

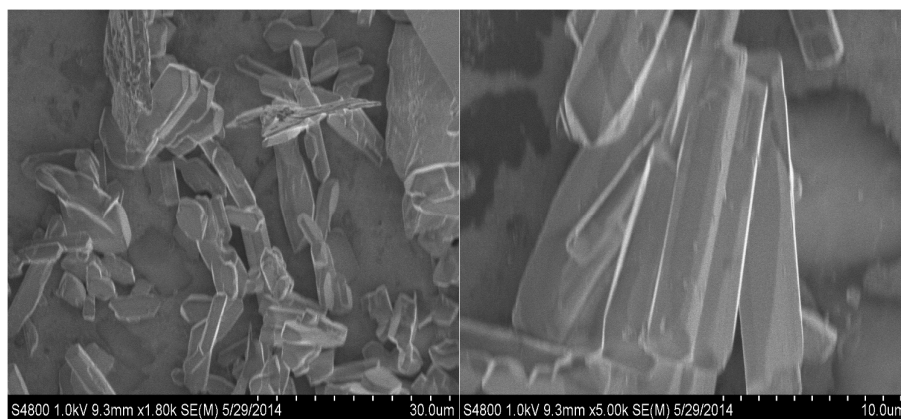
# Supporting Information

## **Eu(III)-functionalized MIL-124 as fluorescent probe for highly selectively sensing ions and organic small molecules especially for Fe(III) and Fe(II)**

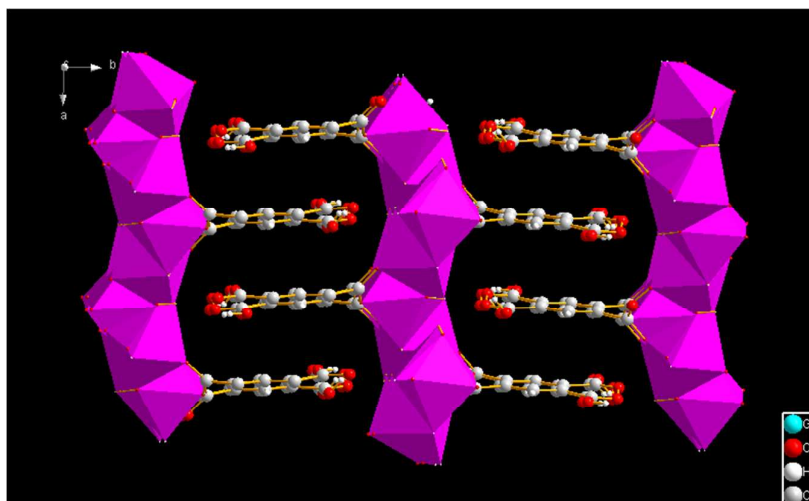
Xiao-Yu Xu, Bing Yan\*

Department of Chemistry, Tongji University, Shanghai 200092, China

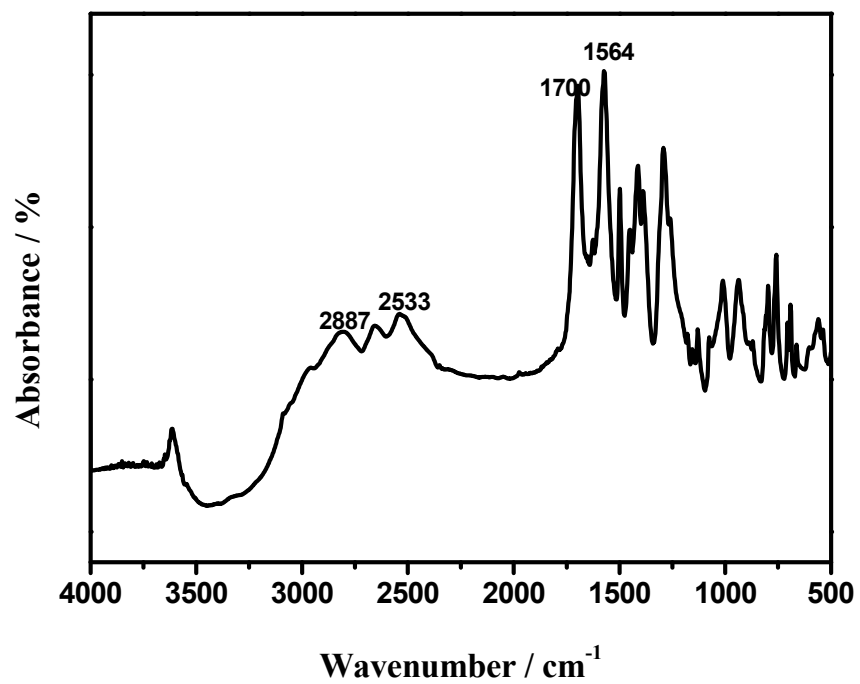
Corresponding author: Prof. Dr. Bing Yan, Email: [byan@tongji.edu.cn](mailto:byan@tongji.edu.cn)



