# Efficient detection of $Al^{3+}$ and $B_4O_7^{2-}$ over trigonal prism In(III) complex

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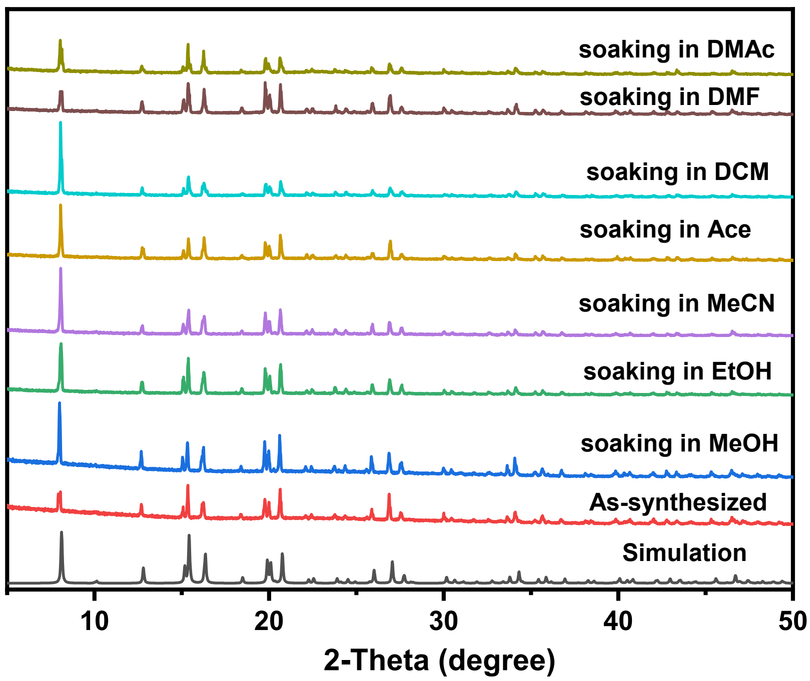



**Fig. S1** The Powder X-ray diffraction patterns of **1** immersing in common solvents: methanol (MeOH), *N*,*N*'-dimethylformamide (DMF), *N*,*N*-dimethylacetamide (DMAc), ethanol (EtOH), acetonitrile (MeCN), dichloromethane (DCM) and acetone (Ace) for 24 h.

