

Electronic Supplementary Information

Visual and dual-fluorescence homogeneous sensor for detection of pyrophosphatase in clinical hyperthyroidism samples based on selective recognition of CdTe QDs and coordination polymerization of Ce³⁺

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Materials and reagents.

All reagents used in this work were of analytical-reagent or higher grade and used without further purification. Pyrophosphatase (PPase, inorganic, from yeast), human serum albumin (HSA), lysozyme, transferrin, papain, α -L-fucosidase (AFu), mucin 1, thrombin, alkaline phosphatase (ALP), and NaF were obtained from Sigma-Aldrich Co., Ltd. (China). Mono-potassium phosphate (KH_2PO_4), dipotassium phosphate (K_2HPO_4), and potassium phosphate (K_3PO_4), were obtained from Sigma-Aldrich Co., Ltd. (China). Sodium pyrophosphate, cerium nitrate hexahydrate ($\text{Ce}(\text{NO}_3)_3 \cdot 6\text{H}_2\text{O}$), MgCl_2 , KCl , NaCl , CaCl_2 , CoCl_2 , MnCl_2 , 1 M Tris-HCl solution (pH 7.4, sterile), and CuCl_2 used in this work were obtained from Shanghai Sangon Biological Engineering Technology and Services Co., Ltd. (China). Cadmium chloride ($\text{CdCl}_2 \cdot 2.5\text{H}_2\text{O}$), sodium tellurite (Na_2TeO_3), and potassium borohydride (KBH_4) were purchased from Kelong Chemical Reagents (Chengdu, China). 3-mercaptopropionic acid (MPA), FeCl_2 , FeCl_3 , AlCl_3 , NaNO_3^- , $\text{K}_2\text{Cr}_2\text{O}_7$, KMnO_4 , and MnSO_4 were obtained from Aladdin Reagent Co., Ltd (Shanghai, China). Human serum samples were donated from the West China Hospital of Sichuan University (Chengdu, China, approval number: 20191045). All solutions were stored at 4 °C in a refrigerator until use.

Instruments.

The absorption and fluorescence spectrum of CdTe QDs and PPI-Ce CPNs were recorded by the Duetta Spectrophotometer (HORIBA Canada Inc). High-resolution

transmission electron microscope (HR-TEM) measurements of CdTe QDs, Cu²⁺ + QDs, PPI-Cu²⁺-PPI + QDs, PPI-Ce CPNs were carried out by a Tecnai G2F20 STWIN TEM at an accelerating voltage of 200 kV (FEI Co., USA). Fourier transform infrared spectra (FTIR) of CdTe QDs were collected using a Nicolet IS10 FTIR spectrometer (Thermo Inc., America).

Synthesis of CdTe QDs.

The CdTe QDs were synthesised referring to the previously reported method.¹⁻³ Firstly, a 50 mL solution containing CdCl₂ (0.5 mmol) and trisodium citrate (0.2 g) was prepared. Then, MPA (52 μL) was instantly added into the above solution, and the solution pH was adjusted to 10.5 with NaOH. Later, Na₂TeO₃ (0.1 mmol) and KBH₄ (50 mg) were added into the above solution, and refluxed 1 h to obtain the CdTe QDs. Subsequently, high purity CdTe QDs was obtained via precipitating withn-propanol and centrifuging (11000 rpm). The purified red CdTe QDs were redispersed in high purity water before to use.

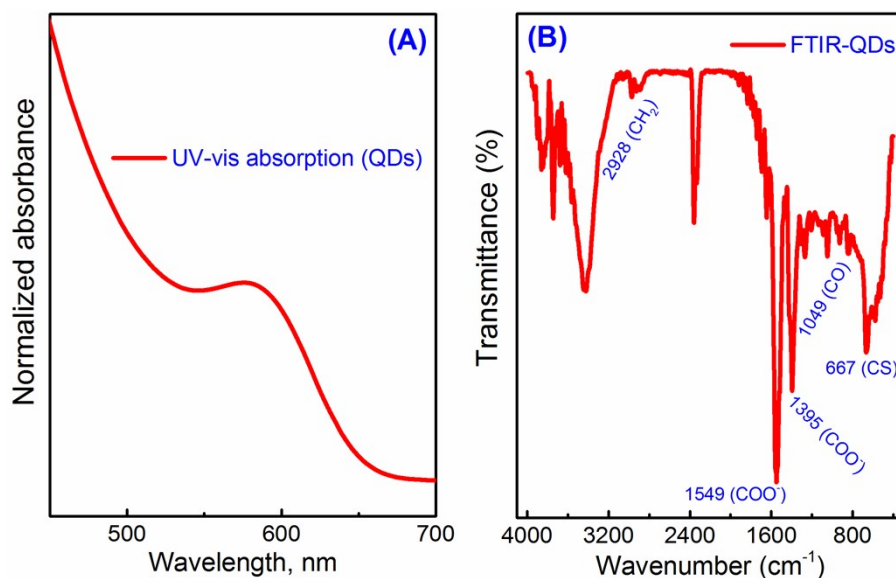


Fig. S1 Characterization of QDs by UV-Vis absorption (A), and Fourier transform infrared spectra (B).

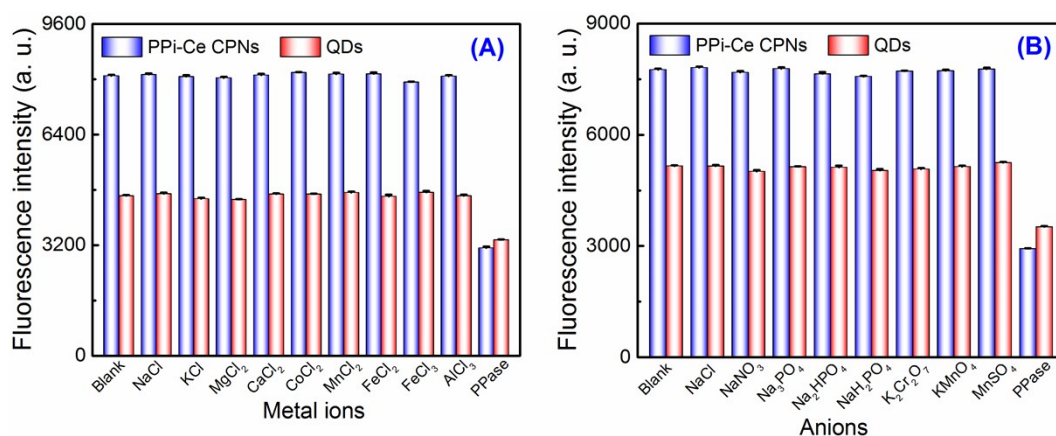


Fig. S2 The potential interference of metal ions (A), and anions (B) on the detection of PPase with PPI-Ce CPNs and CdTe QDs as signal molecules, respectively. Na^+ (100 mM), K^+ (10 mM), Mg^{2+} (10 mM), Ca^{2+} (25 μM), Co^{2+} (25 μM), Mn^{2+} (25 μM), Fe^{2+} (25 μM), Fe^{3+} (25 μM), and Al^{3+} (25 μM); and 100 μM Cl^- , NO_3^- , PO_4^{3-} , HPO_4^{2-} , H_2PO_4^- , $\text{Cr}_2\text{O}_7^{2-}$, MnO_4^- , and SO_4^{2-} . Error bars were estimated from three replicate measurements.

References

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