

Supplementary Material

Hydrothermal Synthesis of Functionalized Carbon Nanodots and Their Clusters as Ionic Probe for High Sensitivity and Selectivity for Sulfate Anions with Excellent Detection Level

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Table S1. The K_{sv} and LOD parameters, together with the r^2 values, of both CND samples towards three metal ions.

Sample	CND			CND-100k		
	K_{sv} (ppm ⁻¹)	r^2	LOD (ppm)	K_{sv} (ppm ⁻¹)	r^2	LOD (ppm)
Fe³⁺	0.2358	0.992	0.05	0.0443	0.997	0.28
Fe²⁺	0.0226	0.999	0.56	0.0191	0.999	0.66
Hg²⁺	0.0051	0.996	2.47	0.0078	0.999	1.62

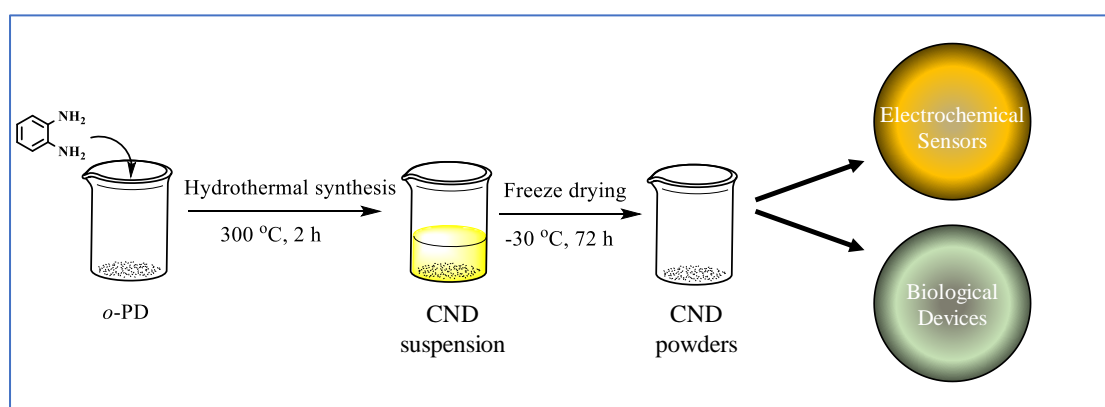
Remark:

$$\sigma = \sqrt{\frac{1}{N} \sum_{i=1}^N (x_i - \bar{x})^2}$$

Table S2. Comparison among the LODs toward metal ions by different CND samples.

Method	detector/metal ion	LOD (ppm)	Reference
Hydrothermal synthesis	CND/Fe ³⁺	0.05	This work
Hydrothermal synthesis	CND/Fe ²⁺	0.56	This work
Hydrothermal synthesis	CND-100k/Hg ²⁺	1.62	This work
Liquid-phase synthesis	N-CQD/Hg ²⁺	2.4	[50]
Solvothermal synthesis	N-CQD/Hg ²⁺	1.0	[51]
Commercial product	Lysozyme/Fe ³⁺	0.1	[52]
Chemical reduction	Ag NP/Hg ²⁺	0.02	[53]
Chemical reduction	Au NP/Fe ²⁺	0.02	[28]

Remark: N-CQD: N-doped carbon quantum dot; Ag NPs: silver nanoplate; Au NPs: gold nanoparticle

**Figure S1.** Schematic diagram for illustrating the preparation of CND powders and their application.

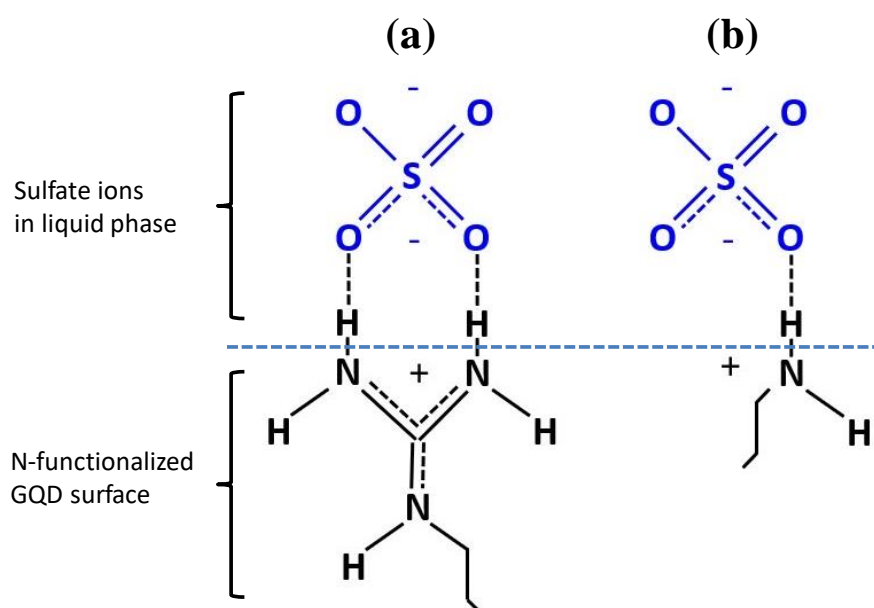


Figure S2. The interaction process through two pathways: (a) two neighboring amino groups via a bidentate hydrogen-bonding and (b) one single amino group via a monodentate hydrogen-bonding with hydrogen sulfate anions on N-functionalized CND surface.

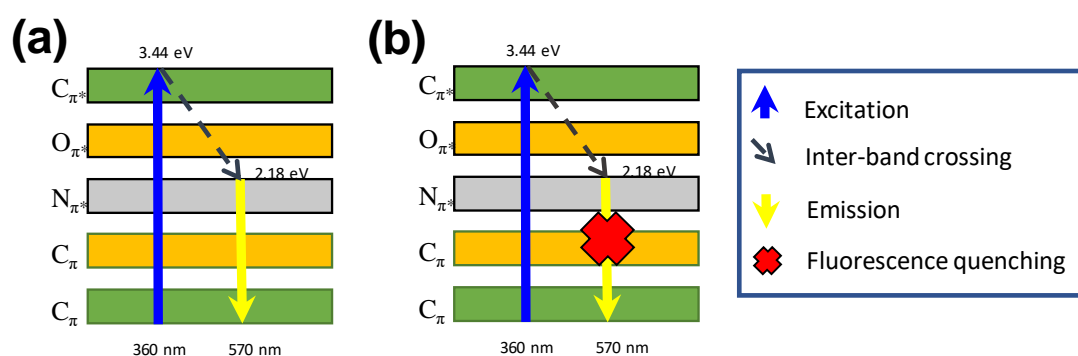


Figure S3. Inter-band gap structure models of CND sample under UV illumination: (a) before and (b) after detecting metal ions.