Supplementary Material

Microwave-assisted rapid synthesis of N-enriched amphibious carbon quantum dots for sensitive detection of ROS and multiple other applications

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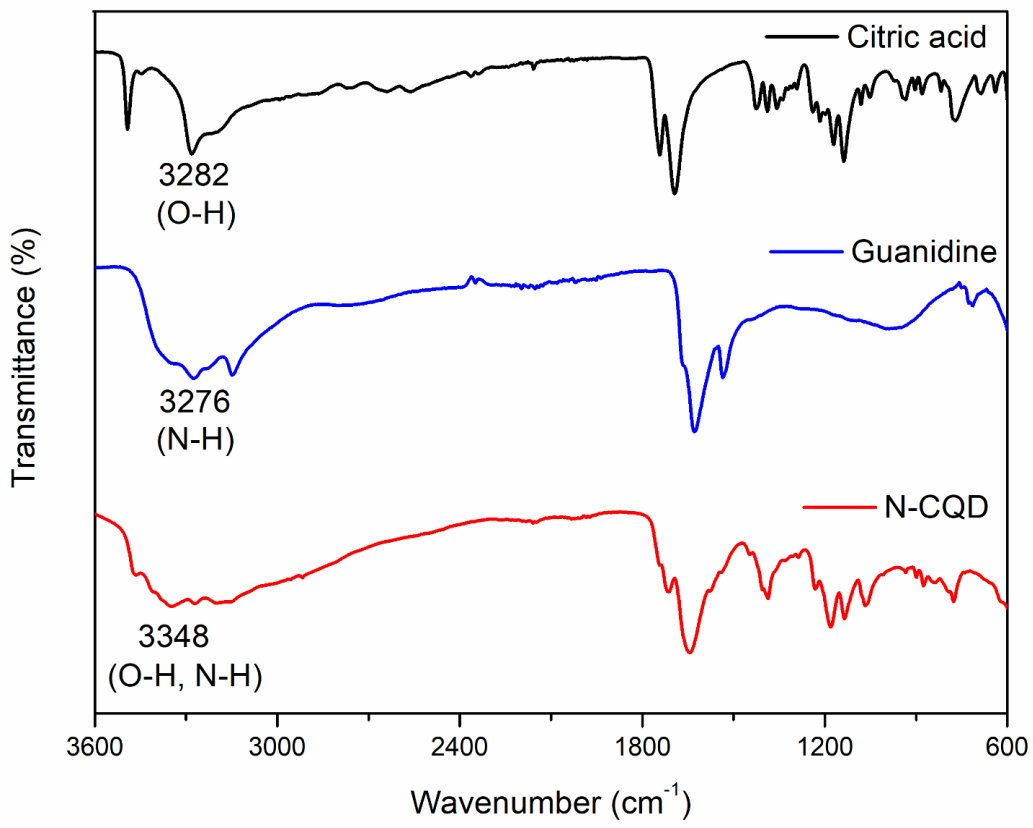


Figure S1. ATR-FTIR spectra of citric acid, guanidine nitrate, and synthesized nitrogen-doped carbon quantum dots (N-CQDs) highlighting the O-H and N-H bands in the wavenumber region from 3,500 to 3,300 cm^{-1}.