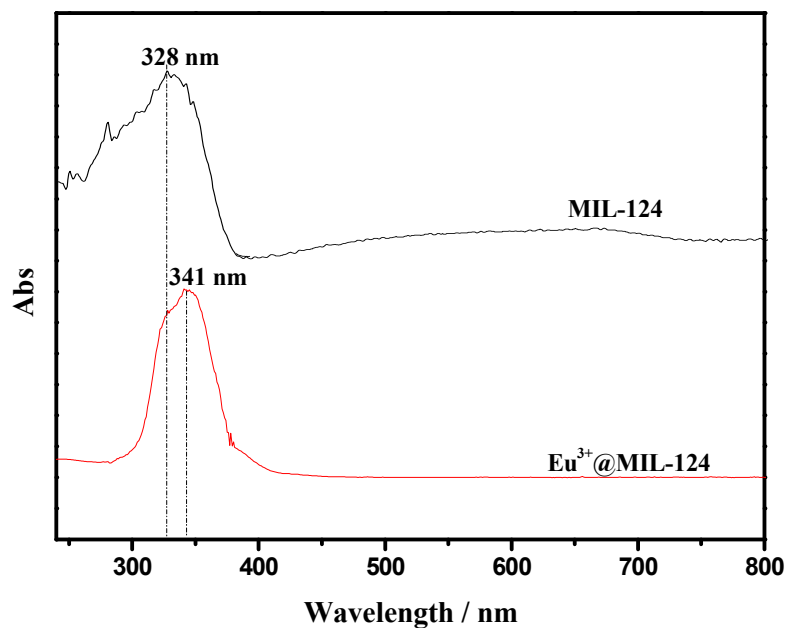
**Figure S1** SEM image of MIL-124.



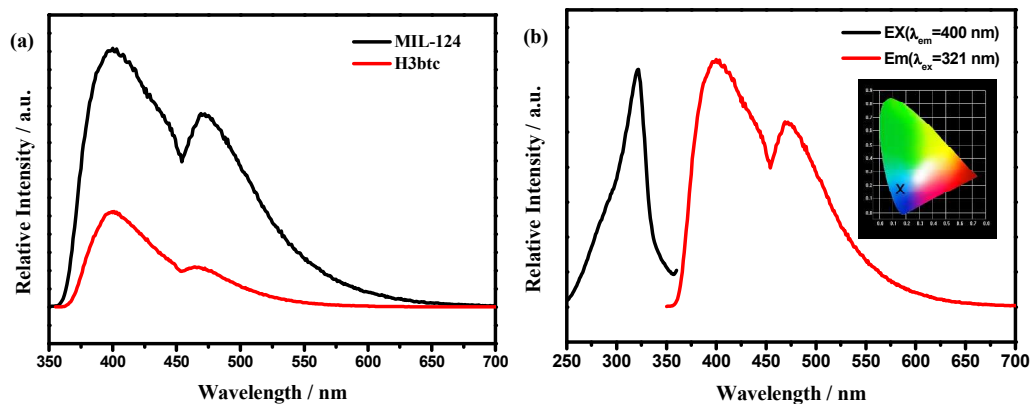
**Figure S2** Representation of the structure of MIL-124 viewed along c axis.



