Supporting Information

Multi-emitting fluorescence sensor of MnO_2-OPD-QDs for the multiplexed and visual detection of ascorbic acid and alkaline phosphatase

Qian Yang,[a,b] Chuyao Li,[a,b] Jinhua Li,[b] Maryam Arabi,[b] Xiaoyan Wang,[b,c] Hailong Peng,[a] Hua Xiong,*[a] Jaebum Choo*[e] and Lingxin Chen*[b,c,d]

[a] State Key Laboratory of Food Science and Technology, Nanchang University, Nanchang 330047, China

[b] CAS Key Laboratory of Coastal Environmental Processes and Ecological Remediation; Research Center for Coastal Environmental Engineering and Technology, Yantai Institute of Coastal Zone Research, Chinese Academy of Sciences, Yantai 264003, China

[c] School of Pharmacy, Binzhou Medical University, Yantai 264003, China

[d] Center for Ocean Mega-Science, Chinese Academy of Sciences, Qingdao 266071, China

[e] Department of Chemistry, Chung-Ang University, Seoul 06974, South Korea

* Corresponding authors.

E-mail addresses: huaxiong100@126.com (H. Xiong); jbchoo@cau.ac.kr (J. Choo); lxchen@yic.ac.cn (L. Chen).

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1. Related descriptions

Synthesis of red-fluorescent CdTe/ZnS QDs (r-QDs)

Red-fluorescent CdTe QDs were firstly synthesized according to the previous work.[1] In brief, 68.4 mg of $CdCl_2 \cdot 5H_2O$ and 78.5 μL of MPA were mixed in 75 mL of ultrapure water to form the cadmium precursor, with pH adjusted to 9.0 and stirring under N_2 for 30 min. Then, 1 mL of freshly prepared NaHTe aqueous solution (with 40 mg of NaBH4 and 38.3 mg of tellurium powder reacting in ethanol-water solution (1.5mL/0.5mL) at 40 °C for 4 h) was expeditiously injected into the above reaction system under stirring. The solution was heated and refluxed for 24 h to obtain the red-fluorescent CdTe QDs. Next, the red-fluorescent CdTe/ZnS QDs were prepared by the situ growth of ZnS shell onto the red-fluorescent CdTe QDs.[2] Briefly, 8 mL of as-prepared red-fluorescent CdTe QDs was added to 25 mL solution containing 1 $mmol \cdot L^{-1}$ $ZnCl_2$ and 4 $mmol \cdot L^{-1}$ GSH. After being adjusted to pH 8, the mixture was heated to 100 °C under open-air conditions and refluxed for 30 min. (*Reagents and materials* Tellurium and sodium borohydride ($NaBH_4$) were offered by Sigma-Aldrich (Shanghai, China). 3-Mercaptopropionic acid (MPA) and reduced glutathione (GSH) was supplied by Aladdin (Shanghai, China). Cadmium chloride pentahydrate ($CdCl_2 \cdot 5H_2O$), zinc chloride ($ZnCl_2$), sodium hydroxide (NaOH) and ethanol were provided by Sinopharm Chemical Reagent Co. Ltd. (Shanghai, China).)

References

1. M.Y. Gao, S. Kirstein, H. Mohwald, A.L. Rogach, A. Kornowski, A. Eychmuller and H. Weller, *J. Phys. Chem. B*, 1998, **102**, 8360–8363.

2. Y. Liu and J. Yu, *J. Colloid Interf. Sci.*, 2010, **351**, 1–9.

2. Figures

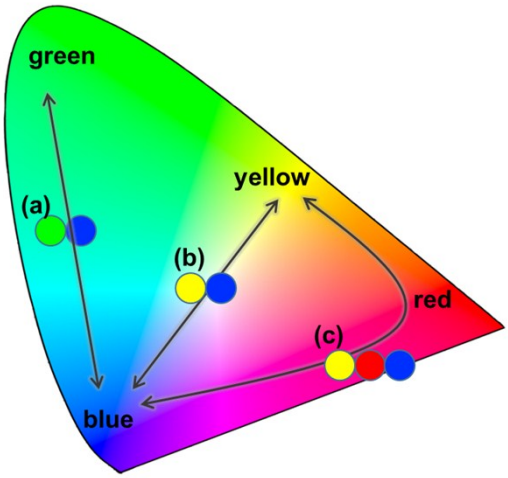

Fig. S1 Chromaticity diagram to indicate the color variation ranges of (a) green- and blue-emission, (b) yellow- and blue-emission, and (c) yellow-, red- and blue-emission based fluorescence sensors.

