Supporting Information
for DOI: 10.1055/s-0031-1290532
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Supporting Information For

C-1 Alkynylation of N-methyl tetrahydroisoquinolines through CDC: A direct access to phenethylisoquinoline alkaloids

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Contents:

1) Experimental procedures and characterization data.

2) Copies of $^1$H NMR and $^{13}$C NMR spectra for all compounds
1) Experimental procedures and characterization data

General information: $^1$H NMR spectra were recorded on JEOL AL 300MHz and BRUKER 400MHz spectrometer in CDCl$_3$ solution and the chemical shifts were reported in parts per million ($\delta$) relative to internal standard TMS (0 ppm). The coupling constants ($J$) are reported in Hertz (Hz). $^{13}$C NMR spectra were obtained at 75 MHz and 100 MHz and referenced to the internal solvent signals (central peak is 77.00 CDCl$_3$). MS data of selected compounds were obtained by Q-Tof Micro™ Mass Spectrometer. Elemental analysis of only final new compounds is given. Purification of compounds was done with column chromatography over silica gel using hexane-ethyl acetate as eluent.

Synthesis of 6a, 6b, 6c:

N-Methyl 1,2,3,4-tetrahydroisoquinoline (6a)

It was prepared from isoquinoline according to the reported procedure.$^1$

6,7-Dimethoxy-2-methyl-1,2,3,4-tetrahydroisoquinoline (6b)

The title compound was prepared from homoveratryl amine according to the reported method.$^2$

6-Isopropoxy-7-methoxy-2-methyl-1, 2, 3, 4-tetrahydro isoquinoline (6c)

The amine 6c was prepared according to Scheme a. Reaction of isovanilline (3-hydroxy- 4-methoxy benaldehyde) (a) with isopropylbromide and K$_2$CO$_3$ using DMF as solvent gave 3-isopropoxy-4-methoxy benzaldehyde (b) which upon condensation with nitromethane gave nitrostryene c.

\[
\begin{align*}
\text{a} & \xrightarrow{\text{K$_2$CO$_3$, DMF, i-PrBr}} \text{b} & \xrightarrow{\text{amm. acetate, CH$_3$NO$_2$}} \text{c} \\
\text{f} & \xrightarrow{\text{POCl$_3$, benzene}} \text{e} & \xrightarrow{\text{ethylformate, CH$_3$I, Et$_2$O}} \text{d} \\
\text{g} & \xrightarrow{\text{NaBH$_4$, MeOH, H$_2$O}} \text{1c} \\
\end{align*}
\]

Scheme a
of e afforded 2-(3-isopropoxy-4-methoxyphenyl) ethyl amine (d). Formylation of d with ethylformate afforded the product e. Bischler-Napieralski cyclisation of formyl derivative e gave the corresponding dihydroisoquinoline f. Quarternisation of amine f with methyl iodide followed by reduction with NaBH₄ gave amine 6c in 68% yield as a light yellow liquid.

Phenylacetylene (7a) was prepared by dehydrobromination of styrene dibromide with sodamide in liquid ammonia in 79% yield.³

**Synthesis of substituted alkynes (7b-7d):** Substituted alkynes used in this work were prepared according to general procedure shown below.

**Substituted cinnamic acids (h):**
A solution of appropriate aldehyde (0.20 mol) and malonic acid (0.44 mol) in a mixture of 100 mL of pyridine and 1 mL of piperidine was heated on water bath for one hour. After cooling the contents were poured into dil. HCl for neutralization. The precipitated solid was filtered, dried and used as such in next step without purification.

**Substituted β-bromostryrene (i):**
The dry cinnamic acid (0.25 mol) was dissolved in 150 mL of hot chloroform and the solution was cooled in ice bath. As soon as solid began to crystallise a solution of Br₂ (0.25 mol) in 25 mL chloroform was added rapidly in three portions. Reaction mixture was allowed to stand in an ice bath for 30 min and 2,3-dibromo-3-phenylpropionic acid was removed by filtration. Crude bromo acid was heated under reflux with 325 mL of 10 % Na₂CO₃, until evolution of carbon dioxide ceased. After cooling to room temperature the β-bromostyrene was extracted with chloroform (3 × 50 mL). The combined organic layer was washed with water, brine and dried over anhyd Na₂SO₄. Concentrated in vacuo afforded crude β-bromostryrene which was used as such in next step.
**Substituted phenyl acetylene (7b-7d):**

Potassium hydroxide 30 g and few drops of water were placed in 100 mL round bottom flask fitted with distillation assembly and was maintained at 200-220°C in an oil bath. 10-12 mL of crude β-bromo styrene was added drop wise on molten KOH. Substituted phenylacetylene begun to distil over, slowly temperature was raised up to 230-250 °C until no product distil over. The distillate was taken in ether and dried over anhyd Na$_2$SO$_4$. Solvent was evaporated in vacuo and residue was distilled under reduced pressure to afford the pure substituted phenyl acetylene.

