

RecyClass Unwrapped



RecyClass Unwrapped

Recyclability Protocols & Technology Approvals

Moderated by Eugenio Longo | Head of sustainability & EU affairs | Borealis





RecyClass Unwrapped Webinar

Recyclability Evaluation Protocols & Technology Approvals

Fabrizio di Gregorio

How to boost plastics circularity in Europe?

Kecy

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 Harmonised Design for Recycling guidelines are essential to give one reference for the industry;

 It covers the need to STANDARDIZE definitions, testing protocols and methodologies to assess recyclability with a scientific approach;

 Having the circularity of plastics as target, it is necessary focus on high end applications as benchmark.

Organisation:	Countr	y: What?	Used for:
Citeo	France	recyclability assessment tool (LCA-based, free)	-
Cotrep	France	DfR guidelines (do & don't approach)	-
Danish Plastics Federation	Denmark	DfR guidelines	-
Der Grune Punkt (DSD)	Germany	DfR guidelines	-
EPBP	Europe	DfR guidelines + lab protocols	technology approvals
EXPRA	Europe	DfR guidelines + tool	-
FH Campus Wien	Austria	DfR guidelines + methodology	-
HTP-Cyclos	Germany	recyclability assessment (certification)	certification
IK	Germany	Eco Design of Plastic Packaging	-
IKV	Netherlands	DfR guidelines (do & don't), decision tree (for rigids)	-
OPRL (on pack recycling label)	UK	recyclability assessment (tool and labelling, only for members)	certification
Petcore Europe	Europe	DfR guidelines + recyclability protocol	technology approvals
Recoup	UK	DfR guidelines + tool (Packscore) - aligned with RecyClass	certification
RecyClass	Europe	DfR guidelines, recyclability assessment (free online tool) + certification, lab protocols	technology approvals
Suez.Circpack	Global	DfR guidelines, recyclability assessment - aligned with RecyClass	certification
WRAP	UK	DfR guidelines (yes please/no thanks approach)	-
Zentrale Stelle	Germany	DfR guidelines + methodology	certification
APR	US	DfR guidelines + lab protocols	technology approvals

What does CIRCULARITY mean?

'A circular economy is one that is restorative and regenerative by design and **aims to keep products**, **components and materials at their highest utility and value at all times**' (*MacArthur*, 2015)



There are cases where functionality requirements make certain packaging hard to be designed for closed-loop recycling systems.

However, design choices leading to **the longer multiplestep cascaded recycling must be favoured**.

What we need is data!





- **Test** on recycled product with and without innovation.
- Comparison of properties
- Technology/Product Approval

- The DfR Guidelines are transposed to the tool.
- The overall recyclability of the finished package can be assessed.

- Recyclability Spf-Assessment
- Recyclability pert-checked
- Recyclability Certification

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- Recyclability Self-Assessment
- Recyclability Expert-checked
- Recyclability Certification

What do protocols do?

- Recyclability Protocol for PE films
- Recyclability Protocol for HDPE containers
- Recyclability Protocol for PP containers
- Recyclability Protocol for PP films (to be released soon)
- Washing Protocol for label adhesives (under development)
- Protocol for paper labels (under development)





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• Sorting Protocol (draft)

https://recyclass.eu/recyclability-evaluation-protocols/

Recyclability Protocol for HDPE containers RecyClass



- Pre-treatments
 Input:
 10 kg innovation
 25 kg control
- Extrusion and pellet characterization Input:
- **3 flake blends** of control and innovation flakes

(with 0, 25% and 50% of innovation)

• **Converting** (50% dilution with virgin) Input:

3 pellet blends of control and innovation pellets

(with 0, 12,5% and 25% of innovation)

RecyClass Protocol – Pre-treatment tests

RecyClass

1) Grinding



Innovative sample

Control sample

2) Air elutriation



3) Washing



Innovative sample flakes after washing

4) Floatation

Rinse water

Wash water



Floatable (HDPE) Sinkable (PET)

