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

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SUJET DE THESE

TITLE : Elastomeric Liquid Silicone Materials and Antimicrobial Activity

SUMMARY :

The main objective of this PhD project is the investigation of the antimicrobial activity of elastomeric liquid silicon materials. Since those are of primary interest for biomedical applications, two approaches will be carried out in parallel.

- **The investigation of antimicrobial activity will be conducted in physiological—like conditions on model surfaces to achieve a comprehensive understanding of the role of materials physical properties, in particular elasticity, on protein adsorption and on bacterial adhesion. The effect of the physiological milieu on the materials properties will be evaluated in a second stage.**
- **A similar approach will be adopted to study antimicrobial activity on devices processed by injection to correlate outcomes gathered with both model surfaces and devices of interest for the biomedical industry.**

Keywords: materials, elastomer, protein adsorption, bacterial adhesion,

CONDITIONS D'EXERCICE

Laboratoire : Institut des sciences analytiques et de physico-chimie pour l'environnement et les matériaux IPREM

Site web : http://iprem.univ-pau.fr/fr/index.html

Directeur de thèse : Corinne NARDIN
Co-Directeur de thèse : Frédéric LEONARDI

Lieu : Pau (France)

Date début : 01/09/2017	**Durée : 3 years**

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

Salaire mensuel brut : 1685 €

SAVOIR-FAIRE DU LABORATOIRE

The institute is a multidisciplinary research laboratory of international calibre, with close ties with the Université de Pau et des Pays de l'Adour (UPPA). Both scientists from the National Scientific Research Center (Centre National pour la Recherche Scientifique CNRS) and professors of the UPPA (about 120 permanent employees) are appointed at IPREM to efficiently associate higher education and scientific research. Widely recognized in analytical sciences and physical chemistry for environmental and materials science, the laboratory is involved in diverse research area: analytical chemistry, physical chemistry, theoretical chemistry, physics and chemistry of polymers, and microbiology. In relation to the proposed project, the institute owns state-of-the-art equipment for polymer synthesis and characterization, analytical and environmental chemistry (5000 m^2 of laboratory).

MISSION - ACTIVITÉS PRINCIPALES

Bacterial contaminations are not only due to poor hygiene conditions or deficient asepsis. Microorganisms can be found in medical devices (catheters, implants, transplants) or on hospital surfaces, which causes adverse complications. Biofouling affects as well water quality, air conditioning systems and food packaging just to cite few examples. Main approaches to develop antimicrobial materials consist in introducing biocide activity to hamper the growth of microorganisms or kill them on contact. In this project, we propose an alternative approach. Over the last decade, dramatic advances have been made by the hypothesis relating material physical properties to cellular response. For instance, it has been demonstrated that the substrate stiffness directs the fate of stem cells and that nanotopography could drive cell differentiation. However, the relative contribution of these effects is still poorly defined and a similar relationship, to the best of our knowledge, has not been established for microbial cell.

We therefore propose to investigate and correlate the role of the physical properties of materials of biomedical interest on antimicrobial activity. Silicone rubber finds common applications as a medical device material due to its mechanical properties and inert nature. These properties can be combined with introduction of biocides. We will however focus on correlating the role of materials stiffness, toughness, topography and related wettability and roughness with antimicrobial activity. Since liquid elastomeric silicone is of primary interest for biomedical applications, two approaches will be carried out in parallel.

- **The investigation of antimicrobial activity will be conducted in physiological—like conditions on model surfaces to achieve a comprehensive understanding of the role of materials physical properties on protein adsorption and on bacterial adhesion. The effect of the physiological milieu on the materials properties will be evaluated in a second stage.**
- **In parallel, a similar approach will be adopted to study antimicrobial activity on devices processed by injection to correlate outcomes gathered with both model surfaces and devices of interest for the biomedical industry.**

Expected results

Based on preliminary results, and those achieved with stem cells, the antimicrobial activity is expected to be primarily affected by the elasticity of the material. Whether it increases with the stiffness of the material needs to be demonstrated.

Research collaborations

All partners of Health Liquid Silicone Rubber project (Program Interreg V-A Espagne-France-Andorre)

COMPÉTENCES REQUISES

The candidate should have a strong background in polymer physics, physical chemistry or materials science with a sound motivation in studying biology and related laboratory practices.

CRITÈRES D'ÉVALUATION DE LA CANDIDATURE

Application procedure: Selection by a commission

Candidates will be selected at first on their application file. An interview will be then organized subsequent to this first selection stage based on the application file. Particular attention will be paid to the:

- Appropriateness of the Master diploma (or equivalent) to the PhD topic
- Grades and ranking in Master, as well as regularity during the bachelor and master studies
- Mastering of English
- Oral and written communication skills
- Professional experience

CONSTITUTION DU DOSSIER DE CANDIDATURE, DATE LIMITE DE DEPOT

Send by email in a single PDF file :

- CV
- Motivation letter
- Master grade sheets including ranking
- Recommandation letters
- The contact information of at least two referees

CONTACT

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