Hydrothermal synthesis of nitrogen and boron doped carbon quantum dots with yellow-green emission for sensing Cr(Ⅵ), anti-counterfeiting and cell imaging

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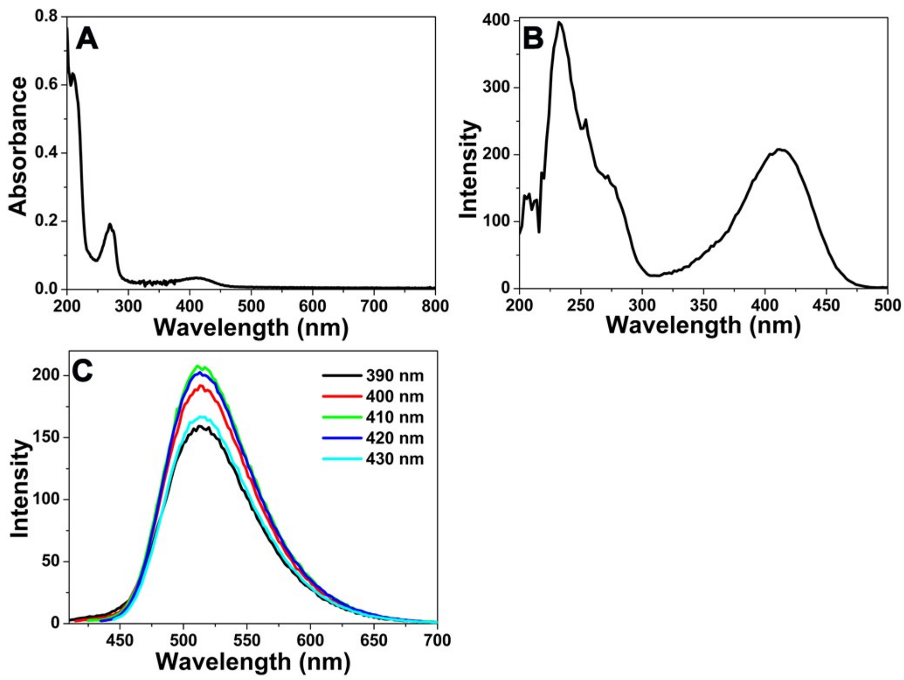

Fig. S1 (A) UV-vis absorption spectrum of NB-CQDs prepared from 2-HPBA and EDA with 1:1. (B) Excitation spectrum of NB-CQDs prepared from 2-HPBA and EDA with 1:1. (C) Emission spectra of NB-CQDs prepared from 2-HPBA and EDA with 1:1 at different excitation wavelengths.