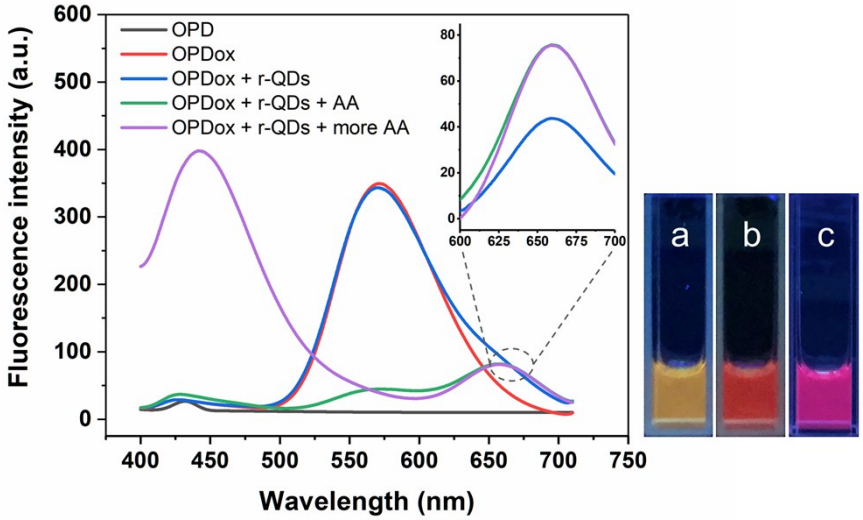

Fig. S2 Fluorescence spectra of OPD (black line), OPDox (red line) and its mixture with r-QDs in the absence (blue line) or presence (green and purple lines) of AA. Inset: fluorescence spectra of r-QDs after eliminating the spectral overlap effect of yellow emission peak, of the mixture of OPDox and r-QDs in the absence (blue line) or presence (green and purple lines) of AA, respectively. Right: fluorescence images of mixture of OPDox and r-QDs in the absence (a) and presence (b, c) of AA, respectively.

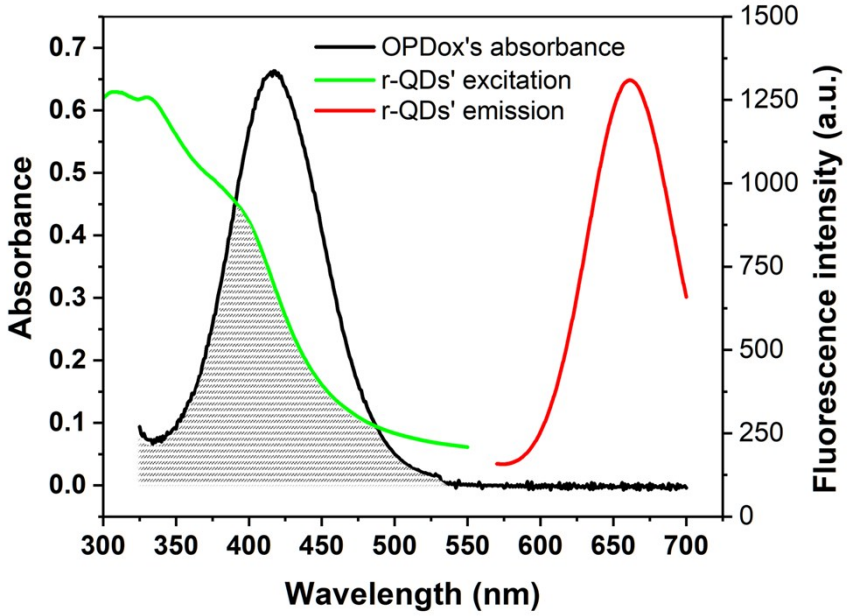

Fig. S3 Absorbance spectrum of OPDox (black line), fluorescence excitation spectrum (green line) and emission spectrum (red line) of r-QDs, and the spectral overlap between OPDox's absorbance and r-QDs' excitation.

