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Supplementary Materials

Carbon Quantum Dots' Synthesis with a Strong Chemical Claw for Five Transition Metal Sensing in the Irving–Williams Series

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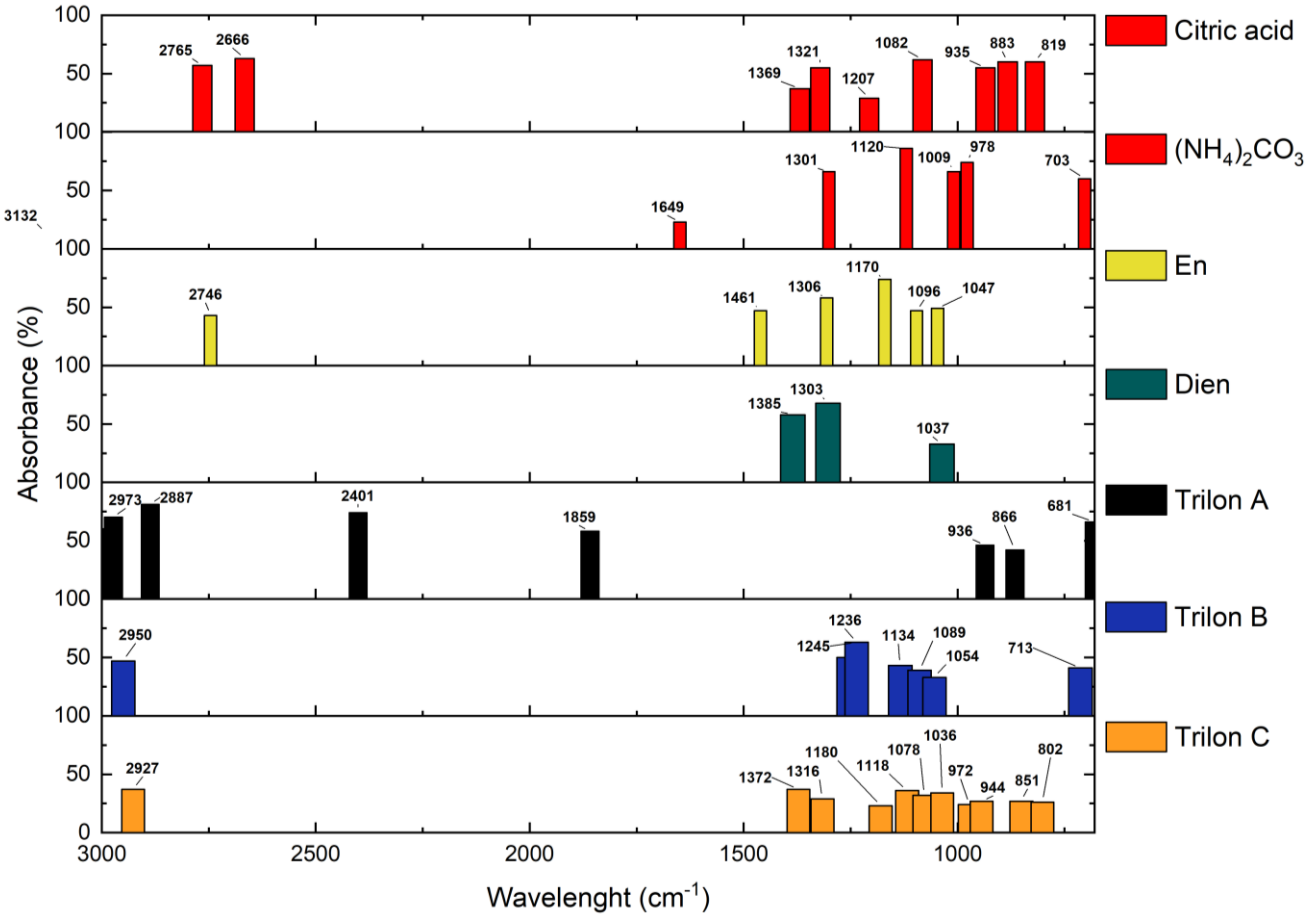


Figure S1. The Mid-infrared (MIR) spectroscopy table data of peak position for the pure citric acid, $(NH_4)_2CO_3$, ethylenediamine (En), diethylenetriamine (Dien), nitrilotriacetic acid (NTA, Trilon A), ethylenediaminetetraacetic acid (EDTA, Trilon B), and diethylenetriaminepentaacetic acid (Trilon C).

