Supporting Information

Modular Isoquinoline Synthesis using Catalytic Enolate Arylation and *In-Situ* Functionalization

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General Methods

^{1}H NMR, ^{13}C NMR and ^{19}F NMR spectra were recorded on a 400 MHz or 500 MHz spectrometer in $CDCl_3$ and referenced to residual solvent peaks or to $SiMe_4$ as an internal standard. Chemical shifts are quoted in ppm (parts per million) to the nearest 0.01 ppm with signal splittings recorded as singlet (s), doublet (d), triplet (t), quartet (q), septet (sept.), multiplet (m) and broad singlet (br. s). Coupling constants, *J*, are measured in Hz to the nearest 0.1 Hz. ^{1}H, ^{13}C and ^{19}F NMR spectra were recorded at room temperature. Assignments were based upon DEPT, COSY and HSQC experiments and by comparison of the spectral data with that of known compounds.

Infrared spectra were recorded neat on a Bruker Tensor 27 FT-IR spectrometer equipped with Attenuated Total Reflectance sampling accessories. Absorption maxima are quoted in wavenumbers (cm^{-1}) for the range 3500-1000 cm^{-1}. Mass spectra were recorded on a Bruker MicroTof (resolution = 10000 FWHM) under conditions of electrospray ionisation (ESI) or field ionisation (FI). Calibration was *via* the lock-mass of tetraoctyl ammonium bromide for positive ions and sodium dodecyl sulfate for negative ions. Melting points (m.p.) were obtained using a Lecia VMTG heated-stage microscope and are uncorrected. Flash column chromatography was performed using silica gel (60 Å, 0.033-0.070 mm, BDH) and TLC analyses were performed on Merck Kiesegel 60 F_{254} 0.25 mm precoated silica plates. Product spots were visualized under UV light (λ_{max} = 254 nm) and/or by staining with potassium permanganate or vanillin solutions.

Reagents obtained from Sigma-Aldrich, Alfa, Fluorochem and TCI suppliers were used directly as supplied other than alkyl bromides which were first purified by being passed through a short plug of K_2CO_3. 1,1'-Bis(di-*tert*-butylphosphino)ferrocene palladium dichloride ((D*t*BPF)$PdCl_2$) was obtained from Johnson Matthey and 1,1'-bis(diphenylphosphino)ferrocene ((DPPF)$PdCl_2$) was obtained from Sigma-Aldrich. The palladium catalysts and bases were stored in a desiccator. Compounds that contained acetals of electron-rich benzaldehydes were found to undergo slow hydrolysis (over a period of weeks) due to atmospheric moisture and hence were also stored in a desiccator. All anhydrous reactions were carried out in flame-dried glassware and under an inert atmosphere of argon. THF was dried by purification through two activated alumina purification columns. Dry DMF and 1,4-dioxane were used directly from Sure/Seal® bottles from Sigma-Aldrich.

General Procedure 1: Cyclic acetal protection of aldehydes and ketones

To a solution of the aldehyde or ketone (1.0 eq.) in toluene (10 mL mmol^{-1}) was added ethane-1,2-diol (2.0 eq.) and *para*-toluenesulfonic acid monohydrate (0.02 eq.). The resulting mixture was stirred at reflux for 18 h using Dean-Stark apparatus then cooled to room temperature and quenched by the addition of a saturated, aqueous solution of $NaHCO_3$ (10 mL). The mixture was extracted with Et_2O (3 × 25 mL) and the combined organic extracts were dried over Na_2SO_4, filtered and concentrated *in vacuo* to give a crude residue which was purified as specifed.

General Procedure 2: One-pot C4-functionalized isoquinoline synthesis (R^1 = H)

To a screw-cap reaction tube fitted with a rubber septum was added (D*t*BPF)$PdCl_2$ (2.5 mol%) and NaO*t*Bu (2.5 eq.). A solution of aryl bromide (1.0 eq.) in anhydrous THF (5 mL mmol^{-1}) was added *via* syringe, followed by the addition of the ketone (1.2 or 2.0 eq.). The septum was replaced with a screw cap and the reaction mixture was heated at 70 °C for 18 h. After cooling to 0 °C, a solution of the specified quantity of electrophilic reagent in THF (5.0 mL) was added dropwise. The reaction mixture was allowed to warm to room temperature and stirred for 8 h. The pH was adjusted to pH 5 by the dropwise addition of 1 M HCl (aq) before a 1 M solution of NH_4Cl in 3:1 EtOH/H_2O (10 eq.) was added. The reaction tube was resealed and heated at 90 °C for 24 h. After cooling to room temperature, the reaction was quenched by the addition of a saturated, aqueous solution of $NaHCO_3$ (10 mL) and the resulting mixture was extracted with Et_2O (3 × 20 mL). The combined organic extracts were dried over Na_2SO_4, filtered and concentrated *in vacuo* to provide a crude residue which was purified as specified.

General Procedure 3: One-pot C4-functionalized isoquinoline synthesis (R^1 = Me)

To a screw-cap reaction tube fitted with a rubber septum was added (D*t*BPF)$PdCl_2$ (2.5 mol%) and NaO*t*Bu (2.5 eq.). A solution of aryl bromide (1.0 eq.) in anhydrous THF (5 mL mmol^{-1}) was added *via* syringe, followed by the addition of the ketone (1.2 eq.). The septum was replaced with a screw cap and the reaction mixture was heated at 70 °C for 18 h. After cooling to 0 °C, a solution of the specified quantity of electrophilic reagent in THF (5.0 mL) was added dropwise. The reaction mixture was allowed to warm to room temperature and stirred for 8 h. The pH was adjusted to pH 5 by the dropwise addition of 1 M

HCl (aq) before a 1 M solution of NH_4Cl in 3:1 EtOH/H_2O (10 eq.) was added. The reaction tube was resealed and heated at 90 °C for 24 h. After cooling to room temperature, the pH was adjusted to pH 9 by the addition of 2 M NH_4HCO_3 (aq) and the reaction was heated at 90 °C for a further 24 h. After cooling to room temperature, the reaction was diluted with H_2O and the resulting mixture was extracted with Et_2O (3 × 20 mL). The combined organic extracts were dried over Na_2SO_4, filtered and concentrated *in vacuo* to provide a crude residue which was purified as specified.

General Procedure 4: One-pot C4-aryl isoquinoline synthesis (R^1 = H)

To a microwave vial fitted with a rubber septum was added (D*t*BPF)$PdCl_2$ (5.0 mol%) and NaO*t*Bu (2.5 eq.). The septum was replaced by a microwave cap and the vessel was evacuated and back-filled with argon. A solution of aryl bromide (1.0 eq.) in anhydrous THF (4 mL $mmol^{-1}$) was added *via* syringe, followed by the addition of the ketone (1.2 eq.). The reaction mixture was heated at 70 °C for 6 h. After cooling to room temperature, the second aryl bromide (2.5 eq.) was added *via* syringe and the reaction mixture was stirred at 100 °C for a further 18 h. After cooling to room temperature a 1 M solution of NH_4Cl in 3:1 EtOH/H_2O (10 eq.) was added and the resulting mixture was stirred at 90 °C for 24 h. The reaction was then cooled to room temperature and quenched by the addition of a saturated, aqueous solution of $NaHCO_3$ (5 mL) and the resulting mixture was extracted with EtOAc (3 × 15 mL). The combined organic extracts were dried over Na_2SO_4, filtered and concentrated *in vacuo* to provide a crude residue which was purified as specified.

General Procedure 5: One-pot C4-aryl isoquinoline synthesis (R^1 = Me)

To a microwave vial fitted with a rubber septum was added (D*t*BPF)$PdCl_2$ (5.0 mol%) and NaO*t*Bu (2.5 eq.). The septum was replaced by a microwave cap and the vessel was evacuated and back-filled with argon. A solution of aryl bromide (1.0 eq.) in anhydrous THF (4 mL $mmol^{-1}$) was added *via* syringe, followed by the addition of the ketone (1.2 eq.). The reaction mixture was heated at 70 °C for 6 h. After cooling to room temperature, the second aryl bromide (2.5 eq.) was added *via* syringe and the reaction mixture was stirred at 100 °C for a further 18 h. After cooling to room temperature, the pH of the mixture was adjusted to pH 5 by the dropwise addition of a 1 M aqueous solution of HCl before a 1 M solution of NH_4Cl in 3:1 EtOH/H_2O (10 eq.) was added. The resulting mixture was stirred at 120 °C for 48 h then cooled to room temperature. A 2 M aqueous solution of NH_4HCO_3 (20 eq.) was then added and the solution was stirred at 90 °C for 6 h. After cooling to room temperature, the reaction was diluted with H_2O and the resulting mixture extracted with EtOAc (3 × 15 mL). The combined organic extracts were dried over Na_2SO_4, filtered and concentrated *in vacuo* to provide a crude residue which was purified as specified.

General Procedure 6: Arylation-alkylation of *tert*-butyl cyanoacetate

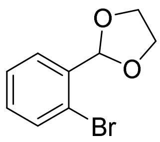
To a microwave vial fitted with a rubber septum was added (DPPF)$PdCl_2$ (2.0 mol%) and NaO*t*Bu (2.5 eq.). The septum was replaced by a microwave cap and the vessel was evacuated and back-filled with argon. A solution of aryl bromide **1** (1.2 eq.) in anhydrous dioxane (4 mL $mmol^{-1}$) was added *via* syringe, followed by the addition of *tert*-butyl cyanoacetate (1.0 eq.). The reaction mixture was heated at 70 °C for 4 h. After cooling to room temperature, the specified quantity of electrophilic reagent was added *via* syringe and the reaction mixture was stirred at 70 °C for a further 8 h. The reaction was cooled to room temperature and quenched by the addition of a saturated, aqueous solution of NH_4Cl (5 mL). The resulting mixture was extracted with EtOAc (3 × 10 mL) and the combined organic extracts were dried over Na_2SO_4, filtered and concentrated *in vacuo* to provide a crude residue which was purified as specified.

General Procedure 7: C4-functionalized 3-amino isoquinoline synthesis

To a screw-cap tube containing the arylated *tert*-butyl cyanoacetate was added EtOH/H_2O mixture (3:2, 10 mL $mmol^{-1}$) and the reaction was stirred at 90 °C for 18 h. After cooling to room temperature, NH_4Cl (10 eq.) was added and the reaction was reheated to 90 °C and stirred for 3 h. The mixture was then cooled to room temperature and a 1 M aqueous solution of NH_4HCO_3 (20 eq.) was added. The reaction mixture was stirred at 90 °C for a further 3 h then cooled to room temperature and extracted with EtOAc/*n*BuOH (4:1, 3 × 10 mL). The combined organic extracts were dried over Na_2SO_4, filtered and concentrated *in vacuo* to provide a crude residue which was purified as specified.

Methods of Preparation and Spectroscopic Data for Compounds

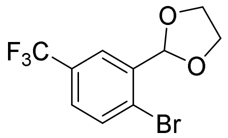
2-(2-Bromophenyl)-1,3-dioxolane (1)



2-Bromobenzaldehyde (5.15 g, 27.8 mmol) was subjected to **General Procedure 1**. Purification by flash column chromatography (SiO_2, 95:5 petrol/EtOAc) afforded acetal **1** as a colourless oil (5.96 g, 26.0 mmol, 94%).

^{1}H NMR (400 MHz, $CDCl_3$) δ_H 7.52 (1 H, dd, J = 7.7 and 1.6, HC$_{Ar}$), 7.48 (1 H, dd, J = 7.8 and 0.7, HC$_{Ar}$), 7.26 (1 H, t, J = 7.2, HC$_{Ar}$), 7.14 (1 H, td, J = 7.7 and 1.6, HC$_{Ar}$), 6.02 (1 H, s, CH(OR)$_2$), 3.94-4.12 (4 H, m, OCH_2CH_2O); **^{13}C NMR** (100 MHz, $CDCl_3$) δ_C 136.6 (C_{Ar}), 132.9 (HC_{Ar}), 130.6 (HC_{Ar}), 127.7 (HC_{Ar}), 127.4 (HC_{Ar}), 122.9 (C_{Ar}), 102.6 (CH(OR)$_2$), 65.4 (OCH$_2$$CH_2$O). Spectroscopic data were consistent with those previously reported.[1]

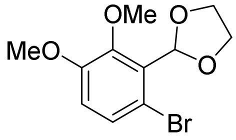
2-(2-Bromo-5-(trifluoromethyl)phenyl)-1,3-dioxolane (S1)



2-Bromo-5-(trifluromethyl)benzaldehyde (1.46 g, 5.77 mmol) was subjected to **General Procedure 1**. Purification by flash column chromatography (SiO_2, 95:5 petrol/EtOAc) afforded acetal **S1** as a colourless oil (1.58 g, 5.32 mmol, 92%).

^{1}H NMR (400 MHz, $CDCl_3$) δ_H 7.87 (1 H, s, HC$_{Ar}$), 7.70 (1 H, d, J = 8.3, HC$_{Ar}$), 7.48 (1 H, d, J = 8.3, HC$_{Ar}$), 6.10 (1 H, s, CH(OR)$_2$), 4.24-4.03 (4 H, m, OCH_2CH_2O); **^{13}C NMR** (100 MHz, $CDCl_3$) δ_C 137.9 (C_{Ar}), 133.6 (HC_{Ar}), 130.0 (q, ^2J = 33.4, C_{Ar}CF$_3$), 127.1 (HC_{Ar}), 126.8 (C_{Ar}), 124.9 (HC_{Ar}), 123.7 (q, ^1J = 273.2, CF$_3$), 101.8 (CH(OR)$_2$), 65.6 (OCH$_2$$CH_2$O); **^{19}F NMR** (377 MHz, $CDCl_3$) δ_F –62.7 (CF_3). Spectroscopic data were consistent with those previously reported.[1]

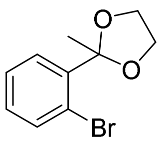
2-(6-Bromo-2,3-dimethoxyphenyl)-1,3-dioxolane (S2)



Iodomethane (860 mg, 6.06 mmol) was added to a solution of 6-bromo-2-hydroxy-3-methoxybenzaldehyde (467 mg, 2.02 mmol) and K_2CO_3 (558 mg, 4.04 mmol) in DMF (5.0 mL) and the resulting mixture was heated at 45 °C for 18 h. The reaction was cooled to room temperature and quenched by the addition of H_2O (20 mL) and aqueous 1.0 M HCl (20 mL). The resulting mixture was extracted with EtOAc (3 × 25 mL) and the combined organic extracts were washed with brine (2 × 50 mL), dried over Na_2SO_4, filtered and concentrated *in vacuo*. The crude product was then subjected to **General Procedure 1**. Purification by flash column chromatography (SiO_2, 9:1 petrol/EtOAc) afforded acetal **S2** as a white solid (572 mg, 1.98 mmol, 98%).

M.p. 78-79 °C (lit. 79 °C); **^{1}H NMR** (400 MHz, $CDCl_3$) δ_H 7.28 (1 H, d, $J = 8.6$, HC_{Ar}), 6.80 (1 H, d, $J = 8.8$, HC_{Ar}), 6.34 (1 H, s, $CH(OR)_2$), 4.29-4.25 (2 H, m, $OCH_aH_bCH_aH_bO$), 4.06-4.02 (2 H, m, $OCH_aH_bCH_aH_bO$), 3.84 (6 H, s, 2 × OCH_3); **^{13}C NMR** (100 MHz, $CDCl_3$) δ_C 152.8, 150.1, 129.4 (3 × C_{Ar}), 129.1, 114.4 (2 × HC_{Ar}), 113.3 (C_{Ar}), 101.7 ($CH(OR)_2$), 65.9 (CH_2OR), 61.6, 56.0 (2 × OCH_3). Spectroscopic data were consistent with those previously reported.[2]

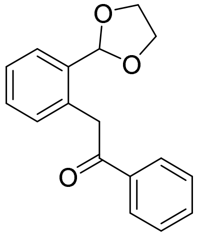
2-(2-Bromophenyl)-2-methyl-1,3-dioxolane (S3)



2'-Bromoacetophenone (1.98 g, 9.92 mmol) was subjected to **General Procedure 1**. Purification by flash column chromatography (SiO_2, 96:4 petrol/EtOAc afforded ketal **S3** as an oil (2.26 g, 9.31 mmol, 94%).

^{1}H NMR (400 MHz, $CDCl_3$) δ_H 7.67 (1 H, dd, $J = 7.9$ and 1.8, HC_{Ar}), 7.59 (1 H, dd, $J = 8.1$ and 1.3, HC_{Ar}), 7.28 (1 H, td, $J = 7.6$ and 1.1, HC_{Ar}), 7.13 (1 H, td, $J = 7.6$ and 1.7, HC_{Ar}), 4.10-4.01 (2 H, m, $OCH_aH_bCH_aH_bO$), 3.80-3.71 (2 H, m, $OCH_aH_bCH_aH_bO$), 1.81 (3 H, s, CH_3); **^{13}C NMR** (100 MHz, $CDCl_3$) δ_C 141.1 (C_{Ar}), 134.9, 129.5, 127.9, 127.1 (4 × HC_{Ar}), 120.5 (C_{Ar}), 108.7 ($C(OR)_2$), 64.2 (CH_2OR), 25.3 (CH_3). Spectroscopic data were consistent with those previously reported.[3]

2-(2-(1,3-Dioxolan-2-yl)phenyl)-1-phenylethan-1-one (2)

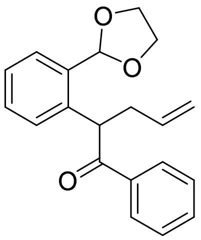


To a screw-cap reaction tube fitted with a rubber septum was added (D*t*BPF)$PdCl_2$ (3.2 mg, 0.0049 mmol) and NaO*t*Bu (58.6 mg, 0.610 mmol). A solution of aryl bromide **1** (56.0 mg, 0.244 mmol) in anhydrous THF (1.2 mL) was added *via* syringe, followed by the addition of acetophenone

(35.2 mg, 0.293 mmol). The septum was replaced with a screw cap and the reaction mixture was heated at 70 °C for 18 h. After cooling to room temperature the reaction was quenched by the addition of H_2O (5.0 mL) and the resulting mixture was extracted with Et_2O (3 × 10 mL). The combined organic extracts were dried over Na_2SO_4, filtered and concentrated *in vacuo*. Purification by flash column chromatography (SiO_2, 9:1 petrol/EtOAc) afforded ketone **2** as a white solid (53.1 mg, 0.201 mmol, 82%).

M.p. 87-89 °C; **^{1}H NMR** (400 MHz, $CDCl_3$) δ_H 8.06 (2 H, dd, *J* = 7.3 and 0.8, 2 × *H*C$_{\text{Ar}}$), 7.58 (2 H, td, *J* = 8.0 and 1.0, 2 × *H*C$_{\text{Ar}}$), 7.49 (2 H, t, *J* = 7.7, 2 × *H*C$_{\text{Ar}}$), 7.36-7.30 (2 H, m, 2 × *H*C$_{\text{Ar}}$), 7.19 (1 H, d, *J* = 6.6, *H*C$_{\text{Ar}}$), 5.89 (1 H, s, C*H*(OR)$_2$), 4.51 (2 H, s, C*H*$_2$), 4.03-3.99 (2 H, m, OC*H*$_a$H$_b$C*H*$_a$H$_b$O), 3.97-3.93 (2 H, m, OCH$_a$*H*$_b$CH$_a$*H*$_b$O); **^{13}C NMR** (100 MHz, $CDCl_3$) δ_C 197.6 (*C*=O), 137.0, 135.6, 133.6 (3 × *C*$_{\text{Ar}}$), 133.0, 131.5, 129.2, 128.6, 128.4, 127.0, 127.0 (7 × H*C*$_{\text{Ar}}$), 102.8 (*C*H(OR)$_2$), 65.0 (*C*H$_2$OR), 42.6 (*C*H$_2$); **IR** ν_{max} (solid)/cm^{-1} 2890, 1687, 1597, 1580, 1490, 1448, 1403, 1333, 1271, 1214, 1112, 1073, 1044, 1023; **HRMS** (ESI$^+$) $C_{17}H_{16}NaO_3$ requires 291.0992, found [M+Na$^+$]291.0994.

2-(2-(1,3-Dioxolan-2-yl)phenyl)-1-phenylpent-4-en-1-one (3)



Method A

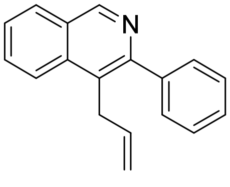
A solution of ketone **2** (35.2 mg, 0.131 mmol) and NaO*t*Bu (12.9 mg, 0.157 mmol) in THF (3.0 mL) was cooled to 0 °C before allyl bromide (31.7 mg, 0.262 mmol) was added dropwise *via* syringe. The reaction mixture was stirred at room temperature for 16 h. The reaction was quenched by the addition of H_2O (25 mL) and the resulting mixture was extracted with Et_2O (3 × 25 mL). The combined organic extracts were dried over Na_2SO_4, filtered and concentrated *in vacuo*. Purification by flash column chromatography (SiO_2, 75:25 petrol/EtOAc) afforded ketone **3** as a white solid (27.4 mg, 0.089 mmol, 68%).

Method B

To a microwave vial fitted with a rubber septum was added (D*t*BPF)PdCl$_2$ (6.9 mg, 0.011 mmol) and NaO*t*Bu (105 mg, 1.06 mmol). The septum was replaced by a microwave cap and the vessel was evacuated and back-filled with argon. A solution of aryl bromide **1** (96.2 mg, 0.420 mmol) in anhydrous THF (2.0 mL) was added *via* syringe, followed by the addition of acetophenone (101 mg, 0.840 mmol). The reaction mixture was heated at 70 °C for 6 h. After cooling to 0 °C, allyl bromide (36.3 µL, 0.420 mmol) was added *via* syringe and the reaction mixture was allowed to warm to room temperature and stirred for 18 h. The reaction was quenched by the addition of a saturated, aqueous solution of NH_4Cl (5.0 mL) and the resulting mixture was extracted with EtOAc (3 × 5 mL). The combined organic extracts were dried over Na_2SO_4, filtered and concentrated *in vacuo*. Purification by flash column chromatography (SiO_2, 1:1 petrol/CH_2Cl_2) afforded ketone **3** as a white solid (102 mg, 0.331 mmol, 78%).

M.p. 71-73 °C; **^{1}H NMR** (400 MHz, $CDCl_3$) δ_H 8.11-8.04 (2 H, m, 2 × *ortho* HC_{Ph}), 7.63-7.57 (1 H, m, HC_{Ar}), 7.49-7.43 (1 H, m, *para* HC_{Ph}), 7.40-7.33 (2 H, m, 2 × *meta* HC_{Ph}), 7.28-7.22 (2 H, m, 2 × HC_{Ar}), 7.18-7.14 (1 H, m, HC_{Ar}), 6.13 (1 H, s, $CH(OR)_2$), 5.87 (1 H, ddt, J = 17.0, 10.2 and 6.8, $HC{=}CH_2$), 5.15 (1 H, dd, J = 9.2 and 4.7, $HC(COPh)R$), 5.08 (1 H, dq, J = 17.1 and 1.6, $HC{=}CH_aH_b$), 4.99 (1 H, m, $HC{=}CH_aH_b$), 4.26-4.18 (2 H, m, $OCH_aH_bCH_aH_bO$), 4.17-4.09 (2 H, m, $OCH_aH_bCH_aH_bO$), 3.04-2.93 (1 H, m, $CH_aH_bCH{=}CH_2$), 2.60-2.48 (1 H, m, $CH_aH_bCH{=}CH_2$); **^{13}C NMR** (100 MHz, $CDCl_3$) δ_C 199.6 ($C{=}O$), 138.4, 136.8 (2 × C_{Ar}), 136.6 ($HC{=}CH_2$), 133.9 (C_{Ar}), 132.7 (*para* HC_{Ph}), 129.7 (HC_{Ar}), 128.9 (2 × *ortho* HC_{Ph}), 128.4 (2 × *meta* HC_{Ph}), 127.8, 127.7, 127.0 (3 × HC_{Ar}), 116.2 ($HC{=}CH_2$), 102.9 ($CH(OR)_2$), 65.2 (OCH_2CH_2O), 65.1 (OCH_2CH_2O), 48.9 ($HC(COPh)Ar$), 38.3 (CH_2CH); **IR** ν_{max} (solid)/cm^{-1} 3070, 2888, 1680, 1597, 1448, 1410, 1343, 1242, 1207, 1103, 1068, 1045; **HRMS** (ESI$^+$) $C_{20}H_{20}NaO_3$ requires 331.1305, found [M+Na$^+$] 331.1301.

4-Allyl-3-phenylisoquinoline (4a)



Method A[1]

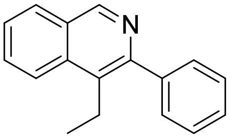
To a screw-cap reaction tube containing ketone **3** (40.3 mg, 0.131 mmol) was added a 1 M solution of NH_4Cl in 3:1 EtOH/H_2O (1.3 mL) and the resulting mixture was stirred at 90 °C for 16 h. After cooling to room temperature the reaction was quenched by the addition of a saturated, aqueous solution of $NaHCO_3$ (5.0 mL). The resulting mixture was extracted with Et_2O (3 × 10 mL) and the combined organic extracts were dried over Na_2SO_4, filtered and concentrated *in vacuo*. Purification by flash column chromatography (SiO_2, 85:15 petrol/EtOAc) afforded isoquinoline **4a** as a yellow oil (30.7 mg, 0.126 mmol, 96%).

Method B

Aryl bromide **1** (84.6 mg, 0.369 mmol) was subjected to **General Procedure 2** using acetophenone (86.1 µL, 0.738 mmol) and allyl bromide (40.2 mg, 0.332 mmol). Purification by flash column chromatography (SiO_2, 85:15 petrol/EtOAc) afforded isoquinoline **4a** as a yellow oil (64.3 mg, 0.262 mmol, 71%).

^{1}H NMR (400 MHz, $CDCl_3$) δ_H 9.26 (1 H, s, *H*C(1)), 8.06-8.01 (2 H, m, *H*C(8) and *H*C(5)), 7.75 (1 H, t, *J* = 6.8, *H*C(7)), 7.65-7.60 (3 H, m, *H*C(6) and 2 × HC_{Ar}), 7.50-7.40 (3 H, m, 3 × HC_{Ar}), 6.16 (1 H, ddt, *J* = 17.1, 10.3 and 5.4, *H*C=CH_2), 5.17 (1 H, d, *J* = 12.0, HC=CH_aH_b), 4.90 (1 H, d, *J* = 17.4, HC=CH_aH_b), 3.84-3.81 (2 H, m, $CH_2CH=CH_2$); **^{13}C NMR** (100 MHz, $CDCl_3$) δ_C 152.6 (H*C*(1)), 150.9 (HC_{Ar}), 141.0 (C_{Ar}), 136.9 (H*C*=CH_2), 135.8 (C_{Ar}), 130.4 (H*C*(7)), 129.2 (H*C*(6)), 128.1 (HC_{Ar}), 128.0 (H*C*(5)), 127.7 (HC_{Ar}), 127.6 (C_{Ar}), 126.6 (HC_{Ar}), 125.5 (C_{Ar}), 124.3 (H*C*(8)), 116.7 (HC=CH_2), 33.1 ($CH_2CH=CH_2$). Spectroscopic data were consistent with those previously reported.[4]

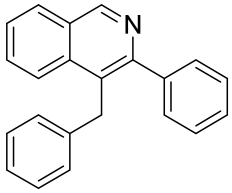
4-Ethyl-3-phenylisoquinoline (4b)



Aryl bromide **1** (70.2 mg, 0.306 mmol) was subjected to **General Procedure 2** using acetophenone (73.5 mg, 0.612 mmol) and ethyl iodide (62.1 mg, 0.398 mmol). Purification by flash column chromatography (SiO_2, 85:15 petrol/EtOAc) afforded isoquinoline **4b** as a white solid (51.4 mg, 0.217 mmol, 72%).

M.p. 98-101 °C (lit. 103 °C); **^{1}H NMR** (400 MHz, $CDCl_3$) δ_H 9.20 (1 H, s, *H*C(1)), 8.10 (1 H, d, *J* = 8.6, *H*C(8)), 8.02 (1 H, d, *J* = 8.1, *H*C(5)), 7.77 (1 H, ddd, *J* = 8.4, 7.0 and 1.3, *H*C(7)), 7.52 (1 H, ddd, *J* = 8.1, 7.0 and 1.0, *H*C(6)), 7.56-7.54 (2 H, m, 2 × HC_{Ar}), 7.51-7.47 (2 H, m, 2 × HC_{Ar}), 7.45-7.41 (2 H, m, 2 × HC_{Ar}), 3.08 (2 H, q, *J* = 7.5, CH_2CH_3), 1.31 (3 H, t, *J* = 7.6, CH_2CH_3); **^{13}C NMR** (100 MHz, $CDCl_3$) δ_C 151.8 (C_{Ar}), 150.1 (H*C*(1)), 141.5, 135.1, (2 × C_{Ar}), 130.3 (H*C*(7)), 130.3 (C_{Ar}), 129.2, 128.3, 128.1 (3 × HC_{Ar}), 127.8 (C_{Ar}), 127.5 (HC_{Ar}), 126.5 (H*C*(6)), 123.6 (H*C*(8)), 21.8 (CH_2CH_3), 15.6 (CH_2CH_3). Spectroscopic data were consistent with those previously reported.[5]

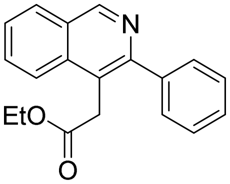
4-Benzyl-3-phenylisoquinoline (4c)



Aryl bromide **1** (82.6 mg, 0.361 mmol) was subjected to **General Procedure 2** using 5.0 mol% (D*t*BPF)PdCl$_2$ (11.8 mg, 0.0180 mmol), acetophenone (86.7 mg, 0.722 mmol) and benzyl bromide (123 mg, 0.722 mmol). Purification by flash column chromatography (SiO$_2$, 9:1 petrol/EtOAc) afforded isoquinoline **4c** as a yellow solid (61.6 mg, 0.209 mmol, 58%).

M.p. 147-149 °C (lit.133-134 °C); **^{1}H NMR** (400 MHz, CDCl$_3$) δ_H 9.24 (1 H, s, *H*C(1)), 7.96 (1 H, d, *J* 7.8, *H*C(8)), 7.78 (1 H, d, *J* = 8.1, *H*C(5)), 7.59-7.49 (2 H, m, *H*C(6) and *H*C(7)), 7.46-7.32 (5 H, m, 5 × *H*C$_{Ar}$), 7.17-6.98 (5 H, m, 5 × *H*C$_{Ar}$), 4.43 (2 H, s, C*H*$_2$); **^{13}C NMR** (100 MHz, CDCl$_3$) δ_C 151.2 (H*C*(1)), 140.8, 136.1 (2 × *C*$_{Ar}$), 130.8 (H*C*(6)), 129.3 (H*C*$_{Ar}$), 128.6 (H*C*(8)), 128.3, 128.2, 128.1, 127.9 (4 × H*C*$_{Ar}$), 127.8, 126.8, 126.8 (3 × *C*$_{Ar}$), 126.8 (H*C*(7)), 126.1 (H*C*$_{Ar}$), 125.8 (*C*$_{Ar}$), 124.6 (H*C*(5)), 34.9 (*C*H$_2$). Spectroscopic data were consistent with those previously reported.[4]

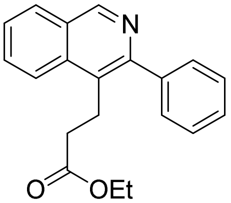
Ethyl 2-(3-phenylisoquinolin-4-yl)acetate (4d)



Aryl bromide **1** (109 mg, 0.476 mmol) was subjected to **General Procedure 2** with acetophenone (68.6 mg, 0.571 mmol) and ethyl bromoacetate (95.4 mg, 0.571 mmol). Purification by flash column chromatography (SiO$_2$, 9:1 petrol/EtOAc) afforded isoquinoline **4d** as a solid (82.6 mg, 0.284 mmol, 60%).

M.p. 86-87 °C; **^{1}H NMR** (400 MHz, CDCl$_3$) δ_H 9.28 (1 H, s, *H*C(1)), 8.03 (1 H, d, *J* = 8.0, *H*C(8)), 7.95 (1 H, dd, *J* = 8.6 and 0.8, *H*C(5)), 7.77 (1 H, ddd, *J* = 8.4, 7.0 and 1.3, *H*C(6)), 7.65-7.60 (3 H, m, *H*C(7) and 2 × *H*C$_{Ar}$), 7.51-7.41 (3 H, m, 3 × *H*C$_{Ar}$), 4.20 (2 H, q, *J* = 7.1, OC*H*$_2$CH$_3$), 4.07 (2 H, s, C*H*$_2$) 1.25 (3 H, t, *J* = 7.2, C*H*$_3$); **^{13}C NMR** (100 MHz, CDCl$_3$) δ_C 171.7 (*C*=O), 153.4 (*C*(3)), 151.7 (H*C*(1)), 140.8, 135.9 (2 × *C*$_{Ar}$), 131.1 (H*C*(6)), 129.5 (H*C*$_{Ar}$), 128.4 (H*C*(8)), 128.3, 128.0 (2 × H*C*$_{Ar}$), 127.6 (*C*$_{Ar}$), 126.9 (H*C*(7)), 123.3 (H*C*(5)), 121.4 (*C*(4)), 61.2 (O*C*H$_2$CH$_3$), 35.6 (*C*H$_2$), 14.2 (*C*H$_3$); **IR** ν_{max} (solid)/cm^{-1} 2979, 1729, 1621, 1574, 1499, 1444, 1421, 1369, 1323, 1251, 1173, 1026; **HRMS** (ESI$^+$) $C_{19}H_{18}NO_2$ requires 292.1332, found [M+H$^+$] 292.1334.

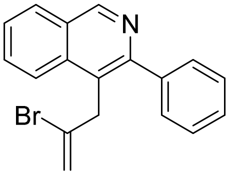
Ethyl 3-(3-phenylisoquinolin-4-yl)propanoate (4e)



Aryl bromide **1** (103 mg, 0.448 mmol) was subjected to **General Procedure 2** using acetophenone (108 mg, 0.896 mmol) and ethyl acrylate (89.7 mg, 0.896 mmol). Purification by flash column chromatography (SiO_2, petrol/EtOAc 85:15) afforded isoquinoline **4e** as a yellow oil (85.9 mg, 0.282 mmol, 63%).

^{1}H NMR (400 MHz, $CDCl_3$) δ_H 9.21 (1 H, s, *H*C(1)), 8.09 (1 H, d, *J* = 8.5, *H*C(8)), 8.02 (1 H, d, *J* = 8.1, *H*C(5)), 7.80-7.76 (1 H, m, *H*C(7)), 7.65-7.61 (1 H, m, *H*C(6)), 7.52-7.42 (5 H, m, 5 × HC_{Ar}), 4.10 (2 H, q, *J* = 7.2, CH_2OR), 3.41 (2 H, t, *J* = 8.6, CH_2), 2.60 (2 H, t, *J* = 8.6, $CH_2C=O$), 1.21 (3 H, t, *J* = 7.2, CH_3CH_2OR); **^{13}C NMR** (100 MHz, $CDCl_3$) δ_C 172.4 (*C*=O), 152.4 (*C*(3)), 150.7 (H*C*(1)), 141.0, 135.0 (2 × C_{Ar}), 130.8 (H*C*(7)), 129.0, 128.4 (2 × HC_{Ar}), 128.3 (H*C*(5)), 127.7 (HC_{Ar}), 127.7, 126.8 (2 × C_{Ar}), 126.7 (H*C*(6)), 123.1 (H*C*(8)), 60.5 (CH_2OR), 35.1 ($CH_2C=O$), 23.8 (CH_2), 14.1 (CH_3); **IR** ν_{max} (film)/cm^{-1} 2981, 2360, 1730, 1620, 1573, 1498, 1445, 1370, 1246, 1180, 1038; **HRMS** (ESI$^+$) $C_{20}H_{20}NO_2$ requires 306.1489, found [M+H$^+$] 306.1481.

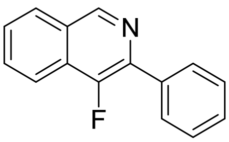
4-(2-Bromoallyl)-3-phenylisoquinoline (4f)



Aryl bromide **1** (113 mg, 0.493 mmol) was subjected to **General Procedure 2** with acetophenone (71.1 mg, 0.591 mmol) and 2,3-dibromopropene (118 mg, 0.591 mmol). Purification by flash column chromatography (SiO_2, 9:1 petrol/EtOAc) afforded isoquinoline **4f** as a solid (71.7 mg, 0.221 mmol, 45%). Despite multiple attempts at purification by chromatography we were unable to remove small impurities in the 0-2 ppm range (^{1}H NMR).

M.p. 128-130 °C; **^{1}H NMR** (400 MHz, $CDCl_3$) δ_H 9.31 (1 H, s, *H*C(1)), 8.05 (1 H, d, *J* = 8.0, *H*C(8)), 7.97 (1 H, d, *J* = 8.5, *H*C(5)), 7.79 (1 H, ddd, *J* = 8.4, 6.9 and 1.3, *H*C(6)), 7.67-7.63 (3 H, m, *H*C(7) and 2 × HC_{Ar}), 7.53-7.43 (3 H, m, 3 × HC_{Ar}), 5.60 (1 H, q, *J* = 1.8, $CRBr=CH_aH_b$), 5.24 (1 H, q, *J* = 2.0, $CRBr=CH_aH_b$), 4.17 (2 H, t, *J* = 1.7, CH_2); **^{13}C NMR** (100 MHz, $CDCl_3$) δ_C 153.0 (*C*(3)), 152.0 (H*C*(1)), 140.4, 135.6 (2 × C_{Ar}), 131.7 ($CRBr=CH_2$), 131.0 (H*C*(6)), 129.0, 128.4 (2 × HC_{Ar}), 128.3, 128.2 (H*C*(8) and HC_{Ar}), 127.6 (H*C*(7)), 127.1 (C_{Ar}), 124.1 (H*C*(5)), 123.9 (*C*(4)), 118.7 ($CH_2=CRBr$), 41.9 (CH_2); **IR** ν_{max} (solid)/cm^{-1} 3058, 2925, 1623, 1574, 1497, 1443, 1369, 1249, 1233, 1149, 1111, 1030; **HRMS** (ESI$^+$) $C_{18}H_{15}{}^{79}BrN$ requires 324.0382, found [M+H$^+$] 324.0390.

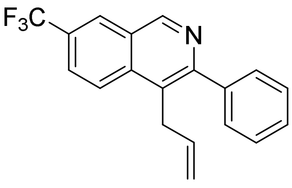
4-Fluoro-3-phenylisoquinoline (4g)



Aryl bromide **1** (80.3 mg, 0.351 mmol) was subjected to **General Procedure 2** with acetophenone (84.2 mg, 0.701 mmol) and Selectfluor® II (112 mg, 0.351 mmol) with stirring for 32 h after electrophile quench. Purification by flash column chromatography (SiO_2, 1:9 petrol/CH_2Cl_2) afforded isoquinoline **4g** as a solid (36.2 mg, 0.162 mmol, 46%).

M.p. 64-68 °C; **^{1}H NMR** (400 MHz, $CDCl_3$) δ_H 9.18 (1 H, s, *H*C(1)), 8.18 (1 H, dd, *J* = 8.3 and 0.7, *H*C(8)), 8.12 (2 H, dt, *J* = 8.3 and 1.5, 2 × HC_{Ar}), 8.03 (1 H, dt, *J* = 8.3 and 1.0, *H*C(5)), 7.81-7.77 (1 H, m, *H*C(7)), 7.68-7.64 (1 H, m, *H*C(6)), 7.57-7.53 (2 H, m, 2 × HC_{Ar}), 7.45 (1 H, tt, *J* = 7.3 and 1.2, HC_{Ar}); **^{13}C NMR** (100 MHz, $CDCl_3$) δ_C 152.4 (d, ^1J = 264.7, *C*(4)), 147.7 (d, ^4J = 5.6, H*C*(1)), 136.7 (d, ^3J = 5.6, C_{Ar}), 135.7 (d, ^2J = 10.3, *C*(3)), 130.7 (H*C*(6)), 129.4 (d, ^4J = 3.2, C_{Ar}), 129.0 (d, ^3J = 6.4, H*C*(5)), 128.6, 128.5, 127.9 (3 × HC_{Ar}), 127.4 (d, ^2J = 16.7, C_{Ar}), 127.0 (H*C*(7)), 120.0 (H*C*(8)); **^{19}F NMR** (377 MHz, $CDCl_3$) δ_F −137.7 *F*C(4)). Spectroscopic data were consistent with those previously reported.[6]

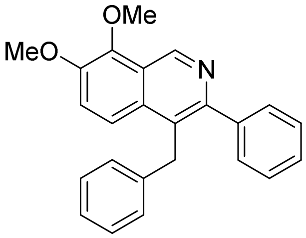
4-Allyl-3-phenyl-7-(trifluoromethyl)isoquinoline (4h)



Aryl bromide **S1** (100 mg, 0.337 mmol) was subjected to **General Procedure 2** with acetophenone (48.4 mg, 0.404 mmol) and allyl bromide (40.8 mg, 0.337 mmol) with stirring for 5 days at 90 °C following the addition of NH_4Cl solution. Purification by flash column chromatography (SiO_2, 3:7 petrol/CH_2Cl_2 then 9:1 petrol/Et_2O) afforded isoquinoline **4h** as a cream solid (63.8 mg, 0.204 mmol, 60%). Despite multiple attempts at purification by chromatography we were unable to remove small impurities in the 0-2 ppm range (^{1}H NMR).

M.p. 91-93 °C; **^{1}H NMR** (400 MHz, $CDCl_3$) δ_H 9.35 (1 H, s, *H*C(1)), 8.34 (1 H, s, *H*C(8)), 8.16 (1 H, dd, *J* = 8.9 and 0.6, *H*C(5)), 7.90 (1 H, dd, *J* = 8.9 and 1.7, *H*C(6)), 7.66-7.60 (2 H, m, 2 × HC_{Ph}), 7.54-7.42 (3 H, m, 3 × HC_{Ph}), 6.24-6.09 (1 H, m, *H*C=CH_2), 5.20 (1 H, dq, *J* = 10.3 and 1.7, HC=CH_aH_b), 4.87 (1 H, dq, *J* = 17.3 and 1.8, HC=CH_aH_b), 3.84 (2 H, dt, *J* = 5.0 and 2.0, CH_2CH); **^{13}C NMR** (100 MHz, $CDCl_3$) δ_C 154.7 (*C*(3)), 151.5 (H*C*(1)), 140.4, 137.3 (2 × C_{Ar}), 136.5 (H*C*=CH_2), 129.2 (HC_{Ph}), 128.5 (q, ^2J = 33.4, *C*(7)), 128.2 (2 × HC_{Ph}), 126.4 (C_{Ar}), 126.0 (q, ^3J = 4.7, H*C*(8)), 125.9 (q, ^3J = 4.5, H*C*(6)), 125.8 (H*C*(5)), 125.6 (C_{Ar}), 123.9 (q, $^1J = 271.8$, CF_3), 117.2 (HC=CH_2), 33.1 (CH_2CH); **^{19}F NMR** (377 MHz, $CDCl_3$) δ_F –62.6 (CF_3); **IR** ν_{max} (solid)/cm^{-1} 1632, 1582, 1438, 1347, 1314, 1273, 1222, 1149, 1122, 1074; **HRMS** (ESI$^+$) $C_{19}H_{15}F_3N$ requires 314.1151, found [M+H$^+$] 314.1151.

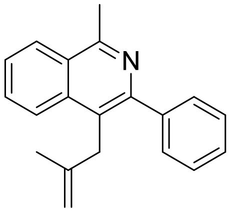
4-Benzyl-7,8-dimethoxy-3-phenylisoquinoline (4i)



Aryl bromide **S2** (105 mg, 0.363 mmol) was subjected to **General Procedure 2** using acetophenone (87.2 mg, 0.726 mmol) and benzyl bromide (124 mg, 0.726 mmol). Purification by flash column chromatography (SiO_2, 1:1 petrol/CH_2Cl_2) afforded isoquinoline **4i** as a cream solid (51.8 mg, 0.146 mmol, 40%).

M.p. 167-168 °C; **^{1}H NMR** (400 MHz, $CDCl_3$) δ_H 9.52 (1 H, d, $J = 0.7$, HC(1)), 7.49 (1 H, dd, $J = 9.3$ and 0.8, HC_{Ar}), 7.46-7.42 (2 H, m, 2 × HC_{Ar}), 7.33-7.26 (4 H, m, 4 × HC_{Ar}), 7.19-7.12 (2 H, m, 2 × HC_{Ar}), 7.10 (1 H, d, $J = 7.3$, HC_{Ar}), 6.99-6.93 (2 H, m, HC_{Ar}), 4.37 (2 H, s, CH_2), 4.01 (3 H, s OCH_3), 3.88 (3 H, s, OCH_3); **^{13}C NMR** (100 MHz, $CDCl_3$) δ_C 151.4 (C(3)), 148.3 (C_{Ar}OMe), 146.1 (HC(1)), 143.9 (C_{Ar}OMe), 141.0, 141.0, 131.6 (3 × C_{Ar}), 129.2, 128.5, 128.1, 128.1, 127.6, 125.9 (6 × HC_{Ar}), 125.1, 123.4 (2 × C_{Ar}), 121.0, 119.7 (2 × HC_{Ar}), 61.7, 56.8 (2 × OCH_3), 35.0 (CH_2); **IR** ν_{max} (solid)/cm^{-1} 1570, 1503, 1448, 1372, 1272, 1243, 1140, 1082, 1015; **HRMS** (ESI$^+$) $C_{24}H_{22}NO_2$ requires 356.1645, found [M+H$^+$] 356.1643.

1-Methyl-4-(2-methylallyl)-3-phenylisoquinoline (4j)

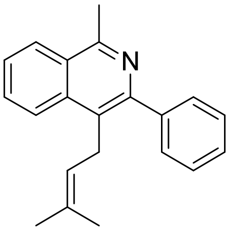


Aryl bromide **S3** (74.3 mg, 0.306 mmol) was subjected to **General Procedure 3** with acetophenone (44.1 mg, 0.367 mmol) and 3-bromo-2-methylpropene (49.5 mg, 0.367 mmol). Purification by flash column chromatography (SiO_2, 95:5 petrol/EtOAc) afforded isoquinoline **4j** as an oil (34.0 mg, 0.172 mmol, 56%).

