# Supporting Information

A double responsive fluorescent platform for sensing heavy metal ions based on a

dual-emitting fluorescent covalent organic framework hydrogel film

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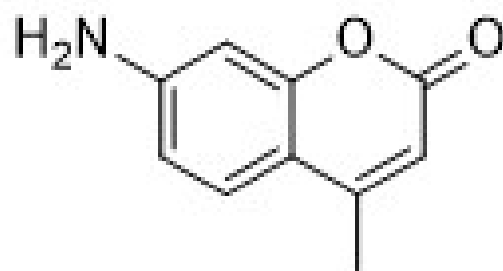
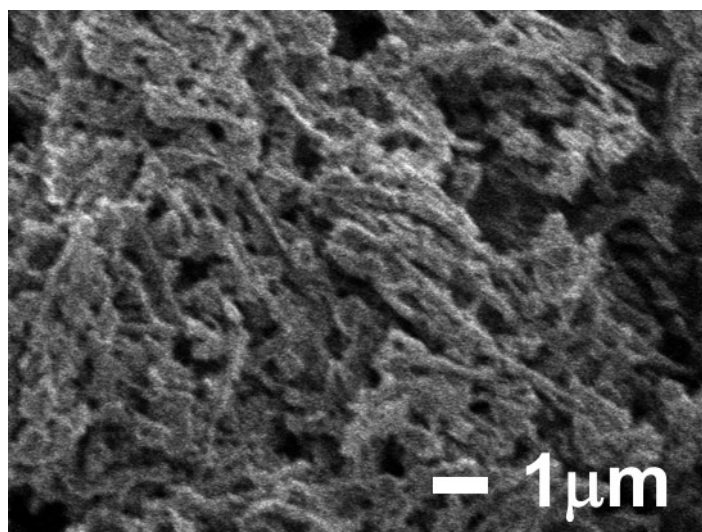**Scheme S1.** The chemical structural formula of 7-amino-4-methyl coumarin.
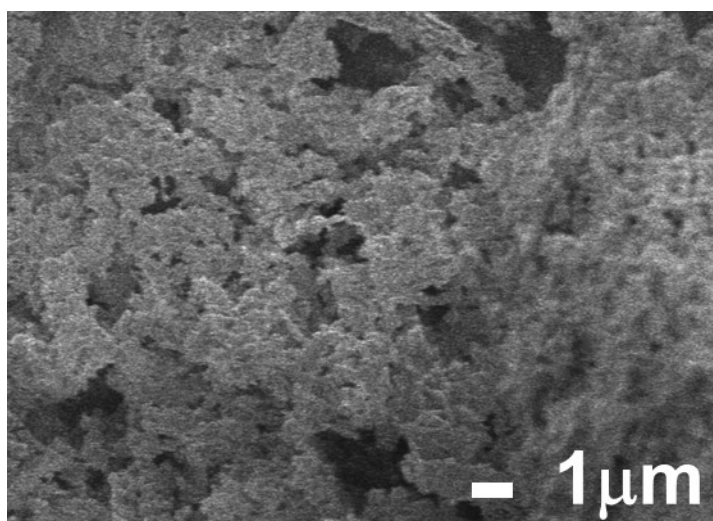
Supporting Figures

Fig. S1 SEM images of TpDq.

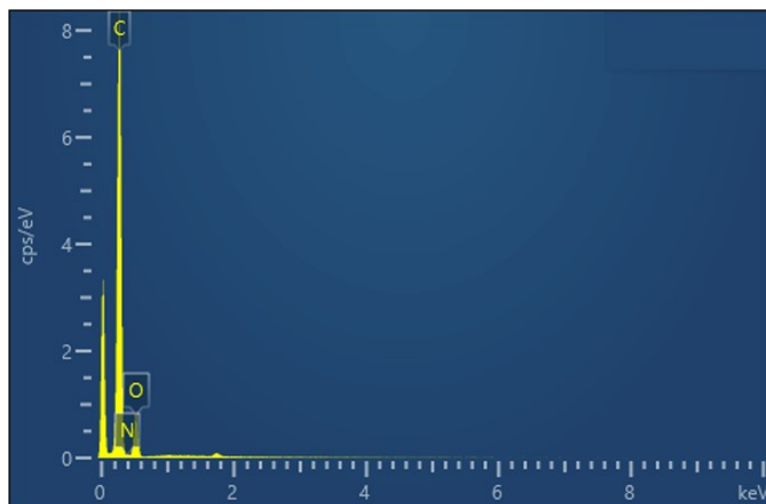**Fig. S2** SEM images of Dye@TpDq.
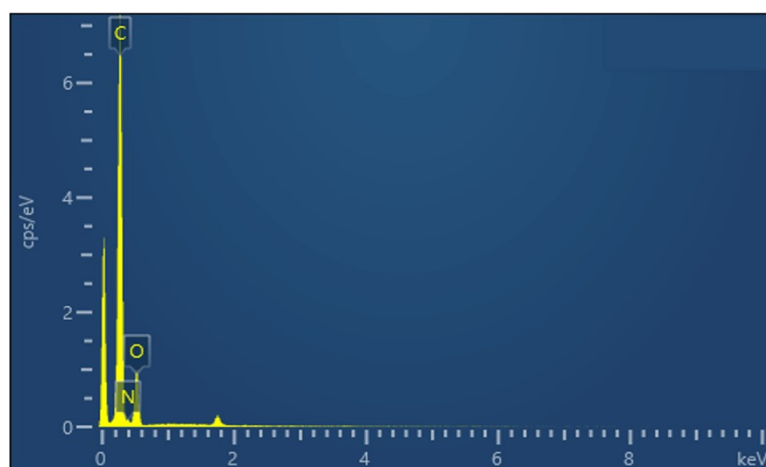
Fig. S3 EDX spectrum of TpDq.

Fig. S4 EDX spectrum of Dye@TpDq.

