



Lead-free, low-cost radiation shielding material for clinical electron beam radiotherapy

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Abstract

Clothing of the conventional radiation shielding protects patients and medical personnel from unnecessary radiation exposures constructed from lead-soaked sheet materials, which is a source of environmental pollution. In addition, the lead sheet materials possess issues with lead toxicity and user inconvenience.

This research was carried out to ascertain a desirable material to fabricate a shielding material used in high-energy electron beams generated by a linear accelerator at the cancer centre of Tellipalai Hospital, Sri Lanka. For electron-beam energies, 6, 8, 10, 12, 15 and 18 MeV, effective linear attenuation coefficients of terry cotton fabrics coated with 4.5 g/cm³ density and 5 cm thickness barium Sulphate (BaSO₄) [1], that was made by impregnation and coating method and kept between compressible frames, were estimated. Explorative step of the research revealed the attenuation coefficient of the combined terry cotton fabric and BaSO₄ were 4.064, 3.665, 3.637, 3.314, 2.337 and 1.152 cm⁻¹ for 10 cm × 10 cm field size for the electron energies 6, 8, 10, 12, 15 and 18 MeV, respectively. We conclude that the BaSO₄ coated terry cotton fabric could be utilized in the production of lab coats and other protective apparel for personnel who are routinely exposed to radiation.

Keywords: Linear attenuation coefficients; Terry cotton fabrics; BaSO₄; radiation shielding

Reference

1. Pietrzyk, D.J., and Frank, C.W., 1979, Introduction to Chemical Reactions in Analytical Chemistry, Academic Press, UK, pp.76-89.