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Supplementary Information for

Artificial Tongue Based on Carbon Dots and Porphyrin Derivative for Pattern Recognition of Metal Ions

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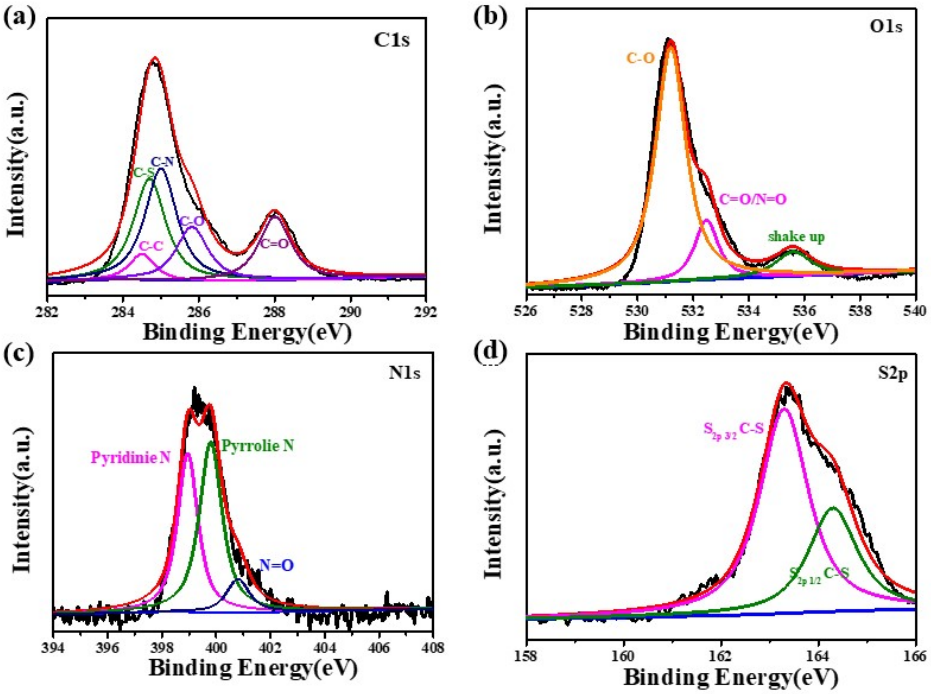


Figure S1. High-resolution XPS spectra of C-Dots (a) C 1s, (b) O 1s, (c) N 1s, and (d) S 2p

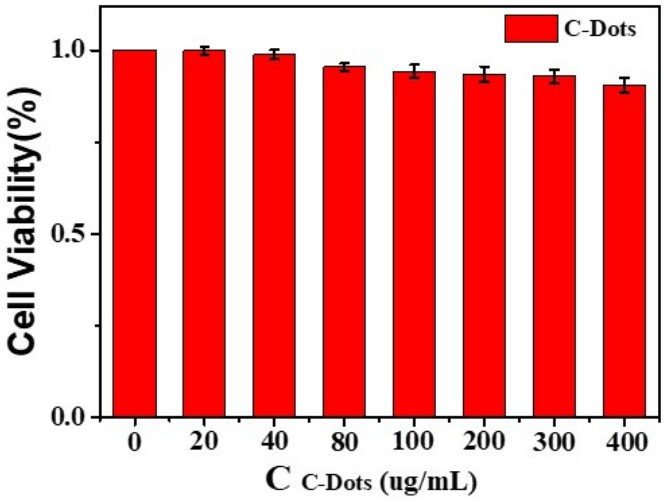


Figure S2. Cell viability of Hela cells with different concentration of C-Dots (1~ 400 μg/mL). 20 μL of MTT (5 mg/mL) was added into each well and the cells were incubated for additional 4 h. The culture medium was removed, and the mixtures were dissolved in 200 mL of dimethyl sulfoxide (DMSO) with continuous shaking for 10 min. The optical density (OD) of the purple formazan in each well at 490 nm was measured using an enzyme-linked immunosorbent assay (ELISA) plate reader with pure DMSO as the blank. The formula of cytotoxicity was: cell viability (%) = OD treated/OD control ×100, in which OD control and OD treated are the OD of the cells before and after the treatment with C-Dots. The results were expressed by the mean standard deviation of five repeated experiments).

