

Production of alpha emitters for cancer therapy

Tuesday 6 September 2022 14:40 (40 minutes)

Alpha emitters hold great promise to improve ligand therapy or Targeted Alpha Therapy (TAT), where an alpha emitter is attached to a biological tracer. The tracer is injected into the blood stream of a cancer patient and accumulates over time in the cells with the targeted expression, e.g. cancer cells. As alpha particles have a relative high Linear Energy Transfer (LET), it typically causes more cell kill than other options for ligand therapy, e.g. the beta emitter ^{177}Lu . Therefore, alpha emitters can be an excellent therapy choice where high LET is required as a last option due to radiation resistance and where external beam therapy with high LET particles (protons, heavy ions) is not applicable (e.g. widely-spread metastases).

First clinical treatment with the alpha emitter ^{225}Ac have caused large excitement due to successes in hard-to-treat prostate cancer [1]. ^{225}Ac does not only send out one alpha particle, but four in its decay chain. But the supply of ^{225}Ac is limited [2]. At TRIUMF, we have the appropriate accelerator (500 MeV cyclotron) to produce large quantities of ^{225}Ac by proton irradiation of ^{232}Th [3]. We successfully developed the target, the handling, and the purification to produce ^{225}Ac . As ^{227}Ac is co-produced and constitutes an unwanted contamination which could accumulate in the bones of patients, potentially causing late side effects or secondary cancer, we also developed the separation of ^{225}Ra . By utilizing the ^{225}Ra as parent isotope and incorporating it into a generator, very pure ^{225}Ac can be produced for curative intent [4, 5].

REFERENCES

- [1] C. Kratochwil, F. Bruchertseifer, F. Giesel, M. Weis, F. Verburg, F. Mottaghy, K. Kopka, C. Apostolidis, U. Haberkorn, A. Morgenstern, ^{225}Ac -PSMA-617 for PSMA-targeted α -radiation therapy of metastatic castration-resistant prostate cancer. *J. Nucl. Med.* 57, 1941–1944 (2016).
- [2] V. Radchenko, A. Morgenstern, A. Jalilian, C. Ramogida, C. Cutler, C. Duchemin, C. Hoehr, F. Haddad, F. Bruchertseifer, H. Gausemel, H. Yang, J. Osso, K. Washiyama, K. Czherwinski, K. Leufgen, M. Pruszyński, O. Valzdorf, P. Causey, P. Schaffer, R. Perron, S. Maxim, S. Wilbur, T. Stora, Y. Li, Production and supply of alpha particles emitting radionuclides for Targeted Alpha Therapy (TAT), *J. Nucl. Med.*, 62 1495 (2021).
- [3] V. Radchenko, C. Hoehr, Modern Alchemy to fight Cancer, *Nuclear Physics News*, 30 28 (2020)
- [4] A. Robertson, A. Lobbezoo, L. Moskven, P. Schaffer, C. Hoehr, New target design to produce Ac-225 at TRIUMF, *Instruments*, 3 18 (2019).
- [5] a. Robertson, B. McNeil, H. Yang, D. Gendron, R. Perron, V. Radchenko, S. Zeisler, P. Causey, P. Schaffer, ^{232}Th -Spallation-Produced ^{225}Ac with Reduced ^{227}Ac Content. *Inorg. Chem.* 59, 12156–12165 (2020).

Primary author: HOEHR, Cornelia (Life Sciences, TRIUMF Canadian Particle Accelerator and University of Victoria, Canada)

Presenter: HOEHR, Cornelia (Life Sciences, TRIUMF Canadian Particle Accelerator and University of Victoria, Canada)

Session Classification: Research on targeted radionuclide therapy and associated technologies

Track Classification: Targeted radionuclide therapy and associated technologies