Fig. S5 Picture of **1**.
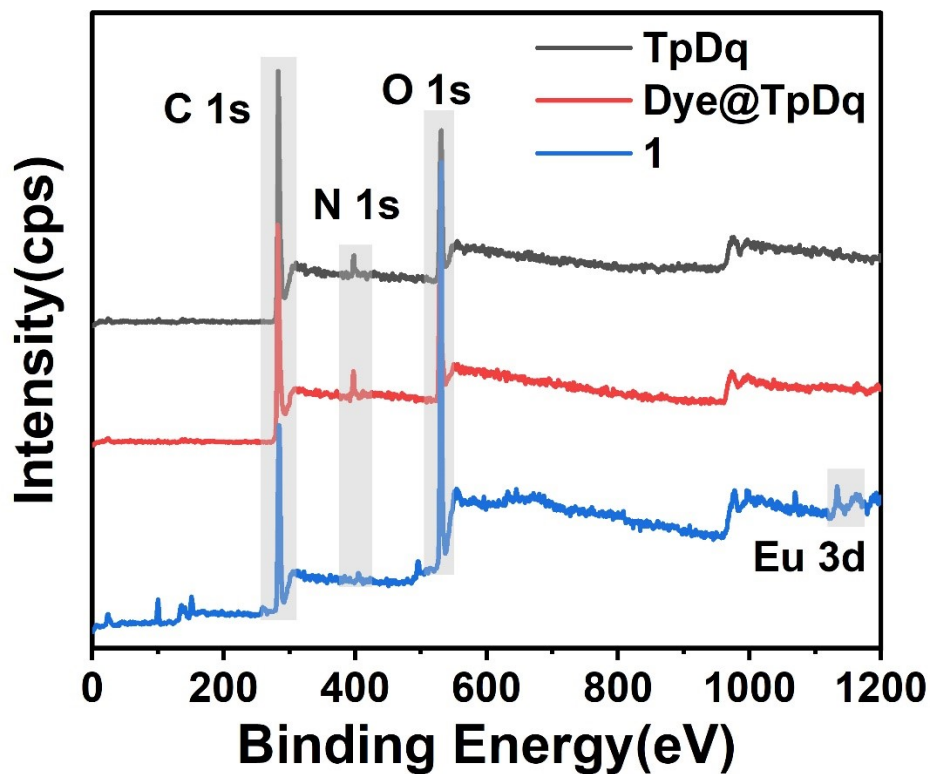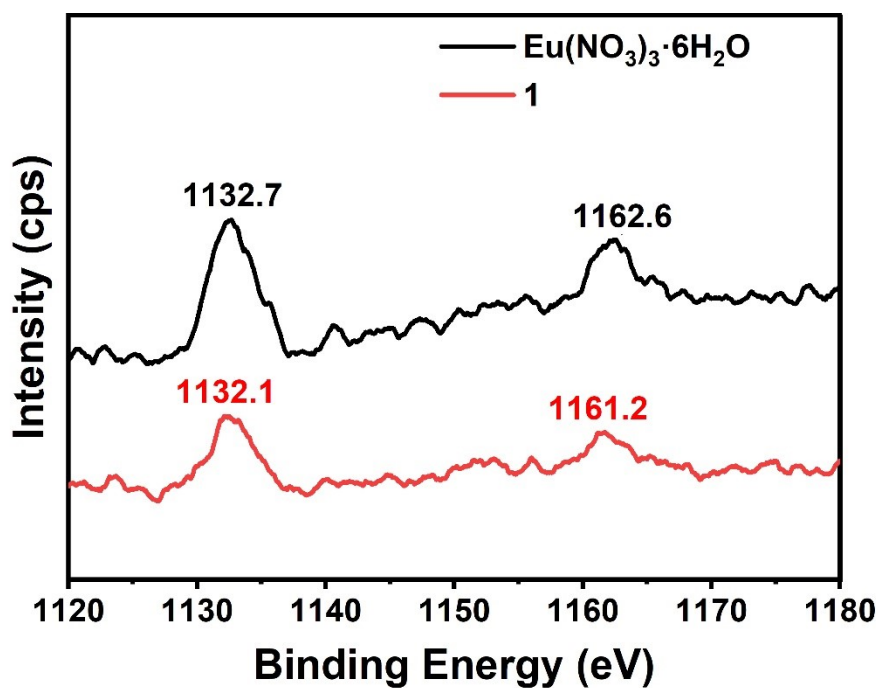
Fig. S6 XPS spectra of pristine TpDq, Dye@TpDq and **1**.

