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47Sc Production: Comparison of the NatV(P,X) and 48Ti(P,X) Routes from the Dosimetric Point of View

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The radionuclide ^{47}Sc is a promising candidate for the development of theranostic radiopharmaceuticals, although its availability is currently low. Yields of ^{47}Sc produced through proton irradiation of both natV and ^{48}Ti targets at energies $E_P \leq 40$ MeV were compared in this work. The co-production of other Sc radioisotopes and their contribution to the dose increment (DI) to the patient, by considering a DOTA-folate conjugate (^{47}Sc -cm10)₂ as an example of radiopharmaceutical, were also evaluated.

About natV target, both ^{48}Sc and ^{46}Sc are co-produced, causing a decrease of the Radio Nuclidic Purity (RNP) over time and an increase of the dose to the patient. For $E_P \leq 35$ MeV and 24 h irradiation, the RNP is $>99\%$ and the DI is $<10\%$ up to $t_{\text{max}}=60$ h after the End of Bombardment (EOB). Increasing the irradiation time to 80 h, the ^{47}Sc yield becomes almost a factor 3 higher, however t_{max} reduces to 30 h.

About ^{48}Ti target, ^{46}Sc , $^{44\text{m}}\text{Sc}$, $^{44\text{g}}\text{Sc}$ and ^{43}Sc contaminants are produced and, in all the considered scenarios, the RNP is initially very low. For $E_P \leq 30$ MeV, the RNP increases, up to achieving 99% about 1500 h (almost 20 half-time of ^{47}Sc) after the EOB.

In conclusion, despite the ^{47}Sc yield obtained by irradiation of ^{48}Ti is larger when compared to the use of natV targets, its RNP is not suitable for medical applications.