Supporting Information

Imidazolium Ionic Liquid-tagged Palladium Complex: An Efficient Catalyst for the Heck and Suzuki Reaction in Aqueous Medium

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1.1 IR spectra of 4 and 5

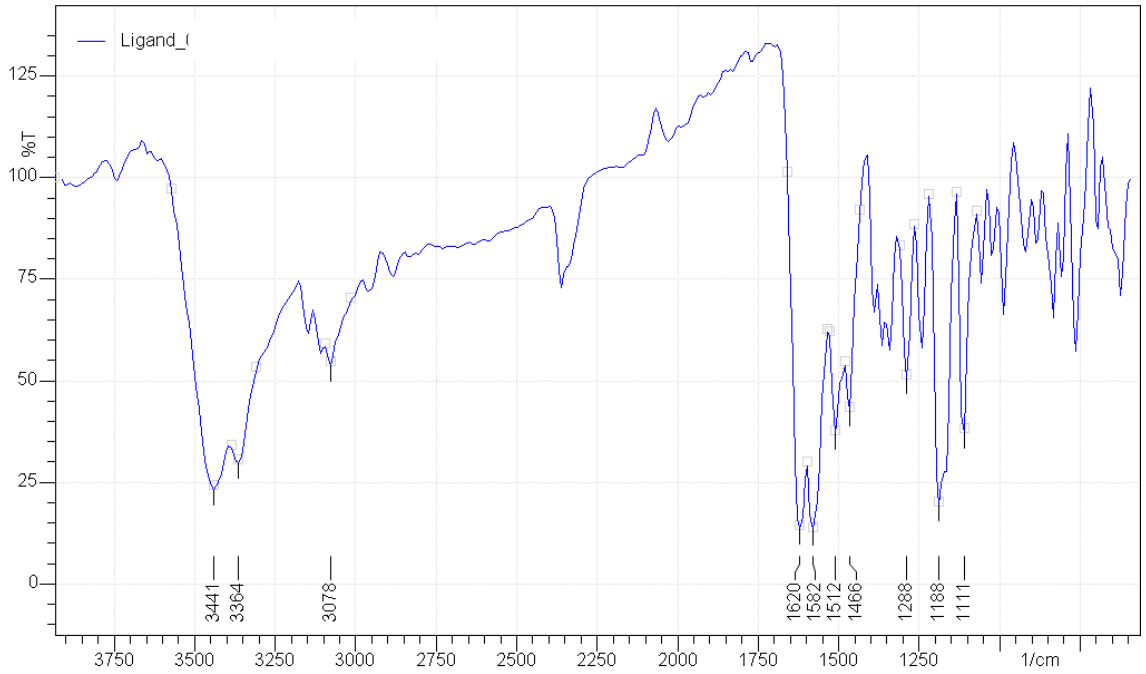


Fig. 1: IR spectra of **4**

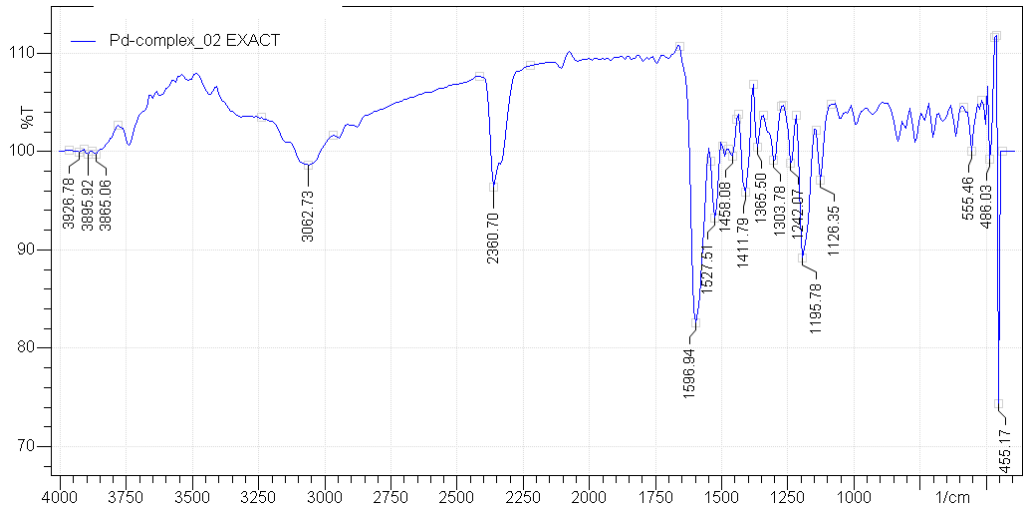


Fig. 2: IR spectra of **5**

1.2 UV-visible spectra of 4 and 5

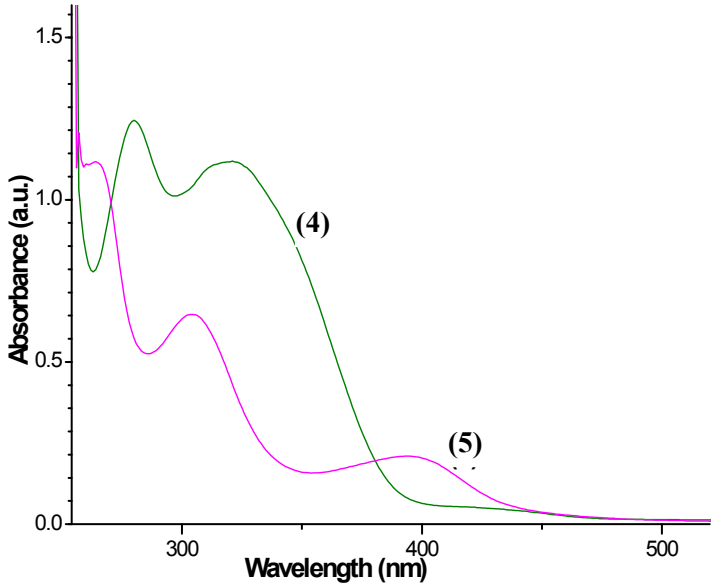


Fig. 3: UV-visible spectra of **4** and **5**

1.3 Powdered XRD spectra of 4 and 5

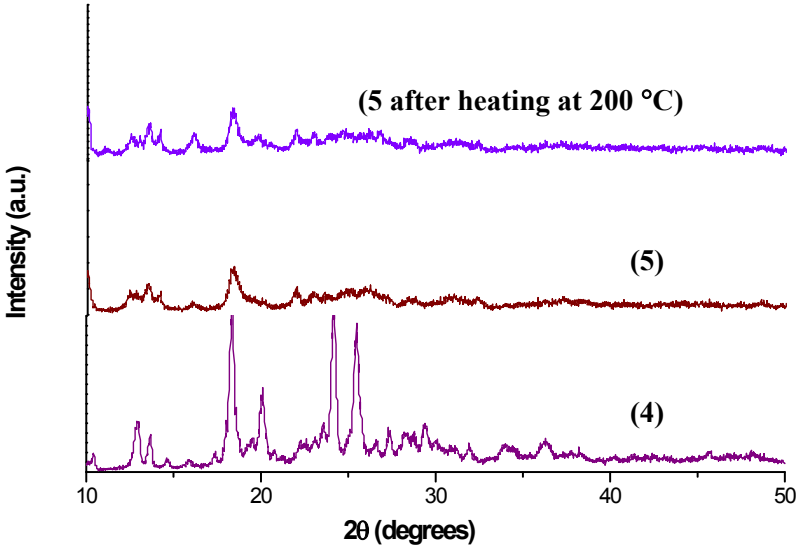


Fig. 4: Powdered XRD spectra of **4** and **5**

1.4 ^{1}H NMR spectra of **2-5** and ^{13}C NMR spectra of **4** & **5**.

Compound 2: ^{1}H NMR (400 MHz, DMSO-d_6) δ 11.00 (s, 1H), 10.02 (s, 1H), 7.63 (d, J = 8.72 Hz, 1H), 6.58 (dd, J = 8.72, 2.16 Hz, 1H), 6.50 (d, J = 2.16 Hz, 1H), 4.14 (t, J = 6.0 Hz, 2H), 3.66 (t, J = 6.52 Hz, 2H), 2.29–2.22 (m, 2H). ESI-MS: 259.0 $[M + H]^+$ and 261.01 $[M + H + 2]^+$ ion.

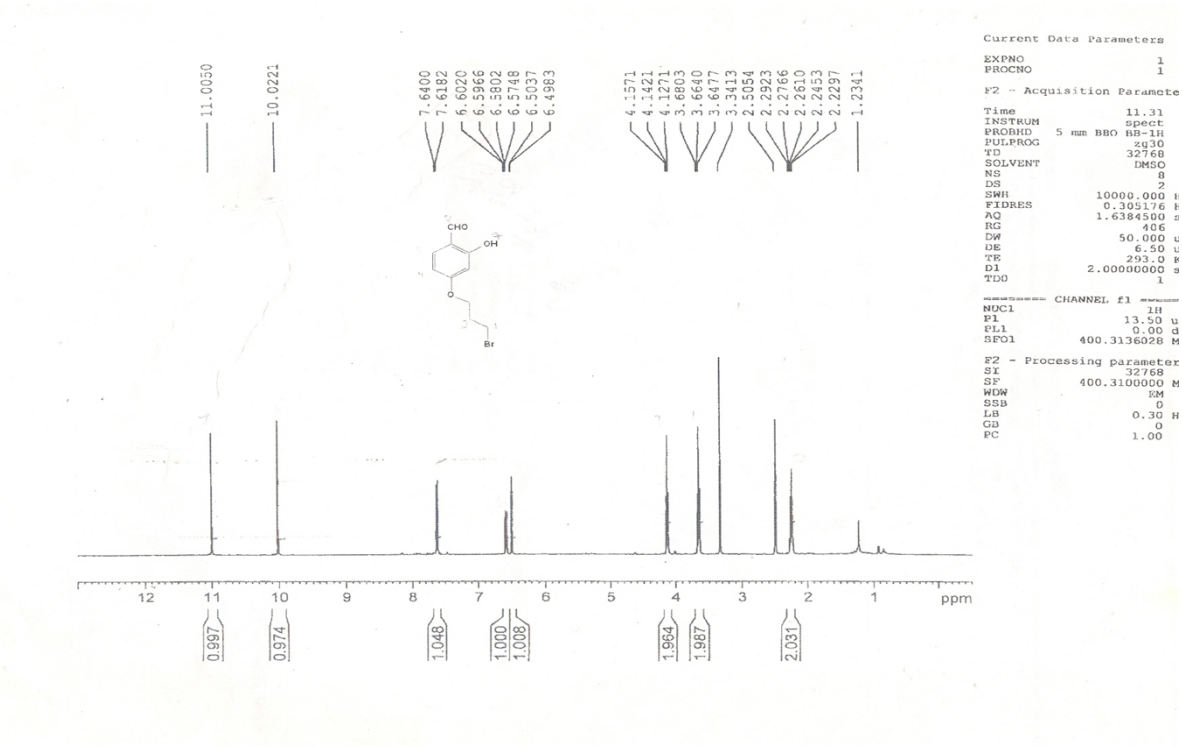


Fig. 5 (a): ^{1}H NMR spectra of **2**

Compound 3:

^{1}H NMR (400 MHz, DMSO-d_6) δ 10.02 (s, 1H), 9.25 (s, 1H), 7.84 (s, 1H), 7.74 (s, 1H), 7.62 (d, J = 8.64 Hz, 1H), 6.52 – 6.42 (m, 2H), 4.36 (t, J = 6.88 Hz, 2H), 4.10 (t, J = 5.88 Hz, 2H), 3.86 (s, 3H), 2.32–2.26 (m, 2H). ESI-MS: 261.2 $[M - Br]^+$.

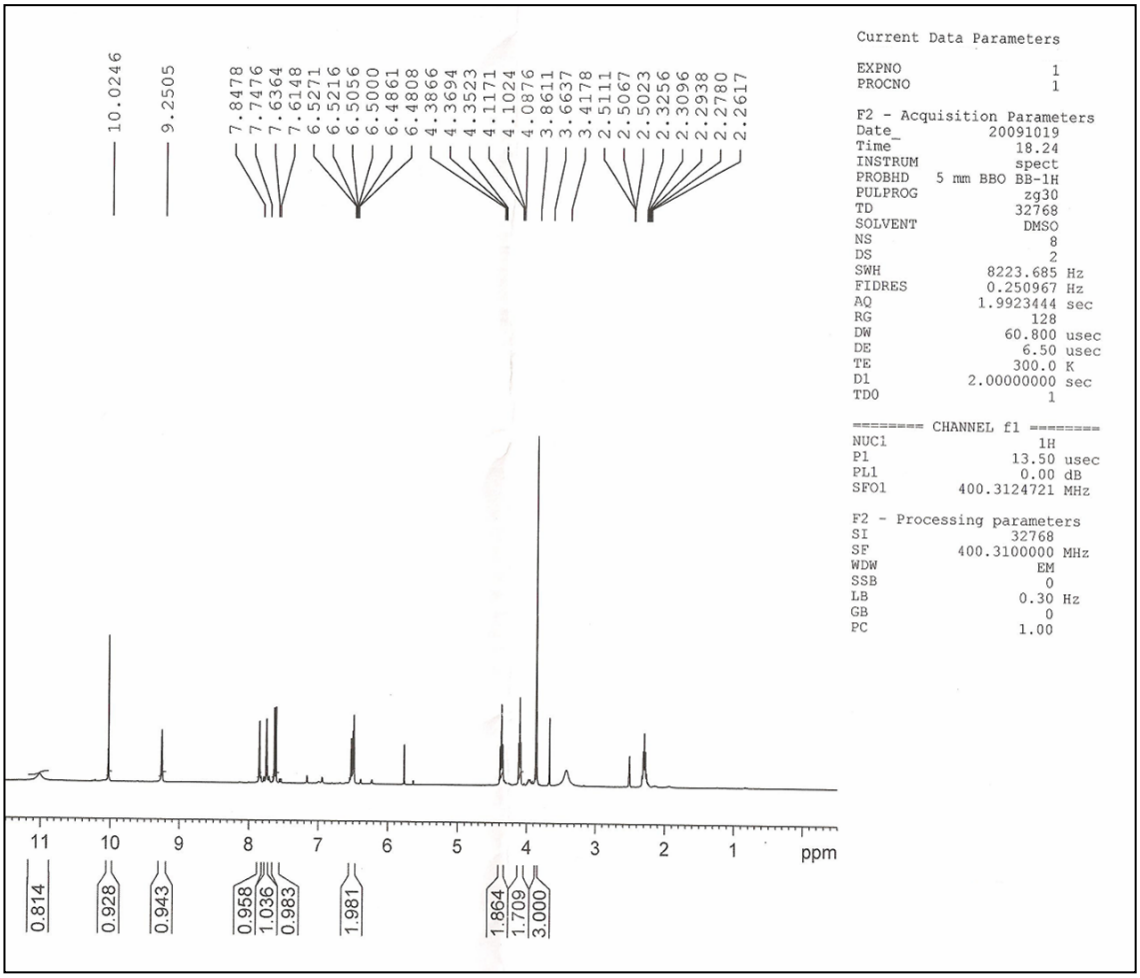


Fig. 5 (b): ^{1}H NMR spectra of **3**

Compound 4: Yellow apparent solid; yield 90%; mp 81- 83 °C;

^{1}H NMR (400 MHz, DMSO-d_6) δ 13.77 (s, 1H), 9.48 (s, 1H), 8.79 (s, 1H), 8.20 (t, J = 1.8, 1H), 7.90 (t, J = 1.8 Hz, 1H), 7.79–7.78 (m, 1H), 7.69 (s, 1H), 7.57–7.48 (m, 3H), 7.29 (d, J = 7.2 Hz, 1H), 6.58–6.47 (m, 2H), 4.50 (t, J = 6.5 Hz, 2H), 4.15 (t, J = 5.1 Hz, 2H), 3.97 (s, 3H), 2.50–2.31 (m, 2H); ^{13}C NMR (126 MHz, DMSO-d_6) δ 163.6, 163.0, 162.9, 148.2, 137.3, 134.7, 129.9, 129.3, 127.0, 124.0, 122.9, 121.6, 114.5, 113.6, 107.5, 101.8, 65.4, 46.7, 36.2, 29.4.

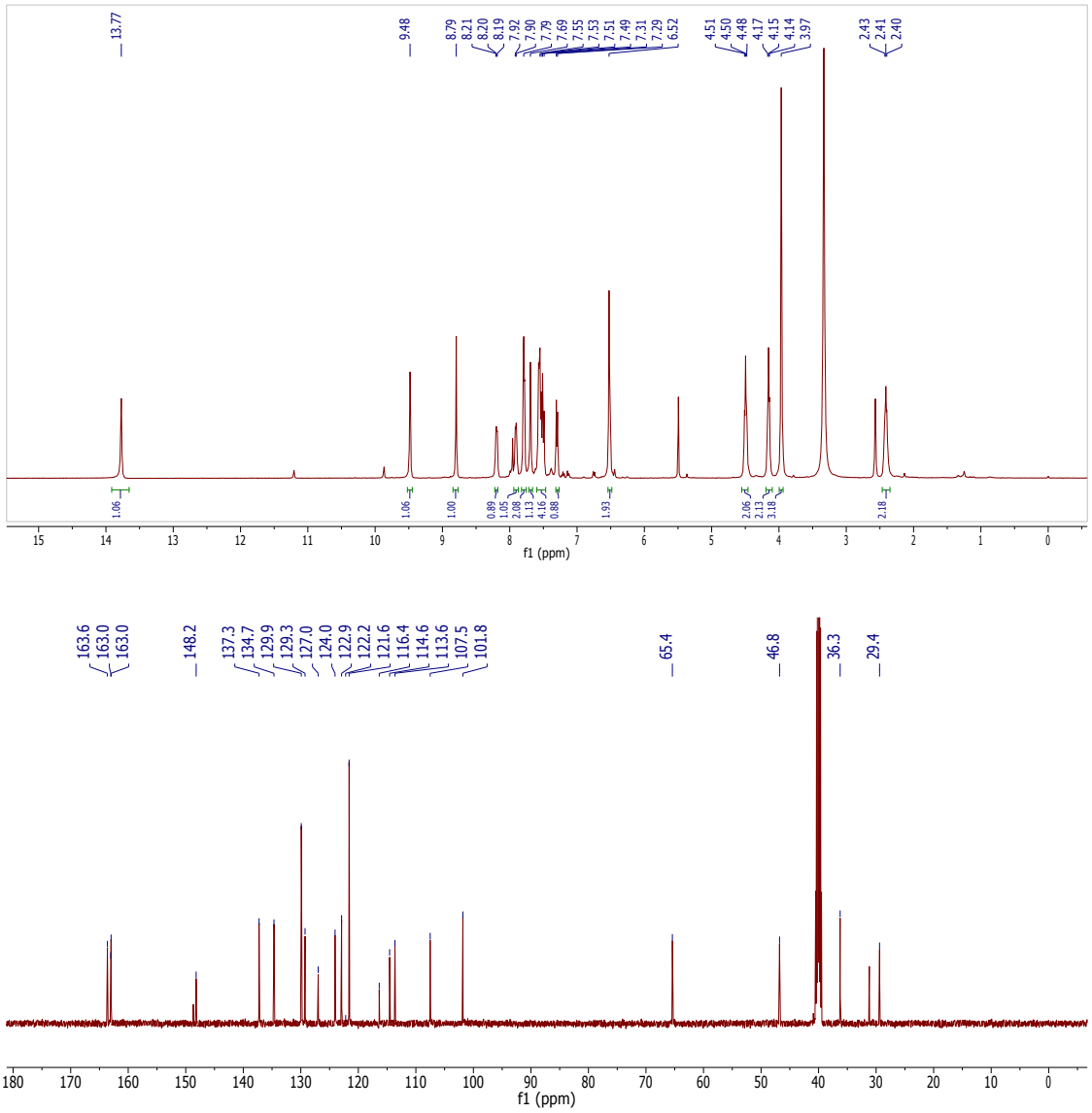


Fig. 5 (c): ^{1}H and ^{13}C NMR spectra of **4**

Compound 5: Orange apparent solid; yield 91%; mp 209-211 °C.

^{1}H NMR (300 MHz, DMSO-d_6) δ 9.16 (s, 2H), 7.93 (s, 2H), 7.80 (t, J = 1.8, 2H), 7.73 (t, J = 1.8 Hz, 2H), 7.46–7.41 (m, 4H), 7.39–7.36 (m, 3H), 7.35 (s, 2H), 7.32 (d, J =1.4 Hz, 3H), 7.30 (s, 2H), 6.12 (dd, J = 8.8, 2.3 Hz, 2H), 4.32 (t, J = 6.9 Hz, 4H), 3.89 – 3.84 (m, 10H), 2.29–2.19 (m, 4H). ^{13}C NMR (75 MHz, DMSO) δ 166.1, 164.3, 162.5, 149.5, 137.3, 128.8, 128.3, 126.4, 125.3, 124.0, 122.9, 115.4, 111.3, 105.5, 102.2, 98.2, 64.9, 46.9, 36.2, 29.3.

