Supplementary information for

Kinetic features of solvent extraction by N,O-donor ligands of *f*-elements: a comparative study of diamides based on 1,10-phenanthroline and 2,2′-bipyridine

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1.1. Solvent extraction kinetic

Fabrication of the droplet generator

The droplet generator was fabricated from condensation cure silicone Best Mold 10 (SP-Polymer, Russia). The components containing polyorganosiloxanes and tin catalyst were mixed in a 50:1 ratio and transferred into a casting mold. The channel system in it was formed from 330 μm diameter copper wire. After 1 day, the generator was removed from the mold. The Figure S1 shows the scheme of the generator channels. The supply tubes were inserted directly into the generator channels at a depth of 3–5 mm.

Measurement of droplet volume and specific contact surface area

Droplets in the capillary tube were imaged by transmitted light microscopy in MBS-9 optical microscope for each trial after the flow was stopped. Images were captured using a Scopetec MDC-560 microscope eyepiece camera and analyzed using ImageJ 1.54 software. The dimensions shown in Figure S2 were measured for the aqueous (convex edges) and organic phase (concave edges) droplets.

The specific interfacial surface was determined as the ratio of the average value of the interfacial surface A to the average volume of the aqueous phase drop V_{aq} in the trial. In all trials, the differences in the values of specific interfacial surface and droplet volume of both aqueous and organic phases did not exceed 4 times. At the same time, the interfacial surface itself changed insignificantly.

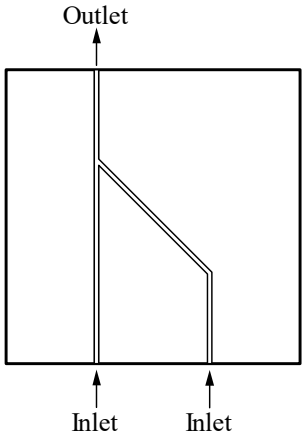


Figure S1 Schematic diagram of the channels of the droplet generator.

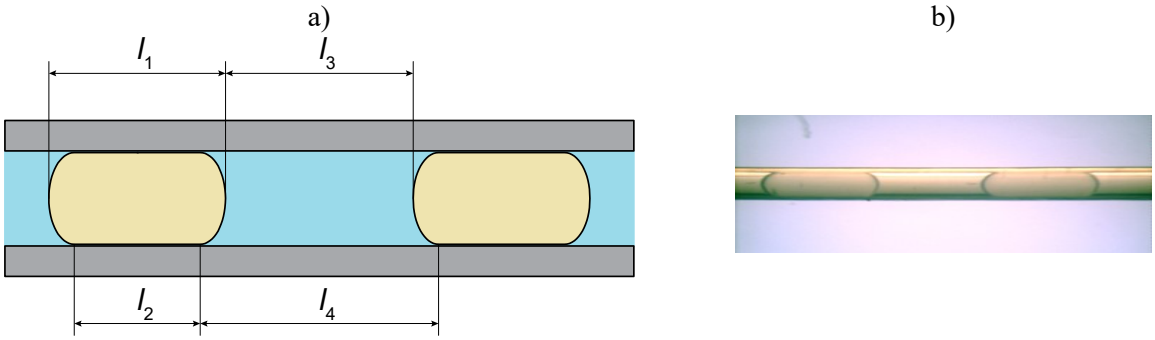


Figure S2 a) Measured droplet parameters of the aqueous (l_1, l_2) and organic (l_3, l_4) phases, b) microscope image of obtained droplets.

The interfacial areas of the droplets (including the slug caps only and not the region in contact with the capillary wall) were calculated based on the approximation of the surface area of an oblate ellipsoid of revolution:

