Supporting Information

Synthesis of Primary Propargylic Alcohols from Terminal Alkyne Using Rongalite as the C1 Unit

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1. General.

All substrates and reagents were commercially available and used without further purification. TLC analysis was performed using pre-coated glass plates. Column chromatography was performed using silica gel (200–300 mesh). ^{1}H spectra were recorded in $CDCl_3$ on 400/600 MHz NMR spectrometers and resonances (δ) are given in parts per million relative to tetramethylsilane. Data are reported as follows: chemical shift, multiplicity (s = singlet, d = doublet, t = triplet, m = multiplet, q = quadruple), coupling constants (Hz) and integration. ^{13}C spectra were recorded in $CDCl_3$ on 100/150 MHz NMR spectrometers and resonances (δ) are given in ppm. HRMS were obtained on a Bruker 7-tesla FT-ICR MS equipped with an electrospray source. The X-ray crystal structure determinations of 3q were obtained on a Bruker SMART APEX CCD system. Melting points were determined using XT-4 apparatus and not corrected.

safety note

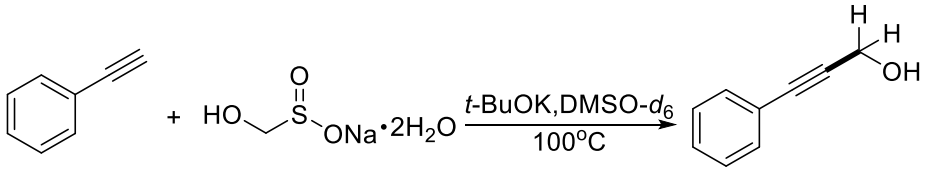
The combination of DMSO and strong base may cause safety problems when thinking about a larger scale synthesis. While no problems were observed in this study, care should be shown when handling DMSO and strong base in large scale synthesis.

2. General procedure for the synthesis of 3 (3a as an example).

A mixture of **1a** ethynylbenzene (0.5 mmol), **2** (0.6 mmol) and *t*-BuOK (0.5 mmol) in DMSO (1.0 mL) was stirred at rt for 5 min in a pressure vessel, and then moved to 100 ^{o}C oil bath for 2.0 h. The resulting mixture was dropped into 25 mL H_2O and extracted with EtOAc 3 times (3 ×25 mL). The organic extract was dried with anhydrous Na_2SO_4, filtered and concentrated. The crude product was purified by column chromatography on silica gel (eluent: petroleum ether/EtOAc = 8/1) to afford the product **3a** as light yellow oil (54.6 mg, 83%).

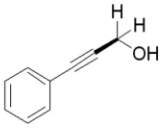
3. Evidence in support of the mechanism

(1) The reaction of **1a** and **2** was also performed in DMSO-*d6* to and none of the deuterated product **3a** was generated (H>99%). (see below).

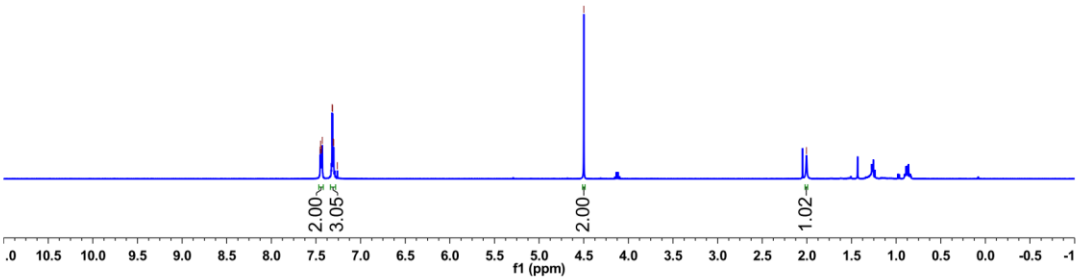


1a **3a'**, 80%(H>99%)

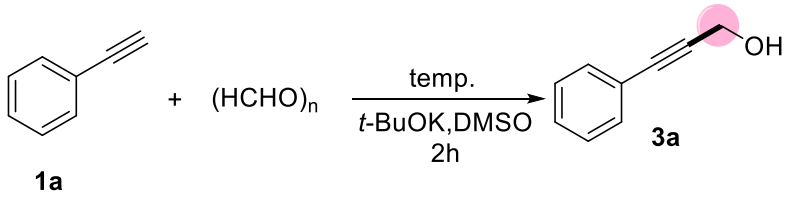
The ^{1}H NMR of **3a'** is list below:



3a', (H>99%)



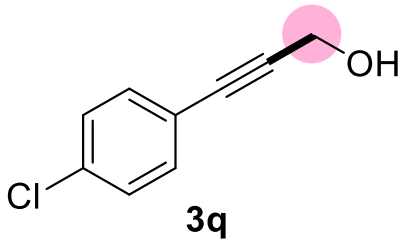
(2) We systematically screened the reaction temperature for the reaction of phenylacetylene and paraformaldehyde, the results indicate that as the temperature increased, the yield gradually decreased, when the temperature reaches 80°C, the corresponding product **3a** cannot be generated. Perhaps the high temperature caused the reaction to become complex.



1a **3a**

	temp.	yield of **3a**
a)	0 °C	39%
b)	25 °C	20%
c)	50 °C	13%
d)	80 °C	0%
e)	100 °C	0%

4. Crystallographic data of 3q.



3q

3-(4-chlorophenyl)prop-2-yn-1-ol (CCDC: 2190850)

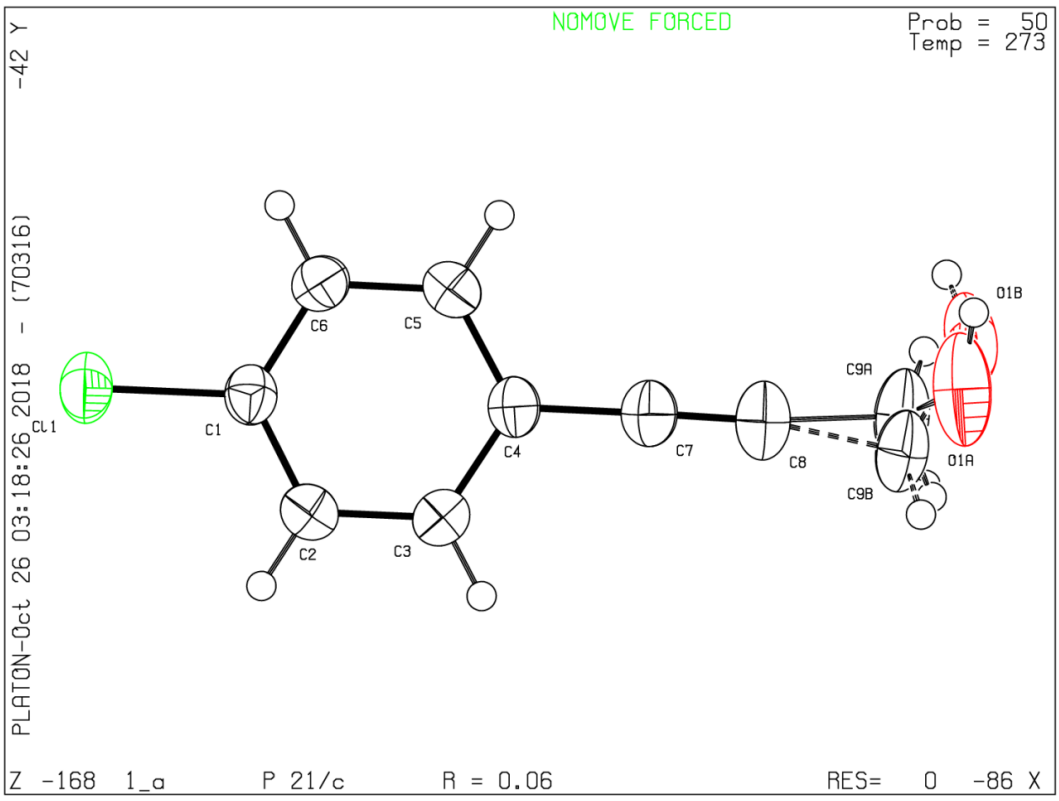


Figure S1. X-ray crystal structure of 3q.

Table S1. Crystal data and structure refinement for compound 3q (CCDC: 2190850)

Bond precision:	C-C = 0.0035 A	Wavelength=0.71073	
Cell:	a=15.423(3)	b=4.9337(9)	c=11.308(2)
	alpha=90	beta=110.313(2)	gamma=90
Temperature:	273 K		

	Calculated	Reported
Volume	806.9(3)	806.9(2)
Space group	P 21/c	P 21/c
Hall group	: -P 2ybc	-P 2ybc
Moiety formula	C9 H7 Cl O	?
Sum formula	C9 H7 Cl O	C9 H7 Cl O
Mr	166.60	166.60
Dx,g cm-3	1.371	1.371
Z	4	4
Mu (mm-1)	0.406	0.406
F000	344.0	344.0
F000′	344.73	
h,k,lmax	23,7,16	22,7,16
Nref	2829	2632
Tmin,Tmax	0.915,0.930	0.864,0.864
Tmin′	0.915	

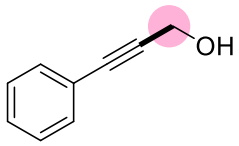
Correction method= # Reported T Limits: Tmin=0.864 Tmax=0.864
AbsCorr = MULTI-SCAN

Data completeness= 0.930 Theta(max)= 32.035

R(reflections)= 0.0625(2363) wR2(reflections)= 0.2021(2632)

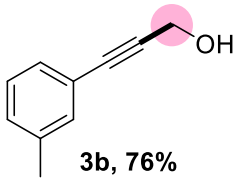
S = 1.059 Npar= 125

5. Characterization data for target compound.



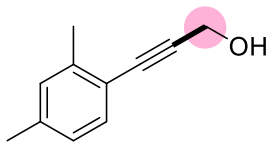
3a, 83%

3-phenylprop-2-yn-1-ol (3a):
Yield: 83%; light yellow oil; ^{1}H NMR (600 MHz, $CDCl_3$) δ 7.44–7.43 (m, 2H), 7.33–7.28 (m, 3H), 4.50 (s, 2H), 2.17 (s, 1H); ^{13}C NMR (150 MHz, $CDCl_3$) δ 131.6, 128.4, 128.3, 122.5, 87.2, 85.6, 51.5. The data are in agreement with those previously reported in the literature.[1a]



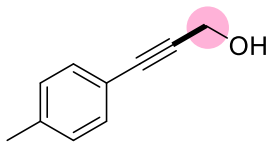
3b, 76%

3-(m-tolyl)prop-2-yn-1-ol (3b):
Yield: 76%; orange oil;^{1}H NMR (400 MHz, $CDCl_3$) δ 7.21 (d, *J* = 9.6 Hz, 2H), 7.15 (t, *J* = 7.6 Hz, 1H), 7.09 (d, *J* = 7.6 Hz, 1H), 4.46 (s, 2H), 2.30 (s, 3H), 2.26 (s, 1H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 137.7, 132.0, 129.1, 128.5, 128.0, 122.1, 86.8, 85.7, 51.6, 21.3. The data are in agreement with those previously reported in the literature.[2a]



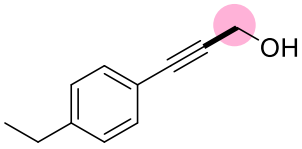
3c, 74%

3-(2,4-dimethylphenyl)prop-2-yn-1-ol (3c):
Yield: 74%; light yellow oil; ^{1}H NMR (600 MHz, $CDCl_3$) δ 7.29 (d, *J* = 4.2 Hz, 1H), 6.99 (s, 1H), 6.92 (s, 1H), 4.51 (s, 2H), 2.38 (s, 3H), 2.29 (s, 3H), 2.22 (s, 1H); ^{13}C NMR (150 MHz, $CDCl_3$) δ 140.0, 138.5, 131.9, 130.2, 126.3, 119.2, 90.3, 84.6, 51.6, 21.3, 20.5. The data are in agreement with those previously reported in the literature. [1b]



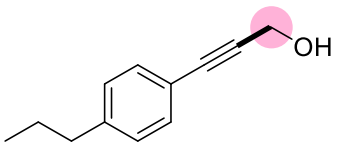
3d, 80%

3-(p-tolyl)prop-2-yn-1-ol (3d):
Yield: 80%; orange oil; ^{1}H NMR (600 MHz, $CDCl_3$) δ 7.32 (d, *J* = 8.4 Hz, 2H), 7.10 (d, *J* = 7.8 Hz, 2H), 4.48 (s, 2H), 2.33 (s, 3H), 2.30 (s, 1H); ^{13}C NMR (150 MHz, $CDCl_3$) δ 138.6, 131.5, 129.0, 119.4, 86.5, 85.7, 51.5, 21.4. The data are in agreement with those previously reported in the literature.[1b]



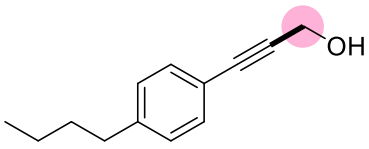
3e, 77%

3-(4-ethylphenyl)prop-2-yn-1-ol (3e):
Yield: 77%; orange oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.32 (d, *J* = 8.0 Hz, 2H), 7.10 (d, *J* = 8.0 Hz, 2H), 4.46 (s, 2H), 2.62 (q, *J* = 7.6 Hz, 2H), 2.03 (s, 1H), 1.21 (t, *J* = 7.6 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 144.7, 131.5, 127.7, 119.5, 86.5, 85.8, 51.7, 28.9, 15.4; HRMS (ESI) *m/z* calcd for $C_{11}H_{12}O^{+}$ $(M)^{+}$ 160.0883, found 160.0881.



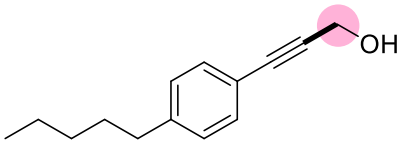
3f, 70%

3-(4-propylphenyl)prop-2-yn-1-ol (3f):
Yield: 70%; light yellow oil;^{1}H NMR (400 MHz, $CDCl_3$) δ 7.33–7.31 (m, 2H), 7.09 (d, *J* = 7.2 Hz, 2H), 4.47 (d, *J* = 4.0 Hz, 2H), 2.56 (t, *J* = 7.6 Hz, 2H), 1.89 (s, 1H), 1.62 (dd, *J* = 14.8, 7.6 Hz, 2H), 0.92 (dd, *J* = 8.0, 6.8 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 143.2, 131.4, 128.3, 119.5, 86.4, 85.8, 51.7, 38.0, 24.5, 13.9; HRMS (ESI) *m/z* calcd for $C_{12}H_{14}O^{+}$ $(M)^{+}$ 174.1039, found 174.1038.



3g, 67%

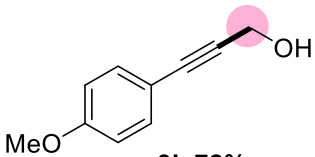
3-(4-butylphenyl)prop-2-yn-1-ol (3g):
Yield: 67%; light yellow oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.35 (d, *J* = 8.0 Hz, 2H), 7.12 (d, *J* = 8.0 Hz, 2H), 4.50 (s, 2H), 2.66–2.57 (m, 2H), 2.36 (s, 1H), 1.60 (dt, *J* = 12.8, 7.6 Hz, 2H), 1.38 (dt, *J* = 14.8, 7.2 Hz, 2H), 0.95 (t, *J* = 7.2 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 143.3, 131.4, 128.2, 119.4, 86.5, 85.7, 51.6, 35.6, 33.4, 22.4, 14.1; HRMS (ESI) m/z calcd for $C_{13}H_{17}O^{+}$ $(M+H)^{+}$ 189.1274, found 189.1279.



3h

3-(4-pentylphenyl)prop-2-yn-1-ol (3h):

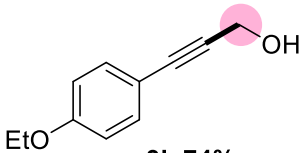
Yield: 69%; light yellow oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.35 (d, *J* = 8.0 Hz, 2H), 7.12 (d, *J* = 7.6 Hz, 2H), 4.49 (s, 2H), 2.63–2.53 (m, 2H), 2.00 (d, *J* = 18.4 Hz, 1H), 1.60 (dd, *J* = 14.4, 7.2 Hz, 2H), 1.31 (d, *J* = 3.2 Hz, 4H), 0.88 (t, *J* = 6.8 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 143.6, 131.6, 128.4, 120.0, 86.5, 85.8, 51.6, 35.8, 31.4, 30.9, 22.5, 14.0; HRMS (ESI) m/z calcd for $C_{14}H_{19}O^{+}$ $(M+H)^{+}$ 203.1430, found 203.1431.



3i, 72%

3-(4-methoxyphenyl)prop-2-yn-1-ol (3i):

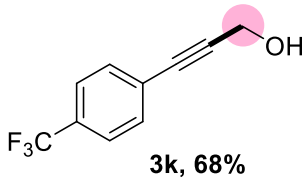
Yield: 72%; light yellow solid; mp: 67.3—68.5°C; ^{1}H NMR (600 MHz, $CDCl_3$) δ 7.36 (d, *J* = 9.0 Hz, 2H), 6.82 (d, *J* = 9.0 Hz, 2H), 4.47 (d, *J* = 4.2 Hz, 2H), 3.79 (d, *J* = 5.4 Hz, 3H), 2.49 (s, 1H); ^{13}C NMR (150 MHz, $CDCl_3$) δ 159.5, 133.1, 114.5, 113.8, 85.9, 85.4, 55.2, 51.5. The data are in agreement with those previously reported in the literature.[1a]



3j, 74%

3-(4-ethoxyphenyl)prop-2-yn-1-ol (3j):

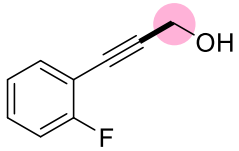
Yield: 74%; light yellow solid; mp: 72.9—74.5°C; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.39–7.32 (m, 2H), 6.82 (d, *J* = 8.8 Hz, 2H), 4.49 (d, *J* = 6.0 Hz, 2H), 4.03 (q, *J* = 6.8 Hz, 2H), 2.00 (s, 1H), 1.43 (t, *J* = 7.2 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ= 158.8, 133.0, 114.2(3), 114.2, 85.7, 85.6, 63.5, 51.7, 14.9; HRMS (ESI) m/z calcd for $C_{11}H_{13}O_2^{+}$ $(M+H)^{+}$ 177.0910, found 177.0909.



