Green emissive water dispersible silicon quantum dots for fluorescent and colorimetric dual mode sensing of curcumin

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Reagents and materials

N-[3-(trimethoxysilyl) propyl]-ethylenediamine (DAMO), p-phenylenediamine, curcumin, urea, glucose, maltose, L-tryptophan, L-cysteine, L-threonine, L-serine, L-arginine, glycine, L-isoleucine, L-glutamic acid, L-methionine, L-valine, vitamin C (VC), and VB_{12} were obtained from Aladdin Chemical Co. Ltd. $NaH_2PO_4 \cdot 2H_2O$ and $Na_2HPO_4 \cdot 12H_2O$ were purchased from Tianjin Fuchen Chemical Reagent Factory. Phosphate buffered saline solution (PBS) was prepared with 10 mM NaH_2PO_4-Na_2HPO_4. Sodium chloride (NaCl), sodium perchlorate ($NaClO_4$), potassium fluoride (KF), potassium bromide (KBr), silver nitrate ($AgNO_3$), manganese chloride ($MnCl_2$), nickel chloride ($NiCl_2$), potassium oxalate monohydrate ($K_2C_2O_4 \cdot H_2O$), cobaltous chloride ($CoCl_2$), potassium lodide (KI), calcium chloride ($CaCl_2$) and zinc nitrate ($Zn(NO_3)_2 \cdot 6H_2O$) were received from Tianjin Kemiou Chemical Reagent Co., Ltd. All reagents were analytical grade and used without further purification. Deionized water was used throughout the experiment.

Preparation of paper sensor

Firstly, a piece of qualitative filter paper was immerged into the SiQDs solution for 20 min. The filter paper was then removed from the solution and dried in an oven at 50 ºC. After cooling to room temperature, the filter paper was cut into strips and kept flat. Afterwards, 10 μL curcumin solution with different concentrations was dropped into the filter paper strips. After the solvent on the filter paper strips was naturally evaporated at room temperature, the filter paper strips were observed and photographed under sunlight and 365 nm UV lamp.

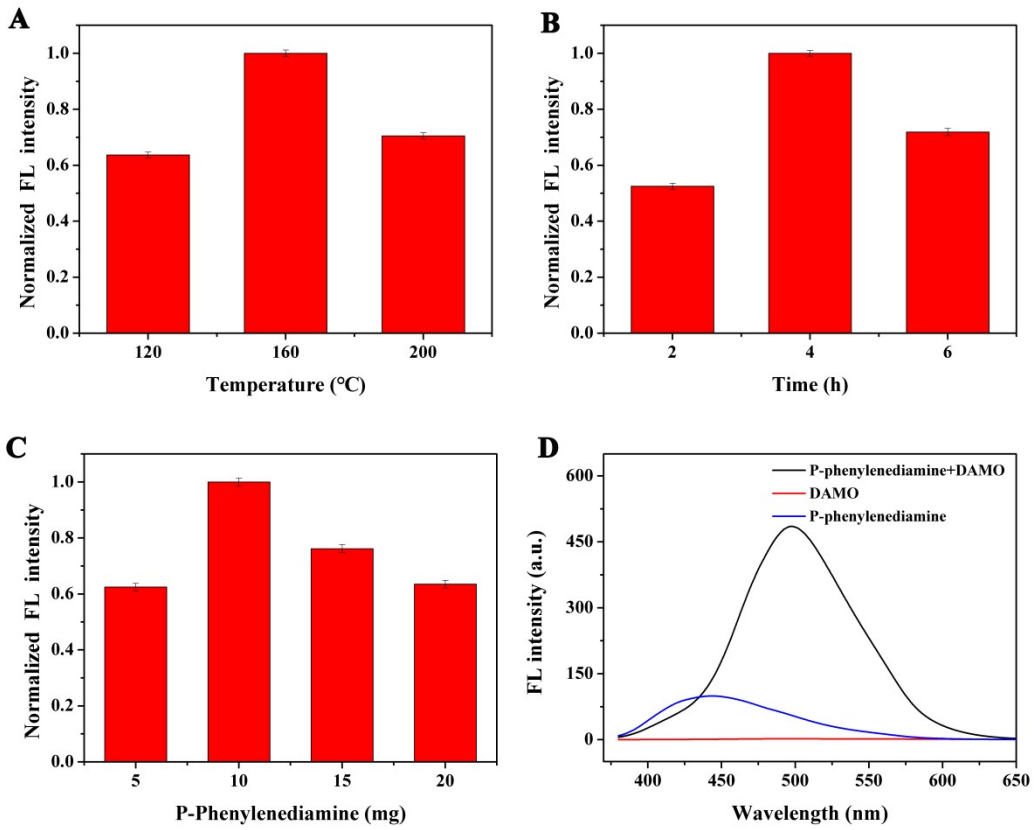
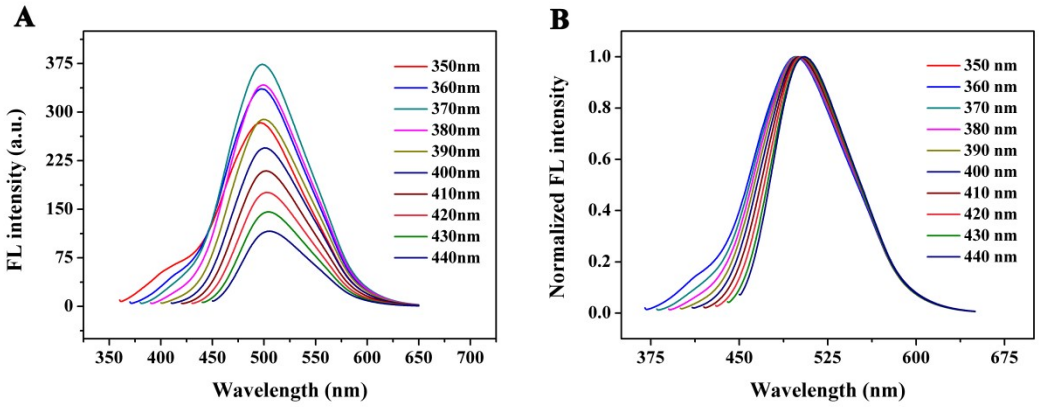


