[Appendix 2]

Methods to determine the quality · structure and recyclability of packing materials

I. Methods used for determination is as follows;

1. Visual determination applies to cases where evaluation for rating is possible based on the status of products without conducting a separate instrumental analysis or testing. The rating of quality·structure that can be determined visually can be conducted without conducting instrumental analysis.

2. Instrumental analysis is a method to analyze quality·structure for rating when evaluation for rating with visual determination is difficult. If the result of instrumental analysis differs from that of visual determination, determination shall be made based on the result of instrumental analysis.

II. Determination method

1. Determine each component (including body, label, stopper and other components) of packing material in accordance with standards for the quality · structure of each packing material.

2. Exclude quality·structure that are determined to be difficult to recycle by producers obligated to recycle from rating.

3. The result of determining grades can be proved by submitting pictures, videos or actual products if it is stated that rating can be conducted visually.

4. If the result of an instrumental analysis is equivalent to the analysis methods presented in these guidelines, or it is possible to identify quality·structure through a document that falls under the following subparagraphs, the result shall be considered as the same result of the instrumental analysis of these guidelines. However, if there is a difference in the results of two or more analysis methods, the result of the determination method prescribed in these guidelines shall

apply in preference.

A. A test report issued by a laboratory accredited under Article 23 of Framework Act on National Standards

B. Report·permission documents under relevant laws including manufacturing and sales licenses under Rules on the Safety of Drugs, etc.

C. Documents used for identifying materials・structures including test reports issued by packing material manufacturers, packing material order specifications and delivery confirmation document with the official seal of relevant companies

III. The definition of terms used in these guidelines is presented in the following table.

1. Common

No.	Term	Definition
1	Synthetic resin	• A generic term for resin-shaped high molecular compound made by the synthesis of chemical organic compounds and also known as plastic. It is classified into thermoplastic resin and thermosetting resin depending on melting points and reactions to heat.
2	Other components	• A generic term for components used for providing usability to containers and enhancing marketability such as the handle of large bottles and character stoppers.
3	Inseparable	• When customer's separating labels, stoppers and other components is difficult without using a tool.
4	Direct printing	• Graphic designs or labels directly printed on the surface of containers. – In the case of glass bottles, a screen printing method is used to print special ink on the curved surface and heat is applied to fuse pigments on the glass surface.
5	PVC-type materials	• Materials containing polyvinyl chloride such as poly vinyl chloride (PVC), chlorinated polyvinyl chloride (PVC-C), unplasticized polyvinyl chloride (PVC-U) and polyvinylidene chloride (PVDC).
6	Composite materials	• Cases where two or more materials · substances are compounded, or used through coating or lamination; in the case of paper materials, it is applicable only when synthetic resin is attached to both sides.

2. Paper packing materials

No.	Term	Definition
1	Lamination	• The same meaning as attachment to prevent from falling off.
2	Laminated aluminum foil	• A generic term for relatively thin (0.006~0.03mm) aluminum foil combined with paper, cellophane and plastic film to have UV protection capability and barrier, moisture resistance and thermal composite properties.

3. Glass bottles

No.	Term	Definition
1	Non-adhesive labels	• Labels that are affixed · maintained without using a separate adhesive when they are put on containers; stretch labels and shrink labels.
2	Screw cap with inseparable retaining ring	• A type that the cap is not detached from the retaining ring when opening.
3	Screw cap with separable retaining ring	• A type that the cap is detached from the retaining ring which remains on the body when opening.
4	Metal stopper overlaid with synthetic resin	• A metal stopper overlaid with synthetic resin.

4. Metal cans (steel cans, aluminum cans)

No.	Term	Definition
1	Composite materials	• Cans formed by combining aluminum with steel or cardboard or by laminating plastic films.

5. General expanded synthetic resin and polystyrene paper

No.	Term	Definition
1	Combination	• Cases that two different things are combined physically.

6. PET bottles

No.	Term	Definition
1	Composite materials	• Materials combined with synthetic resin material other than PET material or a material different from PET material (in the case of paper materials, it is applicable only when synthetic resin is attached to both sides) by means of affixing, etc., and the weight of materials other than PET material accounts for 2% or more of the PET bottle (except other components such as cap and label).
2	PET-G	• Amorphous resin copolymerized by adding CHDM (1.4-cyclohexanedimethanol) as a comonomer to make transparent thick sheets or containers that are difficult to produce with conventional PET resins.
3	Thermal-alkaline separation adhesive	• Adhesives separated in response to a certain temperature (80 ℃) and sodium hydroxide (2%) during recycling.
4	Drinking spring water	• As a type of water under Article 3 (3) of Drinking Water Management Act, water processed to make spring water potable by means of physical treatment, etc.
5	Spring water	• As a type of water under Article 3 (2) of Drinking Water Management Act, naturally clear water in bedrock aquifers, groundwater, or springs which can be safely maintained to be used for drinking purposes.
6	Beverage	• Food code 9. Beverages in Standards and Specifications of Foods No. 2019-31 (Ministry of Food and Drug Safety, April 26, 2019) - Classified into tea, coffee, fruit and vegetable drinks, carbonated drinks, soy milk, fermented beverages, ginseng and red ginseng beverages, and other beverages.
7	PET area	• Entire bottle surface area except the cap (including bottle entrance and support ring)
8	Adhesive application area	• Indicates the surface area of adhesive applied to label or PET bottle when producing·packaging a product.

7. Single material containers · trays (except PET bottles and expanded synthetic resin)

No.	Term	Definition
1	Single material	• The body is composed of one resin among synthetic resins.
2	Container	• A generic term for containers that can hold items and packaged goods.
3	Tray	• Lidless dish-type container made of relatively rigid materials such as paper, pulp, plastic and aluminum foil

8. Composite material containers · trays and single · composite material film · sheets (except PET bottles and expanded synthetic resins)

No.	Term	Definition
1	Composite material synthetic resin	• Composite materials in which two or more composite materials or synthetic resin and other components are compounded; in the case of paper materials, it is applicable only when synthetic resin is attached to both sides.
2	Film	• A shape of plastic membrane shape with a thickness of less than 0.25mm.
3	Sheets	• A shape of thin sheet of plastic with a thickness of 0.25mm or more.
4	Combination	• A material made by combining two or more materials.

