Supplementary Materials

A recyclable Eu^{3+}-functionalized dual-emissive metal-organic framework for portable, rapid detection and efficient removal of malachite green

Hou-Qun Yuan[a], Wei Li[a, b], Yi-Fan Xia[a], Si-Yi Liu[b], Yu-Fei Zhong[b], Zhen-Chong Dou[a], Xia Wei[a], Ran Wang[a], Peiyao Chen[a], Yan-Xia Li[b], Guang-Ming Bao[a, *]

[a] *Key Laboratory of Fermentation Engineering (Ministry of Education), National "111" Center for Cellular Regulation and Molecular Pharmaceutics, Hubei Key Laboratory of Industrial Microbiology, School of Food and Biological Engineering, Hubei University of Technology, Wuhan 430068, China*

[b] *College of Chemistry and Materials, Jiangxi Agricultural University, Nanchang 330045, China*

[*]Corresponding authors. (E-mail: bycb2005@163.com)

Chemicals and Instrumentations

All the chemicals were commercial supplied and used without further purification. $Eu(NO_3)_3 \cdot 6H_2O$ (99.9%), $ZrCl_4$ (98%), MG and other detection substances were obtained from 9-Ding chemistry reagent (China). The fish pond water was collected from local fish farming pond, and fish meat was purchased from the local supermarket.

Fluorescent spectra were recorded on an Edinburgh Instruments FS-5 spectrophotometer. N_2 adsorption-desorption isotherms were conducted on a Micrometrics TriStarII Plus (Micromeritics, U.S.A) at 77 K.

Powder X-ray diffraction (PXRD) patterns were determined using a D8 Advance diffractometer with CuKα radiation. Fourier transform infrared (FT-IR) spectra were recorded on a NICOLET 5700 FT-IR Spectrometer in the range 4000 - 400 cm^{-1} using KBr pellets. XPS signals were recorded on a Thermo Fisher Scientific Escalab 250Xi with a monochromatic Al Kα (hν = 1486.6 eV). Inductively coupled plasma-mass (ICP-MS) date was obtained on Agilent 7700 ce. Energy-dispersive X-ray spectroscopy (OxfordX-MAX) were used to measure and obtain the mi-crographs of the microspheres and the chemical composition.

