

PNRR

Project “Ecosystem for Sustainable Transition in Emilia-Romagna (ECOSISTER)”

Mission 4 - Component 2 - Investment 1.5

Spoke n. 1 - Materials for sustainability and ecological transition – WP 2

Program for a twelve-month research fellowship

Critical issues related to climate change and the unsustainable exploitation of natural resources are urgent and evident. The development of sustainable materials fits the need to support and implement good practices of Circular Economy. In the agro-industrial sector, raw material processing residues are a possible source of bio/pharmaceutical molecules of interest and biomass that can be used to produce innovative and smart materials. This is one of the most transversal priority areas in ECOSISTER project, with the strongest impact towards green innovation.

The goal of this project is to identify and set up an integrated array of sustainable cascade of technologies, to recover, convert and further valorise a significant amount of **(poly)phenols, inulin**, and other potentially value-added components, such as fibrous extraction residues, from **Globe artichoke** (*Cynara cardunculus L.*), an edible thistle cultivated in the Mediterranean Area for scientific and applicative purposes in the Emilia-Romagna region.

The present project will perform a cascade of sequentially activities, namely:

- 1) pre-treatment of initial biomass (drying, grinding)
- 2) extraction by means of enzymatic hydrolysis and /or the use of NADES solvents (Natural Deep Eutectic Solvents) of targeted molecules (mainly, polyphenols). All applied technologies will be selected aiming at the reduction of the environmental impacts of the final processes.
- 3) the biochemical composition of the extracts/hydrolysates will be characterised (total polyphenols, flavonoids, flavanols, hydroxycinnamic acids, etc) by means of spectrophotometric assays. Identification and quantification of specific (poly)phenols will be determined by chromatographic HPLC-DAD analyses.
- 4) the extracts/hydrolysates will be tested to assess the biological activities of the extracted fractions, alone or in combination, and to foresee their possible future applications in the cosmetic, nutraceutical and pharmaceutical fields. In particular, to evaluate the therapeutic potential of single and combined administration of high value extracted molecules, their possible effect on the expression and activity of selected molecular targets of oxidative stress, inflammation, detoxification will be tested by web-based software tools as PASS, Swiss target prediction, SwissADME, commonly used in the prediction of the activity spectrum of biologically active compounds.
- 5) Finally, according to the principle of zero-waste claimed by the circular economy, the large volumes of solid artichoke residues remaining after molecule extractions will be further exploited to prepare bio-composite polymeric materials through melt compounding. Bio-derived and bio-degradable polymers will be used as a matrix, to ensure the CO₂-neutrality as well as the eco-disposal of the achieved materials. The final materials will be characterized in term of chemical, thermal, mechanical, and surface properties.

The candidate will work within the research groups of Environmental Physiology and of Biology and Biotechnology of Plants of the Department of Biological, Geological and Environmental Sciences (BiGeA), Alma Mater Studiorum Università di Bologna, under the supervision of Dr. Tiziana

Guarnieri and Dr. Maura Ferri and with the group of Macromolecular Chemistry of Civil, Chemical, Environmental, and Materials Engineering Department (DICAM), Alma Mater Studiorum Università di Bologna, under the supervision of Prof. Laura Sisti.

Required Skills:

Applicants should preferably have:

- Experience in biochemical techniques dealing with extraction of plant matrices
- Experience in the use of software tools for the prediction of the activity spectrum of biologically active compounds
- Experience in general and analytical chemistry
- Good knowledge of spoken and written English.

English synthesis

The objective of this project is to recover and further valorise a significant number of bioactive molecules and other potentially value-added components, such as fibrous extraction residues, from **Globe artichoke** (*Cynara cardunculus L.*), for scientific and applicative/commercial purposes in the Emilia-Romagna region. The result of this project will be the obtainment of a small number of extracts to be used in the cosmetic, nutraceutical and/or pharmaceutical fields and of biocomposite materials to be used in packaging and material applications.

Italian synthesis

L'obiettivo di questo progetto è quello di recuperare e valorizzare un numero significativo di molecole bioattive ed altri componenti potenzialmente a valore aggiunto, come i residui fibrosi dell'estrazione, dal carciofo Globe (*Cynara cardunculus L.*), per scopi scientifici e applicativi/commerciali nella regione Emilia-Romagna. Il risultato di questo progetto sarà l'ottenimento di miscele bioattive da utilizzare in campo cosmetico, nutraceutico, farmaceutico e di materiali biocompositi da utilizzare per applicazioni nel settore del packaging e dei nuovi materiali.