Electronic Supplementary Material (ESI) for Biomaterials Science.

Supporting information

Energy Transfer Facilitated Near Infrared Fluorescence Imaging and Photodynamic Therapy of Tumor

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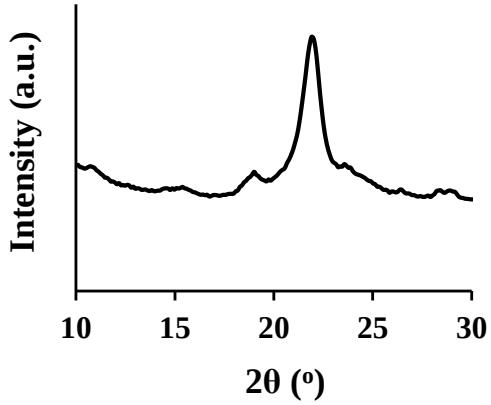

Figure S1. XRD pattern of N, S co-doped GQDs.

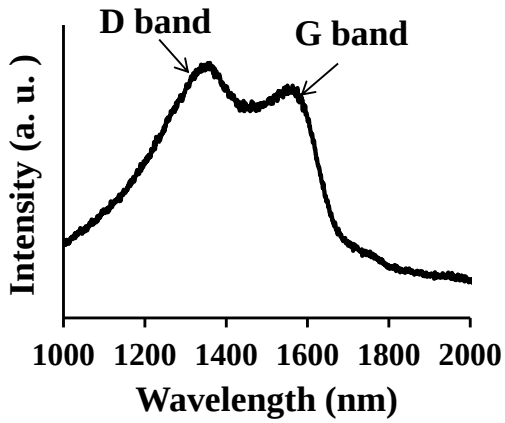

Figure S2. Raman spectrum of N, S co-doped GQDs GQDs.

