METALLIC NANOPARTICLES: SUSTAINABLE APPROACH FOR ENVIRONMENTAL AND BIOMEDICAL APPLICATIONS

Prof. Dr. Habil. Simona Cavalu

Faculty of Medicine, University of Oradea, Romania

Algae, plants, bacteria, and fungus have been employed to produce energy-efficient, low-cost, and nontoxic metallic nanoparticles in the last few decades. Despite the environmental advantages of using green chemistry-based biological synthesis over traditional methods, there are some unresolved issues such as particle size and shape consistency, reproducibility of the synthesis process, and understanding of the mechanisms involved in producing metallic nanoparticles via biological entities. Bio-synthesized Ag and Au nanoparticles have received a great deal of attention in recent years for their potential to combat infectious diseases by closing the gaps in current antimicrobial formulation techniques, eradicating drug resistant microorganisms. To combat a wide range of fungus species found in a drinking water pipeline, ZnONP can be synthesized using the biological extract of *Boswellia ovalifoliolata, Meyerozyma caribbica, Aspergillus parvisclerotigenus, Meyerozyma guilliermondii, Rhizopus oryzae, Aspergillus,* and *Trichoderma asperellum*. Additionally, the ZnO-NPs are reported to be beneficial when combined with the healing processes of wounds and biosensing components to trace small portions of biomarkers linked with various disorders. Recently, we reported the remediation of methylene blue dye from wastewater by using ZnO NPs loaded on nanoclay, and the efficiency of removal varied from 90 to 97%. We also developed iron oxide nanoparticles (IONPs) and employed as an efficient nanocatalyst for heavy metal adsorption via the chemical route. The shape, absorbance optical, crystal phase, and magnetization of as-prepared magnetic nanostructures were characterized using XRD, UV-Vis, HRTEM, FTIR and VSM. In comparison to other metal oxide remediation strategies, iron oxide nanoparticles offer better potential in toxic metal adsorption owing to their infinite surface area, better magnetic character, and precise diameters. The use of different nanocomposites with metal and metal oxide nanoparticles and biomaterials holds great possibilities for water treatment and environmental applications. The addition of metal oxide nanoparticles imparts the properties of disinfection and photocatalysis. Different clay minerals can be functionalized and modified with different metal nanoparticles and natural adsorbent materials. Further research in this area may provide more effective results for water treatment.