Supplementary information

Colorimetric Detection of Urine Glucose using C/CdTe QDs-GOx Aerogel based on Microfluidic Assay Sensor

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Synthesis of CQDs.

Prepare a 50 ml beaker and weigh 7.1g ethyl citrate and 3.7g ethylenediamine in the beaker; Stir the mixture in a beaker of 15 min, and then add solution into the reaction kettle of PTFE lining, the reaction kettle into the oven, heated to 150 ℃, the heat preservation 5 h; Heat removed after the completion of the reaction kettle, with 200 ml ultrapure water dilute solution in reaction kettle, then solution evenly into several frozen tube, placed in the refrigerator to - 20 ℃ frozen for 24 h; The frozen tube was taken out and freeze-dried in the freeze-dryer. Green fluorescent CQDs could be obtained after the product was completely freeze-dried. Then the CQDs was dissolved in 100ml ultra-pure water as the original CQDs solution.

Synthesis of CdTe QDs

Prepare a 100 ml beaker, dry it with nitrogen and add 55mL ultra-pure water; 0.1028 g of CdCl2· 2.5H2O and 0.1844 g of L-GSH were weighed and added to the beaker; A teflon A25 magnetic stirrer was added to the small beaker, and NaOH solution with a concentration of 0.5 mm was prepared. The pH value of the mixed solution in the beaker was detected by mettler pH meter. The solution was continuously stirred with a magnetic stirrer, and NaOH solution was added in drops to adjust the pH value to 10.5.The solution became cloudy during the mediation process, and gradually became transparent after the pH rose to 7.5; Meanwhile, 0.0222 g Na2TeO3 and 0.0038 g NaBH4 were added to the mixed solution of the small beaker successively and stirred for 30min; After the completion of the mixing, the solution in three neck flask, and use the oil bath mixing heating, heating magnetic stirrer oil bath temperature is set to 110 ℃.Every 30 minutes, the solution in the three-necked flask was sampled and tested by fluorescence spectrophotometer and ultraviolet spectrometer.

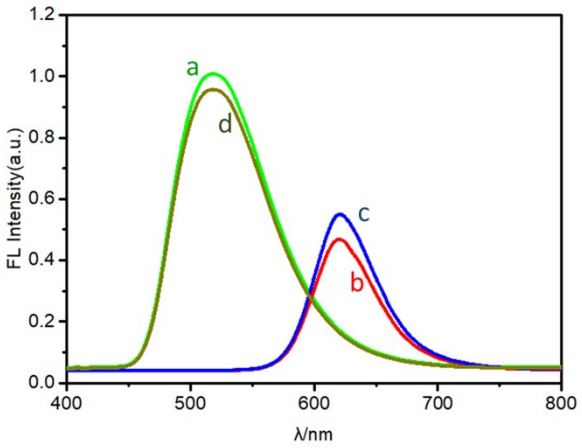

Figure S1. fluorescence spectra of(a)CQDs (b)CdTe QDs

(c) C/CdTe QDs (d) C/CdTe QDs with 30%H2O2

TEM images of QDs probe

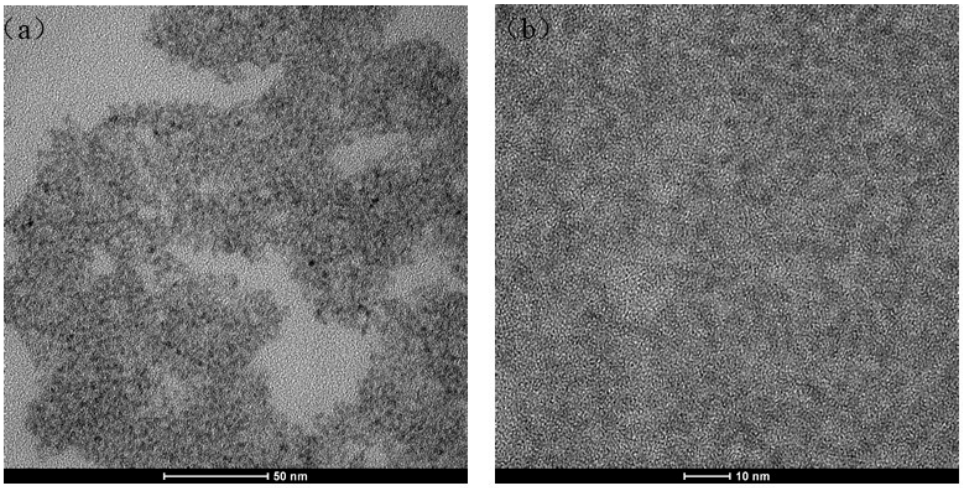

Figure S2. (a) low multiple TEM image of QDs probe (b) high multiple TEM image of QDs probe

Explanation of FRET

FRET is an energy transfer phenomenon that occurs between two fluorescent molecules in close proximity. When the emission spectrum of the donor fluorescent molecule overlaps with the absorption spectrum of the acceptor fluorescent molecule, and the distance between the two molecules is within 10 nm, a non-radioactive energy transfer occurs. Which makes the fluorescence intensity of the donor is much lower than when it is alone (fluorescence quenching), while the fluorescence emitted by the acceptor is enhanced (sensitized fluorescence). We can observe from the fluorescence spectrum in Figure S1 that individual CQDs have a peak around 520nm, and individual CdTe QDs have a peak around 620nm. When the two are mixed in a certain ratio, the peak of the CQDs at 520nm disappears, and the fluorescence intensity of CdTe QDs have been significantly enhanced, which means that FRET has occurred. As we can see in the Figure S1(d), When enough hydrogen peroxide is added, the surface structure of the cadmium telluride quantum dots will be destroyed by hydrogen peroxide and fluorescence quenching will occur, which will cause FRET to stop and the 520nm peak of carbon quantum dots will reappear.

