Electronic supplementary information for

Microfluidic channels with renewable and switchable biological functionalities based on host-guest interactions

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1 Experimental section

1.1 Materials

Escherichia coli (*E. coli* ATCC-700926) and Staphylococcus aureus (*S. aureus*, ATCC-6538) were used to perform bacterial adhesion experiments in this work. Prior to the experiments, the bacteria were incubated, sequentially, in a Luria-Bertani broth medium (LB, Sigma-Aldrich) and a nutrient bouillon medium (NB, Sigma-Aldrich), incubated overnight with shaking at 37 °C, and harvested during the exponential growth phase via centrifugation. The supernatant was then discarded, and the cell pellet was re-suspended in phosphate-buffered saline (PBS, pH 7.4). The final concentration of bacteria was adjusted to approximately 1×10^8 cells·mL^{-1} before use.

1.2 CD-RBITC fluorescence test

Initiator-modified, PDMS-Br, substrates were grafted with copolymers of poly(OEGMA-co-OEGMA-Ada) using OEGMA and OEGMA-Ada monomers (2 mmol total monomer concentration) in different feed ratios (99:1, 19:1, 9:1, 4:1). The modified substrates were then immersed in CD-RBITC solution (1 mg/mL) for 6 h at room temperature. The samples were then washed with ultrapure water and the fluorescence intensity was measured using fluorescence microscopy (IX71, Olympus, Japan). For each sample, ten images were taken randomly from different areas. The data were analyzed using Image J software.

1.3 Cell viability test

To investigate the cytocompatibility of the material, the classical CCK-8 test was carried out for detecting the influence on the growth of L929 cells. Briefly, L929 cells were seeded on the surface of PDMS and PDMS-POA which were placed in the 96-well culture plates (Costar) at a density of 10^4 cells per well. At the end of time 12 h, 24 h and 3 days, the media were replaced by 200 μL of fresh

medium, followed by the addition of 20 μL of CCK-8. And equal volume of fresh medium and CCK-8 were added into some new wells as blank control. Subsequently, the cells were incubated in a humidified 5% CO_2 incubator at 37 °C for 1 h. The absorbance of the resulting solutions was then recorded at 450 nm using a microplate reader.

1.4 Protein and bacteria detection in different concentrations

Different concentrations of avidin-FITC solution ((from 0.0001 mg/mL to 1 mg/mL)) and *E. coli* suspensions (from 10^4 to 10^8 cells/mL) were injected into the microchannels for 2 h at room temperature in the dark. Then the microchannels were washed with fresh PBS and ultrapure water. The adsorbed protein and the adherent bacteria on the microchannels were observed by fluorescence microscopy (IX71, Olympus, Japan).

1.5 Protein and bacteria detection in complex environment

The PDMS-POA/CD-B channels were incubated with avidin-FITC solution in PBS and 10% human plasma diluted in PBS for 2 h at room temperature in the dark. The microchannels were washed with fresh PBS and ultrapure water and the adsorbed protein was observed by fluorescence microscopy.

PDMS-POA/CD-M microchannels were incubated with *E. coli* suspensions (1×10^8 cells/mL) and mixed bacterial suspensions (*S. aureus* and *E. coli*, 1×10^8 cells/mL) for 2 h at room temperature in the dark. The microchannels were then washed with fresh PBS and ultrapure water. The bacteria adherent to the PDMS-POA/CD-M microchannels were examined using a fluorescence microscope.

1.6 Regeneration

Regenerability/renewal of the sensing surface has significant advantages in biosensor applications. To investigate regenerability, the PDMS-POA/CD-B channels were washed with 2% SDS after

adsorption of avidin. The channels were then incubated sequentially with CD-B and avidin-FITC solution again. As shown in Fig. S7a, the fluorescence intensity was reduced by 66% after washing with SDS. After incubation with CD-B and avidin-FITC, strong green fluorescence with intensity similar to that in the first cycle was observed. The fluorescence intensity was similarly "recovered" over three such cycles. The regenerability of the PDMS-POA/CD-M channel was investigated in a similar way (Fig. S3b), and *E. coli* adhesion data showed that the attachment and release of bacteria was repeatable over three cycles, suggesting that the PDMS-POA/CD-M channel can be used repeatedly by regeneration with SDS after each cycle.