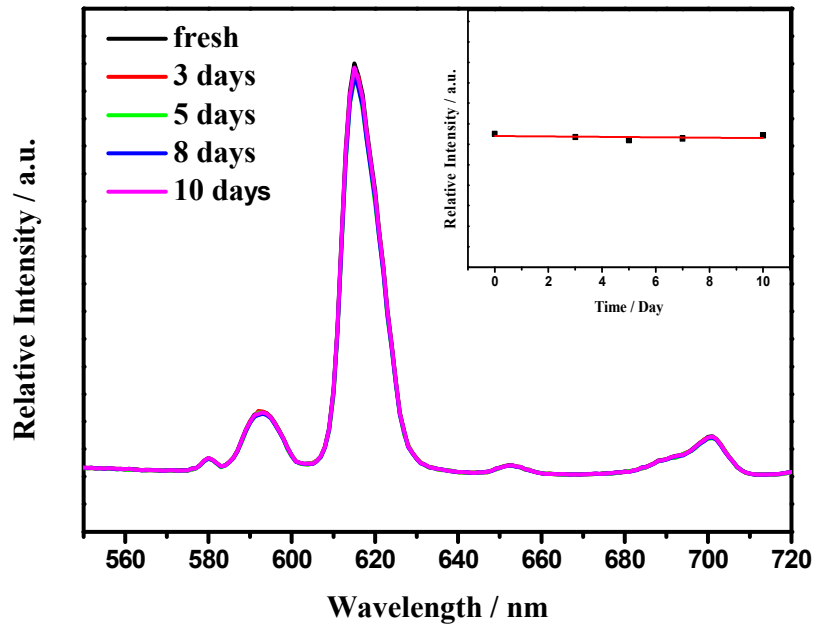
**Figure S3** FTIR spectra of MIL-124.



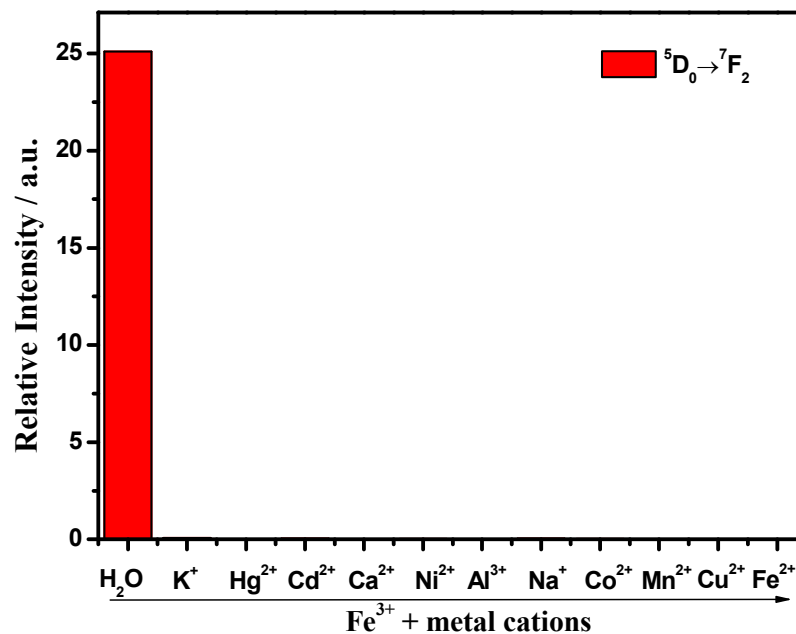
**Figure S4** UV-vis absorption spectra of suspended MIL-124 and Eu<sup>3+</sup>@MIL-124 in H<sub>2</sub>O solution.



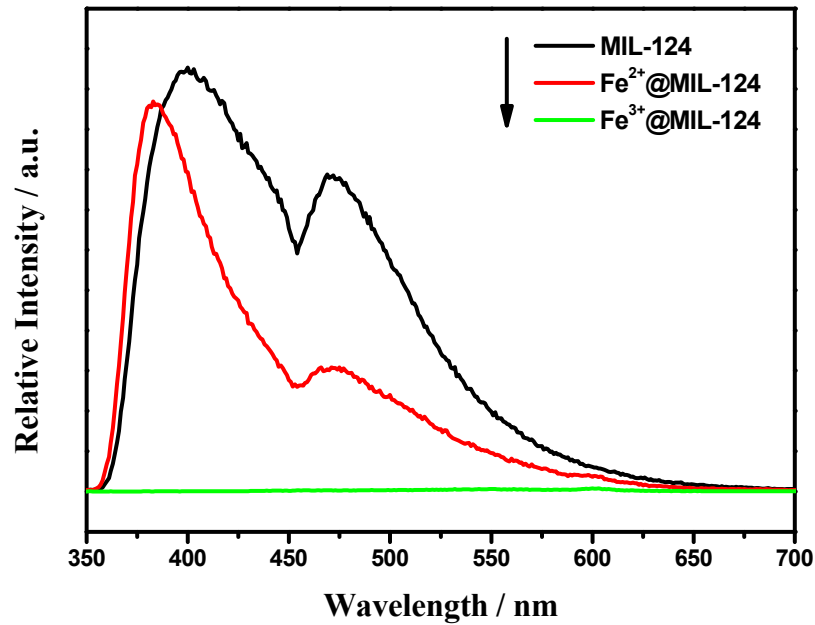
**Figure S5** The fluorescence emission spectra of H<sub>3</sub>btc and MIL-124 (a) and the excitation and emission spectra of MIL-124 (b).