Fig. S7 XPS spectra of **1** and $Eu(NO_3)_3·6H_2O$ for the Eu 3d electron.
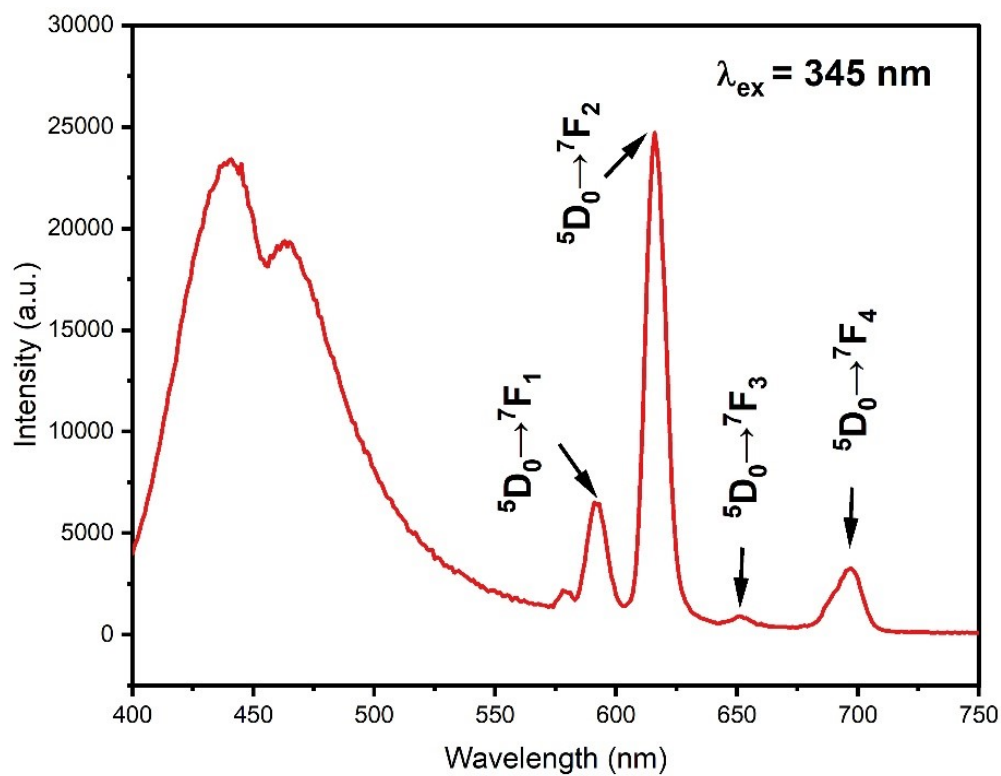
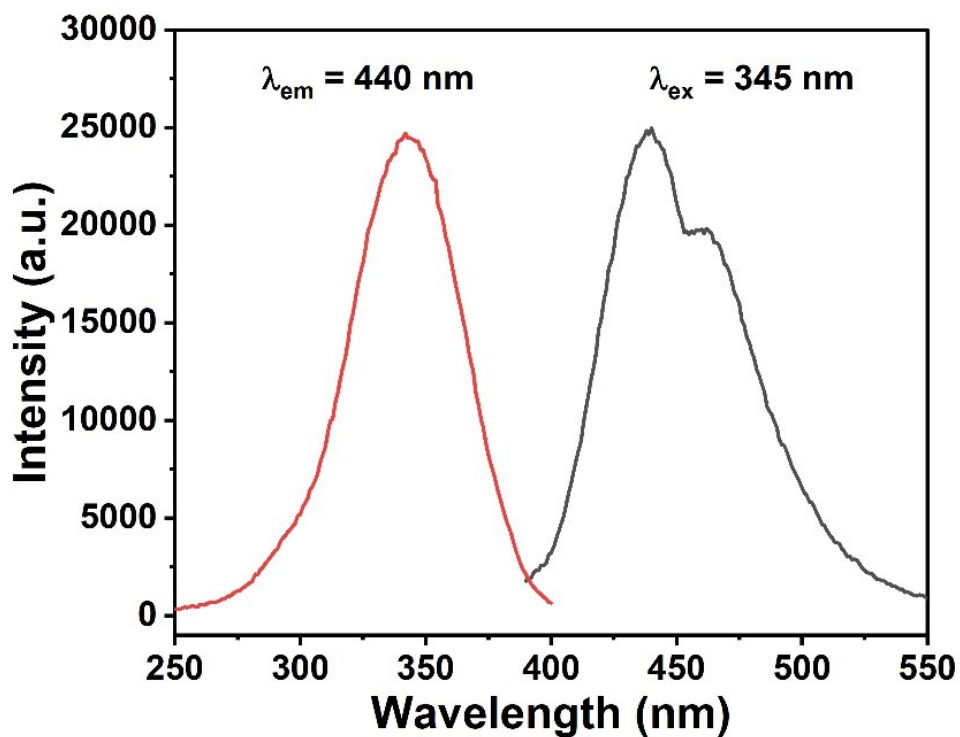**Fig. S8** The luminescence spectrum of **1**.

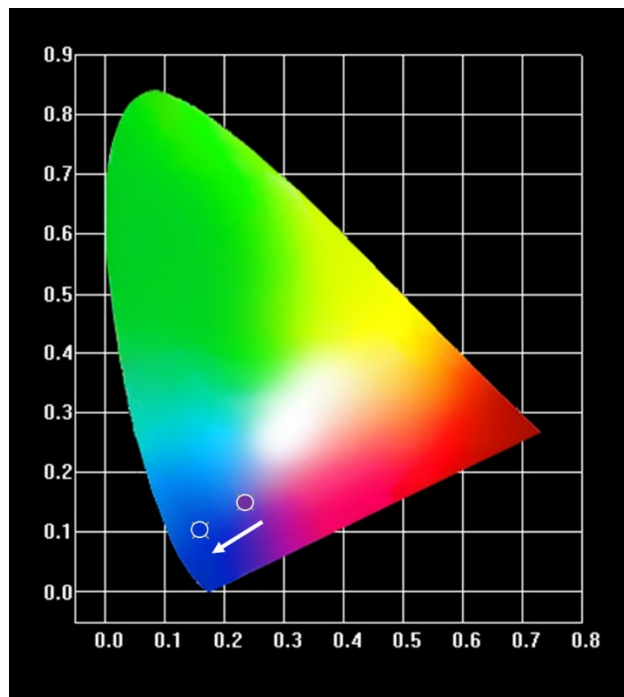**Fig. S9** Excitation and emission spectra of Dye@TpDq in aqueous solution.

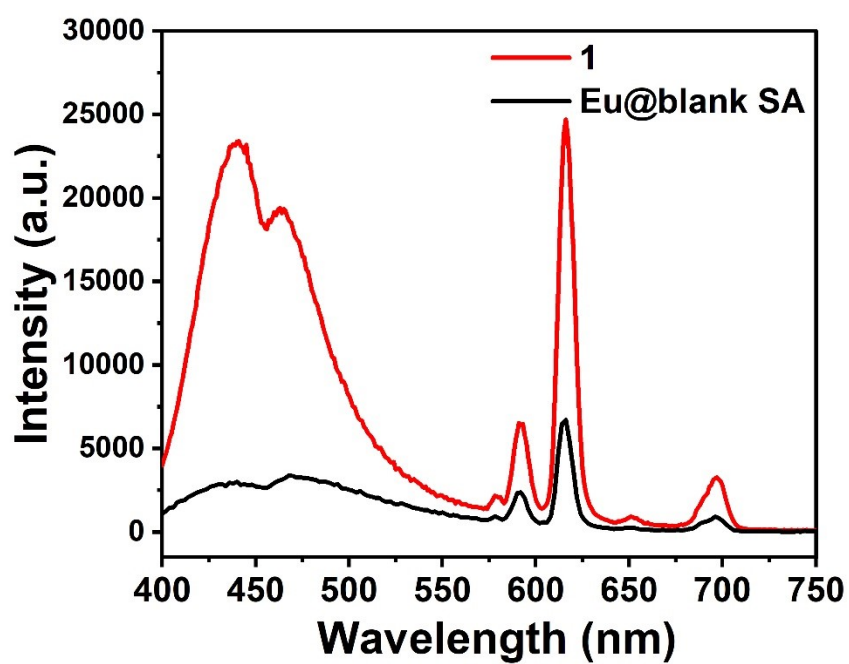**Fig. S10** Changes of CIE coordinates of emitted light after detection of Cu^{2+}.

