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RECYCLABILITY EVALUATION PROTOCOL

FOR LABELS & LIDS
APPLIED ON
PET TRAYS

STANDARD LABORATORY PRACTICE
REP-PETtray-02

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GLOSSARY

Control Sample	Virgin PET Tray used as reference
Innovation Sample	PET Tray containing the innovative label or lid
PET	Polyethylene Terephthalate
TC	Technical Committee
wt%	Weight Percentage

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DISCLAIMER

“RecyClass is a non-profit, cross-industry initiative advancing recyclability, bringing transparency to the origin of plastic waste and establishing a harmonized approach toward recycled plastic calculation & traceability in Europe. The Recyclability Evaluation Protocols will promote recyclability by encouraging the industry to test new plastic technologies, materials or products, providing recommendations on improving their recyclability before market launch.

The Recyclability Evaluation Protocols are freely available to download on the [RecyClass website](#). Companies developing new plastic concepts are encouraged to use them to self-assess the impact of their solutions on recyclability and highlight potential issues. **However, compliance with a Recyclability Evaluation Protocol is not a replacement for an official assessment and may not be used as a marketing tool.** The RecyClass Steering Board, following the recommendations of the Technical Committees, will decide on the compatibility of the innovation with recycling according to the evaluation results, granting a Recyclability Approval Letter to the Applicant.

All tests must follow the Evaluation Protocols recommended by the RecyClass Technical Committees and be conducted by an independent laboratory recognised by RecyClass which has no legal affiliation to the applicant.

More information is reported in the RecyClass Internal Procedures available on the [RecyClass website](#).”

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1. INTRODUCTION AND PURPOSE OF THE PROTOCOL

The “Washing Quick Test Procedure for Labels & Lids applied on PET Trays” referred to in this document as “The Protocol” describes the methodology that the applicant must follow at a laboratory scale in order to determine if label and lids combined with adhesives are compatible with the post-consumer PET trays recycling streams. The Protocol targets companies responsible for introducing a packaging product into the market. The applicant shall proceed with the Protocol as established in the Assessment Process for Applicants of Recyclability Evaluation in the RecyClass Internal Procedures¹ and “RecyClass Recyclability Approval Quality Management & Procedures document”².

The Protocol aims to evaluate the behaviour of labels, or lids, and adhesives during the washing process by performing a quick test at laboratory scale. It aims to guarantee recyclability³ of plastics packaging while encouraging innovation in the label, lids and adhesives market used for PET tray applications. The overall goal is to ensure the removability of the label/lids from the PET tray without obstructing the proper functioning of the PET trays recycling process. The results of the quick test may not be considered as a formal approval by RecyClass. For a complete assessment, further tests are required to highlight all possible effects of adhesives and labels/lids on the recyclability⁴.

In case the combination of label or lids with adhesive tested with the Procedure does not meet the requested assessment criteria, the combination can be submitted to the Recyclability Evaluation Protocols of RecyClass to demonstrate that, even though not washable, the combination does not negatively affect PET recyclability in terms of process and recyclate quality.

This document provides guidance on the tests methodology that shall be followed, including benchmark recommendations to guide the interpretation of the results. Adhesive terminology as it is used in this document refers to adhesive for labels only.

Please note that all units in this protocol are expressed following the International System of Units⁵, from the Bureau International des Poids et Mesures.

¹ [RecyClass Internal Procedures](#)

² [RecyClass Technology Approval Quality Management & Procedures](#)

³ *Recyclability definition according to PRE & APR: Plastics must meet four conditions for a product to be considered recyclable: 1. The product must be made with a plastic that is collected for recycling, has market value and/or is supported by a legislatively mandated program. 2. The product must be sorted and aggregated into defined streams for recycling processes. 3. The product can be processed and reclaimed/recycled with commercial recycling processes. 4. The recycled plastic becomes a raw material that is used in the production of new products.*

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⁵ [SI Brochure - BIPM](#)

2. SCOPE OF THE PROCEDURE

The scope of the Protocol covers any labels, lids, or sealed attachment introduced to the existing packaging solutions for PET trays. Before initiating the evaluation, the applicant shall review the Design for Recycling Guidelines for transparent clear thermoforming mono PET trays⁶ to confirm that the innovation is compatible with PET Thermoforms recycling.