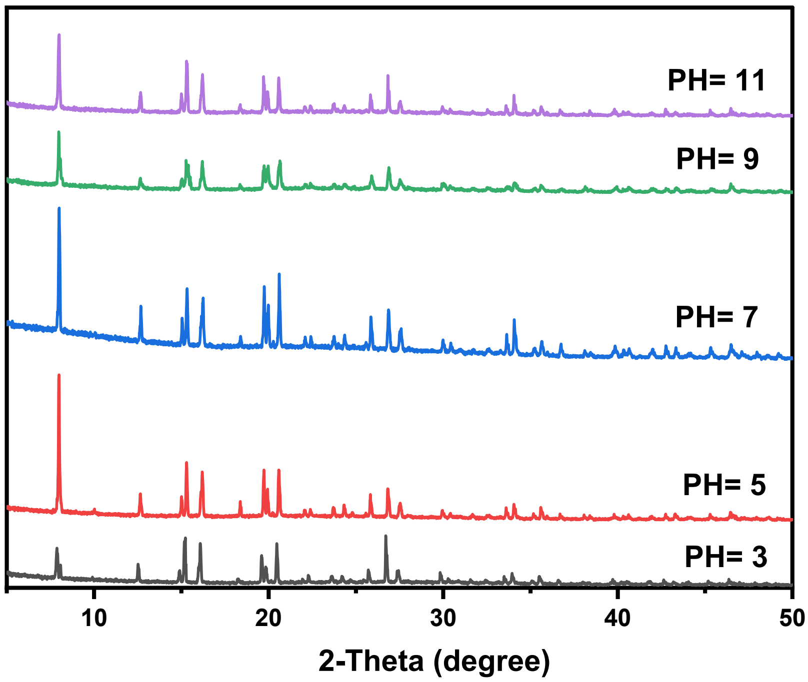



**Fig. S2** The Powder X-ray diffraction patterns of **1** immersing in MeOH in different PH values.

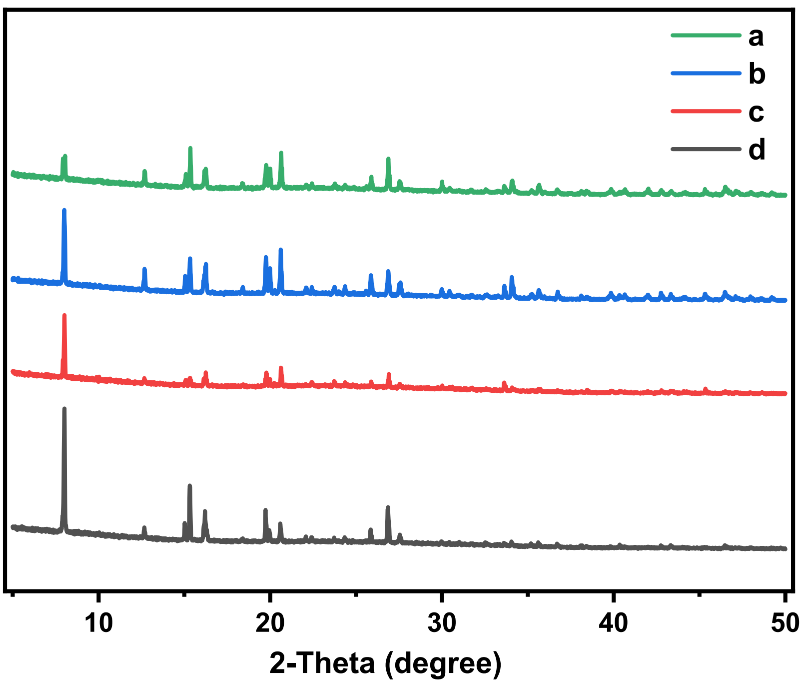



**Fig. S3** The PXRD patterns of (a) as-synthesized. (b) **1** after soaked in MeOH for 48 h. (c) **1** after ultrasonic sound in MeOH containing $Al^{3+}$ ($10^{-3}$ M) for 25 min. (d) **1**after ultrasonic sound in MeOH containing $B_4O_7^{2-}$ ($10^{-3}$ M) for 25 min.

