

**Summary of Method** A method for the preparation of  $^{239}\text{Np}$  ( $t_{1/2} = 2.355$  days) from  $^{243}\text{Am}$  ( $t_{1/2} = 7380$  years) source material is presented. The method employs 2mL cartridges of UTEVA and DGA resins to obtain high purity  $^{239}\text{Np}$  in small volumes of eluate, while preserving valuable  $^{243}\text{Am}$  material. The source material is adjusted to 4M  $\text{HNO}_3$ , 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.  $^{239}\text{Np}$  is retained on UTEVA Resin, while  $^{243}\text{Am}$  is retained on DGA Resin. The  $^{243}\text{Am}$  source is recovered from DGA Resin with a small volume of 0.5M HCl. Following a suitable ingrowth period, the  $^{243}\text{Am}$  can be acidified to 4M  $\text{HNO}_3$  and used to produce additional  $^{239}\text{Np}$ . The  $^{243}\text{Am}$  is preserved nearly indefinitely and continuously purified from chemical and radiologic impurities run to run.  $^{239}\text{Np}$  is recovered from UTEVA resin with 0.5M HCl.

## Reagents

UTEVA Cartridges (Eichrom UT-R50-S)

DGA Cartridges (Eichrom DN-R50-S)

$^{243}\text{Am}$  Source

Deionized Water

HCl

$\text{HNO}_3$

Sulfamic Acid

Fe carrier (10mg/mL)

Ascorbic Acid

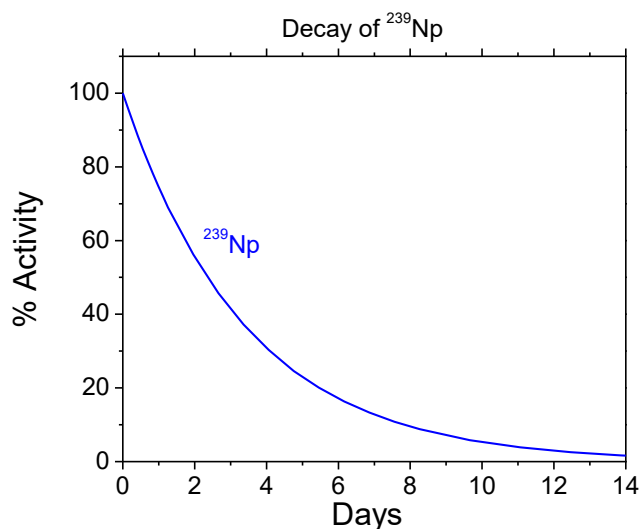
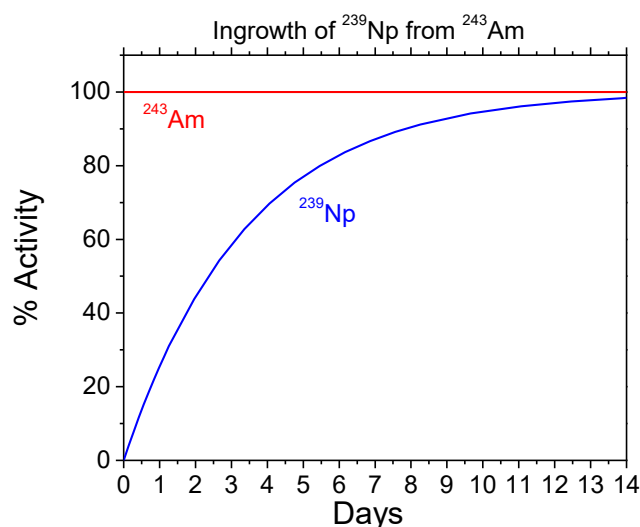
## Equipment

Glass vials for storage of  $^{243}\text{Am}$ .

Glass or plastic vials/bottles for collection of  $^{239}\text{Np}$  and waste.

