Supplementary Material

Ag and N-doped carbon dots-enhanced H_2O_2-Co^{2+} chemiluminescence and its application for the determination of Co^{2+} and hydroquinone†
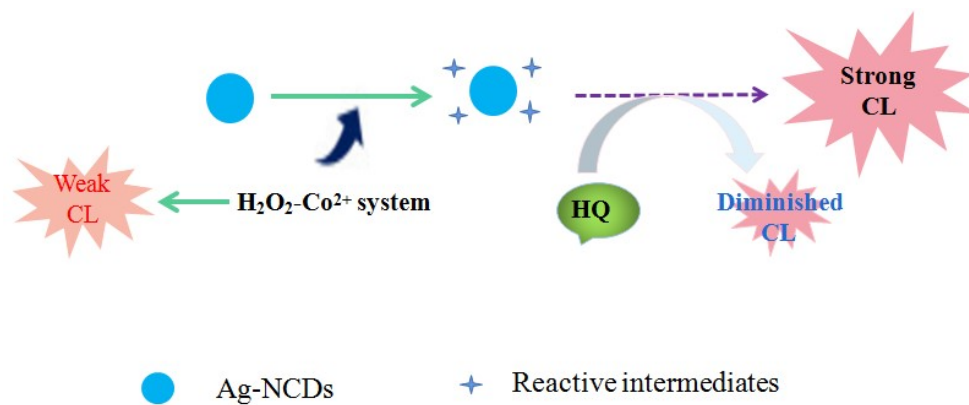
Xiaowei Wang, Zixuan Wang, Yamei Jiang, Suqin Han[*]

School of Chemistry and Material Science, Shanxi Normal University, Taiyuan 030000, Shanxi, P. R. China

[*] Corresponding author at: School of Chemistry and Material Science, Shanxi Normal University, Taiyuan 030000, Shanxi, P. R. China
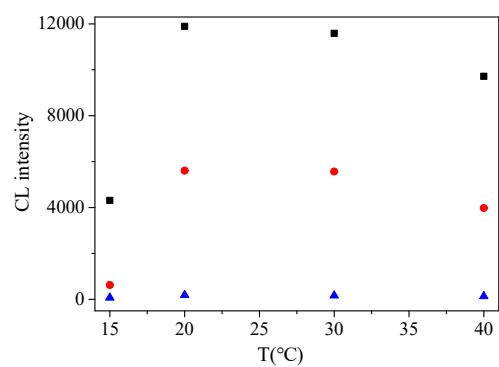
E-mail address: hsq@ sxnu.edu.cn

† Electronic supplementary information (ESI) available.

