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Novel Approach to Prevent Biofilm Development

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Microorganisms can use the formation of biofilm as an adaptation to the environment, particularly in adverse conditions. Bacterial biofilm colonizes a wide variety of hydrated surfaces, (including teeth, food, contact lenses, medical devices, etc.) and can theoretically impact human health both positively (e.g., gut microbiota) and negatively since most infections depend on biofilms presence. Furthermore, the spread of multidrug-resistant (MDR) pathogens has emphasized the urgency of identifying new efficient anti-biofilm agents. Nowadays, ESKAPE pathogens (Escherichia coli, Staphylococcus aureus, Klebsiella pneumoniae, Acinetobacter baumanii, Pseudomonas aeruginosa, Enterococcus faecalis-faecium) are the most common MDR bacteria, often responsible for life-threatening conditions. More specifically, the Gram-negative P. aeruginosa represents an important cause of infection, especially in immune-compromised patients. In this context, our research group has devoted many efforts to the identification of natural compounds targeting non-essential pathways involved in bacterial pathogenicity, contributing to prevent the resistance. The most recent developments concerned the design, obtainment and analytical characterization of silica nanoparticles functionalized with p-aminosalicylic or p-aminocinnamic acids, as non-toxic antibiofilm agents. The novel nanoparticles were used for the coating of glass coverslips as model surfaces and their antibiofilm effect was evaluated on P. aeruginosa, as representative of pathogenic microorganism showing resistance against various antibiotics. The obtained results may constitute the basis for further applications for functional materials preventing biofilm formation.