Electronic Supplementary Information

for

Organic photoredox catalyzed C–H silylation of quinoxalinones or electron-deficient heteroarenes under ambient air conditions

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1 General information

All reagents were obtained from commercial suppliers and used without further purification. Reactions were monitored by thin layer chromatography. Column chromatography was performed using silica gel (300−400 mesh). The NMR spectra were recorded on a Bruker Avance 400 spectrometer at 400 MHz (1H) and 100 MHz (13C) in CDCl₃ or DMSO-d₆ using tetramethylsilane as the internal standard. The following abbreviations were used to explain the multiplicities: s = singlet, d = doublet, dd = doublet of doublet, t = triplet, m = multiplet, q = quartet. High-resolution mass spectra were obtained with an AB Triple 5600 mass spectrometer by ESI on a TOF mass analyzer. Melting points are uncorrected.

2. Reaction optimization

Table S1 Optimization of the reaction conditions

<table>
<thead>
<tr>
<th>Entry</th>
<th>Photocatalyst</th>
<th>Base (equiv.)</th>
<th>Solvent</th>
<th>Yield (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Ir[dpF(CF₃)ppy]₂(dtbbpy)PF₆</td>
<td>K₂CO₃ (1)</td>
<td>DMSO</td>
<td>&lt;10</td>
</tr>
<tr>
<td>2</td>
<td>Ir[dpF(CF₃)ppy]₂(dtbbpy)PF₆</td>
<td>K₂CO₃ (1)</td>
<td>DMF</td>
<td>trace</td>
</tr>
<tr>
<td>3</td>
<td>Ir[dpF(CF₃)ppy]₂(dtbbpy)PF₆</td>
<td>K₂CO₃ (1)</td>
<td>tBuOH</td>
<td>0</td>
</tr>
<tr>
<td>4</td>
<td>Ir[dpF(CF₃)ppy]₂(dtbbpy)PF₆</td>
<td>K₂CO₃ (1)</td>
<td>THF</td>
<td>trace</td>
</tr>
<tr>
<td>5</td>
<td>Ir[dpF(CF₃)ppy]₂(dtbbpy)PF₆</td>
<td>K₂CO₃ (1)</td>
<td>DCM</td>
<td>0</td>
</tr>
<tr>
<td>6</td>
<td>Ir[dpF(CF₃)ppy]₂(dtbbpy)PF₆</td>
<td>K₂CO₃ (1)</td>
<td>1,4-dioxene</td>
<td>0</td>
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<tr>
<td>7</td>
<td>Ir[dpF(CF₃)ppy]₂(dtbbpy)PF₆</td>
<td>K₂CO₃ (1)</td>
<td>DCE</td>
<td>trace</td>
</tr>
<tr>
<td>8</td>
<td>Ir[dpF(CF₃)ppy]₂(dtbbpy)PF₆</td>
<td>K₂CO₃ (1)</td>
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<td>25</td>
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<tr>
<td>9</td>
<td>Ir[dpF(CF₃)ppy]₂(dtbbpy)PF₆</td>
<td>K₂CO₃ (1)</td>
<td>CH₃CN</td>
<td>31</td>
</tr>
<tr>
<td>10</td>
<td>Ir(ppy)₂(dtbbpy)PF₆</td>
<td>K₂CO₃ (1)</td>
<td>CH₃CN</td>
<td>0</td>
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<tr>
<td>11</td>
<td>4CzIPN</td>
<td>K₂CO₃ (1)</td>
<td>CH₃CN</td>
<td>47</td>
</tr>
</tbody>
</table>
3 Experimental procedures

3.1 General procedure for the preparation of 3, 5 and 6

To a tube were added quinoxalin-2(1H)-ones 1 (0.2 mmol, 1.0 equiv.), silanes (1.0 mmol, 5.0 equiv), 4CzIPN (4.0 mg, 0.005 mmol, 2.5 mol%), quinuclidine (9.1 mg, 0.08 mmol, 40 mol%), pyridine (32 μL, 0.4 mmol, 2.0 equiv.) and DMSO/CH$_3$CN (3:1, 4 mL). The reaction mixture was stirred under irradiation (12 W blue LEDs) at room temperature in the presence of open air for 24 h. The resulting solution was diluted with brine (20 mL) and extracted with EtOAc (3 × 15 mL). The combined organic layers were dried over Na$_2$SO$_4$ and concentrated in vacuum. The resulting residue was purified by silica gel column chromatography with petroleum ether/ethyl acetate as eluent to afford the desired products 3, 5 or 6.

3.2 Gram-scale synthesis of 3a

Reactions conditions: 1a (0.2 mmol, 1.0 equiv.), 2a (1.0 mmol, 5.0 equiv.), photocatalyst (2.5 mol%), HAT catalyst (40 mol%), base and solvent (4 mL) were stirred under irradiation (12 W blue LEDs) at room temperature under open air, 24 h. Isolated yield based on 1a. Triisopropylsilylthiol (B) was used as the HAT catalyst. HAT catalyst A (20 mol%). HAT catalyst A (30 mol%). Under light. Under Ar (1 atm). Without light. Under Ar (1 atm). Without light.
To a tube were added 1-methylquinoxalin-2(1H)-one (0.96 g, 6.0 mmol, 1.0 equiv), tert-butylidemethylsilane (4.95 mL, 30.0 mmol, 5.0 equiv), 4CzIPN (118.3 mg, 0.15 mmol, 2.5 mol%), quinuclidine (266.7 mg, 2.4 mmol, 40 mol%), pyridine (384 μL, 12 mmol, 2.0 equiv) and CH₃CN (30 mL). The reaction mixture was stirred under irradiation (2 × 30 W blue LEDs) at room temperature in the presence of open air for 60 h. The resulting solution was diluted with brine (50 mL) and extracted with EtOAc (3 × 50 mL). The combined organic layers were dried over Na₂SO₄ and concentrated in vacuum, and the resulting residue was purified by silica gel column chromatography with petroleum ether/ethyl acetate as eluent to afford the desired product 3a (1.04 g, 63%).

3.3 General procedure for the preparation of 7

A mixture of 1-methylquinoxalin-2(1H)-one 3a (64.0 mg, 0.4 mmol, 1.0 equiv.), PhI(OAc)₂ (193.3 mg, 0.6 mmol, 1.5 equiv.), and Pd(OAc)₂ (4.5 mg, 0.02 mmol, 5 mol%) in AcOH (1.0 mL) was stirred at 100 °C for 24 h, followed by the addition of water (1 mL) and heating at 100 °C for another 24 h. After cooling to room temperature, the reaction mixture was poured into aqueous NaHCO₃ solution (20 mL) and extract with CH₂Cl₂ (3 × 20 mL). The combined organic layers were dried over anhydrous Na₂SO₄, and concentrated under a reduced pressure. The residue was purified by column chromatography on silica gel with methane dichloride/ethyl acetate (1:1) as eluent to afford the product 7 (37.0 mg, 53% yield, yellow solid).
4 Failed substrates

Some substrates did not yield desired products under standard reaction conditions.

Failed examples

1. heteroarenes

2. silanes

To a tube were added 3-methyl-1H-indole (26.4 mg, 0.2 mmol, 1.0 equiv.), 2a (165 μL, 1.0 mmol, 5.0 equiv.), 4CzIPN (3.94 mg, 0.005 mmol, 2.5 mol%), quinuclidine (9.1 mg, 0.08 mmol, 40 mol%), pyridine (32 μL, 0.4 mmol, 2.0 equiv.) and DMSO/CH$_3$CN (3:1, 4 mL). The reaction mixture was stirred under irradiation (12 W blue LEDs) at room temperature in the presence of open air for 24 h. After the reaction was stopped, no desired product was detected. The byproduct N-(2-acetylphenyl)formamide (9) was obtained in 64% yield.