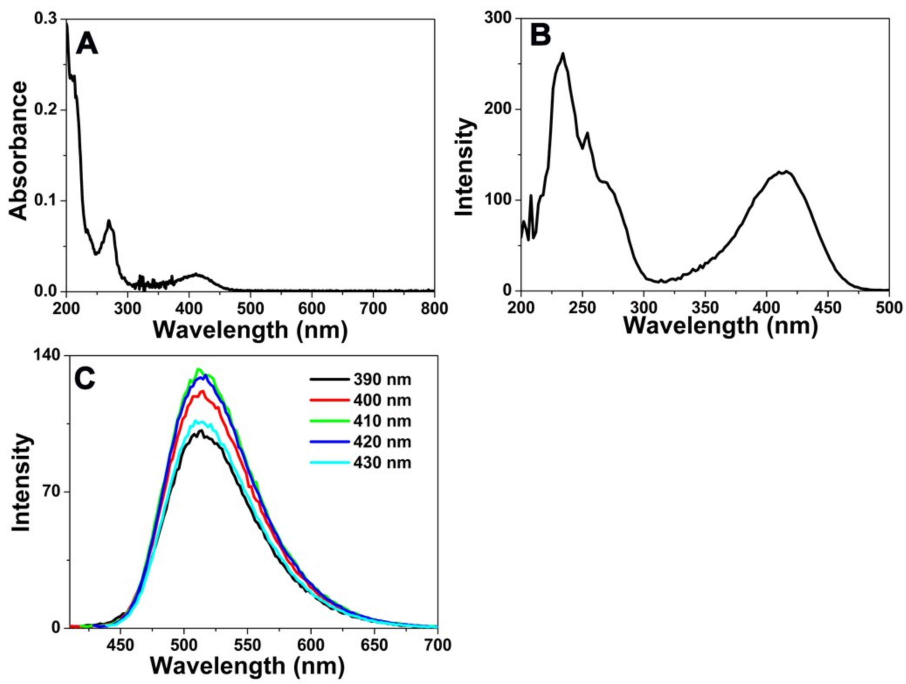

Fig. S2 (A) UV-vis absorption spectrum of NB-CQDs prepared from 2-HPBA and EDA with 1:2. (B) Excitation spectrum of NB-CQDs prepared from 2-HPBA and

EDA with 1:2. (C) Emission spectra of NB-CQDs prepared from 2-HPBA and EDA with 1:2 at different excitation wavelengths.

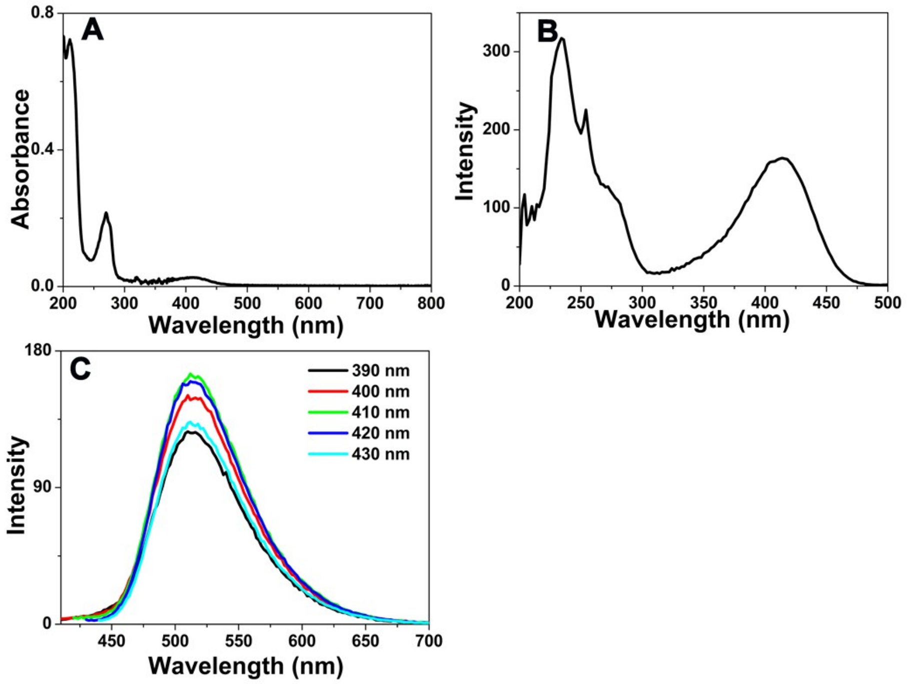

Fig. S3 (A) UV-vis absorption spectrum of NB-CQDs prepared from 2-HPBA and EDA with 2:1. (B) Excitation spectrum of NB-CQDs prepared from 2-HPBA and EDA with 2:1. (C) Emission spectra of NB-CQDs prepared from 2-HPBA and EDA with 2:1 at different excitation wavelengths.

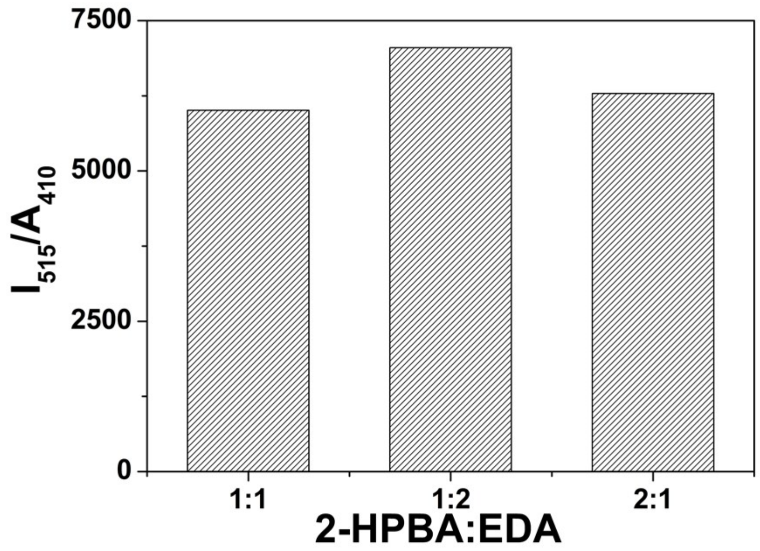

Fig. S4 Comparison of the I_{515}/A_{410} of NB-CQDs prepared from different ratios of 2-

HPBA and EDA.

