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# CARRIER-FREE RADIOISOTOPES FROM CYCLOTRON TARGETS XVII. PREPARATION AND ISOLATION OF $Fe^{59}$ FROM COBALT

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

May 18, 1951

Berkeley, California

# CARRIER-FREE RADIOISOTOPES FROM CYCLOTRON TARGETS XVII. PREPARATION AND ISOLATION OF $Fe^{59}$ FROM COBALT*

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The radionuclide, $Fe^{59}$, produced by the nuclear reaction[1] $Co^{59}(d,2p)$ has been isolated without the use of added isotopic carrier by a separation procedure based on the observation that $Fe^{59}$ forms radiocolloidal aggregates[2] which may be removed by filtration. The radio-iron was produced by bombarding a cobalt metal target with 20 Mev deuterons in the 60-inch cyclotron at the Crocker Laboratory. The only other transmutation products formed concurrently by deuteron bombardment of cobalt include 2.6-hr. $Mn^{56}$(from n,α reaction) which was allowed to decay out prior to chemical separation and approximately $10^5$-year $Ni^{59}$ (from d,2n reaction) which is too long-lived to be produced in detectable amounts by the bombardments reported here.

The target was 10 mil thick foil of "iron-free" cobalt[3] silver-soldered to a water-cooled copper probe. Approximately 100 milligrams of the bombarded surface was removed by dissolution in 12 N HCl. After centrifugation, the solution was diluted with an equal volume of water and neutralized to pH 9 with 15 N $NH_4OH$ to give a clear "solution" which was slowly drawn through a Whatman No. 50 filter paper. The carrier-free $Fe^{59}$ was quantitatively retained

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

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

(2) O. Hahn, Applied Radiochemistry, Cornell University Press, Ithaca, New York (1936)

(3) The cobalt target was prepared by Mr. R. W. Dunn of the Donner Laboratory, Spectrographic analysis showed the iron content to be less than 20 p. p. m.

on the filter as adsorbed radio-colloid. The filter was washed first with dilute $NH_4$ OH until Co could not be detected in the filtrate and then washed with distilled water. Over 98 percent of the $Fe^{59}$ remained on the filter paper. The activity was then removed with 6 N HCl solution which was evaporated to incipient dryness and diluted to 0.1 N at which pH the $Fe^{59}$ remained in true solution.

The $Fe^{59}$ was identified by the assigned 46-day[4] half-life and by the 0.46 Mev and the 0.26 Mev beta particles which have been reported[5]. The gamma radiation had a half-thickness in lead of 11 $gm/cm^2$ which agrees with the previous observations[5]. Chemical separation of an aliquot amount of the activity in the Fe fraction after the addition of Ni, Co, Fe and Mn carriers further identified the activity as $Fe^{59}$.

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

(5) M. Deutsch, J. R. Downing, L. G. Elliott, J. W. Irvine, Jr., and A. Roberts, Phys. Rev. 62 3 (1942)