# Nanozyme colorimetric sensor array for on-site detection and discrimination of sulfur-containing metal salts based on $Au/CeO_2$ heterostructure

Yang Song,[a] Zhongyuan Gu, [a] Hao Wang,[a] Xinxin Shi,[b] Changchun He,[a] Tongxiang Li,[b] Yan Chen,*[a] Zhao Li*[a] and Lin Tian,*[a,b]

[a] *School of Materials and Chemical Engineering, Xuzhou University of Technology, XuZhou 221018, PR China*

[b] *School of Food (Biology) Engineering, Xuzhou University of Technology, XuZhou 221018, PR China*

Corresponding author: Tel: 86-516-83105518

Email: xzittl@xzit.edu.cn (L. Tian); litx@xzit.edu.cn(T. Li); xzitlz@xzit.edu.cn (Z. Li)

## 1 Experimental section

### 1.1 Chemicals and Instrumentation

Cerium nitrate hexahydrate ($Ce(NO_3)_2 \cdot 6H_2O$, 99%), ammonium bicarbonate ($NH_4HCO_3$, 99%), gold chloride trihydrate ($HAuCl_4 \cdot 3H_2O$, 99.9%), sodium sulfide ($Na_2S$, 95%), sodium sulfite ($Na_2SO_3$, 98%), sodium persulfate ($Na_2S_2O_8$, 99%), 3,3′,5,5′-tetramethylbenzidine (TMB, 98%) were purchased from Shanghai Aladdin Technology Co., Ltd. (Shanghai, China). Acetate buffer (HAc-NaAc) solutions (0.1 M) with different pH values were prepared by HAc and NaAc in distilled water. A 96-well polystyrene plate was obtained from Jincanhua (Shenzhen, China). The other reagents were all analytical grade and used without further purification.

The crystal phase of the obtained samples was established on X-ray powder diffractometer (XRD, UIV, Rigaku). The microstructures and morphologies were acquired by operating a scanning electron microscope (SEM, XL30-ESEM, Philips) and transmission electron microscope (TEM, JEM-2100, JEOL). The chemical composition and elemental valence of products were explored on a X-ray photoelectron spectroscopy spectra (XPS, JPS-9010 MC, JEOL). UV-Vis absorbance spectra were obtained from 200 nm to 1000 nm wavelength using a Shimadzu UV-1900 spectrophotometer.

### 1.2 Preparation of Au NPs

20 mL of 0.01% $HAuCl_4$ solution was heat to boiling in a 50 mL round-bottomed. 2 mL of 1% sodium citrate solution was added under vigorous stirring. Then the mixture was refluxed under intense stirring for 10 minutes. After the heating is stopped, the reaction solution was continued stirring for an additional 15 min. Then cooling to room temperature, the Au NPs solution was obtained.

