Electronic Supplementary Information (ESI)

Tuning the fluorescence sensing for Fe^{3+} ions by using different dipyridyl linkers in pillar-layered metal-organic frameworks

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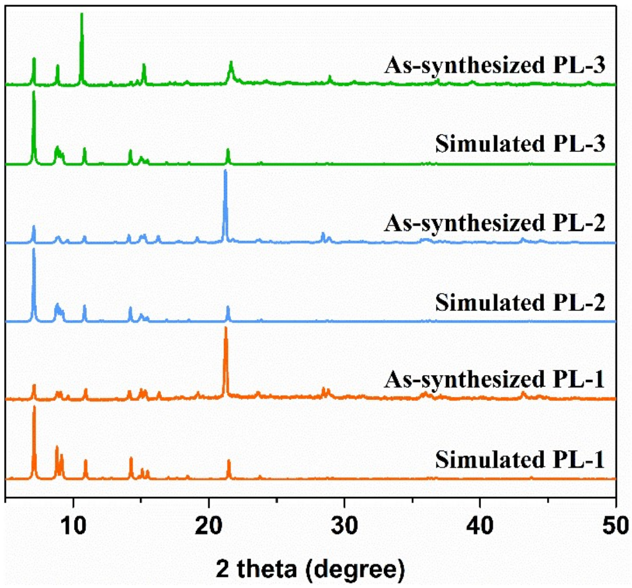


Fig. S1 PXRD patterns of **PL-1**, **PL-2**, and **PL-3**.

