Electronic Supplementary Information (ESI)

Large scale synthesis of graphene quantum dots (GQDs) from waste biomass and their use as efficient and selective photoluminescence *on-off-on* probe for Ag⁺ ions

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Figure S1: Quantum Yield calculations of GQDs and Am-GQDs.

The quantum yield of the GQDs and Am-GQD was calculated using Quinine Sulfate (QS) dissolved in 0.1 M H2SO4 (refractive index $\eta = 1.33$) as the standard ($\Phi = 0.54$). The GQDs and Am-GQD were dispersed in water (refractive index $\eta = 1.33$). Four solutions were prepared for the samples (GQDs), Am-GQDs and the reference (QS) having absorbance in the range of 0 to 0.1. The integrated fluorescence intensity of each such solution was calculated and the linear fitted plots (Fig S1) were thus obtained.

The quantum yield was calculated by the following equation:

$$\Phi = \Phi_{QS} X \left(\frac{M_x}{M_{QS}} \right) X \frac{\eta_x^2}{\eta_{QS}^2}$$

Where Φ is the quantum yield; M is the slope of the linear plots, η is the refractive index of the solvents; 'x' is the sample to be measured and QS is the standard reference (Quinine Sulphate.

Sample	Slope	Refractive index	Quantum yield %
Quinine Sulphate	457499	1.33	54
GQD	8292	1.33	1
Am-GQD	15496	1.33	2

Table S1: Quantum Yield calculations of GQDs and Am-GQDs taking Qunine Sulphate as a reference.

Sr.No.	Starting Material	Quantum Yield (%)	Ref.
1	GQDs Carbon Black	2.29	5
3	GQDs from Dichlorobenzene	2.56	6
2	GQDs from Glucose	7-11	11
4	GQDs from GO	0.7	22
5	GQD from GO	2.5	24
6	Amine functionalized GQD from GO	16.4	24
7	GQDs from GO	2.8	30
8	GQDs from Graphene	3.4	31
9	GQDs from waste biomass	1	Our Work
10	A-GQDS from Waste biomass	2	Our Work

Table S2: Comparison of quantum yields of GQD and Am-GQDs with literature.



Figure S2. HRTEM images of (a) GQD and (b) Am-GQDs.



Figure S3: XRD spectrum of GQDs.



Figure S4: XPS data of GQDs.

Element	Area (A)	ASF (F)	A/F	% C and O
C1s	3435	0.25	13740	76
O1s	2871	0.66	4350	24

Table S3: XPS data analysis for GQDs.



Figure S5. TEM images of (a-b) Am-GQD@Ag and (c-d) Am-GQD-Ag-Cys.



Figure S6. SAED pattern for GQD.



Figure S7. EDAX analysis of Am-GQD@Ag.