New method to prepare liquid Methyl Bromide labeled with ^{82}Br

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Keywords: methyl bromide, radiotracer

In a radiotracer investigation, it is crucial to the correct selection of the radiotracer. Parameters as the half-life, and the energy of the radiation emitted are essential to select an ideal radiotracer. When the study is in a gaseous phase, there are few options to select the radiotracer, for example, some radioisotopes the issue is the half-life (too long or too short); others are only β emmitters. The best choice for a gaseous radiotracer, is methyl bromide, (CH_3Br) labeled with ^{82}Br, due to its physical/chemical characteristics. In this study, Potassium Bromide (KBr) was irradiated in the nuclear reactor to produce the $K^{82}Br$ and used to synthesize the methyl bromide. Traditionally the synthesis is described by the equation (1) [1,2,3]:

$$2\,KBr+(CH_3)_2SO_4 \rightarrow 2\,CH_3Br+K_2SO_4 (1$$

The objective of this work was to synthesize liquid methyl bromide according to the reaction:

$$CH_3OH+H_2SO_4+KBr \rightarrow CH_3Br\;KHSO_4$$

Radioactive methyl bromide is produced by mixing 12.0 ml of methanol (CH_3OH) and 3.0 ml of sulfuric acid (H_2SO_4) solution (9.0 M). After stirring and cooling, the mixture was transferred to do synthesis reactor. This reactor was immersed in a cooling bath and the temperature was slowly lowered to 2.0° C. With magnetic stirring, a solution (4.0 M) with the irradiated KBr salt was slowly dripped, and the cooling bath temperature of the reactor was raised to 4.0°C, the CH^3Br boiling point. The methyl bromide vapors liquefy inside the Friedrichs condenser and drip into the collector flask (immersed in an ice bath). The liquid methyl bromide was transferred to the radiotracer collector using a 3-way stopcock valve and a syringe. The apparatus to process the synthesis is shown in Figure 1.

Figure 1: Glass device for synthesizing the radioactive methyl bromide tracer consisting of four parts: (1) Synthesis vessel, (2) Dropping funnel and (3) Friedrichs condenser.

Using this procedure was possible to prepare the radioactive methyl iodine solution at a yield of about 70%. The radiotracer collector (Figure 2) is a device used to store and transport gases at high pressure where.

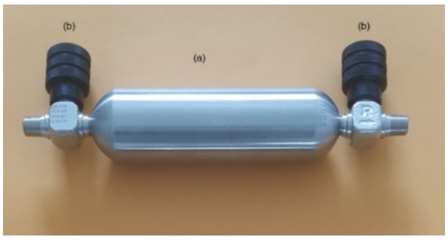

Figure 2: Collector bottle. (a) stainless steel cylinder with two outlets and (b) needle valve

For this, the radiotracer collector was heated for six hours at a temperature of 80° C and the vacuum was made using a mechanical vacuum pump. Inside the radiotracer collector, the methyl bromide volatilizes and is transformed into a gaseous radiotracer.

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