

Title: Exploring the viability of desiccant silica gel beads as A novel material for radiation dosimetry: A preliminary investigation.

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Abstract: Silica gel bead material, with its porous structure, high surface area, uniform particle size, stability, and excellent adsorption capacity, is a key material for advancing dosimeter technologies. These qualities make it ideal for accurately measuring and monitoring ionizing radiation in various environments. The research aims to characterize the response of different ionizing radiation sources on desiccant silica gel beads, laying the groundwork for potential applications in medical dosimetry. In this study, silica gel bead samples were subjected to various radiation sources, including gamma rays with an average energy of 1.25 MeV, photons (6 MV), and electrons (6 MeV). The radiation was administered at doses within the range of 2 Gy–20 Gy, which is commonly used in radiotherapy to evaluate the dosimetric behaviour of the desiccant silica gel bead samples using the conventional thermoluminescence (TL) technique. The silica gel bead samples have been found to provide a highly linear dose response within the dose range of interest, with the coefficient of determination (R^2) ranging between 0.91 and 0.96. Additionally, the samples show high sensitivity at lower doses and maintain excellent reproducibility, with a standard deviation of less than 4%. In regard to fading evaluation, desiccant silica gel beads exhibit minimal signal loss within 35 days post-irradiation, averaging between 20% and 38%. The findings of this study are promising for developing a new dosimeter, which will enhance radiation monitoring and measurement practices in various environments. These improvements cover dosimetric applications in medical and industrial fields including food safety and agricultural development.

Keywords: Silica gel beads, Thermoluminescence (TL), Dosimeter materials, Ionizing radiation, Gamma rays, Photon irradiation, Electron irradiation, Dose–response, Sensitivity, Fading, Reproducibility, Radiation monitoring

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