Supporting Information for

# Visual and efficient immunosensor technique for advancing biomedical applications of quantum dots on *Salmonella* detection and isolation

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# Supplementary Text

## Supplementary Note 1

### Reagents and instruments.

Mouse monoclonal antibodies (Product number: B343M) to *Salmonella* (1 mg/mL) were purchased from Abcam (London). *CdSe/ZnS* QDs (Product number: Q4525) was purchased from Wuhan Jiayuan Quantum Dots Co., Ltd., China. Xylose lysine desoxycholate agar (XLD，Product number: R459902), Rappaport–Vassiliadis agar (RV，Product number: CM1112B), Tryptone Soy Agar (TSA，Product number: CM0277B) and buffered peptone water (BPW，Product number: CM1049B) were purchased from Oxoid (London). Succinimidyl-4-(*N*-maleimidomethyl) cyclohexane-1- carboxylate (SMCC, CAS Number： 64987-85-5, Product Number：S0853) was purchased from TCI Europe (Shanghai, China). Dithiothreitol (DTT, Product Number：20290) and 50X TAE Buffer (Tris-acetate-EDTA) were purchased from Thermo Fisher Scientific Inc (USA). Super-speed Super Absorbing Polymer (SSAP, Product number: 127284) was purchased from Liaocheng City Yongxing Environmental Protection Material Co., Ltd. China. All chemicals were of analytical grade and all aqueous solutions were prepared with double-distilled water.

Swabs were customized from the Hubei Qianjiang Kingphar medical material Co. Ltd., China. All serial dilutions of bacteria were prepared using a turbidity meter (DensiCHEK Plus, bioMerieux). The biochemical identification of the pathogen in samples was performed using an automatic microbiology analyzer (VITEK 2 COMPACT, Biomerieux, France).

The artificial excitation light source based on a blue light-emitting diode (LED) and a matched optical cut-off filter (Standard serial number: ZWB2) were customized from Beijing YongXing Information Sensing Technology Co., Ltd. China. The stereomicroscope (14× -90×, trinocular continuous zoom microscope, SZM-45T1) was ordered from the Ningbo Sunny Instruments Co., Ltd. China. Images of fluorescence emission and absorption spectra were recorded on a UV–visible spectrophotometer (UV-2550, Shimadzu, Japan) and a fluorescence spectrophotometer (LS-55, Shimadzu, Japan).

Laser scanning confocal microscope (LSCM), transmission electron microscopy (TEM) and field emission scanning electron microscope (FESEM) analyses were conducted on an Olympus FuoView™ FV1000 system, a Hitachi 7000FA system and a Hitachi S-4800 system, respectively.

**Supplementary Note 2**

**Preparation of bacterial strains.**

Bacterial strains were purchased from American Type Culture Collection (ATCC), the National Center for Medical Culture Collections (CMCC, Beijing, China) and the Collection Center of Agricultural Microbiology (CCAM, Hubei, China).

A total of 12 type strains were prepared, including *Salmonella Paratyphoid A* (CMCC 50093), *Salmonella Typhimurium* (ATCC 14028), *Salmonella Infantis* (ATCC 51741), *Salmonella manhattan* (CMCC 50152), *Salmonella Enteritidis* (ATCC 13076), *Salmonella senftenberg* (CMCC 50105), *Salmonella Aberdeen* (CMCC 50147), *Salmonella typhi* (ATCC 19430), *Salmonella muenster* (CCAM 090010), *Escherichia coli* (ATCC 25922), *Proteus mirabilis* (ATCC 12453) and *Citrobacter freundii* (ATCC 10787). Forty local *Salmonella* belonging to different serotypes were collected and identified by the Center for Disease Control and Prevention (CDC) in Wuhan, Hubei, China.

## Supplementary Note 3

### Table S1

### Technical Data of optical cut-off filter (ZWB2)

| Test Items | Type/Unit | Parameters of Ultraviolet Glass |
|---|---|---|
| Thickness | mm | 1 |
| A(2856k) | x | 0.532 |
| | y | 0.171 |
| | Y | 0.900 |
| D65(6504k) | x | 0.231 |
| | y | 0.032 |
| | Y | 0.400 |
| ND | | 1.520 |
| $\alpha\times10^{-7}$ | $^{o}C$ | 97 |
| Tg | $^{o}C$ | 515 |
| Ts | $^{o}C$ | 589 |
| S | $g/cm^3$ | 2.65 |
| DA | grade | 2 |
| DW | grade | 2 |
| Tansmitance(313nm) | % | ≥ 38.0 |
| Transmittance(365nm) | % | ≥ 80.0 |
| Transmiitance(405nm) | % | ≤ 8.0 |
| Transmittance(700nm) | % | ≤ 14.0 |
| Bubble | grade | C |
| Stripe | grade | 4 |

| | | |
|---|---|---|
| Stress | $10^{12}$/Pa | 3 |

A(2856k) and D65(6504k) are the chromaticity values; ND, Index of refraction; $\alpha \times 10^{-7}$, Coefficient of thermal expansion; Tg, Transition temperature; Ts, Softening temperature; S, Proportion; DA, Acid resistance; DW, Water resistance; The relative parameters and units are in accordance with the standard of International Commission on Illumination (CIE).

