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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

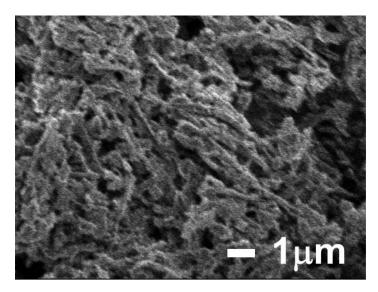


Fig. S1 SEM images of TpDq.

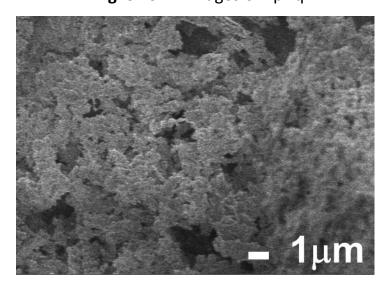


Fig. S2 SEM images of Dye@TpDq.

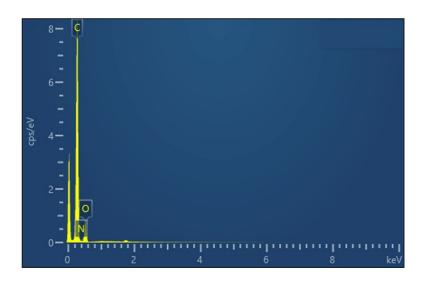


Fig. S3 EDX spectrum of TpDq.

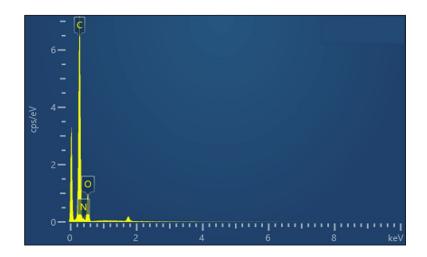


Fig. S4 EDX spectrum of Dye@TpDq.



Fig. S5 Picture of 1.

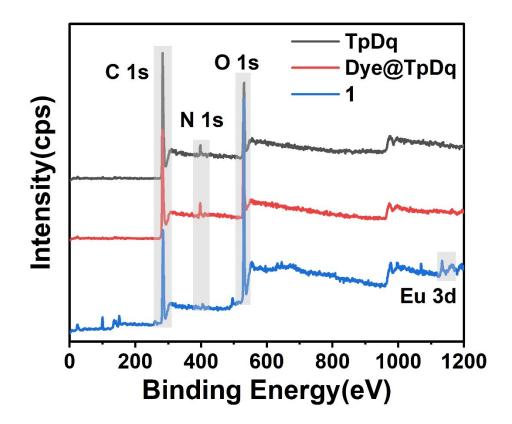


Fig. S6 XPS spectra of pristine TpDq, Dye@TpDq and 1.

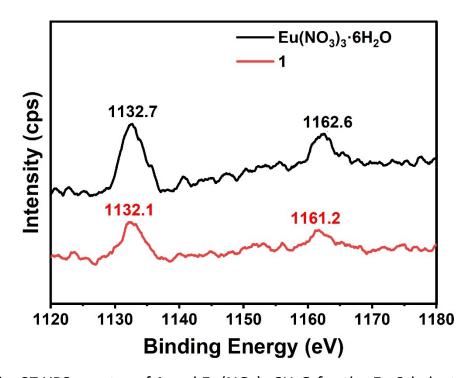


Fig. S7 XPS spectra of 1 and $Eu(NO_3)_3 \cdot 6H_2O$ for the Eu 3d electron.

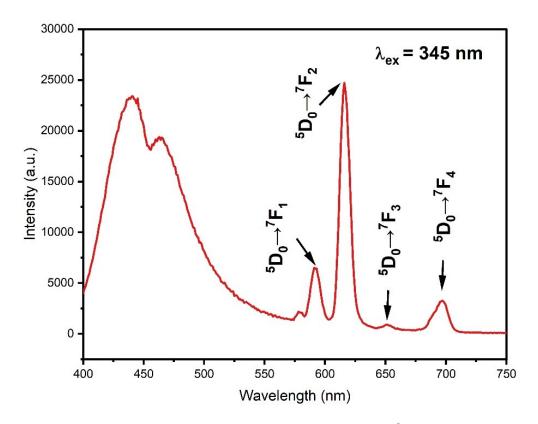


Fig. S8 The luminescence spectrum of 1.