^{1}H NMR (400 MHz, $CDCl_3$) δ_H 8.18 (1 H, d, $J = 8.6$, HC(8)), 7.93 (1 H, d, $J = 8.3$, HC(5)), 7.70 (1 H, ddd, $J = 8.3$, 6.9 and 1.2, HC(6)), 7.65-7.62 (2 H, m, 2 × HC_{Ar}), 7.60 (1 H, ddd, $J = 8.1$, 6.9 and 1.0, HC(7)), 7.45 (2 H, tt, $J = 7.2$ and 1.5, 2 × HC_{Ar}), 7.40 (1 H, tt, $J = 7.3$

and 1.6, *H*C$_{\text{Ar}}$), 4.90 (1 H, m, CR$_2$=C*H*$_a$H$_b$), 4.36 (1 H, m, CR$_2$=CH$_a$*H*$_b$), 3.63 (2 H, s, C*H*$_2$), 3.02 (3 H, s, C*H*$_3$), 1.86 (3 H, s, C*H*$_3$C=CH$_2$); **^{13}C NMR** (100 MHz, CDCl$_3$) δ_C 156.8 (*C*(1)), 151.4 (*C*(3)), 145.1 (*C*R$_2$=CH$_2$), 141.4, 136.2 (2 × *C*$_{\text{Ar}}$), 129.8 (H*C*(6)), 129.1, 128.1, 127.6 (3 × H*C*$_{\text{Ar}}$), 126.5 (H*C*(7)), 126.3 (*C*$_{\text{Ar}}$), 126.0 (H*C*(8)), 125.2 (H*C*(5)), 124.0 (*C*(4)), 112.5 (*C*H$_2$=CR$_2$), 37.3 (*C*H$_2$), 23.6 (*C*H$_3$), 22.6 (*C*H$_3$C=CH$_2$); **IR** ν_{max} (film)/cm^{-1} 3073, 2923, 1651, 1615, 1563, 1504, 1443, 1392, 1336, 1030; **HRMS** (ESI$^+$) C$_{20}$H$_{20}$N requires 274.1590, found [M+H$^+$] 274.1583.

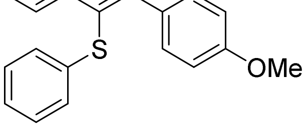
1-Methyl-4-(3-methylbut-2-en-1-yl)-3-phenylisoquinoline (4k)



Aryl bromide **S3** (68.7 mg, 0.283 mmol) was subjected to **General Procedure 3** with acetophenone (40.7 mg, 0.339 mmol) and 1-bromo-3-methyl-2-butene (50.5 mg, 0.339 mmol). Purification by flash column chromatography (SiO$_2$, 95:5 petrol/EtOAc) afforded isoquinoline **4k** as an oil (36.4 mg, 0.172 mmol, 61%).

^{1}H NMR (400 MHz, CDCl$_3$) δ_H 8.19 (1 H, d, *J* = 8.3, *H*C(8)), 8.04 (1 H, d, *J* = 8.3, *H*C(5)), 7.74 (1 H, ddd, *J* = 8.3, 7.0 and 1.4, *H*C(6)), 7.63-7.53 (3 H, m, *H*C(7) and 2 × *H*C$_{\text{Ar}}$), 7.47 (2 H, tt, *J* = 7.3 and 1.6, 2 × *H*C$_{\text{Ar}}$), 7.39 (1 H, tt, *J* = 7.2 and 1.7, *H*C$_{\text{Ar}}$), 5.31-5.28 (1 H, m, *H*C=CR$_2$), 3.69 (2 H, d, *J* = 6.1, C*H*$_2$), 3.00 (3 H, s, C*H*$_3$), 1.72 (3 H, d, *J* = 0.9, CHR=CC$_a$*H*$_3$), 1.64 (3 H, d, *J* 0.9, CHR=CC$_b$*H*$_3$); **^{13}C NMR** (100 MHz, CDCl$_3$) δ_C 156.2 (*C*(1)), 150.8 (*C*(3)), 141.6, 135.8 (2 × *C*$_{\text{Ar}}$), 132.1 (*C*R$_2$=CHR), 129.9 (H*C*(6)), 129.7, 128.2, 127.4 (3 × H*C*$_{\text{Ar}}$), 126.7 (*C*(4)), 126.3, (H*C*(7)), 126.3 (*C*$_{\text{Ar}}$), 126.2 (H*C*(8)), 124.7 (H*C*(5)), 123.7 (*C*HR=CR$_2$), 28.2 (*C*H$_2$), 25.7 (HC=*C*$_a$H$_3$R), 22.6 (*C*H$_3$), 18.1 (HC=*C*$_b$H$_3$R); **IR** ν_{max} (film)/cm^{-1} 3060, 2967, 2927, 2856, 1615, 1564, 1503, 1438, 1392, 1375, 1334, 1261, 1098, 1073, 1030; **HRMS** (ESI$^+$) C$_{21}$H$_{22}$N requires 288.1747, found [M+H$^+$] 288.1736.

3-(4-Methoxyphenyl)-1-methyl-4-(phenylthio)isoquinoline (4l)

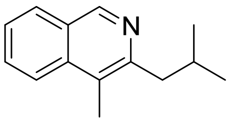


Aryl bromide **S3** (74.1 mg, 0.305 mmol) was subjected to **General Procedure 3** with 4’-methoxyacetophenone (54.9 mg, 0.366 mmol) and diphenyldisulfide (79.9 mg, 0.366 mmol). Purification by flash column chromatography (SiO$_2$, 9:1

petrol/EtOAc) afforded isoquinoline **4l** as an oil (46.2 mg, 0.129 mmol, 42%).

^{1}H NMR (400 MHz, CDCl$_3$) δ_H 8.43 (1 H, d, *J* = 8.1, *H*C(8)), 8.19 (1 H, d, *J* = 8.3, *H*C(5)), 7.69 (1 H, ddd, *J* = 8.3, 7.0 and 1.2, *H*C(7)), 7.65-7.59 (3 H, m, *H*C(6) and 2 × HC_{Ar}), 7.14 (2 H, t, *J* = 7.5, 2 × HC_{Ar}), 7.05 (1 H, tt, *J* = 7.2 and 1.5, HC_{Ar}), 6.97-6.92 (4 H, m, 4 × HC_{Ar}), 3.84 (3 H, s, OC*H*$_3$), 3.08 (3 H, s, C*H*$_3$); **^{13}C NMR** (100 MHz, CDCl$_3$) δ_C 160.0, 159.6, 157.2 (*C*(3), *C*(1) and C_{Ar}), 138.7, 138.3, 133.5 (*C*(4) and 2 × C_{Ar}), 131.2 (H*C*(7)), 131.2 (HC_{Ar}), 128.9 (HC_{Ar}), 127.1 (C_{Ar}), 127.0 (H*C*(6)), 126.8 (H*C*(8)), 126.3 (HC_{Ar}), 126.2 (H*C*(5)), 125.0 (HC_{Ar}), 118.9 (C_{Ar}), 113.2 (HC_{Ar}), 55.3 (O*C*H$_3$), 22.9 (*C*H$_3$); **IR** ν_{max} (film)/cm^{-1} 3001, 2955, 2835, 1606, 1581, 1565, 1545, 1512, 1478, 1435, 1390, 1331, 1288, 1247, 1176, 1034; **HRMS** (ESI$^+$) $C_{23}H_{20}NOS$ requires 358.1260, found [M+H$^+$] 358.1255.

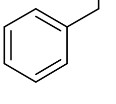
3-*iso*Butyl-4-methylisoquinoline (4m)



Aryl bromide **1** (83.4 mg, 0.364 mmol) was subjected to **General Procedure 2** using 4-methylpentan-2-one (72.9 mg, 0.728 mmol) and methyl iodide (67.1 mg, 0.473 mmol). Purification by flash column chromatography (SiO$_2$, 85:15 petrol/EtOAc) afforded isoquinoline **4m** as a yellow oil (36.3 mg, 0.182 mmol, 50%).

^{1}H NMR (400 MHz, CDCl$_3$) δ_H 9.09 (1 H, s, *H*C(1)), 7.98 (1 H, dd, *J* = 8.6 and 0.8, *H*C(8)), 7.92 (1 H, d, *J* = 8.1, *H*C(5)), 7.69 (1 H, dt, *J* = 6.9 and 1.2, *H*C(7)), 7.53 (1 H, dt, *J* = 8.1 and 1.0, *H*C(6)), 2.90 (2 H, d, *J* = 7.3, C*H*$_2$CH), 2.61 (3 H, s, C*H*$_3$), 2.19 (1 H, sept., *J* = 6.9, C*H*), 0.98 (6 H, d, *J* = 6.6, CH(C*H*$_3$)$_2$); **^{13}C NMR** (100 MHz, CDCl$_3$) δ_C 152.4 (*C*(3)), 149.7 (H*C*(1)), 135.8 (C_{Ar}), 129.9 (H*C*(7)), 128.0 (H*C*(5)), 126.8 (C_{Ar}), 125.7 (H*C*(6)), 123.8 (C_{Ar}), 123.0 (H*C*(8)), 44.5 (*C*H$_2$CH), 29.6 (*C*H(CH$_3$)$_2$), 22.5 (CH(*C*H$_3$)$_2$), 13.9 (*C*H$_3$); **IR** ν_{max} (film)/cm^{-1} 2954, 2867, 2361, 1697, 1622, 1577, 1463, 1381, 1248, 1160, 1016; **HRMS** (ESI$^+$) $C_{14}H_{18}N$ requires 200.1434, found [M+H$^+$] 200.1436.

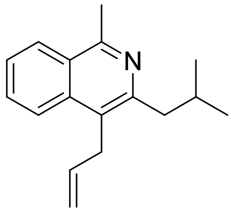
4-Benzyl-3-*iso*butylisoquinoline (4n)



Aryl bromide **1** (81.1 mg, 0.354 mmol) was subjected to **General Procedure 2** with 4-methylpentan-2-one (70.8 mg, 0.707 mmol) and benzyl bromide (121 mg, 0.707 mmol). Purification by flash column chromatography (SiO$_2$, 85:15 petrol/EtOAc) afforded isoquinoline **4n** as a yellow oil (42.1 mg, 0.152 mmol, 43%).

^{1}H NMR (400 MHz, CDCl$_3$) δ_H 9.10 (1 H, s, *H*C(1)), 7.85 (1 H, d, *J* = 7.6, *H*C(8)), 7.76 (1 H, d, *J* = 8.6, *H*C(5)), 7.49 (1 H, dt, *J* = 6.9 and 1.5, *H*C(7)), 7.40 (1 H, dt, *J* = 8.1 and 1.0, *H*C(6)), 7.16-7.05 (3 H, m, 3 × *H*C$_{Ar}$), 6.97 (2 H, d, *J* = 7.1, 2 × *H*C$_{Ar}$), 4.39 (2 H, s, C*H*$_2$Ph), 2.80 (2 H, d, *J* = 7.3, C*H*$_2$CH), 2.17 (1 H, sept., *J* = 6.9, C*H*), 0.86 (6 H, d, *J* = 6.6, CH(C*H*$_3$)$_2$); **^{13}C NMR** (100 MHz, CDCl$_3$) δ_C 153.6 (*C*(3)), 150.9 (H*C*(1)), 140.0, 135.9 (2 × *C*$_{Ar}$), 130.4 (H*C*(7)), 128.6, 128.1, (2 × H*C*$_{Ar}$), 127.9 (H*C*(8)), 127.3 (*C*$_{Ar}$), 126.1 (H*C*$_{Ar}$), 125.9 (H*C*(6)), 125.9 (*C*$_{Ar}$), 123.7 (H*C*(5)), 44.3 (*C*H$_2$CH), 33.4 (*C*H$_2$Ph), 29.5 (*C*H), 22.6 (*C*H$_3$); **IR** ν_{max} (film)/cm^{-1} 2964, 2867, 1739, 1621, 1576, 1494, 1454, 1367, 1229, 1217, 1039; **HRMS** (ESI$^+$) $C_{20}H_{22}N$ requires 276.1747, found [M+H$^+$] 276.1745.

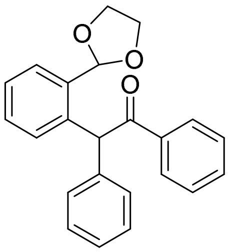
4-Allyl-3-*iso*butyl-1-methylisoquinoline (4o)



Aryl bromide **S3** (108 mg, 0.413 mmol) was subjected to **General Procedure 3** with 4-methyl-2-pentanone (49.6 mg, 0.496 mmol) and allyl bromide (60.0 mg, 0.496 mmol). Purification by flash column chromatography (SiO$_2$, 95:5 petrol/EtOAc) afforded isoquinoline **4o** as an oil (44.9 mg, 0.188 mmol, 45%).

^{1}H NMR (400 MHz, CDCl$_3$) δ_H 8.10 (1 H, d, *J* = 8.3, *H*C(8)), 7.95 (1 H, d, *J* = 8.5, *H*C(5)), 7.65 (1 H, ddd, *J* = 8.3, 6.9 and 1.2, *H*C(6)), 7.52 (1 H, ddd, *J* = 8.3, 6.8 and 0.8, *H*C(7)), 6.04 (1 H, ddt, *J* = 17.1, 10.3 and 5.6, *H*C=CH$_2$), 5.06 (1 H, dq, *J* = 10.2 and 1.7, HC=C*H*$_a$H$_b$), 4.92 (1 H, dq, *J* = 17.1 and 1.7, HC=CH$_a$*H*$_b$), 3.82-3.80 (2 H, m, C*H*$_2$CH=CH$_2$), 2.94 (3 H, s, C*H*$_3$), 2.82 (2 H, d, *J* = 7.3, C*H*$_2$CH(CH$_3$)$_2$), 2.28 (1 H, sept., *J* = 6.9, C*H*), 0.98 (6 H, d, *J* = 6.6, CH(C*H*$_3$)$_2$); **^{13}C NMR** (100 MHz, CDCl$_3$) δ_C 156.1 (*C*(3)), 151.7 (*C*(1)), 136.2 (H*C*=CH$_2$), 135.6 (*C*$_{Ar}$), 129.5 (H*C*(6)), 126.0 (H*C*(8)), 125.9 (*C*$_{Ar}$), 125.4 (H*C*(7)), 124.0 (H*C*(5)), 123.5 (*C*(4)), 116.0 (HC=*C*H$_2$), 43.9 (*C*H$_2$CH(CH$_3$)$_2$), 31.7 (*C*H$_2$CH=CH$_2$), 29.3 (*C*H(CH$_3$)$_2$), 22.6 (CH(*C*H$_3$)$_2$), 22.5 (*C*H$_3$); **IR** ν_{max} (film)/cm^{-1} 3073, 2954, 2867, 1638, 1618, 1569, 1504, 1463, 1391, 1333, 1166, 1033; **HRMS** (ESI$^+$) $C_{17}H_{22}N$ requires 240.1747, found [M+H$^+$] 240.1752.

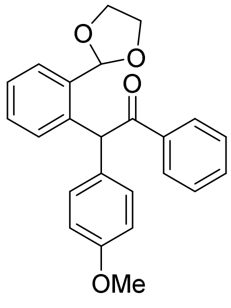
2-(2-(1,3-Dioxolan-2-yl)phenyl)-1,2-diphenylethanone (5a)



To a microwave vial fitted with a rubber septum was added (D*t*BPF)PdCl$_2$ (3.6 mg, 0.0055 mmol) and NaO*t*Bu (52.5 mg, 0.546 mmol). The septum was replaced by a microwave cap and the vessel was evacuated and back-filled with argon. A solution of aryl bromide **1** (50.0 mg, 0.218 mmol) in anhydrous THF (1.0 mL) was added *via* syringe, followed by the addition of acetophenone (31.5 mg, 0.262 mmol). The reaction mixture was heated at 70 °C for 6 h. After cooling to room temperature, bromobenzene (58 µL, 0.55 mmol) was added *via* syringe and the reaction mixture was stirred at 70 °C for a further 18 h. After cooling to room temperature, the reaction was quenched by the addition of a saturated, aqueous solution of NH$_4$Cl (2 mL). The resulting mixture was extracted with EtOAc (3 × 5 mL) and the combined organic extracts were dried over Na$_2$SO$_4$, filtered and concentrated *in vacuo.* Purification by flash column chromatography (SiO$_2$, 1:1 petrol/CH$_2$Cl$_2$) afforded ketone **5a** as a cream solid (66.1 mg, 0.192 mmol, 88%).

M.p. 136-139 °C; **^{1}H NMR (**500 MHz, CDCl$_3$) δ_H 8.14-8.07 (2 H, m, 2 × *H*C$_{Ar}$), 7.66-7.61 (1 H, m, *H*C$_{Ar}$), 7.55-7.48 (1 H, m, *H*C$_{Ar}$), 7.46-7.40 (2 H, m, 2 × *H*C$_{Ar}$), 7.39-7.24 (7 H, m, 7 × *H*C$_{Ar}$), 7.21-7.17 (1 H, m, *H*C$_{Ar}$), 6.73 (1 H, s, *H*C(COPh)Ph), 5.92 (1 H, s, C*H*(OR)$_2$), 4.14-4.07 (1 H, m, OCH_aH$_b$CH$_a$H$_b$O), 4.04-3.98 (1 H, m, OCH$_a$$H_bCH_aH_b$O), 3.98-3.92 (2 H, m, OCH$_a$H$_b$C$H_a$$H_b$O); **^{13}C NMR (**125 MHz, CDCl$_3$) δ_C 198.2 (*C*=O), 138.4, 137.6, 136.7, 134.4 (4 × *C*$_{Ar}$), 132.7, 130.1, 129.4, 129.2, 128.9, 128.6, 128.4, 127.1, 127.0, 127.0 (10 × H*C*$_{Ar}$), 102.7 (*C*H(OR)$_2$), 64.9 (OCH$_2$*C*H$_2$O), 64.8 (O*C*H$_2$CH$_2$O), 55.0 (H*C*(COPh)Ph)); **IR** ν_{max} (solid)/cm^{-1} 2883, 2763, 1690, 1595, 1578, 1494, 1447, 1404, 1206, 1076, 1041; **HRMS** (ESI$^+$) C$_{23}$H$_{20}$NaO$_3$ requires 367.1305, found [M+Na$^+$] 367.1305.

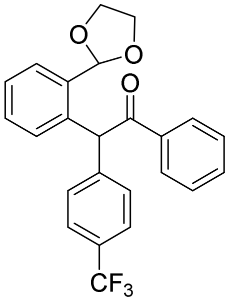
2-(2-(1,3-Dioxolan-2-yl)phenyl)-2-(4-methoxyphenyl)-1-phenylethanone (5b)



To a microwave vial fitted with a rubber septum was added (D*t*BPF)PdCl$_2$ (7.1 mg, 0.011 mmol) and NaO*t*Bu (54.0 mg, 0.546 mmol). The septum was replaced by a microwave cap and the vessel was evacuated and back-filled with argon. A solution of aryl bromide **1** (50.0 mg, 0.218 mmol) in anhydrous THF (1.0 mL) was added *via* syringe, followed by the addition of acetophenone (31.5 mg, 0.262 mmol). The reaction mixture was heated at 70 °C for 6 h. After cooling to room temperature, 4-bromoanisole (68 μL, 0.55 mmol) was added *via* syringe and the reaction mixture was stirred at 100 °C for a further 18 h. After cooling to room temperature the reaction was quenched by the addition of a saturated, aqueous solution of NH_4Cl (4 mL). The resulting mixture was extracted with EtOAc (3 × 5 mL) and the combined organic extracts were dried over Na_2SO_4, filtered and concentrated *in vacuo.* Purification by flash column chromatography (SiO_2, 4:6 petrol/CH_2Cl_2) afforded ketone **5b** as a viscous oil (79.0 mg, 0.211 mmol, 97%).

^{1}H NMR (400 MHz, $CDCl_3$) δ_H 8.08-8.02 (2 H, m, 2 × HC_{Ph}), 7.61-7.56 (1 H, m, HC_{Ar}), 7.52-7.46 (1 H, m, HC_{Ar}), 7.43-7.37 (2 H, m, 2 × HC_{Ph}), 7.31-7.25 (2 H, m, 2 × HC_{Ar}), 7.17-7.11 (3 H, m, HC_{Ar} and 2 × *meta*-OMe HC_{Ar}), 6.90-6.84 (2 H, m, 2 × *ortho*-OMe HC_{Ar}), 6.61 (1 H, s, *H*C(COPh)Ar), 5.88 (1 H, s, C*H*(OR)$_2$), 4.12-4.05 (1 H, m, $OCH_aH_bCH_aH_b$), 4.04-3.91 (3 H, m, $OCH_aH_bCH_aH_b$), 3.79 (3 H, s, OCH_3); **^{13}C NMR** (100 MHz, $CDCl_3$) δ_C 198.6 (C=O), 158.6, 138.0, 136.8, 134.4 (4 × C_{Ar}), 132.7 (HC_{Ar}), 130.5 (*meta*-OMe HC_{Ar}), 130.4 (C_{Ar}), 130.1, 129.3 (2 × HC_{Ar}), 129.0, 128.5 (2 × HC_{Ph}), 127.1, 127.0 (2 × HC_{Ar}), 114.1 (*ortho*-OMe HC_{Ar}), 102.8 (*C*H(OR)$_2$), 65.0 (OCH_2CH_2), 64.9 (OCH_2CH_2), 55.2 (OCH_3), 54.3 (H*C*(COPh)Ar); **IR** ν_{max} (film)/cm^{-1} 2892, 1688, 1610, 1511, 1447, 1277, 1252, 1207, 1179, 1072; **HRMS** (ESI$^+$) $C_{24}H_{22}NaO_4$ requires 397.1410, found [M+Na$^+$] 397.1394.

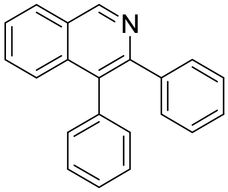
2-(2-(1,3-Dioxolan-2-yl)phenyl)-1-phenyl-2-(4-(trifluoromethyl)phenyl)ethanone (5c)



To a microwave vial fitted with a rubber septum was added (D*t*BPF)$PdCl_2$ (7.1 mg, 0.011 mmol) and NaO*t*Bu (54.0 mg, 0.546 mmol). The septum was replaced by a microwave cap and the vessel was evacuated and back-filled with argon. A solution of aryl bromide **1** (50.0 mg, 0.218 mmol) in anhydrous THF (1.0 mL) was added *via* syringe, followed by the addition of acetophenone (31.5 mg 0.262 mmol). The reaction mixture was heated at 70 °C for 6 h. After cooling to room temperature, 4-bromobenzotrifluoride (123 mg, 0.546 mmol) was added *via* syringe and the reaction mixture was stirred at 100 °C for a further 18 h. After cooling to room temperature the reaction was quenched by the addition of a saturated, aqueous solution of NH_4Cl (4 mL). The resulting mixture was extracted with EtOAc (3 × 5 mL) and the combined organic extracts were dried over Na_2SO_4, filtered and concentrated *in vacuo*. Purification by flash column chromatography (SiO_2, 6:4 petrol/CH_2Cl_2) afforded ketone **5c** as a viscous oil (77 mg, 0.187 mmol, 86%).

^{1}H NMR (400 MHz, $CDCl_3$) δ_H 8.09-8.02 (2 H, m, 2 × HC_{Ar}), 7.66-7.60 (1 H, m, HC_{Ar}), 7.58 (2 H, d, $J = 8.1$, 2 × HC_{Ar}), 7.55-7.48 (1 H, m, HC_{Ar}), 7.45-7.38 (2 H, m, 2 × HC_{Ar}), 7.36-7.29 (4 H, m, 4 × HC_{Ar}), 7.17-7.11 (1 H, m, HC_{Ar}), 6.73 (1 H, s, *H*C(COPh)Ar), 5.84 (1 H, s, C*H*(OR)$_2$), 4.15-4.08 (1 H, m, $OCH_aH_bCH_aH_bO$), 4.07-3.93 (3 H, m, $OCH_aH_bCH_aH_bO$); **^{13}C NMR** (100 MHz, $CDCl_3$) δ_C 197.8 (*C*=O), 142.7, 136.6, 136.3, 134.6 (4 × C_{Ar}), 133.1, 129.9, 129.8, 129.8, 129.5, 129.1, 128.6, 127.5 (8 × HC_{Ar}), 125.5 (q, $^3J = 4.8$, HC_{Ar}), 102.7 (*C*H(OR)$_2$), 65.1 (OCH_2CH_2O), 65.0 (OCH_2CH_2O), 54.8 (H*C*(COPh)Ar), CF_3 and one quaternary carbon not observed; **^{19}F NMR** (377 MHz, $CDCl_3$) δ_F –62.4 (CF_3); **IR** ν_{max} (film)/cm^{-1} 2892, 1688, 1325, 1278, 1210, 1163, 1111, 1068; **HRMS** (ESI$^+$) $C_{24}H_{19}F_3NaO_3$ requires 435.1179, found [M+Na$^+$] 435.1187 (–1.9 ppm).

3,4-Diphenylisoquinoline (6a)



Method A[1]

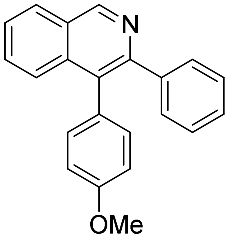
To a screw-cap reaction tube containing ketone **5a** (102 mg, 0.296 mmol) was added a 1 M solution of NH_4Cl in 3:1 EtOH/H_2O (3.0 mL) and the resulting mixture was stirred at 90 °C for 18 h. After cooling to room temperature the reaction was quenched by the addition of a saturated, aqueous solution of $NaHCO_3$ (5 mL). The mixture was extracted with Et_2O (3 × 10 mL) and the combined organic extracts were dried over Na_2SO_4, filtered and concentrated *in vacuo*. Purification by flash column chromatography (SiO_2, 85:15 petrol/EtOAc) afforded isoquinoline **6a** as a white solid (76.5 mg, 0.272 mmol, 92%).

Method B

Aryl bromide **1** (122 mg, 0.533 mmol) was subjected to **General Procedure 4** using acetophenone (76.8 mg, 0.640 mmol) and bromobenzene (142 µL, 1.33 mmol) for the second arylation with stirring at 70 °C. Purification by flash column chromatography (SiO_2, CH_2Cl_2) afforded isoquinoline **6a** as a white solid (115 mg, 0.409 mmol, 77%).

M.p. 156-160 °C (lit. 170 °C); **^{1}H NMR** (400 MHz, CDCl$_3$) δ_H 9.38 (1 H, s, *H*C(1)), 8.09-7.97 (1 H, m, *H*C(8)), 7.71-7.64 (1 H, m, *H*C(5)), 7.63-7.54 (2 H, m, *H*C(6) and *H*C(7)), 7.42-7.30 (5 H, m, 5 × *H*C$_{Ph}$), 7.28-7.12 (5 H, m, 5 × *H*C$_{Ph}$); **^{13}C NMR** (100 MHz, CDCl$_3$) δ_C 151.7 (H*C*(1)), 150.5 (*C*(3)), 140.7, 137.1, 135.9 (3 × *C*$_{Ar}$), 131.1 (H*C*$_{Ph}$), 130.6 (*C*$_{Ar}$), 130.4 (H*C*(6)), 130.2, 128.2, 127.6 (3 × H*C*$_{Ph}$), 127.5 (H*C*(8)), 127.3, 127.0 (2 × H*C*$_{Ph}$), 126.8 (H*C*(7)), 125.5 (H*C*(5)), one quaternary carbon not observed. Spectroscopic data were consistent with those previously reported.[5]

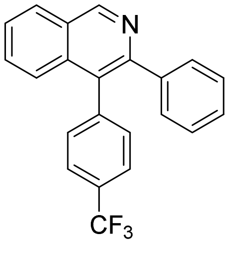
4-(4-Methoxyphenyl)-3-phenylisoquinoline (6b)



Aryl bromide **1** (120 mg, 0.524 mmol) was subjected to **General Procedure 4** using acetophenone (75.6 mg, 0.629 mmol) and 4-bromoanisole (164 µL, 1.31 mmol) for the second arylation. Purification by flash column chromatography (SiO$_2$, CH$_2$Cl$_2$) afforded isoquinoline **6b** as a white solid (131 mg, 0.421 mmol, 80%).

M.p. 135-139 °C (lit. 141-142 °C); **^{1}H NMR** (400 MHz, CDCl$_3$) δ_H 9.25 (1 H, d, J = 0.6, *H*C(1)), 8.05-8.00 (1 H, m, *H*C(8)), 7.75-7.69 (1 H, m, *H*C(5)), 7.64-7.54 (2 H, m, *H*C(6) and *H*C(7)), 7.42-7.35 (2 H, m, 2 × *H*C$_{Ph}$), 7.28-7.18 (3 H, m, 3 × *H*C$_{Ph}$), 7.18-7.11 (2 H, m, 2 × *meta*-OMe *H*C$_{Ar}$), 6.94-6.87 (2 H, m, 2 × *ortho*-OMe *H*C$_{Ar}$), 3.72 (3 H, s, OC*H*$_3$); **^{13}C NMR** (100 MHz, CDCl$_3$) δ_C 158.7 (*C*$_{Ar}$OMe), 151.5 (H*C*(1)), 150.7 (*C*(3)), 140.9, 136.2 (2 × *C*$_{Ar}$), 132.2 (*meta*-OMe H*C*$_{Ar}$), 130.3 (H*C*(6)), 130.2 (H*C*$_{Ph}$), 129.2 (*C*$_{Ar}$), 127.6 (H*C*$_{Ph}$), 127.4 (H*C*(8)), 127.4 (*C*$_{Ar}$), 126.9 (H*C*$_{Ph}$), 126.7 (H*C*(7)), 125.6 (H*C*(5)), 113.7 (*ortho*-OMe H*C*$_{Ar}$), 55.1 (O*C*H$_3$), one quaternary carbon not observed. Spectroscopic data were consistent with those previously reported.[4]

3-Phenyl-4-(4-(Trifluoromethyl)phenyl)isoquinoline (6c)

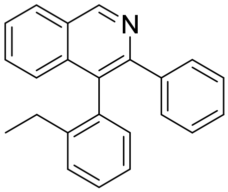


Aryl bromide **1** (120 mg, 0.524 mmol) was subjected to **General Procedure 4** using acetophenone (75.6 mg, 0.629 mmol) and 4-bromobenzotrifluoride (181 µL, 1.31 mmol) for the second arylation.

Purification by flash column chromatography (SiO_2, 3:6 petrol/CH_2Cl_2) afforded isoquinoline **6c** as a cream solid (133 mg, 0.381 mmol, 73%).

M.p. 157-162 °C (lit. 128-129 °C, yellow solid); **^{1}H NMR** (400 MHz, $CDCl_3$) δ_H 9.42 (1 H, s, *H*C(1)), 8.12-8.07 (1 H, m, *H*C_{Ar}), 7.70-7.63 (4 H, m, 4 × *H*C_{Ar}), 7.62-7.57 (1 H, m, *H*C_{Ar}), 7.41 (2 H, d, *J* = 7.9, 2 × *H*C_{Ar}), 7.37-7.31 (2 H, m, 2 × *H*C_{Ar}), 7.26-7.21 (3 H, m, 3 × *H*C_{Ar}); **^{13}C NMR** (100 MHz, $CDCl_3$) δ_C 152.3 (H*C*(1)), 150.7 (*C*(3)), 141.2, 140.1, 135.5 (3 × C_{Ar}), 131.6, 131.0, 130.2, 127.9, 127.8, 127.4 (6 × HC_{Ar}), 127.3 (C_{Ar}), 127.2 (HC_{Ar}), 125.3 (q, $^3J = 3.2$, HC_{Ar}), 125.0 (HC_{Ar}), *C*F_3 and one quaternary carbon not observed; **^{19}F NMR** (377 MHz, $CDCl_3$) –62.4 (C*F*$_3$). Spectroscopic data were consistent with those previously reported.[7]

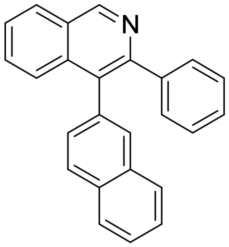
4-(2-Ethylphenyl)-3-phenylisoquinoline (6d)



Aryl bromide **1** (117 mg, 0.511 mmol) was subjected to **General Procedure 4** using acetophenone (73.7 mg, 0.613 mmol) and 1-bromo-2-ethylbenzene (177 µL, 1.28 mmol) for the second arylation. Purification by flash column chromatography (SiO_2, 4:6 petrol/CH_2Cl_2 then 9:1 petrol/Et_2O) afforded isoquinoline **6d** as a white solid (106 mg, 0.343 mmol, 67%).

M.p. 80-83 °C; **^{1}H NMR** (400 MHz, $CDCl_3$) δ_H 9.42 (1 H, s, *H*C(1)), 8.09-8.03 (1 H, m, *H*C(8)), 7.64-7.57 (2 H, m, *H*C(7) and *H*C_{Ar}), 7.49-7.42 (3 H, m, 3 × *H*C_{Ar}), 7.40-7.35 (1 H, m, *H*C_{Ar}), 7.33-7.27 (1 H, m, *H*C_{Ar}), 7.27-7.19 (5 H, m, 5 × *H*C_{Ar}), 2.29-2.10 (2 H, m, CH_aH_b), 0.85 (3 H, t, *J* = 7.6, CH_3); **^{13}C NMR** (100 MHz, $CDCl_3$) δ_C 151.8 (H*C*(1)), 150.2 (*C*(3)), 142.6, 140.6, 136.3, 135.9 (4 × C_{Ar}), 131.6, 130.4 (2 × HC_{Ar}), 129.8 (HC_{Ph}), 129.8 (C_{Ar}), 128.3, 128.1 (2 × HC_{Ar}), 127.5 (HC_{Ph}), 127.5 (HC_{Ar}), 127.2 (C_{Ar}), 127.2, 126.8 (2 × HC_{Ar}), 125.7 (H*C*(7)), 125.5 (HC_{Ar}), 25.7 (*C*H_2), 14.1 (*C*H_3); **IR** ν_{max} (solid)/cm^{-1} 2969, 1616, 1559, 1497, 1447, 1370, 1331, 1248, 1027; **HRMS** (ESI$^+$) $C_{23}H_{20}N$ requires 310.1590, found [M+H$^+$] 310.1582.

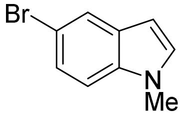
4-(Naphthalen-2-yl)-3-phenylisoquinoline (6e)



Aryl bromide **1** (110 mg, 0.480 mmol) was subjected to **General Procedure 4** using acetophenone (69.2 mg, 0.576 mmol) and a solution of 2-bromonaphthalene (248 mg, 1.20 mmol) in THF (1.0 mL) for the second arylation. Purification by flash column chromatography (SiO_2, 2:8 petrol/CH_2Cl_2 then 7:3 petrol/Et_2O) afforded isoquinoline **6e** as a white solid (105 mg, 0.317 mmol, 66%).

M.p. 148-149 °C; **^{1}H NMR** (400 MHz, $CDCl_3$) δ_H 9.45 (1 H, d, *J* = 0.5, *H*C(1)), 8.12-8.06 (1 H, m, HC_{Ar}), 7.93-7.77 (4 H, m, 4 × HC_{Ar}), 7.73-7.67 (1 H, m, HC_{Ar}), 7.65-7.57 (2 H, m, 2 × HC_{Ar}), 7.59-7.48 (2 H, m, 2 × HC_{Ar}), 7.48-7.42 (2 H, m, 2 × HC_{Ar}), 7.37 (1 H, dd, *J* = 8.4 and 1.7, HC_{Ar}), 7.21-7.13 (3 H, m, 3 × HC_{Ar}); **^{13}C NMR** (100 MHz, $CDCl_3$) δ_C 151.9, (H*C*(1)), 150.9 (*C*(3)), 140.7, 136.2, 134.8, 133.2, 132.5 (5 × C_{Ar}), 130.7 (HC_{Ar}), 130.5 (C_{Ar}), 130.3 (2 signals), 129.3, 128.1, 128.0, 127.8, 127.8, 127.7 (8 × HC_{Ar}), 127.4 (C_{Ar}), 127.2, 127.0, 126.3, 126.3, 125.7 (5 × HC_{Ar}); **IR** ν_{max} (solid)/cm^{-1} 1617, 1556, 1496, 1335, 1246; **HRMS** (ESI$^+$) $C_{25}H_{18}N$ requires 332.1434, found [M+H$^+$] 332.1425.

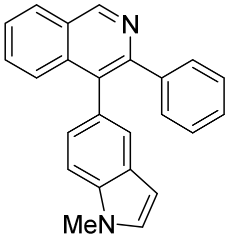
5-Bromo-1-methyl-1H-indole (S5)[8]



A mixture of NaOH (67.2 mg, 1.68 mmol) in DMSO (3.4 mL) was stirred at 85 °C for 18 h to dissolve the solid. After cooling to room temperature, 5-bromoindole (221 mg, 1.13 mmol) was added and the reaction mixture was stirred at room temperature for 1 h before iodomethane (104 μL, 1.68 mmol) was added. After stirring for 5 h, the solution was diluted with H_2O and the resulting mixture was extracted with Et_2O (3 × 5 mL). The combined organic extracts were washed with H_2O (2 × 20 mL) and brine (2 × 20 mL), dried over anhydrous Na_2SO_4 and concentrated *in vacuo*. Purifcation by flash column chromatography (SiO_2, petrol) afforded 5-bromo-*N*-methylindole **S5** as a colourless oil (170 mg, 0.809 mmol, 72%).

^{1}H NMR (400 MHz, $CDCl_3$) δ_H 7.78 (1 H, d, *J* = 1.8, *H*C(4)), 7.32 (1 H, dd, *J* = 8.7 and 1.9, *H*C(6)), 7.20 (1 H, d, *J* = 8.7, *H*C(7)), 7.06 (1 H, d, *J* = 3.1, *H*C(3)), 6.45 (1 H, dd, *J* = 3.1 and 0.8, *H*C(2)), 3.78 (3 H, s, NCH_3); **^{13}C NMR** (100 MHz, $CDCl_3$) δ_C 135.3, 130.0 (2 × C_{Ar}), 130.0 (H*C*(3)), 124.2 (H*C*(6)), 123.2 (H*C*(4)), 112.6 (BrC_{Ar}), 110.6 (H*C*(7)), 100.4 (H*C*(2)), 32.9 (N*C*H_3). Spectroscopic data were consistent with those previously reported.[9]

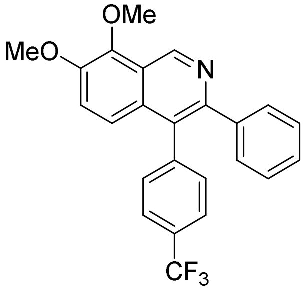
4-(1-Methyl-1H-indol-5-yl)-3-phenylisoquinoline (6f)



Aryl bromide **1** (79.0 mg, 0.345 mmol) was subjected to **General Procedure 4** using acetophenone (49.7 mg, 0.414 mmol) and a solution of 5-bromo-*N*-methylindole **S5** (145 mg, 0.690 mmol) in THF (1.0 mL) for the second arylation. Purification by flash column chromatography (SiO_2, CH_2Cl_2) afforded isoquinoline **6f** as a pale yellow solid (79.2 mg, 0.237 mmol, 69%).

M.p. 197-201 °C; **^{1}H NMR** (400 MHz, $CDCl_3$) δ_H 9.41 (1 H, d, *J* = 0.7, *H*C(1)), 8.09-8.03 (1 H, m, *H*C(8)), 7.78-7.72 (1 H, m, HC_{Ar}), 7.62-7.55 (3 H, m, 3 × HC_{Ar}), 7.50-7.45 (2 H, m, 2 × HC_{Ar}), 7.31 (1 H, d, *J* = 8.4, HC_{Ar}), 7.23-7.15 (3 H, m, 3 × HC_{Ar}), 7.11-7.06 (2 H, m, HC_{Ar} and *H*C(2’)), 6.49 (1 H, dd, *J* = 3.1 and 0.8, *H*C(3’)), 3.82 (3 H, s, NCH_3); **^{13}C NMR** (100 MHz, $CDCl_3$) δ_C 151.2 (H*C*(1)), 150.7 (*C*(3)), 141.2, 136.7, 135.9, 131.7 (4 × C_{Ar}), 130.2, 130.1, 129.2 (3 × HC_{Ar}), 128.3, 127.9 (2 × C_{Ar}), 127.5 (HC_{Ar}), 127.4 (C_{Ar}), 127.3, 126.7, 126.6, 126.1, 124.9, 123.5 (6 × HC_{Ar}), 109.1 (H*C*(2’)), 101.1 (H*C*(3’)), 32.8 (NCH_3); **IR** ν_{max} (solid)/cm^{-1} 1618, 1497, 1441, 1376, 1327, 1246; **HRMS** (ESI$^+$) $C_{24}H_{19}N_2$ requires 335.1543, found [M+H$^+$] 335.1537.

7,8-Dimethoxy-3-phenyl-4-(4-(trifluoromethyl)phenyl)isoquinoline (6g)

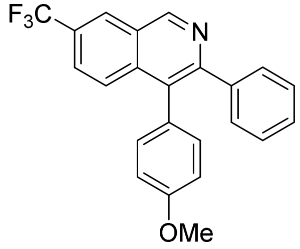


Aryl bromide **S2** (119 mg, 0.412 mmol) was subjected to **General Procedure 4** using acetophenone (59.4 mg, 0.494 mmol) and 4-bromobenzotrifluoride (142 µL, 1.03 mmol) for the second arylation. Purification by flash column chromatography (SiO_2, 98:2 CH_2Cl_2/Et_2O) afforded isoquinoline **6g** as an orange solid (115 mg, 0.281 mmol, 68%).

M.p. 175-178 °C; **^{1}H NMR** (400 MHz, $CDCl_3$) δ_H 9.71 (1 H, d, *J* = 0.9, *H*C(1)), 7.63 (2 H, d, *J* = 7.9, 2 × *ortho*-CF_3 HC_{Ar}), 7.43 (2 H, d, *J* = 9.3, 2 × HC_{Ar}), 7.38 (2 H, d, *J* = 7.9, 2 × *meta*-CF_3 HC_{Ar}), 7.35-7.31 (2 H, m, 2 × HC_{Ar}), 7.25-7.19 (3 H, m, 3 × HC_{Ar}), 4.14 (3 H, s, OCH_3), 4.01 (3 H, s, OCH_3); **^{13}C NMR** (100 MHz, $CDCl_3$) δ_C 149.0, 148.7 (2 × C_{Ar}), 147.2 (H*C*(1)), 143.7, 141.5, 140.2 (3 × C_{Ar}), 131.6 (HC_{Ar}), 131.2 (C_{Ar}), 130.1 (HC_{Ar}), 129.5 (q, ^2J = 33.3, C_{Ar}), 128.6 (C_{Ar}), 127.8, 127.2 (2 × HC_{Ar}), 125.2 (q, ^3J = 3.2, HC_{Ar}), 124.1 (q, ^1J = 271.6, CF_3), 122.9 (C_{Ar}), 121.4, 119.9 (2 × HC_{Ar}), 61.8, 56.9 (2 × OCH_3);

^{19}F NMR (377 MHz, CDCl$_3$) δ_F –62.4 (C*F*$_3$); **IR** ν_{max} (solid)/cm^{-1} 1563, 1500, 1445, 1378, 1322, 1278, 1252, 1166, 1110, 1090, 1068, 1040; **HRMS** (ESI$^+$) $C_{24}H_{19}F_3NO_2$ requires 410.1362, found [M+H$^+$] 410.1370.

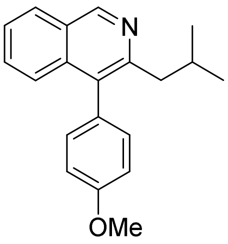
4-(4-Methoxyphenyl)-3-phenyl-7-(trifluoromethyl)isoquinoline (6h)



Aryl bromide **S1** (123 mg, 0.414 mmol) was subjected to **General Procedure 4** using acetophenone (59.7 mg, 0.497 mmol) and 4-bromoanisole (142 µL, 1.03 mmol) for the second arylation. ^{1}H NMR analysis of the crude product indicated incomplete acetal hydrolysis so the crude residue was dissolved in a 1 M solution of NH$_4$Cl in 3:1 EtOH/H$_2$O (10 eq.) and stirred at 90 °C for 48 h. The reaction mixture was then worked up according to **General Procedure 4**. Purification by flash column chromatography afforded isoquinoline **6h** as a cream solid (105 mg, 0.277 mmol, 67%).

M.p. 145-147 °C; **^{1}H NMR** (400 MHz, CDCl$_3$) δ_H 9.36 (1 H, s, *H*C(1)), 8.27 (1 H, s, *H*C(8)), 7.77 (1 H, d, *J* = 9.2, *H*C(5)), 7.68 (1 H, dd, *J* = 9.0 and 1.8, *H*C(6)), 7.33-7.29 (2 H, m, 2 × *H*C$_{Ph}$), 7.20-7.13 (3 H, m, 3 × *H*C$_{Ph}$), 7.09-7.04 (2 H, m, 2 × *meta*-OMe *H*C$_{Ar}$), 6.87-6.82 (2 H, m, 2 × *ortho*-OMe *H*C$_{Ar}$), 3.77 (3 H, s, OC*H*$_3$); **^{13}C NMR** (100 MHz, CDCl$_3$) δ_C 159.1 (*C*$_{Ar}$OMe), 152.8 (*C*(3)), 152.1 (H*C*(1)), 140.3, 137.7 (2 × *C*$_{Ar}$), 132.2 (*meta*-OMe H*C*$_{Ar}$) , 130.3 (*C*$_{Ar}$), 130.2 (H*C*$_{Ar}$), 128.4 (*C*$_{Ar}$), 127.8, 127.4 (2 × H*C*$_{Ar}$), 127.1 (H*C*(5)), 126.2 (*C*$_{Ar}$), 125.8 (q, ^3J = 3.2, H*C*(6)), 125.4 (q, ^3J = 4.8, H*C*(8)), 123.9 (q, ^1J = 273.5, *C*F$_3$), 114.0 (*ortho*-OMe H*C*$_{Ar}$), 55.2 (O*C*H$_3$), one quaternary carbon not observed; **^{19}F NMR** (377 MHz, CDCl$_3$) δ_F –62.6 (C*F*$_3$); **IR** ν_{max} (solid)/cm^{-1}1632, 1610, 1515, 1432, 1351, 1311, 1244, 1159, 1119, 1072, 1033; **HRMS** (ESI$^+$) $C_{23}H_{17}F_3NO$ requires 380.1257, found [M+H$^+$] 380.1239.

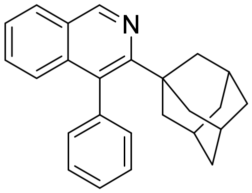
3-*iso*Butyl-4-(4-methoxyphenyl)isoquinoline (6i)



Aryl bromide **1** (115 mg, 0.502 mmol) was subjected to **General Procedure 4** using 4-methyl-2-pentanone (60.3 mg, 0.602 mmol) and 4-bromoanisole (157 µL, 1.26 mmol) for the second arylation. Purification by flash column chromatography (SiO$_2$, CH$_2$Cl$_2$) afforded isoquinoline **6i** as a cream solid (76.8 mg, 0.264 mmol, 53%).

