Supporting Information

Bacteria-responsive functional electrospun membrane: Simultaneous on-site visualized monitoring and inhibition of bacterial infection

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1. Experiments

1.1 The Synthesis of TCS@ZIF-8 nanoparticles

1.5 g of Zn $(NO_3)_2$•$6H_2O$ was weighed and dissolved in 56.5 g of methanol, then 1.0 g of TCS was added. After that, another 56.5 g of methanol (dissolved with 3.3 g of 2-methylimidazole) was dropped in and stirred at room temperature for 24 h. The mixture was centrifugated and washed with ethanol 4 times. After drying in vacuum at 30℃, the product TCS@ZIF-8 nanoparticles were obtained. The ZIF-8 nanoparticles without TCS were prepared as control in the similar procedure.

1.2 Preparation of electrospun PCL+TZ membrane

PCL electrospinning solution (8 wt%) was prepared with the solvent of HFIP. 2 mg TCS@ZIF-8 was added to 1 mL of ethanol solution and sonicated for 5 min. Then the ethanol mixture of TCS@ZIF-8 was added to 20 g of PCL electrospinning solution. After that, the prepared solution was transferred to a syringe after stirring. 14 kV and 0.5 kV for positive and negative voltages were set, respectively. The working distance between the needle tip and the collector was 10 cm, and the spinning was carried out at with the feeding rate of 1.0 mL/h for 2 h. Subsequently, the PCL+TZ membrane was prepared.

1.3 Preparation of electrospun PPB membrane

Firstly, the blending electrospinning solution of PCL (7.4 wt%) and PEG (7.4 wt%) was prepared at room temperature, HFIP was used as the solvent. 20 g of the above electrospinning solution was loaded with 1.0 mL of ethanol solution (containing 12 mg BTB) to prepare the PPB spinning solution. Then the membrane PPB was obtained under the following parameter. The applied positive and negative voltages were set as 14 kV and 0.5 kV, respectively. The working distance between the tip and the collector was set as 10 cm. Besides, the feeding rate of the spinning solution was 1.0 mL/h, and the spinning time was 4 h.

1.4 Mechanical property of PPBT membrane

The membrane is cut into rectangles of 10.0 mm × 50.0 mm. After that, the thickness is measured by a micrometer (C112XBS). The stress-strain curve was tested at a rate of 20.0 mm/min using a servo-controlled universal testing machine.

1.5 The antibacterial ability of TCS@ZIF-8 and ZIF-8

To verify and evaluate the antibacterial ability of ZIF-8 and TCS@ZIF-8, different concentrations of ZIF-8 and TCS@ZIF-8 (200, 100, 50, 25, 12.5, 6.25, 3.13 μg/mL) were prepared. Then 100 μL of bacterial suspensions (10^6 CFU/mL) were added respectively. After co-culture for 12 h, each set of 100 μL was evenly spread on LB plates to incubate at 37°C for 18 h.

1.6 Chromogenic mechanism of BTB

Different concentrations of bacterial solution (8 wt% glucose) were added with the indicator solution of BTB and co-cultured at 37 °C to explore the color variation of the solution. Then the supernatant of the bacterial solution after centrifugation was aspirated and measured with a UV spectrophotometer under 615 nm.

1.7 Bacterial monitoring of PPBT membrane

The monitoring ability of PPBT membrane against *E. coli*, *S. aureus*, *P. aeruginosa* and *C. albicans* was explored as the following shows. The prepared PPBT membrane was cut into several 1 cm×1 cm pieces and placed in 48-well plate with the PPB membrane upward. Then 100 μL (8 wt% glucose) different concentrations of bacterial and fungal solution were added to the membrane surface in well plate. After

that, and the well plate was incubated under constant temperature (37°C) and humidity (90%). Subsequently, the color change of the membrane was observed at the interval of each half an hour.

2. Results

2.1 TEM

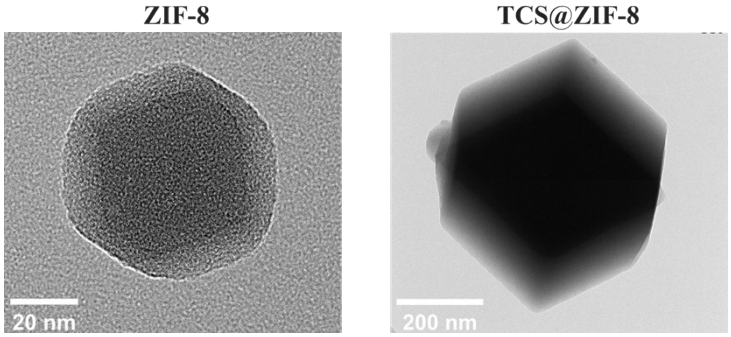

Fig. S1 TEM images of ZIF-8 and TCS@ZIF-8 nanoparticles.

