ELECTRONIC SUPPLEMENTARY INFORMATION

Silica-based monoliths functionalized with DTPA for the removal of transition and lanthanide ions from aqueous solutions†

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1) Figures:

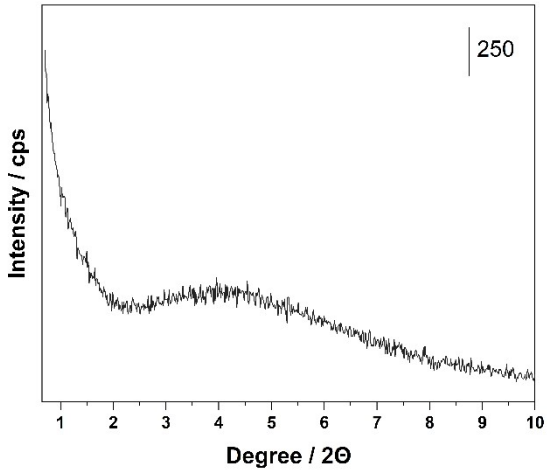

Figure S1. X-ray powder diffractogram of MONO.

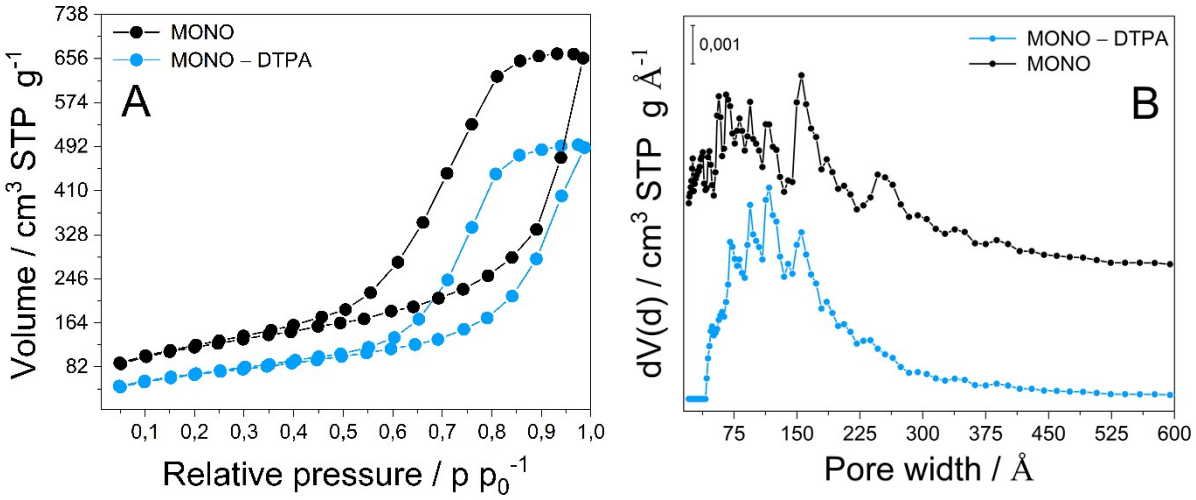

Figure S2: *N_2 adsorption/desorption isotherms at 77K (A) and Pore Volume distribution (B) of MONO (-●-) and MONO-DTPA (-●-).*

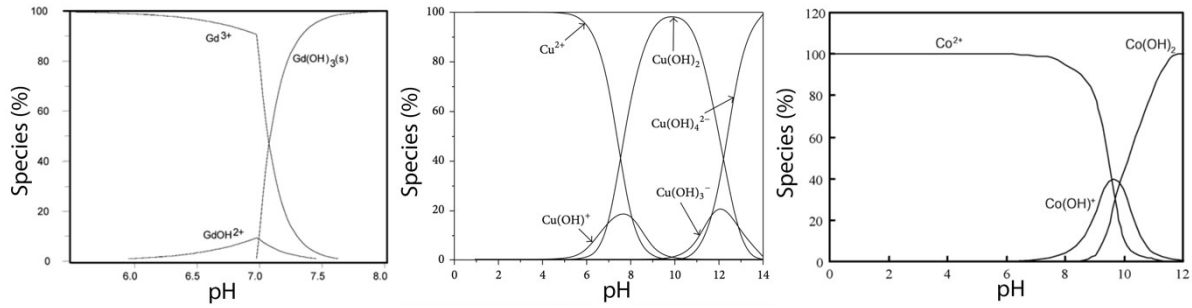

Figure S3. *Speciation diagram of Gd^{3+}, Cu^{2+} and Co^{2+} ions as a function of pH.*[58-60]