3k, 68%

3-(4-(trifluoromethyl)phenyl)prop-2-yn-1-ol (3k):

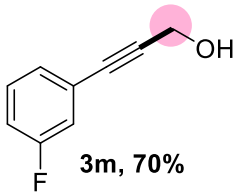
Yield: 68%; light yellow oil; ^{1}H NMR (600 MHz, $CDCl_3$) δ 7.54 (dd, *J* = 22.8, 7.8 Hz, 4H), 4.52 (s, 2H), 2.14 (s, 1H); ^{13}C NMR (150 MHz, CDCl3) δ 131.9, 130.1, 126.3, 125.2 (d, *J* = 2.5 Hz, $^{3}J_{CF}$), 103.9, 89.6, 84.3, 51.5. The data are in agreement with those previously reported in the literature.[1a]



3l, 73%

3-(2-fluorophenyl)prop-2-yn-1-ol (3l):

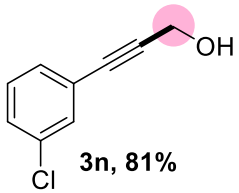
Yield: 73%; light yellow oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.43 (dd, *J* = 10.4, 4.8 Hz, 1H), 7.33–7.27 (m, 1H), 7.08 (dt, *J* = 17.2, 5.2 Hz, 2H), 4.54 (s, 2H), 2.35 (s, 1H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 133.6, 130.3, 123.9, 115.4 (d, *J* = 20.5 Hz, $^{2}J_{CF}$), 111.0 (d, *J* = 15.5 Hz, $^{3}J_{CF}$), 92.4, 78.9, 51.5. The data are in agreement with those previously reported in the literature.[1b]



3m, 70%

3-(3-fluorophenyl)prop-2-yn-1-ol (3m):

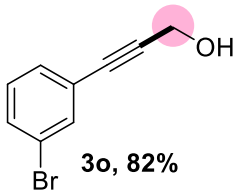
Yield: 70%; light yellow oil; ^{1}H NMR (600 MHz, $CDCl_3$) δ 7.30–7.27 (m, 1H), 7.22 (d, *J* = 7.8 Hz, 1H), 7.13 (d, *J* = 9.0 Hz, 1H), 7.04 (s, 1H), 4.50 (d, *J* = 5.4 Hz, 2H), 1.79 (s, 1H); ^{13}C NMR (150 MHz, $CDCl_3$) δ 129.9, 127.5, 118.5 (d, *J* = 15.2 Hz, $^{3}J_{CF}$), 115.9 (d, *J* = 14.0 Hz, $^{3}J_{CF}$), 88.1, 84.5, 51.5. The data are in agreement with those previously reported in the literature.[2a]



3n, 81%

3-(3-chlorophenyl)prop-2-yn-1-ol (3n):

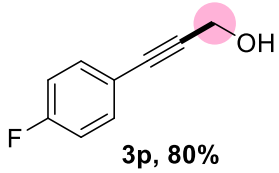
Yield: 81%; light yellow oil; ^{1}H NMR (600 MHz, $CDCl_3$) δ 7.41 (s, 1H), 7.29 (s, 2H), 7.23 (d, *J* = 6.6 Hz, 1H), 4.49 (s, 2H), 2.26 (s, 1H); ^{13}C NMR (150 MHz, $CDCl_3$) δ 134.0, 131.5, 129.7, 129.5, 128.7, 124.2, 88.4, 84.2, 51.4. The data are in agreement with those previously reported in the literature.[2b]



3o, 82%

3-(3-bromophenyl)prop-2-yn-1-ol (3o):

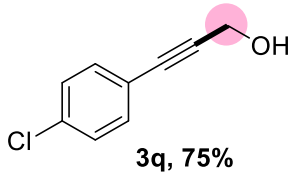
Yield: 82%; light yellow oil; ^{1}H NMR (600 MHz, $CDCl_3$) δ 7.56 (s, 1H), 7.43 (d, *J* = 6.0 Hz, 1H), 7.33 (s, 1H), 7.15 (d, *J* = 7.2 Hz, 1H), 4.48 (s, 2H), 2.55 (s, 1H); ^{13}C NMR (150 MHz, $CDCl_3$) δ 134.3, 131.6, 130.1, 129.7, 124.4, 122.0, 88.5, 84.0, 51.3. The data are in agreement with those previously reported in the literature.[2b]



3p, 80%

3-(4-fluorophenyl)prop-2-yn-1-ol (3p):

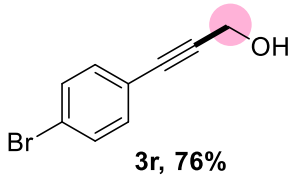
Yield: 80%; light yellow oil; ^{1}H NMR (600 MHz, $CDCl_3$) δ 7.43–7.37 (m, 2H), 6.99 (dd, *J* = 8.4, 7.8 Hz, 2H), 4.48 (s, 2H), 2.18 (s, 1H); ^{13}C NMR (150 MHz, $CDCl_3$) δ 162.5 (d, *J* = 165.6 Hz, $^{1}J_{CF}$), 133.5 (d, *J* = 5.5 Hz, $^{3}J_{CF}$), 118.5, 115.6 (d, *J* = 14.6 Hz, $^{3}J_{CF}$), 86.9, 84.6, 51.5. The data are in agreement with those previously reported in the literature.[2a]



3q, 75%

3-(4-chlorophenyl)prop-2-yn-1-ol (3q):

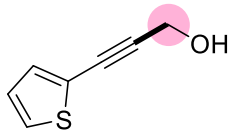
Yield: 75%; yellow solid; mp: 77.1–78.6°C; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.35–7.30 (m, 2H), 7.27–7.22 (m, 2H), 4.47 (s, 2H), 2.19 (s, 1H); ^{13}C NMR (100 MHz, $CDCl_3$) δ = 134.3, 132.7, 128.5, 120.8, 88.1, 84.5, 51.5. The data are in agreement with those previously reported in the literature.[1a]



3r, 76%

3-(4-bromophenyl)prop-2-yn-1-ol (3r):

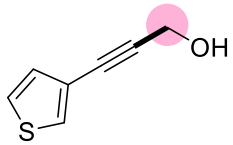
Yield: 76%; pale orange solid; mp: 79.5–81.2°C; ^{1}H NMR (600 MHz, $CDCl_3$) δ 7.45 (d, *J* = 8.4 Hz, 2H), 7.30 (d, *J* = 8.4 Hz, 2H), 4.48 (d, *J* = 5.4 Hz, 2H), 1.75 (s, 1H); ^{13}C NMR (150 MHz, $CDCl_3$) δ 133.1, 131.6, 122.8, 121.4, 88.3, 84.7, 51.6. The data are in agreement with those previously reported in the literature.[1b]



3s, 66%

3-(thiophen-2-yl)prop-2-yn-1-ol (3s):

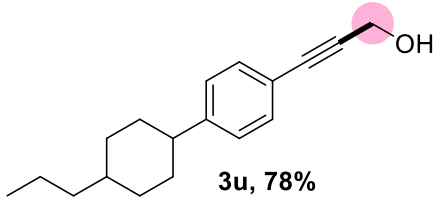
Yield: 66%; brown oil; ^{1}H NMR (400 MHz, CDCl3) δ 7.30–7.14 (m, 2H), 6.96 (dd, *J* = 5.2, 3.6 Hz, 1H), 4.49 (d, *J* = 7.2 Hz, 2H), 2.25 (s, 1H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 132.3, 127.4, 126.9, 122.3, 91.1, 78.9, 51.6. The data are in agreement with those previously reported in the literature.[1b]



3t, 69%

3-(thiophen-3-yl)prop-2-yn-1-ol (3t):

Yield: 69%; brown oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.46 (d, *J* = 2.0 Hz, 1H), 7.26 (dd, *J* = 4.8, 3.2 Hz, 1H), 7.16–7.08 (m, 1H), 4.48 (s, 2H), 1.99 (s, 1H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 129.8, 129.1, 125.4, 121.5, 86.8, 80.8, 51.6. The data are in agreement with those previously reported in the literature.[2a]

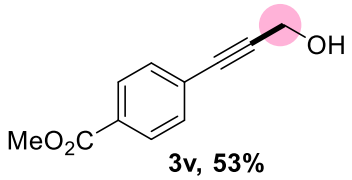


3u, 78%

3-(4-(4-propylcyclohexyl)phenyl)prop-2-yn-1-ol (3u):

Yield: 78%; pale orange solid; mp: 131.2–132.7°C; ^{1}H NMR (600 MHz, $CDCl_3$) δ 7.36 (s, 2H), 7.15 (s, 2H), 4.48 (s, 2H), 2.45 (s, 1H), 1.87–1.86 (m, 5H), 1.42 (d, *J* =

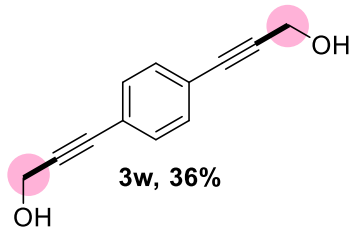
11.4 Hz, 2H), 1.35 (s, 2H), 1.29 (s, 1H), 1.21 (s, 2H), 1.04 (d, *J* = 10.8 Hz, 2H), 0.90 (s, 3H); ^{13}C NMR (150 MHz, $CDCl_3$) δ 148.5, 131.6, 126.8, 119.7, 86.4, 85.9, 51.6, 44.5, 39.6, 36.9, 34.1, 33.4, 20.0, 14.3; HRMS (ESI) m/z calcd for $C_{18}H_{25}O^+$ $(M+H)^+$ 257.1900, found 257.1897.



3v, 53%

methyl 4-(3-hydroxyprop-1-yn-1-yl)benzoate (3v)

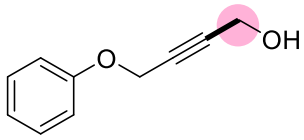
Yield: 53%; light yellow oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.91 (d, *J* = 8.4 Hz, 2H), 7.41 (d, *J* = 8.4 Hz, 2H), 4.45 (s, 2H), 3.85 (s, 3H), 1.78 (s, 1H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 166.5, 131.6, 129.8, 129.5, 127.2, 90.2, 84.9, 52.2, 51.6; The data are in agreement with those previously reported in the literature.[2c]



3w, 36%

3,3'-(1,4-phenylene)bis(prop-2-yn-1-ol) (3w)

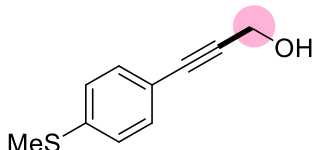
Yield: 36%; light yellow oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.30 (s, 4H), 4.43 (s, 4H), 1.75 (s, 2H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 131.6, 122.7, 89.0, 85.2, 51.6; The data are in agreement with those previously reported in the literature.[2d]



3x, 61%

4-phenoxybut-2-yn-1-ol (3x)

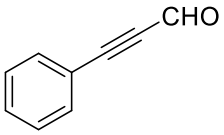
Yield: 61%; light yellow oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.23 (t, *J* = 8.4 Hz, 2H), 6.94–6.88 (m, 3H), 4.66 (s, 2H), 4.23 (s, 2H), 1.62 (s, 1H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 157.6, 129.5, 121.5, 114.8, 85.5, 80.7, 55.9, 51.1; The data are in agreement with those previously reported in the literature.[2e]



3y, 77%

3-(4-(methylthio)phenyl)prop-2-yn-1-ol (3y):

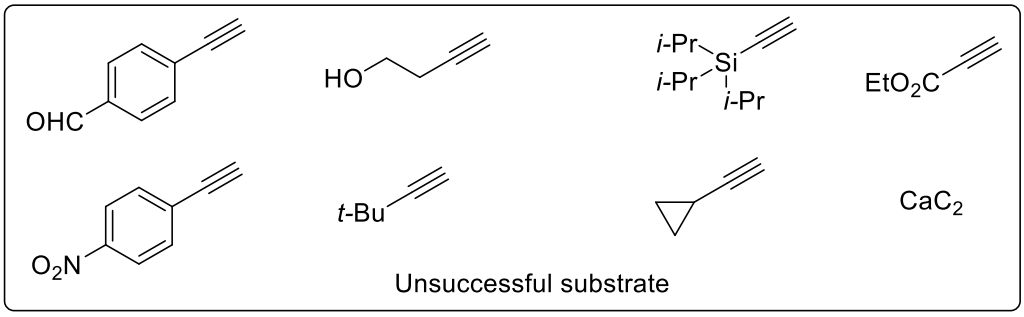
Yield: 77%; Light yellow solid; mp: 56.9–59.0°C; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.34 (d, *J* = 8.4 Hz, 2H), 7.16 (d, *J* = 8.4 Hz, 2H), 4.49 (s, 2H), 2.48 (s, 3H), 1.96 (s, 1H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 139.6, 131.9, 125.7, 118.7, 85.4, 51.7, 15.2. The data are in agreement with those previously reported in the literature.[4]



4, 89%

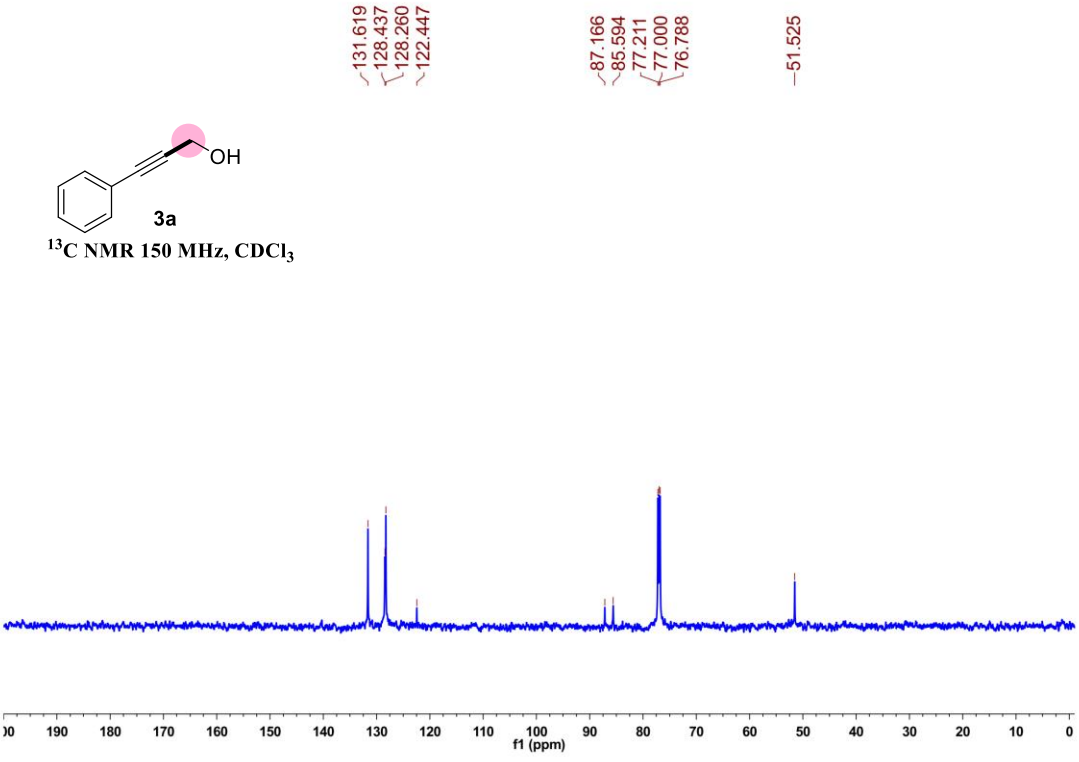
3-phenylpropiolaldehyde (4):

Yield: 89%; colorless liquid; ^{1}H NMR (400 MHz, $CDCl_3$) δ 9.42 (s, 1H), 7.61 (d, *J* = 7.6 Hz, 2H), 7.49 (t, *J* = 7.6 Hz, 1H), 7.41 (t, *J* = 7.6 Hz, 2H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 176.8, 133.3, 131.3, 128.7, 119.4, 95.1, 88.4.[3]

