ABSTRACT

Lead (Pb) utilisation as ionising radiation shielding material has been known for its several negative impacts, such as lead is categorized as a carsinogenic material and the mass relatively heavy for being used as apron. The searches, either experimentally or computationally, have been conducted in order to find the alternative materials for which effectively substitute lead as ionising radiation shielding material. This research, therefore, aims to analyse material such as aluminum (Al) and cuprum (Cu) (single-layer shielding) to aluminum-cuprum (Al-Cu) (double-layer shielding) based on computational method specifically using MCNP 6.2 simulation. Explicitly, the analysis in the research observing the influence of linear attenuation coefficients on X-ray (photon) radiation energies within conventional radiography range of 75-125 keV, comparing MCNP-generated data to XCOM using relative error parameter, which materials in this research effectively substitute the lead, and justify the orientation of the double-layer shielding material arrangement. Data generated by MCNP 6.2 simulations were utilised using the best-fitting feature in Microsoft Excel and manual calculations. The results of this research shown that the linear attenuation coefficients decline as the X-ray energy increase and relative error for all linear attenuation coefficients less than 10%. Moreover, it was found that Cu and Al-Cu are effectively the best candidates of substituting Pb as conventional radiography room shielding, albeit with the consequence of increased thickness, and the orientation of Al and Cu composite arrangement has insignificant impact in attenuating equivalent dose.

Keywords : MCNP 6.2, lead shielding subtitution, conventional radiography