Electronic Supplementary Material (ESI) for Analytical Methods.

Dual-readout performance of Eu^{3+}-doped nanoceria as a phosphatase mimic for degradation and detection of organophosphate

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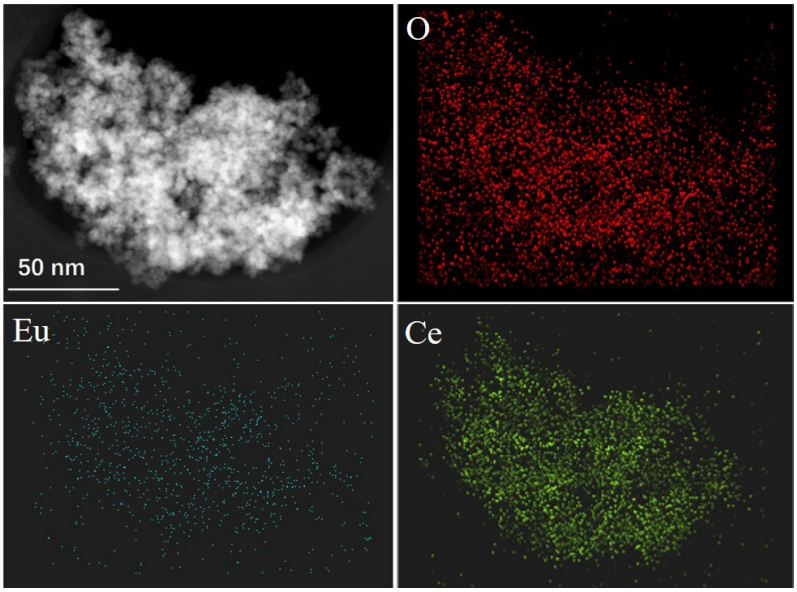

Fig. S1 Elemental map distributions of O, Ce and Eu in Eu:CeO_2.

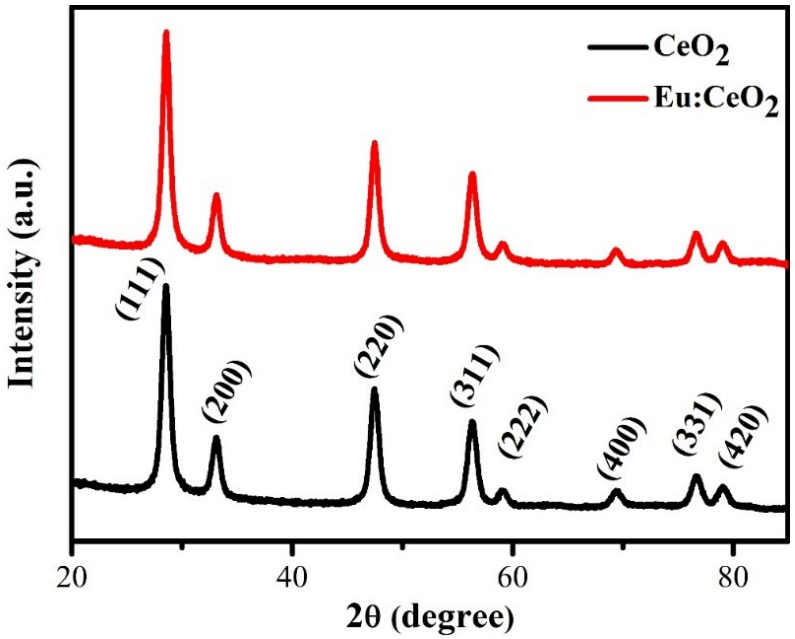

Fig. S2 XRD pattern of CeO_2 and Eu:CeO_2.

