Chemical recycling: Enabling plastic waste to become a valuable resource

"Every year, Europeans generate 25 million tonnes of plastic waste, but less than 30% is collected for recycling" states the 2018 European Plastics Strategy[1].

The EU Green Deal is at the heart of the EU's ambitions of becoming fully circular and climate neutral. To meet the ambitious European objectives, much more plastic waste needs to be collected, sorted and prepared for recycling and a broader range of markets need to be supplied with plastic products containing recycled content. In this respect, Cefic highlights the role of chemical recycling[2] of plastic waste in supporting these objectives. The European ambition to transition from a linear economy towards a sustainable circular economy calls for an array of complementary innovative recycling solutions and business models. Chemical recycling enables the production of chemicals including plastics from End-of-Life plastic waste streams currently being incinerated, landfilled or exported.

Background

The recycling[3] rate for glass, paper, and metals today in the EU is well over 70%. Combinations of different recycling processes, techniques and solutions, like recycling systems, are in place to achieve these recycling rates. Meanwhile, there is a wide range of quantities and qualities of plastic waste, for which no single recycling system can cover all the waste streams. A combination of complementary solutions would be needed to achieve equally high recycling rates for plastics.

Over the last decades, recycling of plastics was mostly limited to plastic waste streams which were relatively easy to collect and recycle through mechanical recycling. For packaging this led to overall plastic recycling rate of 41 %[4]. Yet still today, a large part of plastic waste ends up in landfill or incineration. To further increase plastic recycling, other and **complementary recycling routes** will be required to process plastics that are difficult to be handled in mechanical recycling processes. Chemical recycling can thus fill a void in the plastics recycling loop, conserve valuable resources, and contribute to the creation of a low-carbon circular economy. Chemical recycling technologies allow the use of plastic waste as feedstock to produce new chemicals including plastics. Chemical recycling can **upgrade the quality and produce secondary feedstock materials** that are equivalent to virgin resources and compliant with REACH. Chemical recycling also has the potential **to remove undesired additives and impurities** allowing the use as recycled content in high-demanding applications such as food contact materials or medical applications. In addition, waste streams originating from e.g. automotive and electronics with large quantities of mixed and/or contaminated plastic waste can be converted into secondary raw materials for the chemical industry.

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[1] In 2020, Europeans generated 29.5 million tonnes of plastic waste, yet just 34.6% was collected for recycling. This demonstrates the progress the industry is making since the publication of the 2018 European Plastics Strategy. Plastics Europe report: Plastics The facts 2021

[2] *Cefic definition:* Feedstock recycling, also known as chemical recycling, aims to convert plastic waste into chemicals. It is a process where the chemical structure of the polymer is changed and converted into chemical building blocks including monomers that are then used again as a raw material in chemical processes. Feedstock recycling includes processes such as gasification, pyrolysis, solvolysis, and depolymerisation, which break down plastic waste into chemical building blocks including monomers for the production of plastics.

[3] Common recycling definition: Any recovery operation by which waste materials are reprocessed into products, materials or substances whether for the original or other purposes. It includes the reprocessing of organic material but does not include energy recovery and the reprocessing into materials that are to be used as fuels or for backfilling operations. EU Directive 2008/98/EC of 19 November 2008 on waste, Article 3 (17)

[4] Eurostat plastic packaging waste report < link >

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Chemical recycling technologies can contribute to restoring sustainable carbon cycles, lower the dependency on virgin fossil raw materials, and avoid greenhouse gas (GHG) emissions that occur in feedstock production and from incineration of plastic waste. This positive impact is confirmed by the Quantis report *"Chemical Recycling: Greenhouse gas emission reduction potential of an emerging waste management route"*, commissioned by Cefic.

An ever-increasing number of industrial pilot- and demonstration plants for chemical recycling are under construction or are announced[5]. Full deployment and integration of chemical recycling in the European chemical industry requires scale-up innovation and investments. This creates opportunities to develop new ecosystems in Europe for collection and sorting of plastic waste that is currently incinerated, landfilled or exported. Along with an industrial engagement, this equally requires a political effort to adapt waste and product legislation to accept and integrate chemical recycling in the reporting of recycling metrics. A solid and enabling European policy framework is key.