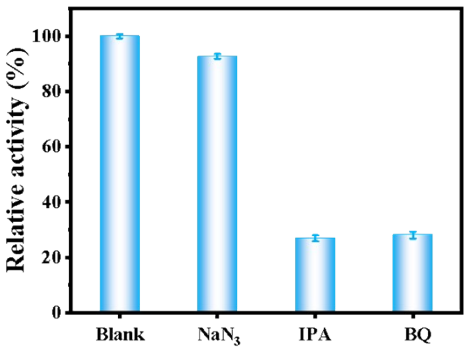


**Fig. S1** The effect of $NaN_3$, IPA and BQ on the peroxidase-like activity

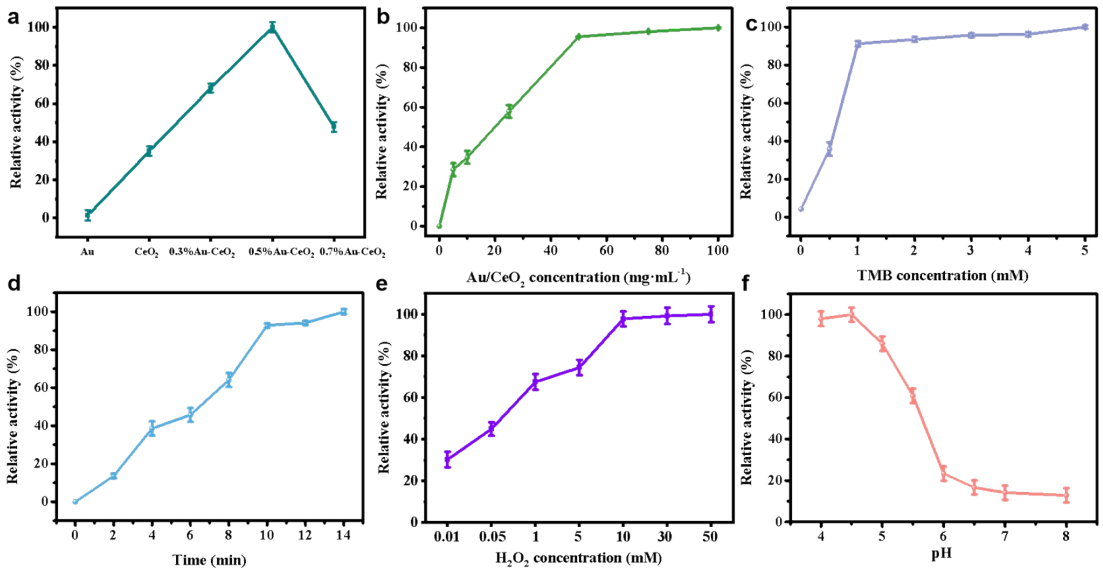


**Fig. S2** Dependences of the peroxidase activity of $Au/CeO_2$ on (a) pH, (b) concentration of $Au/CeO_2$, (c) concentration of TMB, and (d) time.

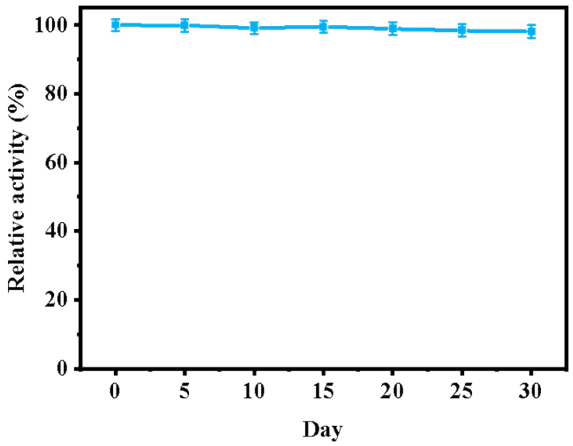


**Fig. S3** Stability of $Au/CeO_2$ at different time.

**Table S1** The comparison of the developed colorimetric sensor array with other methods for SCMs.

| Methods | Materials | Linear range (μM) | Detection limit (μM) | References |
|---|---|---|---|---|
| Fluorescence | AgNF@dsDNA | 1-10 | 0.53 | [1] |
| Fluorescence | FL-$H_2S$ | 1-13 | 0.74 | [2] |
| Fluorescence | CyO-DNP | 0-50 | 0.34 | [3] |
| Electrochemistry | Ammineruthenium(III) | 0.5-10 | 0.17 | [4] |
| Colorimetry | Fe-PPOP | 80-300 | 1.1 | [5] |
| Colorimetry | Au/AgI | uncertain | 40 | [6] |
| Fluorescence | BTN | 0-40 | 1.01 | [7] |
| Colorimetry | CuNPs | 12.5-50 | 8.1 | [8] |
| Colorimetric sensor arry | $Au/CeO_2$ | 5-110 | 4.7 | This work |

AgNF@dsDNA: double-strand DNA (dsDNA)-stabilized silver nanoflakes

DNP: 2, 4-dinitrophenyl

Fe-PPOP: iron porphyrin-based porous organic polymer

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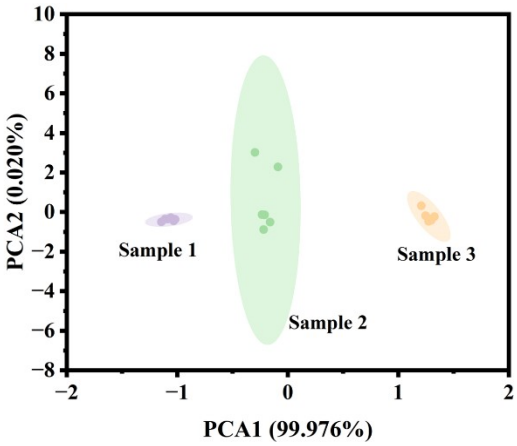


**Fig. S4** PCA diagram of the sensor array in the environmental samples.