Electronic Supplementary Material (ESI) for Nanoscale Horizons.

Supporting information

Carbon quantum dots as a dual platform for the inhibition and light-based destruction of collagen fibers: implications for the treatment of eye floaters

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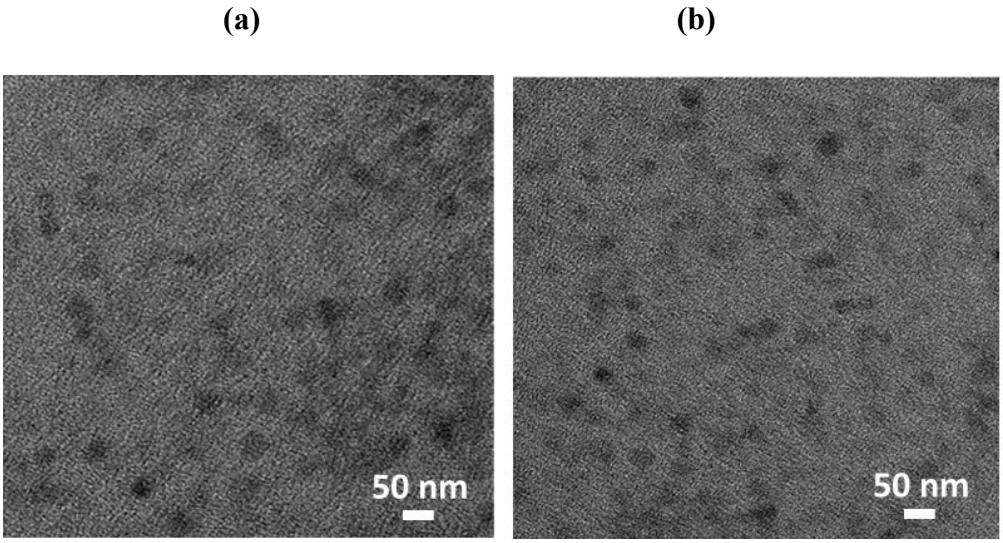


Figure S1: TEM images of CQD-1 (a) and CQD-2 (b)

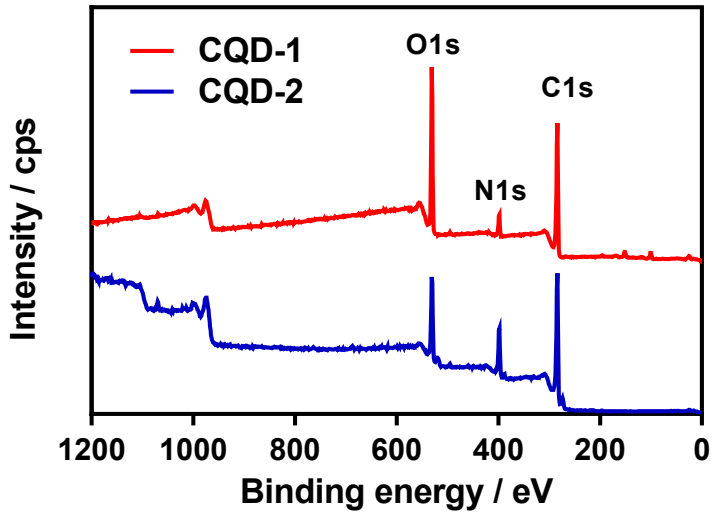


Figure S2: XPS survey spectra of CQD-1 and CQD-2.

