SIMPLIFYING SEPARATIONS BY COLUMN COUPLING

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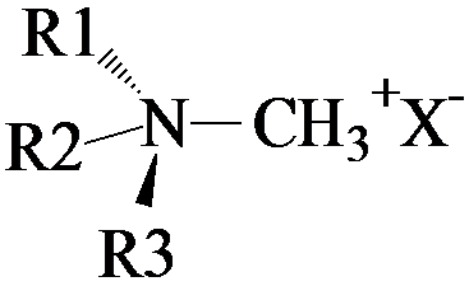
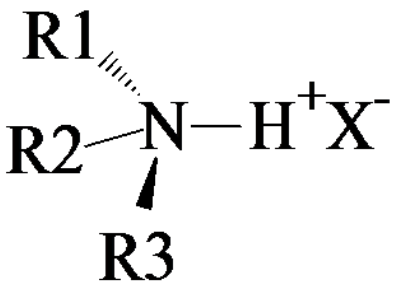
Commercially Available EXC Resins

Resin	Type	Extractant	Major Applications
TEVA	Basic	Quaternary Amine	Tc, Th, Np, Am/Ln
Weak Base EC	Basic	Tertiary Amine	Tc, Np, Pu

R = C_8 or C_{10}



Quaternary Ammonium Extractant

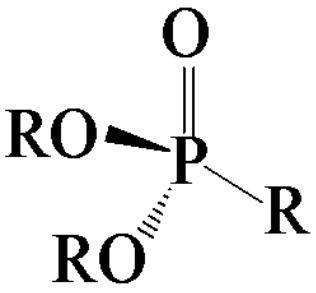


Tertiary Ammonium Extractant

Commercially Available EXC Resins

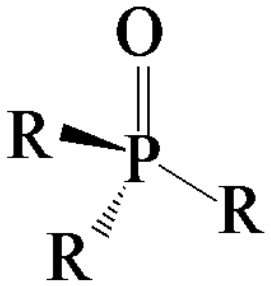
Resin	Type	Extractant	Major Applications
UTEVA	Neutral	Damyl[amyl]phosphonate (DAAP)	U
UTEVA-2	Neutral	DAAP/Trialkylphosphine oxide	U
TRU	Neutral	CMPO/TBP or CMPO/DAAP	U, Pu, Am
Sr	Neutral	DtBuCH18-crown-6/octanol	Sr, Pb, Po
Sr2	Neutral	DtBuCH18-crown-6 (neat)	Ba, Ra
Pb	Neutral	DtBuCH18-crown-6/isodecanol	Pb, Po
Li	Neutral	Nonamethyl-14-crown-4	Li
DGA, Normal	Neutral	tetra(n-octyl)diglycolamide	Ln, Y, Ac, Am
DGA, Branched	Neutral	tetra(2-ethylhexyl)diglycolamide	Ln, Ac, Am
Ni	Neutral	dimethylglyoxime	Ni

