Electronic Supplementary Information (ESI)

Displacement Method to Develop Highly Sensitive and Selective Chemosensor for the Fluorescent and Colorimetric Sensing of Sulfide anion †

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Experimental Section

Materials and Instrumentations

Compound **1** was obtained following literature procedures.[1] All reagents were of analytical reagent grade and used without further purification. Doubly distilled water was used for all experiments. Na_2S, KH_2PO_4, Na_2SO_3, $NaHSO_3$, Na_2SO_4, $KClO_4$, KCl, NaBr, KI, NaF, $NaIO_3$, K_2HPO_4, $K_3PO_4{\cdot}3H_2O$, $K_2C_2O_4{\cdot}H_2O$, K_2CO_3, NaOAc, $S_2O_3^{2-}$, NaCN and $Na_4P_2O_7$ were purchased from Sinopharm Chemical Reagent Beijing Co., Ltd. UV-visible spectra were obtained using a Shimadzu UV-2550 spectrometer, and the pH values were determined by using a DELTA 320 PH dollar. Photoluminescence spectra were performed on a Hitachi F-4500 fluorescence spectrophotometer.

Preparation of solutions of metal ions and anions

0.1 mmol of each inorganic salt (Na_2S, 7.8 mg; KH_2PO_4, 13.6 mg; Na_2SO_3, 12.6 mg; $NaHSO_3$, 10.4 mg; Na_2SO_4, 14.2 mg; $KClO_4$, 10.0 mg; KCl, 7.4 mg; NaBr, 10.2 mg; KI, 16.6mg; NaF, 4.2 mg; $NaIO_3$, 19.8mg; K_2HPO_4, 17.4 mg; $K_3PO_4{\cdot}3H_2O$, 21.2 mg; $K_2C_2O_4{\cdot}H_2O$, 18.4mg; K_2CO_3, 13.8 mg; NaOAc, 8.2 mg; NaCN, 4.9mg; $Na_4P_2O_7$, 26.6 mg;) was dissolved in distilled water (10 mL) to afford 1×10^{-2} mol/L aqueous solution. The stock solutions could be diluted to desired concentrations with water when needed.

UV absorption changes of compound 1 with Cu^{2+}.

Compound **1** was dissolved in H_2O/CH_3OH (3:1, v/v, Britton–Robinson buffer, pH = 7.1). UV absorption changes of compound **1** (2.0×10^{-5} mol/L and 1.0×10^{-5} mol/L) were recorded before and after the addition of Cu^{2+} to the solution of compound **1**.

UV absorption changes of compound 1+Cu^{2+} with S^{2-}.

The solution of Na_2S (1×10^{-2} mol/L) was prepared in distilled water. A solution of compound **1** in H_2O/CH_3OH (3:1, v/v, Britton–Robinson buffer, pH = 7.1) was placed in a quartz cell (10.0 mm width) and the UV absorption spectrum was recorded. After the solution of Cu^{2+} was added to the solution of compound **1**, the solution of Na_2S was introduced in portions and the UV absorption changes were recorded at room temperature each time.

UV absorption changes of compound 1+Cu^{2+} with other anions.

The solutions of anions were prepared in distilled water. A solution of compound **1** in H_2O/CH_3OH (3:1, v/v, Britton–Robinson buffer, pH = 7.1) was placed in a quartz cell (10.0 mm width) and the UV absorption spectrum was recorded. UV absorption changes of the solution of compound **1** and Cu^{2+} were recorded before and after the addition of anions to the solution of complex **1**.

UV absorption changes of compound 1+Cu^{2+} with S^{2-} and other anions.

The UV absorption changes of the solution of compound **1** and Cu^{2+}were recorded before and after the addition of Na_2S and all the other anions.

Fluorescence intensity changes of 1 with Cu^{2+}

Compound **1** was dissolved in H_2O/CH_3OH (3:1, v/v, Britton–Robinson buffer, pH = 7.1).

fluorescence intensity changes of compound **1** (1.0×10^{-5} mol/L, 2.0×10^{-6} mol/L and 5.0×10^{-6} mol/L) were recorded before and after the addition of Cu^{2+} to the solution of compound **1**.

Fluorescence intensity changes of compound 1+Cu^{2+} with S^{2-}.

The solution of Na_2S (1×10^{-2} mol/L) was prepared in distilled water. A solution of compound **1** in H_2O/CH_3OH (3:1, v/v, Britton–Robinson buffer, pH = 7.1) was placed in a quartz cell (10.0 mm width) and the Fluorescence spectrum was recorded. After the solution of Cu^{2+} was added to the solution of compound **1**, the solution of Na_2S was introduced in portions and the fluorescence intensity changes were recorded at room temperature each time.

Fluorescence intensity changes of compound 1+Cu^{2+} with other anions.

The solutions of anions were prepared in distilled water. A solution of compound **1** in H_2O/CH_3OH (3:1, v/v, Britton–Robinson buffer, pH = 7.1) was placed in a quartz cell (10.0 mm width) and the Fluorescence spectrum was recorded. fluorescence intensity changes of the solution of compound **1** and Cu^{2+} were recorded before and after the addition of anions to the solution of complex **1**.

Fluorescence intensity changes of compound 1+Cu^{2+} with S^{2-} and other anions.

The fluorescence intensity changes of the solution of compound **1** and Cu^{2+} were recorded before and after the addition of Na_2S and all the other anions.

Fluorescence intensity changes of compound 1 with H_2O

The fluorescence intensity changes of the solution of compound **1** were recorded before and after the addition of H_2O.

Table S1 Solubility Products of Undissolved Compounds

compound	CuS	CuSe	$Cu(OH)_2$	$Cu_3(PO_4)_2$	$CuCO_3$
k_{sp}	6.3×10^{-36}	7.94×10^{-49}	4.8×10^{-20}	1.30×10^{-37}	2.34×10^{-10}
compound	$Cu(IO_3)2\cdot H_2O$	$CuCrO_4$	CuC_2O_4	$Cu_2[Fe(CN)_6]$	Cu_2S
k_{sp}	7.4×10^{-8}	3.6×10^{-6}	4.43×10^{-10}	1.3×10^{-16}	2.5×10^{-48}
compound	CuCN	CuCl	CuBr	CuI	CuSCN
k_{sp}	3.2×10^{-20}	1.2×10^{-6}	5.3×10^{-9}	1.1×10^{-12}	4.8×10^{-15}

Reference.

(1) David R. Lide, *Handbook of Chemistry and Physics*, 78th. edition, 1997-1998.

(2) J. A. Dean Ed. *Lange's Handbook of Chemistry*, 13th. Edition, 1985.

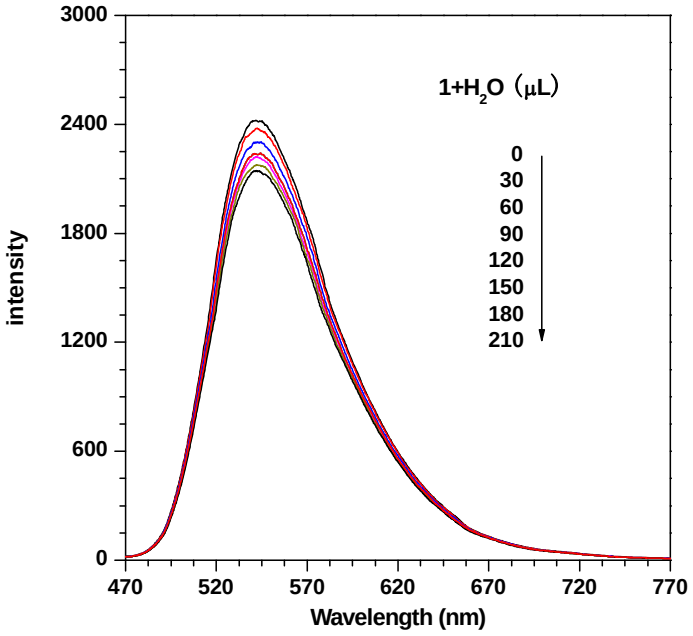

Fig. S1 Fluorescence Emission spectra of **1** (10 μM) in H_2O/CH_3OH (3:1, v/v, Britton–Robinson buffer, pH = 7.1) in the presence of different amounts of H_2O. Excitation wavelength (nm):451.

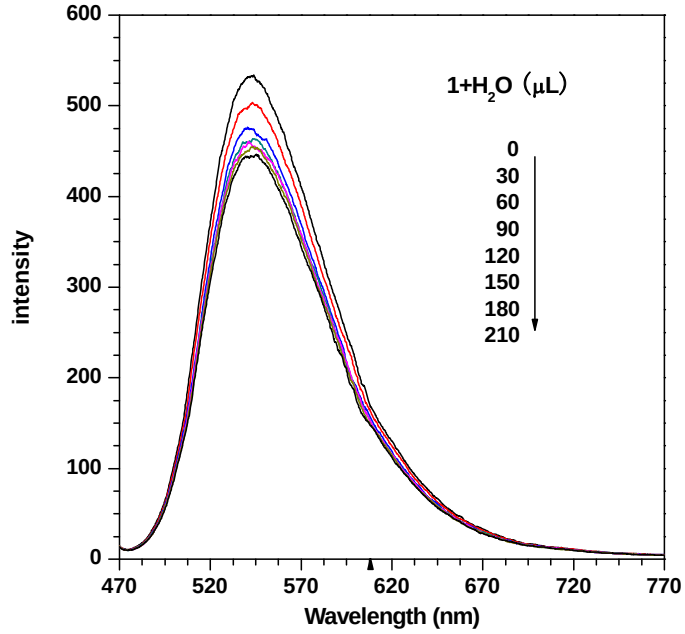

Fig. S2 Fluorescence Emission spectra of **1** (2 μM) in H_2O/CH_3OH (3:1, v/v, Britton–Robinson buffer, pH = 7.1) in the presence of different amounts of H_2O. Excitation wavelength (nm):451.

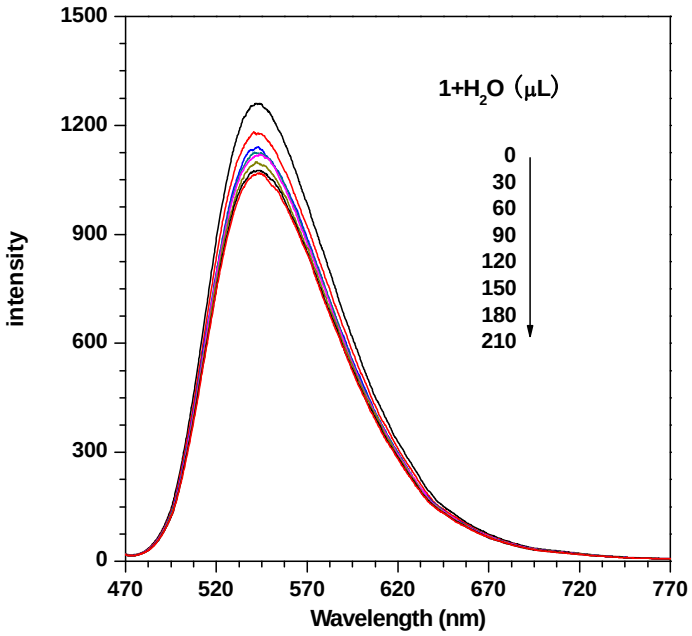

Fig. S3 Fluorescence Emission spectra of **1** (5 μM) in H_2O/CH_3OH (3:1, v/v, Britton–Robinson buffer, pH = 7.1) in the presence of different amounts of H_2O. Excitation wavelength (nm):451.

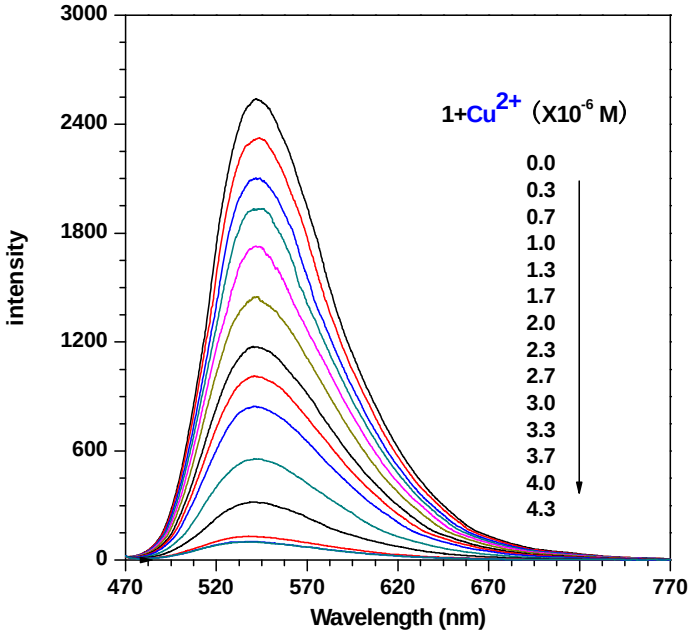

Fig. S4a Fluorescence Emission spectra of **1** (10 μM) in the presence of different concentrations of Cu^{2+} in H_2O/CH_3OH (3:1, v/v, Britton–Robinson buffer, pH = 7.1). Excitation wavelength (nm):451.

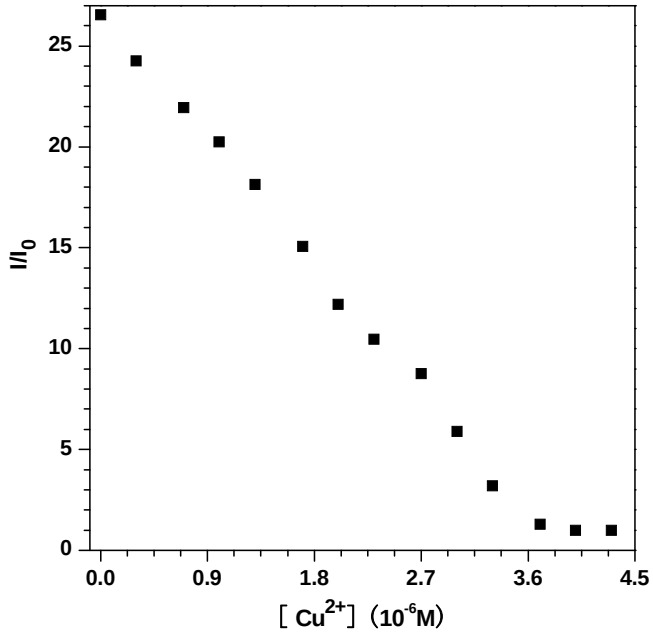

Fig. S4b Fluorescence Emission difference of **1** (10 μM) in the presence of different concentrations of Cu^{2+} in H_2O/CH_3OH (3:1, v/v, Britton–Robinson buffer, pH = 7.1). Excitation wavelength (nm):451.

