

## Electronic Supplementary Information

### Carbon-based dots co-doped with nitrogen and sulfur for Cr(VI) sensing and bioimaging

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#### Measurement of quantum yield ( $\Phi_s$ ):

The  $\Phi_s$  of the NSCDs were determined by a comparative method as follows:

$$\Phi_s = \Phi_R (\text{Grad}_S / \text{Grad}_R) (\eta^2_S / \eta^2_R) \quad (1)$$

where Grad is the gradient from the plot of integrated fluorescence intensity against absorbance and  $\eta(1.33)$  is the refractive index of the solvent. The subscripts S and R represent NSCDs and the reference (quinine sulfate in 0.10 M H<sub>2</sub>SO<sub>4</sub>). To prevent the re-absorption effect, the absorbances of NSCDs and quinine sulfate solutions in the 10-mm fluorescence cuvette were adjusted to less than 0.10 at the excitation wavelength ( $\lambda_{\text{ex}}$ ) of 360 nm (*i.e.*, the absorption maximum of NSCDs). The integrated fluorescence intensity was the area under the PL curve in the wavelength range 380–680 nm. The  $\Phi_R$  was taken as 0.54 since it is almost independent (within 5%) with  $\lambda_{\text{ex}}$  at 200–400 nm.<sup>1</sup>

#### References

- 1 X. Wang, K. Qu, B. Xu, J. Ren, X. Qu, *J. Mater. Chem.*, 2011, **21**, 2445-2450.

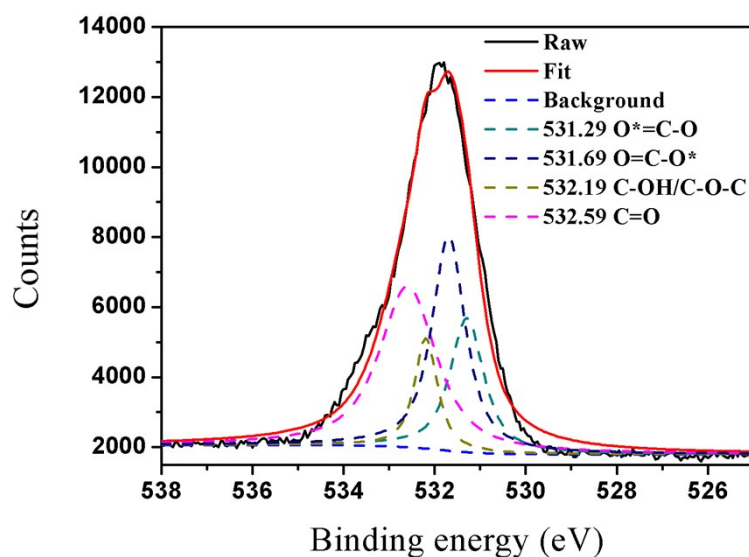
**Table S1.** Elemental analysis of the as-synthesized NSCDs: (A) elemental content and (B) relative number of atom in NSCDs.

(A)

Sample name	Elemental content (%)				
	C	H	N	S	O (Calculated)
NSCDs	41.69	5.07	9.68	11.65	31.91

(B)

