Supplementary information for

"Morpholine-Derived Hydrophilic 1,10-phenanthroline-2,9-dicarboxamide for Americium–Lanthanide Separation in Phosphine Oxide Extraction Systems"

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1. NMR, IR and HRMS spectra of L

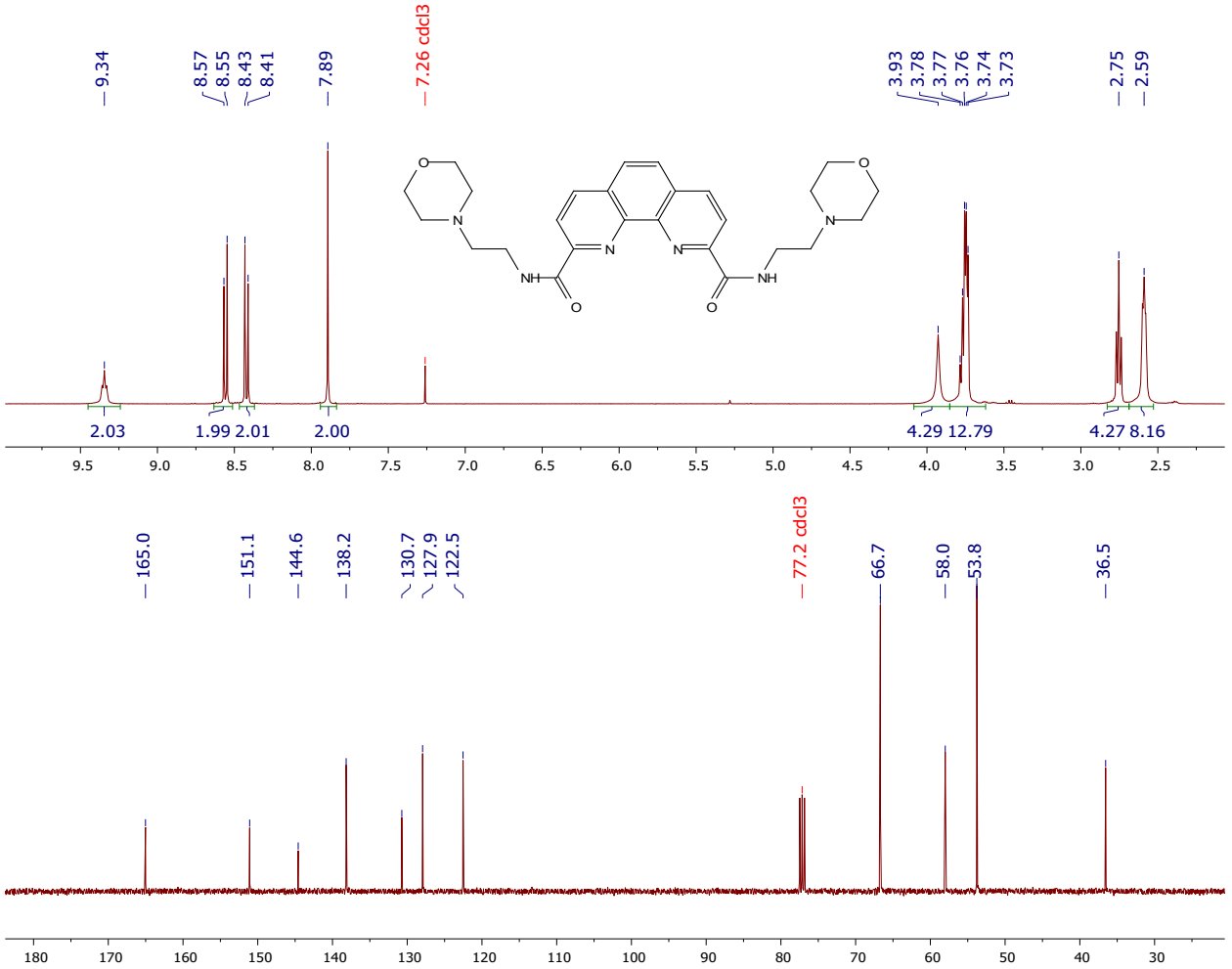


Figure S1. ^{1}H and ^{13}C NMR spectra ($CDCl_3$, 25 °C).