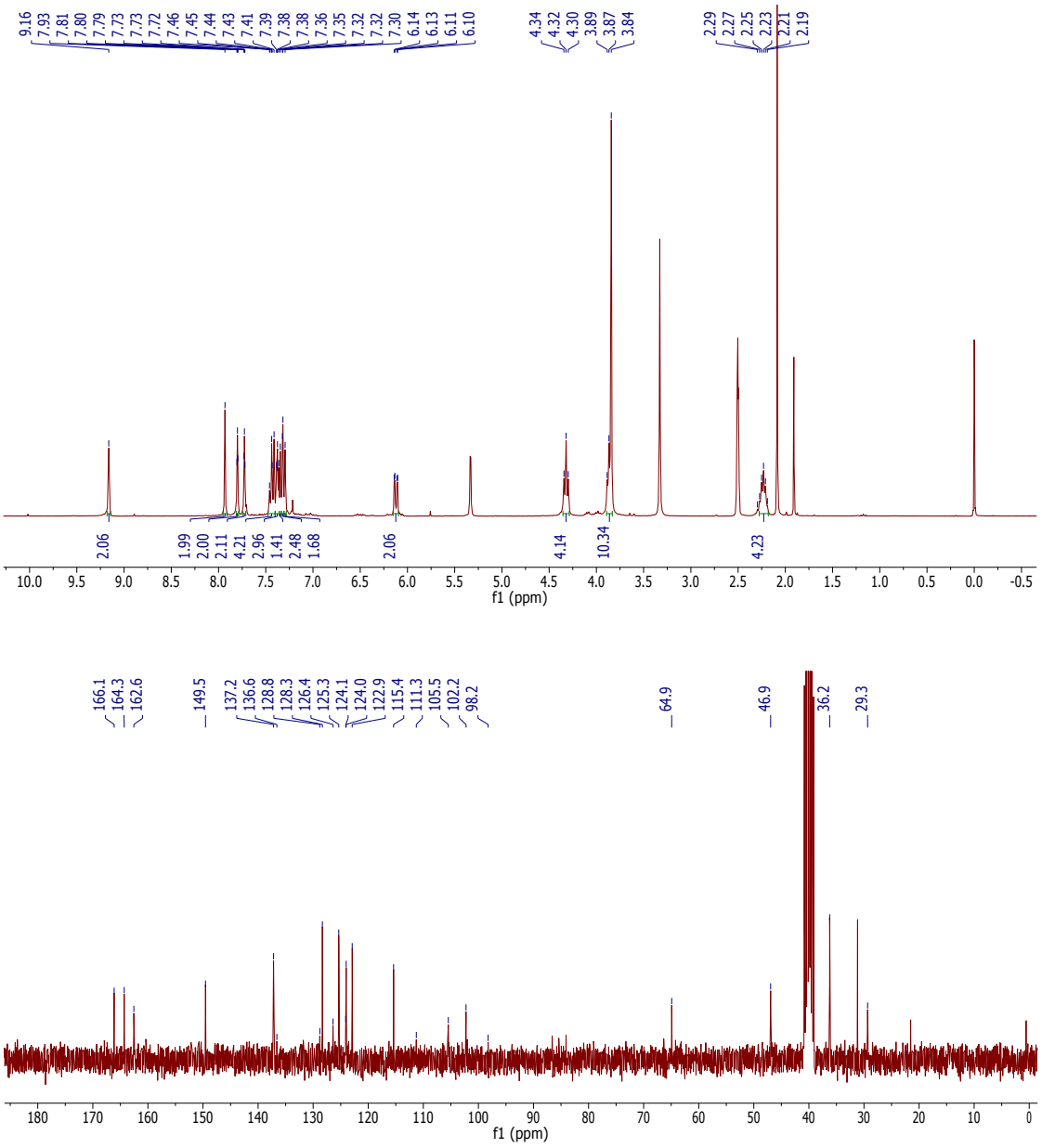


Fig. 6: ^{1}H and ^{13}C NMR spectra of **5**

1.5 ESI Mass spectra of 2-4 and MALDI-Mass spectra of 5

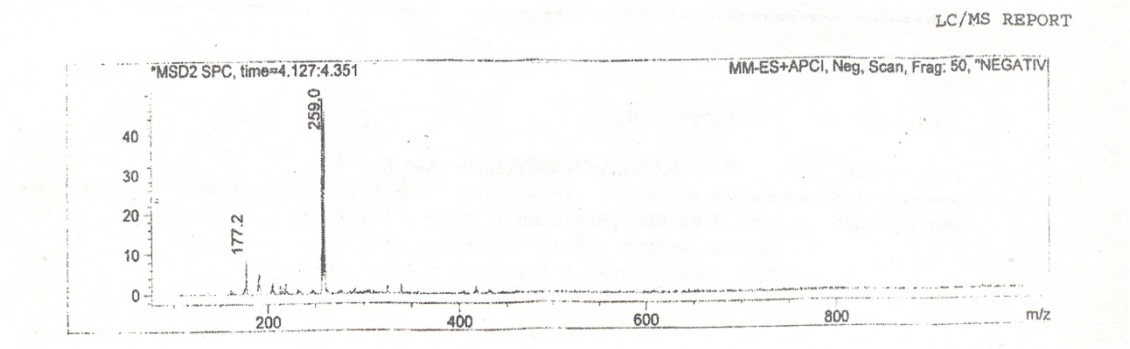


Fig 7 (a): ESI MS of **2**

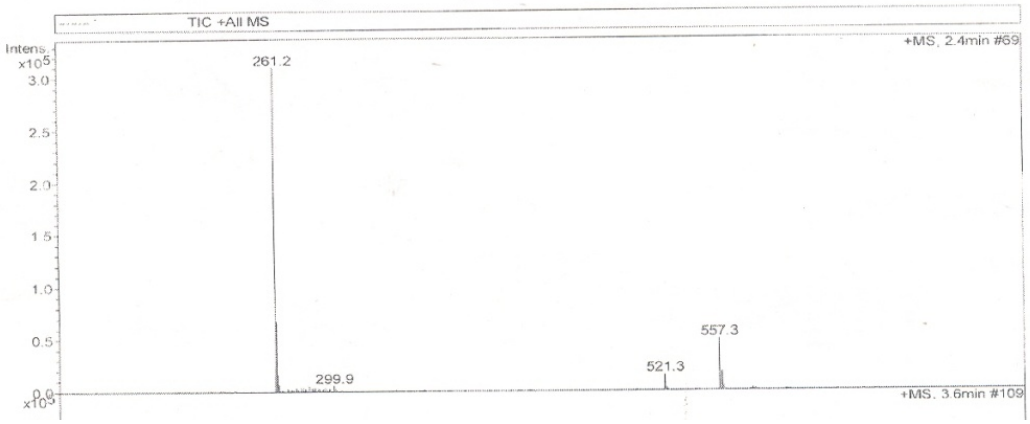


Fig. 7 (b): ESI-MS of **3**

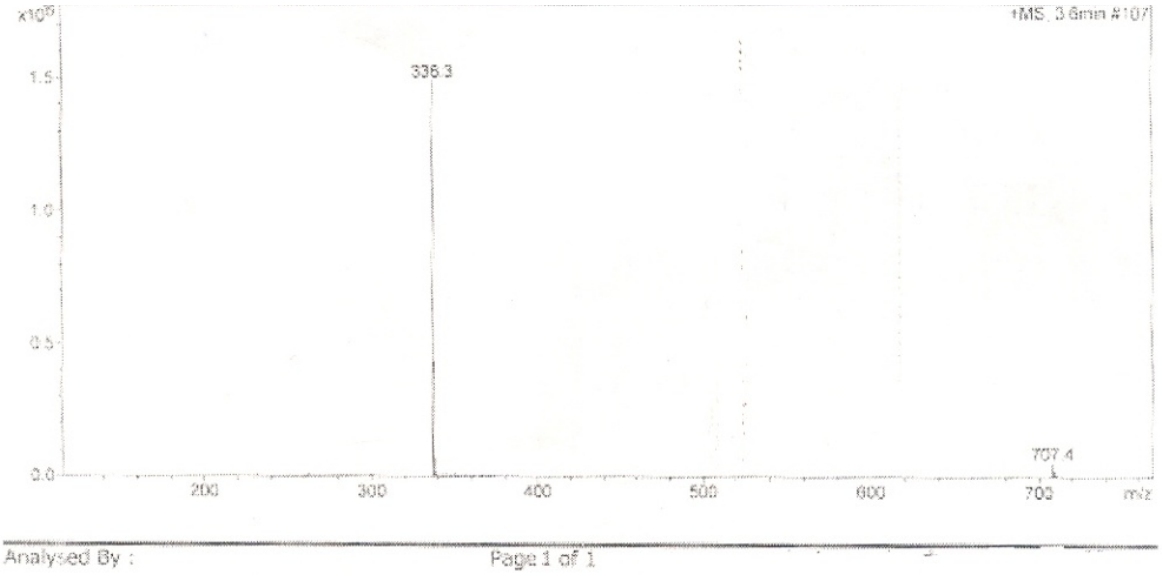


Fig. 7 (c): ESI-MS of **4**

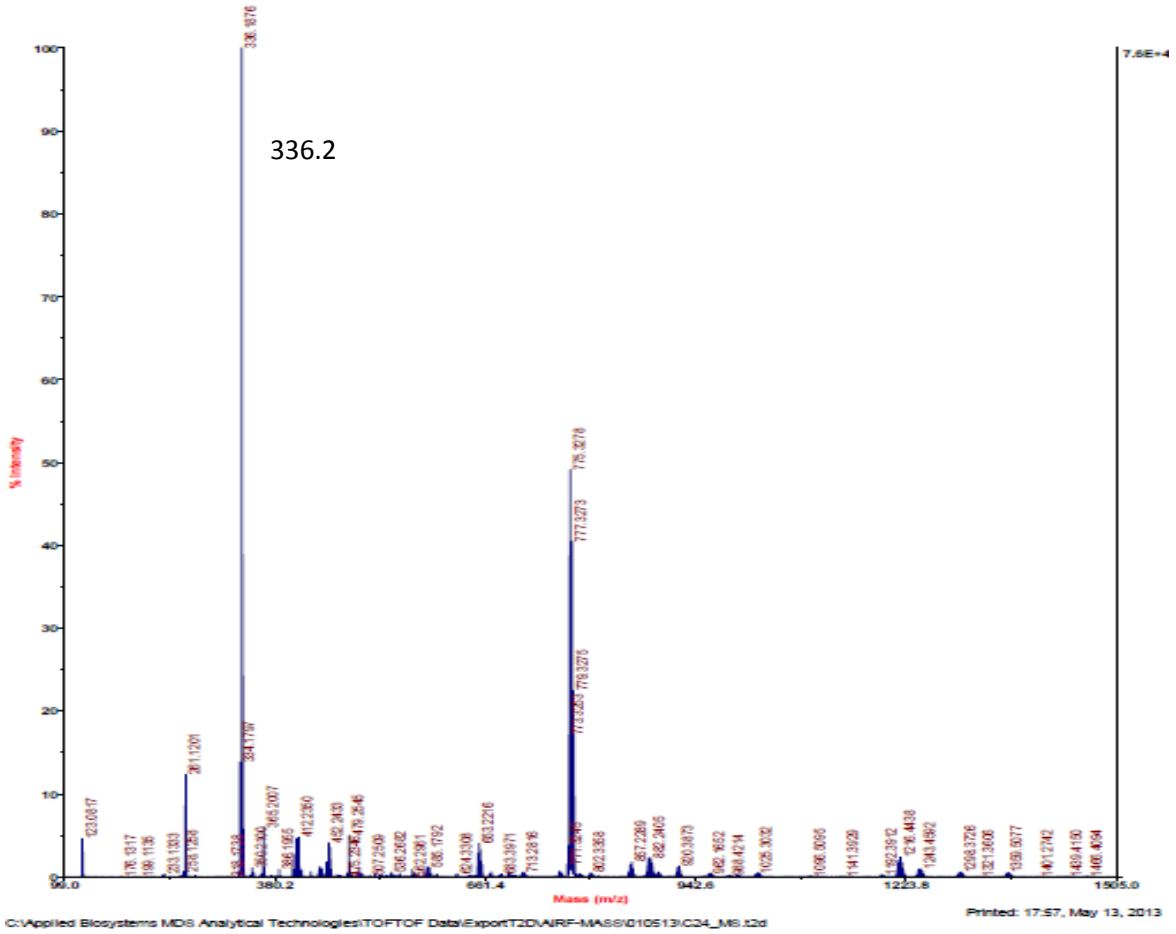


Fig. 8: MALDI-Mass of **5**

2. Analysis of reaction products 8 and 10

2.1 ^{1}H and ^{13}C NMR analysis of the Heck coupling products

(*E*)-Benzyl cinnamate (8aa′): Colorless liquid; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.78 (d, J = 16.0 Hz, 1H), 7.59 – 7.53 (m, 2H), 7.49 – 7.33 (m, 8H), 6.53 (d, J = 16.0 Hz, 1H), 5.30 (s, 2H).^{13}C NMR (100 MHz, $CDCl_3$) δ 166.8, 145.2, 136.10, 134.4, 130.4, 128.9, 128.6, 128.3, 128.3, 128.1, 117.9, 66.4.

(*E*)-Methyl cinnamate (8ab′): Colorless liquid[2]; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.72 (d, J = 16.0 Hz, 1H), 7.59 – 7.52 (m, 2H), 7.45 – 7.37 (m, 3H), 6.47 (d, J = 16.0 Hz, 1H), 3.83 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 167.4, 144.9, 134.4, 130.3, 128.9, 128.1, 117.8, 51.7.

(*E*)-1,2-Diphenylethene (8ac′): Colorless solid; mp 122 – 123 °C (Lit. mp 120 – 122 °C)[1]; ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.55 (dd, J = 8.2, 1.2 Hz, 4H), 7.39 – 7.34 (m, 4H), 7.28 – 7.23 (m, 2H), 7.11 (s, 2H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 137.4, 128.7, 128.7, 127.7, 126.5.

(*E*)-1-Methyl-4-styrylbenzene (8ad′): Colorless solid, mp 114 – 116 °C (Lit. mp 119 − 122 °C)[2]; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.59 – 7.54 (m, 2H), 7.48 (d, *J* = 8.1 Hz, 2H), 7.44 – 7.38 (m, 2H), 7.34 – 7.28 (m, 1H), 7.23 (d, *J* = 7.9 Hz, 2H), 7.14 (d, *J* = 2.6 Hz, 2H), 2.42 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 137.6, 134.6, 129.5, 128.7, 128.7, 127.7, 127.5, 126.5, 126.5, 21.3.

(*E*)-1-Chloro-4-styrylbenzene (8ae′): Colorless solid, mp 128 – 129 °C (Lit. mp 126 − 128 °C)[3]; ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.52 (dd, *J* = 8.2, 1.1 Hz, 2H), 7.44 (d, *J* = 8.2 Hz, 2H), 7.39 – 7.29 (m, 4H) 7.26 (d, *J* = 4.5 Hz, 1H), 7.07 (d, *J* = 2.8 Hz, 2H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 137.0, 135.9, 133.2, 129.3, 128.9, 128.8, 127.9, 127.8, 127.4, 126.6.

(*E*)-1-Bromo-4-styrylbenzene (8af′): Colorless solid, mp 136 – 138 °C (Lit. mp 136.5 − 139)[3]; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.56 – 7.48 (m, 4H), 7.43 – 7.36 (m, 4H), 7.31 (dt, *J* = 4.1, 1.7 Hz, 1H), 7.13 (d, *J* = 16.3 Hz, 1H), 7.06 (d, *J* = 16.3 Hz, 1H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 136.9, 136.3, 131.8, 129.4, 128.7, 128.0, 127.9, 127.3, 126.6, 121.3.

(*E*)-Benzyl 3-(4-methylphenyl)acrylate (8ba′): Yellow crystalline solid, mp 87 – 88 °C; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.73 (d, *J* = 16.0 Hz, 1H), 7.46 – 7.35 (m, 7H), 7.21 (d, *J* = 8.0 Hz, 2H), 6.47 (d, *J* = 16.0 Hz, 1H), 2.40 (s, 3H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 167.0, 145.2, 140.8, 136.2, 131.7, 129.6, 128.6, 128.3, 128.2, 128.1, 116.8, 66.3, 21.5.

(*E*)-Benzyl 3-(4-nitrophenyl)acrylate (8ca′): Pale yellow solid, mp 110 – 112 °C; ^{1}H NMR (500 MHz, $CDCl_3$) δ 8.26 (d, *J* = 8.6 Hz, 2H), 7.77 (d, *J* = 16.0 Hz, 1H), 7.69 (d, *J* = 8.6 Hz, 2H), 7.49 – 7.27 (m, 5H), 6.63 (d, *J* = 16.0 Hz, 1H), 5.30 (s, 2H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 165.8, 148.5, 142.2, 140.5, 135.6, 128.7, 128.5, 128.4, 124.4, 124.2, 122.2, 66.9.

1-(4-Nitrostyryl)benzene (8cc′): Yellow solid, mp 151 – 152 °C (Lit. mp 155 °C)[1]; ^{1}H NMR (500 MHz, $CDCl_3$) δ 8.23 (d, *J* = 8.6 Hz, 2H), 7.64 (d, *J* = 8.5 Hz, 2H), 7.58 (d, *J* = 7.5 Hz, 2H), 7.43 (t, *J* = 7.4 Hz, 2H), 7.37 (t, *J* = 7.2 Hz, 1H), 7.32 – 7.24 (m, 1H), 7.16 (d, *J* = 16.3 Hz, 1H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 146.8, 143.9, 136.2, 133.3, 128.9, 128.9, 127.0, 126.9, 126.3, 124.2.

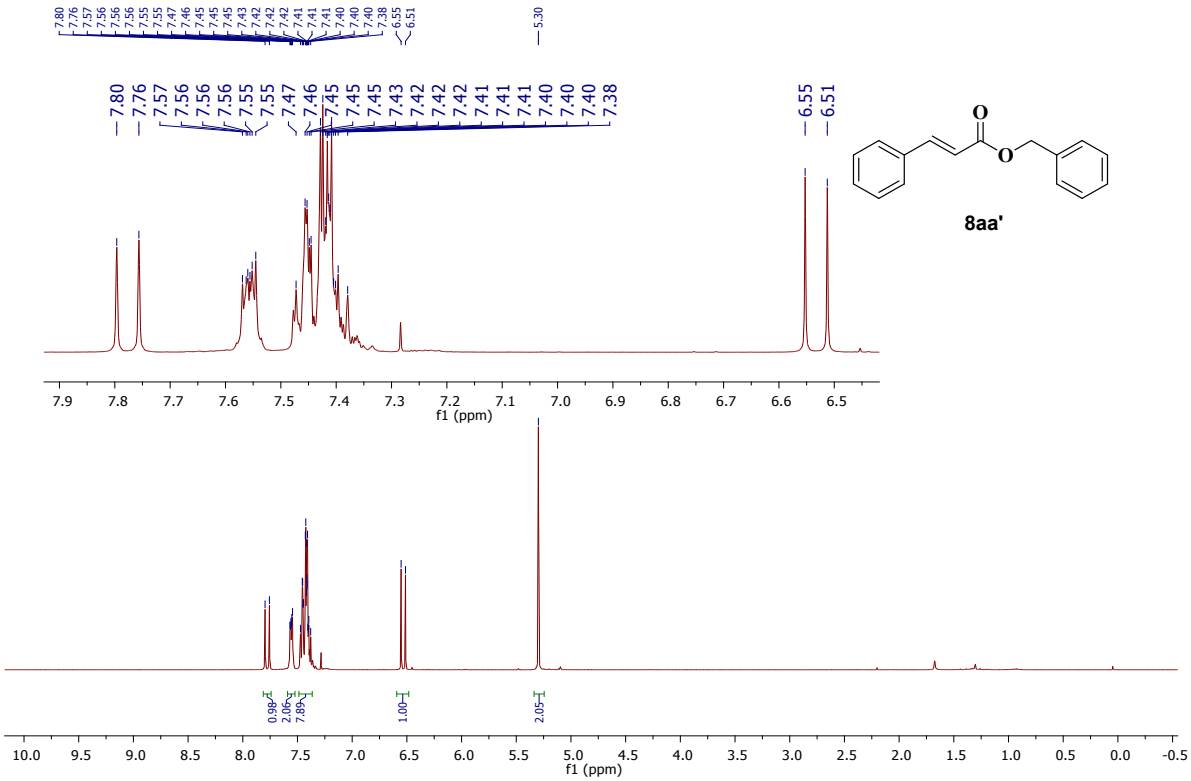
1-(4-Nitrostyryl)-4-methylbenzene (8cd′): Yellow solid, mp 144 – 146 °C; ^{1}H NMR (500 MHz, $CDCl_3$) δ 8.23 (d, *J* = 8.5 Hz, 2H), 7.63 (d, *J* = 8.5 Hz, 2H), 7.48 (d, *J* = 7.6 Hz, 2H), 7.29 – 7.23 (m, 3H), 7.12 (d, *J* = 16.3 Hz, 1H), 2.41 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 146.6, 144.1, 139.0, 133.4, 133.3, 129.6, 127.0, 126.7, 125.3, 124.1, 21.4.

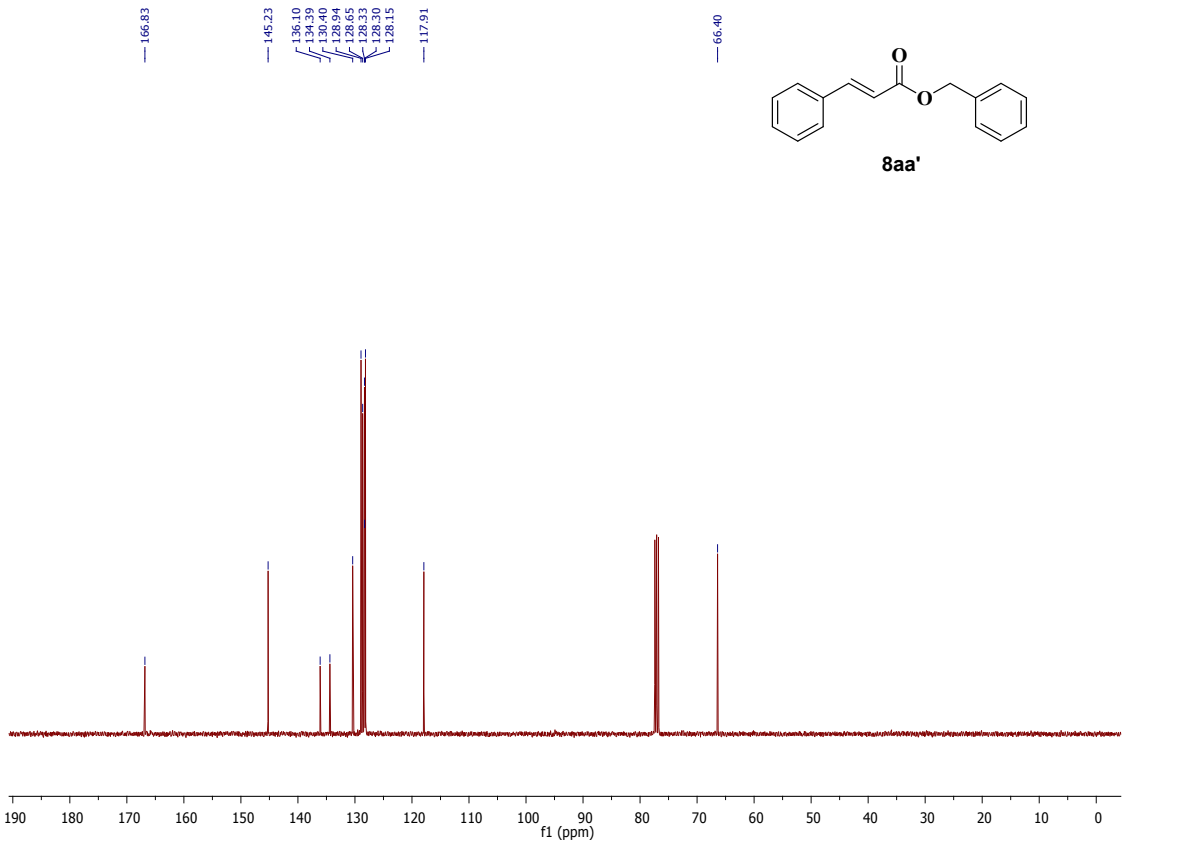
1-(4-Nitrostyryl)-4-chlorobenzene (8ce′): Yellow solid, mp 187 – 188 °C; ^{1}H NMR (500 MHz, $CDCl_3$) δ 8.25 (d, *J* = 8.6 Hz, 2H), 7.65 (d, *J* = 8.6 Hz, 2H), 7.50 (d, *J* = 8.3 Hz, 2H), 7.39 (d, *J* = 8.3 Hz, 2H), 7.30 – 7.21 (m, 1H), 7.14 (d, *J* = 16.3 Hz, 1H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 146.9, 143.5, 134.7, 134.6, 131.9, 129.1, 128.2, 126.9, 126.9, 124.2.