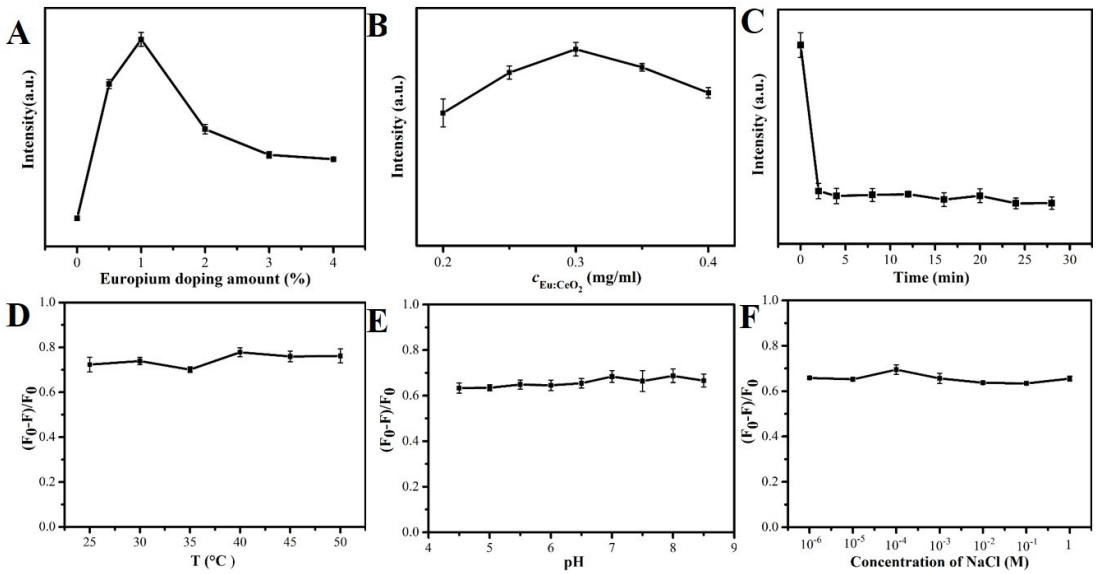

Fig. S3 (A) Effect of europium doping amount on the fluorescence intensity of Eu:CeO_2 at 592 nm; (B) Effect of Eu:CeO_2 content on the fluorescence intensity of Eu:CeO_2 at 592 nm; (C) Effect of reaction time on the fluorescence intensity of Eu:CeO_2 at 592 nm in the presence of p-NPP($\boldsymbol{c}_{\text{p-NPP}}$=990 μM); (D) Effect of temperature on the fluorescence quenching rate $(F_0\text{-}F)/F_0$ of the system in the presence of p-NPP($\boldsymbol{c}_{\text{p-NPP}}$=990 μM); (E) Effect of pH on the fluorescence quenching rate $(F_0\text{-}F)/F_0$ of the system in the presence of p-NPP($\boldsymbol{c}_{\text{p-NPP}}$=990 μM); (F) Effect of different concentrations of NaCl on the fluorescence quenching rate $(F_0\text{-}F)/F_0$ of Eu:CeO_2 (range from 1.0 μM to 1.0 M).

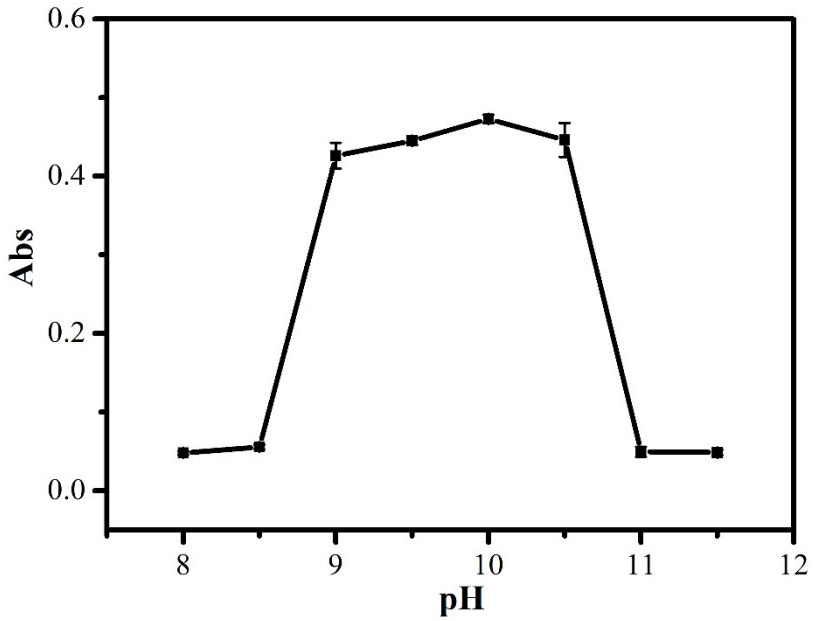

Fig. S4 Effect of pH on absorbance value of the system in the presence of p-NPP ($\boldsymbol{c}_{\text{p-NPP}}$=290 μM).

