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RESEARCH PAPER

Extracellular red *Monascus* pigment-mediated rapid one-step synthesis of silver nanoparticles and its application in biomedical and environment

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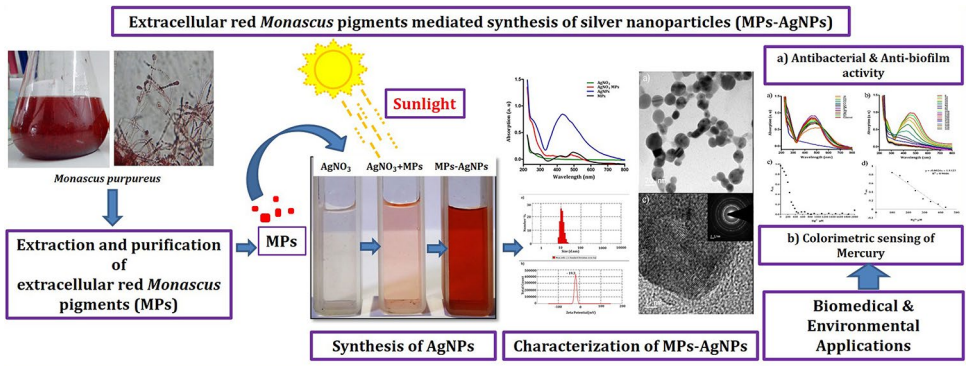
Abstract

The development of a safe and eco-friendly method for metal nanoparticle synthesis has an increasing demand, due to emerging environmental and biological harms of hazardous chemicals used in existing nanosynthesis methods. The present investigation reports a rapid one-step, eco-friendly and green approach for the formation of nanosized silver particles (AgNPs) using extracellular non-toxic-colored fungal metabolites (*Monascus* pigments—MPs). The formation of nanosized silver particles utilizing *Monascus* pigments was confirmed after exposure of reaction mixture to sunlight, by visually color change and further established by spectrophotometric analysis. The size, shape, and topography of synthesized MPs–AgNPs were well-defined using different microscopic and spectroscopic techniques, i.e., FE-SEM, HR-TEM, and DLS. The average size of MPs–AgNPs was found to be 10–40 nm with a spherical shape which was highly stable and dispersed in the solution. HR-TEM and XRD confirmed crystalline nature of MPs–AgNPs. The biocidal potential of MPs–AgNPs was evaluated against three bacterial pathogens such as *Pseudomonas aeruginosa, Escherichia coli*, and *Staphylococcus aureus* and it was observed that the MPs–AgNPs significantly inhibited the growth of all three bacterial pathogens. The anti-biofilm activity of MPs–AgNPs was recorded against antibiotic-resistant *P. aeruginosa*. Besides, the colorimetric metal sensing using MPs–AgNPs was studied. Among the metals tested, the selective Hg^{2+}-sensing potential at micromolar concentration was observed. In conclusion, this is the rapid one-step (within 12–15 min), environment-friendly method for synthesis of AgNPs and synthesized MPs–AgNPs could be used as a potential antibacterial agent against antibiotic-resistant bacterial pathogens.

Graphical abstract



Keywords AgNPs · Eco-friendly · Rapid synthesis · Antibacterial · Anti-biofilm · Sensing

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Extended author information available on the last page of the article

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