

## A new insight of pH-dependent fluorescence switching mechanism and a novel radical scavenging ability of nitrogen-doped citric acid-based carbon dots

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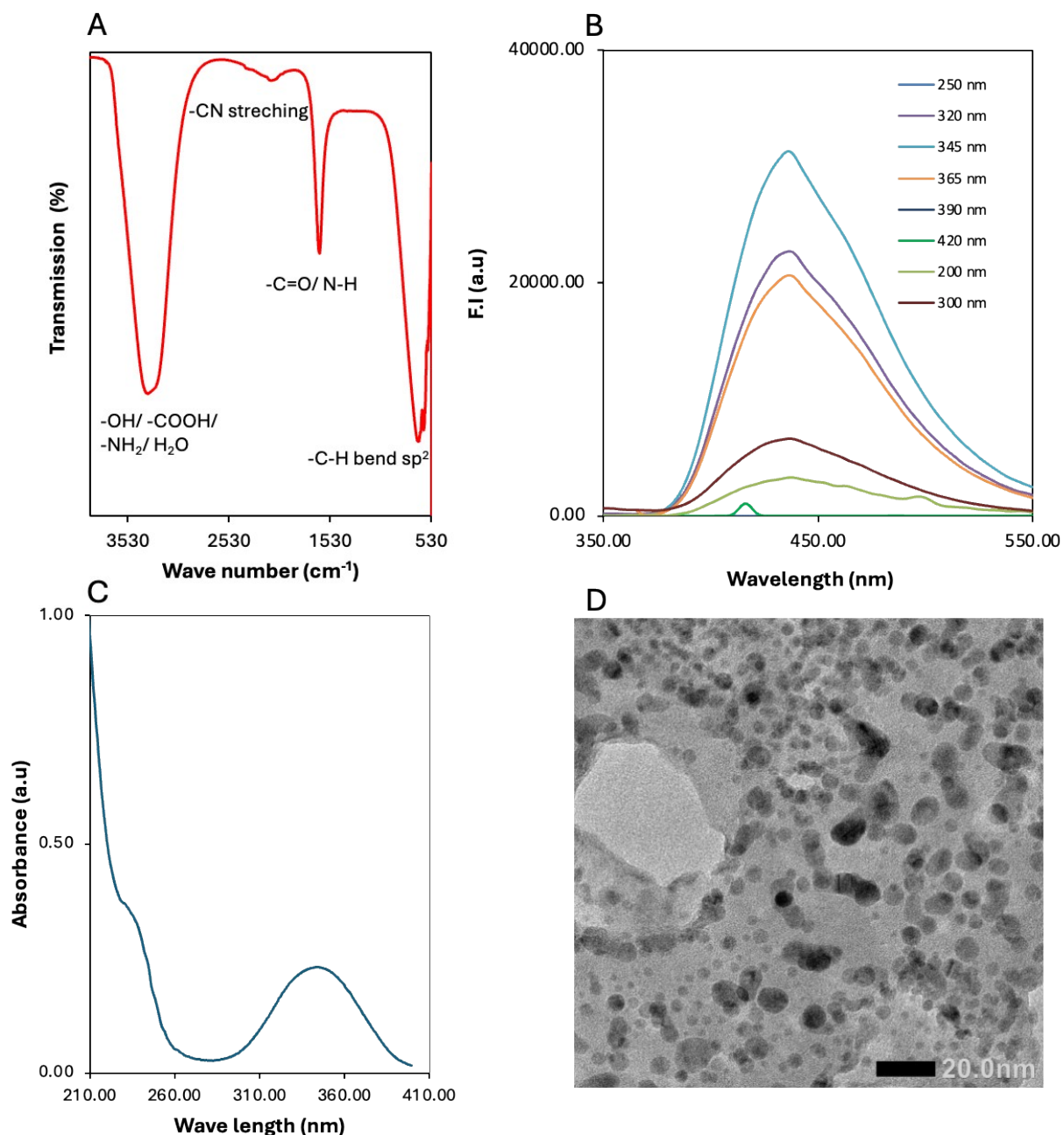


