

Produksi Radionuklida [¹⁷⁷Lu]Lutesium Bebas Pengemban (No Carrier Added) dari Target Ytterbium-Alam Menggunakan Reaktor Riset Nuklir G.A Siwabessy Serpong = The Production of No Carrier Added [¹⁷⁷Lu]Lutetium from Natural Ytterbium Target Using Serpong G.A Siwabessy Nuclear Research Reactor

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Abstrak

Radionuklida [¹⁷⁷Lu]Lu bebas pengemban adalah sediaan radionuklida [¹⁷⁷Lu]Lu dengan aktifitas spesifik yang sangat tinggi namun dibutuhkan pemisahan yang sangat sulit untuk memperolehnya. Pada penelitian ini dikembangkan metode produksi [¹⁷⁷Lu]Lu bebas pengemban dari aktivasi tidak langsung isotop Ytterbium alam menggunakan metode pemisahan kromatografi penukar ion dengan fasa diam resin Dowex W50 X8 dan campuran eluen alpha Hydroxyisobutyric Acid ($\hat{I}\pm$ -HIBA) dan HCl. Hasil penelitian menunjukkan bahwa reaktor nuklir G.A Siwabessy telah mampu menghasilkan [¹⁷⁷Lu]Lu sebanyak 296 MBq/10 mg sampel Yb₂O₃. Dua metode pemisahan spesifik diperoleh, pertama dengan menahan radionuklida [¹⁷⁷Lu]Lu di dalam resin sedangkan ion dan radionuklida pengotor keluar dari kolom menggunakan campuran eluen HCl 0,25 M dan $\hat{E}$ -HIBA 0,1 M yang dapat mengeluarkan pengotor [¹⁷⁵Yb]Yb sekitar $1,6 \times 10^{-3}$ % yield/ml dan [¹⁶⁹Yb]Yb sekitar 4,2 % yield/ml. Metode kedua didapatkan dengan menggunakan peningkatan konsentrasi eluen $\hat{I}\pm$ -HIBA 0,15 M yang menyebabkan [¹⁷⁷Lu]Lu keluar dari kolom sedangkan pengotor tetap berada di dalam kolom dengan kemurnian [¹⁷⁷Lu]Lu sekitar 81,9 % dan aktifitas spesifik (1,163 GBq/mg). Faktor peningkatan konsentrasi HCl diatas 0,25 M pada eluen menyebabkan penurunan selektifitas pemisahan [¹⁷⁷Lu]Lu dari matriks ytterbium. Sedangkan faktor peningkatan temperatur elusi 50 °C dapat menaikkan selektifitas pemisahan dengan menahan lebih baik [¹⁷⁷Lu]Lu di dalam resin.

.....No-carrier added [¹⁷⁷Lu]Lu radionuclide is a [¹⁷⁷Lu]Lu radionuclide preparation with very high specific activity but requires very difficult separation to obtain it. In this research, a carrier-free [¹⁷⁷Lu]Lu production method was developed from indirect activation of natural Ytterbium isotopes using an ion exchange chromatography separation method with a Dowex W50 X8 resin and mixed eluent alpha hydroxyisobutyric acid ($\hat{I}\pm$ -HIBA) and hydrochloric acid (HCl). The research results showed that the G.A Siwabessy nuclear reactor was able to produce [¹⁷⁷Lu]Lu as much as 296 MBq/10 mg Yb₂O₃ sample. Two specific separation methods were obtained, first by retaining the [¹⁷⁷Lu]Lu radionuclide in the resin while the impurity ions and radionuclides come out of the column using a mixture of 0.25 M HCl and 0.1 M $\hat{E}$ -HIBA eluents which can remove [¹⁷⁵Yb]Yb impurities around 1.6×10^{-3} % yield/ml and [¹⁶⁹Yb]Yb around 4.2 % yield/ml. The second method was obtained by using an increase in the eluent concentration of 0.15 M $\hat{I}\pm$ -HIBA which caused [¹⁷⁷Lu]Lu to come out of the column while the impurities remained in the column with a [¹⁷⁷Lu]Lu purity of around 81.9% and specific activity (1.163 GBq/mg). The increasing factor of HCl concentration above 0.25 M in the eluent causes a decrease in the selectivity of

[¹⁷⁷Lu]Lu separation from the ytterbium matrix. Meanwhile, increasing the elution temperature by 50 °C can increase separation selectivity by better retaining [¹⁷⁷Lu]Lu in the resin.