M.p. 77-78 °C; **^{1}H NMR** (400 MHz, CDCl$_3$) δ_H 9.25 (1 H, d, *J* = 0.6, *H*C(1)), 7.99-7.93 (1 H, m, *H*C(8)), 7.56-7.48 (2 H, m, *H*C(6) and *H*C(7)), 7.43-7.37 (1 H, m, *H*C(5)), 7.22-7.16 (2 H, m, 2 × *meta*-OMe *H*C$_{Ar}$), 7.07-7.01 (2 H, m, 2 × *ortho*-OMe *H*C$_{Ar}$), 3.92 (3 H, s, OC*H*$_3$), 2.65 (2 H, d, *J* = 7.3, C*H*$_2$), 2.29-2.16 (1 H, m, C*H*(CH$_3$)$_2$), 0.82 (6 H, d, *J* = 6.7, CH(C*H*$_3$)$_2$); **^{13}C NMR** (100 MHz, CDCl$_3$) δ_C 158.8 (*C*$_{Ar}$OMe), 152.4 (*C*(3)), 151.2 (H*C*(1)), 136.2 (*C*$_{Ar}$), 131.5 (*meta*-OMe H*C*$_{Ar}$), 130.8 (*C*$_{Ar}$), 130.0 (H*C*(6)), 129.6 (*C*$_{Ar}$), 127.3 (H*C*(8)), 126.6 (*C*$_{Ar}$), 125.9 (H*C*(7)), 125.3 (H*C*(5)), 113.7 (*ortho*-OMe H*C*$_{Ar}$), 55.2 (O*C*H$_3$), 44.0 (*C*H$_2$), 29.0 (*C*H(CH$_3$)$_2$), 22.5 (CH(*C*H$_3$)$_2$); **IR** ν_{max} (solid)/cm^{-1} 2960, 2865, 1610, 1571, 1513, 1464, 1381, 1285, 1242, 1179, 1108, 1034; **HRMS** (ESI$^+$) C$_{20}$H$_{22}$NO requires 292.1696, found [M+H$^+$] 292.1689.

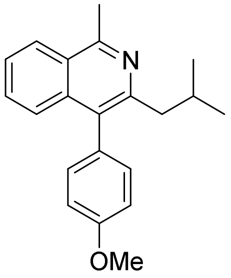
3-(Adamantan-1-yl)-4-phenylisoquinoline (6j)



Aryl bromide **1** (123 mg, 0.537 mmol) was subjected to **General Procedure 4** using 1-adamantyl methyl ketone (115 mg, 0.644 mmol) and bromobenzene (143 µL, 1.34 mmol) for the second arylation. Purification by flash column chromatography (SiO$_2$, 1:1 petrol/CH$_2$Cl$_2$ then 97:3 petrol/Et$_2$O) afforded isoquinoline **6j** as a white solid (99.0 mg, 0.292 mmol, 54%).

M.p. 178-181 °C; **^{1}H NMR** (400 MHz, CDCl$_3$) δ_H 9.30 (1 H, d, *J* = 0.6, *H*C(1)), 7.94 (1 H, dd, *J* = 7.9 and 0.8, *H*C(8)), 7.53-7.40 (5 H, m, 4 × *H*C$_{Ar}$ and HC(7)), 7.33-7.27 (2 H, m, 2 × *H*C$_{Ph}$), 7.09 (1 H, d, *J* = 8.6, *H*C$_{Ar}$), 2.00 (6 H, d, *J* = 2.8, 3 × C(C*H*$_2$R)), 1.95 (3 H, br. s, 3 × C*H*R$_3$), 1.68-1.61 (6 H, m, 3 × C*H*$_2$R$_2$); **^{13}C NMR** (100 MHz, CDCl$_3$) δ_C 157.5 (*C*(3)), 150.5 (H*C*(1)), 139.1, 137.7 (2 × *C*$_{Ar}$), 131.2 (*H*C$_{Ar}$), 129.7, (*C*$_{Ar}$), 129.5, 127.5, 127.3 (3 × H*C*$_{Ar}$), 126.7 (H*C*(8)), 126.1 (*C*$_{Ar}$), 126.0 (H*C*(7)), 125.6 (H*C*$_{Ar}$), 42.7 (C(*C*H$_2$R)$_3$), 42.2 (*C*R$_3$), 36.7 (*C*H$_2$R$_2$), 29.1 (*C*HR$_3$); **IR** ν_{max} (solid)/cm^{-1} 2900, 2847, 1618, 1557, 1497, 1451, 1371, 1308; **HRMS** (ESI$^+$) C$_{25}$H$_{26}$N requires 340.2060, found [M+H$^+$] 340.2057.

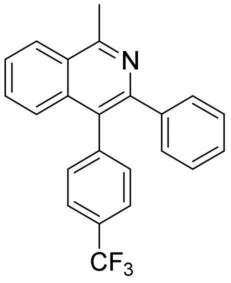
3-*iso*Butyl-4-(4-methoxyphenyl)-1-methylisoquinoline (6k)



Aryl bromide **S3** (115 mg, 0.473 mmol) was subjected to **General Procedure 5** using 4-methyl-2-pentanone (56.9 mg, 0.568 mmol) and 4-bromoanisole (148 μL, 1.18 mmol) for the second arylation. Purification by flash column chromatography (SiO$_2$, CH$_2$Cl$_2$ then 85:15 petrol/Et$_2$O) afforded isoquinoline **6k** as an oil (93.3 mg, 0.305 mmol, 65%).

^{1}H NMR (400 MHz, CDCl$_3$) δ$_H$ 8.15-8.09 (1 H, m, *H*C(8)), 7.55-7.48 (2 H, m, *H*C(6) and *H*C(7)), 7.43-7.37 (1 H, m, *H*C(5)), 7.21-7.15 (2 H, m, 2 × *meta*-OMe *H*C$_{Ar}$), 7.06-7.01 (2 H, m, 2 × *ortho*-OMe *H*C$_{Ar}$), 3.92 (3 H, s, OC*H*$_3$), 3.01 (3 H, s, C*H*$_3$), 2.60 (2 H, d, *J* = 7.3, C*H*$_2$), 2.30-2.18 (1 H, m, C*H*(CH$_3$)$_2$), 0.81 (6 H, d, *J* = 6.7, CH(C*H*$_3$)$_2$); **^{13}C NMR** (100 MHz, CDCl$_3$) δ$_C$ 158.7, 157.0, 151.0, 136.4 (4 × *C*$_{Ar}$), 131.8 (*meta*-OMe H*C*$_{Ar}$), 130.0 (*C*$_{Ar}$), 129.5 (H*C*$_{Ar}$), 129.3 (*C*$_{Ar}$), 126.0 (H*C*(5)), 125.6 (H*C*$_{Ar}$), 125.3 (H*C*(8)), 113.7 (*ortho*-OMe H*C*$_{Ar}$), 55.3 (O*C*H$_3$), 43.9 (*C*H$_2$), 28.9 (*C*H(CH$_3$)$_2$), 22.5 (*C*H$_3$), 22.5 (CH(*C*H$_3$)$_2$), one quaternary carbon not observed; **IR** ν$_{max}$ (film)/cm^{-1} 2954, 1611, 1563, 1514, 1463, 1391, 1286, 1244, 1175, 1036; **HRMS** (ESI$^+$) C$_{21}$H$_{24}$NO requires 306.1852, found [M+H$^+$] 306.1859.

1-Methyl-3-phenyl-4-(4-(trifluoromethyl)phenyl)isoquinoline (6l)

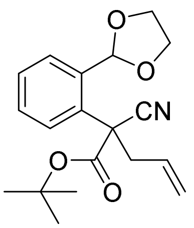


Aryl bromide **S3** (115 mg, 0.473 mmol) was subjected to **General Procedure 5** using acetophenone (68.2 mg, 0.568 mmol) and 4-bromobenzotrifluoride (163 μL, 1.18 mmol) for the second arylation. Purification by flash column chromatography (SiO$_2$, 3:7 petrol/CH$_2$Cl$_2$ then 9:1 petrol/Et$_2$O) afforded isoquinoline **6l** as a pale yellow solid (98.6 mg, 0.270 mmol, 57%).

M.p. 139-140 °C; **^{1}H NMR** (400 MHz, CDCl$_3$) δ$_H$ 8.27-8.21 (1 H, m, *H*C(8)), 7.68-7.61 (4 H, m, 3 × *H*C$_{Ar}$ and *H*C(7)), 7.61-7.55 (1 H, m, *H*C$_{Ar}$), 7.38 (2 H, dd, *J* = 8.6 and 0.7, 2 × *H*C$_{Ar}$), 7.36-7.31 (2 H, m, 2 × *H*C$_{Ar}$), 7.26-7.19 (3 H, m, 3 × *H*C$_{Ar}$), 3.11 (3 H, s, C*H*$_3$); **^{13}C NMR** (100 MHz, CDCl$_3$) δ$_C$ 158.5 (*C*(3)), 149.6 (*C*(1)), 141.7, 140.5, 135.5 (3 × *C*$_{Ar}$), 131.8, 130.3, 130.2 (3 × H*C*$_{Ar}$), 129.3 (q, ^2J = 32.3, *C*$_{Ar}$), 127.8 (H*C*$_{Ar}$), 127.7 (*C*$_{Ar}$), 127.3, 126.8 (2 × H*C*$_{Ar}$), 126.1 (*C*$_{Ar}$), 125.7 (H*C*(8)), 125.6 (H*C*$_{Ar}$), 125.2 (q, ^3J = 3.1, H*C*$_{Ar}$), 124.2 (q, ^1J = 271.5, *C*F$_3$), 22.8 (*C*H$_3$); **^{19}F NMR** (377 MHz, CDCl$_3$) δ$_F$ –62.4 (C*F*$_3$);

IR ν_{max} (solid)/cm^{-1} 1615, 1570, 1553, 1502, 1391, 1322, 1167, 1109, 1064, 1018; **HRMS** (ESI$^+$) $C_{23}H_{17}F_3N$ requires 364.1308, found [M+H$^+$] 364.1314.

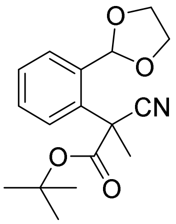
tert-Butyl 2-(2-(1,3-dioxolan-2-yl)phenyl)-2-cyanopent-4-enoate (7a)



Aryl bromide **1** (127 mg, 0.554 mmol) was subjected to **General Procedure 6** using allyl bromide (47.9 µL, 0.554 mmol). Purification by flash column chromatography (SiO_2, 9:1 petrol/EtOAc) afforded nitrile **7a** as a white solid (128 mg, 0.389 mmol, 84%).

M.p. 43-46 °C; ^{1}**H NMR** (400 MHz, $CDCl_3$) δ_H 7.73 (1 H, d, *J* = 9.4, HC_{Ar}), 7.49 (1 H, s, HC_{Ar}), 7.46-7.38 (2 H, m, 2 × HC_{Ar}), 6.21 (1 H, s, $CH(OR)_2$), 5.88-5.74 (1 H, m, $HC{=}CH_2$), 5.28 (1 H, dd, *J* = 17.0 and 1.5, $HC{=}CH_aH_b$), 5.24-5.20 (1 H, m, $HC{=}CH_aH_b$), 4.23-3.96 (4 H, m, OCH_2CH_2O), 3.22-3.12 (1 H, m, CH_aH_b), 3.12-3.02 (1 H, m, CH_aH_b), 1.46 (9 H, s, 3 × CH_3); ^{13}**C NMR** (100 MHz, $CDCl_3$) δ_C 166.5 ($C{=}O$), 135.9, 132.7 (2 × C_{Ar}), 130.9 ($HC{=}CH_2$), 129.5, 128.9, 128.6, 127.5 (4 × HC_{Ar}), 120.8 ($HC{=}CH_2$), 118.6 ($C{\equiv}N$), 99.5 ($CH(OR)_2$), 84.6 ($OC(CH_3)_3$), 65.3 (OCH_2CH_2O), 65.1 (OCH_2CH_2O), 53.1 ($C(CN)R_2$), 41.6 (CH_2), 27.5 (CH_3); **IR** ν_{max} (solid)/cm^{-1} 2982, 2890, 1736, 1453, 1370, 1250, 1146, 1121, 1068; **HRMS** (ESI$^+$) $C_{19}H_{23}N_2NaO_4$ requires 352.1519, found [M+Na$^+$] 352.1506.

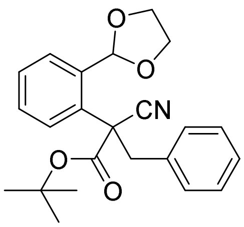
tert-Butyl 2-(2-(1,3-dioxolan-2-yl)phenyl)-2-cyanopropanoate (7b)



Aryl bromide **1** (137 mg, 0.598 mmol) was subjected to **General Procedure 6** using iodomethane (46.6 µL, 0.748 mmol). Purification by flash column chromatography (SiO_2, 85:15 petrol/EtOAc) afforded nitrile **7b** as a white solid (129 mg, 0.425 mmol, 85%).

M.p. 111-113 °C; ^{1}**H NMR** (400 MHz, $CDCl_3$) δ_H 7.76-7.68 (1 H, m, HC_{Ar}), 7.52-7.38 (3 H, m, 3 × $H(C_{Ar})$), 6.21 (1 H, s, $CH(OR)_2$), 4.21-4.12 (1 H, m, $OCH_aH_bCH_aH_bO$), 4.10-3.97 (3 H, m, $OCH_aH_bCH_aH_bO$), 2.06 (3 H, s, CH_3), 1.48 (9 H, s, 3 × CH_3); ^{13}**C NMR** (100 MHz, $CDCl_3$) δ_C 167.6 ($C{=}O$), 135.9, 133.9 (2 × C_{Ar}), 129.6, 128.9, 128.5, 126.8 (4 × HC_{Ar}), 120.0 ($C{\equiv}N$), 100.1 ($CH(OR)_2$), 84.1 ($OC(CH_3)_3$), 65.1 (OCH_2CH_2O), 65.0 (OCH_2CH_2O), 47.6 ($C(CN)R_2$), 27.5 (CH_3), 25.3 (CH_3); **IR** ν_{max} (solid)/cm^{-1} 2980, 2889, 1737, 1458, 1370, 1252, 1142, 1075; **HRMS** (ESI$^+$) $C_{17}H_{21}NNaO_4$ requires 326.1363, found [M+Na$^+$] 326.1358.

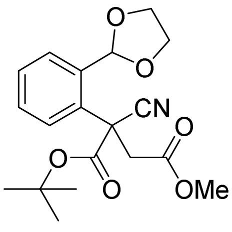
tert-Butyl 2-(2-(1,3-dioxolan-2-yl)phenyl)-2-cyano-3-phenylpropanoate (7c)



Aryl bromide **1** (163 mg, 0.712 mmol) was subjected to **General Procedure 6** using benzyl bromide (212 µL, 1.78 mmol). Purification by flash column chromatography (SiO_2, 9:1 petrol/EtOAc) afforded nitrile **7c** as a viscous oil (205 mg, 0.540 mmol, 91%).

^{1}H NMR (400 MHz, $CDCl_3$) δ_H 7.70-7.63 (1 H, m, HC_{Ar})), 7.32 (1 H, s, HC_{Ar}), 7.21-7.04 (5 H, m, 2 × HC_{Ar} and 3 × HC_{Ph}), 6.97 (2 H, dd, J = 7.8 and 1.7, HC_{Ar}), 5.98 (1 H, s, $CH(OR)_2$), 4.22-4.11 (2 H, m, $OCH_aH_bCH_aH_bO$), 4.02-3.87 (2 H, m, $OCH_aH_bCH_aH_bO$), 3.63 (1 H, d, J = 13.6, CH_aH_bPh), 3.47 (1 H, d, J = 13.6, CH_aH_bPh), 1.35 (9 H, s, 3 × CH_3); **^{13}C NMR** (100 MHz, $CDCl_3$) δ_C 168.6 (C=O), 135.1, 134.0, 133.0 (3 × C_{Ar}), 130.5 (HC_{Ph}), 129.5, 128.8, 128.7, 128.4 (4 × HC_{Ar}), 128.0 (HC_{Ph}), 127.4 (HC_{Ph}), 118.5 (C≡N), 99.3 ($CH(OR)_2$), 84.9 ($OC(CH_3)_3$, 65.4 (OCH_2CH_2O), 65.3 (OCH_2CH_2O), 55.7 ($C(CN)R_2$), 43.0 (CH_2Ph), 27.3 (CH_3); **IR** ν_{max} (film)/cm^{-1} 2981, 1736, 1455, 1370, 1251, 1149, 1123, 1068; **HRMS** (ESI$^+$) $C_{23}H_{25}NNaO_4$ requires 402.1676, found [M+Na$^+$] 402.1671.

1-*tert*-Butyl 4-methyl 2-(2-(1,3-dioxolan-2-yl)phenyl)-2-cyanosuccinate (7d)

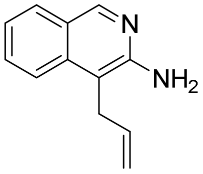


Aryl bromide **1** (256 mg, 1.12 mmol) was subjected to **General Procedure 6** using methyl bromoacetate (441 µL, 4.66 mmol). Purification by flash column chromatography (SiO_2, 85:15 petrol/EtOAc) afforded nitrile **7d** as a viscous oil (293 mg, 0.811 mmol, 87%).

^{1}H NMR (400 MHz, $CDCl_3$) δ_H 7.74-7.66 (1 H, m HC_{Ar}), 7.41-7.25 (3 H, m, 3 × HC_{Ar}), 6.32 (1 H, s, $CH(OR)_2$), 4.12-4.04 (2 H, m, $OCH_aH_bCH_aH_bO$), 4.01-3.93 (2 H, m, $OCH_aH_bCH_aH_bO$), 3.64 (3 H, s, OCH_3), 3.42-3.25 (2 H, m, CH_2), 1.44 (9 H, s, 3 × CH_3); **^{13}C NMR** (100 MHz, $CDCl_3$) δ_C 169.1, 165.8 (2 × C=O), 135.8, 132.3 (2 × C_{Ar}), 129.7, 129.1, 128.7, 127.3 (4 × HC_{Ar}), 118.5 (C≡N), 99.2 ($CH(OR)_2$), 85.2 ($OC(CH_3)_3$), 65.2 (OCH_2CH_2O), 65.2 (OCH_2CH_2O), 52.1 (OCH_3), 50.3 ($C(CN)R_2$), 42.1 (CH_2), 27.4 (CH_3);

IR ν_{max} (film)/cm^{-1} 2981, 1738, 1438, 1370, 1255, 1207, 1149, 1125, 1071; **HRMS** (ESI$^+$) $C_{19}H_{23}NNaO_6$ requires 384.1418, found [M+Na$^+$] 384.1010.

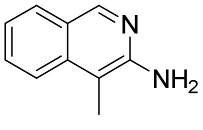
4-Allylisoquinolin-3-amine (8a)



Nitrile **7a** (49.0 mg, 0.149 mmol) was subjected to **General Procedure 7** followed by purification by flash column chromatography (SiO_2, 85:15 petrol/EtOAc) to afford 3-amino isoquinoline **8a** as an orange solid (25.9 mg, 0.141 mmol, 95%). Despite multiple attempts at purification by chromatography we were unable to remove small impurities in the 0-2 ppm range (^{1}H NMR).

M.p. 59-61 °C; **^{1}H NMR** (400 MHz, $CDCl_3$) δ_H 8.83 (1 H, s, *H*C(1)), 7.81 (1 H, d, *J* = 8.1, *H*C(8)), 7.76 (1 H, d, *J* = 8.7, *H*C(5)), 7.59-7.55 (1 H, m, *H*C(6)), 7.34-7.22 (1 H, m, *H*C(7)), 6.04-5.89 (1 H, m, *H*C=CH_2), 5.12 (1 H, dd, *J* = 10.1 and 1.6, HC=CH_aH_b), 5.04 (1 H, dd, *J* = 17.1 and 1.7, HC=CH_aH_b), 4.50 (2 H, br. s, NH_2), 3.66-3.54 (2 H, m, CH_2); **^{13}C NMR** (100 MHz, $CDCl_3$) δ_C 152.7 (*C*(3)), 150.2 (H*C*(1)), 137.0 (C_{Ar}), 134.1 (H*C*=CH_2), 130.4 (H*C*(6)), 128.4 (H*C*(8)), 124.3 (C_{Ar}), 122.6 (H*C*(7)), 121.2 (H*C*(5)), 116.1 (HC=*C*H_2), 106.4 (*C*(4)), 30.2 (*C*H_2); **IR** ν_{max} (solid)/cm^{-1} 3449, 3360, 3192, 2918, 1620, 1582, 1499, 1455, 1378, 1257, 1139; **HRMS** (ESI$^+$) $C_{12}H_{13}N_2$ requires 185.1073, found [M+H$^+$] 185.1074.

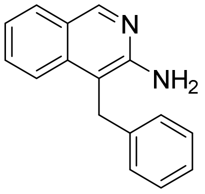
4-Methylisoquinolin-3-amine (8b)



Nitrile **7b** (50.9 mg, 0.168 mmol) was subjected to **General Procedure 7** followed by purification by flash column chromatography (SiO_2, 8:2 petrol/EtOAc) to afford 3-amino isoquinoline **8b** as a pale yellow solid (25.8 mg, 0.158 mmol, 94%).

M.p. 110-113 °C (lit. 118-119 °C); **^{1}H NMR** (400 MHz, $CDCl_3$) δ_H 8.69 (1 H, s, *H*C(1)), 7.74-7.65 (2 H, m, *H*C(5) and *H*C(8)), 7.47 (1 H, m, *H*C(6)), 7.24-7.13 (1 H, m, *H*C(7)), 4.37 (2 H, br. s, NH_2), 2.28 (3 H, s, CH_3); **^{13}C NMR** (100 MHz, $CDCl_3$) δ_C 152.3 (*C*(3)), 149.3 (H*C*(1)), 137.1 (C_{Ar}), 130.1 (H*C*(6)), 128.3 (H*C*(8)), 124.1 (C_{Ar}), 122.4 (H*C*(7)), 121.4 (H*C*(5)), 104.9 (*C*(4)), 11.4 (*C*H_3)). Spectroscopic data were consistent with those previously reported.[10]

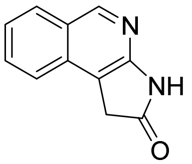
4-Benzylisoquinolin-3-amine (8c)



Nitrile **7c** (50.8 mg, 0.134 mmol) was subjected to **General Procedure 7** followed by purification by flash column chromatography (SiO_2, 85:15 petrol/EtOAc) to afford 3-amino isoquinoline **8c** as a cream solid (22.7 mg, 0.0982 mmol, 73%).

M.p. 125-127 °C (lit. 112-120 °C, orange solid); **^{1}H NMR** (400 MHz, $CDCl_3$) δ_H 8.78 (1 H, s, *H*C(1)), 7.76 (1 H, d, *J* = 8.1, *H*C(8), 7.72 (1 H, d, *J* = 8.7, *H*C(5)), 7.47 (1 H, ddd, *J* = 8.5, 6.9 and 1.3, *H*C(6)), 7.25-7.00 (6 H, m, *H*C(7) and 5 × HC_{Ph}), 4.31 (2 H, br. s, NH_2), 4.17 (2 H, s, CH_2); **^{13}C NMR** (100 MHz, $CDCl_3$) δ_C 152.9 (*C*(3)), 150.6 (H*C*(1)), 138.5, 137.5 (2 × C_{Ar}), 130.7 (H*C*(6)), 128.8 (HC_{Ph}), 128.5 (H*C*(8)), 128.0, 126.5 (2 × HC_{Ph}), 124.3 (C_{Ar}), 122.6 (H*C*(7)), 121.4 (H*C*(5)), 107.6 (*C*(4)), 31.6 (CH_2). Spectroscopic data were consistent with those previously reported.[11]

1H-Pyrrolo[2,3-c]isoquinolin-2(3H)-one (8d)



Nitrile **7d** (88.2 mg, 0.244 mmol) was subjected to **General Procedure 7** followed by purification by flash column chromatography (SiO_2, EtOAc) to afford isoquinoline **8d** as a cream solid (28.8 mg, 0.157 mmol, 65%).

M.p. 235-240 °C; **^{1}H NMR** (500 MHz, $CDCl_3$) δ_H 8.98 (1 H, s, (*H*C(1)), 8.89 (1 H, br. s, N*H*), 7.95 (1 H, d, *J* = 8.4, *H*C(8)), 7.73-7.66 (1 H, m, *H*C(6)), 7.64 (1 H, d, *J* = 8.1, *H*C(5)), 7.45 (1 H, ddd, *J* = 8.2, 6.8 and 1.1, *H*C(7)), 3.85 (2 H, s, CH_2); **^{13}C NMR** (125 MHz, $CDCl_3$) δ_C 175.5 (*C*=O), 152.2 (*C*(2)), 151.1 (H*C*(1)), 133.5 (*C*(8)), 131.7 (H*C*(6)), 129.0 (H*C*(8)), 126.0 (*C*(5)), 124.8 (H*C*(7)), 121.7 (*C*(9)), 110.5 (*C*(4)), 34.8 (CH_2); **IR** ν_{max} (solid)/cm^{-1} 2970, 1751, 1722, 1630, 1566, 1524, 1442, 1367, 1260, 1229, 1143, 1089; **HRMS** (FI$^+$) $C_{11}H_8N_2O$ requires 184.0637, found [M$^+$] 184.0638.

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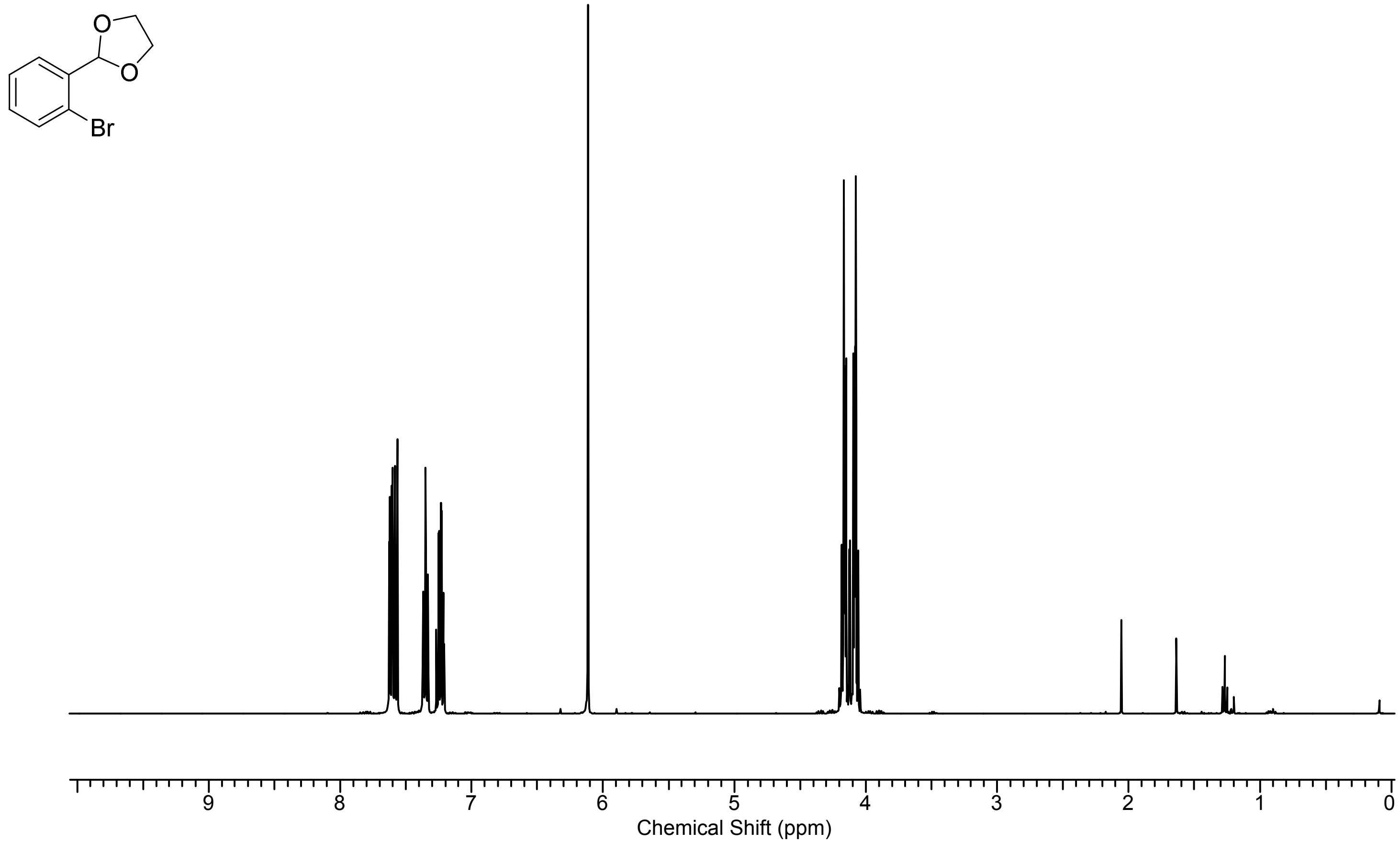
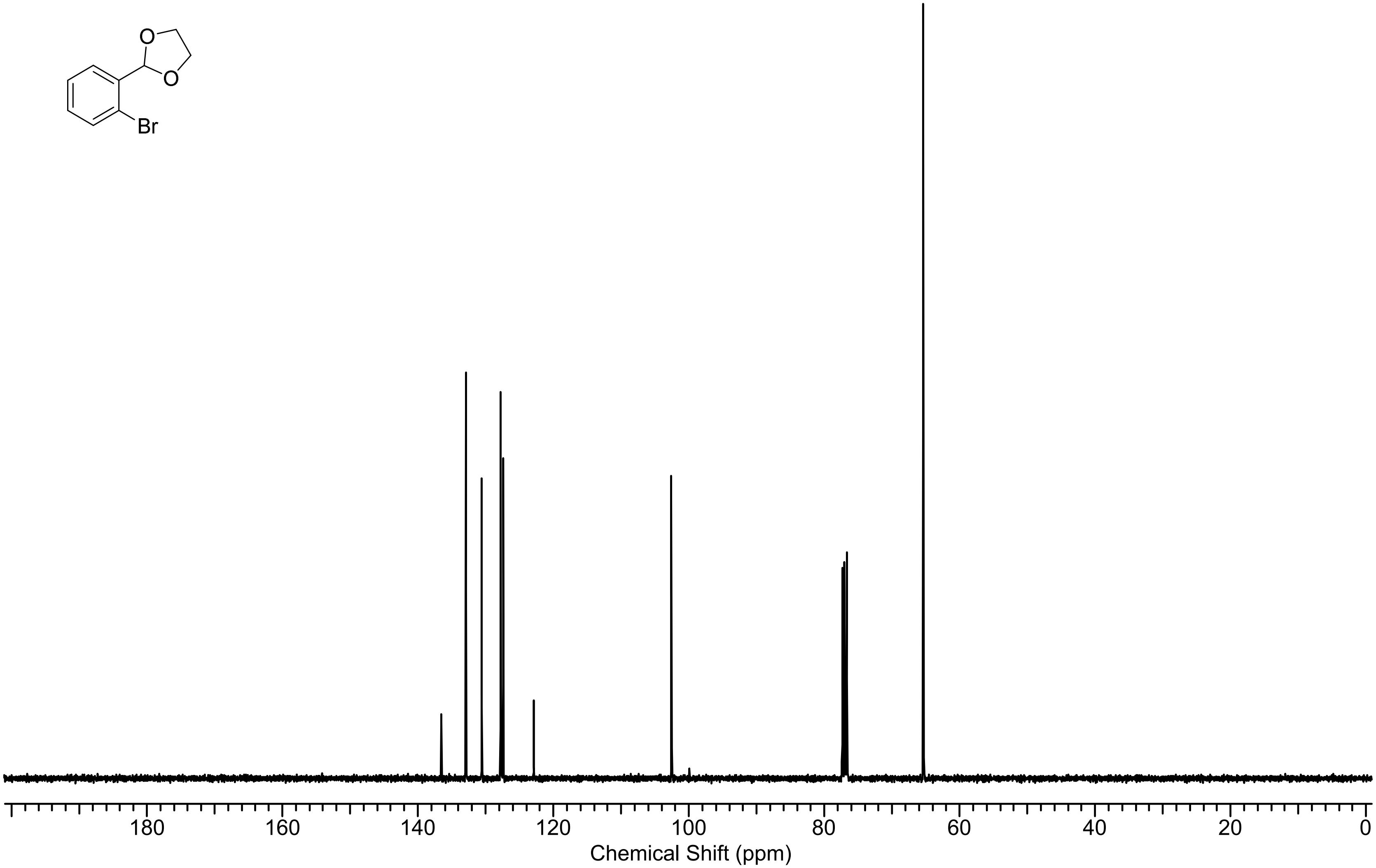
^{1}H NMR and ^{13}C NMR Spectra of Compounds

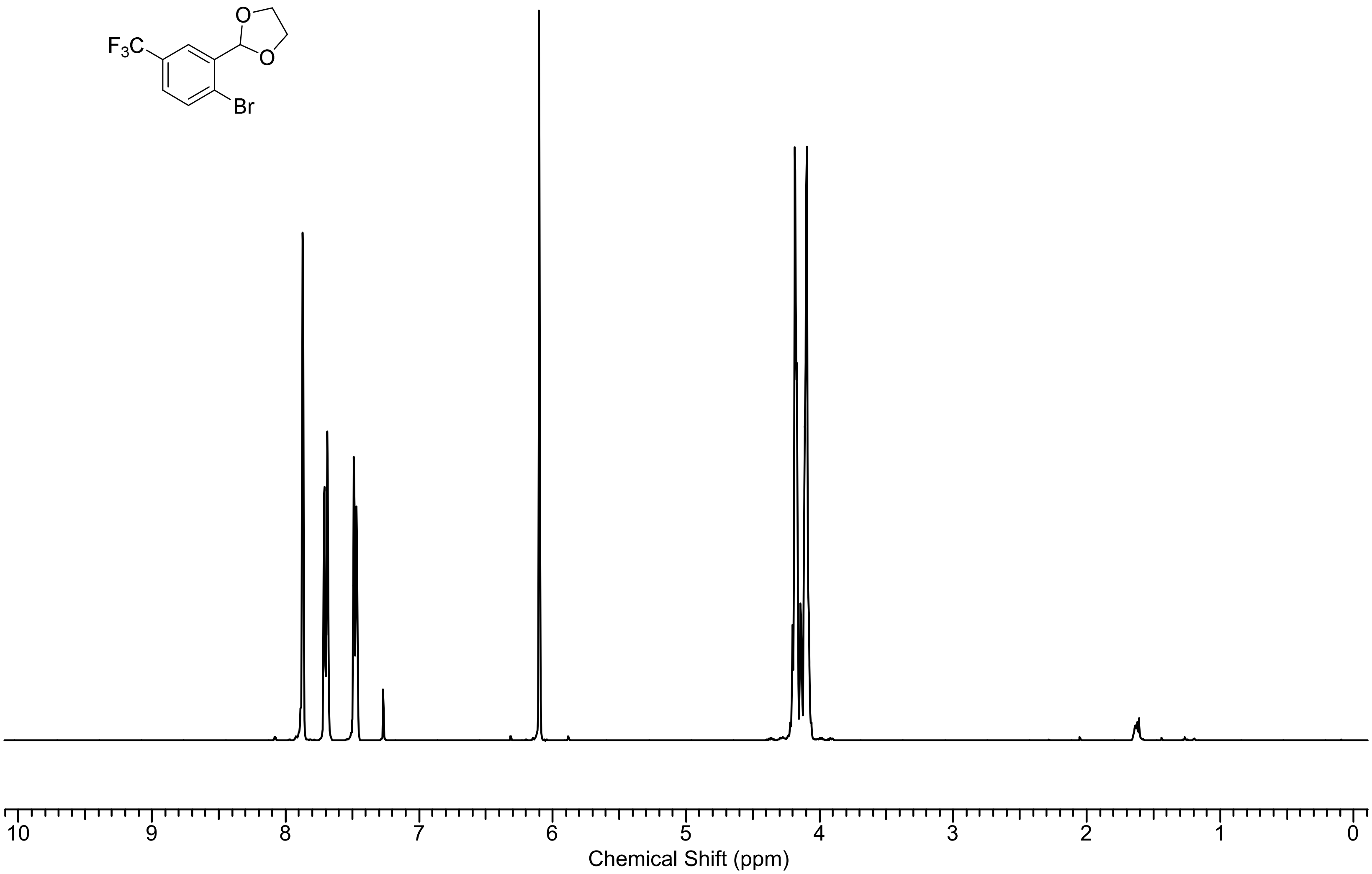
2-(2-Bromophenyl)-1,3-dioxolane **(1)**



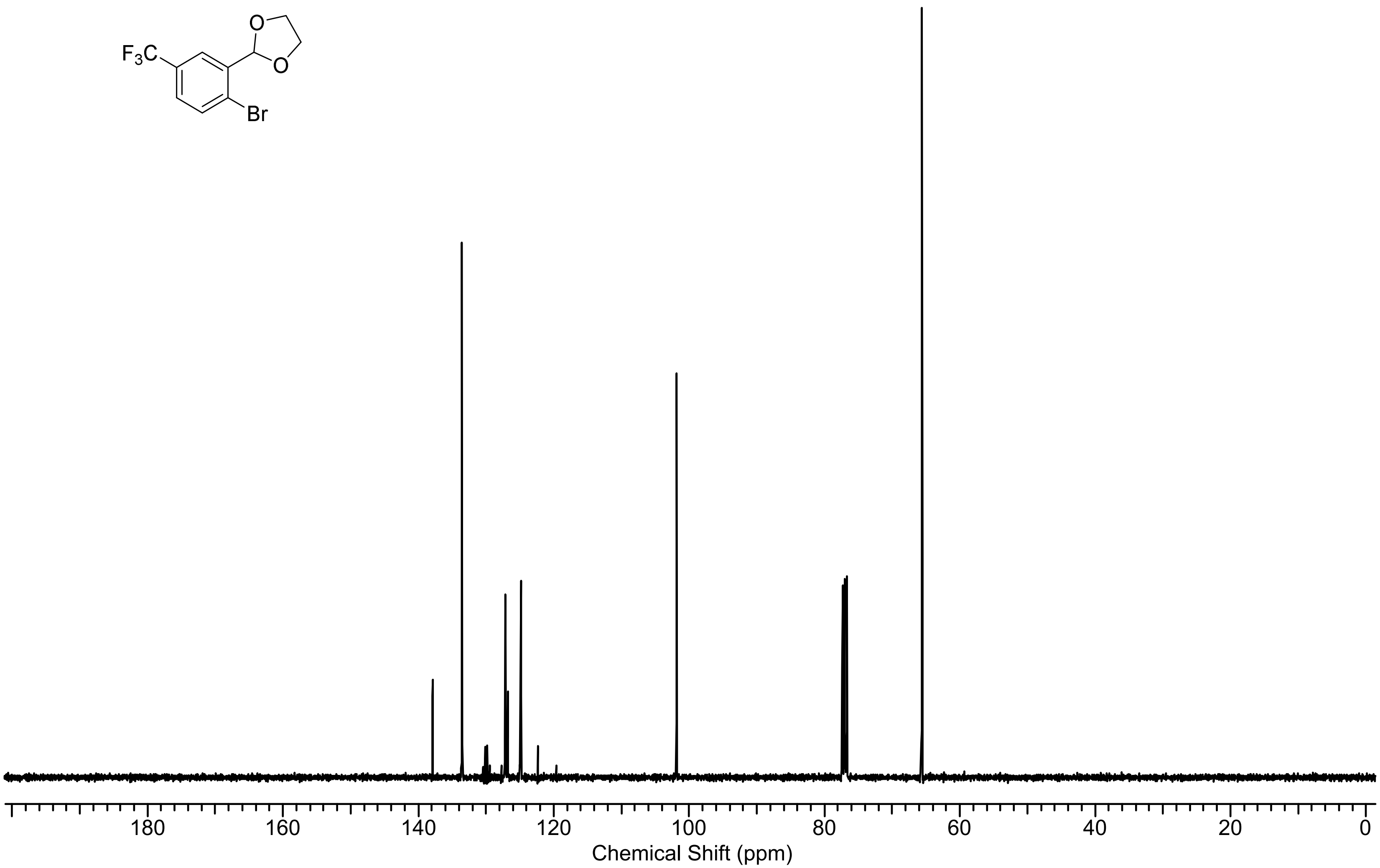
2-(2-Bromophenyl)-1,3-dioxolane **(1)**



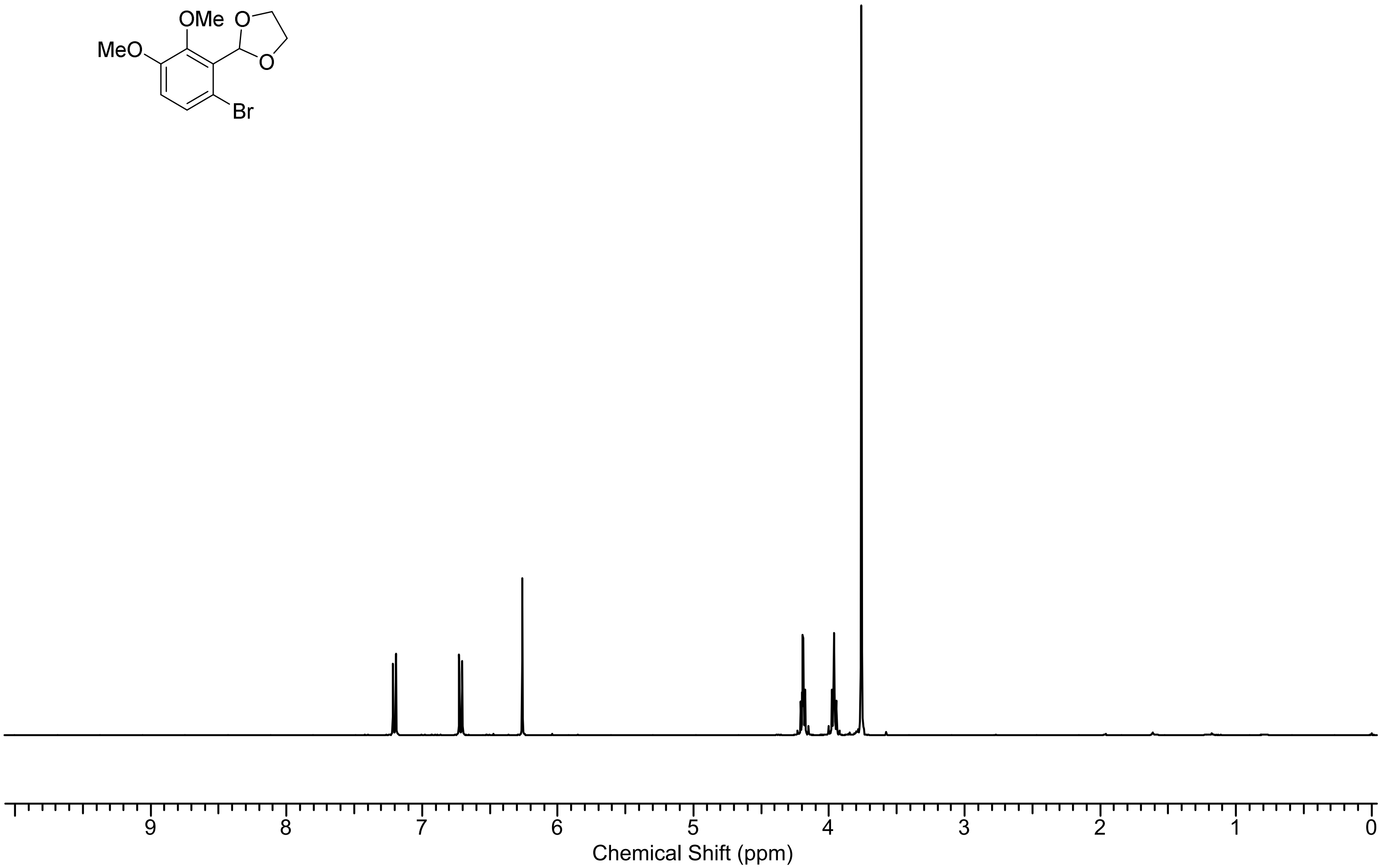
2-(2-Bromo-5-(trifluoromethyl)phenyl)-1,3-dioxolane **(S1)**



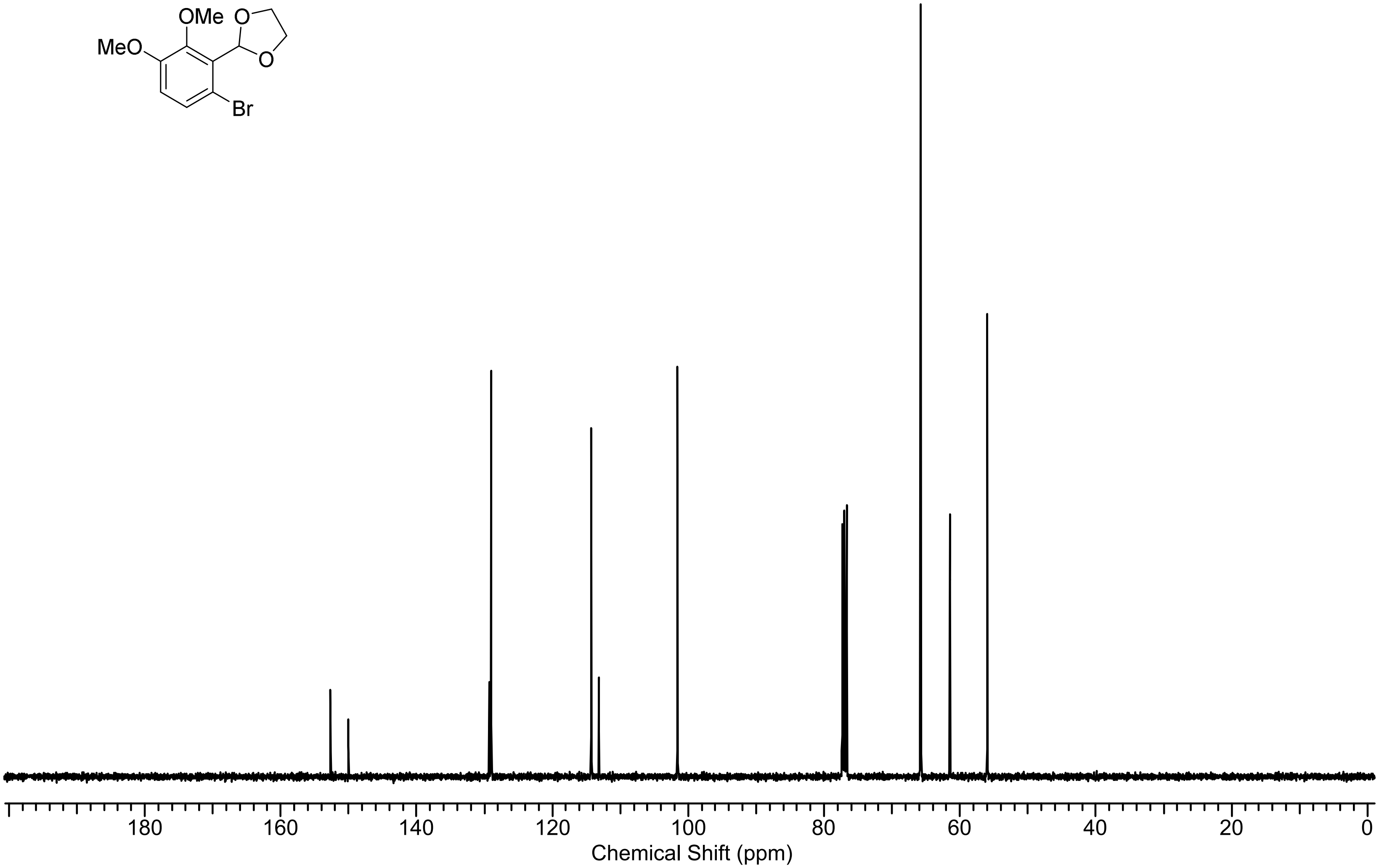
2-(2-Bromo-5-(trifluoromethyl)phenyl)-1,3-dioxolane **(S1)**