To a tube were added 1a (32.0 mg, 0.2 mmol, 1.0 equiv.), triphenylsilane (260.4 mg, 1.0 mmol, 5.0 equiv.), 4CzIPN (3.94 mg, 0.005 mmol, 2.5 mol%), quinuclidine (9.1 mg, 0.08 mmol, 40 mol%), pyridine (32 μL, 0.4 mmol, 2.0 equiv.) and DMSO/CH$_3$CN (3:1, 4 mL). The reaction mixture was stirred under irradiation (12 W blue LEDs) at room temperature in the presence of open air for 24 h. After the reaction was stopped, no desired product was detected. The byproduct N-(2-acetylphenyl)formamide (9) was obtained in 64% yield.
open air for 24 h. After the reaction was stopped, no desired product was detected. The byproduct triphenylsilanol (10) was obtained in 71% yield (isolated yield based on triphenylsilane). Meanwhile, the byproduct 10 was observed through the GC-MS analysis from the reaction solution (Figure S1).

**Figure S1** GC-MS analysis of the byproduct 10.

### 5 Mechanistic studies

#### 5.1 The LC-MS study of byproducts in the model reaction

The model reaction solution was directly used for LC-MS analysis. The formation of tert-butyldimethylsilanol and 1,2-di-tert-butyl-1,1,2,2-tetramethyldisilane were observed by LC-MS, which indicated that tert-butyldimethylsilyl radical was formed in this process.

**Figure S2** LC-MS analysis of the model reaction.

<table>
<thead>
<tr>
<th>4CzIPN</th>
<th>Quinuclidine (HAT)-quencher</th>
<th>Ratio (4CzIPN :Quinuclidine)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.00001 M</td>
<td>0.001 M</td>
<td>1:100</td>
</tr>
<tr>
<td>0.00001 M</td>
<td>0.002 M</td>
<td>1:200</td>
</tr>
</tbody>
</table>

#### 5.2 Stern–Volmer quenching experiments

Ex: 363 nm, Em: 430 nm–710 nm, PMT voltage: 750 V. Fluorescence studies were operated on an F-7100 fluorescence spectrophotometer (Hitachi).
5.3 The radical quenching and trapping experiments
To a tube were added 1a (32.0 mg, 0.2 mmol, 1.0 equiv.), 2a (165 μL, 1.0 mmol, 5.0 equiv.), 4CzIPN (3.94 mg, 0.005 mmol, 2.5 mol%), quinuclidine (9.1 mg, 0.08 mmol, 40 mol%), pyridine (32 μL, 0.4 mmol, 2.0 equiv.), TEMPO (94.5 mg, 0.6 mmol, 3.0 equiv.) and DMSO/CH$_3$CN (3:1, 4 mL). The reaction mixture was stirred under irradiation (12 W blue LED) at room temperature in the presence of open air for 24 h. After the reaction was stopped, no desired product 3a was detected by TLC and LC-MS, indicating that the reaction was completely inhibited. Meanwhile, a trapping product 8 was observed through the LC-MS analysis from the reaction solution (Figure S5).

![Figure S5 LC-MS analysis of the radical-trapping product 8.](image)

To a tube were added 1a (32.0 mg, 0.2 mmol, 1.0 equiv.), 2a (165 μL, 1.0 mmol, 5.0 equiv.), 4CzIPN (3.94 mg, 0.005 mmol, 2.5 mol%), quinuclidine (9.1 mg, 0.08 mmol, 40 mol%), pyridine (32 μL, 0.4 mmol, 2.0 equiv.), 1,1-diphenylethylene (106 μL, 0.6 mmol, 3.0 equiv.) and DMSO/CH$_3$CN (3:1, 4 mL). The reaction mixture was stirred under irradiation (12 W blue LED) at room temperature in the presence of open air for 24 h. The reaction was completely inhibited, indicating that a radical process might be involved in the catalytic cycle.

### 5.4 Kinetic isotope effect experiment
Triisopropylsilane-\textit{d} was prepared according to the procedures of literature.\textsuperscript{1} To a tube were added 1a (32.0 mg, 0.2 mmol, 1.0 equiv.), triisopropylsilane or triisopropylsilane-\textit{d} (410 \textmu L, 2.0 mmol, 10.0 equiv.), 4CzIPN (4.0 mg, 0.005 mmol, 2.5 mol%), quinuclidine (18.2 mg, 0.16 mmol, 80 mol%), pyridine (32 \textmu L, 0.4 mmol, 2.0 equiv.) and DMSO/CH\textsubscript{3}CN (3:1, 4 mL). The reaction mixture was stirred under irradiation (12 W blue LEDs) at room temperature in the presence of open air for 4 h. The two reaction mixtures were separately isolated by flash silica gel column chromatography (petroleum ether/EtOAc = 30/1) to give 6b in 25.3% and 19.9% yields, respectively. The value of \( k_\text{H} / k_\text{D} = 1.27 \) from two parallel reactions indicated that Si–H bond cleavage might not be the kinetically rate-determining step in this reaction.
Experimental data for the products 3, 5, 6 and 7

3-(tert-Butyldimethylsilyl)-1-methylquinoxalin-2(1H)-one (3a). The product was purified by silica gel column chromatography with petroleum ether/ethyl acetate (20:1, v/v). Yellow solid (42.2 mg, 77% yield). mp 81–83 °C. \(^1^H\) NMR (400 MHz, CDCl\(_3\)) \(\delta\) (ppm) 7.94 (dd, \(J = 8.0, 1.6\) Hz, 1H), 7.55–7.51 (m, 1H), 7.34–7.27 (m, 2H), 3.64 (s, 3H), 1.05 (s, 9H), 0.41 (s, 6H). \(^{13}\)C NMR (100 MHz, CDCl\(_3\)) \(\delta\) (ppm) 172.0, 157.0, 134.3, 132.9, 130.8, 123.0, 113.5, 28.4, 27.1, 17.7, -5.6. HRMS (ESI) m/z: [M + H]\(^+\) Calcd for C\(_{15}\)H\(_{23}\)N\(_2\)OSi\(^+\) 275.1574; Found 275.1579.

3-(tert-Butyldimethylsilyl)-6-chloro-1-methylquinoxalin-2(1H)-one (3b). The product was purified by silica gel column chromatography with petroleum ether/ethyl acetate (20:1, v/v). Yellow solid (44.4 mg, 72% yield). mp 112–114 °C. \(^1^H\) NMR (400 MHz, CDCl\(_3\)) \(\delta\) (ppm) 7.93 (d, \(J = 2.4\) Hz, 1H), 7.48 (dd, \(J = 8.9, 2.4\) Hz, 1H), 7.22 (d, \(J = 8.9\) Hz, 1H), 3.63 (s, 3H), 1.03 (s, 9H), 0.39 (s, 6H). \(^{13}\)C NMR (100 MHz, CDCl\(_3\)) \(\delta\) (ppm) 174.0, 156.6, 134.3, 132.9, 130.4, 130.1, 128.4, 114.7, 28.5, 27.0, 17.7, -5.7. HRMS (ESI) m/z: [M + H]\(^+\) Calcd for C\(_{15}\)H\(_{22}\)ClN\(_2\)OSi\(^+\) 309.1184; Found 309.1182.

