Supporting Information for

Au(I)-Catalyzed Expeditious Access to Naphtho[2,3-*c*]furan-1(3-*H*)-ones from Readily Available Propargylic Ynoates

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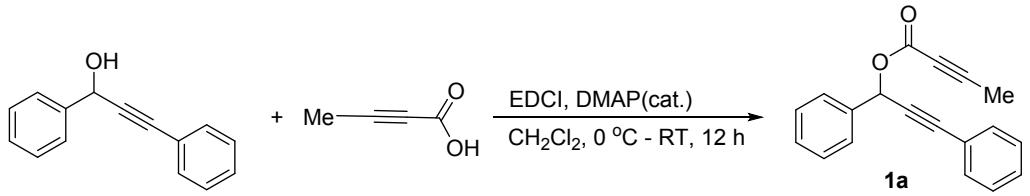
1. General Information

Ethyl acetate (ACS grade), hexanes (ACS grade), dichloromethane (ACS grade) were purchased from Fisher Scientific and used without further purification. ACS grade 1,2-dichloroethane were purchased from Acros Organics and used directly. Commercially available reagents were used without further purification. Reactions were monitored by thin layer chromatography (TLC) using Silicycle precoated silica gel plates. Flash column chromatography was performed over Silicycle silica gel (230-400 mesh). ^{1}H NMR and ^{13}C NMR spectra were recorded on a Varian 400 MHz spectrometer. Unity plus spectrometer, using residue solvent peaks as internal standards ($CDCl_3$, ^{1}H: 7.26 ppm; ^{13}C: 77.00 ppm).Mass spectra were recorded with Waters micromass ZQ detector using electrospray method.

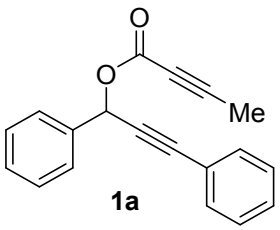
2. Synthesis of Compound 1

General Procedure A: Preparation of Propargylic Ynoates 1:



Taking substrate **1a** for example: To a solution of the propargylic alcohol (2 mmol) and acid (2.2 mmol, 1.1 eq) in CH_2Cl_2 (10 mL) was added catalytic amount DMAP. The solution was cooled in an ice-water bath and treated with EDCI (2.2 mmol, 1.1 eq). The ice-water bath was removed, and the reaction was stirred at room temperature overnight. The urea formed during the reaction was filtered off and the residue after concentration was purified through silica gel flash column chromatography (eluents: EtOAc and hexanes) to give the desired substrate **1a**.

1,3-diphenylprop-2-yn-1-yl but-2-ynoate (1a)



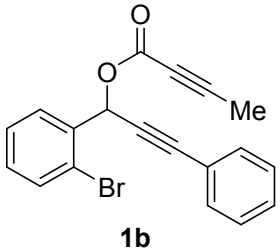
1a

Compound **1a** was obtained as yellow oil in 96% yield according to general procedure **A**.

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.67 – 7.63 (m, 2H), 7.51 – 7.49 (m, 2H), 7.45 – 7.39 (m, 3H), 7.35 – 7.31 (m, 3H), 6.76 (s, 1H), 1.96 (s, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 152.36, 136.22, 131.77, 129.09, 128.80, 128.62, 128.17, 127.83, 121.77, 87.69, 86.91, 84.67, 71.93, 67.36, 3.69.

1-(2-bromophenyl)-3-phenylprop-2-yn-1-yl but-2-ynoate (1b)



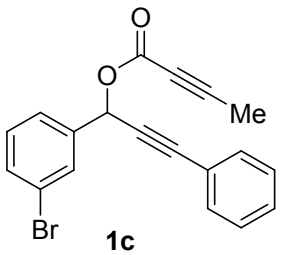
1b

Compound **1b** was obtained as yellow oil in 87% yield according to general procedure **A**.

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.89 (dd, J = 7.8, 1.5 Hz, 1H), 7.61 (d, J = 8.0 Hz, 1H), 7.49 (dd, J = 7.5, 1.8 Hz, 2H), 7.40 (t, J = 7.6 Hz, 1H), 7.35 – 7.19 (m, 5H), 6.98 (s, 1H), 2.00 (s, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 152.10, 135.36, 133.11, 131.95, 130.72, 129.94, 128.99, 128.28, 127.82, 123.52, 121.76, 88.21, 87.10, 83.83, 71.85, 66.92, 3.95.

1-(3-bromophenyl)-3-phenylprop-2-yn-1-yl but-2-ynoate (1c)



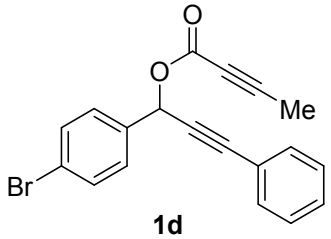
1c

Compound **1c** was obtained as yellow oil in 86% yield according to general procedure **A**.

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.75 (t, *J* = 1.7 Hz, 1H), 7.53 – 7.49 (m, 2H), 7.48 – 7.46 (m, 2H), 7.35 – 7.30 (m, 3H), 7.27 – 7.25 (m, 1H), 6.66 (s, 1H), 1.99 (s, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 152.27, 138.49, 132.28, 131.94, 130.90, 130.27, 129.07, 128.31, 126.52, 122.68, 121.62, 88.24, 87.44, 84.03, 71.84, 66.55, 3.91.

1-(4-bromophenyl)-3-phenylprop-2-yn-1-yl but-2-ynoate (1d)



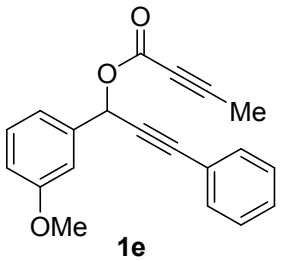
1d

Compound **1d** was obtained as yellow oil in 91% yield according to general procedure **A**.

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.60 – 7.43 (m, 6H), 7.33 (m, 3H), 6.67 (s, 1H), 1.99 (s, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ152.34, 135.41, 131.90, 129.64, 129.05, 128.31, 123.40, 121.64, 88.10, 87.33, 84.14, 71.84, 66.76, 3.92.

1-(3-methoxyphenyl)-3-phenylprop-2-yn-1-yl but-2-ynoate (1e)



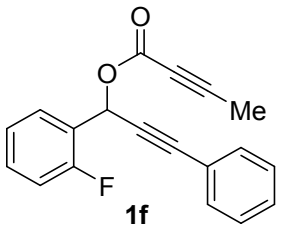
1e

Compound **1e** was obtained as yellow oil in 71% yield according to general procedure **A**.

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.53 – 7.44 (m, 2H), 7.38 – 7.28 (m, 4H), 7.24 – 7.15 (m, 2H), 6.93 (ddd, *J* = 8.2, 2.5, 0.7 Hz, 1H), 6.72 (s, 1H), 3.84 (s, 3H), 1.98 (s, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 159.78, 152.48, 137.73, 131.91, 129.80, 128.93, 128.30, 121.88, 120.22, 114.85, 113.39, 87.75, 87.11, 84.66, 72.01, 67.35, 55.32, 3.89.

1-(2-fluorophenyl)-3-phenylprop-2-yn-1-yl but-2-ynoate (1f)



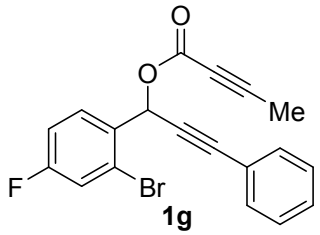
1f

Compound **1f** was obtained as yellow oil in 89% yield according to general procedure **A**.

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.78 (td, *J* = 7.5, 1.7 Hz, 1H), 7.53 – 7.45 (m, 2H), 7.42 – 7.29 (m, 4H), 7.22 (td, *J* = 7.6, 0.9 Hz, 1H), 7.11 (ddd, *J* = 9.5, 8.3, 0.9 Hz, 1H), 6.98 (s, 1H), 1.99 (s, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 160.17 (d, *J* = 250.8 Hz), 152.14, 131.95, 131.19 (d, *J* = 8.3 Hz), 129.73 (d, *J* = 2.8 Hz), 129.01, 128.29, 124.41, 123.59 (d, *J* = 13.2 Hz), 121.73, 115.75 (d, *J* = 21.0 Hz), 87.88, 87.11, 83.65, 71.86, 61.52 (d, *J* = 5.2 Hz), 3.90

1-(2-bromo-4-fluorophenyl)-3-phenylprop-2-yn-1-yl but-2-ynoate (1g)



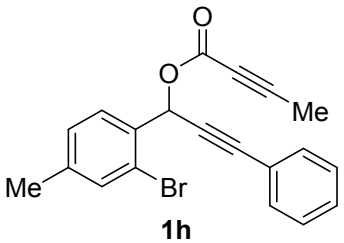
1g

Compound **1g** was obtained as yellow oil in 81% yield according to general procedure **A**.

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.88 (dd, *J* = 8.7, 5.9 Hz, 1H), 7.49 (dd, *J* = 7.5, 1.6 Hz, 2H), 7.42 – 7.27 (m, 4H), 7.12 (td, *J* = 8.3, 2.6 Hz, 1H), 6.93 (s, 1H), 2.00 (s, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 162.66 (d, *J* = 253.4 Hz), 152.01, 131.58 (d, *J* = 3.5 Hz), 131.28 (d, *J* = 8.9 Hz), 129.09, 128.31, 123.86 (d, *J* = 9.9 Hz), 121.58, 120.38 (d, *J* = 24.8 Hz), 115.01 (d, *J* = 21.2 Hz), 88.42, 87.26, 83.63, 71.74, 66.24, 3.95.

1-(2-bromo-4-methylphenyl)-3-phenylprop-2-yn-1-yl but-2-ynoate (1h)



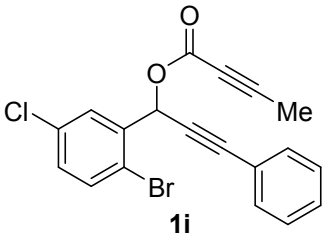
1h

Compound **1h** was obtained as yellow oil in 86% yield according to general procedure **A**.

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.77 (d, *J* = 7.9 Hz, 1H), 7.49 (dd, *J* = 7.3, 1.8 Hz, 2H), 7.43 (s, 1H), 7.40 – 7.24 (m, 3H), 7.20 (d, *J* = 7.9 Hz, 1H), 6.97 (s, 1H), 2.34 (s, 3H), 1.98 (s, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 152.17, 141.28, 133.52, 132.37, 131.93, 129.73, 128.99, 128.63, 128.31, 123.28, 121.81, 88.05, 87.00, 84.12, 71.94, 66.82, 20.87, 3.91.

1-(2-bromo-5-chlorophenyl)-3-phenylprop-2-yn-1-yl but-2-ynoate (1i)



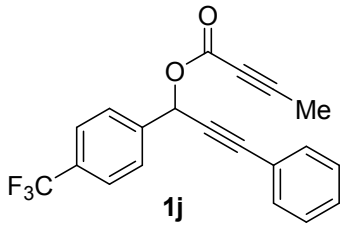
1i

Compound **1i** was obtained as yellow oil in 82% yield according to general procedure **A**.

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.83 (d, *J* = 2.5 Hz, 1H), 7.57 – 7.44 (m, 3H), 7.38 – 7.29 (m, 3H), 7.25 – 7.16 (m, 1H), 6.90 (s, 1H), 2.01 (s, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 151.87, 137.21, 134.17, 133.94, 131.99, 130.69, 129.78, 129.16, 128.32, 121.48, 121.09, 88.54, 87.55, 83.16, 71.67, 66.33, 3.96.

3-phenyl-1-(4-(trifluoromethyl)phenyl)prop-2-yn-1-yl but-2-ynoate (1j)



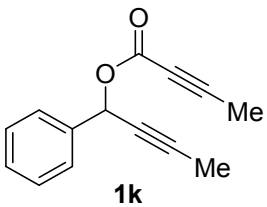
1j

Compound **1j** was obtained as yellow oil in 88% yield according to general procedure **A**.

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.74 (d, *J* = 8.3 Hz, 2H), 7.68 (d, *J* = 8.3 Hz, 2H), 7.52 – 7.43 (m, 2H), 7.42 – 7.28 (m, 3H), 6.76 (s, 1H), 2.00 (s, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 152.27, 140.24, 131.95, 131.28 (q, *J* = 32.7 Hz), 129.17, 128.36, 128.21, 125.77 (q, *J* = 3.8 Hz), 124.94, 122.76, 121.56, 88.46, 87.58, 83.94, 71.79, 66.64, 3.89.

1-phenylbut-2-yn-1-yl but-2-ynoate (1k)



1k

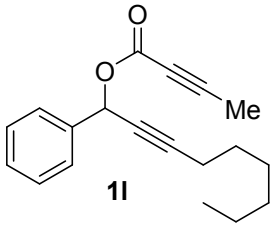
Compound **1k** was obtained as yellow oil in 72% yield according to general

procedure **A**.

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.54 – 7.51 (m, 2H), 7.43 – 7.32 (m, 3H), 6.45 (q, *J* = 2.1 Hz, 1H), 1.97 (s, 3H), 1.91 (d, *J* = 2.1 Hz, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 152.58, 136.78, 129.00, 128.61, 127.81, 86.64, 84.75, 75.18, 72.11, 67.48, 3.86, 3.82.

1-phenylnon-2-yn-1-yl but-2-ynoate (1l)



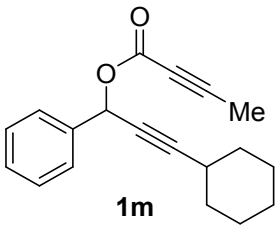
1l

Compound **1l** was obtained as yellow oil in 82% yield according to general procedure **A**.

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.58 – 7.52 (m, 2H), 7.48 – 7.32 (m, 3H), 6.50 (t, *J* = 2.0 Hz, 1H), 2.28 (td, *J* = 7.2, 2.1 Hz, 2H), 1.98 (s, 3H), 1.55 (dt, *J* = 14.8, 7.2 Hz, 2H), 1.46 – 1.22 (m, 6H), 0.90 (t, *J* = 8.3Hz, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 152.27, 140.24, 131.95, 131.28 (q, *J* = 32.7 Hz), 129.17, 128.36, 128.21, 125.77 (q, *J* = 3.8 Hz), 124.94, 122.76, 121.56, 88.46, 87.58, 83.94, 71.79, 66.64, 3.89.

3-cyclohexyl-1-phenylprop-2-yn-1-yl but-2-ynoate (1m)



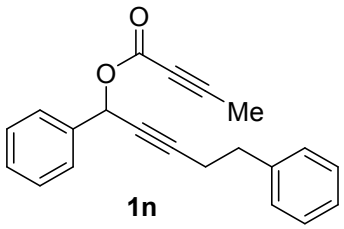
1m

Compound **1m** was obtained as yellow oil in 84% yield according to general procedure **A**.

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.55 (dt, *J* = 8.4, 2.2 Hz, 2H), 7.46 – 7.33 (m, 3H), 6.53 (d, *J* = 1.8 Hz, 1H), 2.54 – 2.32 (m, 1H), 1.97 (s, 3H), 1.86 – 1.78 (m, 2H), 1.77 – 1.67 (m, 2H), 1.58 – 1.45 (m, 3H), 1.41 – 1.24 (m, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 152.59, 136.95, 128.95, 128.57, 127.93, 93.12, 86.52, 75.93, 72.21, 67.51, 32.30, 32.28, 29.09, 25.83, 24.76, 3.85.

1,5-diphenylpent-2-yn-1-yl but-2-ynoate (1n)



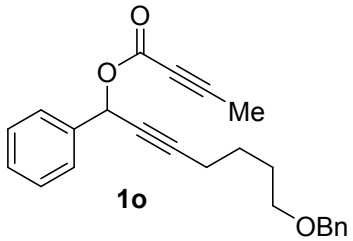
1n

Compound **1n** was obtained as yellow oil in 95% yield according to general procedure **A**.

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.46 (m, 2H), 7.40 – 7.33 (m, 3H), 7.32 – 7.26 (m, 2H), 7.24 – 7.18 (m, 3H), 6.46 (t, *J* = 2.0 Hz, 1H), 2.85 (t, *J* = 7.5 Hz, 2H), 2.57 (td, *J* = 7.4, 2.0 Hz, 2H), 1.98 (s, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 152.56, 140.29, 136.56, 128.97, 128.56, 128.49, 128.39, 127.87, 126.32, 88.27, 86.66, 76.76, 72.09, 67.38, 34.62, 21.06, 3.88.

7-(benzyloxy)-1-phenylhept-2-yn-1-yl but-2-ynoate (1o)



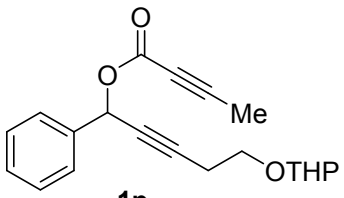
1o

Compound **1o** was obtained as yellow oil in 91% yield according to general procedure **A**.

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.53 (dd, *J* = 7.5, 1.8 Hz, 2H), 7.43 – 7.26 (m, 8H), 6.47 (s, 1H), 4.49 (s, 2H), 3.49 (t, *J* = 6.1 Hz, 2H), 2.31 (td, *J* = 6.8, 1.9 Hz, 2H), 1.96 (s, 3H), 1.75 – 1.61 (m, 4H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 152.55, 138.51, 136.76, 128.96, 128.58, 128.33, 127.85, 127.58, 127.48, 88.84, 86.59, 76.17, 72.81, 71.81, 69.66, 67.45, 28.82, 25.08, 18.66, 3.86.

1-phenyl-5-((tetrahydro-2*H*-pyran-2-yl)oxy)pent-2-yn-1-yl but-2-ynoate (1p)



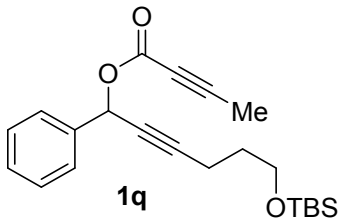
1p

Compound **1p** was obtained as yellow oil in 88% yield according to general procedure **A**.

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.53 (dd, *J* = 7.4, 1.9 Hz, 2H), 7.44 – 7.29 (m, 3H), 6.47 (d, *J* = 1.8 Hz, 1H), 4.64 (t, *J* = 3.3 Hz, 1H), 3.96 – 3.76 (m, 2H), 3.62 – 3.42 (m, 2H), 2.58 (td, *J* = 7.0, 2.0 Hz, 2H), 1.97 (s, 3H), 1.89 – 1.43 (m, 6H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 152.51, 136.56, 129.00, 128.57, 127.85, 98.66, 98.62, 86.69, 86.00, 76.90, 72.05, 67.29, 65.23, 65.20, 62.02, 30.47, 25.38, 20.38, 19.23, 3.85.

6-((*tert*-butyldimethylsilyl)oxy)-1-phenylhex-2-yn-1-yl but-2-ynoate (1q)



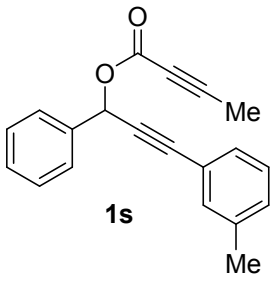
1q

Compound **1q** was obtained as yellow oil in 86% yield according to general procedure **A**.

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.54 (dd, *J* = 7.6, 1.6 Hz, 2H), 7.38 (dt, *J* = 6.9, 4.1 Hz, 3H), 6.49 (t, *J* = 2.0 Hz, 1H), 3.70 (t, *J* = 6.1 Hz, 2H), 2.38 (td, *J* = 7.1, 2.1 Hz, 2H), 1.97 (s, 3H), 1.78 – 1.70 (m, 2H), 0.90 (s, 9H), 0.06 (s, 6H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 152.50, 136.78, 128.96, 128.57, 127.81, 88.67, 86.53, 76.17, 72.12, 67.40, 61.41, 31.31, 25.91, 18.28, 15.25, 3.78, -5.39.

1-phenyl-3-(*m*-tolyl)prop-2-yn-1-yl but-2-ynoate (1s)



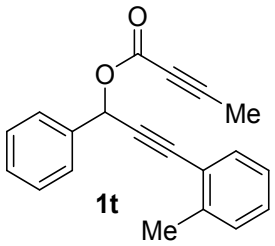
1s

Compound **1s** was obtained as yellow oil in 71% yield according to general procedure **A**.

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.62 (d, *J* = 6.3 Hz, 2H), 7.44 – 7.37 (m, 3H), 7.33 – 7.27 (m, 2H), 7.18 (dd, *J* = 17.9, 7.6 Hz, 2H), 6.72 (s, 1H), 2.33 (s, 3H), 1.99 (s, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 152.52, 137.97, 136.38, 132.47, 129.77, 129.16, 128.96, 128.70, 128.15, 127.97, 121.71, 87.98, 86.90, 84.33, 72.04, 67.52, 21.15, 3.88.

1-phenyl-3-(*o*-tolyl)prop-2-yn-1-yl but-2-ynoate (1t)



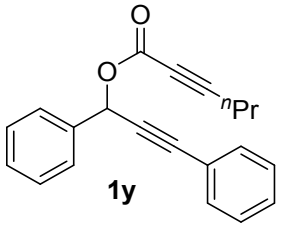
1t

Compound **1t** was obtained as yellow oil in 71% yield according to general procedure **A**.

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.63 (dd, *J* = 7.7, 1.5 Hz, 2H), 7.47 – 7.39 (m, 4H), 7.25 – 7.18 (m, 2H), 7.16 – 7.11 (m, 1H), 6.76 (s, 1H), 2.44 (s, 3H), 1.99 (s, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 152.55, 140.72, 136.42, 132.24, 129.43, 129.16, 128.89, 128.70, 127.98, 125.48, 121.70, 88.55, 86.85, 86.83, 72.05, 67.68, 20.67, 3.89.

1,3-diphenylprop-2-yn-1-yl hex-2-ynoate (1y)



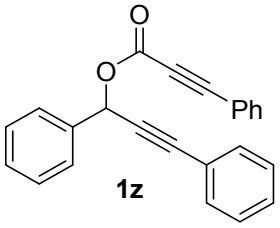
1y

Compound **1y** was obtained as yellow oil in 86% yield according to general procedure **A**.

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.65 – 7.61 (m, 2H), 7.52 – 7.47 (m, 2H), 7.45 – 7.38 (m, 3H), 7.36 – 7.31 (m, 3H), 6.74 (s, 1H), 2.31 (t, *J* = 7.1 Hz, 2H), 1.61 (dd, *J* = 14.5, 7.2 Hz, 2H), 1.01 (t, *J* = 7.4 Hz, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 152.65, 136.38, 131.91, 129.16, 128.87, 128.70, 128.25, 127.99, 121.94, 90.93, 87.74, 84.79, 72.79, 67.42, 20.98, 20.69, 13.48..

1,3-diphenylprop-2-yn-1-yl 3-phenylpropiolate (1z)



1z

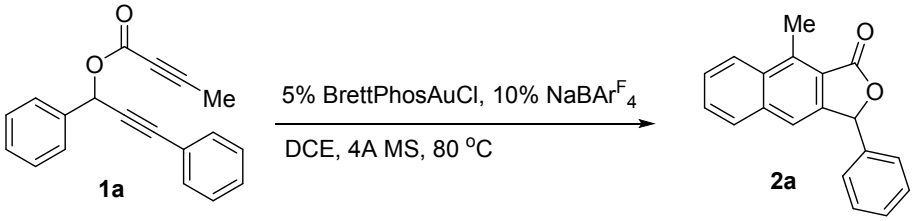
Compound **1z** was obtained as yellow oil in 88% yield according to general procedure **A**.

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.69 (dd, *J* = 7.8, 1.4 Hz, 2H), 7.63 – 7.57 (m, 2H), 7.56 – 7.50 (m, 2H), 7.49 – 7.42 (m, 4H), 7.35 (m, 5H), 6.84 (s, 1H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 152.95, 136.26, 133.06, 131.96, 130.80, 129.32, 128.97, 128.80, 128.57, 128.31, 128.10, 121.88, 119.40, 88.00, 87.55, 84.68, 80.27, 67.80.

3. Synthesis of Compound 2

General Procedure B: Au(I)-catalyzed formation of Naphtho[2,3-*c*]furan-1(3*H*)-ones

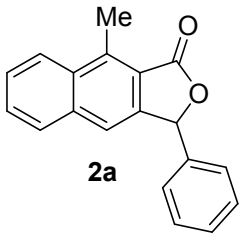


1a **2a**

Taking substrate **2a** for example: To a solution of **1a** in DCE (0.1 M) was added the Au catalyst, $NaBAr^F_4$, and 4Å MS. The reaction mixture was stirred at 80 °C for 2 hours. The resulting mixture was concentrated and the residue was purified through silica gel flash column chromatography (eluents: EtOAc and hexanes) to give the

desired product **2a**.

9-methyl-3-phenylnaphtho[2,3-*c*]furan-1(3*H*)-one (2a)



2a

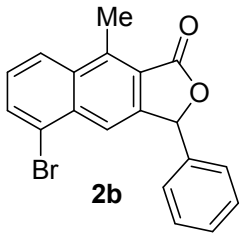
Compound **2a** was obtained as a white solid in 95% yield according to general procedure **B**.

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.27 (dd, *J* = 6.3, 3.5 Hz, 1H), 7.83 (dq, *J* = 6.8, 3.4 Hz, 1H), 7.68 – 7.59 (m, 2H), 7.56 (s, 1H), 7.49 – 7.31 (m, 5H), 6.47 (s, 1H), 3.19 (s, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 170.86, 143.47, 139.33, 137.65, 135.96, 133.02, 129.11, 128.90, 128.82, 128.57, 127.05, 126.73, 125.52, 120.02, 119.73, 81.26, 12.55.

HRMS m/z (ESI) Calcd for $C_{19}H_{14}O_2Na$ [M+Na^+], 297.0886, found 297.0882.

5-bromo-9-methyl-3-phenylnaphtho[2,3-*c*]furan-1(3*H*)-one (2b)



2b

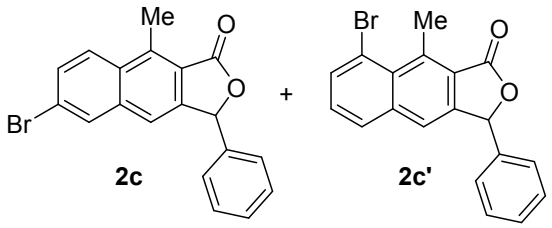
Compound **2b** was obtained as a white solid in 88% yield according to general procedure **B**.

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.35 (d, *J* = 8.6 Hz, 1H), 8.12 (s, 1H), 8.01 (d, *J* = 8.6 Hz, 1H), 7.55 (t, *J* = 8.6 Hz, 1H), 7.52 – 7.41 (m, 5H), 6.60 (s, 1H), 3.28 (s, 1H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 170.15, 144.78, 139.78, 137.27, 134.69, 134.58, 132.81, 129.35, 129.09, 127.17, 126.98, 125.49, 123.77, 119.47, 81.57, 12.86.

HRMS m/z (ESI) Calcd for $C_{19}H_{14}BrO_2Na$ [M+Na^+], 374.9991, found 374.9998.

6-bromo-9-methyl-3-phenylnaphtho[2,3-*c*]furan-1(3*H*)-one (2c) and 8-bromo-9-methyl-3-phenylnaphtho[2,3-*c*]furan-1(3*H*)-one (2c')

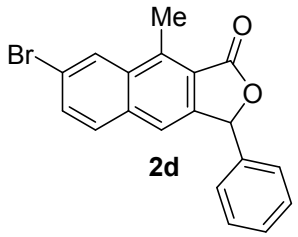


Compound **2c** was obtained as a white solid in 86% combined yield according to general procedure **B**.

^{13}C NMR (101 MHz, $CDCl_3$) δ 170.48, 170.44, 144.71, 143.87, 141.78, 139.58, 138.88, 137.26, 137.00, 134.88, 131.62, 131.56, 130.80, 130.18, 129.42, 129.24, 128.97, 128.45, 127.18, 127.00, 126.96, 123.30, 122.22, 121.68, 121.03, 120.43, 118.84, 81.16, 80.22, 18.01, 12.53.

HRMS m/z (ESI) Calcd for $C_{19}H_{14}BrO_2Na$ [M+Na^+], 374.9991, found 374.9998.

7-bromo-9-methyl-3-phenylnaphtho[2,3-*c*]furan-1(3*H*)-one (2d)



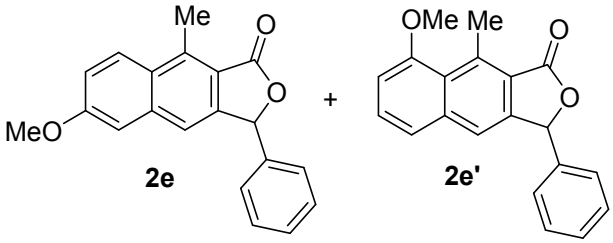
Compound **2d** was obtained as a white solid in 71% yield according to general procedure **B**.

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.41 (d, *J* = 0.7 Hz, 1H), 7.69 (m, 2H), 7.53 (s, 1H), 7.45 – 7.30 (m, 5 H), 6.45 (s, 1H), 3.14 (s, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 170.38, 143.95, 138.40, 137.29, 134.35, 134.25, 131.93, 130.30, 129.24, 128.97, 127.96, 127.00, 121.18, 120.97, 119.75, 81.26, 12.53.

HRMS m/z (ESI) Calcd for $C_{19}H_{14}BrO_2Na$ [M+Na^+], 374.9991, found 374.9998.

6-methoxy-9-methyl-3-phenylnaphtho[2,3-*c*]furan-1(3*H*)-one (2e) and 8-methoxy-9-methyl-3-phenylnaphtho[2,3-*c*]furan-1(3*H*)-one (2e')

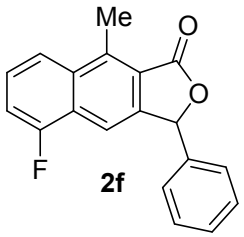


Compounds **2e** and **2e'** were obtained as a white solid in 91% combined according to general procedure **B**.

^{13}C NMR (101 MHz, $CDCl_3$) δ 171.03, 171.01, 160.09, 159.61, 144.65, 144.04, 142.18, 139.12, 138.61, 137.99, 137.80, 137.72, 129.06, 129.03, 128.86, 128.39, 127.11, 127.03, 127.00, 125.75, 121.14, 119.97, 119.68, 119.35, 118.30, 118.05, 106.39, 105.98, 81.08, 80.32, 55.42, 55.39, 17.11, 12.59.

HRMS m/z (ESI) Calcd for $C_{20}H_{16}O_3Na$ [M+Na^+], 327.0992, found 327.0995.

5-fluoro-9-methyl-3-phenylnaphtho[2,3-*c*]furan-1(3*H*)-one (2f)



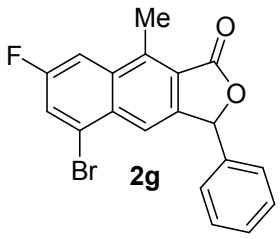
Compound **2f** was obtained as a white solid in 81% yield according to general procedure **B**.

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.05 (d, *J* = 8.7 Hz, 1H), 7.85 (s, 1H), 7.63 – 7.50 (m, 1H), 7.48 – 7.27 (m, 6H), 6.49 (s, 1H), 3.19 (s, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 170.49, 158.93 (d, *J* = 252.5 Hz), 143.82 (d, *J* = 1.7 Hz), 139.29 (d, *J* = 2.6 Hz), 137.28, 134.57 (d, *J* = 4.0 Hz), 129.22, 128.98, 126.97, 126.45 (d, *J* = 8.5 Hz), 126.37 (d, *J* = 16.4 Hz), 121.40 (d, *J* = 4.2 Hz), 120.92, 112.63 (d, *J* = 6.8 Hz), 112.14 (d, *J* = 19.9 Hz), 81.40, 12.84.

HRMS m/z (ESI) Calcd for $C_{19}H_{13}O_2BFNa$ [M+Na^+], 315.0792, found 315.0791.

5-bromo-7-fluoro-9-methyl-3-phenylnaphtho[2,3-*c*]furan-1(3*H*)-one (2g)



2g

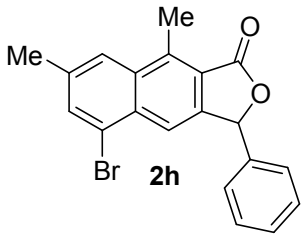
Compound **2g** was obtained as a white solid in 96% yield according to general procedure **B**.

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.00 (s, 1H), 7.87 (dd, *J* = 10.2, 2.3 Hz, 1H), 7.77 (dd, *J* = 10.2, 2.4 Hz, 1H), 7.44 – 7.31 (m, 5H), 6.50 (s, 1H), 3.13 (s, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ170.04, 159.70 (d, *J* = 251.3 Hz).144.12 (d, *J* = 2.8 Hz), 138.83 (d, *J* = 6.3 Hz), 137.01, 134.77 (d, *J* = 8.8 Hz), 131.82, 129.34, 129.05, 127.05, 124.56 (d, *J* = 10.4 Hz), 123.33 (d, *J* = 28.2 Hz), 121.79, 119.38 (d, *J* = 1.7 Hz), 109.17 (d, *J* = 21.2 Hz), 81.46, 12.80.

HRMS m/z (ESI) Calcd for $C_{19}H_{12}O_2BrFNa$ [M+Na$^+$], 392.9897, found 392.9894.

5-bromo-7,9-dimethyl-3-phenylnaphtho[2,3-*c*]furan-1(3*H*)-one (2h)



2h

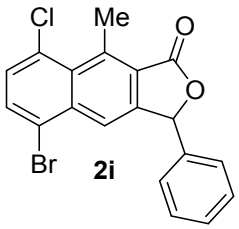
Compound **2h** was obtained as a white solid in 91% yield according to general procedure **B**.

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.00 (s, 1H), 7.96 (s, 1H), 7.80 (s, 1H), 7.44 – 7.32 (m, 5H), 6.49 (s, 1H), 3.16 (s, 3H), 2.56 (s, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 170.51, 143.80, 138.78, 137.33, 137.08, 134.78, 134.51, 132.83, 129.19, 128.96, 127.07, 124.49, 123.29, 120.88, 119.09, 81.44, 21.65, 12.72.

HRMS m/z (ESI) Calcd for $C_{20}H_{15}O_2BrNa$ [M+Na$^+$], 389.0148, found 389.0143.

5-bromo-8-chloro-9-methyl-3-phenylnaphtho[2,3-*c*]furan-1(3*H*)-one (2i)



2i

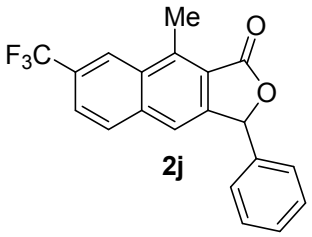
Compound **2i** was obtained as a white solid in 90% yield according to general procedure **B**.

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.11 (s, 1H), 7.78 (d, *J* = 8.0 Hz, 1H), 7.50 (d, *J* = 8.0 Hz, 1H), 7.37 (m, 5H), 6.46 (s, 1H), 3.56 (s, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 169.99, 145.26, 142.11, 136.90, 136.75, 133.91, 132.35, 132.17, 130.41, 129.38, 129.09, 127.01, 123.07, 122.63, 120.64, 80.52, 17.81.

HRMS m/z (ESI) Calcd for $C_{19}H_{12}O_2BrClNa$ [M+Na$^+$], 408.9601, found 408.9603.

9-methyl-3-phenyl-7-(trifluoromethyl)naphtho[2,3-*c*]furan-1(3*H*)-one (2j)



2j

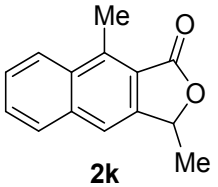
Compound **2j** was obtained as a white solid in 69% yield according to general procedure **B**.

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.56 (s, 1H), 7.95 (d, *J* = 8.7 Hz, 1H), 7.78 (d, *J* = 8.7, 1H), 7.63 (s, 1H), 7.46 – 7.30 (m, 5H), 6.50 (s, 1H), 3.24 (s, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 170.13, 145.70, 140.48, 137.09, 132.08, 130.01, 129.34, 129.02, 128.63 (q, *J* = 32.7 Hz), 126.99, 125.36, 124.09 (q, *J* = 3.0 Hz), 123.28 (q, *J* = 4.6 Hz), 122.64, 121.38, 121.38, 119.80, 81.27, 12.58.

HRMS m/z (ESI) Calcd for $C_{20}H_{13}O_2F_3Na$ [M+Na$^+$], 365.0760, found 365.0761.

3,9-dimethylnaphtho[2,3-*c*]furan-1(3*H*)-one (2k)



2k

Compound **2k** was obtained as a white solid in 61% yield according to general

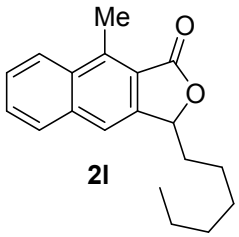
procedure **B**.

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.25 (d, *J* = 8.4 Hz, 1H), 7.93 – 7.89 (m, 1H), 7.66 (s, 1H), 7.66 – 7.60 (m, 2H), 5.80 – 5.42 (m, 1H), 3.13 (s, 3H), 1.70 (d, *J* = 6.7 Hz, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 170.82, 145.04, 139.26, 135.90, 132.94, 128.71, 128.48, 126.54, 125.53, 120.38, 118.12, 77.26, 77.00, 76.75, 76.16, 21.22, 12.46.

HRMS m/z (ESI) Calcd for $C_{14}H_{12}O_2Na$ [M+Na^+], 235.0730, found 235.0731.

3-hexyl-9-methylnaphtho[2,3-*c*]furan-1(3*H*)-one (2l)



2l

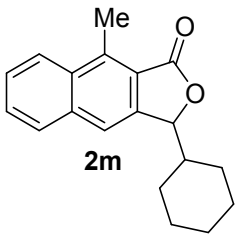
Compound **2l** was obtained as a white solid in 92% yield according to general procedure **B**.

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.26 (d, *J* = 8.3 Hz, 1H), 7.92 (d, *J* = 8.3 Hz, 1H), 7.71 – 7.55 (m, 3H), 5.55 (dd, *J* = 7.5, 4.0 Hz, 1H), 3.15 (s, 3H), 2.20 – 1.97 (m, 1H), 1.93 – 1.72 (m, 1H), 1.70 – 1.15 (m, 8H), 0.89 (t, *J* = 7.0 Hz, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 171.04, 143.94, 139.18, 135.84, 132.95, 128.72, 128.44, 126.48, 125.52, 120.77, 118.25, 79.84, 35.58, 31.62, 29.06, 24.69, 22.55, 14.03, 12.47.

HRMS m/z (ESI) Calcd for $C_{19}H_{22}O_2Na$ [M+Na^+], 305.1512, found 305.1514.

3-cyclohexyl-9-methylnaphtho[2,3-*c*]furan-1(3*H*)-one (2m)



2m

Compound **2m** was obtained as a white solid in 80% yield according to general procedure **B**.

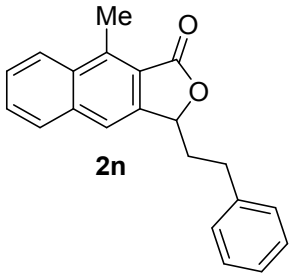
^{1}H NMR (400 MHz, $CDCl_3$) δ 8.24 (dd, *J* = 8.3, 0.9 Hz, 1H), 7.99 – 7.83 (m, 1H),

7.72 – 7.54 (m, 3H), 5.39 (d, *J* = 3.0 Hz, 2H), 3.13 (s, 4H), 1.98 (ddd, *J* = 15.0, 8.0, 3.4 Hz, 1H), 1.91 (d, *J* = 12.5 Hz, 1H), 1.83 (dd, *J* = 8.7, 5.6 Hz, 1H), 1.74 – 1.63 (m, 2H), 1.47 – 1.07 (m, 6H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 171.04, 143.94, 139.18, 135.84, 132.95, 128.72, 128.44, 126.48, 125.52, 120.77, 118.25, 79.84, 35.58, 31.62, 29.06, 24.69, 22.55, 14.03, 12.47.

HRMS m/z (ESI) Calcd for $C_{19}H_{20}O_2Na$ [M+Na$^+$], 303.1356, found 303.1354.

9-methyl-3-phenethylnaphtho[2,3-*c*]furan-1(3*H*)-one (2n)



2n

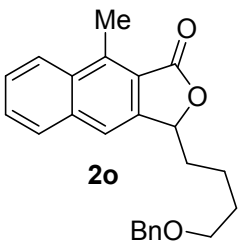
Compound **2n** was obtained as a white solid in 88% yield according to general procedure **B**.

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.28 – 8.22 (m, 1H), 7.91 – 7.85 (m, 1H), 7.68 – 7.57 (m, 3H), 7.35 – 7.15 (m, 5H), 5.53 (dd, *J* = 8.5, 3.0 Hz, 1H), 3.14 (s, 3H), 2.96 – 2.79 (m, 2H), 2.49 – 2.36 (m, 1H), 2.11 (m, 1H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 170.94, 143.58, 140.78, 139.38, 135.84, 132.99, 128.72, 128.55, 128.55, 128.53, 126.57, 126.19, 125.53, 120.61, 118.27, 78.77, 37.50, 31.18, 12.49.

HRMS m/z (ESI) Calcd for $C_{21}H_{18}O_2Na$ [M+Na$^+$], 325.1199, found 325.1194.

9-methyl-3-phenethylnaphtho[2,3-*c*]furan-1(3*H*)-one (2o)



2o

Compound **2o** was obtained as a white solid in 76% yield according to general

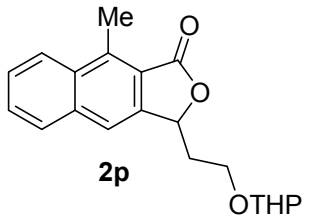
procedure **B**.