Neutral Extractants



Phosphonate

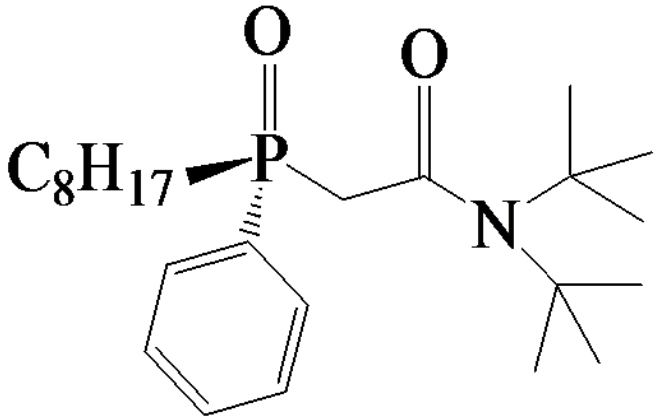
R = C_5H_{11}



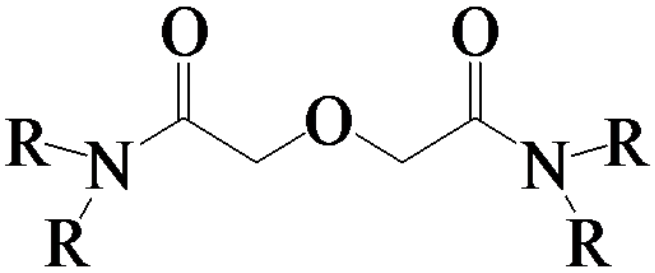
Phosphine Oxide

R = C_8H_{17}

Neutral Extractants

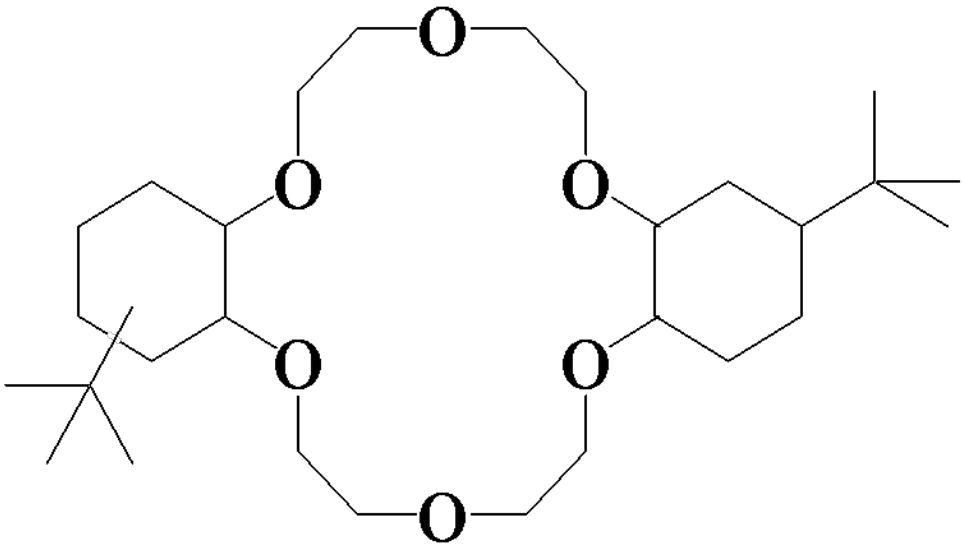


Carbamoylphosphine oxide

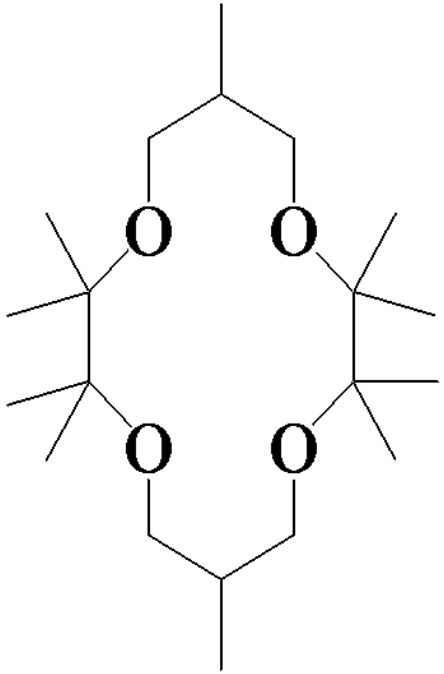


Diglycolamide
R = *n*-octyl, 2-ethylhexyl

Neutral Extractants



Di-*t*-butylcyclohexano-
18-crown-6



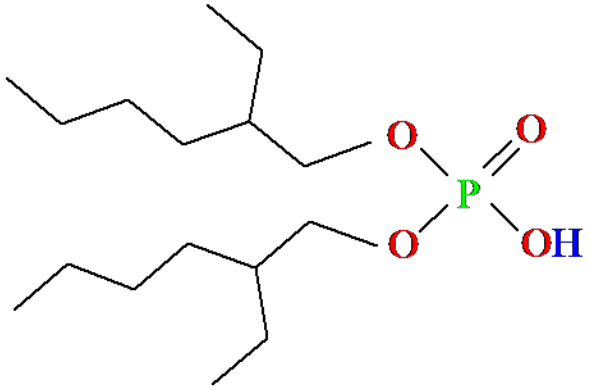
Nonamethyl-14-crown-4

Commercially Available EXC Resins

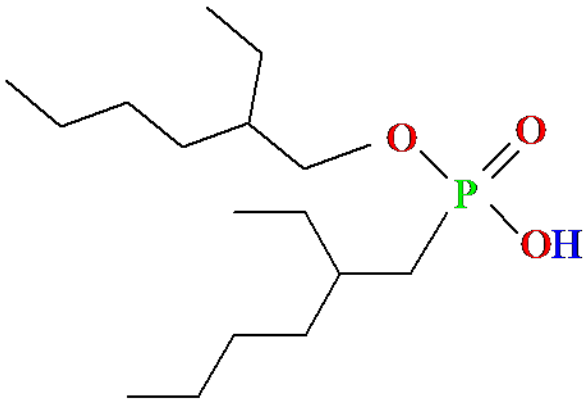
Resin	Type	Extractant	Major Applications
Ln	Acidic	Alkyl phosphoric acid	Ln, Ac
Ln 2	Acidic	Alkyl phosphonic acid	Ln, Y, Ac
Ln 3	Acidic	Alkyl phosphinic acid	U
Actinide	Acidic	alkyl bisphosphonic acid	Actinides, Be
DNNS	Acidic	dinonylnaphthalene sulfonic acid	Ra

Acidic Extractants

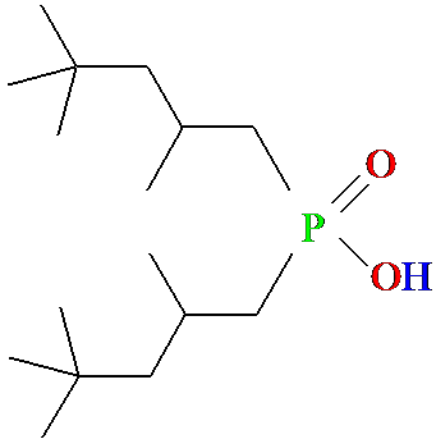
The LN Series of Resins



HDEHP (LN)



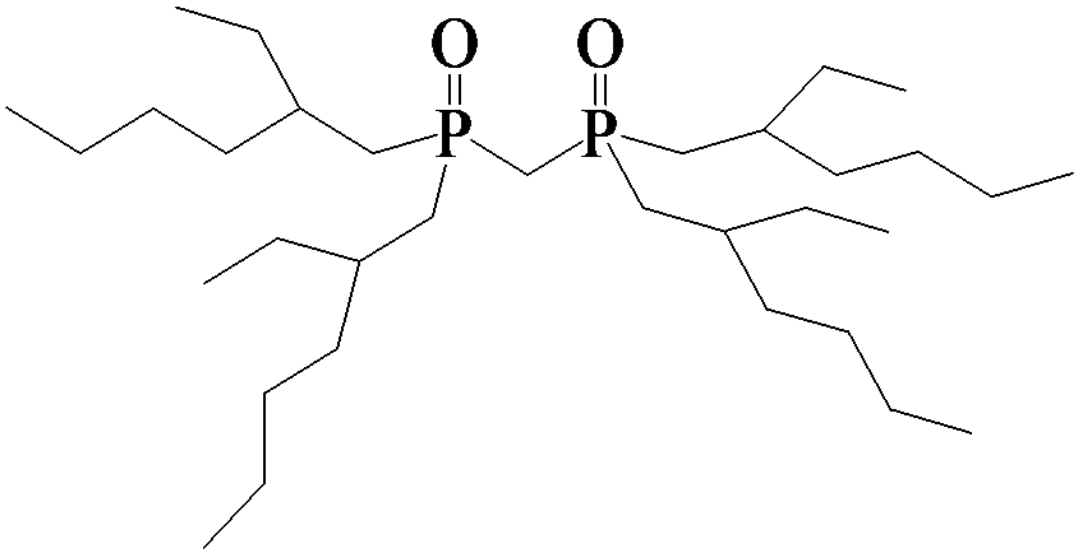
HEH[EHP] (LN2)



