Graphene Oxide Treated Nasopharyngeal Cancer Cells for Photon Radiotherapy and FTIR Mapping Using Synchrotron Radiation

Selvaraj Rajesh Kumar[1] and Shingjiang Jessie Lue[1,2,3]

[1] Department of Chemical and Materials Engineering, Chang Gung University, Taoyuan City 33302, Taiwan
[2] Department of Orthopedic Surgery, Chang Gung Memorial Hospital, Keelung City 20445, Taiwan
[3] Department of Safety, Health and Environment Engineering, Ming-Chi University of Technology, New Taipei City 24301, Taiwan
(rajeshkumarnst@gmail.com; jessie@mail.cgu.edu.tw)

Abstract

Photon radiotherapy is an important part of cancer management, and about two-thirds of the cancer patients (50%-60%) received radiation therapy during their treatment. In cancer treatment, the usage of nanomaterials has provided better penetration ability that used for photon therapy and diagnosis with lower risk compared to conventional drugs. Thereby, the ultimate aim of photon radiation therapy is to deliver a prescribed dose to a tumor precisely while minimizing dose to the critical structures. The present work investigates the synthesis of nanometric GO from graphite and study its interaction with nasopharyngeal cancer cells (NPC-BM1) through Fourier transform infrared spectroscopy (FTIR) mapping using synchrotron radiation source. The GO nanosheets was characterized by X-ray diffraction (XRD), transform electron microscopy (TEM), X-ray photoelectron spectroscopy (XPS), Fourier Transform infrared spectroscopy (FTIR), Raman spectroscopy, zeta potential and thermogravimetric analysis (TGA), respectively. The GO particle size was observed as <100 nm and produce negative surface charge. The cellular responses and FTIR mapping of vascular endothelial cells (ECP-8 cells) and nasopharyngeal cancer cell line (NPC-BM1) were examined in terms of cell viability and growth parameters. Based on FTIR mapping, the GO treated NPC-BM1 cells were highly damaged in nucleus than those of ECP-8 cells. This was owing to the more sensitive effect of NPC-BM1 cells and strong interaction through GO negative surface charge. To further study the radiation effects and its cellular response of GO treated cancerous NPC-BM1 cells, the photon radiation was applied with increasing dose range from 2-8 Gy. The result confirms nanometric GO caused less cytotoxicity effect and more photon radiation effects to cancer cells that would be appropriate as an effective nanocarriers for radiotherapy and targeted drug delivery.

Keywords: Nanosheets; Synchrotron radiation; Cell cytotoxicity; Photon radiotherapy.