Polyolefin Packaging Design

Borealis 10 Codes of Conduct for Design for Recyclability (DfR)

At Borealis, we work closely with our value chain partners to develop polyolefin-based material solutions and concepts that accelerate the transition to the Circular Economy. There are promising opportunities for business growth in replacing the linear model of "take-make-dispose" with a more circular one focused on recycling. Polyolefins are an ideal material for designing packaging that can be recycled and these Design for Recyclability (DfR) codes need to be adopted to optimise their recyclability.

DfR incorporates recycling codes of conduct into the design process keeping in mind the end-of-life aspects after its original intended use. These DfR codes are an essential tool for delivering to market plastic packaging, with the right functionalities, yet also, helps conserve natural resources and minimise waste (including product waste) disposal or incineration and littering. DfR can maximise recycling rates for all kinds of plastic packaging because it makes separation and reprocessing more efficient. It also ensures the steady and affordable supply of high-quality recyclates, from so called "recycling-ready" packaging. Those recyclates also have a significantly lower CO_2 footprint and require less fossil fuel in the manufacturing process versus production of virgin resin.

While there are many aspects of plastic packaging design that make packaging **"recycling-ready"**, we have identified three key overarching codes of conduct when designing the function of the packaging eg, preservation, safety, wastage

- Use as few different polymer types, components and materials as possible in the design of the overall packaging. This applies to all packaging components such as the body, closures (caps, liners seals), lidding and any other additional components.

- Make it easy to strip and wash off all decoration (e.g., labels or sleeves and adhesive, printing, ink etc) from the main functional part of the packaging

- By no means, should packaging, designed according to the DfR codes, come at the detriment of food/product preservation/protection

The following "dos and don'ts" help our partners and customers navigate the relatively new and complex field of DfR in polyolefins. These codes are based on current circumstances and technologies used in European countries and we recommend that you regularly consult trade and industry bodies such as **Plastics Recyclers Europe (PRE)** and the **Institute Cyclos-HTP** in order to stay up to date on emerging technologies, waste stream evolutions, and new sorting and reprocessing capabilities

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Be sure to. . .	Doing so is important because...
1. Use PE or PP whenever possible to form a mono-layer, mono-material packaging body.	Mono-materials are more easily recyclable than multi-layer, multi-material packaging. Generally speaking, the most efficient and widespread collection, sorting and recycling systems are currently in place for PE, PP and PET. While collection and sorting systems for polymer types like PS and technical plastics do exist in certain regions, they are not yet available on an industrial scale.
2. Use transparent (unpigmented), or white, for the main body of the pack.	With existing technologies, it is difficult, costly and sometimes impossible for recyclers to remove pigments from the pack body. In instances in which the pack needs a light barrier, a white body is the preferred option.
3. Design the package in such a way that it can be fully emptied after use.	If the content of the pack cannot be fully emptied, the residue complicates the recycling process: it makes it more expensive, and produces an inferior recyclate because odour, colour or mechanical properties contaminate the result. The LCA of such a product is inferior.
4. Use compatible and separable combinations when it comes to polymer types, barrier layers, dyes and adhesives.	Minimising incompatibilities produces a recyclate with better mechanical properties, and one more suitable for a second life in consumer goods packaging. There are markets where we do recognise that in certain cases incompatible resins are necessary to match the application's requirements. For these types of packaging, it is necessary to design the packaging so that it can easily be separated from the PO recycling streams during the washing process (owing to the difference in densities)
5. Use aluminium foil as a barrier layer only when it can be easily separated from the main pack for aluminium recycling.	Aluminium foil as an inseparable barrier layer can be problematic in the recycling process. If used, efforts should be made to ensure that aluminium foil can be separated from the main pack body (or fragments thereof containing aluminium particles) by way of eddy-current separation.
6. Follow specific density guidelines when selecting pack components, including labels.	In the recycling process, polyolefins are sorted by density in a water-based float sink system. This cleanly separates waste streams according to type, such as PE/PP or PET. However, if barrier layers, foaming agents or fillers are used, they change the density of the polymers. This may lead to incorrect sorting. The type of labels used also affects density; ideally, labels should be removable.
7. Design labels, sleeves and other on-pack printing in such a way that they can be easily separated from the main pack body. For both PE and PP packs, use the same polymer and same colour for the entire pack – body, caps, closures and labels.	These components complicate the recycling process and contaminate the recycled product. Ideally, labels and sleeves should be completely removable. On-pack pigments and colours applied through direct, reverse or trap printing can only be removed in the recycling process through a short friction washing cycle using natural water at temperatures of up to 50° C. If (e.g. for in-mould labels) that is not sufficient to remove the label from pack body, use washable inks. It is good to print only the most essential information directly on the main body in order to fulfil legal requirements (sell-by date, batch number etc.). Consistency in components helps the optical scanner sort the packs correctly for recycling.
8. Use as little surface space as possible for printing or labelling on the pack.	As a rule, the less space taken up by a label, the more likely the pack is to be recognised during sorting.
9. Use light-coloured, non-gassing inks for essential on-pack information.	Inks that cannot be removed and thermally neutralised during recycling disrupt the process. This is why it is important to use light-coloured, non-gassing inks that are temperature resistant up to 240° C.
10. Ensure that paper and plastic used in combination on a single pack must be separated by the end user before the pack is actually opened and used.	Paper fibres cannot be effectively removed in the recycling process, clinging to polymer flakes, degrading under heat, setting off gasses, and otherwise causing discolouration and odours.

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