The following packaging solutions and/or innovations are covered by the scope of this Protocol:

1. Adhesives for labels (pressure sensitive adhesives, non-pressure sensitive hotmelts, wet labelling adhesives)
2. Unprinted or printed labels
3. Unprinted or printed lids
4. Other sealed attachments

The Protocol provides guidance on the behaviour of the labels, lids, and adhesives during the PET recycling process. The labels and the lids should detach from the packaging and with no adhesive remaining on the washed PET flakes. The adhesive layer should preferably remain on the labels and lids. Adhesive dissolving in the water represents extra effort for water treatment and are therefore not recommended. While adhesive remaining on the PET flakes may lead to discoloration of the recycled PET material. Printed labels or lids must be tested additionally according to the bleeding inks procedure to evaluate the potential issue coming from the inks.

3. DISCLAIMER

The Protocol is created to represent as accurately as possible how the actual PET trays recycling works at an industrial scale. RecyClass PET Technical Committee reserves the right for further testing if necessary, to issue a final opinion on the recyclability of the tested innovation. The Recyclability Evaluation Protocol for Labels & Lids on PET Trays establishes some benchmark recommendations to guide the decision-making process. However, only some of the properties listed in the protocol are provided with a benchmark recommendation, given that the evaluation also based on the technical expertise of the Technical Committee.

Sorting behavior of PET trays is also important to consider, since some labels/decorations can negatively affect the sorting efficiency to the right PET stream. Therefore, it is recommended to perform a sorting test according to RecyClass Sorting Evaluation Protocol for Plastic Packaging to ensure that packaging presenting a risk of missorting is sorted in the right PET stream.

4. LABORATORY TESTING METHODOLOGY

This methodology aims to reproduce the washing step of the PET trays recycling process at laboratory scale to determine the suitability of an innovative adhesive, lid or label with the PET tray recycling streams. The methodology described below shall be followed precisely and any modifications or problems during the testing phase must be noted by laboratory technicians. Additional tests may be requested by the PET TC for specific cases requiring particular attention. A Laboratory Evaluation Report compiling objectively all the results obtained shall be prepared and

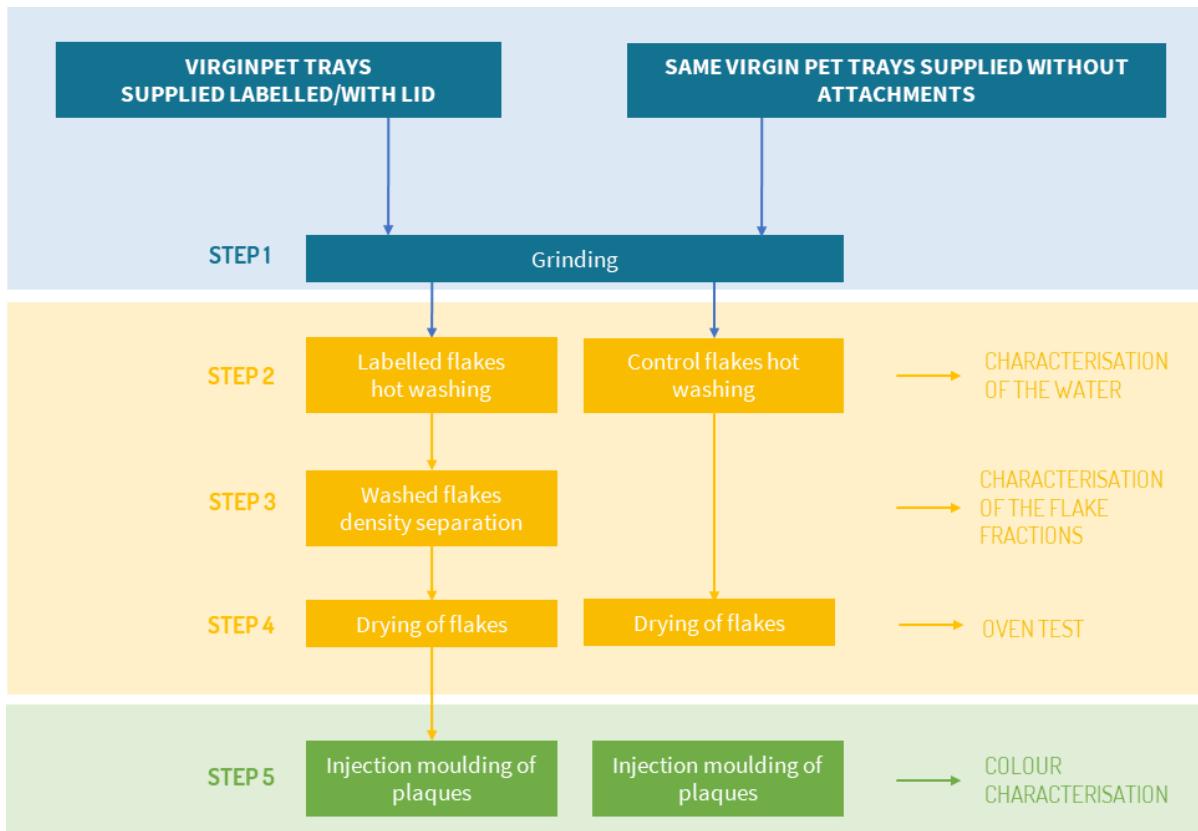
⁶ [Design for Recycling Guidelines](#)

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submitted to the RecyClass PET Technical Committee which will interpret the final results and define the compatibility or not with recycling. Any remarks during the laboratory tests described in the Protocol shall be also noted down.

