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Microbial synthesis of silver nanoparticles: Characterization and applications in environmental science

Abstract:

Silver nanoparticles (AgNPs) are widely recognized for their unique physical and chemical properties, making them valuable in various fields, including antimicrobial coatings for medical devices, water purification technologies, and biosensors for electronics and bioimaging. However, traditional physical and chemical synthesis methods are often environmentally harmful, generating substantial side products. This has led to increasing interest in eco-friendly alternatives, particularly those leveraging microorganisms. Among these, bacteria isolated from extreme environments are particularly promising, as their resilience to harsh conditions enables the synthesis of nanoparticles under a broad range of parameters often inaccessible with conventional techniques. In this study, AgNPs were biosynthesized using the cell-free secretomes of different thermophilic microorganisms belonging to our collection. The synthesis process was monitored using UV-Vis spectrophotometry and the resulting nanoparticles characterised through transmission electron microscopy, Fourier transform infrared spectroscopy, and dynamic light scattering with zeta potential analysis. Their catalytic potential was also assessed by evaluating their ability to degrade dyes, highlighting their potential for environmental applications. These findings position extremophilic microorganisms as biological sources for the sustainable production of nanomaterials, further emphasizing their role in developing eco-friendly biotechnological processes.

Biography

Gabriella Fiorentino is an Associate Professor of Biochemistry at the University of Naples Federico II. She has published about 60 papers in reputed journals and has been serving as an editorial board member of repute. Over the years, research activities have fostered international collaborations, contributing to the leadership and participation in funded projects. Additionally, they have enabled the organization and participation of national and international scientific workshops and conferences. Currently, her major research focuses on the identification and characterization of novel microorganisms from extreme environments and their ability to produce metal nanoparticles as a cost-effective and environmentally sustainable process for biotechnological applications in various fields.