Multifunctional porous Tröger’s base polymer with tetrphenylethene unit: CO$_2$
adsorption, luminescence and sensing property
Yuanzheng Cui, Yuchuan Liu, Jiancong Liu, Jianfeng Du, Yue Yu, Shun Wang,
Zhiqiang Liang* and Jihong Yu*
State Key Lab of Inorganic Synthesis and Preparative Chemistry, Jilin University,
Changchun, 130012, P. R. China
E-mail: liangzq@jlu.edu.cn; jihong@jlu.edu.cn.
Fig. S1 Experimental powder X-ray diffraction PXRD pattern of LMOP-15

Fig. S2 TGA curve of LMOP-15 under N₂.
Fig. S3 SEM images of LMOP-15.

Fig. S4 Size distribution of LMOP-15 in EtOH (0.1 mg/mL) determined by DLS analysis.
Fig. S5 TEM images of LMOP-15.

Fig. S6 Pore size distribution of LMOP-15.
Heat of CO₂ Adsorption Calculation

The isosteric heats (Qₘₑₜ) of adsorption for LMOP-15 were calculated by fitting the CO₂ adsorption isotherms measured at 273 K, 283 K and 298 K to the Virial equation.

\[
\ln P = \ln N + \frac{1}{T} \sum_{i=0}^{m} a_i N_i + \sum_{i=0}^{n} b_j N_i
\]

\[
Q_{st} = - R \sum_{i=0}^{m} a_i N_i
\]

- \(N\): adsorbed volume (cm³/g);
- \(P\): pressure (mmHg);
- \(T\): temperature (K);
- \(a_i, b_j\): constants;
- \(R\): 8.314 J·mol⁻¹·K⁻¹

![Fig. S7 Virial fitting for CO₂ isotherms of LMOP-15.](image-url)
Fig. S8 The isosteric heat of adsorption for LMOP-15.

Fig. S9 Nitrogen adsorption isotherm at 273 K of LMOP-15.
**Fig. S10** CO$_2$/N$_2$ selectivity for LMOP-15 at 273 K calculated using the Henry’s Law constants in the linear low pressure range.

![CO$_2$ and N$_2$ adsorption data](image)

- CO$_2$: $y = 0.13084 + 0.27946x$
  - $R^2 = 0.99567$
- N$_2$: $y = 0.03112 + 0.00453x$
  - $R^2 = 0.99305$

**Fig. S11** Luminescent spectra of LMOP-15 ($\lambda_{ex} = 380$ nm) in solid state, as well as LMOP-15 dispersed in ethanol (0.1 mg/mL). The photographs were taken under visible light and UV light illumination (365 nm).

![Luminescent spectra](image)
Fig. S12 Luminescent spectra of LMOP-15 ($\lambda_{ex} = 380$ nm) in different solvents (0.1 mg/mL).
Fig. S13 Fluorescent titrations of LMOP-15 dispersed in ethanol solution (0.1 mg/mL) with the addition of different metal ions in ethanol with a concentration of 5.9 μM (λ<sub>ex</sub> = 380 nm). The slit width for excitation and emission is 2.5 nm and 2.5 nm, respectively.
Fluorescent titrations of LMOP-15 dispersed in ethanol solution (0.1 mg/mL) with the addition of NACs in ethanol with a concentration of 47.62 μM ($\lambda_{ex} = 380$ nm). The slit width for excitation and emission is 2.5 nm and 2.5 nm, respectively.

Fig. S14 Fluorescent titrations of LMOP-15 dispersed in ethanol solution (0.1 mg/mL) with the addition of NACs in ethanol with a concentration of 47.62 μM ($\lambda_{ex} = 380$ nm). The slit width for excitation and emission is 2.5 nm and 2.5 nm, respectively.
**Fig. S15** The quenching and recovery test of LMOP-15 dispersed in ethanol in the presence of Cu$^{2+}$ solution (13.6 μM).

**Fig. S16** The quenching and recovery test of LMOP-15 dispersed in ethanol in the presence of PA solution (90.9 μM).
Fig. S17 $^1$H and $^{13}$C NMR spectra of 1,1,2,2-tetrakis(4-nitrophenyl)ethene (TNPE).
Fig. S18 $^1$H and $^{13}$C NMR spectra of 1,1,2,2-tetrakis(4-aminophenyl)ethene (TAPE).
Table S1 Elemental analysis of LMOP-15.

<table>
<thead>
<tr>
<th>Element</th>
<th>LMOP-15</th>
<th>Calculated</th>
</tr>
</thead>
<tbody>
<tr>
<td>C [%]</td>
<td>78.57</td>
<td>81.79</td>
</tr>
<tr>
<td>H [%]</td>
<td>5.79</td>
<td>5.49</td>
</tr>
<tr>
<td>N [%]</td>
<td>10.53</td>
<td>12.72</td>
</tr>
</tbody>
</table>

Limit of detection (LOD) Calculation

Limit of detection of was determined according to the following definitions:

\[ S_b = \sqrt{\frac{\sum_{i=1}^{n} (x_i - \bar{x})^2}{n - 1}} \]  

(1)

\[ S = \frac{\Delta l}{\Delta c} \]  

(2)

\[ LOD = \frac{3S_b}{S} \]  

(3)

Firstly, the standard deviation \( S_b \) was calculated by measuring the fluorescence intensity of LMOP-15 in ethanol for 11 times and then got the average intensity \( \bar{x} \). By fitting the data into equation (1), the value of standard deviation \( S_b \) was obtained. Secondly, a certain amount of picric acid was added into the solvent and the resulting variation of the intensity \( \Delta l \) was recorded. By fitting the data into equation (2), where \( \Delta l \) is the variation of intensity, and \( \Delta c \) is the variation of quencher concentration, the value of precision \( S \) was calculated. Finally the LOD was calculated according to Function (3). The LODs of LMOP-15 for Cu\(^{2+}\) and PA are 5.1 \times 10^{-8} M and 3.3 \times 10^{-7} M, respectively.