

The AgriLoop Horizon Europe EU-CN project: upgrading agricultural residues into high added-value bio-products.

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The potential of global agricultural energy yield exceeds twice the human metabolic energy requirement. Systematic energy losses are associated with the large amounts of unused agricultural and food materials, as well as with the recent diversion of agricultural lands and primary crops toward non-food production (e.g. biofuel). The generation of large and diverse waste streams ending mostly landfilled, spread or incinerated are associated with significant environmental burdens. These streams are i) primary agri-residues, generated close to the fields, in dispersed small quantity, and ii) secondary residues that are available in large quantity on plant processing where they are co-produced with food. Agri-residues, which overall account for 50% of the fresh weight of harvested crops, represent a huge pool of untapped biomass resources (dry matter): > 2245 Mt/year worldwide, with 42.5% produced in China (Fu et al. 2021). They have the potential to support human well-being and saving resources, by being converted into additional food, feed and petrochemical substitutes or novel non-food end-products.

The AgriLoop project was conceived to contribute to the advent of a sustainable economy by unlocking the potential of agri-residues to be converted into new opportunities. It aims to develop safe and sustainable-by-design bioconversion processes integrated in cascading biorefinery approach (figure 1) to eco-efficiently extend the value of agricultural residues (from plant or animal) for the production of proteins, polyesters (such as polyhydroxyalkanoates), and other high added-value bioproducts for food, feed and materials applications, in pilot scale ((Bolzonella *et al*, 2023).

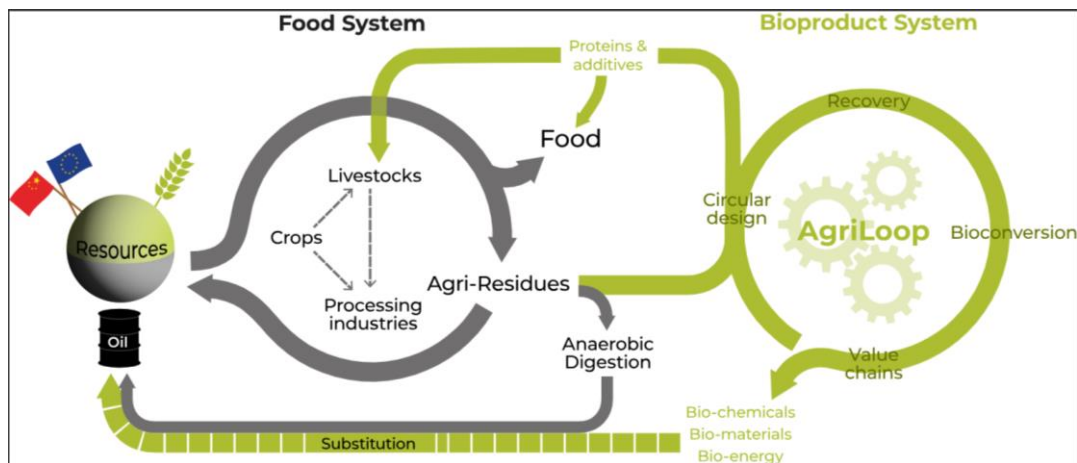


Figure 1. AgriLoop's concept for sustainable biorefineries based on agricultural residues.

AgriLoop is an international project which aims to extend the agricultural production value of two major players of the global bioeconomy: Europe and China. The consortium involves 35 different partners from 11 different countries. These include 8 countries from the European Union - France, Netherlands, Belgium, Denmark, Spain, Italy, Portugal, Croatia -, 2 from non-EU countries - Switzerland and United Kingdom - and 13 partners from the Republic of China. AgriLoop has received 10 million euros in funding from the European Union, UK Research and Innovation and the Chinese government.

The EU-China collaboration is at the core of the AgriLoop project. By strengthening EU-China cooperation in agri-residues management and developing mutual scientific understanding and advances in their cascading uses to provide alternative materials, AgriLoop is playing a full role to implement rational internationalisation strategies to achieve sustainable and circular management of agricultural resources, decrease pollution, tackle climate change and unlock the bioeconomy sector (figure 2).

