Hybrid nanomaterials and nanoparticles for the prevention of biodeterioration of cultural heritage objects

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Duración del proyecto: 2018-2022
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Microorganisms are highly proficient at inhabiting and decaying paper, leather and stone objects, generating serious problems for the conservation of paintings, textiles and sculptures. The associated health risks coupled with the cost of decontaminating infected artefacts, exhibition rooms and depots make this a pertinent topic for museums, local authorities and private collectors alike. Moreover, our shared cultural heritage is a social, economic and environmental resource for Europe.[1] The overall aim of our current research efforts is to engineer a range of molecular and hybrid materials with modular and tunable properties antimicrobial properties, which act to help prevent the biodeterioration of cultural heritage objects.[2] This talk is centered on the development and application of magnesium oxide nanoparticles (MgO NPs) and polyoxometalate ionic liquids (POM-ILs) against different bacterial and fungal strains.[3-6] The MgO NPs (average diameter 10-12 nm), synthesized by sol-gel method, have been tested against different microorganisms and possess antibacterial activity against both Gram-negative (*E. coli*) and Gram-positive (*B. subtilis*) bacteria, and antifungal activity against fungi commonly found colonizing paper heritage (*A. niger*, *C. cladosporioides* and *T. reesei*). Moreover, these particles have successfully used as a protective coating for 18th century paper samples, inhibiting not only the bacterial and fungal growth, but also the cellulase activity of *T. reesei* and *A. niger*.[5,6] On the other hand, we have demonstrated how POM-ILs can protect different types of natural stones from environmental corrosion and microbial colonization due to their hydrophobic, acid resistance and antimicrobial properties. Furthermore, their tunable characteristics have allowed us to develop new promising broad-spectrum antimicrobials against non-pathogenic and pathogenic bacteria, environmental and mycotoxin-producing moulds, and phototrophic cyanobacteria and algae.[4,7,8] Both MgO NPs and POM-ILs can be applied as a non-visible coating to the human eye, making them highly appropriate for the conservation of cultural heritage objects and architecture.[4-7]

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