

Electronic Supplementary Information

**Ultrasonic-Assisted Synthesis of Leather-Derived Luminescent Graphene Quantum Dots:
Catalytic Reduction and Switch on-off Probe for Nitro-Explosives**

Shamsa Kanwal^{a,b,c}, Shanaz Jahan^c, Farukh Mansoor^{*a}

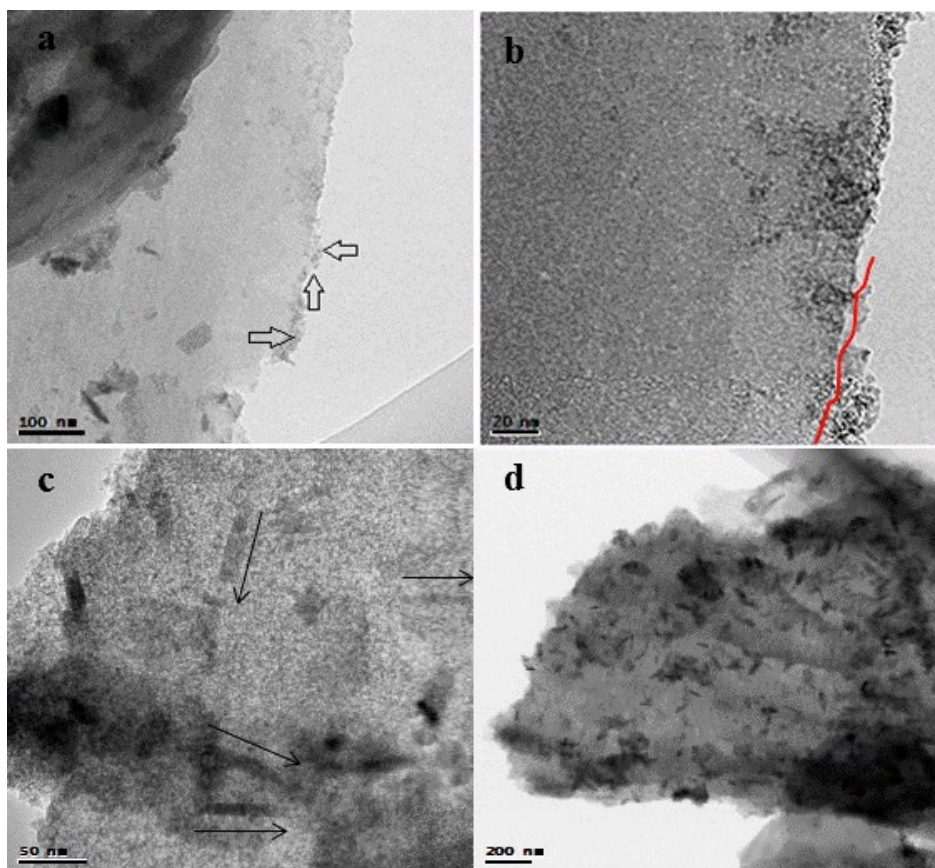


Figure S1: TEM images of GOS oxidative cleavage (a), shortening of GOS sheets (b), production of GONFs (c) and GOQDs (d) during the synthesis of GQDs.

