Supplementary Information (SI) for Analyst.

Supporting Information

Synergistic Peroxidase-like Activity of Cu-Zn MOF-Incorporated g-C_3N_4 Nanozyme Integrated with a Smartphone-based Colorimetric Sensing of Ciprofloxacin

Surendhar Sasikumar[a], Arunjegan Amalraj[b], Panneerselvam Perumal[a*]

[a]Department of Chemistry, SRM Institute of Science and Technology, Kattankulathur, 603203 Tamil Nadu, India.

[b]School of the Environment and Safety Engineering, Jiangsu University, Zhenjiang 212013, China.

1. Instrumentation

To determine the elemental composition and distribution of Cu-Zn-MOF/g-C_3N_4, X-ray photoelectron spectroscopy (XPS) was utilized with magnesium as the radiation source (PerkinElmer Phi 1600 ESCA). X-ray diffraction measurements were collected using a BRUKER USA D8 Advance Davinci diffractometer with Cu Kα radiation at angles ranging from 5 to 90^o to analyze the crystalline phase of the prepared materials. The surface morphologies and microstructures of the synthesized Cu-Zn-MOF/g-C_3N_4 were examined using a high-resolution scanning electron microscope (Thermo Scientific Apreo S) at 20 kV. In contrast, the internal morphology was examined using a high-resolution transmission electron microscope (JEOL Japan, JEM-2100 Plus). The ISIS300 energy dispersive X-ray spectroscopy (EDXS) equipment was used to determine the profiles of copper, zinc, nitrogen, carbon, and oxygen on the surface of Cu-Zn-MOF/g-C_3N_4, providing insight into the surface chemistry of these materials. Fourier Transform-Infrared (FT-IR) spectroscopy with an observation range of 400-4000 cm^{-1} (SHIMADZU, IRTRACER 100) was utilized to observe the stretching frequencies of functional groups, which can provide information about the chemical structure of the oxide. Quantachrome ASiQwin instrument used for the adsorption-desorption isotherm studies. Particle size distribution and surface were analysed by Zeta potential. The absorbance intensity of the tender sensor was analyzed by a UV-Vis spectrometer.