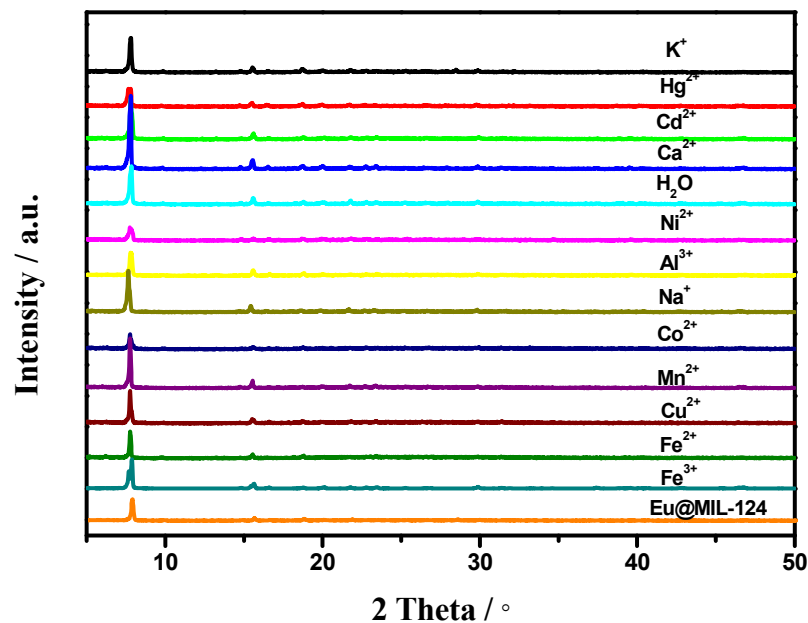
**Figure S6** Day-to-day fluorescence stability of Eu<sup>3+</sup>@MIL-124 under excitation at 298 nm.



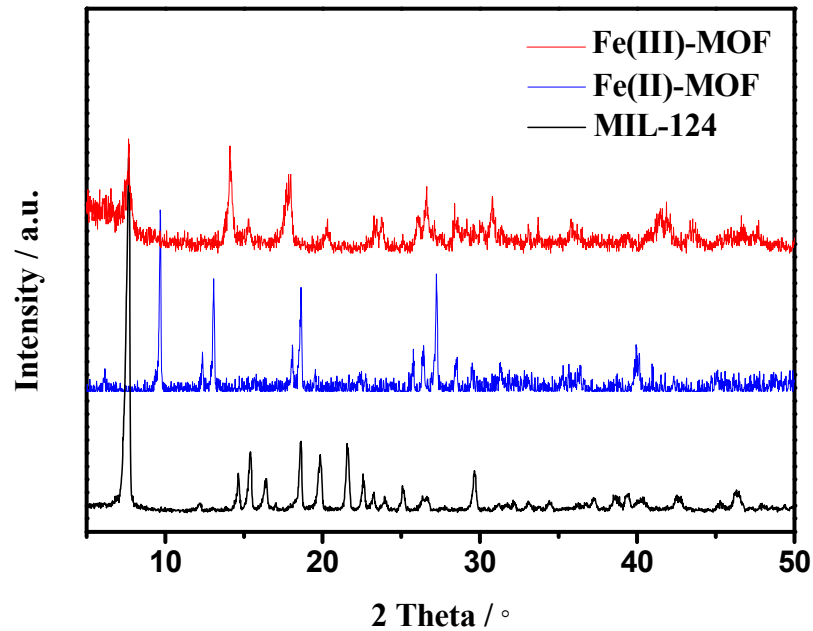
**Figure S7** Luminescence intensity of Eu<sup>3+</sup>@MIL-124 upon the addition of Fe<sup>3+</sup> in the presence of background of metal cations in aqueous solution ( $\lambda_{\text{ex}} = 298$  nm;  $\lambda_{\text{em}} = 615$  nm).



