Supplementary Information

Onsite naked-eye detection and quantification of Cu(II) ions in drinking water using N-doped Carbon nanodots

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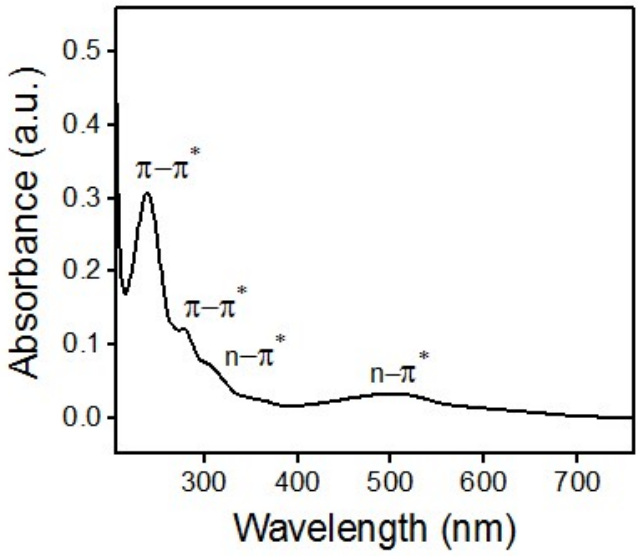


Figure S1: UV-vis absorbance spectrum of PD-CNDs

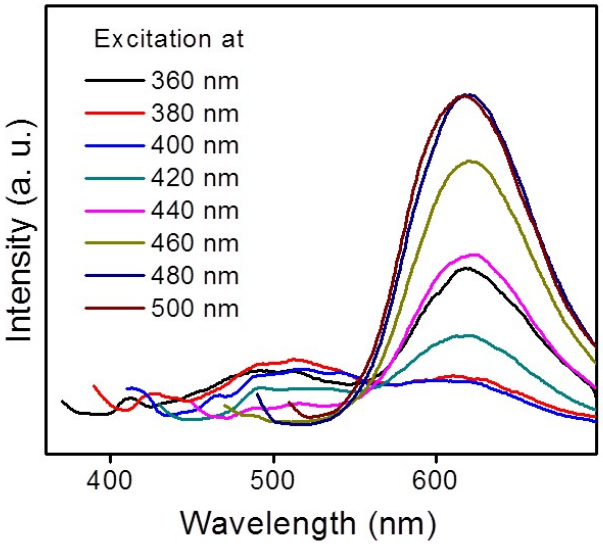


Figure S2: Excitation dependency nature of PD-CNDs

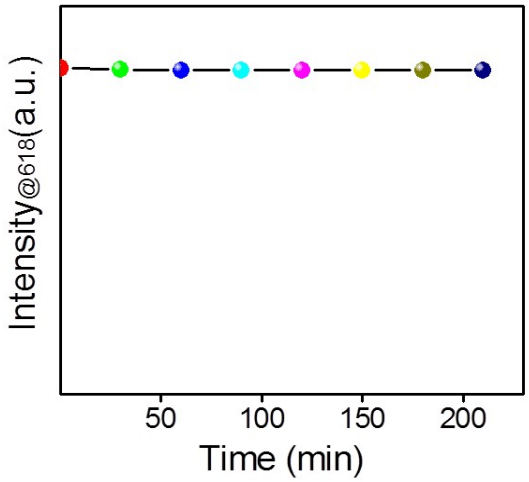


Figure S3: photostability curve of PD-CNDs

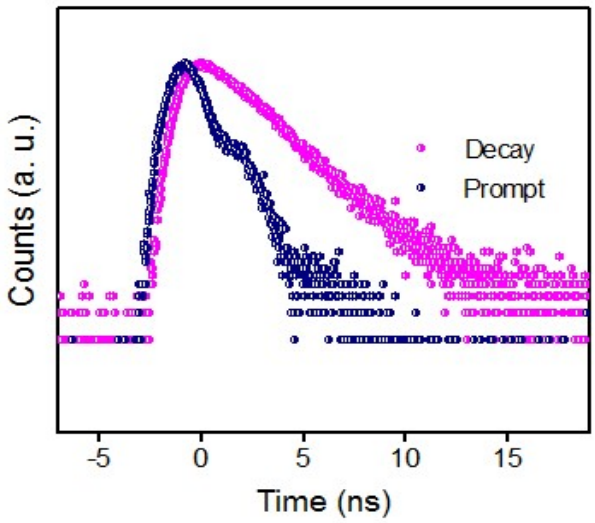


Figure S4: fluorescence lifetime decay profile of PD-CNDs (λ_{em}= 618 nm)

