Secteur des Sciences et Technologies

Invitation à la soutenance publique de thèse de

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Master bioingénieur : chimie et bio-industries

Pour l'obtention du grade de Docteur en sciences agronomiques et ingénierie biologique

« Protein-polyelectrolyte complexes for the surface immobilization of bioactive proteins»

qui se déroulera
le mercredi 12 juin 2019 à 16h
Auditoire LAVO 51
Place Louis Pasteur, 1
1348 Louvain-la-Neuve

Membres du jury :

Prof. Christine Dupont (UCLouvain), promoteur
Prof. Jacques Devaux (UCLouvain), président
Prof. Damien Debecker (UCLouvain), secrétaire
Prof. Véronique Préat (UCLouvain)
Prof. Alain Jonas (UCLouvain)
Prof. Pierre Schaaf (UDS – France)
Prof. Joseph Schlenoff (FSU – USA)

Modern technologies steadily rely on the ability to create functionality at interfaces. In this view, the immobilization of proteins on surfaces is becoming topical for chemical engineering, healthcare and diagnosis. Layer-by-Layer (LbL) self-assembly is one of the most used method to immobilize macromolecules on surfaces. It consists in the alternate adsorption of oppositely charged species, resulting in the formation of a multilayer. This method in principle allows any charged object to be immobilized on any surface, from aqueous solutions. However, when it comes to protein, the promises of versatility, simplicity and universality that the LbL approach holds are unmet due to the heterogeneity of protein properties.

This thesis aims at demonstrating that protein surface properties can be standardized via their complexation with soluble charged polymers, *i.e.* polyelectrolytes (PEs), and that the resulting protein-polyelectrolyte complex (PPCs) can be used as building blocks for LbL assembly. The results show that using PPCs, LbL assembly becomes independent of the protein electrical properties, as demonstrated for the immobilization of lysozyme. In particular conditions, highly hydrated films that only contain PEs are obtained, even though a protein was used to construct them. Upon dehydration, these films are shown to irreversibly lose their water content. When compared to the LbL assembly of bare proteins, the PPCs-based method is shown to maintain a higher protein bioactivity and to immobilize larger protein amounts, which results in a higher total bioactivity. For applications aiming at delivering proteins, a higher bioactivity is obtained, which is attributed to a self-reorganization of the multilayer upon release. Finally, the method is translated to the creation of a useful functional material, i.e. a dressing designed for wound healing, on which an antimicrobial peptide that failed to be immobilized without PPCs formation is immobilized. The LbL assembly of PPCs thus holds much promises in terms of universality. It also allows to create new functionality and structures at interfaces, which will be beneficial for the design of drug delivery systems, biomaterials and sensors