

Introduction to Masterbatch & Custom Color Advanced Solutions

2022

A look at the LyondellBasell portfolio

LEADING⁽¹⁾

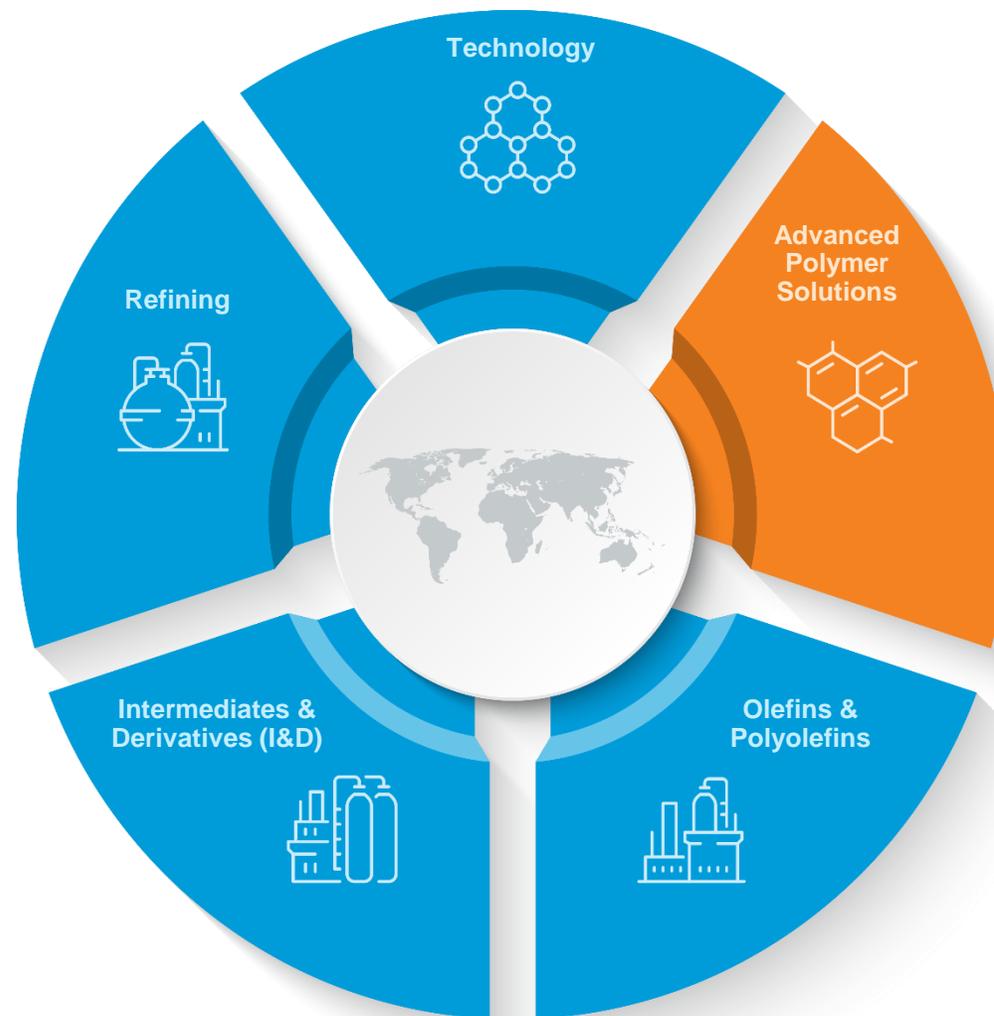
#1

- Producer of **polypropylene compounds** globally
- Licensor of **polyolefin technologies** globally
- Producer of **polyethylene** in Europe
- Producer of **polypropylene** in Europe and North America
- Producer of **oxyfuels** in Europe and North America

GLOBAL



Every day, our **employees** work around the clock to safely **advance solutions** to our world's biggest challenges.



LyondellBasell has the scope and scale to serve global markets



Note: Information as of December 31, 2020.