Microfluidic chip flow channel distribution and size

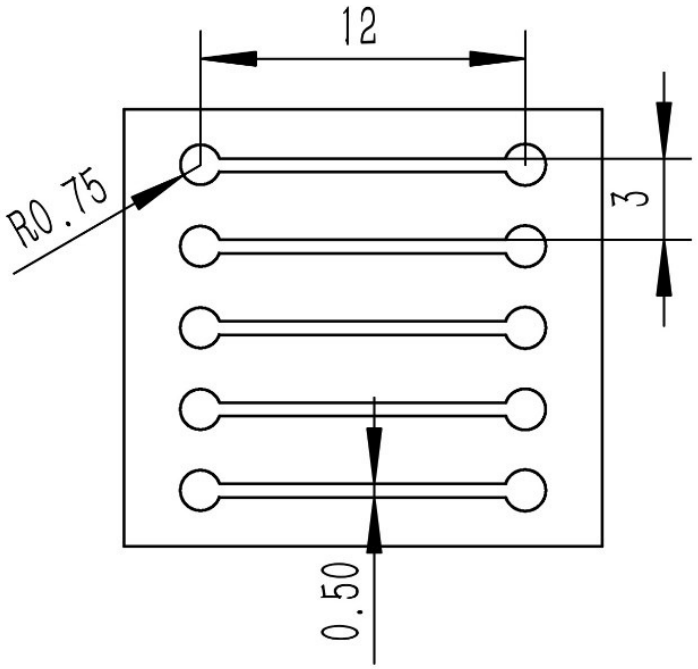

Figure S3. Microfluidic chip flow channel distribution and size

Description of the detection platform

The changing ambient light does cause some interference to this experiment. So in order to solve the interference of ambient light. We have built an experimental platform to carry out this experiment. As shown in Figure S3. Our experiment was done in a dark box, and the outside light did not cause any interference. In the dark box, there is an ultraviolet lamp emitting at 365 nm to excite fluorescence. Light intensity is uniform .The position of the sensor in the dark box is fixed. There is a camera on the top of the dark box for image capture. Its distance from the sensor is constant, and the focal length is also fixed. These guarantee that the conditions of the outside world are fixed every time, and the external interference is avoided to affect the experimental results. The camera model we use is Canon 7D. The effective pixel is 18 million, and the highest resolution is 5184×3456.We use electronic shutter to control time.

Figure S4. Detection platform physical map

Feasibility verification

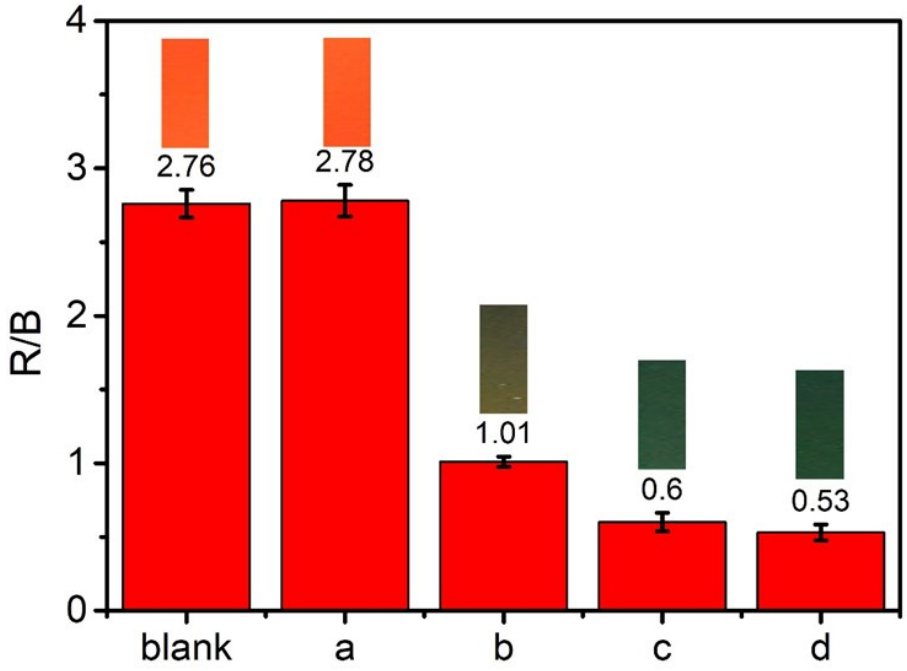

Figure S5. the feasibility of C/CdTe-GOx aerogel microsensor for glucose detection (blank: 0.8μl ultrapure water, a: 0.8μl 26Mm glucose, b: 0.8μl 26Mm glucose+GOx, c: 0.8μl 30%H_2O_2, d: 0.8μl 30%H_2O_2+GOx)