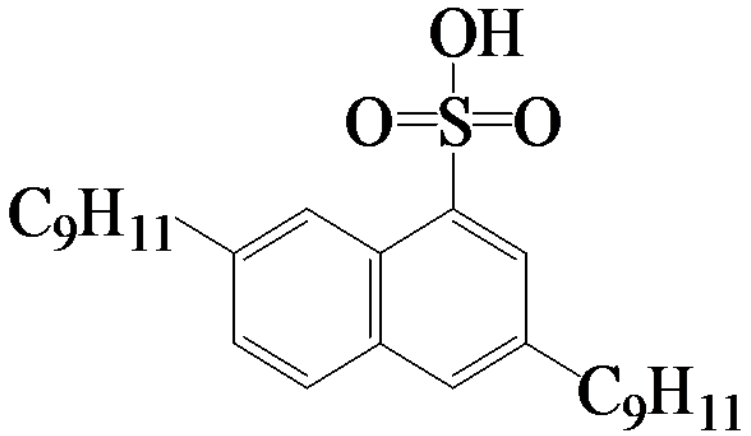
H[TMPeP] (LN3)

$$M^{3+} + 3\overline{(HY)_2} \leftrightarrow \overline{M(HY_2)_3} + 3H^+$$

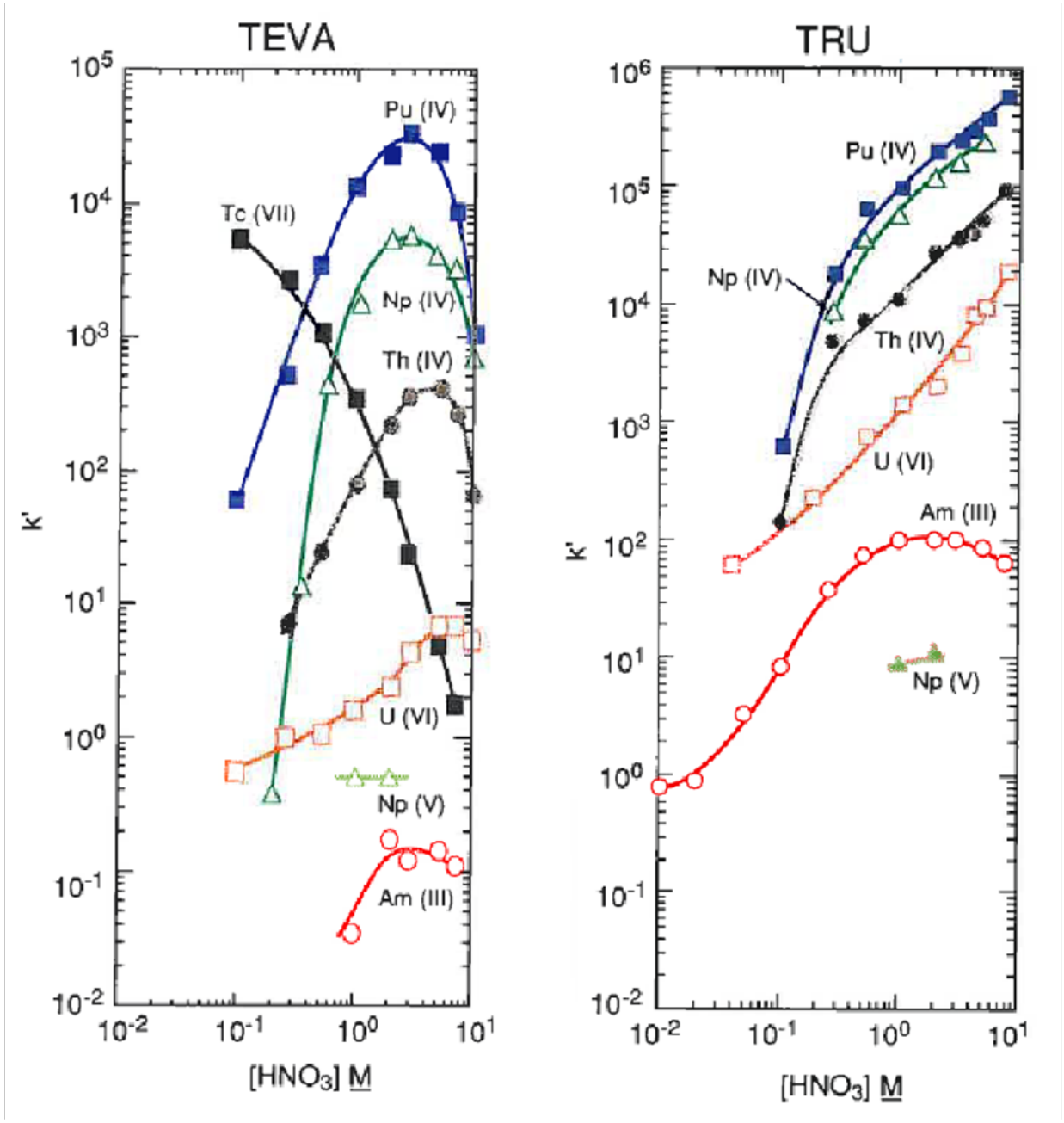
Acidic Extractants



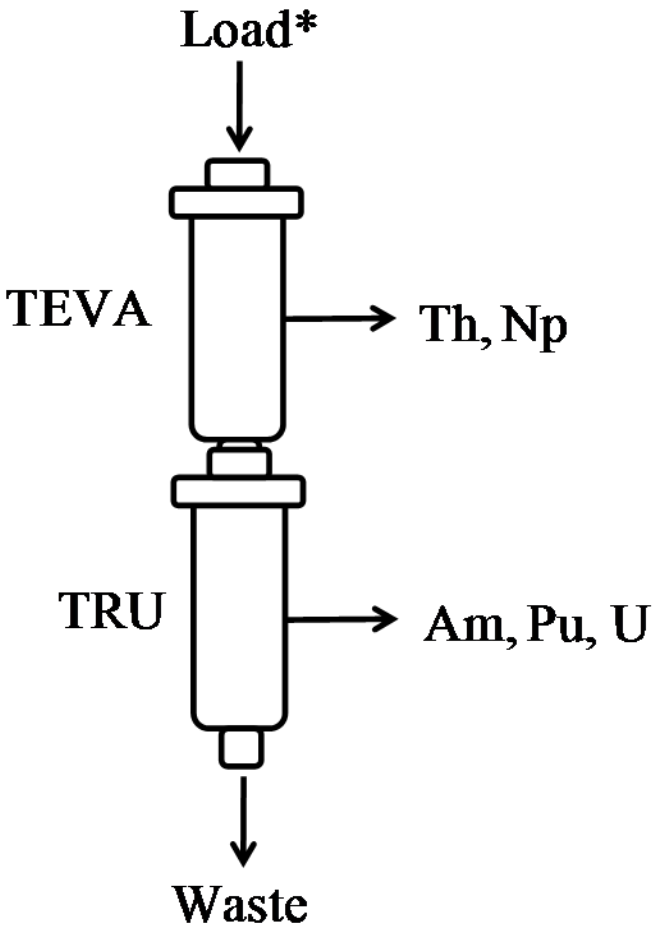
Alkylbisphosphonic Acid
(Dipex)



