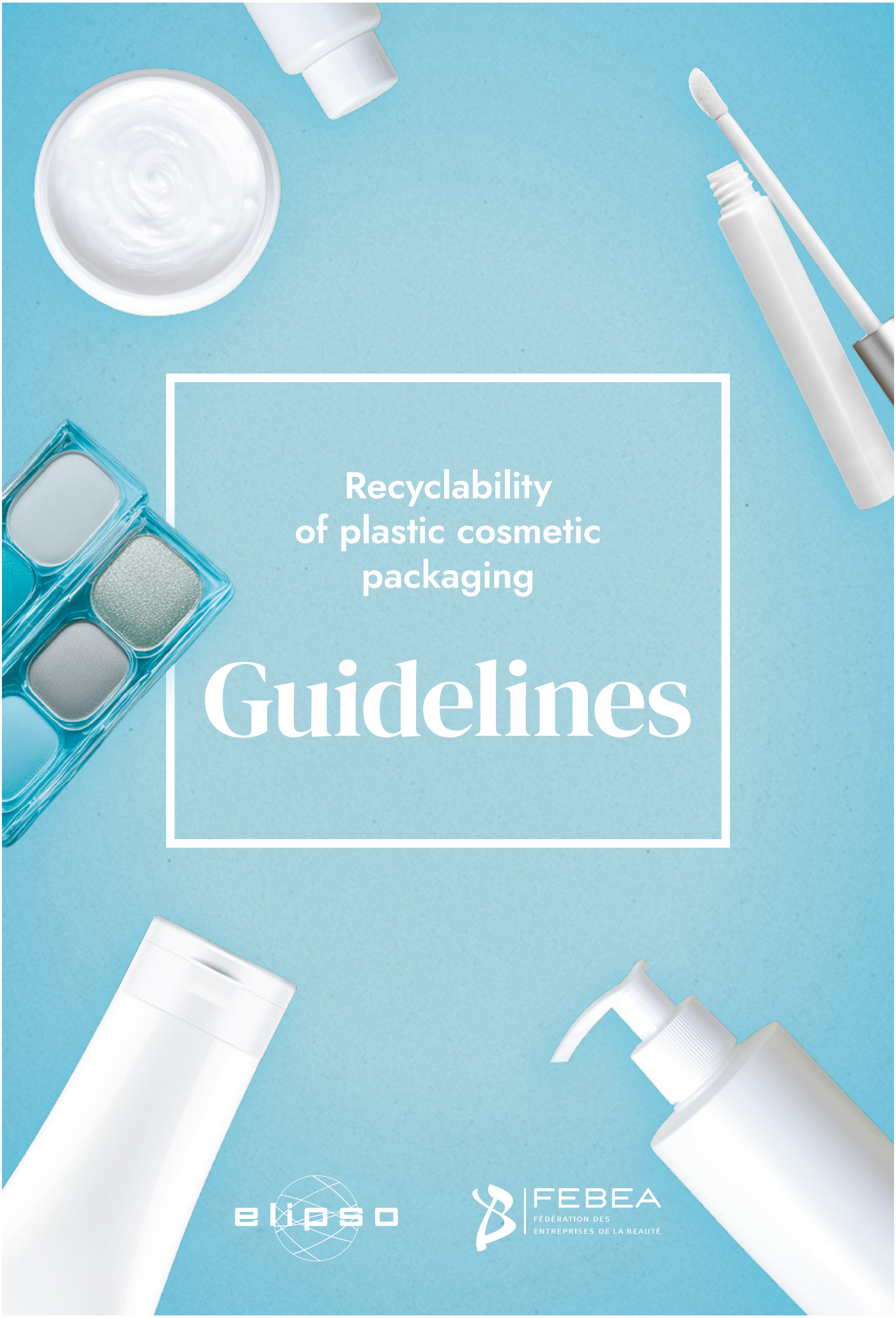

Recyclability of plastic cosmetic packaging

Guidelines

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Acknowledgements

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List of FEBEA-ELIPSO participants

ALBEA	GUINOT
ALPOL	HERMES PARFUMS
APTAR	INCC PARFUMS
BERDOUES PARFUMS ET COSMETIQUES	INTERPARFUMS
BIOLOGIQUE RECHERCHE	KENVUE - JONHSON & JONHSON
CARTIER PARFUMS	EXPANSCIENCE LABORATORIES
CHANEL	LA BROSSE ET DUPONT
CLARINS	LA PHOCEENNE DE COSMETIQUE
COTY	LVMH RECHERCHE
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EUROFINS ATS	NAOS
FAIVELEYTECH	NOVAMEX
FAREVA CARE	NUXE
FRANCELAB	PUIG
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Introduction

In a complex context that is constantly evolving in terms of packaging recyclability criteria, ELIPSO and FEBEA have produced this guide to provide an overview of the current situation. It identifies the key challenges and potential levers for improving the recyclability of household plastic packaging specific to the cosmetics sector.

The aim of this guide is not to offer "turnkey" solutions for cosmetics packaging, given the requirements and positioning of each brand, but rather to clarify the situation by analysing the packaging identified as non-recyclable and to guide companies towards improved recyclability.

It deals specifically with eco-design approaches for improving the recyclability of cosmetic packaging intended for consumers (i.e. those covered by the Extended Producer Responsibility (EPR) scheme for household packaging in France), **based on a regulatory overview and available standards.**

To qualify as recyclable, packaging must, for the most part, be collected, sorted and then regenerated. These three stages are inseparable when it comes to assessing the recyclability of packaging. Criteria that are not specific to cosmetic packaging and for which no rules have yet been defined may be mentioned as points where vigilance is required, without being dealt with in particular detail (e.g. small packaging, rolling and compact packaging, etc.).

In view of the existing recycling technologies, this guide only covers the criteria for mechanical recycling of packaging. The various chemical recycling methods that exist or are being developed do not currently allow us to make standardised recommendations for this type of recycling, but these technologies are already considered in certain standards.

The packaging studied in this guide is **household plastic packaging.** For packaging made from glass, aluminium or any other material also used in cosmetics, please contact the federations, technical committees or other bodies that deal with these materials.

The ELIPSO and FEBEA editorial team would like to thank all those involved in the production of this document, each type of packaging having been selected and worked on in consultation with packaging manufacturers and producers in the sector.

March 2025

Context

Today, France and Europe are working to encourage all players to design products that are part of a circular economy. Recyclability is one of the criteria in this eco-design approach, alongside reduction, re-use and the integration of recycled materials[1]. However, when it comes to assessing the recyclability of packaging on a European, or even international, scale, the rules are not always clear and can even be at odds with each other.

Challenges & Objectives

Without waiting for the harmonised rules planned at European level by the future Packaging & Packaging Waste Regulation (PPWR), the cosmetics plastic packaging value chain has deemed it necessary to formalise the latest developments in this complex subject area.

The ELIPSO/FEBEA working group was set up following discussions during the Cosmetics Mediation process, which began in January 2023 and aimed to resolve, with the public authorities, certain issues in the sector arising between packaging manufacturers and cosmetics prime manufacturers. The two organisations felt that it would be interesting, as an extension of this Mediation and in the context of French (Anti-waste law for a circular economy, known as the AGEC law, Climate and resilience law) and European (PPWR) regulations, to draw up joint sectoral recommendations on the conditions for producing recyclable cosmetic plastic packaging.

These recommendations are intended to serve as guidelines for public authorities, as an industrial vision of the recyclability aspect of the eco-design of plastic cosmetic packaging.

The purpose of this guide is:

- to help inform eco-design choices for plastic cosmetic packaging by providing a clear understanding of the issues and general principles of recycling, which are common to all standards (France, Europe, International);
- to identify levers for action, through joint development between packaging manufacturers and producers, for six of the most characteristic categories of plastic cosmetic packaging:

- Tubes
- Compact cases, makeup palettes and powder dispensers
- Sticks (deodorant and lipstick)
- Pumps
- Jars
- Dip-ins (mascara, lip gloss, etc.)

[1] To work on the integration of recycled materials in the cosmetics sector, you can consult the ELIPSO-FEBEA 2024 guide dedicated to the subject. Its aim is to provide the keys and best practices to encourage the use of recycled materials in packaging for cosmetic applications.
The guide can be downloaded from the federations' websites:
https://www.elipso.org/publications/guide-incorporation-plastiques-recycles-emballages-cosmetiques-europe/
https://www.febea.fr/etudes-et-rapports/guide-incorporation-plastiques-recycles-emballages-cosmetiques-elipso-febea

Tubes

Sticks
(deodorant & lipstick)

Pumps
(airless & atmospheric)

6 types of packaging

Jars

Dip-ins
(mascaras, lip gloss, etc.)

Compact cases, makeup palettes and powder dispensers

Contents

1

Recyclability: State of the art

1 Recyclability: State of the art

1 Regulations to consider

Recyclability and the rules governing recycling have accelerated in recent years, as a result of a collective awareness of the depletion of resources and the environmental impact of each and every one of us. Governments and industries are gradually developing recycling and the regulations governing these activities are being tightened.

At the time of writing, regulations on recyclability were evolving around the world. The information given below is therefore only valid at the date of publication. Consequently, this guide is only only a temporary reference to indicate the current regulatory bases, pending in particular the formalisation of the delegated acts of the European Packaging and Packaging Waste Regulation (PPWR), which should propose harmonised and operationally applicable criteria for assessing the recyclability of packaging at EU level. **We recommend that you check the current regulations in force at the time you read this document** (published in December 2024 in french and translated in March 2025).

A In France

In France, two laws, the AGEC Law (Law no. 2020-105 of 10 February 2020 on the fight against waste and the circular economy) **and the Climate and Resilience Act** (Law no. 2021-1104 of 22 August 2021 on combating climate imbalance and strengthening resilience to its effects) **have introduced new obligations to transform the linear economy (produce, consume, dispose) into a circular economy. This has a major impact on plastic packaging and its end-of-life, including recycling.**

FOUR KEY TEXTS for packaging are analysed below:

- **Decree 3R - Decree no. 2021-517 of 29 April 2021 (Article 7 of the Agec law):** Setting 3R targets including recycling for the period 2021-2025
- **EQC Decree (Environmental Qualities and Characteristics) no. 2022-748 of 29 April 2022 (Article 13-I of the Agec law):** Obligation to inform consumers about the level of recyclability of packaging, to be phased in from 1 January 2023
- **Article 23 of the Climate & Resilience Act** Ban on non-recyclable styrenic packaging from 1 January 2025
- **Article 61 of the Agec law, amending Article L. 541-9 of the Environmental Code:** All packaging must be incorporated into a recycling process by 1 January 2030

1 3R Decree - Decree no. 2021-517 of 29 April 2021

One of the main objectives of the Agec law is to move away from single-use plastics, with a particular focus on ending the sale of single-use plastic packaging by 2040. To achieve this, reduction, reuse and recycling targets have been set by decree. These targets are planned over four 5-year periods in order to gradually rethink the use of single-use plastics.

The 3R decree defines three objectives for the period 2021-2025. The decree applies to all packaging, whether it is considered household or not, with consequences for all materials:

- A target of a 20% reduction in single-use plastic packaging by the end of 2025 compared with the 2018 baseline, at least half of which will be achieved through reuse and recycling
- An objective to aim for a 100% reduction of 'unnecessary'[2] single-use plastic packaging, such as plastic blister packs around batteries and light bulbs, and toys, by the end of 2025
- **A target of 100% recycling of single-use plastic packaging by 1 January 2025** and, to achieve this, a target for single-use plastic packaging placed on the market to be recyclable, to not disrupt existing sorting or recycling chains, and to not contain any substances or inseparable elements likely to limit the use of the recycled material.

To help achieve this recycling target, product manufacturers must encourage the inclusion of recycled material in plastic packaging wherever possible, to support the development of recycling streams and increase their outlets.

2 Decree no. 2022-748 of 29 April 2022 on consumer information on the environmental qualities and characteristics of waste-generating products (EQC)

Article 13-I of the Agec law requires producers to provide consumers with regulated information on the environmental qualities and characteristics of waste-generating products, particularly packaging:

- The incorporation of recycled material
- Recyclability
- Opportunities for re-use
- Compostability (for certain types of packaging only).

Decree no. 2022-748 of 29 April 2022 specifies the claims to be used to inform consumers about these qualities and characteristics electronically by means of a document entitled "product sheet relating to environmental qualities and characteristics", available on the product page or a dedicated website. These documents will be phased in from 1 January 2023, based on annual sales and units sold per year in France for the products in question.

This decree sets out a definition of recyclability based on the following 5 criteria:

1. The ability to be collected efficiently throughout the local area, by ensuring that people have access to local collection points;
2. The ability to be sorted, i.e. directed towards recycling streams for recycling;
3. The absence of elements or substances that interfere with or disrupt sorting and recycling or limit the use of recycled material;
4. The ability of recycling processes to recover more than 50% by mass of the waste collected;
5. The ability to be recycled on an industrial scale and in practice, in particular by guaranteeing that the quality of the recycled material obtained is sufficient to guarantee the sustainability of outlets over the long term, and that the recycling sector can demonstrate its ability to handle products that may be integrated into it.

Information on recyclability is communicated to the producer by the producer responsability organisation (PRO). This information is generated by software made available to producers, a tool for calculating product recyclability based on the 5 criteria. This system aims to standardise the assessment of recyclability and provide consumers with clear, reliable information while drawing on the expertise of the PROs to ensure that the assessments are relevant and up-to-date.

If the recycled material produced by the selected recycling processes represents more than 95% by mass of the waste collected, the information made available may include the words *"fully recyclable packaging"*.

"When the ability to be recycled corresponds to the recycling of materials that are mostly reincorporated into products of an equivalent nature that fulfil an identical use and purpose without functional loss of the material, the producer may supplement the information on recyclability with the words "packaging that can be recycled into packaging of the same type".

[2] Unnecessary packaging is defined as packaging that has no essential technical function, such as protection, health and product integrity, transport or regulatory information

Please note that packaging is now considered recyclable[3] from 50% onwards (i.e. the recycled material produced represents more than 50% by mass of the waste collected). **It should be noted that the future PPWR regulation would set this threshold at 70% in 2030 and 80% in 2038. The methods for calculating these percentages will be specified in future delegated acts.**

3 Styrenics: Article 23 of the Climate & Resilience Act

Article 23 of the Climate and Resilience Act states that *"**From 1 January 2025,** packaging made wholly or partly of polymers or styrenic copolymers that cannot be recycled and are unable to be integrated into a recycling stream will be banned".*

Due to the inconsistency with the PPWR, the 1 January 2025 deadline has been called into question by means of a notice published in the JORF (Journal Officiel de la République Francaise) on 28 September 2024: it is indicated that: "The application, from 1 January 2025, of the penultimate paragraph of III of article *L. 541-15-10 of the Environment Code entails a risk of conflict with the future European regulation. **[PPWR].** Therefore, for the purposes of this provision of the Environmental Code, packaging made wholly or partly of styrenic polymers or copolymers that cannot be recycled and cannot be integrated into a recycling stream is defined as packaging that does not fall into recyclability performance classes A, B or C as set out in Article 6 of the draft regulation."*

This confirms that the ban imposed by article 23 of the "Climate and Resilience" Law will not apply from 1 January 2025.

We now have to wait for the publication of this future regulation, which stipulates that "the assessment of recyclability shall be based on design criteria with a view to recycling and a methodology defined by delegated acts of the European Commission". In drawing up these delegated acts, the Commission will take account of "the standards established by the European standardisation organisations in this field".

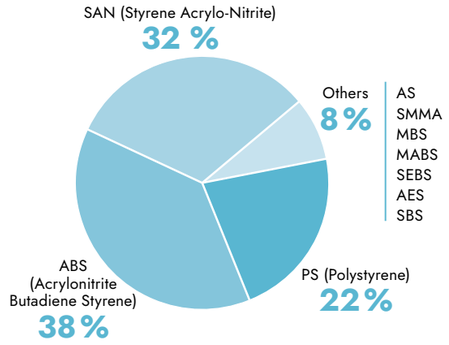
Given how frequently styrenic polymers are used in certain categories of packaging, this ban has had a major impact on packaging choices, which will be analysed in detail in the second part of this guide.

Among styrenic materials, a distinction should be made between PS, XPS and EPS resins, for which recycling streams already exist or are under study, and resins more specific to the cosmetics sector, such as ABS, ASA and SAN.

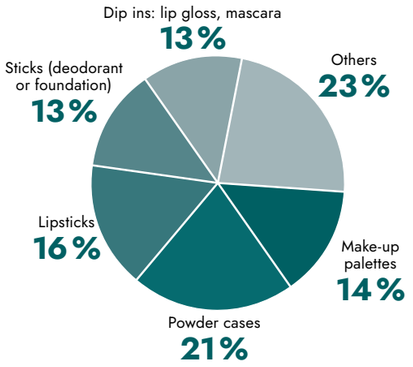
In 2022, tonnages of ABS, SAN and ASA represented 0.8 million tonnes out of 43.7 million tonnes of fossil-based plastics produced worldwide, according to Plastics Europe *(The Circular Economy for Plastics - A European analysis - 2024).* **In cosmetics, these ABS- and SAN-type styrenics are used in particular for make-up packaging.**

[3] producer responsability organisation

Figure 1: Breakdown of materials and products affected by the ban on styrenics



ABS and SAN account for almost 70% of styrenic materials used in cosmetic products



77% of the products concerned are make-up

Source: Survey of FEBEA members carried out between 19 April and 7 May 2024 (40 responses) on styrenics

ABS and SAN represent a tiny proportion of the resins used in packaging, so it would be both technically and operationally very complex to create a dedicated recycling stream. Furthermore, even if recycled ABS or recycled SAN were available on the market, it is unlikely that this material could be used for cosmetic packaging, given the specific requirements of the sector.

ABS does not come exclusively from the packaging sector, but mainly from electronic waste.

As a result, substances such as brominated flame retardants from electronic equipment can interfere with recycling.

ABS and SAN are classified in red in the COTREP (Technical Committee for the Recycling of Household Plastics Packaging in France) guidelines in 2023, i.e. considered incompatible and disruptive to PS recycling: so not recyclable: https://www.cotrep.fr/etapes/pots-et-barquettes/pb-ps/

DEFINITIONS

Main material: the main material is a material that is part of the composition of the packaging and represents more than 50% of the total weight: the packaging belongs to the "X" family if it is made up of more than 50% by weight of material "X" (the 50% threshold was chosen by Citéo in its methodology for calculating recyclability). The weight of all packaging elements (main and associated) is taken into account in this calculation.

Predominant material (introduced in article 6 of the PPWR)**:** the predominant material is a material that is part of the composition of the packaging and represents the highest % weight of the packaging (no 50% threshold). It is not necessarily the main material.

