Supporting Information

An efficient approch to access 1,1,2-triarylethanes enabled by organo-photoredox-catalyzed decarboxylative addition reaction

Jing Guo, Gong-Bin Huang, Qiao-Lei Wu, Ying Xie, Jiang Weng,* Gui Lu*

Guangdong Provincial Key Laboratory of New Drug Design and Evaluation, School of Pharmaceutical Sciences, Sun Yat-sen University, Guangzhou 510006, P. R. China

E-mail: *wengj2@mail.sysu.edu.cn; lugui@mail.sysu.edu.cn*

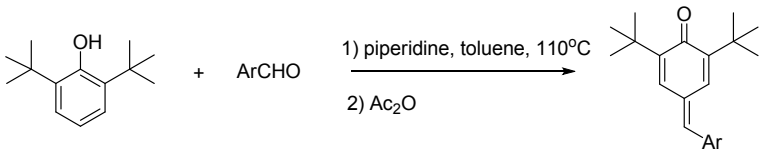
Table of Contents

1. General Information

All the commercial reagents were used as such without further purification. All solvents were used as commercial anhydrous grade without further purification. The flash column chromatography was carried out over silica gel (230-400 mesh). ^{1}H and ^{13}C NMR spectra were recorded on a Bruker Avance-400 MHz spectrometer and Bruker Avance-500 MHz spectrometer. Chemical shifts in ^{1}H NMR spectra were reported in parts per million (ppm, δ) downfield from the internal standard Me_4Si (TMS, δ = 0 ppm). Chemical shifts in ^{13}C NMR spectra were reported relative to the central line of the chloroform signal (δ = 77.0 ppm). Peaks were labeled as singlet (s), doublet (d), triplet (t), quartet (q), and multiplet (m). High resolution mass spectra were obtained with a Shimadzu LCMS-IT-TOF mass spectrometer. Chemical yields refer to pure isolated substances.

2. General Procedure for the Synthesis of Substrates

(a) General synthetic method of *p*-QMs derivatives[1]

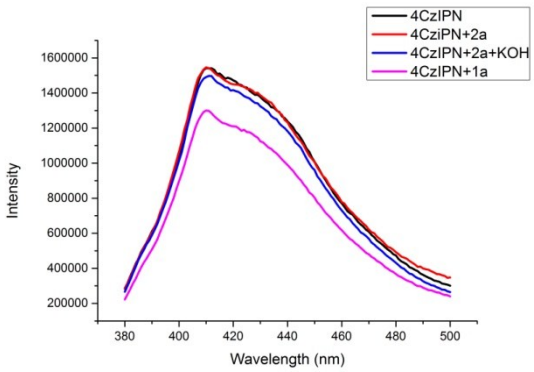


1a-1n

In a dry 100 mL round-bottom flask, a solution of phenols (25.0 mmol) and the corresponding aldehydes (25.0 mmol) in toluene (100 mL) was heated to reflux. Piperidine (50.0 mmol, 4.95 mL) was dropwise added within 1 h. The reaction mixture was continued to reflux for 12-18 h. After cooling just below the boiling point of the reaction mixture, acetic anhydride (50.0 mmol, 2.55 g) was added and the stirring was continued for 15 min. Then the reaction mixture was cooled to room temperature, poured into water and extracted with CH_2Cl_2. The combined organic phases were dried over anhydrous Na_2SO_4 and solvents were removed under reduced pressure. The crude products were purified by flash column chromatography and further recrystallized from *n*-hexane, affording the desired *p*-QMs **1a**-**1n**.

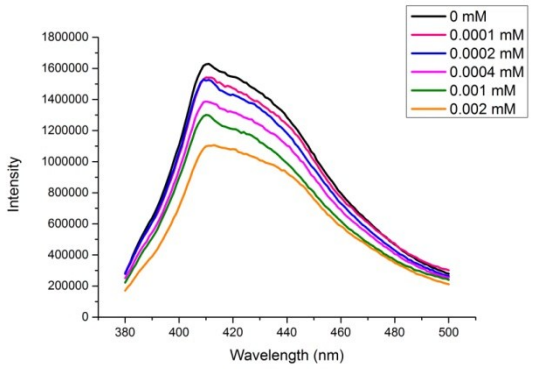
3. The Fluorescence Quenching Studies and Radical Trapping Experiment

(a) The Fluorescence Quenching Studies

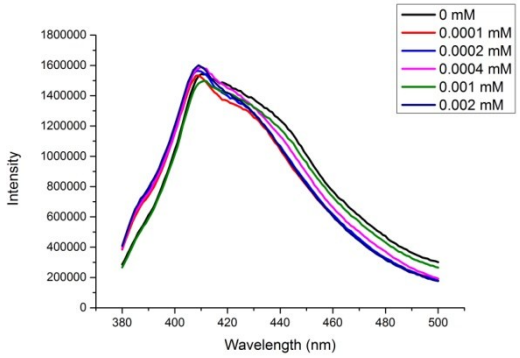


a) Fluorescence quenching of excited 4CzIPN* with arylacetic acid (**2a**), *p*-QM (**1a**) or carboxylate anion (**2a**+KOH)

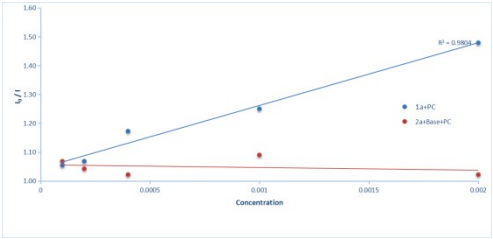
in DMF (excitation wavelength: 365 nm). 4CzIPN (1.25 nM) in DMF (black line), 4CzIPN (1.25 nM) with **2a** (1 μM) in DMF (red line), 4CzIPN (1.25 nM) with **2a** (1 μM) and KOH (1 μM) in DMF (blue line), 4CzIPN (1.25 nM) with **1a** (1 μM) in DMF (pink line).



b) 4CzIPN emission quenching by different concentrations of *p*-QM **1a** (excitation wavelength: 365 nm).

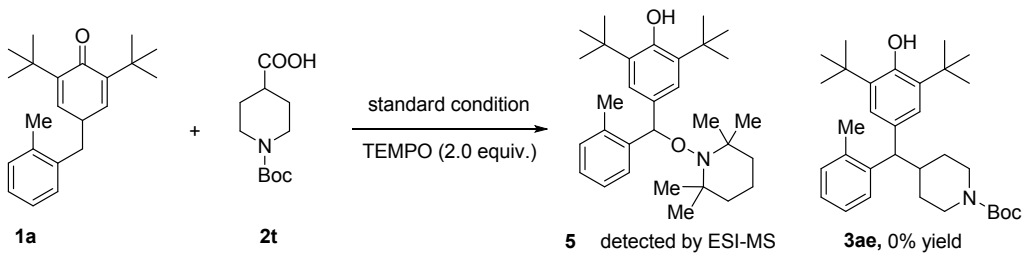


c) 4CzIPN emission quenching by different concentrations of carboxylate anion (**2a**+KOH) (excitation wavelength: 365 nm).

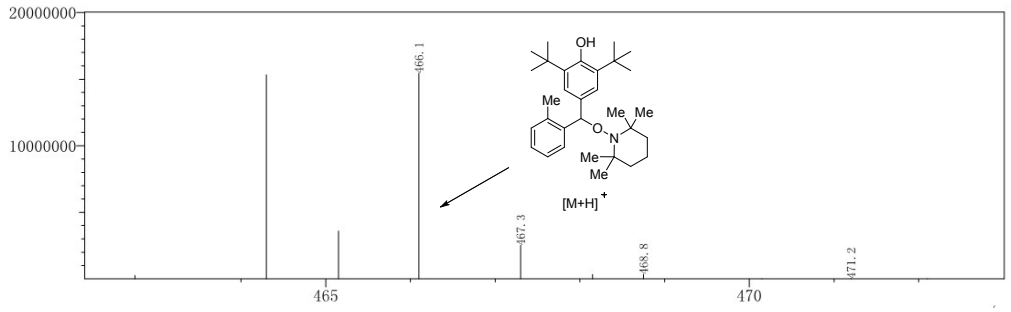


d) Stern-Volmer emission quenching studies of 4CzIPN by carboxylate anion (**2a**+KOH) or *p*-QM (**1a**)

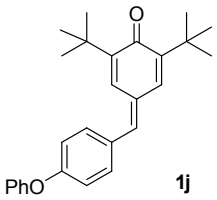
(b) Radical Trapping Experiments



1a **2t** **5** detected by ESI-MS **3ae,** 0% yield

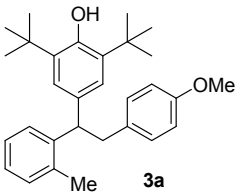


4. Characterization of Compounds 1j, 3a-3al and 4a



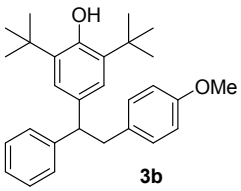
1j

2,6-di-*tert*-Butyl-4-(4-phenoxybenzylidene)cyclohexa-2,5-dienone (1j). ^{1}H NMR (400 MHz, $CDCl_3$) δ: 7.54 (s, 1H), 7.45 (s, 2H), 7.39 (m, 2H), 7.18 (m, 1H), 7.13 (s, 1H), 7.09 (m, 2H), 7.04 (m, 2H), 7.00 (s, 1H), 1.39-1.29 (m, 18H). ^{13}C NMR (126 MHz, $CDCl_3$) δ: 186.5, 158.8, 155.9, 149.3, 147.5, 142.0, 135.3, 132.2, 132.2, 131.2, 130.0, 130.0, 127.6, 124.3, 120.0, 120.0, 118.2, 118.2, 35.5, 35.0, 29.6, 29.6. ESI-HRMS: *m/z* $[M+H]^+$ calcd. for $C_{27}H_{31}O_2$: 387.2319; found: 387.2321.



3a

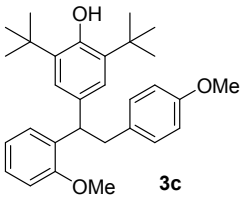
2,6-di-*tert*-Butyl-4-(2-(4-methoxyphenyl)-1-*o*-tolylethyl)phenol (3a). Yield: 31.4 mg, 73%. Yellow solid, M.p. 122-124 °C. ^{1}H NMR (400 MHz, $CDCl_3$) δ: 7.33 (d, *J* = 7.7 Hz, 1H), 7.13 (m, 1H), 7.04-6.93 (m, 2H), 6.77 (d, *J* = 17.5 Hz, 4H), 6.67-6.54 (m, 2H), 4.91 (s, 1H), 4.17 (t, *J* = 7.7 Hz, 1H), 3.67 (s, 3H), 3.29-2.93 (m, 2H), 2.06 (s, 3H), 1.27 (s, 18H). ^{13}C NMR (101 MHz, $CDCl_3$) δ: 157.7, 151.8, 143.1, 136.2, 135.2, 134.5, 133.0, 130.2, 130.2, 130.0, 130.0, 126.8, 125.9, 125.7, 124.7, 124.7, 113.3, 113.3, 55.2, 48.7, 42.1, 34.3, 34.3, 30.3, 20.0. ESI-HRMS: *m/z* $[M-H]^-$ calcd. for $C_{30}H_{37}O_2$: 429.2799; found: 429.2801.



3b

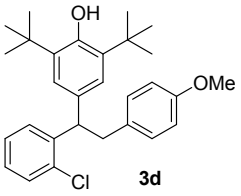
2,6-di-*tert*-Butyl-4-(2-(4-methoxyphenyl)-1-phenylethyl)phenol (**3b**). Yield: 21.6 mg, 52%. Yellow solid, M.p. 127-129 °C. ^{1}H NMR (400 MHz, $CDCl_3$) δ: 7.19 (m, 5H), 6.94 (s, 2H), 6.86 (d, *J* = 8.2 Hz, 2H), 6.70 (d, *J* = 8.2 Hz, 2H), 5.01 (s, 1H), 4.17-3.95 (m, 1H), 3.71 (d, *J* = 17.3 Hz, 3H), 3.38-3.09 (m, 2H), 1.33 (d, *J* = 29.6 Hz, 18H). ^{13}C NMR (101 MHz, $CDCl_3$) δ: 157.7, 152.0, 144.9,

135.4, 135.2, 132.9, 130.1, 130.1, 128.9, 128.2, 128.2, 128.2, 128.2, 125.9, 124.5, 124.5, 113.4, 113.4, 55.2, 53.5, 42.0, 34.3, 34.3, 30.3. ESI-HRMS: *m/z* [M-H]$^-$ calcd. for $C_{29}H_{35}O_2$: 415.2643; found: 415.2643.



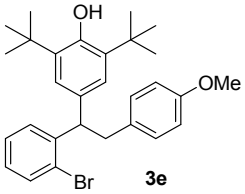
3c

2,6-di-*tert*-Butyl-4-(1-(2-methoxyphenyl)-2-(4-methoxyphenyl)ethyl)phenol (**3c**). Yield: 38.4 mg, 86%. Yellow solid, M.p. 105-107 °C. ^{1}H NMR (400 MHz, $CDCl_3$) δ: 7.30 (d, *J* = 9.2 Hz, 1H), 7.16 (m, 1H), 7.05 (s, 2H), 7.01-6.90 (m, 3H), 6.87-6.68 (m, 3H), 5.00 (s, 1H), 4.62 (t, *J* = 7.8 Hz, 1H), 3.75 (d, *J* = 12.6 Hz, 6H), 3.25 (m, 2H), 1.41 (s, 18H). ^{13}C NMR (101 MHz, $CDCl_3$) δ: 157.6, 157.0, 151.7, 135.1, 134.7, 133.8, 133.4, 130.0, 130.0, 128.1, 126.8, 125.5, 124.9, 124.9, 120.4, 113.3, 113.3, 110.8, 55.5, 55.2, 45.3, 40.9, 34.3, 34.3, 30.4. ESI-HRMS: *m/z* [M-H]$^-$ calcd. for $C_{30}H_{37}O_3$: 445.2748; found: 445.2746.



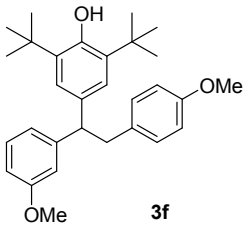
3d

2,6-di-*tert*-Butyl-4-(1-(2-chlorophenyl)-2-(4-methoxyphenyl)ethyl)phenol (3d). Yield: 33.8 mg, 75%. Yellow solid, M.p. 139-141 °C. ^{1}H NMR (400 MHz, $CDCl_3$) δ: 7.38 (m, 1H), 7.32-7.16 (m, 2H), 7.11-7.03 (m, 1H), 7.01-6.88 (m, 4H), 6.79-6.52 (m, 2H), 5.01 (s, 1H), 4.70 (t, *J* = 7.8 Hz, 1H), 3.73 (s, 3H), 3.24 (d, *J* = 2.0 Hz, 2H), 1.37 (s, 18H). ^{13}C NMR (101 MHz, $CDCl_3$) δ: 157.8, 152.1, 142.5, 135.4, 135.4, 134.2, 133.5, 132.3, 129.9, 129.9, 129.6, 128.7, 127.0, 126.7, 124.8, 124.8, 113.5, 113.5, 55.2, 48.3, 41.0, 34.3, 34.3, 30.4. ESI-HRMS: *m/z* [M-H]$^-$ calcd. for $C_{29}H_{34}O_2Cl$: 449.2253; found: 449.2256.



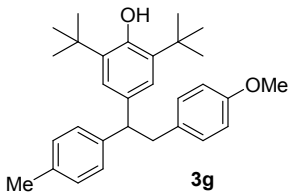
3e

4-(1-(2-Bromophenyl)-2-(4-methoxyphenyl)ethyl)-2,6-di-*tert*-butylphenol (3e). Yield: 30.6 mg, 62%. Yellow solid, M.p. 140-142 °C. ^{1}H NMR (500 MHz, $CDCl_3$) δ: 7.47 (d, *J* = 7.9 Hz, 1H), 7.37 (d, *J* = 7.8 Hz, 1H), 7.26 (d, *J* = 7.2 Hz, 1H), 7.10-6.89 (m, 5H), 6.71 (d, *J* = 8.2 Hz, 2H), 5.02 (s, 1H), 4.71 (m, 1H), 3.73 (s, 3H), 3.35-3.14 (m, 2H), 1.38 (s, 18H). ^{13}C NMR (126 MHz, $CDCl_3$) δ: 157.8, 152.1, 144.2, 135.4, 135.4, 133.4, 132.9, 132.2, 129.9, 129.9, 128.9, 127.4, 127.4, 125.3, 124.8, 124.8, 113.4, 113.4, 55.2, 50.8, 41.2, 34.4, 34.4, 30.4. ESI-HRMS: *m/z* [M-H]$^-$ calcd. for $C_{29}H_{34}O_2Br$: 493.1748; found: 493.1754.



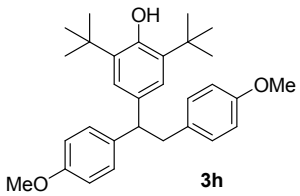
3f

2,6-di-*tert*-Butyl-4-(1-(3-methoxyphenyl)-2-(4-methoxyphenyl)ethyl)phenol (3f). Yield: 35.7 mg, 80%. Yellow oil. ^{1}H NMR (400 MHz, $CDCl_3$) δ: 7.07 (m, 1H), 6.88 (s, 2H), 6.80 (d, *J* = 8.6 Hz, 2H), 6.74 (d, *J* = 7.6 Hz, 1H), 6.68 (m, 1H), 6.62 (m, 3H), 4.93 (s, 1H), 3.95 (m, 1H), 3.66 (d, *J* = 2.5 Hz, 6H), 3.28-2.94 (m, 2H), 1.30 (s, 18H). ^{13}C NMR (101 MHz, $CDCl_3$) δ: 159.4, 157.7, 152.0, 135.4, 135.4, 135.0, 132.86, 130.0, 130.0, 129.1, 124.5, 124.5, 120.6, 114.2, 114.2, 113.4, 113.4, 111.1, 55.2, 55.1, 53.5, 42.0, 34.3, 34.4, 30.4. ESI-HRMS: *m/z* [M-H]$^-$ calcd. for $C_{30}H_{37}O_3$: 445.2748; found: 445.2751.



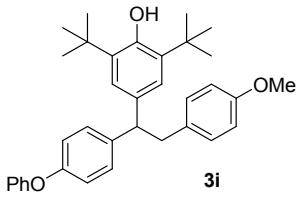
3g

2,6-di-*tert*-Butyl-4-(2-(4-methoxyphenyl)-1-*p*-tolylethyl)phenol (3g). Yield: 29.2 mg, 68%. Yellow solid, M.p. 117-119 °C. ^{1}H NMR (400 MHz, $CDCl_3$) δ: 7.10 (d, *J* = 7.8 Hz, 2H), 7.04 (d, *J* = 7.8 Hz, 2H), 6.94 (s, 2H), 6.87 (d, *J* = 8.2 Hz, 2H), 6.70 (d, *J* = 8.2 Hz, 2H), 4.99 (s, 1H), 4.02 (t, *J* = 7.8 Hz, 1H), 3.73 (s, 3H), 3.21 (m, 2H), 2.28 (s, 3H), 1.37 (s, 18H). ^{13}C NMR (101 MHz, $CDCl_3$) δ: 157.6, 151.9, 141.9, 135.4, 135.4, 135.4, 135.3, 133.0, 130.1, 130.1, 128.9, 128.9, 128.0, 128.0, 124.5, 124.5, 113.4, 113.4, 55.2, 53.1, 42.1, 34.3, 34.3, 30.3, 21.0. ESI-HRMS: *m/z* [M-H]$^-$ calcd. for $C_{30}H_{37}O_2$: 429.2799; found: 429.2797.



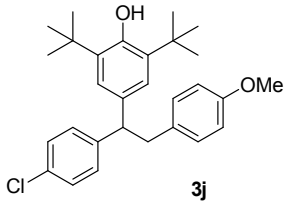
3h

4-(1,2-bis(4-Methoxyphenyl)ethyl)-2,6-di-*tert*-butylphenol (3h). Yield: 27.7 mg, 62%. Yellow solid, M.p. 230-232 °C. ^{1}H NMR (400 MHz, $CDCl_3$) δ: 7.15-7.05 (m, 2H), 6.93 (s, 2H), 6.88-6.82 (m, 2H), 6.81-6.74 (m, 2H), 6.73-6.65 (m, 2H), 5.00 (s, 1H), 4.01 (t, *J* = 7.8 Hz, 1H), 3.75 (d, *J* = 12.1 Hz, 6H), 3.31-3.05 (m, 2H), 1.37 (s, 18H). ^{13}C NMR (101 MHz, $CDCl_3$) δ: 157.7, 157.7, 151.9, 137.1, 135.6, 135.4, 133.0, 130.1,129.5, 129.5, 129.1, 129.1, 124.4, 124.4, 113.6, 113.6, 113.4, 113.4, 55.2, 55.2, 52.6, 42.3, 34.3, 34.3, 30.3. ESI-HRMS: *m/z* [M-H]$^-$ calcd. for $C_{30}H_{37}O_3$: 445.2748; found: 445.2750.



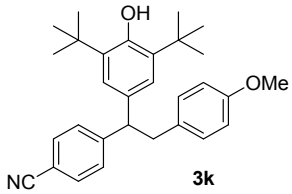
3i

2,6-di-*tert*-Butyl-4-(2-(4-methoxyphenyl)-1-(4-phenoxyphenyl)ethyl)phenol (3i). Yield: 33.5 mg, 66%. Yellow oil. ^{1}H NMR (400 MHz, $CDCl_3$) δ: 7.30 (m, 2H), 7.14 (m, 2H), 7.09-7.03 (m, 1H), 7.02-6.81 (m, 8H), 6.77-6.66 (m, 2H), 5.04 (s, 1H), 4.05 (t, *J* = 7.8 Hz, 1H), 3.75 (s, 3H), 3.30-3.10 (m, 2H), 1.38 (s, 18H). ^{13}C NMR (101 MHz, $CDCl_3$) δ: 157.7, 157.7, 155.0, 152.0, 140.0, 135.4, 135.2, 132.8, 130.1, 130.1, 129.6, 129.6, 129.4, 129.4, 128.4, 124.5, 124.5, 122.9, 118.9, 118.9, 118.4, 118.4, 113.4, 113.4, 55.2, 52.8, 42.2, 34.4, 34.4, 30.3. ESI-HRMS: *m/z* $[M-H]^-$ calcd. for $C_{35}H_{39}O_3$: 507.2905; found: 507.2912.



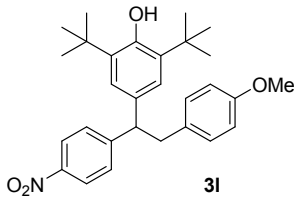
3j

2,6-di-*tert*-Butyl-4-(1-(4-chlorophenyl)-2-(4-methoxyphenyl)ethyl)phenol (3j). Yield: 27.9 mg, 62%. Yellow solid, M.p. 124-126 °C. ^{1}H NMR (400 MHz, $CDCl_3$) δ: 7.22-7.15 (m, 2H), 7.09 (d, *J* = 8.5 Hz, 2H), 6.92 (s, 2H), 6.87-6.81 (m, 2H), 6.76-6.66 (m, 2H), 5.03 (s, 1H), 4.04 (t, *J* = 7.8 Hz, 1H), 3.74 (s, 3H), 3.19 (m, 2H), 1.38 (s, 18H). ^{13}C NMR (101 MHz, $CDCl_3$) δ: 157.8, 152.1, 143.4, 135.6, 135.6, 134.7, 132.4, 131.6, 130.0, 130.0, 129.5, 129.5, 128.3, 128.3, 124.4, 124.4, 113.5, 113.5, 55.2, 52.8, 41.9, 34.4, 34.4, 30.3. ESI-HRMS: *m/z* $[M-H]^-$ calcd. for $C_{29}H_{34}O_2Cl$: 449.2253; found: 449.2242.



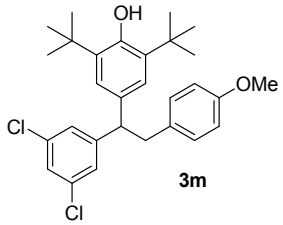
3k

4-(1-(3,5-di-*tert*-Butyl-4-hydroxyphenyl)-2-(4-methoxyphenyl)ethyl)benzonitrile (3k). Yield: 30.9 mg, 70%. Yellow oil. ^{1}H NMR (400 MHz, $CDCl_3$) δ: 7.60-7.38 (m, 2H), 7.24 (d, *J* = 8.3 Hz, 2H), 6.93 (s, 2H), 6.89-6.76 (m, 2H), 6.71 (d, *J* = 8.6 Hz, 2H), 5.10 (s, 1H), 4.13 (m, 1H), 3.72 (s, 3H), 3.37-3.02 (m, 2H), 1.38 (s, 18H). ^{13}C NMR (101 MHz, $CDCl_3$) δ: 158.0, 152.4, 150.6, 135.9, 135.9, 133.8, 132.1, 132.1, 131.8, 130.0, 130.0, 129.0, 129.0, 124.4, 124.4, 119.2, 113.6, 113.6, 109.8, 55.2, 53.5, 41.5, 34.4, 34.3, 30.3. ESI-HRMS: *m/z* $[M-H]^-$ calcd. for $C_{30}H_{34}NO_2$: 440.2595; found: 440.2594.



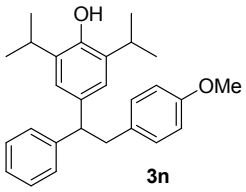
3l

2,6-di-*tert*-Butyl-4-(2-(4-methoxyphenyl)-1-(4-nitrophenyl)ethyl)phenol (3l). Yield: 35.6 mg, 77%. Yellow oil. ^{1}H NMR (400 MHz, $CDCl_3$) δ: 8.25-7.93 (m, 2H), 7.29 (d, *J* = 8.7 Hz, 2H), 7.05-6.60 (m, 6H), 5.09 (s, 1H), 4.19 (m, 1H), 3.74 (s, 3H), 3.42-3.11 (m, 2H), 1.39 (s, 18H). ^{13}C NMR (101 MHz, $CDCl_3$) δ: 158.0, 152.8, 152.5, 146.3, 136.0, 136.0, 133.6, 131.6, 129.9, 129.9, 129.0, 129.0, 124.4, 124.4, 123.5, 123.5, 113.7, 113.7, 55.2, 53.3, 41.5, 34.4, 34.4, 30.3. ESI-HRMS: *m/z* [M-H]$^-$ calcd. for $C_{29}H_{34}NO_4$: 460.2493; found: 460.2495.



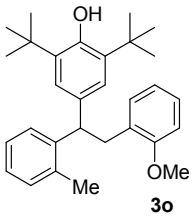
3m

2,6-di-*tert*-Butyl-4-(1-(3,5-dichlorophenyl)-2-(4-methoxyphenyl)ethyl)phenol (3m). Yield: 31.9 mg, 66%. Yellow oil. ^{1}H NMR (400 MHz, $CDCl_3$) δ: 7.07 (m, 1H), 7.02-6.95 (m, 2H), 6.85-6.72 (m, 4H), 6.65 (d, *J* = 8.5 Hz, 2H), 5.00 (s, 1H), 3.92 (t, *J* = 7.8 Hz, 1H), 3.67 (s, 3H), 3.10 (d, *J* = 7.8 Hz, 2H), 1.31 (s, 18H). ^{13}C NMR (101 MHz, $CDCl_3$) δ: 158.0, 152.4, 148.4, 135.8, 135.8, 134.5, 133.6, 131.8, 130.0, 130.0, 129.4, 126.7, 126.7, 126.2, 124.4, 124.4, 113.6, 113.6, 55.3, 53.1, 41.6, 34.4, 34.4, 30.3. ESI-HRMS: *m/z* [M-H]$^-$ calcd. for $C_{29}H_{33}O_2Cl_2$: 483.1863; found: 483.1852.



3n

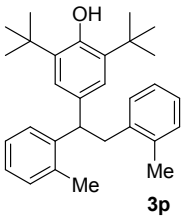
2,6-di-*iso*-Propyl-4-(2-(4-methoxyphenyl)-1-phenylethyl)phenol (3n). Yield: 27.9 mg, 72%. Yellow oil. ^{1}H NMR (400 MHz, $CDCl_3$) δ: 7.24-7.11 (m, 5H), 6.96-6.77 (m, 4H), 6.70 (d, *J* = 8.1 Hz, 2H), 4.64 (s, 1H), 4.08 (t, *J* = 7.7 Hz, 1H), 3.73 (s, 3H), 3.24 (m, 2H), 3.08 (m, 2H), 1.19 (m, 12H). ^{13}C NMR (126 MHz, $CDCl_3$) δ: 157.7, 148.2, 145.0, 136.4, 133.3, 132.8, 130.0, 130.0, 128.2, 128.2, 128.1, 128.1, 125.9, 125.9, 123.1, 123.1, 113.4, 113.4, 55.2, 53.3, 41.9, 27.3, 27.3, 22.8, 22.8. ESI-HRMS: *m/z* [M-H]$^-$ calcd. for $C_{27}H_{31}O_2$: 387.2330; found: 387.2337.



3o

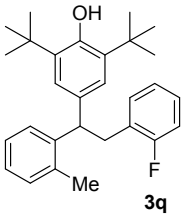
2,6-di-*tert*-Butyl-4-(2-(2-methoxyphenyl)-1-*o*-tolylethyl)phenol (3o). Yield: 36.1 mg, 84%. Yellow solid, M.p. 107-109 °C. ^{1}H NMR (400 MHz, $CDCl_3$) δ: 7.47 (d, *J* = 7.7 Hz, 1H), 7.23 (m, 1H), 7.18-7.05 (m, 3H), 6.86 (s, 2H), 6.83-6.68 (m, 3H), 4.96 (s, 1H), 4.43 (t, *J* = 7.6 Hz, 1H), 3.74 (s, 3H), 3.30 (m, 2H), 2.16 (s, 3H), 1.36 (s, 18H). ^{13}C NMR (101 MHz, $CDCl_3$) δ: 157.7, 151.6, 143.4, 136.3, 135.0, 134.9, 134.7, 130.8, 130.1, 129.2, 127.0, 126.9, 125.7, 125.6, 124.8, 124.8,

120.0, 110.1, 55.2, 46.5, 37.0, 34.2, 34.3, 30.3, 19.8. ESI-HRMS: *m/z* [M-H]$^-$ calcd. for $C_{30}H_{37}O_2$: 429.2799; found: 429.2801.



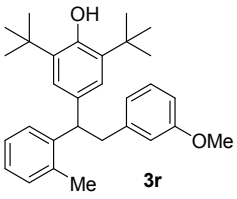
3p

2,6-di-*tert*-Butyl-4-(1,2-di-*o*-tolylethyl)phenol (3p). Yield: 25.7 mg, 62%. Yellow solid, M.p. 109-111 °C. ^{1}H NMR (400 MHz, $CDCl_3$) δ: 7.48 (m, 1H), 7.27-7.20 (m, 1H), 7.15-6.94 (m, 5H), 6.80 (d, *J* = 7.4 Hz, 1H), 6.71 (s, 2H), 4.95 (s, 1H), 4.23 (t, *J* = 7.5 Hz, 1H), 3.24 (d, *J* = 7.5 Hz, 2H), 2.12-2.02 (m, 3H), 1.98 (s, 3H), 1.30 (s, 18H). ^{13}C NMR (101 MHz, $CDCl_3$) δ: 151.8, 143.1, 139.0, 136.6, 136.4, 135.2, 134.2, 130.3, 130.0, 129.8, 126.7, 125.9, 125.8, 125.8, 125.5, 124.8, 124.8, 124.8, 47.8, 40.0, 34.2, 34.2, 30.2, 19.8, 19.2. ESI-HRMS: *m/z* [M-H]$^-$ calcd. for $C_{30}H_{37}O$: 413.2850; found: 413.2848.



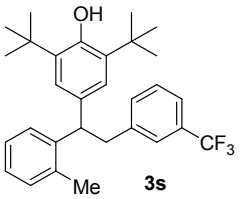
3q

2,6-di-*tert*-Butyl-4-(2-(2-fluorophenyl)-1-*o*-tolylethyl)phenol (3q). Yield: 22.2 mg, 53%. Yellow solid, M.p. 127-129 °C. ^{1}H NMR (400 MHz, $CDCl_3$) δ: 7.37 (d, *J* = 7.7 Hz, 1H), 7.17-7.09 (m, 1H), 7.07-6.93 (m, 3H), 6.90-6.75 (m, 4H), 6.71 (m, 1H), 4.90 (s, 1H), 4.29 (t, *J* = 7.8 Hz, 1H), 3.35-3.05 (m, 2H), 2.09 (s, 3H), 1.26 (s, 18H). ^{13}C NMR (101 MHz, $CDCl_3$) δ: 151.9, 142.7, 136.3, 135.3, 134.1, 131.5 (d, *J* = 24 Hz, 1C), 130.3, 130.3, 127.5 (d, *J* = 40 Hz, 1C), 127.4, 126.6, 125.9 (d, *J* = 16 Hz, 2C), 124.7, 124.7, 123.5 (d, *J* = 12 Hz, 1C), 115.0, 114.8, 46.9, 35.9, 34.3, 34.3, 30.3, 19.9. ESI-HRMS: *m/z* [M-H]$^-$ calcd. for $C_{29}H_{34}OF$: 417.2599; found: 417.2586.



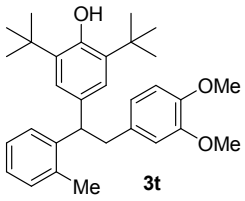
3r

2,6-di-*tert*-Butyl-4-(2-(3-methoxyphenyl)-1-*o*-tolylethyl)phenol (3r). Yield: 30.1 mg, 70%. Yellow oil. ^{1}H NMR (400 MHz, $CDCl_3$) δ: 7.46-7.38 (m, 1H), 7.24-7.16 (m, 1H), 7.12-7.02 (m, 3H), 6.85 (s, 2H), 6.66 (m, 1H), 6.59 (m, 1H), 6.34 (m, 1H), 4.98 (s, 1H), 4.26 (t, *J* = 7.7 Hz, 1H), 3.61 (s, 3H), 3.24 (t, *J* = 7.6 Hz, 2H), 2.14 (s, 3H), 1.34 (s, 18H). ^{13}C NMR (101 MHz, $CDCl_3$) δ: 159.1, 151.8, 143.1, 142.4, 136.3, 135.3, 134.3, 130.3, 128.9, 126.7, 125.9, 125.8, 124.8, 124.8, 124.8, 121.6, 114.5, 111.6, 54.9, 48.6, 43.1, 34.3, 34.3, 30.3, 20.0. ESI-HRMS: *m/z* [M-H]$^-$ calcd. for $C_{30}H_{37}O_2$: 429.2799; found: 429.2792.



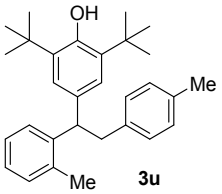
3s

2,6-di-*tert*-Butyl-4-(1-(*o*-tolyl)-2-(3-(trifluoromethyl)phenyl)ethyl)phenol (3s). Yield: 23.4 mg, 50%. Yellow oil. ^{1}H NMR (400 MHz, $CDCl_3$) δ: 7.43 (d, *J* = 7.8 Hz, 1H), 7.37 (d, *J* = 7.8 Hz, 1H), 7.24 (d, *J* = 13.0 Hz, 3H), 7.14-7.04 (m, 3H), 6.82 (s, 2H), 4.99 (s, 1H), 4.25 (t, *J* = 7.8 Hz, 1H), 3.45-3.16 (m, 2H), 2.13 (s, 3H), 1.33 (s, 18H). ^{13}C NMR (101 MHz, $CDCl_3$) δ: 152.0, 142.5, 141.8, 136.1, 135.5, 133.5, 132.5, 130.4, 128.3, 126.5, 126.0, 126.0, 125.9 (d, *J* = 12 Hz, 1C), 124.7, 124.7, 124.7, 124.7, 122.6, 122.5, 48.6, 42.7, 34.3, 34.3, 30.3, 19.9. ESI-HRMS: *m/z* [M-H]$^-$ calcd. for $C_{30}H_{34}F_3O$: 467.2567; found: 467.2564.