See below in Figure 1 a diagram describing the methodology.

Figure 1: Methodology Diagram



4.1 CONTROL SAMPLE

The control PET tray to use following the Protocol must be a PET container without any attachment and made of 100% virgin PET. The control PET tray must be the same tray used as basis for the innovation sample. At least 2 kg of PET trays without any attachment (label, lid, others) must be provided.

4.2 INNOVATION SAMPLE

For the purpose of the tests, the Applicant should provide at least 2 kg of PET trays, with the label or lid already applied. For labelled trays, the labelled surface should represent at least 20 % coverage of the back of the tray. Concerning lidded trays, the lid should be sealed on the 4 sides of the tray. More labelled material may also be required if the label/lid coverage is not sufficient to obtain the amount of flakes and/or if additional tests are required. It is recommended to use a 100% virgin mono A-PET tray like for control material.

While both transparent and coloured labels and lids can be used for this recyclability assessment, it is preferred to operate with coloured polyolefin in order to facilitate the separation and identification of the bottle and label/lid flakes after washing.

5. LABORATORY TEST PROCEDURES

5.1 SAMPLE PREPARATION

Before grinding, measure the weight of 1 control and 1 innovation tray by doing an average on 10 trays, and report them as m_c and m_i in Annex 1 table. Report also the number of innovation trays that are going to be used for the recyclability evaluation, as N_{innov} in Annex 1 table.

5.1.1 STEP 1: GRINDING

Control and innovation samples are separately ground in order to prepare controlled-size flakes.

Procedure:

- Record the total weight of respectively the control and innovation packaging before grinding as “ A_c ” and “ A_i ” and report it in Annex 1 table.
- Grind separately control and innovation sample to flakes, starting by the control flakes using a 12-15 mm screen with a dry grinder, leading to 8-12 mm flakes. Clean the grinder between both grinding.
- Ideally, flakes should be big enough to be able to easily identify flakes coming from the rim of the trays.
- Report on the quantity of fines (< 1 mm) that are obtained.
- Store ground samples in separate containers.
- Document the innovation and control flakes with one or more photographs.
- Record the total weight of respectively the control and innovation flakes as “ B_c ” and “ B_i ” and report it in Annex 1 table.

As PET Thermoforms are generally very brittle, the fines (< 2 mm) and losses during the grinding step should not represent more than 25 wt% combined.

5.2 WASHING & SEPARATION BY DENSITY STEPS

5.2.1 STEP 2: WASHING

At the state of the art, European PET recycling lines typically use hot washing conditions (about 70 °C), caustic soda and detergents, in a multiple step washing process. The washing step is carried out at 70 °C with caustic soda and no additives in this Protocol to avoid brittle effect. The following procedure must be applied to both control and innovation flakes, separately.

Procedure hot-washing:

- Prepare the washing stainless steel tank for a 1:8 ratio (1 kg flakes vs 8 L solution) at 70 °C with a solution of 1.6 wt% NaOH and 0.3 wt% MacDermid RP-34 detergent. The steel tank must contain 3 or 4 baffles to deflect flakes while stirring.
- Wash control and then innovation samples separately at a 1:8 ratio (1 kg flakes vs 8 L solution) at 700 rpm for 15 minutes. The stirrer should contain 2 disks or 2 sets of 3-leaves impeller. Report on the presence and amount of fines.
- Make sure that the labels/lids do not stick to the stirrer, nor the side of the tank. It is important to ensure free agitation of PET and label flakes.
- Collect flakes and separate them from the washing solution over a vibrating table or using a strainer. No flakes must be lost in the transfer process.
- Use tap water to rinse both flakes and the tank to ensure recovering every flake and removing remaining traces of caustic soda.
- Dry both control and innovation flakes separately in an oven at 80 °C for 2 hours. Then, let the flakes come back to room temperature.
- Store the dried flakes for 24 hours.
- Evaluate the moisture content with a moisture analyser.
- Record the total weight of respectively the control and innovation flakes after washing and drying as “ C_c ” and “ C_i ” and report it in Annex 1 table.
- Record the washing process with a series of photographs. Any stickiness, odour, suspended particles, or discolouration shall be recorded, and illustrated with pictures.
- In case of discolouration of the washing water, take pictures of the washing solutions used for innovation and control flakes side by side.

