Electronic Supplementary Material (ESI) for Analyst.

Reversed-phase/hydrophilic bifunctional interaction mixed-mode monolithic column with biphenyl and quaternary ammonium stationary phases for capillary electrochromatography

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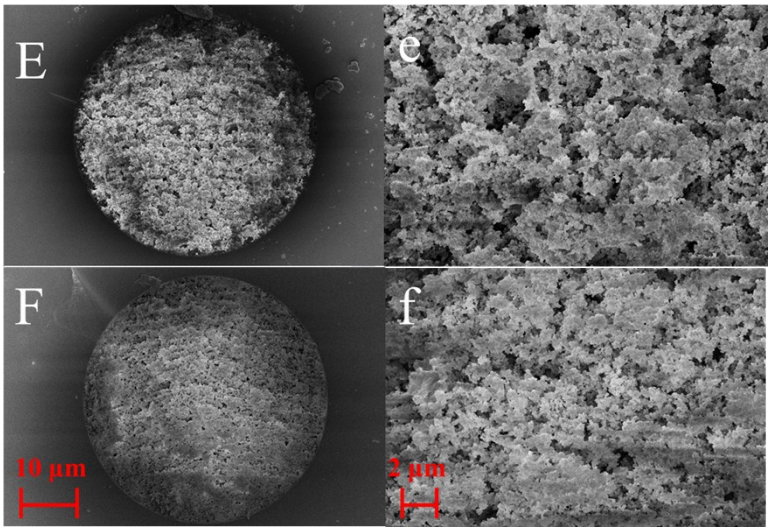


Fig. S1. Characterization of SEM for the monoliths (column No. 7: E, 750 ×; e, 3000 ×. Column No. 8: F, 750 ×; f, 3000 ×.).

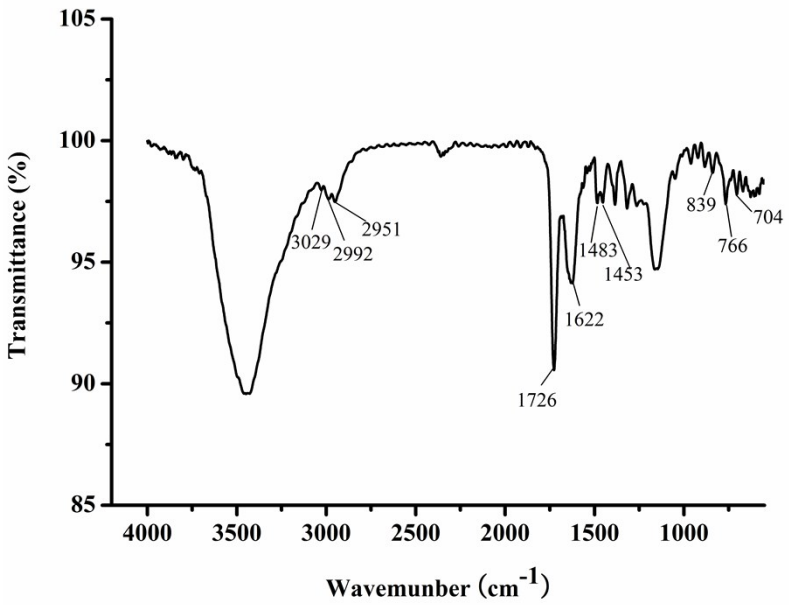
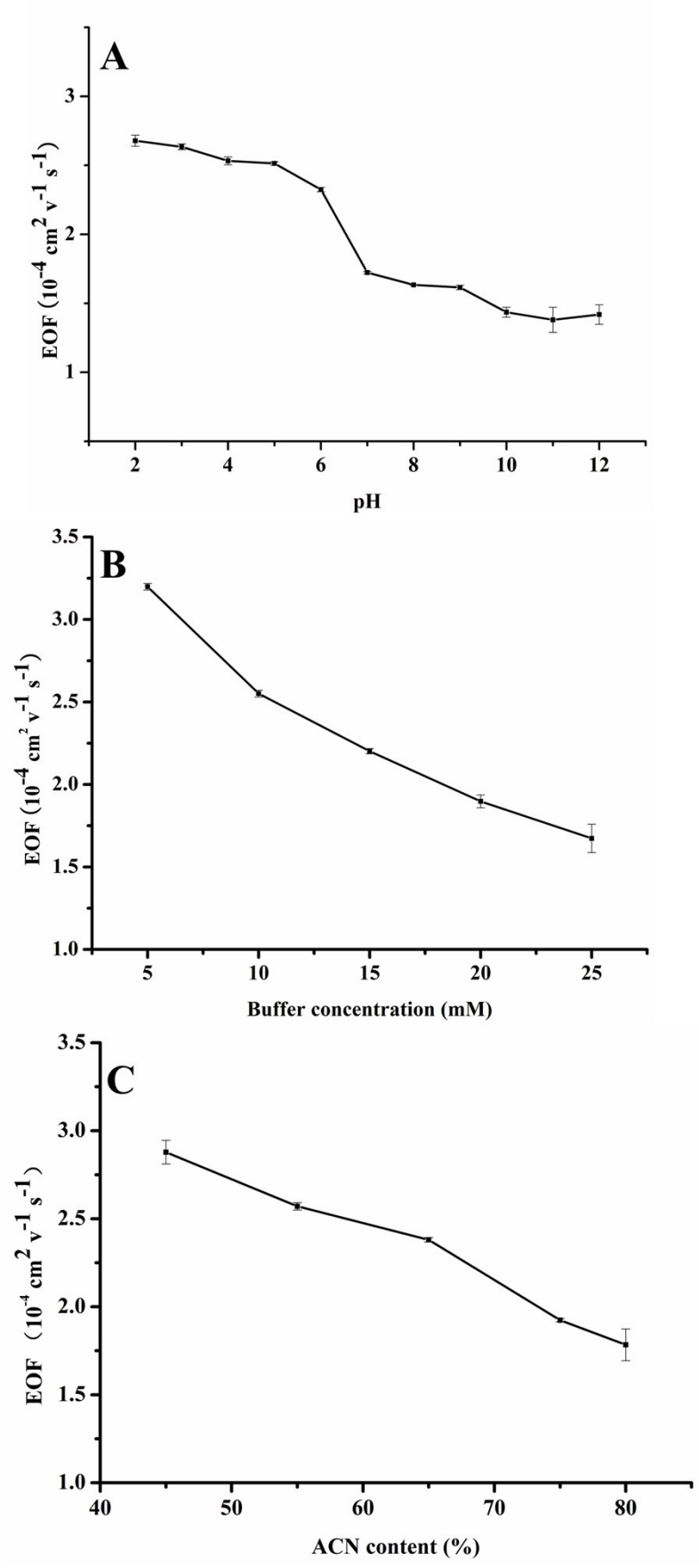


