

Fact Sheet: Zirconium-89

Zirconium-89

-Half-Life: 78.4 hours

Zirconium-89 is employed in specialized diagnostic applications using positron emission tomography imaging, for example, with zirconium-89 labeled antibodies (immuno-PET).

About BV Cyclotron VU

BV Cyclotron VU is a leading provider of PET-radiopharmaceuticals and radionuclides for the nuclear medicine community. Our expert team ensures reliable supply of our products and the highest possible product quality. Total annual output is about 35,000 patient doses.

Process Data

Nuclear reaction

proton irradiation of natural yttrium-89

Assay

Gamma-ray spectrometry: the most prominent gamma photon has an energy of 909 keV

Product Specification

Definition

Zirconium-89 in 1 mol/L oxalic acid

Specific activity

No carrier added

Activity concentration*

Between 740 – 1850 MBq/mL (20 – 50 mCi/mL)

Radionuclidic purity*

$^{89}\text{Zr} \geq 99.9\%$

Others $\leq 0.1\%$

Tests

pH: lower than 4

Endotoxin content

< 17.5 EU/mL

Packaging

2.0 mL V-bottom screw top glass vials

Availability

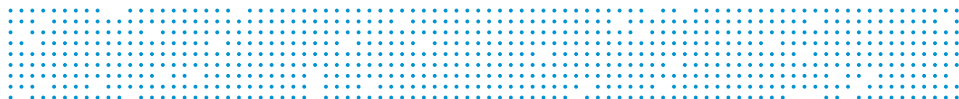
Dispensed every week

Delivery Service

Cyclotron counts on its cooperation partner PerkinElmer for the distribution of the diagnostic radionuclide zirconium-89.

* At reference time

Please note that the zirconium-89 is not tested for sterility. Verification of its suitability for use in humans is the sole responsibility of the purchaser.



Physical Data

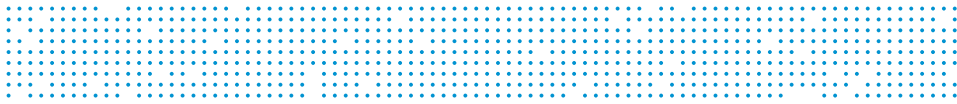
Rad. Type	Energy (keV)	Radiation Intensity (%)
B+	395.5	22.74
E-AU-L	1.91	79
E-AU-K	12.7	19.47
G-AN	511	45.48
G	909.15	99.04
G	1620.8	0.073
G	1657.3	0.106
G	1713	0.745
G	1744.5	0.123

Decay Table

Physical half-life: 78.41 hours

Hours	0	1	2	3	4	5	6	7	8	9
0	1.000	0.991	0.982	0.974	0.965	0.957	0.948	0.940	0.932	0.924
10	0.915	0.907	0.899	0.891	0.884	0.876	0.868	0.860	0.853	0.845
20	0.838	0.831	0.823	0.816	0.809	0.802	0.795	0.788	0.781	0.774
30	0.767	0.760	0.754	0.747	0.740	0.734	0.727	0.721	0.715	0.708
40	0.702	0.696	0.690	0.684	0.678	0.672	0.666	0.660	0.654	0.648
50	0.643	0.637	0.631	0.626	0.620	0.615	0.610	0.604	0.599	0.594
60	0.588	0.583	0.578	0.573	0.568	0.563	0.558	0.553	0.548	0.543
70	0.539	0.534	0.529	0.524	0.520	0.515	0.511	0.506	0.502	0.497
80	0.493	0.489	0.484	0.480	0.476	0.472	0.468	0.463	0.459	0.455
90	0.451	0.447	0.443	0.439	0.436	0.432	0.428	0.424	0.420	0.417
100	0.413	0.409	0.406	0.402	0.399	0.395	0.392	0.388	0.385	0.382
110	0.378	0.375	0.372	0.368	0.365	0.362	0.359	0.355	0.352	0.349
120	0.346	0.343	0.340	0.337	0.334	0.331	0.328	0.325	0.323	0.320
130	0.317	0.314	0.311	0.309	0.306	0.303	0.301	0.298	0.295	0.293
140	0.290	0.288	0.285	0.282	0.280	0.278	0.275	0.273	0.270	0.268
150	0.266	0.263	0.261	0.259	0.256	0.254	0.252	0.250	0.247	0.245
160	0.243	0.241	0.239	0.237	0.235	0.233	0.231	0.228	0.226	0.224
170	0.223	0.221	0.219	0.217	0.215	0.213	0.211	0.209	0.207	0.205
180	0.204	0.202	0.200	0.198	0.197	0.195	0.193	0.191	0.190	0.188
190	0.186	0.185	0.183	0.182	0.180	0.178	0.177	0.175	0.174	0.172

