

## Supplementary information

### Cysteamine-Modified Photonic Crystal Hydrogel Sensors for Visual Detection of Hg<sup>2+</sup> Ions

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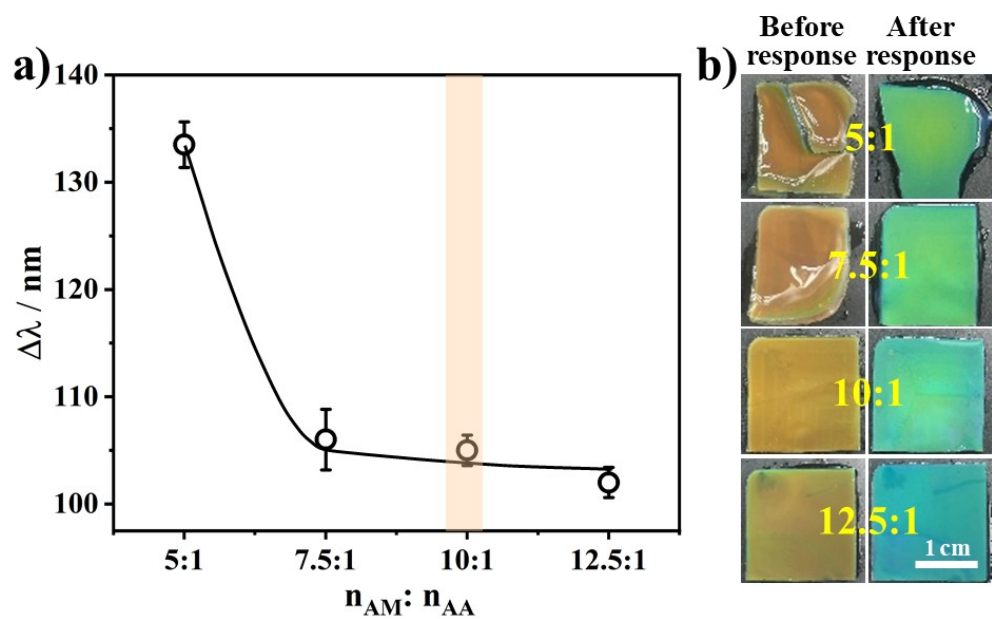
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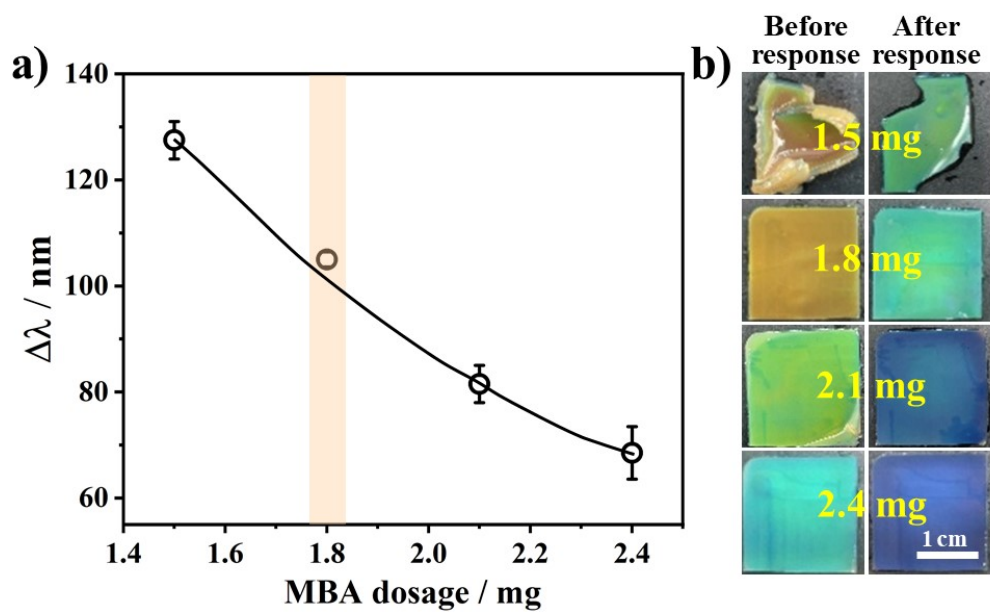