Figure S5: PD-CND solution (left) and after adding Cu^{2+} solution (20 μM) captured within 1 min

Application of PD-CNDs in real samples

To further evaluate the practicability, the as-synthesized PD-CNDs were used to detect Cu^{2+} in different water samples by the standard addition method. All the water samples were directly mixed with the CND solution, and then subjected to the fluorescence measurements. A consistent decrease in fluorescence intensity as well as the colour change **(Figure S6)** of PD-CND was noted across the three samples selected for the analysis. The corresponding Stern-volmer plots are displayed in **Figure S7.** The limit of detection in these samples are closely matching with that observed in deionized water. These results confirm the application of the system in real sample analysis. Known concentration of Cu^{2+} ions were added to each samples and the error percentage was calculated using the linear calibration plots. The results depicted in **Table S1** confirm the reliability of analysing Cu^{2+} in real water samples.

Figure S6: Real sample analysis using different water samples. The PD-CND solution prepared in different water samples and black colour developed after addition of Cu^{2+} ion solution (20 μM). The photographs are taken after 5 minutes of analyte addition.

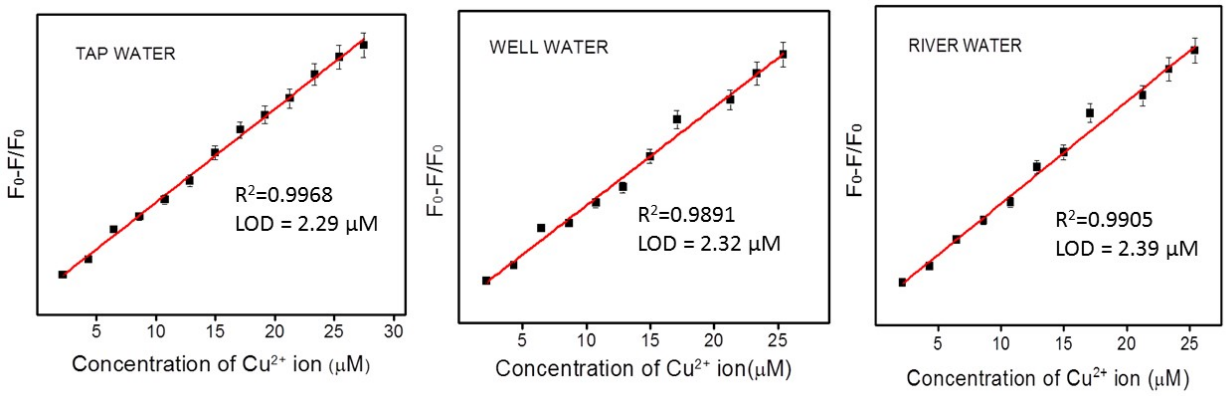


Figure S7: Stern-volmer plots of real sample analysis

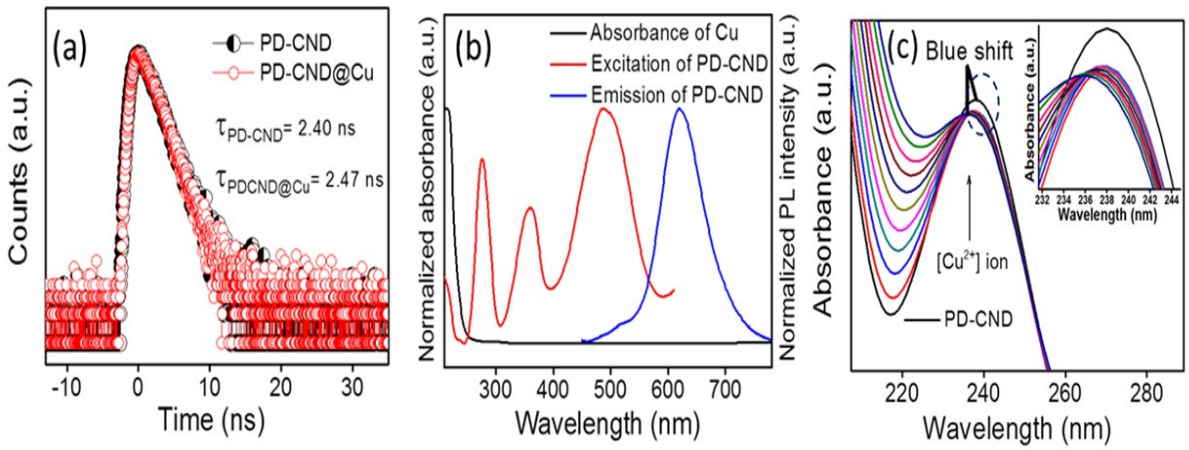
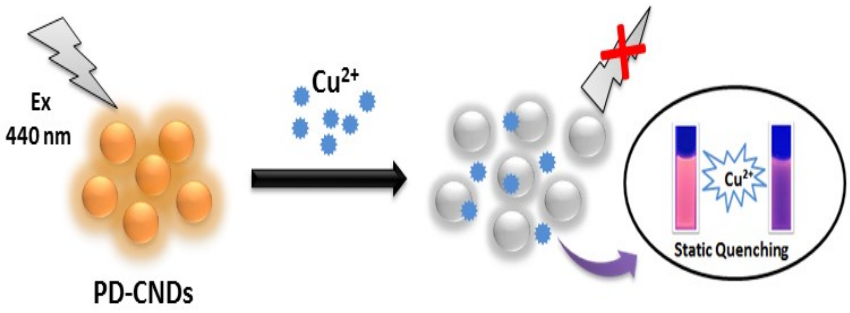


Figure S8: (a) Fluorescence decay profile of PD-CNDs before and after introduction of Cu^{2+} ion solution, (b) combination of absorption spectrum of copper, excitation and emission spectrum of PD-CNDs, (c) shift in the UV-vis absorption spectrum of PD-CNDs after addition of Cu^{2+} ion solution.



Scheme 1. Schematic representation of the luminescence reduction in presence of Cu^{2+}

