# Supporting Information

**Decagram-scale Synthesis of Multicolor Carbon Nanodots: Self-tracking Nano-heaters with Inherent and Selective Anticancer Properties**

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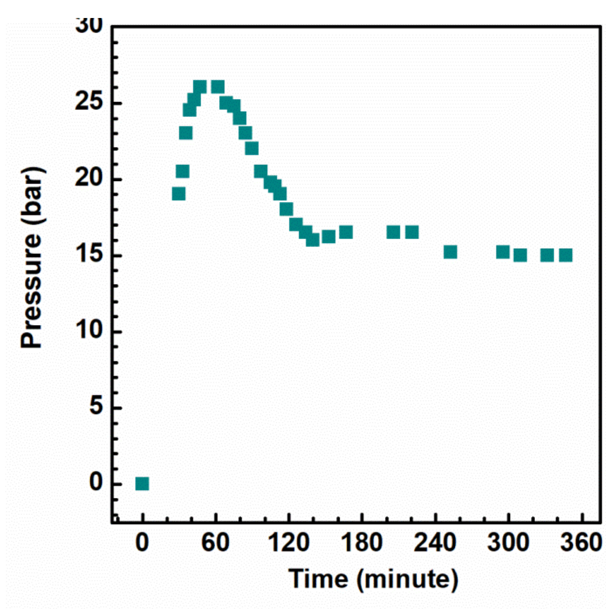


Figure S1. Pressure of the autoclave during the reaction

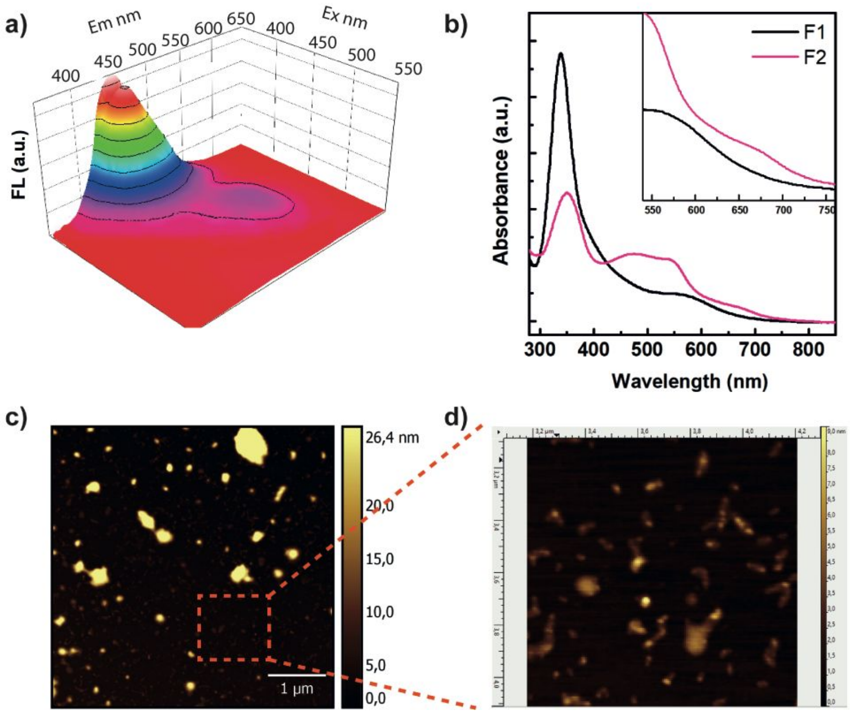


Figure S2. Preliminary characterization of the F1 fraction. a) 3D emission spectrum of the F1 fraction; b) absorption spectra of the F1 and F2 fractions. c-d) AFM micrographs of the F1 fraction

## 1. Mathematical model for evaluation of the photothermal conversion efficiency

The photothermal efficiency of the $SO_x$-CDs carbon nanodots were calculated by considering the photothermal kinetic of a dispersion of carbon nanodots in ultrapure water () place into a 1 cm quartz cuvette and irradiated using a diode laser of proper wavelength, and the dissipation curve obtained after the heating processes during the cooling period.

