CiQUS Lecture

Wednesday, May 11, 2022
12:15 p.m. CiQUS Seminar Room

FONDO EUROPEO DE DESENVOLVEMENTO REXIONAL
PO FEDER Galicia 2014-2020 – *Unha maneira de facer Europa*

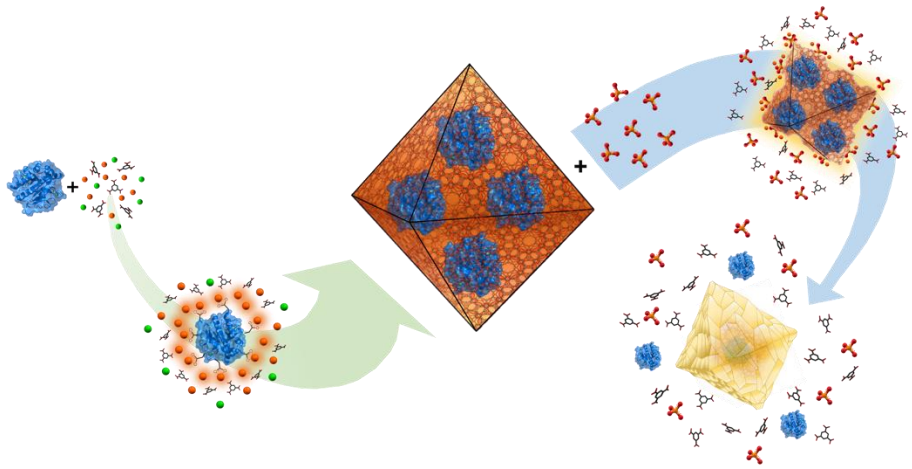
Link to group website: https://icmol.es/prometeu-2019-066/
Email: monica.gimenez-marques@uv.es

Abstract:

Biohybrid nanostructures in which Metal-Organic Frameworks (MOFs) are used as functional porous scaffolds for the entrapment and preservation of different bioentities is a prolific topic in the field of MOFs that has grown very rapidly in the last years. The biocompatibility, processability, and plausible large-scale production of these biohybrids have fulfilled industrial requirements and are providing innovative solutions in biotechnology, health and food-related applications, among others.

In this communication, we will cover examples of biohybrid nanostructures obtained by different synthetic approaches such as direct impregnation or in situ biomineralization. We will show the encapsulation of a natural preserving food molecule, carvacrol, into mesoporous MIL-100(Fe) nanoparticles with high payloads. When processed in polymeric films, MIL-100(Fe) scaffold endorses a remarkable carvacrol sustained delivery with improved bactericide activity against E. Coli and L. innocua.[1] These features position the obtained biohybrid as a competitive candidate for food packaging.

Second, we will introduce a general method for the preparation of protein@MOFs biohybrids triggered by the spontaneous MOF growth under biocompatible conditions. For the first time, a MOF is grown onto a broad variety of proteins regardless of their surface nature, including alkaline proteins previously inaccessible by the well-developed azolate-route.[2] These biohybrids retain protein activity in denaturing conditions and allow triggered release which is highly convenient for advanced therapies including immunotherapies and the development of RNA-based vaccines. Finally, we will demonstrate the potential of these biohybrids in the intracellular release of myoglobin (Mb) and subsequent O2 delivering into hypoxic A549 cells overcomimg hypoxia-associated chemoresistance.



Scheme 1. Biohybrid formation by in situ MOF growth and triggered protein release.

[1] K. Caamaño, et. al. ACS Applied Materials & Interfaces, 2022, 14, 8, 10758–10768.
[2] J. Cases Díaz, et. al. ChemRxiv DOI: 10.33774/chemrxiv-2021-5c1cs

Biosketch:

Dr. Mónica Giménez Marqués (b. 1984, Valencia) is a Ramón y Cajal Research Fellow at the Institute of Molecular Science (ICMol) of the University of Valencia. She obtained her PhD in 2013 at the ICMol in the field of molecular magnetism. In 2014 she moved her interests towards different uses of porous materials, first, with a post-doctoral position at the Institut Lavoisier de Versailles (France), under the supervision of Prof. Christian Serre, Dr. Patricia Horcajada and Prof. Patrick Couvreur to study the biomedical use of MOFs; In 2015, she gained a Marie-Sklodowska Curie Individual Fellowship to work at the Institut des Matériaux Poreux de Paris to develop heterometallic MOFs for their use in heterogeneous catalysis with a research stay in Prof. Hermenegildo García's group at ITQ (Polytechnic University of Valencia).

In 2018 she joined the ICMol as Juan de la Cierva Incorporation and was then appointed Junior Leader Incoming Fellow from La Caixa Foundation (2019) and Ramón y Cajal Fellow (2020). Since then, Mónica is co-leading the Crystal Engineering Lab in which she develops new MOF hybrid materials and composites to study fundamental properties and their uses in biomedical and environmental related fields.

Dr. Giménez Marqués has received several distinctions such as attending the 67th Lindau Nobel Laureate Meeting (2017), the Talento Joven Award (2018), the Algemesí Scientific and Technical Award (2019), and the RSEQ Young Researcher Award (2021).