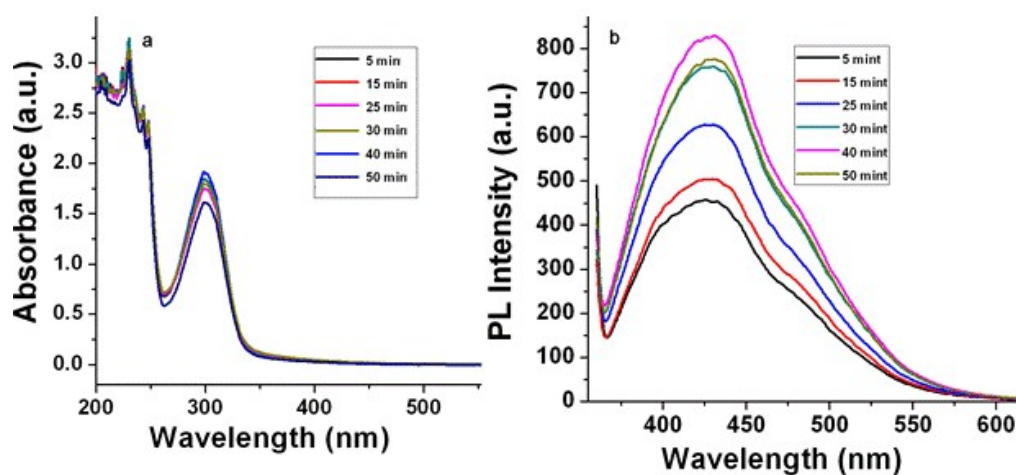


Figure S2: UV-visible (a) and PL spectra (b) of GQDs under nitric acid oxidation at successive ultrasonic time intervals (5-50 min).

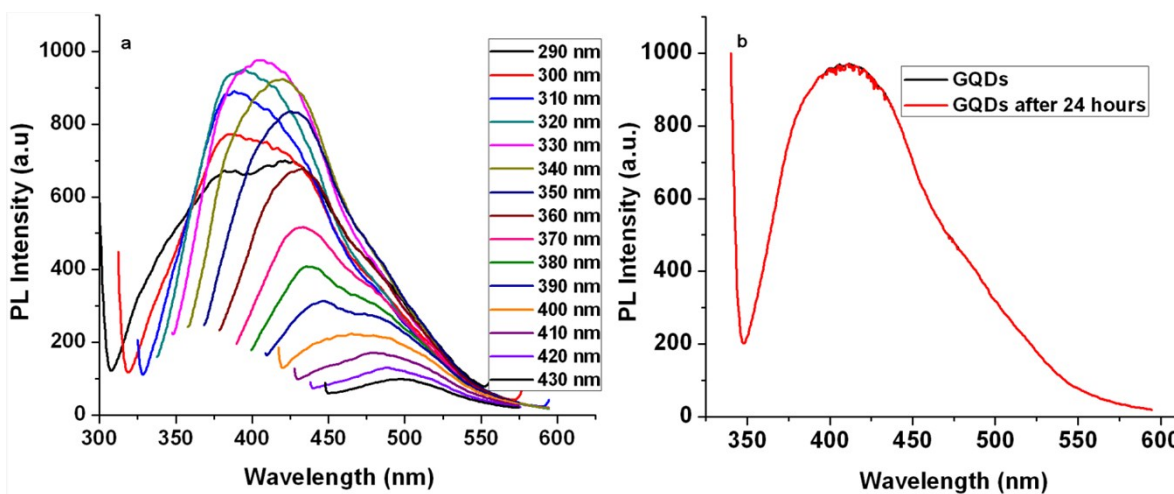


Figure S3: PL spectra of GQDs (70 μL to 5 ml H_2O) at different excitation wavelengths from 270 nm to 420 nm (a); The representative PL spectra of GQDs before and after 24 h exposure to UV-lamp at 360 nm wavelength (b).

