

## Evaluating X-ray absorption of nano-bismuth oxide ointment for decreasing risks associated with X-ray exposure among operating room personnel and radiology experts

M. Rashidi<sup>1</sup>, M. Saffari<sup>2</sup>, H. Shirkhanloo<sup>3\*</sup>, M.R. Avadi<sup>4</sup>

<sup>1</sup>Msc of Nanotechnology, Department of Medical Nanotechnology, Faculty of Advanced Sciences & Technology, Pharmaceutical Sciences Branch, Islamic Azad University, Tehran-Iran (IAUPS)

<sup>2</sup>Assistant Professor of Pharmacology of Kashan University of Medical Science, Iran

<sup>3</sup>Assistant Professor of Iranian Petroleum Industry Health Research Institute (IPIHRI), Occupational and Environmental Health Research Center (OEHRC- PIHO) and Islamic Azad University, Tehran, Iran

<sup>4</sup>Department of Nano Technology, pharmaceutical sciences Branch, Assistant Professor of Islamic Azad University, Tehran, Iran

### Abstract

**Introduction:** During recent years, carcinogenic effects of X-ray have been proven. Today, lead is used in many equipment such as coats, thyroid shield, and gloves for body protection against X-ray. However, these equipments have several disadvantages including toxicity, heaviness, and inflexibility. Hence, newer methods like protective semisolid products (cream, ointment) for topical application are being replaced. Therefore, the feasibility of using an ointment containing bismuth oxide nanoparticles (Bi<sub>2</sub>O<sub>3</sub>) as a X-ray adsorbent was evaluated in this study.

**Material and Method:** First, synthesis of Bi<sub>2</sub>O<sub>3</sub> and then formulating it in the form of ointment was investigated. In this study, X-ray device and dosimeter was employed to check the X-ray absorption in different thickness of bismuth oxide nanoparticles ointment.

**Result:** In dosimetry test, the protective effect of the ointment containing Bi<sub>2</sub>O<sub>3</sub> nanoparticles was evaluated significantly ( $P < 0.05$ ) better than control group and equal sheet lead group. Dosimetry tests showed that the bismuth oxide nanoparticles ointment and cream absorb 56% of the radiation whereas this value is 41% for lead. K absorption edge for bismuth is higher than other metals and its nanoparticles have more absorbent surface to volume ratio (S/V).

**Conclusion:** It seems that due to higher atomic number and lower toxicity, Bi<sub>2</sub>O<sub>3</sub> nanoparticles have better efficiency in X-ray absorption, comparing to the lead. Cream and ointment of bismuth oxide nanoparticles can be used as X-ray absorbant for different professions such as physicians, dentists, radiology experts, and operating room staff and consequently increase health and safety of these employees.

**Key words:** *Bismuth oxide nanoparticles, Ointment, Protection against X-ray, Safety and Health of Medical personnel*

\* Corresponding Author Email: [hamid.shirkhanloo@yahoo.ca](mailto:hamid.shirkhanloo@yahoo.ca)