisfied.

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.

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"> • Test report by an accredited testing laboratory in accordance with ISO 14855 (Determination of the ultimate aerobic biodegradability and disintegration of plastic materials under controlled composting conditions - Method by analysis of evolved carbon dioxide) 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		Test report by an accredited testing laboratory in accordance with the applicable standards or certificate of equivalent
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 environmental mark certification in case of trying to prove that the products are manufactured by using raw materials for formation certified with environmental mark. 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 environmental mark 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

The result of test shall be numerically set according to the KS A 3251-1 (Statistical interpretation of data - Part 1: Statistical presentation of data).

5. Reasons for Certification

“Readily degradable in the environment, less ecological toxicity” or “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 environmental mark 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 (Wi) of derivative curve get by differentiating the heat weight curve and the middle point(Wf) 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 0.5cm×0.5cm 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 5g, weigh them precisely, put them into the cellulose filter (thimble for abstraction), put 200mL chloroform in a 250mL 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℃ 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℃ 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 3cm×3cm(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 in the shape of film that 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 chrome 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 4000~400cm⁻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 40mg, 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 (CDCl₃), get NMR spectrum by using hydrogen NMR with the frequency of more than 250MHz 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 environmental mark certification, manufacturers who received environmental mark certification of 'EL724. biodegradable resin product' shall submit the test result data related to quality by 2.1 and 2.4 of the criteria to the chairman of environmental mark committee 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 the criteria regarding manufactured formed products to the chairman of environmental mark committee.

3.3.2

Test items related to quality in the 3.3.1 above, shall be selected by the chairman of environmental mark committee, and the test result on these items shall be accorded with the test result data of the relevant raw material registered in environmental mark committee with the error range.

[Common Criteria]

1. With respect to the proper disposal of environmental pollutants such as air-water pollutants, waste material and harmful chemical substance generated in the manufacturing process, products for environmental mark shall observe the environmental laws and agreements relevant to the region where the facility is located. Also, checking whether the product fits with the criteria or not shall be replaced with confirming-verifying the supporting documents for the relevant items that have been made for 1 year before the date of application.
2. It makes a rule to mark the criteria of 'information for consumers' on the surface of the product with the way that cannot be easily erased, and in case that marking on the surface of the product is impossible or undesirable, mark on the appropriate part such as product packaging, product guidebook and use description that consumers can recognize.
3. A person who has applied the certification of environmental mark or received the use certification in order to establish fair trade order and to protect consumer, shall observe the laws on fairness of indication-advertisement with respect to the environmental capability of the product.
4. For all kinds of standards quoted from certification criteria each product, the latest one shall be applicable in application as long as there is no separate reference.
5. With respect to the verification methods in accordance with test methods specified in certification criteria by product item, it makes rules to do the followings:
 - 5.1 Test reports in accordance with specified test methods refer to the test reports by authorized national test institutions. However, in case of using test reports issued by test-verification institutions that is not certified publicly or by laboratories of applicant companies, confirmation-verification shall be given through prior discussion with environmental mark certification institutions and in the presence of experts with respect to conducting the test.
 - 5.2 "Submitted documents" refer to the test report submitted to prove that applicants for environmental mark certification act on the relevant criteria, details on raw material supply and demand/production, use description/ guidebook related to the product or the product.