FABRICATION AND CALIBRATION OF A WATER PHANTOM FOR DOSIMETRY STUDIES

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Abstract

Water phantoms are being used for the dose calibration in radiotherapy treatment. In general phantoms are imported and the dimensions of such phantoms are usually 30 cm × 30 cm × 30 cm. But in few treatment cases such as lung, total body irradiation (TBI) and for routine calibrations a large size phantom is required. For that reason a phantom of dimensions 45 cm × 45 cm × 33 cm was fabricated in the present study. Dose measurements of ^{60}Co beam were made at depths 2.5, 5.0, 7.5, 10.0, 12.5, 15.0, 17.5, 20.0, 22.5, 25.0, 27.5 and 30.0 cm for field sizes 5 × 5, 10 × 10, 15 × 15, 20 × 20, 25 × 25 and 30 × 30 cm^2. Also in the case of linear accelerator doses were measured for the field sizes 5 × 5, 10 × 10, 15 × 15, 20 × 20, 25 × 25, 30 × 30, 35 × 35, and 40 × 40 cm^2 at the same depths. An ionization chamber (Model 23323) of volume 0.1 cm^3 in conjunction with a PTW UNIDOS electrometer was used for dose measurement. To get IAEA standard dose a conversion factor of 1.0343 is established. The requirement of this factor may be mainly due to the different properties of the phantom material (perspex). The measured dose in locally fabricated phantom was not same as that measured in IAEA standard phantom until multiplied by the above mentioned conversion factor. Percentage of error was less than 1% after conversion of the measured doses. The measured doses for each field size have been analyzed by coefficient of determination and found to fit an empirical equation of the form $y = mx + c$. For a particular depth, the measured doses with the side of square field have also been analyzed by coefficient of determination and fitted to an equation of the form $y = m_1 Ln(x) + c_1$. Measurements are also performed for cobalt beam to determine the extent of leakage and contribution of scattered radiation to have an idea for estimation of dose at different points in the body outside the primary beam. It was found to extend several centimeters outside the treatment field and was of the order of as much as 36% of the central axis dose. Doses outside the field were measured up to distances where until about 5% of the central axis dose was obtained. The scattered and leakage radiation show a strong dependence on field size and distance to the beam axis and is predominant only at short distances. The beam profiles of different field sizes were measured for both cobalt beam and linear accelerator.