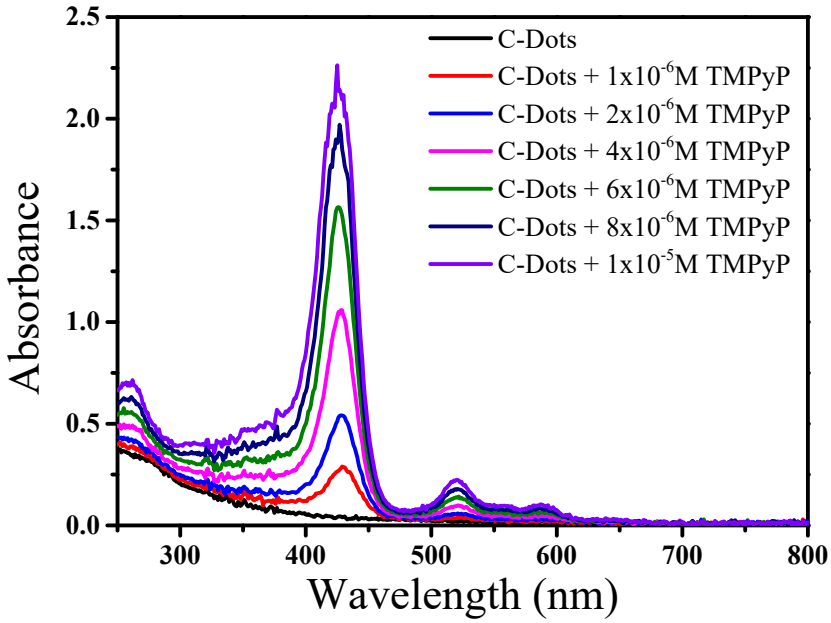


Figure S3. UV–Vis spectra of C-Dots solution in the presence of increasing TMPyP concentrations (0-10 uM).

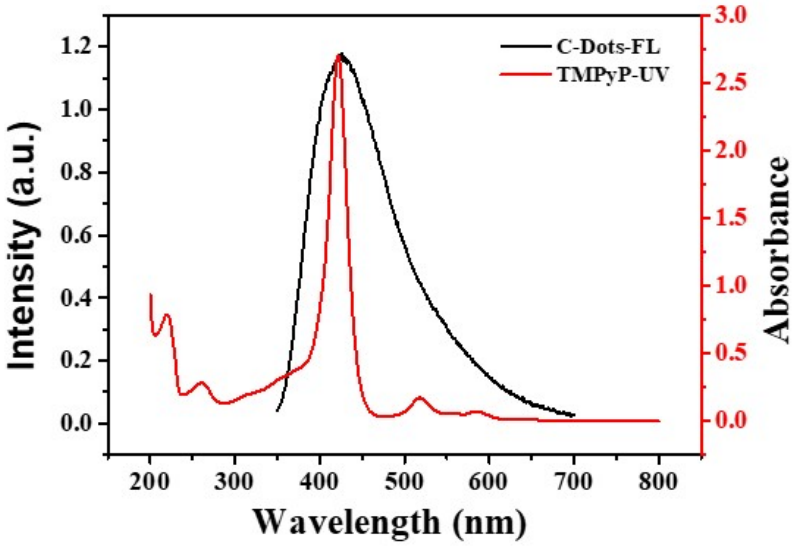


Figure S4. Fluorescence emission spectra of C-Dots (excited at 320 nm) and UV-Vis spectra of TMPyP.

