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Capabilities of JSC "SSC RIAR"in Producing 227ThCl4

227Th is considered to be one of the promising radionuclides for target radionuclide therapy of cancer. Its advantages are chemical properties which are good for the synthesis of the complexes with chelating agents and emission of five alpha particles with complete decay of one 227Th nucleus. The apparent disadvantage is the presence of 223Ra among daughter products the chemical properties of which are fundamentally different from thorium that can cause its redistribution in the human body. A rather big half-life of 227Th (18.7 days), on the one hand, is good for the preparation production and shipment, and on the other hand, it specifies high-level requirements to the preparation stability in the human body.

In addition to using 227Th for radiopharmaceutical synthesis, it can be applied in manufacturing 223Ra generators. While such generators have a rather small period of use, they have a number of advantages over 227Ac/223Ra generators. In particular, there is no need to check every batch for the 227Ac content, and there are no long-lived radioactive wastes.

JSC "SSC RIAR"performs experiments to produce trial samples of 227Th by generating from long-lived parent radionuclide 227Ac extracted from the 226Ra targets irradiated during 20-25 days in the SM reactor neutron trap. To separate 227Th and 227Ac, thorium is sorbed on BioRad AG 1x8 (NO3-) strongly basic anion-exchange resin from 8M HNO3 with further elution using 0.1-0.5 M HNO3 or HCl. To produce the preparation of desired radionuclide purity, the purification process must be carried out at least twice. The key challenge in producing 227Th is determination of the 227Ac content. It is not possible to directly determine 227Ac by its own alpha radiation at its activity of less than 1% of the 227Th activity. The yield of alpha radiation in 227Ac decay is only 1.38 %, and its peak in the spectrum is on the low-energy tail of 227Th and its daughter products. 227Th conversion electrons and beta radiation of the daughter products, namely 211Pb and 211Bi, are obstacles in measuring the 227Ac activity by beta radiation. The presentation discusses possible methods to check the content of 227Ac with its preliminary chemical extraction from a preparation aliquot and gives the characteristics of 227Th experimental samples.

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