Extrusion test

	Benchmark recommendation	
Bulk Density [kg m ⁻³]	> 550	
Density [kg m⁻³]	± 10 for A.25 and A.50 vs. A.0; < 995 (A.50)	
Melt Index [dg min ⁻¹]	0.2 – 0.9	
Ash Content [wt%]	< 2 (A.50)	
Filtration	no build-up	
Moisture [wt%]	<u> </u>	
Melting Point [°C]	130 – <mark>1</mark> 40	
Impurities	—	
Surface Appearance		
Volatiles [wt%]	± 0.1 % for A.25 and A.50 vs. A.0	
PP content [wt%]	< 2 for A.25 and A.50	
Delta Pressure [MPa]	< 10 % for A.25 and A.50 vs. A.0	



Converting tests

	Benchmark recommendation
Bottle Appearance	
Bottle Integrity	
Bottle Dimension (Height)	± 5 % vs. B.0
Bottle Weight	± 5 % vs. B.0
Bottle Capacity	± 5 % vs. B.0
Thickness (top side wall)	≥ 0.3 mm
Thickness (mid side wall)	≥ 0.3 mm
Thickness (bottom side wall)	≥ 0.3 mm
Thickness (shoulder)	≥ 0.3 mm
Thickness (base corner)	≥ 0.3 mm
Top Load	< 5 % decrease vs. B.0
Drop Impact	≥ 95 % vs. B.0
Additional Observations	no more than for B.0

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Tensile properties

	Standard
Stress at Yield [MPa]	ISO 527-2
Stress at Break [MPa]	ISO 527-2
Elongation at Yield [%]	ISO 527-2
Elongation at Break [%]	ISO 527-2
Strength [MPa]	ISO 527-2
Elongation at Strength [%]	ISO 527-2

Technology / Product Approvals

pproval Evaluation Protocols test with RecyClas **Accredited Laboratories** Application review Communication & TC Group designation Statement RecyClass Support • **Test** on recycled product with and Assessment Technical Review Validation & Evaluation without innovation Yes or Yes with conditions NO TC Desicion TEST? Yes Comparison of properties Evaluation Protocol custom design TC Group Steering Board • Approvals given by the RecyClass TCs External Communication Testing to the applicant lass Recy

Application

External Communication

(with applicant a

Thank you for your attention

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RecyClass Unwrapped



An insight into the scientific functioning of the protocols and testing

Ing. Vanessa Gutiérrez Aragonés – Mechanical Recycling Group



- AIMPLAS Overview
- Protocols scheme
 - Pre-treatment
 - Blending
 - Converting
- Remarks and conclusions





Excellence in Plastics









PATERNA (Valencia) SPAIN Technology center with more than 30 years' experience in the plastic sector.

Covering the whole value chain 9.000 m2 Of cutting-edge facilities

5.000 m² pilot plants

4.000 m² Labs



AIMPLAS in Figures



More than 160 highly qualified professionals







610 associated companies



Comprehensive management to provide global solutions





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An insight into the scientific functioning of the protocols and testing

Equipment and main work lines



Review on Protocol Scheme

Technology Approval protocols consist in different phases that simulates a recycling process:

- **Pre-treatment**: grinding and washing tests
- **Extrusion**: pelletizing different blends
- Converting:
 - Film extrusion
 - Blow-film extrusion for LDPE films
 - Cast film extrusion for PP films
 - Blow-extrusion for rigid HDPE and PP
 - Injection moulding for rigid HDPE and PP
 - Sheet extrusion for rigid HDPE and PP





Pre-treatment



In the pre-treatment phase the evaluations corresponds to the following parameters:

Grinding process:

- Homogeneous size and easy-flow flakes
- No stringing.
- Adequate bulk density

Washing/flotation/drying (only for printed, labelled, or glued products)

- Water colour
- Floating/sinking particles
- Water intake



Pre-treatment

Main reason to evaluate pre-treatment behaviour is: Assure Innovation materials will behave as regular materials, in standard recycling streams.



Full separation by flotation in a PO stream



Right flowability and suitable size to fit the extruder entrance



Low water content after drying to avoid problems in extrusion, such as pellet foaming.