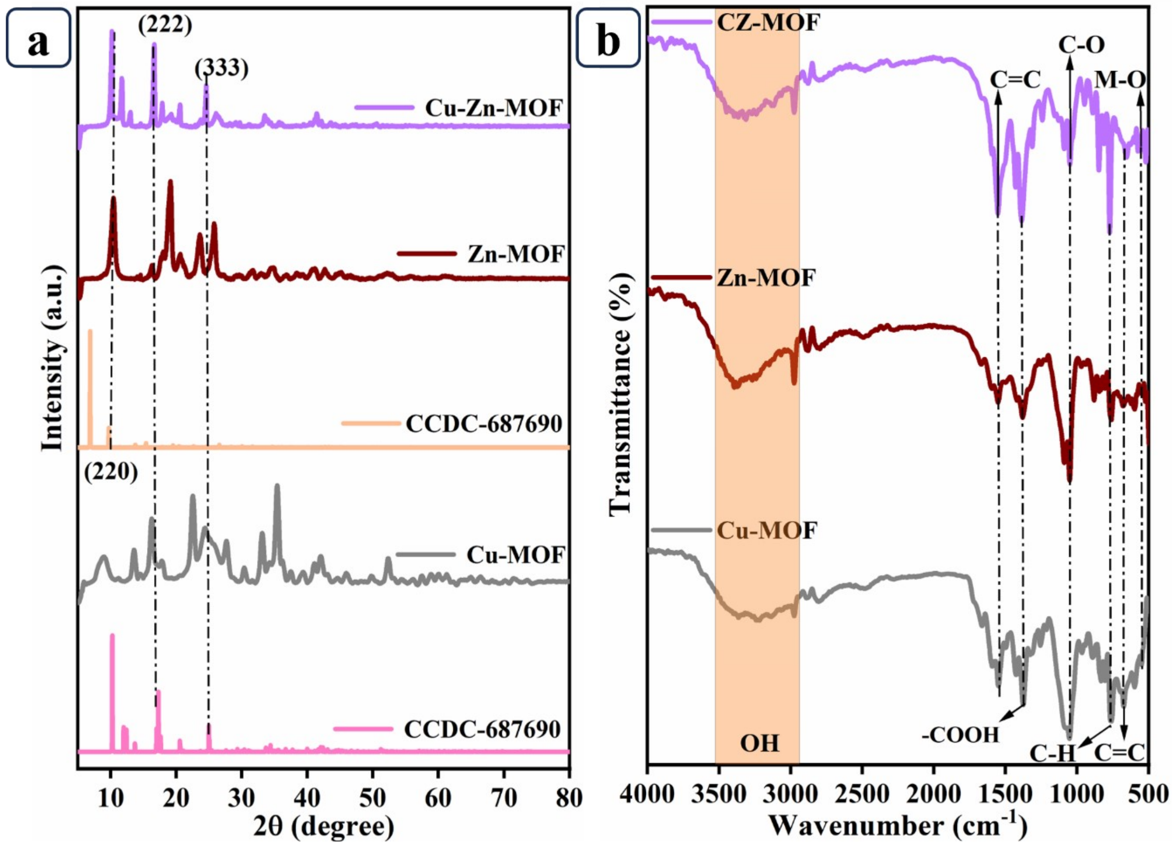

Fig. S1 (a) XRD and **(b)** FTIR spectrum of Cu-MOF, Zn-MOF and Cu-Zn-MOF.

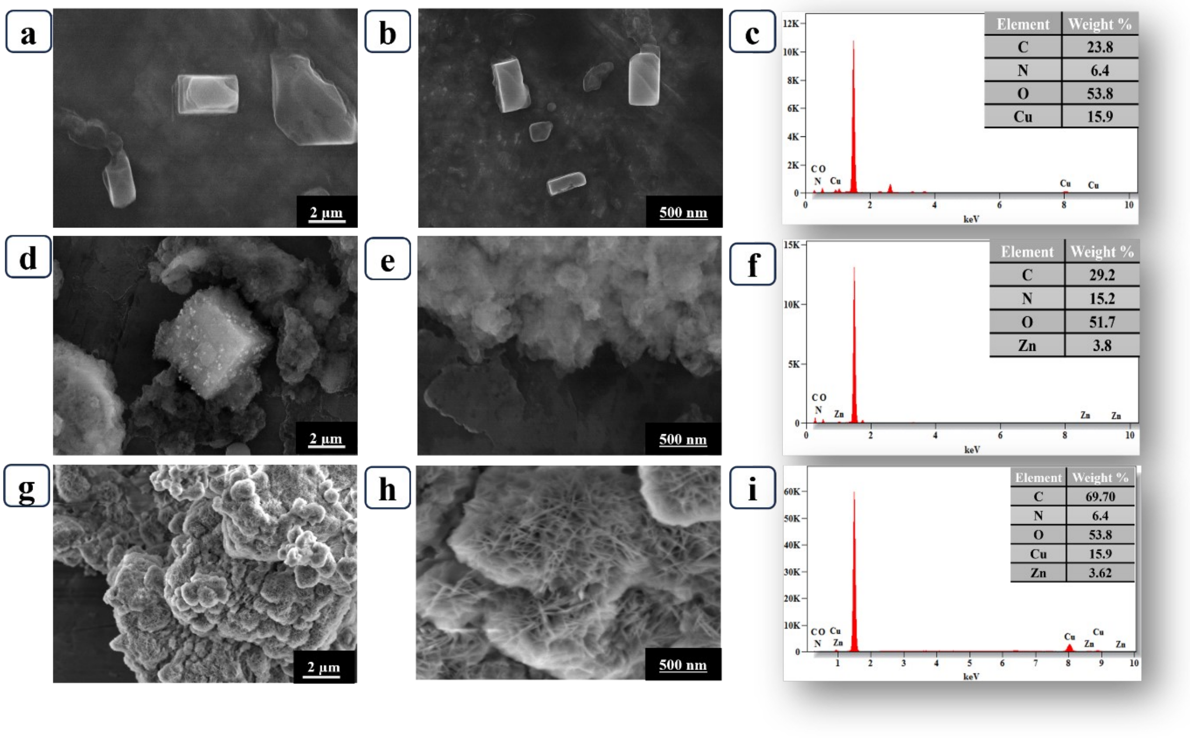

Fig. S2 HR-SEM micrographs and EDX of **(a, b, c)** Cu-MOF, **(d, e, f)** Zn-MOF, and **(g, h, i)** Cu-Zn-MOF.