6-Bromo-3-(tert-butyldimethylsilyl)-1-methylquinoxalin-2(1H)-one (3c). The product was purified by silica gel column chromatography with petroleum ether/ethyl acetate (20:1, v/v). Yellow solid (33.1 mg, 47% yield). mp 109–111 °C. \(^1^H\) NMR (400 MHz, CDCl\(_3\)) \(\delta\) (ppm) 8.11 (d, \(J = 2.4\) Hz, 1H), 7.63 (dd, \(J = 8.8, 2.3\) Hz, 1H), 7.18 (d, \(J = 8.9\) Hz, 1H), 3.63 (s, 3H), 1.03 (s, 9H),
0.40 (s, 6H). $^{13}$C NMR (100 MHz, CDCl$_3$) $\delta$ (ppm) 174.0, 156.6, 134.9, 133.2, 133.1, 132.1, 115.6, 115.0, 28.5, 27.0, 17.7, -5.7. HRMS (ESI) m/z: [M + H]$^+$ Calcd for C$_{15}$H$_{23}$BrN$_2$Si$^+$ 353.0679; Found 353.0682.

3-(tert-Butyldimethylsilyl)-1-methyl-6-nitroquinoxalin-2(1H)-one (3d). The product was purified by silica gel column chromatography with petroleum ether/ethyl acetate (20:1, v/v). Yellow solid (25.5 mg, 40% yield). mp 187−189 °C. $^1$H NMR (400 MHz, CDCl$_3$) $\delta$ (ppm) 8.81−8.80 (m, 1H), 8.40 (dd, $J$ = 9.2, 2.6 Hz, 1H), 7.40 (d, $J$ = 9.2 Hz, 1H), 3.70 (s, 3H), 1.04 (s, 9H), 0.41 (s, 6H). $^{13}$C NMR (100 MHz, CDCl$_3$) $\delta$ (ppm) 175.9, 156.4, 142.9, 137.7, 133.0, 126.4, 125.0, 114.2, 29.0, 27.0, 17.7, -5.7. HRMS (ESI) m/z: [M + H]$^+$ Calcd for C$_{15}$H$_{22}$N$_3$O$_3$Si$^+$ 320.1425; Found 320.1424.

3-(tert-Butyldimethylsilyl)-1,6,7-trimethylquinoxalin-2(1H)-one (3e). The product was purified by silica gel column chromatography with petroleum ether/ethyl acetate (20:1, v/v). Yellow solid (46.5 mg, 77% yield). mp 89−91 °C. $^1$H NMR (400 MHz, CDCl$_3$) $\delta$ (ppm) 7.72 (s, 1H), 7.06 (s, 1H), 3.63 (s, 3H), 2.43 (s, 3H), 2.36 (s, 3H), 1.04 (s, 9H), 0.40 (s, 6H). $^{13}$C NMR (100 MHz, CDCl$_3$) $\delta$ (ppm) 170.0, 157.2, 140.4, 132.9, 131.9, 130.9, 130.9, 114.0, 28.3, 27.1, 20.6, 19.1, 17.7, -5.5. HRMS (ESI) m/z: [M + H]$^+$ Calcd for C$_{17}$H$_{26}$N$_2$O$_3$Si$^+$ 303.1887; Found 303.1888.

3-(tert-Butyldimethylsilyl)-6,7-difluoro-1-methylquinoxalin-2(1H)-one (3f). The product was purified by silica gel column chromatography with petroleum ether/ethyl acetate (20:1, v/v).
Yellow solid (40.3 mg, 65% yield). mp 92–93 °C. $^1$H NMR (400 MHz, CDCl$_3$) $\delta$ (ppm) 7.77–7.73 (m, 1H), 7.11–7.06 (m, 1H), 3.60 (s, 3H), 1.02 (s, 9H), 0.38 (s, 6H). $^{13}$C NMR (100 MHz, CDCl$_3$) $\delta$ (ppm) 172.9 (d, $J = 3.6$ Hz), 156.5, 151.7 (dd, $J = 253.6$, 14.4 Hz), 146.3 (dd, $J = 246.6$, 14.0 Hz), 130.5 (dd, $J = 9.0$, 2.9 Hz), 130.2 (dd, $J = 9.1$, 1.8 Hz), 118.3 (dd, $J = 17.5$, 2.3 Hz), 102.0 (d, $J = 22.9$ Hz), 28.9, 27.0, 17.6, -5.7. HRMS (ESI) m/z: [M + H]$^+$ Calcd for C$_{15}$H$_{21}$F$_2$N$_2$OSi$^+$ 311.1386; Found 311.1383.

![Chemical Structure](image1)

3-(tert-Butyldimethylsilyl)-6,7-dichloro-1-methylquinoxalin-2(1H)-one (3g). The product was purified by silica gel column chromatography with petroleum ether/ethyl acetate (20:1, v/v).

Yellow solid (43.8 mg, 64% yield). mp 121–123 °C. $^1$H NMR (400 MHz, CDCl$_3$) $\delta$ (ppm) 8.01 (t, $J = 1.4$ Hz, 1H), 7.37 (s, 1H), 3.60 (s, 3H), 1.02 (s, 9H), 0.39 (s, 6H). $^{13}$C NMR (100 MHz, CDCl$_3$) $\delta$ (ppm) 174.3, 156.3, 134.5, 133.1, 132.4, 131.5, 126.8, 115.0, 28.2, 27.0, 17.7, -5.7. HRMS (ESI) m/z: [M + H]$^+$ Calcd for C$_{15}$H$_{21}$Cl$_2$N$_2$OSi$^+$ 343.0795; Found 343.0796.

![Chemical Structure](image2)

6,7-Dibromo-3-(tert-butyldimethylsilyl)-1-methylquinoxalin-2(1H)-one (3h). The product was purified by silica gel column chromatography with petroleum ether/ethyl acetate (20:1, v/v).

Yellow solid (26.8 mg, 31% yield). mp 181–183 °C. $^1$H NMR (400 MHz, CDCl$_3$) $\delta$ (ppm) 8.19 (s, 1H), 7.57 (s, 1H), 3.60 (s, 3H), 1.02 (s, 9H), 0.39 (s, 6H). $^{13}$C NMR (100 MHz, CDCl$_3$) $\delta$ (ppm) 174.6, 156.3, 134.7, 133.8, 132.9, 126.8, 118.2, 118.2, 28.6, 27.0, 17.7, -5.7. HRMS (ESI) m/z: [M + H]$^+$ Calcd for C$_{15}$H$_{21}$Br$_2$N$_2$OSi$^+$ 430.9784; Found 430.9786.

![Chemical Structure](image3)
**3-***(tert-Butyldimethylsilyl)-1-methylbenzo[g]quinoxalin-2(1H)-one** *(3i)*. The product was purified by silica gel column chromatography with petroleum ether/ethyl acetate (3:1, v/v). Yellow solid (42.8 mg, 66% yield). mp 185–186 °C. ¹H NMR (400 MHz, CDCl₃) δ (ppm) 8.42 (s, 1H), 7.95 (d, J = 8.2 Hz, 1H), 7.86 (d, J = 8.3 Hz, 1H), 7.55 (t, J = 6.9 Hz, 1H), 7.49–7.44 (m, 2H), 3.67 (s, 3H), 1.10 (s, 9H), 0.48 (s, 6H). ¹³C NMR (100 MHz, CDCl₃) δ (ppm) 173.3, 156.6, 133.9, 133.4, 131.4, 130.1, 129.4, 128.6, 127.9, 127.1, 125.1, 109.6, 28.3, 27.1, 17.7, -5.4. HRMS (ESI) m/z: [M + H]⁺ Calcd for C₁₉H₂₅N₂OSi 325.1731; Found 325.1731.

