Supporting information

Carbon Dots as Co-sensitizers in Dye Sensitized Solar Cell and Fluorescence Chemosensor for 2,4,6-Trinitrophenol Detection

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1. Quantum yield measurement. Five different concentrations each of green emitting carbon dots (G-CDs), blue emitting carbon dots (B-CDs), fluorescein and quinine sulfate (QS) were prepared in distilled water (refractive index (η) = 1.33), dimethyl formamide (DMF) (refractive index (η) = 1.43), 0.1 M NaOH (η = 1.33) and 0.1 M H₂SO₄ (η = 1.33) respectively. The UV-visible absorbance intensities and the photoluminescence (PL) intensities of all the samples were recorded at their excitation wavelengths. The literature value of the quantum yield of fluorescein ($\Phi_{fluorescein}$) is 0.95 and that of QS (Φ_{QS}) is 0.54. The integrated PL intensities of each sample at different concentrations were plotted against their corresponding absorbance values. From the slopes of the plotted lines (m_{fluorescein} for fluorescein, m_{QS} for QS, m_{G-CD} for G-CDs and m_{B-CD} for B-CDs), the quantum yields of both types of CDs (Φ_{G-CD} and Φ_{B-CD}) were calculated by using **relations (S1)** and **(S2)**.

$$\Phi_{G-CD} = \Phi_{fluorescein} (m_{G-CD} / m_{fluorescein}) (\eta^2_{water} / \eta^2_{0.1 M NaOH})$$
(S1)

$$\Phi_{\rm B-CD} = \Phi_{\rm QS} \left(m_{\rm B-CD} / m_{\rm QS} \right) \left(\eta_{\rm DMF}^2 / \eta_{0.1 \,\rm M \, H_2 SO_4}^2 \right)$$
(S2)

2. Cyclic voltammetry (CV) measurement of G-CDs. CV was used to calculate the highest occupied molecular orbital (HOMO) and lowest unoccupied molecular orbital (LUMO) energy levels of the G-CDs.^{S1,S2} A three-electrode set-up was used to record the CV profiles, with a glassy carbon electrode working electrode, an Ag/AgCl reference electrode and a platinum wire counter electrode. The electrolyte consisted of a solution containing 0.1 M tetrabutylammonium hexafluorophosphate as the supporting electrolyte in acetonitrile with 0.1 mg mL⁻¹ G-CDs. The scan rate was maintained at 25 mV s⁻¹. The HOMO and LUMO energy levels were determined using relations (S3) and (S4):

$$E_{HOMO} = -(E_{onset,ox} + 4.4)eV$$
(S3)

$$E_{LUMO} = -(E_{onset,red} + 4.4)eV$$
(S4)

where E_{HOMO} and E_{LUMO} are the HOMO and LUMO energy levels respectively. E_{onset,ox} and E_{onset,red} are the onset oxidation and reduction potentials.



Figure S1. Photoluminescence vs. absorbance plots of (**a**) G-CDs and fluorescein, and (**b**) B-CDs and QS, recorded at excitation wavelengths of 490 nm and 340 nm respectively.



Figure S2. PL spectra of (a) G-CDs and (b) B-CDs at different excitation wavelengths.



Figure S3. Particle size histograms of G-CDs and B-CDs.



Figure S4. X-ray diffraction patterns of G-CDs and B-CDs.



Figure S5. UV-visible spectrum of N719 dye in ethanol, and overlap of the G-CD emission spectrum with N719 dye absorption spectrum.



Figure S6. CV profile of G-CDs recorded at a scan rate of 25 mV s⁻¹.



Figure S7. Variation of PL emission of B-CD with addition of (**a**) 2,4-dinitrophenol and (**b**) p-nitrophenol.



Figure S8. UV-visible spectra of TNP, 2,4-DNP and p-NP, and their overlap with the B-CD emission spectrum.



Figure S9. UV-visible spectra of B-CDs in the presence of TNP with different concentrations.

Table S1. Fluorescence quenching constant (Ksv) and correlation values of different analytes.		
Analyte	Ksv/ M ⁻¹	Correlation coefficient
TNP	2.42×10^4	0.9998
2,4-DNP	3.7 x 10 ³	0.9992
p-NP	8.0 x 10 ²	0.9946

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