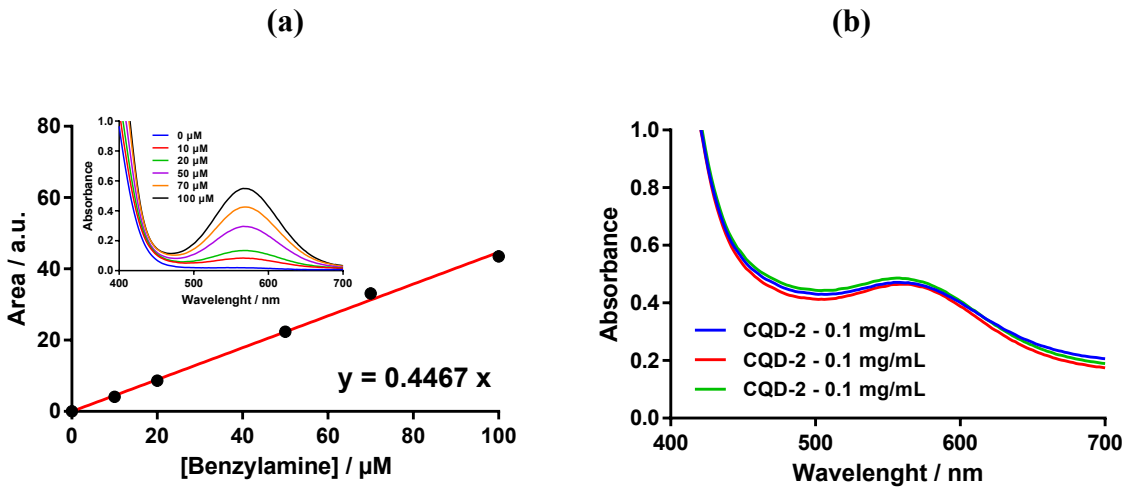


Figure S3: Kaiser test for the determination of the presence of primary amine groups: (a) Calibration curve of benzylamine solution (from 10 to 100 µM) treated with 50 µL of phenol solution (40 g in 10 mL EtOH), 50 µL of potassium cyanide (2 mL of KCN solution - 65 mg in 100 mL water - in 100 mL pyridine) and 50 µL of ninhydrin solution (2.5 g in 50 mL EtOH) and heated at 100 °C during 10 min, cooled down on ice and further diluted with 1 mL of ethanolic solution (EtOH/water=60/40). (b) UV-vis absorption spectra of CQD-2 after treatment with phenol/potassium cyanide/ ninhydrin solutions and heating.

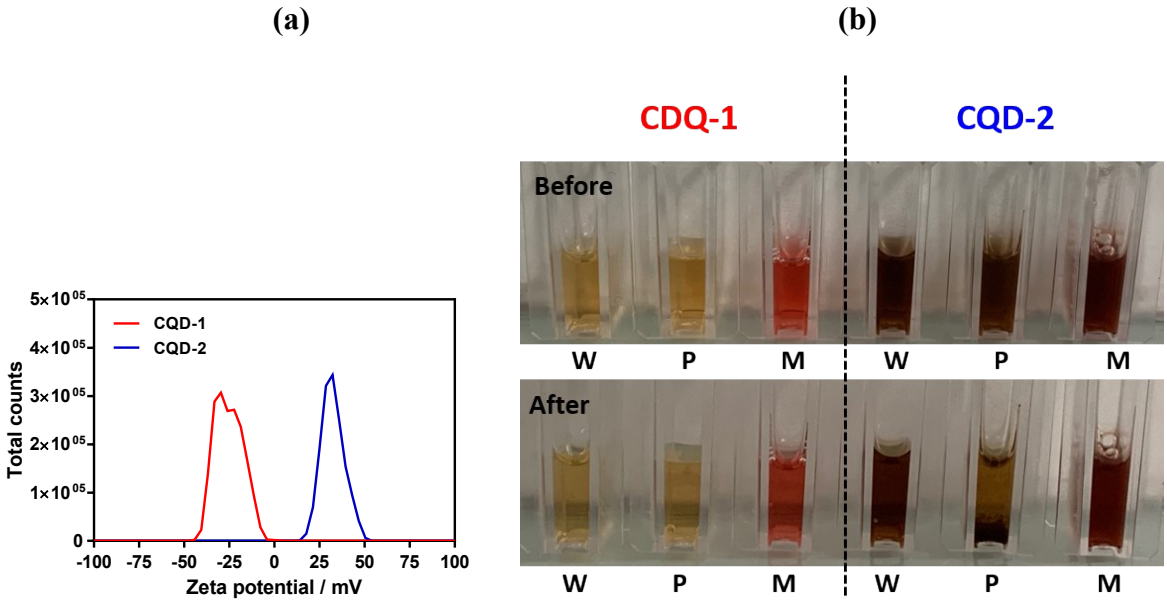
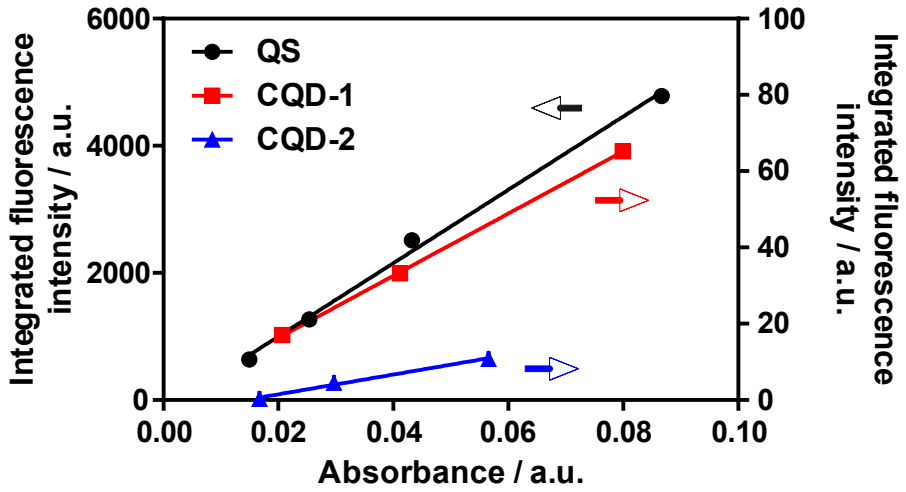