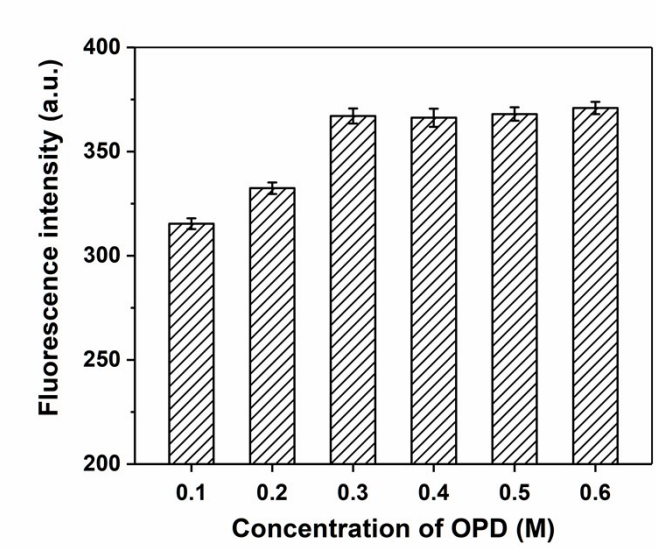

Fig. S4 Fluorescence intensity of OPDox prepared with different concentrations of OPD.

