

## Support Information

### **Simple free-enzyme detection for uric acid by in situ fluorescence and colorimetric method based on the Co-PBA with high oxidase activity**

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## Experimental section

### Reagents and materials

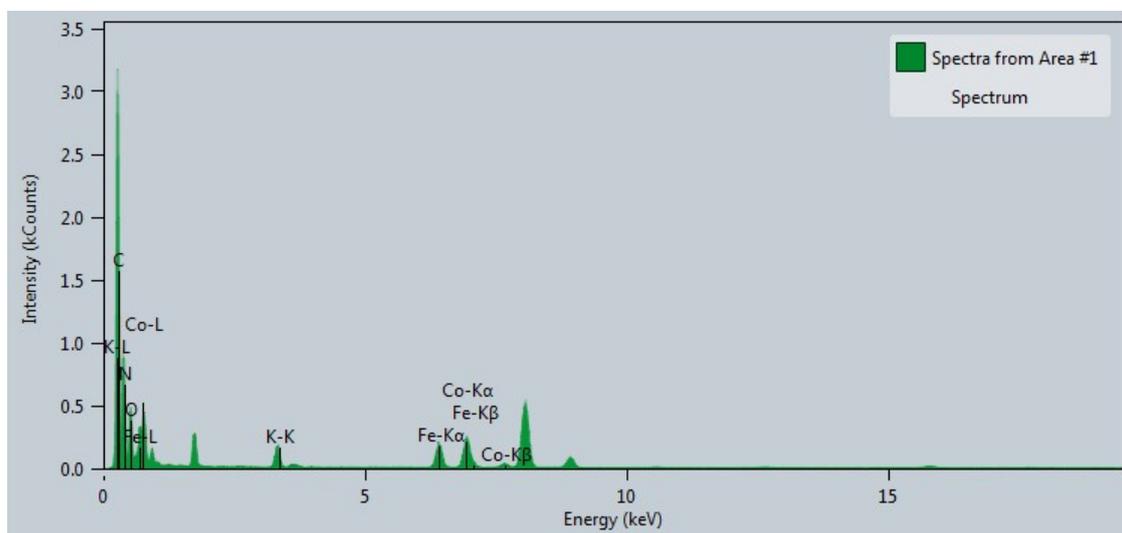
Uric acid (UA), 10-Acetyl-3,7-dihydroxyphenoxazine(AR), urea, creatine anhydrous, creatinine, 3,3',5,5'-tetramethylbenzidine (TMB), 5,5-dimethyl-1-pyrroline N-oxide(DMPO), 2,2,6,6-Tetramethylpiperidine (TEMP), o-phenylenediamine (OPD), p-benzoquinone (PBQ) were purchased from Shanghai Aladdin Biochemical Technology Co. 2,2' -Hydrazine-bis(3-ethylbenzothiazoline-6-sulfonic acid) diamine salt (ABTS) was obtained from Shanghai Biotechnology Co. Sodium acetate trihydrate, sodium citrate dihydrate ( $\text{Na}_3\text{C}_6\text{H}_5\text{O}_7 \cdot 2\text{H}_2\text{O}$ ), potassium ferricyanide, acetic acid,  $\text{AgNO}_3$ ,  $\text{I}_2$  purchased from Xilong Science Co. (Guangdong, China), Cobalt nitrate hexahydrate ( $\text{Co}(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$ ) was purchased from Xilong Chemical Co.(Guangdong, China),Anhydrous ethanol and ethylenediaminetetraacetic acid (EDTA) were purchased from Shanghai Sinopharm Group Chemical Reagent Co. Isopropyl alcohol (IPA) from the Fuchen Chemical Reagent Factory(Tianjin, China); Starch from the Guangzhou Chemical Reagent Factory; All solutions were prepared from ultra-pure water ( $18.2 \text{ M}\Omega \cdot \text{cm}$ ), and human serum was obtained from the Fifth People's Hospital of Guilin. All chemicals used in the experiment were analytical grade and no further purification was required.

