Supporting information

A label-free fluorescence sensing platform based on $NaY_{0.47}F_4:Ce_{0.1},Gd_{0.4},Eu_{0.03}$@PEIF down-conversion for selective detection of Cu^{2+} in aqueous environments

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1. Reaction principles and characterization of PEIF

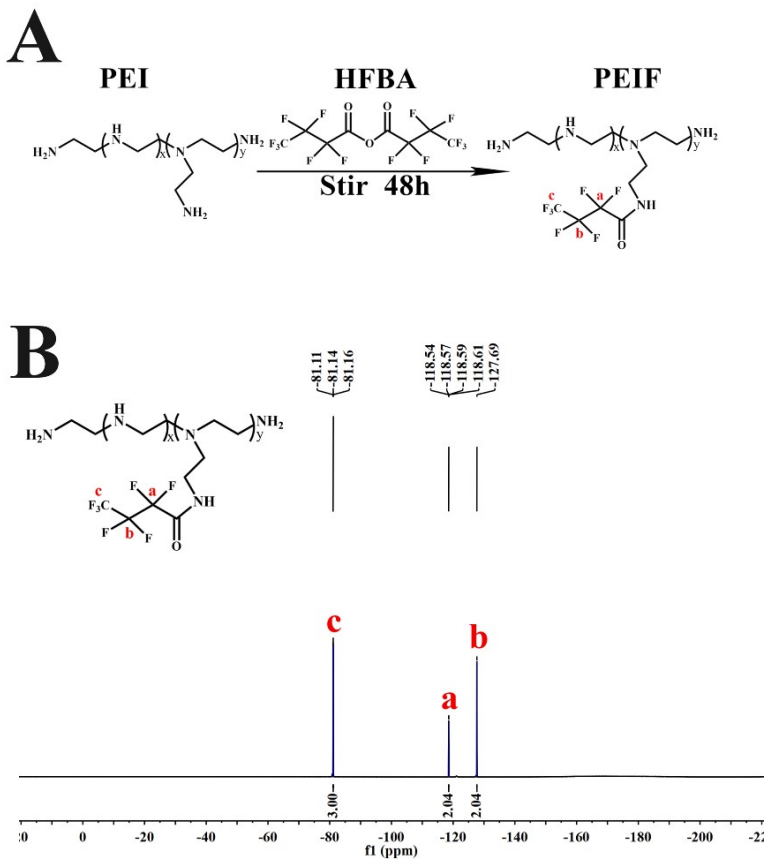

Fig. S1 (A) PEIF reaction equation (B) PEIF F NMR spectra

2. Distribution of elements in Eu NPs and Eu@PEIF NPs

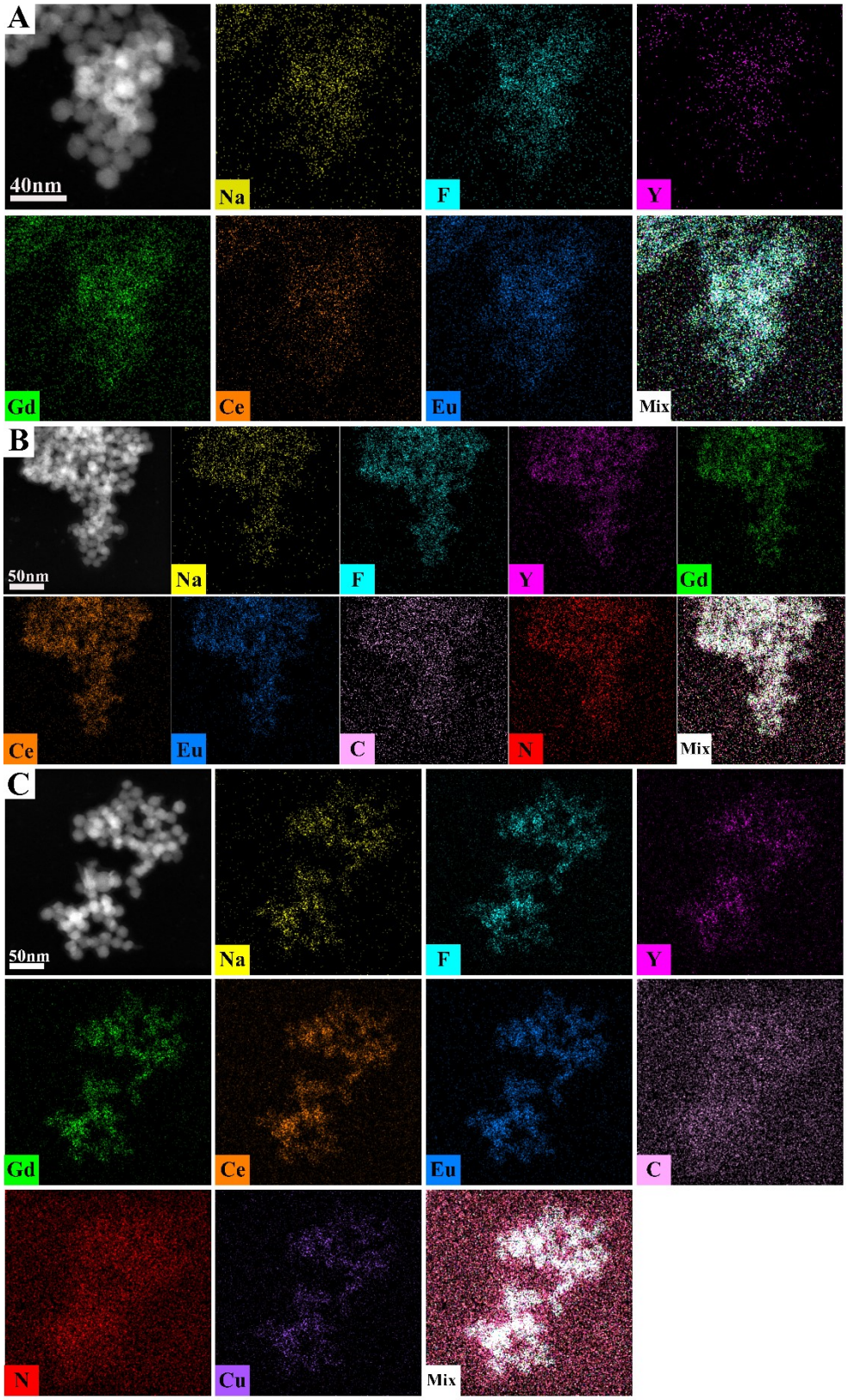