Advanced Polymer Solutions



ADVANCED POLYMER SOLUTIONS

Our diverse portfolio is used to create customizable products including:



Reduced GHG emissions & improved fuel economy



Delivering potable water



Quality healthcare



Agricultural efficiency



Food safety & access



Sustainable & modern living

Catalloy

Polybutene-1

Specialty Powders

Polypropylene Compounds

Engineered Composites

Engineered Polymers

Color Concentrates

Masterbatches

Masterbatch & Color Concentrates

Application Areas



Packaging



Building & Construction



Transportation



Agriculture



Consumer Goods



Appliances

Key Properties

Processing Additives

- Anti-oxidant
- Processing aid, Lubricant

Functional Properties

- Slip, Anti-blocking, De-nesting, Release agent
- Anti-static, Anti-fog
- Filler, Nucleating agent, Blowing agent, Flame retardant,
- UV stabilizer, Anti-oxidant, UV and IR absorber

Optical Appearance & Aesthetics

- White, Black
- Matt, Synthetic paper, Soft-touch
- Colors, Pearlescent, Metallic

Core portfolio:

Our Masterbatch portfolio addresses modern customer needs

- *Polybatch* Color Concentrates: Standard Colors, Custom Colors, Special Effects
- *Polyblak* Black
- *Polywhite* White
- *Polybatch* Additives

Advanced Solutions addressing:

Plastic Waste / Climate Change / Thriving Society

- *Circulen*
 - *CirculenRecover*
 - *CirculenRevive*
 - *CirculenRenew*

Carriers – A variety of different carriers are available

- PP, PE, EVA, Styrenics, PET, PETG, PA, Bio-resins, Technical polymers
- *Sustainable Polymers + Sustainable Ingredients*
- *PCR, PIR, r-PET, Bio-renewable feedstock, Advanced recycling*

Global Masterbatch Asset Footprint



- Global production network with 20 masterbatch manufacturing sites
- Masterbatch technology centers in each region
- Local color development centers with application specialty

- Standardized manufacturing and laboratory process providing flexible and consistent service
- Extensive materials expertise, analytical laboratories and pilot process capability to support customer developments and innovation

- Certified quality standards; supporting global regulatory requirements

Our approach to Sustainability

PLASTIC WASTE



2 million metric tons
of recycled and renewable-based
polymers will be marketed and
produced annually by 2030

100% of plastic packaging
worldwide is reused, recycled and/or
recovered by 2040*

Zero plastic pellet loss
to the environment from our facilities
and supply chain

Millions of tons
of plastic waste diverted through
Alliance to End Plastic Waste projects

