Abstract

During the past few years, the biological problem of antibiotic resistance has increased and become a major concern to treat infections that is leading towards the finding of alternatives of antibiotics. Medicinal plants have long been used in treating infectious diseases because of their strong therapeutic potential. *Nigella sativa*, commonly known as black seed, is a widely used spice as well as a vital ingredient in many ancient herbal medicines. The therapeutic potential of *N. sativa* is associated with the presence of potential phytochemicals i.e., thymoquinone, dithymoquinone and thymol it. In this regard, the extracts of medicinal plants containing phytochemicals can prove a best option as an antibiotic alternative. Nanoparticles are in greater demand as a result of their diverse applications in fields like environmental sciences, electronics, and medicine. In the present study, *Nigella sativa* conjugated silver nanoparticles (NS-AgNPs) were synthesized at three different conditions i.e., concentration (2 mg/mL, 4 mg/mL and 6 mg/mL), temperature levels (4°C, 25°C, 37°C and 75°C) and pH values (4, 7 and 11). The characterization of NS-AgNPs was conducted via UV-visible spectroscopy and Fourier transform infrared spectroscopy (FTIR). The antibacterial activity of all the nanoparticles was performed against *Escherichia coli, Bacillus subtilis, Pseudomonas aeruginosa, Staphylococcus aureus, Aeromonas veronii* and *Klebsiella pneumoniae* via well diffusion assay. Moreover, the antioxidant activity of NS-AgNPS with 2, 4 and 6 mg/mL concentration was performed by DPPH scavenging assay using ascorbic acid as a standard. The results of antibacterial activity assay revealed significant antibacterial potential of NS-AgNPs at highest concentration used (6 mg/mL) against all bacteria. However, highly significant zone of growth inhibition was observed against *P. aeruginosa* (31.8±0.4 mm) and less significant zone of inhibition was seen for *E. coli* (10.5±0.2 mm). The NS-AgNPs synthesized at different temperatures and pH showed high stability while the NS-AgNPs synthesized at high temperature (75°C) showed significantly highest zone of growth inhibition against *P. aeruginosa* (27.8±0.4 mm) and basic pH value (11) showed significantly highest zones of growth inhibition against *A.veronii* (15.2. ±0.3 mm) respectively, as compared to the NS-AgNPs synthesized at low temperature and acidic pH. The antioxidant activity of NS-AgNPs showed maximum free

radical scavenging activity (43.9±0.5%) at 6 mg/mL while minimum free radical scavenging activity (25.1±0.4%) at 2 mg/mL. Current study showed that green synthesized *Nigella sativa* conjugated silver nanoparticles have significant zones of growth inhibition against all the bacteria and also shown the good antioxidant activity.