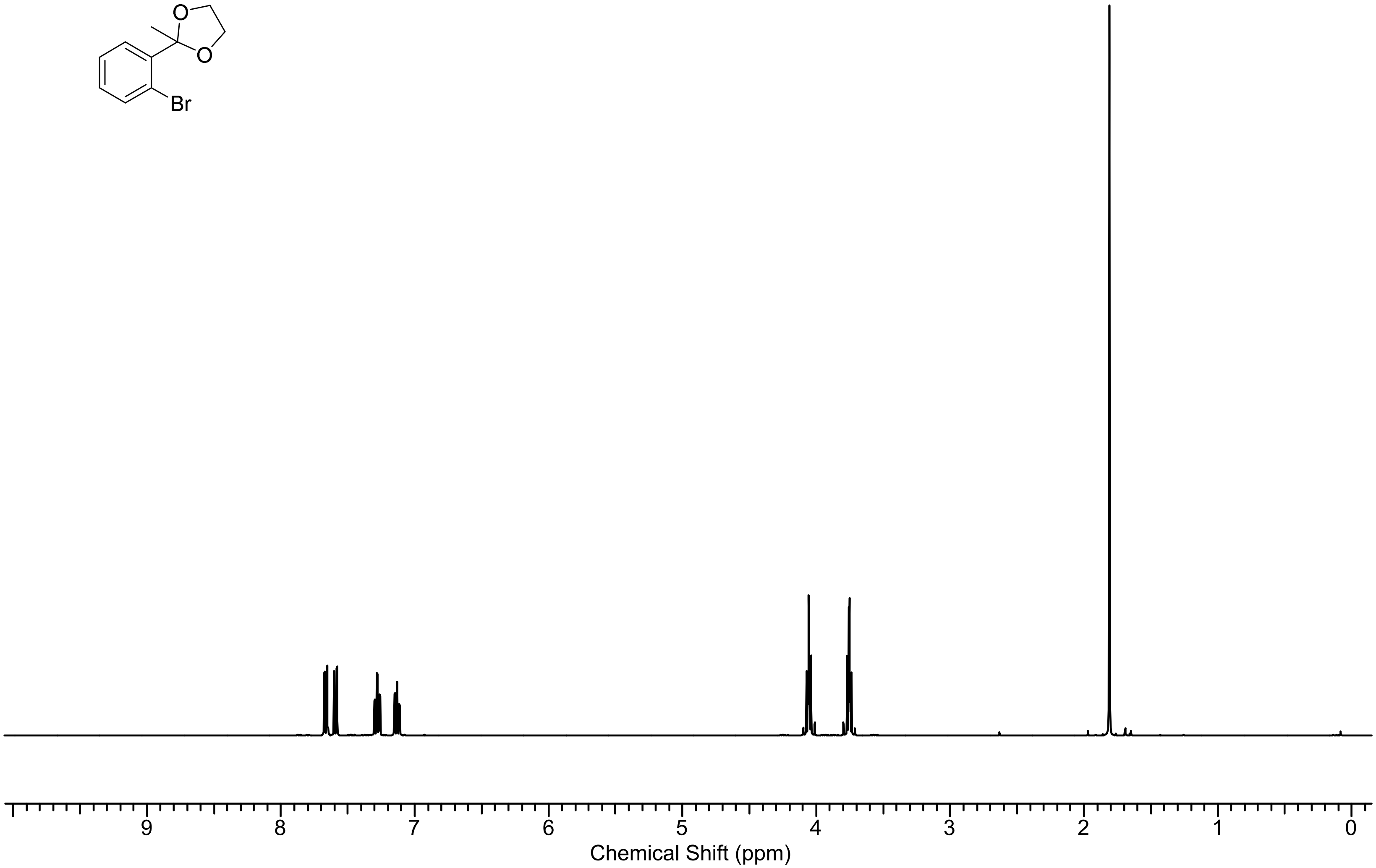
2-(6-Bromo-2,3-dimethoxyphenyl)-1,3-dioxolane **(S2)**



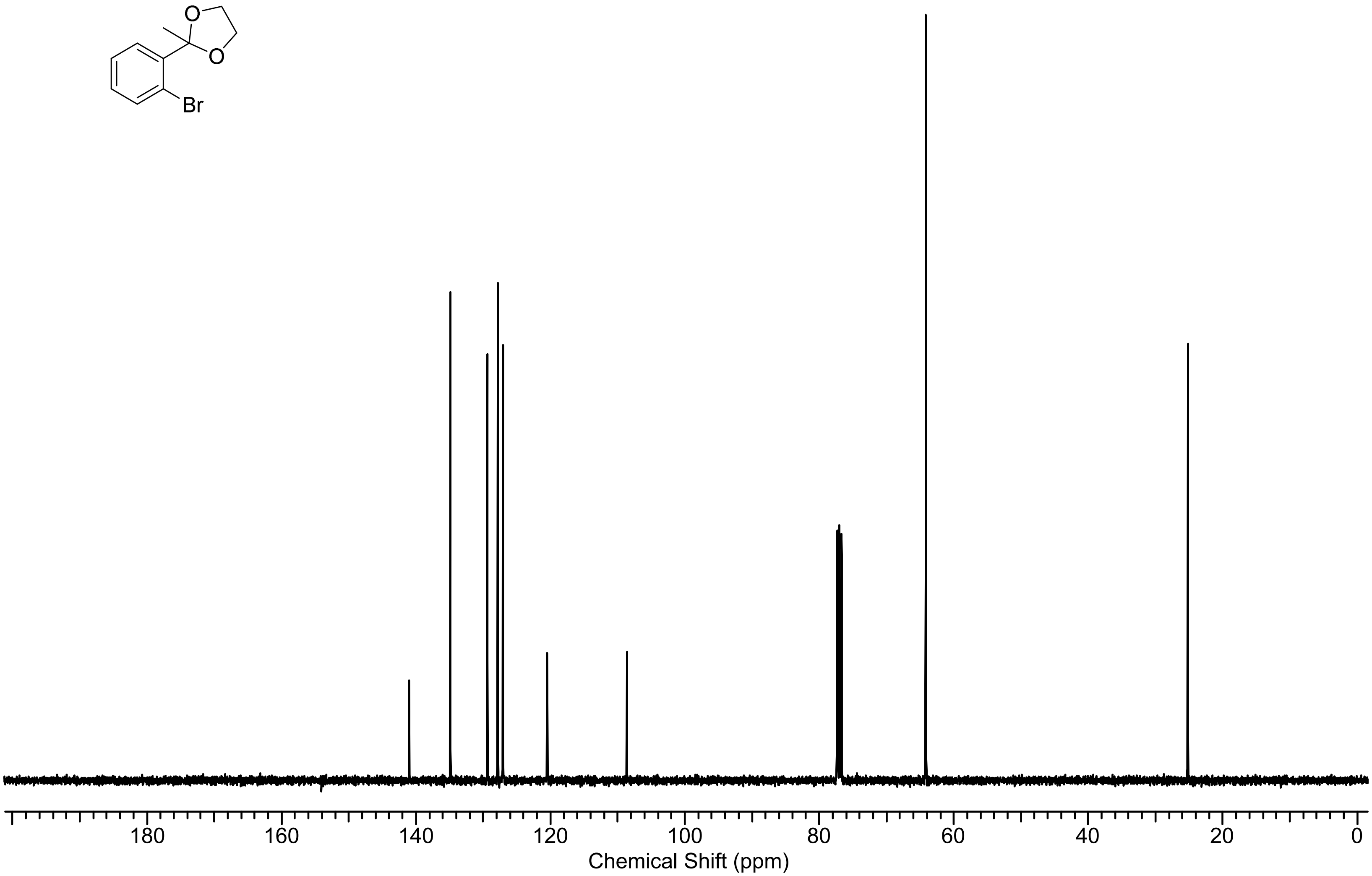
2-(6-Bromo-2,3-dimethoxyphenyl)-1,3-dioxolane **(S2)**



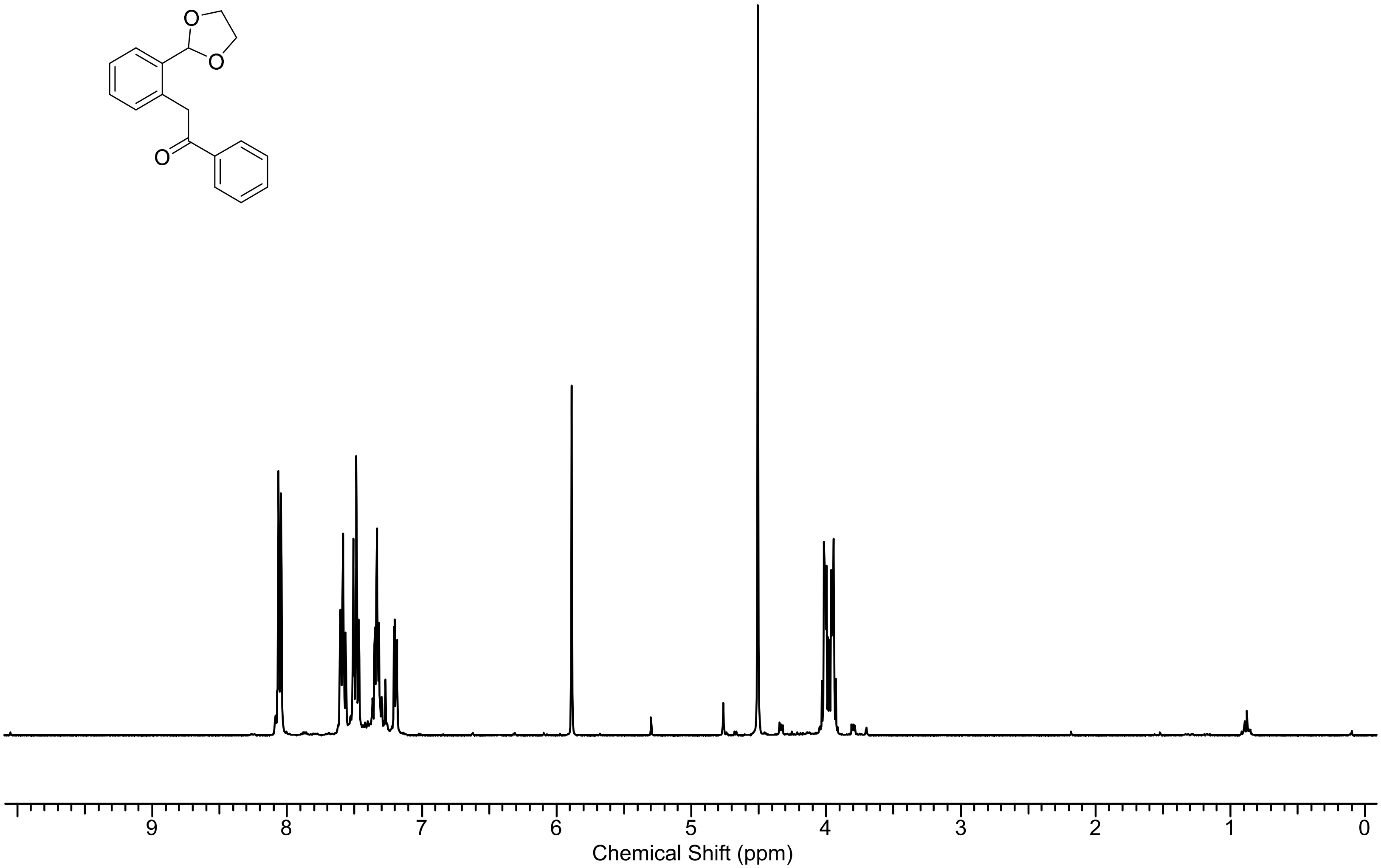
2-(2-Bromophenyl)-2-methyl-1,3-dioxolane **(S3)**



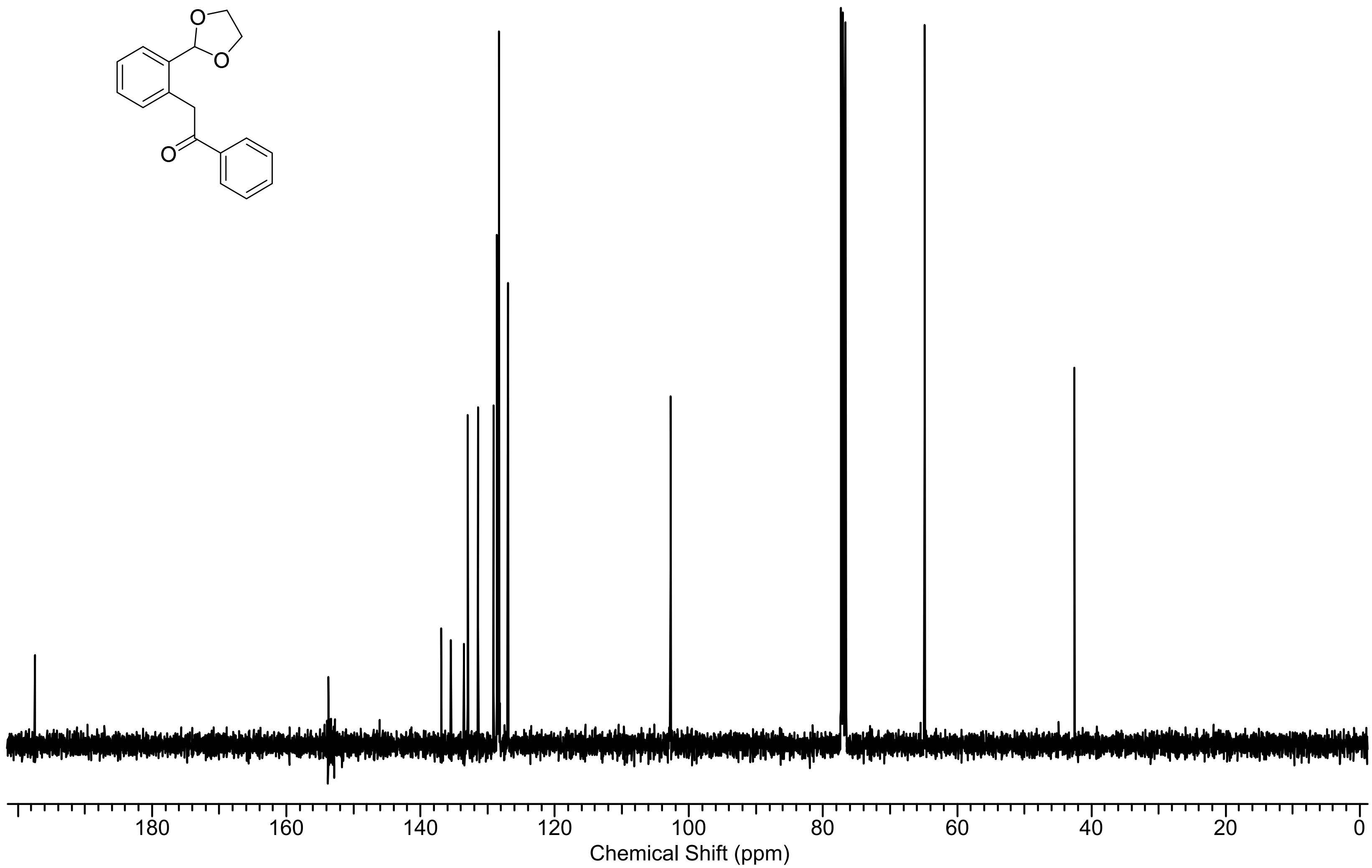
2-(2-Bromophenyl)-2-methyl-1,3-dioxolane **(S3)**



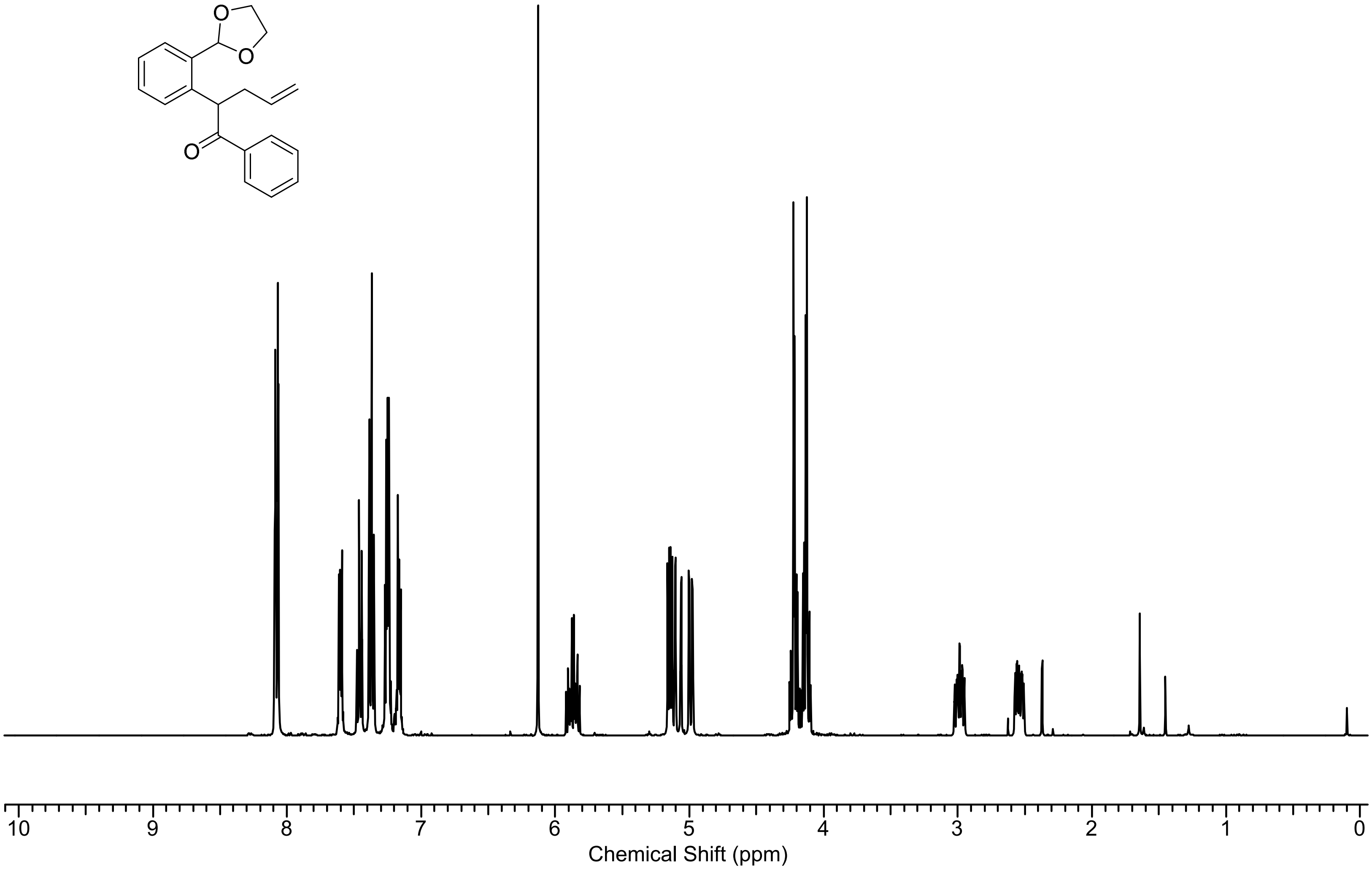
2-(2-(1,3-Dioxolan-2-yl)phenyl)-1-phenylethan-1-one **(2)**



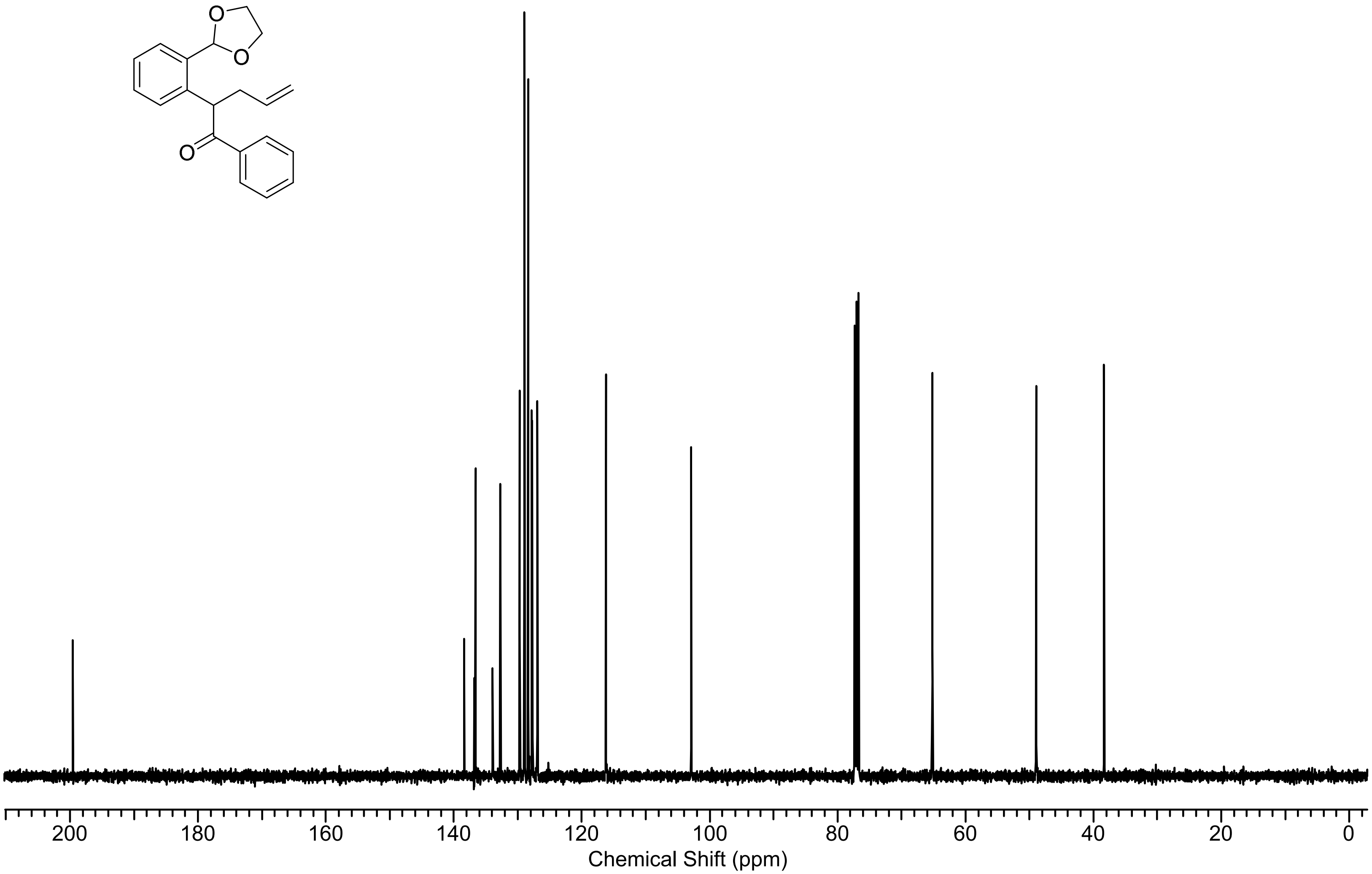
2-(2-(1,3-Dioxolan-2-yl)phenyl)-1-phenylethan-1-one **(2)**



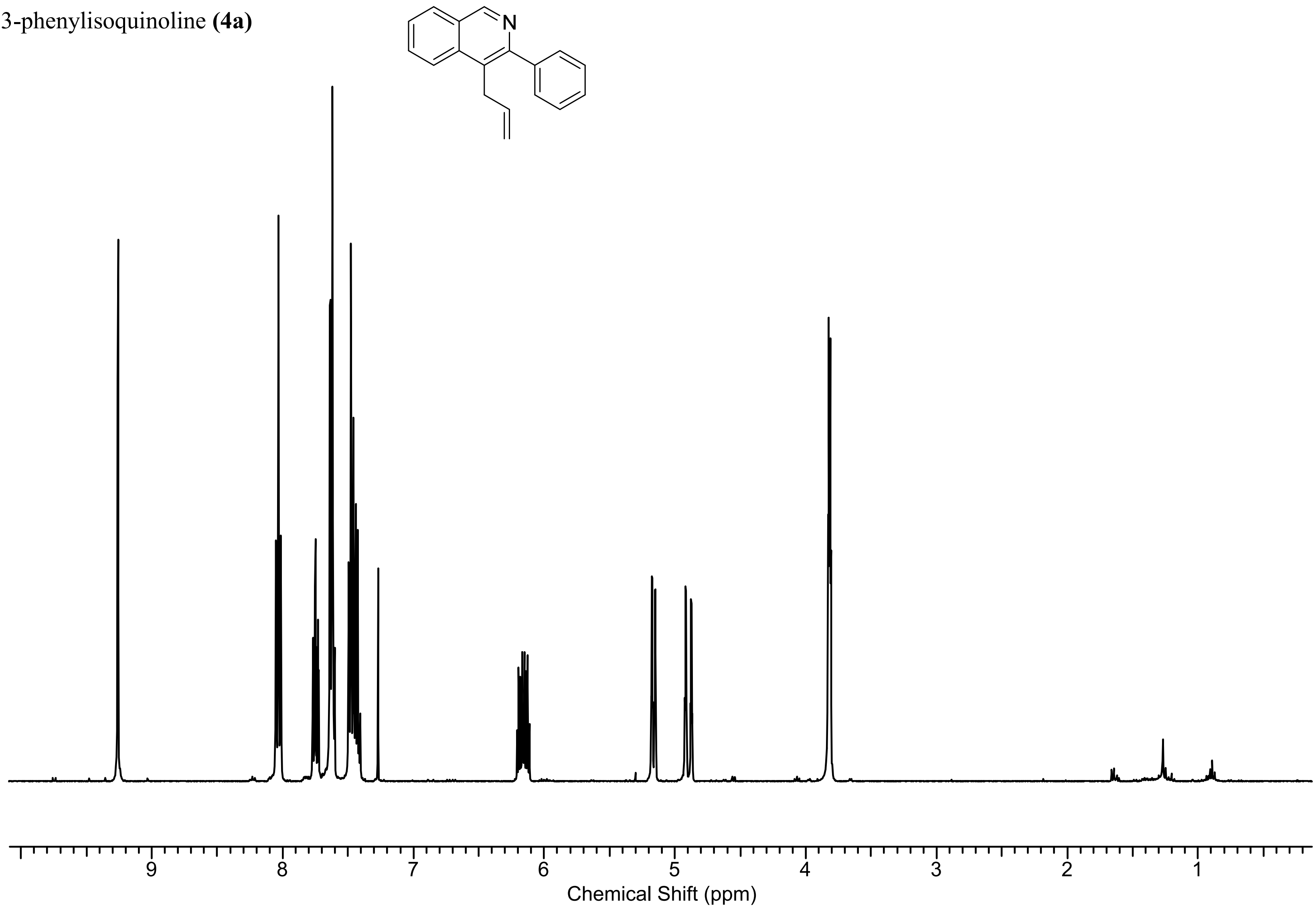
2-(2-(1,3-Dioxolan-2-yl)phenyl)-1-phenylpent-4-en-1-one **(3)**



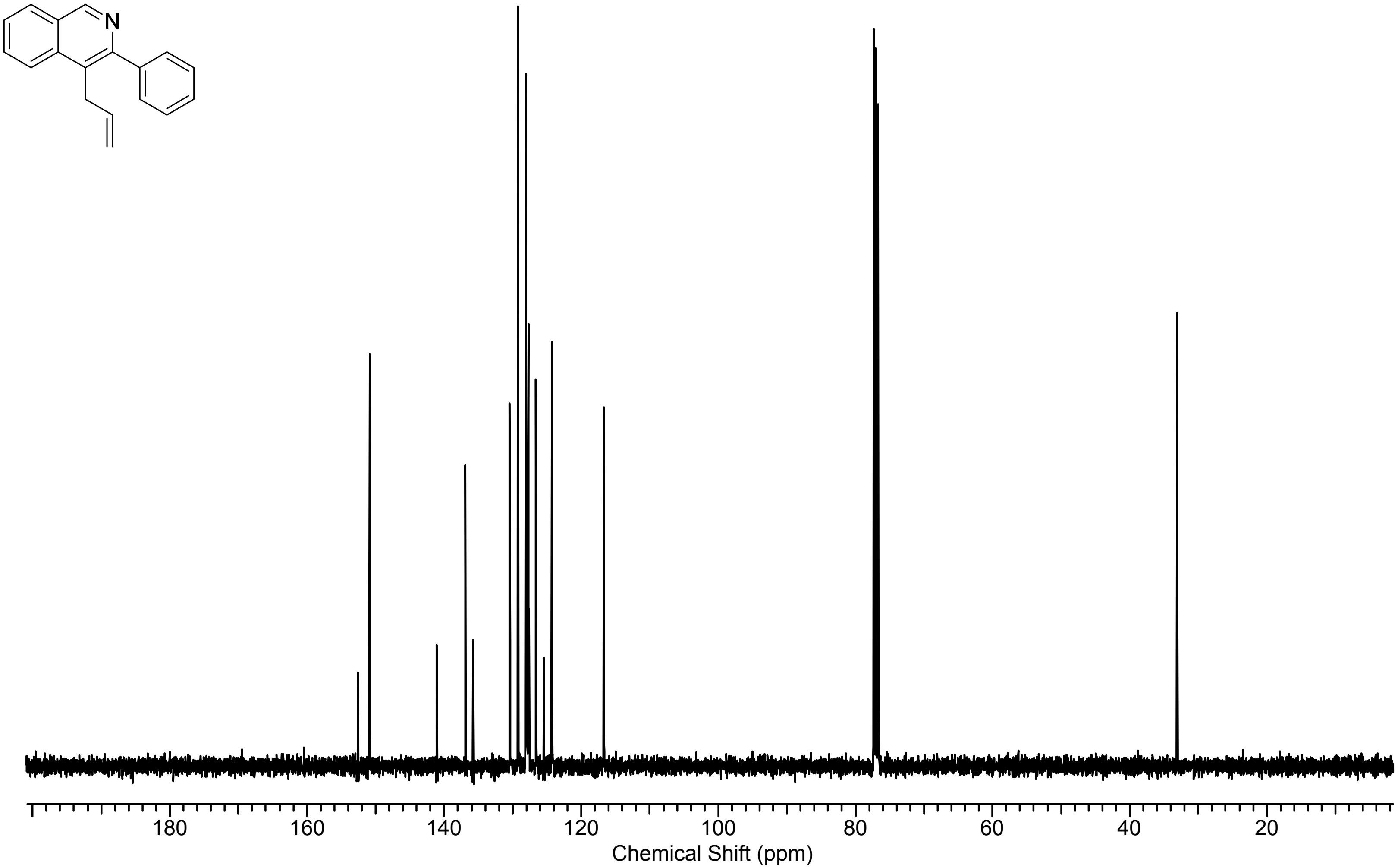
2-(2-(1,3-Dioxolan-2-yl)phenyl)-1-phenylpent-4-en-1-one **(3)**