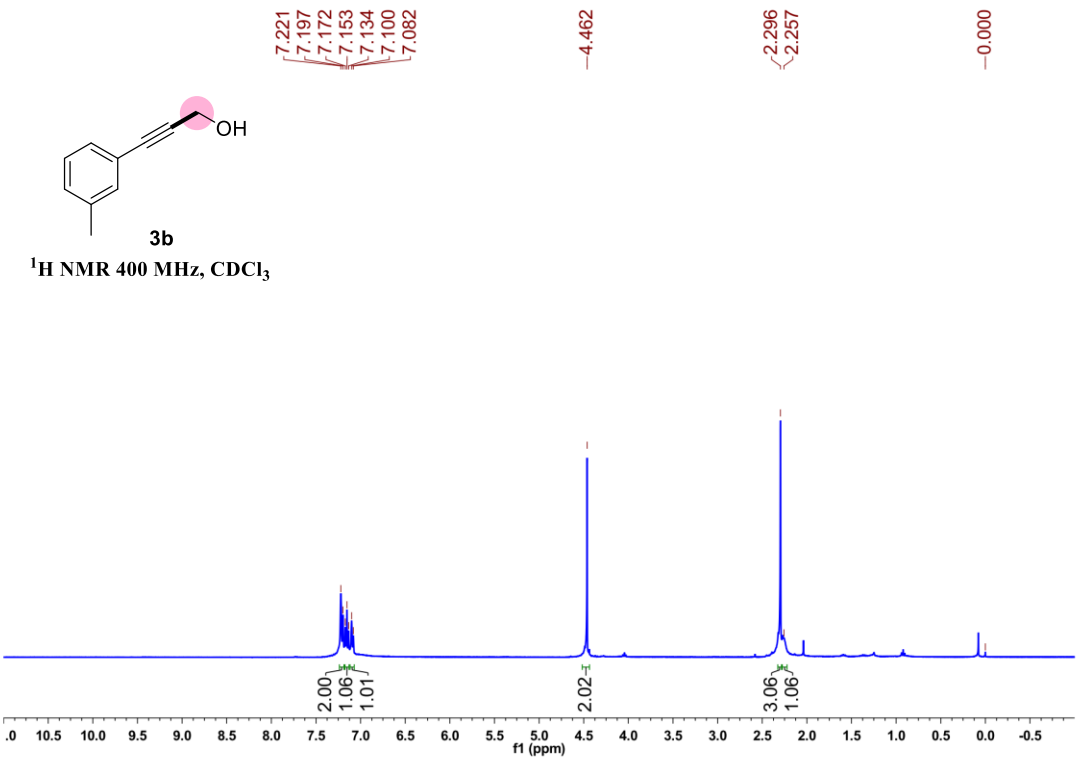


6. Copies of ^{1}H NMR, ^{13}C NMR

^{1}H NMR 600 MHz, $CDCl_3$

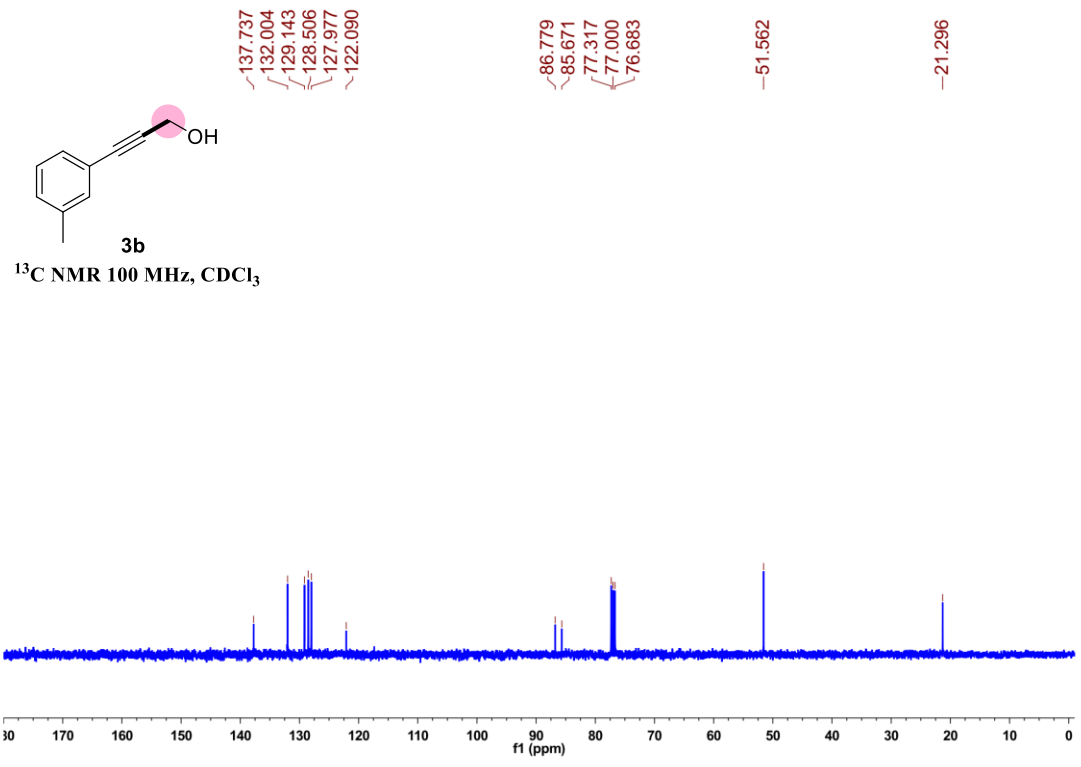


^{13}C NMR 150 MHz, $CDCl_3$



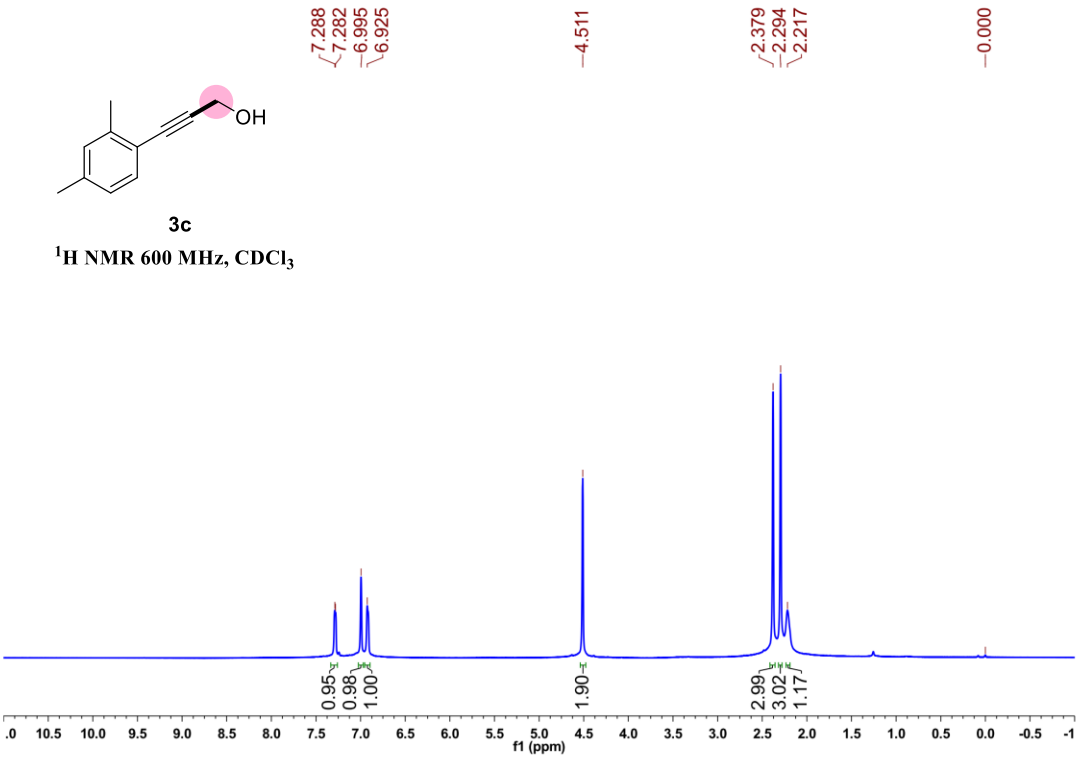
3b

^{1}H NMR 400 MHz, $CDCl_3$



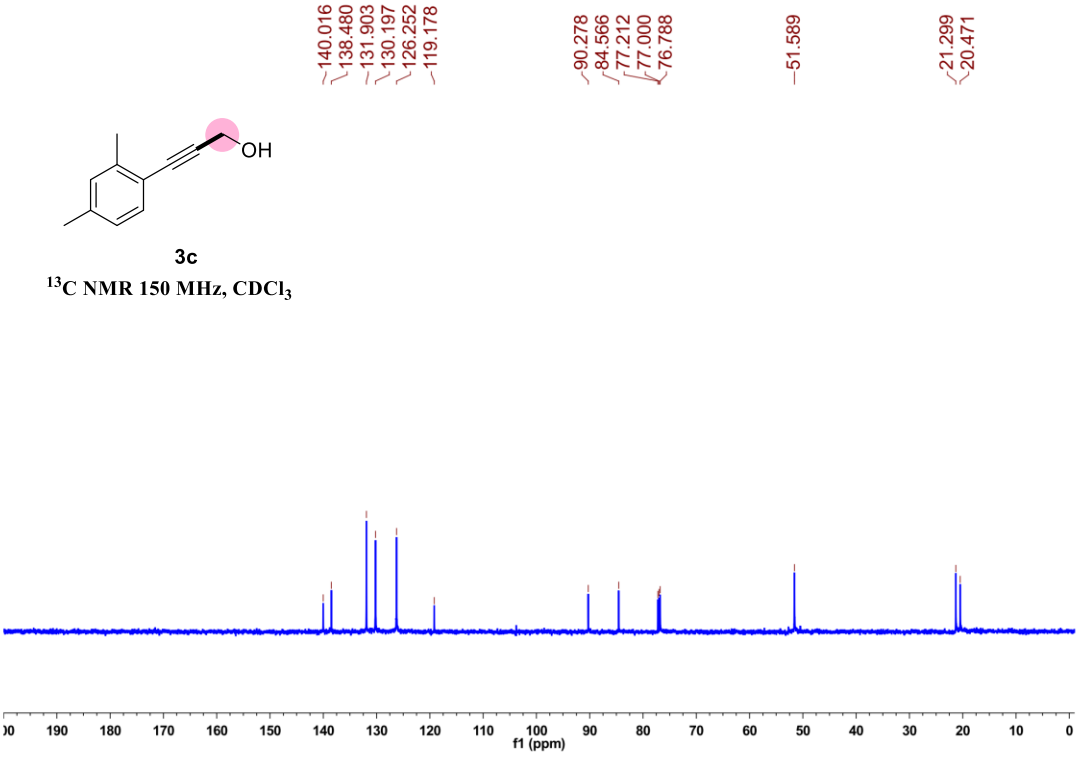
3b

^{13}C NMR 100 MHz, $CDCl_3$



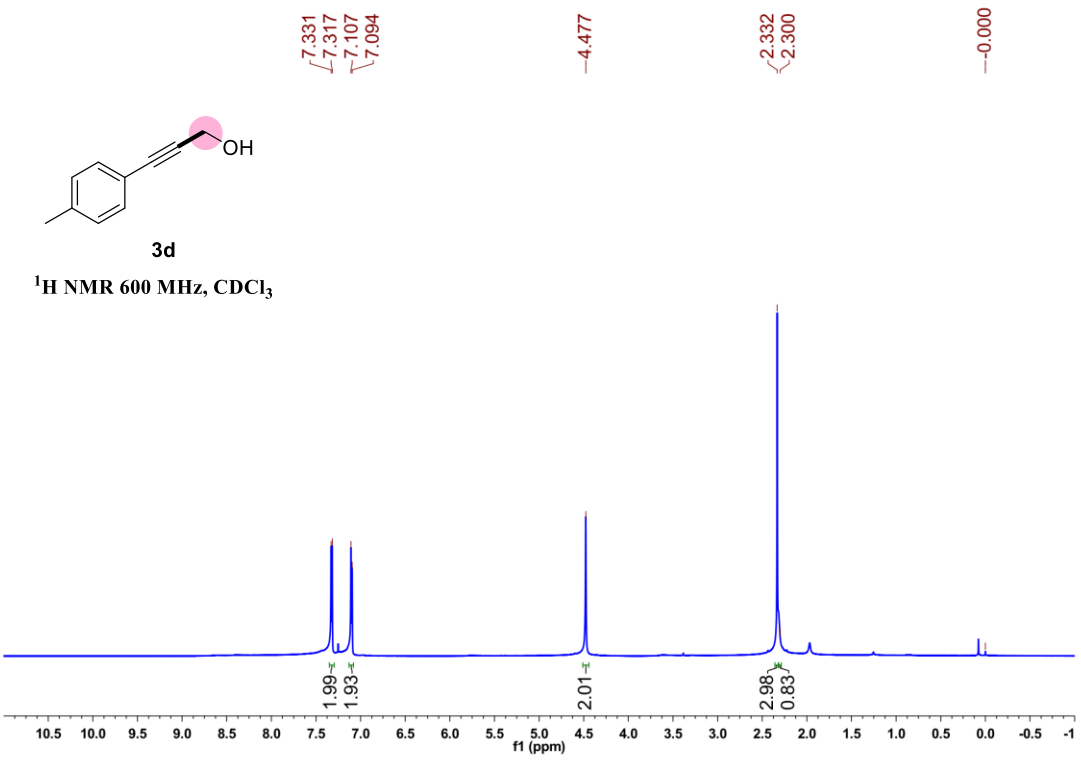
3c

^{1}H NMR 600 MHz, $CDCl_3$



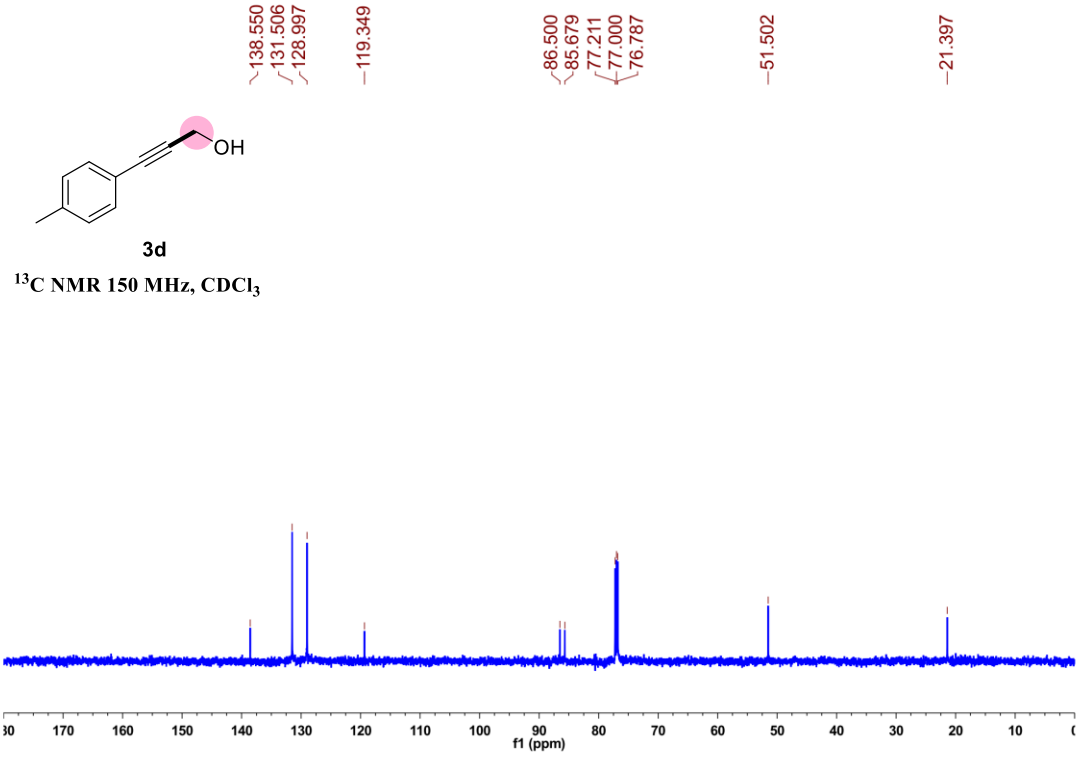
3c

^{13}C NMR 150 MHz, $CDCl_3$



3d

^{1}H NMR 600 MHz, $CDCl_3$



3d

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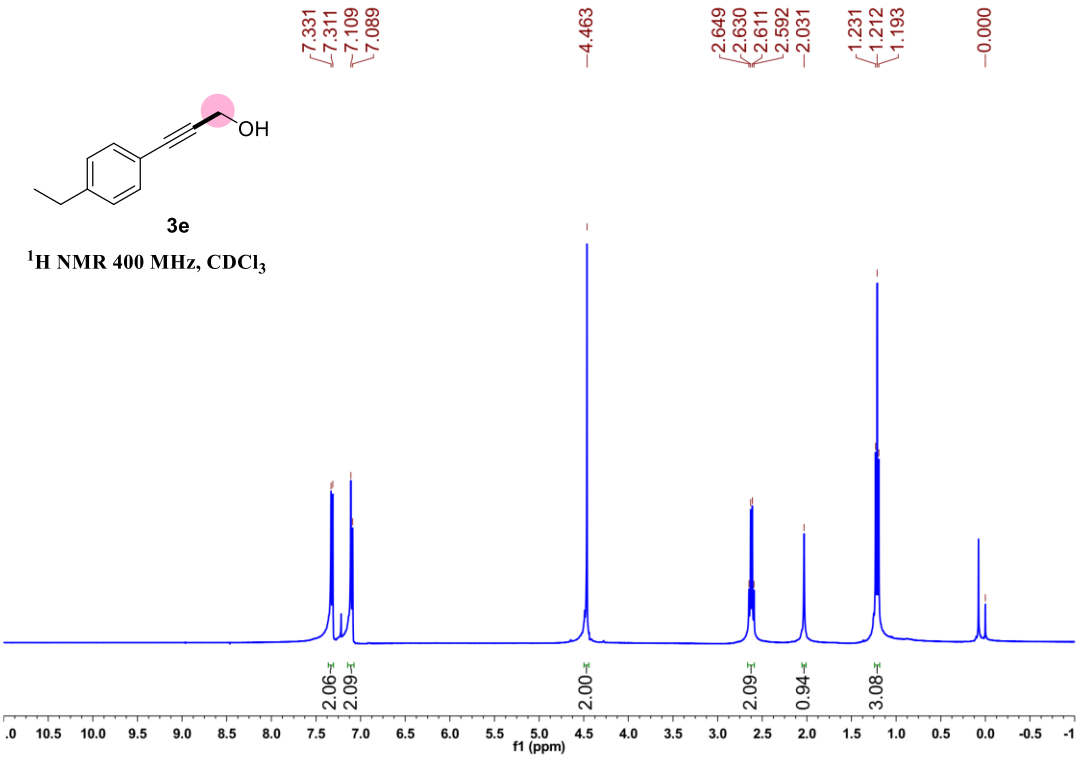
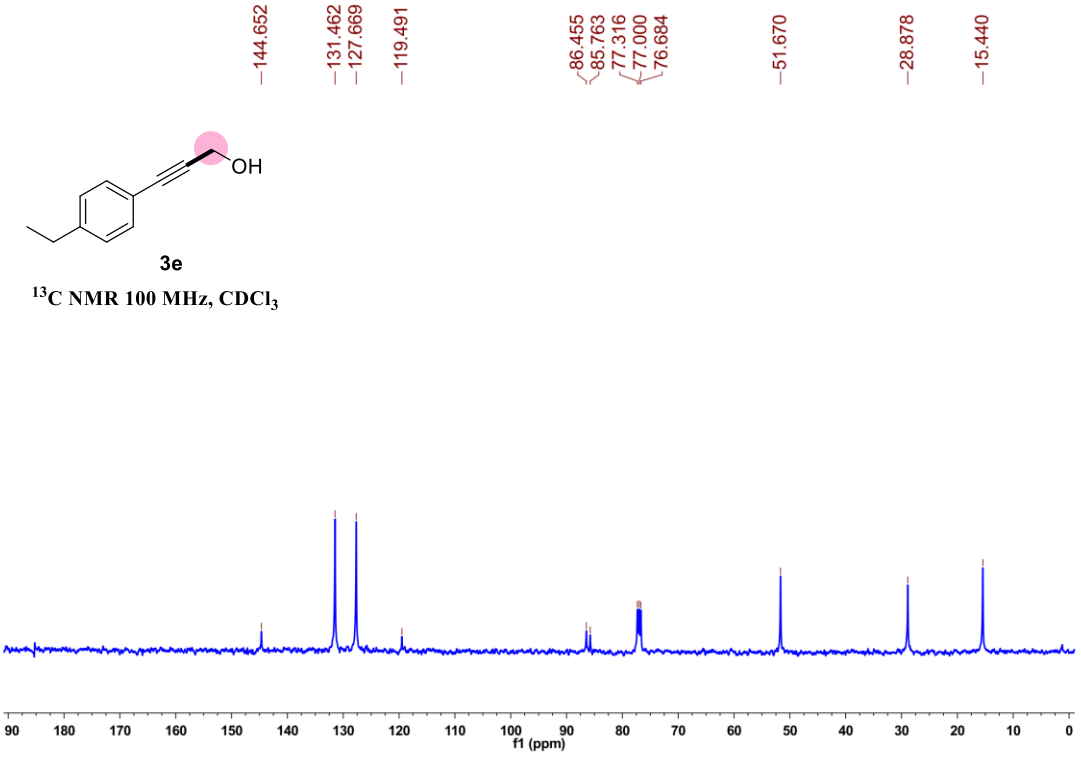


