Contribution ID: **58** Type: **poster**

111In medical isotope production via different accelerator types

Tuesday, 10 September 2024 18:35 (1 hour)

The radionuclide 111In is one of the widely used radionuclides in diagnostic nuclear medicine. Research on its production has been carried out since the second half of the last century. For commercial purposes, 111In is produced in proton or alpha particle induced reactions on cadmium or silver targets [1, 2]. However, in recent years, various activation methods have been proposed to obtain it. In this review, we analyze the routes to obtain 111In, comparing our experimental results with published data. The analysis presented in this review will be useful for selecting the appropriate nuclear reaction to produce high purity 111In for applications.
In our experiments, we investigated nuclear reactions on enriched tin targets induced by protons and photons, based on availability of compact medical cyclotron and linear electron accelerator in Yerevan.
The stack of enriched (63.2%) 114Sn foils was irradiated using 18 MeV proton beam provided by cyclotron IBA Cyclone18/18 [3]. Cross-sections of the 114Sn(p,α)111In reaction using the stacked-foil activation technique were measured. This method allows us to calculate cross sections for several energies under the same conditions in a single irradiation.
The enriched (92.6%) 112Sn target was irradiated at the linear electron accelerator LUE-75 of A. Alikhanian National Science Laboratory at the bremsstrahlung endpoint energy Eγmax = 55 MeV. The cross section per equivalent quantum for reaction 112Sn(γ,x)111In, have been measured via the method of activation and off-line γ-ray spectrometric technique [4].
The cross sections of the 111Cd(p,n)111In reactions have been measured repeatedly and have large cross-sections at the maximum of the excitation function [2]. But the excitation function of 114Sn(p,α)111In has been measured for the first time in Ref. [3]. Comparison of experimental data confirmed that the probability of 111In formation in the case of proton-nucleus reactions on the 114Sn target is lower than in the 111Cd(p,n)111In [5].
The experimental data showed that the yield of 111In in the 112Sn(γ,x) reaction is significantly lower than in case of using proton-nuclear reactions on cadmium, but is comparable to other reactions for producing 111In [2]. Our research allows us to conclude that it is possible to use the photonuclear method for the production of 111In if the proton beam is not available. An important point is the low activity of impurities in the final product, and in the case of photonuclear production, radioactive impurities are short-lived and their amount becomes insignificant a day after irradiation.

References

1. Susanta Lahiri, Moumita Maiti, et al., J. of Radioanalytical and Nuclear Chemistry, 297 (2013) 309–318.
2. Technical reports series № 468, IAEA, Vienna, 2009.
3. G.H. Hovhannisyan, T.M. Bakhshiyan, et al., Eur. Phys. J. A, (2023) 59:161.
4. T.M. Bakhshiyan, G.H. Hovhannisyan, JINST (2024) accepted for publication.
5. F.Tarkanyi, F.Szelecsenyi, et al., Applied Radiation and Isotopes, 45 (1994) 239.

Primary authors: BAKHSHIYAN, Tiruhi (Institute of Applied Problems of Physics of the National Academy of Sciences of the Republic of Armenia IAPP NAS RA); Ms HAKOBYAN, Azniv (Institute of Applied Problems of Physics of the National Academy of Sciences of the Republic of Armenia IAPP NAS RA); Dr HOVHANNISYAN, Gohar (Yerevan State University)

Presenter: BAKHSHIYAN, Tiruhi (Institute of Applied Problems of Physics of the National Academy of Sciences of the Republic of Armenia IAPP NAS RA)

Session Classification: Poster session 2