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.25 (d, *J* = 8.3 Hz, 1H), 7.89 (d, *J* = 7.7 Hz, 1H), 7.70 – 7.52 (m, 3H), 7.36 – 7.26 (m, 5H), 5.53 (dd, *J* = 7.7, 4.0 Hz, 1H), 4.54 – 4.46 (m, 2H), 3.55 – 3.43 (m, 2H), 3.13 (s, 3H), 2.14 (ddd, *J* = 14.4, 8.0, 2.9 Hz, 1H), 1.89 – 1.80 (m, 1H), 1.76 – 1.59 (m, 4H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 170.95, 143.71, 139.19, 138.46, 135.81, 132.93, 128.72, 128.44, 128.33, 127.62, 127.51, 126.50, 125.49, 120.66, 118.29, 79.65, 72.91, 69.95, 35.32, 29.41, 21.63, 12.45.

HRMS m/z (ESI) Calcd for $C_{24}H_{24}O_3Na$ [M+Na$^+$], 383.1618, found 383.1614.

9-methyl-3-(2-((tetrahydro-2*H*-pyran-2-yl)oxy)ethyl)naphtho[2,3-*c*]furan-1(3*H*)-one (2p)



2p

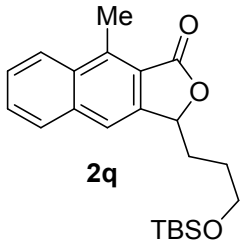
Compound **2p** was obtained as a white solid in 91% yield according to general procedure **B**.

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.25 (d, *J* = 8.8 Hz, 1H), 8.08 – 7.87 (m, 1H), 7.72 (d, *J* = 7.1 Hz, 1H), 7.70 – 7.51 (m, 2H), 5.74 (dd, *J* = 8.8, 3.4 Hz, 1H), 4.63 (d, *J* = 2.9 Hz, 1H), 4.22 – 3.38 (m, 5H), 3.13 (s, 3H), 2.51 – 2.35 (m, 1H), 2.03 (ddd, *J* = 14.5, 9.2, 4.6 Hz, 1H), 1.85 – 1.67 (m, 2H), 1.67 – 1.44 (m, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 170.89, 170.87, 143.78, 143.76, 139.28, 139.26, 135.87, 135.84, 132.97, 128.78, 128.75, 128.48, 126.54, 125.50, 125.50, 120.56, 120.51, 118.56, 118.52, 99.74, 98.62, 77.06, 76.86, 63.52, 63.01, 62.78, 62.15, 36.18, 36.07, 30.70, 30.57, 25.40, 25.39, 19.80, 19.37, 12.46.

HRMS m/z (ESI) Calcd for $C_{20}H_{22}O_4Na$ [M+Na$^+$], 349.1410, found 349.1412.

3-(3-((*tert*-butyldimethylsilyl)oxy)propyl)-9-methylnaphtho[2,3-*c*]furan-1(3*H*)-one (2q)



2q

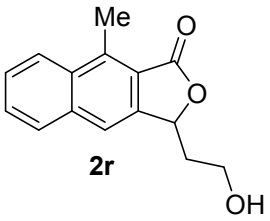
Compound **2q** was obtained as a white solid in 80% yield according to general procedure **B**.

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.32 – 8.22 (m, 1H), 8.00 – 7.88 (m, 1H), 7.68 (s, 1H), 7.68 – 7.60 (m, 2H), 5.60 (dd, *J* = 7.1, 4.2 Hz, 1H), 3.86 – 3.44 (m, 2H), 3.15 (s, 3H), 2.29 – 2.22 (m, 1H), 2.04 – 1.87 (m, 1H), 1.84 – 1.64 (m, 2H), 0.91 (s, 9H), 0.06 (s, 3H), 0.05 (s, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 170.97, 143.78, 139.22, 135.85, 132.97, 128.75, 128.46, 126.52, 125.51, 120.75, 118.37, 79.65, 62.45, 32.05, 27.81, 25.94, 18.32, 12.47, -5.33.

HRMS m/z (ESI) Calcd for $C_{22}H_{30}O_3SiNa$ [M+Na^+], 393.1856, found 393.1857.

3-(2-hydroxyethyl)-9-methylnaphtho[2,3-*c*]furan-1(3*H*)-one (2r)



2r

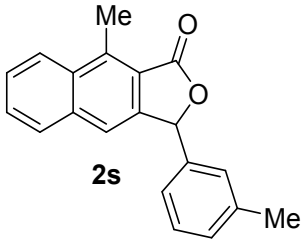
Compound **2r** was obtained as a white solid in 79% yield according to general procedure **B**.

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.18 (d, *J* = 8.3 Hz, 1H), 7.84 (d, *J* = 7.7 Hz, 1H), 7.63 (s, 1H), 7.57 (dtd, *J* = 16.5, 6.8, 1.2 Hz, 2H), 5.67 (dd, *J* = 9.5, 3.0 Hz, 1H), 3.95 (ddd, *J* = 10.8, 8.3, 4.8 Hz, 1H), 3.89 (dt, *J* = 10.8, 5.4 Hz, 1H), 3.06 (s, 3H), 2.33 (tdd, *J* = 8.5, 5.6, 3.4 Hz, 1H), 1.92 (ddt, *J* = 14.6, 9.8, 5.0 Hz, 1H), 1.72 (br, 1H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 170.70, 143.57, 139.49, 135.84, 132.97, 128.74, 128.58, 126.63, 125.50, 120.23, 118.38, 77.20, 59.13, 38.46, 12.47.

HRMS m/z (ESI) Calcd for $C_{15}H_{14}O_3Na$ [M+Na^+], 265.0835, found 265.0837.

9-methyl-3-(*m*-tolyl)naphtho[2,3-*c*]furan-1(3*H*)-one (2s)



2s

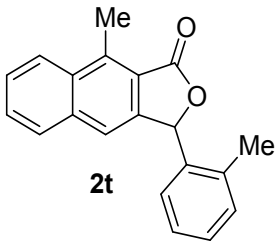
Compound **2s** was obtained as a white solid in 80% yield according to general procedure **B**.

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.26 (dd, *J* = 6.3, 3.5 Hz, 1H), 7.82 (dd, *J* = 6.2, 3.4 Hz, 1H), 7.63 – 7.59 (m, 2H), 7.54 (s, 1H), 7.27 (t, *J* = 7.6 Hz, 1H), 7.16 (dd, *J* = 11.5, 7.7 Hz, 2H), 7.11 (s, 1H), 6.41 (s, 1H), 3.18 (s, 3H), 2.32 (s, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 170.89, 143.61, 139.24, 138.74, 137.57, 135.98, 133.01, 129.87, 128.83, 128.74, 128.51, 127.52, 126.67, 125.50, 124.16, 120.07, 119.69, 81.34, 21.35, 12.53.

HRMS m/z (ESI) Calcd for $C_{20}H_{16}O_2Na$ [M+Na^+], 311.1043, found 311.1041.

9-methyl-3-(*o*-tolyl)naphtho[2,3-*c*]furan-1(3*H*)-one (2t)



2t

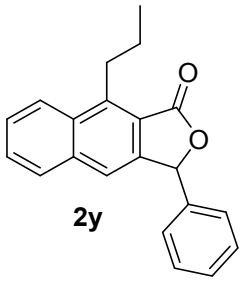
Compound **2t** was obtained as a white solid in 68% yield according to general procedure **B**.

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.29 (dd, *J* = 6.2, 3.5 Hz, 1H), 7.84 (dd, *J* = 6.2, 3.4 Hz, 1H), 7.66 – 7.60 (m, 2H), 7.56 (s, 1H), 7.27 (t, *J* = 4.1 Hz, 2H), 7.13 (dd, *J* = 8.3, 4.5 Hz, 1H), 7.02 (d, *J* = 7.7 Hz, 1H), 6.74 (s, 1H), 3.19 (s, 3H), 2.53 (s, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 170.93, 143.10, 139.36, 137.09, 135.93, 135.29, 133.05, 131.08, 129.18, 128.85, 128.58, 127.55, 126.72, 126.37, 125.56, 120.81, 119.75, 79.10, 19.45, 12.55.

HRMS m/z (ESI) Calcd for $C_{20}H_{16}O_2Na$ [M+Na^+], 311.1043, found 311.1041.

3-phenyl-9-propylnaphtho[2,3-*c*]furan-1(3*H*)-one (2y)



2y

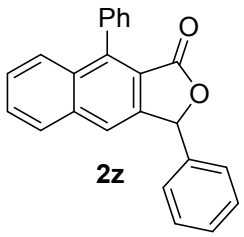
Compound **2y** was obtained as a white solid in 78% yield according to general procedure **B**.

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.29 (dd, *J* = 6.3, 3.6 Hz, 1H), 7.85 – 7.81 (m, 1H), 7.64 – 7.57 (m, 2H), 7.56 (s, 1H), 7.45 – 7.28 (m, 5H), 6.46 (d, *J* = 0.6 Hz, 1H), 3.77 – 3.66 (m, 2H), 1.82 (dd, *J* = 15.1, 7.6 Hz, 2H), 1.12 (t, *J* = 7.3 Hz, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 170.43, 144.18, 143.59, 137.71, 136.39, 132.28, 129.08, 128.96, 128.89, 128.44, 127.04, 126.62, 125.52, 119.84, 119.74, 81.21, 28.07, 24.78, 14.32.

HRMS m/z (ESI) Calcd for $C_{21}H_{18}O_2Na$ [M+Na^+], 325.1199, found 325.1195.

3,9-diphenylnaphtho[2,3-*c*]furan-1(3*H*)-one (2z)



2z

Compound **2z** was obtained as a white solid in 84% yield according to general procedure **B**.

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.90 (d, *J* = 8.2 Hz, 1H), 7.83 (d, *J* = 8.5 Hz, 1H), 7.76 (s, 1H), 7.61 (dd, *J* = 11.1, 3.9 Hz, 1H), 7.57 (m, 3H), 7.53 – 7.35 (m, 8H), 6.53 (s, 1H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 169.00, 143.61, 142.15, 137.58, 136.33, 134.35, 132.87, 130.17, 130.01, 129.17, 128.94, 128.69, 128.36, 128.27, 128.08, 128.07, 128.03, 127.06, 126.92, 121.38, 119.73, 81.14.

HRMS m/z (ESI) Calcd for $C_{24}H_{16}O_2Na$ [M+Na^+], 359.1043, found 359.1048.

4. X-ray of compound 2f

The data can be obtained free of charge from The Cambridge Crystallographic Data Centre (CCDC 1855919) via www.ccdc.cam.ac.uk/data_request/cif.

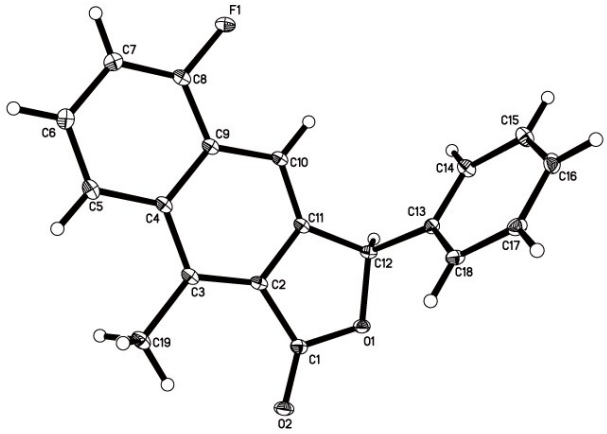


Figure S1. Ortep drawing of compound **2f.**

Table S1: Crystallographic Details for **2f**

Complex.	**2f**
empirical formula	C_{19} H_{13} F O_2
formula weight	292.29
temperature, K	103(2)
radiation (Mo Kα), Å	0.71073
crystal system	Monoclinic
space group	P 21/c
a, Å	7.508(15)
b, Å	12.35(2)
c, Å	14.70(3)
α, °	90
β, °	91.40(8)
γ, °	90
V, Å^3	1363(5)
Z	4
F(000)	608
crystal size, mm	0.25x 0.20 x 0.10

θ range, °	3.26 to 25.99
indep reflns	13551 / 2613 [R(int) = 0.1266]
data-restraints-params	2613/ 0 / 199
GOF on F^2	0.636
final R ($I > 2\sigma(I)$)	R_1 = 0.0590, wR_2 = 0.1623
R indices (all data)	R_1 = 0.1454, wR_2 = 0.2243
peak and hole, e.Å^{-3}	0.184 and -0.288


7.65
7.64
7.63
7.50
7.50
7.49
7.49
7.49
7.44
7.44
7.43
7.42
7.41
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7.32
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7.31
7.30
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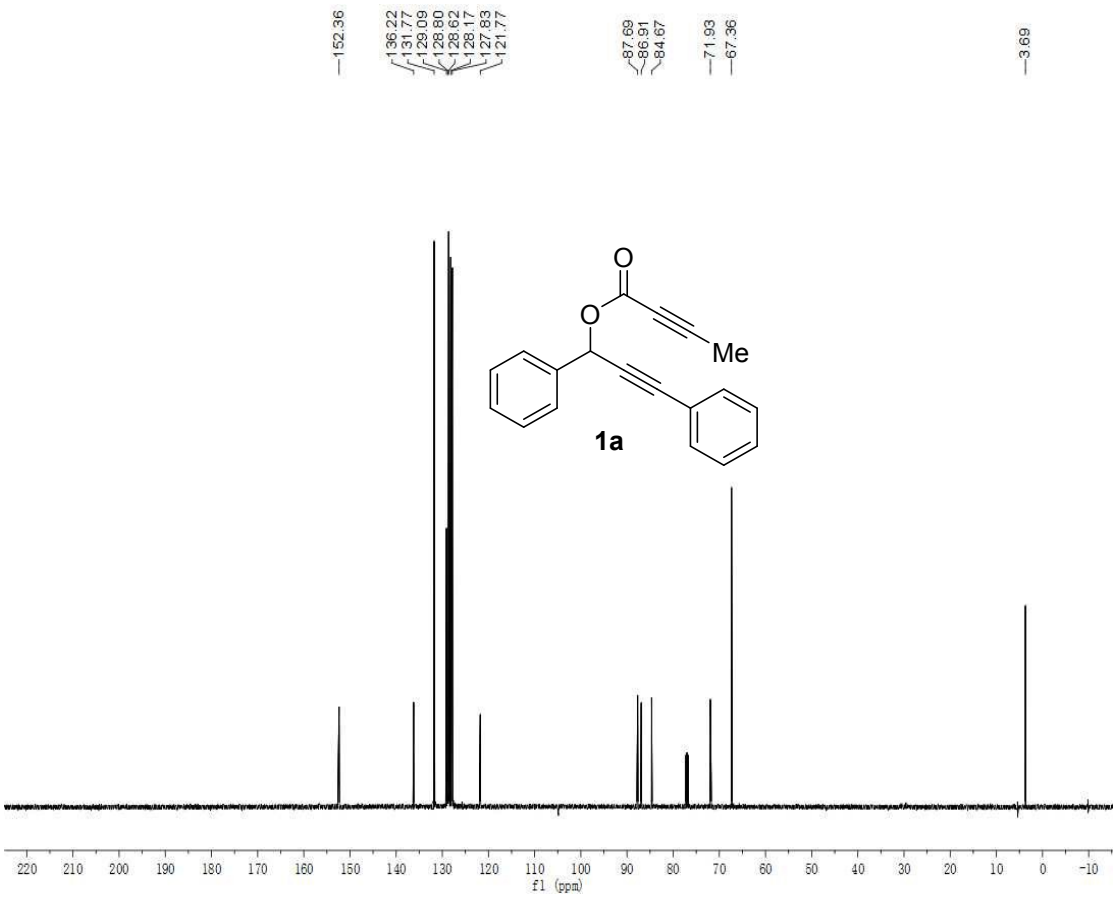
f1 (ppm)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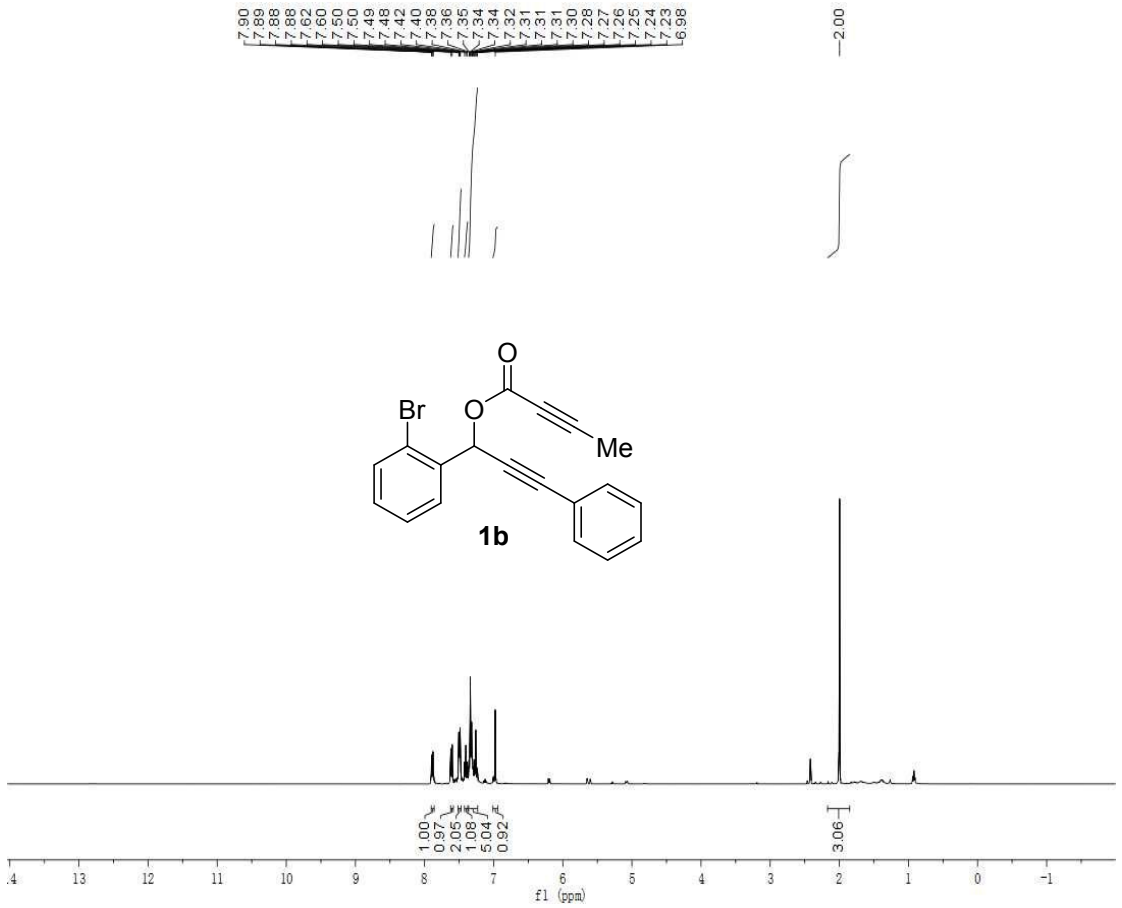
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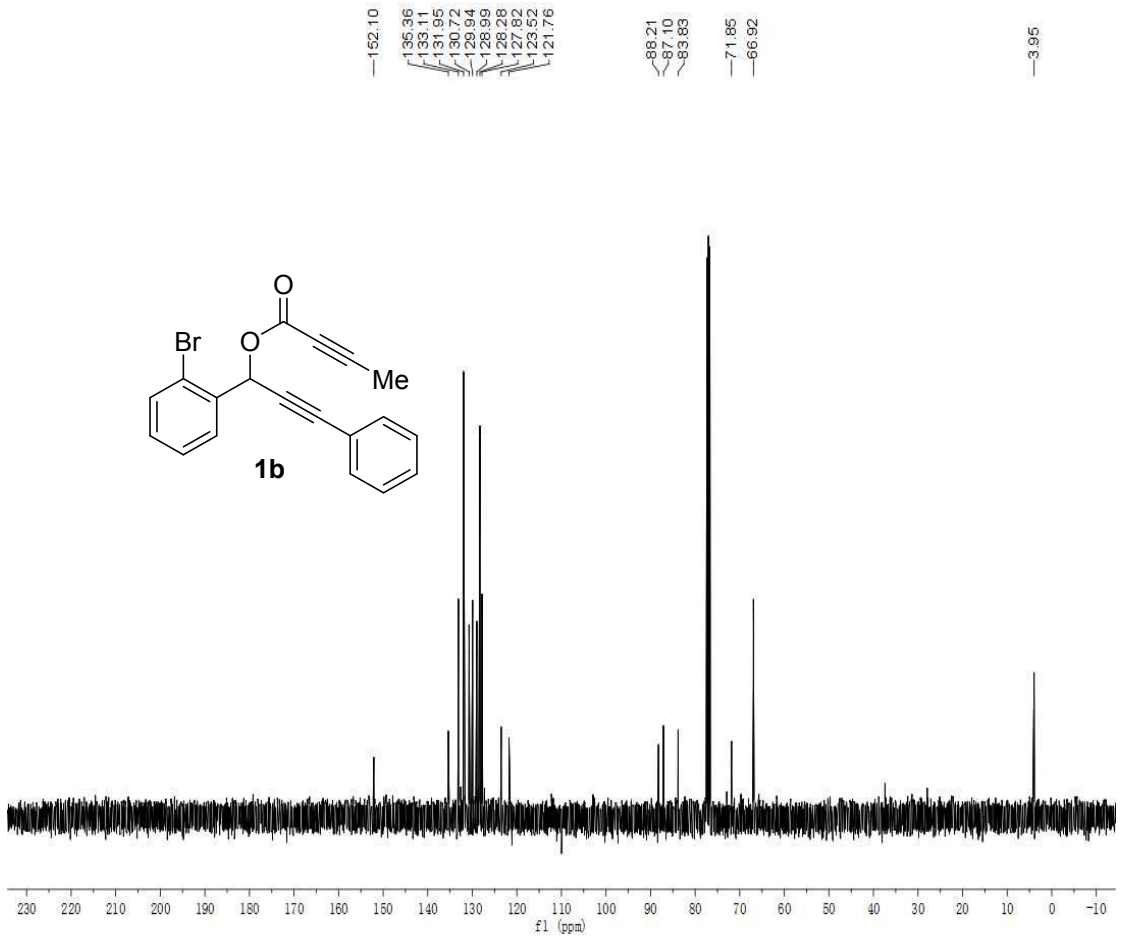
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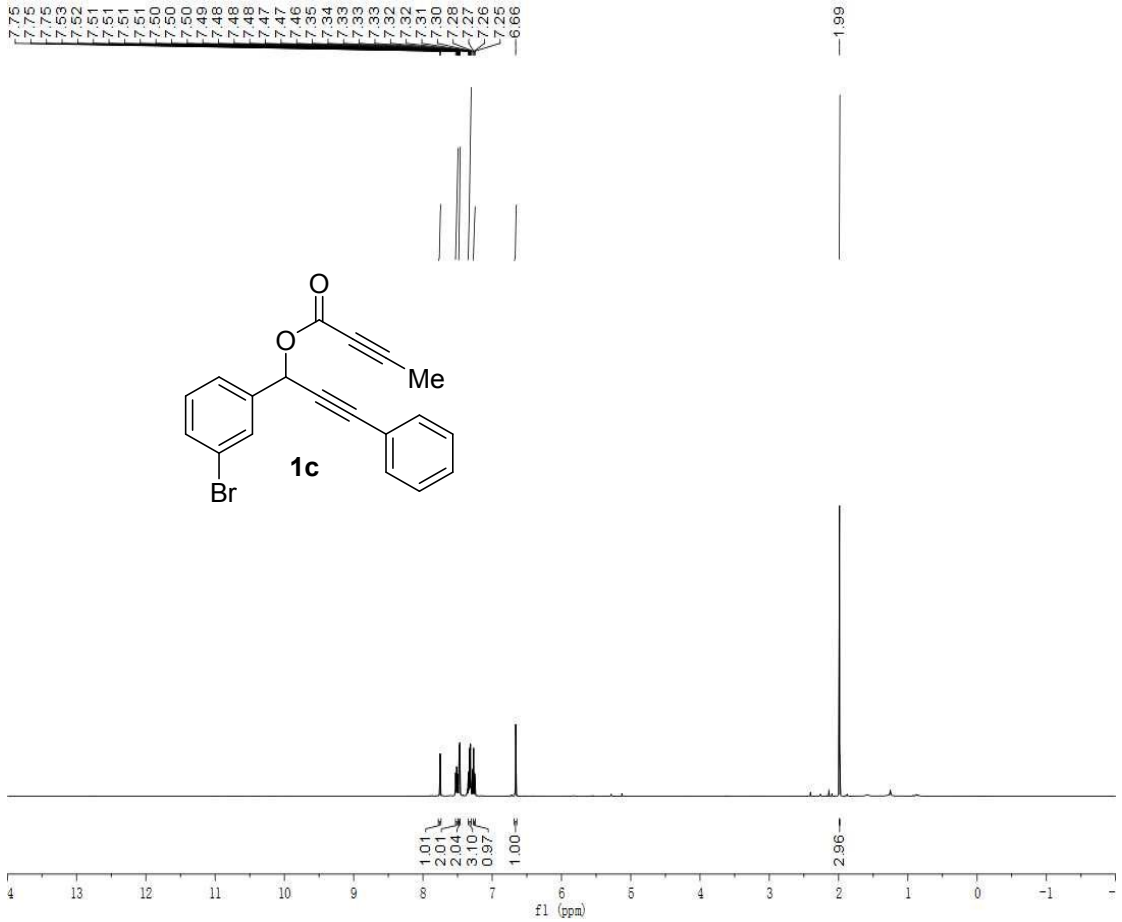
f1 (ppm)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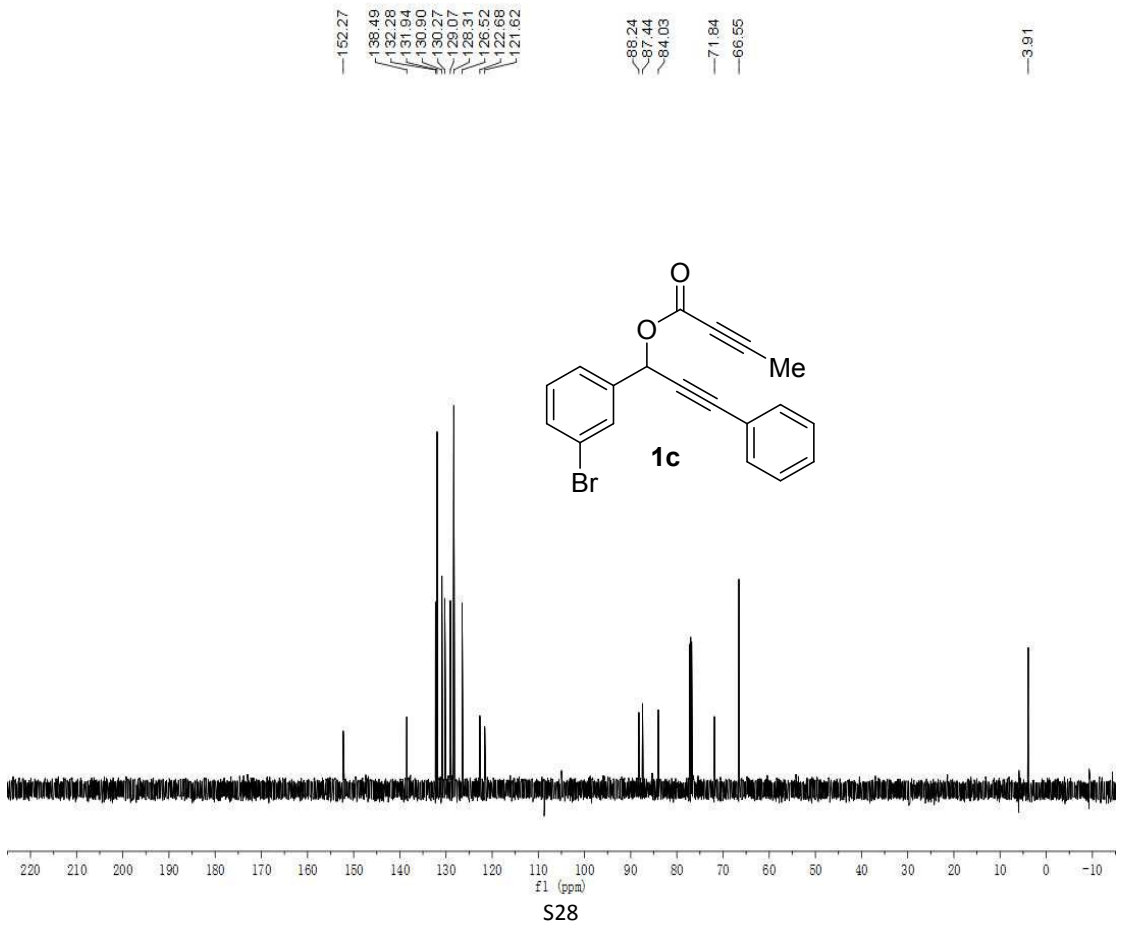
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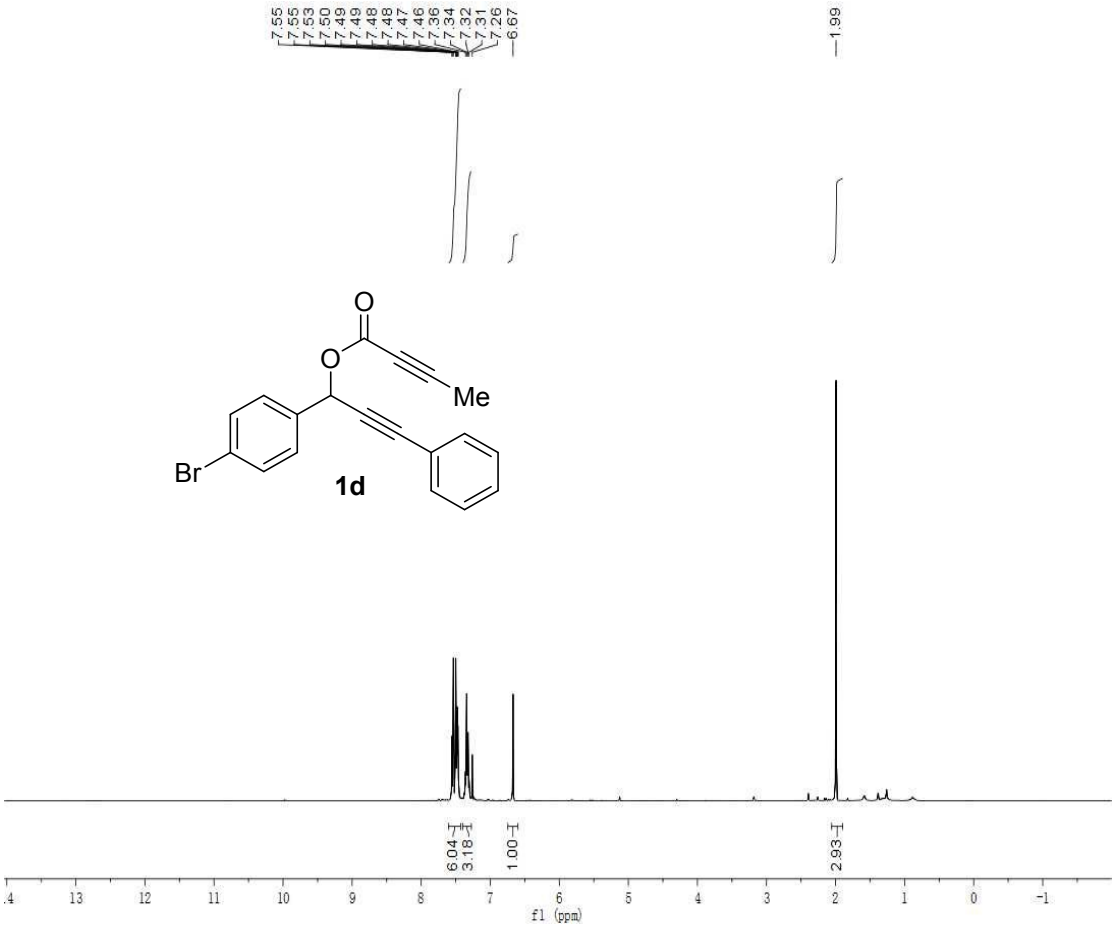
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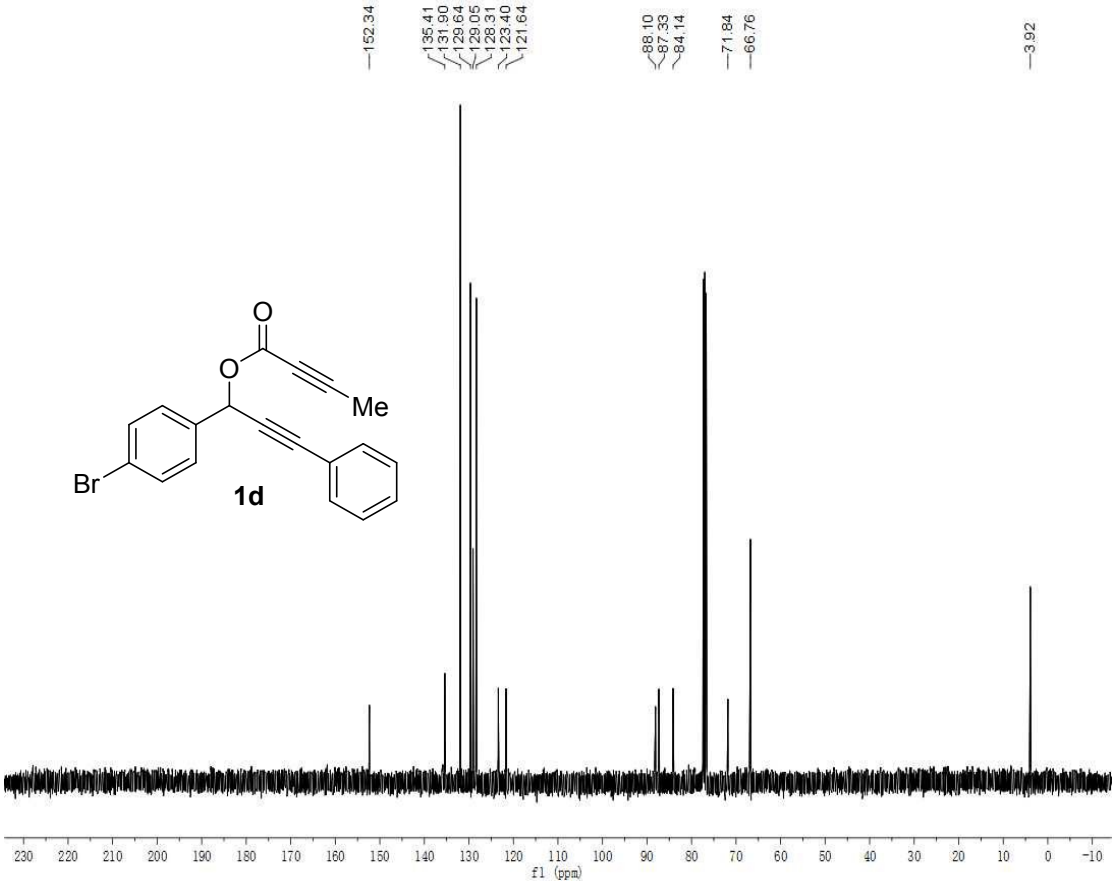
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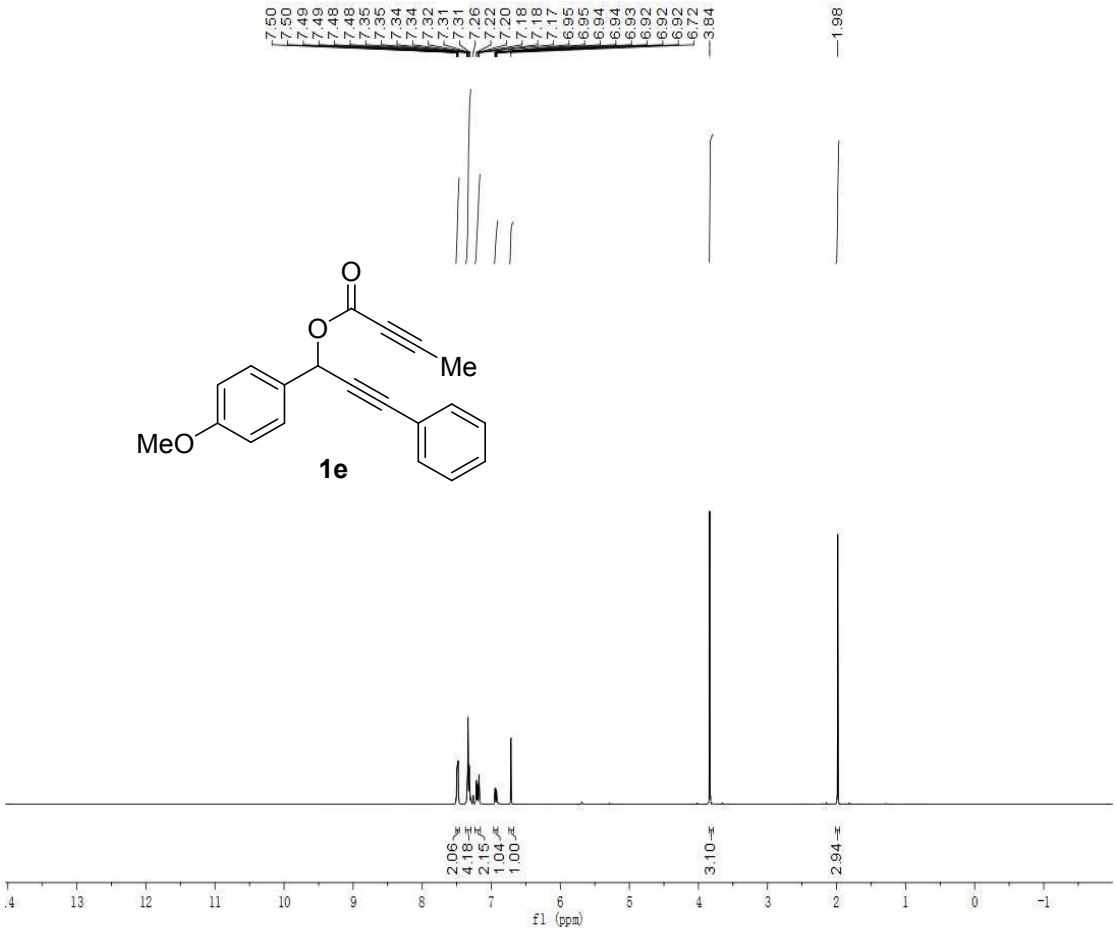
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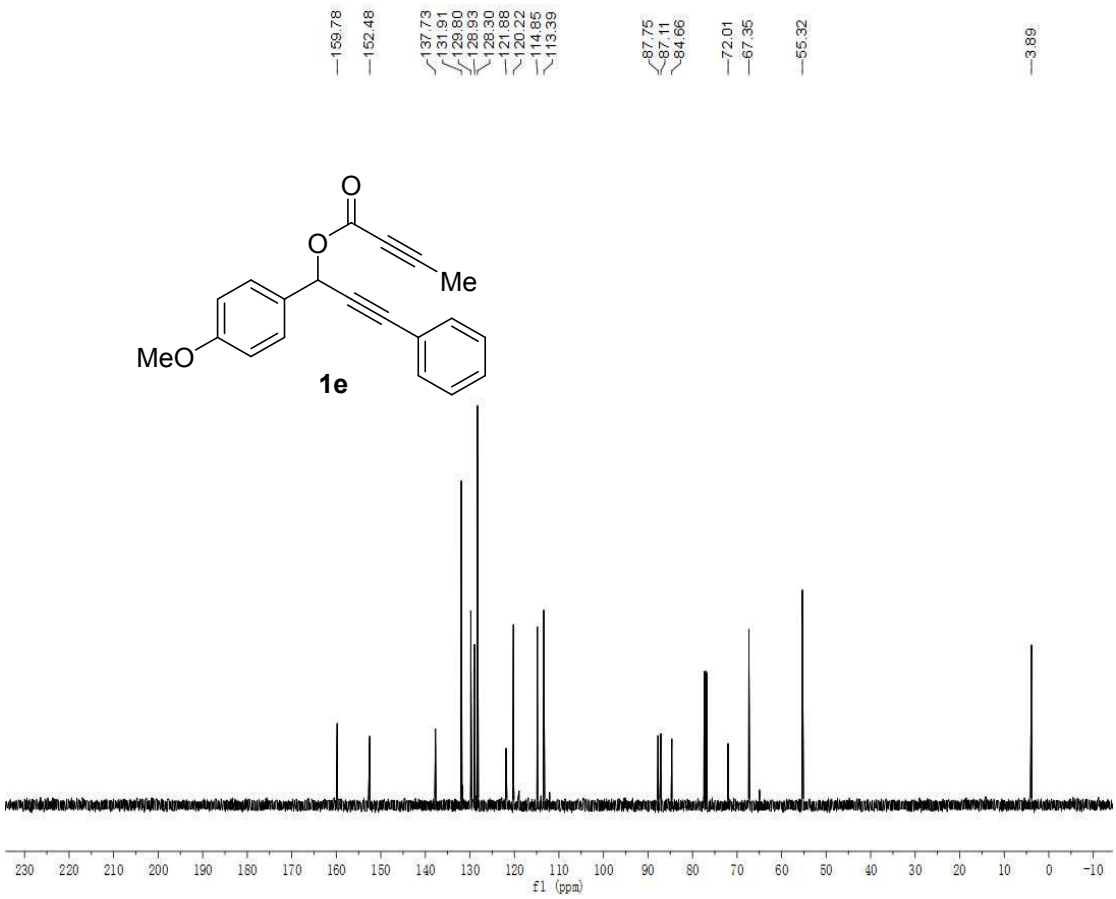
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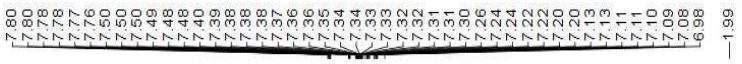
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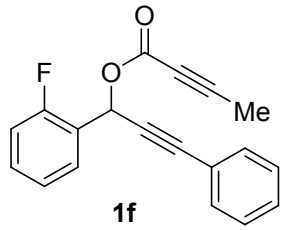
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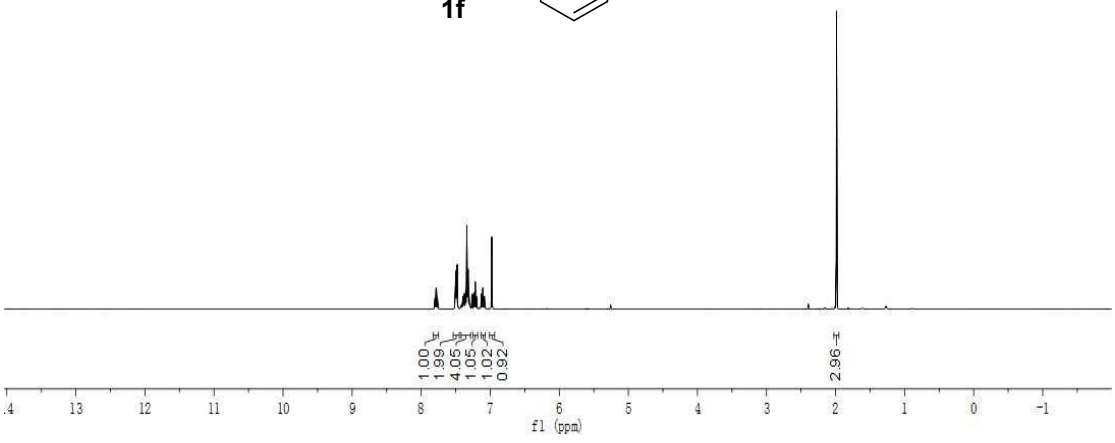
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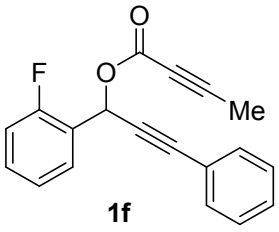
3.90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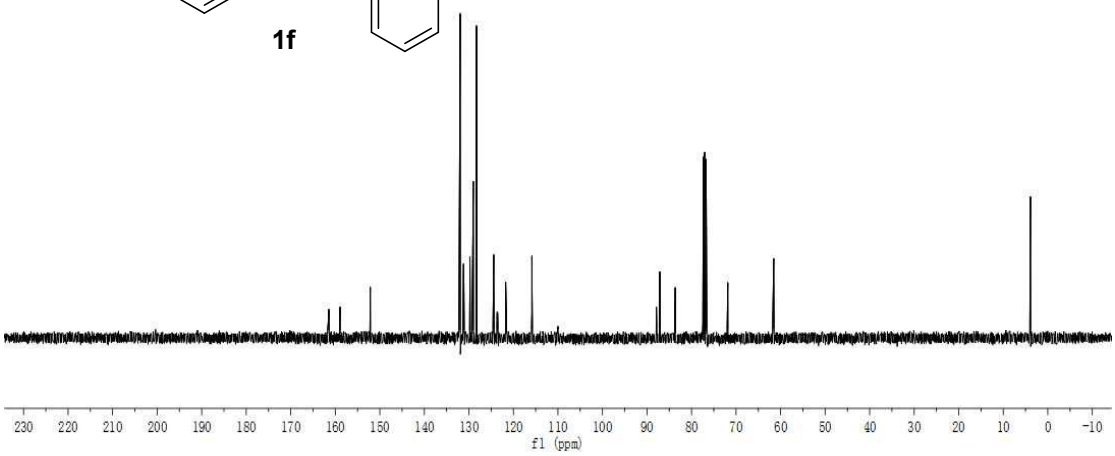
O
Me

