Supporting information for

Size-Focusing Results in Highly Photoluminescent Sulfur Quantum Dots with Steadfast Emission Wavelength

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Optimization of the synthesis method. Some important parameters such as the volume of PEG-400, the concentration of NaOH, the concentration of H_2O_2 and the ultrasound-microwave pretreatment time before adding H_2O_2 for the SQDs synthesis were optimized (Figure S1). The fluorescence intensities of SQDs were recorded at an excitation wavelength of 364 nm. We found the following experimental conditions to give best results: (a) a NaOH concentration of 1.6 M; (b) a PEG-400 volume of 1.2 mL; (c) a H_2O_2 concentration of 1.2 mM; (d) an ultrasound-microwave pretreatment time of 60 min.

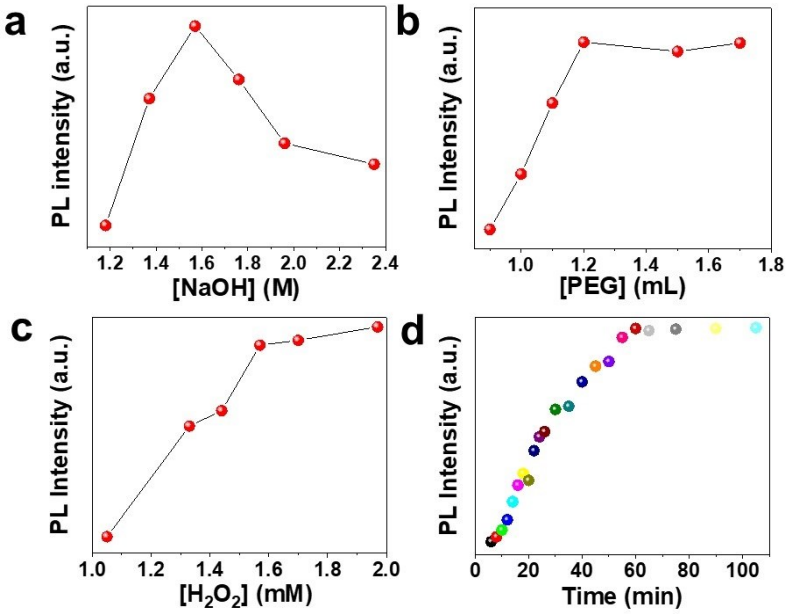

Fig. S1. Optimization of the effect of a) the volume of PEG-400, b) the concentration of NaOH, c) the concentration of H_2O_2 and d) ultrasound-microwave pretreatment time before adding H_2O_2 for the SQDs synthesis.

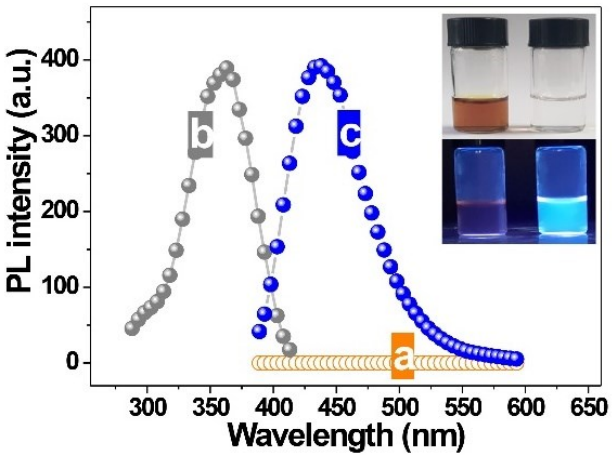

Fig. S2. a) PL emission spectrum of SNPs. b) PL excitation spectrum of SQDs. c) PL emission spectrum of SQDs. Inset: Photographs of SNPs (left) and SQDs (right) in ambient light (top) and UV light (bottom).

