Supporting Information

An Alternative Approach for Preparation of Core-Shell Bimetallic Central Metal-Organic Framework as Hydrophilic Interaction Liquid Chromatography Stationary Phase

Tiantian Si[1,2] Licheng Wang[1] Xiaofeng Lu[1] Xiaojing Liang[1] Shuai Wang[1]* Yong Guo[1]*

[1]CAS Key Laboratory of Chemistry of Northwestern Plant Resources and Key Laboratory for Natural Medicine of Gansu Province, Lanzhou Institute of Chemical Physics, Chinese Academy of Sciences, Lanzhou 730000, China

[2]University of Chinese Academy of Sciences, Beijing 100049, China

E-mail: licpws@hotmail.com* (Shuai Wang); guoyong@licp.cas.cn* (Yong Guo)

Phone: +86 931 4968266 Fax: +86 931 4968013

Captions:

Figures:

(S1) Fig.S1a-b: the SEM micrographs of bare silica and the ZnCoMOF@silica: a bare silica, b ZnCoMOF@silica; Fig.S1b: FTIR spectra results of bare silica, ZnCoMOF and ZnCoMOF@silica; Fig.Sc: the PXRD results of bare silica, ZnCoMOF and ZnCoMOF@silica; Fig.S1d: the N_2 adsorption-desorption isotherms of ZnCoMOF@silica.

(S2) Batch-to-batch reproducibility of the ZnCoMOF@silica. Chromatograms for the separation of seven carbohydrates with ZnCoMOF@silica. L-rhamnose monohydrate (1), D-ribose (2), D-Fructose (3), sucrose (4), lactose (5), melezitose (6) and raffinose

(7) mobile phase: 90% acetonitrile, 10% water; flow rate = 0.8 mL min^{-1}, T = 25℃. ELS detector: gas flow:4 L min^{-1}, tube temperature 115℃.

(S3) Effect of pH on the retention factor (k) of alkaloids and effect of buffer concentration for the separation of nucleosides and nucleobases with the ZnCoMOF@silica columns. Conditions: a, 90% acetonitrile and 10% 100 mmol L^{-1} ammonium acetate; flow rate = 0.8 mL min^{-1}, T = 25℃, UV detection: 254 nm. The rang of pH is 4-10; b, mobile phase: 0-6 min 90% acetonitrile, 10% water, 6-8 min 70% acetonitrile, 30% water, 18-20 min 60% acetonitrile, 40% water, flow rate = 0.8 mL min^{-1}, T = 25℃, UV detection: 254 nm. The rang of buffer concentration is 10-250 mol L^{-1}

(S4) Chromatograms for the separation of five amino acid compounds on ZnCoMOF@silica, bare silica and amino modified columns. L-Cysteine (1), L-Tryptophan (2), L-Methionine (3), DL-Threonine (4)，Glycine (5); mobile phase: 60% acetonitrile, 40% water, flow rate = 0.8 mL min^{-1}, T = 25℃. ELS detector: gas flow: 4 L min^{-1}, tube temperature 115℃.

(S5) Chromatograms for the separation of seven alkaloids on ZnCoMOF@silica, bare silica and amino modified columns. sanguinarine (1), caffeine (2), theophylline (3), berberine (4), Palmatine chloride (5), coptisine(6), jatrorrhizine (7); mobile phase: 90% acetonitrile and 10% 100 mmol L^{-1} ammonium acetate; flow rate = 0.8 mL min^{-1}, T = 25℃, UV detection: 254 nm.

(S6) Chromatograms for the separation of six antibiotic compounds on ZnCoMOF@silica,bare silica and amino modified columns. cefotaxime sodium(1),

ceftizoxime (2) ceftiofur hydrochloride (3), cefuroxime sodium (4), cefalexin (5), cefpirome sulfate(6); mobile phase: 0-6 min 90% acetonitrile, 6-8 min 70% acetonitrile, another mobile phase is 100mM ammonium acetate solution, flow rate = 0.8 mL min^{-1}, T = 25℃, UV detection: 254 nm.

(S7) Chromatograms for the separation of four sulfonamides on ZnCoMOF@silica,bare silica and amino modified columns. sulfadimoxine (1), sulfaguanidine (2), sulfadiazine (3), sulfasalazine (4). mobile phase: 90% acetonitrile and 10% 100 mmol L^{-1} ammonium acetate; flow rate = 0.8 mL min^{-1}, T = 25℃, UV detection: 254 nm.