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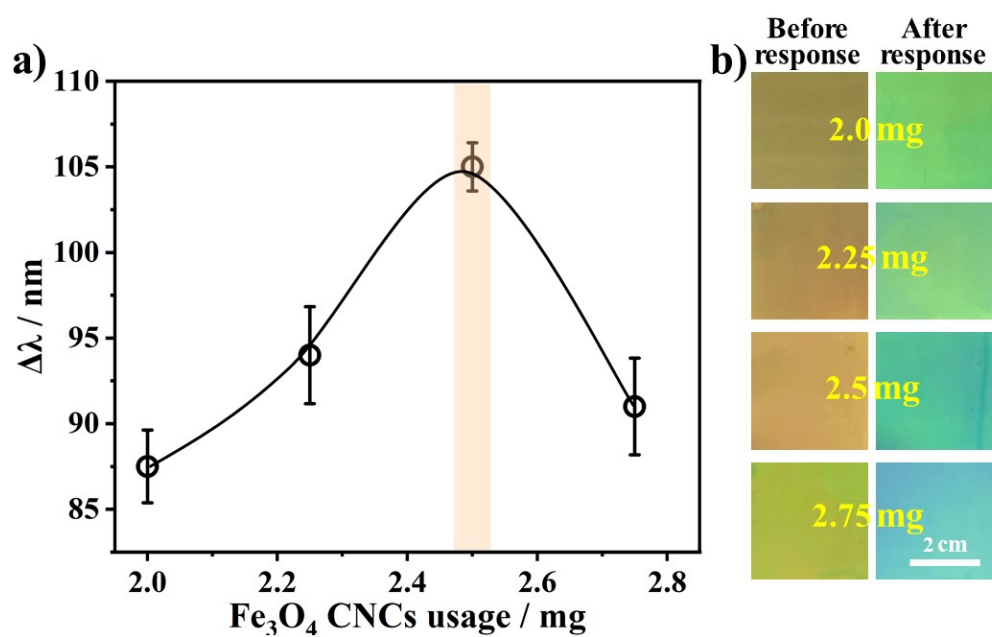
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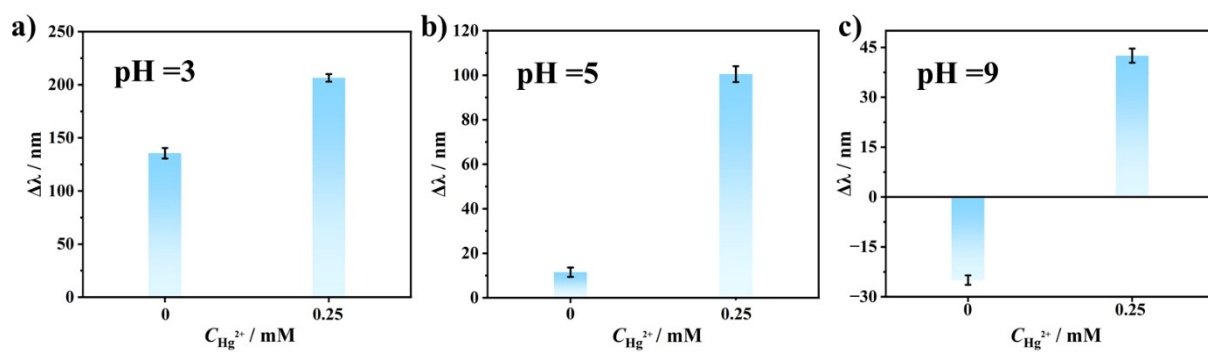
**Fig. S1** Effect of the molar ratio of AM to AA on CPCH responsiveness to  $\text{Hg}^{2+}$  (a) and their corresponding structural colors (b).



