

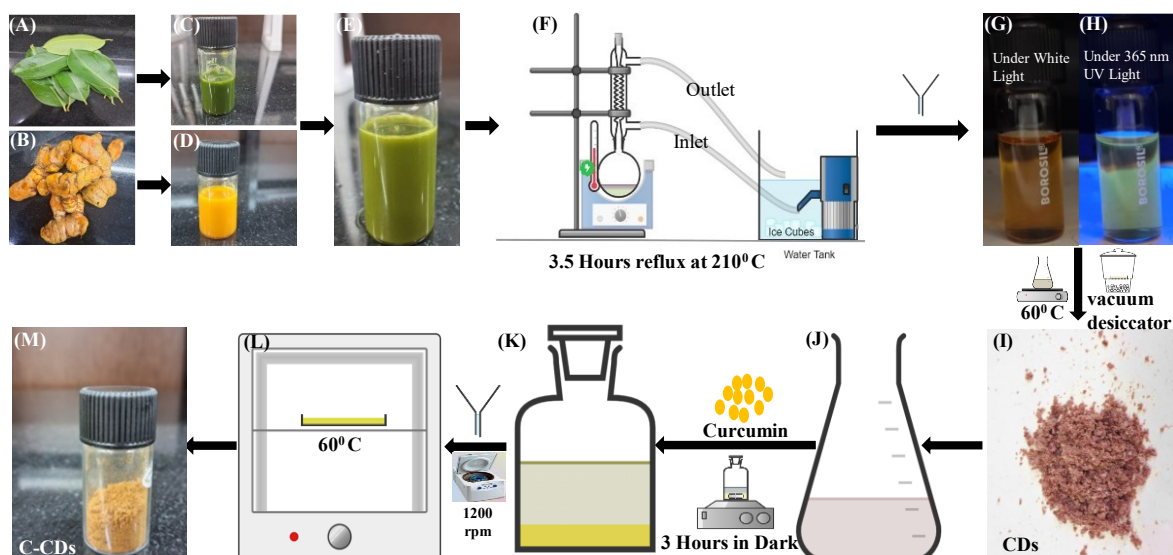
## Supporting Information

# Biomolecular Interaction and Diffusion of Curcumin-Loaded Carbon Dot in Live Cell: Implications to Drug Delivery

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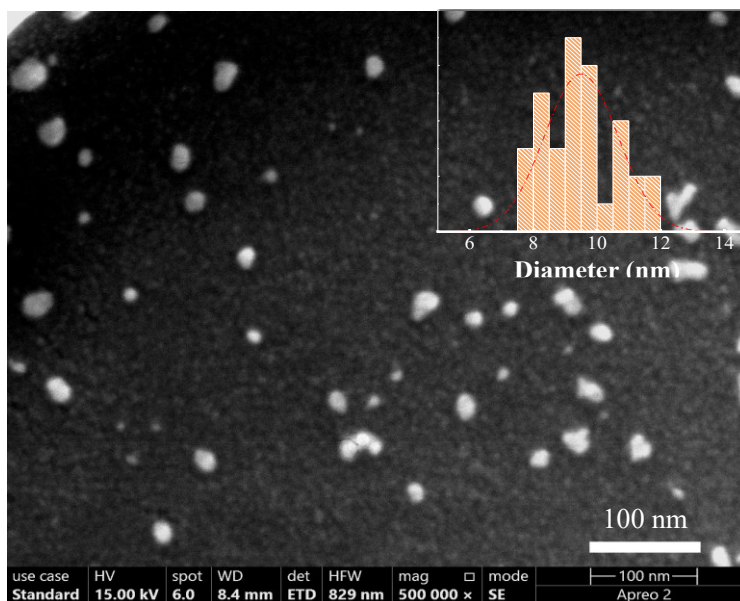
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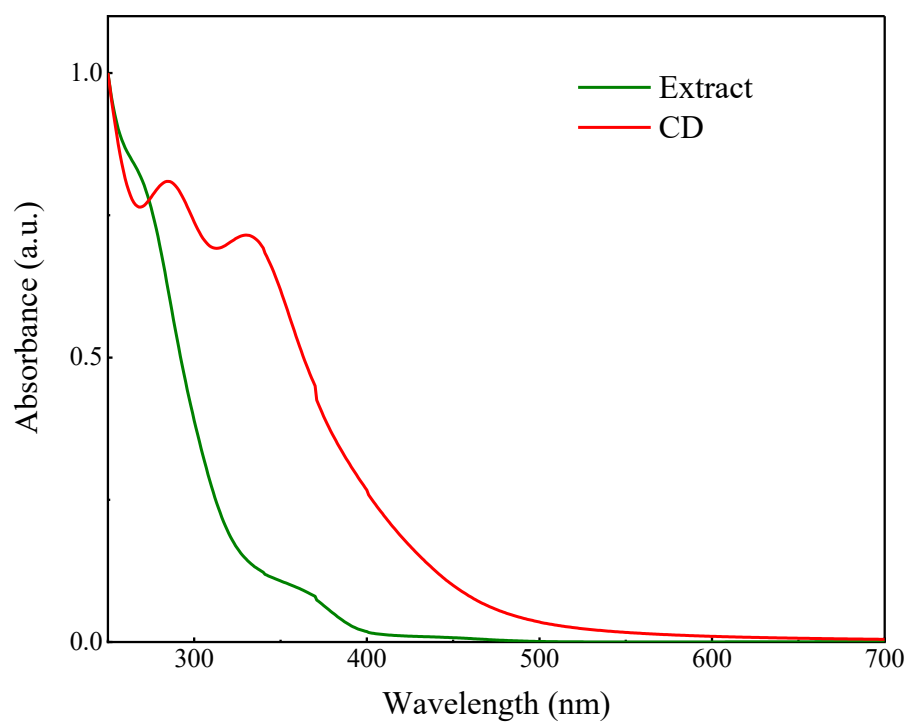
**Scheme S1. Green synthesis of Carbon Dots (CD) and Curcumin-loaded Carbon Dots (C-CD).**