5.2.2 STEP 3: DENSITY SEPARATION

Since no density separation is expected for the control sample, only innovation sample should be going through the density separation step.

Procedure density separation:

- Pour the washed flakes in a tank filled with water at a 1:10 weight ratio at a room temperature. The tank should be high enough to enable separation of sinking and floating fractions. Add 0.1 wt% of a non-ionic surfactant such as MacDermid RP 24.
- Stir at 240 rpm for 1 minute, and let the solution settle for 10 minutes. Ensure that no flakes or labels/lids remain on the stirrer, and that no flakes are lost in the process.

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- Carefully collect the floating fraction with a sieve. Place the collected flakes on filter paper for gross removal of water. Then, transfer the floating fraction within a crystallizer.

- In case some labels or lids are trapped within the PET sinking fraction, a new stirring and settling step can be done under the abovementioned conditions (240 rpm, 1 min). This operation can be repeated maximum 2 times.

- After collecting the floating fraction, collect the sinking fraction by filtration. Place the collected flakes on filter paper for gross removal of water. Then, transfer the sinking fraction within a second crystallizer.

- Take picture of both floating and sinking fractions.

- Report the mass of innovation sample after sink-float separation as “ D_{IF} ” and “ D_{IS} ” for the floating and sinking fraction respectively (Annex 1).

- In the case that some lids or labels flakes would remain present in the PET sinking fraction, report them with pictures and observations.

5.2.3 STEP 4: DRYING STEP

Labelled flakes: The last step before the assessment is to reduce the flakes moisture content to less than 1 wt%.

Drying procedure:

- Dry both floating and sinking fraction separately in an oven at 80 °C for 2 hours. Then, let the flakes come back to room temperature.

- Store the dried flakes for 24 hours.

- Evaluate the moisture content with a moisture analyser.

- Report the mass of innovation samples after drying as “ E_{IF} ” and “ E_{IS} ” for the floating and sinking fraction respectively (Annex 1)

- Save about 50 g of each fraction to perform flakes separation assessment and oven test reported in sections 5.3.1 and 5.3.2.

5.2.4 STEP 5: INJECTION MOULDING STEP

Plaques will be produced via injection moulding in order to perform colour characterization of both control and innovative samples. Production of the 3 mm plaques should be done as follows:

Procedure:

- If flakes are too big for injection, a second grinding phase can be performed to reduce the size of flakes to the injection feeder hop.
- Dry the control and innovation samples at 160 °C maximum to reach a moisture level below 50 ppm.
- Mould both control and innovation samples, under similar conditions at 275-285 °C into plates with measures of about 3.0 mm thickness.
- The mould temperature should be set between 15 and 20 °C, while melt residence time should be between 4 and 6 minutes. The specimens should be completely filled without any shrinkage, overspray, and inclusions.
- Save the plaques for colour characterisation.

5.3 CHARACTERISATIONS

5.3.1 FLAKES SEPARATION & ASSESSMENT

Labelled flakes: Evaluate the efficiency of adhesive and label removal.

Procedure:

- Compare the values of “ E_{iF} ” and “ E_{iS} ” to the initial weight of the innovation samples “ B_i ”
- Quantitatively inspect the PET Trays flakes:
 - Check the sinking fraction to identify any traces of remaining lids/labels attached to PET flakes. Quantify the amount of PET flakes with labels or lids still attached, and report it as “ F_i ” (Annex 1).
 - For lids, try to identify at least 20 flakes generated from the rim of the trays, and evaluate residual stickiness of the rim section of these flakes. Report the number of flakes showing residual stickiness. Besides, report any traces of remaining adhesives on the rim of the tray.
 - For labels, as it is difficult to identify flakes generated from previously labelled area, stickiness evaluation on both sides of flakes should be done on 40 flakes. Report the number of flakes showing residual stickiness. Besides, report any traces of remaining adhesives on the rim of the tray.
- Document the PET trays flakes (with and without residual labels/lids) with one or more photographs.

For removed labels/lids, even partially, the report should report the adhesive behaviour: water-soluble or releasable (i.e., remains on the label). Visual inspection of the dried label/lid flakes and residual stickiness should confirm whether the adhesive remains on the label or get released into water.

