Effects of copper oxide nanoparticles and copper ions to zebrafish (Danio rerio) cells, embryos and fry - DTU Orbit (01/12/2018)

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The use of engineered metal nanoparticles (NPs) is continuously increasing and so is the need for information regarding their toxicity. This study compares the toxicity of CuO NPs with ionic Cu in three zebrafish model systems; zebrafish hepatoma cell line (ZFL), fish embryo toxicity test (FET) and fry locomotion. In the ZFL tests, no significant cytotoxicity (cell death, decreased metabolic or cell membrane integrity) was detected for either treatment, though both significantly affected reactive oxygen species (ROS) production. Embryo mortality was affected by both Cu ions and CuO NPs with similar concentration-response relationships, whereas only Cu ions affected fry mortality (24h LC50≈30μM, ≈2mgCuL-1 for Cu ions and no significant mortality observed at up to 200μM, 12.7mgCuL-1 for CuO NP). Both Cu forms increased fry swimming activity during light cycles and decreased activity during dark cycles: Cu ions had significant impact at lower concentrations than CuO NPs. The implications are that Cu ions generally are more toxic than CuO NPs to embryos and fry but there is a marked difference in toxicity among the different zebrafish model systems. Metal NPs release into the environment may have adverse effects on fish and other aquatic organisms.

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