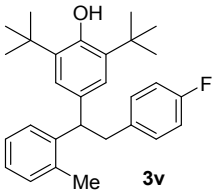
3t

2,6-di-*tert*-Butyl-4-(2-(3,4-dimethoxyphenyl)-1-(*o*-tolyl)ethyl)phenol (3t). Yield: 21.6 mg, 47%. Yellow oil. ^{1}H NMR (400 MHz, $CDCl_3$) δ: 7.45-7.39 (m, 1H), 7.24-7.17 (m, 1H), 7.13-7.01 (m, 2H), 6.88 (s, 2H), 6.70 (d, *J* = 8.2 Hz, 1H), 6.56 (m, 1H), 6.19 (d, *J* = 2.0 Hz, 1H), 4.99 (s, 1H), 4.21 (t, *J* = 7.7 Hz, 1H), 3.81 (s, 3H), 3.59 (s, 3H), 3.21 (d, *J* = 7.6 Hz, 2H), 2.13 (s, 3H), 1.35 (s, 18H). ^{13}C NMR (101 MHz, $CDCl_3$) δ: 151.8, 148.2, 147.1, 143.2, 136.3, 135.4, 134.5, 133.5, 130.3, 126.7, 125.9, 125.8, 124.8, 124.8, 124.8, 121.0, 112.6, 111.0, 55.9, 55.4, 48.9, 42.6, 34.3, 34.3, 30.3, 20.0. ESI-HRMS: *m/z* [M-H]$^-$ calcd. for $C_{31}H_{39}O_3$: 459.2905; found: 459.2907.



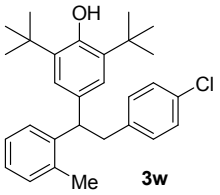
3u

2,6-di-*tert*-Butyl-4-(1-(*o*-tolyl-2-*p*-tolylethyl)phenol (3u). Yield: 25.3 mg, 61%. Yellow oil. ^{1}H NMR (400 MHz, $CDCl_3$) δ: 7.40 (d, *J* = 7.8 Hz, 1H), 7.25 (s, 1H), 7.23-7.12 (m, 1H), 7.11-7.01 (m, 2H), 6.95 (d, *J* = 7.7 Hz, 2H), 6.88-6.76 (m, 3H), 4.96 (s, 1H), 4.28 (t, *J* = 7.7 Hz, 1H), 3.22 (m, 2H), 2.26 (s, 3H), 2.13 (s, 3H), 1.34 (s, 18H). ^{13}C NMR (101 MHz, $CDCl_3$) δ: 151.8, 143.1, 137.7, 136.2, 135.3, 135.0, 134.6, 130.2, 130.2, 129.0, 129.0, 128.6, 128.6, 126.8, 125.8, 125.7, 124.7, 124.7, 48.5, 42.5, 34.3, 34.3, 30.3, 21.0, 19.9. ESI-HRMS: *m/z* [M-H]$^-$ calcd. for $C_{30}H_{37}O$: 413.2850; found: 413.2846.



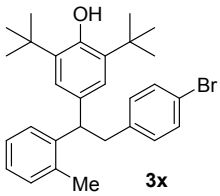
3v

2,6-di-*tert*-Butyl-4-(2-(4-fluorophenyl)-1-(*o*-tolylethyl)phenol (3v). Yield: 18.4 mg, 44%. Yellow solid, M.p. 126-128 °C. ^{1}H NMR (500 MHz, $CDCl_3$) δ: 7.47-7.32 (m, 1H), 7.20 (m, 1H), 7.12-7.01 (m, 2H), 6.82 (s, 6H), 5.00 (s, 1H), 4.23 (t, *J* = 7.7 Hz, 1H), 3.23 (dd, *J* = 9.8, 7.7 Hz, 2H), 2.12 (s, 3H), 1.34 (s, 18H). ^{13}C NMR (126 MHz, $CDCl_3$) δ: 162.2, 160.3, 151.9, 142.8, 136.5, 136.2, 135.4, 134.2, 130.5, 130.5, 130.3, 126.7, 126.0 (d, *J* = 12 Hz, 1C), 124.7, 124.7, 124.7, 114.7, 114.6, 48.7, 42.2, 34.3, 34.3, 30.3, 20.0. ESI-HRMS: *m/z* [M-H]$^-$ calcd. for $C_{29}H_{34}FO$: $C_{29}H_{34}FO$: 417.2599; found: 417.2597.



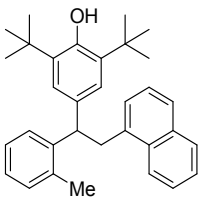
3w

2,6-di-*tert*-Butyl-4-(2-(4-chlorophenyl)-1-*o*-tolylethyl)phenol (3w). Yield: 26.0 mg, 60%. Yellow solid, M.p. 125-127 °C. ^{1}H NMR (400 MHz, $CDCl_3$) δ: 7.39 (m, 1H), 7.20 (m, 1H), 7.14-6.98 (m, 4H), 6.83 (m, 4H), 5.00 (d, *J* = 1.9 Hz, 1H), 4.24 (m, 1H), 3.40-3.01 (m, 2H), 2.12 (s, 3H), 1.34 (s, 18H). ^{13}C NMR (101 MHz, $CDCl_3$) δ: 151.9, 142.6, 139.3, 136.2, 135.4, 135.4, 134.1, 131.5, 130.5, 130.5, 130.4, 128.0, 128.0, 126.7, 126.0, 126.0, 124.7, 124.7, 48.4, 42.3, 34.3, 34.3, 30.3, 20.0. ESI-HRMS: *m/z* [M-H]$^-$ calcd. for $C_{29}H_{34}OCl$: 433.2304; found: 433.2299.



3x

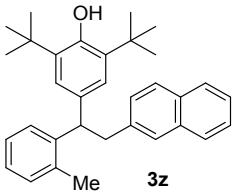
4-(2-(4-Bromophenyl)-1-*o*-tolylethyl)-2,6-di-*tert*-butylphenol (3x). Yield: 23.9 mg, 50%. Yellow solid, M.p. 131-133 °C. ^{1}H NMR (400 MHz, $CDCl_3$) δ: 7.31 (d, *J* = 7.9 Hz, 1H), 7.24-7.08 (m, 3H), 7.00 (m, 2H), 6.84-6.62 (m, 4H), 4.91 (s, 1H), 4.16 (t, *J* = 7.7 Hz, 1H), 3.27-3.01 (m, 2H), 2.05 (s, 3H), 1.27 (s, 18H). ^{13}C NMR (101 MHz, $CDCl_3$) δ: 151.9, 142.6, 139.9, 136.2, 135.5, 134.0, 131.0, 131.0, 130.9, 130.9, 130.4, 126.7, 126.0, 125.9, 124.7, 124.6, 124.6, 119.6, 48.4, 42.4, 34.3, 34.3, 30.3, 19.9. ESI-HRMS: *m/z* [M-H]$^-$ calcd. for $C_{29}H_{34}OBr$: 477.1799; found: 477.1789.



3y

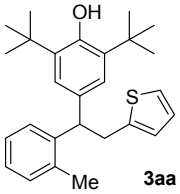
2,6-di-*tert*-Butyl-4-(2-(naphthalen-1-yl)-1-*o*-tolylethyl)phenol (3y). Yield: 26.1 mg, 58%. Yellow solid, M.p. 120-122 °C. ^{1}H NMR (400 MHz, $CDCl_3$) δ: 7.92-7.75 (m, 2H), 7.60 (m, 2H), 7.39 (m, 2H), 7.30-7.16 (m, 2H), 7.15-7.00 (m, 2H), 6.86 (d, *J* = 6.9 Hz, 1H), 6.71 (s, 2H), 4.92 (s, 1H), 4.44 (t, *J* = 7.4 Hz, 1H), 3.71 (t, *J* = 7.2 Hz, 2H), 1.97 (s, 3H), 1.26 (s, 18H). ^{13}C NMR (101 MHz, $CDCl_3$) δ: 151.8, 143.2, 136.8, 136.5, 135.3, 135.3, 134.4, 133.7, 132.3, 130.3, 128.7, 127.3, 126.7, 126.5, 125.9, 125.9, 125.6, 125.2, 125.1, 124.7, 124.7, 123.8, 47.7, 40.0, 34.2, 34.2, 30.3,

19.8. ESI-HRMS: *m/z* [M-H]$^-$ calcd. for $C_{33}H_{37}O$: 449.2850; found: 449.2837.



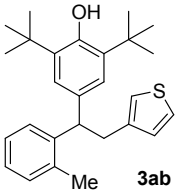
3z

2,6-di-*tert*-Butyl-4-(2-(naphthalen-2-yl)-1-*o*-tolylethyl)phenol (3z). Yield: 24.8 mg, 55%. Yellow oil. ^{1}H NMR (400 MHz, $CDCl_3$) δ: 7.71-7.62 (m, 1H), 7.56 (m, 2H), 7.40 (d, *J* = 7.7 Hz, 1H), 7.35-7.22 (m, 3H), 7.19-7.10 (m, 1H), 7.09-6.92 (m, 3H), 6.79 (s, 2H), 4.89 (s, 1H), 4.32 (t, *J* = 7.7 Hz, 1H), 3.36 (t, *J* = 7.7 Hz, 2H), 2.07 (s, 3H), 1.23 (s, 18H). ^{13}C NMR (101 MHz, $CDCl_3$) δ: 151.9, 143.0, 138.4, 136.2, 135.4, 135.4, 134.3, 133.4, 132.0, 130.3, 127.8, 127.5, 127.5, 127.5, 127.4, 126.8, 125.9, 125.9, 125.6, 125.0, 124.8, 124.8, 48.5, 43.2, 34.3, 34.3, 30.3, 20.0. ESI-HRMS: *m/z* [M-H]$^-$ calcd. for $C_{33}H_{37}O$: 449.2850; found: 449.2841.



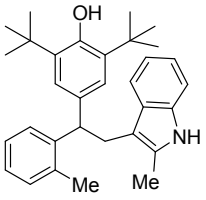
3aa

2,6-di-*tert*-Butyl-4-(2-(thiophen-2-yl)-1-*o*-tolylethyl)phenol (3aa). Yield: 25.2 mg, 62%. Brown solid, M.p. 92-94 °C. ^{1}H NMR (500 MHz, $CDCl_3$) δ: 7.39 (d, *J* = 7.7 Hz, 1H), 7.21 (m, 1H), 7.10 (s, 2H), 7.02 (m, 1H), 6.95 (s, 2H), 6.80 (m, 1H), 6.56 (d, *J* = 3.4 Hz, 1H), 5.02 (s, 1H), 4.35 (t, *J* = 7.7 Hz, 1H), 3.50 (m, 2H), 2.24 (s, 3H), 1.37 (s, 18H). ^{13}C NMR (126 MHz, $CDCl_3$) δ: 152.0, 143.5, 142.4, 136.3, 135.4, 134.1, 130.4, 129.8, 126.5, 126.3, 126.0, 126.0, 125.2, 124.6, 124.6, 123.2, 48.7, 37.0, 34.3, 34.3, 30.3, 20.0. ESI-HRMS: *m/z* [M-H]$^-$ calcd. for $C_{27}H_{33}OS$: 405.2258; found: 405.2255.



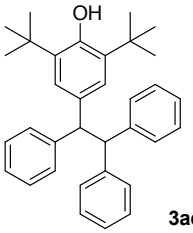
3ab

2,6-di-*tert*-Butyl-4-(2-(thiophen-3-yl)-1-*o*-tolylethyl)phenol (3ab). Yield: 24.4 mg, 60%. Yellow oil. ^{1}H NMR (400 MHz, $CDCl_3$) δ: 7.39 (d, *J* = 7.7 Hz, 1H), 7.19 (s, 1H), 7.14-7.04 (m, 3H), 6.90 (s, 2H), 6.75-6.53 (m, 2H), 4.99 (s, 1H), 4.29 (t, *J* = 7.7 Hz, 1H), 3.28 (m, 2H), 2.18 (s, 3H), 1.36 (s, 18H). ^{13}C NMR (101 MHz, $CDCl_3$) δ: 151.9, 143.0, 141.1, 136.2, 135.4, 134.6, 130.3, 128.7, 126.6, 125.9, 125.8, 124.6, 124.6, 124.6, 124.5, 121.2, 47.8, 37.4, 34.3, 34.3, 30.3, 19.9. ESI-HRMS: *m/z* [M-H]$^-$ calcd. for $C_{27}H_{33}OS$: 405.2258; found: 405.2252.



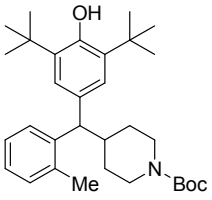
3ac

2,6-di-*tert*-Butyl-4-(2-(2-methyl-1*H*-indol-3-yl)-1-*o*-tolylethyl)phenol (3ac). Yield: 38.1 mg, 84%. Yellow solid, M.p. 147-149 °C. ^{1}H NMR (400 MHz, $CDCl_3$) δ: 7.55-7.51 (s, 1H), 7.45 (s, 1H), 7.27 (s, 1H), 7.17 (m, 2H), 7.07-6.89 (m, 4H), 6.65 (s, 2H), 4.85 (s, 1H), 4.22 (m, 1H), 3.23 (m, 2H), 1.93 (s, 3H), 1.64 (s, 3H), 1.20 (s, 18H). ^{13}C NMR (101 MHz, $CDCl_3$) δ: 151.8, 143.8, 136.7, 135.2, 135.1, 135.1, 131.9, 130.2, 129.1, 126.7, 125.7, 125.7, 124.8, 124.8, 124.8, 120.6, 119.0, 117.9, 110.2, 109.9, 47.1, 34.2, 34.2, 32.0, 30.3, 19.9, 10.9. ESI-HRMS: *m/z* $[M-H]^-$ calcd. for $C_{32}H_{38}NO$: 452.2959; found: 452.2953.



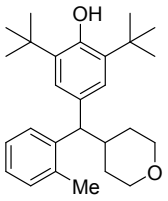
3ad

2,6-di-*tert*-Butyl-4-(1,2,2-triphenylethyl)phenol (3ad). Yield: 26.8 mg, 58%. Yellow solid, M.p. 146-148 °C. ^{1}H NMR (400 MHz, $CDCl_3$) δ: 7.23 (d, J = 4.7 Hz, 3H), 7.18-6.91 (m, 12H), 6.83 (s, 1H), 6.75 (s, 1H), 4.86 (d, J = 3.0 Hz, 1H), 4.77 (s, 1H), 4.61 (d, J = 4.8 Hz, 1H), 1.26 (d, J = 6.5 Hz, 18H). ^{13}C NMR (101 MHz, $CDCl_3$) δ: 151.6, 144.5, 144.2, 143.7, 143.5, 135.0, 134.9, 133.8, 128.7, 128.7, 128.7, 128.7, 128.6, 128.6, 128.2, 128.2, 128.1, 127.9, 127.8, 125.9, 125.8, 125.6, 125.5, 125.4, 57.5, 56.4, 34.2, 34.2, 30.3, 30.3. ESI-HRMS: *m/z* $[M-H]^-$ calcd. for $C_{34}H_{37}O$: 461.2850; found: 461.2841.



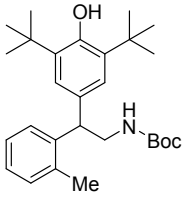
3ae

***tert*-Butyl 4-((3,5-di-*tert*-butyl-4-hydroxyphenyl)(*o*-tolyl)methyl)piperidine-1-carboxylate (3ae)**. Yield: 48.3 mg, 98%. White solid. M.p. 183-185 °C. ^{1}H NMR (500 MHz, $CDCl_3$) δ: 7.42 (dd, J = 7.8, 1.3 Hz, 1H), 7.19 (m, 1H), 7.11-6.98 (m, 4H), 4.98 (s, 1H), 4.07 (s, 2H), 3.64 (d, J = 10.9 Hz, 1H), 2.67 (s, 2H), 2.34 (s, 3H), 2.26-2.02 (m, 1H), 1.67-1.54 (m, 2H), 1.41 (d, J = 23.0 Hz, 29H). ^{13}C NMR (101 MHz, $CDCl_3$) δ: 154.8, 151.9, 142.3, 136.3, 135.6, 133.2, 130.6, 126.1, 126.1, 126.1, 125.6, 124.7, 124.7, 79.2, 52.9, 40.7, 40.7, 34.3, 34.3, 31.3, 31.1, 30.4, 28.5, 20.3. ESI-HRMS: *m/z* $[M-H]^-$ calcd. for $C_{32}H_{46}NO_3$: 492.3483; found: 492.3494.



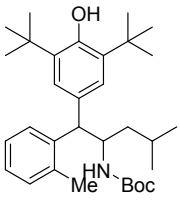
3af

2,6-di-*tert*-Butyl-4-((tetrahydro-2*H*-pyran-4-yl)(*o*-tolyl)methyl)phenol (3af). Yield: 35.9 mg, 91%. White solid. M.p. 130-132 °C. ^{1}H NMR (400 MHz, $CDCl_3$) δ: 7.34 (d, *J* = 7.7 Hz, 1H), 7.11 (t, *J* = 7.5 Hz, 1H), 7.06-6.89 (m, 4H), 4.91 (s, 1H), 3.84 (m, 2H), 3.59 (d, *J* = 10.9 Hz, 1H), 3.28 (m, 2H), 2.28 (s, 3H), 2.19 (m, 1H), 1.63-1.42 (m, 2H), 1.35 (s, 18H), 1.19 (d, *J* = 4.6 Hz, 2H). ^{13}C NMR (101 MHz, $CDCl_3$) δ: 151.9, 142.1, 136.4, 135.5, 133.0, 130.58, 126.2, 126.1, 125.7, 125.6, 124.8, 124.8, 68.3, 68.1, 53.2, 39.7, 34.3, 34.2, 32.3, 32.1, 30.4, 20.4. ESI-HRMS: *m/z* $[M-H]^-$ calcd. for $C_{27}H_{37}O_2$: 393.2799; found: 393.2809.



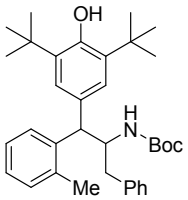
3ag

***tert*-Butyl 2-(3,5-di-*tert*-butyl-4-hydroxyphenyl)-2-*o*-tolylethylcarbamate (3ag).** Yield: 39.9 mg, 91%. White solid. M.p. 124-126 °C. ^{1}H NMR (400 MHz, $CDCl_3$) δ: 7.32-7.17 (m, 2H), 7.13 (d, *J* = 7.0 Hz, 2H), 6.96 (s, 2H), 5.06 (s, 1H), 4.51 (s, 1H), 4.25 (t, *J* = 7.9 Hz, 1H), 3.83-3.49 (m, 2H), 2.29 (s, 3H), 1.39 (d, *J* = 13.3 Hz, 27H). ^{13}C NMR (101 MHz, $CDCl_3$) δ: 155.8, 152.3, 140.4, 137.0, 135.7, 132.1, 130.8, 126.3, 126.2, 126.1, 126.1, 124.7, 124.7, 79.2, 46.6, 45.2, 34.4, 34.4, 30.3, 28.4, 19.9. ESI-HRMS: *m/z* $[M-H]^-$ calcd. for $C_{26}H_{40}NO_3$: 438.3014; found: 438.3017.



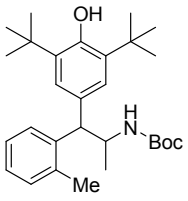
3ah

***tert*-Butyl 1-(3,5-di-*tert*-butyl-4-hydroxyphenyl)-4-methyl-1-*o*-tolylpentan-2-ylcarbamate (3ah).** Yield: 42.1 mg, 85%. White solid. ^{1}H NMR (400 MHz, $CDCl_3$) δ: 7.49 (dd, *J* = 22.6, 7.8 Hz, 1H), 7.20 (s, 1H), 7.12-6.91 (m, 4H), 4.99 (d, *J* = 9.7 Hz, 1H), 4.47 (s, 1H), 4.11 (dd, *J* = 21.5, 8.6 Hz, 1H), 3.91 (d, *J* = 8.7 Hz, 1H), 2.32 (d, *J* = 31.0 Hz, 3H), 1.50-1.27 (m, 29H), 1.00-0.73 (m, 7H). ^{13}C NMR (101 MHz, $CDCl_3$) δ: 155.6, 152.1, 141.4, 135.7, 135.2, 135.2, 132.8, 130.6, 126.4, 125.9, 125.6, 125.6, 124.9, 78.4, 52.8, 51.9, 44.3, 34.3, 34.3, 30.4, 28.4, 25.0, 23.7, 21.8, 20.3. ESI-HRMS: *m/z* $[M-H]^-$ calcd. for $C_{32}H_{48}NO_3$: 494.3649; found: 494.3652.



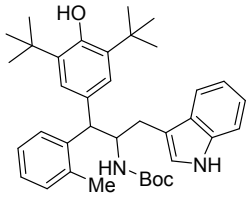
3ai

***tert*-Butyl 1-(3,5-di-*tert*-butyl-4-hydroxyphenyl)-3-phenyl-1-*o*-tolylpropan-2-ylcarbamate (3ai).** Yield: 42.9 mg, 81%. White solid. ^{1}H NMR (500 MHz, $CDCl_3$) δ: 7.55 (s, 1H), 7.29-7.05 (m, 8H), 7.02 (d, *J* = 5.5 Hz, 2H), 5.00 (d, *J* = 5.4 Hz, 1H), 4.69 (s, 1H), 4.28 (s, 1H), 3.93 (s, 1H), 2.88 (dd, *J* = 19.4, 10.6 Hz, 1H), 2.76-2.51 (m, 1H), 2.22 (d, *J* = 5.3 Hz, 3H), 1.52-1.26 (m, 27H). ^{13}C NMR (126 MHz, $CDCl_3$) δ: 155.0, 152.2, 141.6, 138.4, 136.1, 135.4, 131.4, 130.8, 129.6, 129.6, 128.2, 128.2, 126.4, 126.4, 126.4, 126.2, 126.1, 125.4, 125.4, 78.7, 54.7, 50.3, 39.6, 34.3, 34.3, 30.4, 28.3, 20.3. ESI-HRMS: *m/z* $[M-H]^-$ calcd. for $C_{35}H_{46}NO_3$: 528.3483; found: 528.3490.



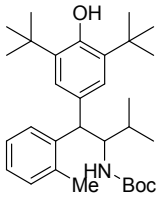
3aj

***tert*-Butyl 1-(3,5-di-*tert*-butyl-4-hydroxyphenyl)-1-*o*-tolylpropan-2-ylcarbamate (3aj).** Yield: 37.2 mg, 82%. White solid. ^{1}H NMR (400 MHz, $CDCl_3$) δ: 7.53-7.35 (m, 1H), 7.23-7.13 (m, 1H), 7.11 (d, *J* = 9.4 Hz, 4H), 5.04 (s, 1H), 4.59-4.08 (m, 2H), 4.01-3.67 (m, 1H), 2.44-2.17 (m, 3H), 1.47-1.31 (m, 27H), 1.08 (dd, *J* = 10.3, 6.4 Hz, 3H). ^{13}C NMR (101 MHz, $CDCl_3$) δ: 155.4, 152.2, 141.8, 140.7, 135.8, 135.4, 132.2, 130.5, 126.7, 126.7, 126.3, 126.0, 125.2, 78.8, 53.6, 53.0, 34.3, 34.3, 30.4, 28.4, 20.8, 20.3. ESI-HRMS: *m/z* $[M-H]^-$ calcd. for $C_{29}H_{42}NO_3$: 452.3171; found: 452.3170.



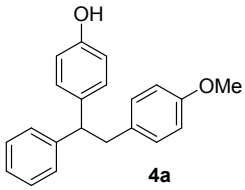
3ak

***tert*-Butyl 1-(3,5-di-*tert*-butyl-4-hydroxyphenyl)-3-(1*H*-indol-3-yl)-1-*o*-tolylpropan-2-ylcarbamate (3ak).** Yield: 47.2 mg, 83%. White solid. ^{1}H NMR (400 MHz, $CDCl_3$) δ: 8.27-7.89 (m, 1H), 7.84-7.46 (m, 1H), 7.42 (s, 1H), 7.34-7.21 (m, 2H), 7.20-6.95 (m, 6H), 6.88 (s, 1H), 5.13-4.88 (m, 1H), 4.87-4.59 (m, 1H), 4.40 (d, *J* = 22.0 Hz, 1H), 4.07-3.80 (m, 1H), 2.99 (d, *J* = 55.1 Hz, 2H), 2.29-2.04 (m, 3H), 1.43-1.21 (m, 27H). ^{13}C NMR (101 MHz, $CDCl_3$) δ: 155.3, 152.1, 141.8, 136.3, 135.3, 130.7, 130.7, 128.2, 126.4, 126.4, 126.1, 125.5, 125.5, 122.8, 122.8, 121.8, 121.8, 119.3, 119.3, 112.3, 110.9, 78.5, 54.1, 50.3, 34.3, 34.3, 30.4, 28.9, 28.3, 20.2. ESI-HRMS: *m/z* $[M+H]^+$ calcd. for $C_{37}H_{48}N_2O_3$: 569.3592; found: 569.3602.



3al

***tert*-Butyl (1-(3,5-di-*tert*-butyl-4-hydroxyphenyl)-3-methyl-1-*o*-tolylbutan-2-ylcarbamate (3al).** Yield: 41.4 mg, 86%. White solid. ^{1}H NMR (400 MHz, $CDCl_3$) δ: 7.58 (d, *J* = 7.9 Hz, 1H), 7.14 (d, *J* = 2.1 Hz, 5H), 5.14-4.82 (m, 1H), 4.47 (d, *J* = 2.9 Hz, 1H), 4.27-3.78 (m, 2H), 2.43-2.11 (m, 3H), 1.40 (dd, *J* = 12.4, 7.4 Hz, 18H), 1.25 (d, *J* = 5.8 Hz, 9H), 0.97-0.72 (m, 7H). ^{13}C NMR (101 MHz, $CDCl_3$) δ: 155.8, 152.1, 141.6, 135.7, 135.2, 125.2, 132.1, 130.7, 126.4, 126.4, 125.9, 125.3, 125.3, 78.4, 57.9, 50.1, 34.3, 34.3, 30.4, 28.3, 20.8, 20.2, 15.5. ESI-HRMS: *m/z* $[M-H]^-$ calcd. for $C_{31}H_{46}NO_3$: 480.3483; found: 480.3483.



4a

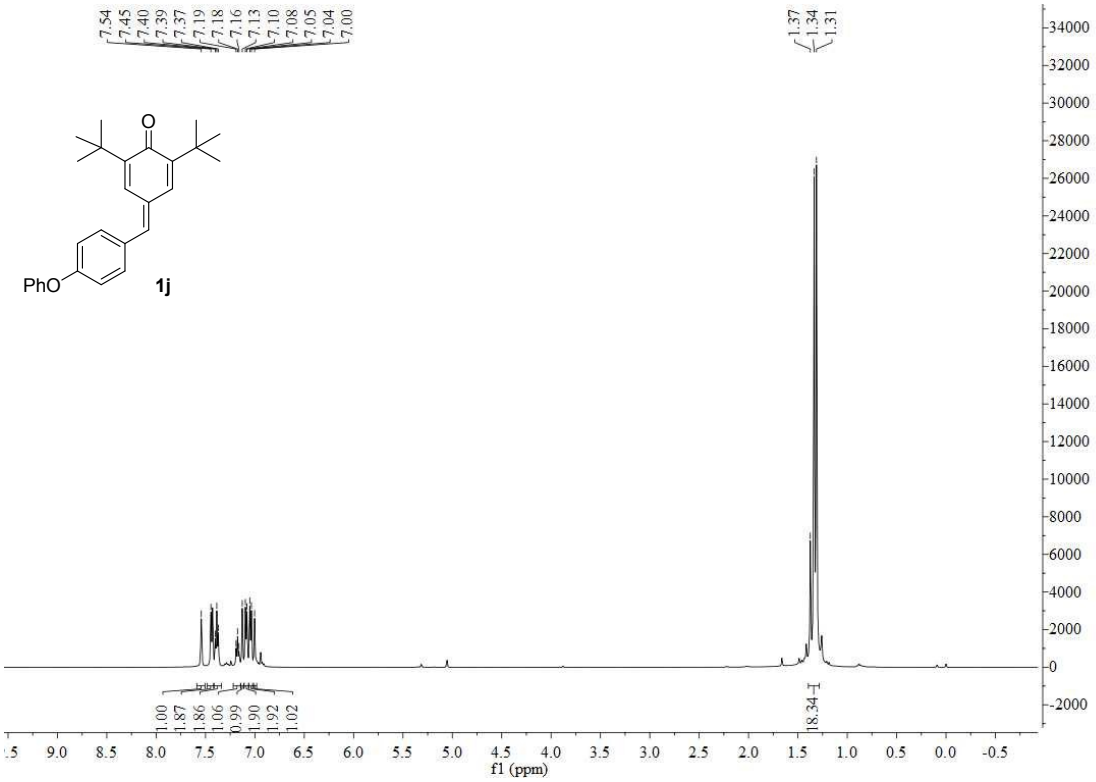
4-**(2-(4-Methoxyphenyl)-1-phenylethyl)phenol (4a)**. Yield: 21.3 mg, 70%. Yellow oil. ^{1}H NMR (400 MHz, $CDCl_3$) δ: 7.24 (d, *J* = 7.5 Hz, 2H), 7.21-7.11 (m, 3H), 7.04 (d, *J* = 8.5 Hz, 2H), 6.89 (d, *J* = 8.6 Hz, 2H), 6.71 (d, *J* = 8.4 Hz, 4H), 4.72 (s, 1H), 4.11 (t, *J* = 7.8 Hz, 1H), 3.74 (s, 3H), 3.25 (m, 2H). ^{13}C NMR (101 MHz, $CDCl_3$) δ: 157.7, 153.8, 144.9, 136.9, 132.4, 130.0, 130.0, 129.2, 129.2, 128.3, 128.3, 128.0, 128.0, 126.1, 115.1, 115.1, 113.4, 113.4, 55.2, 52.5, 41.4. ESI-HRMS: *m/z* $[M-H]^-$ calcd. for $C_{21}H_{19}O_2$: 303.1391; found: 303.1387.

5. References

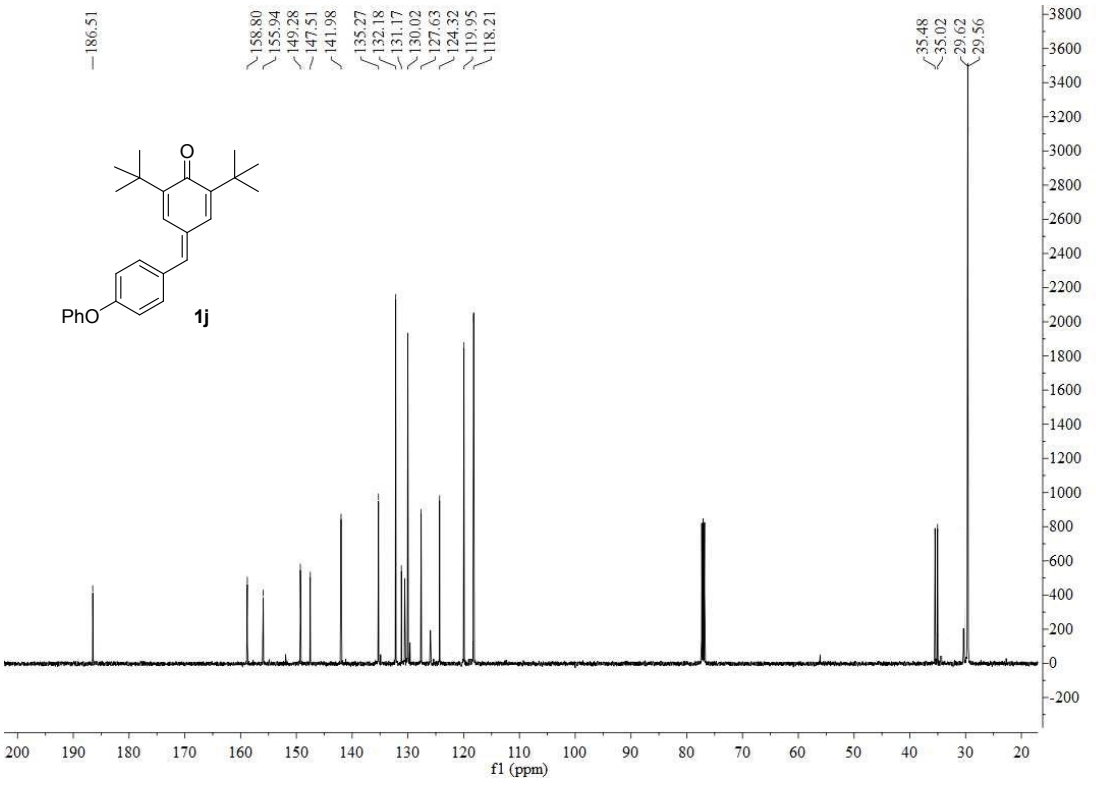
(1) (a) W.-D. Chu, L.-F. Zhang, X. Bao, X.-H. Zhao, C. Zeng, J.-Y. Du, G.-B. Zhang, F.-X. Wang, X.-Y. Ma, C.-A. Fan, *Angew. Chem., Int. Ed.* 2013, **52**, 9229. (b) L. Caruana, F. Kniep, T. K. Johansen, P. H. Poulsen, K. A. Jørgensen, *J. Am. Chem. Soc.* 2014, **136**, 15929. (c) D. Richter, N. Hampel, T. Singer, A. R. Ofial, H. Mayr, *Eur. J. Org. Chem*. 2009, **19**, 3203.

