PERSPECTIVES FOR Tb-161 RADIOPHAMACEUTICALS LOCAL PRODUCTION AT ENEA TRIGA RC-1 REACTOR IN ROME

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Terbium-161 is an interesting radionuclide in cancer treatment, showing similar decay characteristics and chemical behaviour to clinically employed Lutetium-177 (177Lu). Its emission of a larger number of conversion and Auger electrons would make it more effective in the treatment of the smallest metastases, as well as single cancer cells. The ENEA TRIGA RC-1 reactor is involved in the EC funded SECURE Project (October 2022 - September 2025) aiming at studying the feasibility of an Italian local production of such radionuclide for medical applications. The goal is to produce Terbium-161 by neutron activation of gadolinium target (highly enriched in 160Gd) exploiting the reaction channel 160Gd(n,γ)161Gd(β-) 161Tb. Its production at intrinsic low-magnitude neutron flux irradiation facilities such as ENEA TRIGA RC-1 reactor implies that 161Tb has to be purified from massive amount of irradiated Gd oxide raw material, being the Tb/Gd mass ratio intrinsically low. An efficient separation and isolation process is necessary to produce a 161Tb solution with chemical and radiological features suitable for a radiopharmaceutical production. A recycling step of the processed Gadolinium to create new targets to be irradiated once again is also expected to optimize the economics of the whole cycle. The work here is presenting the steps carried out at the ENEA premises, describing both irradiation and chemical processing experiments, giving a general overview of the potential Italian production cycle of such 161Tb precursor of the radiopharmaceutical.

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