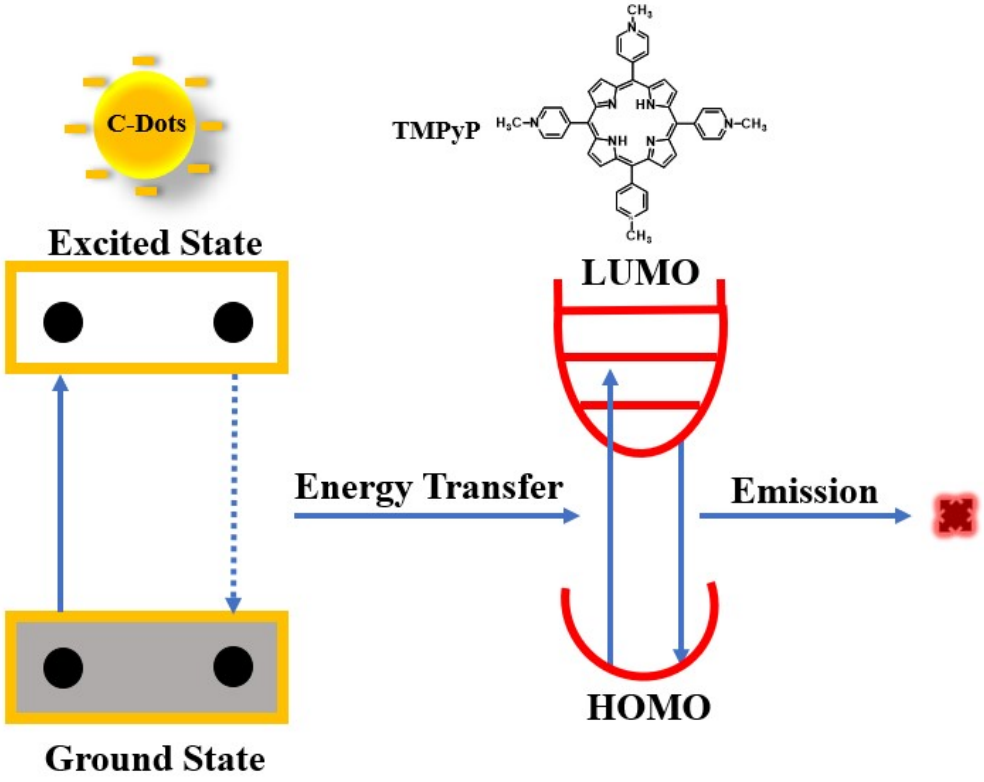


Figure S5. Luminescence mechanism of Fluorescence resonance energy transfer between C-Dots and TMPyP.

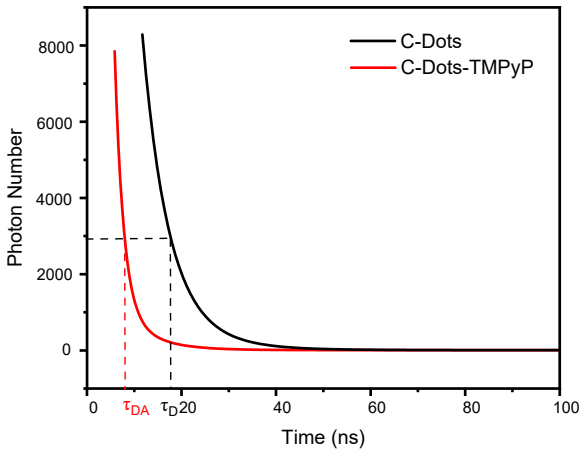


Figure S6 The lifetime of C-Dots (τ_D) and C-Dots-TMPyP (τ_{DA})