6. Copies of ^{1}H and ^{13}C NMR Spectra of Products 1j, 3a-3al and 4a

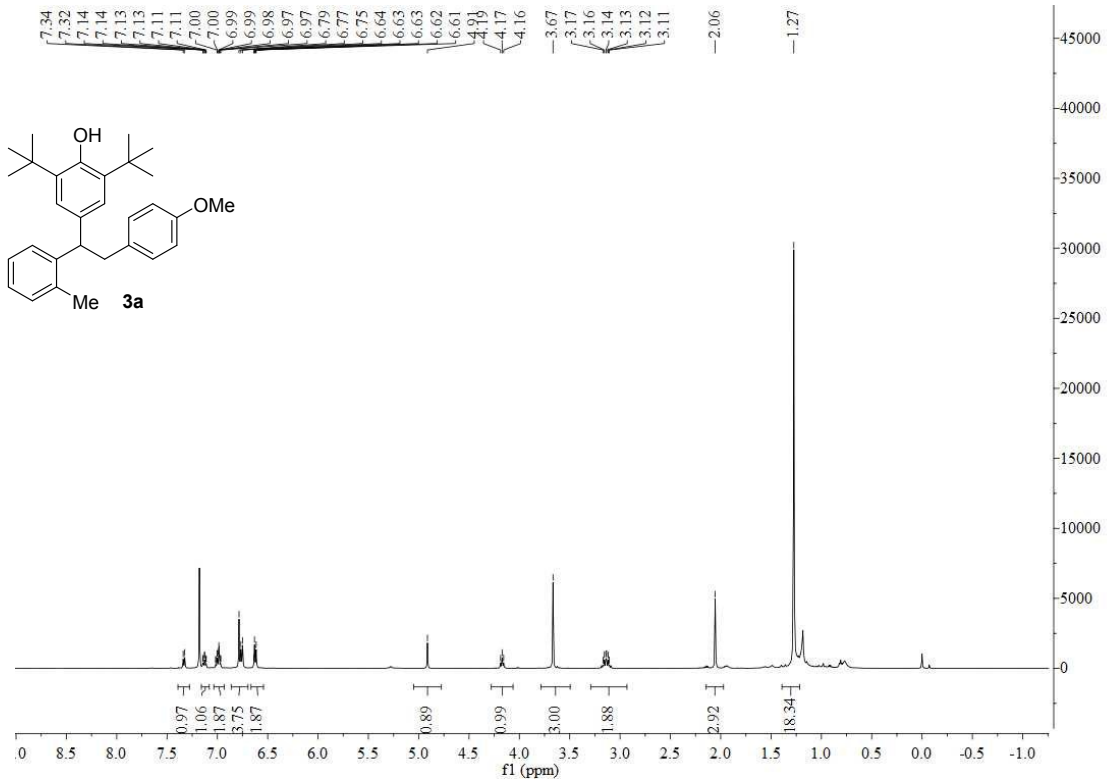
^{1}H NMR of 1j



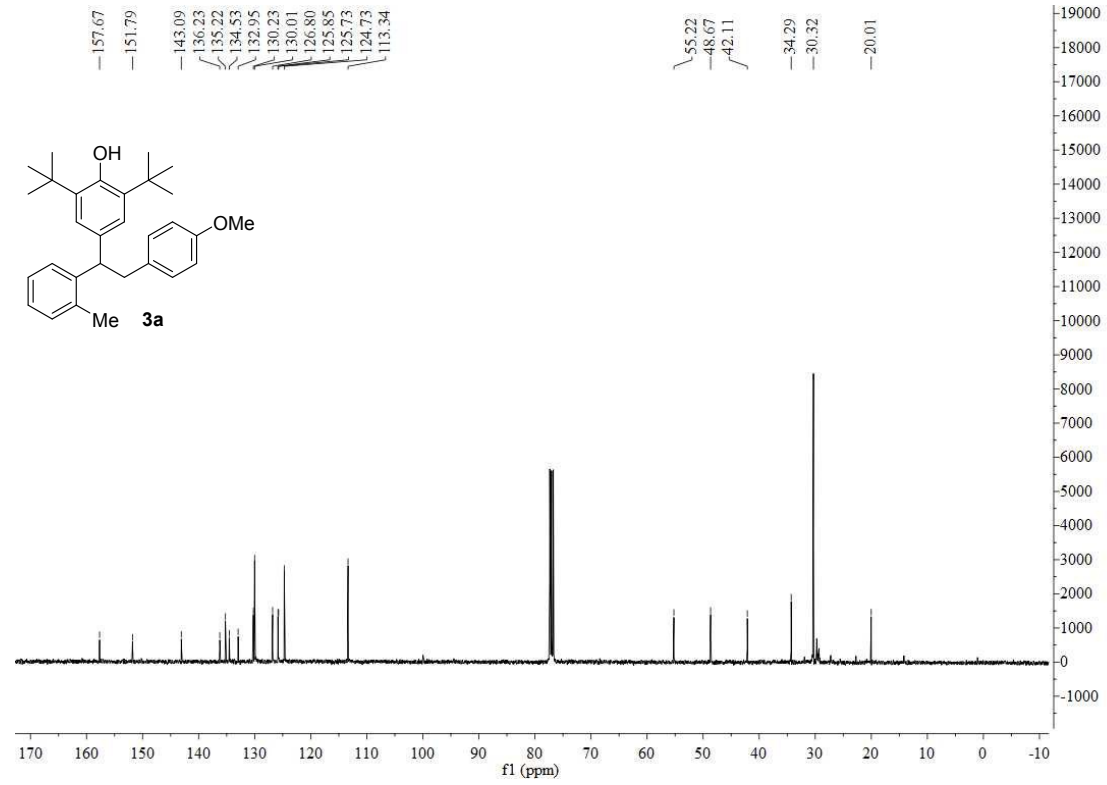
^{13}C NMR of 1j



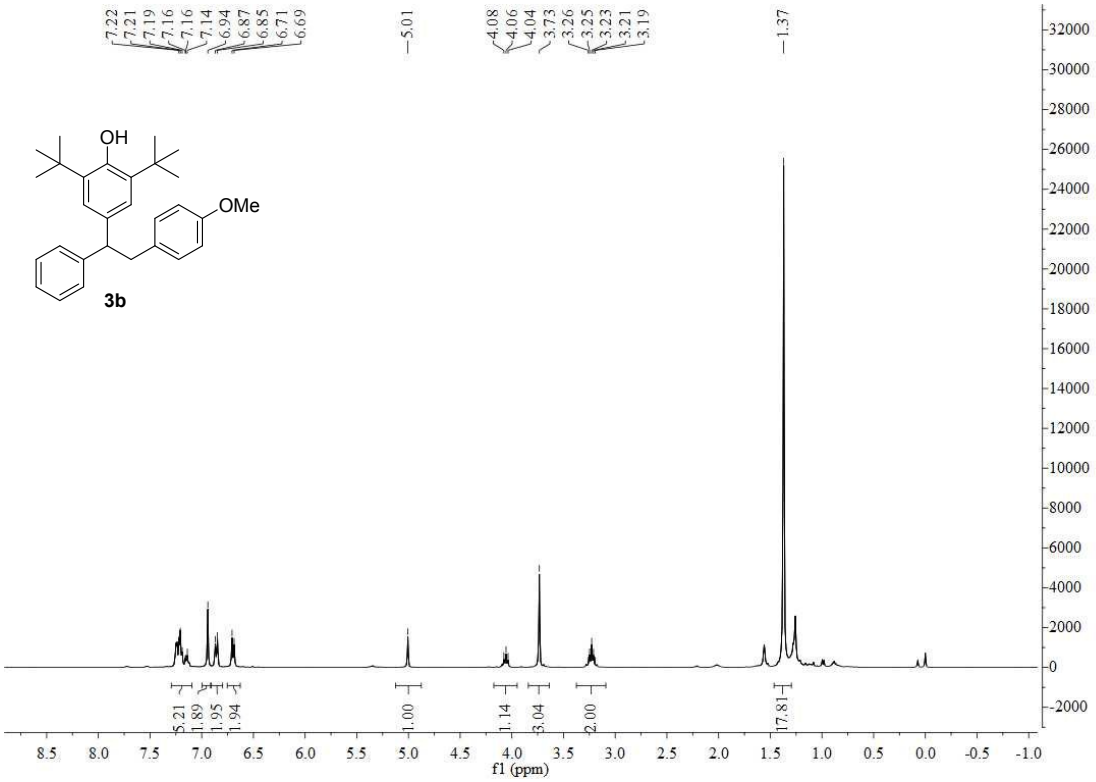
^{1}H NMR of 3a



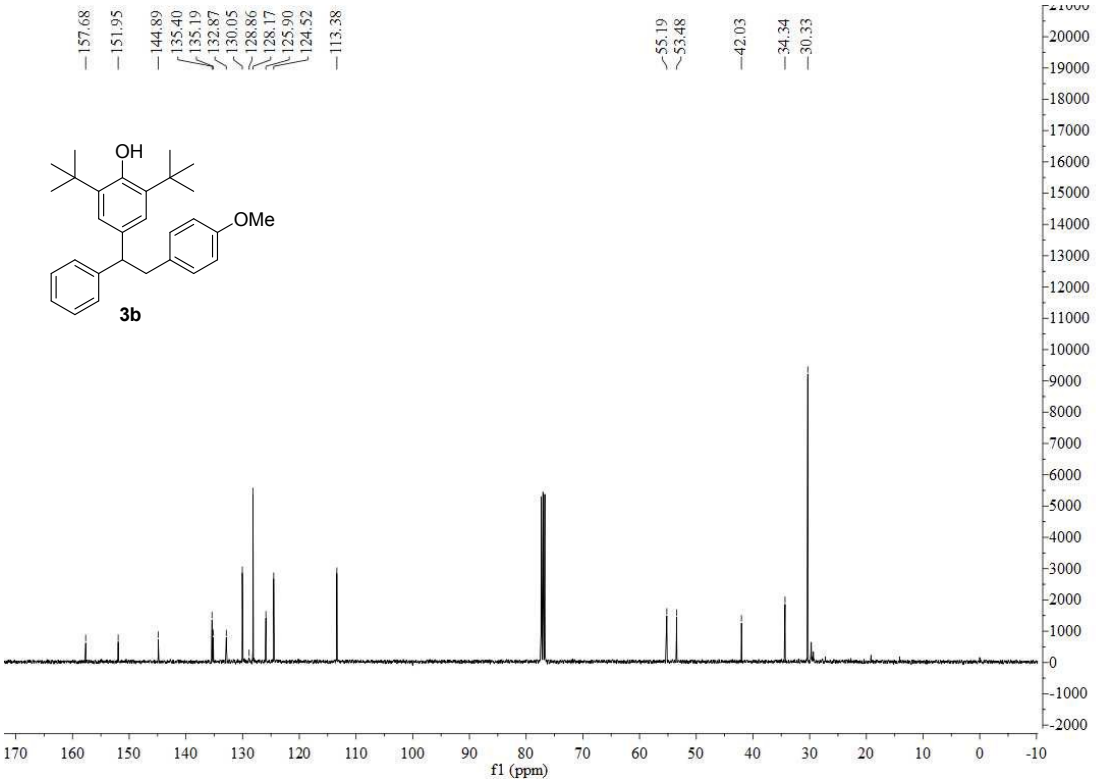
^{13}C NMR of 3a



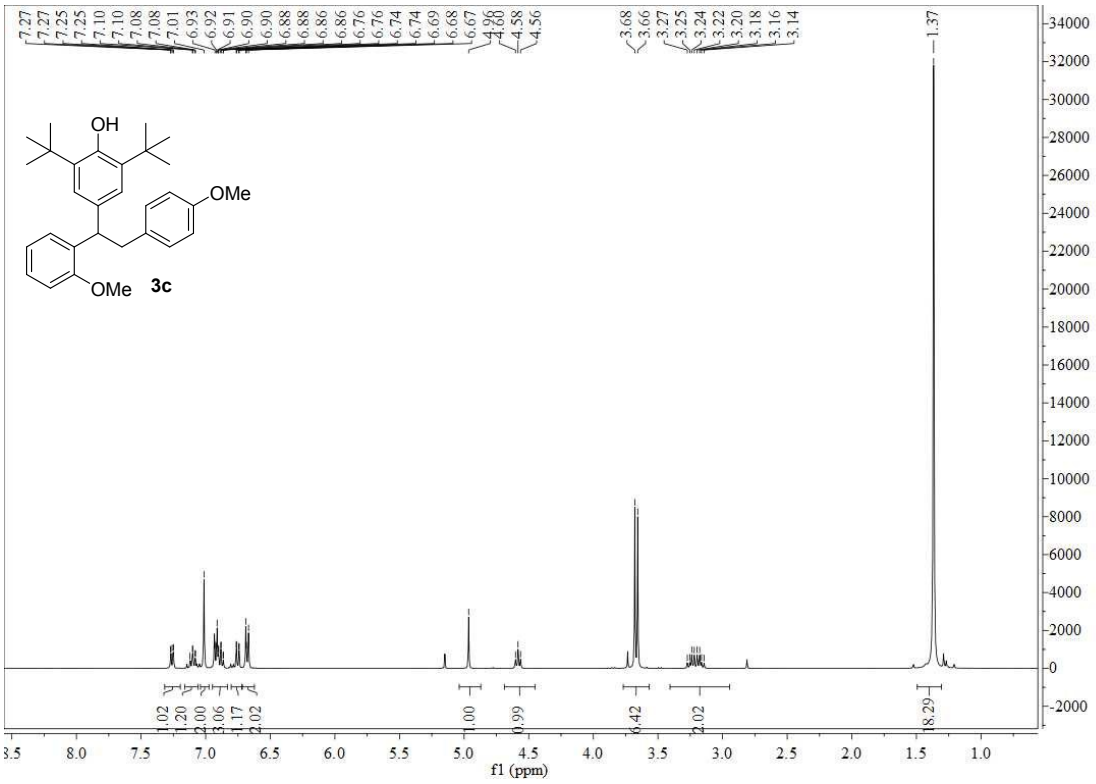
^{1}H NMR of 3b



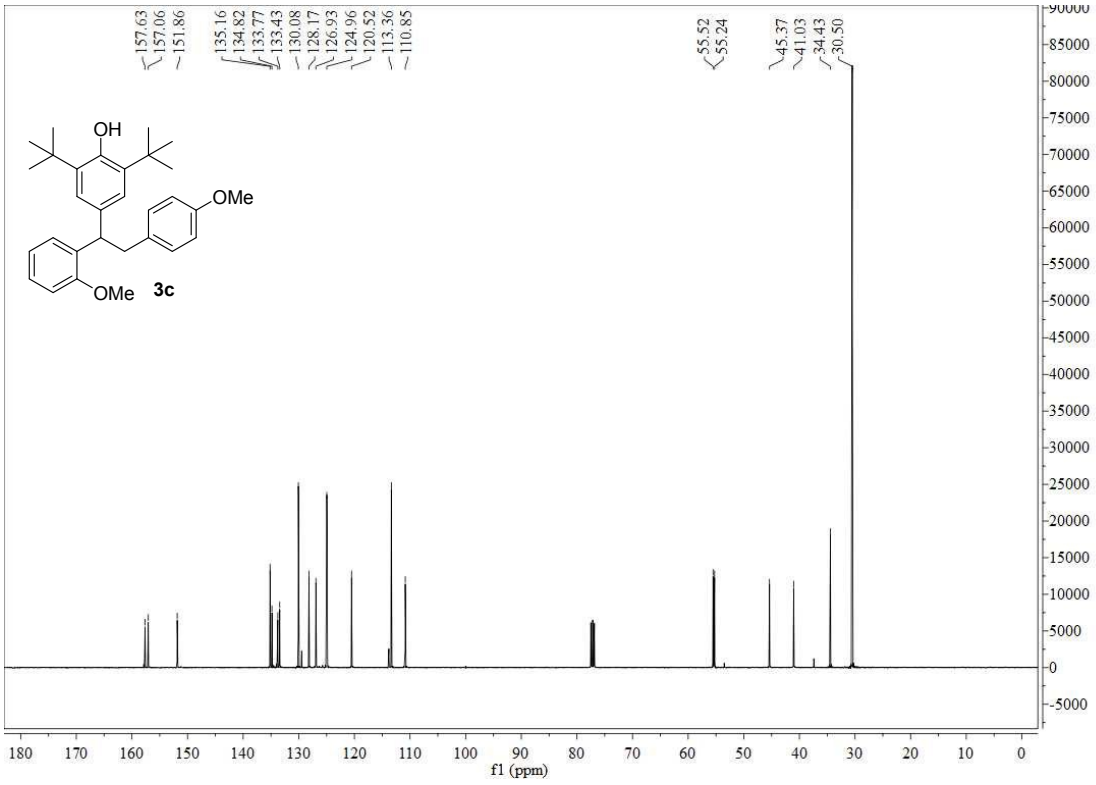
^{13}C NMR of 3b



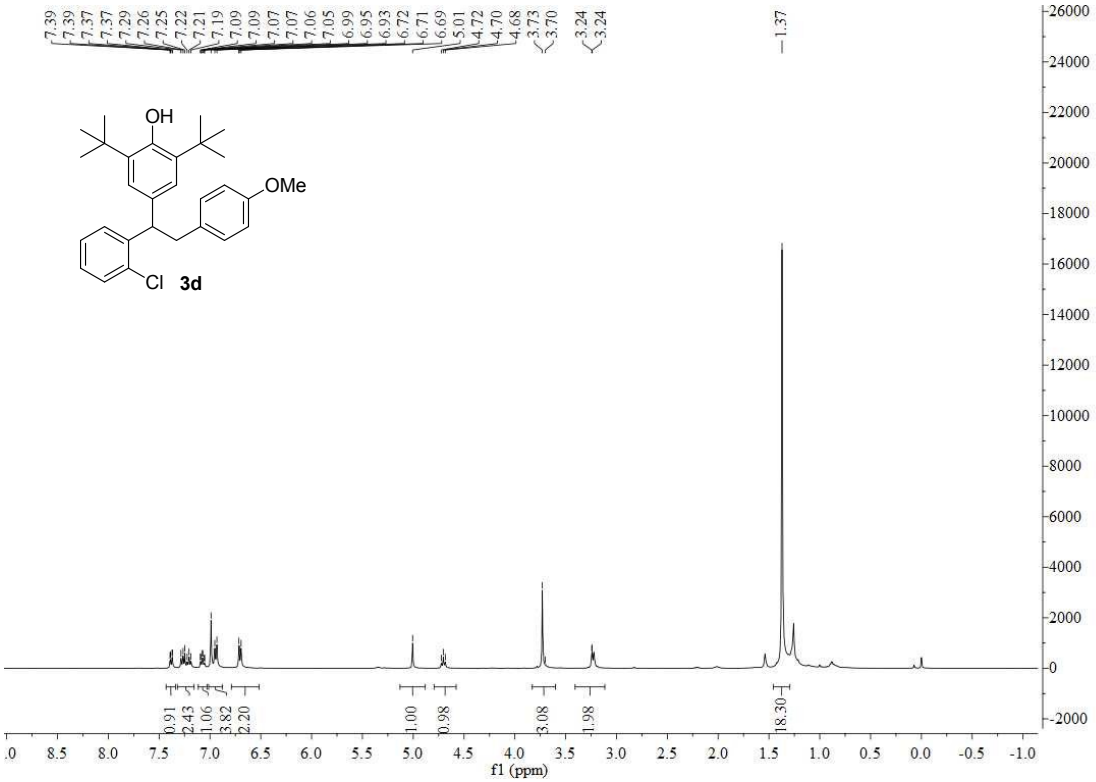
^{1}H NMR of 3c



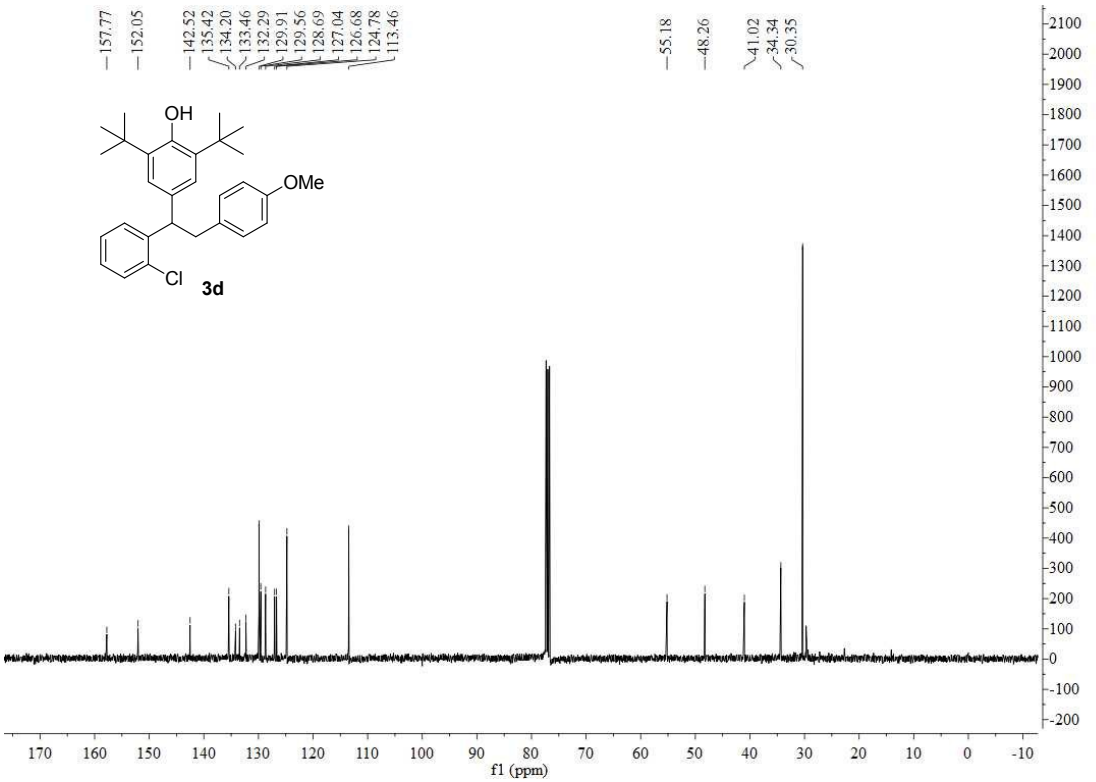
^{13}C NMR of 3c



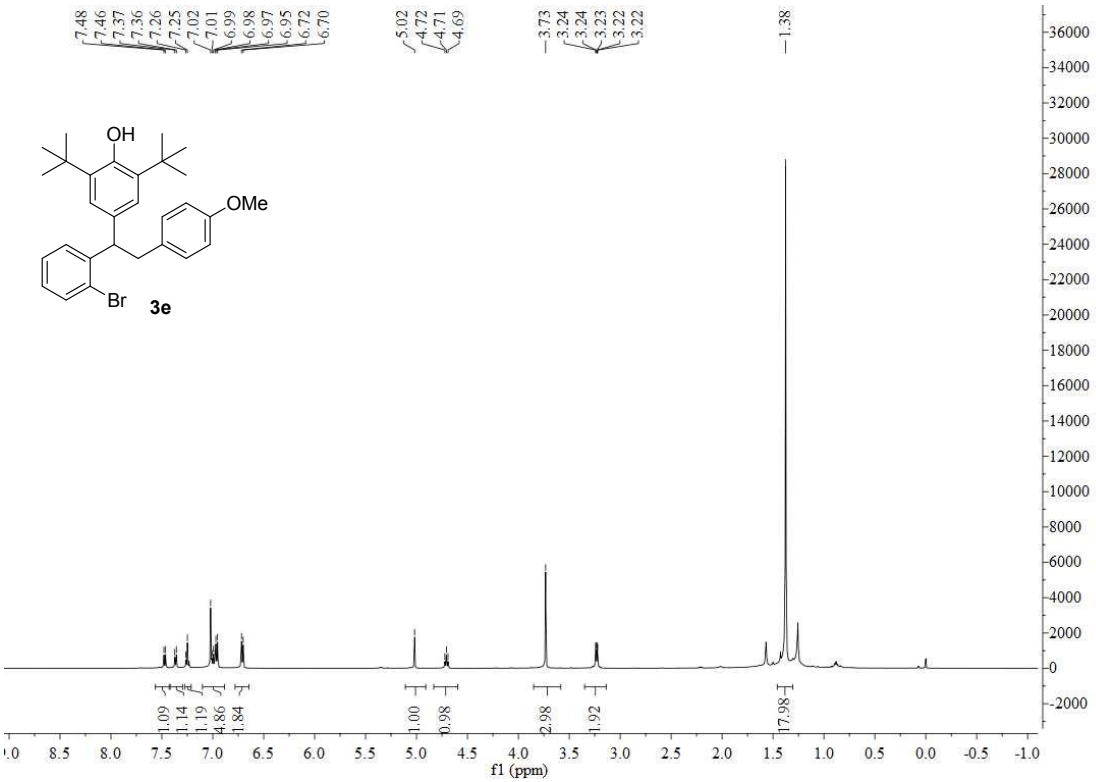
^{1}H NMR of 3d



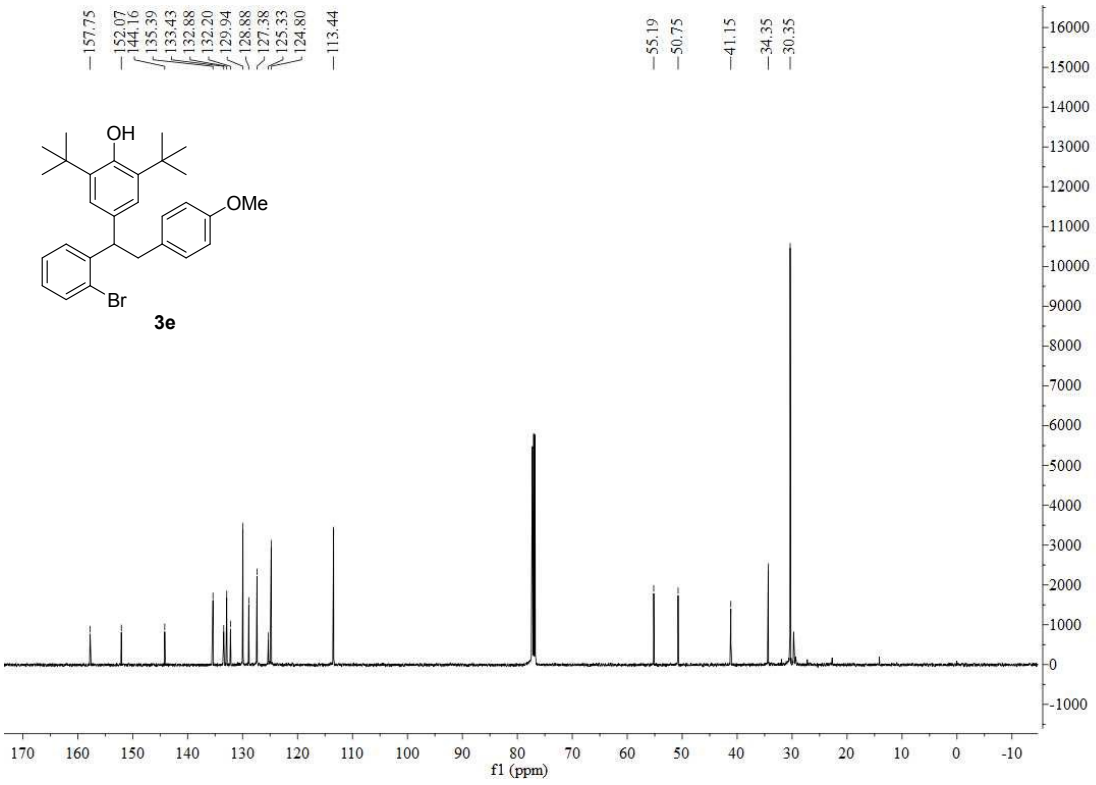
^{13}C NMR of 3d



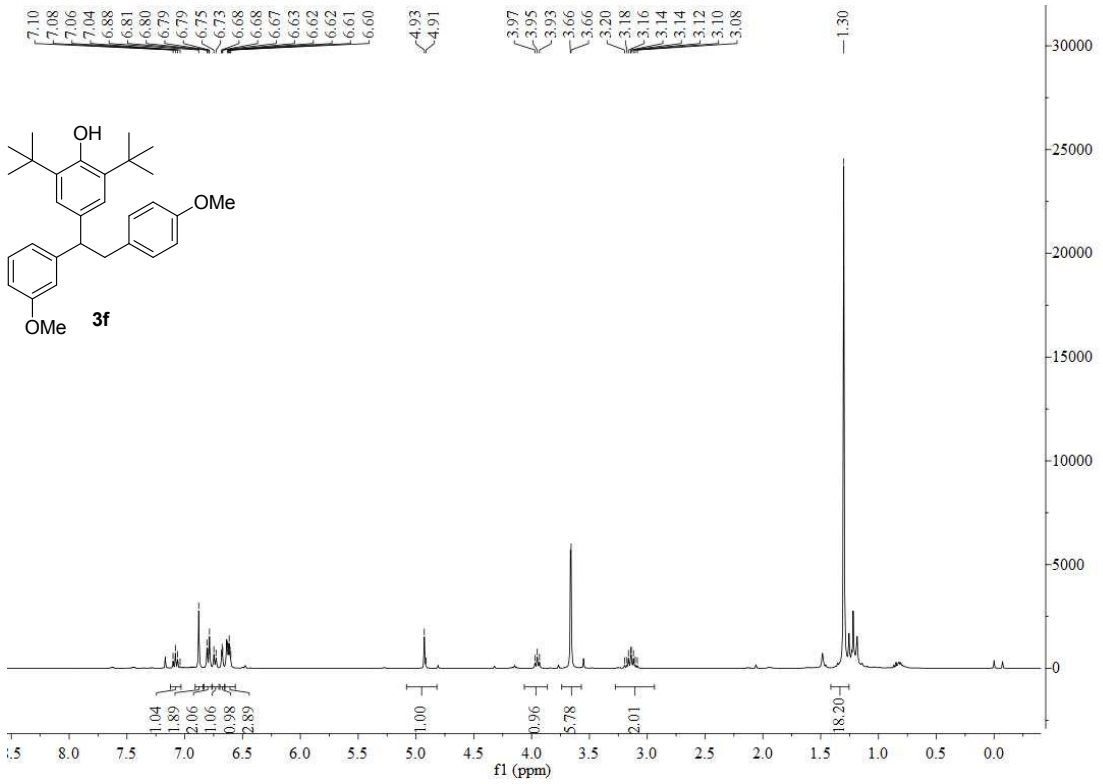
^{1}H NMR of 3e



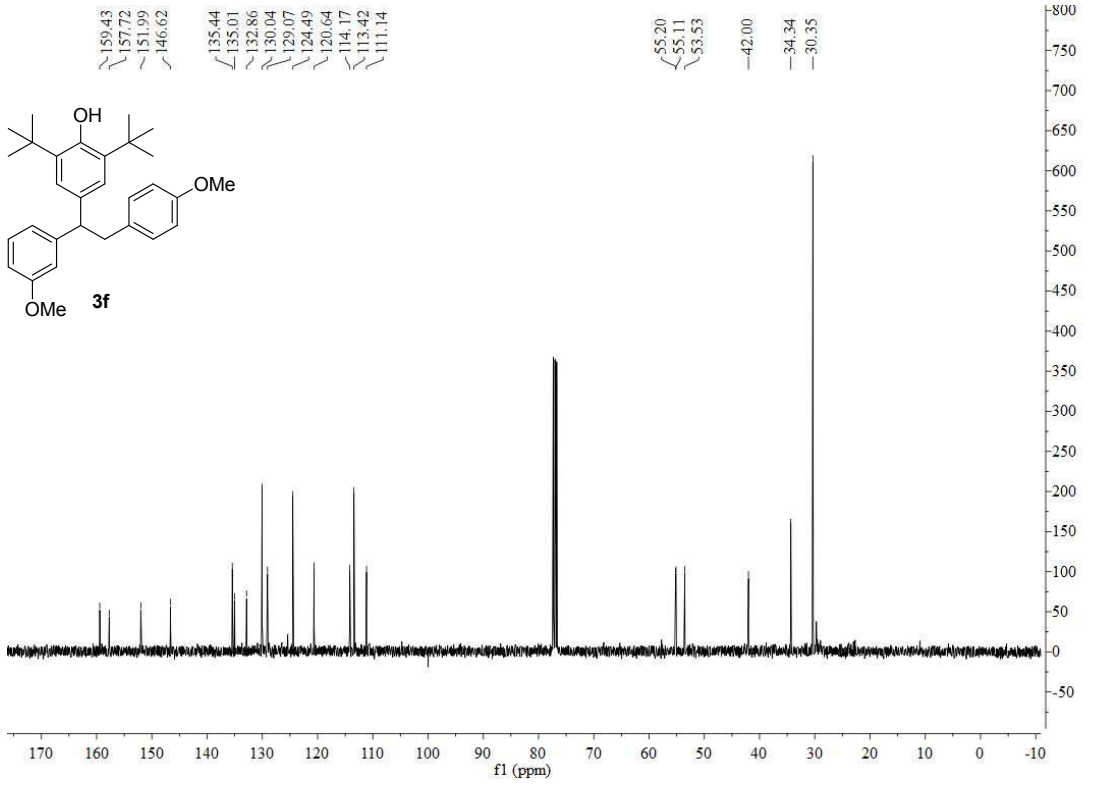
^{13}C NMR of 3e



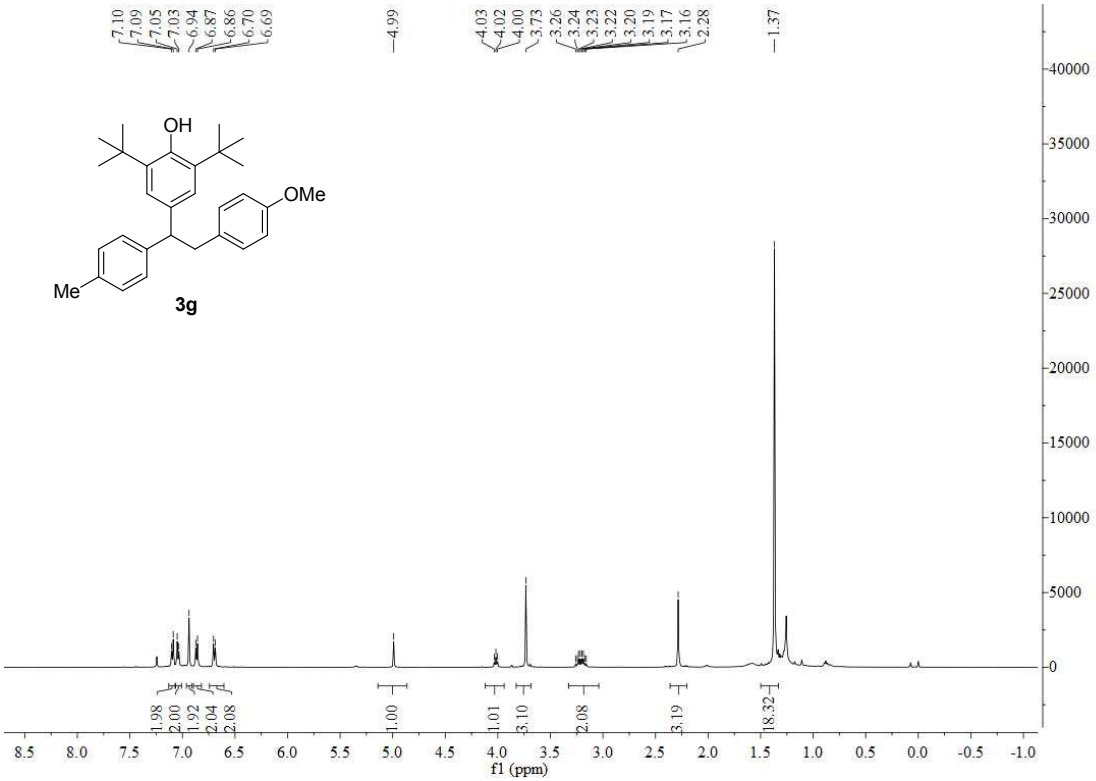