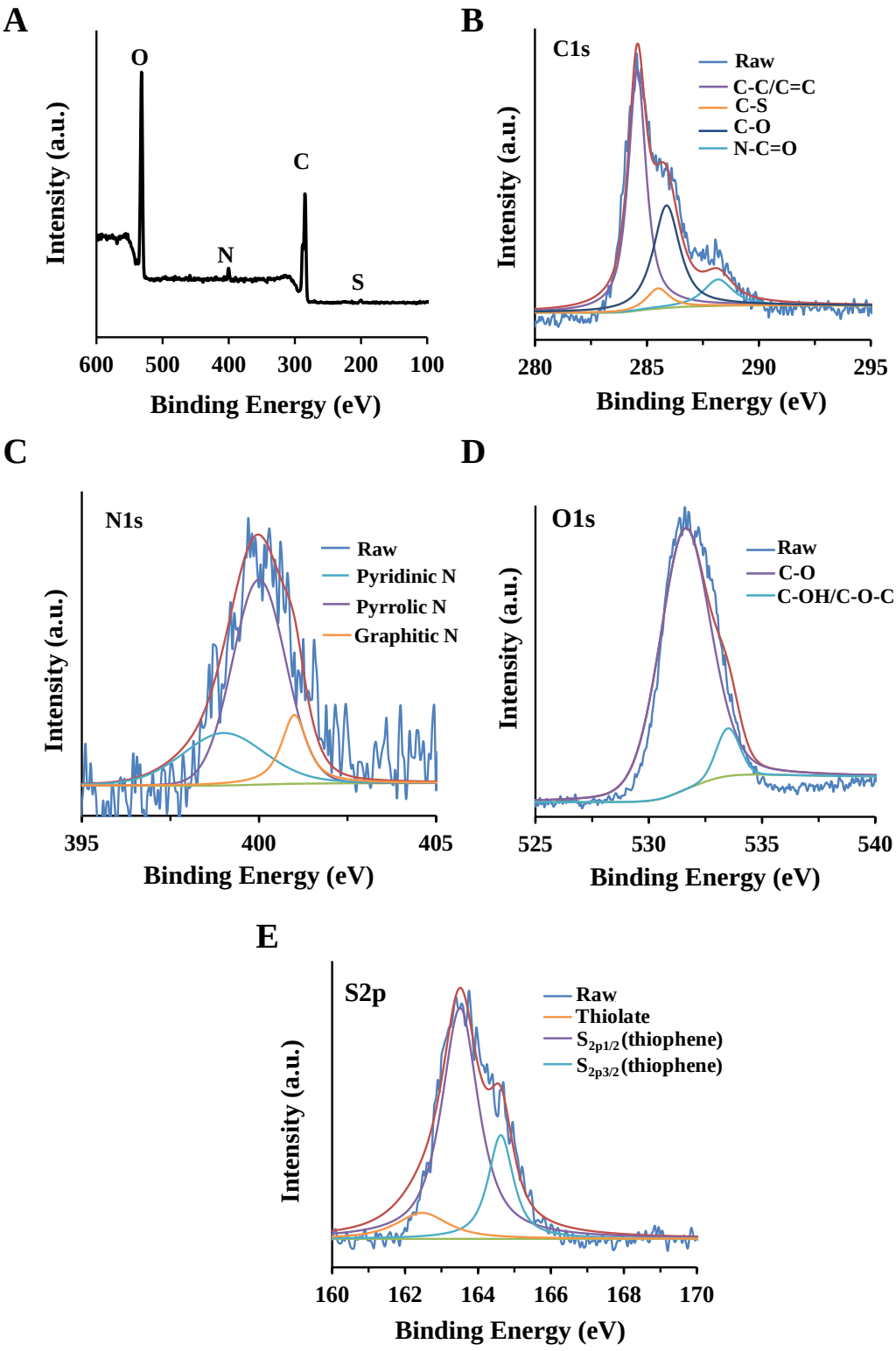

Figure S3. a) XPS survey spectrum and high-resolution spectra for (b) C 1s, (c) N 1s, (d) O 1s, and S 2p of N, S co-doped GQDs.

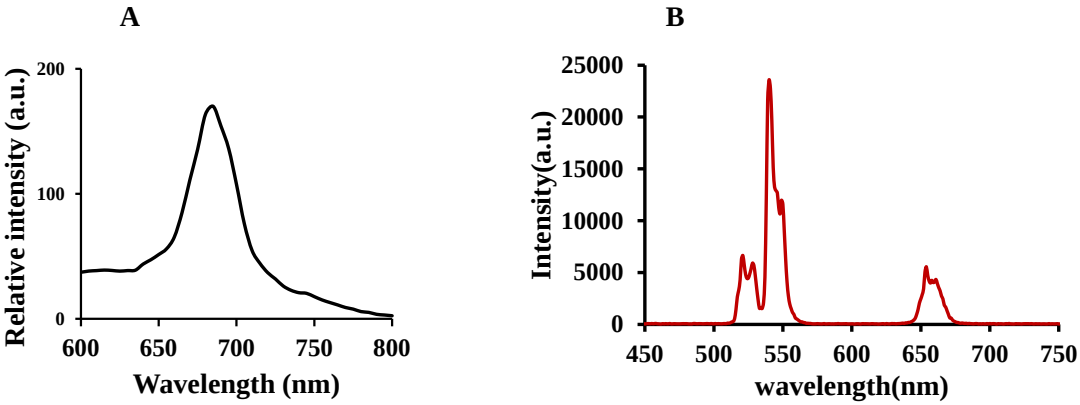

Figure S4. Fluorescence spectra of (a) N, S co-doped GQDs under 530 nm excitation and (b) GUCNPs under 980 nm excitation.

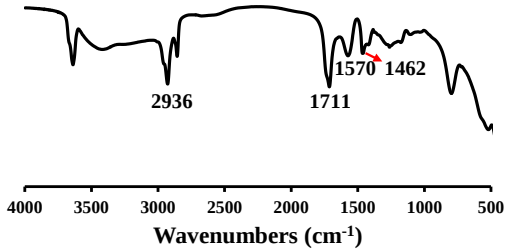

Figure S5. FT-IR spectra of $_{PNS}$GQDs.

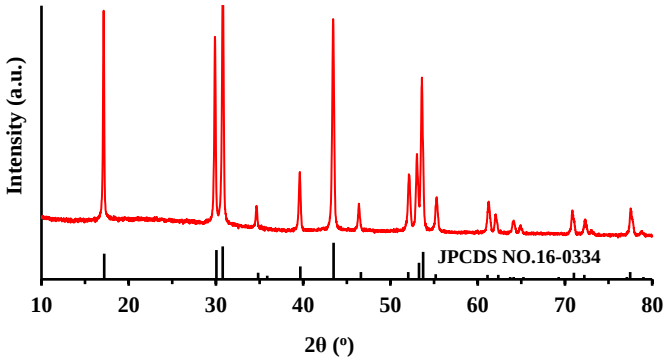

Figure S6. XRD patterns of UCNPs and JCPDS card.

