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## Evaluation of Antioxidant, Antimicrobial and Wound Healing Activities of ZnO-CuO Nanoparticles Synthesized Using *Azadirachta indica* Leave Extract

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### Abstract

The neem tree (*Azadirachta indica* A.), which belongs to the family *Meliaceae* and subfamily *Melioideae*, is renowned for its medical properties. The physiologically active component of neem, Azadirachtin, is thought to be responsible for the beneficial benefits of various portions of the plant. Present study was designed to assess the anti-microbial, antioxidant and *in vivo* wound healing activity of bimetallic ZnO-CuO nanoparticles by controlling physiological reactions. For this purpose, bimetallic nanoparticles were prepared and characterized using Scanning electron microscopy (SEM), X-ray diffraction (XRD), Fourier transform infrared spectroscopy (FTIR) and spectrophotometer to examine the physical and chemical properties of these NPs. Five different strains of bacteria were subjected to antibacterial activity tests, and a positive control antibiotic disc ciprofloxacin, was employed and it was done by agar well diffusion method through which inhibition zones will be observed. *Staphylococcus aureus* was the microbe that showed significant results among all pathogens having  $10 \pm 0.2$  mm value in 100  $\mu$ l concentration of bimetallic NPs. The antioxidant activity of ZnO-CuO NPs and Neem extract was evaluated using the DPPH free radical scavenging technique and FRAP assay. Ascorbic acid will be used as a standard in both assays. The scavenging activity was assessed by taking absorbance at 520 nm which showed that NPs had higher scavenging potential than ascorbic acid and proved by IC<sub>50</sub> value that is 9.44  $\mu$ g/ml. *In vitro* cytotoxicity was done so that percentage of viable cells can be measured. For this purpose, HEPG2 cell lines were used. In the range of 1.5-200  $\mu$ g/ml, BNPs showed higher toxicity for cancerous cells. For *in vivo* wound healing activity, mice were used as a model to examine the healing on incisional wounds and calculate wound contraction percentage in certain days. Different formulations of nanoparticles loaded carbopol gel had been prepared. Additionally, four groups of rats were made for *in vivo* study and in each group six rats were placed. Biogenic ZnO-CuO nanoparticles were anticipated to have antioxidant, antibacterial and wound healing properties in which 1.5% NPs loaded gel had non-significant results. The findings of this study have potential to contribute to development of novel therapeutic interventions. Histopathological studies were also done in order to find out the fibrosis at 10<sup>th</sup> day on skin of rats by observing fibroblast and macrophages spreading which showed gradual increase in fibroblast and scattered macrophages.

**Keywords:** *Azadirachta indica* A., Bimetallic NPs, antibacterial activity, *In vivo* wound healing activity, cytotoxicity, Histopathological studies

