

## **Evaluation of radiation attenuation properties on a various composition of polydimethylsiloxane (PDMS) for fabrication of kidney phantom**

### **ABSTRACT**

Chemical compounds such as polydimethylsiloxane (PDMS) and hydrogen silicone (HS) have been extensively used for fabricating medical phantoms due to its human tissue equivalency. This study aimed to evaluate the mass attenuation coefficient, effective atomic number, and other radiation attenuation properties of various polydimethylsiloxane samples and to verify the best material that can be used to simulate the kidney tissue. There are six samples of polymers in total, which are denoted as S0, S1, S2, S3, S4 and S5; these were 20/0/0, 16/4/0, 16/0/4, 12/4/4, 10/4/6 and 8/4/8, respectively with the composition of PDMS, HS and water. The Photon Shielding and Dosimetry (Phy-X/PSD) software (Phy-x.net) were used to estimate the attenuation properties, and the results were compared with the theoretical values obtained from the XCOM platform. The values of effective atomic number, mass attenuation coefficient, and linear attenuation coefficient, for PDMS S0 are reported to be the highest compared to all other samples, as S0 is based on 100% PDMS without any water and HS. The S1 sample, which only contained 20% of HS, was found to be higher than S2 sample, which had 20% water but without any HS. Hence, the water in samples significantly influences the radiation attenuation properties for photon energy. The Zeff for soft tissue and PDMS are different; their respective atomic numbers differ due to a presence of higher elements such as Si. This study reveals that the modified material, S1 samples constructed from 80% PDMS and 20% hydrophilic can be used to simulate the kidney in terms of the total mass attenuation coefficient, CT number and effective atomic number.

**Keyword:** X-ray attenuation properties; Medical phantom; Polydimethylsiloxane; Hydrogen silicone; Effective atomic number