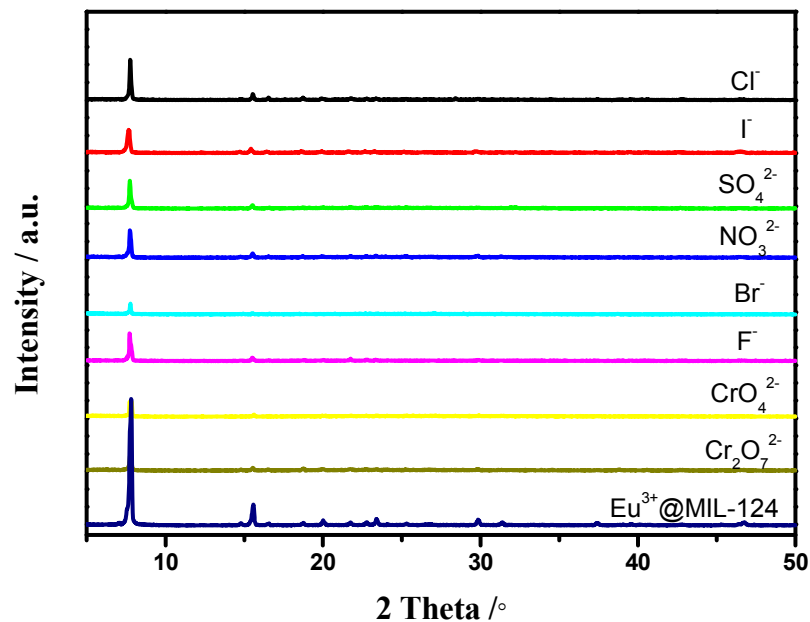
**Figure S8** Responses of the fluorescence of pure MOF towards aqueous solution of Fe<sup>3+</sup> and Fe<sup>2+</sup>.



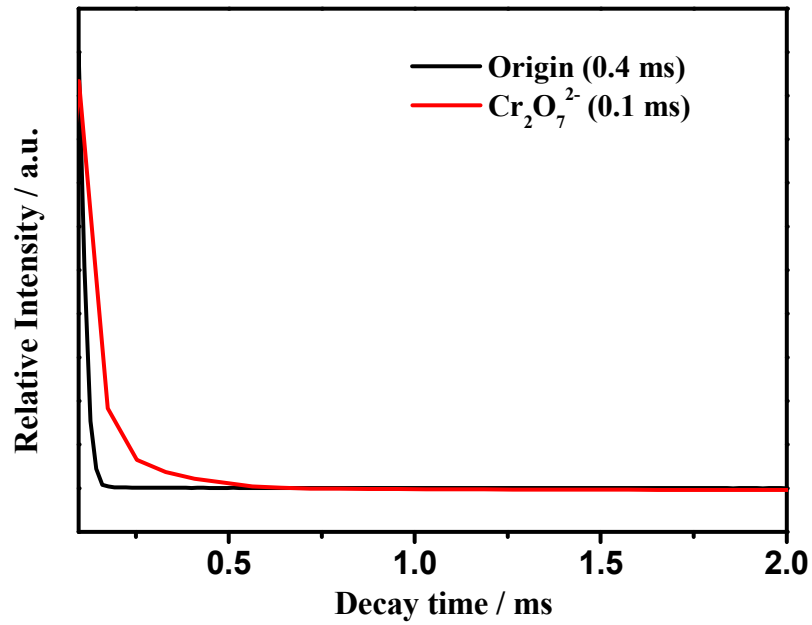
**Figure S9** PXRD patterns of the Eu<sup>3+</sup>@MIL-124 after immersing in aqueous solution with various metal ions.