To obtain a precalibration number, divide by the decay factor.
For a postcalibration number, multiply by the decay factor.
(See also: <http://2cyc.eu/d>)



More Information

Aerts HJWL, Dubois L, Perk L, Vermaelen P, van Dongen GAMS, Wouters BG, Lambin P. Disparity between in vivo EGFR expression and ⁸⁹Zr-labeled cetuximab uptake assessed with PET. *J Nucl Med.* 2009 Jan;50(1):123-31. PMID: 19091906.

Börjesson PK, Jauw YW, Boellaard R, de Bree R, Comans EF, Roos JC, Castelijns JA, Vosjan MJ, Kummer JA, Leemans CR, Lammermsma AA, van Dongen GA. Performance of immuno-positron emission tomography with zirconium-89-labeled chimeric monoclonal antibody U36 in the detection of lymph node metastases in head and neck cancer patients. *Clin Cancer Res.* 2006 Apr 1;12(7 Pt 1):2133-40. PMID: 16609026.

Börjesson PK, Jauw YW, de Bree R, Roos JC, Castelijns JA, Leemans CR, van Dongen GA, Boellaard R. Radiation dosimetry of ⁸⁹Zr-labeled chimeric monoclonal antibody U36 as used for immuno-PET in head and neck cancer patients. *J Nucl Med.* 2009 Nov;50(11):1828-36. PMID: 19837762.

Dijkers EC, Oude Munnink TH, Kosterink JG, Brouwers AH, Jager PL, de Jong JR, van Dongen GA, Schröder CP, Lub-de Hooge MN, de Vries EG. Biodistribution of ⁸⁹Zr-trastuzumab and PET imaging of HER2-positive lesions in

patients with metastatic breast cancer. *Clin Pharmacol Ther.* 2010 May;87(5):586-92. PMID: 20357763.

Hoeben BA, Kaanders JH, Franssen GM, Troost EG, Rijken PF, Oosterwijk E, van Dongen GA, Oyen WJ, Boerman OC, Bussink J. PET of hypoxia with ⁸⁹Zr-labeled cG250-F(ab')₂ in head and neck tumors. *J Nucl Med.* 2010 Jul;51(7):1076-83. PMID: 20554724.

Holland JP, Divilov V, Bander NH, Smith-Jones PM, Larson SM, Lewis JS. ⁸⁹Zr-DFO-J591 for immunoPET of prostate-specific membrane antigen expression in vivo. *J Nucl Med.* 2010 Aug;51(8):1293-300. PMID: 20660376.

Holland JP, Sheh Y, Lewis JS. Standardized methods for the production of high specific-activity zirconium-89. *Nucl Med Biol.* 2009 Oct;36(7):729-39. Epub 2009 Jul 29. PMID: 19720285. PMID: 17631557.

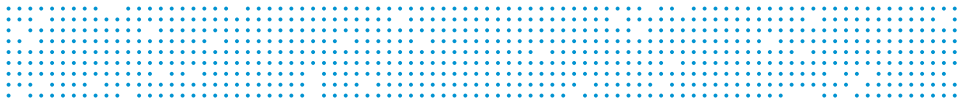
Holland JP, Williamson MJ, Lewis JS. Unconventional nuclides for radiopharmaceuticals. *Mol Imaging.* 2010 Feb;9(1):1-20. PMID: 20128994.