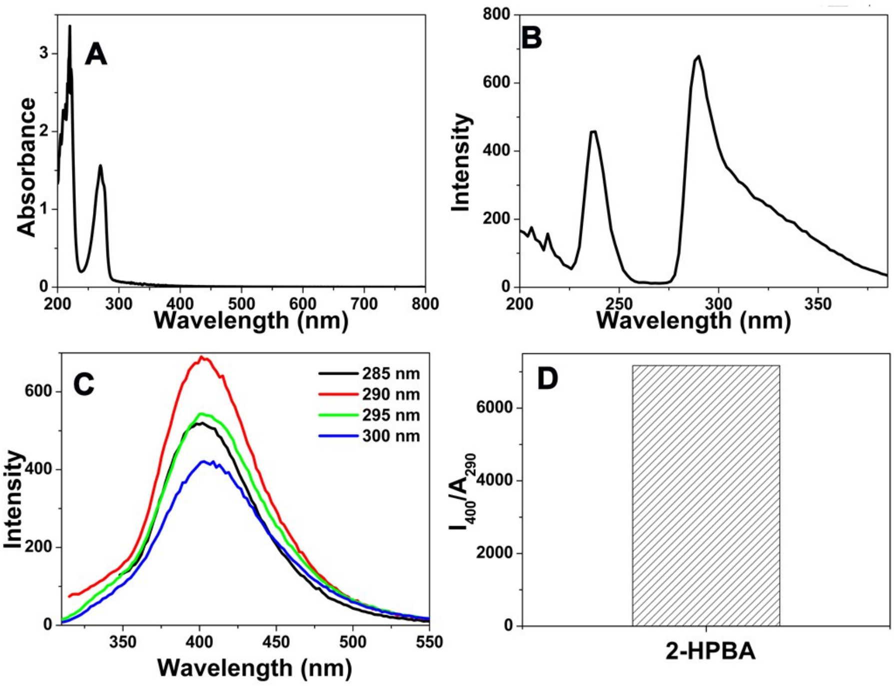

Fig. S5 (A) UV-vis absorption spectrum of CQDs synthesized from 2-HPBA. (B) Excitation spectrum of CQDs synthesized from 2-HPBA. (C) Emission spectra of CQDs synthesized from 2-HPBA at different excitation wavelengths. (D) Histogram of I_{400}/A_{290} against 2-HPBA.

