OFFRE D'ALLOCATION DE THESE

ÉCOLE DOCTORALE SCIENCES EXACTES ET LEURS APPLICATIONS - ED 211

Avenue de l'université BP 1155 64 013 PAU Cedex – France

SUJET DE THESE

TITRE : Biosourced insulating materials

RESUME : This PhD focuses on the elaboration and characterization of insulating biobased porous material and aims to continue the research activities leaded by the IPREM EPCP team in the field of developing polymeric porous material from lignocellulosic resources[1,2,3,4]. The main challenge of this thesis is the elaboration and characterization of porous material with improved properties. This through:

- The improvement of the production process as well as the characteristics of the porous biobased material.
- The development of new formulations by diversifying, notably, the origin and structure of the raw material and more particularly that of lignin.

Mots clés (key words): Biobased porous materials, biomass, lignin, tannins

CONDITIONS D'EXERCICE / POSITION DETAILS

Laboratoire (Laboratory): UMR 5254 CNRS-UPPA, INSTITUTE OF ANALYTICAL AND PHYSICOCHEMICAL SCIENCES FOR THE ENVIRONMENT AND MATERIALS (IPREM)

Site web : www.iprem.univ-pau.fr

Directeur de thèse (PhD Director) : Dr. Fatima Charrier – El Bouhtoury

Lieu (place): EPCP, IPREM (UMR 5254), site de Mont de Marsan, 371 rue du Ruisseau, 40004 Mont de Marsan, France

Date début (start): Octobre 2017	**Durée (duration): 3 years**

Employeur : Université de Pau et des Pays de l'Adour (UPPA)

Salaire mensuel brut (monthly salary before taxes): 1685 €

SAVOIR-FAIRE DU LABORATOIRE / HOST LABORATORY PROFILE

The Institute of Analytical Sciences and Physicochemistry for the Environment and Materials IPREM -UMR CNRS 5254 is the concretization of a synergy and a history around research in environment and materials. Its competencies revolve around fundamental disciplines using analytical chemistry, physical chemistry, theoretical chemistry, physics and chemistry of polymers and microbiology.

Physics and Chemistry Polymer Team (PCP) of the Institute of Multidisciplinary Research Environment and Materials (IPREM) develops its research covering three main areas: macromolecular engineering, surfaces, interfaces, and rheology of complex fluids. The research activities of this multidisciplinary team are conducted around the polymeric materials, their structures, properties and applications. The group has skills in resins formulation, the development of biobased composites and materials. The implementation of these applications results in much academic and industrial. collaboration locally, nationally and internationally.

MISSION - ACTIVITES PRINCIPALES / MISSION – PRINCIPAL ACTIVITIES

Le contexte scientifique - Scientific Context

The development of innovative biosourced insulating materials is a relevant element that can help meeting the needs of energy conservation and environmental friendliness while enhancing byproducts valuation. Therefore, the valorization of lignocellulosic biomass as a promising source of renewable products and chemicals is of interest. This project aims to stimulate the transition toward a circular economy and sustainable management of bio-waste and reduce the impact on the environment. Wood and paper industries generate several by-products such as tannins and lignin. These by-products can be used to produce insulating materials. This, with aiming to promote a global approach to eco-industrial development that should be of interest for wood-paper and insulation industrial sectors**.**

Les objectifs - Science Objectives

The project will be constituted of the elaboration and characterization of biosources porous material, the synthesis and preparation of hydrogels based on these polymers and finally by the evaluation of physico-chemical, the physical and the mechanical properties of the resulting materials (swelling ratio, wettability, flexibility, mechanical properties, roughness of the surface, etc…)

The specific objectives of this PhD project are:

1. Development and characterization of a more than 90% biosourced insulating material.
2. There will be great interest in the selection and characterization of raw materials, including lignin, in order to improve the structure and thus the properties of the final material. Indeed, industrial lignin's have high levels of polydispersity, adding more complexity to ensure good control of the macromolecular architecture. Work on the limitation of this polydispersity by fractions of the lignins to be used will be carried out.
3. Different foaming strategies will be implemented with the aim of achieving a reduction in the density and friability of the materials that we have previously developed.
4. Mechanical, thermal, acoustic characterization of the materials developed and analysis of their morphology by techniques such as electron microscopy and tomography.
5. Study of the durability of the most efficient materials and life cycle analysis as well as technical and economic prospects and industrial transferability.

