Anti-biofouling nanocomposite coatings for bio-threats prevention

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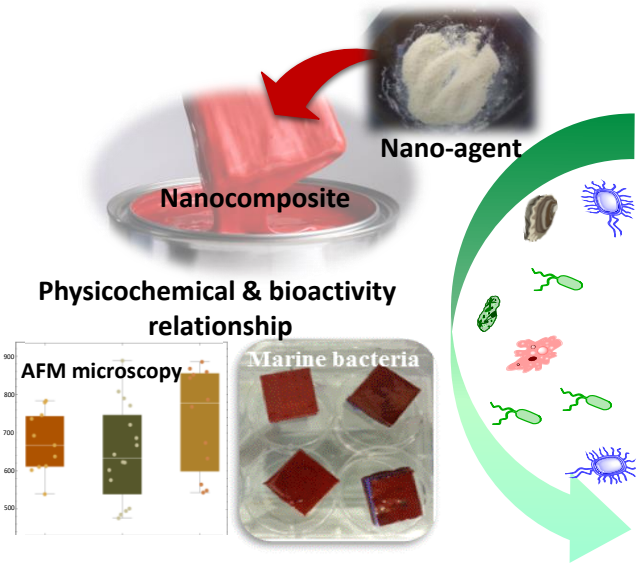
Abstract / MSc thesis project proposal

The current global pandemic is changing the way society face the growing threat of infectious diseases to human health. Global efforts have been promoted to face bio-threats, where prevention of its main route of transmission, via respiratory droplets, was the keyword, but other transmission risky routes exist since pathogenic microorganism are prone to colonize and form biofilms on surfaces. This route of transmission is particularly relevant on surfaces in contact with water, such as wastewaters circuits and those highly exposed to pathogens (e.g., water circuits and medical devices in hospitals). Most effective antimicrobial protection strategies on surfaces rely on chemical-based disinfection, which release toxic and persistent agents into the environment, remaining ineffective in preventing biofilm formation and progressive biofouling on surfaces under the current environmental demand and guidelines.



In previous work, newly synthesised bioactive metal oxide nano-agents demonstrated auspicious antimicrobial effects against two major aquatic pathogenic bacteria (e.g., methicillin-resistant Staphylococcus aureus). This project aims to foster these findings to achieve application validation of the most promising nano-agents as anti-biofouling nanocomposite coatings suitable for various industrial applications, including those involving an aquatic environment (e.g., water treatment, marine infrastructures).

Specifically, three interrelated R&D objectives can be outlined:

- Formulate and optimise nanocomposite coatings containing immobilised nano-agents suitable for different applications.
- Investigate the relationship between nanocomposite coatings´ physicochemical properties (e.g., adhesion, roughness, nano-agent content) and bioactivity (e.g., anti-biofouling, bio-adhesion effects), allowing for a better understanding of nanocomposite tailoring properties toward bioactive function.
- Evaluate the anti-biofouling potential of nanocomposite coatings under simulated conditions and ultimately at real aquatic conditions.