

Abstract Title:

Germination and early plant development of 10 plant species exposed to Nano TiO₂ and CeO₂

Authors:

Christian Andersen, Western Ecology Division, National Health and Environmental Effects Research Laboratory, U.S. Environmental Protection Agency, Corvallis, OR; Milt Plocher, Marjorie Storm, George King, Dynamac Corporation, Corvallis, OR; Paul Rygiewicz, Western Ecology Division, National Health and Environmental Effects Research Laboratory, U.S. Environmental Protection Agency, Corvallis, OR

Abstract:

Ten agronomic plant species were exposed to different concentrations of nano-TiO₂ or CeO₂ (0, 250, 500 and 1000 ug/l) and followed to examine effects on germination and early seedling development. For TiO₂, cabbage showed increased and corn decreased percent germination, while the other 8 species showed no significant change in percent germination. However, TiO₂ accelerated the timing of germination in 5 species, and had significant effects on final root length in 9 of 10 species, with five species showing increased and four species showing decreased root length. For CeO₂, only one species showed a change (slight decrease) in germination percent, while 5 species showed a decrease in final root length. In a companion study with *Arabidopsis*, CeO₂ was found to alter gene expression more strongly in roots than shoots, consistent with the hypothesis that TiO₂ and CeO₂ may affect roots and shoots differently. Overall, the responses observed did not consistently relate to nanoparticle concentration, suggesting that concentration may not be an appropriate metric for expressing effects with these two nanoparticles. The results suggest that TiO₂ and CeO₂ have different effects on early plant growth of agronomic species, which may alter the timing of specific developmental events during their life cycle. In addition, the standard germination test, which is commonly used for toxicity screening of new materials, may not detect the subtle but potentially more important changes associated with early growth and development in terrestrial plants.

Keywords:

Nanoparticles, TiO₂, CeO₂, Terrestrial Plants, Ecotoxicology