Supplementary Information (SI)

Carbon Dots from a Single Source Exhibiting Tuneable Luminescent Colors through the Modification of Surface Functional Groups in ORMOSIL Films

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S1. Quantum yield (QY) measurement

Relative quantum yield measurement of CDs was done with respect to 10^{-4} M quinine sulphate in 0.01N H_2SO_4 solution as a standard. In order to minimize re-absorption effect diluted CD solution was used for QY measurement. Relative QY was calculated using eq S1:

$$QY_{sample} = (F_{sample}/F_{ref})(A_{ref}/A_{absorbance})(n^2_{sample}/n^2_{ref}) \times QY_{ref}. \quad \ldots. \quad S1$$

F ⟶ Integrated area under the PL emission curve.

A ⟶ Absorbance at excitation wavelength.

n ⟶ Refractive index of the sample

QY_{sample} ⟶ Quantum yield of the sample.

QY_{ref} ⟶ Quantum yield of the reference (here quinine sulphate).

S2. Calculation method of life time values

The PL decay kinetics can be clearly analysed using a multi-exponential decay function as shown in the equation S2.

$$I(t) = \sum \alpha_i \exp(-t/r_i) \quad \ldots.. \quad S2$$

In our case, the solution CDs and GF as well as YF were fitted well in bi-exponential decay functions and for OF, the tri-exponential decay fitting has been used.

Table S1: Calculated quantum yield of three films with respect to 10^{-4} M standard quinine sulphate solution.

Sample name	**Absorbance at excitation wavelength (275 nm)**	**Integrated emission area**	**Refractive index of the medium**	**Quantum yield (%)**
10^{-4} M standard quinine sulfate (in water)	0.0856	2559.25	(H_2O) = 1.33	54
CDs in ethanol	0.0783	2251.18	1.36 (in ethanol)	55.27
GF	0.109	1997.669	1.4621	36.13
YF	0.1023	1142.28	1.4623	24.277
OF	0.112	1061.84	1.4618 in silica glass (film)	17.82

Table S2: Calculated average lifetime (from fitting data) of three CD incorporated ORMOSIL films.

Sample name	**a_1**	**a_2**	**a_3**	**τ1(ns)**	**τ1(ns)**	**τ1(ns)**	**τ_{av} (ns)**	**χ^2**	**Pattern**
CDs in ethanol	0.113	0.88711	0	1.075	1.031	0	1.0348	1.2507	Bi-exponential
OF	0.682	0.29	0.023	1.18	2.6	7.26	1.724	1.2	Tri-exponential
YF	0.6504	0.3495	0	0.0658	3.07	0	1.1147	1.29	Bi-exponential
GF	0.689	0.3109	0	0.0637	3.198	0	1.038	1.18	Bi-exponential

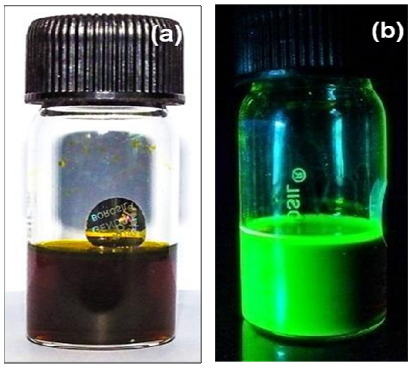

Figure S1. Digital photos of purified CDs under (a) visible and (b) UV light (λ=365 nm).

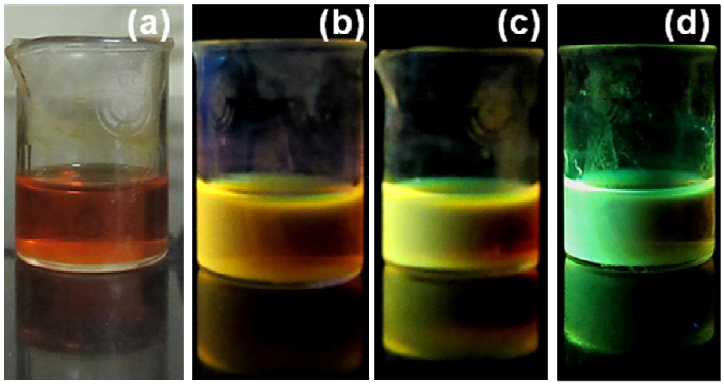

Figure S2. Digital photos of CDs incorporated ORMOSIL sol under visible light (a) and UV light, λ = 365 nm (b). The same sol (orange emitting PL) produced yellow and green colored PL emission after pH tuning at pH ~7 and ~9 (λ = 365 nm).

