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Supporting Information

Identification of Eight Pathogenic Microorganisms by A Single Concentration-dependent Multicolor Carbon Dots

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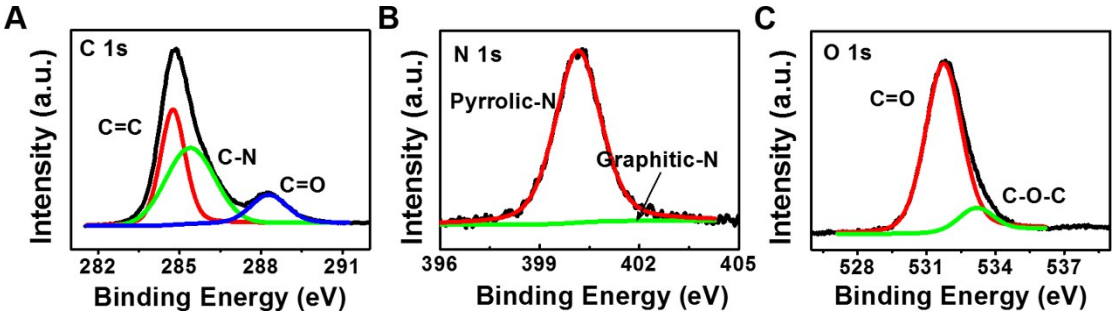

Fig. S1. A) XPS spectra of C 1s; B) XPS spectra of N 1s; C) XPS spectra of O 1s.

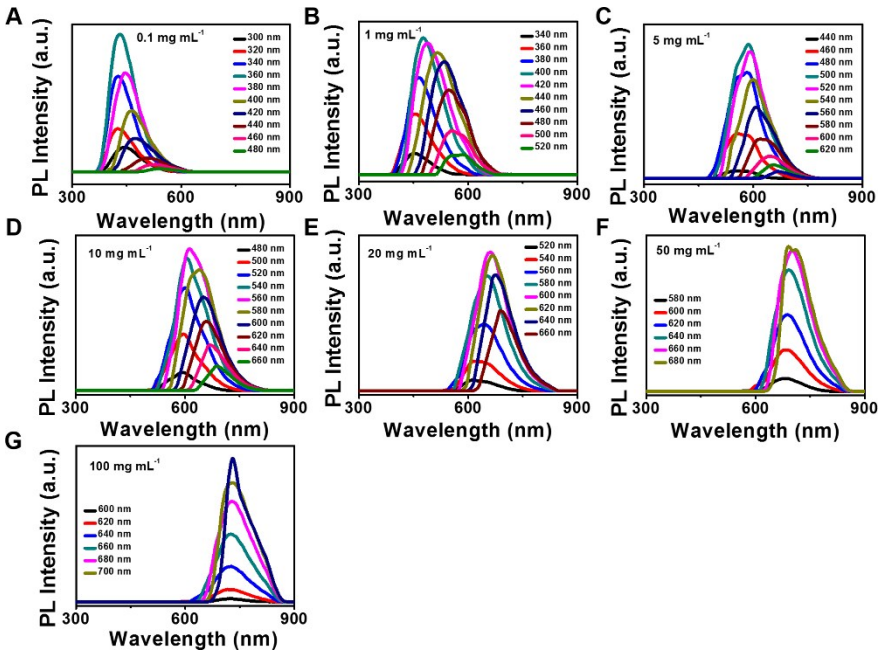

Fig. S2. PL spectra of different concentrations of CDs solution with different excitation wavelengths.