Fig. S11 Comparison of emission spectra of Eu@blank SA film and **1**.
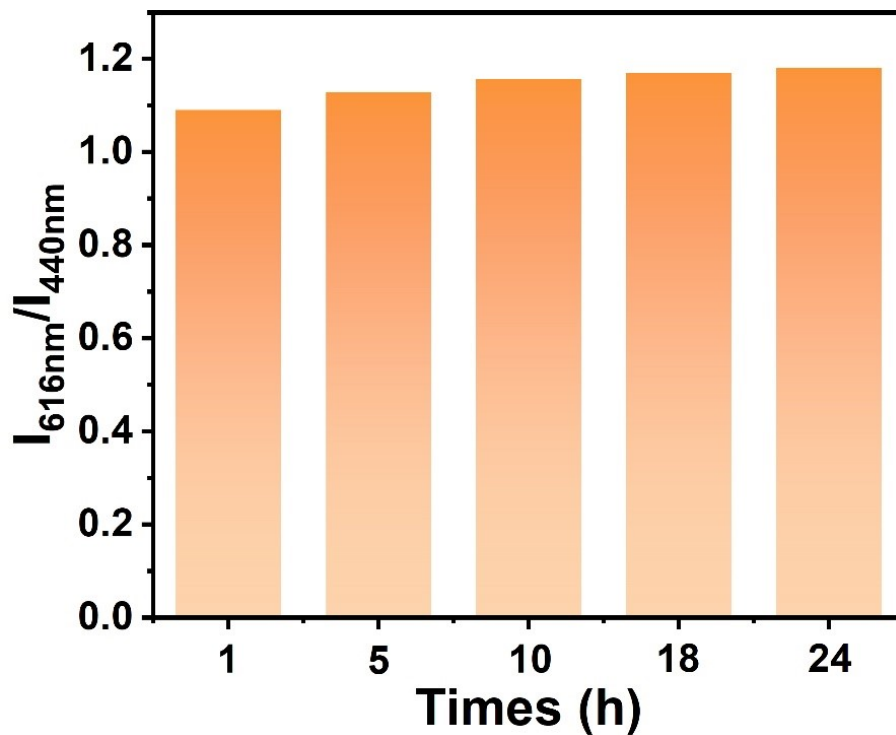
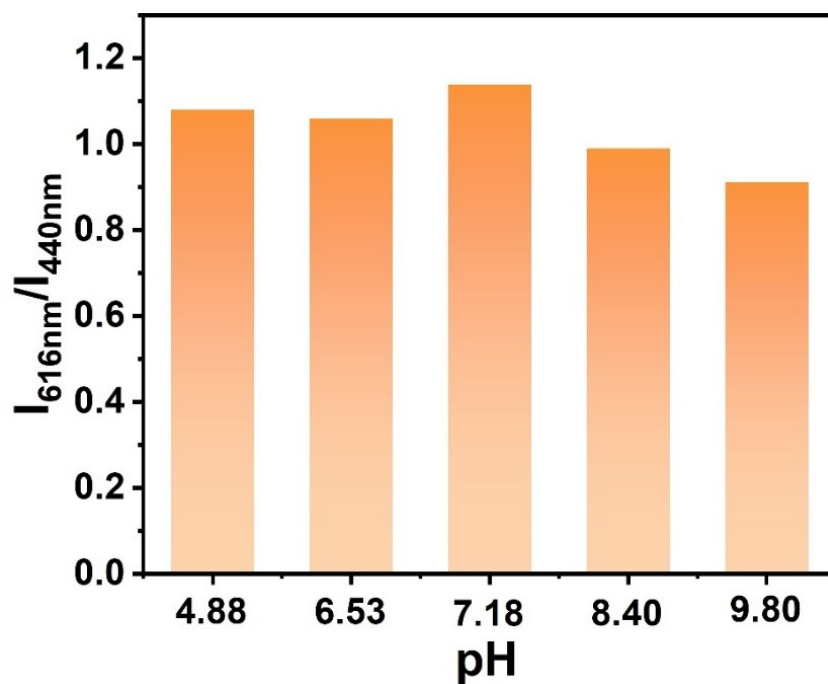**Fig. S12** Time-dependent emission intensities ratio (I_{616nm}/I_{440nm}) of 1 soaking in aqueous solution.

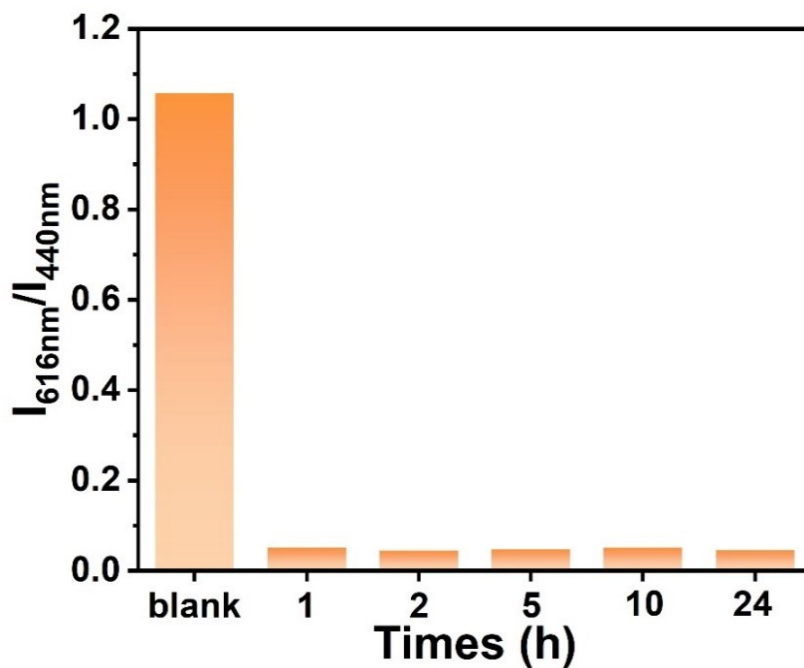**Fig. S13** The emission intensities ratio (I_{616nm}/I_{440nm}) of **1** immersed in different pH solutions for 30 min.