Quantum dot concentration optimization

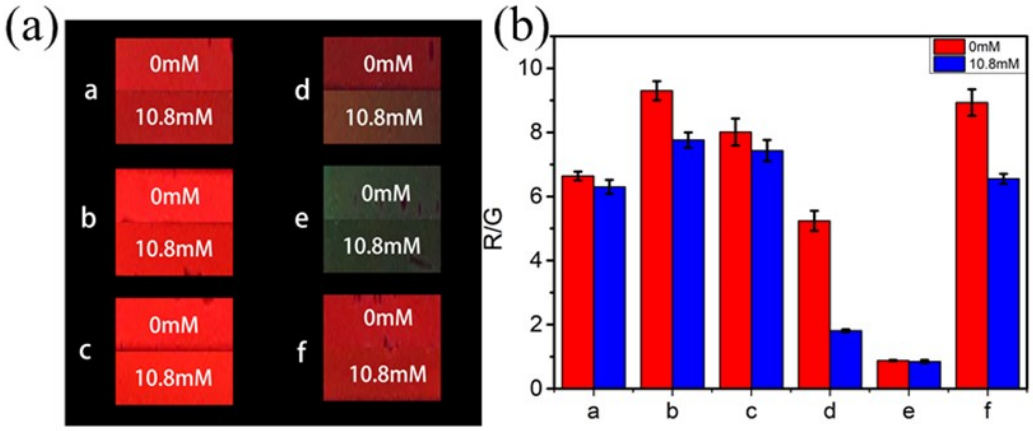

Figure S6. Optimization of quantum dot concentration (control group concentration ratio: ((a) CdTe: C = 1:1; (b) CdTe: C = 1: 0.5; (c) CdTe: C = 1: 0.25; (d) CdTe: C = 0.5: 1; (e) CdTe: C = 0.25: 1; (f) CdTe: C = 0.5: 0.5)

Detection time optimization

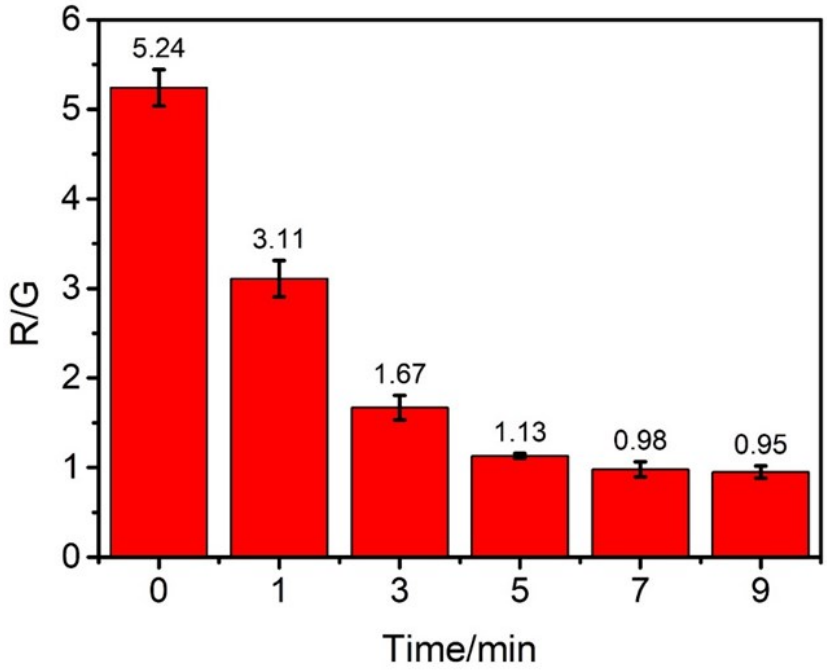

Figure S7. Optimization of sensor detection time

Table S1. Detection of glucose using different colorimetic sensor system.

Indicator	Linear range（mM）	LOD(mM)	Reference
KI	0.5~5	0.05	1
TMB	0.05~0.25	0.035	2
PTB-GOx	0.075~7.5	0.0222	3
KI	0~12	0.1	4
4-AAP/TBHBA	1-11	0.3	5
4-AAP/MAOS	0.3~8	0.3	6
C/CdTe	0~13	0.223	This work

Table S2. Measurement of glucose in real serum samples using a commercial instrument Beckman Coulter Synchronous LX-20 Automatic Biochemical Analyzer from UIT, Nanjing Zhongda Hospital) and aerogel microsensor

Sample	Blood glucose(mM)	Found(mM)	Recovery	Photo
a	1.10	1.07	97.27%	
b	6.38	6.71	105.17%	
c	9.61	10.00	104.06%	
d	13.73	13.29	96.80%	
e	14.66	14.96	102.05%	

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