Electronic Supplementary Information

Bacteria-derived fluorescent carbon dots for microbial live/dead differentiation

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**Fig. S1** The EDS result of CDs-\textit{S. aureus}.

**Fig. S2** Fluorescence emission spectra of CDs-\textit{S. aureus} dispersed in cell PBS solution excited at different wavelengths from 300 to 540 nm with an increment of 20 nm.

**Fig. S3** The high-resolution XPS peaks of (A) Si2p, (B) P2p and (C) S2p, respectively.
Fig. S4 The fluorescence decay curve of CDs-\textit{S. aureus}.
**Fig. S5** Characterizations of CDs-E. coli. (A) TEM image of CDs-E. coli. (B) UV–vis spectrum of CDs-E. coli. Inset shows the CDs irradiated under white light (left) and UV (365 nm) light (right). (C) Fluorescence emission spectra of CDs-E. coli excited at different wavelengths from 300 to 540 nm with an increment of 20 nm. (D) FTIR spectrum of CDs-E. coli. (E) XPS spectrum of dried CDs-E. coli. (F–H) The high-resolution XPS peaks of C1s, N1s and O1s, respectively.

**Fig. S6** PL properties of CDs-S. aureus as a function of (A) pH, (B) temperature, (C) ionic strength (different concentrations of PBS solution, pH = 7.4) and UV irradiation time. The PL intensity ($P$) was measured at 416 nm ($\lambda_{ex} = 332$ nm). $P_0$ is the PL intensity of CD solution in the control group (pure water, pH =7, 25 °C, without laser irradiation).
**Fig. S7** The confocal fluorescence images (A) and flow cytometric analyses (B) of live and dead *S. aureus* stained with CDs- *E. coli* for 1 h. Fluorescence images were captured under the excitation of 405, 488 and 552 nm, respectively. Flow cytometric analyses were conducted using three channels of FITC, PE and PE-Texes Red.

**Fig. S8** Bright field and fluorescence images of live/dead bacteria including two other Gram-
positive bacteria (*M. luteus* and *B. subtilis*) and three Gram-negative bacteria (*E. coli*, *P. vulgaris* and *P. aeruginosa*) stained with CDs-*E. coli*. Fluorescence images were captured upon excitation at 405, 488 and 552 nm, respectively.

**Fig. S9** Bright field and fluorescence images of live and dead fungal cells (yeast and *T. reesei*) stained with CDs-*E. coli*. Fluorescence images were captured upon excitation at 405, 488 and 552 nm, respectively.
Fig. S10 Bright and fluorescence images of live and dead *S. aureus* cells stained with CDs-*S. aureus* at various concentrations. Fluorescence images were captured upon excitation at 405, 488 and 552 nm, respectively.

<table>
<thead>
<tr>
<th>Control</th>
<th>50 μg/mL</th>
<th>100 μg/mL</th>
<th>200 μg/mL</th>
<th>500 μg/mL</th>
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<td>Bright Field</td>
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<td>405 nm</td>
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<td>488 nm</td>
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<td>552 nm</td>
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</table>

Fig. S11 Bright and fluorescence images of live and dead *S. aureus* cells stained with CDs-*E. coli* at various concentrations. Fluorescence images were captured upon excitation at 405, 488 and 552 nm, respectively.
**Fig. S12** Bright field and fluorescence images of CDs- E. coli (200 μg/mL)-stained live S. aureus and dead S. aureus that were killed in different ways. Fluorescence images were captured upon excitation at 405, 488 and 552 nm, respectively.

**Fig. S13** (A) Real-time cell growth monitoring of S. aureus bacteria and (B) colony unit forming counting assay for yeast cells (incubated with 30 μM PI or different concentrations of CDs-S. aureus). (C) Real-time cell growth monitoring of S. aureus bacteria and (D) colony unit forming counting assay for yeast cells (incubated with different concentrations of CDs-E. coli).
**Fig. S14** The zeta potential values of four types of CDs dissolved in cell PBS solution and pure water.