1f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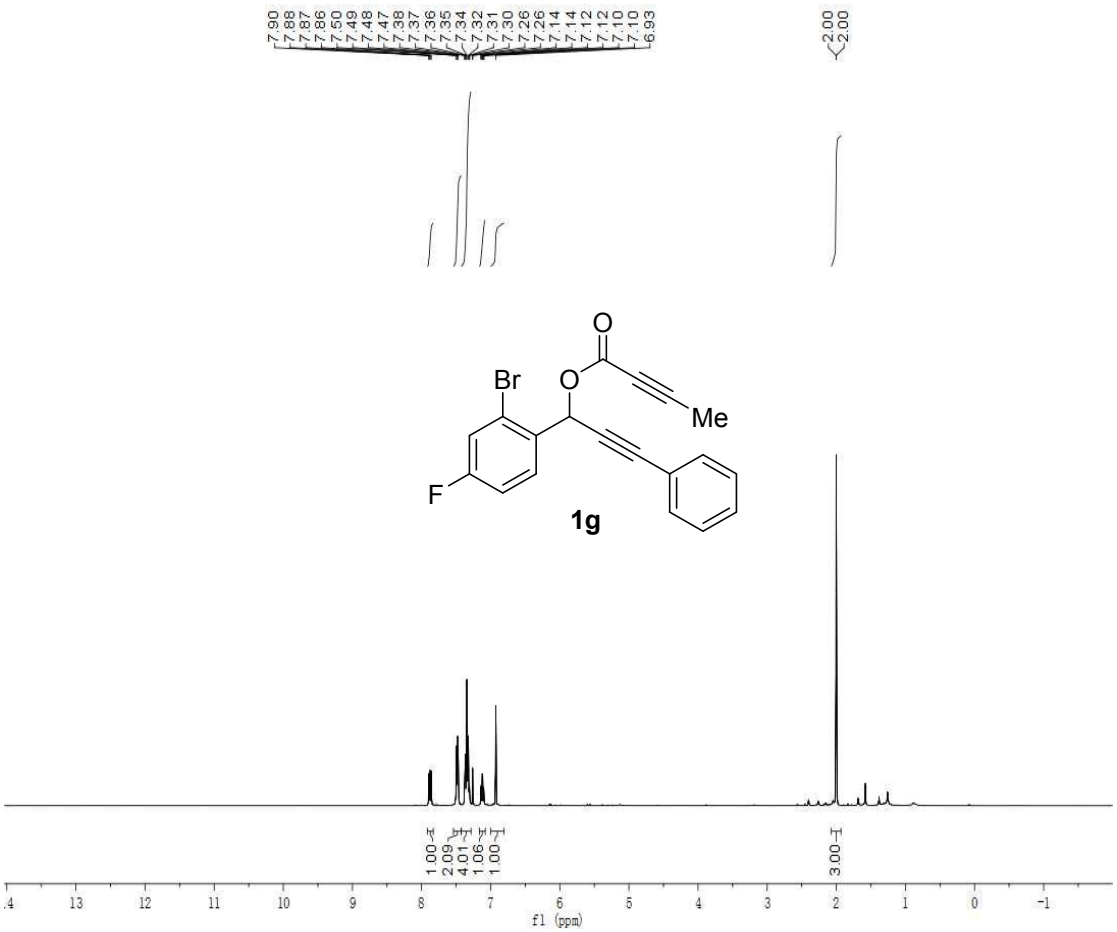
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7.34
7.32
7.31
7.30
7.26
7.14
7.12
7.10
6.93
2.00
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Me
F
1g
1.00
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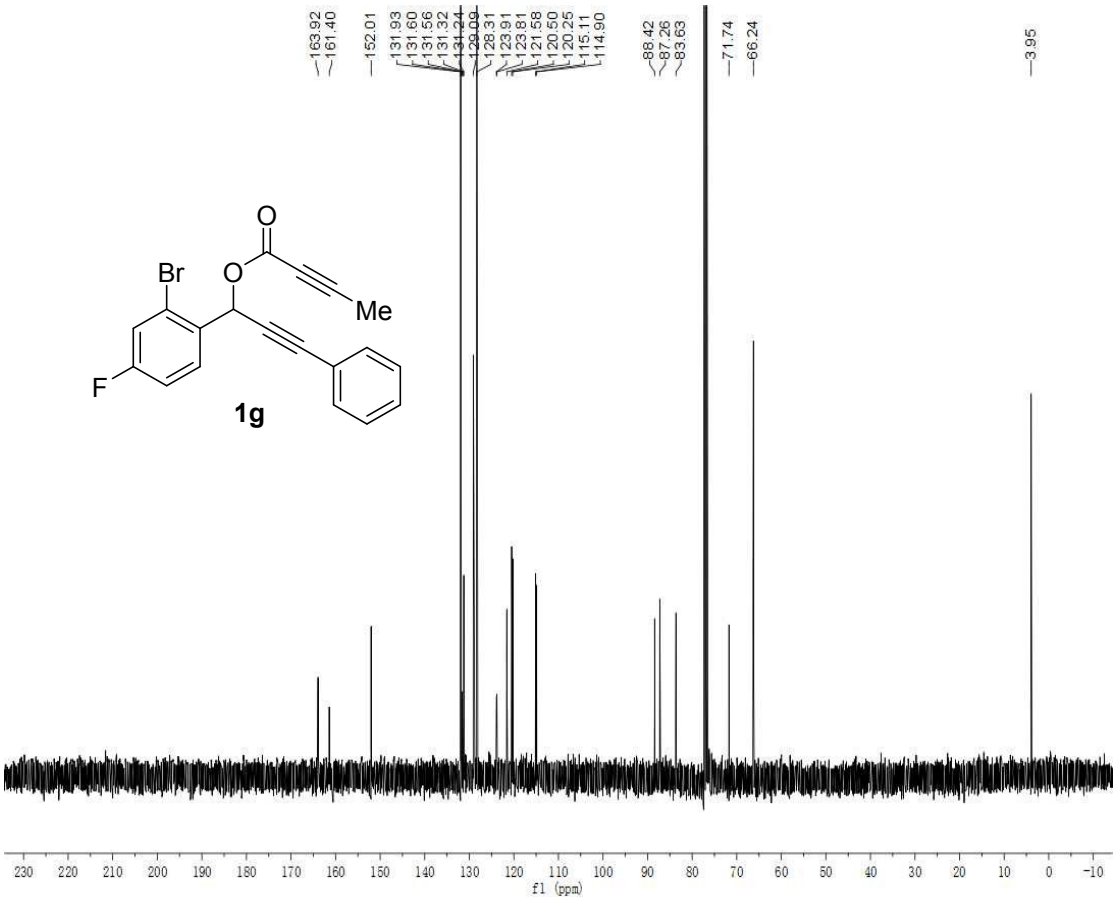
4.01
1.06
1.00
3.00
f1 (ppm)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120.50
120.25
115.11
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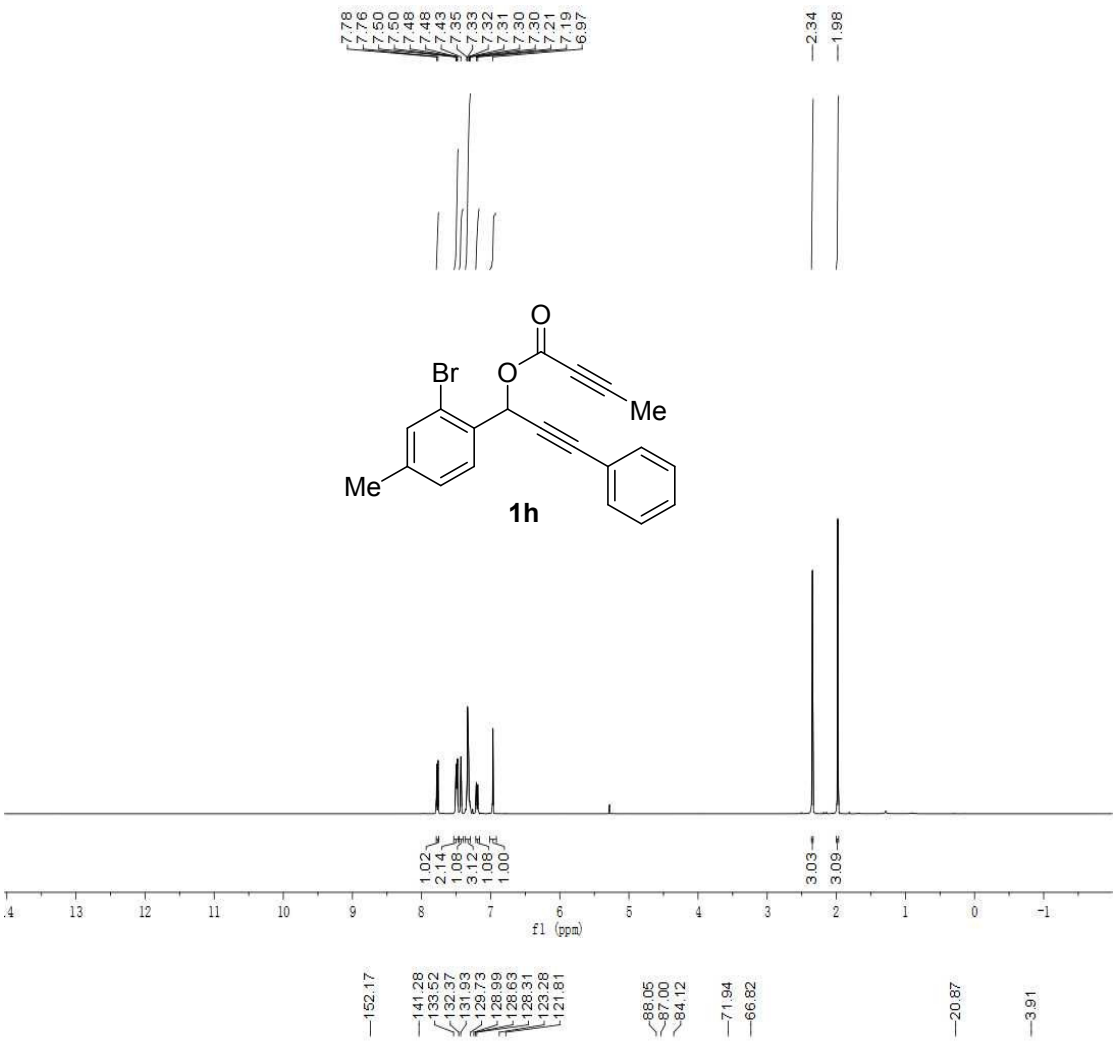
O
O
Me
F
1g
f1 (ppm)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7.19
6.97
2.34
1.98
O
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3.09
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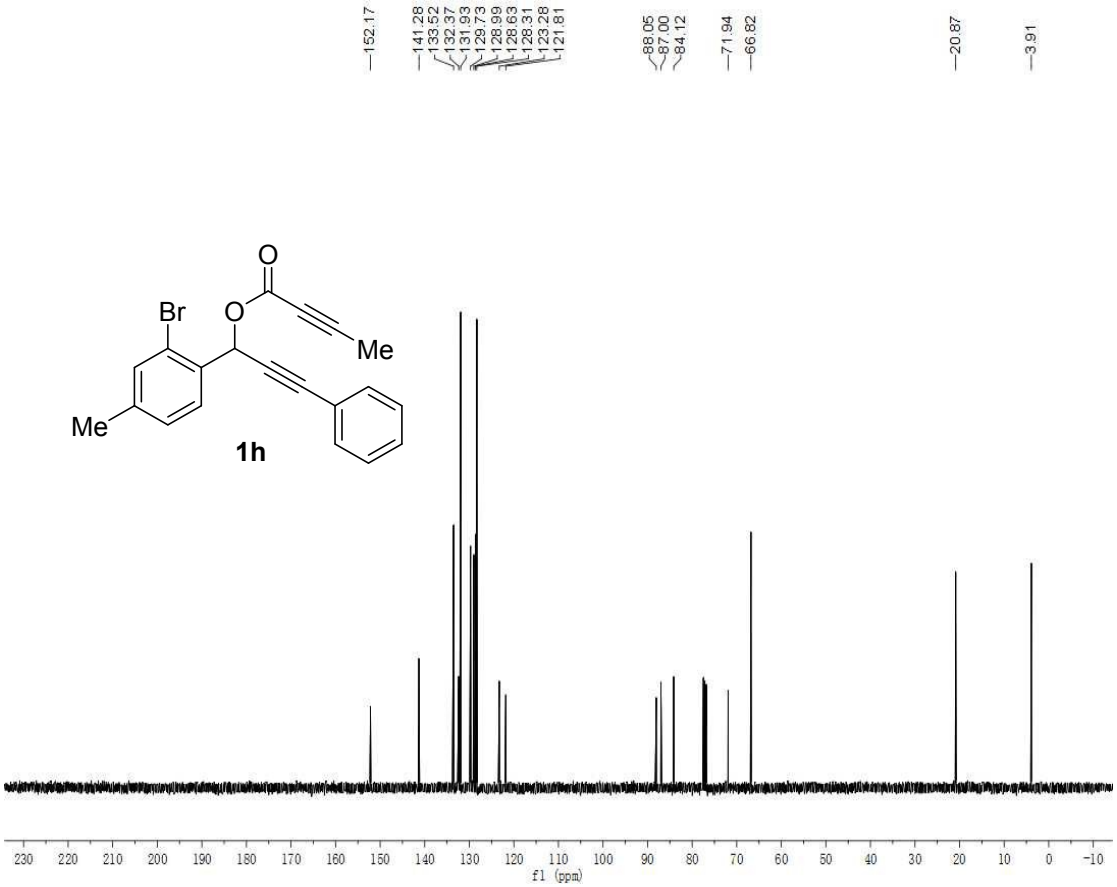
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3.91
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Br
O
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Me
1h
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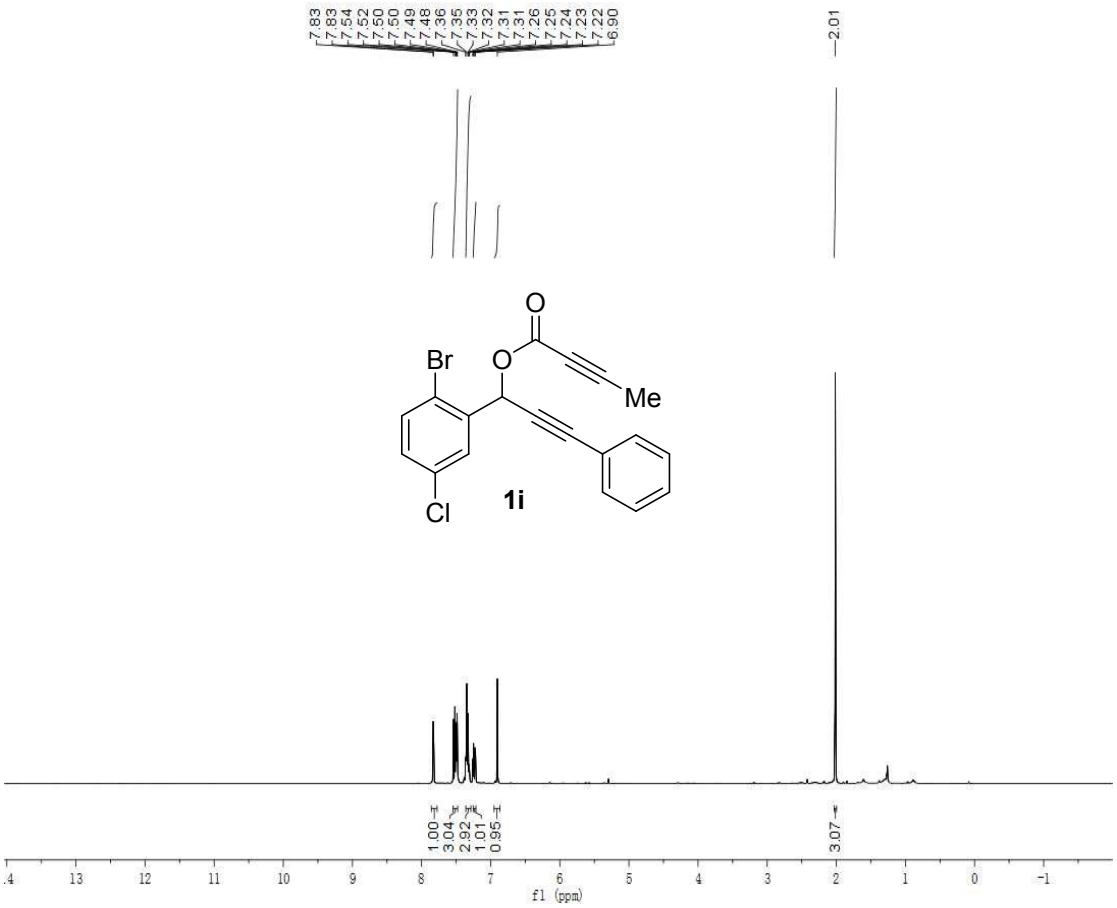
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7.31
7.26
7.25
7.24
7.23
7.22
6.90
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Cl
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3.07
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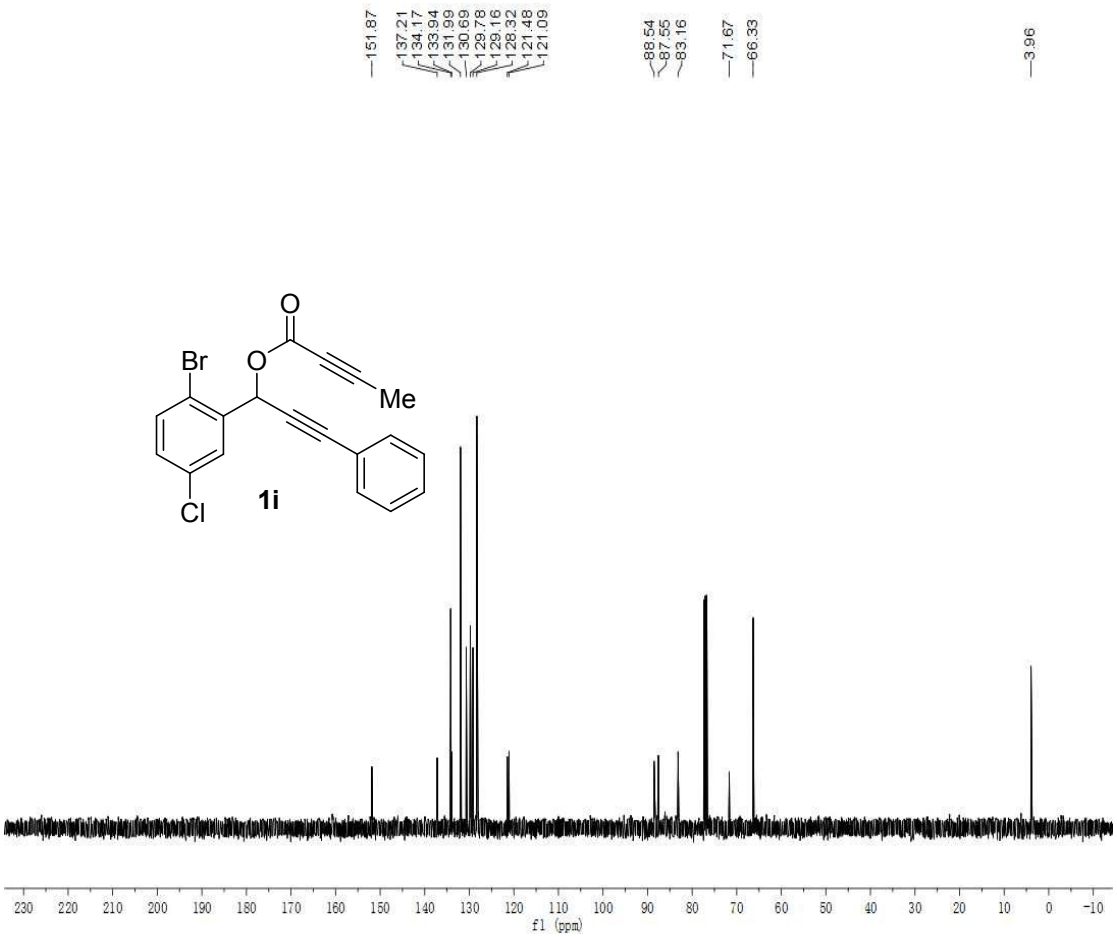
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O
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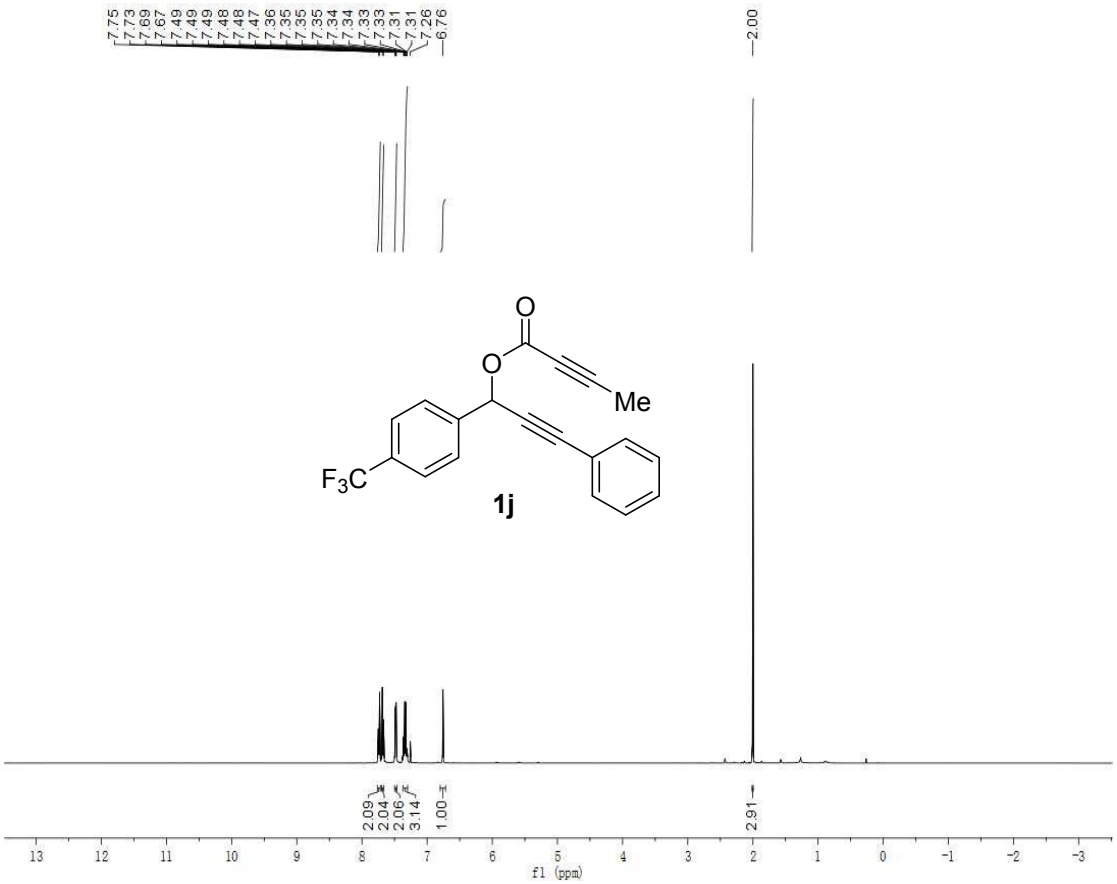
Cl
1i
f1 (ppm)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7.33
7.33
7.31
7.31
7.26
6.76
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F3C
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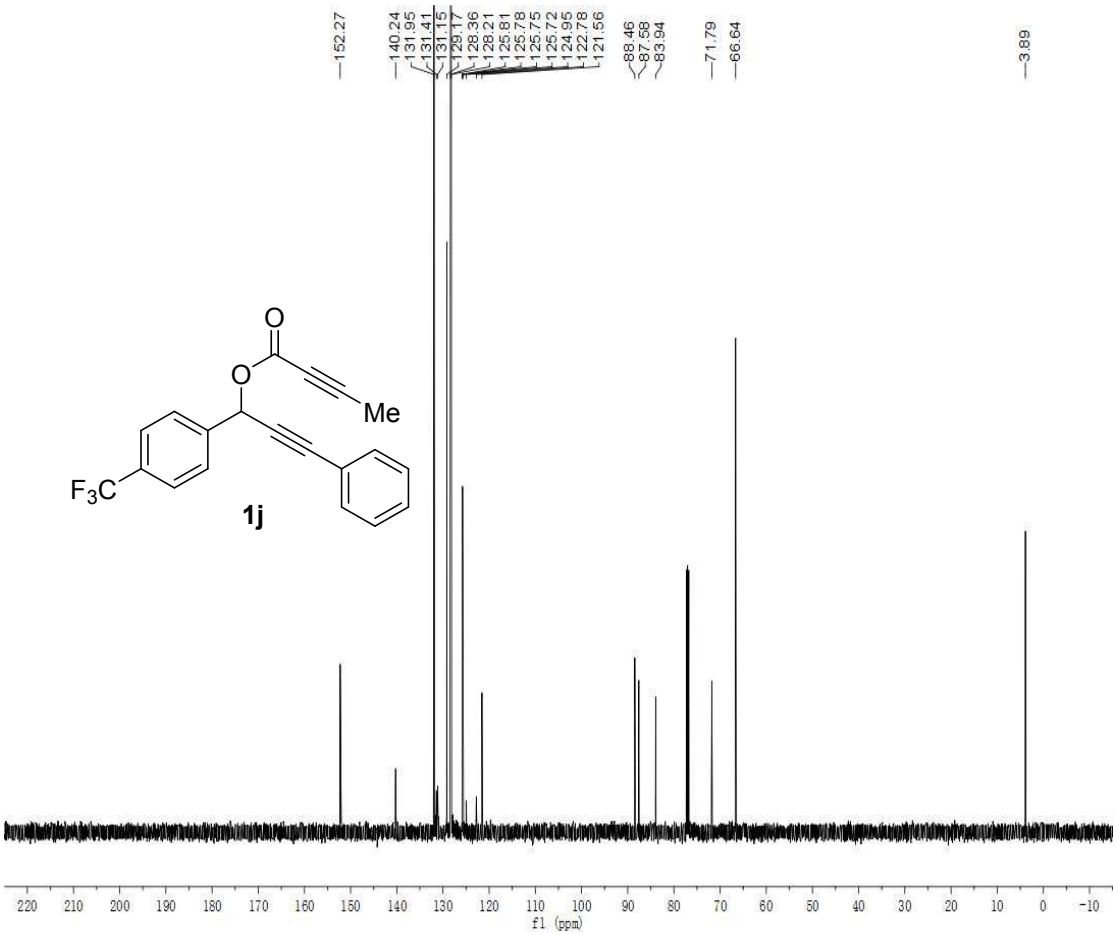
2.91
f1 (ppm)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122.78
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83.94
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66.64
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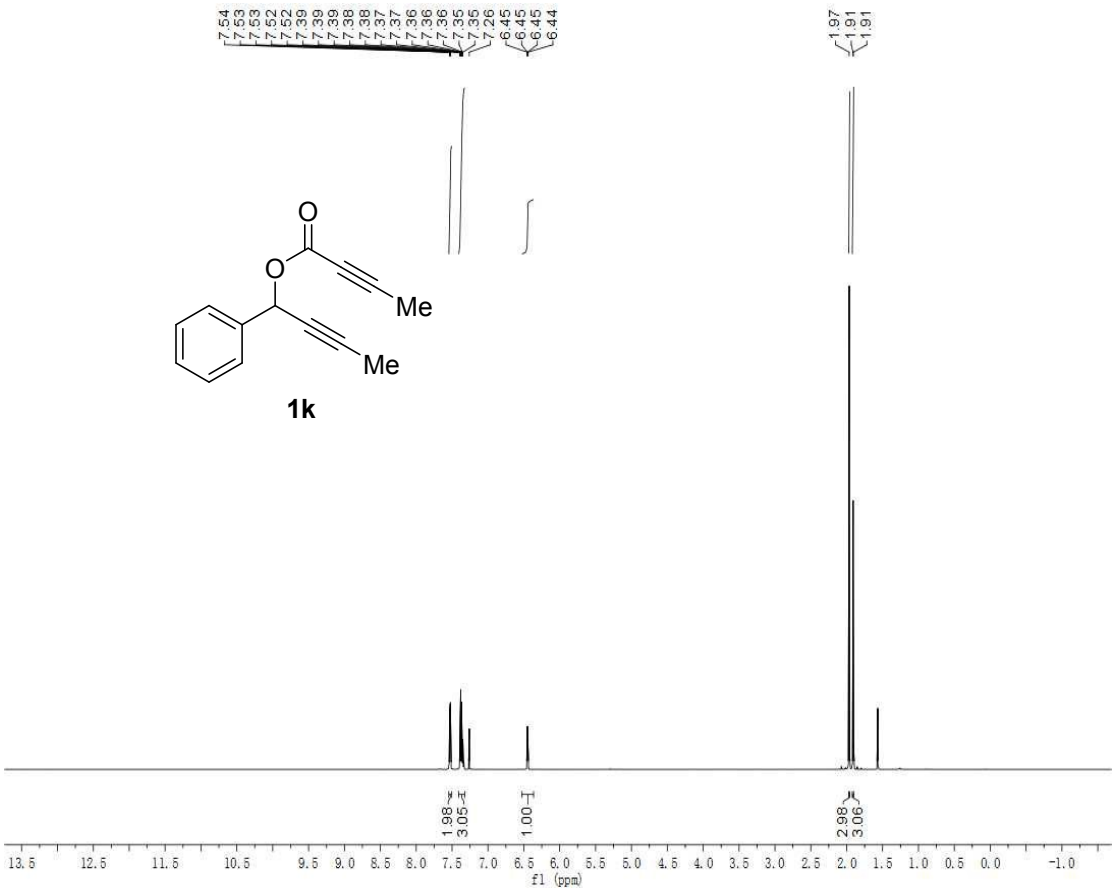
O
O
Me
F3C
1j
f1 (ppm)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7.26
6.45
6.45
6.44
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O
O
Me
Me
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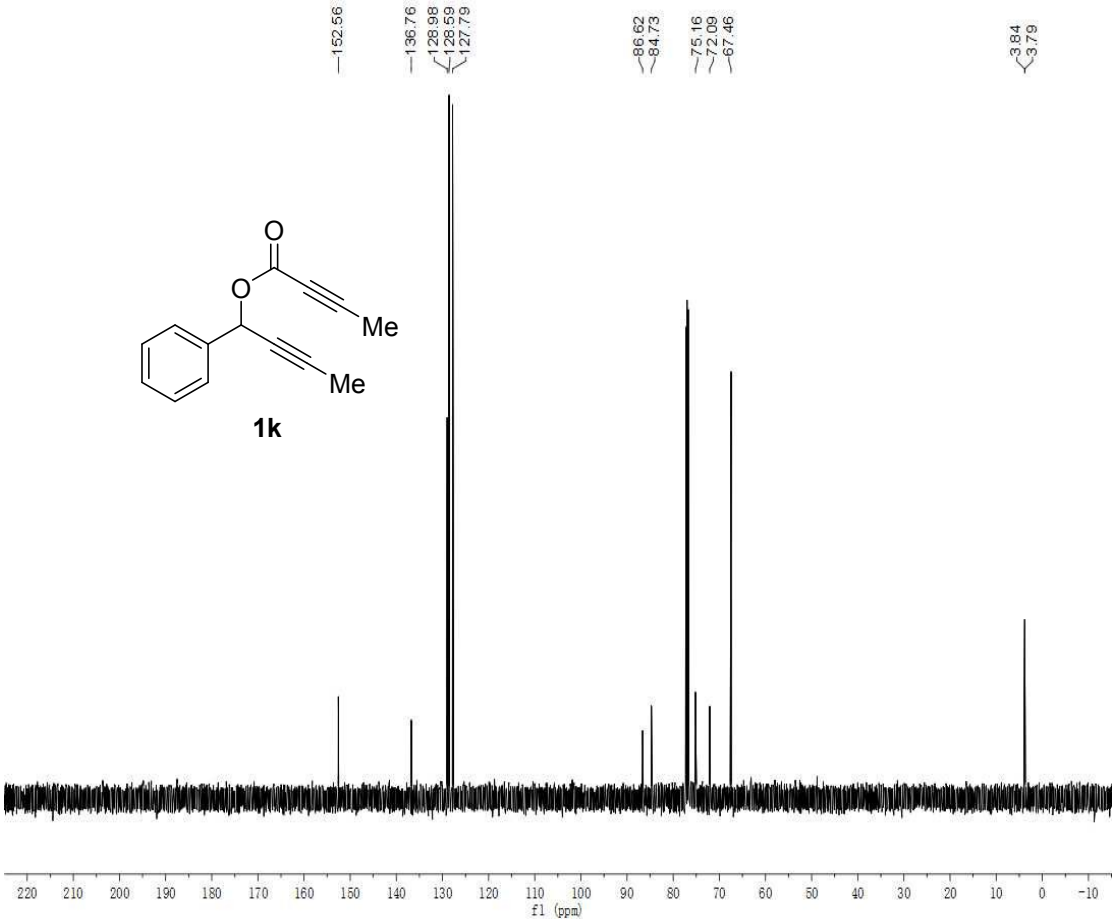
1.00
2.98
3.06
f1 (ppm)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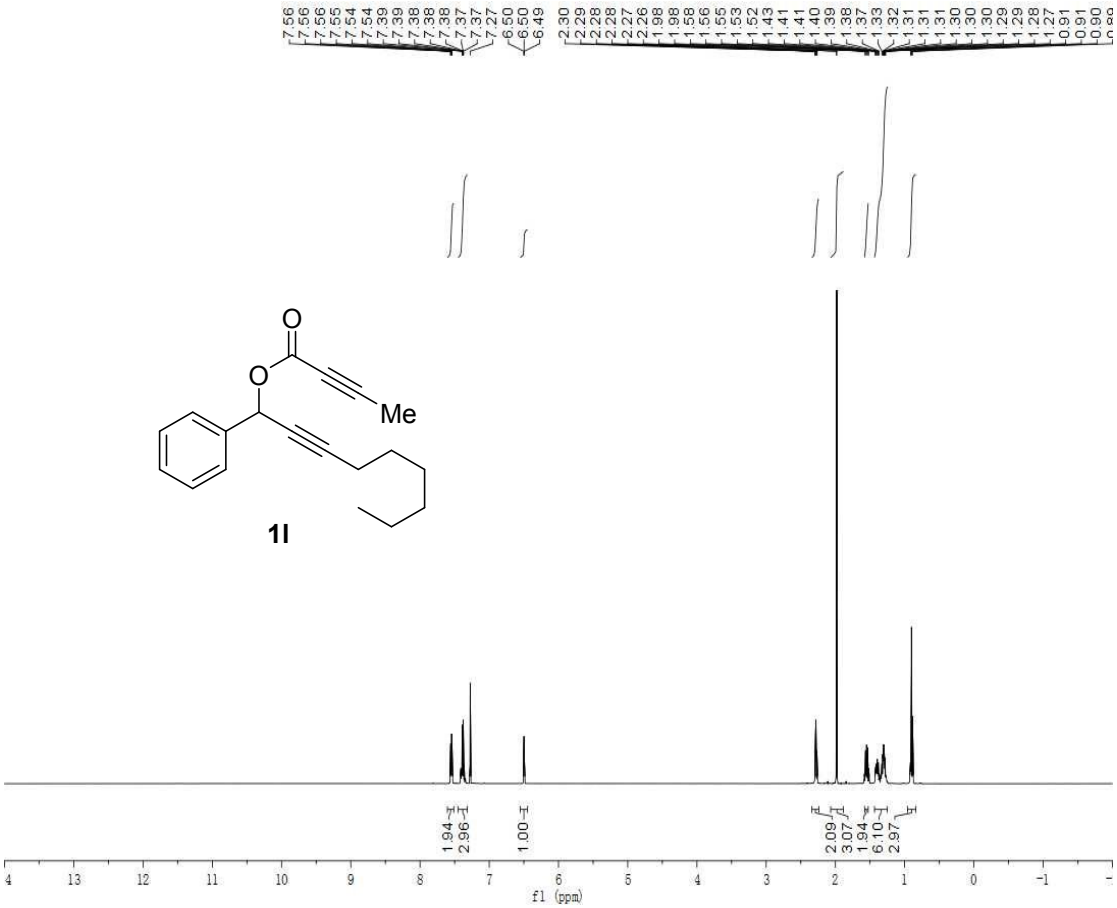
Me
1k
f1 (ppm)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2.30 2.29 2.28 2.28 2.27 2.26 1.98 1.98 1.58 1.56 1.55 1.53 1.52 1.43 1.41 1.40 1.39 1.38 1.37 1.33 1.32 1.31 1.31 1.31 1.30 1.30 1.30 1.29 1.29 1.28 1.27 0.91 0.91 0.90
O
O
Me
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1.00
2.09
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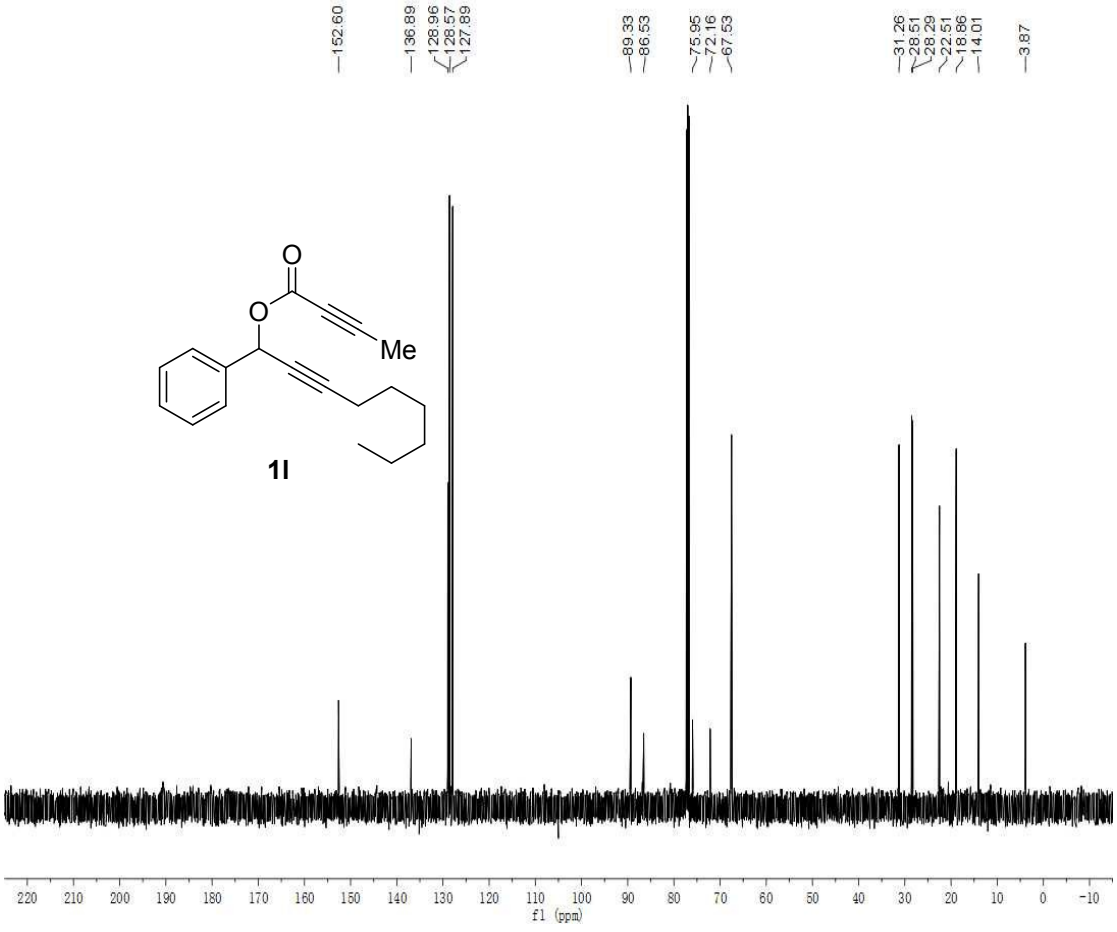
1.94
6.10
2.97
f1 (ppm)

