Secteur des Sciences et Technologies

Invitation à la soutenance publique de thèse de

Monsieur Jean-François ART

Master bioingénieur : chimie et bioindustries

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

« Quartz crystal microbalance sensors to elucidate interaction mechanisms between antigens and aluminium-based vaccine adjuvants»

qui se déroulera

le lundi 24 septembre 2018 à 16h30

Auditoire LAVO 51

Place Louis Pasteur, 1

1348 Louvain-la-Neuve

Membres du jury :

Prof. Christine Dupont (UCL), supervisor
Prof. Jacques Devaux (UCL), chairperson
Prof. Eric Gaigneaux (UCL), secretary
Prof. Véronique Préat (UCL)
Dr. Caroline Dekeyser (GSK Vaccine, Belgium)
Dr. Grégory Francius (CNRS – LCPME – Université de Lorraine, France)

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Vaccines produced from antigenic subunits, such as proteins, are poorly immunogenic. They fail to trigger a sufficient immune response and a memory effect, especially in children. The immunostimulation capacity of most vaccines is enhanced using vaccine adjuvants, among which aluminum hydroxide (AH) is the most widely used. Antigen adsorption on AH adjuvant particles is known as an important step to produce effective vaccines. Controlling antigen-AH interactions is thus a key challenge in vaccine formulation.

The aim of this work was to develop a new platform, based on quartz crystal microbalance (QCM), to monitor directly and in real time the adsorption of proteins, taken as model antigens, on adjuvant particles. The addressed challenges were (i) to assemble AH particles at the surface of QCM sensors into thin, continuous and stable layers, and (ii) to use these AH-modified sensors for the measurement of protein adsorption in different pH and ionic strength conditions, with a view to unravel adsorption mechanisms.

The modified sensors were successfully elaborated with two different commercial AH adjuvants. The immobilized AH particle layers were thin (20-80 nm thick), stable under different pH and saline conditions, and reached a high surface coverage on the QCM sensors. The adsorption results revealed that bovine serum albumin (BSA) adsorption was not exclusively driven by electrostatic interactions at physiological pH. Moreover, the role of PO_4-OH ligand exchanges was highlighted in the adsorption of ovalbumin, as well as in BSA adsorption, despite the fact that the latter has a low phosphate content. The two different AH adjuvants behaved differently towards protein adsorption, even though their physicochemical properties were similar.

The immobilization of adjuvant particles on QCM sensors offers a new platform for the study of antigen adsorption, to the benefit of vaccine formulation, and also enriches the range of applications for which QCM can be exploited, especially in colloid science.