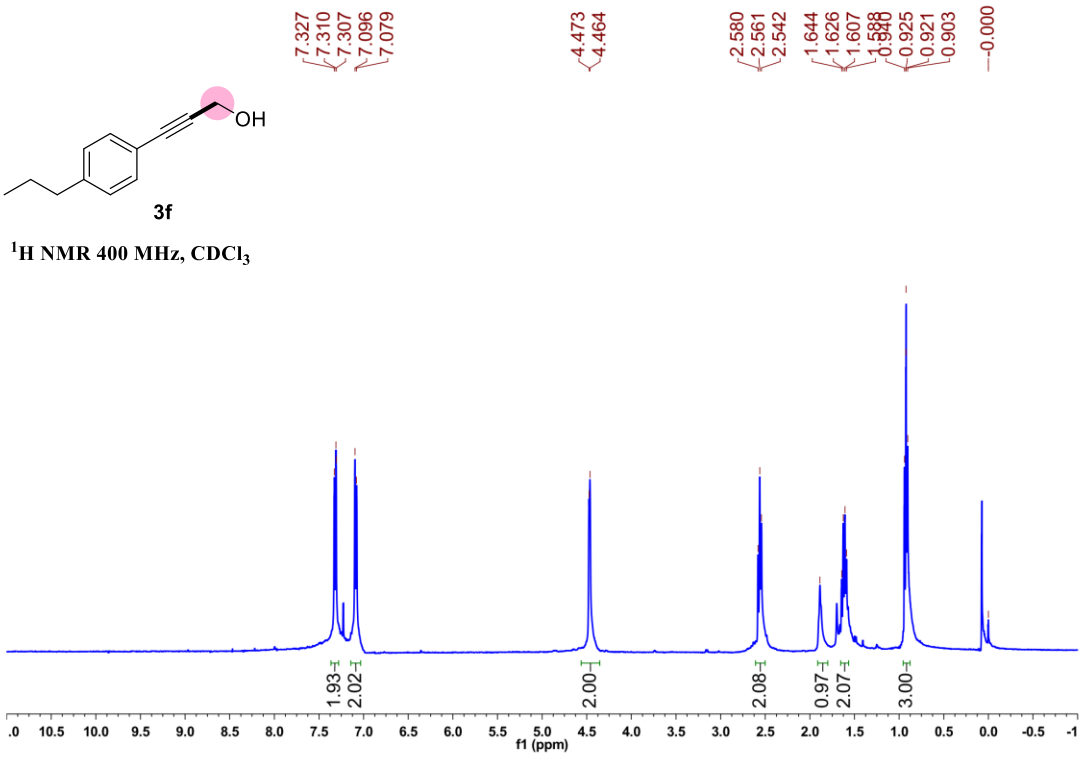
3e

^{1}H NMR 400 MHz, $CDCl_3$



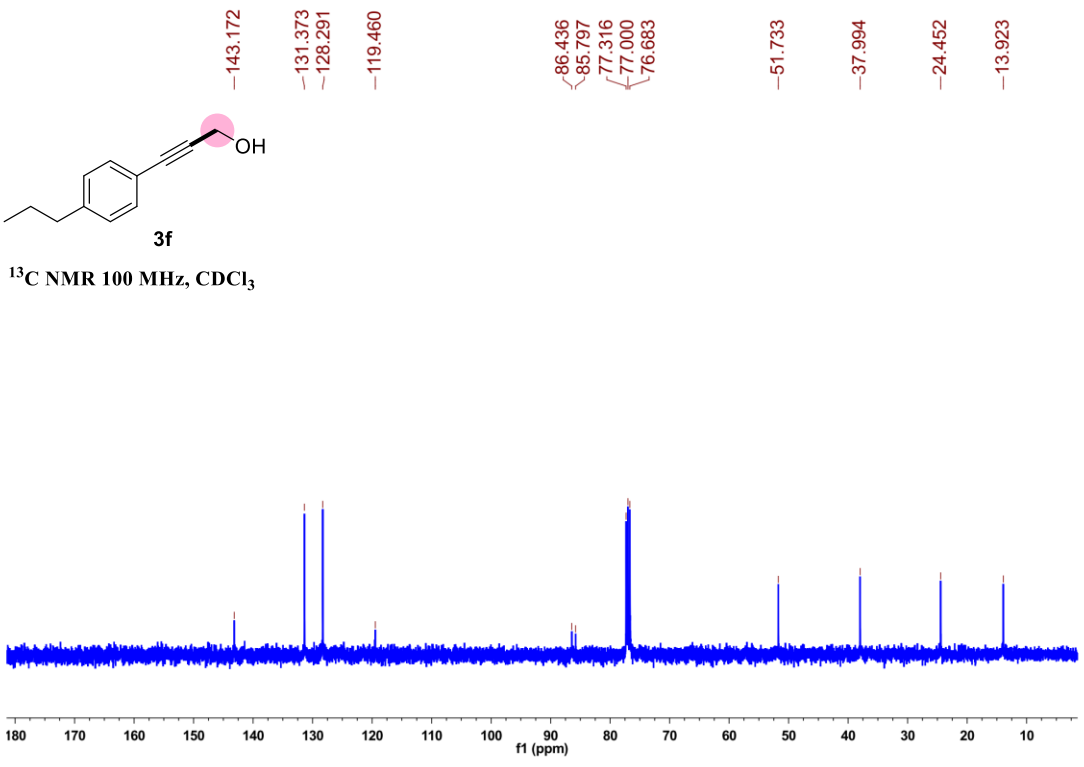
3e

^{13}C NMR 100 MHz, $CDCl_3$



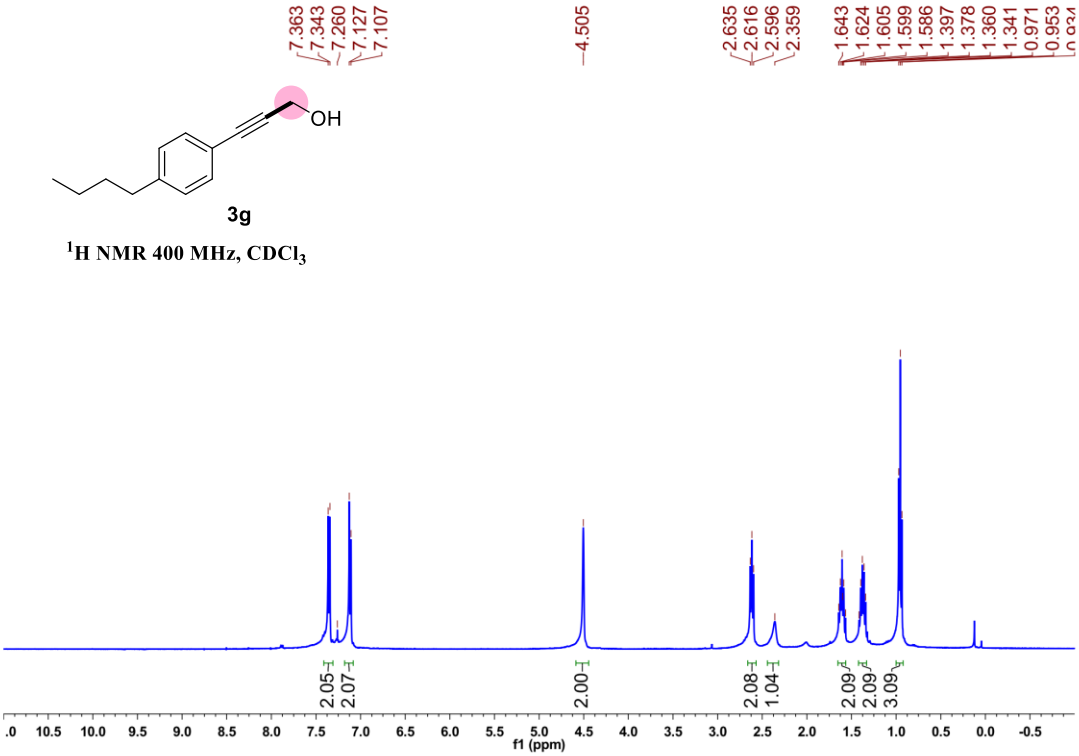
3f

^{1}H NMR 400 MHz, $CDCl_3$



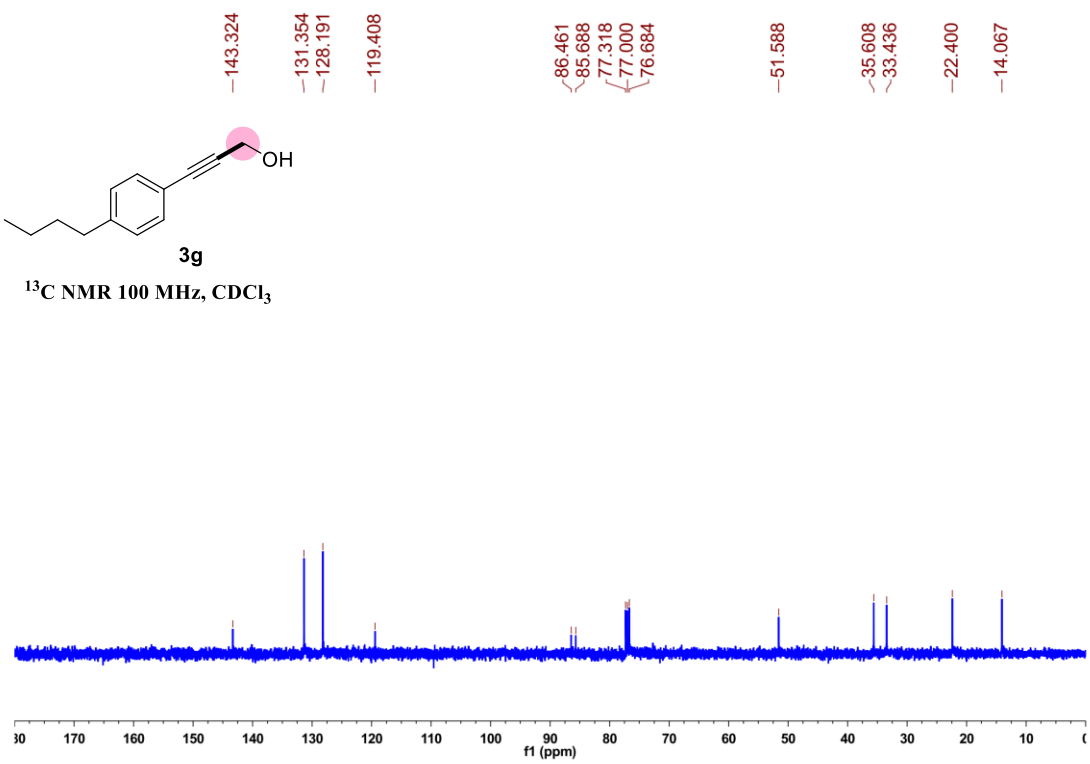
3f

^{13}C NMR 100 MHz, $CDCl_3$



3g

^{1}H NMR 400 MHz, $CDCl_3$



3g

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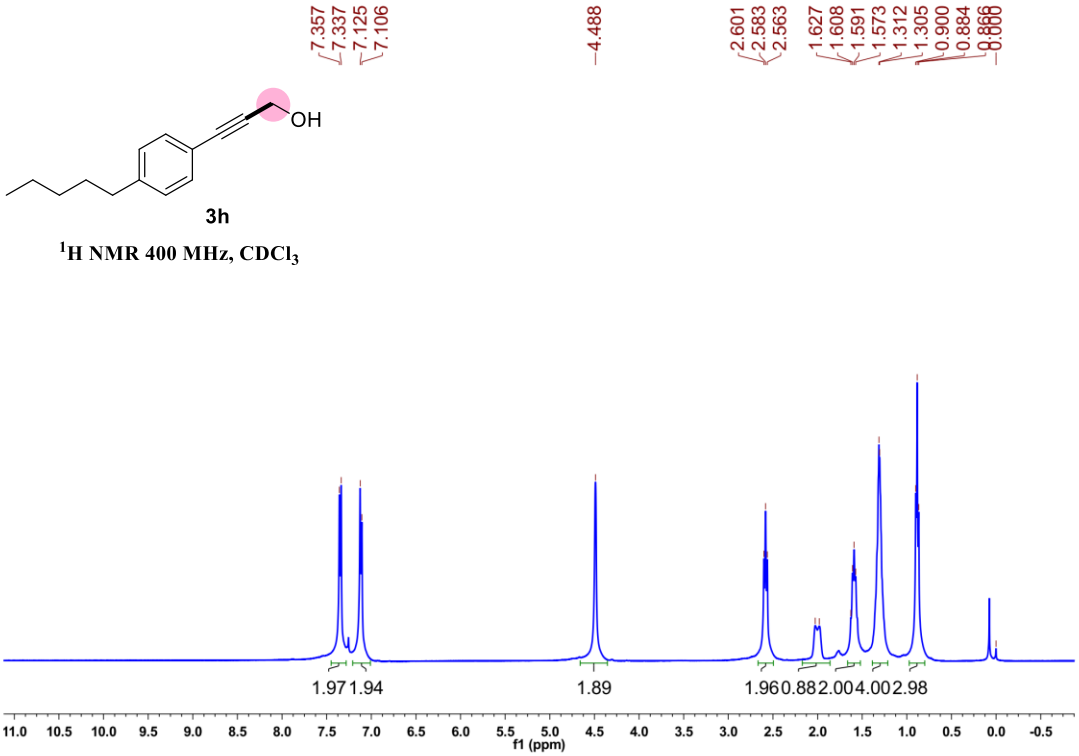

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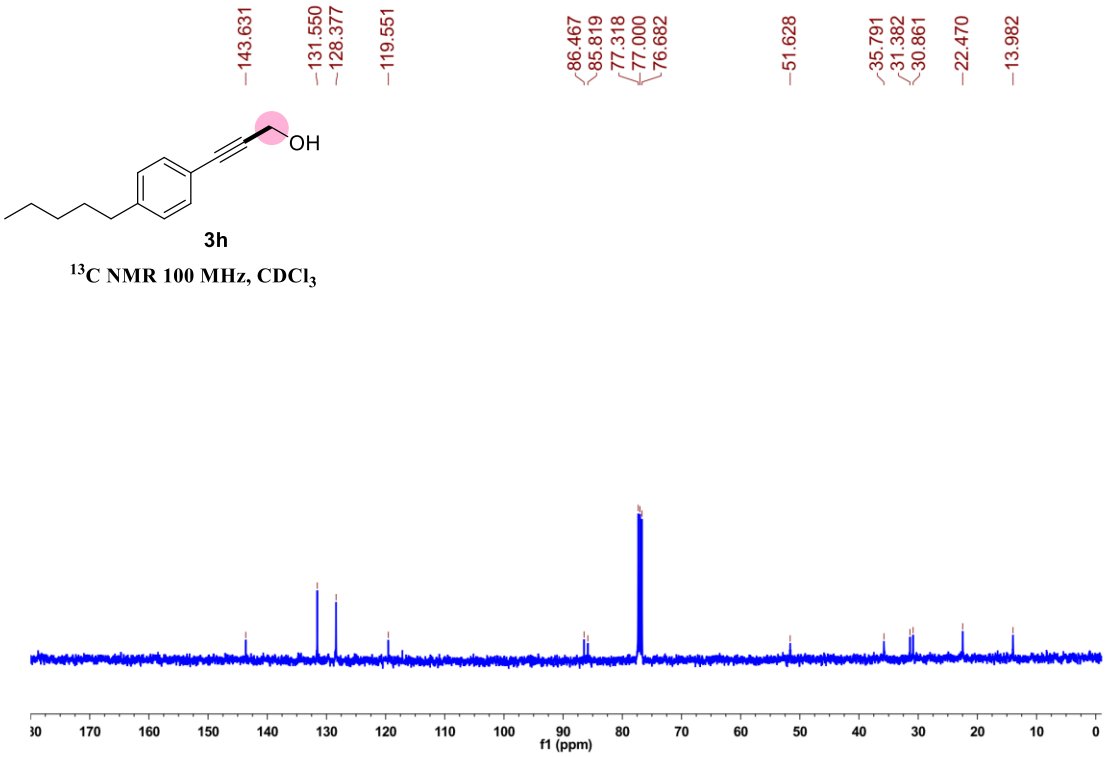

