

Version 4.0, 23 April 2024

## **Plastic Tubes Committee / Laminate Tubes Committee Position Paper on the Recyclability of Plastic Tubes**

### **1. Background**

The European Green Deal and Circular Economy Action Plan made commitments to increase the recycling of plastics and therefore reduce the use of virgin materials. All packaging on the EU market shall be recyclable or reusable by 2030 in order to achieve the best possible level of waste prevention and resource efficiency.

In November 2022 the EU Commission submitted a draft for a Packaging and Packaging Waste Regulation. The Regulation lays down recycling targets of packaging waste that EU Member States must meet by 31 December 2025 and by 31 December 2030, which are the same as in the original Packaging and Packaging Waste Directive 94/62/EC. For plastic packaging the recycling targets are as follows: 50% by end of 2025, 55% by end of 2030.

### **2. Assets of plastic tubes for better resource efficiency and sustainability**

Plastic tubes produced by extrusion or laminated production technologies are contributing to a high level of resource efficiency because:

- they are a light-weight packaging and offer a better packaging weight to filling volume ratio compared to other packaging such as bottles
- their weight has been considerably reduced over the years and this development keeps going on
- they are, contrary to other packaging like bottles, mainly direct printed and therefore foster monomaterial solutions
- they allow a high restitution rate
- they offer different barrier options to protect the filled product and thus avoid product/food waste

Packaging in general should not be downgauged without proper consideration of shelf-life and product protection requirements because much more energy resources are contained in the packed product compared to the packaging.

Life Cycle Assessments (LCA) can be a helpful tool to assess a product's sustainability performance and to optimize the design for recycling.

### **3. Recyclability of plastic tubes**

A high recyclability of plastic tubes needs to be ensured by consistent design for recycling of packaging and requires an efficient post-consumer collection, sorting and recycling infrastructure. Moreover, clearly defined regulations and differentiated thresholds for the use of recycled material in food, rinse-off and leave-on cosmetic packaging are important for an appropriate risk assessment.

### 3.1 Design for recycling

Consistent design for recycling means that plastic tubes (including shoulder and caps) should consist of only one material, if technically feasible and functionally reasonable. Material mixtures should only be used as long as they do not impede the recyclability of the tube in existing waste management systems. Plastic tubes shall be designed so that they comply with the sorting requirements for rigid PE or PP containers, as tubes will be sorted into the rigid PE or PP packaging stream. In addition, masterbatches/varnishes/inks should be minimized and selected in order not to hamper the tube's recyclability.

Several organizations such as [RecyClass](#) by Plastics Recyclers Europe (PRE), [American Plastic Recyclers](#) (APR) or the [Stina Inc initiative](#) in Europe and the US have analyzed the existing recycling infrastructure and are developing industry guidelines which lay down requirements for the recyclability of plastic tubes in existing waste management systems. In Europe, for example, PRE's RecyClass guideline is widely accepted (<https://recyclclass.eu/recyclability/design-for-recycling-guidelines/>). In the US APR have published the paper "Plastic Squeeze Tubes Design Resource Document - HDPE and PP Based Tube Packaging" last updated in December 2022.

The design for recycling recommendations in chapter 3.1 were derived in consideration of these guidelines and should in principal secure PE and PP tubes' compatibility with the recycling requirements of existing waste management systems.

The main design for recycling recommendations on material recycling compatibility of PE and/or PP tubes are as follows:

- Mono-material design required (e. g. PE body and shoulder and PE/HDPE cap or PP body and shoulder and PP cap)
- For full recycling compatibility, tube body, shoulder and cap need to consist of > 90% of PE or > 90% of PP
- For limited recycling compatibility, tube body, shoulder and cap need to consist of >70% of PE or > 70% of PP
- Limited compatibility with HDPE, if PP  $\leq$  10 wt% of the total weight of the packaging
- Limited compatibility with PP, if HDPE  $\leq$  10 wt% of the total weight of the packaging
- Low compatibility with HDPE, if PP is between 10 and 30 wt%, leading to 2 class deduction according to RecyClass' criteria or if PP > 30 wt%, leading to 3 class deduction
- Low compatibility with PP, if HDPE > 10 wt%
- With PE tubes, HDPE in contrast to LDPE/LLDPE to be maximized
- For full recycling compatibility, EVOH barrier material content  $\leq$  6.0%wt + PE-g-MAH tie layers with MAH > 0,1%wt and EVOH:tie layers ratio  $\leq$  2, including body, shoulder and cap
- For limited recycling compatibility, EVOH barrier material content > 6.0%wt + PE-g-MAH tie layers with MAH > 0,1%wt and EVOH:tie layers ratio  $\leq$  2; or EVOH  $\leq$  1% with any other tie layers
- For full recycling compatibility, tie layers need to be PE-g-MAH layers with MAH > 0.1% (polyethylene-grafted maleic anhydride)
- Light-color masterbatches preferred
- Direct printing with non-bleeding inks following EuPIA Guidelines representing <1 wt% of total packaging (minimized surface coverage preferred)
- Amount of additives, pigments and fillers only to an extent that density of total tube material <0.970 g/cm<sup>3</sup>
- Liners in caps and applicators PE-based (for PE tubes) or PP-based (for PP tubes); TPO or TPS based, if < 1% for both PE or PP tubes

- Tamper-evident ABL/PBL foils allowed on PE/PP tube shoulder (removed by end consumer before use)
- Metallization of caps and applicators only allowed, if near-infrared (NIR) detection is not affected
- Concerning product residues in the packaging, full recycling compatibility, if the index is < 5%; limited recycling compatibility, if the index is < 10%

Even tubes with small dimensions can be efficiently sorted out of the packaging waste stream with state-of-the-art sorting technology.

### **3.2 Collection, sorting and recycling infrastructure**

Besides a consistent design for recycling, consumers' willingness to separate their household waste and an efficient infrastructure for collection, sorting and recycling is required in order to achieve high-quality recycling of plastics. A corresponding consumer education and investment in state-of-the-art collection/sorting/recycling technology is paramount.

The recyclable tube needs to be compatible with these state-of-the-art infrastructure's requirements. In this context the EU Commission is pushing in its Circular Economy Action Plan for a harmonization of Extended Producer Responsibility systems in Europe to implement efficient collection and sorting schemes across the EU to allow for a comprehensive recycling of materials. Modern technologies such as NIR detection or future digital marking technologies under development are needed to efficiently sort plastic packaging materials.

Bio-ethanol based plastic materials (e.g. sugarcane-PE) can be handled in existing recycling streams, whereas bio-degradable and oxo-degradable plastic materials should not be used because they impair the quality of the sorted plastic packaging fraction.

## **4. Conclusion**

Plastic tubes are a resource efficient packaging and fully recyclable, if certain design for recycling criteria are fulfilled, consumers properly separate their household waste and a state-of-the-art collection, sorting and recycling infrastructure is in place.

## **5. Disclaimer**

This document must be considered as a living document which needs updating in case of changes to the legislation and guidelines mentioned.