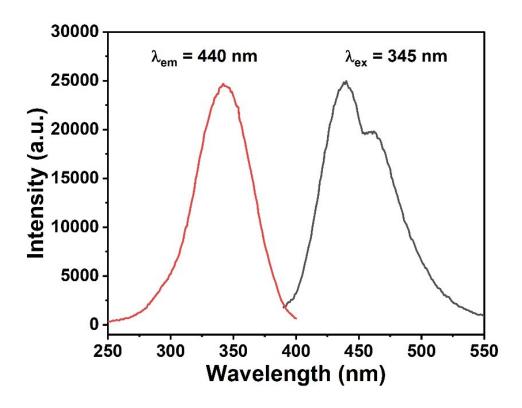


Fig. S9 Excitation and emission spectra of Dye@TpDq in aqueous solution.

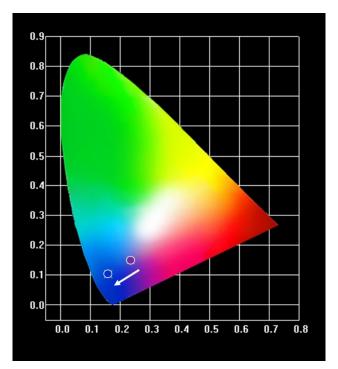


Fig. S10 Changes of CIE coordinates of emitted light after detection of Cu²⁺.

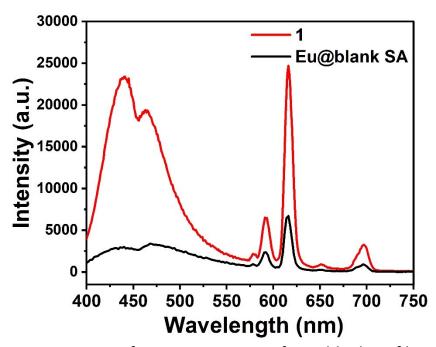


Fig. S11 Comparison of emission spectra of Eu@blank SA film and 1.

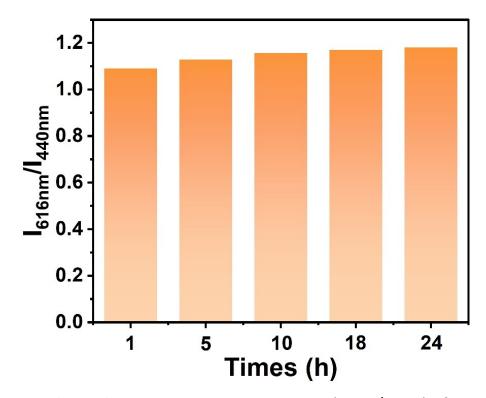


Fig. S12 Time-dependent emission intensities ratio (I_{616nm}/I_{440nm}) of 1 soaking in aqueous solution.

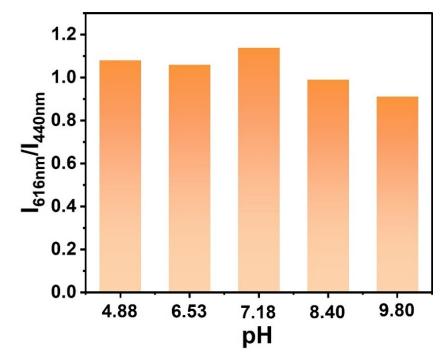


Fig. S13 The emission intensities ratio (I_{616nm}/I_{440nm}) of **1** immersed in different pH solutions for 30 min.

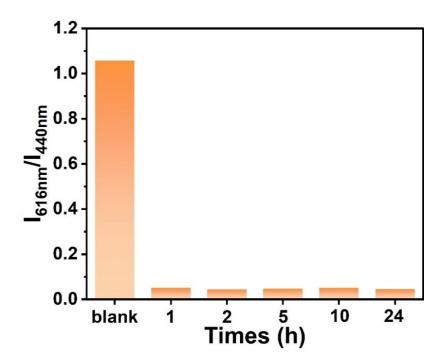


Fig. S14 The emission intensities ratio (I_{616nm}/I_{440nm}) of **1** added 10⁻² M Cu²⁺ in aqueous solution set aside with different times. The emission of blank was used as a reference for other samples.

