



Contribution ID: 85

Type: **Poster**

Separation of carrier free ^{177}Lu from $^{177}\text{Lu}/\text{Yb}$ mixture by electro-amalgamation of ytterbium

Wednesday 19 September 2012 18:00 (1h 50m)

The process of isolation of no-carrier added ^{177}Lu produced via $^{176}\text{Yb}(n,\gamma)^{177}\text{Yb} - ^{177}\text{Lu}$ from mixture containing macroscopic amounts of the ytterbium target material was investigated. For this purpose a novel method of electrochemical selective amalgamation of ytterbium from $^{177}\text{Lu}/\text{Yb}$ mixture into mercury-pool cathode was applied. The electrolyte solution contained mixture of 20 mg ytterbium in 5M HCl and ^{177}Lu as $^{177}\text{LuCl}_3$ in 0.15 M sodium citrate. As anode platinum plate was used. In order to develop an optimal condition of amalgamation of ytterbium, effects of pH of the electrolyte solution, potential and time of the electrochemical process as well as number of cycle of electrolysis performed under the same conditions using fresh electrodes were examined. The concentration of lutetium and ytterbium in the electrolyte solution was determined by spectrometry ICP-OES. The best performance of the method, allowing cementation up to 94 % of ytterbium from the $^{177}\text{Lu}/\text{Yb}$ mixture was obtained at pH of 6-7, potential of 8 V, time of 60 min and two cycles of the electrolysis. Concentration of ^{177}Lu in the solution after fixing ytterbium in amalgam remained at the same level. As results of such defines process molar ratio of Yb:Lu was reduced from 3000 to 170. The atomic absorption spectroscopy (AAS) measurement showed that the content of mercury in the solution containing ^{177}Lu after cementation of the ytterbium was below detection and determination limit level amounted respectively 0.3 and 0.6 $\mu\text{g}/\text{kg}$.

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Session Classification: Poster Session

Track Classification: Nuclear Chemistry, Radionuclide Production, High-Power Targetry