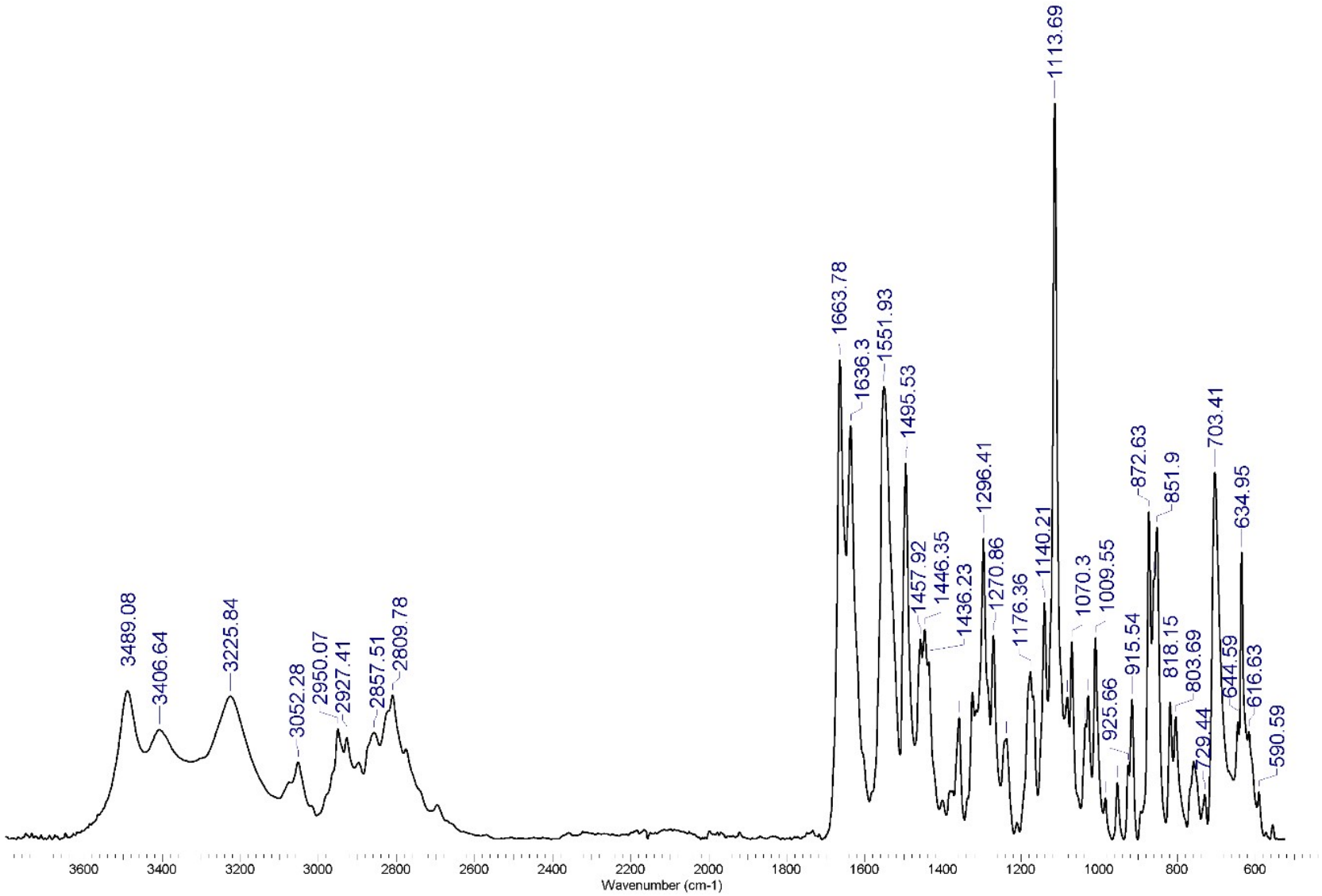


Figure S2. Solid-state IR spectrum of **L**.

