

Doctoral position in process engineering and biology

Valorisation of by-products from arboriculture in bioactive extracts for plant protection

Many arboriculture products such as branches and leaves are considered waste and are undervalued by the sector. However, these by-products have an interesting composition of secondary metabolites. Preliminary work has identified phenolic compounds in cherry tree branches (Willig et al., 2022). Phenolic compounds are a class of secondary metabolites possessing numerous biological activities such as antioxidant, anti-inflammatory or anti-microbial activity. The objective of this subject is the production of natural extracts from the by-products of arboriculture as an alternative solution for plant protection. For this, it will be necessary (i) to implement and optimize an extraction process adapted to the co-products targeted, (ii) to identify and quantify the secondary metabolites present in the produced extracts and (iii) to assess the potential for exploiting extracts for the protection of plants. This subject is at the interface of process engineering and biology.

The production of extracts will require the use of several extraction technologies (conventional, accelerated by pressure, intensified by ultrasound, by supercritical fluid). The analytical part will require the use of liquid and gas chromatography techniques coupled with mass spectrometry. The valorization of the extracts for plant protection will be evaluated *in vitro* on a panel of plant pathogens (culture of fungi, antagonistic tests, growth inhibition) and then *in planta* under controlled conditions (greenhouse, production of plants, assays of foliar treatments). Treatments will be evaluated in terms of protection (reduction of diseases) and plant physiology (impact on carbohydrate metabolism related to plant vigor, and plant defense responses).

Laboratories implied:

This PhD is a CIFRE PhD funded by Chestnut (www.chestnut-co.com). The subject will be carried out between two laboratories: RIBP from the University Reims Champagne-Ardenne (<http://www.univ-reims.fr/ribp/>) and l'URD ABI from AgroParisTech (<https://urd-abi-agroparistech.com/Home/>).

Chestnut, located in Valence (Drôme) develops innovative extracts from agricultural by-products for cosmetics, food, wellness industries and aims to innovate in plant protection products. The development and production of these extracts are based on securing short and local supply chains, according to circular economy principle and sustainability of its processes.

RIBP (Induced Resistance and Plant Bioprotection) Research Unit, located at UFR SEN of the University of Reims Champagne-Ardenne, is focusing on plant protection (field crops including grapevine) by beneficial bacteria and natural compounds. RIBP has both long and relevant expertise in the analysis of plant responses at the physiological, biochemical, cytological and

molecular levels and has generated a wide range of tools related to modulation of plant immunity under both biotic and abiotic stresses.

ABI (Industrial Agro Biotechnologies) Research and Development Unit, located at the European Center for Bioeconomy and Biotechnology at the heart of the Pomacle-Bazancourt biorefinery (Marne), is dedicated to developing expertise in chemistry, biotechnology and process engineering at the service of biomass valorization through processes that meet the standards of green chemistry and white biotechnology.

Candidate profile:

- Engineering or master's degree in biology or process engineering.
- Theoretical and/or practical knowledge in process engineering and biology (microbiology, plant assays management, molecular analysis would be a plus)
- Knowledge of analytical chemistry would be a plus.
- An interest in biomass valorization and in work at the biology/process engineering interface.
- Rigorous, autonomous and dynamic student

Location:

URD ABI (European Center for Biotechnology and Bioeconomy), 3 Rue des Rouges-Terres, Pomacle (51110), located 15 km from Reims, France.

RIBP, USC INRAE 1488, University of Reims Champagne-Ardenne, Moulin de la Housse – Bât. 18, 51687 Reims cedex 2, France.

Deadline for submission: June 30, 2022

Send a CV, cover letter and letter(s) of recommendation to:

-Pr Florence FONTAINE (RIBP) florence.fontaine@univ-reims.fr

-Pr Irina IOANNOU (URD ABI) irina.ioannou@agroparistech.fr