Packaging unit (PPWR definition): a unit, including any integrated or separate components, which as a whole serves a packaging function, such as the containment, protection, handling, delivery, storage, transport or presentation of products, and includes independent units of grouped or transport packaging where they are discarded prior to the point of sale.

A component is an element of the packaging unit.

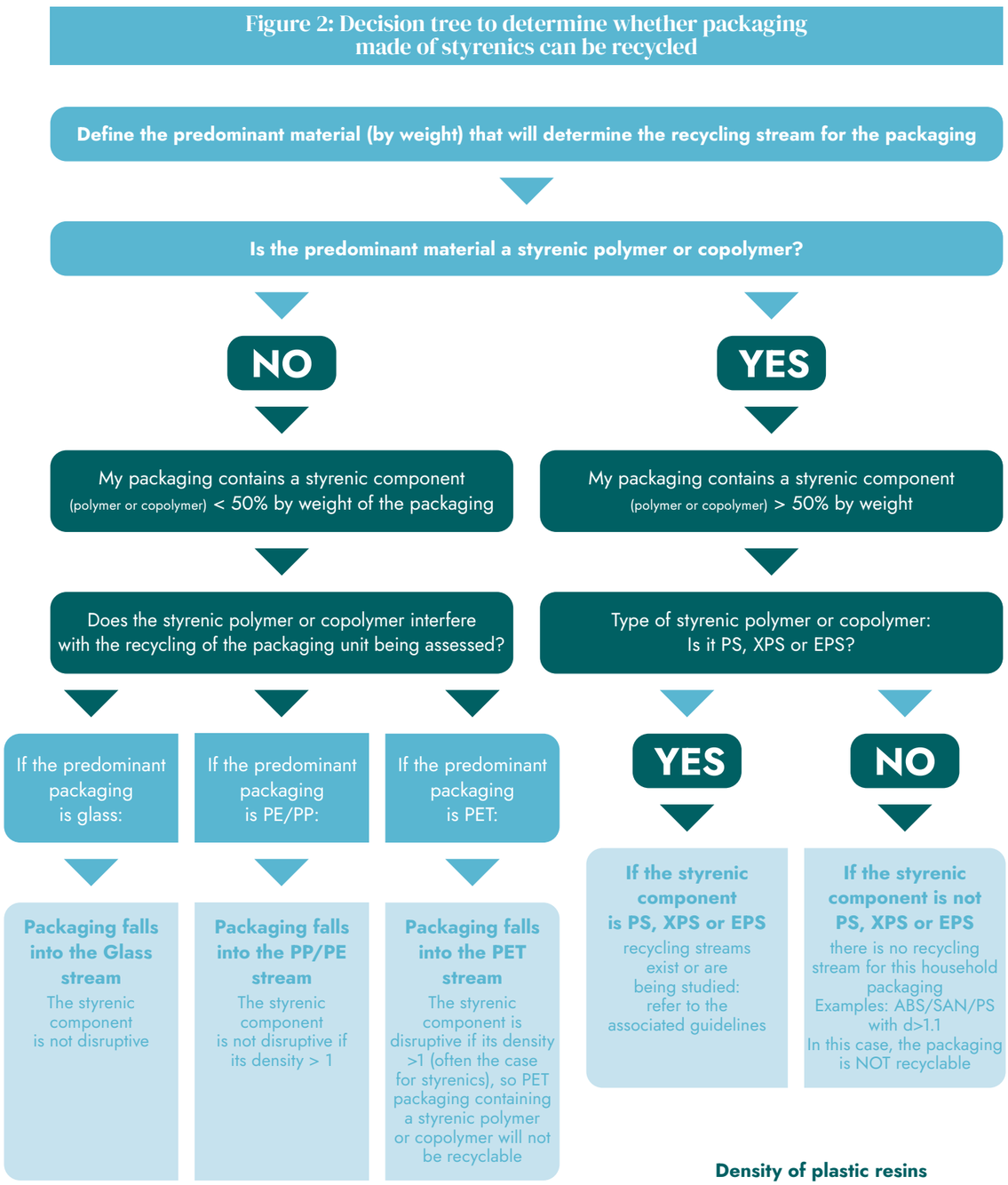
A distinction is made between an integrated component and a separate component according to PPWR definitions:

"integrated component": a packaging component, whether or not of the same material as, or distinct from, the main body of the packaging unit, that is integral to the packaging unit and its functioning, that does not need to be separated from the main body of the packaging unit in order to ensure the functionality of the packaging unit and that is typically discarded at the same time as the main body of the packaging unit, although not necessarily via the same disposal route;

"separate component": a packaging component, whether or not from the same material as the main body of the packaging unit, that is distinct from the main body of the packaging unit, that needs to be disassembled completely and permanently from the main body of the packaging unit and that is typically discarded prior to and separately from the main body of the packaging unit, including packaging components that can be separated from each other simply through mechanical stress during transportation or sorting;

A constituent corresponds to the materials that make up the packaging unit.

Figure 2: Decision tree to determine whether packaging made of styrenics can be recycled



When the packaging contains a styrenic polymer or copolymer in a quantity of less than 50% by weight, it is essential to check that this component does not interfere with the recycling of the predominant component of the packaging if it remains associated with it. It is possible to refer to the density of the components for this check: if the styrenic polymer or copolymer has a different density which allows it to be separated and removed during the sorting and washing stages and therefore does not disrupt the recycled flows, it should not be considered as disruptive.

Density of plastic resins

EPS: 0.04
PP: 0.9
LDPE: 0.92
HDPE: 0.94
I: limit of buoyancy in water
PS: 1.05
PLA: 1.24
PET: 1.34
PVC: 1.34 - 1.40

4 | Article 61 of the Agec law, amending Article L. 541-9 of the Environmental Code:

This article states that by no later than 1 January 2030, producers, product manufacturers or importers who are **responsible for placing at least 10,000 units of products on the market per year and with a turnover of more than €10 million will have to justify that the waste generated by the products they manufacture, place on the market or import are able to be recycled.** This obligation does not apply to packaging that cannot be recycled for technical reasons, including by modifying its design.

In this case, the producers, manufacturers or importers of these products must justify this impossibility and are obliged to reassess the possibility of redesigning the products concerned every five years with a view to them being integrated into a recycling stream.

A decree by the Council of State is to define the conditions of application and penalties for producers, manufacturers and importers whose products cannot be integrated into any recycling stream and who are unable to demonstrate that it is impossible to integrate their products into a recycling stream of this kind.

FOCUS ON SOME KEY STANDARDS

Several standards have been developed to govern the recyclability of packaging:

- NF EN 13193 Packaging (2000)
  Packaging and the environment - Terminology: Definition of terms used in the field of packaging and the environment
- NF EN 13430 Packaging (2000 - revised in 2004)
  Requirements for packaging recoverable by material recycling
- NF EN 13440 Packaging (2003)
  Recycling rate - Definition and calculation method for recycling packaging and packaging materials
- FD CEN/TS 13688 Packaging (2008)
  Material recycling - Report on requirements for substances and materials designed to avoid any lasting barriers to recycling

These standards are designed to meet the needs of the market. They can support the application of technical regulations and guide companies in their efforts to achieve compliance.

B | In Europe

The revision and transformation of directive 94/62/EC on packaging and packaging waste (PPWD) into a regulation aims to combat the constant increase in waste, harmonise the rules of the European internal market, encourage the circular economy and achieve climate neutrality by 2050. The Packaging and Packaging Waste Regulation (PPWR) was published in the Official Journal of the European Union (OJEU) on 22 January 2025, for entry into force on February 11, 2025 and application from August 12, 2026.

The aim is to strengthen the essential requirements relating to packaging in order to minimise it, guarantee its reuse and recycling, stimulate the adoption of recycled content and improve marking requirements. Measures are also planned to combat over-packaging and reduce packaging waste.

The PPWR Regulation stipulates that all packaging placed on the market must be designed to be compatible with recycling streams by 1 January 2030 (so that it can be recycled in one of the recognised recycling streams on an industrial scale).

Two deadlines will have an impact on plastic packaging:

- **Design for recycling criteria on 1 January 2030:** *"Packaging is considered recyclable if it is designed for material recycling, which enables the use of resulting secondary raw materials that are of sufficient quality when compared to the original material that they can be used to substitute primary raw materials"*. To this end, design criteria for recycling and recycling performance classes (A ≥95%, B ≥80% and C ≥70%) will be defined in delegated acts planned for no later than 1 January 2028. These delegated acts will be based on the work of the European Committee for Standardization (CEN), which is currently being drawn up.

Packaging that does not fall into classes A, B or C will be banned from the market by 1 January 2030 at the latest, and from classes A or B in 2038.

- **Scalable recyclability at 1 January 2035:** *"Packaging is considered recyclable if, when it becomes waste, it can be collected separately, sorted into specific waste streams without affecting the recyclability of other waste streams and recycled at scale, (i.e. guaranteeing an annual quantity of recycled material equal to or greater than 30% for wood and 55% for all other materials)"*. The method for assessing recycling at scale will be defined by an implementing act drawn up by 1 January 2030 at the latest.

Summary of PPWR recyclability obligations

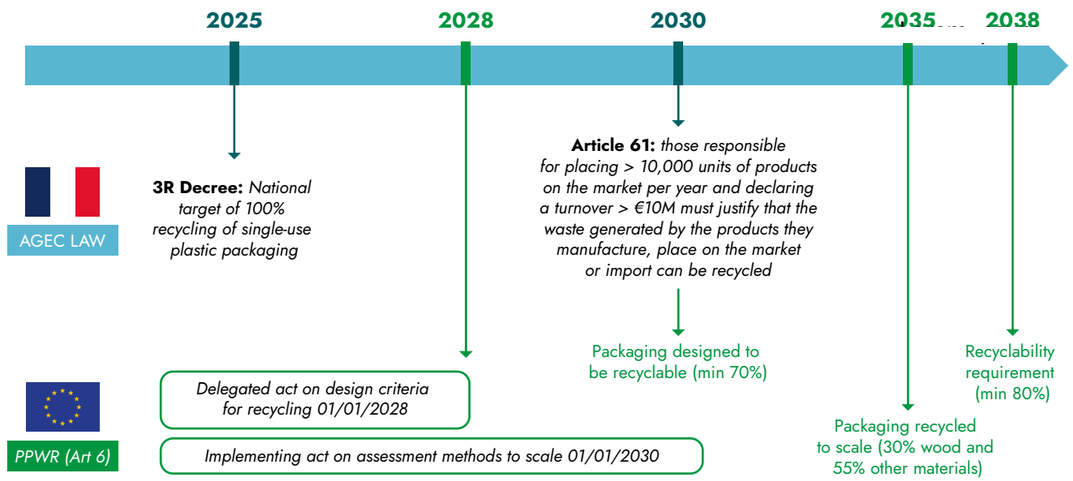
Recyclability rate*	2030	2035	2038
Grade A ≥ 95%	OK	OK if to scale	OK if to scale
Grade B ≥ 80%	OK	OK if to scale	OK if to scale
Grade C ≥ 70%	OK	OK if to scale	NOK
< 70%	NOK	NOK	NOK

* the methods for calculating the rate will be defined in the delegated acts, per unit of packaging, in terms of weight

As in France, packaging regulations have also been published in other European countries in anticipation of the revision of Directive 94/62/EC. This is particularly the case for **Spain** with Royal Decree 1055/2022 on packaging and packaging waste, which sets various targets for the reduction, reuse, collection and recycling of packaging and packaging waste placed on the Spanish market.

In the United Kingdom, a draft regulation is being drafted with obligations on recyclability. Once this project has been approved, the producers concerned will have to carry out an assessment of the recyclability of all the primary packaging and shipping packaging they supply. From 1 April 2027, designated producers will also have to ensure that this packaging complies with the stipulated requirements in terms of recycling labelling.

French and European regulatory deadlines for recyclability



C | Internationally

To date, there is no universal definition of recyclability at the packaging level and no regulatory texts to define it. At international level, a number of countries are also carrying out initiatives on recyclability.

In China, work is underway (via CPRRA - China Plastics Reuse and Recycling Association https://en.cprra.org.cn/) to develop recyclability rules. It is not yet certain whether this work gives rise to a legal obligation.

In California, the law SB 54 signed in June 2022, requires that all packaging in the state be recyclable or compostable by 2032, that plastic packaging be reduced by 25% in 10 years, and that 65% of all single-use plastic packaging be recycled within the same timeframe. SB 54 is the most significant reform of plastics and packaging recycling policy in California's history. It goes further than any other state in reducing plastic production at source and continues to develop the circular economy needed to combat climate change.

The **International Treaty** on plastic pollution, currently under negotiation, represents a major step forward in the fight against this global environmental problem. It aims to establish binding measures covering the entire life cycle of plastics, with an ambitious target of eliminating plastic pollution by 2040 and restricting the production of primary plastics.

The fifth and final session of the Intergovernmental Negotiating Committee (INC-5) will be held in Busan, South Korea, from 25 November to 1 December 2024. The negotiators will have to address key issues, including the scope of the agreement, potential binding measures (possible reductions or even bans on substances of concern and problematic and avoidable plastics) and the necessary financial resources. The aim is to reach a final agreement at this session, to be signed at a diplomatic conference in the first half of 2025.

In summary, the available regulations currently in force in each EU Member State should be modified by the PPWR and will become more precise over the coming years. At international level, draft regulations along the same lines are also being drawn up and will need to be analysed carefully. **It is therefore necessary to distinguish between the time scale and the geographical scope, which are not currently harmonised.**

2 Recyclability: sector definitions and infrastructures to scale

There are various guidelines, standards and laws that govern and encourage the recyclability of packaging. As these various texts generally do not allow for the fully operational assessment of recyclability on a packaging scale, it is necessary to turn to non-harmonised private standards and guidelines.

Recycling can theoretically be defined as all the recovery operations by which waste is reprocessed into products, materials or substances for its original function or for other purposes. Energy recovery, conversion for use as fuel or for backfilling operations are excluded[4].

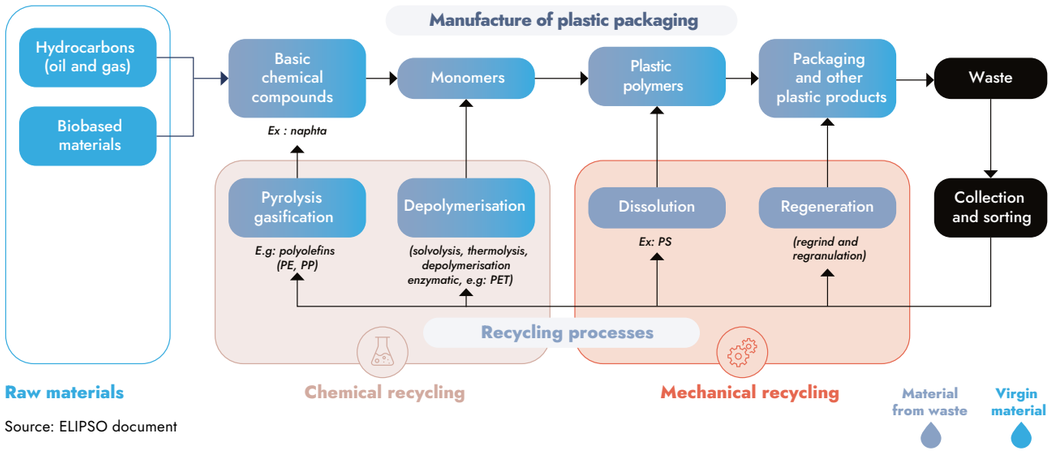
To achieve this, regardless of the type of recycling technology applied, the packaging must pass through 3 successive stages before the recycled raw materials resulting from the process can be used by converters:

- **Collection**
- **Sorting**
- **Regeneration**

Plastics can be recycled in two ways:

- **Mechanical recycling** which includes all the processes used to recover material without altering the chemical structure of the waste. It involves grinding, cleaning and decontaminating plastic resins to reduce contamination resulting from their previous use below a threshold that does not present a risk for the intended use. To date, only mechanical recycling is taken into account in the objectives of the Agec law and the PPWR.
- **Chemical recycling** or "advanced" recycling, which includes all the technologies used to recover materials and substances by modifying the chemical structure of the waste. The substances obtained in this way can be used to produce new polymers, whose properties can be comparable to those of virgin materials. **They can also be used to manufacture other chemical products.** (Mass Balance allocation method currently being defined as part of the Single Use Plastics Directive - SUPD).

Figure 3: Mechanical and chemical recycling stages



Source: ELIPSO document

[4] Definition of directive 2008/98/EC on waste and the French Environment Code

FOCUS ON CHEMICAL RECYCLING

The development of new chemical recycling technologies will lead to changes in standards and guidelines, and certain packaging resins will be able to be recycled using these technologies. One of the key points to be clarified is the way in which the quantities recycled can be accounted for in order to calculate the associated recycling rates.

There is as yet no standardised methodology approved at European level for accurately quantifying the recycled plastic content resulting from chemical recycling. The mass balance approach is at the heart of the discussions to enable the recycled content to be allocated to the final products depending on the inputs in the chemical recycling process.

This guide exclusively covers the criteria for mechanical recycling of packaging. Existing chemical recycling methods, or those currently being developed, do not yet allow standardised recommendations to be made.

A Latest developments: general principles

In practice, packaging is recyclable if there is a nationwide industrial system in place to ensure that it can be effectively **collected, sorted** in dedicated units and **recycled by regenerators** so that the material can be used in a new cycle to replace virgin materials: recycling cannot be sustainable without a downstream market. This recycled material can be used again in packaging or in other plastic products, keeping the material as circular as possible.

At present, the regulatory texts do not provide a precise definition to validate the recognition of a recycling stream to scale. However, the Packaging and Packaging Waste Regulation (PPWR) does address this issue, notably in Article 6. The following definition is proposed: *"packaging waste which is collected separately, sorted and recycled in installed infrastructure, using established processes proven in an operational environment which ensure, at Union level, an annual quantity of recycled material under each packaging category listed in Table 2 of Annex II equal to or greater than 30 % for wood and 55 % for all other materials; it includes packaging waste that is exported from the Union for the purpose of waste management and which can be considered to meet the requirements of Article 53(11)".*

While we await an official definition, some organisations are proposing criteria for establishing the basic principles of a scaled recycling system. The framework developed by the Ellen MacArthur Foundation is a notable reference in this field (see box p 20).

This guide focuses specifically on household consumer packaging. Consequently, the criteria are examined on the basis of the amount collected from households. However, it **is important to emphasise that other collection methods can also enable collection and sorting on a large scale,** particularly for other types of packaging and associated streams, managed through Extended Producer Responsibility (EPR) schemes. One example is the EPR for Professional Packaging (PP), scheduled to come into force in France in January 2025.

