Supporting Information

for

Electrosynthesis of enaminones directly from methyl ketones and amines with nitromethane as a carbon source

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**General remarks:**

NMR spectra were recorded on 300MHz or 400 MHz (75 MHz or 100 MHz for $^{13}$C NMR) Bruker NMR spectrometer with CDCl$_3$ as the solvent and tetramethylsilane (TMS) as the internal standard. Chemical shifts were reported in parts per million (ppm, $\delta$ scale) downfield from TMS at 0.00 ppm and referenced to the CDCl$_3$ at 7.26 ppm (for $^1$H NMR) or 77.16 ppm (for $^{13}$C NMR). HRMS was recorded on a Micromass UK LTD GCT spectrometer. Melting points were determined on a melting point apparatus and are uncorrected. All reagents were commercially available and were used without further purification.

**General procedure for the reaction**

The reaction was carried out using an undivided cell (20 mL) equipped with a platinum plate cathode (1.3 cm* 1.3 cm), a platinum plate anode (1.3 cm* 1.3 cm) and a magnetic stirring bar. The distance between cathode and anode was 3 cm. Methyl ketone (0.5 mmol), MeOH (8 mL), CF$_3$CH$_2$OH (1 mmol), amine (2 mmol), KI (1 mmol) and MeNO$_2$ (1mL) were added in sequence, and the total solution volume was almost 10 mL. The constant current electrolysis (20 mA) was carried out at room temperature under 1 atm of oxygen atmosphere (O$_2$ balloon). After the reaction was finished, the solvent was removed under reduced pressure. The resulting crude product was purified with flash chromatography (Hex: EtOAc = 3:1:1:1) to give enaminone as a yellow solid or pale yellow oil.
Optimization of the carbon source

In this part, some common carbon sources were screened. However, only nitromethane could be employed as an ideal carbon source, while others failed to give the corresponding product. The results were shown as below.

Table S1. Screening the proper carbon source

<table>
<thead>
<tr>
<th>Entry</th>
<th>Carbon Source</th>
<th>Yield[^b]</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>4</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>5</td>
<td>CH$_3$NO$_2$</td>
<td>41</td>
</tr>
<tr>
<td>6</td>
<td>EtNO$_2$</td>
<td>0</td>
</tr>
</tbody>
</table>

[^a]: Reaction condition: 1a (0.5 mmol), 2a (2 mmol), n-Bu$_4$NI (1 mmol), EtOH (8 mL), carbon source (1 mL), platinum sheet as an anode and a cathode in an undivided cell, at a constant current of 20 mA for 7 hours, room temperature.  
[^b]: Isolated yield.
Characterization of the products

For the $^1$HNMR, the peaks of hydrogens on the piperidine cycle should be multiplet, however, in most cases, they were shown as a single peak. For the $^{13}$CNMR, the chemical shift of carbons on the piperidine cycle should be different, however, in some cases, only one carbon was found even if the concentration of the sample in CDCl$_3$ was increased. These phenomena were in accordance with the references.

pale yellow solid; $^1$H NMR (400 MHz, CDCl$_3$) $\delta$ 7.88 (d, $J = 7.2$ Hz, 2H), 7.78 (d, $J = 12.5$ Hz, 1H), 7.49 – 7.34 (m, 3H), 5.82 (d, $J = 12.4$ Hz, 1H), 3.56 – 3.23 (m, 4H), 1.77 – 1.54 (m, 6H). $^{13}$C NMR (101 MHz, CDCl$_3$) $\delta$ 189.20, 153.30, 140.82, 130.90, 128.20, 127.53, 91.32, 55.05 (brs, NCH$_2$), 46.74 (brs, NCH$_2$), 26.21(brs), 24.13. MS (EI) m/z 215 (M$^+$); IR(KBr) 1210, 1280, 1371, 1446, 1541, 1639, 2937 cm$^{-1}$; mp90-91°C. [S1,3]

