Master 2 internship

Improving the fibers' bonding ability of recycled fibers using chemistry!

Context

Paper and cardboard recycling has made great progress in recent decades. However, conventional processes cannot recycle more than 90% of the material. The remaining 10% waste, in liquid or solid form, is not valorized by the papermaker. This represents both a cost and a challenge in terms of environmental impact. The "PACkaging, Recycling, Recyclability, Re-use of papers and cardboards" (PAC3R) project focuses on cellulose-based packaging. The project is part of a national program, known as PEPR (Priority Programs and Equipment for Research), funded by the French National Research Agency (ANR). The global objective is to add value to products derived from paper/cardboard recycling, to be able to recycle all paper grades, and to recover all recycling waste.

In particular, the aim is to develop new and sustainable processes to improve the properties of fibers originating from corrugated paper recycling. The demand for recycled cellulosic fibers is growing, leading to the use of increasingly low-quality recovered paper and cardboard. The intensification of recycling processes also affects fiber quality. To compensate for this quality loss, paper mills are currently adding starch and/or virgin fibers. The mission is to avoid these additions by increasing the fibers' bonding potential through the introduction of COOH groups (oxidation) in the fibers or fiber cross-linking (esterification). Another focus is on improving the hydrophobic character of recycled fibers, a major issue in the development of water-barrier packaging.

Missions

The work will focus on conventional processes to increase the fibers' bonding potential. After pulping, the fibers suspension will be treated by chemical treatments, found suitable by the intern after a literature review. Possible routes may be oxygen oxidation (reinforced by hydrogen peroxide), or enzymatic treatment (laccase oxidation) or polycarboxylic crosslinking (citric acid, BTCA). After treatment, the pulp will be chemically analyzed (water retention value, cellulose degree of polymerization, kappa number, COOH content, etc.) and handsheet will be made to test mechanical properties (tensile, burst, compression, contact angle or Cobb test if relevant, etc.). The aim is to assess how these different treatments improve the mechanical properties of recycled paper.

Profile

Student in Master 2 Chemistry, Materials or Process Engineering, looking for an internship in the research sector applied to industrial challenges. Pre-requisites in chemical engineering, analytical chemistry and lignocellulosic biomass are expected. The selected candidate will be able to demonstrate scientific curiosity, rigor, autonomy and dynamism, as well as team spirit and personal skills. Candidates should be fluent in French or English and have good writing and presentation skills. The gratification will be equal to that required by the legislation.

The internship will start in **February 2025 for a duration of 5 to 6 months**. The internship will be located at LGP2 (Grenoble, France, https://lgp2.grenoble-inp.fr/en), on the campus of Saint Martin d'Hères. The student will be supervised by Amélie Lefèvre, PhD student and her supervisors. Collaboration with CERMAV (Grenoble, France, https://cermav.cnrs.fr/en/) could be possible.

Contact

Please send your CV and a cover letter **before November 8th, 2024** to Amélie LEFEVRE, amelie.lefevre@grenoble-inp.fr, and Nathalie MARLIN, nathalie.marlin@grenoble-inp.fr.