This differentiated approach based on packaging type and collection method highlights the need for an in-depth and specific analysis for each recycling stream, taking into account the particularities of each waste stream and existing infrastructure.

Approach proposed by the Ellen McArthur Foundation (EMF)

This framework set out in the NEW PLASTICS ECONOMY GLOBAL COMMITMENT of February 2020 offers a global and systemic approach to the circular economy of plastics, taking into account the entire value chain, from the packaging design right through to the end-of-life. It establishes clear and measurable criteria for assessing recyclability, including not only the technical aspects of recycling, but also the existing collection and sorting infrastructures, as well as the economic outlets for recycled materials. This holistic approach helps to identify the obstacles and opportunities specific to each territory, while providing a common language and shared objectives for industry players, governments and non-governmental organisations, thereby facilitating collaboration and the harmonisation of efforts on an international scale. The conceptual framework thus established proposes a hierarchical approach to packaging management, focusing on the circularity of materials. This approach stipulates that packaging design must, as a matter of priority, incorporate its recyclability, through mechanical or chemical processes. In certain specific and limited cases, composting can be considered as an alternative, but should not be seen as a universal solution.

Definitions are provided to clarify certain concepts related to recycling:

"**at scale**" means that the evidence must go beyond a laboratory trial, a pilot project or a single small region. The recycling of a certain type of packaging must be proven in practice in several regions, collectively representing a significant geographical area in terms of population, ideally across different archetypes of countries and cities/towns. This indicates that the recycling in practice is reproducible and that the design of the packaging is not an obstacle to recycling being put into practice in other countries.

"**In practice**" means that in each of these regions, the recycling system (end-to-end system, from consumer to recycled material) effectively recycles a significant proportion of all packaging of this type placed on the market.

In other words, in this region, a significant recycling rate is achieved for this type of packaging.

This framework uses a threshold of 95% to define the recyclability of packaging: "**a packaging item can be considered recyclable if its main packaging components, together representing >95% of the total weight of the packaging, are recyclable according to the above definition, and if the remaining minor components are compatible with the recycling process and do not hinder the recyclability of the main components.** Otherwise, only the recyclable components of a packaging [...] can be taken into account to meet this commitment, and only if the other components do not hinder or contaminate their recyclability."

In concrete terms, packaging is considered to be recyclable "at scale" and "in practice" if a rate of 30% recycling of post-consumer packaging is achieved, in several regions that collectively represent at least 400 million inhabitants. A possible alternative for specific areas is to measure a 30% recycling rate in all areas where the packaging is sold.

The effectiveness of packaging collection is also taken into account when assessing recyclability: the same type of packaging may be considered recyclable in an industrial scheme if a dedicated collection system exists (e.g. film around pallets), whereas it may be considered non-recyclable as household packaging if it is not properly collected (e.g. film around a consumer product).

The Ellen MacArthur Foundation's "New Plastics Economy Global Commitment" has been criticised in particular for the increased use of virgin plastic among its signatories, and for the emphasis on recycling compared with solutions for reuse. Despite these criticisms, the Global Commitment remains essential because it mobilises over 1,000 organisations around a common vision and provides a common language and shared objectives that facilitate large-scale coordinated action to combat plastic pollution.

B | Latest infrastructural developments in France

Each country has its own recycling infrastructure and streams, and there is no universal model. The French model, with its collection, sorting and recycling infrastructure, is described here.

With the extension of sorting instructions, launched in 2015 and rolled out nationwide by 2022, the French can now dispose of all their packaging, whatever the material, in the packaging waste collection receptacles (yellow bin), with the exception of glass (glass bin). In this way, collection is encouraged with a view to developing the recycling of plastic packaging waste collection receptacles: certain flexible plastics, certain trays, etc.

The detailed conditions for a collection, sorting and industrial recycling system to be recognised as "to scale" are set out in the Citeo document Méthodologie d'évaluation de la recyclabilité des emballages ménagers (Methodology for assessing the recyclability of household packaging), the most recent version of this document dates from April 2024:

• Collection stage

Collection must be effective throughout the country to ensure sufficient capture of the flows to be recycled. It is effective if at least 90% of the population is served by a collection system, i.e. if there is one collection point for non-glass packaging for every 500 inhabitants in an urban area or 200 inhabitants in a rural area, for example.

• Sorting stage

Once the waste has been collected, it generally needs to be sorted.
Separate collection of household packaging ensures an initial level of quality in the waste to be treated, as it is not mixed with Residual Household Waste (RHW). This source, which contains a mixture of all types of household packaging (except glass), forms the basis for the sorting stage, which is essential to be able to deliver bales of sufficient quality to the regenerators.

In France, this sorting stage is carried out in two ways for household plastic packaging:

• **By the sorting centres,** which cover the whole of France and directly process the contents of the sorting bins (yellow bins). According to Citeo[5], 123 sorting centres were operational in France in 2023.

Packaging is sorted by material family and sent to one of the 6 existing regeneration facilities:

1. CLEAR PET bottles and containers
2. COLOURED AND WHITE OPAQUE PET bottles and containers
3. Rigid HDPE
4. Rigid PP
5. Other rigid CLEAR PET WITHOUT LID
6. PE films and laminates

Another stream, made up of a mixture of rigid plastics, will be sent to a "downstream sorting centre" for re-sorting. This flow is "in development". All other packaging that is not in this "Dev Stream" or that has left the sorting centres will be sent for disposal.

• **By downstream sorting centres,** dedicated to plastic packaging from the "in development" stream associated with the extension of sorting instructions. They can be used to sort the development stream into several fractions (PET trays, opaque PET, PS, etc.) for recycling. Three downstream sorting plants were set up in France under the auspices of Citeo between 2023 and 2024.

- Épinal (25,000 t/year) operated by Suez Barisien, which opened in November 2023 and was inaugurated in June 2024
- Ruffey-lès-Beaune (30,000 t/year) operated by Bourgogne Recyclage (Côte-d'Or) was inaugurated in January 2024
- Mende (15,000 t/year) operated by Environnement Massif Central (EMC), scheduled for deployment by the end of 2024.

• Regeneration stage

The resulting streams are sent to plastic resin regenerators. In order for the recycled tonnes to be recognised and for recycling to be shown to be "to scale", regenerators must be able to guarantee that the recycling stream involved in this scheme meets the following conditions:

- Transparency regarding outlets, the number of tonnes recycled per year (presentation of a recycling certificate) and the storage time before recycling.
- The quality of the recycled material obtained is sufficient to guarantee long-term outlets.

[5] Source: Observatoire de la Qualité - 2023 Review

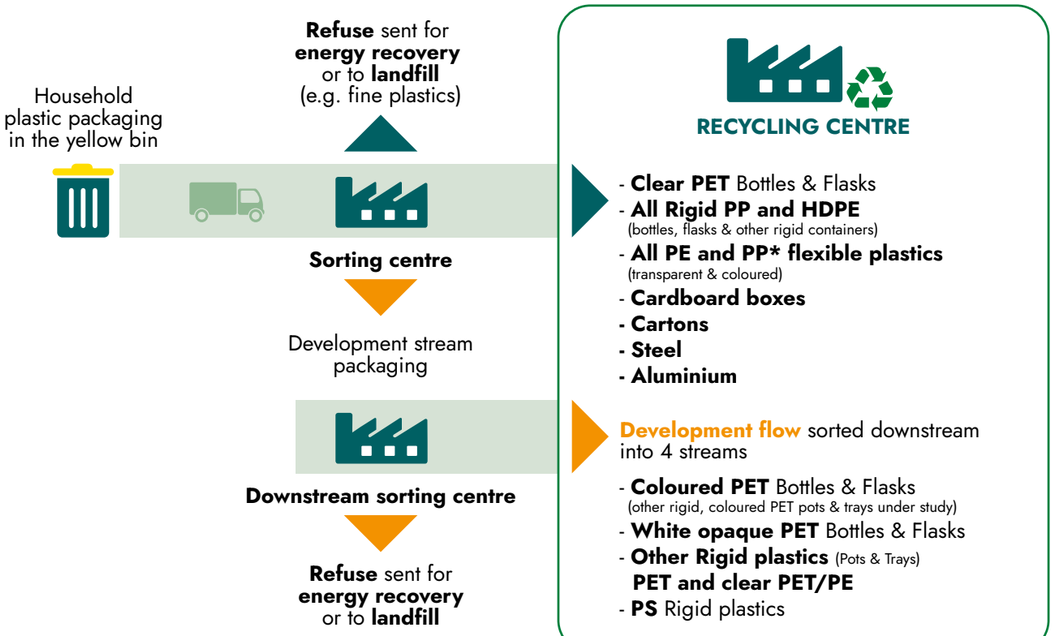
For developing stream:

On the basis of current R&D projects, they need to be able to define a recycling stream that exists in practice and on the scale required, i.e.:

- Concrete R&D projects aimed at collecting, sorting or isolating and recycling the majority of targeted packaging;
- The guarantee, for these projects, of obtaining a sufficient quality of recycled material to ensure the sustainability of outlets for household packaging;
- The recycling stream must be set up within 5 years of the "stream under development" status being granted.

For these developing streams, the PROs in charge of EPR for household packaging become direct operators. This means they own the waste from the downstream sorting centres in which they have invested (to treat rigid packaging for which the stream and processes are being developed), and have signed contracts with regenerators to ensure the processing of the types of packaging and resins targeted in these developing streams (see Appendix 1 for the new recyclers in the developing streams).

Figure 4: Stages in the collection, sorting and industrial recycling system in France



* The recycler will re-sort the flexible PE stream from the stream of flexible plastics, mainly made of PP, which has been added to the packaging for which recycling is being developed.

C | Other approaches in Europe

At present, the European Union does not have a harmonised approach to the collection and sorting of packaging waste. One of the main reasons for this is directly linked to product consumption, which differs from one country to another: polystyrene yoghurt pots, for example, are widely consumed by the French on a daily basis, whereas in other European countries, the use of styrene in packaging is lower, so its collection, sorting and recyclability have no real impact on the country's recycling rate.

Member States have adopted a variety of strategies, particularly with regard to the separation of material streams (for example, separate or joint collection of paper/cardboard and plastics). This diversity of collection methods has a significant impact on the composition of streams entering sorting centres.

As a result, the configuration and operation of sorting centres are strongly influenced by the selective collection methods used upstream. This interdependence between collection systems and sorting infrastructures is a key factor in optimising the recycling value chain.

Although this guide is not intended to provide an exhaustive inventory of the collection and sorting methods in use throughout Europe, it is essential to stress the close correlation between these two components of the waste management process. This direct relationship partly explains the variations observed in packaging recyclability criteria between the different European countries.

Disparities in sorting processes, resulting from different collection methods, can lead to the development of country-specific recyclability standards. These standards may therefore differ from the French model, reflecting the specific features of local waste management systems.

In addition, these infrastructures are also linked to financing, which is itself linked to the existence of mandatory EPR systems for household packaging in Europe, but which are based on management models that differ from one country to another. For more information on the EPR models that influence recyclability rules, please refer to appendix 2.

This heterogeneity highlights the need for a nuanced approach to assessing the recyclability of packaging on a European scale, taking into account the specific features of each Member State's collection and sorting infrastructure.

The Belgian FostPlus model, for example, differs from the French model. In Belgium, there are three sorting bins:

1. Glass
2. Paper and cardboard
3. PMC (plastic/metal/beverage cartons) in the blue bag

The sorting centre is organised in the basis of the collections. Everything thrown away in the blue bag is sorted and recycled at Belgian PMC plants, which have the appropriate infrastructure to sort and direct this stream.

3 Methods and tools for assessing recyclability at packaging level

It is important to distinguish between two complementary levels in assessing the recyclability of packaging.

- First level: at the level of the recycling streams (does the recycling stream for this material exist?)
- Second level: at the level of the packaging, which may or may not be able to integrate the recycling stream identified as being "to scale" (will this packaging be able to integrate the recycling stream?)

Once the collection and sorting system and the recycling stream have been identified, **the recyclability of the packaging must be assessed in the light of the stream for which it is intended.** Depending on the recycling stream, the applications for the recycled material and the associated recycling processes, the packaging components can have a different impact on the recycling stream.

Depending on the standards, the target stream for assessing the recyclability of a packaging item can be determined in two different ways:

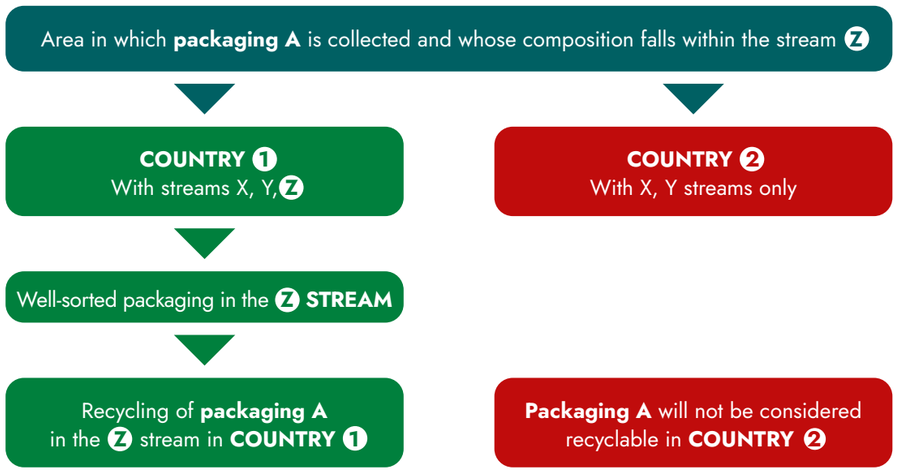
- By determining the main material of the packaging and ensuring that it is properly directed into the stream for the identified material.
- By carrying out practical tests in sorting centres (or on pilot lines) which will determine where the majority of the packaging to be assessed ends up.

Currently, there is no consensus on the methodology for ensuring that packaging is sorted into the main material stream. Standardisation work is underway to try and harmonise this methodology. In France, product manufacturers must use the standards of the PROs to which they belong, in line with the QCE (Consumer Information) decree.

However, irrespective of the standard and the geographical area in which the packaging is to be assessed (the area where the packaging will be disposed of by the consumer), the main principles that will feed into a standard are the same:

- **Existence of recycling streams**
- **Packaging collection capacity and traceability system to ensure that the tonnes collected are actually recycled** (e.g. SYDEREP data for France)

Figure 5: The same packaging waste: recyclable or not, depending on where it is collected



A | In France

In France, two producer responsability organisations (PRO) are approved by the Ministry for Ecological Transition to manage household packaging waste: Citeo (with its subsidiary Adelphe) and Leko. They are required to provide their members[6] with a recyclability assessment tool.

A-1 | Citeo reference system and TREE tool

Citeo has developed a method and a tool for analysing recyclability and determining the compatibility of each packaging component with the recycling stream being targeted. It is based on the regularly updated recyclability tables issued by the Comité Technique pour le Recyclage des Emballages Plastiques (COTREP).

COTREP is a centre of resources and expertise on the recyclability of household plastic packaging in France, bringing together the expertise of Citeo, Elipso, Valorplast and SRP. At the request of plastic manufacturers, designers, developers and manufacturers of plastic household packaging, COTREP tests and verifies their compatibility with sorting and recycling streams in France. All these tests and studies are available in the form of recommendations and technical notices which, for each recycling stream, allow packaging components to be categorised according to their compatibility with the recycling stream in question. For more information, visit the COTREP website: https://www.cotrep.fr/

The methodology proposed by Citeo consists of 6 steps, described below:

Step 1: Define the scope of the packaging to be assessed.

The recyclability analysis must be **carried out at the level of the packaging as it is sorted by the consumer, which is made up of all the household packaging elements that may remain associated during the sorting process after the product has been consumed.** The main component is often the packaging, which represents the majority of the packaging's weight (e.g. jar, tube, vial, bottle), and the associated components are those that are not separated at the collection or sorting stage and therefore arrive at the regenerator in the bales to be recycled (lid, labels, caps or pumps).

Step 2: Define the material family to which the packaging belongs

Once the perimeter has been defined, it is necessary to identify whether a material is present as a main material (i.e. more than 50% by weight in relation to the weight of the complete packaging).

Step 3: Check whether a collection, sorting and industrial recycling system exists for this packaging

Once the main material has been identified, determine whether it has a dedicated stream. For plastic packaging, the following flows exist or are being developed in France:

Existing streams and associated packaging categories

- Clear PET bottles & flasks
- Coloured PET bottles & flasks (including other rigid, coloured PET pots & trays)
- White opaque PET bottles & flasks
- Other rigid (pots & trays) unsealed clear PET
- Rigid PP and HDPE (bottles, flasks and other rigid containers such as pots or trays)
- PE flexible plastics

Streams in development

- Other rigid clear PET/PE (pots and trays)
- Other rigid clear PET with lid (pots and trays)
- PP and PP/PE flexible plastics
- Rigid PS

Work is underway with Citeo and COTREP on the coloured PET stream - Other Rigids - in relation to the introduction of new streams under development to adjust their orientation into the right streams.

[6] In accordance with decree no. 2022-748 of 29 April 2022 implementing article 13.1 of the AGEC law (anti-waste and circular economy) on the obligation to make available information on the environmental qualities and characteristics of products through QCE sheets

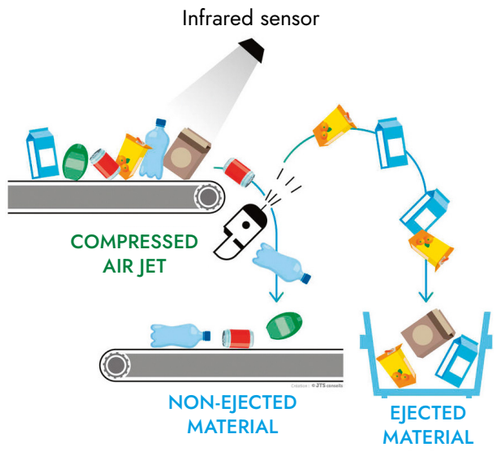
Step 4: Determine whether the packaging can be directed, in a sorting center (or other sorting facility), towards the recycling stream and integrate it.

4.1 Sortability

In assessing recyclability, the sortability of the packaging must also be evaluated to ensure that it is correctly directed into the target stream.

