J.RADIOANAL.NUCL.CHEM.,LETTERS 145 /5/ 361-368 /1990/

REDETERMINATION OF SEVERAL HALF-LIVES

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Received 4 June 1990
Accepted 11 June 1990

The half-lives of ^{41}Ar, ^{80m}Br, ^{94m}Nb, ^{101}Mo, ^{101}Tc, ^{109}Pd, ^{109m}Pd, ^{122}Sb, ^{123m}Sn, ^{152m}Eu and ^{239}Np have been measured more accurately compared to previous measurements.

INTRODUCTION

The half-lives of 12 nuclides accessible at the on-campus research reactor of the Centre de Recherches Nucléaires of Strasbourg have been remeasured more accurately compared to previous values. Previously 39 other nuclides have been investigated in a similar manner[1]. Even-

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tually, all of these half-lives will be cited in the forthcoming project "Nuclides Chart-Strasbourg 1990" /Ref. 2/.

EXPERIMENTAL

The isotopes were obtained by $|n_{th},\gamma|$ reactions. The samples were irradiated at the core of the reactor where the thermal neutron flux was 1.1×10^{12} $n.cm^{-2}.sec^{-1}$. Half-lives were extracted from the decay curves of the most intense γ-rays following β^- decay of EC/β^+ decay, or isomeric transition. Single γ-ray spectra were recorded with a 85 cm^3 coaxial HP/Ge detector for all investigations except that of the 37.1 keV γ-ray of ^{80m}Br where a 45 mm diameter 5 mm thick NaI/Tl/ detector was employed. The FWHM resolution of the Ge detector was 1.8 keV for the 1333 keV γ-ray of ^{60}Co.

Table 1 summarizes some of the experimental details.

The sample to produce ^{41}Ar consisted of air in polyethylene cylinder having a volume of about 50 cm^3 which was irradiated for 10 min. The nuclei ^{101}Tc and ^{239}Np were produced by β^- decay of ^{101}Mo and ^{239}U, respectively. Counting of these two isotopes began following a cooling off period of three half-lives of the parent.

RESULTS

Figures 1-4 show the decays of several γ-ray peaks as a function of time. The weighted averages of the half-lives extracted from a least squares fitting to such curves are given in Table 2. Substantial improvements of half-lives have been made in the present investigation.

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TABLE 1

Sample, irradiation and counting times

Sample	Isotopic abundance, %	Quantity of sample, mg	Irradiation time, min	Product nucleus investigated	Counting interval
$C^{79}Br_4$	50.7	15	6	^{80m}Br	2.5 h
$^{93}Nb_2O_5$	100	50	3	^{94m}Nb	4.25 min
^{100}Mo	9.6	50	3	^{101}Mo	10.25 min
				^{101}Tc	10.25 min
^{108}Pd	90	20	2	^{109}Pd	6.0 h
				^{109m}Pd	2.25 min
$^{121}Sb_2O_3$	57.3	50	3	^{122}Sb	12.0 h
				^{122m}Sb	3.25 min
$^{122}SnO_2$	92.2	10	2	^{123m}Sn	20.25 min
$^{151}Eu_2O_3$	47.8	50	1	^{152m}Eu	4.5 h
$^{238}UO_2/NO_3/_2$	99.3	12	2	^{239}Np	4.25 h