2 Supporting Results

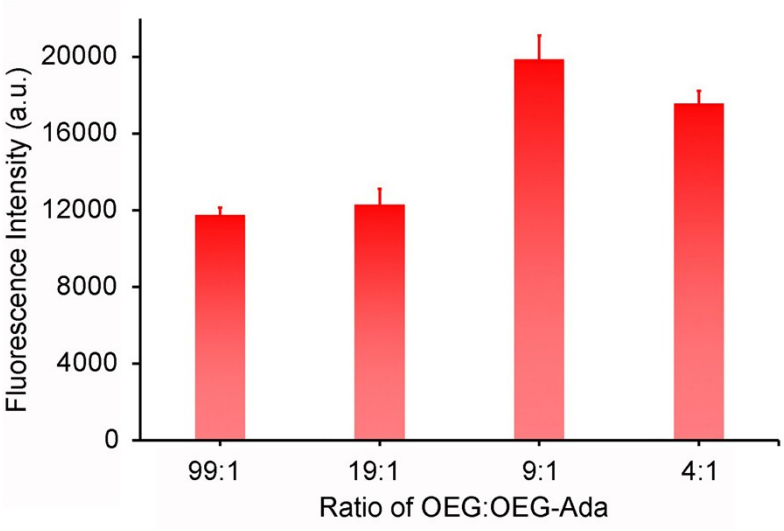

Fig. S1. Fluorescence intensity of CD-RBITC adsorbed on PDMS-POA substrates grafted with OEG:OEG-Ada copolymers formed using different feed ratios. Data are means ± standard error (n = 10).

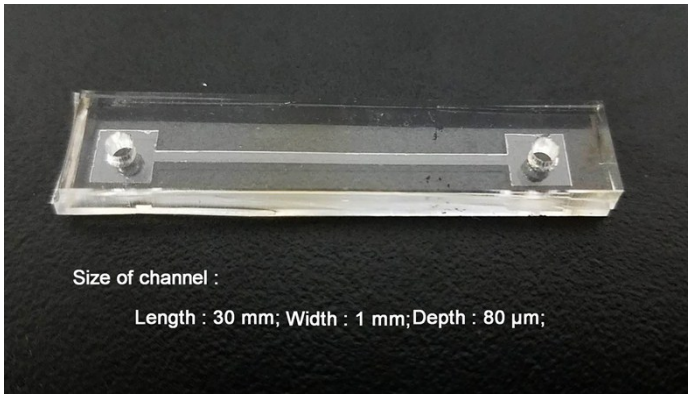

Fig. S2. Photograph of the PDMS-POA microfluidic device.

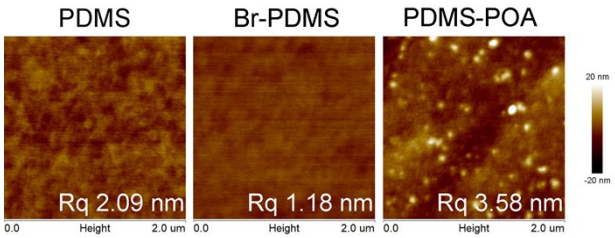

Fig S3. AFM images of PDMS, Br-PDMS and PDMS-POA surfaces.