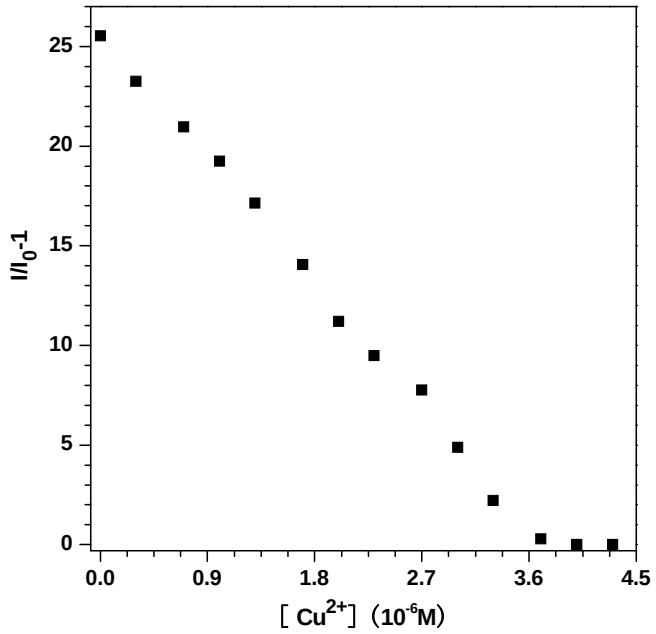

Fig. S4c Fluorescence Emission difference of **1** (10 μM) in the presence of different concentrations of Cu^{2+} in H_2O/CH_3OH (3:1, v/v, Britton–Robinson buffer, pH = 7.1). Excitation wavelength (nm):451.

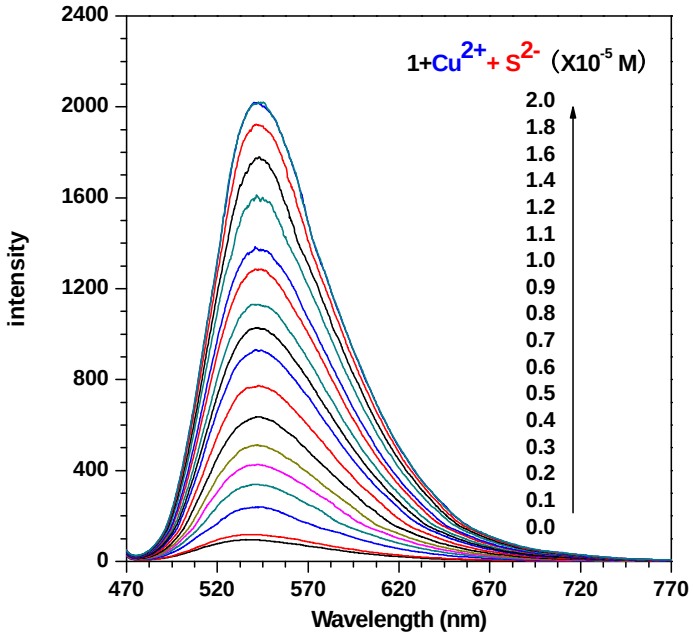

Fig. S5a Fluorescence Emission spectra of **1** (10 μM) and Cu^{2+} (4.0×10^{-6} mol/L) in H_2O/CH_3OH (3:1, v/v, Britton–Robinson buffer, pH = 7.1) in the presence of different amounts of S^{2-}. Excitation wavelength (nm): 451.

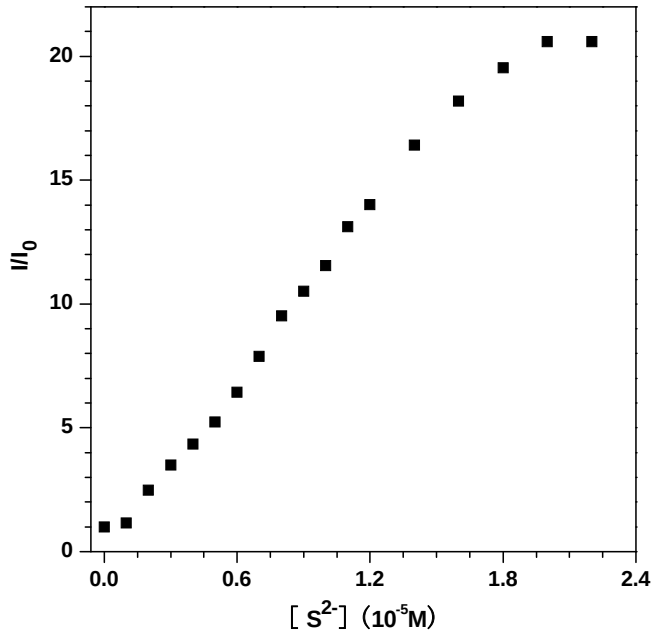

Fig. S5b Fluorescence Emission difference of **1** (10 μM) and Cu^{2+} (4.0×10^{-6} mol/L) in H_2O/CH_3OH (3:1, v/v, Britton–Robinson buffer, pH = 7.1) in the presence of different amounts of S^{2-}. Excitation wavelength (nm): 451.

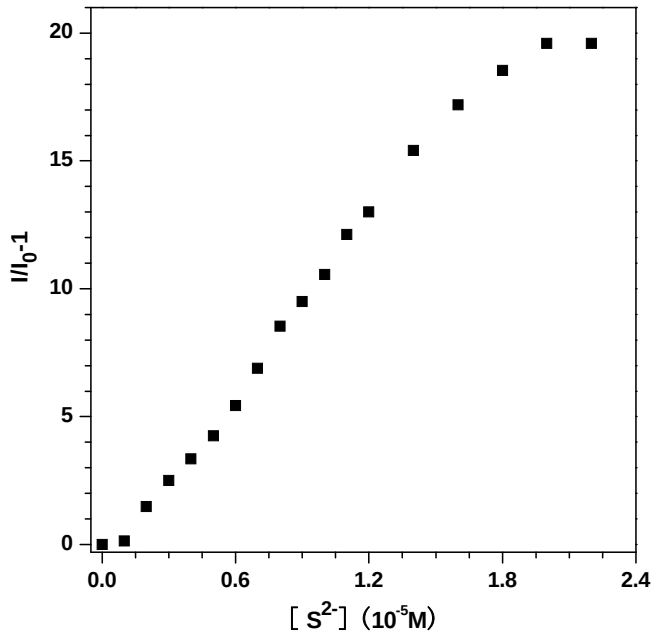

Fig. S5c Fluorescence Emission difference of **1** (10 μM) and Cu^{2+} (4.0×10^{-6} mol/L) in H_2O/CH_3OH (3:1, v/v, Britton–Robinson buffer, pH = 7.1) in the presence of different amounts of S^{2-}. Excitation wavelength (nm): 451.

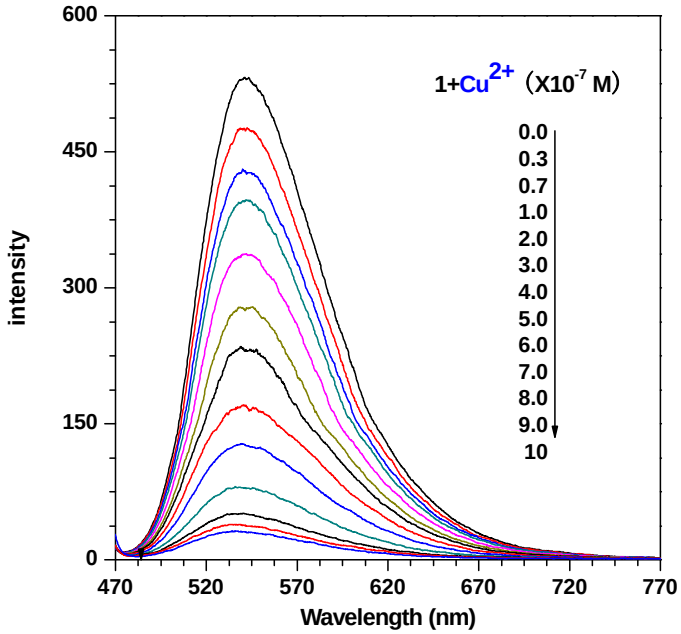

Fig. S6a Fluorescence Emission spectra of **1** (2 μM) in the presence of different concentrations of Cu^{2+} in H_2O/CH_3OH (3:1, v/v, Britton–Robinson buffer, pH = 7.1). Excitation wavelength (nm): 451.

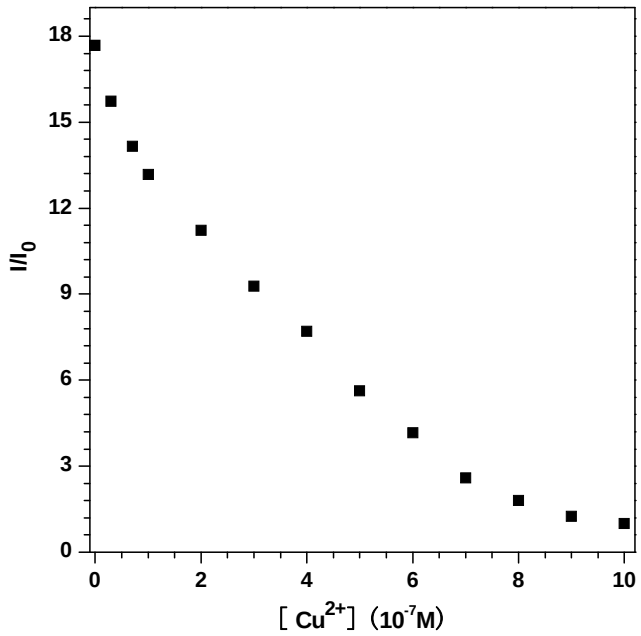

Fig. S6b Fluorescence Emission difference of **1** (2 μM) in the presence of different concentrations of Cu^{2+} in H_2O/CH_3OH (3:1, v/v, Britton–Robinson buffer, pH = 7.1). Excitation wavelength (nm): 451.

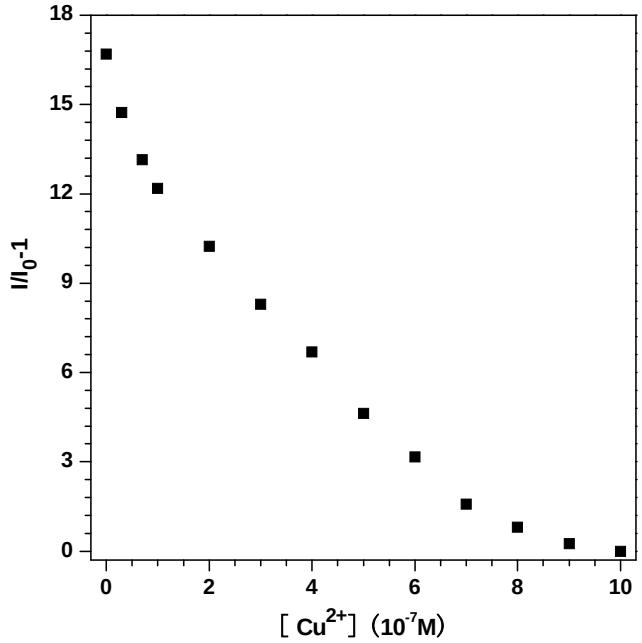

Fig. S6c Fluorescence Emission difference of **1** (2 μM) in the presence of different concentrations of Cu^{2+} in H_2O/CH_3OH (3:1, v/v, Britton–Robinson buffer, pH = 7.1). Excitation wavelength (nm): 451.

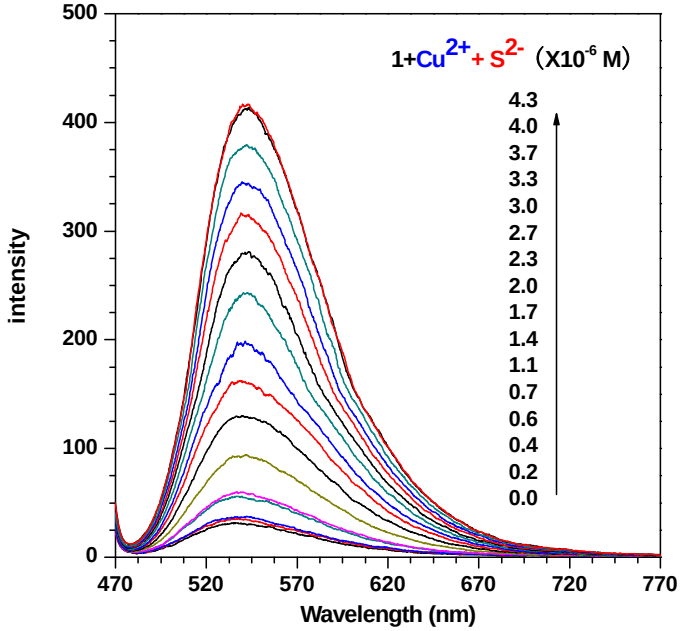

Fig. S7a Fluorescence Emission spectra of **1** (2 μM) and Cu^{2+} (1.0×10^{-6} mol/L) in H_2O/CH_3OH (3:1, v/v, Britton–Robinson buffer, pH = 7.1) in the presence of different amounts of S^{2-}. Excitation wavelength (nm): 451.

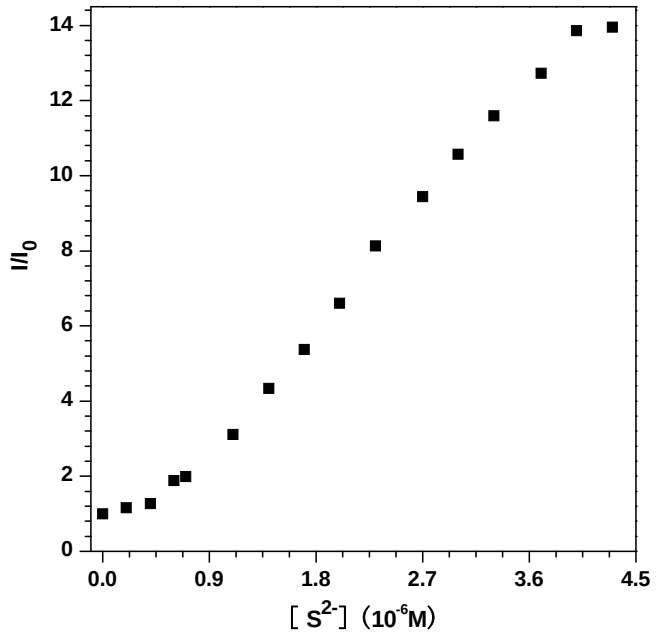

Fig. S7b Fluorescence Emission difference of **1** (2 μM) and Cu^{2+} (1.0×10^{-6} mol/L) in H_2O/CH_3OH (3:1, v/v, Britton–Robinson buffer, pH = 7.1) in the presence of different amounts of S^{2-}. Excitation wavelength (nm): 451.