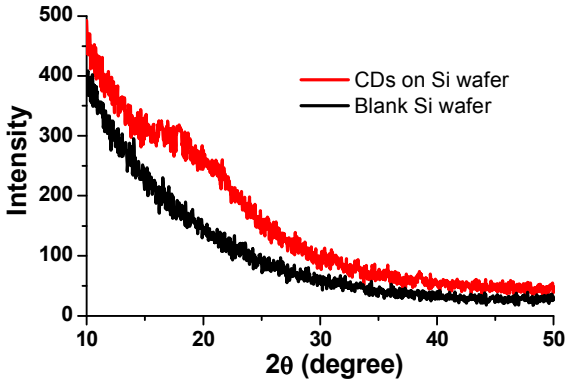

Figure S3. GIXRD pattern of purified CDs (drop-casted on silicon wafer) showing amorphous hump in the range of 16.5–22 º2θ. The GIXRD pattern of the blank silicon wafer acquired under similar condition is also shown as reference.

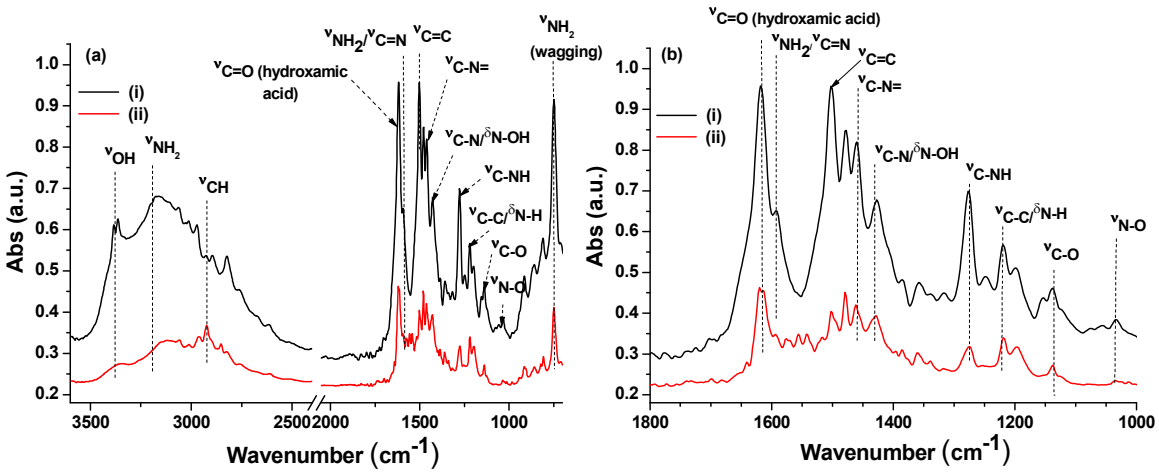

Figure S4. FT-IR spectra of CDs in the range of (a) 3600–700 cm^{-1} and (b) magnified view (1800-1200 cm^{-1}) before (i) and after (ii) column purification.