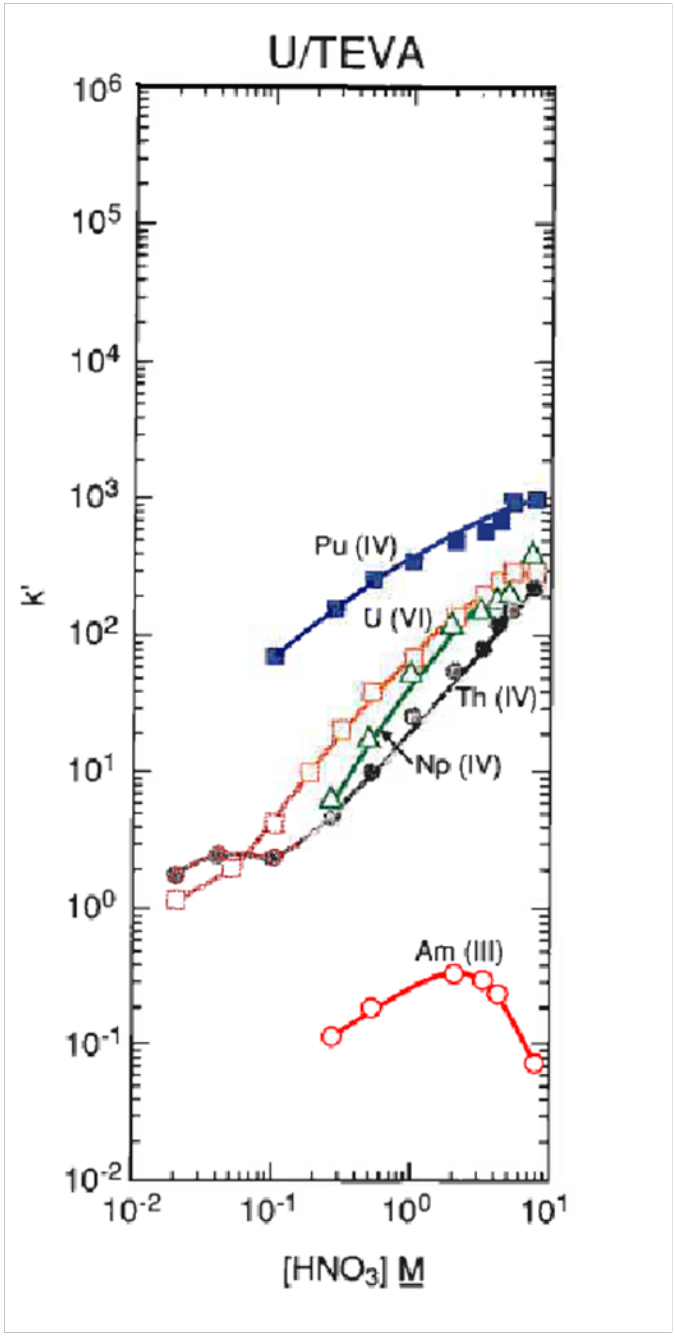
Dinonylnaphthalene
Sulfonic Acid (DNNSA)


TEVA
k'
Pu (IV)
Tc (VII)
Np (IV)
Th (IV)
U (VI)
Np (V)
Am (III)
[HNO3] M
TRU
k'
Pu (IV)
Np (IV)
Th (IV)
U (VI)
Am (III)
Np (V)
[HNO3] M

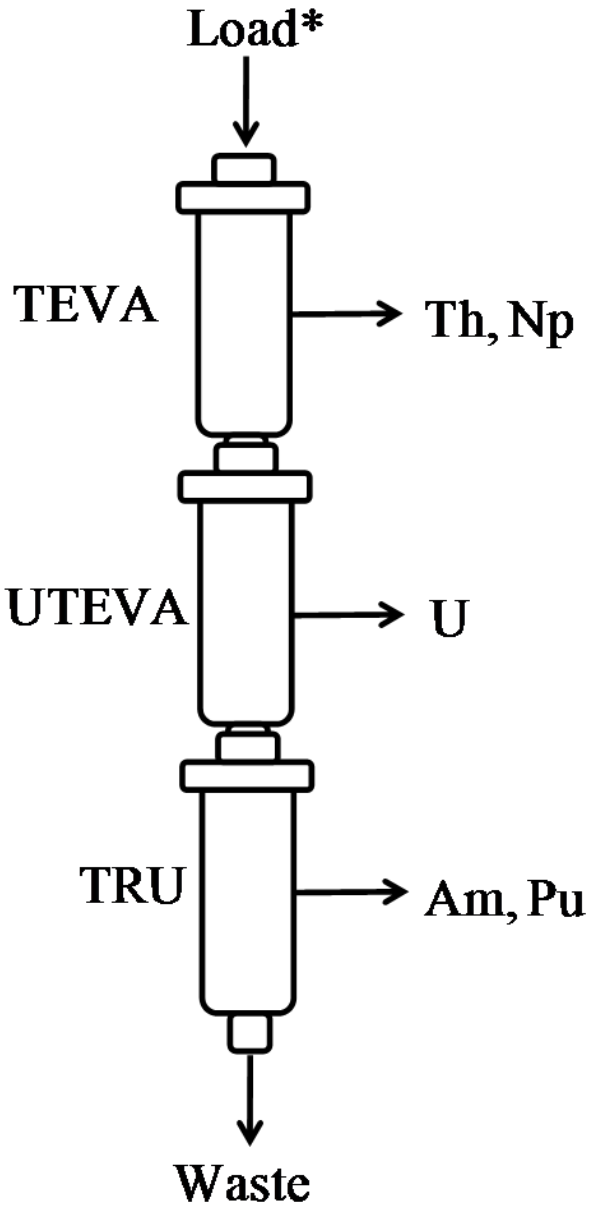
Examples of Coupled Column Arrangements



*Load = Nitric acid solutions of water, bioassay, or leached or dissolved soil samples.