Figure S 1

The N-CADots FT-IR spectrum (A), emission independent excitation spectra (B), absorbance spectrum (C), TEM image (D)

		Before dialysis				After dialysis			p (pK <sub>a</sub> ) before and after dialysis	pK <sub>a</sub> average	pK <sub>a</sub> RSD
		CA or NH <sub>4</sub> Cl	CA- NH <sub>4</sub> Cl - pH nature	CA- NH <sub>4</sub> Cl Adjusted pH acid	CA- NH <sub>4</sub> Cl Adjusted pH base	CA- NH <sub>4</sub> Cl nature	CA- NH <sub>4</sub> Cl Adjusted pH acid	CA- NH <sub>4</sub> Cl Adjusted pH base			
CA	pK <sub>a1</sub>	3.25	3.24	3.58	3.79	3.78	3.41	3.68	0.55	3.54	0.20
		3.32	3.38	3.68	3.82	3.64	3.53	3.42			
	pK <sub>a2</sub>	4.84	5.04	5.10	5.12	5.06	5.10	5.19	0.43	5.00	0.12
		4.94	4.78	4.92	5.06	4.94	5.05	4.84			
	pK <sub>a3</sub>	6.37	6.65	6.68	6.63	6.60	6.47	6.57	0.33	6.52	0.10
		6.60	6.50	6.45	6.55	6.40	6.57	6.37			
C (mM)	5.1	4.9	4.8	5.0	3.2	2.8	2.9				
	4.9	5.0	4.9	4.9	3.0	2.9	3.1				
NH <sub>4</sub> <sup>+</sup>	pK <sub>a</sub>	9.34	9.35	9.33	9.30	9.42	9.38	9.27	0.48	9.33	0.05
		9.37	9.38	9.27	9.28	9.30	9.39	9.31			
	C (nM)	51.0	50.0	50.0	52.1	9.6	11.4	10.0			
		51.4	51.2	51.0	51.2	10.4	11.6	9.4			

Table S 1 The apparent pK<sub>a</sub> of purified citrate acid (CA) and ammonium solutions

	pK <sub>a1</sub>	pK <sub>a2</sub>	pK <sub>a3</sub>	pK <sub>a4</sub>	pK <sub>a5</sub>	pK <sub>a6</sub>	pK <sub>a7</sub>	pK <sub>a8</sub>	pK <sub>a9</sub>
	2.35	3.14	4.66	5.22	5.81	6.10	7.10	9.33	9.65
	2.02	3.75	4.46	5.11	5.57	6.39	7.21	9.33	9.80
	2.35	3.13	4.76	4.98	5.87	6.25	6.77	9.33	9.50
			4.52			6.47	7.02	9.38	9.78
			4.37			6.58	7.11		9.67
			4.17			6.42			9.70
			4.24						
			4.10						
Apparent pK <sub>a</sub>	2.24±0.19	3.34 ± 0.36	4.41 ± 0.22	5.10 ± 0.12	5.75 ± 0.16	6.37 ± 0.17	7.04 ± 0.19	9.34 ± 0.03	9.69 ± 0.12
t-test between pK <sub>a<sub>i</sub></sub> and pK <sub>a<sub>i+1</sub></sub>	0.017	0.022	0.000	0.006	0.004	0.000	0.000	0.000	

Table S 2 The apparent pK<sub>a</sub> of N-CAdots synthesis system after dialysis