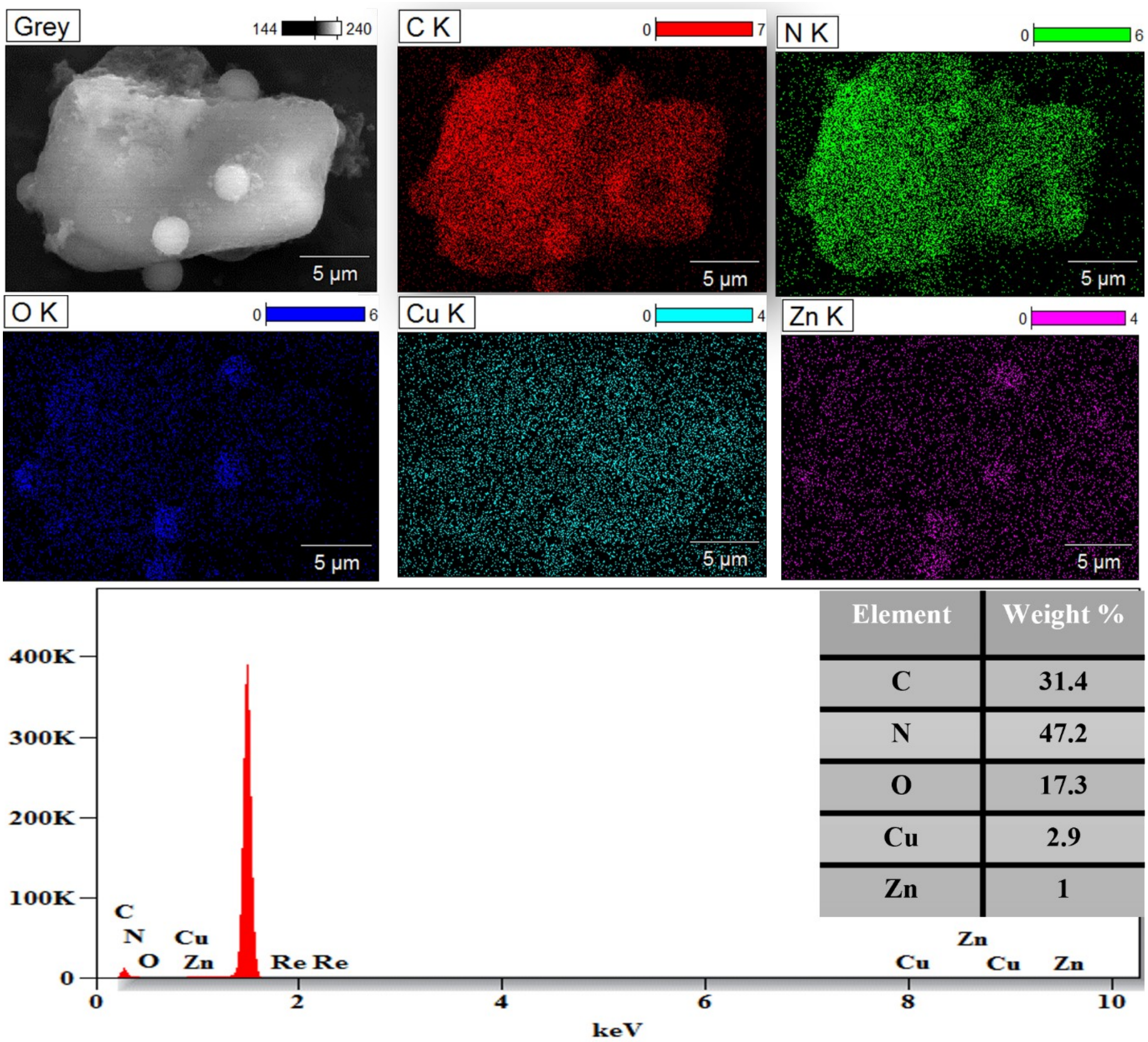

Fig. S3 HR-SEM elemental mapping images and EDX spectrum of Cu-Zn-MOF/g-C_3N_4.