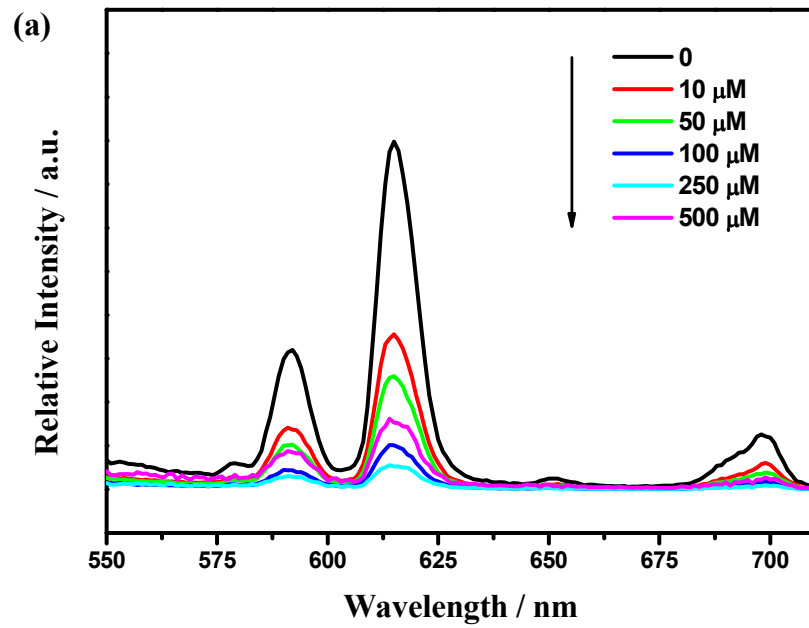
**Figure S10** PXRD patterns of synthesized Fe(III)-MOF and Fe(II)-MOF.