pale yellow solid; $^1$H NMR (300 MHz, CDCl$_3$) $\delta$ 7.80 (d, $J = 8.1$ Hz, 2H), 7.21 (d, $J = 7.9$ Hz, 2H), 5.83 (d, $J = 12.5$ Hz, 1H), 3.37 (m, 4H), 2.39 (s, 3H), 1.67 (m, 6H). $^{13}$C NMR (75 MHz, CDCl$_3$) $\delta$ 188.89, 153.16, 141.25, 137.97, 128.86, 127.60, 91.14, 55.48 (brs), 46.27 (brs), 25.86 (brs), 24.11, 21.54. MS (EI) m/z 229 (M$^+$); IR(KBr) 768, 1206, 1368, 1447, 1546, 1641, 2857, 2938 cm$^{-1}$; mp120-121°C. [S2]

pale yellow solid; $^1$H NMR (400 MHz, CDCl$_3$) $\delta$ 7.91 – 7.75 (m, 2H), 7.77 (d, $J = 12.5$ Hz, 1H), 6.92 – 6.89 (m, 2H), 5.81 (d, $J = 5.6$ Hz, 1H), 3.85 (s, 3H), 3.39 – 3.33 (m, 4H), 1.70 – 1.63 (m, 6H). $^{13}$C NMR (101 MHz, CDCl$_3$) $\delta$ 187.85, 161.97, 152.93, 133.33, 129.46, 113.58, 90.79, 54.99, 24.12. HRMS calc. C$_{15}$H$_{19}$NO$_2$ (M$^+$): 245.1416, Found: 245.1419. IR(KBr) 778, 1167, 1213, 1252, 1448, 1546, 1601, 1639, 2855, 2937 cm$^{-1}$; mp125-126°C.
pale yellow solid; $^1$H NMR (400 MHz, CDCl$_3$) $\delta$ 7.84 - 7.82 (m, 2H), 7.77 (d, $J = 12.5$ Hz, 1H), 7.43 - 7.41 (m, 2H), 5.82 (d, $J = 12.5$ Hz, 1H), 3.36 (s, 4H), 1.67 (s, 6H), 1.33 (s, 9H). $^{13}$C NMR (101 MHz, CDCl$_3$) $\delta$ 188.92, 154.27, 153.02, 138.04, 127.38, 125.11, 91.30, 55.00 (brs), 47.20 (brs), 34.93, 31.32, 25.98 (brs). 24.13. HRMS calc. C$_{18}$H$_{25}$NO (M$^+$): 271.1936, Found: 271.1941. IR(KBr) 762, 1207, 1640, 2938 cm$^{-1}$; mp111-112$^\circ$C.

pale yellow solid; $^1$H NMR (400 MHz, CDCl$_3$) $\delta$ 7.91 - 7.88 (m, 2H), 7.78 (d, $J = 12.4$ Hz, 1H), 7.07 (t, $J = 8.7$ Hz, 2H), 5.77 (d, $J = 12.4$ Hz, 1H), 3.37 (s, 4H), 1.67 (s, 6H). $^{13}$C NMR (101 MHz, CDCl$_3$) $\delta$ 187.57, 164.58 (d, $J = 250.5$ Hz), 153.36, 136.97 (d, $J = 3.0$ Hz), 129.79 (d, $J = 8.8$ Hz), 115.08 (d, $J = 21.5$ Hz), 90.77, 55.01 (brs), 46.51 (brs), 25.90 (brs). 24.12. HRMS calc. C$_{14}$H$_{16}$FNO (M$^+$): 233.1216, Found: 233.1222. IR(KBr) 1213, 1446, 1538, 1595, 1638, 2852, 2940 cm$^{-1}$; mp114-115$^\circ$C.

mp127-128$^\circ$C. [52]

pale yellow solid; $^1$H NMR (400 MHz, CDCl$_3$) $\delta$ 7.88 - 7.79 (m, 3H), 7.37 (d, $J = 8.6$ Hz, 2H), 5.77 (d, $J = 12.4$ Hz, 1H), 3.38 (br, 4H), 1.68 (m, 6H). $^{13}$C NMR (101 MHz, CDCl$_3$) $\delta$ 187.60, 153.50, 139.14, 136.95, 128.99, 128.42, 90.79, 24.12. MS (EI) $m/z$ 249 (M$^+$); IR(KBr) 1446, 1540, 1631, 2935 cm$^{-1}$; mp127-128$^\circ$C.