1l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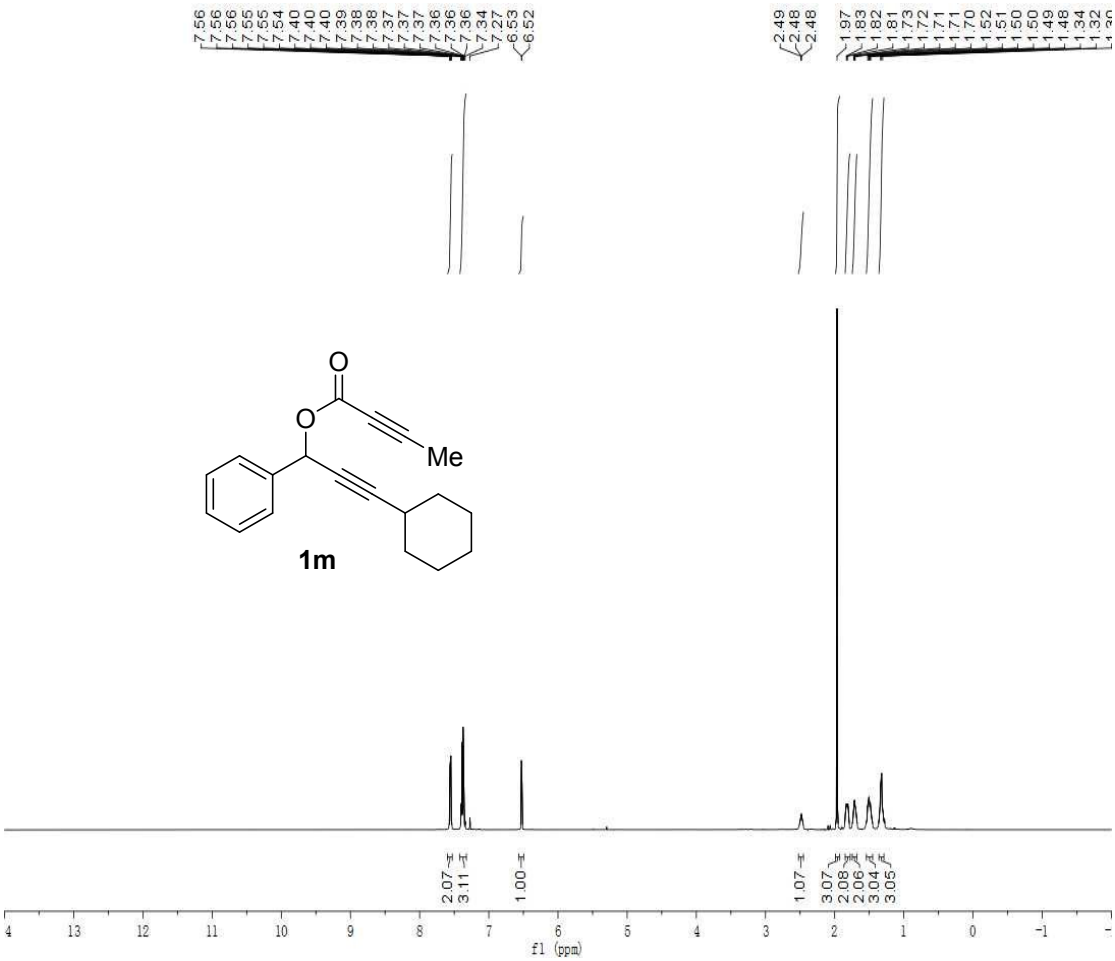
Me
f1 (ppm)

1l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1.71
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1.52
1.51
1.50
1.50
1.49
1.48
1.34
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O
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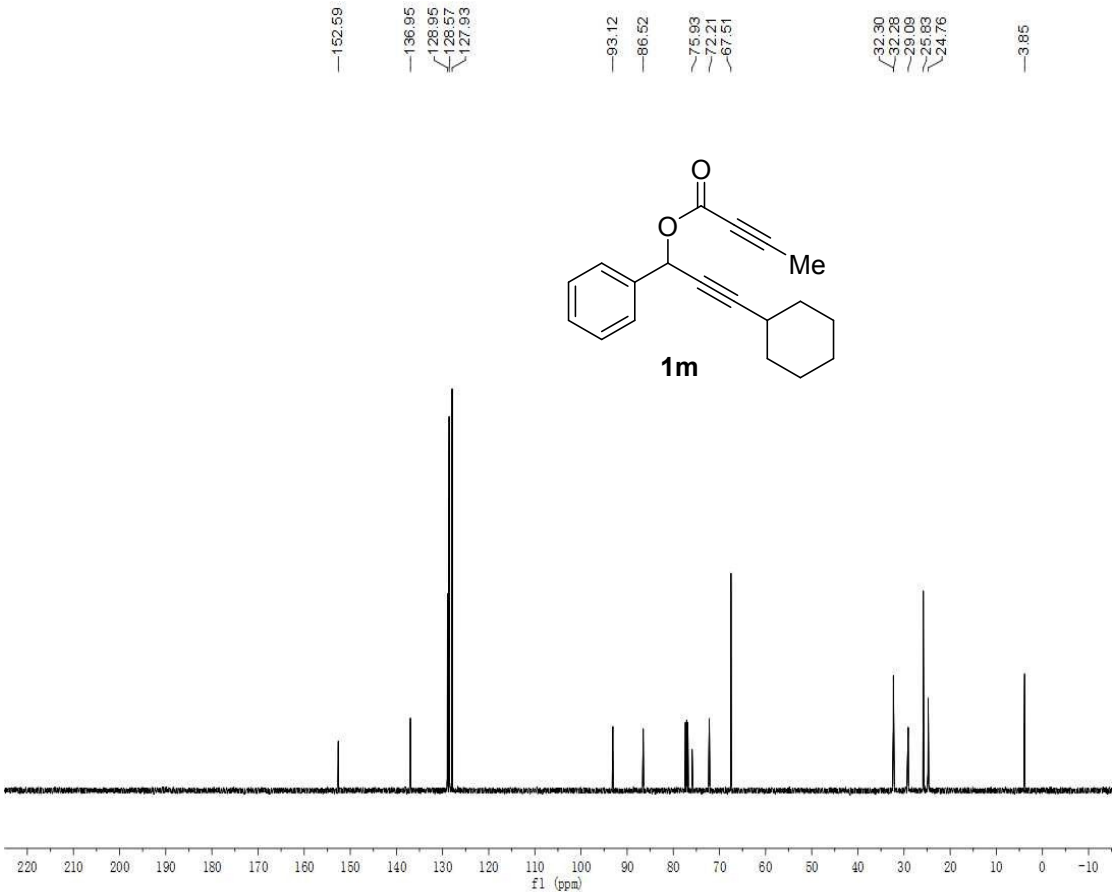
3.05
f1 (ppm)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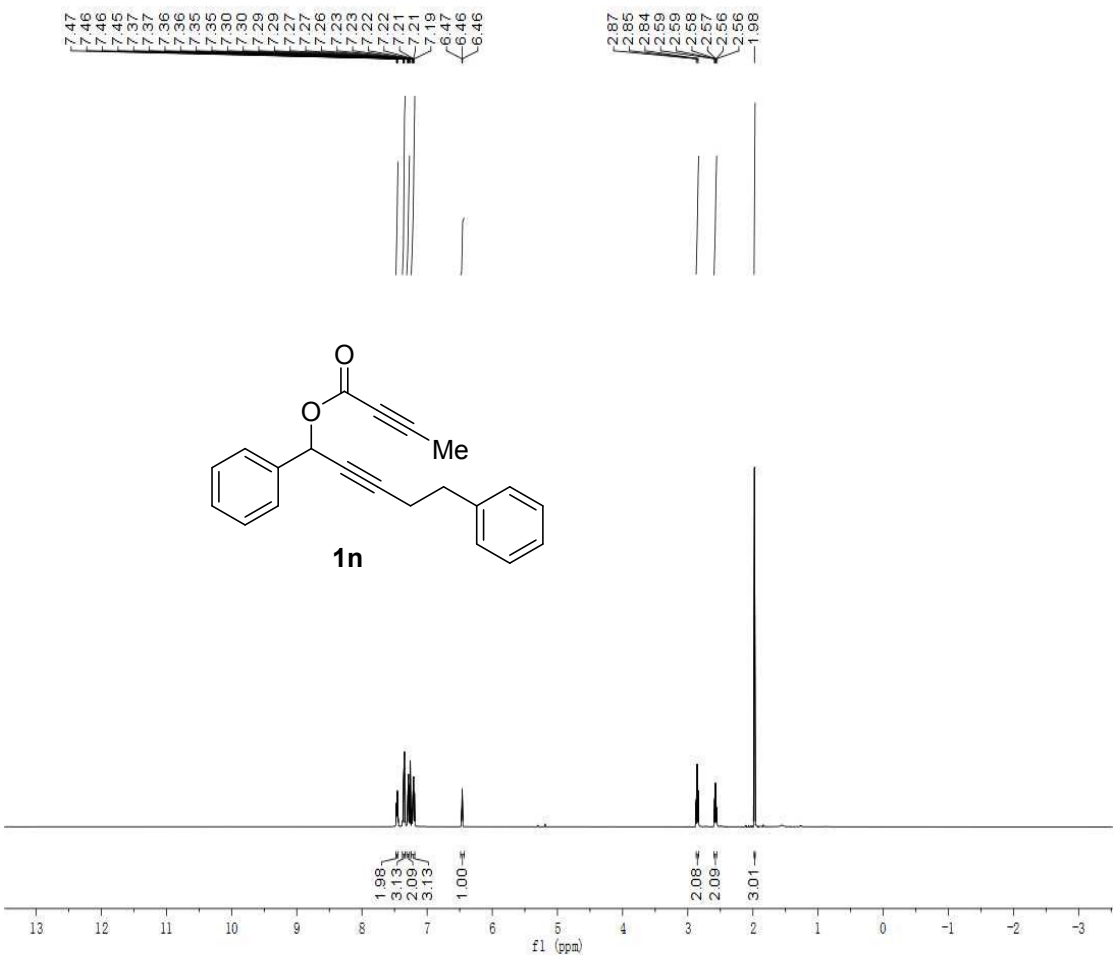
f1 (ppm)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2.58
2.57
2.56
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O
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2.09
3.13
1.00
2.08
2.09
3.01
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1
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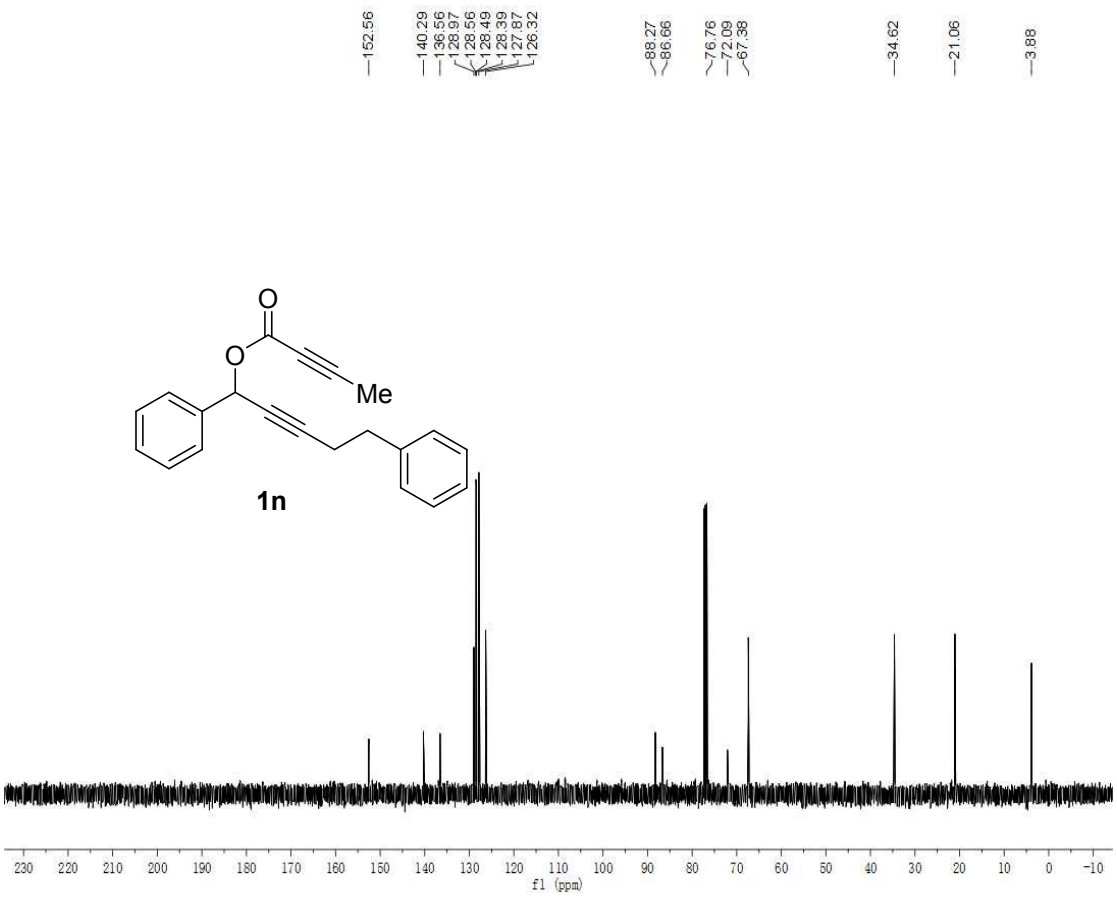
-2
-3
f1 (ppm)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67.38
34.62
21.06
3.88
O
O
Me
1n
230
220
210
200
190
180
170
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30
20
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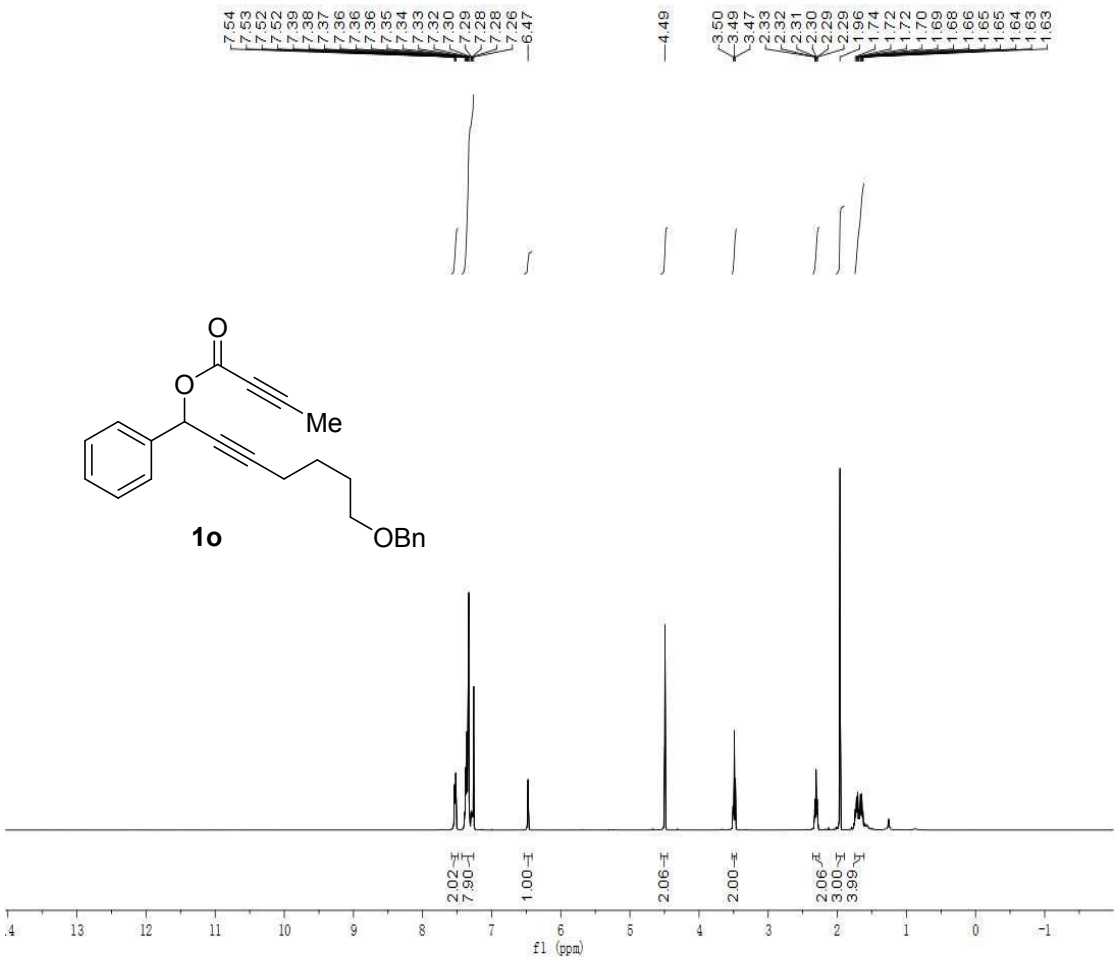
f1 (ppm)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1.64
1.63
1.63
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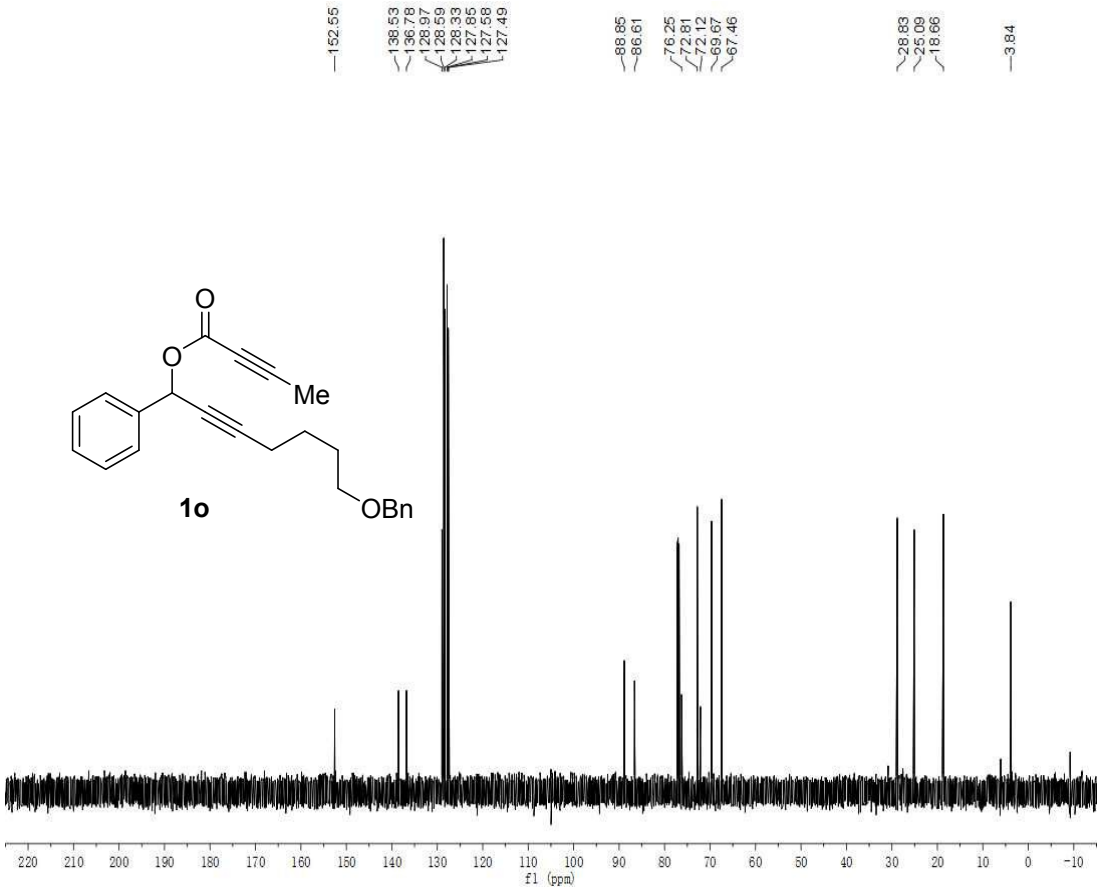
2.06
3.00
3.99
f1 (ppm)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Me
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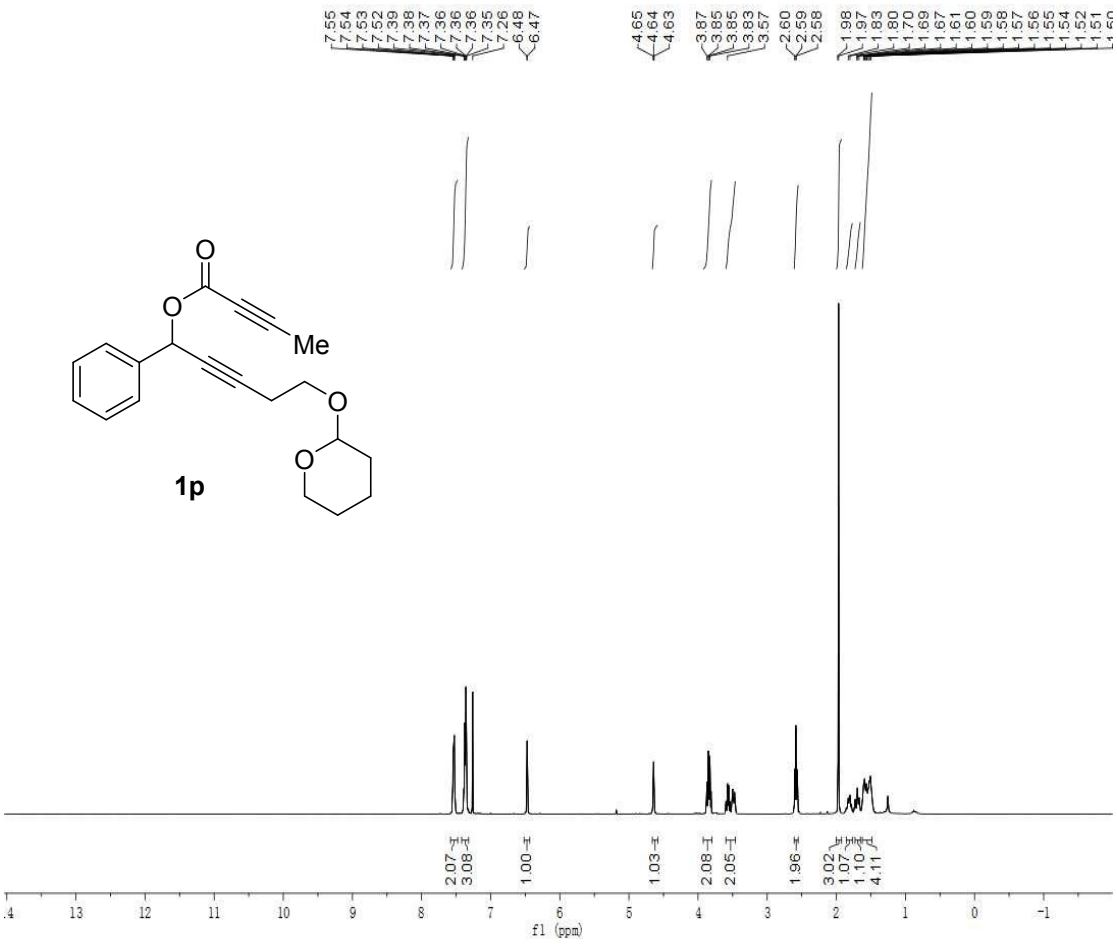
OBn
f1 (ppm)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1.56
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1.54
1.52
1.51
O
O
Me
O
O
1p
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4.11
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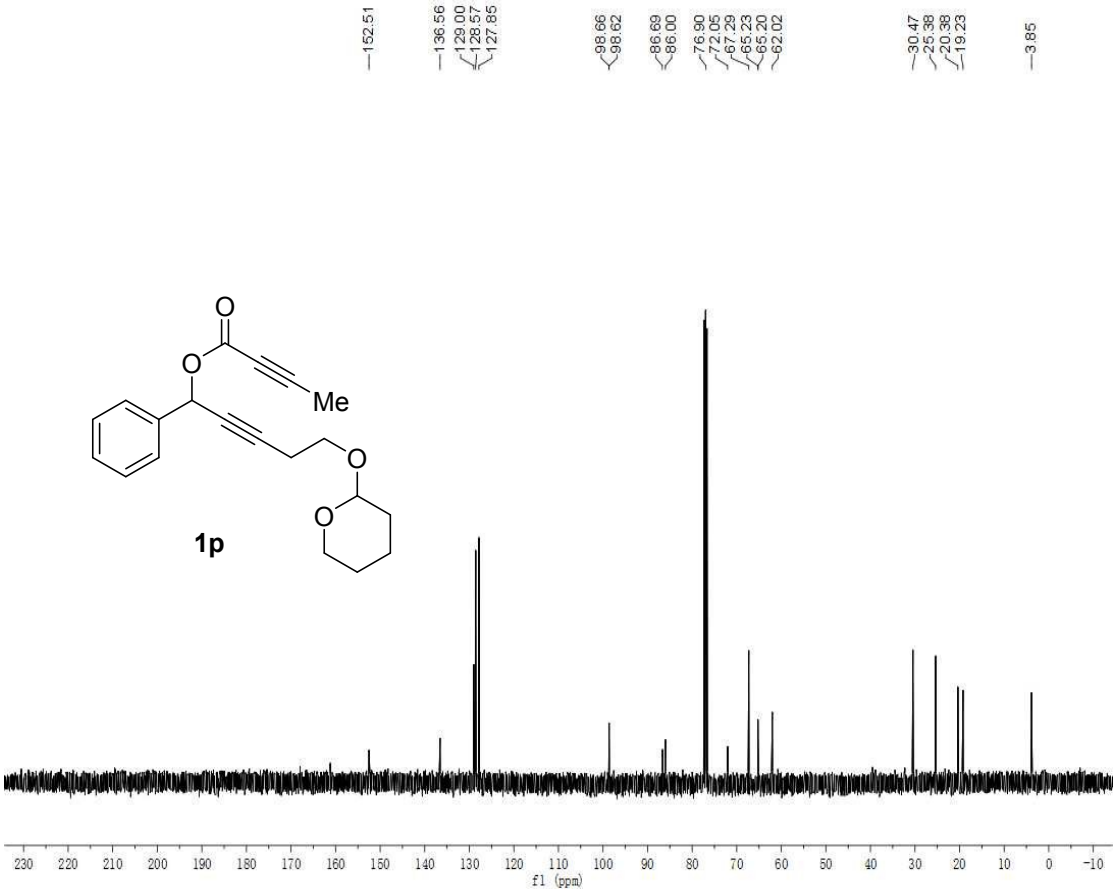
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19.23
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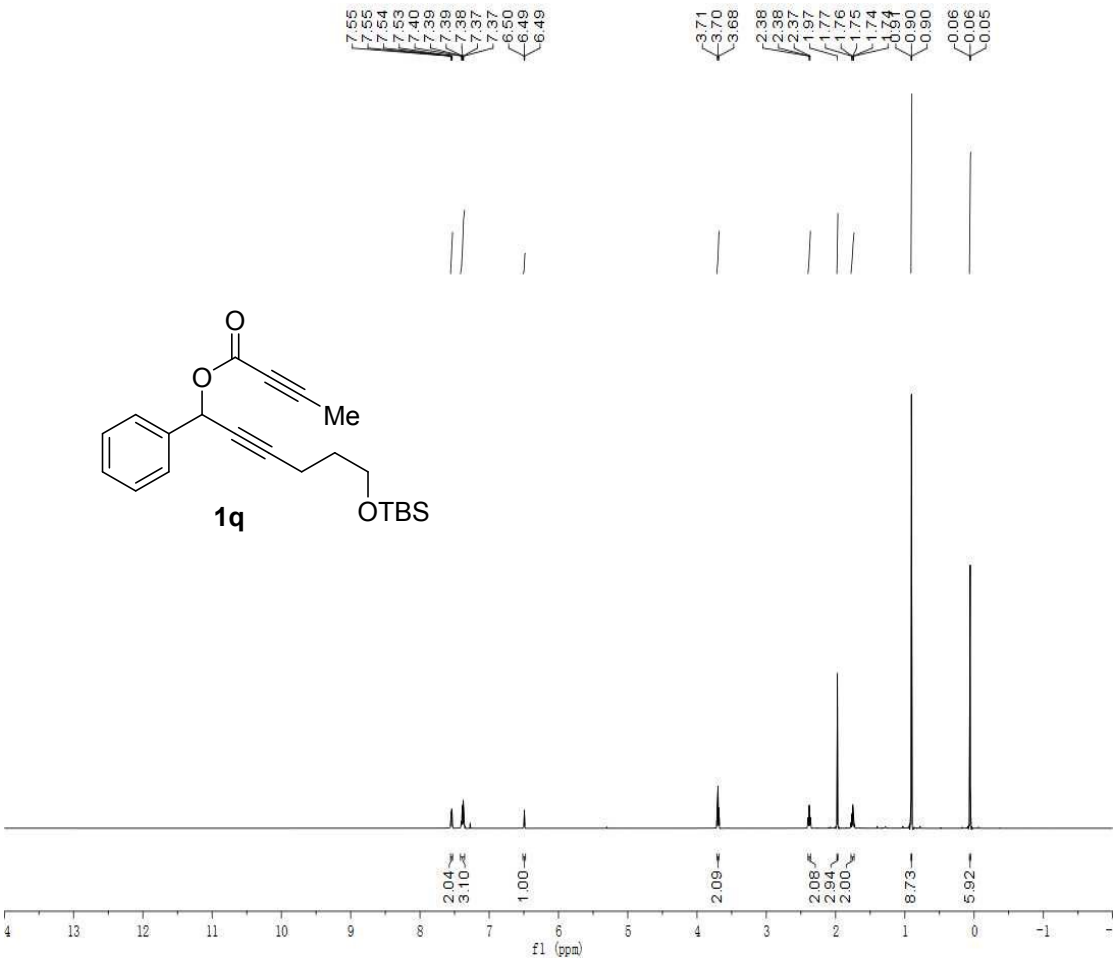
O
O
Me
O
O
1p
f1 (ppm)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3.70
3.68
2.38
2.38
2.37
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1.77
1.76
1.75
1.74
1.74
0.91
0.90
0.90
0.06
0.06
0.05
O
O
Me
OTBS
1q
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1.00
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2.08
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2.00
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5.92
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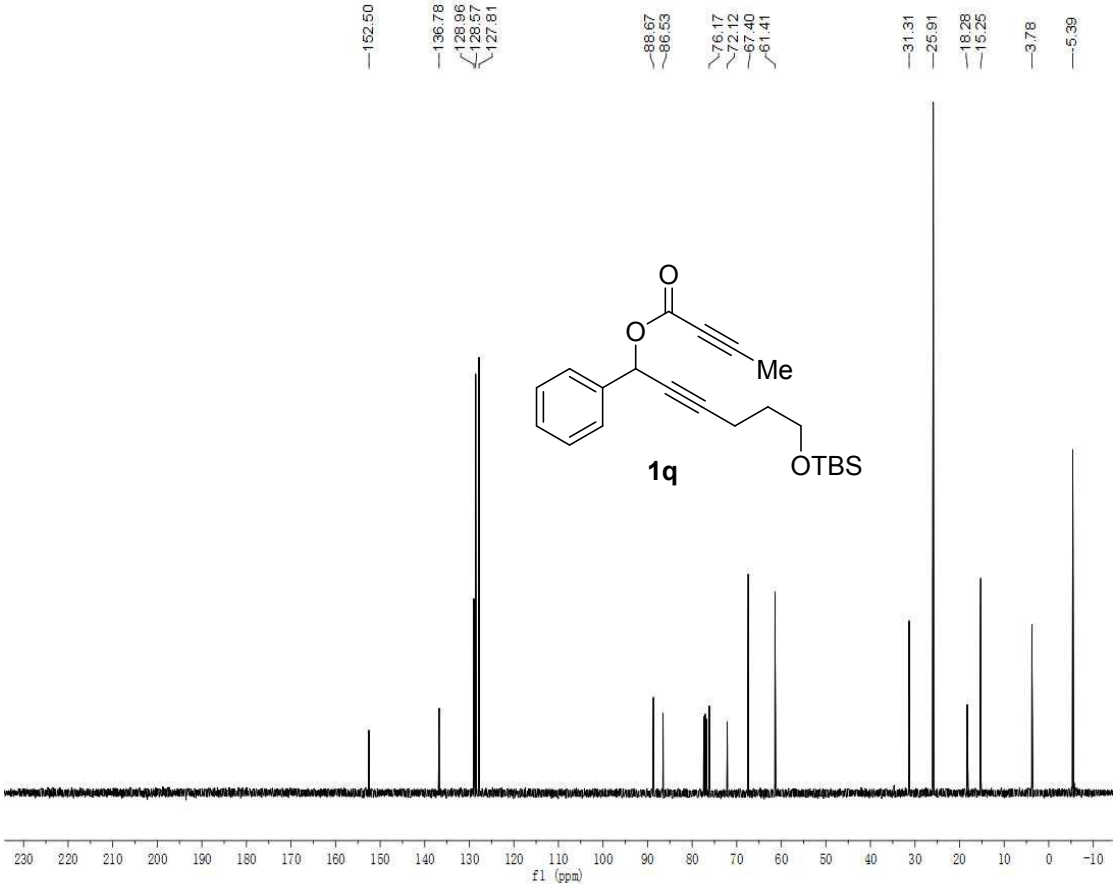
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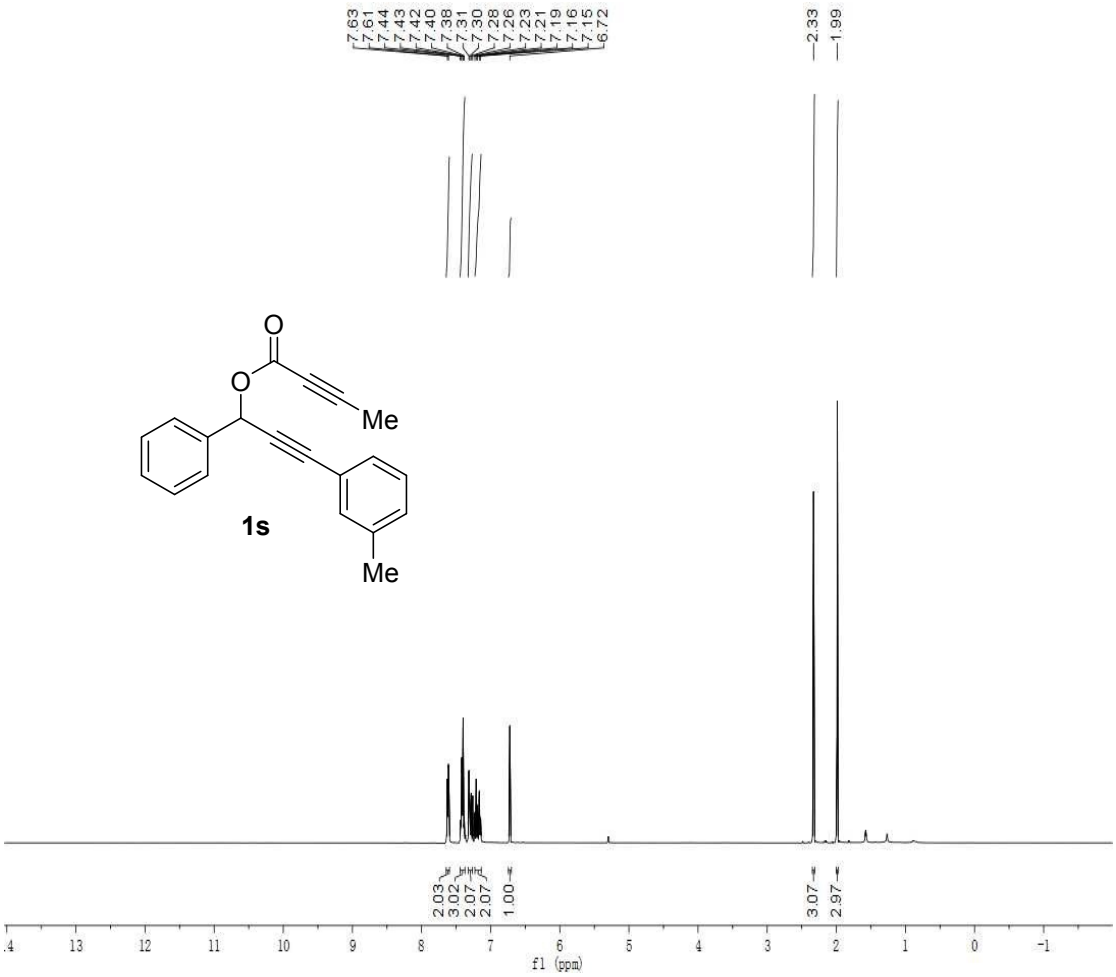
O
O
Me
OTBS
1q
f1 (ppm)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7.19
7.16
7.15
6.72
2.33
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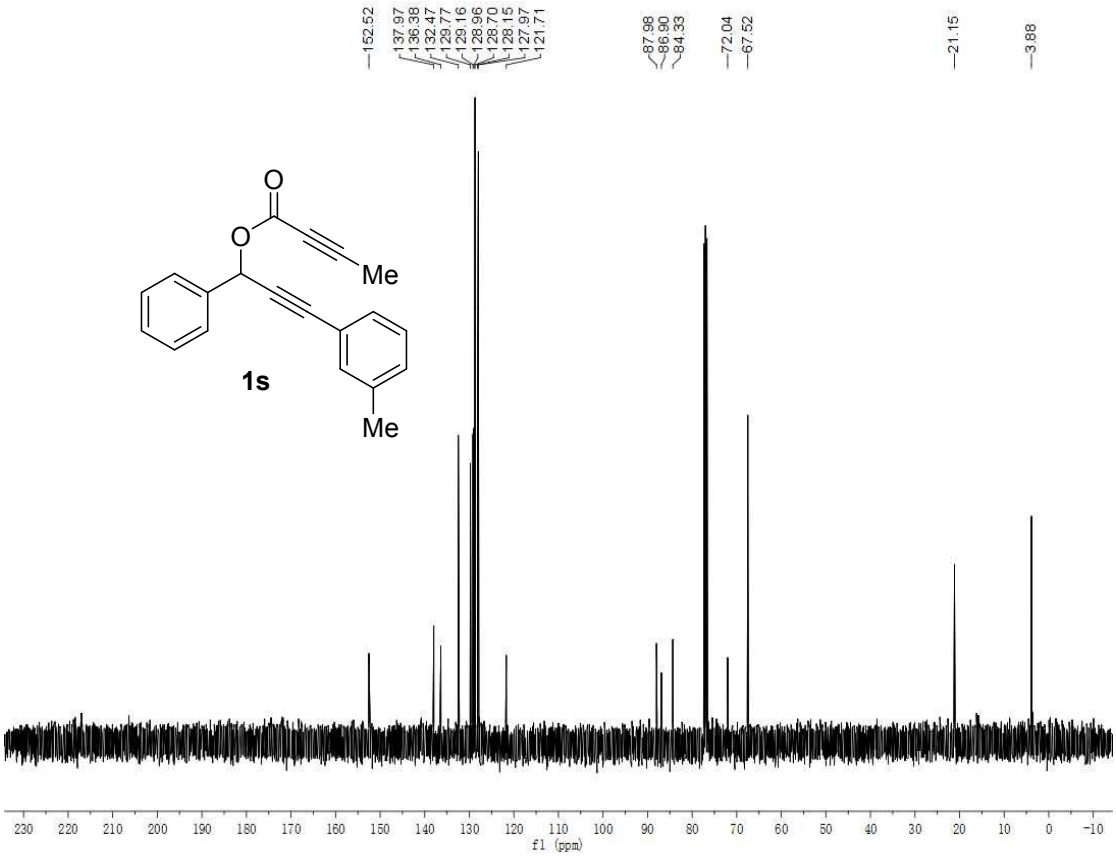
1s
Me
2.03
3.02
2.07
2.07
1.00
3.07
2.97
f1 (ppm)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O
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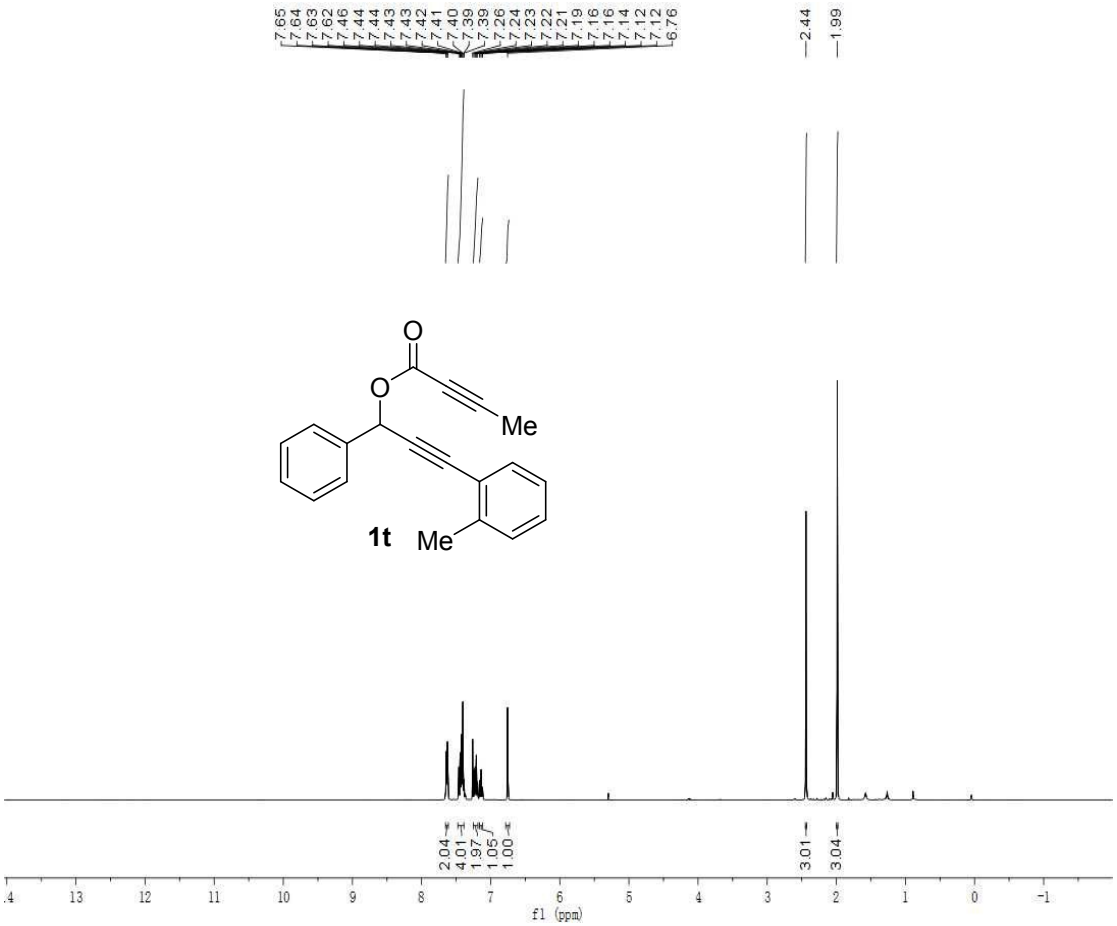
1s
Me
f1 (ppm)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7.14
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7.12
6.76
2.44
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Me
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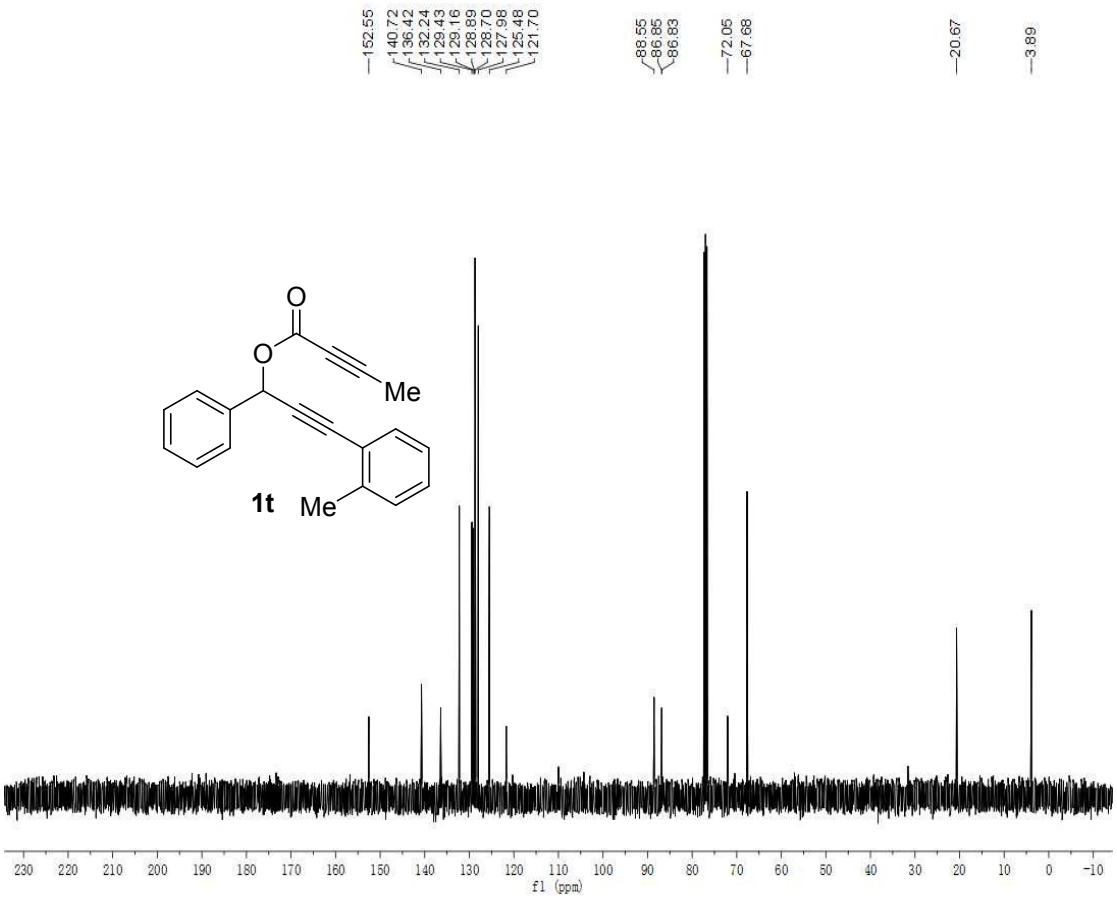
1.00
3.01
3.04
f1 (ppm)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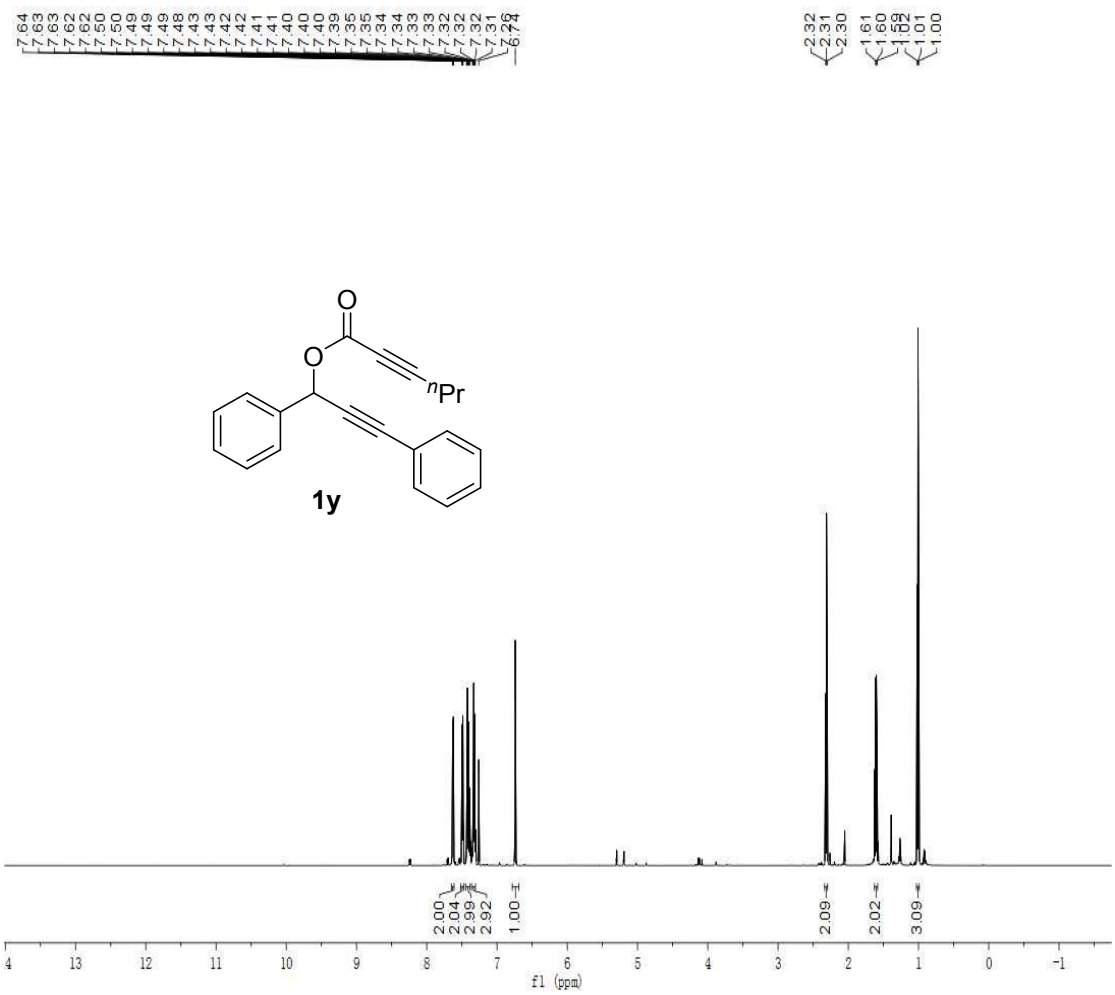
86.83
72.05
67.68
20.67
3.89
O
O
Me
1t
Me
f1 (ppm)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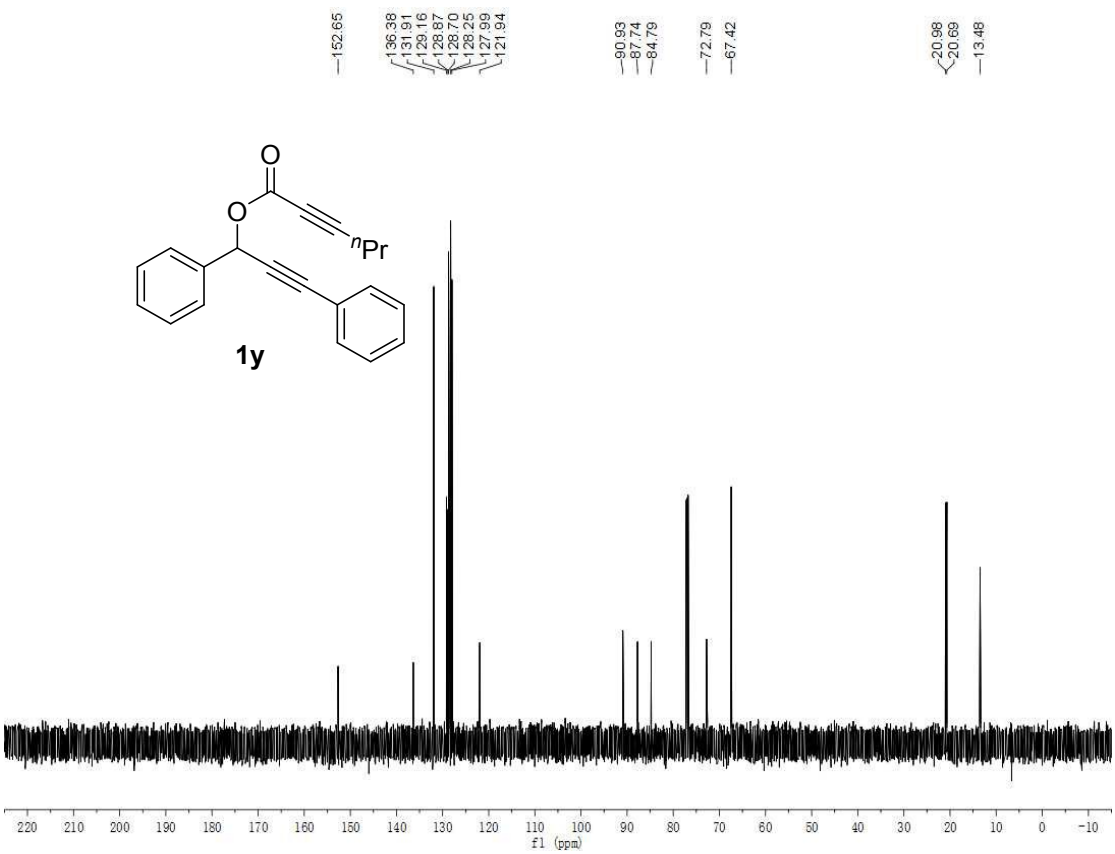
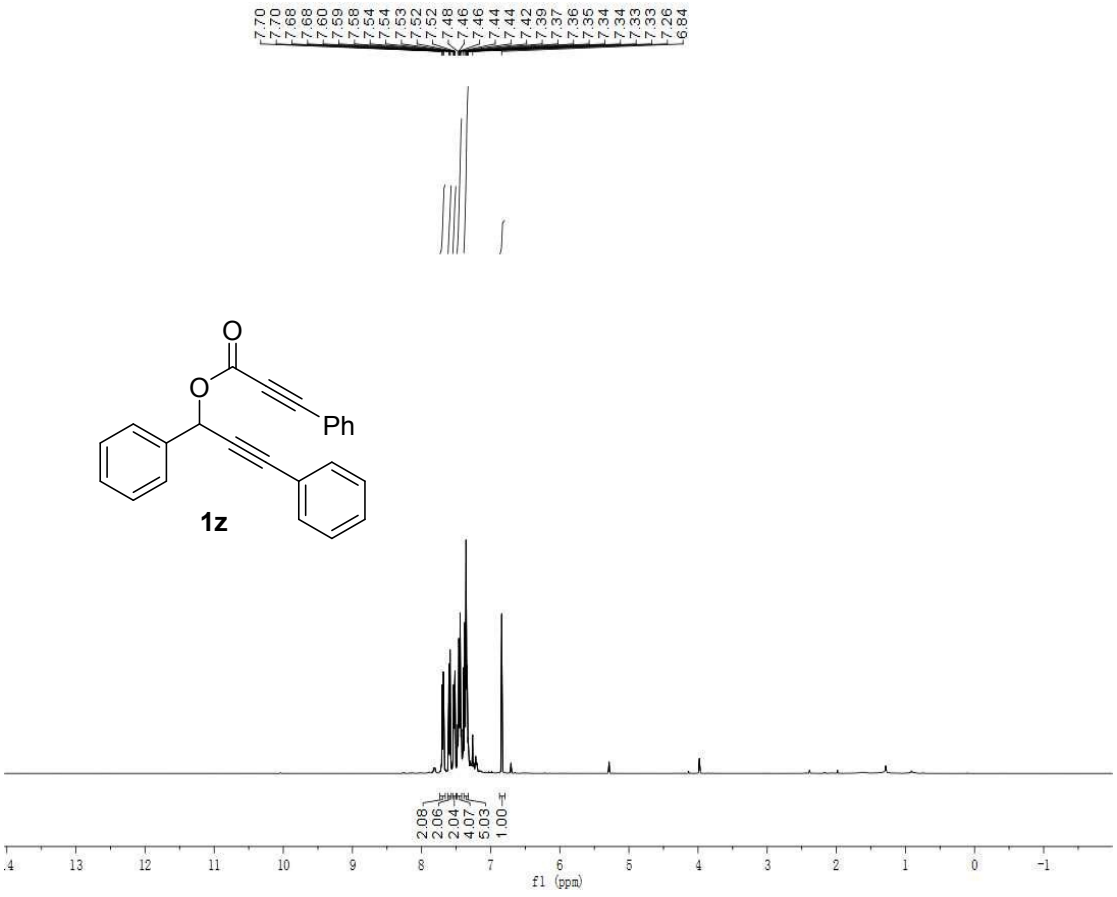
2.32 2.31 2.30 1.61 1.60 1.59 1.02 1.01 1.00
O
O
nPr
1y
2.00 2.04 2.99 2.92 1.00 2.09 2.02 3.09
f1 (ppm)