McCabe KE, Wu AM. Positive progress in ImmunoPET – not just a coincidence. *Cancer Biother Radiopharm.* 2010 Jun;25(3):253-61. PMID: 20578830.

Nagengast WB, de Korte MA, Oude Munnink TH, Timmer-Bosscha H, den Dunnen WF, Hollema H, de Jong JR, Jensen MR, Quadt C, Garcia-Echeverria C, van Dongen GA, Lub-de Hooge MN, Schröder CP, de Vries EG. ⁸⁹Zr-bevacizumab PET of early anti-angiogenic tumor response to treatment with HSP90 inhibitor NVP-AUY922. *J Nucl Med.* 2010 May;51(5):761-7. PMID: 20395337.

Nagengast WB, de Vries EG, Hospers GA, Mulder NH, de Jong JR, Hollema H, Brouwers AH, van Dongen GA, Perk LR, Lub-de Hooge MN. In vivo VEGF imaging with radiolabeled bevacizumab in a human ovarian tumor xenograft. *J Nucl Med.* 2007 Aug;48(8):1313-9. PMID: 17631557.

Perk LR, Stigter-van Walsum M, Visser GW, Kloet RW, Vosjan MJ, Leemans CR, Giaccone G, Albano R, Comoglio PM, van Dongen GA. Quantitative PET imaging of Met-expressing human cancer xenografts with ⁸⁹Zr-labelled monoclonal antibody DN30. *Eur J Nucl Med Mol Imaging.* 2008 Oct;35(10):1857-67. PMID: 18491091.



More Information

Perk LR, Vosjan MJ, Visser GW, Budde M, Jurek P, Kiefer GE, van Dongen GA. p-Isothiocyanatobenzyl-desferrioxamine: a new bifunctional chelate for facile radiolabeling of monoclonal antibodies with zirconium-89 for immuno-PET imaging. *Eur J Nucl Med Mol Imaging*. 2010 Feb;37(2):250-9. PMID: 19763566.

Tinianow JN, Gill HS, Ogasawara A, Flores JE, Vanderbilt AN, Luis E, Vandlen R, Darwish M, Junutula JR, Williams SP, Marik J. Site-specifically ⁸⁹Zr-labeled monoclonal antibodies for ImmunoPET. *Nucl Med Biol*. 2010 Apr;37(3):289-97. PMID: 20346868.

van Dongen GAMS, Visser GWM, Lub-de Hooge MN, de Vries EG, Perk LR. Immuno-PET: a navigator in monoclonal antibody development and applications. *Oncologist*. 2007 Dec;12(12):1379-89. PMID: 18165614.

van Dongen GAMS, Vosjan MJ. Immuno-positron emission tomography: shedding light on clinical antibody therapy. *Cancer Biother Radiopharm*. 2010 Aug;25(4):375-85. PMID: 20707716.

Verel I, Visser GWM, Boellaard R, Stigter-van Walsum M, Snow GB, van Dongen GAMS. ⁸⁹Zr immuno-PET: Comprehensive procedures for the production of ⁸⁹Zr-labeled monoclonal antibodies. *J Nucl Med*. 2003 Aug;44(8):1271-81. PMID: 12902418.

Vosjan MJ, Perk LR, Visser GW, Budde M, Jurek P, Kiefer GE, van Dongen GA. Conjugation and radiolabeling of monoclonal antibodies with zirconium-89 for PET imaging using the bifunctional chelate p-isothiocyanatobenzyl-desferrioxamine. *Nat Protoc*. 2010;5(4):739-43. PMID: 20360768.

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- The Future of Immuno-PET
 - ⁸⁹Zr-PET Applications
- <http://2cyc.eu/zrwp>

BV CYCLOTRON VU
De Boelelaan 1081
1081 HV Amsterdam
Postbus 71802
1008 EA Amsterdam
The Netherlands

T +31 (0)20 444 9123
F +31 (0)20 444 9128
web@cyclotron.nl
twitter.com/cyclotronvu