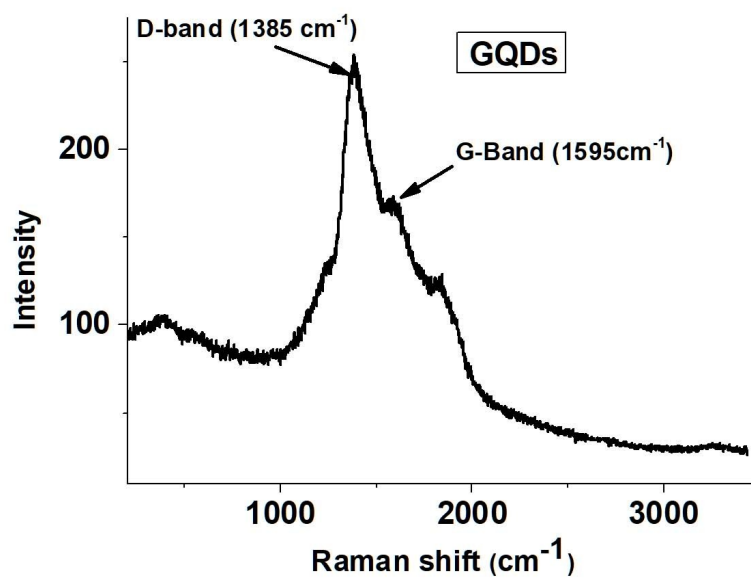


Figure S4: Raman spectra of GQDs

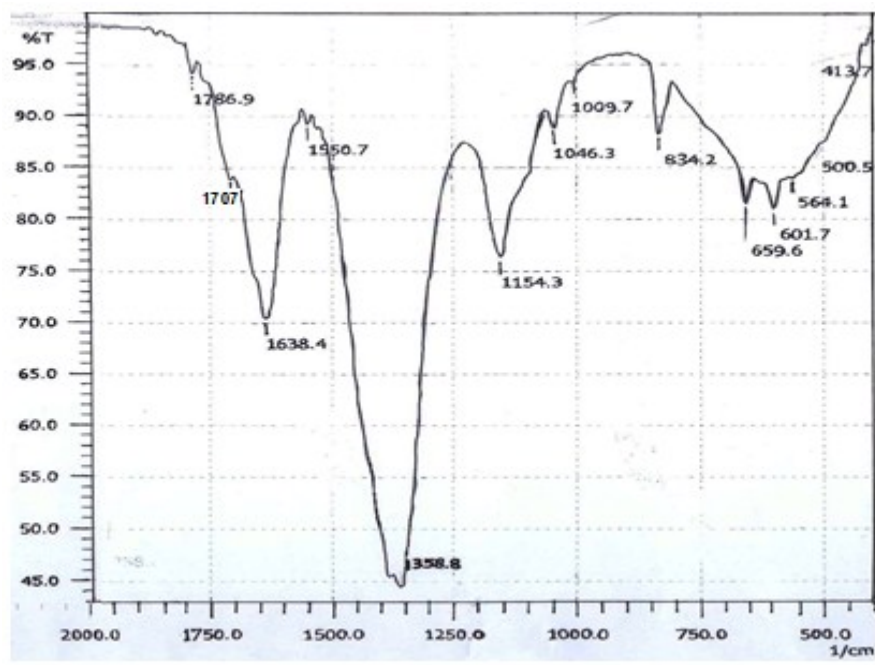


Figure S5: FTIR spectra of GQDs

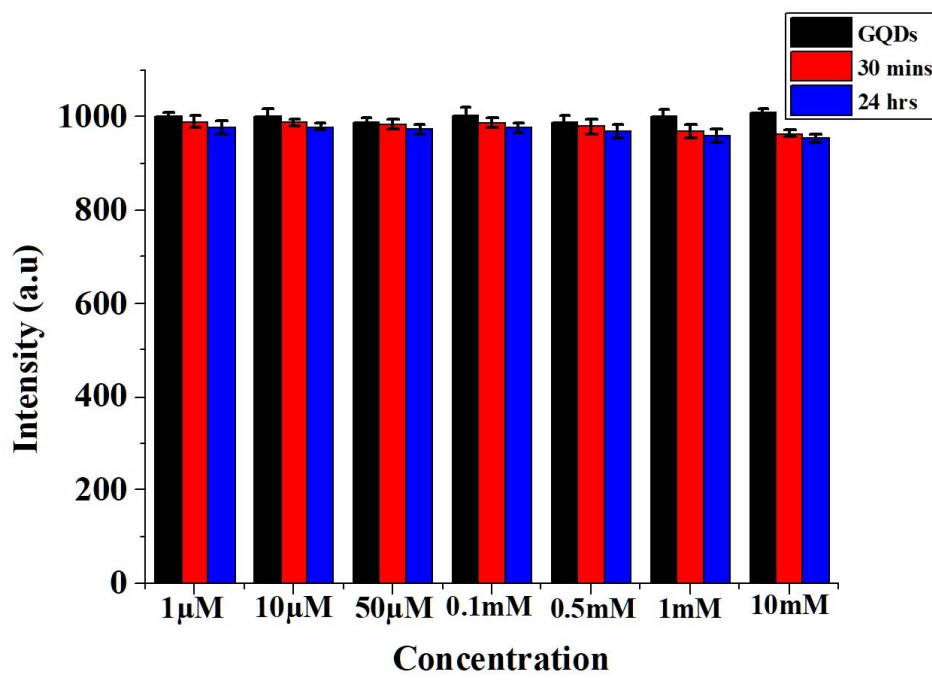