CLIMATE CHANGE



Net zero emissions
from global operations by 2050

30%
absolute emissions reduction from
operations by 2030**

50% minimum
of electricity procured from renewable
sources by 2030

THRIVING SOCIETY

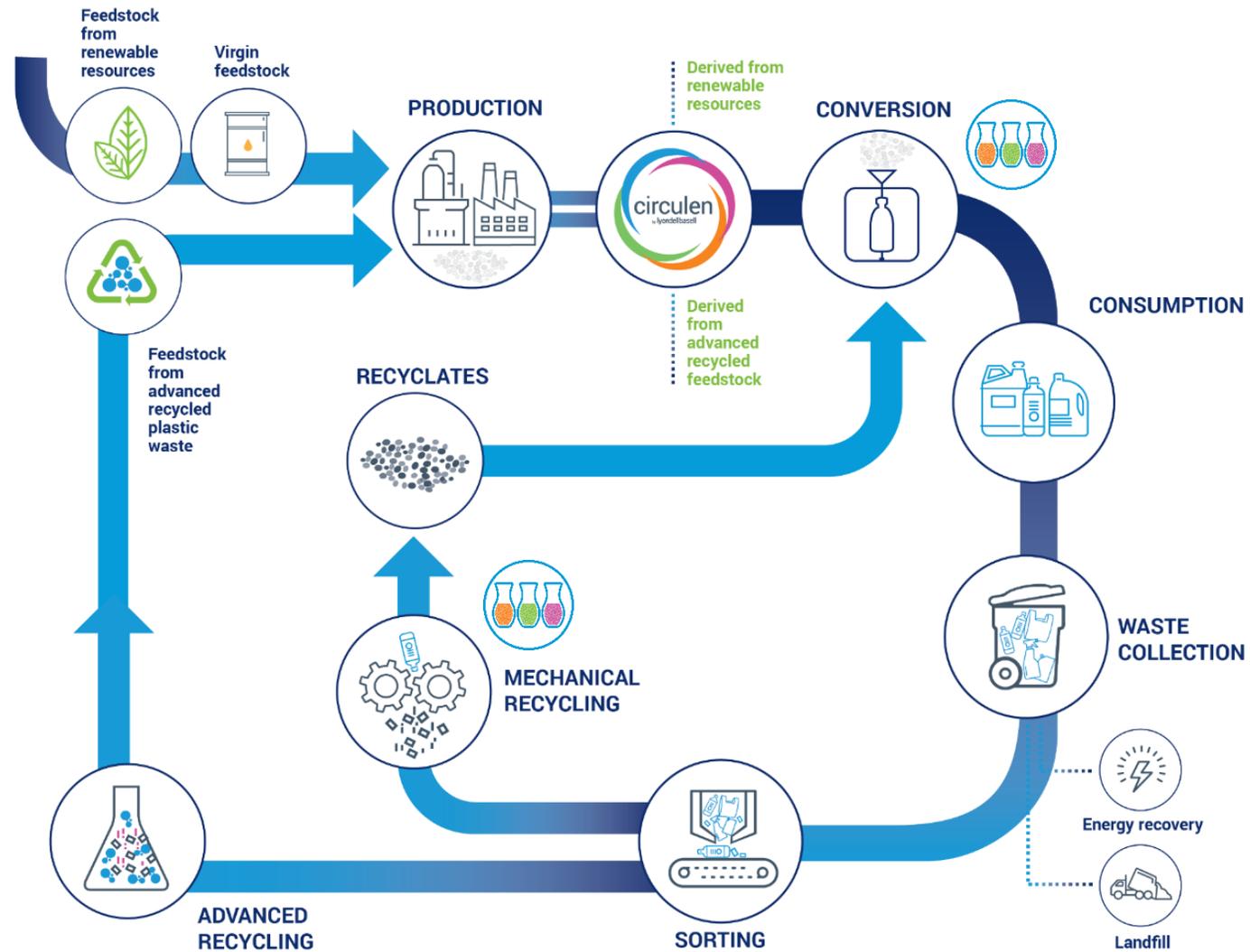


Zero
Incidents, injuries and accidents

Build diverse teams
that reflect the communities where we
operate

Invest
in programs that strengthen our
communities, our planet and tomorrow's
workforce

LyondellBasell supports circularity in the value chain with its Circulen family of products



The *Circulen* Portfolio



LyondellBasell's *Circulen* Portfolio
Helps You Reduce Your Carbon
Footprint and Address Plastic Waste



- Made from plastic waste through a **mechanical recycling process**



- Made from* **renewable feedstocks** such as used cooking oil



- Made using* an **advanced (molecular) recycling process** to convert plastic waste into feedstock to produce the new polymers, which have a wide range of uses

*Using a Mass Balance approach

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ADVANCING CIRCULARITY

LyondellBasell CirculenRecover Recycled solutions contain post or pre-consumer recyclate as carrier resin

- Many OEMs and brand owners have committed to increasing recycled content in their end products
- *CirculenRecover* masterbatch grades with post-or pre-consumer carrier help our customers reach their recycled content goals



CirculenRecover - Masterbatch solutions with post-consumer recycle carrier resin

Application*

- Rigid Packaging
- Flexible Packaging
- Agriculture
- Building & Construction



Key Benefits

- Support in maximizing recycled content in final article
- Maintaining packaging integrity
- Supporting circularity, preparing packaging for further recycling loop
- Ensuring vibrant, colorful design is maintained with recycle carrier resins



* Non-food contact applications



CirculenRecover - Masterbatch solutions with post-consumer recycle carrier resin

Product	Properties
<i>CirculenRecover</i> MB White	TiO2 masterbatch
<i>CirculenRecover</i> MB Black	Carbon black masterbatch
<i>CirculenRecover</i> MB Additive	Additive masterbatch for improvement of processing or properties when using PCR resin
<i>CirculenRecover</i> MB Color	Color masterbatch; including special effect and NIR detectable colors matched in PCR resin

