^{239}Np Generator

AN-1619-10

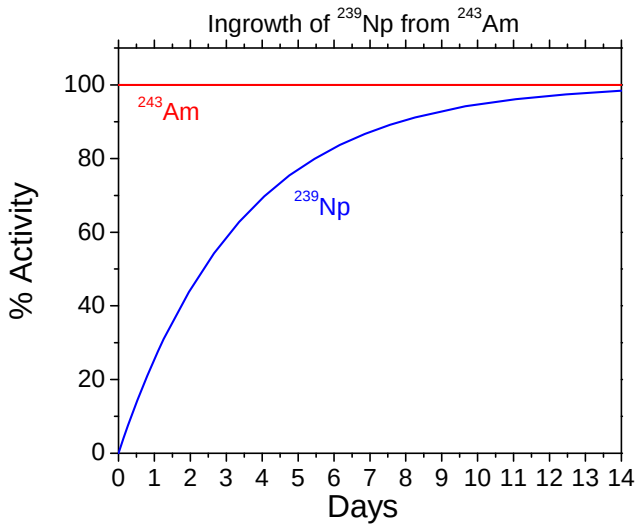
Summary of Method A method for the preparation of ^{239}Np ($t_{1/2}$ = 2.355 days) from ^{243}Am ($t_{1/2}$ = 7380 years) source material is presented. The method employs 2mL cartridges of UTEVA and DGA resins to obtain high purity ^{239}Np in small volumes of eluate, while preserving valuable ^{243}Am material. The source material is adjusted to 4M HNO_3, treated with iron, sulfamic acid and ascorbic acid to fix the Np(IV) oxidation state, and loaded onto stacked 2mL cartridges of UTEVA and DGA resins. ^{239}Np is retained on UTEVA Resin, while ^{243}Am is retained on DGA Resin. The ^{243}Am source is recovered from DGA Resin with a small volume of 0.5M HCl. Following a suitable ingrowth period, the ^{243}Am can be acidified to 4M HNO_3 and used to produce additional ^{239}Np. The ^{243}Am is preserved nearly indefinitely and continuously purified from chemical and radiologic impurities run to run. ^{239}Np is recovered from UTEVA resin with 0.5M HCl.

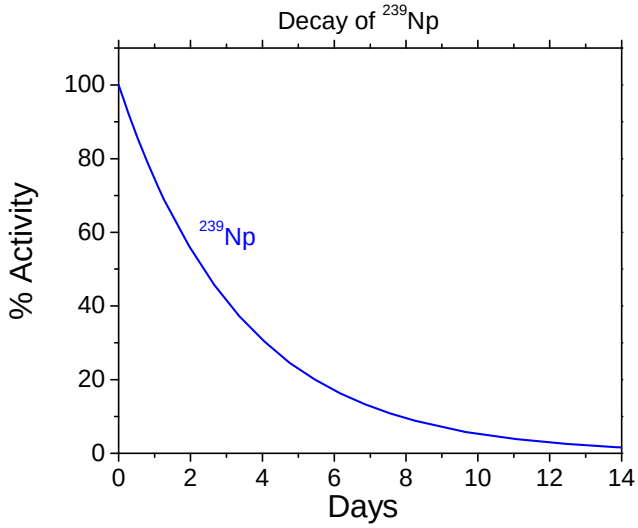
Reagents

UTEVA Cartridges (Eichrom UT-R50-S)
DGA Cartridges (Eichrom DN-R50-S)
^{243}Am Source
Deionized Water
HCl
HNO_3
Sulfamic Acid
Fe carrier (10mg/mL)
Ascorbic Acid

Equipment

Glass vials for storage of ^{243}Am.
Glass or plastic vials/bottles for collection of ^{239}Np and waste.
10, 20 or 30mL plastic luer lock syringes
Gamma Spectrometry System for measurement of ^{239}Np and ^{243}Am.





$^{228}Th/^{232}U$ or $^{231}Th/^{235}U$ Separation

(1) Precondition stacked 2mL cartridges of UTEVA and DGA Resins with 10mL 4M HNO_3.