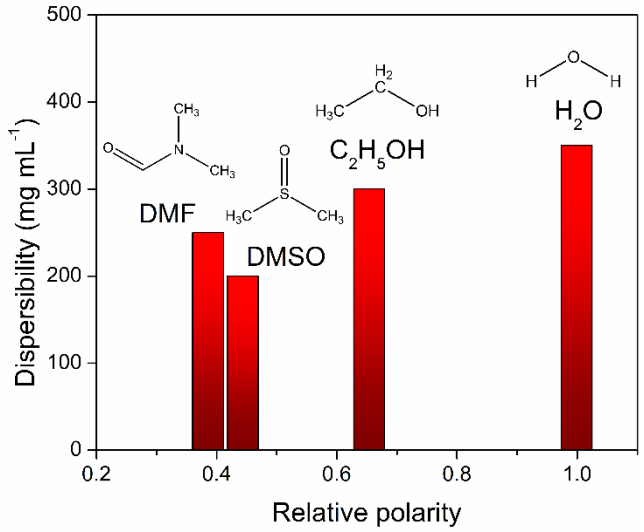
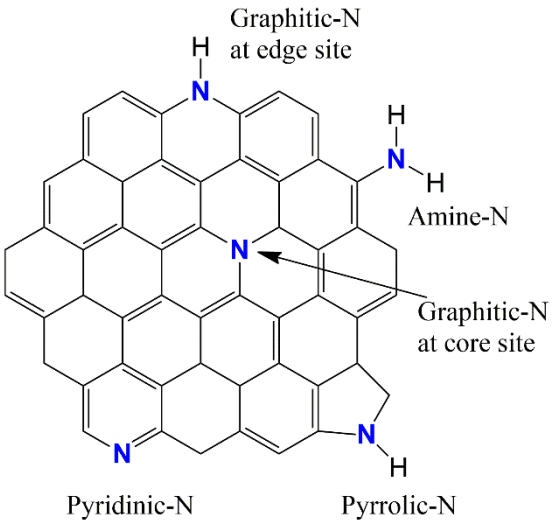


Figure S2. The dispersibility of nitrogen-doped carbon quantum dots in solvents with different solvent polarities. Abbreviation. DMSO: dimethyl sulfoxide.



Scheme S1. A schematic presentation of the different types of nitrogen containing moieties in nitrogen-doped carbon quantum dots.

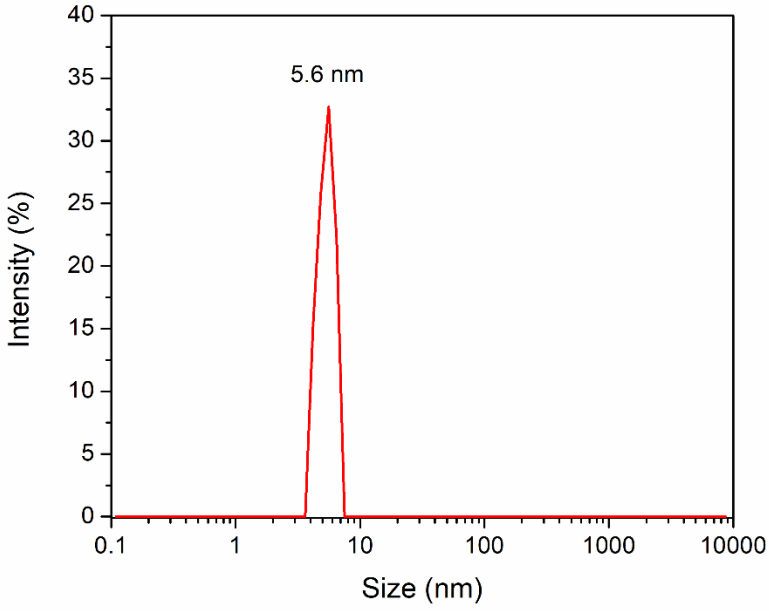


Figure S3. The size distribution of the synthesized N-CQDs measured in water was found to be within the range 3 to 8 nm which centered around 5.6 nm.

