Feasibility study of ^{64}Cu production using neutron activation for potential application in Positron Emission Tomography (PET) in Sri Lanka

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Among various medical imaging techniques, Positron Emission Tomography (PET) is increasingly being used in medical diagnosis. However, PET scanning is quite expensive owing to the difficulties in manufacturing radioactive tracer. Isotopes used in PET medical diagnosis are commonly produced using nuclear reactions with proton beams generated in cyclotrons and neutron flux from reactors. PET isotopes are not readily available in underdeveloped countries such as Sri Lanka due to high production cost. It is worthwhile to utilize low-cost approach using thermal Neutron Activation (NA). The present study was aimed to produce Copper-64 (^{64}Cu) PET isotope using NA method, which is available in Sri Lanka. Natural copper sulphate sample was irradiated to produce ^{64}Cu. In addition to the desired isotope, ^{66}Cu is produced as a contaminant due to NA of naturally occurring ^{65}Cu. Activity of ^{64}Cu was studied as a function of sample activation time, sample size, and cooling time to optimize ^{64}Cu yield and minimize contaminants. Production properties of ^{64}Cu such as neutron flux and half-life have been measured as a part of optimization and identification. The best specific activities of ^{64}Cu and ^{66}Cu are 139.8 ± 12.85 Bq g-1 and 17.4 ± 7.23 Bq g-1, respectively, using 241Am/Be neutron source in the University of Colombo. Activity values show that there is a potential of producing the ^{64}Cu radioisotope from the ^{63}Cu isotope under the optimal conditions using the thermal neutron activation. Further development of this technique requires isotope separation in large scales. The study revealed the ^{64}Cu isotope produced using NA method can be used in laboratory trials.

Keywords: PET, NA, ^{64}Cu, ^{65}Cu, ^{66}Cu