Chemical and green synthesis of CuO nanoparticles and its impact on pearl millet seed germination and morphological traits

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Abstract

The metal-based nanoparticles have drawn a lot of attention in plant sciences recently because they stand out from their bulk counterparts and were said to contribute to improved plant growth and germination rates, which led to increased agronomical traits. Traditional bottom-up nanoparticle manufacturing is less preferred since it often includes hazardous chemicals that are toxic to human health and environment. Researchers have focused on the chemical and green synthesis of nanoparticles in order to develop a method that is safe, affordable and environmentally friendly. The goal of the present investigation was to establish a reproducible protocol for synthesis nanoparticles using both chemical and biological method and characterize for their potential applications. The Bovine Serum Albumin capped (BSA-CuO NPs) and bio-functionalized cuprous oxide nanoparticles (Bio-CuO NPs), were synthesized using chemical and green synthesis. Both the nanoparticles were analyzed for its physical and chemical properties using standard methods. A constant, monoclinic, crystalline and moderately monodisperse CuO NPs of average size of 29.33 nm and 90.79 nm, respectively was synthesized. The EDX spectra confirmed the composition of the synthesized nanoparticles. The FTIR spectra revealed the chemical reactions involved in the formation of CuO NPs in both methods. The seeds of pearl millet **(***Pennisetum glaucum* L.) were treated with diverse doses of nanoparticles and germinated *in vitro* on MS medium. CuO NPs boosted the germination rate but there were no significant changes was observed. The morphological parameters such as length of root, shoot and leaf and fresh weight of the pearl millet seedling showed significant variation between the test and the control group. The higher concentration of Bio-CuO NPs significantly increased the fresh weight of the pearl millet seedlings.

Keywords: Biofunctionalized; chemical method; characterization; copper oxide nanoparticles; pearl millet.