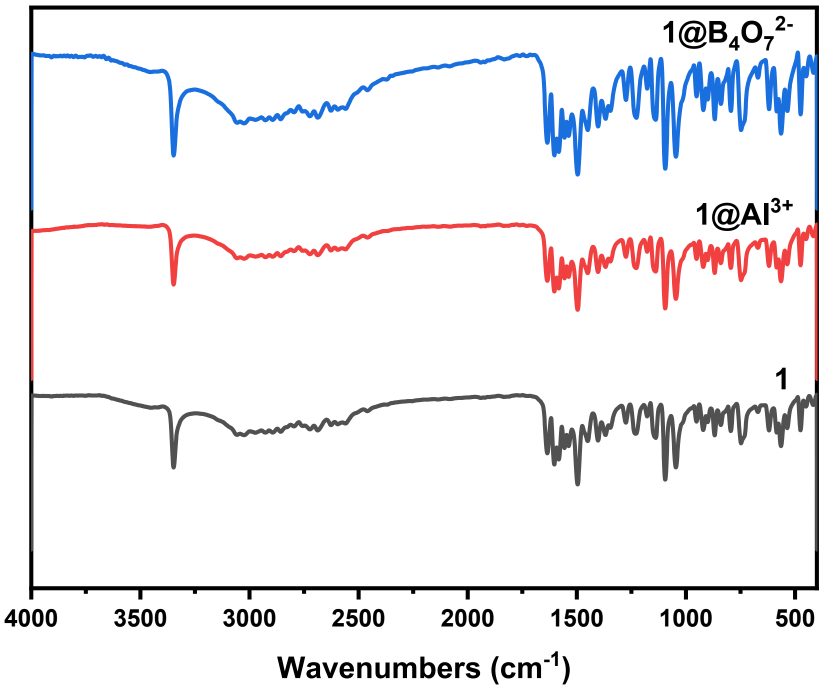



**Fig. S4** The FT-IR spectra of **1** before and after being ultrasonic in MeOH containing $Al^{3+}$ and $B_4O_7^{2-}$.

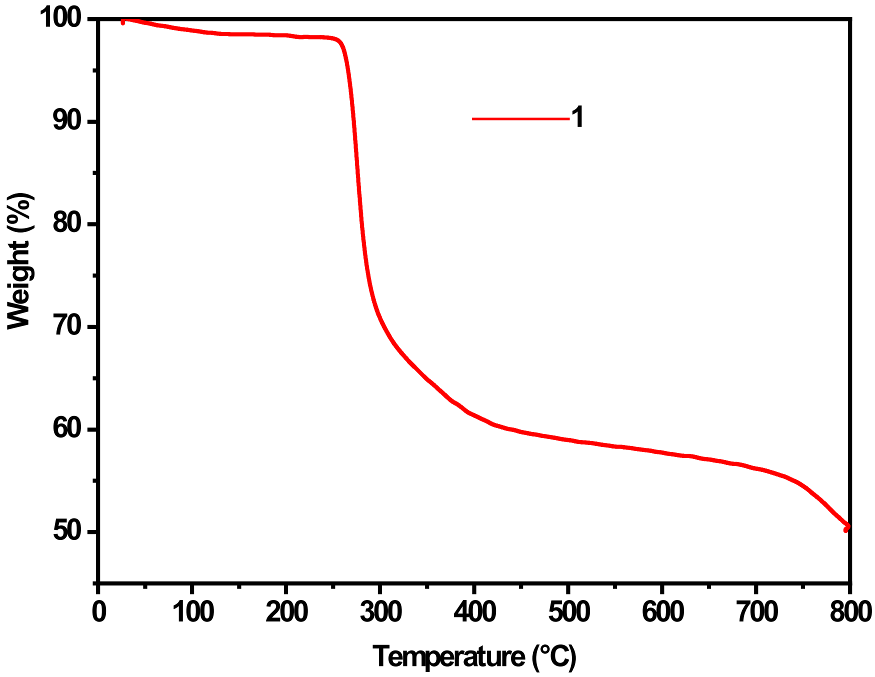



**Fig. S5** TGA plot of **1** under $N_2$ condition.

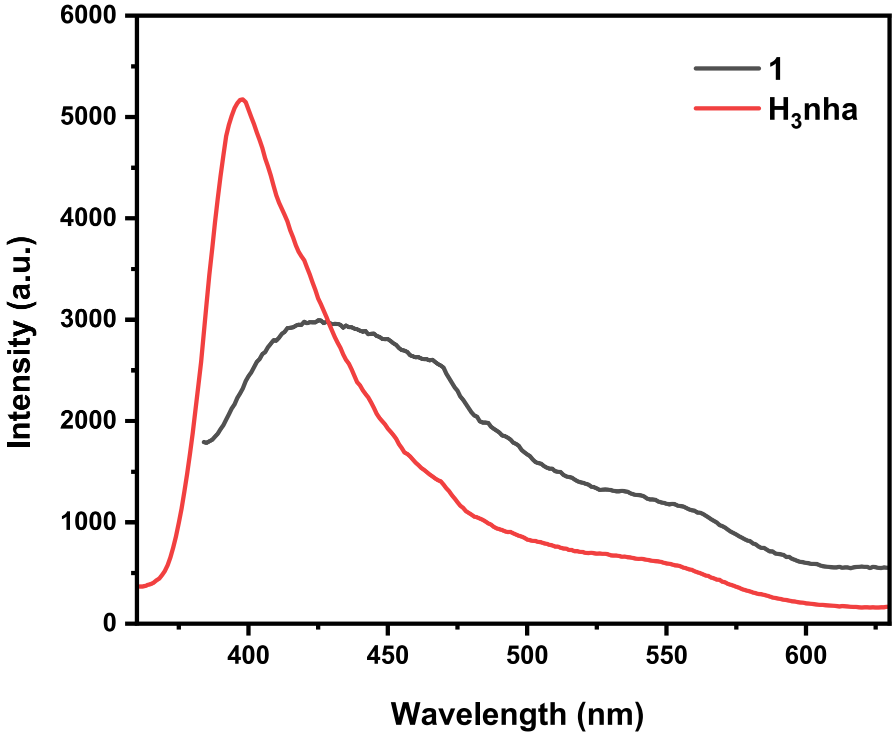



**Fig. S6** Solid state luminescence spectra of $H_3$nha ( $\lambda_{ex}$=325 nm,) and **1** ( $\lambda_{ex}$=330 nm)

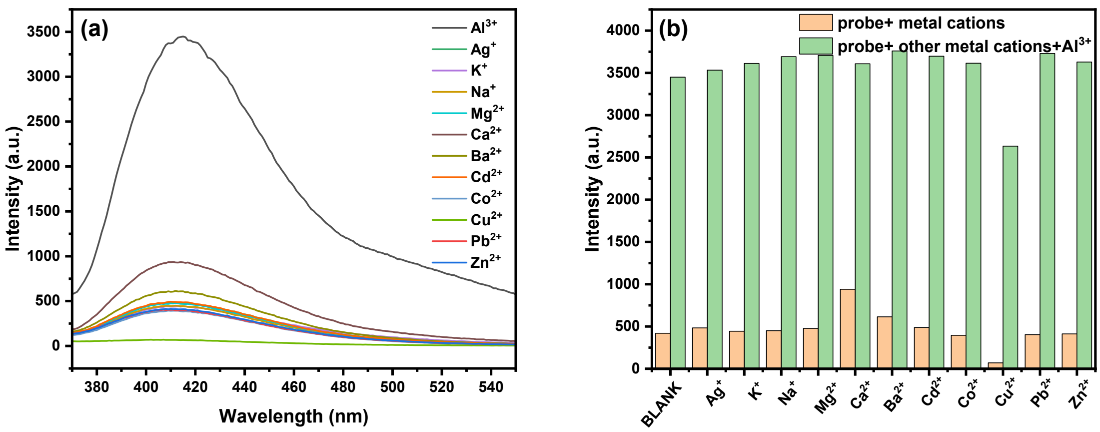



**Fig. S7** (a) Luminescence spectra of $H_3$nha ($10^{-4}$ M) in MeOH upon the addition of different metal ions; (b) Luminescence intensities at 325 nm of $H_3$nha ($10^{-4}$ M) in MeOH in the presence of only $Al^{3+}$ ($10^{-3}$ M) and $Al^{3+}$ with the other metal ions ($10^{-3}$ M).

