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

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

September 1949

Berkeley, California

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Radioactive silver, produced by bombardment of palladium with 19 Mev deuterons, has been isolated without added isotopic carrier. Four long-lived radioisotopes of silver³ are produced in a thick target by (d,n) and (d,2n) reactions with deuterons of this energy: 45-day Ag¹⁰⁵, 8.2-day Ag¹⁰⁶, 225-day Ag¹¹⁰ and 7.5-day Ag¹¹¹. 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 μ a-hr. at an average beam intensity of 20 μ a. 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 Hg₂Cl₂ containing over 95% of the radio-silver was centrifuged, washed with 0.5 N HCl and dissolved in a minimum volume of 16 N HNO₃. 200 mg of Na₂SO₄ 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-day⁶ period of Ag¹⁰⁵. 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-day⁷ period of Ag¹¹⁰; aluminum absorption measurements one week after bombardment showed the approximately 1.0 Mev beta particle previously reported^{8,9} for Ag¹⁰⁶ and Ag¹¹¹; a tracer amount of activity added to a solution of Pd, Rh, Ru and Ag in carrier amounts was quantitatively 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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