^{1}H NMR of 3f



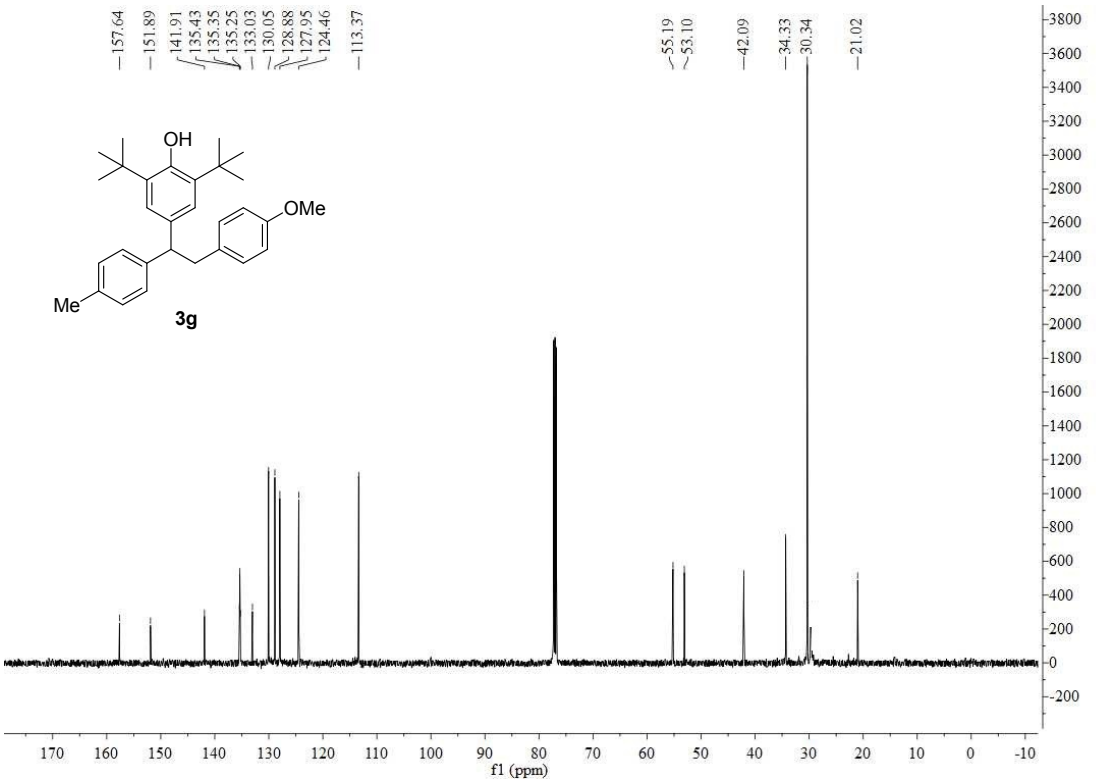
^{13}C NMR of 3f



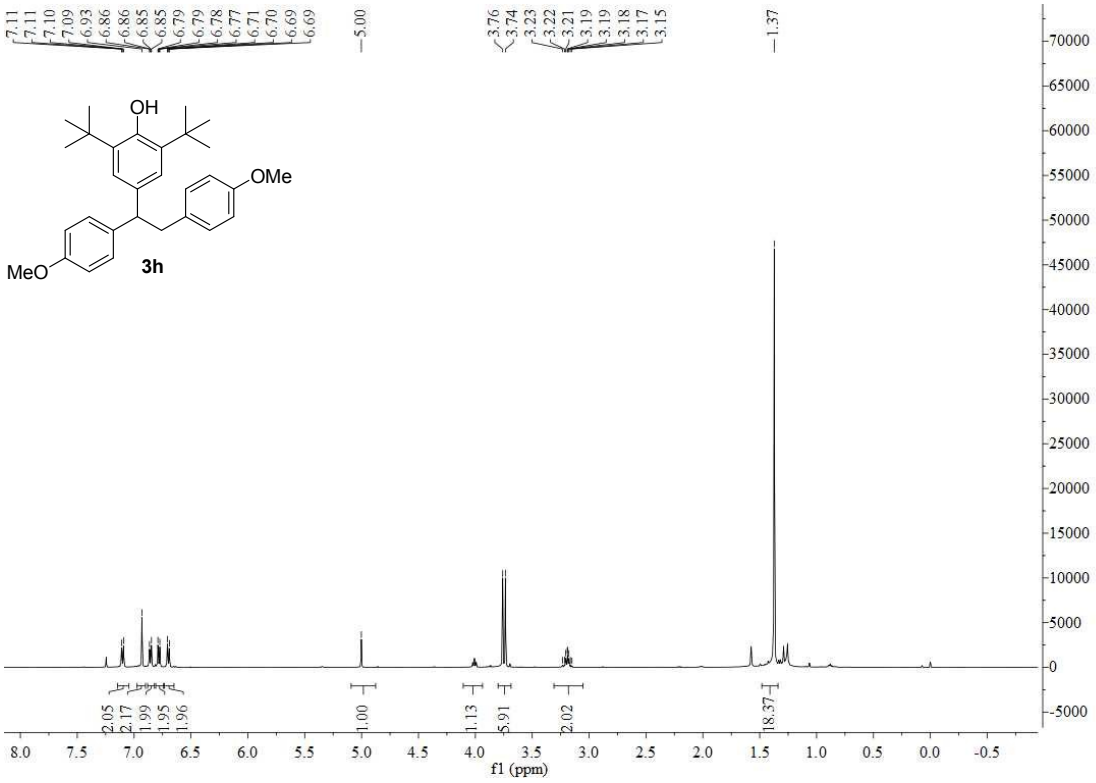
^{1}H NMR of 3g



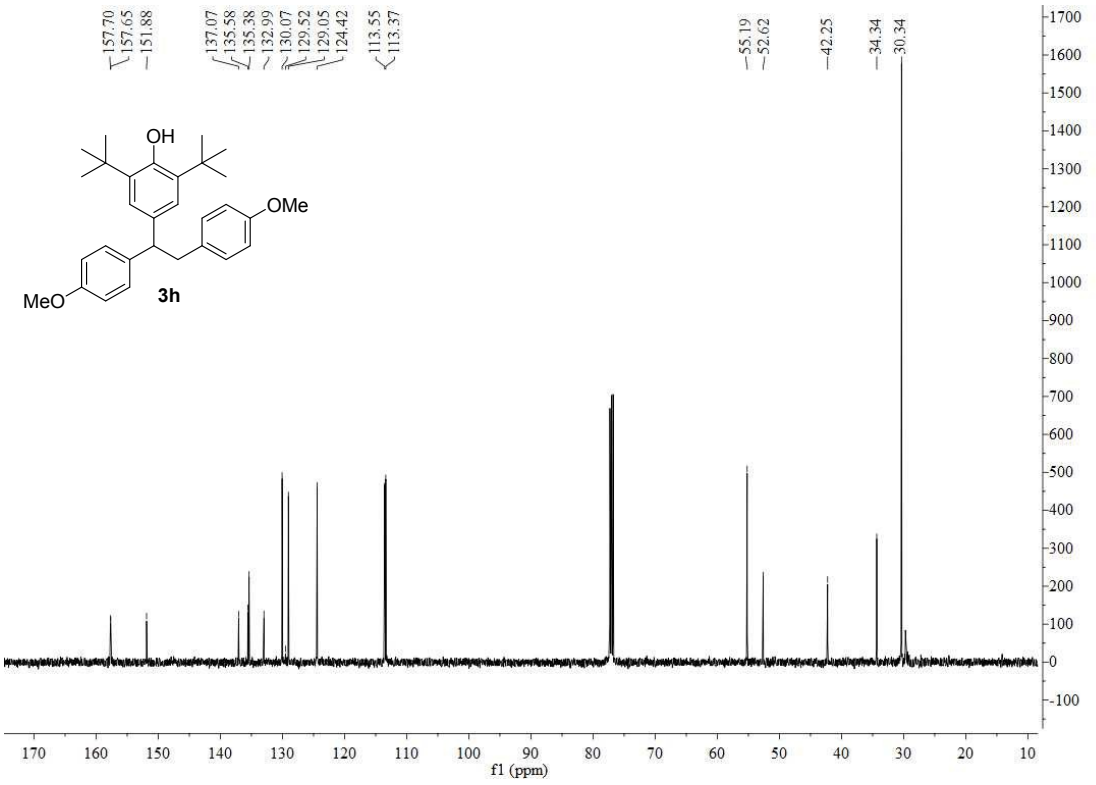
^{13}C NMR of 3g



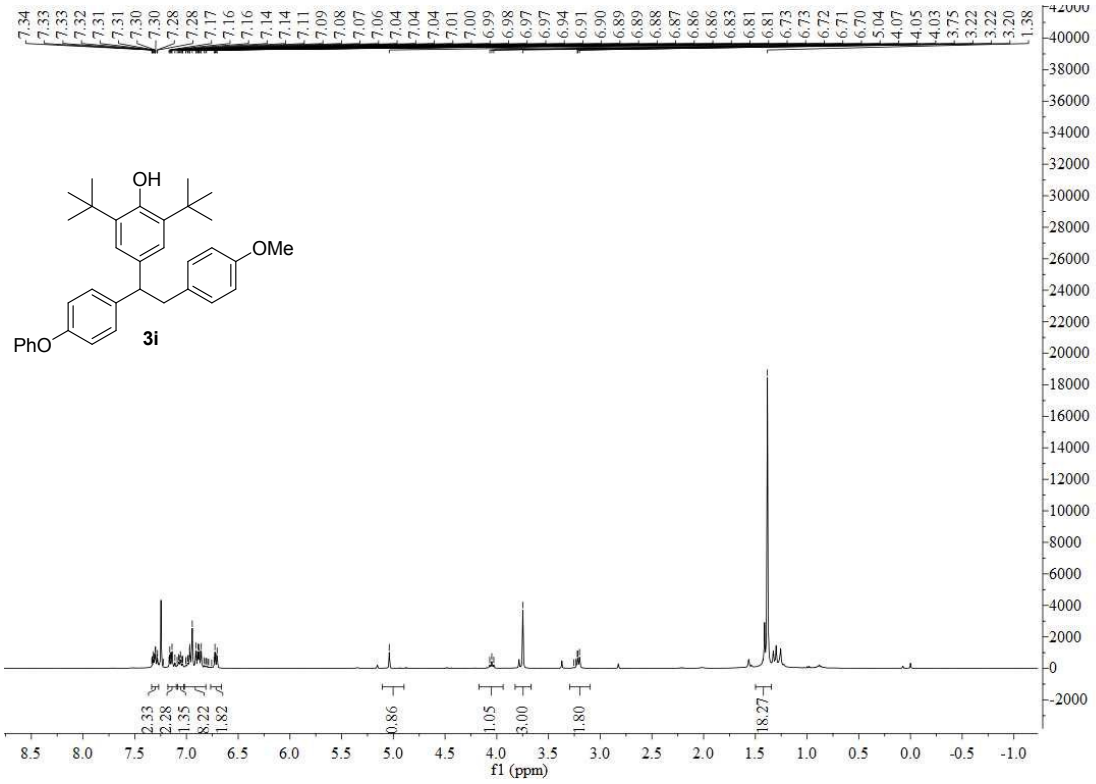
^{1}H NMR of 3h



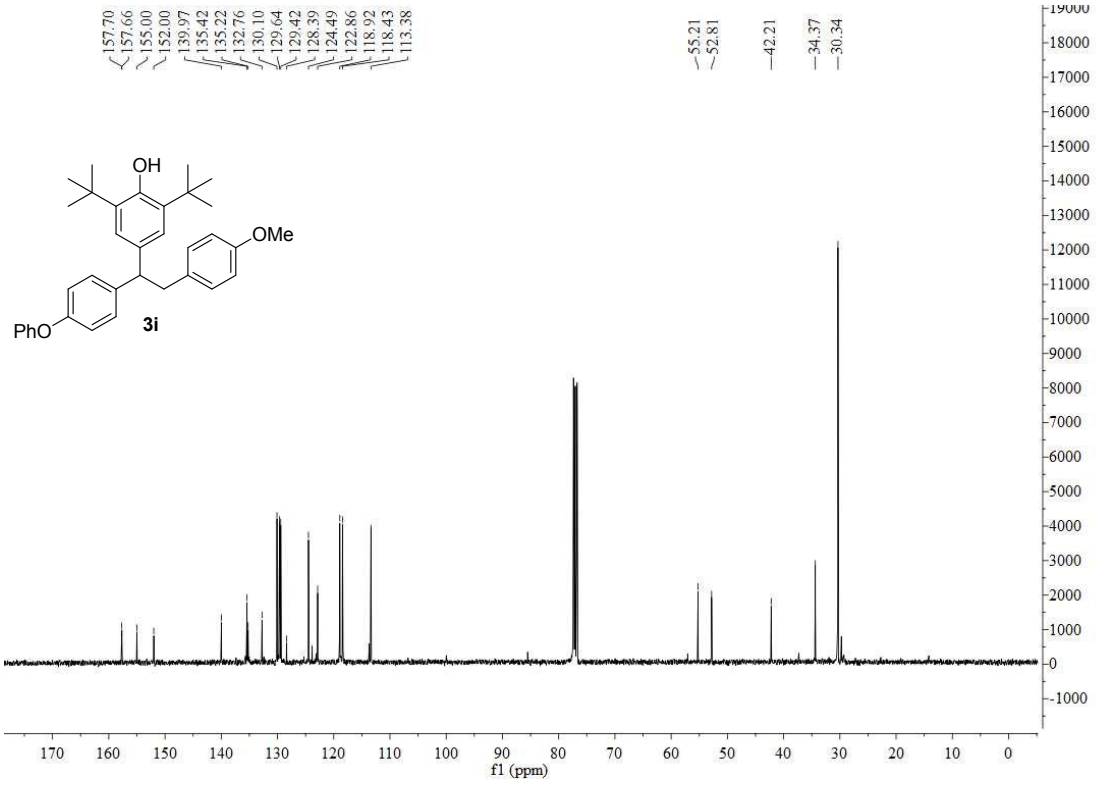
^{13}C NMR of 3h



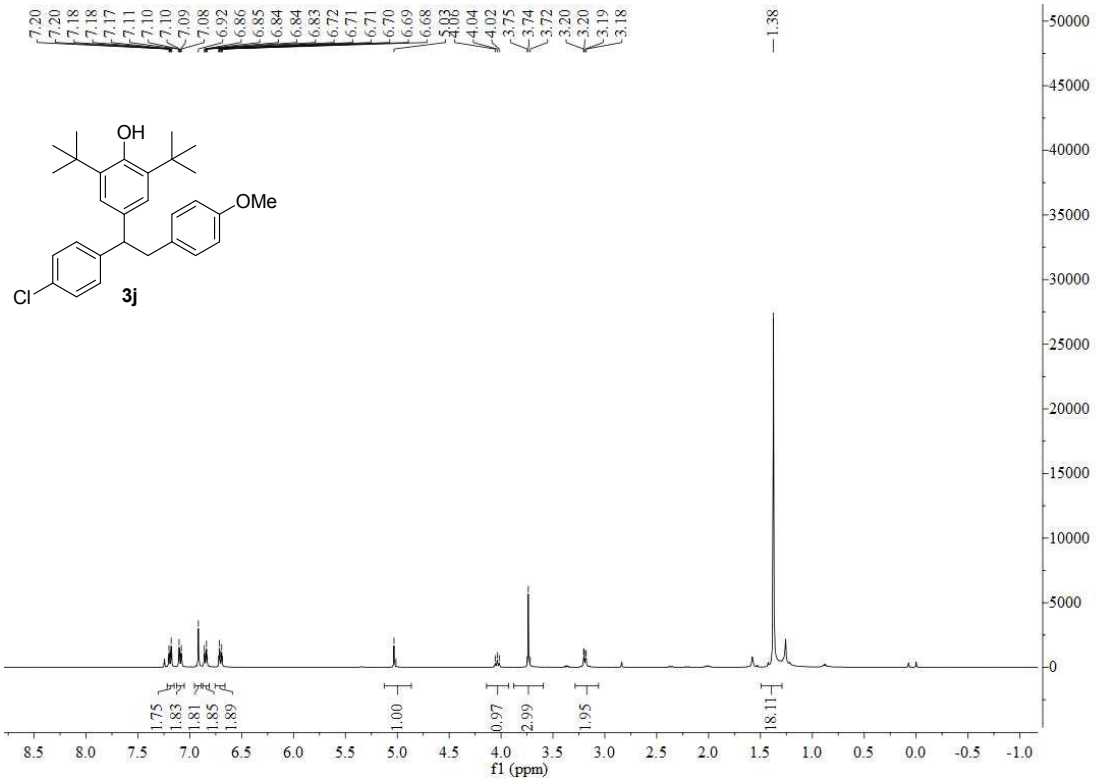
^{1}H NMR of 3i



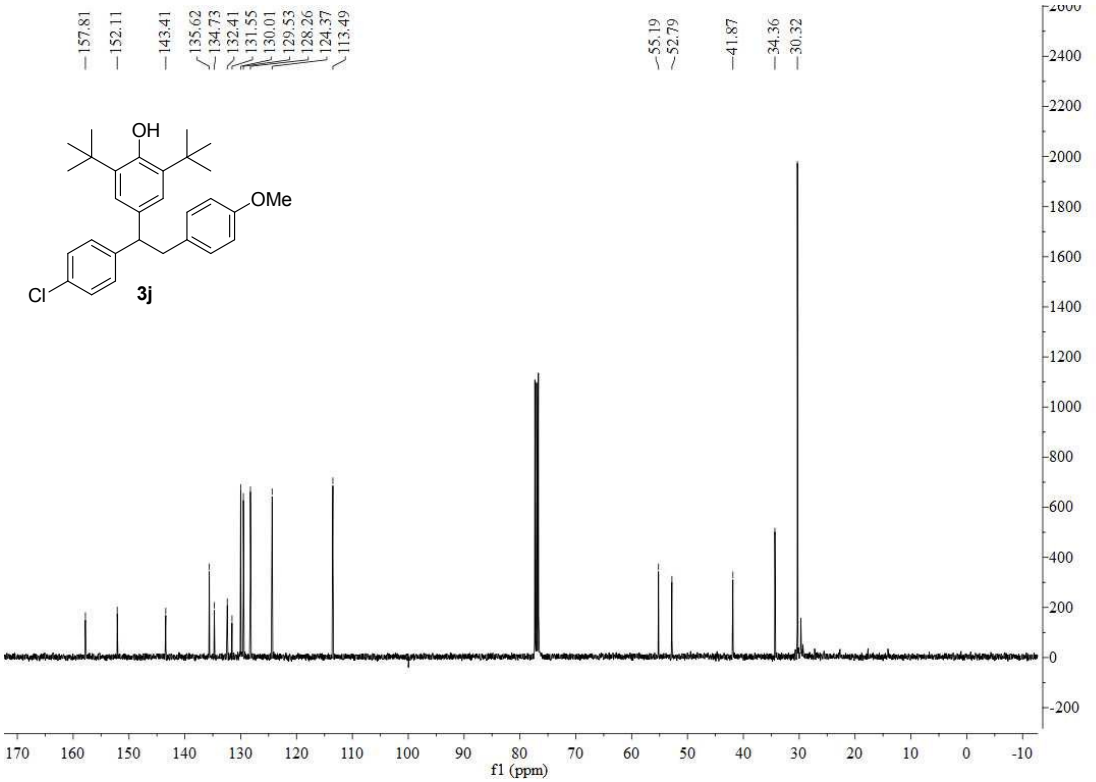
^{13}C NMR of 3i



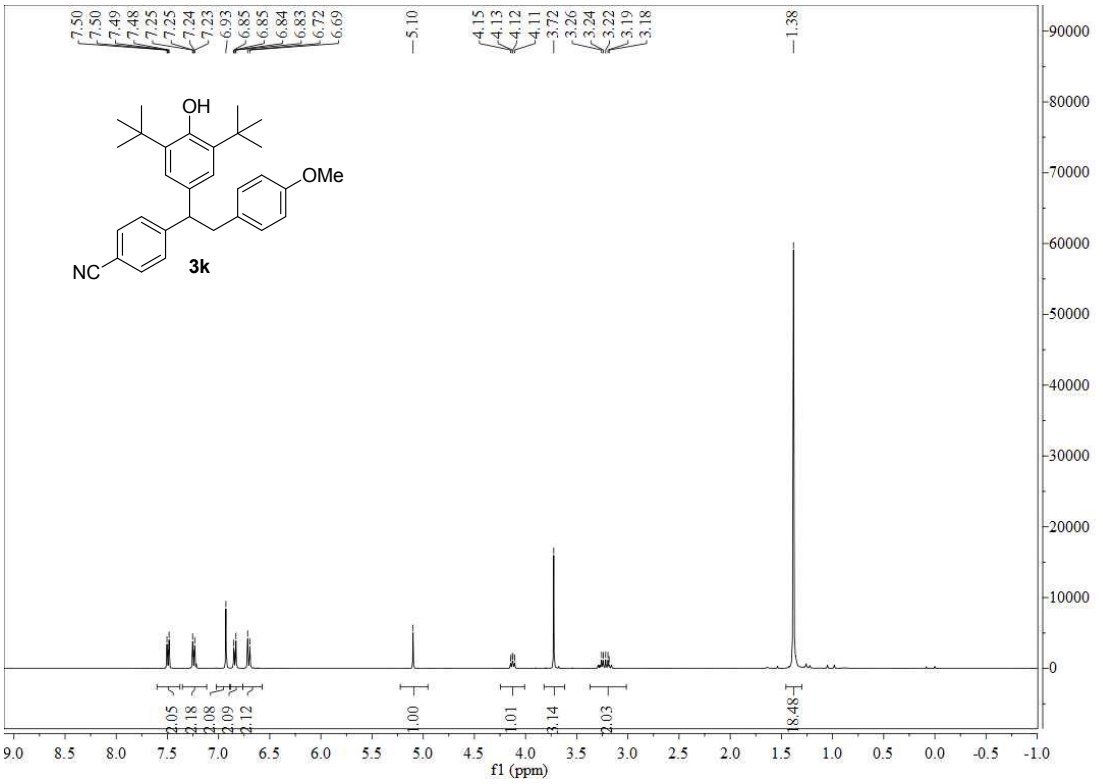
^{1}H NMR of 3j



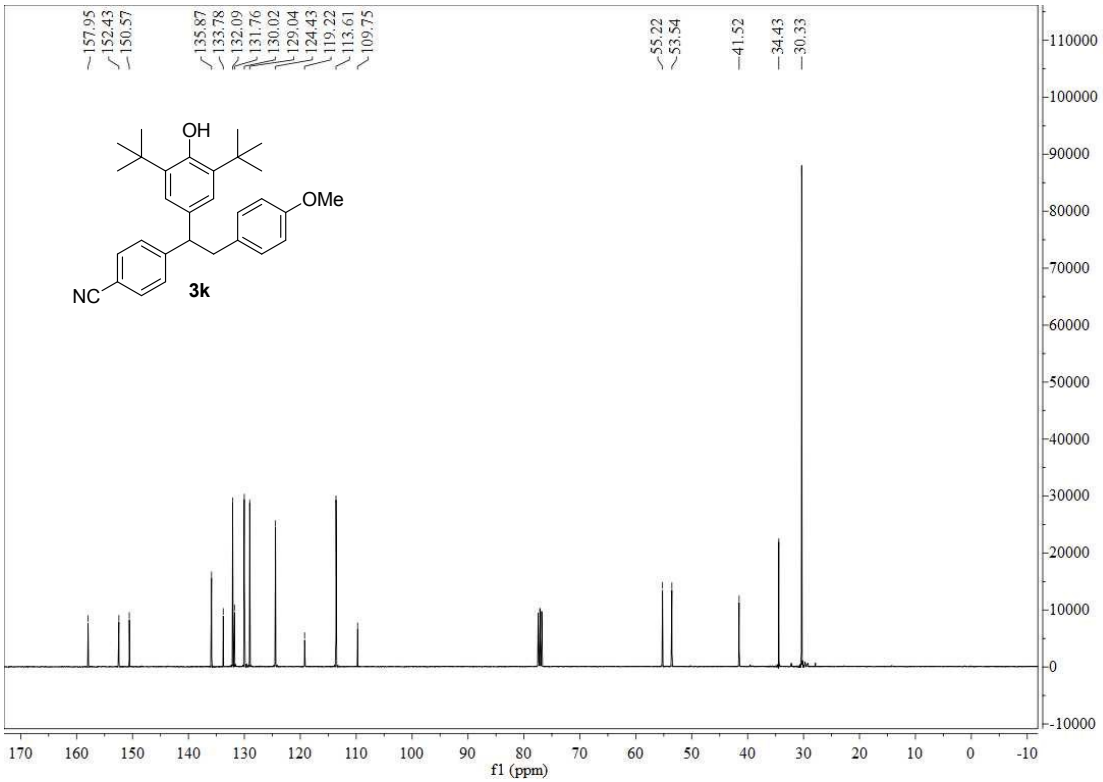
^{13}C NMR of 3j



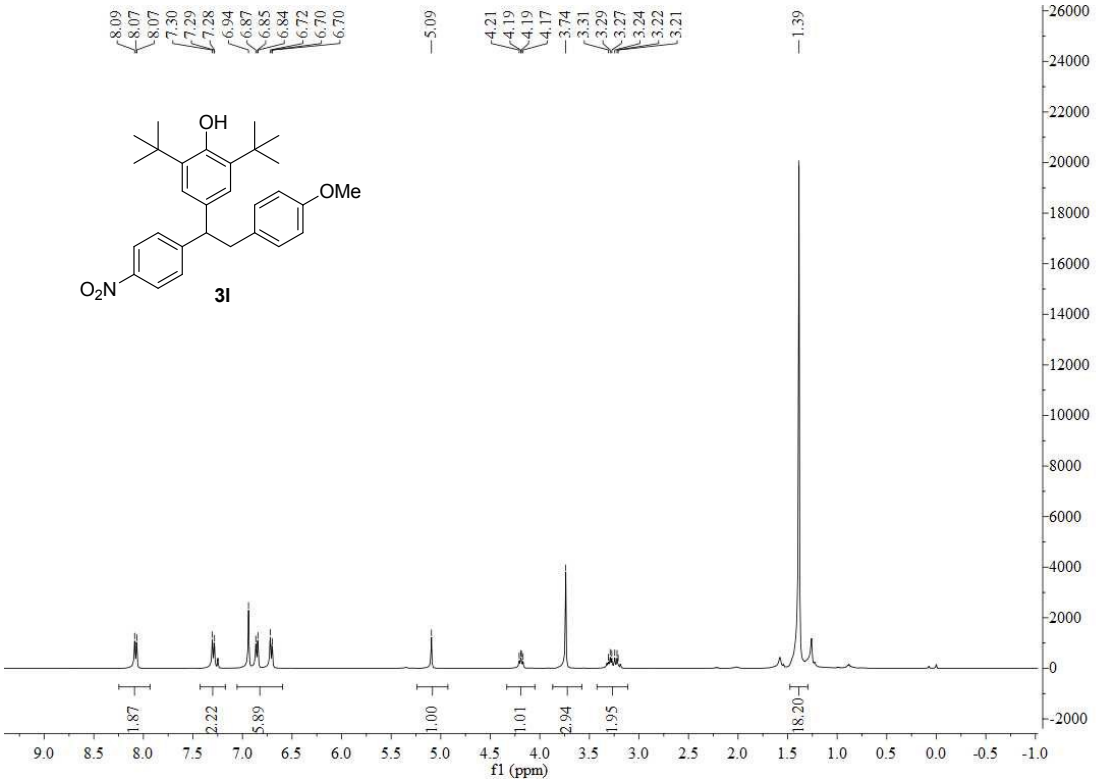
^{1}H NMR of 3k



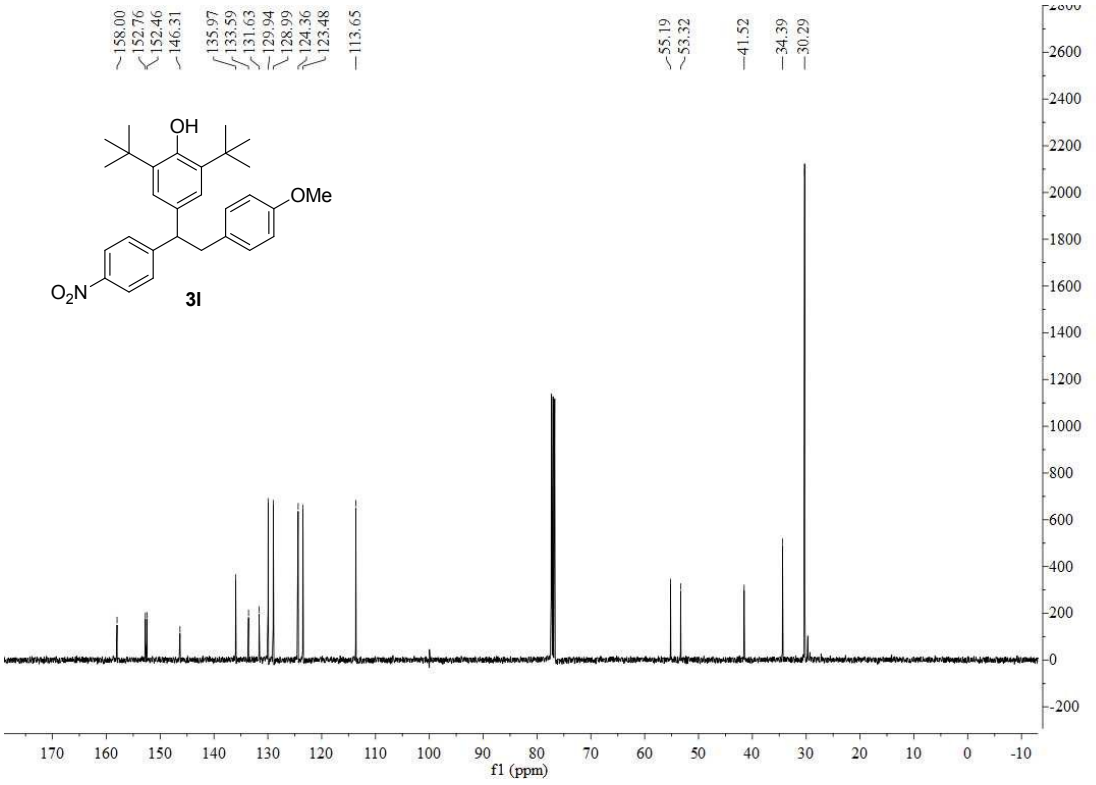
^{13}C NMR of 3k



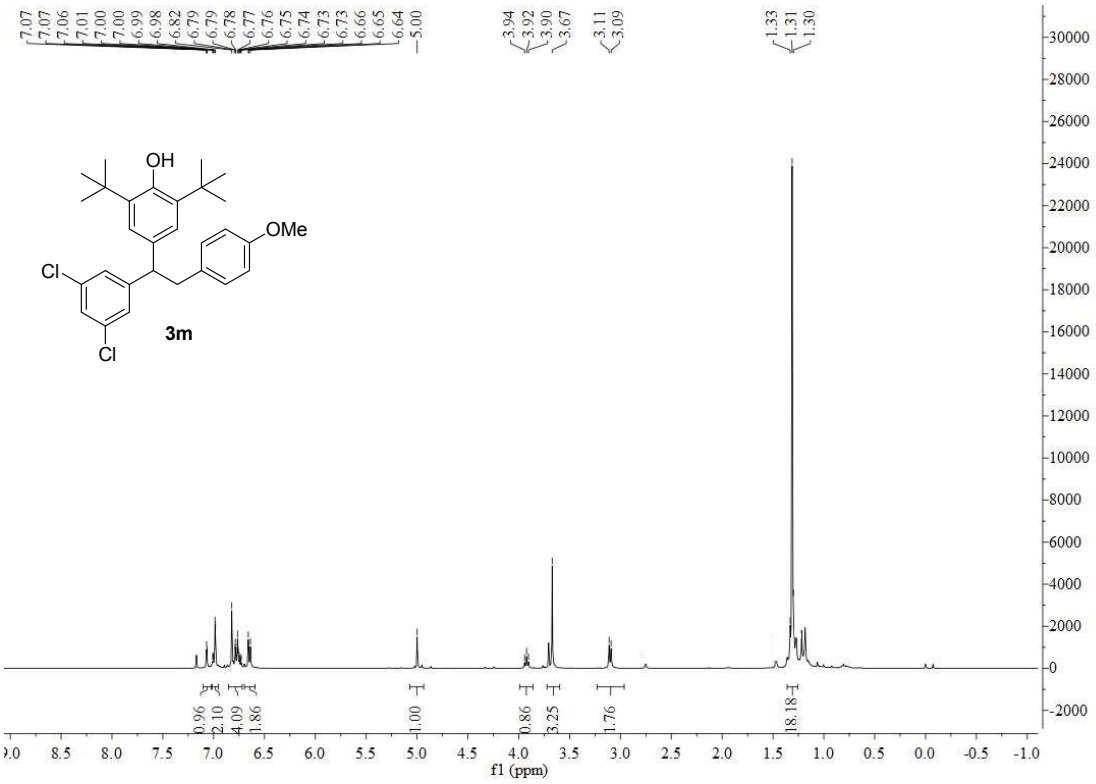
^{1}H NMR of 3l



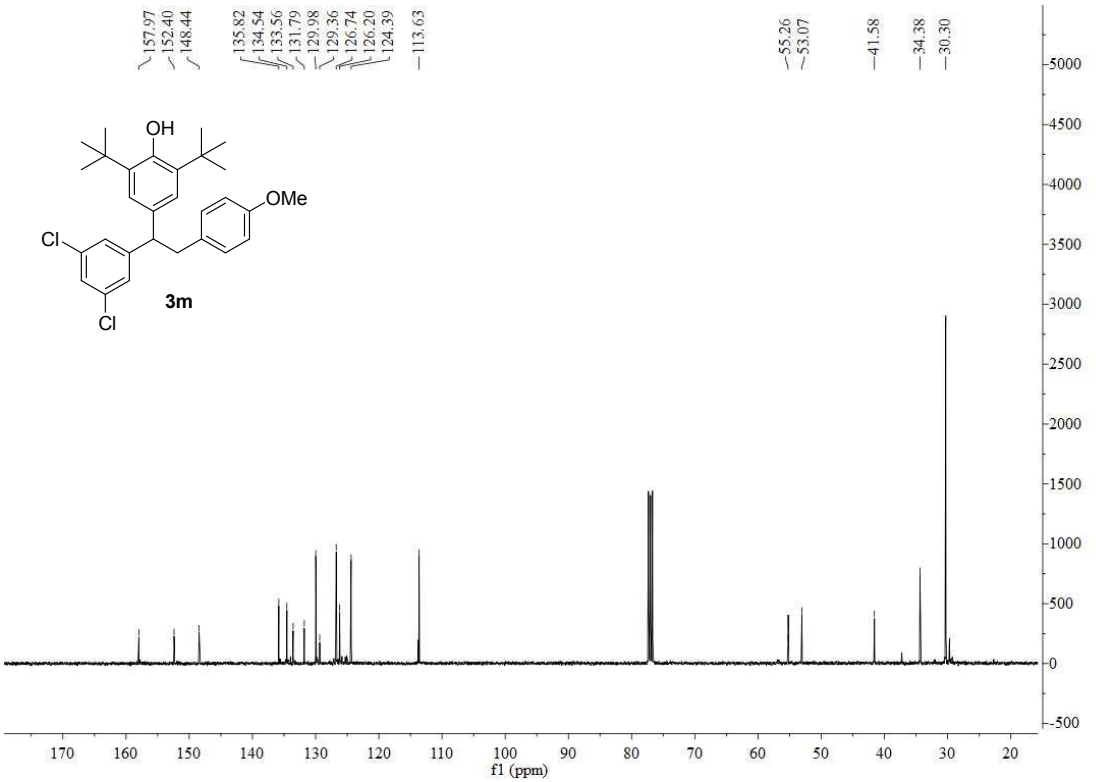
^{13}C NMR of 3l