Evaluation of the Interplane Distance by the following Bragg's Equation,

$d_{(hkl)} = \lambda/(2\text{Sin }\theta)$,

Here, d = interplane spacing, and $\lambda = 0.15406$ nm

For, $2\theta = 19.4$, $d_{(002)} = 0.15406/(2\text{Sin }(19.4/2)) = 0.46$ nm

For, $2\theta = 9$, $d_{(100)} = 0.15406/(2\text{Sin }(9/2)) = 0.98$ nm

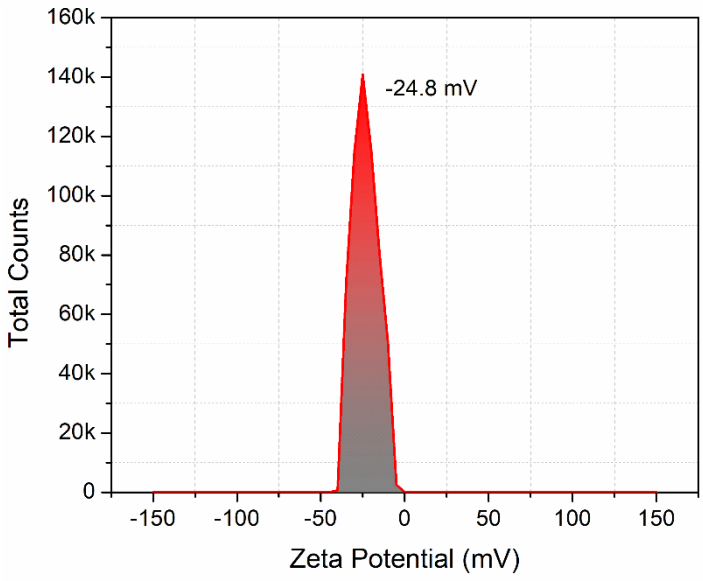


Figure S4. The surface charge of synthesized N-CQDs obtained by zeta-potential measurements in PBS buffer of pH 7.4.

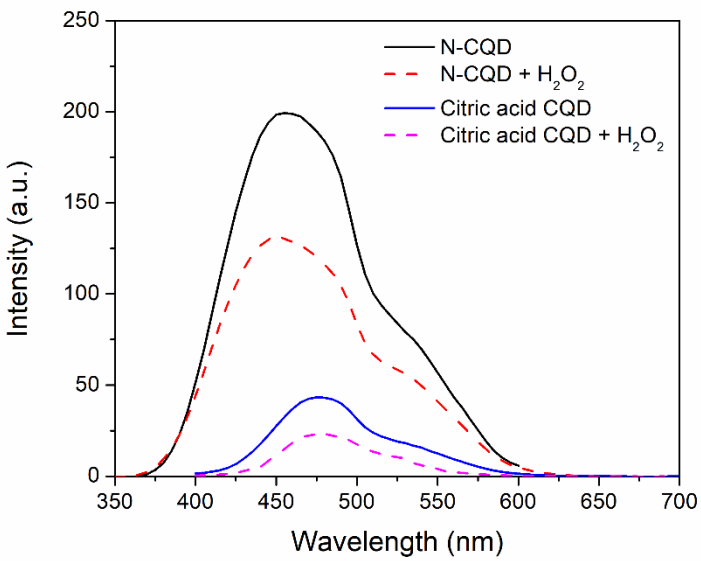


Figure S5. Fluorescence intensity of nitrogen-doped carbon quantum dot (N-CQD) is much higher than that of the carbon quantum dot prepared from citric acid (citric acid CQD). In addition, interaction of H_2O_2 with N-CQD is much more efficient than that of citric acid CQD.

Calculation of Quantum Yield

$$Q = Q_{\mathrm{R}} \frac{I}{I_{\mathrm{R}}} \frac{A_{\mathrm{R}}}{A} \left(\frac{\eta}{\eta_{\mathrm{R}}}\right)^2 = 0.31 \times \frac{60.3}{29.1} \times \frac{0.054}{0.089} \times \left(\frac{1.33}{1.33}\right)^2 = 0.39$$

Table S1. The different mass ratio of Citric Acid and Guanidine Nitrate and different reaction duration were investigated in this study.

Reaction Duration Mass Ratio of Citric Acid and Guanidine Nitrate	10 min	7 min	5 min	3 min	2 min
1 : 1	√	√	√	√	√
1 : 2	√	√	√	√	√
2 : 1	√	√	√	√	√

