

Supporting Information

A novel fluorescent “on-off-on” assay for discriminative detection of Cu(II) and L-cysteine based on red-emissive Si-CDs and cellular imaging application

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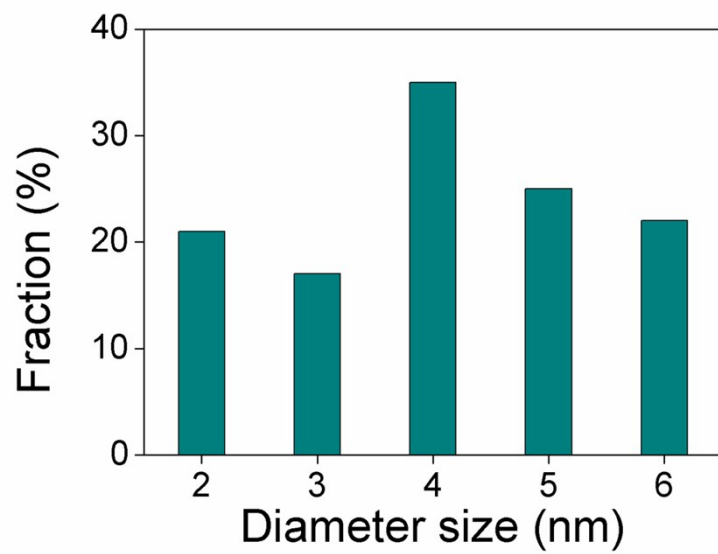


Figure S1: Size distribution of the Si-CDs.

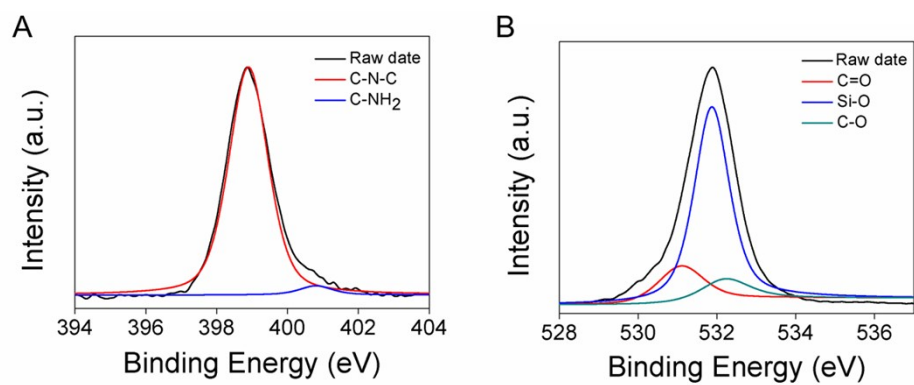


Figure S2: (A) N 1s XPS of Si-CDs. (B) O 1s XPS of Si-CDs.

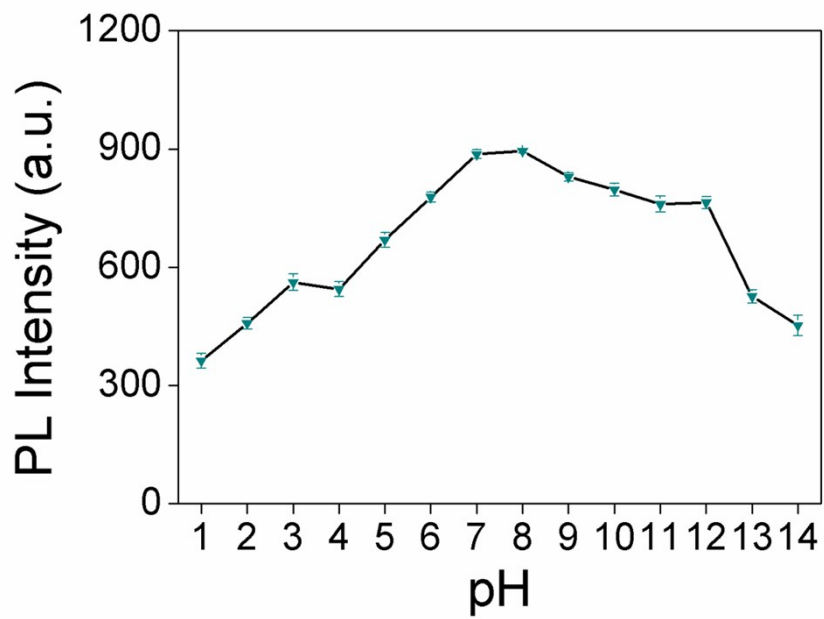


Figure S3: Effect of pH value on the PL intensity of Si-CDs system.