![1-Butyl-3-(tert-butyldimethylsilyl)quinoxalin-2(1H)-one](image)

**1-Butyl-3-***(tert-butyldimethylsilyl)quinoxalin-2(1H)-one** *(3j)*. The product was purified by silica gel column chromatography with petroleum ether/ethyl acetate (20:1, v/v). Yellow oil (44.9 mg, 71% yield). ¹H NMR (400 MHz, CDCl₃) δ (ppm) 7.95 (dd, J = 7.9, 1.6 Hz, 1H), 7.56–7.51 (m, 1H), 7.33–7.29 (m, 2H), 4.21–4.17 (m, 2H), 1.77–1.69 (m, 2H), 1.53–1.45 (m, 2H), 1.04 (s, 9H), 1.01 (d, J = 7.4 Hz, 3H), 0.41 (s, 6H). ¹³C NMR (100 MHz, CDCl₃) δ (ppm) 172.0, 156.7, 134.6, 132.1, 131.1, 130.4, 122.8, 113.5, 41.4, 29.3, 27.1, 20.4, 17.7, 13.9, -5.5. HRMS (ESI) m/z: [M + H]⁺ Calcd for C₁₈H₂₉N₂OSi 317.2044; Found 317.2042.

![1-(tert-Butyldimethylsilyl)-1-(cyclopropylmethyl)quinoxalin-2(1H)-one](image)

**1-(tert-Butyldimethylsilyl)-1-(cyclopropylmethyl)quinoxalin-2(1H)-one** *(3k)*. The product was purified by silica gel column chromatography with petroleum ether/ethyl acetate (30:1, v/v). Light yellow oil (39.6 mg, 63% yield). ¹H NMR (400 MHz, CDCl₃) δ (ppm) 7.95 (dd, J = 8.0, 1.6 Hz, 1H), 7.54–7.50 (m, 1H), 7.40 (d, J = 8.4 Hz, 1H), 7.31–7.28 (m, 1H), 4.15 (d, J = 7.0 Hz, 2H), 1.32–1.25 (m, 1H), 1.04 (s, 9H), 0.56–0.52 (m, 4H), 0.41 (s, 6H). ¹³C NMR (100 MHz, CDCl₃) δ
N\_N\_O\_Si

COOEt

**Ethyl 2-(3-(tert-butyldimethylsilyl)-2-oxoquinoxalin-1(2\(H\))-yl)acetate** (3l). The product was purified by silica gel column chromatography with petroleum ether/ethyl acetate (20:1, v/v). Yellow solid (50.5 mg, 73% yield). mp 63–64 °C. \(^1\)H NMR (400 MHz, CDCl\(_3\)) \(\delta\) (ppm) 7.96 (dd, \(J = 8.0, 1.5 \text{ Hz, 1H}\), 7.52–7.47 (m, 1H), 7.34–7.30 (m, 1H), 7.05 (dd, \(J = 8.4, 1.2 \text{ Hz, 1H}\), 4.98 (s, 2H), 4.24 (q, \(J = 7.1 \text{ Hz, 2H}\)), 1.26 (t, \(J = 7.1 \text{ Hz, 3H}\), 1.03 (s, 9H), 0.41 (s, 6H). \(^{13}\)C NMR (100 MHz, CDCl\(_3\)) \(\delta\) (ppm) 171.8, 167.3, 156.3, 134.3, 132.0, 131.2, 130.7, 123.4, 112.9, 62.0, 42.9, 27.0, 17.7, 14.1, -5.6. HRMS (ESI) m/z: [M + H]\(^+\) Calcd for C\(_{18}\)H\(_{27}\)N\(_2\)O\(_3\)Si\(^+\) 347.1785; Found 347.1786.

N\_N\_O\_Si

1-Allyl-3-(tert-butyldimethylsilyl)quinoxalin-2(1\(H\))-one** (3m). The product was purified by silica gel column chromatography with petroleum ether/ethyl acetate (30:1, v/v). Yellow oil (30.6 mg, 51% yield). \(^1\)H NMR (400 MHz, CDCl\(_3\)) \(\delta\) (ppm) 7.95 (dd, \(J = 8.0, 1.6 \text{ Hz, 1H}\), 7.53–7.49 (m, 1H), 7.34–7.30 (m, 1H), 7.26 (dd, \(J = 8.4, 1.2 \text{ Hz, 1H}\), 6.00–5.90 (m, 1H), 5.28–5.24 (m, 1H), 5.17–5.11 (m, 1H), 4.87–4.85 (m, 2H), 1.04 (s, 9H), 0.42 (s, 6H). \(^{13}\)C NMR (100 MHz, CDCl\(_3\)) \(\delta\) (ppm) 172.1, 156.5, 134.5, 132.1, 130.9, 130.4, 123.0, 117.7, 114.0, 43.8, 27.1, 17.7, -5.6. HRMS (ESI) m/z: [M + H]\(^+\) Calcd for C\(_{17}\)H\(_{25}\)N\(_2\)O\(_3\)Si\(^+\) 301.1731; Found 301.1733.
1-(tert-Butyldimethylsilyl)-1-(prop-2-yn-1-yl)quinoxalin-2(1H)-one (3n). The product was purified by silica gel column chromatography with petroleum ether/ethyl acetate (30:1, v/v). Yellow solid (32.8 mg, 55% yield). mp 42–43 °C. \(^1\)H NMR (400 MHz, CDCl\(_3\)) \(\delta\) (ppm) 7.96 (dd, \(J = 8.0, 1.5\) Hz, 1H), 7.61–7.56 (m, 1H), 7.45 (dd, \(J = 8.4, 1.3\) Hz, 1H), 7.38–7.34 (m, 1H), 5.01 (d, \(J = 2.6\) Hz, 2H), 2.30 (t, \(J = 2.5\) Hz, 1H), 1.04 (s, 9H), 0.42 (s, 6H). \(^{13}\)C NMR (100 MHz, CDCl\(_3\)) \(\delta\) (ppm) 172.0, 155.7, 134.5, 131.3, 131.0, 130.6, 123.5, 114.0, 77.1, 73.0, 30.8, 27.0, 17.7, -5.6. HRMS (ESI) m/z: [M + H]\(^+\) Calcd for C\(_{17}\)H\(_{23}\)N\(_2\)OSi\(^+\) 299.1574; Found 299.1579.

1-(tert-Butyldimethylsilyl)-1-((tetrahydrofuran-2-yl)methyl)quinoxalin-2(1H)-one (3o). The product was purified by silica gel column chromatography with petroleum ether/ethyl acetate (30:1, v/v). Yellow oil (46.1 mg, 67% yield). H NMR (400 MHz, CDCl\(_3\)) \(\delta\) (ppm) 7.92 (d, \(J = 8.4\) Hz, 1H), 7.54–7.48 (m, 2H), 7.32–7.28 (m, 1H), 4.51–4.47 (m, 1H), 4.36–4.30 (m, 1H), 4.15 (dd, \(J = 13.9, 7.1\) Hz, 1H), 3.92 (dd, \(J = 14.1, 7.6\) Hz, 1H), 3.77–3.71 (m, 1H), 2.13–1.73 (m, 4H), 1.04 (s, 9H), 0.41 (s, 6H). \(^{13}\)C NMR (100 MHz, CDCl\(_3\)) \(\delta\) (ppm) 171.6, 157.1, 134.5, 132.7, 130.8, 130.3, 123.0, 114.5, 76.9, 68.3, 45.6, 29.6, 27.1, 25.5, 17.7, -5.6. HRMS (ESI) m/z: [M + H]\(^+\) Calcd for C\(_{19}\)H\(_{29}\)N\(_2\)O\(_2\)Si\(^+\) 345.1993; Found 345.1996.
**3-(tert-Butyldimethylsilyl)-1-phenylquinoxalin-2(1H)-one (3p).** The product was purified by silica gel column chromatography with petroleum ether/ethyl acetate (30:1, v/v). Yellow solid (47.7 mg, 71% yield). mp 110–112 °C. $^1$H NMR (400 MHz, CDCl$_3$) $\delta$ (ppm) 8.03 (dd, $J = 7.5$, 2.1 Hz, 1H), 7.67–7.63 (m, 2H), 7.59–7.55 (m, 1H), 7.38–7.31 (m, 4H), 6.72 (dd, $J = 7.8$, 1.8 Hz, 1H), 1.12 (s, 9H), 0.48 (s, 6H). $^{13}$C NMR (100 MHz, CDCl$_3$) $\delta$ (ppm) 173.1, 156.6, 135.8, 134.1, 133.6, 130.5, 130.4, 130.2, 129.3, 128.5, 123.3, 115.4, 27.2, 17.8, -5.4. HRMS (ESI) m/z: [M + H]$^+$ Calcd for C$_{20}$H$_{25}$N$_2$OSi$^+$ 337.1731; Found 337.1731.