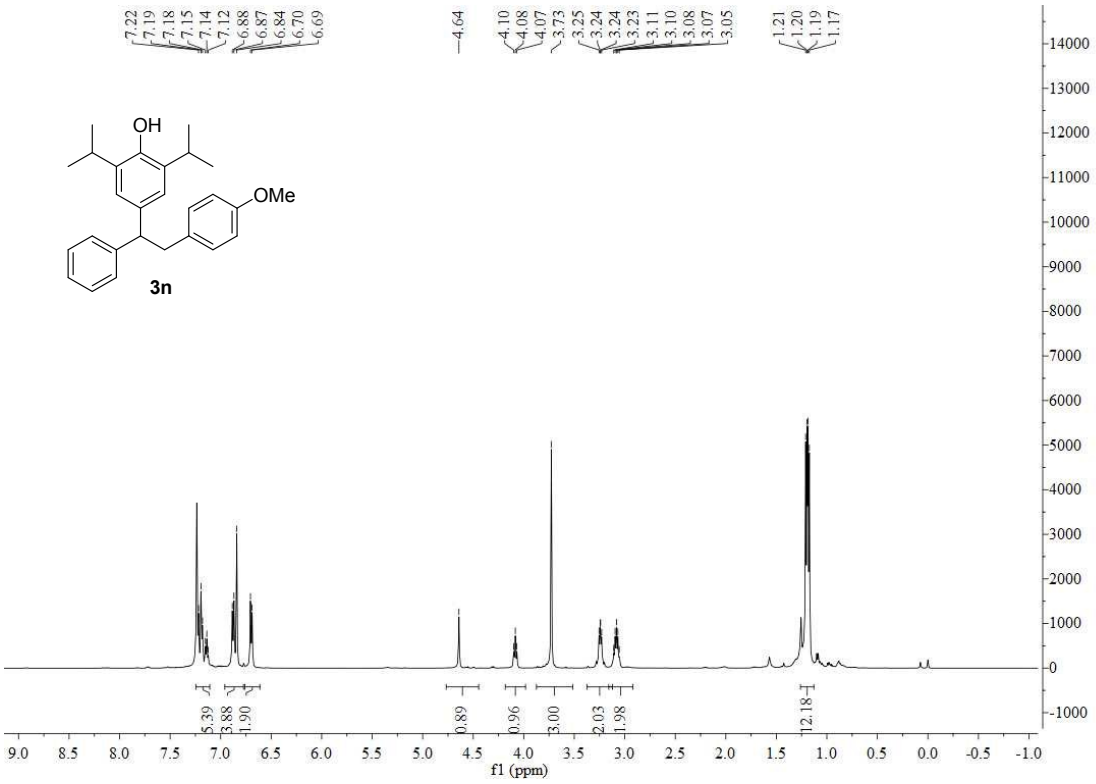
^{1}H NMR of 3m



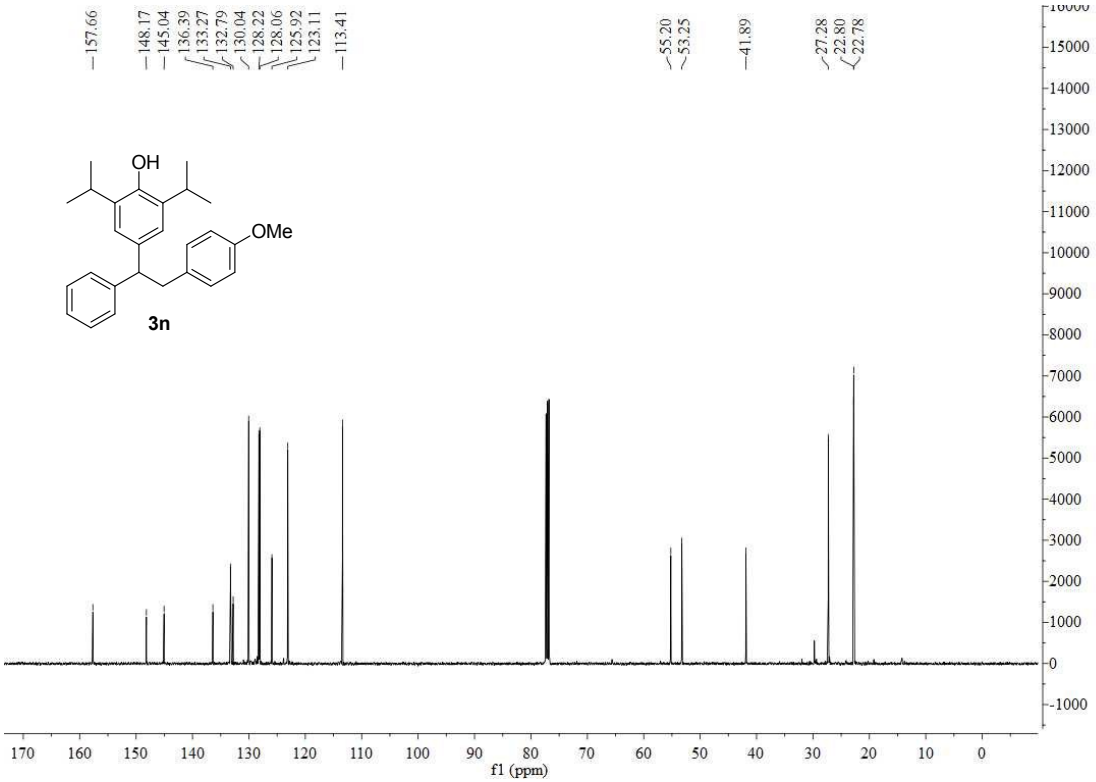
^{13}C NMR of 3m



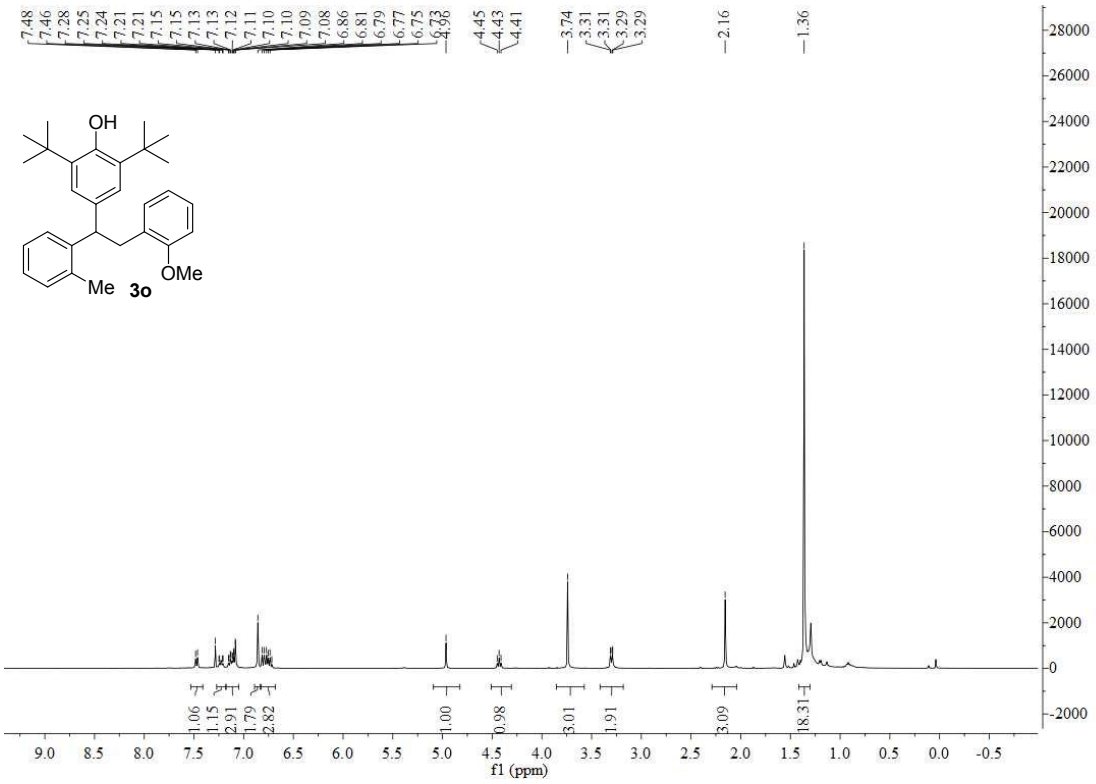
^{1}H NMR of 3n



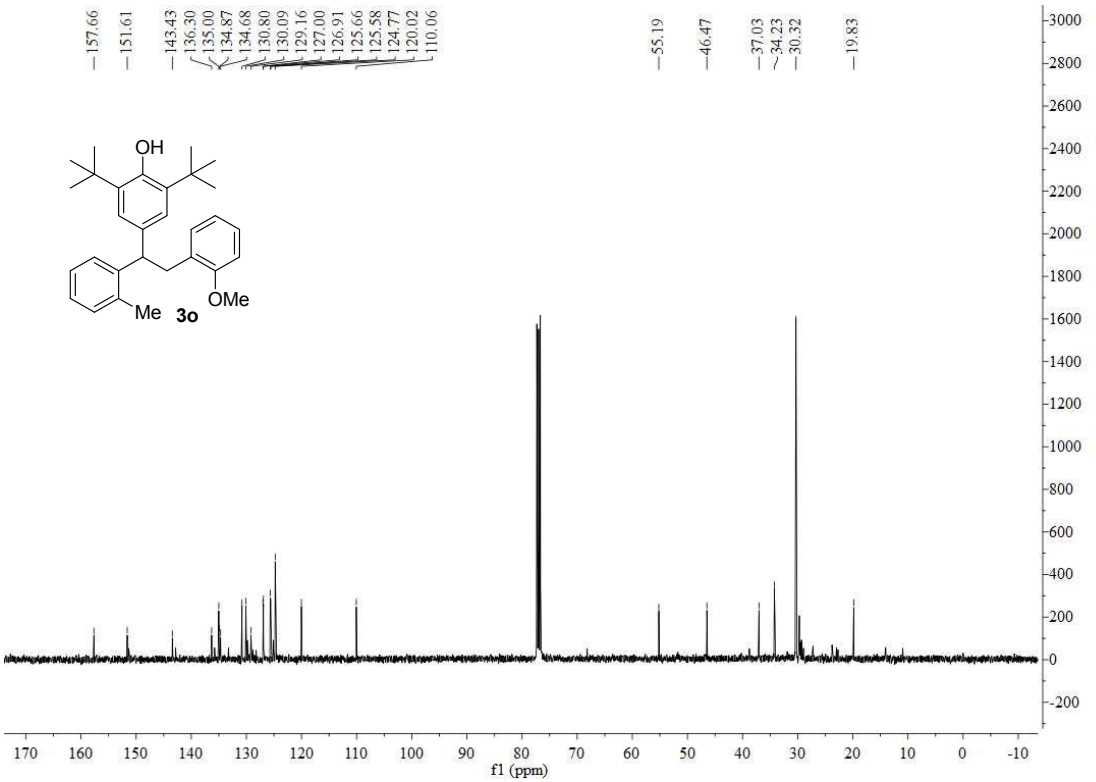
^{13}C NMR of 3n



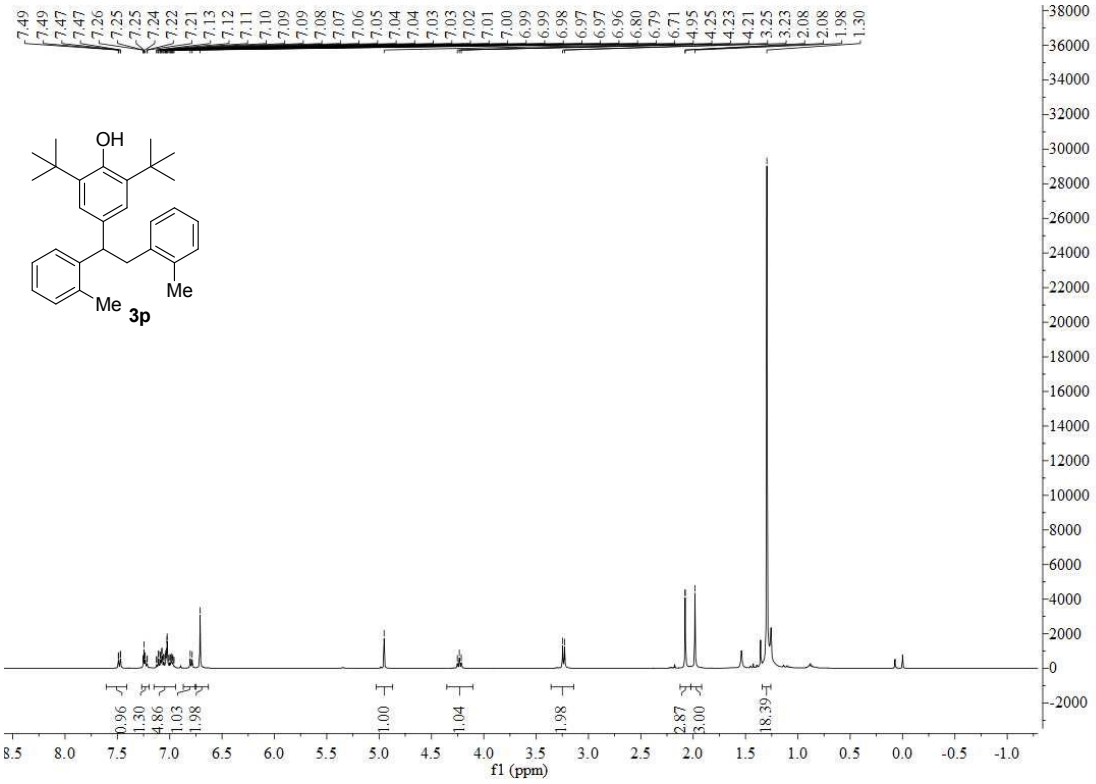
^{1}H NMR of 3o



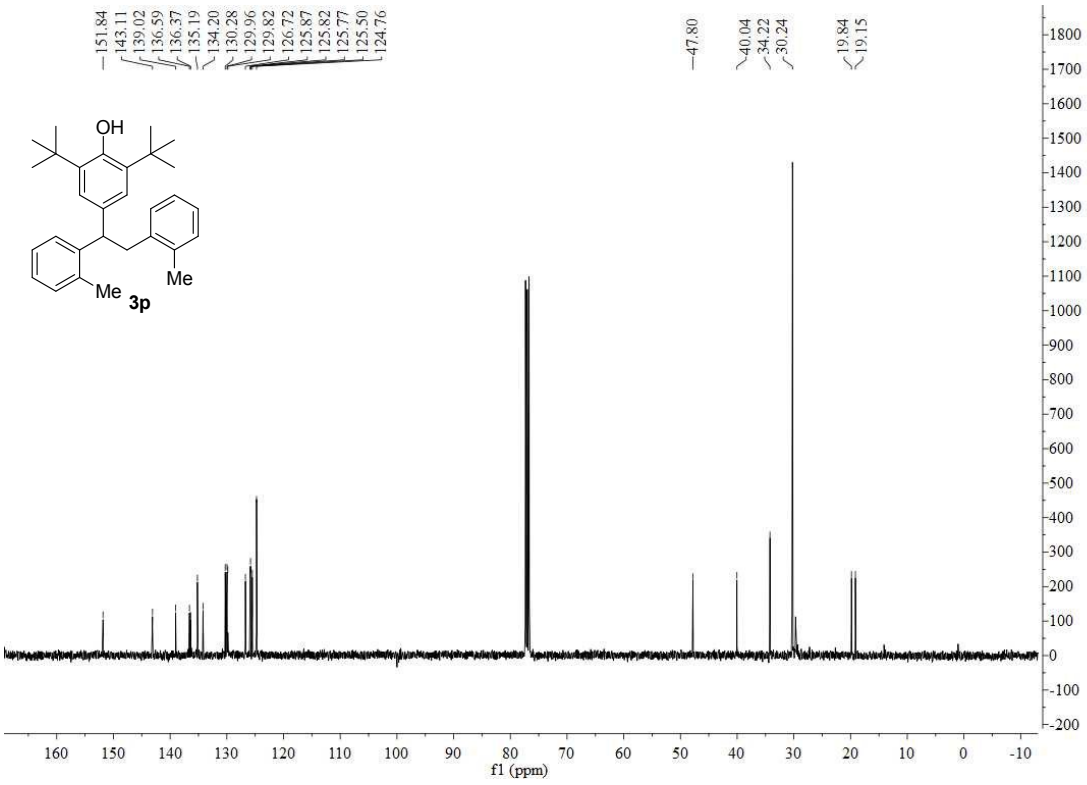
^{13}C NMR of 3o



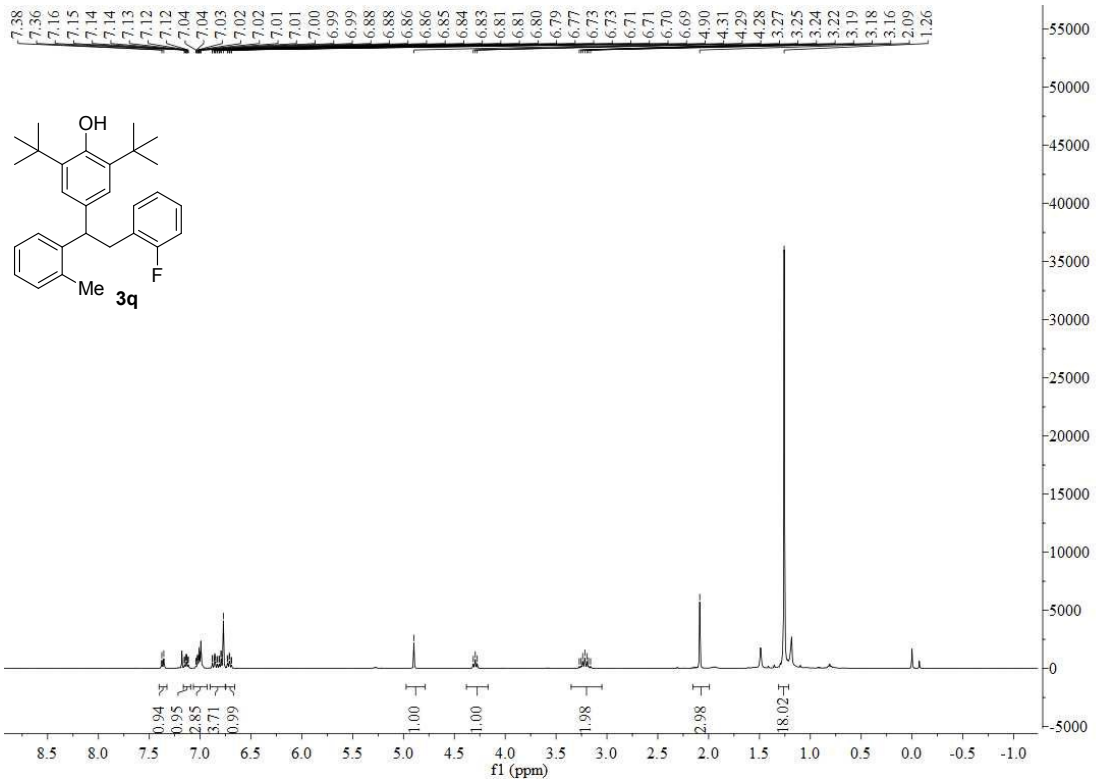
^{1}H NMR of 3p



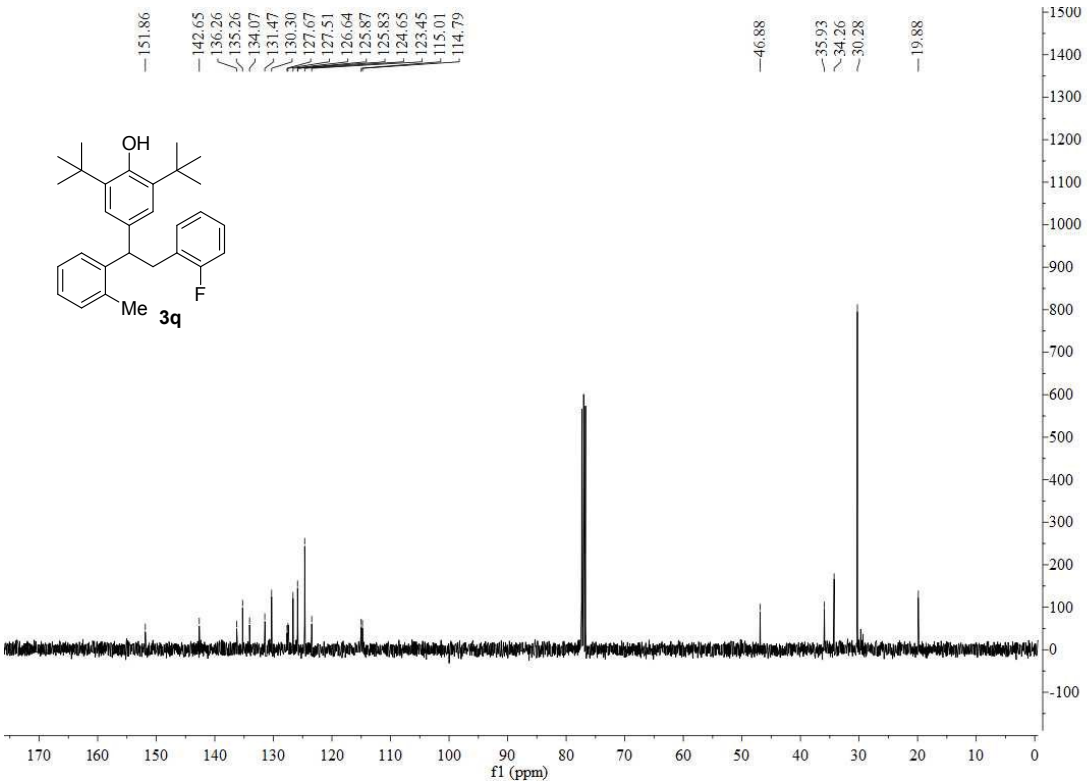
^{13}C NMR of 3p



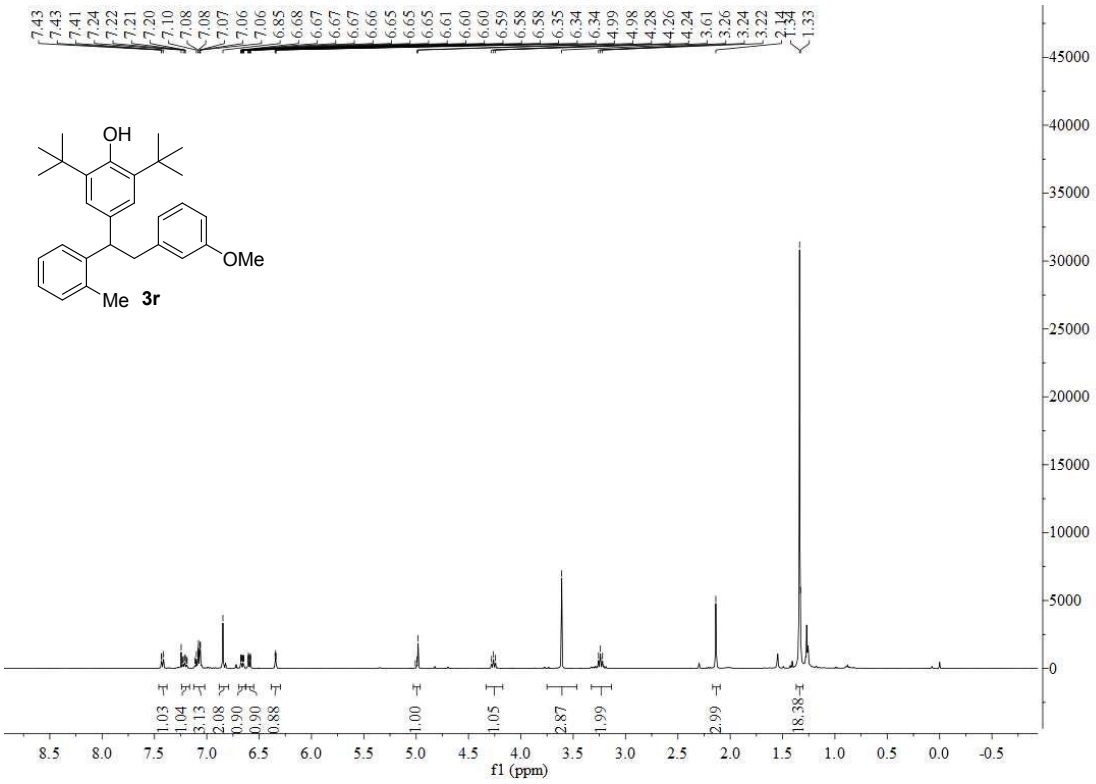
^{1}H NMR of 3q



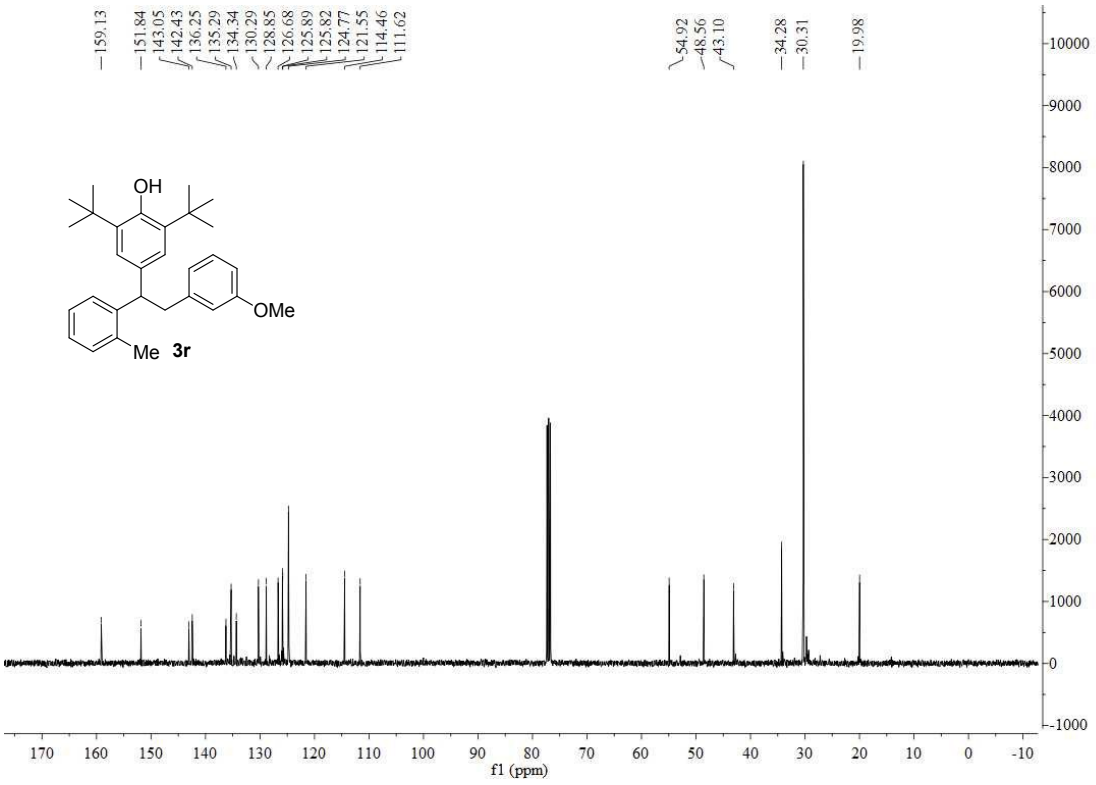
^{13}C NMR of 3q



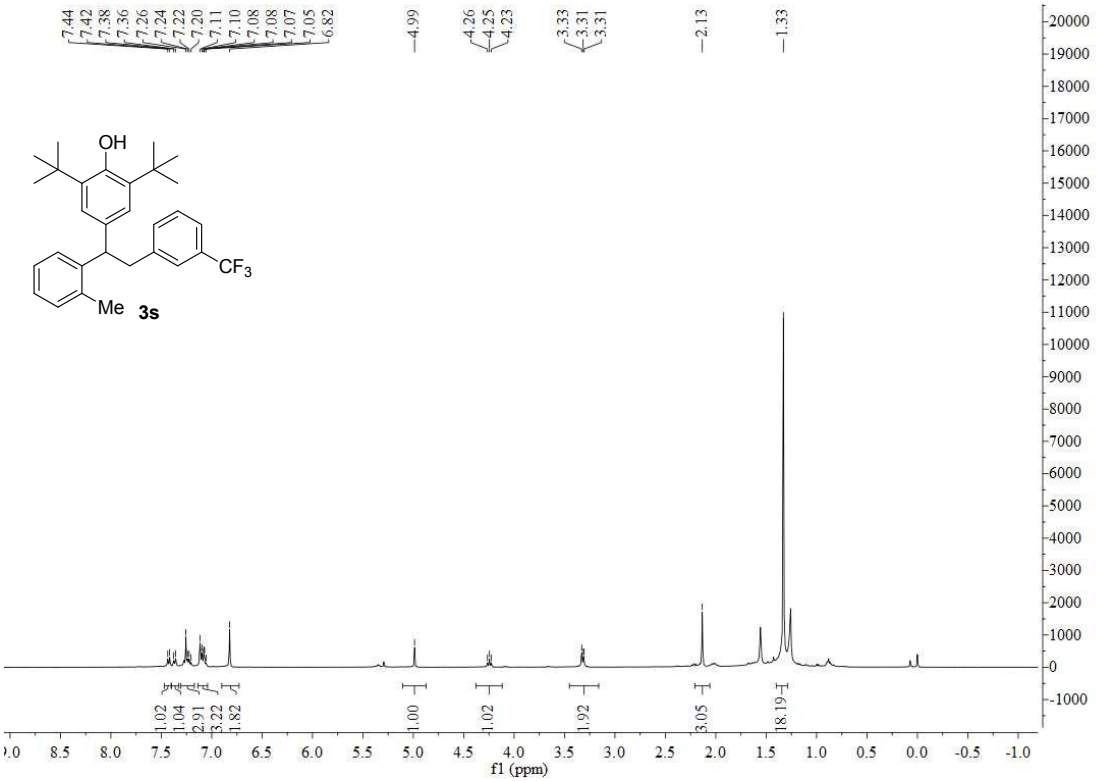
^{1}H NMR of 3r



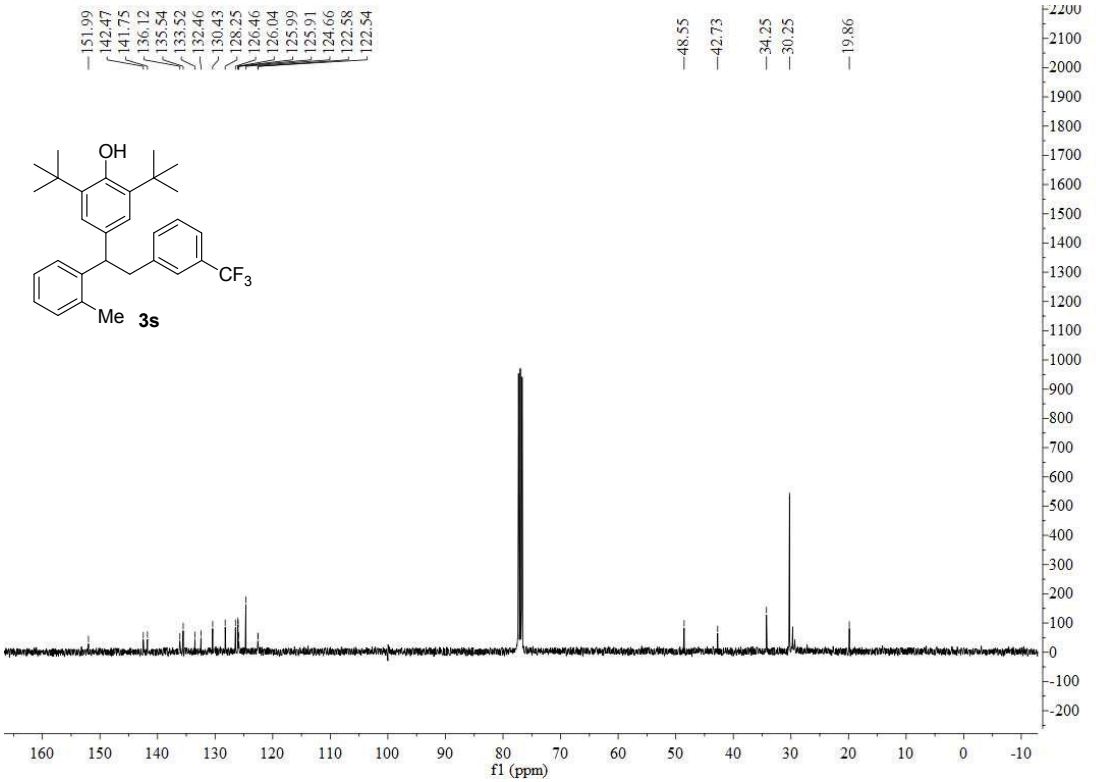
^{13}C NMR of 3r



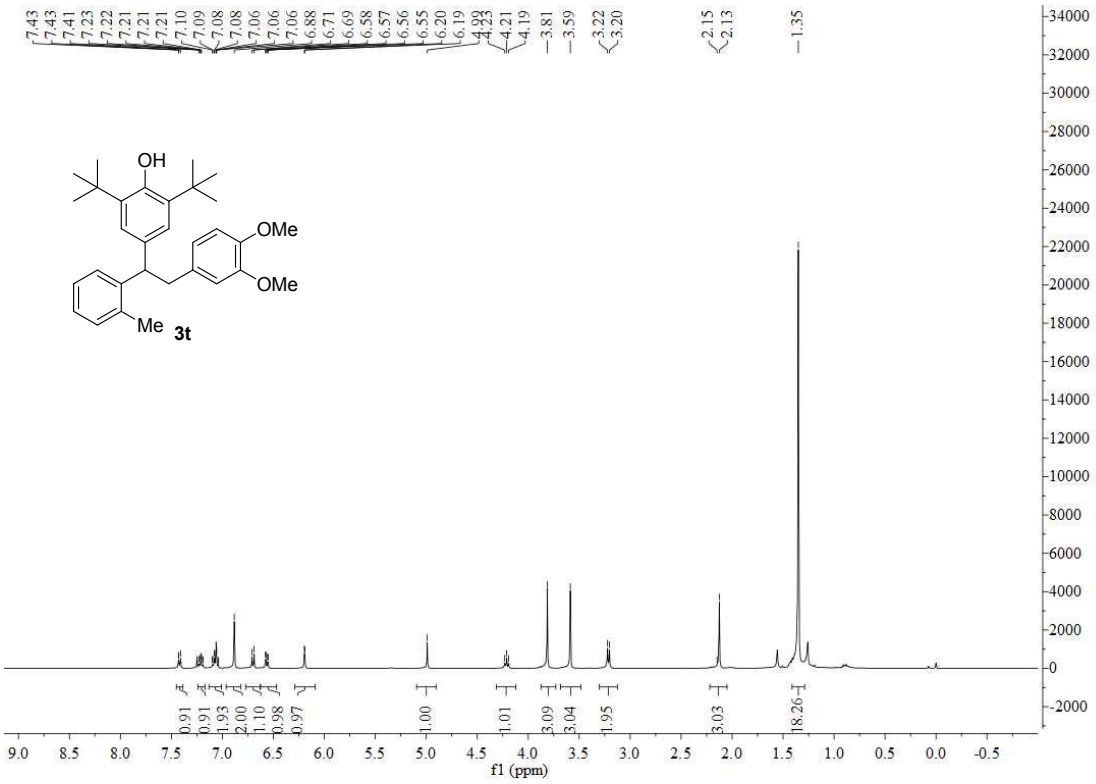
^{1}H NMR of 3s



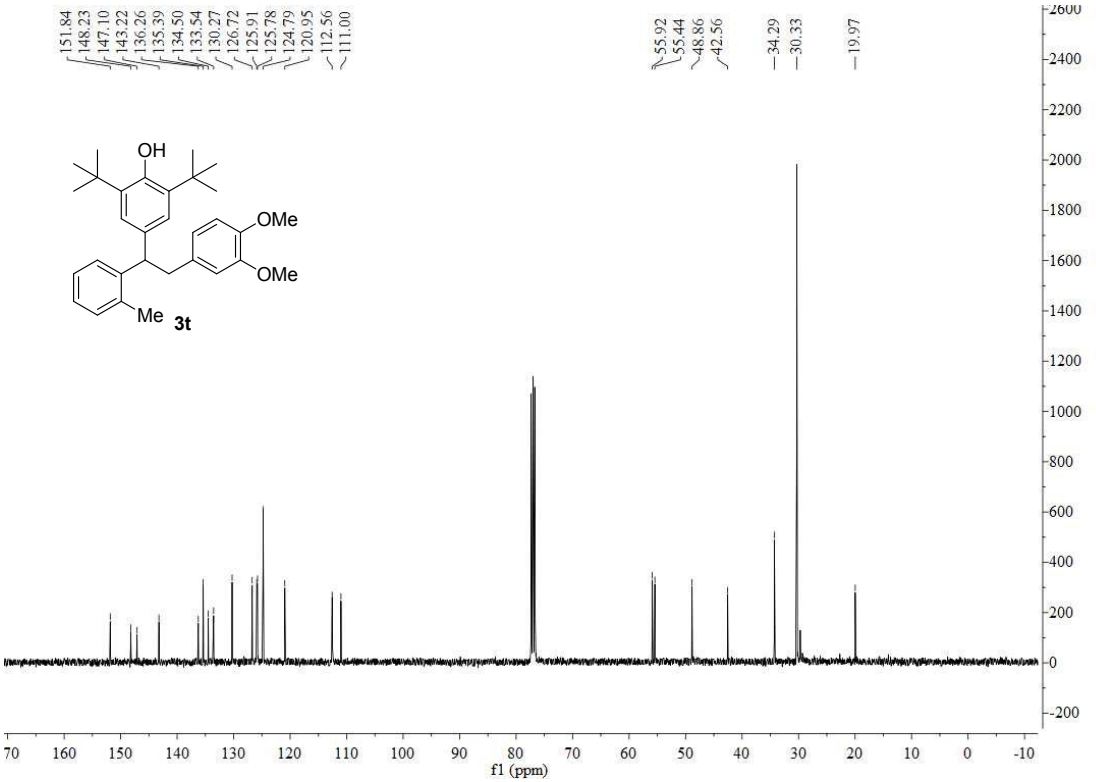
