

Dose Calibrate and Compare with International Standard for Linear Accelerator from Dong Nai General Hospital

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ABSTRACT

The accuracy of the dose rate of accelerators for radiotherapy is very important, it is directly related to the results of cancer treatment. This paper presents process dose calibrate for evaluating dose accuracy of the dose rate of photons emitted from a linear accelerator (LINAC) in Dong Nai General Hospital. The samples Thermo luminescent Dose (TLD) of Agency International Atomic Energy (IAEA) provided irradiated with 2 Gy absorbed dose on the LINAC at Hospital. Then, the samples are sent back to the IAEA to analyze and evaluate error. The results compare standard doses with errors less than 5% and in the range of allowed radiation. The results also showed that the radiation on accelerator in Dong Nai Hospital is credible.

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Key words: Quality assurance, Linear accelerators (LINAC), Absorbed dose, Dose calibrate

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INTRODUCTION

In 1969, the Agency International Atomic Energy (IAEA) and the

World Health Organization (WHO) set the project to send the samples TLD by mailed to calibrate the radiation beam at the developing countries, This project applied to more than 3300 radiotherapy centers all around the world. In the process of benchmarking has discovered many errors and has recommended treatment time during calibration. In Vietnam, this project in collaboration with the Institute of Atomic Energy Vietnam has been conducted in most of the radiation facility in the country. Recently, Dong Nai General Hospital enjoy in the first round of benchmarking in March 2013. The initial results, it was encouraging us in work measurement, quality assurance of radiation therapy accelerator LINAC.

EXPERIMENTAL AND RESULTS

Laboratory equipment and instruments

Accelerator Primus Siemens M5497 was the quality assurance of periodically.

Dose 1 dosimeters, ionization chamber FC 65 and systems water phantom and plastic phantom.

TLD samples: The samples TLD Capsule, was filled with about 155 mg of LIF powder was heat treated, outer cylindrical polyethylene material, black, length about 20 mm, 3 mm diameter, 1 mm thickness. Photographs of samples and experiments are presented in Figure 1.

Request irradiated TLD

The centers radiation therapy enjoy quality assurance comparable requirements irradiation 02 samples with a dose with 2 Gy (Gray) TLD in water, at a depth of 10 cm, field size 10 cm × 10 cm, distance from surface water sources (SSD) of 100 cm, During irradiation the TLD are located in the rack provided by the IAEA, is presented in Figure 2.

The principle operation of the TLD presented in figure 3

The compounds LIF when exposed to radiation will be absorbed energy of the crystal lattice, electrona get the energy will move from valence band to conduction band then trapped on electron trap. When heated, electrons will provide the temperature enough to get out of the trap, returned to its original state, will be accompanied by visible light,

The light intensity proportional to the radiation dose absorbed. Used spectrometer measure light I will know the radiation energy beamed.

Experimental

(a) Calculate the number of MU at the depth of 10 cm, field size $10 \times 10 \text{ cm}^2$, SSD = 100 cm.

Standard dose for 6 MV photon energies in depth $d_{max} = 1.6 \text{ cm}$, dose = 200 MU be the standard dosage of absorbed dose of 200 cGy (200 MU) at 1.6 cm for 6 MV photon energies .

The accelerator emit at 200 MU of energy.

Measuring and recording the absorbed dose at a depth of 10 cm in water phantom (Figure 4).

The number of MU required to play TLD received 2 cGy at a depth of 10 cm.

(b) Irradiation TLD with the calculated number of MU.

(c) Send samples of TLD have been irradiated to the IAEA to read the results.

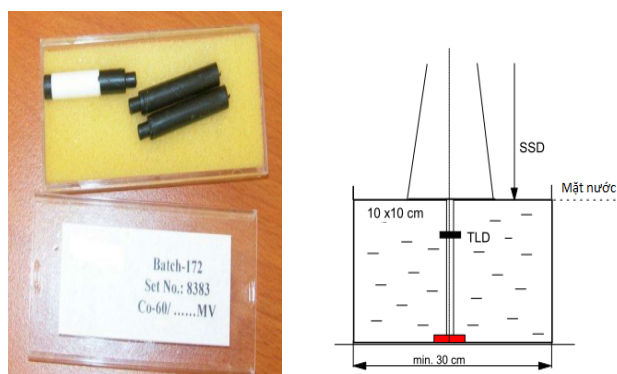


Figure 1 Samples TLD irradiation experiment.