Sorting centres, PRO and Original Equipment Manufacturers (OEM) are working together to improve the correct detection of packaging and identify the criteria that can disrupt sorting. The COCET - Comité Technique d'Evaluation du Comportement en Centre de Tri - is made up of sorting operators and optical sorting manufacturers, and is used to advance studies on the behaviour of typical packaging in sorting centres by issuing opinions on, for example, the impact of metallic decoration on optical detection, the impact of aluminium elements on plastic packaging or the best approach to processing cardboard packaging when it is combined with other materials (plastic lamination, varnish, etc.). For more information on sorting centre technologies, visit the following interactive website: https://visite-centre-tri.citeo.com/

Figure 6: Optical sorting system



It is the return signal of the IR (Infra Red) spectrum sent that is analysed by the optical sorting machine sensor. The identified material is confirmed by comparison with the reference database.

Source: https://www.bordeauxmetropolevalorisation.fr/sites/g/files/dvc3536/files/styles/default/public/image/2023/03/schema_trieurs_optiques.jpg?itok=Z1slBjUs

4.2 Integration into the recycling stream

Once the packaging has been directed into the right stream, it is important to ensure that the components that make up the complete package do not interfere with the recycling process. They are classified into three categories on the basis of tests, knowledge and technical opinions drawn up by COTREP, whose recommendations incorporate work done by COCET:

FULL COMPATIBILITY - IDEAL	PARTIAL COMPATIBILITY - TOLERATED	LIMITED COMPATIBILITY - TO BE AVOIDED	INCOMPATIBLE AND/OR DISRUPTIVE

The light and dark green categories group together elements that do not currently pose a problem during the recycling process.

dark green is for the elements that are most compatible with the recycling of the stream identified.

light green is for the elements that are compatible insofar as COTREP considers that compatibility is controlled via the processes in the stream to be recycled.

The orange category features elements which do not prevent the packaging from being recycled, but which have a significant impact on recycling (impact on the quality of the material recycled, impact on the recycling yield, etc.).

The red category includes elements that compromise the overall recyclability of the packaging. If one of these elements is used in the packaging, the packaging is currently considered to be non-recyclable in France.

These lists are subject to change to take account of developments in sorting and recycling technologies.

Step 5: Calculate the recyclability rate of the packaging

The recyclability rate of a packaging item is defined as the maximum proportion of the packaging by weight that could actually be recycled, if sorted by the consumer. This rate depends on the composition of the packaging and its ability to be integrated into the collection, sorting and recycling system currently in place in France.

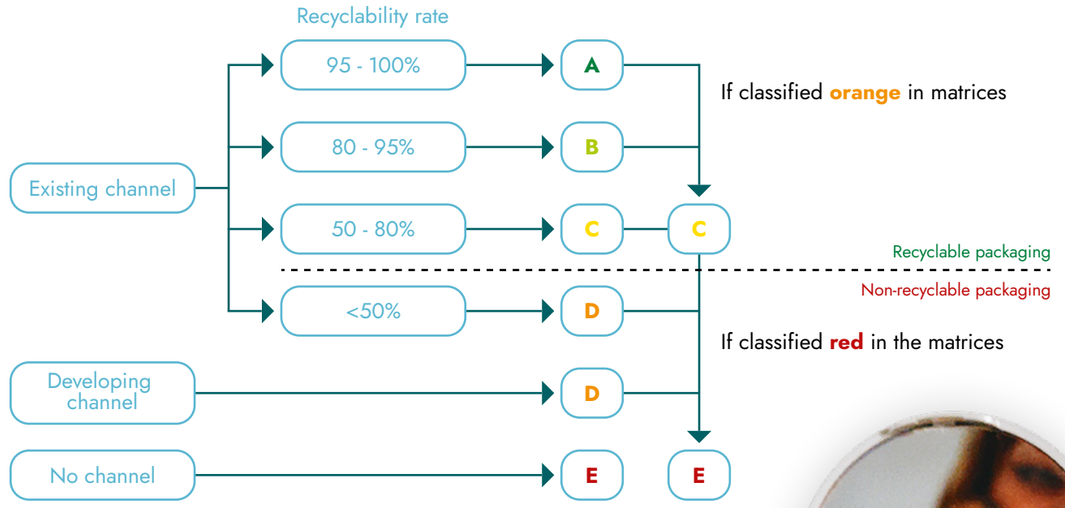
For more details on calculating the recyclability rate of plastic packaging, please refer to the methodological document which provides the calculations by recycling stream (sheet 7).

Step 6: Define the "recyclability level" of the packaging

Based on this method, companies can use Citeo's TREE tool to obtain a recyclability score to make the recyclability assessment more operational and visual.

The TREE recyclability score is calculated by combining the recyclability rate calculated on the basis of Citeo's assessment methodology and the impacts of associated elements that may disrupt the recycling of the overall packaging.

The TREE scores range from A to E, based on a combination of the mass rate and the qualitative elements (green/orange/red) identified in the recyclability matrices.



The tool and associated methodological guide are available by registering on the https://tree.citeo.com/fr/ website

A-2 | Léko guidelines and Circulate tool

Léko offers a tool, Circulate, which is essentially based on the German guidelines and the RecyClass reference system.

The scope of the packaging to be assessed is that in its post-consumer configuration:

- If the packaging is made up of several elements that will be placed in the sorting bin separately by the consumer, each packaging element must be assessed separately.
- If the various packaging elements are linked and do not need to be separated in order to consume the product, then the packaging should be assessed as a whole.

Generally speaking, the way in which the packaging is identified by optical scanning and its ballistic behaviour should be analysed to determine which stream the packaging will be directed into. At the sorting centre, machines distinguish between the type of format (bottles, jars, trays) which separate the **"hollow bodies"** and the **"flat bodies"**, and between PP/PE/PET materials using optical sorters.

5 stages are taken into account when assessing recyclability:

1. Definition of the packaging unit
2. Identification of the main raw material for this unit
3. Check that there is a recycling stream for this material
4. Check that the packaging will be correctly sorted into this stream at the sorting centre
5. Check that there are no contaminants/ regeneration disruptors in the stream

The Circulate tool offers a score ranging from A++ (greater than 95%), which means that the packaging is fully recyclable, to C (0% to 49%), which means that the packaging is non-recyclable.

The special feature is that the scores are adapted depending on the country in which the product is marketed (Germany, Austria, Spain and France). There are differences between countries, particularly in terms of sorting and sometimes recycling techniques (paper, cardboard, steel, aluminium, etc.).

To find out more: https://www.leko-organisme.fr/mesurez-la-recyclabilite-de-vos-emballages-avec-our-new-tool-circulate/

B | In Europe: Focus on the RecyClass standard

At European level, **the RecyClass standard proposed by PRE is fairly detailed.** A definition developed by the Association of Plastics Recyclers (APR) and Plastics Recyclers Europe (PRE) was drawn up in 2018.

Four conditions must be met for packaging to be considered recyclable:

1. The packaging must be made from a resin that is collected for recycling, has a market value and/or is supported by a programme mandated by law.
2. The packaging must be sorted and grouped into defined streams for recycling processes.
3. The packaging can be processed and recovered/ recycled using commercial recycling processes.
4. The recycled plastic becomes a raw material used in the production of new packaging.

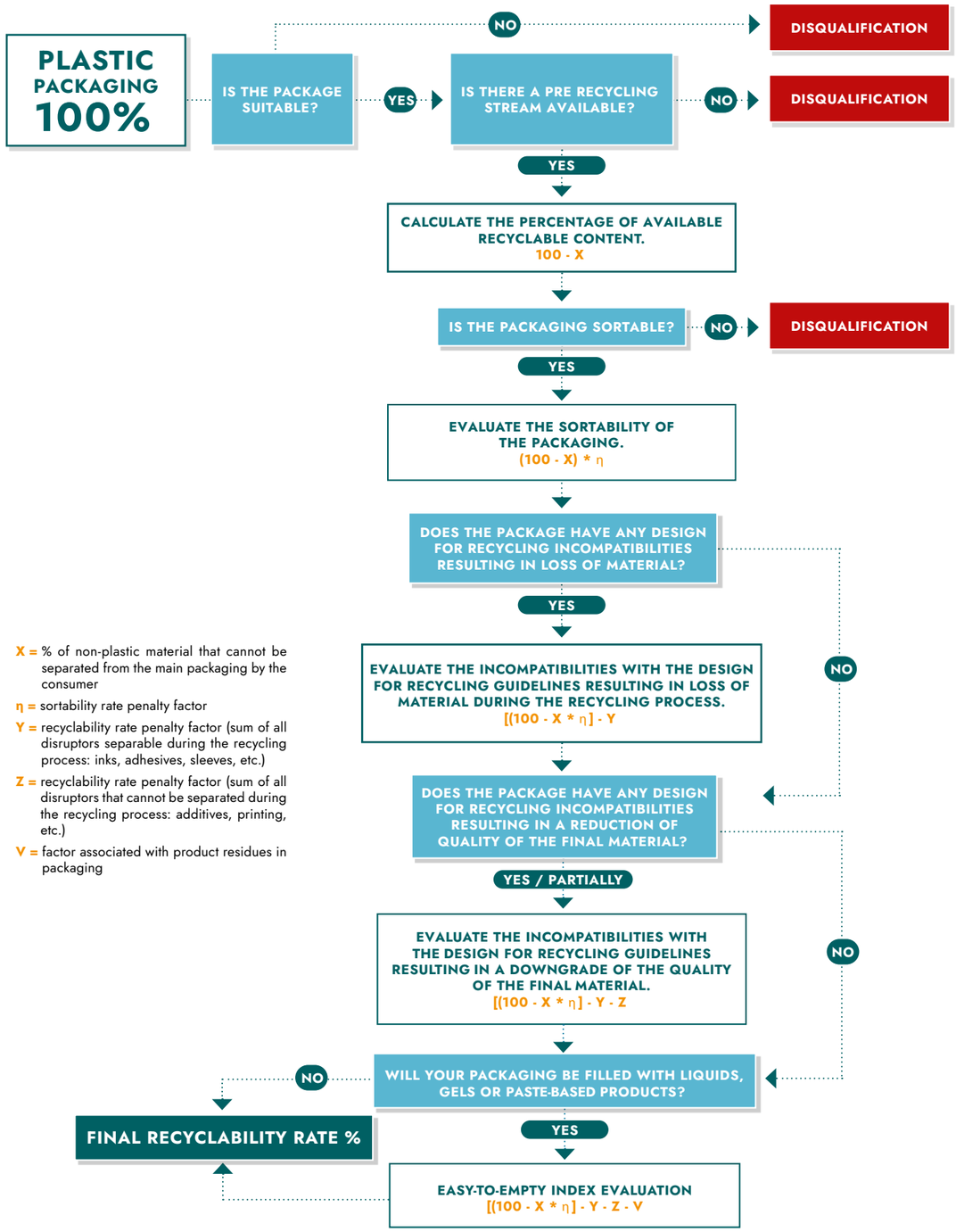
However, meeting these four conditions is a preliminary step in assessing the recyclability of a plastic packaging item and does not automatically deem a packaging item as recyclable.

The assessment of the recyclability rate takes into account:

- Packaging collection (at local or European level)
- The availability of sorting and recycling infrastructure (at local or European level)
- The compatibility of packaging with sorting and recycling
- The product restitution rate
- The absence of intentionally added substances identified as SVHCs (Substances of Very High Concern)in REACH. These elements may be subject to a penalty,lowering the recyclability score.
- The quality of the recycled plastic generated by the packaging

The graph below summarises the stages taken into account in assessing recyclability based on the RecyClass process. The principle of 50% main material has been used again.

Figure 7: Assessment of the RecyClass recyclability rate



Source: Appendix 1 RecyClass RECYCLABILITY METHODOLOGY. Version 2.3, last updated February 2024- page 40

The definition proposed above is not intended to restrict innovation. For innovative materials to be recyclable, it must be demonstrated that they are collected and sorted in sufficient quantities and that they are compatible with existing industrial recycling processes.

Sorting is taken into account, as it is in all the standards, with consideration of the following impacts:

- **Consumer behaviour and sorting habits** (for assessment of separated components, for example, if separation is proven/demonstrated)
- **The packaging's ability to be compacted** during collection and transport, prior to sorting at the sorting centre
- The size, shape and rigidity of the packaging (to assess the case of rolling packaging on sorting conveyors, for example)
- Separation of metal components (steel and aluminium)
- Optical detection with sorting by resin and by colour in certain cases (e.g. PET bottles)

Particular attention must be paid to certain types of packaging for which sorting centre tests are required to assess their recyclability.

This is particularly the case for packaging with a high degree of coverage by another material (>50% if packaging < 500 mL or 70% if packaging > 500 mL); complex structures; packaging decorated with metallisation or colours that cannot be detected by optical sorting; packaging that is round, rigid and difficult to compact.

RecyClass has developed an assessment tool that is available to everyone here: https://tool.recyclass.eu/. The tool can be used to assess the recyclability of plastic packaging and show how suitable it is for recycling. This analysis is based on the RecyClass methodology.

The results are expressed as grades from A to F. Class A, B and C packaging is considered recyclable, while class D, E and F packaging is not[7].

[7] https://recyclass.eu/wp-content/uploads/2024/03/RECYCLASS-RECYCLABILITY-METHODOLOGY_v.2.3.pdf

C | Other European and international standards

Other standards co-exist in Europe and internationally. Some of these are presented in this section.

In Germany, Zentrale Stelle Verpackungsregister (Central Agency Packaging Register - ZSVR) https://www.verpackungsregister.org/en

This central agency is responsible for minimum standards for the recyclability of packaging, as well as other issues such as monitoring indicators for environmental targets, including calculations of recycling rates, like ADEME in France.

For more information, please consult the Minimum Standard Packaging Act (version 2024): https://www.verpackungsregister.org/en/foundation-authority/minimum-standard

For the EU zone, Switzerland and the United Kingdom, Cyclos HTP Institute (CHI), a company specialising in the classification, assessment and certification of the recyclability of packaging and products, has developed an approved test standard for assessing the recyclability and compatibility with recycling of packaging materials, along with various scientific publications on recyclability: https://www.cyclos-htp.de/cyclos-htp/

In the United Kingdom:

- **RECOUP** (Recycling of Used Plastics Limited), the UK's not-for-profit, charitable resource management organisation for plastic packaging, carries out numerous case studies and guidelines on recyclability. To find out more: https://www.recoup.org/our-work/packaging-recyclability-and-design/
- **WRAP,** a UK-based climate action NGO, has produced a design guide for the recyclability of rigid plastic packaging for households in November 2022, including a red, orange and green list of preferred materials and formats: https://www.wrap.ngo/resources/guide/design-guidance- recyclability-household-rigid-plastic-packaging
- **OPRL,** a not-for-profit company limited by guarantee, is the UK's independent expert on packaging recyclability. It has introduced a labelling system with a binary approach, i.e. "Recycle" or "Do not recycle", to encourage consumers to recycle easily. The company also offers a certification system to assess the recyclability of packaging. For more information: https://oprl.org.uk/

The guidelines defined by Wrap/OPRL/RECOUP are very similar to those found in the EU. OPRL is already penalising certain components on the basis of design via "Recycle" vs "Don't recycle" labelling, and the "Design For Recycling guidelines" should help to implement the eco-modulation planned in the UK.

At international level, there are some fifteen standards for the plastic packaging recycling sector, including:

- **United States:** although each state has its own technical references and collection streams, the **APR** (Association of Plastic Recyclers) has established standards for the main resins (PET, HDPE, PE, PP). Packaging made from PVC, EPS, rigid PS, rigid PLA is not recyclable according to the APR definition and does not meet the criteria for consumer access to collection set out in the U.S. Federal Trade Commission's Green Guide.
  For packaging to be considered "recyclable according to the APR definition", a number of criteria must be met, for example that at least 60% of consumers have access to a collection system that accepts the item, or that the item can be economically processed, through a conventional recycling process, into a post-consumer plastic raw material that can be used in new products. To find out more: https://plasticsrecycling.org/apr-design-guide
- **Australia:** APCO (The Australian Packaging Covenant Organisation) also draws up standards for the main PET, PP and HDPE resins. For more information: https://apco.org.au/sustainable-packaging-guidelines
- **South Korea:** Since 2020, the PRECS (Packaging Recycle Easiness Classification Standard) has set out a system for assessing packaging materials, structures and ease of recycling, with an incentive to take ease of recycling into account right from the product design stage.

D | Main differences between the guidelines

1 | Target application and associated process

This is the first structuring point that can explain the differences between the standards: the requirements and success criteria for assessing the recyclability of an element will differ depending on the target application of the recycled material.

For example, the impact of an ink on the recycling of a coloured PET bottle can vary considerably depending on the intended purpose. In the case of a use or application which aims to return the recycled material, which includes inks compatible with recycled coloured PET resin, to packaging, the results will be different from those for application in the textile sector, where health issues are taken into account separately.

Even if the target application is similar, differences can also be explained by the level of requirements expected. Some standards assess the impact of the component based on the process and the current recycling outlets, while others may point to components that are identified as undesirable with a view to optimising the quality of the recycled material or that hinder process optimisation (e.g. certain metallic elements that are eliminated by filters during extrusion and therefore require regular filter changes). So, depending on the ambition of the standard (target quality or ability to be processed by date), the associated requirements will be different.

A key point to consider in the application section concerns the comparative basis used to measure success criteria. For RecyClass, the comparison is made with packaging made from virgin resin, while for COTREP, the element to be analysed is assessed in relation to the current stream of recycled material already used by local regenerators processing French material.

2 | Scope

The scope can be understood in several ways:

- **Geographical:** some standards are valid at EU level, while others take into account more local specificities, and are representative of the industrial reality of the area under study (e.g. COTREP for France)

- **Materials:** some players are positioning themselves to assess all packaging materials, while others specialise in plastic resins

- **Maturity of processes taken into account:** in general, technologies used on an industrial scale are considered. Chemical recycling is included in certain standards in order to guide packaging designers in anticipation of new recycling technologies and the deployment of the industrial sites that will implement them (in line with the PPWR notion of "to scale")

- **Consideration of packaging sortability:** as mentioned above, the sorting stage is an integral part of recyclability. Given that the state of knowledge is not set in stone regarding the capacity of different types of packaging to be correctly sorted, recyclability standards include this stage more or less automatically, with more or less formalised criteria

- **Activity/representativeness:** the governance of these different standards is managed by different players (PROs, centralised at national level, representatives of recyclers, etc.), which may explain why different points of view, issues and associated degrees of prioritisation are reflected in the recommendations.

3 | Protocol

When the recyclability of a packaging item is tested, the technical recyclability of a resin can be tested (new PETG, PEF, PLA resin, etc.) on the one hand and the impact of a very specific element in the transformation process of the resin in which it is used on the other (impact of an element in a thermoplastic resin stream, such as PET, PP, PE, PS which are all technically recyclable). The way in which the elements to be tested are introduced, particularly their concentration in the base resin, can lead to significant differences in the results.

