^{228}Th/^{231}Th Generator

AN-1618-10

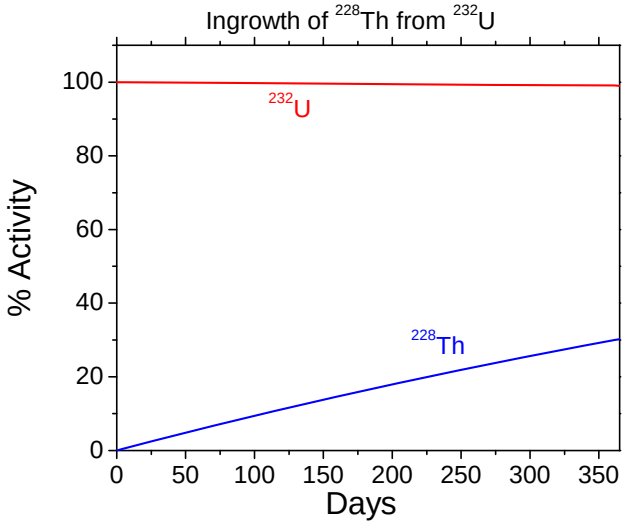
Summary of Method A method for the preparation of ^{228}Th ($t_{1/2}$ = 1.913 years) from ^{232}U ($t_{1/2}$ = 72 years) source material or ^{231}Th ($t_{1/2}$ = 25.52 hours) from ^{235}U ($t_{1/2}$ = 7.04E8 years) is presented. The method employs 2mL cartridges of TEVA and UTEVA resins to obtain high purity ^{228}Th or ^{231}Th in small volumes of eluate while preserving valuable ^{232}U or ^{235}U source material. The source material in 4M HNO_3, is loaded onto stacked 2mL cartridges of TEVA and UTEVA resins. ^{228}Th or ^{231}Th is retained on TEVA Resin, while ^{232}U or ^{235}U is retained on UTEVA Resin. The ^{232}U or ^{235}U source is recovered from UTEVA Resin with a small volume of 1M HCl. Following a suitable ingrowth period, the ^{232}U or ^{235}U can be acidified to 4M HNO_3 and used to produce additional ^{228}Th or ^{231}Th. The ^{232}U or ^{235}U is preserved nearly indefinitely and continuously purified from chemical and radiologic impurities run to run. ^{228}Th or ^{231}Th is recovered from TEVA

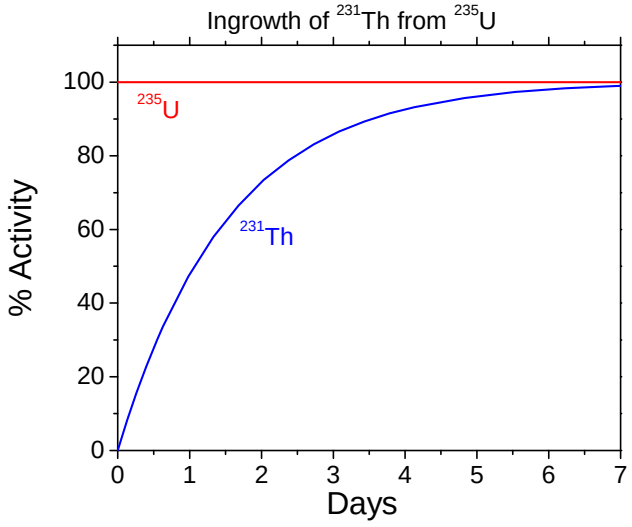
Reagents

UTEVA Cartridges (Eichrom UT-R50-S)
TEVA Cartridges (Eichrom TE-R50-S)
^{232}U or ^{235}U Source
Deionized Water
HCl
HNO_3

Equipment

Glass vials for storage of ^{232}U or ^{235}U source.
Glass or plastic vials/bottles for collection of ^{228}Th or ^{231}Th and waste.
10, 20 or 30mL plastic luer lock syringes
Gamma Spectrometry System and/or Alpha Spectrometry System for measurement of ^{228}Th and ^{232}U or ^{231}Th and ^{235}U.