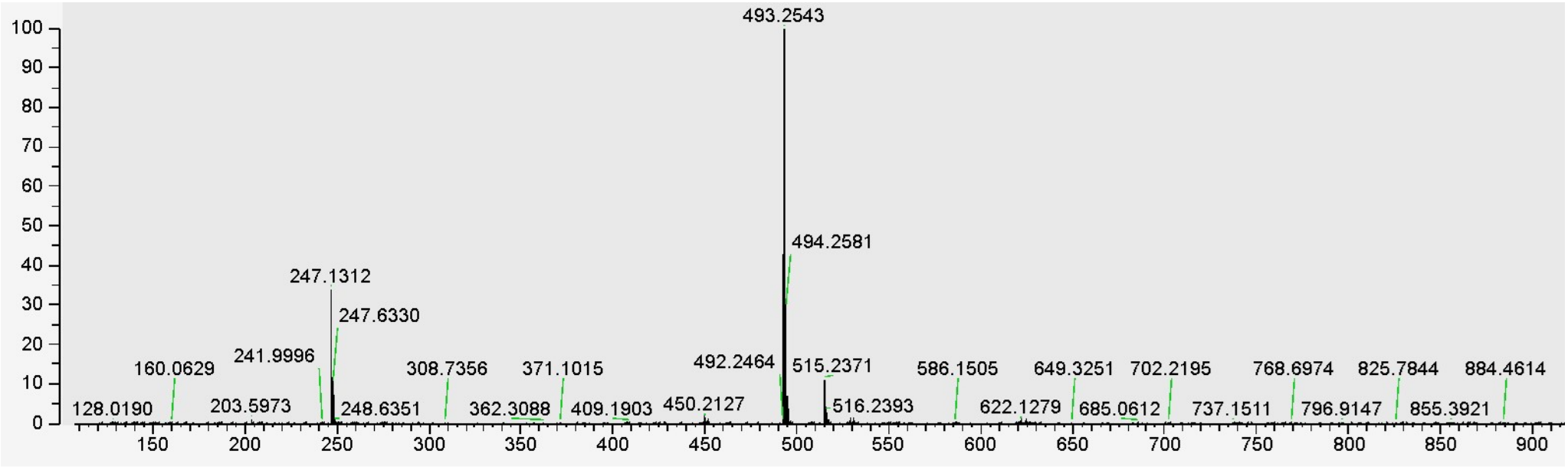


Figure S3. HRMS spectrum of **L**.

2. Potentiometric titration data

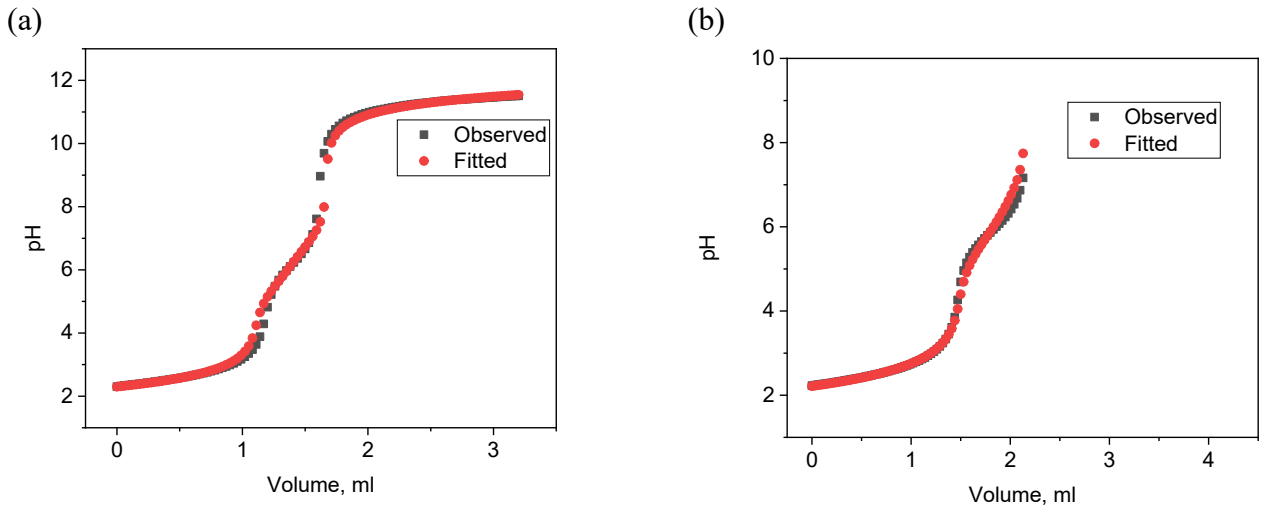


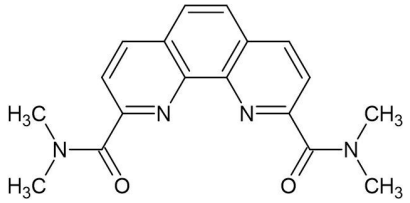
Figure S4. (a) Potentiometric titration curves observed (black points) and fitted (red points) for aqueous solution ofligand **L** ($[L]_{total}$ = 1.0 mM) as a function of pH. (b) Potentiometric titration curves observed (black points) and fitted (red points) for aqueous solution of ligand **L** ($[L]_{total}$ = 2.0 mM) in the presence of Eu(III) ($[Eu]_{total}$ = 1.0 mM) as a function of pH.

