Contribution ID: **9** Type: **Verbal**

Optimisation of the long lived ¹²¹Te contaminant in production of ¹²³I trough the ¹²⁴Xe(p,x) route

Tuesday, 20 April 2010 04:00 (15 minutes)

At present the preferred route for ¹²³I (T_{1/2} = 13.2 h) production is bombardment of highly enriched ¹²⁴Xe with 35 MeV protons and taking advantage of the cascade decay ¹²³Cs-¹²³Xe-¹²³I. After irradiation the gas targets are allowed to cool for 7 h ensuring optimal in-growth of ¹²³I from its precursors. A separation of I from all other elements is performed resulting in a nca, pure solution.
An unavoidable contaminant is ¹²¹I (T_{1/2} = 2.12 h) produced by ¹²⁴Xe(p,alpha;) reaction with a cross section maximum around 20 MeV.
This rather short lived radioiodine will disappear quickly from the ¹²³I solution, but its long lived decay product ^{121g}Te (16.8 d) accumulates and impairs the late use (several half lives of ¹²³I after calibration date) of the solution.This situation could be improved by lowering the ¹²¹I production through limitation of the target thickness and imposing a higher exit energy.
As the only values for the ¹²⁴Xe(p,alpha;) reaction were reported by Tarkanyi et al. [1] at higher energy, reliable data on the excitation function need to be measured for the first time.
Highly enriched ¹²⁴Xe was bombarded with protons between 13 and 37 MeV with the double aim of determining cross sections for ¹²¹I production and resolving discrepancies existing in the previously published values for production of ¹²³Cs and ¹²³Xe [2].
Here only results for ¹²¹I are presented and compared with results from different theoretical codes.
In the experimental (and production) conditions formation of ¹²¹Cs and ¹²¹Xe are impossible or extremely low (practical threshold of 1 mb at 38 MeV [1]).
Direct formation of ^{121g}Te (16.8d) or ^{121m}Te (154d) through the (p,3pn) reaction are not of importance because of the needed chemical separation at EOB+ 7 h .
The cross sections for ¹²¹I production show a practical threshold at 9.5 MeV rising to a maximum of 13 mb at 21 MeV, not in agreement with theoretical results.
From a fit to our excitation curve, production yields for short irradiations on thick targets are calculated. The ¹²¹I activity present at the optimal cooling time is then calculated for different energy degradation in the target and for different irradiation times (up to 13 h, 1 half life of ¹²³I, saturation of ¹²¹I).
By comparing to the cumulative produced ¹²³I in the same irradiation conditions, the evolution of the relative activity of both ¹²¹I (decreasing in time) and ¹²¹Te (increasing in time) is calculated. By defining maximal admissible contaminations levels for late use of the ¹²³I solution, limits on target thickness are defined.

[1] F. Tarkanyi et al. , Applied Radiation and Isotopes, 42, 1991, p221
[2] IAEA TECDOC 1211, Vienna 2001.

Primary author: Prof. HERMANNE, Alex (Cyclotron, Vrije Universiteit Brussel)

Co-authors: Prof. IGNATYUK, Anatoly (Institute of Physics and Power Engineering (IPPE), Obninsk, Russia); Dr TARKANYI, Ferenc (Institute of Nuclear Research of the Hungarian Academy of Sciences (ATOMKI),

Debrecen, Hungary); Dr SCHWEICKERT, Hermann (Zyklotron AG ,Eggenstein, Germany); Mr ADAM REBELES, Razvan (Vrije Universiteit Brussel (VUB), Brussels, Belgium); Mr SPELLERBERG, S (3 Institut für Nuklearchemie, Forschungszentrum Jülich, Jülich, Germany); Dr TAKACS, Sandor (Institute of Nuclear Research of the Hungarian Academy of Sciences (ATOMKI), Debrecen, Hungary)

Presenter: Prof. HERMANNE, Alex (Cyclotron, Vrije Universiteit Brussel)

Session Classification: Production and Application of Radionuclides 1

Track Classification: Production and Application of Radionuclides