Electronic Supplementary Information

Novel application of CoFe-layered double hydroxides nanoplates for colorimetric detection of H_2O_2 and glucose

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Experimental Section

Materials: NaH_2PO_4, Na_2HPO_4, $Fe(NO)_3{\cdot}9H_2O$, $CoCl_2{\cdot}6H_2O$, sodium acetate (NaAc) were purchased from Beijing Chemical Corp. Acetic acid, TMB, glucose, fructose, lactose, maltose and H_2O_2 (30 wt%) were purchased from Aladin Ltd. (Shanghai, China). HRP and GOx were purchased from Aldrich Corp. All chemicals were used as received without further purification. The water used throughout all experiments was purified through a Millipore system.

Preparation of CoFe-LDHs: The CoFe-LDHs was prepared by a modified coprecipitation method as reported by Duan et al. Typically, the pH of the 10 mL aqueous solution containing $CoCl_2$ (0.16 M) and $Fe(NO)_3$ (0.055 M) was adjusted to 8.0 with NaOH solution (1.0 M), and then it was aged in an autoclave at 130℃ for 24 h. The precipitate was centrifuged and washed three times with deionized water, and then it was filtrated using a membrane filter (0.2 μm, Millipore) to remove large LDHs particles.

Detection of H_2O_2: For detection of H_2O_2, measurements were carried out by monitoring the absorbance change at 652 nm. In a typical run, 10 μL of CoFe-LDHs (about 0.3 mg mL^{-1}) dispersion was added into 800 μL of NaAc buffer solution (pH: 4.0), followed by adding 200 μL of TMB solution (1 mM in ethanol).The concentration of H_2O_2 was 44 mM, unless otherwise stated. The UV-vis spectra were recorded after reaction for 30 min at 30 ºC.

Detection of glucose: Glucose detection was performed according to the following three steps: 1) 100 μL of 1mg mL^{-1} GOx and 100 μL of glucose of different concentrations in 200 μL of 10 mM Na_2HPO_4 buffer (pH 7.0) were incubated at 37 °C for 1 h; 2) 200 μL of TMB (1 mM in ethanol) and 10 μL of the CoFe-LDHs dispersion were added into the above glucose reaction solution; 3) the resulting mixture was incubated at 30 °C for 30 min before measurements.

Characterization Transmission electron microscopy (TEM) measurement was made on a HITACHI H-8100 EM (Hitachi, Tokyo, Japan) with an accelerating voltage of

200 kV. UV-vis spectra were obtained on a UV5800 Spectrophotometer. X-ray photoelectron spectroscopy (XPS) analysis was measured on an ESCALABMK II X-ray photoelectron spectrometer using Mg as the exciting source. Fourier transform infrared (FTIR) spectroscopic measurements were taken on a Bruker Vertex 70 Fourier transform spectrometer.

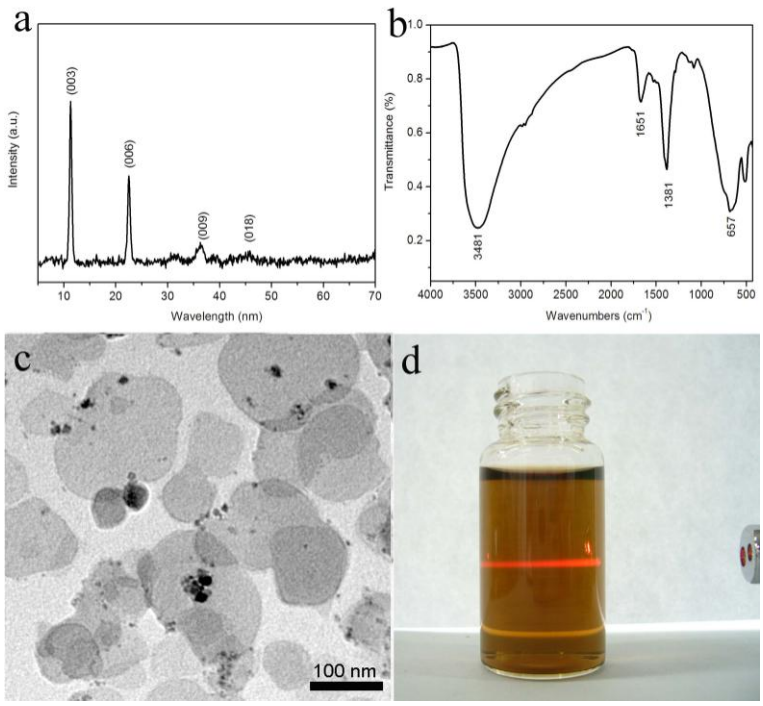

Fig. S1 (a) XRD pattern, (b) FT-IR spectrum, and (c) TEM image of the CoFe-LDHs thus formed. (d) Tyndall effect exhibited by CoFe-LDHs dispersion in water passed through with red laser light.