2.2 EDS images of TEM

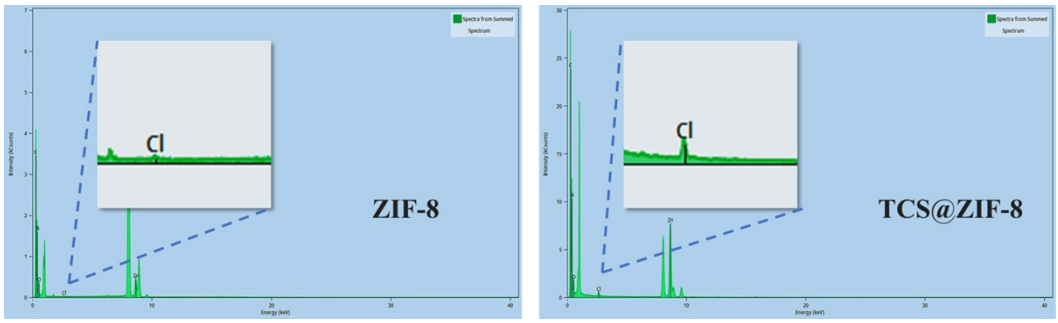

Fig. S2 EDS images of TEM belonging to ZIF-8 and TCS@ZIF-8 nanoparticles.

2.3 SEM and EDS images

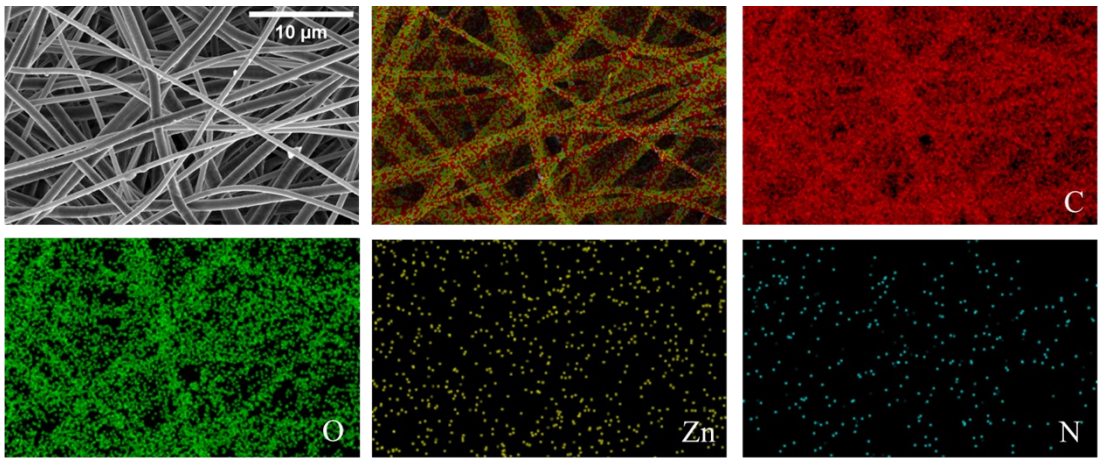

Fig. S3 SEM and EDS images of PCL+TZ membrane.