### Apparatus

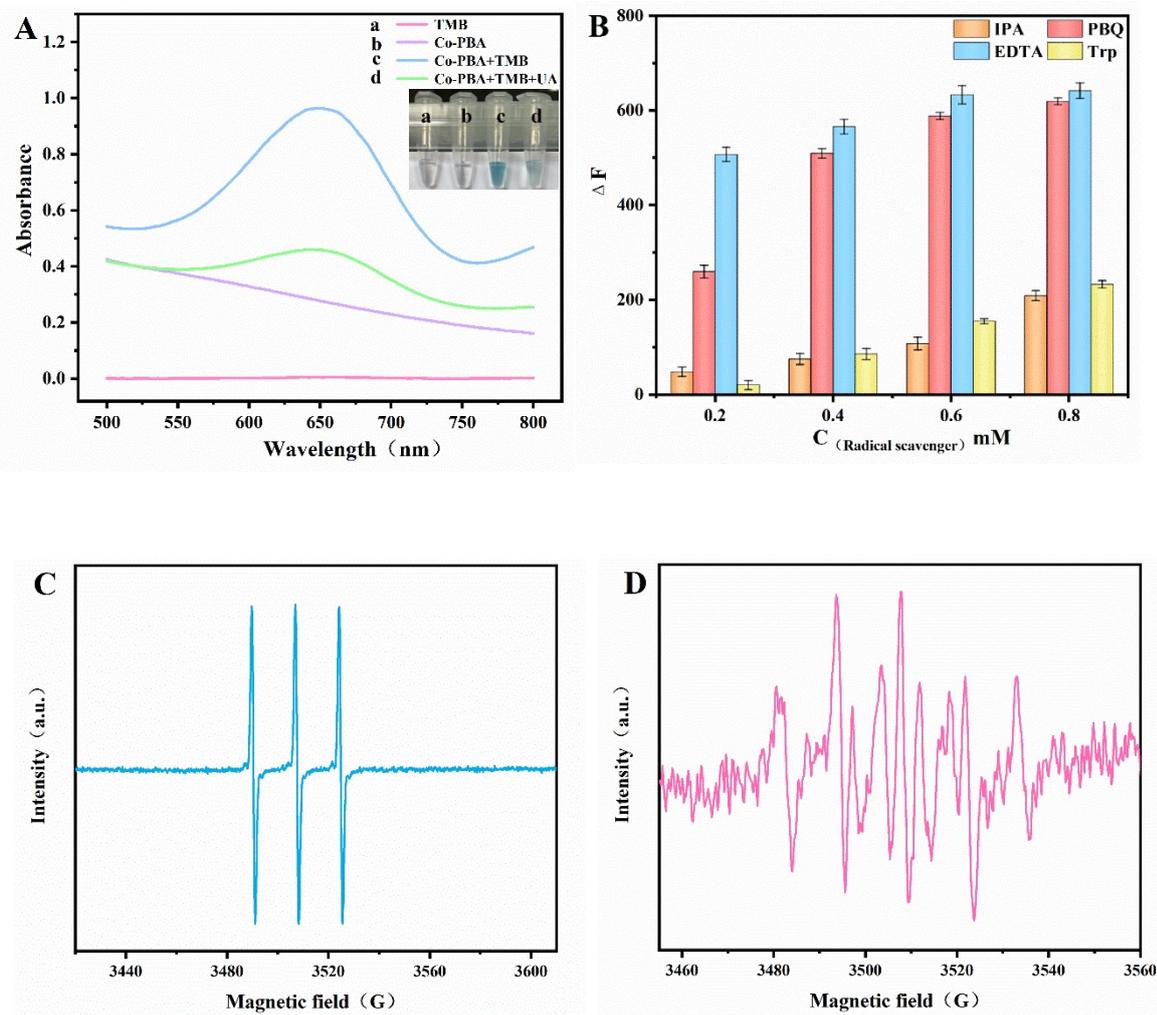
The fluorescence spectrum was obtained on the fluorescence spectrophotometer LS-55 (Perkin Elmer), the ultraviolet absorption visible spectrum was obtained on the ultraviolet-visible spectrophotometer Cary-60 (Agilent Technologies Co., Ltd.),

