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CARRIER-FREE RADIOISOTOPES FROM CYCLOTRON TARGETS XXVI. PREPARATION AND ISOLATION OF W181 FROM TANTALUM

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XXVI. PREPARATION AND ISOLATION OF W¹⁸¹ FROM TANTALUM

Jeanne D. Gile, Warren M. Garrison and Joseph G. Hamilton

September 19, 1951

Berkeley, California

CARRIER-FREE RADIOISOTOPES FROM CYCLOTRON TARGETS
XXVI. PREPARATION AND ISOLATION OF W^{181} FROM TANTALUM*

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September 19, 1951

Deuteron bombardment of tantalum produces the 140-day W^{181}
by the nuclear reaction ⁽¹⁾ $Ta^{181}(d,2n)W^{181}$. This paper reports a
radiochemical isolation of carrier-free W^{181} from a tantalum target
bombarded with 19 Mev deuterons in the 60-inch cyclotron at Crocker
Laboratory. Other possible concurrent reactions include formation of
radioisotopes of tantalum by the (d,p) reaction and hafnium by the
(n,p) reaction.

The target, a circular plate of tantalum metal ⁽²⁾ approximately
10 mils thick, mounted in a bell-jar type of target assembly, was bombarded
with 19 Mev deuterons for a total of 500 microampere-hours at an average
beam intensity of 20 microamperes. The back of the tantalum foil was
cooled with a stream of cold water. After bombardment, the tantalum
foil was trimmed and the inactive metal discarded. The tantalum was
dissolved in a minimum volume of 16 N HNO_3 containing 10 percent HF by

*This document is based on work performed under Contract No. W-7405-eng-48-A
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(1) G. T. Seaborg and I. Perlman, Rev. Mod. Phys. 20, 585 (1948)

(2) Spectrographic analysis of tantalum foil showed it to be tungsten-free.

volume in a platinum evaporating dish. The HF was removed by boiling with 36 N H₂SO₄ and the cooled acid solution poured slowly into an excess of 20 per cent NaOH with constant stirring. The precipitate was digested for 30 minutes and the tantalum hydroxide separated by centrifugation with repeated reductions in volume of the basic solution. The carrier-free tungsten was retained in the supernatant. This process was repeated three times to insure complete removal of the radio-tungsten from the tantalum target. The combined supernatants were evaporated to a small volume, the Na₂SO₄ formed by evaporation was centrifuged out, and the radio-tungsten was recovered in the supernatant. The basic solution was acidified with HCl, 5 mg of Fe⁺³ were added and the solution carefully brought to pH 4 with NaOH. At this pH the Fe(OH)₃ carries the radio-tungsten quantitatively. Three such precipitations were done to insure the complete removal of any tantalum present. The Fe(OH)₃ was dissolved in 6 N HCl and the iron extracted with ethyl ether. The aqueous phase containing HCl and W¹⁸¹ was evaporated to dryness on 20 mg NaCl. The activity dissolved quantitatively in distilled water.

The decay curve was followed for 130 days and showed the 140-day half-life of W¹⁸¹. Mass absorption measurements in aluminum and lead showed the 0.07 Mev conversion electron and the 0.13 Mev and 1.8 gamma rays previously reported for W¹⁸¹ (3). A trace amount of carrier-free tungsten was added to a solution containing milligram amounts of tungsten, tantalum and hafnium= the tungsten 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 crew of the 60-inch cyclotron at Crocker Laboratory for bombardments, and Miss Margaret Gee for technical assistance in counting.

(3) G. Wilkinson, Nature, 160, 864 (1947)