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Toxicity screening of cupric oxide nanoparticles exposed on Chinese hamster ovary cell line

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ABSTRACT

Chinese hamster ovary, (CHO) cell line derived from its ovary cells is often used in biomedical research and was introduced in 1960s as a cultured monolayer. These cells require amino acid trypsin and serum in culture medium and make them ideal for genetic research. Nanoparticle is a microscopic particle with at least one dimension less than 100 nm. It has a very high surface area to volume ratio that provides tremendous driving force for its diffusion in to cell especially at elevated temperatures. The copper nanoparticles are smaller than 50nm and are considered as super hard material that do not exhibit the same malleability and ductility as bulk copper. In the current paper, CuO nanoparticles have been used in chromosomal study and toxicity screening of CHO cell line and have been found to be the most toxic among the metallic oxides. Occasional changes in the genetic makeup of cultured cells allowed them to proliferate intimate, making them effectively immortal.

Key words : *CHO cell line, CuO, Nanoparticles, Toxicity concentration.*

INTRODUCTION

Nanoscale structures and materials have been explored in many biological applications because of their novel optical and electronic properties that differ from their bulk counterparts (National Nanotechnology Coordination Center, 2006) (Jong *et al.*, 2010). Beside, high volume/surface ratio, surface tailor-ability, and multifunctionality allow nanoparticles as an ideal probe for molecular and cellular imaging.[2] The transition metal oxide nanoparticles are used in catalysis (Noronha *et al.*, 1997), magnetocooling (Roy *et al.*, 1993), optical and recording devices (Prinz, 1999; Vassiliou *et al.*, 1993), purification of enzymes and other biological materials (Airapetyan *et al.*, 2001), water purification devices (Kobe *et al.*, 2001), magnetic field assisted radionuclide therapy (Gruttner and Teller, 1997), embolics(Howard *et al.*, 1999; Howard *et al.*, 1996; Gardy *et al.*, 2000) and targeted drug delivery (Wellman *et al.*, 1998).

Among the transitional metal oxides, titanium oxide (TiO_2), cupric oxide (CuO) and zinc oxide(ZnO) have received the most attention due to their unique physical and chemical properties.

Cupric oxide (CuO) is used as a pigment in ceramics to produce blue, red and green (sometimes gray, pink or black) glazes. CuO is a p-type semiconductor due to its narrow band gap of 1.2 eV. It also can be used to produce dry cell batteries as well as wet cell batteries as the cathode. It is used as abrasive polish optical equipment, and to dispose of hazardous materials such as cyanide, hydrocarbons, halogenated hydrocarbons and dioxins via oxidation processes (Hung *et al.*, 2010). The potential adverse health effects of such nanomaterials have been expressed especially to workers and users (Long *et al.*; 2007; Balbus *et al.*, 2007).

Nanotoxicology is emerged as an application in biomedical area to elucidate the relationship of the physical and chemical properties of such nanostructures with induction of toxic biological responses and to detect any concerns in terms of risk to human health and the environments.

Therefore, for clinical adaptation of such nanoparticles, screening of toxicity effect should be performed. Because of expense of *in vivo* experiments and public and governmental urging to develop alternatives to animal testing, *in vitro* models may be more attractive for preliminary testing of nanomaterials to assess their potential toxicologic effect and their ability to elicit disease.

MATERIAL AND METHODS

Fetal Calf Serum (FCS) and Trypsin were obtained from

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