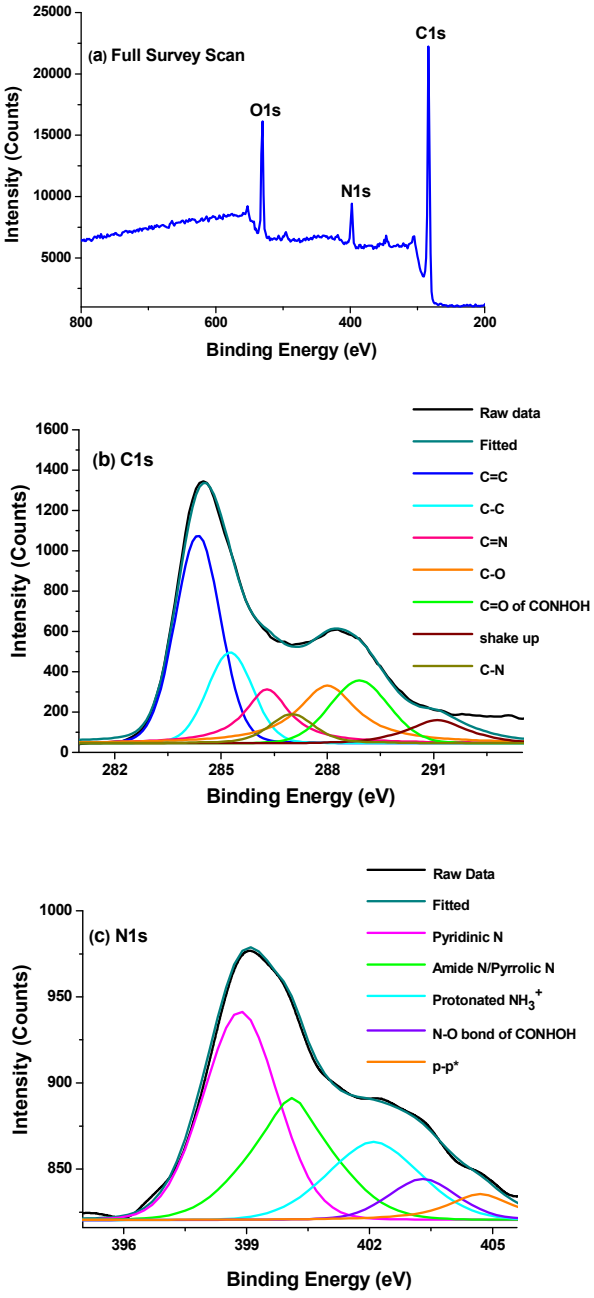

Figure S5. XPS spectra of column purified CDs in ethanol: (a) Survey scan; (b) and (c) High resolution scans of C1s and N1s, respectively with deconvolutions.

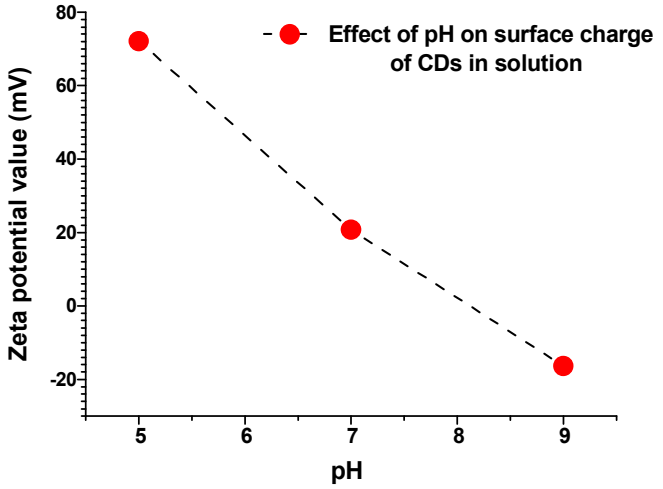

Figure S6. Change of zeta potential values of CDs in solution with increase of pH values. The data points are joined for visual guidance.

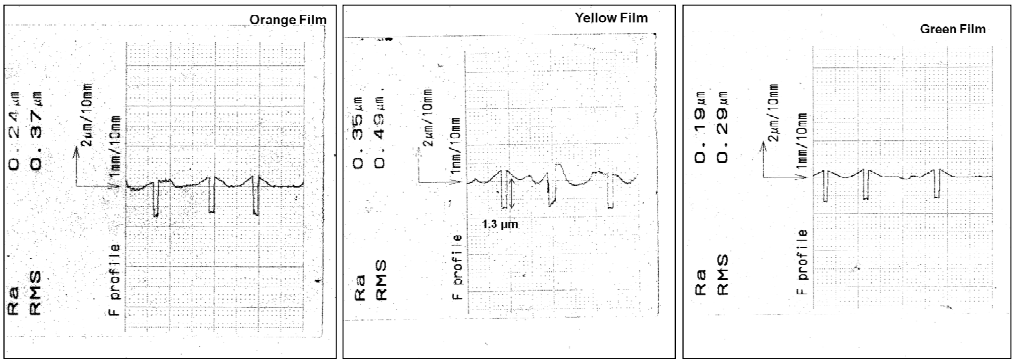

Figure S7. Profilometric traces at three different places of three representative CD-ORMOSIL films deposited on glass substrate (The as-prepared film was first scratched with a sharp steel blade and then cured at 70 °C for 2 h).

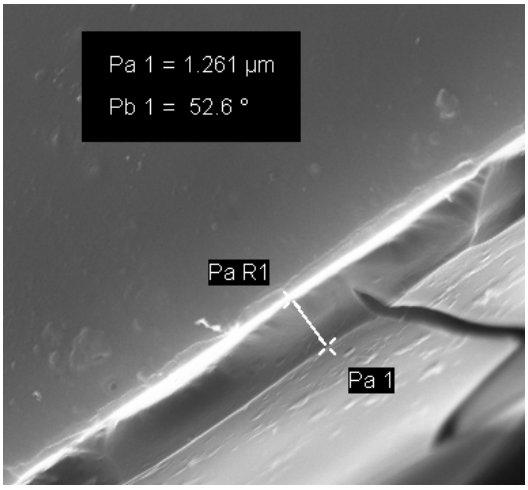

Figure S8. Cross sectional view of FESEM image of orange emitting film prepared via standard dip coating method.

