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# Study Effect of Zinc oxide Nanoparticles on *Helianthus annuus* L. Growth and Physiology for Mitigating Salinity and Drought Stress

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**Abstract**

The main goal of nanotechnology in agriculture is to increase crop yield. Biological synthesis of metallic nanoparticles using plant extract is cost-effective and environmentally friendly. Zinc is an essential metal for the production of chlorophyll, cell growth, regulation of gene expression and metabolism of RNA in plants. Zinc oxide nanoparticles are superior than any other metal oxide nanoparticle due to its inorganic photocatalytic nature with the highest photocatalytic efficiency. In this study, Zinc oxide nanoparticles were synthesized using *Mentha spicata* L.(MS) leaf extract, characterized and applied on sunflower (*Helianthus annuus* L.) plant for improving growth and physiology under salinity and drought stress conditions. Characterization through UV absorbance analysis showed a strong absorption peak at 368nm and confirms MS- zinc oxide nanoparticles formulation. Its FTIR spectra was at 3730.14 $cm^{-1}$ which represents the functional group like OH stretching of alcohols and phenols. XRD confirms the hexagonal(wurtzite) structure of MS- ZnO nanoparticles. The synthesized nanoparticles were applied to sunflower plant under three treatments (normal, drought stress and salinity stress) in three concentration 50mg/L, 100mg/L and 150mg/L. The foliar application of 150mg/L ZnONPs in drought treatment were shown to enhance plant root and shoot length, root and shoot dry and fresh weight, number of leaves and relative water content as compared to control conditions while no significant results obtained in salinity treatment. Overall, this study proved that 150mg/L concentration of ZnONPs is sufficient for improving plant growth under drought conditions.

***Key Words:*** *Nanoscale, Nano science, Nano Fertilizer, Biological Fertilizer, Poison Tumor, T cells, Plant Growth.*