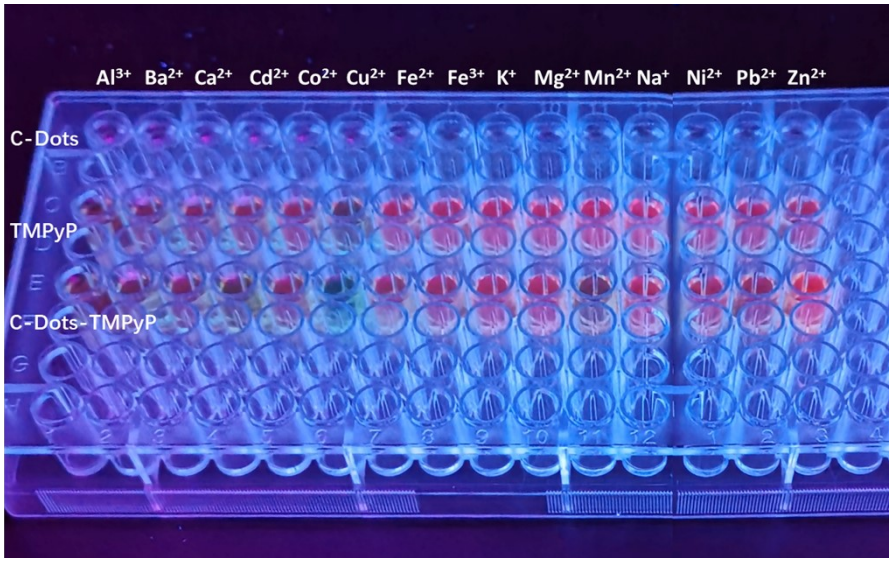


Figure S7 The sensor array of different metal ions under UV light

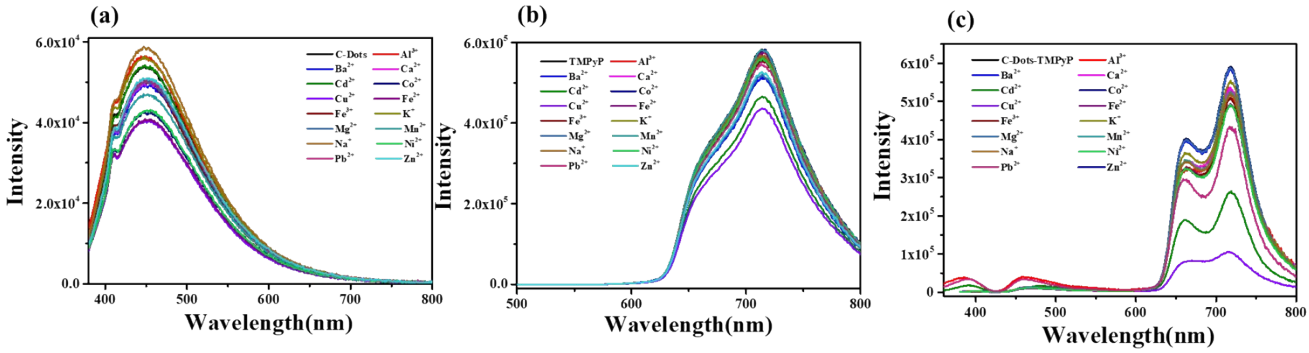


Figure S8 Fluorescence spectra (a) C-Dots, (b) TMPyP and (c) C-Dots-TMPyP upon addition of various metal ions (metal ions = 16 μM). The excitation wavelengths were 320 nm, 420 nm and 320 nm respectively.