![Chemical Structure](image)

**3-(tert-Butyldimethylsilyl)-1-(4-chlorophenyl)quinoxalin-2(1H)-one (3q).** The product was purified by silica gel column chromatography with petroleum ether/ethyl acetate (30:1, v/v). Yellow oil (54.0 mg, 73% yield). $^1$H NMR (400 MHz, CDCl$_3$) $\delta$ (ppm) 8.01 (dd, $J = 7.8$, 1.7 Hz, 1H), 7.62–7.59 (m, 2H), 7.40–7.31 (m, 2H), 7.29–7.26 (m, 2H), 6.71 (dd, $J = 8.1$, 1.5 Hz, 1H), 1.07 (s, 9H), 0.43 (s, 6H). $^{13}$C NMR (100 MHz, CDCl$_3$) $\delta$ (ppm) 173.0, 156.4, 135.3, 134.2, 134.0, 133.2, 130.6, 130.6, 130.3, 130.0, 123.5, 115.0, 27.1, 17.7, -5.5. HRMS (ESI) m/z: [M + H]$^+$ Calcd for C$_{20}$H$_{24}$ClN$_2$OSi$^+$ 371.1341; Found 371.1342.

![Chemical Structure](image)

**1-Benzyl-3-(tert-butyldimethylsilyl)quinoxalin-2(1H)-one (3r).** The product was purified by silica gel column chromatography with petroleum ether/ethyl acetate (20:1, v/v). Yellow solid (53.9 mg, 77% yield). mp 72–73 °C. $^1$H NMR (400 MHz, CDCl$_3$) $\delta$ (ppm) 7.97 (dd, $J = 7.9$, 1.6 Hz, 1H), 7.44–7.39 (m, 1H), 7.36–7.21 (m, 7H), 5.47 (s, 2H), 1.09 (s, 9H), 0.47 (s, 6H). $^{13}$C NMR (100 MHz, CDCl$_3$) $\delta$ (ppm) 172.2, 157.0, 135.6, 134.6, 132.2, 131.0, 130.5, 128.9, 127.6, 126.8,
123.1, 114.3, 45.2, 27.1, 17.8, -5.5. HRMS (ESI) m/z: [M + H]^+ Calcd for C_{21}H_{27}N_{2}OSi^+ 351.1887; Found 351.1885.

3-(*tert*-Butyldimethylsilyl)-1-(4-methoxybenzyl)quinoxalin-2(1H)-one (3s). The product was purified by silica gel column chromatography with petroleum ether/ethyl acetate (20:1, v/v). Yellow solid (54.0 mg, 71% yield). mp 60–61 °C. ^1H NMR (400 MHz, CDCl$_3$) δ (ppm) 7.96 (dd, $J = 8.3$, 1.5 Hz, 1H), 7.45–7.41 (m, 1H), 7.30–7.26 (m, 2H), 7.23–7.19 (m, 2H), 6.88–6.85 (m, 2H), 5.40 (s, 2H), 3.78 (s, 3H), 1.09 (s, 9H), 0.47 (s, 6H). ^13C NMR (100 MHz, CDCl$_3$) δ (ppm) 172.2, 159.0, 157.0, 134.6, 132.2, 131.0, 130.5, 128.3, 127.7, 123.1, 114.3, 114.3, 55.3, 44.6, 27.2, 17.8, -5.5. HRMS (ESI) m/z: [M + H]^+ Calcd for C_{22}H_{29}N_{2}O_{2}Si^+ 381.1993; Found 381.1994.

4-(*tert*-Butyldimethylsilyl)-2-oxoquinoxalin-1(2H)-yl)methyl)benzonitrile (3t). The product was purified by silica gel column chromatography with petroleum ether/ethyl acetate (5:1, v/v). Yellow oil (51.0 mg, 68% yield). ^1H NMR (400 MHz, CDCl$_3$) δ (ppm) 7.99 (dd, $J = 7.9$, 1.6 Hz, 1H), 7.63 (d, $J = 8.3$ Hz, 2H), 7.46–7.41 (m, 1H), 7.34–7.30 (m, 3H), 7.08 (dd, $J = 8.3$, 1.2 Hz, 1H), 5.50 (s, 2H), 1.06 (s, 9H), 0.44 (s, 6H). ^13C NMR (100 MHz, CDCl$_3$) δ (ppm) 172.2, 156.7, 141.0, 134.5, 132.8, 131.8, 131.3, 130.8, 127.5, 123.6, 118.5, 113.7, 111.6, 44.9, 27.1, 17.7, -5.6. HRMS (ESI) m/z: [M + H]^+ Calcd for C_{22}H_{26}N_{3}OSi^+ 376.1840; Found 376.1842.
2(1H)-one (3u). The product was purified by silica gel column chromatography with petroleum ether/ethyl acetate (20:1, v/v). Yellow solid (67.7 mg, 81% yield). mp 89−91 °C. $^1$H NMR (400 MHz, CDCl$_3$) δ (ppm) 8.00 (dd, $J = 8.0$, 1.5 Hz, 1H), 7.60 (d, $J = 7.9$ Hz, 2H), 7.46−7.42(m, 1H), 7.36−7.30 (m, 3H), 7.13 (dd, $J = 8.4$, 1.2 Hz, 1H), 5.52 (s, 2H), 1.08 (s, 9H), 0.46 (s, 6H). $^{13}$C NMR (100 MHz, CDCl$_3$) δ (ppm) 172.3, 156.8, 139.6, 134.5, 131.9, 131.2, 130.7, 129.9 (q, $J = 32.5$ Hz), 124.0 (q, $J = 27.2$ Hz), 127.1, 126.0 (q, $J = 3.8$ Hz), 123.4, 113.9, 44.8, 27.1, 17.7, -5.6. HRMS (ESI) m/z: [M + H]$^+$ Calcd for C$_{23}$H$_{26}$F$_3$N$_2$OSi$^+$ 419.1761; Found 419.1762.

2-(tert-Butyldimethylsilyl)quinoxaline (5a). The product was purified by silica gel column chromatography with petroleum ether/ethyl acetate (50:1, v/v). Yellow oil (24.9 mg, 51% yield). $^1$H NMR (400 MHz, CDCl$_3$) δ (ppm) 8.93 (s, 1H), 8.21−8.17 (m, 1H), 8.11−8.07 (m, 1H), 7.78−7.73 (m, 2H), 1.00 (s, 9H), 0.47 (s, 6H). $^{13}$C NMR (100 MHz, CDCl$_3$) δ (ppm) 164.0, 148.4, 143.8, 141.5, 130.1, 129.9, 129.4, 26.6, 17.2, -6.3. HRMS (ESI) m/z: [M + H]$^+$ Calcd for C$_{14}$H$_{21}$N$_2$Si$^+$ 245.1469; Found 245.1469.