Figure S1. Normalized FL intensity of the SiQDs synthesized at different reaction temperature (A), different reaction time (B) and different weight of p-phenylenediamine(C); The fluorescence emission spectra of the materials prepared by the reaction of only DAMO, only p-phenylenediamine, DAMO+ p-phenylenediamine under the same conditions(D).



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45 **Figure S2.** FL intensity (A), and normalized FL intensity (B) of the prepared SiQDs

46 at different excitation wavelengths.

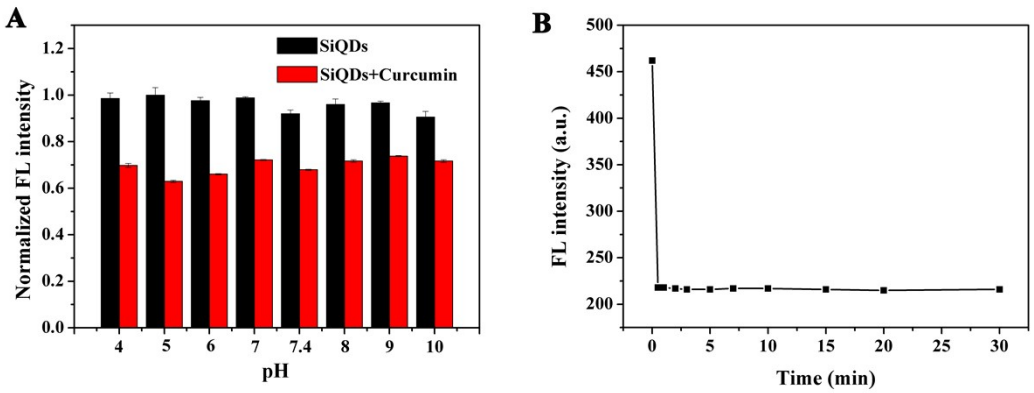


Figure S3. (A) Normalized FL intensity of the SiQDs (black bars) and the subsequent addition of 5 μM curcumin (red bars) at different pH values. (B) Time-dependent FL intensity of the SiQDs with the addition of curcumin (10 μM) at room temperature.