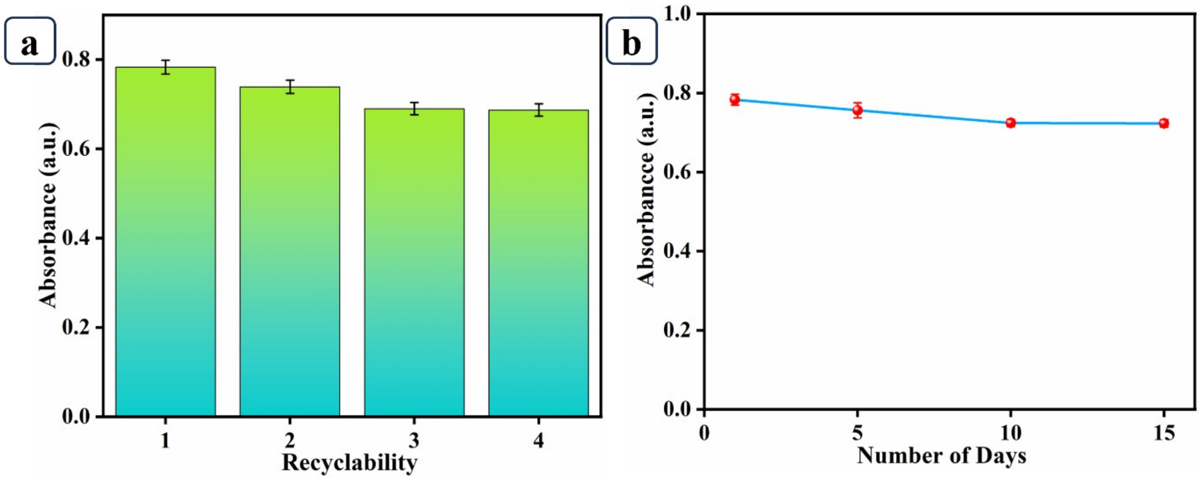

Fig. S4 (a) Recyclability of Cu-Zn-MOF/g-C_3N_4 nanozyme. **(b)** Stability of Cu-Zn-MOF/g-C_3N_4 nanozyme.

Table S1 Comparison between the proposed ciprofloxacin sensor and other known methods

S.No	Sensor	Linear range	LOD	Real sample	Reference
1	Spectrophotometric	2-8 μg ml^{-1}	1.65 μg ml^{-1}	Ciprofloxacin hydrochloride tablet	1
2	ATG-AuNPs	0-100 μM	1.30 μM	Tap and lake water	2
3	Uv spectrophotometric	-	18.9 μM	Ciproxin tablet	3
4	Fe@g-C_3N_4 (Electrochemical sensor)	0.001-1.0 μM	5.4 nM	Blood sample	4
5	β-galactosidase enzyme	1-1000 μM	51 μM	Cow milk	5
6	PUE-AuNPs	-	3 μM	Tap water and Cow milk	6
7	4WJ/COS/AuNPs nanozyme	0.0014-1.4 μM	961.0 μM	seafood samples	7
8	Colorimetric sensor	2 – 100 μM	0.6 μM	Drinking, tap, and lake water	This work

Reference

1 M. S. Mohammed, H. H. El-Feky, T. Y. Mohammed and S. A. Shama, *Asian Journal of Chemical Sciences*, 2022, 45–53.

2 L. Zhang, J. Li, J. Wang, X. Yan, J. Song and F. Feng, *Sensors 2025, Vol. 25,* DOI:10.3390/s25103228.

3 S. Naveed and N. Waheed, DOI:10.1128/AAC.00306-13.

4 H. Shivarudraiah Vedhavathi, ; Ballur, P. Sanjay, M. Basavaraju, ; Beejaganahalli, S. Madhukar and N. Kumara Swamy, *J. Electrochem. Sci. Eng*, 2022, **12**, 59–70.

5 T. Zehra, F. Ahsan, M. A. Versiani, S. Wahid, S. Jahangir and M. R. Shah, *Turk. J. Chem.*, 2021, **45**, 1814.

6 R. M. Kalunke, G. Grasso, R. D'Ovidio, R. Dragone and C. Frazzolis, *Microchemical Journal*, 2018, **136**, 128–132.

7 W. Wang, L. Zhang, W. Dong, K. Wei, J. Li, J. Sun, S. Wang and X. Mao, *J. Hazard. Mater.*, DOI:10.1016/j.jhazmat.2023.131995.