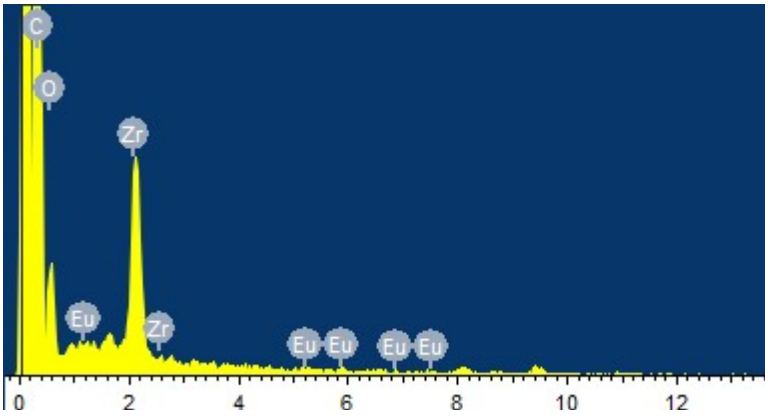

Fig. S1. EDX spectrum of the visualized excerpt **EuUCNDA**

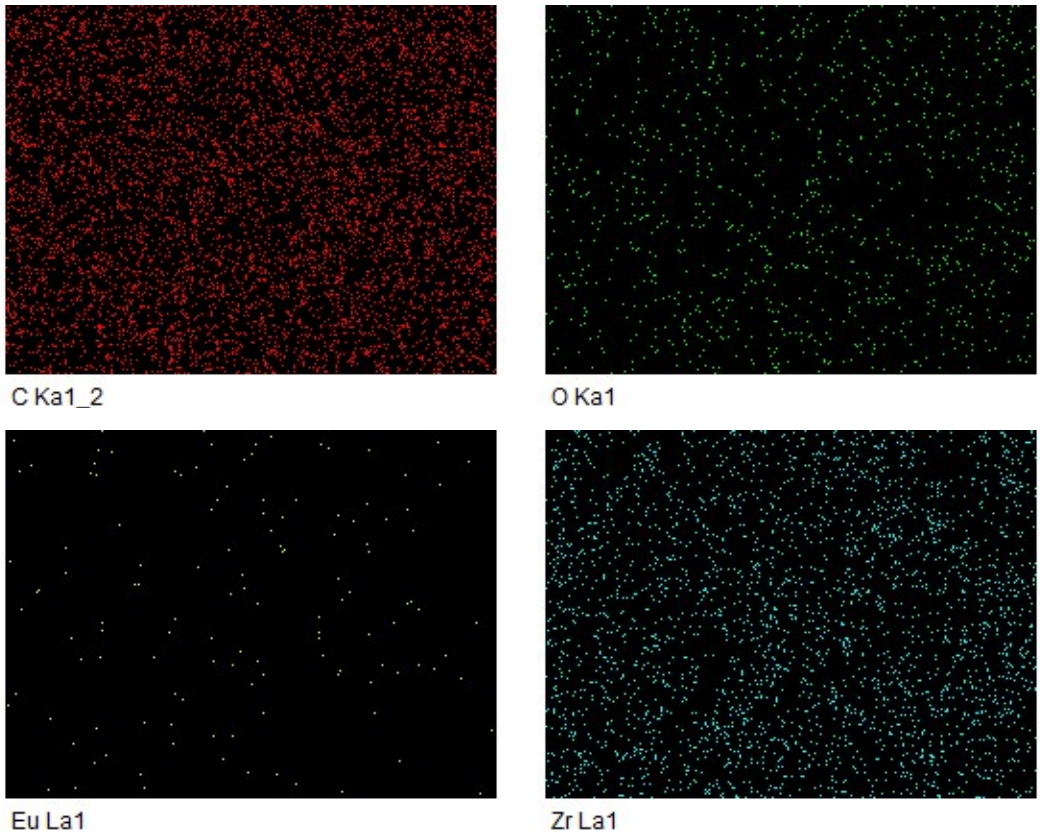

Fig. S2. Element mapping for C, O, Zr and Eu.

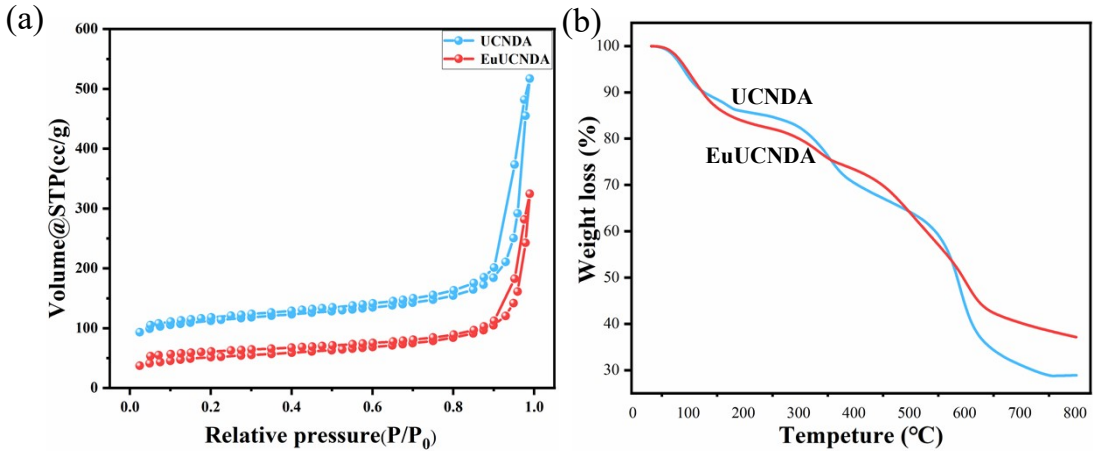

Fig. S3. (a) N_2 adsorption−desorption isotherms of UCNDA and **EuUCNDA**. (b) Thermogravimetric Analysis of the UCNDA and **EuUCNDA**.