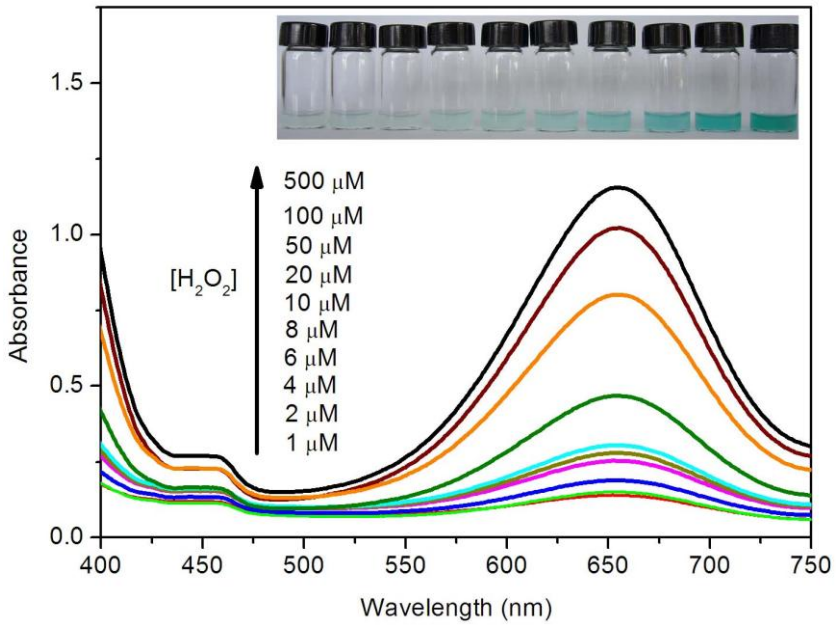

Fig. S2 (a) UV-vis spectra for a solution of TMB-H_2O_2-CoFe-LDHs in 0.2 M NaAc buffer (pH 4.0) at 30 °C. The TMB concentration was 200 μM and 10 μL of CoFe-LDHs dispersion was used. Inset: the corresponding images of colored products.

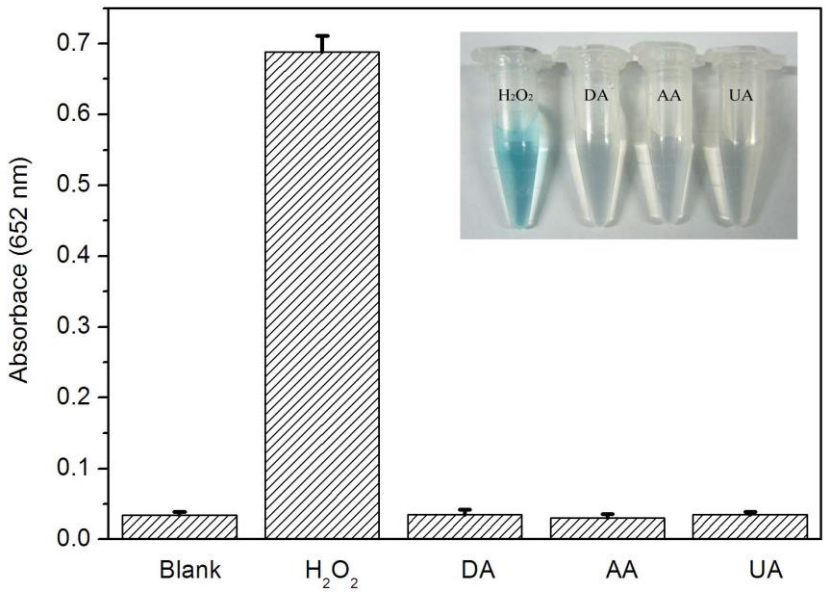

Fig. S3 Selectivity analysis of this system for H_2O_2 detection by measuring the absorbance at 652 nm ([DA]=[AA]=[UA]=5 mM, [H_2O_2]=50 μM). Inset: photographs of different solutions.

