Electronic Supplementary Material (ESI) for Analyst

Electronic supplementary information

Table 1: Synthesis conditions and structural and textural parameters of cubic Pm3n aluminosilica membrane carriers fabricated using microemulsion phases of Brij 98 as soft templates with a wide range of Si/Al mole ratios. The unit lattice constant (a_{pm3n}= $d_{210}\sqrt{5}$), BET surface area (S_{BET}), and NLDFT pore size distribution (PSD), and pore volume (*Vp*) are indicated.

Si/Al	**Synthesis conditions**			**Structure parameters**			
	10^2 T/mol	(10^3)$Al(NO_3)_3$ /mol	Brij 98/TMOS w/w	*a* nm	S_{BET} m^2/g	*R* nm	V_p cm^3/g
19	1.31	0.7	0.5	14.1	703	4.3	0.73
4	1.31	3.4	0. 5	14.7	543	4.2	0.70
2.3	1.31	5.8	0.5	14.9	445	4.0	0.68
1.0	1.31	13.6	0. 5	15.2	390	3.9	0.43

Synthesis and characterization of the DSAHMP dye

The DSAHMP dye was prepared by dissolving 25 mmol (2.372 g) of 4,5-diamino-6-hydroxy-2-mercaptopyrimidine in 20 mL of DMF. The solution was then stirred for 3 h. Thereafter, 50 mmol (6.106 mL) of salicylaldehyde was mixed in 150 mL of ethanol. The 4,5-diamino-6-hydroxy-2-mercaptopyrimidine solution was added to the salicylaldehyde solution using an overhead stirrer for complete mixing, and the reaction mixture was refluxed for 2 h. The yellow precipitate was filtered, washed with a small amount of ethanol, and then dried at 60 °C. The purity of the (DSAHMP) dye product was analyzed using CHNS elemental analyses as follows: 58.99% C, 3.81% H, 15.35% N, and 8.70% S. The results are consistent with the C18H14N4O3S molecular formula, which requires 59.02% C, 3.82% H, 15.30% N, and 8.74% S. The product was characterized by 1H NMR and 13C NMR spectroscopy. The 1H NMR spectra were shown with the following signal resonances: δ 12.15 (H, s, SH), 11.53 (H, s, OH Pyr), 5.35 (2H, s, OH Ph), 7.02 (2H, m, CH Ph), 7.08 (2H, m, CH Ph), 7.52 (2H, m, CH Ph), 7.66 (2H, m, CH Ph), and 8.59 (2H, s, CH Azo), where the Ph, Pyr, and Azo are the phenyl, pyridine, and azo-methine groups, respectively. The 13C NMR spectra were shown with the following signal resonances: d 172.3 (C–SH), 166.7 (Pyr, C–OH), 174.7 (Pyr, C), 134.1 (Pyr, C), 161.8 (Azo, CH), 160.0 (Azo, CH), 120.5 (2Ph, C), 117.8 (2Ph, CH), 132.4 (2Ph, CH), 132.1 (2Ph, CH), 121.4 (2Ph, CH), and 161.1 (2Ph, C–OH). In addition, the dye product was recorded using UV–vis spectroscopy and displayed an absorbance band at λ_{max} = 369 nm (ε, $dm^3 mol^{-1}cm^{-1}$ = 40,650).

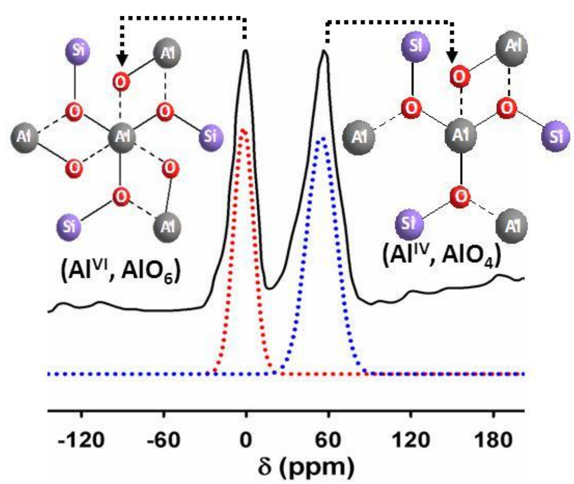

Figure S1 ^{27}Al MAS NMR spectra and a deconvolution of each peak of aluminosilica carriers fabricated with a Si/Al ratio of 4.