<table>
<thead>
<tr>
<th>S.No</th>
<th>Alkyne</th>
<th>b.pt.(°C)</th>
<th>lit. b.pt.</th>
<th>yield(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Phenylacetylene(7a)</td>
<td>140-145(760mm Hg)</td>
<td>140-142(760 mm Hg)</td>
<td>79</td>
</tr>
<tr>
<td>2.</td>
<td>4-Chlorophenylacetylene(7b)</td>
<td>55-60(11mm Hg)</td>
<td>84(25 mm Hg)</td>
<td>38</td>
</tr>
<tr>
<td>3.</td>
<td>4-Methoxyphenylacetylene(7c)</td>
<td>90-93(11 mm Hg)</td>
<td>89-94(15 mm Hg)</td>
<td>35</td>
</tr>
<tr>
<td>4.</td>
<td>3,4-Dimethoxyphenylacetylene(7d)</td>
<td>Solid(m.pt 70-72 °C)</td>
<td>lit m.pt 67-70 °C</td>
<td>40</td>
</tr>
</tbody>
</table>

1-Octyne (7e) was purchased from commercial source and used without purification.

**CuI/DEAD mediated CDC Reactions:**

**General Procedure** : To a solution of appropriate N-methyltetrahydroisoquinoline (1 mmol) in THF (2 mL), taken in 10 mL two-necked round bottom flask, was added DEAD (1.1 mmol) dropwise in 1-2 minutes at 0-5 °C and the reaction mixture was allowed to come to room temperature and stirred for 1 hr. After re-cooling to 0-5 °C, CuI (0.05 mmol) was added followed by drop wise addition of the alkyne (1.5 mmol). The resulting mixture was stirred for 5-6 hours at room temperature and then the solvent was evaporated under reduced pressure. The residue was purified by column chromatography over silica gel using hexane- ethyl acetate mixture (9:1 – 6:4) as the eluent to give the pure products 8a-8j.
2-Methyl-1-(phenylethynyl)-1,2,3,4-tetrahydroisoquinoline (8a): Brownish oily liquid. Isolated yield 82%. \(^{1}H\) NMR (CDCl\(_3\)) \(\delta\) 7.31-7.28(m, 3H), 7.24-7.21(m, 3H), 7.14-7.12(m, 3H), 4.59(s, 1H), 3.01-2.90(m, 1H), 2.87-2.81(m, 1H), 2.78-2.71(m, 1H), 2.63-2.57(m, 1H), 2.51(s, 3H). \(^{13}C\) NMR: 135.13, 133.28, 131.70, 128.78, 128.07, 127.92, 127.52, 126.87, 125.85, 123.14, 87.38, 86.37, 56.81, 48.50, 43.62, 28.77.

1-(4-Chlorophenylethynyl)-2-methyl-1,2,3,4-tetrahydroisoquinoline (8b): Yellow oil. Isolated yield 70%. \(^{1}H\) NMR (CDCl\(_3\)) \(\delta\) 7.22(d, \(J = 8.8\text{Hz}, 2\text{H}\)), 7.20-7.21(m, 1H), 7.13(d, \(J = 8.7\text{Hz}, 2\text{H}\)), 7.06(m, 2H), 6.99(m, 1H), 4.61(s, 1H), 2.99-2.93(m, 1H), 2.90-2.84(m, 1H), 2.81-2.74(m, 1H), 2.67-2.62(m, 1H), 2.52(s, 3H). \(^{13}C\) NMR: 134.82, 134.13, 133.30, 132.98, 128.90, 128.51, 127.53, 127.07, 125.99, 121.61, 88.43, 85.39, 56.84, 48.56, 43.63, 28.73.