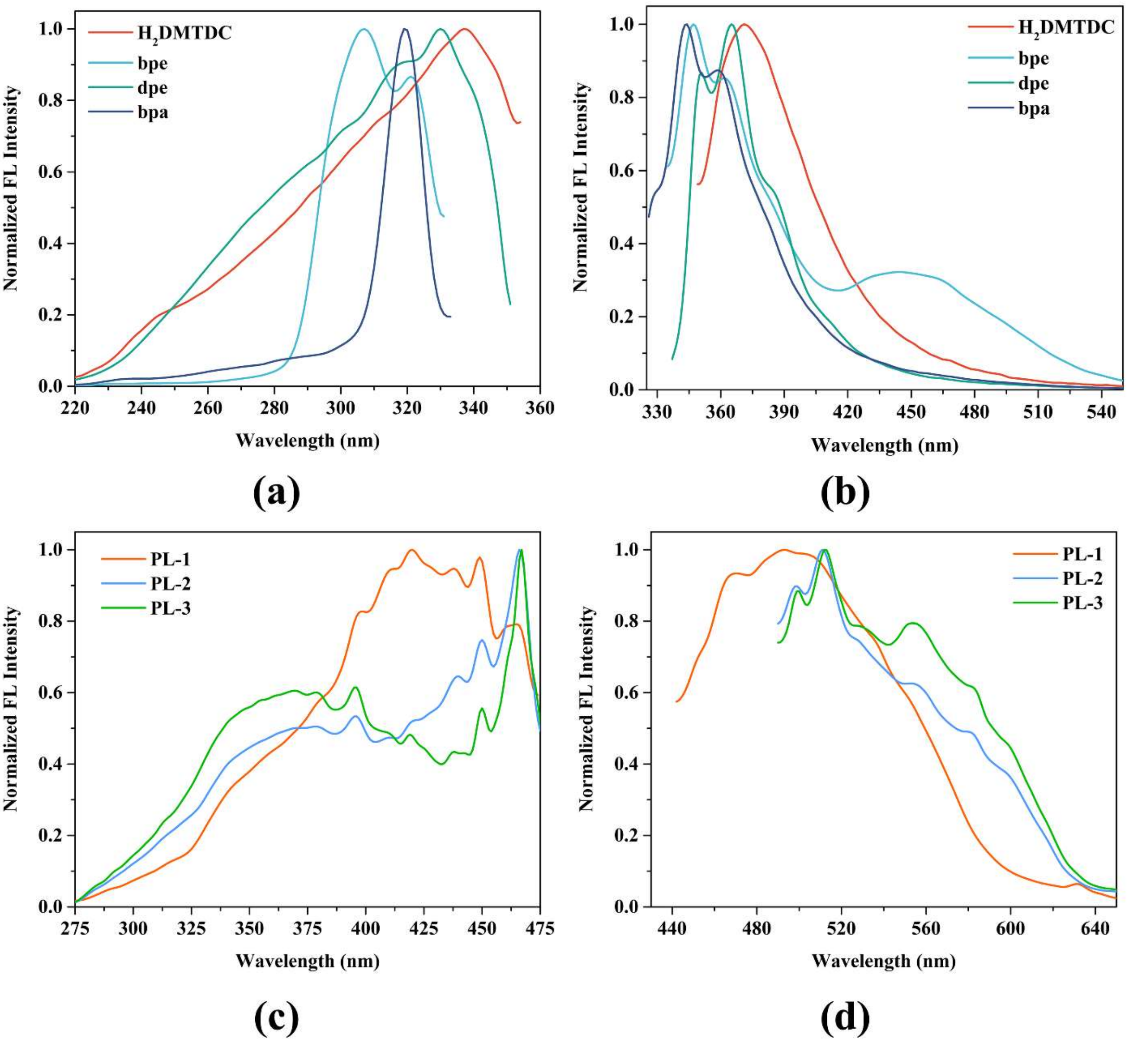


Fig. S2 Solid-state excitation (a, c) and emission (b, d) spectra of ligands and MOFs.

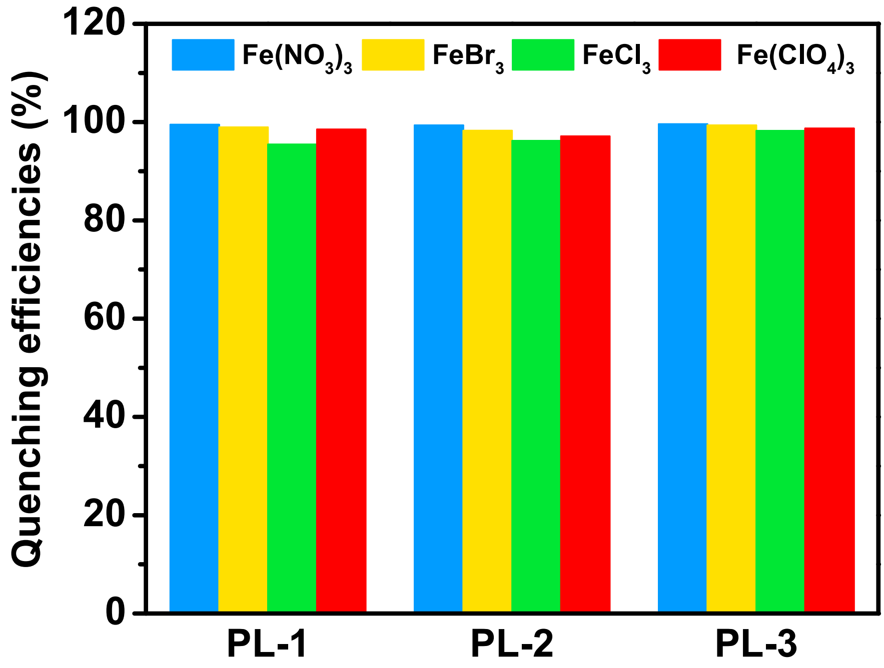


Fig. S3 The comparison of the quenching efficiency of **PL-1**, **PL-2**, and **PL-3** dispersed in EtOH upon the addition of 400 μL of various anions of Fe^{3+} solutions (10 mM).