Les résultats attendus – Deliverables

This project will contribute:

1. To develop material whose characteristics and properties are at least equivalent, if not better, than those of conventional non biosourced materials.

2. To study of the influence of the polymeric composition and foaming process on the final structure of the product and to model the structure and performances behavior.

3. To try to offer new value-added opportunities for wood residues. Indeed, lignin is a residue of the paper industry which is currently poorly valued and which is generally burnt.

4. To better understand the measured structural properties of the biosourced porous materials which can allows the optimization of their formulation according to the properties necessary in other fields of application such as storage or depollution in addition to that of the insulation.

Moreover, in addition to one solid PhD thesis, 3-4 high profile papers will result from the proposed activities. The results will also be presented at professional international meetings.

Les collaborations de recherche - Collaborations

Interactions with supporting partners in Cachan (Prof. R. Bennacer), Pau (Prof. P. Moonen) and Spain (Prof. J. Labidi) will enhance the value of this work through their characterisations and modelling work.

Références bibliographiques (Literature references):

1-Merle J., M. Birot, H. Deleuze, P. Trinsoutrot, H. Carré, Q. Huyette, F. Charrier - El Bouhtoury. **2016**. Arabian Journal of Chemistry. http://dx.doi.org/10.1016/j.arabjc.2016.09.006.

2-Merle J., P. Trinsoutrot, F. Charrier - El Bouhtoury. **2016**. European Polymer Journal, 84: 577-588.

3-Merle J., P. Sénéchal, F. Guerton, P. Moonen, P. Trinsoutrot, M. Birot, F. Charrier - El Bouhtoury. **2016**. RCS Adv, 6: 96057-96064.

4-Merle J., M. Birot, H. Deleuze, C. Mitterer, H. Carré, F. Charrier - El Bouhtoury. **2016**. Materials & Design, 91:186-192.

5-Fatima Charrier - El Bouhtoury. **2016**. Taylor & Francis Group. CRC Press. https://doi.org/10.1201/9781315371184-3

COMPETENCES REQUISES / REQUIRED COMPETENCES

The successful candidate will be highly motived to work in an interdisciplinary scientific context. Skills required for completion of the proposed Ph.D. project are necessarily multiple (polymer chemistry, chemistry, physico-chemistry, material science…). Experience in modelling is advantageous. Excellent communication skills are essential; good English will be a clear advantage.

CRITÈRES D'ÉVALUATION DE LA CANDIDATURE / CRITERIA USED TO SELECT THE CANDIDATE

Traitement du dossier : Jury de sélection (The successful candidate will be chosen by jury)

Les candidats seront sélectionnés d'abord sur dossier. Un entretien sera organisé après la première phase de sélection du dossier de candidature. (1st selection is made on the application, 2nd by jury)

- Adéquation entre le diplôme de Master (ou équivalents) et le sujet de thèse (Relevance of prior studies to the PhD)
- Notes et classements en Master, et régularité dans le cursus universitaire (Consistency of marks in prior exams)
- Maîtrise de l'anglais (English proficiency)
- Capacité du candidat à présenter ses travaux (Capacity to report work)
- Expériences professionnelle de type stage(s) en laboratoire ou autre ; éventuels travaux de recherche déjà réalisés (rapports, publications). (Relevant laboratoryand related experiences)

CONSTITUTION DU DOSSIER DE CANDIDATURE, DATE LIMITE DE DEPOT / REQUIRED DOSSIER, DATE

Envoyer par email un dossier de candidature comprenant :

- CV
- lettre de motivation cover letter detailing your motivations
- relevé de notes et classements en Master 1 et 2 your MSc 1 and 2 marks
- lettres de recommandation letters of recommendation
- coordonnées des personnes du milieu professionnel (minimum deux) à contacter contact details for 2 referees

DATE LIMITE DE DEPOT DU DOSSIER (limiting date):	**25 juin 2017**

CONTACT

NOM : Fatima Charrier – El Bouhtoury
MAIL : fatima.charrier@univ-pau.fr