(A) and (B) The precursors taken for the synthesis of Carbon Dots (CDs) are Jamun leaves and raw turmeric, respectively, from where (C) and (D) the juice extracts were collected. (E) A 3:1 mixture of corresponding juice extracts is taken for the green synthesis. (F) The setup used for the green synthesis of Carbon Dots (CDs) using reflux conditions, which forms a brown color solution under normal light (G), turns green (H) under 365 nm UV light. Under 60 °C, on top of the hot plate, followed by a vacuum desiccator, which will form a solid form of CDs (I). In its solution form with water (J), the addition of curcumin followed by a continuous magnetic stirring in dark conditions will result curcumin-loaded CDs (K), which after filtration followed by centrifugation, results in C-CDs that are kept in a hot oven (L) at 60 °C, resulting in solid C-CDs (M)



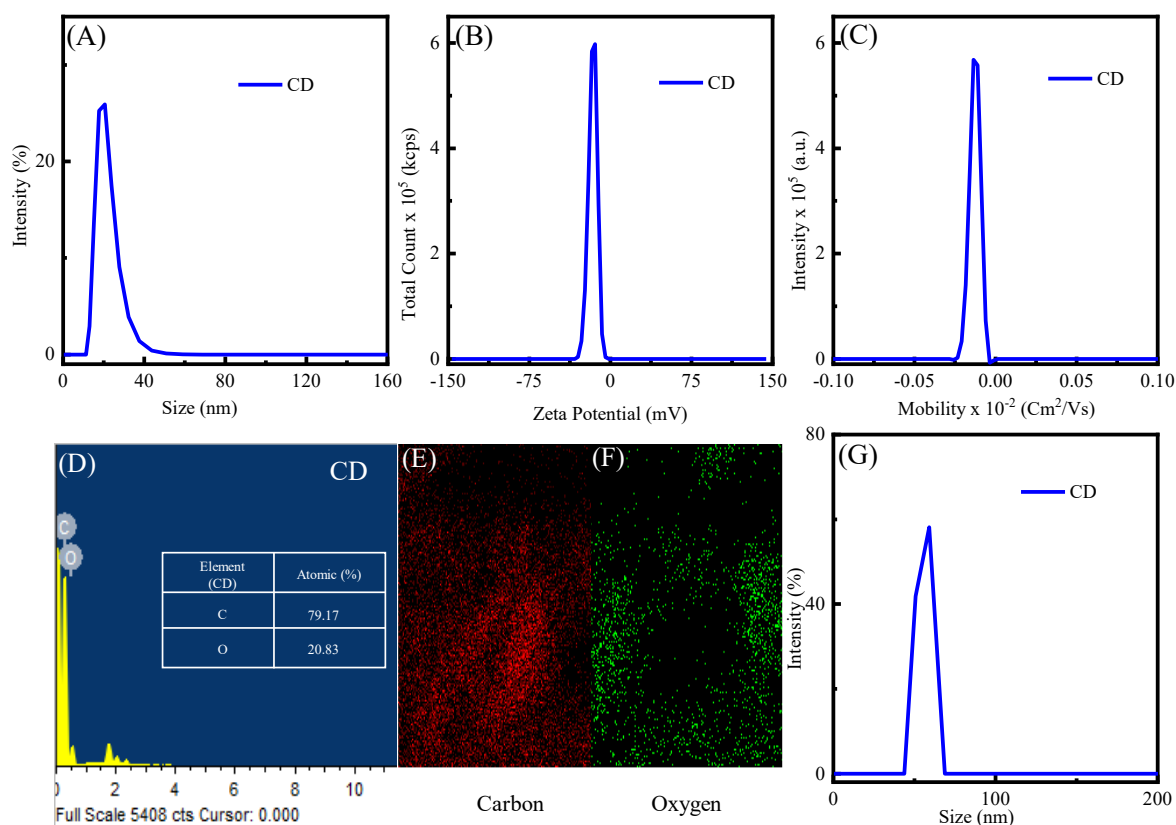
**Figure S1.** Field emission Scanning Electron Microscopy (FESEM) Image of CDs. CDs are evenly distributed over the surface with a spherical shape. The inset shows the average diameter of CDs falling within the range of <10 nm. Scale Bar=100 nm

