URD ABI
by AgroParisTech

Doctoral position in Biochemistry

In vitro synthesis of bio-based styrenes by enzymatic approaches and their adaptation in a Millifluidic ISPR system

The growing customer demand for natural antioxidants and flavours concur with new enzymatic tools providing an alternative access to healthier flavour compounds. Styrenes are particularly valuable products in the food, cosmetic, pharmaceutical, and chemical industries. For example, 4-vinylphenols are essentially obtained by chemical decarboxylation of *p*-coumaric acid (*p*-CA) or ferulic acid (FA) which are *p*-hydroxycinnamic acids (*p*-HCAs) using metal catalysts under harsh conditions which raises concerns about the product safety and hazardous waste. Thus, producing renewable 4-vinylphenols from biomass through a sustainable way is a growing research topic.

Several studies tend to use decarboxylases as biocatalysts to develop bioproduction processes under mild conditions. However, the toxicity of the compounds impedes the achievement of high products concentration in microbial processes. This problem can be alleviated by the implementation of a biphasic system. Indeed, the biphasic system enables the product to be selectively transferred into the organic phase while the substrate and the *E. coli* producing rFAD remain in the aqueous phase, thereby minimizing the toxicity of the product and enhancing its final concentration. However, such strategy is hindered by the cost of biobased *p*-HCAs and the lack of robustness of biphasic technics.

Thesis project aims to study the *in vitro* production of 4-vinylphenols using selected decarboxylases rFAD and/or rPAD prior to adapt it in an innovative continuous ISPR millifluidic process. Two approaches will be studied: improvement of phenolic acid decarboxylases activity using site-directed mutagenesis and development of a chemical method for 4-vinylphenols detection. Mastering the synthesis of cost-effective *p*-HCAs or their 4-vinylphenols forms will be a breakthrough innovation towards the development of the biomimetic synthetizes of natural antioxidants, flavours and fragrances as well styrene biopolymers.

Laboratories implied:

This thesis is a PhD funded by ANR (Agence National de la Recherche). The subject will be carried out at URD ABI from AgroParisTech (https://urd-abiagroparistech.com/Home/) with a very close exchange with CentraleSupélec from University Paris-Saclay (https://www.centralesupelec.fr/) and University of Bordeaux, CNRS-CRPP, UMR 5031 (Pessac) (http://sms.crpp-bordeaux)

URD ABI (AgroParisTech, European Centre of Biotechnogy and Bioeconomy (CEBB) Pomacle) is an interdisciplinary research team dedicated to biomass valorization using white biotechnologies, green chemistry and downstream processing, for the production of value-added renewable compounds.

Candidate profile:

- Engineering or master's degree in biotechnology/biochemistry
- Theoretical and/or practical knowledge in biochemistry (enzymology, microbiology)
- Knowledge in analytical chemistry is appreciated
- Chemistry skills would be a plus
- An interest in working at the biochemistry-microbiology/analytical chemistry 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.

Send a CV, cover letter and recommendation letters to:

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