



Ecole Doctorale - 104

Sciences de la Matière, du Rayonnement
et de l'Environnement

ESTABLISHMENT : University of Lille

Laboratory(ies) of affiliation : UMRt BioEcoAgro

Scientific field, Speciality:

DS10 | Food Biotechnology, Food Science, Physiology

Thesis director: FIRDAOUS Loubna, MCF-HDR, loubna.firdaous@univ-lille.fr

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Affiliate programme(s): CPER BiHauts Eco de France/ANR PRC NISINNOV

Planned (co)-funding: Région Hauts de France/ED SMRE (in progress)

Title of the thesis : Advancing nisin production: Integrated adsorption/desorption and membrane processes for sustainable purification

THESIS SUBJECT (ABOUT 1/2 PAGE)

Nisin is a bacteriocin produced by strains of lactic acid bacteria and has broad spectrum antibacterial activity against gram-positive bacteria. This property, combined with its low toxicity, has contributed to its worldwide success as a natural food additive (E234). In addition, it is attracting great interest as a potential therapeutic agent to combat bacterial infections. However, conventional methods for the production and purification of nisin have limitations, particularly in terms of efficiency, cost, and environmental impact, which limits the availability of pure nisin at a reasonable cost. In this context, this PhD proposal aims to develop an innovative approach to optimize nisin production and its purification through the combination of adsorption/desorption and membrane processes, in order to improve the profitability and sustainability of the overall production process. The aim is to propose a process for nisin production and purification that is not only more efficient and economical but also more environmentally friendly.

The project is divided into four parts:

1. The first part focuses on optimizing nisin production while minimizing the formation of undesirable impurities that could hinder subsequent purification steps.
2. The second part focuses on the design and implementation of a pre-purification step by adsorption/desorption. This step aims to reduce the impurity load and concentrate the nisin prior to the membrane purification processes.
3. In the third part, the application of membrane processes for the concentration and purification of nisin will be examined. Processes such as ultrafiltration and nanofiltration will be assessed for their effectiveness in separating nisin from small molecules and remaining impurities. Particular attention will be paid to understanding the transfer phenomena involved in separation.
4. Finally, a technical-economic and environmental impact study of the overall process developed will be carried out.

This PhD project is part of WP 4 of the CPER BiHauts Eco project in France and the ANR PRC NISINNOV project. Close collaboration with the laboratories UMET (Centrale Lille) and TIMR (UTC, Compiègne) is planned.

Expected date of recruitment : 01/10/2024

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Additional remarks/comments:

Required profile

- Education: Engineer, Master 2 or equivalent.
- Desired skills: process engineering, separation processes, biotechnology. Microbiology skills would be an advantage.