Under NIR irradiation, the change in temperature $T$ is described by the energy balance equation (1):

$$\sum m_i C_i dTdt = E_{abs} - E_{loss} \tag{1}$$

Equation (2) can be used to describe the energy transfer

$$T(t) = T_0 + \frac{A}{B}\left(1 - e^{-Bt}\right) + (T_i - T_0) \tag{2}$$

where A is the rate of energy absorption and B is the rate of heat dissipation, $T_0$ is the ambient temperature and $T_i$ is the initial temperature value.

In order to retrieve the photothermal conversion efficiency $\eta$, it is needed to measure the temperature variation of the $SO_x$-CDs dispersions as a function of time during both the photothermal heating (laser on, $A \neq 0$ and $T_i = T_0$) and the subsequent cooling (laser off, $A = 0$ and $T_i > T_0$).

Thus obtaining equation (3) and (4), respectively:

$$T(t) = T_0 + \frac{A}{B}(1 - e^{-Bt}) \tag{3}$$

$$T(t) = T_0 + \frac{A}{B}(1 - e^{-Bt}) + (T_i - T_0) \tag{4}$$

By fitting the experimental curve with equation (1), the values of $A$ and $B$ can be obtained and employed to calculate the experimental photothermal conversion efficiency $\eta$:

$$\eta = \frac{A \Sigma_i m_i C_i}{P\,(1 - 10^{-A_\lambda})} \tag{5}$$

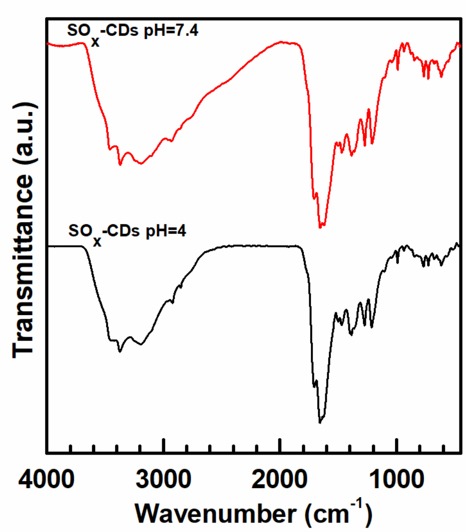


Figure S3. FTIR spectrum of $SO_x$-CDs at pH 7.4 and pH 4 after two days incubation.

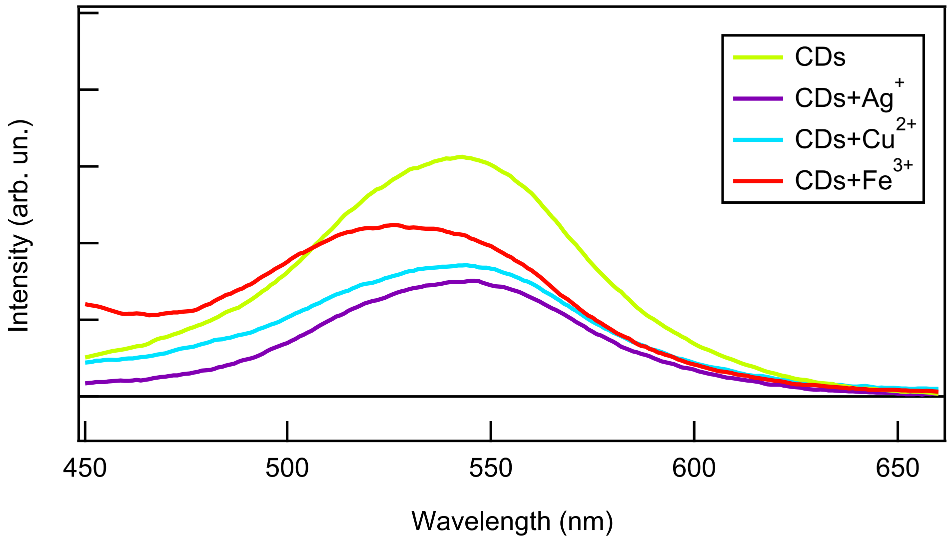


Figure S4. Fluorescence spectra of CDs in presence of metal ions.