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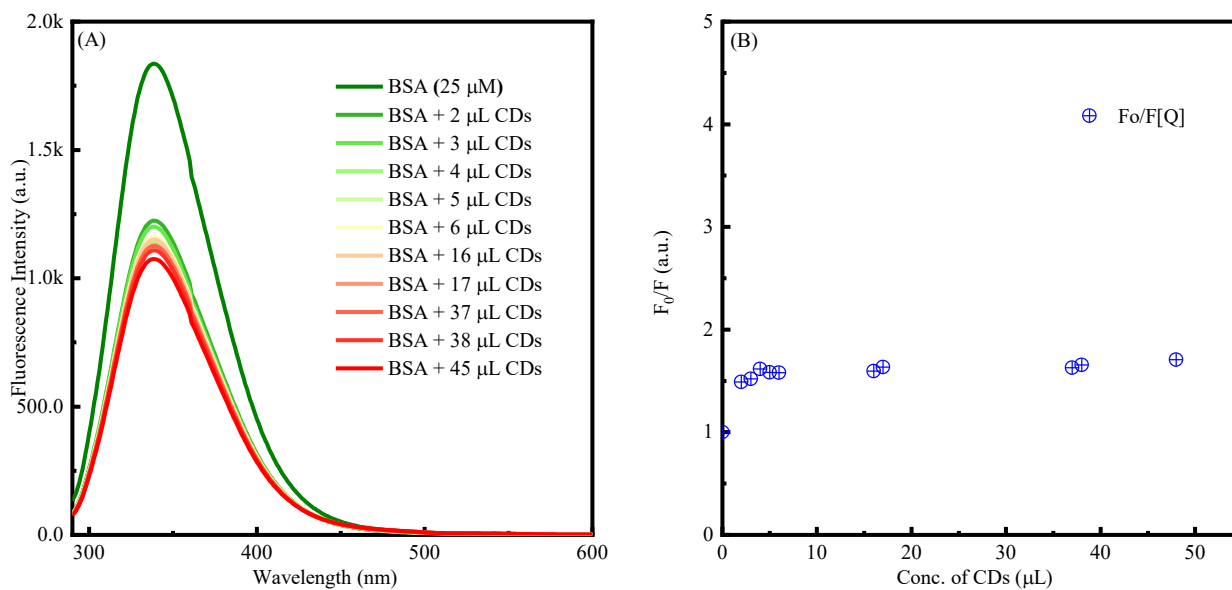
**Figure S2: The normalized excitation spectra of CDs in comparison with only the leaf extract. It has been found that there is no such defined peak in the case of only the extract. But in the case of CDs, two well-defined peaks are there because of  $n-\pi^*$  and  $\pi-\pi^*$  transitions.**

