

## **C4-modified bipyridinium multi-mode stationary phase for reversed phase, hydrophilic interaction and ion exchange chromatography**

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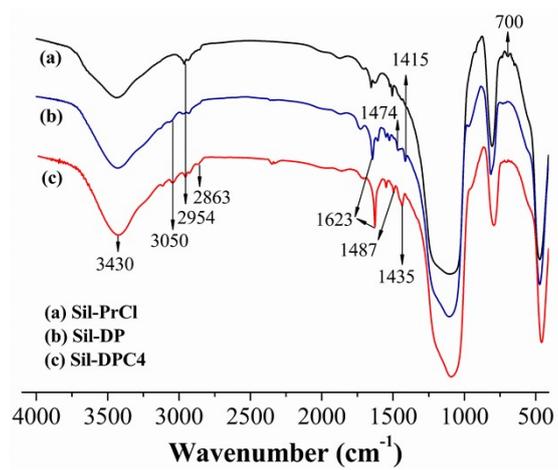
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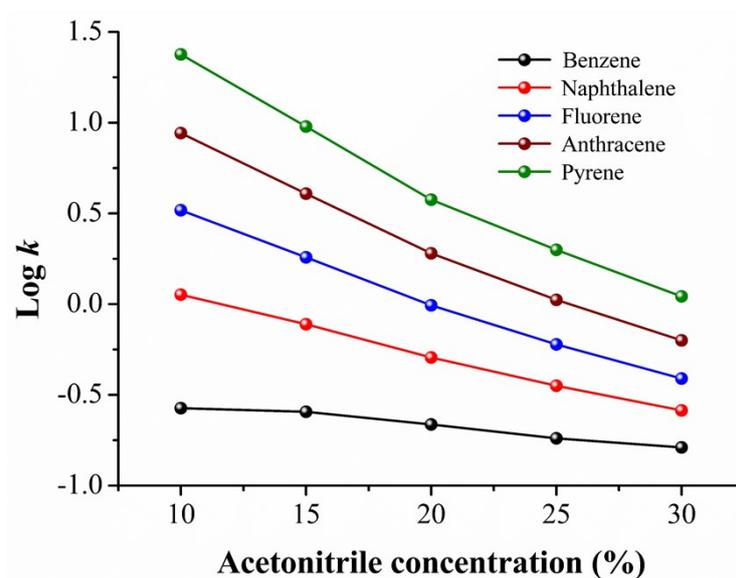
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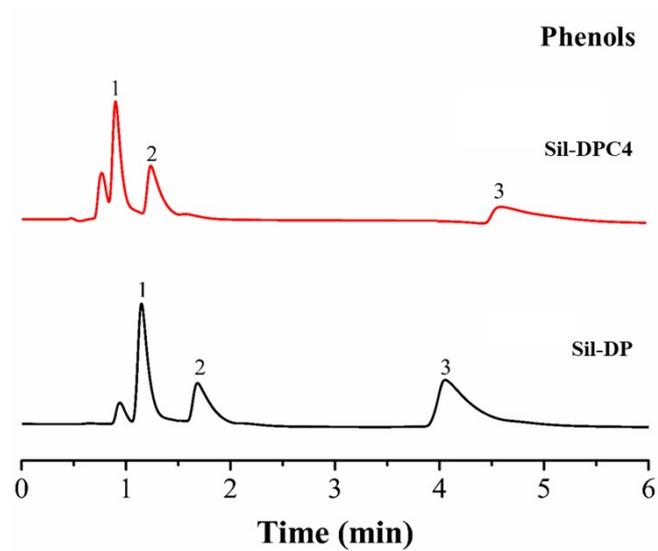
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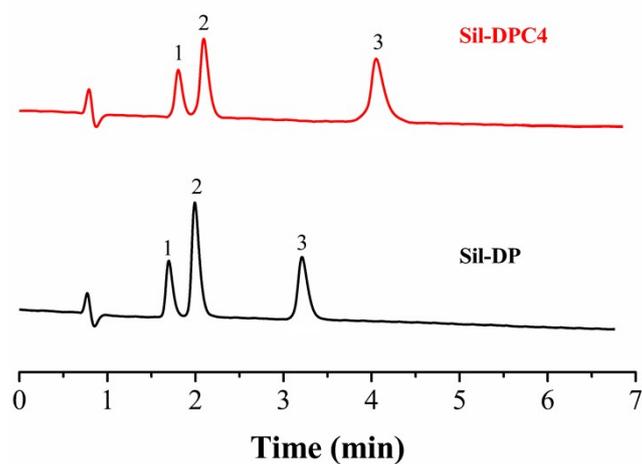
**Figure S1.** FT-IR analysis of Sil-PrCl (a), Sil-DP (b), and Sil-DPC4 (c).



