PRODUCTION OF ROS DUE TO NANOTITANIA UPTAKE ON GIANT ZEBRAFISH. (DANIO AEQUIPINNATUS)

P. Sujatha¹, P. Shankar² and P. Ekambaram¹

¹Molecular toxicology lab, Department of Biotechnology, Bharathiar University Coimbatore- 641046
²QIS College of Engineering and Technology, Ongole, Andhra Pradesh 523 272, India

Abstract: Nanotitania is one of the important commercial materials used for its photocatalytic property in a wide range of consumer products, thereby increasing the possibility for occupational and other environmental exposures to humans and other species. One of the possible mechanisms associated with nanoparticle toxicity is reactive oxygen species (ROS). The study is designed to characterize the particles and to look at the particle induced oxidative stress and cellular uptake of particles using giant zebrafish. The particle characterization was done using XRD, SEM and TEM for phase and size confirmations. The grain size of TiO2 is < 60nm confirmed by XRD, SEM and TEM. Electron diffraction patterns show a spotty ring pattern typical of nano-crystalline materials. Dark field images further confirm the nanocrystalline nature of the powder particles and the particle sizes match well with the grain size estimates from peak broadening of X-ray diffraction materials. XRD and Electron diffraction patterns show phase purity of the powders investigated. The effects of nanotitania were assessed in vivo using the zebrafish (1-3 months old, adult) as a model organism for nanotoxicology evaluations categorized in five groups (Control, microsized on 24, 48 hr & treatment, nanotitania treated 24hr, 48 hr). The concentration was chosen based on LD50. Amongst all tissues Gills and Brain were chosen based on behavioral observations. Considerable disparity between test group and control on protein concentration was observed. A significant increase in lipid per oxidation and in contrast decreased activity of antioxidants like superoxide dismutase (SOD), Catalase, Glutathione peroxidase (GPx), were also observed which was due to nanotitania induced oxidative stress. Histo-pathological examination of nanotitania administrated groups shows cellular damage established was confirmed by single cell (SCGE) or COMET assay apart from DNA fragmentation which furthermore approves the possibility of oxidative stress. Scanning Electron Microscope (SEM) for topological confirmation & Transmission Electron Microscope (TEM) analysis of tissue samples further deals on major impact of nanotitania uptake especially to confirm on location cellular level damage. Inductively Coupled Plasma - Optical Emission Spectrophotometric (ICP-OES) analysis confirmed the presence of nanotitania in the tissues activity. It is highly evidential with these observations that genotoxicity is highly prevalent due to nanotitania treatment.

Key-words: nanotitania, Reactive oxygen species (ROS), Zebrafish, SEM, TEM, DNA fragmentation, genotoxicity