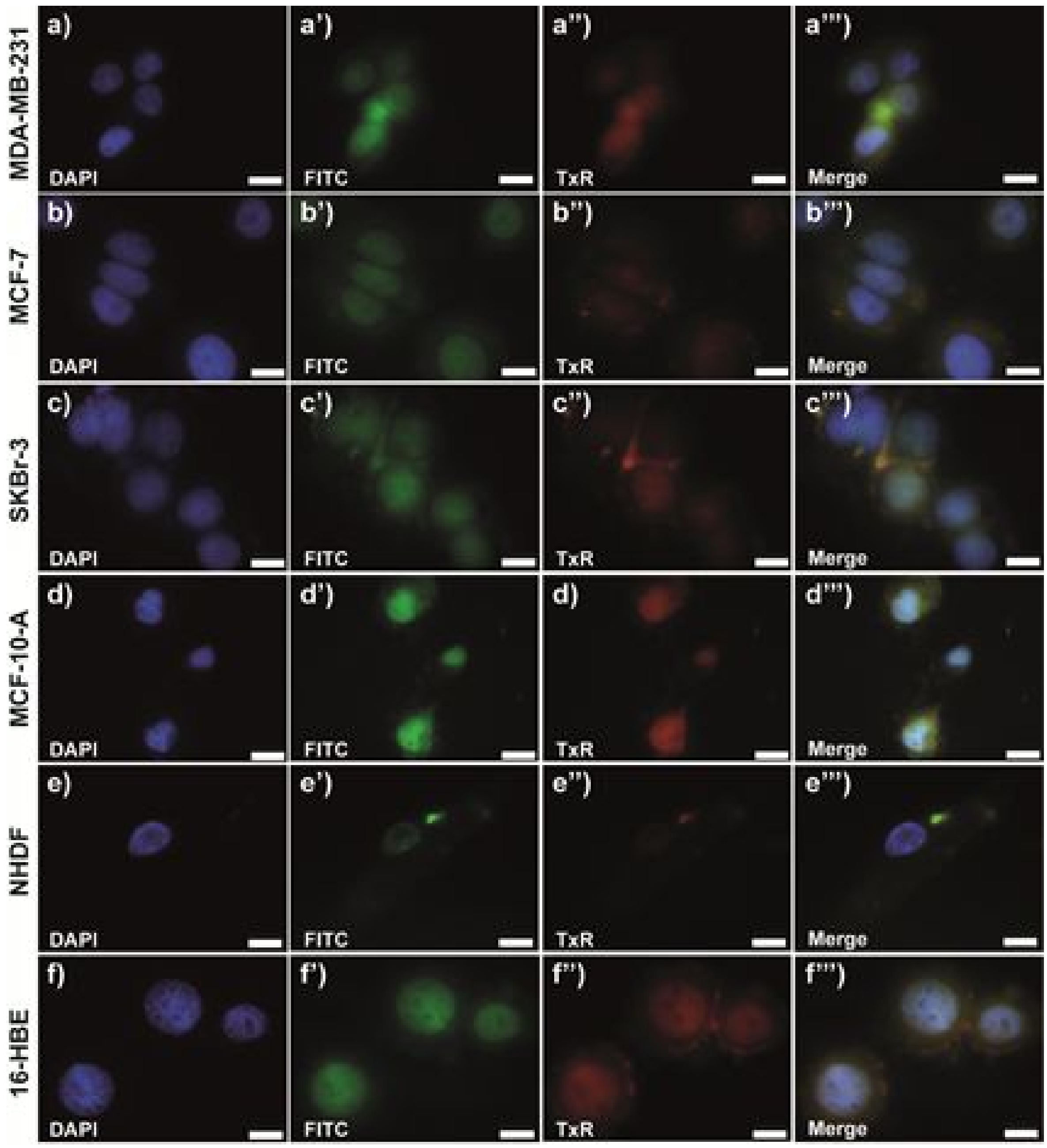


Figure S5. Fluorescence imaging of cancerous breast cell lines (MDA-MB-231, **a-a’’’**; MCF-7, **b-b’’’**; and SKBr-3, **c-c’’’**), pre-cancerous (MCF-10A, **e-e’’’**) and healthy (16-HBE, **f-f’’’**) cell lines treated with $SO_x$-CDs (0.25 mg $ml^{-1}$) for 2 h. Nuclei are marked with DAPI (**a-f**), $SO_x$-CDs self-fluorescence in the green (**a’-f’**) and red (**a’’-f’’**) region, and merge channels (**a’’’-f’’’’**) . Scale bar: 10 μm.