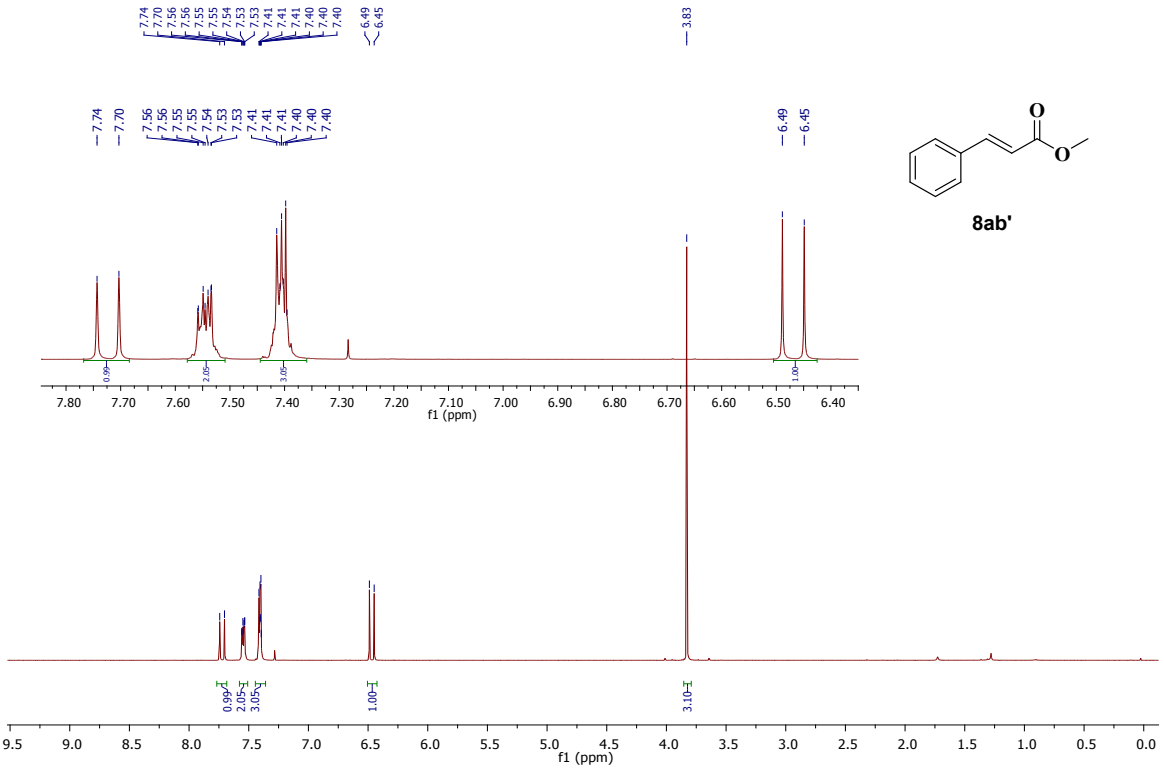
(*E*)-Benzyl 3-(4-methoxyphenyl)acrylate (8da′): Colorless liquid; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.73 (d, *J* = 16.0 Hz, 1H), 7.53 – 7.47 (m, 2H), 7.47 – 7.36 (m, 5H), 6.93 (d, *J* = 8.8 Hz, 2H), 6.40 (d, *J* = 16.0 Hz, 1H), 5.28 (s, 2H), 3.86 (s, 3H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 167.1, 161.4, 144.9, 136.2, 129.8, 128.6, 128.3, 128.2, 127.1, 115.3, 114.3, 66.2, 55.4.

(*E*)-Benzyl 3-(thiophen-2-yl)acrylate (8ea'): Yellow solid, mp 46 − 47 °C; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.86 (d, *J* = 15.7 Hz, 1H), 7.47 – 7.35 (m, 6H), 7.30 – 7.24 (m, 1H), 7.08 (dd, *J* = 5.1, 3.6 Hz, 1H), 6.32 (d, *J* = 15.7 Hz, 1H), 5.27 (s, 2H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 166.6, 139.5, 137.6, 136.1, 131.1, 128.6, 128.6, 128.3, 128.3, 128.1, 116.6, 66.4.