**Supplementary Note 4**

**Table S2**

**SSAP (127284) Technical Data**

| Test Items | Type/Unit | Parameters |
|---|---|---|
| Appearance | | White powder |
| Free Absorbency For Distilled Water | g/g | ≥ 500 |
| Free Absorbency (0.9 % salty water) | g/g | ≥ 50 |
| Retention Capacity | g/g | ≥ 40 |
| Absorbing Capacity Under Load (0.3 PSI) | g/g | ≥ 30 |
| Absorbing Rate (g/g/sec) (25 Times Salty Water) | seconds | ≤ 40 |
| Moisture Content | % | ≤ 7 |
| PH Value | | 6.5~7.5 |
| ≤ 20 Mesh (On 830 μm) | % | 0 |
| 20~40 Mesh (830 μm -380 μm) | % | 30±5 |
| 20~60 Mesh (830 μm -250 μm) | % | ≥ 70 |
| 60~80 Mesh (250 μm -180 μm) | % | ≤ 20 |
| 80~100 Mesh (180 μm -150 μm) | % | ≤ 5 |
| ≥ 100 Mesh (Under 150 μm) | % | 1 |

PSI, Pounds per square inch; Mesh, Unit of granule diameter.

**Supplementary Note 5**

**Characterization of mAbs-conjugated QDs bioprobes.**

As shown in **Figure S1A,** the mAbs-conjugated QDs run slower than the QDs. Under optimal conditions, the concentration of mAbs-conjugated QDs was $98.6 \times 10^{-2}$ μg/μL. The technique using antibody- conjugated QDs has been designed to increase analytic sensitivity of the detection method.[1, 2]

We used an ultraviolet (UV) visible spectrophotometer and a fluorescence spectrophotometer to record the fluorescence absorption and emission spectra of these mAbs-conjugated QDs (**Figure S1B)**. The major antigen on the outer cell wall of *Salmonella* is lipopolysaccaride (LPS), which is about 8 - 10 nm thick. With TEM, we found that most mAbs-conjugated QDs bioprobes attached onto the surface of *Salmonella* **(Figure S1C)**.[3] We observed that the nanoparticles tended to aggregate on the outer cell wall of *Salmonella*.

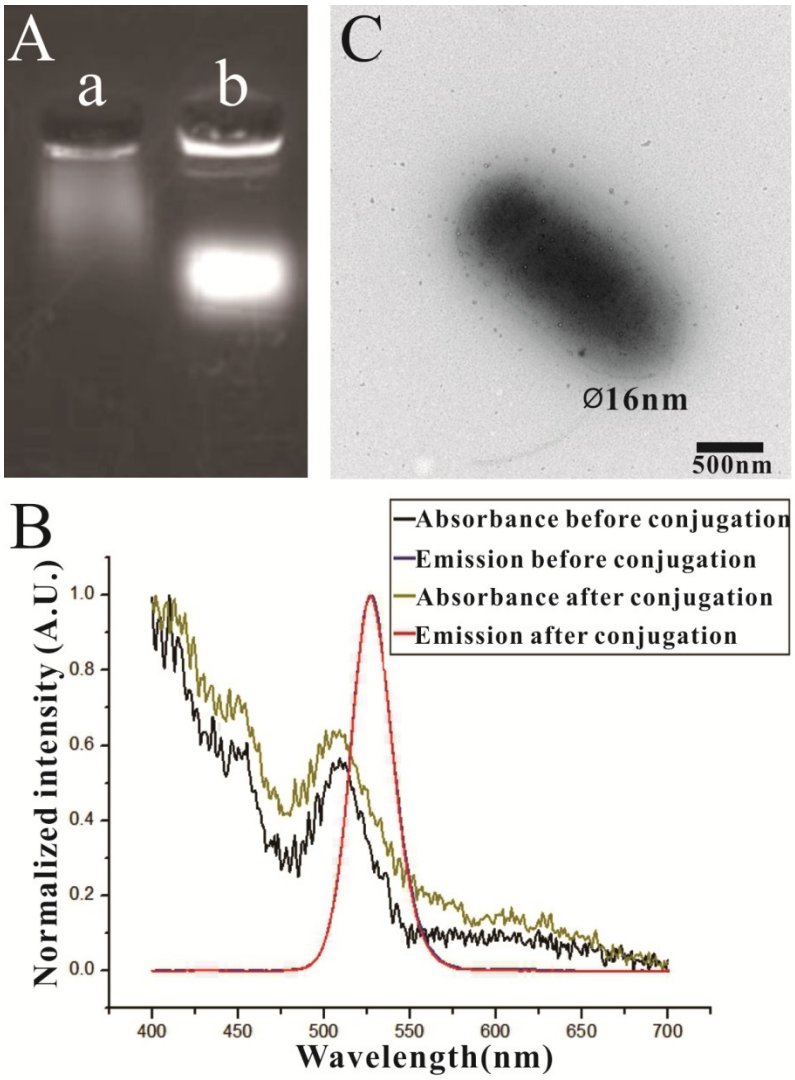


**Figure S1. Characterization of mAbs-conjugated QDs bioprobes.** (A) Images of gel electrophoresis of mAbs-conjugated QDs (lane a) and QDs (lane b). (B) Fluorescence absorption and emission spectra of water-soluble QDs before and after the conjugation. **The fluorescence emission spectras of water-soluble QDs before and after the conjugation are almost entirely consistent around 526 nm.** (C) TEM micrograph (H-7000FA, magnification of 20.0 k, 75 kV) of *Salmonella* incubated with mAbs-conjugated QDs for 15 min. UV scanning wavelength range is 400 - 700 nm; scan spacing is 0.5 nm; scan speed is high speed; excitation wavelength is 380 nm; scan step is 1 nm; reference solution is 10 mM PBS (pH 7.4).

## References

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***Supporting Information Available:*** Description of the material. Refer to Web version on PubMed Central for supplementary material.