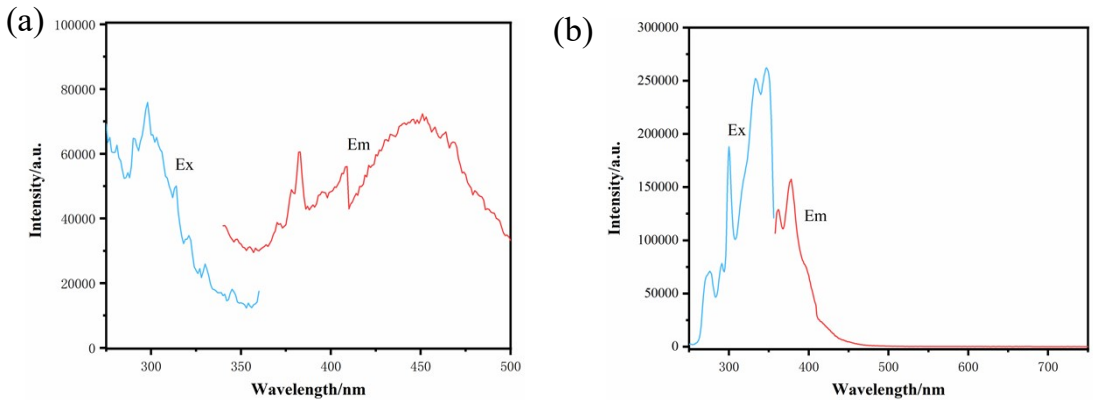

Fig. S4. (a) Solid state excitation and emission spectra of UCNDA. (b) The excitation and emission spectra of UCNDA in DMF.

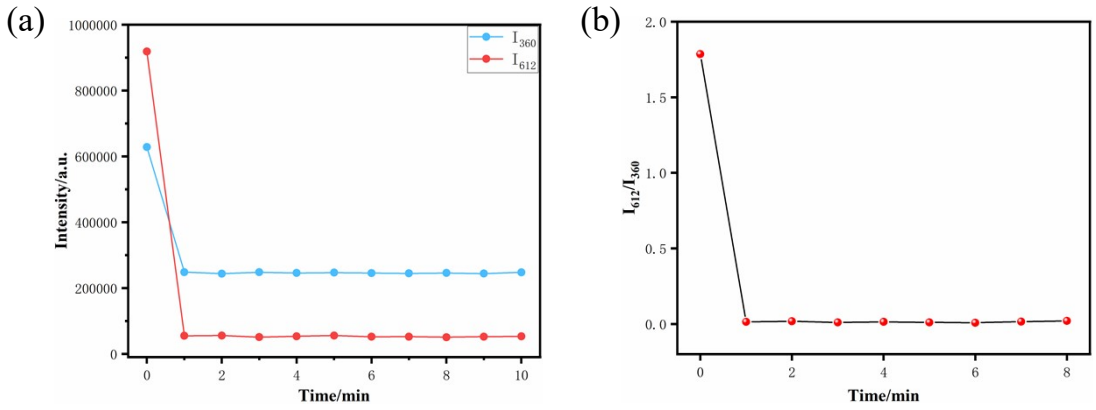

Fig. S5. Time-resolved fluorescence responses of **EuUCNDA** towards MG in DMF solution.