2-(tert-Butyldimethylsilyl)-3-chloroquinoxaline (5b). The product was purified by silica gel column chromatography with petroleum ether/ethyl acetate (50:1, v/v). Colorless solid (30.6 mg, 55% yield). mp 41−42 °C. $^1$H NMR (400 MHz, CDCl$_3$) δ (ppm) 8.18−8.14 (m, 1H), 8.00–7.96 (m, 1H), 7.80−7.73 (m, 2H), 1.05 (s, 9H), 0.54 (s, 6H). $^{13}$C NMR (100 MHz, CDCl$_3$) δ (ppm) 164.0,
152.3, 141.4, 140.6, 129.7, 129.5, 128.2, 26.9, 18.2, -4.4. HRMS (ESI) m/z: [M + H]\(^+\)  
Caled for C\(_{14}\)H\(_{20}\)ClN\(_2\)Si\(_2\) 279.1079; Found 279.1082.

2-(tert-Butyldimethylsilyl)benzo[d]thiazole (5c).\(^2\) The product was purified by silica gel column chromatography with petroleum ether/ethyl acetate (50:1, v/v). Colorless oil (32.4 mg, 65% yield). \(^1\)H NMR (400 MHz, CDCl\(_3\)) \(\delta\) (ppm) 8.24 (d, \(J = 8.1\) Hz, 1H), 8.01–7.99 (m, 1H), 7.54–7.50 (m, 1H), 7.45–7.41 (m, 1H), 1.05 (s, 9H), 0.50 (s, 6H). \(^1^3\)C NMR (100 MHz, CDCl\(_3\)) \(\delta\) (ppm) 174.9, 156.1, 136.1, 125.7, 125.1, 123.4, 121.5, 26.4, 17.0, -5.4.

4-(tert-Butyldimethylsilyl)-3,6-dichloropyridazine (5d). The product was purified by silica gel column chromatography with petroleum ether/ethyl acetate (20:1, v/v). Colorless solid (40.3 mg, 77% yield). mp 98–99 °C. \(^1\)H NMR (400 MHz, CDCl\(_3\)) \(\delta\) (ppm) 7.49 (s, 1H), 0.96 (s, 9H), 0.44 (s, 6H). \(^1^3\)C NMR (100 MHz, CDCl\(_3\)) \(\delta\) (ppm) 160.8, 155.6, 143.1, 137.2, 26.8, 17.9, -4.8. HRMS (ESI) m/z: [M + H]\(^+\) Caled for C\(_{10}\)H\(_{17}\)Cl\(_2\)N\(_2\)Si\(_2\) 263.0533; Found 263.0536.

8-(tert-Butyldimethylsilyl)-6-chlorimidazo[1,2-b]pyridazine (5ea). The product was purified by silica gel column chromatography with petroleum ether/ethyl acetate (5:1, v/v). Colorless solid (28.8 mg, 54% yield). mp 96–98 °C. \(^1\)H NMR (400 MHz, CDCl\(_3\)) \(\delta\) (ppm) 7.88 (d, \(J = 1.2\) Hz, 1H), 7.79 (d, \(J = 1.3\) Hz, 1H), 7.03 (s, 1H), 0.97 (s, 9H), 0.49 (s, 6H). \(^1^3\)C NMR (100 MHz, CDCl\(_3\)) \(\delta\) (ppm) 146.2, 141.4, 140.8, 133.9, 124.7, 116.2, 26.9, 17.4, -5.5. HRMS (ESI) m/z: [M + H]\(^+\) Caled for C\(_{12}\)H\(_{19}\)Cl\(_2\)N\(_3\)Si\(_3\) 268.1031; Found 268.1035.
7-(tert-Butyldimethylsilyl)-6-chlorimidazo[1,2-b]pyridazine (5eb). The product was purified by silica gel column chromatography with petroleum ether/ethyl acetate (5:1, v/v). Yellow oil (2.7 mg, 5% yield). $^1$H NMR (400 MHz, CDCl$_3$) $\delta$ (ppm) 8.12 (s, 1H), 7.93 (s, 1H), 7.81 (s, 1H), 0.98 (s, 9H), 0.46 (s, 6H). $^{13}$C NMR (100 MHz, CDCl$_3$) $\delta$ (ppm) 151.6, 141.4, 135.0, 134.4, 128.7, 116.8, 27.0, 17.9, -4.0. HRMS (ESI) m/z: [M + H]$^+$ Calcd for C$_{12}$H$_{19}$ClN$_3$Si$^+$ 268.1031; Found 268.1036.

![Chemical structure of 7-(tert-Butyldimethylsilyl)-6-chlorimidazo[1,2-b]pyridazine](image)

3-(tert-Butyldimethylsilyl)-2H-chromen-2-one (5f). The product was purified by silica gel column chromatography with petroleum ether/ethyl acetate (20:1, v/v). White solid (22.9 mg, 44% yield). mp 98–100 ºC. $^1$H NMR (400 MHz, CDCl$_3$) $\delta$ (ppm) 7.82 (s, 1H), 7.54–7.48 (m, 2H), 7.32–7.24 (m, 2H), 0.98 (s, 9H), 0.34 (s, 6H). $^{13}$C NMR (100 MHz, CDCl$_3$) $\delta$ (ppm) 162.8, 154.8, 151.6, 131.8, 128.0, 127.7, 124.0, 119.2, 116.6, 27.0, 17.3, -5.7. HRMS (ESI) m/z: [M + H]$^+$ Calcd for C$_{15}$H$_{21}$O$_2$Si$^+$ 261.1305; Found 261.1307.

![Chemical structure of 3-(tert-Butyldimethylsilyl)-2H-chromen-2-one](image)

3-(tert-Butyldimethylsilyl)-2H-benzo[b][1,4]oxazin-2-one (5g). The product was purified by silica gel column chromatography with petroleum ether/ethyl acetate (20:1, v/v). Yellow solid (11.0 mg, 21% yield). mp 44–45 ºC. $^1$H NMR (400 MHz, CDCl$_3$) $\delta$ (ppm) 7.86 (dd, $J = 7.9, 1.7$ Hz, 1H), 7.52–7.48 (m, 1H), 7.39–7.34 (m, 1H), 7.27 (dd, $J = 8.2, 1.4$ Hz, 1H), 1.04 (s, 9H), 0.41 (s, 6H). $^{13}$C NMR (100 MHz, CDCl$_3$) $\delta$ (ppm) 169.7, 153.6, 146.0, 132.3, 131.4, 129.8, 125.0, 116.5, 26.8, 17.6, -6.0. HRMS (ESI) m/z: [M + H]$^+$ Calcd for C$_{14}$H$_{20}$NO$_2$Si$^+$ 262.1258; Found 262.1259.

![Chemical structure of 3-(tert-Butyldimethylsilyl)-2H-benzo[b][1,4]oxazin-2-one](image)
Ethyl 2-(**tert**-butyldimethylsilyl)isonicotinate (5h). The product was purified by silica gel column chromatography with petroleum ether/ethyl acetate (3:1, v/v). Light yellow oil (17.5 mg, 33% yield). $^1$H NMR (400 MHz, CDCl$_3$) $\delta$ (ppm) 8.84 (s, 1H), 8.67 (d, $J = 5.1$ Hz, 1H), 7.52 (d, $J = 5.1$ Hz, 1H), 4.37 (q, $J = 7.1$ Hz, 2H), 1.40 (t, $J = 7.2$ Hz, 3H), 0.96 (s, 9H), 0.33 (s, 6H). $^{13}$C NMR (101 MHz, CDCl$_3$) $\delta$ (ppm) 168.0, 156.8, 149.9, 145.9, 131.1, 122.3, 61.8, 27.3, 17.9, 14.2, -3.8. HRMS (ESI) m/z: [M + H]$^+$ Calcd for C$_{14}$H$_{24}$NO$_2$Si$^+$ 266.1571; Found 266.1572.

