## Supporting information

# Black Phosphorus Quantum Dots Enhance the Radiosensitivity of Human Renal Cell Carcinoma Cells through Inhibition of DNA-PKcs Kinase

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## Other methods

### *Synthesis and Characterization of BPQDs*

Bulk BP crystals (99.998%) were mixed with NMP (99.5%, anhydrous) and maintained for 12 h at 140 °C under vigorous stirring and $N_2$ protection. Afterwards, this mixture was centrifuged at 12,000 rpm for 20 min, and the supernatant solution was collected for further characterization and application. The morphology and thickness of BPQDs were detected using transmission electron microscopy (TEM, Tecnai G-20, FEI) and atomic force microscopy (AFM, Dimension Icon, Bruker), respectively. The hydrodynamic size and zeta potential of BPQDs were measured using a particle analyzer (Zetasizer Nano-ZS, Malvern).

**Table S1 Characterization of BPQDs.**

| Characterization | Condition | Results |
|---|---|---|
| Zeta potential | DI water | -24.3 ± 0.8 mV |
| Hydrodynamic size | DI water | 11.7 ± 1.5 nm |
| Zeta potential | PBS | -16.9 ± 0.3 mV |
| Hydrodynamic size | PBS | 26.5 ± 2.3 nm |

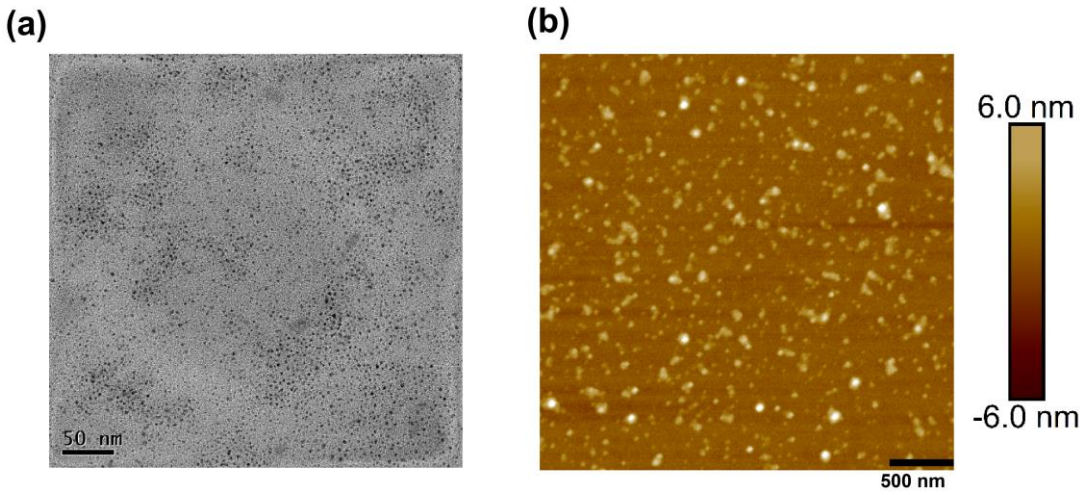



**Figure S1.** (a) TEM and (b) AFM images of BPQDs.

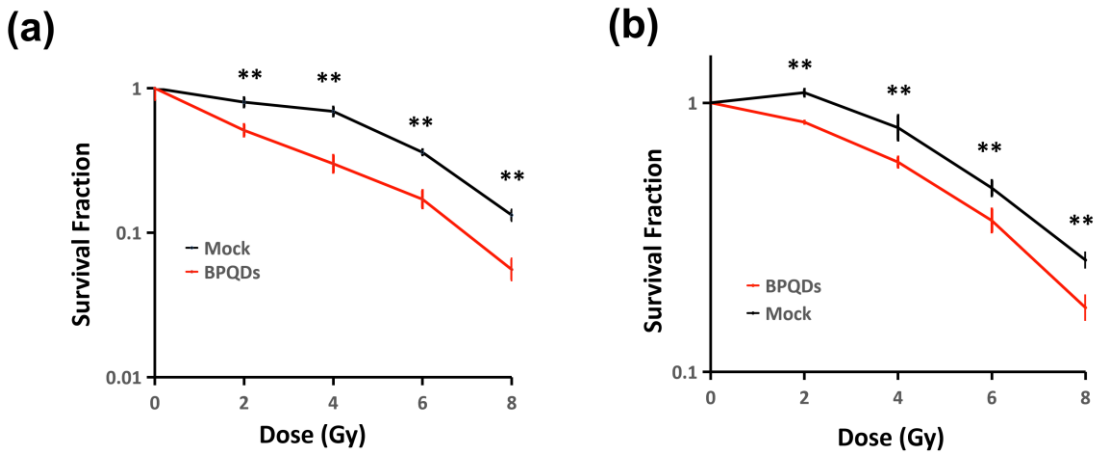



**Figure S2**. BPQDs treatment sensitizes RCC cells to irradiation. (a) 786O and (b) A498 cells were subjected to indicated dose of X-ray irradiation in combination with or without BPQDs treatment (20 μg/mL, 12 h before IR), and were analyzed for clonal survival ability, $^{**}P < 0.01$.

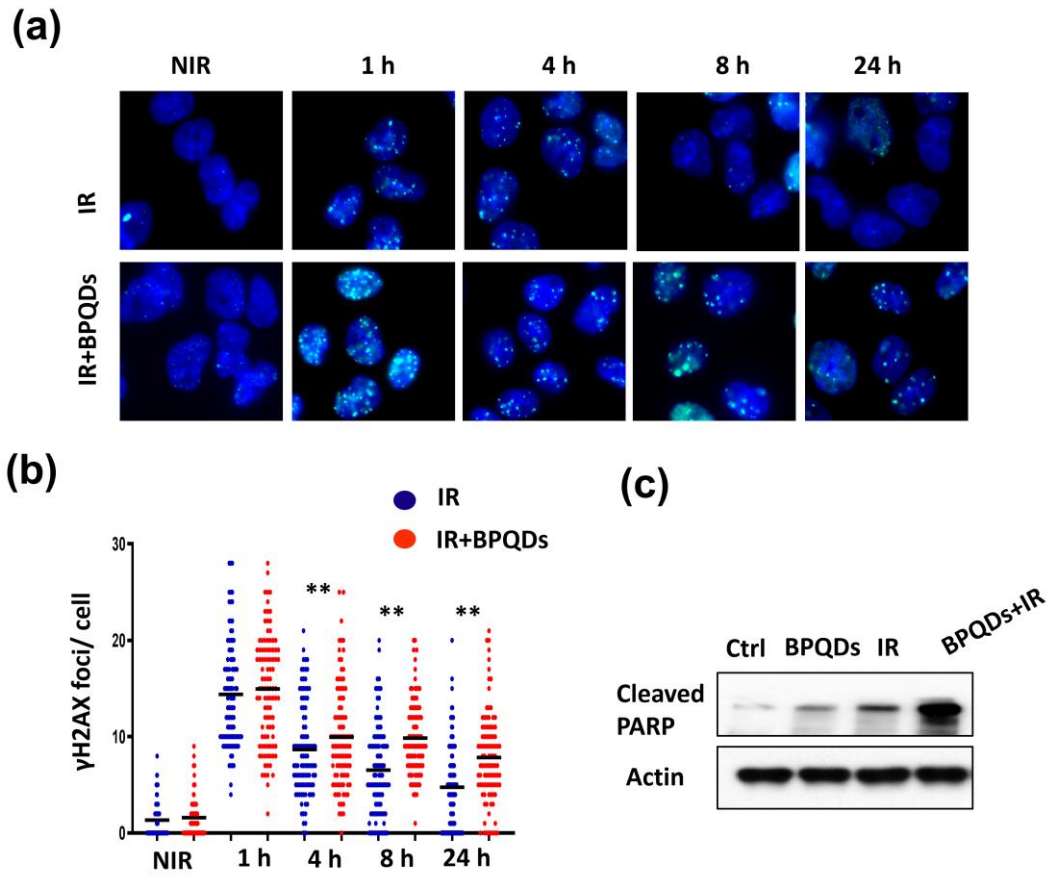



**Figure S3**. BPQDs decrease the capacity of DNA DSBs and enhance IR-induced apoptosis in A498 cells. (**a**) Representative IF images showing γH2AX foci in A498 cells treated with 20 μg/mL BPQDs or PBS 2 h before 2 Gy IR . (**b**) Number of γH2AX foci per cell at the indicated time points post-IR ($^{**}p < 0.01$). (**c**) A498 cells were exposed to 20 μg/mL BPQDs along or in combination with 5 Gy IR for 24 h and subjected to immunoblotting with anti-Cleaved PARP (Asp214), and anti-Actin antibodies.