2.2 Copies of ^{1}H & ^{13}C NMR for Heck coupled products (8)



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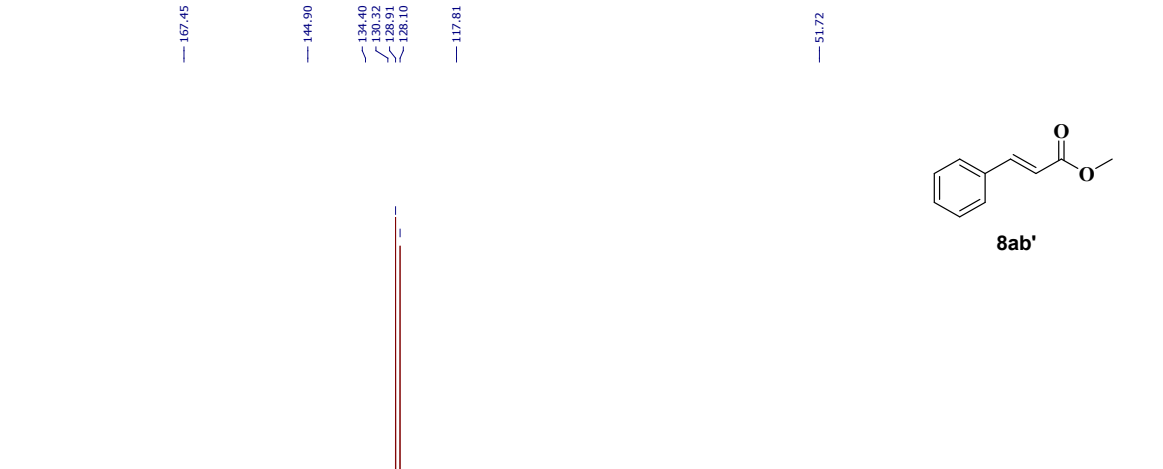
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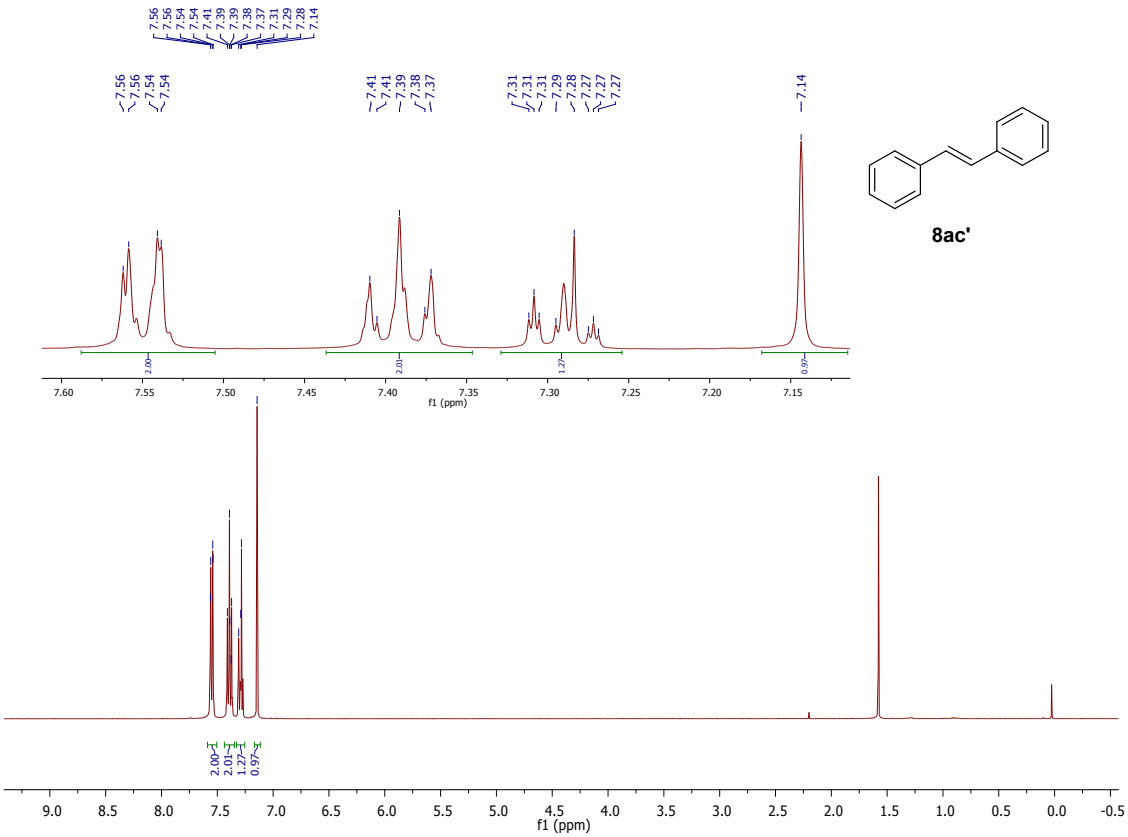
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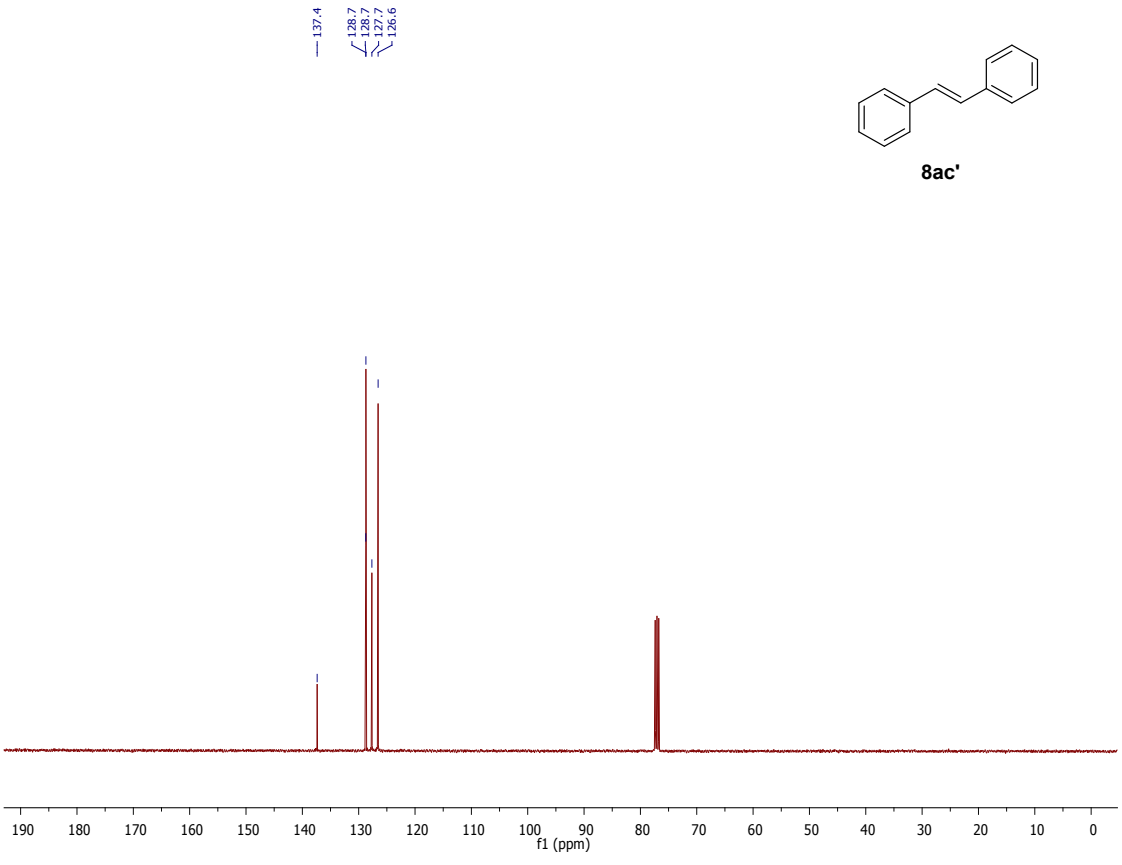
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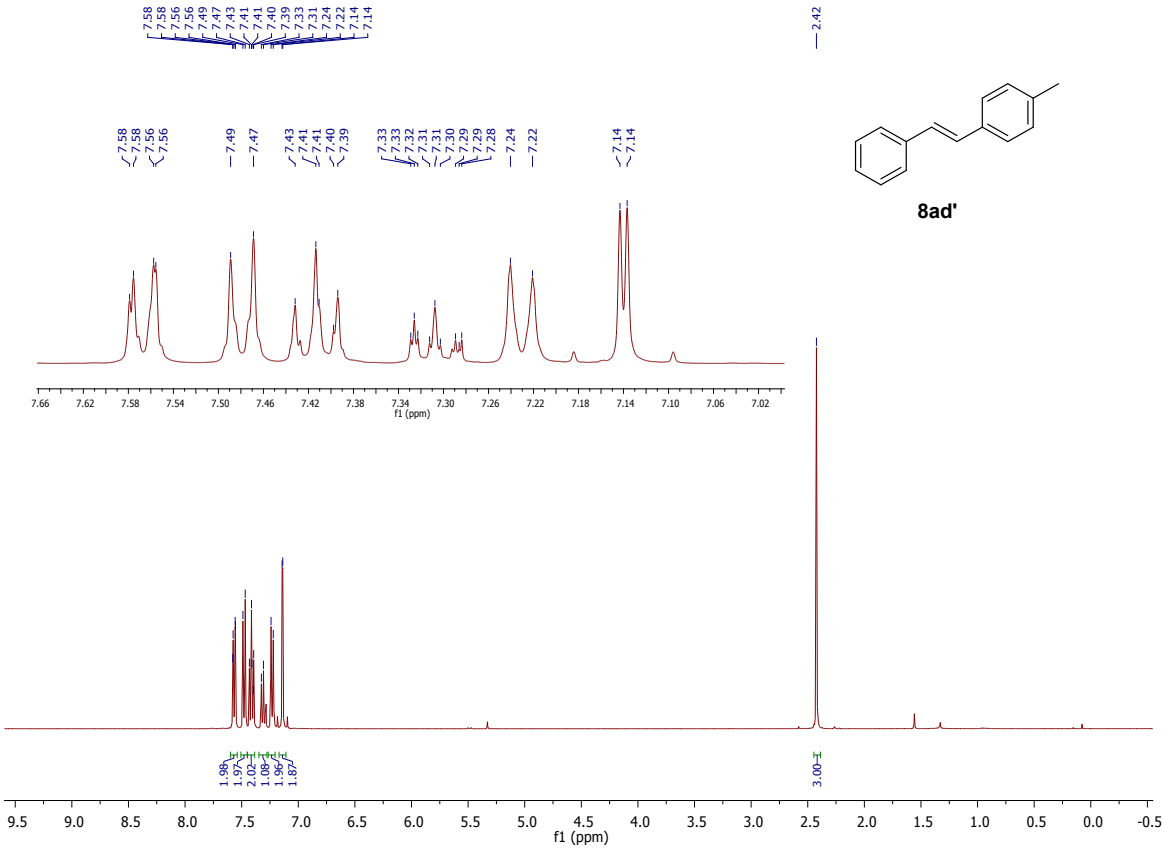
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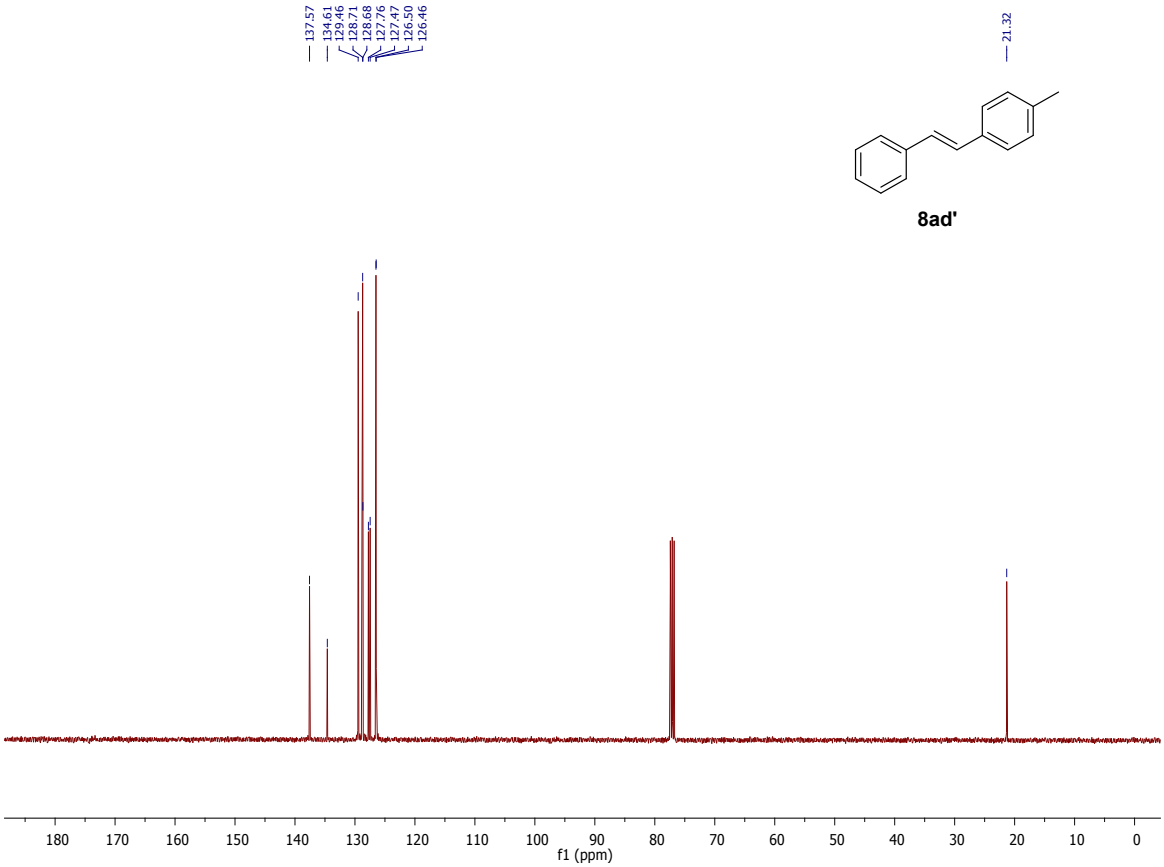
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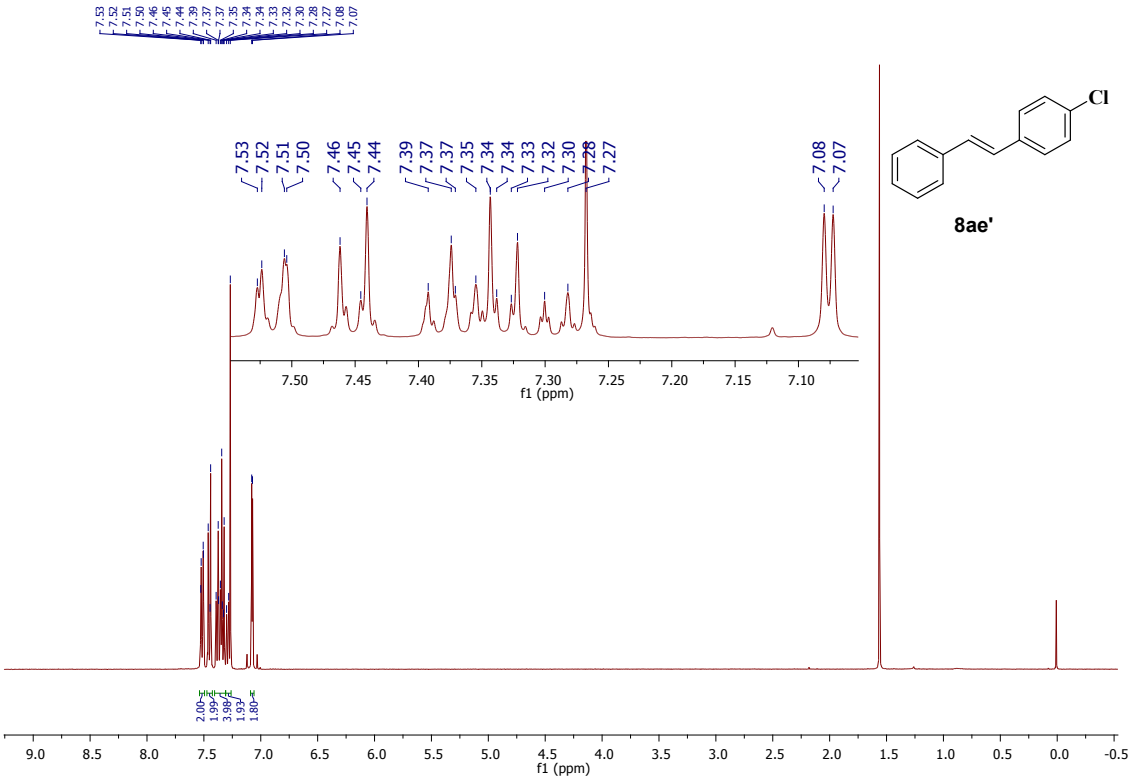
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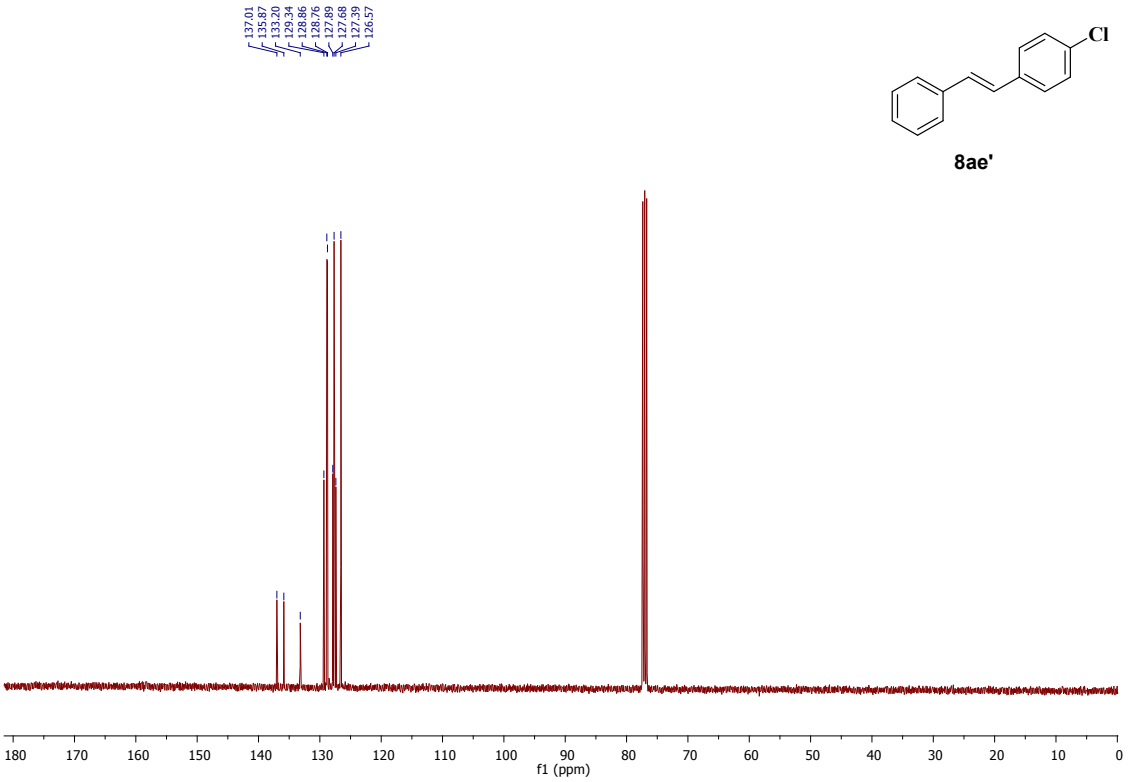
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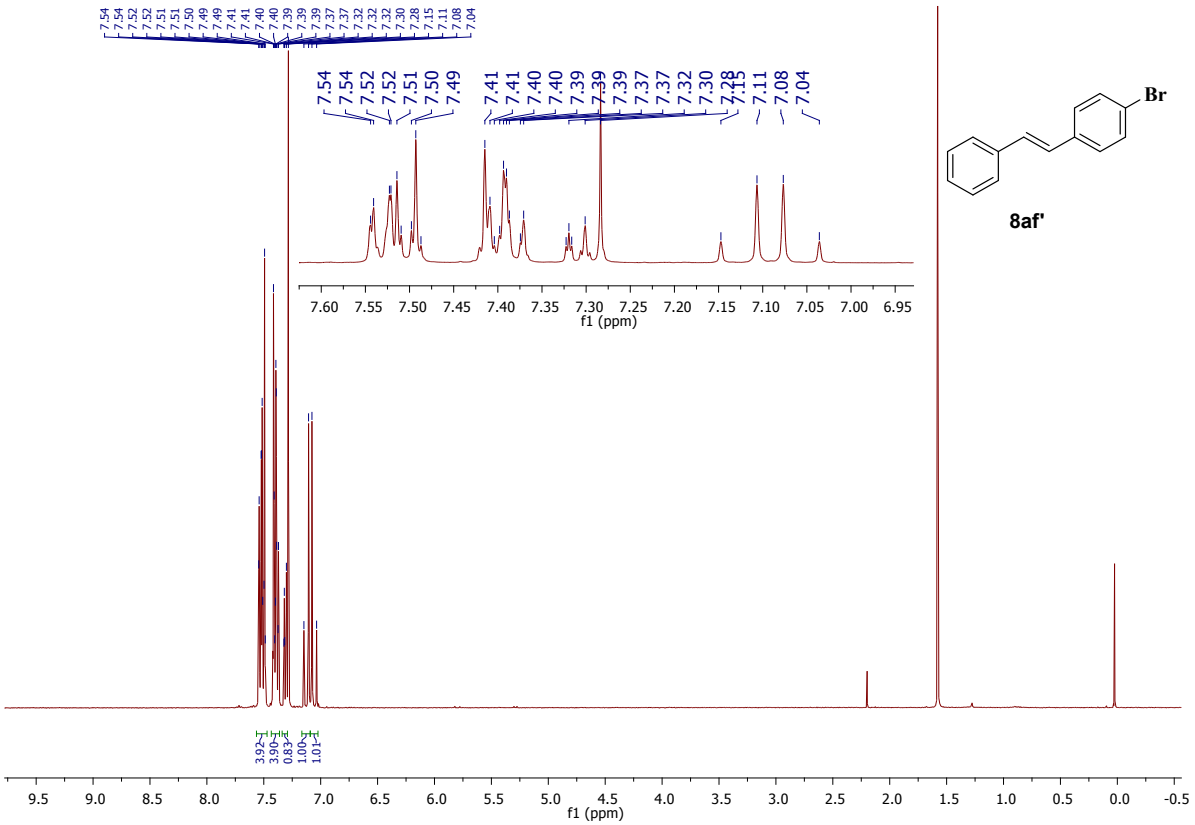
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7.04
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f1 (ppm)
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3.90
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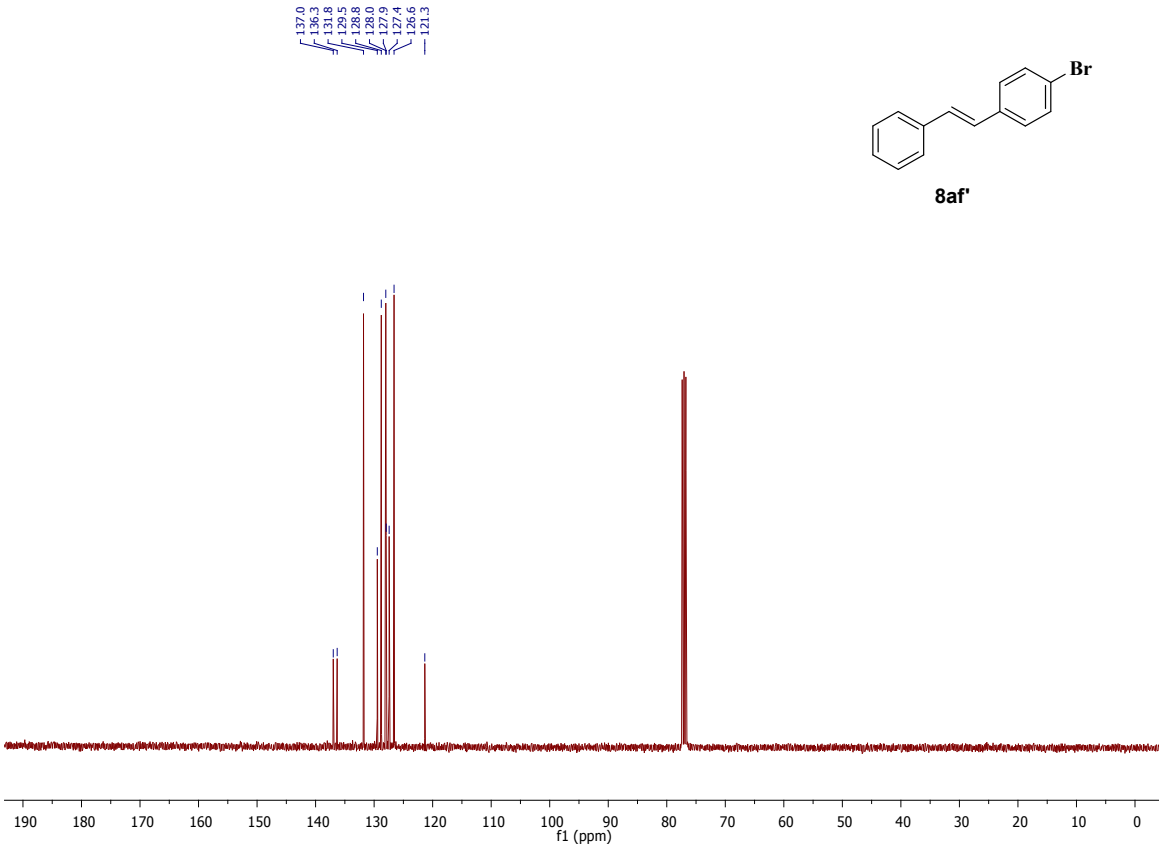
1.00
1.01
9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5
f1 (ppm)
Br
8af'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136.3
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Br
8af'
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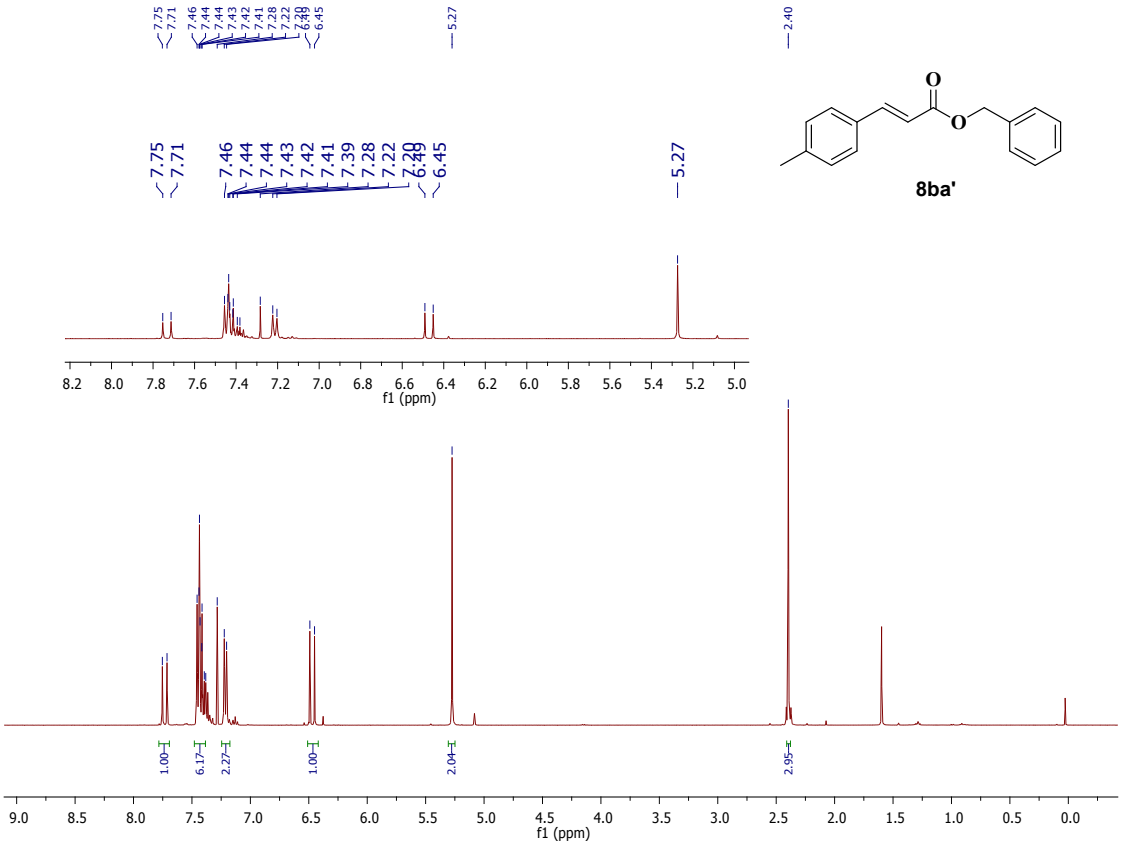
f1 (ppm)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6.45
5.27
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O
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f1 (ppm)
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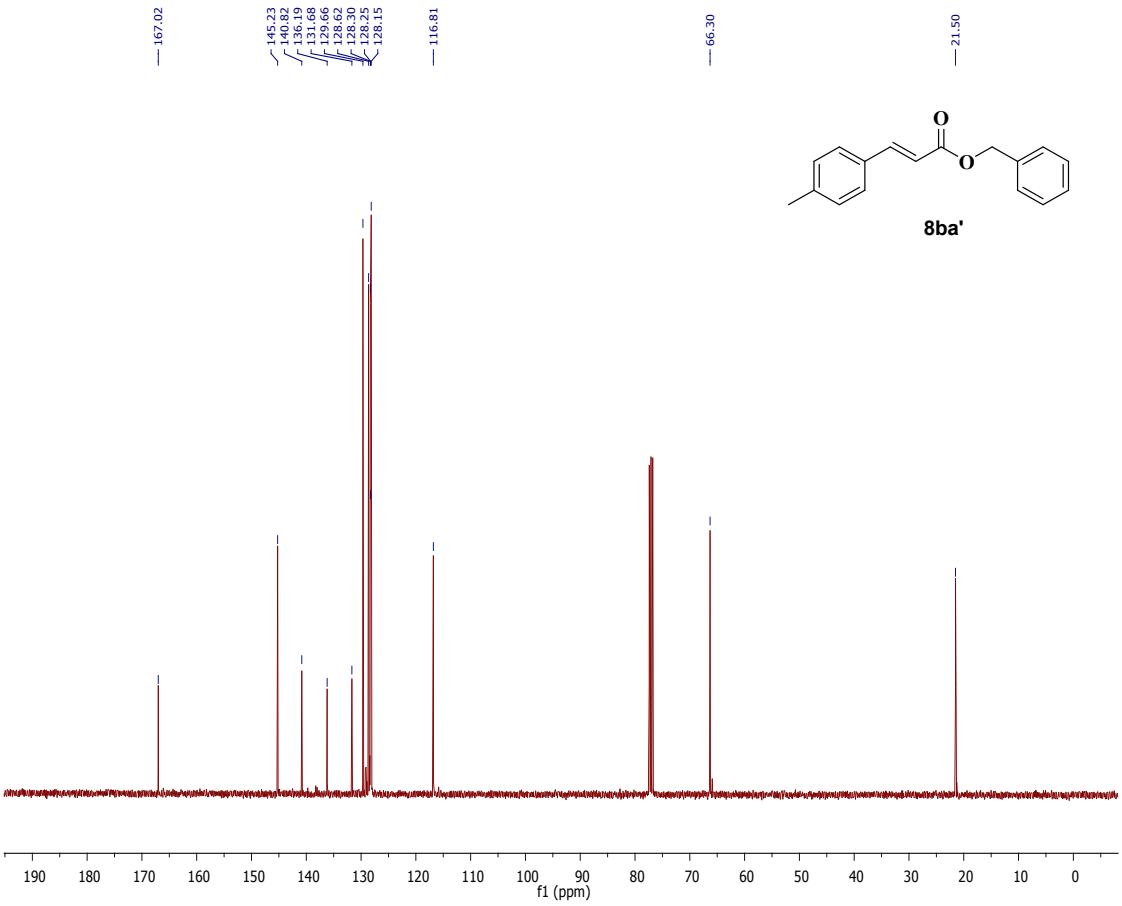
1.00
2.04
2.95
f1 (ppm)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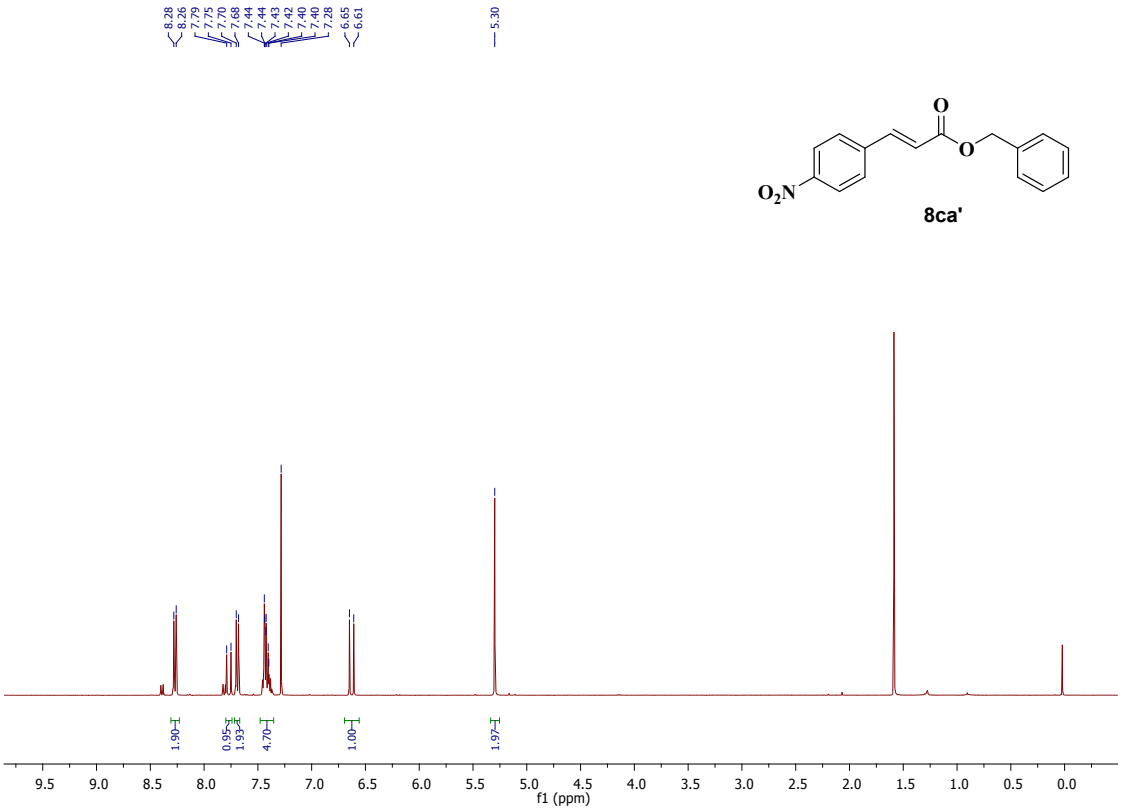
21.50
O
O
8ba'
f1 (ppm)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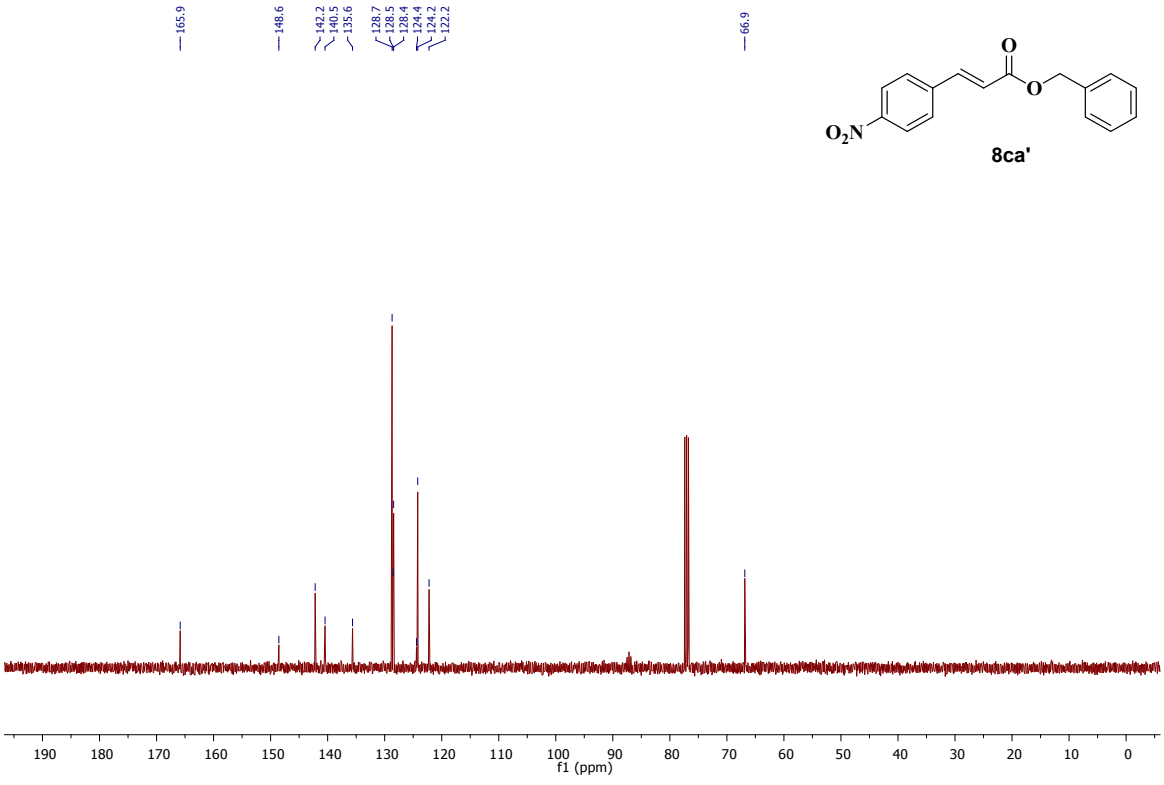
7.28
6.65
6.61
5.30
O
O
O2N
8ca'
1.90
0.95
1.93
4.70
1.00
1.97
9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)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122.2
66.9
O
O
O2N
8ca'
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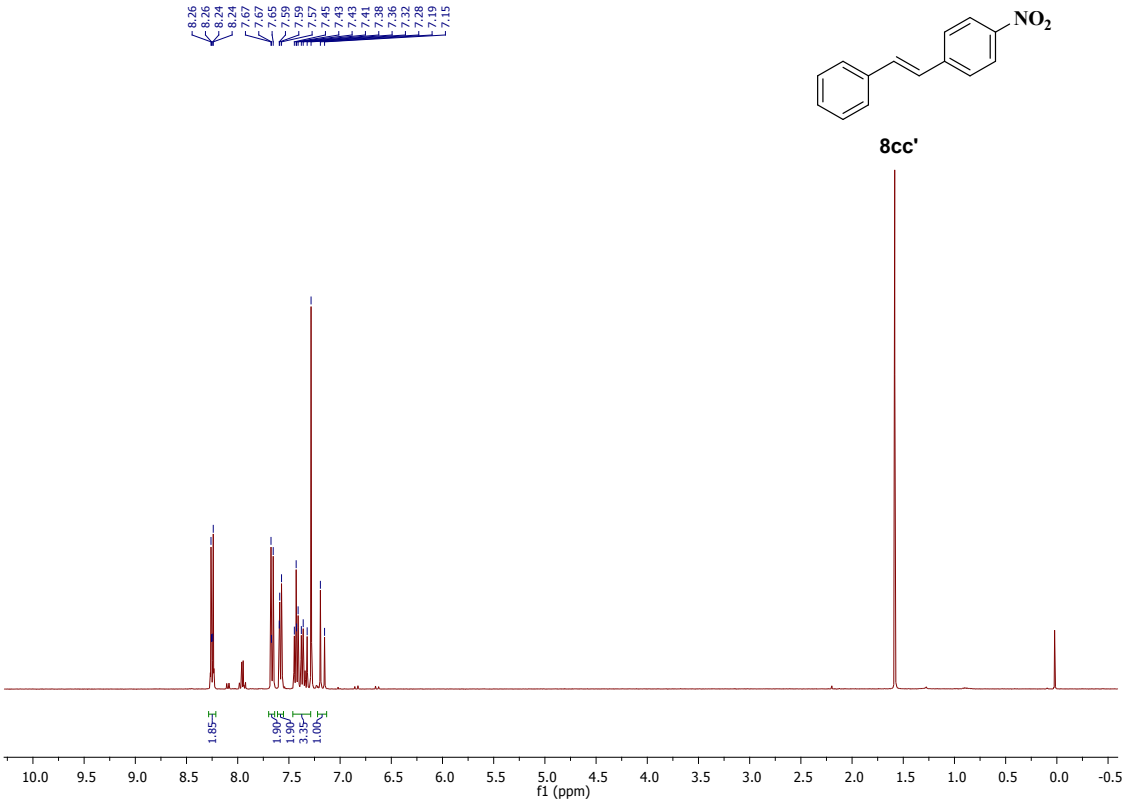
f1 (ppm)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8.24
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7.57
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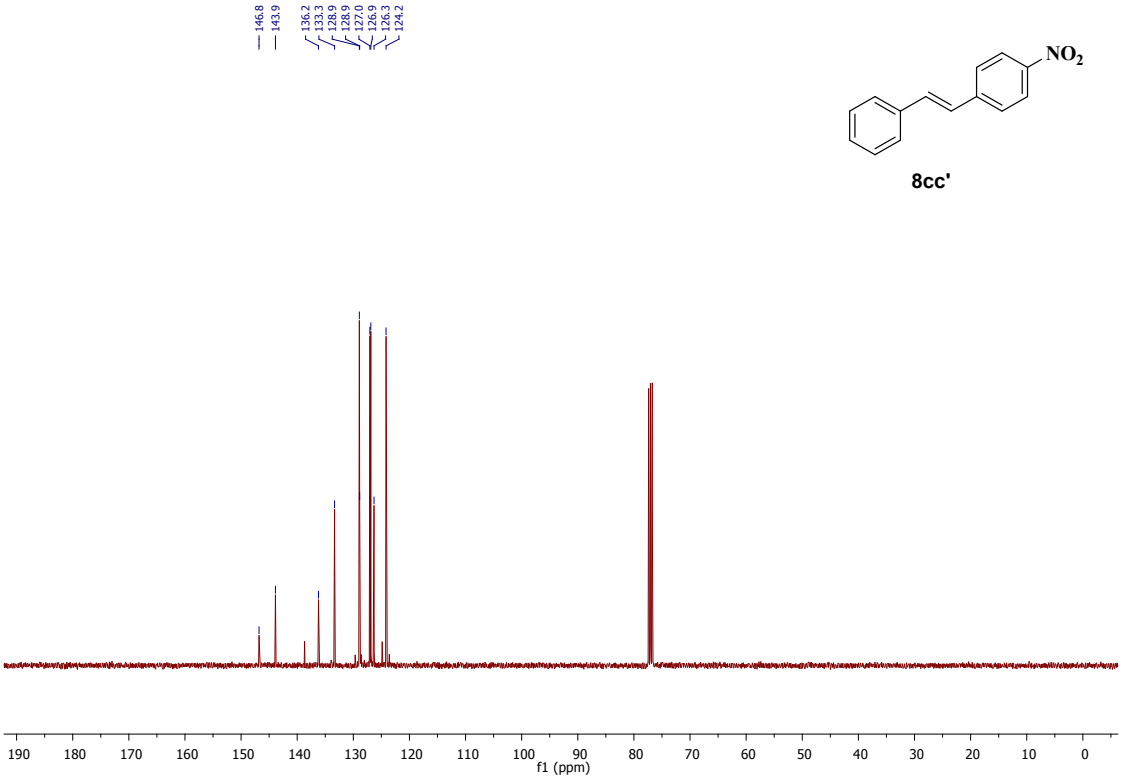
7.43
7.41
7.38
7.36
7.32
7.28
7.19
7.15
NO2
1.85
1.90
1.90
3.35
1.00
10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5
f1 (ppm)