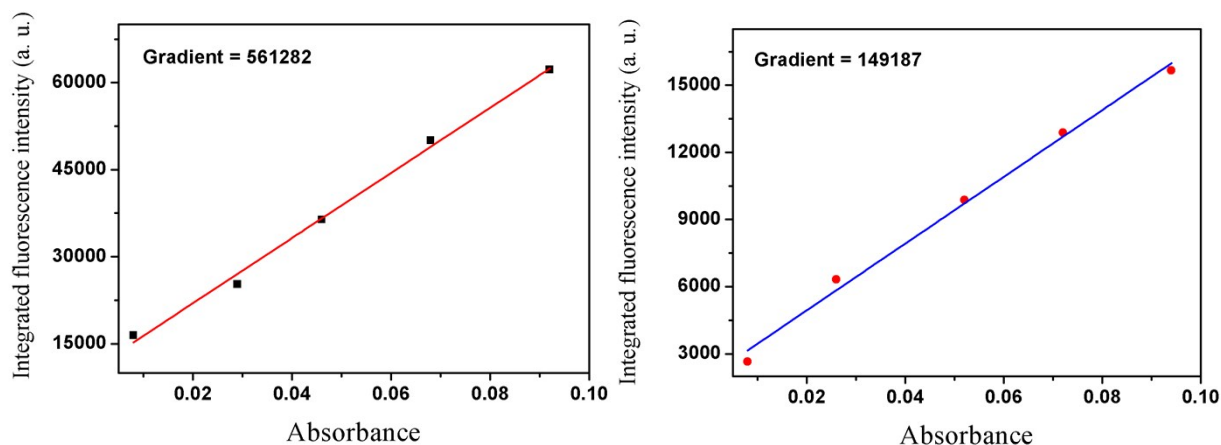
Sample name	Relative number of atom					Empirical formula
	C	H	N	S	O	
NSCDs	19	28	4	2	11	$C_{19}H_{28}N_4S_2O_{11}$



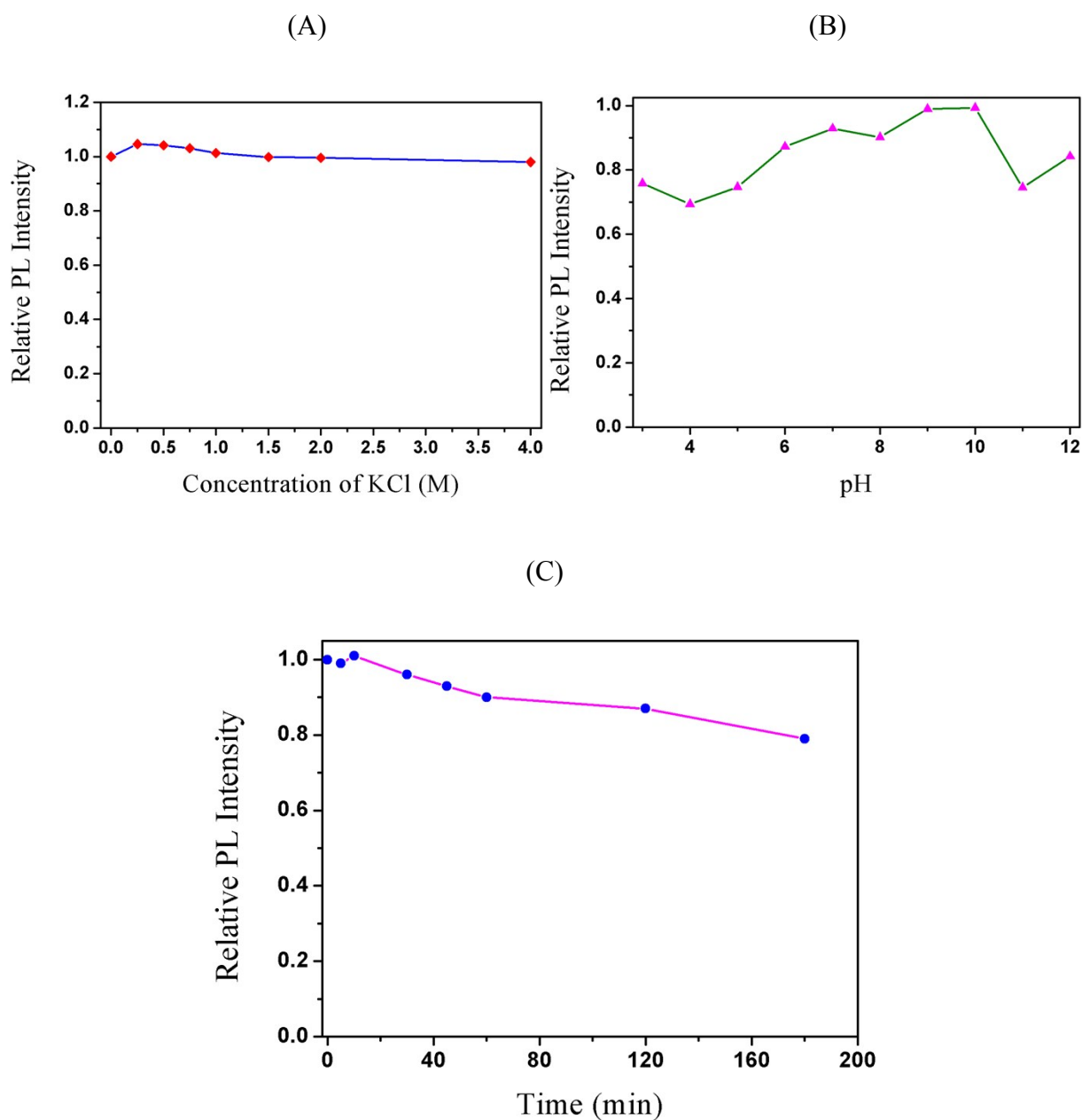
**Fig. S1** O1s XPS of NSCDs.