Figure S4: (a) Zeta potential analysis of CQD-1 and CQD-2. (b) Photographs of CQDs suspensions (250 µg mL^{-1}) after 1h incubation at 37 °C in water (W), PBS (0.01 M, P) and Dulbecco's Modified Eagle's medium (M).



Sample	Slope	Refractive index of solvent (η)	Quantum yield (Φ)
QS	57671	1.33	0.54
CQD-1	815.21	1.33	0.008
CQD-2	259.12	1.33	0.002

Figure S5: The relationship between the integrated fluorescence intensity and the absorbance of quinine sulfate (QS), CQD-1 and CQD-2. The quantum yield (Φ) of CQDs was calculated by comparing the integrated PL intensity (excitation at 350 nm) in aqueous dispersion (refractive index η = 1.33) and absorbance values at 350 nm against quinine sulphate in 0.1 M H_2SO_4 (refractive index η = 1.33, quantum yield of 0.54 at 350 nm) with the following equation: $\Phi = \Phi_{QS}(I/I_{QS})(A_{QS}/A)(\eta^2/\eta^2_{QS})$, where Φ is the quantum yield, A is the optical density, I is the measured integrated emission fluorescence intensity, and η is the refractive index. Optical density values of the solutions were kept under 0.1 at the excitation wavelength to minimize reabsorption effects.