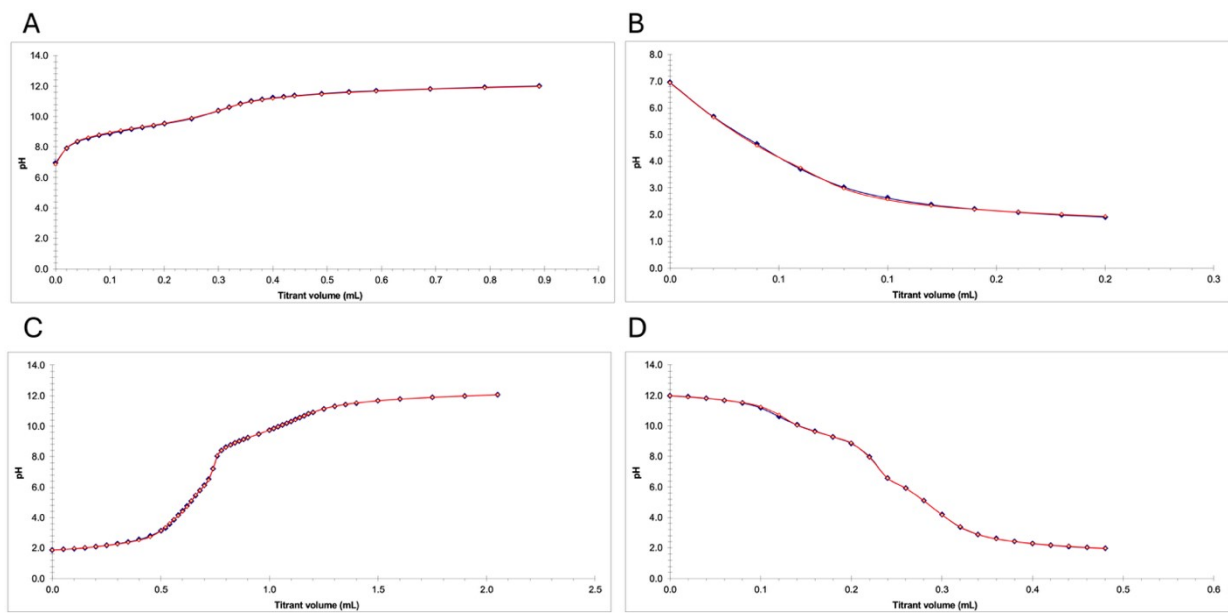


Figure S 2 The potentiometric titration curves and fitting curves using Curtipot software. The nature N-CADot dialysis solution titrated with KOH (A) and HCl (B). Adjusted N-CADot dialysis solution titrated with KOH (C) and HCl (D)

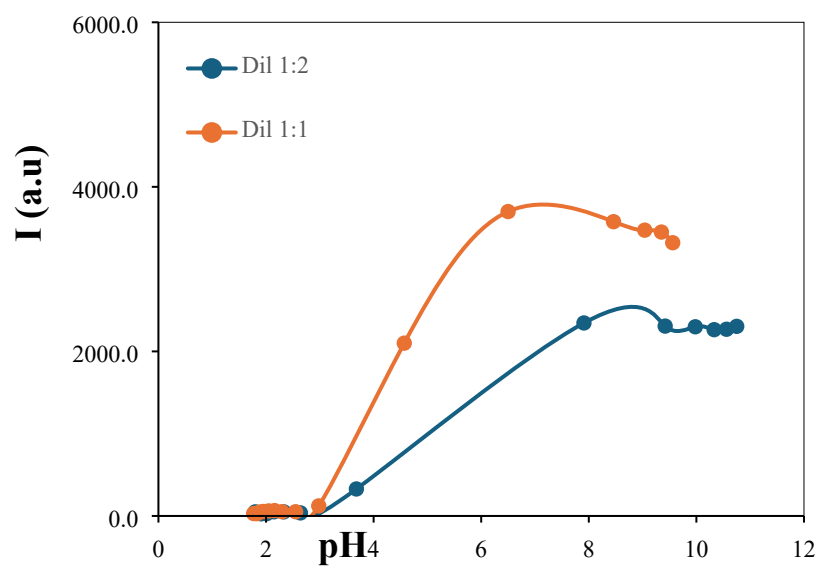


Figure S 3 Fluorescence titration curves of adjusted N-CADots dialysis solution titrated with KOH