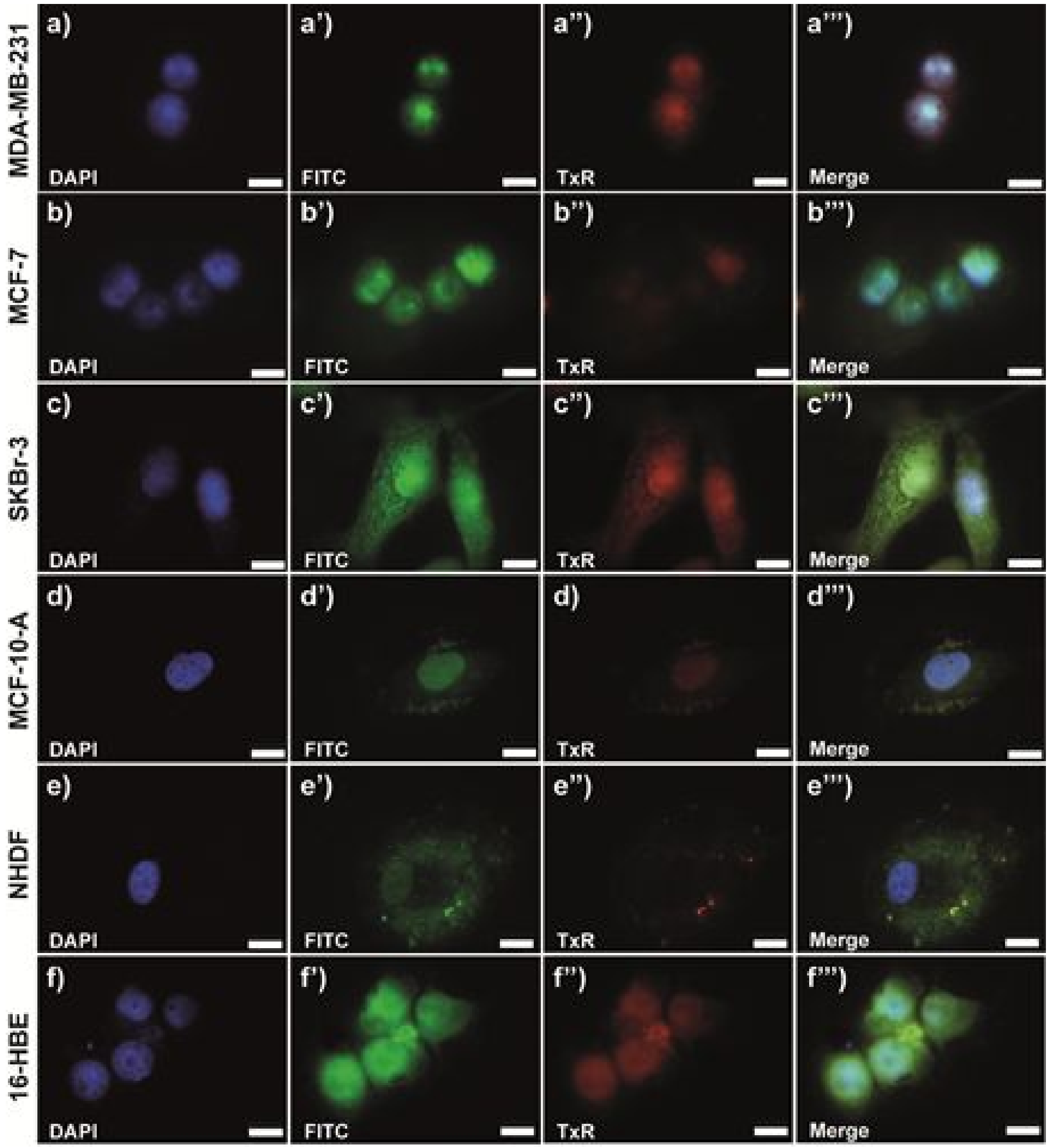


Figure S6. Fluorescence imaging of cancerous breast cell lines (MDA-MB-231, **a-a'''**; MCF-7, **b-b'''**; and SKBr-3, **c-c'''**), pre-cancerous (MCF-10A, **e-e'''**) and healthy (16-HBE, **f-f'''**) cell lines treated with $SO_x$-CDs (0.25 mg $ml^{-1}$) for 6 h. Nuclei are marked with DAPI (**a-f**), $SO_x$-CDs self-fluorescence in the green (**a'-f'**) and red (**a''-f''**) region, and merge channels (**a'''-f'''**). Scale bar: 10 μm.