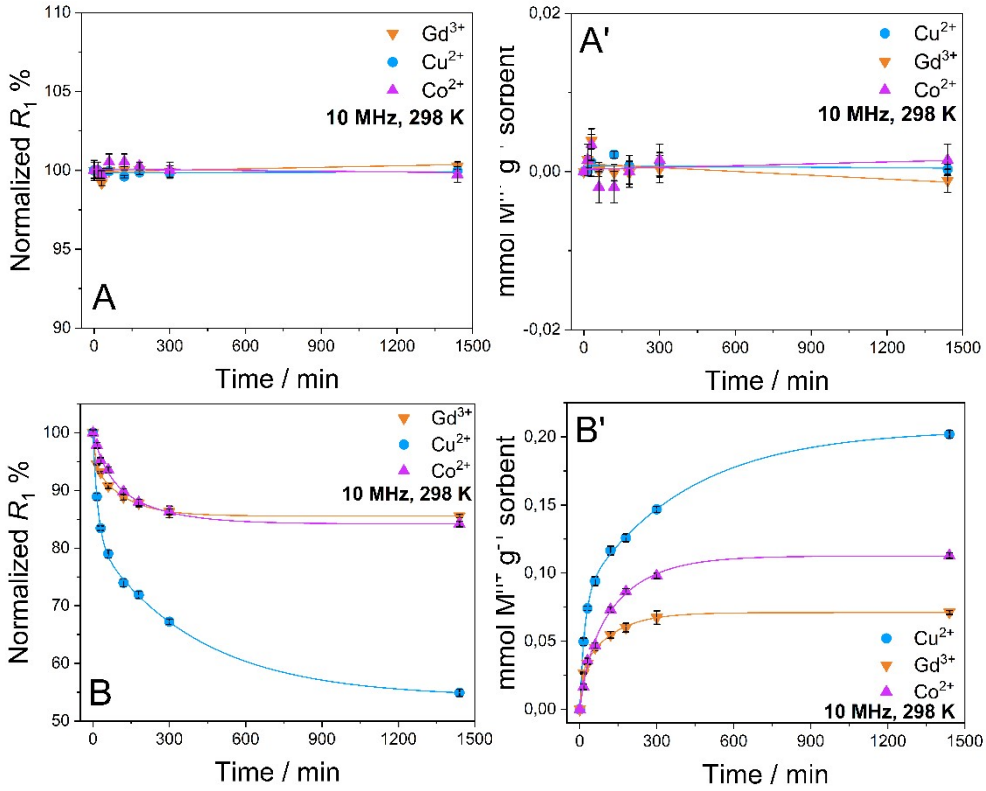

Figure S4. *A, B) R_1 percentage decrease overtime; A') amounts of Cu^{2+}, Co^{2+} and Gd^{3+} in mmol of captured metal per g of MONO overtime; B') amounts of Cu^{2+}, Co^{2+} and Gd^{3+} in mmol of captured metal per g of MONO-APTS overtime; (the points represent the mean value and the error bars indicate the standard deviation; n = 3).*

