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Calibration of a Gamma ray dosimeter: A new method based on spectrometry in laboratory conditions

Mohammad Nouri and Faezeh Rahmani*

Department of Physics, K.N. Toosi University of Technology

E-mail: frahmani@kntu.ac.ir

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Abstract

Today, online gamma-ray dosimetry is one of the most widely used approaches for radiation dose measurement. One of the most comprehensive dosimetry methods is the direct conversion of the recorded gamma-ray energy spectrum into dose, or, in other words, the conversion of a spectrometer into a dosimeter. Among the numerous methods for converting a spectrometer into a dosimeter, the G(E) function method is considered one of the most suitable and accurate methods due to its use of energy-dependent conversion coefficients. In this study, the MCNP6 simulation code and a 2×2-inch NaI(Tl) spectrometer were used to calculate equivalent dose based on the recorded spectrum. Based on the equivalent-dose measurement conditions for a directional extended source, the novelty of this work is the development of a practical and efficient method for calibrating a point-source-based dosimeter in the laboratory, allowing valid equivalent-dose results to be obtained without the need to place the dosimeter in the radiation field of a directional extended calibration source.

Keywords: Dosimeter, Spectrometer, Ambient equivalent dose, G(E) function, MCNP6 simulation

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