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CCDSS (CARBON COW DUNG SANDWICH STRUCTURE)- RADIATION SHIELDING MATERIAL

Abstract

In space missions the astronauts are exposed to harmful ionizing radiation. Minimizing radiation effects is a major task to stations in space. It is necessary to develop an affordable and reliable radiation shielding material with good mechanical strength and low chemical degradation rate. In this context, cow dung (CD) fibers and epoxy resin system are mixed to produce lightweight inexpensive composites. It is a sandwich structure of CD fiber and carbon fiber. These composites are fabricated at CSIR-NAL, Bengaluru, India using wet-layup method. The radiation shielding capability of these blocks is studied with simulation and experimental methods. The attenuation of high energetic ions through fabricated composites was explored using SRIM-a Monte Carlo simulation and OLTARIS software developed by NASA (National Aeronautics and Space Administration). The gamma radiation mass absorption coefficients (cm2/g) for the composites are studied with XCOM –photon cross section evaluation software. The cross sections for energy 0.662MeV (137Cs), 1.172MeV (60Co) and 1.332MeV (60Co) validated with experimental measurement with Multichannel analyzer (MCA) system coupled to 3"x3" NaI(Tl) gamma detector. Beta ray absorption is studied with simulation technique and comparison with co-relative experimental measurements. The facility was availed at the Nuclear Physics Lab of HBNI-Deemed University Mumbai. The beta mass absorption coefficient (cm2/g) for 0.763MeV is evaluated for Al-foil measurement of attenuated beta rays with GM detector. The identical set up is simulated to obtain mass absorption coefficient for the same energy. The measured and simulated values were within 3% which validated the simulated model. The mass absorption coefficient (cm2/g) and absorption thickness (mm) evaluated for different beta energy. HZE ions and high energy beta radiation stopped at the most 4mm (about 0.16 in) thick proposed composite without radiating secondary radiations. Fabrication cost is 4-8 times lower than currently used material like Kevlar-k149 and UHMW-PE. It can be proposed to be used in aerospace, defense, and nuclear industries.