## **Supplementary material**

## A portable self-calibrating logic detector for gradient detecting

## formaldehyde based on luminescent metal organic frameworks hybrids

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Scheme S1 The crystal structure of Bio-MOF-1.



Figure S1 The FT-IR images of Bio-MOF-1 and Eu<sup>3+</sup>@Bio-MOF-1.



**Figure S2** Eu 4d XPS spectra of  $Eu^{3+}@Bio-MOF-1$  and  $Eu(NO_3)_3 \cdot 6H_2O$ ; N 1s and O 1s XPS spectra of Bio-MOF-1 and  $Eu^{3+}@Bio-MOF-1$ .



Figure S3 The UV-vis spectra of Bio-MOF-1 and Eu<sup>3+</sup>@Bio-MOF-1.



Figure S4 Thermal gravimetric analysis curves for Bio-MOF-1 and Eu<sup>3+</sup>@Bio-MOF-1.



Figure S5 The excitation (black line) and emission (red line) spectra of Bio-MOF-1.



Figure S6 The corresponding CIE chromaticity diagram of (a) Bio-MOF-1 and (b) Eu<sup>3+</sup>@Bio-MOF-1.



Figure S7 The luminescent spectra of Bio-MOF-1 and Bio-MOF-1 dispersed in FA.



Figure S8 The line chart of luminescent intensity of Eu<sup>3+</sup>@Bio-MOF-1 with different immersion time in FA.



2ppm 4ppm 6ppm 8ppm 10ppm 12ppm14ppm

Figure S9 Linear curve of the luminescent intensity of Eu<sup>3+</sup>@Bio-MOF-1 toward different concentrations of FA.



**Figure S10 (a)** The fluorescence stability of  $Eu^{3+}@Bio-MOF-1$  in H<sub>2</sub>O of different PH; (b) Day to day fluorescence stability of  $Eu^{3+}@Bio-MOF-1$ .



**Figure S11** (a) The structure stability of  $Eu^{3+}@Bio-MOF-1$  in  $H_2O$  of different PH; (b) Day to day structure stability of  $Eu^{3+}@Bio-MOF-1$  in water.



Figure S12 The UV-vis spectra of Eu<sup>3+</sup>@Bio-MOF-1 and FA.



Figure S13 Eu 4d XPS spectra of Eu<sup>3+</sup>@Bio-MOF-1 and FA- Eu<sup>3+</sup>@Bio-MOF-1