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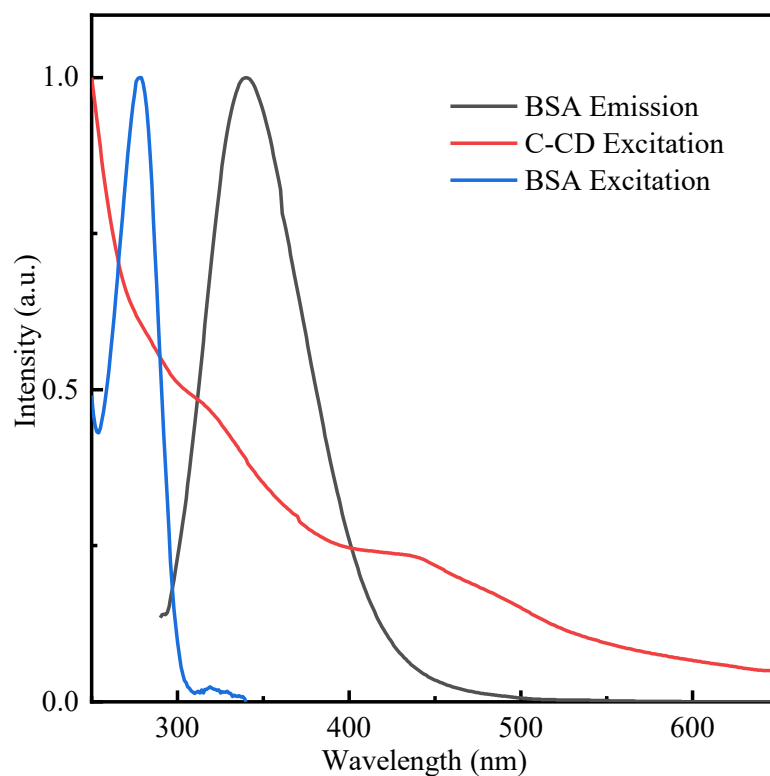
**Figure S3. DLS and EDX analyses were performed to characterize the physicochemical properties of CDs and C-CDs.** (A) Dynamic light Scattering experiment with CD confirms the hydrodynamic diameter with a peak at 18.66 nm. (B) Zeta potential of CDs showing a peak at -17.23 mV, ranging from -33.04 mV to -4.58 mV, with (D) electrophoretic mobility of  $-0.0001102 \text{ Cm}^2/\text{Vs}$ . (A) EDX spectra of CDs confirm the major elements present are Carbon (C) and Oxygen (O). Elemental mapping of CDs, (E) for carbon and (F) for Oxygen. The inset table displays the weight percentage and atomic percentage of CDs. (G) The hydrodynamic diameter of C-CD, with a peak at 59.07 nm, confirms a higher hydrodynamic diameter than CDs.

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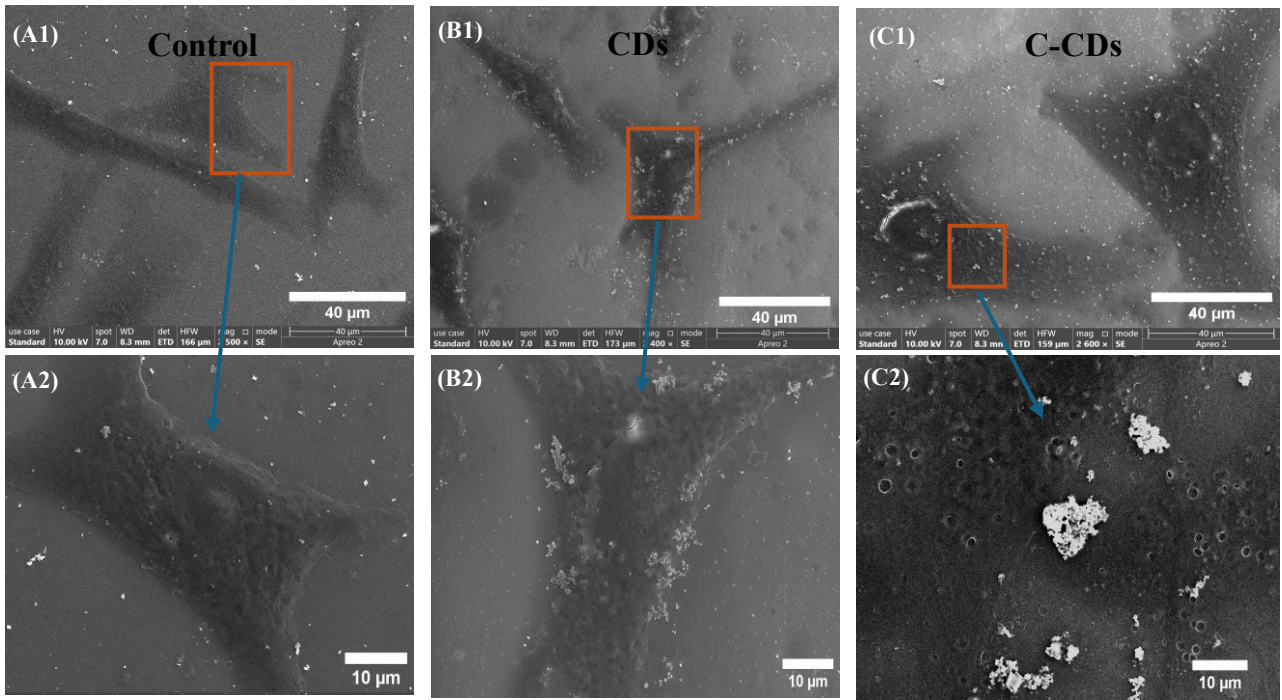
**Figure S4. Fluorescence emission spectra were recorded to investigate the interaction of BSA with CDs.** (A) The results show that there is no quenching of fluorescence upon the addition of only CDs. However, there is a sharp decrease in fluorescence with the addition of 2  $\mu$ L of CDs, which may be due to the effect of CDs on BSA. (B) The corresponding Benesi-Hildebrand plots show no linear relationship.

