

Supplementary information

Ratiometric fluorescence immunoassay based on carbon quantum dots for sensitive detection of malachite green in fish

Guangxin Yang^{1,2,†}, Jingru Zhang^{1,2,†}, Lin Gu², Yunyu Tang^{1,*}, Xuan Zhang¹,
Xuanyun Huang¹, Xiaosheng Shen¹, Wenlei Zhai³, Essy Kouadio Fodjo⁴, Cong Kong^{1,*}

¹ East China Sea Fisheries Research Institute, Chinese Academy of Fishery Sciences, Shanghai 200090, China

² School of Environment and Architecture, University of Shanghai for Science and Technology, Shanghai 200090, China

³ Institute of Quality Standard and Testing Technology, Beijing Academy of Agriculture and Forestry Science, No. 9 Middle Road of Shuguanghuayuan, Haidian District, Beijing 100097, China

⁴ Physical Chemistry Laboratory, UFR SSMT, Université Felix Houphouët Boigny, 22 BP 582 Abidjan 22, Cote d'Ivoire

† These authors contributed equally to this work.

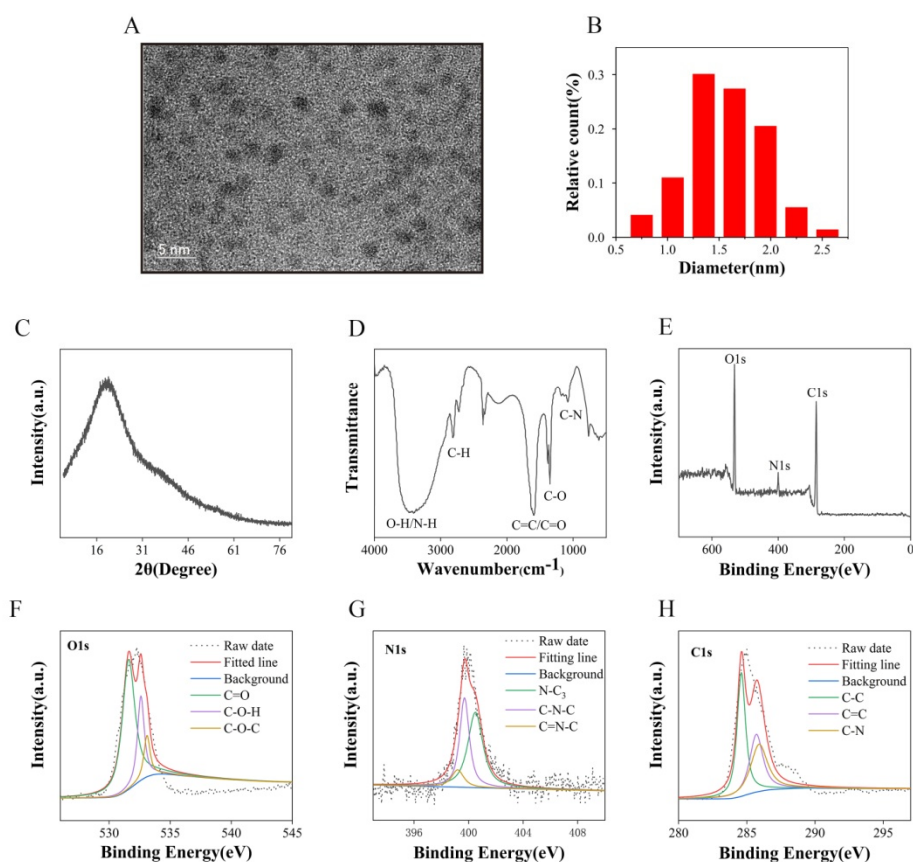


Figure S1. (A) TEM image, (B) Particle size distribution, (C) XRD spectrum, (D) FTIR spectrum, (E)

Full scan XPS, (F) O1s of XPS spectrum, (G) N1s of XPS spectrum, and (H) C1s of XPS spectrum of N-CQDs.

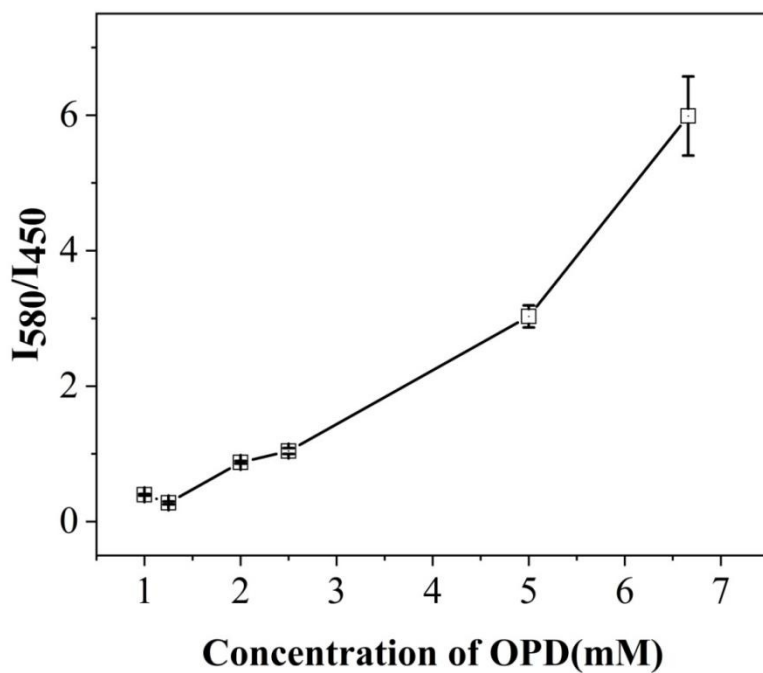


Figure S2. The I_{580}/I_{450} of the ratiometric fluorescent immunoassay for the addition of different amounts of OPD for optimization.