8cc'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136.2
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128.9
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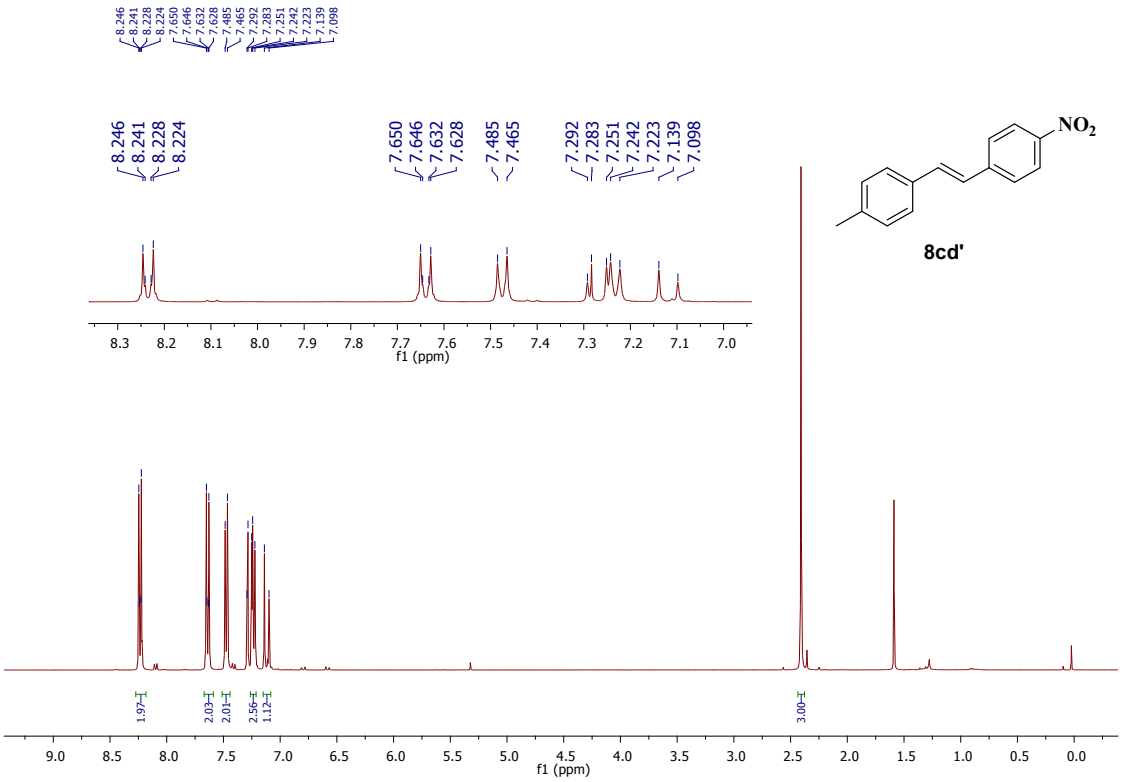
126.3
124.2
NO2
190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

8cc'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7.628
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7.465
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7.283
7.251
7.242
7.223
7.139
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2.56
1.12
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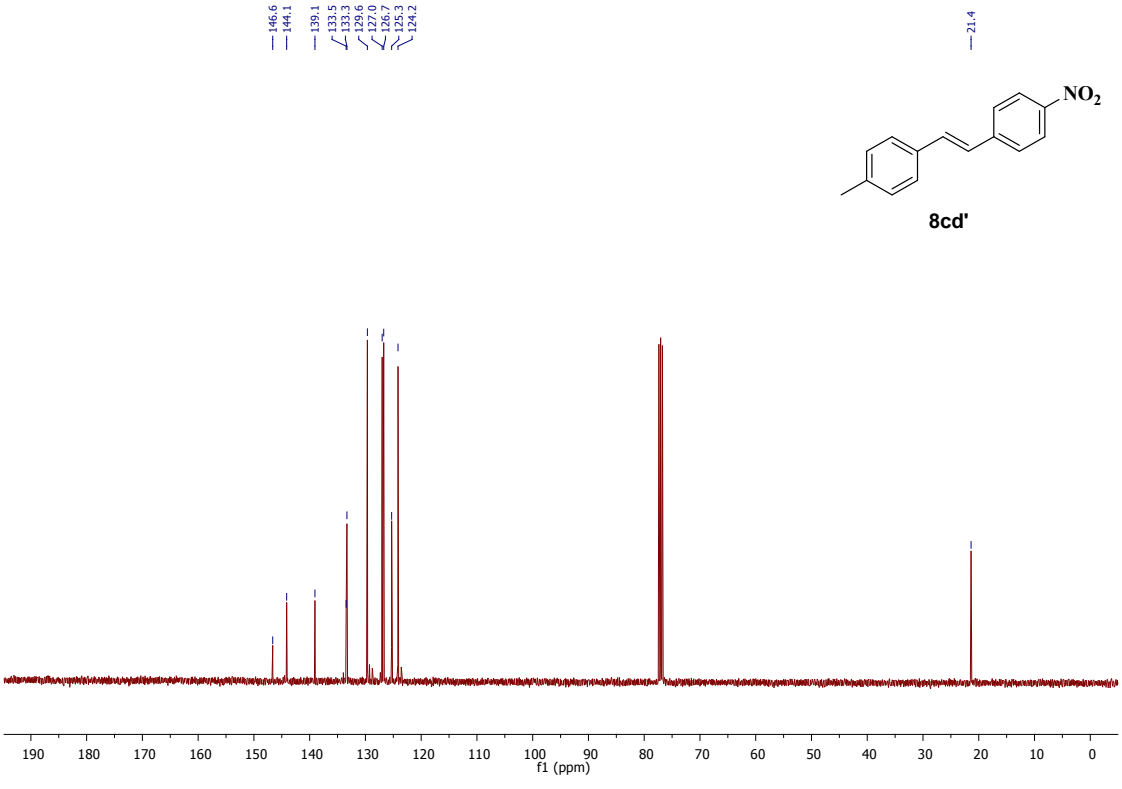
8cd'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139.1
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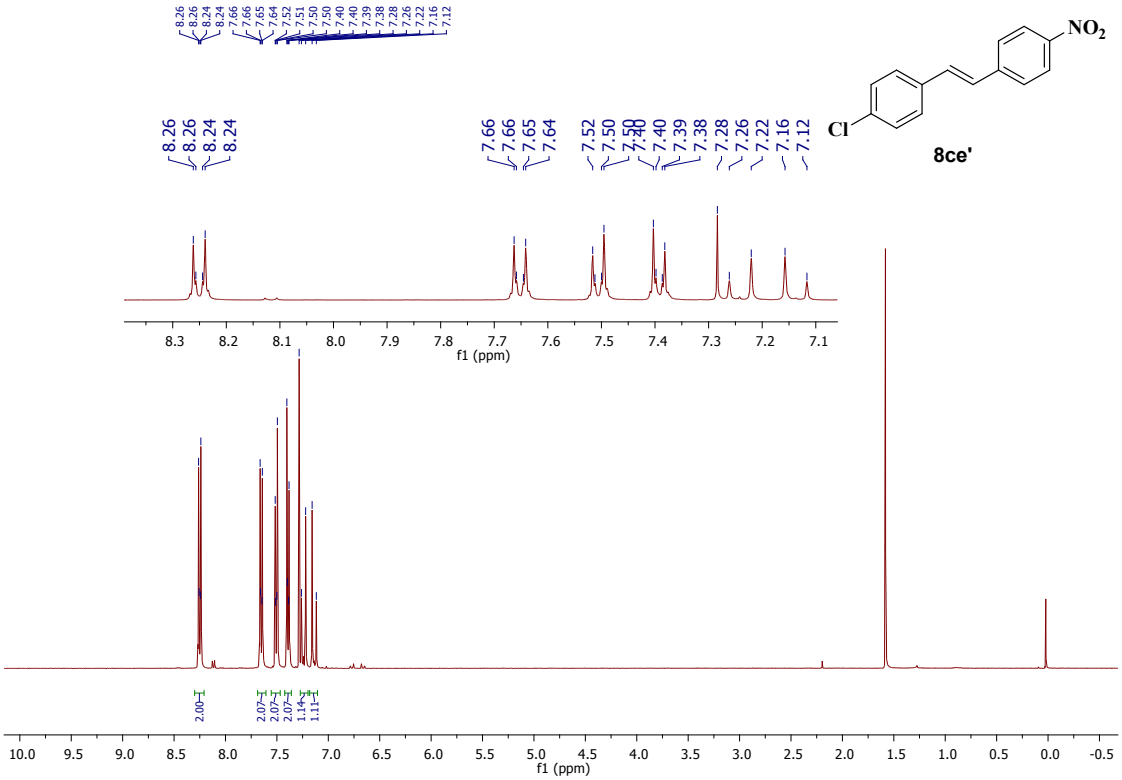
129.6
127.0
126.7
125.3
124.2
21.4
f1 (ppm)
NO2
8cd'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8.24
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7.22
7.16
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f1 (ppm)
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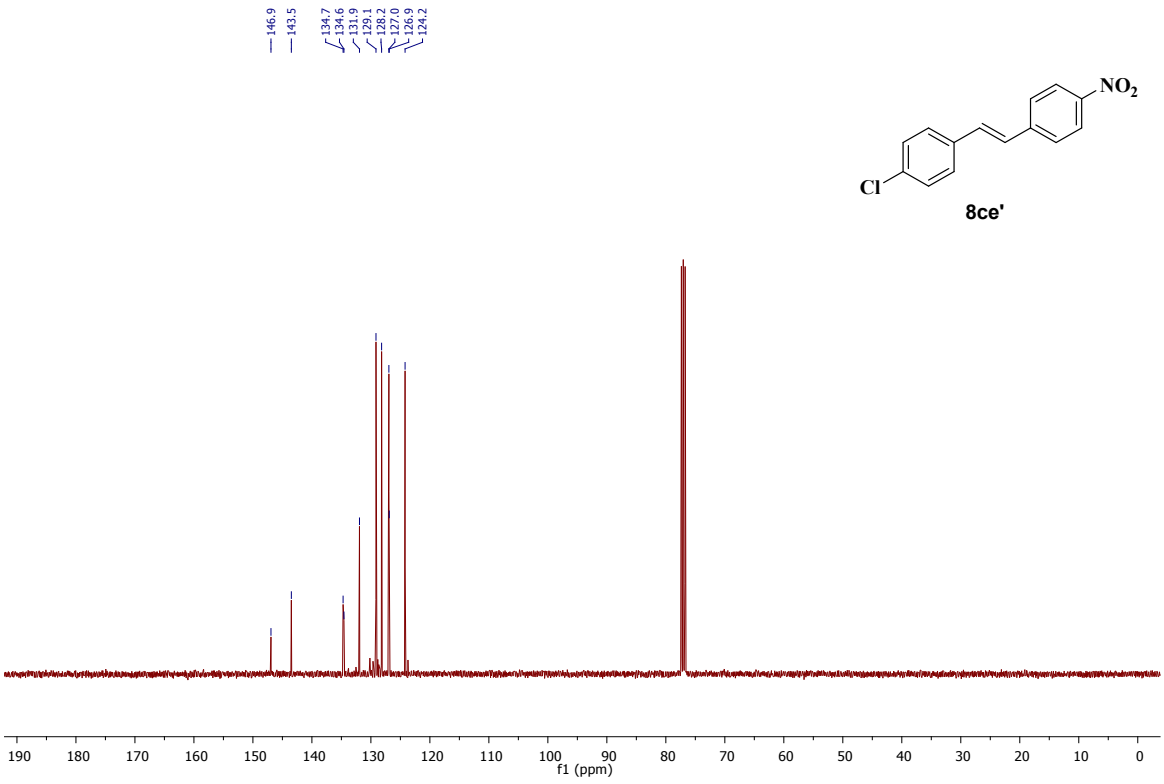
2.07
2.07
2.07
1.14
1.11
f1 (ppm)

NO2
Cl

8ce'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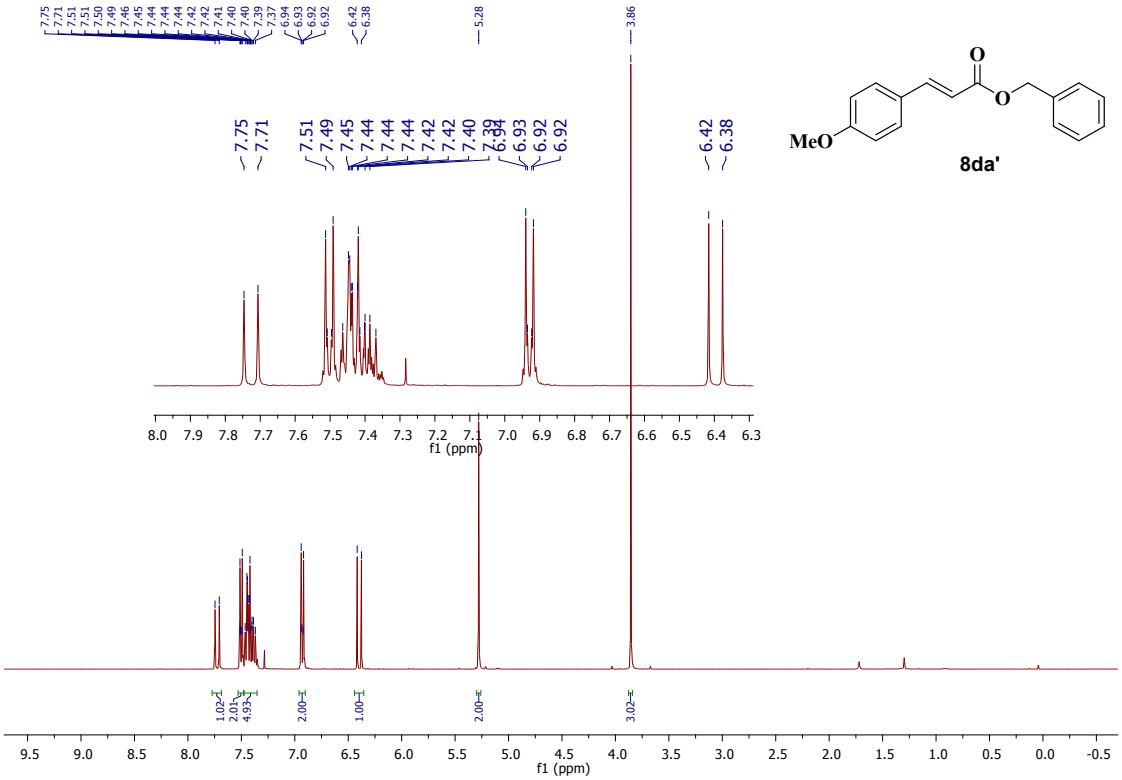
127.0
126.9
124.2
f1 (ppm)