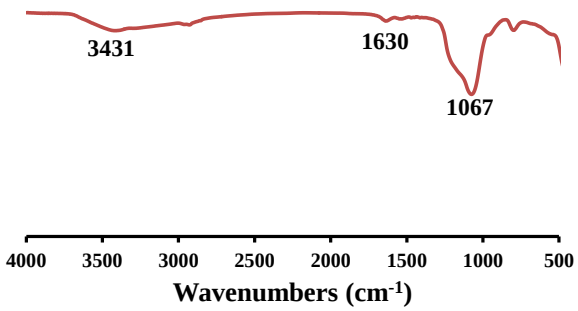

Figure S7. FT-IR spectra of $_{AS}$UCNPs.

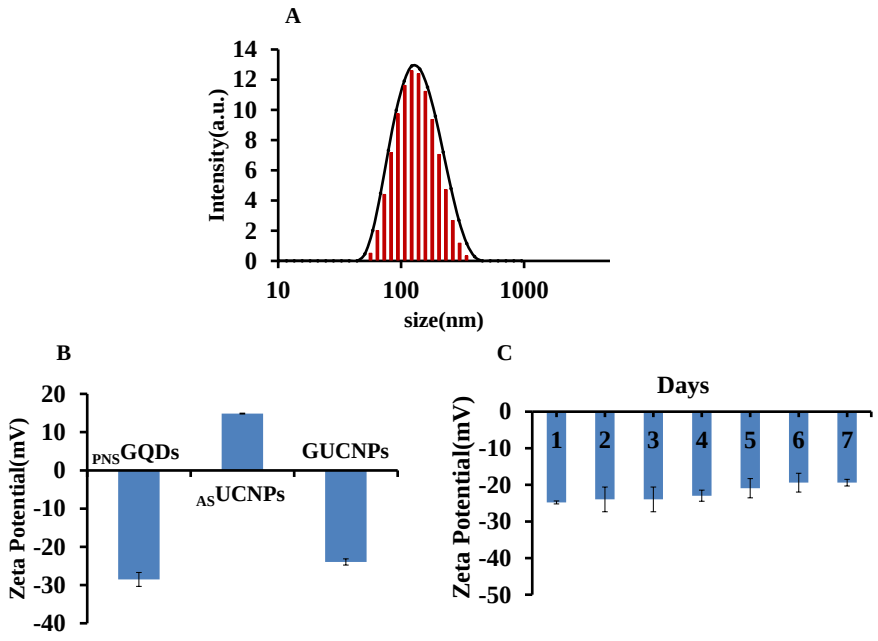

Figure S8. (a) Size distribution of GUCNPs by DLS; (b) Surface charge of the $_{PNS}$GQDs, $_{AS}$UCNPs and GUCNPs; (c) Surface charge variation of GUCNPs within 7 days

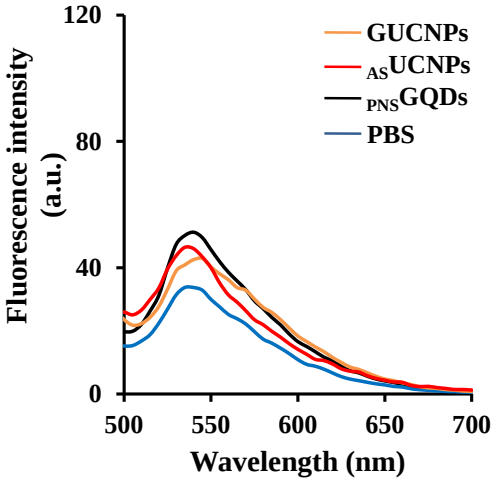

Figure S9. $^1O_2$ generation on $_{PNS}$GQDs, $_{AS}$UCNPs, and GUCNPs assessed by SOSG fluorescence emission without 980 nm laser irradiation. 30 μg mL^{-1} $_{PNS}$GQDs, 170 μg mL^{-1} ASUCNPs, or 200μg mL^{-1} GUCNPs were incubated with 12 μmol L^{-1} SOSG, and the fluorescence emission spectra of SOSG were recorded from 500 to 700 nm (λ_{ex} = 393 nm). The concentrations of $_{AS}$UCNPs and $_{PNS}$GQDs were equivalent to those in GUCNPs.