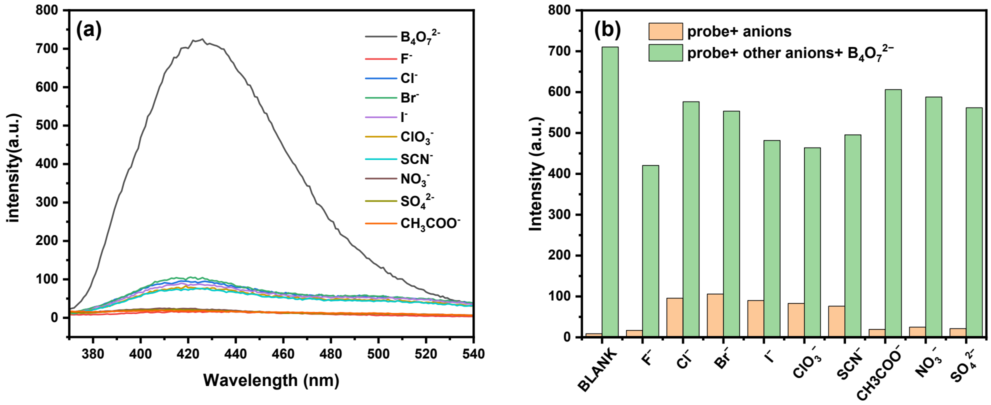



**Fig. S8** (a) Luminescence spectra of $H_3nha$ ($10^{-4}$ M) in solution ($MeOH{:}H_2O$, v/v =9:1) upon the addition of different non-metal anions; (b) Luminescence intensities at 325 nm of $H_3nha$ ($10^{-4}$ M) in solution ($MeOH{:}H_2O$, v/v = 9:1) in the presence of only $B_4O_7^{2-}$ ($10^{-3}$ M) and $B_4O_7^{2-}$ with the other anions ($10^{-3}$ M).

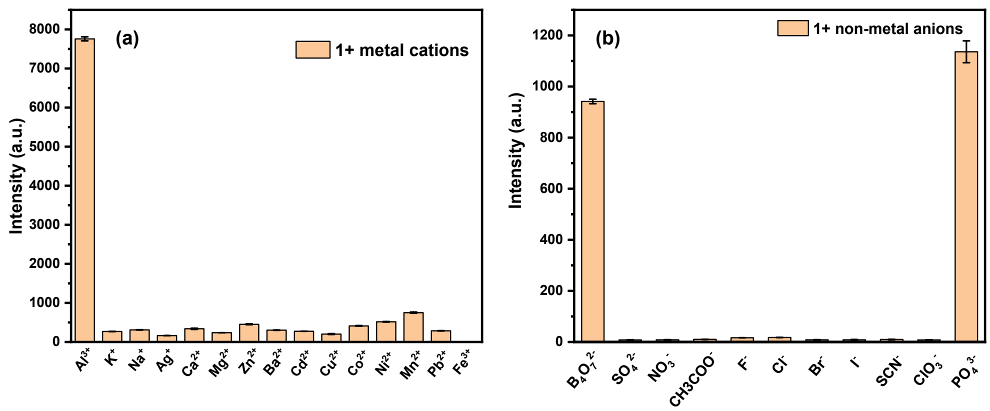



**Fig. S9** Luminescence spectra of **1** in MeOH upon the addition of (a) different metal ions and (b) different non-metal anions;

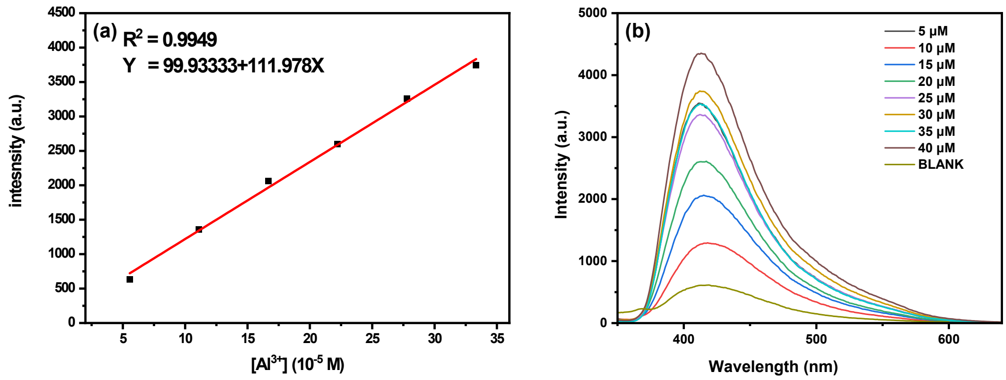



**Fig. S10** (a) Linear relationship of the luminescence intensity at 330 nm of **1** with the concentration of $Al^{3+}$. (b) The luminescence spectra of **1** in MeOH with different concentration of $Al^{3+}$.

