Poster Presentation

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Modelling the release of biological molecules from ordered mesoporous silica

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This work reports preliminary results of the application of a theoretical model [1] in the study of incorporation and release of biological molecules from the porous structure of the SBA-15 [2] ordered mesoporous silica. A theoretical model taking into account the shape and spatial coordination of the pores in the amorphous silica structure is fitted through a non-linear least-squares method and the behavior of the parameters obtained from curves acquired in-situ during incorporation and release experiments are interpreted in the context of different media. Preliminary studies included experiments regarding the coating of the SBA-15 silica with the Eudragit® polymer and the stability of SBA-15 in experimental media (water and PBS solution) and in simulated body fluids. Small angle X-ray scattering experiments were performed mainly with bovine serum albumin (BSA) and insulin, and showed the silica's capacity of sheltering those molecules inside its structure, as well as the influence of Eudragit® on their release dynamics. In-situ experiments made during the incorporation and release of insulin helped elucidate the dynamics of those phenomena, through the reinterpretation of the theoretical model, which was originally designed to study the synthesis process of SBA-15. In this model, fit parameters were monitored during the experiment and, from their behaviors, some conclusions are drawn, such as the delay in BSA release for the SBA-15 plus Eudragit® in gastric fluid. The in-situ studies of insulin loading showed that this molecule's uptake takes place in the course of a few minutes and that it remains inside the pores. Also the in-situ studies of insulin release showed that this molecule is protected inside the silica walls, and the use of Eudragit® is, in a way, optional.

[1] *Sundblom, A., Oliveira, C. L. P., Palmqvist, A. E. C., et al. The Journal of Physical Chemistry C, 2009, 113(18), 7706–7713,* ***[2]*** *Zhao, D., Feng, J., Huo, Q., et al. Science, 1998, 279(5350), 548–552*

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