DOI: 10.46991/JISEES.2025.SI1.089

"Green synthesis" of Silver Nanoparticles with Antimicrobial Activity Using Biomass of Microalgae

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ABSTRACT

The biotechnological potential of microalgae lies in their rich content of proteins, vitamins, carotenoids, minerals, and other valuable compounds. In addition, microalgae have emerged as promising candidates for the **"**green synthesis**"** of nanoparticles (NPs). The aim of this study is to synthesize AgNPs using the "green biomass" of microalgae *Parachlorella kessleri* MDC6524 and *Spirulina (Arthrospira) platensis* Pc-005, and to evaluate their antimicrobial activity against conditionally pathogenic bacteria (*Staphylococcus aureus, Enterococcus hirae*, *Salmonella typhimurium, Pseudomonas aeruginosa*), and fungi (*Aspergillus flavus, Penicillium aurantioviolaceum, Trichoderma viride*). The **"**green synthesis**"** of AgNPs was carried out under illumination using the microalgae biomass. The UV-Vis spectroscopy of AgNPs derived from *Parachlorella* and *Spirulina* showed prominent absorption peaks at 440 and 425 nm, respectively. TEM results revealed that these AgNPs exhibit a spherical morphology with nanoscale dimension: 46 nm for *Parachlorella*-mediated AgNPs and 30 nm for *Spirulina*-mediated AgNPs. XRD pattern suggests that the biogenic NPs are well crystallized and have a high purity. Microalgae-derived AgNPs exhibited a significant antibacterial effect at low concentration (5-10 µg/mL) against the tested bacteria. Furthermore, AgNPs demonstrated a more pronounced effect on Gram-negative bacteria. However, AgNPs showed antifungal effects only at higher concentrations (100-300 µg/mL) compared to their antibacterial activity. This disparity is likely due to differences in the structure and composition of bacterial and fungal cell walls. Thus, microalgae-derived AgNPs can have a potential as antimicrobial agents and hold significant promise for future applications.

Keywords: microalgae, silver nanoparticles, green synthesis, antimicrobial potential

Acknowledgement: *The research was supported by the Higher Education and Science Committee of MESCS RA (Research project No. 25RG-1F098).*

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