3. X-ray crystallography

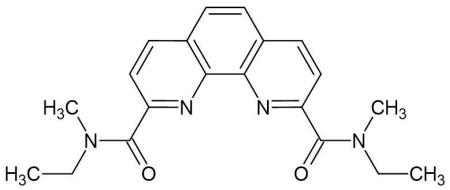
Table S1. Crystal data and structure refinement parameters.

Identification code	LaL	EuL	ErL
Empirical formula	$C_{26}H_{35}LaN_{10}O_{17}$	$C_{26}H_{37}EuN_{10}O_{18}$	$C_{26}H_{44}ErN_{11}O_{24}$
Formula weight	898.55	929.61	1061.98
Temperature/K	100	100	100
Crystal system	triclinic	triclinic	monoclinic
Space group	P-1	P-1	C2/c
a/Å	9.1879(3)	9.2372(6)	29.3427(15)
b/Å	9.3337(3)	9.2714(5)	7.2948(4)
c/Å	21.2534(8)	21.8651(12)	36.3733(17)
α/°	88.7220(10)	98.190(2)	90
β/°	79.5490(10)	92.689(2)	91.742(2)
γ/°	69.9790(10)	110.491(2)	90
Volume/Å^3	1682.51(10)	1726.71(18)	7782.1(7)
Z	2	2	8
ρ_{calc}g/cm^3	1.774	1.788	1.813
μ/mm^{-1}	1.363	1.912	2.264
F(000)	908.0	940.0	4296.0
Crystal size/mm^3	0.13 × 0.1 × 0.01	0.17 × 0.05 × 0.03	0.39 × 0.18 × 0.01
Radiation	MoKα (λ = 0.71073)	MoKα (λ = 0.71073)	MoKα (λ = 0.71073)
2Θ range for data collection/°	3.902 to 52.9	3.784 to 53.996	4.482 to 51.124
Reflections collected	22739	25475	30311
Independent reflections	6919 [R_{int} = 0.0397, R_{sigma} = 0.0465]	7524 [R_{int} = 0.0523, R_{sigma} = 0.0552]	7262 [R_{int} = 0.0558, R_{sigma} = 0.0502]
Data/restraints/parameters	6919/0/499	7524/106/529	7262/2/569
Goodness-of-fit on F^2	1.060	1.156	1.073
Final R indexes [I>=2σ (I)]	R_1 = 0.0362, wR_2 = 0.0735	R_1 = 0.0591, wR_2 = 0.1349	R_1 = 0.0437, wR_2 = 0.0775
Final R indexes [all data]	R_1 = 0.0426, wR_2 = 0.0758	R_1 = 0.0628, wR_2 = 0.1389	R_1 = 0.0536, wR_2 = 0.0807
Largest diff. peak/hole / e Å^{-3}	0.94/-1.07	4.10/-3.71	1.49/-1.47
CCDC	2481118	2481119	2481120

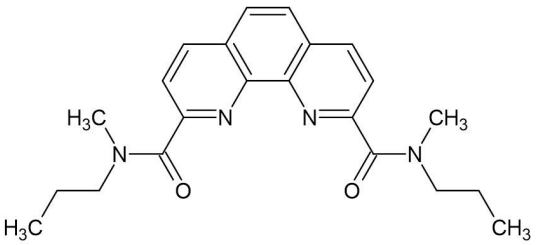
4. Structural formulas of some ligands discussed in the work