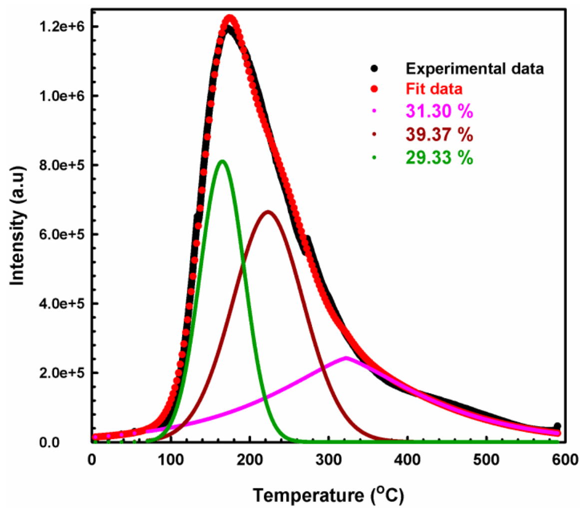

Figure S3 NH_3-TPD spectra and a deconvolution of each peak of hexagonal aluminosilica monoliths fabricated with a Si/Al mole ratio of 4. To determine the amount and strength of acid sites of the mesoporous aluminosilica particles quantitatively, we deconvoluted the peaks around 100 °C to 500 °C using a Gaussian function with temperature as the variant.

Table S2

The evidence of the selective removal of targets without disturbance of other interfered ions using ICP-AES analyses of metal ions. The metal ions was spiked in aqueous samples and measured before and after removal of metal ion target using a nanocaptor. This captor was fabricated with a Si/Al ratio of 4. The analysis was repeated 10 times for high accuracy and precision.