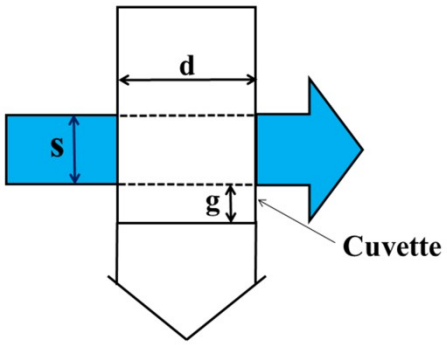
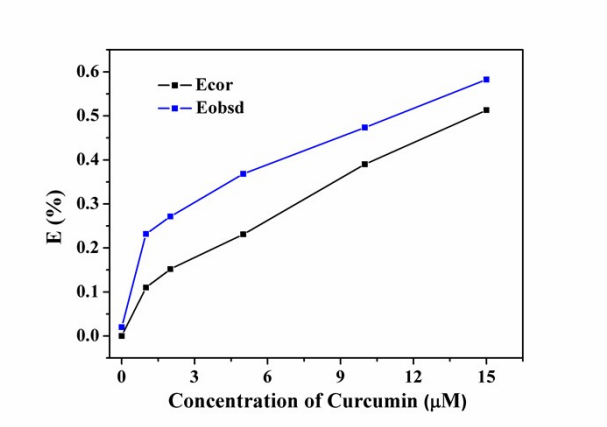


Figure S4. Parameters related to equation 1.



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54 **Figure S5.** Suppressed efficiency (E, %) of observed (blue line, E_{obsd}) and corrected

55 (black line, E_{cor}) FL intensity.

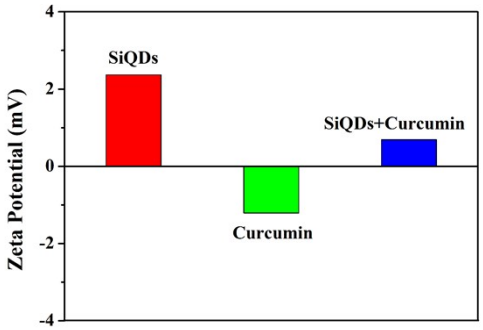

Figure S6. Zeta potentials of the SiQDs, curcumin and the mixtures of the SiQDs and curcumin in a pH 5.0 PBS solution.

Table S1 Influence of different curcumin concentrations on fluorescence lifetime of SiQDs.

Concentration of curcumin (μM)	Fluorescence lifetime (ns)
0	4.81
1	4.81
10	4.76
25	4.74

Table S2 Parameters for calculate IFE of curcumin on the fluorescence of the SiQDs.

curcumin (μM)	A_{ex}[a]	A_{em}[b]	CF[c]	F_{obsed}[d]	F_{cor}[e]	E_{obsd}[f]	E_{cor}[g]
0	0.497	0.059	1.79	407	728.4	0.000	0.000
1	0.525	0.071	1.86	362	673.3	0.110	0.076
2	0.538	0.085	1.92	345	663	0.152	0.090
5	0.590	0.097	2.04	313	637.8	0.231	0.124
10	0.649	0.218	2.46	246	610.1	0.390	0.162
15	0.722	0.351	2.94	198	582.1	0.513	0.201

[a]A_{ex} and [b]A_{em} are the absorbance of the SiQDs upon addition of curcumin at 368 and 498 nm, respectively.

[c]Corrected factor (CF) is calculated as F_{cor}/F_{obsd}.

[d]F_{obsd} is the measured FL intensity of the SiQDs upon addition of curcumin at 498 nm.

[e]F_{cor} is the corrected FL intensity with Eq. (1) by removing IFE from the measured FL intensity (F_{obsd}).

[f]E_{obsd} =1-$F_{obsd}/F_{obsd,0}$, in which $F_{obsd,0}$ is the observed FL intensities of the SiQDs in the absence of curcumin.

[g]E_{cor}=1-$F_{cor}/F_{cor,0}$, in which $F_{cor,0}$ is the corrected FL intensities of the SiQDs in the absence of curcumin.