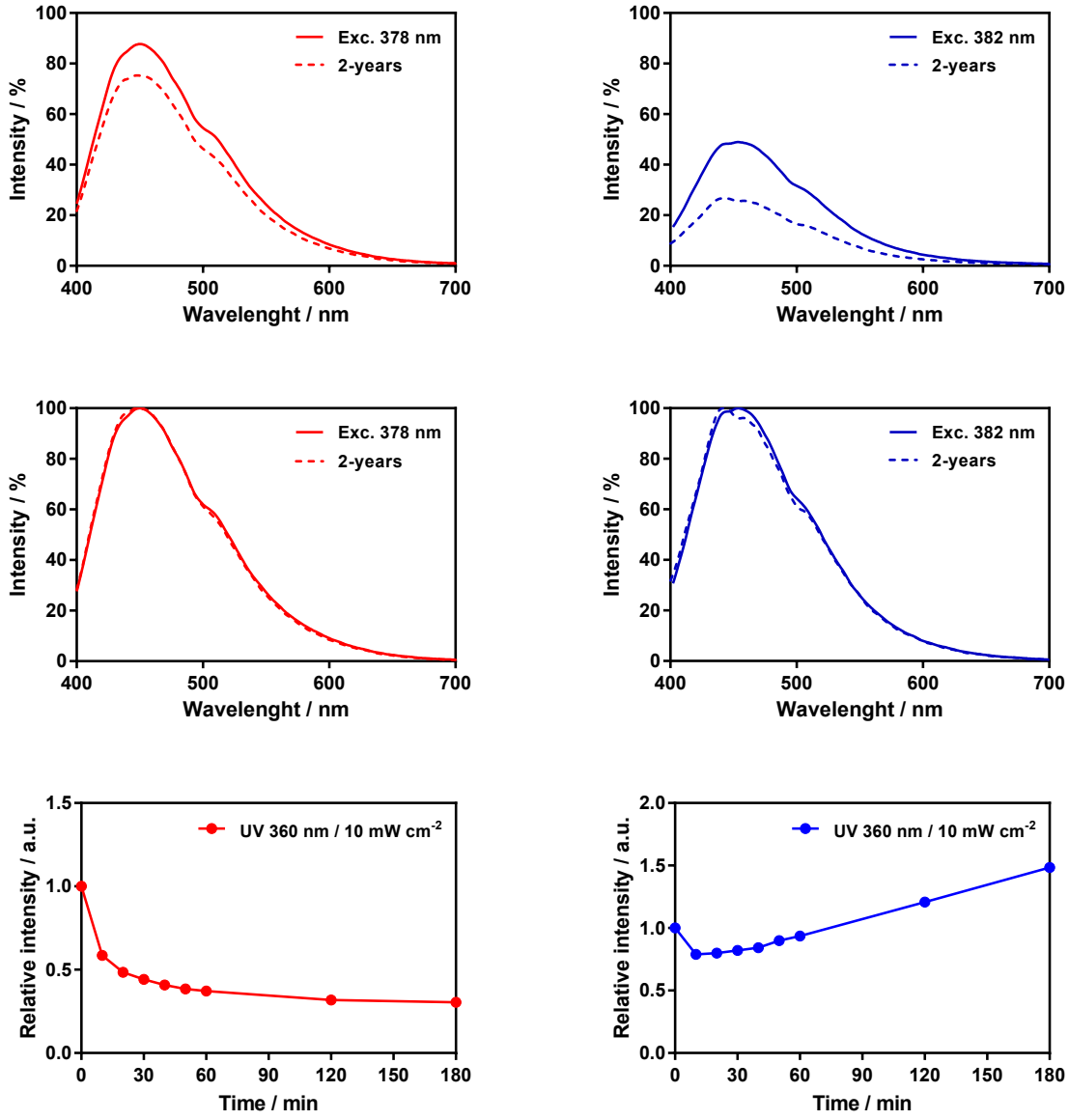
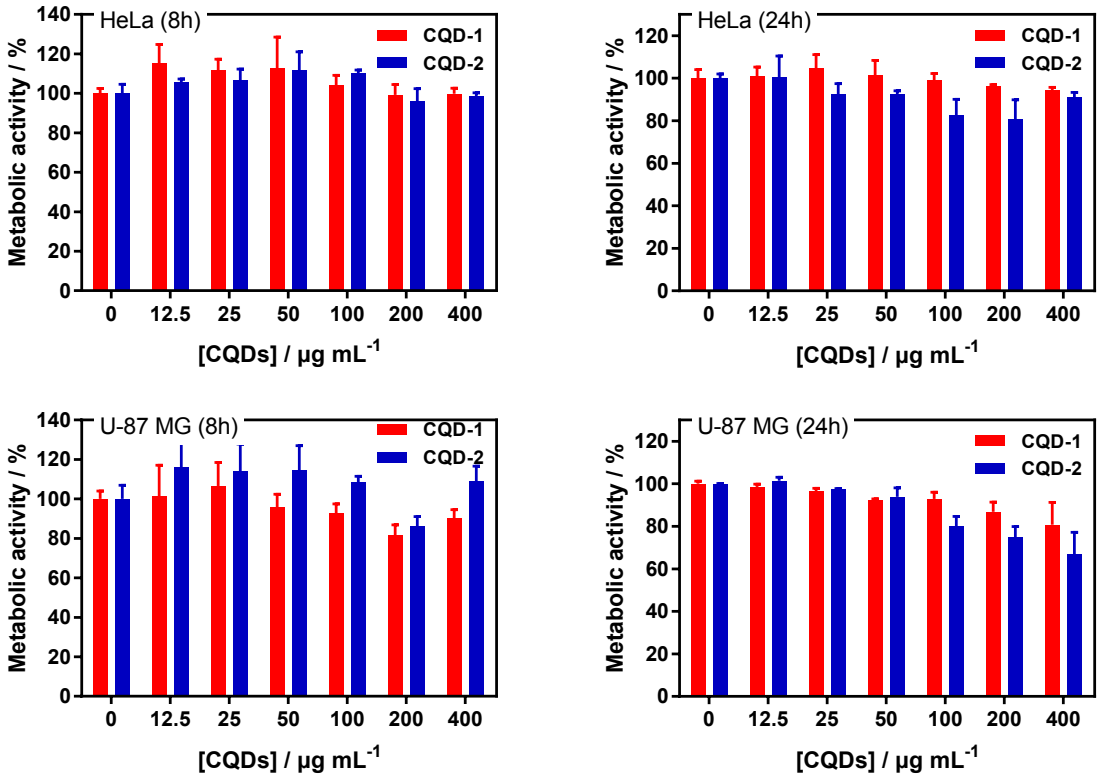


Figure S6: Optical stability of CQD-1 (red) and CQD-2 (blue) in various conditions: Fluorescence emission after 2-years, normalized fluorescence emission after 2-years and relative fluorescence emission of CQDs solution (20 µg mL^{-1} in PBS) during UV light irradiation at 360 nm (10 mW cm^{-2}) during 3 hours.