Transmission electron microscope X-ray photoelectron spectroscopy (XPS) was performed using the Thermo ESCALAB 250XI Electron Spectrometer (Thermo, America), and electron spin resonance (ESR) was performed using the A300-10/12 Bruker, Germany. The powder X-ray diffraction (XRD) pattern was recorded by a D/max 2550 VB/PC diffractometer (Rigaku, Japan). (TEM) images were obtained on a Talos F200S transmission electron microscope (Thermo Scientific, Netherlands), and a scanning electron microscope (SEM) was performed using FEI Quanta 400 FEG (FEI, USA). The ultra-pure water used in the experiment was from the Direct-Q3 ultra-pure water system (Merck Millipore, USA).

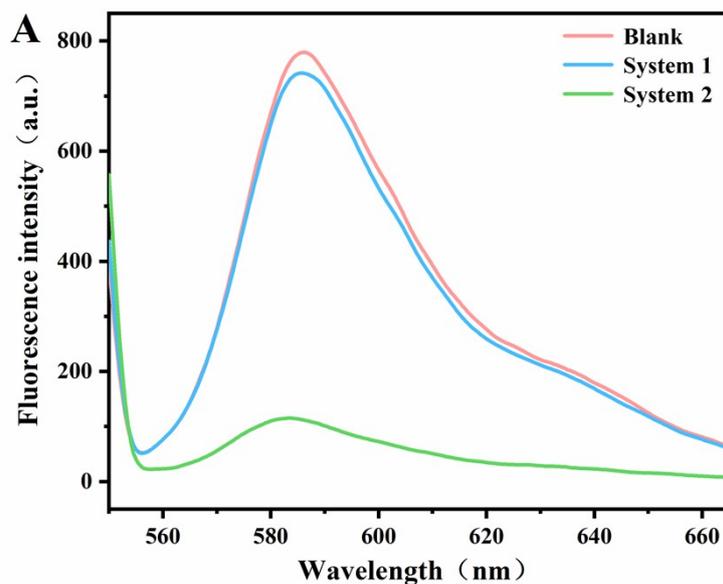
## Results and discussion



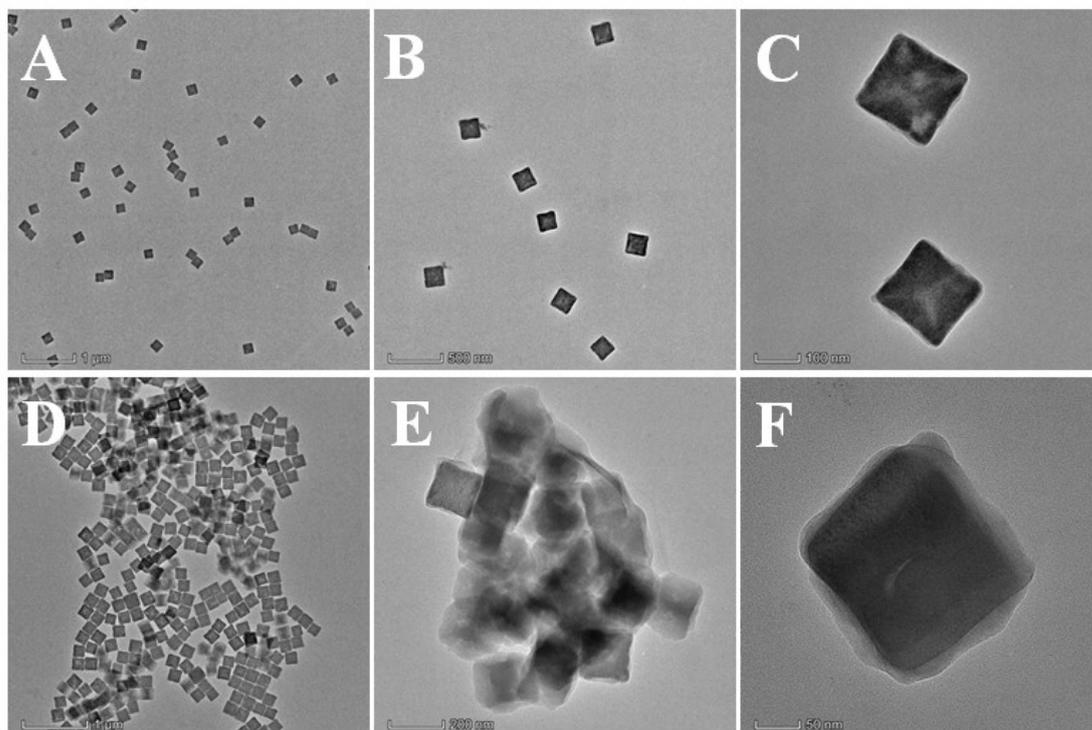
**Figure S1** EDS mapping of Co-PBA.



