ABSTRACT

3D printing technology has been applied in various fields due to its ability to produce objects with complex designs, high precision, and material efficiency. One widely used method is Stereolithography Apparatus (SLA), which is capable of producing print quality with better resolution compared to some other 3D printing methods. In addition, the fabrication process is relatively simple and economical, opening up various opportunities for the utilization of this technology. One such application is the production of phantoms for phytosanitary purposes. Therefore, this study was conducted to analyze the mechanical properties of photopolymer resins as candidate materials for phytosanitary phantoms following gamma irradiation. Three types of photopolymer resins—Standard, Plant-Based, and High Clear—were printed using the SLA method and irradiated with Co-60 gamma rays at doses of 0, 200, 400, 600, 1000, 1500, and 50,000 Gy. Characterization was performed via tensile testing with five replicates for each dose variation to determine tensile strength, tensile modulus, and elongation at break. The results showed that all three resins exhibited similar response patterns to increasing irradiation doses. At high doses (50 kGy), there was an increase in tensile strength and tensile modulus—from approximately 45 MPa to 67 MPa and from 2,011 MPa to 2,728 MPa, respectively, for the Standard resin—as well as a decrease in elongation from approximately 7% to 4%, indicating the dominance of cross-linking mechanisms at high doses. Among the three materials tested, the Standard resin exhibited the best mechanical performance after irradiation, characterized by the highest tensile strength and tensile modulus as well as better elongation stability compared to the Plant -Based resin (33 MPa to 47 MPa and 6% to 3%) and High Clear resin (40 MPa to 53 MPa and 10% to 5%). Thus, the Standard resin is considered the most promising for use as a phytosanitary phantom material.

Keywords : *Gamma Irradiation, 3D Printing, Stereolithography Apparatus (SLA), Tensile Test, Phantom*