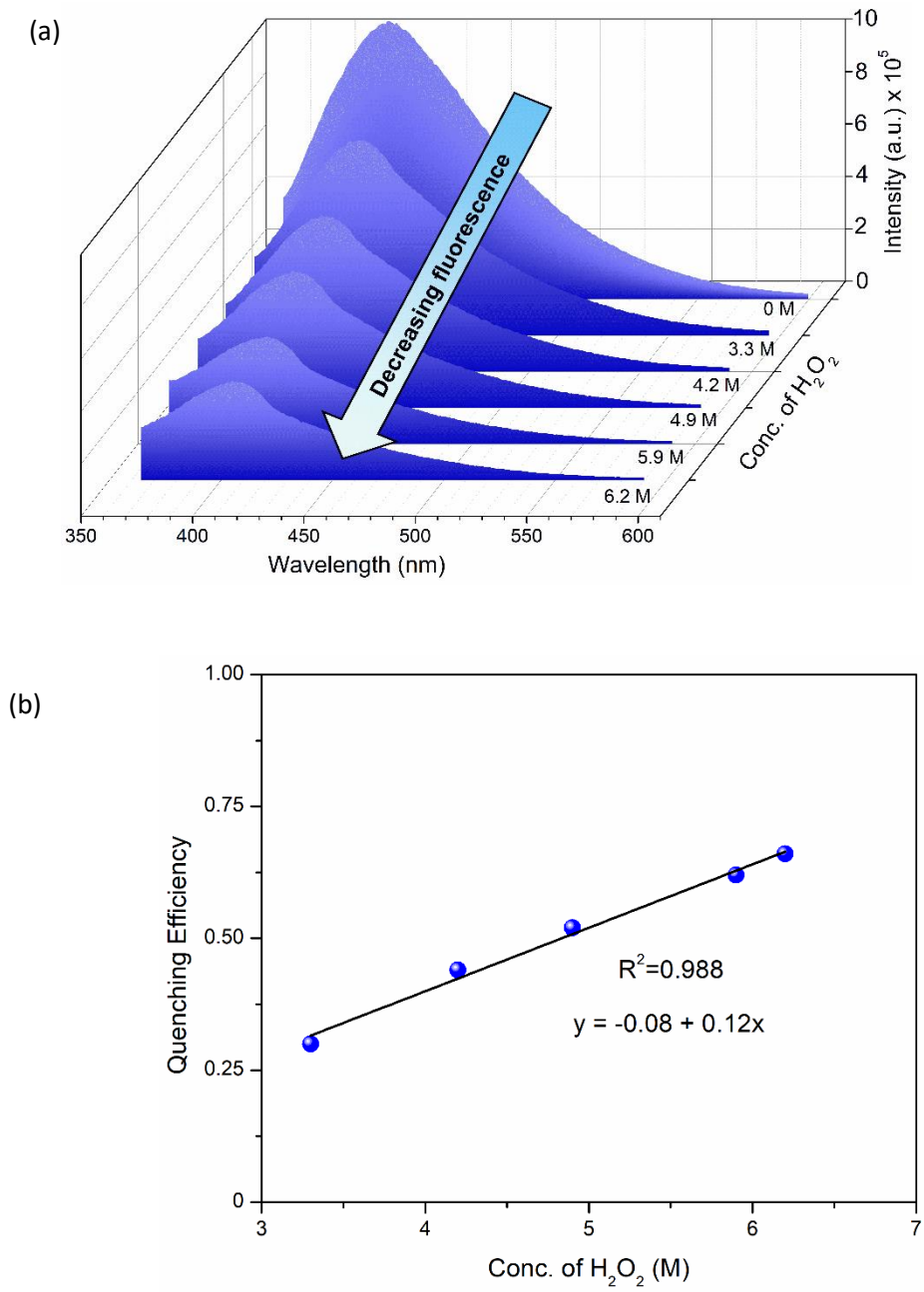


Figure S6. (a) Fluorescence response of synthesized N-CQDs (1 mg mL^{-1}) at different concentrations of H_2O_2. (b) The fluorescence quenching efficiency at different concentrations of H_2O_2 obeyed a straight-line equation. The quenching efficiency was calculated using the expression $(I_o\text{-}I)/I_o$, where I = fluorescence intensity of N-CQDs in presence of H_2O_2 and I = fluorescence intensity of N-CQDs in absence of H_2O_2.

Table S2. A comparison of the H_2O_2 detection by the proposed method with similar other reported methods.

Sl. No.	Synthesis method	Detection method	Limit of detection	Linear range	Ref.
1	Hydrothermal	Colorimetry	6.5 μM	315 μM – 6.5 μM	[1]
2	Hydrothermal	Colorimetry	5.3 μM	1170 μM – 20 μM	[2]
3	Solvothermal	Fluorometry	8 μM	1 mM – 100 μM	[3]
4	Solvothermal	Chemiluminescence	11.7 μM	50 mM – 1 mM	[4]
5	Solvothermal	Fluorometry	14 mM	0.5 M – 50 mM	[5]
6	Microwave	Fluorometry	2.1 μM	6.2 M – 50 μM	This work

References

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