Supporting Information

Aggregation-induced Emission Enhancement of Gold Nanoclusters in Metal–organic Frameworks for Highly Sensitive Fluorescent Detection of Bilirubin

Mengfan Xia\textsuperscript{a,b}, Yucun Sui\textsuperscript{a,b}, Ying Guo\textsuperscript{a,b}, Yaodong Zhang\textsuperscript{a,b,*}

\textsuperscript{a}Key Laboratory of Applied Surface and Colloid Chemistry of Ministry of Education, \textsuperscript{b}Key Laboratory of Analytical Chemistry for Life Science of Shaanxi Province, School of Chemistry and Chemical Engineering, Shaanxi Normal University, Xi’an 710062, PR China.

* Corresponding author.

E-mail: ydzhang@snnu.edu.cn; Fax: +86-29-81530727; Tel: +86-29-81530726

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**Section S1.** Characterization of ZIF-8 and AuNCs@ZIF-8

Figure S1. SEM images of ZIF-8(A), AuNCs@ZIF-8(B) and AuNCs@ZIF-8 after adding BR(C,D)

Figure S2. TEM images of ZIF-8(A,B) and AuNCs@ZIF-8(C,D,E,F)
Figure S3. FTIR spectra for ZIF-8(a) and AuNCs@ZIF-8(b) (The peak at 422 cm$^{-1}$ is attributed to the Zn-N stretching vibration. The bands in the spectral region of 500–1350 cm$^{-1}$ (994 cm$^{-1}$, 1145 cm$^{-1}$ and 1308 cm$^{-1}$) are assigned as the plane bending and stretching of imidazole ring, respectively. The C=N stretch mode which is expected at 1459 cm$^{-1}$ and 1581 cm$^{-1}$. The absorption peaks at 2924 cm$^{-1}$ and 3129 cm$^{-1}$ are due to the N-H and C-H stretching vibrations, respectively.)

Figure S4. Zeta potential for ZIF-8, AuNCs and AuNCs@ZIF-8

Figure S5. TGA curve of ZIF-8(a) and AuNCs@ZIF-8(b)
Figure S6. (A) UV–vis absorption spectra of ZIF-8(a), AuNCs (b), and AuNCs@ZIF-8 (c). The inset shows the photographs of ZIF-8(a), AuNCs (b), and AuNCs@ZIF-8 (c) under daylight. (B) Fluorescence intensity variation in AuNCs@ZIF-8 for 120 min.

Figure S7. XPS spectrum of Au NCs (A) and AuNCs@ZIF-8 (B)

Section S2. Response time of AuNCs@ZIF-8 to BR

Figure S8. Time-dependent fluorescence emission intensity of AuNCs@ZIF-8 upon the addition of bilirubin (6 μM)

Section S3. Possible mechanism of AuNCs@ZIF-8 for sensing BR
Figure S9. Fluorescence emission spectra of Zn\(^{2+}\) (10 \(\mu\)M, A) or Zn\(^{2+}\) (100 \(\mu\)M, B) with different concentrations of BR. (C) Fluorescence emission intensity (660 nm) of different concentrations of Zn\(^{2+}\) with different concentrations of BR.

Figure S10. (A) UV–vis absorption spectra of BR (2 \(\mu\)M, a) with Zn\(^{2+}\) (50 \(\mu\)M, b) or AuNCs@ZIF-8 (0.06 mg/mL, c) after centrifugation (inset: magnified view between 500–700 nm). (B) UV–vis absorption spectra of BR (10 \(\mu\)M, a) with Zn\(^{2+}\) (50 \(\mu\)M, b) or AuNCs@ZIF-8 (0.06 mg/mL, c) after centrifugation (inset: magnified view between 500–700 nm)

Figure S11. Emission spectra of Au NCs containing different concentrations of BR.
**Section S4.** Comparison of the performance of methods for detection of BR

**Table S1.** Comparison of the performance of methods for detection of BR

<table>
<thead>
<tr>
<th>Materials</th>
<th>Principle</th>
<th>Linear Range</th>
<th>LOD</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>HAS-AuNCs</td>
<td>Interaction between BR and HSA</td>
<td>1-50 μM</td>
<td>0.248 μM</td>
<td>3</td>
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<tr>
<td>HSA–CuNCs</td>
<td>Binding attraction between BR and HAS-CuNCs</td>
<td>1.25-7.50 μM</td>
<td>0.035 μM</td>
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<tr>
<td>BSA-Cu Nanoclusters</td>
<td>Fluorescence regain by the addition of BR to Fe^{3+} + BSA-CuNCs</td>
<td>0.1 pM-0.1μM</td>
<td>6.62 nM</td>
<td>5</td>
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<tr>
<td>Mn:ZnS QDs</td>
<td>PET*</td>
<td>10.99-63.84 μM</td>
<td>1.8 μM</td>
<td>6</td>
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<tr>
<td>MoS$_2$ QDs</td>
<td>FRET* and IIF*</td>
<td>0.5-10 μM</td>
<td>2.1 nM</td>
<td>7</td>
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<tr>
<td>UiO-66(COOH)$_2$:Eu</td>
<td>FRET</td>
<td>0-15 μM</td>
<td>0.45 μM</td>
<td>8</td>
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<tr>
<td>Eu-MOFs</td>
<td>PET and IIF</td>
<td>0-56.6 μM</td>
<td>1.75 μM</td>
<td>9</td>
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<tr>
<td>Eu(tta)$_3$</td>
<td>Special σ-hole bonding between Htta and BR</td>
<td>0-50 μM</td>
<td>0.068 μM</td>
<td>10</td>
</tr>
<tr>
<td>AuNCs@ZIF-8</td>
<td>AIEE*</td>
<td>0.1-5 μM</td>
<td>0.07 μM</td>
<td>This work</td>
</tr>
</tbody>
</table>

(PET*: Photoinduced Electron Transfer. FRET*: Fluorescent Resonant Energy Transfer. IIF*: Inner Filter Effect. AIEE*: Aggregation-induced Emission Enhancement)
References


2 S. Chao, X. Li, Y. Li, Y. Wang and C. Wang, J. Colloid Interface Sci., 2019, 552, 506-516.