Scheme S1 Schematic illustration of the Ag-NCDs amplified Fenton-like CL emissions.
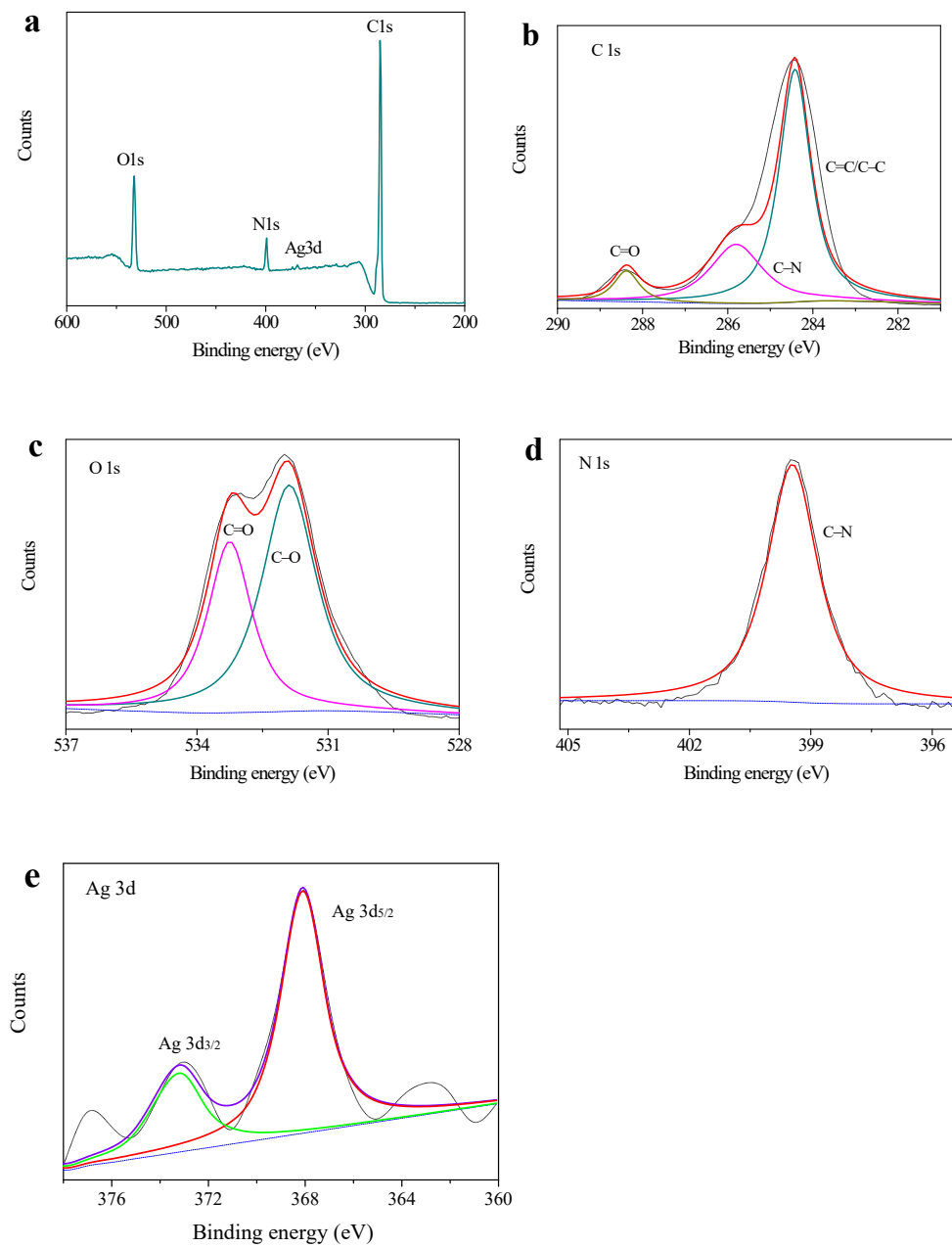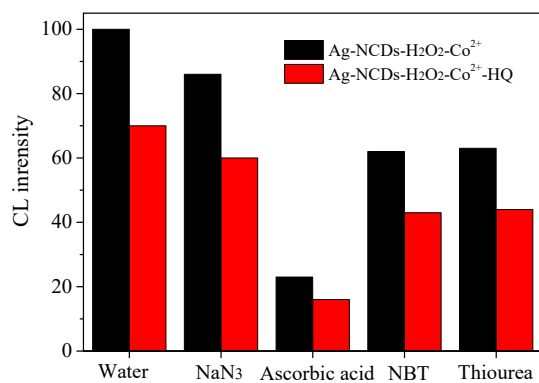
Fig. S1 XPS spectrum of Ag-NCDs (a) and high resolution XPS spectra of Ag-NCDs: (b) C1 s, (c) O1 s, (d) N1 s and (e) Ag 3d.