Fig. S14 The emission intensities ratio (I_{616nm}/I_{440nm}) of **1** added 10^{-2} M Cu^{2+} in aqueous solution set aside with different times. The emission of blank was used as a reference for other samples.
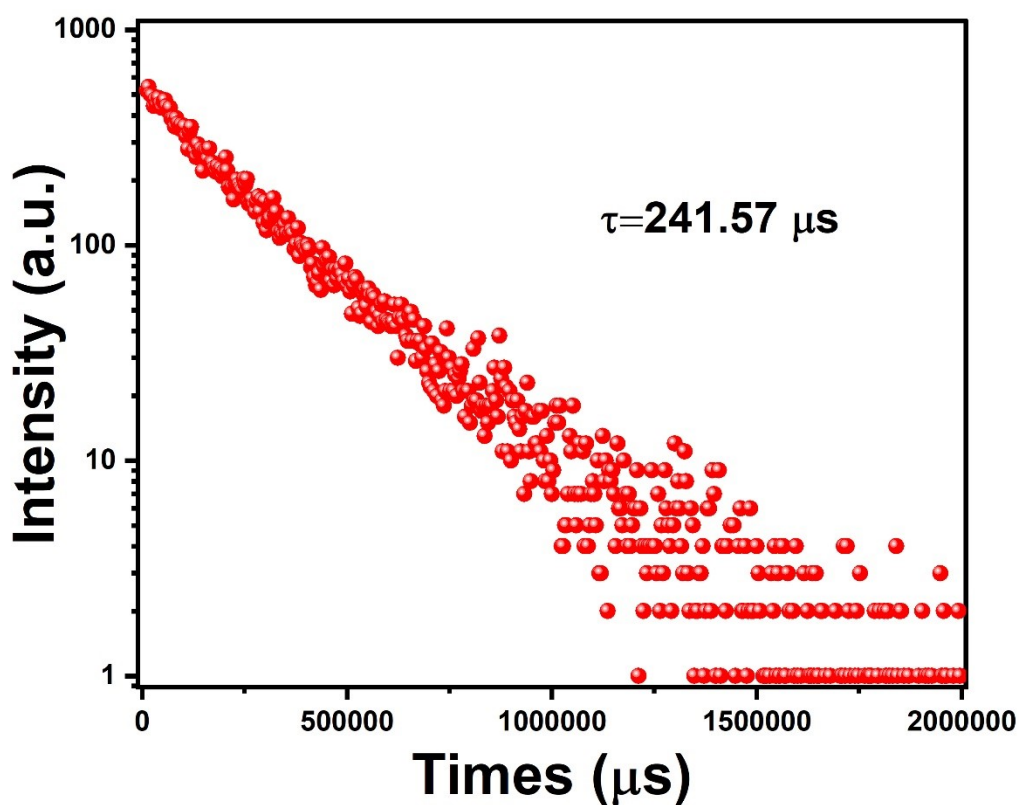

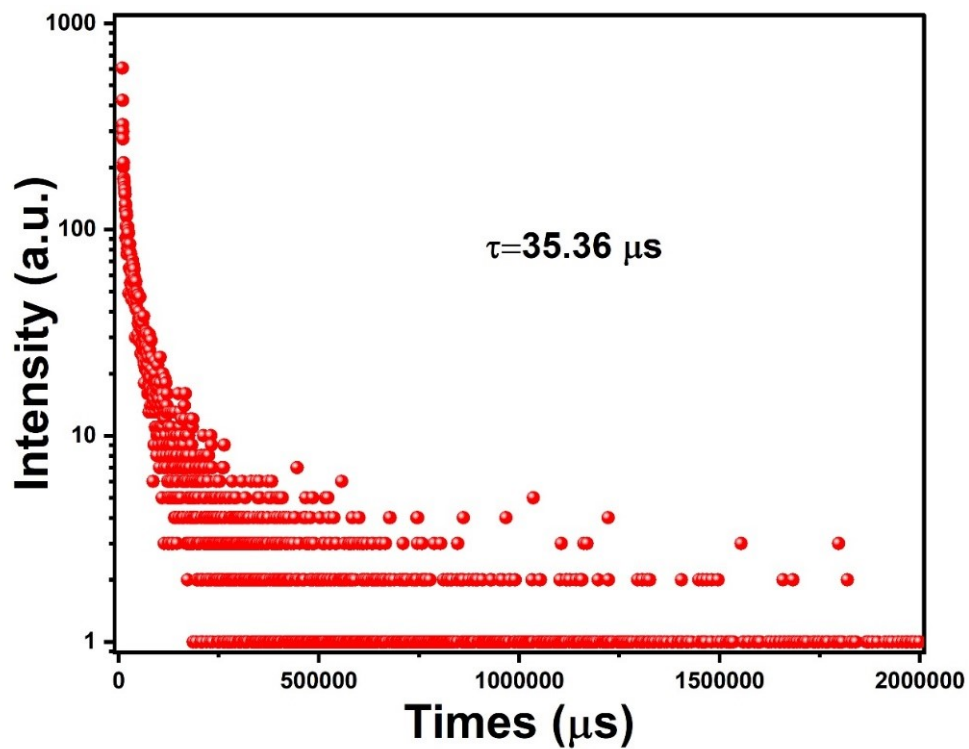**Fig. S15** Lifetime decay curve of **1** (λ_{ex} = 345 nm, λ_{em} = 616 nm).