Fig. S2. FT-IR spectra of the poly(VBP-*co*-EDMA-*co*-VBTA) monolith (column No. 5).


A
EOF (10^{-4} cm^2 v^{-1} s^{-1})
pH
B
EOF (10^{-4} cm^2 v^{-1} s^{-1})
Buffer concentration (mM)
C
EOF （10^{-4} cm^2 v^{-1} s^{-1}）
ACN content (%)

39

40

Fig. S3. Influence of pH (A), buffer concentration (B), ACN content (C) in RP-mode to the EOF mobility on monolithic column No. 5. Experimental conditions: mobile phase, (A) 10 mM phosphate buffer (pH 2.0−12.0) with 55% ACN, (B) pH 4.0 phosphate buffer (5.0−25.0 mM) with 55% ACN, (C) phosphate buffer (10 mM, pH 4.0) with different content ACN; applied voltage, − 20 kV; electrokinetic injection, − 5 kV × 5 s; detection wavelength, 214 nm; EOF marker, DMF.

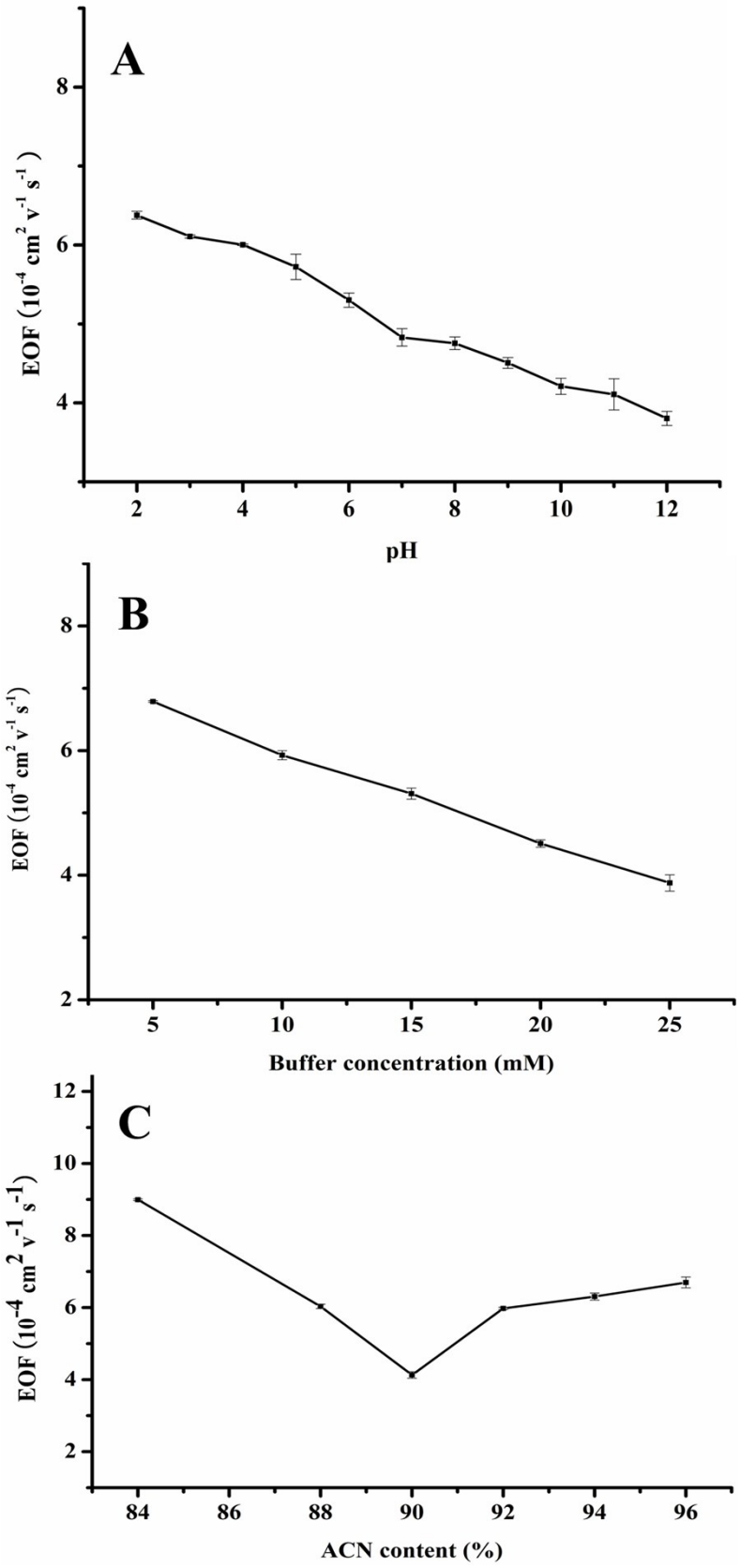


Fig. S4. Influence of pH (A), buffer concentration (B), ACN content in HILIC-mode (C) to the EOF mobility on monolithic column No. 5. Experimental conditions:

mobile phase, (A) 10 mM phosphate buffer (pH 2.0−12.0) with 92% ACN, (B) pH 4.0 phosphate buffer (5.0−25.0 mM) with 92% ACN, (C) phosphate buffer (10 mM, pH 4.0) with different content ACN; applied voltage, − 20 kV; electrokinetic injection, − 5 kV × 5 s; detection wavelength, 214 nm; EOF marker, acetophenone.