Chapter 1 Methods to determine the quality · structure and recyclability of paper packing materials

1. Body

1.1 Rating of the quality · structure and recyclability of body packing materials

1.1.1 Excellent for recycling

Paper packing materials in which an aluminum-laminated structure is not used.

1.1.2 Difficult for recycling

Packing materials with the body in which aluminum lamination or unbleached pulp is used; products using pulp packaging in color other than white.

1.1.3 Normal for recycling

Packing materials that do not fall under any criteria for the category of excellent or difficult for recycling.

1.2 Methods for determining body recyclability

1.2.1 Visual determination

1.2.1.1 Determination of aluminum-laminated structure: Examine visually the exterior and cross section of products to verify the existence of aluminum lamination. If it is impossible to determine visually or difficult to determine clearly, conduct an instrumental analysis or an equivalent test analysis or confirm with supporting documents.

1.2.2 Instrumental analysis

1.2.1.1 Determination of aluminum-laminated structure

① Conduct a qualitative analysis by means of instrumental analysis to determine whether there is a peak on diffraction

angle or wavelength scale for Al.

② Instrumental analyses prescribed in these guidelines shall be in compliance with "KS D 1654: 2003 General rules for fluorescence X-ray analysis of iron and steel" or "KS D 1655: 2008 Fluorescence X-ray analysis of iron and steel".

1.2.1.2 Determining unbleached pulp

① If the measurement of ISO whiteness of pulp is less than 80% according to an instrumental analysis, it is determined as unbleached pulp.

② The instrumental analysis prescribed in these guidelines shall be in compliance with "KS M ISO 2470-1: 2009 Paper, cardboard and pulp - Whiteness measurement using blue diffuse reflection ratio - Part 1: Indoor daylight conditions (ISO whiteness)" or "KS M ISO 2470-2: 2009 Paper, cardboard and pulp - Whiteness measurement method - Part 2: Outdoor light source conditions (D65 Whiteness)".

2. Stopper and other components

2.1 Rating of the quality · structure and recyclability of packing materials of stopper and other components

2.1.1 Excellent for recycling

Cases where no stopper or other components are used.

2.1.2 Difficult for recycling

Cases where it is difficult to separate stoppers and other components without using a tool, and the weight of formed structures of PE stopper and other components exceeds 10% of the total weight.

2.1.3 Normal for recycling

Cases where the weight of the PE stopper and other components among stoppers and other components is less than 10% of the total weight (including the body and separable stopper) or packing materials that are not classified into excellent for recycling or difficult for recycling.

2.2 Methods to determine the recyclability of stoppers and other components

2.2.1 Visual determination

2.2.1.1 Determine visually if they can be separated from the body without using a tool.

2.2.1.2 Visual determination of the weight and material of formed structures is not possible. Therefore, it shall be carried out by instrumental analysis or equivalent testing and support documents.

2.2.2 Instrumental analysis

2.2.2.1 Weight of formed structures: Dry a formed structure for 3 hours or more in a dryer at 60±1 ℃ and measure precisely its weight down to 0.01g to obtain the total weight ratio.

2.2.2.2 Determining synthetic resin material

① Conduct a qualitative analysis by means of instrumental analysis to determine PE material.

② Instrumental analyses prescribed in these guidelines shall be in compliance with "KS M 0024: 2017 General rules for infrared spectroscopy", KS M ISO 11357-1: 2009 Plastic - Differential Scanning Calorimeter (DSC) - Part 1: General Principles " or "KS M ISO 11358-1: 2014 Plastic - Polymer

Thermogravimetric Analysis (TGA)– Part 2: Determination of activation energy”.

Chapter 2 Method to determine the quality · structure and recyclability of glass bottle packing materials

1. Body

1.1 Rating of the quality · structure and recyclability of body packing materials

1.1.1 Excellent for recycling

Cases of colorless, brown and green materials.

1.1.2 Difficult for recycling

Cases of colors other than colorless, brown and green, or surface coated or painted bodies except hot coating, cold coating and plastic coating.

1.1.3 Normal for recycling

Packing materials that do not fall under any criteria for the category of excellent or difficult for recycling.

1.2 Methods for determining body recyclability

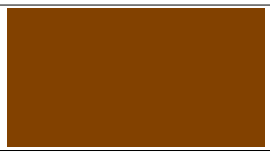
1.2.1 Visual determination

1.2.1.1 Determining colorless, brown and green colors

① Selection of assessors: select persons who are 19 years of age or older, who are not color blind or color weakness to the colors subject to determination and who have the ability to perceive standard colors.

② Standard colors: Standard colors for color determination for "colorless" are L*= 88, a*= 0 and b*= 3, "green" are L*= 71, a*= −26 and b*= 29 and "brown" are L*= 35, a*= 23, b*= 59.

<Sample of standard colors>

Colorless	Green	Brown
		

③ How to determine: Assessors who are provided with the sample of the standard colors put a target sample in front of white paper and determine the color of them.

④ Result: Colors are determined when an assessor perceives the colors of the standard color sample and target sample as the same color.

⑤ If it is impossible to determine visually or difficult to determine clearly, conduct an instrumental analysis or an equivalent test analysis or confirm with supporting documents.

1.2.1.2 Determine visually the existence of surface coating and painting.

1.2.2 Instrumental analysis

1.2.2.1 Determination of colorless, green and brown

① According to instrumental analyses, if measurements are L*=88 ± 4, a*=0 ± 1 and b*=3 ± 3, it is “colorless”; if measurements are L*=71 ± 6, a*=−26 ± 6 and b*=29 ± 10, it is “green”; if measurements are L*=35 ± 8, a*=23 ± 3 and b*=59 ± 12, it is “brown”.

② If necessary, an instrumental analysis can be conducted by fabricating a flat −shaped sample of 10 ± 0.1mm.

