T101: Synthesis and characterization of nanostructured materials

Innovative nanostructure synthesis for antimicrobial applications: Combining electrospinning, electrospraying and atomic layer deposition techniques

Juan Escrig
Departamento de Física, Universidad de Santiago de Chile; Centro para el Desarrollo de la Nanociencia y Nanotecnología (CEDENNA)

Various research groups are exploring novel approaches to combat microorganisms using nanomaterials. Nanoparticles possess a small size and large surface area, which enables them to establish close contact with cell walls and catalyze chemical reactions that disrupt cellular function. For instance, under ultraviolet light exposure, titanium dioxide nanoparticles can generate reactive oxygen species that oxidize the lipids and proteins of the cell membrane. Consequently, nanomaterials are being investigated as bactericidal coatings for hospital surfaces and food processing equipment worldwide.
The search and synthesis of new antimicrobial nanostructures are vital in mitigating the incidence of infectious diseases and the crisis of antibiotic resistance, two pressing issues in global public health. In this presentation, we will introduce an innovative strategy that combines the electrospinning and electrospraying techniques with atomic layer deposition to develop controlled and homogeneous hollow nanospheres and nanotubes of different materials, such as TiO_2 [1-3], ZnO [3,4], Ni [5], and Fe_3O_4 [6]. We will also evaluate the antimicrobial properties of these nanostructures against various bacteria, including resistant strains of E. coli and S. aureus. We aim to demonstrate that the combination of these techniques holds great promise in creating novel antimicrobial materials.

Acknowledgments

The authors acknowledge financial support by Fondecyt 1200302 and Financiamiento Basal para Centros Científicos y Tecnológicos AFB220001.

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