Società Chimica Italiana
Divisione di Chimica dell'Ambiente e dei Beni Culturali

XXI CONGRESSO NAZIONALE DELLA DIVISIONE DI CHIMICA DELL' AMBIENTE E DEI BENI CULTRALI
CREMONA, 10-13 SETTEMBRE 2025

UNIVERSITÀ DI PAVIA

XXI CONGRESSO NAZIONALE DELLA DIVISIONE DI CHIMICA DELL'AMBIENTE E DEI BENI CULTURALI

Cremona, 10 - 13 settembre 2025

BOOK OF ABSTRACT

POSTER 25096

Novel sustainable BIOactive COATings to preserve metal surfaces in Cultural heritage and Healthcare: The BIO-COATCH PRIN PNRR Project

A. Timoncini[1], M. Cappelletti[1], E. Bernardi[2], C. Martini[3], L. Lorenzetti[3] M. Cianciavicchia[1], E. Sassoni[4], M. Gori[5], G. Graziani[6], A. Balbo[7], L. Ciacci[2], E. Buratti[7], M. Bertoldo[7], F. Zanotto[7] and C. Chiavari[8]*

[1]Department of Pharmacy and Biotechnology, University of Bologna;
[2]Department of Industrial Chemistry "Toso Montanari", University of Bologna;
[3]Department of Industrial Engineering, University of Bologna;
[4]Department of Civil, Chemical, Environmental and Materials Engineering, University of Bologna;
[5]Institute of Biochemistry and Cell Biology (IBBC) – National Research Council (CNR), Monterotondo Scalo (Rome);
[6]Department of Chemistry, Materials and Chemica Engineering "Giulio Natta", Politecnico di Milano;
[7]Department of Engineering, Corrosion and Metallurgy Study Centre "A. Daccò", University of Ferrara,
[8]Department of Cultural Heritage, University of Bologna, Italy.

** andrea.timoncini2@unibo.it*

Bacterial contamination or colonisation of metal surfaces represents a significant challenge across numerous facets of contemporary society, necessitating the pursuit of solutions applicable to diverse fields. In the cultural heritage (CH) one, bacterial colonisation of artefacts can exacerbate metal corrosion through the acceleration of anodic or cathodic reactions, with precise mechanisms largely uncharacterized. In healthcare (H) settings, healthcare-associated infections (HAIs) often result from pathogenic bacteria present on biomedical devices, surgical instruments, and high-touch surfaces, with transmission primarily through direct contact. Considering these challenges, this project aims to develop and evaluate durable, biocompatible, and sustainable coatings with combined anticorrosion and antibacterial properties for metal substrates in cultural heritage and healthcare fields. The considered metal substrates are copper for H and bronze for the CH sector. The coating selected encompasses a cutin-based (CUT) [1] one and β-tricalcium phosphate, β-TCP. Cutin, a tomato industry byproduct, has shown promise as a source for sustainable, corrosion-protective treatments for metal alloys. Starting from cutin, a cutin/silane ((3-Mercaptopropyl)trimethoxy silane) coating (CUT/PSH) was developed within this project. β-TCP coatings, initially for stone protection, offer durable and sustainable rain dissolution resistance via *in situ* formation from phosphate and calcium precursors. The antibacterial properties are achieved via silane utilisation or embedding antibacterial Ag and Zn nanoparticles within the coatings. The evaluation of anticorrosion properties includes the utilisation of electrochemical impedance spectroscopy, while for durability, artificial and natural ageing with characterisation ante/post ageing are applied. Antibacterial and antibiofilm properties are investigated by testing an infection-associated strain and one from the environment, in specific media. The preliminary tests show promising results for the CUT/PSH coating in terms of anticorrosion properties and antibiofilm/antibacterial properties. β-TCP development is still ongoing. The findings of this project are expected to yield innovative solutions for enhanced protection of historical monuments and improved safety in healthcare institutions and public spaces.

References

[1] A.Montanari, L. Bolzoni, et. al., 2014, Agro Food Industry Hi Tech 10.17660/ActaHortic.2017.1159.24