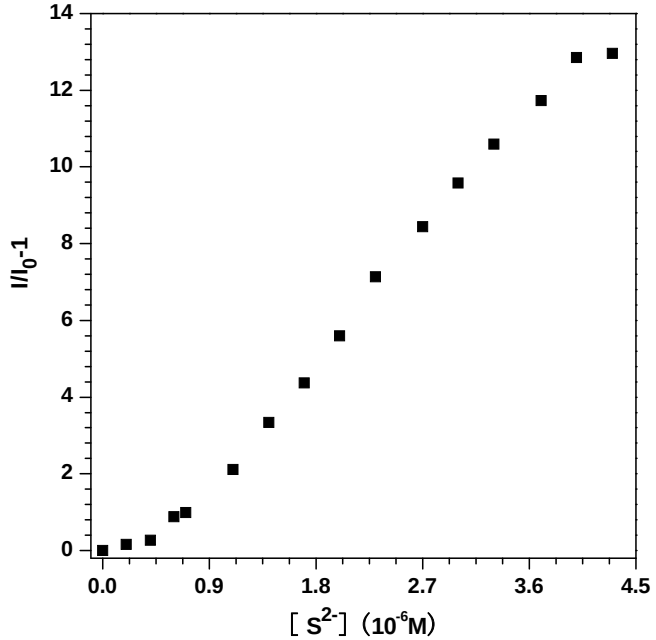

Fig. S7c Fluorescence Emission difference of **1** (2 μM) and Cu^{2+} (1.0×10^{-6} mol/L) in H_2O/CH_3OH (3:1, v/v, Britton–Robinson buffer, pH = 7.1) in the presence of different amounts of S^{2-}. Excitation wavelength (nm): 451.

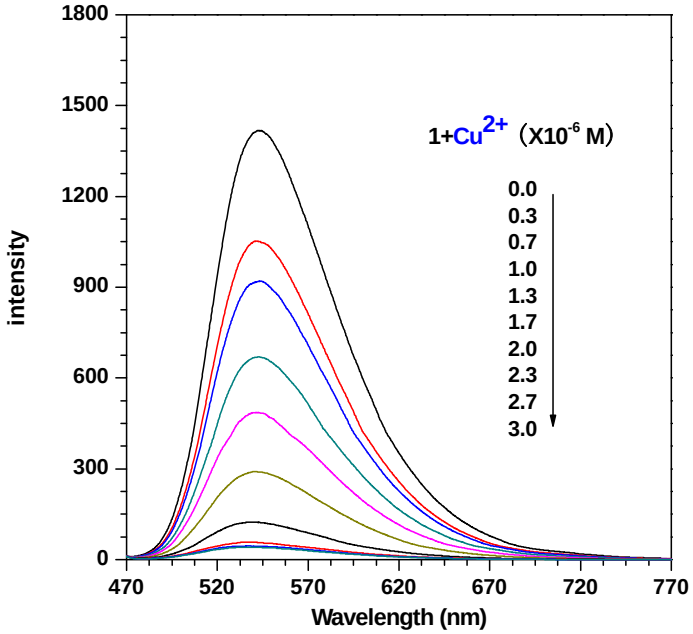

Fig. S8a Fluorescence Emission spectra of **1** (5 μM) in the presence of different concentrations of Cu^{2+} in H_2O/CH_3OH (3:1, v/v, Britton–Robinson buffer, pH = 7.1). Excitation wavelength (nm): 451.

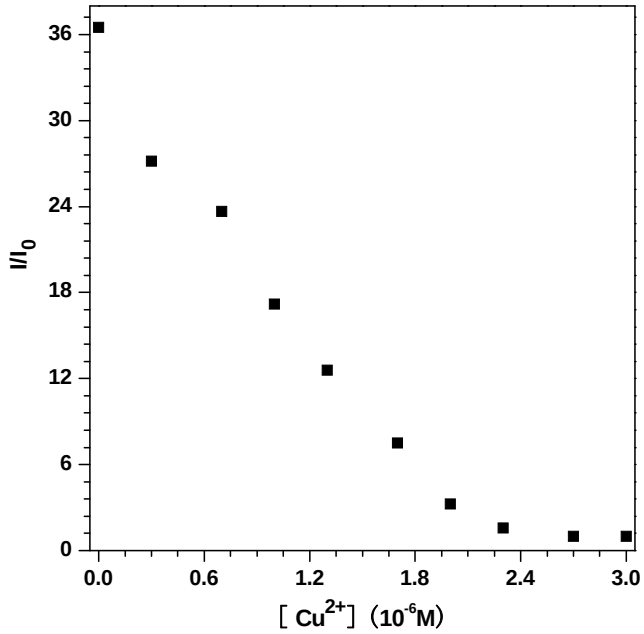

Fig. S8b Fluorescence Emission difference of **1** (5 μM) in the presence of different concentrations of Cu^{2+} in H_2O/CH_3OH (3:1, v/v, Britton–Robinson buffer, pH = 7.1). Excitation wavelength (nm): 451.

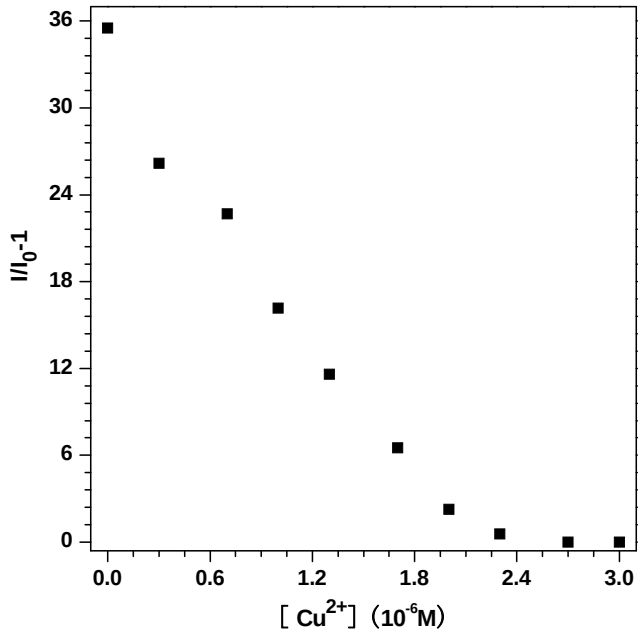

Fig. S8c Fluorescence Emission difference of **1** (5 μM) in the presence of different concentrations of Cu^{2+} in H_2O/CH_3OH (3:1, v/v, Britton–Robinson buffer, pH = 7.1). Excitation wavelength (nm): 451.

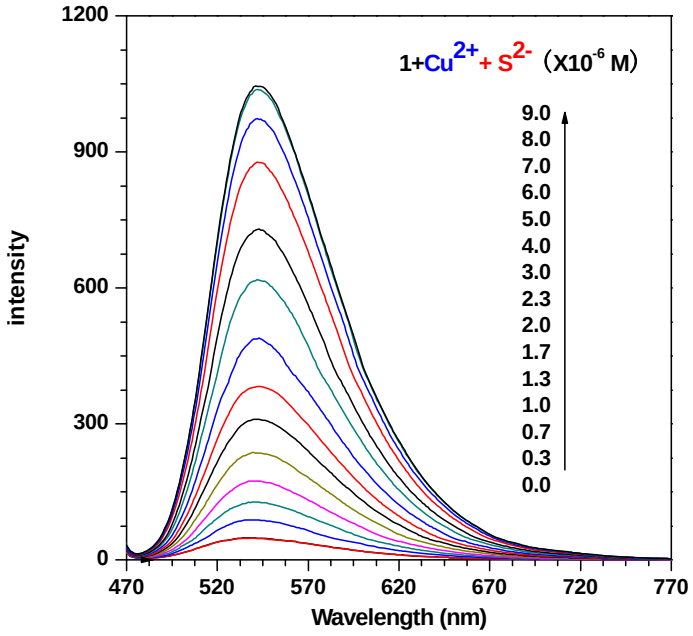

Fig. S9a Fluorescence Emission spectra of **1** (5 μM) and Cu^{2+} (2.7×10^{-6} mol/L) in H_2O/CH_3OH (3:1, v/v, Britton–Robinson buffer, pH = 7.1) in the presence of different amounts of S^{2-}. Excitation wavelength (nm): 451.

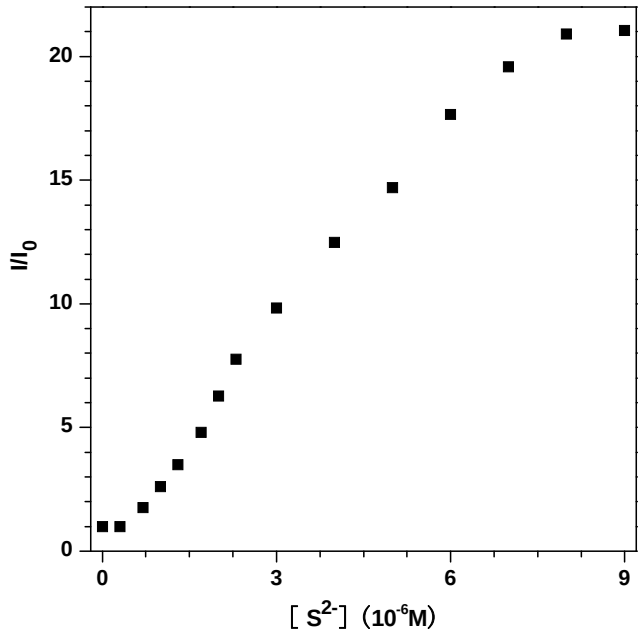

Fig. S9b Fluorescence Emission difference of **1** (5 μM) and Cu^{2+} (2.7×10^{-6} mol/L) in H_2O/CH_3OH (3:1, v/v, Britton–Robinson buffer, pH = 7.1) in the presence of different amounts of S^{2-}. Excitation wavelength (nm): 451.

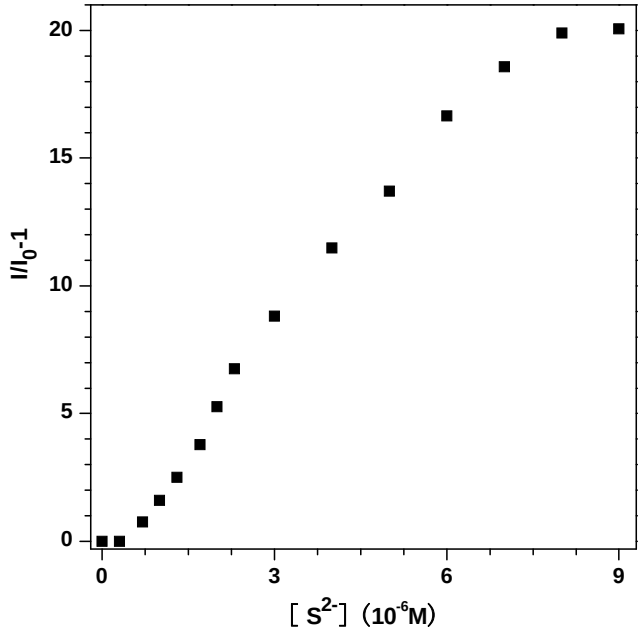

Fig. S9c Fluorescence Emission difference of **1** (5 μM) and Cu^{2+} (2.7×10^{-6} mol/L) in H_2O/CH_3OH (3:1, v/v, Britton–Robinson buffer, pH = 7.1) in the presence of different amounts of S^{2-}. Excitation wavelength (nm): 451.

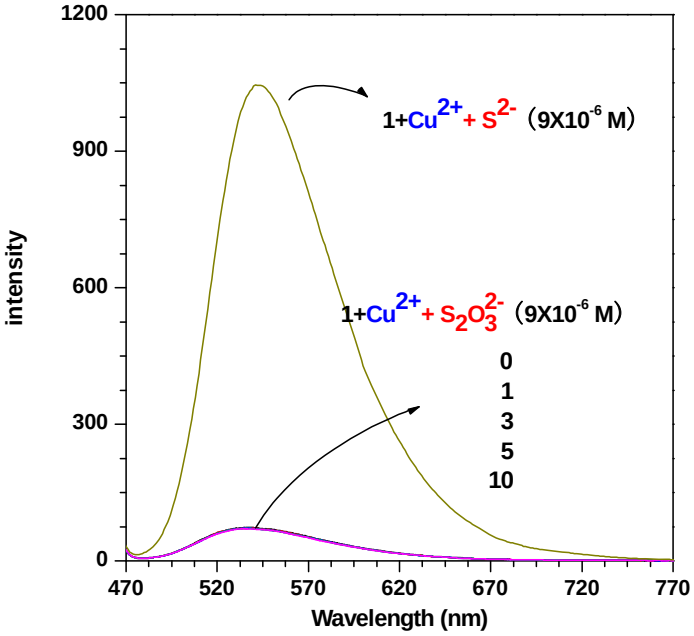

Fig. S10a Fluorescence Emission spectra of **1** (5 μM) and Cu^{2+} (2.7×10^{-6} mol/L) in H_2O/CH_3OH (3:1, v/v, Britton–Robinson buffer, pH = 7.1) in the presence of different amounts of $S_2O_3^{2-}$. Excitation wavelength (nm):451.

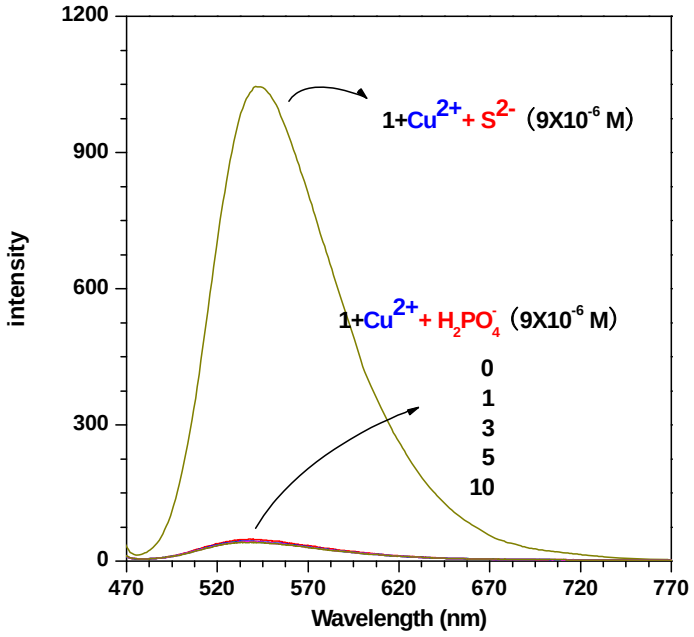

Fig. S10b Fluorescence Emission spectra of **1** (5 μM) and Cu^{2+} (2.7×10^{-6} mol/L) in H_2O/CH_3OH (3:1, v/v, Britton–Robinson buffer, pH = 7.1) in the presence of different amounts of $H_2PO_4^-$. Excitation wavelength (nm): 451.