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

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

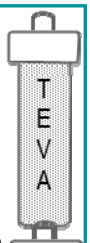
(2) Acidify ^{232}U or ^{235}U eluate from previous separation with 5mL conc. HNO_3. (If new ^{232}U or ^{235}U source, dilute to 20mL with 4M HNO_3.)

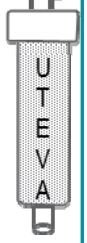
(3) Load $^{228}Th/^{232}U$ or $^{231}Th/^{235}U$ in 20mL 4M HNO_3

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

(5) Discard syringe used for load/first rinse. Replace with clean syringe.

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



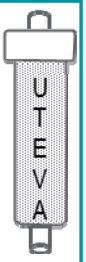


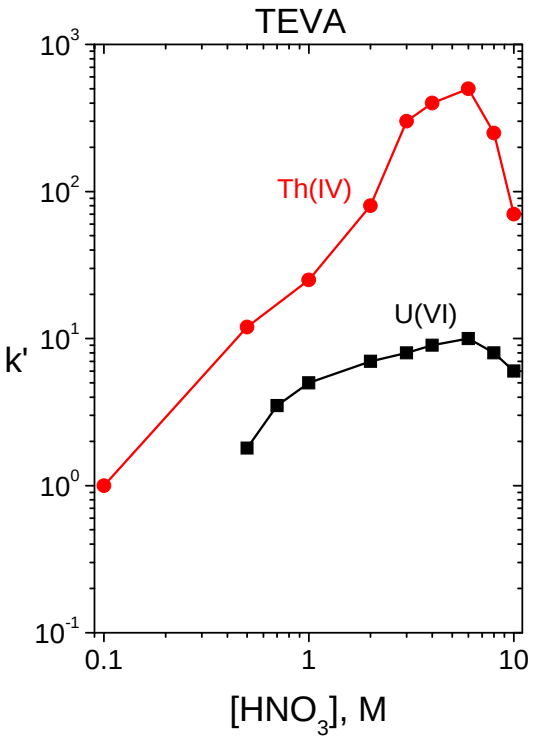
(7) Separate TEVA/UTEVA.

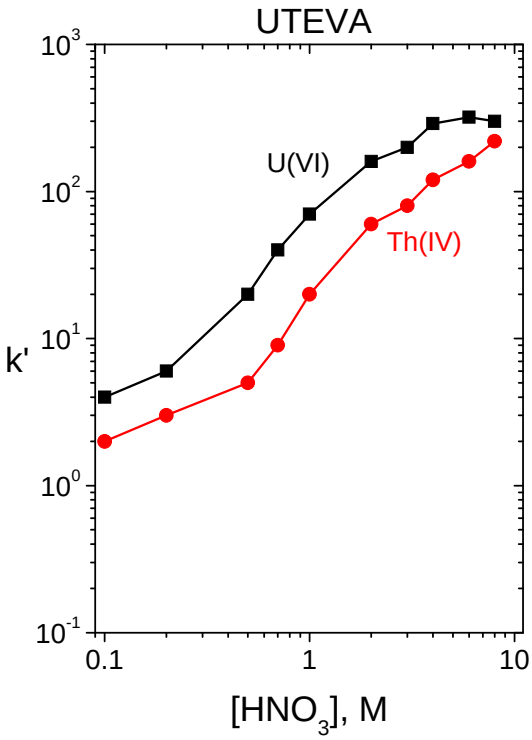
(8) Rinse TEVA with 20mL 4M HNO_3.

(9) Strip ^{228}Th or ^{231}Th with 10mL 0.5M HCl.

(10) Strip ^{232}U or ^{235}U from UTEVA with 15mL 1M HCl. Save ^{232}U or ^{235}U 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).