

Phototoxicity of TiO₂ nanoparticles to two aquatic species: *Daphnia magna* and Zebrafish (*Danio rerio*) embryo

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Abstract-Ecotoxicological studies on TiO₂ nanoparticles (nano-TiO₂) are expanding rapidly due to their widespread use in both industrial and consumer products. However, few studies have focused on their potential phototoxicity related to the photocatalytic property of the material. In this study, phototoxicity of nano-TiO₂ under simulated solar radiation (SSR) was investigated to two aquatic species – *Daphnia magna* and Zebrafish (*Danio rerio*) embryo, using 48-h and 96-h assays, respectively. In parallel, toxicity assays were performed under standard laboratory lighting. Phototoxicity of nano-TiO₂ to *D. magna* under SSR was enhanced by four orders of magnitude as compared to laboratory light, with a 48-h LC50 of 29.8 µg/L. Similarly, phototoxicity of nano-TiO₂ to zebrafish embryos under SSR was significantly enhanced as compared to laboratory lab, as indicated by a wide variety of malformations (e.g., pericardia edema, scoliosis, etc.) in the nano-TiO₂ treated embryos/larvae under SSR. This dramatic increase in toxicity of nano-TiO₂ under environmentally realistic levels of SSR indicates the need for incorporating this mode of action into risk assessment of TiO₂ and other photoreactive nanomaterials.