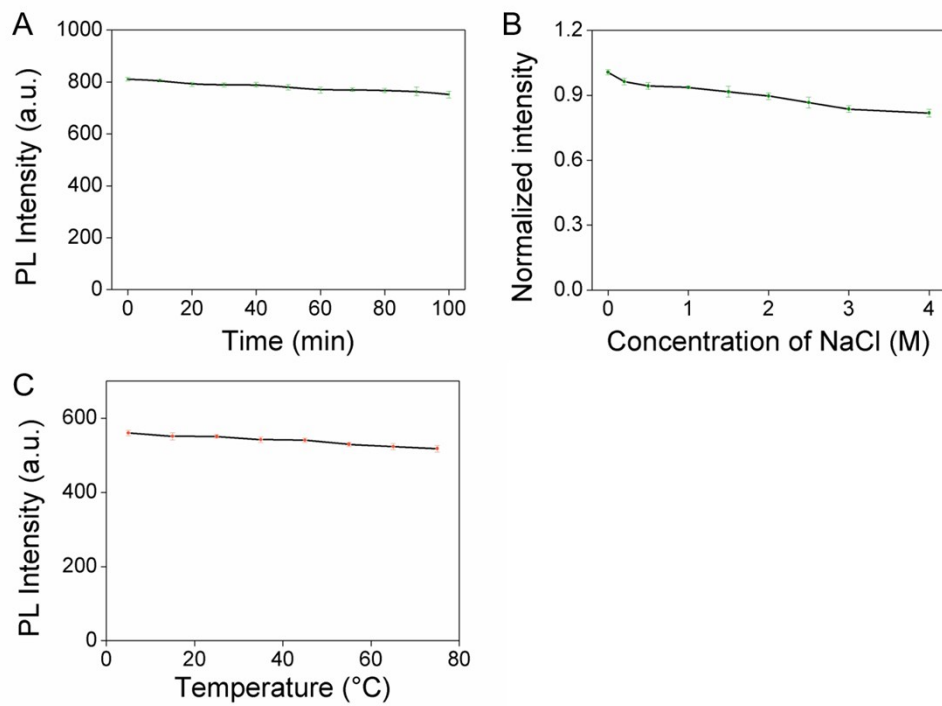


Figure S4: Effects of (A) UV irradiation, (B) ionic strength and (C) different temperature on the PL intensity of Si-CDs.

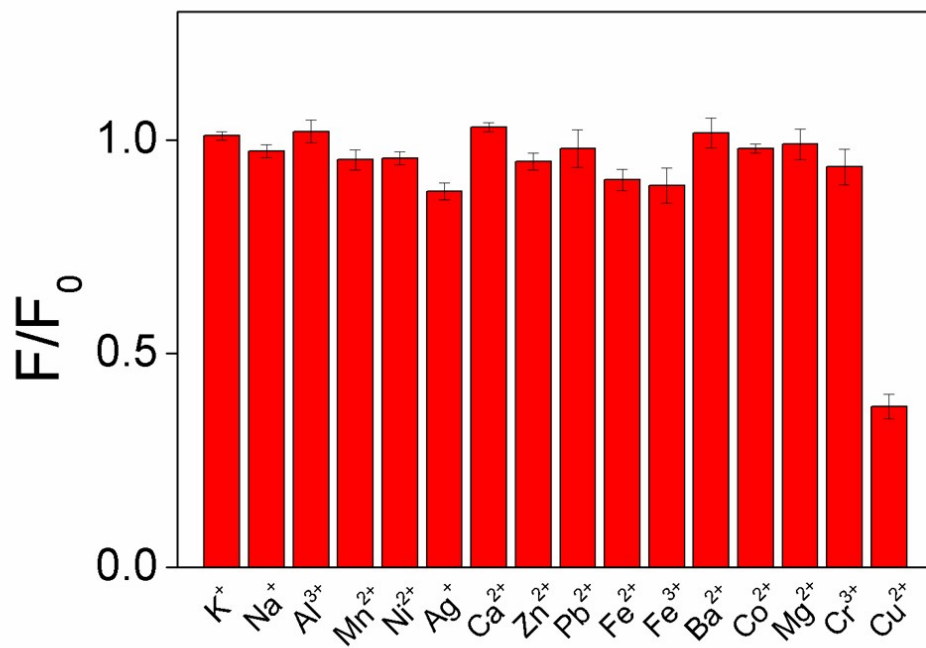


Figure S5: Various metal ions effects on Cu^{2+} determination.