NO2
Cl

8ce'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6.92
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6.38
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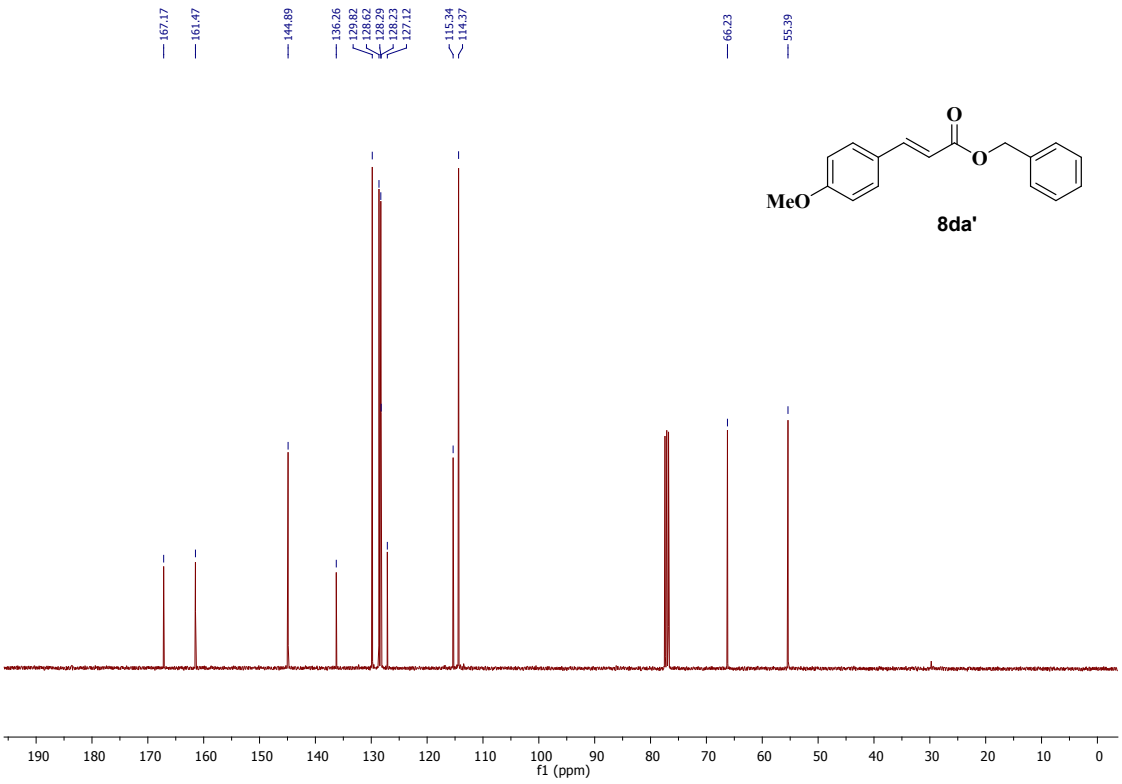
MeO
O
O
8da'
f1 (ppm)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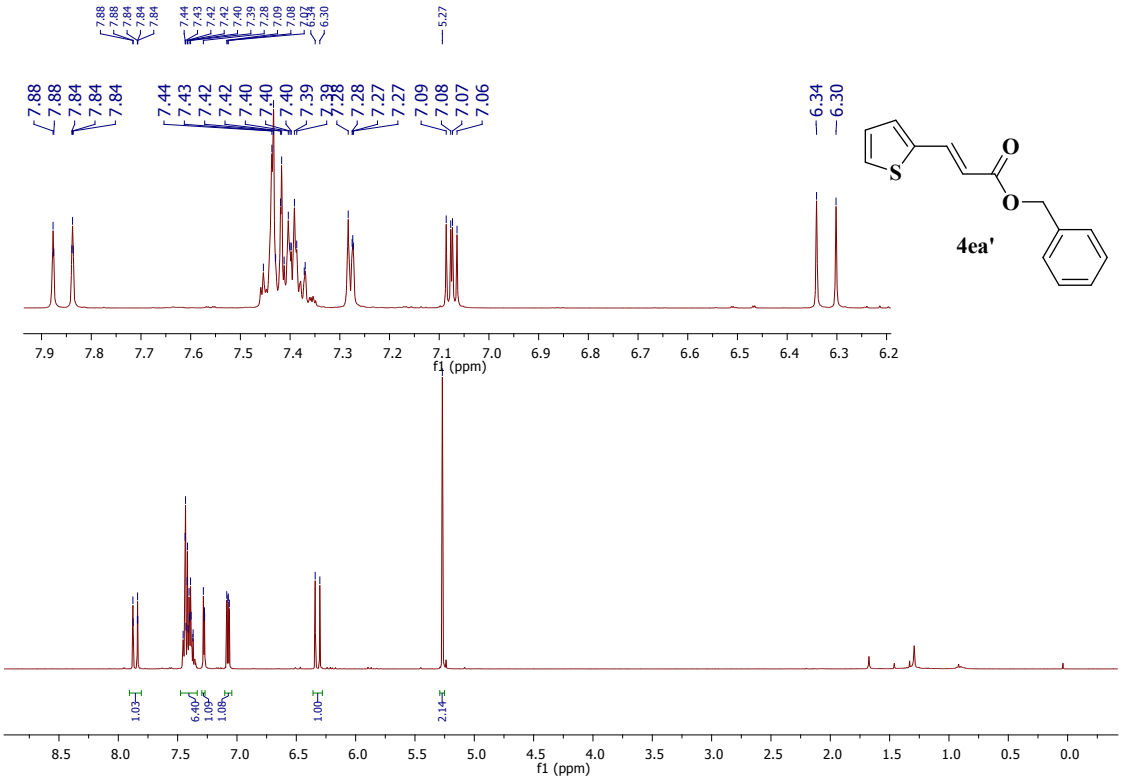
114.37
66.23
55.39
MeO
O
O
8da'
f1 (ppm)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7.27
7.27
7.09
7.08
7.07
7.06
6.34
6.30
5.27
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O
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4ea'
f1 (ppm)
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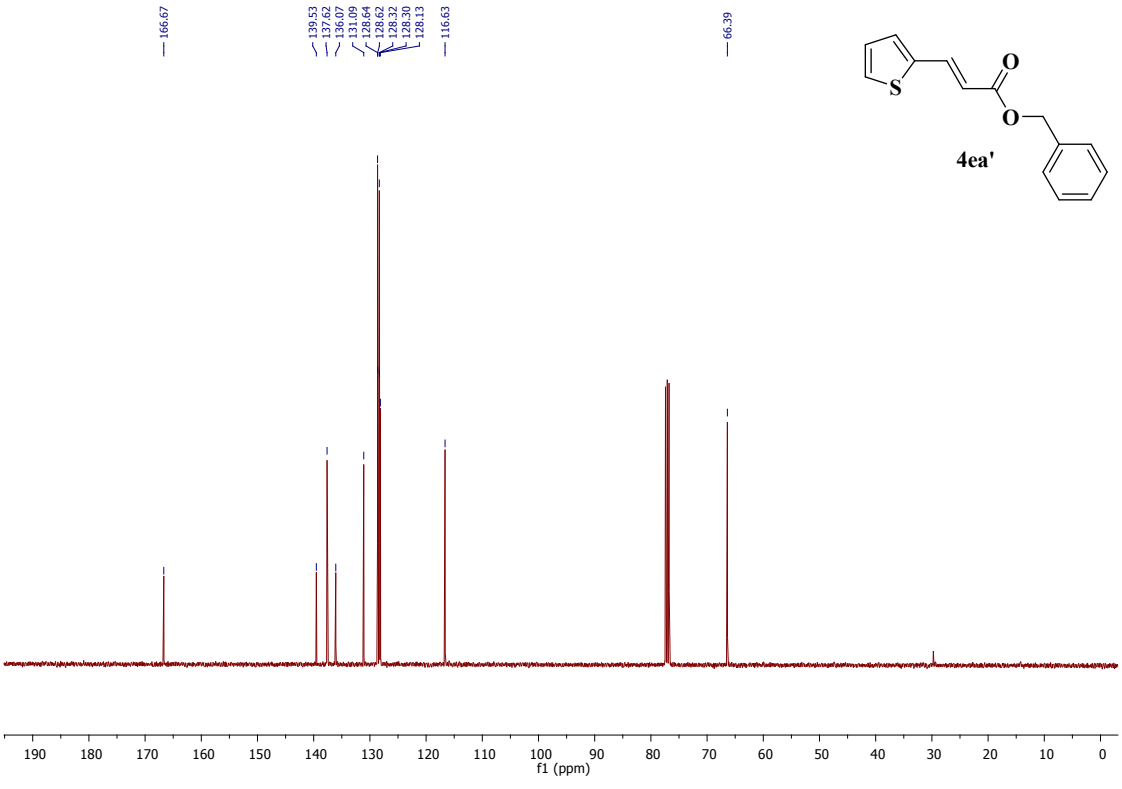
1.09
1.08
1.00
2.14
f1 (ppm)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128.32
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128.13
116.63
66.39
O
O
S
4ea'
f1 (ppm)

2.3 ^{1}H and ^{13}C NMR analysis of the Suzuki coupling products

1,1'-Biphenyl (10aa′): Colorless solid; mp 68 – 70 °C (Lit. mp 71 – 72 °C)[4]; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.66 – 7.61 (m, 2H), 7.52 – 7.45 (m, 2H), 7.41 – 7.36 (m, 1H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 141.4, 128.9, 127.4, 127.3.

3,4,5-Trimethoxy-1,1'-biphenyl (10ab′): Colorless solid, mp 141 – 141.5 °C; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.63 – 7.56 (m, 2H), 7.50 – 7.43 (m, 2H), 7.41 – 7.34 (m, 1H), 6.81 (s, 2H), 3.95 (s, 6H), 3.92 (s, 3H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 153.5, 141.4, 137.6, 137.3, 128.8, 127.3, 127.1, 104.5, 61.0, 56.2.

4-Methyl-1,1'-biphenyl (10ba′): Colorless solid, mp 49–50 °C (Lit. mp 49 − 51 °C)[1]; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.64 – 7.60 (m, 2H), 7.57 – 7.52 (m, 2H), 7.50 – 7.44 (m, 2H), 7.40 – 7.34 (m, 1H), 7.29 (d, *J* = 7.3 Hz, 2H), 2.44 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 141.2, 138.4, 137.1, 129.5, 128.8, 128.8, 127.1, 127.0, 21.2.

4-Nitro-1,1'-biphenyl (10ca′): Pale yellow coloured solid, mp 113–114 °C (Lit. mp 113 − 115)[1]; ^{1}H NMR (300 MHz, $CDCl_3$) δ ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.33 (dt, *J* = 8.8, 2.4 Hz, 2H), 7.77 (dt, *J* = 8.8, 2.4 Hz, 2H), 7.66 – 7.63 (m, 2H), 7.55 – 7.45 (m, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 147.7, 147.1, 138.8, 129.2, 128.9, 127.8, 127.4, 124.1.

2-Methyl-1,1'-biphenyl (10ha′): Colorless liquid[5]; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.70 – 7.63 (m, 1H), 7.54 – 7.44 (m, 3H), 7.44 – 7.40 (m, 1H), 7.40 – 7.36 (m, 1H), 7.35 – 7.28 (m, 3H), 2.34 (s, 3H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 141.98, 135.39, 130.35, 129.84, 129.24, 128.80, 128.11, 127.29, 127.22, 126.81, 125.81, 20.52.

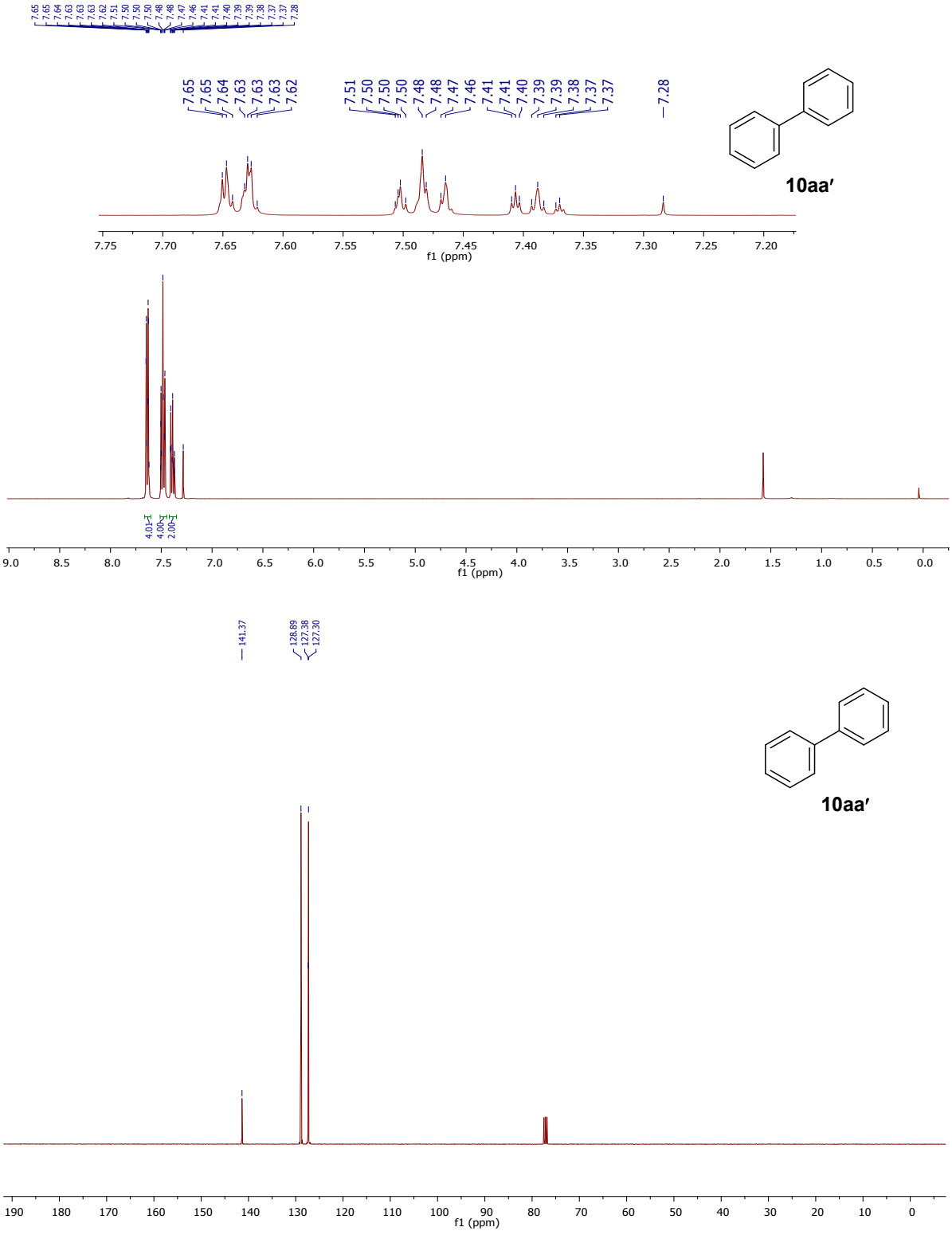
4-Methoxy-1,1'-biphenyl (10da′): Colorless solid, mp 87 – 90 °C (Lit. mp 88 − 92 °C)[1]; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.62 – 7.52 (m, 4H), 7.47 – 7.42 (m, 2H), 7.37 – 7.30 (m, 1H), 7.01 (dt, *J* = 8.8, 2.4 Hz, 2H), 3.88 (s, 3H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 159.2, 140.9, 133.8, 128.8, 128.2, 126.8, 126.7, 114.2, 55.4.

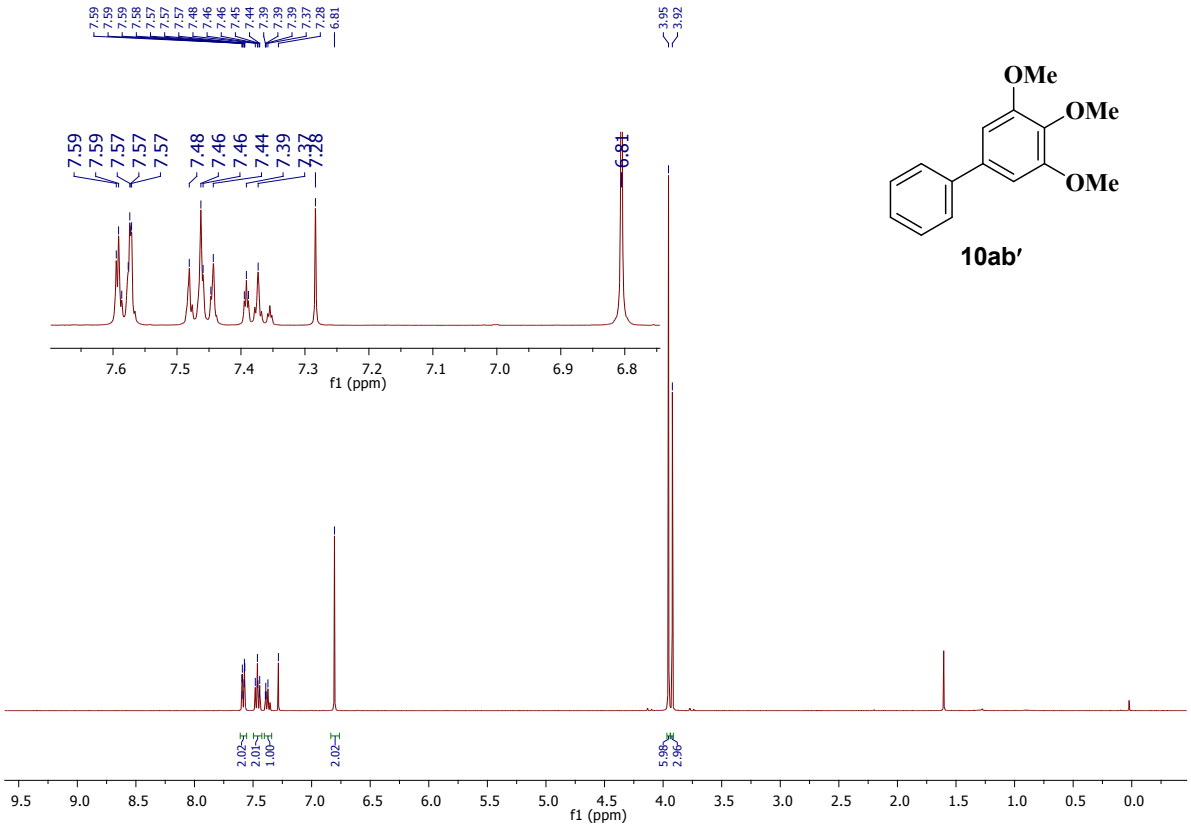
2-Amino-1,1'-biphenyl (10ia′): Colorless solid, mp 47–50 °C (Lit. mp 50 – 53 °C)[4]; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.56 – 7.45 (m, 4H), 7.44 – 7.35 (m, 1H), 7.26 – 7.15 (m, 2H), 6.88 (dt, *J* = 7.5, 3.8 Hz, 1H), 6.84 – 6.79 (m, 1H), 3.77 (br s, 2H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 143.5, 139.6, 130.5, 129.1, 128.9, 128.5, 127.7, 127.2, 118.7, 115.6.

4-Naphthyl-1,1'-biphenyl (10ja′): Colorless liquid; ^{1}H NMR (300 MHz, $CDCl_3$) δ 8.17–8.04(m, 3H), 7.73 – 7.59 (m, 9H). ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.14 (d, *J* = 7.8 Hz, 1H), 8.09 (d, *J* = 8.8 Hz, 1H), 8.04 (d, *J* = 8.2 Hz, 1H), 7.72 – 7.65 (m, 5H), 7.66 – 7.58 (m, 4H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 141.0, 140.5, 134.0, 131.9, 130.3, 129.0, 128.5, 128.4, 127.9, 127.4, 127.2, 126.2, 125.9, 125.6.

2-phenylthiophene (10ea′): Low melting colorless solid (Lit. mp 34 – 36 °C)[5]; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.71 – 7.65 (m, 2H), 7.47 – 7.40 (m, 2H), 7.37 (dd, *J* = 3.6, 1.2 Hz, 1H), 7.36 – 7.31 (m, 2H), 7.13 (dd, *J* = 5.1, 3.6 Hz, 1H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 144.5, 134.5, 128.9, 128.1, 127.5, 126.0, 124.9, 123.1.

