ABSTRAK

Pengaruh Variasi Dosis Iradiasi Proton Terhadap Kuantitas Impuritas Dalam Produksi Fluor-18. Berkas proton yang dipercepat didalam mesin siklotron dapat digunakan untuk produksi radionuklida F-18 yang dapat dimanfaatkan untuk diagnosa kelainan fungsi organ tubuh dengan menggunakan metode *Positron Emission Tomography-Computed Tomography* (PET-CT). Produksi radionuklida Fluor-18 dengan menggunakan berkas proton yang dipercepat dalam siklotron Eclipse berpotensi menghasilkan radionuklida pengotor sehingga perlu dilakukan analisis dan pengukuran aktivitas radionuklida pengotor tersebut. Dalam penelitian ini, proton berenergi 11 MeV ditembakan ke dalam target air diperkaya ($H_2{}^{18}O$) dengan beberapa variasi arus berkas dan waktu iradiasi. Dalam proses produksi radionuklida F-18, berkas proton ditembakkan ke target yang berada di dalam sistem target. Sistem target tersebut terdiri dari kolimator yang terbuat dari *stainless-steel*, foil/jendela target (*Havar window*) dan bodi target yang terbuat dari perak. Hasil penelitian menunjukan bahwa radionuklida pengotor yang dihasilkan dalam proses produksi radionuklida F-18 diantaranya radionuklida Co-56, Mn-52, Cd-109 dan Ag-110m. Aktivitas radionuklida yang dihasilkan sangat dipengaruhi oleh besarnya dosis iradiasi yang digunakan. Semakin besar dosis iradiasi maka semakin besar pula aktivitas radionuklida yang dihasilkan. Perbandingan hasil perhitungan *End-Of-Bombardment* (EOB) *yield* secara eksperimen dan teori dipengaruhi beberapa faktor seperti perbedaan tampang lintang reaksi nuklir dan ketidakstabilan berkas proton ketika menembak target. Hal ini menyebabkan perbedaan nilai EOB *yield* yang cukup signifikan antara data eksperimen dan perhitungan teori. Hasil produksi radionuklida F-18 yang telah disintesis hanya akan menghasilkan senyawa bertanda atau radiofarmaka dalam bentuk ^{18}FDG dan radionuklida impuritas dalam jumlah yang relatif kecil.

***Kata kunci* :** Energi Proton, Fluor-18, PET-CT, Siklotron, kolimator, Foil/Jendela Havar, EOB *yield*

ABSTRACT

The influence of proton iradiation dose variation on impurity quantity in fluorine-18 production. Proton beams accelerated in a cyclotron machine can be employed for F-18 radionuclide production that can be used to diagnose abnormalities of organ function by using Positron Emission Tomography-Computed Tomography (PET-CT). Fluorine-18 radionuclide

production using proton beams accelerated in Eclipse cyclotron could potentially generate radionuclide impurities, therefore, analysis and measurement of the radioactivity of the radionuclide impurities is necessary. In this experiment, typical 11 MeV protons were bombarded into an enriched water ($H_2{}^{18}O$) target with some variation of beam current and irradiation time. In the production process of F-18 radionuclide, proton beams were fired in the targets inside the target system. The target system consists of collimator made of stainless-steel, foil/target window (Havar window) and a target body made of silver. The results showed that the radionuclide impurities generated in the production process of F-18 radionuclide included Co-56, Mn-52, Cd-109 and Ag-110m radionuclides. The resulting radionuclide activity is strongly influenced by the amount of irradiation dose used. The greater the irradiation dose, the higher the activity of the radionuclide produced. Comparison of the calculated End-Of-Bombardment (EOB) and experimental yields is influenced by several factors such as differences in the nuclear reaction cross section and the instability of the proton beam when bombarding the targets. This causes significant difference in the values of EOB yields between experimental data and theoretical calculations. The production of F-18 radionuclide which has been synthesized was used to label a radiopharmaceutical compound in the form of ^{18}FDG. It was also found that there was no residual radionuclide or impurities left over in the ^{18}FDG.

Keywords: Proton Energy, Fluorine-18, PET-CT, Cyclotron, collimator, Foil/ Window Havar, EOB yield.