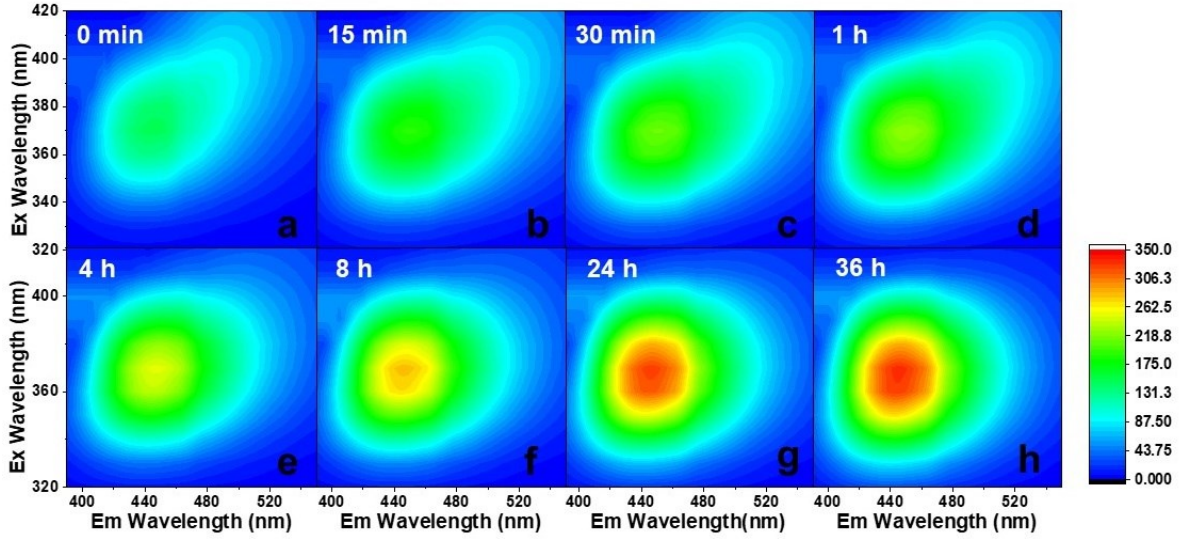

Fig. S3. 3D-EEM fluorescence spectra of SQDs placing at room temperature after adding H_2O_2 at different duration: a) 0 min, b) 15 min, c) 30 min, d) 1 h, e) 4 h, f) 8 h, g) 24 h, and h) 36 h.

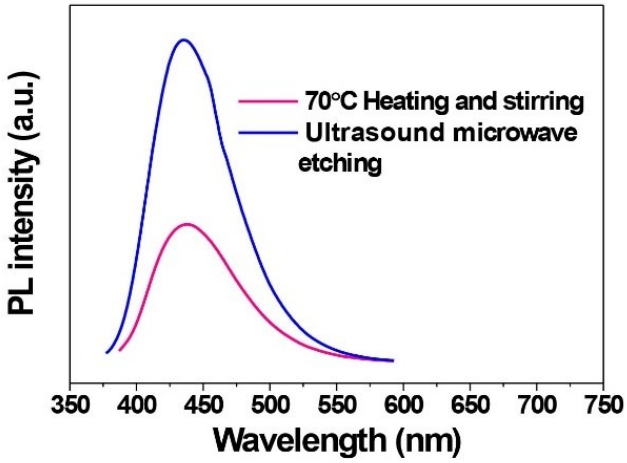

Fig. S4. PL spectra of SQDs with two different kinds of heating methods: a) 70 ºC water-bath heating with stirring and b) 70 ºC ultrasound microwave heating after treatment.

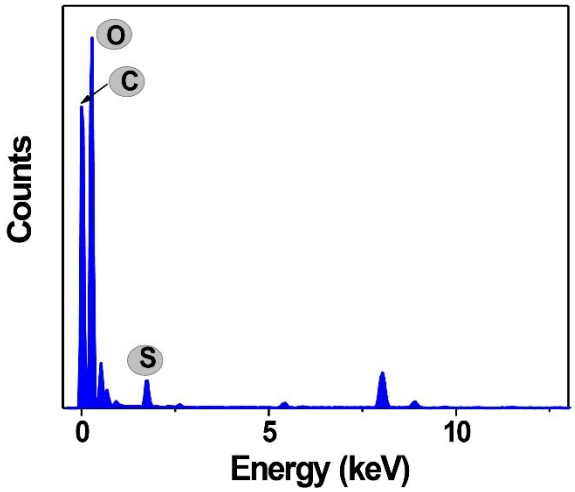

Fig. S5. EDS spectrum of SQDs.

