Development of a Novel Radiation Shielding Material

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Radiation and nuclear terrorism are growing threats for humanity in today’s world. One reason for this is the lack of a shielding material that is effective against both neutron and gamma radiations. The objective of this study is to develop a novel non-toxic and inexpensive radiation shielding material that protects against neutrons, gamma and X-rays. Initially, sodium pentaborate was synthesized, characterized by using FTIR, AAS, XRD and boron oxide analyses, and applied to the produced fabrics and aircraft canopy prototypes. After implementation, those materials were subjected to radiation tests. The fabric which contains only 230 g of sodium pentaborate has reached 75, 21% absorption rate of neutron. While sodium pentaborate improved neutron shielding properties of materials outstandingly, it was not an ideal shielding material against gamma-rays. The obtained results prompted us to back it up by another gamma-ray absorber; therefore, sodium pentaborate and barium sulfate were combined to form a novel shielding material. The novel shielding material was characterized by FTIR, AAS, XRF, XRD techniques. In application studies; interior material of shelter, nuclear protective clothing, space shuttle and aircraft radiation shielding paints were produced. The neutron, gamma and X-ray attenuation coefficients (μ) of samples increased extremely in radiation tests due to novel shielding material’s effect. Eventually, in comparison with current lead shielding material; our novel radiation shielding material is 136 times less expensive, non-toxic and effective against neutrons, gamma and X-rays. Key words: Sodium pentaborate, barium sulfate, FTIR, AAS, XRD, XRF, radiation shielding, neutron, gamma and X-ray.

Awards Won:

Second Award of $2,000