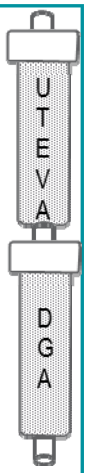
(2) Acidify ^{243}Am eluate from previous separation with 5mL conc. HNO_3. (If new ^{243}Am source, dilute to 20mL with 4M HNO_3.)

(3) Add 0.1mL of 10mg/mL Fe carrier and 1mL 1.5M sulfamic acid. Mix.

(4) Add 1mL 1M ascorbic acid. Mix. Wait 10-20 min.

(5) Load $^{239}Np/^{243}Am$ on UTEVA/DGA.

(6) Rinse UTEVA/DGA with 10mL 4M HNO_3.



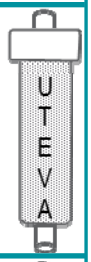
(7) Remove syringe used for load/ rinse and discard.

(8) Add clean syringe.

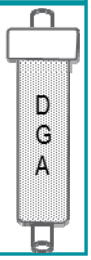
(9) Rinse UTEVA/DGA with 10mL 4M HNO_3.

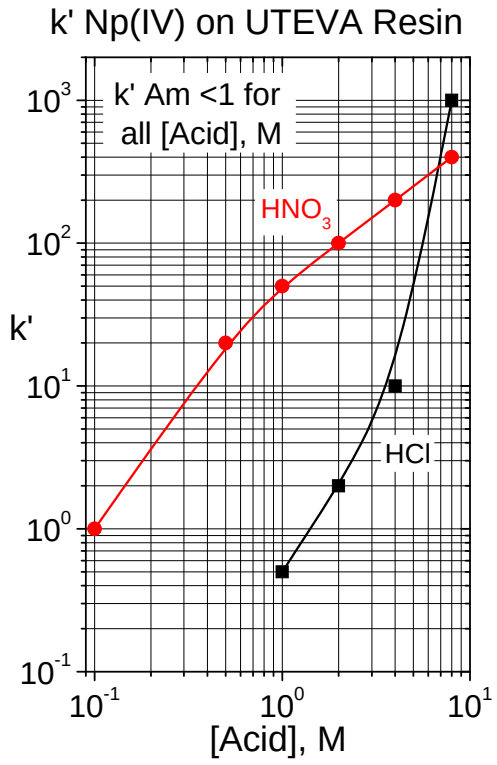
(10) Separate UTEVA/DGA.

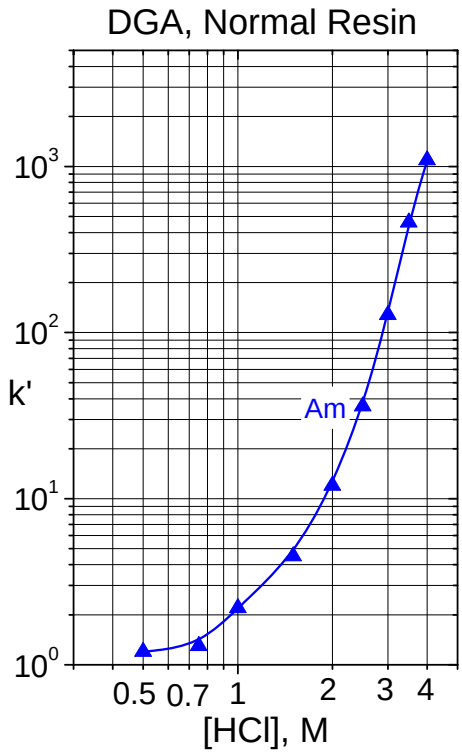
(11) Strip ^{239}Np from UTEVA with 10mL 0.5M HCl. Recovery of ^{239}Np can be improved by stripping in opposite direction of load.



(12) Strip ^{243}Am from DGA with 13mL 0.5M HCl. Save ^{243}Am for future use.







References

1) McAlister and Horwitz, "Chromatographic Generator Systems for the actinides and natural decay series elements," *Radiochimica Acta*, 99:1-9 (2011).