U/TEVA
k'
10^6
10^5
10^4
10^3
10^2
10^1
10^0
10^{-1}
10^{-2}
Pu (IV)
U (VI)
Th (IV)
Np (IV)
Am (III)
10^{-2}
10^{-1}
10^0
10^1
[HNO_3] M

Examples of Coupled Column Arrangements



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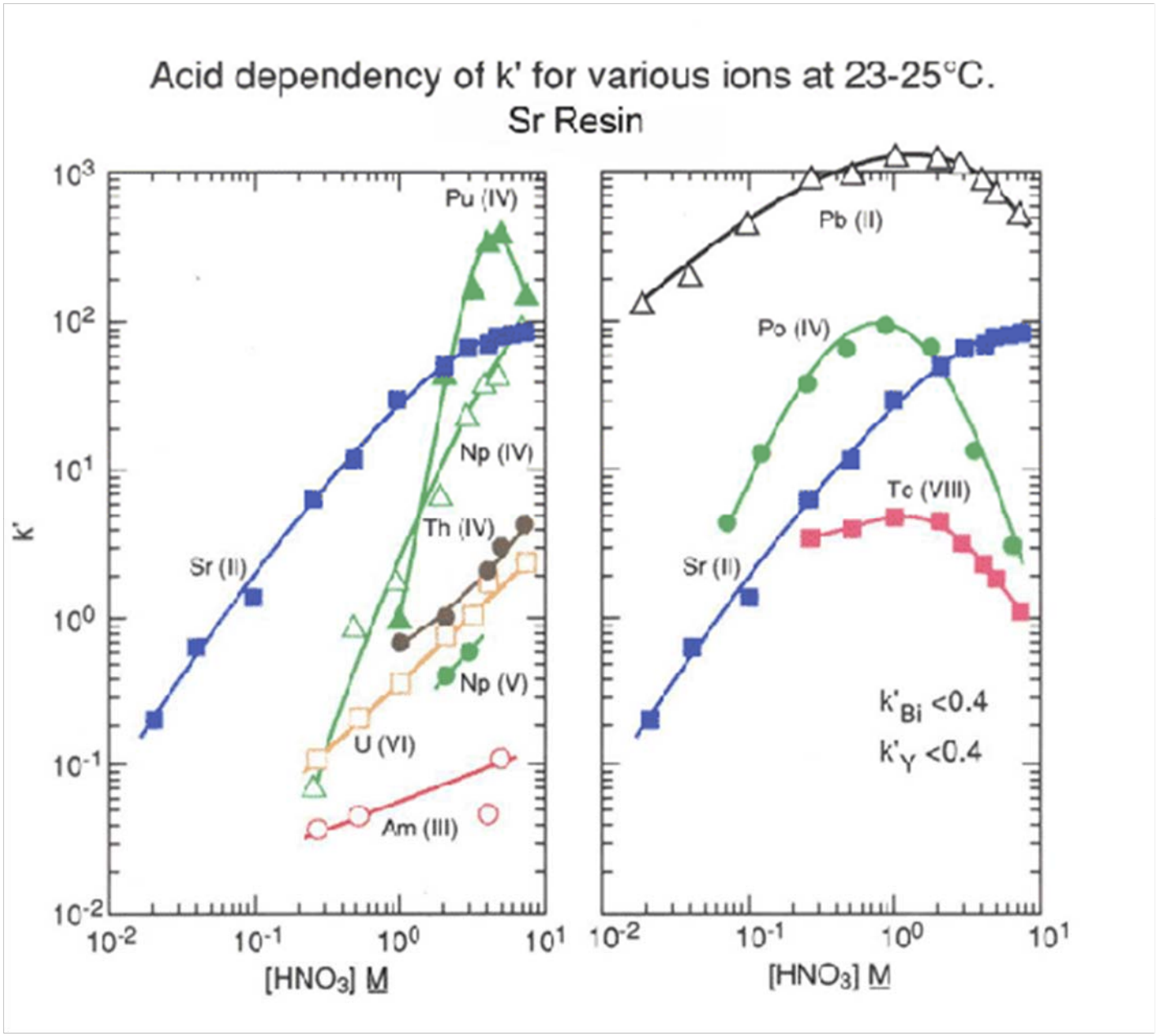
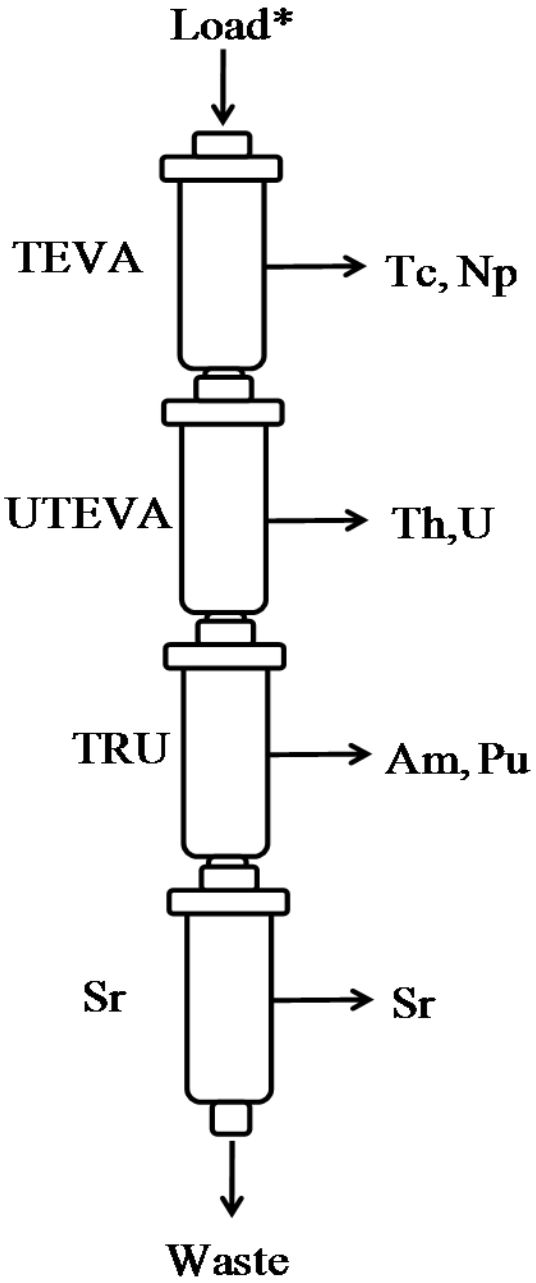
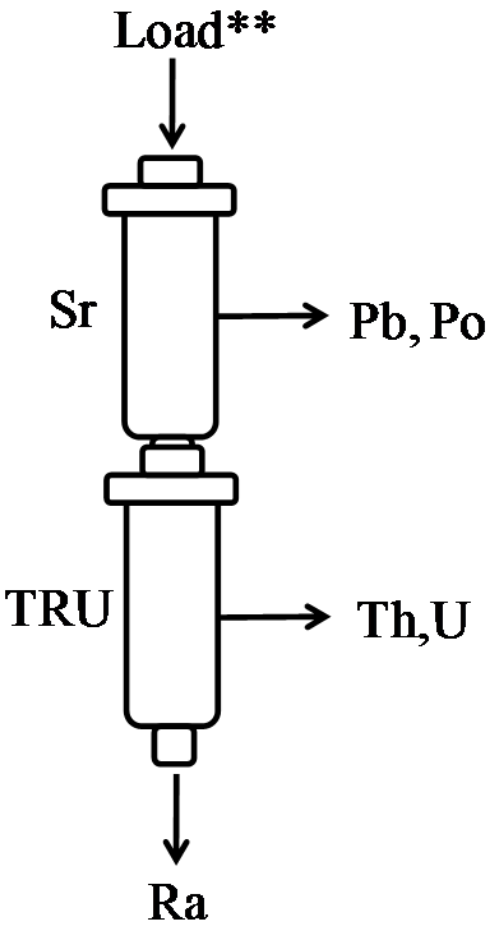

