Available internship positions for ERASMUS+ students
Academic year 2021-2022 and 2022-2023

The Biochemical Process Engineering research group at Luleå University of Technology (Sweden) consists of >20 people working with biomass pretreatment, carbon dioxide capture and utilization, design and use of enzymes and microorganisms for production of fuels, chemicals and materials. Their expertise ranges from molecular biology, metabolic engineering, microbial physiology, fermentation, enzyme discovery and technology, protein chemistry, process technology to modeling of bioprocesses. During the past year, we have hosted many international students engaging with diverse and interesting projects related to biotechnology (https://www.ltu.se/research/subjects/Biochemical-Process-Engineering/Utbytesstudenter?l=en).

We are currently offering various internship projects for ERASMUS+ students. Preferred duration for the internship is 3-6 months. The internship can start either the winter or spring semester.

Project 1: Enzymatic functionalization of hydrogels for production of wound healing agents
Hydrogel nanofibers made from plant biomass residues have emerged as a sustainable solution towards developing would healing dressings. In this project, we aim to functionalize hydrogels by attaching bioactive phenolics via a crosslinking reaction, catalyzed by an oxidase enzyme. The reaction conditions will be optimized in terms of enzyme load, time, temperature, pH and crosslinking agent concentration. The resulting functionalized hydrogel will be characterized *in vitro* for its enhanced bioactive properties.

Project 2: Enzymatic stabilization of bioactive compounds from halophyte *Salicornia* species for use as anti-inflammatory agents
Halophyte plants such as *Salicornia europaea* have the ability to grown in saline soils and/or be irrigated with seawater. The green tips of Salicornia is sold as food, while the woody part is considered a residue. However, this residue biomass is rich in valuable bioactive molecules that can be extracted using simple and affordable processing. In this project, the enzyme class of feruloyl esterases will be used to stabilize *Salicornia* extracts via esterification reactions, in order to modify their lipophilicity and even enhance their bioactive properties. This strategy will enable their incorporation as anti-inflammatory agents in cosmetics, food and fish feed products.

Project 3: Co-immobilization of enzymes for efficient hydrolysis of pretreated biomass residues
Enzymatic hydrolysis of pretreated plant biomass is a step that offers the release of simple sugars that can be further utilized for fermentation towards biofuels. Enzyme cost can be

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decreased by immobilization strategies, which can also enhance operational stability. In this project, the conditions of co-immobilization of various hydrolases will be optimized towards the efficient hydrolysis of cellulose and starch streams.

Project 4: Life cycle assessment for the novel high-added value products based on valorization strategies of lignocellulose

Life cycle assessment (LCA) is a methodology for assessing environmental impacts associated with all the stages of the life cycle of a product, process, or service. An LCA study involves a thorough inventory of the energy and materials required across the industry value chain and calculates the corresponding emissions to the environment. In particular, 'cradle to gate' analyses, involve all impacts from resource extraction (cradle) to the factory gate. In this project, we will utilize mass and energy balances from bioprocesses developed in our lab, to highlight the environmental benefits of biomass-based products over fossil-based counterparts. The study will be implemented using the simulation tool SimaPro.

Other projects may be also available during the year.

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For applications and deadlines, please consult with the ERASMUS+ office within your university.