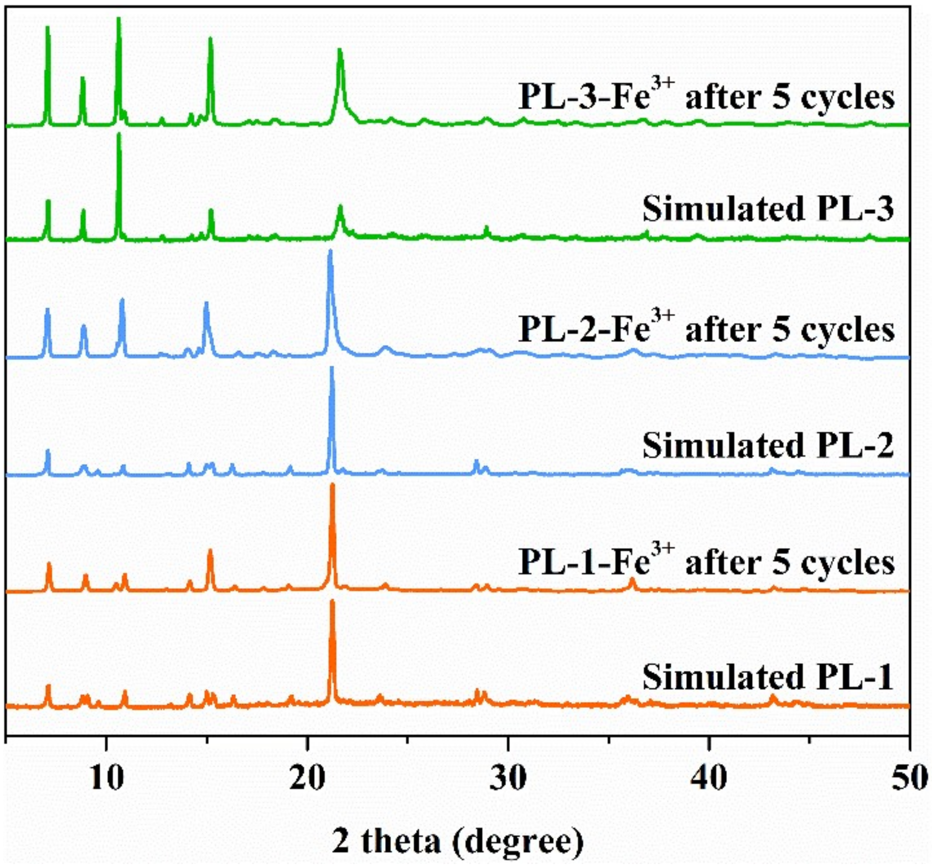


Fig. S4 PXRD patterns of **PL-1**, **PL-2**, and **PL-3** after 5 cycles for sensing Fe^{3+} ions.

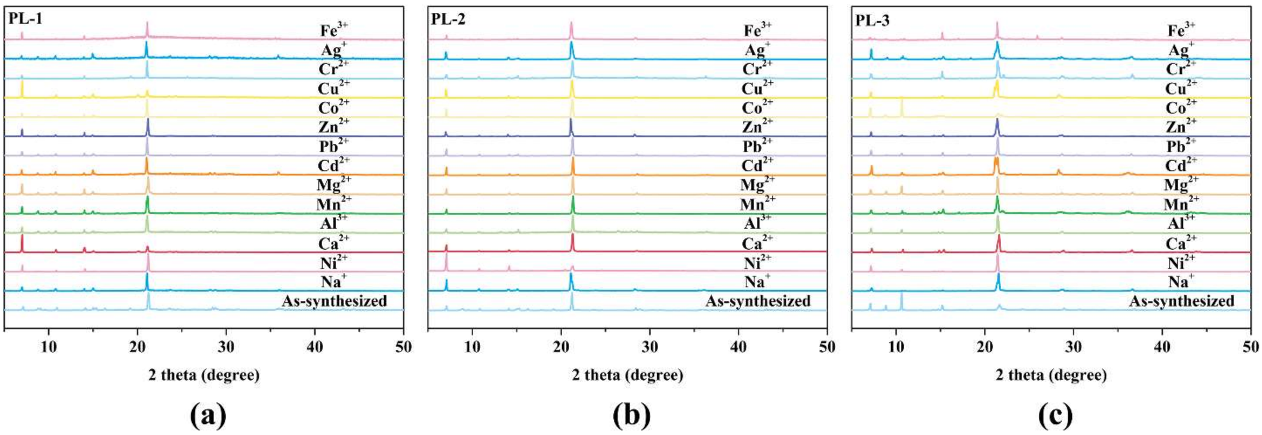


Fig. S5 PXRD patterns of **PL-1** (a), **PL-2** (b), and **PL-3** (c) after being soaked in different metal solutions.

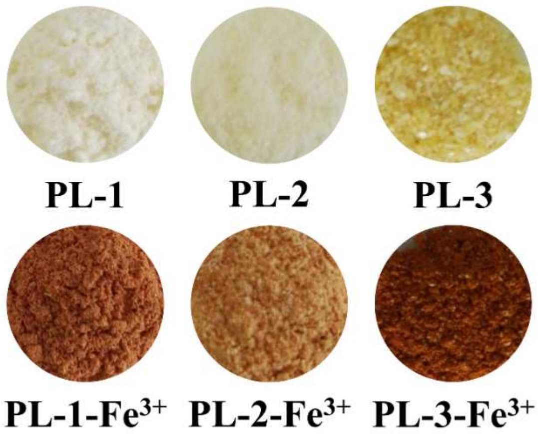


Fig. S6 Photographs of **PL-1**, **PL-2**, **PL-3** and Fe^{3+} incorporated **PL-1**, **PL-2**, **PL-3**.