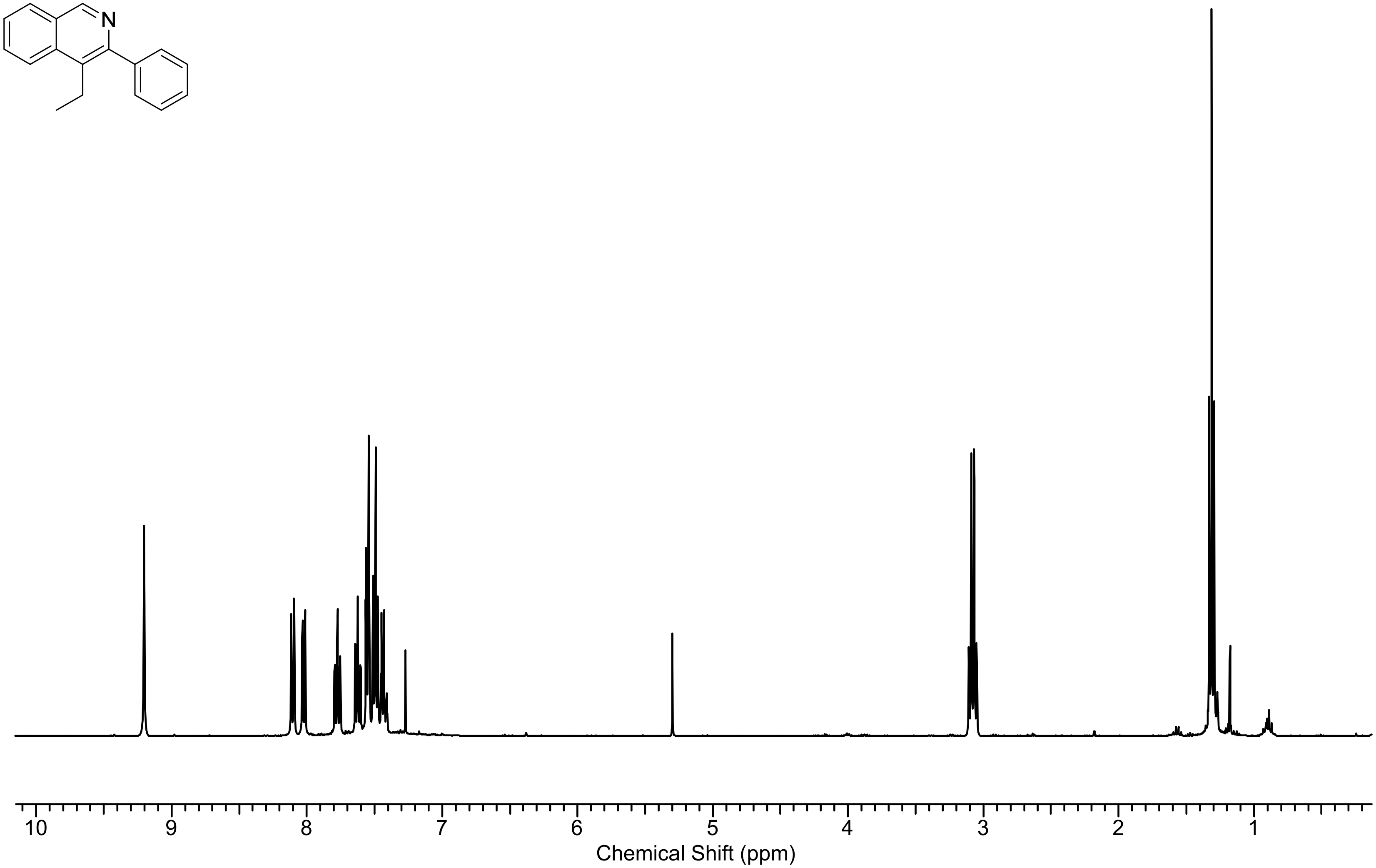
4-Allyl-3-phenylisoquinoline **(4a)**



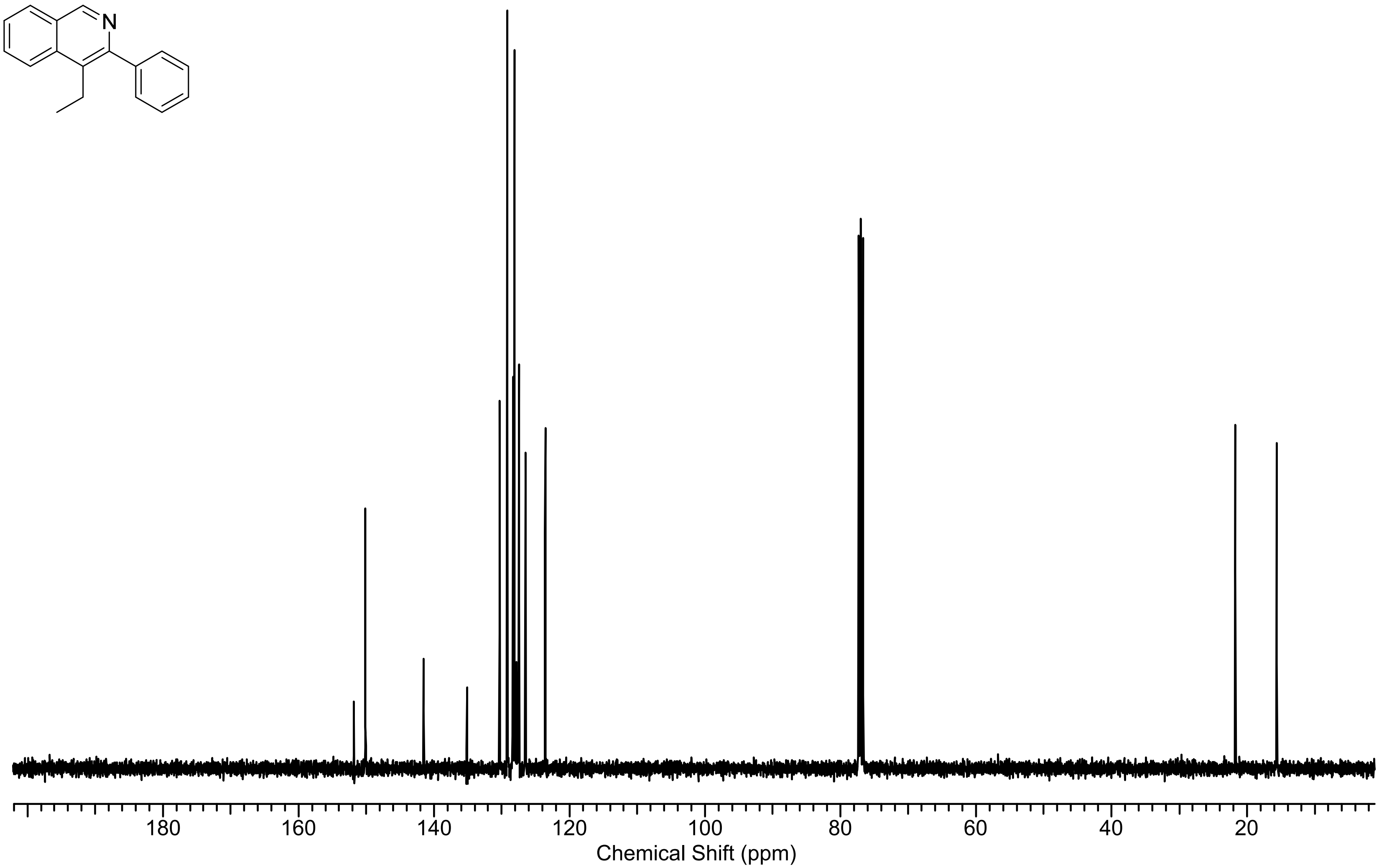
4-Allyl-3-phenylisoquinoline **(4a)**



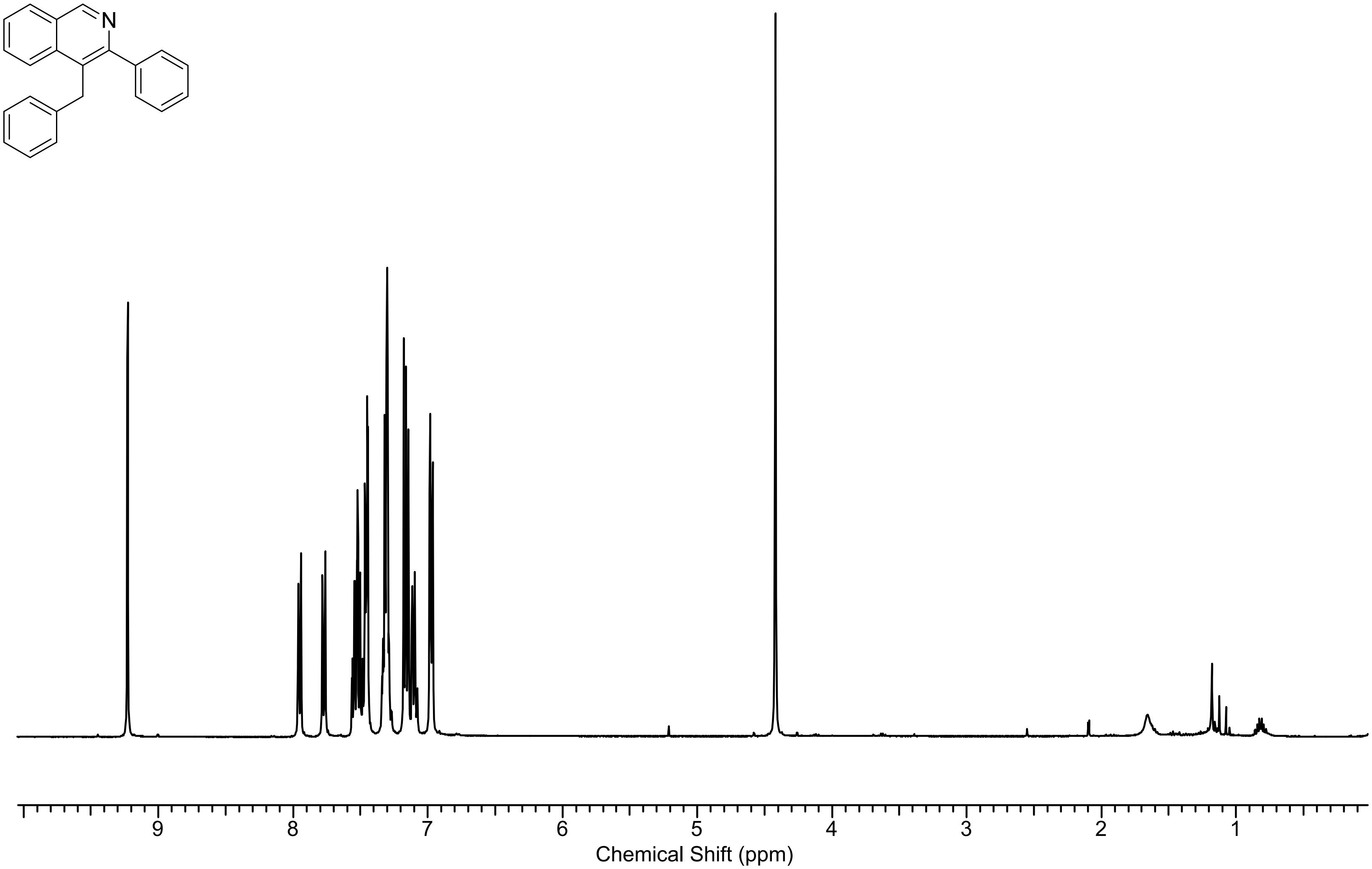
4-Ethyl-3-phenylisoquinoline **(4b)**



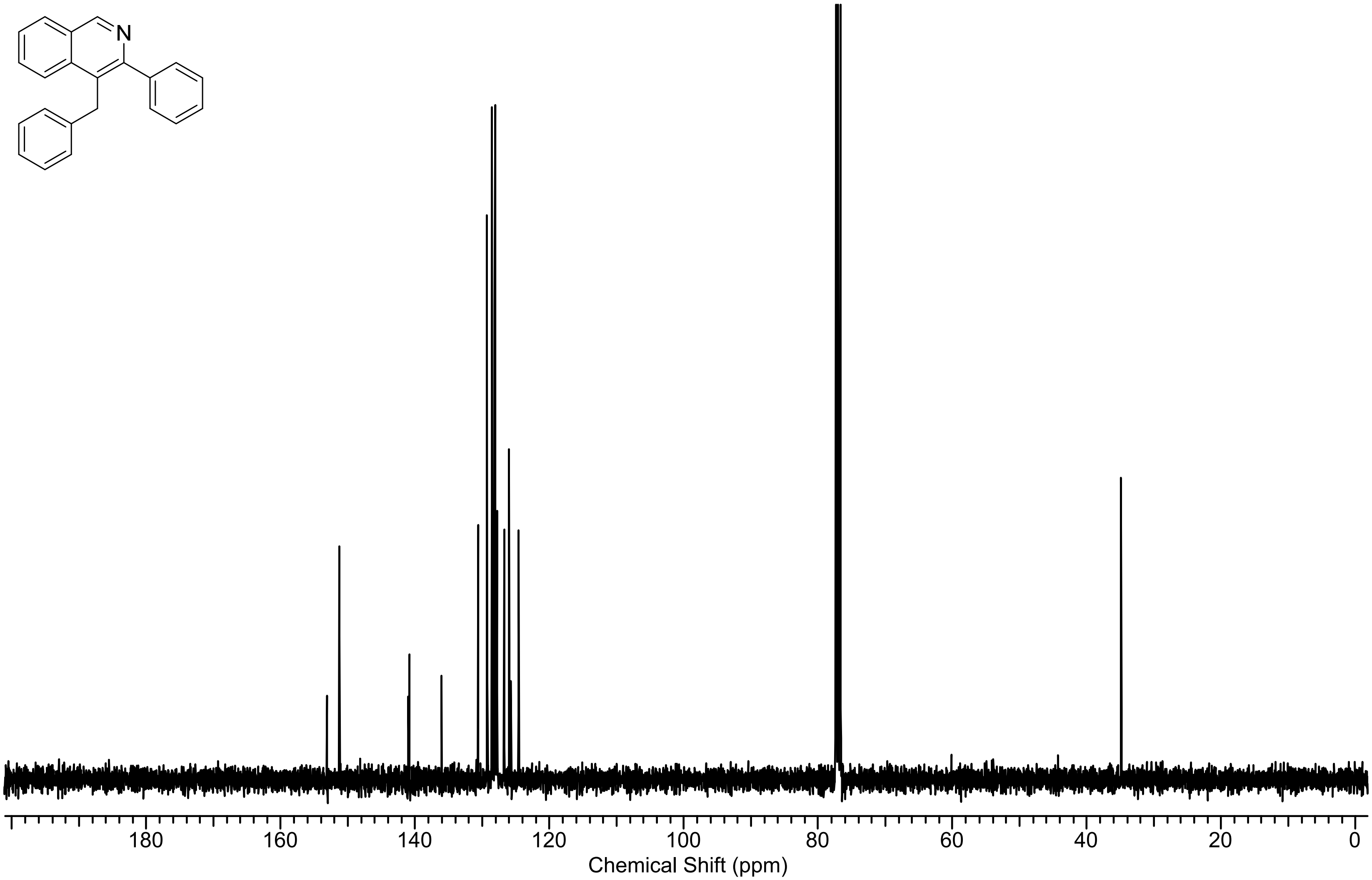
4-Ethyl-3-phenylisoquinoline **(4b)**



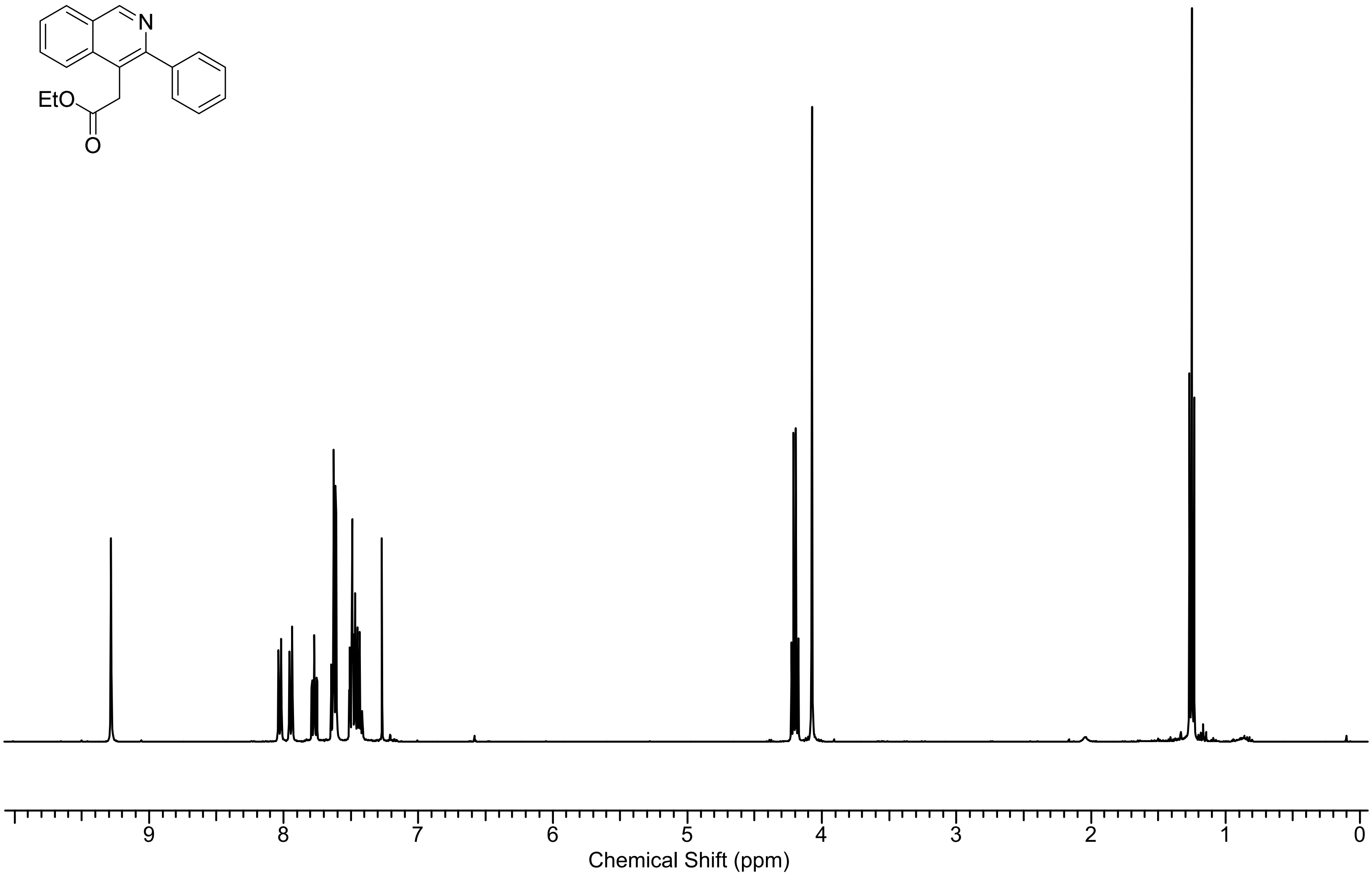
4-Benzyl-3-phenylisoquinoline **(4c)**



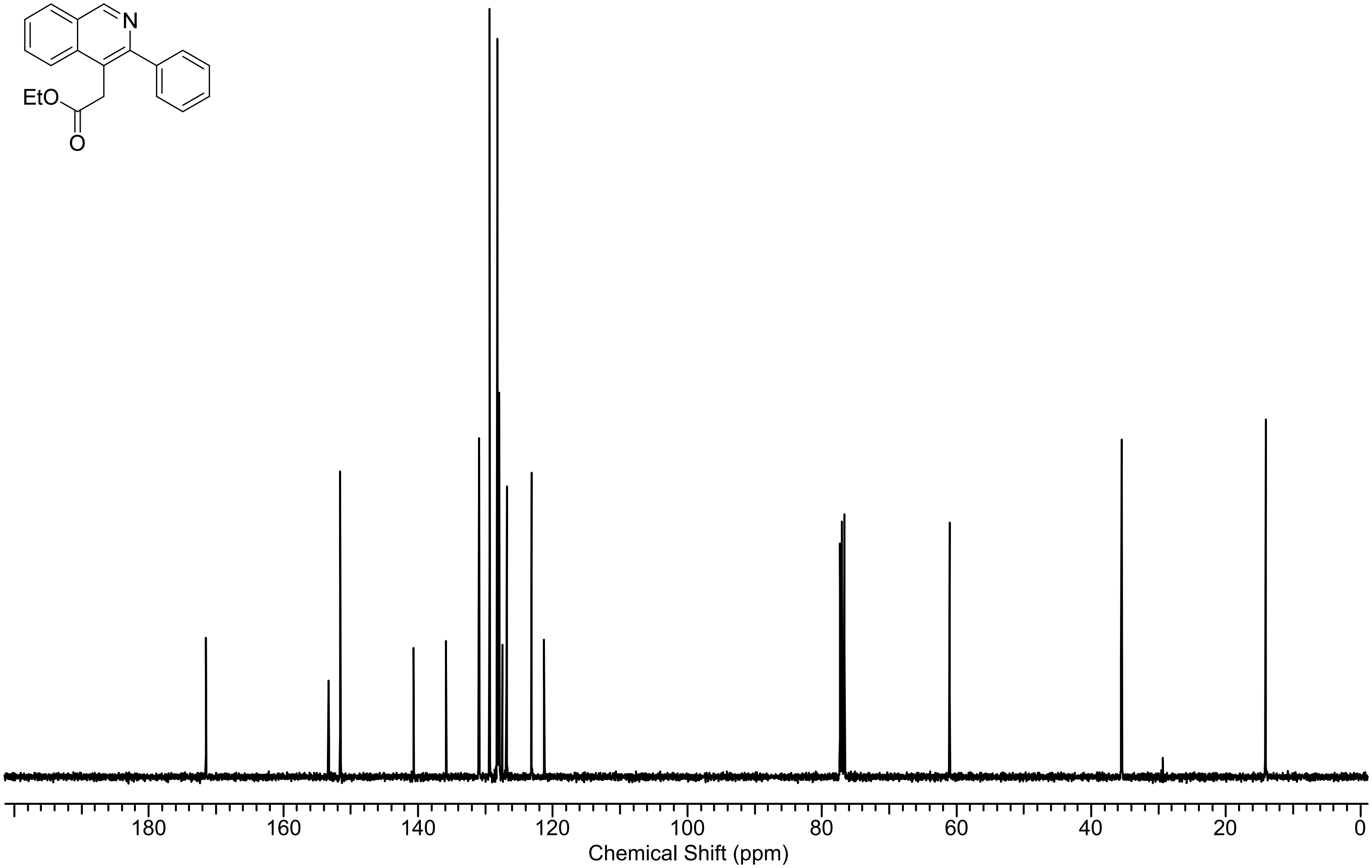
4-Benzyl-3-phenylisoquinoline **(4c)**



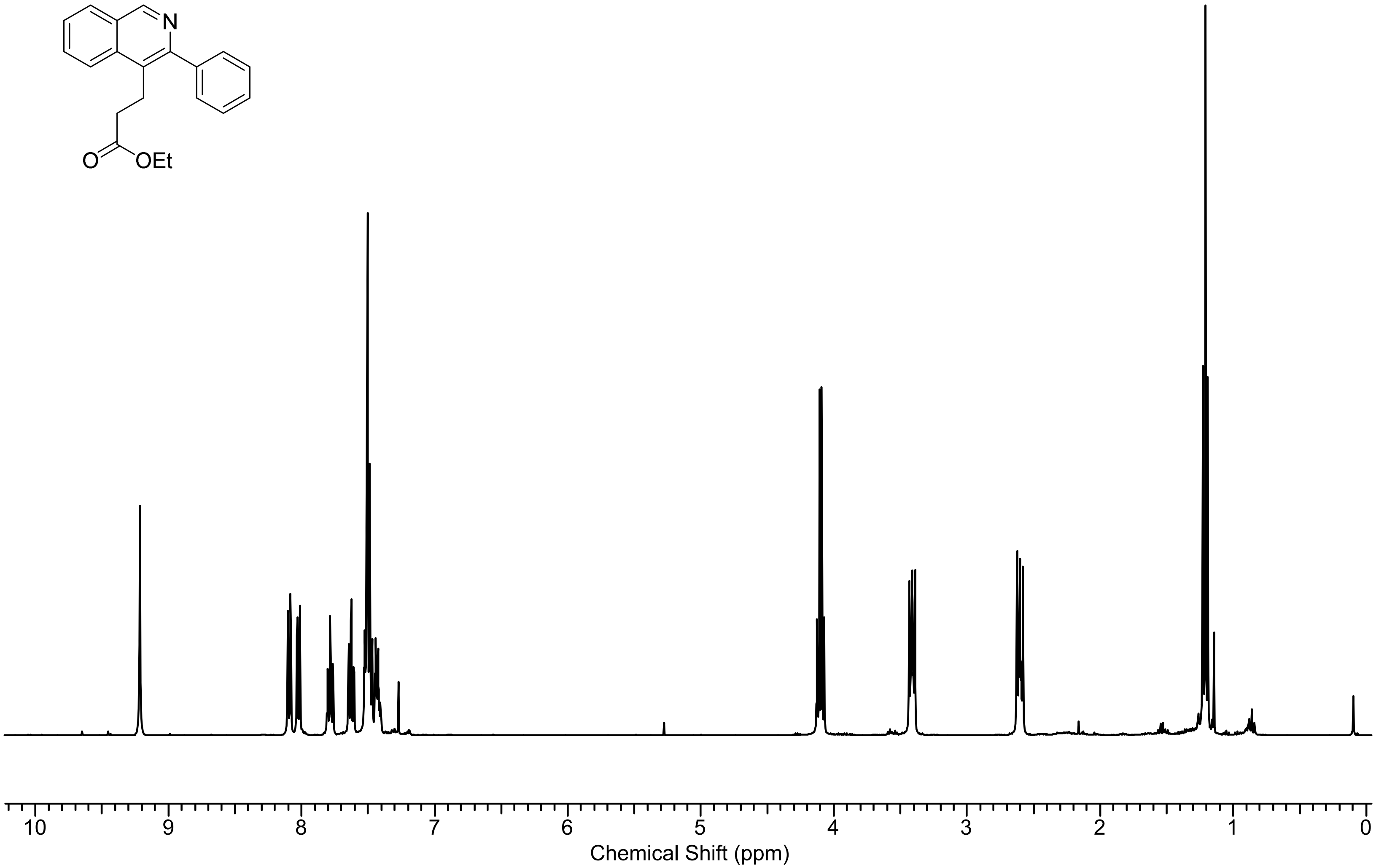
Ethyl 2-(3-phenylisoquinolin-4-yl)acetate **(4d)**



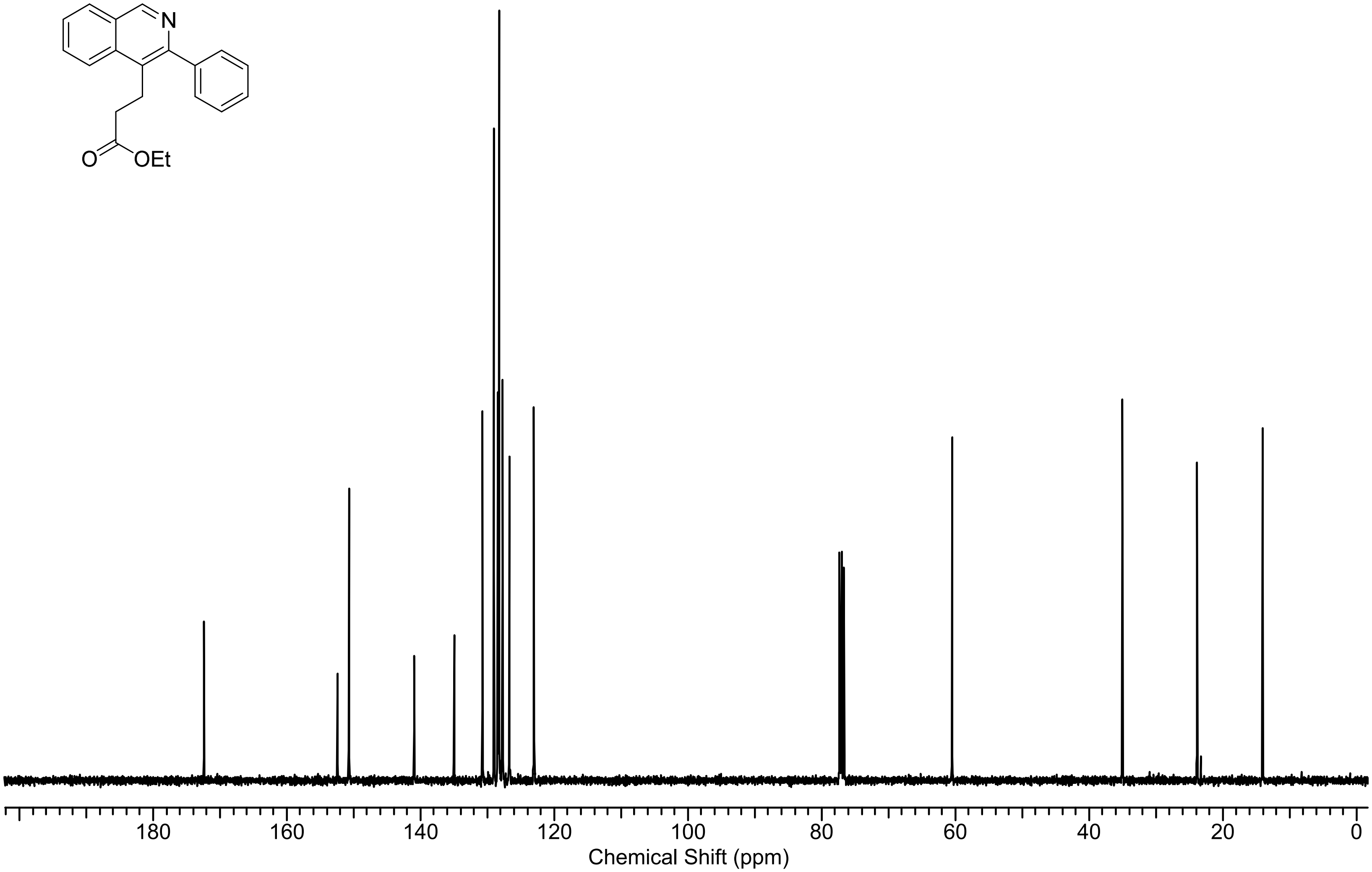
Ethyl 2-(3-phenylisoquinolin-4-yl)acetate **(4d)**



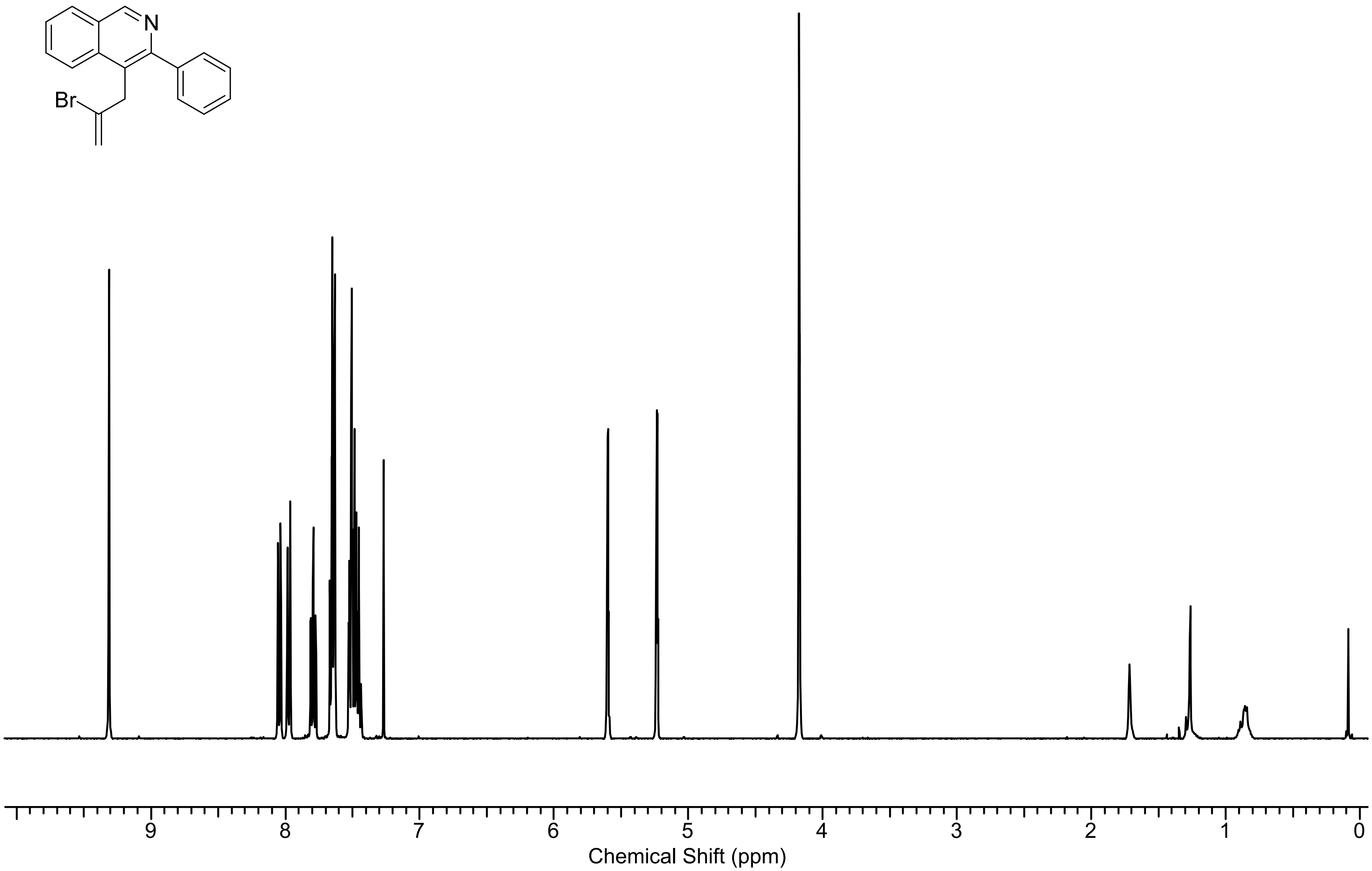
Ethyl 3-(3-phenylisoquinolin-4-yl)propanoate **(4e)**



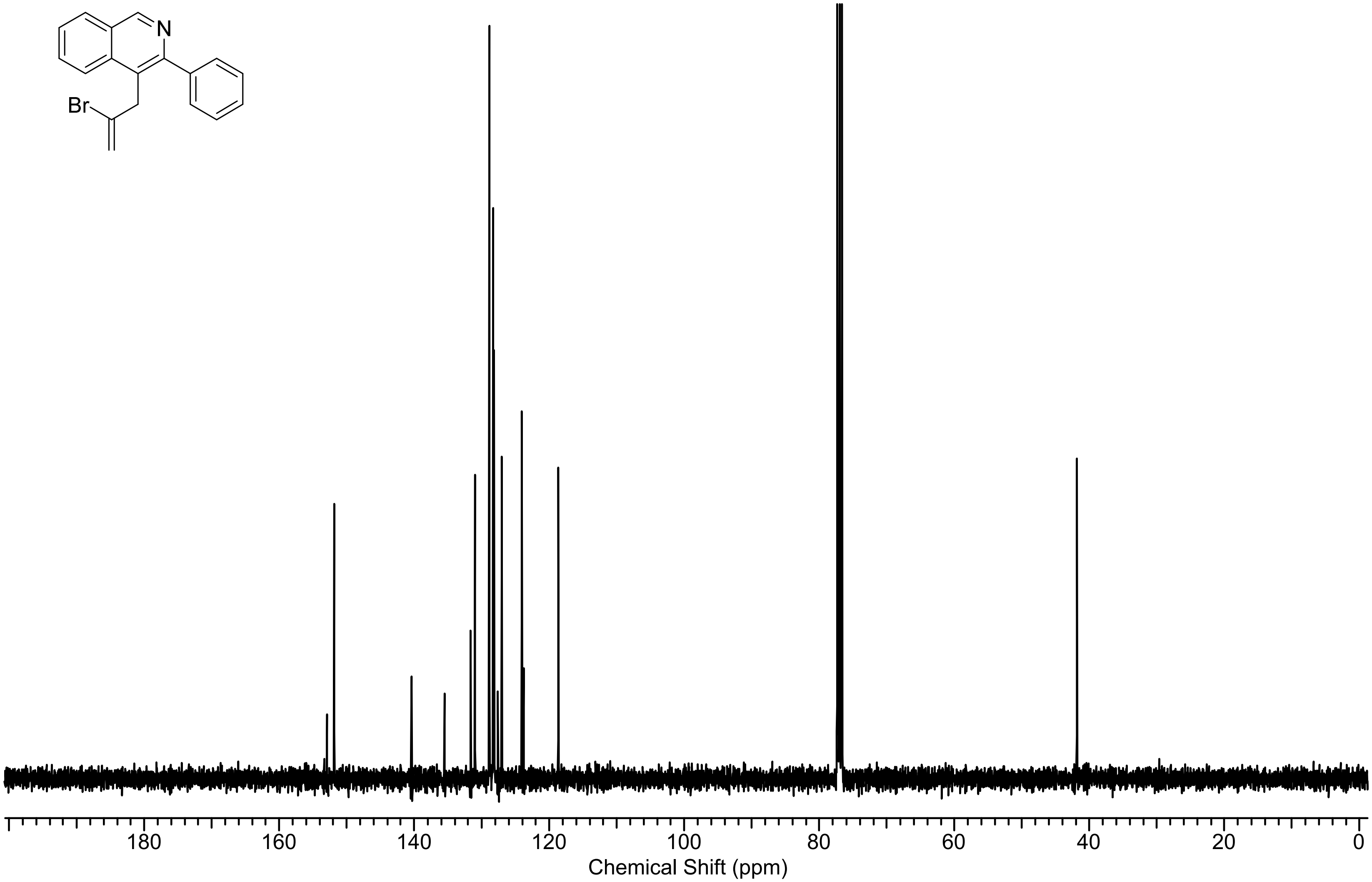
Ethyl 3-(3-phenylisoquinolin-4-yl)propanoate **(4e)**



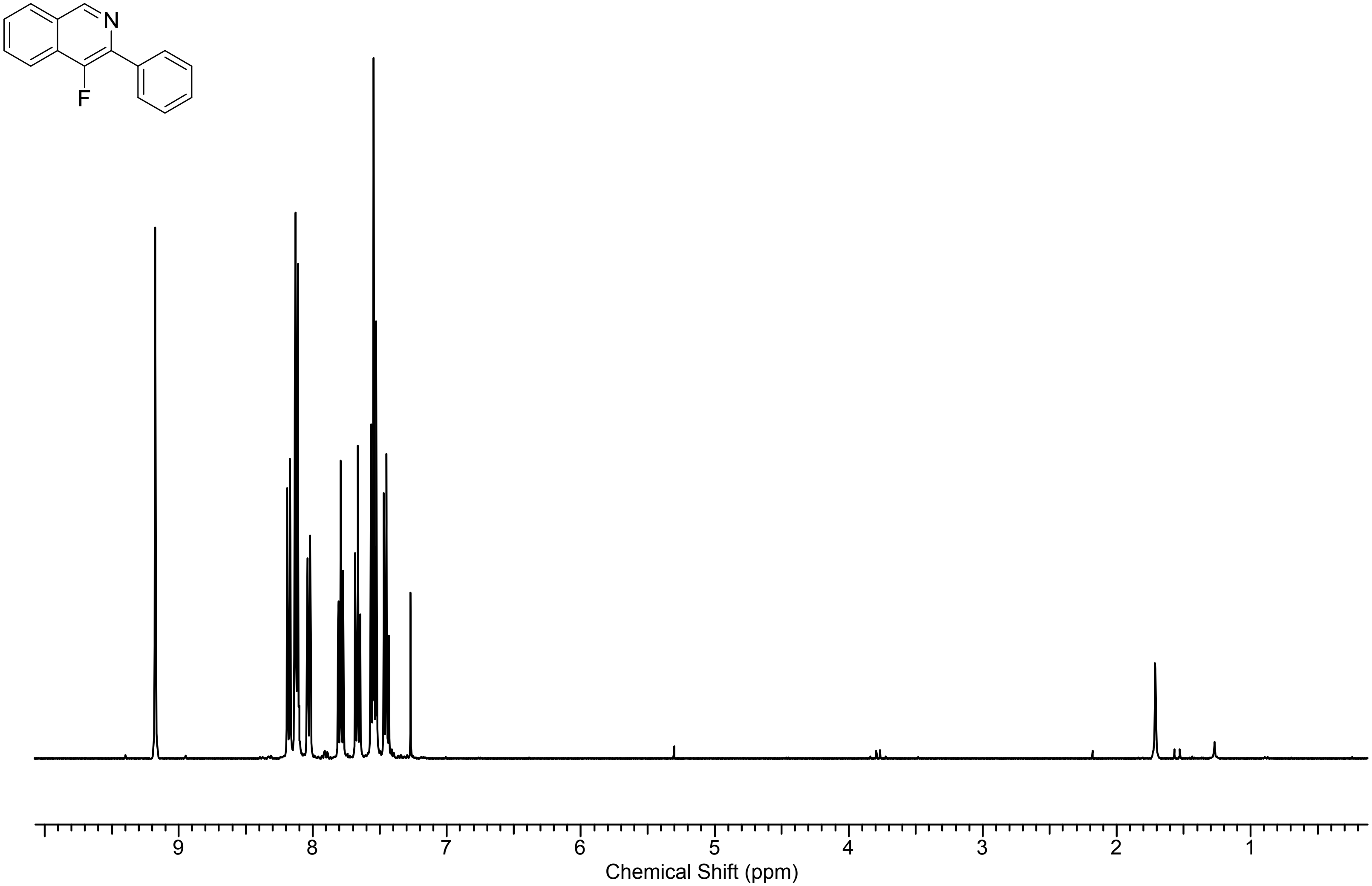
4-(2-Bromoallyl)-3-phenylisoquinoline **(4f)**



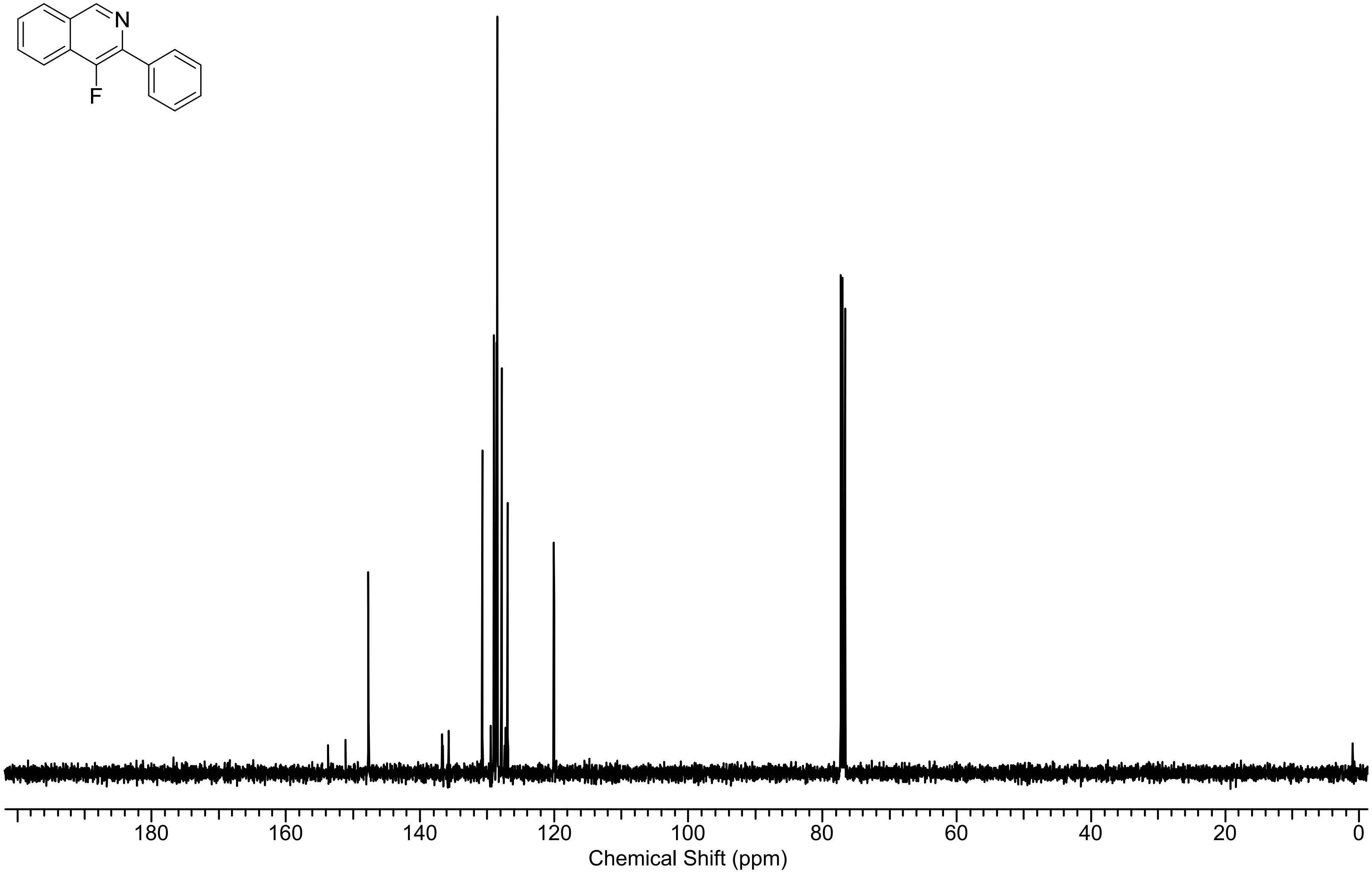
4-(2-Bromoallyl)-3-phenylisoquinoline **(4f)**



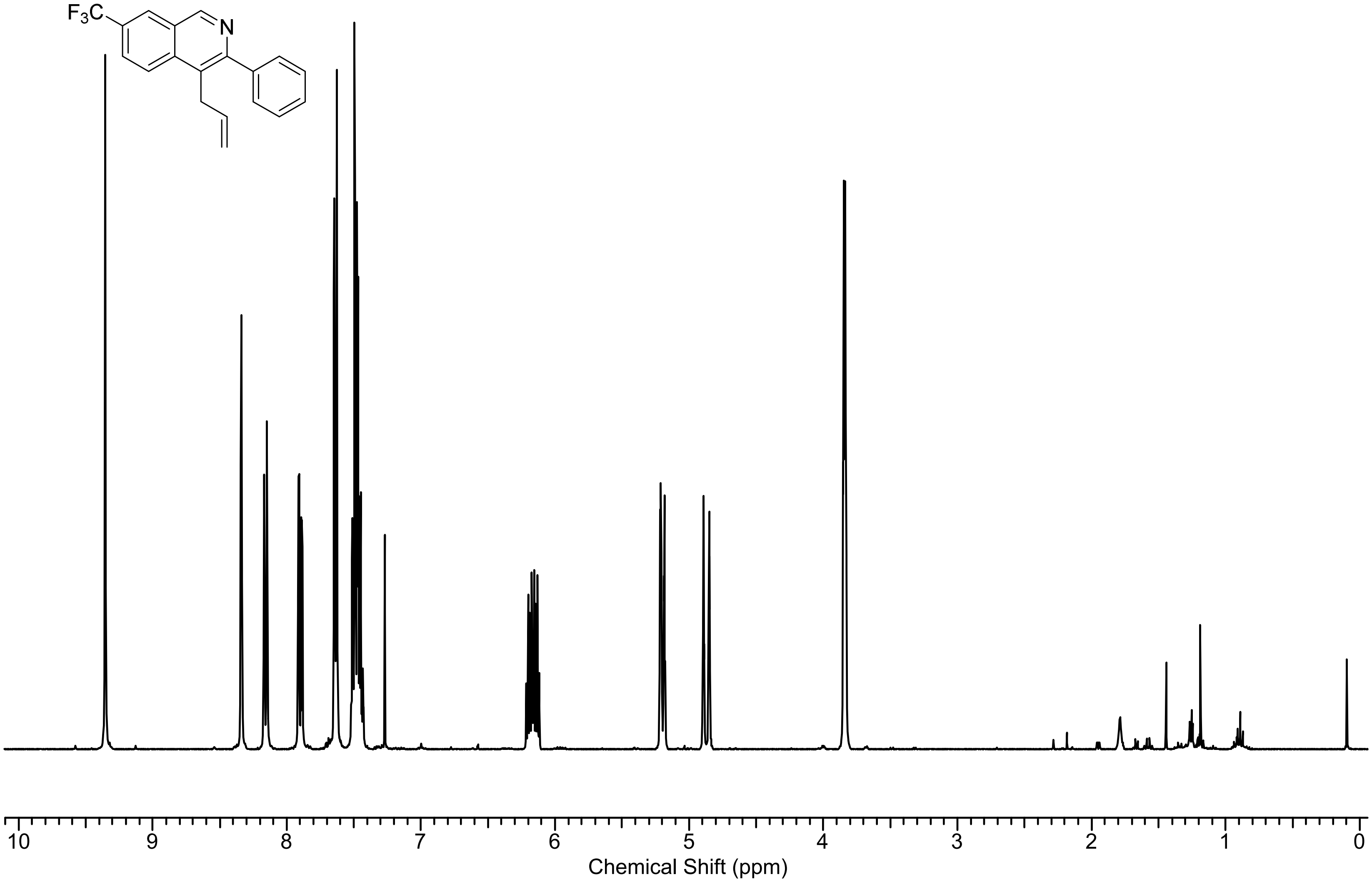
4-Fluoro-3-phenylisoquinoline **(4g)**



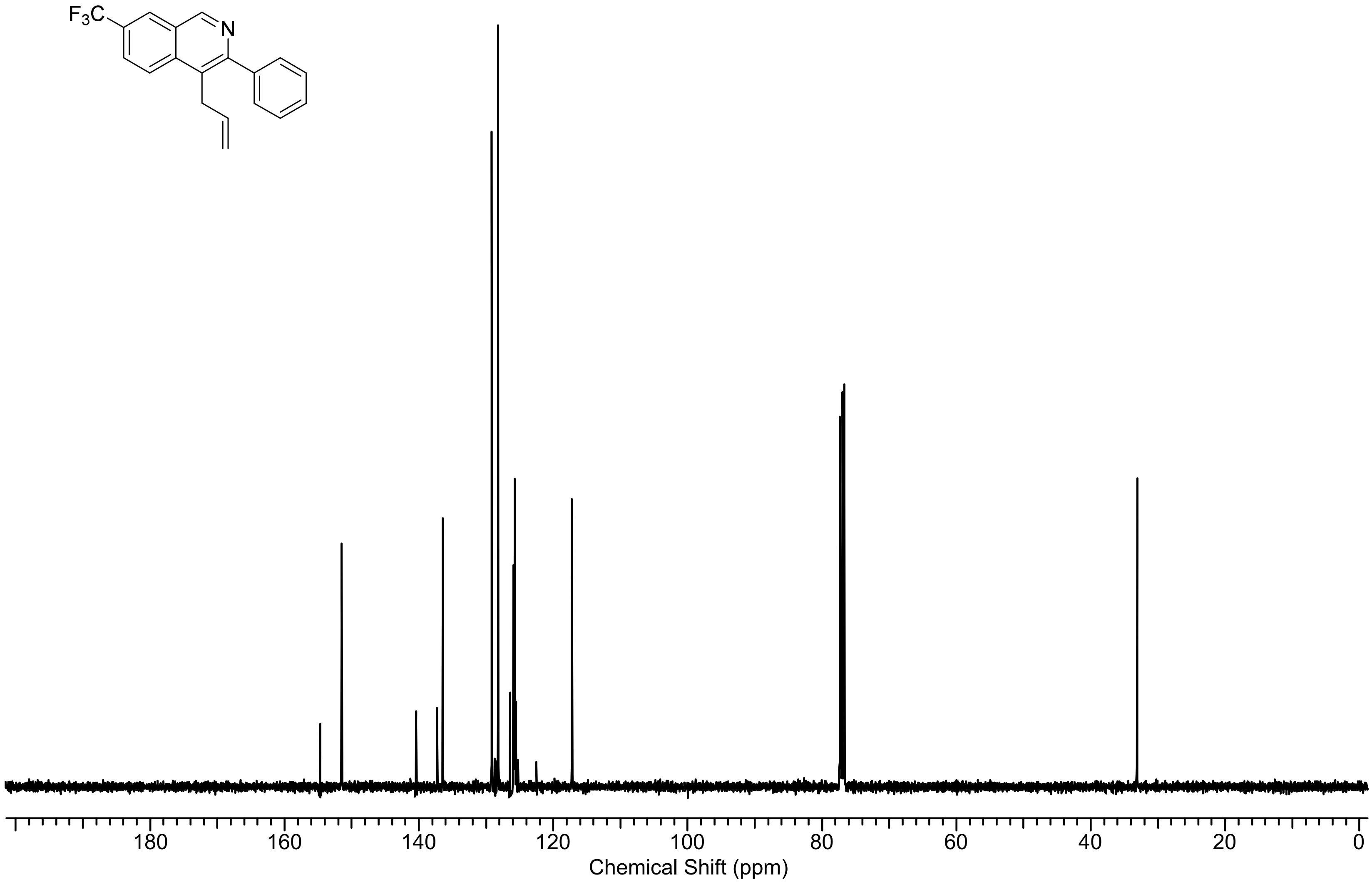
4-Fluoro-3-phenylisoquinoline **(4g)**



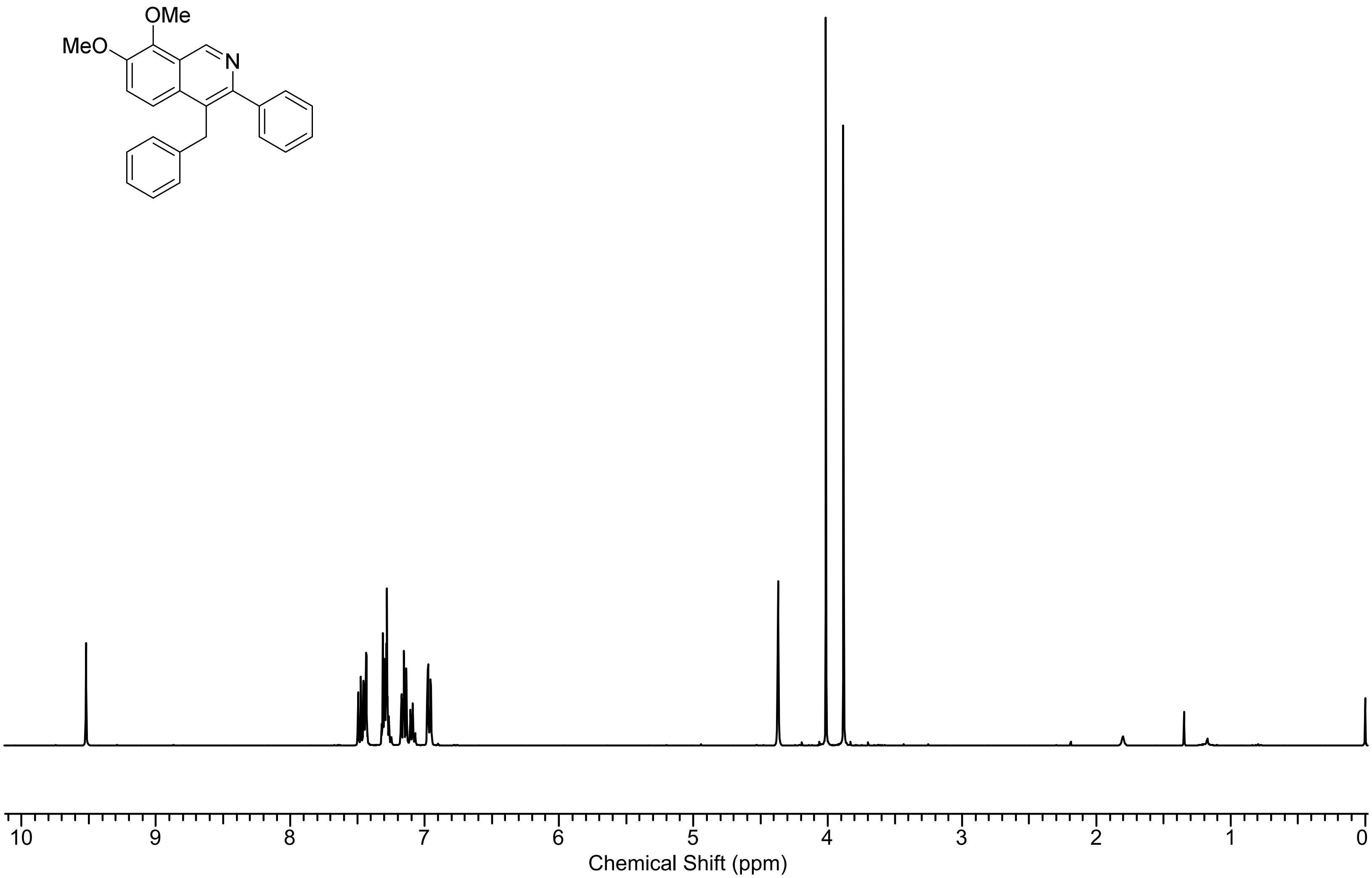
4-Allyl-3-phenyl-7-(trifluoromethyl)isoquinoline **(4h)**



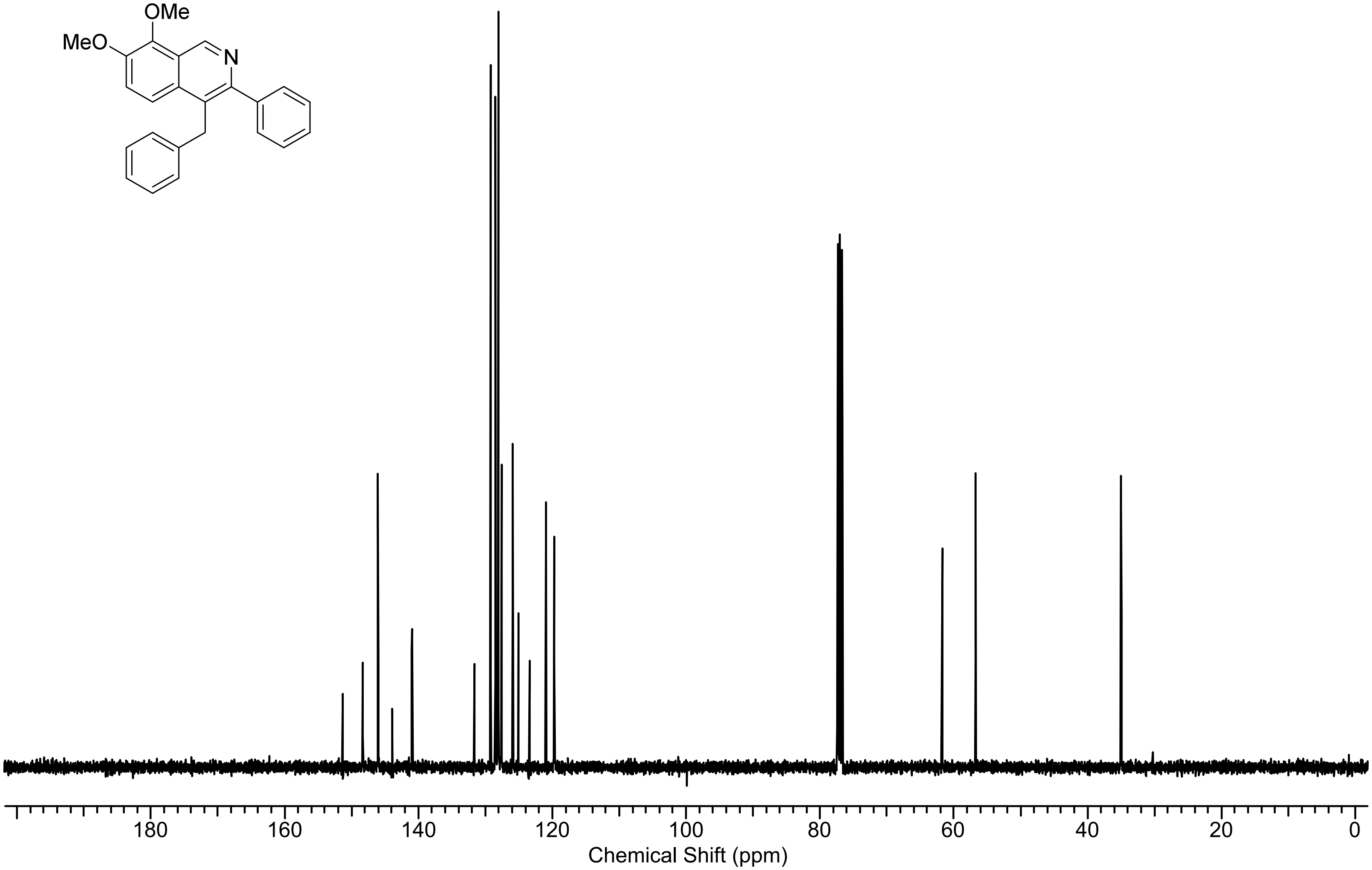
4-Allyl-3-phenyl-7-(trifluoromethyl)isoquinoline **(4h)**