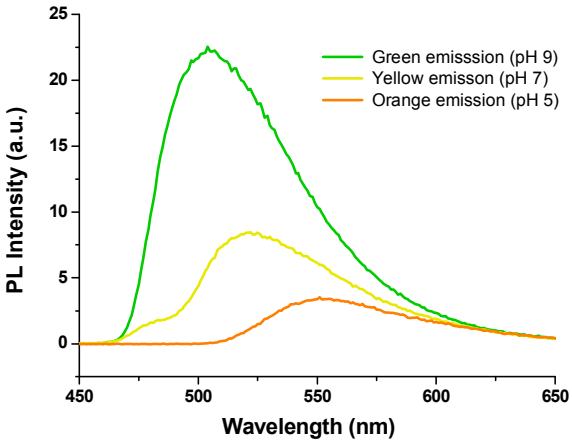

Figure S9. pH dependent tricolor emissions of purified CDs in solution.

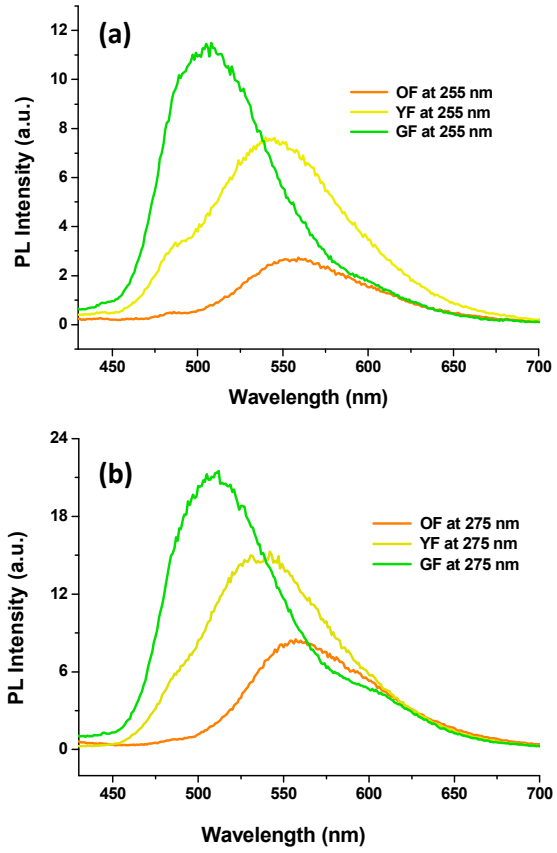

Figure S10. Excitation independent PL emissions of orange (OF), yellow (YF) and green (GF) films at two different excitation wavelengths (a) 255 nm and (b) 275 nm.

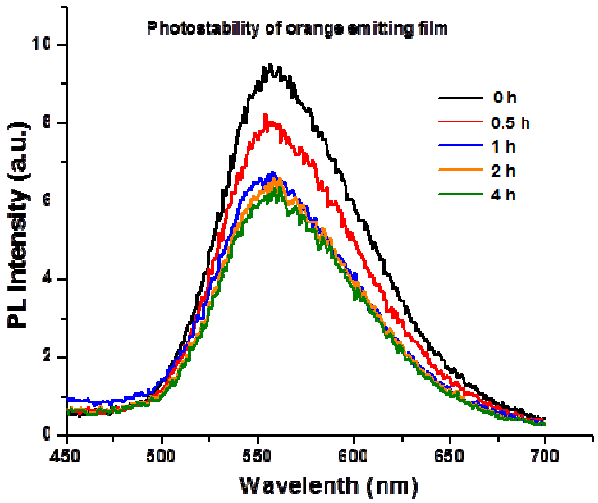

Figure S11. PL curves showing the photo stability of orange emitting film under UV (λ=275 nm) irradiation.

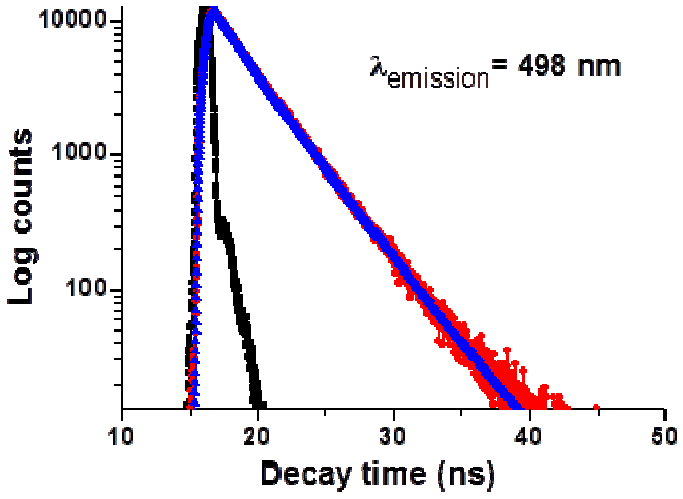

Figure S12. Decay lifetime curve of column purified CDs in ethanol.