(S8) The separation of amino acid compounds on 5μm or 3 μm ZnCoMOF@silica for column efficiency comparison.

Tables:

(S1) BET analysis results of bare silica and ZnCoMOF@silica.

(S2) Batch-to-batch reproducibility of the ZnCoMOF@silica.

(S3) The results of regression coefficients of Eq. (1) for the model compounds on ZnCoMOF@silica stationary phase.

(S4) Repeatability and reproducibility of ZnCoMOF@silica column.

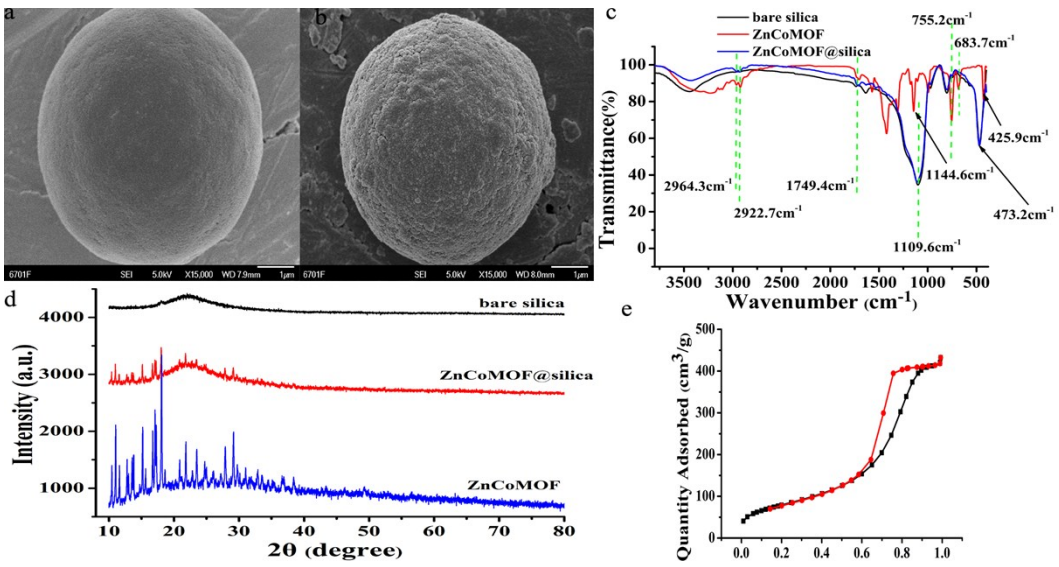

Figure S1

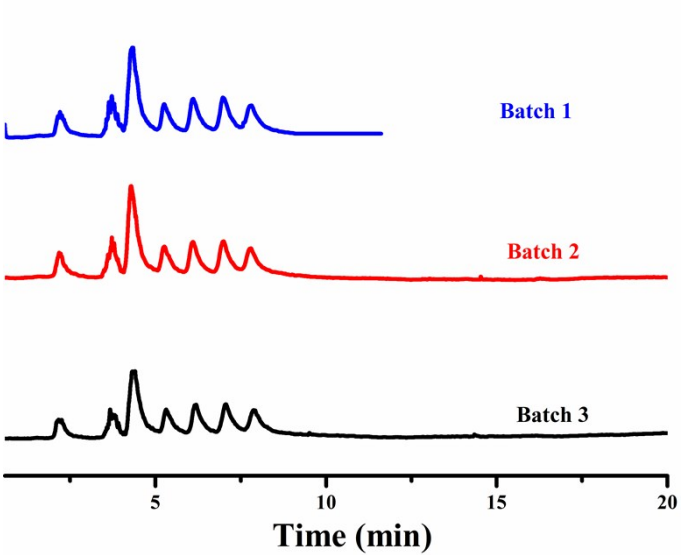

Figure S2

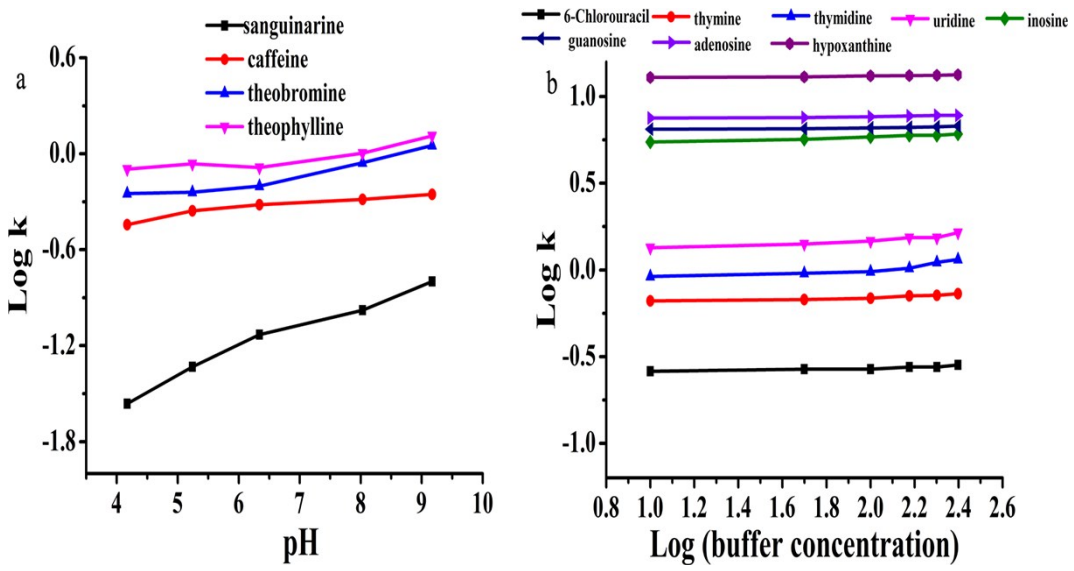

Figure S3

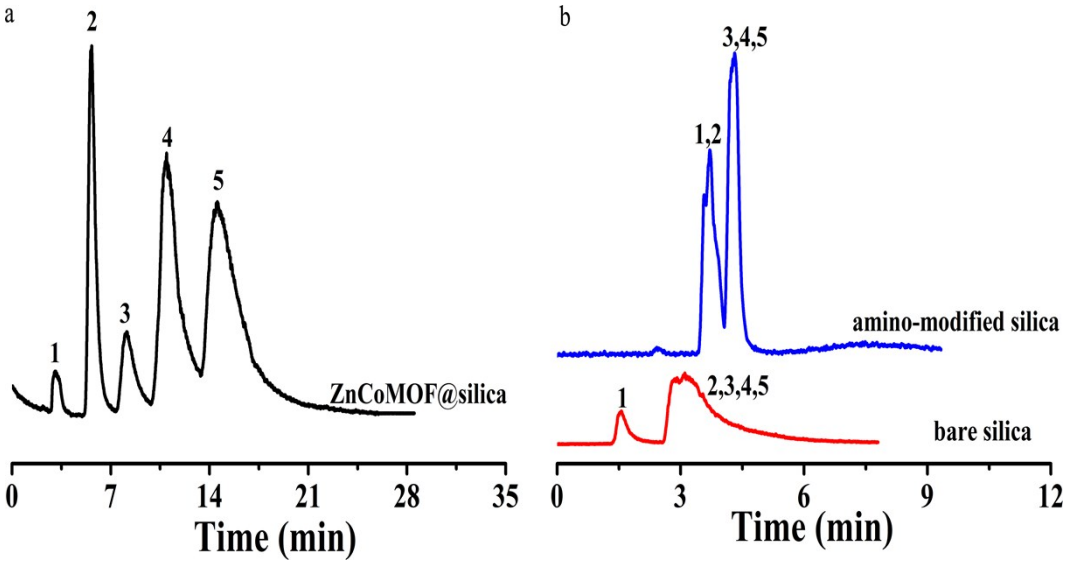