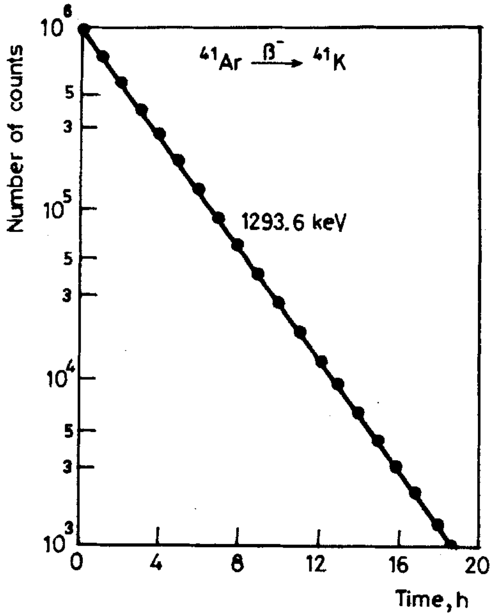

Fig. 1. Decay curve of ^{41}Ar

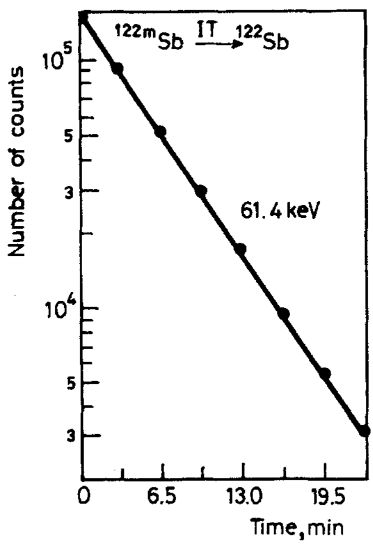

Fig. 2. Decay curve of ^{122m}Sb

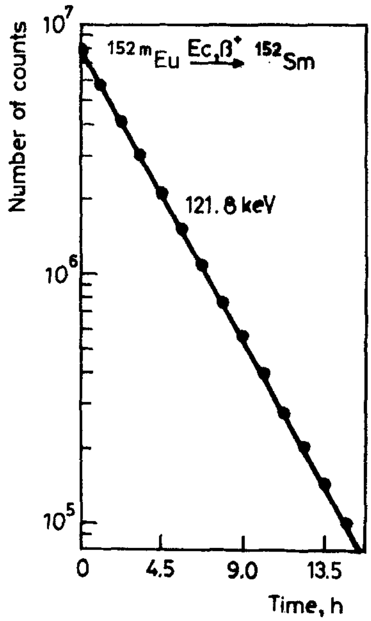

Fig. 3. Decay curve of ^{152m}Eu

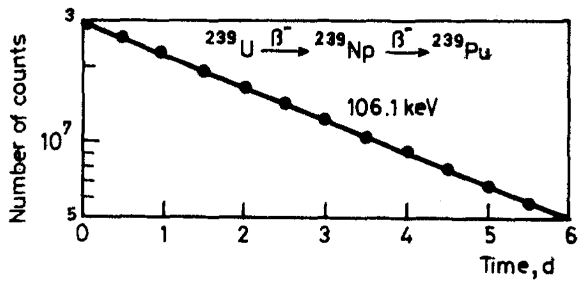

Fig. 4. Decay curve of ^{239}Np

The collaboration of R. Wohlgemuth of the reactor staff is gratefully acknowledged.

TABLE 2

Half-lives determined in the present work compared to previous values

Nuclide	E, analyzed, keV	Half-life /this work/	Half-life /previous values/	Ref.
^{41}Ar	1293.6	109.640±0.038 min	109.4±1.0 min	3
			109.6±0.4 min	4
			111.0±1.0 min	5
			109.0±2.0 min	6
^{80m}Br	37.1	4.4205±0.0008h	4.38±0.02 h	7
			4.40±0.05 h	8
			4.37±0.04 h	9
			4.42±0.01 h	10
^{94m}Nb	871.1	6.263±0.004 min	6.29±0.05 min	11
			6.26±0.01 min	12
^{101}Mo	191.9	14.61±0.03 min	14.6±0.1 min	13
^{101}Tc	306.8	14.224±0.008 min	16.5±0.5 min	14
			14.3±0.1 min	13
^{109}Pd	88.0	13.7012±0.0024 h	14.1±0.3 h	14
			13.47±0.01 h	15
			13.67±0.07 h	16
^{109m}Pd	188.9	4.696±0.003 min	4.6±0.4 min	16
^{122}Sb	564.4	2.7238±0.0002 d	2.80±0.02 d	17
			2.75±0.02 d	18
			2.681±0.003 d	19
			2.82±0.05 d	20
			2.68±0.04 d	21
			2.714±0.006 d	22
			2.84±0.12 d	23
^{122m}Sb	61.4	4.191±0.003 min	3.5 min	24
			4.15±0.20 min	25
			4.2±0.2 min	26
			4.21±0.02 min	27
^{123m}Sn	160.3	40.06±0.01 min	41.5±0.5 min	14
			40.0±1.0 min	28
			40.1±0.2 min	29
			38.9±0.4 min	30
^{152m}Eu	121.8	9.3116±0.0013 h	9.30±0.05 h	31
			9.274±0.009 h	32
^{239}Np	106.1	2.3565±0.0004 d	2.354±0.008 d	33
			2.346±0.004 d	34

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