3h

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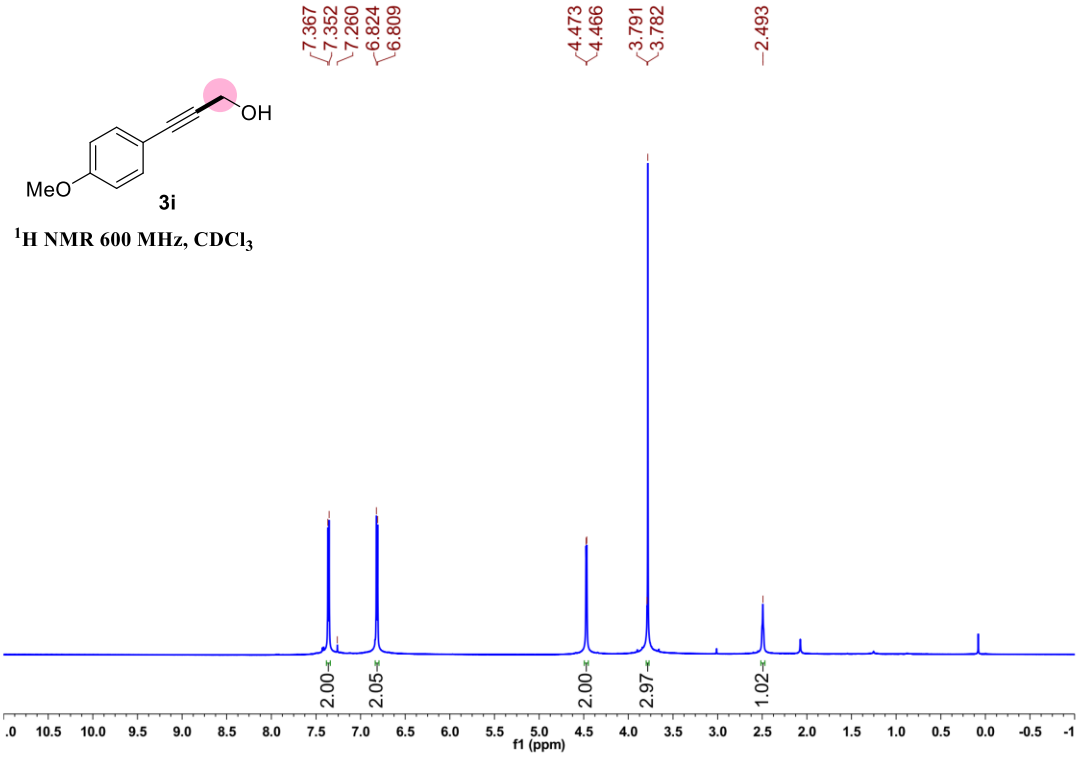
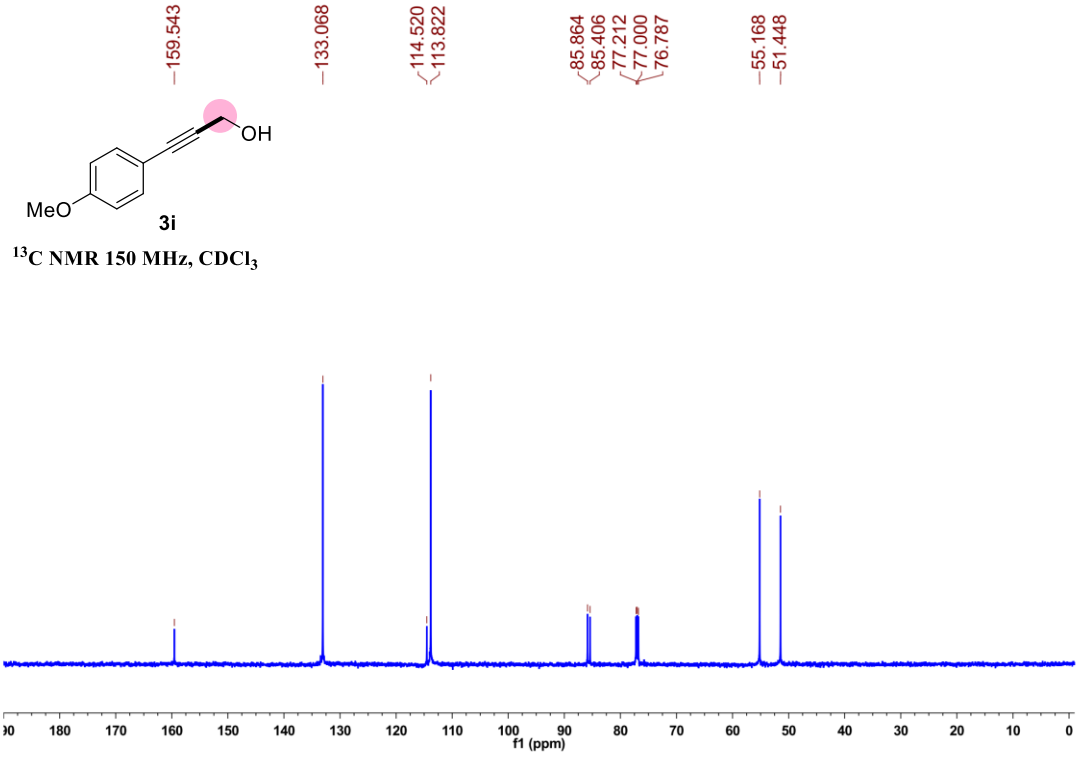


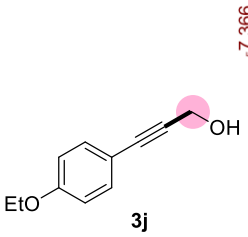
3i

^{1}H NMR 600 MHz, $CDCl_3$



3i

^{13}C NMR 150 MHz, $CDCl_3$



3j

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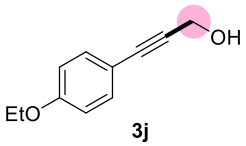
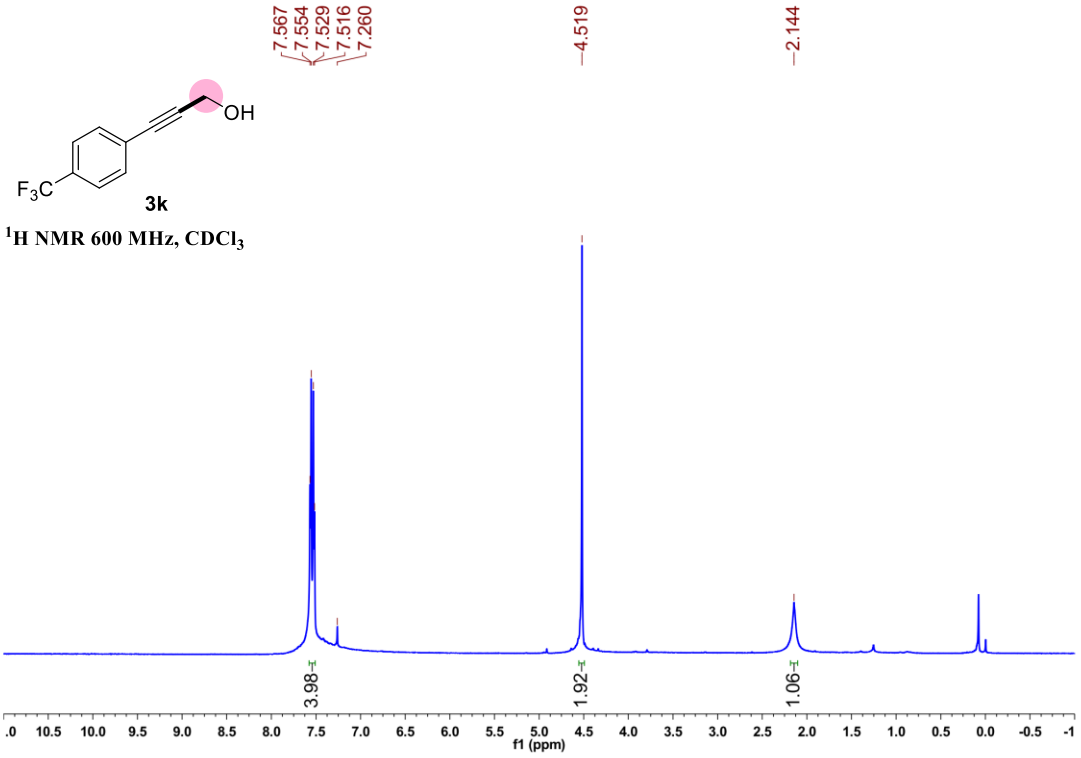


3j

^{13}C NMR 100 MHz, $CDCl_3$



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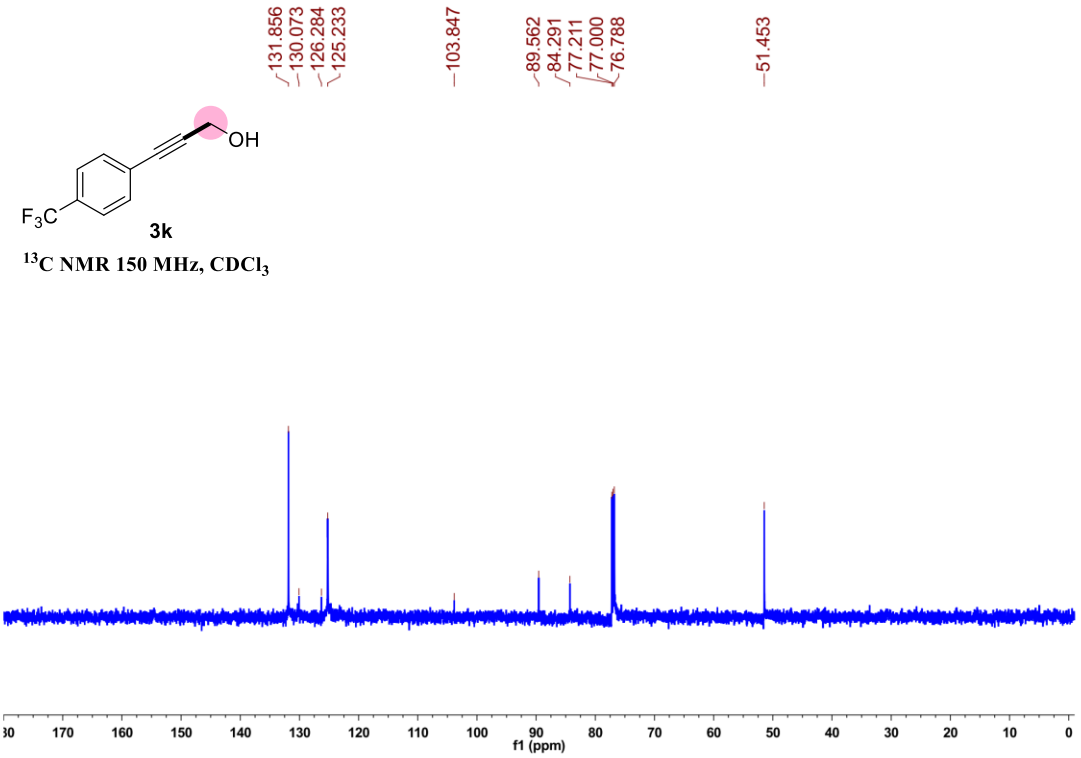
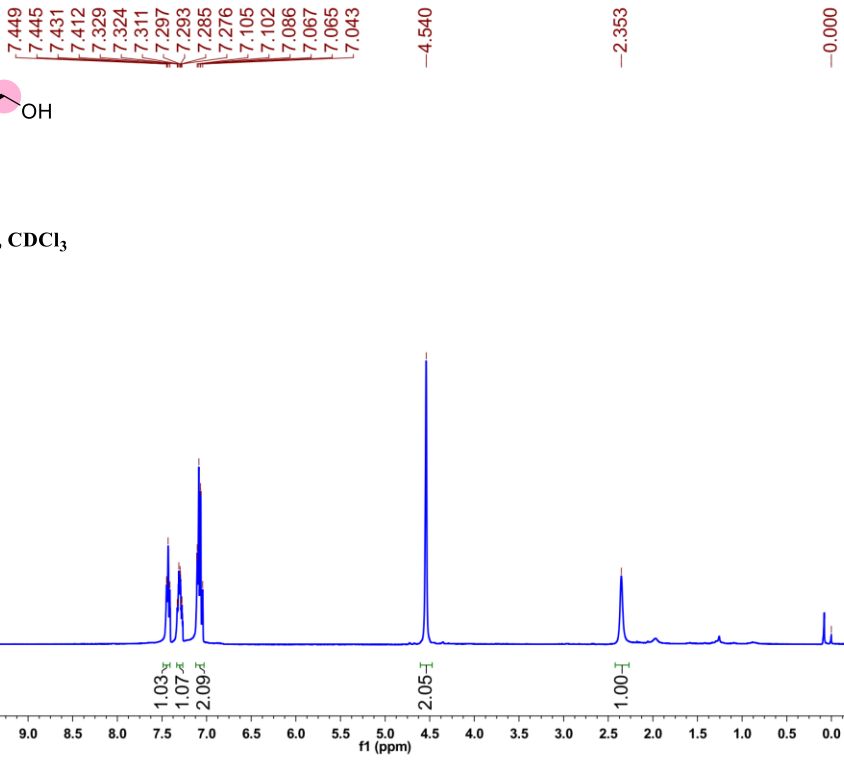
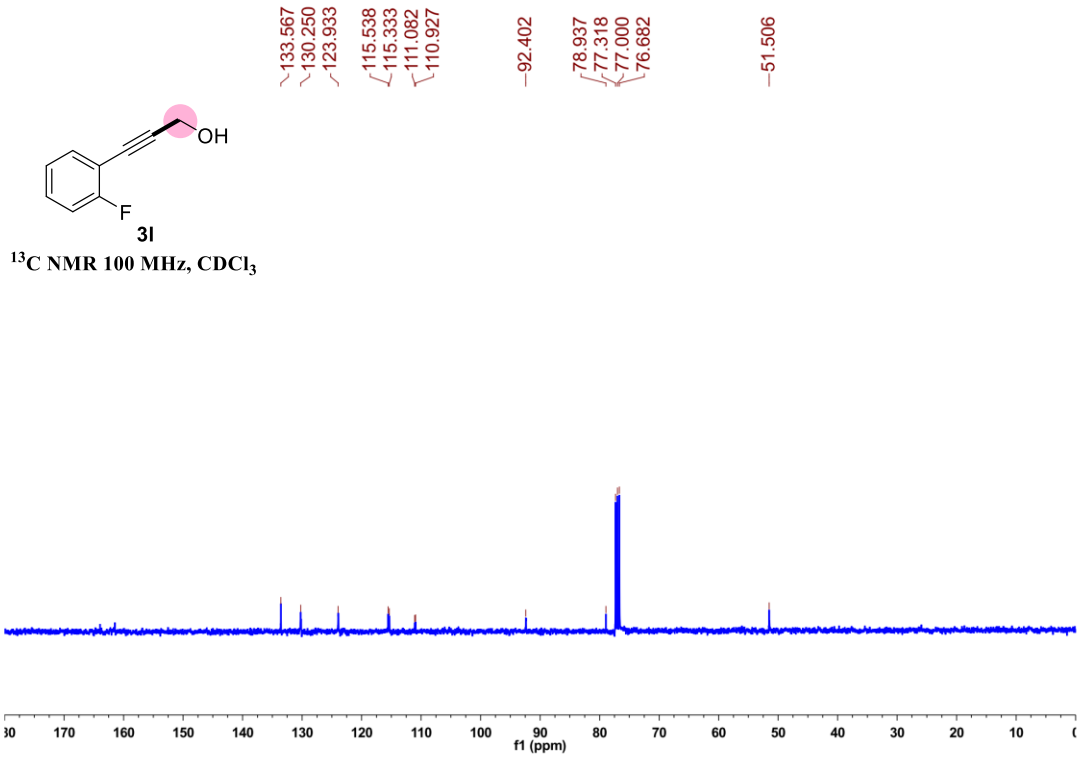


^{13}C NMR 150 MHz, $CDCl_3$



3l

^{1}H NMR 400 MHz, $CDCl_3$



3l

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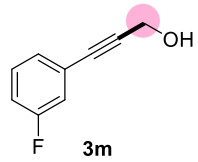