③ The instrumental analysis prescribed in these guidelines shall be in compliance with “KS A 0066: 2015 Measuring method of object’s color”.

④ Colors shall be described as L* a* b* in accordance with “KS

A 0067: 2015 Description method of object' s color according to L* a* b* color metric system and L* u* v* color metric system".

1.2.2.2 Surface and painting determination: "KS M 0024: 2017 General rules for infrared spectroscopic analysis".

2. Label

2.1 Rating of the quality · structure and recyclability of label packing materials

2.1.1 Excellent for recycling

Non-adhesive synthetic resin materials with no label or containing paper material or cut lines allowing customers to separate easily.

2.1.2 Difficult for recycling

Synthetic resins in which an adhesive is used, mixed metal materials and cases that information except expiration date and production date is directly printed on the body.

2.1.3. Normal for recycling

Packing materials that do not fall under any criteria for the category of excellent or difficult for recycling.

2.2 Methods for determining label recyclability

2.2.1 Visual determination

Determine visually material (paper, synthetic resin and mixed metal), the use of adhesive and cut lines, and direct printing. If it is impossible to determine visually or difficult to

determine clearly, conduct an instrumental analysis or an equivalent test analysis or confirm with supporting documents.

2.2.2 Instrumental analysis

2.2.2.1 Material determination

① Paper: Shall be in compliance with “KS M ISO 5263-1: 2014 Pulp - Laboratory wet dissociation - Part 1 Chemical pulp dissociation” or “KS M ISO 5263-2: 2014 Pulp - Laboratory wet dissociation - Part 2 Mechanical pulp dissociation at 20℃”.

② Synthetic resin: Conduct a qualitative analysis based on the instrument analysis method of ‘2.2.2.2 ②’ of ‘Chapter 1 Methods to determine the quality · structure and recyclability of paper packing materials’.

③ Mixed metal: ‘1.2.2 ②’ of ‘Chapter 1 Methods to determine the quality · structure and recyclability of paper packing materials’ 의 ‘1.2.2 ②’ applies.

2.2.2.2 Adhesive use determination: Shall be in compliance with “KS M 0024: 2017 General rules for infrared spectroscopic analysis.

3. Stopper and other components

3.1 Rating of the quality · structure and recyclability of packing materials of stopper and other components

3.1.1 Excellent for recycling

Cases where the retaining ring is not separated from the stopper or can be separated from the body when customer

open the stopper.

3.1.2 Difficult for recycling

Cases where the retaining ring is separated from the stopper when customer opens the stopper; where there is a metal stopper overlaid with synthetic resin, cork and metallic materials other than stopper; where other types of stoppers that are inseparable from the body.

3.1.3 Normal for recycling

Packing materials that do not fall under any criteria for the category of excellent or difficult for recycling.

3.2 Methods for determining stopper and other components recyclability

3.2.1 Visual determination

3.2.1.1 Determination of separable or inseparable stopper · retaining ring: "Inseparable stopper · retaining ring" indicates that the retaining ring is not separable from the stopper. "Separable stopper · retaining ring" indicates that the retaining ring is separable from the stopper.

3.2.1.2 Determination of separability from the body: If stopper can be separated manually without using a tool, it is considered as separable.

3.2.1.3 Determine visually metal stoppers overlaid with synthetic resin and cork materials.

3.2.1.4 Determination of metal materials: Examine visually to determine metal materials.

If it is impossible to determine visually or difficult to

determine clearly, conduct an instrumental analysis or an equivalent test analysis or confirm with supporting documents.

3.2.2 Instrumental analysis

3.2.2.1 Determination of metal material

① Conduct a qualitative analysis by means of instrumental analysis to determine whether there is a peak on diffraction angle or wavelength scale for metal material.

② The instrumental analysis shall be conducted in accordance with ‘1.2.2 ②’ of ‘Chapter 1 Methods to determine the quality · structure and recyclability of paper packing materials.

Chapter 3 Methods to determine the quality · structure and recyclability of metal can packing materials (steel can)

1. Body

1.1 Rating of the quality · structure and recyclability of body packing materials

1.1.1 Excellent for recycling

Refers to steel cans.

1.1.2 Normal for recycling

Packing materials that do not fall under any criteria for the category of excellent for recycling.

1.2 Methods for determining body recyclability

1.2.1 Visual determination

1.2.1.1 Determination of metal (steel) material: Examine visually whether magnetics stick to the body.

If it is impossible to determine visually or difficult to determine clearly, conduct an instrumental analysis or an equivalent test analysis or confirm with supporting documents.

1.2.2 Instrumental analysis

1.2.2.1 Determination of metal (steel) material

① Conduct a qualitative analysis by means of instrumental analysis to determine whether there is a peak on diffraction angle or wavelength scale for Fe.

② The instrumental analysis shall be conducted in accordance with ‘1.2.2 ②’ of ‘Chapter 1 Methods to determine the quality · structure and recyclability of paper packing materials.

2. Label

2.1 Rating for determining the quality · structure and recyclability of label

2.1.1 Excellent for recycling

Cases where label information is directly printed on the body.

2.1.2 Normal for recycling

Packing materials that do not fall under any criteria for the category of excellent for recycling.

2.2 Methods for determining label recyclability

2.2.1 Visual determination

2.2.1.1 Examine visually whether label information is directly printed on the body.

3. Stoppers and other components

3.1 Rating of the quality · structure and recyclability of packing materials of stopper and other components

3.1.1 Excellent for recycling

Cases where the material of them is steel or aluminum, which is the same as that of the body.

3.1.2 Normal for recycling

Packing materials that do not fall under any criteria for the category of excellent for recycling.

3.2 Methods to determine the recyclability of stoppers and other components

3.2.1 Visual determination

3.2.1.1 Determination of metal (steel) materials : shall be conducted in accordance with '1.2.1.1' of 'Chapter 3 Determination the quality · structure and recyclability of packing materials (steel can)'

1.2.2.2 Determination of composite materials except aluminum: A qualitative analysis shall be conducted in accordance with '2.2.2.2 ②' of 'Chapter 1 Methods to determine the quality · structure and recyclability of paper packing materials'.