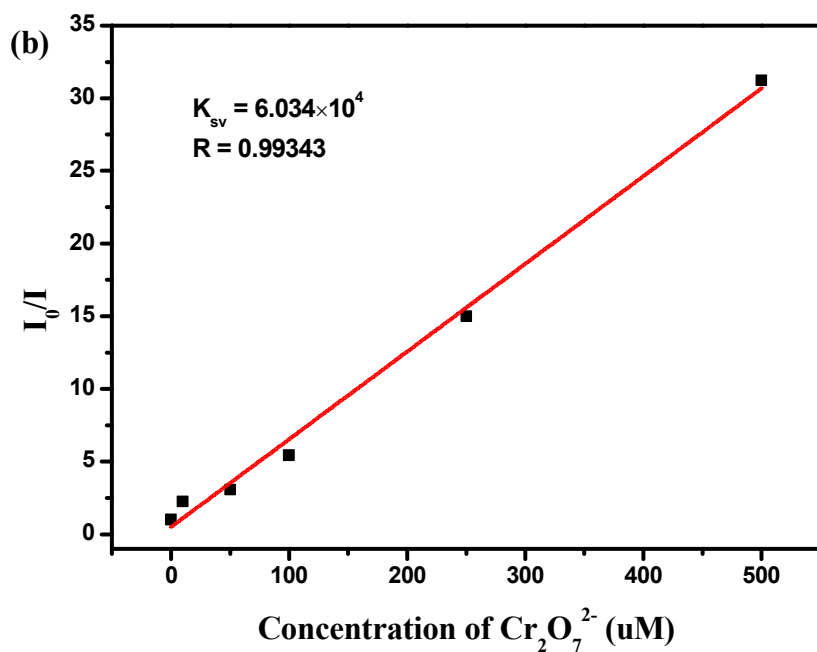


**Figure S11** PXRD patterns of the Eu<sup>3+</sup>@MIL-124 after immersing in aqueous solution with various anions.

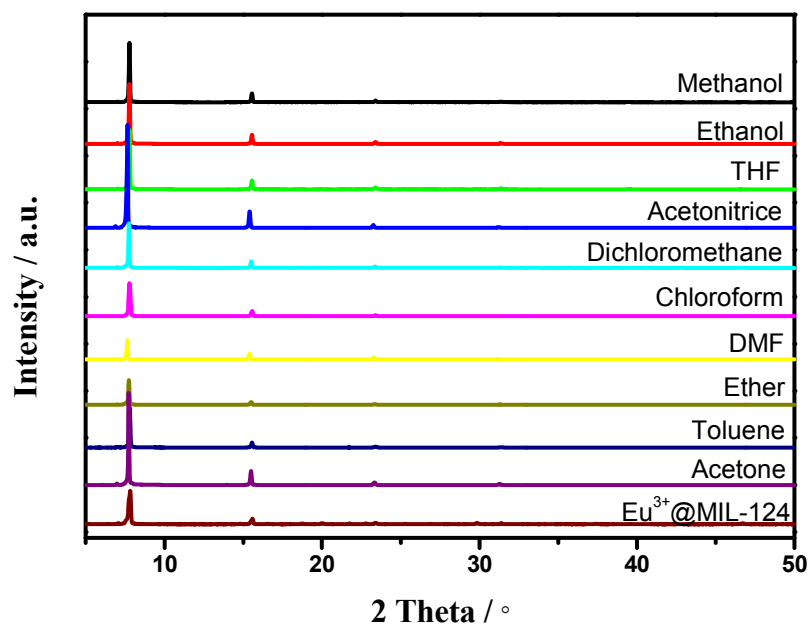


**Figure S12** Fluorescence lifetime of Eu<sup>3+</sup>@MIL-124 in the absence (red) and presence (black) of Cr<sub>2</sub>O<sub>7</sub><sup>2-</sup> in aqueous solution.

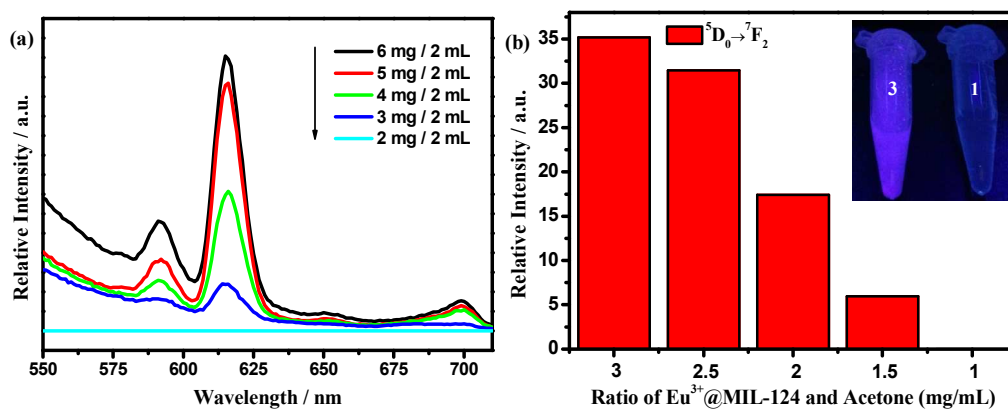




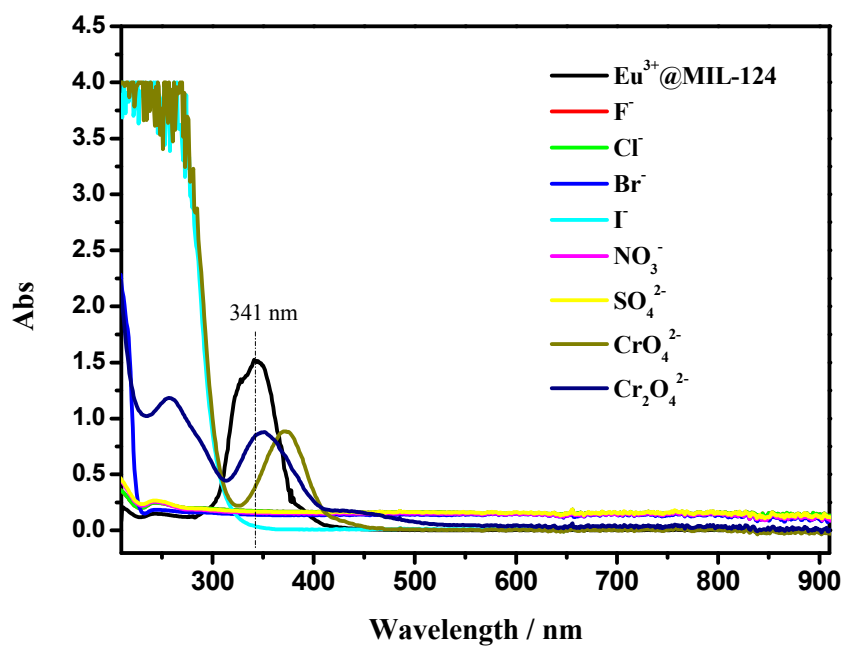
**Figure S13** Emission spectra (a) and Ksv curve (b) of  $\text{Eu}^{3+}$ @MIL-124 in aqueous solutions in the presence of various concentrations of  $\text{Cr}_2\text{O}_7^{2-}$  under excitation at 298 nm.



