Toxicity assessment of Titanium Dioxide and Cerium Oxide nanoparticles in *Arabidopsis thaliana* L.

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The production and applications of nanoparticles (NP) in diverse fields has steadily increased in recent decades; however, knowledge about risks of NP to human health and ecosystems is still scarce. In this study, we assessed potential toxicity of two commercially used engineered nanoparticles (ENP), titanium dioxide (TiO_2) and cerium oxide (CeO), using thale cress *Arabidopsis thaliana* as a model system. The responses of the plant to ENPs, at concentration 500mg/L and ~100nm diameter range, were observed at morphological, physiological and molecular genetic levels. ENP exposed *Arabidopsis* seedlings showed enhanced germination (radical emergence, cotyledon and hypocotyl visibility, fully grown leaves) at different growth stages. Phenological observations revealed initial differences in plant growth (number of rosettes, rosette diameter, and plant height) between the treatment and the control. However, this difference was not noticed in the later stages of development. For molecular studies, *Arabidopsis* plants were exposed to the ENPs, starting in the seed stage, and subsequently with the growth of plants, both root and shoot systems were also exposed. Three different tissues (cotyledons, roots, and leaves) at different developmental stages were harvested for transcriptomic analysis using microarrays. RNA was extracted from the harvested tissues, processed into biotin-labeled cRNA and hybridized to Affymetrix GeneChip Arabidopsis ATH1 Genome Arrays (Affymetrix) to obtain the tissue-specific transcriptome profile of *Arabidopsis*. We identified several functional pathways including oxidative stress pathways that were affected by exposure to TiO_2 and CeO_2 nanoparticles. Our findings so far convey that the two ENPs in this study have the potential to affect initial growth and development of the plant (germination stages), as well as affecting various signaling pathways at the transcriptome level in tissue-specific pattern. Although our observations did not reveal any significant differences at the later growth stages of *Arabidopsis*, further studies are required to evaluate if toxicity associated with these ENPs can alter plant response to other environmental stresses, or whether ENP effects may be passed on transgenerationaly to subsequent progeny.