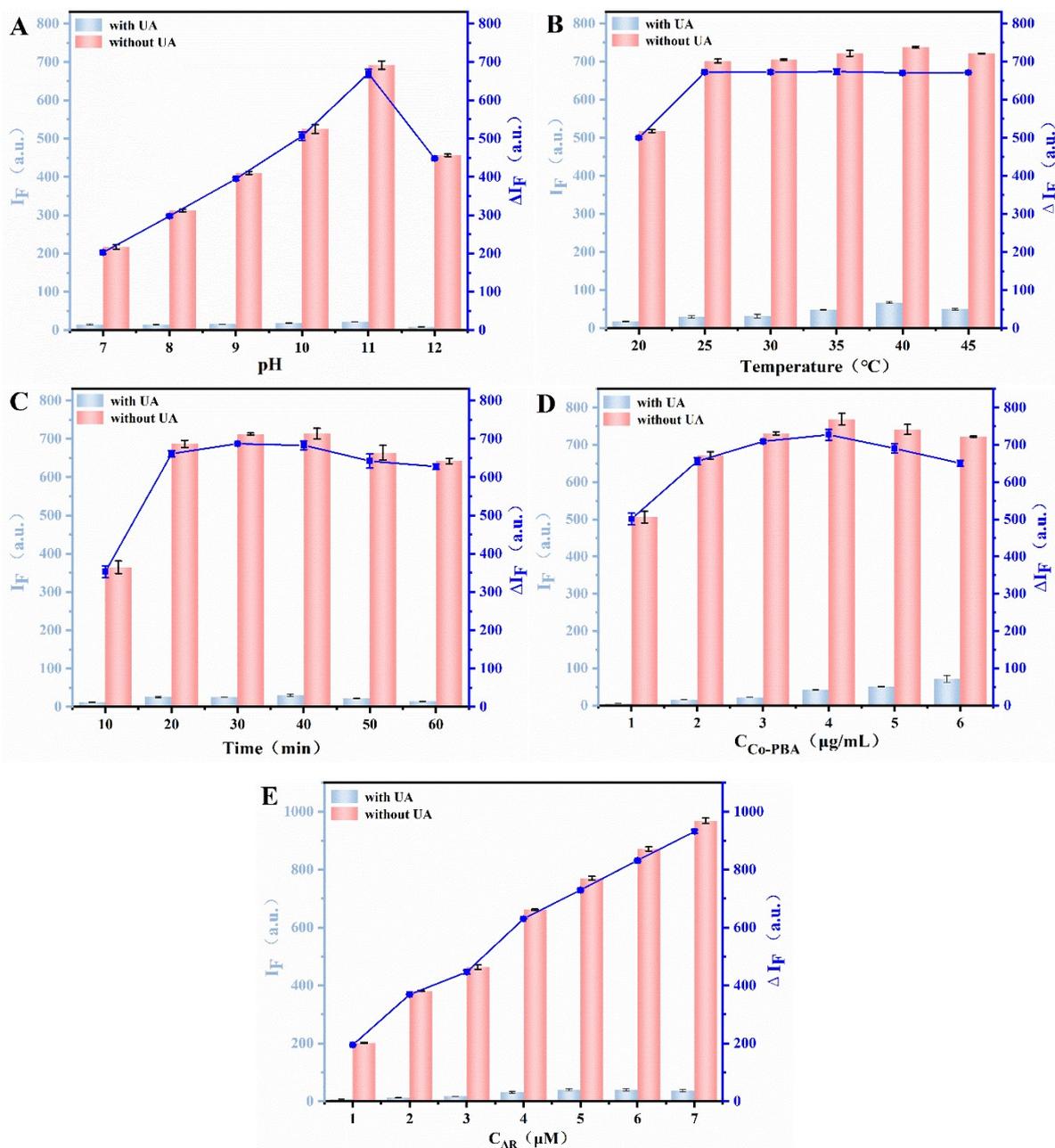
**Figure S 2** (A) UV-visible absorption spectra under different reaction systems (inset: corresponding color images); (B) different concentrations of free radical scavengers (IPA, PBQ, EDTA, Trp) were added to the Co-PBA+AR system.  $\lambda_{em}=585$  nm,  $\lambda_{ex}=540$  nm; (C) ESR spectrum of Co-PBA mixed with TEMP. (D) ESR spectrum of Co-PBA mixed with DMPO.



