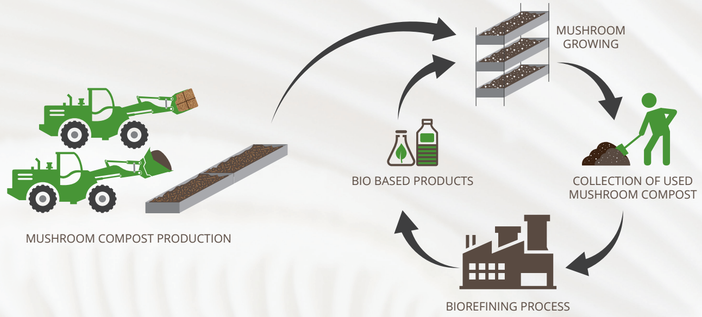
# CHALLENGES AND OPPORTUNITIES FOR ENHANCING THE VALUE OF MUSHROOM COMPOST

To satisfy consumer demand for mushrooms, European farmers use over five million tonnes of compost each year. This compost, which is prepared solely for growing mushrooms, is only suitable for one to three harvests even though it contains valuable organic components. As a result, used mushroom compost is currently collected from mushroom farms for a fee and disposed of, creating significant economic and logistical problems for Europe's farmers.

Additionally, concerns about the depletion of non-renewable resources are encouraging the mushroom industry to replace fossil fuel-based products such as pesticides and fertilisers with sustainable and biodegradable alternatives.

In order to reduce disposal costs and move to more sustainable and efficient business models, mushroom producers are looking for innovative processes to recover and repurpose mushroom compost. The transformation of mushroom compost into bio-based products could represent one of these solutions.

However, due to limited awareness of the value of mushroom compost, the mushroom industry currently lacks adapted technological solutions to upgrade it into valuable products. Closing this technology gap could represent a great opportunity to unlock the potential of mushroom compost conversion and support the move towards a more circular economy in the mushroom industry.




## CONSORTIUM

CENER - National Renewable Energy Centre
Spain

Monaghan Mushrooms
Ireland

University of Naples "Federico II"
Italy

MetGen
Finland

CLEA Technologies
Netherlands

Zabala Innovation Consulting
Spain

Greenovate! Europe
Belgium

Max Planck Institute for Polymer Research
Germany

Celignis
Ireland

Imperial College London
United Kingdom

C-Tech Innovation
United Kingdom

## COORDINATOR

**Inés Del Campo**
CENER
idelcampo@cener.com

www.biorescue.eu

This project has received funding from the Bio-based Industries Joint Undertaking under the European Union's Horizon 2020 research and innovation programme under grant agreement No 720708.

*Printed using vegetable-based ink on 100% recycled paper.*
*Pictures: Monaghan Mushrooms*

# BIO RESCUE

## A novel biorefinery concept for mushroom compost

**ENHANCED BIOCONVERSION OF AGRICULTURAL RESIDUES THROUGH CASCADING USE**

# TOWARDS A CIRCULAR ECONOMY IN THE MUSHROOM INDUSTRY

**The BIOrescue project** will contribute to Europe's circular economy by recovering the vast majority of mushroom compost and reducing disposal costs for farmers. The project aims to create new value from mushroom compost by developing a novel biorefinery concept to transform it into bio-based products such as bio-pesticides, biodegradable nano-carriers for drug or fertiliser encapsulation and bio-based horticultural fertilisers.

**The BIOrescue consortium** is a multidisciplinary team bringing together industrial players and research centres from eight different European countries, co-ordinated by Spain's National Renewable Energy Centre (CENER) with the support of Monaghan Mushrooms as technical coordinator. Together, the project partners will optimise the processes and technologies available for biomass conversion while adapting them to the transformation of mushroom compost.

It is expected that the bio-based products developed within the project will be capable of replacing many fossil-based alternatives currently on the market and generate new income streams for mushroom producers. The concept will be developed for a conventional mushroom farm in Ireland that will be retrofitted to become a sustainable and efficient biorefinery. To strengthen the competitiveness of the novel biorefinery concept, project partners will conduct economic and environmental impact assessments of the newly developed processes and bio-based products.

> The technology development inherent in BIOrescue will offer great opportunities to create value from by-products from mushroom processing. This will generate significant incomes for the sector while supporting the move towards a circular economy.

**Philippe Mengal,**
Executive Director of the Bio-based Industries Joint Undertaking, Brussels.

# UNLOCKING THE POTENTIAL OF MUSHROOM COMPOST CONVERSION

**The BIOrescue project aims to demonstrate a resource-efficient biorefinery concept for mushroom compost that will allow its transformation into valuable bio-based products.**

## CHARACTERISATION OF BIOMASS FEEDSTOCKS

The composition of mushroom compost and the availability of other underutilised feedstocks in mushroom producing regions will be analysed. In addition, rapid methods for real-time evaluation of biomass feedstocks will be developed.

## SEPARATION AND FRACTIONATION

The concept will include a two-step fractionation process for mushroom compost.

1. **EXTRACTION:** a novel methodology for the extraction of high added value components from mushroom compost will be designed.
2. **BIOMASS PRE-TREATMENT:** the biomass thermo-chemical pretreatment process will be adapted for mixtures of mushroom compost and other agricultural feedstocks.

## ENZYMATIC HYDROLYSIS

The definition of an innovative enzymatic hydrolysis process including enzyme immobilisation and recycling will increase resource and cost efficiency of biomass conversion.

## CHEMICAL AND BIOCHEMICAL CONVERSION

Partners will implement different chemical and biochemical conversion processes to produce biodegradable products from mushroom compost.

## ENVIRONMENTAL, RESOURCE, TECHNO-ECONOMIC AND SOCIAL ASSESSMENT

BIOrescue will demonstrate major societal impacts of the new biorefinery related to the integrated production of cost-competitive bio-based products.