^{13}C NMR of 3s



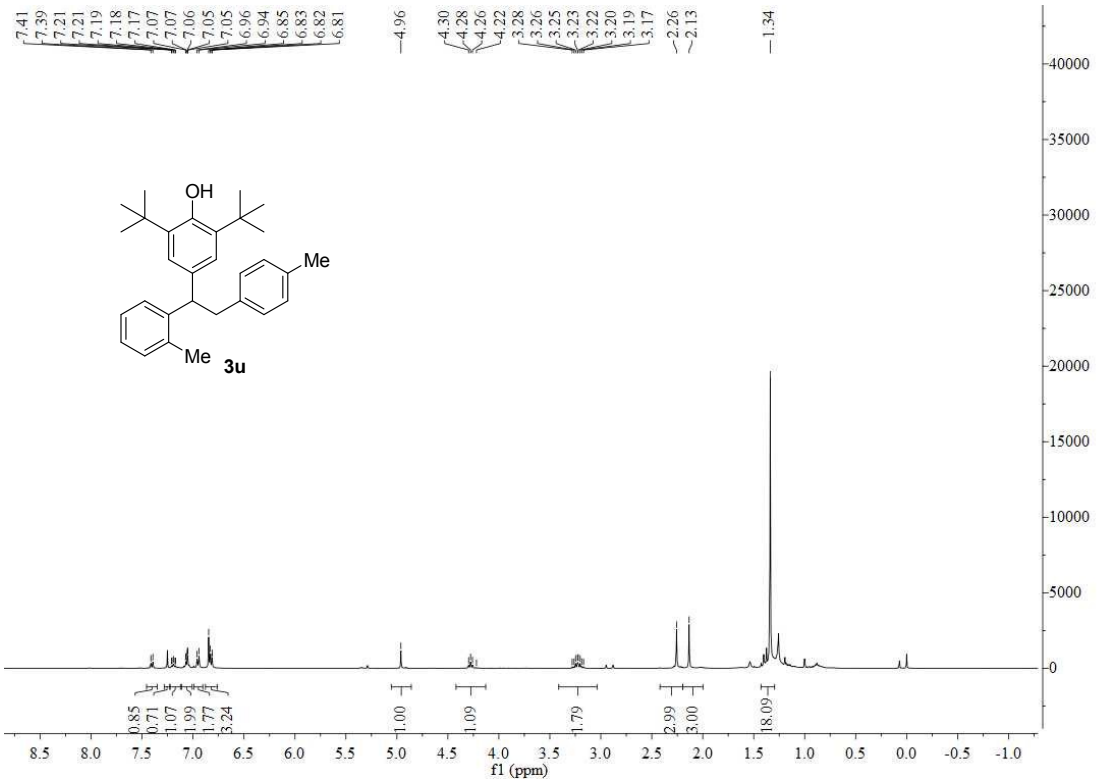
^{1}H NMR of 3t



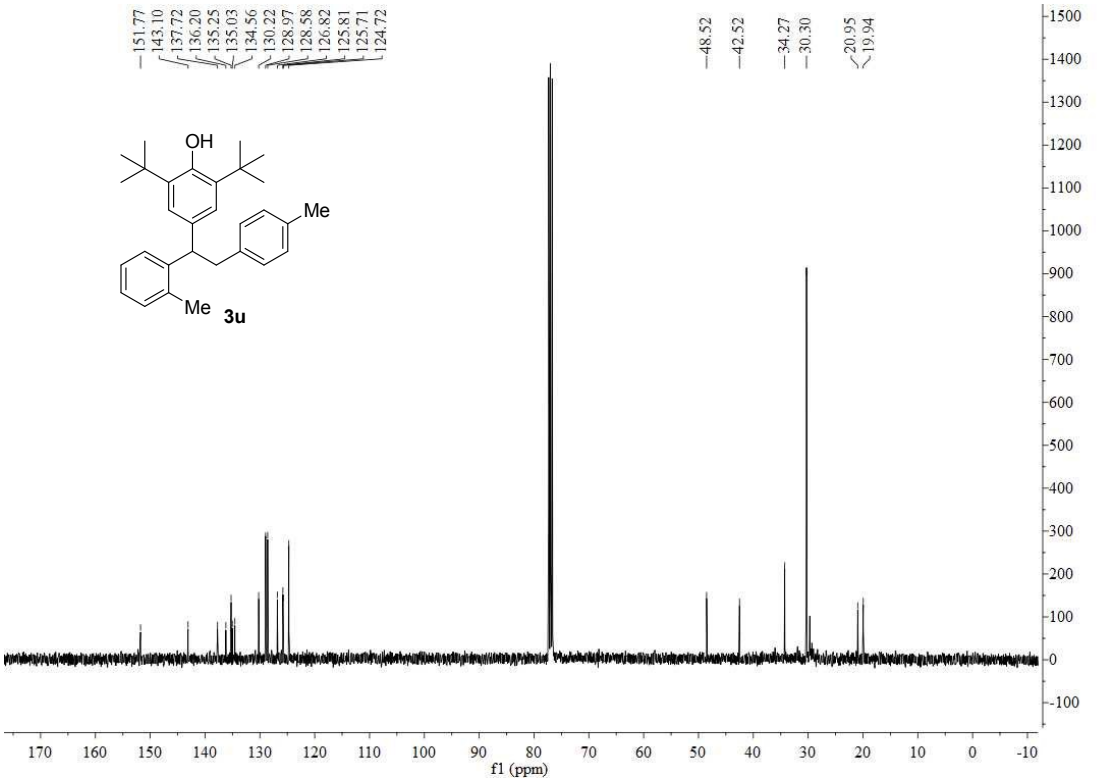
^{13}C NMR of 3t



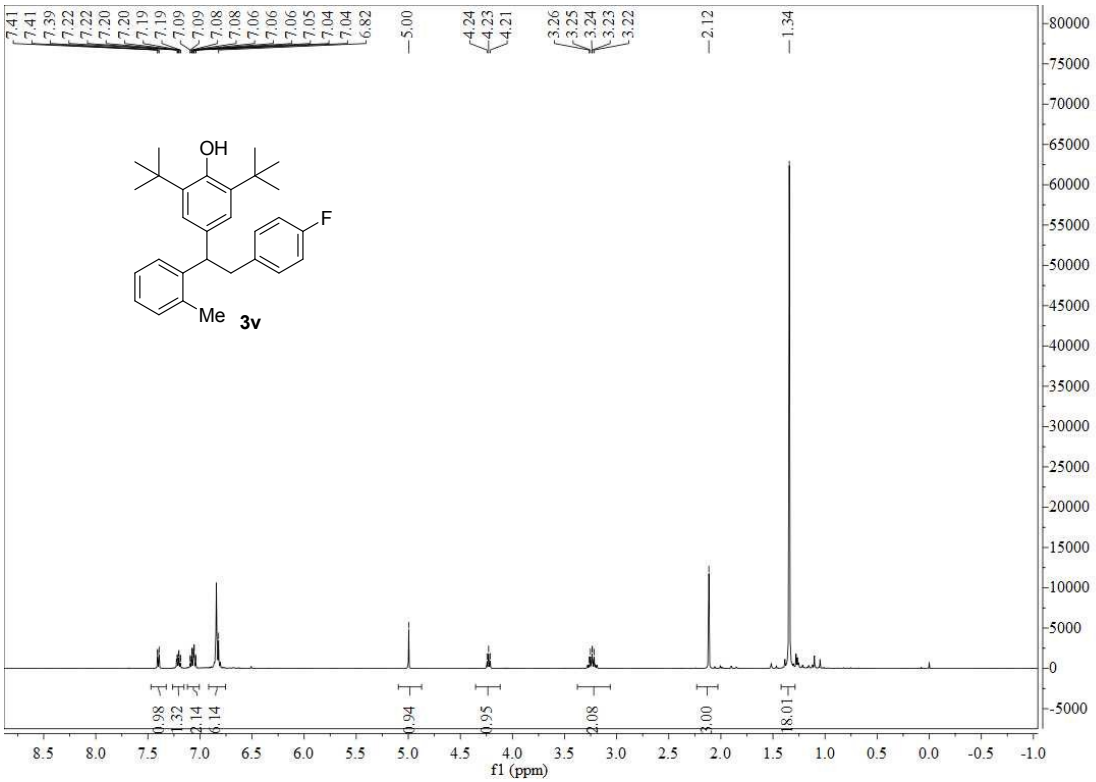
^{1}H NMR of 3u



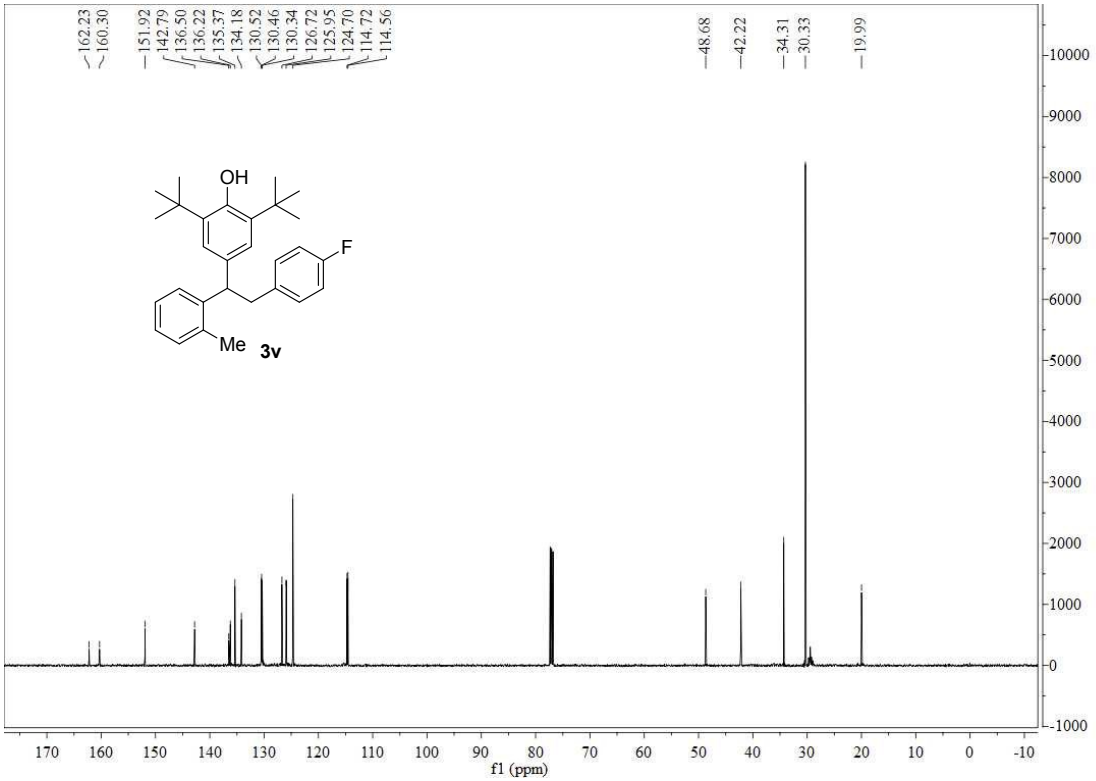
^{13}C NMR of 3u



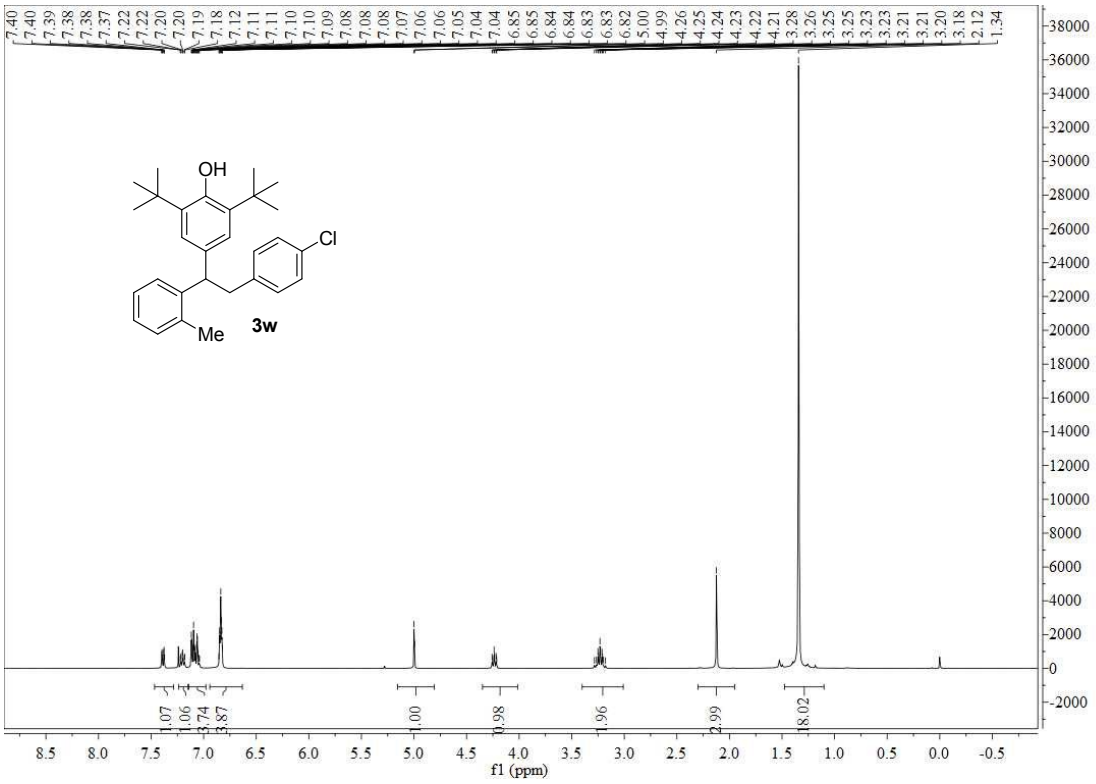
^{1}H NMR of 3v



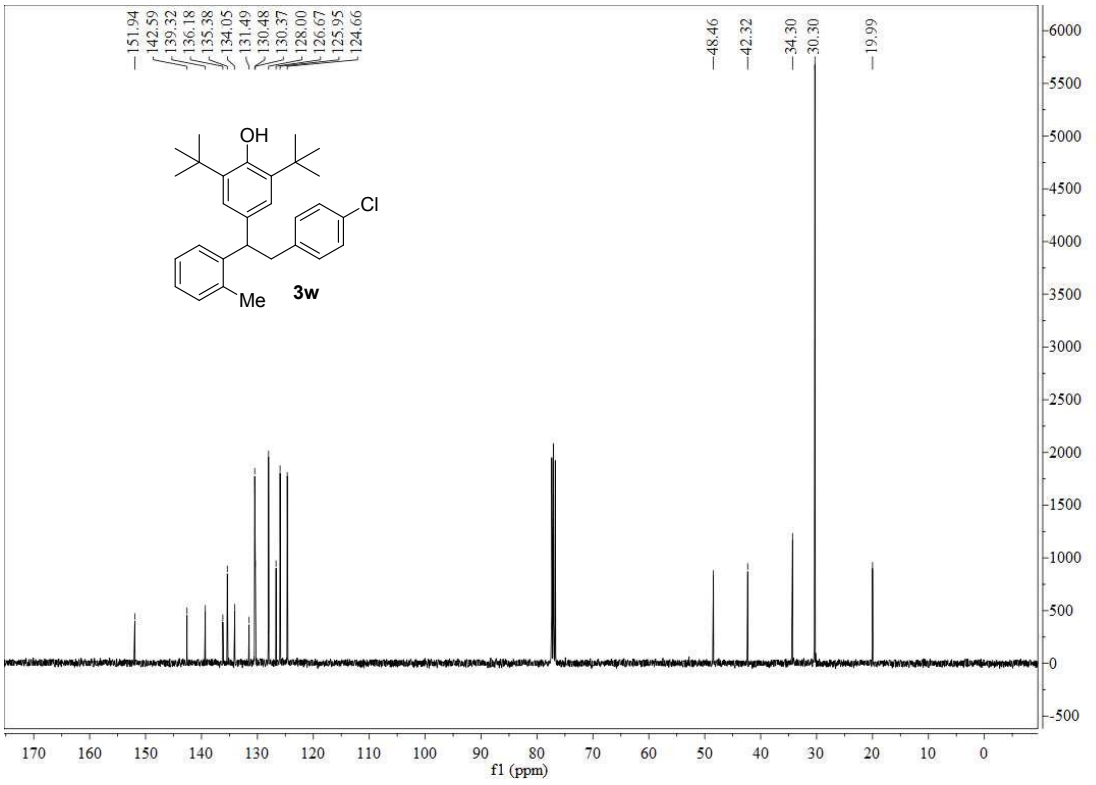
^{13}C NMR of 3v



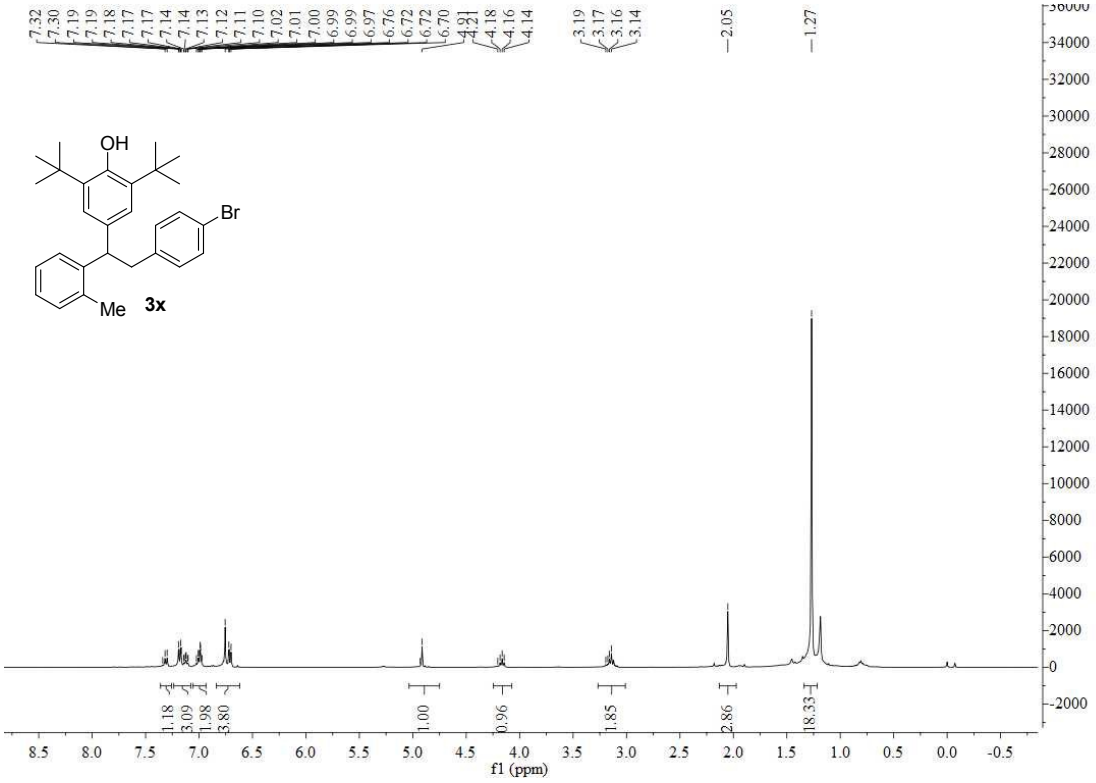
^{1}H NMR of 3w



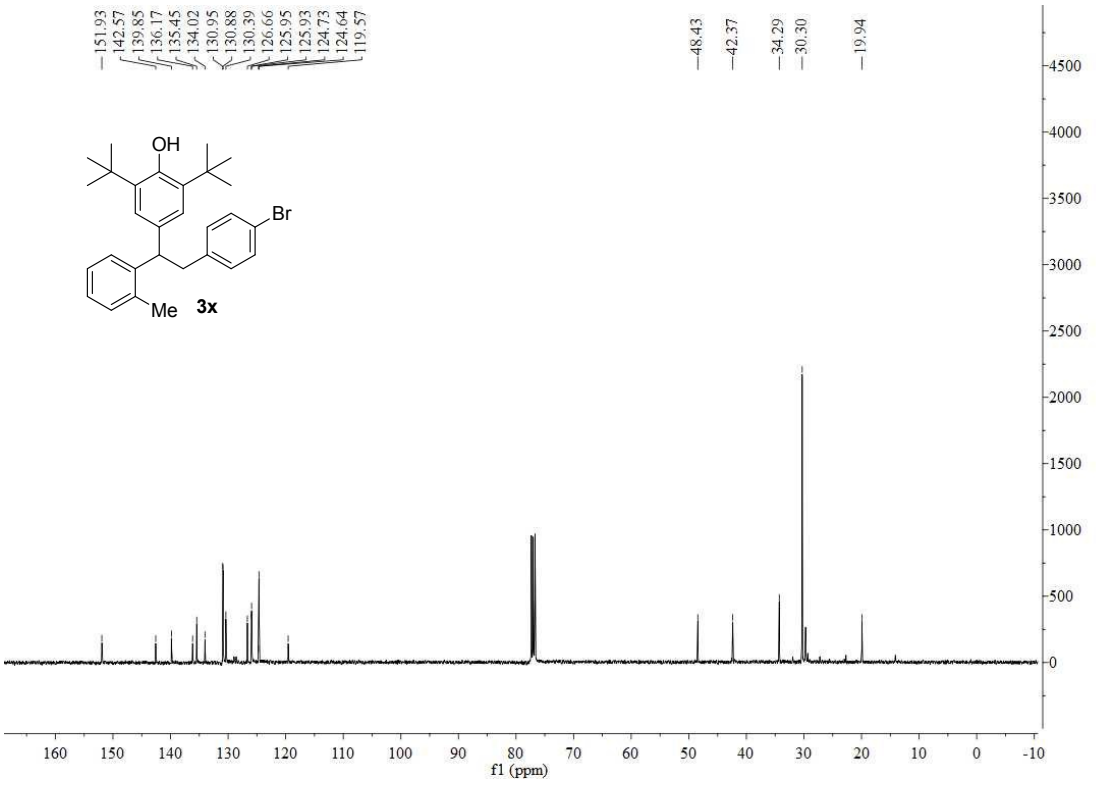
^{13}C NMR of 3w



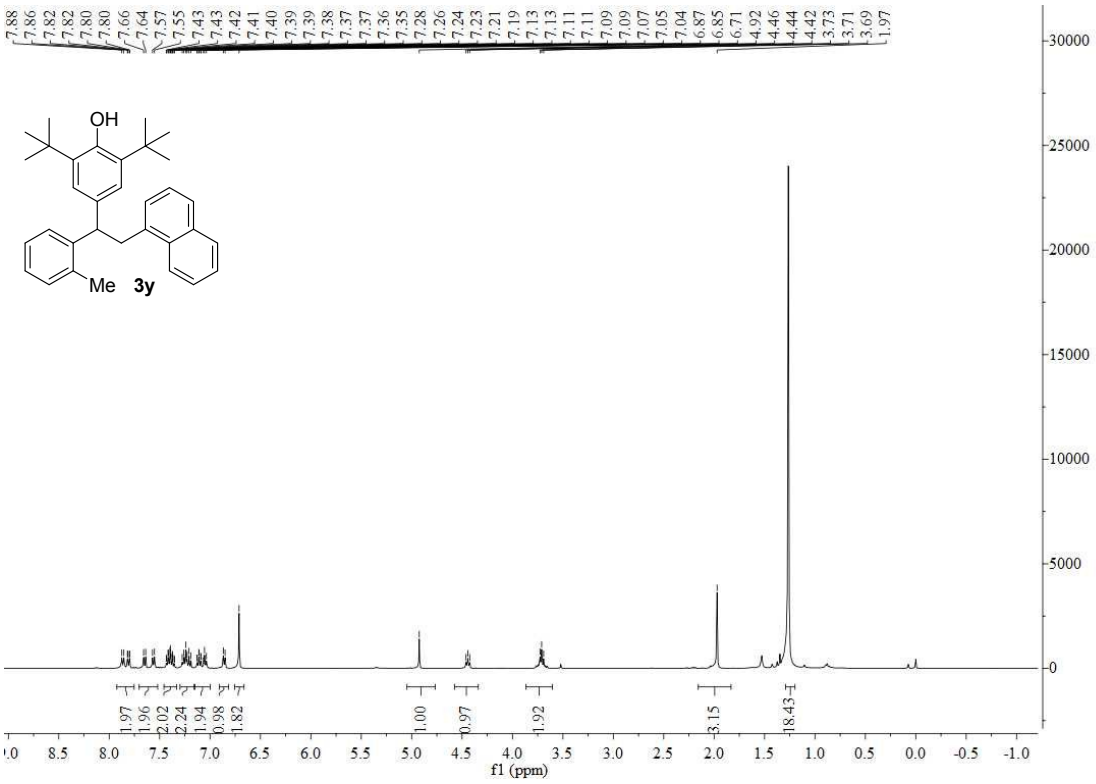
^{1}H NMR of 3x



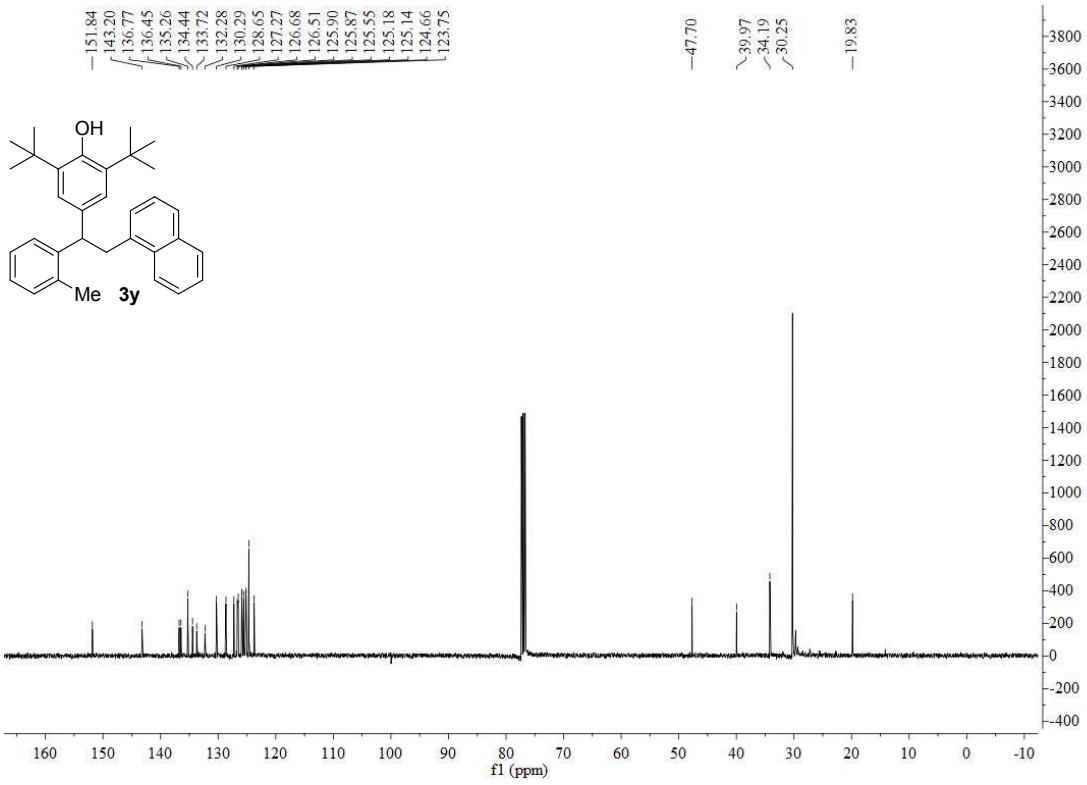
^{13}C NMR of 3x



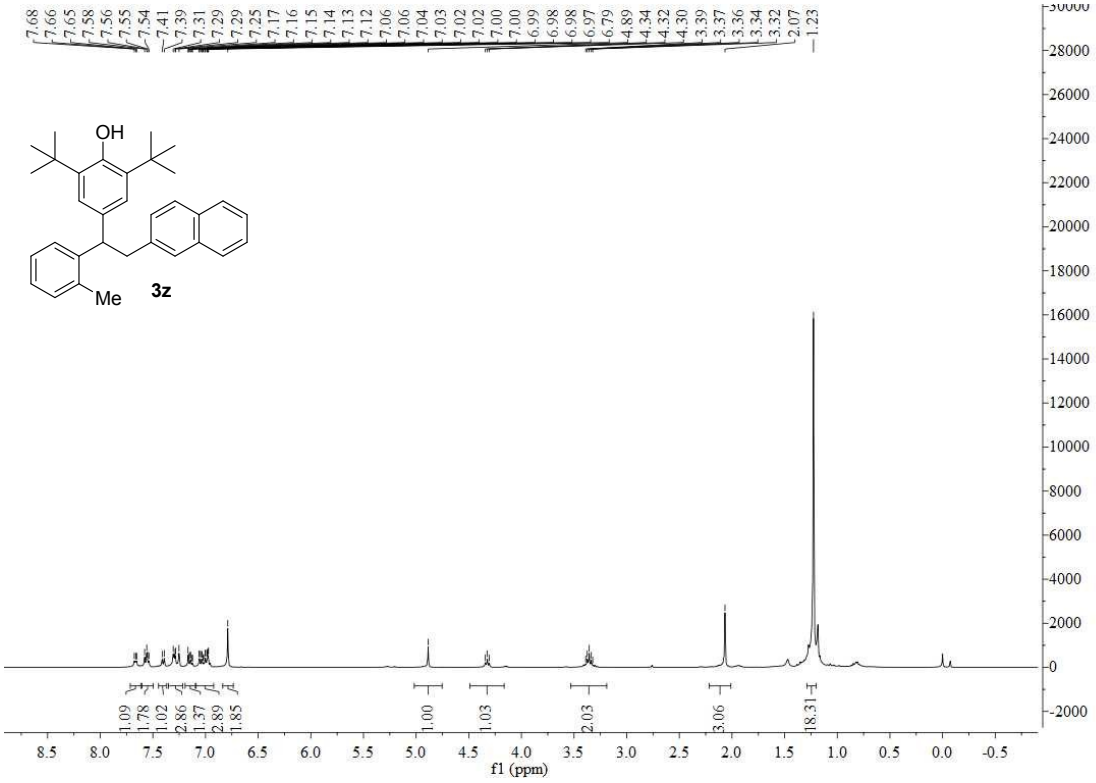
^{1}H NMR of 3y



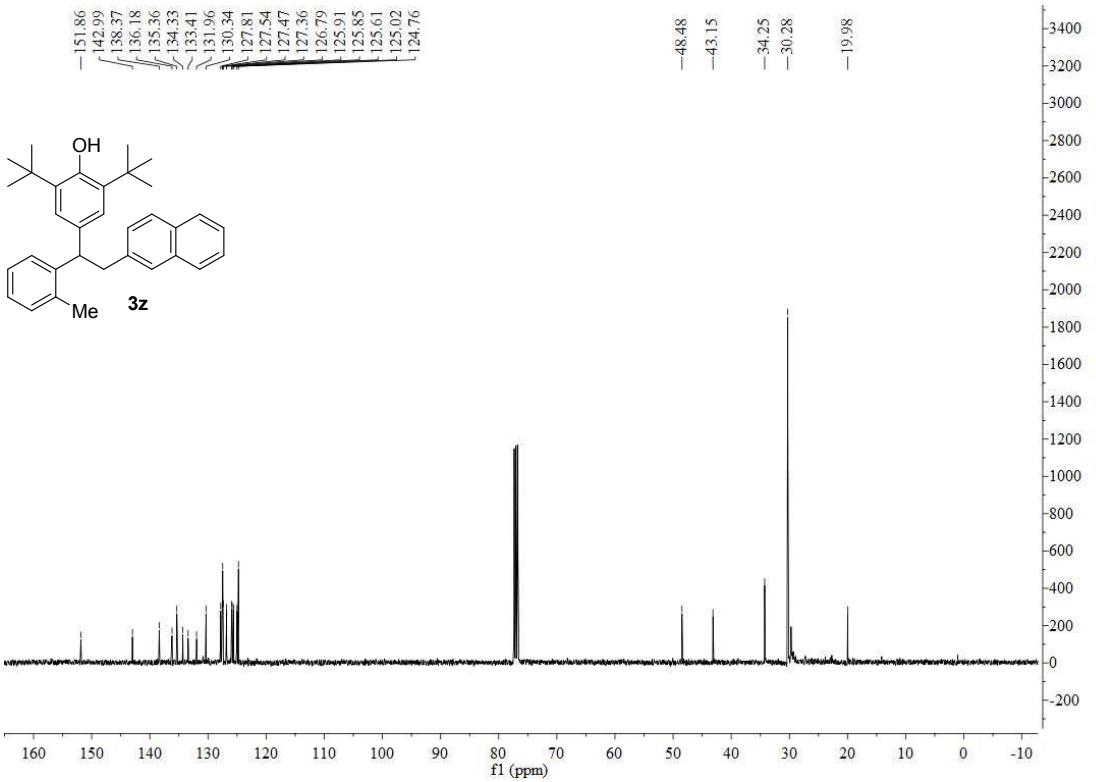
^{13}C NMR of 3y



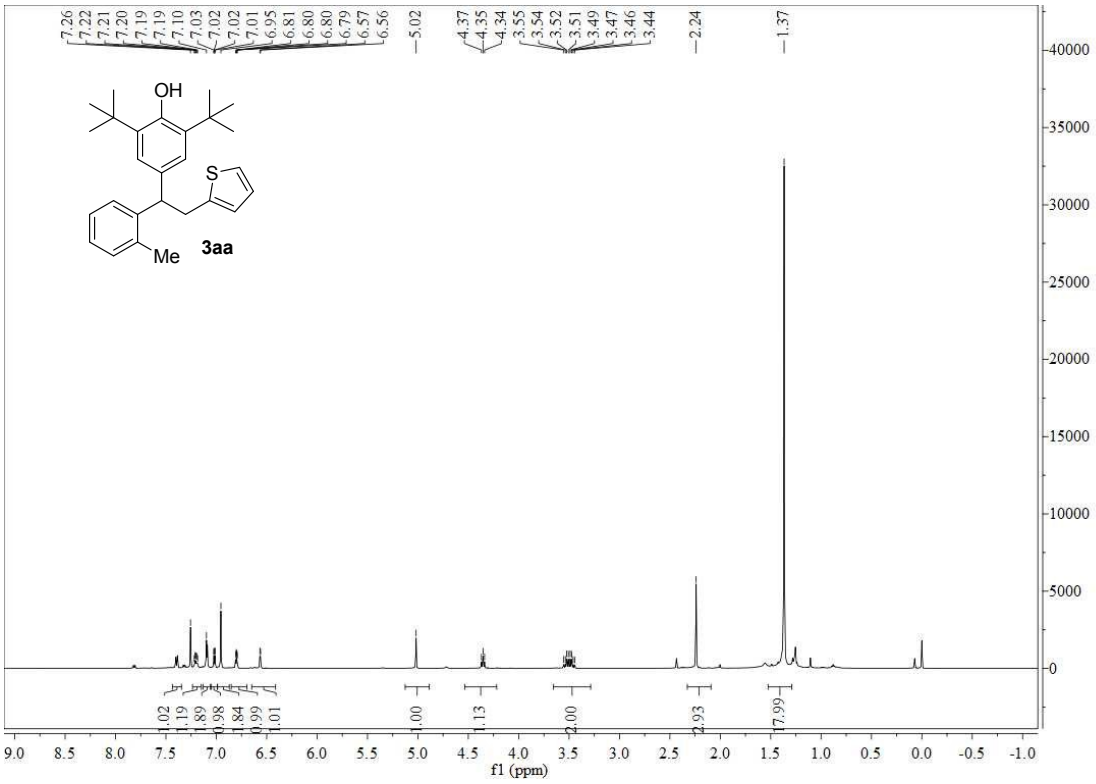
^{1}H NMR of 3z



