APPLICATION OF THERMOLUMINESCENCE DOSIMETER FOR DOSE MEASUREMENT OF HIGH-LET RADIATION.

Fumio Yatagai and Kazushiro Nakano

The Institute of Physical and Chemical Research, Saitama 351.

Both an accurate dosimetry and a uniform irradiation are required for investigating various effects of high-LET radiation on biological materials. For the purpose of uniform irradiation, elastically scattered beam at a certain angle with respect to beam axis has been used in the biological-irradiation system of IPCR cyclotron (Fig. 1).

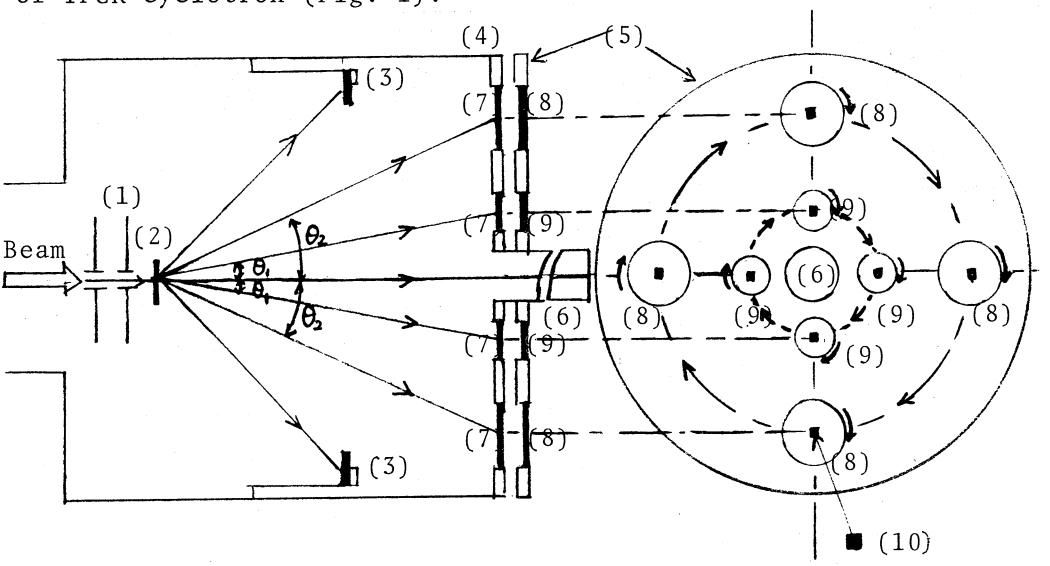

Fig.1 Scheme or the apparatus for biological irradiation. (1) slit (2) scattering foil (3) solid state detector (4) end of vacuum chamber (5) sample wheel (6) Faraday cup (7) vacuum window (8)&(9) sample holder for low- or high-dose irradiation, respectively. (10) TLD ribbons (LiF700)

Thermoluminescence dosimeter (TLD, Harshow Model 200) was employed to examine whether or not this irradiation system provide a uniform irradiation. A fairly well uniformity (±10%) was obtained in the area of surface of sample holder when TLD ribbons LiF700, 0.25mm in thickness, mounted on the holders were rotated during irradiation with N ions (4.7 MeV/amu).
A small fluctuation in TL response was also observed among the TLD ribbons mounted on the different holders, each of which faces the different vacuum windows located on the same circle.

Measurements for dose-response curves of biologicalsamples are usually carried out by eliminating the above fluctuation with either of the two methods as follows. One of them is to assay the biological activity for each dose after mixing all the samples irradiated at the four different windows. The other is circulating the sample holder window to window during irradiation so that total dose for each sample may be given by fractionated irradiation at the four different windows (Fig. 2).

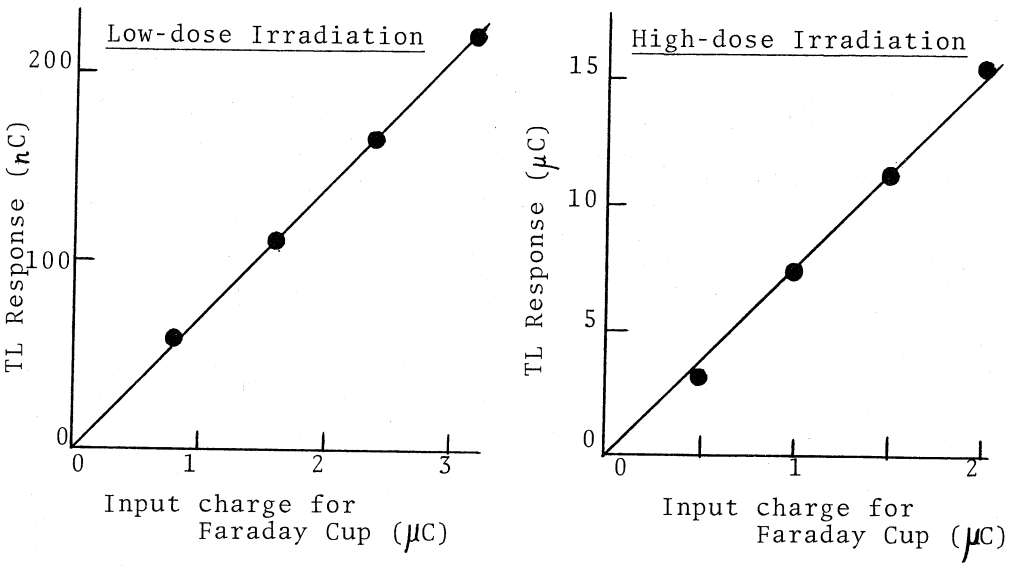

Fig. 2 Dose-response curves of TLD ribbons (LiF700).
TLD ribbons on the sample holders for low- or high-dose irradiation, corresponding to (8) or (9) in Fig. 1, respectively, were exposed to N ions (4.7 MeV/amu).
Total dose for each TLD ribbon was given by fractionated irradiation at the four different windows (see text).

As can be seen from the dose response curves in Fig. 2, TLD is useful to monitor the dose of high-LET radiation.