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Multifunctional Bismuth-Based Nanoparticles as Theranostic Agent for Imaging and Radiation Therapy

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Abstract : In recent years many studies have been focused on bismuth-based nanoparticles as radiosensitizer and contrast agent in radiation therapy and imaging due to the high atomic number (Z = 82), high photoelectric absorption, low cost, and low toxicity. This study aims to introduce a new multifunctional bismuth-based nanoparticle as a theranostic agent for radiotherapy, computed tomography (CT) and magnetic resonance imaging (MRI). We synthesized bismuth ferrite (BFO, BiFeO3) nanoparticles by sol-gel method and surface of the nanoparticles were modified by Polyethylene glycol (PEG). After proved biocompatibility of the nanoparticles, the ability of them as contract agent in Computed tomography (CT) and magnetic resonance imaging (MRI) was investigated. The relaxation time rate (R2) in MRI and Hounsfield unit (HU) in CT imaging were increased with the concentration of the nanoparticles. Moreover, the effect of nanoparticles on dose enhancement in low energy was investigated by clonogenic assay. According to clonogenic assay, sensitizer enhancement ratios (SERs) were obtained as 1.35 and 1.76 for nanoparticle concentrations of 0.05 mg/ml and 0.1 mg/ml, respectively. In conclusion, our experimental results demonstrate that the multifunctional nanoparticles have the ability to employ as multimodal imaging and therapy to enhance theranostic efficacy.

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