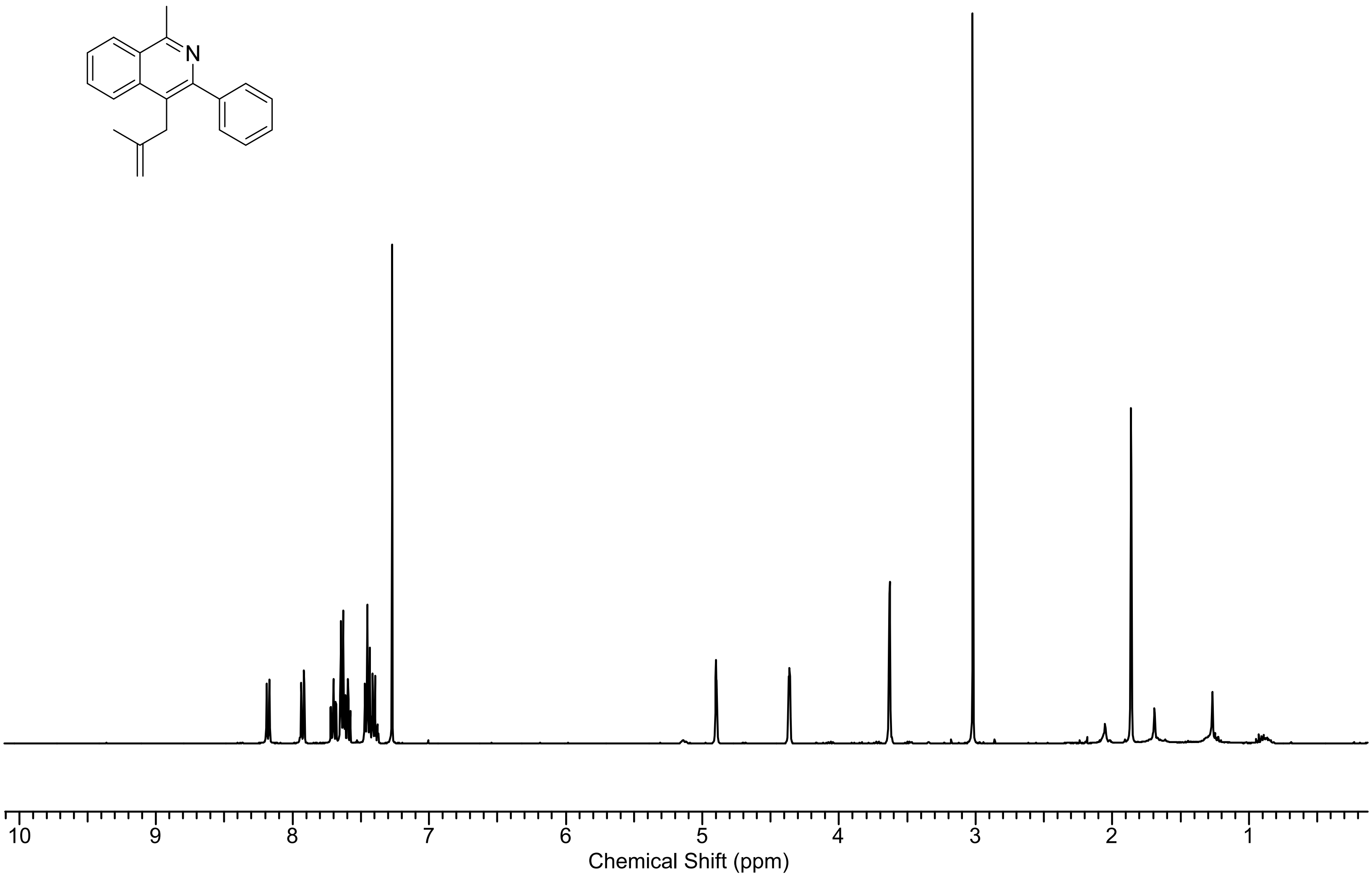
4-Benzyl-7,8-dimethoxy-3-phenylisoquinoline **(4i)**



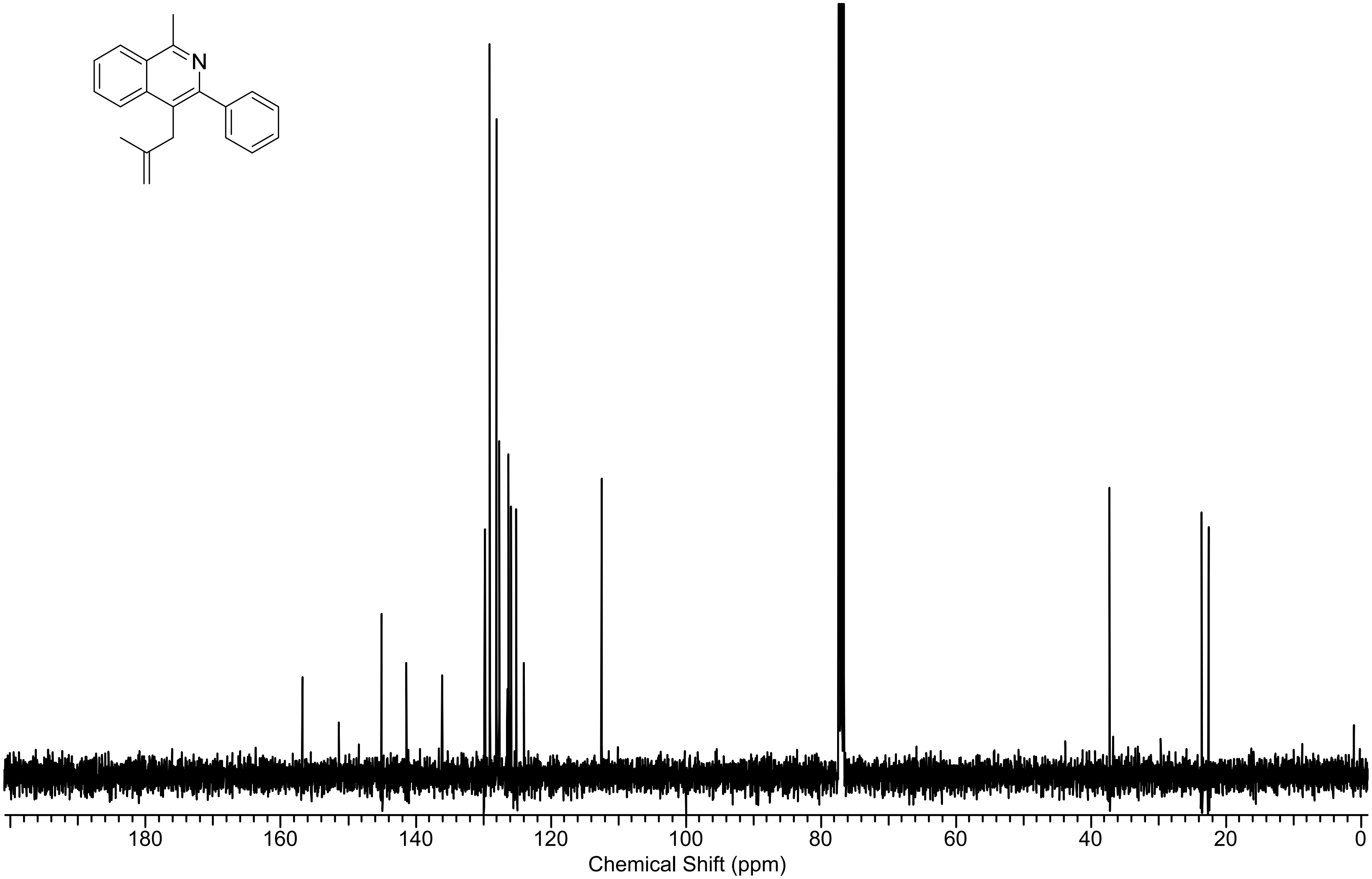
4-Benzyl-7,8-dimethoxy-3-phenylisoquinoline **(4i)**



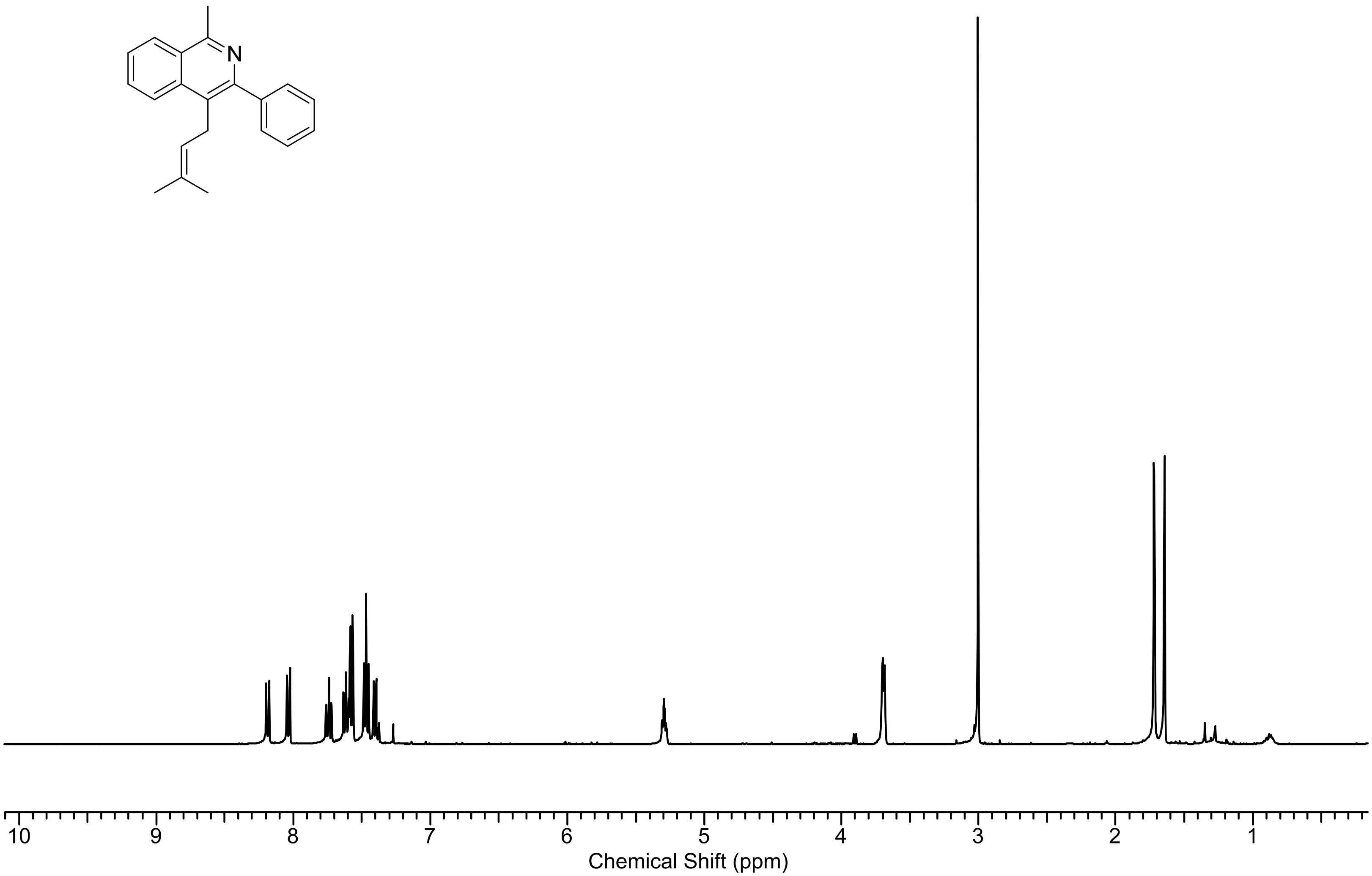
1-Methyl-4-(2-methylallyl)-3-phenylisoquinoline **(4j)**



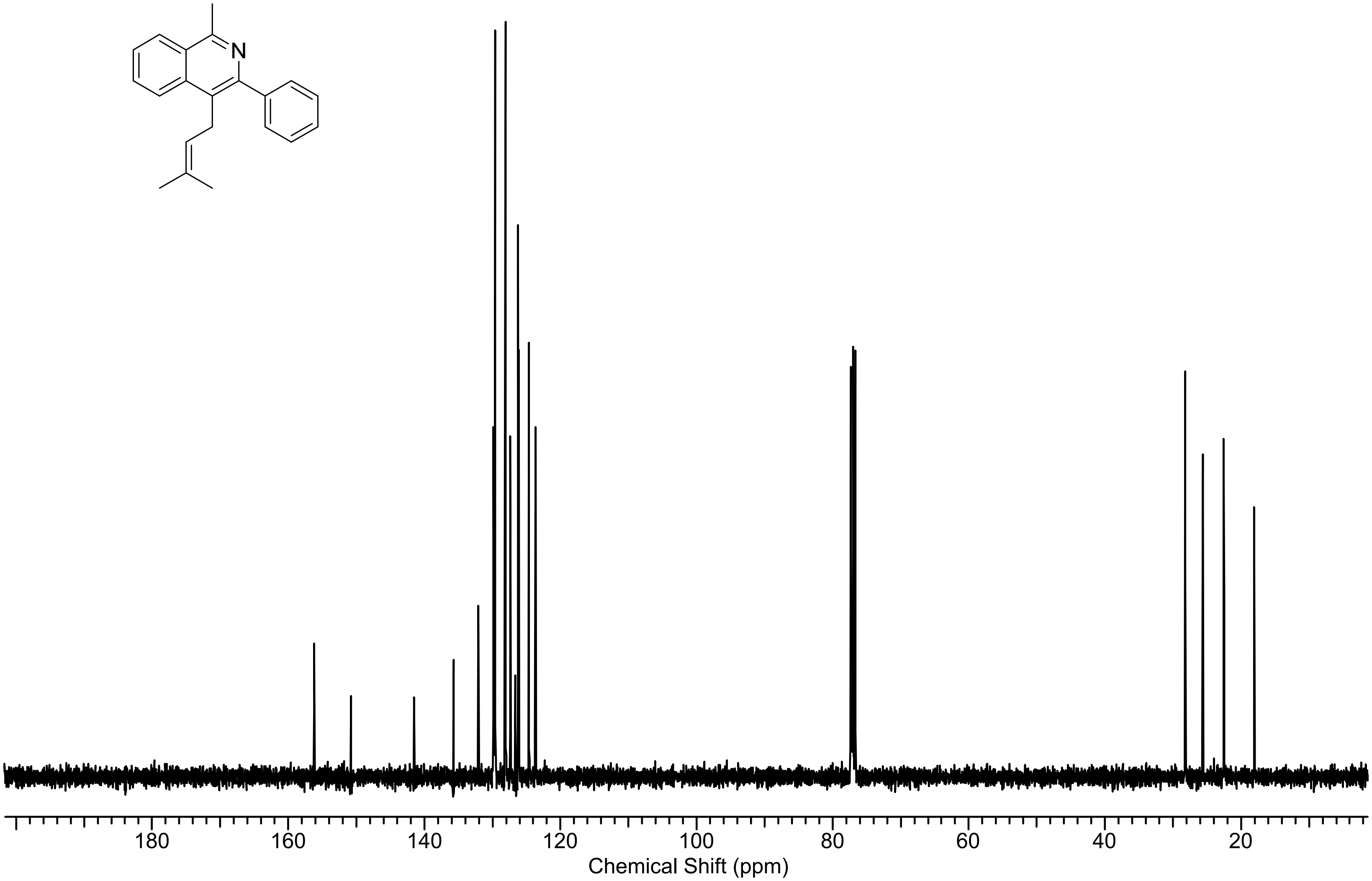
1-Methyl-4-(2-methylallyl)-3-phenylisoquinoline **(4j)**



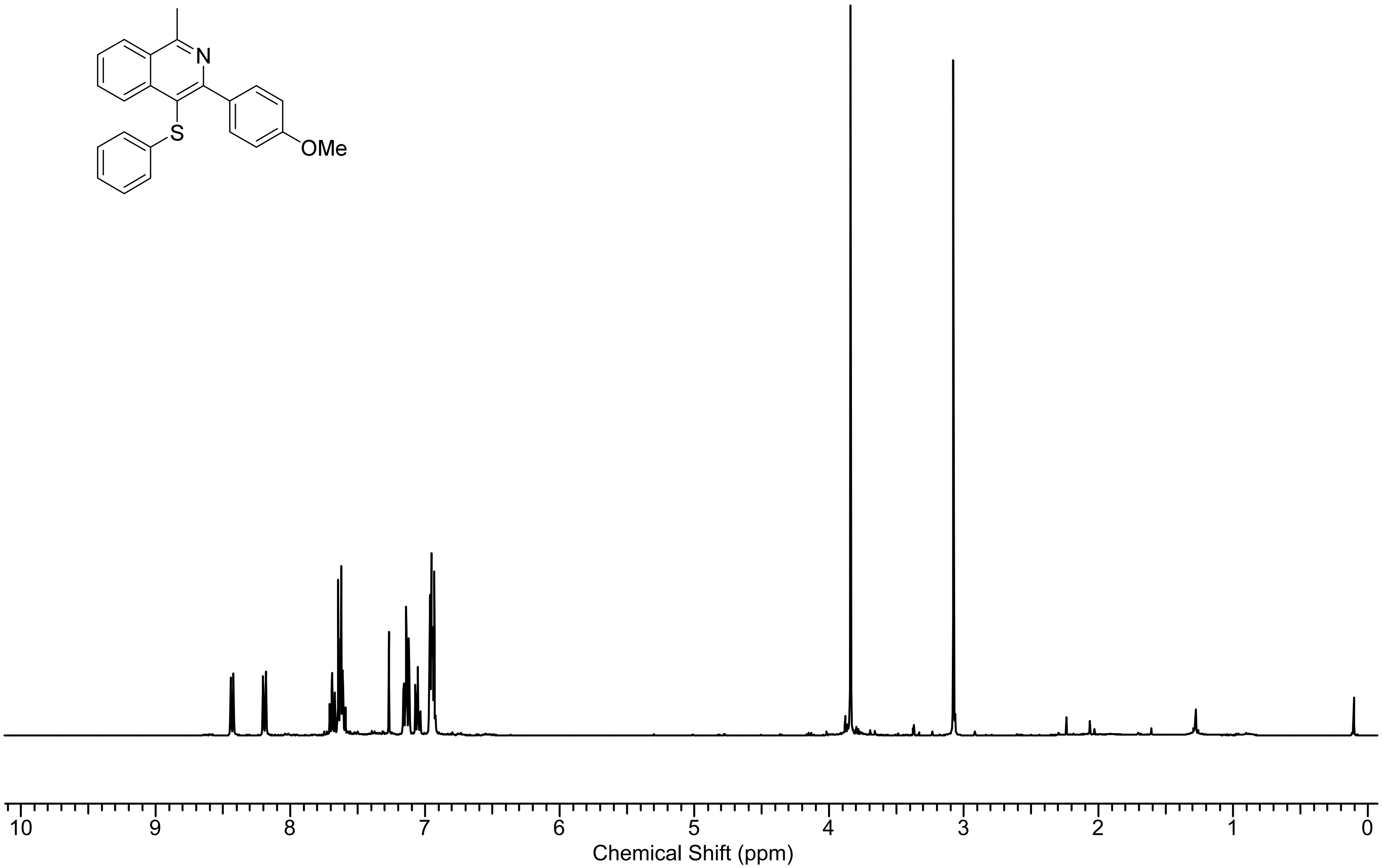
1-Methyl-4-(3-methylbut-2-en-1-yl)-3-phenylisoquinoline **(4k)**



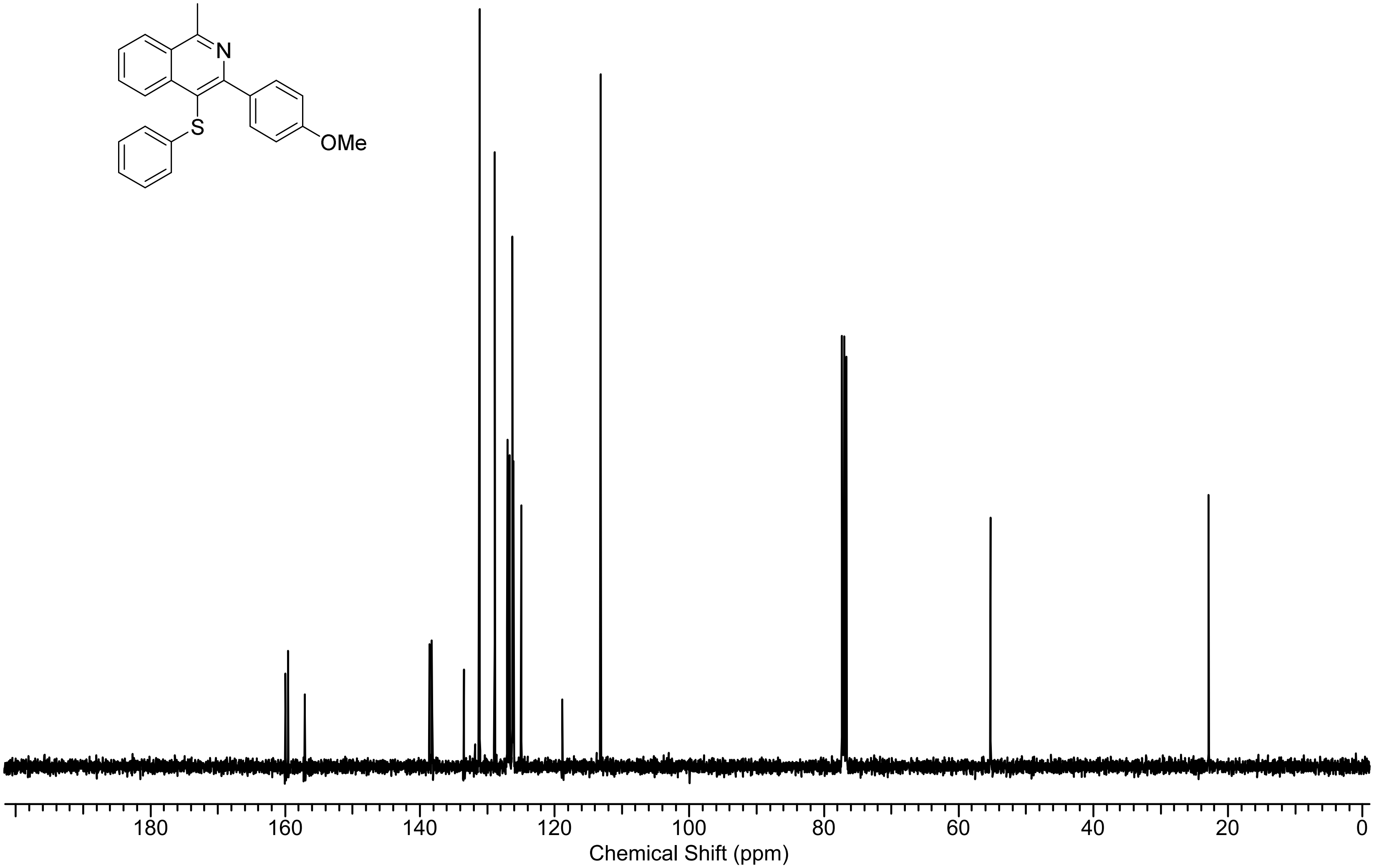
1-Methyl-4-(3-methylbut-2-en-1-yl)-3-phenylisoquinoline **(4k)**



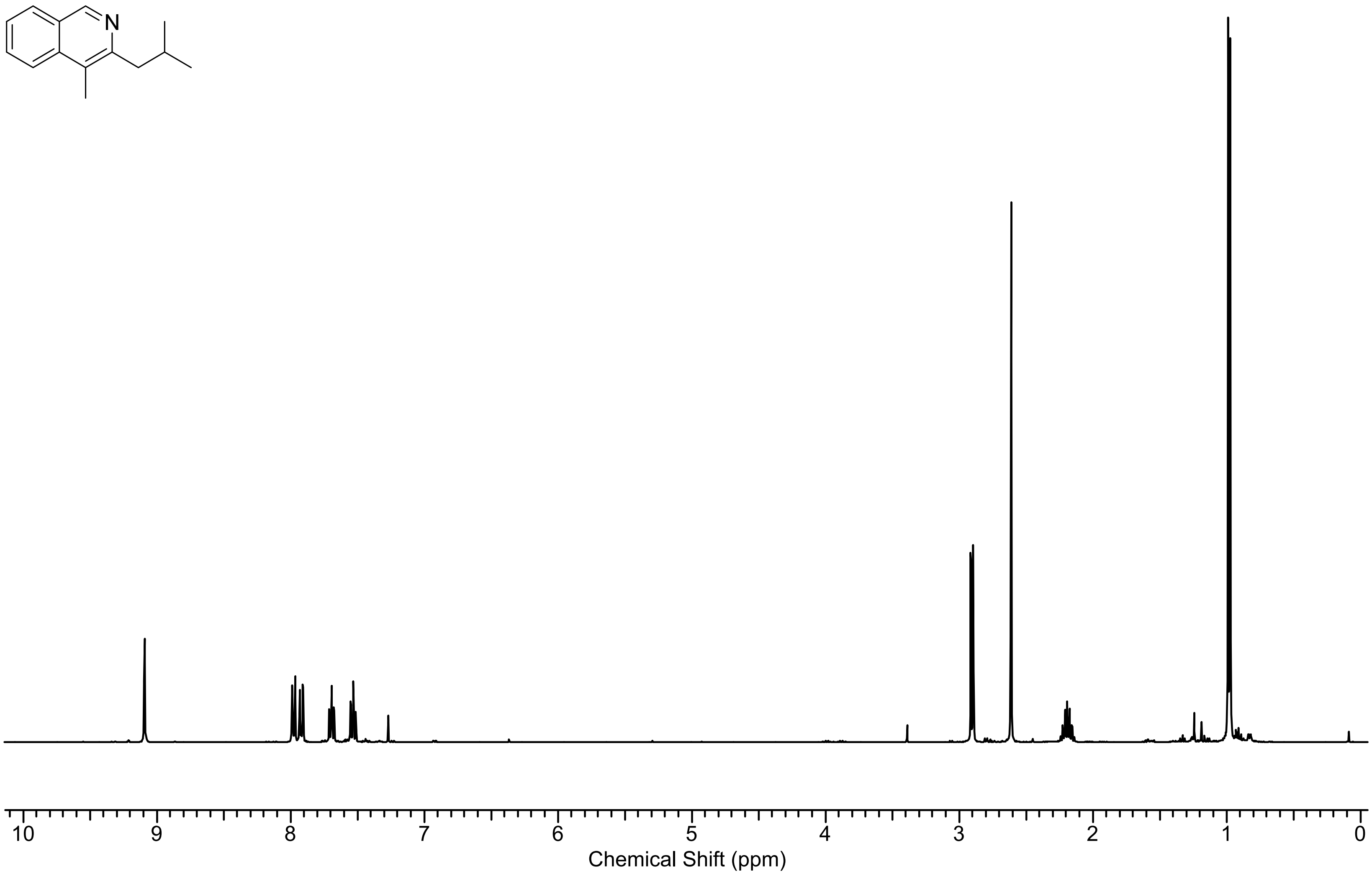
3-(4-Methoxyphenyl)-1-methyl-4-(phenylthio)isoquinoline **(4l)**



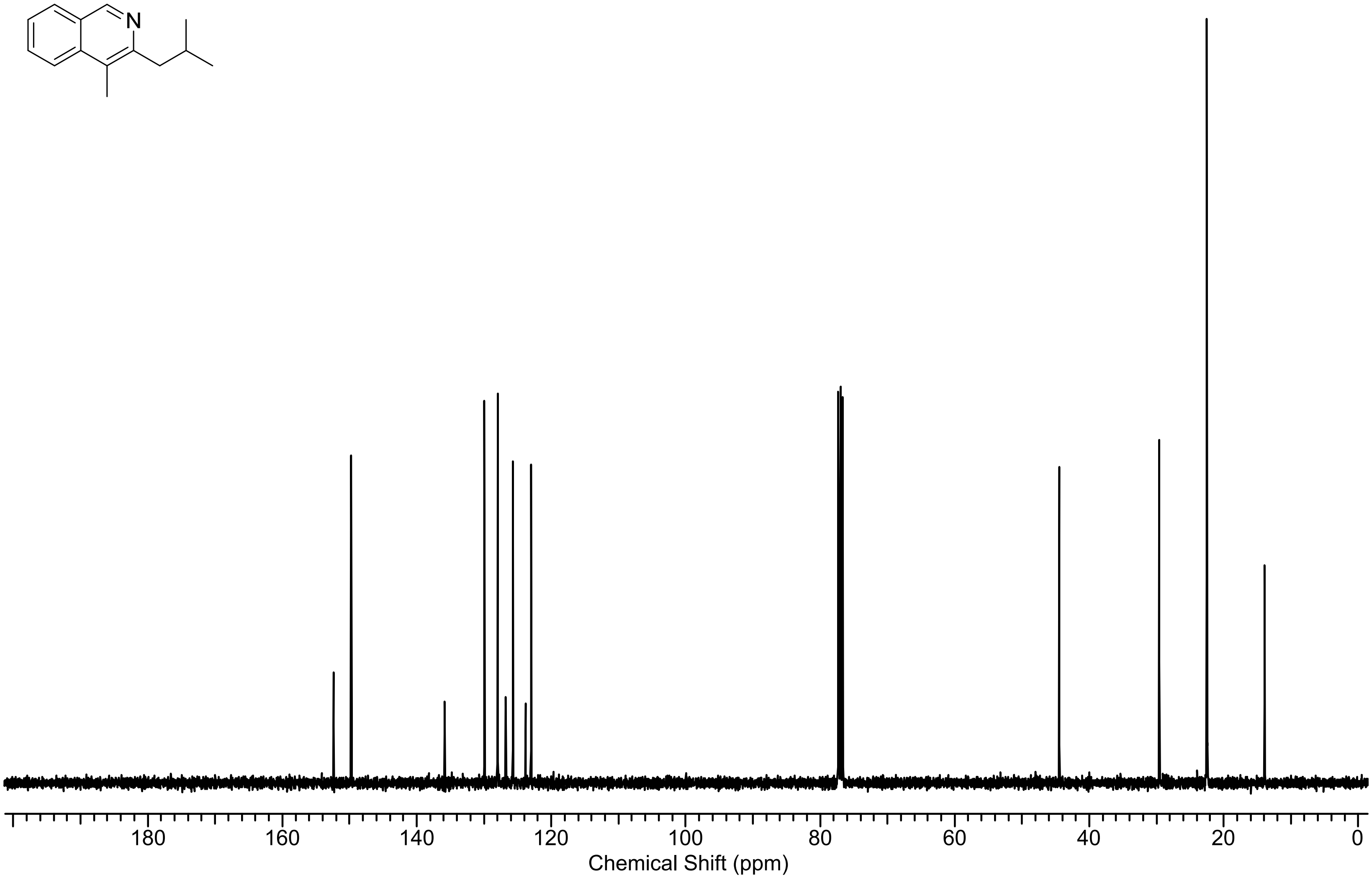
3-(4-Methoxyphenyl)-1-methyl-4-(phenylthio)isoquinoline **(4l)**



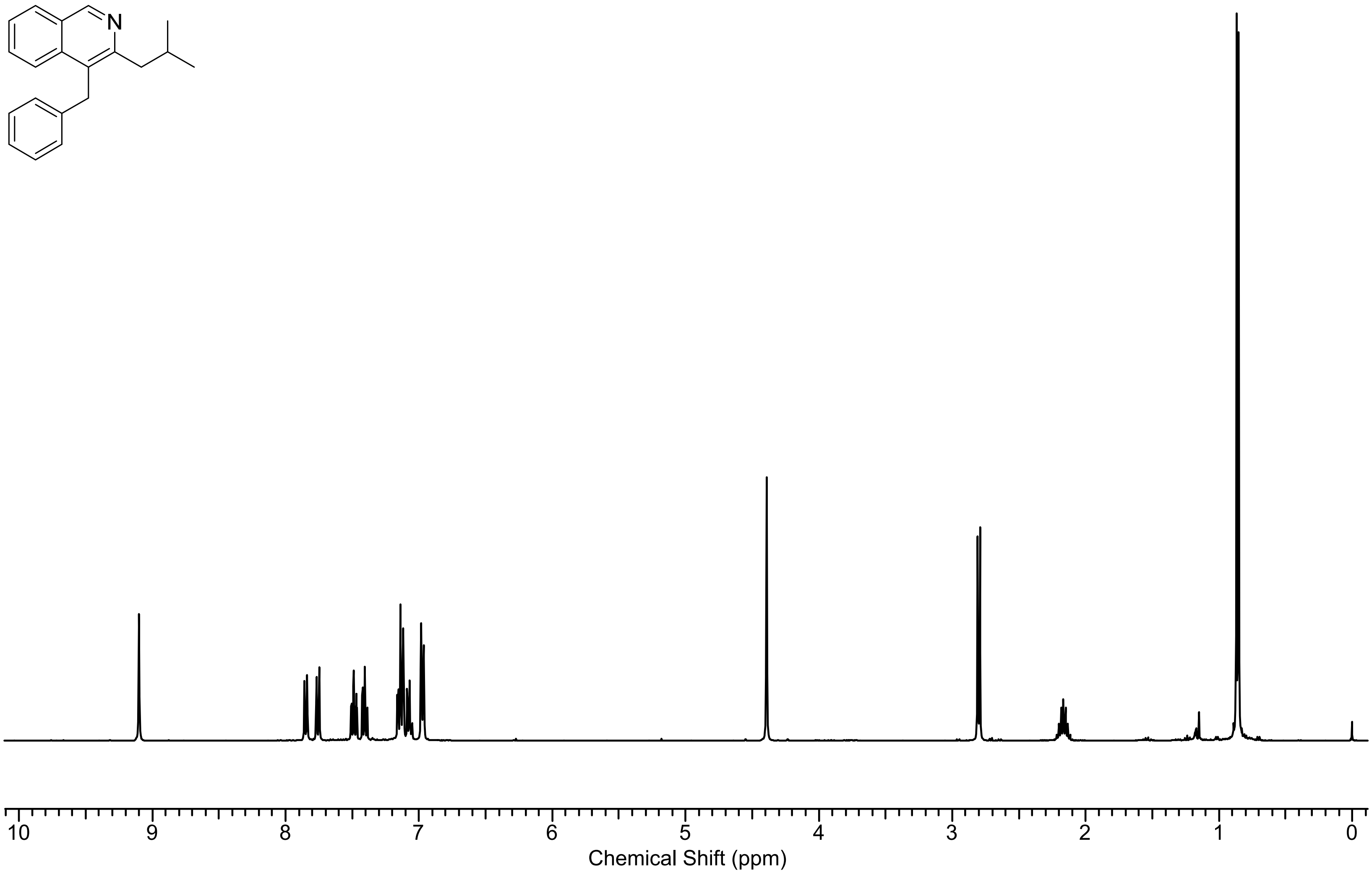
3-*iso*Butyl-4-methylisoquinoline **(4m)**



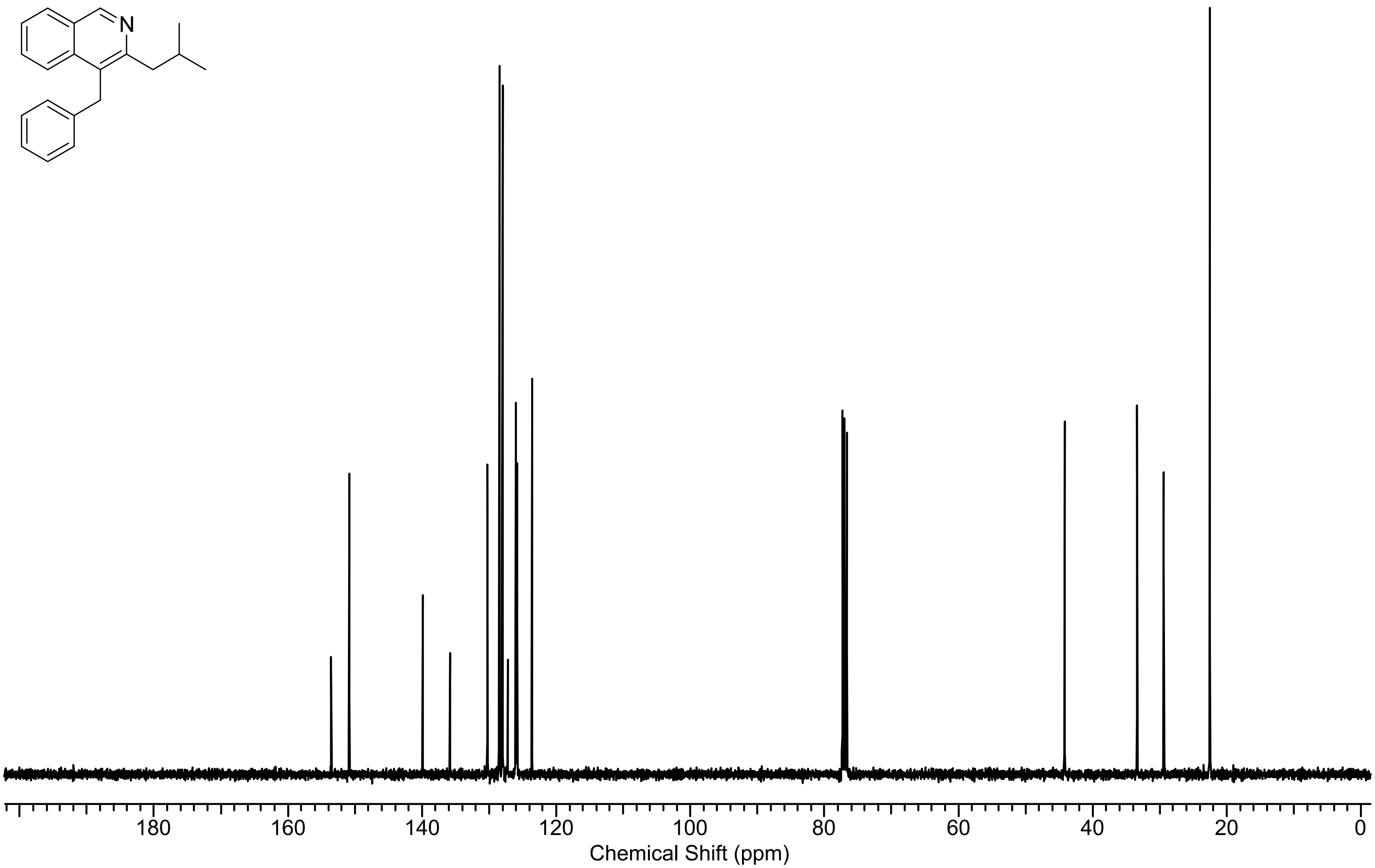
3-*iso*Butyl-4-methylisoquinoline **(4m)**



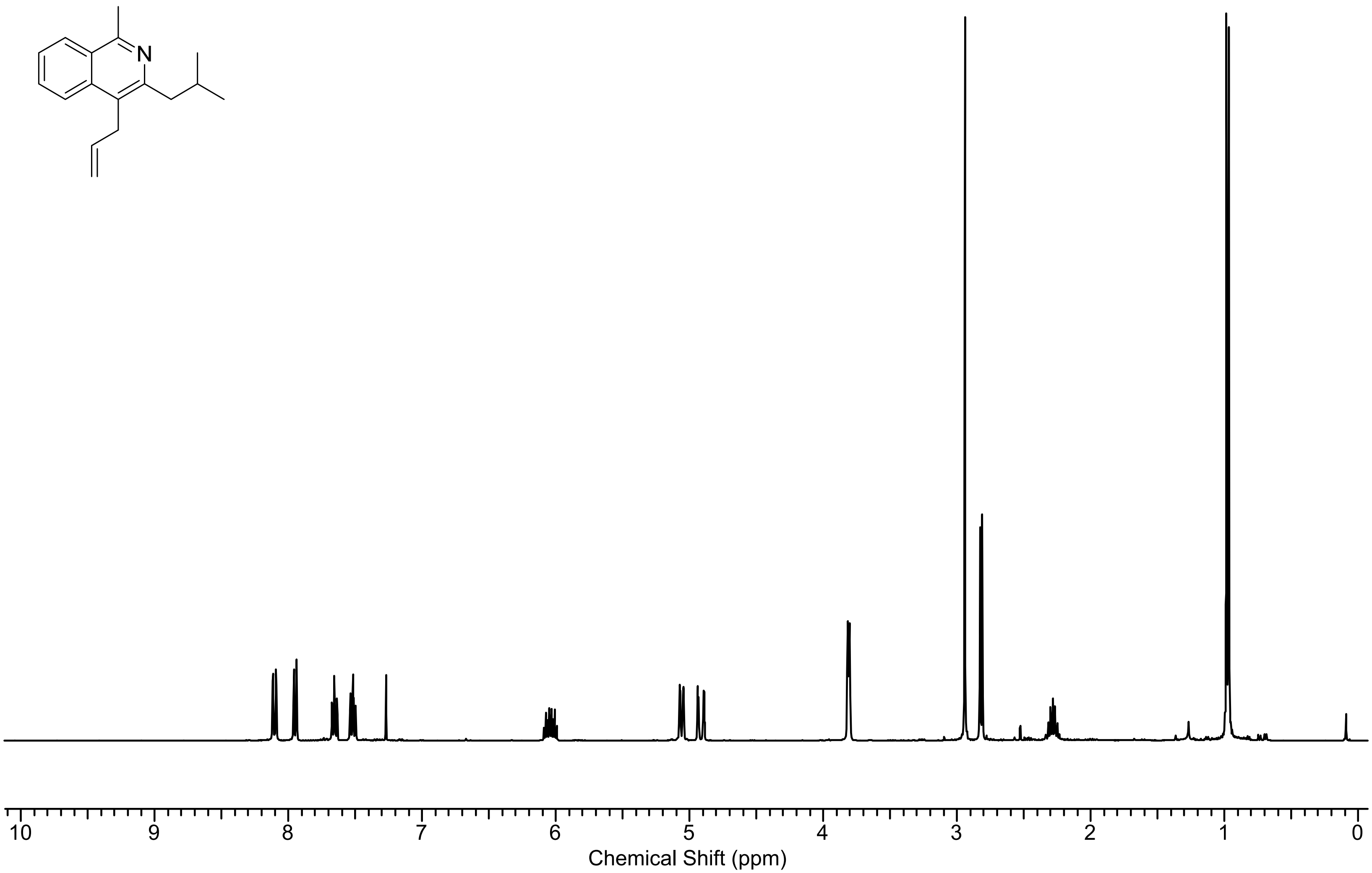
4-Benzyl-3-*iso*butylisoquinoline **(4n)**



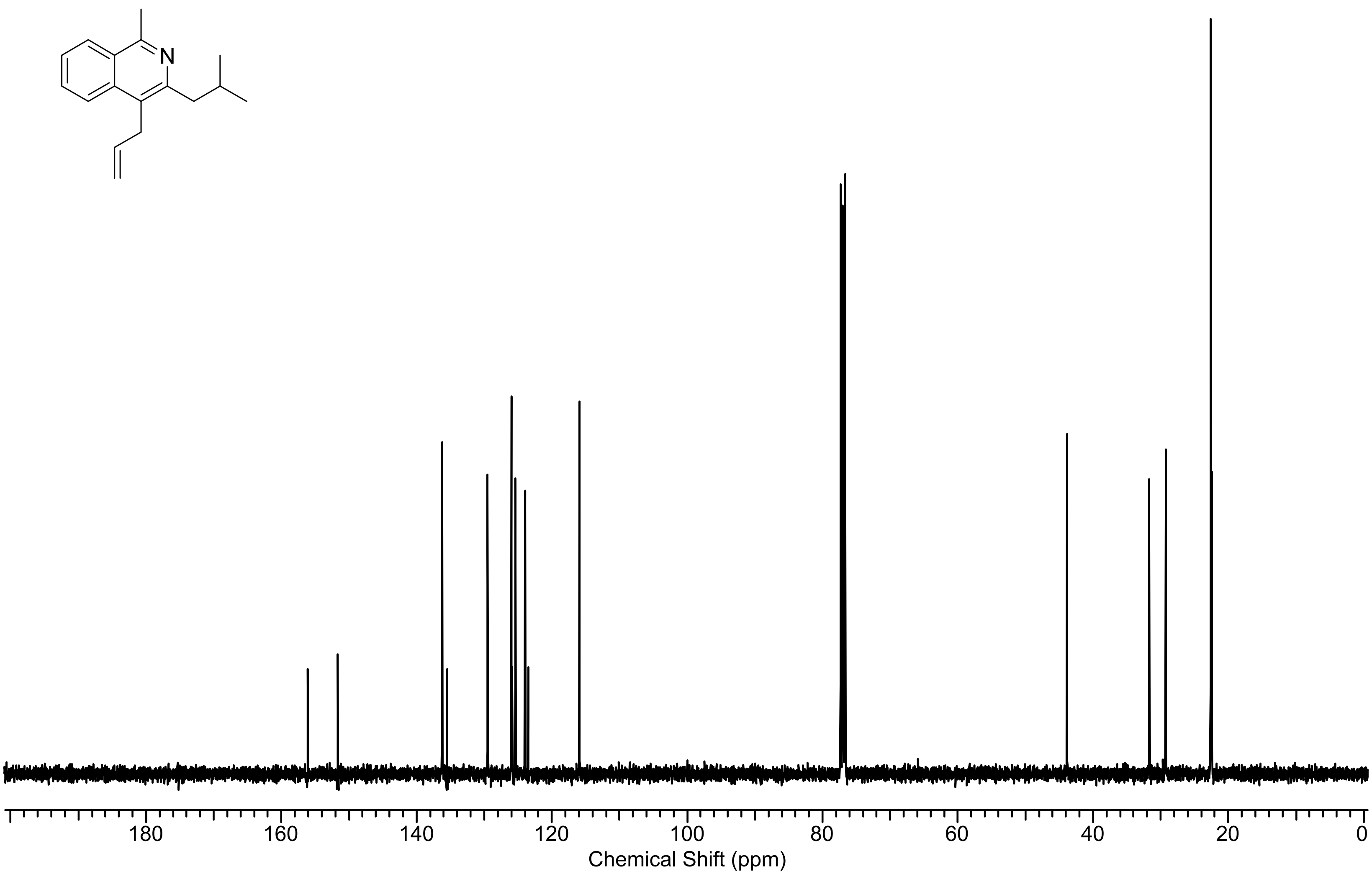
4-Benzyl-3-*iso*butylisoquinoline **(4n)**