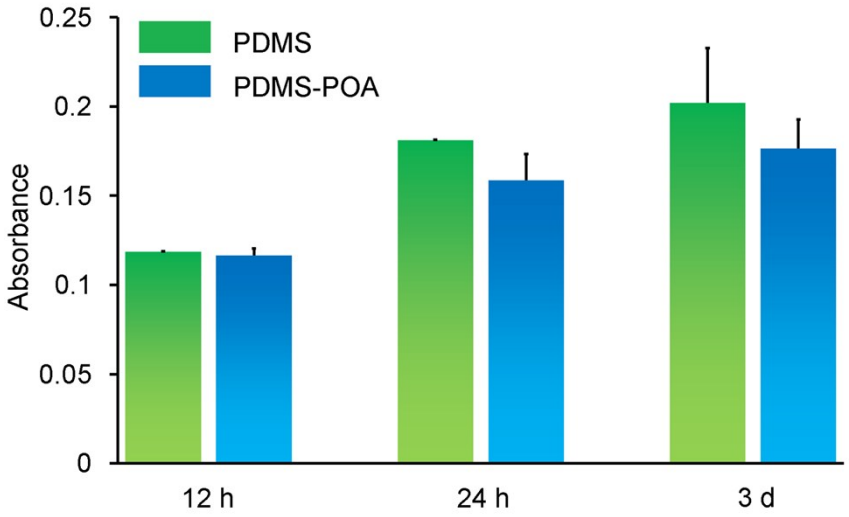

Fig. S4. Cell viability of L929 cells on PDMS and PDMS-POA after 12 h, 24 h and 3 days culture. Data are means ± standard error (n = 3).

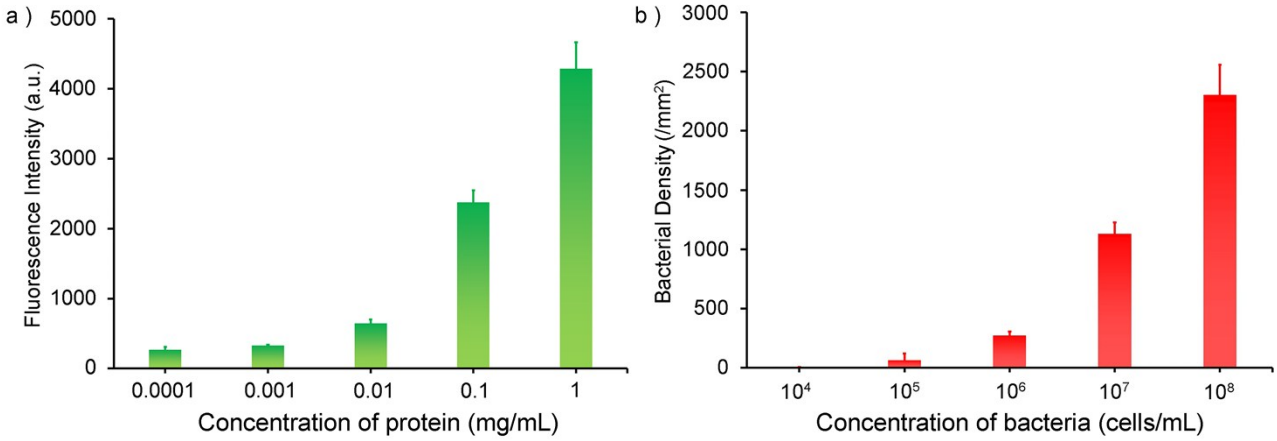

Fig. S5. (a) Fluorescence intensity of avidin-FITC at increasing concentrations (from 0.0001 mg/mL to 1 mg/mL) adsorbed on PDMS-POA/CD-B microfluidic channels and (b) bacterial density of *E. coli* (ATCC-700926) at increasing concentrations (from 10^4 to 10^8 cells/mL) adhered on PDMS-POA/CD-M microfluidic channels. Data are means ± standard error (n = 10).

