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Research Article

Assessment of Gamma Ray Shielding Properties for Skin

Roya Boodaghi MALIDARRE[1*], Huseyin Ozan TEKIN[2,3], Kadir GUNOGLU[4], Hakan AKYILDIRIM[5]

[1]Payame Noor University, Tehran-Iran
* **Corresponding Author Email:** roya_boodaghi@yahoo.com - **ORCID:** 0000-0003-4505-7900

[2]Medical Diagnostic Imaging Dep., College of Health Sciences, University of Sharjah, Sharjah, United Arab Emirates
[3]Istinye University, Faculty of Engineering and Natural Sciences, Computer Engineering Dep., Istanbul 34396, Turkiye
Email: tekin765@gmail.com - **ORCID:** 0000-0002-0997-3488

[4]Isparta Applied Science University, 32200, Isparta-Turkiye
Email: kadirgunoglu@isparta.edu.tr - **ORCID:** 0000-0002-9008-9162

[5]Suleyman Demirel University, 32200, Isparta-Turkiye
Email: hakanakyildirim@sdu.edu.tr - **ORCID:** 0000-0001-5723-958X

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Abstract:

Gamma ray is uncharged radiation type and having high energy it can ionize any atom and thus can damage human cells. Because of this harmful effect cell should be protected. Besides developing new alternative to lead and lead based materials, it should be interesting to obtain shielding properties of skin. This paper presents a results on the shielding properties of skin.

1. Introduction

Radiation is due to the natural or artificial sources and it is used in wide variety of fields from medicine to many different commercial facilities [1-5]. On the other hand there is a negative effects of the radiation on the human cell and thus the researchers focused on this subject in order to set a limit the exposure. Radiation dosimetry have been developed for this purposes and namely time-distance and shielding were set as radiation protection rules. The conventional shielding materials for several years are lead, tungsten, and other heavy elements. Besides these materials which have a high absorption rate, researcher developed new alternative materials due to negative aspect of this conventional materials [6-20]. In order to obtain cell from harmful radiation effect, the shielding character of the skin itself should be known. Thus in this paper gamma ray shielding properties have been obtained using Phy-X/PSD code.

2. Materials and Methods

The gamma ray shielding properties have been calculated using Phy-X/PSD code [21]. This is done by obtaining linear attenuation coefficients (LAC), mean free path (mfp), half-value length (HVL), thenth value length (TVL).
The LAC is defined as the probability of gamma ray interaction with materials and given as in equation 1.

$$\mu = n\sigma \qquad (1)$$

where μ is LAC, n is the atomic numbers per volume and σ is the cross section.
With the help of the LAC, the mfp, HVL and TVL were calculated. The mfp shows the path where there will be no any interaction and it is given as in equation 2.

$$mfp = \frac{1}{\mu} \qquad (2)$$

The HVL is defined as the length where gamma ray did not interact with the substrate reduced to half its initial value and it is given as in equation 3.

$$HVL = \frac{Ln(2)}{\mu} \qquad (3)$$

The TVL is defined as the length where gamma ray did not interact with the substrate reduced to tenth its initial value and it is given as in equation 4.

$$TVL = \frac{Ln(10)}{\mu} \qquad (4)$$

3. Results and Discussions

The gamma shielding properties of skin have been investigated. For this purposes the obtained LAC has been shown in Fig.1. It can be seen from this figure that the interaction of gamma rays with medium is energy dependent. Using LAC the mfp have been obtained and shown in Fig.2 where it can be seen that the mfp is energy

