

#### Preparation of SiO<sub>2</sub>@IPTS@ACA

The 0.5 g active bare silica gel was dispersed in 30 mL toluene, and then spiked with 500  $\mu$ L (2 mmol) IPTS. The mixture was vortex mixed and reacted at 105°C for 16h with reflux. The IPTS modified silica gel was repeated washing with DMF for 3 times, and then was added in 30 mL DMF with 10 mmol ACA. The reaction was occurred at 95°C for 5h. The silica gel synthesized in the previous step was repeatedly washed by DMF and MES buffer (50 mM, pH 5.5 $\pm$ 0.1) for 3 times. Finally, the synthesis of SiO<sub>2</sub>@IPTS@ACA@CST was carried out by the steps of “2.3.3”.

#### Preparation of SiO<sub>2</sub>@NH<sub>2</sub>@HDMI@ACA

The 0.5 g SiO<sub>2</sub>@NH<sub>2</sub> was dispersed in 30 mL DMF, and then spiked with 400  $\mu$ L (2.5 mmol) HDMI. The mixture was vortex mixed and reacted at 70°C for 2h. The HDMI modified silica gel was purified via repeated washing with DMF for 3 times. and then was added in 30 mL DMF with 10 mmol ACA. The reaction was occurred at 70°C for 12h. The silica gel synthesized in the previous step was repeatedly washed with DMF and MES buffer (50 mM, pH 5.5 $\pm$ 0.1) for 3 times. Finally, SiO<sub>2</sub>@NH<sub>2</sub>@HDMI@ACA@CST was synthesized by the steps of “2.3.3”.

#### Preparation of SiO<sub>2</sub>@NH<sub>2</sub>@COOH@ACA

The 0.5 g COOH modified silica gel was dispersed in 25 mL MES solution (50 mM, pH 5.5 $\pm$ 0.1), and then spiked with 50 mg EDC·HCl and NHS. The mixture was vortex mixed and reacted at room 25 °C for 1 h. The modified silica gel was purified via repeated washing with MES solution for 3 times. and then was added in 25 mL MES solution with 10 mmol ACA and reaction was carried out at 25°C for 2 h. The silica gel synthesized in the previous step was repeatedly washed with MES buffer and ultrapure water for 3 times. Finally, SiO<sub>2</sub>@COOH@ACA@CST was synthesized by the steps of “2.3.3”.

The number of *E. coli* at various wet weigh was counted and their relationship was also evaluated. The number of *E. coli* cells is remarkably correlated with the wet weigh ( $y = 4.05 \times 10^8 x$ ,  $r^2 = 0.9965$ ,  $n = 3$ ). Consequently, the number of bacteria cells adsorbed by modified silica gel could be expressed as the wet weigh of *E. coli*.

#### Adsorption kinetics models

Pseudo-first-order and pseudo-second-order kinetic model were adopted to fit the dynamic adsorption model. The fitting equation of Pseudo-first-order kinetic model is shown in formula (3). Pseudo-first-order kinetic model was fitted by taking  $Q_t$  as the Y-axis and  $t$  as the X-axis. Parameters of  $Q_e$  and  $K_1$  were calculated according to the fitting equation.

$$Q_t = Q_e(1 - e^{-k_1 t}) \quad (1)$$

where  $Q_t$  ( $\times 10^{11}$  CFU/g) means adsorption capacity of *E. coli* at different time;  $Q_e$  means equilibrium adsorption capacity obtained by fitting and  $K_1$  ( $\text{min}^{-1}$ ) is Pseudo-first-order kinetic model rate constant.

Pseudo-second-order kinetic model was fitted by taking  $Q_t$  as the Y-axis and  $t$  as the X-axis. Parameters of  $Q_e$  and  $K_2$  were calculated according to the fitting equation.

$$Q_t = \frac{k_2 Q_e^2 t}{1 + k_2 Q_e t} \quad (2)$$

where  $K_2$  ( $\text{g} \times 10^{11} \text{ CFU}^{-1} \text{ min}^{-1}$ ) is Pseudo-first-order kinetic model rate constant

