CHARACTERIZATION AND TOXICOLOGICAL STUDIES OF METAL OXIDE NANOPARTICLES

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Abstract: Nanoparticles are materials at sub micro meter scales, 1-100 nm possess a large surface to volume ratio. Nanoparticles have significant adsorption capacities, therefore they are able to bind or carry other molecules such as chemical compounds, drugs, probes and proteins attached to the surface by covalent bonds or by adsorption. Nano toxicological studies are intended to determine whether and to what extent these properties may pose a threat to the environment and to human beings. The main objective of our present study was to understand and know the toxic effects of TiO₂, ZnO, NiFe₂O₄, CuFe₂O₄, nanoparticles in various bio systems such as animal models (chick embryo) and microorganisms. The above nanoparticles were chemically synthesised and characterized in the lab using SEM for their nano size confirmation. In vivo and In vitro toxicological studies of chemically synthesised nanoparticles with different concentrations varying from 2.5 mM, 5mM, 7.5 mM and 10mM were tested in mice Lymphocytes, fibroblast and liver tissues of chick embryo and in microorganisms (Pseudomonas aeruginosa and Escherichia coli.). In our present study it was interesting to note that In vitro cytotoxic studies of nanoparticles against Lymphocytes recorded decreased viability per cent as the concentration increases in the nanoparticles. In vivo studies of the measured parameters were lipid peroxidation (LPO), the enzymatic activity of superoxide dismutase (SOD), glutathione peroxidase (GPx), the results showed that TiO₂, NiFe₂O₄, CuFe₂O₄, caused oxidative stress and damage in chick embryo fibroblast and liver tissue. From our study, it was noted that ZnO nanoparticle was observed to be less toxic than the other nanoparticles, The Cytotoxic effects of ZnO Nanoparticles were also checked on cultured microorganisms such as E.coli and P. aeruginosa. It was observed that the ZnO had a significant effect on P. aeruginosa than in E.Coli. Hence for further studies on drug delivery studies ZnO can be used because it is observed to be less toxic.

Key words: Oxidative stress, antioxidants, TiO₂, ZnO, NiFe₂O₄, CuFe₂O₄, nanoparticles.