Fig. S16 Lifetime decay curve of **1** added with 10^{-2} M Cu^{2+} (λ_{ex} = 345 nm, λ_{em} = 616 nm).
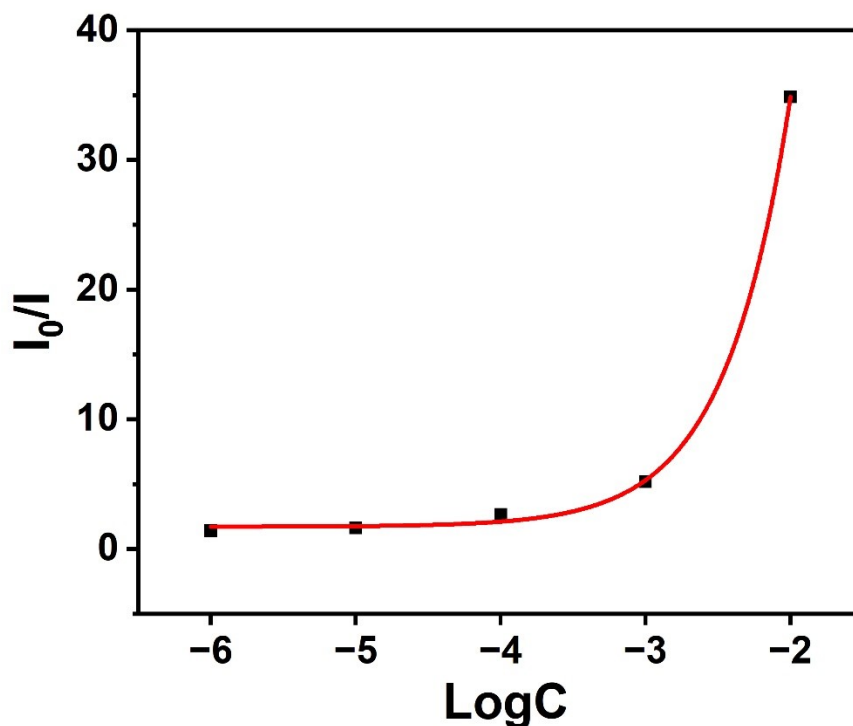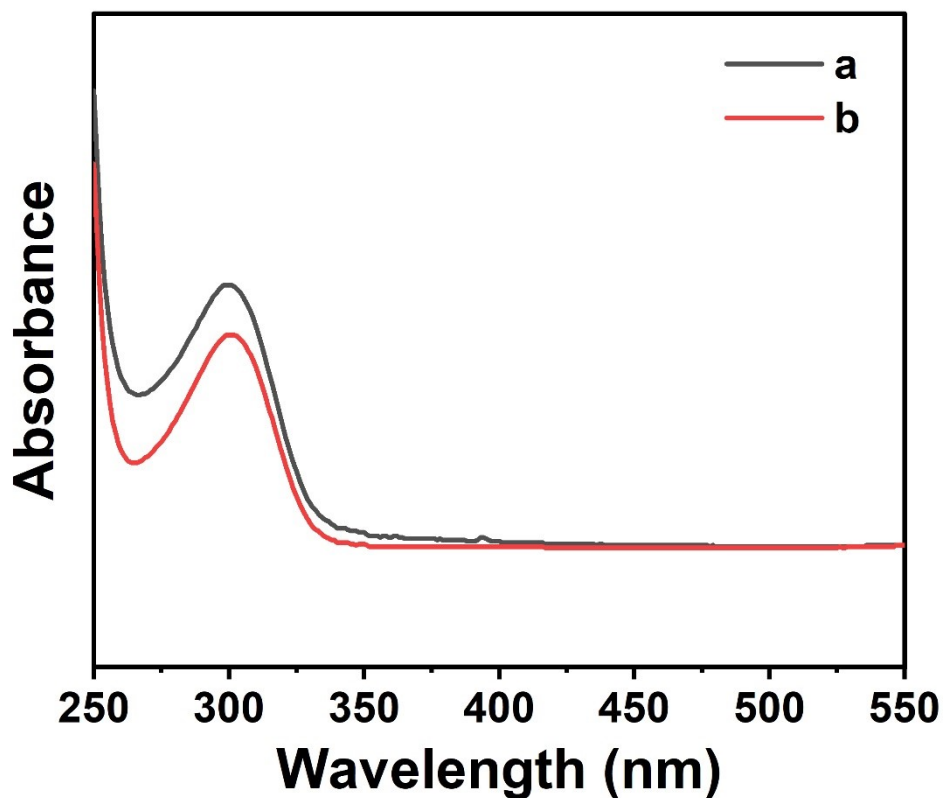

Fig. S17 S–V intensity plot of Cu^{2+}.

Fig. S18 UV-vis absorption spectra of Cu²⁺solusions before (a) and after (b) soaking **1**.

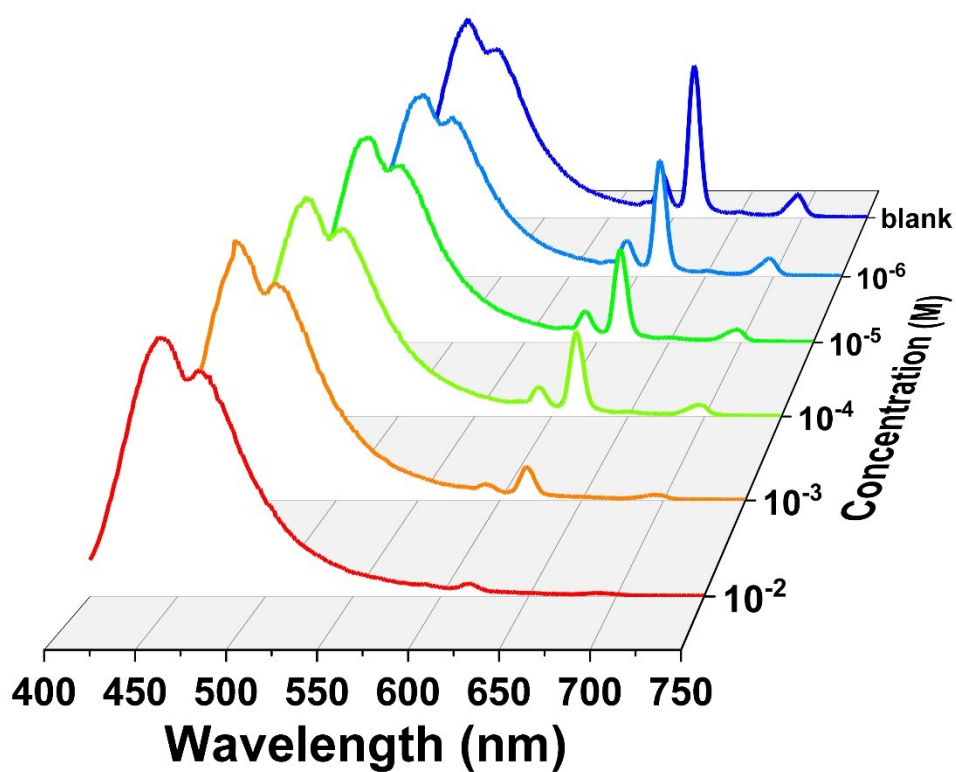**Fig. S19** Luminescence spectra of 1 after immersion in 10^{-6}-10^{-2} M Cu²⁺ drinking water solution (λ_{ex} = 345 nm)
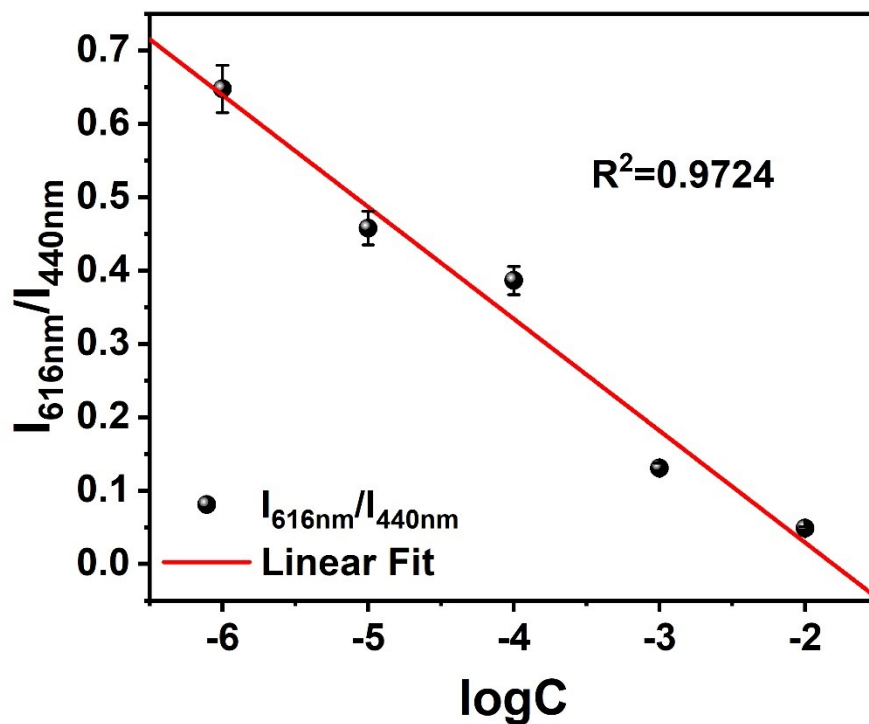
Fig. S20 The corresponding calibration curves (I_{616nm}/I_{440nm}).