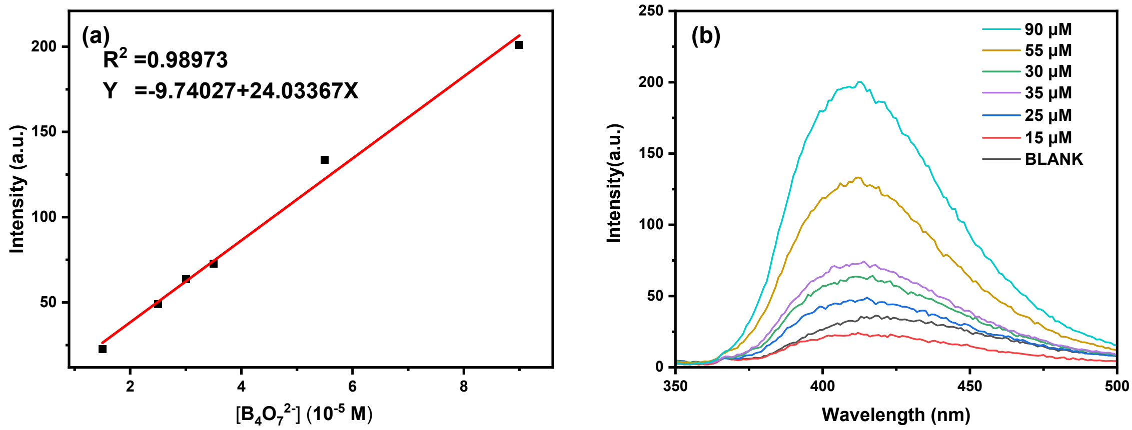



**Fig.S11** (a) The luminescence spectra of **1** in solution (MeOH:$H_2O$, v/v =9:1) with different concentration of $B_4O_7^{2-}$ (b) Linear relationship of the luminescence intensity at 330 nm of **1** with the concentration of $B_4O_7^{2-}$.