RESULTS AND DISCUSSION

The relative error is calculated as: $100 \times (\text{dose at the hospital} - \text{average dose IAEA}) / \text{average dose IAEA}$.

Error coming from the accelerator in Dong Nai hospital is 0.99%, less than the allowed error (< 5%). So must be confident in the inspection for accelerator dose since inception to date.

Measur and standardized dose is one of the important tasks and depends very much on the experience and expertise of the engineer physics. Radiation Facility of the new Dong Nai Hospital was established in 2009 and a team of engineers, physicists are formed. Therefore, Are needed the support of knowledge and experience from major hospitals in the country such as Ho Chi Minh City Hospital Cancer, Cho Ray Hospital, K Hospital , Bach Mai Hospital.

CONCLUSION

The dose emitted from Siemens accelerators in Dong Nai General Hospital is the proper care of the physical engineering team. Machine regularly inspect weekly, monthly and yearly. Recently, we have participated in the program of the IAEA standard dose collaboration with the Institute of Atomic Energy Vietnam held on May 3/2013 with error results in the permissible limit (0.99%). This is significant because had contributed to the success of the treatment works.

CONFLICT OF INTEREST

There are no conflicts of interest with regard to the present study.

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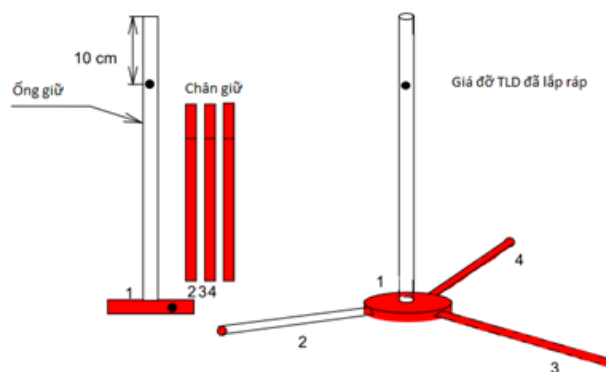


Figure 2 the rack TLD.

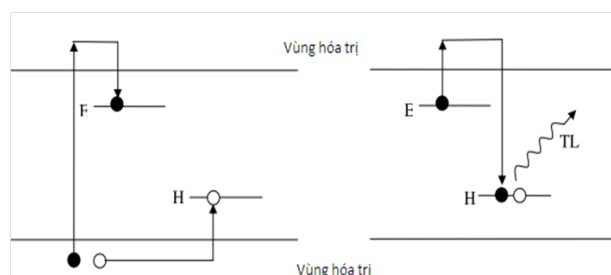


Figure 3 Principle operation of the TLD.

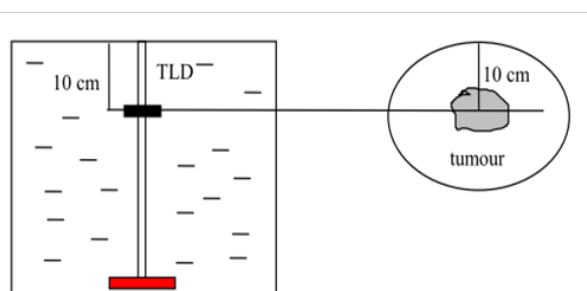


Figure 4 Calculate the number of MU required to emit TLD received 2 cGy at a depth of 10 cm.

Table 1 Compare with IAEA.

Energy of photon	LINAC	Time	Serial TLD	Dose emit (cGy)	Mesuaure IAEA (cGy)	error (%)
6 MV	Siemens #5497	3/2013	12619	2.00	2.02	0.99