Fig. S2 (A) Eu NPs EDS mapping. (B) Eu@PEIF NPs EDS mapping. (C) Eu@PEIF NPs after addition of Cu^{2+} EDS mapping

Table S1 Element atomic fraction of Eu NPs, Eu@PEIF NPs and Eu@PEIF NPs+Cu^{2+}

	Na(%)	F(%)	Y(%)	Gd(%)	Ce(%)	Eu(%)	C(%)	N(%)	Cu(%)
Eu NPs	10.28	69.21	12.83	5.74	1.52	0.42	-	-	-
Eu@PEIF NPs	2.43	24.44	3.71	1.60	0.34	0.15	64.04	3.29	-
Eu@PEIF NPs+Cu^{2+}	0.79	9.54	0.82	0.45	0.12	0.03	83.90	1.85	2.5

3. UV absorption of PEIF mixed with Cu^{2+}

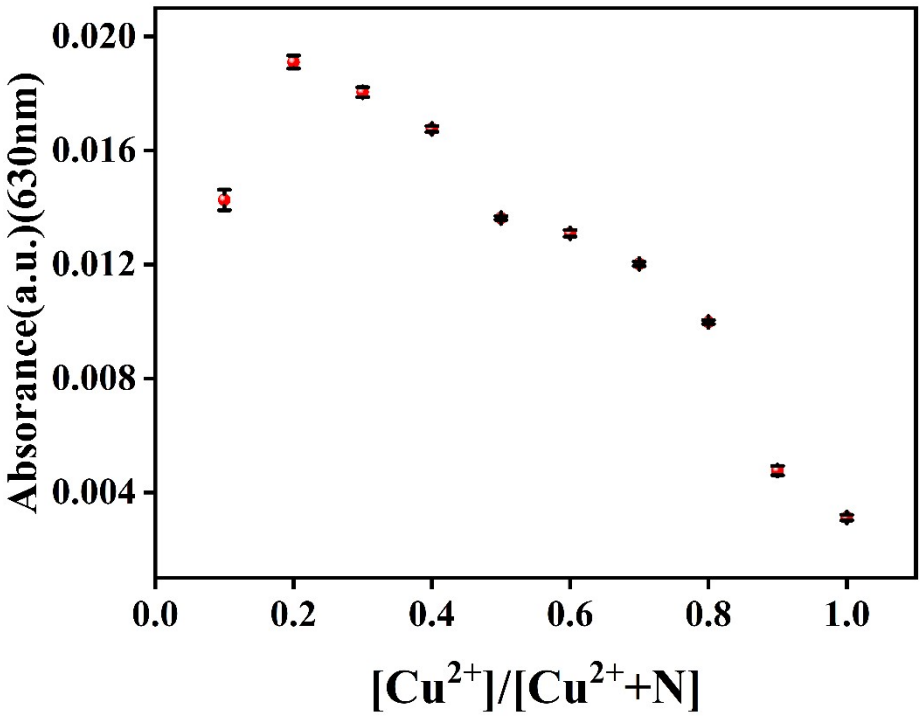

Fig. S3 UV absorption of Cu^{2+} and PEIF mixtures located at 630 nm at different proportional concentrations