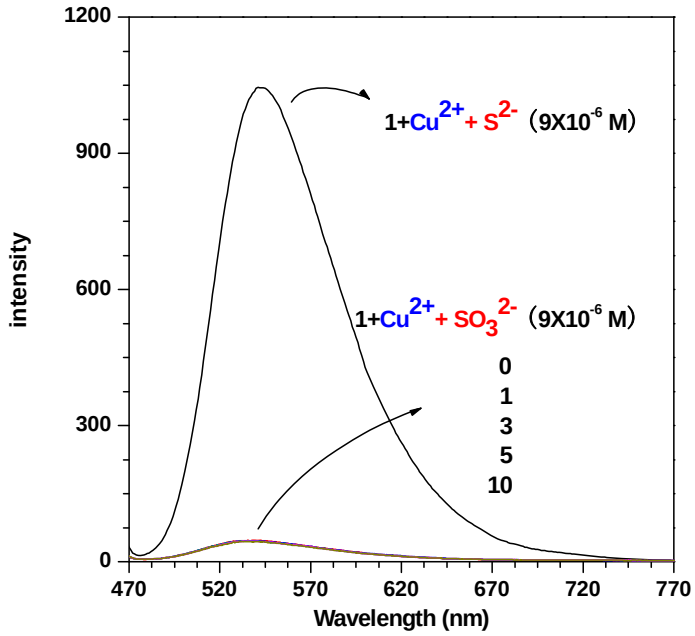

Fig. S10c Fluorescence Emission spectra of **1** (5 μM) and Cu^{2+} (2.7×10^{-6} mol/L) in H_2O/CH_3OH (3:1, v/v, Britton–Robinson buffer, pH = 7.1) in the presence of different amounts of SO_3^{2-}. Excitation wavelength (nm): 451.

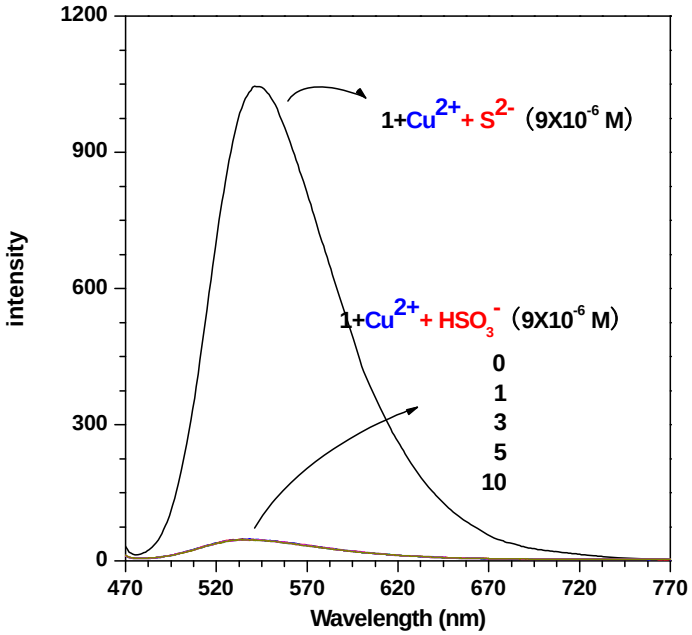

Fig. S10d Fluorescence Emission spectra of **1** (5 μM) and Cu^{2+} (2.7×10^{-6} mol/L) in H_2O/CH_3OH (3:1, v/v, Britton–Robinson buffer, pH = 7.1) in the presence of different amounts of HSO_3^-. Excitation wavelength (nm): 451.

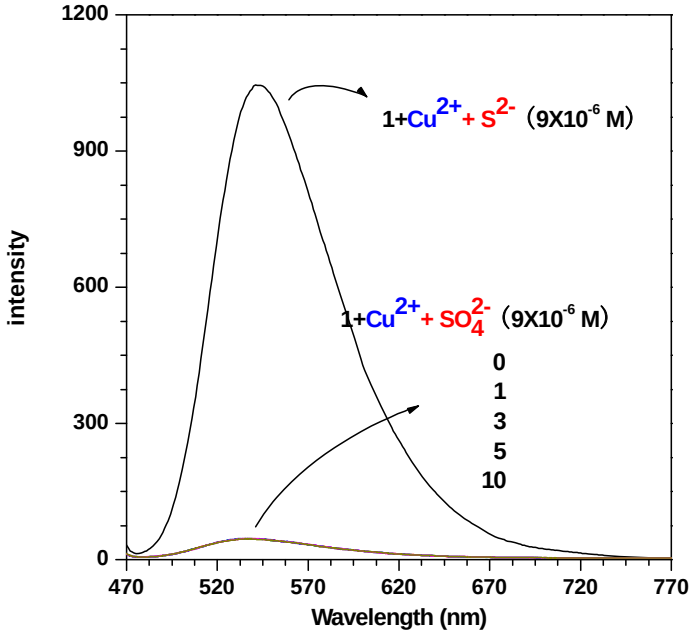

Fig. S10e Fluorescence Emission spectra of **1** (5 μM) and Cu^{2+} (2.7×10^{-6} mol/L) in H_2O/CH_3OH (3:1, v/v, Britton–Robinson buffer, pH = 7.1) in the presence of different amounts of SO_4^{2-}. Excitation wavelength (nm): 451.

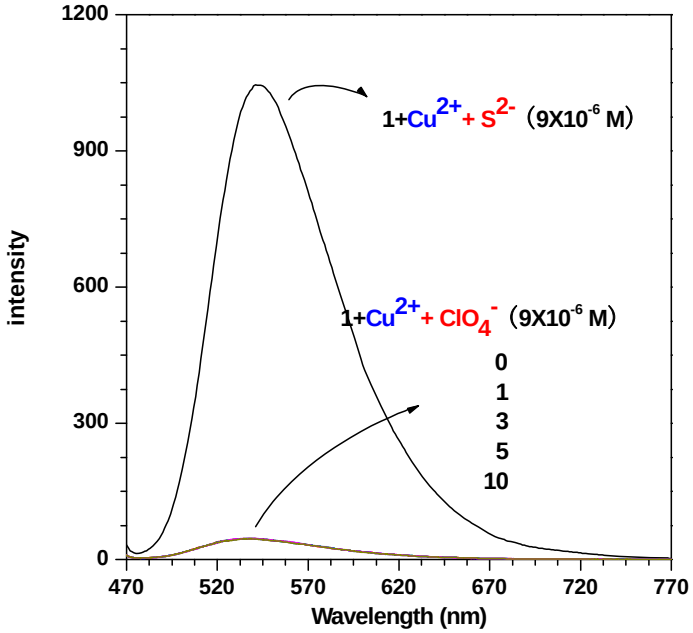

Fig. S10f Fluorescence Emission spectra of **1** (5 μM) and Cu^{2+} (2.7×10^{-6} mol/L) in H_2O/CH_3OH (3:1, v/v, Britton–Robinson buffer, pH = 7.1) in the presence of different amounts of ClO_4^-. Excitation wavelength (nm): 451.

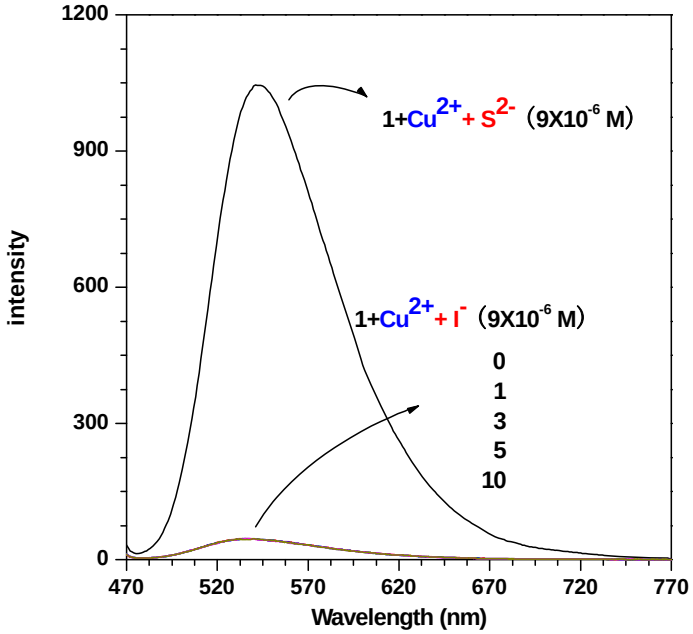

Fig. S10g Fluorescence Emission spectra of **1** (5 μM) and Cu^{2+} (2.7×10^{-6} mol/L) in H_2O/CH_3OH (3:1, v/v, Britton–Robinson buffer, pH = 7.1) in the presence of different amounts of I^-. Excitation wavelength (nm): 451.

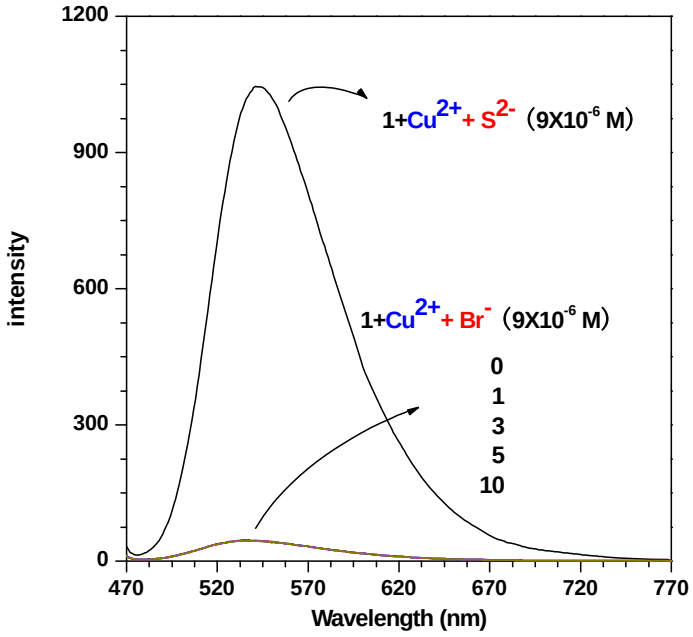

Fig. S10h Fluorescence Emission spectra of **1** (5 μM) and Cu^{2+} (2.7×10^{-6} mol/L) in H_2O/CH_3OH (3:1, v/v, Britton–Robinson buffer, pH = 7.1) in the presence of different amounts of Br^-. Excitation wavelength (nm): 451.

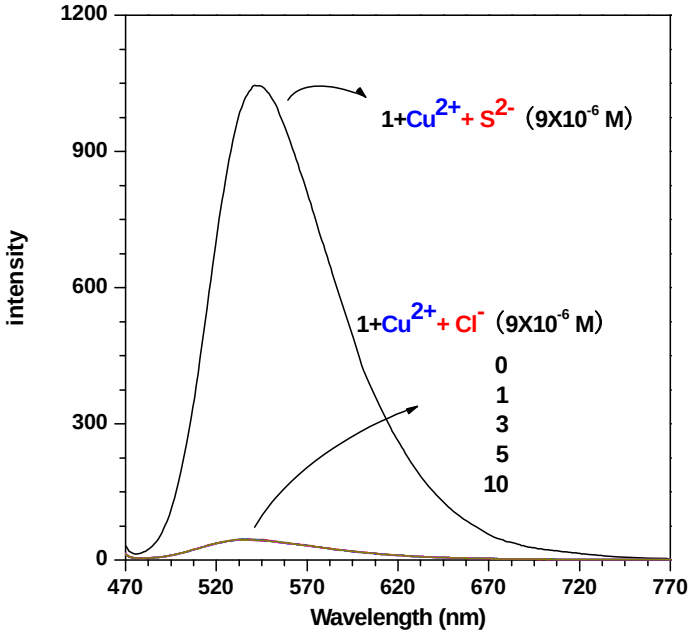

Fig. S10i Fluorescence Emission spectra of **1** (5 μM) and Cu^{2+} (2.7×10^{-6} mol/L) in H_2O/CH_3OH (3:1, v/v, Britton–Robinson buffer, pH = 7.1) in the presence of different amounts of Cl^-. Excitation wavelength (nm): 451.

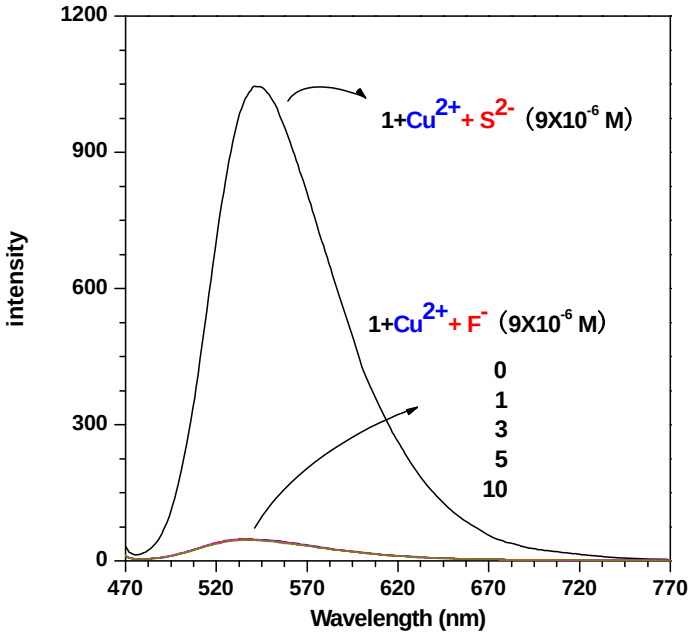

Fig. S10j Fluorescence Emission spectra of **1** (5 μM) and Cu^{2+} (2.7×10^{-6} mol/L) in H_2O/CH_3OH (3:1, v/v, Britton–Robinson buffer, pH = 7.1) in the presence of different amounts of F^-. Excitation wavelength (nm): 451.

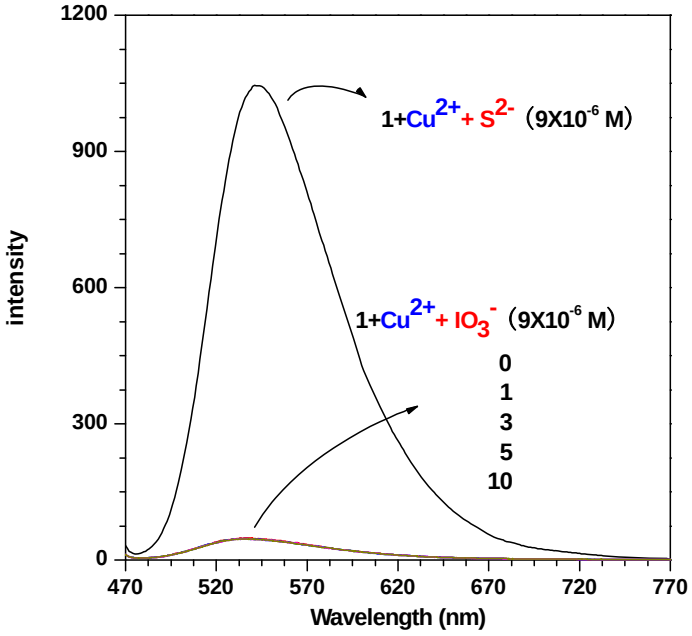

Fig. S10k Fluorescence Emission spectra of **1** (5 μM) and Cu^{2+} (2.7×10^{-6} mol/L) in H_2O/CH_3OH (3:1, v/v, Britton–Robinson buffer, pH = 7.1) in the presence of different amounts of IO_3^-. Excitation wavelength (nm): 451.

