Electronic Supplementary Material (ESI) for Analytical Methods.
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Supporting Information

Highly Efficient Turn-on Fluorescence Detection of Zinc (II) Based on Multi-ligand Metal Chelation

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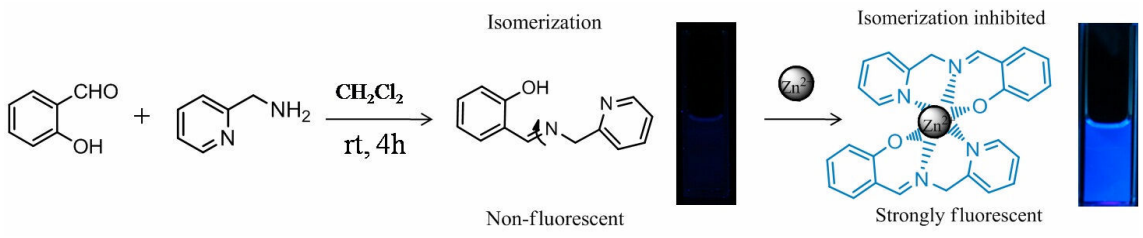

Scheme S1 Synthesis of the probe PPI and the coordination reaction with Zn(II). The images were taken from 2.0 μM PPI solution before (left) and after (right) addition of 5 equiv of Zn(II), indicating the fluorescence turn-on.

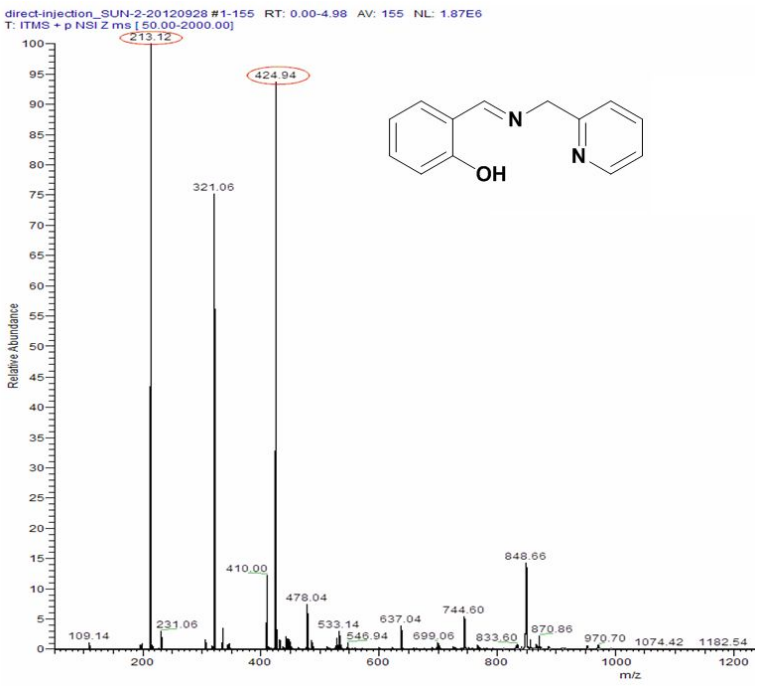

Fig. S1 ESI-Mass spectrum for compound PPI, the molecular weight of PPI (M) is 212, found $[M + H]^+ = 213$. The peak at 424 is the dipolymer of PPI.