2.4 The distribution of fiber diameter

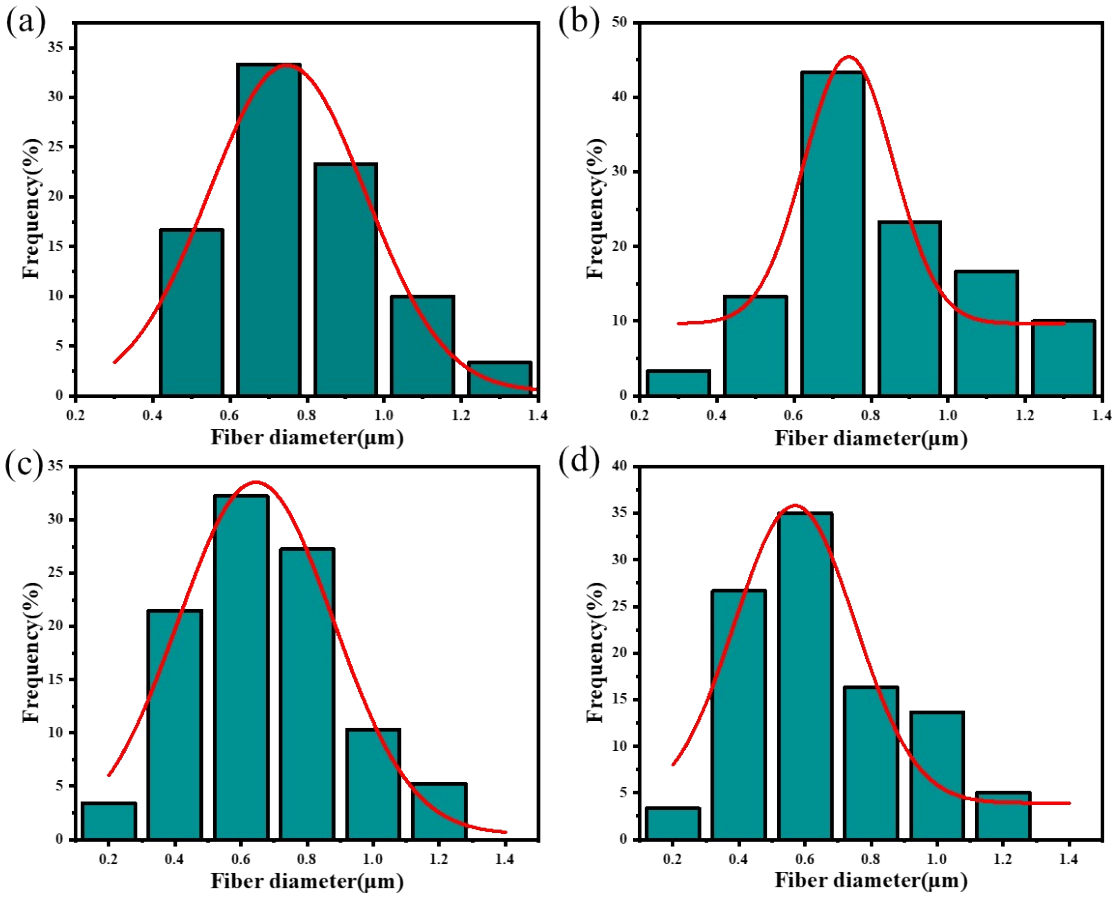

Fig. S4 The fiber diameter of (a) PCL membrane; (b) PCL+TZ membrane; (c) PCL+PEG membrane; (d) PPB membrane.

2.5 FTIR spectrum

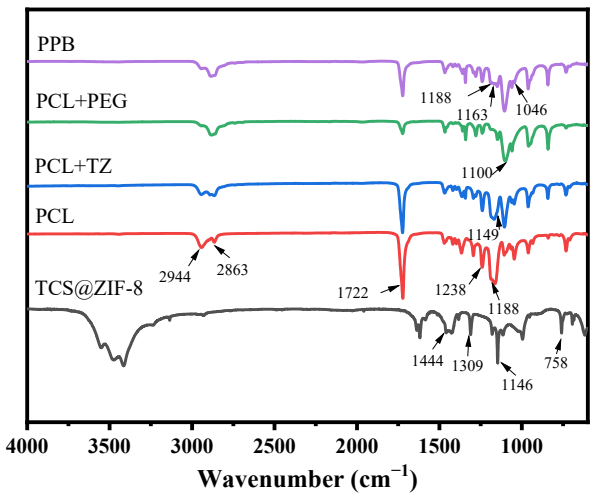

Fig. S5 FTIR spectra of membranes and TCS@ZIF-8 nanoparticles.

