BioISI - Biosystems & Integrative Sciences Institute

Antimicrobial nanocomposite coatings for bio-threats prevention

Place of work: Laboratories 8.6.42 and 8.4.23

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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. The 2019 coronavirus (SARS-CoV-2) disease promoted global efforts, 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 on surfaces under current environmental demand and guidelines [1, 2].

Inspired in a previously developed grafting methodology for the immobilisation of bioactive agents in coatings, capable of generating antimicrobial coatings without releasing toxic agents, and with proven industrial application [3], this project aims to develop innovative and environmentally friendly nano-based coatings, to prevent pathogenic microfouling on surfaces. Using the developed methodology, and new strategies for nanoparticles functionalization this project will develop new bioactive nanoparticles that can be immobilised in coating formulations, including biocompatible formulations, and infer protective antimicrobial effects.

The supervisor team provides expertise and specific resources for the functional bioactive agents and antifouling coatings development. Available resources include reaction systems, standard protocols and equipment for the nano-systems development and evaluation, mainly regarding leaching behaviour, coating adhesion, and antimicrobial activity. It also provides expertise and several AFM facilities essential for the biophysical properties evaluation of the nano-systems [4]. For example, morphological characteristics of surfaces (e.g. roughness, dispersion), and adhesion of organic matter and bacteria on coating films using AFM tip functionalization.

Bibliography:

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