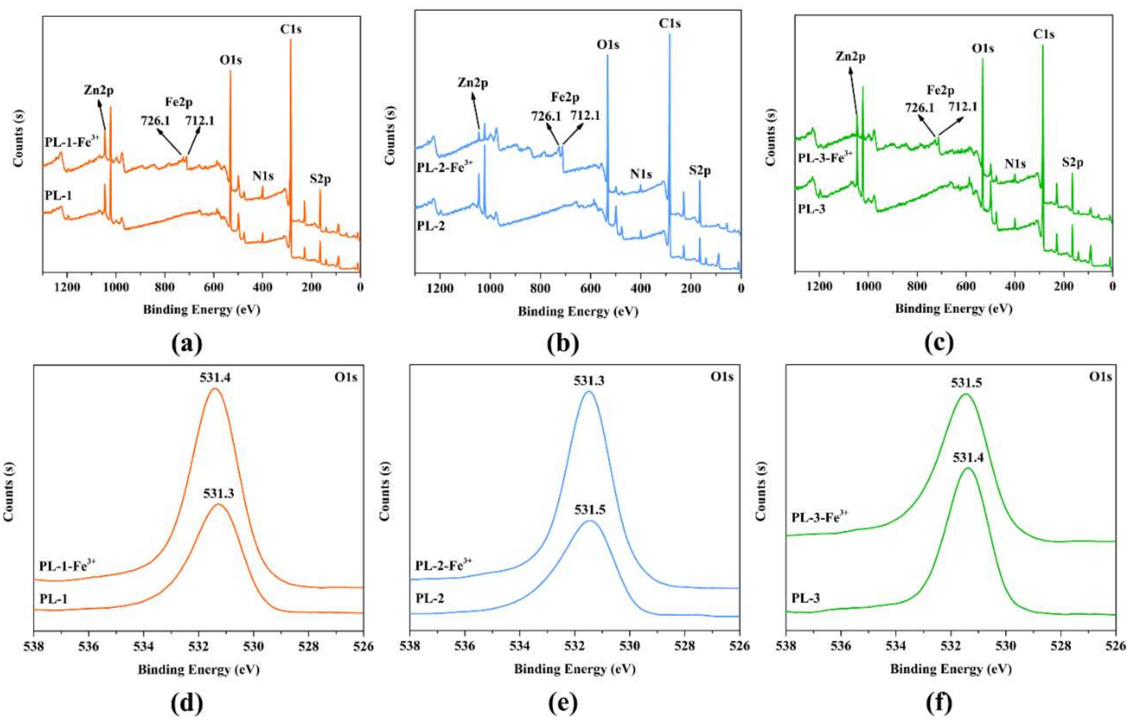


Fig. S7 XPS survey (a, b, c) and O1s XPS spectra (d, e, f) of **PL-1**, **PL-2**, and **PL-3** before and after being immersed in EtOH solutions of $Fe(NO_3)_3$.

