RadChem 2010



Contribution ID: 17

Type: Verbal

Radiochemical measurement of cross sections for the production of the therapeutic radionuclide ^{193m}Pt

Tuesday, 20 April 2010 04:15 (15 minutes)

The radionuclide $\langle \sup \rangle 193m \langle \sup \rangle Pt$ (T $\langle \sup \rangle 1/2 \langle \sup \rangle = 4.33$ d), a high spin isomer, decaying by highly converted isomeric transition, emits about 33 Auger electrons per decay. It is of great potential interest in internal radiotherapy because of its suitable decay properties and platinum-complexes (like cis-platin and others) used in chemotherapy, i.e., potent antitumor agents. In order to avoid side effects of chemotherapy, it is advisable to use this radionuclide in the same chemical complex with high specific activity. So far the specific activity of $\langle \sup \rangle 193m \langle \sup \rangle Pt$ produced has been rather low due to the use of the $\langle \sup \rangle 192 \langle \sup \rangle Pt(n,\gamma)$ process at a reactor. In a recent study, the $\langle \sup \rangle 192 \langle \sup \rangle Os(\alpha,3n)$ reaction was measured up to 28 MeV [1]. The aim of the present work was to establish reliable and reproducible chemical preparation of thin targets from highly enriched osmium and to extend the measurement of excitation function of the $\langle \sup \rangle 192 \langle \sup \rangle Os(\alpha,3n)$ reaction up to 35 MeV, where the optimum energy range was expected, and to increase the yield and the specific activity of the $\langle \sup \rangle 193m \langle \sup \rangle Pt$ at a cyclotron.

We optimized the dissolution and conversion of osmium to osmium tetroxide vapor and trapping in KOH solution, the electrolytic preparation of thin target samples of highly enriched ¹⁹²Os on Ni, and the complete radiochemical separation of radioplatinum.

The excitation function of the $\langle sup > 192 \langle sup > Os(\alpha, 3n) \langle sup > 193m \langle sup > Pt$ reaction was measured from 26 MeV to 39 MeV using the conventional stacked-foil activation technique. Several stacks containing 99.65 % enriched $\langle sup \rangle$ enriched $\langle sup \rangle$ by targets and thin Ti and Cu foils were irradiated by 40 MeV α -particle beam of about 100 nA for 2 h at the Brussels Cyclotron. The Ti-nat(α ,X)⁵¹Cr reaction induced in the Ti foil was used to monitor the incident beam intensity. After complete separation of radioplatinum, the radioactivity of ^{193m}Pt was measured by X-ray spectrometry using the Pt X-ray line of 66.8 keV. The measured count rates were converted to decay rates by correcting for the X-ray intensities, self absorption in the source, and the efficiency of the detector using the well known formula; thereafter the nuclear reaction cross section was calculated. The cross section of the $¹⁹²Os(\alpha,3n) < sup>193m </sup>Pt reaction$ 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 by this method was found in the energy range 30 - 38 MeV; the integral yield of ^{193m}Pt being about 40 times higher than that in the energy region below 28 MeV [1]. The results provide basic information on the production of high-quality ^{193m}Pt for therapeutic application. Tests on impurity, the yield and specific activity are underway.

Reference

[1] K. Hilgers, H.H. Coenen and S.M. Qaim. Appl. Radiat. Isot. 66, 545-551 (2008).

Primary author: Dr UDDIN, Md. Shuza (Institut für Neurowissenschaften und Medizin, INM-5: Nuklearchemie, Forschungszentrum Jülich, D-52425 Jülich, Germany)

Co-authors: HERMANNE, Alex (Cyclotron Laboratory, Vrije Universiteit Brussel (VUB), B-1090 Brussels, Belgium); SCHOLTEN, Bernhard (Institut für Neurowissenschaften und Medizin, INM-5: Nuklearchemie, Forschungszentrum Jülich, D-52425 Jülich, Germany); COENEN, Heinz H. (Institut für Neurowissenschaften und Medizin, INM-5: Nuklearchemie, Forschungszentrum Jülich, D-52425 Jülich, Germany); SUDAR, Sandor (Institute of Experimental Physics, Debrecen University, H-4001 Debrecen, Hungary); QAIM, Syed M. (Institut für Neurowissenschaften und Medizin, INM-5: Nuklearchemie, Forschungszentrum Jülich, D-52425 Jülich, Germany)

Presenter: Dr UDDIN, Md. Shuza (Institut für Neurowissenschaften und Medizin, INM-5: Nuklearchemie, Forschungszentrum Jülich, D-52425 Jülich, Germany)

Session Classification: Production and Application of Radionuclides 1

Track Classification: Production and Application of Radionuclides