The industry's efforts

Chemical recycling is an important contribution to solving the plastic waste issue, but it is not the only solution. Where possible, mechanical recycling or dissolution recycling[6] should be used. To ensure the scale up, integration and full deployment of chemical recycling, our industry commits to work under the following guiding principles:

- ***Increase collaboration*** **to bring more valuable recycled content to the market, towards also achieving EU recycling targets.**
    - Accelerate the development of business cases, investments, the creation of new facilities and integration in existing production facilities. Continue to leverage the innovation ecosystems to address, amongst other topics, the yield of recycling waste-to-materials, operability, quality, and performance.
    - Close the loop for hard-to-recycle plastic waste streams currently going to landfill and incineration, or streams that do not find a recycling route in Europe.
    - Engage in the development of quality standards and application of certification schemes to provide clarity, consistency, and transparency. These developments should consider chemical recycling process types, design for recycling, recyclability, end-of-waste criteria, food contact and REACH legislation.
- ***Generate and collect data*** **to better understand the environmental performance, benefits, and contributions of chemical recycling.**
    - Conduct Life Cycle Assessment (LCA) studies and publish their findings. Contribute to common ways for looking at LCA methods. Work with stakeholders and policymakers to test methodologies and provide case data to measure the environmental impact along the full life cycle (cradle-to-cradle) of products made from plastics.
    - Work further on unlocking the potential of chemical recycling to help manage for example, the so-called legacy chemicals and substances of very high concern (SVHC) that can be present in end-of-life plastic after multiple years of use. Chemical recycling does not replace other ways of managing these substances.

[5] Cefic Chemical Recycling virtual exhibition < link >

[6] *Cefic definition:* **Dissolution recycling** Is a process in which the plastics is dissolved in a suitable solvent, in which a series of purification steps are undertaken to separate the target polymer/polymers from additives and other added materials (e.g. e.g. fibers, fillers, colorants) and contaminants. The resulting output is the recovered polymers, which remain largely unaffected by the process and can be reformulated into plastics. This process may also enable the recovery of other valuable components of the plastic.

- ***Foster transparency and contribute to the development*** **of uniform standards for a chain of custody mass balance approach**.
    - Promote the principles of a chain of custody mass balance approach for the accounting and attribution of recycled content from chemically recycled materials. Mass balance is included in the chain of custodies models as defined in ISO 22095.
    - Contribute to the development of standards and certification systems which include clear rules on feedstock qualification, chain of custody mass balance calculations, and the use of product claims and labelling.
    - Implement transparent certification of the mass balance system, data and claims verified by independent auditors. Help stakeholders understand the role and position of chain of custody systems in the transition towards a full circular economy for plastics.

An enabling policy framework

We invite policymakers to integrate into their decisions the following key enablers, necessary for ensuring investment for the scale up, and full deployment of chemical recycling and dissolution recycling:

- Acceptance of **chemical recycling as an integral solution** in the definitions and functioning of a circular economy for plastics:
    - Ensure a level playing field with mechanical recycling of plastic waste. **Chemical recycling falls under the recycling definition**, where the secondary raw materials derived are used for the production of chemicals including plastics.
    - Adapt and harmonise **definitions for Recycling and Recyclability** that include chemical recycling and enable a balanced use – across plastic recycling routes – of eco-modulation of extended producer responsibility (EPR) schemes.
    - **Implement and enforce the existing waste legislation** (SUPD - PPWD – WFD – WSR) across all member states, thereby diverting plastic waste from landfilling, export or incineration towards novel recycling routes.
- Develop an **enabling policy framework** which supports and duly integrates chemical recycling, building on the common definition of the Waste Framework Directive (2008/98/EC), and taking into account the following aspects:
    - **Waste recycling-rate calculations:** these calculations should account for the contribution of chemical recycling
    - **Calculating recycled content**: Develop, through product legislation, harmonised calculation rules throughout the EU for recycled content in products accepting the use of a chain of custody mass balance approach.
    - **End of Waste & Product Regulation**: Resolve disconnects, complexity and inconsistency of approach caused by the **co-existence** of "waste" and "product" (REACH) regulations. A key obstacle is the lack of clarity about the point at which End of Waste status is reached in the chemical recycling process. Different competent authorities have made different rulings, creating overall uncertainty as well as barriers to cross-border recycling activities.
    - **Food contact:** Build a regulatory framework for recycled plastics that uses risk assessment principles and supports placing on the market of products from novel technologies (including pilot plants).
    - **Access to waste:** Harmonise Waste Shipment Regulation (WSR) and End of Waste framework. Create an open, single market for plastic waste and secondary raw materials used for the production of chemicals including plastics.

- **Enable investments** into the scale-up and further advancement of chemical recycling:
    - Support the inclusion of chemical recycling in the EU Taxonomy for sustainable investment given its potential to substantially contribute to the environmental objectives outlined in the Taxonomy Regulation – including on climate change mitigation and circular economy.
    - Drive investments into R&D programmes and development of new and innovative business models. Enable investment towards the scale-up and further integration of chemical recycling while enabling the creation of new jobs and development of new value chains for collection and sorting of plastic waste across Europe.

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About Cefic:
Cefic, the European Chemical Industry Council, founded in 1972, is the voice of large, medium and small chemical companies across Europe, which provide 1.1 million jobs and account for 15% of world chemicals production.