The presence of peaks at 2870, 1402, 1080 and 870 cm^{-1} in PEG sample ascribed to the stretching vibration of C-H, the bending vibration of C-H, the symmetrical stretching vibration of C-O-C, and in-plane bending vibration of C-H, respectively. All the above characteristic peaks of PEG could also be observed in SQDs sample, which indicated that only

physical interaction presented between PEG and SQDs. Besides, a new band at 1430 cm^{-1} of SQDs sample corresponded to the coupling of the S=O stretching vibration, which implied that SQDs surface contained a large number of sulfonyl groups.

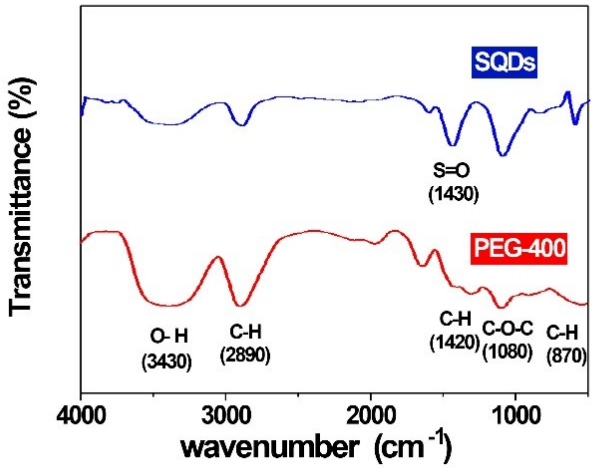

Fig. S6. FT-IR spectra of the PEG-400 (red curve) and SQDs (blue curve).

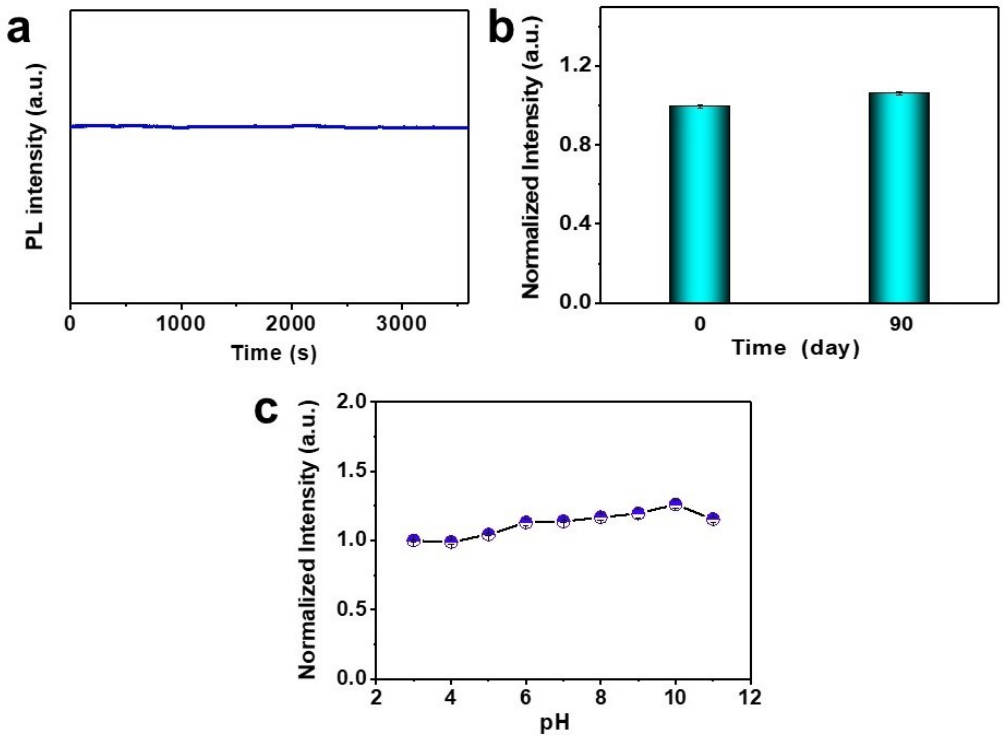

Fig. S7. PL stability of the as-prepared SQDs: a) fluorescence intensity of SQDs after xenon arc light exposure for different times; relative fluorescence intensity of SQDs for b) different room temperature storage time and c) pH.