Figures

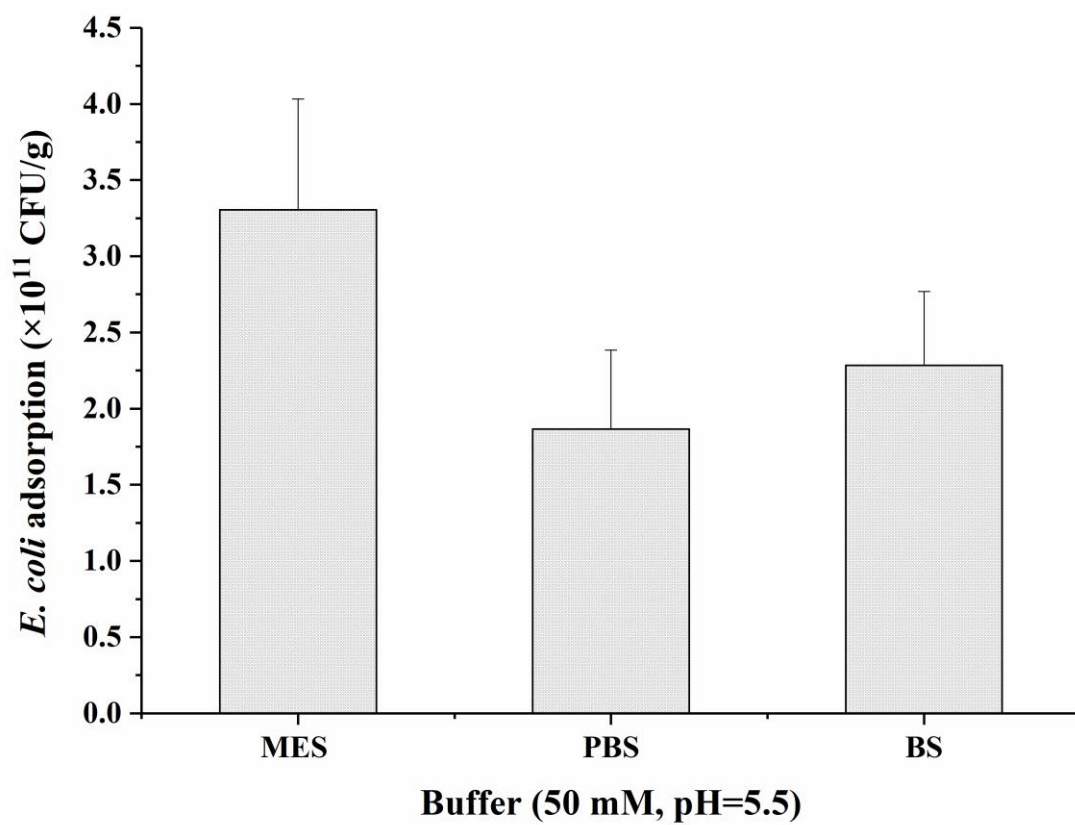


Figure S1: Effect of reaction buffers on adsorption of *E. coli* by SiO<sub>2</sub>@NH<sub>2</sub>@COOH@CST.

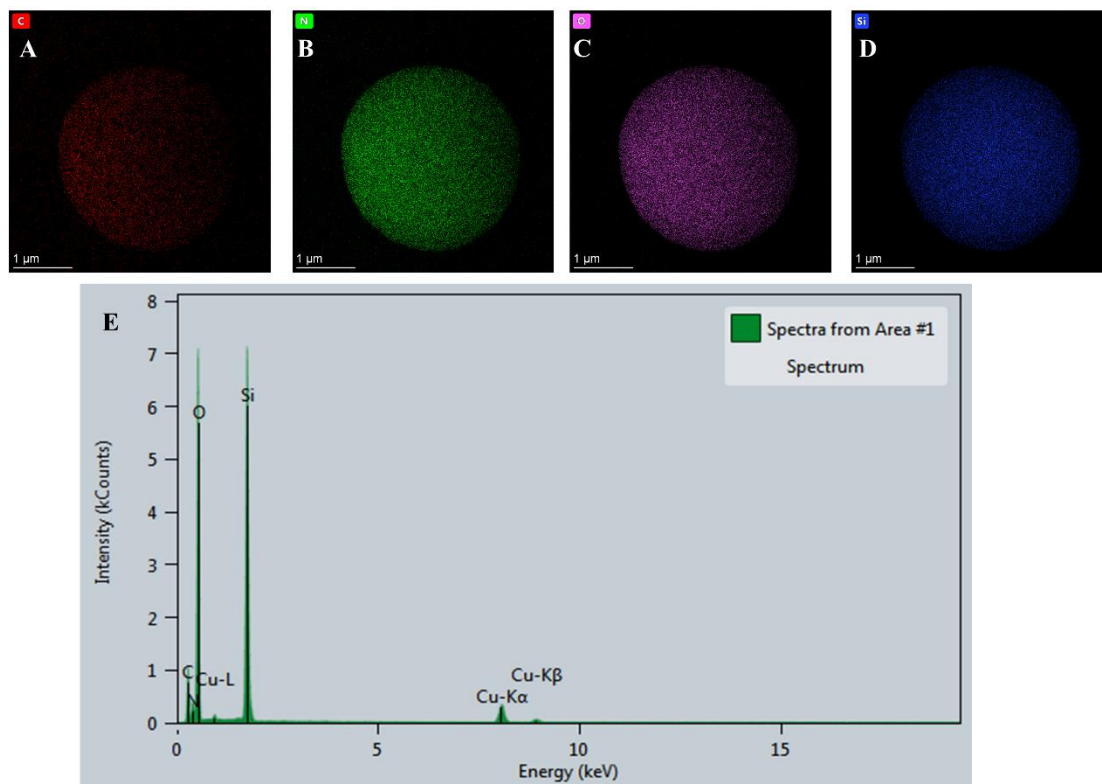


Figure S2: Element mapping of C (A), N (B), O (C) and Si (D) of  $\text{SiO}_2@\text{NH}_2@\text{COOH}@CST$  by TEM. EDS spectra of  $\text{SiO}_2@\text{NH}_2@\text{COOH}@CST$  depicting the expected elemental presence of C, N, Si, and O (E).

