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CARRIER-FREE RADIOISOTOPES FROM CYCLOTRON TARGETS  
III. PREPARATION AND ISOLATION OF Sb<sup>122,124</sup> FROM TIN

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CARRIER-FREE RADIOISOTOPES FROM CYCLOTRON TARGETS  
 III PREPARATION AND ISOLATION OF  $\text{Sb}^{122,124}$  FROM TIN<sup>1</sup>

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Deuteron bombardment of tin produces  $^3\text{Sb}^{122,124}$  by the nuclear reactions  $\text{Sn}^{122}(\text{d},2\text{n})\text{Sb}^{122}$ ,  $\text{Sn}^{124}(\text{d},2\text{n})\text{Sb}^{124}$ . The present paper reports a carrier-free method of isolating these activities from the target element and from the radioisotopes of indium (n,p) and cadmium (n, $\alpha$ ) which are formed concurrently by secondary neutrons produced by the 19 Mev deuteron beam of the 60-inch medical cyclotron at Crocker Laboratory. Other possible<sup>4</sup> shorter-lived radioisotopes of antimony were allowed to decay out prior to the chemical separation.

The target was a block of C.P. tin, soft soldered to a water-cooled copper plate. It was bombarded with 19 Mev deuterons for a total of 83.1  $\mu\text{a-hr}$  in the 60-inch cyclotron at Crocker Laboratory. The bombarded surface was removed by milling.

0.5 gram of turnings were dissolved in a minimum volume of aqua regia. 12 N HCl was added to destroy excess  $\text{HNO}_3$  and the solution was diluted to approximately 25 ml of 0.1 N HCl. 10 mg of cadmium were added and precipitated with  $\text{H}_2\text{S}$  after addition of 1 gm. of oxalic acid to prevent<sup>5</sup> precipitation of tin sulfide.

- (1) This document is based on work performed under auspices of the Atomic Energy Commission.
- (2) Lieutenant Colonel, U. S. Army, now stationed at Walter Reed Hospital, Washington, D.C.
- (3) J. J. Livingood and G. T. Seaborg, Phys. Rev. 55 667 (1939)
- (4) G. T. Seaborg and I. Perlman, Rev. Mod. Phys. 20 585 (1948)
- (5) F. P. Treadwell and W. T. Hall, Analytical Chemistry Vol. II, John Wiley & Sons, New York, 1942

The antimony activity carried quantitatively. The CdS was dissolved in HCl plus oxalic acid, reprecipitated with H<sub>2</sub>S, dissolved in a minimum volume of 12 N HCl and transferred to an all-glass distilling flask<sup>6</sup>. 15 ml of 60% HClO<sub>4</sub> were added and traces of tin were distilled<sup>7</sup> at 200° C. during the gradual addition of 10 ml of 12 N HCl. Approximately 98% of the carrier-free antimony remained in the residue. The antimony activity was then distilled with the gradual addition of 10 ml of 40% HBr. The distillate contained 95% of the Sb<sup>122,124</sup>. Indium and cadmium were retained in the residue.

To obtain carrier-free radio-antimony in isotonic saline for subsequent biological investigation, the distillate was treated with aqua regia to destroy HBr and evaporated to dryness on 40 mg of NaCl. The activity dissolved quantitatively with the addition of 5 ml of distilled water.

The decay curve was followed for 300 days and showed two periods: 2.8 day Sb<sup>122</sup> and 60-day Sb<sup>124</sup>. One month after bombardment, the activity contained only 60-day Sb<sup>124</sup>; mass absorption measurements in Pb showed the 1.7 Mev gamma ray previously reported<sup>7</sup>. A tracer amount of carrier-free antimony was added to a solution containing milligram amounts of tin, antimony and indium; the antimony fraction was separated chemically<sup>5</sup> and contained 98% of the activity.

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(6) J. A. Scherrer, J. Research Natl. Bur. Standards, 21 95 (1938)

(7) W. Rall and R. G. Wilkinson, Phys.Rev. 71, 321 (1947)

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