Acid dependency of k' for various ions at 23-25°C.
Sr Resin
k'
Pu (IV)
Np (IV)
Th (IV)
Sr (II)
Np (V)
U (VI)
Am (III)
[HNO3] M
Pb (II)
Po (IV)
Tc (VIII)
Sr (II)
k'Bi <0.4
k'Y <0.4
[HNO3] M

Examples of Coupled Column Arrangements

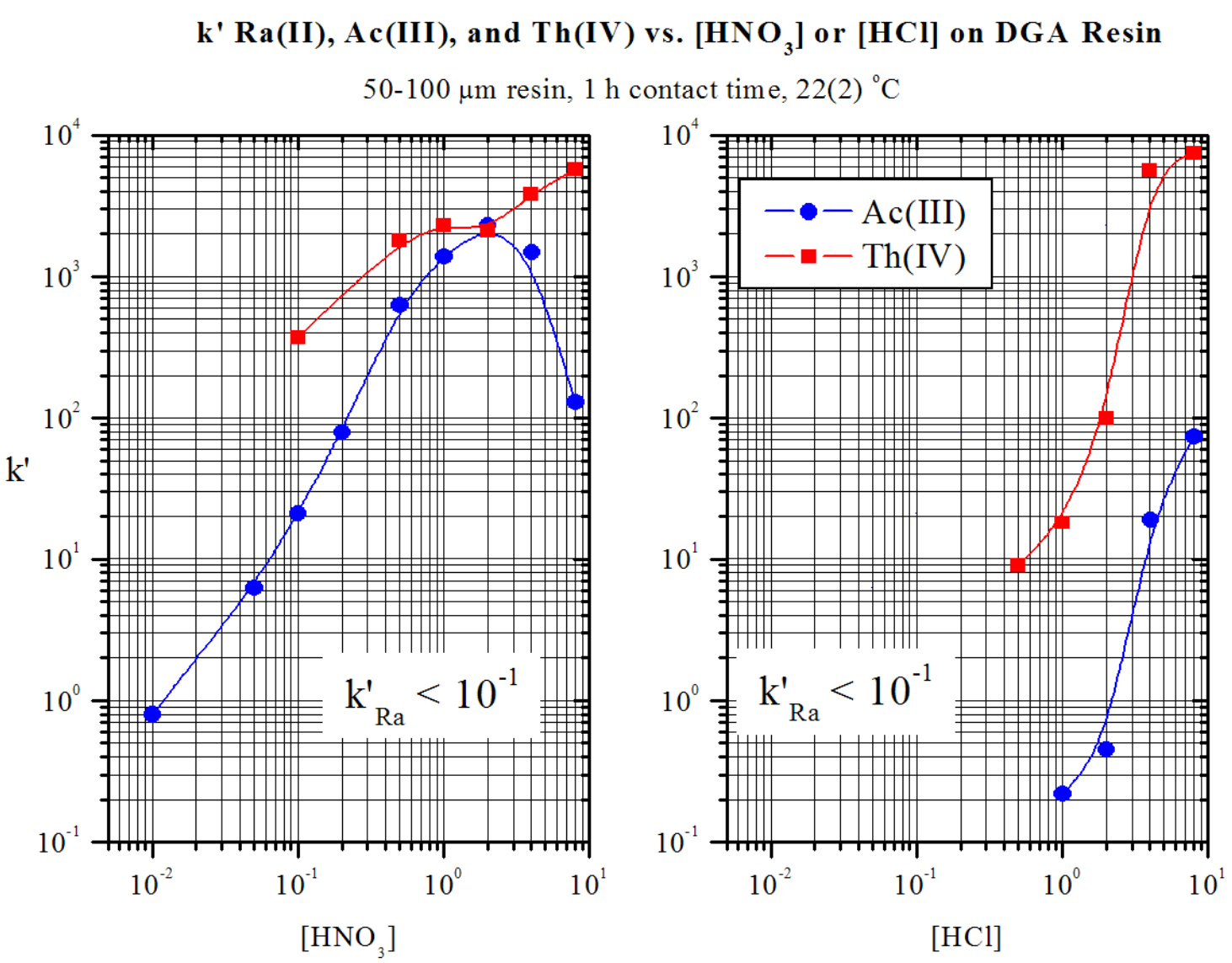


*Load = Nitric acid solutions of water, bioassay, or leached or dissolved soil samples.

