

PhD Position

« CONCEPT-CELL: Novel concepts and developments for pure cellulose production from recycled boards»

Project summary

Today recycled papers and boards are a major source of sustainable fibers for the papermaking industry. High paper grades are recycled into writing and printing papers while brown grades are used for corrugated board production. Since OCC (Old Corrugated Containers) contain mixtures of high quality kraft fibers and low quality, highly lignified fibers and fines from mechanical pulps, they follow the recycling line of brown pulps to make low quality papers and boards.

This project proposes to design new processes for OCC recycling involving a novel concept, the chemical pulping of OCC. The aim will be to produce high quality cellulose for special grade papers and for the production of dissolving pulps designed to chemical applications.

OCC will be used as wood substitute. The main challenge will be to design a unique delignification operation adapted to isolated recycled fibers instead of wood chips. Cooking fibers and fines is likely to be easier than cooking chips, since factors like morphological structure, lignin accessibility and diffusion path length are much improved in fibers compared to the case of wood. However new factors such as the presence of fiber aggregates in the suspensions, the presence of fines from the mechanical pulp fraction, and the mixture of several pulps with varying delignification reactivity, are likely to make the pulping operation unconventional and possibly harsher. Therefore pulping will require the investigation of new parameters to treat this novel raw material in a good way.

Delignification trials will be conducted on two OCC models: a “wood free OCC model” with low amount of lignin mainly originating from kraft fibers, and a “wood containing model” with high amount of lignin and a mixture of kraft and native lignin with different reactivity. Several already existing delignification processes (kraft cooking, oxygen delignification ...) will be explored and adapted to the new raw material in order to target a minimum of residual lignin without serious loss of pulping yield and polysaccharide degradation. From these studies, new kinetic equations will be developed and incorporated in pulping simulators formerly developed for wood. After delignification, the OCC pulps will be purified to produce paper pulp and pure cellulose for dissolving pulps. Paper pulp production requires total lignin removal and full bleaching while limiting cellulose degradation. As regards to dissolving pulps, both lignin and hemicelluloses should be removed to achieve a high level of cellulose purification, while activating its reactivity for subsequent conversion. Therefore, two parallel bleaching and purification sequences will be developed using conventional bleaching chemicals (H_2O_2 , ClO_2 , O_3) in usual or unusual conditions, in combination with pre- or post- treatments if required. The efficiency of the sequence will be assessed in terms of pulp specifications according to the application.

Location and practical aspects

This is 3 years PhD fellowship offer. The successful applicant will be hosted by the LGP2 (Laboratory of Pulp and Paper Science and Graphic Arts, Grenoble INP, France) in the “BioChip (Biorefinery: chemistry and eco-processes)” team. He/she will work under the supervision of Pr. Gérard MORTHA and Dr. Nathalie MARLIN from LGP2. The gross salary will be 1787 euros/months, equivalent to a net salary of 1452 euros/month.

Qualifications of the applicant

The applicant must have a Master's degree and strong academic background in chemical engineering, basic chemistry, both organic and analytical chemistry. Applicants who have already worked in laboratory on lignocellulosic materials are of special interest. Skills in modeling (Visual Basic under Excel or Matlab) will also be required. Personal skills include social competence. An open and inclusive personality, an independent thinking and attitude are all useful qualities. The position requires a very high level of accomplishment in writing and communication in English.

Applications

Interested candidates should send their CV and cover letter by e-mail to Nathalie MARLIN and Gérard MORTHA: Nathalie.Marlin@pagora.grenoble-inp.fr, gerard.mortha@grenoble-inp.fr

Deadline for the application: 15 mai 2015