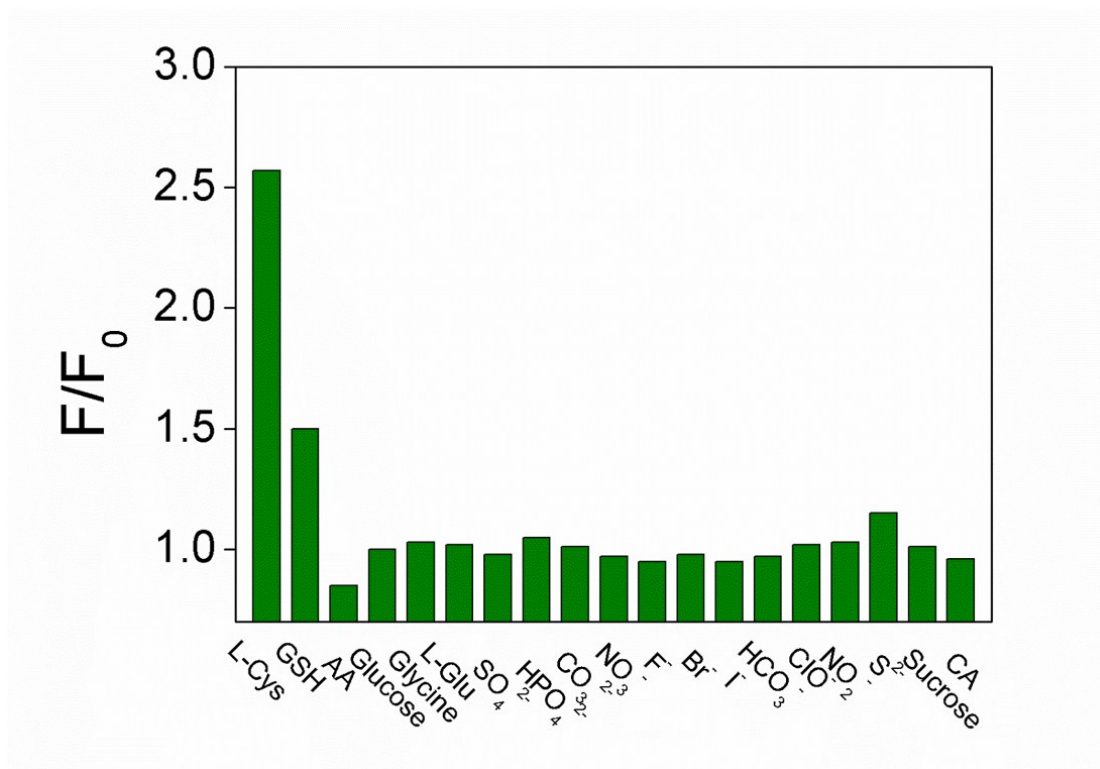


Figure S6: Fluorescence response of the Si-CDs@Cu²⁺ system in the presence of different analytes.

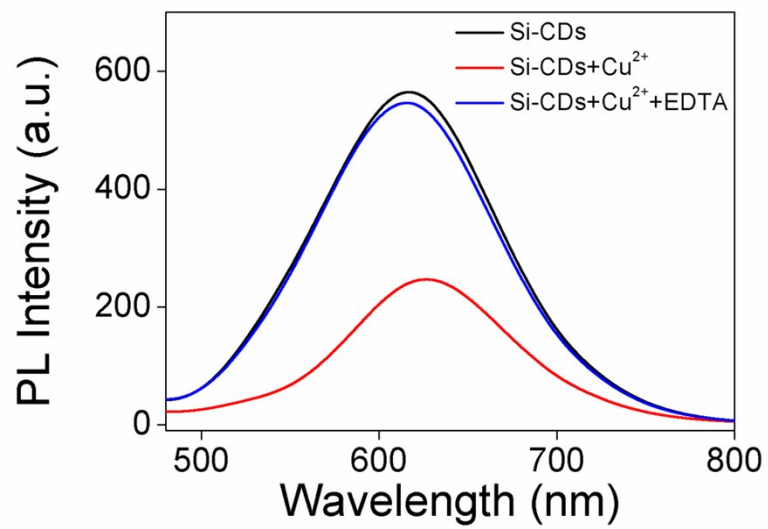


Figure S7: Fluorescence spectra of Si-CDs, Si-CDs+Cu²⁺, and Si-CDs+Cu²⁺+EDTA.

