Thesis title: Design of smart porous materials for controlled drug release

Laboratory: MADIREL

Team: Axis 1: Porous materials and powders

PhD Supervisor: Virginie HORNEBECQ

E-mail: Virginie.Hornebecq@univ-amu.fr

Context

The development of more effective drug delivery systems is a major societal challenge. Indeed, with an aging population, drug consumption has been rising steadily in recent years, and with it, the number of reported side effects. One solution to this problem is the design of biocompatible drug carriers into which large quantities of active ingredients can be introduced without their premature release before reaching their target. Such systems can deliver the drug directly into the target's environment, thereby reducing the associated dose and side effects. Over the past thirty years, several types of materials have been developed with the aim of delivering molecules of pharmaceutical interest. Among these materials, mesoporous silica has been the focus of active research due to its unique properties.

Descriptif du sujet

Recently, research has turned to the design of smart materials which, using an external stimulus (physical or chemical), can control the release of molecules of pharmaceutical interest. This is the main objective of this thesis. First, hybrid silicas will be developed and characterized. They will be functionalized either by grafting organic ligands or by grafting supramolecular machines, both being sensitive to one stimulus. Two examples of functionalization for pH-sensitive materials are shown in Figure 1 Secondly, after encapsulation of the drugs within the silicas, the controlled release properties will be studied as a function of the complexity of the medium (aqueous, proteinaceous, or non-proteinaceous saline) and parameters such as pH and temperature. We will look at the adsorption and release of one or more drugs, to study more deeply the cooperative effect that we have recently demonstrated [1]. Finally, in a last step, the cytotoxic effect of these delivery systems will be studied in collaboration with the Faculty of Pharmacy of Marseille.

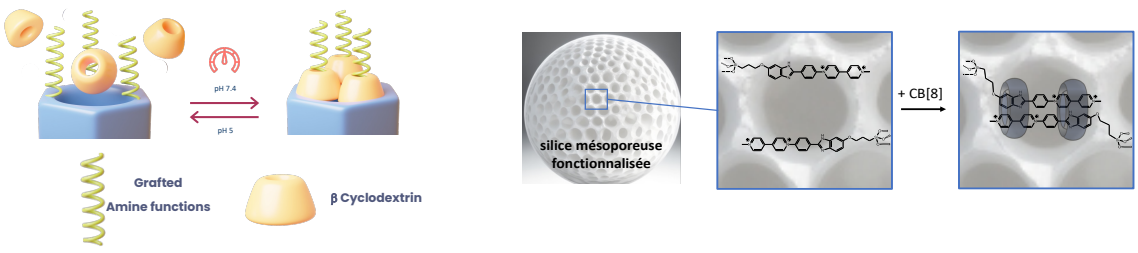

Figure 1: Schematic representation of pH-sensitive drug delivery systems

Reference

pH-responsive mesoporous silica drug delivery system, its biocompatibility and co-adsorption/co-release of 5-Fluorouracil and Naproxen
E. Benova, V. Hornebecq, V. Zelenak, V. Huntosova, M. Almasi, M. Macajova, D. Berge-Lefranc
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