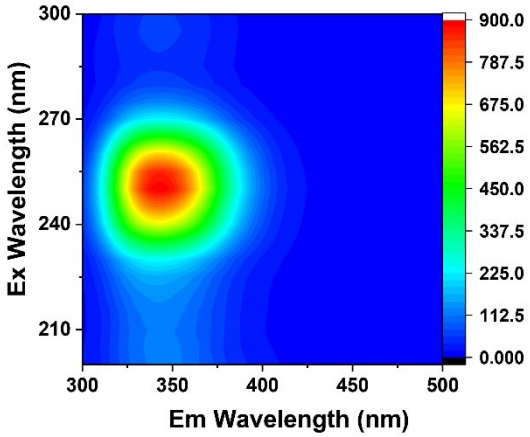

Fig. S8. The 3D-EEM spectrum of SQDs/Ce(IV) system.

Optimization of SQD-based PL sensing for Ce(IV) . As shown in Figure S9a, With the increasing of pH value, the quenching efficiency of Ce(IV) decreased conspicuously, which may result from the hydrolyzation of Ce(IV) under higher pH environment, demonstrating that alkaline conditions were not favourable for the redox reaction of SQDs and Ce(IV). Thus, pH of 3 was selected as the appropriate value for all subsequent experiments. In addition, the PL inhibition efficiency improved with reaction time and then reached a plateau at 10 min (Figure S9b). Thus, 10 min was the optimal time for the SQDs/Ce(IV) quenching reaction.

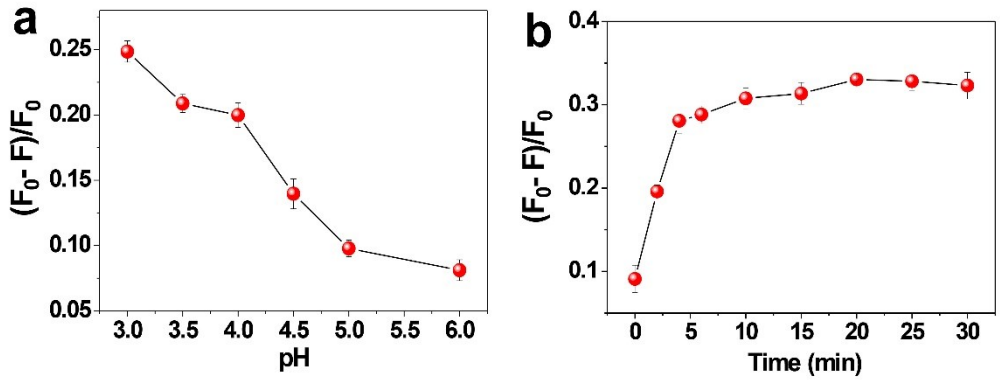

Fig. S9. Optimization of a) pH and b) reaction time for the redox reaction between SQDs and Ce(IV).

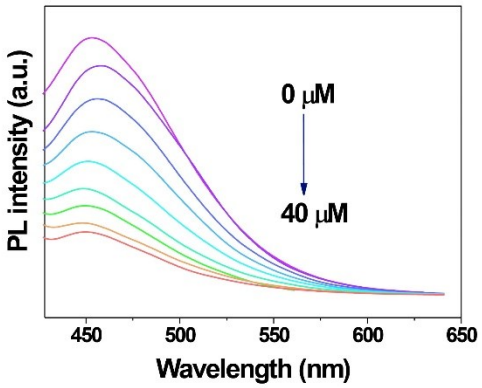

Fig. S10. Fluorescent spectra of SQDs in the presence of different concentrations of Ce(IV). From top to bottom: 0, 0.5, 1.0, 2.0, 4.0, 8.0, 10.0, 20.0, and 40.0 μM.