pale yellow solid; $^1$H NMR (400 MHz, CDCl$_3$) $\delta$ 7.81 - 7.74 (m, 3H), 7.55 - 7.52 (m, 2H), 5.76 (d, $J = 12.4$ Hz, 1H), 3.38 (br, 1H), 1.68 (m, 3H). $^{13}$C NMR (101 MHz, CDCl$_3$) $\delta$ 187.67, 153.50, 139.58, 131.37, 129.19, 125.48, 90.74, 55.29, 46.67, 26.53, 25.12, 24.10. HRMS calc. C$_{14}$H$_{16}$BrNO (M$^+$): 293.0415, Found: 293.0417. IR(KBr) 1447, 1540, 1634, 2938, 3021 cm$^{-1}$; mp133-134$^\circ$C.
pale yellow solid; \(^1\)H NMR (400 MHz, CDCl\(_3\)) \(\delta\) 7.76 (dd, \(J = 16.1, 10.3\) Hz, 3H), 7.61 (d, \(J = 8.1\) Hz, 2H), 5.75 (d, \(J = 12.4\) Hz, 1H), 3.47–3.26 (m, 4H), 1.79–1.56 (m, 6H). \(^{13}\)C NMR (101 MHz, CDCl\(_3\)) \(\delta\) 187.82, 153.48, 140.13, 137.35, 129.21, 97.86, 90.65, 55.17, 46.35, 26.63, 24.82, 24.07. HRMS calc. C\(_{14}\)H\(_{16}\)INO (M\(^+\)) : 341.0277, Found: 341.0282. IR(KBr) 762, 881, 1446, 1541, 1571, 1634, 2853, 2938 cm\(^{-1}\); mp111-112°C.

pale yellow solid; \(^1\)H NMR (400 MHz, CDCl\(_3\)) \(\delta\) 7.96 (d, \(J = 8.1\) Hz, 2H), 7.82 (d, \(J = 12.4\) Hz, 1H), 7.65 (d, \(J = 8.2\) Hz, 2H), 5.78 (d, \(J = 12.4\) Hz, 1H), 3.39 (m, 4H), 1.69 (m, 6H). \(^{13}\)C NMR (101 MHz, CDCl\(_3\)) \(\delta\) 187.63, 153.82, 144.00, 132.30 (q, \(J = 32\) Hz), 127.80, 124.12 (d, \(J = 270\) Hz), 125.23 (q, \(J = 3.7\) Hz), 91.05, 55.38, 46.58, 26.52, 25.04, 24.07. HRMS calc. C\(_{15}\)H\(_{16}\)F\(_3\)NO (M\(^+\)) : 283.1184, Found: 283.1187. IR(KBr) 1333, 1546, 1641, 1641, 229.1467, Found: 229.1471. IR(KBr) 767, 1210, 1368, 1447, 1546, 1640, 2858, 2938 cm\(^{-1}\); mp75-76°C.