Figure S4

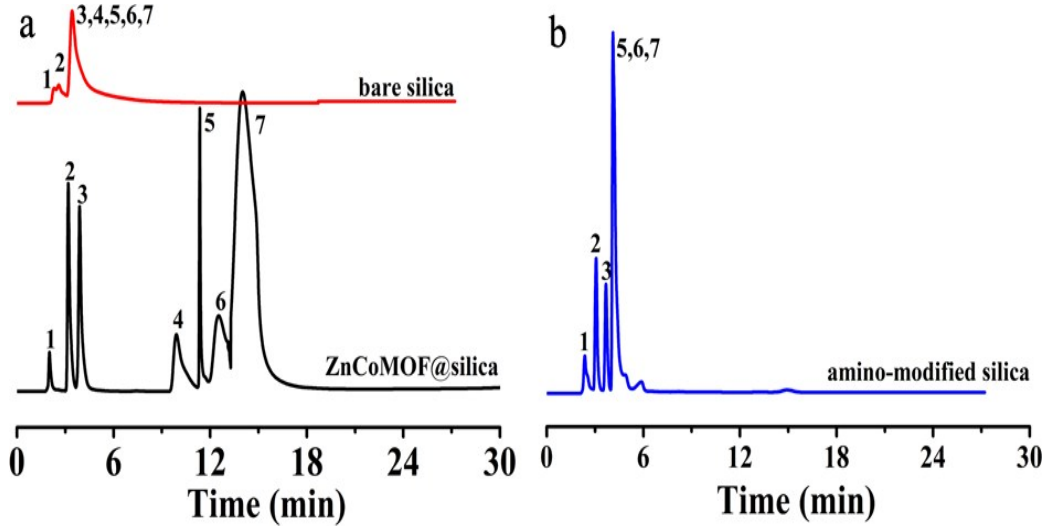

Figure S5

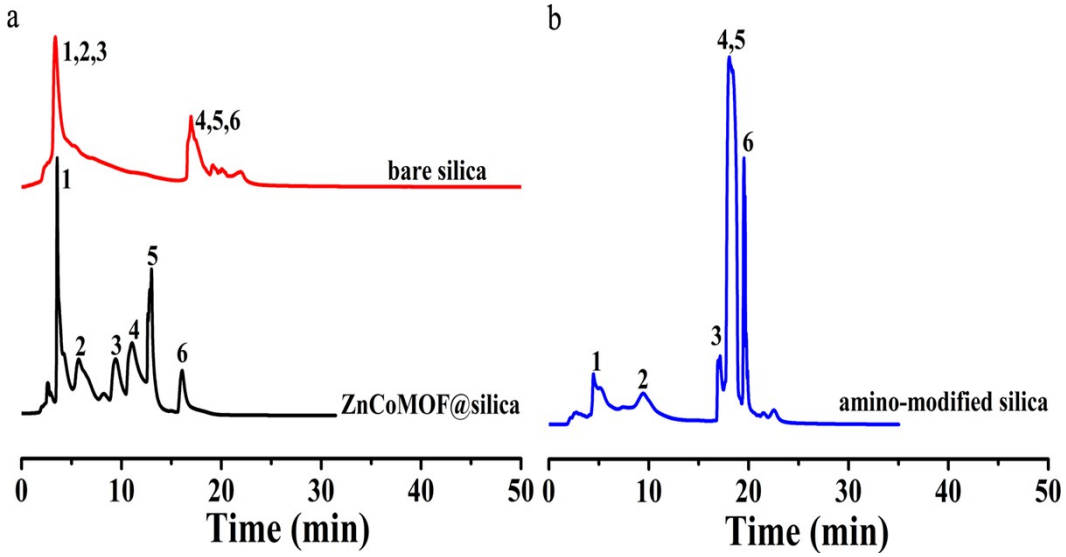

Figure S6

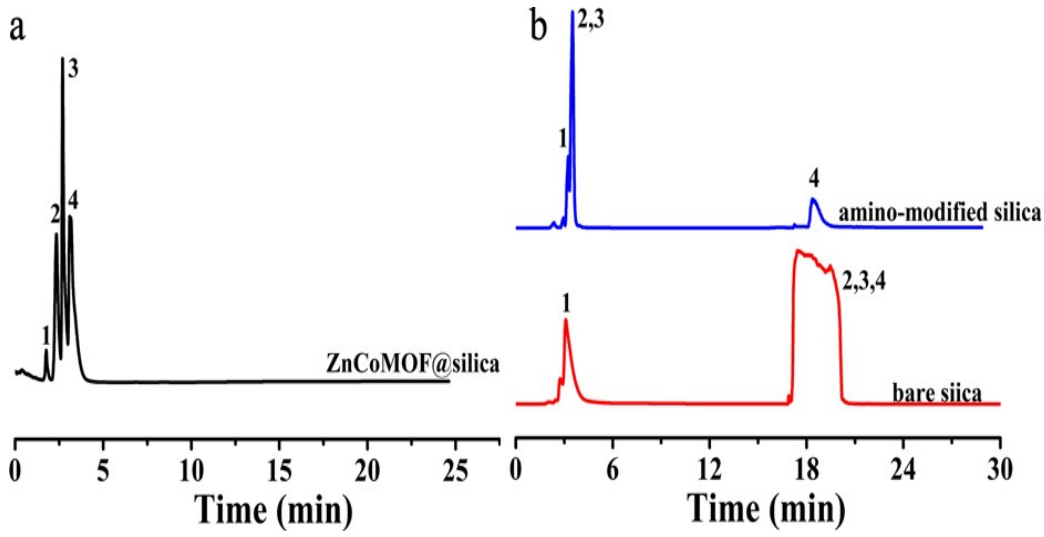
a
3
2
4
1
ZnCoMOF@silica
0
5
10
15
20
25
Time (min)
b
2,3
1
4
amino-modified silica
1
2,3,4
bare siica
0
6
12
18
24
30
Time (min)