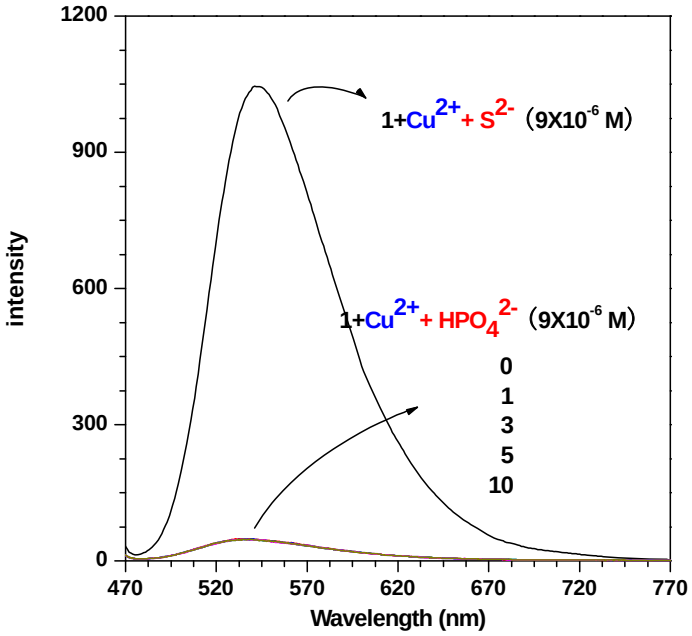

Fig. S10l Fluorescence Emission spectra of **1** (5 μM) and Cu^{2+} (2.7×10^{-6} mol/L) in H_2O/CH_3OH (3:1, v/v, Britton–Robinson buffer, pH = 7.1) in the presence of different amounts of HPO_4^{2-}. Excitation wavelength (nm): 451.

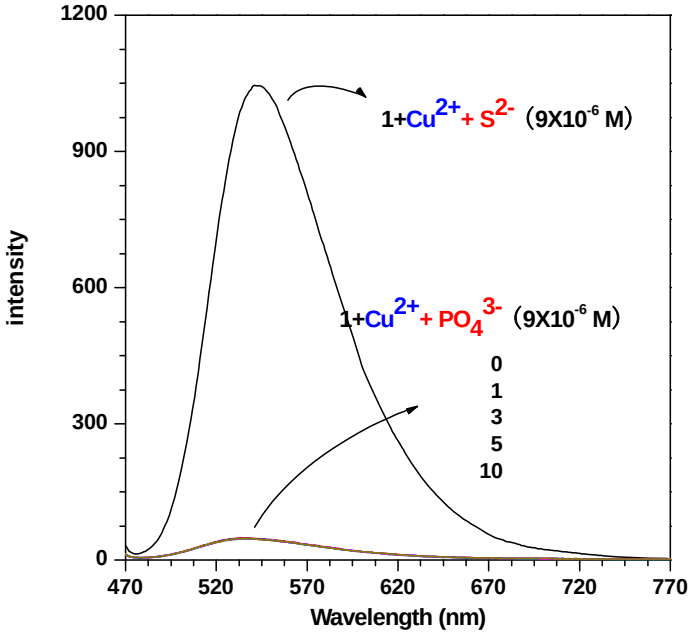

Fig. S10m Fluorescence Emission spectra of **1** (5 μM) and Cu^{2+} (2.7×10^{-6} mol/L) in H_2O/CH_3OH (3:1, v/v, Britton–Robinson buffer, pH = 7.1) in the presence of different amounts of PO_4^{3-}. Excitation wavelength (nm): 451.

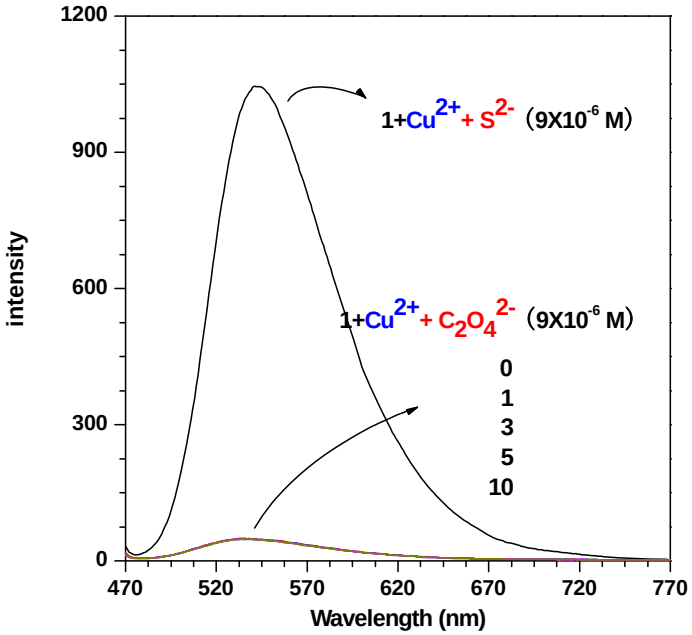

Fig. S10n Fluorescence Emission spectra of **1** (5 μM) and Cu^{2+} (2.7×10^{-6} mol/L) in H_2O/CH_3OH (3:1, v/v, Britton–Robinson buffer, pH = 7.1) in the presence of different amounts of $C_2O_4^{2-}$. Excitation wavelength (nm): 451.

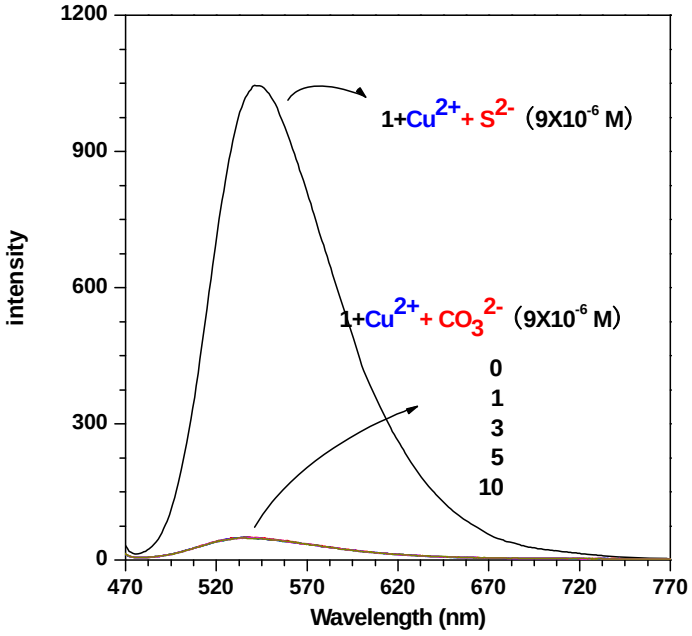

Fig. S10o Fluorescence Emission spectra of **1** (5 μM) and Cu^{2+} (2.7×10^{-6} mol/L) in H_2O/CH_3OH (3:1, v/v, Britton–Robinson buffer, pH = 7.1) in the presence of different amounts of CO_3^{2-}. Excitation wavelength (nm): 451.

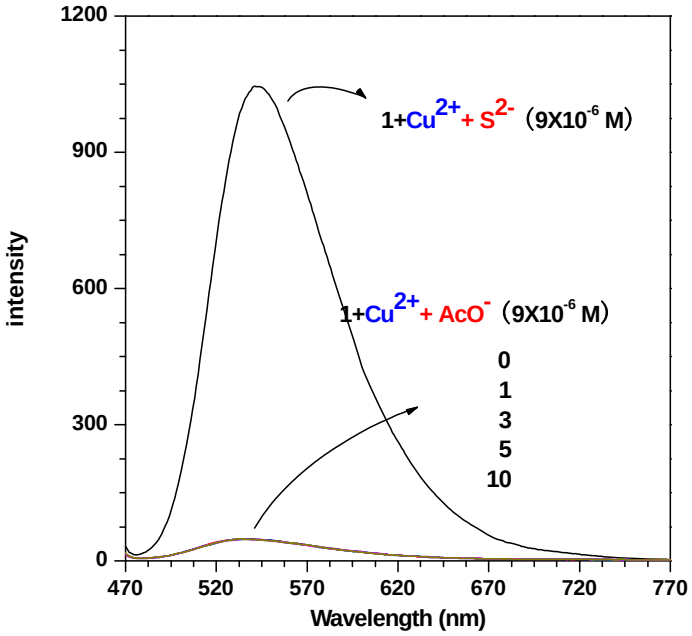

Fig. S10p Fluorescence Emission spectra of **1** (5 μM) and Cu^{2+} (2.7×10^{-6} mol/L) in H_2O/CH_3OH (3:1, v/v, Britton–Robinson buffer, pH = 7.1) in the presence of different amounts of AcO^-. Excitation wavelength (nm): 451.

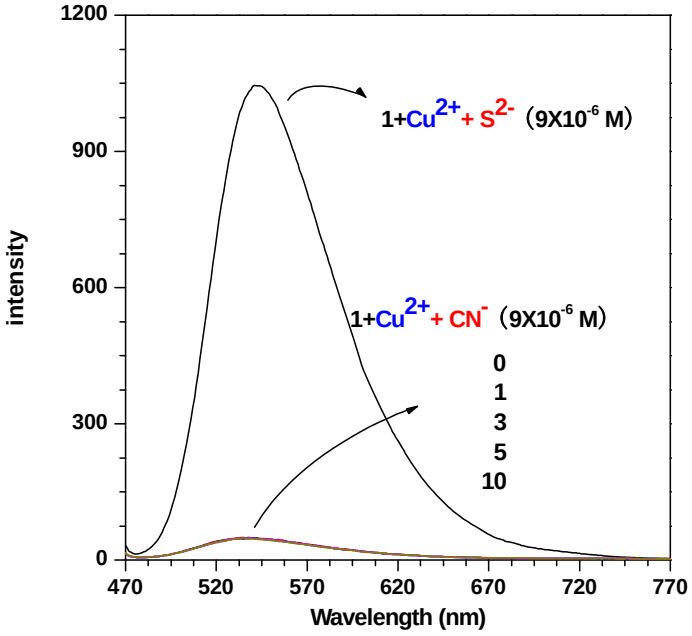

Fig. S10q Fluorescence Emission spectra of **1** (5 μM) and Cu^{2+} (2.7×10^{-6} mol/L) in H_2O/CH_3OH (3:1, v/v, Britton–Robinson buffer, pH = 7.1) in the presence of different amounts of CN^-. Excitation wavelength (nm): 451.

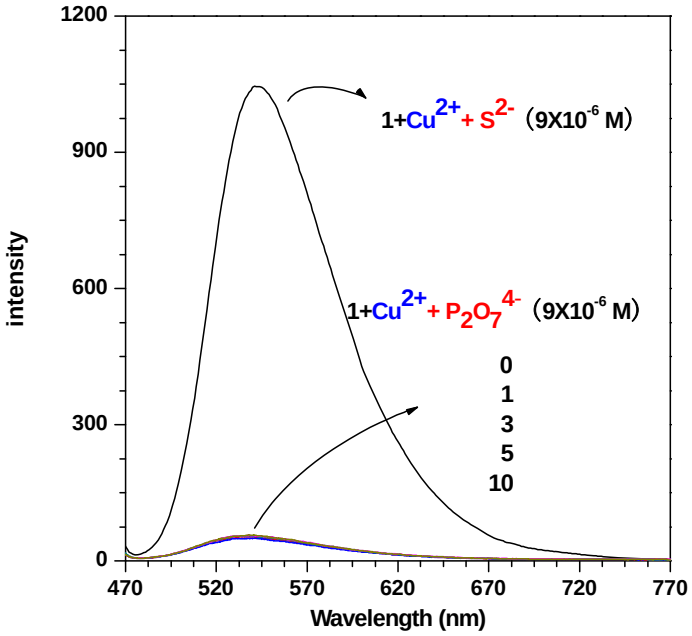

Fig. S10r Fluorescence Emission spectra of **1** (5 μM) and Cu^{2+} (2.7×10^{-6} mol/L) in H_2O/CH_3OH (3:1, v/v, Britton–Robinson buffer, pH = 7.1) in the presence of different amounts of $P_2O_7^{4-}$. Excitation wavelength (nm): 451.

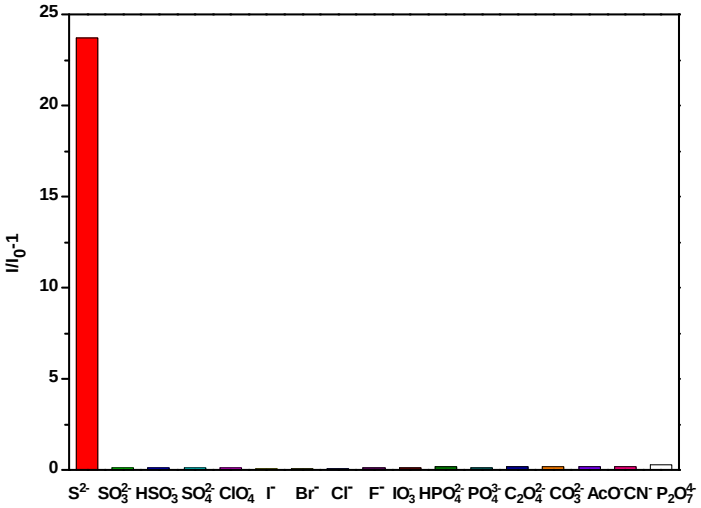

Fig. S11a Fluorescence emission response profiles of **1** (5 μM)+**Cu**$^{2+}$(2.7×10^{-6} mol/L) in H_2O/CH_3OH (3:1, v/v, Britton–Robinson buffer, pH = 7.1). The concentration of different anions were 4.5×10^{-5} mol/L, $[S^{2-}]=9.0\times10^{-6}$ mol/L. Excitation wavelength (nm): 451.

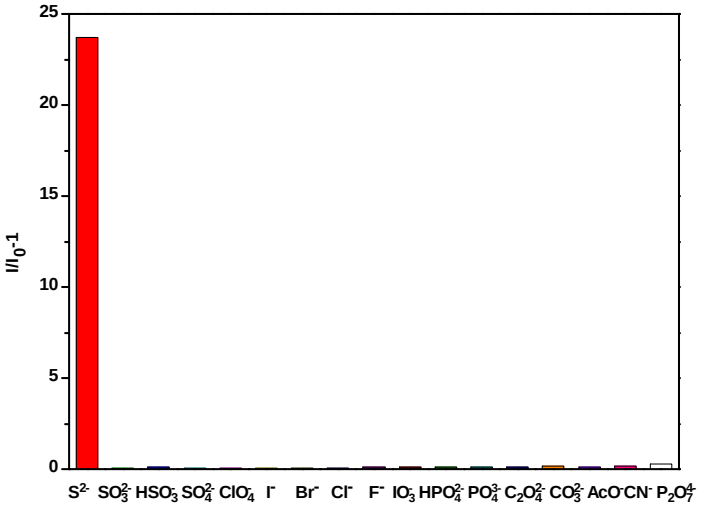

Fig. S11b Fluorescence emission response profiles of **1** (5 μM)+**Cu**$^{2+}$(2.7×10^{-6} mol/L) in H_2O/CH_3OH (3:1, v/v, Britton–Robinson buffer, pH = 7.1). The concentration of different anions were 2.7×10^{-5} mol/L, $[S^{2-}]=9.0\times10^{-6}$ mol/L. Excitation wavelength (nm): 451.