1-(4-Methoxyphenylethynyl)-2-methyl-1,2,3,4-tetrahydroisoquinoline (8c): Yellow oil. Isolated yield 80%. \(^{1}H\) NMR (CDCl\(_3\)) \(\delta\) 7.23(d, \(J = 8.4\text{Hz}, 3\text{H}\)), 7.07-7.04(m, 2H), 7.01-6.98(m, 1H), 6.66(d, \(J = 8.7\text{Hz}, 2\text{H}\)), 4.57(s, 1H), 3.66(s, 3H), 2.92-2.89(m, 1H), 2.87-2.81(m, 1H), 2.78-2.71(m, 1H), 2.63-2.57(m, 1H), 2.51(s, 3H). \(^{13}C\) NMR: 159.34, 135.44, 133.30, 133.06, 128.74, 127.55, 126.77, 125.79, 115.29, 113.70, 86.12, 85.91, 56.94, 48.59, 43.70, 28.85.

1-(3,4-Dimethoxyphenylethynyl)-2-methyl-1,2,3,4-tetrahydroisoquinoline (8d): Yellow viscous oil. Isolated yield 82%. \(^{1}H\) NMR (CDCl\(_3\)) \(\delta\) 7.25-7.22(m, 1H), 7.09-7.03(m, 2H), 7.01-6.99(m, 1H), 6.88(dd, \(J = 8.1\text{Hz}, 1.8\text{Hz}, 1\text{H}\)), 6.78(d, \(J = 1.8\text{Hz}, 1\text{H}\)), 6.61(d, \(J = 8.4\text{Hz}, 1\text{H}\)), 4.60(s, 1H), 3.00-2.94(m, 1H), 2.90-2.84(m, 1H), 2.81-
2.76(m, 1H), 2.66-2.61(m, 1H), 2.53(s, 3H); $^{13}$C NMR: 149.28, 148.47, 135.02, 133.10, 128.67, 127.48, 126.80, 125.79, 124.90, 115.20, 114.49, 110.83, 86.33, 85.47, 56.73, 55.63, 55.61, 48.45, 43.45, 28.53.

6,7-Dimethoxy-2-methyl-1-(phenylethynyl)-1,2,3,4-tetrahydroisoquinoline (8e): Yellowish brown oil. Isolated yield 81%.

$^1$H NMR (CDCl$_3$) δ 7.33-7.29(m, 2H), 7.18-7.16(m, 3H), 6.70(s, 1H), 6.47(s, 1H), 4.52(s, 1H), 3.78(s, 3H), 3.75(s, 3H), 2.97-2.85(m, 1H), 2.82-2.77(m, 1H), 2.72-2.70(m, 1H), 2.63-2.57(m, 1H), 2.51(s, 3H); $^{13}$C NMR: 148.26, 147.51, 131.73, 128.11, 127.96, 127.06, 125.42, 123.19, 111.35, 110.43, 87.50, 86.29, 56.44, 55.72, 48.54, 43.61, 28.77; MS (ESI) m/z = 308.1 [M + H]$^+$

1-(4-Chlorophenylethynyl)-6,7-dimethoxy-2-methyl-1,2,3,4-tetrahydroisoquinoline (8f): Yellow viscous liquid. Isolated yield 68%.

$^1$H NMR (CDCl$_3$) δ 7.27-7.23(m, 2H), 7.18-7.15(m, 2H), 6.97(s, 1H), 6.49(s, 1H), 4.53(s, 1H), 3.78(s, 3H), 3.77(s, 3H), 2.96-2.86(m, 2H), 2.83-2.78(m, 1H), 2.73-2.70(m, 1H), 2.51(s, 3H); $^{13}$C NMR: 148.35, 147.54, 134.15, 132.96, 128.54, 126.73, 125.48, 121.62, 111.35, 110.37, 88.59, 85.21, 56.42, 55.96, 55.80, 48.53, 43.58, 28.33; MS (ESI) m/z = 342.1 [M + H]$^+$

6,7-Dimethoxy-1-(4-methoxyphenylethynyl)-2-methyl-1,2,3,4-tetrahydroisoquinoline (8g): Yellow viscous oil. Isolated yield 78%.

