E-Abstract Book

IUPAC 2025
Kuala Lumpur, Malaysia

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Kuala Lumpur Convention Centre, Malaysia

53rd IUPAC General Assembly (53GA)
12th - 16th July 2025

50th World Chemistry Congress (50WCC)
14th - 19th July 2025

Organised by:

IUPAC
INTERNATIONAL UNION OF PURE AND APPLIED CHEMISTRY

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GREEN STRATEGIES FOR NEXT-GENERATION COATING SYSTEMS: MICROBIAL APPROACHES AT MATERIAL INTERFACES

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Abstract
Advancing sustainable coating systems requires innovative approaches that combine functionality, environmental compatibility, and material durability. This work presents a bio-based approach aligned with green chemistry principles for next-generation surface technologies, integrating microbial systems into materials development. Designed as living coatings, these systems offer potential for carbon sequestration, pollutant capture, oxygen production, and durability with self-healing properties.

The coating functionality is achieved through the selection and spatial organization of metabolically active microorganisms, tailored to support material compatibility and enhance surface performance. Computational tools, including metabolic modeling and machine learning, guide the formulation of stable and responsive microbial assemblies suited to diverse substrates.

The REMEDY project provides the research framework for advancing this approach, combining microbiology, materials chemistry, and sustainable design. Emphasis is placed on compatibility with porous and non-porous substrates, the development of nutrient-efficient formulations, and the potential for circular use cycles. These living coatings contribute to the evolution of Engineered Living Materials (ELMs) and represent a shift toward biologically enhanced materials with built-in adaptability.

This work aligns with the principles of green chemistry and the Safe and Sustainable by Design (SSbD) framework. It also directly contributes to the United Nations Sustainable Development Goals (SDGs), particularly: 3, 7, 9, 11, 12, 13, and 15, by proposing coatings that reduce chemical inputs, extend material life, and enable intelligent environmental response.

Keywords: sustainable coatings, biointerfaces, surface functionality, SDG, engineered living materials

Acknowledgments
This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement No 101185862. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or European Innovation Council and SMEs Executive Agency (EISMEA). Neither the European Union nor the granting authority can be held responsible for them.