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Production of alpha emitters for cancer therapy

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Alpha emitters hold great promise to improve ligandtherapy 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 ligandtherapy, e.g.the beta emitter 177Lu. Therefore, alpha emitters can be an excellent therapy choice where high LET is required as a last option due to radiation resistance and whereexternal beam therapy with high LET particles (protons, heavy ions) is not applicable (e.g.widely-spread metastases).

First clinical treatment with the alpha emitter 225Ac have caused large excitement due to successes in hard-to-treat prostate cancer [1]. 225Ac does not only send out one alpha particle, but four in its decay chain. But the supply of 225Ac is limited [2]. At TRIUMF, we have the appropriate accelerator (500 MeV cyclotron) to produce large quantities of 225Ac by proton irradiation of 232Th [3]. We successfully developed the target, the handling, and the purification to produce225Ac. As227Ac is co-produced and constitutes an unwantedcontamination which could accumulate in the bones of patients, potentially causing late side effects or secondary cancer, we also developed the separation of 225Ra. By utilizing the 225Ra as parent isotope and incorporating it into a generator, very pure 225Ac can be produced for curative intent [4, 5].

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