2.6 XRD and XPS spectrum

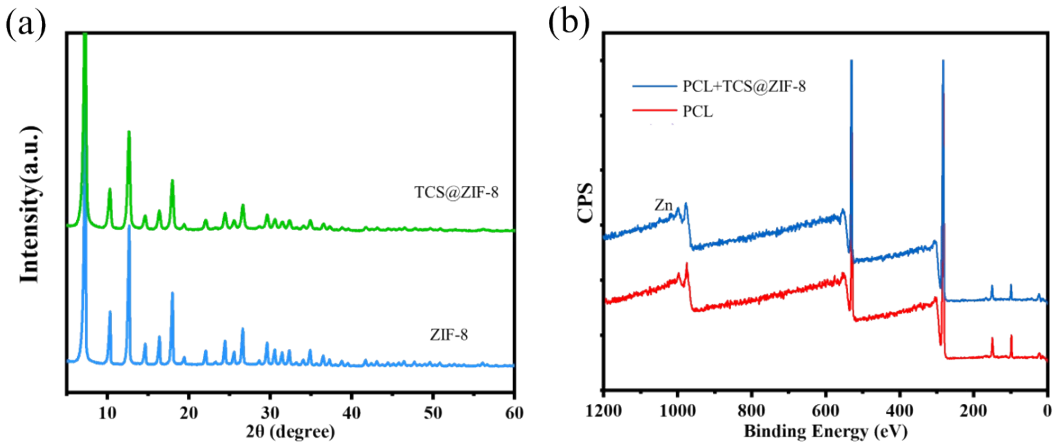

Fig. S6 (a) XRD image of nanoparticles; (b) XPS spectra of PCL+ TZ membranes.

2.7 Antibacterial experiment of ZIF-8 and TCS@ZIF-8

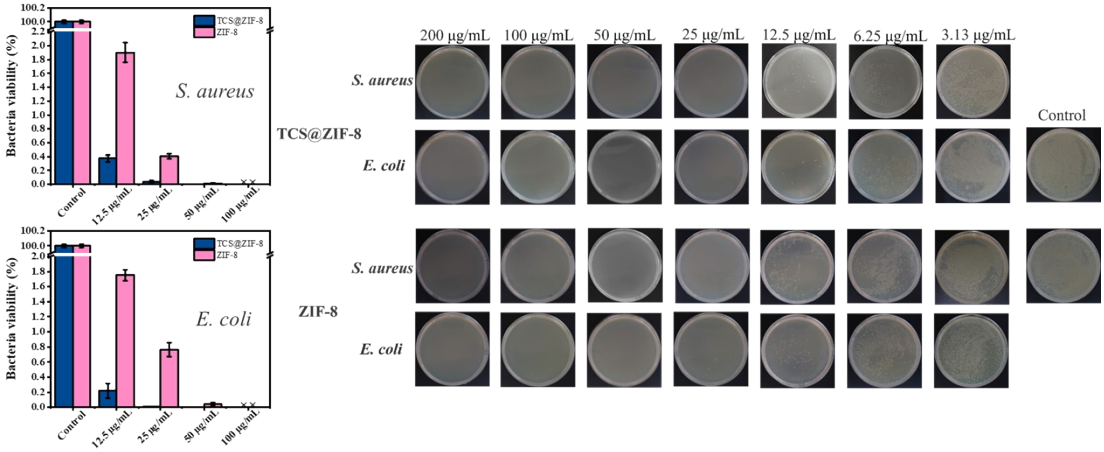

Fig. S7 Antibacterial experiment of ZIF-8 and TCS@ZIF-8 against *S. aureus* and *E. coli*.

2.8 UV spectra of BTB

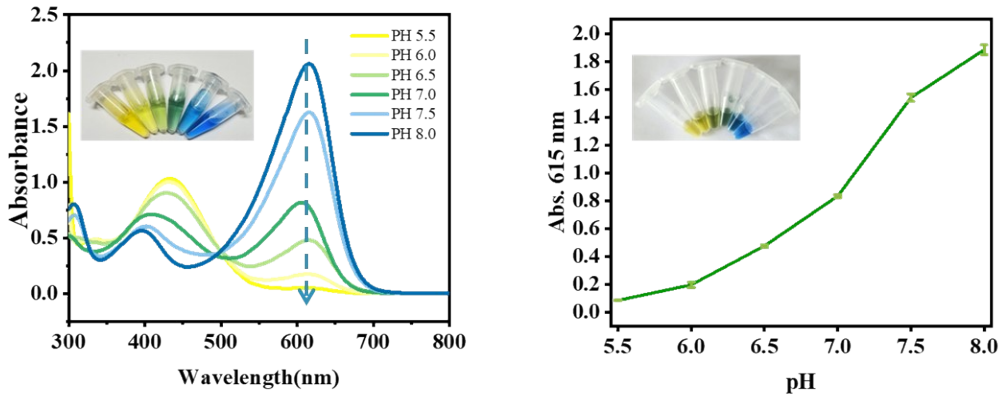

Fig. S8 The scanning spectrum of BTB from 300~800 nm at different pH (8.0~5.5) and characteristic absorbance changes of 615 nm.