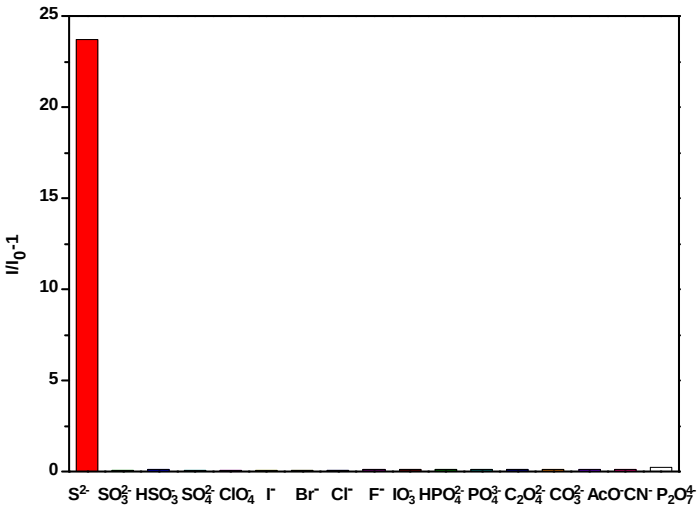

Fig. S12 Fluorescence emission response profiles of **1** (5 μM)+**Cu**$^{2+}$(2.7×10^{-6} mol/L) in H_2O/CH_3OH (3:1, v/v, Britton–Robinson buffer, pH = 7.1). The concentration of different anions were 0.9×10^{-5} mol/L, [S^{2-}]=9.0×10^{-6} mol/L. Excitation wavelength (nm): 451.

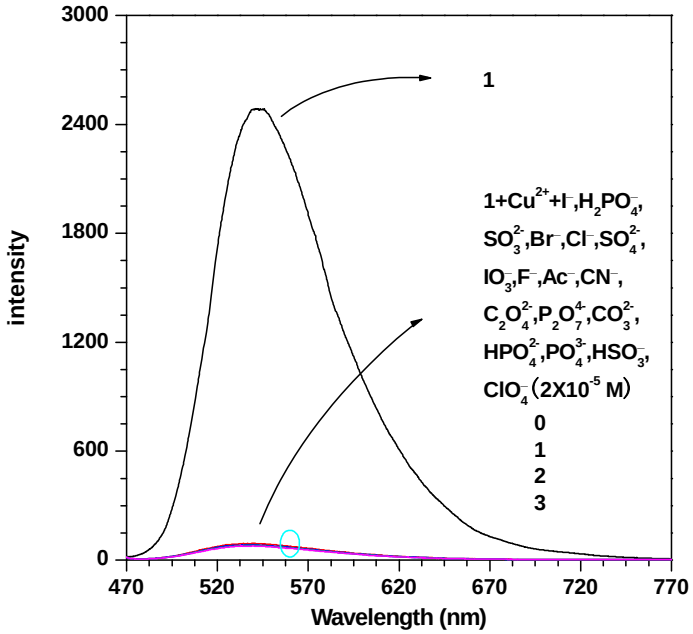

Fig. S13 Fluorescence Emission spectra of **1** (10 μM) and Cu^{2+} (4.0×10^{-6} mol/L) in H_2O/CH_3OH (3:1, v/v, Britton–Robinson buffer, pH = 7.1) in the presence of different amounts of anions. Excitation wavelength (nm): 451.

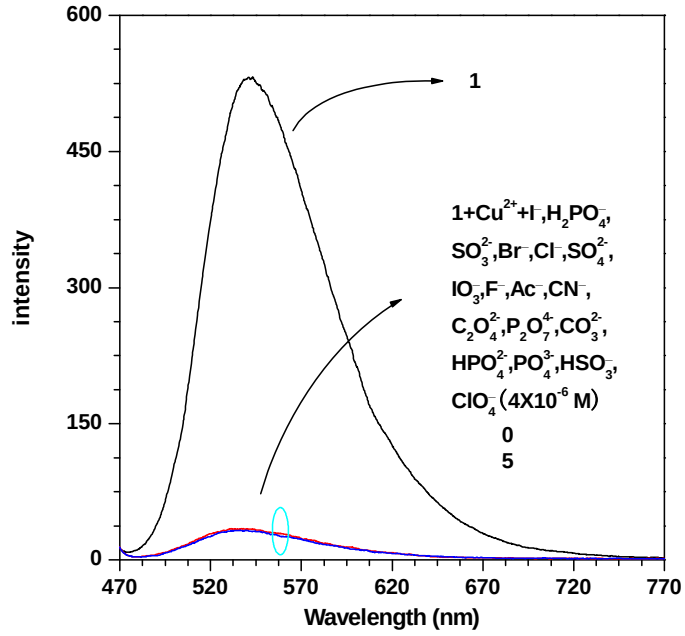

Fig. S14 Fluorescence Emission spectra of **1** (2 μM) and Cu^{2+} (1.0×10^{-6} mol/L) in H_2O/CH_3OH (3:1, v/v, Britton–Robinson buffer, pH = 7.1) in the presence of different amounts of anions. Excitation wavelength (nm): 451.

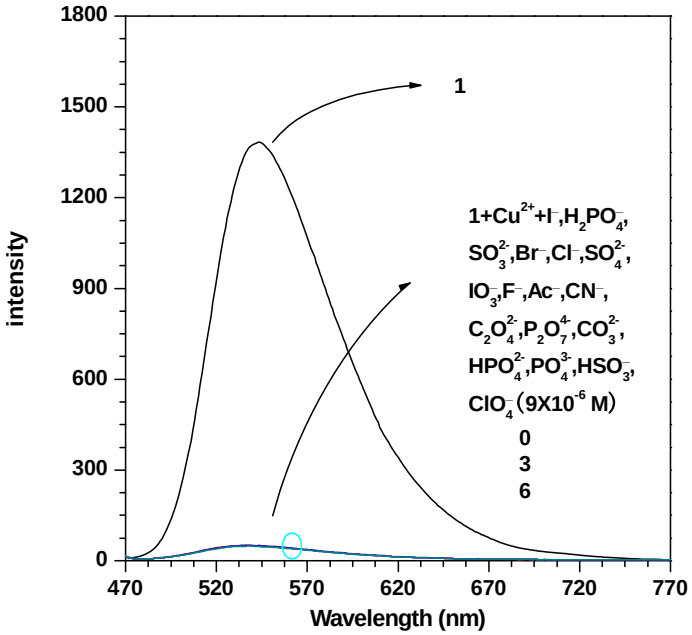

Fig. S15 Fluorescence Emission spectra of **1** (5 μM) and Cu^{2+} (2.7×10^{-6} mol/L) in H_2O/CH_3OH (3:1, v/v, Britton–Robinson buffer, pH = 7.1) in the presence of different amounts of anions. Excitation wavelength (nm): 451.

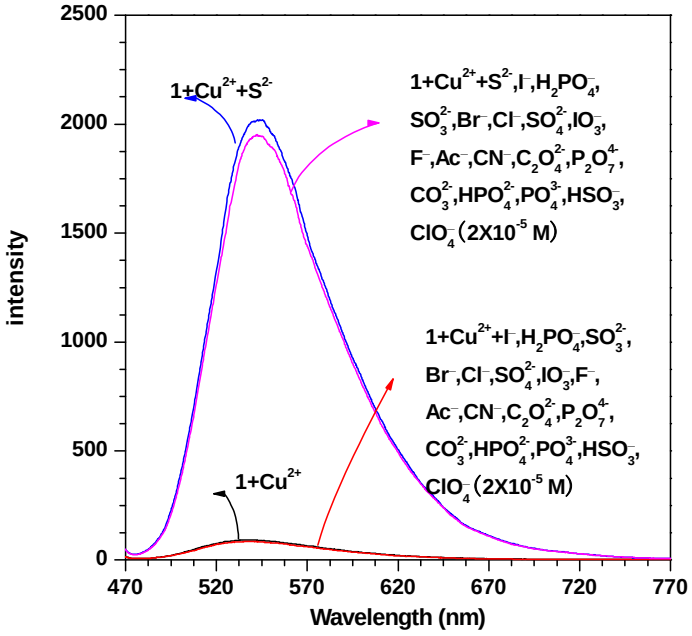

Fig. S16 Fluorescence Emission spectra of **1** (10 μM) and Cu^{2+} (4.0×10^{-6} mol/L) in H_2O/CH_3OH (3:1, v/v, Britton–Robinson buffer, pH = 7.1) in the presence of different amounts of anions. The concentration of S^{2-} was 2.0×10^{-5} mol/L. Excitation wavelength (nm): 451.

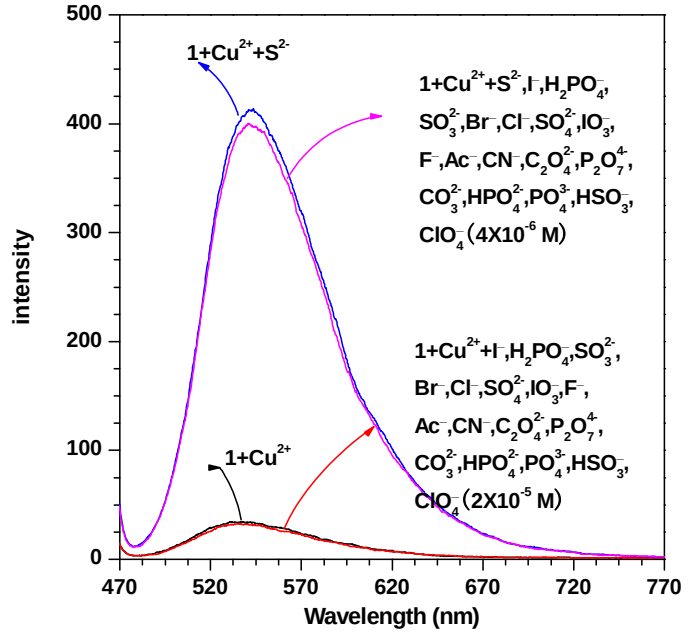

Fig. S17 Fluorescence Emission spectra of **1** (2 μM) and Cu^{2+} (1.0×10^{-6} mol/L) in H_2O/CH_3OH (3:1, v/v, Britton–Robinson buffer, pH = 7.1) in the presence of different amounts of anions. The concentration of S^{2-} was 4.0×10^{-6} mol/L. Excitation wavelength (nm): 451.

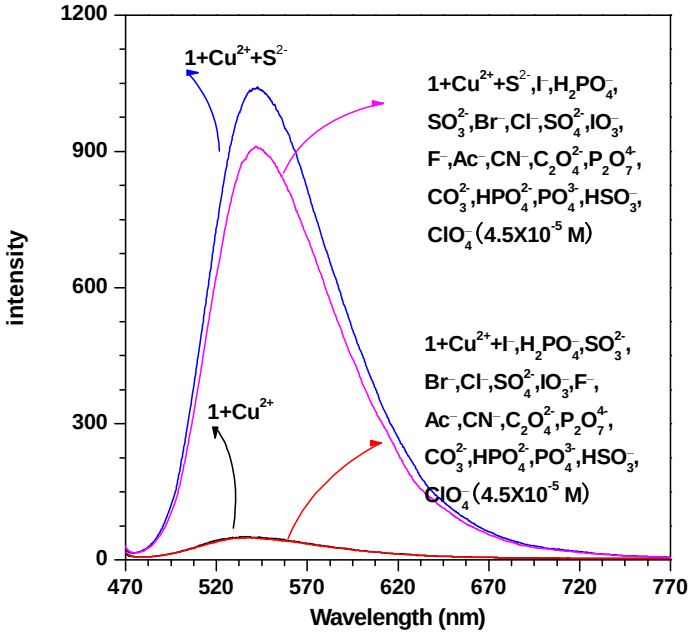

Fig. S18 Fluorescence Emission spectra of **1** (5 μM) and Cu^{2+} (2.7×10^{-6} mol/L) in H_2O/CH_3OH (3:1, v/v, Britton–Robinson buffer, pH = 7.1) in the presence of different amounts of anions. The concentration of S^{2-} was 9.0×10^{-6} mol/L. Excitation wavelength (nm): 451.

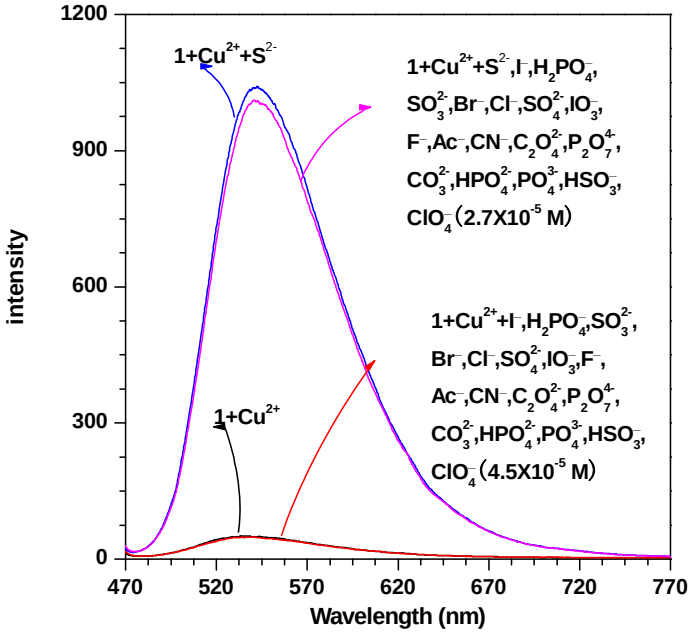

Fig. S19 Fluorescence Emission spectra of **1** (5 μM) and Cu^{2+} (2.7×10^{-6} mol/L) in H_2O/CH_3OH (3:1, v/v, Britton–Robinson buffer, pH = 7.1) in the presence of different amounts of anions. The concentration of S^{2-} was 9.0×10^{-6} mol/L. Excitation wavelength (nm): 451.

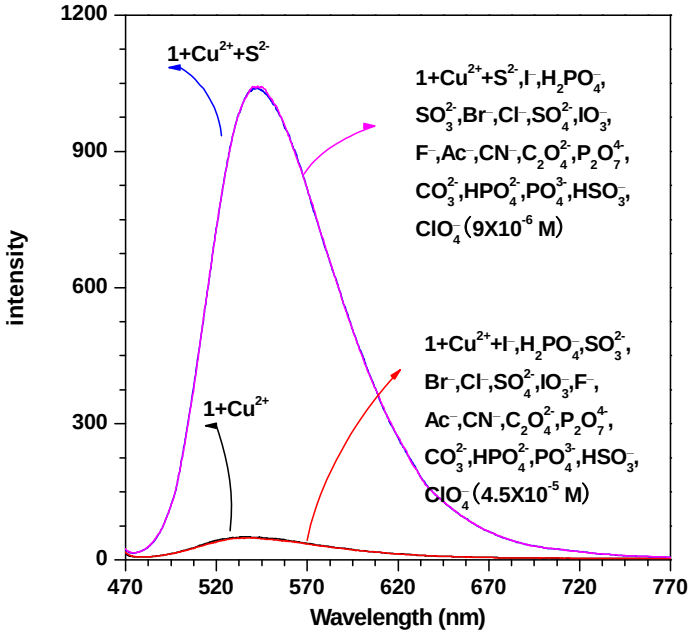

Fig. S20 Fluorescence Emission spectra of **1** (5 μM) and Cu^{2+} (2.7×10^{-6} mol/L) in H_2O/CH_3OH (3:1, v/v, Britton–Robinson buffer, pH = 7.1) in the presence of different amounts of anions. The concentration of S^{2-} was 9.0×10^{-6} mol/L. Excitation wavelength (nm): 451.