Optics



Resistance



Mechanical



Processability



Circular Solution

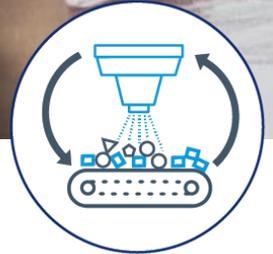
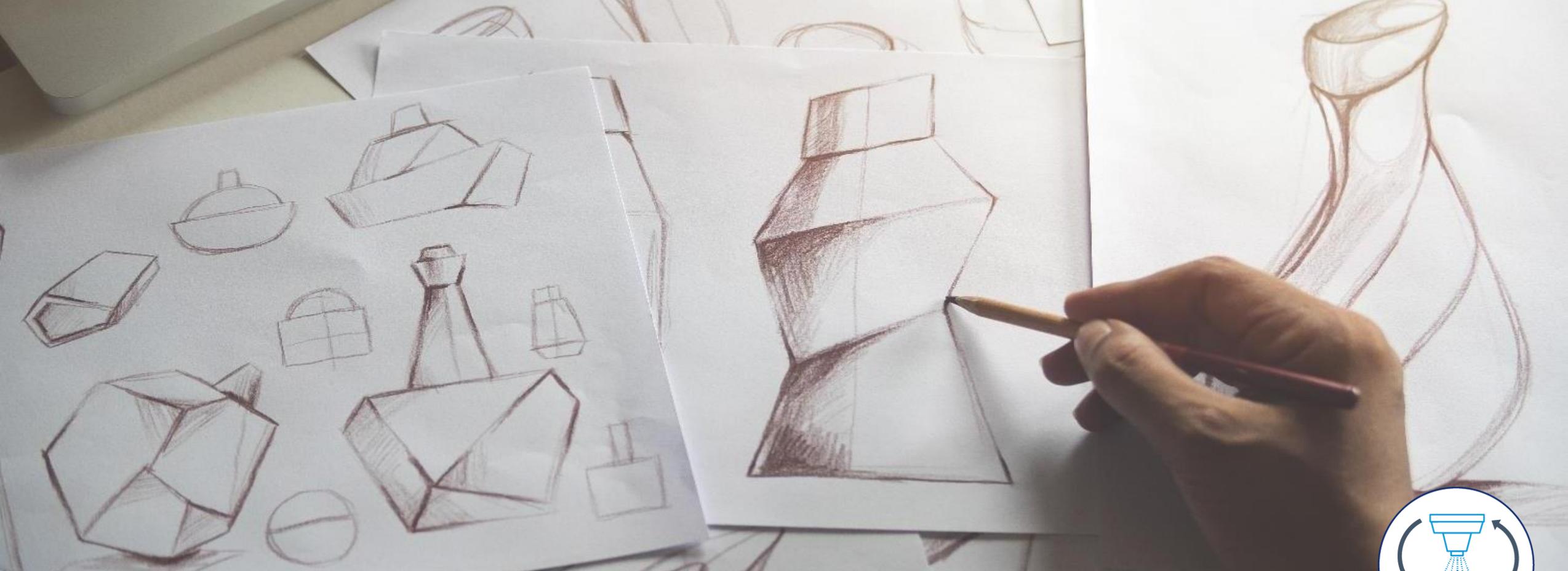




Personal Care Products packaged in post-consumer mechanical recycled resin

- LyondellBasell supports brand owner commitments to ensure that **100% of plastic packaging is designed to be fully reusable, recyclable, or compostable.**
- LyondellBasell and its mechanical recycling joint venture QCP have developed **packaging made from recycled plastic waste** for beauty and household brands.
- LyondellBasell collaborated **to develop sustainable solutions that don't compromise on quality** and meet the target to reduce the use of virgin plastic and maximize the content of post-consumer mechanical recycled resins.
- *CirculenRecover* MB ZAP92450 based on PCR carrier resin was developed to be used in *CirculenRecover* HD5603 Grey HDPE blow molded bottles to provide packaging with the **maximum PCR content.**
- *CirculenRecover* MB ZAP92450 is also designed for sorting by NIR technology in waste plastic sorting centers.

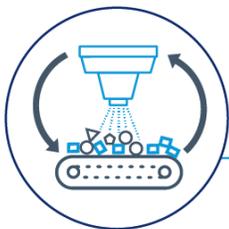




ADVANCING CIRCULARITY

LyondellBasell Solutions
support intelligent design of
articles to improve recyclability of
a given product

- Design for circularity is optimizing packaging design which supports sorting and recycling processes
- Mono-material packaging, ease of sorting and the use of additives play an important role in determining the recyclability of a given product and eventual quality of the recycle



Advancing Possible through Design for Circularity

Design for Circularity: Material solutions to address the challenge of designing functional and aesthetic packaging which can be more easily sorted and mechanically recycled.

Mono-material packaging

- Re-design complex and difficult to recycle multi-material packaging to mono-material alternatives while maintaining desired properties and performance.
- *Polybatch* additives for processing of orientated PE films used in food packaging.