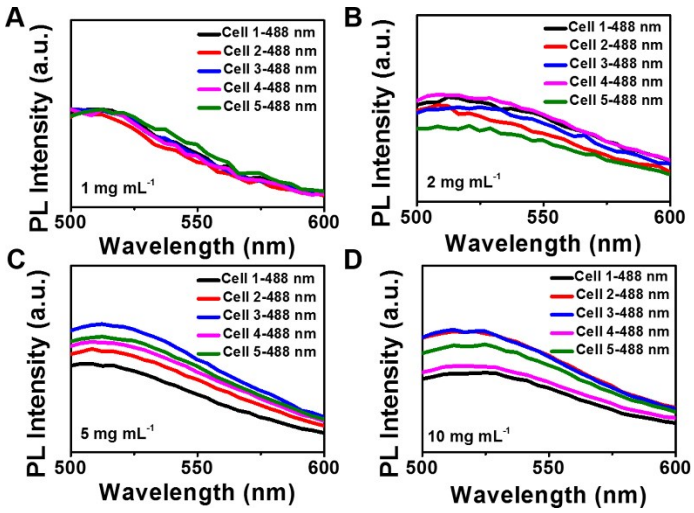

Fig. S3. PL spectra of five ROIs of individual cells of *S. Typhimurium* stained with different concentrations of CDs.

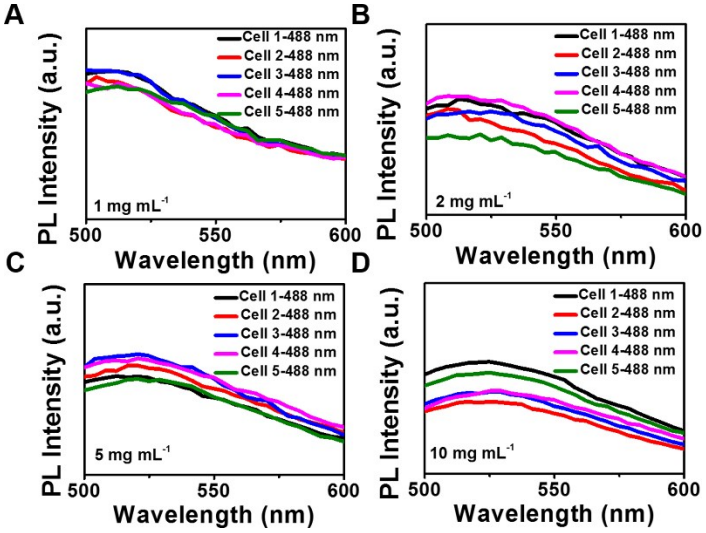

Fig. S4. PL spectra of five ROIs of individual cells of *C. neoformans* stained with different concentrations of CDs.

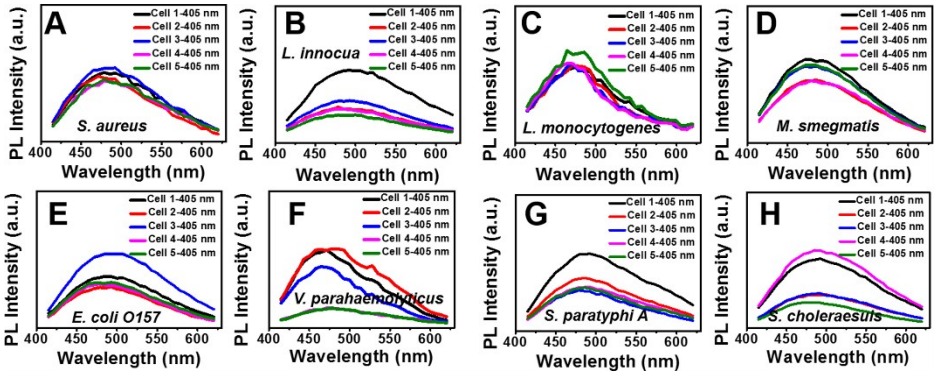

Fig. S5. PL spectra of five ROIs of individual cells of eight kinds of microorganisms stained with 5 mg mL^{-1} CDs with excitation wavelength of 405 nm.

