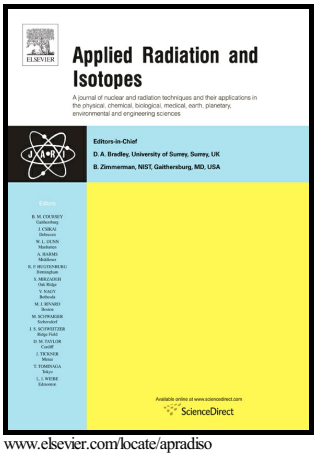
BNCT of skin tumors using the high-energy D-T neutrons

S. Farhad Masoudi, Fatemeh S. Rasouli, Marjan Ghasemi



www.elsevier.com/locate/apradiso

PII: S0969-8043(17)30036-2
DOI: http://dx.doi.org/10.1016/j.apradiso.2017.01.010
Reference: ARI7732

To appear in: *Applied Radiation and Isotopes*

Received date: 20 January 2016
Revised date: 13 January 2017
Accepted date: 13 January 2017

Cite this article as: S. Farhad Masoudi, Fatemeh S. Rasouli and Marjan Ghasemi BNCT of skin tumors using the high-energy D-T neutrons, *Applied Radiation and Isotopes,* http://dx.doi.org/10.1016/j.apradiso.2017.01.010

BNCT of skin tumors using the high-energy D-T neutrons

S. Farhad Masoudi[1]

Department of Physics, KN Toosi University of Technology, P.O. Box 15875-4416, Tehran, Iran

Fatemeh S. Rasouli

Department of Physics, K.N. Toosi University of Technology, P.O. Box 15875-4416, Tehran, Iran

Marjan Ghasemi

Department of Physics, K.N. Toosi University of Technology, P.O. Box 15875-4416, Tehran, Iran

Abstract

Owing to the continuing need for providing improved and universally accepted facilities to be used in radiation therapies, a number of recently published BNCT-related studies have focused on investigating appropriate neutron sources as alternatives for nuclear reactors. Of special interest are D-T neutron generators, which theoretically have shown the potential to be utilized as neutron sources for BNCT of deep-seated tumors. This work is devoted to investigate the feasibility of using the high-energy neutrons emitted from these generators for treatment of surface tumors, especially skin. Using a set of MCNPX simulations, the D-T neutrons are passed through an optimized arrangement of materials to slow-down toward the desired energy range, and to remove the neutron and gamma contamination considering the IAEA recommended criteria, especially determined for pre-clinical survey for treatment of surface tumors. By assessment with these parameters, it is shown that the designed beam, corresponding to a configuration composed of natural uranium as neutron multiplier, D_2O as moderator, Pb as reflector, Bi as gamma filter, and polyethylene and BeO as collimators provides high-intensity of desired neutrons, and low-background doses as well. It was found that an appropriate material for collimator, if accompanied with an optimized geometry, is an important parameter for keeping the undesired components to the recommended level.

A typical simulated phantom, subjected to the irradiation of the designed spectrum, is used to study the performance of the resultant beam in shallow tissue. For an arbitrary chosen ^{10}B concentration, the evaluated depth-dose curves show