The key elements that vary according to the protocols and may have a direct impact on the recommendations are:

- **Control materials (virgin/recycled)**
- **The dilution rate of the element to be tested**
- **Extrusion conditions (including temperature, for example)**
- **Target applications:** back to packaging, conversion processes or other current applications.
- **Taking sorting into account** (with size or other criteria that have an impact on sorting).
- **The rate of restitution/residue of product contained in the packaging**

COTREP vs RecyClass Focus

Technical opinions from COTREP and RecyClass were used to analyse the case studies for cosmetic packaging in this guide. However, the recommendations resulting from these two initiatives differ depending on the target application, the scope and the protocol used.

RecyClass is fairly strict when it comes to the rates of incorporation of the packaging tested (fixed rates of 25%, 50% incorporation of the packaging to be tested), whereas COTREP assesses the impact of an element according to its rate of presence in the current supply of household packaging in France, and the comparison is made with recycled material.

For more information on the COTREP and RecyClass protocols, see appendix 3.

CONCLUSION ON STATE OF THE ART

This overview highlights the complexity of the situation and the different approaches to assessing recyclability, with their common principles for designing more recyclable plastic packaging, pending implementation of the PPWR and its delegated acts. This convergence is an opportunity to accelerate and plan for the circularity of plastic packaging with the entire value chain, since each link will have a role to play (process investments, production lines, choice of resins at the design stage, reworking of packaging component moulds, etc.).

In France, pending harmonisation with the PPWR at European level, manufacturers must refer to the standards of the PRO which they belong, in line with the QCE (Consumer Information) decree.

In this context, the ELIPSO / FEBEA working group has analysed six types of packaging specific to cosmetic products and identified possible solutions to improve their recyclability. **Nevertheless, it will remain the reader's responsibility to ensure that the solutions studied and developed do not have a greater environmental impact than existing solutions, over and above the requirement for recyclability.**

The second part of the guide focuses on specific criteria for the recyclability of cosmetic packaging. A detailed examination of these criteria will help us to understand how the specific characteristics of cosmetic packaging influence its recycling potential. These six case studies illustrate the challenges and opportunities specific to the sector, while providing practical recommendations for improving the recyclability of plastic packaging used in the cosmetics industry.

2

Case studies

2 Case studies

1 Methodology applied to studied packaging

For the case studies, the evolving regulatory framework and recyclability assessment methodologies (Citeo and COTREP tables, RecyClass) described in the previous chapters were taken into account and applied to the different categories of plastic packaging specific to the cosmetics sector.

A global approach for France and the EU has been applied to the identification of recycling disruptors, highlighting differences depending on the standards in force.

Although some standards require a real sorting test to be carried out in order to confirm the target stream for the material, it was decided to start from the study of packaging with a main material of plastic resin (> 50% by weight of the complete packaging), which was itself clearly identified as having a recycling stream.

The working method applied is based on 2 stages, which are presented below:

Method applied

Stage 1: Identification of problematic cases for each type of packaging

1. Identification of the main constituent (>50% by weight)
   - → Identification of cases that do not have a main constituent with a stream **< 50% by weight**
2. Identification of the associated stream
3. Identification of sorting disrupters (for correct orientation)
   - → Identification of cases to be worked on* recognised as poorly sorted at the sorting centre
     **Size criteriaor other criteria that require testing according to Recyclass are not taken into account and are not taken into account by Citeo / COTREP*
4. Identification of recycling disruptors (FR/EUR)
   - → Identification of cases requiring work where recycling is a concern

Stage 2: Identification of solutions & criteria to be assessed for each potential solution

5. Analysis of problematic cases for each type of packaging
   - → **Summary of cases from the following causes:**
     - ✔ no main material
     - ✔ known sortability problem
     - ✔ recyclability problem
6. Identification of essential criteria for selected cases
   - → **Makes it possible to list the points that must be addressed by the alternatives to be developed:**
     - ✔ appearance criteria
     - ✔ process constraint criteria...
7. Identification of possible alternatives for each case
   - → **Alternatives to be chosen from resins with recycling streams and consideration of existing recyclability recommendations to identify solutions compatible with recycling**
8. Assessment of the impact of each alternative identified
   - → **Makes it possible to list the areas for attention or compromise that need to be found to validate the alternatives:**
     - ✔ economic impacts
     - ✔ process impacts
     - ✔ performance impacts...

2 Common elements to all case studies

In this chapter, the common elements to all types of packaging, such as adhesives and decorations, are described in detail.

Although some recommendations may remain specific depending on the streams handled and the associated recycling processes, for which a detailed analysis is then necessary, **the main principles for understanding the impact of these elements on recycling, and the specific recommendations arising from them, are highlighted here.**

A Label adhesives

The precise recommendations concerning the adhesives used on labels are heavily dependent on the latest developments in recycling processes.

In the PPWR (APPENDIX II Table 4) - *Adhesives can be used in such a way that they can be easily separated in the recycling process or by the end user or in a way that they do not affect the efficiency of the sorting and recycling processes. The presence of adhesive residues on the packaging can downgrade the quality (purity) of the secondary raw materials. Washable adhesives can ensure the separation from the main packaging body and that no adhesive residue remains in the secondary raw material."*

In most cases, the idea is to be able to separate the adhesive and associated components from the resin, with a controlled impact on recycling processes, equipment and effluents.

The points that will influence whether the adhesives separate correctly are:

- Temperature,
- pH,
- Friction, measurable under real or semi-industrial conditions

To date, it is mainly the 'washable' nature of the adhesive (via pH and temperature) that is documented in the recommendations.

For example, for PET bottles today, it is recommended to use adhesives that can be washed with water at 60-80°C under alkaline conditions, with no residue and no reactivation. For rigid PP and PE, the recommendations suggest adhesives that can be washed off at room temperature without leaving any residue on the packaging.

Other work on the impact of friction is also being carried out (RecyClass protocol): RecyClass tested shampoo bottles and found a label removal rate of over 90%. The main factor is the friction imposed on the sample during the grinding stage.

The subject of adhesives is particularly important for cosmetics packaging, which has to withstand high temperatures and humidity in a bathroom environment (e.g. a bottle of shampoo or shower gel).

B | Decoration

Decoration includes all coatings (varnishes, primers, lacquers, coatings, inks, etc.), markings, metallizations, electroplating, etc. that are applied directly to the surface of the packaging.

They can have an impact on the recyclability of household packaging at two distinct levels:

- **Impact on packaging detection:** depending on the decorated surface, the decoration can interfere with the correct detection of the packaging at the sorting centre. Recommendations are generally given on the coverage rates to be respected to ensure good detection of the packaging.
- **Impact on the regeneration process:** the decoration can have an impact on the regeneration process, in terms of the quality of the material, with the following impacts:
  - **Visual** (inclusions or colour variations...)
  - On the **mechanical properties** of the material (e.g. more brittle material with mineral content)
  - On **recycling equipment** (e.g. clogging of filters or wear and tear on moulds at converters that incorporate recycled material)
  - **Health impacts** (e.g. Direct printing with inks on PET bottles is not authorised to limit the potential contamination as much as possible as the recycled material from those PET bottles needs to be suitable for food contact.

It should be noted that collection, sorting and regeneration processes continue to evolve, so it is necessary to study the impact of the decoration used for each packaging item on a case-by-case basis.

Direct decoration

(decoration applied directly to the primary packaging, main component: screen printing, hot or cold stamping, metallization, etc.):

- For clear PET rigid packaging: direct printing is to be avoided as far as possible, or even classified as not compatible with recycling depending on the guidelines.
- It is, however, possible for rigid PE or PP packaging with inks that are generally non-washable at room temperature.

While waiting for harmonised standards on recyclability, it is necessary to consult the specific criteria of each player involved in the subject (COTREP, RecyClass, EPBP, etc.).

Decoration applied to other materials associated with the main packaging

This applies to all elements associated with the main packaging element (labels, sleeves, header cards, etc.), which may or may not be assessed separately.

Depending on the nature and composition of the associated element, the recommendations will be different if the printed element tends to follow the material (e.g. PETG or Crystal sleeves on PET bottles or PP labels on PS jars) or, on the contrary, to be eliminated with the ink it supports during the washing and sorting process. In this second case, the recommendations to be followed will mainly concern the adhesives that can be used to attach the printed element to the body of the packaging, and **the degree of coverage** of the said element, which can interfere with the correct detection of the resin making up the main body of the packaging to be recycled.

The coverage rate of labels, sleeves, inks and lacquers is a parameter that will be taken into account in the design for recycling criteria set out in the PPWR.

Table of decoration parameters for design criteria with a view to recycling set out in the PPWR (ANNEX II Table 4)

Parameters for design criteria with a view to recycling	Relevance of the parameter
Labels	Coverage rate of labels can affect the efficiency of the sorting process. Material from which the label is made and type of glue or adhesive also affect the quality of the secondary raw material.
Sleeves	Coverage rate of the sleeve on the main packaging body affects the possibilities for sorting. In addition, the use of sleeves can affect the ability to separate them from the main packaging body. The material from which the sleeve is made can affect both the sortability and the recyclability of the packaging.
Inks and lacquers / printing / coding	Inks and lacquers are mixtures of colorants with other substances applied onto the material by a printing or coating process (ink) or a protective coating made of resin or cellulose ester, or both, dissolved in a volatile solvent (lacquer). Coding refers to printing applied directly to sales packaging for the purpose of batch coding and other information and branding. The use of inks with substances of concern hinders recycling, as those packaging units cannot be recycled. Printing inks when released can contaminate the recycling stream through the washing water. Likewise, printing inks which are not released can impair the transparency of the recycling stream.

Coverage rates have a real impact on sortability. It is essential to read the latest recommendations on the standards presented for the types of packaging and associated resins. These recommendations are subject to change as sorting and regeneration technologies improve. To avoid loss during sorting, it is recommended to limit the coverage rate to 50% of the surface of the packaging.

C | Other common points of vigilance

Certain criteria are not fully defined in the PPWR and will be taken into account when the delegated acts providing further details are published. For cosmetics packaging, several criteria may have an impact on the assessment of recyclability:

- **The restitution rate / product residue rate:** Packaging content residue can have an impact on sortability (dynamic sorting behaviour of the packaging) and recyclability. The packaging should be designed so that it can be easily emptied of its contents and be completely empty when disposed of. (Example: "EASY TO EMPTY INDEX" or "EASY TO ACCESS INDEX" from RecyClass)
- **The size and shape of the packaging:** small, rolling and compact/rigid packaging can be a hindrance at the sorting stage, as it will roll along the conveyor belts, preventing proper recovery of the packaging during the optical sorting phase (poor ejection = reduced efficiency). These characteristics are not addressed in this guide because there is no consensus or formalization at this stage in the regulatory texts.

These are points to be aware of, particularly for the DIP-IN product category.

To date, these two criteria have been taken into account by RecyClass, but not by Citeo: the size of the packaging and the rate of capture at the sorting centre are not taken into account when assessing the recyclability of a packaging item, in particular because some small packaging items are captured and so as not to encourage an irrelevant action aimed at increasing the size of a packaging item in order to be recyclable. All packaging, even the smallest, must be recyclable. In order to anticipate the possibility of taking into account the capture rate at sorting centres, Citeo is carrying out studies at sorting centres.

- **The separability of components by consumers (sorting behaviour) and in sorting centres (separation during the collection and sorting stages):** if the associated components are not correctly separated from the main component of the packaging to be recycled, their composition may interfere with recycling, depending on the standards (e.g. lid, sleeves, pans, mirrors, rhodoid in palettes, for example). As far as possible, associated components should be designed to be compatible with the recycling of the main packaging component. Work is in progress (at French and European level) to define how to assess the separation of associated elements.
- **Styrenics:** as a general rule, the subject of styrenics was dealt with in the first part of this guide, since it is linked to a regulatory constraint. **As with all resins, the most important thing is to have packaging whose main component can be directed to a recycling stream in the designated collection area.**

3 Studied packaging

The aim of this work is to analyse the recyclability of packaging typical of the cosmetics sector.

As a reminder, **more generally, a life cycle assessment (LCA) with the identification of impact transfers is recommended in order to avoid alternative recyclable solutions that have a greater impact on all the LCA indicators. For example, tools such as SPICE offer open access (https://tool.open-spice.com/) or any other LCA tool (SimaPro, Gabi, etc.).**

This guide solely focuses on **plastic packaging**. For glass and aluminium packaging or any other material also used in cosmetics, we recommend that you refer to the associated standards or technical committees and contact the federations or bodies that deal with these other materials.

In France, Citeo has a number of technical committees that bring together the PRO and the various sectors:

- FEDEVERRE for glass[8],
- COTREM (https://www.cotrem-emballages.fr/) for metals;
- ALUTREC (https://www.alutrec.fr/) for small aluminium
- CEREC (https://www.cerec-emballages.fr/) for paper and cardboard

All these committees, with updated information, are available here: https://www.citeo.com/eco-concevoir

The criteria below have been deliberately excluded from the scope of the analysis because, although some studies are underway, there is as yet nothing formalised on these subjects which are not specific to the cosmetics sector:

- Formula residues in packaging
- Packaging size
- The cylindrical, non-compactable shape of the packaging

The solutions presented are based on existing standards and not on those in the pipeline. The optimisation of sorting centre processes, the development of new stream and new recycling technologies will undoubtedly enable us to identify new avenues of work in the future.

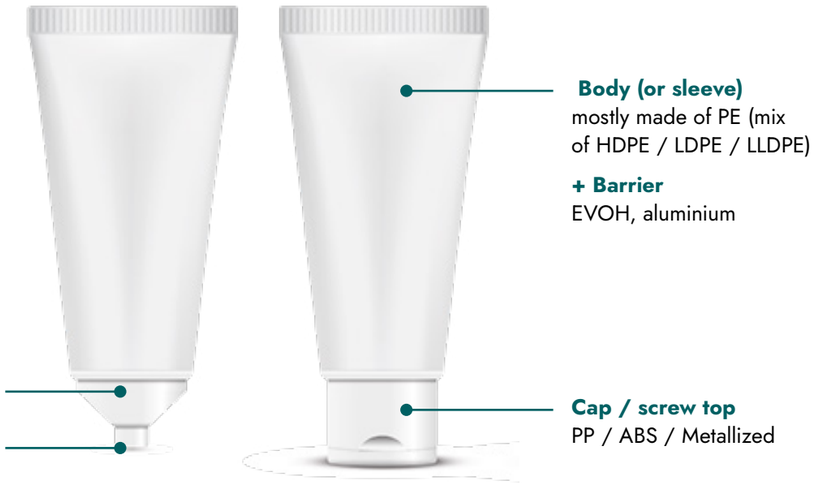
Chemical recycling technologies do not have formalised criteria in all existing standards (certain COTREP recommendations for PS, PET/PE and PO flexible materials in the "in development" stream have already taken them into account) and have therefore not been developed in this guide. Chemical recycling will also need to be considered within the context of the latest developments with associated scale-up potential before it can be recognised by PPWR.

[8] A "COTREV" technical committee made up of Citeo and the glass industry is to be set up to disseminate general recommendations on eco-design for glass packaging recycling

A | Tubes

1 | Description of a typical package

Figure 8: Description of a standard tube made mainly of PE



Non-exhaustive standard description

For PP-based tubes: the same segmentation can be applied and the assessment should be based on recyclability criteria in the mechanical recycling stream for rigid PP. In order to meet the 70% and then 80% recyclability targets set out in the PPWR regulation, it is important to always check, in both cases (PP or PE as main material), the mass share of each resin in the entirety of the packaging being assessed (including the cap).

2 | Identification of blocking points

Non-recyclable components for packaging in this category are assessed **on the basis of known criteria for rigid packaging,** since the latest developments regarding tubes indicate that they are directed into the rigid packaging stream.

Labels: These may be present on the body or associated with the cap (e.g. tamper-evident label).

As indicated in the elements common to all cosmetic packaging, labels that can be washed off/separated at room temperature, unless they are made of the same material as the tube, are preferable. However, shower products, for example, need labels that are resistant to water and ambient temperature: **the adhesive part is therefore an issue to be addressed in terms of the use of products suitable for the hot, humid environment of a bathroom.**

For more information, we recommend that you refer to the existing standards that cover different configurations. For example, Notices on labels and sleeves are available on the COTREP website.

Separability of components:

Elements that can be separated **irrevocably and completely when the product is used for the first time** (e.g. tamper-evident lid) must be analysed separately. These elements are therefore not included in the recyclability study for the main packaging if they have to be removed when the product is first used. If this is not the case, it needs to be demonstrated.

To date, Citeo only recognises the "Ketchup-type" lid on PET bottles as separate. All others are still considered to be associated with the main packaging. This issue will be addressed in 2025 with a separation rule that applies all packaging.

In general, any other element or component will only be defined as separable if it can be demonstrated that it is effectively separated either by the consumer, during collection or at the sorting stage. Without this demonstration, the element or component will be defined as integrated and will have to be included in the analysis of the packaging unit.

It is not yet clear whether the tamper-evident sleeve in the packaging unit or the lid should be assessed separately or not. Even if the component is detachable, it must be proven that it is actually separated and therefore disposed of by the consumer at a different time, via a consumer study or a study on arrival at the sorting centre (assessment of the rate of separated materials).

Rules are currently being drawn up by French and European PROs to enable them to assess how the element can be validated separately when assessing the recyclability of a packaging item.

Barrier layer:

An aluminium or EVOH barrier layer is sometimes used to give the tube enhanced protection against light, oxidation, water or weight loss.

However, they are disruptive to recycling:

- Aluminium disrupts recycling in any quantity
- **EVOH** can be used in accordance with the thresholds indicated in the standards:
  - In the COTREP standard, no threshold is indicated because of its estimated presence in household packaging is considered as being compatible with the PE sector.
  - In RecyClass, it is classified as green if it is used at less than 6% and as yellow if it is used at more than 6%. The recommendations on EVOH take into account the use of PE maleic anhydride grafted polymer as tie layers.

Colour containing carbon black or non-detectable infrared colours in the body:

Carbon black interferes with sorting because it prevents materials from being detected during the optical sorting stage. R&D work is underway by some packaging manufacturers to remove carbon black, but obtaining a deep black without carbon black remains complicated to date, particularly on PE (which is milkier than PP). There is no guarantee that colours will be equivalent to current requirements and market codes.

There is a list of dark dyes that do not prevent detection during optical sorting. This list of approved dyes is published by COTREP (Avis Etudes Techniques 'Tri Emballages Sombres' ('Dark packaging sorting')).

Decoration:

Metallization on the body can hinder recyclability, particularly in terms of detection/sortability at sorting centres (see the section on elements common to all cosmetic packaging).

