Calculation of BNCT Dosimetry in Brain Cancer Cases Using PHITS Code

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Abstract Cancer is a dangerous disease caused by the growth of a mass of cells that are unnatural and uncontrollable. One of the dangerous disease brain cancers is glioblastoma, which it's called glioblastoma multiforme (GBM). The dismal prognosis associated with glioblastoma is attributable not only to its aggressive and infiltrative behavior, but also to its location typically deep in the parenchyma of the brain. To answer that, the BNCT method can be a solution. This study aims to calculate BNCT dosimetry in different of cancer positions and irradiation geometries using PHITS code. The results show that the deeper the cancers target at brain the slower the total absorbed dose rate of cancer target. It takes a longer treatment time. Based on the treatment time and total absorbed dose rate of cancer target, the TOP irradiation geometry is an appropriate choice in treating the cancer target in this case. To achieve the histopathological cure of GBM at the primary site, the absorbed dose of brain was calculated to be 1.07 Gy and 1.64 Gy for the LLAT and PA irradiation geometry, respectively. While, For cancer position of 3 cm, 5 cm, 7.15 cm, 9 cm, and 11 cm, the absorbed dose of brain is 0.25 Gy, 0.48 Gy, 0.85 Gy, 1.33 Gy, and 2.01 Gy, respectively. In addition to the stochastic effect, it was found also deterministic effects that may be produced such as cataracts.

Keywords: BNCT dosimetry; GBM; brain cancer cases; PHITS; irradiation geometry; cancer position; ORNL MIRD phantom