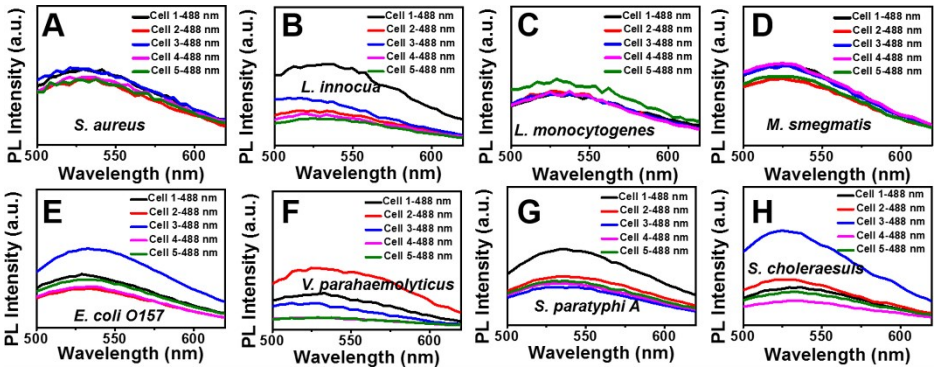

Fig. S6. PL spectra of five ROIs of individual cells of eight kinds of microorganisms stained with 5 mg mL^{-1} CDs with excitation wavelength of 488 nm.

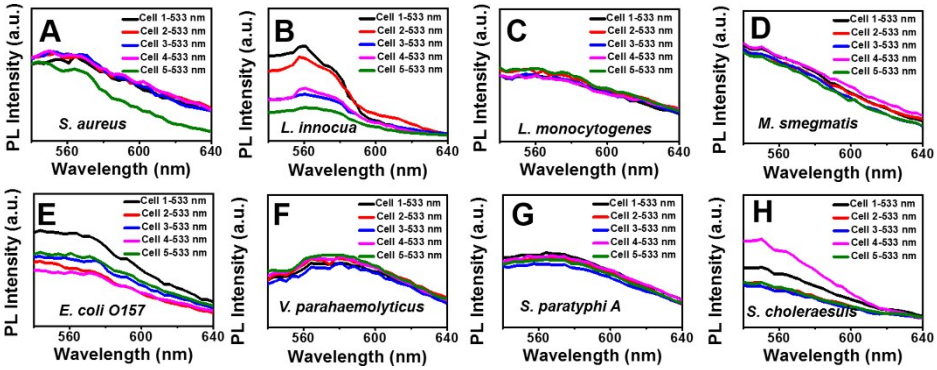

Fig. S7. PL spectra of five ROIs of individual cells of eight kinds of microorganisms stained with 5 mg mL^{-1} CDs with excitation wavelength of 533 nm.

Table S1

CDs / Con. / Em (nm)	1 mg mL^{-1}	2 mg mL^{-1}	5 mg mL^{-1}	10 mg mL^{-1}
S. Typhimurium	508.28	512.42	520.69	528.97
S. Typhimurium	504.14	512.42	520.69	528.97
S. Typhimurium	504.14	514.83	520.69	528.97
S. Typhimurium	504.14	512.42	520.69	528.97
S. Typhimurium	504.14	516.69	520.69	524.83
C. neoformans	500	504.14	512.42	520.69
C. neoformans	500	504.14	508.28	520.69
C. neoformans	500	504.14	508.28	516.56
C. neoformans	500	500	508.28	516.56
C. neoformans	500	500	512.42	524.83

Table S1. Five duplicates of the maximum emission wavelengths of *S. Typhimurium and C. neoformans* stained with different concentrations of CDs excited with 488 nm.

Table S2

Microorganisms	PL wavelength (E_m, nm)			Results LDA			Group
analytes	E_x 405	E_x 488	E_x 533	F1	F2	F3	