152.65 136.38 131.91 129.16 128.87 128.70 128.25 127.99 121.94 90.93 87.74 84.79 72.79 67.42 20.98 20.69 13.48
O
O
nPr
1y
f1 (ppm)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7.53
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7.48
7.46
7.46
7.44
7.44
7.42
7.39
7.37
7.36
7.35
7.34
7.34
7.33
7.33
7.26
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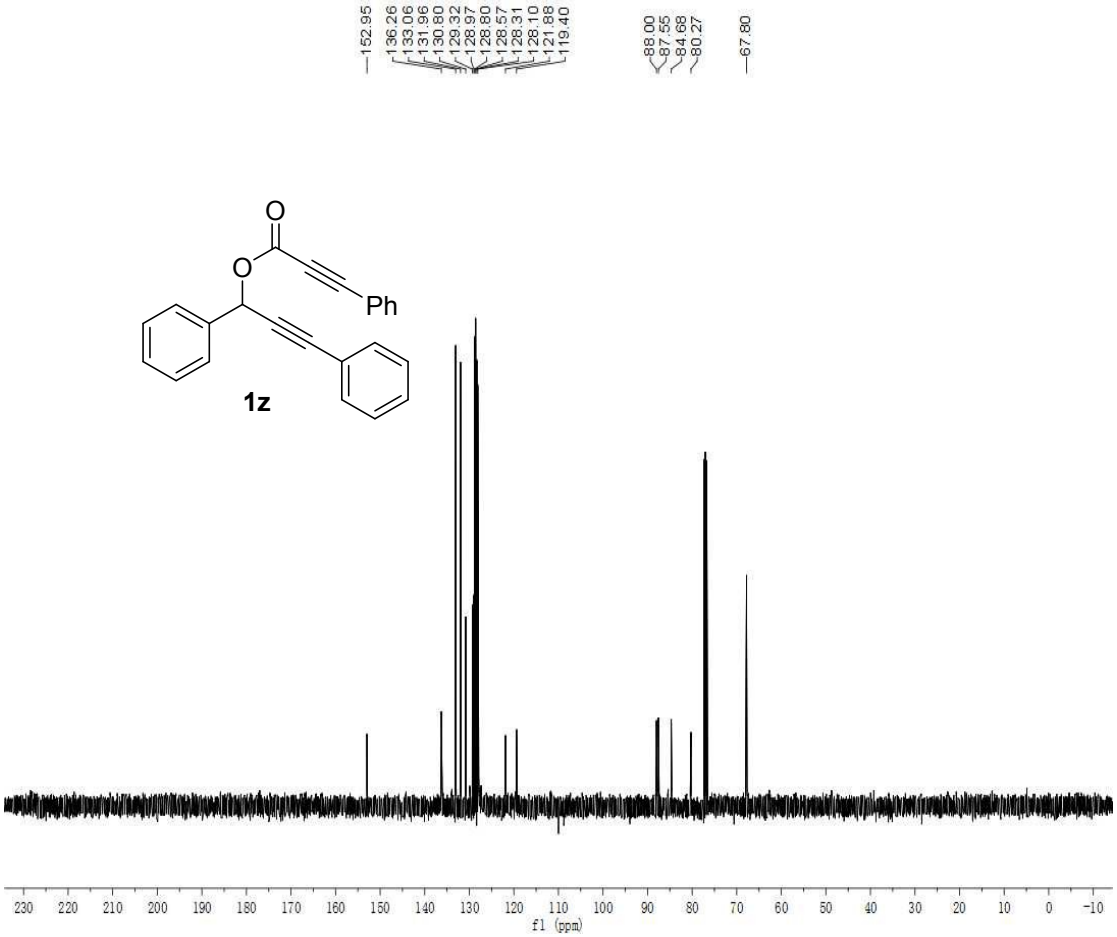
O
O
Ph
1z
2.08
2.06
2.04
4.07
5.03
1.00
f1 (ppm)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128.80
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128.31
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88.00
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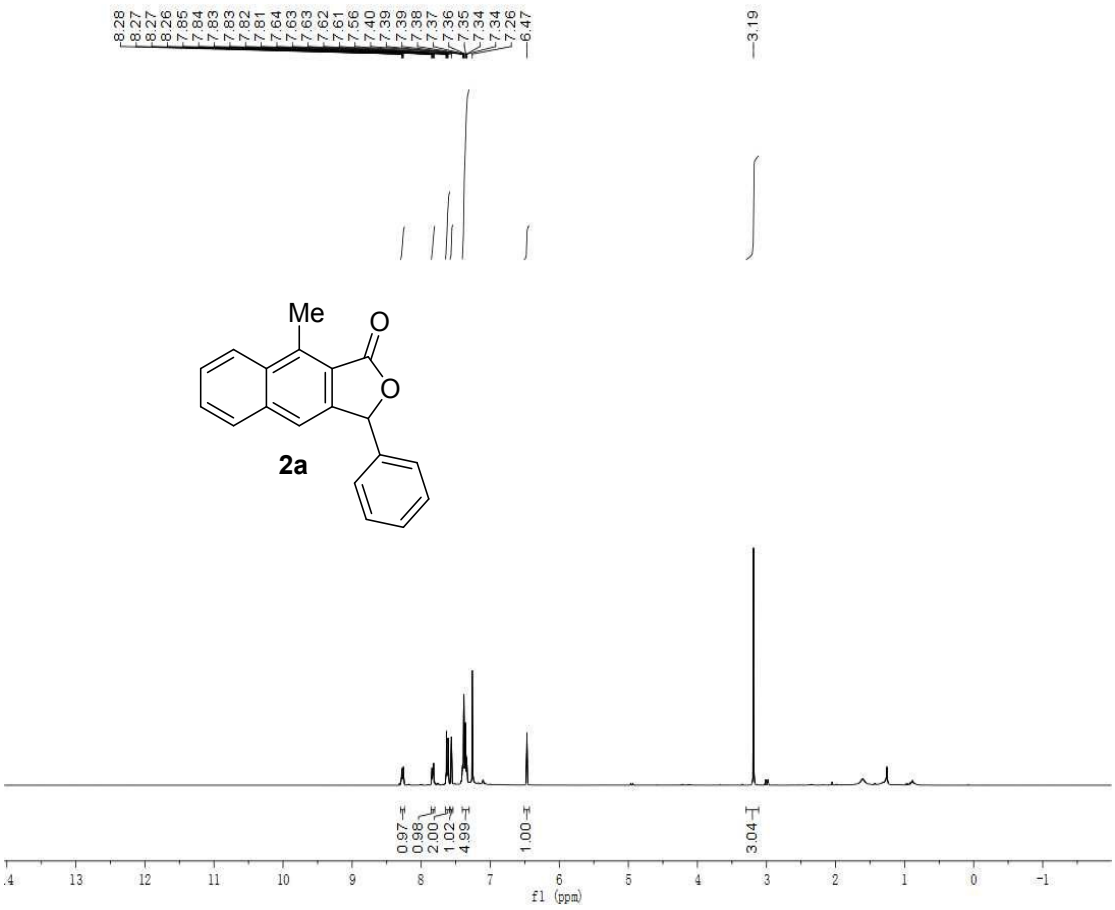
84.68
80.27
67.80
O
O
Ph
1z
f1 (ppm)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7.83
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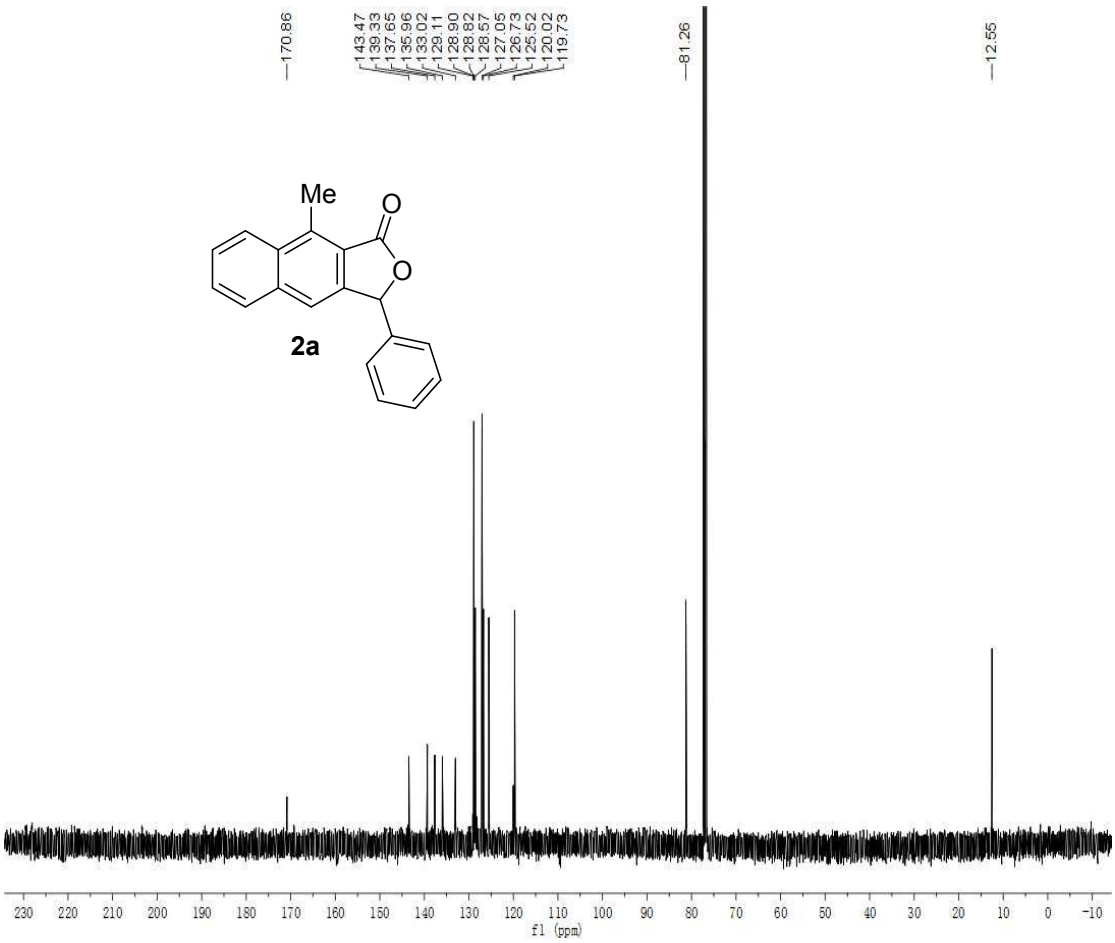
7.81
7.64
7.63
7.63
7.62
7.61
7.56
7.40
7.39
7.39
7.38
7.37
7.36
7.35
7.34
7.34
7.26
6.47
3.19
Me
O
O
2a
0.97
0.98
2.00
1.02
4.99
1.00
3.04
f1 (ppm)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126.73
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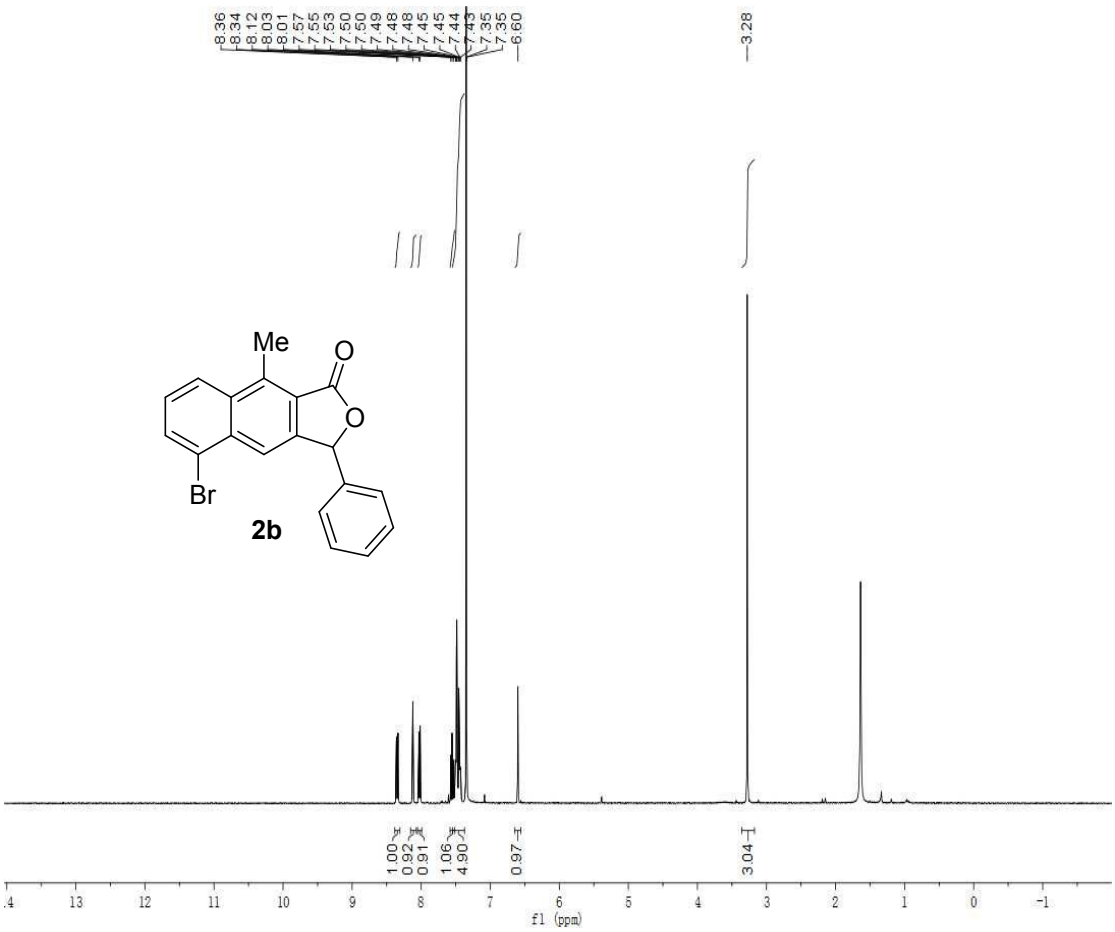
81.26
12.55
Me
O
O
2a
f1 (ppm)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8.01
7.57
7.55
7.53
7.50
7.50
7.49
7.48
7.48
7.45
7.45
7.44
7.43
7.35
7.35
6.60
3.28
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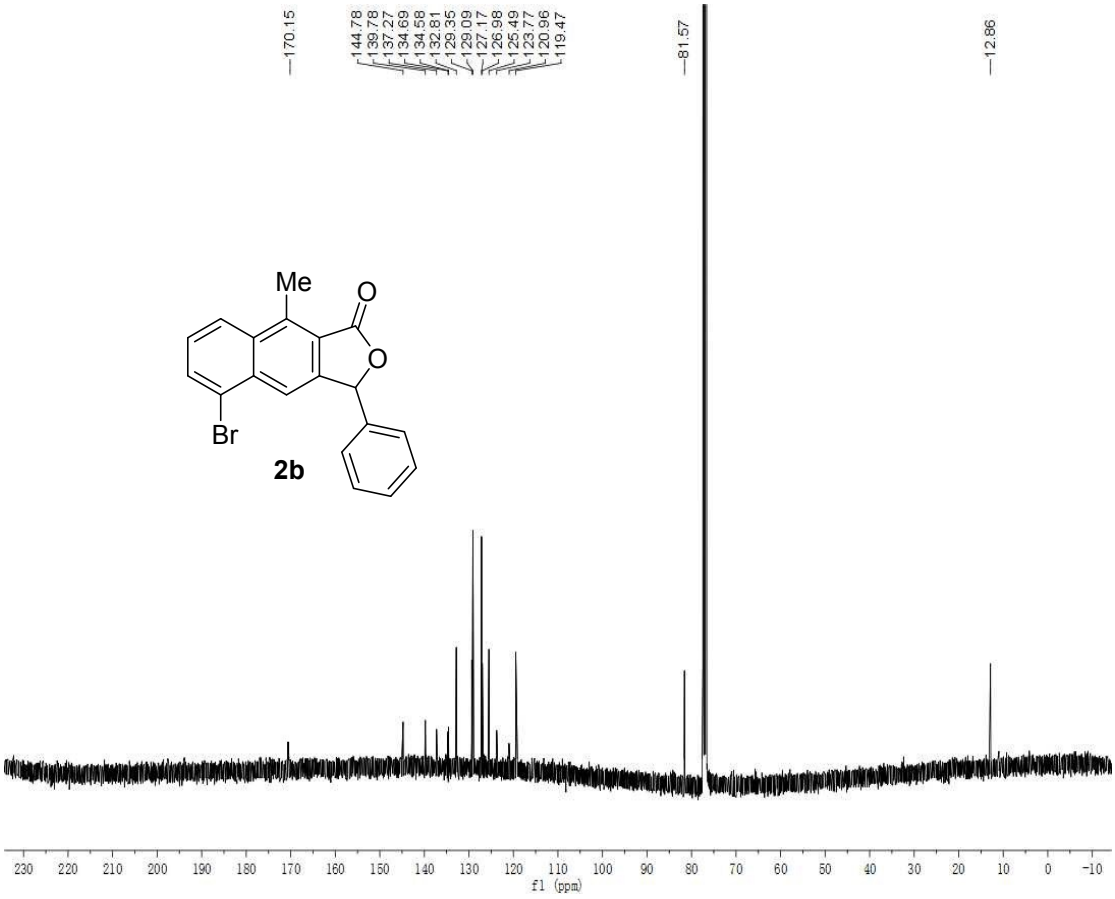
Br
2b
1.00
0.92
0.91
1.06
4.90
0.97
3.04
f1 (ppm)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129.35
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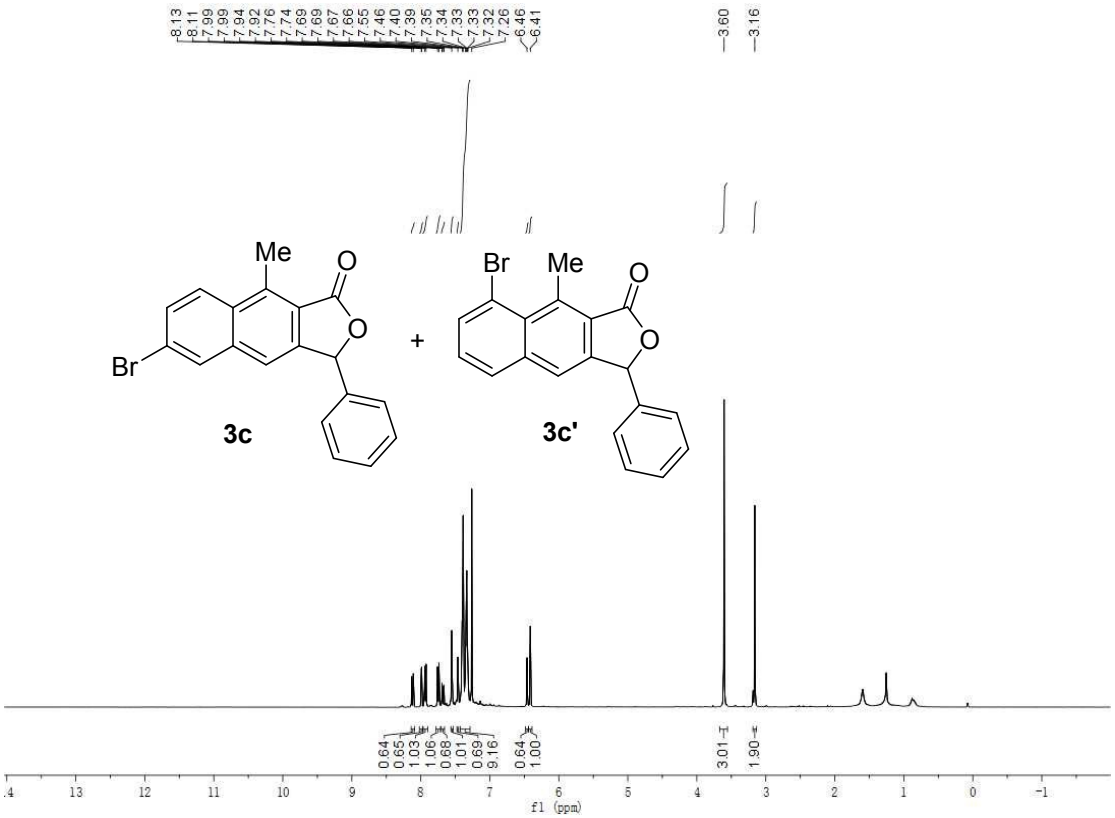
123.77
120.96
119.47
81.57
12.86
Me
O
O
Br
2b
f1 (ppm)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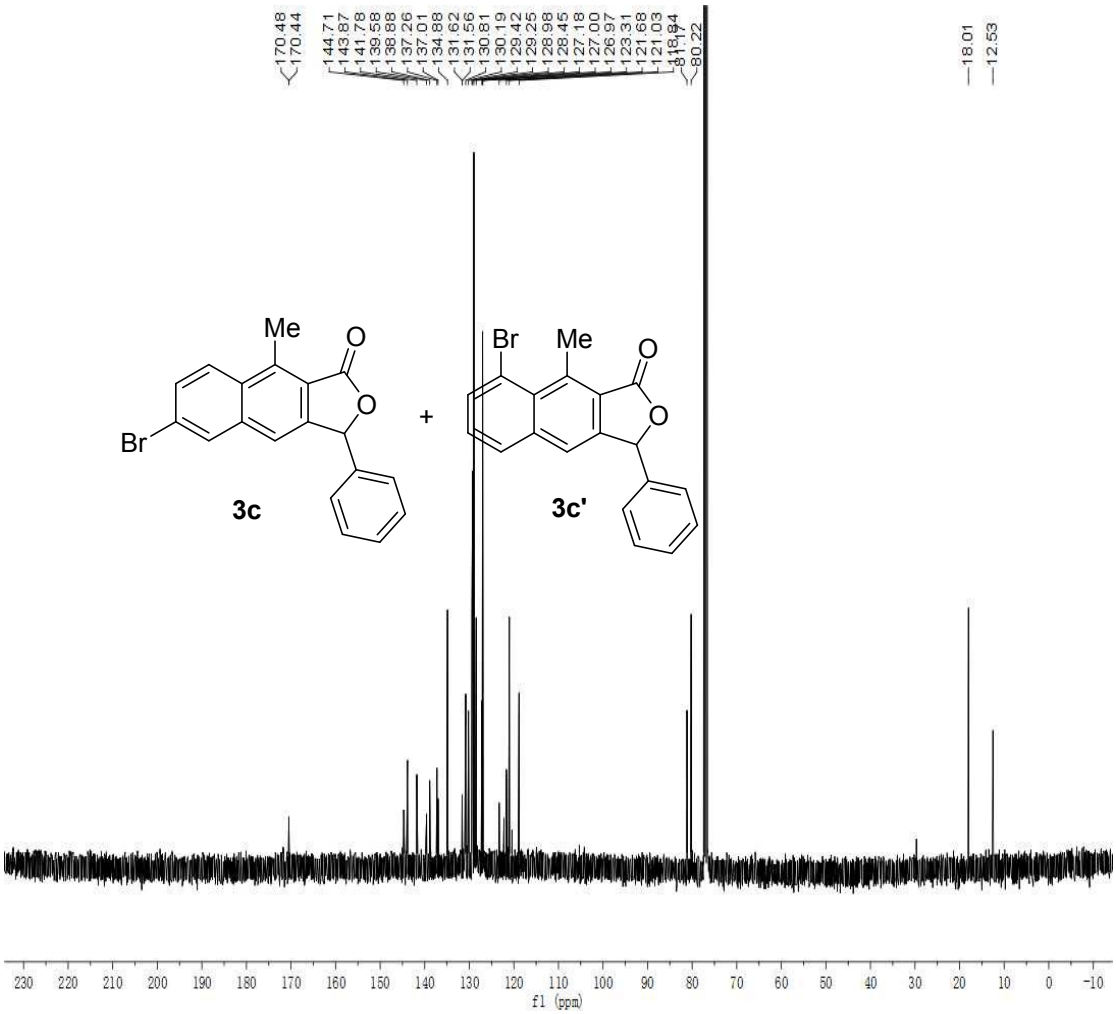
7.99
7.94
7.92
7.76
7.74
7.69
7.69
7.67
7.66
7.55
7.46
7.40
7.39
7.35
7.34
7.33
7.33
7.32
7.26
6.46
6.41
3.60
3.16
Me
O
O
Br
3c
+
Br
Me
O
O
3c'
0.64
0.65
1.03
1.06
0.68
1.01
0.69
9.16
0.64
1.00
3.01
1.90
f1 (ppm)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139.58
138.88
137.26
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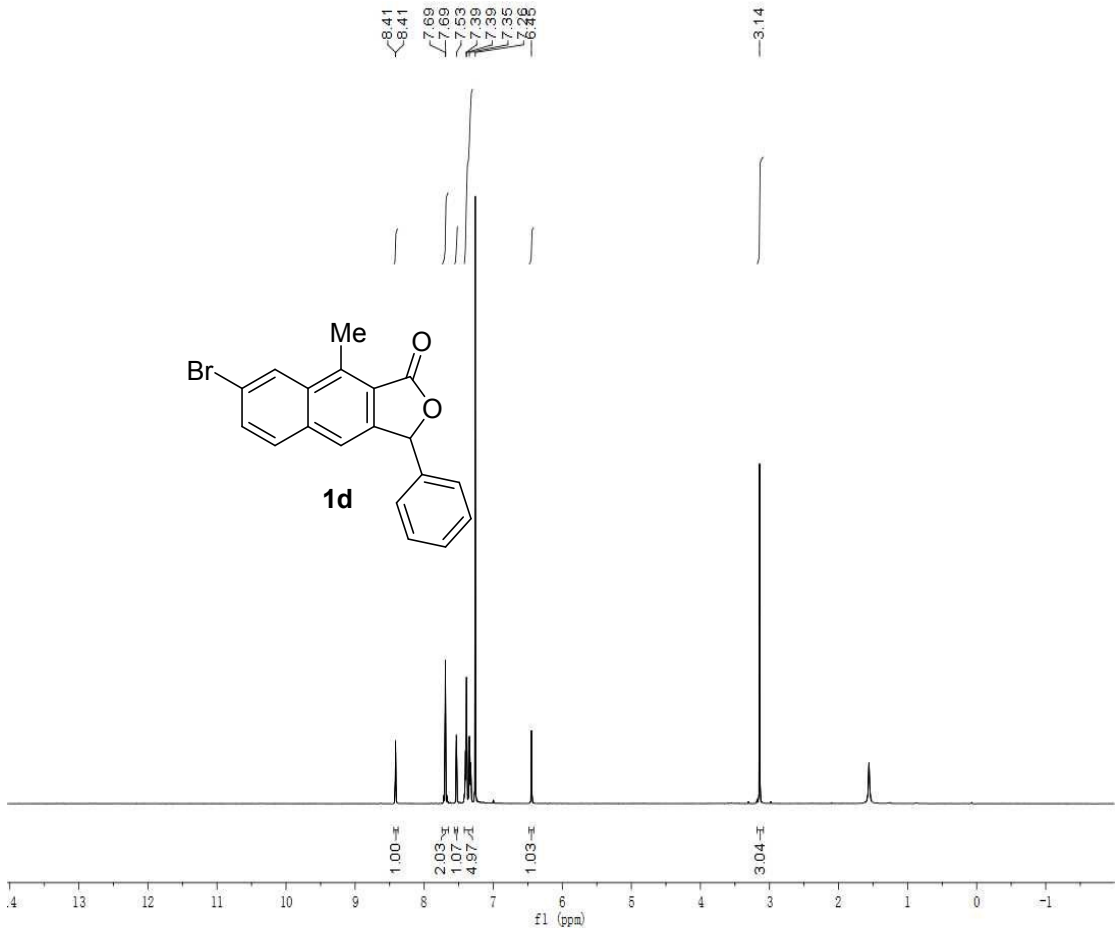
134.88
131.62
131.56
130.81
130.19
129.42
129.25
128.98
128.45
127.18
127.00
126.97
123.31
121.68
121.03
118.84
80.22
18.01
12.53
Me
O
O
Br
3c
+
Br
Me
O
O
3c'
f1 (ppm)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8.41
7.69
7.69
7.53
7.39
7.39
7.35
7.26
6.45
3.14
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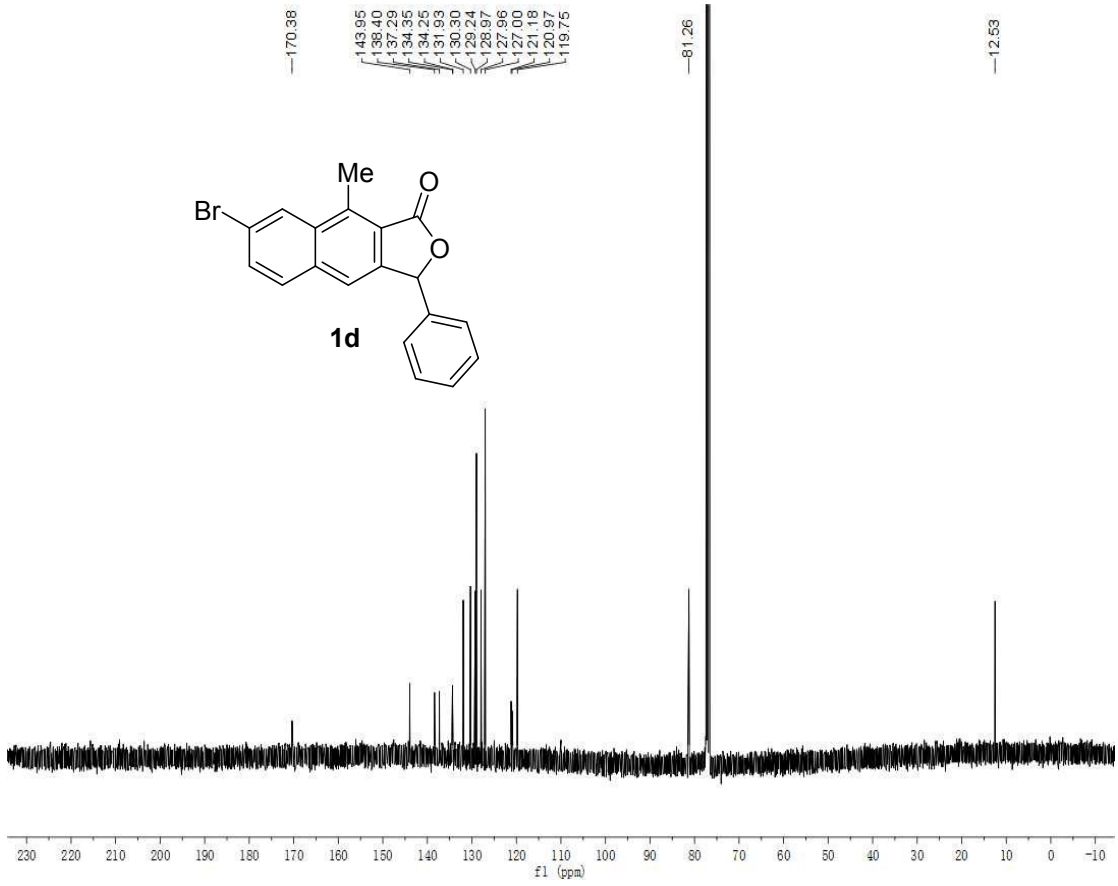
O
Br
O
1d
1.00
2.03
1.07
4.97
1.03
3.04
f1 (ppm)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129.24
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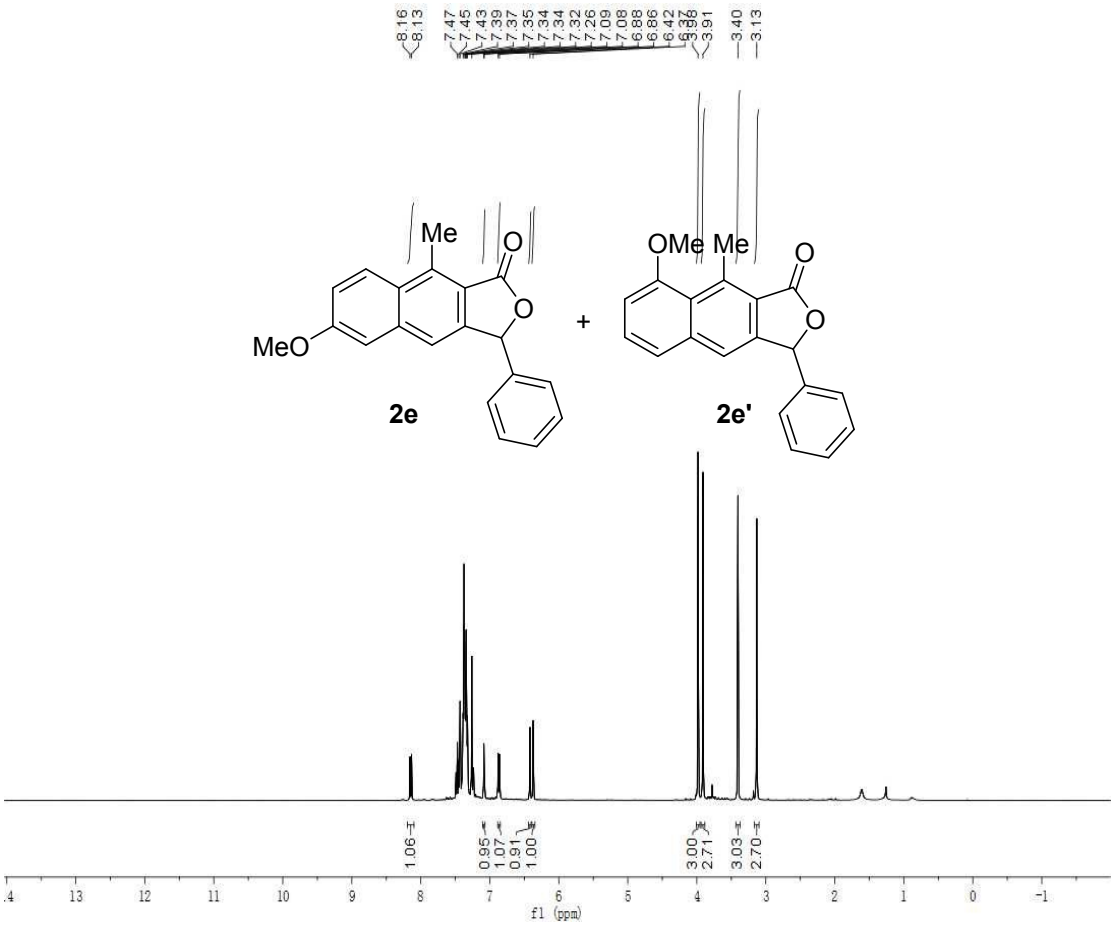
121.18
120.97
119.75
81.26
12.53
Me
O
Br
O
1d
f1 (ppm)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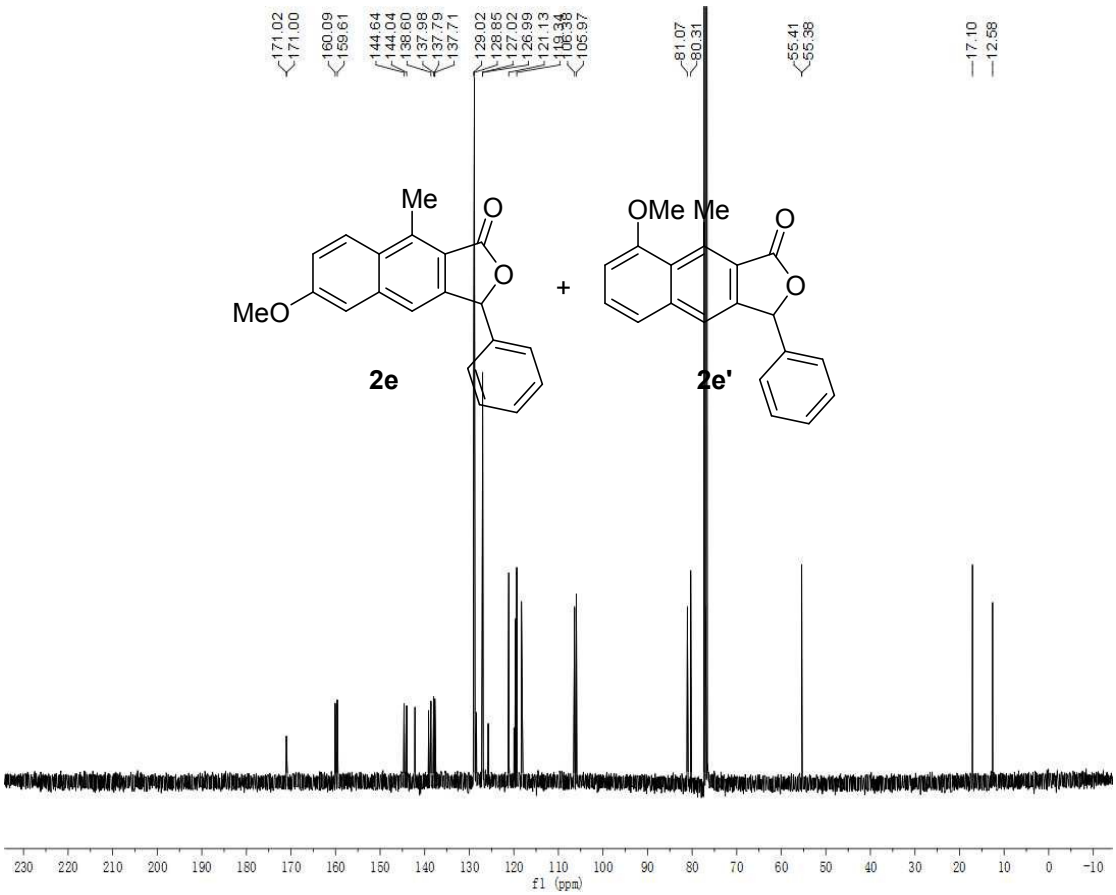
7.45
7.43
7.39
7.37
7.35
7.34
7.34
7.32
7.26
7.09
7.08
6.88
6.86
6.42
6.37
3.98
3.91
3.40
3.13
Me
O
MeO
O
+
OMe Me
O
O
2e
2e'
1.06
0.95
1.07
0.91
1.00
3.00
2.71
3.03
2.70
f1 (ppm)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137.79
137.71