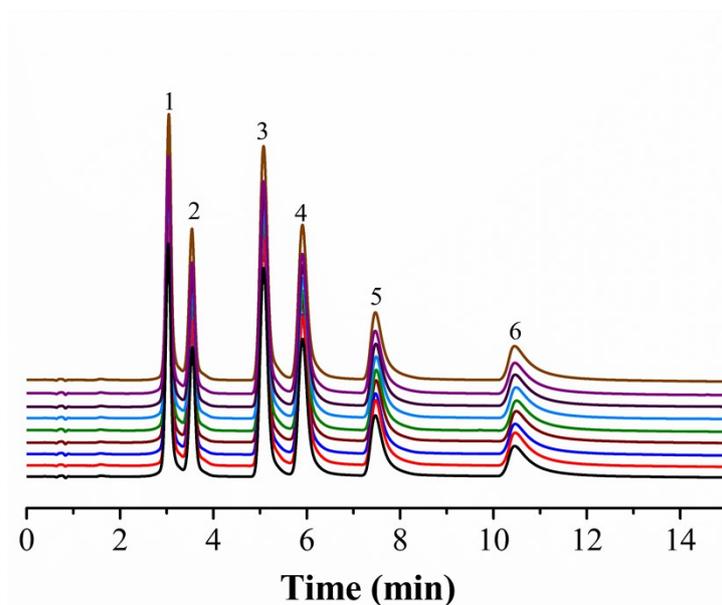
**Figure S2.** Effect of acetonitrile concentration on Log  $k$  of PAHs. Analytes: benzene (1), naphthalene (2), fluorene (3), anthracene (4), pyrene (5); mobile phase: different acetonitrile concentration in water; flow rate: 0.5mL/min; UV detection: 254 nm; Temperature: 25 °C.



**Figure S3.** Separation of Phenols on Sil-DPC4 and Sil-DP. Analytes: 4-Aminophenol (1), 4-Chlorophenol (2), p-Nitrophenol (3). Mobile phase: 100% water. Flow rate: 0.5mL/min, and UV detection: 254 nm. Temperature: 25 °C.



**Figure S4.** Separation of organic ions on Sil-DPC4 and Sil-DP. Solute: sodium benzenesulfonate (1), sodium benzoate (2), potassium biphthalate (3); Mobile phase: 25% ACN in 50 mmol/L phosphate buffer solution at pH. 4.5. UV detection: 210 nm. Flow: 0.5 mL/min. Temperature: 25 °C.



**Figure S5.** The reproducibility test of Sil-DPC4. Analytes: iodate (1), nitrite (2), bromide (3), nitrate (4), iodide (5), and thiocyanate (6). Mobile phase: 10 mmol/L phosphate buffer solution at pH 3.1. Flow rate: 0.5mL/min, and UV detection: 210 nm. Temperature: 25 °C.

**Table S1.** Elemental analysis and surface coverage of Sil-PrCl, Sil-DP and Sil-DPC4.

	N%	C%	H%	Surface coverage ( $\mu\text{mol}/\text{m}^2$ )
Sil-PrCl	0.44	5.69	0.72	4.93
Sil-DP	1.37	10.01	1.05	1.13
Sil-DPC4	1.29	10.89	1.38	0.57
Sil-C18		15.23	2.86	2.2