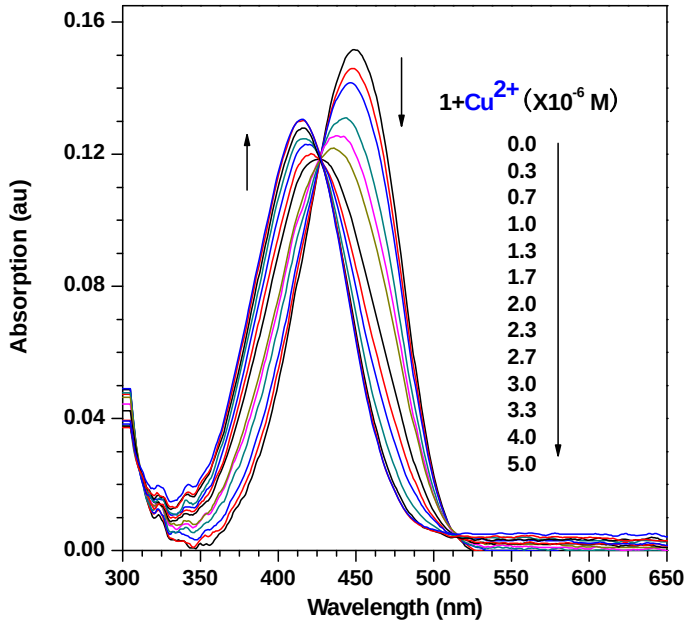

Fig. S21a Absorption spectra of **A** (10 μM) in the presence of different concentrations of Cu^{2+} in H_2O/CH_3OH (3:1, v/v, Britton–Robinson buffer, pH = 7.1).

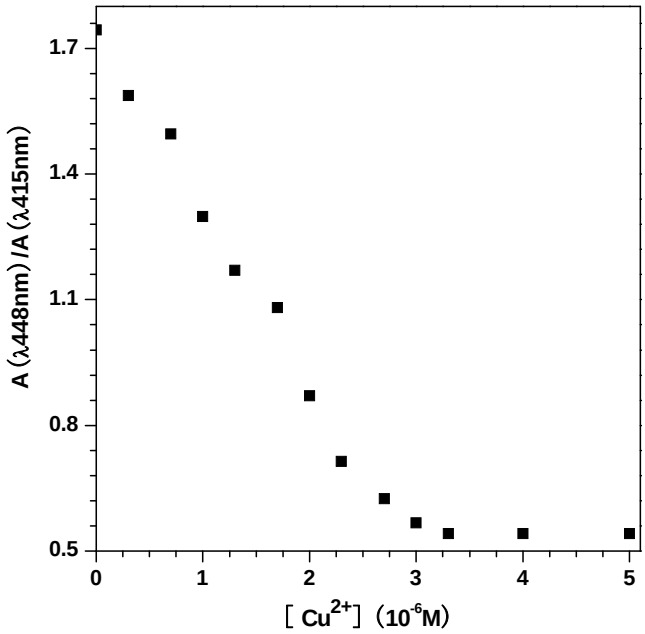

Fig. S21b Absorption difference of **1** (10 μM) in the presence of different concentrations of Cu^{2+} in H_2O/CH_3OH (3:1, v/v, Britton–Robinson buffer, pH = 7.1).

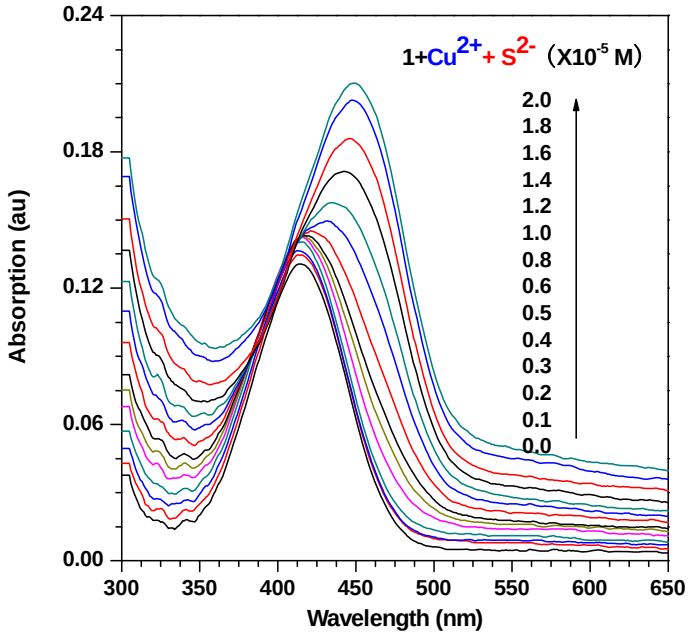

Fig. S22a Absorption spectra of **1** (10 μM) and Cu^{2+} (4.0×10^{-6} mol/L) in H_2O/CH_3OH (3:1, v/v, Britton–Robinson buffer, pH = 7.1) in the presence of different amounts of S^{2-}.

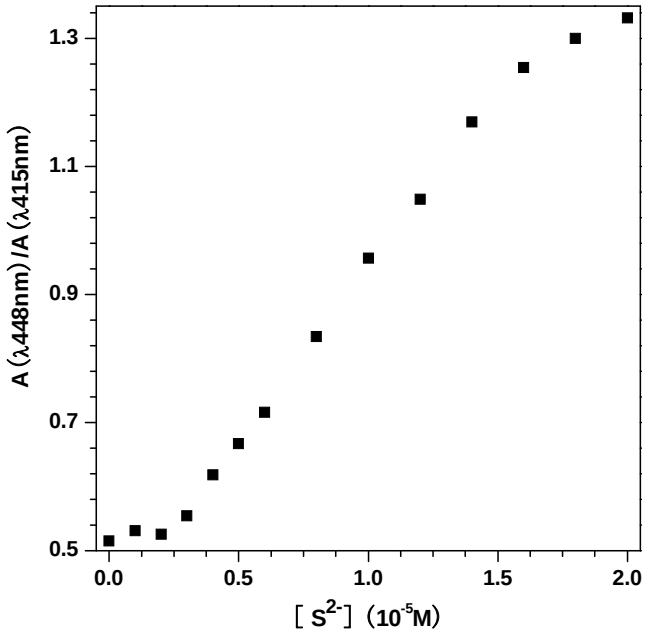

Fig. S22b Absorption difference of **1** (10 μM) and Cu^{2+} (4.0×10^{-6} mol/L) in H_2O/CH_3OH (3:1, v/v, Britton–Robinson buffer, pH = 7.1) in the presence of different amounts of S^{2-}.

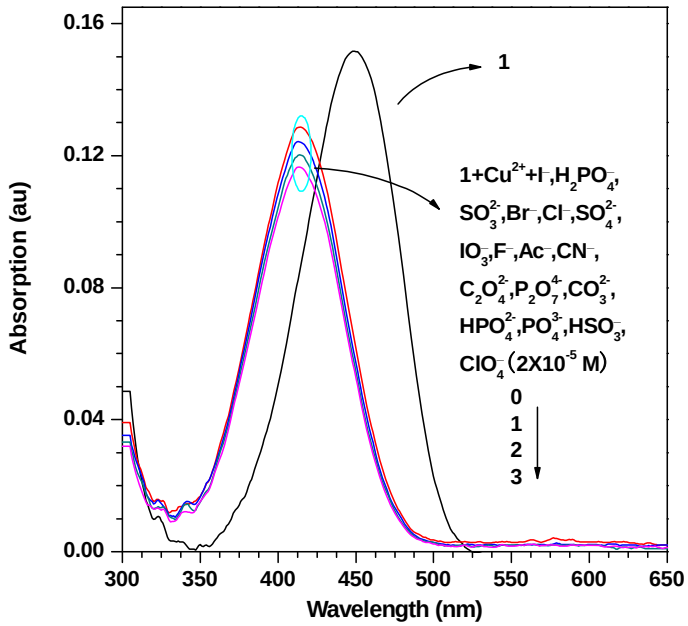

Fig. S23a Absorption spectra of **1** (10 μM) and Cu^{2+} (4.0×10^{-6} mol/L) in H_2O/CH_3OH (3:1, v/v, Britton–Robinson buffer, pH = 7.1) in the presence of different anions.

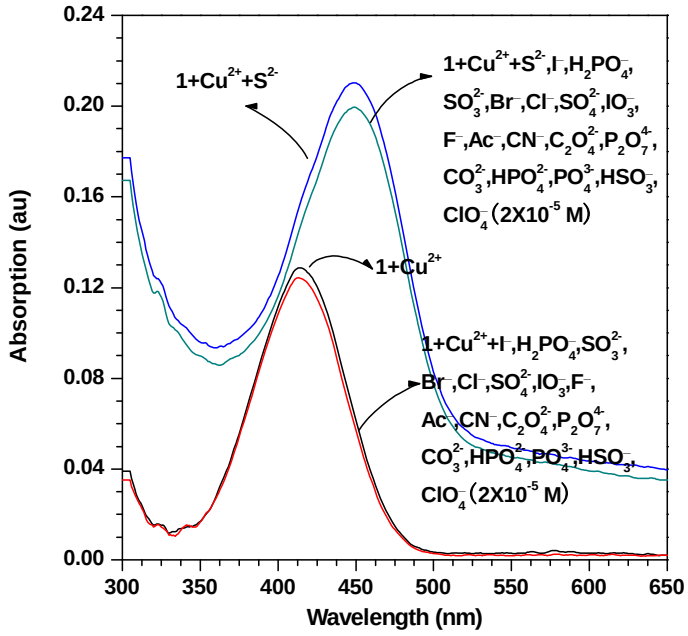

Fig. S24b Absorption spectra of **1** (10 μM) and Cu^{2+} (4.0×10^{-6} mol/L) in H_2O/CH_3OH (3:1, v/v, Britton–Robinson buffer, pH = 7.1) in the presence of different anions . The concentration of S^{2-} was 2.0×10^{-5} mol/L.

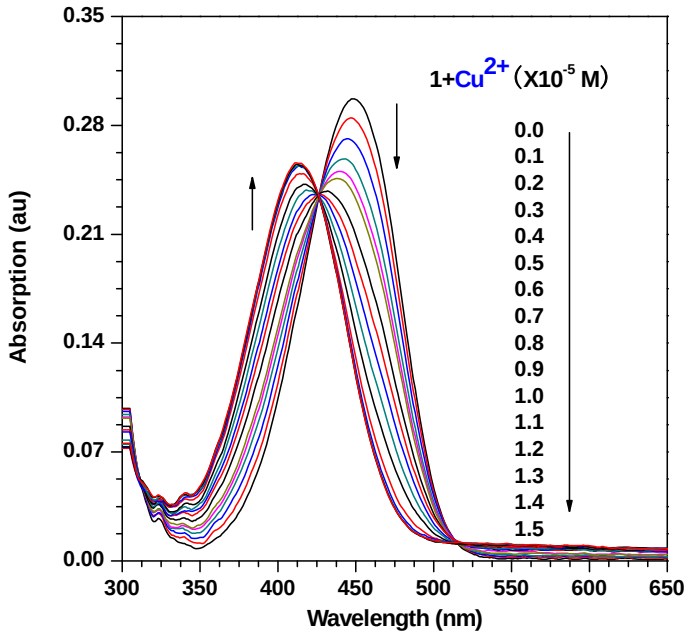

Fig. S25a Absorption spectra of **1** (20 μM) in the presence of different concentrations of Cu (II) in H_2O/CH_3OH (3:1, v/v, Britton–Robinson buffer, pH = 7.1).

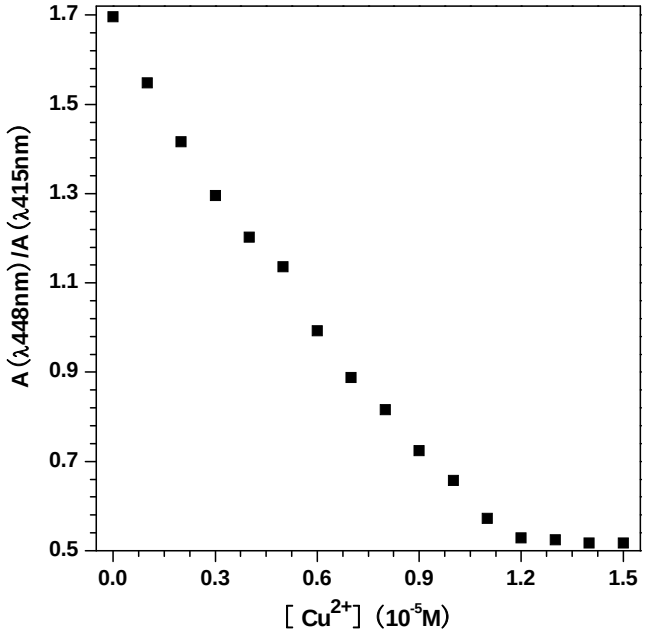

Fig. S25b Absorption difference of **1** (20 μM) in the presence of different concentrations of Cu (II) in H_2O/CH_3OH (3:1, v/v, Britton–Robinson buffer, pH = 7.1).

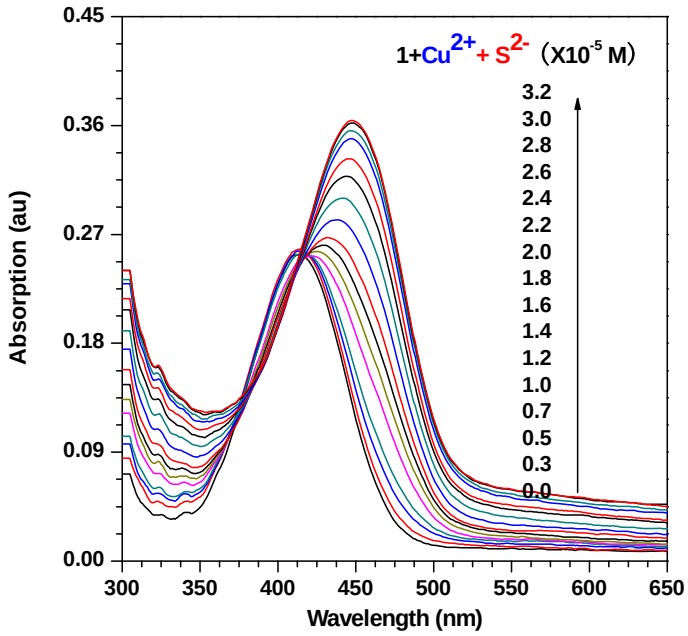

Fig. S26a Absorption spectra of **1** (20 μM) and Cu^{2+} (1.2×10^{-5} mol/L) in H_2O/CH_3OH (3:1, v/v, Britton–Robinson buffer, pH = 7.1) in the presence of different amounts of S^{2-}.