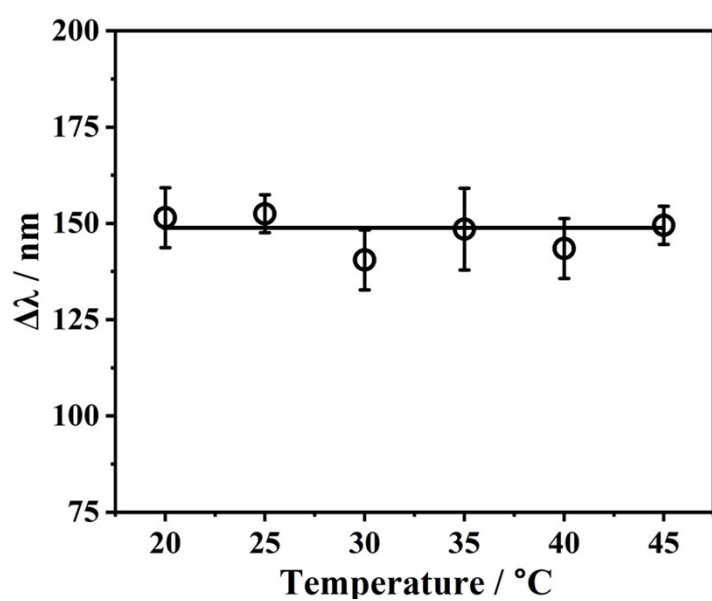
**Fig. S2** Effect of crosslinker MBA dosage on CPCH responsiveness to  $\text{Hg}^{2+}$  (a) and their corresponding structural colors (b).



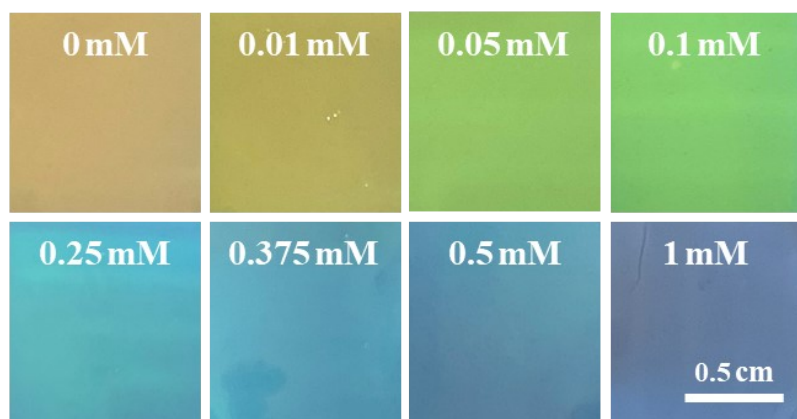
**Fig. S3** Effect of Fe<sub>3</sub>O<sub>4</sub> CNCs dosage on CPCH responsiveness to Hg<sup>2+</sup> (a) and their corresponding structural colors (b).



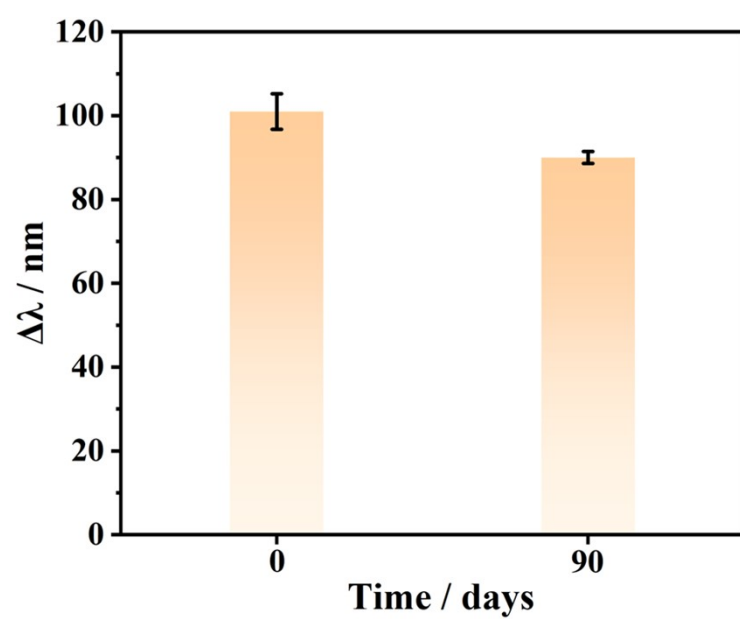
**Fig. S4** Response of CPH at various solution pH at 0 mM and 0.25 mM  $\text{Hg}^{2+}$ .  
a) pH = 3; b) pH = 5; and c) pH = 9.