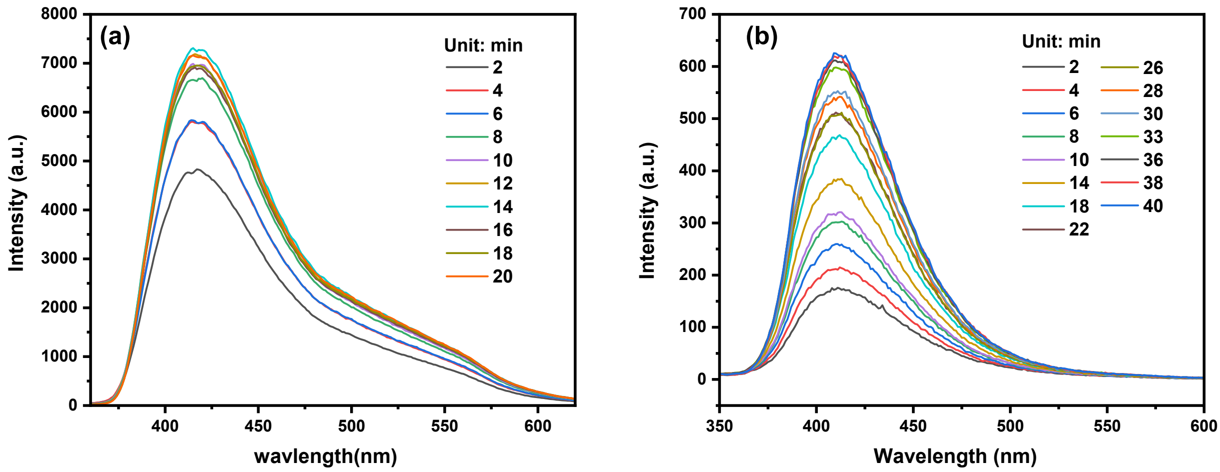



**Fig.S12** The luminescence intensity of (a) **1**@$Al^{3+}$ and (b) **1**@$B_4O_7^{2-}$ with the increase of time.

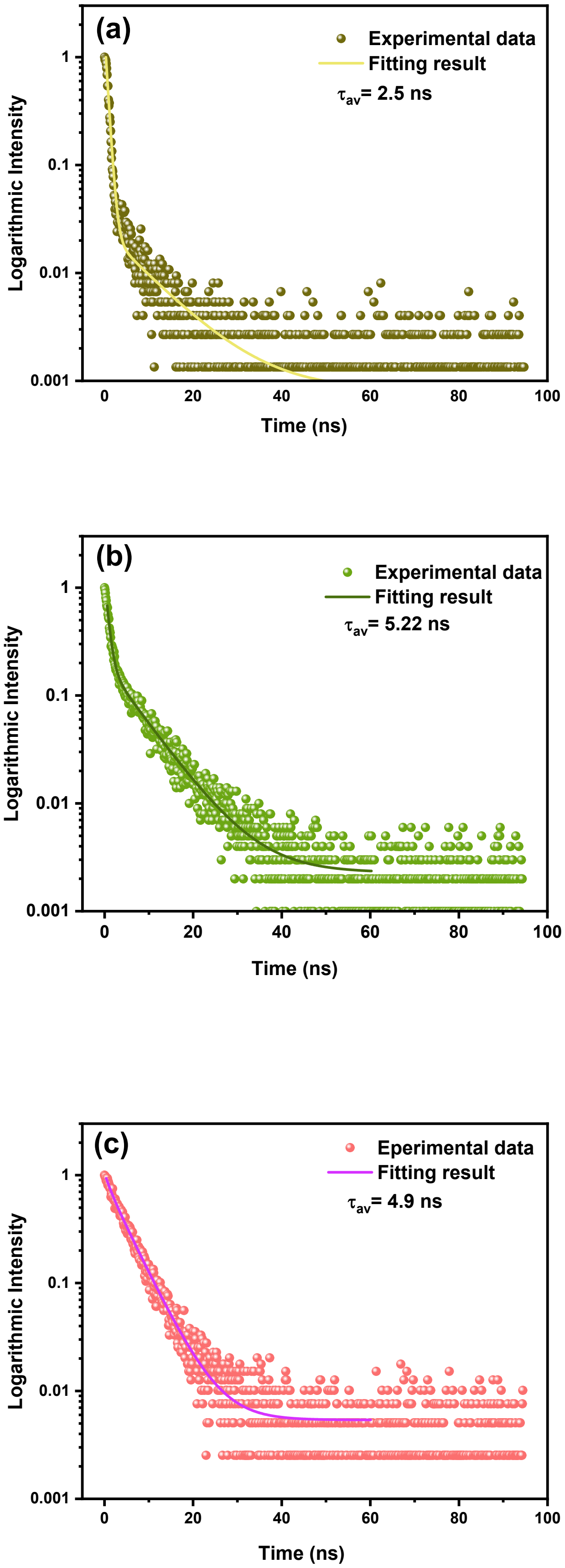



**Fig. S13** The time resolved luminescence decay corresponding fitted lines of **1** (a) in MeOH, (b) **1**@$Al^{3+}$, (c) **1**@$B_4O_7^{2-}$.

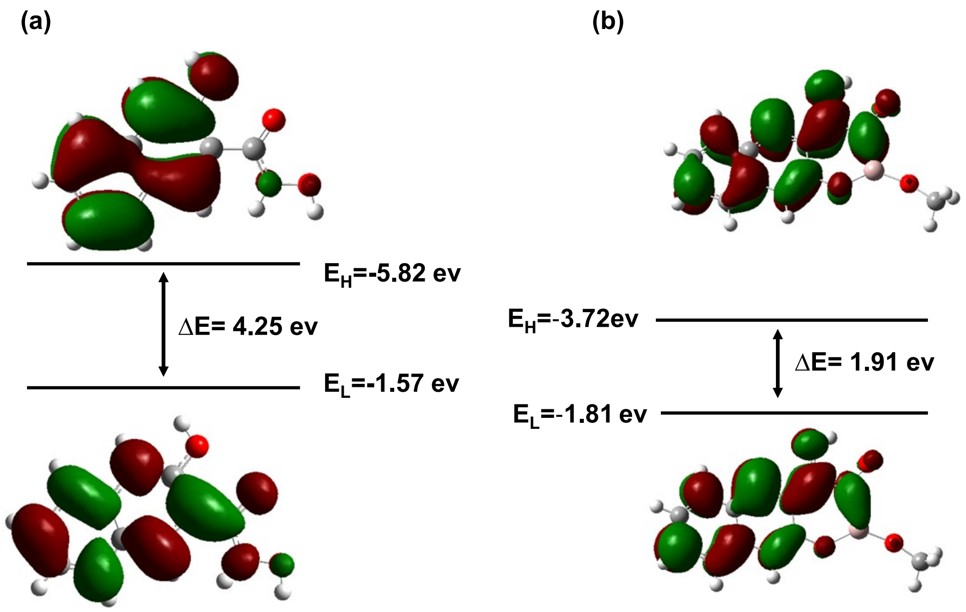



**Fig. S14** HOMO and LUMO energies for **1** and **1**@$Al^{3+}$.

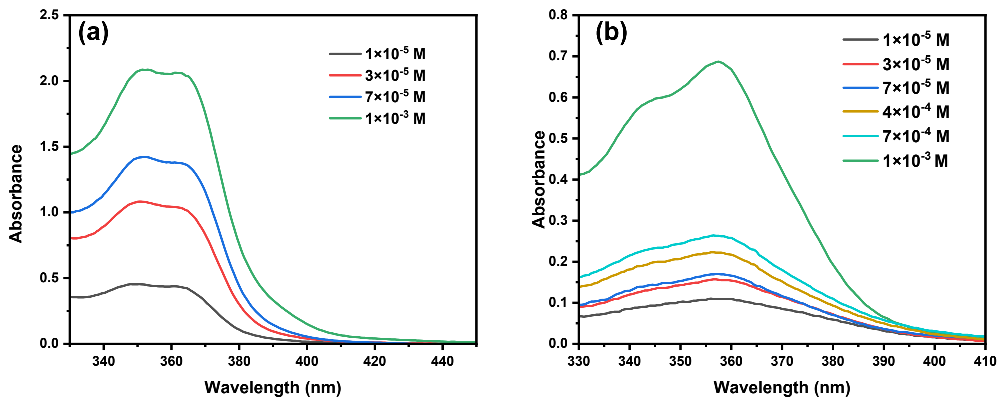



**Fig. S15** The absorption spectra of **1** by addition of different concentrations of (a) $Al^{3+}$ and (b) $B_4O_7^{2-}$.