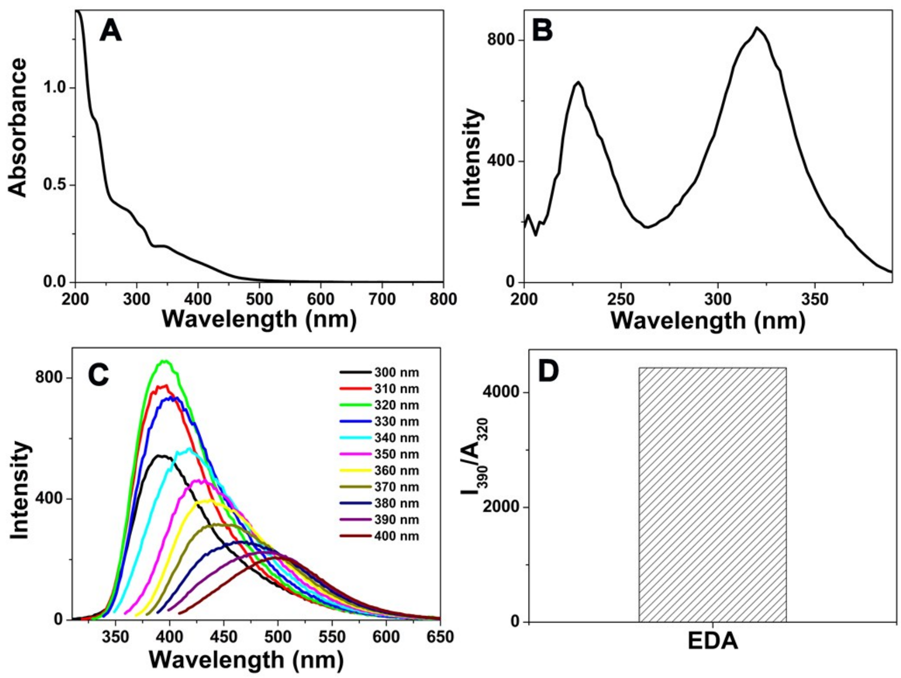

Fig. S6 (A) UV-vis absorption spectrum of CQDs synthesized from EDA. (B) Excitation spectrum of CQDs synthesized from EDA. (C) Emission spectra of CQDs synthesized from EDA at different excitation wavelengths. (D) Histogram of I_{400}/A_{290} against EDA.

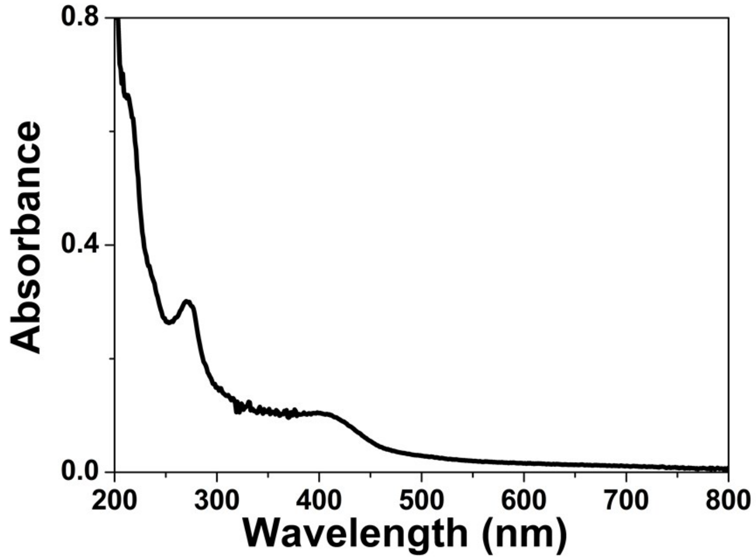

Fig. S7 UV-vis absorption spectrum of purified NB-CQDs.