Target	Captor	ICP analysis of the samples	Efficiency[(a)]
Cu (II)	Al/HOM- DSAHMP	**Mixture (1)** (1) 1000 ppm of K^{+}, (2) 1000 ppm of Li^{+}, (3) 500.0 ppm of Ca^{2+}, (4) 100 ppm of Mg^{2+}, (5) 4.0 ppm of Cr^{6+}, (6) 4.0 ppm of Al^{3+}, (7) 3.0 ppm of Ba^{2+}, (8) 4.5 ppm of Ni^{2+}, (9) 4.5 ppm of Mn^{2+}, (10) 4.5 ppm of Zn^{2+}, (11) 4.0 ppm of Co^{2+}, (12) 4.0 ppm of Cd^{2+}, (13) 4.0 ppm of Pb^{2+}, (14) 4.0 ppm of Hg^{2+}, (15) 3.5 ppm of Fe^{3+}, (16) 4.0 ppm of Bi^{3+}, (17) 3.5 ppm of Sb^{3+}, (17) 4.0 ppm of Mo^{6+}, and (19) 4.0 ppm of Se^{4+} (20) **2.0 ppm of Cu^{2+}**	
		(A) Removal	98.25 %
		(1) 1000 ppm of K^{+}, 1000 ppm of Li^{+}, (3) 500.0 ppm of Ca^{2+}, (4) 100 ppm of Mg^{2+}, (5) 4.0 ppm of Cr^{6+}, (6) 3.98 ppm of Al^{3+}, (7) 2.9 ppm of Ba^{2+}, (8) 4.4 ppm of Ni^{2+}, (9) 4.6 ppm of Mn^{2+}, (10) 4.5 ppm of Zn^{2+}, (11) 4.0 ppm of Co^{2+}, (12) 4.0 ppm of Cd^{2+}, (13) 3.85 ppm of Pb^{2+}, (14) 4.0 ppm of Hg^{2+}, (15) 3.45 ppm of Fe^{3+}, (16) 4.0 ppm of Bi^{3+}, (17) 3.5 ppm of Sb^{3+}, (17) 4.0 ppm of Mo^{6+}, and (19) 3.9 ppm of Se^{4+} (20) **0.035 ppm of Cu^{2+}**	
		(B) Extraction/separation = 1.9 ppm	95.5 %
Zu (II)	Al/HOM- DZ	**Mixture (2)** (1) 1000 ppm of K^{+}, (2) 1000 ppm of Li^{+}, (3) 500.0 ppm of Ca^{2+}, (4) 100 ppm of Mg^{2+}, (5) 4.0 ppm of Cr^{6+}, (6) 4.0 ppm of Al^{3+}, (7) 3.0 ppm of Ba^{2+}, (8) 4.5 ppm of Ni^{2+}, (9) 4.5 ppm of Mn^{2+}, (10) 4.5 ppm of Cu^{2+}, (11) 4.0 ppm of Co^{2+}, (12) 4.0 ppm of Cd^{2+}, (13) 4.0 ppm of Pb^{2+}, (14) 4.0 ppm of Hg^{2+}, (15) 3.5 ppm of Fe^{3+}, (16) 4.0 ppm of Bi^{3+}, (17) 3.5 ppm of Sb^{3+}, (17) 4.0 ppm of Mo^{6+}, and (19) 4.0 ppm of Se^{4+} (20)**1.0 ppm of Zn^{2+}**	
		(A) Removal	98.9 %
		(1) 1000 ppm of K^{+}, 1000 ppm of Li^{+}, (3) 500.0 ppm of Ca^{2+}, (4) 100 ppm of Mg^{2+}, (5) 3.92 ppm of Cr^{6+}, (6) 3.99 ppm of Al^{3+}, (7) 2.9 ppm of Ba^{2+}, (8) 4.3 ppm of Ni^{2+}, (9) 4.6 ppm of Mn^{2+}, (10) 4.49 ppm of Cu^{2+}, (11) 4.0 ppm of Co^{2+}, (12) 4.0 ppm of Cd^{2+}, (13) 3.85 ppm of Pb^{2+}, (14) 3.89 ppm of Hg^{2+}, (15) 3.5 ppm of Fe^{3+}, (16) 4.0 ppm of Bi^{3+}, (17) 3.48 ppm of Sb^{3+}, (17) 4.0 ppm of Mo^{6+}, and (19) 3.8 ppm of Se^{4+}, **0.011 ppm of Zn^{2+}**	
		(B) Extraction/separation = 0.98 ppm	98.0 %

[(a)] The efficiency of the nanocaptor was calculated from the % ratio of the metal uptake or extracted concentrations and the initial concentration of metal ions in mixture.

Table S3 Analysis of Zn(II), and Cu(II) in spiked environmental samples with optical mesocaptors using amount of 20 mg, volume of 20 mL, and temperature of 25 °C

Sample Source	**Sample composition ($mg\ dm^{-3}$)**	Zn^{2+} or Cu^{2+} **spiked amount (ppb)**	Zn^{2+} **analysed amount (ppb) -**	Cu^{2+} **analysed amount (ppb) -**
Food processing	0.005-As^{5+}, 10-Mn^{2+}; 0.2 - Sn^{2+}, Sb^{2+}; 10 - Ca^{2+}, 1.5 - Ni^{2+}, Fe^{2+}; 0.05 - $Cr^{3+/6+}$, Mg^{2+}	100	100.1 ± 3.2	99.7 ± 2.2
Hospital effluent	1.75 - Co^{2+}, Ni^{2+}, Mn^{2+}, Fe^{2+}; 20 - Ca^{2+}, 100 - Na^{+}, K^{+}, Mg^{2+}	100	99.5 ± 4.0*	99.6 ± 3.0*