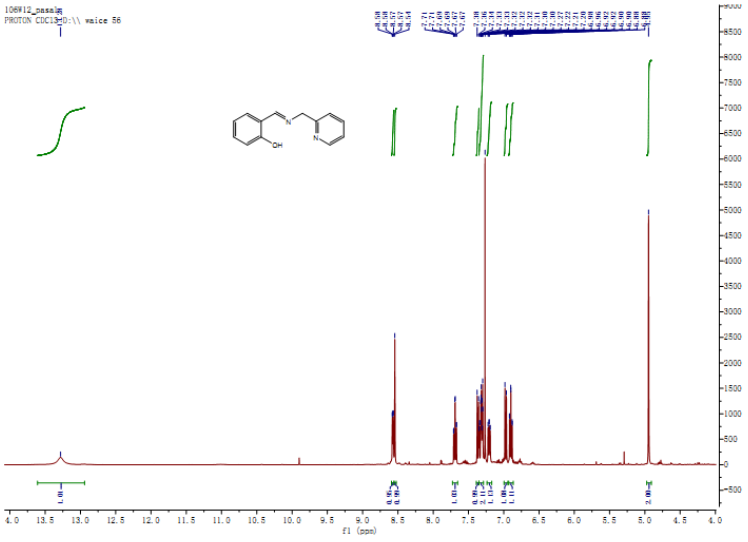

Fig. S2 ^{1}H-NMR Spectrum of PPI in $CDCl_3$. ^{1}H NMR (400 MHz, $CDCl_3$, ppm): δ 13.28 (1H, s), 8.57 (1H, dd, J = 4.8,0.7 Hz), 8.54 (1H, s), 7.69 (1H, td, *J* = 7.7,1.8 Hz), 7.37 (1H, d, *J* = 7.8 Hz) , 7.35-7.29 (2H, m) , 7.21 (1H, dd, *J* = 7.1,5.3 Hz) , 6.97 (1H, d, *J* = 8.1 Hz), 6.90 (1H, td, *J* = 7.5,1.0 Hz), 4.95 (2H, s).

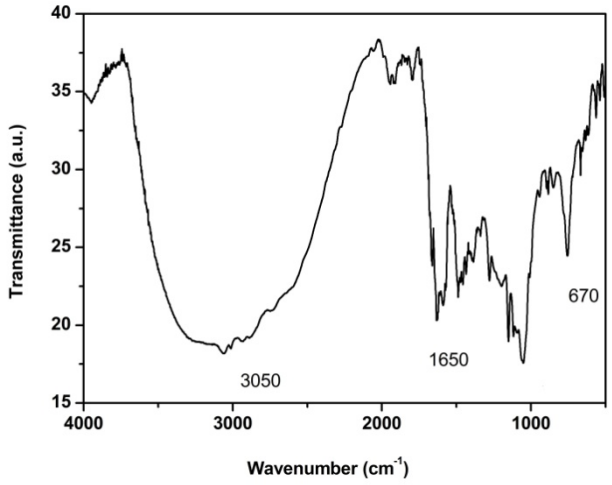

Fig. S3 IR spectrum of PPI. The vibration band at 1650 cm^{-1} can be assigned as the stretch of imide linkage (-C=N-) groups in the PPI molecules.

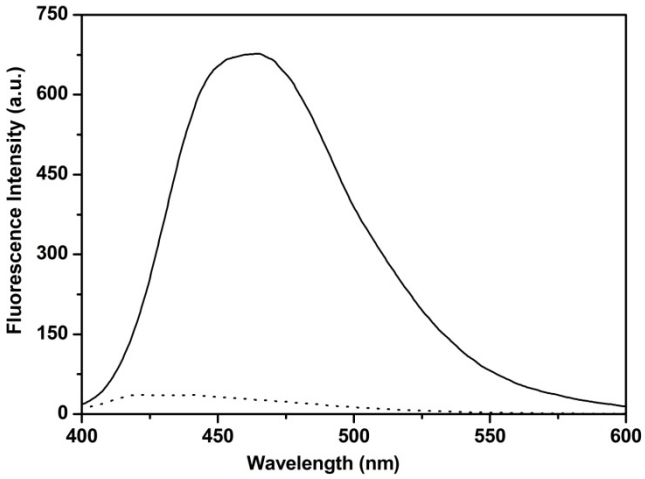

Fig. S4 The fluorescence spectra of PPI dissolved in ethanol solution (1.0 μM). The dot line and solid line are the fluorescence spectra of PPI before and after the addition of one equivalent Zn(II), respectively. The fluorescence spectra were recorded with excitation at 372 nm.

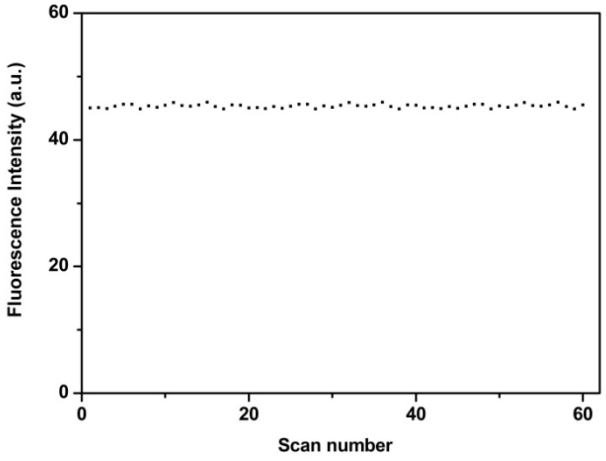

Fig. S5 Photostability of the fluorescence intensity of the probe PPI in ethanol solution (1 μM) upon excitation at room temperature. The PL spectra were recorded with excitation at 372 nm.