Fig. S2 The effect of reaction cell temperature on CL intensity: Ag-NCDs-H_2O_2 (blue), Ag-NCDs-H_2O_2-Co^{2+} (black), and Ag-NCDs-H_2O_2-Co^{2+}-HQ (red).
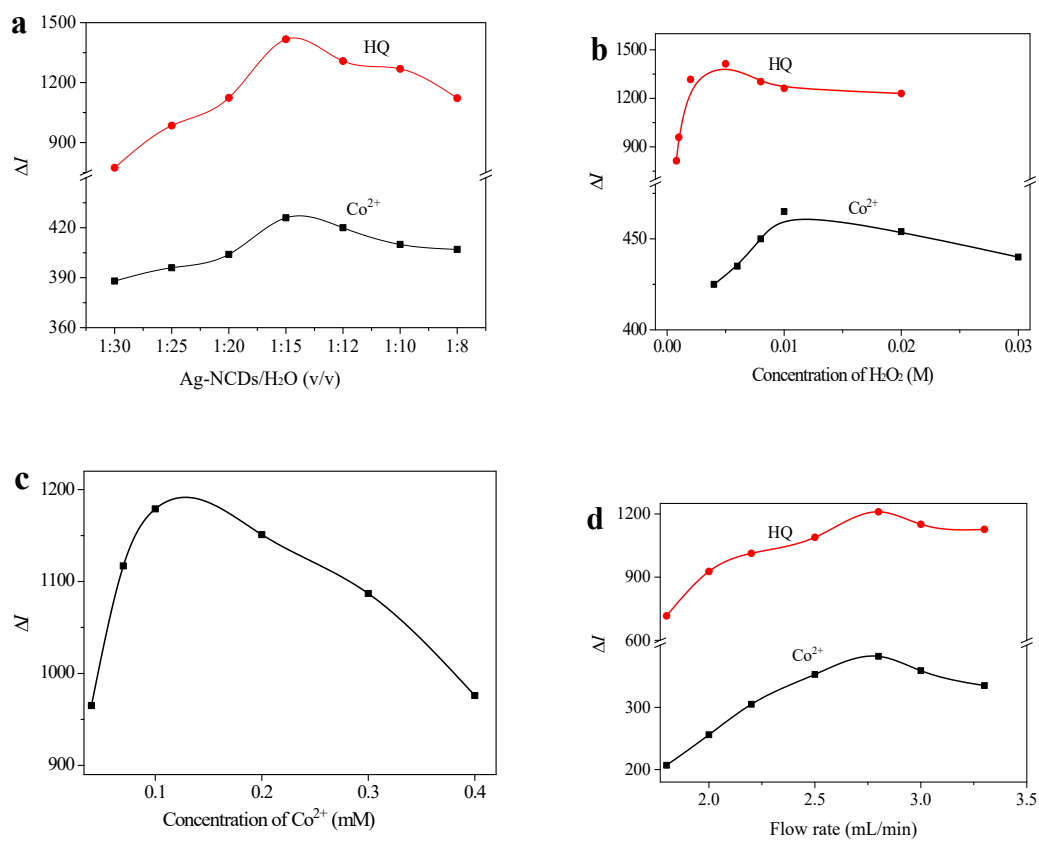
Fig. S3 Optimization of CL reaction conditions. (**a**) Ag-NCDs concentration; (**b**) H_2O_2 concentration; (**c**) Co^{2+} concentration; (**d**) flow rate.