4. Analysis of the quenching mechanism

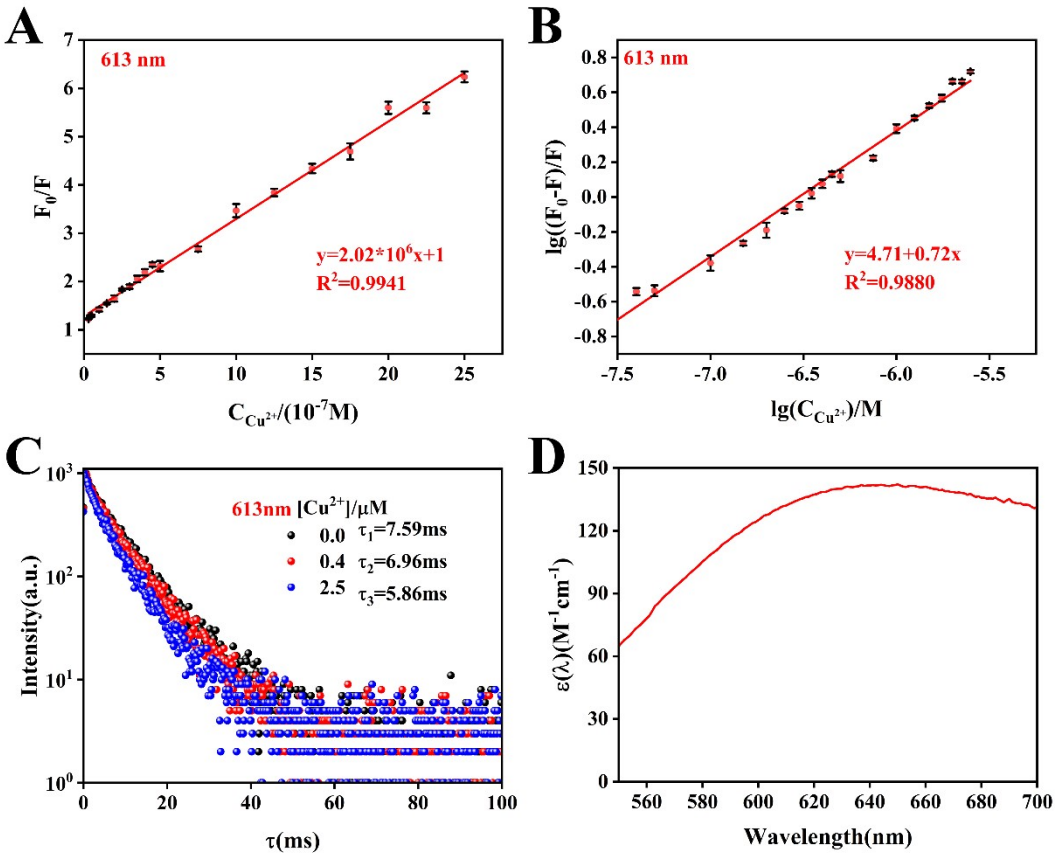

Fig. S4 (A) Linear fitting plot of F_0/F at 613 nm. (B) The double logarithmic curve at 613 nm. (C) Fluorescence lifetimes of Eu@PEIF NPs located at 613 nm after addition of different concentrations of Cu^{2+}. (D) Molar absorbance absorption of 550 nm-700 nm PEIF with Cu^{2+} complex.