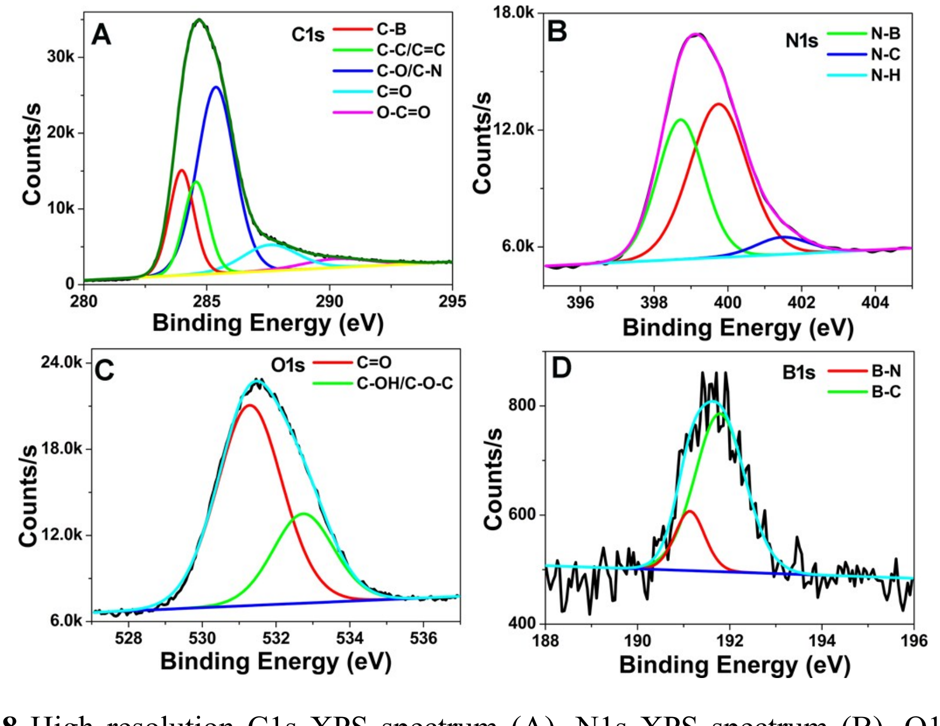

Fig. S8 High resolution C1s XPS spectrum (A), N1s XPS spectrum (B), O1s XPS spectrum (C) and B1s XPS spectrum (D) of the as-prepared NB-CQDs.

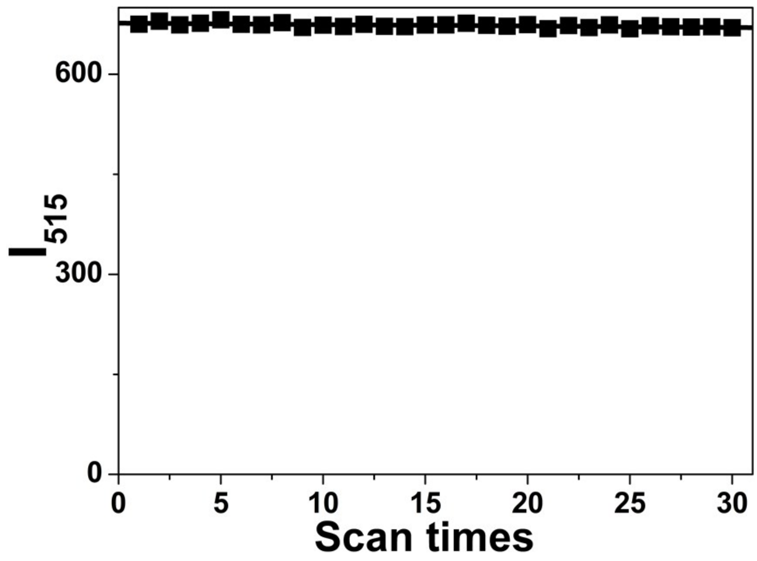

Fig. S9 The effect of scan time on the fluorescent intensity of NB-CQDs.

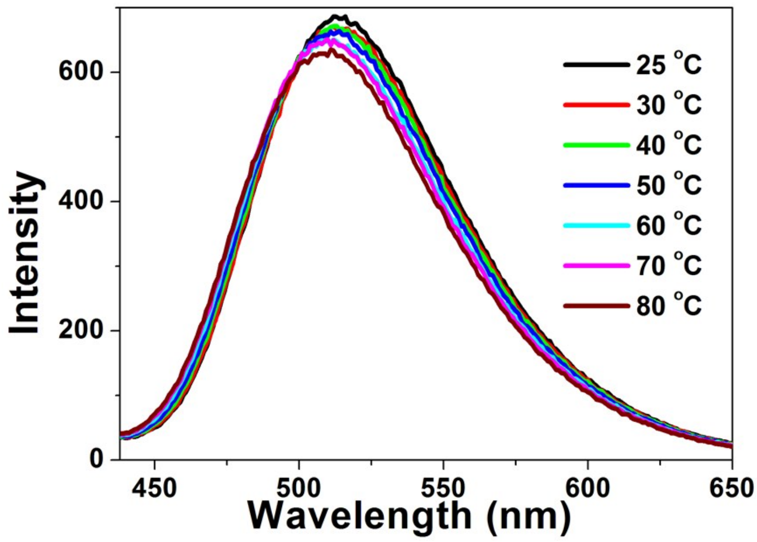

Fig. S10 The effect of temperature on the fluorescent intensity of NB-CQDs.

Table S1 Comparison of the performance of the presented method with some other reported nanosensors for Cr(VI) detection.

