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CARRIER-FREE RADIOISOTOPES FROM CYCLOTRON TARGETS
VI - PREPARATION AND ISOLATION OF $Ag^{105,106,111}$ FROM PALLADIUM

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CARRIER-FREE RADIOISOTOPES FROM CYCLOTRON TARGETS VI - PREPARATION AND ISOLATION OF $Ag^{105,106,111}$ FROM PALLADIUM[1]

Herman R. Haymond, Kermit H. Larson, Roy D. Maxwell[2], Warren M. Garrison and Joseph G. Hamilton.

Crocker Laboratory and Divisions of Medical Physics, Experimental Medicine, and Radiology; Radiation Laboratory; University of California, Berkeley, California

Radioactive silver, produced by bombardment of palladium with 19 Mev deuterons, has been isolated without added isotopic carrier. Four long-lived radioisotopes of silver[3] are produced in a thick target by (d,n) and (d,2n) reactions with deuterons of this energy: 45-day Ag^{105}, 8.2-day Ag^{106}, 225-day Ag^{110} and 7.5-day Ag^{111}. Radioactive rhodium and radioactive ruthenium are also produced by (n,p) and (n,α) reactions respectively. The carrier-free radio-silver was separated from the target element and from the radioisotopes of rhodium and palladium by a precipitation technique using mercurous chloride as the co-precipitant.

A C.P. palladium metal target (1/4" Pd strip, soldered to a water-cooled copper plate with a silver-free hard solder) was bombarded with 19 Mev deuterons for a total of 200 μa-hr. at an average beam intensity of 20 μa. The irradiated surface was milled off (approximately 0.5 gm. of Pd) and dissolved in aqua regia. The solution was evaporated to dryness and dissolved in 500 ml of 0.5 N HCl containing 50 mg. each of rhodium and ruthenium hold-back carrier.

0.5 ml of a saturated solution of mercurous nitrate was added while the solution was stirred vigorously. The precipitate of Hg_2Cl_2 containing over 95% of the radio-silver was centrifuged, washed with 0.5 N HCl and dissolved in a minimum volume of 16 N HNO_3. 200 mg of Na_2SO_4 were added and the solution was

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(1) This document is based on work performed under the auspices of the Atomic Energy Commission.

(2) Lieutenant Colonel, U. S. Army, now stationed at Walter Reed Hospital, Washington, D. C.

(3) G. T. Seaborg and I. Perlman, Rev. Mod. Phys. 20 585 (1948)

evaporated to dryness in a porcelain dish which was then heated to 450°C. for two hours to drive off the mercury carrier. The activity was quantitatively soluble in 10 ml of distilled water to give an isotonic saline solution of carrier-free radio-silver which was used in subsequent biological experiments.

The radio-silver was identified by half-life determinations, absorption measurements and by chemical separation with carrier. The decay was followed for 200 days and showed the approximately 8-day[4,5] period of $Ag^{106,111}$ and the 45-day[6] period of Ag^{105}. One month after bombardment the activity showed only the 45-day period. After 150 days the decay curve began to level off, presumably into the 225-day[7] period of Ag^{110}; aluminum absorption measurements one week after bombardment showed the approximately 1.0 Mev beta particle previously reported[8,9] for Ag^{106} and Ag^{111}; a tracer amount of activity added to a solution of Pd, Rh, Ru and Ag in carrier amounts was quantitively precipitated with the AgCl fraction.

We wish to thank the 60-inch cyclotron crew for the bombardments and target preparations, and Professor G. T. Seaborg for helpful suggestions.

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(4) J. D. Kraus and J. M. Cork, Phys. Rev. 52 763 (1937)

(5) M. L. Pool, Phys. Rev. 53 116 (1938)

(6) T. Enns, Phys. Rev. 56 872 (1939)

(7) J. J. Livingood and G. T. Seaborg, Phys. Rev. 54 88 (1938)

(8) N. Feather and J. V. Dunworth, Proc. Roy. Soc. (London) A 168, 566 (1938)

(9) E. P. Steinberg, Plutonium Project Report, cc-1331, p. 23 (Feb. 1944)

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