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Makirita, Winisia E

Ingenta

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Effects of Nanoparticles of Metal Oxides on the Survival of the Entomopathogenic Nematode: Steinernema carpocapsae

Makirita, Winisia E.; Yong, Liu; He, Nongyue; Mbega, Ernest R.; Chacha, Musa; Li, Xiaolong; Zhang, Fengqin

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Abstract

Nanoparticles (NPs) are technological engineered materials with unique physical and chemical properties, and dimension of less than 100 nm. Nanotechnology has developed at a rapid pace, resulting into tremendous wide application that has resulted into concerns and ecotoxicological consequences. The antimicrobial potentials of the nanoparticles have been extensively studied, however, little has been done on the allied health and environmental toxicity assessments. Thus, the current work evaluated the toxicity effects of the ZnO, TiO2 and Fe3O4 NPs on the survival of the entomopathogenic nematodes (Steinernema carpocapsae), as well as their growth inhibition effects on the nematode symbiotic bacteria (Xenorhabdus nematophila). The metal oxides NPs were characterized by scanning electron microscope and transmission electron microscope. Their toxicity effects were evaluated at various concentrations with the consideration of the media on the toxicity influence. All metal oxides had less influence on the survival of the entomopathogenic nematode and growth of the nematode symbiotic bacterial partner in a concentration dependant manner NPs. The observed toxicity was in the order of Fe3O4 < TiO2 < ZnO NPs respectively, with no significant difference between the NPs. The less toxic effect of the NPs noted may be associated with the ability of entomopathogenic nematodes and their bacterial partner to tolerate toxicants. Nonetheless, other toxicity parameter of NPs on the beneficial nematodes needs to be evaluated for consideration of the compatibility potential of the nematodes and NPs for pest management.

Keywords

Entomopathogenic Nematodes; Metal Oxides; Nanoparticle; Steinernema carpocapsae; Toxicity; Xenorhabdus nematophila