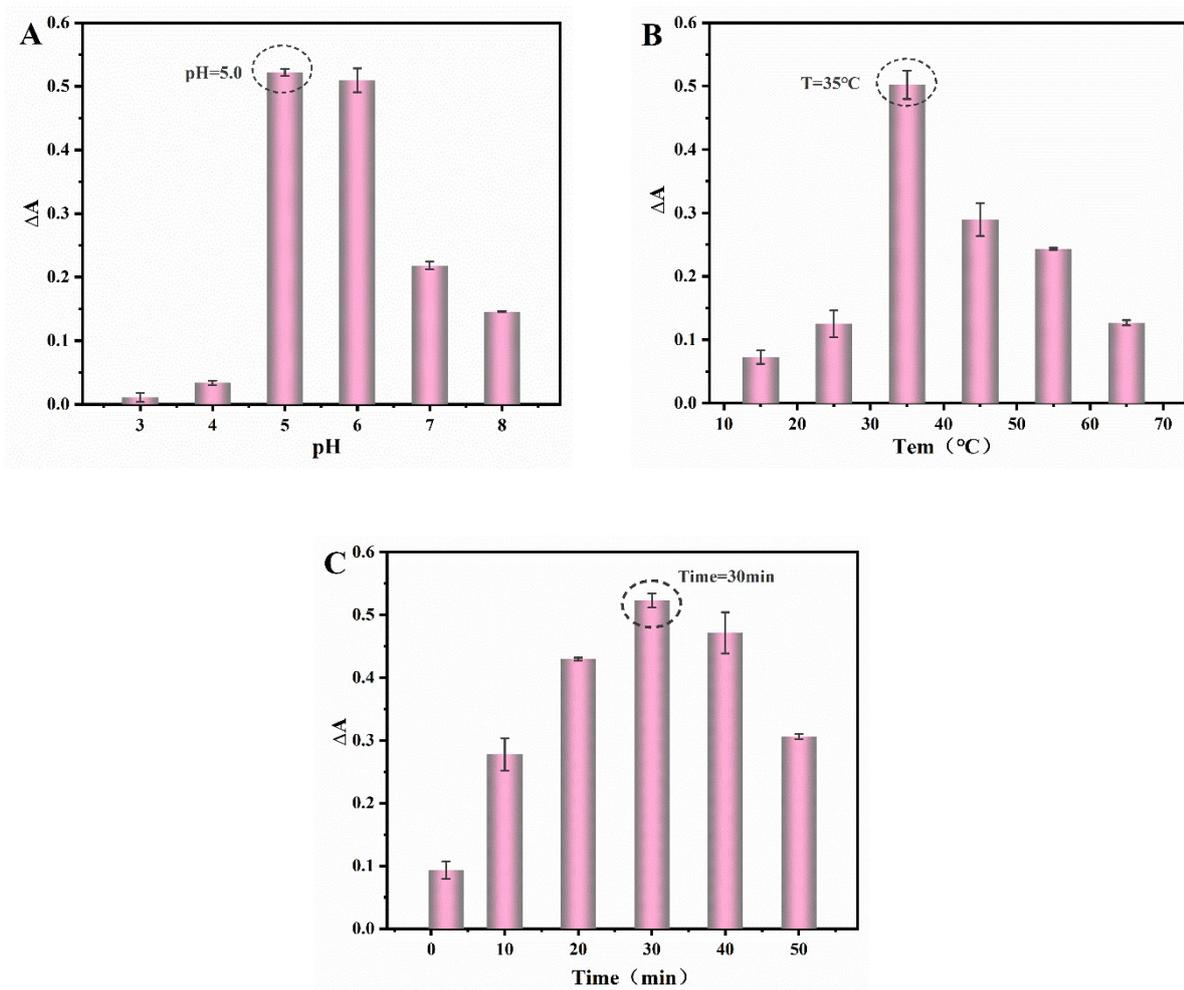
**Figure S3** Fluorescence spectra in different reaction condition. (A) Blank: Co-PBA+AR reaction for 30 min; System 1: incubation with Co-PBA+AR for 10 min, followed by UA for 20 min; System 2: incubation with Co-PBA+UA for 10 min, followed by AR for 20 min; (B) the color images of the mixed solutions incubated for ten minutes with Co-PBA+UA+AR, Co-PBA, Co-PBA+UA from left to right.



