2012 International Symposium on radiation Physics - ISRP 2012
Rio de Janeiro, RJ, Brazil, October 07-12, 2012
INTERNATIONAL RADIATION PHYSICS SOCIETY - IRPS

USING A GRAPHITE IONIZATION CHAMBER IN MEDIUM-ENERGY X-RAY BEAMS

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Radiotherapy X-ray beams are still in use for treatments of several superficial disorders, including malignant lesions, mainly due to their rapidly attenuation on tissue. Additionally, these radiation qualities have also been used in intraoperative radiotherapy and in treatments involving nanoparticles that may promote dose enhancement. The application of such radiation qualities implies on the need of quality control programs of the equipment, because the efficacy of the treatment is highly dependent on the accurate dosimetry of the radiation beam. With the aim to improve the dosimetric systems available at the Calibration Laboratory of the IPEN, this work presents the experimental characterization, according to international standards, of a new graphite cylindrical ionization chamber. This new dosimeter has walls and collecting electrode made of graphite, stem of Teflon, which was also used as insulator between the collecting electrode and the walls. The sensitive volume (2.4 cm^3) is filled with air, and it is unsealed. The tests undertaken were: short- and medium-term stability, leakage current, saturation curve, ion collection efficiency, polarity effect, linearity of response and energy dependence. The highest variation in the stability tests was 0.2%, and the highest leakage current was 0.3% before and after all irradiations. The dosimeter achieved saturation for all tested voltages, the ion collection efficiency was better than 99.9%, while the polarity effect was 0.6%. In the linearity of response test the correlation coefficient (r^2) was 0.999. These results are all within the limits of the IEC Standard 60731 (Dosimeters with ionization chambers as used in radiotherapy). Furthermore, in order to comprehend the influence of its different components to the energy deposited in the sensitive volume, a study with Monte Carlo simulations was carried out. The simulations provided a better understanding of the behavior of this ionization chamber in relation to the used radiation beams.