ABSTRACT SUBMISSION

To be submitted before Feb. 22nd, 2019 online at https://biomatsante.sciencesconf.org

Biomat – Materials for Health Congress – June 3-7 2019 – La Grande Motte, France

Porous materials for the detection of low concentrated biomolecules

D. Bergé-Lefranc[1], C. Belliardo[2], T. N. T Phan[3], D. Rayeroux[3], C. Pardanaud[4], A. Merlen[5], K. Mabrouk[3], M. Rollet[3], D. Gigmes[3], R. Denoyel[2] and V. Hornebecq[2]

1. IMBE, UMR 6263 Faculty of Pharmacy, Aix-Marseille University, Marseille, France
2. MADIREL UMR 7246, Aix-Marseille University, Marseille, France
3. ICR, UMR 7273, Aix-Marseille University, Marseille, France
4. PIIM UMR 7345, Aix-Marseille University, Marseille, France
5. IM2NP UMR 7334, Université de Toulon, Toulon, France

Type of contribution desired: x **ORAL** ☐ **POSTER**

☐ Candidating to best presentation award for PhD students/young scientists* ?
(*PhD defense in 2018 or before the end of 2019".

Keywords: *Porous materials, functionalization, adsorption, detection, biomolecules*

ABSTRACT

The detection of low-concentrated biomolecules is a key issue in many areas of life sciences such as drug intoxication, medical diagnostic assistance, prevention of pathology's appearance and environmental integrity monitoring. Currently, in case of biological matrices, the main analytical methods used are either immunological or chromatographic. These two technics are powerful from both qualitative and quantitative point of view. However, some points limit their routine use for preventive superposes. Chromatographic methods require high qualified personnel, equipment and their maintenance are expensive and pre-treatment phases are time-consuming. Immunological methods are rapid, sensitive but have some limitations such as problem of interferences with other molecules or the impossibility of detecting certain biomolecules or drugs. The introduction of a solid/liquid interface to promote a controlled adsorption phenomenon can lead to the development of a complementary method for the detection of molecules at low concentration. Adsorption has the advantage of simultaneously allowing an overconcentration and a specific (or selective) interaction with a targeted molecule for routine uses with an acceptable costs and accuracy. In this presentation, two examples will be developed to illustrate the use of porous materials to detect, after adsorption, low concentrated biomolecules.

In the first example, the surface of a porous silica material was functionalized with specific functions able to realize "lock/key" type interaction with the target. Using an innovative synthesis procedure, hybrid mesoporous silicas with uniformly and densely covered polypeptides (glutathione) functions on its surface were prepared starting from a diblock copolymer composed of a polylactide hydrophobic block and a polypeptides hydrophilic block. The reactivity and accessibility of the confined glutathione functions towards benzoquinone that is a main metabolite of benzene were studied from a thermodynamic point of view. Adsorption parameters, such as the affinity between benzoquinone and porous materials functionalized with polypeptides and maximal adsorption capacities, were obtained. The crosschecking with the results of calorimetric experiments led to the energetic aspect of the interaction. These thermodynamic parameters were found similar to those determined in solution for the same interaction.

In the second example, gold nanoparticles were immobilized in the pores of the silica material (Figure 1). The resulting porous nanocomposite was used as a substrate to detect oxazepam, a benzodiazepine metabolite. This detection is based on the SERS effect that corresponds to a Raman

signal enhancement observed when Raman-active molecules are adsorbed on "nanostructured" metal surfaces. The Raman response of oxazepam was coupled with its adsorption properties on such substrates allowing to understand the synergistic interplay between materials parameters/adsorption process and the drug detection threshold.

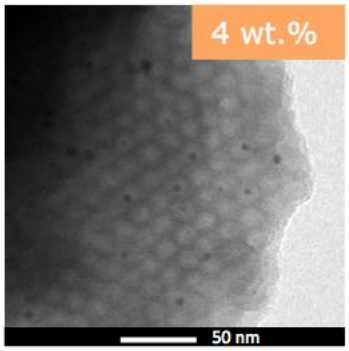

Figure 1: Transmission Electronic Microscopy picture of Au-based porous nanocomposite