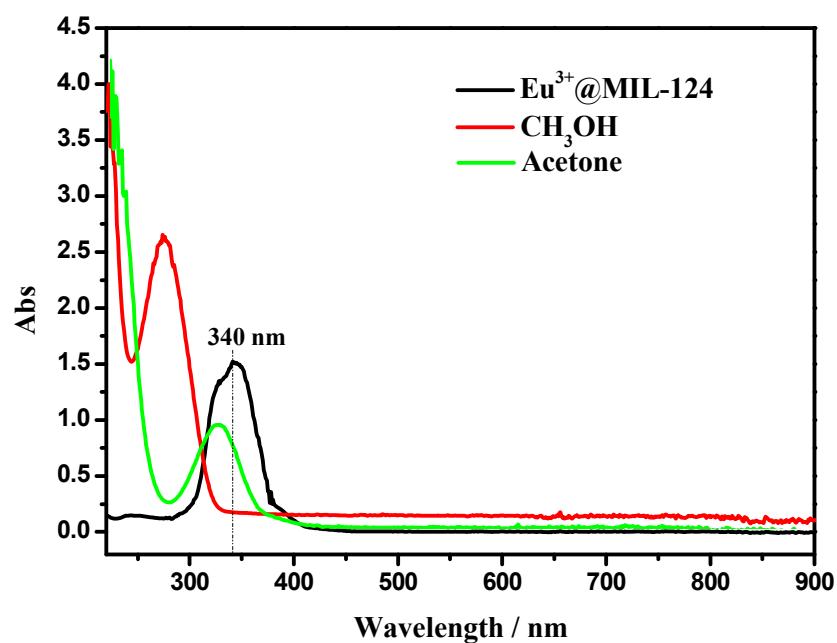
**Figure S14** PXRD patterns of the  $\text{Eu}^{3+}$ @MIL-124 after immersing in different organic small molecules.



**Figure S15** PL spectra (a) and luminescence intensity of the <sup>4</sup>D<sub>0</sub>-<sup>7</sup>F<sub>2</sub> of Eu<sup>3+</sup>@MIL-124(b) in the presence of various ratios of Eu<sup>3+</sup>@MIL-124 and acetone under excitation at 298 nm.



**Figure S16** Liquid UV-vis absorption of different anions.



**Figure S17** UV-visabsorption spectra of  $\text{Eu}^{3+}@\text{MIL-124}$  and target solvents ( $\text{CH}_3\text{OH}$  and acetone).

Table S1 The detailed ICP studies of MIL-124,  $\text{Eu}^{3+}@\text{MIL-124}$  and target metal ions ( $\text{K}^+$ ,  $\text{Co}^{2+}$ ,  $\text{Fe}^{2+}$  and  $\text{Fe}^{3+}$ )

| Samples                              | $\text{Ga}^{3+}$ (ppm) | $\text{Eu}^{3+}$ (ppm) | $\text{M}^{n+}$ (ppm) | $\text{Ga}^{3+}:\text{Eu}^{3+}:\text{M}^{n+}$ |
|--------------------------------------|------------------------|------------------------|-----------------------|-----------------------------------------------|
| MIL-124                              | 35.02                  | --                     | --                    | --                                            |
| $\text{Eu}^{3+}@\text{MIL-124}$ (1a) | 33.24                  | 0.56                   | --                    | --                                            |
| $\text{K}^+@1\text{a}$               | 32.45                  | 0.60                   | 0.23                  | 141:3:1                                       |
| $\text{Co}^{2+}@1\text{a}$           | 30.72                  | 0.23                   | 0.84                  | 134:1:4                                       |
| $\text{Fe}^{2+}@1\text{a}$           | 31.56                  | 0.07                   | 0.58                  | 451:1:8                                       |
| $\text{Fe}^{3+}@1\text{a}$           | 13.41                  | 0.04                   | 3.84                  | 335:1:96                                      |