2.4 Copies of ^{1}H and ^{13}C NMR spectra of Suzuki coupling products 10

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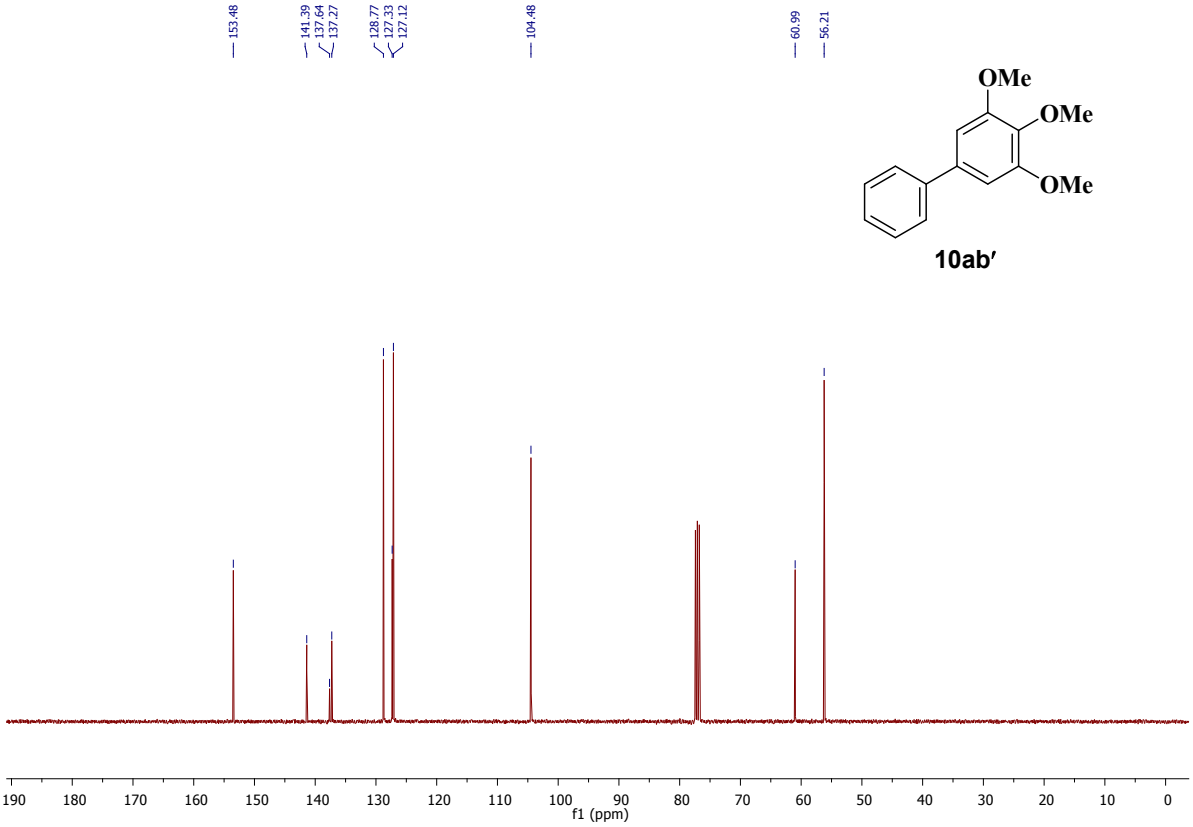
OMe
OMe
10ab′
f1 (ppm)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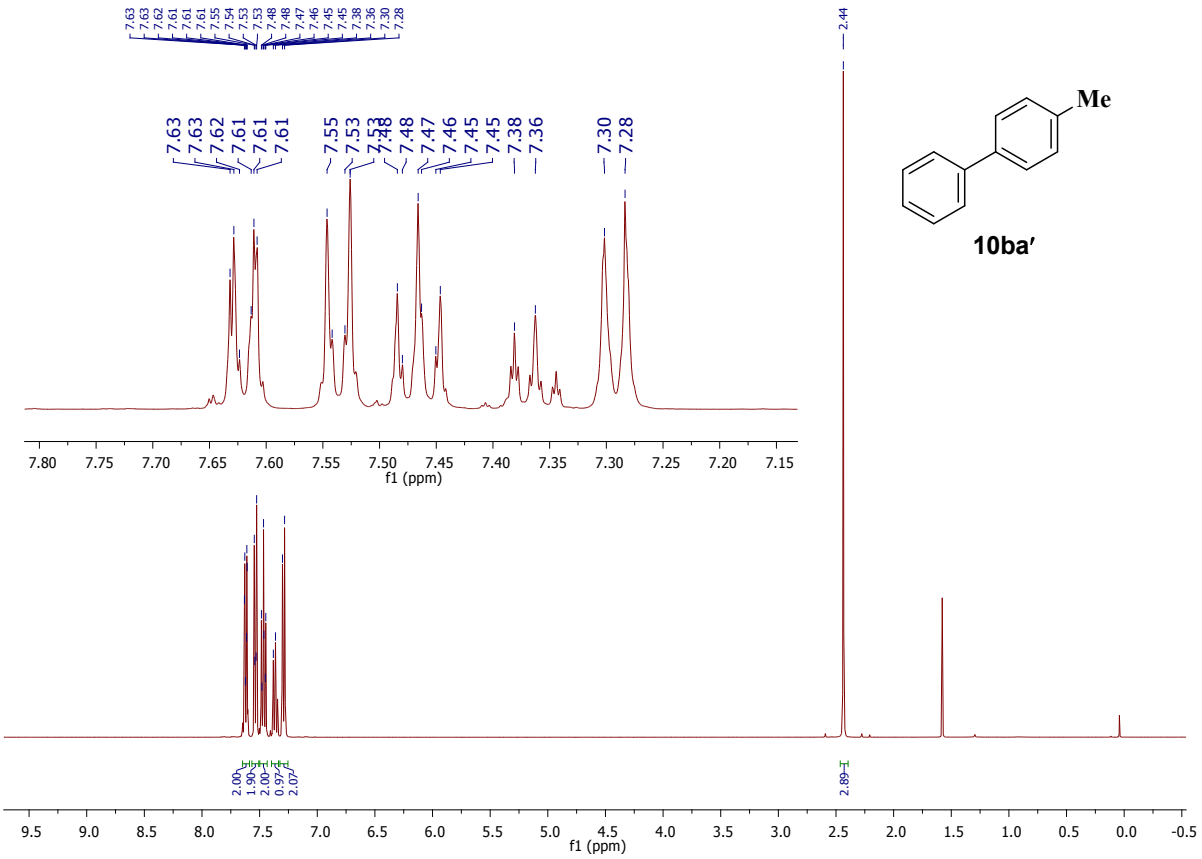
OMe
OMe
10ab′
f1 (ppm)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7.36
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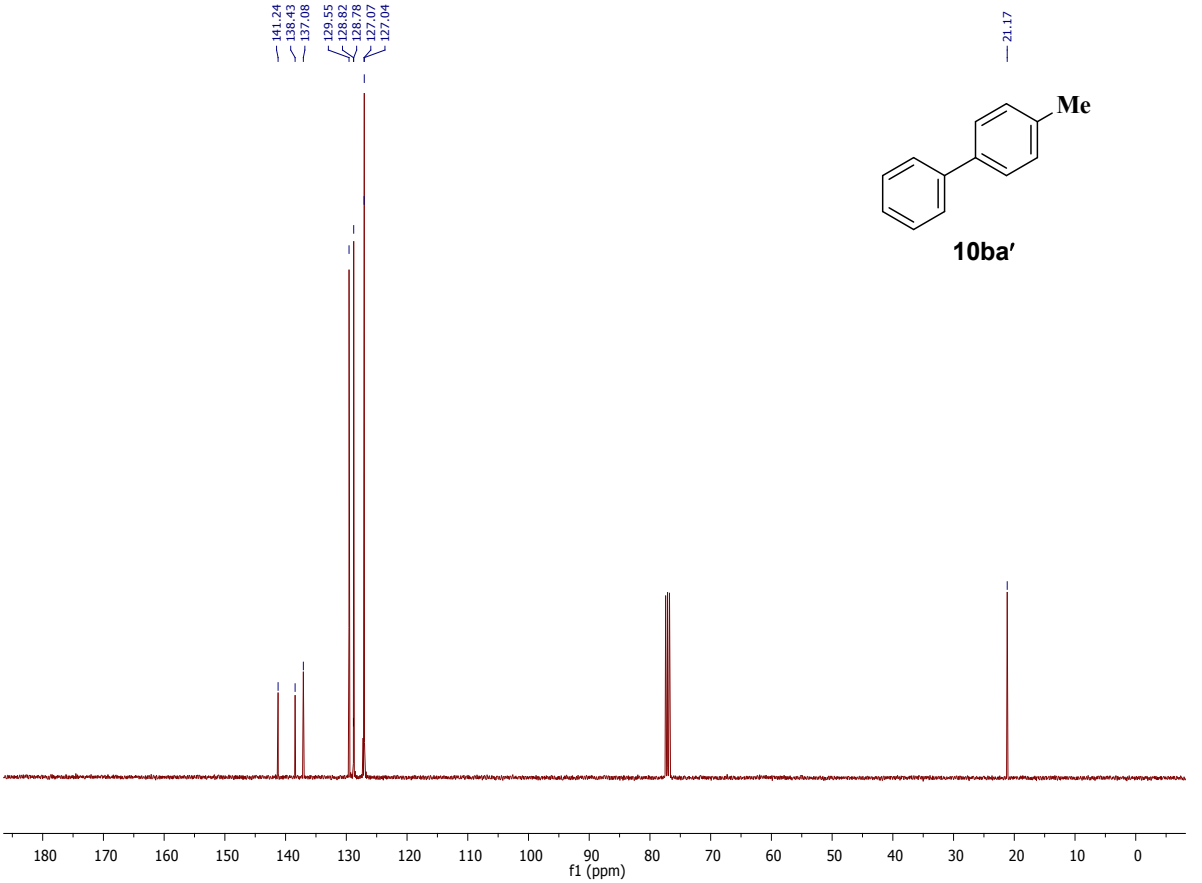
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127.04
21.17
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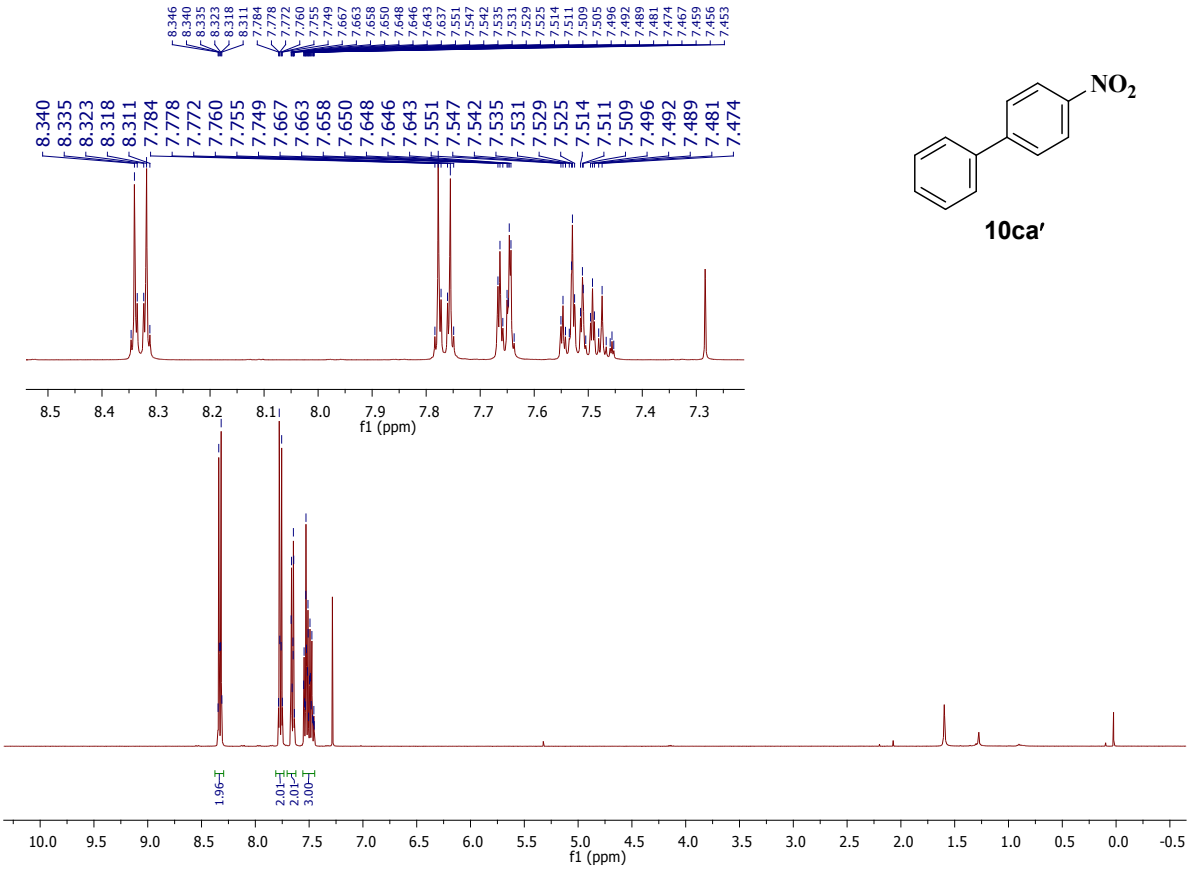
10ba′
f1 (ppm)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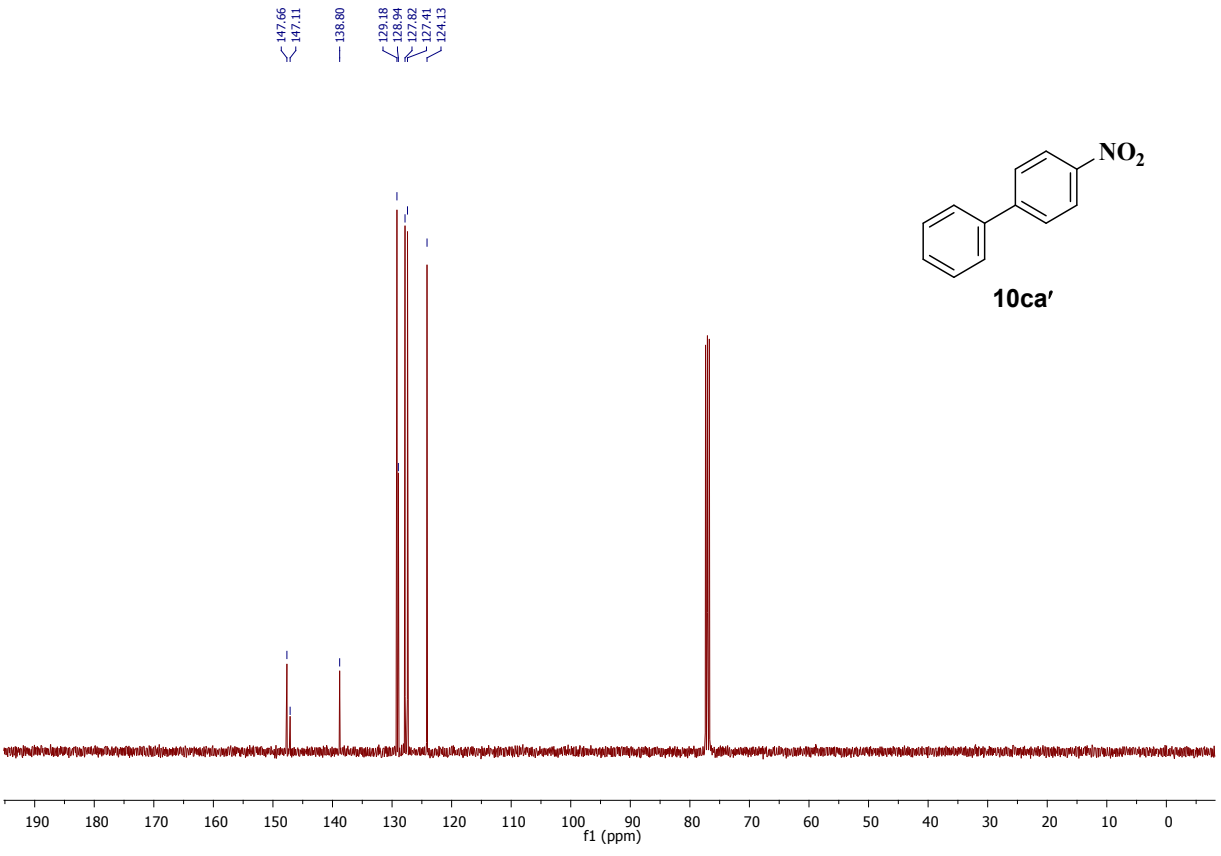
3.00
f1 (ppm)

NO2

10ca′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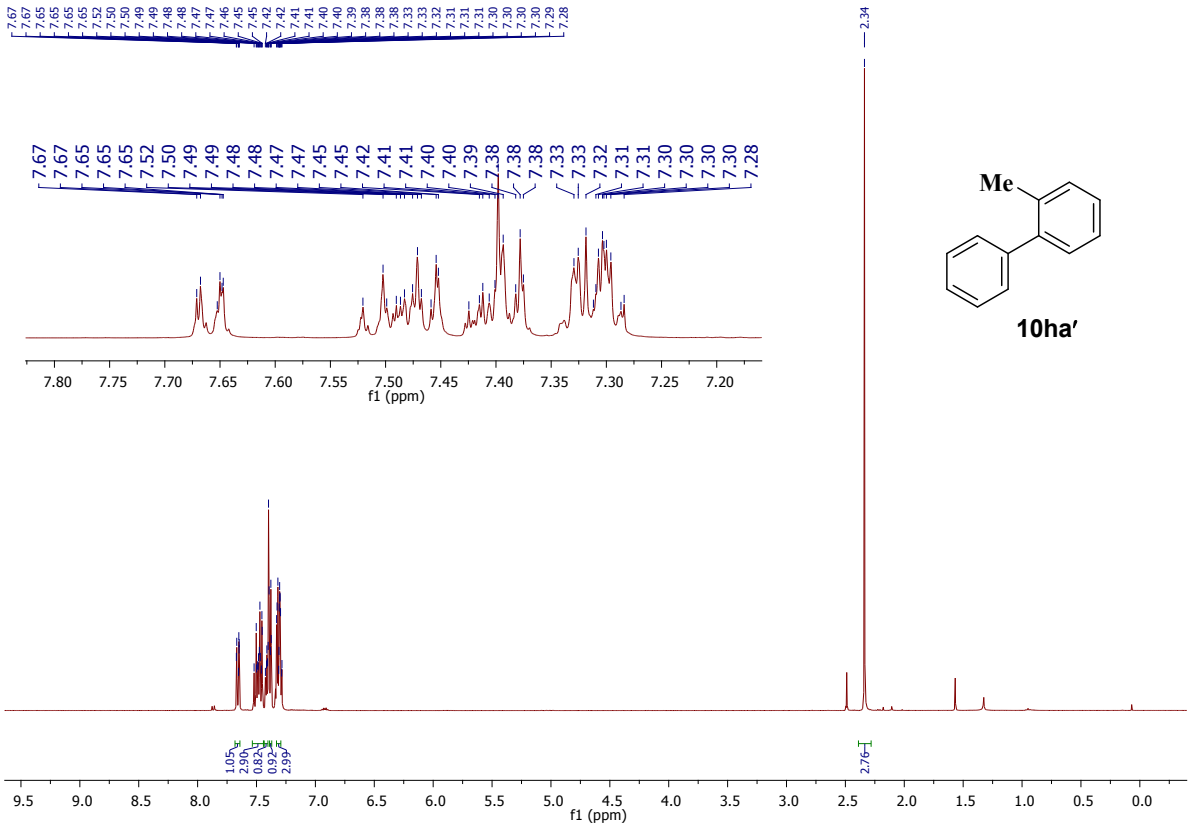
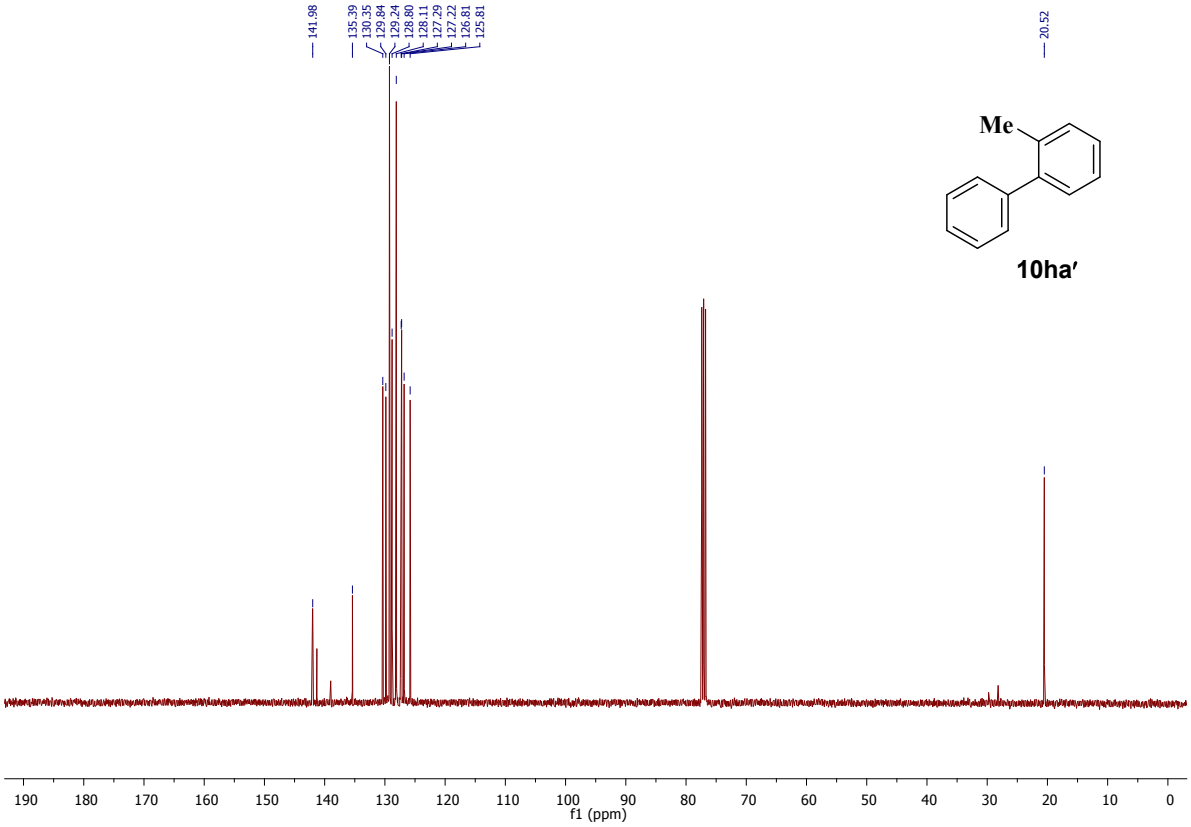
f1 (ppm)

NO2

10ca′


Me
10ha′
f1 (ppm)


Me
10ha′
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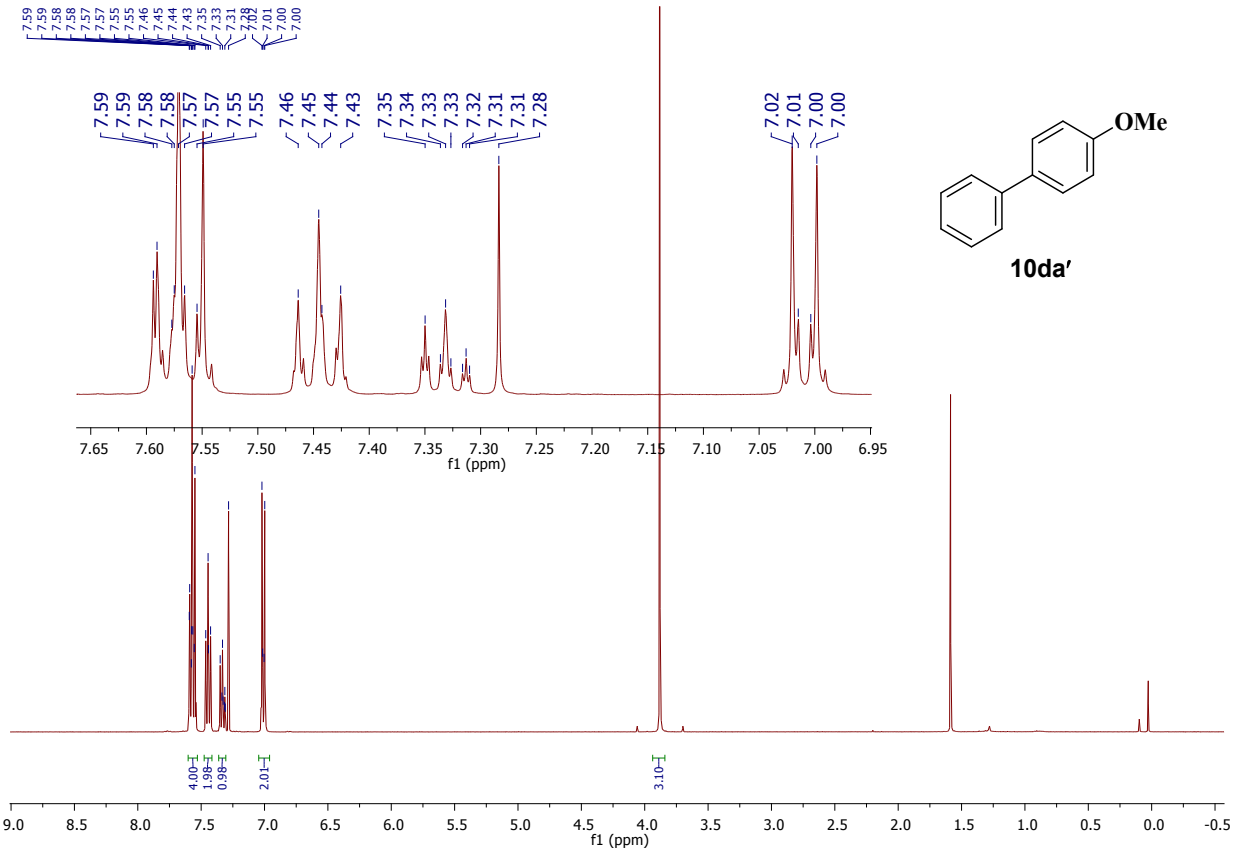
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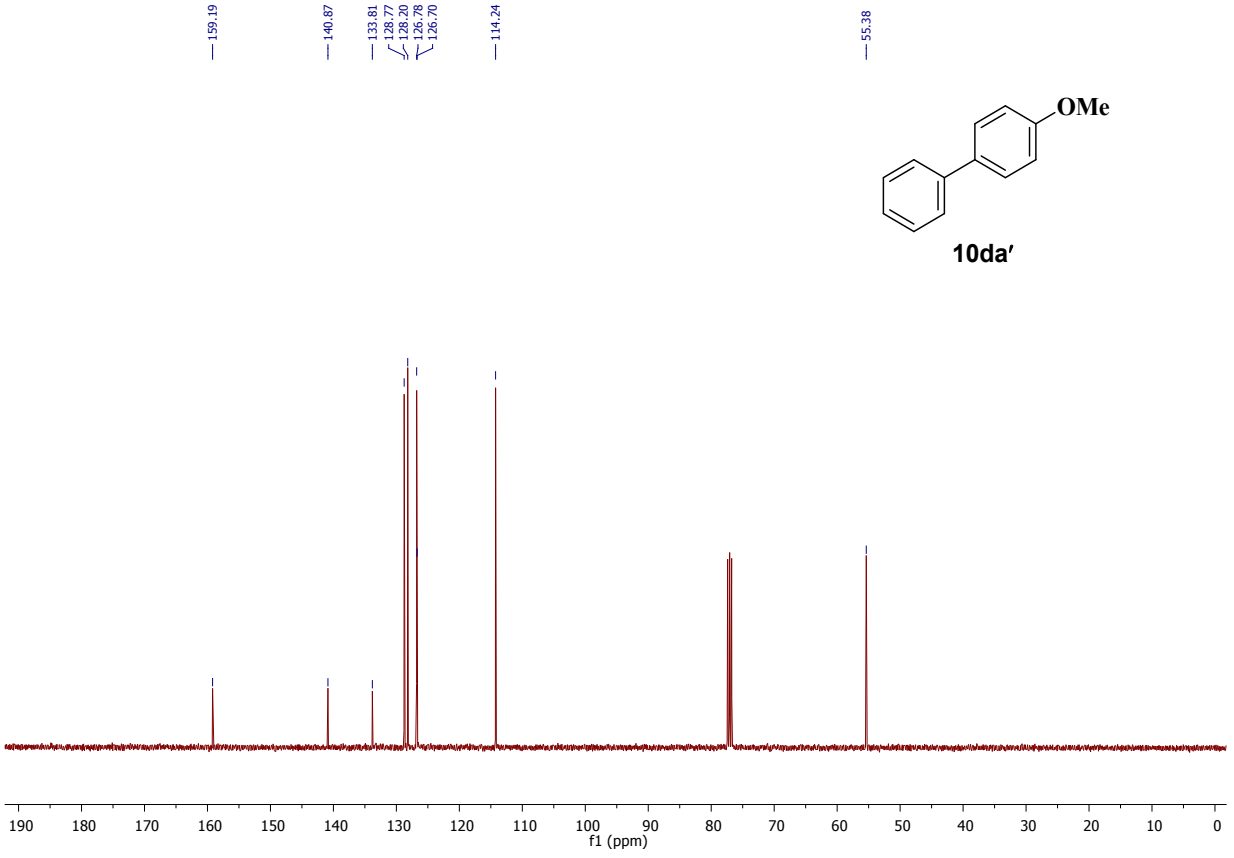
f1 (ppm)

