

Supplementary material

Table S1: Distribution ratio of Li⁺ and LIB metal cations. Experimental settings were c(Li⁺) = 2.5 g L⁻¹, c(H⁺) ranges from 0 to 1.85 M, MgCl₂ as chloride source, n(Fe³⁺/Li⁺) = 1.4 (mol/mol) and R(O/A) = 1.3 (v/v).

log c(H ⁺ ,eq)	Al	Co	Cu	Fe	Li	Mn	Ni
-2.5229	0.0128	0.0195	0.0509	1646	5.2334	0.0620	0.0110
-2.3372	0.0137	0.0198	0.0528	3880	5.6042	0.0661	0.0050
-2.2218	0.0008	0.0193	0.0513	201.9	5.4817	0.0618	0.0047
-2.0088	0.0017	0.0162	0.0445	3192	4.7216	0.0551	0.0040
-1.9355	0.0008	0.0143	0.0395	1632	4.6306	0.0494	0.0036
-1.3655	0.0417	0.0078	0.0237	212.8	3.0892	0.0273	0.0033
-0.8035	0.0086	0.0048	0.0158	905.9	1.3280	0.0098	0.0039
-0.4800	0.0749	0.0046	0.0181	3616	1.0179	0.0075	0.0032
-0.2861	0.0349	0.0050	0.0178	4777	0.4937	0.0044	0.0022
-0.0123	0.0415	0.0065	0.0230	5163	0.3330	0.0037	0.0023
0.1545	0.0362	0.0070	0.0255	5629	0.2205	0.0030	0.0023

Table S2: Distribution ratio of LIB metals for different chloride sources. Experimental settings were R(O/A) = 1.2, n(Fe³⁺/Li⁺) = 1.3 and c(H⁺, initial) = 0.1 M.

	Al	Co	Cu	Fe	Li	Mn	Ni
AlCl ₃	0.0095	0.0282	0.0423	1362	19.4017	0.4154	0.0010
CoCl ₂	0.0427	0.0135	0.0316	289.3	7.7384	0.2076	0.0060
CuCl ₂	0.0874	0.0097	0.0237	29.51	3.6068	0.1448	0.0043
MnCl ₂	0.0634	0.0029	0.0322	290.5	2.3898	0.0367	0.0010
NiCl ₂	0.0505	0.0170	0.0324	360.8	9.9130	0.2556	0.0085
MgCl ₂	0.0065	0.0107	0.0471	1563	4.2382	0.0413	0.0010

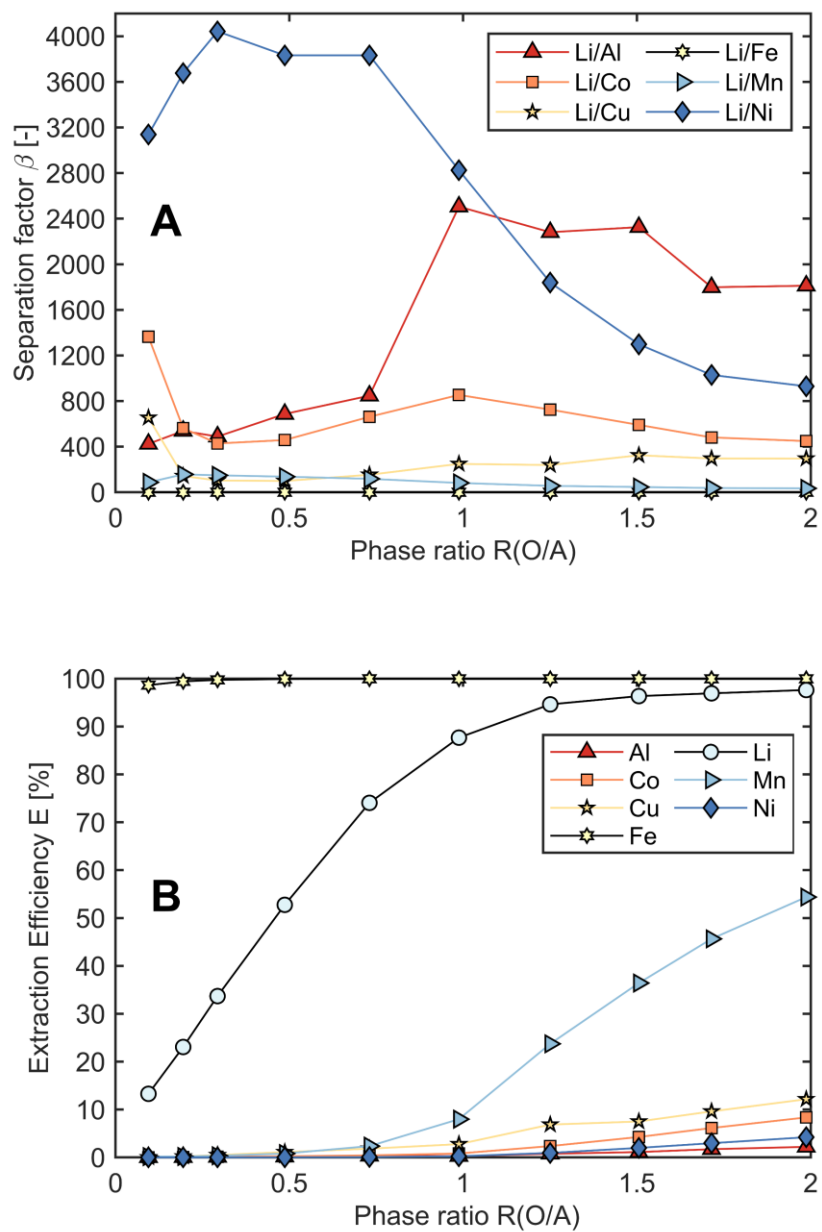


Figure S1: Effect of phase ratio R(O/A) on separation factor β of Li over LIB metals(A) and fraction extracted E of LIB metals (B). Experimental settings were $n(\text{Fe}/\text{Li}) = 1.3$ and $c(\text{H}^+, \text{initial}) = 0.1 \text{ M}$. AlCl_3 was utilized as chloride source.