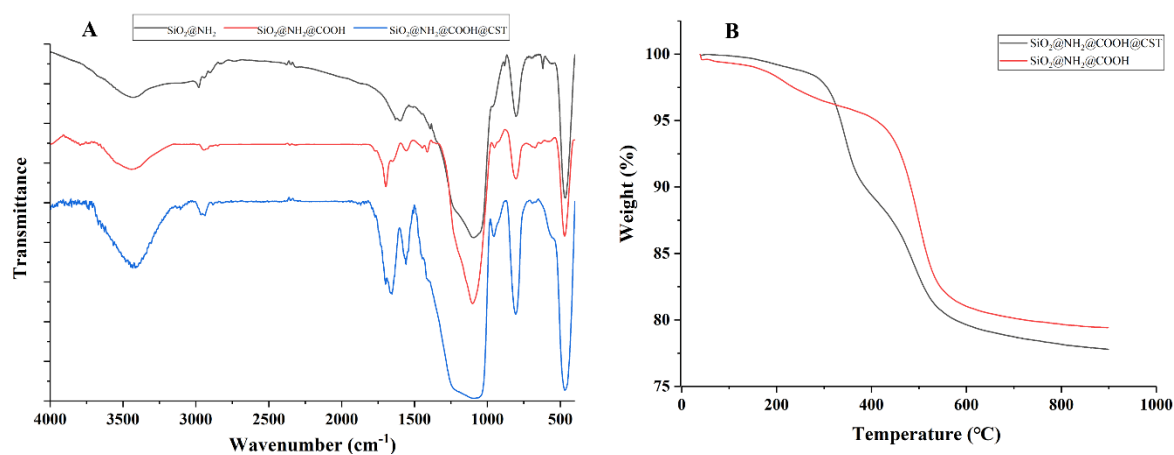


Figure S3: The FT-IR characterization of  $\text{SiO}_2@\text{NH}_2$ ,  $\text{SiO}_2@\text{NH}_2@\text{COOH}$  and  $\text{SiO}_2@\text{NH}_2@\text{COOH}@CST$  (A); the thermogravimetric analysis of  $\text{SiO}_2@\text{NH}_2@\text{COOH}$  and  $\text{SiO}_2@\text{NH}_2@\text{COOH}@CST$  (B).

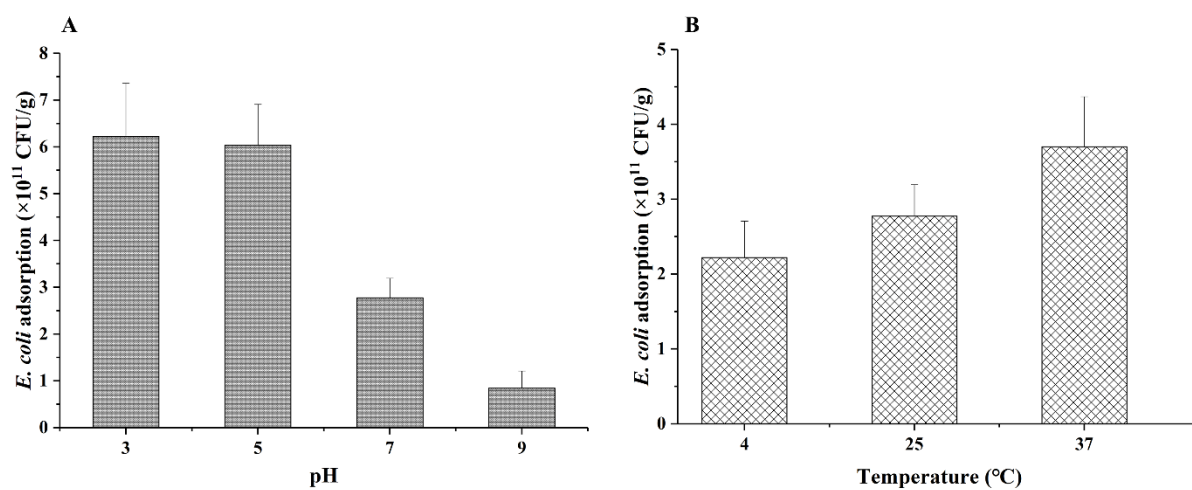


Figure S4: Effect of pH (A) and temperature (B) on the adsorption of *E. coli* by  $\text{SiO}_2@\text{NH}_2@\text{COOH}@\text{CST}$ .