

SALINITY-DEPENDENT TOXICITIES OF ZINC OXIDE NANOPARTICLES TO THE MARINE DIATOM *THALASSIOSIRA PSEUDONANA*

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This study comprehensively investigated the influences of salinity, exposure concentration and time on the aggregate size, surface charge and dissolution of zinc oxide nanoparticles (ZnO-NPs; 20 nm) in seawater, and examined the interacting effect of salinity and waterborne exposure of ZnO-NPs on the marine diatom *Thalassiosira pseudonana* for 96 h. We found that aggregate sizes of ZnO-NPs significantly increased with increasing salinity, but generally decreased with increasing exposure concentration. Ion release decreased with increasing salinity, whereas the surface charge of the particles was not affected by salinity. The increased aggregate size and decreased ion release with increasing salinity, and consequently lower concentration of bioavailable zinc ions, resulted in decreased toxicity of ZnO-NPs at higher salinity in general in terms of growth inhibition (IC₅₀) and chlorophyll fluorescence (EC₅₀ - Φ_{Po} and EC₅₀ - Φ₂). However, IC₅₀s and EC₅₀s of ZnO-NPs were smaller than those of Zn²⁺ (from ZnO-NPs ultrafiltrate and ZnCl₂), indicating that dissolved Zn²⁺ can only partially explain the toxicity of ZnONPs. SEM images showed that ZnO-NPs attached on the diatom frustule surface, suggesting that the interaction between the nanoparticles and the cell surface mayacerbate the toxicity of ZnO-NPs. Our results linked the physicochemical characteristics of ZnO-NPs in seawater with their toxicities to the marine diatom and highlighted the importance of salinity as an influential environmental factor governing the aggregation, dissolution and the toxicity of ZnO-NPs.