A Multimethod Approach for Investigating Algal Toxicity of Platinum Nanoparticles

The ecotoxicity of platinum nanoparticles (PtNPs) widely used in for example automotive catalytic converters, is largely unknown. This study employs various characterization techniques and toxicity end points to investigate PtNP toxicity toward the green microalga Pseudokirchneriella subcapitata and Chlamydomonas reinhardtii. Growth rate inhibition occurred in standard ISO tests (EC50 values of 15–200 mg Pt/L), but also in a double-vial setup, separating cells from PtNPs, thus demonstrating shading as an important artifact for PtNP toxicity. Negligible membrane damage, but substantial oxidative stress was detected at 0.1–80 mg Pt/L in both algal species using flow cytometry. PtNPs caused growth rate inhibition and oxidative stress in P. subcapitata, beyond what was accounted for by dissolved Pt, indicating NP-specific toxicity of PtNPs. Overall, P. subcapitata was found to be more sensitive toward PtNPs and higher body burdens were measured in this species, possibly due to a favored binding of Pt to the polysaccharide-rich cell wall of this algal species. This study highlights the importance of using multimethod approaches in nanoecotoxicological studies to elucidate toxicity mechanisms, influence of NP-interactions with media/organisms, and ultimately to identify artifacts and appropriate end points for NP-ecotoxicity testing.

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