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## **Supporting information**

## A Separation-Free Paper-based Hydrogel Device for One-Step

## **Reactive Oxygen Species Determination by Smartphone**

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Figure S1. Size distribution of prepared nanoparticles, a) Pd NPs, b) ZIF-8, C) Pd NPs loaded ZIF-8.

Elements	Weight percentage (%)	Wt % sigma	Atom percentage (%)
Zn	3.54	0.32	1.15
С	16.99	4.7	29.96
Ν	11.99	1.11	18.13
Pd	0.19	0.7	0.04
Si	67.28	3.88	50.72
Total	100		100

 Table S1: EDX analysis of prepared Pd-ZIF-8 NPs.



Figure S2. The EDX spectrum of prepared Pd-ZIF-8 NPs.



**Figure S3.** Elemental mapping of prepared Pd-ZIF-8 NPs (green dots stand for carbon element, cyan dots stand for nitrogen element, red dots stand for zinc element, purple dots stand for potassium element).



**Figure S4**. Optimizing the reaction time by measuring absorbance change of TMB-nano-enzyme system in aqueous solution.



Figure S5. Optimizing the reaction pH value of TMB-nano-enzyme system in aqueous solution.



Figure S6. Optimizing the reaction temperature value of TMB-nano-enzyme system in aqueous solution.



Figure S7. Steady-state kinetic assay and catalytic mechanism of Pd-ZIG-8.



Figure S8. Color change of TMB-nano-enzyme system with various of  $H_2O_2$  concentration in HAc-NaAc buffer (pH=5.5).



Figure S9. Alginate precursor concentration optimizing.



**Figure S10.** The relationship of reaction signal and thickness of prepared hybrid hydrogel in each well of 96-well plate.



Figure S11. The fabrication process of paper-based analytic device.



Figure S12. Layout of test zone and sample zone on the PAD and hydrogel-based catalysis feasibility with adding of  $H_2O_2$  (concentration, 10 mM, volume, 100  $\mu$ L).



Figure S13. Optimizing the reaction time by measuring absorbance change of hybrid hydrogel system.



Figure S14. Optimizing the reaction time by measuring absorbance change of hybrid hydrogel system.



Figure S15. The photograph of a mini-LED photographic light box



Figure S16. Sensor performance over a 10-day storage period (In 4 degree) under three different concentration conditions.