3.2.2 Instrumental analysis

3.2.2.1 Determination of metal material (steel and aluminum)

① Conduct a qualitative analysis by means of instrumental analysis to determine whether there is a peak on diffraction angle or wavelength scale for Fe, Al.

② The instrumental analysis shall be conducted in accordance with '1.2.2 ②' of 'Chapter 1 Methods to determine the quality · structure and recyclability of paper packing materials.

Chapter 4 Rating for determining the quality · structure and recyclability of metal can packing material (aluminum can)

1. Body

1.1 Rating of the quality · structure and recyclability of body packing materials

1.1.1 Excellent for recycling

Metal aluminum cans.

1.1.2 Difficult for recycling

Composite materials including synthetic resin, etc. except aluminum.

1.1.3 Normal for recycling

Packing materials that do not fall under any criteria for the category of excellent or difficult for recycling.

1.2 Method to determine body recyclability

1.2.1 Visual determination

1.2.1.1 Determine visually the existence of composite material structure except aluminum. If it is impossible to determine visually or difficult to determine clearly, conduct an instrumental analysis or an equivalent test analysis or confirm with supporting documents.

1.2.1.2 Since it is impossible to identify aluminum material visually, an instrumental analysis or an equivalent analysis is required or it shall be confirmed with supporting documents.

1.2.2 Instrumental analysis

1.2.2.1 Determination of metal material (aluminum)

① Conduct a qualitative analysis by means of instrumental analysis to determine whether there is a peak on diffraction angle or wavelength scale for Al.

② The instrumental analysis shall be conducted in accordance with '1.2.2 ②' of 'Chapter 1 Methods to determine the quality · structure and recyclability of paper packing materials.

1.2.2.2 Determination of composite materials except aluminum: A qualitative analysis shall be conducted in accordance with '2.2.2.2 ②' of 'Chapter 1 Methods to determine the quality · structure and recyclability of paper packing materials'.

2. Label

2.1 Rating for determining the quality · structure and recyclability of label

2.1.1 Excellent for recycling

Cases where label information is directly printed on the body.

2.1.2 Difficult for recycling

Cases where materials other than aluminum are inseparable from the body.

2.1.3 Normal for recycling

Packing materials that do not fall under any criteria for the category of excellent or difficult for recycling.

2.2 Method to determine the recyclability of labels.

2.2.1 Visual determination

2.2.1.1 Examine visually whether label information is directly printed on the body.

2.2.1.2 Determination of the separability from the body: '3.2.1.2' of Chapter 2 Method to determine the quality · structure and recyclability of glass bottle packing materials shall apply.

2.2.1.3 Since it is impossible to identify aluminum material visually (whether it is different from the body), an instrumental analysis or an equivalent analysis is required or it shall be confirmed with supporting documents.

2.2.2 Instrumental analysis

2.2.2.1 Determination of metal (aluminum) materials: '1.2.2.1' of Chapter 4 Rating for determining the quality · structure and recyclability of metal can packing material (aluminum can) shall apply.

3. Stoppers and other components

3.1 Rating of the quality · structure and recyclability of packing materials of stopper and other components

3.1.1 Excellent for recycling

Cases where the material of them is aluminum, which is the same as that of the body.

3.1.2 Difficult for recycling

Cases where they are made of a material other than aluminum

and are not separable from the body.

3.1.3 Normal for recycling

Packing materials that do not fall under any criteria for the category of excellent or difficult for recycling.

3.2 Methods to determine the recyclability of stoppers and other components

3.2.1 Visual determination

3.2.1.2 Determination of the separability from the body: '3.2.1.2' of Chapter 2 Method to determine the quality · structure and recyclability of glass bottle packing materials shall apply.

3.2.1.1 Since it is impossible to identify aluminum material visually, an instrumental analysis or an equivalent analysis is required or it shall be confirmed with supporting documents.

3.2.2 Instrumental analysis

2.2.2.1 Determination of metal (aluminum) materials: '1.2.2.1' of Chapter 4 Rating for determining the quality · structure and recyclability of metal can packing material (aluminum can) shall apply.

Chapter 5 Method to determine the quality · structure and recyclability of general expanded synthetic resin single·composite packing materials

1. Body

1.1 Rating of the quality · structure and recyclability of body packing materials

1.1.1 Excellent for recycling

Single white, EPS, EPP or EPP material.

1.1.2 Difficult for recycling

Materials in color other than white (except black EPE and EPP materials) or composite structures including those combine with other materials.

1.1.3 Normal for recycling

Materials that are black EPE or EPP using recycled materials or that do not fall under any criteria for the category of excellent or difficult for recycling.

1.2 Method to determine body recyclability

1.2.1 Visual determination

1.2.1.1 Determination of white and black

① Selection of assessors: select persons who are 19 years of age or older, who are not color blind or color weakness to the colors subject to determination and who have the ability to perceive standard colors.

② Standard color: Standard colors: Standard colors for color

determination for N9.5 white and N0.5 black are L*= 95.06 and L*= 2.86, respectively according to the "Guide for Standard Color of Public Design" .

③ How to determine: Assessors who are provided with the sample of the standard colors put a target sample in front of white paper and determine the color of them.

④ Result: Colors are determined when an assessor perceives the colors of the standard color sample and target sample as the same color.

1.2.1.2 Since it is impossible to identify visually whether it is a single material or composite material, an instrumental analysis or an equivalent analysis is required or it shall be confirmed with supporting documents. (However, it is possible to visually identify a composite material if the exterior appearance clearly shows the properties of combination with other material.)

1.2.2 Instrumental analysis

1.2.2.1 Determination of single and composite materials

① Conduct a qualitative analysis by means of instrumental analysis to determine whether they are synthetic resin materials (PS, PP, PE) or composite materials (including those combined with other materials).

② '2.2.2.2 ②' of 'Chapter 1 Methods to determine the quality · structure and recyclability of paper packing materials' shall apply to the instrumental analysis in these guidelines.