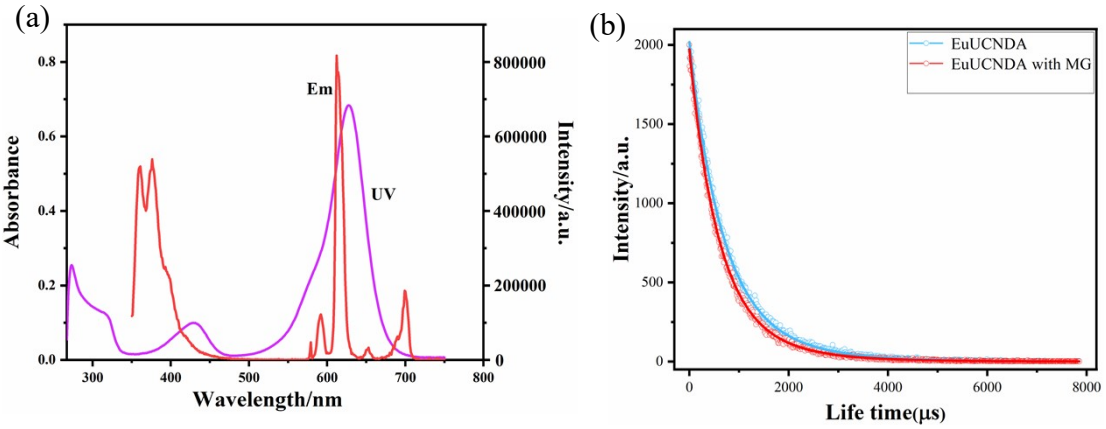

Fig. S6. (a) Emission spectrum of **EuUCNDA** and ultraviolet absorption spectrum of MG; (b) Fluorescence lifetimes of **EuUCNDA** and **EuUCNDA** with MG.

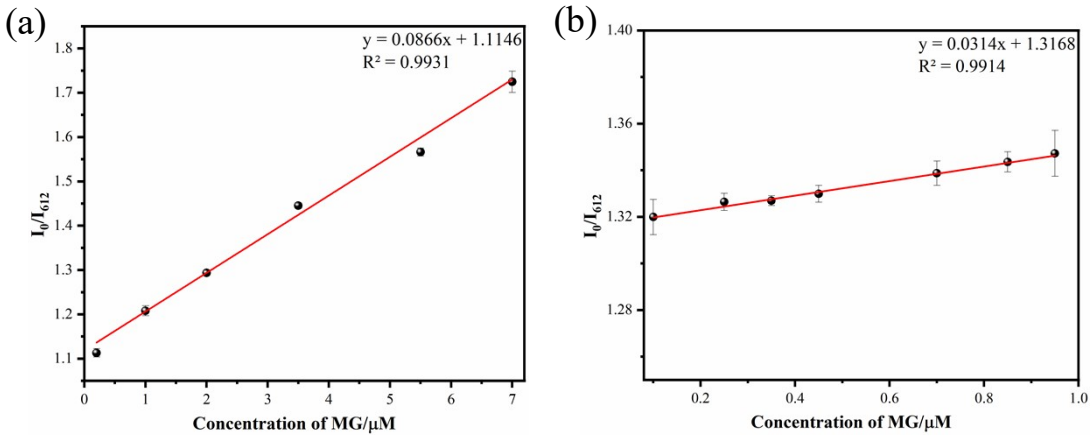

Fig. S7. (a) Relationship between in I_0/I_{612} the concentration of MG in fish pond water; (b) Relationship between in I_0/I_{612} the concentration of MG in grass carp.

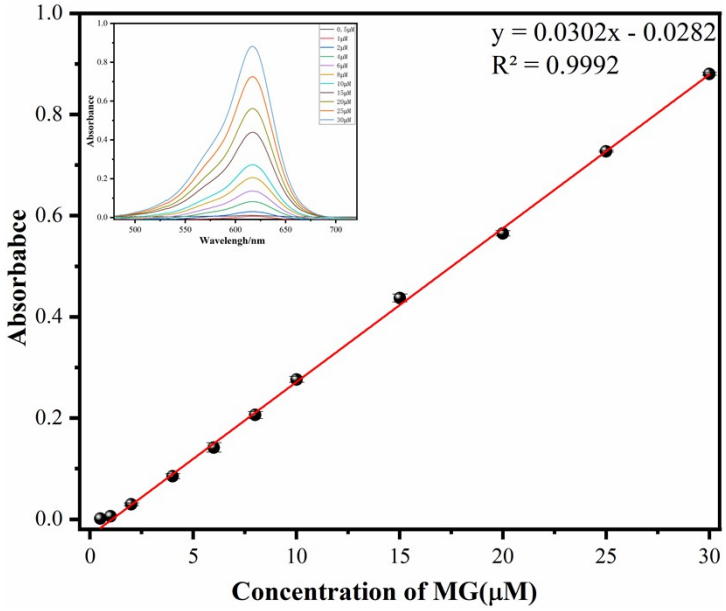

Fig. S8. The relationship between UV absorption and MG concentration.