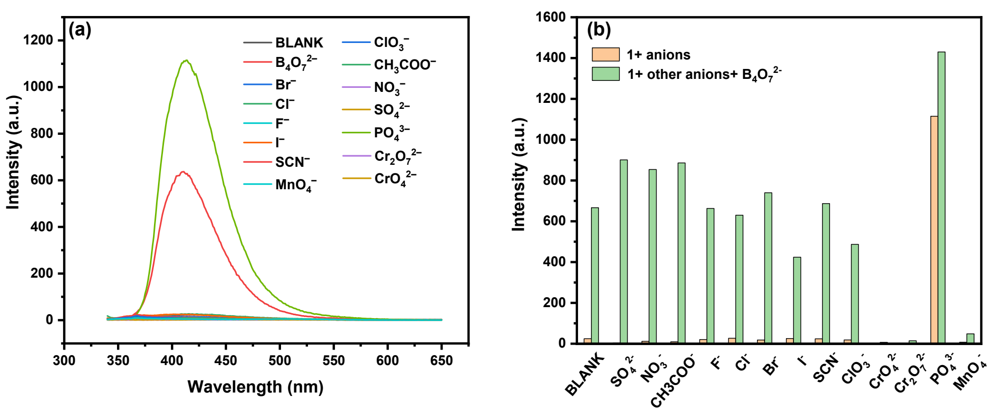



**Fig. S16** (a) Luminescence spectra of 1 in solvent (MeOH:$H_2O$, v/v = 9:1) upon the addition of different non-metal anions; (b) Luminescence intensities at 330 nm of 1 in the presence of only $B_4O_7^{2-}$ ($10^{-3}$ M) and $B_4O_7^{2-}$ with the other non-metal anions ($10^{-3}$ M).

**Table S1** The continuous shape measures value calculated using SHAPE 2.1.

| Complex | HP($D_{6h}$) | PPY($C_{5v}$) | OC($O_h$) | TPR($D_{3h}$) | JPPY ($C_{5v}$) |
|---|---|---|---|---|---|
| **1** | 35.956 | 19.726 | 5.131 | 4.439 | 23.839 |

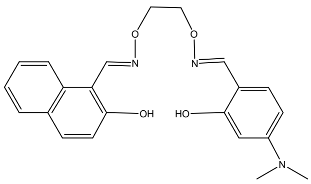
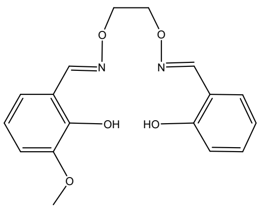
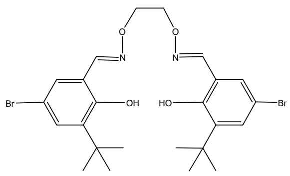
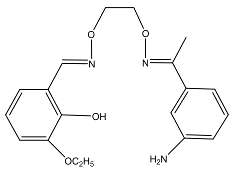
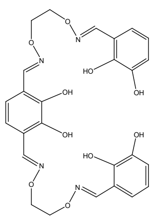
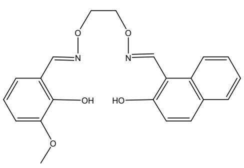
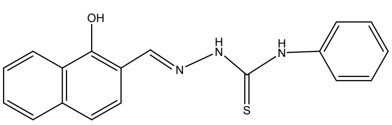
**Table S2** Selected bond lengths (Å) for **1**.

| **Selected bond lengths** | |
|---|---|
| In(1)–O(1) | 2.1540(19) |
| In(1)–O(2) | 2.132(2) |
| N(1)–O(1) | 1.372(3) |
| C(1)–O(2) | 1.268(3) |
| C(1)–N(1) | 1.315(3) |