Near-infrared (NIR) sortable packaging

- NIR detectable masterbatches for a range of polymers to enable sorting of black and dark colored plastic articles in post-consumer waste streams.
- *Polybatch 73641* NIR with COTREP certification

Masterbatches for Recyclates

- Masterbatch additives for recyclers and converters to improve processing and quality of recycled material.
- Enables recyclates for multiple recycling loops.





Design for Circularity: Mono Material and NIR Solutions

Product Type	Properties & Applications
Anti-blocking	Prevents blocking of film; enhances vacuum deposition process for metallized film
Slip	Reduces the coefficient of friction to enable faster packaging line speeds
Anti-static	Prevents build-up of electrostatic charge; improves powder filling and reduces dust attraction
Anti-fog	Prevents condensation on the film surface; reduces spoilage of packed foods and improves appearance
Processing Aid	Improves polymer extrusion with multi-layers, reduces dies deposits, enhances film quality
Antioxidants	Protects polymer from thermal degradation during extrusion; reduces gels and yellowing
Modifiers	Facilitates extrusion and stretchability of polymers; enhances appearance, stiffness and barrier properties
Matt	Specialty compounds to provide matt surface appearance or soft-touch haptics
Colors	Standard and custom colors; brand identity
NIR Colors	Alternatives for black and dark colors to enable for NIR sorting

Optics



Resistance



Mechanical



Processability

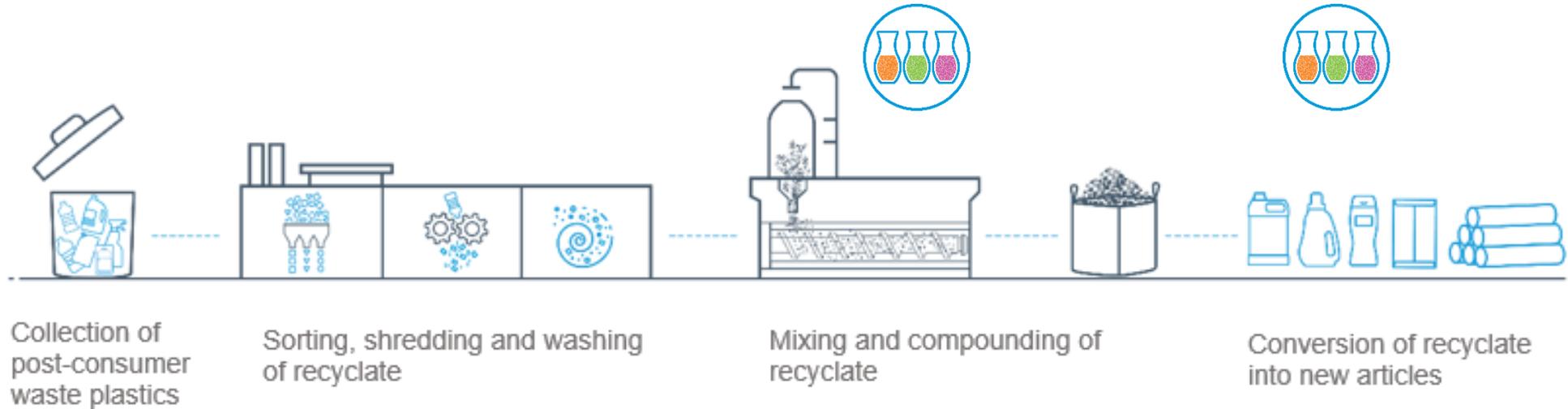


Circular Solution





Design for Circularity: The Recycling Flow and Challenges



- There is growing demand for mechanical recycled polyolefins with the requirement for **higher recycled material content** in packaging applications
- Recyclers face several challenges to provide higher quality and easily processed recycled material to plastics converters

Challenges with recycling polyolefins:

- Thermal degradation
- Loss of mechanical performance and rheology
- Reduced aesthetic quality (gel formation, yellow color and increased odour)
- High moisture and volatiles content



Design for Circularity: Masterbatch for Recyclates

Product Type	Properties & Applications
Antioxidant	Protection of the polymer from thermal degradation to control melt rheology, reduce gels and yellowing
Desiccant	Absorbs moisture and allows for higher recyclate content
Odor Absorber	Reduces the odor of recycled polymer
Acid Scavenger	Reduces corrosion and odor by neutralizing acidic degradation products from EVA copolymers
Blue Toner	Improves color when using recycled transparent polymer
Compatibilizer	Improves the compatibility and properties of mixed PE-PP recyclate
Processing Aid	Improves processing and quality when processing with recycled polymer
Slip Absorber	Regulates slip properties when using recycled polymer
Color	Improves the color and color consistency of recycled polymer