The wash water should be observed, as reported in step 2. Turbid wash water may indicate the adhesive being only partially dissolved or dispersed in the wash water.

If the characterization of the adhesive's behaviour is not possible, the report must mention it.

5.3.2 OVEN TEST

An oven test will need to be performed for both innovation (only PET tray flakes sinking fraction) and control fraction to see any potential discolouration of the PET flakes and presence of remaining adhesives.

Procedure:

- Preheat the oven at 220 °C.
- Take about 50 g of both samples and put them on two different crystallisers. Spread the fractions evenly in the crystallisers.
- Place the samples in the oven at 220 °C for 1 hour.
- Let the samples cool down at room temperature.
- By transferring each fraction on a white surface, evaluate flakes for any colouration, black specks, stickiness or degradation signs. Guidance on characterisation of the levels of coloration of PET flakes can be found in Figure 2.
- Document the innovation and control flakes with one or more photographs on a white background.

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Figure 2: Pass/fail criteria for PET tray flakes coloration.



5.3.3 COLOUR MEASUREMENT

Colour measurement on the plaques produced from the control material and sinking fraction of innovation flakes must be performed in order to identify any sign of degradation due to residual adhesive on the innovation PET flakes.

Procedure:

- The colour measurement must be performed in transmittance mode with a D65 illuminant, 8-10 °angle, SCI gloss settings. L^* , a^* , b^* and Δb^* (compared to control material) must be calculated for at least 3 specimen, and standard deviations must be calculated.

5.4 RESULTS INTERPRETATION

As success criteria for this Recyclability Evaluation Protocol for lids and labels applied on PET Thermoforms, the following conditions shall be met:

1. **No adhesive visible by eyes on PET flakes. It should be dispersed in the washing water, or remaining on label/lid flakes**
2. **No discoloration of the washing water.**
3. **Removal efficiency (γ – see Annex 1 table) superior to 95 %**
4. **No sign of intense degradation on PET flakes after oven test (Homogeneous coloration of flakes or major located degradation).**
5. **For plaques: $\Delta b^* < 5$**

Note that all the parameters will be considered by the RecyClass PET Technical Committee to assess the recyclability of the solution tested.

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6. REPORT CONTENT

The report should contain the following information:

- Reference to the Procedure and its version: *Recyclability Evaluation Protocol for Labels & Lids Applied on PET Trays - v. 1.1*
- A full and complete identification of the material tested, including:
 - **Label/Lid:** size, structure, and density.
 - **Adhesive:** amount per surface unit and technology (wet labelling adhesive, pressure sensitive adhesive, or non-pressure sensitive hotmelt).
- Description and photographs of the testing equipment.
- Description of the samples during each step (especially on colour changes, deposits, sinking or non-detached label/lid fragments, residual stickiness, ...).
- The photographs indicated in the test procedure. Additional photographs are welcome whenever useful for documenting specific situations.
- In case of removed labels/lids, characterization of the adhesive behaviour (water soluble or water releasable); even for partial label washability (removal efficiency > 0%).
- Details of any deviation from the test method, as well as any incident which may have influenced the results.
- Summary table present in Annex 1 filled with results.
- Test figures. Use the tables in Annexes.

DOCUMENT VERSION HISTORY

VERSION	PUBLICATION DATE	REVISION NOTES
1.0	March 2025	Recyclability Evaluation Protocol for Labels & Lids Applied on PET Trays release
1.1	January 2026	Mandatory to use virgin PET Trays Modifications washing conditions Addition of drying steps Modification of guidance on flake discoloration after drying step

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Identification of versions

v.X - Structural modification impacting the protocol.

v.X.Y – Updates to testing conditions, integration of new tests, technologies or analytical methods.

v.X.Y.Z - Editorial modifications not impacting the content of the Protocol.

ANNEX 1 – SUMMARY TABLE

Table 1: Mass balance

VARIABLE	VALUE	CONTROL MATERIAL	INNOVATION MATERIAL	
Mass of 1 tray	X,xx g	m _c	m _i	
Number of used trays	-	-	N _{innov}	
Initial weight	X,xx g	A _c	A _i	
Weight after grinding	X,xx g	B _c	B _i	
Weight after washing	X,xx g	C _c	C _i	
Weight of floating and sinking fraction after density separation	X,xx g		Floating fraction	Sinking fraction
			D _{iF}	D _{iS}
Weight after drying	X,xx g		E _{iF}	E _{iS}
Weight of PET flakes with lid or labels remaining	X,xx g		F _i	
Removal yield	%	-	$\gamma = E_{iF} / ((m_i - m_c) * N_{innov}) * 100$	

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