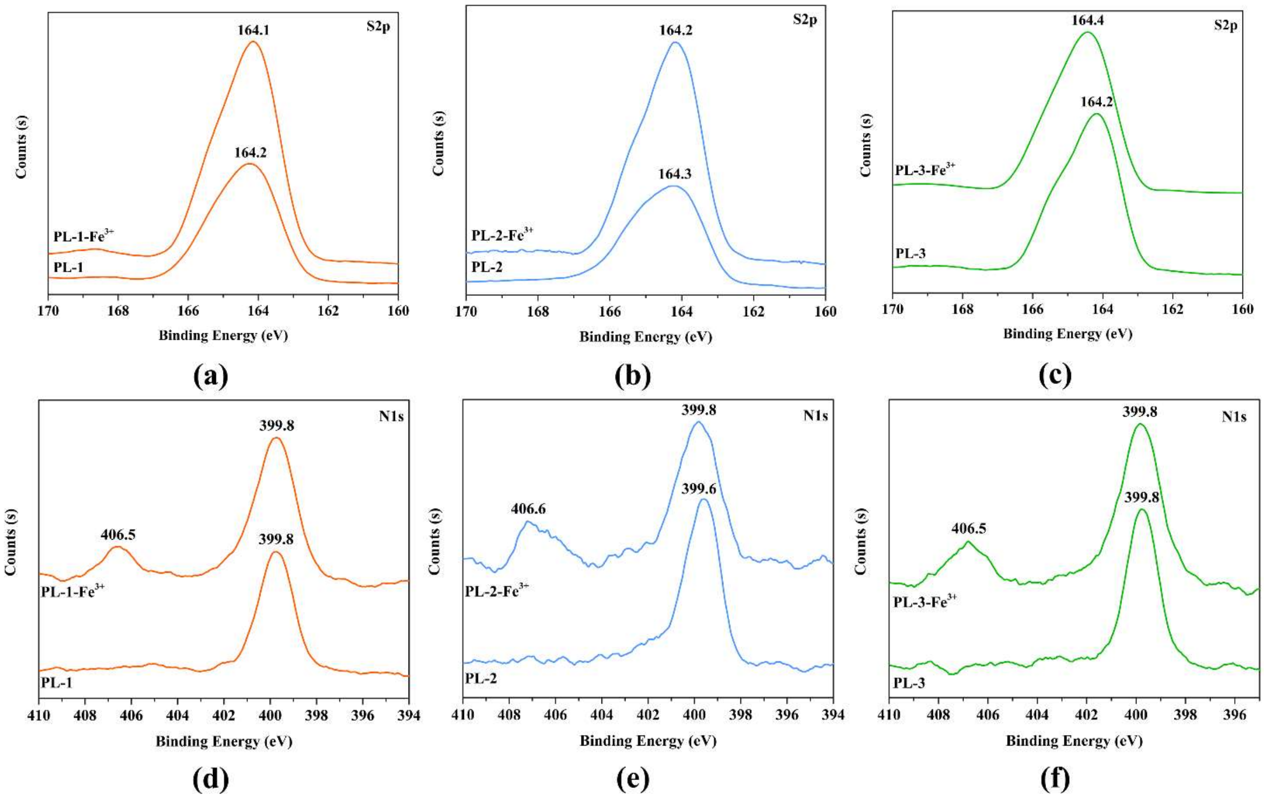


Fig. S8 S2p (a, b, c) and N1s (d, e, f) XPS spectra of **PL-1**, **PL-2**, and **PL-3** before and after being immersed in EtOH solutions of $Fe(NO_3)_3$.

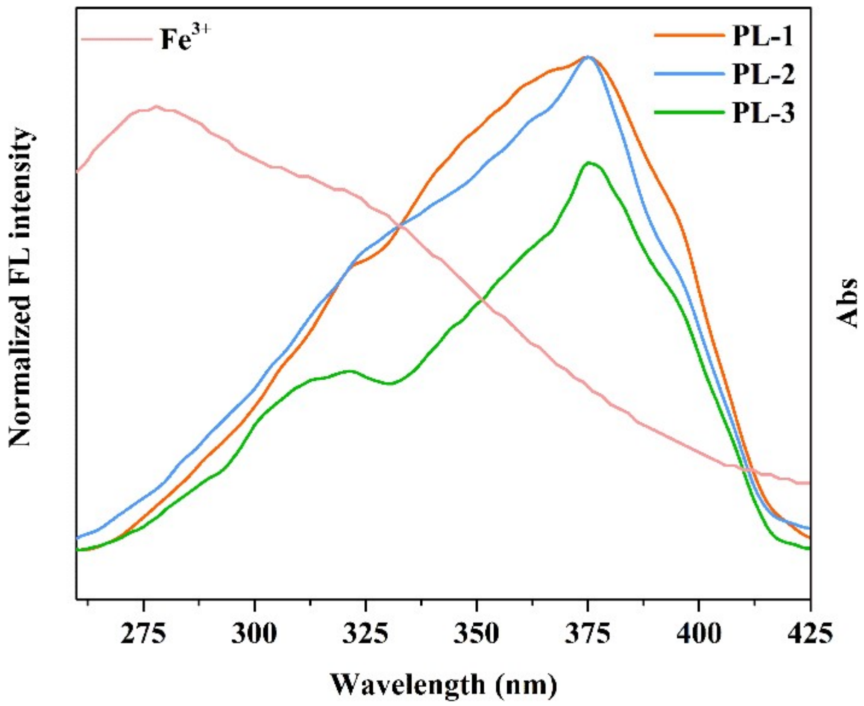


Fig. S9 Excitation spectra of **PL-1**, **PL-2**, and **PL-3** dispersed in EtOH and UV-vis absorption spectrum of Fe^{3+} ions in EtOH.