Optics



Resistance



Mechanical



Processability



Circular Solution



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ADVANCING CIRCULARITY

**LyondellBasell Masterbatch
and Color Concentrates based
on renewable resources**
offering the same properties as
their virgin counterparts

- Masterbatch based on renewable non-fossil fuel carriers are ideal drop-in solutions for sustainable food packaging, toys and cosmetics.
- The products can be applied, with no restrictions, to the same applications as fossil-based equivalents offering lifetime performance and especially recyclability.

*Using a Mass Balance approach



CirculenRenew - Masterbatch solutions with renewable-based resource carrier resin

Product	Properties
<i>CirculenRenew</i> MB White	TiO ₂ masterbatch
<i>CirculenRenew</i> MB Black	Carbon black masterbatch
<i>CirculenRenew</i> MB Additive	Additive masterbatch
<i>CirculenRenew</i> MB Color	Color masterbatch

Optics



Resistance



Mechanical



Processability



Circular Solution



*Using a Mass Balance approach



Personal Care Products packaged in renewable-based plastic

- In 2019, LyondellBasell achieved the **first parallel production of polypropylene and low-density polyethylene made from renewable raw materials** as an alternative to fossil-derived resources.
- Since that time, we have expanded our renewable-based polymers to help our customers **create packaging that appeals to consumers who prioritize sustainability.**
- For a known personal care brand our **renewable-based polymers** made sense. In 2021, they have launched a baby & intimate product range, including shower gels and shampoos packaged in LyondellBasell's *CirculenRenew* high density polyethylene polymers.

“THE MOST INNOVATIVE RESULTS COME FROM WORKING TOGETHER WITH OUR CUSTOMERS TO DESIGN EFFECTIVE SOLUTIONS. IT IS OUR AMBITION TO NOT ONLY OFFER A VAST RANGE OF MATERIALS, BUT ALSO SUSTAINABLE SOLUTIONS TO ADVANCE THEIR GOALS.”

Richard Roudeix

Senior Vice President of Olefins & Polyolefins, Europe, Middle East, Africa and India for LyondellBasell



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CirculenRevive - Masterbatch solutions with advanced recycled carrier resin

Product	Properties
CirculenRevive MB White	TiO2 masterbatch
CirculenRevive MB Black	Carbon black masterbatch
CirculenRevive MB Additive	Additive masterbatch
CirculenRevive MB Color	Color masterbatch

Optics



Resistance



Mechanical



Processability



Circular Solution



LyondellBasell Advanced Polymer Solutions



Leading global supplier of high-performance plastic compounds, masterbatches and resins



Providing innovative solutions to exactly meet customer application requirements



One-Stop shop for color and additive masterbatches



Raw materials harmonization to ensure consistent quality and supply, worldwide



Specialized color competence and masterbatch technology centers



Sustainability is a core value and a driver

Thank you



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Back Up



LyondellBasell *CirculenRenew*
Derived from Renewable-based Resources

- **2nd Generation Renewable feedstock** which contains only **waste and residues** and therefore not in competition with the food chain and **unsuitable for human consumption**
- Masterbatch based on renewable non-fossil fuel carriers are ideal drop-in solutions for sustainable food packaging, toys and cosmetics.
 - C14: Masterbatch (upon request) can be produced with measurable renewable content
 - Mass Balance: Masterbatch Sites to be ISCC+ certified in H2 2022
- Customers can use these certificates to verify **compliance with sustainability and traceability requirements**

*Using a Mass Balance approach



CirculenRenew and CirculenRevive

Masterbatch solutions with renewable-based resource carrier resin

Product		Properties
<i>CirculenRenew</i> <i>CirculenRevive</i>	MB White	TiO2 masterbatch
<i>CirculenRenew</i> <i>CirculenRevive</i>	MB Black	Carbon black masterbatch
<i>CirculenRenew</i> <i>CirculenRevive</i>	MB Additive	Additive masterbatch
<i>CirculenRenew</i> <i>CirculenRevive</i>	MB Color	Color masterbatch

Optics



Resistance



Mechanical



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Circular Solution



*Using a Mass Balance approach