pale yellow solid; \(^1\)H NMR (400 MHz, CDCl\(_3\)) \(\delta\) 7.74–7.72 (m, 2H), 7.44–7.31 (m, 1H), 7.17 (td, \(J = 7.6, 1.0\) Hz, 1H), 7.06 (ddd, \(J = 10.5, 8.4, 0.9\) Hz, 1H), 5.71 (d, \(J = 12.6\) Hz, 1H), 3.34 (m, 4H), 1.65 (m, 6H). \(^{13}\)C NMR (75 MHz, CDCl\(_3\)) \(\delta\) 194.98, 153.81, 142.36, 135.43, 130.73, 128.71, 127.17, 125.30, 96.98, 24.09, 19.92. HRMS calc. C\(_{15}\)H\(_{16}\)NO (M\(^+\)) : 229.1467, Found: 229.1471. IR(KBr) 767, 1210, 1368, 1447, 1546, 1640, 2858, 2938 cm\(^{-1}\); mp75-76°C.
pale yellow solid; $^1$H NMR (400 MHz, CDCl$_3$) $\delta$ 7.38 (d, $J = 10.7$ Hz, 1H), 7.24 (d, $J = 7.6$ Hz, 1H), 7.05 – 6.93 (m, 2H), 5.44 (d, $J = 12.8$ Hz, 1H), 3.37 – 3.19 (m, 4H), 2.38 (s, 3H), 2.32 (s, 3H), 1.64 (m, 6H). $^{13}$C NMR (101 MHz, CDCl$_3$) $\delta$ 194.88, 153.71, 139.37, 138.64, 135.62, 131.57, 127.42, 125.89, 96.82, 77.48, 77.16, 76.84, 55.02, 45.89, 26.17, 24.98, 24.08, 21.29, 19.99. HRMS calc. C$_{16}$H$_{21}$NO ($M^+$): 243.1623, Found: 243.1626. IR(KBr) 766, 1206, 1447, 1546, 1638, 2856, 2940 cm$^{-1}$; mp125-126°C.

pale yellow solid; $^1$H NMR (300 MHz, CDCl$_3$) $\delta$ 7.78 (d, $J = 12.5$ Hz, 1H), 7.73 – 7.58 (m, 2H), 7.38 – 7.14 (m, 2H), 5.81 (d, $J = 12.5$ Hz, 1H), 3.37 (s, 4H), 2.39 (s, 3H), 1.67 (s, 6H). $^{13}$C NMR (75 MHz, CDCl$_3$) $\delta$ 187.36, 152.96, 149.94, 147.73, 135.40, 122.54, 107.97, 107.62, 101.43, 90.78, 25.72, 24.10. HRMS calc. C$_{15}$H$_{19}$NO ($M^+$): 229.1467, Found: 229.1470. IR(KBr) 768, 1206, 1368, 1447, 1546, 1641, 2857, 2938 cm$^{-1}$; mp113-114°C.

pale yellow solid; $^1$H NMR (400 MHz, CDCl$_3$) $\delta$ 7.78 (d, $J = 12.5$ Hz, 1H), 7.51 – 7.40 (m, 2H), 7.35 – 7.23 (m, 1H), 7.03 – 6.93 (m, 1H), 5.79 (d, $J = 12.5$ Hz, 1H), 3.85 (s, 3H), 3.36 (m, 4H), 1.64 (m, 6H). $^{13}$C NMR (101 MHz, CDCl$_3$) $\delta$ 188.84, 159.64, 153.30, 142.35, 129.09, 119.93, 117.14, 112.31, 91.36, 55.46, 54.95, 46.39, 24.09. HRMS calc. C$_{15}$H$_{19}$NO$_2$ ($M^+$): 245.1416, Found: 245.1420. IR(KBr) 778, 1213, 1252, 1448, 1546, 1639, 2855, 2937 cm$^{-1}$; mp116-118°C.

pale yellow solid; $^1$H NMR (400 MHz, CDCl$_3$) $\delta$ 7.69 (d, $J = 12.5$ Hz, 1H), 7.47 (d, $J = 1.9$ Hz, 1H), 7.41 (dd, $J = 8.4$, 2.0 Hz, 1H), 6.78 (d, $J = 8.4$ Hz, 1H), 5.75 (d, $J = 12.5$ Hz, 1H), 3.87 (s, 3H), 3.85 (s, 3H), 3.29 (s, 4H), 1.59 (s, 6H). $^{13}$C NMR (101 MHz, CDCl$_3$) $\delta$ 187.81, 152.92, 151.55, 148.77, 133.70, 120.95, 110.58, 109.99, 90.71, 56.05, 56.04, 25.89, 24.13. HRMS calc. C$_{16}$H$_{21}$NO$_3$ ($M^+$):
275.1521, Found: 275.1527. IR(KBr) 778, 1168, 1448, 1546, 1601, 1637, 2855, 2936cm⁻¹; mp136-137°C.