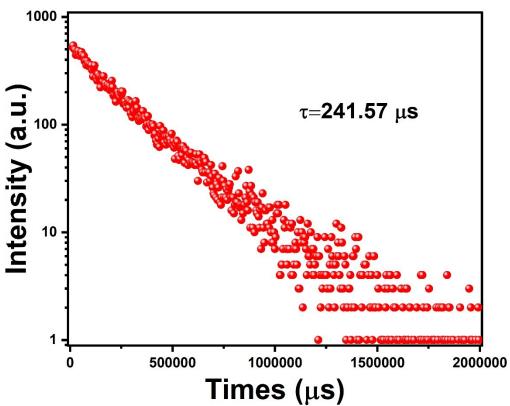


Fig. S15 Lifetime decay curve of **1** (λ_{ex} = 345 nm, λ_{em} = 616 nm).

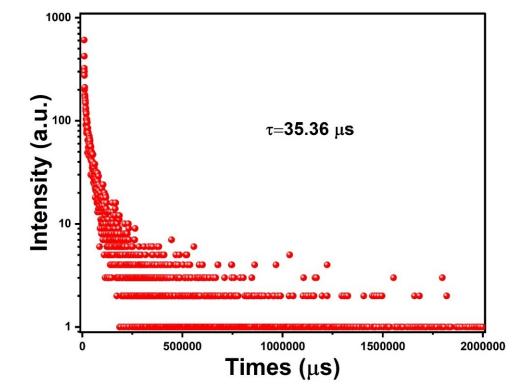


Fig. S16 Lifetime decay curve of **1** added with 10⁻² M Cu²⁺ (λ_{ex} = 345 nm, λ_{em} = 616 nm).

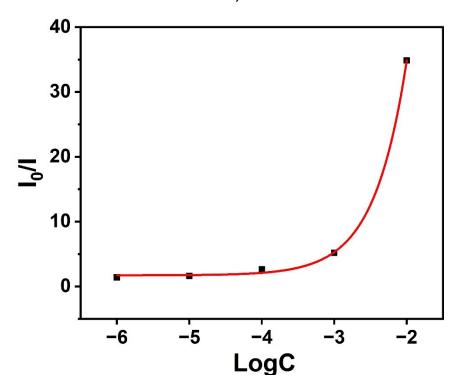


Fig. S17 S–V intensity plot of Cu²⁺.

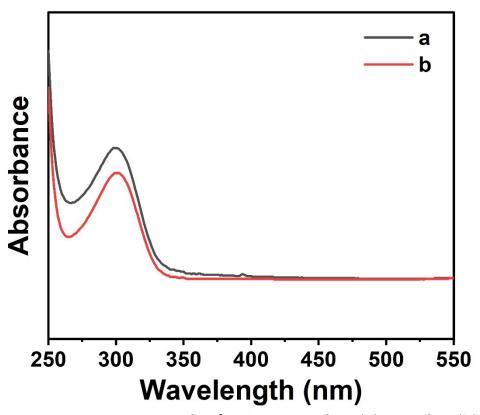


Fig. S18 UV-vis absorption spectra of Cu²⁺solusions before (a) and after (b) soaking 1.

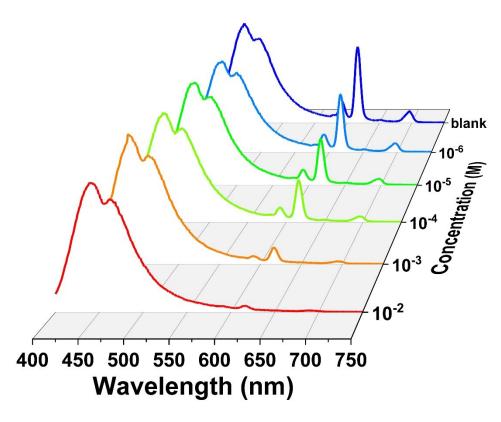


Fig. S19 Luminescence spectra of 1 after immersion in 10^{-6} - 10^{-2} M Cu²⁺ drinking water solution (λ_{ex} = 345 nm)

