

Supporting Information

One-step fabrication of high quantum yield sulfur- and nitrogen-doped carbon dots for sensitive and selective detection of Cr (VI)

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Determination of fluorescence quantum yield

The quantum yield of the carbon dots was measured according to the reported method.¹ Quinine sulfate dispersed in 0.1 M H₂SO₄ (quantum yield: 0.54 at 360nm) was used as a standard. Absolute values were calculated using the standard reference sample that had a fixed and known fluorescence quantum yield value. In order to minimize absorption effects absorbencies, the absorbance of the solutions for carbon dots and quinine sulfate was kept below 0.05 at 360 nm. For calculation of QY, five concentrations of quinine sulfate and carbon dots were made respectively. Quinine sulfate was dissolved in 0.1 M H₂SO₄ (refractive index (η) of 1.33) and the carbon dots were dissolved in water ($\eta=1.33$). An UV–Vis absorption spectrometer was used to determine the absorbance values of the samples at a 360 nm excitation wavelength. The respective solvents were used as the references. A quartz cuvette with a path length of 1.00 cm was used to contain the samples during the UV-Vis and FL experiments. A Hitachi F-4600 fluorescence spectrophotometer set with an excitation slit width of 0.3 nm and an emission slit width of 0.3 nm was used to excite the samples at 360 nm and to record their FL spectra. The integrated fluorescence intensity is the area under the PL curve in the wavelength range from 370 to 600 nm. The QY was calculated by the equation:

$$Q_{CD} = Q_R \cdot \frac{I_{CD}}{I_R} \cdot \frac{A_R}{A_{CD}} \cdot \frac{\eta_{CD}^2}{\eta_R^2}$$

where ‘ Q ’ is the quantum yield, ‘ I ’ is the integrated area of the fluorescence spectra, ‘ A ’ is the absorbance at excited wavelength and ‘ η ’ is the refractive index of the solvent used. The subscripts ‘CD’ for carbon dots and ‘R’ for reference are used in this equation.

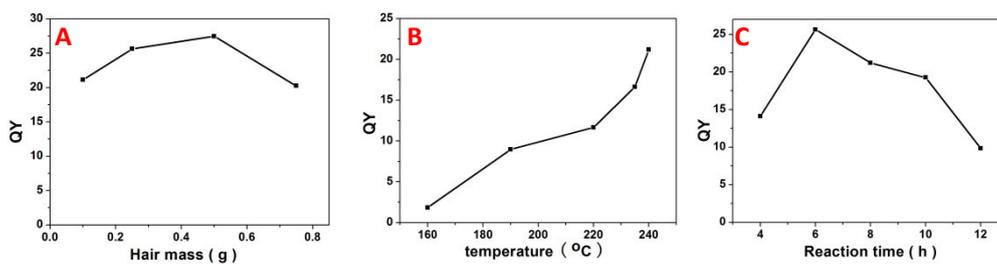


Figure S1 Effect of wool-mass (A), temperature of the hydrothermal method (B), and time of reaction (C) on the quantum yield (QY) of W-CDs

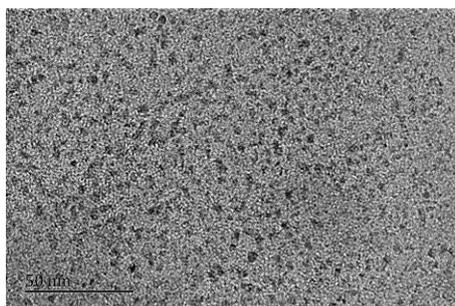


Figure S2 TEM image of the P-CDs

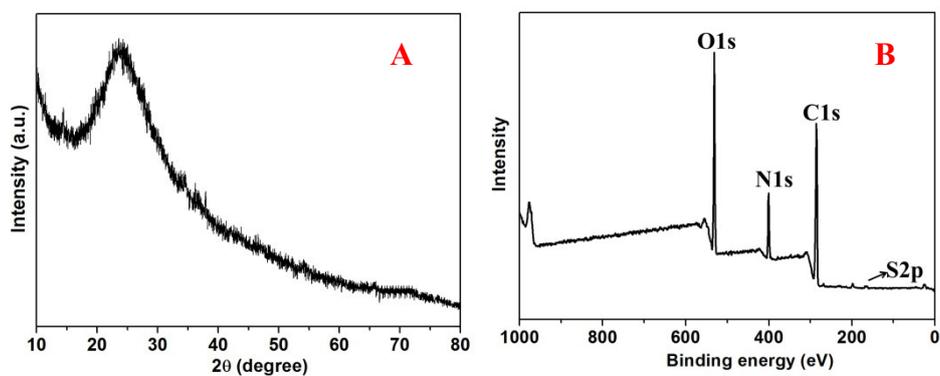


Figure S3 XRD (A) and XPS (B) spectrum of W-CDs

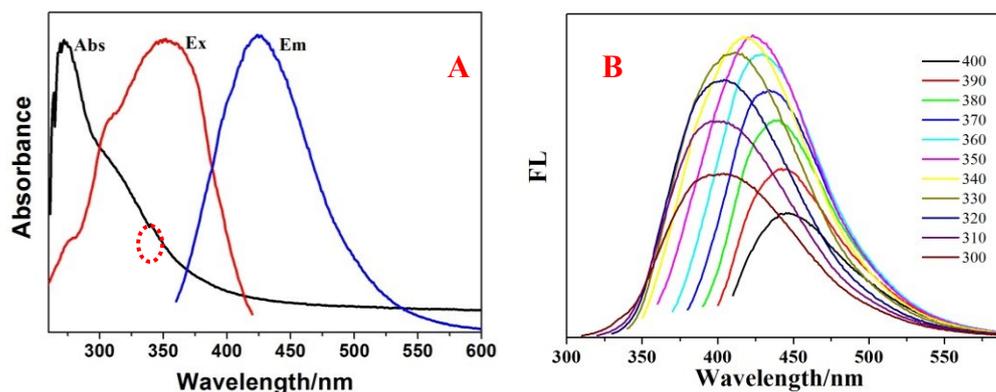


Figure S4 (A) UV-vis absorption, excitation and emission spectra of W-CDs. (B) The excitation-dependent emission spectra of W-CDs