**Fig. S5** Effect of environmental temperature on the CPCH response performance.



**Fig. S6** Structural colors of CPCH in response to various  $\text{Hg}^{2+}$  concentrations.



**Fig. S7** Stability of the CPCH sensor.

**Table. S1** Comparison of the performance between CPCH sensor and other reported methods.

| Sensing material                     | Method                       | Instrument                                   | Visualization | operation     | Cost       | Response Performance | Stability     | Ref.             |
|--------------------------------------|------------------------------|----------------------------------------------|---------------|---------------|------------|----------------------|---------------|------------------|
| Cu-MOF                               | Electrochemical measurements | Electrochemical workstation                  | No            | Complex       | Medium     | Not mentioned        | 4 day         | Ref.1            |
| CMCME                                | ICPMS                        | Inductively coupled plasma mass spectrometry | No            | Complex       | High       | Not mentioned        | Not mentioned | Ref.2            |
| HCYS                                 | Fluorescence                 | Fluorescence spectrometer                    | Yes           | Complex       | High       | 1 min                | Not mentioned | Ref.3            |
| AuNRAs                               | SERS                         | Raman spectrometer                           | No            | Complex       | High       | 5 min                | Not mentioned | Ref.4            |
| AH-COF                               | Fluorescence                 | Fluorescence spectrometer                    | Yes           | Complex       | High       | Not mentioned        | Not mentioned | Ref.5            |
| N, P-CDs@CMC/PEI                     | Fluorescence/<br>Visual      | Fluorescence spectrophotometer               | Yes           | Medium        | Medium     | 300 min              | Not mentioned | Ref.6            |
| Cys-BCH                              | Visual                       | Not required                                 | Yes           | Medium        | Low        | 120 min              | Not mentioned | Ref.7            |
| aptamer-functionalized colloidal PCH | Visual                       | Not required                                 | Yes           | Complex       | Medium     | 30 min               | Not mentioned | Ref.8            |
| 2D PCH                               | Visual                       | Not required                                 | Yes           | Simple        | Low        | 4 min                | Not mentioned | Ref.9            |
| <b>CPCH hydrogel</b>                 | <b>Visual</b>                | <b>Not required</b>                          | <b>Yes</b>    | <b>Simple</b> | <b>Low</b> | <b>5 min</b>         | <b>90 day</b> | <b>this work</b> |

**Note:** Cu-MOF: cubic copper-metal-organic framework; CMCME: chip-based array monolithic capillary microextraction; ICPMS: inductively coupled plasma mass spectrometry; HCYS: hemicyanine-based fluorescent probe; AuNRAs: Au ordered nanorod arrays; SERS: surface-enhanced Raman scattering; AH-COF: allyl together with hydroxy groups functionalized covalent organic frameworks; N, P-CDs@CMC/ PEI: polyethyleneimine (PEI) as the second interpenetrating network and nitrogen-phosphorus-doped carbon dots (N, P-CDs) as the fluorescent probe; Cys-BCH: cysteamine-functionalized biomimetic chromotropic hydrogel; 2D PCH: Two-dimensional photonic crystal hydrogel; CPCH: cysteamine-modified photonic crystal hydrogel.

## Reference

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