

Supporting Information

Silicon-Doped Carbon Dots Crosslinked Carboxymethyl Cellulose Gel: Detection and Adsorption of Fe³⁺

Section 1: Si-CDs structural analysis

The full XPS spectrum of CMCS (Figure S1a) shows the presence of four elements, C, N, O, and Na. In the C 1s spectrum of CMCS (Figure S1b), C-C, C-N, C-O, C=O correspond to 284.80, 285.45, 286.55, 288.55 eV. In the N 1s spectrum of CMCS (Figure S1c), N-C, N-H correspond to 399.15, 399.95 eV. In the O 1s spectrum of CMCS (Figure S2d), O-H, O-C, O=C correspond to 531.35, 532.25, 533.25 eV[22].

Table S1. Peak fitting data of XPS for 5Si-CDs

Peak	Binding Energy (eV)	FWHM	Peak	Binding Energy (eV)	FWHM
C-O/C=O	287.43	1.30	O=C	533.99	1.40
C-N	285.68	0.99	O-Si	531.73	2.18
C-C	284.80	1.10	O-C	530.04	1.64
C-Si	283.74	1.45	Si-O	101.83	0.96
N-H	400.30	1.78	Si-N	101.01	0.95
N-C	399.23	1.12	Si-C	100.09	0.90
N-Si	398.08	1.33			

Table S2. Peak fitting data of XPS for CMCS

Peak	Binding Energy (eV)	FWHM	Peak	Binding Energy (eV)	FWHM
C=O	288.55	1.60	N-C	399.15	1
C-O	286.55	1.56	O=C	533.25	1.87
C-N	285.45	0.88	O-C	532.25	1.36
C-C	284.80	0.81	O-H	531.35	1.19
N-H	399.95	1.08			

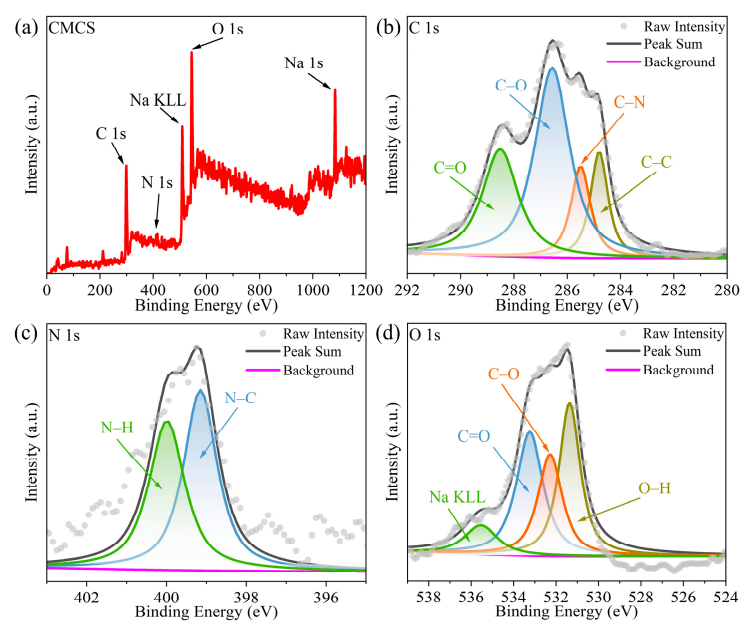
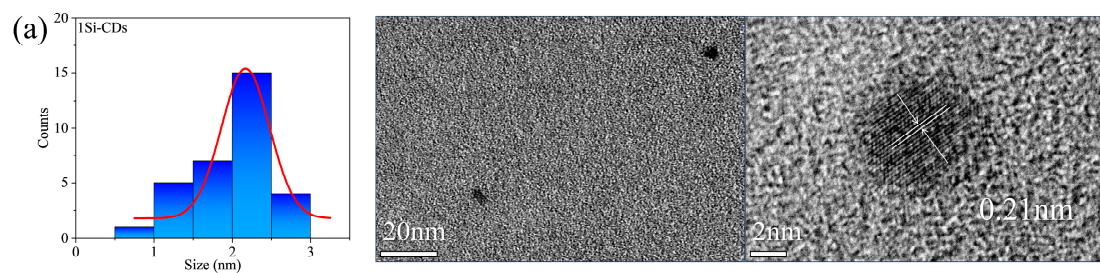


Figure S1. XPS spectra of CMCS. (a) Full spectrum, (b) C 1s fitting spectra, (c) N 1s fitting spectra, (d) O 1s fitting spectra.



