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CARRIER-FREE RADIOISOTOPES FROM CYCLOTRON TARGETS XVIII. PREPARATION AND ISOLATION OF Cr^{51} FROM VANADIUM

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

May 18, 1951

Berkeley, California

CARRIER-FREE RADIOISOTOPES FROM CYCLOTRON TARGETS XVIII. PREPARATION AND ISOLATION OF Cr^{51} FROM VANADIUM*

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

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May 18, 1951

Deuteron bombardment of vanadium produces 26-day Cr^{51} (1) by the nuclear reaction $V^{51}(d,2n)Cr^{51}$. This paper reports a radiochemical isolation of carrier-free Cr^{51} from a vanadium target which had been bombarded with 19 Mev deuterons from the 60-inch cyclotron at the Crocker Laboratory. The possible radioisotopes of titanium (from the n,p and d,2p reactions) and scandium (from the n,α reaction) were allowed to decay out prior to the separation.

A 2 mm layer of "chromium-free" vanadium (2) powder supported on a grooved water-cooled copper target plate by a 0.25 mil tantalum foil was bombarded for 100 microampere hours at a beam intensity of 8 microamperes. After aging, the bombarded vanadium was dissolved in a minimum volume of 6N HNO_3. Ten milligrams of Fe^{+++} were added and the solution was slowly poured into an excess of boiling 10 percent NaOH solution. The Cr^{51} carried quantitatively on the $Fe(OH)_3$ precipitate which was then redissolved and reprecipitated as above. Three such cycles were required to remove last traces of sodium vanadate. The final $Fe(OH)_3$ precipitate containing the Cr^{51} was redissolved in 6N HNO_3 previously saturated with Br_2 and reprecipitated by the addition of dilute

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

(2) Spectrographic analysis showed less than 0.001% of chromium to be present.

NaOH. The temperature of the solution was maintained at approximately 90°C. Under these conditions, the carrier-free Cr^{51} as chromate was retained in the solution which was then made 1 N in HNO_3 and saturated with SO_2, 2 milligrams of Fe^{+++} was added and precipitated by the addition of dilute NH_4OH. The $Fe(OH)_3$ precipitate containing the Cr^{51} was washed, dissolved in 6N HCL and Fe was extracted with ether. The HCl solution was evaporated to dryness on 20 milligrams of NaCl. The carrier-free Cr^{51} was re-dissolved quantitatively in 2 ml of water at pH 5 to give an isotonic saline solution for biological investigation.

The activity was identified by half-life determinations, by absorption measurements and by chemical separation with added carriers. The decay curve was followed for 5 half-lives and showed a single period of 26 days which agrees with previously published values[3,4]. Absorption measurements in lead showed the 0.32 Mev gamma ray reported[5,6] for Cr^{51}. In a chemical separation using added Cr, V, Ti and Sc carriers, over 98 percent of the activity was recovered in the Cr fraction.

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

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(3) H. H. Hopkins, Jr., Phys. Rev. 77 717 (1950)

(4) H. H. Hopkins, Jr. and B. B. Cunningham, Phys. Rev. 73 406 (1948)

(5) F. N. D. Kurie and M. Ter-Pogossian, Phys. Rev. 74 677 (1948)

(6) B. D. Kern, A. C. G. Mitchell and D. J. Zaffarano, Phys. Rev. 76 94 (1949)