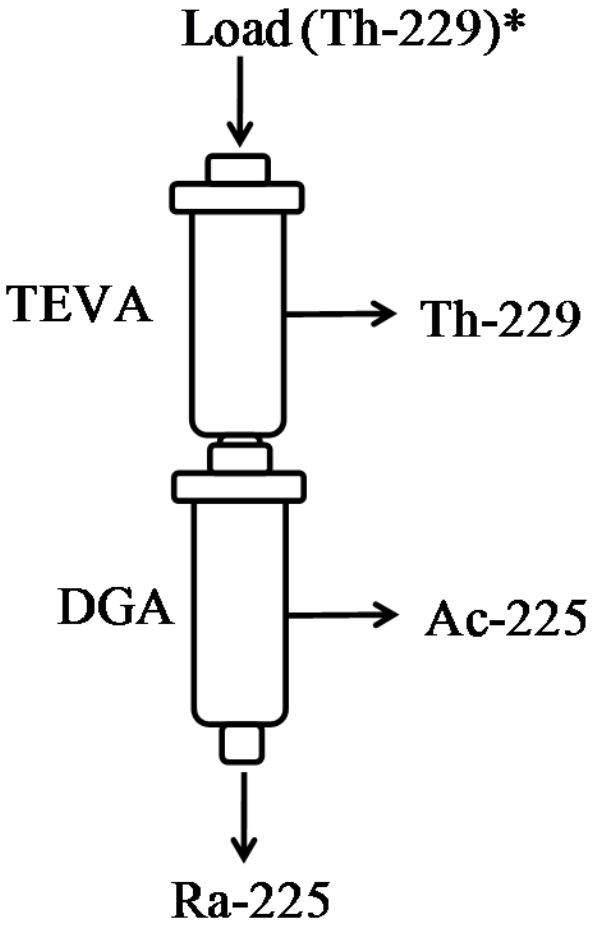
Examples of Coupled Column Arrangements

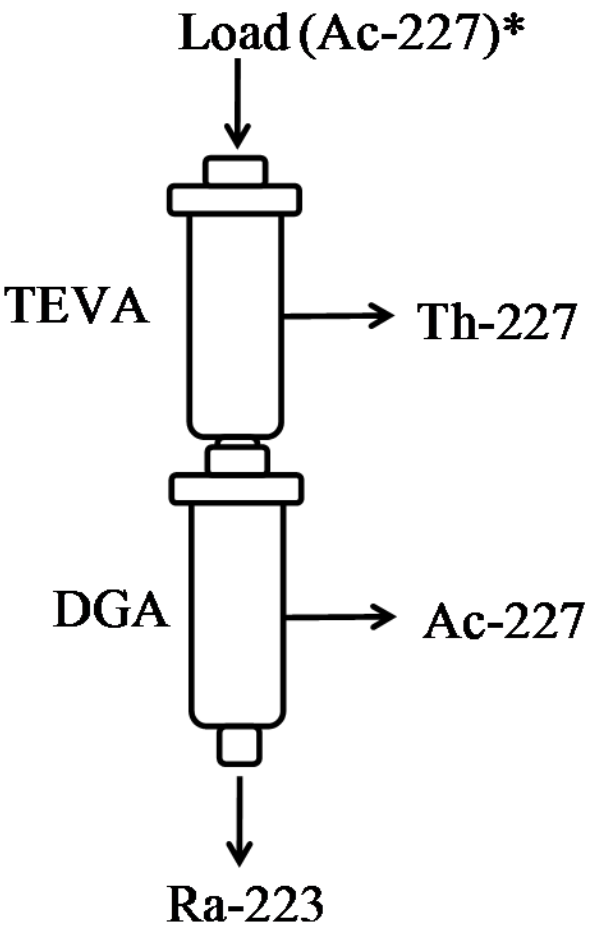


**Load = Hydrochloric acid solutions of dissolved or leached soil, water


k' Ra(II), Ac(III), and Th(IV) vs. [HNO3] or [HCl] on DGA Resin
50-100 µm resin, 1 h contact time, 22(2) °C
k'
[HNO3]
[HCl]
k'Ra < 10-1
k'Ra < 10-1
Ac(III)
Th(IV)