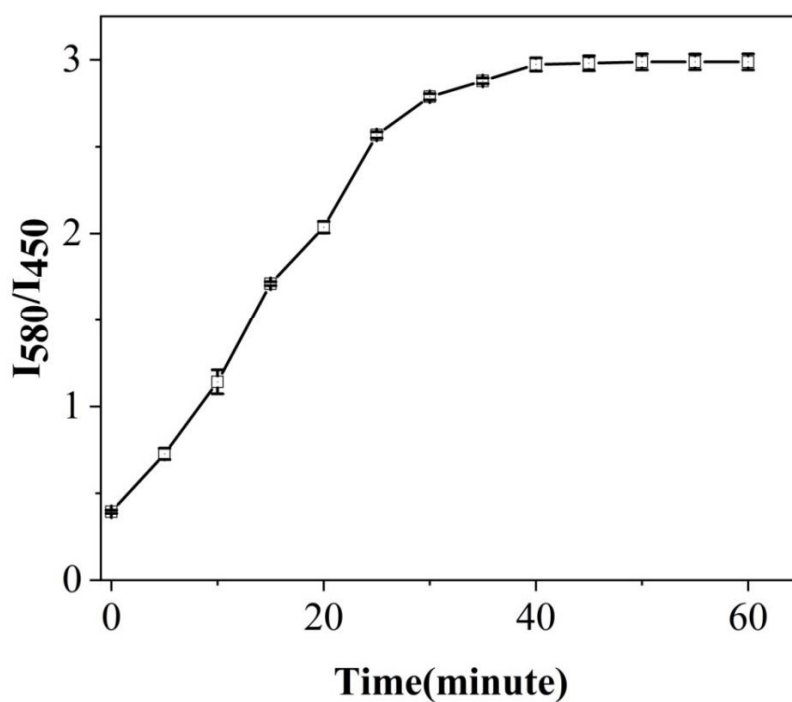


Figure S3. The I_{580}/I_{450} of the ratiometric fluorescent immunoassay with the evolution of reaction time.

Table S1. The optimization of the concentrations of MG-OVA and MG-Ab.

Dilution of	Dilution of MG-OVA				
MG-Ab	1:2000	1:4000	1:8000	1:16000	1:32000
1:2000	1.31	1.693	1.6	0.981	0.583
1:4000	1.008	0.805	0.704	0.487	0.372
1:8000	0.996	0.785	0.677	0.482	0.321
1:16000	0.376	0.278	0.255	0.228	0.245
1:32000	0.413	0.334	0.296	0.243	0.197

Table S2. Comparison of the method with those in the previous literature for the detection of MG.

Method	Materials	Linear range	LODs	Refs
Spectrofluorimetry	Nitrogen-doped carbon quantum dots	10-80 $\mu\text{mol L}^{-1}$	5.16 $\mu\text{mol L}^{-1}$ (1.8 mg L^{-1})	[1]
	Fluorescent Al-MOF nanosheet	5.3-200 $\mu\text{mol L}^{-1}$	1.6 $\mu\text{mol L}^{-1}$	[2]
	Carbon dots	0.07-2.5 $\mu\text{mol L}^{-1}$	21 nmol L^{-1} (7.66 ng mL^{-1})	[3]
	CdTe quantum dots coated with molecularly imprinted silica	0.08 to 20 $\mu\text{mol L}^{-1}$	12 $\mu\text{g}\cdot\text{kg}^{-1}$	[4]
Immunoassay	Bovine serum albumin-stabilized Au nanoclusters	0.3-20 $\mu\text{mol L}^{-1}$	0.19 $\mu\text{mol L}^{-1}$ (69.26 $\mu\text{g L}^{-1}$)	[5]
	Molecularly imprinted polymer film	0.27-274 nmol L^{-1}	0.82 nmol L^{-1}	[6]
	$\text{Fe}_3\text{O}_4\text{NPs}$	0.06–2.38 $\mu\text{mol L}^{-1}$	16.7 $\mu\text{g}\cdot\text{kg}^{-1}$	[7]
	CdTe quantum dots coated with molecularly imprinted polymers	0.1–32 $\mu\text{mol L}^{-1}$	8.8 $\mu\text{g}\cdot\text{kg}^{-1}$	[8]
This work	N-CQDs	0.1-12.8 $\text{ng}\cdot\text{mL}^{-1}$	0.097 $\mu\text{g}\cdot\text{kg}^{-1}$	

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