An innovative multifunctional coating with controlled antifouling properties based on the encapsulation of two different biocides

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The interaction of the micro-organisms with the stone monuments is one of the most important decay process. Usually, the application of biocides is used to remove patinas and to protect the stone from their reappearance. However, the direct application of biocides on the material can have some drawbacks, such as poor control of the release speed of the antifouling. This study proposes an innovative multifunctional coating with antifouling properties in which the biocide is encapsulated within two silica-based nanodevices: nanocapsules and mesoporous nanoparticles. Two different biocides were tested: a commercial biocide, 2-mercaptobenzothiazole and a Natural Product Antifoulant, the zosteric sodium salt. The coatings were synthesized by mixing the loaded nanodevices and nanoparticles of titanium dioxide in a TEOS-based matrix. The obtained coatings were applied on stone materials with different textural properties such as mortar, brick, travertine, and marble. Finally, to evaluate the effect on water transport properties, colour and morphology surface, and the penetration depth, a multi-analytical approach was adopted.