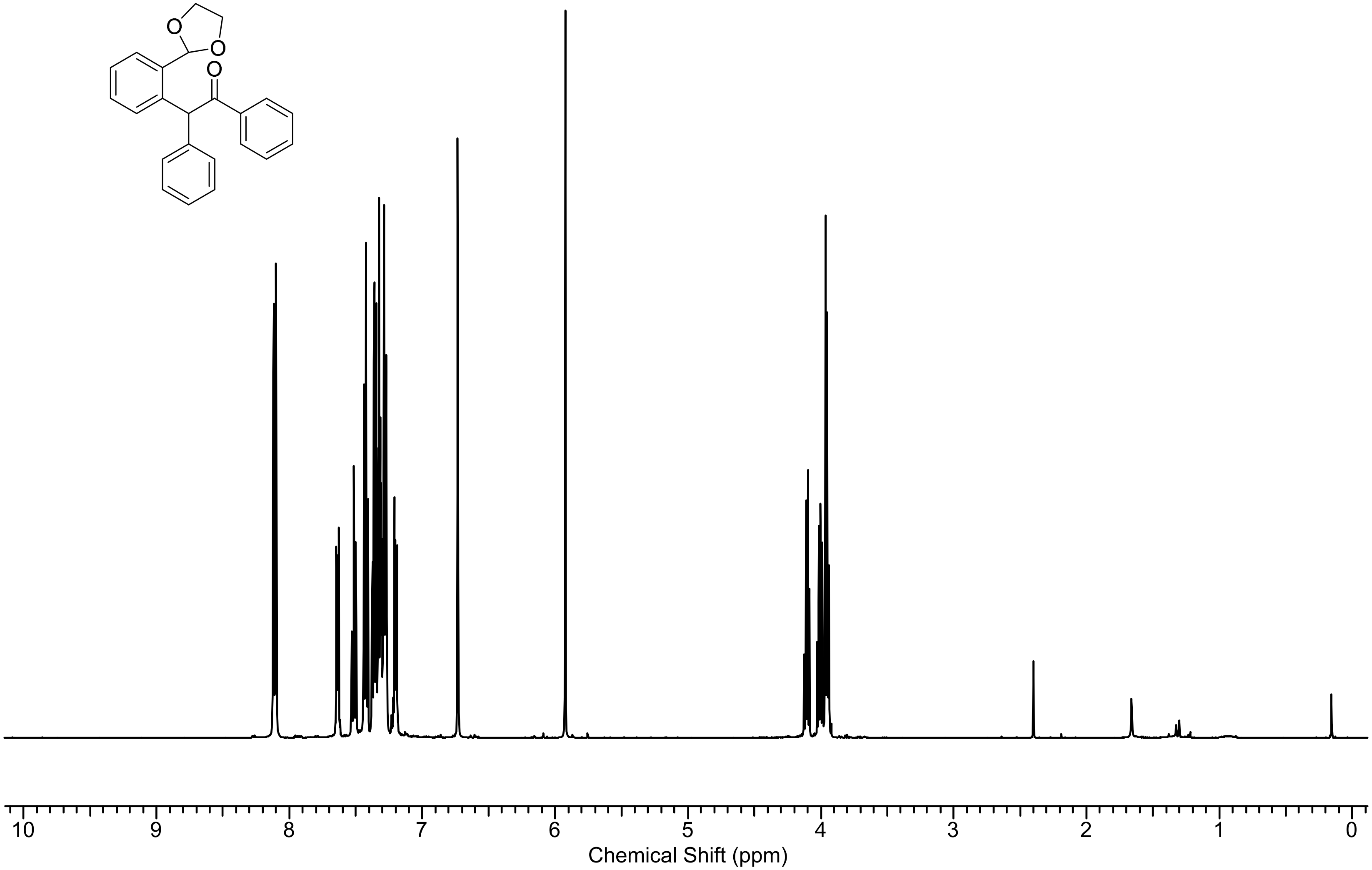
4-Allyl-3-*iso*butyl-1-methylisoquinoline **(4o)**



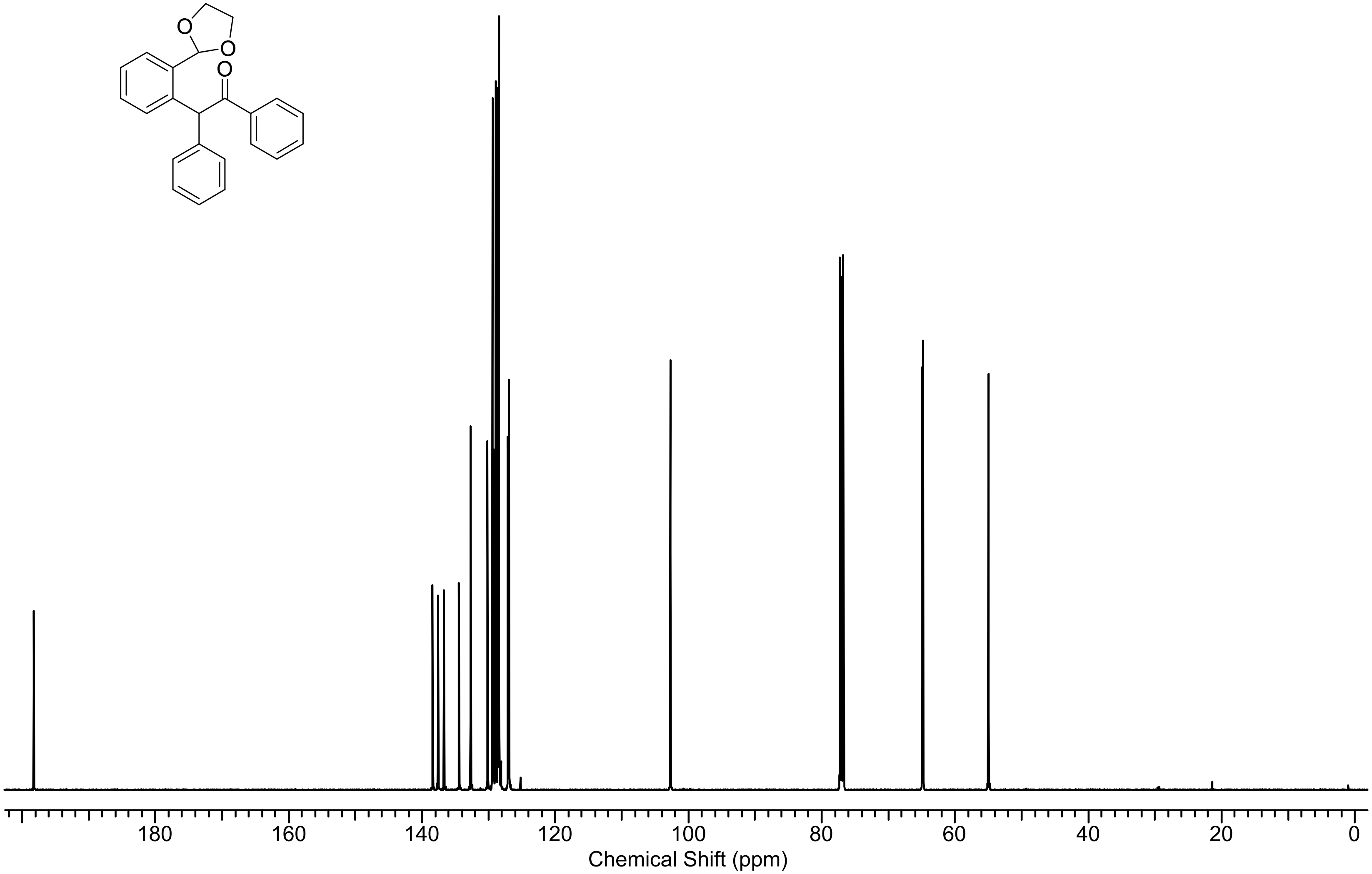
4-Allyl-3-*iso*butyl-1-methylisoquinoline **(4o)**



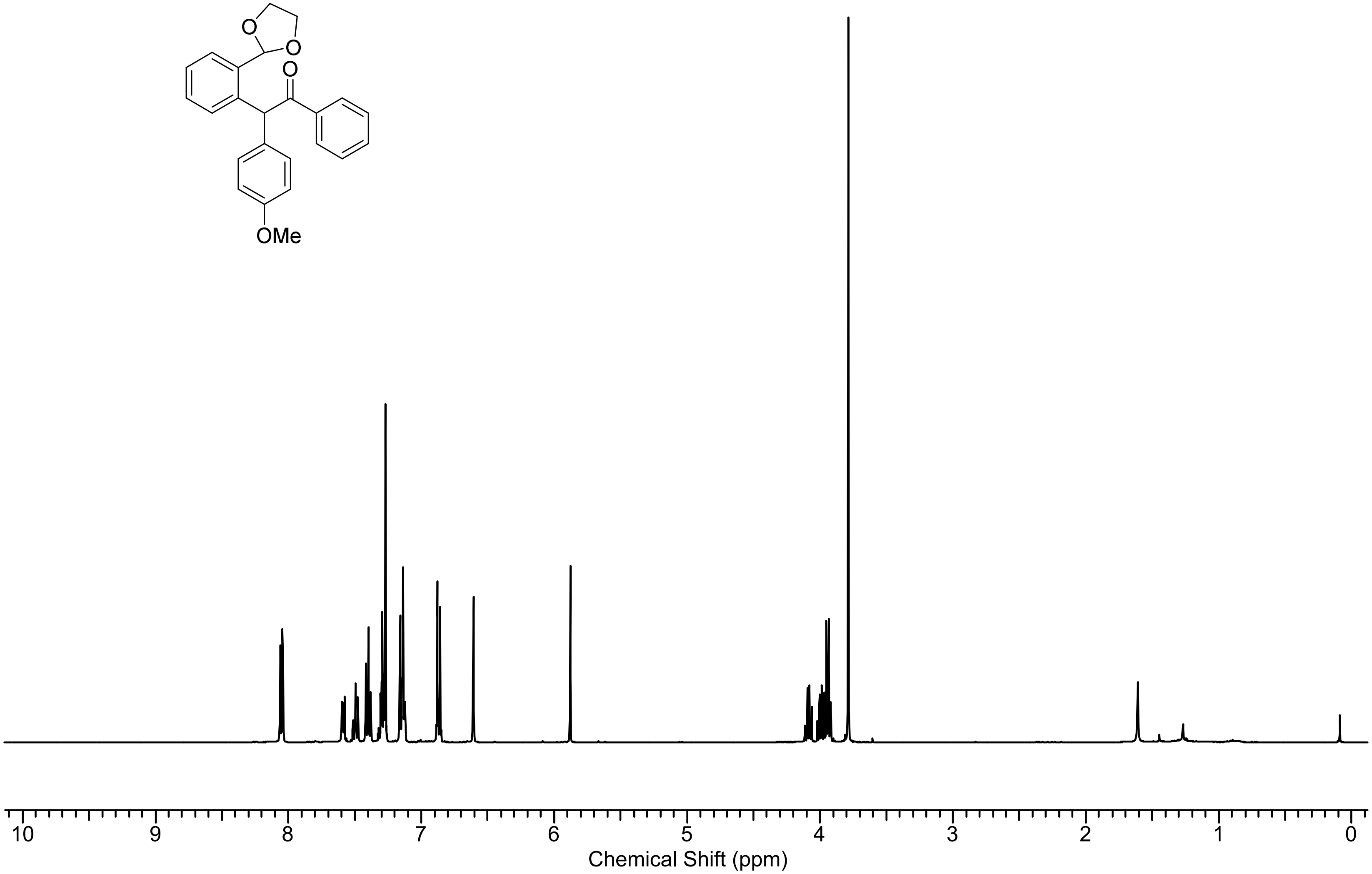
2-(2-(1,3-Dioxolan-2-yl)phenyl)-1,2-diphenylethanone **(5a)**



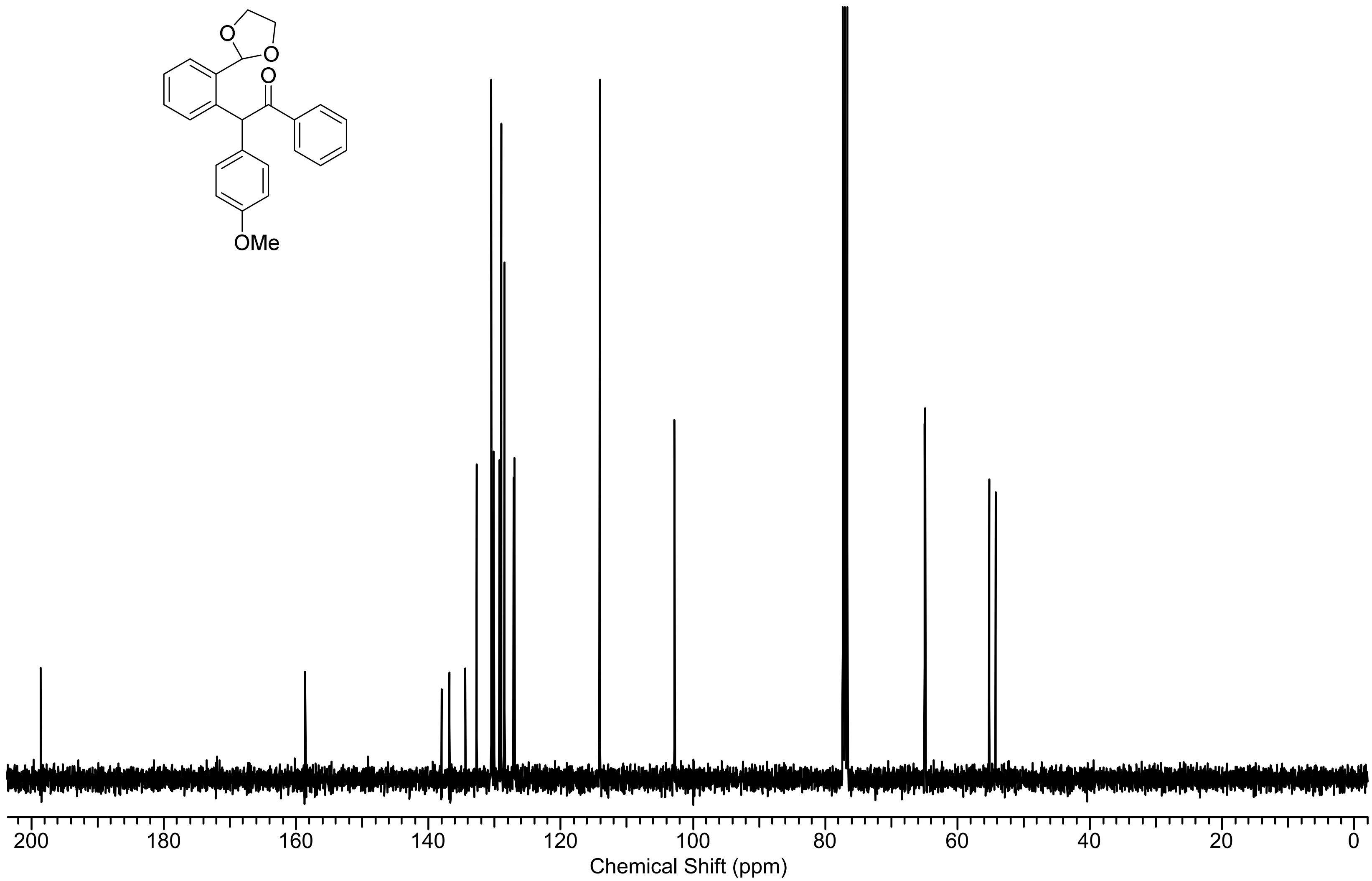
2-(2-(1,3-Dioxolan-2-yl)phenyl)-1,2-diphenylethanone **(5a)**



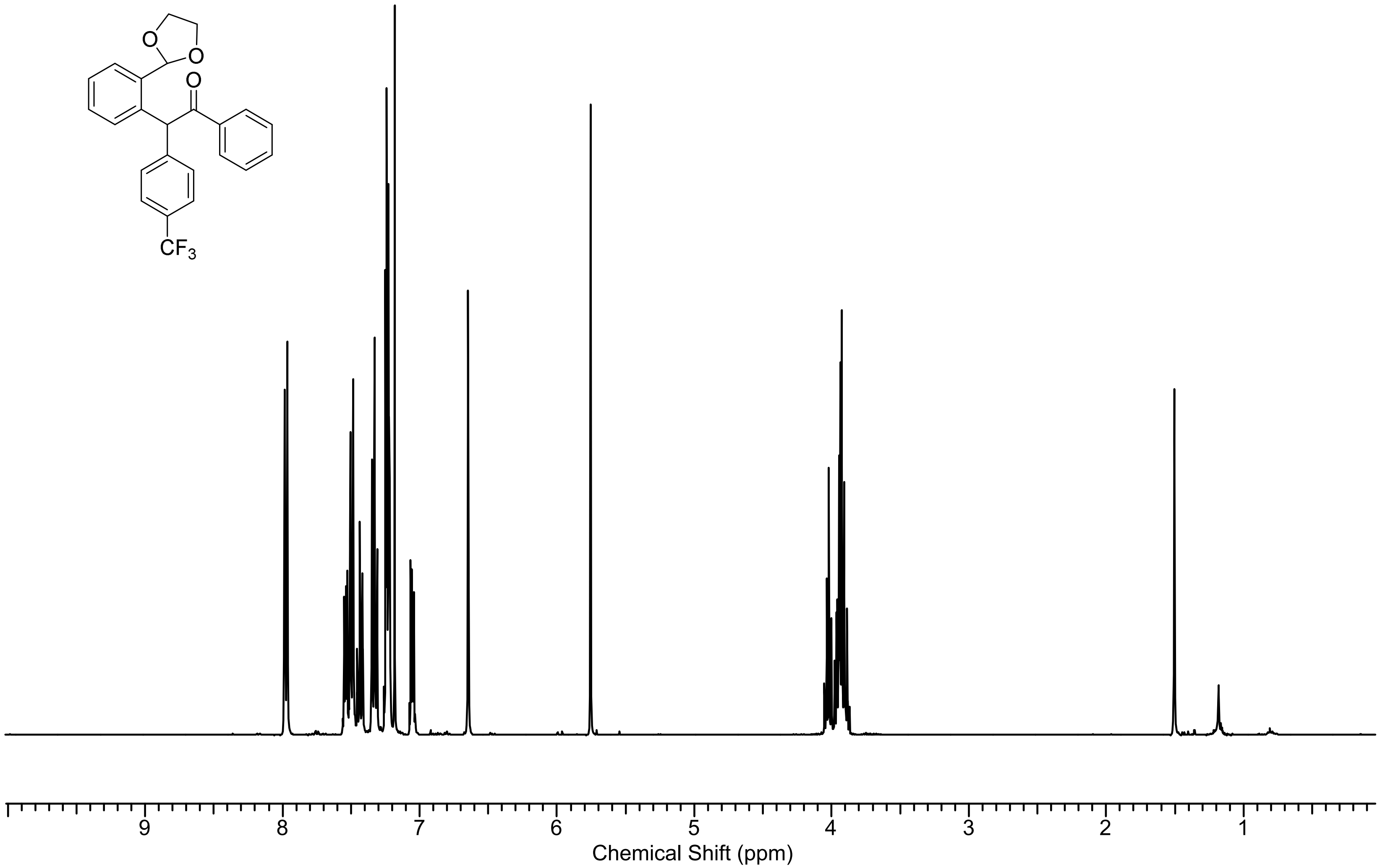
2-(2-(1,3-Dioxolan-2-yl)phenyl)-2-(4-methoxyphenyl)-1-phenylethanone **(5b)**



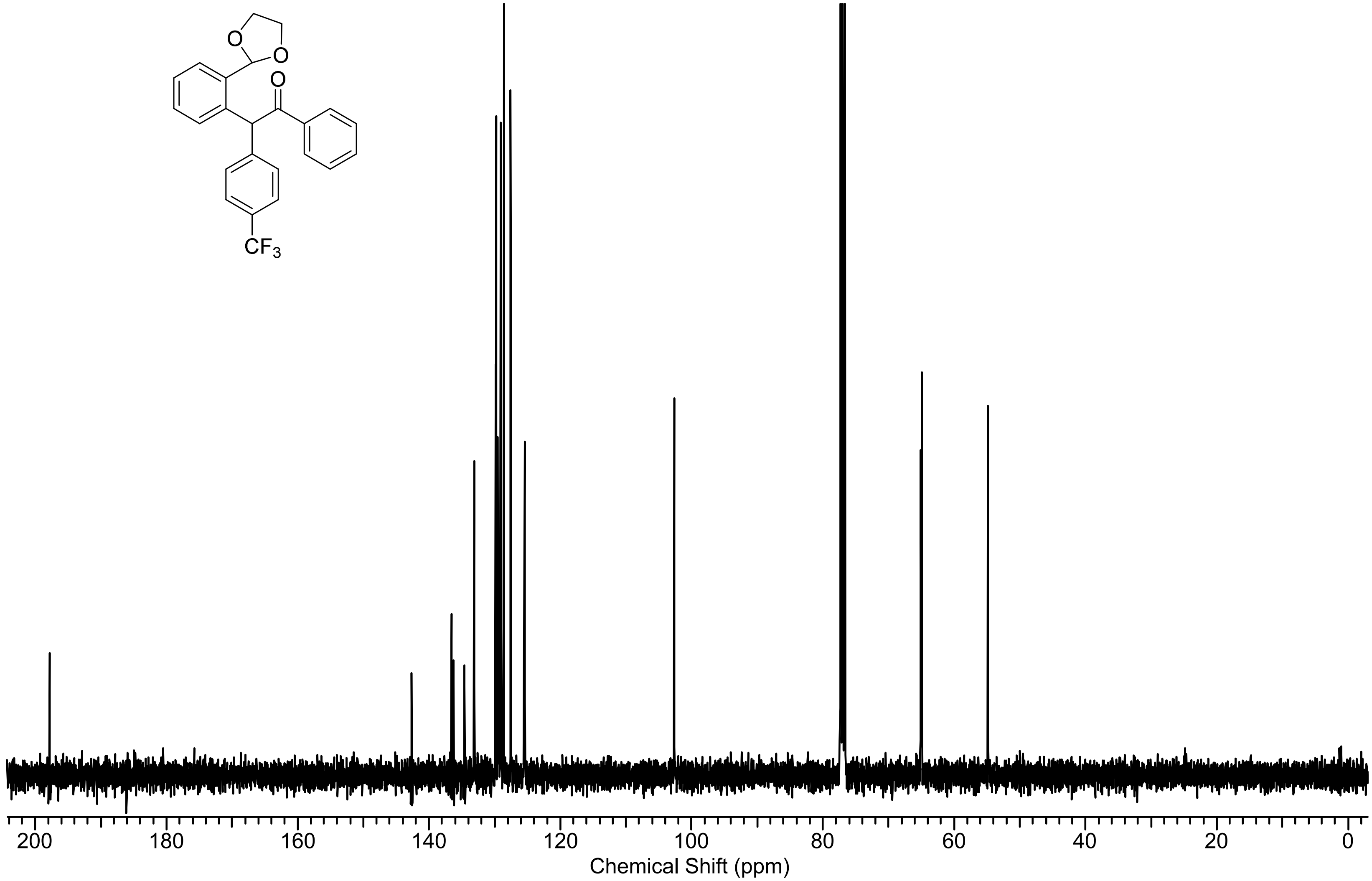
2-(2-(1,3-Dioxolan-2-yl)phenyl)-2-(4-methoxyphenyl)-1-phenylethanone **(5b)**



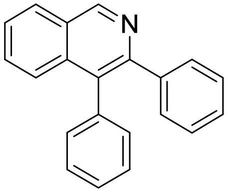
2-(2-(1,3-Dioxolan-2-yl)phenyl)-1-phenyl-2-(4-(trifluoromethyl)phenyl)ethanone **(5c)**

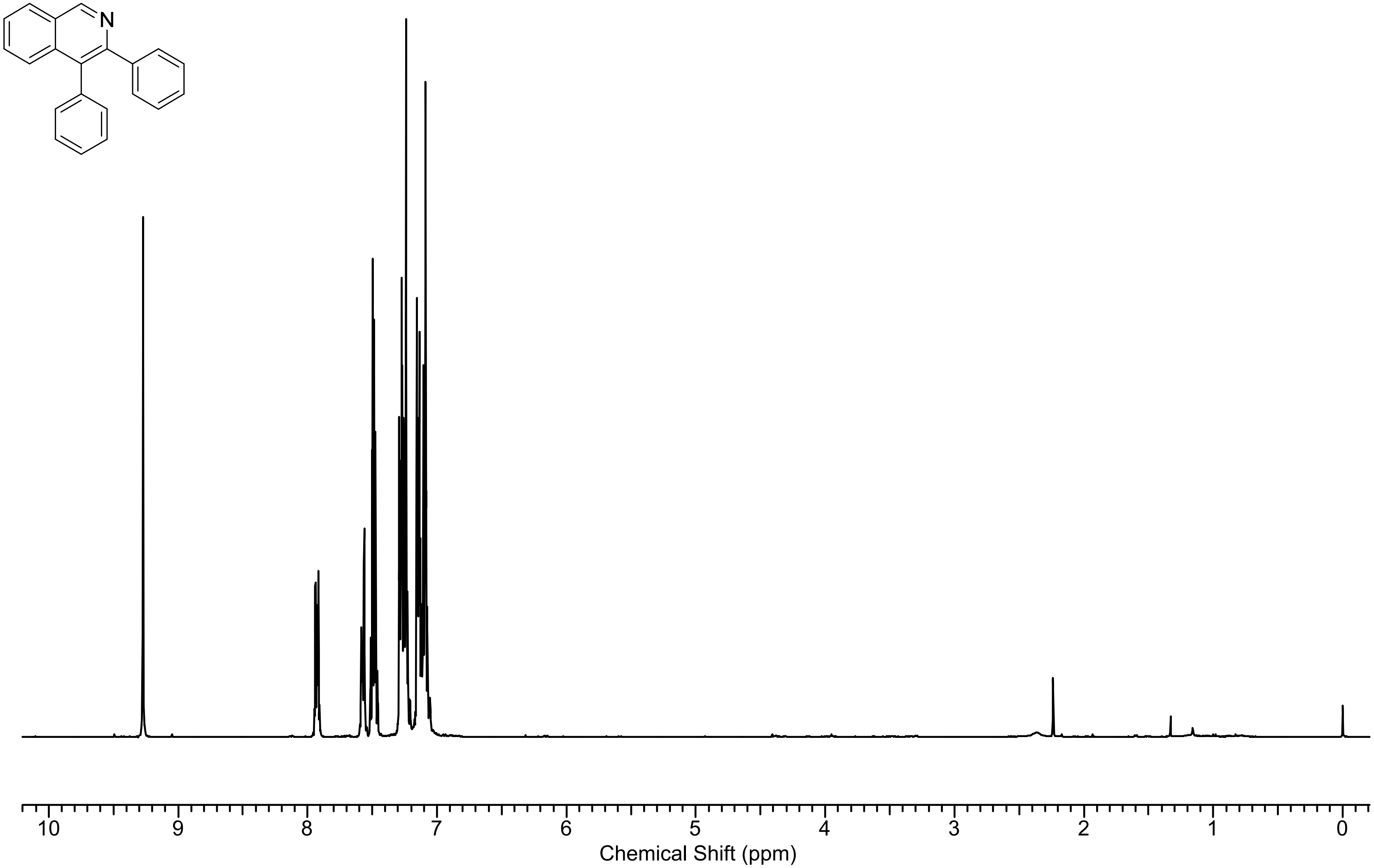


2-(2-(1,3-Dioxolan-2-yl)phenyl)-1-phenyl-2-(4-(trifluoromethyl)phenyl)ethanone **(5c)**

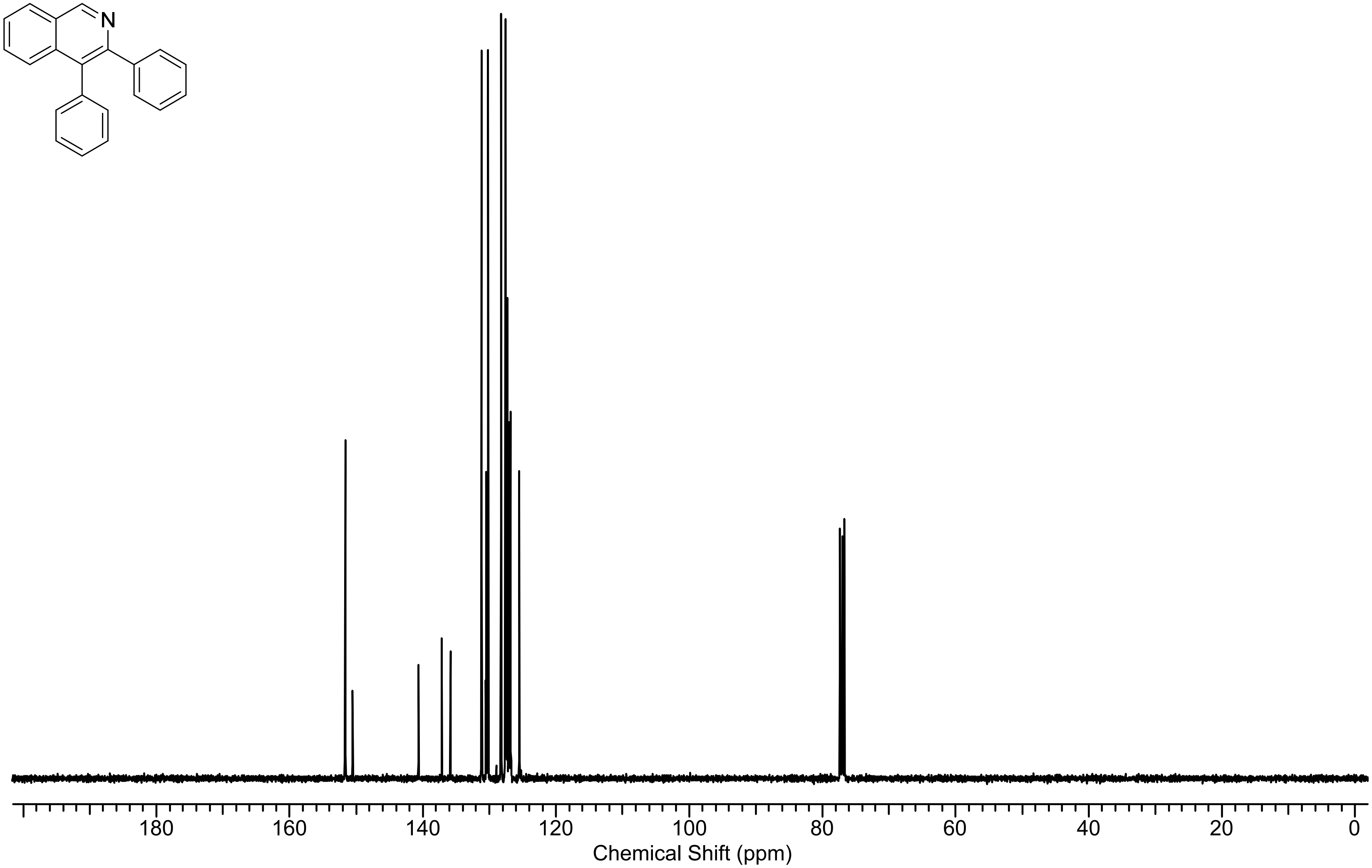


3,4-Diphenylisoquinoline **(6a)**

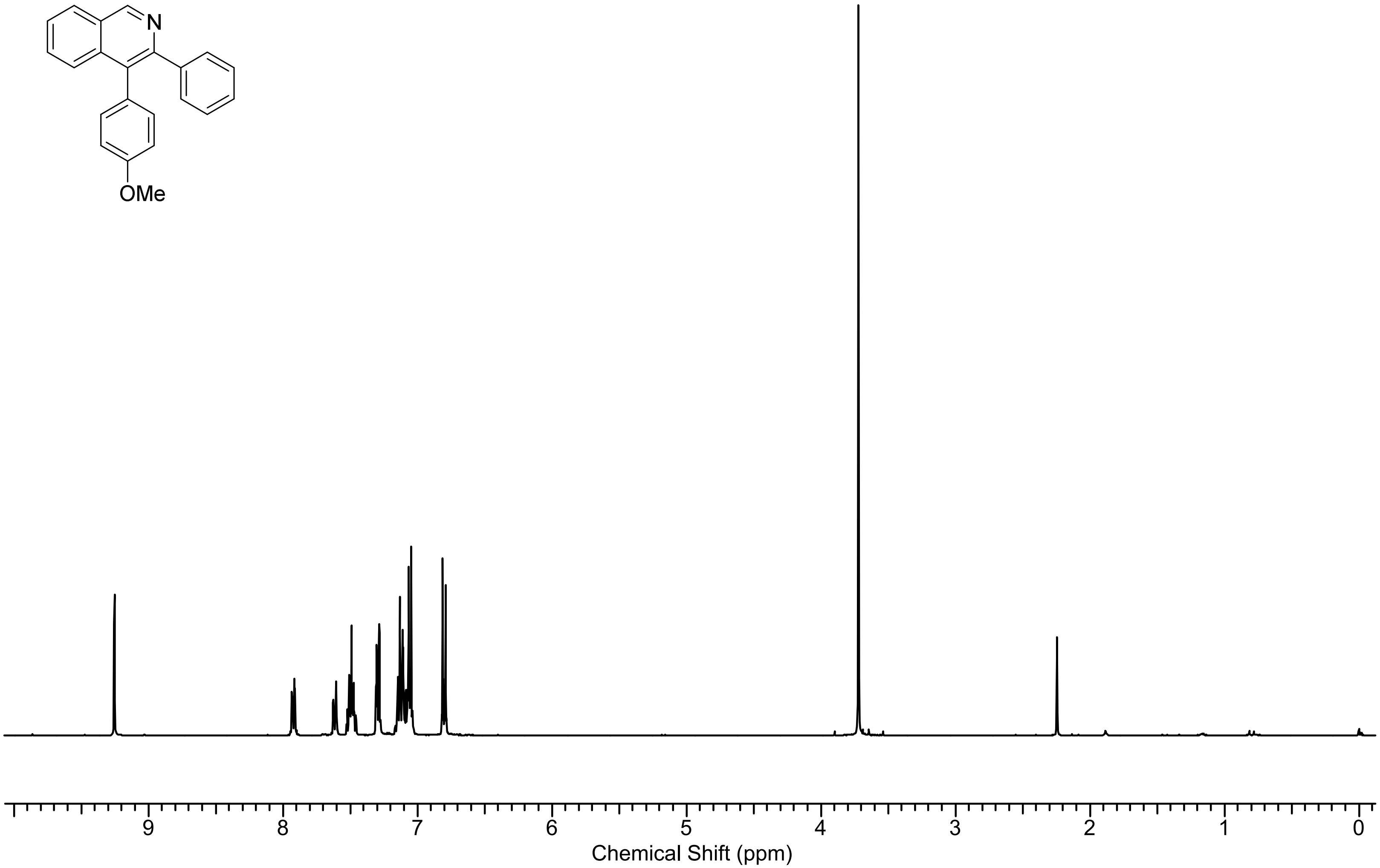




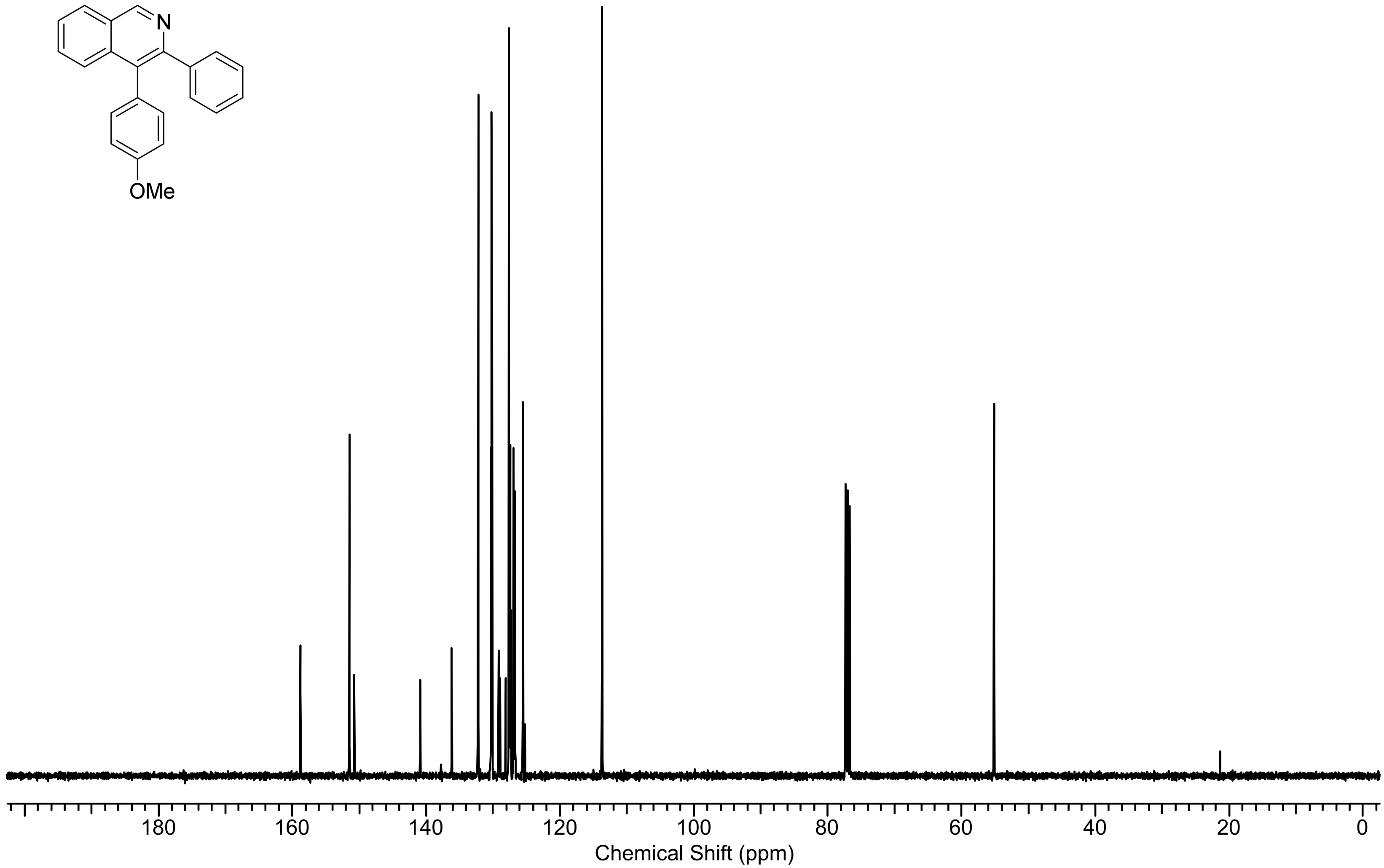
3,4-Diphenylisoquinoline **(6a)**



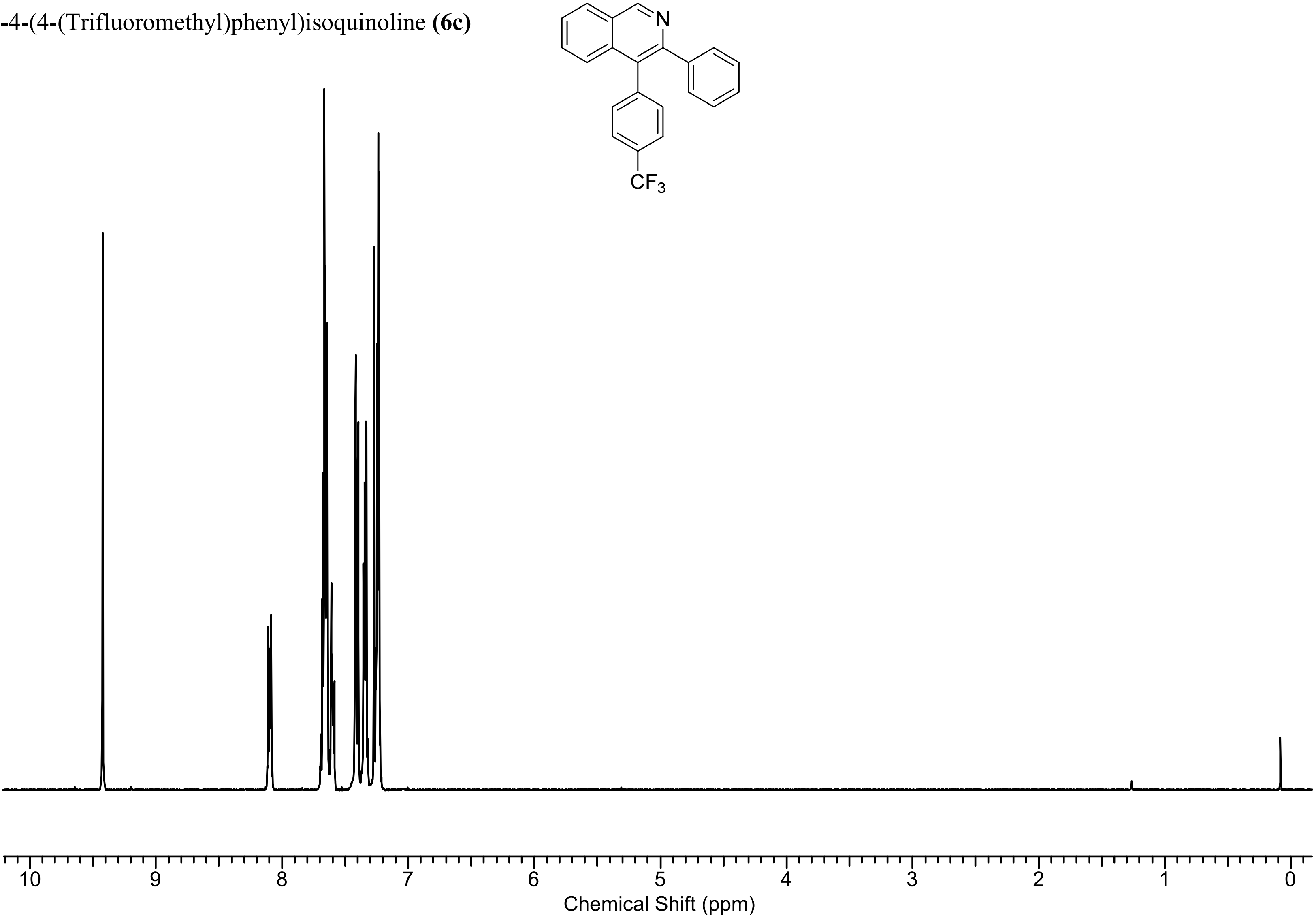
4-(4-Methoxyphenyl)-3-phenylisoquinoline **(6b)**



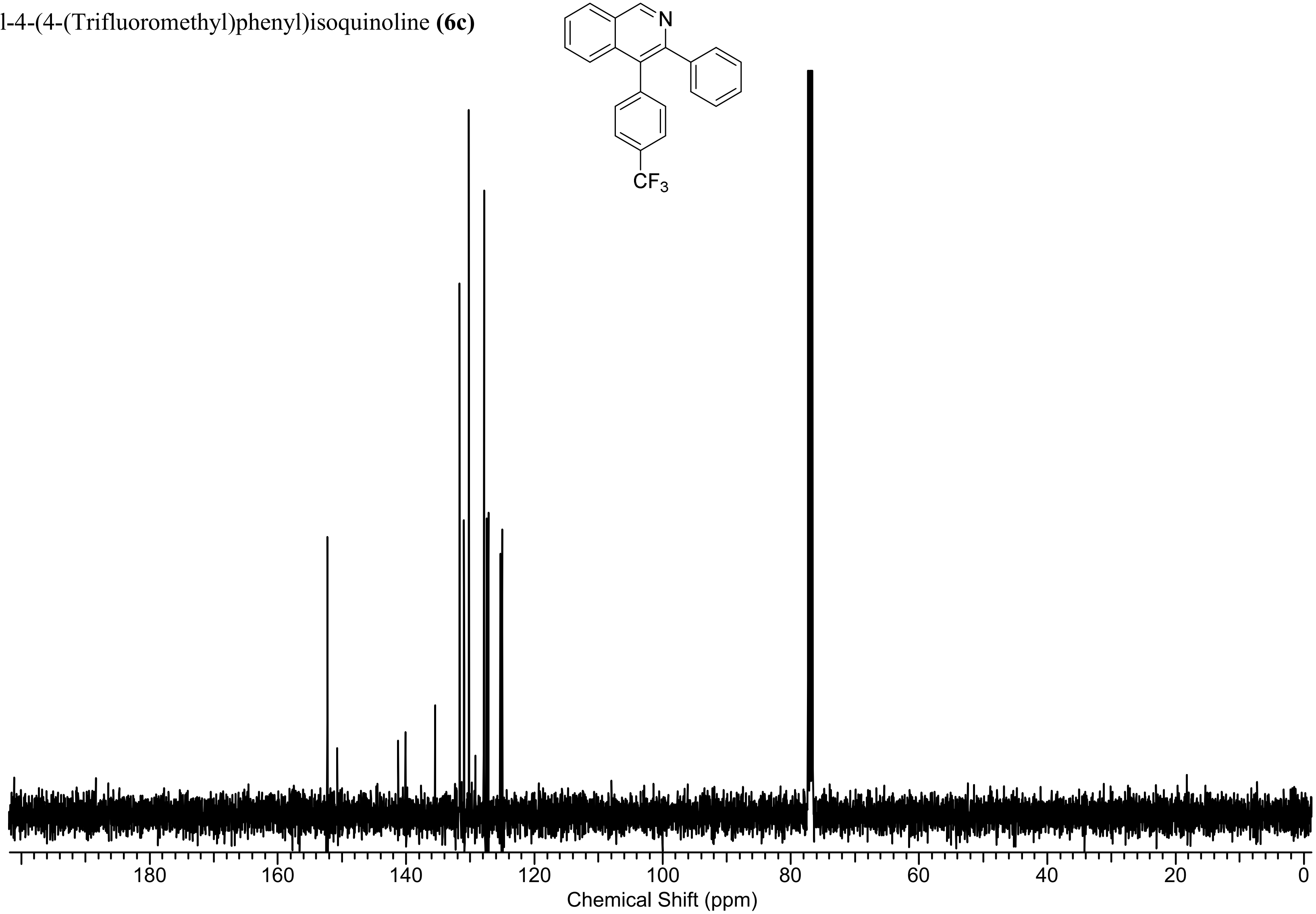
4-(4-Methoxyphenyl)-3-phenylisoquinoline **(6b)**