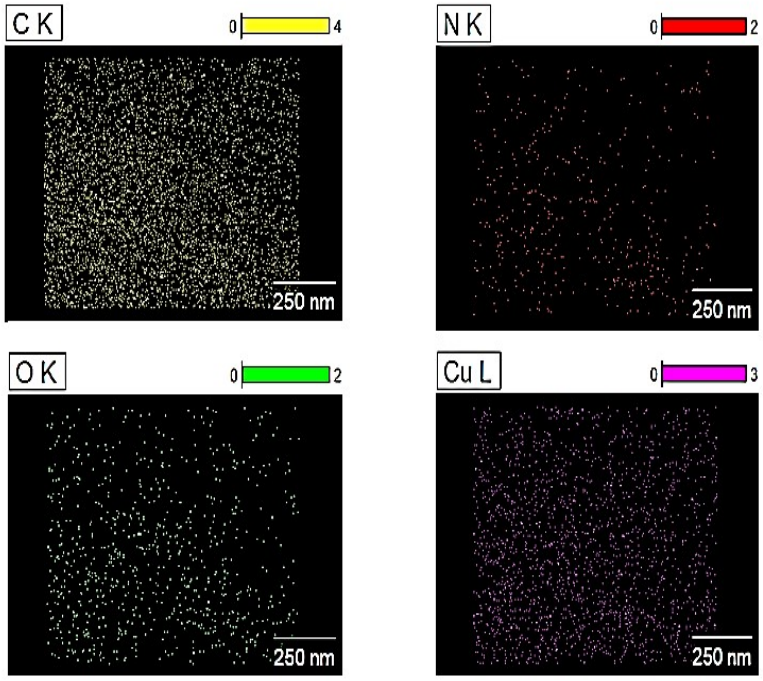


Figure S9: Elemental mapping of PD-CND@Cu

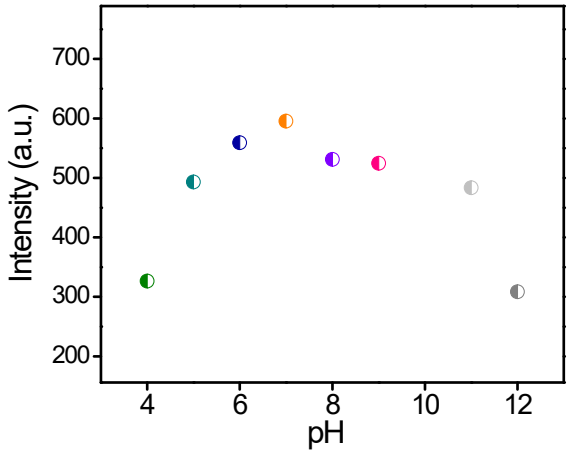


Figure S10: Effect of pH on luminescence intensity

Table S1: Results of Cu^{2+} detection in real samples using PD-CNDs

Water Samples	**Amount of Cu^{2+} added (µM)**	**Found using PD-CNDs (µM)**	**Error %**
TAP WATER	4.329	4.3580	0.66
	10.752	10.7885	0.33
	17.094	17.2123	0.69
WELL WATER	4.329	4.4080	1.82
	10.752	10.8023	0.46
	17.094	17.1322	0.22
RIVER WATER	4.329	4.2965	0.75
	10.752	10.8179	0.61
	17.094	17.1134	0.11

Table S2: Various carbon nanodot based sensors for the detection of Copper ions

Precursor	Method	LOD (in μM)	Ref
Ethylenediamine	Fluorescence	10	1
Citric acid/L-cystein/dextrin	Fluorescence	0.02	2
pipe tobacco	Fluorescence	0.01	3
o-Phenylenediamine/ammonium sulfate	Colorimetric Fluorescence	0.1 1	4
poly(vinylpyrrolidone) and L-Cysteine	Fluorescence	0.15	5
hexamethylene-tetramine and ammonium citrate	Fluorescence	0.025	6
aminophenylboronic acid	Fluorescence	0.3	7
bamboo leaves , polyethylenimine	Fluorescence	0.115	8
p-Phenylenediamine	Fluorescence	2.28	Present work

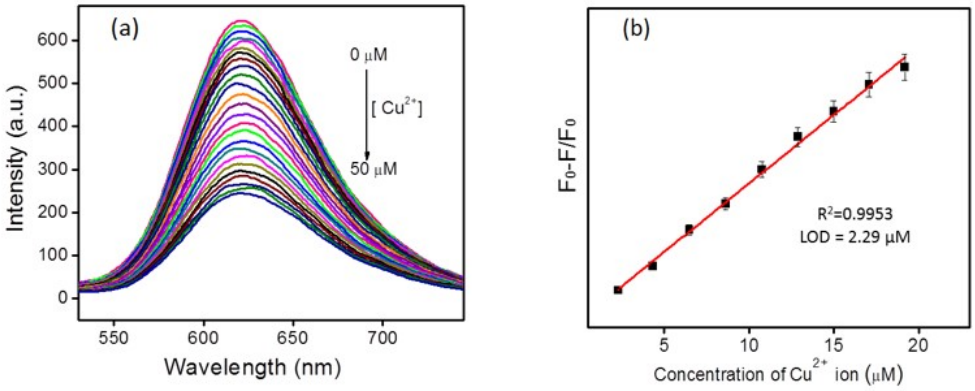


Figure S11: Data indicating excellent reproducibility of the system. (a) Fluorescence quenching observed upon Cu^{2+} addition to PD-CNDs synthesised in another batch, (b) Corresponding Stern-Volmer plot.

References

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