

DOZIMETER OF PHOTON RADIATION FOR SIMULTANEOUS HYPERThERMIA, CREATED BY MICROWAVE RADIATION, AND γ -THERAPIE

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The applicators emitting microwave powers for heating tissues have heterogeneous structure. The applicators, manufactured in “Istok”, are flexible enough and they fit snugly to phantom or body. But cooling water does not spread uniformly over the lower surface of applicator. Traditionally application of ionization chamber can disturb the temperature field in the body. Therefore TLD detectors were chosen. The cassette for TLD was designed. The cassette was manufactured from plastic without metallic component. The monocrystal LiF detectors (DTG-4, Russia) were used. They have diameter 4,5 mm, thickness – 0,9 mm. They were chosen because of infinitesimal of spread in sensitivity. For example, root-mean-square deviation is equal 15% for single crystals Al_2O_3 , 7% for polycrystalline LiF (TLD-1011) and 4,8% for single crystals LiF (DTG-4). Sometimes it can be examined outlier measuring doses. Therefore our cassette contained 5 TLD. The largest and minimal values were eliminated in calculation average data and their root-mean-square deviation. This decreased deviation to (1,8-3)%.

The dependence of dose sensitivity as function of energy was calculated by Monte-Carlo method taking into account electron interchange between detector and cassette. The ratios absorbed doses in LiF inside cassette to doses in water as function was calculated analytical method too, used crude approximation to electron penetration. The data are shown in the table.

The constancy of dose sensitivity for interval 20-3000 keV was achieved by application ZrO_2 filter (diameter 2 mm, thickness 3 mm). The dose sensitivity did not change after exposure to microwave influence and heating phantom up to 50⁰C. The cassette did not alter the parameters of microwave field almost.

The ratio of absorbed doses in LiF dosimeter to absorbed doses in water
as function photon energy

Energy, keV	Analytical calculation	Calculation on a method of Monte Carlo	Random error of a method of Monte Carlo
10	0,233	–	–
15	0,815	1,050	0,94
20	1,086	1,010	0,96
50	1,159	1,250	2,5
80	0,982	1,020	5,2
100	0,957	0,940	2,1
200	0,945	0,83	1,9
400	0,953	0,830	4,2
600	0,960	0,810	4,0
1000	0,980	0,920	3,5
2000	–	0,820	2,7

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