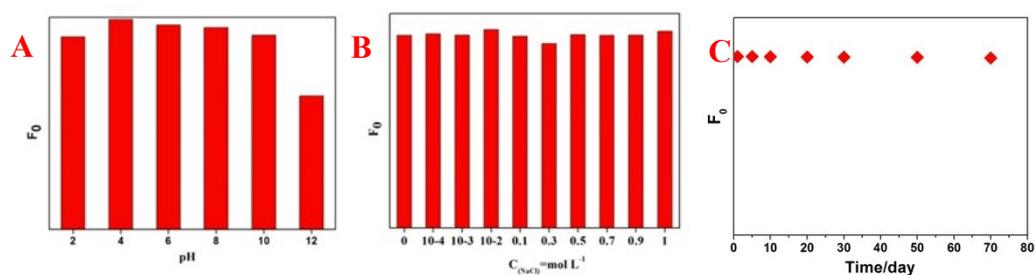


Figure S5 (A) FL responses of W-CDs at different pH values, (B) FL intensity of the W-CDs in the NaCl solution, (C) Stability of the W-CDs as a function of the storage time.

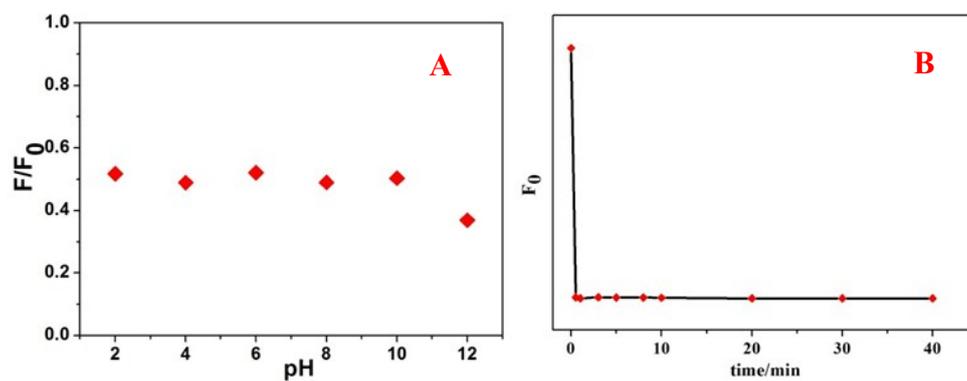


Figure S6 FL intensity of the W-CDs as a function of the pH value (A) and reaction time (B) in the presence of 100 μM of Cr (VI).

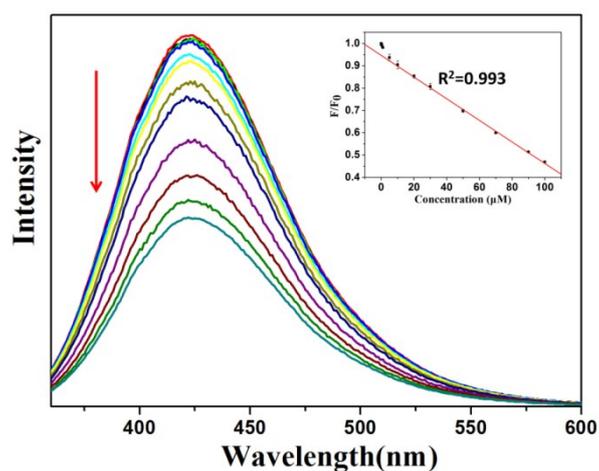


Figure S7 Fluorescent emission spectra of P-CDs upon addition of various concentration of Cr (VI) (from top to bottom, 0, 0.05, 0.5, 1, 5, 8, 10, 20, 30, 50, 70, 90 and 100 μM). Insets show the dependence of F/F_0 on the concentration of Cr (VI).

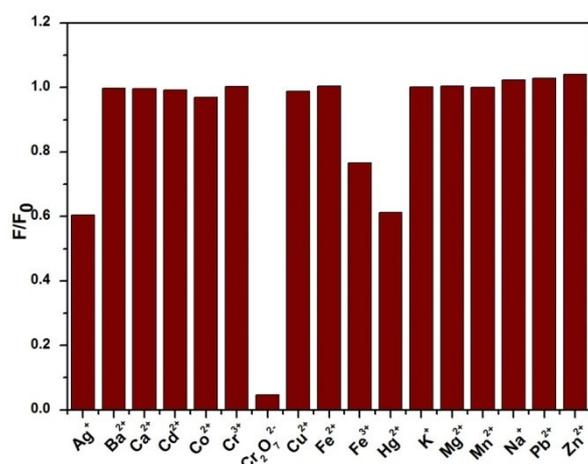


Figure S8 Fluorescence response of P-CDs in the presence of different metal ions

Reference

1. D. Sun, R. Ban, P.-H. Zhang, G.-H. Wu, J.-R. Zhang and J.-J. Zhu, *Carbon*, 2013, **64**, 424-434.