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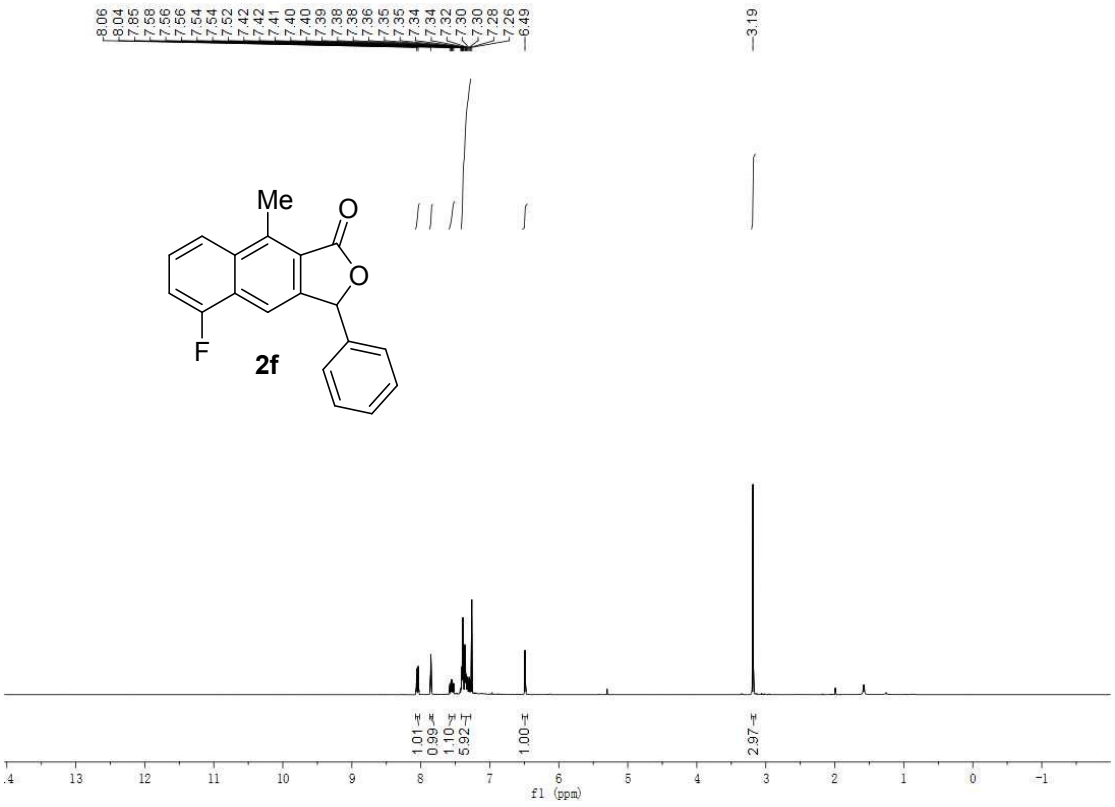
128.85
127.02
126.99
121.13
119.34
106.38
105.97
81.07
80.31
55.41
55.38
17.10
12.58
Me
O
MeO
O
+
OMe Me
O
O
2e
2e'
f1 (ppm)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7.56
7.54
7.54
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7.42
7.42
7.41
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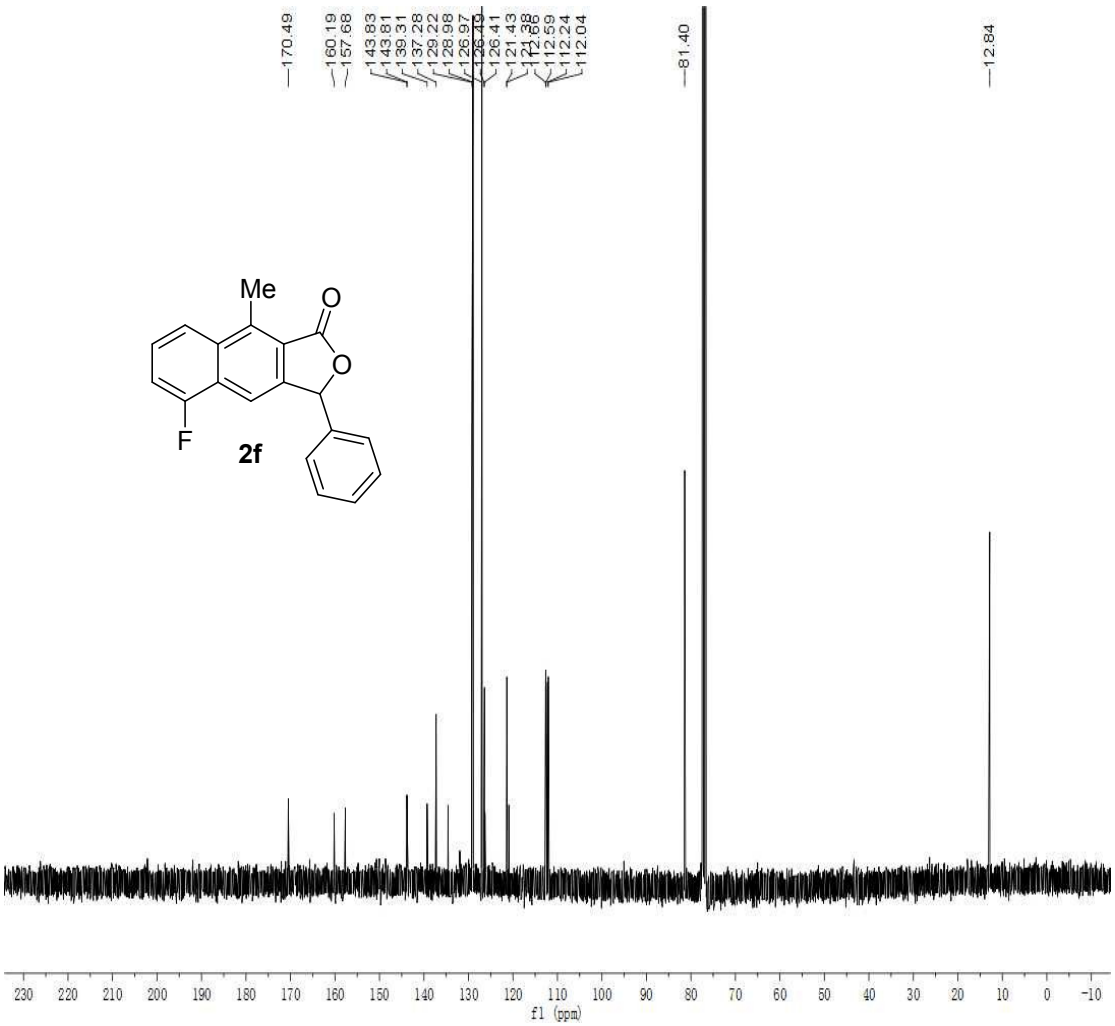
7.40
7.39
7.38
7.38
7.36
7.35
7.35
7.34
7.34
7.32
7.30
7.30
7.28
7.26
6.49
3.19
Me
O
O
F
2f
1.01
0.99
1.10
5.92
1.00
2.97
f1 (ppm)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126.49
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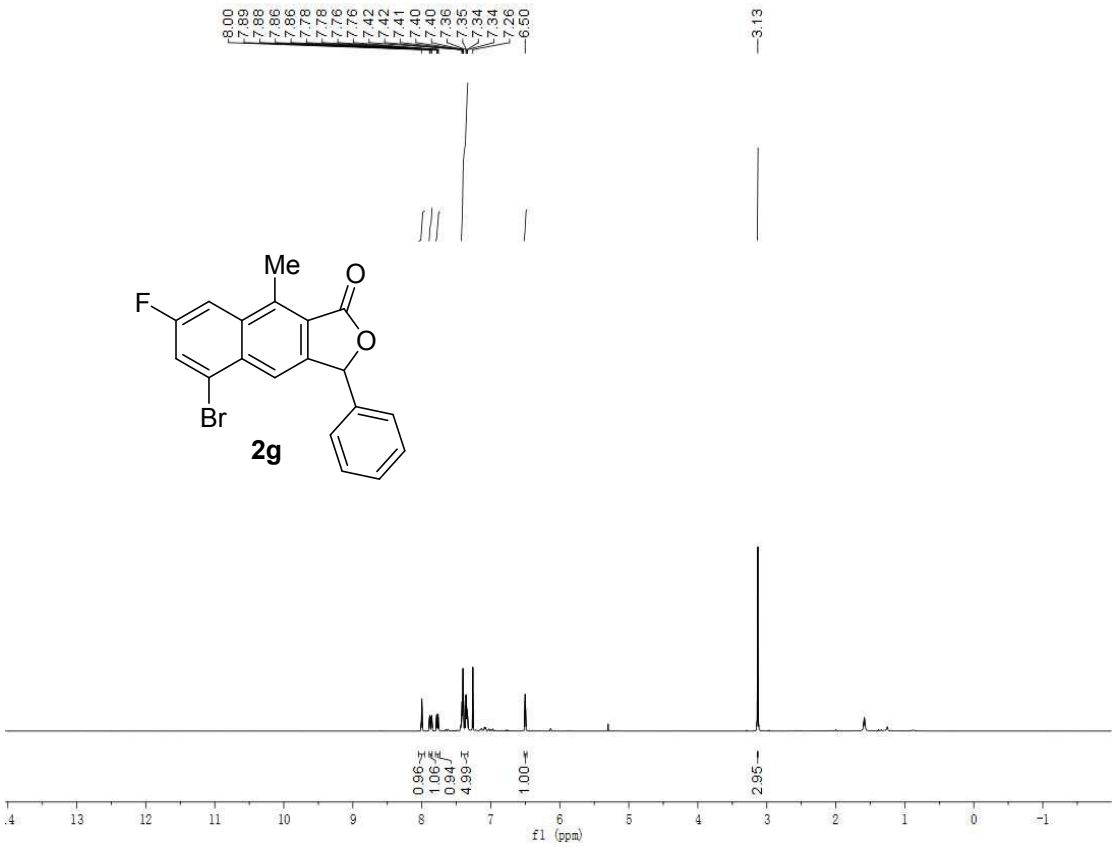
112.59
112.24
112.04
81.40
12.84
Me
O
O
F
2f
f1 (ppm)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7.41
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7.40
7.36
7.35
7.34
7.34
7.26
6.50
3.13
Me
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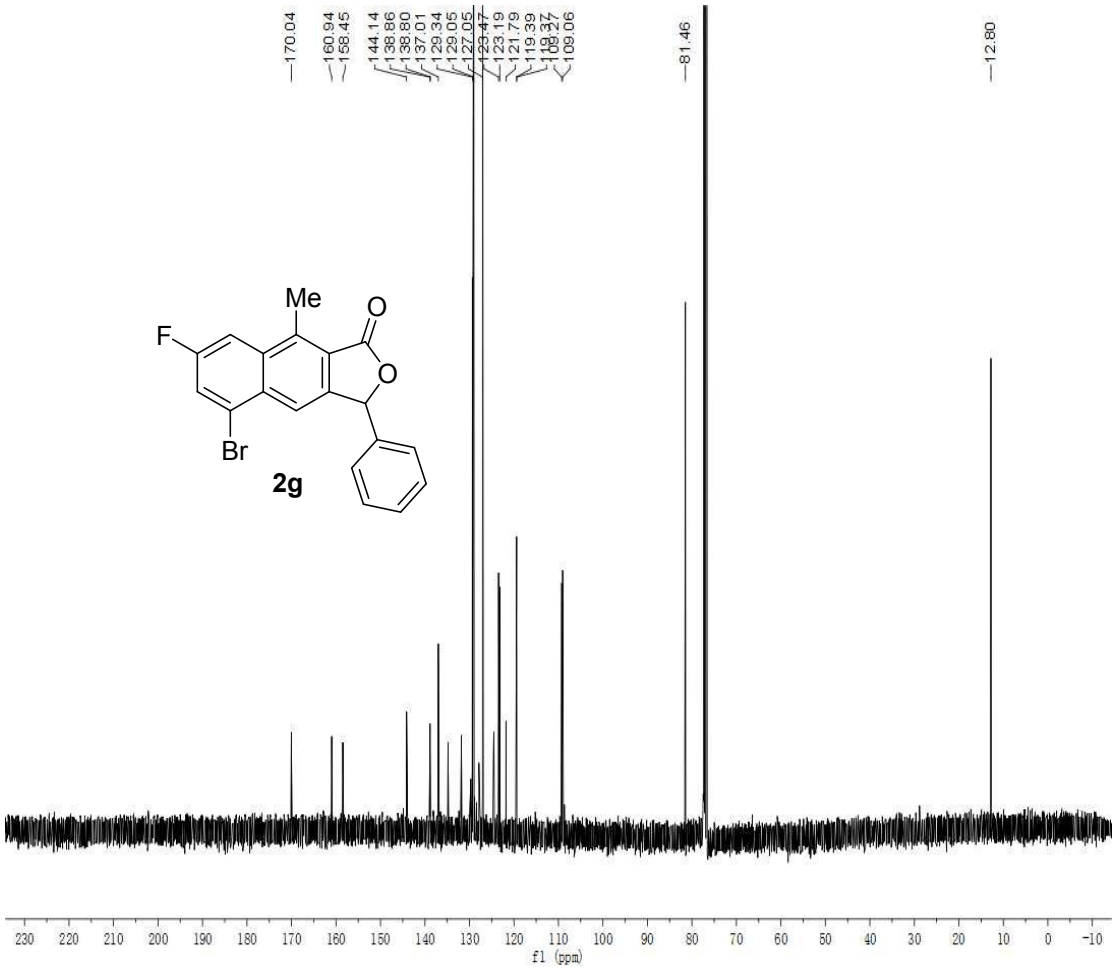
F
O
Br
2g
0.96
1.06
0.94
4.99
1.00
2.95
f1 (ppm)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158.45
144.14
138.86
138.80
137.01
129.34
129.05
127.05
123.47
123.19
121.79
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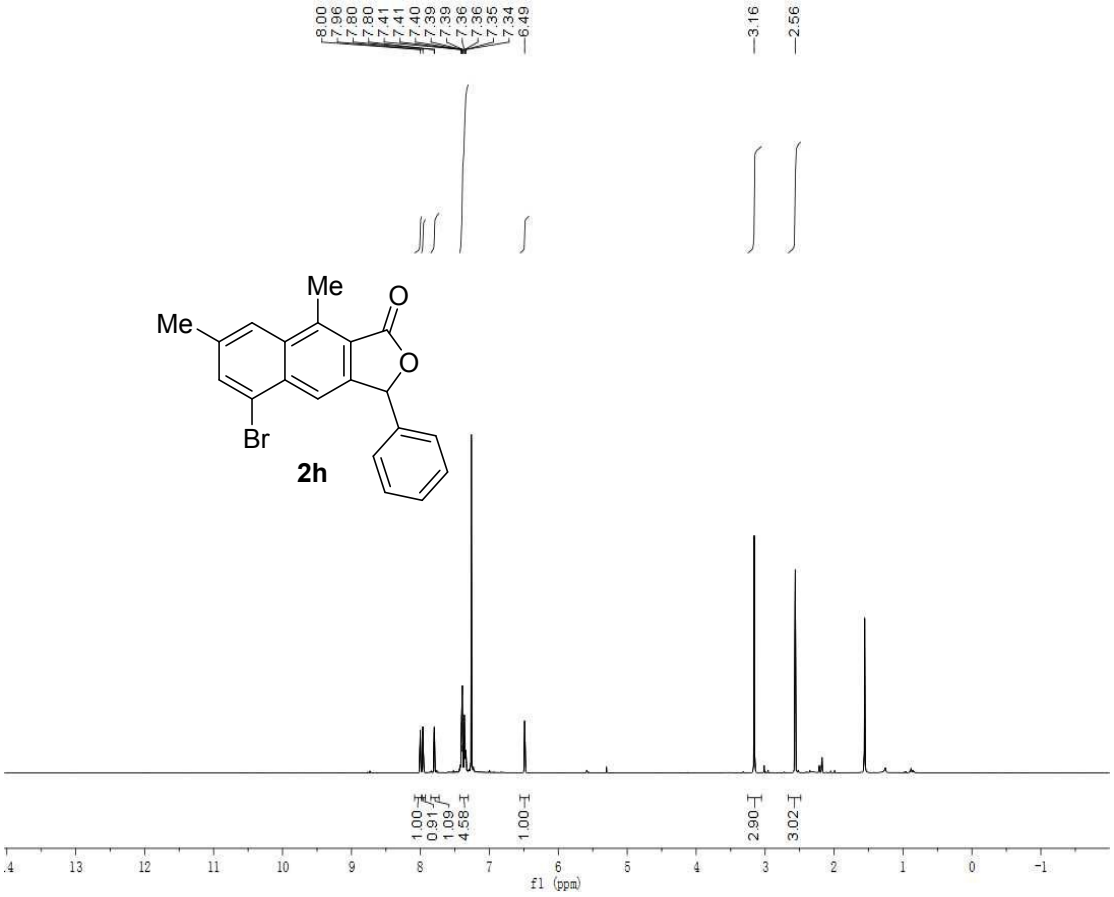
109.27
109.06
81.46
12.80
Me
O
F
O
Br
2g
f1 (ppm)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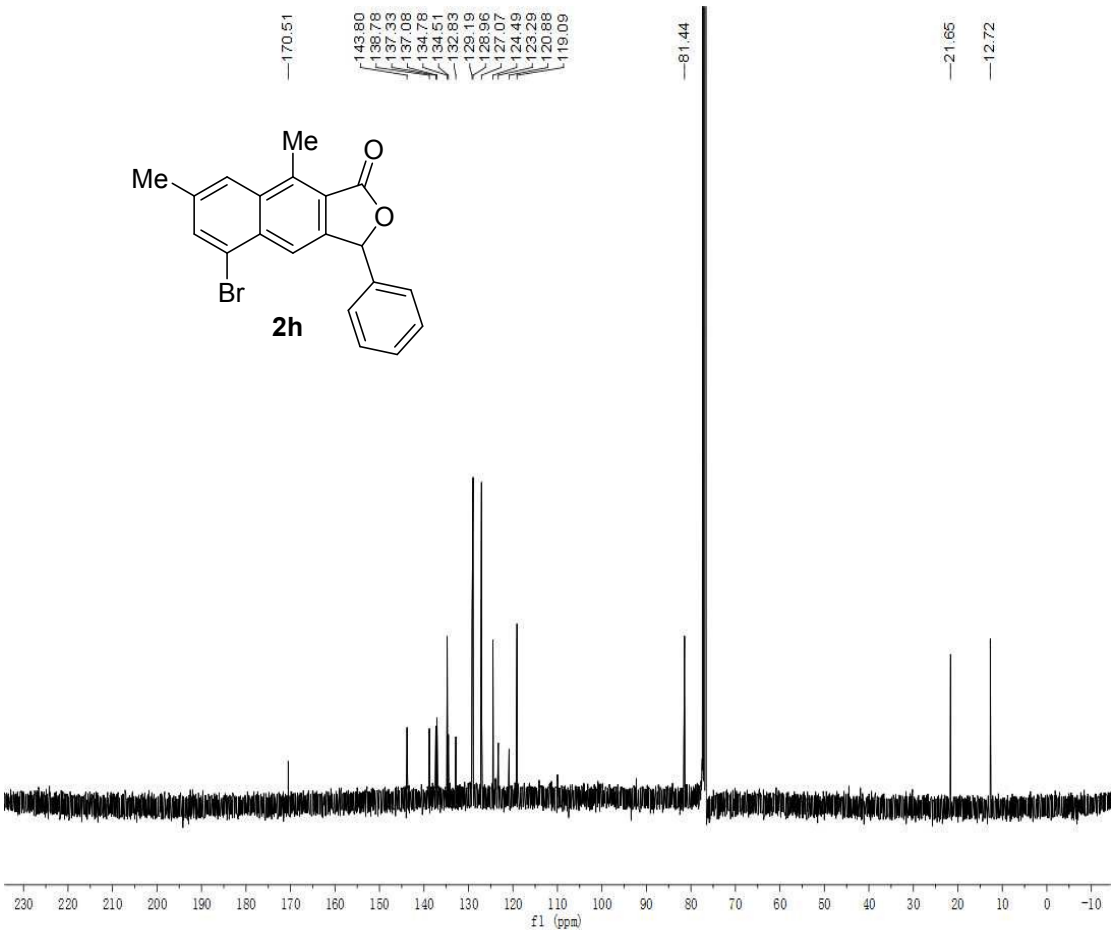
7.39
7.39
7.36
7.36
7.35
7.34
6.49
3.16
2.56
Me
Me
O
O
Br
2h
1.00
0.91
1.09
4.58
1.00
2.90
3.02
f1 (ppm)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127.07
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119.09
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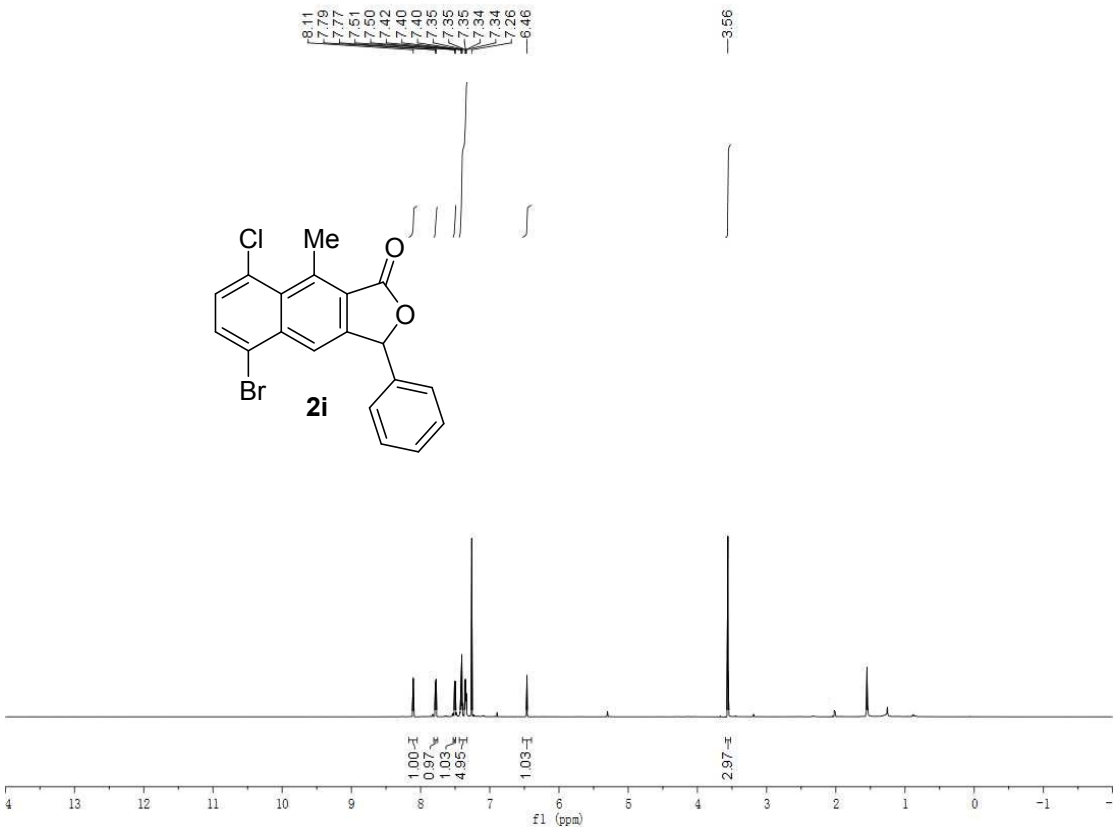
21.65
12.72
Me
Me
O
O
Br
2h
f1 (ppm)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7.40
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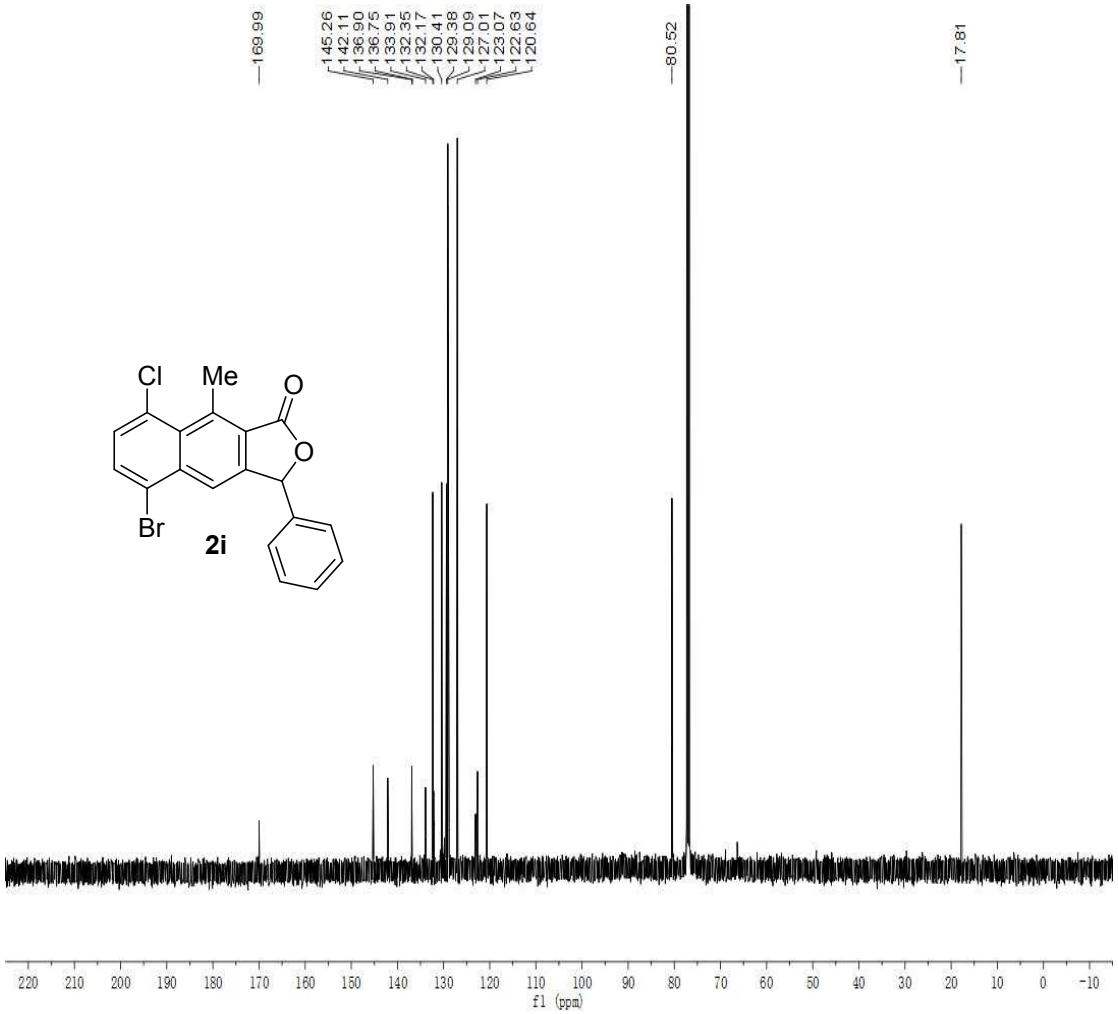
7.35
7.34
7.34
7.26
6.46
3.56
Cl
Me
O
O
Br
2i
1.00
0.97
1.03
4.95
1.03
2.97
f1 (ppm)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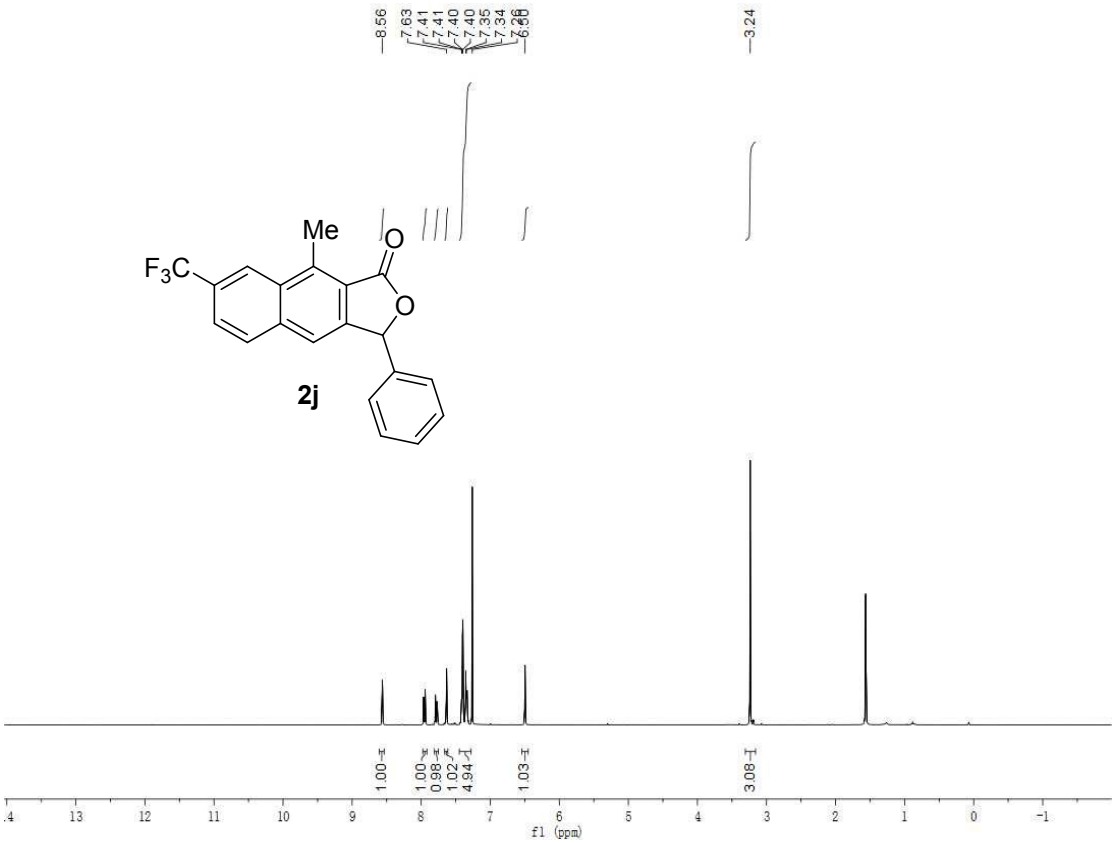
80.52
17.81
Cl
Me
O
O
Br
2i
f1 (ppm)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7.26
6.80
3.24
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O
F3C
O
2j
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1.00
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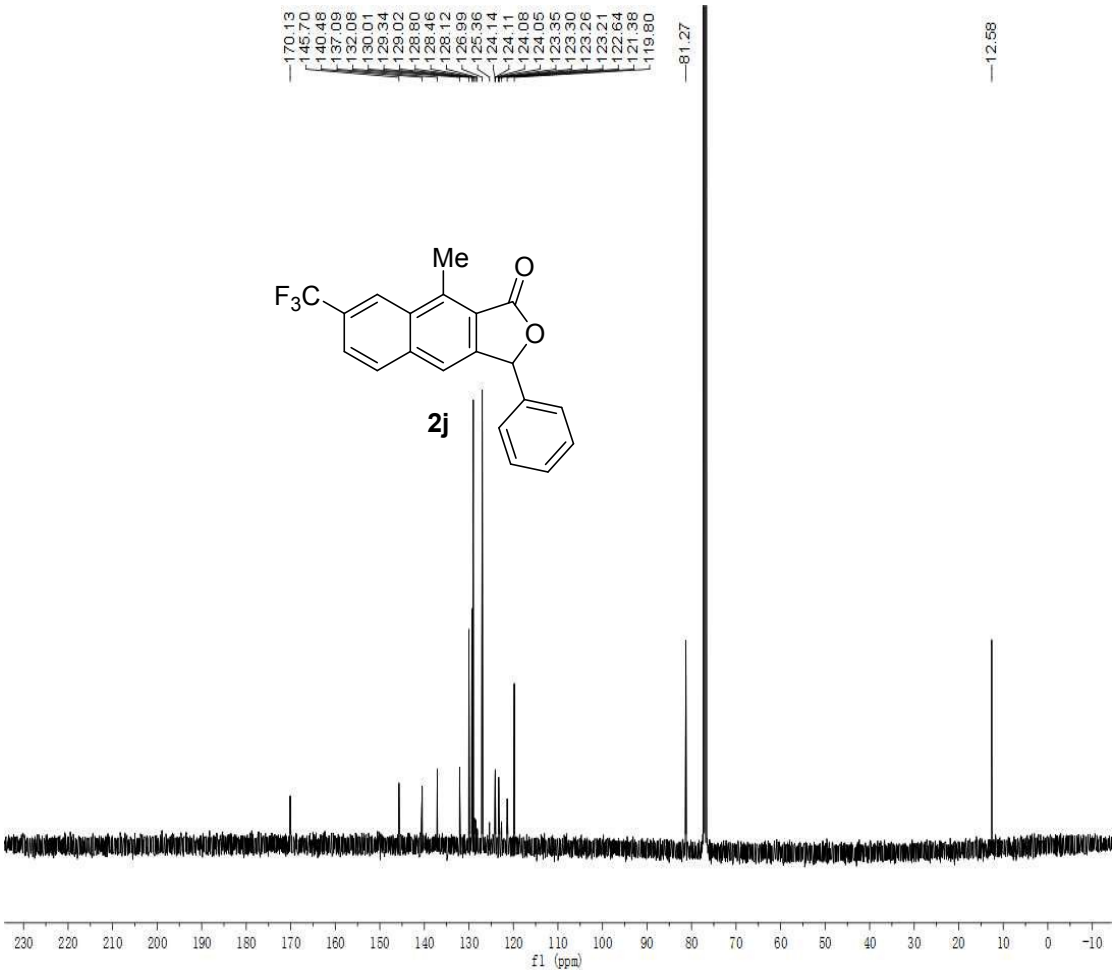
1.02
4.94
1.03
3.08
f1 (ppm)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129.02
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128.12
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124.11
124.08
124.05
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123.30
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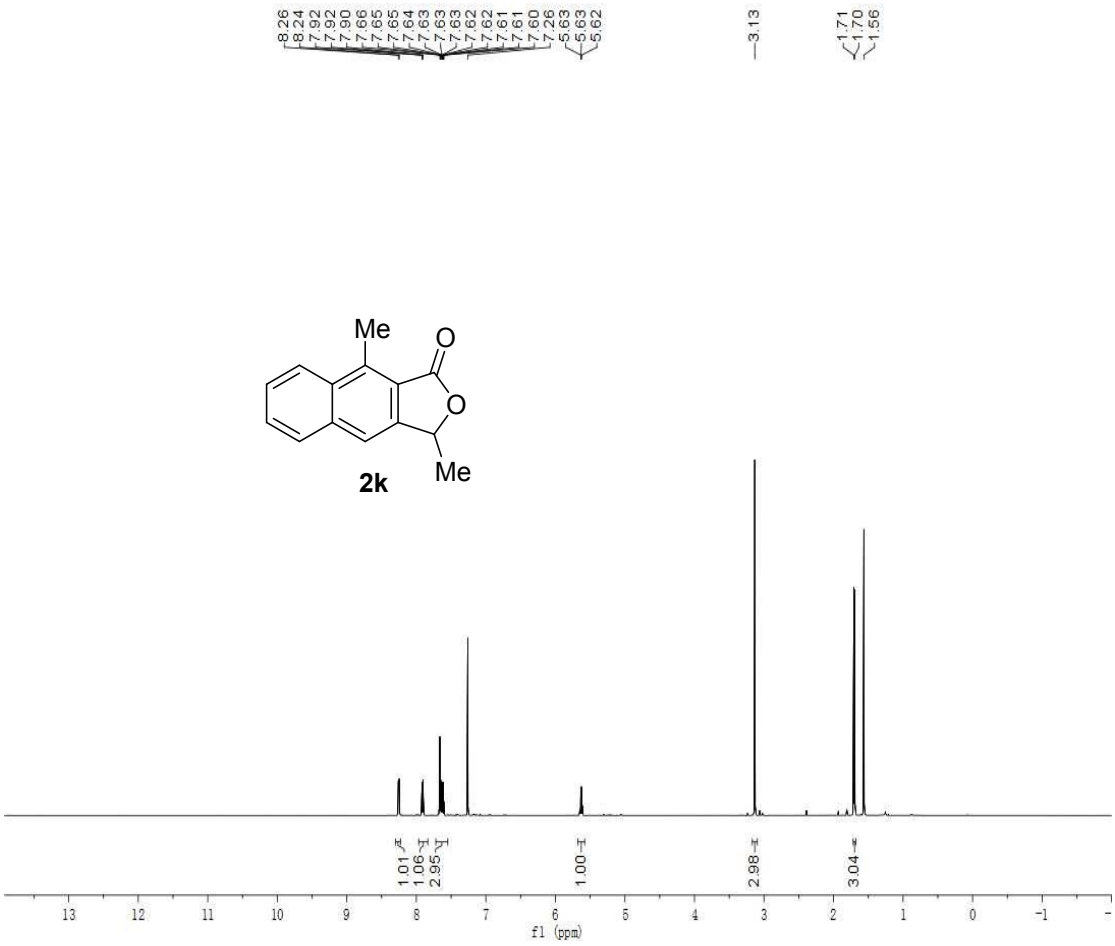
12.58
Me
O
F3C
O
2j
f1 (ppm)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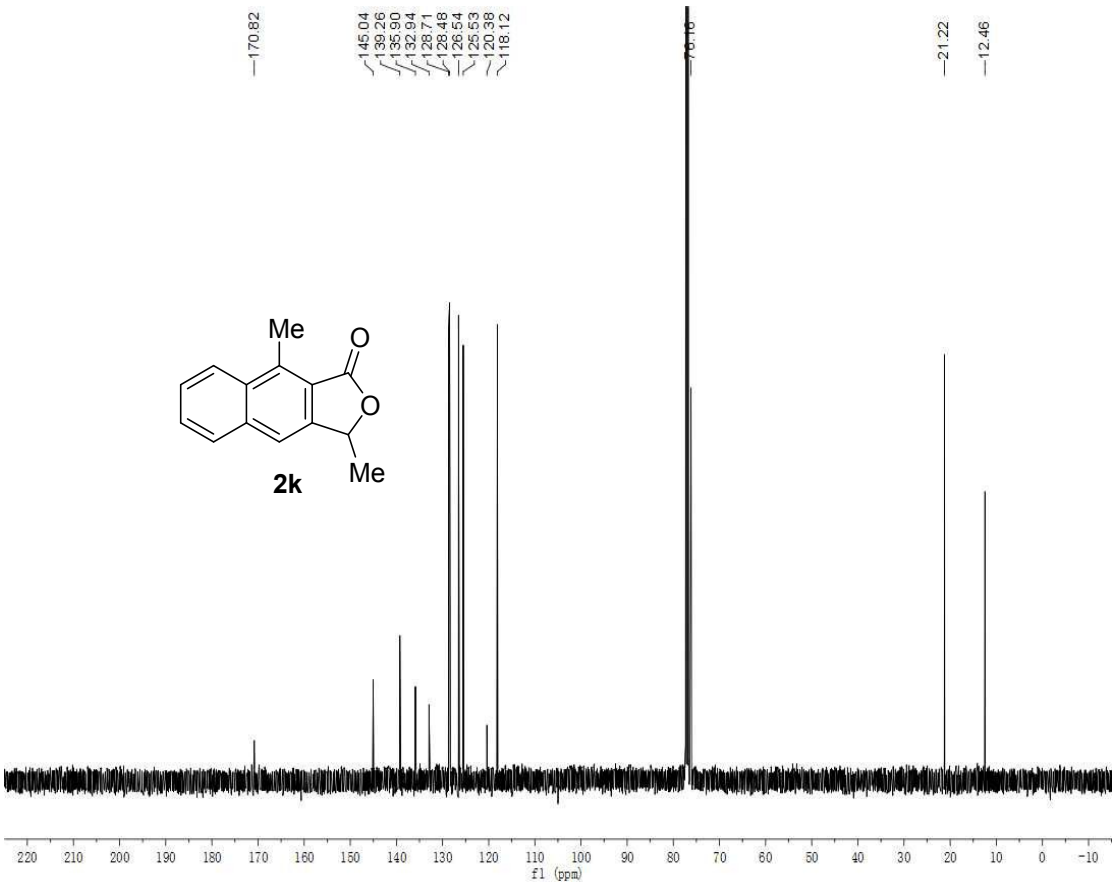
7.61
7.61
7.60
7.26
5.63
5.63
5.62
3.13
1.71
1.70
1.56
Me
O
O
Me
2k
1.01
1.06
2.95
1.00
2.98
3.04
f1 (ppm)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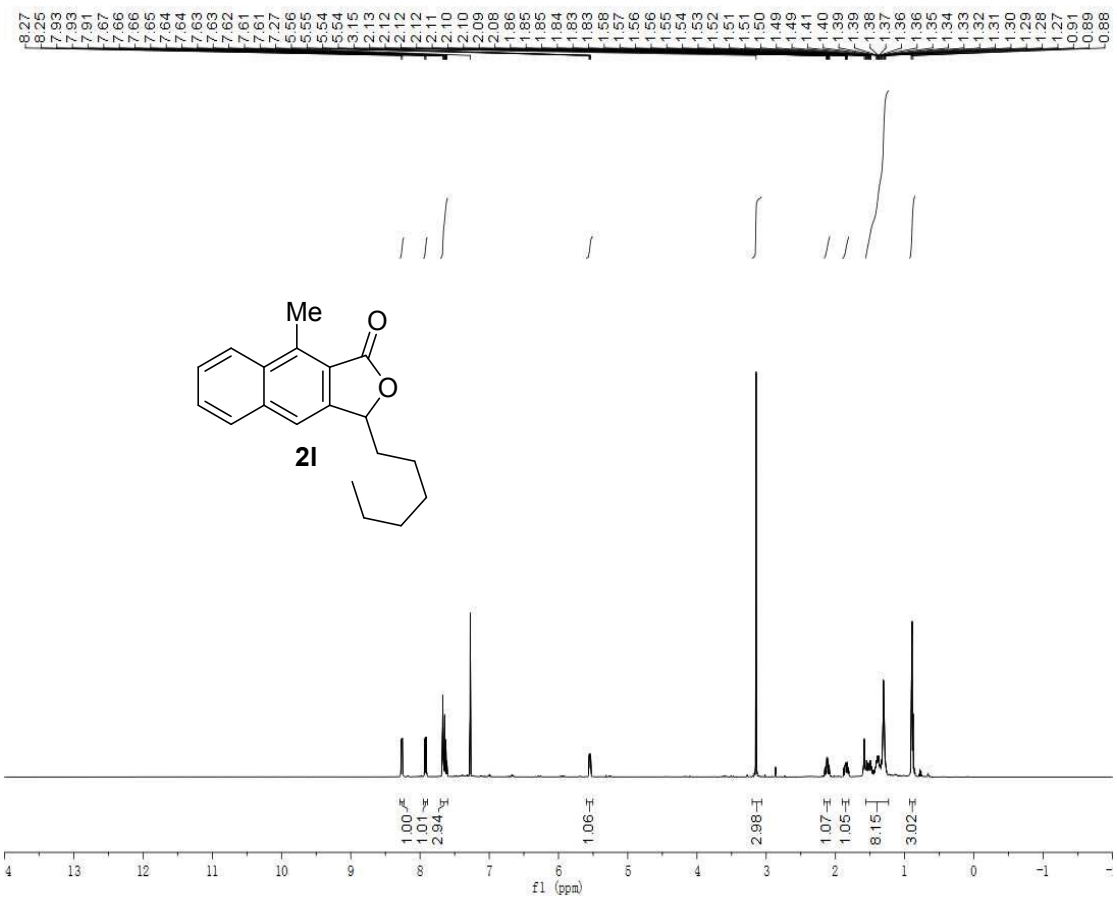
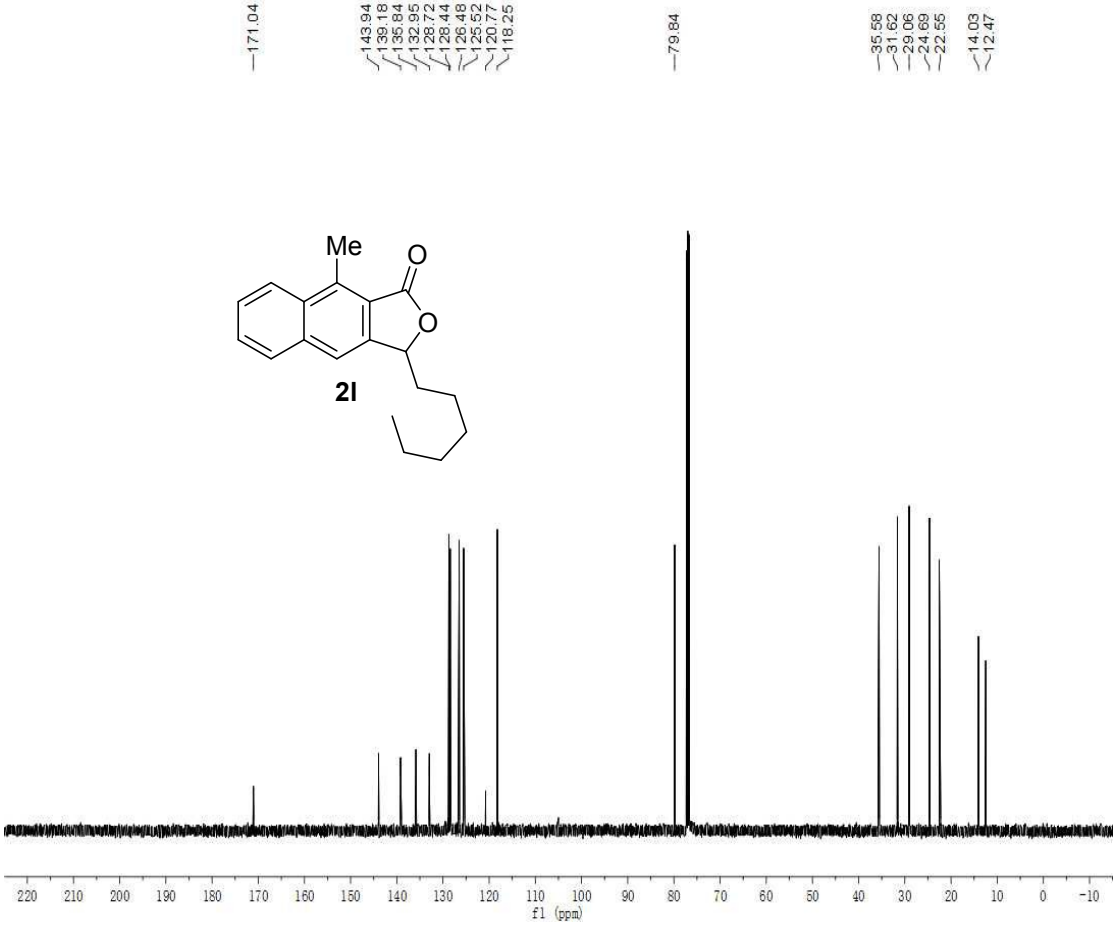
21.22
12.46
Me
O
O
Me
2k
f1 (ppm)