PP cap with PE body:

As the material is normally detected at the body level, sortability is not affected by the combination of a PP cap on a PE body. However, it can have an impact on recyclability depending on the percentage of PP in relation to PE:

- **Less than 10% of PP associated with PE or PE associated with PP** generates a deduction of one class, which results in a class B in the RecyClass standard (classified in yellow).
- **Between 10 and 30% of PP associated with PE** is tolerable, this represents a deduction of 2 classes, i.e. class C will be obtained: this is the highest grade that could be achieved in the RecyClass standard (classified in red).
- PP combined with PE is classified as light green under COTREP for the closure system, again following source stream assessments in France. (for more information, please consult the Avis General (General Notice) COTREP N°48)

3 | Identified solutions and limits

The analysis of products packaged in tubes highlighted a number of particular concerns in terms of recyclability requirements. Certain investments at manufacturer or subcontractor packaging sites may be necessary when there are changes to packaging (particularly linked to sealing technology, etc.).

Critical element or limiting the quality of the recycled material	Essential criteria/ purpose	Identified areas of development	Impacts	Comments
Body with Aluminium (ABL)	Barrier light + O^2, water	EvoH according to the thresholds indicated in the standards	- Functional: Less O^2 barrier, no light barrier - Cost impact - Process impact: change in welding technology and associated equipment	Most demanding application: hair dye OK with EvOH barrier
Body colouration (dyed in the mass)	Aesthetics: opacity, market code BLACK or other dark colour	Dye detectable during optical sorting Specific DARK notices for COTREP. RecyClass sorting test also possible	Difficulty in achieving the colour desired by marketing, or in achieving range onsistency in the case of an existing range	Prevents traces of dirt on the body during use
Metallised decoration of the body surface (depending on rate of coverage)	Aesthetics	Work with a decoration whose coverage rate does not prevent detection*.	Change of appearance	
PP cap with PE tube	Mechanical resistance	PE cap on HDPE tube	Stress cracking Scratch resistance, colour rendering, closure system (different noise)	

* for the COTREP standard, for bottles and tubes, it is recommended not to exceed 70% for packages > 500 ml and 50% for packages < 500 ml

B | Compact cases, makeup palettes and powder compacts

There are two types of product in this category:

- **Compact powders:** the product is in the form of a powder that has been compacted in a container
  - Compression resistance for metal pans: compaction force up to 40,000 kg
  - For foundations placed directly in the plastic base (slurry technology), the possible compaction force is between 3,000 and 5,000 kg.

- **Baked or cast powders:** the product is poured into the container. The constraints applied in terms of pressure are less severe than for compact powders, but the temperatures the container has to withstand are higher.
  - Temperature resistance for cast powders: casting temperature approx. 80 °C

Type of powder	Filling temperature	Pressure
Compact - pressed	Ambient	Up to 40,000 kg
Cast - baked	80 °C	Atmospheric

1 | Description of a typical package

Figure 9: Non-exhaustive standard description of a case/ powder compact (for compact and loose powder)

Non-exhaustive standard description

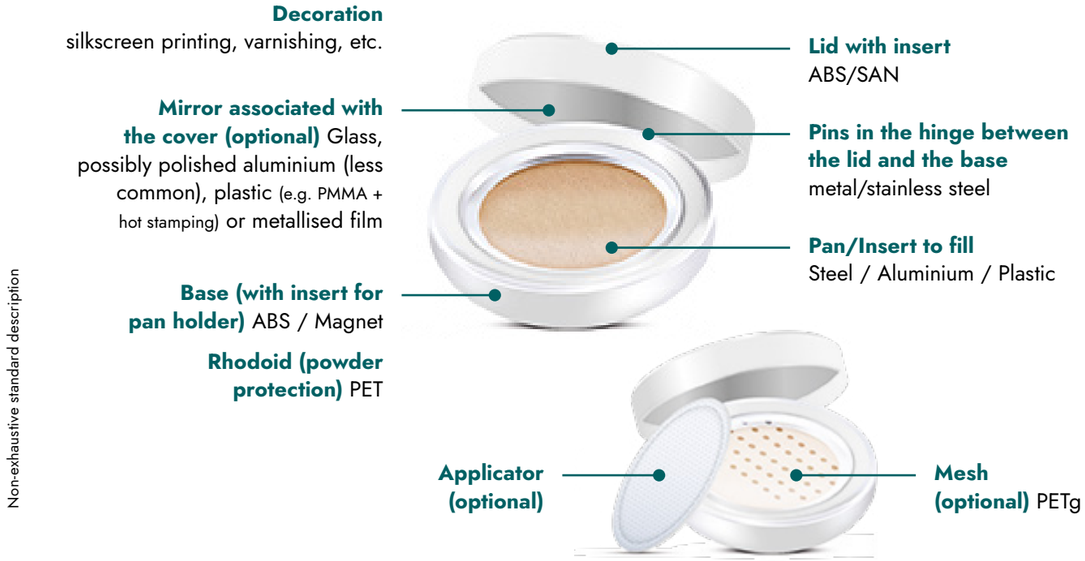
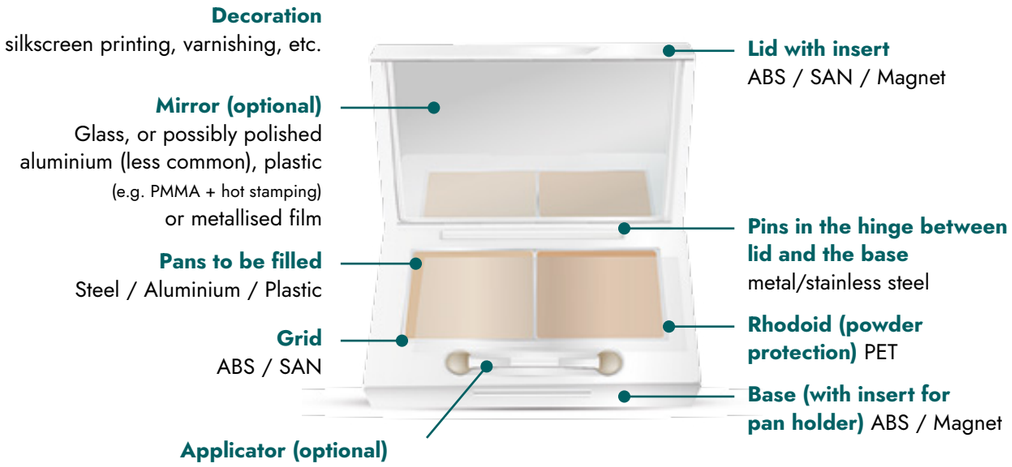


Figure 10: Non-exhaustive standard description of a palette



For the applicator, two distinctions can be made to determine whether it is packaging:

- If the applicator is integrated into the grid or lid, it is to be integrated into the packaging system.
- If the brush or applicator can be completely separated from the packaging system, the applicator is considered a product. It should therefore not be included in the packaging assessment.

The pins in the hinge between the lid and the base are essential to the mechanism for holding the lid open and closed.

There are two types of grid for palettes:

- Technical grid: wedging that can be present in addition to the base to organise the palette and hold the pans in place
- Aesthetic grid (can be the same as the technical one or different): this hides the edge of the metal pans

These two grids are often made of the same material as the base.

Adhesive/glue is systematically used to stick the pans and/or to stick the grid onto the base. Magnets can also be used to hold steel pans in place in rechargeable cases.

2 | Identification of blocking points

Packaging with ABS as main material (base and lid):

ABS is a material for which there is no recycling stream when it comes from household packaging streams.

Metal pan:

COTREP allows metal pans to be used in conjunction with PP, since the metal elements are supposed to be properly separated after flotation grinding before the regeneration stage (PP and PE must have densities <1, unlike metals of d>1).

If the metallic elements are not separated before regeneration, they risk:

- creating defects such as metallic inclusions or non-melted parts
- causing wear and tear to the shredders, which are adapted to plastic materials. For this reason, RecyClass refers to metal as a sorting disrupter for the PP and PET streams.

Decoration:

Metallisation and Electroplating are obstacles to recyclability, particularly for the detection/sortability stage in sorting centres.

Electroplating (with density > 1 g/cm³) is tolerated (classified as orange) by the RecyClass standard. That said, it should be remembered that a galvanised part will always have a density > 1, and will therefore be lost during PP recycling. Electroplating is therefore not possible on a major part of the packaging (too much loss).

PETG meshes for powder compacts:

PETG* is currently non-recyclable and difficult to substitute, and there are few alternatives that meet the characteristics of the mesh (PP is a possible alternative). Sometimes, the mesh is injected with the body (included in the base), and the base is clipped on behind it. The various elements that are injected and then assembled to make up the powder compact will guide the choice of compatible resins.

*PETG is a generic name covering a family of modified PETs. If modified PET is used, it is necessary to ensure that the grade has been assessed for recyclability.

Black colour:

Carbon black interferes with sorting because it prevents materials from being detected by optical sorting. The removal of carbon black is currently under consideration. However, obtaining a deep black without carbon black seems complicated, especially on PE (which is milkier than PP). There is no guarantee that colours will be equivalent to current requirements and market codes.

There is a list of dark dyes that do not prevent detection during optical sorting. This list of approved dyes is published by COTREP (Avis Etudes Techniques 'Tri Emballages Sombres').

Separability of rhodoids:

There are two possibilities:

- **As a separable element:** it must be proven that it is actually separated and therefore discarded by the consumer at a different time (when it is first used, for example), with this proven by a consumer study or on arrival at the sorting centre.
- **As an integrated element,** sometimes the rhodoïd is kept to protect the mirror. It may follow the packaging through to recycling provided that the consumer keeps it throughout their use of the product (to protect the mirror, for example).

The same problem occurs with pans and mirrors. Even if the element is detachable, the situation must be assessed to determine whether it should be considered as a separable element or an integrated element.

In the absence of any obvious conclusion, the recommendation is to choose a component that is compatible with the recycling of the case.

3 | Identified solutions and limits

There are a number of alternatives to ABS:

- **PP:** the PP stream already exists in France and tolerates the presence of metals
- **PET:** Streams for coloured PET in household packaging have been established in some regions (e.g. the Netherlands and the UK) and are currently being studied in France. This sector is not yet harmonised at European level.

There are many co-polyesters on the market (PETG, PCTA, etc.) and to date they are not compatible with mechanical PET recycling processes.

- Sorting technologies are evolving to include sorting of the different types of polyester. Depending on their properties, they could potentially be channelled into an existing process.
- The development of chemical and enzymatic recycling technologies will open up new opportunities. However, some polymers may not be recyclable in the long term, due to incompatibility with recycling processes, or because they are poorly collected at the sorting stage.

- **PS:** this area also needs to be investigated, with recommendations which are currently not harmonised between countries, due to the variability in this source depending on the consumption habits of Europeans.

Limits

These substitutions will have a major impact on investment in new moulds. The moulds currently used for ABS and SAN cannot be reused for other resins such as PP/PE/PET: the viscosities are not the same and semi-crystalline PET, for example, is a much more complex material to inject.

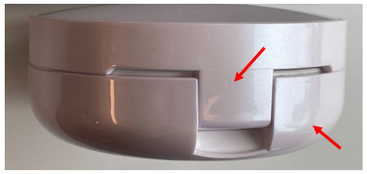
What's more, in some cases these PP/PE/PET alternatives do not meet the specifications in terms of appearance for this type of product. Aesthetic issues need to be objectively assessed in order to determine whether these polymers are suitable on a case-by-case basis, by defining gloss and transparency thresholds in more concrete terms.

The geometry and detail of the finishes may also be affected by these changes in resins. For example, it is possible to see re-adhesion lines appearing for logos (waves): the part of the material that is slowed down and which goes around the logos, may have a moulding defect that is more visible at this level. There is more likelihood of visual defects in particular when the logo is recessed (risk of material shrinkage: depression or re-adhesion lines).

Switching to these materials will also have an impact on other packaging components. Push buttons, for example, will have to be redesigned because their properties will not be the same with ABS versus PP (flexibility of the push button necessary for opening comfort - closing mechanism)

Recycled PE/PP/PET polymers can also be used. (Refer to the ELIPSO/FEBEA[9] guide dedicated to this subject)

It's important to take a holistic approach to the design and not just replace the resin to meet iso specifications.



Shrinkage illustration

Re-adhesion lines illustration

Critical element or limiting the quality of the recycled material	Essential criteria/ purpose	Identified areas of development	Impacts	Comments
Material of base + lid ABS/SAN (if majority weight of packaging)	Gloss, impact resistance, durability, colour depth	PP HDPE PS and PET (under development)	Mould changes Visual impact	The PS and PET streams are currently being developed, but vigilance is required around to scale recyclability in 2035
Steel/aluminium pans	Pressure/T°C resistance when the formula is packaged	Plastic pan / direct casting, or separate element	Not assessed to date	The pan must be recyclable on its own (e.g. refill) or with the palette
Metal pins	Hinges / Opening mechanism	Plastic element, to be checked against standards	Size of part, noise, lubrication may be necessary to avoid squeaking	
Aluminium mirror		Courses of action to be studied in the light of the existing available standards	Changing market codes, rethinking functionality	
Presence of glass mirror with associated type of assembly (glue)	Product use / practicality	Depending on the resin, see if an internal metallised area is acceptable without glass	Rendering quality	
BLACK not detectable by optical sorter	Aesthetics	NIR Masterbatch OK	Rendering quality/ depth of black	

[9] The guide can be downloaded from the federations' websites:
https://www.elipso.org/publications/guide-incorporation-plastiques-recycles-emballages-cosmetiques-europe/
https://www.febea.fr/etudes-et-rapports/guide-incorporation-plastiques-recycles-emballages-cosmetiques-elipso-febea

C | Sticks

1 | Description of a typical package

Two types of cosmetic sticks were studied:

- **Deodorant** (can also be used for foundation sticks or sun protection sticks)
- **Lipstick** (guided and unguided stick).

Figure 11: Non-exhaustive standard description of a deodorant stick

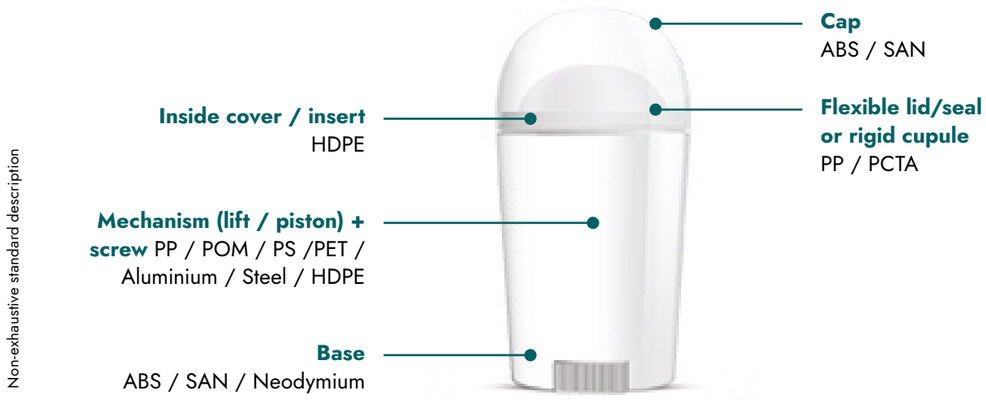
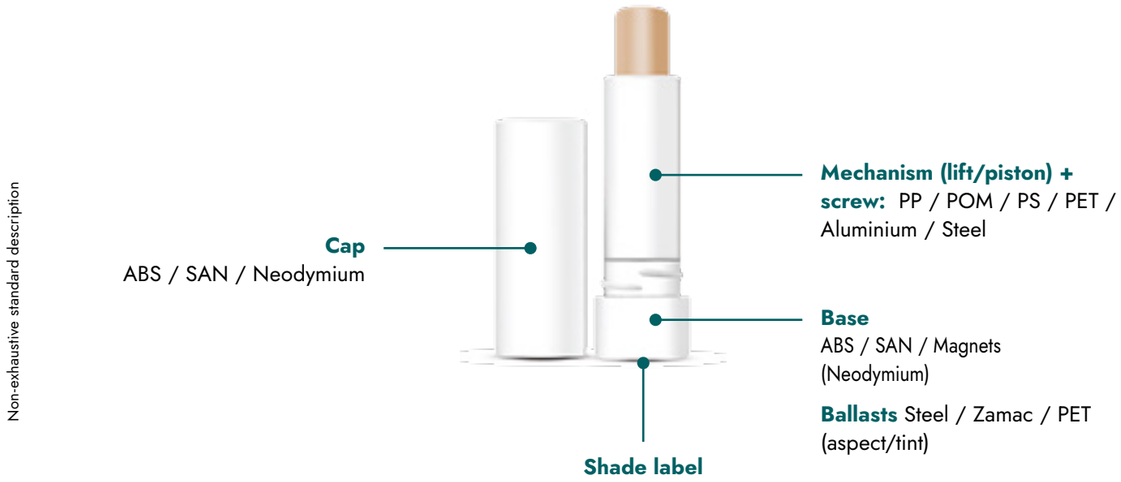
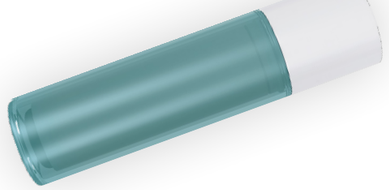


Figure 12: Non-exhaustive standard description of a lipstick





2 | Identification of blocking points

Main material is ABS (base and cover):

ABS is a material for which there is no recycling stream when it comes from household packaging streams.

Ballast in steel or zamac or other metal:

The ballast can be located in the cap or the base. They allow the product to be applied whilst holding the product comfortably in the hand. They are perceived as a sign of product quality. They are generally made of steel, zamac, filler, sintered metal or rolled metal: all these metals disrupt sorting and the recycling process (particularly as they are likely to damage the shredders adapted to plastic). The decorations and the black colour already mentioned for the cases and palettes are also disruptive elements.

3 | Identified solutions and limits

Alternatives are proposed to replace ABS, notably with PP (existing stream). As with palettes and cases, these substitutions will have a major impact on investment in new moulds.

Furthermore, a PP alternative will have an impact on other packaging components. The following constraints have been identified:

Packaging/formula compatibility (but not necessarily the need for watertightness):

PP is incompatible with the isododecanes or alkanes frequently used in formulas.

The comfort/smoothness of the mechanism:

The combination of different materials can help to achieve a certain degree of smoothness in order to obtain mechanisms that meet market expectations in terms of user experience (closing noise, ease of rotation for raising/lowering the colour stick, etc.). It is also possible to have a sliding agent to make it easier to raise and lower the mechanism. An HDPE mechanism for raising and lowering the colour sticks must be proportionately less than 10% for the packaging to be considered recyclable in the PP stream according to the RecyClass standard, and compatibility is also identified as "limited - to be avoided" in the COTREP recommendations.

