EFFECTS OF CuO NANOPARTICLES ON GOLDFISH: ACCUMULATION, OXIDATIVE STRESS, RED AND WHITE BLOOD CELLS

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Abstract: Increasing applications of nanomaterials and nanoscale products demand the need to clarify and understand nanotoxicity. Aquatic environments are repositories for nanomaterials as for many toxic substances. Fish are excellent sentinels of environmental health as they are sensitive to a wide range of xenobiotic chemicals. In this study, acute toxicity (15 days) was conducted on goldfish to determine the effects of copper oxide nanoparticles (CuO NPs 40nm) exposure through water and food. Accumulation limits were measured along with toxicity measures including lipid peroxidation and changes in red and white blood cell counts. First group of were to CuO NPs directly by adding into water at 1 and 10 mg/L CuO NPs. A second group fish were exposed to CuO NPs by feeding with Artemia salina nauplii that had been pre-exposed to 10 and 100 mg/L concentrations of CuO NPs for 24h. No significant acute effects were found in the first group or in the second group fish that were exposed through food. However, it was found that NPs accumulate significantly in intestine, gills and liver of the fish. Average CuO NPs content was about 3.35, 0.107 and 0.014 µg/g in the intestine, gills the liver, respectively. No significant accumulation was detected in the heart, brain and muscle tissue of any treatments compared with the controls. Oxidative stress was measured through malondialdehyde assay (MDA) in the liver and gills. MDA levels increased at low dose of CuO NPs and were 101 and 35.0 nmol/g for the liver and gills, respectively, indicating elevated toxicity at lo concentrations. This result was also confirmed with increasing number in white cell counts, ranging between 12.3 and 15.2x10⁶. Red blood cell counts (2.1-3.4 x10⁷) did not show any significant changes. The results indicate that CuO NPs exhibit toxic effects to goldfish at low levels under acute long-term exposure.

Key words: CuO nanoparticle, accumulation, oxidative stress, blood cell, goldfish

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