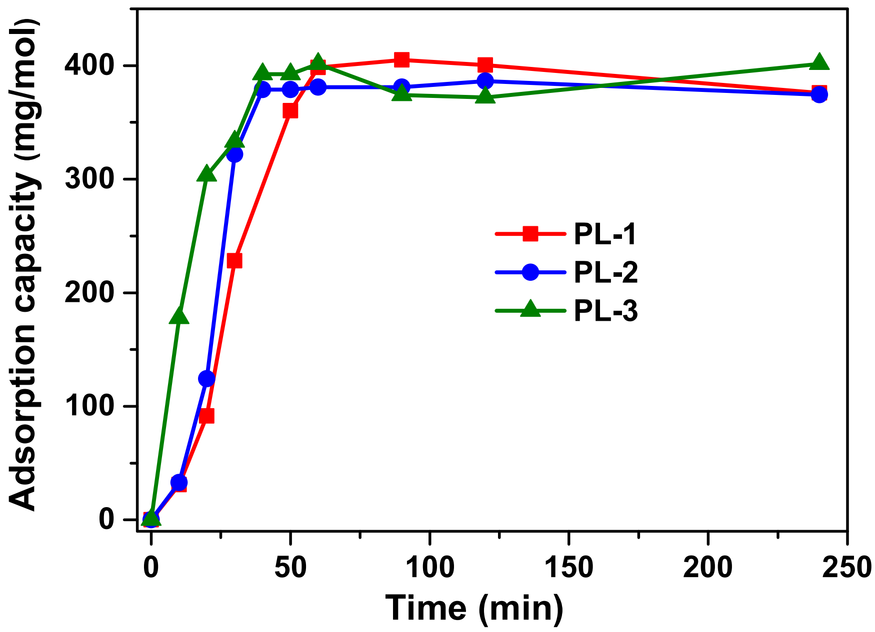


Fig. S10 Polts of adsorption capacities of Fe^{3+} ions *vs.* the adsorption time for **PL-1**, **PL-2**, and **PL-3**. The saturated adsorption capacity for Fe^{3+} ions is comparable for **PL-1**, **PL-2** and **PL-3** with *ca.* 376, 374, and 402 mg/mol at 4 h, respectively. The adsorption rate (from the slope for this curve) below 30 min obviously follows the order: **PL-3** > **PL-2** > **PL-1**.

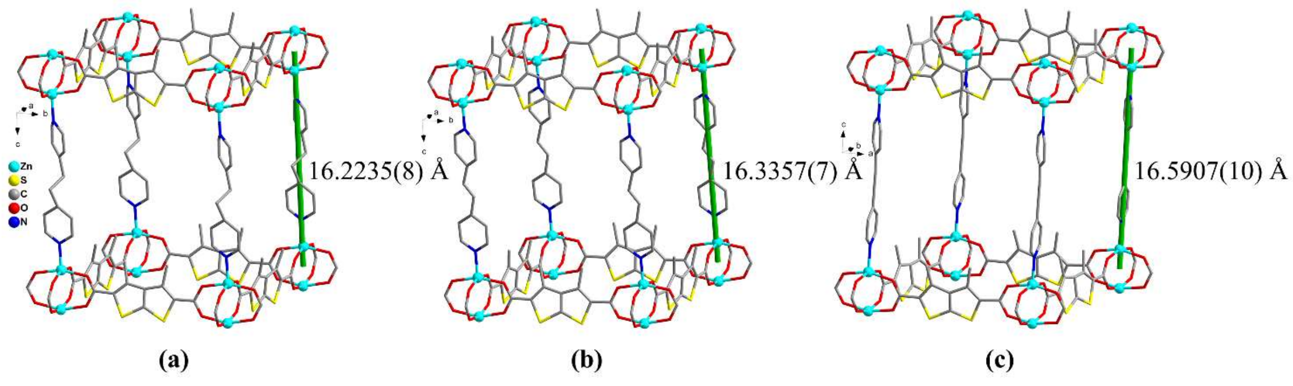
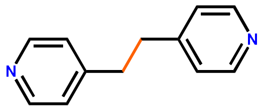
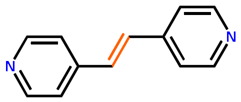


Fig. S11 Lengths of pillar for **PL-1** (a), **PL-2** (b), and **PL-3** (c).