**tert**-Butyldimethylsilyl)terephthalonitrile (5i). The product was purified by silica gel column chromatography with petroleum ether/ethyl acetate (10:1, v/v). Colorless solid (31.5 mg, 65% yield). mp 93–95 °C. $^1$H NMR (400 MHz, CDCl$_3$) $\delta$ (ppm) 7.87 (d, $J = 1.7$ Hz, 1H), 7.82 (d, $J = 8.0$ Hz, 1H), 7.75 (dd, $J = 8.0$, 1.7 Hz, 1H), 0.95 (s, 9H), 0.51 (s, 6H). $^{13}$C NMR (100 MHz, CDCl$_3$) $\delta$ (ppm) 144.6, 139.4, 134.2, 132.3, 122.0, 119.1, 117.7, 115.4, 26.5, 18.0, -5.1.

**tert**-Butyldimethylsilyl)quinoline-4-carbonitrile (5j). The product was purified by silica gel column chromatography with petroleum ether/ethyl acetate (20:1, v/v). White solid (36.5 mg, 68% yield). mp 55–57 °C. $^1$H NMR (400 MHz, CDCl$_3$) $\delta$ (ppm) 9.08 (s, 1H), 8.27–8.25 (m, 1H), 8.17 (d, $J = 8.4$ Hz, 1H), 7.86–7.82 (m, 1H), 7.76–7.72 (m, 1H), 0.98 (s, 9H), 0.59 (s, 6H). $^{13}$C NMR (100 MHz, CDCl$_3$) $\delta$ (ppm) 154.4, 147.6, 135.6, 131.3, 130.0, 129.0, 126.5, 125.1, 125.1, 117.0, 26.5, 18.4, -5.0. HRMS (ESI) m/z: [M + H]$^+$ Calcd for C$_{16}$H$_{21}$N$_2$Si$^+$ 269.1469; Found 269.1465.

**tert**-Butyldimethylsilyl)isoquinoline-4-carbonitrile (5ka). The product was purified by silica gel column chromatography with petroleum ether/ethyl acetate (100:1, v/v). White solid (30.0 mg,
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56% yield). mp 35−36 °C. $^1$H NMR (400 MHz, CDCl$_3$) $\delta$ (ppm) 9.03 (s, 1H), 8.37 (d, $J$ = 8.5 Hz, 1H), 8.21 (d, $J$ = 8.3 Hz, 1H), 7.90−7.86 (m, 1H), 7.77−7.72 (m, 1H), 0.97 (s, 9H), 0.58 (s, 6H). $^{13}$C NMR (100 MHz, CDCl$_3$) $\delta$ (ppm) 177.4, 146.7, 132.8, 132.7, 131.8, 129.4, 128.3, 124.9, 116.7, 104.7, 27.0, 18.0, -3.1. HRMS (ESI) m/z: [M + H]$^+$ Calcd for C$_{16}$H$_{21}$N$_2$Si$^+$ 269.1469; Found 269.1466.

1,3-Bis(tert-butyldimethylsilyl)isoquinoline-4-carbonitrile (5kb). The product was purified by silica gel column chromatography with petroleum ether/ethyl acetate (100:1, v/v). White solid (14.5 mg, 19% yield). mp 78−80 °C. $^1$H NMR (400 MHz, CDCl$_3$) $\delta$ (ppm) 8.31 (d, $J$ = 8.4 Hz, 1H), 8.26 (d, $J$ = 8.3 Hz, 1H), 7.87−7.82 (m, 1H), 7.74−7.70 (m, 1H), 1.01 (s, 9H), 0.96 (s, 9H), 0.58 (s, 1H), 0.57 (s, 1H). $^{13}$C NMR (100 MHz, CDCl$_3$) $\delta$ (ppm) 173.8, 163.1, 132.4, 131.3, 131.1, 129.1, 128.2, 124.9, 118.2, 111.4, 27.1, 26.8, 18.2, 17.9, -3.0, -4.7. HRMS (ESI) m/z: [M + H]$^+$ Calcd for C$_{22}$H$_{35}$N$_2$Si$_2^+$ 383.2333; Found 383.2332.

1-Methyl-3-(triethylsilyl)quinoxalin-2(1H)-one (6a). The product was purified by silica gel column chromatography with petroleum ether/ethyl acetate (30:1, v/v). Orange oil (28.0 mg, 51% yield). $^1$H NMR (400 MHz, CDCl$_3$) $\delta$ (ppm) 7.96 (dd, $J$ = 7.9, 1.5 Hz, 1H), 7.57−7.53 (m, 1H), 7.36−7.28 (m, 2H), 3.66 (s, 3H), 1.07−0.97 (m, 15H). $^{13}$C NMR (100 MHz, CDCl$_3$) $\delta$ (ppm) 172.2, 157.0, 134.5, 132.8, 130.8, 130.5, 123.1, 113.5, 28.3, 7.6, 3.0. HRMS (ESI) m/z: [M + H]$^+$ Calcd for C$_{15}$H$_{23}$N$_2$OSi$^+$ 275.1574; Found 275.1575.

1-Methyl-3-(triisopropylsilyl)quinoxalin-2(1H)-one (6b). The product was purified by silica gel column chromatography with petroleum ether/ethyl acetate (30:1, v/v). Yellow solid (41.7 mg, 66%
yield). mp 67–69 °C. $^1$H NMR (400 MHz, CDCl$_3$) $\delta$ (ppm) 7.96 (d, $J = 7.9$ Hz, 1H), 7.56 (t, $J = 7.8$ Hz, 1H), 7.36–7.30 (m, 2H), 3.67 (s, 3H), 1.70–1.62 (m, 3H), 1.17 (d, $J = 7.5$ Hz, 18H). $^{13}$C NMR (100 MHz, CDCl$_3$) $\delta$ (ppm) 171.7, 157.0, 134.4, 132.8, 130.8, 130.4, 123.0, 113.5, 28.5, 19.0, 11.8. HRMS (ESI) m/z: [M + H]$^+$ Calcd for C$_{18}$H$_{29}$N$_2$OSi$^+$ 317.2044; Found 317.2043.

1-Methyl-1,4-dihydroquinoxaline-2,3-dione (7). Yellow solid (37.3 mg, 53% yield). mp 285–286 °C. $^1$H NMR (400 MHz, DMSO-d$_6$) $\delta$ (ppm) 12.02 (s, 1H), 7.35 (s, 1H), 7.18 (s, 3H), 3.51 (s, 3H). $^{13}$C NMR (100 MHz, DMSO) $\delta$ (ppm) 155.7, 154.1, 127.7, 126.0, 124.0, 123.7, 115.8, 115.5, 30.1.

N-(2-acetylphenyl)formamide (9). White solid (28.2 mg, 64% yield). mp 70–71 °C. $^1$H NMR (400 MHz, CDCl$_3$) $\delta$ (ppm) 11.64 (brs, 1H), 8.84–8.64 (m, 1H), 8.50 (brs, 1H), 7.93 (dd, $J = 8.0$, 1.6 Hz, 1H), 7.59–7.55 (m, 1H), 7.22–7.14 (m, 1H), 2.68 (s, 3H). $^{13}$C NMR (100 MHz, CDCl$_3$) $\delta$ (ppm) 202.9, 160.0, 139.9, 135.2, 131.7, 123.1, 121.9, 121.6, 28.7.