**Figure S4** (A) (B) (C) shows TEM images of Co-PBA; (D) (E) (F) shows TEM images of Co-PBA after co-incubation with UA.



**Figure S5** (A)-(C) are the changes of fluorescence emission number intensity of the Co-PBA/AR/UA system at 585 nm under the excitation of 540 nm wavelength for different pH, reaction temperature, and reaction time, respectively; (D)-(E) are the changes of fluorescence emission number intensity of the Co-PBA/AR/UA system at 585 nm under the excitation of 540 nm wavelength for the mixed solution in the presence of different concentrations of Co-PBA and AR, respectively.



**Figure S6** (A)-(C) shows the changes in the difference in absorbance intensity at 652 nm for the Co-PBA/TMB/UA system at different pH, reaction temperature, and reaction time, respectively.

**Table S1** Comparison of the performance of UA sensing platforms that have been reported to be designed based on nanomaterials

Method	Material	LOD ( $\mu\text{M}$ )	Detection range ( $\mu\text{M}$ )	Ref.
Colorimetry	PCN-222 (Fe) /UOX	3.5	10-800	1
Colorimetry	MIL-53 (Fe) /UOX	1.3	4.5–60	2
Colorimetry	MnO <sub>2</sub> NSs	0.21	0.5-30	3
Colorimetry	Ag <sub>5</sub> PMo <sub>12</sub> @PPy	0.47	1–50	4
Fluorometry	GSH-CdTe NPs/UOX	0.1	0.22-6	5
Fluorometry	BSA-Au/Ag NCs/UOX	5.1	5-50	6
Fluorometry	GSH-Ti <sub>3</sub> C <sub>2</sub> MQDs/HRP	0.125	1.2-75	7
Fluorometry	Tb-dtpa-bdap	5.8	10-50	8
Fluorometry	MnO <sub>2</sub> - S,N-CDs	0.8	2.5-30	9
Fluorometry	Co-PBA	0.389	0.625-40	This work
Colorimetry	Co-PBA	9.49	10-280	This work

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