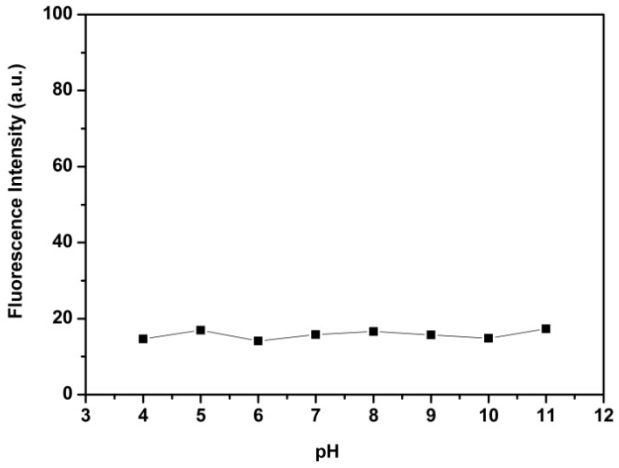

Fig. S6 The dependence of the fluorescence intensity of PPI (1 μM) on the pH in phosphate buffer-ethanol (50%, v/v) solution.

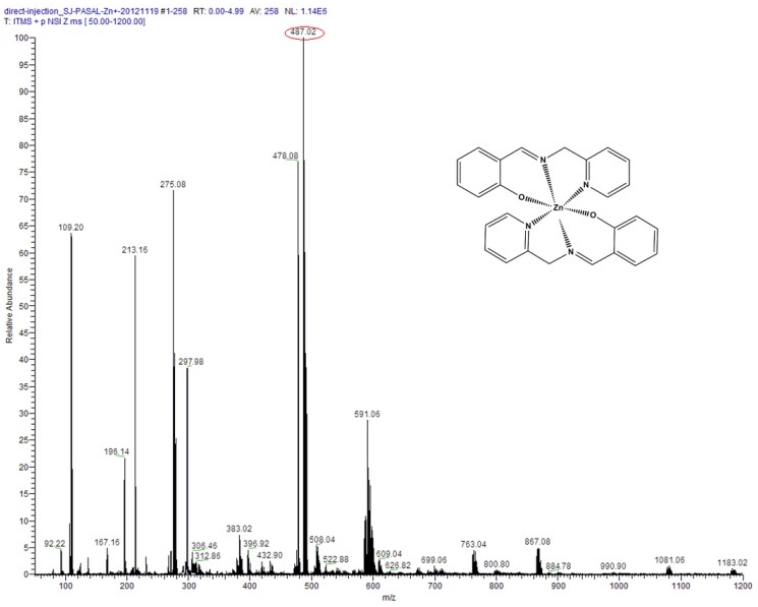

Fig. S7 ESI-Mass spectrum for compound $Zn(PPI)_2$, the dominating new peak at 487 $[M + H]^+$ assigns to the $Zn(PPI)_2$ calculated to be 486.12.