Figure S6: Effect of NaCl concentration on PL intensity of ■ GQDs ■ GQDs+NaCl after 30 mins ■ GQDs+NaCl after 24 h

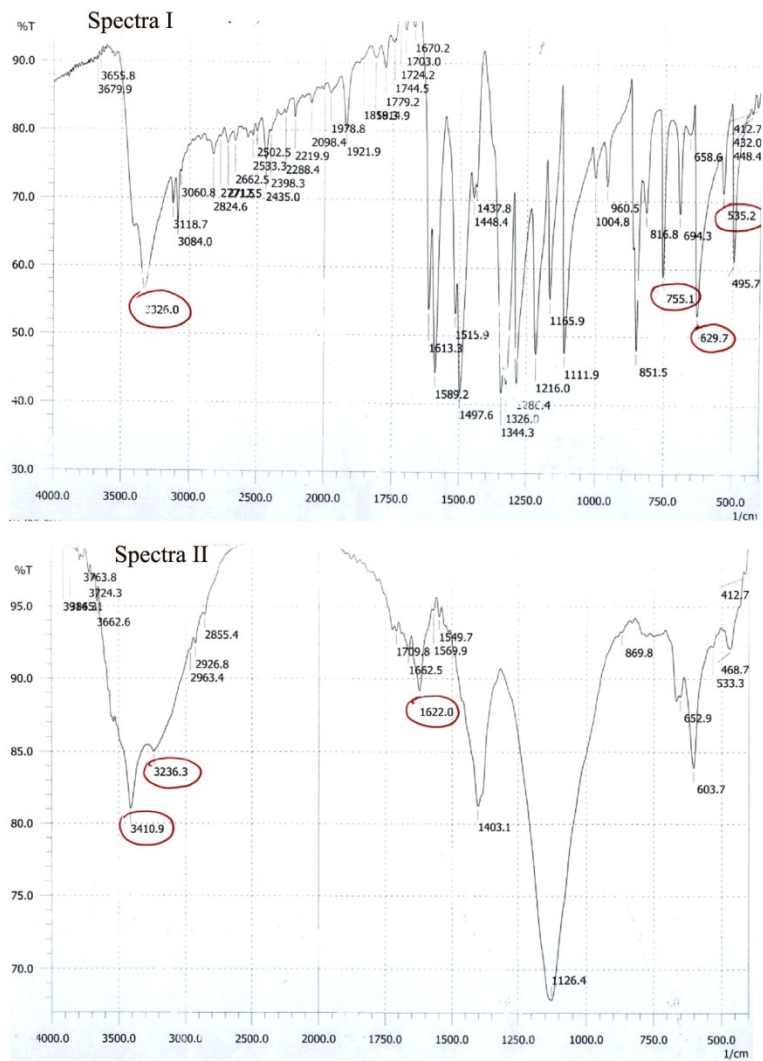


Figure S7: FTIR spectra I of pure PNP; and II of PNP-GQDs mixture under 360 nm UV irradiation for 2 h.