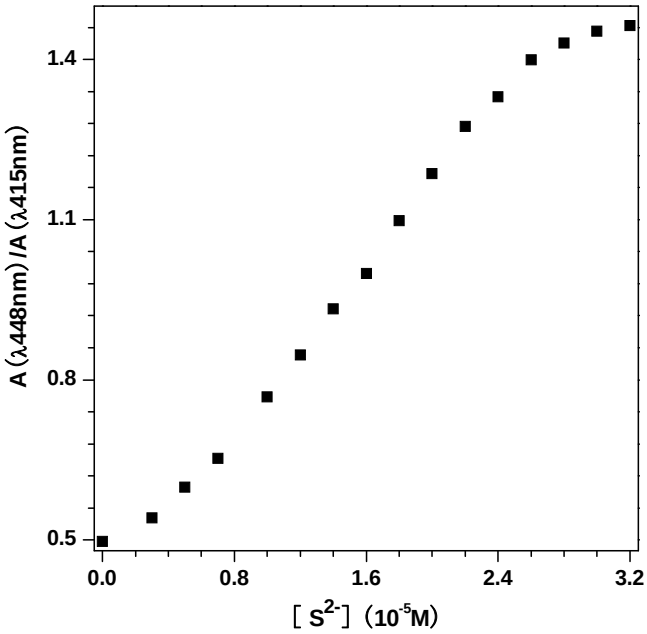

Fig. S26b Absorption difference of **1** (20 μM) and Cu^{2+} (1.2×10^{-5} mol/L) in H_2O/CH_3OH (3:1, v/v, Britton–Robinson buffer, pH = 7.1) in the presence of different amounts of S^{2-}.

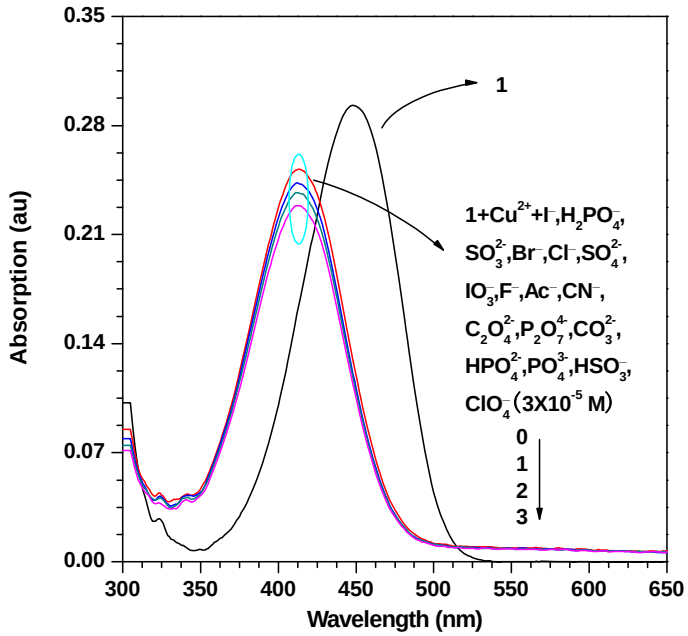

Fig. S27 Absorption spectra of **1** (20 μM) and Cu^{2+} (1.2×10^{-5} mol/L) in H_2O/CH_3OH (3:1, v/v, Britton–Robinson buffer, pH = 7.1) in the presence of different anions.

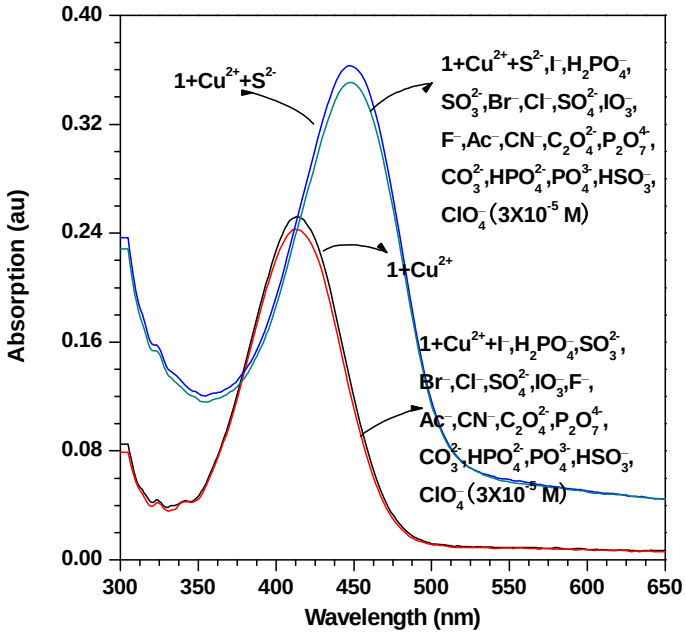

Fig. S28 Absorption spectra of **1** (20 μM) and Cu^{2+} (1.2×10^{-5} mol/L) in H_2O/CH_3OH (3:1, v/v, Britton–Robinson buffer, pH = 7.1) in the presence of different anions . The concentration of S^{2-} was 3.0×10^{-5} mol/L.

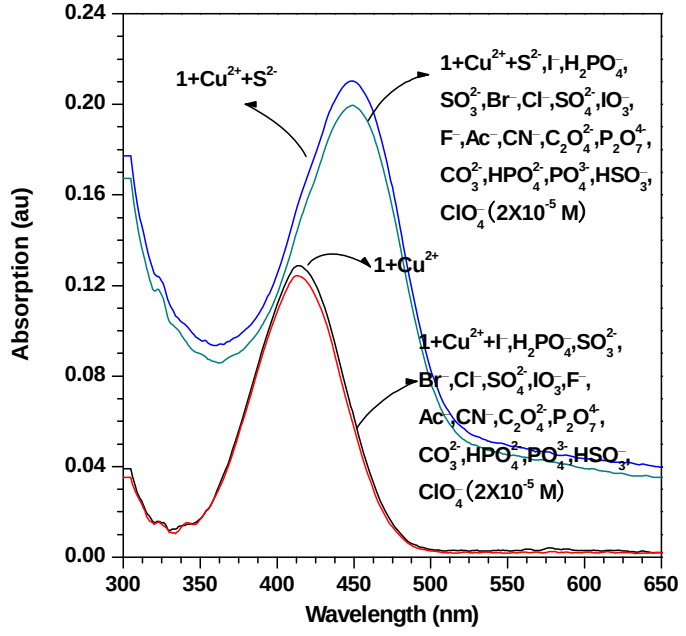

Fig. S29 Absorption spectra of **1** (10 μM) and Cu^{2+} (4.0×10^{-6} mol/L) in H_2O/CH_3OH (3:1, v/v, Britton–Robinson buffer, pH = 7.1) in the presence of different anions. The concentration of S^{2-} was 2.0×10^{-5} mol/L.

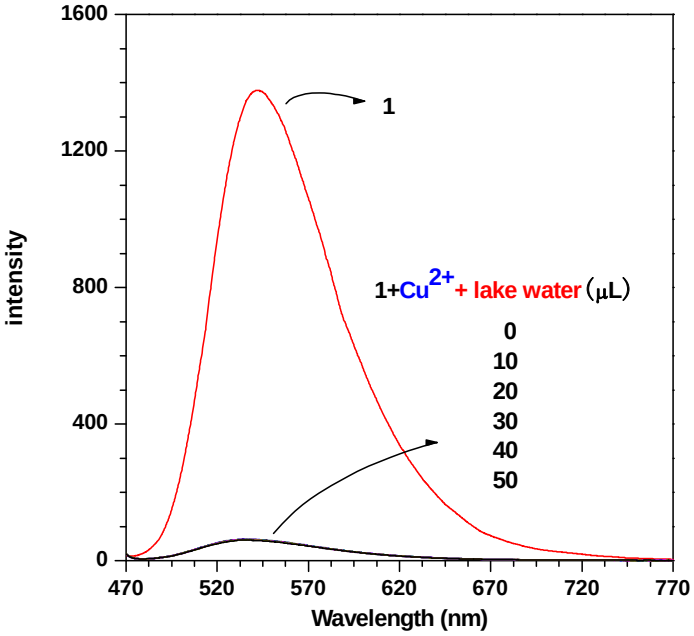

Fig. S30 Fluorescence Emission spectra of **1** (5 μM) and Cu^{2+} (2.7×10^{-6} mol/L) in H_2O/CH_3OH (3:1, v/v, Britton–Robinson buffer, pH = 7.1) in the presence of different amounts of the east lake water. Excitation wavelength (nm): 451.

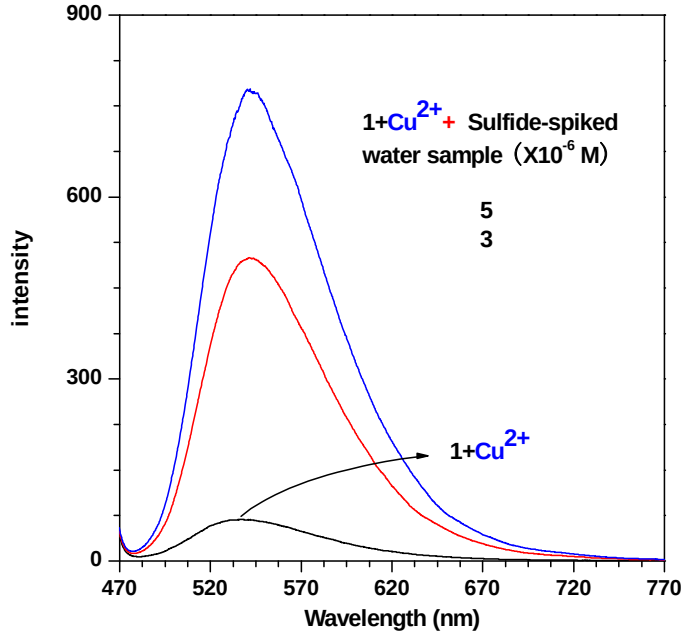

Fig. S31 Fluorescence Emission spectra of **1** (5 μM) and Cu^{2+} (2.7×10^{-6} mol/L) in H_2O/CH_3OH (3:1, v/v, Britton–Robinson buffer, pH = 7.1) in the presence of different amounts of lake water spiked with sulfide for the first time. Excitation wavelength (nm): 451.

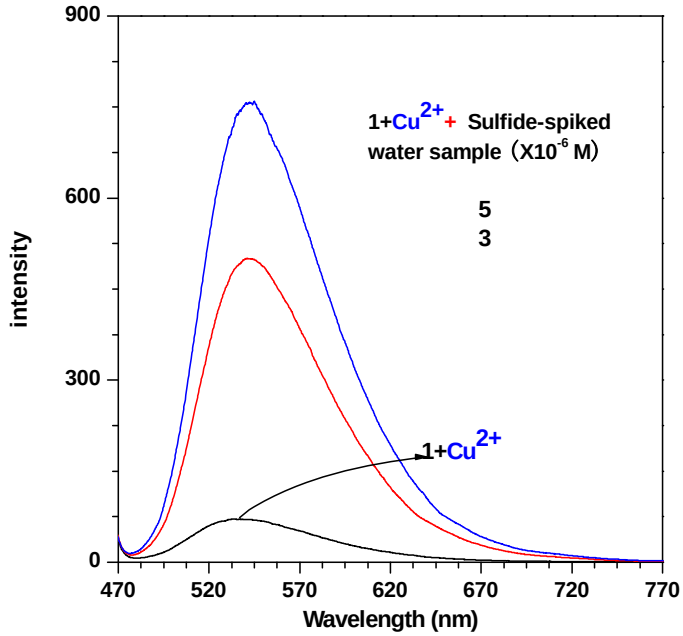

Fig. S32 Fluorescence Emission spectra of **1** (5 μM) and Cu^{2+} (2.7×10^{-6} mol/L) in H_2O/CH_3OH (3:1, v/v, Britton–Robinson buffer, pH = 7.1) in the presence of different amounts of lake water spiked with sulfide for the second time. Excitation wavelength (nm): 451.

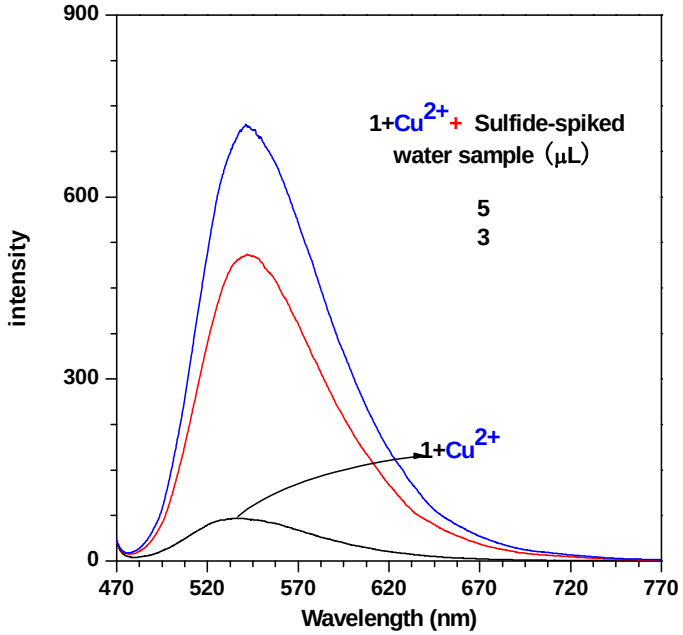

Fig. S33 Fluorescence Emission spectra of **1** (5 μM) and Cu^{2+} (2.7×10^{-6} mol/L) in H_2O/CH_3OH (3:1, v/v, Britton–Robinson buffer, pH = 7.1) in the presence of different amounts of east lake water spiked with sulfide for the third time. Excitation wavelength (nm): 451.

An excellent linear relationship was obtained between fluorescence intensity and the sulfide ion concentration in the range from 3.0×10^{-7} to 8×10^{-6} M. The regression equation was $y = 0.52627 + 2.7423x$ ($R^2 = 0.9869$), where y is fluorescence intensity I/I_0, and x is the concentration of sulfide ion in deionized water.

Table S1. Determination of S^{2-} in sulfide- spiked lake water.

S^{2-} added ($\times10^{-6}$mol/L)	I/I_0	Determination of S^{2-} ($\times10^{-6}$mol/L)	RSD %	S^{2-} added ($\times10^{-6}$mol/L)	I/I_0	Determination of S^{2-} ($\times10^{-6}$mol/L)	RSD %
3	7.49	2.54		5	11.56	4.02	
3	7.38	2.50	2.18	5	11.15	3.87	1.93
3	7.67	2.61		5	10.93	3.79	