Fig. S4 Effect of radical scavengers (1.0 mM concentration) on the CL intensity.
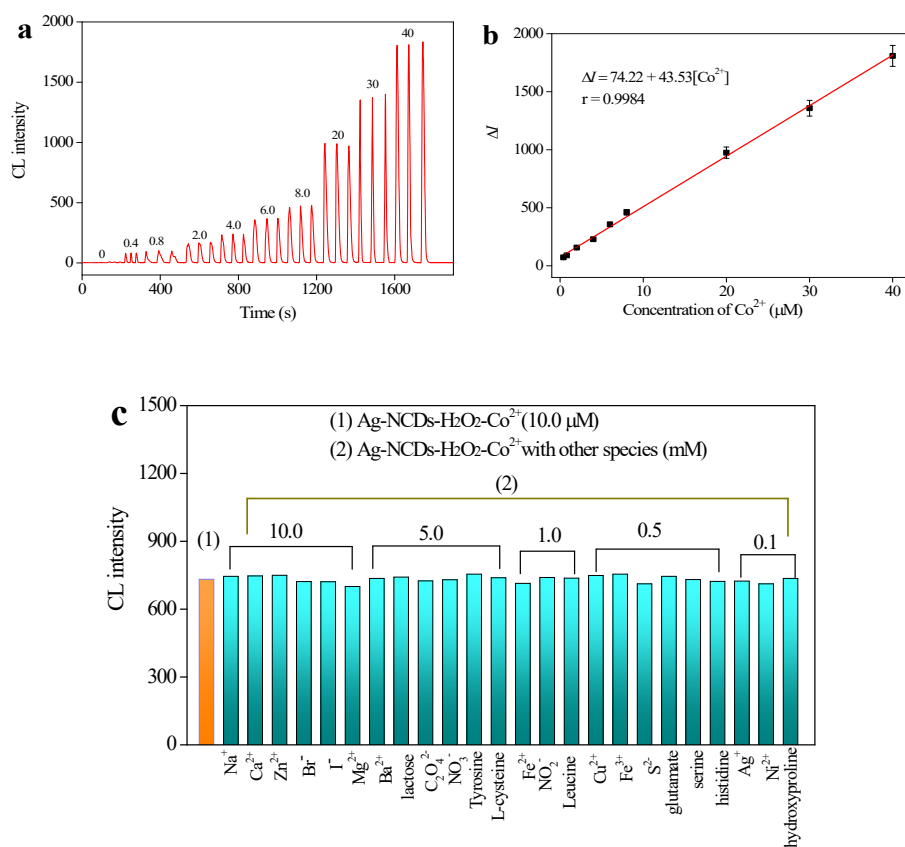
Fig. S5 (**a**) CL intensity of the Ag-NCDs-H_2O_2 system upon addition of different concentrations (μM) of Co^{2+}; (**b**) corresponding calibration curve for the Co^{2+} assay; (**c**) Influence of various concentrations other species on the CL intensity of Ag-NCDs-H_2O_2-Co^{2+} system.
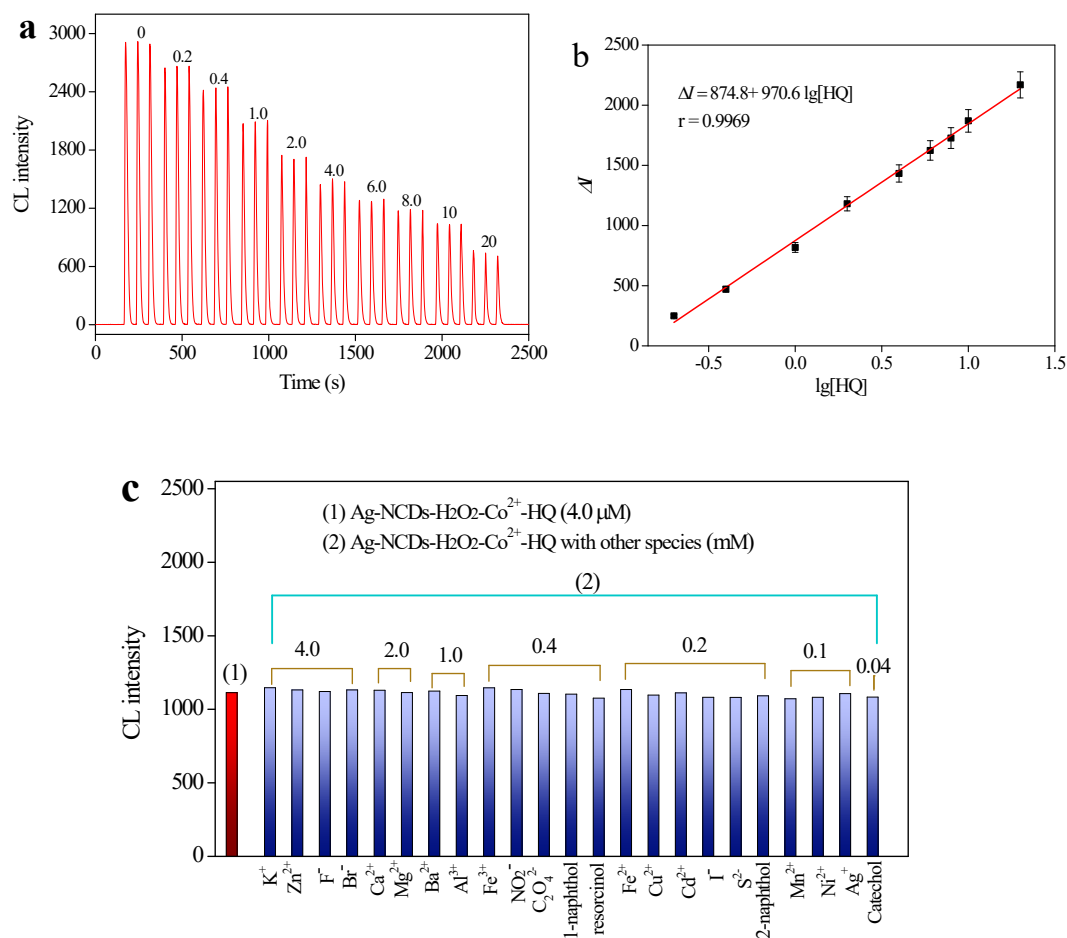
Fig. S6 (a) CL intensity of Ag-NCDs-Co^{2+}-H_2O_2 system at different concentrations (μM) of HQ; **(b)** corresponding calibration for HQ determination; **(c)** Effect of different ions at 0.1–4.0 mM and phenols at 0.04–0.4 mM on the CL of the Ag-NCDs-Co^{2+}-H_2O_2-HQ system.

