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Accelerator production of Ac-225 for generating Bi-213 for targeted alpha therapy

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The generator system Ac-225 / Bi-213 (half life of 45.6 min) is a suitable method of producing an alpha-emitter for targeted alpha therapy. However, the production of Ac-225 is difficult and only a limited quantity of this isotope has so far been available for clinical use. Till recently it was exclusively produced by the decay of Th-229, which itself is generated by the decay of U-233 (half life of 159200 years). By making use of our production yield curves we have estimated the production of Ac-225 through (p,2n) and (d, 3n) on Ra-226, and also estimated the unwanted activities being produced simultaneously through (p,n), (d,n) and (d,2n) reactions on Ra-226. It is shown that from a thick Ra - target production yields of 1.1×10^{10} Bq, 1.85×10^{10} Bq and 2.04×10^{10} Bq respectively at proton bombarding energies of 20, 30 and 34 MeV can be obtained at incident proton currents of 100 μ A but irradiation time of only one day which is a lot more practical than previously quoted 10 days of irradiation. Similarly production yields of Ac-225 through the (d,3n) reactions on Ra-226 have also been estimated to be 4.2×10^9 Bq, 1.1×10^{10} Bq and 1.4×10^{10} Bq at deuteron energies of 20, 30 and 34 MeV respectively for irradiation time of 1 day at beam intensities of 100 micro-A. As the production yields data is presented in graphical form, the production of Ac-225, from a moderately thick or even a thin Ra-226 target can also be obtained for any irradiation conditions.

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