

Supporting Information

# Paper-Based Vapor Detection of Formaldehyde: Colorimetric Sensing with High Sensitivity

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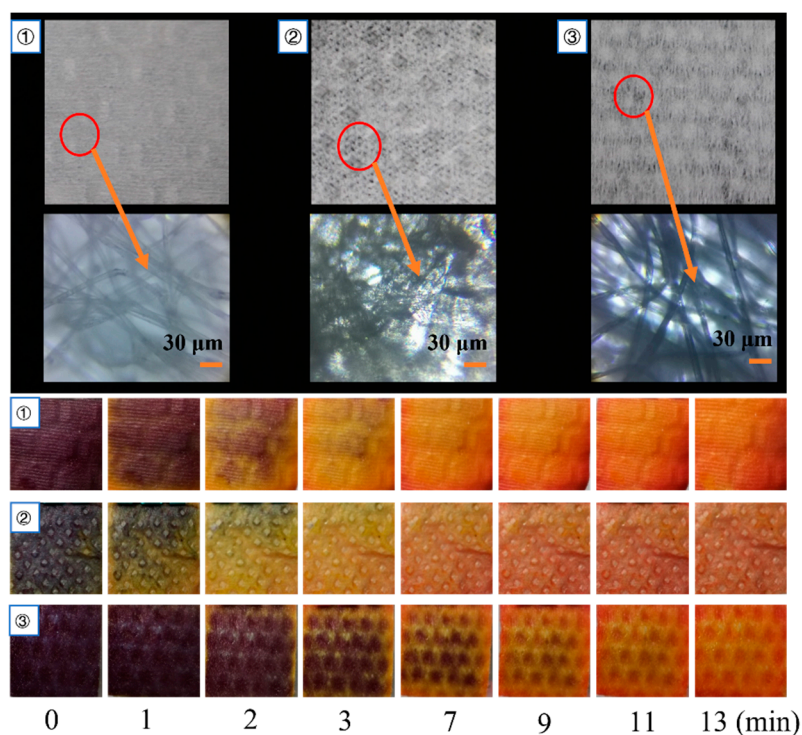
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Comparison of colorimetric response of sensor strips fabricated from different paper towels:



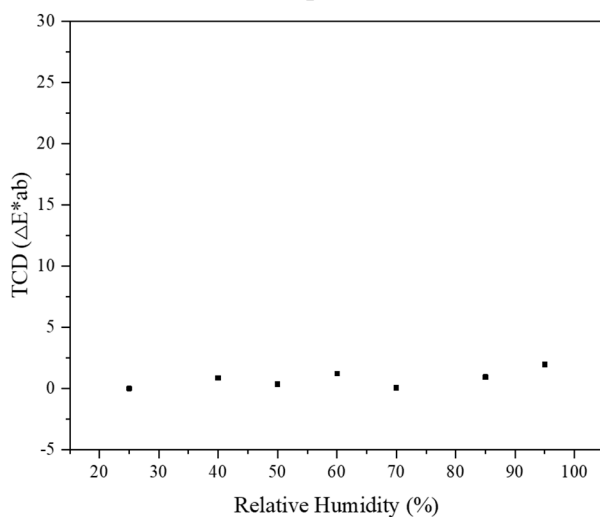
**Figure S1.** (Top two panels) photos of the three types of paper towels, No.1, No.2, and No.3. Also shown are the optical microscope photographs of the paper towels, revealing clearly the cellulose fibril network. (Lower three panels) The color response of the sensor strips made from the three paper towels coated with  $(\text{NH}_4\text{OH})_2 \cdot \text{H}_2\text{SO}_4$  and pH indicators when exposed to FA vapor (10 ppm). The initial pH value of the immersion solution used for preparing the sensor strips was  $4.7 \pm 0.1$ , and all measurements were performed, at 25 °C and 45% RH.

### Selection of hydroxylamine acid salts:

**Table S1.** Comparison of five hydroxylamine acidic salts and the pH change upon reaction with FA in aqueous solutions.

Hydroxylamine acid salt			V <sub>water</sub> (mL)	H <sup>+</sup> concentration (mol/L, entirely hydrolytic)	Initial pH		FA (mmol)	pH after reaction
Structure	M (g)	M <sub>H<sup>+</sup></sub> (mmol)			Theoretical (entirely hydrolytic)	Measured		
<chem>N-O</chem> <chem>Cl</chem>	0.139	2	20	0.1	1	2.30	0.151	1.07
<chem>O=S(=O)(O)N-O</chem> <chem>Cl</chem>	0.164	2	20	0.1	1	3.97	0.151	1.32
<chem>O=S(=O)(O)N</chem> <chem>Cl</chem>	0.226	2	20	0.1	1	1.21	0.151	1.03
<chem>CC(C)(C)ON</chem> <chem>Cl</chem>	0.251	2	20	0.1	1	2.45	0.151	1.21
<chem>OC(=O)CNC</chem> <chem>Cl</chem>	0.437	2	20	0.1	1	2.95	0.323	2.78

### The stability of the initial color of the sensor strip under different humidity:



**Figure S2.** Colorimetric response ( $\Delta E^*ab$ ) of the sensor strip upon exposure to different humidity levels (25-95%) in the absence of FA.