Table S1 Summary of the values of K_{sv} for the fluorescent MOFs used for sensing Fe^{3+} ions.

Fluorescent MOF materials	Media	K_{SV} (M^{-1})	Ref.
$\{[Cd_2(bptc)(2,2'\text{-bipy})_2(H_2O)_2]\}_n$	H_2O	8.61×10^3	S1
$\{[Cd_2(bptc)(phen)_2]\cdot 4H_2O\}_n$	H_2O	3.07×10^3	S1
$\{[Cd_2(bptc)(4,4'\text{-bipy})(H_2O)_2]\cdot 4H_2O\}_n$	H_2O	6.21×10^3	S1
$[Zn_2(trz)_2(btdb)]\cdot 4DMF$	H_2O	2.4×10^2	S2
$[Cd_{1.5}(L)_2(bpy)(NO_3)]$	H_2O	1.13×10^4	S3
$[Eu(BCB)(DMF)]\cdot (DMF)_{1.5}(H_2O)_2$	H_2O	2.35×10^4	S4
$[Zn(DHT)(BPP)]_n$	H_2O	1.77×10^4	S5
$[Cd_{1.5}(L)_2(bpy)(NO_3)]$	H_2O	1.91×10^4	S6
$[Eu_2(L)_3(DMF)_2(H_2O)_4]\cdot 2DMF$	H_2O	8.31×10^3	S7
$[Tb_2(L)_3(DMF)_2(H_2O)_4]\cdot 2DMF$	H_2O	5.63×10^3	S7
$[Gd_2(L)_3(DMF)_2(H_2O)_4]\cdot 2DMF$	H_2O	2.86×10^4	S7
$[Y_2(L)_3(DMF)_2(H_2O)_4]\cdot 2DMF$	H_2O	1.50×10^4	S7
$[Co_6(oba)_4(Hatz)(atz)(H_2O)_2(\mu_3\text{-}OH)_2(\mu_2\text{-}OH)]\cdot H_2O$	H_2O	9.61×10^4	S8
UiO-67	H_2O	5.981×10^4	S9
UiO-67@N	H_2O	5.252×10^4	S9
UiO-67@NN	H_2O	1.646×10^4	S9
$\{[Zn_4(tpta)_2(OH)_2(bib)_4]\cdot H_2O\}_n$	H_2O	7.8×10^3	S10
JLUMOF201-Y	H_2O	7.67×10^3	S11
JLUMOF201-Tb	H_2O	8.38×10^3	S11
$\{[H_2N(Me)_2]_2[Zn_5(L)_2(OH)_2]\cdot 3DMF\cdot 4H_2O\}_n$	H2O	9.799×10^4	S12
$[Zn_2(trz)_2(btdb)]\cdot 4DMF$	MeOH	3.3×10^3	S2
$[Eu_2(TDC)_3(CH_3OH)_2(CH_3OH)]$	MeOH	3.42×10^3	S13
$[Tb_2(TDC)_3(CH_3OH)_2(CH_3OH)]$	MeOH	3.04×10^4	S13
$[Cd_2(L1)(tdc)_2(H_2O)]_n$	EtOH	3.01×10^3	S14
$[Cd(L2)_{0.5}(tdc)]_n$	EtOH	4.22×10^3	S14
Tb^{3+}@Zn-MOF	EtOH	3.26×10^4	S15
$CH_3\text{-dpb}]_2[Mg_3(1,4\text{-NDC})_4(\mu\text{-}H_2O)_2(CH_3OH)(H_2O)]\cdot 1.5H_2O$	EtOH	1.6×10^4	S16
$[La(TPT)(DMSO)_2]\cdot H_2O$	EtOH	1.36×10^4	S17
EuL_3	EtOH	4.1×10^3	S18
$[Eu_2K_2(dcppa)_2(H_2O)_6]\cdot 5H_2O$	EtOH	4.30×10^4	S19
$[Eu_3(FDA)_4(DMSO)_2(NO_3)(H_2O)_2]_n$	EtOH	3.3×10^4	S20
PL-1	EtOH	1.58×10^4	This work
PL-2	EtOH	1.72×10^4	This work
PL-3	EtOH	2.47×10^4	This work

Table S2 List of the structure parameters and K_{sv} for the pillar-layered MOFs.