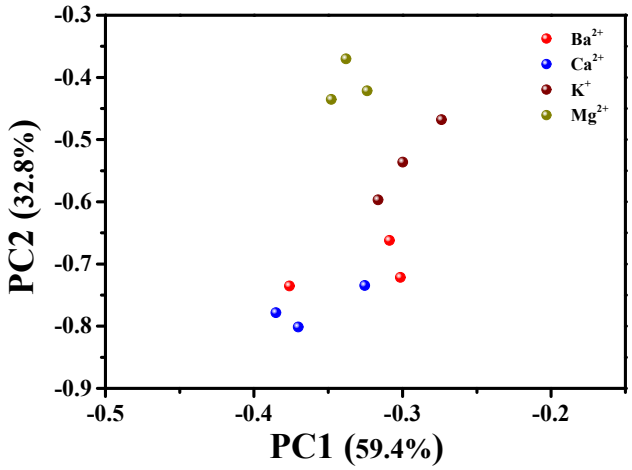
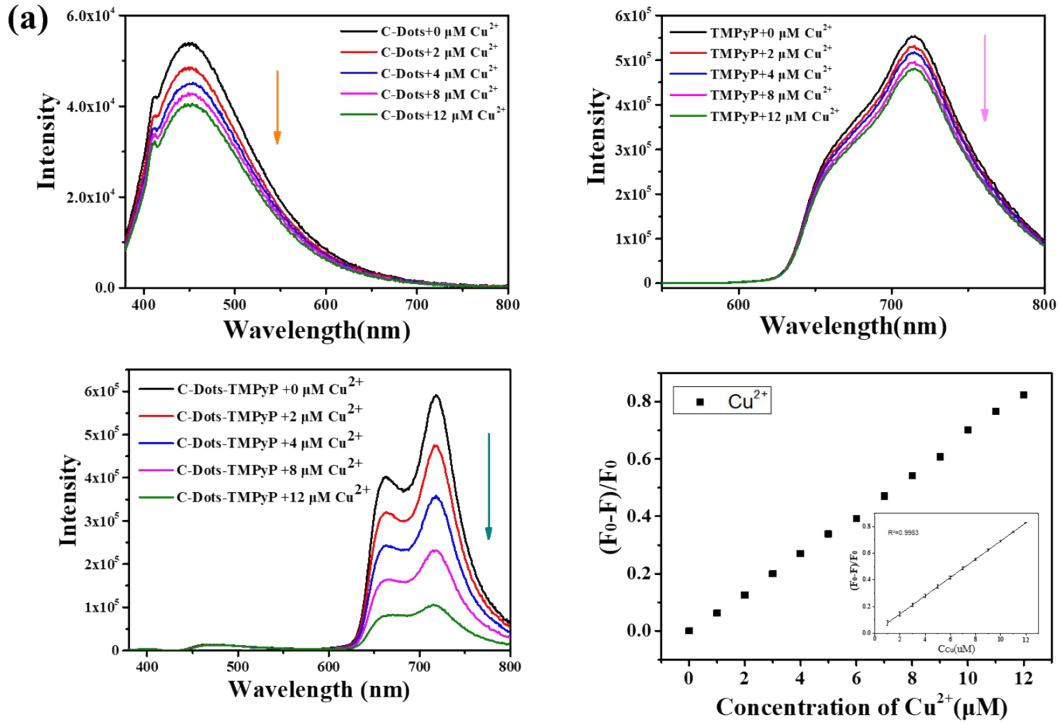
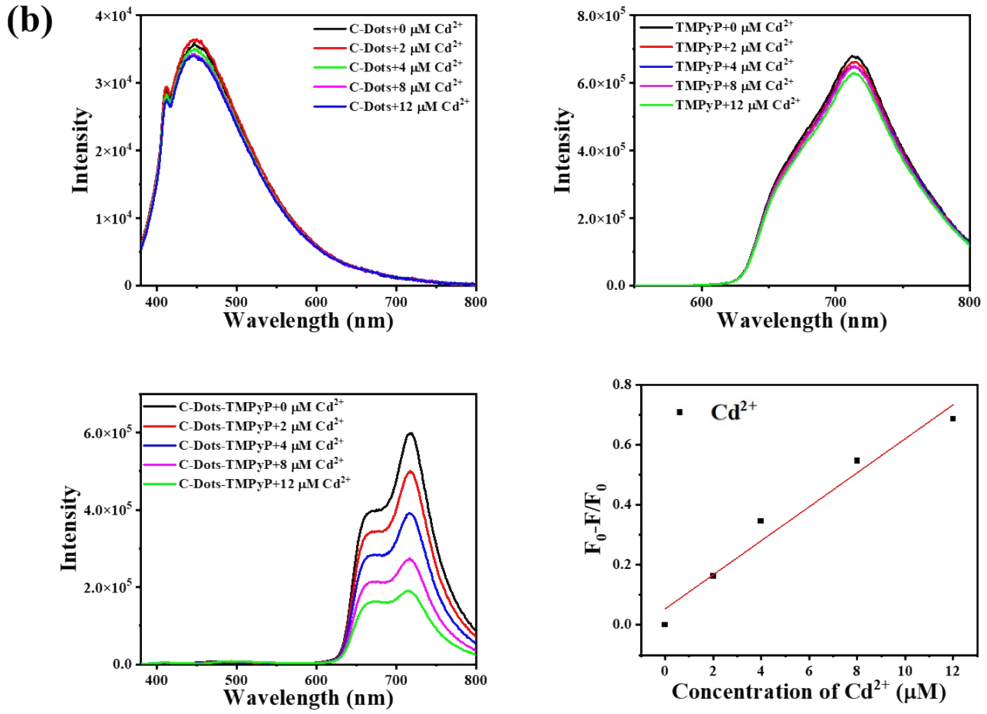
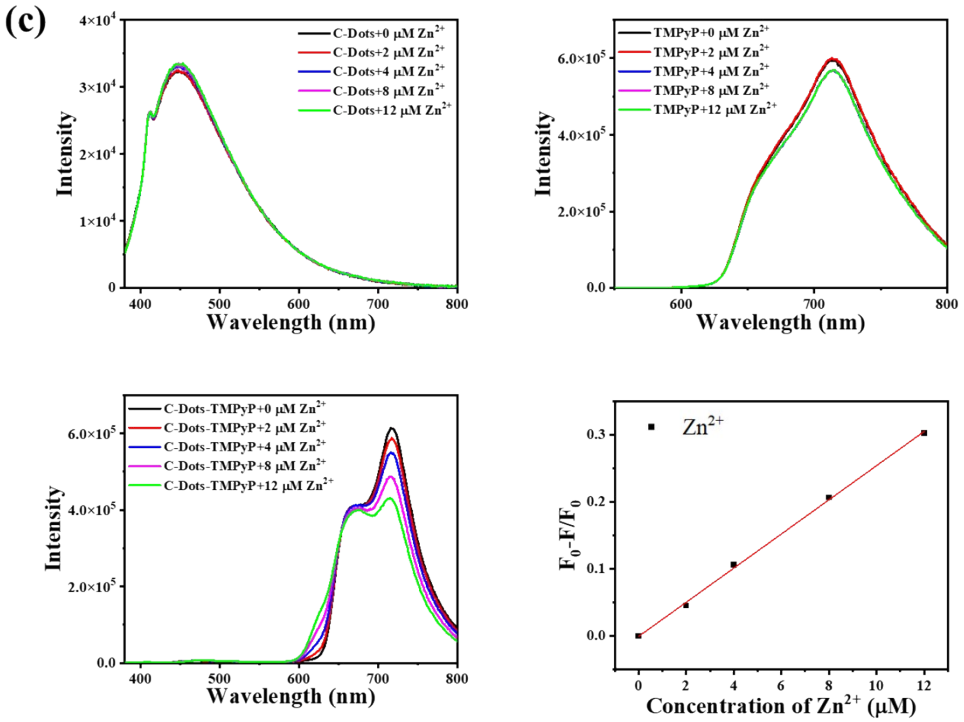