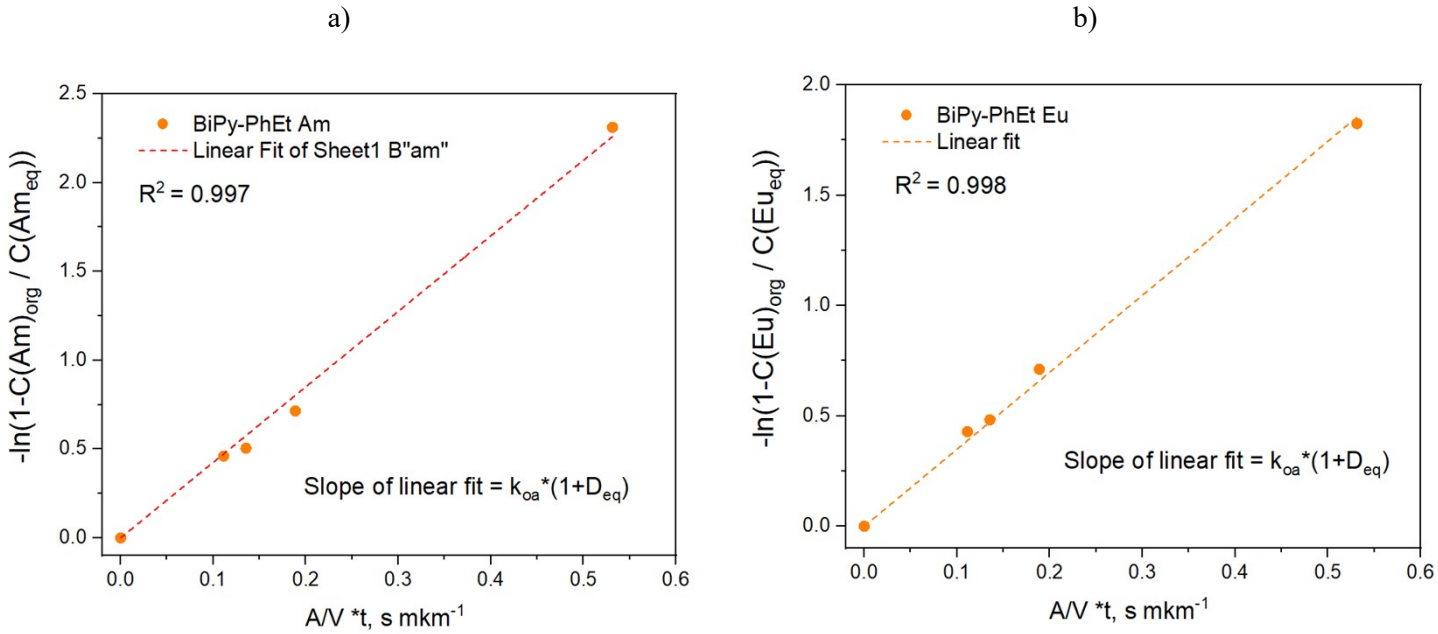
$$A = 2\pi a^2 \left(1 + \frac{c^2}{ea^2} \tanh^{-1} e\right),$$

where $e^2 = 1 - c^2 / a^2$, a – inner radius of the capillary tube, $c = (l_1 - l_2) / 2$.

The volumes of aqueous (V_{aq}) and organic phase droplets (V_{org}) were calculated according to the following expressions:

$$V_{aq} = \pi a^2 l_2 + \frac{4}{3}\pi a^2 \frac{(l_1 - l_2)}{2},$$

$$V_{org} = \pi a^2 l_4 - \frac{4}{3}\pi a^2 \frac{(l_4 - l_3)}{2}.$$



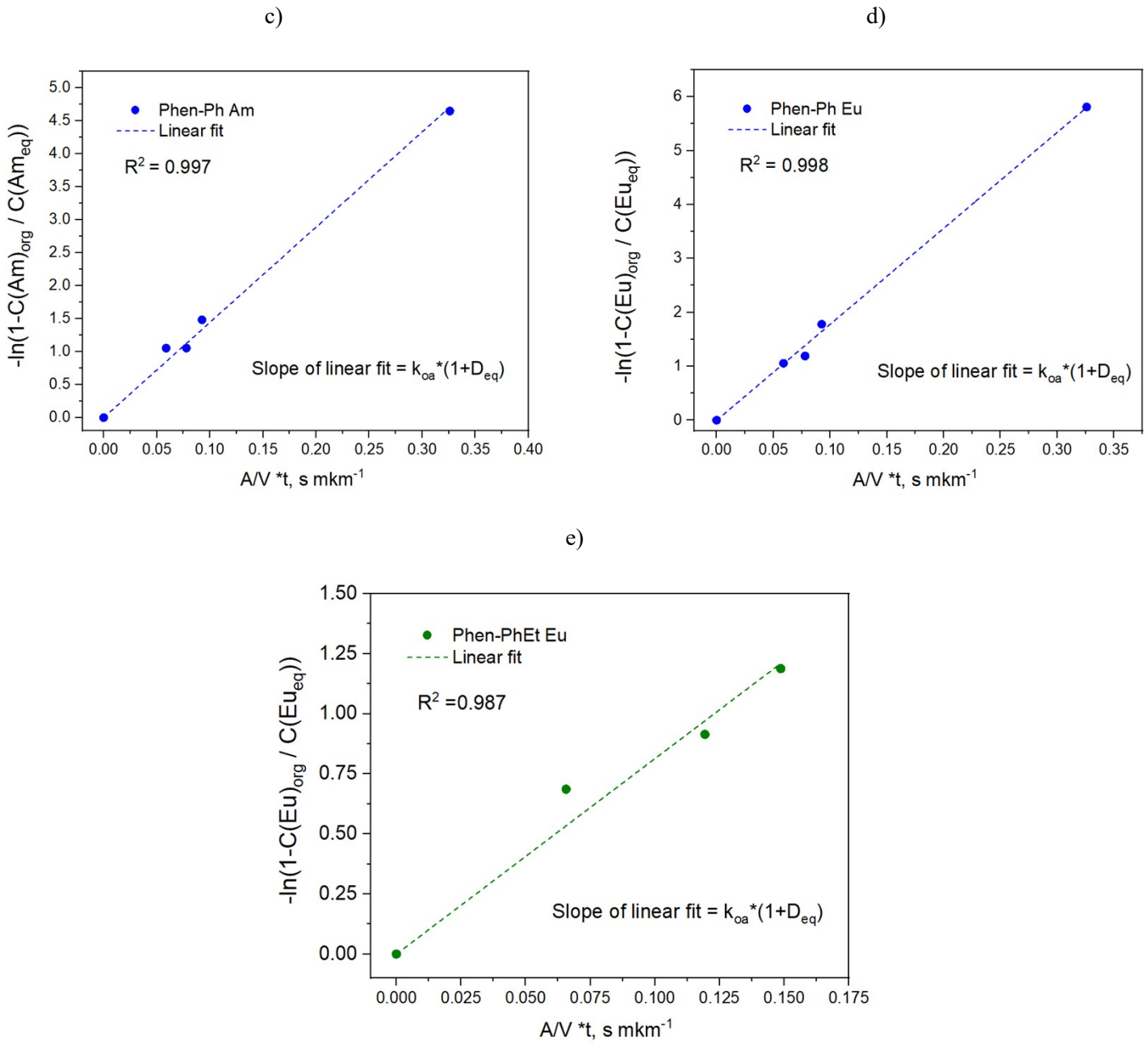


Figure S3 Kinetics data for the experiment: **aqueous phase:** HNO_3 3 mol L^{-1} with ^{152}Eu radiotracer, **organic phase**: C(Phen-Ph) or C(Phen-PhEt) = 0.01 mol L^{-1}, or C(BiPy-PhEt) = 0.05 mol L^{-1} in F-3, T = 23 ± 1 °C.

Table S1 Am(III) interfacial mass transfer rate data. k_{obs} corresponds to the slope of the dependence of $-\ln(1 - C_{org} / C_{eq})$ on t (see Figure S2) The errors are obtained from the values of the standard deviation when performing the linear approximation.

Ligand	k_{oa}, mm/s	k_{ao}, mm/s	k_{obs}
BiPy-PhEt	$(1.53 \pm 0.05) \cdot 10^{-3}$	$(2.72 \pm 0.08) \cdot 10^{-3}$	$(1.45 \pm 0.02) \cdot 10^{-2}$
Phen-PhEt	-	-	-
Phen-Ph	$(1.93 \pm 0.06) \cdot 10^{-3}$	$(1.25 \pm 0.04) \cdot 10^{-2}$	$(2.93 \pm 0.04) \cdot 10^{-2}$

1.2. Crystal data

Table S2 Crystallographic details for BiPy-PhEt structures.

Empirical formula	$C_{32}H_{34}N_4O_2$
M_w	506.63
Temperature (K)	100(2)
Crystal size (mm^3)	0.18 × 0.15 × 0.06
Crystal system	monoclinic
Space group	$P2_1/n$
a (Å)	9.3987(15)
b (Å)	11.4649(16)
c (Å)	13.311(2)
α (°)	90
β (°)	103.835(5)
γ (°)	90
V ($Å^3$)	1392.7(4)
Z	2
ρ_{calc} (g/cm^3)	1.208
μ (mm^{-1})	0.076
$F(000)$	540
2θ range for data collection (°)	$4.75 < 2\theta < 53.99$
Reflections collected	14623
Independent reflections	3035
Data/restraints/parameters	3035/0/174
Goodness-of-fit on F^2	1.021
Final R indexes [$I \geq 2\sigma(I)$]	$R_1 = 0.0523$, $wR_2 = 0.0975$
Final R indexes [all data]	$R_1 = 0.0957$, $wR_2 = 0.1176$
Largest diff. peak/hole (e $Å^{-3}$)	0.22 / −0.27

Table S3 Significant torsion angles in BiPy-PhEt ligand.

Torsion angle	°
N1-C1-C1A-N1A (N_{py}-N_{py})	180.00(13)
N1-C5-C6-O1 (N_{py}-O_{amide})	147.72(17)
O1-C6-N2-C7 (O_{amide}-C_{aryl})	162.03(17)