![Image](3pa)
pale yellow solid; ¹H NMR (400 MHz, CDCl₃) δ 7.75 (d, J = 12.4 Hz, 1H), 7.47 (dd, J = 8.1, 1.7 Hz, 1H), 7.42 (d, J = 1.6 Hz, 1H), 6.81 (d, J = 8.1 Hz, 1H), 6.00 (s, 2H), 5.75 (d, J = 12.4 Hz, 1H), 3.35 (m, 4H), 1.66 (m, 6H). ¹³C NMR (101 MHz, CDCl₃) δ 187.44, 153.04, 149.98, 147.75, 135.40, 122.58, 108.01, 107.66, 101.47, 90.77, 25.81, 24.13. HRMS calc. C₁₅H₁₇NO₃ (M⁺): 259.1208, Found: 259.1211; mp127-128°C.

![Image](3qa)
pale yellow solid; ¹H NMR (300 MHz, CDCl₃) δ 8.39 (s, 1H), 8.07 – 7.77 (m, 5H), 7.59 – 7.41 (m, 2H), 5.99 (d, J = 12.4 Hz, 1H), 3.42 (s, 4H), 1.69 (s, 6H). ¹³C NMR (75 MHz, CDCl₃) δ 188.82, 153.20, 138.12, 134.76, 132.88, 129.20, 127.83, 127.76, 127.69, 127.17, 126.24, 124.73, 91.44, 24.08. HRMS calc. C₁₈H₁₉NO (M⁺): 265.1467, Found: 265.1472. IR(KBr) 1209, 1280, 1446, 1541, 1638, 2937cm⁻¹; mp110-111°C.

![Image](3ab)
pale yellow solid; ¹H NMR (400 MHz, CDCl₃) δ 7.95 – 7.85 (m, 2H), 7.80 (d, J = 12.4 Hz, 1H), 7.49 – 7.37 (m, 3H), 5.72 (d, J = 12.4 Hz, 1H), 3.13 (s, 3H), 2.93 (s, 3H). ¹³C NMR (101 MHz, CDCl₃) δ 188.88, 154.44, 140.63, 131.00, 128.23, 92.35, 44.85, 37.36. MS (El) m/z 175 (M⁺); IR(KBr) 760, 1206, 1465, 1640, 2968cm⁻¹; mp89-90°C. [S3]

![Image](3ac)
pale yellow foam; ¹H NMR (300 MHz, CDCl₃) δ 7.89-7.81 (m, 3H), 7.45 – 7.37 (m, 3H), 5.77 (d, J = 12.5 Hz, 1H), 3.33 (q, J = 7.1 Hz, 4H), 1.24 (t, J = 7.1 Hz, 7H). ¹³C NMR (101 MHz, CDCl₃) δ 188.92, 152.51, 140.93, 130.87, 128.22, 127.59, 91.89, 50.69, 42.97, 14.92, 11.70. MS (El) m/z 203 (M⁺); IR(KBr) 762, 1050, 1281, 1365, 1465, 1546, 1639, 2855, 2968cm⁻¹. [S3]
pale yellow oil; $^1$H NMR (300 MHz, CDCl$_3$) $\delta$ 7.89-7.86 (m, 3H), 7.43-7.40 (m, 3H), 5.75 (d, $J = 12.4$ Hz, 1H), 3.23 (br, 4H), 1.68-1.66 (m, 4H), 0.95 – 0.85 (m, 6H). $^{13}$C NMR (101 MHz, CDCl$_3$) $\delta$ 189.00, 153.63, 140.86, 130.85, 128.19, 127.54, 91.89, 58.32, 50.46, 22.54, 19.78, 11.61, 11.09. HRMS calc. C$_{15}$H$_{21}$NO (M$^+$): 231.1623, Found: 231.1629.