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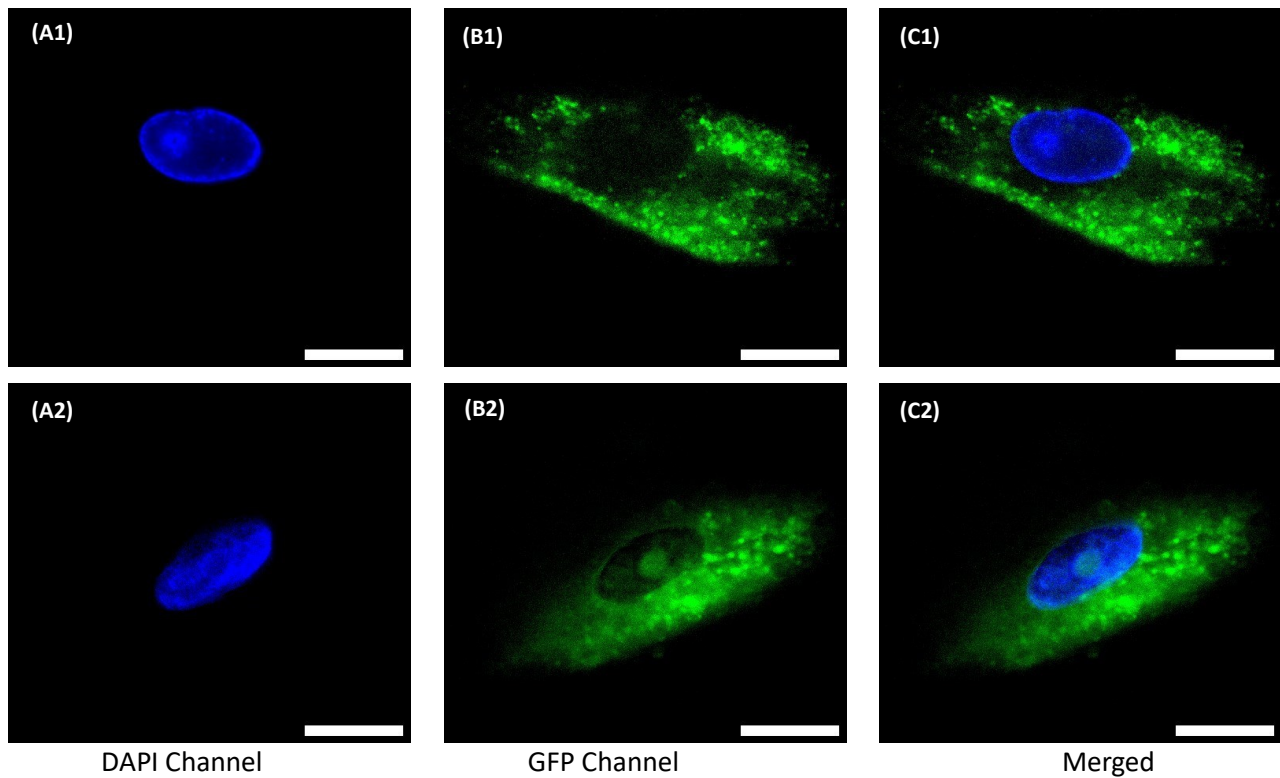
**Figure S5. The normalized Overlap excitation and emission spectra of Donors and acceptors for the FRET study.** From the FRET images, it is indicated that the emission of donor (BSA) overlaps with the excitation spectra of acceptor (C-CDs)

