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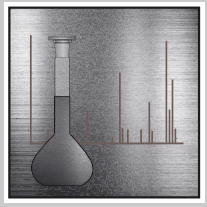

Highlights of Analytical Sciences in Switzerland

Division of Analytical Sciences

A Division of the Swiss Chemical Society

Innovative Approaches towards a Green and Sustainable Metal Conservation

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Our research topics integrate innovative aspects and inventive interdisciplinary approach at the boundaries between art conservation and natural sciences, with the aim to act against corrosion on metal artefacts (*i.e.* sculptures, archaeological items) or composite objects, such as painted metals. Thanks to advanced chemical imaging techniques, we study interactions between metals and their environment, and aspire to propose alternative green approaches in metal conservation.

For example, the application of biopassivation processes result in the formation of biogenic layers whose performances are assessed through stratigraphy studies and ageing procedures. Not only copper-based substrates are successfully treated but also iron and modern alloys, such as zinc and aluminum.

In addition, extraction methods based on siderophores or specific bacterial metabolisms are developed to remove iron or sulfur species from archeological iron objects or waterlogged wood with iron parts. Siderophores and sulfur-oxidizing bacteria solubilize harmful Fe/S species without damaging the wood structure. Also, iron-reducing bacteria are able to reduce iron(III) compounds and to form biogenic minerals.

Finally, fungal-induced translocation is applied to successfully remove rust, demonstrating high potential to develop biocleaning methods for altered and tarnished surfaces from iron but also copper and silver artworks.

In the case of painted metals, the use of spectral imaging techniques allows to provide end-users with a non-destructive diagnostic tool.

Applying the latest advances in chemical imaging and biotechnology to conservative perspectives, significant steps are achieved toward going beyond the boundaries and preconceived ideas allowing to solve the complex and multifaceted issues of heritage degradation.

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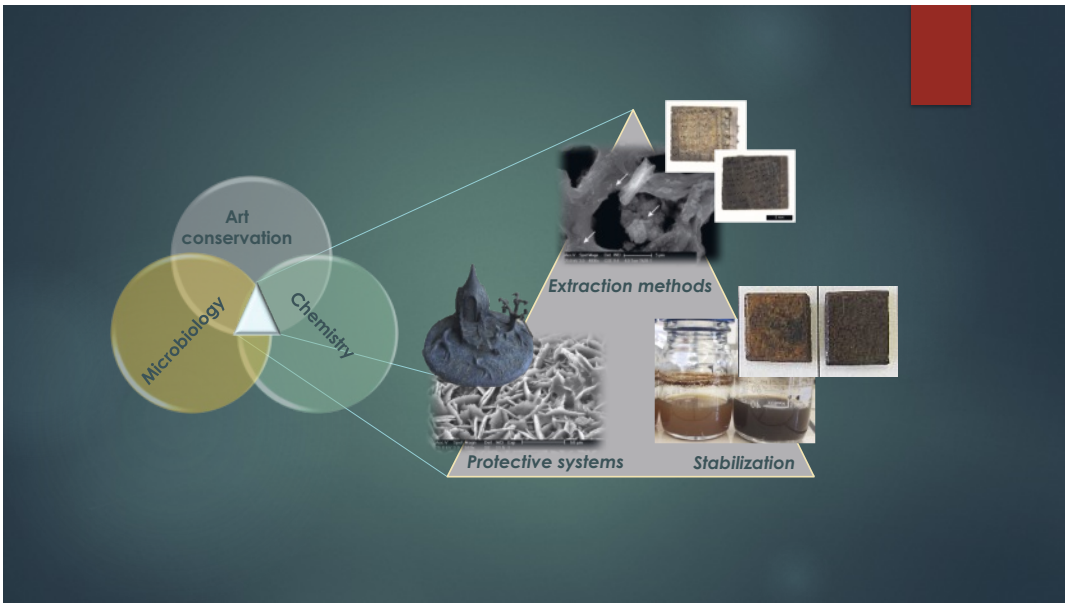
E. Joseph, P. Junier, *New Biotechnology* **2020**, *56*, 21.



Research topics applied to the preservation of cultural heritage.

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