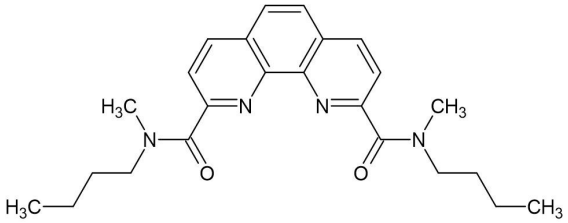
DAPhen-1



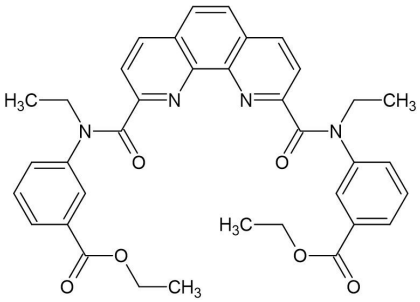
DAPhen-2



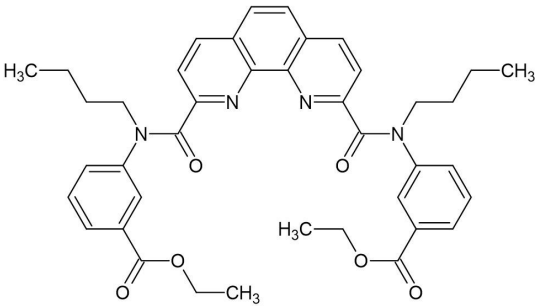
DAPhen-3



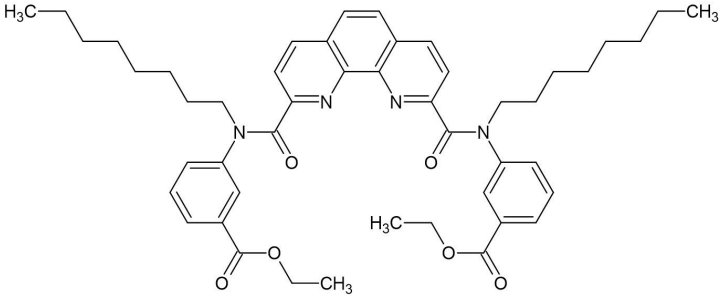
DAPhen-4



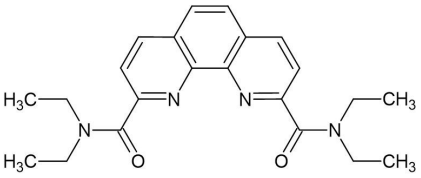
Et-EB-DAPhen



But-EB-DAPhen



Oct-EB-DAPhen



Et-Et-DAPhen

Figure S5. Structural formulas of selected ligands discussed in the work.

5. Solvent extraction with TODGA

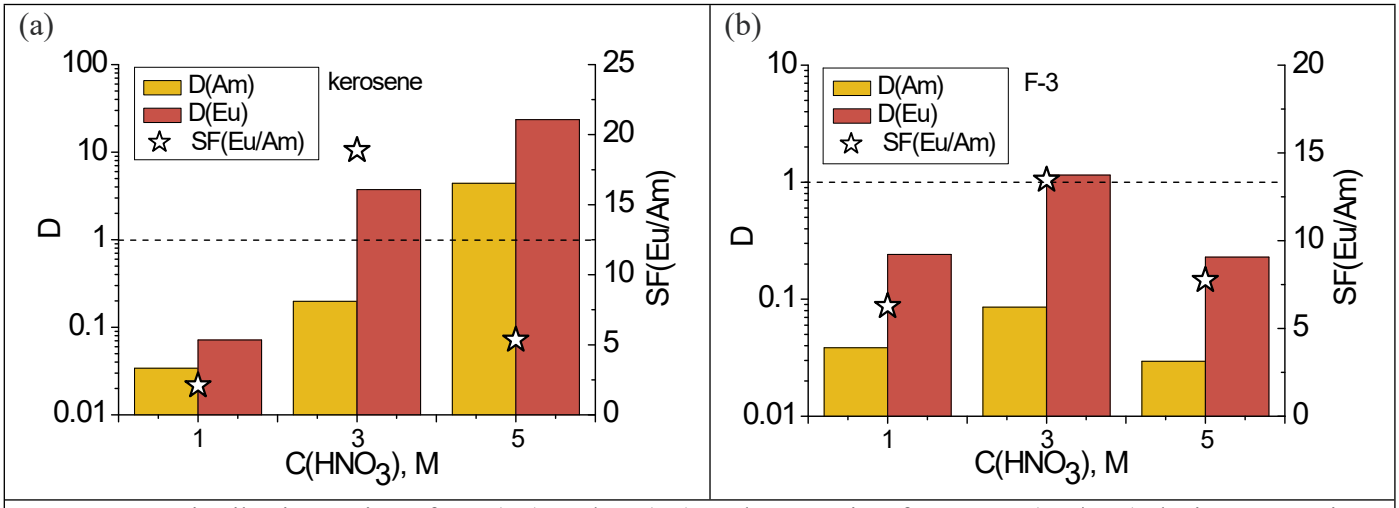


Figure S6. Distribution ratios of Am(III) and Eu(III) and separation factors SF(Eu/Am) during extraction by 0.005 mol/L TODGA in kerosene (a) or F-3 (b). Aqueous phase: 0.01 mol/L **L** in 1-5 mol/L HNO_3 + $^{241}Am/^{152}Eu$ radiotracers.