Triphenylsilanol (10). White solid (196.0 mg, 71% yield). mp 52–53 °C. $^1$H NMR (400 MHz, CDCl$_3$) $\delta$ (ppm) 7.75–7.71 (m, 6H), 7.45–7.40 (m, 8H), 7.37–7.35 (m, 1H). $^{13}$C NMR (100 MHz, CDCl$_3$) $\delta$ (ppm) 135.6, 135.1, 130.0, 127.9.

7 References


$^{1}H$ and $^{13}C$ NMR spectra of the products

3a ($^{1}H$ NMR) (400 MHz, CDCl$_3$)

3a ($^{13}C$ NMR) (100 MHz, CDCl$_3$)
3b (\(^1\)H NMR) (400 MHz, CDCl\(_3\))

3b (\(^{13}\)C NMR) (100 MHz, CDCl\(_3\))
3c ($^1$H NMR) (400 MHz, CDCl$_3$)

3c ($^{13}$C NMR) (100 MHz, CDCl$_3$)
$^{13}\text{C NMR}$ (400 MHz, CDCl$_3$)

$^{13}\text{C NMR}$ (100 MHz, CDCl$_3$)
$3e \left( ^1H \text{ NMR} \right) \left( 400 \text{ MHz, CDCl}_3 \right)$

$3e \left( ^13C \text{ NMR} \right) \left( 100 \text{ MHz, CDCl}_3 \right)$
3f (\(^1\)H NMR) (400 MHz, CDCl\(_3\))

3f (\(^{13}\)C NMR) (100 MHz, CDCl\(_3\))
3g (\textsuperscript{1}H NMR) (400 MHz, CDCl\textsubscript{3})

3g (\textsuperscript{13}C NMR) (100 MHz, CDCl\textsubscript{3})
3h ($^1$H NMR) (400 MHz, CDCl$_3$)

3h ($^{13}$C NMR) (100 MHz, CDCl$_3$)
3i (\textsuperscript{1}H NMR) (400 MHz, CDCl\textsubscript{3})

3i (\textsuperscript{13}C NMR) (100 MHz, CDCl\textsubscript{3})
$\text{3j } (^{1}\text{H NMR) (400 MHz, CDCl}_3)$

$\text{3j } (^{13}\text{C NMR) (100 MHz, CDCl}_3)$
3k ($^1$H NMR) (400 MHz, CDCl$_3$)

3k ($^{13}$C NMR) (100 MHz, CDCl$_3$)
$\text{COOEt}$

$\text{3l (}^{1}\text{H NMR) (400 MHz, CDCl₃)}$

$\text{3l (}^{13}\text{C NMR) (100 MHz, CDCl₃)}$
3m (¹HNMR) (400 MHz, CDCl₃)

3m (¹³CNMR) (100 MHz, CDCl₃)
$3n$ ($^1$H NMR) (400 MHz, CDCl$_3$)

$3n$ ($^{13}$C NMR) (100 MHz, CDCl$_3$)
3o ($^1$H NMR) (400 MHz, CDCl$_3$)

3o ($^{13}$C NMR) (100 MHz, CDCl$_3$)
$^{1}H$ NMR (400 MHz, CDCl$_3$)

$^{13}C$ NMR (100 MHz, CDCl$_3$)
3q (¹H NMR) (400 MHz, CDCl₃)

3q (¹³C NMR) (100 MHz, CDCl₃)
3r (\(^1\)H NMR) (400 MHz, CDCl\(_3\))

\[
\begin{align*}
\text{N} & \text{N} \\
\text{O} & \\
\text{Si} & \text{3r}
\end{align*}
\]

3r (\(^{13}\)C NMR) (100 MHz, CDCl\(_3\))

\[
\begin{align*}
\text{N} & \text{N} \\
\text{O} & \\
\text{Si} & \text{3r}
\end{align*}
\]
$3s\ \text{(}^1H\ \text{NMR)}\ \text{(}400\ \text{MHz, CDCl}_3\text{)}$

3s $\text{(}^{13}C\ \text{NMR)}\ \text{(}100\ \text{MHz, CDCl}_3\text{)}$
3t (1H NMR) (400 MHz, CDCl₃)

3t (13C NMR) (100 MHz, CDCl₃)
$3u$ ($^1H$ NMR) (400 MHz, CDCl$_3$)

$3u$ ($^{13}C$ NMR) (100 MHz, CDCl$_3$)
5a ($^1$H NMR) (400 MHz, CDCl$_3$)

5a ($^{13}$C NMR) (100 MHz, CDCl$_3$)
5b (\(^1\)H NMR) (400 MHz, CDCl\(_3\))

5b (\(^{13}\)C NMR) (100 MHz, CDCl\(_3\))
5c ($^1$H NMR) (400 MHz, CDCl$_3$)

5c ($^{13}$C NMR) (100 MHz, CDCl$_3$)
5d ($^1$H NMR) (400 MHz, CDCl$_3$) 

5d ($^{13}$C NMR) (100 MHz, CDCl$_3$)
5ea (¹H NMR) (400 MHz, CDCl₃)

5ea (¹³C NMR) (100 MHz, CDCl₃)
5eb ($^1$H NMR) (400 MHz, CDCl$_3$)

5eb ($^{13}$C NMR) (100 MHz, CDCl$_3$)
5f (1H NMR) (400 MHz, CDCl₃)

5f (13C NMR) (100 MHz, CDCl₃)
\[ \text{S53} \]

\[ \text{ON} \text{Si} \text{S5g} \]

\[ (1^H \text{NMR}) (400 \text{ MHz, CDCl}_3) \]

\[ (13^C \text{NMR}) (100 \text{ MHz, CDCl}_3) \]
$5h$ (\textsuperscript{1}H NMR) (400 MHz, CDCl$_3$)

$5h$ (\textsuperscript{13}C NMR) (100 MHz, CDCl$_3$)
$5i \left( ^1H \text{ NMR} \right) \left( 400 \text{ MHz, CDCl}_3 \right)$

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$5i \left( ^{13}C \text{ NMR} \right) \left( 100 \text{ MHz, CDCl}_3 \right)$
5j ($^1$H NMR) (400 MHz, CDCl$_3$)

5j ($^{13}$C NMR) (100 MHz, CDCl$_3$)
5ka (\textsuperscript{1}H NMR) (400 MHz, CDCl\textsubscript{3})

5ka (\textsuperscript{13}C NMR) (100 MHz, CDCl\textsubscript{3})
5kb ($^1$H NMR) (400 MHz, CDCl$_3$)

5kb ($^{13}$C NMR) (100 MHz, CDCl$_3$)
6a ($^1$H NMR) (400 MHz, CDCl$_3$)

6a ($^{13}$C NMR) (100 MHz, CDCl$_3$)
6b ($^1$H NMR) (400 MHz, CDCl$_3$)

6b ($^{13}$C NMR) (100 MHz, CDCl$_3$)
$7\ (^{1}H\ NMR)\ (400\ MHz,\ DMSO-d_{6})$

$7\ (^{13}C\ NMR)\ (100\ MHz,\ DMSO)$
9 (\textsuperscript{1}H NMR) (400 MHz, CDCl\textsubscript{3})

9 (\textsuperscript{13}C NMR) (100 MHz, CDCl\textsubscript{3})
OH
Si

10 (\(^1\)H NMR) (400 MHz, CDCl\(_3\))

\[\text{Chemical Structure Image}\]

OH
Si

10 (\(^{13}\)C NMR) (100 MHz, CDCl\(_3\))

\[\text{Chemical Structure Image}\]