

## SIMULATION THE EFFECT OF $^{11}\text{B}$ ISOTOPE ON THE PROTON AND ALPHA PARTICLE DOSE DISTRIBUTIONS USING MONTE CARLO METHOD

*Tuesday, 12 July 2022 16:00 (20 minutes)*

The advantages of proton therapy make it useful for treating tumors located in the regions that surround radiosensitive tissues and, in the tissues, where surgical access is limited [1]. Recent studies [2-3] have indicated that Proton-Boron Capture Therapy (PBCT) induces tumor cell death through three alpha particles via the reaction between proton and  $^{11}\text{B}$ . When a proton reacts with boron ( $^{11}\text{B}$ ) based on the following equation, the  $^{11}\text{B}$  changes to  $^{12}\text{C}$  in an excited state. Then, the excited carbon nucleus splits into an alpha particle with the energy of 3.76 MeV and  $^8\text{Be}$ . Finally,  $^8\text{Be}$  splits into two alpha particles each with the energy of 2.74 MeV.  $^{11}\text{B} + \text{p} \rightarrow ^{12}\text{C} \rightarrow ^8\text{Be} + \alpha \rightarrow 3\alpha + 8.7 \text{ MeV}$  (1)

The therapy results can be more effective than proton therapy if the energy deposition due to the alpha particles and the proton's Bragg-peak in the tumor regions could be matched. Of course, further studies are needed to evaluate the use of PBCT in clinical practices. It is also important to investigate secondary particles in radiotherapy. Secondary particles such as neutrons and photons can be produced by the Coulomb interaction of protons with atomic electrons, elastic nuclear scattering, and the passing of protons through tissues. The main aim of this study was to determine the dose of protons and alpha particles for boron different concentrations, investigate the role of secondary particles in the PBCT treatment method as compared to the conventional proton beam therapy using Monte-Carlo simulation package FLUKA. To do so, first, the variation of the Bragg-peak dose and the depth of protons were examined depending on the boron concentration and the proton energy. The doses of these particles were calculated for boron concentrations in the range of 1; 1,5; ...; and 5% and different proton energies including, 60; 90; 120; and 150 MeV.

### The speaker is a student or young scientist

Yes

### Section

1. Nuclear technology and methods in medicine, radioecology

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