Title

CARRIER FREE RADIOISOTOPES FROM CYCLOTRON TARGETS X. PREPARATION AND ISOLATION OF Mg27 FROM ALUMINUM

Authors

Haymond, H.R.
Bowers, J .Z.
Garrison, W.M.
et al.

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

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CARRIER-FREE RADIOISOTOPES FROM CYCLOTRON TARGETS. X. PREPARATION AND ISOLATION OF Mg^{27} FROM ALUMINUM.*

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

May 8, 1950

Crocker Laboratory, Radiation Laboratory, and Divisions of Medical Physics, Experimental Medicine, and Radiology; University of California, Berkeley and San Francisco, California.

The 10.2 min. Mg^{27} was produced from aluminum by the nuclear reaction $Al^{27}(d,2p)Mg^{27}$ using the 20 Mev deuteron beam of the 60-inch cyclotron at the Crocker Laboratory. With deuterons of this energy, 14.8 hr Na^{24} is also produced in comparable yield by the reaction, $Al^{27}(d,\alpha p)Na^{24}$. Other possible[1] concurrent reactions produce radioisotopes having half-lives of only a few seconds, with the exception of the 2.3 min. Al^{28}. The separation described here is based on our observation that carrier-free Mg^{27} in alkaline solution forms radio-colloidal aggregates[2,3] which may be removed by filtration.

A block of "magnesium-free" aluminum[4] was clamped to a water-cooled aluminum target plate and bombarded for 10 minutes at an average beam intensity of 10 μa. The bombarded surface (approx. 0.2 gm.) was removed by dissolution in 50 ml of hot 10 percent sodium hydroxide. This solution containing sodium aluminate, sodium hydroxide and radio-colloidal Mg^{27} was diluted with an equal volume of water and drawn through two consecutive Whatman No. 50 filter papers. The first paper retained over 95 percent of the carrier-free Mg^{27} as adsorbed radio-colloid. This was washed with 5 percent sodium hydroxide until aluminum could not be detected in the filtrate followed by distilled water to remove the sodium hydroxide retained in the filter paper. Less than 5 percent of the magnesium

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[1] G. T. Seaborg and I. Perlman, Phys. Rev. 52 777 (1937)

[2] O. Hahn, Applied Radiochemistry, Cornell University Press, Ithaca, New York, 1936.

[3] M. H. Kurbatov and J. D. Kurbatov, J. Chem. Phys. 13, 208 (1945)

[4] Spectrographic analysis showed less than .001% magnesium.

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

activity was lost during the washing. The Mg^{27} was then removed from the filter paper with a minimum volume of 0.1 N hydrochloric acid which on neutralization gave an isotonic solution of carrier-free radio-magnesium for biological investigations. Corrected for decay, a yield of 2.5 millicuries per micro-ampere hour was obtained.

The decay curve was followed for 15 half-lives and showed a single period of 10.7 min. which agrees closely with previously reported values[5,6]. Absorption measurements in aluminum showed the 1.8 Mev beta particle assigned[7] to Mg^{27}. The activity was further identified by chemical separation through the use of aluminum, sodium and magnesium carriers.

We wish to thank Mr. T. Putnam, Mr. 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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5 M. C. Henderson, Phys. Rev. 48, 306 (1935)

6 S. Eklund and N. Hole, Arkiv. Mat. Astron. Fys. 29A, 4, No. 26 (1943)

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