**Table S3** Comparison of various sensors for the detection of $Al^{3+}$ and $B_4O_7^{2-}$.

| | Complex | Sensing type | Identification substance | LOD | Reference |
|---|---|---|---|---|---|
| 1 | A-curcumin@MOF-5 | Turn-on | $Al^{3+}$ | 3.10 μM | 1 |
| 2 | B-curcumin@MOF-5 | Turn-on | $Al^{3+}$ | 2.84 μM | 1 |
| 3 | $Eu^{3+}$@UiO-66-$(COOH)_2$/OH | Turn-off | $Al^{3+}$ | 0.36 μM | 2 |
| 4 | [Zn$(ICA)_2$(DMF)$(H_2O)_3$] | Turn-on | $Al^{3+}$ | 0.607 μM | 3 |
| 5 | {[Cd(2-amino-1,4-benzenedicarboxylate) (4,4′azopyridine)] (DMA)}$_n$ | Turn-on | $Al^{3+}$ | 0.38 μM | 4 |
| 6 | {[$Zn_2$$(NDC)_2$(4bppyttz)]1.5DMF} | Turn-on | $Al^{3+}$ | 2.9 μM | 5 |
| 7 | In$(H_2nha)_3$ | Turn-on | $Al^{3+}$ | 1.3 μM | This work |
| 8 | {[Tb(dppa)$(H_2O)_2$] dima $H_2O$·0.5O}$_n$ | Turn-on | $B_4O_7^{2-}$ | 1.49 μM | 6 |
| 9 | In$(H_2nha)_3$ | Turn-on | $B_4O_7^{2-}$ | 6.2 μM | This work |

**Table S4** Various sensors for the detection of $B_4O_7^{2-}$.

| | Fluorescent sensor | Sensing type | The detected anions | Ref |
|---|---|---|---|---|
| 1 | $\{[Tb(dppa)(H_2O)_2]\cdot dima\cdot H_2O\cdot 0.5O\}_n$ | Turn-on | $B_4O_7^{2-}$, $HSO_3^-$, $CO_3^{2-}$, $CH_3COO^-$, $HCO_3^-$, $S_2O_3^{2-}$, $I^-$, $S^{2-}$, $C_2O_4^{2-}$, $Br^-$, $Cl^-$, $SO_4^{2-}$, $NO_2^-$, $CrO_4^{2-}$, $Cr_2O_7^{2-}$ | 6 |
| 2 |  | Turn-on | $F^-$, $Cl^-$, $Br^-$, $I^-$, $HSO_4^-$, $S^{2-}$, $SO_3^{2-}$, $SO_4^{2-}$, $CO_3^{2-}$, $HCO_3^-$, $CN^-$, $HPO_4^{2-}$, $H_2PO_4^-$, $P_2O_7^{2-}$, $B_4O_7^{2-}$, $CH_3COO^-$, $ClO_4^-$ | 7 |
| 3 |  | Turn-off | $F^-$, $Cl^-$, $Br^-$, $I^-$, $HPO_4^{2-}$, $H_2PO_4^-$, $P_2O_7^{4-}$, $S^{2-}$, $CH_3COO^-$, $SO_4^{2-}$, $CO_3^{2-}$, $HCO_3^-$, $CN^-$, $ClO_4^-$, $B_4O_7^{2-}$ | 8 |
| 4 |  | Turn-on | $B_4O_7^{2-}$, $Cl^-$, $ClO_4^-$, $CN^-$, $CO_3^{2-}$, $H_2PO_4^-$, $HPO_4^{2-}$, $HS^-$, $I^-$, $NO_2^-$, $NO_3^-$, $CH_3COO^-$, $P_2O_7^{4-}$, $F^-$, $S^{2-}$, $Br^-$, $HCO_3^-$ | 9 |
| 5 |  | Turn-off | $F^-$, $Cl^-$, $Br^-$, $I^-$, $ClO_4^-$, $S^{2-}$, $HS^-$, $SO_3^{2-}$, $S_2O_8^{2-}$, $CO_3^{2-}$, $SO_4^{2-}$, $HCO_3^-$, $CN^-$, $SCN^-$, $CH_3COO^-$, Ppi, $H_2PO_4^-$, $HPO_4^{2-}$, $NO_2^-$, $NO_3^-$, $B_4O_7^{2-}$ | 10 |
| 6 |  | Turn-on | $F^-$, $Cl^-$, $Br^-$, $I^-$, $ClO_4^-$, $H_2PO_4^-$, $CN^-$, $SiO_3^{2-}$, $CH_3COO^-$, $B_4O_7^{2-}$, $HS^-$, $S^{2-}$, $NO_3^-$, $CO_3^{2-}$, $HCO_3^-$, $HPO_4^-$, $P_2O_7^{4-}$, $NO_2^-$ | 11 |
| 7 |  | Turn-on | $F^-$, $Cl^-$, $Br^-$, $I^-$, $HPO_4^-$, $H_2PO_4^-$, $P_2O_7^{4-}$, $S^{2-}$, $CH_3COO^-$, $CO_3^{2-}$, $HCO_3^-$, $CN^-$, $ClO_4^-$, $HS^-$, $NO_2^-$, $NO_3^-$, $B_4O_7^{2-}$ | 12 |
| 8 |  | Turn-on | $B_4O_7^{2-}$, $SO_4^{2-}$, $PO_4^{3-}$, $NO_3^-$, $NO_2^-$, $P_2O_7^{2-}$, $H_2PO_4^-$, $F^-$, $CH_3COO^-$, $Br^-$, $HCO_3^-$ | 13 |

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