

Benign cascade extractive biorefinery for converting agri-food side streams into high-value polyphenolic bioactives and functional fibres for pharma, cosmeceuticals, nutraceuticals and food products

WHAT? The main aim of PHENOLEXA project is to develop a benign, efficient and environmentally friendly biorefinery process to procure high-value polyphenolic bioactive compounds (BACs) with preserved, tailored and/or improved functionality and targeted biological activities (antioxidant, antimicrobial, antifungal, anti-inflammatory, anticancer, antiviral, anti-aging, mood stabilising) to be used in pharmaceutical, nutraceutical and cosmeceutical products while also generating some functional fibres and colourants to be used in food products.

HOW? PHENOLEXA investigates 4 types of agricultural residues: olive & grape shoots & leaves, onion, and chicory leftovers (Fig. 1). Innovative technologies will be developed: microbial, fungal, ultrasound and pulsed-electric field pre-treatment of biomass, natural-deep eutectic solvents (NADES) and sub-critical water extraction, membrane filtration and centrifugal partition chromatography, micro-encapsulation, and chemical functionalisation. PHENOLEXA will provide a full in vitro & in vivo characterisation of the obtained bioactives for their antioxidant, antimicrobial, antifungal, anti-inflammatory, anticancer, antiviral, anti-aging, and mood stabilising potential and create lab scale prototypes of cosmetic, nutraceutical, pharma, and functional food products.

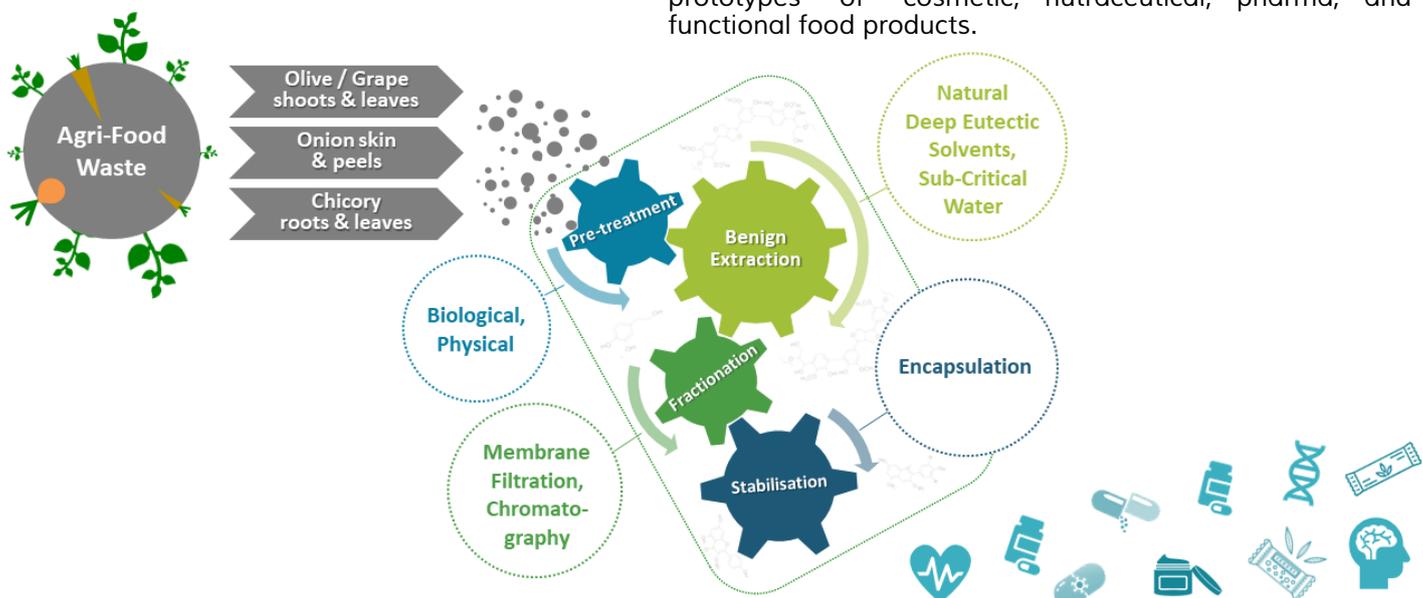


Figure 1. Schematic representation of PHENOLEXA project, demonstrating the feedstocks, the approach and the final products.

Pharmaceuticals	Cosmeceuticals	Nutraceuticals	Functional Foods
<ul style="list-style-type: none"> • Anticancer / Antiviral • Anti-microbial • Anti-fungal • Anti-inflammatory • Mood stabilisers 	<ul style="list-style-type: none"> • Anti-inflammatory • Anti-oxidant • Anti-aging 	<ul style="list-style-type: none"> • Antioxidant • Anti-inflammatory • Prebiotic 	<ul style="list-style-type: none"> • Bulking / texturizing fibres • Food preservatives • Food colourants



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WHY? In the pursuit of a circular economy, it is important to identify and use feedstocks to their maximum potential and value. Still, major inefficiencies are remaining in making best use of what is available. In Europe's agricultural sector around half of its residual biomass is currently wasted. Much residual biomass finds its way to low- and mid-value applications such as biofuels, animal feed, or platform chemicals and polymers. In part, this is because the feedstock is challenging to upcycle to higher-value products due to its varied and variable makeup, supply fluctuations, presenting a challenge also technologically. However, certain agricultural side streams, e.g., those from olives, wine-ries, chicory, and onions, are rich in phenolic bioactive ingredients. Many of these bioactives possess anti-oxidant, antimicrobial, antifungal, anti-inflammatory properties, potentially even anticancer and antiviral activities. Their full potential has yet to be realised, due to a lack of technologies capable of preserving the complexity and functionality of these compounds in a way that is safe, sustainable and can do so in financially viable quantities.

