^{210}Po/^{210}Bi Generator

AN-1616-10

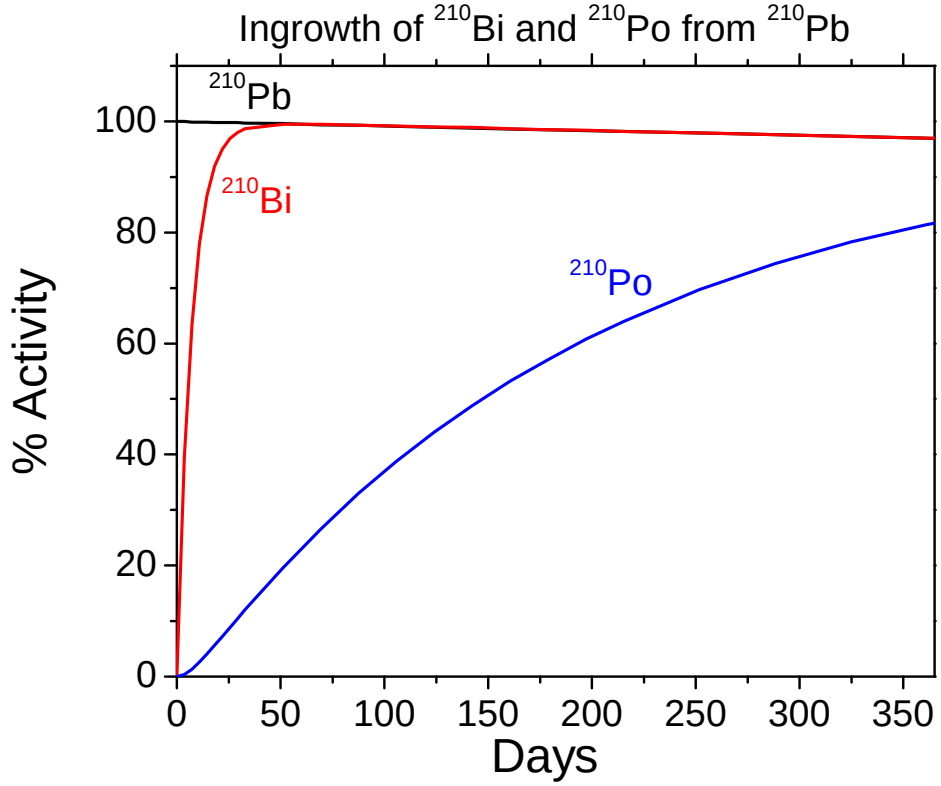
Summary of Method A method for the preparation of ^{210}Po ($t_{1/2}$ = 138.4 days) and ^{210}Bi ($t_{1/2}$ = 5.013 days) from ^{210}Pb ($t_{1/2}$ = 22.26 years) source material is presented. The method employs 2mL cartridges of DGA and Sr resins to obtain high purity ^{210}Po and ^{210}Bi in small volumes of eluate while preserving valuable ^{210}Pb source material. The source material, containing ^{210}Pb/^{210}Bi/^{210}Bi in 2.67M HCl, is loaded onto stacked 2mL cartridges of DGA and Sr resins. ^{210}Po is retained on DGA Resin, while ^{210}Pb is retained on Sr Resin and ^{210}Bi is not retained. The ^{210}Pb source is recovered from Sr Resin with a small volume of 8M HCl. Following a suitable ingrowth period, the ^{210}Pb can be diluted to 2.67M HCl and used to produce additional ^{210}Po and ^{210}Bi. The ^{210}Pb is preserved nearly indefinitely and continuously purified from chemical and radiologic impurities run to run. ^{210}Po is recovered from DGA resin with 0.5M $HN0_3$. The DGA/Sr Resin chemistry is an improvement over the UTEVA/Sr Resin chemistry previously described. The UTEVA/Sr Resin system required 6M HNO_3 to recover the ^{210}Po.

Reagents

Sr Resin Cartridges (Eichrom SR-R50-S)
DGA, Normal Cartridges (Eichrom DN-R50-S)
Liquid Scintillation Cocktail
^{210}Pb Source
Deionized Water
HCl
HNO_3

Equipment

Glass vials for storage of ^{210}Pb source.
Glass or plastic vials/bottles for collection of ^{210}Po, ^{210}Bi and waste.
10, 20 or 30mL plastic luer lock syringes
Liquid Scintillation System for measurement of ^{210}Bi and ^{210}Po .
Gamma Spectrometry System for measurement of ^{210}Pb.