Figure S9 The enlarged 2D plot of the metal ions including Ba^{2+} ， Ca^{2+}, K^{+} and Mg^{2+} ions.




(b)
C-Dots+0 μM Cd2+
C-Dots+2 μM Cd2+
C-Dots+4 μM Cd2+
C-Dots+8 μM Cd2+
C-Dots+12 μM Cd2+
Intensity
Wavelength (nm)
TMPyP+0 μM Cd2+
TMPyP+2 μM Cd2+
TMPyP+4 μM Cd2+
TMPyP+8 μM Cd2+
TMPyP+12 μM Cd2+
C-Dots-TMPyP+0 μM Cd2+
C-Dots-TMPyP+2 μM Cd2+
C-Dots-TMPyP+4 μM Cd2+
C-Dots-TMPyP+8 μM Cd2+
C-Dots-TMPyP+12 μM Cd2+
Cd2+
F0-F/F0
Concentration of Cd2+ (μM)


(c)
C-Dots+0 μM Zn2+
C-Dots+2 μM Zn2+
C-Dots+4 μM Zn2+
C-Dots+8 μM Zn2+
C-Dots+12 μM Zn2+
Intensity
Wavelength (nm)
TMPyP+0 μM Zn2+
TMPyP+2 μM Zn2+
TMPyP+4 μM Zn2+
TMPyP+8 μM Zn2+
TMPyP+12 μM Zn2+
C-Dots-TMPyP+0 μM Zn2+
C-Dots-TMPyP+2 μM Zn2+
C-Dots-TMPyP+4 μM Zn2+
C-Dots-TMPyP+8 μM Zn2+
C-Dots-TMPyP+12 μM Zn2+
Zn2+
F0-F/F0
Concentration of Zn2+ (μM)

