and radiogaschromatography.

When injected intravenously in mice, the radioactivity accumulated in blood, liver, kidney and brain. The brain uptake was found to be about 2.5% of injected dose per gram tissue at 5 min after injection. This result suggests that ^{11}C-caffeine may be a useful brain scanning agent.

Large Scale Production of ^{11}C-Methanol—Precursor for ^{11}C-Labeled Organic Compounds

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Though ^{11}C-labeled organic compounds are expected to be very useful for clinical diagnosis, their practical uses are often confronted with difficulties, most of which are attributed to a short half life of ^{11}C (20.34 min). A large scale of precursors have to be produced for their synthesis, followed by the necessity of procedures rapid and remote-controlled techniques. We have made a try on a large scale production of ^{11}C-methanol, one of main precursors, for the purpose of a practical use of ^{11}C-labeled organic compounds.

$^{11}CO_2$ was produced by 9 MeV proton irradiation at 20 μA with the $^{14}N(p,\alpha)^{11}$ Creaction. Immediately after the end of irradiation, $^{11}CO_2$ was transferred in a current of a target gas of N_2 to the reaction apparatus. The synthetic procedures of $^{11}CH_3OH$ from $^{11}CO_2$ are as below. For an introduction of $^{11}CO_2$ into a $LiAlH_4$

$^{11}CO_2 \xrightarrow{(1)} LiAl(O^{11}CH_3)_4$: (1) 19 mg $LiAlH_4$ in 0.5 m*l* diethyl carbitol (0°C)

$LiAl(O^{11}CH_3)_4 \xrightarrow{(2)} {}^{11}CH_3OH$: (2) 0.7 m*l* carbitol (100°C)

solution, two methods were compared: (A) $^{11}CO_2$ was directly introduced into the $LiAlH_4$ solution from a target tube (100 m*l*/min), and (B) $^{11}CO_2$ was first collected in a silica gel trap at −78°C (500 m*l*/min), then released by heating to 170°C and carried by a current of N_2 into the $LiAlH_4$ solution. Carbitol was added to the solution and the temperature was immediately brought to 100°C. The resulting $^{11}CH_3OH$ was carried by a current of N_2 and collected in an acetone trap at −78°C. The purity was examined by radiogaschromatography.

For a large scale production, the method of (B) was superior to that of (A) in a $^{11}CH_3OH$ yield. The performance of the production was completed within 15 min after the EOB. The use of electric valves helped a rapid and remote-controlled synthesis of $^{11}CH_3OH$. The radiochemical yield of $^{11}CH_3OH$ was 74% and its radiochemical purity was more than 99.9%. It turned out that more than 800 mCi of $^{11}CH_3OH$ can be produced if a high pressure target (>10 atm) and a high incident energy (>15 MeV) are used.

The Production of Pure ^{123}I and the Possibility for the Clinical Application of ^{125}Xe

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It is known that ^{123}I has ideal characteristics for the diagnosis of thyroid gland. On the other hand ^{125}Xe is not known so widely, although it seems to be useful for the clinical diagnosis.

Pure ^{123}I without impurities other than <0.2% ^{125}I was produced by the ^{127}I (p, 5n) $^{123}Xe \xrightarrow{\beta^+, EC,\ 2.1\ h} {}^{123}I$ reaction with 60 MeV protons in 1.5 g/cm^2 NaI target. At the same time ^{125}Xe was obtained as by-products. To increase the yield of ^{123}I,

following modifications were applied; 1) The tube line for carrying produced radioactive xenons was exchanged from teflon to SUS 316 beause radioactive xenons were significantly absorbed on the teflon tube. 2) Immediately after the irradiation, the NaI target was dissolved with distilled water. Radioactive xenons remained in the target were purged off by bubbling a He gas into the solution. The yield of ^{123}I treated by the above procedure was increased up to 5.8 mCi/μA.h. (Max.; 7.5 mCi/μA.h).

For a clinical diagnosis the chemical forms of ^{123}I are very important. The effect of trapping materials on the final chemical forms of ^{123}I was therefore studied with liq. chromatograph. The radiochemical purity of $^{123}I^-$ was 85% with unused glass trap. But the value was gradually decreased to 26%, repeating the applications of the glass for trapping radioactive xenons. Coating the inner part of the used glass trap with H_3PO_2 or H_3PO_4, the value was increased to 67% and 54% respectively. In any cases the radiochemical purity of iodide treated by these methods is not enough for the clinical usages. The best way to obtain the highest purity of $^{123}I^-$ is as follows; 1) Purge out the undecayed radioactive xenons with a He gas and recover them into a balloon. 2) Elute the radioactive iodides from the trap with 1 m*l* of 0.02N-NaOH. 3) Add 5 μ mole of sodium thiosulfate into the eluate. 4) Heat gently the solution until the volume of the solution is reduced to one-half. The solution obtained in this way contained 99.6% of $^{123}I^-$.

At the same time ^{125}Xe was recovered with the yield of 8.4 mCi/μA.h at the end of bombardment. Clear images of phantom containing ^{125}Xe could be obtained.

Clinical Uses of I-123 Produced by ^{127}I (p, 5 n) ^{123}Xe to ^{123}I Reaction in NIRS

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I-123 has been currently supplied on commercial bases by The Nihon Medi-physics Company using $^{122}Te(d, n)^{123}I$ reaction. It was however reported that several radio-impurities were inevitable in minute amounts with this reaction. In recent, National Institute of Radiological Sciences (NIRS) in Japan has experimentally produced I-123 using high energy proton beams above 50 MeV and $^{127}I(p, 5n)^{123}Xe$ and ^{123}Xe—^{123}I reaction.

The purpose of this study is to examine physical properties and radio-impurities in I-123 products using both reactions and to evaluate their clinical advantages. The methods used composed of gamma-ray spectrometry and scintigrams of the thyroid phantom and the patient. NIRS I-123 showed no discernible radio-impurity except I-125 in 0.5% on a calibration time. Nihon Medi-physics I-123, however, revealed radio-impurities of I-124, I-125, I-126, I-130, and I-131. Increases of radio-impurities of long half-lives result in enhancement of radiation exposure to a patient administered. The absorbed dose in thyroid with both I-123 products was calculated as 1.3 times in NIRS and 5 times in Nihon Medi-physics more than that of pure I-123. The absorbed dose of total body also calculated as 1.09 and 1.5 times respectively. The thyroid scintigram, however, did not show perceptible differences between both I-123 products except a slight increase of body background counts seen in those of Nihon Medi-physics. This brought an impression of slightly better quality of scintigram with NIRS products.