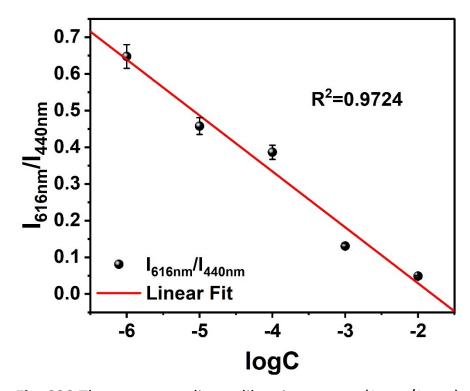


Fig. S20 The corresponding calibration curves (I_{616nm}/I_{440nm}) .

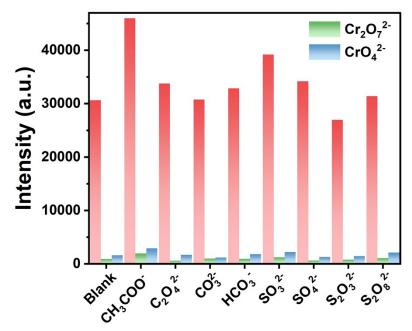


Fig. S21 Histogram of the 616 nm emission intensities of **1** in various anion solutions before and after the addition of $Cr_2O_7^{2-}$ and CrO_4^{2-} (10^{-2} M).

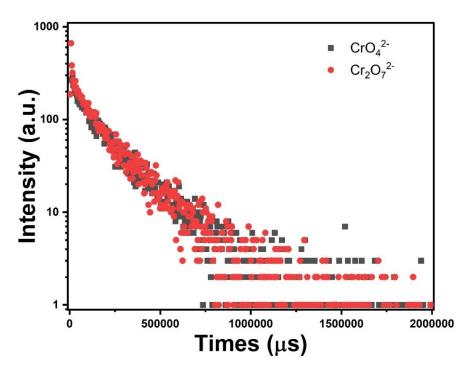


Fig. S22 Lifetime decay curve of 1 added with 10^{-2} M $Cr_2O_7^{2-}$ and CrO_4^{2-} (λ_{ex} = 345 nm, λ_{em} = 616 nm).

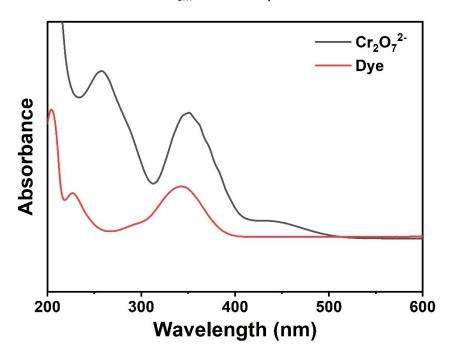


Fig. S23 UV-vis absorption spectra of Cr(VI) and dye.

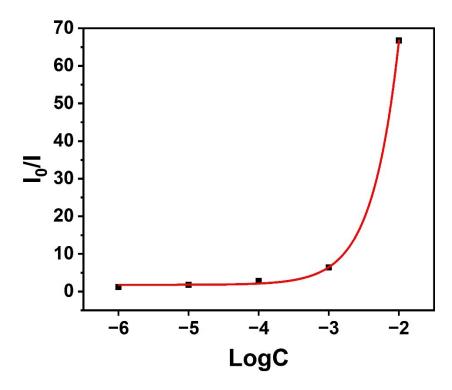


Fig. S24 S–V intensity plot of Cr₂O₇²⁻.

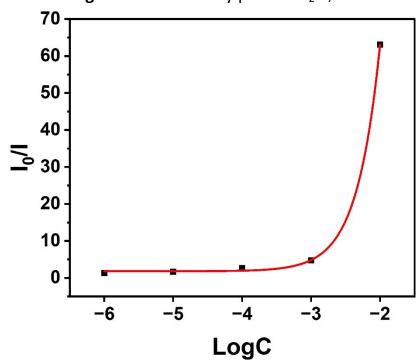


Fig. S25 S–V intensity plot of CrO₄²-.

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
О	17.43	20.88	40.53
Eu	-	-	12.36

Table S2 Responses of luminescence lifetimes of $\bf 1$ 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:

 3.3σ / LOD = Signal intensity (A) / 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.