2. Label, stopper and other components

2.1 Rating of the quality · structure and recyclability of packing materials of label, stopper and other components

2.1.1 Excellent for recycling

Cases where a part of label information (those that need to be contained in the label) is printed on the body or they are made of the same material as that of the body.

2.1.2 Difficult for recycling

Cases where information (other than those that need to be contained in the label) is directly printed on the body, they are made of a PVC-based material or a material different from that of the body but are inseparable.

2.1.3 Normal for recycling

Packing materials that do not fall under any criteria for the category of excellent or difficult for recycling.

2.2 Methods to determine the recyclability of label, stoppers and other components

2.2.1 Visual determination

2.2.1.1 Examine visually whether label information is directly printed on the body.

2.2.1.2 Determination of the separability from the body: '3.2.1.2' of Chapter 2 Method to determine the quality · structure and recyclability of glass bottle packing materials shall apply.

2.2.1.3 Since it is impossible to identify visually whether it is the same material as the body or a PVC-based material, an instrumental analysis or an equivalent analysis is required or it shall be confirmed with supporting documents. (However, it is possible to visually identify a composite material if the exterior appearance clearly shows the properties of other material including the combination with other material, which is different from the body.)

2.2.2 Instrumental analysis method

2.2.2.1 Composite resin material determination

① Conduct a qualitative analysis by means of instrumental analysis to determine whether they are the same material as that of the body or a PVC-based material.

② '2.2.2.2 ②' of 'Chapter 1 Methods to determine the quality · structure and recyclability of paper packing materials' shall apply to the instrumental analysis in these guidelines.

Chapter 6 Methods to determine the quality · structure and recyclability of polystyrene paper (PSP) packing materials

1. Body

1.1 Rating of the quality · structure and recyclability of body packing materials

1.1.1 Excellent for recycling

White and single materials

1.1.2 Difficult for recycling

Materials in color other than white or composite material structure.

1.1.3. Normal for recycling

Packing materials that do not fall under any criteria for the category of excellent or difficult for recycling.

1.2 Methods to determine body recyclability

1.2.1 Visual determination

1.2.1.1 Visual determination of white

① Selection of assessors: select persons who are 19 years of age or older, who are not color blind or color weakness to the colors subject to determination and who have the ability to perceive standard colors.

② Standard color: Standard color for color determination for N9.5 white is L*= 95.06 according to the “Guide for Standard Color of Public Design” .

③ How to determine: Assessors who are provided with the sample of the standard colors put a target sample in front of white paper and determine the color of them.

④ Result: Colors are determined when an assessor perceives the colors of the standard color sample and target sample as the same color.

1.2.1.2 Since it is impossible to identify visually whether it is a single material or composite material, an instrumental analysis or an equivalent analysis is required or it shall be confirmed with supporting documents. (However, it is possible to visually identify a composite material if the exterior appearance clearly shows the properties of combination with other material.)

1.2.2 Instrumental analysis

1.2.2.1 Single material and composite material determination

① Conduct a qualitative analysis by means of instrumental analysis to determine whether they are synthetic resin materials (PS) or composite materials.

② '2.2.2.2 ②' of 'Chapter 1 Methods to determine the quality · structure and recyclability of paper packing materials' shall apply to the instrumental analysis in these guidelines.

2. Label, stopper and other components

2.1 Rating of the quality · structure and recyclability of packing materials of stopper and other components

2.1.1. Best for recycling

Cases where they are not used or the same material as that of the body, and separable from the body.

2.1.2. Excellent for recycling

Cases where a part of label information is printed on the body or they are made of a material different from that of the body and are inseparable from the body.

2.1.3. Difficult for recycling

Cases where information (other than those that need to be contained in the label) is directly printed on the body, they are made of a PVC-based material or a material different from that of the body but are inseparable.

2.1.4. Normal for recycling

Packing materials that do not fall under any criteria for the category of excellent or difficult for recycling.

2.2 Methods to determine the recyclability of label, stoppers and other components

2.2.1 Visual determination

2.2.1.1 It is possible to identify visually non-use but impossible to identify visually whether it is the same materials with the body or a PVC-based material, an instrumental analysis or an equivalent analysis is required or it shall be confirmed with supporting documents. (However, it is possible to visually identify a composite material if the exterior appearance clearly shows the properties of

combination with other material, which is different from the body.)

2.2.1.2 Examine visually whether label information is directly printed on the body.

2.2.1.3 Determination of the separability from the body: '3.2.1.2' of Chapter 2 Method to determine the quality · structure and recyclability of glass bottle packing materials shall apply.

2.2.2 Instrumental analysis

2.2.2.1 Synthetic resin material determination

① Conduct a qualitative analysis by means of instrumental analysis to determine whether they are the same material (PS) as that of the body.

② '2.2.2.2 ②' of 'Chapter 1 Methods to determine the quality · structure and recyclability of paper packing materials' shall apply to the instrumental analysis in these guidelines.

Chapter 7 Methods to determine the quality · structure and recyclability of PET bottle packing materials

1. Body

1.1 Rating of the quality · structure and recyclability of body packing materials

1.1.1 Excellent for recycling

Single and colorless materials

1.1.2. Difficult for recycling

Materials combined with PET-G, or colored materials in the case of drinking spring water·beverage, or single material bottles in a color other than green and used for a purpose other than containing drinking spring water·beverage, or composite materials.

1.1.3. Normal for recycling

Packing materials that do not fall under any criteria for the category of excellent or difficult for recycling.

1.2 Method to determine body recyclability

1.2.1 Visual determination

1.2.1.1 Single material determination: Leave the entire part of the PET bottle in a distilled water at 80℃ for 10 minutes and remove water on the surface with gauze. If it is impossible to determine visually or difficult to determine clearly, conduct an instrumental analysis or an equivalent test analysis or confirm with supporting documents.

1.2.1.2 Since it is impossible to identify visually glycol-modified PET resin (PET-G), an instrumental analysis or an equivalent analysis is required or it shall be confirmed with supporting documents.