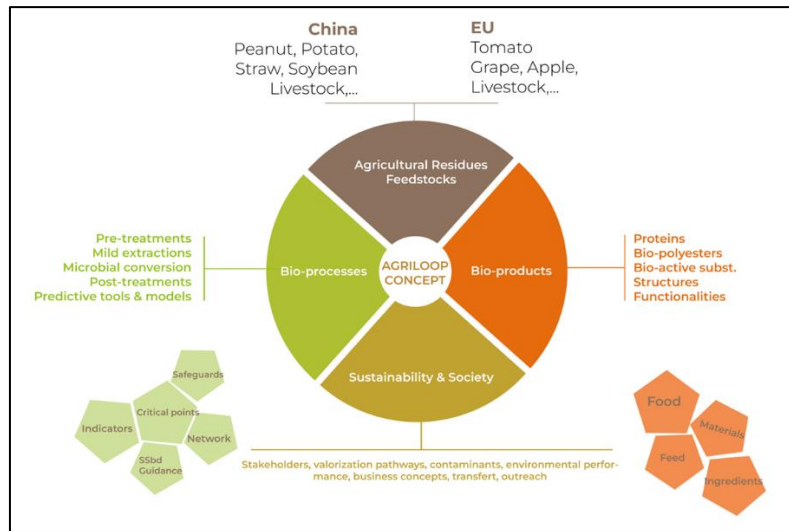


Figure 2. Details of the AgriLoop concept, showing both Chinese and EU contributions.

During the 48 months of the project lasting from December 2022 to November 2026, AgriLoop European and Chinese partners will:

- convert agricultural residues, such as tomatoes, soybean, peanuts, apples, straw, potatoes, brewery grains, oil, grapes and manure, into highly functional native molecules, plant and microbial proteins polyesters, biomaterials and fertilizers.
- develop new products and processes for the food, health and agricultural sectors;
- anticipate the complex circularities of agri-residues solutions by applying a 'safe-and-sustainable-by-design' approach that avoids or minimizes harmful impacts;
- demonstrate innovative and sustainable value chains;
- achieve several environmental, societal and economic goals from its innovative approach.

To achieve these objectives, AgriLoop was organized in 6 work packages (WPs, Figure 3). WP1 is dedicated to early assess the sustainability of the innovative circular agri-residues based-value chains (foundational circular flows). WP2 aims to develop an integrated cascading extraction process to recover proteins and other biomolecules. WP3 is developing biological conversion routes for the production of microbial and fungal proteins and polyesters. WP4 is demonstrating in close to real environment the best innovative value chains developed in WP2 and WP3, considering WP1 early guidance. Communication, dissemination and exploitation are handled in WP5 and coordination and management, in WP6. The project is now starting its second year, and by the end of 2026 the partners will eco-efficiently upgrade under-exploited agricultural residues into a portfolio of high added-value bio-products able to generate new bio-based markets or to compete with, and gain market share of, oil- and food crops- based equivalents.

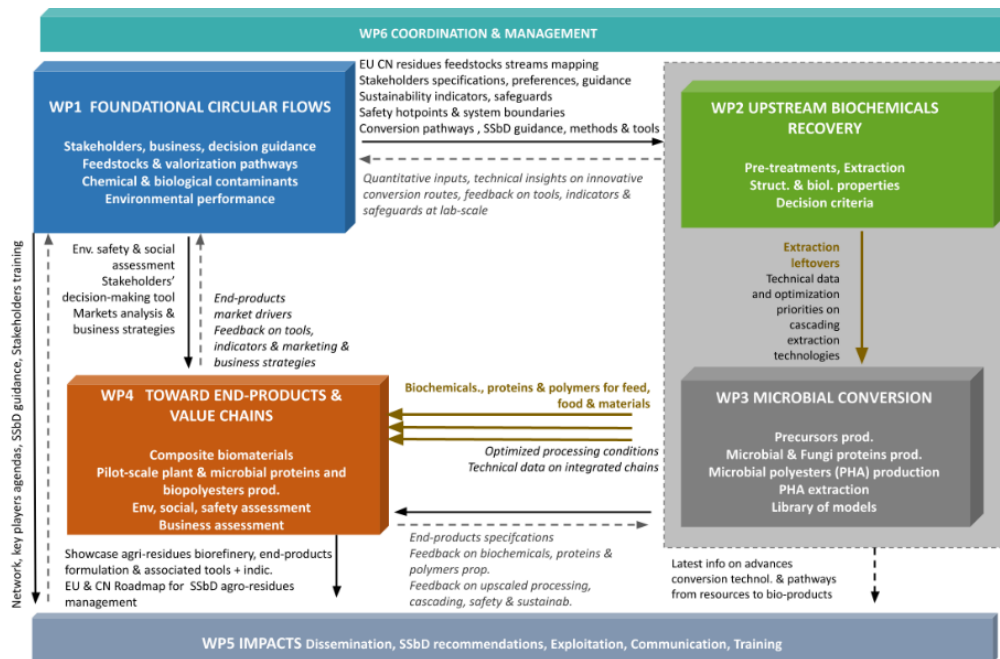


Figure 3. Diagram illustrating the 6 work packages of the AgriLoop project.

References

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