AN EFFICIENT [^{18}F]FLUORIDE PRODUCTION METHOD USING A RECIRCULATING ^{18}O WATER TARGET

Jean-Luc Morelle, Yves Jongen, Benoit Georges
Ion Beam Applications SA, Chemin du Cyclotron, 2
B-1348 Louvain-la-Neuve (Belgium)

Michel Cogneau, Daniel Labar
Laboratoire de Tomographie Par Positrons, U.C.L., Chemin du Cyclotron, 2
B-1348 Louvain-la-Neuve (Belgium)

ABSTRACT

A recirculating ^{18}O water target for ^{18}F production has been developed in Louvain-la-Neuve. The target material is fully recoverable and multicurie quantities of ^{18}F are extracted in a suitable chemical form for F.D.G. synthesis by the Kryptofix method.

INTRODUCTION

The feasibility of a totally automated, multicurie ^{18}F production system has been tested in Louvain-la-Neuve. The tested procedure comprises the following steps:

- irradiation
- cooling of the ^{18}O water in a heater exchanger
- adsorption of $^{18}F^-$ in an anionic column
- desorption and transfer of $^{18}F^-KF$ to an F.D.G. chemical synthesis module, and allows 100% recovery of enriched water.

EXPERIMENTAL EQUIPMENT DESCRIPTION

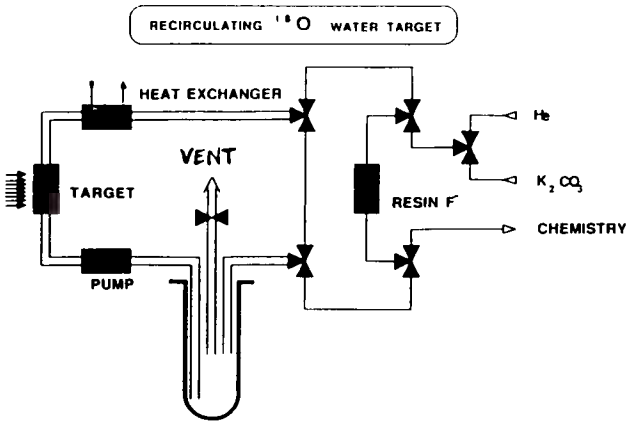

Figure 1

The target is a watercooled nickel cell, with two havar windows. The cavity's dimensions are 20 mm in diameter by 5 mm in depth, with a volume of 1.6 ml.

An H.P.L.C. pump (GILSON 302 - Head SC 100) is adapted to the system with two flow settings: 100 ml/min and 2 ml/min.

A gas-water separator allows the recuperation of radiolytic gases.

The column (1 mm diameter, 20 mm length) is filled with an anionic exchange resin (Merck Lewattit M5080).

The heat exchanger allows the ^{18}O water temperature to be maintained at 20°C.

PROCESS DESCRIPTION

The process has three steps:

1. Irradiation - the protons with an initial energy of 30 MeV enter the chamber at 23 MeV. The target water is circulated by the pump via the gas-water separator and is cooled by the heat exchanger. The flow rate for this step is 100 ml/min. The total volume of this first loop is 7 ml. Experiments are performed with 10% enriched water at different beam intensities for periods of an hour (4 μA, 12 μA and 20 μA).
2. Adsorption - the anionic exchange column is inserted in the loop, the low flow rate pushes the water through the column and the $^{18}F^-$ anions are adsorbed on the resin with 95% efficiency. Total recuperation of the target water is obtained with this method without heavy distillation.
3. Desorption - the column is flushed three times by 0.5 ml of a K_2CO_3 solution (4.6 mg/ml) and the $^{18}F^-$ anions are desorbed with a total efficiency of 96%.

The suitability of the $^{18}F^-$ is tested by the $^{18}F^-$ F.D.G. method.[1]

PRELIMINARY RESULTS

The results given below (Table I) were extrapolated to an enrichment level of 98.3%, and were found to be in good agreement with Van Bree et al.[2] However, a heat exchanger was not used in these first experiments which allowed only low beam intensities as are shown below.

Further experiments are planned during next weeks, and a heat exchanger will be inserted in the circuit, allowing us to reach higher beam intensities.

Beam intensity (μA)	Activity After 1 h (mCi)	Yield (mCi/μA)	Activity After 2 h (mCi)
4	300	178	450
12	850	168	1275
20	1200	142	1805
30	1800	142	2700

REFERENCES

1. Hamacker K., Coenen H., Stocklin G. (1986).
2. Van Bree N., Van den Broek J., van Genderen W., de Goeij J., Janssen A. (1988).