Supporting Information

Production of superoxide anion radicals as an evidence for carbon nanodots as electron donors by chemiluminescence method

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Experimental Section

Reagents. All chemicals used in our work were analytical grade and were used without any purification. Poly(ethylene glycol)(PEG200 average MW 180 \sim 220), diethylenetriaminepentaacetic acid, ascorbic acid, sodium hydroxide (NaOH), sodium azide (NaN₃) and thiourea were brought from Beijing Chemical Reagent Co. (Beijing, China). 5, 5-dimethyl-1-pyrroline-N-oxide (DMPO) was purchased from Tokyo Kasei Kogyo Co. Ltd (Tokyo, Japan). NaOH solution was prepared freshly before using.

Apparatus. Batch CL experiments were carried out with a BPCL luminescence analyzer (Institute of Biophysics, Chinese Academy of Sciences, Beijing, China). The flow injection was performed with a flow CL analyzer (LumiFlow LF 800 detector, NITI ON, Funabashi, Japan). UV-vis spectra were collected by a UV-3900 spectrophotometer (Hitachi, Japan). Emission spectra were measured with a F-7000 fluorescence spectrophotometer (Hitachi, Japan). The Fourier Transform Infrared (FTIR) spectrum was obtained with FTIR spectrometer (Massachusetts, USA).

Electron paramagnetic resonance (EPR) spectra were measured on a Model JES-FA200 spectrometer (JEOL, Tokyo, Japan). Transmission electron microscopy image was recorded by a JEM 2010 electron microscope (JEOL, Japan). The CDs were synthesize by microwave oven with 800w power(Galanz, China).

Synthesis of CDs. Water soluble CDs were synthesized via microwave treatment as previously reported.¹⁰ First, 400 mg of diethylenetriaminepentaacetic acid as novel carbon source was mixed with 2.0 ml PEG200. Then the mixture was heated in microwave oven for 5 min and then sticky brown product was obtained. The as-prepared carbon nanodots were purified by dialysis (The cut-off of the dialysis membrane equivalent to Mw ~ 2000).The concentration of CDs was based on the carbon concentration in carbon precursor.



Figure S1 The FL intensity(excited at 380nm) and the CL intensuty in basic medium of CDs with different heating time



Figure S2 The CL kinetic file of CDs/NaOH system with different concentration of CDs. Conditions: The CDs concentration were 5×10^{-6} M, 1×10^{-5} M, 5×10^{-5} M, 1×10^{-4} M and 2.5×10^{-4} M, respectively. Each concentration was carried out in duplicate.



Figure S3 The CL kinetic file of CDs/NaOH system with addition of different concentration NaOH solution of 0.1, 0.15, 1 and 1.5 M, respectively. Each concentration was carried out in duplicate.



Figure S4. (A) The UV-vis spectra and (B) FL spectrum(excited at 380nm) of CDs after addition of increasing NaOH concentration ; (C) The FTIR spectra of CDs before (b) and after (a) addition of 1M NaOH solution

Bubble gas	Change ratio of CL intensity (%)	
bubbl of O ₂	1.3	
bubble of N ₂	-11.3	
^a The experiment was carried out with flow injection system.		
^{b} Solution condition: the concentration of NaOH was 1M ; the concentration of		
carbon nanodots was $2\!\times\!10^{\text{-5}}\text{M}$ (the concentration was based on the carbon		
concentration in carbon source).		

Table S1 Effect of quench reagent on CDs-NaOH CL System^{*a,b*}

Table S2 Effect of quench reagent on CDs-NaOH CL System^{*a,b*}

Quench reagent	Concentration (M)	Inhibition ratio of CL intensity (%)
ascorbic acid	10 ⁻⁵	31.5
NaN ₃	10 ⁻³	14
thiourea	10-2	12

^{*a*}The experiments were carried out with flow injection system.

^bSolution condition: the concentration of NaOH was 1M ; the concentration of carbon nanodots was

 2×10^{-5} M (the concentration was based on the carbon concentration in carbon source).