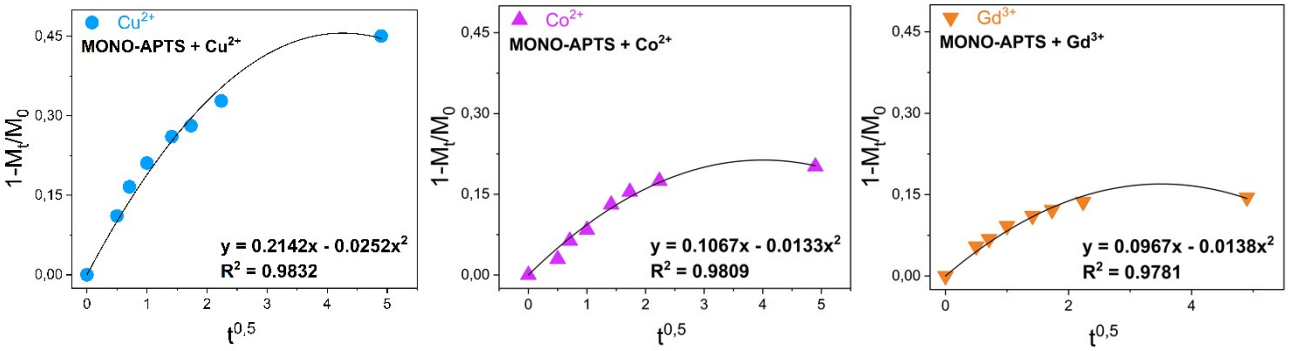

Figure S5. *Kinetic analysis of the uptake data for MONO-APTS sample.*

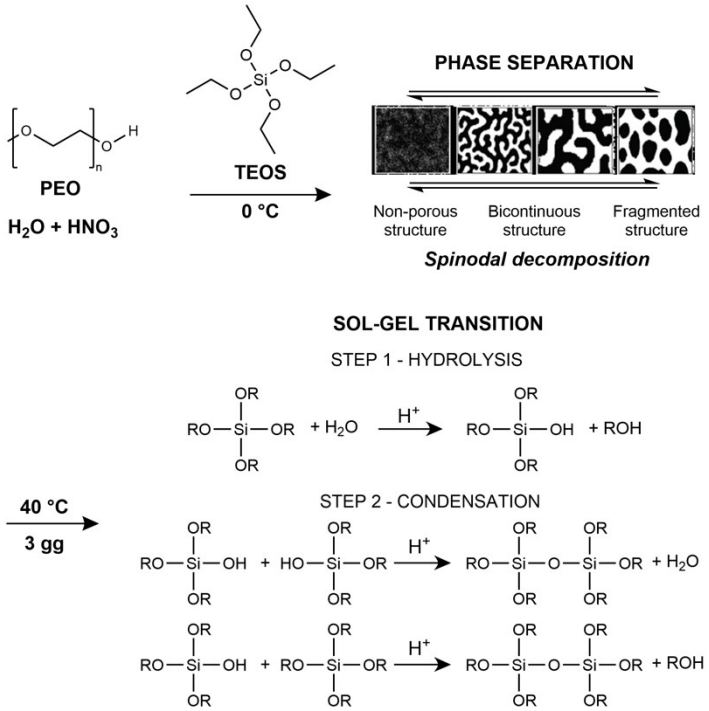

Figure S6. Digital image (left) and synthesis mechanism of MONO (right).