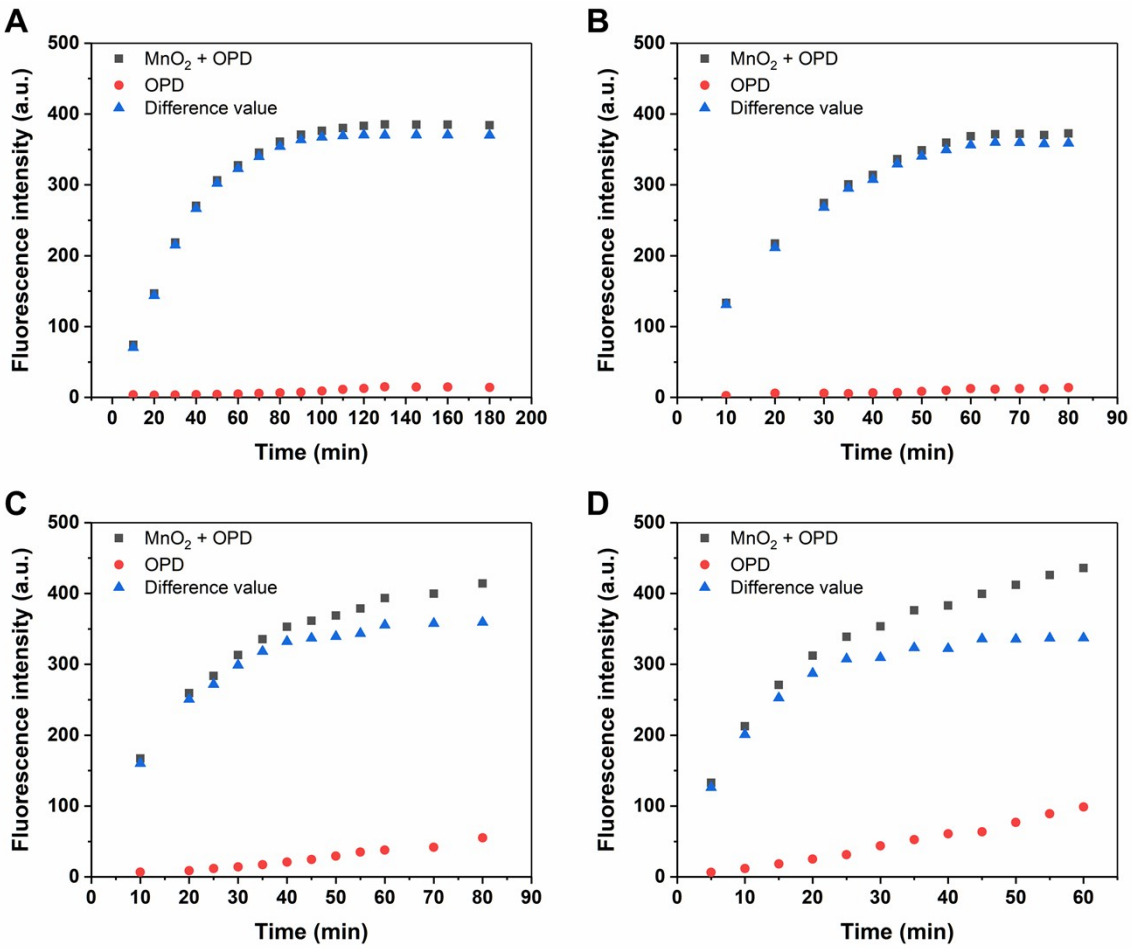

Fig. S5 Reaction time-dependent fluorescence intensity change of OPDox synthesized at different reaction temperature of (A) 30 °C, (B) 40 °C, (C) 50 °C and (D) 60 °C.

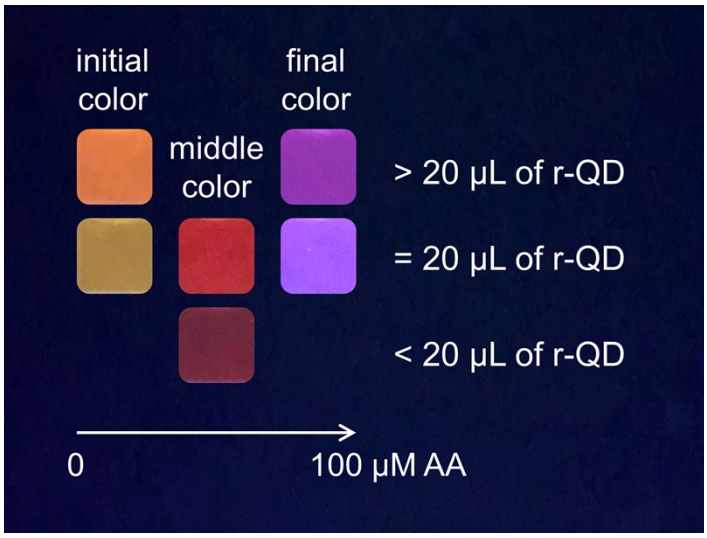

Fig. S6 Fluorescence colors of MnO_2-OPD-QDs sensors containing different volumes of r-QDs before and after interaction with AA.

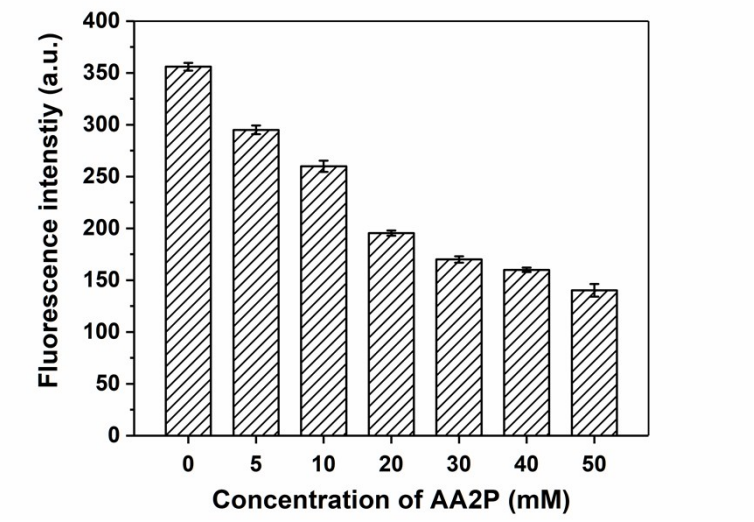

Fig. S7 Fluorescence intensity of OPDox provided by the MnO_2-OPD-QDs sensor with increasing concentration of AA2P.