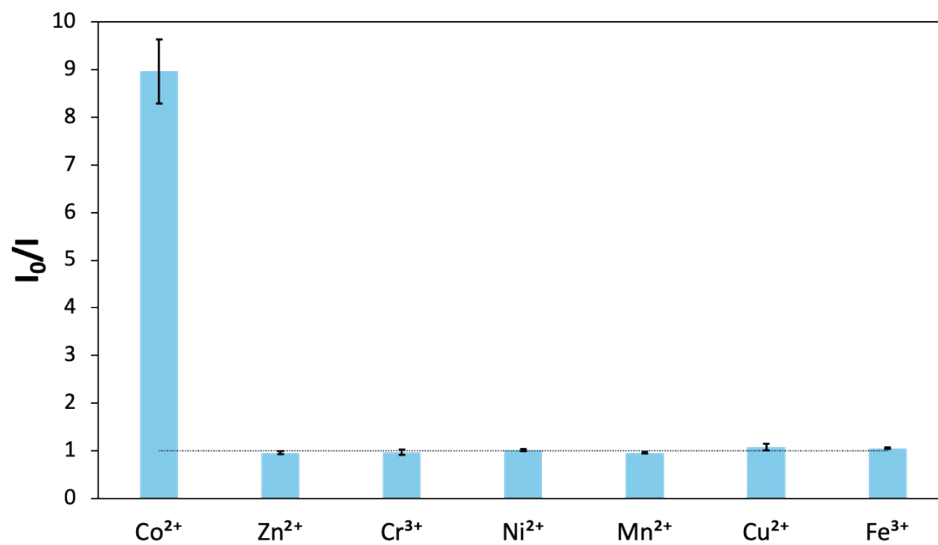


Figure S 4 The effect of TMIs on the ability of catalysed PMC to produce ROS

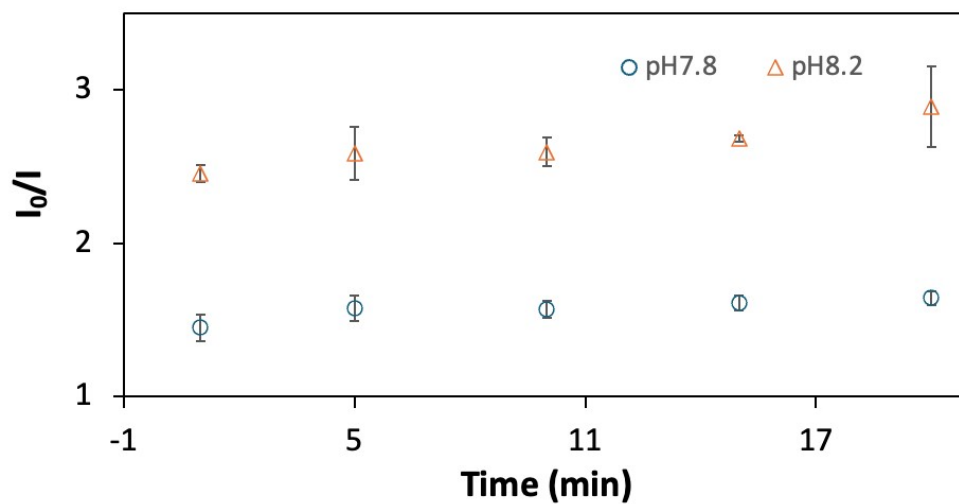


Figure S 5 The effect time on the N-CAdots-AHC- $\text{H}_2\text{O}_2$ - $\text{Co}^{2+}$  reaction at pH 7.8 and pH 8.2