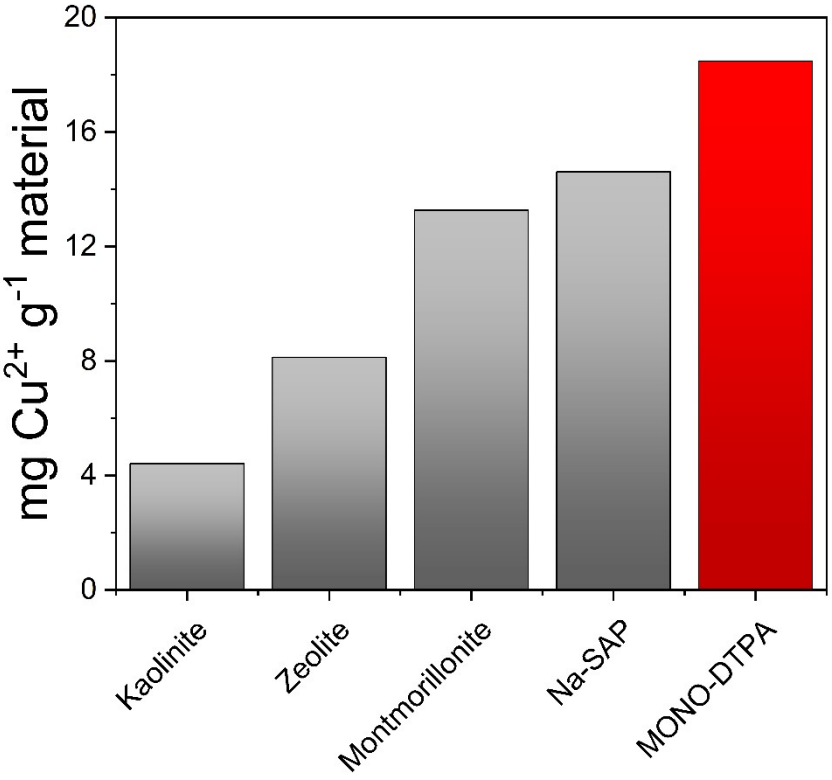

Figure S7. *Maximum adsorption capacities of Cu^{2+} ions of MONO-DTPA, Kaolinite clay,[65] Zeolite,[66] Montmorillonite clay,[67] sodium exchanged saponite clay (Na-SAP).[47]*

Tables:

Sample	C [%]	N [%]	H [%]	[APTS] (mmol/g)	[DTPA] (mmol/g)
MONO	0.157 ± 0.029	-	1.297 ± 0.053	-	-
MONO-APTS	4.832 ± 0.041	1.894 ± 0.018	1.571 ± 0.078	1.35 ± 0.02	-
MONO-DTPA	9.312 ± 0.028	3.171 ± 0.010	2.226 ± 0.034	-	0.31 ± 0.01

Table S1. *Average weight percentages (%) of carbon, nitrogen and hydrogen, and concentration (mmol/g) of APTS and DTPA obtained by CHN analysis on MONO, MONO-ATPS and MONO-DTPA; (standard deviations were calculated from a triplicate set of analyses).*

Sample	Specific Surface Area (SSA) [m^2/g]	Total Pore Volume [cm^3/g]	Mesopore Volume [cm^3/g]	Macropore Volume [cm^3/g]	Average Pore Diameter [Å]
MONO	430	0.999	0.939	0.060	155
MONO-DTPA	254	0.739	0.711	0.028	117

Table S2. *Specific surface area (SSA), volume and average pore diameter values for MONO and MONO-DTPA samples.*

Sample	mg M^{n+} / g sorbent	% Captured M^{n+} [a]	[APTS] (mmol /g)	Captured [M^{n+}] (mmol / g)
MONO + Gd^{3+}	0.18 ± 0.23	0.0 ± 0.0	-	0.00 ± 0.01
MONO + Cu^{2+}	0.00 ± 0.00	0.1 ± 0.0	-	0.00 ± 0.01
MONO + Co^{2+}	0.09 ± 0.11	0.3 ± 0.3	-	0.00 ± 0.01
MONO-APTS + Gd^{3+}	11.19 ± 0.23	14.5 ± 0.3	1.35 ± 0.03	0.07 ± 0.02
MONO-APTS + Co^{2+}	6.65 ± 0.99	20.1 ± 0.4	1.35 ± 0.03	0.11 ± 0.02
MONO-APTS + Cu^{2+}	12.83 ± 0.18	45.1 ± 0.6	1.35 ± 0.03	0.20 ± 0.03

[a] = in reference to the initial concentration value of each metal solution used (10 mM)

Table S3. *Amount of Gd^{3+}, Cu^{2+} and Co^{2+} metal ions captured by MONO and MONO-ATPS from their respective aqueous solutions after 24h, expressed as mg M^{n+} / g sorbent, mmol/g and % captured M^{n+}; (standard deviations were calculated from a triplicate set of analyses).*

Sample	Gd^{3+}	Co^{2+}	Cu^{2+}
MONO-APTS	k = 0.0967 s^{-1} R^2 = 0.9781	K = 0.1067 s^{-1} R^2 = 0.9809	k = 0.2142 s^{-1} R^2 = 0.9832

Table S4. *Kinetic constants (k) and determination coefficient (R^2) obtained by the fitting of the NMR relaxometric data of Fig. S5.*

Adsorbent	Uptake capacity (mg/g)	References
MONO-DTPA	18.48	-
Kaolinite	4.42	65
Zeolite	8.13	66
Montmorillonite	13.27	67
Na-SAP	14.61	47

Table S5. *Maximum adsorption capacities of Cu^{2+} ions captured by different materials.*