ABSTRACT

In recent ages, green nanotechnology has gained attraction in the synthesis of metallic nanoparticles due to their cost-effectiveness, simple preparation steps, and environmentally-friendly. In the present study, copper oxide nanoparticles (CuO NPs) were prepared using *Parthenium hysterophorus* whole plant aqueous extract as a reducing, stabilizing, and capping agent. The CuO NPs were characterized via UV–Vis Spectroscopy, Fourier Transform Infrared Spectroscopy (FTIR), powder X-Ray Diffraction (XRD), Scanning Electron Microscopy (SEM), Transmission Electron Microscopy (TEM), and Dynamic Light Scattering (DLS). The UV–Vis spectra of CuO NPs showed a surface plasmonic resonance band to occur at 340 nm. FTIR analysis revealed the presence of secondary metabolites on the surface of CuO NPs, with a characteristic Cu–O stretching band being identified at 522 cm^{-1}. Scanning electron micrographs and transmission electron micrographs showed that CuO NPs were nearly spherical, with an average particle of 59.99 nm obtained from the SEM micrograph. The monoclinic crystalline structure of CuO NPs was confirmed using XRD, and crystallite size calculated using the Scherrer-Debye equation was found to be 31.58 nm. DLS showed the presence of nanoparticle agglomeration, which revealed uniformity of the CuO NPs. Furthermore, the degradation ability of biosynthesized nanoparticles was investigated against rifampicin antibiotic. The results showed that the optimum degradation efficiency of rifampicin at 98.43% was obtained at 65℃ temperature, 50 mg dosage of CuO NPs, 10 mg/L concentration of rifampicin solution, and rifampicin solution at pH 2 in 8 min. From this study, it can be concluded that CuO NPs synthesized from *Parthenium hysterophorus* aqueous extract are promising in the remediation of environmental pollution from antibiotics. In this light, the study reports that *Parthenium*

hysterophorus-mediated green synthesis of CuO NPs can effectively address environmental pollution in cost-effective, eco-friendly, and sustainable ways.