S.aureus	485.69	533.10	553.79	-0.160	0.971	-1.608	1
S.aureus	492.76	533.10	553.79	-0.089	2.475	-1.082	1
S.aureus	485.69	533.10	553.34	-0.464	1.017	-1.624	1
S.aureus	485.69	533.10	553.79	-0.160	0.971	-1.608	1
S.aureus	492.76	533.10	553.34	-0.394	2.520	-1.097	1
L. innocua	478.62	528.97	560.69	3.867	-1.719	-0.722	2
L. innocua	478.62	528.97	557.24	1.522	-1.371	-0.843	2
L. innocua	478.62	520.67	560.69	2.682	-2.702	1.620	2
L. innocua	478.62	528.97	560.69	3.867	-1.719	-0.722	2
L. innocua	478.62	537.24	560.69	5.051	-0.736	-3.064	2
L.monocytogenes	485.69	520.69	550.34	-4.281	-0.155	1.784	3
L.monocytogenes	485.69	520.69	553.79	-1.937	-0.502	1.905	3
L.monocytogenes	485.69	520.69	553.79	-1.937	-0.502	1.905	3
L.monocytogenes	485.69	524.83	550.34	-3.689	0.337	0.613	3
L.monocytogenes	485.69	524.83	550.34	-3.689	0.337	0.613	3
M. smegmatis	492.76	520.69	540.00	-11.244	2.392	1.948	4
M. smegmatis	478.62	516.55	540.00	-11.837	-1.106	2.066	4
M. smegmatis	492.76	516.55	540.00	-11.385	1.901	3.119	4
M. smegmatis	478.62	520.69	540.00	-11.385	-0.615	0.895	4
M. smegmatis	478.62	520.69	540.00	-11.835	-0.615	0.895	4
E. coli O157	492.76	528.97	543.45	-7.715	3.027	-0.273	5
E. coli O157	485.69	533.10	543.45	-7.193	2.015	-1.971	5
E. coli O157	485.69	533.10	543.45	-7.193	2.015	-1.971	5
E. coli O157	492.76	533.10	543.45	-7.123	3.518	-1.445	5
E. coli O157	485.69	528.97	543.45	-7.786	1.524	-0.800	5
V. parahaemolyticus	492.76	537.24	574.48	14.570	0.879	-1.527	6
V. parahaemolyticus	499.83	528.97	577.93	15.801	1.052	1.463	6
V. parahaemolyticus	492.76	528.97	577.93	15.730	-0.451	0.936	6
V. parahaemolyticus	499.83	533.10	577.93	16.393	1.544	0.292	6

V. parahaemolyticus	499.83	533.10	581.38	18.738	1.196	0.413	6
S. paratyphi A	492.76	528.97	564.14	6.352	0.940	0.452	7
S. paratyphi A	492.76	524.83	567.59	8.104	0.101	1.744	7
S. paratyphi A	485.69	524.83	567.59	8.034	-1.402	1.218	7
S. paratyphi A	485.69	528.97	567.59	8.626	-0.911	0.047	7
S. paratyphi A	492.76	524.83	564.14	5.760	0.449	1.624	7
S. choleraesuis	478.62	524.83	550.34	-3.759	-1.167	0.086	8
S. choleraesuis	464.48	524.83	550.34	-3.900	-4.174	-0.967	8
S. choleraesuis	464.48	520.69	550.34	-4.493	-4.665	0.204	8
S. choleraesuis	464.48	528.97	546.89	-5.652	-3.335	-2.259	8
S. choleraesuis	464.48	528.97	546.89	-5.652	-3.335	-2.259	8

Table S2. Training matrix of fluorescence emission wavelength obtained from the CDs against 8 kinds of microorganisms. LDA was carried out and resulting in 3 factors of the canonical scores and group generation. Jackknifed classification matrix showed the 100% correct classification.

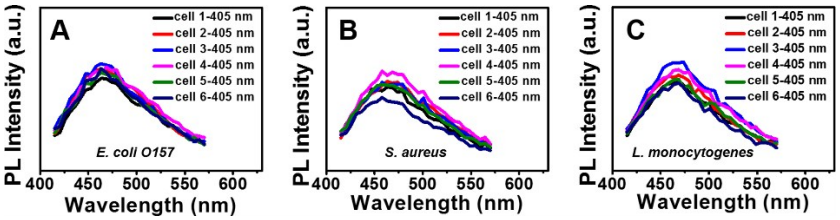

Fig. S8. PL spectra of six labelled cells of three kinds of microorganisms in the mixture with excitation wavelength of 405 nm.

