Abstract

The objective of this work is to investigate the antibacterial properties of nickel oxide nanoparticles (NiO NPs) that have been generated utilizing an environmentally sustainable green synthesis method. The hydrogel was synthesized using Tragacanth Gum powder, whereas the precursor $NiSO_4$ was employed for the creation of NiO nanoparticles. Various analytical methods were used to characterize the produced nanoparticles, including UV-visible spectroscopy, Fourier transform infrared spectroscopy, and scanning electron microscopy with energy dispersive X-ray.The NiO nanoparticles exhibited a peak absorption at 290 nm during the UV-visible examination. NiO nanoparticles were characterized as spherical particles with irregular shapes and nanoscale sizes. They are mainly found agglomerated and bulky. The average crystallite size of the obtained NiO nanoparticles was 34 nm. The peaks at 669 and 794 cm^{-1} were assigned to the Ni-O stretching vibrational mode according to the FTIR spectra of NiO NPs. The antibacterial efficacy of the produced NPs was evaluated against three distinct bacterial strains, including both gram-positive (*B. subtilis and S. aureus*) and gram-negative (*E. coli*) species. The zones of inhibition around *B. subtilis*, *S. aureus*, and *E. coli* when exposed to nanoparticles (at concentrations of 50 and 25 µL) were measured to be 19.67 and 16.8 mm, 17.1 and 15.1 mm, and 20 and 15.5 mm, respectively. In comparison, the zone of inhibition for Rifampicin was found to be 19, 19, and 17 mm for the corresponding bacteria. The study revealed that the inhibitory effect of NiO nanoparticles generated using the TG on bacterial growth was like that of the antibiotic Rifampicin. The minimum inhibitory concentration (MIC) and minimum bactericidal concentration (MBC) values of nickel oxide nanoparticles (NiO NPs) against *Bacillus subtilis*, *Staphylococcus aureus*, and *Escherichia coli* were determined to be 0.83, 1.16, and 1.667 mg for MIC, and 1.83, 2.5, and 3.67 mg for MBC, respectively.