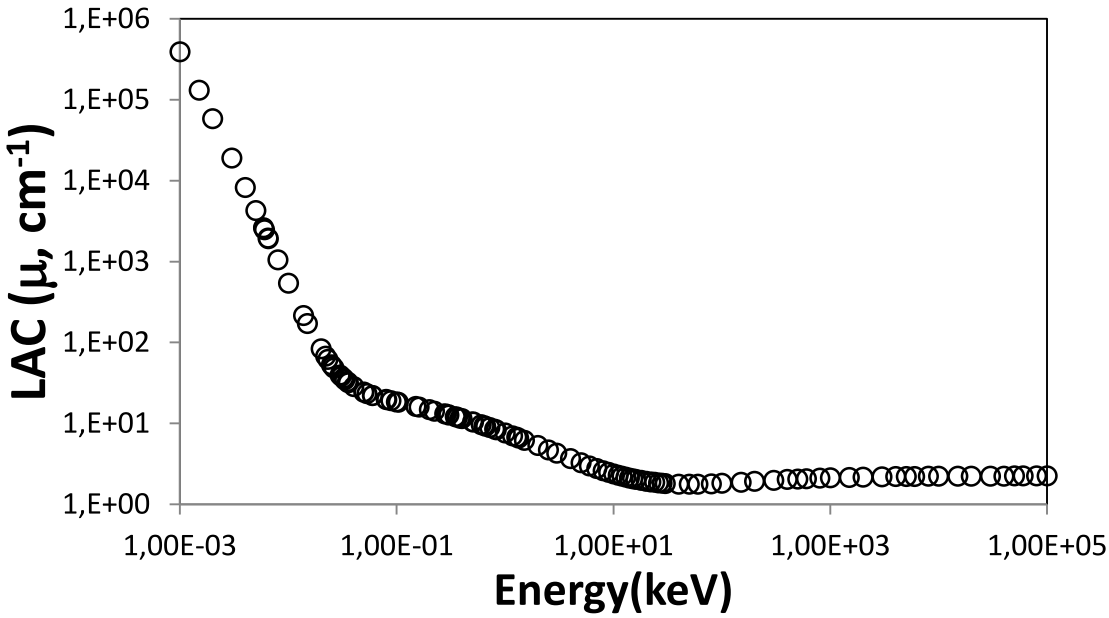

Figure 1. *Obtained LAC as a function of gamma ray energies*

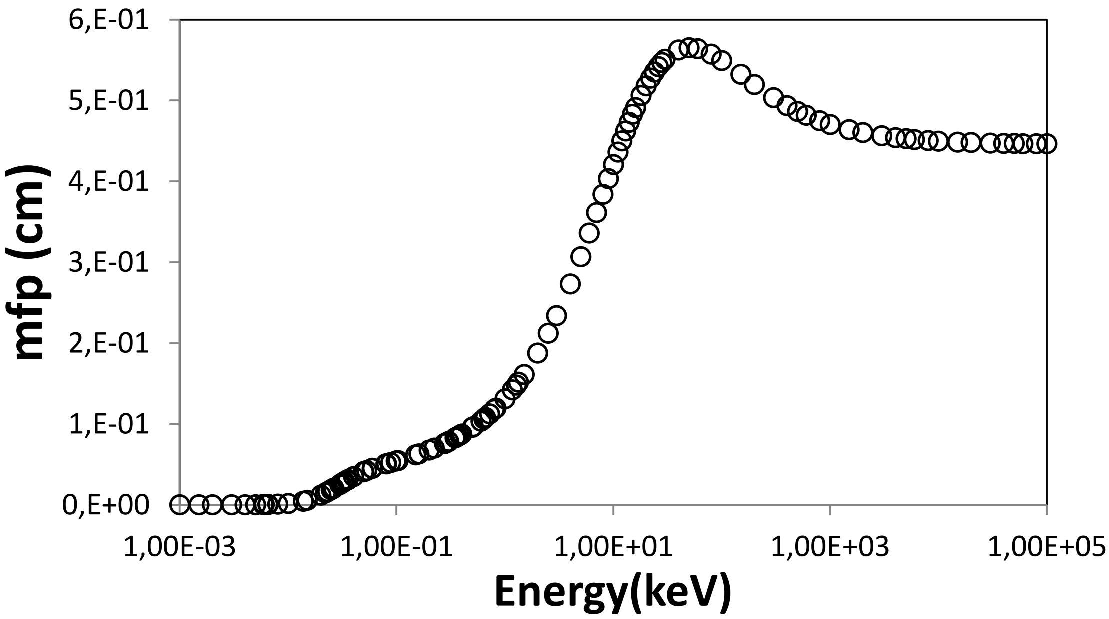

Figure 2. *Obtained mfp as a function of gamma ray energies*

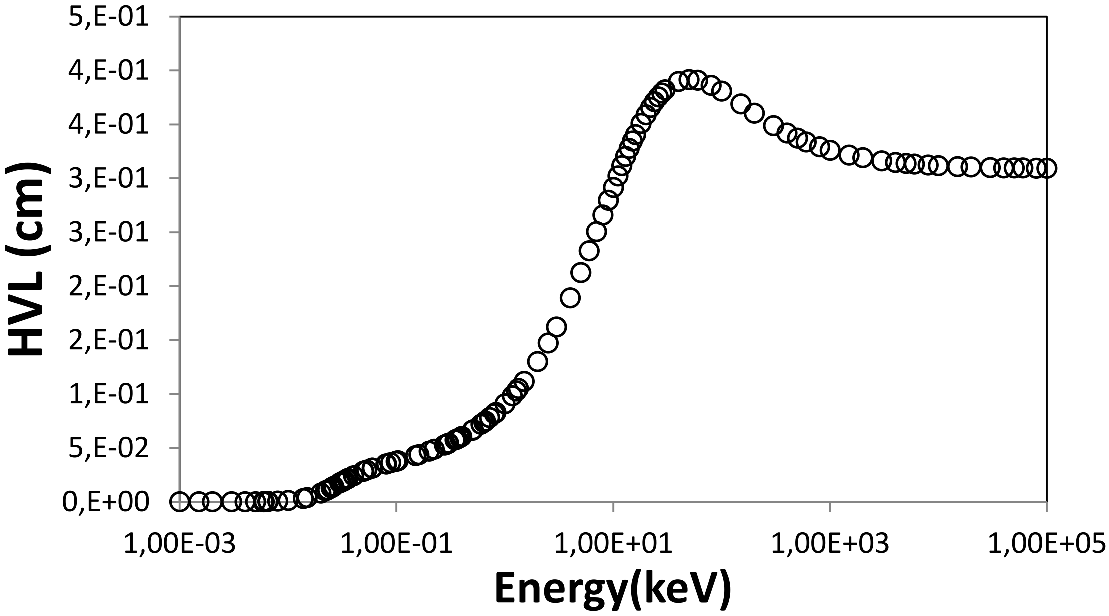

Figure 3. *Obtained HVL as a function of gamma ray energies*

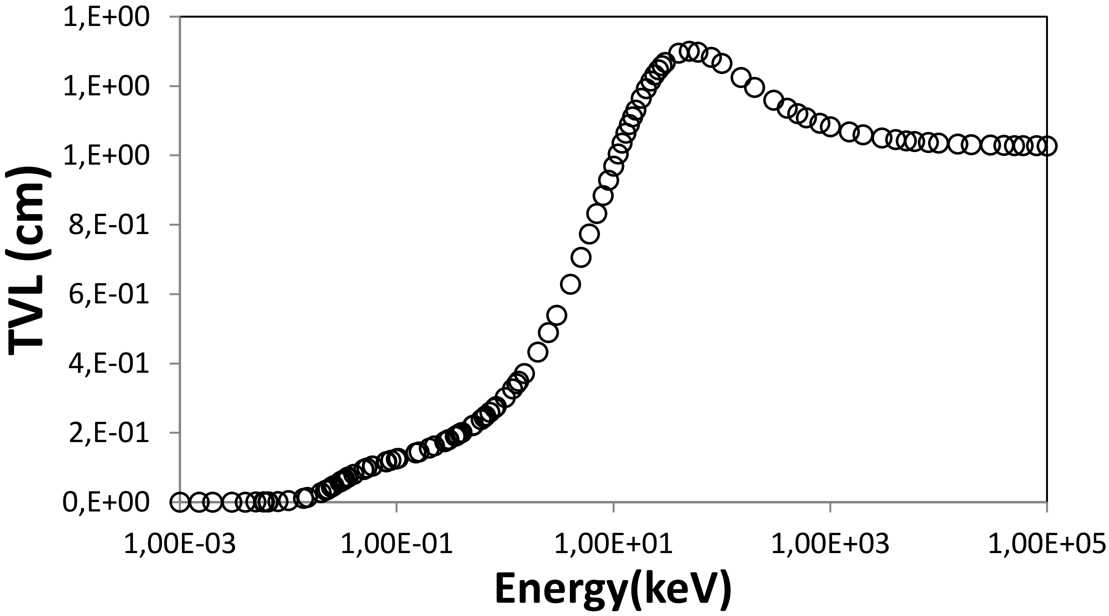

Figure 4. *Obtained TVL as a function of gamma ray energies*

dependent. One of the crucial characteristics for defining the shielding effectiveness is HVL values and obtained results were illustrated as a function of photon energy in Fig. 3. It can be seen from this figure that a similar distribution with the mfp has been obtained. Moreover, in order to confirm the validity shielding properties of skin the TVL values were also obtained. The obtained results were displayed in Fig.4 where it is also seen a similar behave with mfp and also HVL.

4. Conclusions

In the current study, various parameters have been obtained for radiation shielding properties of skin. The shielding performances of the skin in the study were examined for the energy range of 10^{-3}-10^{5} keV. It can be concluded from this work that the energy increases, the value of the linear attenuation coefficient decreased.

Author Statements:

- **Ethical approval:** The conducted research is not related to either human or animal use.
- **Conflict of interest:** The authors declare that they have no known competing financial interests or personal relationships that could have

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