PRODUCTION OF HIGH-PURITY ^{123}I FOR CLINICAL AND RESEARCH PURPOSES

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The motivation for the production of high purity ^{123}I stems from its use in nuclear medicine. The advantages of its use compared to other radioisotopes have been thoroughly reviewed[1,2,3] along with the various means of its production.[4,5,6] The program at Indiana utilizes the $^{127}I(p,5n)^{123}Xe \xrightarrow{\beta+} {}^{123}I$ reaction on a pure ^{127}I "Self-Vapor Cooled" target system of the type described by Blue et al.[7] A complete description of the target and collection system can be found in last year's Technical Report.

The development effort on the target system was mainly aimed at improving the reliability and reusability of the ^{127}I target, which has a demonstrated ability of producing ^{123}I at a rate of 16 mCi/μAhr. A recent study by Paans et al.[8] has remeasured the $^{127}I(p,5n)^{123}Xe$ reaction cross section and estimated the maximum yield of ^{123}I from this reaction to be approximately 21 mCi/μAhr. Our measured rate is the amount removed from the trap, hence, the difference is believed to be caused by not completely removing all of the ^{123}I from the trap, as well as not collecting all the ^{123}Xe produced in the target.

The principle requirement of the target assembly for proper operation is to keep the temperature of the ^{127}I constant throughout bombardment. If the temperature is too low, such that the Iodine is not in liquid form, the ^{123}Xe produced does not readily escape the target material to be collected in the cold trap. On the other hand, a too high temperature will cause the Iodine to condense out of the target area, causing blockage of the helium gas lines, and eventually having no material in the target area. The difficulty arises because the temperature difference between these extremes is quite small (< 10°C). Beam intensities on target vary considerably from run to run and during any given 6 hour irradiation. Hence, a thermistor controlled temperature regulation unit is being installed on the present target to insure a constant temperature during irradiation.

Another improvement was made in the isotope production room with the installation of a multi-position foil changing system in the beam line upstream of the ^{127}I target. The system consists of two wheels of 9 positions each. Carbon foils of various thicknesses ranging from 4 to 26 mm are located in the target wheels to facilitate energy variations of the beam on target. The optimum proton beam energy on the ^{127}I target for ^{123}I production is 100 MeV. The use of this energy degrading system, however, will allow the use of any proton beam energy from 80 to 180 MeV for isotope production without requiring a cyclotron energy change.

Comparisons are currently being made between this target system and the ^{133}Cs self-vapor cooled target[9] (also described in this report) for the production of ^{123}I. The advantages of the ^{133}Cs target are that it does not have the stringent operating temperature requirements of the ^{127}I

target, and it can also be used to produce other radioxenon isotopes simply by changing the incident beam's energy. Its disadvantages are a reduced production rate and a higher level of contamination by neighboring radioiodines. Work is continuing on the ^{133}Cs target to determine the production rate and purity for ^{123}I.

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1) W. Meyers, Radioactive Pharmaceuticals, Proc. ORINS Symposium, Nov. 1965 (USAEC, Div. Tech. Inf., 1966), page 217.

2) H.N. Wellman et al., CRC Critical Reviews in Clinical Radiology and Nuclear Medicine, p. 81 (Feb. 1975).

3) Proc. Symposium on Applications of ^{123}I in Nuclear Medicine (Bureau of Radiological Health, Rockville, Md., 1975).

4) V.J. Sodd et al., Tech. Report BRH/DMRE 70-4 (Bureau of Radiological Health, Rockville, Md., 1970).

5) V.J. Sodd, Intern. Symp. on Radio Pharmaceuticals, Feb. 12-15, 1974.

6) M.A. Fusa et al., Journal of Nuclear Medicine 14, 729 (1972).

7) J.W. Blue et al., NASA Tech. Mem., NASA TMX-71620, Oct. 1974.

8) A.M.J. Paans et al., Int. Journal of Applied Radiation and Isotopes, Vol. 27, No. 8, 465 (1976).

9) D.L. Friesel et al., A Study of Radioxenon Production from Proton Bombardment of Metalic Cesium, This Report, p. 153.