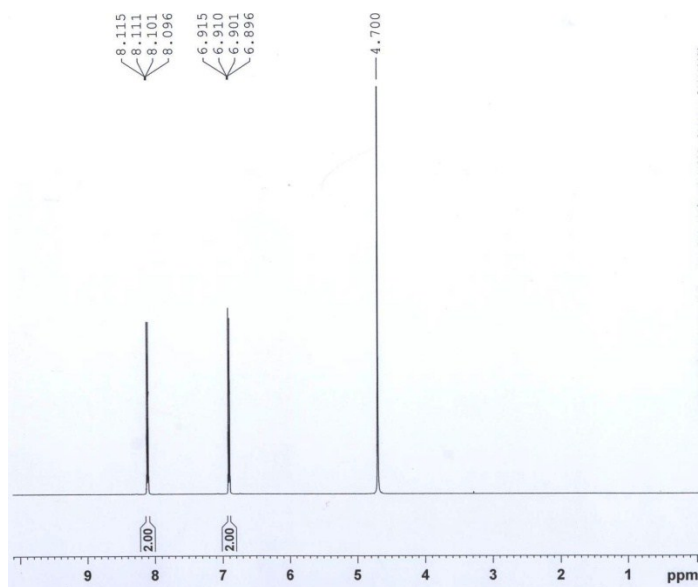


Figure S8a: ^1H -NMR for pure PNP in D_2O .

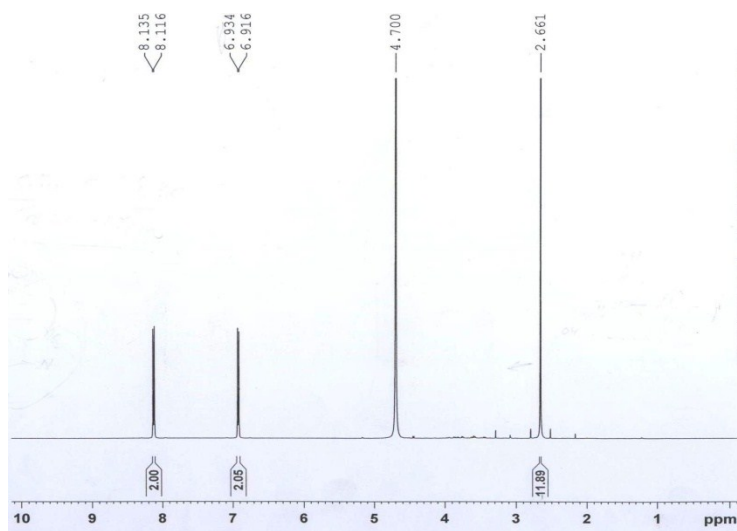


Figure S8b: ^1H -NMR for PNP- NaBH_4 -GQDs in deionized water.

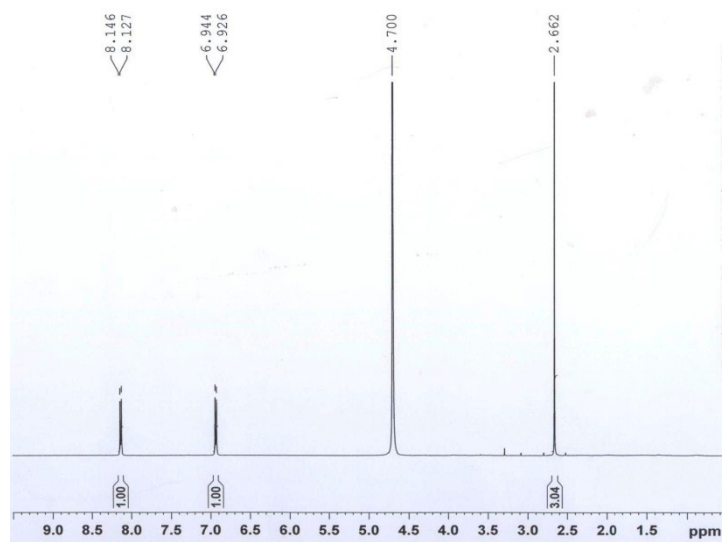


Figure S8c: H^1 -NMR for PNP-GQDs (under UV-illumination for 2 hours) in deionized water.