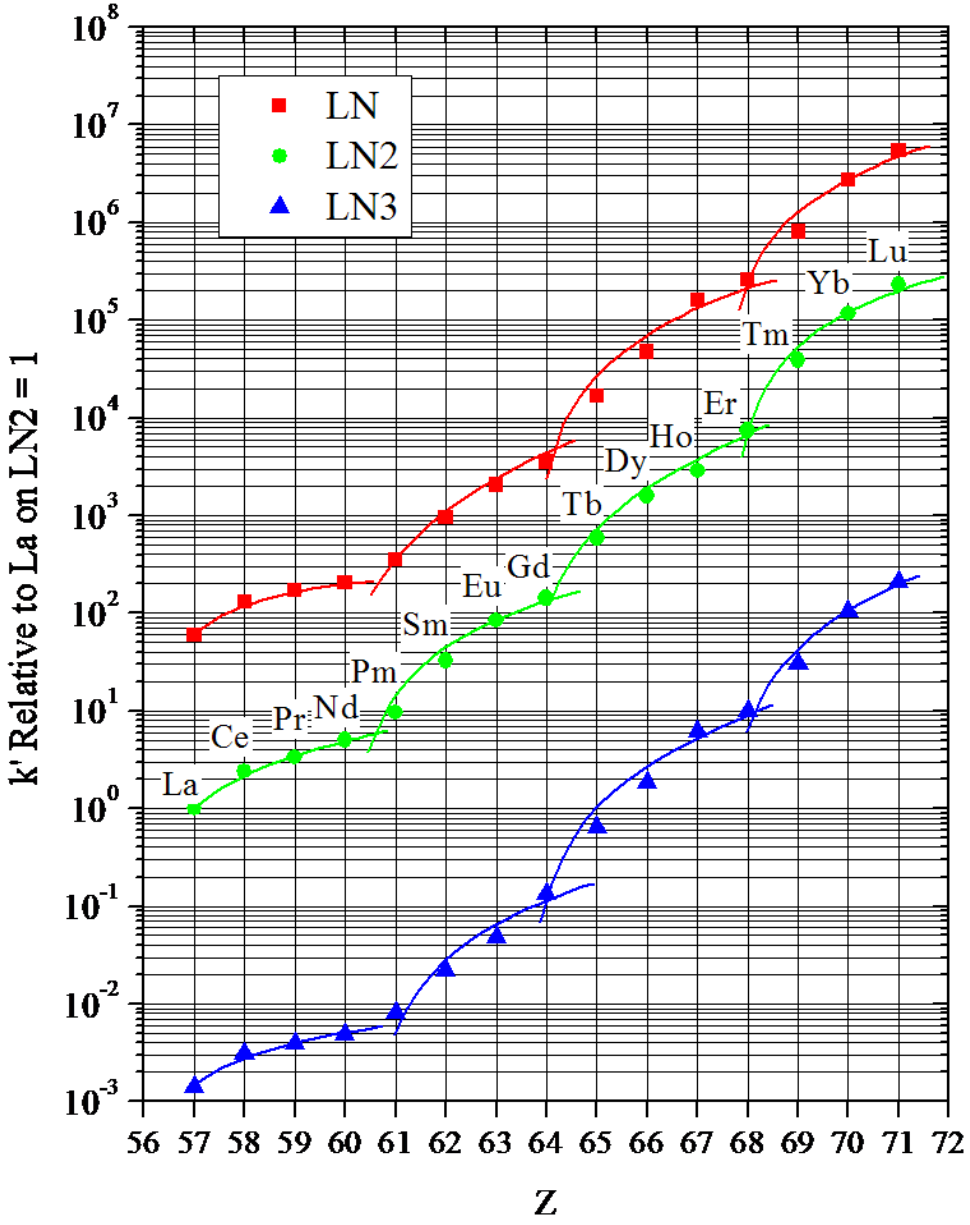
Examples of Coupled Column Arrangements





*Load = Nitric acid solutions of water, bioassay, or leached or dissolved soil samples.

Relative Extraction of Ln(III)



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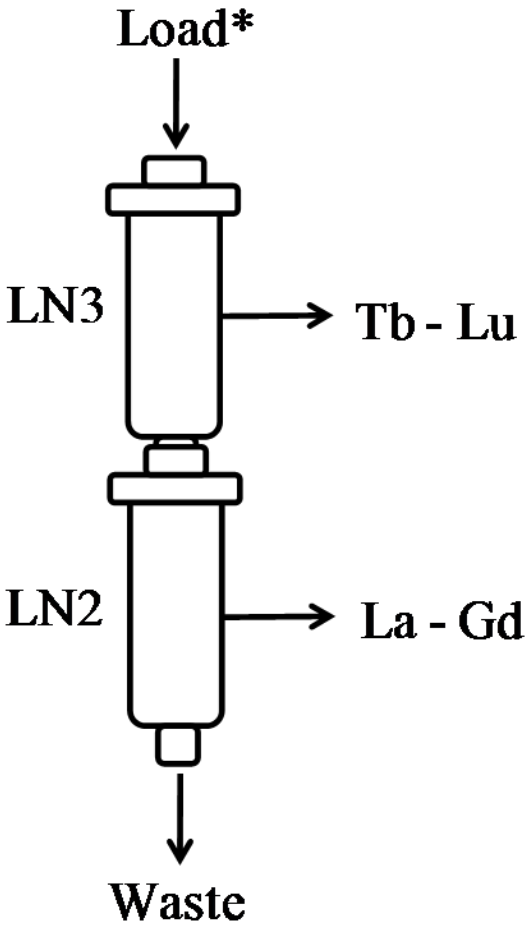

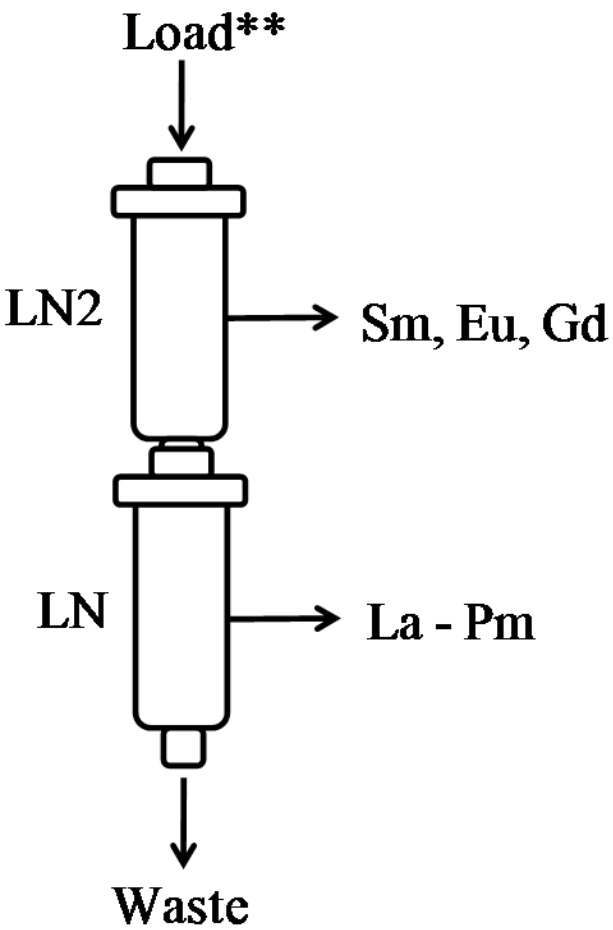

*Load = 0.02 M HNO_3 or HCl

**Load = 0.1 M HNO_3 or HCl