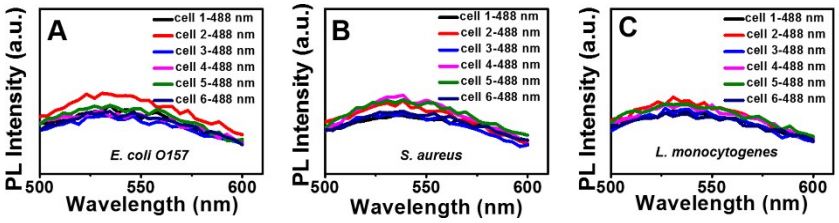

Fig. S9. PL spectra of six labelled cells of three kinds of microorganisms in the mixture with excitation wavelength of 488 nm.

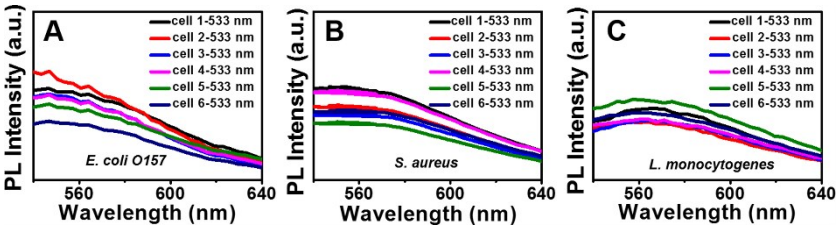

Fig. S10. PL spectra of six labelled cells of three kinds of microorganisms in the mixture with

excitation wavelength of 533 nm.

Table S3

Bacteria cells#	PL wavelength (Em, nm)			Results LDA		Group	Analytes identification
	Ex 405	Ex 488	Ex 533	F1	F2		
Red 1	463.22	530.97	546.91	-1.980	10.104	1	*E.coli O157*
Red 2	463.18	530.77	546.72	-2.066	10.554	1	*E.coli O157*
Red 3	463.18	530.74	546.62	-1.962	10.758	1	*E.coli O157*
Red 4	463.22	530.73	547.21	-1.699	10.020	1	*E.coli O157*
Red 5	463.91	530.76	546.43	-0.983	11.340	1	*E.coli O157*
Red 6	465.76	534.62	546.69	-0.600	7.195	1	*E.coli O157*
Green 1	457.76	537.46	550.75	-12.816	-5.331	2	*S.aureus*
Green 2	457.73	538.96	550.35	-13.943	-6.650	2	*S.aureus*
Green 3	457.66	538.46	550.05	-13.827	-5.694	2	*S.aureus*
Green 4	457.72	538.06	550.25	-13.449	-5.446	2	*S.aureus*
Green 5	457.76	537.96	550.96	-13.064	-6.206	2	*S.aureus*
Green 6	457.79	534.62	553.79	-9.968	-5.772	2	*S.aureus*
Blue 1	468.45	526.92	564.14	13.974	-4.527	3	*L.monocytogenes*
Blue 2	468.85	526.32	564.44	15.040	-3.990	3	*L.monocytogenes*
Blue 3	469.05	526.52	564.24	15.141	-3.879	3	*L.monocytogenes*
Blue 4	468.05	526.62	564.14	13.577	-4.358	3	*L.monocytogenes*
Blue 5	473.79	534.62	557.59	14.783	-2.850	3	*L.monocytogenes*
Blue 6	468.25	526.92	564.64	13.845	-5.265	3	*L.monocytogenes*

Table S3. Detection and identification of microorganisms mixture sample. Training matrix of fluorescence emission wavelength obtained from the CDs. LDA was carried out and resulting in 2 factors of the canonical scores and group generation.

Table S4

	E.coli	*L.monocytogenes*	*S.aureus*	%correct
E.coli	6	0	0	100
L.monocytogenes	0	6	0	100
S.aureus	0	0	6	100
Total	6	6	6	100

Table S4. Jackknifed classification matrix showed the 100% correct classification.