Even if the restitution rate is a cross-cutting criterion for all packaging, it remains a major criterion to be met for this type of product (with reference to the maximum of 20% residual product according to the RecyClass standard).

Critical element or limiting the quality of the recycled material	Essential criteria/ purpose	Identified areas of development	Impacts	Comments
Base material ABS / SAN	Protection of the formula + aesthetics (shine) / visual traces of colour stick / mechanical clipping, noise	Mainly: PP PET PS HDPE	Mould changes Compatibility of certain formulas with plastic resin Check the colour of the resin Closing noise, smoothness/sliding, overall perception	For PS and PET, the streams are being developed are being developed, with a focus on recyclability to scale in 2035
Ballast in steel or zamac or other metal	Perception of product quality, comfort when holding/applying the product	Consumer education to change perception/ market code	Change in product perception / market code Reduction in total packaging weight	
Material densification	Product perception	Reducing loads, increasing density	Change in product perception / market code	
Magnet (ex: Neodymium, ferrite,...)	Magnetic closure system	Magnet-free closure mechanism system to be studied		

D | Pumps

This subject is dealt with specifically for this packaging element because this system is extensively present in the cosmetics packaging sector.

Cosmetic products concerned: **Lotions, Shower gels, Body lotions, Serums, Oils, Creams...**

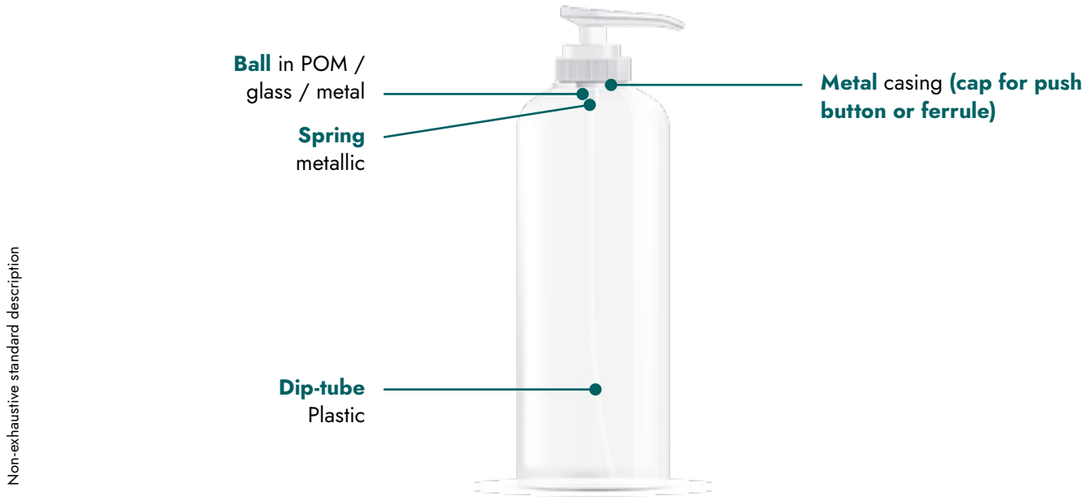
This element, often associated with a bottle, requires multiple components to perform its function, some of which have been identified as incompatible with the recycling of the plastic bottles with which they are associated (e.g. metal spring, glass ball).

To describe the impacts and solutions identified, in line with the methodology applied throughout this guide, the plastic bottles associated with the pumps have been used as the starting point for the analysis, on the basis that the pump is not separated from the bottle during the consumer's sorting gesture and that its recyclability should therefore be analysed in relation to the nature of the bottle.

Reminder: the case of pumps used with glass or metal bottles is not dealt with here, only pumps and their impact in association with plastic bottles are assessed.

1 | Description of a typical package

Figure 13: Non-exhaustive standard description of a pump bottle



Non-exhaustive standard description

For the bottles, three resins were analysed: PP, PE and PET. These pump bottles are used in all three cosmetics market sectors:
fragrance / make up / skincare

HDPE bottles are mainly used for large capacities, while PP bottles are used for specific applications where transparency is required, for small capacities (promotions, samples), for perfume samples or for airless bottles.

There are also pumps on PE tubes for suncare or skincare products (there are also some jars with pumps).

There are two categories of pump: atmospheric and airless.

Airless pump bottles are used to protect formulas, and are mainly made of PP for reasons of transparency and simpler functionality (piston airless - obtained by injection), and for its mechanical resistance (rigidity) and appearance (bag airless - obtained by extrusion/blowing).

What is true for the atmospheric pump also applies to an airless system: impact of the spring or the pump's metal casing.

There are also airless systems (with screw pumps and snap pumps) for bottles made from PET derivatives (co-polyesters, PETG), in particular with pistons. Airless products are currently being developed with a glass body and a plastic piston (before, the body and piston were both made of plastic).

2 | Identification of blocking points

The blocking points for the pump element may vary depending on the material from which the associated bottle is made (PET or PP/PE).

By reversing the density of the bottle (by flotation to sort PET or, on the contrary, by sinking for PP or PE), certain elements present in the pump can be easily eliminated.

Metal and metallization:

As far as the functional elements to be reworked are concerned, it's the metal spring, the metal casing (for the push button or ferrule) and the POM/glass/metal ball that disrupt the sorting and recycling process.

In the current PET bottle stream, all printing, lacquering and metallisation are prohibited. Other avenues could be explored depending on the other possible streams for PET.

For PE/PP matrices, check against the standards. Metal is authorised in the COTREP standard but not in the RecyClass standard: these metallic elements could disrupt the sorting process and will disrupt the recycling process, particularly at the shredding stage where the equipment is designed to shred plastics and not metal.

3 | Identified solutions and limits

Solutions have been identified with a view to the publication of the PPWR and are currently at the **R&D development stage.**

Firstly, new pump bodies are being developed in PBT / PPH to replace POM, and without metal springs. It should be noted that designing a new pump can take **up to 10 years.** Polyesters, which will also have a negative impact on recycling, should also be avoided. Materials with a different density to PET must be used for separation: PP/PE.

The POM/glass/metal ball that interferes with recycling can be replaced by PP or PE. Glass and metal balls were favoured because, on the one hand, a ball of high density (stainless steel or glass) will naturally be pressed into position by its weight and, on the other hand, the dimensional accuracy and chemical resistance of stainless steel/metal balls are superior to plastic balls. However, this change in ball material must be checked on the basis of the cosmetic formula in order to avoid any risk of swelling that could cause the pump to malfunction, and to ensure compliance with the recommended thresholds for the associated packaging (limit of PP in HDPE to be respected).

Respecting tolerances has a major impact on packaging components: **pumps are essentially designed using virgin materials, for reasons of compatibility and sealing of parts. The incorporation of recycled materials remains limited.**

Another piece of legislation that will have an impact on packaging and its components is CARB 2031 in the USA, which imposes a reduction in the alcohol content of fragrances. The formulas will have to be reviewed and will be more water-based / Oil in Water / Water in Oil with different fluidities, which in turn will lead to changes in packaging materials. The pump will also have to evolve. These regulations will need to be taken into account in R&D projects.

PET bottles with a sprayed oil/water mixture (external spraying) to avoid static electricity on the lines: there are no constraints on this point in the recyclability guidelines for PET packaging (other possible method of avoiding static electricity: eddy currents).

Critical element or limiting the quality of the recycled material	Essential criteria/ purpose	Identified areas of development	Impacts	Comments
Presence of metal for the mechanism	Distribution of the formula	Single-material plastic mechanisms, complying with density criteria in relation to the bottle	Slight weight loss Minor on distribution	
Collar in coloured plastic and/or decorated by hot stamping / metallisation	Covers the top of the pump mechanism	Work on the surface of the collar with a satin or textured finish to provide a certain aesthetic effect instead of metal		
POM/glass/metal ball	Watertight valve	Change of material: PE or PP or moulded valves	Risk of swelling leading to pump malfunction / chemical resistance	

E | Jars

Two main resins were studied for jars: PET and PP. In general, formulas (or products) are water-based and therefore require packaging with a certain barrier to water and gas transfer.

Reminder glass and aluminium jars are not included. Materials other than plastics are not covered in this guide.

1 | Description of a typical package

Figure 14: Non-exhaustive standard description of a jar

Among other things, the lid/seal provides barrier properties against oxidation and prevents the loss of water weight - fragrance. Without an lid/seal, a cream can dry out. What's more, the triseal seal is not watertight enough to ensure a shelf life of 3 years from the date of packaging.

Cosmetic products: **skincare creams, masks, balms, scrubs, etc. (body, face, hair)**

2 | Identification of blocking points

Recycling streams:

Plastic jars, which are now mainly made from recyclable resin, are sorted:

- Either into the PE/PP rigid stream
- Or into the new stream being developed for clear rigid PET (which is then sent to downstream sorting centres)

Polyesters and copolyesters:

Polyesters and copolyesters are an extremely large and varied family of polymers: PBT, PCTA, PCTG, PEF, PET, PETG, PHA, PHB and PLA. These different chemical compositions, which are mainly the result of the selection of certain monomers, make it possible to obtain very different mechanical, chemical and aesthetic performances.

With regard to recyclability, it is important to understand that we cannot talk about the recyclability of polyesters or copolyesters in general and that we need to be much more specific. Today, the only existing recycling process for polyester and copolyester packaging is mechanical recycling of PET.

Certain copolyesters that are very similar to PET are authorised to enter this recycling stream, provided that they can be shown not to disrupt it when present in small quantities. These include certain slightly modified PETGs.

If the stream is mechanically recycled, most copolyesters and polyesters other than PET are problematic because they melt quickly and at different temperatures. They block the extrusion screws during regeneration, which poses a problem for recyclers. However, it may be possible to incorporate them into chemical recycling in certain streams in the future (the fact that they are clear or coloured may have an impact on the possibilities).

However, some polyesters and copolyesters cannot be recycled, either mechanically or chemically.

The sorting and recycling of other rigid coloured PET is being studied by COTREP with a view to a potential transition to recyclable status under the QCE (consumer information) decree by 2026. The compatibility of coloured copolyester pots can be analysed with this coloured PET process.

To date, this stream is recycled with other rigid materials such as coloured PET bottles and flasks.

In addition, other resins are still used as standard on the cosmetic jar market, such as PMMA/SMMA, which are not and will not be recyclable. Finally, if biosourced materials come onto the market, it is important to check that the resin obtained is one of the plastics that can be recycled in the household stream (e.g. biosourced polyethylene).

Lid/seal/cap of different material to that of the jar:

Even if it is indicated on the jar that elements such as the lid/seal must be separated, consumers do not systematically do so. However, in a sorting centre, if the jar arrives on the conveyor belt with its cap/lid/seal in place, it can be detected on the basis of different orientations: on the bottom, on the front or on the side. If the metal cap, for example, is detected, the metal blocks the IR (infrared) rays and the packaging will not be detectable, so it will go into the sorting waste. In the same way, ABS or wooden caps have a disruptive effect on recycling: the packaging is rejected because these materials have no sorting and recycling streams. If, on the other hand, the metallisation is limited to one area or the interior, it will not be visible on the outside and will not be disruptive.

For PP jars, the advantage is that the aluminium foil sinks during flotation and is therefore eliminated in the flotation baths.

In addition, markings and direct prints, which are generally disruptive to PET in flotation baths, can also disrupt sorting (depending on the surface area concerned).

Seal (triseal® type):

According to the RecyClass standards, this element is considered to be non-disruptive for the PET and PE sector in particular. For PE, expanded coatings (based on PO) are fully compatible with the stream, with densities of less than 1 g/cm³ (https://recyclass.eu/wp-content/uploads/2024/07/Technical-Review-Foaming-Revised.pdf). The criterion to be met is to reverse the density in relation to the resin to avoid polluting the stream as much as possible.

Label adhesive:

The adhesive used for the labels is an important factor, as the label must be detachable from the packaging during the recycling process. For more information, please refer to the section on common elements at the beginning of the second part.

3 | Identified solutions and limits

Lid/seal:

As the lid/seal is relatively easily separated by the consumer on first use, this element was not considered in the context of this study. Since the separation method has not been clearly established, assessments can take the lid/seal into account (as in Citeo's TREE tool). Further work is therefore required to support these positions.

Label adhesive:

As far as adhesives are concerned, there are more and more wash-off adhesives for PET streams (water at 85°C + soda) that can be used. However, it is important to test the adhesive's resistance to the product in the bottle.

It is recommended that the same material be used for the pot and its lid/cap, so that the entire package can be placed in the correct resin stream, whatever the orientation of the pit on the conveyor belt at the sorting centre. As cosmetic pots are often thrown away closed with their lid/cap, the latter can be the object of detection.

It is also worth looking at the specifications for the bales purchased by recyclers. Wood and glass are banned from the plastics industry (PRE - Plastics Recyclers Europe - bale specification (https://www.plasticsrecyclers.eu/), APR US, SRP syndicat des recycleurs), even though these materials are not necessarily identified in the recyclability standards but are identified as disruptors by plastic resin regenerators.

POINT OF VIGILANCE

In addition to the trend towards single-material packaging, the cylindrical shape of the pots can have an impact on proper recovery on sorting conveyors, a criterion not currently taken into account in recyclability assessments: cosmetic jars (and certain bottles) cannot be compacted because they are quite rigid and can roll on conveyor belts, which prevents proper recovery of the packaging during optical sorting: they will be detected but are difficult to eject. These experiences have not yet been formalised by Citeo. They follow on from specific tests carried out as part of various projects and have not yet led to widespread recommendations for inclusion in matrices and eco-modulations or assessment tools such as TREE. This criterion could be adopted in the years to come, along with the notion of recyclability on a large scale.

Critical element or limiting the quality of the recycled material	Essential criteria/ purpose	Identified areas of development	Impacts	Comments
Pot material ABS / SAN / PMMA	Protection of formula + aesthetics (gloss)	PP, PE, PS or PET	Colours, appearance, drop test	Monitor the arrival or possibility of chemical recycling
Aluminium lid/seal	Seals packaging before opening	Non-metallic lid/seal Lid/seal cannot be kept after first opening	Loss of water content in the formula, change in texture	
Pot material coloured PET	Aesthetic appearance, barrier properties of PET	To be determined according to recommendations for the sector		Uncertainties over the criteria for the coloured PET sector in France in the management of the stream in development
Seal	Ensures that the packaging is watertight	Reverse density in relation to the resin in the pot		For PE, expanded coatings (PO-based) are fully compatible with the stream, with densities of less than 1 g/cm³ (https://recyclass.eu/wp-content/uploads/2024/07/Technical-Review-Foaming-Revised.pdf)

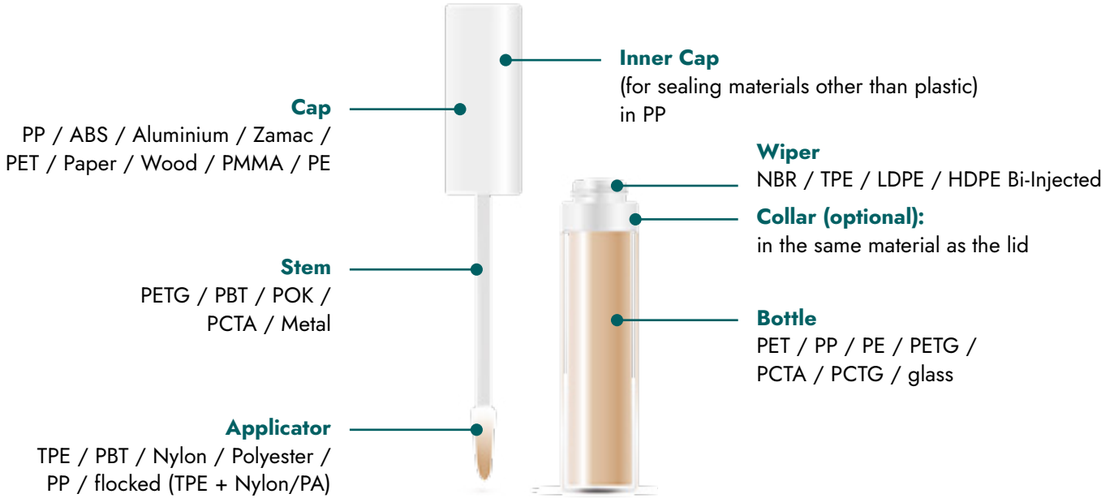
F | Dip-ins

Reminder: glass and aluminium packaging are not taken into account. Materials other than plastics are not covered in this guide.

Based on the same principle as the pumps associated with different bottles, the dip-ins feature a variety of parts needed for the correct use of the product, with multiple materials to fulfil the different functions. These are made up of several parts as follows:

1 | Description of a typical package

Figure 15: Non-exhaustive standard description of a dip-in



Non-exhaustive standard description

For each dip-in packaging:

- **The bottle** contains the formula and can be made up of one blow-moulded part or two injected, assembled and welded parts. The upper part of the bottle (the neck), the collar, is ultrasonically welded to create a seal between the 2 parts. The bottle should be modelled in "other rigid materials" in Citeo's TREE tool.
- **The wiper:** each dip-in contains a wiper at the neck of the bottle outlet with materials that can be different (diameter narrower than the applicator to wipe it before taking it out of the bottle and is flexible / deformable so as not to damage the applicator).
- **The applicator** can be in different shapes and materials depending on its use and the area of application: fibre or plastic brushes, foam, flocking, etc.
- **The stem** holds the applicator. It can be in one piece: it then forms a single element with the applicator (e.g. eye contour serums, etc.).
- **The cap and the inner cap** forms the sealing screw system. The challenge is to limit the drying of the formula inside the bottle so as to limit the residual rate of formula at the time of sorting.

Cosmetic products contained: **mascara, lip gloss, highlighter, etc.**

2 | Identification of blocking points

Main body material and recycling stream:

One of the first challenges with this type of packaging is to identify **the stream in which it will be recycled.** If it is assimilated to the "bottles and flasks" stream, the criteria will be more restrictive, with the aim of returning to sensitive contact for these streams (PET, PP, rigid PE). The bottle should be modelled in "other rigid materials" in Citeo's TREE tool.

- **PET bottle:** the PET sector prohibits the majority of materials used for other DIP IN components (PBT, PETG, POK, metal, etc.).
- **PA bottles:** they are not recyclable to date.
- **For PCTG / PCTA / PETG bottles,** the rules have not yet been written. ELIPSO and FEBEA will monitor the definition of these recyclability matrices with the development of chemical recycling.

Formula/packaging compatibility:

There are generally 2 types of dip-in formula: washable and waterproof (or long-lasting), which uses special solvents. **Compatibility between these solvents and packaging materials is a real issue. Isododecanes and alkanes alter PP. PET works, but there are other problems, such as the association of metal.**

Restitution rate / product residue rate:

Residues from the contents of the packaging can have an impact on sortability and recyclability.

