Cobalt-60 dose calculations using Monte Carlo N-Particle Method for radiation therapy

Jowi Tsidkenu Cruz, Abigail Rodriguez, Jade Dungao Trono

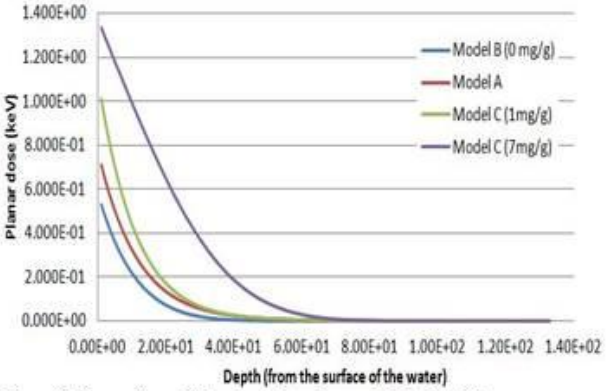

Figure 1. Comparison of the planar dose for models A, B and C

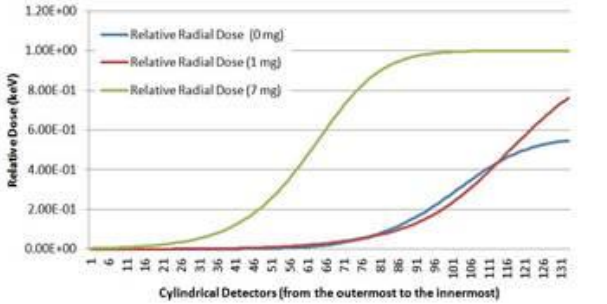

Figure 2 . Comparison of the relative dose in keV for different GNP concentrations

Abstract: In this paper, amplification in dose due to the presence of gold nanoparticles was quantified using Monte Carlo N-Particle (MCNP) simulation. Simulation models included the irradiation of a 30 cm x 30 cm x 15 cm pure water-volume phantom with a beam of 1.17 MeV and 1.33 MeV Cobalt spectral emissions as source. Planar and concentric water panel detectors placed at a distance of intervals of 0.1 cm from the center and the surface were used to obtain radial and depth doses within. To verify the accuracy of the program codes and the phantom specifications used, baseline data using water phantom were compared to calibration data. Amplification in irradiation of a water phantom with spherical tumour and irradiation of a water phantom with varying concentrations GNP-embedded tumour was also determined. Statistical comparisons were done using Analysis of Variance (ANOVA) and T-test to determine the relationships among the data parameters garnered. As expected, GNPs amplified radiation dose through photoelectric effect showing an increase of 0.407% for 1 mg/g and 8.54% for 7 mg/g GNP-concentrations. 1mg/g and 7mg/g GNP concentration recorded 68.68 and 104.81 percentage difference, respectively, in comparison with planar doses achieved in model B. A percent of difference of 128.51, on the other hand, was obtained when planar doses of 1 mg/g and 7 mg/g GNP-concentrations were compared.

De La Salle University
Manila