(A)

(B)



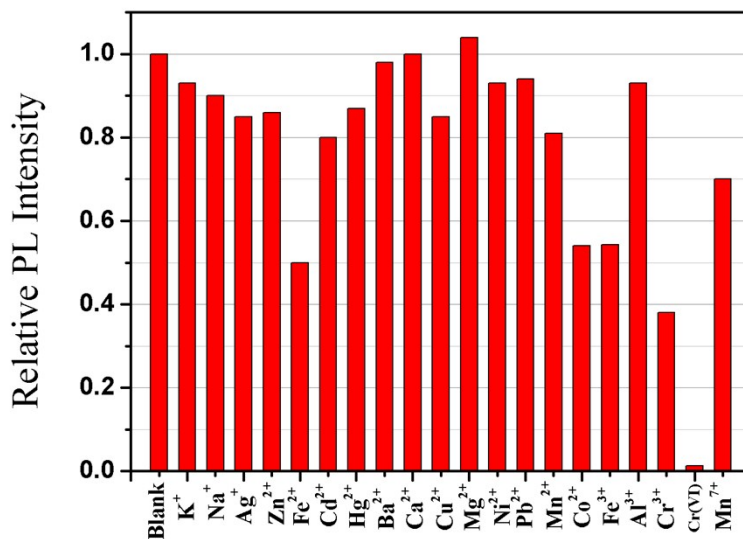
**Fig. S2** Plots of integrated PL intensity against absorbance of (A) quinine sulfate and (B) NSCDs at excitation 360 nm.



**Fig. S3** (A) Effect of ionic strength on fluorescence intensity of NSCDs. The ionic strengths are controlled by various concentrations of KCl. (B) Effect of pH on fluorescence intensity of NSCDs. The pH is adjusted by the PBS buffers. The excitation/emission wavelengths ( $\lambda_{\text{ex}}/\lambda_{\text{em}}$ ) are 362/443 nm. (C) Dependence of fluorescence intensity on UV excitation time for NSCDs in DDI water at  $\lambda_{\text{ex}}/\lambda_{\text{em}}$  of 362/443 nm. The concentration of NSCDs is 0.50 mg mL<sup>-1</sup>.

**Table S2** Double-exponential fitting of NSCDs and NSCDs/Cr(VI) decay curves.

Sample name	NSCDs	NSCDs/Cr(VI)
$\tau_1(\text{ns})/A_1(\%)$	10.19/83.24	9.56/90.72
$\tau_2(\text{ns})/A_2(\%)$	1.486/16.76	0.4619/9.275
$\tau(\text{ns})$	8.732	8.717



**Fig. S4** Comparison of fluorescence intensity of NSCDs ( $0.50 \text{ mg mL}^{-1}$ ) after the addition of Cr(VI) ( $1.0 \text{ mM}$ ) and other different metal ions ( $10 \text{ mM}$ ).