Facile preparation of polyvinyl alcohol coated SiO$_2$ stationary phases for high performance liquid chromatography

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Scheme-1 Chemical structures of the analytes used for evaluation

<table>
<thead>
<tr>
<th>Material</th>
<th>BET Surface Area (m²/g)</th>
<th>Pore Volume (cm³/g)</th>
<th>C%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Silica</td>
<td>360.89</td>
<td>0.87</td>
<td>&lt;0.3%</td>
</tr>
<tr>
<td>PVA-Sil</td>
<td>289.15</td>
<td>0.78</td>
<td>2.47%</td>
</tr>
</tbody>
</table>
SI-Fig. 1 Effect of PVA solution concentration on the chromatographic performance.

Conditions: mobile phase: A: ACN; B: H$_2$O; C: H$_2$O (250 mM NH$_4$FA, pH, 5.7), isocratic mode, 75%A/19% B/6% C; detection wavelength, 254 nm; flow rate, 1.0 mL/min; injection volume, 10 μL; column temperature, 30 °C; model analyte, cytosine.
SI-Fig. 2 Scanning electron micrographs of PVA-Sil.

SI-Fig. 3 IR spectra of bare silica (a) and PVA-sil (b).
SI-Fig. 4 Solid phase $^{13}$C-CP/MAS NMR spectrum of PVA-Sil stationary phase

SI-Fig. 5 Titration curve of bare silica and PVA-Sil.

Titration procedure: 0.3 g of silica or PVA-Sil was dissolved in 3 mL of pure water; the suspensions were titrated with addition of 10 µL standard NaOH solution (0.1 M) each time. Then the suspensions were shaked and measured by a pH meter.
SI-Fig. 6 Plot of back pressure vs linear velocity of mobile phase.

Conditions: mobile phase, pure water.

SI-Fig. 7 Stability test of PVA-Sil column at extreme pH value (pH 11).

Conditions: mobile phase: ACN/triethylamine (v/v=90/10).
SI-Fig. 8 Separation of small molecular acids on bare silica and PVA-Sil. Conditions: mobile phase: A: ACN; B: H$_2$O; C: H$_2$O (250 mM NH$_4$FA, pH, 3.15). 90% A/4% B/6% C; other conditions same to Fig. 3. Peak identification: A, sorbic acid, B, salicylic acid, C, acetyl salicylic acid, D, phthalic acid.

SI-Fig. 9 Plots of lnk & logarithm of the volume fraction of water in the mobile phase.

Conditions same to Fig. 3.
SI-Fig. 10 Effect of salt concentration in the mobile phase on retention.

Conditions same to Fig. 4.

SI-Fig. 11 Effect of pH value of the mobile phase on retention.

Chromatographic conditions: mobile phase with pH value varying from 3.1 to 5.7 and other conditions same to Fig. 4.
SI-Fig. 12 Separation of polycyclic aromatic hydrocarbons on PVA-SDS column.

Conditions: column size, 4.6 mm i.d.×150 mm length, 5 μm dia.; mobile phase, MeOH/ H₂O (v/v=20/80); flow rate, 1 mL/min; column temperature, 30 °C; injection volume, 10 μL; detection wavelength, 254 nm; peak identification, 1, uracil; 2, benzene; 3, toluene; 4, naphthalene; 5, biphenyl; 6, phenanthrene; 7, pyrene.
SI-Fig. 13 Separation of inorganic anions on PVA-PEI column

Conditions: column size, 4.6 mm i.d. × 150 mm length, 5 μm dia.; mobile phase, 2 mM NaCl; flow rate, 1 mL/min; column temperature, 30 °C; injection volume, 10 μL; detection wavelength, 210 nm.