INSTITUT DES SCIENCES ANALYTIQUES

Synthesis and evaluation of new reactive particles for in vitro biomedical diagnosis using microsystems

Keywords: Reactive particles, biofunctionalization, microfluidics, microfabrication

Context and objectives:

In the case of biomedical and environmental diagnostics, very low quantities of pathogen or target molecules should be detected within a large sample volume. Hence, early diagnostics should be specific and sensitive. Specificity can be obtained by working on particular components of the pathogen such as proteins. Many efforts have been devoted to extract and to identify the target molecules using combined steps. For instance, to gain the sensitivity of molecular biology, the nucleic acids (i.e. DNA) should be first non-specifically extracted from crud sample, purified, concentrated, amplified using polymerization chain reaction (PCR) before any specific detection.

The aims of this project are the elaboration of a new generation of reactive carriers and the development of processes related to biomolecules immobilization (i.e. antibodies; proteins, enzymes and also nucleic acids). The final particles bearing well-defined immobilized biomolecules will be used for specific extraction of target. In this subject we will mainly focus on antibodies for in vitro biomedical diagnosis.

This problem requires the development of new technology leading to the preparation of new reactive colloids adapted for the specific capture of the targeted antigen molecules, and the development of new surface chemistry via the elaboration of new molecules (ligands monomer derivatives). The antibody immobilization on the reactive particles will be investigated in order to point out the driven parameters controlling antibody-ligand interactions. Finally, the final particles containing antibody will be compared to the manufactured and existing systems. This research project will be conducted following the following tasks

(i) Elaboration and characterization of reactive particles (submicronic in size) bearing molecule ligands

(ii) Antibody-molecule ligand interaction as a function of pH, salinity antibody concentration, development of new monomers or reactive molecules for specific capture of DNA molecules and

(iii) Specific capture of antigen using the prepared particles containing well defined antibody.

(iv) Integration in microsystem based microfluidic technology dedicated to fast ELISA analysis.

The final results should lead to an alternative, simple, fast and possible automated methodology to the existing techniques such as chemical immobilization of antibody via activation steps onto particles bearing amine and carboxylic groups.

The results emanated from this study will be essential for samples preparation before any fine and specific analyses, and the established technique will be easily integrated in automats dedicated to biomedical diagnosis where the sensitivity, and detection speed are of great and pertinent interest.

Contact:

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