WHO? PHENOLEXA runs from June 2021 until June 2024, bringing together a consortium team of 12 European partners from Spain, UK, Italy, Belgium, Germany, France, Estonia, and Poland (Fig. 2). The total project budget is €4.6 Mn with BBI JU contribution of €3.9 Mn.

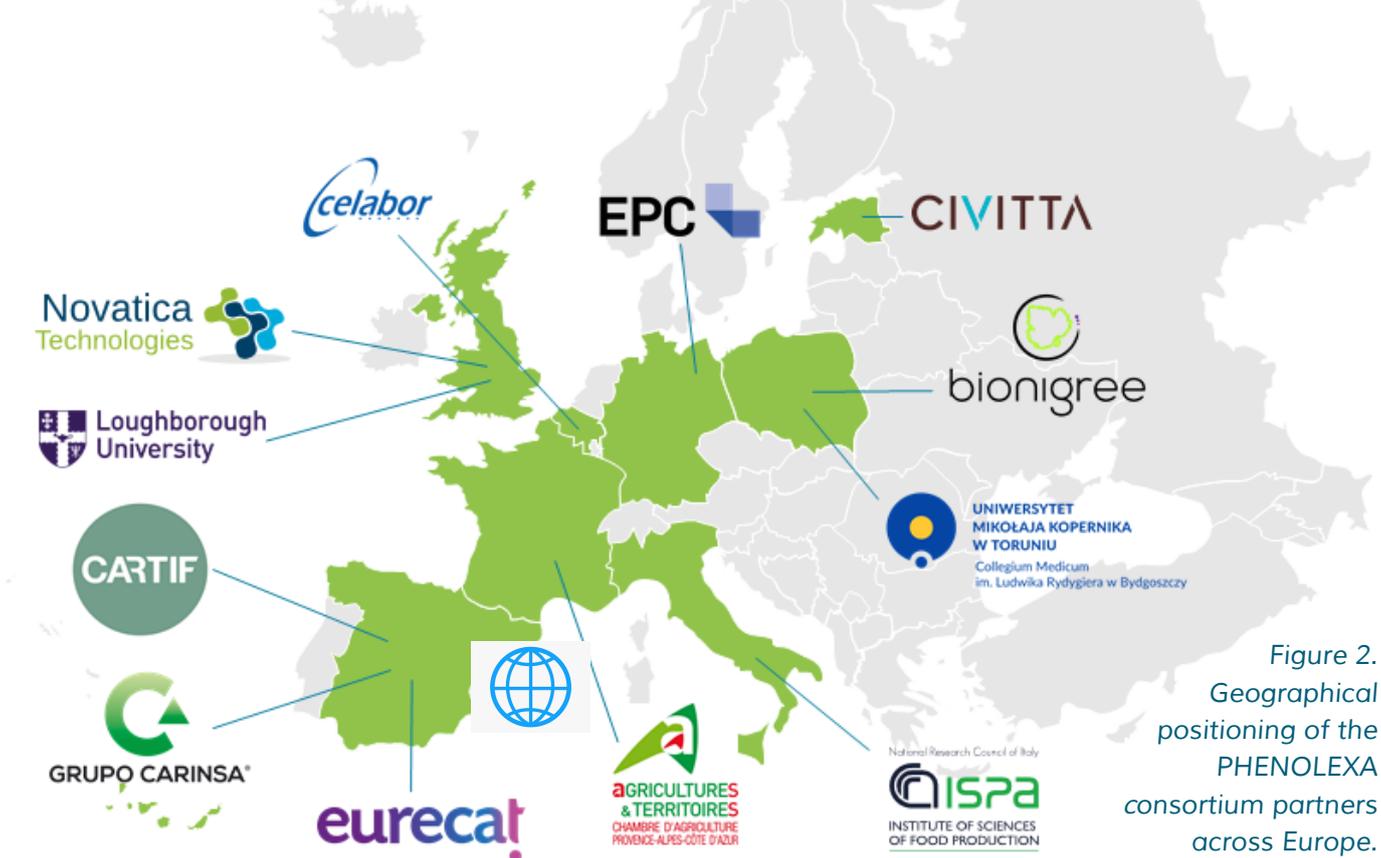


Figure 2. Geographical positioning of the PHENOLEXA consortium partners across Europe.

Contact:

Project coordination: Civitta Eesti AS, (Coordinator), EST



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