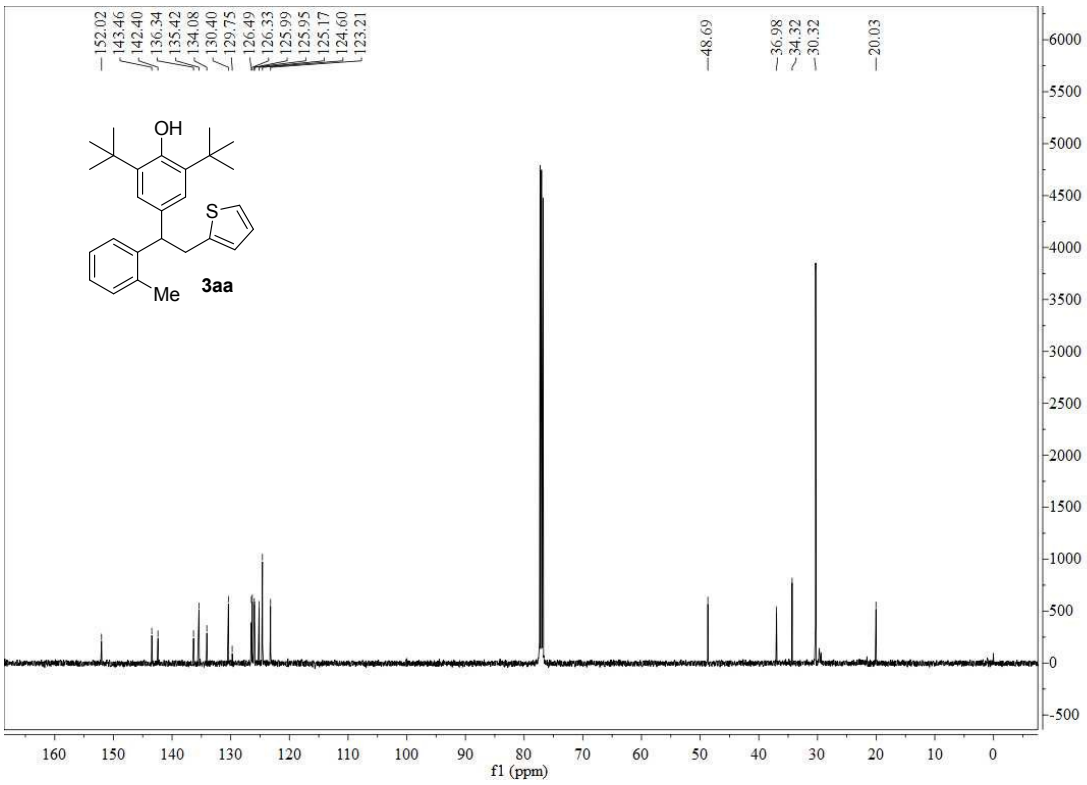
^{13}C NMR of 3z



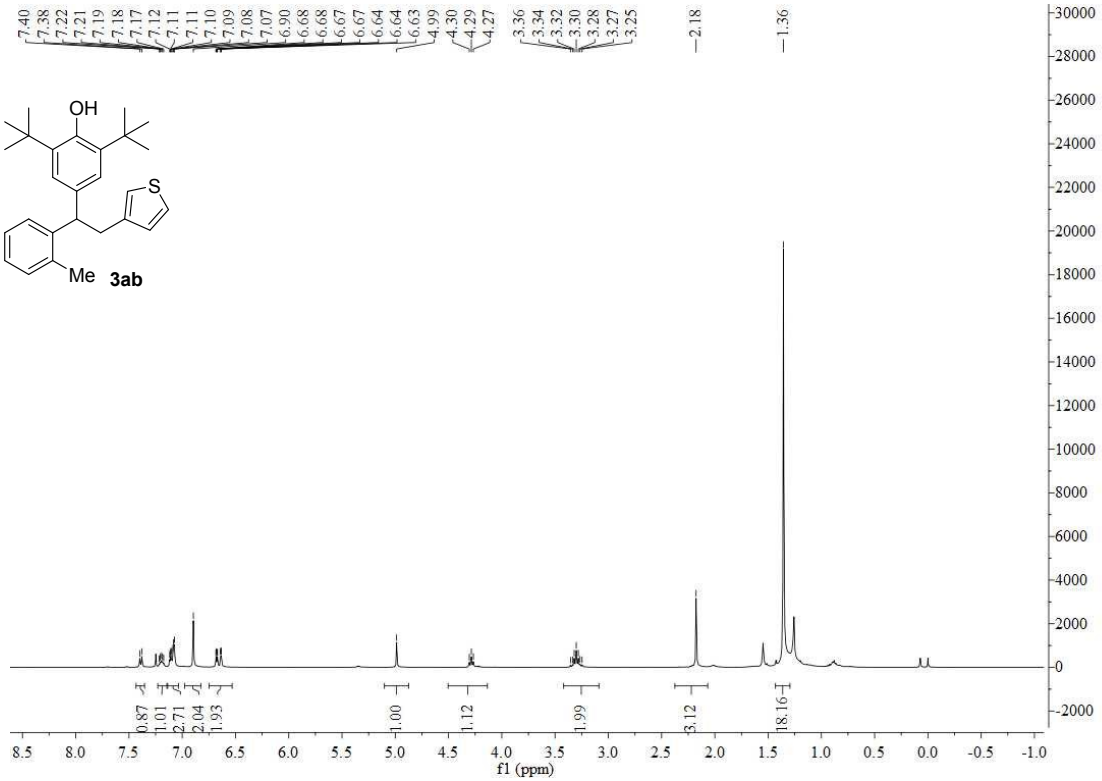
^{1}H NMR of 3aa



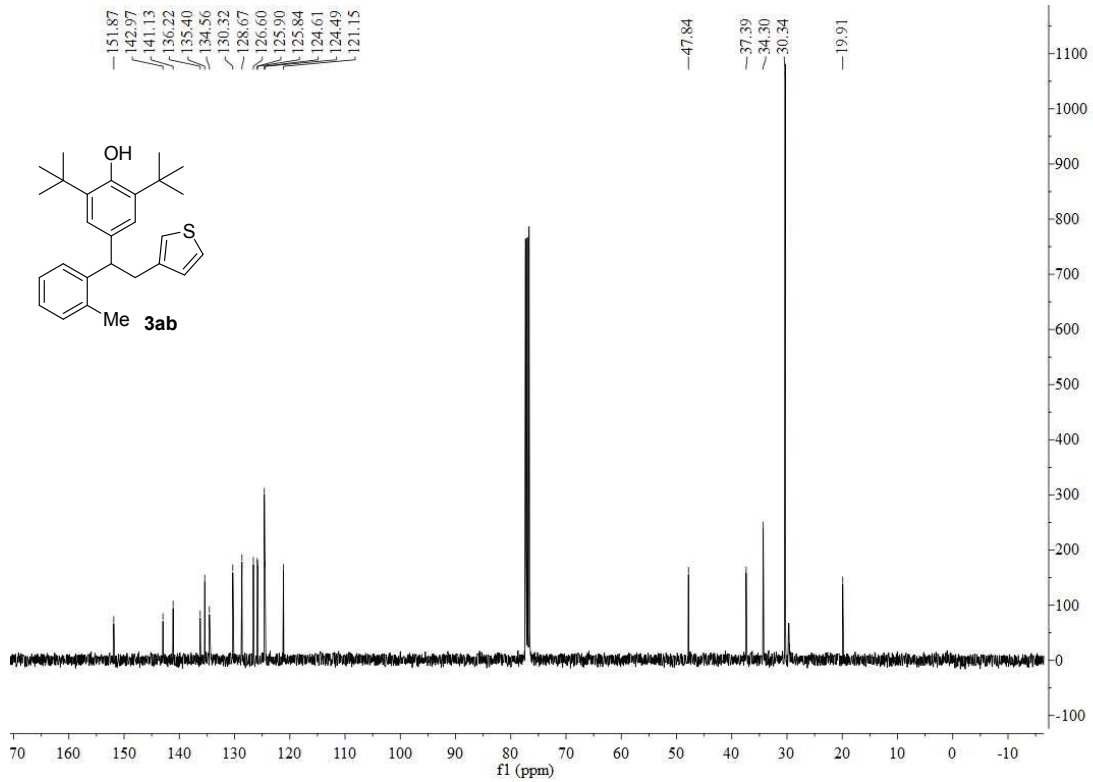
^{13}C NMR of 3aa



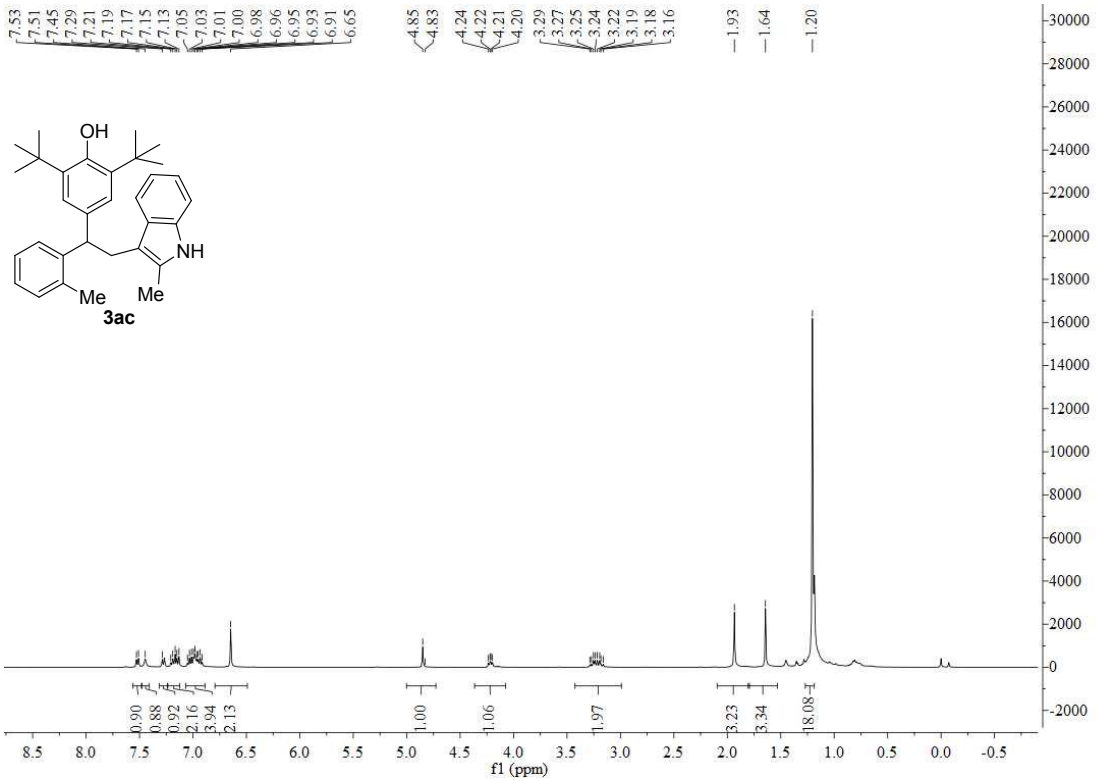
^{1}H NMR of 3ab



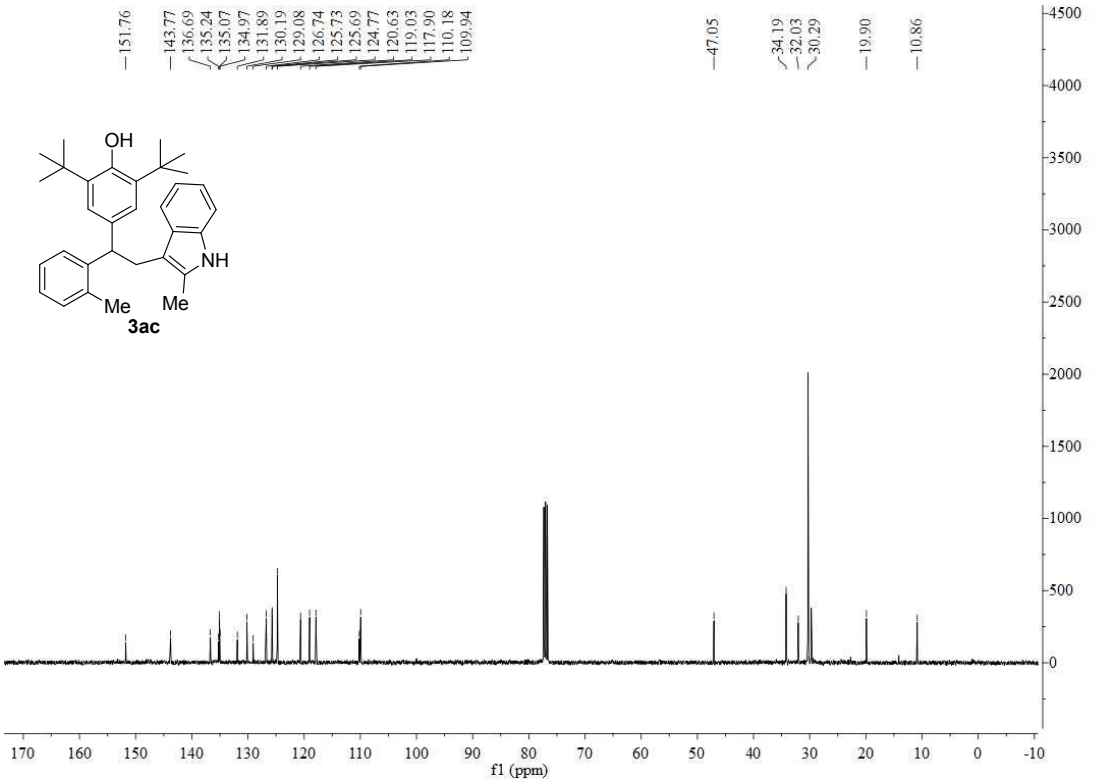
^{13}C NMR of 3ab



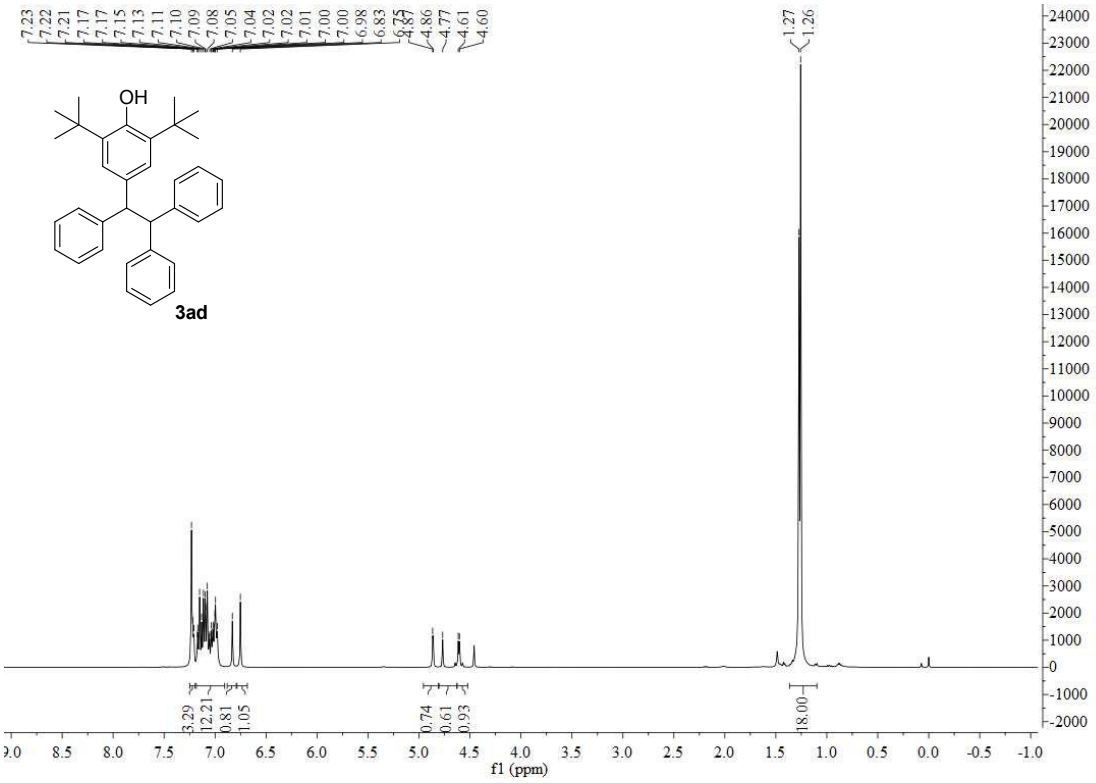
^{1}H NMR of 3ac



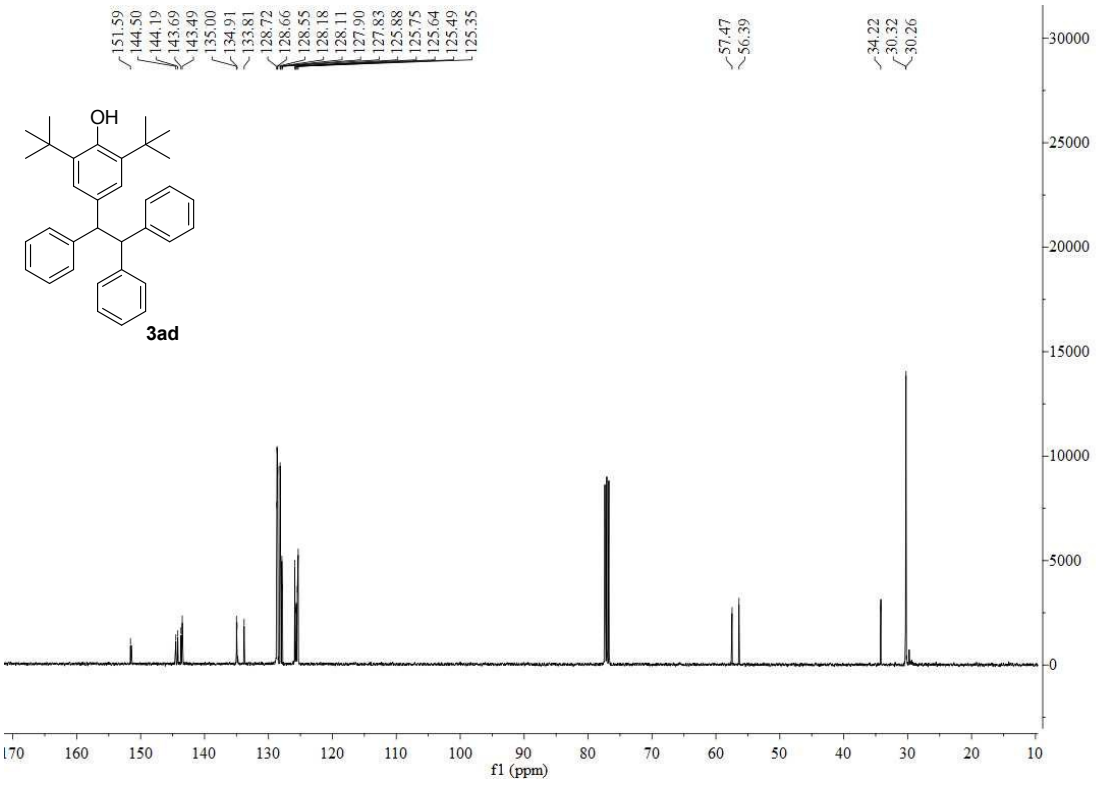
^{13}C NMR of 3ac



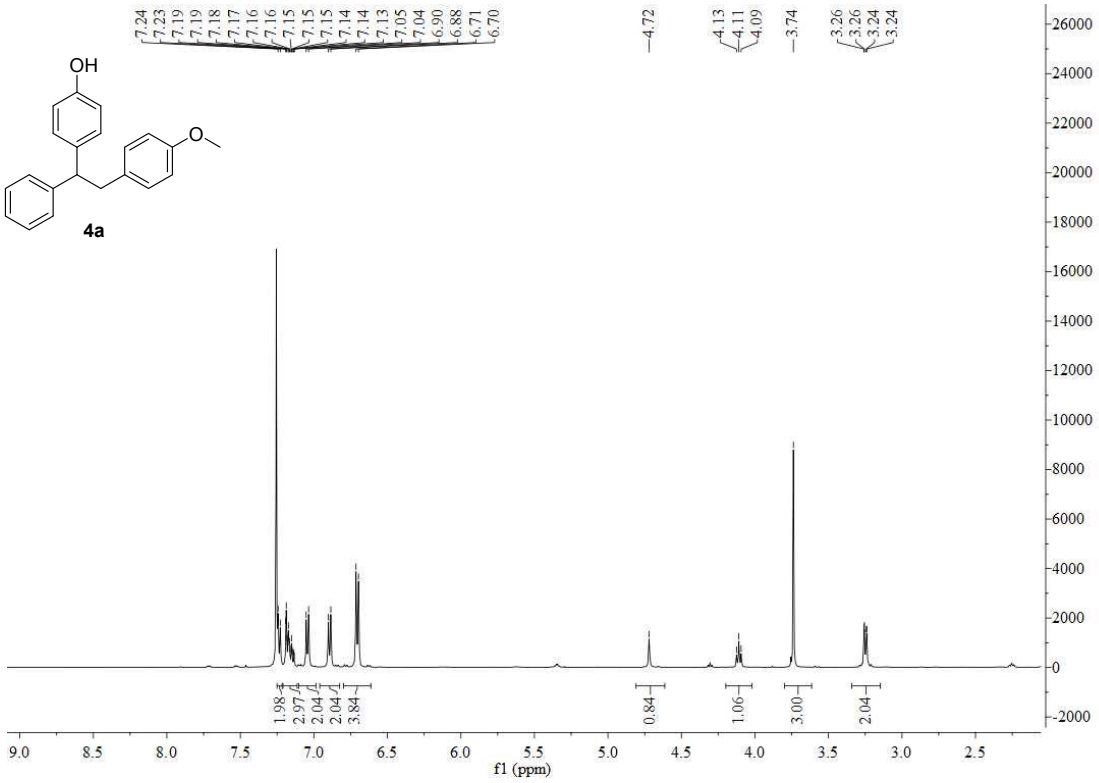
^{1}H NMR of 3ad



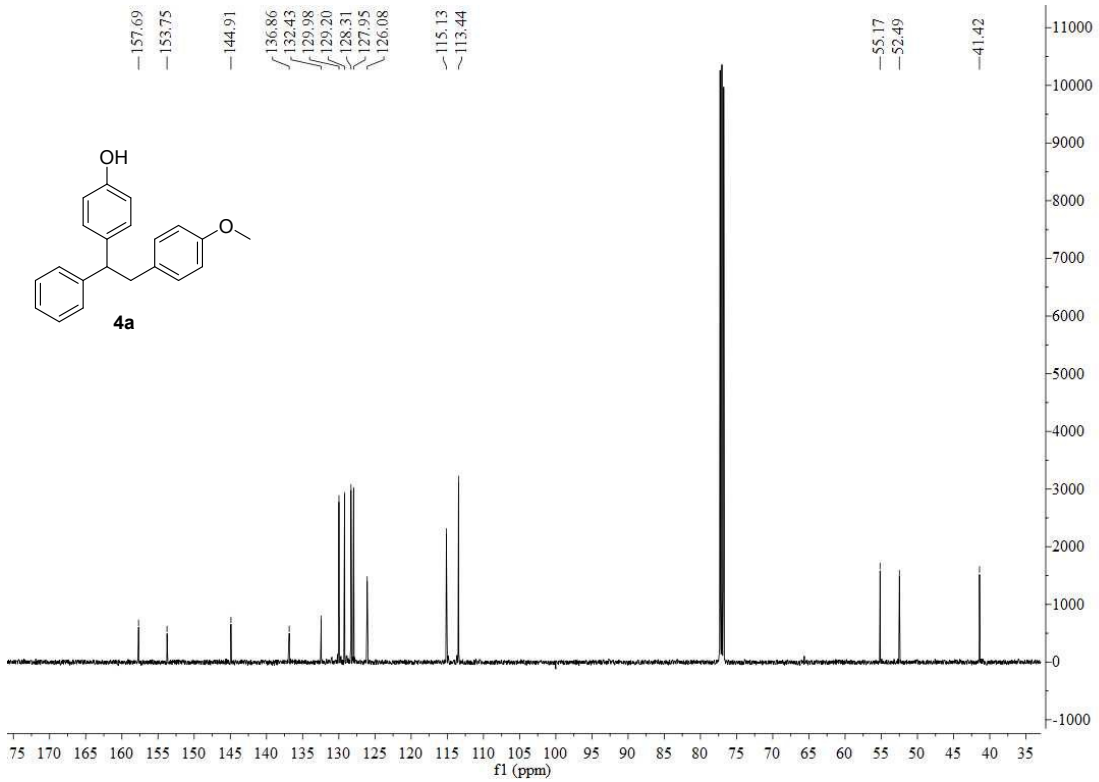
^{13}C NMR of 3ad



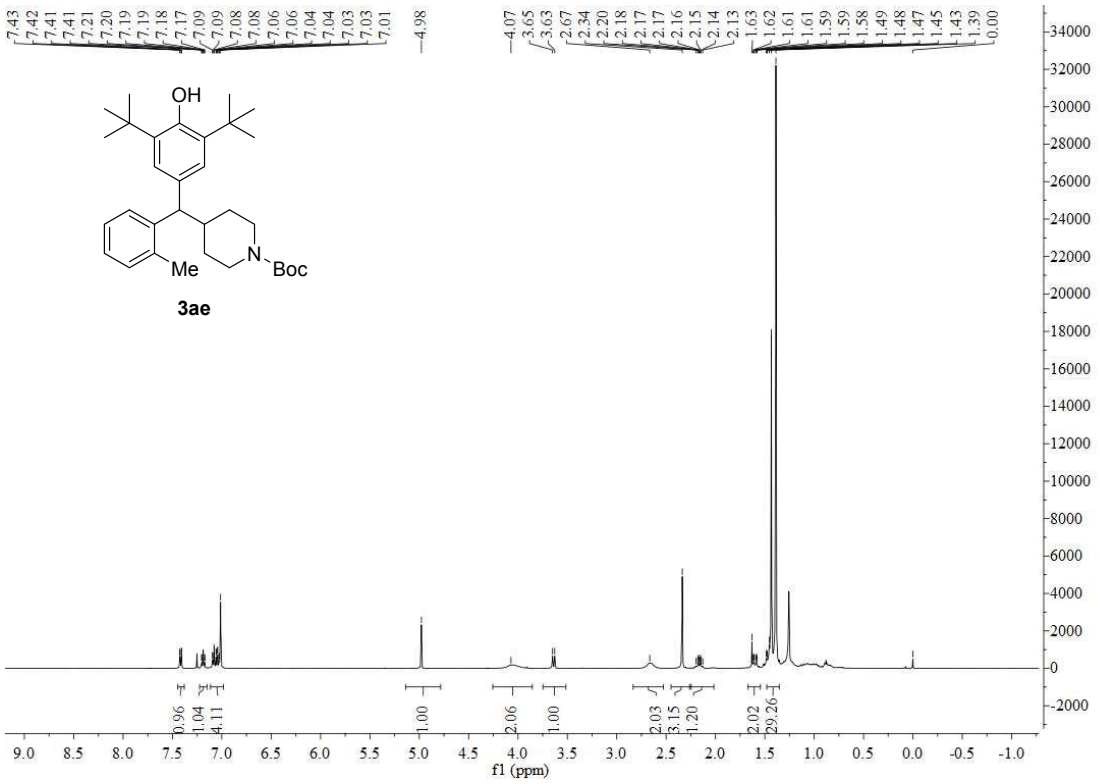
^{1}H NMR of 4a



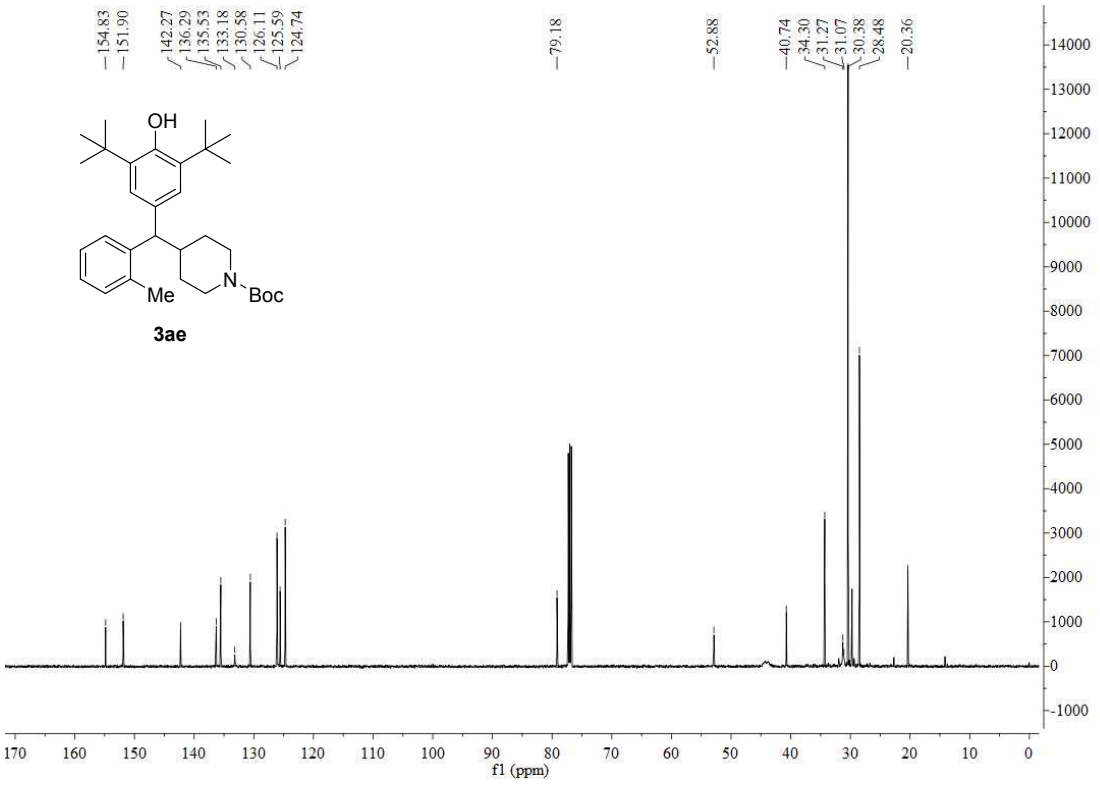
^{13}C NMR of 4a



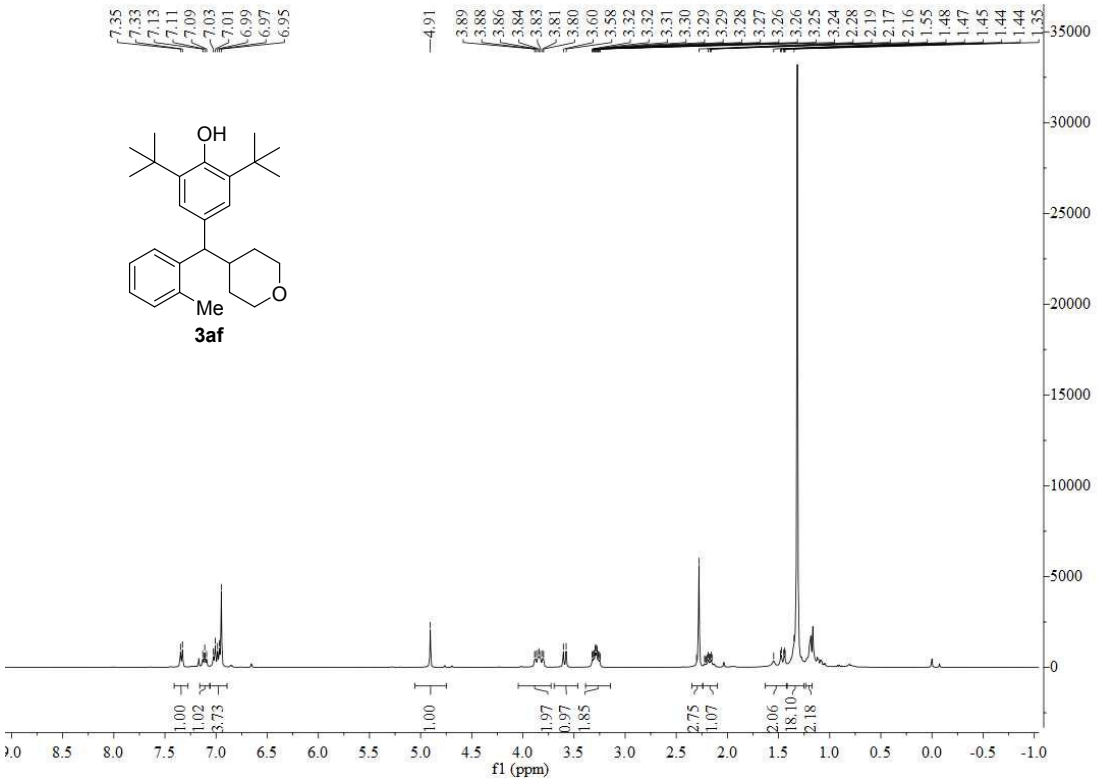
^{1}H NMR of 3ae



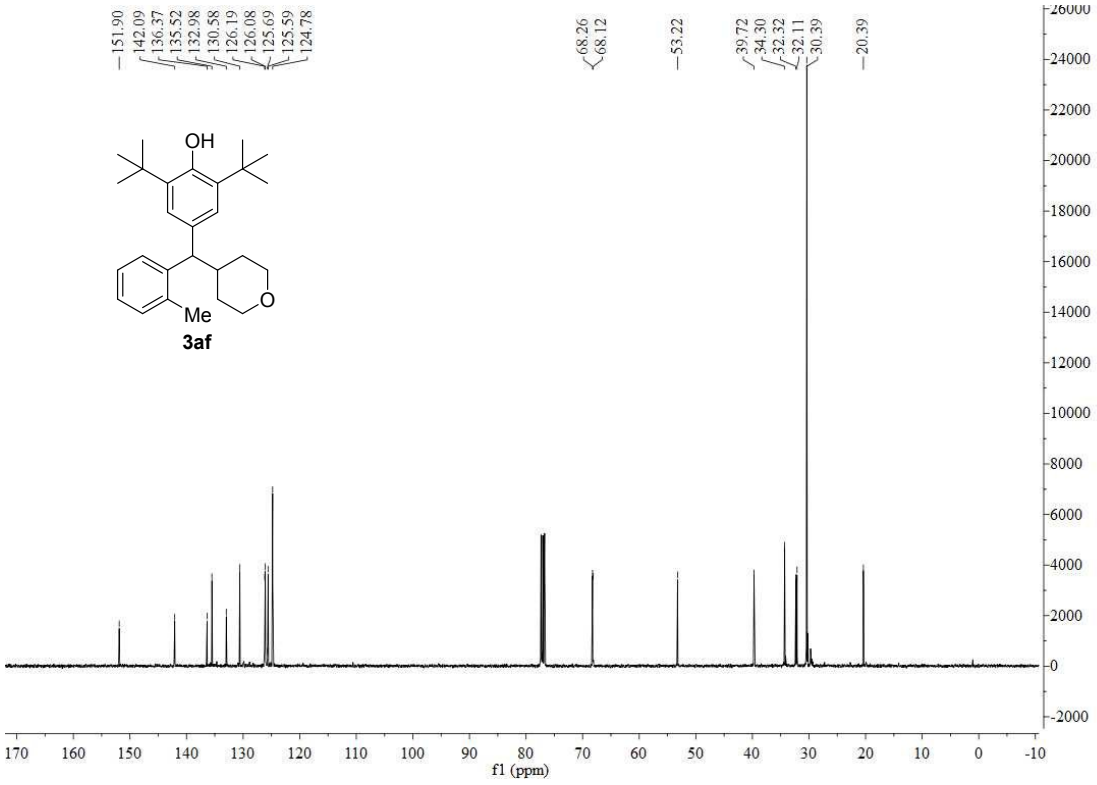
^{13}C NMR of 3ae



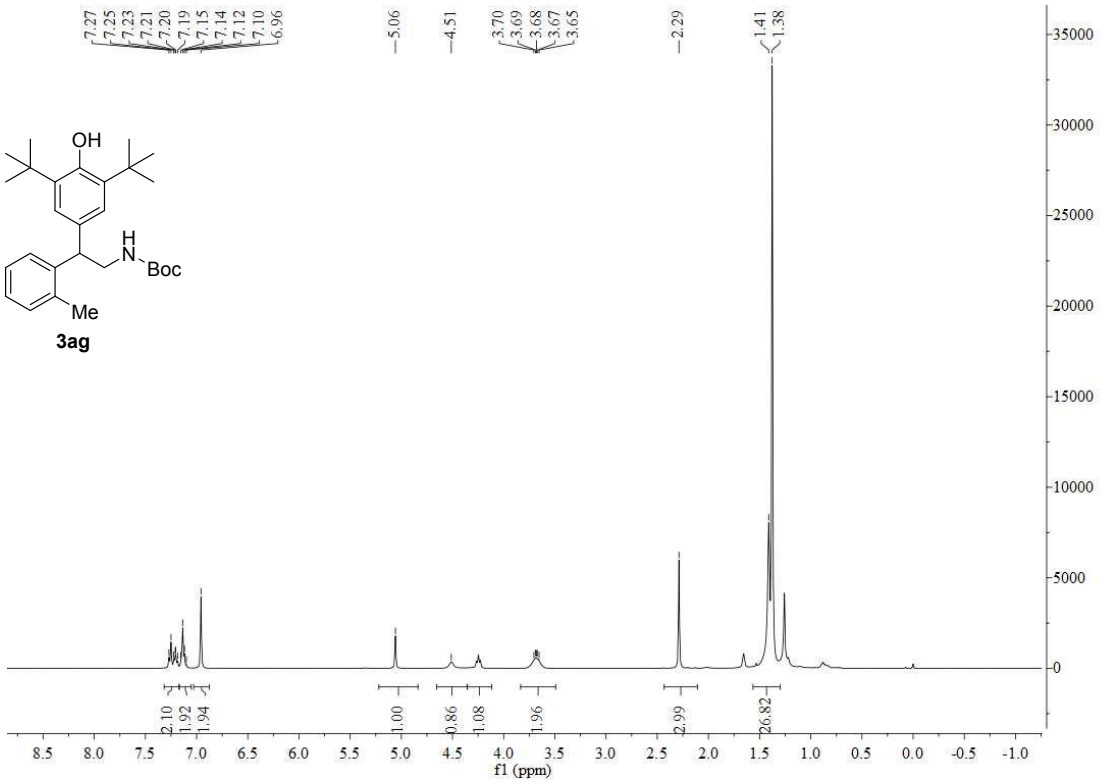
