Contribution ID: **912** Type: **Oral**

44mSc/44gSc generator based on the after-effects of radioactive decay

Monday 11 October 2021 14:30 (15 minutes)

A stable complex of radionuclide with suitable chelator is one of the key components in design of the radiopharmaceuticals for nuclear medicine. In certain cases the radioactive daughter might be fully or partially released from the complex due to so-called 'after-effects', which create the challenges in application of such radiopharmaceuticals [1]. The after-effects strongly depend on the decay mode, chemical difference of parent and daughter radionuclide and the choice of the chelate.
44gSc presents a particular interest for application in nuclear medicine as a positron emission tomography (PET) agent due to its favourable nuclear properties, such as t1/2 = 3.97 h, Eβ+max = 1.47 MeV, branching ratio 94.3 % β+ [2]. However, due to short half-life 44gSc has limitation in transportation and carrying out longer pharmacokinetic studies. 44mSc (t1/2 = 58.61 h) decays by isomeric transition (IT) into 44gSc accompanied by 12% of conversion electron emission, which can cause a partial release of the daughter 44Sc from the chelate complex. The after-effects in 44mSc/44gSc pair can be considered as an advantage in the context of the generator to produce a radiochemically pure 44Sc, and disadvantage in case of *in vivo* generator [3,4].
In present work, 44mSc/44gSc generator based on the radiolabeling of DOTATOC and C-18 cartridge with both metastable and ground state of scandium-44 was designed and tested. Both isotopes were produced via 44Ca(p,n)44m,gSc reaction from natural calcium target irradiated at TR13 MeV cyclotron at TRIUMF. The final product was purified using solid ion-exchange chromatography and radiolabeled with 10-4 M DOTATOC. Further analysis was performed using instant thin layer chromatography (iTLC) and gamma-spectroscopy with HPGe detector.
The yield of the daughter isotope release was equal to 9.68±1.15%. This result demonstrates not only fundamental importance of the after-effects in nuclear medicine, but also its impact on the radiopharmaceutical synthesis. Moreover, the production of the parent 44mSc via other routes (e.g. 41K(α,n)44mSc, natTi(p,2pxn)44mSc using medium and high energy protons, 42Ca(α,pn)44mSc) would give the opportunity for generator source of 44gSc to enable transport and kit labeling synthesis directly in the medical facility.
References
[1] Kurakina ES, Radchenko V, Belozub AN, Bonchev G, Bozhikov GA, Velichkov AI, et al. Perturbed Angular Correlation as a Tool to Study Precursors for Radiopharmaceuticals. Inorg Chem 2020;59:12209–17. https://doi.org/10.1021/acs.inorgchem.0c01208.
[2] Filosofov D V., Loktionova NS, Rösch F. A 44Ti/44Sc radionuclide generator for potential application of 44Sc-based PET-radiopharmaceuticals. Radiochim Acta 2010;98:149–56. https://doi.org/10.1524/ract.2010.1701.
[3] Rosch F, Knapp FF. 40 Radionuclide Generators. Handb. Nucl. Chem., Springer Science+Business Media B.V.; 2011, p. 1936–67. https://doi.org/10.1007/978-1-4419-0720-2.
[4] Edem PE, Fonslet J, Kjær A, Herth M, Severin G. In vivo radionuclide generators for diagnostics and therapy. Bioinorg Chem Appl 2016;2016. https://doi.org/10.1155/2016/6148357.

Authors: Ms KURAKINA, Elena (1)JINR 2)MUCTR 3)TRIUMF); Dr RADCHENKO, Valery (3)TRIUMF, 4)UBC); Dr MAGOMEDBEKOV, Eldar (2)MUCTR); Dr FILOSOFOV, Dmitry (1)JINR)

Presenter: Ms KURAKINA, Elena (1)JINR 2)MUCTR 3)TRIUMF)

Session Classification: Life Science

Track Classification: Life Science