The role of mechanical and advanced (chemical) recycling in a circular economy for plastics

Key messages

- LYB is investing in the complementary technologies of mechanical and advanced (chemical) recycling to help advance a circular economy for plastics.
- Mechanical and advanced recycling have unique strengths and limitations, and both are needed in order to enable the recovery of a wide range of plastics and the generation of recycled content for a broad range of applications.
- Policy and legislation supporting both mechanical and advanced recycling has an important role to play in ensuring the successful advancement of a circular economy. For LYB's positions on policies which help advance a circular economy for plastics, please see here.

Introduction

According to the Ellen MacArthur Foundation, achieving a circular economy for plastics by 2040 has the potential to reduce the annual volume of plastics entering our oceans by 80%, reduce greenhouse gas (GHG) emissions by 25%, generate savings of $200 billion per year, and create 700,000 net additional jobs.[1]

Many companies have made pledges to sell goods that have a lower impact on the environment. According to a recent survey by McKinsey, more than 80 global Consumer Packaged Goods (CGP), packaging, and retail companies have made public commitments to reach between 15% to 50% recycled content in their packaging by 2025. These pledges affect a large portion of the plastic products people use or encounter in everyday life, including food packaging materials such as bottles, caps, meal trays, and flexible film wrap.[2] This paradigm shift also impacts other sectors, such as the automotive sector. As an example, the vehicle manufacturer Mercedes Benz declared that they are working to increase the proportion of recycled materials in their car fleets to an average of 40% by 2030.[3]

The importance of advancing both mechanical and advanced recycling

It is clear that the demand for circular polymers is rapidly increasing—but capacity announcements are not on pace with demand growth.[4] LYB believes that to meet its sustainability goals and market demands, investments are needed in all promising recycling technologies, including in both mechanical and advanced recycling technologies.[5] Investment and use of these complementary technologies will allow more types of plastics to be recycled, resulting in increased volumes of recycled content that can be used to make new products that remain in the economy. Moreover, the recycled content produced by both technologies can reduce the need for fossil-based raw materials used in the production of new plastics and other valuable products. An overview of plastic recycling is provided to better explain the complementary nature of mechanical and advanced recycling, along with descriptions of the input and output of both.

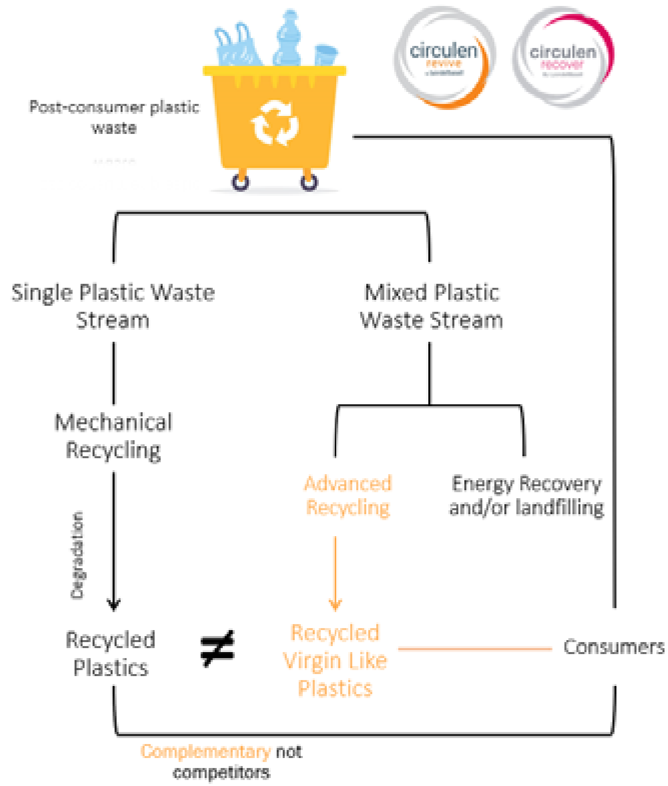
1. Plastics in a Circular Economy | Ellen MacArthur Foundation
2. Advanced recycling: Opportunities for growth | McKinsey
3. On the road to the circular economy. | Mercedes-Benz Group > Sustainability > Resources
4. Global Commitment 2022 Progress Report | Shared by New Plastics Economy (thirdlight.com)
5. See the LyondellBasell 2023 Sustainability Report, highlighting investments in both mechanical and chemical (or advanced) recycling

Plastic recycling overview

Post-consumer plastic waste is typically sorted into two streams: single plastic waste and mixed plastic waste. Single plastic waste streams contain items made up of single polymer types such as PET soda bottles and HDPE milk jugs. Mixed plastic waste streams consist of many polymer types that cannot easily be further sorted and cleaned. Single plastic waste streams are often routed to mechanical recycling, as this is an energy and cost-efficient recycling technology to recover these high quality, single polymer type waste streams. Mixed plastic waste streams have historically been routed to energy recovery and/or landfilling. Advanced recycling now unlocks the possibility to recover difficult to recycle materials by converting plastic waste into feedstock that can be used to replace fossil-based raw materials in the production of new plastic products requiring virgin-like quality. As such, advanced recycling is applied to complement mechanical recycling capabilities and diverts these plastic waste streams from landfills, incineration or the environment.

Complementary waste input

Plastic waste feedstocks used for mechanical and advanced recycling are generally distinct rather than being in competition with one another. While there can be some overlap depending on pretreatment options, these feedstocks have different characteristics. Mechanical recycling feedstock has a premium in the marketplace due to the required higher purity. For example, mechanical recycling cannot process complex plastic waste streams, like films or laminates, multilayer and flexible plastics, mixed materials, small formats, and composites, most of which are currently being sent to incineration or landfill. Advanced recycling can process these difficult to recycle waste stream feedstocks with a wider range of quality and divert them from landfill or incineration.



Complementary product output

The products made from mechanical and advanced recycling are complementary as well in addressing product application needs. While mechanically recycled polyolefins can reach high performances and be used in specialized applications such as blow molding or injection molding applications for the manufacturing of detergent bottles, caps and containers, they are generally not suitable solutions for products subject to strict regulations or with very technically-demanding and safety-critical requirements (e.g. food contact, medical). In such cases, advanced recycling can provide the required product specifications and safety characteristics, hence representing a suitable alternative to virgin plastics of fossil origin.

About us

We are LyondellBasell (LYB) – a leader in the global chemical industry creating solutions for everyday sustainable living. Through advanced technology and focused investments, we are enabling a circular and low carbon economy. Across all we do, we aim to unlock value for our customers, investors and society. As one of the world's largest producers of polymers and a leader in polyolefin technologies, we develop, manufacture and market high-quality and innovative products for applications ranging from sustainable transportation and food safety to clean water and quality healthcare. For more information, please visit www.lyb.com or follow @LyondellBasell on LinkedIn.