Production of ^{11}C and ^{13}N Labeled Gases

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^{11}CO, $^{11}CO_2$ and $^{13}N_2$ are well known to be usefull for lung function study. They can be, however, used only at medical facilities equipped with cyclotrons because of their short half-lives (^{11}C; 20 min, ^{13}N; 10 min). We have investigated a rapid and contineous production method of these radioactive gases by using the NIRS Medical Cyclotron.

A target gas was held constant in the irradiation tube and it flowed out constantly from the tube together with produced radioactive gases, which was then purified by passing through reaction and absorption tubes, followed by analysis with a "on-line" radio-gaschromatograph. Energies of incident protons were 12 MeV and 15 MeV for the ^{11}C and ^{13}N production, respectively. A current of proton beams used in this study was 10 μA.

The ^{11}CO and $^{11}CO_2$ production The chemical form of the ^{11}C produced by the $^{14}N(p, \alpha)^{11}C$ reaction was observed to be chiefly ^{11}CO and $^{11}CO_2$, and they could be easily changed into either of them by passing through a CuO column at 700°C or a Zn column at 390°C for $^{11}CO_2$ or ^{11}CO, respectively. Radioactive concentrations were 40 μCi/m*l* for $^{11}CO_2$ and 35 μCi/m*l* for ^{11}CO at a N_2 flow rate of 100 m*l*/min. Radiochemical purity was more than 98% and radiochemical contaminants were $^{11}CH_4$ and $^{13}N_2$.

The $^{13}N_2$ production A mixed gas (CO_2: 90%, He: 10%) was used as a target. CO_2 was removed with NaOH from the target gas after passing through the irradiation tube, and then it contained 130 μCi of $^{13}N_2$ per 1 m*l* of He with more than 99.9% of radiochemical purity. Only $^{13}N_2O$ was found as impurity (less than 1%) which decreased with a longer irradiation.

Production of High Purity ^{123}I Wight ^{124}I Contaminant

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The $^{127}I(p, 5n)^{123}Xe(\beta^+, EC/2.1\ hr.)^{123}I$ reaction was used with 60 MeV protons to obtain high purity ^{123}I. About 10 MeV of the proton energy is lost in the target of 1.5 g/cm^2 NaI powder. A generator method in a single pass configuration similar to that of Sodd, et al., was used to separate the generated radioactive xenons from the target and a carrier He gas.

The ^{123}I activity recovered from the liquid N_2 trap was about 15 mCi at ~7 hr. after the irradiation of 2.5 hr with 1 μA. Radioactive contaminants except ^{125}I were not detected in the solution after purging with a fresh He gas, at a flow rate of 20 m*l*/min for 5 min and the ratio to that of ^{123}I was 0.1% at ~7 hr, after the end of bonbardment. Without this treatment, the eluate from the trap contained about 1% ^{125}Xe and 2×10^{-4} % ^{127}Xe in the final solution.

To obtain high purity ^{123}I, it is essential to treat the trap with a fresh He gas or to reflux the solution.