In general, when a mascara is thrown away, between 35 and 50% of the formula remains in the packaging (dried formula). It is the loss of the solvent part of the formula that is problematic in terms of sealing. For lip gloss dips with a higher solvent content, this may be less critical.

It's not just the problem of the formula drying out, but the very design of the dip-in, with an applicator that doesn't touch the sides, and the presence of a wiper, inevitably means that not all of the formula can be recovered.

Metal:

The metal used for the fibre brushes has been identified as being incompatible with the recycling of the PET bottle. But today, **there is no metal-free alternative, so it's a colossal change that needs to be made.**

For PE and PP, the recommendations differ from one standard to another: COTREP authorises metal, while RecyClass does not. Everything will depend on what is included in the design criteria for recycling at European level.

Small, rolling and compact packaging:

As explained above, this type of packaging is not currently taken into account by sorting centres because of its size or shape. Dip-ins are particularly affected by these characteristics.

The decorations and the black colour already mentioned for the compact cases and makeup palettes are also disruptive elements in the dip-ins.

3 | Identified solutions and limits

The two main challenges for DIP-INs are:

- **Compatibility between formulas and packaging materials.** To obtain recyclable solutions, we need to carry out R&D on possible formula/material combinations by adapting the formula and packaging.
- **The technical nature of the parts and the associated materials used, enabling good preservation of the formula and ease of application for consumers.** Elements such as the applicator or wiper require materials that are compatible with the main packaging resin that can be used for the bottle and cap. We need to go back to the functional analysis of these elements of DIP INs in relation to the diversity of polymers used to identify possible alternatives that are compatible with the type of the resin from which the bottle is made.

Chemical recycling may make it possible to authorise more resins such as PCTA, PCTG and PETG, but it will not cover everything.

It is preferable to opt for PP or PE solutions where all the different materials used (for the stem, the wiper, the applicator) are compatible with the recycling stream.

Note that there are also metal-free plastic applicators or brushes on the market that perform well.

Another solution is to work on variants with new designs and dimensions for the same type of product. The packaging must be designed in such a way that it is easy to empty its contents and must be completely empty when disposed of.

HDPE is much more widely used than LDPE for dip-ins in the form of rigid tubes. Melt Flow Index (MFI) constraints are available in the RecyClass standard, harmonised on the basis of APR work.

Critical element or limiting the quality of the recycled material	Essential criteria/ purpose	Identified areas of development	Impacts	Comments
PET bottle	Aesthetic appearance, barrier properties of PET	PP / PE resins	formula / packaging compatibility	Chemical recycling may make it possible to authorise more resins such as PCTA, PCTG and PETG, but it will not cover everything.
ABS/SAN (for caps/lids)	Closure system for watertightness / aesthetics / gloss	Other resins: PP, PE	Rendering Slippery Compatibility formula / packaging, mechanism	
Caps made of wood or fibre or other material not compatible with plastic	Closure system / aesthetics	Ensure continuity of material between the cap and the base		
Applicator or wiper (or dropper teat)	Elastomers/silicones used as applicators/wipers	Development of plastic applicators Work on new designs: packaging should be designed so that it is easy to empty its contents and is completely empty when disposed of.		Check the use of the material in relation to the predominant component on a case-by-case basis
Metal stem	Stem strength and rigidity. The applicator can also be made of metal for cool-touch application	Development of plastic applicators Work on new designs		

Conclusion: Recommandations for recycling streams and alternatives to be investigated

The joint analysis of the six main types of cosmetic packaging by plastic packaging suppliers and product manufacturers has highlighted the most common technical problems and possible solutions. For certain challenges, however, there are currently no existing alternatives on the market, and new solutions need to be developed through innovation.

In general, it is important to ensure that the predominant constituent of the packaging will be able to enter an existing recycling stream and to check that the associated components do not interfere with the recyclability of the predominant component.

For all types of packaging, improving recyclability requires the following levers to be activated:

- **Decoration adhesives:** limit the use of adhesives resistant to extreme conditions to the products concerned and limit the quantity applied.
- **Decoration:** avoid metallizations or reduce the coverage rate below 50% of the total surface of the packaging. Specific recommendations, particularly on coverage rates, exist for sleeves that are not direct decorations.
- **Dyes:** use the positive and negative lists provided when creating the packaging for the main components.
- **ABS/SAN styrenics** (as the predominant constituent) will have to be eliminated as they do not and will not have a dedicated recycling stream for household packaging.
- **PET-based polyesters and copolyesters:** Coordination between all the players in the recycling sector is needed to speed up the development of large-scale chemical recycling plants, so that they can be integrated into the harmonised European recyclability standards.

  However, it is important to bear in mind that if specific recycling technologies are required, **it is essential to be able to sort these polyesters and copolyesters so that their own recycling streams can be created.**
- **Associated metal components** will have to be addressed: to date, there is no harmonised rule between the different standards.
- **Associated glass components** should be removed: they are known to be disruptive for all streams (e.g. glass mirrors, glass beads).
- For some packaging, it will be necessary to **rethink the design** as a whole, because changes in resin can lead to changes in appearance (there is no equivalent to ABS and SAN, for example): a compromise on shape and appearance will have to be found (gloss, etc.).
- **Issues relating to the cosmetic formula / container-content compatibility:** This work on design should be carried out in parallel with the work on the cosmetic formula. The formula is also subject to numerous restrictions on the ingredients that make it up, which means that it has to be reformulated and creates complexity in terms of compatible packaging materials choice (container/content interactions). Certain technical materials are still required for specific formulas.

  These points need to be addressed as part of the harmonisation of recyclability rules underway for PPWR, its delegated acts and related standards.

For each category of packaging, the industry's joint work has highlighted the following areas that need to be addressed to ensure the recyclability of plastic cosmetics packaging:

- **Tubes:** no blocking points identified in general, but there are still design changes to be made, common to all packaging types. It is also important to ensure that the restitution rate is optimised (formula / tube flexibility / aperture diameter suitability).
- **Jars:** the choice of cap/lid material is important to ensure better sorting: preferably opt for the same resin as the jar so that the complete package is directed into the right resin stream whatever the orientation of the jar on the conveyor belt at the sorting centre.

• **Bottles and pumps:** full-plastic pumps have already been developed or are under development. R&D work will need to be carried out more specifically to address the specific constraints of each packaging/product pairing.

• **For all make-up products (dip-ins, palettes, lipstick sticks)** for which the packaging has a dual function: to contain the formula but also to be able to apply it correctly ("packaging-tool" function), several problematic points have been raised on which in-depth work needs to be carried out to find recyclable alternatives compatible with the formulas and with similar properties: metal parts, black colour, non-recyclable styrenic polymers, etc.

The transition to fully recyclable cosmetics packaging by 2030 requires effective cooperation between all the players in the sector. To achieve this objective, it is essential to engage in a process of co-construction along several strategic lines:

• **Research and Development:** Collaborate on innovation by ensuring compatibility between formulas and packaging to optimise recyclability.

• **Investment in processes:** Allocate financial resources to modernising production processes, thereby ensuring better integration of recyclable materials.

• **Mould design:** Invest in the development of new moulds adapted to designs that encourage recycling.

• **Packaging design:** Work on the shape and decoration of packaging to enable it to be recycled while maintaining an aesthetic that is acceptable to the product manufacturer.

• **Closure systems:** Develop closure systems that facilitate recycling while maintaining product integrity.

• **Consumer perception:** Implement actions to change consumer perceptions of cosmetic packaging, while supporting marketing teams in this process.

• **Improving collection and sorting streams:** Develop strategies to optimise the integration of packaging into collection, sorting and regeneration systems.

These changes are considerable and will require a reassessment of all types of packaging, particularly those used for make-up, so that they are designed with recyclability in mind by 2030.

A holistic approach is needed: It is crucial to adopt a global approach that takes into account not only recyclability, but also other criteria required by the PPWR regulations, such as minimising packaging, incorporating recycled materials and reuse.

Choosing plastic resins that can be recycled is a high-impact change, and provides an opportunity to completely rethink the packaging/product system. **It will be everyone's responsibility to ensure that the solutions that are developed do not have a greater environmental impact than existing solutions, over and above the recyclability requirement that has been addressed in this guide. It is therefore strongly recommended that the entire life cycle is analysed in order to eco-design products and reduce their impact efficiently.**

Acronyms

ABS: Acrylonitrile Butadiene Styrene

AGEC: Anti-Gaspillage et Economie Circulaire / Anti-Waste and Circular Economy (French law)

APR: Association of Plastics Recyclers (USA)

ASA: Acrylonitrile Styrene Acrylate

CARB: California Air Resource Board

COCET: Comité Technique d'Evaluation du Comportement en Centre de Tri / Technical Committee for Sorting Centre Behaviour Assessment

COTREP: Comité Technique pour le Recyclage des Emballages Plastiques / Technical Committee for the Recycling of Plastic Packaging

EPBP: European PET Bottle Platform

EPS: Expanded Polystyrene

EVOH: Ethylene vinyl alcohol

HDPE: High-density polyethylene

IR: Infrared

LCA: Life cycle analysis

LDPE: Low-density polyethylene

LLDPE: Linear low-density polyethylene

NBR: Nitrile Butadiene Rubber

NIR: Near Infra Red

PA: Polyamide

PBT: Polybutylene terephthalate

PCR: Post Consumer Recycled or Post Consumer Resin

PCR: Post-consumer recycled material

PCTA: Acid-modified polycyclohexylenedimethylene terephthalate

PCTG: Polycyclohexylenedimethylene modified with glycol terephthalate

PE: Polyethylene

PEF: Product Environmental Footprint

PET: Polyethylene terephthalate

PETG: PolyEthylene Terephthalate Glycol

PLA: Polylactic acid

PMC: Paper Metal Cardboard

PMMA: Poly methyl acrylate

PO: Polyolefins

POK: Polyketone

POM: Polyoxymethylene

PP: Polypropylene

PPWR: Packaging and Packaging Waste Regulation (European regulation on packaging and packaging waste)

PRE: Plastics Recyclers Europe - Association representing recyclers in Europe

PRO: Producer Responsability Organisation

PS: Polystyrene

PVC: Polyvinyl chloride

REACH: Registration, Evaluation and Authorisation of Chemicals (evaluation and authorisation of chemical substances in Europe)

EPR: Extended Producer Responsibility

SAN: Styrene Acrylonitrile

SMM: Styrene-Methyl Methacrylate

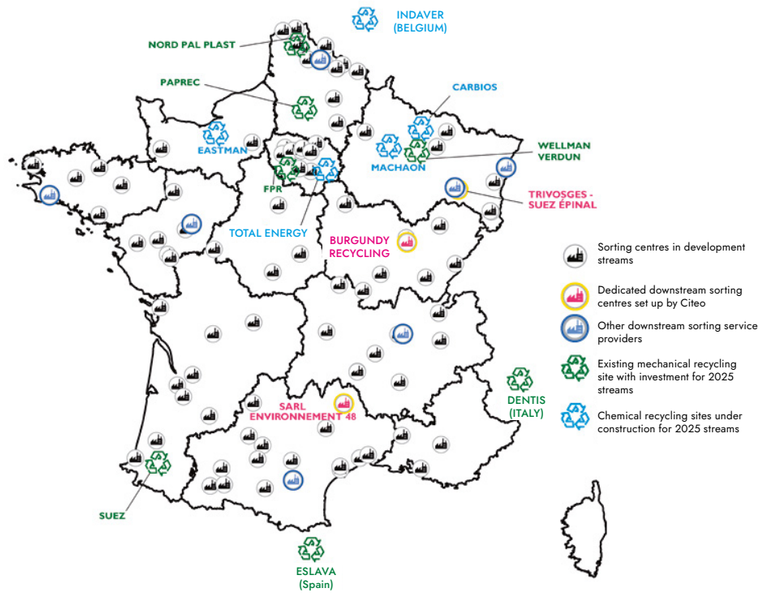
SVHC: Substances of Very High Concern

TPE: Thermoplastic elastomers

XPS: eXtruded Polystyrene

Appendices

Appendix 1: Sorting and recycling operators in France for household packaging



Source: https://www.citeo.com/le-mag/les-centres-de-surtri-le-nouveau-maillon-de-la-chaine-du-recyclage-en-france

Appendix 2: Packaging EPR models

The Extended Producer Responsibility (EPR) schemes for packaging are based on the principle that producers are responsible for the entire life cycle of their products, from eco-design to end-of-life management. This approach aims to encourage a more sustainable economy by encouraging producers to improve the recyclability of their packaging and reduce its environmental impact. In France, the EPR system is implemented by creating specific streams for different types of products, including packaging, to ensure efficient waste management and to promote recycling.

If you would like to find out more about the different EPR models, please consult the document proposed by Citeo on this subject: Citeo pan-EPR on the international stage

CEFLEX also offers this mapping of the EPR in 2023

Source: Graphic source: Derek Stephenson, Strategy Matters
https://ceflex.eu/epr-in-the-global-south-part-2-a-deeper-dive-into-countries-and-regions/

Appendix 3: COTREP and RecyClass standard protocols

The recyclability of plastic packaging is often based on tests to check its compatibility with the target resin in three successive stages (common to all protocols):

Stage 0: Sorting

The assessment of packaging 'sortability' is more or less formalised and taken into account depending on the standards.

RecyClass has a specific protocol for testing the sortability of plastic packaging:
https://recyclass.eu/wp-content/uploads/2024/01/SORTING-EVALUATION-PROTOCOL-FOR-PLASTIC-PACKAGING_-V2.0-FINAL.pdf

Stage 1: Regeneration of recycled material

The packaging containing the element to be tested will be crushed and washed to obtain flakes ready to be remelted to obtain granules ready to be reincorporated into packaging.

Stage 2: Shaping a new product containing recycled material with the element to be tested

The COTREP and RecyClass standards on which the case study analyses in this guide are based, incorporate these key stages.

COTREP standard protocol:

COTREP tests packaging on the basis of its rate of presence, representative of the market in the household packaging waste stream processed for recycling, within the scope of its standard, which is France. The ratio of the presence rate of the element to be tested is assessed in relation to the data on the marketing of the household packaging source, transmitted by Citeo.

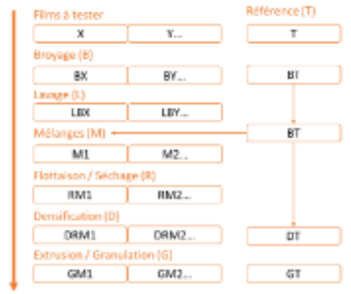
The sorting and regeneration stages are described in the following guide:
https://www.cotrep.fr/content/uploads/2019/01/cotrep-guide-recyclabilite-fr.pdf

To illustrate these steps, the example of the PE flexible plastics protocol is described below. Some differences can be made for other protocols to ensure the best representativeness of the industrial scale. For example, for PET, mixing with the reference material will only take place at the extrusion stage, as is the case for other PET protocols (EPBP, RecyClass)

Principles of COTREP test protocols

- **STAGE 1**

Granules from the packaging to be tested, comprising different rates that are **representative of the French source**, are regenerated and compared to a control reference on different criteria depending on the stages



Example of stages for the flexible PE flexible

- **STAGE 2 manufacture of new packaging**

From the granules obtained, a **mixture with 50% virgin resin and 50% recycled** material will be made to create a new packaging and also compare the different characteristics, technical and process impacts between the control and the granules containing the material to be tested

Figure 3 : Descriptif des étapes du protocole d'extrusion-gonflage

Example of stages for the flexible PE protocol

RecyClass standard protocol

In the example of flexible PE, the steps for regenerating granules are similar to those in the COTREP protocol. **It is the dilution rates of the packaging or packaging component to be tested** in the granules used to make the new packaging that are different (at the extrusion stage):

A.0: control packaging, generally compared 100% to packaging made from virgin resin.

A.25: the granules from the test pack are diluted 75% with the control packaging or granules (virgin)

A.50: 50% dilution.

A.100: optional, processing using only the granules from the control packaging

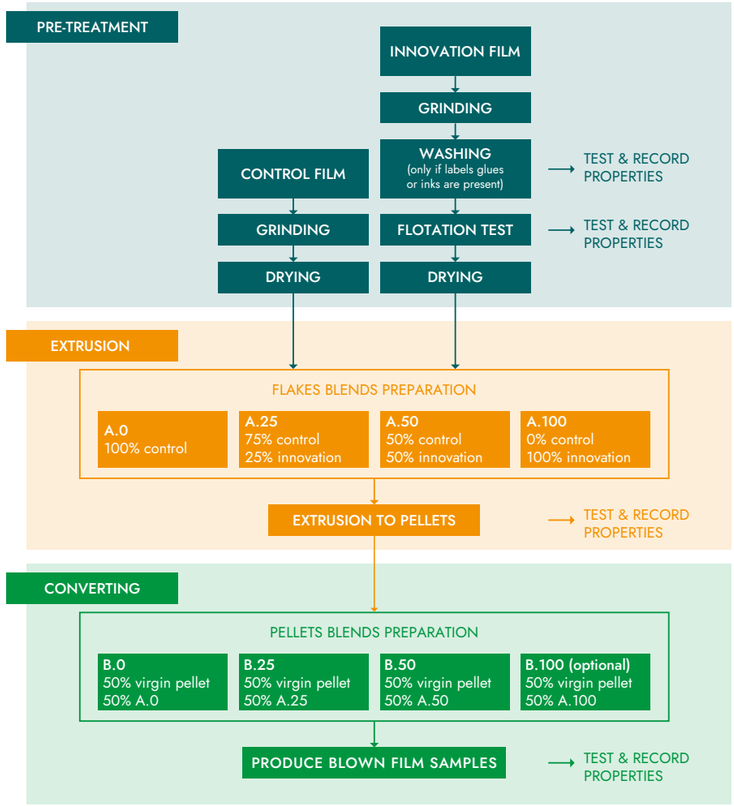
The second differentiating factor is the comparison with packaging generally made from virgin resin. For the flexible plastics used in the example below, there is some latitude on the:

the selection of the control PE sample used to carry out the protocol:

- Option 1: if there is a PE film known to be recyclable, composed of the same base PE resin as the innovation, with the exception of the specific ingredient/characteristic being evaluated, it can be selected as a control for this protocol, with the approval of the RecyClass PO films Technical Committee.

- Option 2: The applicant may select a PE resin listed in the Annex (or another grade with a similar MFI and density from other suppliers) to be used as a control for this protocol, with the approval of the RecyClass PO Film Technical Committee.

To obtain the control, the selected PE resin must be extruded once, following the extrusion recommendations in this protocol, in order to simulate the same thermal history as real packaging. The same physical form as the new material should be used where possible.



Source: https://recyclass.eu/recyclability/test-methods/

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