(a)



(b)

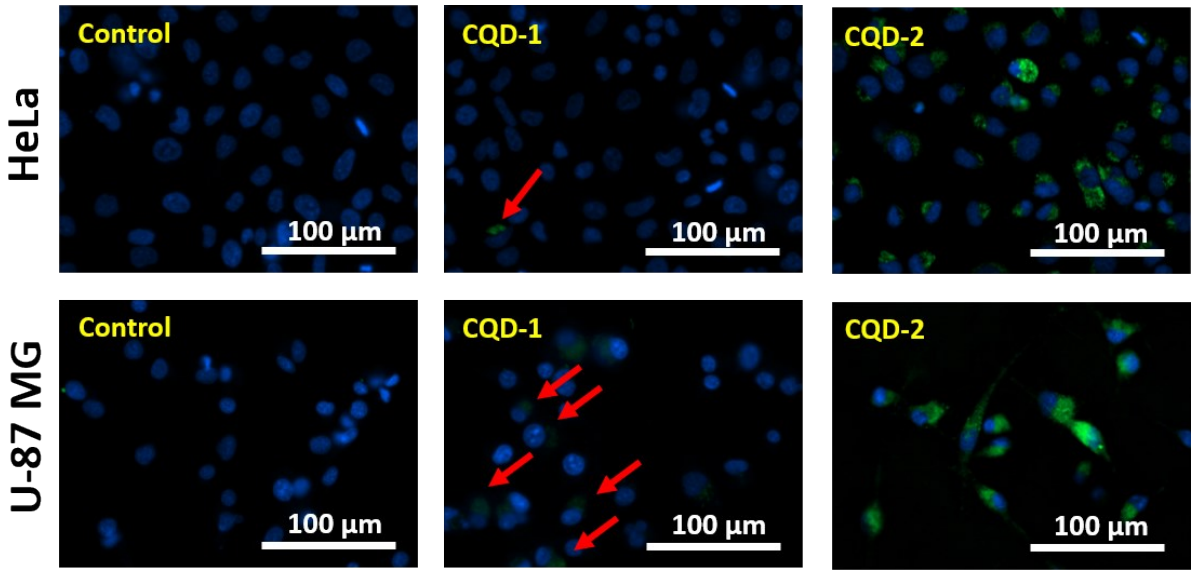


Figure S7: Metabolic activity and CQDs uptake: (a) Metabolic activity of HeLa and U-87 MG cells treated with CQDs: cells were grown in 96-well plates (10^4 cells/well) with 100 µL of culture medium containing increasing concentration of CQDs for 8 h (left) and 24 h (right). The results, expressed as percentage of viability, are the mean value of two independent experiments

with each treatment performed in triplicate. Negative control: without CQDs. (b) Fluorescence microscopy of HeLa and U-87 MG cells treated with 100 µg mL^{-1} of CQDs for 24 h The blue signal corresponds to the nuclei stained with Hoechst 33258, while the green signal is attributed to CQDs. Scale bars = 100 µm.

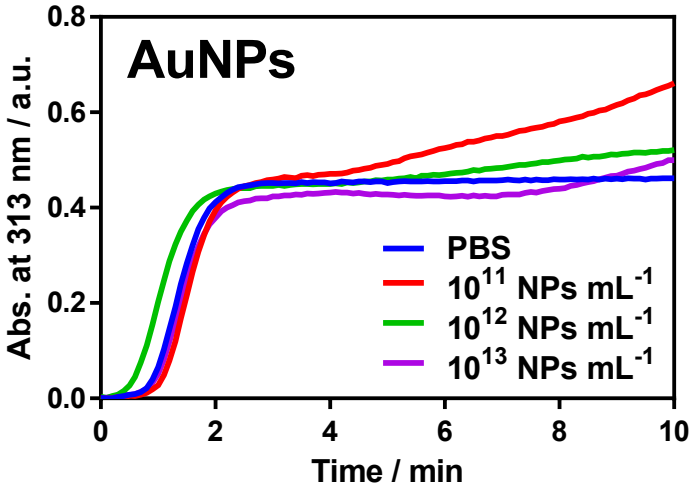


Figure S8: Fibril formation study of collagen I using turbidity data: UV-vis absorption evolution of collagen I (0.3 mg mL^{-1}) at 313 nm in PBS buffer (pH 7.4) at 37 °C under static condition (blue) and in the presence of increasing concentrations of gold nanoparticles (AuNPs) (10^{11}-10^{13} AuNPs mL^{-1}).