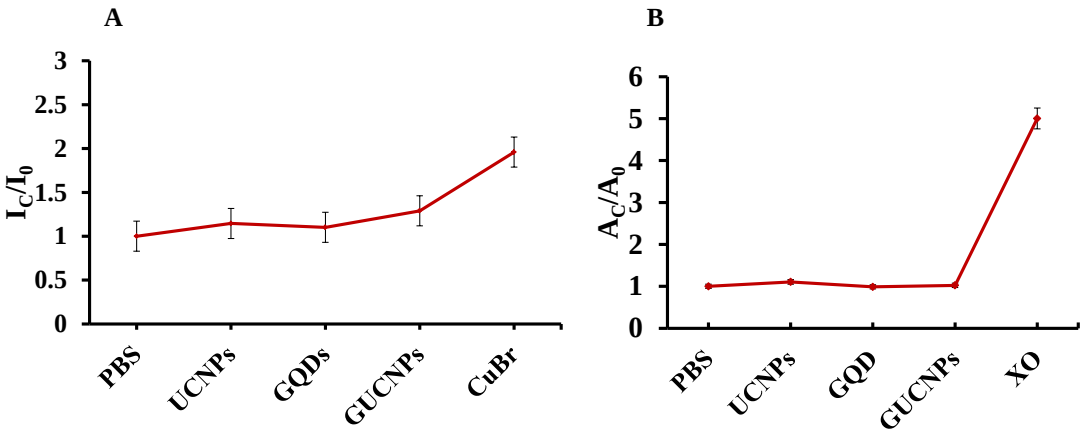

Figure S10. The other types of ROS detection.(a)TA detection assay for hydroxyl radical.20 μL 10 μM stock solution were added into 100 μL 1 mg mL-1 GUCNPs, UCNPs, GQDs respectively. The TA fluorescence emission spectra were collected at 430 nm. (b) XTT detection assay for

superoxide radicals. 20 μL 100 μM stock solution were added into 100 μL 1 mg mL^{-1} GUCNPs, UCNPs, GQDs respectively. The absorbance of XTT was recorded at 460 nm.

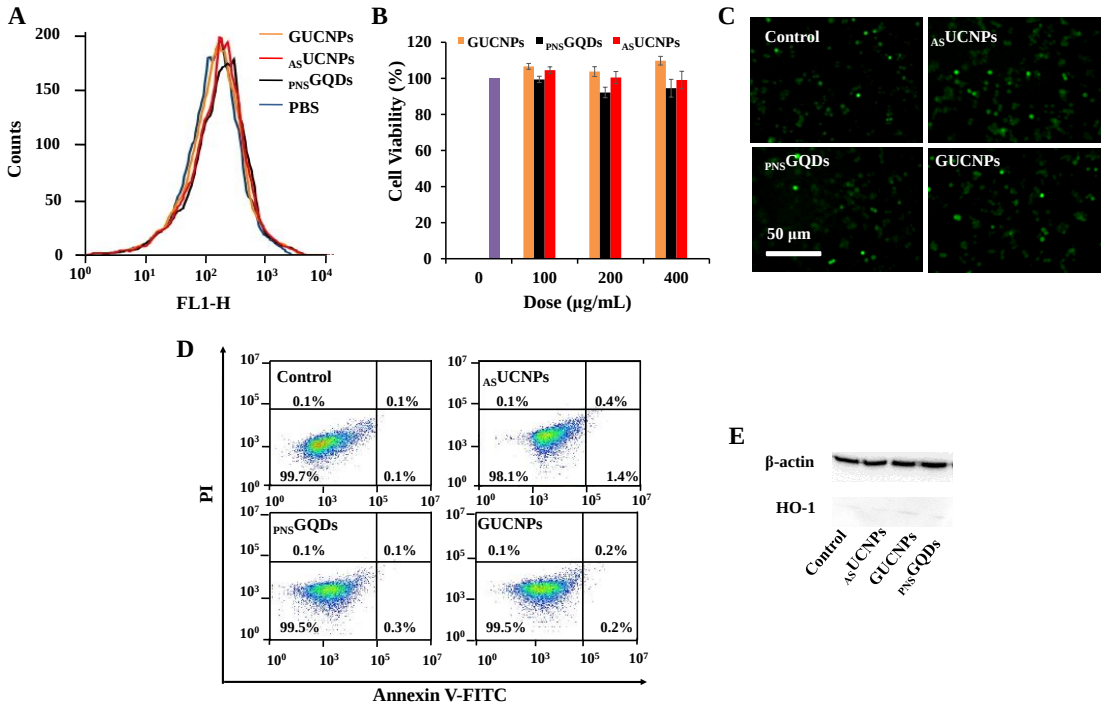

Figure S11. Cellular responses of GUCNPs in 4T1 cells without 980 nm laser irradiation. (a) Cellular ROS production detected by flow cytometric analysis based on DCF assay; (b) Cell viability assessment by MTS assay; Cells were treated with various NPs for 24 h; (c) Live/Dead cell staining based on calcein AM/PI assay; (d) Apoptotic cells analyzed by flow cytometry based on Annexin V-FITC/PI staining; (e) HO-1 expression analyzed by western blot. For figures (a), and (c-e), cells were treated with 30 μg mL^{-1} PNSGQDs, 170 μg mL^{-1} ASUCNPs, or 200 μg mL^{-1} GUCNPs for 24 h. For figure (b), cells were treated with 15-60 μg mL^{-1} $_{PNS}$GQDs, 85-340 μg mL^{-1} ASUCNPs, or 100-400 μg mL^{-1} GUCNPs for 24 h. The concentrations of $_{AS}$UCNPs and $_{PNS}$GQDs were equivalent to those in GUCNPs.