$^1$H NMR (CDCl$_3$) δ 7.26(d, $J = 9$Hz, 2H), 6.76(s, 1H), 6.71(d, $J = 9$Hz, 2H), 6.51(s, 1H), 4.54(s, 1H), 3.78(s, 3H), 3.77(s, 3H), 3.71(s, 3H), 3.00-2.92(m, 1H), 2.83-2.68(m, 2H), 2.65-2.58(m, 1H), 2.53(s, 3H); $^{13}$C NMR: 159.40, 148.06, 147.30, 133.10, 127.10, 125.40, 115.17, 113.78,
6,7-Dimethoxy-1-(3,4-dimethoxyphenylethynyl)-2-methyl-1,2,3,4-tetrahydroisoquinoline (8h): Yellow viscous liquid. Isolated yield 80%. \(^1\)H NMR (CDCl\(_3\)) \(\delta\) 6.90 (dd, \(J = 8.1\) Hz, 1.8 Hz, 1H), 6.80 (d, \(J = 1.8\) Hz, 1H), 6.72 (s, 1H), 6.65 (d, \(J = 8.4\) Hz, 1H), 6.49 (s, 1H), 4.50 (s, 1H), 3.78 (s, 6H), 3.77 (s, 6H), 2.94-2.73 (m, 3H), 2.62-2.58 (m, 1H), 2.52 (s, 3H); \(^{13}\)C NMR: 149.39, 148.59, 148.21, 147.45, 125.43, 125.00, 115.38, 114.61, 111.27, 110.93, 110.48, 86.14, 85.90, 56.57, 56.52, 55.92, 55.74, 48.66, 43.66, 28.39; MS (ESI) \(m/z\) = 368.1 [M + H]\(^+\)

6-Isopropoxy-7-methoxy-1-(4-methoxyphenylethynyl)-2-methyl-1,2,3,4-tetrahydroisoquinoline (8i): Yellow oil. Isolated yield 76%. \(^1\)H NMR (CDCl\(_3\)) \(\delta\) 7.28 (d, \(J = 6.7\) Hz, 2H), 6.77 (s, 1H), 6.73 (d, \(J = 6.6\) Hz, 2H), 6.55 (s, 1H), 4.54 (s, 1H), 4.30 (m, 1H), 3.76 (s, 3H), 3.72 (s, 3H), 2.99-2.94 (m, 1H), 2.83-2.78 (m, 1H), 2.76-2.70 (m, 1H), 2.65-2.61 (m, 1H), 2.55 (s, 3H), 1.27 (d, \(J = 6\) Hz, 6H); \(^{13}\)C NMR: 159.45, 148.73, 146.72, 133.18, 127.40, 125.31, 115.62, 115.21, 113.83, 111.03, 86.07, 85.87, 71.35, 56.69, 56.12, 55.30, 48.85, 43.65, 28.21, 22.13, 22.09, 22.02.

2-Methyl-1-(oct-1-ynyl)-1,2,3,4-tetrahydroisoquinoline (8j): Yellow oil. Isolated yield 82%. \(^1\)H NMR (CDCl\(_3\)) \(\delta\) 7.16-7.13 (m, 1H), 7.03-6.97 (m, 2H), 6.94-6.91 (m, 1H), 4.31 (s, 1H), 2.86-2.91 (m, 1H), 2.85-2.72 (m, 2H), 2.52-2.47 (m, 1H), 2.41 (s, 3H), 2.06 (td, \(J = 6.9\) Hz, 2.1 Hz, 2H), 1.42-1.32 (m, 2H), 1.30-1.23 (m, 2H), 1.18-1.16 (m, 4H), 0.76 (t, \(J = 6.9\) Hz, 3H); \(^{13}\)C NMR: 135.77, 132.92, 128.42, 127.27, 125.47, 86.24, 77.83, 56.37, 48.35, 43.36, 31.11, 28.65, 28.32, 22.36, 18.60, 13.86.
General procedure for synthesis of phenethylisoquinolines. To the corresponding C-1 alkynylated product 8 (100 mg) was added Pd/C (20 mg, 5% palladium on charcoal) in ethanol solution and the reaction mixture was stirred under hydrogen atmosphere at room temperature and at atmospheric pressure until completion of reaction. Reaction was monitored by TLC. Crude product was purified by column chromatography using hexane-ethylacetate mixture (8:2 - 4:6) as eluent.

