

R&D Internship Offer

For Final-Year Engineering Students and Second-Year Master's Students

RESEARCH PROJECT

Biorefinery Integrated in Paper Recycling : Extraction of Starch from Recycled Cellulosic Fibers and its Valorization into High Value-Added Products

CONTEXT & OBJECTIVE

In France, nearly 5 million tons of paper and cardboard are recycled and reused each year. During the recycling operations, part of the starch used as an additive in paper and cardboard manufacturing is released into the process waters, which favors the contamination of process waters by microorganisms. The build-up of starch biodegradation products in the process waters causes several issues in paper and cardboard manufacturing mills, such as process disruptions, biofouling, odor issues, and an increase in the chemical and biochemical oxygen demand of wastewater, to name just a few.

Thus, the development of a starch extraction process at the beginning of the paper recycling chain presents the dual benefit of minimizing issues related to starch biodegradation during papermaking operations and saving a substantial amount of starch (which represents 5 to 10% of paper and cardboard by weight) to produce valuable polymers and molecules of interest. Such an approach is part of circular economy and sustainable development dynamic.

This research project is part of a major research project led by LGP2: the PAC3R project (PACkaging, Recycling, Recyclability, Re-use of paper and cardboard). This large-scale project is funded by the French National Research Agency through a PEPR¹ program and brings together five research institutions : LGP2, the RAPSODEE research center (IMT Mines Albi), CEMEF (Mines Paris), the UniLaSalle Polytechnic Institute, and CERMAV.

MISSIONS

The main objective of this internship is to optimize a process for extracting starch from recycled cellulosic fibers. To this end, various chemical and biochemical extraction methods will be explored and compared. For instance, the use of starch-depolymerizing enzymes, such as α -amylase, and the use of green oxidizing agents, such as ozone, may be subject to a comprehensive study. In a subsequent phase, the purification of the extracted starch fractions via membrane filtration may be considered. The macromolecular features of the extracted starch will be determined using a flow field-flow fractionation technique in collaboration with the UniLaSalle Polytechnic Institute.

In order to assess the efficiency of each extraction process, various starch quantification methods will be compared. The glucose content obtained after total acid or enzymatic hydrolysis of starch will be analyzed using colorimetric (UV-Vis) and chromatography (HPAEC-PAD) techniques.

During the internship, the selected candidate will be invited to participate in meetings and scientific discussions with researchers from partner laboratories involved in the PAC3R project.

¹ PEPR : Programmes et Equipements Prioritaires de Recherche (Priority Research Programs and Equipments)

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PROFILE

This internship is intended for second-year master's students and final-year engineering students who have a strong interest in research and experimental work. For the successful completion of the internship, knowledge in chemistry of vegetal biomass, conversion processes used in biorefineries, and analytical chemistry is particularly expected. Additional knowledge in paper and cardboard manufacturing processes, as well as commonly used additives in papermaking, would be a plus. In addition, the selected candidate will have to demonstrate scientific rigour, autonomy, and possess a strong team spirit.

The selected candidate will join LGP2 (Laboratory of Process Engineering for Biorefinery, Bio-based Materials and Functional Printing), located on the Saint-Martin-d'Hères campus near Grenoble. The intern will join the Biochip research team and be supervised by Alicia TESTON, Ph.D. student at LGP2, and Christine CHIRAT, professor at Grenoble INP-Pagora and LGP2. The internship will last five to six months, depending on the requirements of the candidate's academic program, and will start in February or March 2025.

Internship compensation is in line with current regulations, at 4,35 euros par hour worked, for a maximum of 35 hours per week.

CONTACT

To apply for this position, please send a resume and cover letter to Christine CHIRAT (email : christine.chirat@grenoble-inp.fr) and Alicia TESTON (email : alicia.teston@grenoble-inp.fr), before November 8, 2024.