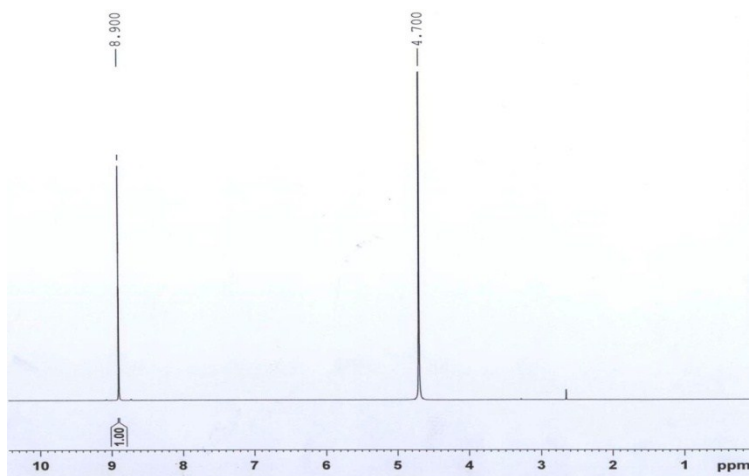


Figure S9a: H^1 -NMR for pure TNP in deionized water.

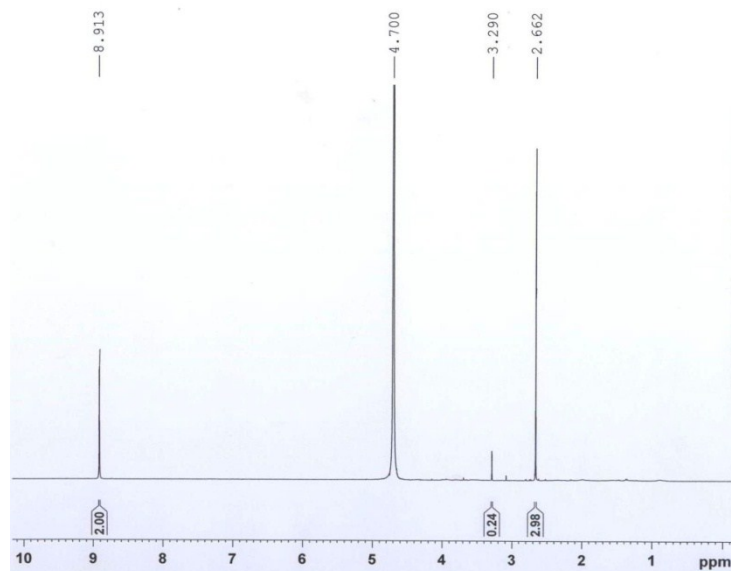


Figure S9b: ^1H -NMR for TNP-GQDs (under UV illumination for 2 h) in deionized water.

