

# Bio-based materials from agrifood waste for sustainable packaging

Plastics are often used in single-use products that lead to large amounts of waste, which takes hundreds of years to decompose. ECOSYSTEM is born to address this Challenge. ECOSYSTEM is an EU-funded initiative selected at the Challenge 3 of the Pathfinder programme. The project is inspired by an ecosystem and its dynamics, where waste biomass, raw materials, polymers, and final products interact through innovative tools, forming a more sustainable value chain.

**The project's approach** is based on leveraging berry-fruits crop waste to create eco-active and biodegradable products using innovative and sustainable methods involving the entire agrifood value chain. Then, the obtained products will be used to manufacture packaging for food and pharmaceuticals, as well as agricultural films.

This approach aims to contribute to reducing pressure on fossil reserves thanks to the use of biomass feedstock, and to help reduce environmental impact during the production and use of the targeted demonstrators.

ECOSYSTEM brings together **9 partners** from 5 countries (Spain, Italy, Denmark, Cyprus and Switzerland), including 3 research institutions, 4 industrial organisations and 2 academic institutions.

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Emerging eco-active materials  
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 [info@ecosystem-he.eu](mailto:info@ecosystem-he.eu)

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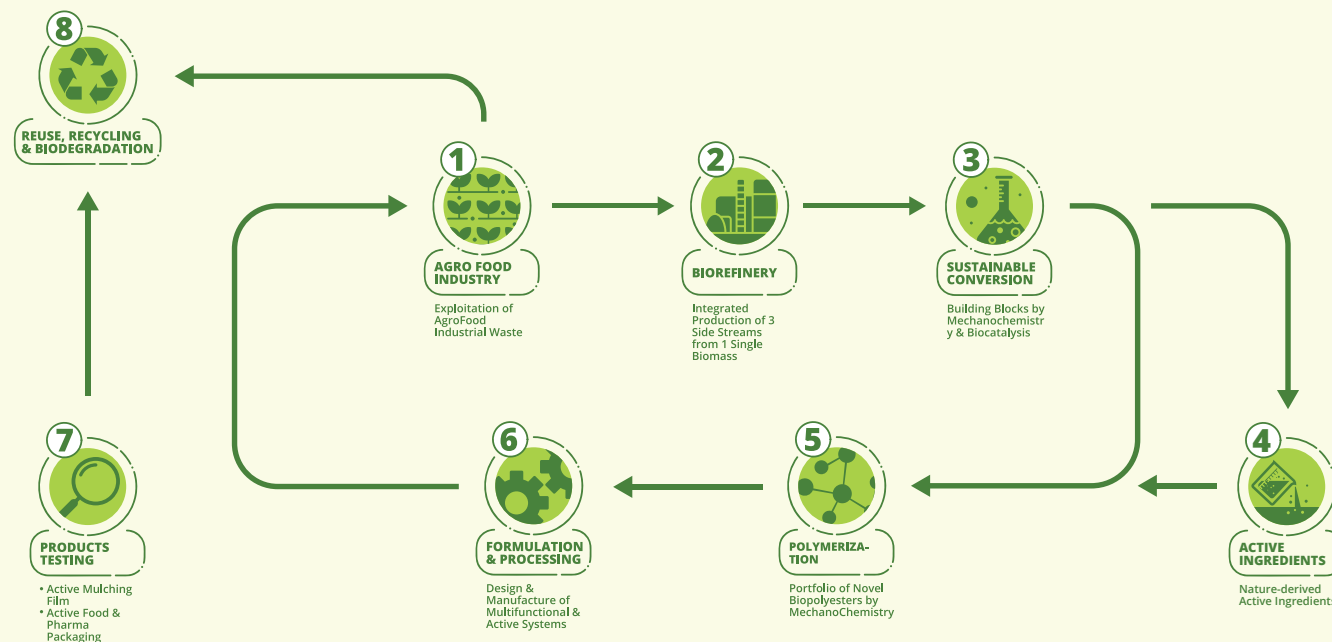
# Objetives

- Development of a new generation of biobased polyesters using mechanochemical and biotechnological techniques.
- Describe and optimise sustainable by design technologies
- Produce sustainable and biodegradable clam-shell packaging, pharma blisters and mulching films.
- Go one step forward in circularity in the agrifood value chain.

# Expected impacts

- Provide alternatives to the fossil-based production of plastics and non-circular methodologies that are currently being used.
- Reduce CO<sub>2</sub> emissions and chemical waste during plastic precursor and packaging obtention processes.
- Mitigate plastic pollution and accumulation, especially in agricultural fields.
- Improve environmental outcomes and support consumer demand for sustainable packaging.

# Circular bio-based value chain for sustainable polymers and active materials



ECOSYSTEM will use polymers and raw materials extracted from nature (cellulose, lignin and furfural), nature-inspired polymers (microbial and fungal materials) and synthetic raw materials obtained via mechanochemistry from building blocks. The materials developed in ECOSYSTEM will be used in the manufacture of plastic-based packaging, and their barrier properties, recyclability and reusability will be investigated.

# Innovations

The project will integrate several specific innovations spanning from the design of the new materials to the end-of-life of associated products.

- 1 Use of Sustainable tools and technologies** - Mechanochemistry will be used to enhance quick green solvent-free transformations, and White Technologies such as enzymes and bacterial biostimulants will be used to improve crop yields.

- 2 Use of eco-active materials** - antimicrobials will be introduced for improving the shelf-life of products.
- 3 Multifunctional mulching films** - the films are designed to enhance plant growth, better soil monitoring and less plastic pollution.
- 4 Reusability of resources** - Used biobased polyester will be adapted and transformed into heterogeneous catalysts for Redox reactions.