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EPR Dosimetry Systems; Assessment and Developed in NCRRT

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During the last two decades, a team of NCRRT researchers developed and assisted many dosimetry systems depending on the electron paramagnetic resonance (EPR) analyzing method. EPR dosimetry is characterized by its non-destructive read-out and the possibility of dose archival. Recently, monosodium glutamate powder and prepared rods containing different concentration of it (3×10 mm) were studied to be a radiation sensitive dosimeter measured by ESR method of analysis. The dose range from 10–90 kGy tested for powder, whereas, rods are useful in the dose range from 10–120 kGy.

NCRRT researchers studied different substances evaluated as; taurine, strontium carbonate, riboflavin, strontium carbonate, anhydrous strontium sulfate, 2-methylalanine, magnesium lactate, ammonium oxalate, and arginine mono-hydrochloride.
The response of taurine to γ-radiation doses in the range from 0.1 to 50 kGy was investigated, as well as that in the range from 1.0 to 20.0 Gy using numerically enhanced EPR taurine spectra. The radiation-induced defects in strontium carbonate ($SrCO_3$) rod dosimeter in the dose range of 2.5 Gy–25 kGy was investigated using EPR resonance technique. The un-irradiated riboflavin (RF) exhibits a very weak EPR signal ($g = 2.00950$) and upon γ-ray exposure the signal increases up to an absorbed dose of 50 kGy. Anhydrous strontium sulfate ($SrSO_4$) has shown a promise candidate as a dosimeter for low dose applications producing unique EPR signals with γ-rays which it has a linear response relationship ($r_2 \approx 0.999$) in the range of 1–100 Gy. The dosimetric characteristics of γ-radiation induced free radicals in 2-methylalanine (2MA) pellet dosimeter are investigated using EPR in the high-dose range of 1–100 kGy. The EPR spectrum of irradiated magnesium lactate (ML) rods was characterized by a quartet signal with the spectroscopic splitting g-factor of 2.0048700003 at 0.4 mT. The useful dose range of the rod dosimeter was 100 Gy to 80 kGy. The dosimetric properties of the of ammonium oxalate $(COONH_4)_2H_2O$ studied under low and high radiation doses. The EPR spectra of ammonium oxalate have the spectroscopic splitting g-factor of 2.00095 for $C_2O_4^-$ radical detected as EPR signal. The dose-response curves have very good linearity in the range 10–1000 Gy for low doses and show slight sub-linearity in high dose region up to 25 kGy. Arginine mono-hydrochloride rods (3–10 mm) were irradiated with ^{60}Co γ-rays to study radicals for dosimetric materials with EPR. The rods have significant signal which develops upon irradiation and the intensity of signal increases upon the increase in irradiation dose, in the dose range from 5 to 120 KGy.

More and more articles ware published by the NCRRT researchers group dialing with this issue represents the unique analyzing method of using EPR in the field of dosimetry.

Country/Organization invited to participate

Egypt

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