Extrusion

In the Extrusion Phase two Innovation material blends are prepared, filtered and pelletized, and compared to Control material, **to guarantee processability, process stability and pellet quality.**

The following aspects are monitored:

- Extruder intake: no blockage of hopper
- No die-build up
- Pellets aspect homogeneous, low yellowing compared to control
- Process stability: torque and pressure.
- Physical properties









Extrusion



Stable pressure and torque (30 minutes run-time)



Stable torque, rising pressure (60 minutes run-time)



Extrusion





Converting

In the Converting Phase two Innovation pellet blends are prepared, processed and compared to Control, **to verify effect on a final product, regarding processability, process stability and product performance.**

The following aspects are monitored:

- Process stability: torque and pressure.
- Bubble/film/sheet stability
- Achieve aimed blow-up ratio/stretching and thickness without rupture
- General aspect (gels, specks, melt-fracture, etc)
- Mechanical performance





Converting

No specs or gels



() AIMPLAS

Main objective of RecyClass Technology Approval Protocol is: **verify recyclability of novel and innovation materials** (PP and PE bases) in a standard recycling stream.

Protocols verify the effect of these materials/structures in a controlled scenario, taking into account the **most** restrictive scenario: a post-industrial recycling process.

If in this type of recycling process, materials have **low or no effect on standard PE or PP performance**, they will also have low or no **effect on a post-consumer recycling stream**.

If the later occurs, innovation materials can be considered as recyclable.



Thank you!





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Colgate Tube

Recyclability Protocols & Technology Approval



Colgate Internal Work Tube Redesign



Recyclable Tubes: Begin with the End in Mind





Requirements for Recycling

- Identify the recycling path to HDPE bottle stream
- Can the tube be sorted and directed in the HDPE bottle stream (compatibility)
- Specify the range of the key parameters to meet recyclability requirements: melt index (0,2-0.9), density (+/- 0.01 from that of control bottle)
- Develop the right Laminate according to the technical requirements



Recyclable Tube Initial Dev Milestones

Phase I: 2014

Orange peel surface, Wavy laminate

Phase II: 1H 2015

Flavor scalping, Surface finish Shoulder resin inadequate

<u>Phase III: 2H 2015</u> Web curling, Tube ovality

Phase IV: 1H 2016

Flat, non-curling laminate was made Tube making at multiple CP facilities















Recyclable Tube Development – Phase V

- Scaled up film making
- Scaled up tube making

- Structure passed qualification protocols
 - Laminate Quality
 - Formed Tube Quality
 - Printing Quality
 - Tube Performance



These tubes are designated as **Samson Tubes**



Plastics Recyclers Europe (PRE) / RecyClass

- Represents European Reprocessors and the whole value chain
- HDPE Technology Approval received January 2020
 - o Tube was first HDPE item to be tested under PRE protocol
 - Minor difference testing from APR







Colgate-Palmolive

RECYCLASS PRODUCT APPROVAL

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Brussels, 21st January 2020

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The RecyClass HDPE Technical Committee was requested to carry

'Samson tube' by Colgate-Palmolive to verify its impact on the qu

The innovative packaging is a decorated multi-layer toothpas laminate tube making machine, which mounts the tube sleeve c shoulder assembly contains a HDPE shoulder and a PET insert. T of the total weight of the package. **RecyClass**[™]

For immediate release
PRESS RELEASE

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Brussels, 21st January 2020

Colgate-Palmolive's Recyclable toothpaste tube tested by RecyClass

An independent laboratory testing of 'Samson Technology' by Colgate-Palmolive shows that it can be recycled in a high-density polyethylene containers (HDPE) recycling stream, with minor recyclability issues. 'Samson tube' is a directly printed toothpaste packaging made of HDPE containing 5% (by weight) of ethylene vinyl alcohol (EVOH) barrier, and a polyethylene terephthalate (PET) insert.



RecyClass Methodology Diagram



Objective:

Compare Pellet properties vs Benchmark

Compare Bottle properties vs Benchmark



Commercialization in EU

- Jan., 2020 ground-breaking new toothpaste Smile for Good :
 - Minimal number of ingredients listed on the front of the pack clearly explaining their purpose - an industry first
 - Packaged in Colgate's first-of-its kind recyclable plastic tube.













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Questions & Answers session



Use the Q&A box on the top-right corner of your screen



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Thank you for your participation!

Next webinars: 27 January 2021 24 February 2021 24 March 2021

28 April 2021 26 May 2021 23 June 2021

More information to follow www.recyclass.eu