1.2.1.3 Determination of colorless and green

① Selection of assessors: select persons who are 19 years of age or older, who are not color blind or color weakness to the colors subject to determination and who have the ability to perceive standard colors.

② Standard colors: Standard colors: Standard colors for color determination for "colorless" are L*= 91, a*= 0 and b*= 1, "green" are L*= 76, a*= -46 and b*= 31 or L*= 88, a*= -30 and b*= 23.

<Standard color samples>

Colorless	Green (1)	Green (2)
		

③ How to determine: Assessors who are provided with the sample of the standard colors put a target sample in front of white paper and determine the color of them.

④ Result: Colors are determined when an assessor perceives the colors of the standard color sample and target sample as the same color.

⑤ If it is impossible to determine visually or difficult to determine clearly, conduct an instrumental analysis or an

equivalent test analysis or confirm with supporting documents.

1.2.2 Instrumental analysis

1.2.2.1 Determination of single and composite materials and the combination of PET-G material

① Conduct a qualitative analysis by means of instrumental analysis to determine whether they are single synthetic resin materials, composite materials or composite PET-G materials.

② '2.2.2.2 ②' of 'Chapter 1 Methods to determine the quality · structure and recyclability of paper packing materials' shall apply to the instrumental analysis in these guidelines.

1.2.2.2 Determination of colorless and green

① According to instrumental analyses, if measurements are L* ≥ 91, a* = 0 ± 1 and b* = 1 ± 1, it is colorless; if measurements are L* = 76 ± 9, a* = −46 ± 18 and b* = 31 ± 14 or L* = 88 ± 5, a* = −30 ± 14 and b* = 23 ± 13, it is green.

② If necessary, an instrumental analysis can be conducted by fabricating a flat -shaped sample of 10 ± 0.1mm.

③ The instrumental analysis prescribed in these guidelines shall be in compliance with "KS A 0066: 2015 Measuring method of object's color".

④ Colors shall be described as L* a* b* in accordance with "KS A 0067: 2015 Description method of object's color according to L* a* b* color metric system and L* u* v* color metric system".

2. Label

2.1 Rating for determining the quality · structure and recyclability of label

2.1.1 Best for recycling

Cases where they are non-adhesive synthetic resin materials with a specific gravity less than 1 or synthetic resin materials with a specific gravity less than 1; where thermal-alkaline separation adhesive is applied to an area less than 0.5% of the entire area of label; and they have a structure including cut line or no application of adhesive to edges, making it easy for customers to remove it.

2.1.2 Excellent for recycling

① Synthetic resin materials with a specific gravity less than 1 to which thermal-alkaline separation adhesive, which can be separated during the recycling process, is applied.

② A structure with a cut line or no application of adhesive to edges to make it easy for customers to remove it, and the area of adhesive application is less than 20% of the entire PET bottle surface (except the cap) and 60% of the label area.

2.1.3 Difficult for recycling

① Synthetic resin materials with a specific gravity of 1 or more without a structure to make it easy for customers to remove it.

② Cases where an adhesive that does not allow

thermal-alkaline separation is used, label information (except expiration date and production date) is directly printed on the body, or they are made of a PVC-based material, a material other than synthetic resin, or a mixed metal material.

2.1.4 Normal for recycling

Packing materials that do not fall under any criteria for the category of excellent or difficult for recycling.

2.2 Label recyclability determination

2.2.1 Visual determination

2.2.1.1 Determine visually cut lines, no application of adhesive to edges, the use of adhesive and the direct printing on the body. If it is impossible to determine visually or difficult to determine clearly, conduct an instrumental analysis or an equivalent test analysis or confirm with supporting documents.

2.2.1.2 Since it is impossible to identify visually synthetic resin materials, an instrumental analysis or an equivalent analysis is required or it shall be confirmed with supporting documents. (However, it is possible to identify visually a material other than synthetic resin.)

2.2.1.3 Since it is impossible to identify visually a material with a gravity less than 1, the use of thermal-alkaline separation adhesive, the applied area·volume of adhesive, an instrumental analysis or an equivalent analysis is required or it shall be confirmed with supporting documents.

2.2.2 Instrumental analysis

2.2.2.1 Determination of specific gravity less than 1

① Cut a label into more than 100 pieces in a size of 6 to 8mm uniformly. Put them in distilled water (1L), stir it for 2 to 3 minutes and leave it for 1 minute. Separate labels floating the surface after 1 minute of leaving, and repeat the process of stirring and separation with a glass rod more than 3 times until no precipitated sample floats.

② Count the number of floated label samples. If it is more than 97%, its specific gravity shall be determined to be less than 1.

③ In addition to the above test methods, specific gravity can be measured, if necessary, according to "KS M ISO 1183-1: 2014 Plastics - Density measurement of unexpanded plastics - Part 1: Immersion, liquid pycnometer and titration methods", "KS M ISO1183 - 2: 2014 Plastics - Density measurement of unexpanded plastics - Part 2: Density column method" or "KS M ISO 1183-3: 1999 Plastics-Density Measurement of unexpanded plastics - Part 3: Gas pycnometer method".

2.2.2.2 Determination of thermal-alkaline separation adhesive

① Analysis method

A. Prepare samples by cutting and crushing the (affixed, stuck, shrunken or stamped) label area of PET bottle into a size of 6 to 8mm. Samples with sizes beyond the range shall be excluded from the analysis.

B. Dry the crushed samples in a dryer at 60±1 ℃ for 3 hours or more.

C. Measure the weight of an appropriate amount of the dried samples (about 50g) to the range of 0.01g. Prepare 10g

of samples only when the weight of adhesive label area per bottle is less than 1g.

D. Put samples in 2% NaOH solution (1L) and stir the mixture at a speed of 200 r/min for 10 minutes with an agitator set at 80±1℃.

E. Leave it for 1 minute and separate floated samples on the surface. Repeat stirring and separation with a glass rod 3 times or more until no precipitated samples float.

F. Separate precipitated samples with a sieve and clean (and rinse) the separated samples with 1L of distilled water for 3 times.