2-Methyl-1-phenethyl-1,2,3,4-tetrahydroisoquinoline (9): Isolated yield is 75% as brownish oil. $^1$H NMR (CDCl$_3$) δ 7.18-7.14(m, 2H), 7.09-6.97(m, 7H), 3.38(t, $J$ = 5.4Hz, 1H), 3.10-3.03(m, 1H), 2.74-2.58(m, 4H), 2.48-2.40(m, 1H), 2.38(s, 3H), 2.03-1.95(m, 2H); $^{13}$C NMR: 142.89, 138.07, 134.81, 128.68, 128.41, 128.22, 126.99, 125.79, 125.73, 125.51, 63.05, 48.36, 42.81, 36.64, 31.36, 28.77. Anal. Calcd for C$_{18}$H$_{21}$N: C, 86.01; H, 8.42; N, 5.57 Found: C, 85.99; H, 8.46; N, 5.55.

1-(4-Methoxyphenethyl)-2-methyl-1,2,3,4-tetrahydroisoquinoline (10): Isolated yield is 73% as light yellow oil. $^1$H NMR (CDCl$_3$) δ 7.14-7.07(m, 6H), 6.82-6.79(m, 2H), 3.77(s, 3H), 3.46(t, $J$ = 5.4Hz, 1H), 3.18-3.12(m, 1H), 2.84-2.64(m, 4H), 2.47-2.42(m, 1H), 2.44(s, 3H), 2.09-2.00(m, 2H); $^{13}$C NMR: 157.60, 138.18, 134.94, 129.29, 128.71, 127.06, 125.80, 125.74, 113.70, 63.03, 55.22, 48.31, 42.82, 36.93, 30.59, 26.14. Anal. Calcd for C$_{19}$H$_{23}$NO: C, 81.10; H, 8.24; N, 4.98. Found C, 81.19; H, 8.33; N, 4.89.

1-(3,4-Dimethoxyphenethyl)-2-methyl-1,2,3,4-tetrahydroisoquinoline (11): Isolated yield is 74% as yellow oil. $^1$H NMR (CDCl$_3$) δ 7.03-6.94(m, 4H), 6.62-6.57(m, 3H), 3.76(s, 3H), 3.74(s, 3H), 3.36(t, $J$ = 5.4Hz, 1H), 3.12-3.03(m, 1H), 2.75-2.62(m, 2H), 2.60-2.54(m, 2H),
2.38(s, 3H), 2.37-2.30(m, 1H), 2.00-1.91(m, 2H); $^{13}$C NMR: 148.88, 147.12, 138.07, 135.49, 134.65, 128.69, 127.05, 125.84, 125.75, 120.20, 112.10, 111.44, 62.87, 55.82, 55.69, 48.19, 42.83, 37.11, 31.00, 26.07. Anal. Calcd for C$_{20}$H$_{25}$NO$_2$: C, 77.14; H, 8.09; N, 4.50. Found C 77.18; H 8.20; N 4.40.

6,7-Dimethoxy-2-methyl-1-phenethyl-1,2,3,4-tetrahydroisoquinoline (12): Isolated yield is 74% as yellow pasty mass. This compound is known. $^4$ $^1$H NMR (CDCl$_3$) $\delta$ 7.21-7.16(m, 2H), 7.12-7.09(m, 3H), 6.50(s, 1H), 6.44(s, 1H), 3.77(s, 3H), 3.74(s, 3H), 3.44(t, $J$ = 4.8Hz, 1H), 3.19-3.11(m, 1H), 2.87-2.66(m, 4H), 2.59-2.50(m, 1H), 2.44(s, 3H), 2.10-1.94(m, 2H); $^{13}$C NMR: 147.46, 147.33, 142.43, 128.74, 128.39, 128.29, 125.85, 125.65, 111.26, 110.06, 62.59, 55.93, 55.76, 47.41, 42.03, 36.64, 31.76, 24.82; MS (ESI) m/z = 312.5 [M + H]$^+$