Fig. S21 Histogram of the 616 nm emission intensities of **1** in various anion solutions before and after the addition of $Cr_2O_7^{2-}$ and CrO_4^{2-} (10^{-2} M).
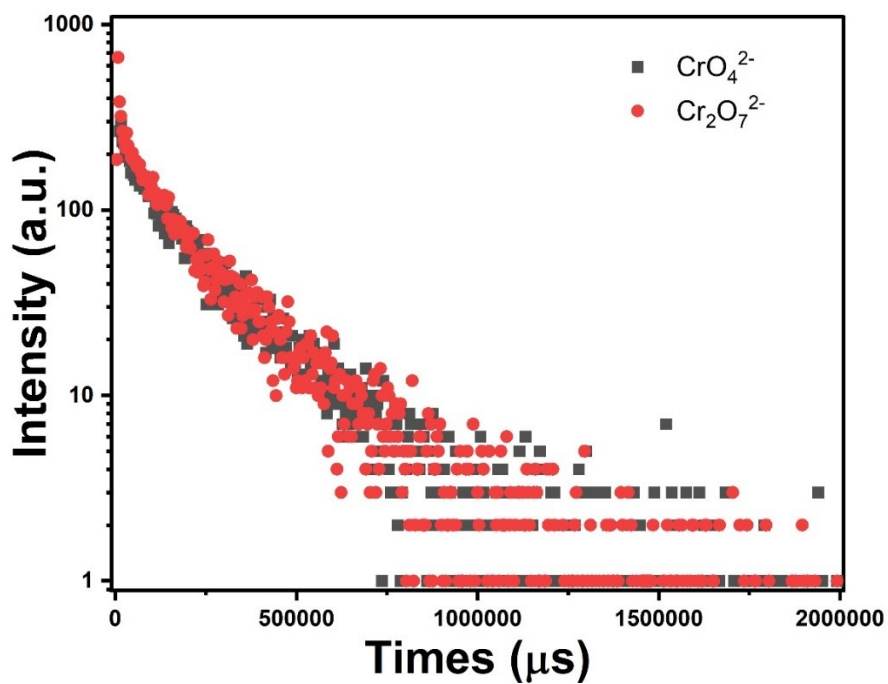
Fig. S22 Lifetime decay curve of 1 added with 10^{-2} M $Cr_2O_7^{2-}$ and CrO_4^{2-} (λ_{ex} = 345 nm, λ_{em} = 616 nm).

Fig. S23 UV-vis absorption spectra of Cr(VI) and dye.

Fig. S24 S–V intensity plot of $Cr_2O_7^{2-}$.