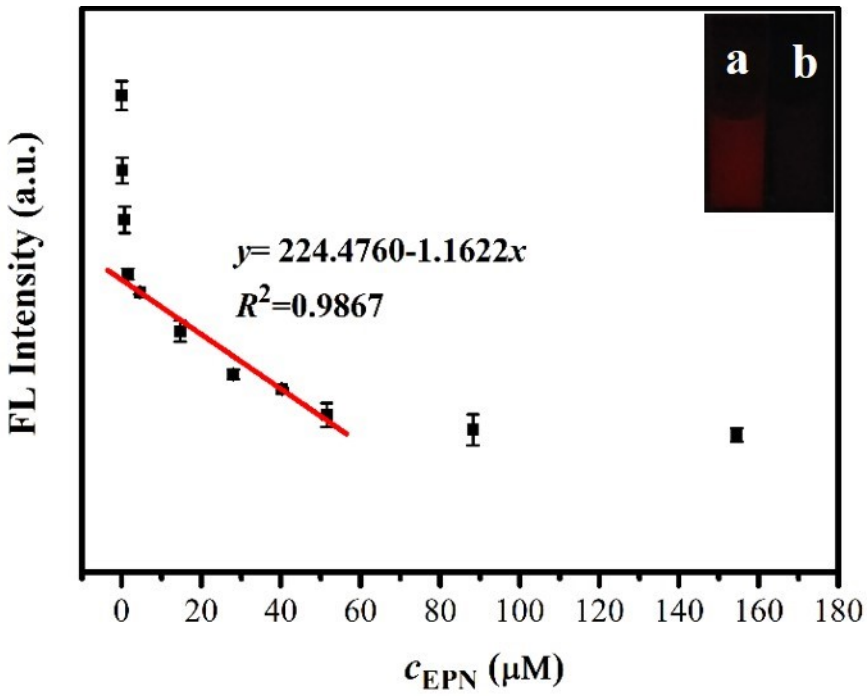

Fig. S5 linear equation of the fluorescence intensity of Eu:CeO_2 versus the concentrations of EPN(inset: images of (a) Eu:CeO_2, (b) Eu:CeO_2 + ENP(160 μM) under 365 nm UV light).

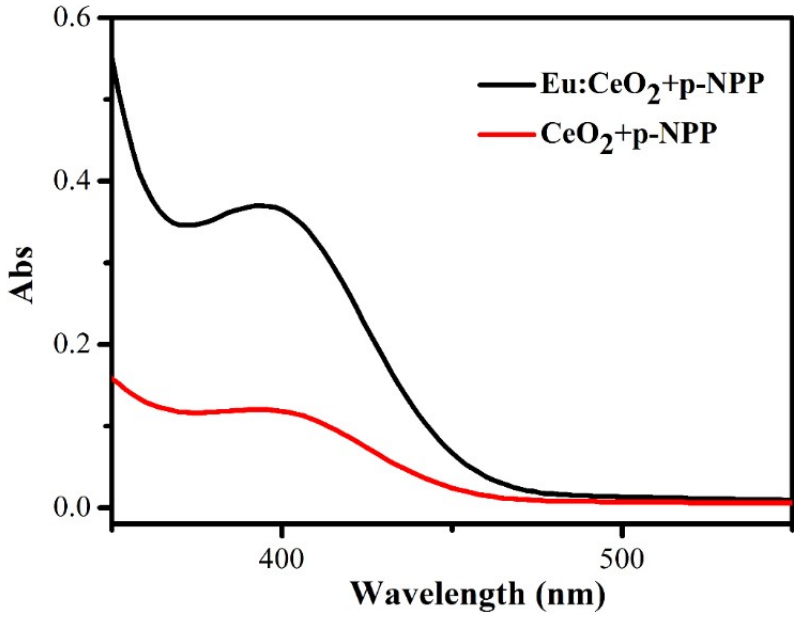

Fig. S6 Comparison of simulated phosphatase activity between CeO_2 and Eu:CeO_2.