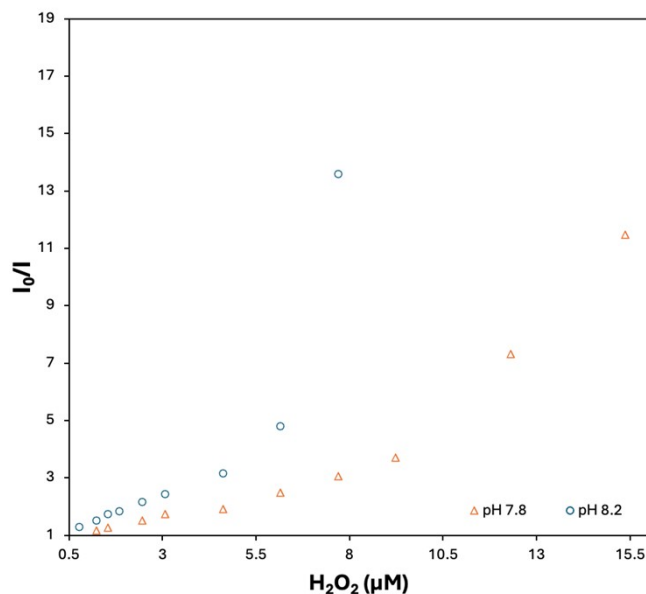


Figure S 6 The nonlinear response of  $I_0/I$  value versus  $H_2O_2$  concentrations at pH 7.8 and pH 8.2

Concentration(μM) / (ppb)	$I_0/I$	Calculated	Recovery (%)	RSD (%)	Concentration(μM) / (ppb)	$I_0/I$	Calculated	Recovery (%)	RSD (%)
1.23/(39) ~ LOQ	1.3063	1.33	83.4 - 109.3	9.0	3.07/(105)	1.8289	2.77	85.4 - 109.4	7.8
	1.2448	1.16				1.7801	2.63		
	1.2813	1.26				1.9375	3.07		
	1.3128	1.35				1.8756	2.90		
	1.3000	1.31				1.8625	2.86		
	1.2790	1.25				1.8756	2.90		
	1.2886	1.28				1.7662	2.59		
	1.1981	1.03				1.9427	3.08		
	1.0293	1.21				1.9517	3.10		
9.22/(313)	3.6784	7.86	85.1 - 103.3	6.6					
	3.8221	8.26							
	4.1755	9.23							
	4.1636	9.20							
	4.1814	9.25							
	4.1994	9.30							
	3.8271	8.27							
	4.0321	8.83							
	4.2852	9.53							

Table S 3 The validation of detection  $H_2O_2$  by N-CAdots-AHC-Co<sup>2+</sup> at pH 7.8

Concentration ( $\mu\text{M}$ )/ (ppb)	$I_0/I$	Calculated	Recovery (%)	RSD (%)	Concentration ( $\mu\text{M}$ )/ (ppb)	$I_0/I$	Calculated	Recovery (%)	RSD (%)
0.76 / (25) ~ LOQ	1.3295	0.79	85.0 - 114.8	9.1	4.61/(148)	3.2783	3.28	85.4 - 109.4	7.8
	1.3113	0.75				3.0477	3.05		
	1.2990	0.72				2.8562	2.86		
	1.3321	0.79				3.1267	3.13		
	1.3340	0.80				3.0611	3.06		
	1.3791	0.89				3.3905	3.39		
	1.2906	0.71				3.2475	3.25		
	1.2652	0.65				3.0113	3.01		
1.84/(59)	1.7835	1.73	90.1 - 108.5	6.8					
	1.9048	1.98							
	1.7531	1.66							
	1.8186	1.80							
	1.8564	1.88							
	1.9180	2.00							
	1.8638	1.89							

Table S 4 The validation of detection  $\text{H}_2\text{O}_2$  by N-CAdots-AHC- $\text{Co}^{2+}$  at pH 8.2

Concentration ( $\mu\text{M}$ )/ (ppb)	$I_0/I$	Calculated	Recovery (%)	RSD (%)	Concentration ( $\mu\text{M}$ )/ (ppb)	$I_0/I$	Calculated	Recovery (%)	RSD (%)
5.1/(0.55) ~ LOQ	1.7254	4.82	92.6 - 101.8	3.2	7.67/ (0.825)	3.8884	7.84	88.8 - 102	3.5
	1.7901	4.91				3.4772	7.27		
	1.8740	5.03				3.5911	7.43		
	1.8076	4.94				3.7315	7.62		
	1.6540	4.72				3.4013	7.16		
	1.9017	5.07				3.4609	7.24		
	1.9913	5.19				3.1513	6.81		
15.34/ (1.65)	8.7547	14.64	84.8 - 104	7.8					

Table S 5 The validation of new modified GOD method