Supporting information for

**FRET-based colorimetric and ratiometric fluorescent probe for Cu\(^{2+}\) with a new trimethylindolin fluorophore**

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**Table S1** Comparison of the recently reported probes for the detection of Cu²⁺.
**Fig. S1** The overlap (shown with oblique stripes) between emission of the donor and absorption spectra of the acceptor, respectively.

**Fig. S2** Absorbance plot of RhF against Cu$^{2+}$ concentration from 0 to 120 µM.
Fig. S3 Bensei-Hildebrand plot of RhF-Cu$^{2+}$ complex obtained from the UV-Vis absorption (absorbance calculated from 555 nm) studies.

Fig. S4 Changes of the fluorescence spectra of RhF (10 μM) observed upon addition of various metal ions in a CH$_3$CN/aqueous HEPES buffer (10 mM, pH 7.3; 4:1, v/v).

Fig. S5 Calculations for FRET efficiency:

Energy transfer efficiency ($\Phi_{\text{ET}}$) was evaluated through the following equation: $^{1-4}$

$$
\Phi_{\text{ET}} = 1 - \frac{F'_{D}}{F_D}
$$

where F'$_D$ and F$_D$ denote the donor fluorescence intensity with and without an acceptor respectively in the presence of Cu$^{2+}$ ions.

Fig. S6 Fluorescence titration spectra of RhF (10 μM) in the presence of different concentrations of Cu$^{2+}$ (0-50μM). λ$_{ex}$ = 345 nm.
**Fig. S7** The plot of the emission intensity ratios of RhF at 1582/1503 against Cu$^{2+}$ (88-140µM).

**Fig. S8** Effect of pH on probe for the detection of Cu$^{2+}$ (based on absorbance data).

**Fig. S9** The changes of fluorescence intensity at 503 nm of probe RhF exposed to light for a long time.
Fig. S10 Job’s plot of probe RhF with Cu\(^{2+}\) in a CH\(_3\)CN/aqueous HEPES buffer (10 mM, pH=7.3; 4:1 v/v). Where Xn is the mole fraction of RhF and △Ι is the change (Ι-I\(_0\)) in the absorbance in presence of Cu\(^{2+}\). The total concentration of RhF and Cu\(^{2+}\) was 20μM.

Fig. S11 ESI-MS spectrum of probe RhF-Cu\(^{2+}\) complex.

Fig.S12 \(^1\)H NMR spectra of RhF-Cu\(^{2+}\) (a) in DMSO-\(d_6\) with D\(_2\)O and RhF (b) in DMSO-\(d_6\).
Fig. S13. XPS of as prepared samples: (A) survey spectra of RhF-Cu$^{2+}$ complex; (B) Cu 2p of RhF-Cu$^{2+}$ complex.

Fig. S14 IR spectral data of RhF and RhF-Cu$^{2+}$ complex.

Fig. S15 Effect of water content on probe for the detection of Cu$^{2+}$. 
Fig. S16 ESI-MS spectrum of probe RhF.

Fig. S17 $^1$H NMR Spectrum of probe RhF.

Fig. S18 $^{13}$C NMR Spectrum of probe RhF.
Table S1 Comparison of the recently reported probes for the detection of Cu^{2+}.

<table>
<thead>
<tr>
<th>Probes</th>
<th>$\lambda_{ex}/\lambda_{em}$ (nm)</th>
<th>Detection Limit (µM)</th>
<th>Working system</th>
<th>Operation mode</th>
<th>Analytical application: test strips</th>
<th>Ref.</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1" alt="Probe 1" /></td>
<td>455/519</td>
<td>0.15</td>
<td>CH$_3$CN-H$_2$O (70:30, v/v, MOPS, 10 mM, pH = 7.0)</td>
<td>Turn-ON</td>
<td>NO</td>
<td>[5]</td>
</tr>
<tr>
<td><img src="image2" alt="Probe 2" /></td>
<td>290/355, 470</td>
<td>0.46</td>
<td>CH$_3$CN-H$_2$O (3:2, v/v, 10 mM Tris-HCl)</td>
<td>Turn-OFF</td>
<td>NO</td>
<td>[6]</td>
</tr>
<tr>
<td><img src="image3" alt=" Probe 3" /></td>
<td>295/365</td>
<td>0.2</td>
<td>CH$_3$CN-H$_2$O (2:3, v/v)</td>
<td>Turn-ON</td>
<td>NO</td>
<td>[7]</td>
</tr>
<tr>
<td><img src="image4" alt=" Probe 4" /></td>
<td>376/439</td>
<td>14.5</td>
<td>CH$_3$CN</td>
<td>Turn-ON</td>
<td>NO</td>
<td>[8]</td>
</tr>
<tr>
<td><img src="image5" alt=" Probe 5" /></td>
<td>437/637</td>
<td>1.568</td>
<td>CH$_3$CN</td>
<td>Turn-ON</td>
<td>NO</td>
<td>[9]</td>
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<tr>
<td><img src="image6" alt=" Probe 6" /></td>
<td>None</td>
<td>0.29</td>
<td>CH$_3$CN</td>
<td>Turn-ON</td>
<td>NO</td>
<td>[10]</td>
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<tr>
<td><img src="image7" alt=" Probe 7" /></td>
<td>435/532</td>
<td>0.052</td>
<td>CH$_3$CN-H$_2$O (20:80, v/v, pH=7.4)</td>
<td>Turn-ON</td>
<td>NO</td>
<td>[11]</td>
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<tr>
<td><img src="image8" alt=" Probe 8" /></td>
<td>419/524</td>
<td>13.05</td>
<td>CH$_3$CN-H$_2$O (99:1, v/v)</td>
<td>Turn-ON</td>
<td>NO</td>
<td>[12]</td>
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<tr>
<td><img src="image9" alt=" Probe 9" /></td>
<td>420/540, 568</td>
<td>0.12</td>
<td>CH$_3$CN–HEPES (1 : 1, v/v, 20 mM, pH=7.4)</td>
<td>Turn-ON</td>
<td>No</td>
<td>[13]</td>
</tr>
<tr>
<td><img src="image10" alt=" Probe 10" /></td>
<td>345/503, 582</td>
<td>0.01168</td>
<td>CH$_3$CN-aqueous HEPES buffer (4:1, v/v, 10 mM, PH=7.3)</td>
<td>Turn-ON</td>
<td>YES</td>
<td>This work</td>
</tr>
</tbody>
</table>
References