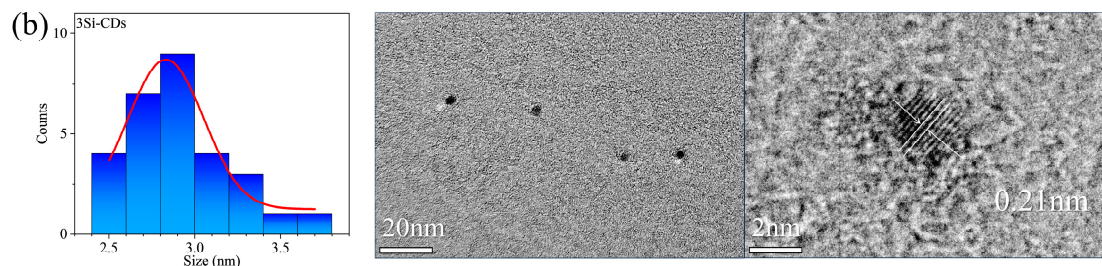


Figure S2. Histograms of particle size distribution, TEM images and HRTEM images of (a) 1Si-CDs, (b) 3Si-CDs.

Section 2: DCG structural analysis

The full XPS spectrum of CMC (Figure S2a) shows the presence of four elements, C, O, and Na. In the C 1s spectra of CMC (Figure S1b), C-C, C-O, C=O correspond to 284.80, 286.21, 287.73 eV. In the O 1s spectra of CMC (Figure S2c), O-H, O-C, O=C correspond to 530.98, 532.08, 533.23 eV[57].

Table S3. Peak fitting data of XPS for 5DCG

Peak	Binding Energy (eV)	FWHM	Peak	Binding Energy (eV)	FWHM
C-O/C=O	287.05	2.13	O=C	533.27	1.99
C-N	285.50	1.51	O-Si/O-C	532.00	1.54
C-C/C-Si	284.00	1.73	O-H	530.88	2.17
N-H	400.94	1.79	Si-O	102.30	1.62
NH-C=O	399.73	1.80	Si-N	101.76	0.94
N-Si	398.80	1.32	Si-C	100.97	0.94

Table S4. Peak fitting data of XPS for CMC

Peak	Binding Energy (eV)	FWHM	Peak	Binding Energy (eV)	FWHM
C=O	287.73	1.89	O=C	533.23	1.89
C-O	286.21	1.81	O-C	532.08	1.66
C-C	284.80	1.95	O-H	530.98	2.05

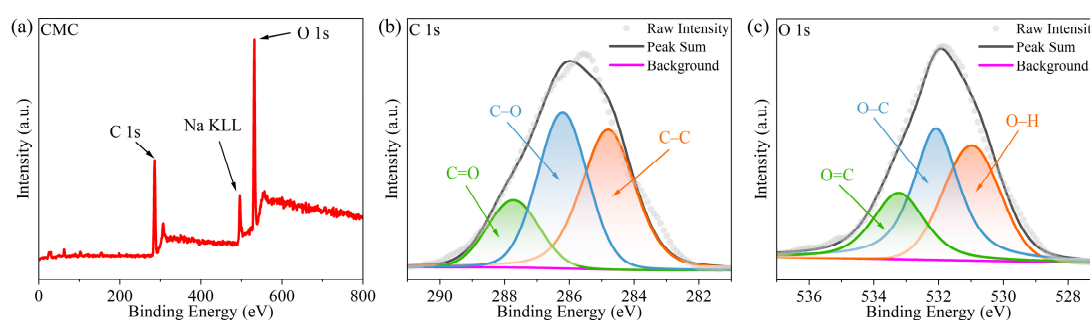


Figure S3. XPS spectra of CMC. (a) Full spectrum, (b) C 1s fitting spectra, (c) N 1s fitting spectra, (d) O 1s fitting spectra.