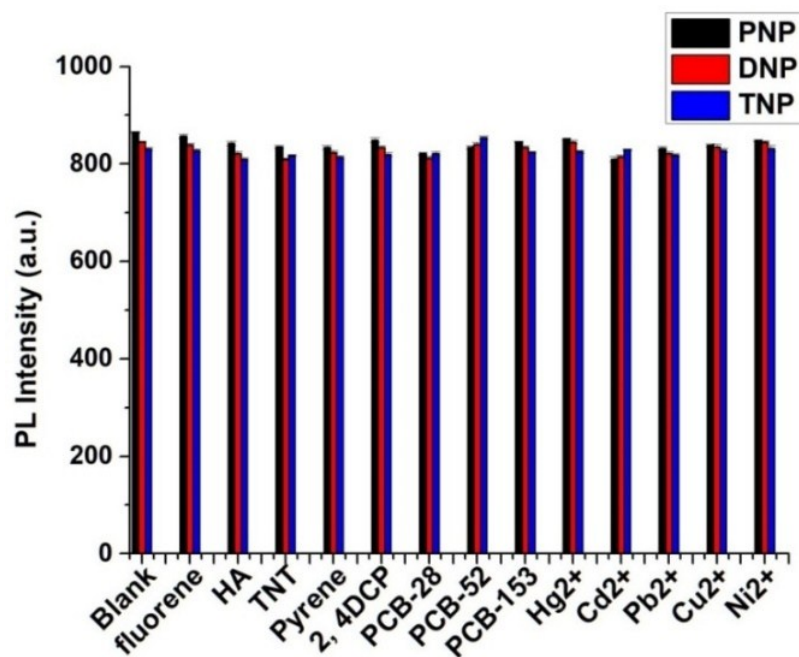


Figure S10: Photocatalytic reduction of PNP, DNP and TNP in the presence of interfering species. The concentration of fluorene, HA, TNT, pyrene, Hg^{2+} , Cd^{2+} and Pb^{2+} was 10 nM and for 2, 4 DCP, PCB-28, PCB-52, PCB-153 was 50 nM. Whereas, 100 nM concentration was used for, Cu^{2+} and Ni^{2+} .

Table S1: Specified UV-Vis and PL peak intensities/wavelength with different carbonized source and HNO₃ concentration (20 min ultrasonication).

Reaction parameters	Amount/Concentration	Absorbance	PL
	(mg or N)	I/270 nm	I/420 nm
Graphite source concentration	3 mg	0.188	200
	6 mg	0.339	600
	9 mg	1.872	875
	12 mg	0.392	420
Concentration of HNO ₃	0.25N	1.112	130
	0.5N	1.442	770
	1N	1.875	874
	2N	1.101	800

Table S2: FTIR peak assignments/intensities of few specific functional groups of graphitic products with respect to ultrasonication reaction time (RT) and their related band gaps (eV).

FTIR peaks & Related band gap (eV)	Peak intensity @5RT/30°C	Peak intensity @10RT/40°C	Peak intensity @15RT/50°C	Peak intensity @20RT/60°C	Peak intensity @25RT/70°C	Peak intensity @40RT/90°C
Carbonyl (C=O) at 1709 cm ⁻¹	-	89%T	88%T	86%T	84%T	-
Epoxy (C-O-C) at 1042 cm ⁻¹	98%T	94%T	92%T	91%T	89%T	-
Related band gap (eV)	0.82 eV	0.87 eV	0.90 eV	0.96 eV	1.00 eV	1.04 eV

Table S3: FTIR peak characterization of some assigned groups before and after addition of 5 nM catalyst GQDs into 2 mL of 1 μ M PNP.

S. No.	FTIR Assigned Peaks	Spectral Data I	Spectral Data II
1.	PNP		
	NO ₂ rocking vibration at 535 cm ⁻¹	✓	-
	NO ₂ scissoring at 629 cm ⁻¹	✓	-
	NO ₂ wagging at 755 cm ⁻¹	✓	-
2.	PNP+GQDs		
	Symmetric N-H stretch at 3236 cm ⁻¹	-	✓
	Asymmetric N-H stretch at 3410 cm ⁻¹	-	✓
	N-H bending vibration at 1662cm ⁻¹	-	✓

Table S4: Linear ranges, LODs and regression equations for detection of nitrophenols on PL quenching of GQDs.

Type of nitrophenols	Linear detectable Concentration range	LOD	Regression equation, coefficient (R ²)
PNP	10-550 nM	10 pM	I= 914.97+(-1.038) C, 0.995
DNP	20-310 nM	65 pM	I= 975.30+(-1.9502) C, 0.995
TNP	10-500 nM	80 pM	I= 943.03+(-1.261) C, 0.996

Table S5: Determination of PNP and TNP in industrial water and in soil samples, respectively.

Samples	Nitrophenols detected nM, RSD, n=3	Samples Spiked^a nM	Nitrophenols measured nM, RSD, n=3	Recoveries
Soil Sample 1	320.3±1.1 TNP	400 TNP	359.6±1.4 TNP	99.73%
Soil Sample 2	47.3± 2.3 TNP	52 TNP	49.3±2.1 TNP	98.6%
Industrial Water 1	90.3±1.7 PNP	100 PNP	95.4±1.9 PNP	101.3%
Industrial Water 2	120±2.1 PNP	135 PNP	127.4±3.1 PNP	99.7%

^a1 mL of spiked solution was added to 1 mL of sample volume.