

Chemical Sciences 2018: Effect of ZnO and CuO nanoparticles on physiology, steviol glycosides and antioxidant activities in invitro grown shoots of stevia rebaudiana bertonii - Rabia Javed - National University of Medical Sciences

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Objective/Purpose: This study describes the effect of various concentrations (0, 0.1, 1.0, 10, 100 or 1000 mg/L) of ZnO (34 nm in size) and CuO (47 nm in size) nanoparticles on the physiological parameters, steviol glycosides (rebaudioside A and stevioside) content, and antioxidant activities in tissue culture grown shoots of highly valuable medicinal plant, *Stevia rebaudiana* Bertoni.

Material and Methods: ZnO and CuO nanoparticles are synthesized by co-precipitation method, and characterized by X-Ray Diffraction (XRD), Fourier transform infrared spectroscopy (FTIR), UV-Visible Spectrophotometry, Scanning Electron Microscopy (SEM) and Energy Dispersive X-ray (EDX). Shoot nodal explants of *Stevia rebaudiana* undergo direct shoot organogenesis in MS medium containing ZnO and CuO nanoparticles that create oxidative pressure.

Results: The highest percentage of shoots formation (89.6 % and 88.5 %) at 1 mg/L and 10 mg/L of ZnO and CuO nanoparticles, respectively, is obtained that indicates positive influence of the nanoparticles on the growth of *S. rebaudiana* plant. The high performance liquid chromatography (HPLC) results illustrate significant enhancement of steviol glycosides (almost doubled than control) in micro propagated shoots grown under an oxidative stress of 1 mg/L and 10 mg/L of ZnO and CuO nanoparticles, respectively. Furthermore, the antioxidant activities encompassing total phenolic content (TPC), total flavonoid content (TFC), total antioxidant capacity (TAC), total reducing power (TRP) and DPPH free radical scavenging activity shows significant increase under the respective concentration of 1 mg/L and 10 mg/L of ZnO and CuO nanoparticles. However, the physiology and biochemistry parameters reveal a sudden decline after crossing the threshold of 1 mg/L and 10 mg/L of ZnO and CuO nanoparticles, elucidating phytotoxicity at this concentration.

Conclusion/Discussion: Hence, it is revealed/concluded that ZnO and CuO nanoparticles can be applied in in vitro batch cultures of *S. rebaudiana* containing upto 1 mg/L and 10 mg/L concentration on respective basis. Further increase of ZnO and CuO nanoparticles concentration causes phytotoxic effect due to the generation of reactive oxygen species (ROS). Keywords: ZnO nanoparticles, CuO nanoparticles, *Stevia rebaudiana* Bertoni, Steviol glycosides, Physiology, Antioxidant activities.