Synthesis, Characterization and Antimicrobial Activity of Bacillus subtilis-Derived Silver Nanoparticles Against Multidrug-Resistant Bacteria

ABSTRACT

Background: Silver nanoparticles (AgNPs) have received great attention in the biomedical field because of their intrinsic therapeutic properties. Nanoparticles synthesized from silver have been studied as antimicrobial, antiviral and anticancer agents and found particularly an attractive source for the development of a new and advance group of antimicrobial agents. Objectives: In the present study, silver nanoparticles were synthesized from non-pathogenic Bacillus subtilis strain to assess their antimicrobial activity. Methods: Different strains of Bacillus spp. were selected and screened against silver nitrate (AgNO3) toxicity. Finally, B. subtilis strain (FCBP-WB-0174) was selected based on its silver resistant nature, among other strains. Silver nanoparticles were synthesized and optimized from the supernatant of B. subtilis culture at 37°C by the reduction of silver ions using the various molar concentration of AgNO3. The synthesized AgNPs were characterized by UV-Vis spectrophotometry and scanning electron microscopy (SEM). These synthesized AgNPs were used for evaluating antimicrobial activity against four multidrug-resistant bacterial strains. Results: The silver ion reduction was found at a ratio of 1:1 from all the three molar concentrations (1, 2, and 3 mM) of AgNO3. The characterized nanoparticles were found to have a characteristic absorption peak at 426 nm, and the particles were found to have spherical shape under SEM with an average diameter of about 80 ± 0.18 nm, which was also reconfirmed using Zeta Sizer Nano. Prepared Silver nanoparticles have found potential antimicrobial activities against all tested pathogenic, including strains, e.g., Acinetobacter baumannii, Pseudomonas aeruginosa, Methicillin-Resistant Staphylococcus aureus (MRSA) and Escherichia coli. Conclusions: Effective AgNP's were produced from selected B. subtilis strain, and the strain itself was resistant to AgNO3. The current study evidenced that biologically synthesized silver nanoparticles from B. subtilis has promising antimicrobial activities against pathogenic and multidrug-resistant bacteria