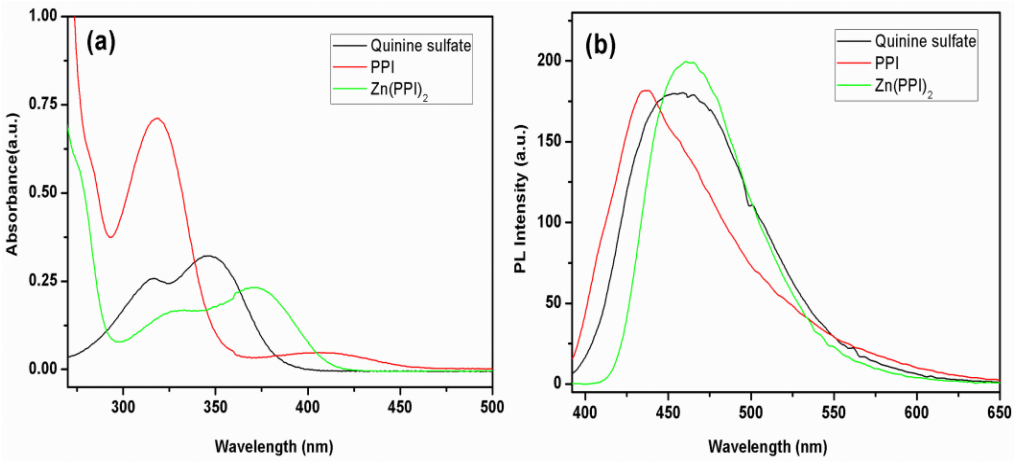

Fig. S8 (a) UV-vis absorption of 32 μM/L quinine sulfate in 0.1 M H_2SO_4, 300 μM/L PPI in ethanol and 30 μM/L $Zn(PPI)_2$ in ethanol. (b) Fluorescence spectra of 0.16 μM/L quinine sulfate in 0.1 M H_2SO_4, 300 μM/L PPI in ethanol and 0.15 μM/L $Zn(PPI)_2$ in ethanol.

Table S1 Example for the fluorescence quantum yield calculation of PPI and $Zn(PPI)_2$ in ethanol based on the standard quinine sulfate in 0.1 M H_2SO_4.

Sample	*A*	F_{372nm}	*η*	*Φ*
Quinine Sulfate	17407	1.37×10^{-3}	Water (1.33)	54.0%
PPI	16205	5.58×10^{-2}	Ethanol (1.36)	1.29%
$Zn(PPI)_2$	15454	2.66×10^{-3}	Ethanol (1.36)	25.9%

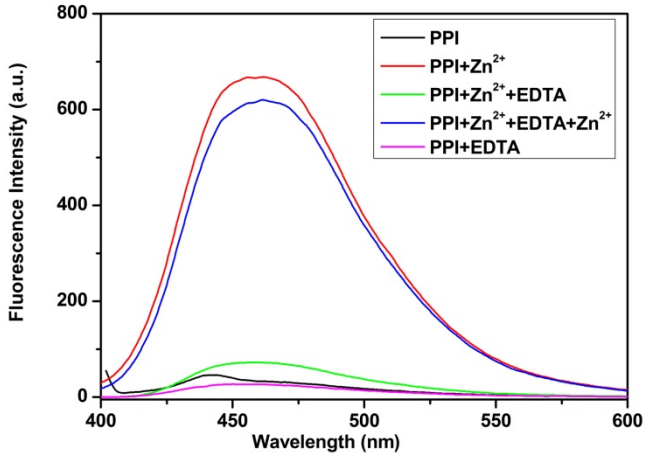

Fig. S9 Fluorescence emission responses of PPI in ethanol solution (1μM) in the presence of Zn(II) (1 equiv) and EDTA disodium (1 equiv). The PL spectra were recorded with excitation at 372 nm.

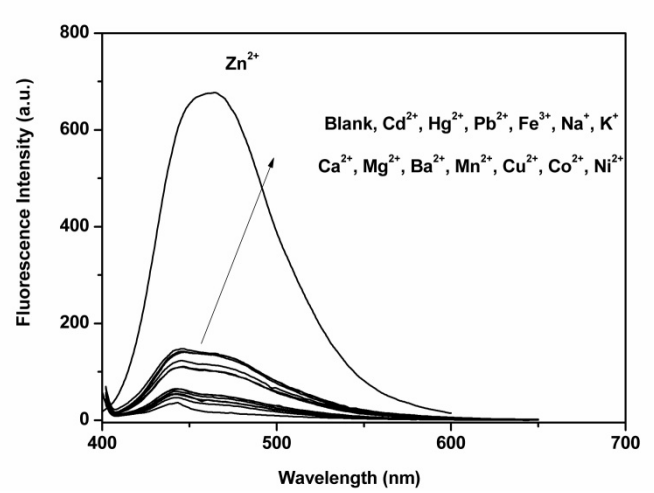

Fig. S10 Fluorescence spectra response of PPI in ethanol solution (1 μM) in the presence of Na^+, K^+, Ca^{2+}, Ba^{2+}, Mg^{2+}, Fe^{3+}, Mn^{2+}, Cd^{2+}, Cu^{2+}, Ni^{2+}, Hg^{2+}, Co^{2+}, Pb^{2+} (100 μM for Na^+ and K^+, 1 μM for other metal ions). The PL spectra were recorded with excitation at 372 nm.