Figure S7

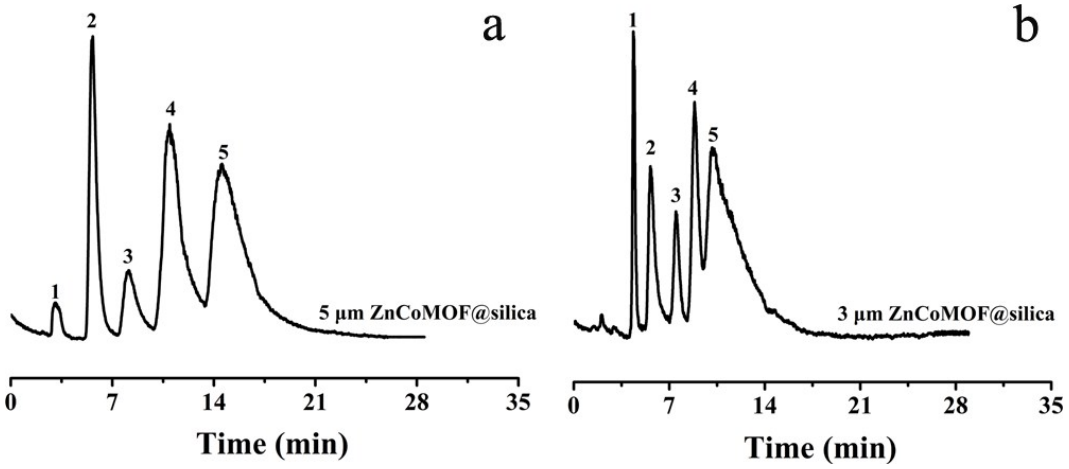
a
b
1
2
3
4
5
5 μm ZnCoMOF@silica
3 μm ZnCoMOF@silica
0
7
14
21
28
35
Time (min)

Figure S8

Table S1

BET Analysis	Bare silica	ZnCoMOF@silica
BET Surface Area (m^2/g)	365.7	290.0
Adsorption pores volume (cm^3/g)	0.69	0.65
Adsorption average pore width (nm)	7.1	8.9

Table S2

Analytes	Retention time (min)			
	Column 1	Column 2	Column 3	RSD(%)
D-ribose	2.178	2.191	2.23	1.23
L-rhamnose monohydrate	3.723	3.845	3.613	3.11
D-Fructose	4.288	4.391	4.301	1.29
sucrose	5.259	5.291	5.257	0.36
D-Lactose	6.097	6.31	6.083	2.06
melezitose	6.998	7.212	7.121	1.51
raffinose	7.768	7.801	7.891	0.81

Table S3

Solutes	a	b	c	R^2
D-ribose	2.65	0.592	-7.21	0.9983
D-Fructose	0.17	-0.507	-2.73	0.9991
sucrose	1.08	-0.184	-3.73	0.9978
lactose	-0.218	-0.91	-1.909	0.9992
melezitose	-2.97	-2.15	2.69	0.9986
raffinose	-5.25	-3.27	6.11	0.9995

Table S4

RSD%	
ZnCoMOF@silica	
Stability (n=9)	0.32–0.67%
Reproducibility(n=10)	0.14-0.56%
Reproducibility of preparation (n=7)	0.36-3.11%