Abstract

The focus of the present research work is on the formation of nanoparticles of zinc oxide (ZnO-NPs). The nanoparticles were produced by implementing a green synthesis method, involving using a hydrogel derived from the seeds of *Mimosa pudica*. The *Mimosa pudica* seed hydrogel was combined with zinc acetate. The synthesis of ZnO nanoparticles was conducted by employing seed hydrogel derived from a botanical source. The confirmation of the nanoparticles produced was conducted by evaluating the observed changes in the color of the solution and analyzing the UV-visible spectrum. The ZnO nanoparticles exhibited a distinct absorption peak in the UV-visible spectrum at 390 nm. The ZnO nanoparticles were subjected to scanning electron microscopy (SEM) and FTIR examination. The presence of various peaks, including O-H at 3367 cm^{-1}, C-H at 2976 cm^{-1}, C=O at 1546 cm^{-1}, the Zn-OH at 687 cm^{-1}, and the peak at 484 cm^{-1} confirmed the presence of ZnO in the sample through FTIR analysis. The nanoparticles obtained through the use of scanning electron microscopy (SEM) exhibit a size measurement of 19 nm. The antibacterial effectiveness of ZnO-NPs was assessed against four bacterial strains such as *Staphylococcus aureus, Pseudomonas aeruginosa, Bacillus subtilis* and *Escherichia coli.* The results showed varying levels of inhibitory zones, suggesting that gram-positive bacterial strains were more susceptible to ZnO-NPs than gram-negative bacterial strains. The gram-positive bacteria such as *S. aureus* and *B. subtilis* showed the zone of inhibition values of 15.5 mm and 17.5 mm, respectively. In addition, the nanoparticles exhibited antifungal properties against the fungi *Aspergillus fumigatus* and *Aspergillus niger* showed the zone of inhibition values of 13.2 and 14.1 mm, respectively. To evaluate the wound healing potential, the topically applied ZnO-NPs synthesized were administered to wounds in mice. The results of wound contraction showed that the use of ZnO-NPs led to a significant enhancement of the healing process, as indicated by the nearly complete closure of wounds by the 10th day. The histopathological examination revealed that the application of ZnO-NPs led to enhanced tissue regeneration, collagen synthesis, and re-epithelialization.

Keywords: *Mimosa pudica*, Zinc oxide, Nanoparticles, Nanotechnology, Hydrogel, Wound Healing, Microbicidal