Supporting Information

for

Metal-organic coordination polymers of Tb$_{2-x}$Eu$_x$(BDC)$_3$(H$_2$O)$_n$ with tunable fluorescence and smart response toward aldehydes ($0 \leq x \leq 2$, BDC=1,4-benzenedicarboxylate)

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1. Chemicals and Instrumentation

1.1 Chemicals. Tb(NO$_3$)$_3$·5H$_2$O and Eu(NO$_3$)$_3$·5H$_2$O were purchased from Aldrich. Na$_2$BDC (BDC=1,4-benzenedicarboxylate) was purchased from TCI Shanghai. Cetyltrimethyl ammonium bromide (CTAB) and acetaldehyde were purchased from Chengdu Kelong Chemical Reagent Company. Formaldehyde, propionaldehyde, methanol, ethanol, N,N-dimethylformamide, dimethyl sulfoxide, and tetrahydrofuran were all purchased from Chongqing Chuandong Chemical (Group) Co., Ltd. All chemicals were of analytical grade. Millipore purified water (18.2 MΩ) was used throughout.

1.2 Instrumentation. The fluorescence spectra were measured on a Hitachi F-2500 spectrophotometer (Tokyo, Japan). And the scanning electron microscope (SEM) images were observed with a Hitachi S-4800 scanning electron microscope (Tokyo, Japan). AL204 analytical balance was purchased from METTLER TOLEDO. H1650-W centrifuge was purchased from Xiangyi Centrifuge Instrument Co., Ltd. (Changsha, China). DZF-6020 vacuum drying box was purchased from Shanghai Qixin Scientific Instrument Co., Ltd. (Shanghai, China). KXH202-1AB constant temperature drying box was made by Shanghai science analysis test instrumentation factory and
Chengdu science analysis test set company. A QL-901 vortex mixer (Qilinbeier instrument manufacture Ltd., Haimen, China) was used to blend the solutions. Powder X-ray diffraction patterns were collected on an XD-3 X-ray diffractometer (Beijing, China).

2. Methods

2.1 Procedures for Fluorescence detection of aldehydes.

A certain amount of Ln₂(BDC)₃(H₂O)ₙ (Ln = Tb, Eu) was dispersed in doubly distilled water, named Solution A for further use. 50 µL Solution A and a certain volume of the aldehyde solution were mixed together. The mixture was then diluted to 500 µL with doubly distilled water and mixed thoroughly again. Afterwards, the mixture was transferred for fluorescence measurements.

2.2 Calibration of the concentration of aldehydes

2.2.1 Calibration of the concentration of formaldehyde

According to the method in the environmental protection standard HJ601-2011 of the People’s Republic of China for determination of formaldehyde in water, the concentration of formaldehyde used in this work was calibrated to 0.94 mol/L.

2.2.2 Calibration of the concentration of acetaldehyde

According to GBZ/T 160.54-2007, the concentration of acetaldehyde used in this work was calibrated to 0.905 mol/L.

3. Supporting figures

Fig. S1 SEM images of Eu₂(BDC)₃(H₂O)ₙ particles.
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Fig. S2 Powder X-ray diffraction pattern of the \( \text{Ln}_2(\text{BDC})_3(\text{H}_2\text{O})_n \) polymers (\( \text{Ln} = \text{Tb}, \text{Eu} \)).

![Graph showing powder X-ray diffraction pattern](image)

Fig. S3 The emission intensity of the \( \text{Eu}_2(\text{BDC})_3(\text{H}_2\text{O})_n \) polymers at 615 nm in the presence of a succession of organic reagents.

![Bar chart showing emission intensity](image)

Fig. S4 \( \text{Eu}_2(\text{BDC})_3(\text{H}_2\text{O})_n \) polymers redispersed in different analytes (excited at 254 nm and monitored at 615 nm).

From left to right were \( \text{HCHO}, \text{CH}_3\text{CHO}, \text{C}_2\text{H}_5\text{CHO}, \text{OHCC}_3\text{H}_6\text{CHO}, \text{H}_2\text{O}, \text{CH}_3\text{OH}, \text{C}_2\text{H}_5\text{OH}, \text{DMSO}, \) and \( \text{THF} \).
Fig. S5 The effects of formaldehyde on the fluorescence of Tb₂(BDC)₃(H₂O)ₙ. (a) The fluorescence spectral changes of Tb₂(BDC)₃(H₂O)ₙ in the presence of different amounts of formaldehyde; (b) The plot of the quenching degree of the fluorescence at 549 nm against the concentration of formaldehyde. λₑₓ = 254 nm, λₑₘ = 549 nm, c₉/formaldehyde from top to bottom, 0, 0.05, 0.1, 0.2, 0.3, 0.4, 0.5, 0.6, 0.7, 0.8 and 0.9 mol/L.

Fig. S6 The effects of acetaldehyde on the fluorescence of Tb₂(BDC)₃(H₂O)ₙ. (a) The fluorescence spectral changes of Tb₂(BDC)₃(H₂O)ₙ in the presence of different amounts of acetaldehyde; (b) The plot of the quenching degree of the fluorescence at 549 nm against the concentration of acetaldehyde. λₑₓ = 254 nm, λₑₘ = 549 nm, c₉/acetaldehyde from top to bottom, 0, 0.005, 0.008, 0.02, 0.04, 0.05, 0.08, 0.1, 0.3, 0.5 and 0.6 mol/L.
Fig. S7 The effects of propionaldehyde on the fluorescence of Tb₂(BDC)_3(H₂O)_n. (a) The fluorescence spectral changes of Tb₂(BDC)_3(H₂O)_n in the presence of different amounts of propionaldehyde; (b) The plot of the quenching degree of the fluorescence at 549 nm against the concentration of propionaldehyde. \( \lambda_{ex} = 254 \text{ nm, } \lambda_{em} = 549 \text{ nm,} \) propionaldehyde from top to bottom, 0, 0.0005, 0.001, 0.002, 0.005, 0.008, 0.02, 0.04, 0.05, 0.08, 0.1, 0.3, 0.5, 0.6 mol/L.