1-(4-Chlorophenethyl)-6,7-dimethoxy-2-methyl-1,2,3,4-tetrahydroisoquinoline or Methopholine (1): Isolated yield is 75% as light yellow oil. This compound is known. $^5$ $^1$H NMR (CDCl$_3$) 7.10(d, $J$ = 8.4Hz, 2H), 7.00(d, $J$ = 8.4Hz, 2H), 6.45(s, 1H), 6.39(s, 1H), 3.76(s, 3H), 3.73(s, 3H), 3.32(t, $J$ = 4.8Hz, 1H), 3.10-3.05(m, 1H), 2.66-2.64(m, 4H), 2.43-2.41(m, 1H), 2.40(s, 3H), 1.97-1.93(m, 2H); $^{13}$C NMR: 145.34, 138.73, 129.17, 127.51, 126.59, 126.13, 126.04, 123.96, 109.20, 107.89, 60.30, 53.69, 53.46, 45.59, 40.20, 34.66, 28.61, 22.88; MS (ESI) m/z = 346.2 [M + H]$^+$

6,7-Dimethoxy-1-(4-methoxyphenethyl)-2-methyl-1,2,3,4-tetrahydroisoquinoline (13): Isolated yield is 76% as yellow mass. $^1$H NMR (CDCl$_3$) $\delta$ 7.00(d, $J$ = 8.4Hz, 2H), 6.72(d, $J$ = 8.7Hz, 1H), 6.49(s, 1H), 6.46(s, 1H), 3.77(s, 3H), 3.75(s, 3H), 3.70(s, 3H), 3.31(t, $J$ = 5.4Hz, 1H), 3.09-3.02(m, 1H), 2.56-2.69(m, 4H), 2.43-
6,7-Dimethoxy-1-(3,4-dimethoxyphenethyl)-2-methyl-1,2,3,4-tetrahydroisoquinoline or Homolaudanosine (2): Isolated yield is 78% as light yellow oil. This compound is known.\textsuperscript{6} \textsuperscript{1}H NMR (CDCl\textsubscript{3}) \(\delta\) 6.69-6.62(m, 3H), 6.47(s, 1H), 6.42(s, 1H), 3.77(s, 3H), 3.76(s, 3H), 3.74(s, 3H), 3.37(t, \(J = 5.4\)Hz, 1H), 3.11-3.04(m, 1H), 2.70-2.57(m, 5H), 2.41(s, 3H), 1.98-1.97(m, 2H); \textsuperscript{13}C NMR: 148.87, 147.44, 147.12, 135.14, 129.04, 126.03, 120.17, 111.93, 111.32, 110.21, 62.56, 55.95, 55.86, 55.76, 47.54, 42.30, 37.04, 31.29, 24.90; MS (ESI) \(m/z = 372.2\) [M + H]\textsuperscript{+}.

7-Methoxy-1-(4-methoxyphenethyl)-2-methyl-1,2,3,4-tetrahydroisoquinolin-6-ol or Colchiethine (3): The reduced product (1 equiv) was dissolved in dry DCM and anhyd AlCl\textsubscript{3} (1.3 equiv/isopropyl group) was added. Stirred the reaction mixture for 2-3 hr.\textsuperscript{7} Saturated aq NH\textsubscript{4}Cl solution was added and extracted with DCM (2 \(\times\) 10 mL). Organic layer was dried over anhyd Na\textsubscript{2}SO\textsubscript{4} and solvent was evaporated under vacuo. Crude product was purified by column chromatography. Isolated overall yield is 67% as yellowish viscous liquid. This compound is known.\textsuperscript{8} \textsuperscript{1}H NMR (400 MHz) (CDCl\textsubscript{3}) 7.17(d, \(J = 8.2\)Hz, 2H), 6.83(d, \(J = 8.2\)Hz, 2H), 6.74(s, 1H), 6.40(s, 1H), 3.83(s, 3H), 3.78(s, 3H), 3.49-3.56(m, 1H), 3.26-3.18(m, 2H), 2.93-2.75(m, 5H), 2.71(s, 3H), 2.55-2.56(m, 1H), 2.04-1.85(m, 2H); \textsuperscript{13}C NMR: 158.10, 145.91, 145.65, 132.39, 129.51, 123.46, 123.14, 114.69, 114.08, 109.71, 62.99, 56.09, 55.29, 45.70, 40.58, 36.52, 31.22, 22.38; MS (ESI) \(m/z = 328.4\) [M + H]\textsuperscript{+}. 

\(\text{S10}\)
References:


2) Copies of $^1$H NMR and $^{13}$C NMR spectra for all compounds

In $^{13}$C spectra, peak at 96.1 is due to CCl$_4$. 

![NMR Spectrum Image]
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