Table S1 Comparison of the proposed Co^{2+} detection method with other methods

Methods	Systems	Linear range (μM)	Detection limit (μM)	References
FAAS	SS-LPME-SQT	3.40–33.96	1.27	5
UV-vis	AgNPs	1.7–20	0.68	6
FL	β-CD@ZnO QDs	1.0–10	0.34	9
FL	Polymer dots	3.4–50	1.0	10
CL	Luminol-DBF	0.005–1.0	0.018	13
CL	NBS-rCDs(OH$^-$)	0.1–1000	3.25	14
CL	Ag-NCDs-Co^{2+}-H$_2$O$_2$	0.4–40	0.07	This work

Table S2 Determination results of Co^{2+} and HQ in real samples

Analyst	Sample	Added (µM)	Founded (µM)	RSD (%)	Recovery (%)
Co^{2+}	Egg yolk	0	Not found		
		4.0	3.98	0.33	99.5
		6.0	6.06	1.65	101.0
	vitamin B12	0	2.02	1.98	
		4.0	6.00	0.58	99.5
		6.0	8.14	0.45	102.0
HQ	Tap water	0	Not found		
		2.0	2.01	0.85	100.5
		4.0	3.87	1.09	96.8
	Lake water	0	Not found		
		2.0	2.07	0.96	103.5
		4.0	3.94	1.14	98.5

Table S3 Comparison of the proposed HQ detection method with other methods

Methods	Systems	Linear range (µM)	Detection limit (µM)	References
UV-vis	$KMnO_4$	0.64–18.17	0.191	7
UV-vis	NH_4VO_3-O_2	0.23–18.17	0.064	8
FL	g-CNQDs	0.5–11.6	0.04	11
FL	N/S/P-CDs	0.56–375	0.16	12
CL	GQDs-$KMnO_4$	9.05–2261.58	0.77	15
ED	COF/CPE	1–400	0.64	16
ED	OM-$MnFeO_x$/GCE	1–2000	0.31	17
CL	Ag-NCDs-Co^{2+}-H_2O_2	0.2–20	0.04	This work