5. Selectivity to Cu^{2+}

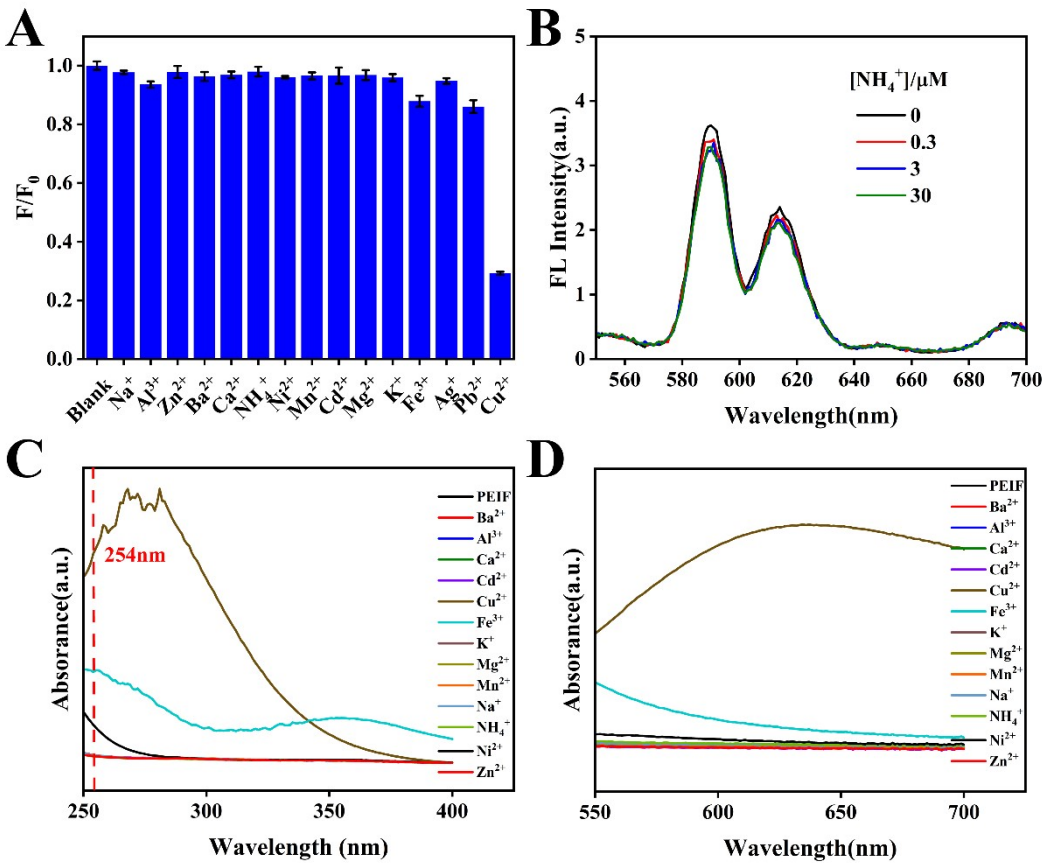

Fig. S5 (A) Fluorescence changes of Eu@PEIF NPs after individual addition of a certain amount of interfering ion (Na^+, Al^{3+}, Zn^{2+}, Ba^{2+}, Ca^{2+}, NH_4^+, Ni^{2+}, Mn^{2+}, Cd^{2+}, Mg^{2+}, K^+ and Fe^{3+} all at a concentration of 100 μM, and Cu^{2+} at a concentration of 0.5 μM). (B)Fluorescence changes of Eu@PEIF NPs after addition of a certain amount of Cu^{2+} with different concentrations of NH_4^+. UV absorption at (C) 250 nm-400 nm and (D) 550 nm- 700 nm of different ions mixed with PEIF at the same concentration.

6. The detection of Cu^{2+} in an actual sample

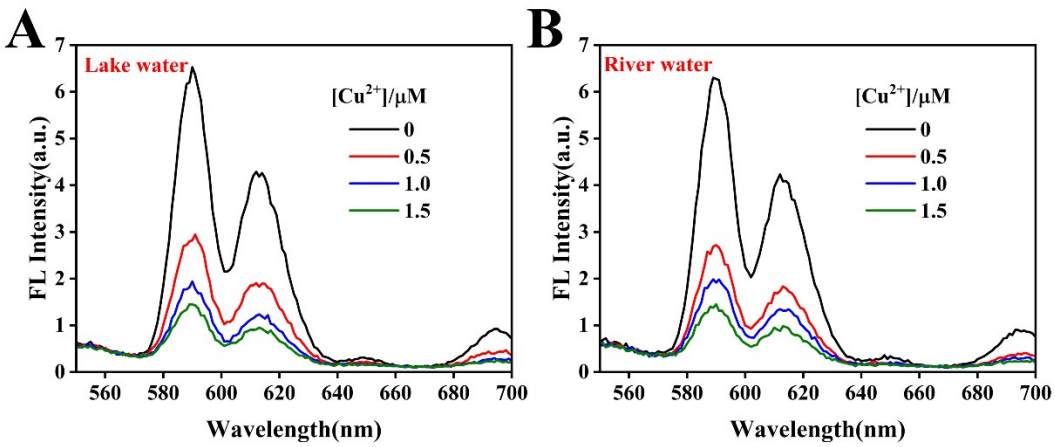

Fig. S6 Spectra of Eu@PEIF NPs after adding different concentrations of Cu^{2+} in (A) lake water and (B)river water