$^{210}Pb/^{210}Bi/^{210}Po$ Separation

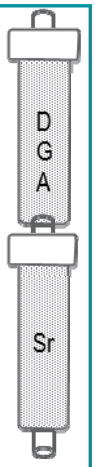
(1) Precondition stacked 2mL cartridges of DGA and Sr Resins with 10mL 2M HCl.

(2) Dilute ^{210}Pb eluate from previous separation with 20mL DI H_2O. (If new ^{210}Pb source, dilute to 20mL with 2M HCl.)*

(3) Load $^{210}Pb/^{210}Bi/^{210}Po$ in 30mL 2.67M HCl. (20mL 2M HCl). Collect ^{210}Bi.

(4) Rinse DGA/Sr with 10mL 2M HCl. Collect ^{210}Bi.

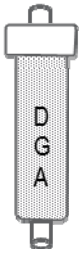
(5) Elute 10mL 8M HCl through DGA/Sr, collecting ^{210}Pb Source material. Save ^{210}Pb for future use.



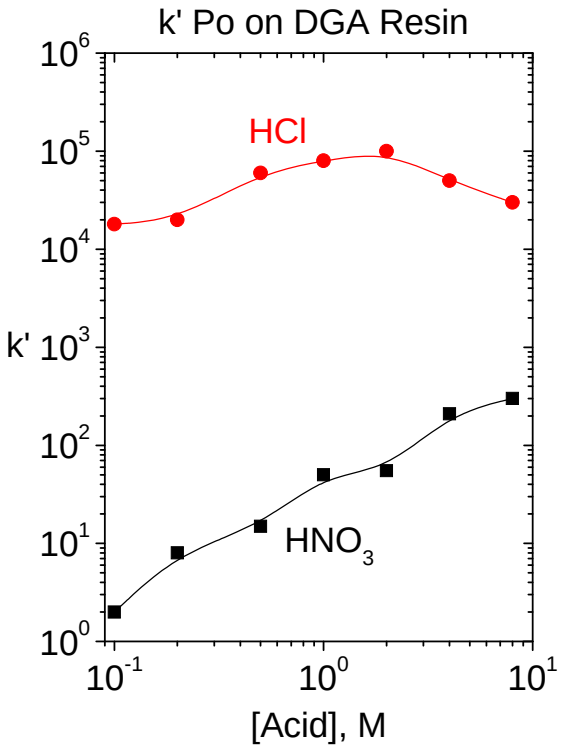
(6) Separate DGA/Sr.

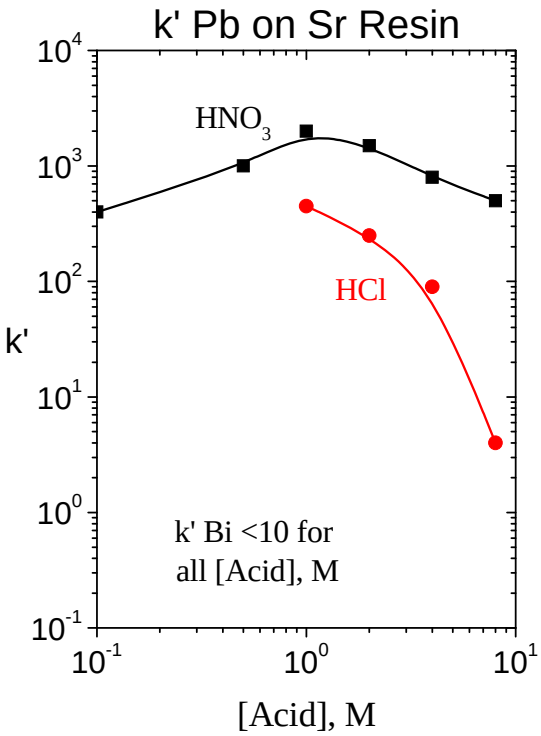
(7) Rinse DGA with 10mL 8M HNO_3. Discard as waste.

(8) Strip ^{210}Po from UTEVA with 15mL 0.5M HNO_3.



*Adding 1mg of stable Pb to the ^{210}Pb source can help improve ^{210}Pb recovery from Sr Resin (do only once, not each time).





References

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