^{1}H NMR of 3af



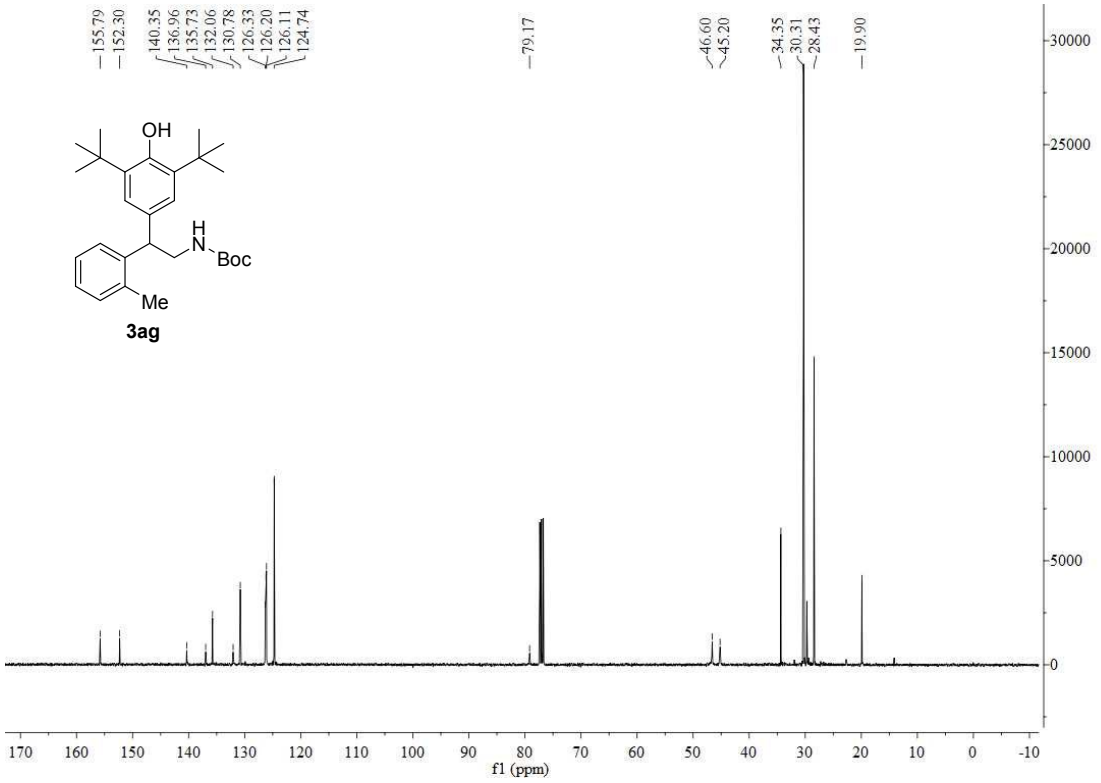
^{13}C NMR of 3af



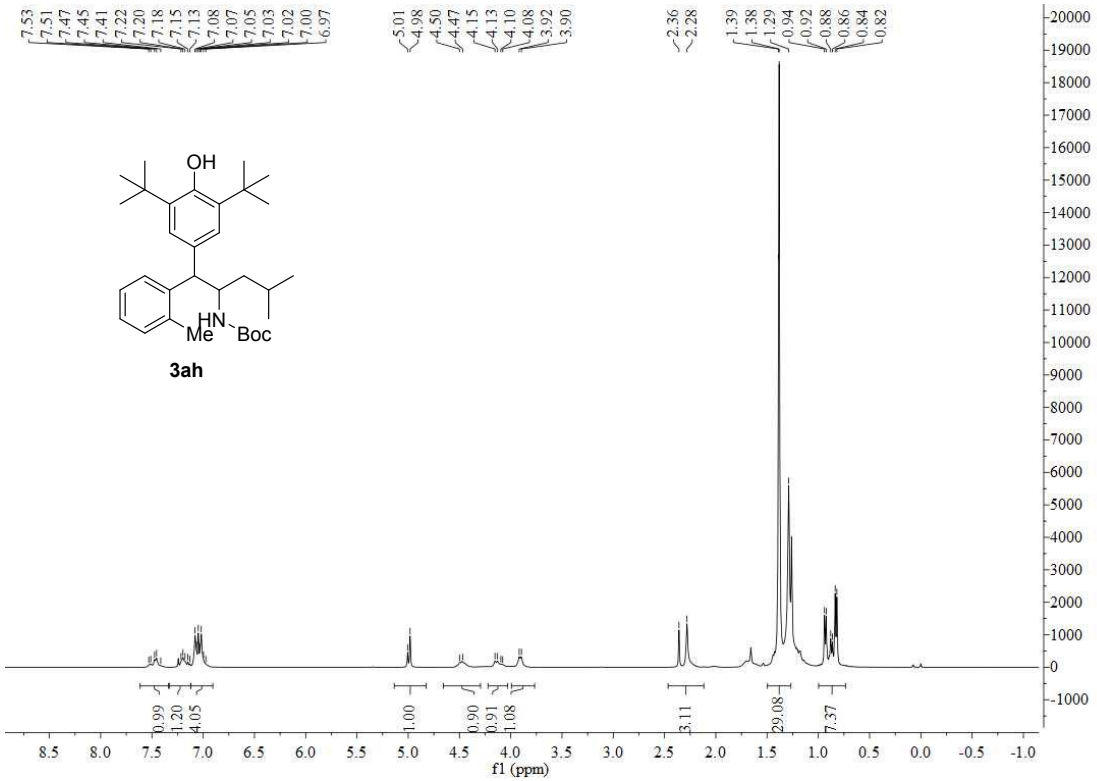
^{1}H NMR of 3ag



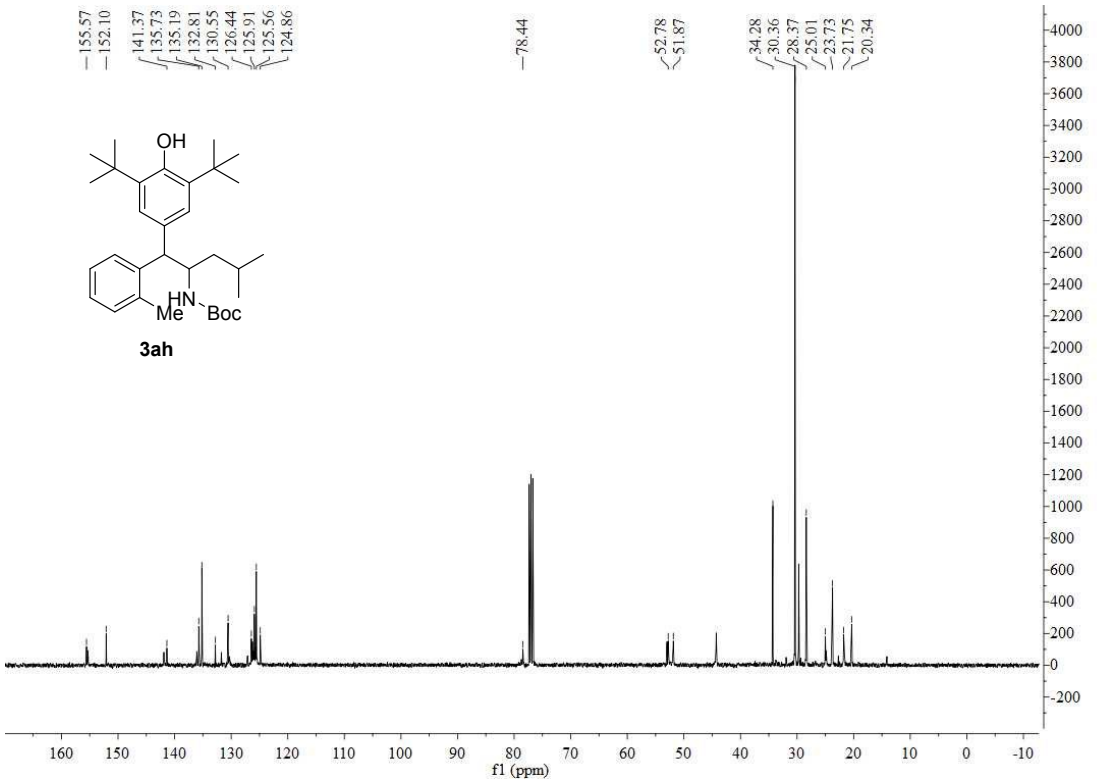
^{13}C NMR of 3ag



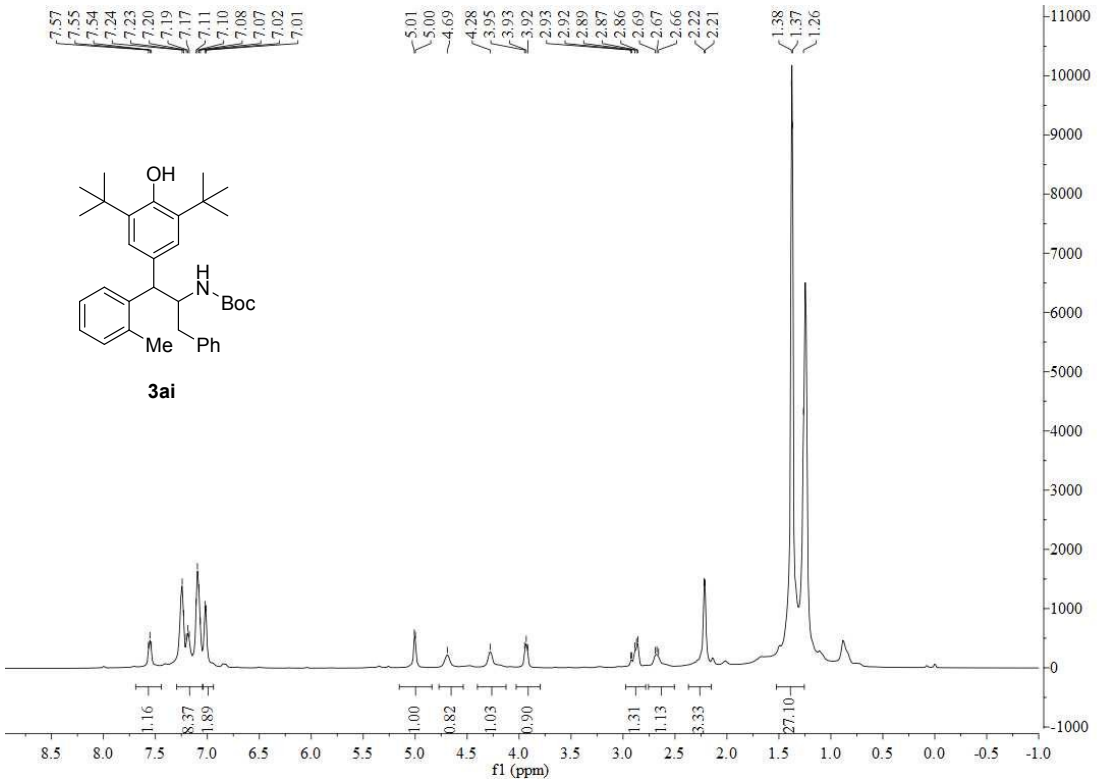
^{1}H NMR of 3ah



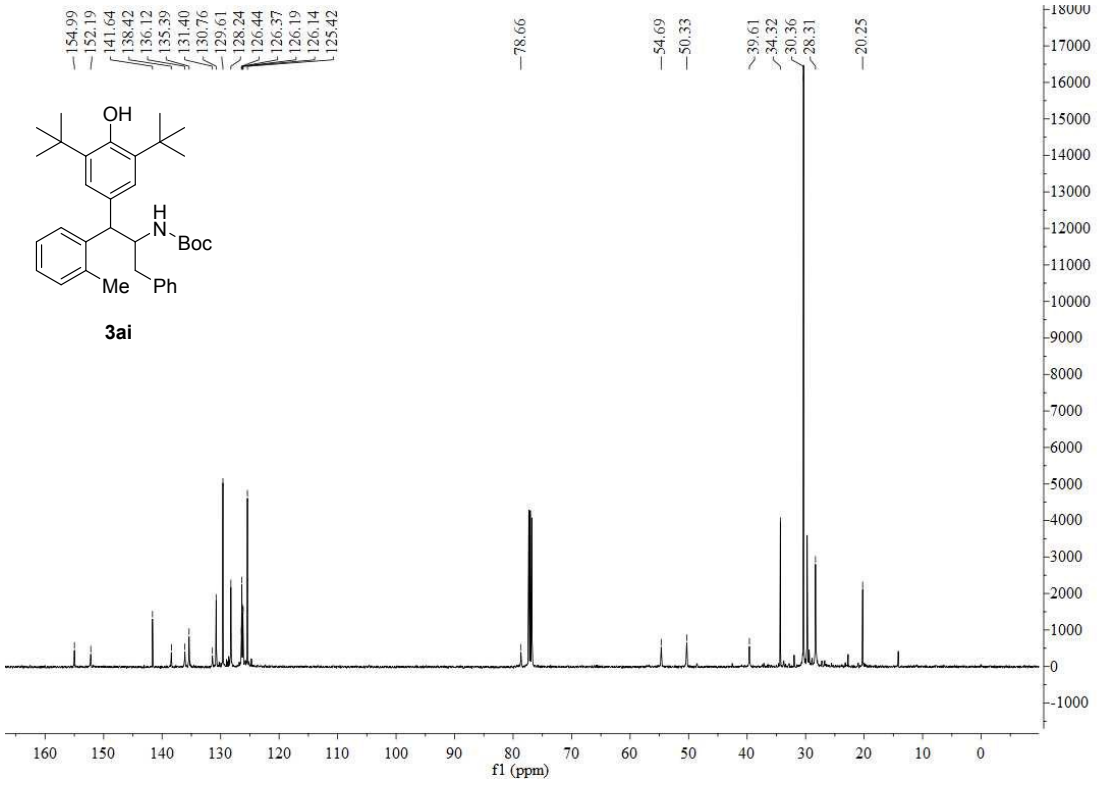
^{13}C NMR of 3ah



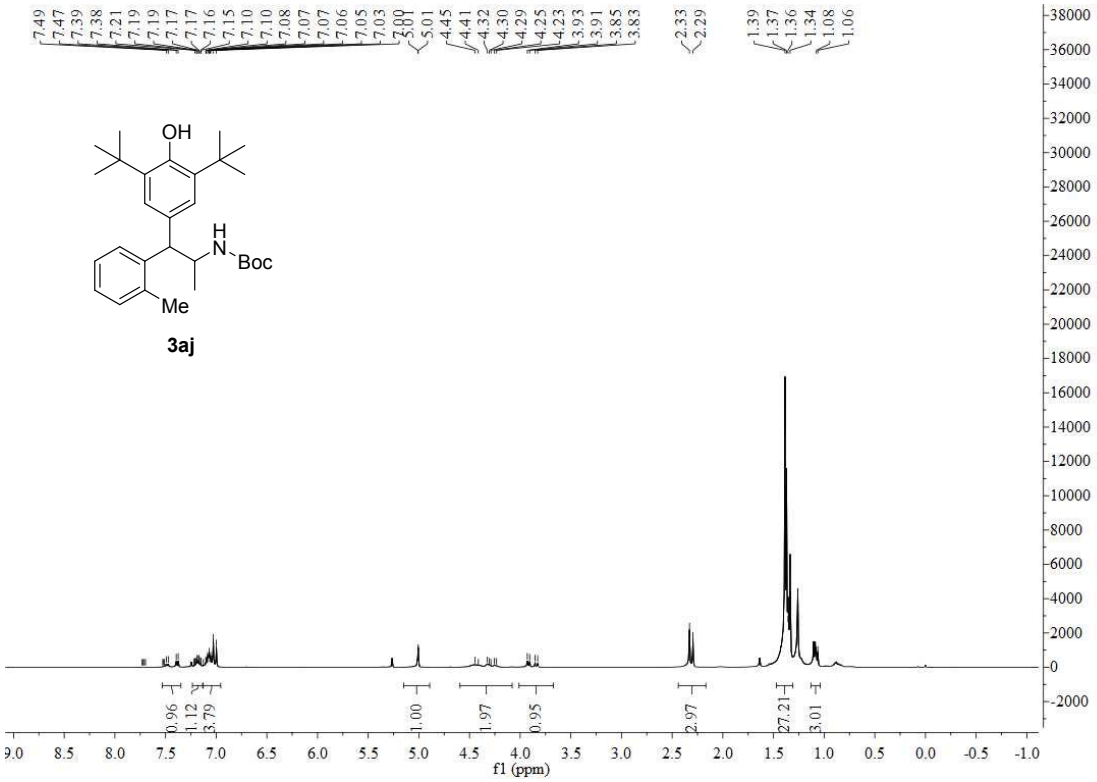
^{1}H NMR of 3ai



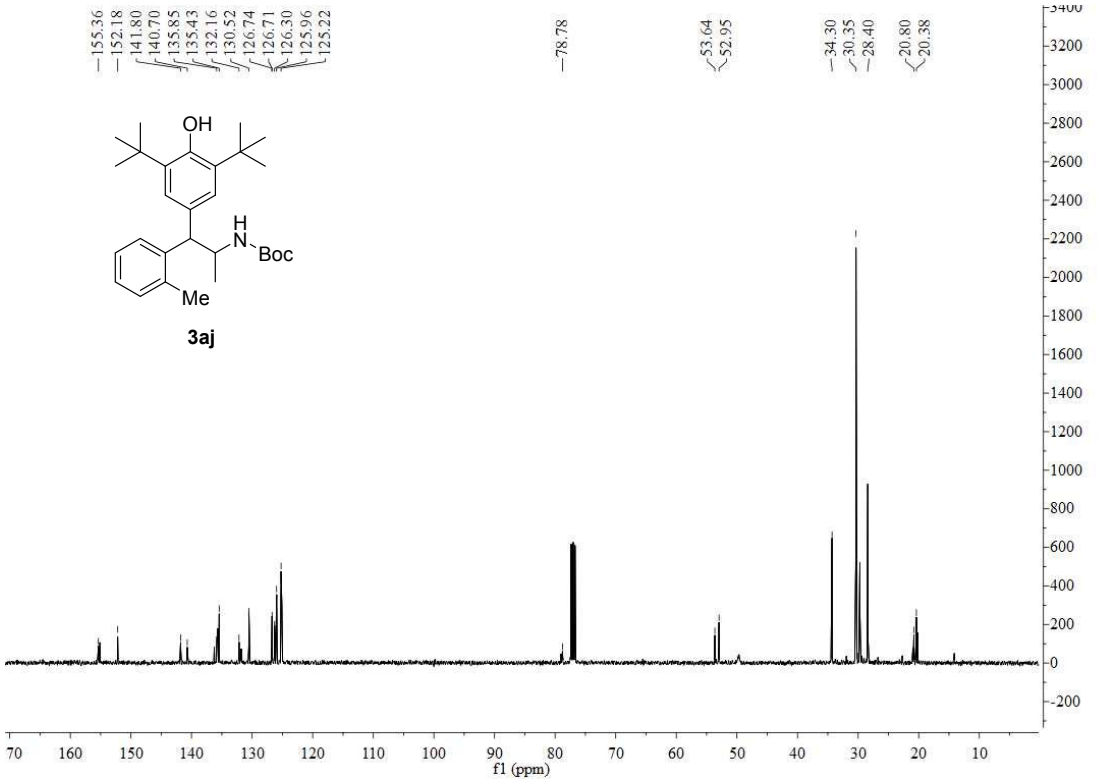
^{13}C NMR of 3ai



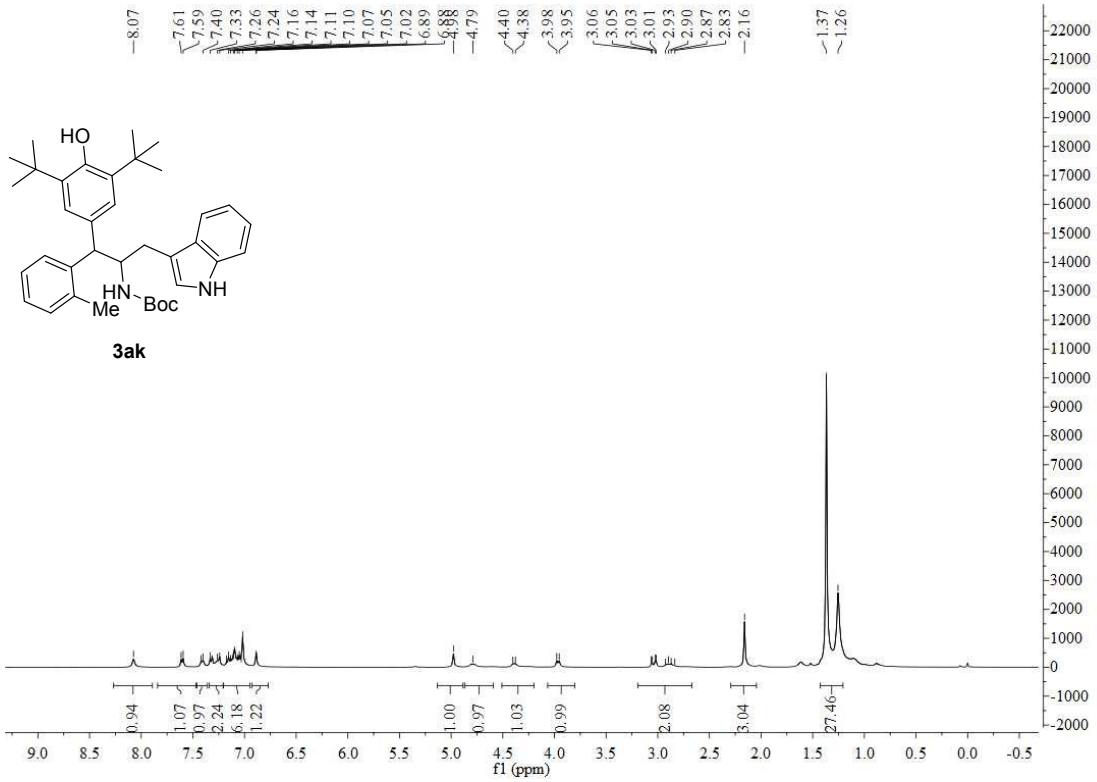
^{1}H NMR of 3aj



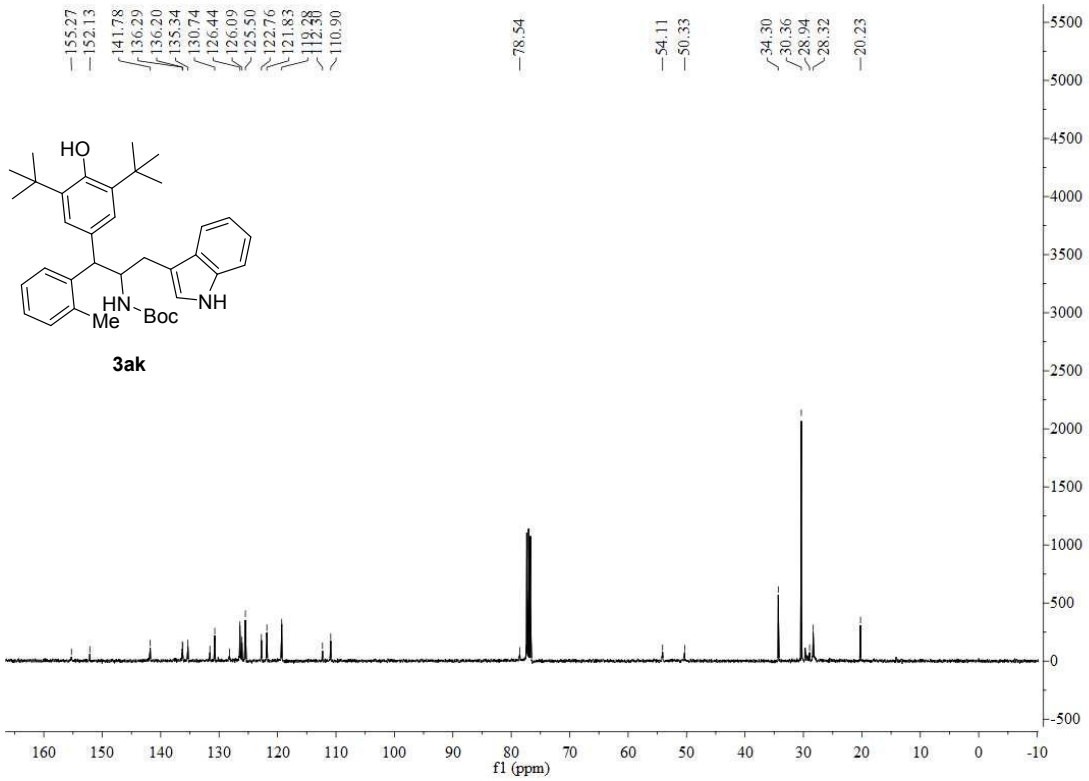
^{13}C NMR of 3aj



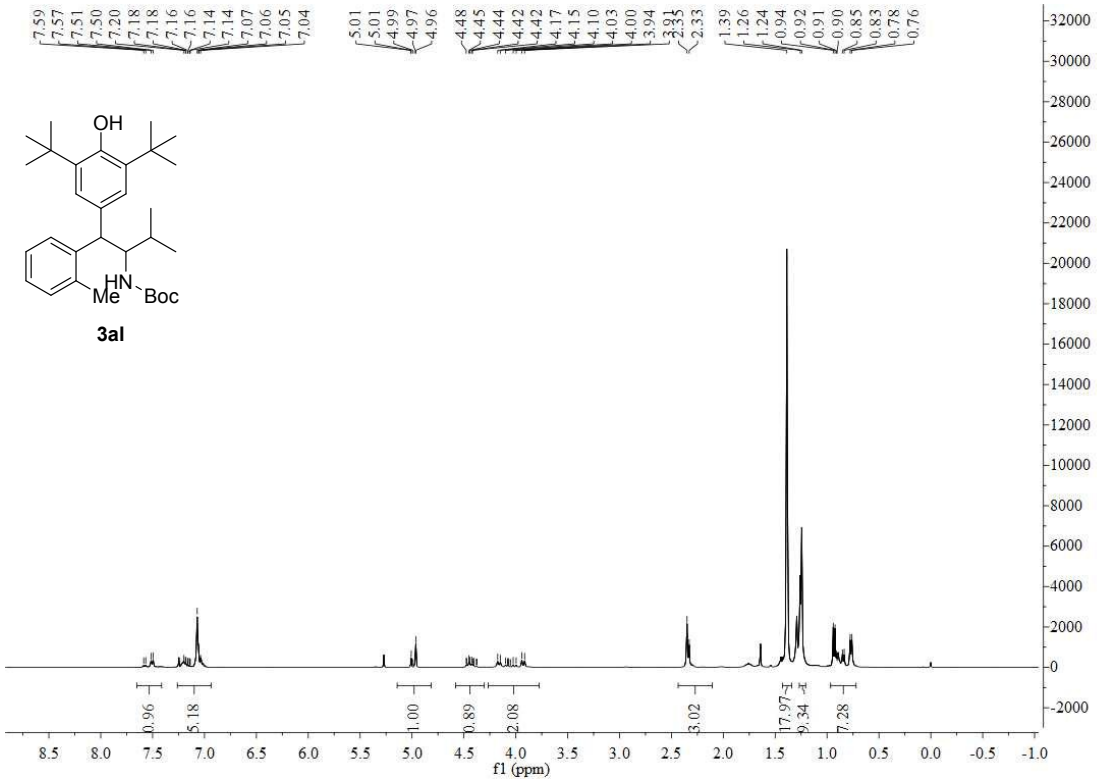
^{1}H NMR of 3ak



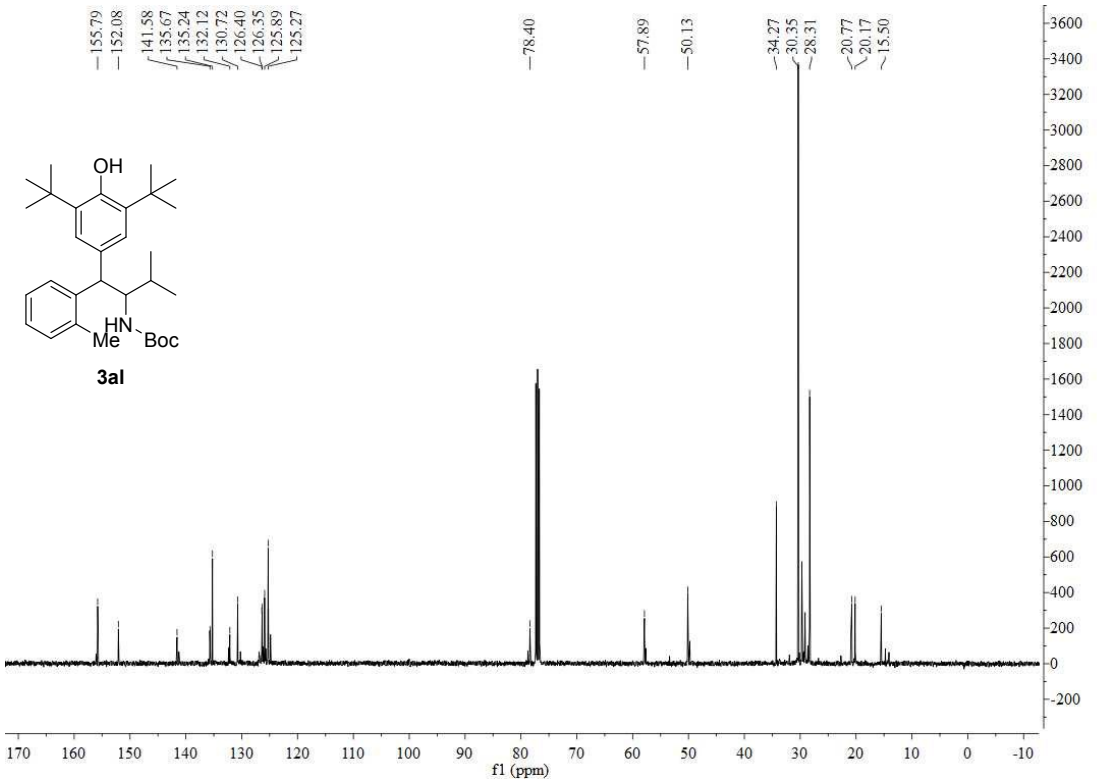
^{13}C NMR of 3ak



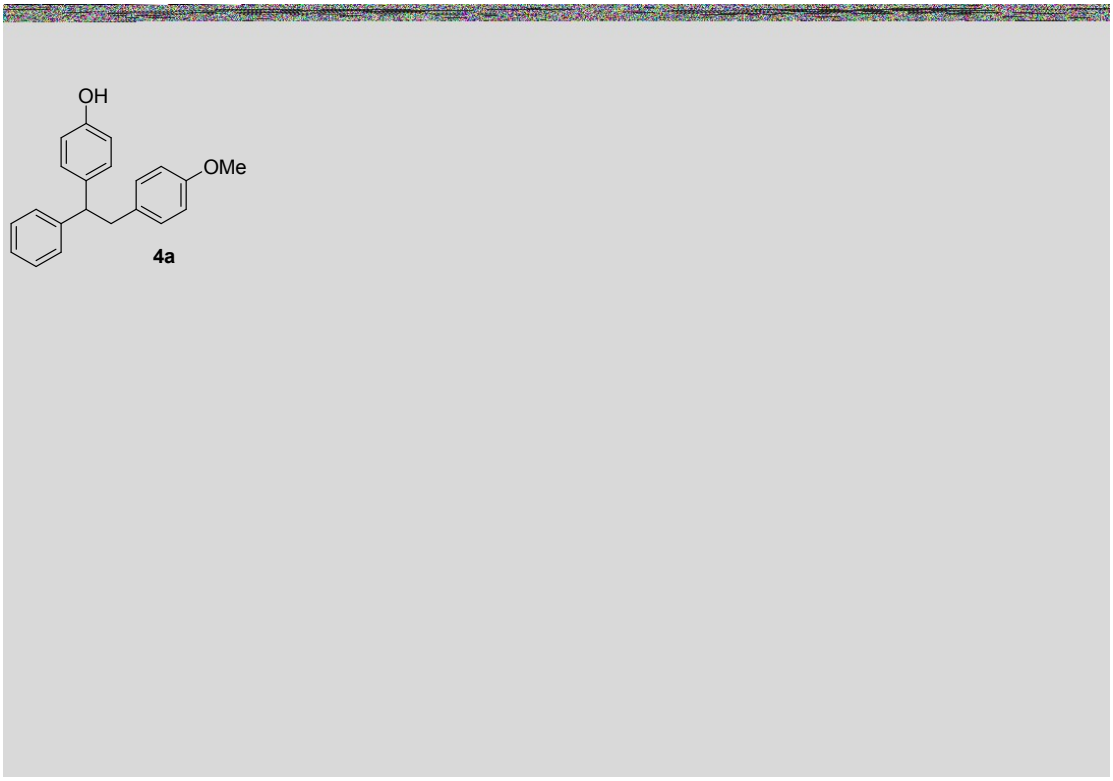
^{1}H NMR of 3al



^{13}C NMR of 3al



^{1}H NMR of 4a



^{13}C NMR of 4a