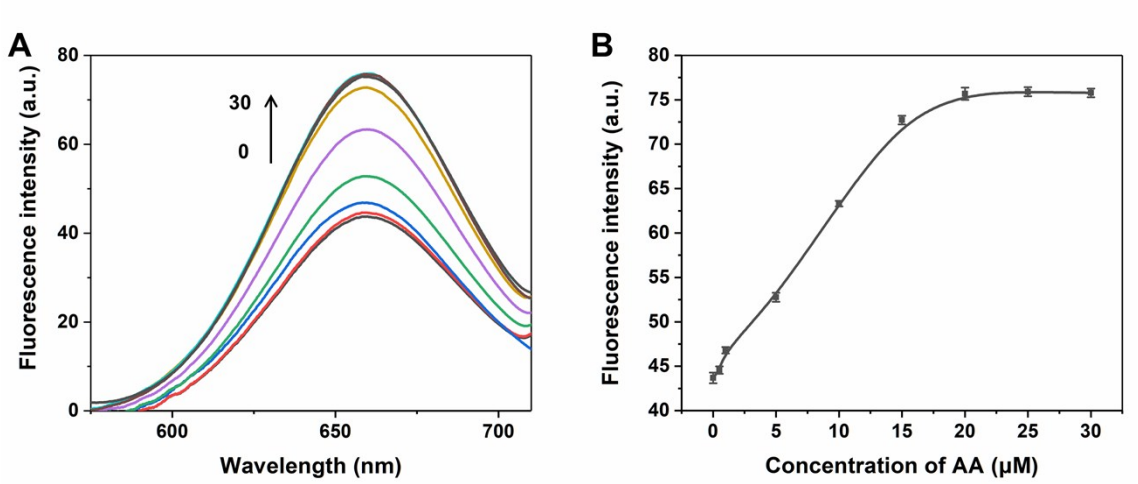

Fig. S8 (A) Fluorescence spectra and (B) intensities of r-QDs after eliminating the effect of spectral overlap with increasing concentration of AA (from 0 to 30 μM).

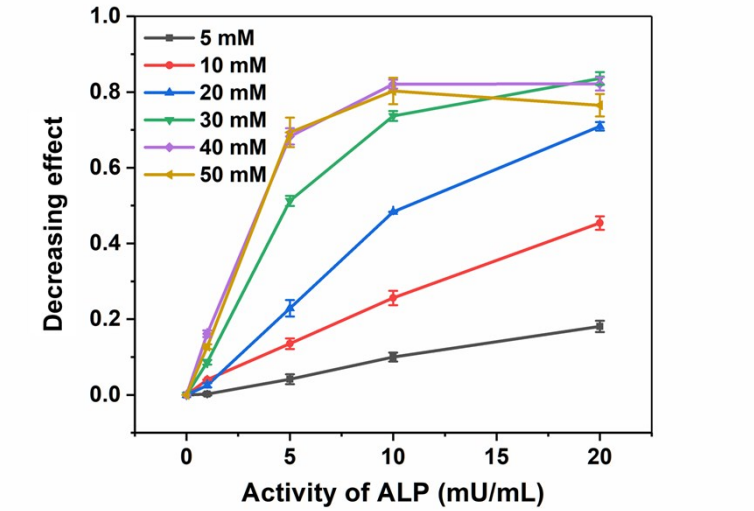

Fig. S9 Fluorescence intensity decreasing effect of OPDox in the MnO_2-OPD-QDs sensor with increasing activity of ALP and increasing concentration of AA2P (5, 10, 20, 30, 40 and 50 mM).

3. Table

Table S1 The nonlinear fitting curves for the ratiometric fluorescence intensity change of blue- and yellow-emission peaks in Fig. 4, *i.e.*, $(I_{441}/I_{569})/(I_{441}/I_{569})_0$, and the related parameter values

	line A (ternary-emission)	line B (dual-emission)
model	logistic	logistic
equation	y = A2 + (A1 - A2) / (1 + (x / x0) ^ p)	y = A2 + (A1 - A2) / (1 + (x / x0) ^ p)
A1	2.23564 ± 0.92572	2.65482 ± 1.07491
A2	101.38703 ± 1.7115	118.51309 ± 1.8406
x0	37.55776 ± 0.72186	37.79741 ± 0.66606
p	3.99263 ± 0.2533	4.41419 ± 0.28306
reduced Chi-Sqr	4.77464	6.76023
r-square (COD)	0.99786	0.99787
Adj. r-square	0.99733	0.99734