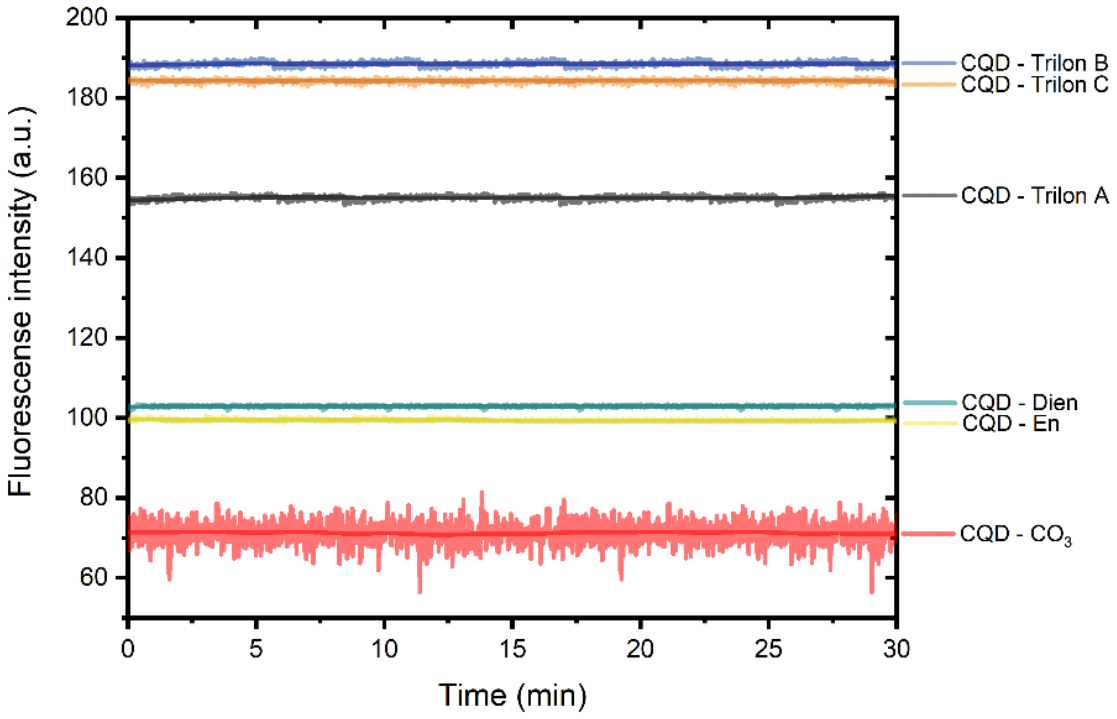


Figure S2. The stability measurements of fluorescence intensity of CQD in 0.05 mg/ml concentration.

