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Feasibility of ^{177}Lutetium Radioisotope Production Using Natural Ytterbium for Targeted Radiotherapy

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Abstract

Research related ^{177}Lu is most attractive in the last decade due to its applications in both cancer treatments and applications in diagnostic imaging of nuclear medicine. ^{177}Lu is not yet used or imported for either nuclear medicine applications or research level applications in Sri Lanka. This study made a ^{177}Lu radioisotope using exciting facilities for cancer research applications. Natural stable Yb sample was irradiated with neutron flux to produce ^{177}Yb, subsequently, it decays to the final product ^{177}Lu undergoes ^{176}Yb $(n,\gamma)^{177}$Yb ^{177}Lu nuclear reaction, and which has a half-life of 6.7 days. Characteristics of Lu were studied using sample spectrum by irradiation of a naturally stable sample of Lu compound. In this method, ^{177}Lu can be purely chemically separated from Yb contaminations to produce career free end product. Irradiation and decay cycle of ^{177}Lu was studied and measured the final product activity using gamma spectroscopy. Theoretically calculated each irradiation decay cycle was compared with the end product during the first three cycles of production. 0.9725 g of natural Yb sample produced 13.30 ± 0.30 Bq/g activity after three irradiation cycles, which agreed with theoretical calculations. The amount produces using this method is sufficient to carry out laboratory-level cancer research in Sri Lanka.

Keywords: *Radioisotopes, Neutron activation, Gamma spectroscopy,* ^{177}*Lu,* ^{176}*Yb*