IR(KBr) 760, 1048, 1280, 1365, 1462, 1548, 1640, 2870, 2968 cm$^{-1}$.

pale yellow oil; $^1$H NMR (300 MHz, CDCl$_3$) $\delta$ 7.90 – 7.82 (m, 3H), 7.45-7.43 (m, 3H), 5.76 (d, $J = 12.4$ Hz, 1H), 3.28 (s, 4H), 1.63 (br, 4H), 1.38 (br, 4H), 0.98 (br, 6H). $^{13}$C NMR (101 MHz, CDCl$_3$) $\delta$ 128.17, 127.53, 91.85, 56.36, 48.56, 31.43, 28.52, 20.41, 19.87, 13.85. MS (EI) m/z 259 (M$^+$);

IR(KBr) 762, 1049, 1204, 1285, 1460, 1549, 1640, 2872, 2956 cm$^{-1}$. [S1]

pale yellow foam; $^1$H NMR (400 MHz, CDCl$_3$) $\delta$ 7.88 (dd, $J = 8.1$, 1.5 Hz, 2H), 7.75 (d, $J = 12.5$ Hz, 1H), 7.45 – 7.40 (m, 3H), 5.85 (d, $J = 12.6$ Hz, 1H), 4.17 (q, $J = 7.1$ Hz, 2H), 3.66 (d, $J = 12.4$ Hz, 2H), 3.18 (br, 2H), 2.60-2.53 (m, 1H), 2.03 – 1.99 (m, 2H), 1.85 – 1.75(m, 2H), 1.27 (t, $J = 7.1$ Hz, 3H). $^{13}$C NMR (101 MHz, CDCl$_3$) $\delta$ 189.32, 173.80, 153.00, 140.49, 131.08, 128.23, 127.54, 92.05, 60.89, 40.49, 27.76, 14.26. HRMS calc. C$_{17}$H$_{21}$NO$_3$ (M$^+$): 287.1521, Found: 287.1525. IR(KBr) 990, 1195, 1640, 1710, 2940, 2961 cm$^{-1}$.

pale yellow oil; $^1$H NMR (400 MHz, CDCl$_3$) $\delta$ 8.04 – 7.99 (m, 2H), 7.57-7.53 (m, 1H), 7.45 (t, $J = 7.8$ Hz, 2H), 3.81 (s, 2H), 2.58 (m, 4H), 1.66 (dt, $J = 11.3$, 5.6 Hz, 4H), 1.46 (dt, $J = 11.5$, 5.9 Hz, 2H). $^{13}$C NMR (101 MHz, CDCl$_3$) $\delta$ 196.83, 136.33, 133.24, 128.59, 128.27, 65.26, 54.88, 25.82, 24.05.

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pale yellow oil; $^1$H NMR (400 MHz, CDCl$_3$) $\delta$ 7.88 (d, $J$ = 7.5 Hz, 2H), 7.38 (d, $J$ = 7.3 Hz, 1H), 7.28 (t, $J$ = 7.7 Hz, 2H), 3.63 (s, 2H), 2.82 (d, $J$ = 10.9 Hz, 2H), 1.98 (t, $J$ = 10.9 Hz, 2H), 1.47 (d, $J$ = 9.1 Hz, 2H), 1.22 (dd, $J$ = 14.6, 6.6 Hz, 3H), 0.79 (d, $J$ = 5.3 Hz, 3H). $^{13}$C NMR (101 MHz, CDCl$_3$) $\delta$ 196.73, 136.23, 133.16, 128.52, 128.18, 64.85, 54.26, 34.06, 30.40, 21.87.

yellow solid; $^1$H NMR (400 MHz, CDCl$_3$) $\delta$ 8.13 (d, $J$ = 13.2 Hz, 1H), 8.02 – 8.00 (m, 2H), 7.72 – 7.68 (m, 2H), 7.59 – 7.55 (m, 2H); $^{13}$C NMR (101 MHz, CDCl$_3$) $\delta$ 187.15, 148.28, 136.02, 135.00, 129.78, 129.37, 129.07. IR(KBr) 721, 796, 945, 1014, 1450, 1533, 1620, 1672, 2924cm$^{-1}$; mp102-103$^\circ$C.
Detection of the reaction intermediates

