POST-DOC POSITION

Peptide-like materials as highly specific molecular imprints: from microfluidic device fabrication towards diagnostic applications

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Context : The Post-doc position is granted by the Agence Nationale de la Recherche (ANR) for 18 months starting from 1st September 2019.

Project description :

The project aims to the **development of molecular imprinted hybrid-PDMS microfluidic devices for the extraction, concentration, separation and detection of biomolecules in biological samples (plasma, blood).** Highly specific tridimensional and functionalized imprints of biomolecules (peptides, proteins) will be prepared inside microchannels by template-assembly and inorganic polymerization of a variety of original hybrid building blocks mimicking amino acids. At the end of the fabrication steps of microfluidic devices, **the hybrid silicone channel will display on its surface nanometric cavities dressed with the chemical functions complementary to the template-biomolecule.** The hollow cavities will be able to capture the biomolecule with very high selectivity and affinity in complex media (Figure 1). Indeed, unlike classical molecular imprint polymers (MIPs) [1], the resulting inorganic/bioorganic hybrid material will recapitulate not only the shape but also the complementary functions of the biomolecular template. Then, an electrical field will be applied to migrate the analyte (e.g. the template-molecule) inside the microchannel filled with separation buffer. Separation by electrophoresis will be detected by several detection devices (UV, fluorescence, C^4D and mass spectrometry) and compared with the use of a non-imprinted device.

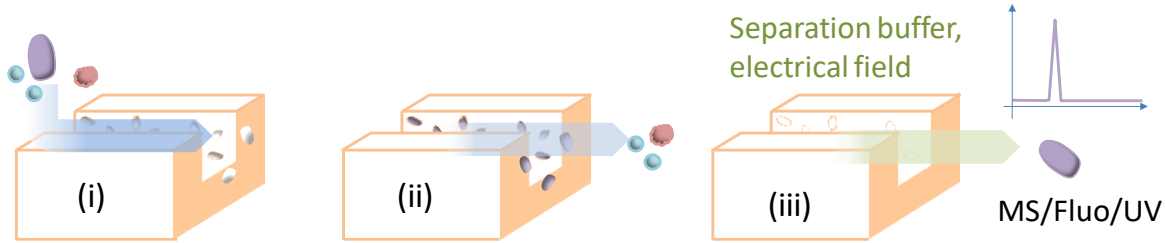

Figure 1: ***Direct electrophoretic separation in molecular imprinted hybrid PDMS microfluidic device.*** *(i) The channel is filled with a complex mixture containing the molecule template (i.e. the analyte) and washed to get rid of unwanted molecules (ii) only the analyte of interest is captured in the cavities of the microchannel. (iii) the analyte migrates in the microchannel filled with a separation buffer under the application of an electrical field to the detector.*

Several peptide and proteins templates covering a wide range of size (from 1.5 to 150 kDa) and functions will be used as models to evaluate the efficiency of imprinted hybrid-PDMS material for the

electrophoretic separation of molecules templates. **It includes vancomycin, C-peptide, human Kallikrein 1, antibody fragments and therapeutic antibody**. All of them are important biomarkers to be quantified in the fluids of patients. **Different designs of microfluidic devices (i.e. channels geometry, size …) will be prepared with the OptoMicrofluidic Platform of Montpellier (POMM) according to the type of biological sample to be analyzed**. Then, the choice of electrophoretic conditions (nature of BGE, ionic strength, pH, …) will be first investigated by capillary electrophoresis and then transferred in microfluidic devices. An in-line electrophoretic stacking (concentration of analytes in the microchannel) methodology, based on a difference in mobilities of the analyte between the sample and the separation buffer, will be also developed after the capture step to obtain better peak efficiencies, good resolution and high sensitivity [2]. Analytical performance of hybrid-PDMS microfluidic devices will be evaluated by the determination of extraction efficiency, specificity, selectivity, resolution, analysis time, limit of detection (LOD) and limit of quantification (LOQ).

The post-doc will be supported by the complementarity and expertise of several teams located in Montpellier and specialized in the conception of bioactive compounds (IBMM-team amino acids), sol-gel process and hybrid materials (ICGM, partner 2), microfluidics devices fabrication (L2C-team POMM) and analytical development (IBMM-team analytical sciences).

Qualification:

- You are highly motivated to work at the boundary between analytical chemistry, microfluidics, microfabrication and sol-gel polymerization.
- You have practical experience in microfluidics and/or microfabrication, with a good expertise in analytical chemistry
- Good knowledge about electrokinetics methodologies (preconcentration, separation) and analysis of biomolecules is advantageous.
- You enjoy working independently and challenging scientific obstacles with an optimist aptitude.

Send your application by e-mail before 30 May 2019 to yoann.ladner@umontpellier.fr and catherine.perrin@umontpellier.fr including CV with names and addresses of two referees and motivation letter.

- **Référence bibliographiques** :

[1] L. Chen, X. Wang, W. Lu, & al., Chem. Soc. Rev. 45 (2016) 2137–2211.
[2] B.C. Giordano, D.S. Burgi, S.J. Hart, A. Terray, Anal. Chim. Acta 718 (2012) 11–24.