Title

CARRIER-FREE RADIOISOTOPES FROM CYCLOTRON TARGETS XXIII. PREPARATION AND ISOLATION OF Rh100A|lA02>105 FROM RUTHERNIUM

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XXIII. PREPARATION AND ISOLATION OF $Rh^{100,101,102,105}$ FROM RUTHENIUM*

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Radioactive rhodium, produced by the bombardment of ruthenium with 19-Mev deuterons, has been isolated without added isotopic carrier. Several radioisotopes of rhodium(1) are produced by (d,n) and (d,2n) reactions with deuterons of this energy: 19-hour Rh^{100}, 4.3-day Rh^{101}, 210-day Rh^{102}, and 37-hour Rh^{105}, and short-lived Rh^{103} and Rh^{104}. The target was aged a few days to allow Rh^{103} and Rh^{104} to decay out prior to chemical separation. Small amounts of technetium are also produced concurrently by (n,p) reaction.

A 2 mm layer of C.P. ruthenium powder,(2) supported on a grooved water-cooled copper plate by a 0.25 mil platinum foil, was bombarded for 35 μa-hr. at an average beam intensity of 5.5 μa. The ruthenium powder was fused with 10 g of Na_2O_2 in a nickel crucible at 300° C. for 30 minutes. The small amount of Tc produced is lost in this step. The fused mass was dissolved in aqua regia with heating and the insoluble material centrifuged out. The solution was made basic with KOH, heated to approximately 100° C., and Cl_2 gas was bubbled through to volatilize the target ruthenium as RuO_4. The residue containing the radioactive rhodium and nickel which was dissolved from the crucible during fusion,

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* This document is based on work performed under Contract No. W-7405-eng-48-A for the AEC.

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

(2) Spectrographic analysis of Ru powder showed less than .017 per cent Rh.

was centrifuged out and found to carry 95 per cent of the radio-rhodium. The precipitate of nickel hydroxide was washed with water and dissolved in a minimum volume of dilute HNO_3. Five mg of Fe^{+3} were added to the acid solution and the $Fe(OH)_3$ precipitated with NH_4OH, which carried the active rhodium quantitatively and left the nickel in solution as $Ni(NH_3)_6^{++}$. The $Fe(OH)_3$ was reprecipitated twice, carrying the activity completely each time. The iron was dissolved in 6 N HCl and extracted with ethyl ether. The aqueous phase containing HCl and the active rhodium was evaporated to dryness on 50 mg of NaCl and dissolved quantitatively in 5 ml of distilled water.

The decay curve was followed for 200 days and showed three periods:(3) 37-hour Rh^{105}, 4.3-day Rh^{101}, and 210-day Rh^{102}. Twenty days after bombardment the decay curve showed the single period of 210-day Rh^{102}. Mass absorption measurements in aluminum and lead two days after bombardment showed the 0.78-Mev beta-particles of Rh^{105}, and the 0.35-Mev and 0.33-Mev gamma-rays of Rh^{101} and Rh^{105} respectively. Milligram amounts of Ru and Rh were added to an aliquot of the preparation. The rhodium fraction was separated chemically and contained 98 per cent of the activity.

We wish to thank Professor G. T. Seaborg for helpful suggestions, Mr. B. Rossi and the staff of the 60-inch cyclotron at Crocker Laboratory for bombardments, and Miss Margaret Gee for technical assistance in counting.

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(3) W. H. Sullivan, N. R. Sleight, and E. M. Gladrow - P.P.R., CC-1493,(1944).