

# Nano form of titanium dioxide can be toxic to marine organisms

January 24 2012

---

The Bren School-based authors of a study published Jan. 20 in the journal *PLoS ONE* have observed toxicity to marine organisms resulting from exposure to a nanoparticle that had not previously been shown to be toxic under similar conditions.

Lead author and assistant research biologist Robert Miller and co-authors Arturo Keller and Hunter Lenihan – both Bren School professors and lead scientists at the UC Center for Environmental Implications of Nanotechnology (UC CEIN) – Bren Phd student Samuel Bennett, and Scott Pease, a former UCSB undergraduate and current graduate student in public health at the University of Washington, found that the nanoparticulate form of [titanium dioxide](#) (TiO<sub>2</sub>) exposed to ultraviolet radiation (UVR) can be toxic to [marine organisms](#).

"Application of nanomaterials in consumer products and manufacturing is quickly increasing, but there is concern that these materials, including [nanoparticles](#), may harm the environment," says Miller. "The oceans could be most at risk, since wastewater and factory discharges ultimately end up there."

Nano-titanium dioxide is highly reactive to sunlight and other forms of ultraviolet radiation (UVR), the authors write, adding that TiO<sub>2</sub>'s property of generating reactive oxygen species (ROS) when exposed to UVR makes it useful in antibacterial coatings and wastewater disinfection, and potentially valuable as an anti-cancer agent.

Until now, they say, no research has demonstrated that photoactivity causes environmental [toxicity](#) of  $\text{TiO}_2$  under natural levels of UVR.

"Previous experiments have suggested that  $\text{TiO}_2$  does not affect aquatic organisms, but these experiments used artificial lighting that generated much lower levels of UVR than sunlight," Miller explains. "In these new experiments, we used lights simulating natural sunlight."

But now, the authors say, "We show that relatively low levels of ultraviolet light, consistent with those found in nature, can induce toxicity of  $\text{TiO}_2$  nanoparticles to marine phytoplankton, the most important primary producers on Earth.

"With no exposure to UVR, the  $\text{TiO}_2$  had no effect on phytoplankton, but under low-intensity UVR, ROS in seawater increased with increasing concentrations of nano-  $\text{TiO}_2$ ."

The concern is that rising concentrations of nano-  $\text{TiO}_2$  "may lead to increased overall oxidative stress in seawater contaminated by  $\text{TiO}_2$ , and cause decreased resiliency of marine ecosystems."

The authors suggest, therefore, that UVR exposure should be considered when conducting experiments to determine the ecotoxicity of nanomaterials having photoactive potential.

Provided by University of California - Santa Barbara

Citation: Nano form of titanium dioxide can be toxic to marine organisms (2012, January 24) retrieved 27 April 2024 from

<https://phys.org/news/2012-01-nano-titanium-dioxide-toxic-marine.html>

This document is subject to copyright. Apart from any fair dealing for the purpose of private

study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.