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Effect of ZnO nanoparticles on the bacterial community and other soil health parameters

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The rapid growth of metallic nanoparticles (such as ZnO) in the present time increases the risk of the contamination of soil because it is the sink for all the nanoparticles, intentionally or unintentionally, and affects the microorganism productivity and damages the soil health. Zinc oxide nanoparticles are widely used in agriculture and other industries at the current time. Our study aimed to evaluate the toxicological effects of zinc oxide nanoparticles on the bacterial diversity of soil. A microcosm experiment was conducted by mixing the 1000 µg/gm of ZnO nanoparticles in the soil. After 60 days, the effect of zinc oxide nanoparticles on bacterial diversity was determined using Illumina MiSeq sequencing of 16S rRNA genes. The soil's physiochemical characteristics, such as C, H, and N content, were analyzed and compared with non-treated samples. Dehydrogenases (DH) and fluorescein diacetate (FDA) were assayed as the soil health indicator. Results have shown that the relative abundances of the dominant and agriculturally significant phyla, namely, Proteobacteria and Actinobacteria, were altered in the presence of Zinc Oxide nanoparticles. However, it was also observed that Zinc oxide nanoparticles showed negligible effects at the phylum level. The dissolution of ZnO nanoparticles was also estimated with the help of ICP-MS, which was 870 µg/gm after 60 days. DH activity was higher and FDA activities were lowered compared to the non-treated soil.