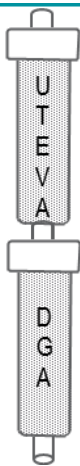
10, 20 or 30mL plastic luer lock syringes

Gamma Spectrometry System for measurement of  $^{239}\text{Np}$  and  $^{243}\text{Am}$ .



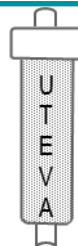
## <sup>239</sup>Np/<sup>243</sup>Am Separation

- (1) Precondition stacked 2mL cartridges of UTEVA and DGA Resins with 10mL 4M HNO<sub>3</sub>.
- (2) Acidify <sup>243</sup>Am eluate from previous separation with 5mL conc. HNO<sub>3</sub>. (If new <sup>243</sup>Am source, dilute to 20mL with 4M HNO<sub>3</sub>.)
- (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 <sup>239</sup>Np/<sup>243</sup>Am on UTEVA/DGA.
- (6) Rinse UTEVA/DGA with 10mL 4M HNO<sub>3</sub>.

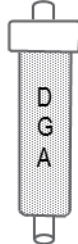


- (7) Remove syringe used for load/rinse and discard.
- (8) Add clean syringe.
- (9) Rinse UTEVA/DGA with 10mL 4M HNO<sub>3</sub>.
- (10) Separate UTEVA/DGA.

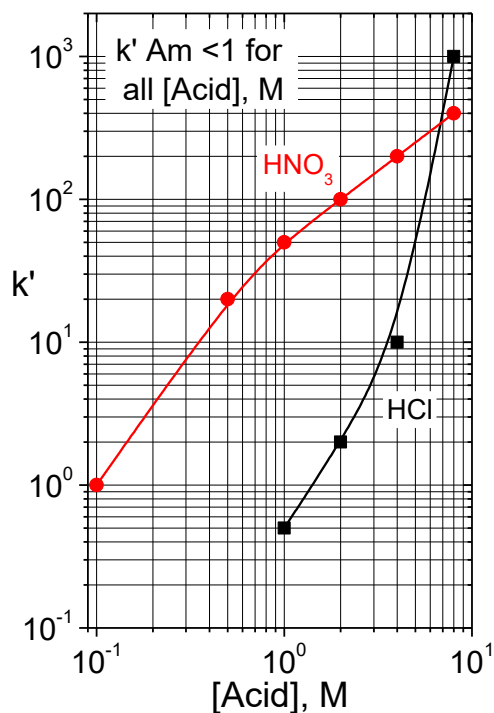
- (11) Strip <sup>239</sup>Np from UTEVA with 10mL 0.5M HCl. Recovery of <sup>239</sup>Np can be improved by stripping in opposite direction of load.



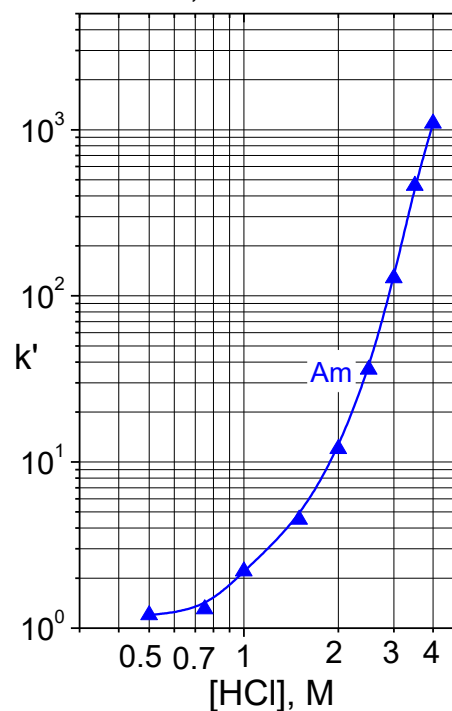
- (12) Strip <sup>243</sup>Am from DGA with 13mL 0.5M HCl. Save <sup>243</sup>Am for future use.



k' Np(IV) on UTEVA Resin



DGA, Normal Resin



## References

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