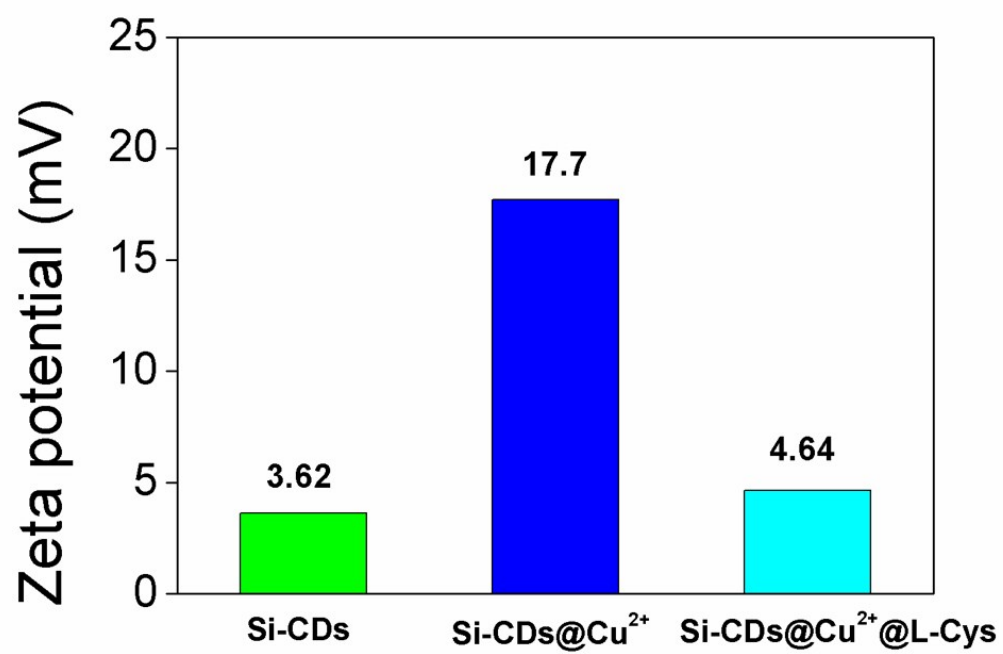


Figure S8: Zeta potential values of the Si-CDs, Si-CDs@Cu²⁺ and Si-CDs@Cu²⁺@L-Cys.

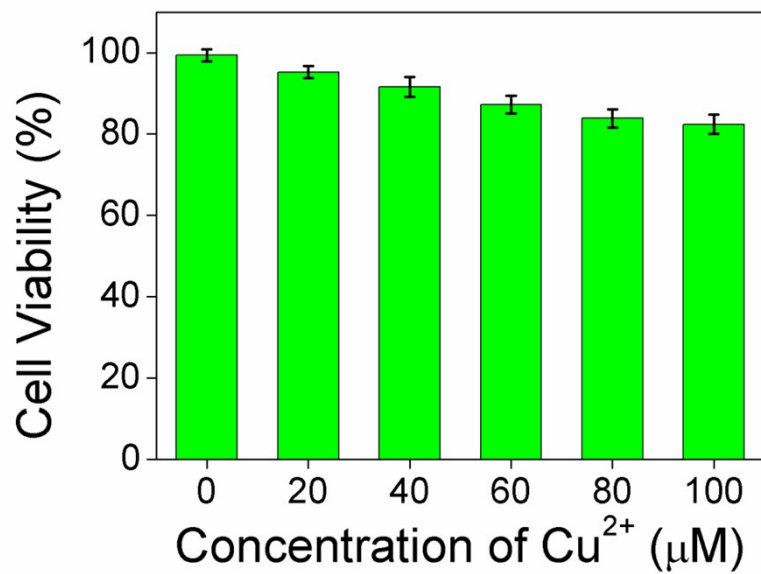


Figure S9: Cytotoxicity test of Si-CDs@Cu²⁺ on HeLa cells viability.

Table S1. Different methods for Cu²⁺ detection.

Methods	Linear range (μM)	Detection limit (μM)	Detection Wavelength	Reference
Colorimetry	0.1-10.0	0.632	—	1 ¹
Electrochemistry	0.08–2.2	0.0355	—	2 ²
B,N-carbon dots	1-25.0	0.3	green	3 ³
NCDs	10-400	10	blue	4 ⁴
CNDs	0.6-35.0	0.17	blue	5 ⁵
FIIS	0-70.0	0.11	529 nm	6 ⁶
Si-CDs	10 ~ 90	0.53	red	This work

Table S2: Fitted parameters of the FL decay curves of the Si-CDs, Si-CDs@Cu²⁺, Si-CDs@Cu²⁺@L-Cys in aqueous solution. Note: The lifetime was monitored by the emission wavelength at 615 nm.

Sample	τ_1 (ns)	A ₁ (%)	τ_2 (ns)	A ₂ (%)	ϕ	τ_{avg} (ns)
Si-CDs	2.5	75.29	7.9	24.71	1.273	5.25
Si-CDs@Cu ²⁺	2.09	74.11	5.89	25.89	1.203	3.97
Si-CDs@Cu ²⁺ @L-Cys	2.64	74.31	7.71	25.69	1.16	5.19

Table S3. Determination of the level of Cu²⁺ ions in tap water samples and L-Cys in human plasma samples.

Sample	Analyte	Add (μM)	Found (μM)	Recovery (%)	RSD (n=3, %)
Tap water 1	Cu ²⁺	5	5.03	100.6	2.3
Tap water 2	Cu ²⁺	10	10.28	102.8	1.0
Plasma 1	L-Cys	10	10.43	104.3	1.5
Plasma 2	L-Cys	20	19.84	99.2	3.6

References :

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