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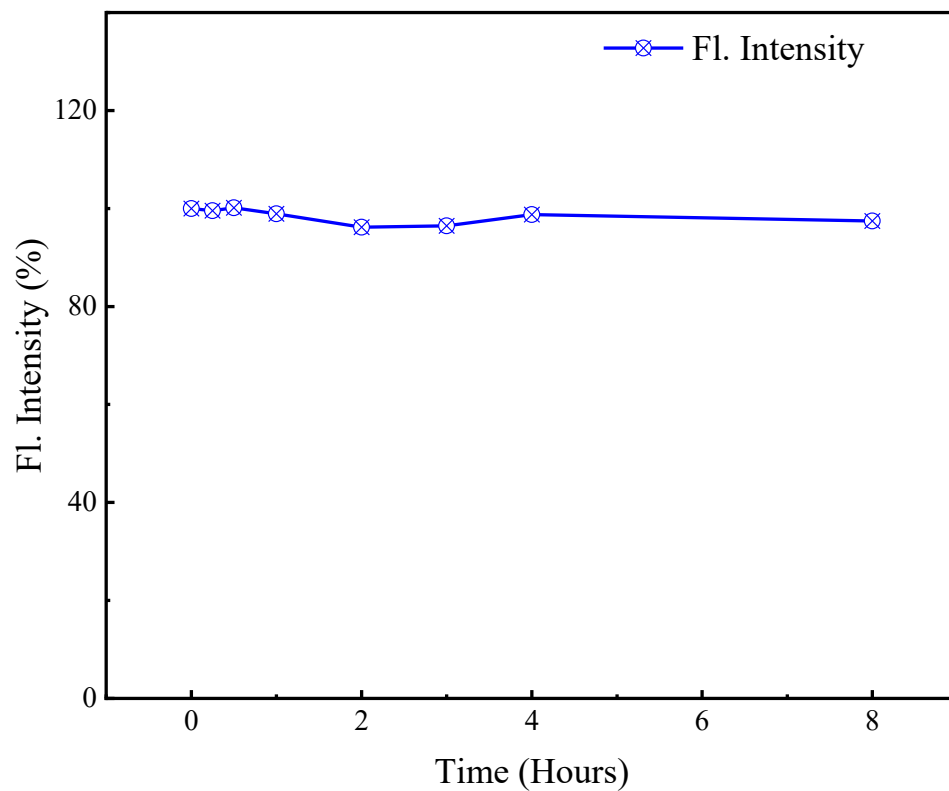
**Figure S6. FESEM Image of A549 cells labelled with CDs and C-CDs to investigate the morphological changes and membrane interactions.** After incubation of cells with CDs and C-CDs in different cover glasses for 30 minutes, it was then fixed with 4% paraformaldehyde. (A1) and (A2) Cells without treatment of any sample were considered as a control, where no pore formation was found on the cell membrane. (B1) and (B2) Treatment with CDs shows the attachment of CDs on the surface of the cell membrane, along with small pores at the cell membrane. (C1) and (C2) Cells treated with C-CDs also confirm the primary attachment of C-CDs with larger-sized, frequent larger pores on the surface. Scale bar of A1, B1 and C1 = 40 μm & Scale bar of A2, B2 and C2 are 10 μm.

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**Figure S7. Fluorescence Imaging of the live A549 cell using carbon dots (CDs) and curcumin-loaded carbon dots (C-CDs) in different channels to confirm the penetration of CDs and C-CDs into the cytoplasm region selectively.** (A1) Imaging of an A549 cell treated with DAPI and CDs in the DAPI channel and (B1) the same cell in the GFP channel (C1) along with the merged of these two channels. (A2), (B2), and (C2), respectively, are the fluorescence images of A549 cells treated with C-CDs and DAPI in the DAPI channel, GFP channel, and Merged (respectively). Scale Bar = 20  $\mu\text{m}$

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**Figure S8: Optical stability of CDs** by fluorescence intensity percentage change with respect to time upon excitation of a UV- lamp of 365 nm.

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