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Radiochemical and cross section studies for the production of the therapeutic radionuclide ^{193m}Pt

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The radionuclide ^{193m}Pt (T_{1/2} = 4.33 d) decays by highly converted isomeric transition emitting about 33 Auger electrons. It is of great potential interest in internal radiotherapy because of its suitable decay properties. So far the specific activity of ^{193m}Pt produced has been rather low due to the use of the ¹⁹²Pt(n,γ)-process at a reactor. The aim of this work was to measure the excitation function of the ¹⁹²Os(α,3n) reaction. Furthermore, the yield and the specific activity of ^{193m}Pt produced was determined.
The dissolution of osmium, its conversion to OsO₄ vapor and trapping in KOH solution for electrolytic preparation of thin target samples of highly enriched ¹⁹²Os on Ni as well as the complete radiochemical separation of radioplatinum including ¹⁹²Os recovery were optimized.
The excitation function of the ¹⁹²Os(α,3n) ^{193m}Pt reaction was measured up to 39 MeV using the stacked-foil activation technique with 99.65 % enriched ¹⁹²Os targets at the Brussels Cyclotron. The ^{nat}Ti(α,x) ⁵¹Cr reaction induced in Ti foils was used to monitor the incident beam intensity of about 100 nA. After a clean separation of radioplatinum, the radioactivity of ^{193m}Pt was measured via X-ray spectrometry using the Pt K_{α1} X-ray line of 66.8 keV. The cross section of the ¹⁹²Os(α,3n) ^{193m}Pt reaction reaches a value of about 1.5 b at the maximum at about 35 MeV. It was also calculated theoretically using the compound-precompound nuclear model codes TALYS and STAPRE. The calculated values are consistent with the measured data. The optimum production of the ^{193m}Pt radionuclide via this route was found in the range 30-38 MeV; the integral yield of ^{193m}Pt amounted to 10 MBq/μAh. Its radionuclidic purity was found to be > 99% and the determined specific activity amounted to 1 GBq/μg Pt, which is by about 10³ higher than in reactor production. Thus basic information on the production of high-quality ^{193m}Pt for therapeutic application is provided.

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