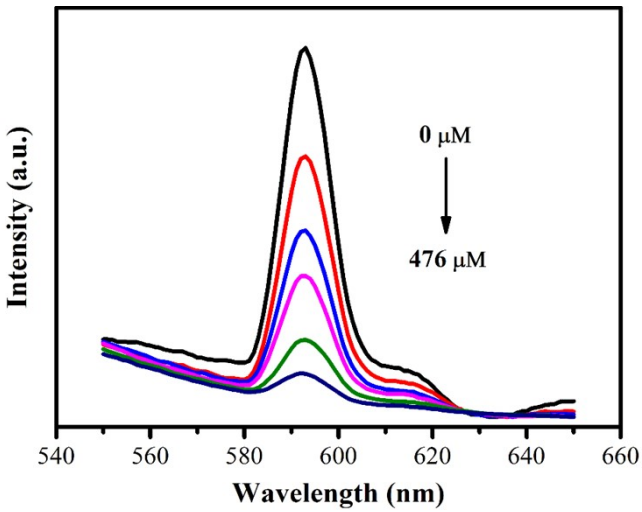

Fig. S7 Fluorescence response versus PNP concentration from 0 μM-476 μM.

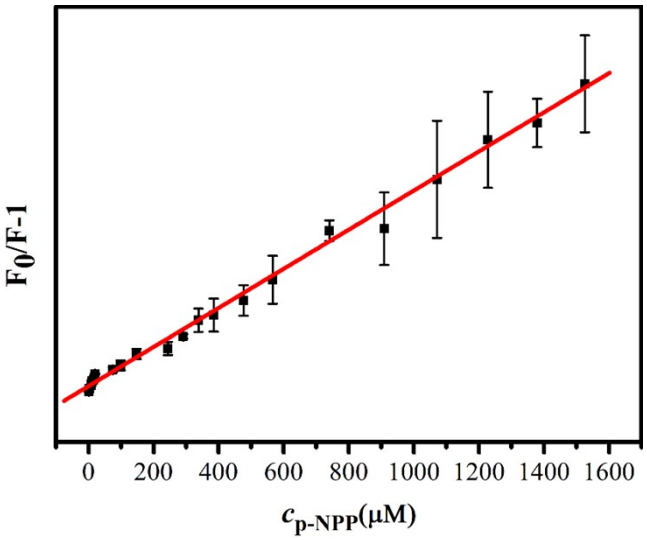

Fig. S8 Stern-Volmer equation simulation.

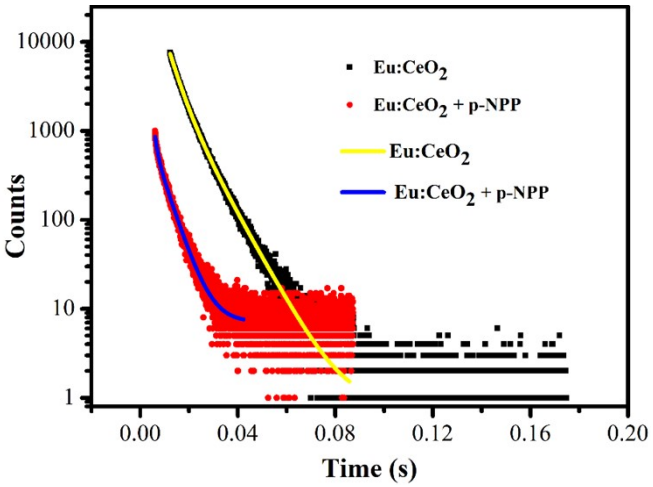

Fig. S9 Fluorescence lifetime of Eu:CeO_2 and p-NPP-added Eu:CeO_2 system.

