Metal-Orgainc Frameworks for the encapsulation of biological entities: potential as vaccine formulation

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Bio-entities benefit from unparalleled activities of high interest in many applications such as environmental and medical field. However, these are fragile entities, easily degraded under non-native conditions. Encapsulation, i.e. inclusion within a host matrix, is particularly interesting for bio-entities stabilization and protection, and Metal-Organic Frameworks (MOFs) have arisen as a host matrix of choice, resulting in the design of novel functional materials.[1] However, the number of MOF/bio-entities couples is limited either due to size matching constraints or to a narrow window of compatible synthetic conditions.

In this presentation, we will present our efforts to expand synthetic routes and processing methods to explore new compositions and hierarchical structures of bio-entities-MOFs hybrids. We will describe the synthesis and characterization of MOFs-based living materials, using the mesoporous iron polycarboxylate MIL-100(Fe).[2] We will also present our latest finding on the design of bio-entities@Al-MOF.[3] We will show that the bio-entities@Al-MOF act as a potent vaccine formulation as it demonstrated in-vivo a stronger adjuvant effect than the benchmark Al-adjuvant, was fully resorbable, disappearing from the injection site, was not exhibiting any toxicity, and was stable for two years.

References:
1- (a) E. Gkaniatsou et al., Mater. Horiz. 2017, 55; (b) R. J. Drout et al., Chem. Rev. 2019, 150; (c) X. Wang et al., ACS Cent. Sci., 2020, 9; (d) S. Huang et al., Angew. Chem. Int. Ed 2020, 8786; (e) W. Liang et al., Chem. Rev. 2021, 1077.