2.9 Absorbance of bacteria and fungi

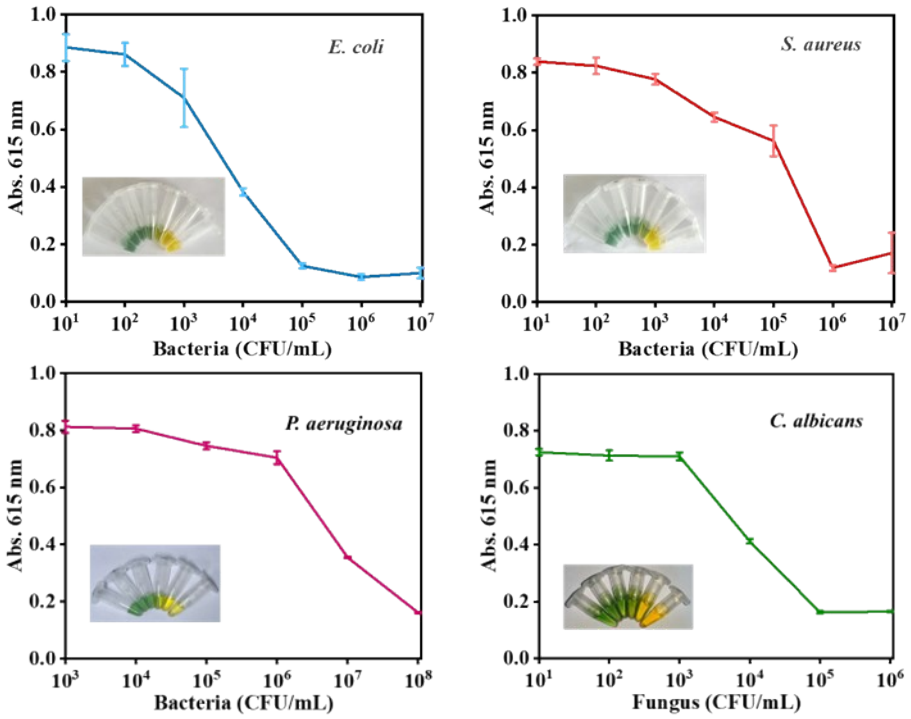

Fig. S9 Absorbance of bacterial and fungal solutions with BTB at 615 nm.

2.10 Colony growth of *E. coli* on membrane PPBT

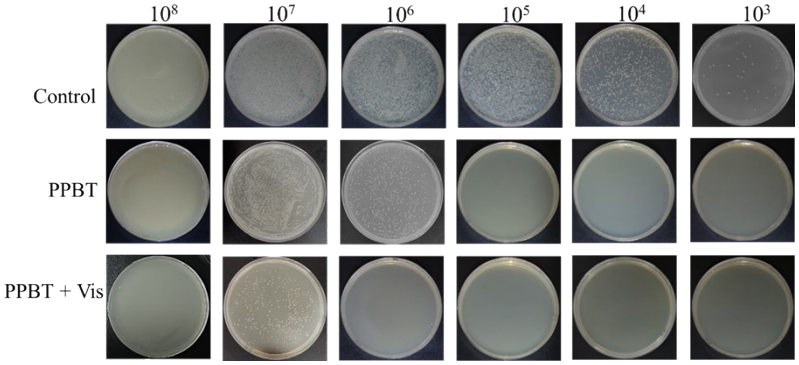

Fig.S10 Colony growth images of *E. coli* after plating.

2.11 Colony growth of *P. aeruginosa* on membrane PPBT

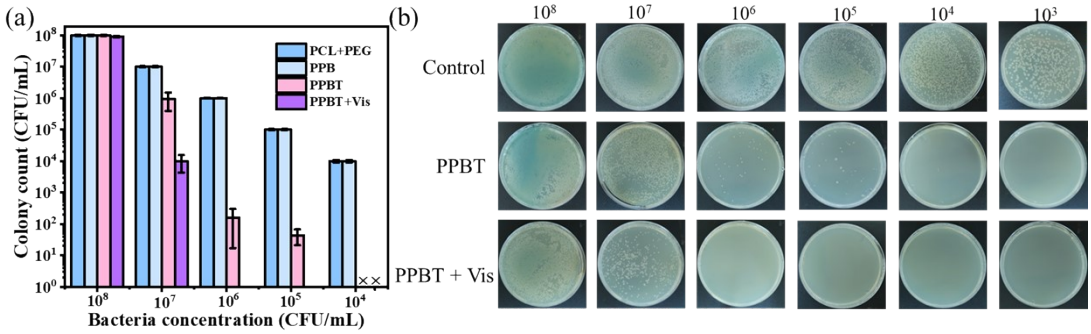

Fig. S11 (a) Surviving colonies of *P. aeruginosa*; (b) Colony growth images of *P. aeruginosa* after plating.