OMe

10da′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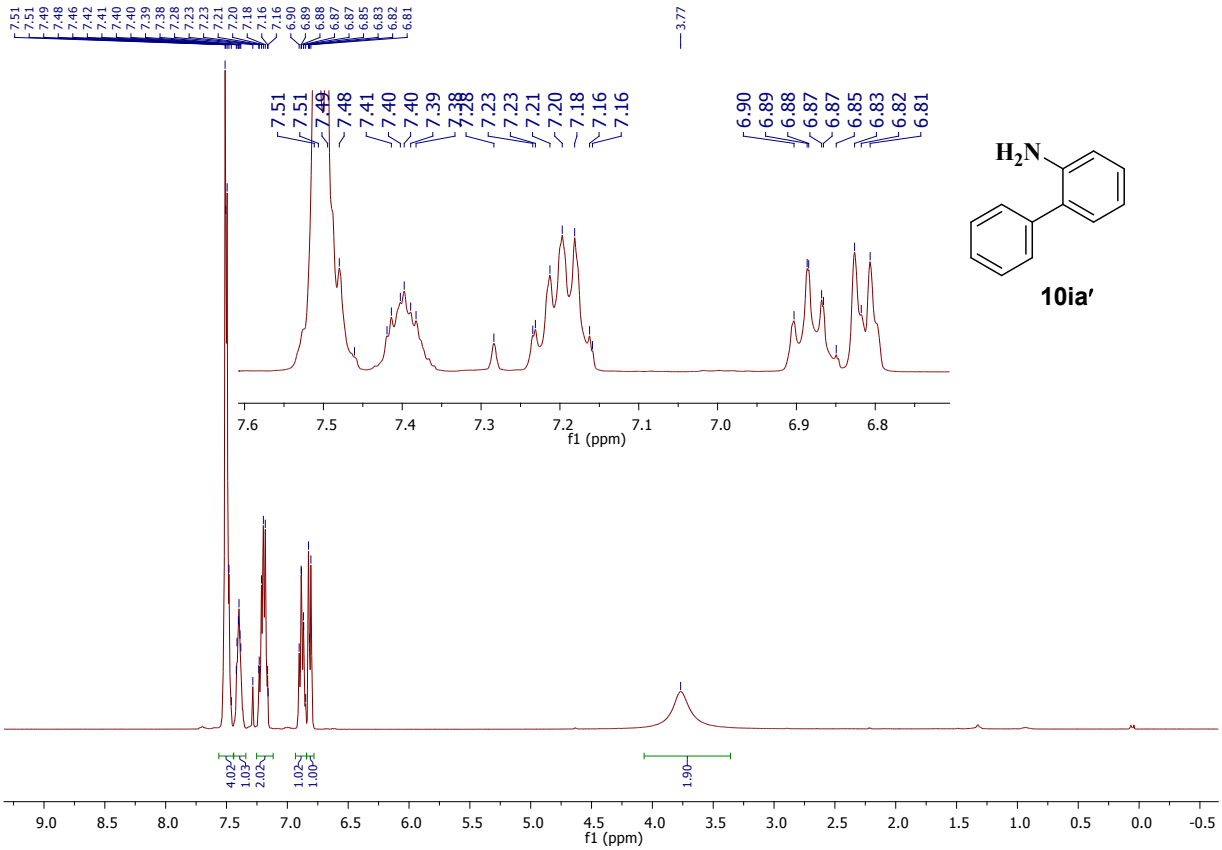
f1 (ppm)

OMe

10da′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6.87
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6.81
3.77
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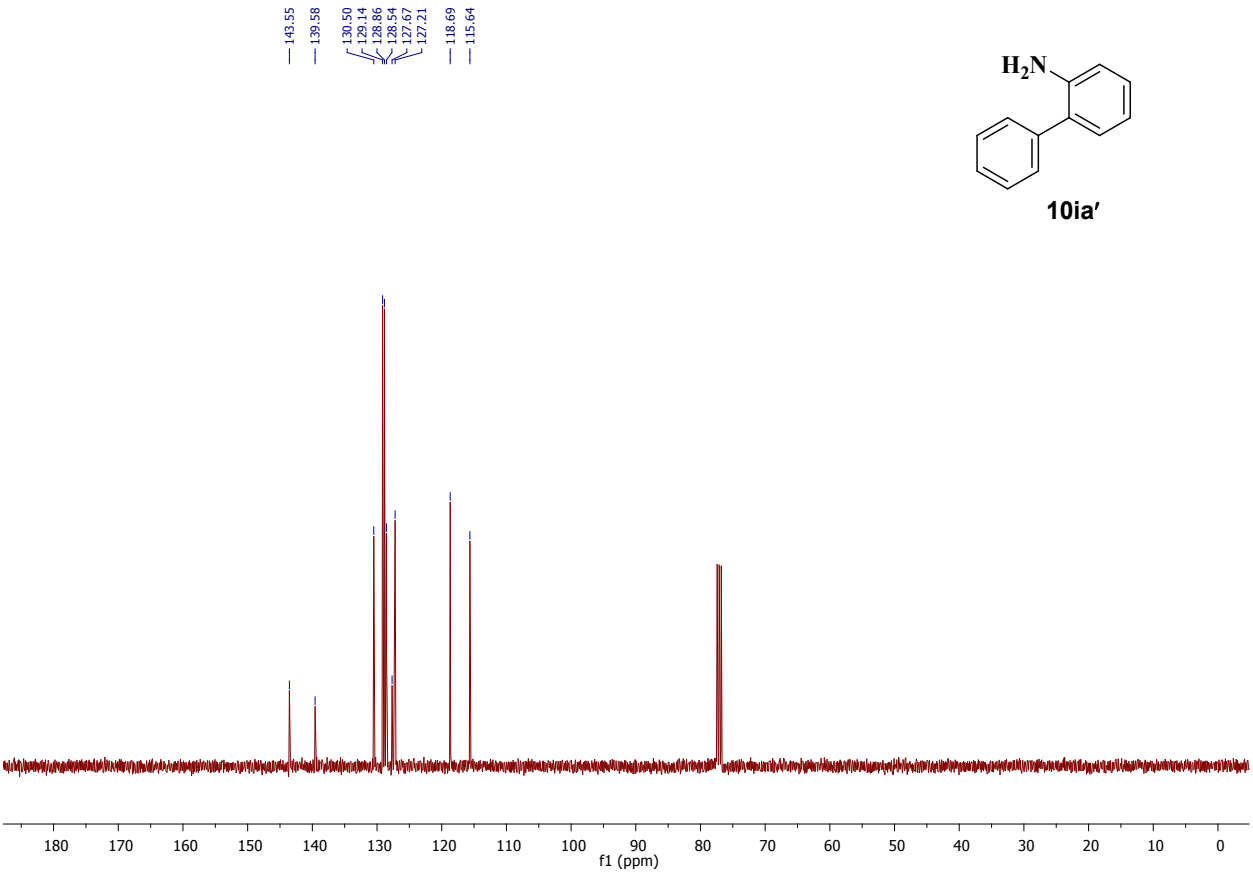
1.02
1.00
1.90
f1 (ppm)

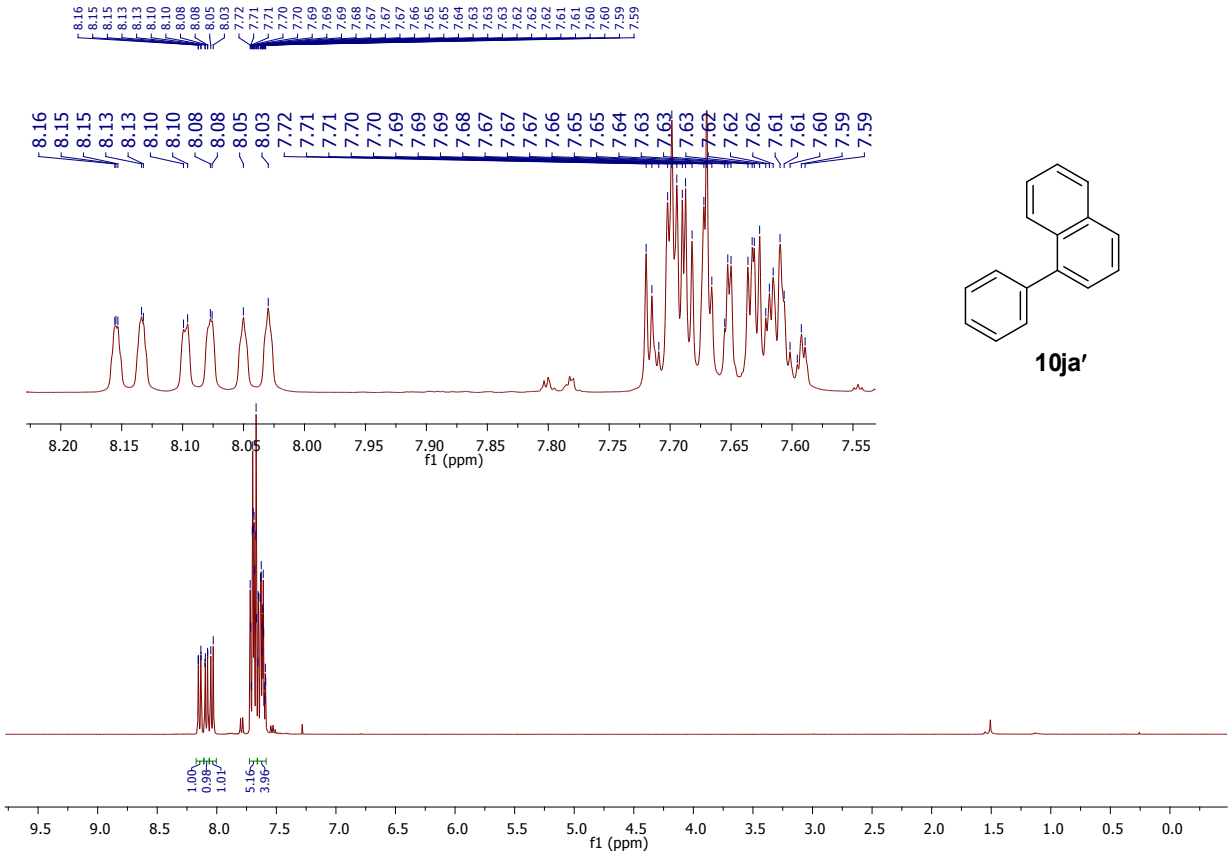
H_2N

10ia′


143.55
139.58
130.50
129.14
128.86
128.54
127.67
127.21
118.69
115.64
f1 (ppm)

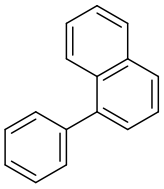
H_2N

10ia′

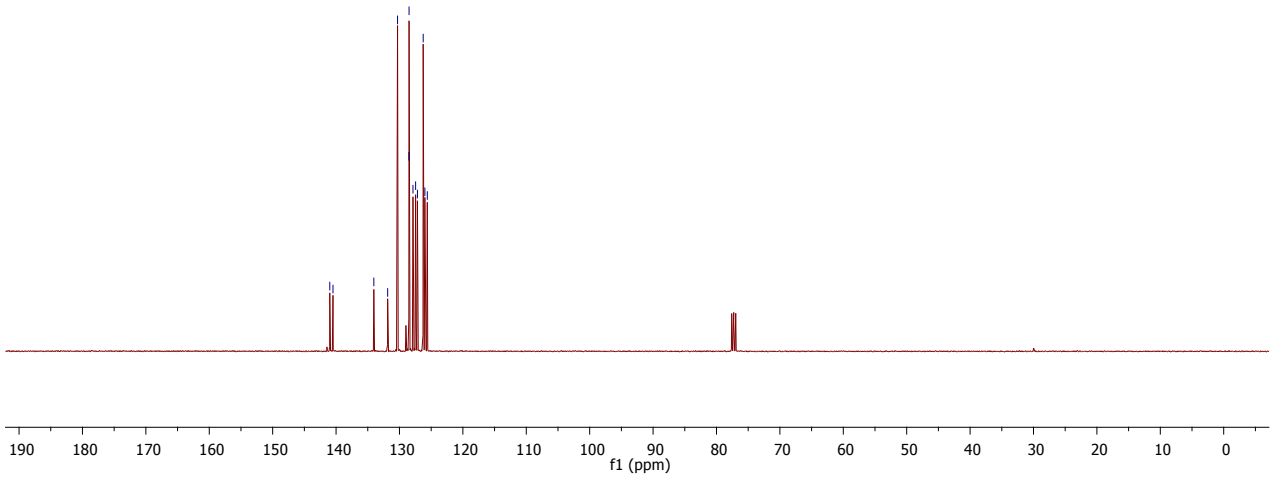

8.16 8.15 8.15 8.13 8.13 8.10 8.10 8.08 8.08 8.05 8.03 7.72 7.71 7.71 7.70 7.70 7.69 7.69 7.69 7.68 7.67 7.67 7.67 7.66 7.65 7.65 7.64 7.63 7.63 7.63 7.62 7.62 7.62 7.61 7.61 7.60 7.59 7.59
f1 (ppm)
1.00 0.99 1.01 5.16 3.96
f1 (ppm)

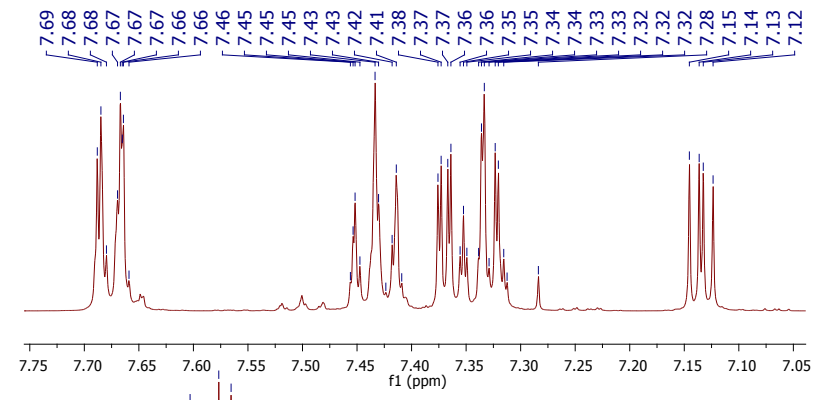
10ja′

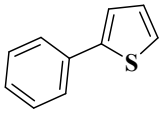

140.99 140.48 134.04 131.86 130.30 128.51 128.49 127.87 127.45 127.17 126.26 125.99 125.61



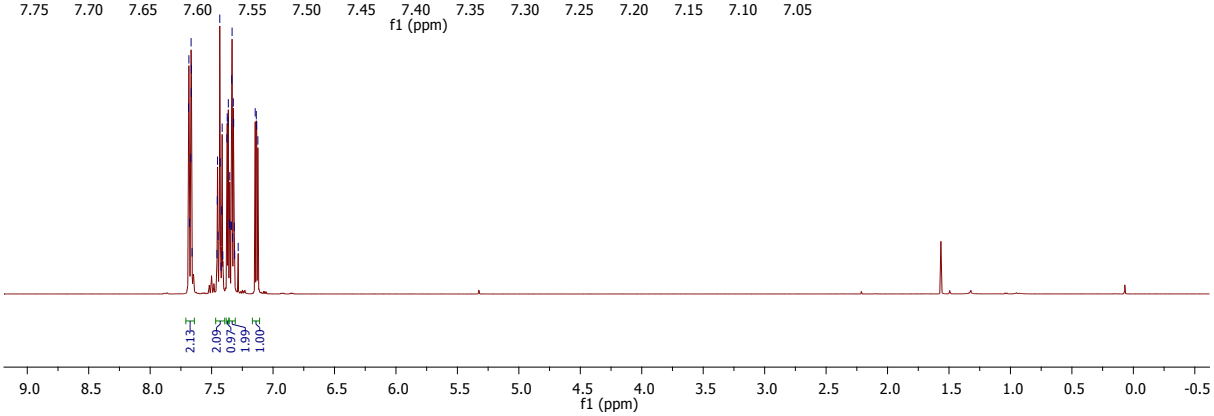
10ja′

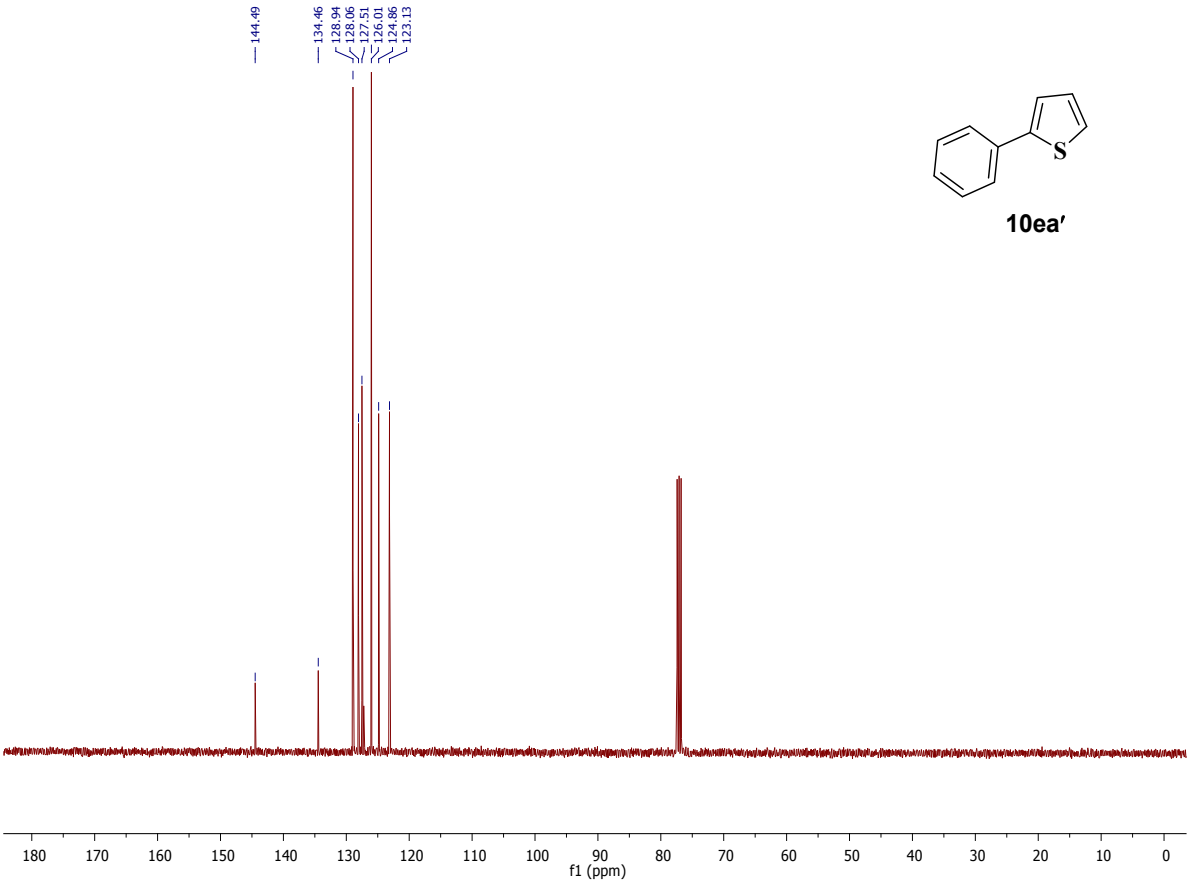

f1 (ppm)





10ea′





10ea′

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