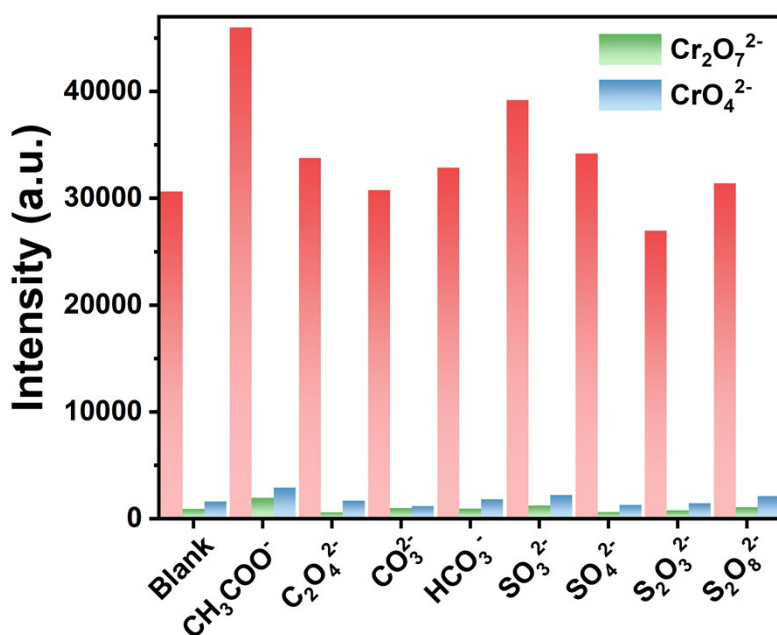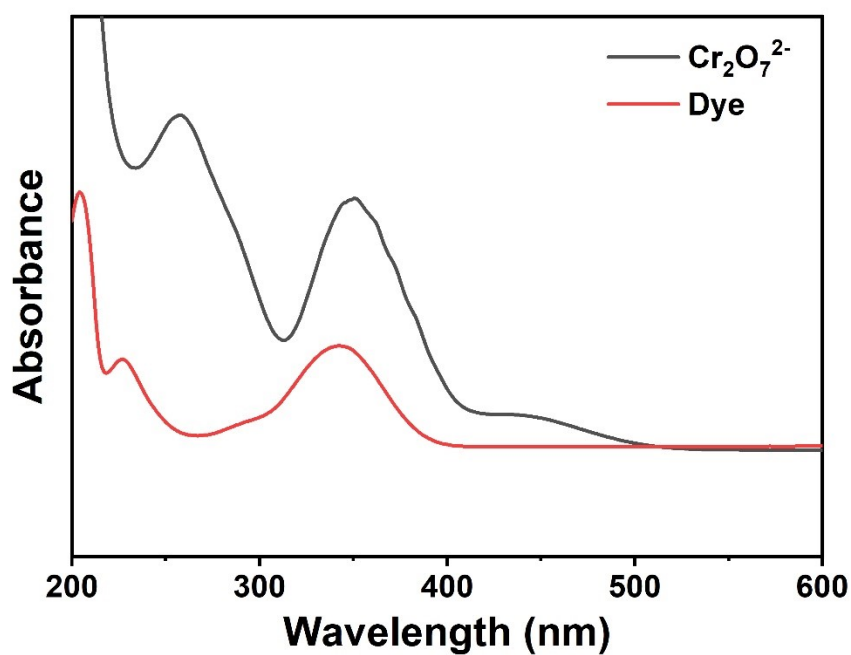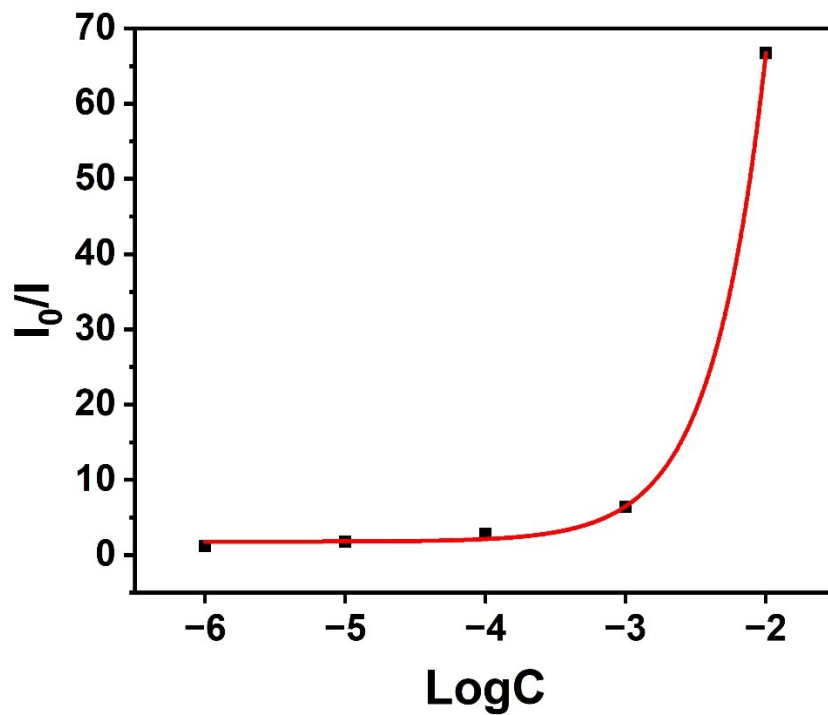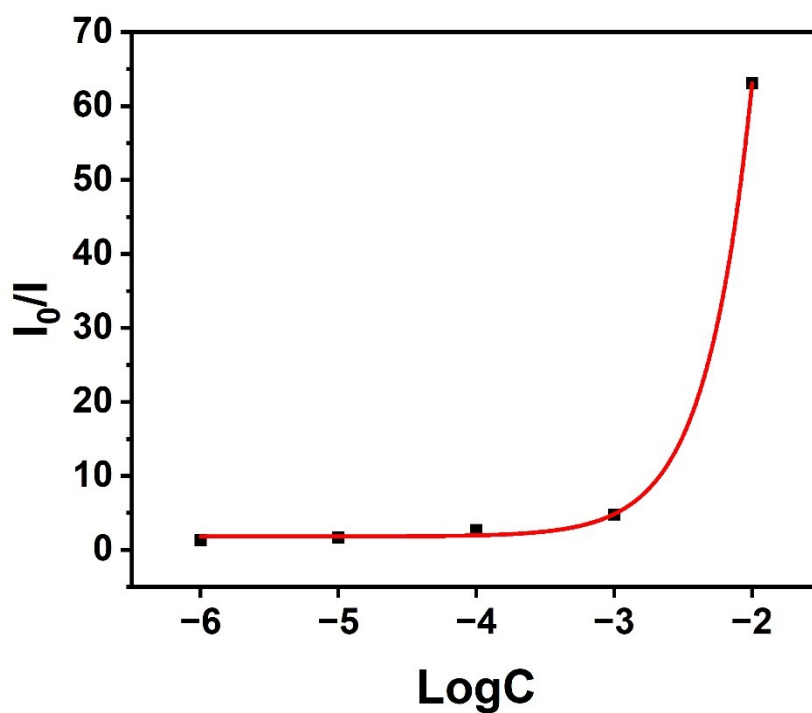**Fig. S25** S–V intensity plot of CrO_4^{2-}.

Table S1 The weight percentage of all elements in TpDq, Dye@TpDq and **1** determined by Energy dispersive X-ray (EDX).

Element	Weight percentages		
	TpDq	Dye@TpDq	1
C	75.31	69.77	45.75
N	7.25	9.35	1.36
O	17.43	20.88	40.53
Eu	-	-	12.36

Table S2 Responses of luminescence lifetimes of **1** towards various concentrations of Cu^{2+}.

Concentration (mol/L)	τ (μs)
0	241.57
10^{-6}	214.30
10^{-4}	174.57
10^{-2}	35.36

Table S3 Responses of luminescence lifetimes of **1** towards various concentrations of $Cr_2O_7^{2-}$ (top) and CrO_4^{2-} (bottom).

Concentration (mol/L)	τ (μs)
0	241.57
10^{-6}	207.00
10^{-4}	179.13
10^{-2}	167.77

Concentration (mol/L)	τ (μs)
0	241.57
10^{-6}	207.93
10^{-4}	182.17
10^{-2}	174.31

The detection limit (LOD) can be calculated by the following equation:

$$3.3\sigma \,/\, LOD = \text{Signal intensity (A)} \,/\, \text{Concentration (A)}$$

σ is the standard deviation of luminescent intensity for 20 replicating fluorescence measurements of blank solutions,

A is the minimum concentration in the linear relationship.