Probes	Readout	LOD	Linear range	References
Carbon dots	Fluorescence	15 nM	0.05-10.0 μM	1
Fluorescent copper nanoclusters	Fluorescence	43 nM	0.2–60 μM	2
Fluorescent silicon nanoparticles	Fluorescence	28 nM	0.1-200 μM	3
Gallic acid capped	UV	0.1 μM	0.15-21 μM	4

gold nanoparticles				
meso-2,3-dimercaptosuccinic acid capped gold nanoparticles	UV	10 nM	0.01-0.5 μM	[5]
NB-CQDs	Fluorescence	0.5 μM	0-250 μM	This work

Table S2 Results of NB-CQDs for the detection of Cr(VI) in tap water and lake water.

Samples	**Added (μM)**	**Found (μM)**	**Recovery(%)**	**RSD(%)**
Tap water	0	0	-	-
	60.0	68.03	113.4	2.96
	80.0	83.13	103.9	4.38
Lake water	0	0	-	-
	60.0	61.22	102.0	4.98
	80.0	82.11	102.6	3.43

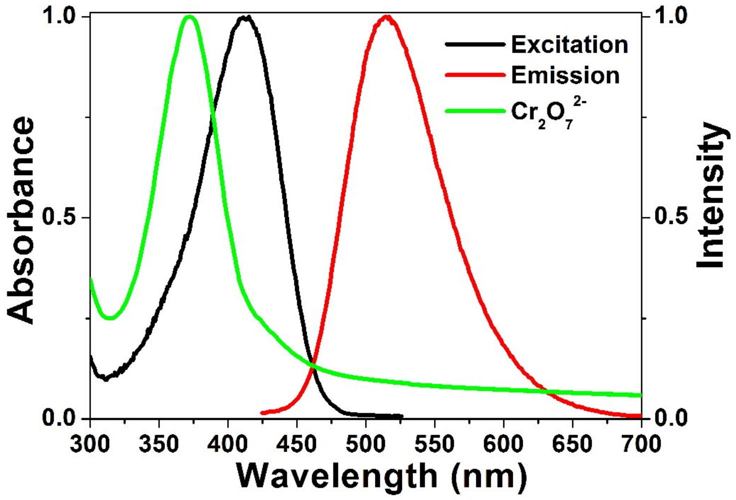

Fig. S11 UV-vis absorption spectrum of $K_2Cr_2O_7$ (100 μM), excitation spectrum of NB-CQDs and emission spectrum of NB-CQDs (excitation wavelength is 410 nm).

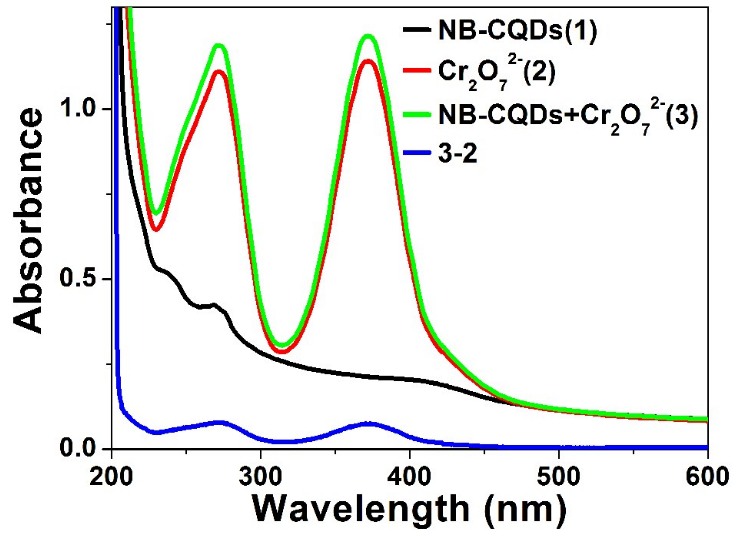

Fig. S12 UV-vis absorption spectra of NB-CQDs (1), 100 μM $K_2Cr_2O_7$ (2), the mixture of NB-CQDs and 100 μM $K_2Cr_2O_7$ (3), and the blue curve was obtained by subtracting curve 2 from curve 3.