G. Dry "cleaned flakes without removing label " in a dryer set at 60±1 ℃ for 3 hours or more and measure the weight to the range of 0.01g.

H. Calculate the retention rate (%) of cleaned flakes without removing label and the specific gravity separation rate (%) of label using the weight measurement.

㉠ Retention rate (%) of cleaned flakes without removing label = (b / a) × 100

a : Weight (g) of crushed PET bottle (label + flakes) prior to testing

b : Weight (g) of cleaned flake without removing (stripping) label after testing

㉡ Specific gravity separation rate of label (%) = [1− (d / c)] × 100

c : Weight (g) of the total label (separately preserved label + precipitated label)

d : Weight (g) of precipitated label

I. Examine the residual adhesive of "cleaned flakes from which label is removed (stripped)" "visually" and with an "infrared spectroscopy (FT-IR)". (The instrumental analysis can be skipped if residual adhesive can be identified visually.)

② Analysis result: The ratio of cleaned flakes with residual label shall be less than 3%, no residual adhesive shall be observed visually and the result of instrumental analysis shall indicate that the PET material and the spectrum be identical.

2.2.2.3 Determination of synthetic resin materials (including PVC-based materials)

① Conduct a qualitative analysis by means of instrumental analysis to determine whether they are synthetic resin materials (including PVC-based materials)

② '2.2.2.2 ②' of 'Chapter 1 Methods to determine the quality · structure and recyclability of paper packing materials' shall apply to the instrumental analysis of these guidelines.

※ While '2.2.2.1 ①' of 'Method to determine the quality · structure and recyclability of glass bottle packing materials' shall apply to paper labels, '1.2.2 ②' of 'Chapter 1 Methods to determine the quality · structure and recyclability of paper packing materials' shall apply to mixed metal materials.

2.2.2.4 Adhesive area·quantity determination

① Analysis method

A. Measure the surface area of PET bottle (except the cap;

the same applies to the following) and the application area of adhesive, and calculate the converted value of the ratio.

B. Scan a target area with a 3D scanner and calculate the 3D area to obtain the size. If necessary, verify the surface, label and adhesive application areas of PET bottles using product' s mold or other materials that can provide the information of product' s surface area.

② Analysis result

A. If the adhesive application area of a label in which thermal-alkaline separation adhesive is used is less than 0.5% of the label area, it falls under the category of best for recycling.

B. If the adhesive application area of a label in which thermal-alkaline separation adhesive is used is less than 20% of the surface area of PET bottle and 60% of the label area, it falls under the category of excellence for recycling.

2.2.2.5 Mixed metal material determination: a qualitative analysis shall be conducted in accordance with '1.2.2 ②' of 'Chapter 1 Methods to determine the quality · structure and recyclability of paper packing materials' .

3. Stoppers and other components

3.1 Rating of the quality · structure and recyclability of packing materials of stopper and other components

3.1.1 Excellent for recycling

Colorless single PET material or synthetic resin with a specific gravity less than 1.

3.1.2 Difficult for recycling

Synthetic resin material with a specific gravity of 1 or more(except colorless single PET material), or PVC-based material or materials other than synthetic resin(except other components that can be completely separated from the body and caps).

3.1.3 Normal for recycling

Packing materials that do not fall under any criteria for the category of excellent or difficult for recycling.

3.2 Methods to determine the recyclability of stoppers and other components

3.2.1 Visual determination

3.2.1.1 Colorless material determination: '1.2.1.3' of 'Chapter 7 Methods to determine the quality · structure and recyclability of PET bottle packing materials' shall apply.

3.2.1.2 Since it is impossible to identify visually synthetic resin materials, an instrumental analysis or an equivalent analysis is required or it shall be confirmed with supporting documents. (However, it is possible to identify visually a material other than synthetic resin.)

3.2.1.3 Since it is impossible to identify visually a material with a gravity less than 1, an instrumental analysis or an equivalent analysis is required or it shall be confirmed with supporting documents.

3.2.1.4 Determination of complete separability from the body

① If it is impossible to determine visually or difficult to determine clearly, conduct an instrumental analysis or an equivalent test analysis or confirm with supporting documents.

② The visual determination is to examine the residual material of the stopper and other components other than synthetic resin material when the stopper and other components are removed by hands.

3.2.2 Instrumental analysis

3.2.2.1 Colorless material determination : '1.2.2.2' of 'Chapter 7 Methods to determine the quality · structure and recyclability of PET bottle packing materials' shall apply.

3.2.2.2 Synthetic resin material: Perform a qualitative analysis by applying the instrumental analysis method prescribed in 2.2.2.2 ②' of 'Chapter 1 Methods to determine the quality · structure and recyclability of paper packing materials' .

3.2.2.3 Determination of a specific gravity less than 1: '2.2.2.1' of 'Chapter 7 Methods to determine the quality · structure and recyclability of PET bottle packing materials' shall apply.

3.2.2.4 Determination of the complete separability from the body: If two or more of 10 samples when the lid is pulled at a speed of 20~500 mm/min with a tensile tester or push-pull gauge meet the following conditions, they are determined to be completely separable.

A. Adhesive strength less than 10kgf

B. Lid does not tear during separation

C. No materials other than synthetic resin such as Al and

paper remain on the adhesive side

Chapter 8 Methods to determine the quality · structure and recyclability of single synthetic resin containers and trays (except PET bottles and expanded synthetic resins)

1. Body

1.1 Rating of the quality · structure and recyclability of body packing materials

1.1.1 Excellent for recycling

Single materials (and colorless single PET materials).

1.1.2 Difficult for recycling

Materials combined with PET-G or colored PET or PVC-based materials.

1.1.3 Normal for recycling

Packing materials that do not fall under any criteria for the category of excellent or difficult for recycling.

1.2 Method to determine body recyclability

1.2.1 Visual determination

1.2.1.1 Colorless material determination: '1.2.1.3' of 'Chapter 7 Methods to determine the quality · structure and recyclability of PET bottle packing materials' shall apply.