Me
O
O
2l
f1 (ppm)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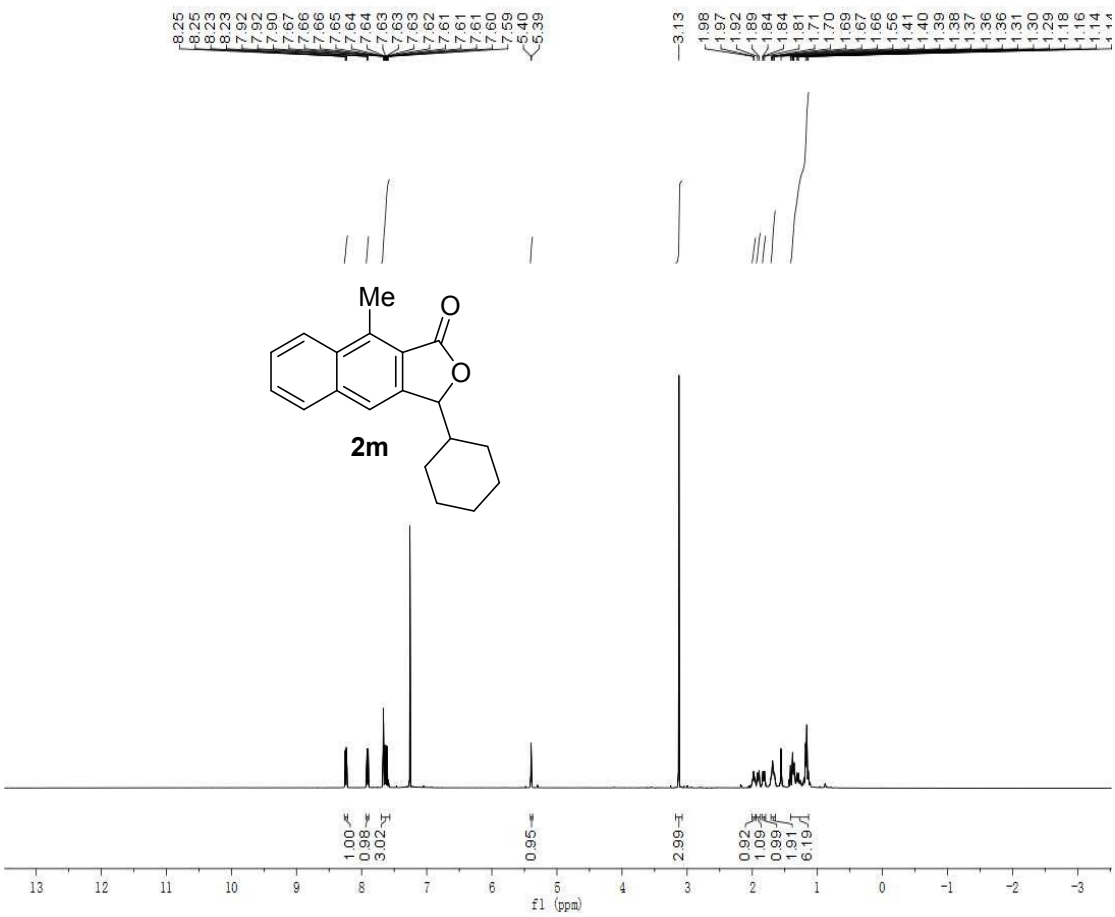
O
O
2l
f1 (ppm)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1.16
1.14
Me
O
O
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0.99
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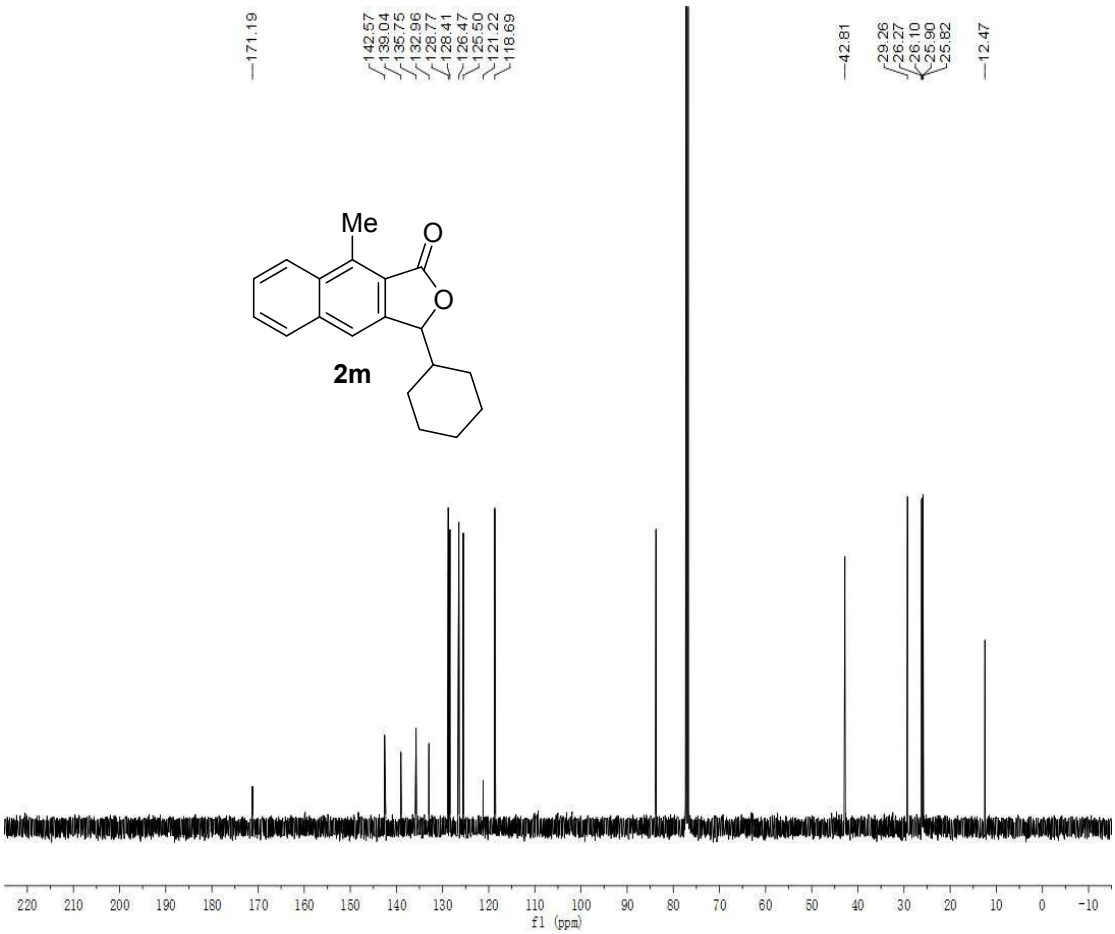
f1 (ppm)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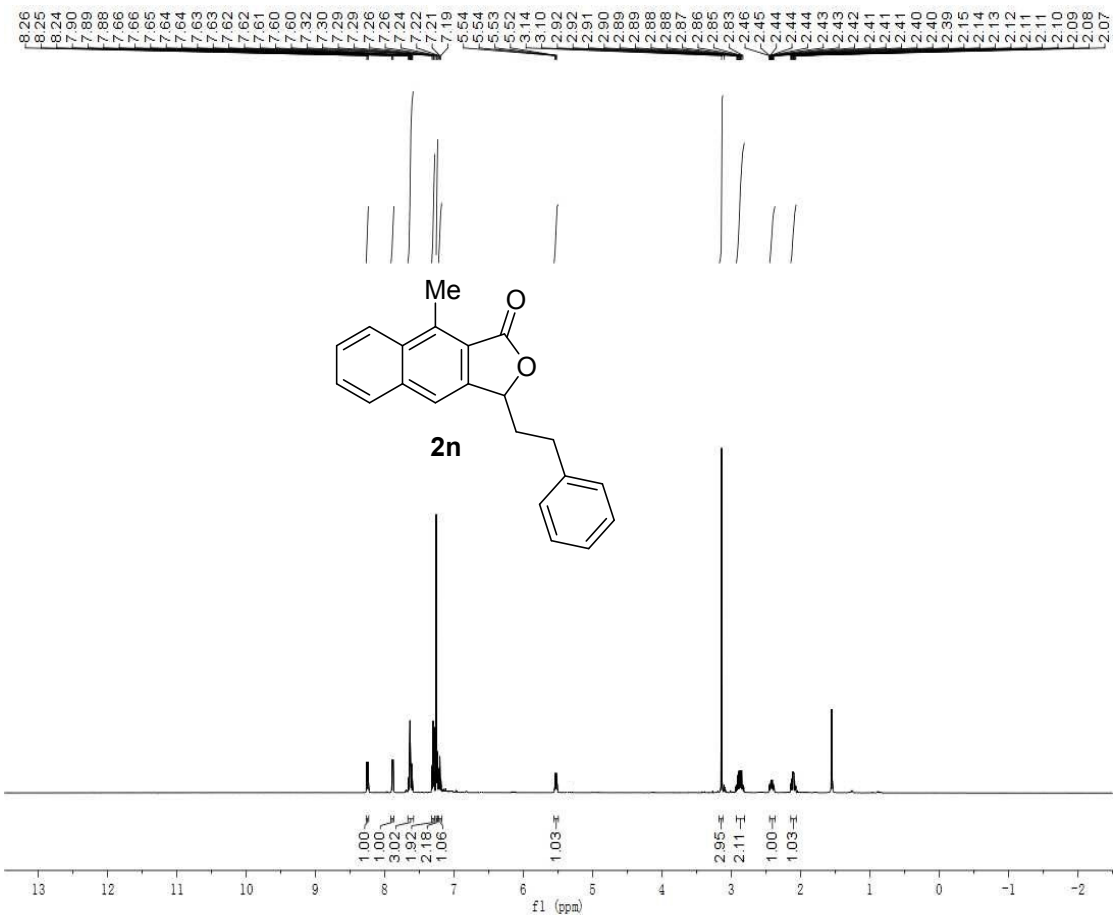
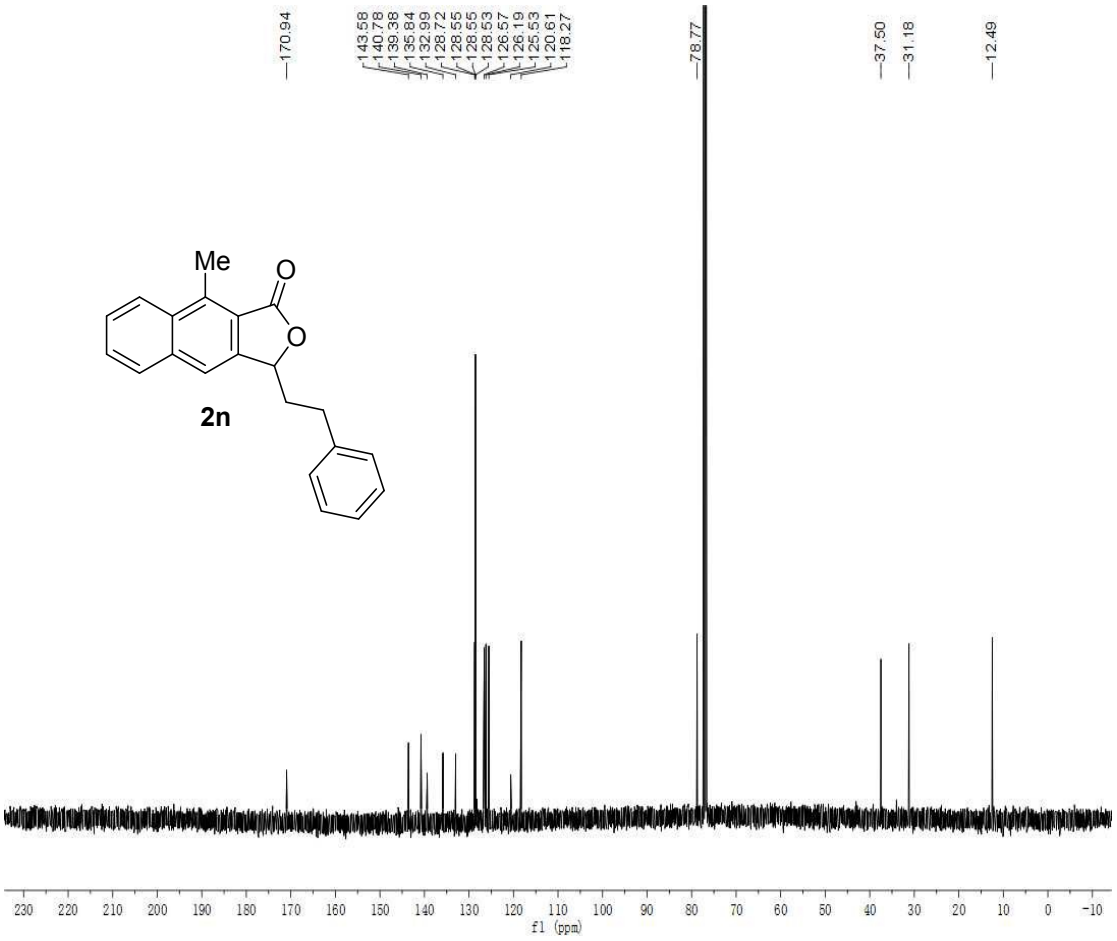
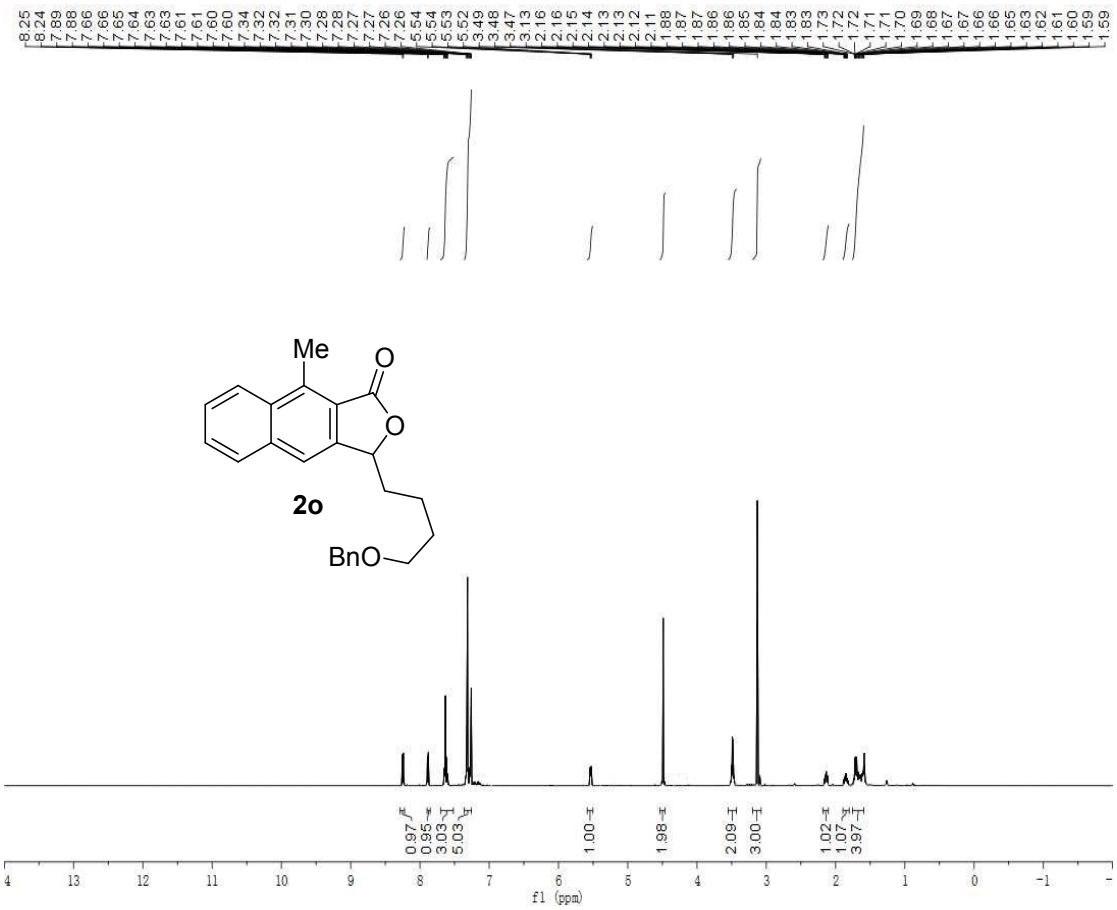
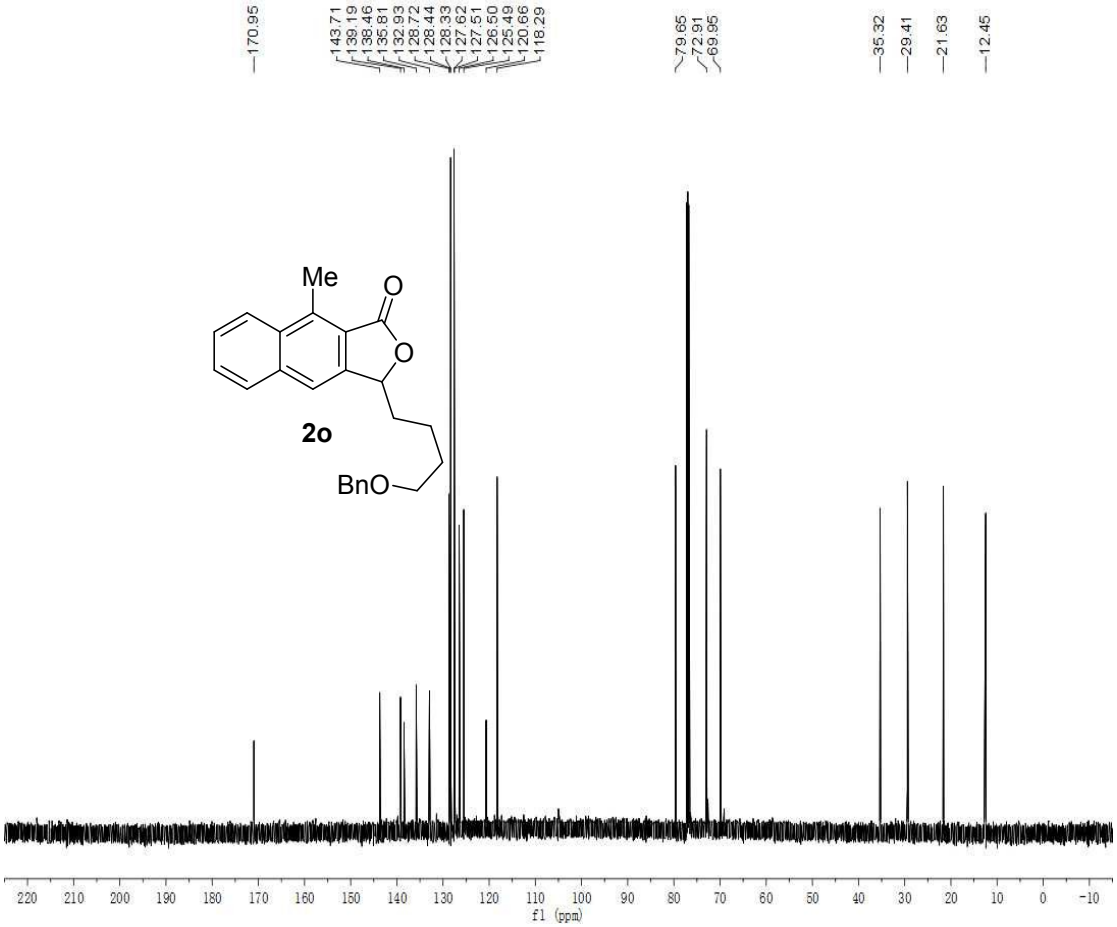
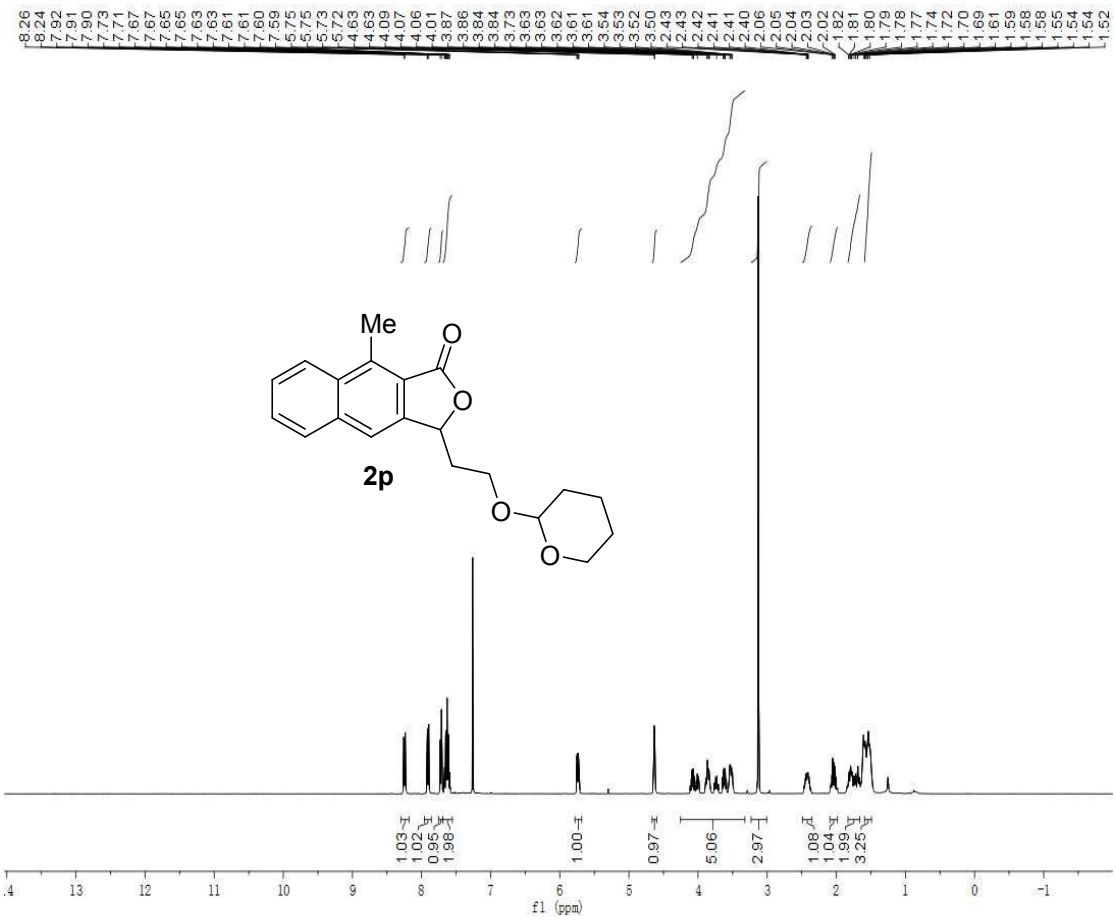
29.26
26.27
26.10
25.90
25.82
12.47
Me
O
O
2m
f1 (ppm)


