UNIVERSITI TEKNOLOGI MARA

NANOTOXICITY ASSESSMENT OF IRON OXIDE NANOPARTICLES COATED WITH PERCHLORIC ACID AND SiPEG IN COMPARISON TO IODINE AS A RADIOGRAPHIC CONTRAST MEDIA

BY

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DECLARATION

"I hereby declare that this thesis is my original work and has not been submitted previously or currently for any other degree at UiTM or any other institutions."

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ABSTRACT

Nanotoxicity Assessment of Iron Oxide Nanoparticles coated with Perchloric Acid and Silane-Polyethylene Glycol (SiPEG) in Comparison to Iodine as a Radiographic Contrast Media

Engineered nanoparticles have been extensively explored in various biomedical settings including nanoparticulate imaging agents due to its promising benefits to mankind. Iodine-intolerance patients have caused alarming concerns in searching new contrast media with lower toxicity effect. However, proper potential mechanism of nanoparticles has yet to be fully established despite its early acceptance and emerging usage. By using animal model system, our aim is to assess acute nanotoxicity of 14 nm iron oxide nanoparticles (IONPs) coated with perchloric acid and silane-polyethylene glycol (SiPEG) in comparison to iodine. Eighteen Wistar Rats were used in order to explore the underlying toxicity of coated IONPs in liver tissues. ·OH free radicals were elucidated by using reactive oxygen species (ROS) production assay and western blotting for the presence of p53 protein expression. The results revealed coated IONPs produced higher ROS level compared to iodine, however no statistical significant were observed. It can be hypothesized that higher amount of antioxidant has been produced by rats in iodine group in correlation to combat higher amount of ROS produced before assayed was conducted. Expressions of the p53 protein from the coated IONPs group were further observed. Expression of p53 protein suggested initiation of antioxidants production by the protein to ameliorate intracellular ROS production to further achieve normal redox balance in curtailing further damage. The outcomes highlighted that short-term administration of IONPs with functionalization surfaces are safe to be applied as radiographic contrast media.

CHAPTER 1

INTRODUCTION

1.1 Background

Nanotechnology research is blooming worldwide and relatively new to field of sciences and technologies. According to the Oxford Dictionaries, nanotechnology is defined as a branch of technology compromise with amplitudes and tolerance of subject especially administration of individuals atoms and molecules of characteristic dimension less than 100 nanometres. It had been well accepted in the 21st century and believed to have great potential area in medical, pharmaceutical, biotechnology, manufacturing, engineering, information technology (IT) and telecommunications.

Nanomaterials, specifically metal nanoparticles (NPs) due to its catalytic properties are extremely small and with high surface volume ratio give benefits to the physicochemical properties compare to bulk materials (Nath & Banerjee, 2013). Surface modifications of nanomaterials have been made to enhance its usage and as stabilizing agent. Nevertheless, this property on nano-scale carriers themselves may exert adverse effects of its great importance.

Nanomedicine has become a dominating research field. The desperate need by community of globalisation era make the findings of safer, effective, cheaper and less toxic drug to combat diseases such as cancer by scientists (Roy, Gaur, Jain,