Electronic Supplementary Information

Real-Time Colorimetric Water Content Monitoring of Organic Solvents by an Azo Dye Incorporated into AlPO₄-5 Nanochannel

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SI.1 N$_2$ isotherm of ground AlPO$_4$-5

Fig. S1 N$_2$ isotherm of ground AlPO$_4$-5 from BET as indicated.
SI. 2 The water vapor adsorption isotherm of AlPO$_4$-5 and AZO@AlPO$_4$-5

Fig. S2 The water vapor adsorption isotherm of AlPO$_4$-5.
SI. 3 Characterization of synthesized AZO dye.

Table S1. Results of $^1$H NMR, $^{13}$C NMR and HR-MS.

<table>
<thead>
<tr>
<th></th>
<th>$^1$H NMR (CDCl$_3$)</th>
<th>$^{13}$C NMR (CDCl$_3$)</th>
<th>MS-ESI-TOF (m/z)</th>
<th>C$<em>{16}$H$</em>{21}$N$_4$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemical shift, δ/ppm, J/Hz</td>
<td>δ$_{\text{H}}$ (600 MHz) 9.16 (2 H, d, J 7.1), 8.03 (2 H, d, J 7.0), 7.90 (2 H, d, J 9.4), 6.74 (2 H, d, J 9.4), 4.82 (2 H, s), 3.19 (6 H, s), 2.04 (2 H, m), 1.00 (3 H, t, J 7.4)</td>
<td>δ$_{\text{C}}$ (151 MHz) 162.07, 155.95, 145.58, 144.87, 127.76, 112.37, 62.06, 40.58, 25.32, 10.68</td>
<td>Calculated: 269.1761</td>
<td>Found: 269.1758</td>
</tr>
</tbody>
</table>
Fig. S3 The spectra of (a) $^1$H NMR (b) $^{13}$C NMR and (c) HR-MS as indicated.
SI. 4 Inclusion of the AZO dye into AlPO$_4$-5 nanochannel in methanol

**Fig. S4** (a) Digital photographic images (before, after incorporation of the AZO dye and after centrifugation) and (b) UV-vis spectra of the supernatant solution that depicts the process of the complete incorporation of the AZO dye into AlPO$_4$-5.
SI. 5 The calculation of concentration for AZO dye encapsulated in AlPO₄-5

Chemical composition of AlPO₄-5’s unit cell:

Molecular weight of AlPO₄-5’s unit cell:
(1) The # mole of unit cell in AlPO₄-5 (1.00g)
   → 1.00 / (molecular weight of unit cell)
   → \(6.83 \times 10^{-4}\) mole

(2) We have confirmed that AZO dye in methanol solution (10 mL, 0.23 mM) completely incorporated into AlPO₄-5 (1.00 g) using UV-vis spectroscopy analysis. The total # mole of AZO dye incorporated into AlPO₄-5 (1.00g)
   → \(2.30 \times 10^{-6}\) mole

(3) The number of AZO dye in a AlPO₄-5’s unit cell
   → [value from (2)] / [value from (1)]
   → \(3.37 \times 10^{-3}\)

(4) The volume of AlPO₄-5’s unit cell
   → 1420.6 Å³
   → \(1.4206 \times 10^{-27}\) m³
   → \(1.4206 \times 10^{-24}\) L

(5) The concentration of AZO dye encapsulated in AlPO₄-5
   → [value from (3)] / (# of Avogadro)] / [value from (4)]
   → \(3.94 \times 10^{-3}\) mole·L⁻¹
   → \(3.94\) mM
SI. 6 The relationship between relativity polarity and sensitivity of AZO@AlPO$_4$-5 in primary alcohol.

![Plot showing the relationship between relativity polarity and sensitivity of AZO@AlPO$_4$-5 in primary alcohol.](image)

**Fig. S6** The plot for relationship between relativity polarity and sensitivity of AZO@AlPO$_4$-5 in linear primary alcohol.
SI. 7 The effect of dye loading on water detection sensitivity

**Fig. S7** UV-vis absorption (Kubelka-Munk, K/M) spectra of different AZO dye loaded AlPO₄-5 (0.01, 0.06 and 0.1 per unit cell) in (a) ethanol sample (0.0 wt% H₂O), (c) ethanol sample (3.1 wt% H₂O) and (b) digital photographic images as indicated.
SI. 8 Evolution performance of recovered AZO@AlPO$_4$-5

**Fig. S8.** UV-vis absorption spectra of fresh and recovered AZO@AlPO$_4$-5 dispersed ethanol sample (4.0 wt % H$_2$O).