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Effect of Nanoscale Bismuth Oxide on Radiation Shielding and Interaction Characteristics of Polyvinyl Alcohol-Based Polymer for Medical Apron Design

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Abstract : This study evaluated radiation shielding and interaction characteristics of polyvinyl alcohol (PVA) polymer separately doped with 10% and 20% nanoscale Bi_2O_3, respectively, for medical apron design and shielding special electronic installations. Prepared samples were characterized by scanning electron microscopy (SEM) and energy dispersive spectrometry (EDS). The EDS results showed that Carbon (C), Oxygen (O), and bismuth (Bi) elements were the predominant elements present in the prepared samples. The SEM result displaced surface irregularities due to a special bonding matrix between PVA and Bi_2O_3. Mass attenuation coefficient (MAC), effective atomic number (Zeff), Half value layer (HVL), Mean free path (MFP), Fast neutron removal cross-section (R), Total Mass Stopping Power (TSP), and photon Range (R) of the prepared polymer composites (PV-1Bi and PV-2Bi) were evaluated with XCOM and PHITS computer programs. Results showed that the MAC of the prepared polymer samples was significantly higher than some recently developed composites at 0.662MeV and 1.25MeV gamma energy. Therefore, polyvinyl alcohol (PVA) polymer doped with Bi_2O_3 should be deployed in medical apron design and shielding special electronic installations where flexibility and high adhesion ability are crucial.

Keywords : polyvinyl alcohol (PVA);, polymer composite, gamma-rays, charged particles
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