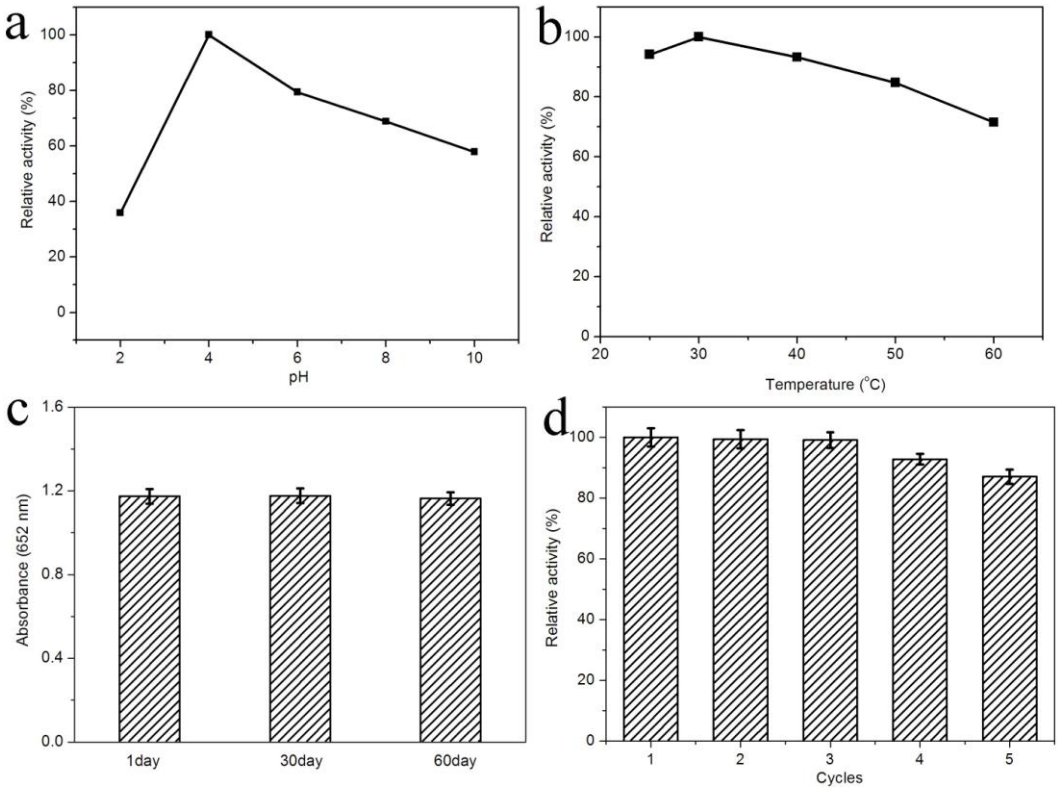

Fig. S4 The stability and reusability of CoFe-LDHs: (a) CoFe-LDHs were first incubated at pH 0–10 for 2 h and then the colorimetric assay was measured under standard conditions; (b) CoFe-LDHs were first incubated at 0–60 °C for 2 h and then the colorimetric assay was measured under standard conditions; (c) long-term stability; (d) the reusability after repeated cycles of H_2O_2 sensing.

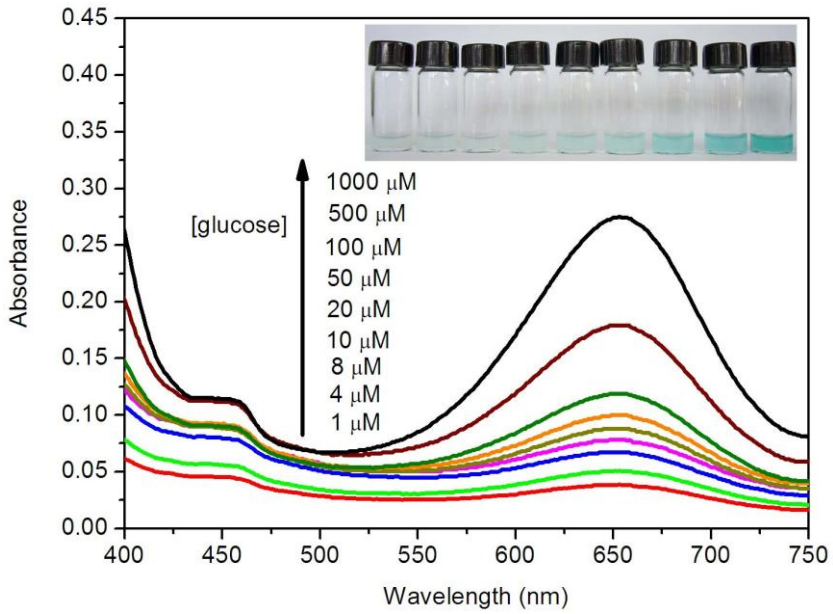

Fig. S5 UV/Vis spectra for the mixed solution of TMB-CoFe-LDHs and glucose incubation solution (pH 7.0 buffer, containing GOx) in 0.2 M NaAc buffer (pH 4.0) at 30 °C. The TMB concentration was 140 μM and 10 μL of CoFe-LDHs dispersion was used. Inset: the corresponding images of colored products.