3m

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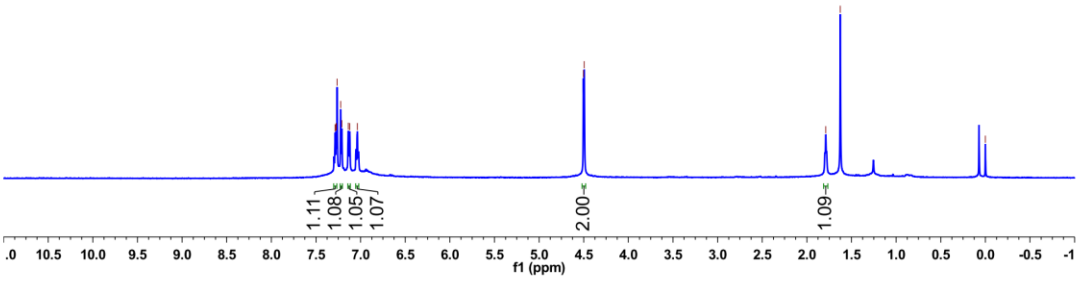
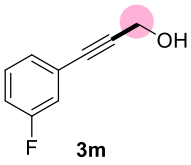
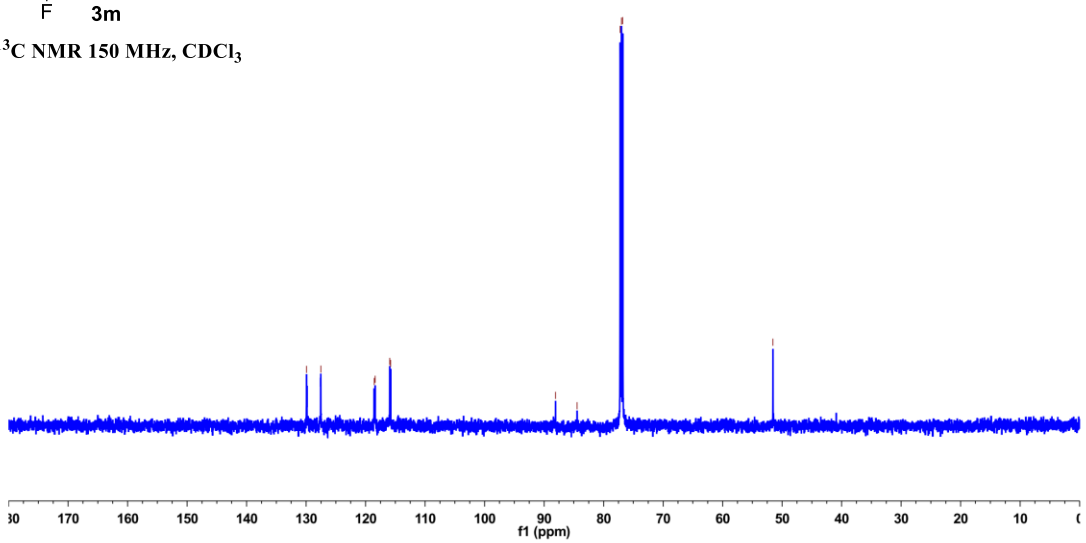
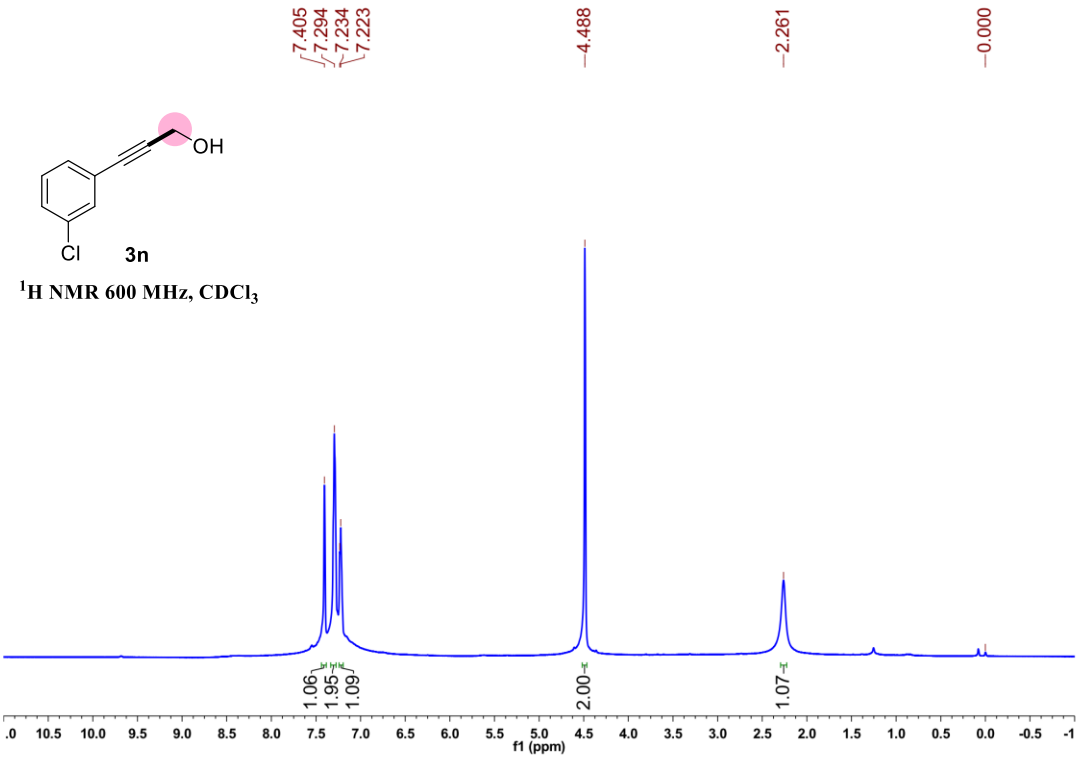




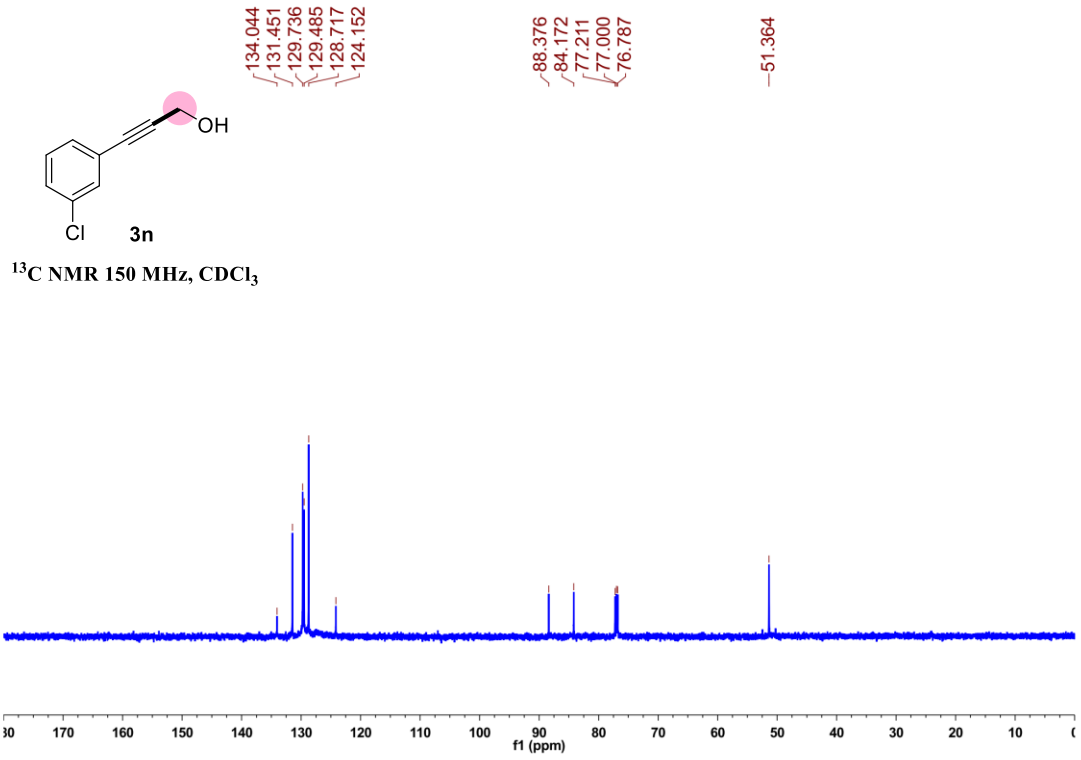
3m

^{13}C NMR 150 MHz, $CDCl_3$

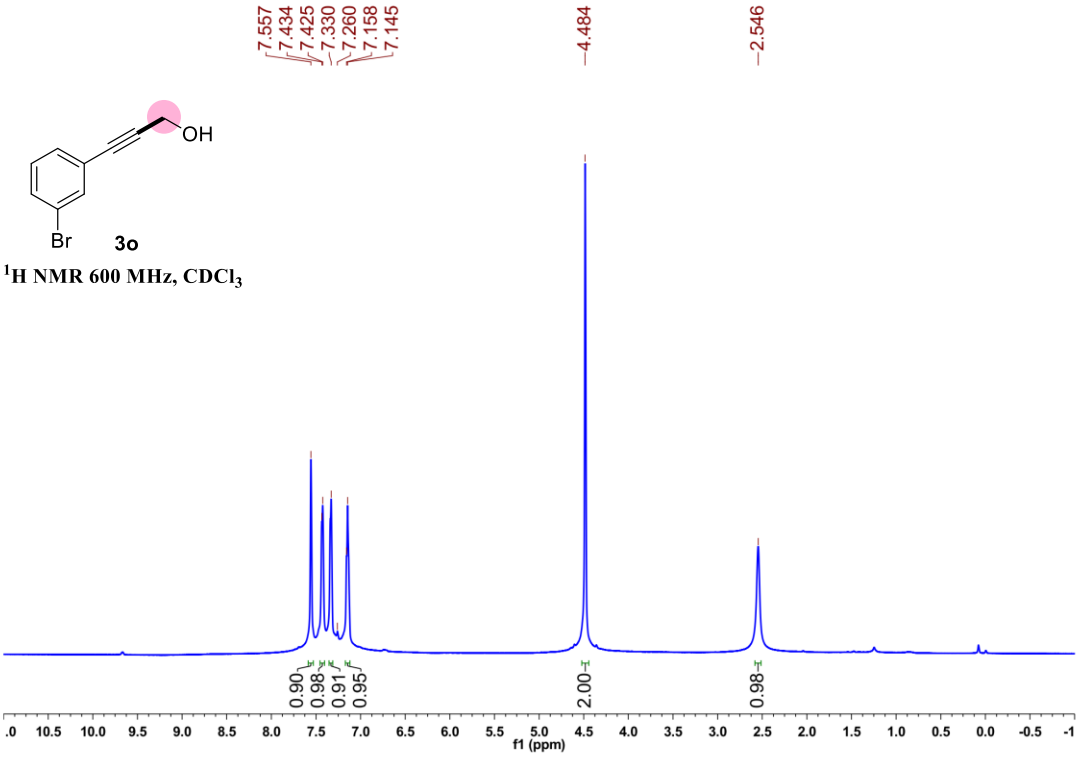




^{1}H NMR 600 MHz, $CDCl_3$



^{13}C NMR 150 MHz, $CDCl_3$



3o

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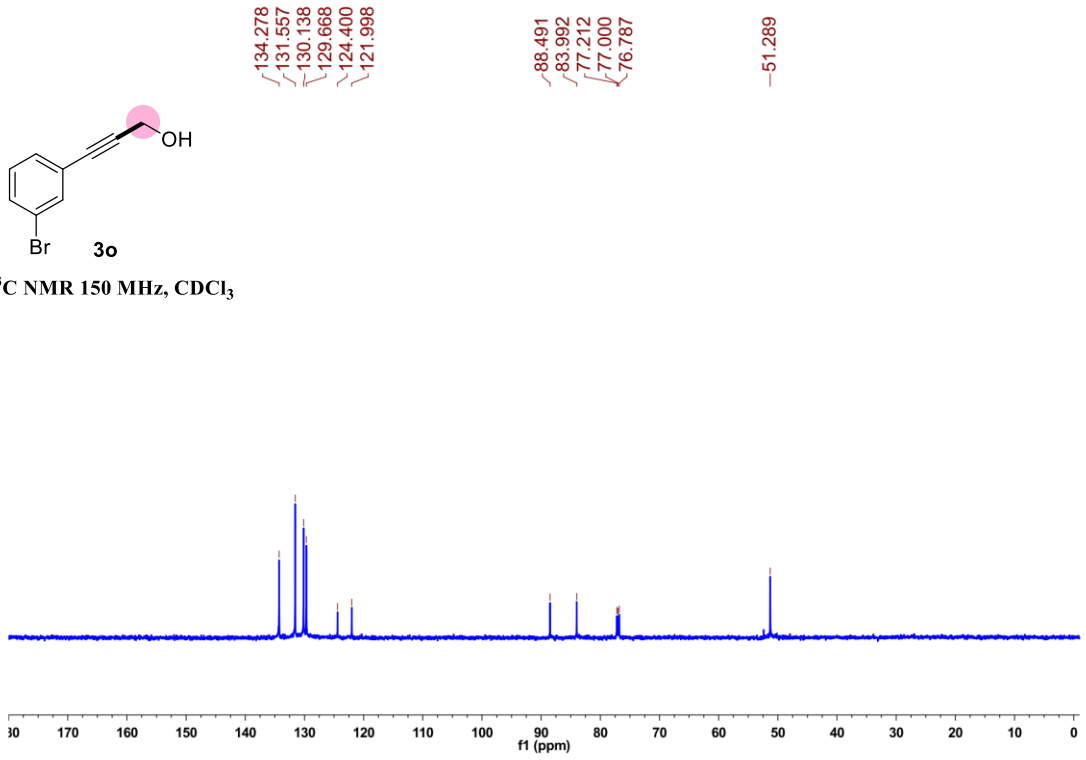

3o

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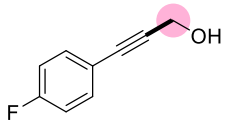
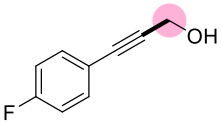