1.2.1.2 Since it is impossible to identify visually composite materials, an instrumental analysis or an equivalent analysis is required or it shall be confirmed with supporting documents. (However, it is possible to visually identify a

material other than composite materials.)

1.2.2 Instrumental analysis

1.2.2.1 Colorless material determination: '1.2.2.2' of 'Chapter 7 Methods to determine the quality · structure and recyclability of PET bottle packing materials' shall apply.

1.2.2.2 Synthetic resin materials (including PET-G and PVC-based materials): Perform a qualitative analysis by applying the instrumental analysis prescribed in '2.2.2.2 ②' of 'Chapter 1 Methods to determine the quality · structure and recyclability of paper packing materials'.

2. Label, stopper and other components

2.1 Rating for the quality · structure and recyclability of labels, stoppers and other components

2.1.1 Excellent for recycling

Materials that meet any of the following fall under the category of best for recycling.

① Cases where the body is a PET material and there is no label, stopper and other components or no adhesive is used.

② Cases where the body is made of a material other than PET and has no label, stopper or other components; where label information is directly printed on the body; where they are made of the same materials as that of the body; or they are made of a synthetic resin material different from the body but fully separable from the body.

2.1.2 Difficult for recycling

If any of the following is met, it falls under the category of difficult for recycling.

① While the body is made of a PET material, label, stopper and other components are made of a PVC-based material.

② Cases where the body is made of a material other than PET but label, stopper and other components are made of a PVC-based material; where a straw is attached to the lid or stopper; they are made of a material other than synthetic material; or where they are made of a material different from the body but are inseparable.

2.1.3 Normal for recycling

Packing materials that do not fall under any criteria for the category of excellent or difficult for recycling.

2.2 Method to determine the recyclability of labels, stoppers and other components

2.2.1 Visual determination

2.2.1.1 Examine visually no use, the application of adhesive or direct printing on the body.

2.2.1.2 Determination of the separability from the body: 3.2.1.2 of Chapter 2 Method to determine the quality · structure and recyclability of glass bottle packing materials shall apply.

2.2.1.3 Determination of the complete separability from the body

① If it is impossible to determine visually or difficult to

determine clearly, conduct an instrumental analysis or an equivalent test analysis or confirm with supporting documents.

② The visual determination is to examine the residual material of the stopper and other components other than synthetic resin material when the stopper and other components are removed by hands.

2.2.2 Instrumental analysis

2.2.2.1 Determination of synthetic resin material (including PVC-based material): '2.2.2.2 ②' of 'Chapter 1 Methods to determine the quality · structure and recyclability of paper packing materials' shall apply.

2.2.2.2 Determination of the complete separability from the body: If two or more of 10 samples when the lid is pulled at a speed of 20~500 mm/min with a tensile tester or push-pull gauge meet the following conditions, they are determined to be completely separable.

A. Adhesive strength less than 10kgf
B. Lid does not tear during separation
C. No materials other than synthetic resin such as Al and paper remain on the adhesive side

Chapter 9 Methods to determine the quality · structure and recyclability of composite material containers·trays and single·composite material film·sheets (except PET bottles and expanded synthetic resins)

1. Body

1.1 Rating of the quality · structure and recyclability of body packing materials

1.1.1 Excellent for recycling

Synthetic resin film·sheets (including the use of aluminum less than 20㎛) or composite material containers·trays

1.1.2 Difficult for recycling

Combined use of materials other than synthetic resin or PVC-based materials.

1.1.3 Normal for recycling

Packing materials that do not fall under any criteria for the category of excellent or difficult for recycling.

1.2 Method to determine body recyclability

1.2.1 Instrumental analysis

1.2.1.1 Determination of the combined use of synthetic resin materials (including PVC-based materials) and materials other than synthetic resin: The instrumental analysis method prescribed in '2.2.2.2 ②' of 'Chapter 1 Methods to determine the quality · structure and recyclability of paper

packing materials' shall apply.

1.2.1.2 Since it is impossible to determine thickness visually, an instrumental analysis or an equivalent analysis is required or it shall be confirmed with supporting documents. For instrumental analysis, one of the following methods shall be used. If there is a difference in measurements, the result of measurement based on "KS D 0246" plating thickness test method shall apply by priority and then section cutting precision measurement method shall apply.

① Instrumental analysis method 1: Measurement after stripping

A. Prepare a sample in the shape of flat sheet and a rectangular in size more than 5cm in each dimension.

B. Put a sample in 70% nitrogen solution for 5 hours and remove Al foil. Remove residual adhesive with water and residual water through natural dry or using a dryer.

C. Calculate the thickness by measuring the weight of A1 foil and measure the thickness with a tool capable of measuring micro units.

② Instrumental analysis method 2: cross section cutting

A. Prepare a sample in the shape of flat sheet and a rectangular in size more than 5cm in each dimension.

B. While holding a sample, cut its plane vertically to expose the laminated side of A1 foil.

C. Measure the thickness of cut AI foil section with an optical microscope.

③ Instrumental analysis 3: Follow "KS D 0246" plating

thickness test method.

2. Label, stopper and other components

2.1 Rating of the quality · structure and recyclability of packing materials of label, stopper and other components

2.1.1 Excellent for recycling

Synthetic resin material or directly printed on the body.

2.1.2 Difficult for recycling

PVC-based material or a material other than synthetic resin inseparable from the body.

2.2.2 Normal for recycling

Packing materials that do not fall under any criteria for the category of excellent or difficult for recycling.

2.2 Method to determine the recyclability of labels, stoppers and other components

2.2.1 Visual determination

2.2.1.1 Examine visually whether label information is directly printed on the body.

2.2.1.2 Determination of the separability from the body: 3.2.1.2 of Chapter 2 Method to determine the quality · structure and recyclability of glass bottle packing materials shall apply.

2.2.1 Instrumental analysis

2.2.1.1 Determination of synthetic resin material (including

PVC-based materials): '2.2.2.2 ②' of 'Chapter 1 Methods to determine the quality · structure and recyclability of paper packing materials' shall apply.