DOISIMETRIC ANALYSIS OF CELL IRRADIATION IN RADIobiological EXPERIMENT

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Purpose: Dose analysis is important for biological cell irradiation study. When cell irradiation was performed by using a high energy radiotherapy Linac, the dose uncertainties caused by the inhomogeneity structures of the cell containers make it difficult to estimate the cell dose. In this study, cell doses were measured and analysed for different setup conditions.

Materials and Methods: 6 MV, 10 MV photon beams and 10 MeV, 12 MeV, 15 MeV electron beams generated by Electa SL-18 Linac were used in this study. Field sizes of 20×20 cm² for photon beams and 25×25 cm² for electron beams were designed to have a fully side scatter condition. Dosimetry analyses for AP and PA directions were performed for 86 mm×19.5 mm Polystyrene petri dish, 25 cm² × 24.3 mm and 75 cm² × 36.5 mm Tissue Culture Flask. Extra thin TLDs (0.1 mm) were used for dose measurements. The cell irradiation condition is similar to the inhomogeneity distribution in a human body. CET (Coefficient of Equivalent Thickness) is used to evaluate the dose distribution which beyond the inhomogeneity structures. The dose variations for calculation and measurement were analyzed in different setup conditions.

Results and Discussion: In AP setup, the calculation dose was consistent for electron beams, within 3%, but was under estimated for both of photon beams, maximum variation of 7% in 6 MV and 5% in 10 MV. In PA setup, the calculation doses were under estimated for electron and photon beams, and are more significant for higher photon energy and larger air cavity. The depth dose distribution in buildup region is much sharper for photon beam than electron beam. This behavior makes a smaller dose variation in electron beams than in photon beams when evaluated position is located at the buildup area.

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Key words: Cell irradiation, Interface does, TLD, CET