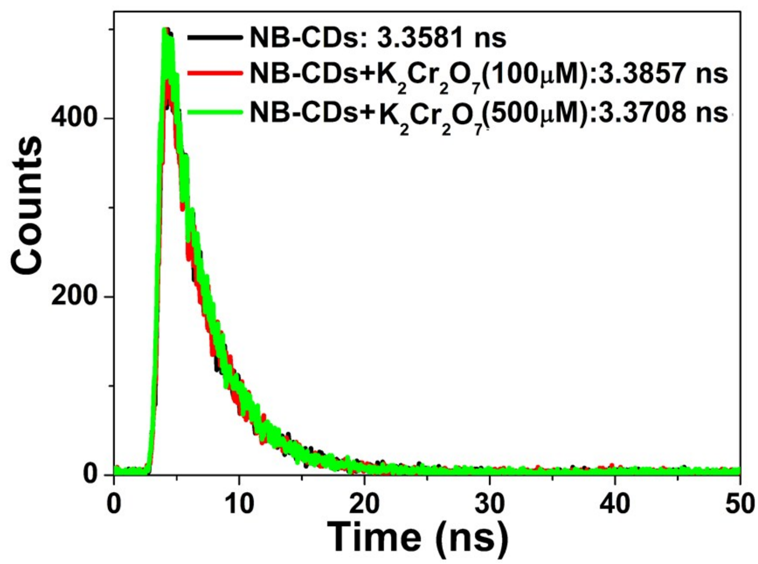

Fig. S13 Fluorescence decay spectra of NB-CQDs in the absence and presence of $K_2Cr_2O_7$ (100 μM and 500 μM).

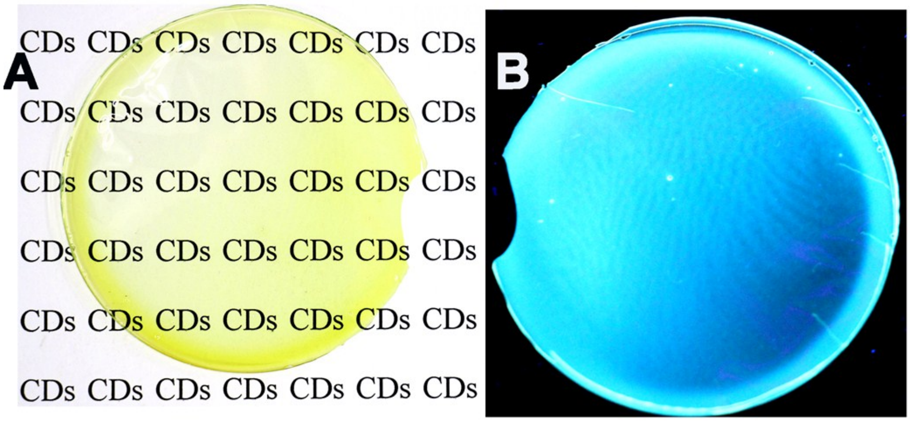

Fig. S14 Picture of NB-CQDs/PVA film in visible light (A) and 365 nm UV light (B).

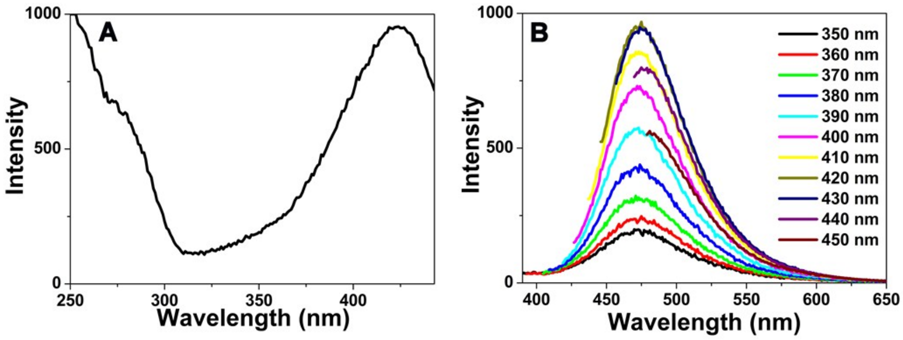

Fig. S15 (A) Excitation spectrum of NB-CQDs in PVA film. (B) Emission spectra of NB-CQDs in PVA film at different excitation wavelengths.

References:

1. X. Liu, T. Li, Q. Wu, X. Yan, C. Wu, X. Chen and G. Zhang, *Talanta*, 2017, **165**, 216-222.
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