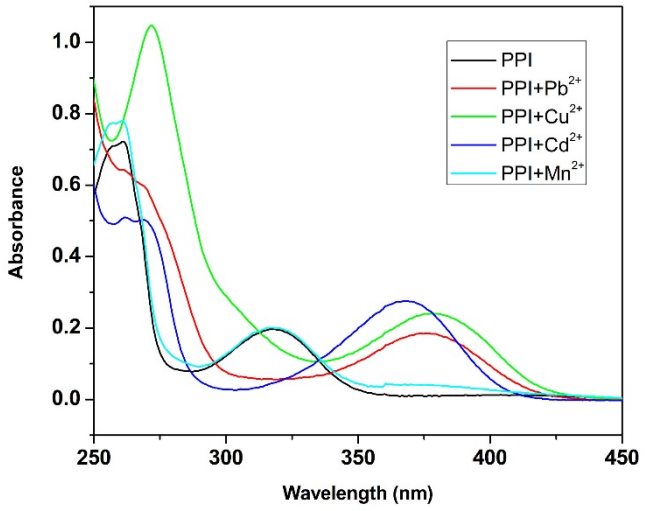

Fig. S11 UV-vis spectral responses of the probe PPI (50 μM) in ethanol to other metal ions.

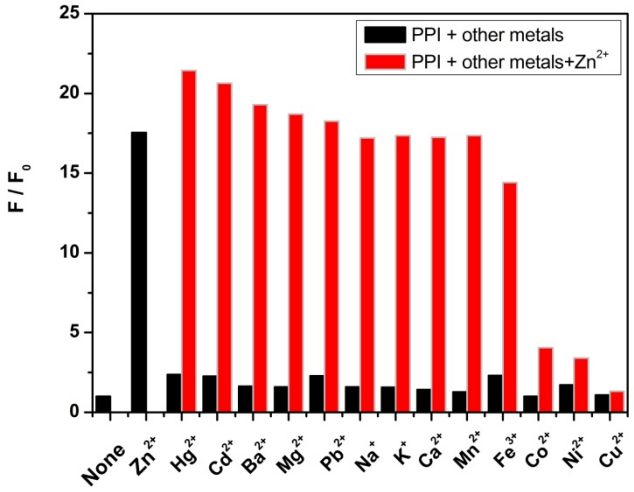

Fig. S12 Fluorescence responses of PPI in ethanol solution to various metal ions (black bars) and fluorescence change of the mixture of PPI and Zn(II) after addition of an excess of the appropriate metal ions (red bars). λex = 372 nm, [Zn(II)] = 1 μM, the equiv ratio of Zn(II) to each Na^+, K^+ is 1/100, and the concentrations of other metal ions are 5 times as zinc ion.

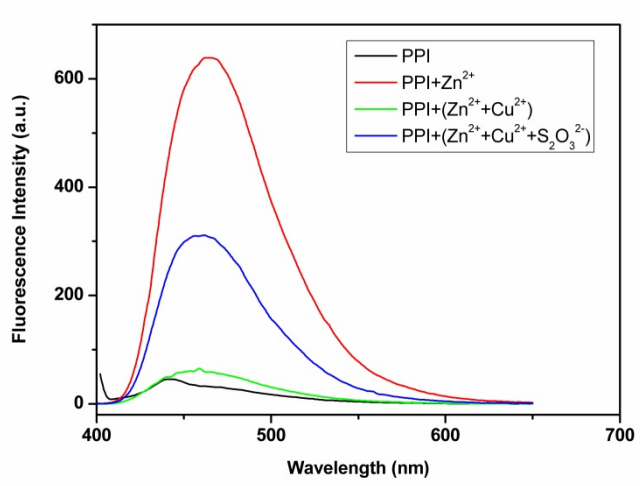

Fig. S13 This figure demonstrated the simple sample pretreatment with hyposulfite ion to eliminate the interference of Cu^{2+}. The black, red and green curves were the fluorescence spectra of the initial PPI in ethanol solution, upon the addition of Zn^{2+}, and upon the addition of mixture of Zn^{2+} and Cu^{2+}, respectively. Compared to Zn^{2+}, the mixture of Zn^{2+} and Cu^{2+} inhibited the fluorescence enhancement, showing the interference of Cu^{2+}. But the interference of Cu^{2+} could be partly eliminated by the addition of hyposulfite ion. When $S_2O_3^{2-}$ was added in the mixture of Zn^{2+} and Cu^{2+}

solution, the Cu^{2+} was masked and after adding the probe PPI, the fluorescence enhanced to a large extent (blue curve). The results suggested that the simple pretreatment with hyposulfite ion addition effectively eliminated the interference of copper ions. The concentration of PPI, Zn^{2+} and Cu^{2+} were 1 μM. The concentration of hyposulfite ions for the sample pretreatment was 5 μM.