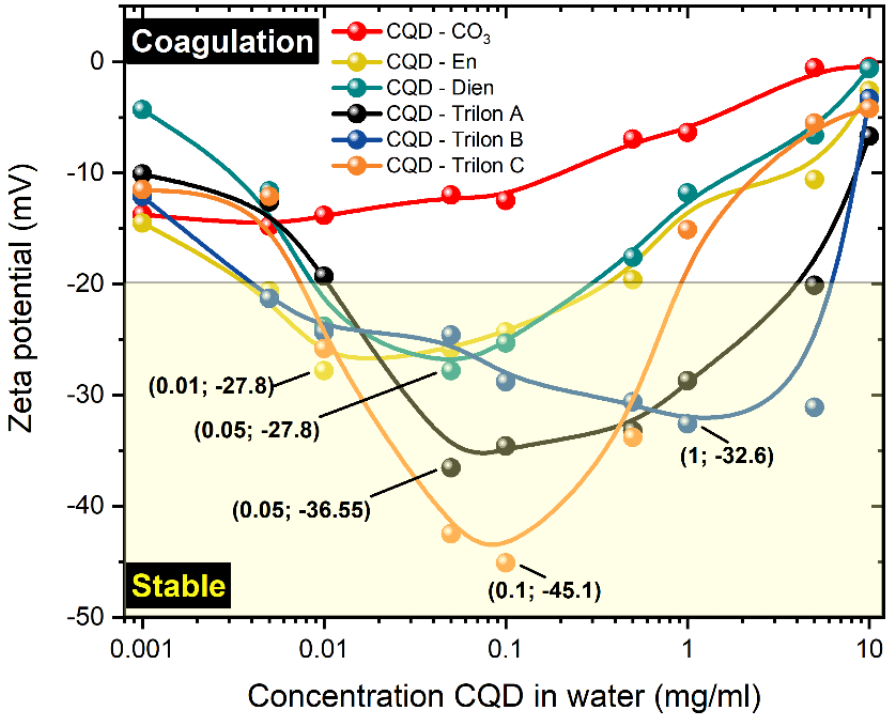


Figure S3. The Zeta-potential data of CQD dispersion.

Table S1. The CQDs literature overview via characteristic properties and application of dots from ethylenediamine, diethylenetriamine, and three types of Trilon (A, B and C) precursors.

Article	Precursirs	Synthesis route	Size, nm	PL, nm	QYs	Application	Aplication in particular	Functional groups		
								OH	NH_2	COOH
[1]	Ethylenediamine, alanine	hydrothermal method	8	390	46.2%	biolabeling and bioimaging	**Sensing dihydronicotin-amide adenine dinucleo-tide (NADH)**	1	1	1
[2]	Ethylenediamine, bike soot	hydrothermal method	5.6 nm	396	12.7%	sensing	**Trinitrotoluene**	1	1	1
[3]	Ethylenediamine,citric acid, boronic acid	hydrothermal method	4.5 nm	447	no inf	medisine	**Inhibition of HCoV-229E (COVID)**	1	1	1
[4]	Ethylenediamine, 2,7-dihydroxynaphthalene	hydrothermal method	3.31 nm	493	70.90%	light sourse	**Light emitting diodes**	1	1	1
[5]	Ethylenediamine, ammonium citrate	hydrothermal method	4.8 nm	445	66.8%	sensing	**Sensing Hg2+**	1	1	1
[6]	Ethylenediamine, mandelic acid	hydrothermal method	2.5 nm	429	41.4%.	sensing	**Detection of picric acid**	1	1	1
[7]	Ethylenediamine, microcrystalline cellulose	hydrothermal method	3.2 nm.	360	51%	sensing	**Detection of Fe3+ ions in an acidic environment**	1	1	1
[8]	Ethylenediamine, thiosalicylic acid	hydrothermal method	2.3 nm	420	51.4%	light sourse	**White light emitting diodes**	1	1	1
[9]	Ethylenediamine, citric acid	hydrothermal method	6.7 nm	450	no inf	sensing	**Fe3+ ion detection**	1	1	1
[10]	Ethylenediamine citric acid, polyethylenimine	termoactivated carbonization	1.45 nm	445	no inf	sensing	**Protein sensing**	1	1	1

