Mechanisms of Biotransformation of Metal Oxide Nanoparticles in Terrestrial Plants

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Given the widespread use of engineered nanoparticles (ENPs) in consumer goods, a large portion of these materials will soon go into the waste stream; potentially, to soil and sediments or added directly to agricultural lands via biosolids. Preliminary data from several research groups have shown that ENPs may have direct impact on food safety and the food chain. However, our knowledge about detection and characterization of ENPs in the environment, especially in terrestrial environments, is still not well understood. Synchrotron techniques are nondestructive analytical tools that can provide information about the crystal structure, elemental (chemical) composition and physical properties of the ENPs. By using the synchrotron facilities at Stanford University, Lawrence Berkeley National Laboratories, and the European Synchrotron Facility (Grenoble, France), we have obtained clear evidence of the presence of CeO2 NPs in roots of alfalfa (Medicago sativa), cucumber (Cucumis sativus), corn (Zea mays), soybean (Glycine max), and tomato (Lycopersicum esculentum)1. Other XAS studies have shown that TiO2 ENPs are absorbed by the roots and translocated to the leaves in cucumber plants; while no presence of ZnO ENPs was detected in soybean and the desert plants blue palo verde (Parkinsonia florida), tumbleweed (Salsola tragus), velvet mesquite (Prosopis juliflora-velutina) germinated and grown in ZnO ENP suspensions. Our X-ray absorption spectroscopy results demonstrated that CeO2 and TiO2 ENPs are potentially transmitted to the next plant generation, threatening the environmental and human health.

Suggested References:

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