Plastic, Packaging

Strategies to solve the problem of hardly recyclable Packaging Materials

Bio-Waste

Extracting valuable compounds from different Bio-waste streams

Water

Water Symbiosis Strategies in Industry, Agriculture, and Urban contexts

CIRCSYST Circular Systemic Solutions

PLASTIC • PACKAGING • BIO-WASTE • WATER

Demonstrator 5

Flexible and Intelligent Biorefinery for Bio-waste Circularity

PÄIJÄT-HÄME, LAHTI, FINLAND

CIRCSYST | Circular Cities & Regions Initiative | UK Research and Innovation | Funded by the European Union

Start 2024

36 mo

€ 10.24 M

32 partners

9 pilots /
8 regions

About CircSyst

Resource extraction is responsible for nearly half of global greenhouse gas emissions and the vast majority of biodiversity loss. With 90% of world economy still linear, plastics, water and bio waste are treated as single use commodities rather than valuable resources. The CircSyst project addresses this challenge by developing Circular Systemic Solutions (CSS) that drive sustainable, circular economic models.

Over 36 months, 32 partners led by AIJU will run nine large-scale pilot systems spread across eight European regions, targeting three priority value chains from the EU Circular Economy Action Plan: water management, bio-waste valorisation, and plastics & packaging. The pilots exchange by-products and know-how so that, for example, a plastic fraction recovered in Greece can feed a recycling line in Spain. In this way, CircSyst forms an industrial-symbiosis network that supports the EU's Circular Cities and Regions Initiative (CCRI) and provides replicable and scalable solutions.

Sustainable PHA Biopolymer Production from Wastewater Sludge

DEMO 5, led by LAB University of Applied Sciences, **focuses on the recovery of valuable materials and components from waste to produce polyhydroxyalkanoate (PHA) biopolymer** and to extract other value components, while also considering CO_2 recovery routes. The **pilot plant is a mobile container** located at the Lahti Aqua Ltd wastewater treatment facility in Päijät-Häme.

The production process of DEMO 5 is an alternative pathway to conventional biogas production, improving energy efficiency and enabling recovery of various high-value components like PHAs, key nutrients and chemicals from wastewater treatment. The demonstration also includes assessment of potentially hazardous chemical and biological contaminants, as well as defining and testing methods to remove them. The properties of PHAs from different sources will be evaluated and the most sustainable and economically feasible potential end products will be selected. The piloted PHA-production model is applicable to different raw materials and production environments. Scaling and optimization of the process will be done by utilizing digital modelling. **The key points** of the DEMO 5 are listed below:

- **PHA biopolymer production** as a sustainable alternative to fossil-based plastics, produced from wastewater sludge
- **Additional resource recovery** including nutrient and chemical extraction from the waste stream
- **Assessment of hazardous contaminants** to ensure the safety of the products
- **Digital modelling** (digital twin) to optimize and develop the process efficiency

The main goal of the pilot is to develop a smart bio-based industry that aims for added-value products through multiple and interconnected processes. By integrating multiple processes, DEMO 5 enhances energy efficiency compared to traditional biogas production, reduces environmental impact, and creates new business opportunities through high-value bio-based products. The resources recovered from the wastewater sludge can either be sold as raw materials or processed further, depending on the current market value.

Who is involved?

University of Helsinki focuses on production and extraction of PHAs, in addition to developing technologies for efficient recovery of nutrients. Small pilots of biomass hydrolysis and PHA accumulation will be upscaled to 500-1000 L containers in a portable research unit placed in Lahti Aqua Ltd.'s wastewater treatment facilities. LAB University of Applied Sciences focuses on evaluating processing methods for the extracted PHAs, as well as utilizing AI for process optimization and scalability.

CIRCSYST

Circular Systemic Solutions

- Waste to Value
- Sustainable Bioplastics
- Prototypes of PHA based products
- Mobile Pilot Plant
- Energy-Efficient Alternative
- Smart bio-based industry

PARTNERS

LAB University of Applied Sciences

UNIVERSITY OF HELSINKI

www.circsyst.eu

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