Simulation of porous silica structure embedded with antigens to develop oral vaccines

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The pandemic crisis generated by the Covid-19 virus boosted, in an unprecedented way, the development of a variety of new injectable vaccines, which is the most efficient way to produce immunization. On the other side, even less costly, easier administration and friendlier, oral vaccines were not urgently considered, since they have to overcome the gastrointestinal barrier to produce antibodies, a difficult task in their viable production and use. For more than 15 years, a team of researchers in Physics, Chemistry and Immunology is working on the development of oral vaccines having ordered mesoporous silica (OMS) as the protective vehicle/adjuvant of antigens. The proof of principle, regarding the efficacy of the immunogenic complex, was performed with model proteins encapsulated in the SBA-15 type OMS [1]. Antigens of Hepatitis B, diphtheria and tetanus anatoxins were analyzed by means of Small Angle X-ray Scattering (SAXS), whose simulated results provided information on the antigen site and release, by means of *in-situ* experiments. Also, imaging reconstruction techniques using X-rays and neutrons gave complementary information on the morphology of the immunogenic complex, necessary to determine the best concentration of antigens to avoid their agglomeration, that provokes less contact area with immunogenic cells. Complementary techniques demonstrated the achievement of high concentration of antibody titers even in low antibody responder mice, proving that there is a promising future for this vaccination route [2,3].

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References:

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