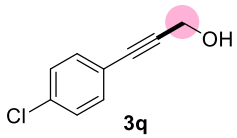
3p

^{1}H NMR 600 MHz, $CDCl_3$



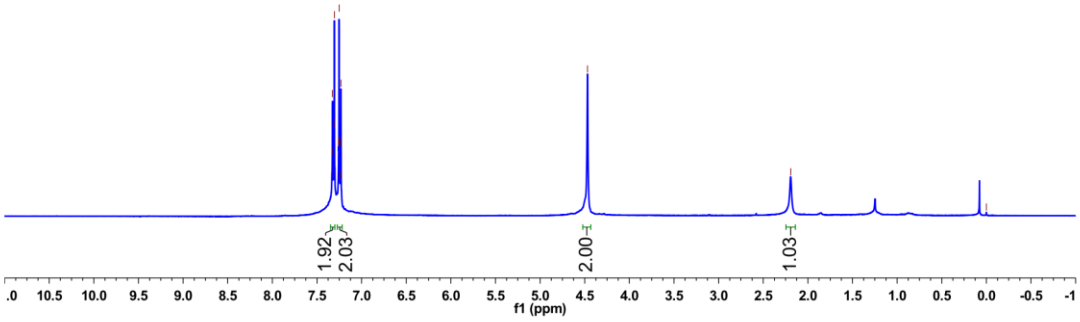
3p

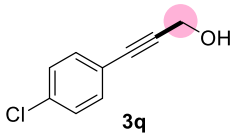
^{13}C NMR 150 MHz, $CDCl_3$



3q

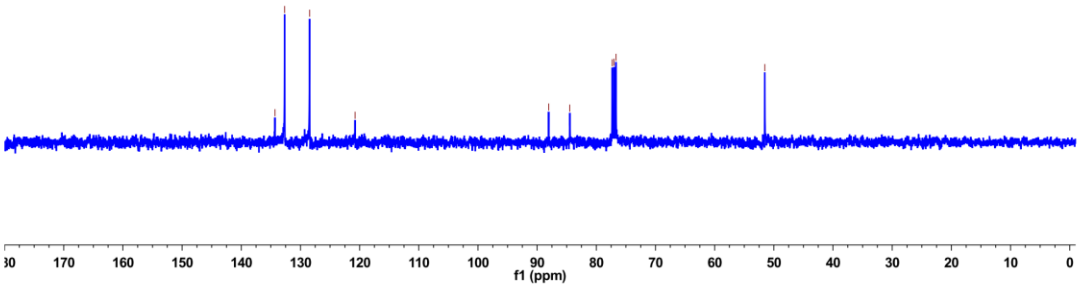
^{1}H NMR 400 MHz, $CDCl_3$

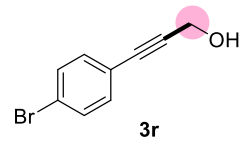




3q

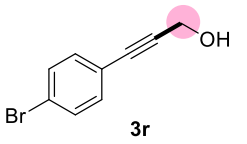
^{13}C NMR 100 MHz, $CDCl_3$





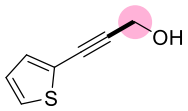
3r

^{1}H NMR 600 MHz, $CDCl_3$



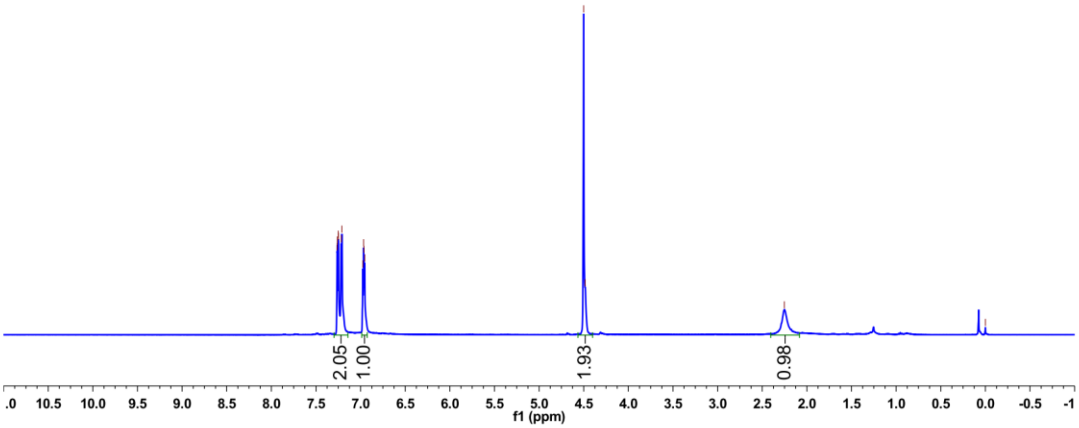
3r

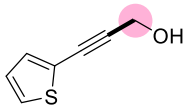
^{13}C NMR 150 MHz, $CDCl_3$



3s

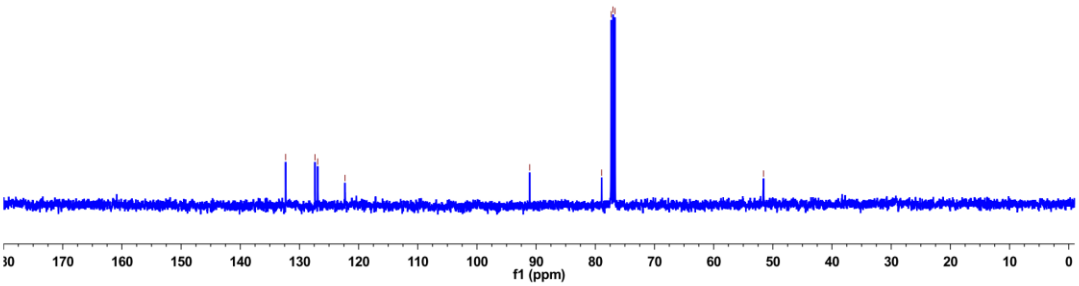
^{1}H NMR 400 MHz, $CDCl_3$





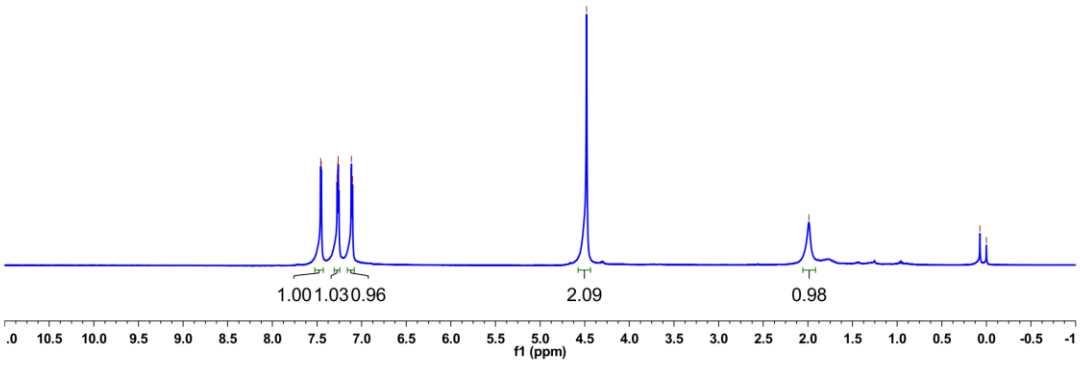
3s

^{13}C NMR 100 MHz, $CDCl_3$



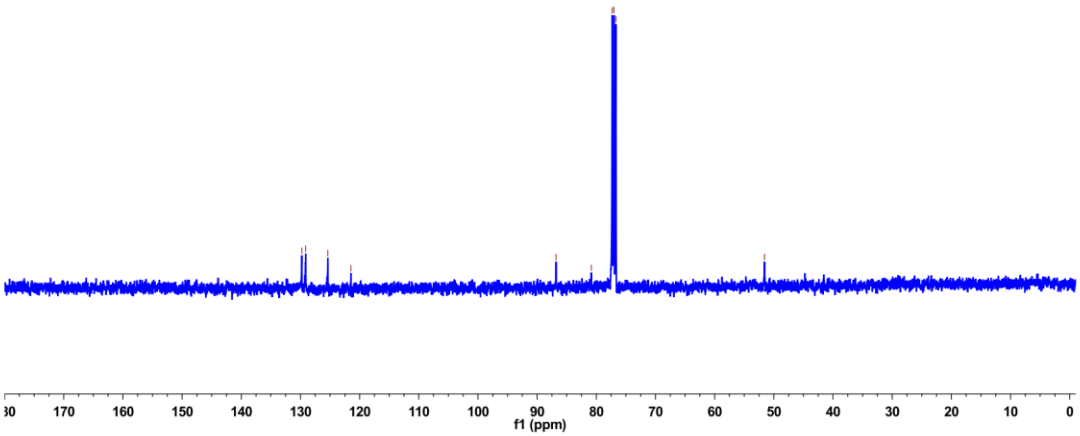
3t

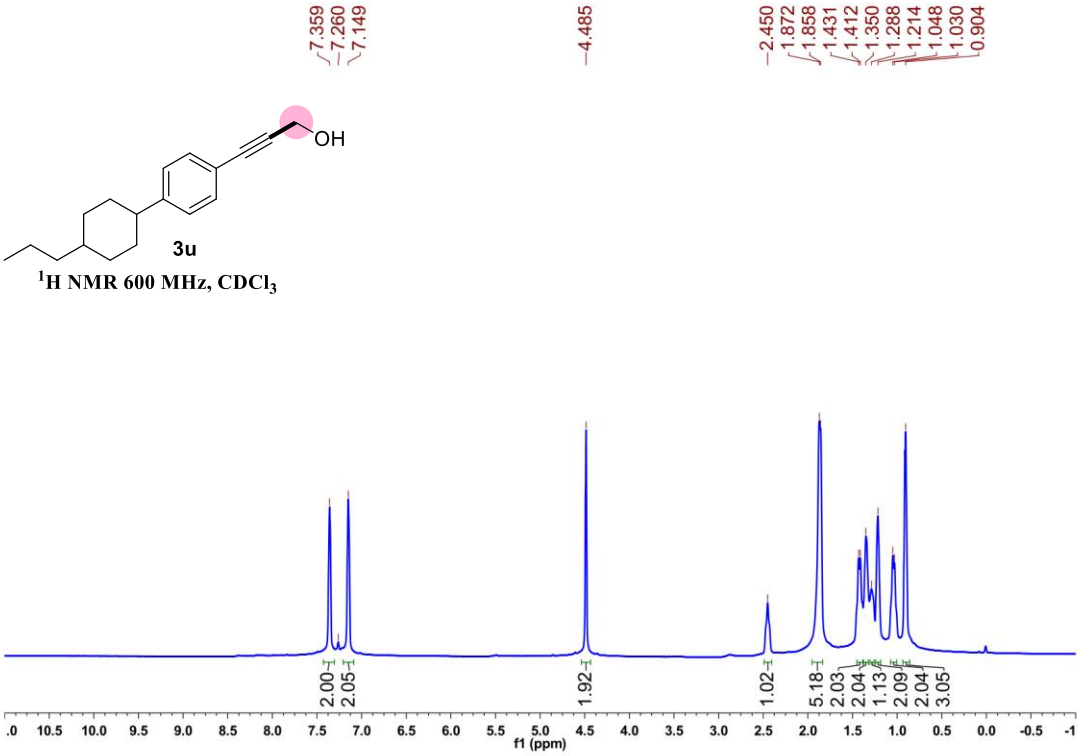
^{1}H NMR 400 MHz, $CDCl_3$



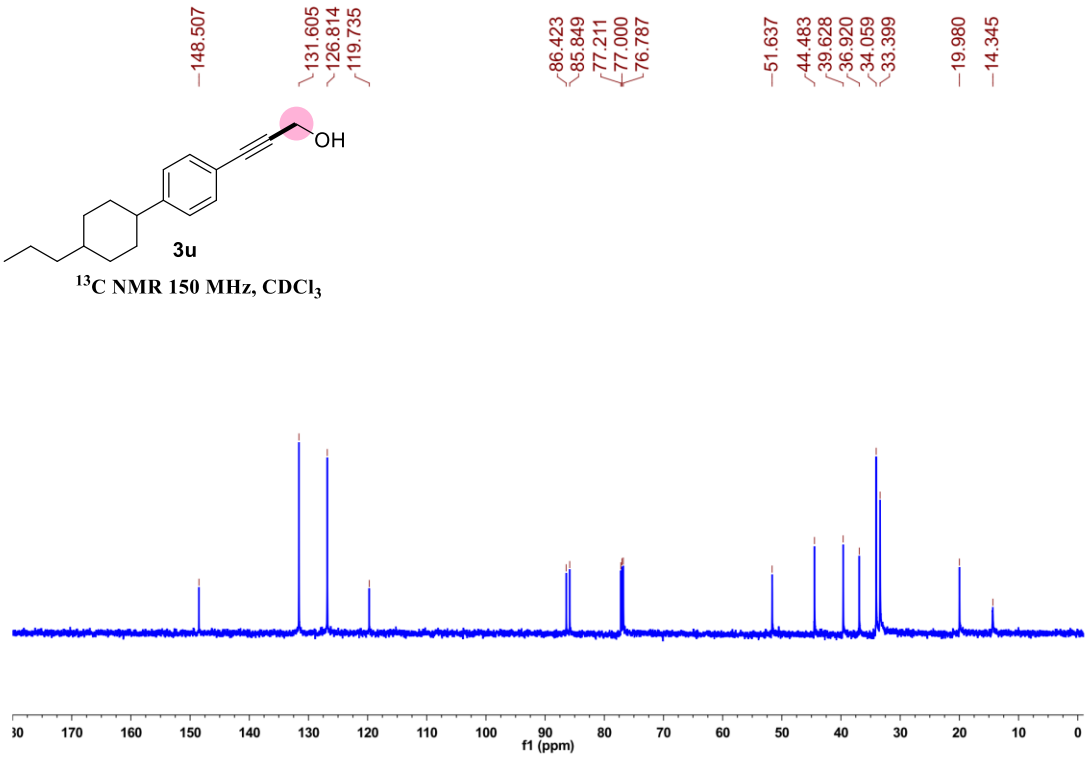
3t

^{13}C NMR 100 MHz, $CDCl_3$

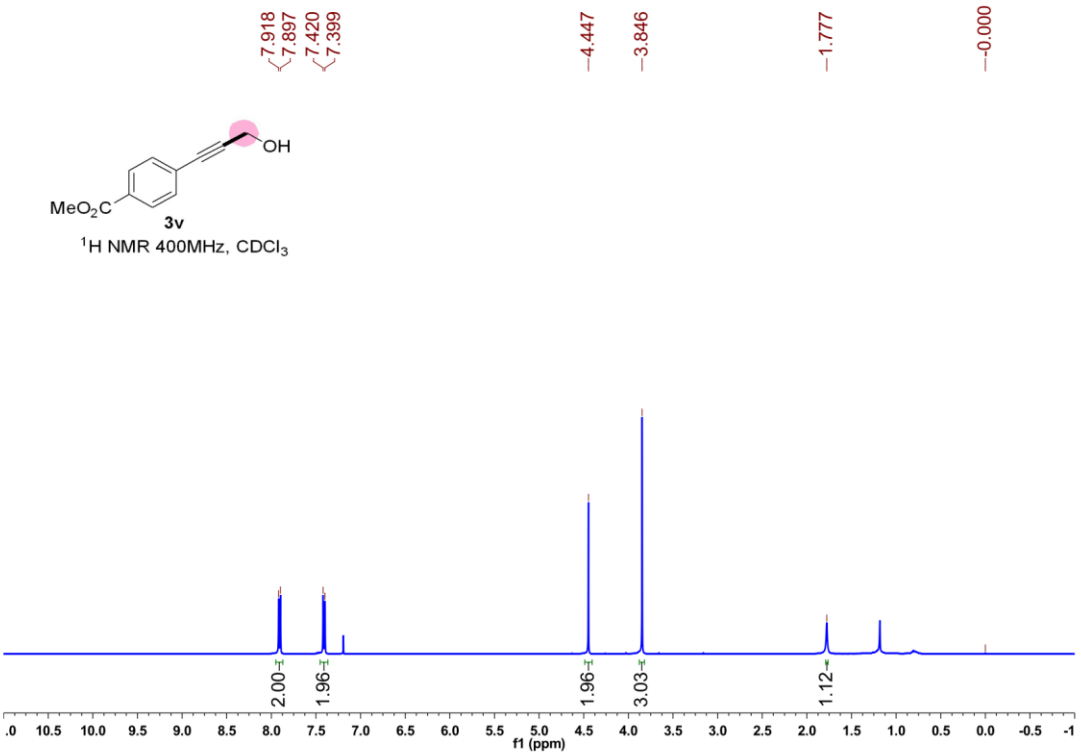


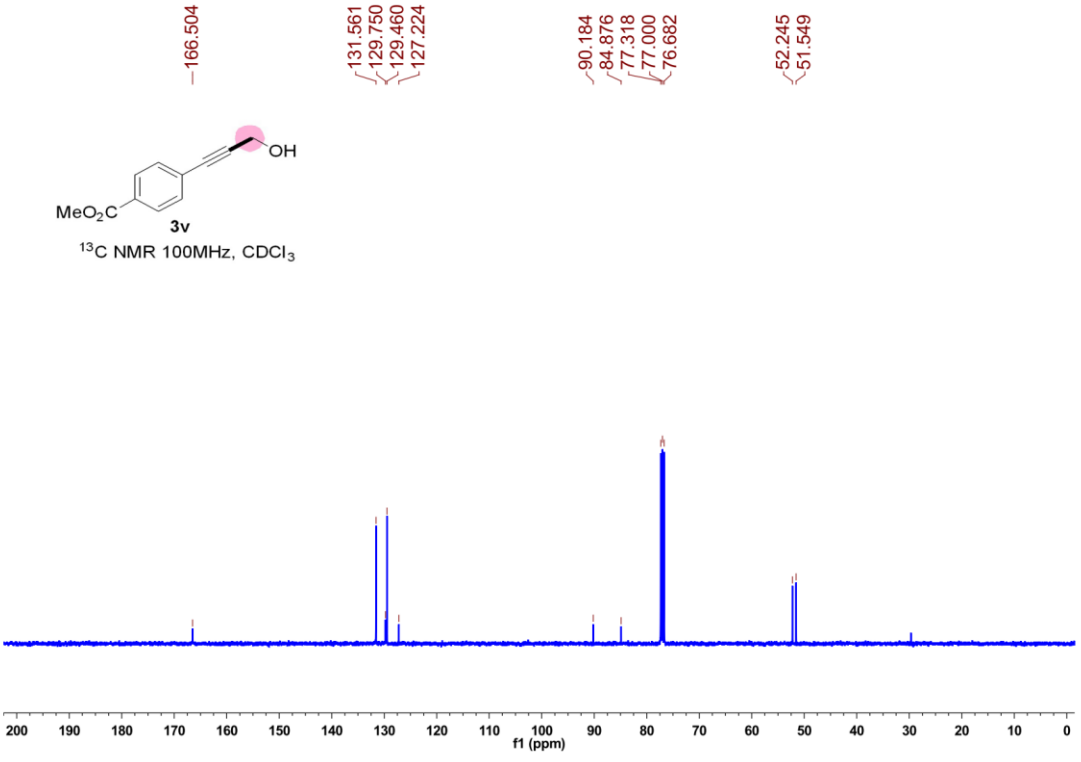


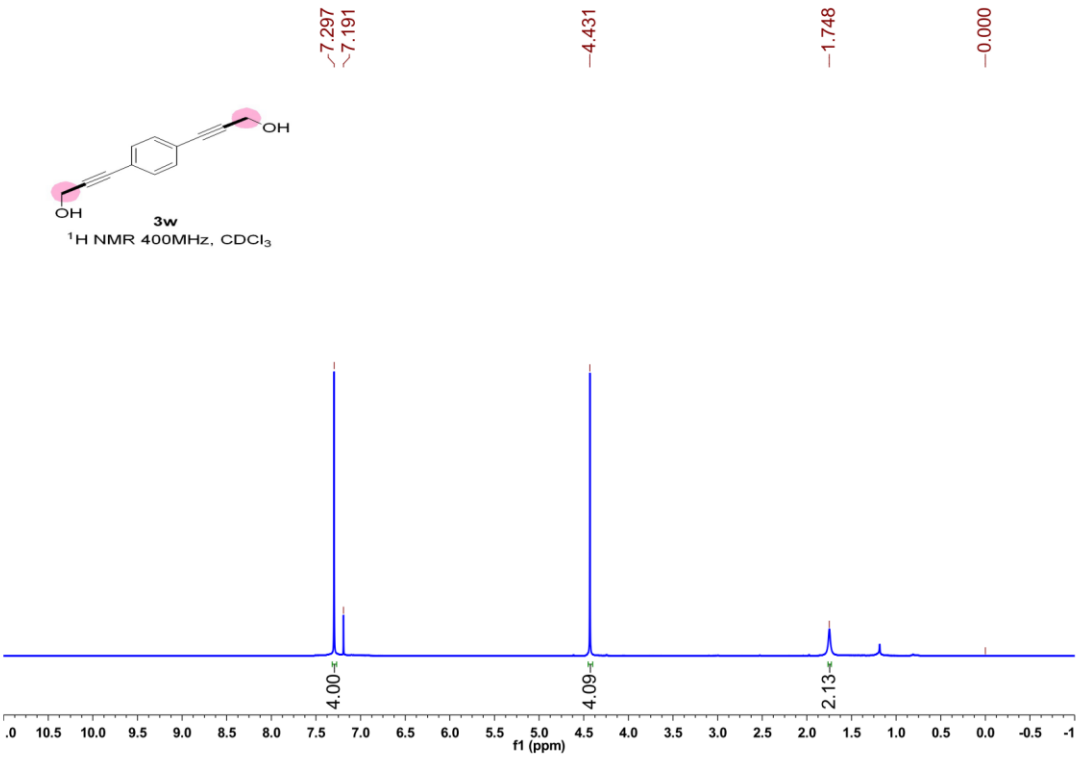
^{1}H NMR 600 MHz, $CDCl_3$

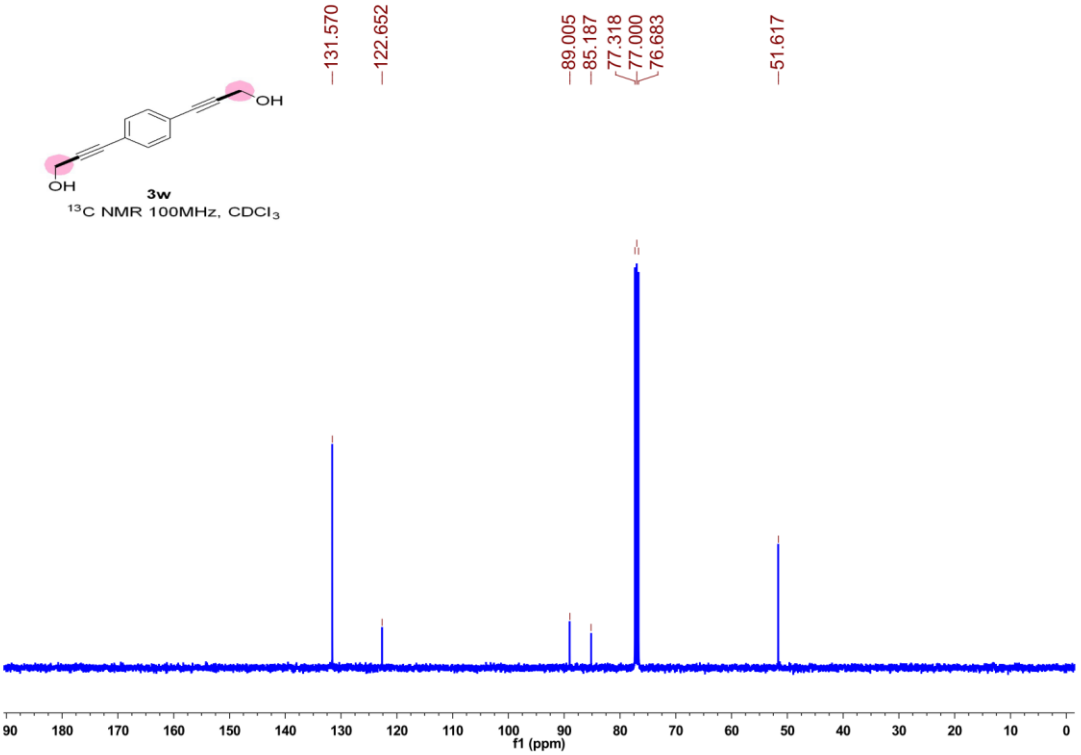


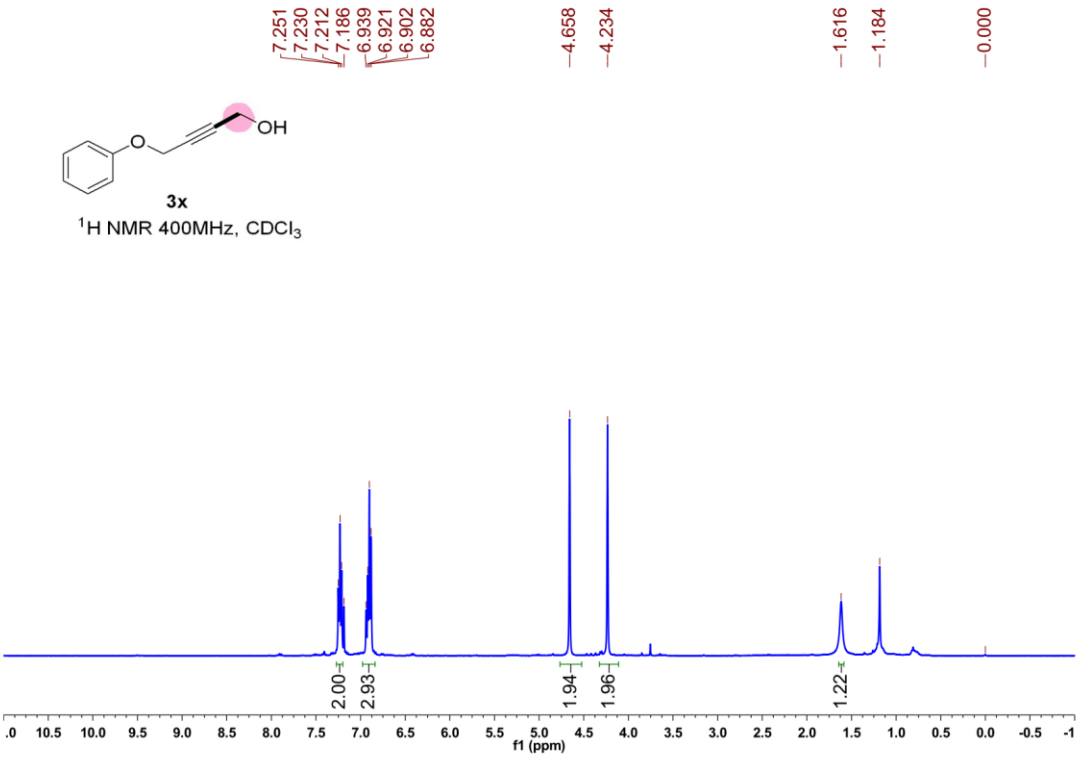
^{13}C NMR 150 MHz, $CDCl_3$

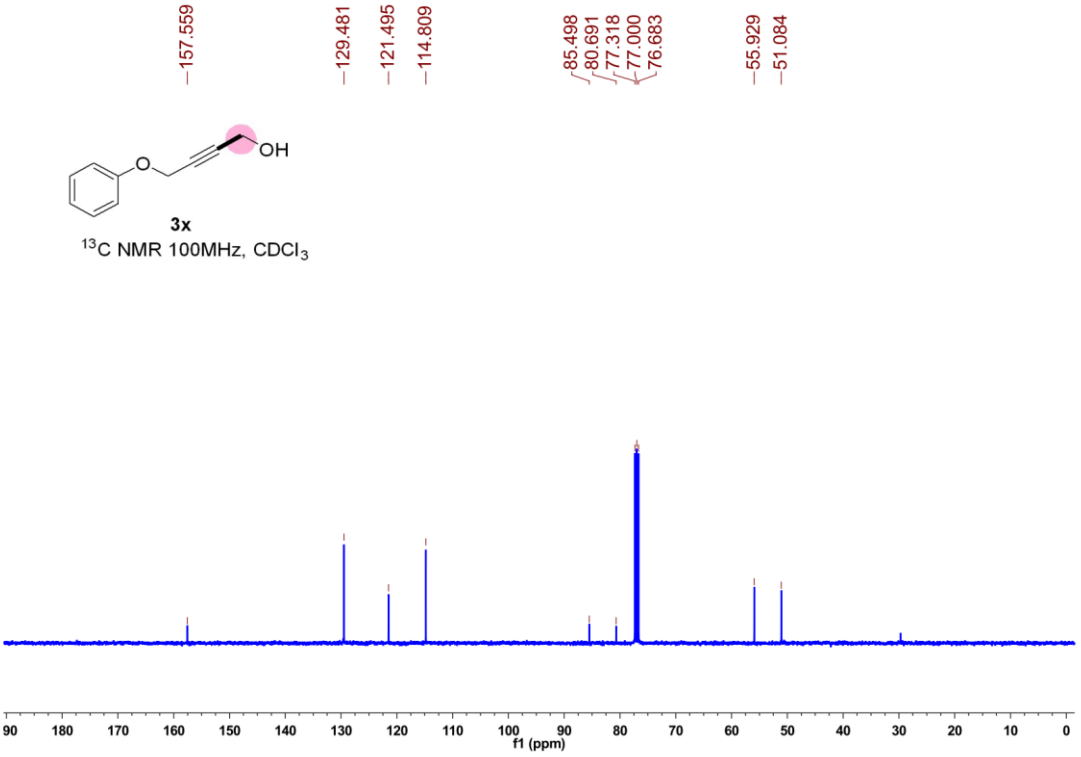

7.918
7.897
7.420
7.399
4.447
3.846
1.777
0.000
OH
MeO2C