XRD tests: X-ray diffraction patterns were carried out using a CuK α ($\lambda = 1.542 \text{ \AA}$) radiation monochromator with a scanning range of 5-90°.

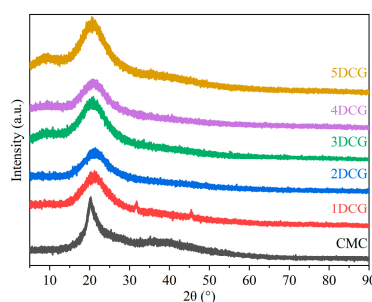


Figure S4. XRD spectra of CMC and DCG

Section 3 Analysis of Fluorescence Properties

Photoluminescence Spectrometer (FLS1000) was used to measure the fluorescence lifetime. The fluorescence decay curves of Si-CDs consistently adhere to a second-order exponential function, exhibiting correlation coefficients (R^2) greater than 0.97. The calculated fluorescence lifetimes consistently fall within the millisecond range[58].

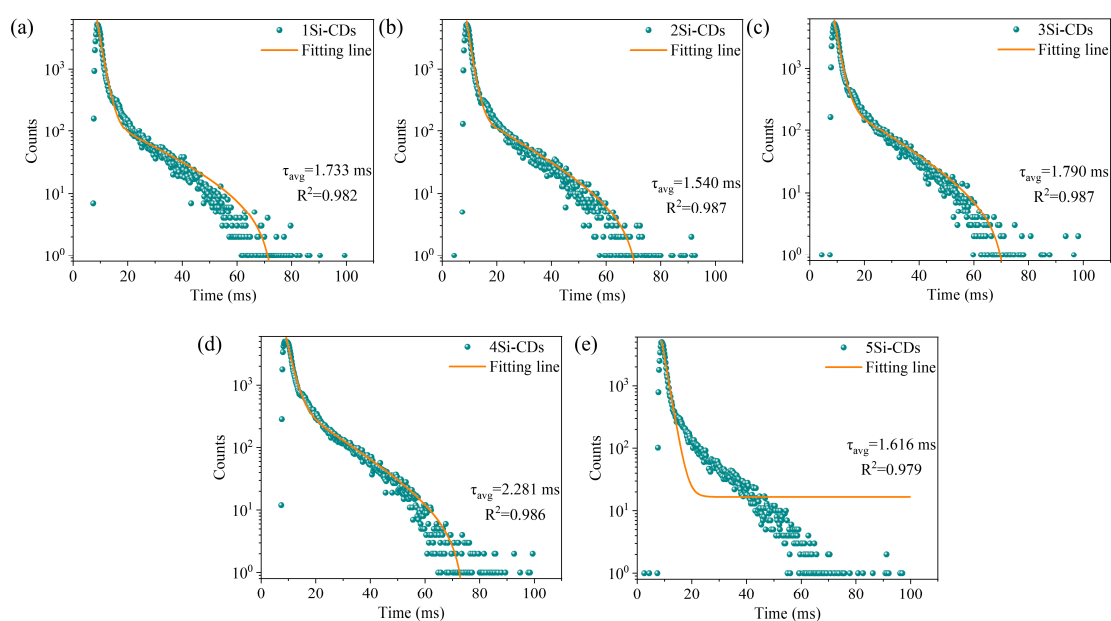


Figure S5. Fluorescence emission lifetime decay diagram and fitting curve of (a) 1Si-CDs, (b) 2Si-CDs, (c) 3Si-CDs, (d) 4Si-CDs and (e) 5Si-CDs

References

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