



# PACKALL

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European alliance for innovation training  
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Linking **Academy** to **Industry**.

## Training program: modules

- New materials and biomaterials
- Eco-design & novel manufacturing processing
  - Residue management and valorisation
  - **Citizen and Consumer Engagement**



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# **The Case of Chemical Recycling of Plastics in Circular Economy**

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# Framework Directive of Waste Hierarchy in EU

- Chemical recycling is positioned as tertiary recycling within a four-tier recycling system.
- Primary and secondary levels involve physical processes and are referred to as mechanical recycling, and quaternary recycling produces energy from plastic waste.



# EU's Circular Economy Action Plan 2021

- CEAP is regulatory-based, with a number of major new regulations in the pipeline along with amendments of existing directives to include stricter targets and actions.

# Cross-cutting measures of CEAP

Crosscutting measures aim to integrate sustainability and circularity throughout the whole European economy.

- business-led initiatives to develop environmental accounting and integrate sustainability into business strategies
- regulatory measures and
- measures aimed at tightening the requirements for public funding,
- adding circularity and sustainability criteria for the obtaining of funds.

# Effects of the CEAP on plastics

New product types to the  
**eco-design directive**

Electrical and Electronics

Batteries

Plastics



Construction

Food

Other Cross-cutting  
measures

**PLASTICS:** In the plastics sector, the CEAP intends to expand on the ban of single-use packaging in the EU by driving design for reuse and recyclability of packaging and to address the over-complexity of packaging to decrease the incidence of overpackaging. It also intends to restrict the intentional addition of microplastics in some products, develop a standard label that will consider the sustainability of the plastic products used, and encourage the use of biodegradable and compostable plastic solutions.

# Levels of recycling

- **Primary and secondary levels involve physical processes** and are referred to as mechanical recycling, and **quaternary recycling produces energy from plastic waste.**
- **Tertiary recycling covers both the recovery of plastics and the production of fuels and other substances = chemical recycling.**
- In the WFD, materials used for energy recovery, as fuels, or for backfilling purposes are excluded from the definition of recycling.
- According to WFD, recovery in form of production of fuels is less desirable than recycling operations (European Parliament, 2008).



# How does chemical recycling differ from other forms of recycling?

- Changes chemical structure of the polymer
- Literature reviews do not address dissolution as a chemical recycling technology
- Thermal – pyrolysis and gasification
- Chemical - a group of technologies, referred to as chemolysis





# Outputs of chemical recycling

- Are used for the production of plastics or fuels.
- In terms of the European Parliament's (2008) definition of 'recycling', chemical recycling technologies can only in part be classified as recycling.



# Chemical recycling and CEAP 1/2

- **an additional waste management option** that may contribute to reducing waste entering the natural environment and substitute ineffective waste management practices, which increase environmental pollution (e.g., landfilling or incineration). Could also be complementary to the conventional mechanical recycling of plastics.



# Chemical recycling and CEAP 1/2

- **an additional tool to increase the circularity of plastic waste** by recycling mixed and contaminated plastic waste streams that constitute the main part of municipal plastic waste (Crippa et al., 2019; Ragaert et al., 2017).
- some chemical recycling technologies are seen as promising in **eliminating substances that** were formerly used as plastic additives but that, in the meantime, **have been recognised as substances of very high concern** and/or persistent organic pollutants and were therefore banned or restricted (Wagner & Schlummer, 2020).



# Controversies and doubts

- Chemical recycling started receiving attention in the 1990s when various projects were launched. However, many of these projects subsequently failed
- The contribution of chemical recycling to the circularity of materials varies
- Opinions about chemical recycling prospects are strongly polarised among stakeholders
- Projections and evaluations of the environmental, economic, and technological performance of chemical recycling and their viability under close-to-real-life conditions are currently missing.



# References

- [Chemical Recycling of Polymeric Materials from Waste in the Circular Economy 2021 - a report for European Chemical Agency.](#)
- [Circular Economy Action Plan.](#)





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## Linking Academy to Industry.



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