3v
1H NMR 400MHz, CDCl3
2.00
1.96
1.96
3.03
1.12
f1 (ppm)

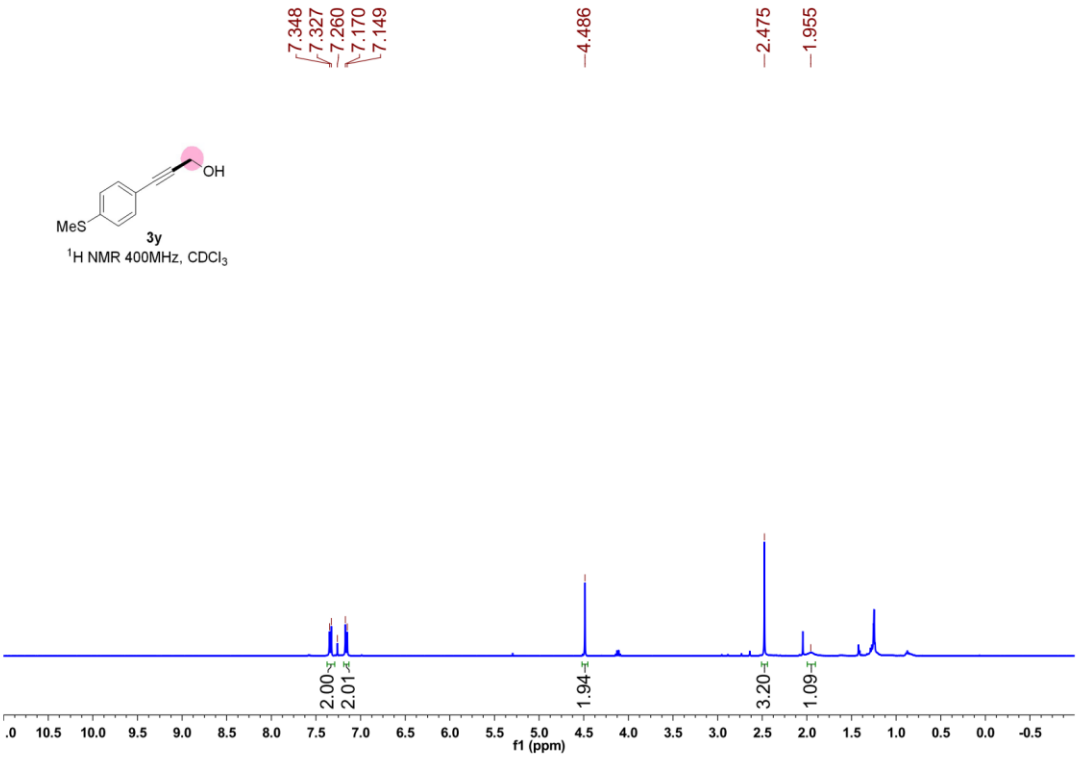

166.504
131.561
129.750
129.460
127.224
90.184
84.876
77.318
77.000
76.682
52.245
51.549
OH
MeO2C
3v
13C NMR 100MHz, CDCl3
f1 (ppm)

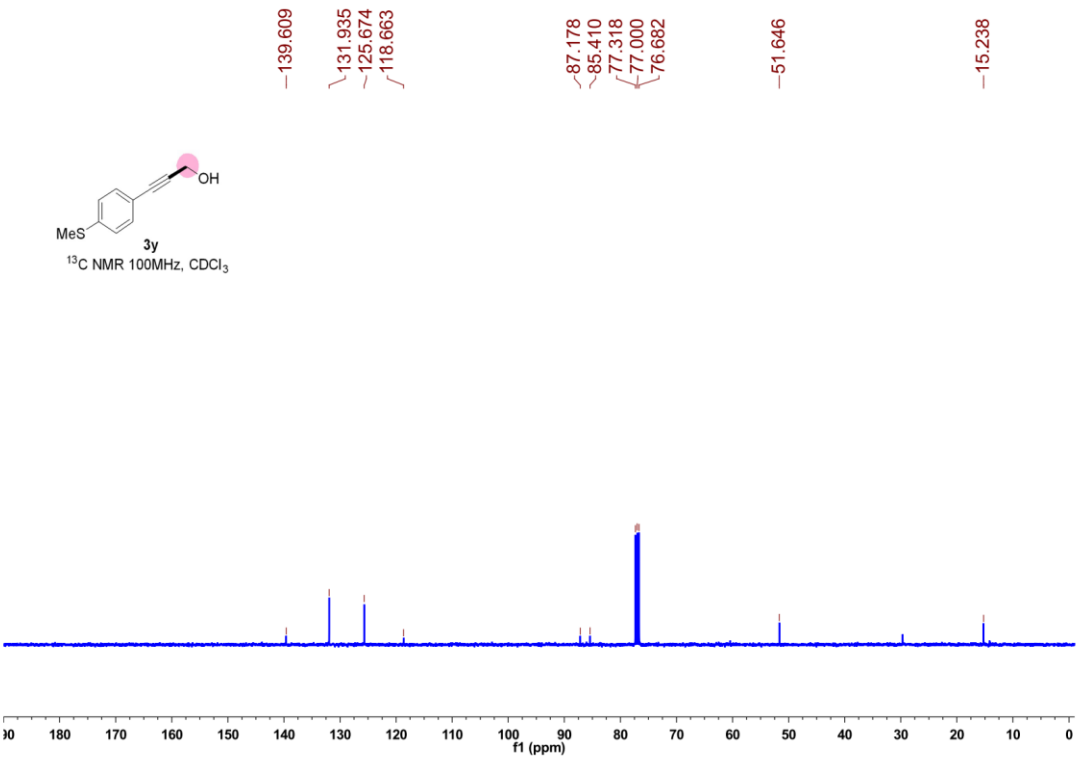

7.297
7.191
4.431
1.748
0.000
OH
OH
3w
^{1}H NMR 400MHz, $CDCl_3$
4.00
4.09
2.13
f1 (ppm)

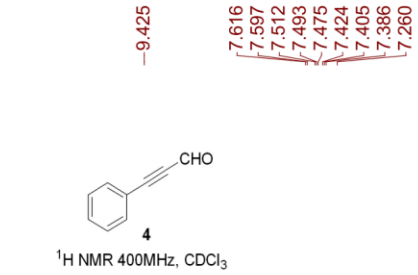

131.570
122.652
89.005
85.187
77.318
77.000
76.683
51.617
OH
OH
3w
^{13}C NMR 100MHz, $CDCl_3$
f1 (ppm)


7.251
7.230
7.212
7.186
6.939
6.921
6.902
6.882
4.658
4.234
1.616
1.184
0.000
OH
O
3x
^{1}H NMR 400MHz, CDCl$_3$
2.00
2.93
1.94
1.96
1.22
f1 (ppm)

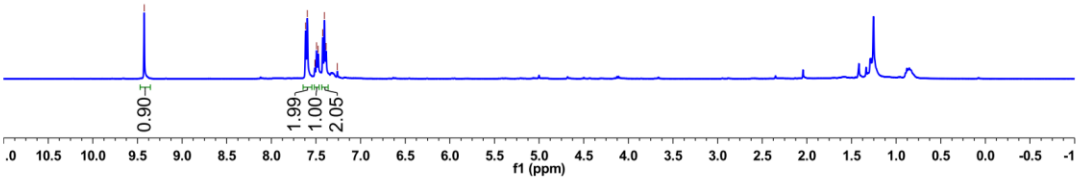

157.559
129.481
121.495
114.809
85.498
80.691
77.318
77.000
76.683
55.929
51.084
OH
O
3x
^{13}C NMR 100MHz, CDCl$_3$
f1 (ppm)

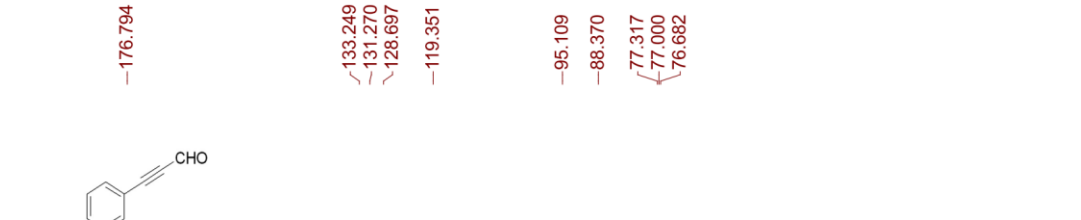

7.348
7.327
7.260
7.170
7.149
4.486
2.475
1.955
OH
MeS
3y
^{1}H NMR 400MHz, CDCl$_3$
2.00
2.01
1.94
3.20
1.09
f1 (ppm)


139.609
131.935
125.674
118.663
87.178
85.410
77.318
77.000
76.682
51.646
15.238
OH
MeS
3y
^{13}C NMR 100MHz, CDCl$_3$
f1 (ppm)

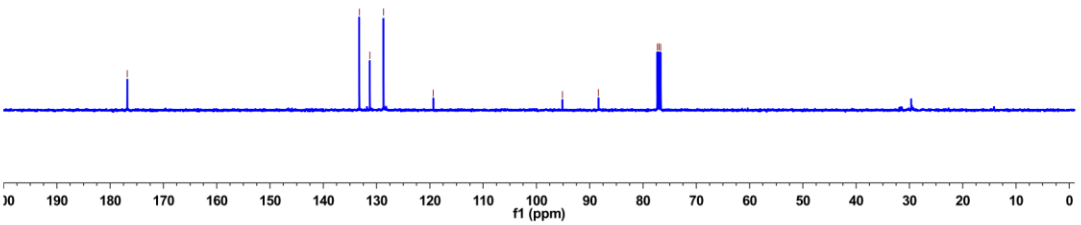


^{1}H NMR 400MHz, $CDCl_3$





^{13}C NMR 100MHz, $CDCl_3$



7. References.

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