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Titanium Dioxide(TiO2) Nanoparticle-based Solution as an Algal Growth Regulator

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Abstract

Titanium dioxide nanoparticles were synthesized as a means of controlling the proliferation of *Pyrodinium bahamense* var. *compressum* populations into a Harmful Algal Bloom (HAB). HABs, commonly known as red tides, are known to be harmful to both humans and seagrass beds. The nanoparticle solution was formed from a Titanium (IV) isopropoxide, 97% base chemical; mixed with propanol and treated with glacial acetic acid; and then hydrolyzed. The *P. bahamense* samples were cultured in a controlled laboratory set-up. Nine flasks, each containing 75 mL of algal culture, were treated with varying volumes of 5 ppm titanium dioxide nanoparticle solution: three flasks with 22.5 mL, three flasks with 33.75 mL and three flasks with 45 mL. Three flasks of the algal culture were kept untreated. Saxitoxin level and algal cell count determination were done after treatment.

Continuous increase in algal cell numbers was observed in all untreated flasks while cell lysis resulting to a significant decrease in the number of algal cells was observed in all samples treated with the nanoparticle solution. Continuous diminishing of the algal cell numbers was observed 120 hours after treatment and in the absence of UV light in 12-hour intervals.

From the study, it can be concluded that the titanium dioxide nanoparticle-based solution induces cell lysis, thereby significantly decreasing algal cell numbers. It can also be concluded that the solution maintains the ability to induce cell lysis long after

the application of the treatment and, despite titanium dioxide's photocatalytic properties, in the absence of UV light illumination.

The synthesis of the titanium dioxide nanoparticle-based solution can prove to be a vital step in attaining balance in seagrass bed ecosystems and avoiding red tide-related injuries and fatalities during HAB occurrences.

評語

本作品從 TiO_2 之合成，結晶鑑測對澡類生長之影響以及光照因素之研究，可謂相當完整與廣泛。尤其是作品發現在夜晚仍能繼續發揮破壞澡類生長之機制，頗為難得。