Me
O
O
2n
f1 (ppm)


Me
O
O
2n
f1 (ppm)


Me
O
O
2o
BnO
f1 (ppm)


Me
O
O
2o
BnO
f1 (ppm)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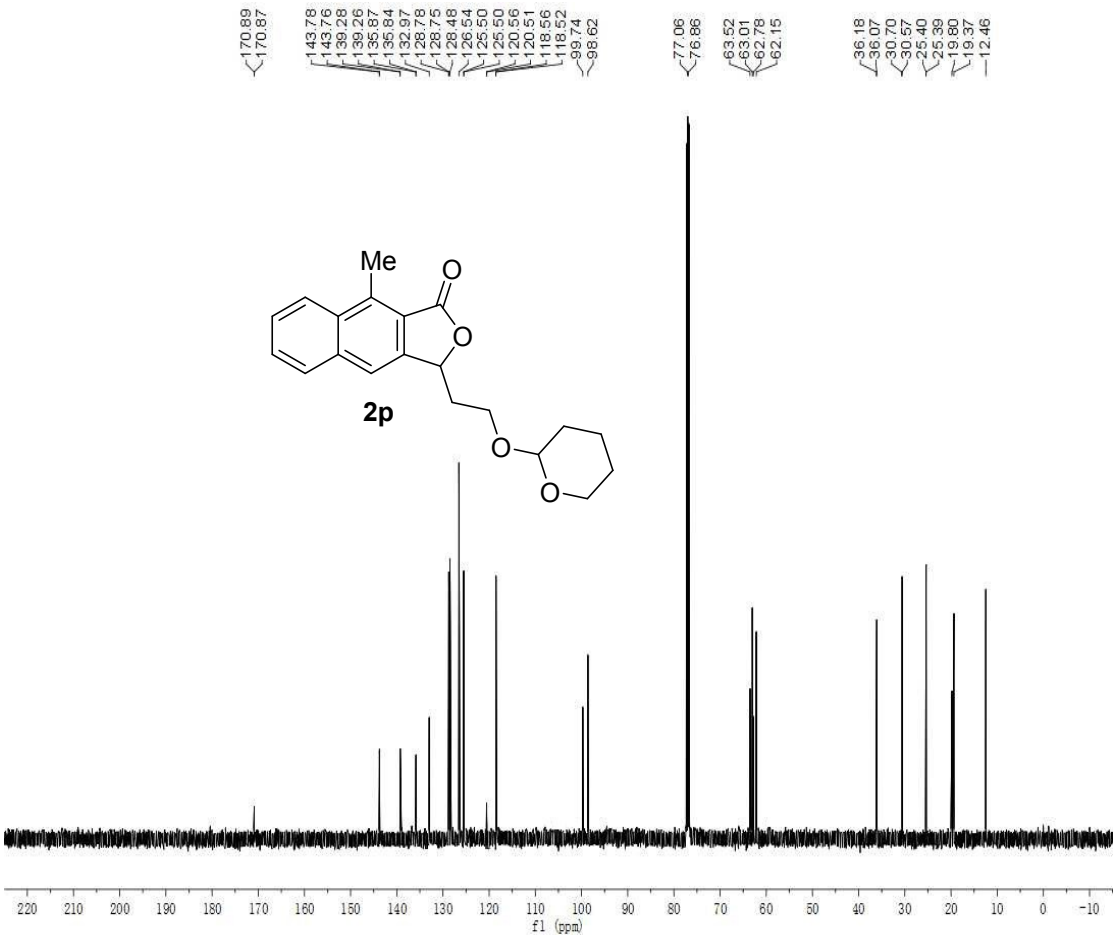
8.24
7.92
7.91
7.90
7.73
7.71
7.67
7.67
7.65
7.65
7.63
7.63
7.61
7.61
7.60
7.59
5.75
5.75
5.73
5.72
4.63
4.63
4.09
4.07
4.06
4.01
3.87
3.86
3.84
3.84
3.73
3.63
3.63
3.62
3.61
3.61
3.54
3.53
3.52
3.50
2.43
2.43
2.42
2.41
2.41
2.40
2.06
2.05
2.04
2.03
2.02
1.82
1.81
1.80
1.79
1.78
1.77
1.74
1.72
1.70
1.69
1.61
1.59
1.58
1.58
1.55
1.54
1.54
1.52
Me
O
O
O
O
2p
1.03
1.02
0.95
1.98
1.00
0.97
5.06
2.97
1.08
1.04
1.99
3.25
f1 (ppm)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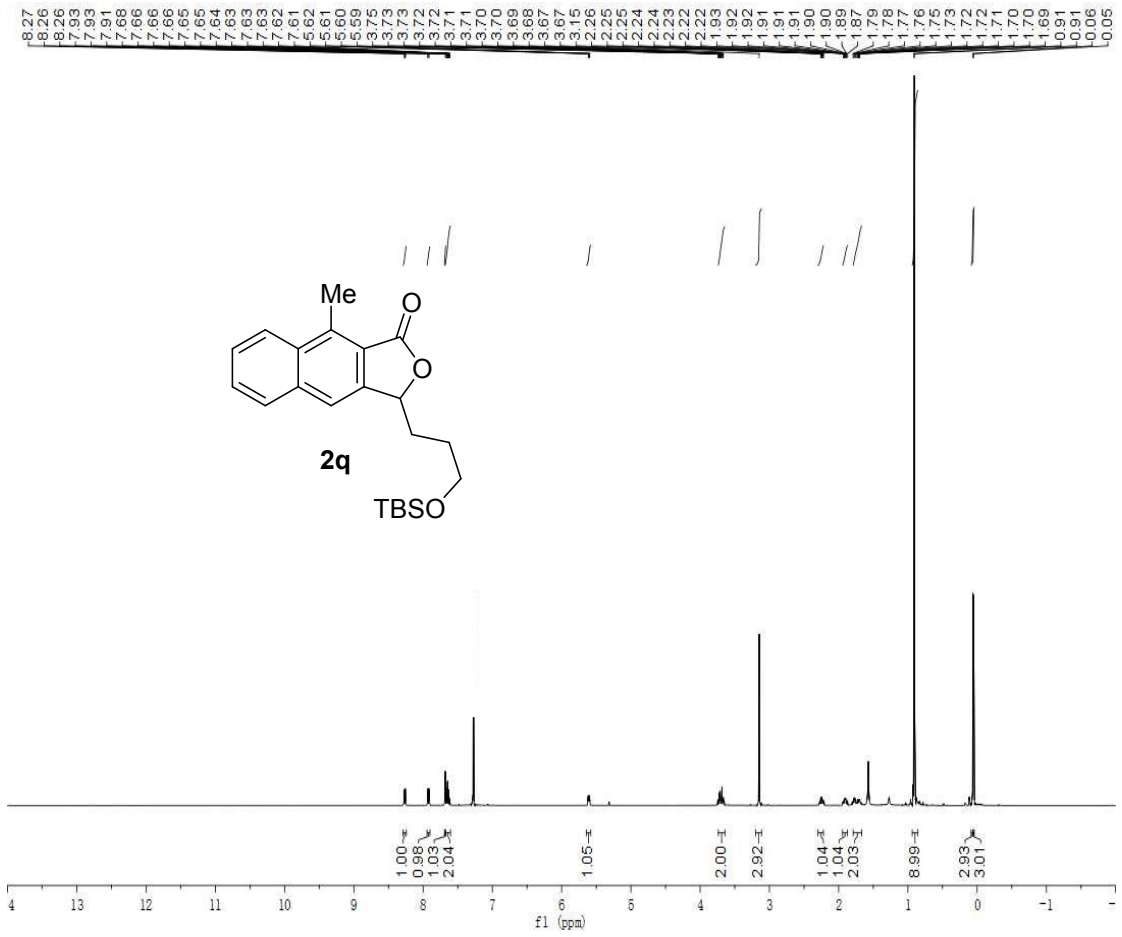
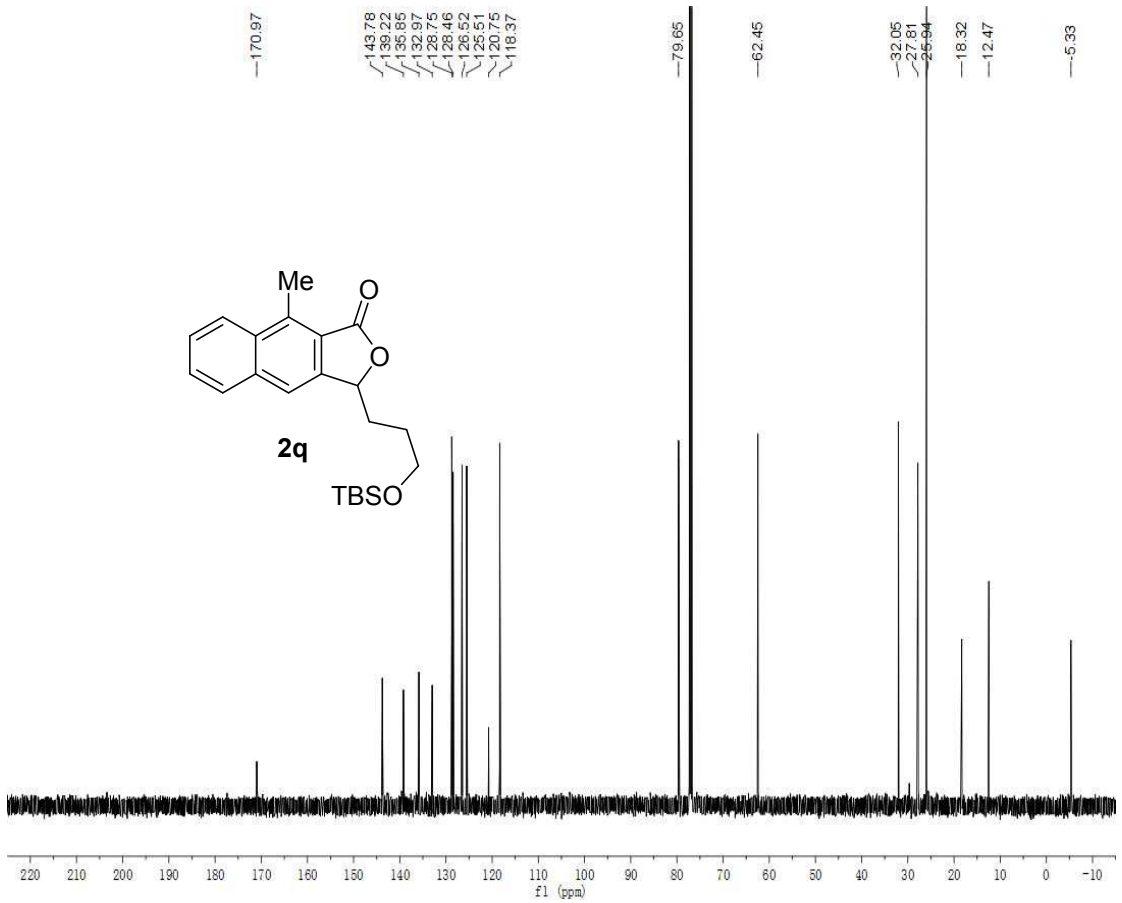
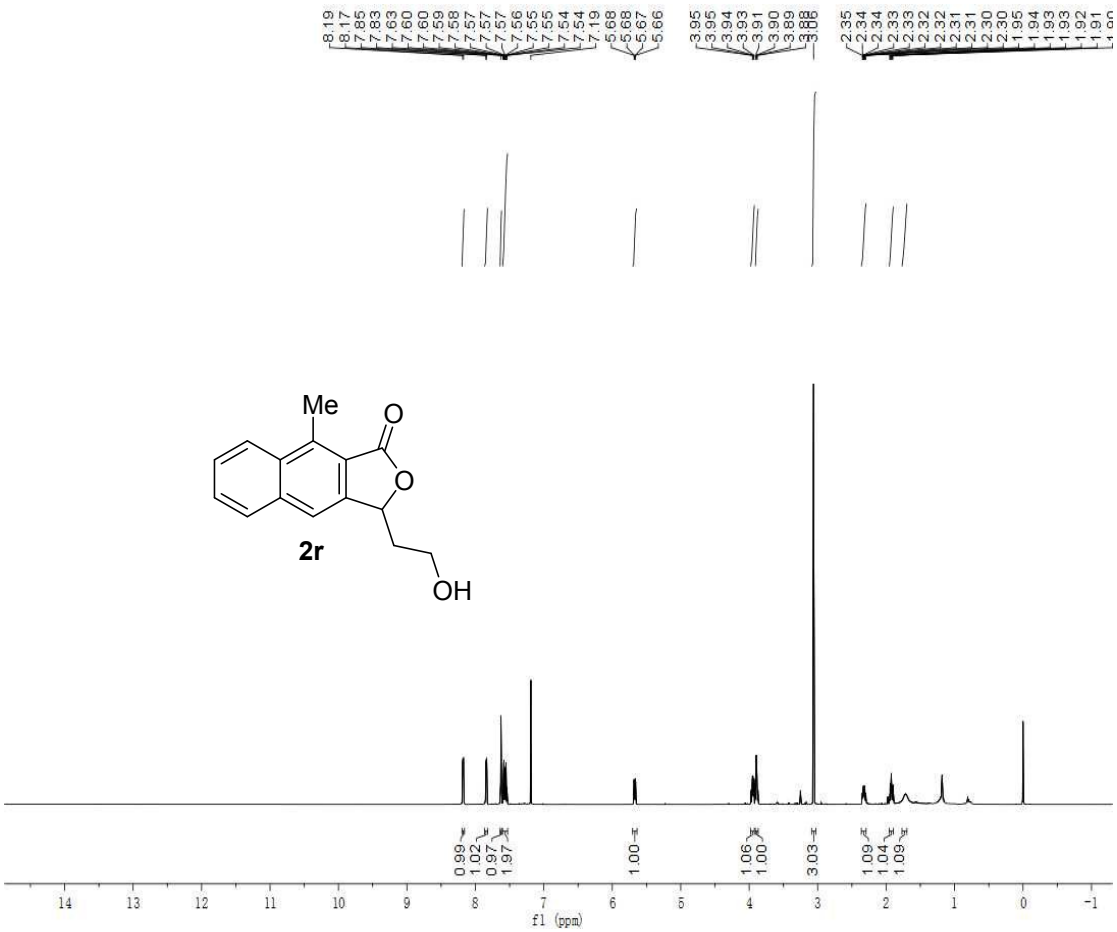
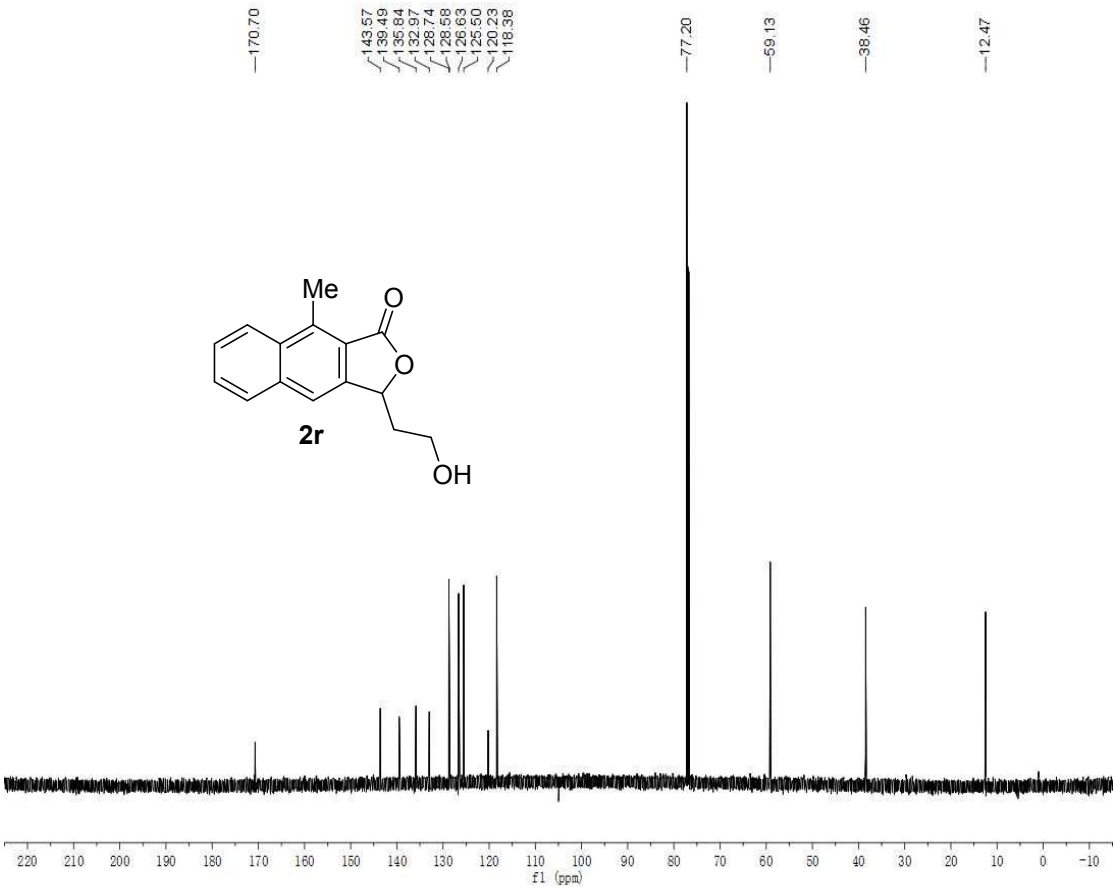
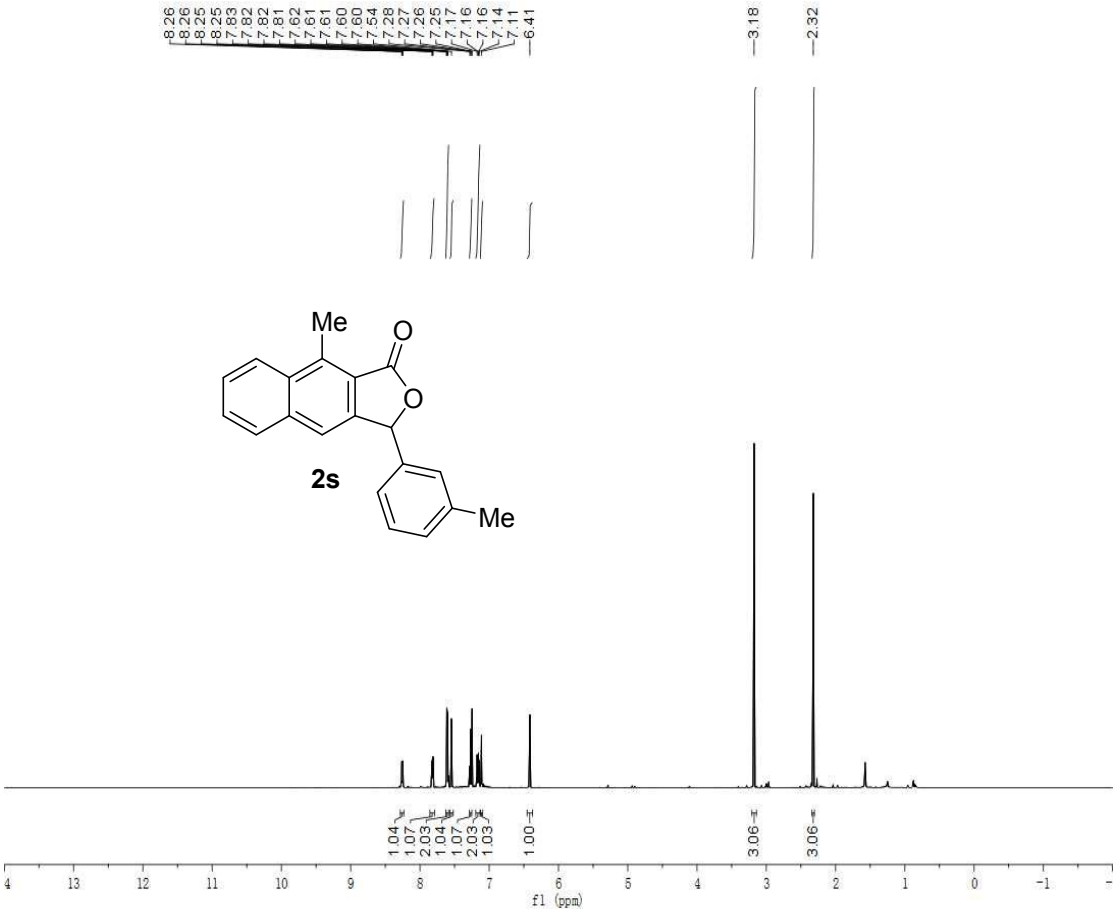
170.87
143.78
143.76
139.28
139.26
135.87
135.84
132.97
128.78
128.75
128.48
126.54
125.50
120.56
120.51
118.56
118.52
99.74
98.62
77.06
76.86
63.52
63.01
62.78
62.15
36.18
36.07
30.70
30.57
25.40
25.39
19.80
19.37
12.46
Me
O
O
O
O
2p
f1 (ppm)

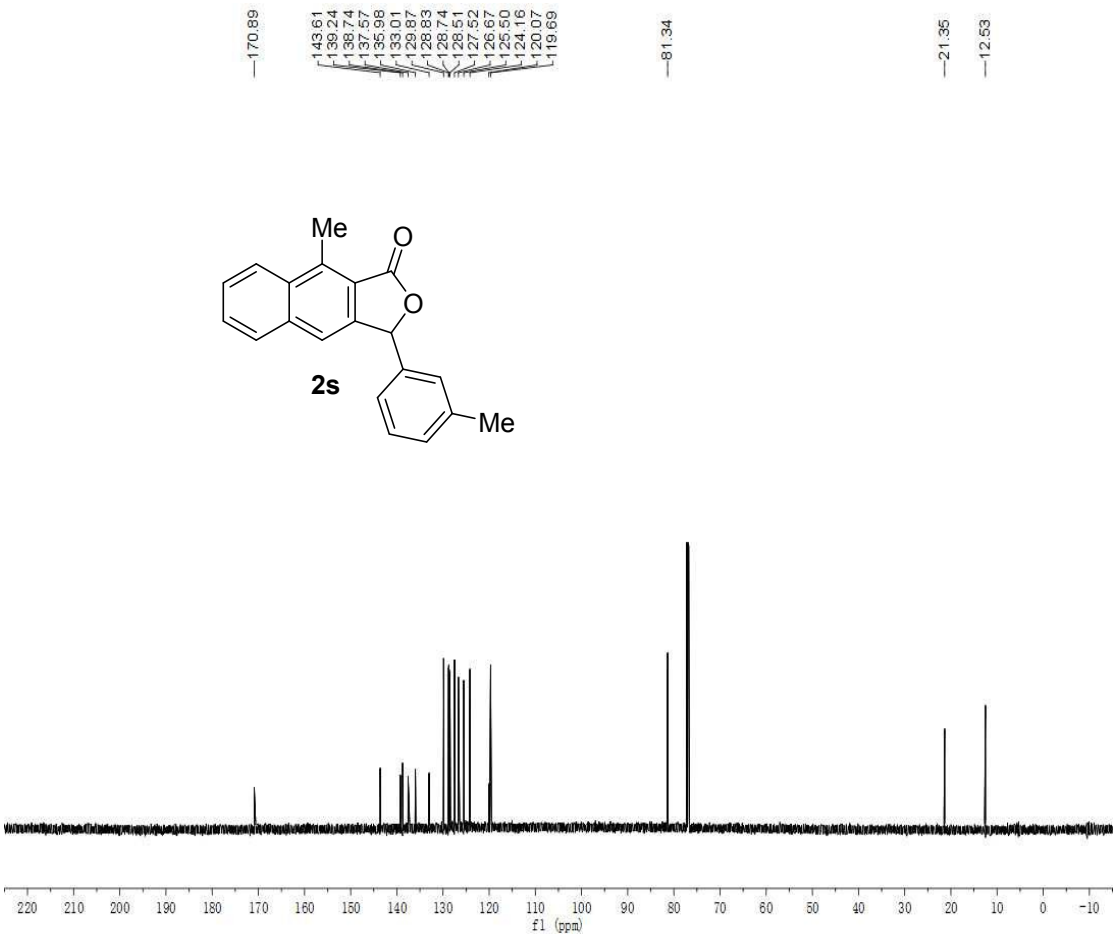

Me
O
O
2q
TBSO
f1 (ppm)


Me
O
O
2q
TBSO
f1 (ppm)


Me
O
O
OH
2r
f1 (ppm)


Me
O
O
OH
2r
f1 (ppm)


8.26
8.26
8.25
8.25
7.83
7.82
7.82
7.81
7.62
7.61
7.61
7.60
7.60
7.54
7.28
7.27
7.26
7.25
7.17
7.16
7.16
7.14
7.11
6.41
3.18
2.32
Me
O
O
2s
Me
1.04
1.07
2.03
1.04
1.07
2.03
1.03
1.00
3.06
3.06
f1 (ppm)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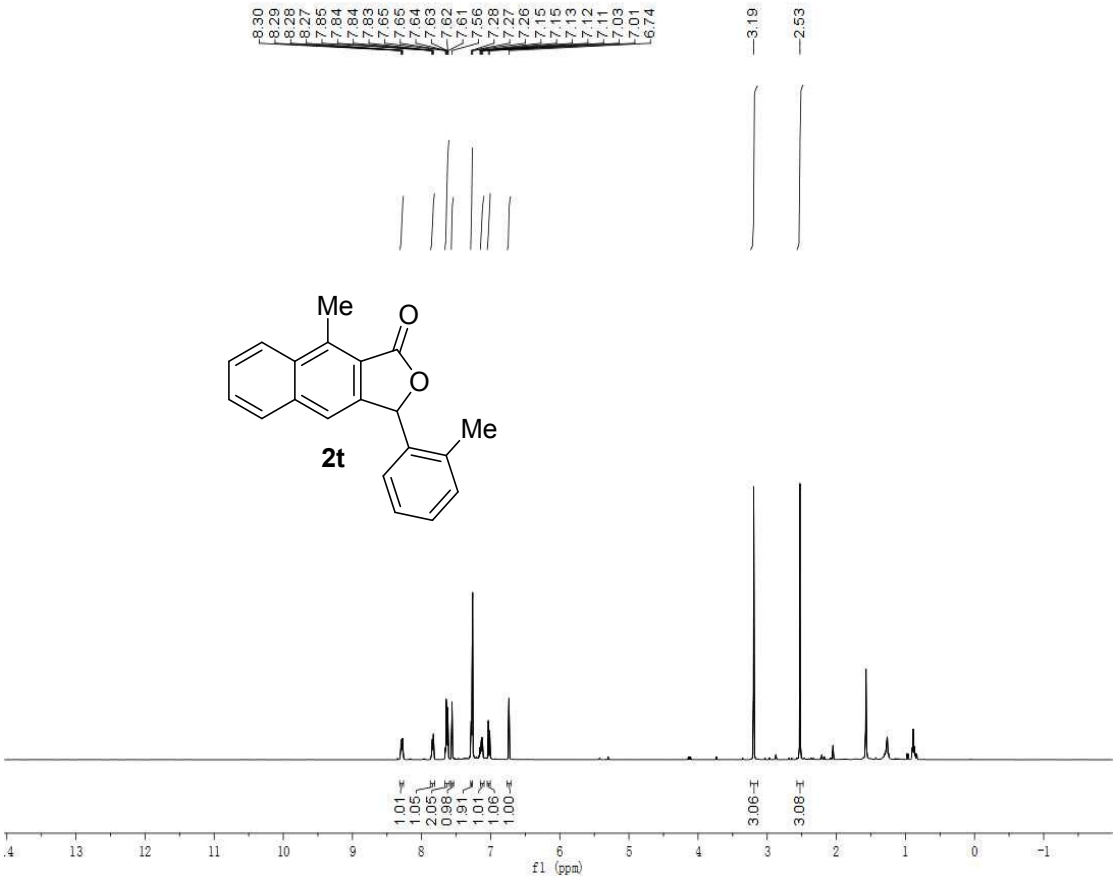
143.61
139.24
138.74
137.57
135.98
133.01
129.87
128.83
128.74
128.51
127.52
126.67
125.50
124.16
120.07
119.69
81.34
21.35
12.53
Me
O
O
2s
Me
f1 (ppm)


8.30
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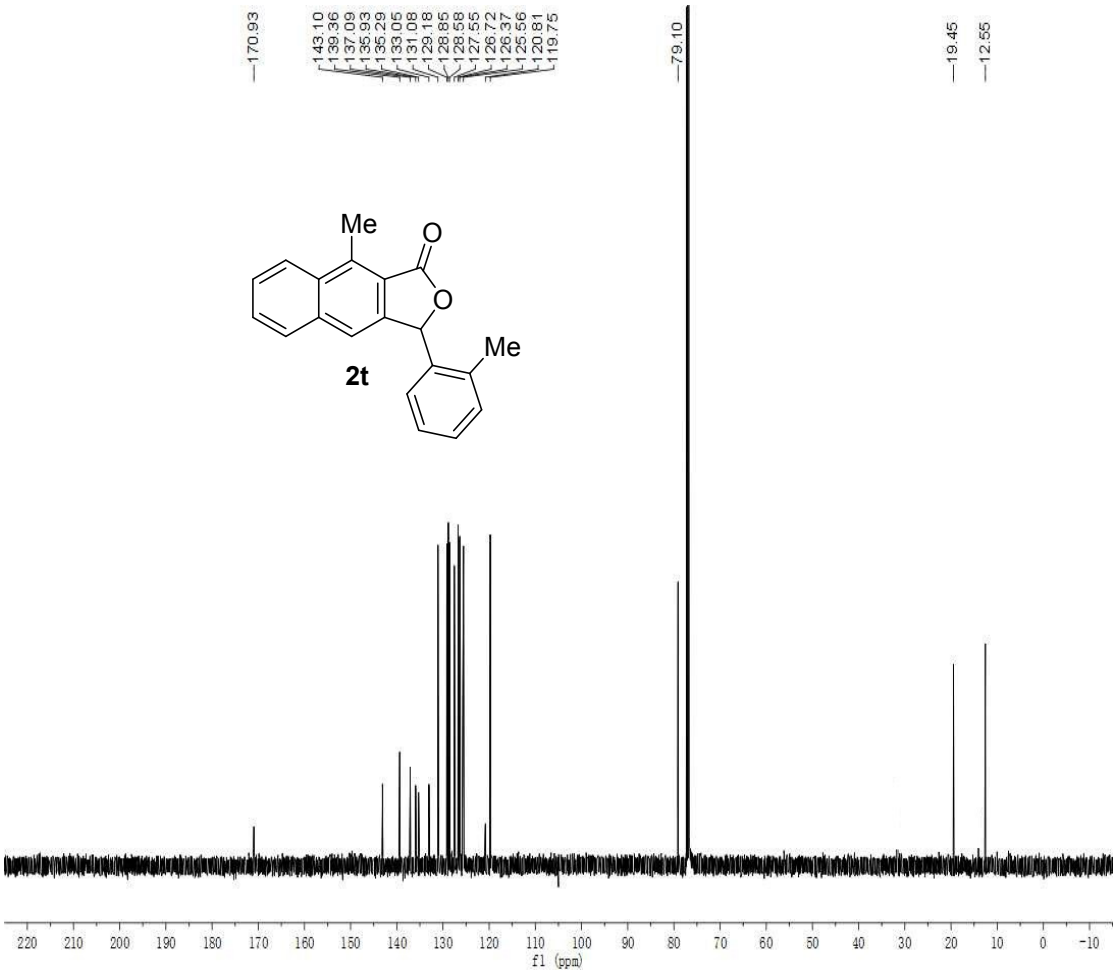
8.28
8.27
7.85
7.84
7.84
7.83
7.65
7.65
7.64
7.63
7.62
7.61
7.56
7.28
7.27
7.26
7.15
7.13
7.12
7.11
7.03
7.01
6.74
3.19
2.53
Me
O
O
Me
2t
1.01
1.05
2.05
0.98
1.91
1.01
1.06
1.00
3.06
3.08
f1 (ppm)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139.36
137.09
135.93
135.29
133.05
131.08
129.18
128.85
128.58
127.55
126.72
126.37
125.56
120.81
119.75
79.10
19.45
12.55
Me
O
O
Me
2t
f1 (ppm)


8.30
8.29
8.29
8.28
7.84
7.83
7.83
7.82
7.62
7.61
7.61
7.60
7.59
7.56
7.40
7.40
7.39
7.39
7.39
7.38
7.38
7.38
7.37
7.37
7.35
7.35
7.35
7.34
7.34
7.34
7.26
6.46
3.75
3.75
3.74
3.73
3.73
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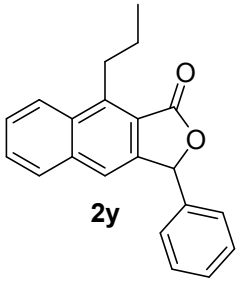
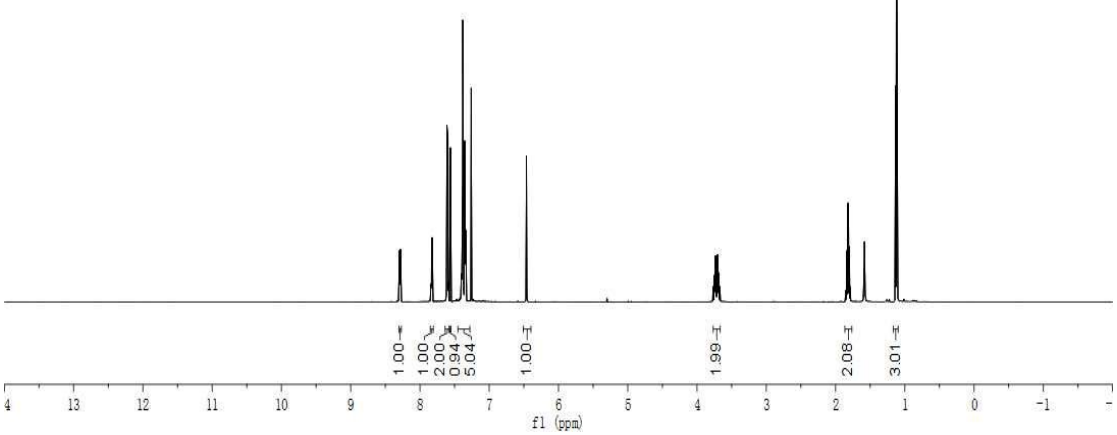
1.81
1.80
1.58
1.13
1.12
1.11


O
O

2y


1.00
1.00
2.00
0.94
5.04
1.00
1.99
2.08
3.01
f1 (ppm)


170.43
144.18
143.59
137.71
136.39
132.28
129.08
128.96
128.89
128.44
127.04
126.62
125.52
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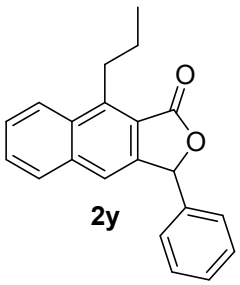
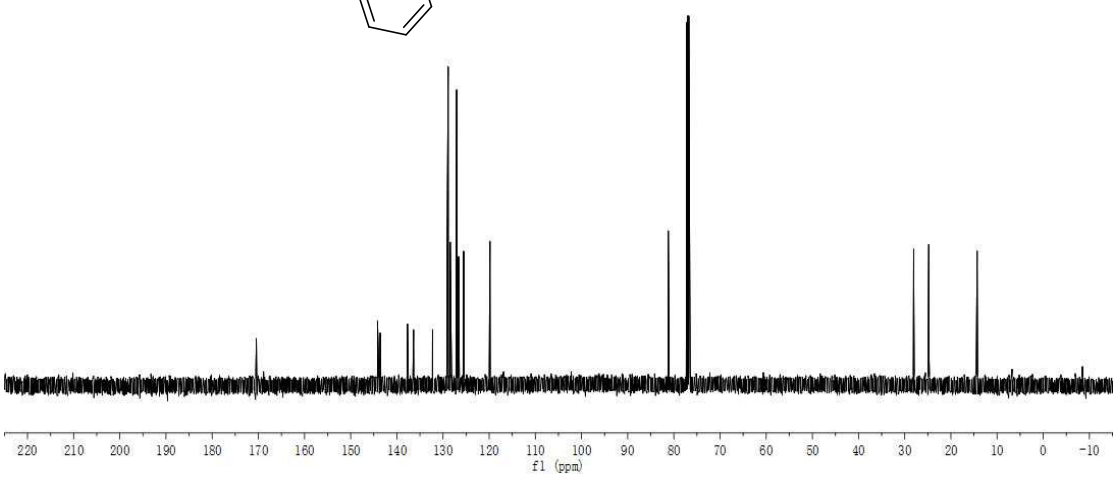
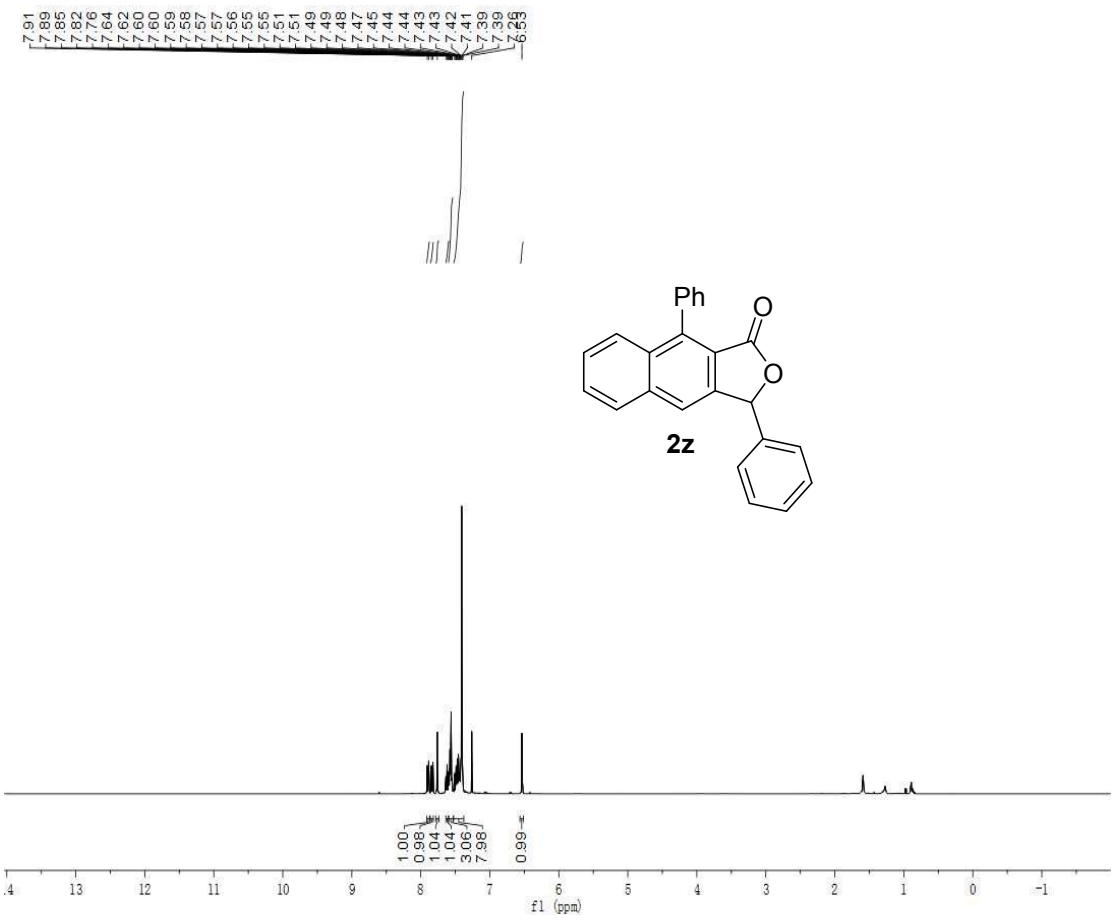
119.74
81.21
28.07
24.78
14.32


O
O

2y


f1 (ppm)


7.91
7.89
7.85
7.82
7.76
7.64
7.62
7.60
7.60
7.59
7.58
7.57
7.57
7.56
7.55
7.55
7.51
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7.49
7.49
7.48
7.47
7.45
7.44
7.44
7.43
7.43
7.42
7.41
7.39
7.39
7.26
6.53
Ph
O
O
2z
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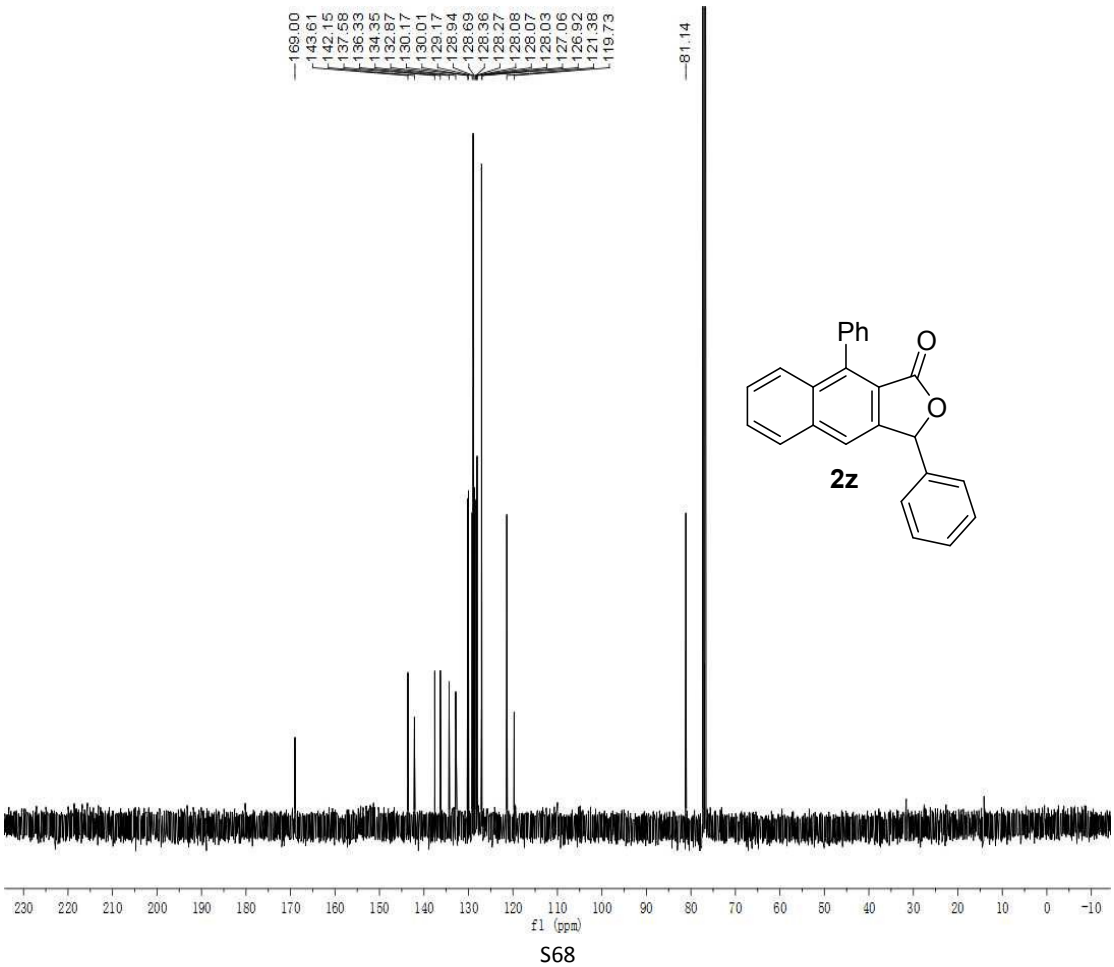
0.98
1.04
1.04
3.06
7.98
0.99
f1 (ppm)


169.00
143.61
142.15
137.58
136.33
134.35
132.87
130.17
130.01
129.17
128.94
128.69
128.36
128.27
128.08
128.07
128.03
127.06
126.92
121.38
119.73
81.14
Ph
O
O
2z
f1 (ppm)