MOFs	Dipyridyl ligand	Length of the pillar (Å)	Pore volume (%)	K_{SV} (M^{-1})
PL-1	 bpe	16.2235(8)	45.5	1.60×10^4
PL-2	 dpe	16.3357(7)	45.7	1.73×10^4
PL-3	 bpa	16.5907(10)	46.0	2.52×10^4

References

S1. Y. Lin, X. Zhang, W. Chen, W. Shi and P. Cheng, *Inorg. Chem.*, 2017, **56**, 11768-11778.

S2. X.-T. Hu, Z. Yin, X.-P. Luo, C.-H. Shen and M.-H. Zeng, *Inorg. Chem. Commun.*, 2021, **129**, 108664.

S3. M. Singh, S. Senthilkumar, S. Rajput and S. Neogi, *Inorg. Chem.*, 2020, **59**, 3012-3025.

S4. M. Y. Zhang, F. Y. Yi, L. J. Liu, G. P. Yan, H. Liu and J. F. Guo, *Dalton Trans.*, 2021, **50**, 15593-15601.

S5. S. T. Wang, X. Zheng, S. H. Zhang, G. Z. Li and Y. Xiao, *CrystEngComm*, 2021, **23**, 4059-4068.

S6. M. Singh, G. Kumar and S. Neogi, *Front. Chem.*, 2021, **9**, 651866.

S7. L. J. Zhao, B. Li and G. P. Yong, *CrystEngComm*, 2023, **25**, 2813-2823.

S8. W. S. Zhang, G. Q. Wang, Y. X. Wang, Y. L. Yang, X. Bai, H. Cui, Y. Lu and S. X. Liu, *Dalton Trans.*, 2023, **52**, 4407-4414.

S9. S. Fajal, W. Mandal, D. Majumder, M. M. Shirolkar, Y. D. More and S. K. Ghosh, *Chem. Eur. J.*, 2022, **28**, e202104175.

S10. D. Qi, X. Si, L. Guo, Z. Yan, C. Shao and L. Yang, *Colloid and Surfaces A*, 2022, **649**, 129477.

S11. Q. Hu, T. Xu, J. Gu, L. Zhang and Y. Liu, *CrystEngComm*, 2022, **24**, 2759-2766.

S12. Y.-T. Yan, Y.-L. Wu, L.-N. Zheng, W. Cai, P.-F. Tang, W.-P. Wu, W.-Y. Zhang and Y.-Y. Wang, *New J. Chem.*, 2022, **46**, 4292–4299.

S13. K. Xu, F. Wang, S. Huang, Z. Yu, J. Zhang, J. Yu, H. Gao, Y. Fu, X Li, Y. Zhao, *RSC Adv*., 2016, **6**, 91741-91747.

S14. Y. Q. Su, L. Fu and G. H. Cui, *Dalton Trans.*, 2021, **50**, 15743-15753.

S15. Y.-J. Liang, J. Yao, M. Deng, Y.-E. Liu, Q.-Q. Xu, Q.-X. Li, B. Jing, A.-X. Zhu and B. Huang, *CrystEngComm*, 2021, **23**, 7348-7357.

S16. Z. F. Wu, L. K. Gong and X. Y. Huang, *Inorg. Chem.*, 2017, **56**, 7397-7403.

S17. C. Zhang, Y. Yan, Q. Pan, L. Sun, H. He, Y. Liu, Z. Liang J. Li, *Dalton Trans.*, 2015, **44**, 13340 -13346.

S18. M. Zheng, H. Tan, Z. Xie, L. Zhang, X. Jing Z. Sun, *ACS Appl. Mater. Interfaces*. 2013, **5**, 1078-1083.

S19. H. Zhang, R. Fan, W. Chen, J. Fan, Y. Dong, Y. Song, X. Du, P. Wang, Y. Yang, *Cryst. Growth Des*. 2016, **16**, 5429-5440.

S20. H. Zhang, G.-Y. Liu, X.-H. Diao, Y. Muhammad, C. Chen, Y.-Y. Gao, H. Wang, C.-S. Qi, W. Li, *J. Solid State Chem.*, 2023, **324**, 124114.