

Effectiveness of Al₂O₃:C OSL dosimeter towards entrance surface dose measurement in common X-ray diagnostics

ABSTRACT

We report the successful use of nanoDots Optically Stimulated Luminescence Dosimeters (OSLDs) for the determination of the entrance surface dose (ESD) in common X-ray diagnostics. ESD evaluation is made on six radiographic projections including abdomen (AP and LAT), chest (AP and PA), skull (AP), and thoracic spine (AP). Indirect and direct ESD measurements have been performed with and without whole-body anthropomorphic phantom using GE radiography system installed at the Diagnostic Imaging Laboratory, Universiti Kebangsaan Malaysia (UKM), wherein the International Atomic Energy Agency protocol (IAEA TRS-457) has been followed. The CALDose_X 5.0 software is used to calculate ESDs in these projections. The mean ESDs obtained with indirect measurements for AP abdomen, LAT abdomen, AP chest, PA chest, AP thoracic spine, and AP skull projections are 4.8, 8.3, 0.7, 0.2, 7.2, and 3.7 mGy respectively, and with direct measurements, the respective mean ESDs are 4.3, 8.3, 0.7, 0.3, 6.8, and 2.8 mGy. The values obtained by CALDose_X calculations are 8.3, NA, 1.1, 0.7, 8.8, and 4.5 mGy, respectively. Significant variations ranging from 18% to 59% are observed between measured and calculated ESDs, which are attributed to the difference in phantom size and field size. The overall uncertainty for direct measurements has a maximum of ± 0.86 mGy compared to ± 0.47 mGy for indirect measurement. Measured ESDs are within the IAEA and European Commission (EC) DRLs range, while calculated ESDs are slightly above the measured values. It is concluded that the use of nanoDots OSLD is beneficial for ESD measurement in routine X-ray examinations.

Keyword: X-ray diagnostic; ESD; DRLs; OSLD; Radiography