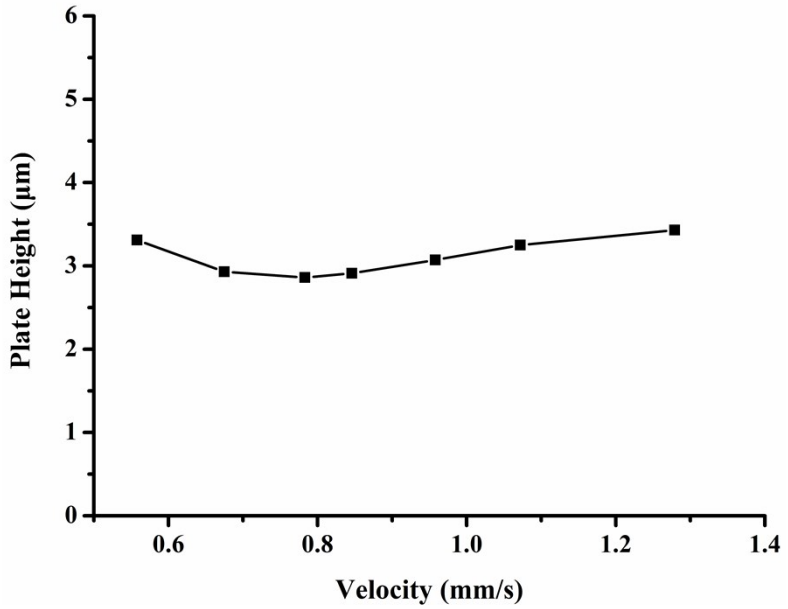


Fig. S5. Effect of linear velocity of mobile phase on the plate height of the monolithic column (No. 5). Experimental conditions: mobile phase, 55% ACN in pH 4.0 10 mM phosphate buffer; applied voltage, from − 12 kV to − 25 kV; electrokinetic injection, − 5 kV × 5 s; detection wavelength, 214 nm. Marker: benzene.

Table S1

Compositions of the polymerization mixtures for the poly(VBP-*co*-EDMA-*co*-VBTA) monoliths.

Column	Monomers/porogens (wt%)	Monomers			Porogens		Backpressure (MPa)	Permeability (10^{-14} m^2)
		4-Vinylbiphenyl (wt%)	VBTA (wt%)	EDMA (wt%)	Cyclohexanol (wt%)	Dodecanol (wt%)		
1	15:85	0	6	9	42.5	42.5	0.7	3.28
2	15:85	2.2	3.8	9	42.5	42.5	0.3	6.97
3	15:85	3	3	9	42.5	42.5	0.5	4.18
4	15:85	3.8	2.2	9	46.8	38.2	1.2	1.74
5	15:85	3.8	2.2	9	42.5	42.5	0.8	2.61
6	15:85	3.8	2.2	9	38.2	46.8	0.5	4.18
7	15:85	4.6	1.4	9	42.5	42.5	2.2	0.95
8	20:80	5	3	12	40	40	Blocked	–

"–" is no detection.

Table S2

Intra-day and inter-day (n = 5), column-to-column and batch-to-batch (n = 3) RSDs of the monolithic column (No. 5) for separation of five alkylbenzenes under RPLC mode. The experimental conditions are same as Fig. 3.

Analytes	Time (RSDs%)			
	Intra-day (n = 5)	Inter-day (n = 5)	Column-to-column (n = 3)	Batch-to-batch (n = 3)
DMF	0.92	1.23	1.86	1.16
Benzene	1.76	2.18	2.29	1.85
Toluene	1.82	2.26	2.93	2.72
Ethylbenzene	1.97	2.87	3.76	3.29
Propylbenzene	2.87	3.92	4.13	3.81
Butylbenzene	3.79	4.68	4.66	4.53

Table S3

Intra-day and inter-day (n = 5), column-to-column and batch-to-batch (n = 3) RSDs of the monolithic column (No. 5) for separation of 6-hydroxypurine and 2,6-dihydroxypurine under HILIC mode. The experimental conditions are same as Fig. 8.

Analytes	Time (RSDs%)			
	Intra-day (n = 5)	Inter-day (n = 5)	Column-to-column (n = 3)	Batch-to-batch (n = 3)
Acetophenone	1.02	0.98	1.39	1.13
6-Hydroxypurine	1.28	0.93	1.89	3.61
2,6-Dihydroxypurine	2.71	2.02	3.36	4.06

Table S4

Comparison of different mixed-mode monolithic columns.

Stationary phases	Mixed-mode	Analytical method	Analytes	Elution time (min)	column efficiency (N/m)	Ref.
Poly(*p*-MAPHA-*co*-PETA)	RPLC/HILIC/IEC	cLC	PAHs, nucleosides, basic compounds	25	0.76×10^5	[7]
Poly(DASP-*co*-PETA)	RPLC/HILIC	cLC	Acidic and basic compounds, alkylbenzenes	25	0.97×10^5	[8]
Sil-G4-BDDE-DA	RPLC/HILIC/IEC	LC	Alkylbenzenes, PAHs, nucleobases, nucleosides	120	–	[9]
Long-alkyl-chain-based hybrid monoliths	RPLC/IEC	CEC	Alkylbenzenes, aromatic amines	12	1.15×10^5	[11]
Quinine-modified poly(GMA-*co*-EDMA) monoliths	RPLC/IEC	CEC	Alkylbenzenes, PAHs acidic compounds, excitants	17	1.90×10^5	[15]
poly(VBP-*co*-EDMA-*co*-VBTA) monoliths	RPLC/HILIC	CEC	Vanillin substances, neutral and alkaline compounds	9	3.49×10^5	This work

"–" No data.