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Optimized production of ^{155}Tb via ^{155}Dy decay for theranostics

The production of the theranostic radionuclide ^{155}Tb is under the spotlight of the nuclear medicine community for its dual role in SPECT imaging and Auger electron therapy, as well as its complementarity with other terbium isotopes (^{149}Tb , ^{152}Tb , ^{161}Tb). We investigated three alternative production routes, using natural targets and different beams (protons, deuterons and α particles), to generate ^{155}Tb via the decay of its precursor ^{155}Dy . These routes are feasible with current or near-future intermediate-energy research cyclotrons ($E < 70$ MeV), offering higher yields and purities compared to standard methods. Cross-section calculations were refined with the TALYS code, optimizing the relevant model parameters and validating the results with experimental data. The study also includes theoretical modeling of radiochemical separations, with the selection of the optimal irradiation parameters. This work identifies the proton-induced pathway as the most advantageous and establishes a robust framework for further studies in this field.

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