The reaction conditions were the same as the general procedure as shown in page S2. For the GC-MS analysis of the reaction mixture, small samples were taken with a syringe at different reaction times and then were diluted with EtOAc. The results showed that phenacyl iodine 5 and tertiary amine 6 were generated as the reaction continues. After 6h, these two intermediates were consumed almost entirely. However, intermediate 11 can’t be detected by GC-MS even if the reaction mixture was rapidly cooling by liquid nitrogen. The main reason may due to the high reaction rate between intermediate 11 and piperidine. The control experiment showed that this reaction was completed in less than 5 minutes (Scheme 3, eq 4 in the main text).

The GC-MS spectra at different reaction stage (t= 1h, 6h) are shown as below:

Retention time for intermediates and product:

Acetophenone 1a t=3.40 min; Phenacyl iodine 5 t=4.72 min; tertiary amine 6 t=5.27 min; enaminon 3aa t=8.40 min.

Fig 1. GC spectrum for reaction mixture at 1h
Fig 2. MS spectrum for substance with retention time at 3.39 min

Fig 3. MS spectrum for substance with retention time at 4.72 min (compound 5)
Fig 4. MS spectrum for substance with retention time at 5.27 min (compound 6)

Fig 5. MS spectrum for substance with retention time at 8.39 min (compound 3aa)
Fig 6. GC spectrum for reaction mixture at 6h

Reference:


$^1$H NMR of 3aa (CDCl$_3$, 400MHz)

$^{13}$C NMR of 3aa (CDCl$_3$, 100MHz)
$^1$HNMR of 3ba (CDCl$_3$, 300MHz)

$^{13}$CNMR of 3ba (CDCl$_3$, 100MHz)
$^{1}H$ NMR of 3ca (CDCl$_3$, 400MHz)

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

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

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

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

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

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

$^{13}$C NMR of 3ia (CDCl$_3$, 100MHz)
$^1$H NMR of 3ja (CDCl$_3$, 300MHz)

$^{13}$C NMR of 3ja (CDCl$_3$, 75MHz)
$^{1}$$\text{H}$NMR of $3ka$ (CDCl$_3$, 400MHz)

$^{13}$$\text{C}$NMR of $3ka$ (CDCl$_3$, 100MHz)
$^1$HNMR of 3-la (CDCl$_3$, 400MHz)

$^{13}$C NMR of 3-la (CDCl$_3$, 100MHz)
$^1$H NMR of 3ma (CDCl$_3$, 300MHz)

$^{13}$C NMR of 3ma (CDCl$_3$, 75MHz)
$^1$HNMR of 3na (CDCl$_3$, 400MHz)

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

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

$^{13}$C NMR of 3pa (CDCl$_3$, 100MHz)
$^1$H NMR of 3qa (CDCl$_3$, 300MHz)

$^{13}$C NMR of 3qa (CDCl$_3$, 75MHz)
$^1$H NMR of 3ab (CDCl$_3$, 400MHz)

$^{13}$C NMR of 3ab (CDCl$_3$, 100MHz)
$^1$H NMR of 3ac (CDCl$_3$, 300MHz)

$^{13}$C NMR of 3ac (CDCl$_3$, 100MHz)
$^1$H NMR of 3ad (CDCl$_3$, 300MHz)

$^{13}$C NMR of 3ad (CDCl$_3$, 75MHz)
$^1$H NMR of 3ae (CDCl$_3$, 300MHz)

$^{13}$C NMR of 3ae (CDCl$_3$, 100MHz)
$^1$H NMR of 6 (CDCl$_3$, 400MHz)

$^{13}$C NMR of 6 (CDCl$_3$, 100MHz)
$^1$H NMR of 7 (CDCl$_3$, 400MHz)

$^{13}$C NMR of 7 (CDCl$_3$, 100MHz)
$^1$HNMR of 11 (CDCl$_3$, 400MHz)

$^{13}$CNMR of 11 (CDCl$_3$, 100MHz)