EFFECTS OF TITANIUM DIOXIDE (TiO$_2$ 10-30nm) NANOPARTICLES ON GOLDFISH (*Carassius auratus*)

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Abstract: The increased use of nano-sized materials is likely to result in the release of these particles into the environment. It is, however, unclear if these materials are harmful to aquatic animals. Furthermore, because the dissolution of such nanomaterials will occur, it is probable that some adverse effects will result from the dissolved metal species. The aquatic environment is particularly at risk of exposure to nanoparticles (NPs), yet, there is currently little known about their behaviour in aquatic systems, their capacity to be taken up by aquatic organisms or their potential toxic effects. In this study, we investigated the impact of titanium dioxide nanoparticles (TiO$_2$-NPs) on goldfish (*Carassius auratus*). A semi-static test system was used to expose goldfish to either a freshwater control, 0.1 or 1.0 mg/L TiO$_2$ NPs for up to 96 hours. Exposure was made by suspending the NPs in growth water. Uptake rate and toxicity were evaluated under short-term exposure. Tissues, including gills, muscle and intestine were analyzed for Ti content by ICP-MS. Substantial levels of Ti were detected in gills (118 ppb) and intestine (~2000 ppb) with no significant accumulation in the muscle. Uptake significantly increased with increasing dose up to 118 ppb for 0.1 mg/L TiO$_2$ and 2000 ppb for 1 mg/L TiO$_2$. No toxic effects were observed even under 1 mg/L levels to the fish. Oxidative stress test for malondialdehyde (MDA) verified the result that TiO$_2$ did not exhibit any toxicity to the goldfish within 96 h. While the controls showed about 10% increase in body weight, those exposed 0.1 mg/L showed very little increase (1%) in body mass and for those exposed to 1 mg/L there was about 20% loss of weight within 96 h. These results suggest that though TiO$_2$ NPs impede the food uptake and growth though they don’t exhibit immediate toxicity.

Key Words: Nanotoxicology, TiO$_2$ nanoparticle, Goldfish, Aquatic toxicology

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