75 **Table S1** Comparison of major characteristics of different probe of MG

Probe	Linear range	LOD	Respond time	Sample	Ref.
Eu-TDA	0-40μM	22.1nM	1 min	-	（1）
Eu^{3+}@MIL-53 (Al)	0-400μM	57nM	5 min	fish	（2）
Al-MOF/RhB	0.54~216μM	1700nM	-	fish	（3）
MOF-Apt@MIP	0 -10μM	60nM	30min	water and fish sample	（4）
$Eu(MAA)_3Phen$	0.5-20μM	117.2nM	5 min	aquaculture water	（5）
$Eu(PDCA)_2$	0 -3μM	39nM	-	-	（6）
CdTe QDs	0.01–20μM	4.7nM	4 min	fish	（7）
CdTe@MIP	0.05 - 20μM	17nM	10min	fish	（8）
MIPs-C_3N_4/CdTe QDs	54–1079nM	10.8nM	10min	fish	（9）
MIP-coated QDs	0.1-20μM	59nM	5 min	water and fish sample	（10）
PVP-Au/Cu-NCs	0.05-25μM	16nM	-	water	（11）
N, S-GQDS	1.37-13.7 nM	0.46 nM	-	fish	（12）
R-CDs	0-25μM	12.9 nM	1s	fish	（13）
CDs	0.07-2.5μM	21.0 nM	-	fish	（14）
CdTe QDs	0.027-137μM	17.0 nM	-	water	（15）
EuUCNDA	0.01-50μM	13.04nM	1 min	fish pond water and fish	This work

76

Table S2

Quantification of MG in the fish with RSD

Sample	picture	Added(μM)	Found(μM)	RSD	Recover
Grass carp1		4	4.39	4.18%	109.84%
Grass carp2		35	35.37	4.91%	101.06%
Grass carp3		65	59.19	1.14%	91.02%

References

1 L. J. Han, Y. J. Kong, G. Z. Hou, H. C. Chen, X. M. Zhang and H. G. Zheng, *Inorganic Chemistry*, 2020, **59**, 7181-7187.

2 K. Yi and L. Zhang, *Food Chemistry*, 2021, **354**, 129584.

3 X. Yue, Y. Li, S. Xu, J. Li, M. Li, L. Jiang and Y. Bai, *Food Chemistry*, 2022, **371**, 131164.

4 N. Duan, X. Chen, X. Lin, D. Ying, Z. Wang, W. Yuan and S. Wu, *Sensors and Actuators B: Chemical*, 2023, **384**, 133665.

5 G. Fu, H. Weng, Z. Lai, Z. Lin and Z. Huang, *Journal of Chemical Sciences*, 2021,**133**, 54.

6 Y. J. Kong, G. Z. Hou, Z. N. Gong, F. T. Zhao and L. J. Han, *RCS. advances*, 2022, **12(14)**, 8435-8442.

7 J. Yang, Z. Z. Lin and Z. Y. Huang, *Marine Pollution Bulletin*, 2020, **151**, 110812.

8 J. Yang, H. Wu, M. H. Wu, J. Zeng, Z. Z. Lin, X. M. Chen and Z. Y. Huang, *Dyes and Pigments*, 2018, **155**, 171-178.

9 H. Shi, L. Zhang, G. Yu, Y. Liu and L. Chen, *Microchimica Acta*, 2019, **186**, 1-10.

10 L. Wu, Z. Z. Lin, H. P. Zhong, X. M. Chen and Z. Y. Huang, *Sensors and Actuators B: Chemical*, 2017, **239**, 69-75.

11 Z. Li, T. Shen, J. Gu and S. A. Chattha, *New journal of Chemistry*, 2022, **46(4)**, 1658-1664.

12 J. Qiu, L. Na, Y. Li, W. Bai, J. Zhang and L. Jin, *Food Chemistry*, 2022, **390**, 133156.

13 S. Cai, J. Li, P. Sun, J. Tao, Y. Fu, R. Yang and L. Qu, *Sensors and Actuators B: Chemical*, 2023, **380**, 133311.

14 Y. Hu, Z. Gao and J. Luo, *Food Chemistry*, 2021, **335**, 127677.

15 W. Gui, H. Wang, Y. Liu and Q. Ma, *Sensors and Actuators B: Chemical*, 2018, **266**, 685-691.