[11]	Diethylenetriamine, Graphen QD	pulsed laser ablation	3.4 nm	450	66%	investigation of properties	**no inf**	1	1	1
[12]	Diethylenetriamine, citric acid	hydrothermal method	4.5 nm.	431	95%	catalyst	**Photocatalytic performance**	1	1	1
[13]	Diethylenetriamine, citric acid	hydrothermal method	3.16 nm	440	84.79%	sensing	**Selectively detecting ellagic acid**	1	1	1
[14]	Diethylenetriamine, aspartic acid, phosphoric acid,	hydrothermal method	4.2 nm	410	73%.	sensing	**Detection of Cr (VI) and ascorbic acid**	1	1	1
[15]	Diethylenetriamine, Trisodium citrate dihydrate	hydrothermal method	3.5 nm.	450	43%	sensing	**Quantification of Vitamin B12**	1	1	1
[16]	Diethylenetriamine, citric acid	hydrothermal method	10 nm	462	no inf	sensing	**Fluorescent detection of acidic gas**	1	1	1
[17]	Diethylenetriamine, citric acid, urotropine	hydrothermal method	11 nm	451	no inf	sensing	**Sensitive Hg2+ detection**	1	1	1
[18]	Diethylenetriamine, citric acid	microwave method	4–10 nm	450	no inf	chemistry	**Corrosion Inhibition**	1	1	1
[19]	Diethylenetriamine, citric acid	thermal synthesis	4.6 nm	456	11.7%	sensing	**pH-sensitive carbon quantum dots**	1	1	1
[20]	Diethylenetriamine, D(+)-glucose, ethanol, chloral hydrate	chemical route	2–5 nm	455	no inf	biological	**Antimicrobial agent**	1	1	1
[21]	Nitrilotriacetic acid	hydrothermal method	3.7 nm.	440	no inf	sensing	**Folic acid (FA) in human serum samples**	1	1	1
[22]	Nitrilotriacetic acid	hydrothermal method	29 nm.	462	45.8%	investigation of properties	**no inf**	1	1	0
[23]	Nitrilotriacetic acid, ortho-phenylenediamine	hydrothermal method	2.6 nm	450	no inf	sensing	**Colorimetric sensors for water and humidity**	1	1	1

[24]	Ethylenediaminetetraacetic acid disodium salt, $CuCl_2 \bullet 2H_2O$	hydrothermal method	4 nm	480	54%	sensing	**Sensing of hydrogen sulfide**	1	1	1
[25]	Ethylenediaminetetraacetic acid, ascorbic acid, vitamin C,	microwave method	7-10 mn	490	42%,	sensing	**Dopamine Detection**	1	1	1
[26]	Ethylenediaminetetraacetic acid, 4, 7, 10-trioxa-1, 13-tridecanediamine	microwave method	20 nm	475.4	53.3%	sensing	**Metal ion sensor**	1	1	1
[27]	Ethylenediaminetetraacetic acid, ascorbic acid,	microwave method	10 nm	450	42%	sensing	**CuO and Cu2O by fluorescence quenching**	1	1	1
[28]	Ethylenediaminetetraacetic acid, $Fe(NO_3)_3 \cdot 9H_2O$,	hydrothermal method	3.5 nm	430	16.23%	sensing	**Dopamine sensing**	1	1	1
[29]	Diethylenetriaminepentaacetic acid (DTPA), Glucose anhydrous, or Metformin hydrochloride (MH)	hydrothermal method (self-polimerization)	3.58 nm.	430	34.23%	investigation of properties	**no inf**	1	1	1
[30]	Diethylenetriaminepentaacetic acid (DTPA), acetic anhydride, pyridine		5.0 nm	460	5.2%	imaging	**Fluorescence and magnetic resonance dual-modal bioimaging**	1	1	1
[31]	Diethylenetriaminepentaacetic acid (DTPA)	heating process	2.5 nm	420	no inf	sensing	**Protein detection**	1	1	1
[32]	Diethylenetriaminepentaacetic acid (DTPA)	heating process	2 nm.	429	no inf	sensing	**Electrochemiluminescent Immunosensor**	1	1	1
[33]	Diethylenetriaminepentaacetic acid (DTPA), p-phenylenediamine, GdCl3·6H2O,	microwave method	2-5 nm	440 to 560 nm	5.76%	imaging	**Fluorescence-MR dual-modality applications**	1	1	1

[34]	Diethylenetriaminepentaacetic acid (DTPA), graphite	laser irradiation	15 nm	400	no inf	investigation of properties	**no inf**	1	1	1
[35]	Diethylenetriaminepentaacetic acid (DTPA), NaOH aque-ous solution	hydrothermal method	3–7 nm	454	4.04%	sensing	**Sensing nitrophenols**	1	1	1
[36]	Diethylenetriaminepentaacetic acid (DTPA), Fe $(NO_3)_3 \bullet 9H_2O$	hydrothermal method	4–6 nm.	450	no inf	sensing	**Ratiometric fluorescence and colorimetric dual-mode assay for H2O2 and xanthine**	1	1	1
[37]	Diethylenetriaminepentaacetic acid (DTPA) powder	heating	5 nm	420	17%	sensing	**Determination of curcumin based**	1	1	1

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