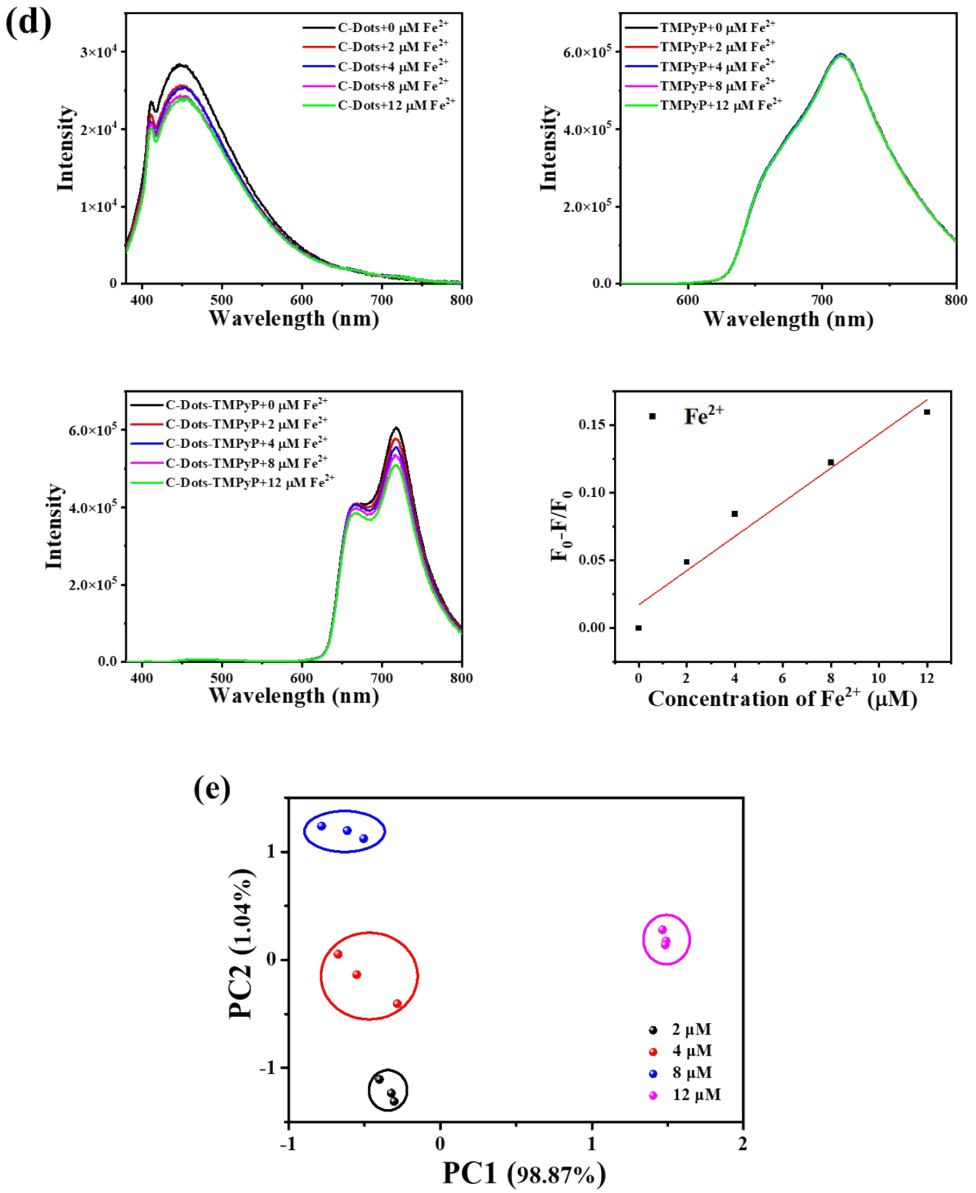


Figure S10. Fluorescence spectra of C-Dots, TMPyP and C-Dot-TMPyP upon addition of Cu^{2+}, Cd^{2+}, Zn^{2+} and Fe^{2+} (a-d) solutions with various concentrations. (The excitation wavelengths were 320 nm, 420 nm and 320 nm respectively). (a) bottom right: relationship between the relative PL intensity (F_0-F/F_0) of C-Dots-TMPyP and Cu^{2+} concentration (Inset: copper ion detection limit (LOD) = 0.25 μM). (e) Plot derived from Cu^{2+} samples with four different concentrations by PCA.

Table S1 The information of all the calibration curves

Metal ions	Calibration equation	R-squared value
Cu^{2+}	$(F_0-F)/F_0=0.069[Cu^{2+}]-0.00973$	0.9983
Cd^{2+}	$(F_0-F)/F_0=0.056[Cd^{2+}]+0.05373$	0.9641
Fe^{2+}	$(F_0-F)/F_0=0.012[Fe^{2+}]+0.0174$	0.9541
Zn^{2+}	$(F_0-F)/F_0=0.025[Zn^{2+}]-0.0033$	0.9989