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CARRIER-FREE RADIOISOTOPES FROM CYCLOTRON TARGETS

XV. PREPARATION AND ISOLATION OF Mn^{32} FROM CHROMIUM*

Herman R. Haymond, Warren M. Garrison and Joseph G. Hamilton

December 4, 1950

Berkeley, California

CARRIER-FREE RADIOISOTOPES FROM CYCLOTRON TARGETS XV. PREPARATION AND ISOLATION OF Mn^{52} FROM CHROMIUM*

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December 4, 1950

Deuteron bombardment of chromium produces[1] three radioisotopes of manganese (46-min Mn^{51}, 6.5-day and 21-min Mn^{52}, and 310-day Mn^{54}) by (d,n) and (d,2n) reaction. This paper describes a radiochemical procedure used in isolating carrier-free radio-manganese (6.5-day Mn^{52}) from a chromium target which had been bombarded with 19 Mev deuterons in the 60-inch cyclotron at Crocker Laboratory. The Mn^{51} and Mn^{52m} had decayed out prior to chemical separation. The 310-day period of Mn^{54} was not observed, presumably due to the low abundance of $Cr^{53,54}$. Other possible concurrent reactions include the formation of radio-vanadium by (d,α) reaction and radio-titanium by (d,αp) reaction. A quantitative separation from vanadium is obtained with the procedure described here. Radio-titanium, Ti^{51}, was not detected.

Spectrographically-pure[2] chromium powder, supported on a water-cooled aluminum target plate by 0.25 mil platinum foil, was bombarded for 20 μa-hr. at a beam intensity of 10 μa. After bombardment, the chromium powder (approx. 1 gm.) was dissolved in a minimum volume of 12N hydrochloric acid and the resultant solution was evaporated to incipient dryness. Twenty milligrams of ferric chloride were added and the chromic chloride containing the

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

[2] Manganese was not detected by spectrographic analysis.

carrier-free radio-manganese was re-dissolved in 50 ml of 1N hydrochloric acid. This solution was then added with stirring to 200 ml of 2.5N sodium hydroxide solution previously saturated with bromine. Under these conditions, the carrier-free radio-manganese, presumably in the tetrapositive state, is quantitatively carried on the ferric hydroxide precipitate[3]. Chromium and vanadium are retained in the supernatant. Two additional reprecipitations were made to insure complete separation. The ferric hydroxide was washed, dissolved in 6N hydrochloric acid and iron was extracted with ethyl ether. The solution of carrier-free radio-manganese in 6N hydrochloric acid was evaporated to dryness after the addition of 5 ml of isotonic saline solution. The activity dissolved quantitatively with the addition of 5 ml of water.

The decay curve was followed for eight half-lives and showed a single period of 6.2 days which agrees closely with the reported[4] value for Mn^{52}. Absorption measurements in aluminum showed the assigned[5] 0.6 Mev positron. The activity was further identified by chemical separations using manganese, chromium, vanadium and titanium carriers. Over 99 percent of a sample of the activity was recovered in the manganese fraction.

We wish to thank Mr. T. Putnam, Mr. G. B. Rossi and the crew of the 60-inch cyclotron for bombardments and Professor G. T. Seaborg for his continued interest in this work.

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[3] Maxwell, Gile, Garrison and Hamilton, J. Chem. Phys. 17 1340 (1949)

[4] J. J. Livingood and G. T. Seaborg, Phys. Rev. 54 391 (1938)

[5] W. C. Peacock and M. Deutsch, Phys. Rev. 69 306 (1946)