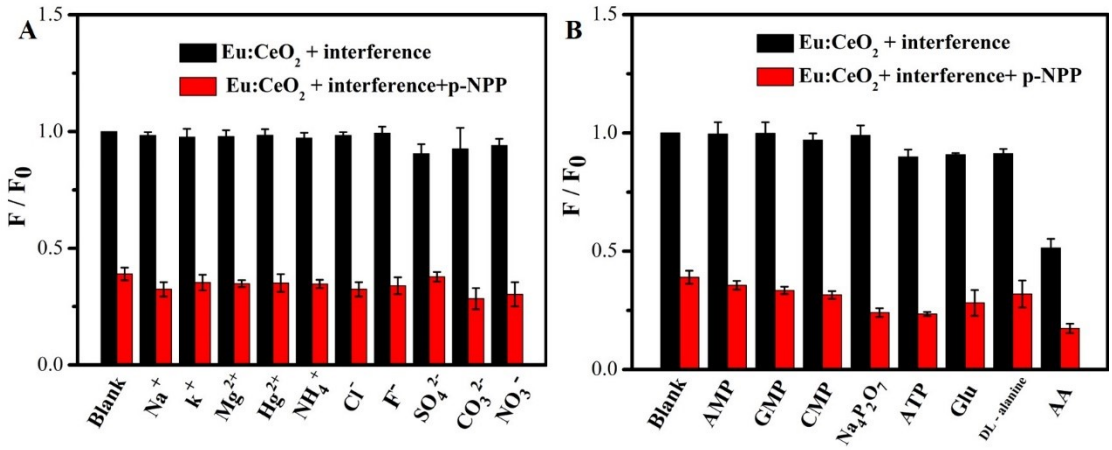

Fig. S10 Influence by various interference (Na^+, K^+, Mg^{2+}, Hg^{2+}, NH_4^+, Cl^-, F^-, SO_4^{2-}, CO_3^{2-}, NO_3^-, AMP, GMP, CMP, $Na_4P_2O_7$, ATP, GLU, DL-alanine, AA).

Table S1 Comparison of different analytical methods for OPC detection

OPC	Method	Liner range	Detect limit	Reference
EPN	headspace SPME-GC	0.1-0.8 mg/L	0.08 mg/L	[1]
EPN	LC-MS	0.5-8 μg/L	0.17 μg/L	[2]
EPN	GC-MS(ASE)	0.01-1.0 mg/L	0.005 mg/L	[3]
paraoxon	Fluorescence	25 - 400 μM	8 μM	[4]
pretilachlor	Fluorescence	5.7-61.5 μM	2.9 μM	[5]
ethyl paraoxon	Fluorescence	0.1- 0.5 mM	0.056 mM	[6]
dichlorvos	Fluorescence	0-10 μM	1.18μM	[7]
EPN	Fluorescence	6-52 μM (1.94-16.81 mg/L)	5.86 μM(1.89 mg/L)	This work

Reference:

[1] X. P. Lee, T. Kumazawa, K. Sato, O. Suzuki, *Chromatographia*, 1996, **42**, 135-140.

[2] S. Inoue, T. Saito, H. Mase, Y. Suzuki, K. Takazawa, I. Yamamoto, S.Inokuchi, J. Pharm. Biomed. Anal., 2007, **44**, 258–264.

[3] S. K. Cho, A. M. A. El-Aty, H. R. Jeon, J. H. Choi, H. C. Shin and J. H.

Shim, *Biomed. Chromatogr.*, 2008, **22**, 727–735.

[4] K. R. Rogers, Y. Wang, A. Mulchandani, P. Mulchandani and W. Chen, *Biotechnol. Progr.*, 1999, **15**, 517−521.

[5] M. J. Deka, P. Dutta, S. Sarma, O. K. Medhi, N. C. Talukdar, D. Chowdhury, *Heliyon*, 2019, **5**, e01985.

[6] M. Jain, P. Yadav, B. Joshi, A. Joshi, P. Kodgire, *Appl. Microbiol. Biotechnol.*, 2021, **105**, 389–400.

[7] L. A. Ibrahim, A. M. Abbas, H. M. Darwish, *Luminescence*, 2017, **32**, 1541–1546.