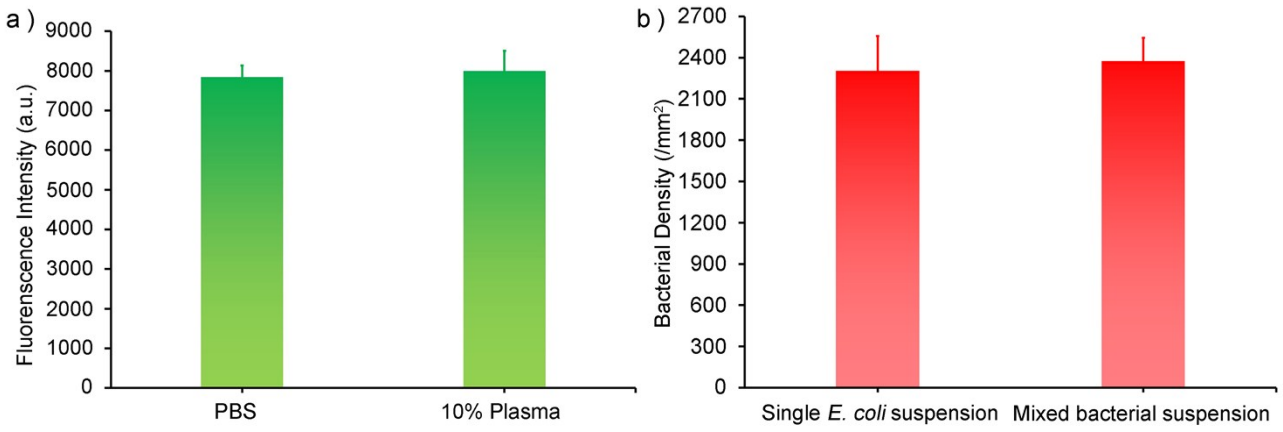

Fig. S6. (a) Fluorescence intensity of avidin-FITC adsorbed on PDMS-POA/CD-B microfluidic channels in PBS and 10% plasma, (b) bacteria density of *E. coli* adhered on PDMS-POA/CD-M microfluidic channels in single *E. coli* suspension and the mixture suspension of *E. coli* and *S. aureus*. Data are means ± standard error (n = 10).

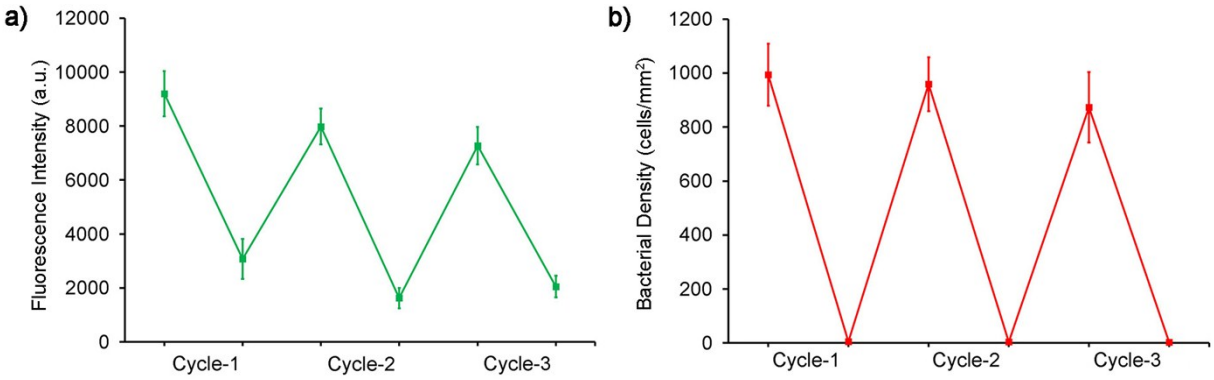

Fig. S7. (a) Adsorption and release of avidin-FITC on the PDMS-POA/CD-B surface over three cycles. For each cycle, the surface was treated with 2% SDS solution, followed by fresh CD-B for avidin "capture" anew. (b) Adhesion and release of *E. coli* on the PDMS-POA/CD-M surface over three cycles. For each cycle, the surface was treated with 2% SDS solution, followed by fresh CD-M for bacteria "capture" anew. Data are means ± standard error (n = 10).