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Thinking Circular

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Polyolefin Packaging Design

10 Codes of Conduct for Design for Recyclability

As part of our EverMinds platform and approach to Thinking Circular, 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 (PE and PP) are an ideal material for designing flexible and rigid packaging that can be recycled and these Design for Recyclability (DfR) Codes should 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 for the function (such as preservation, safety and wastage) of the packaging:

- 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/or wash off all decoration (such as labels, sleeves, adhesives, printing and inks) from the main functional part of the packaging

- By no means, should packaging designed according to the DfR Codes impact the preservation/protection the food or product, however do ensure that the requirement is really necessary and not over-engineering.

The following "do's 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** and the **Institute Cyclos-HTP** in order to stay up to date on emerging technologies, waste stream evolutions, application-specific DfR guidelines, recyclability assessments and new sorting and reprocessing capabilities.

Be sure to. . .	Doing so is important because...
1. Use PE or PP whenever possible to form a mono-material flexible or rigid 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 mono-material PE, PP and PET. While collection and sorting systems for other plastics do exist in certain regions, they are not yet available on an industrial scale.
2. Use transparent, clear 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. White pigment body of packaging ONLY if barrier to light is required.
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 is more expensive and produces an inferior recyclate (recycled plastic) because the odour, colour or mechanical properties contaminate the final result, and the environmental (LCA) impact of the product is inferior.
4. Use compatible and separable combinations of polymer types, barrier layers, dyes and adhesives.	Minimising incompatibilities produces a recyclate with better properties and therefore more suitable for a second life in consumer goods packaging. We recognise that in certain cases there are markets where incompatible resins are necessary to match an application's requirements. For these types of packaging it is necessary to design the packaging so that it can easily be separated from the PE and PP 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 pack for aluminium recycling.	Aluminium foil as an inseparable barrier layer is problematic in the recycling process. If required every effort should be made to ensure that aluminium foil can be separated from the main pack body (or fragments thereof containing aluminium particles) for aluminium recycling by means of eddy-current separation.
6. Follow specific density guidelines when selecting pack components, including labels, sleeves and metallisation.	In the recycling process polyolefins are sorted by density in a water-based float sink system. This cleanly separates waste streams according to polymer types, such as PE, PP or PET. However, if barrier layers, foaming agents or fillers are used, they change the density of the polymers and this may lead to incorrect sorting. As the type of labels used also affects density, labels and sleeves should ideally be removable and separable by density.
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.	Labels, sleeves and other on-pack components complicate the recycling process and contaminate the recycled product. Ideally they 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 that is not sufficient to remove the label from pack body such as for in-mould labels use washable inks. It is preferable to print only the most essential information to fulfil legal requirements (sell-by date, batch number, etc.) directly on the main body pack. 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 or printing inks, the more likely the pack is to be recognised during sorting and results in higher quality recyclates.
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. It is therefore very important to use light-coloured, non-gassing inks that are temperature resistant up to 240° C.
10. Ensure that when paper is designed in combination with plastics on a single pack, it must be separable and separated from the main plastic body by the end user in order to access the contents.	Paper fibres cannot be effectively removed in the recycling process as it clings to polymer flakes and degrades under heat, setting off gasses, and otherwise causing discolouration and odours. It is essential that the end user can separate the paper from the main plastic body of the pack.

For further information and additional technical guidance on designing Polyolefin packaging for recyclability, contact sustainability@borealisgroup.com

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EverMinds™ - Thinking Circular | Date of issue: January 2019

About Borealis Borealis is a leading provider of innovative solutions in the fields of polyolefins, base chemicals and fertilizers. With its head office in Vienna, Austria, the company currently has around 6,600 employees and operates in over 120 countries. Borealis generated EUR 7.5 billion in sales revenue and a net profit of EUR 1,095 million in 2017. Mubadala, through its holding company, owns 64% of the company, with the remaining 36% belonging to Austria-based OMV, an integrated, international oil and gas company. Borealis provides services and products to customers around the world in collaboration with Borouge, a joint venture with the Abu Dhabi National Oil Company (ADNOC).

Borealis and Borouge aim to proactively benefit society by taking on real societal challenges and offering real solutions. Both companies are committed to the principles of Responsible Care®, an initiative to improve safety performance within the chemical industry, and work to solve the world´s water and sanitation challenges through product innovation and their Water for the World programme.

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