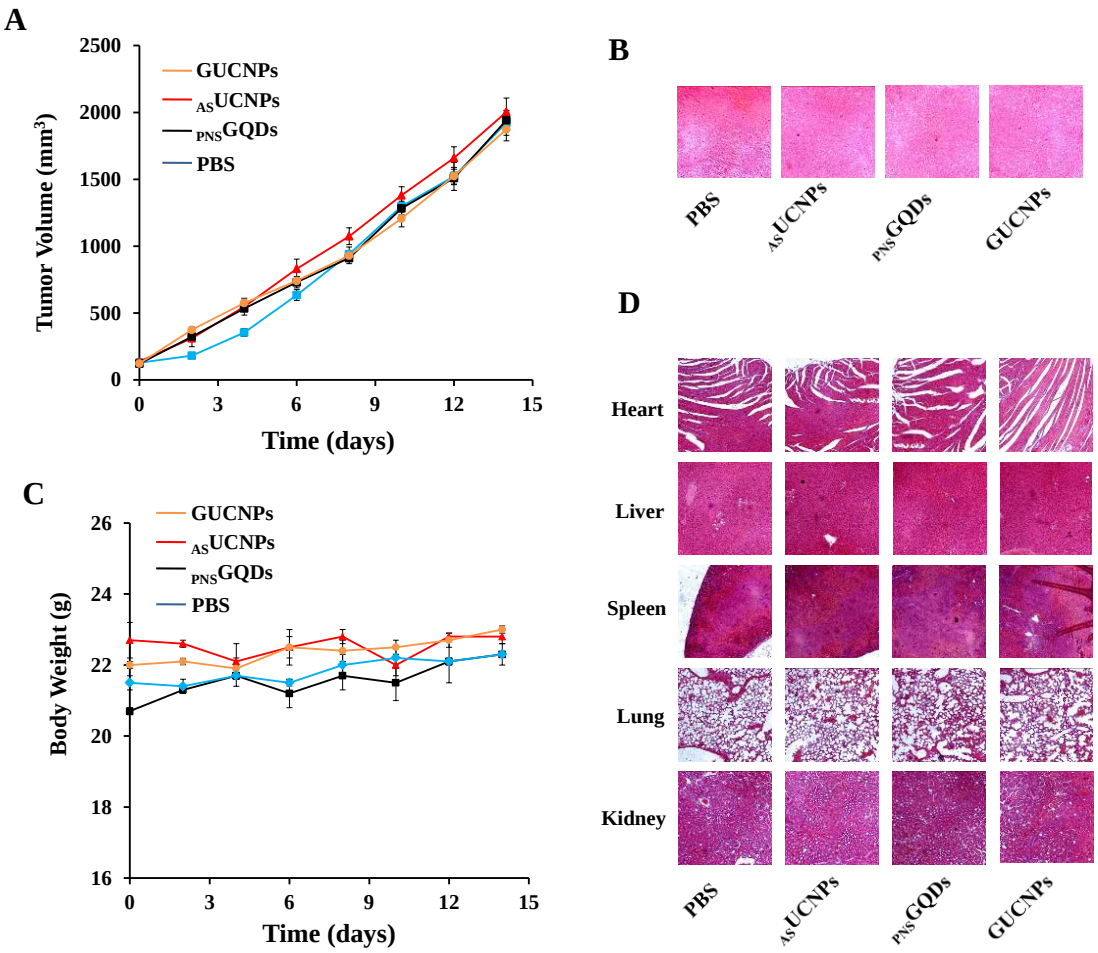

Figure S12. The biosafety assessment of GUCNPs in 4T1 tumor bearing mice without 980 nm laser irradiation. (a) Tumor growth curves of mice intravenously administered with $_{PNS}$GQDs, $_{AS}$UCNPs, or GUCNPs; (b) H&E stained histological images of the tumor tissues harvested from mice at the end of treatment; (c) Body weight variation of mice during the treatment period; (d) H&E stained histological images of major organs collected at the end of treatment.