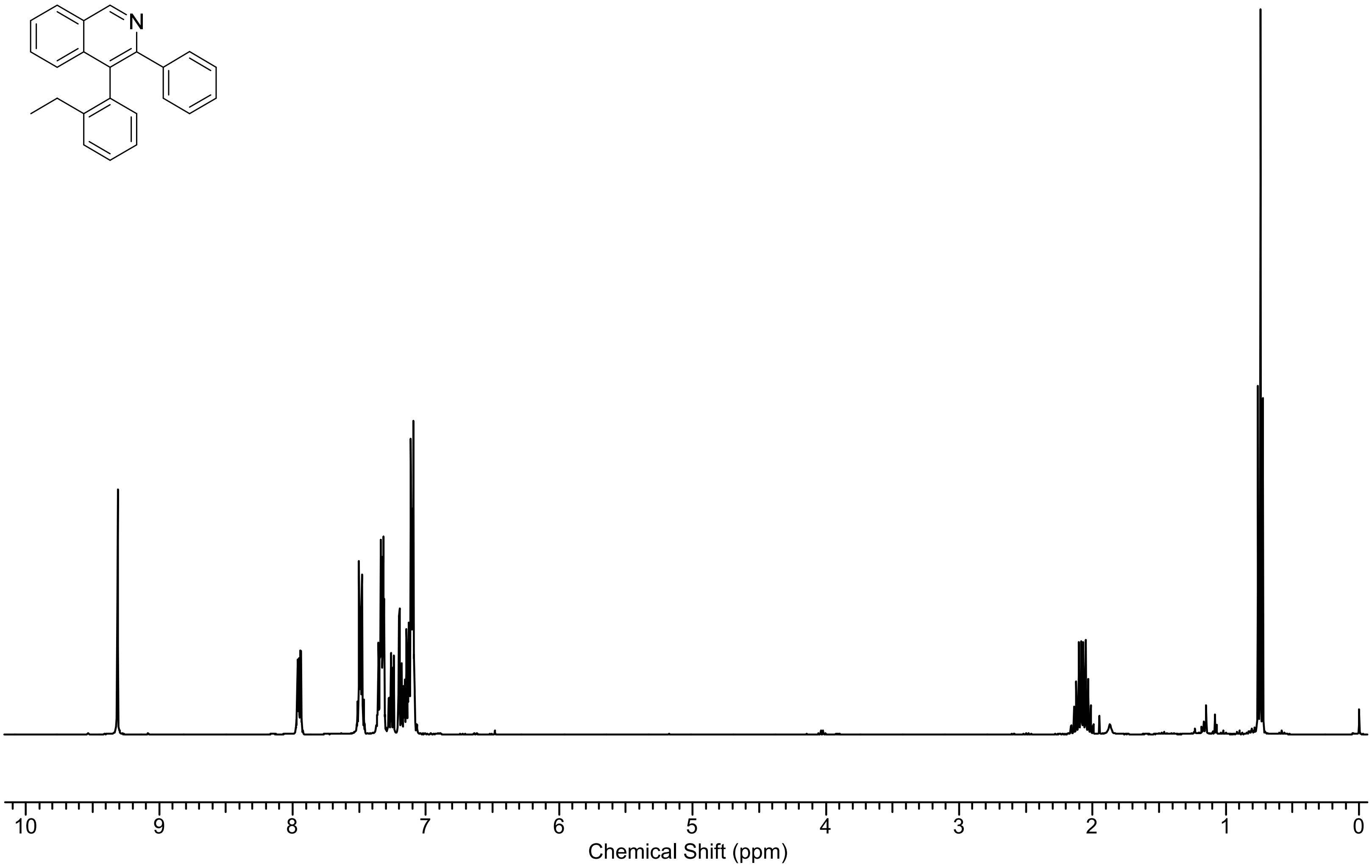
3-Phenyl-4-(4-(Trifluoromethyl)phenyl)isoquinoline **(6c)**



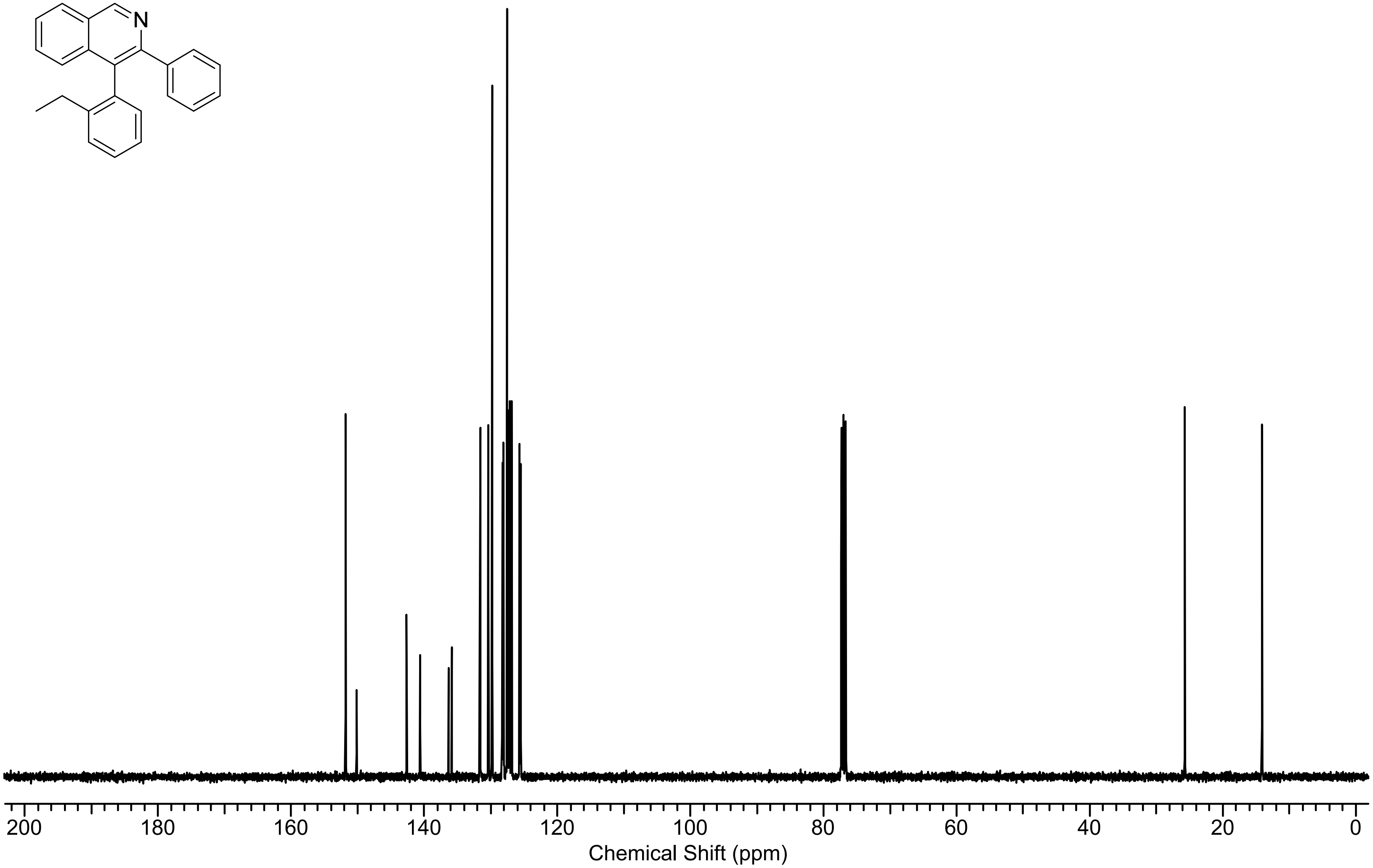
3-Phenyl-4-(4-(Trifluoromethyl)phenyl)isoquinoline **(6c)**



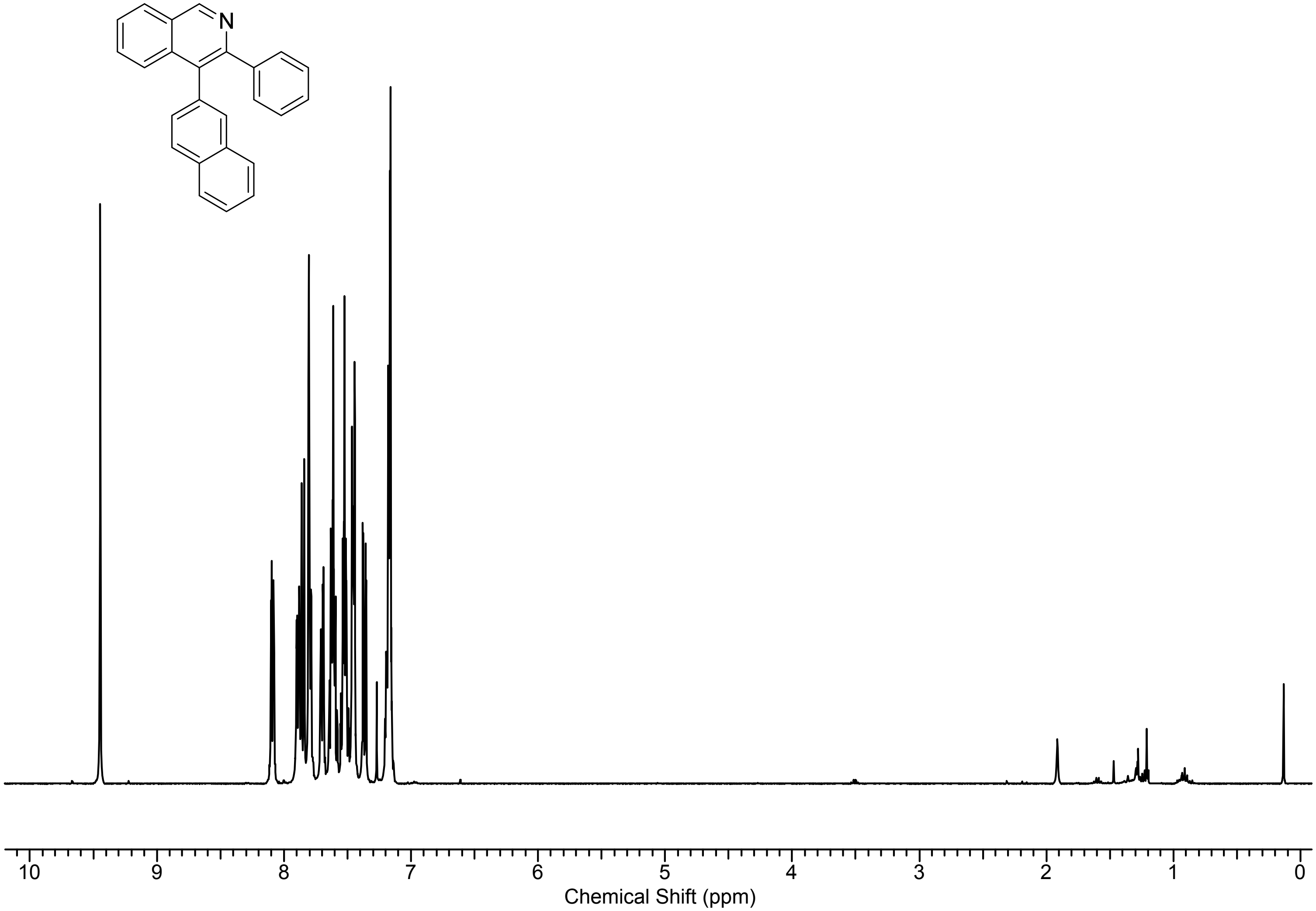
4-(2-Ethylphenyl)-3-phenylisoquinoline **(6d)**



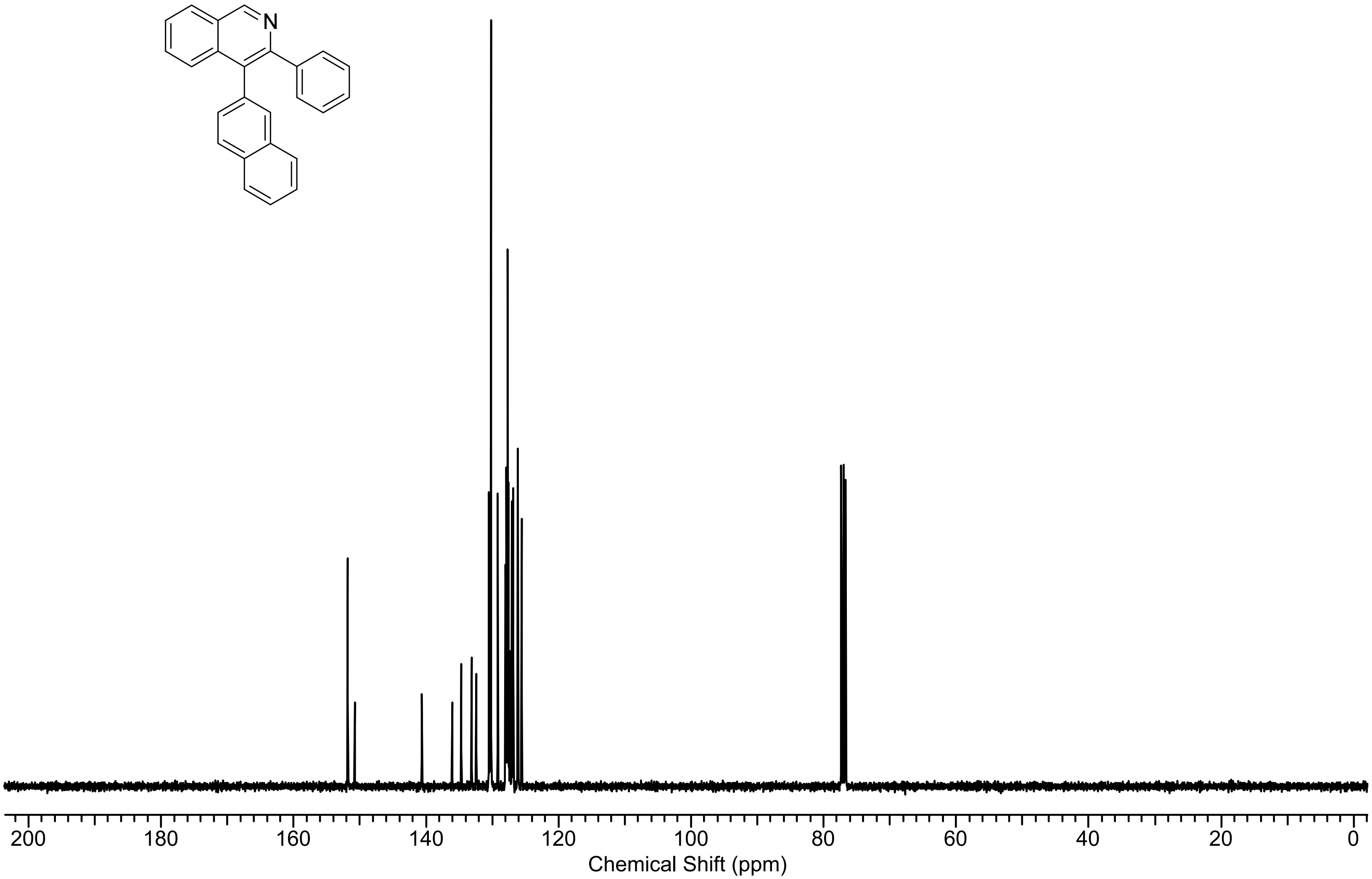
4-(2-Ethylphenyl)-3-phenylisoquinoline **(6d)**



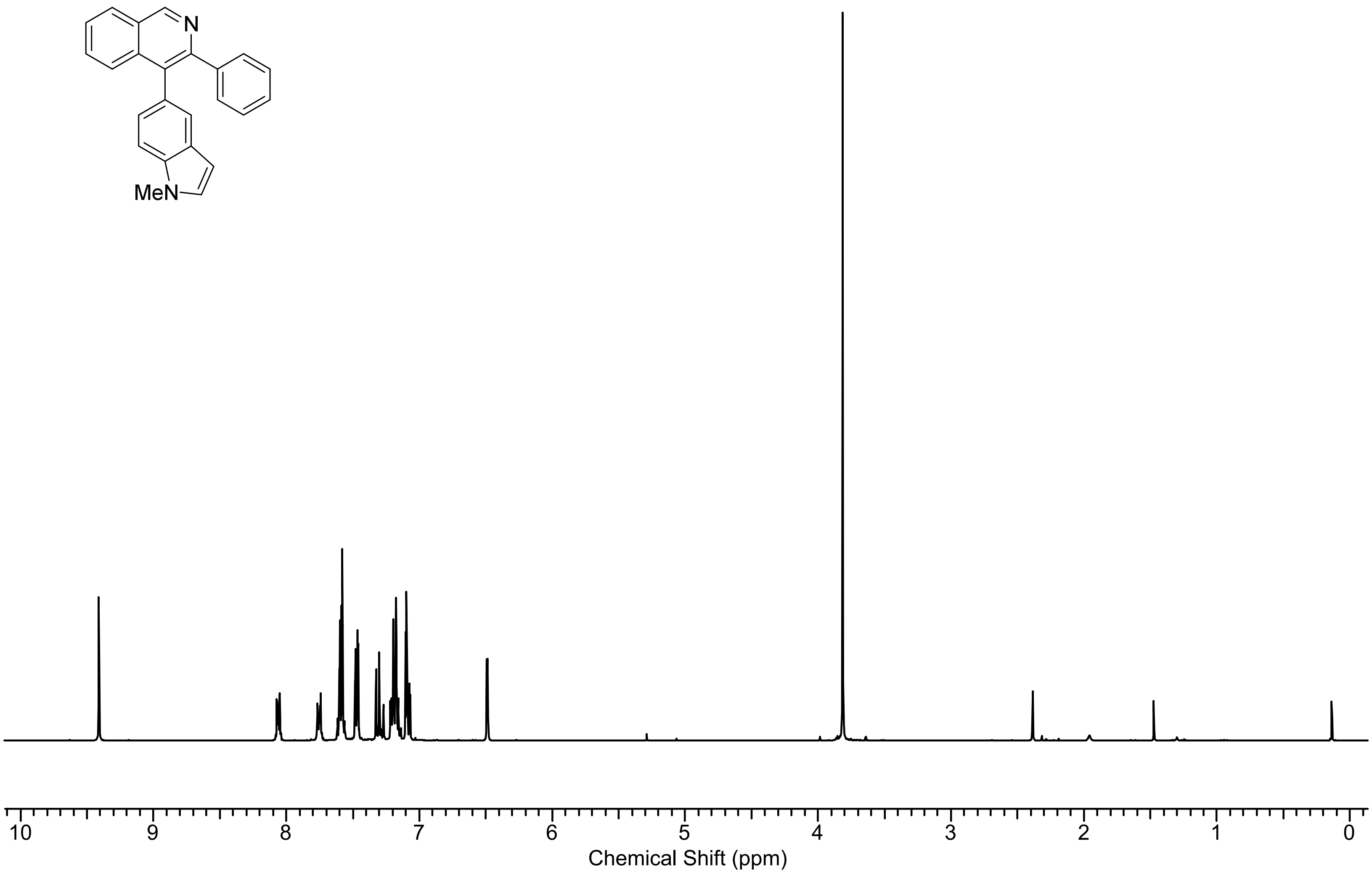
4-(Naphthalen-2-yl)-3-phenylisoquinoline **(6e)**



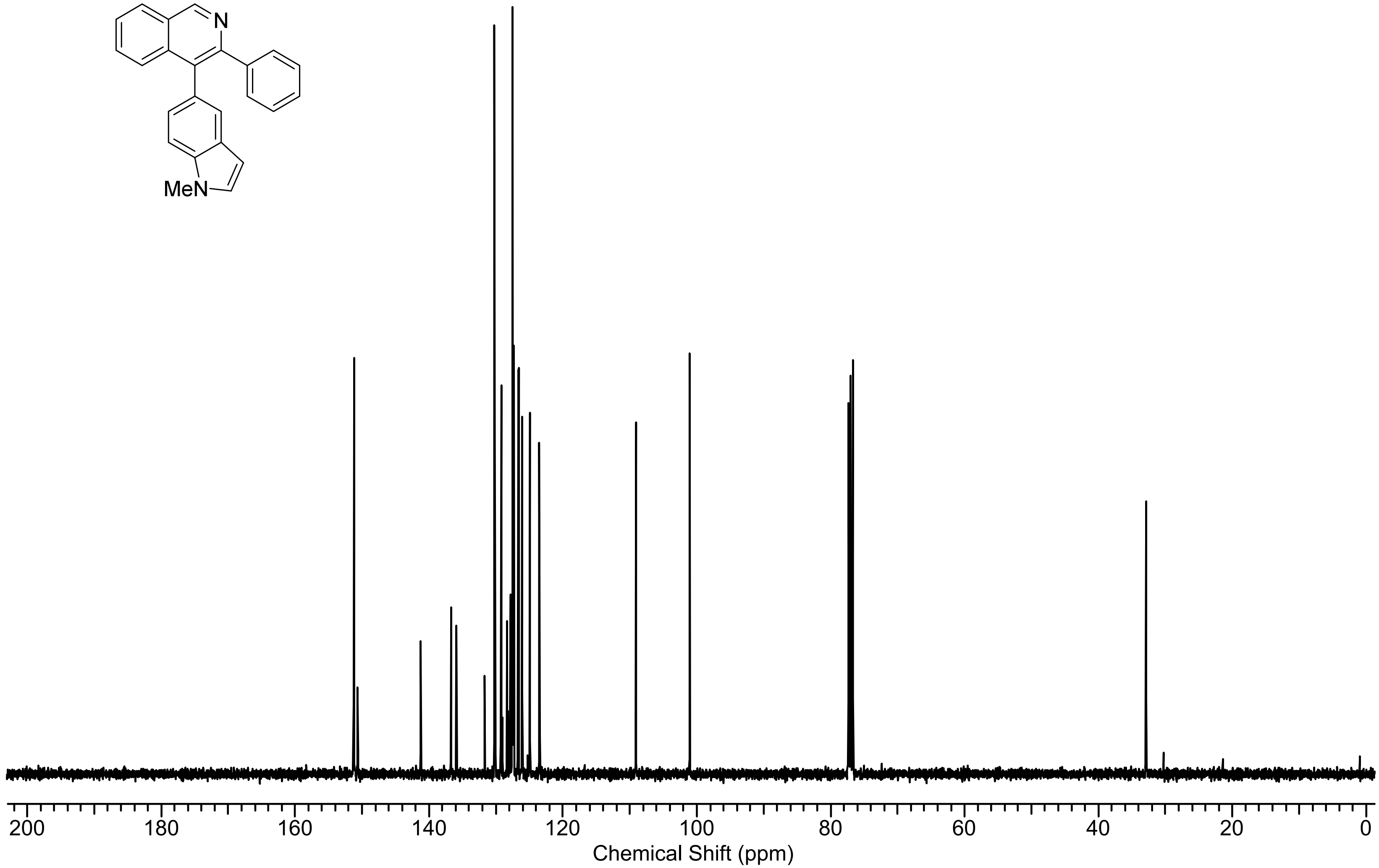
4-(Naphthalen-2-yl)-3-phenylisoquinoline **(6e)**



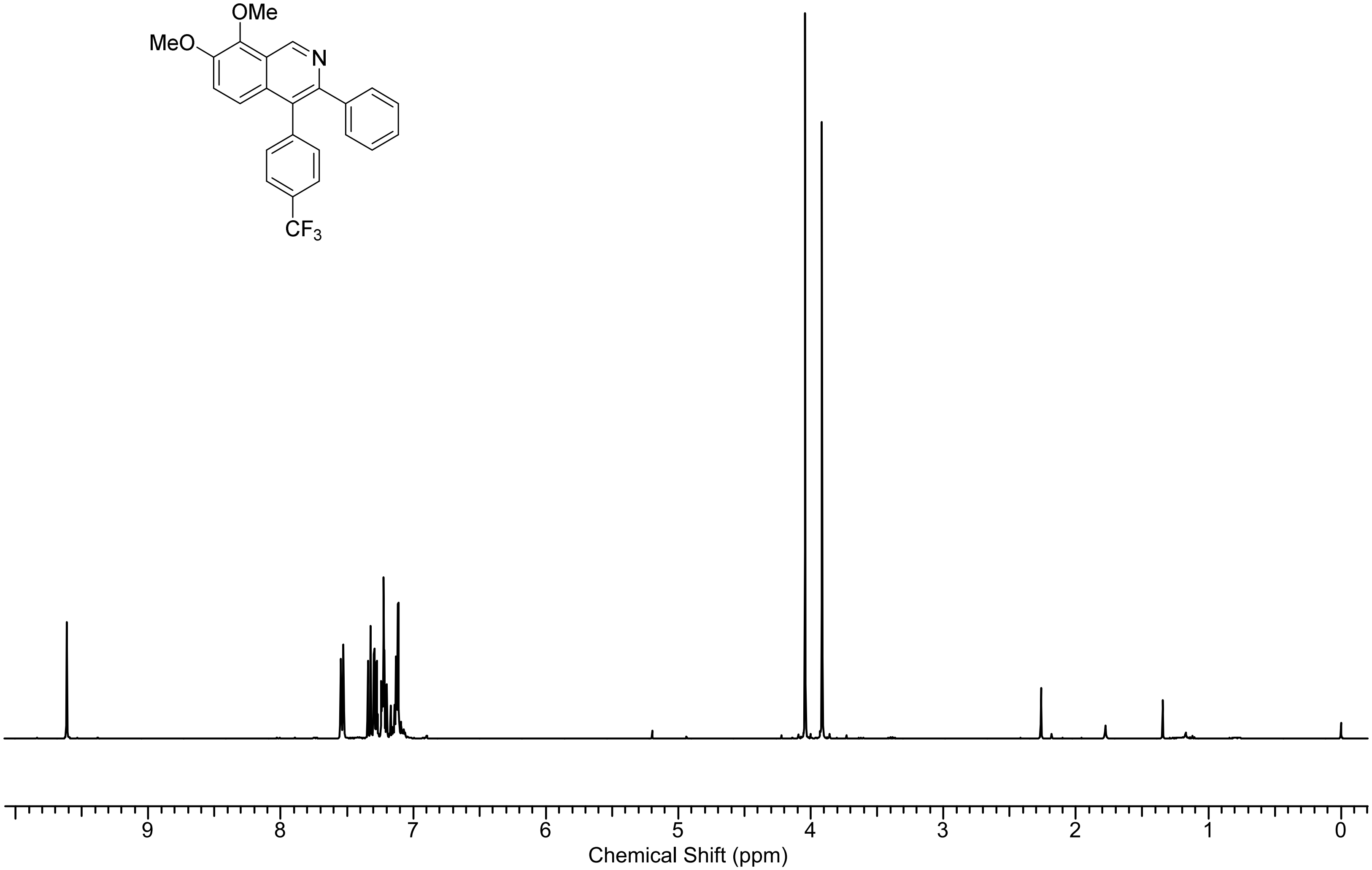
4-(1-Methyl-1H-indol-5-yl)-3-phenylisoquinoline **(6f)**



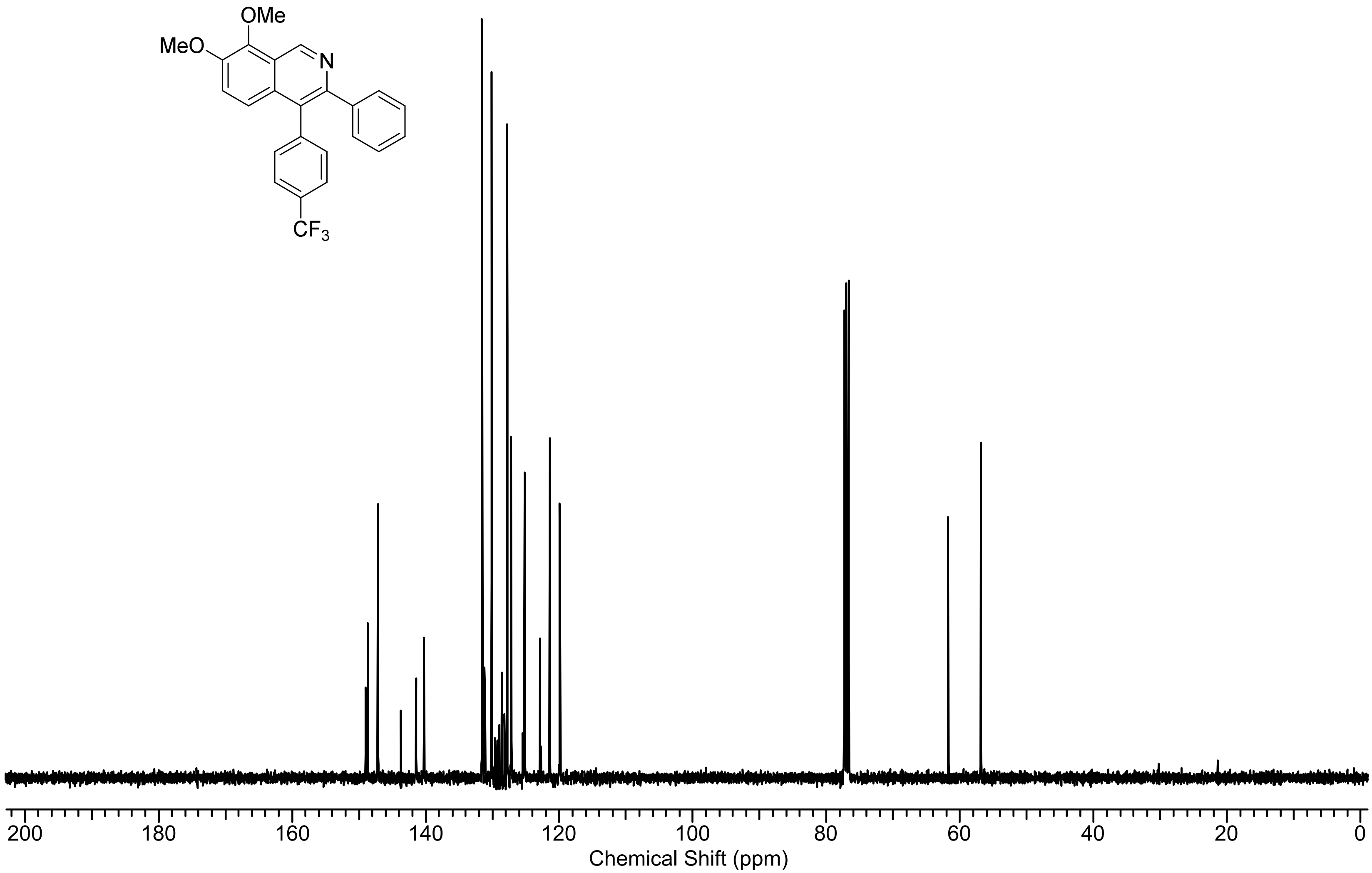
4-(1-Methyl-1H-indol-5-yl)-3-phenylisoquinoline **(6f)**



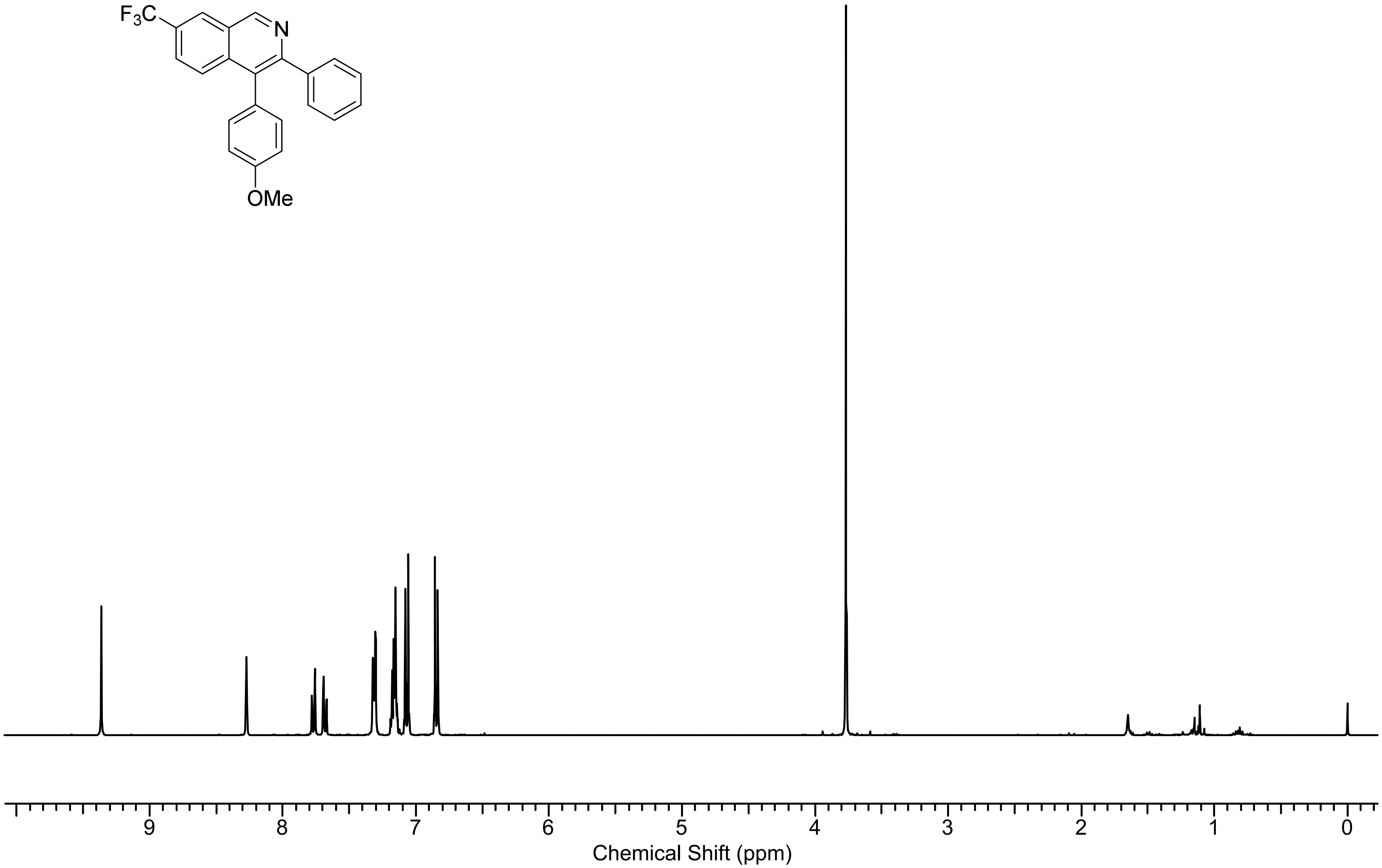
7,8-Dimethoxy-3-phenyl-4-(4-(trifluoromethyl)phenyl)isoquinoline **(6g)**



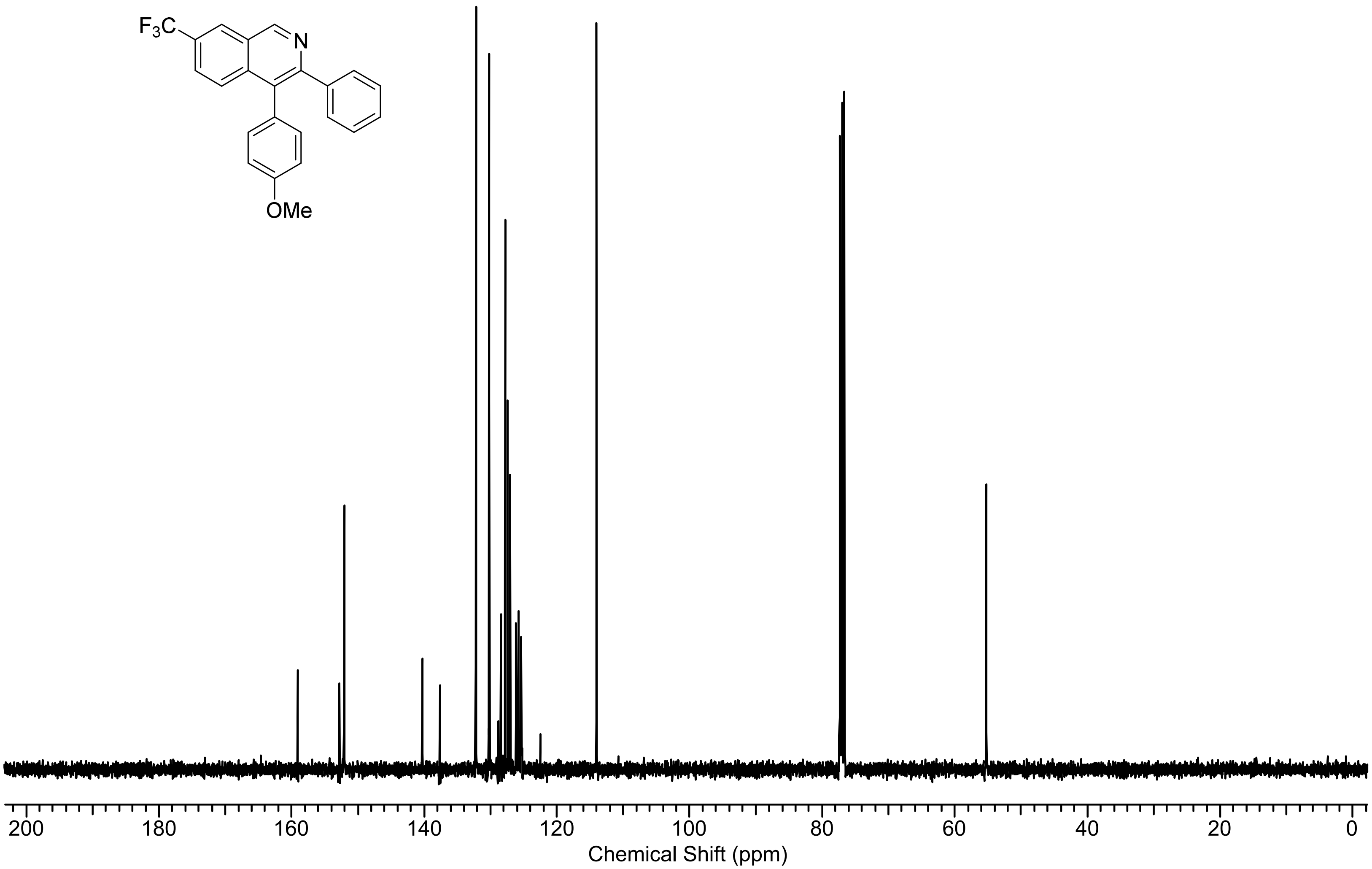
7,8-Dimethoxy-3-phenyl-4-(4-(trifluoromethyl)phenyl)isoquinoline **(6g)**



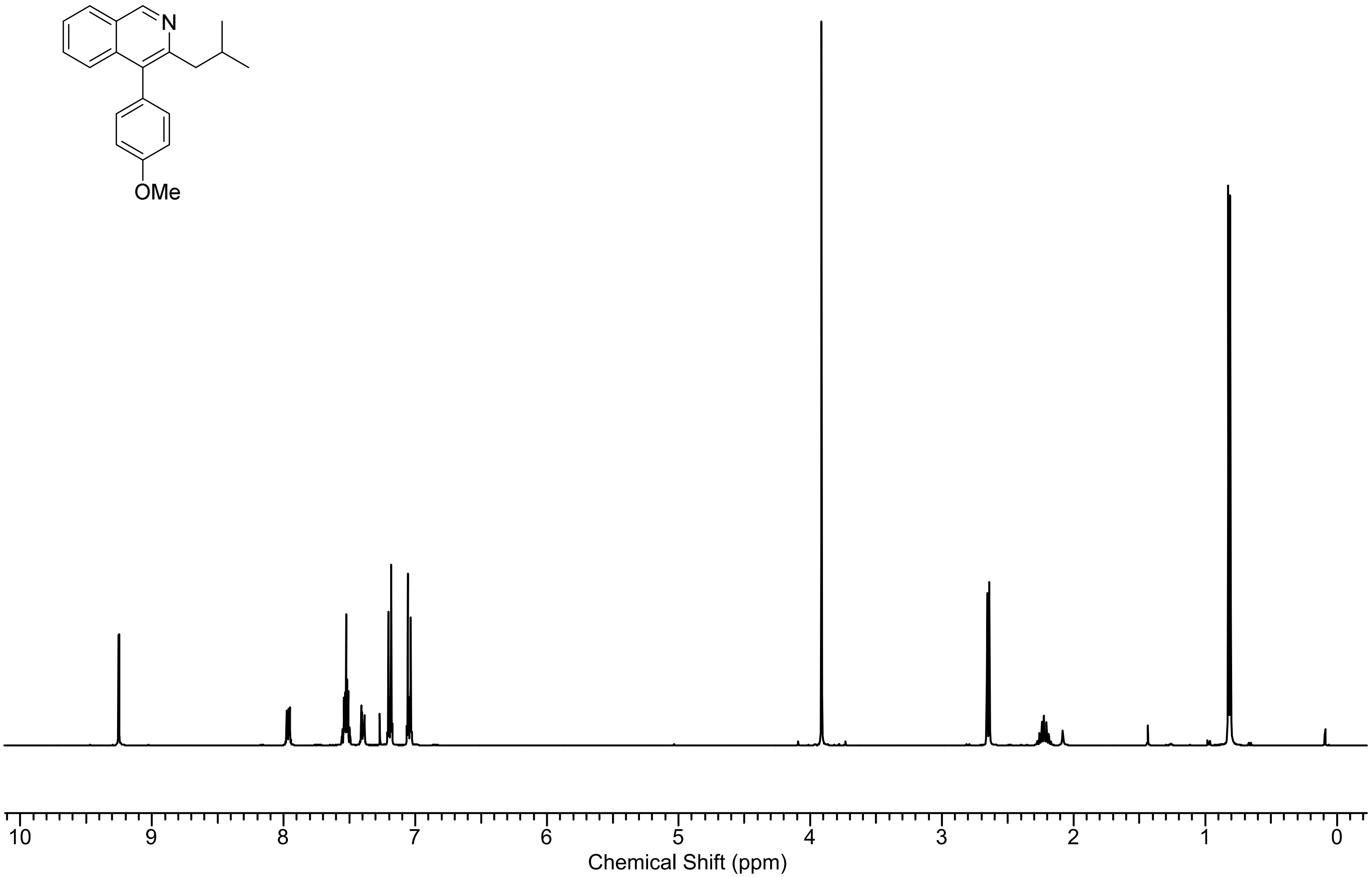
4-(4-Methoxyphenyl)-3-phenyl-7-(trifluoromethyl)isoquinoline **(6h)**



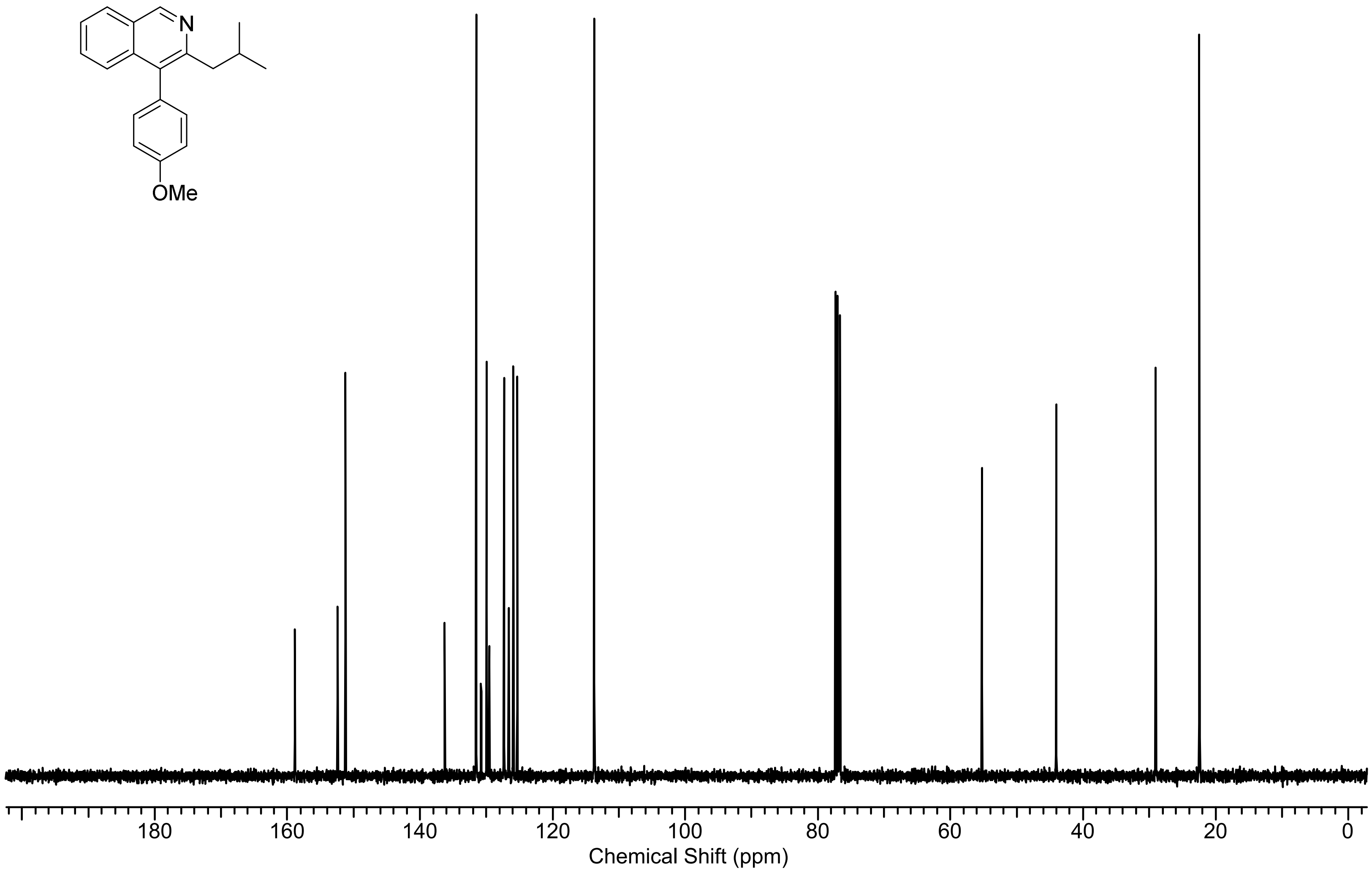
4-(4-Methoxyphenyl)-3-phenyl-7-(trifluoromethyl)isoquinoline **(6h)**



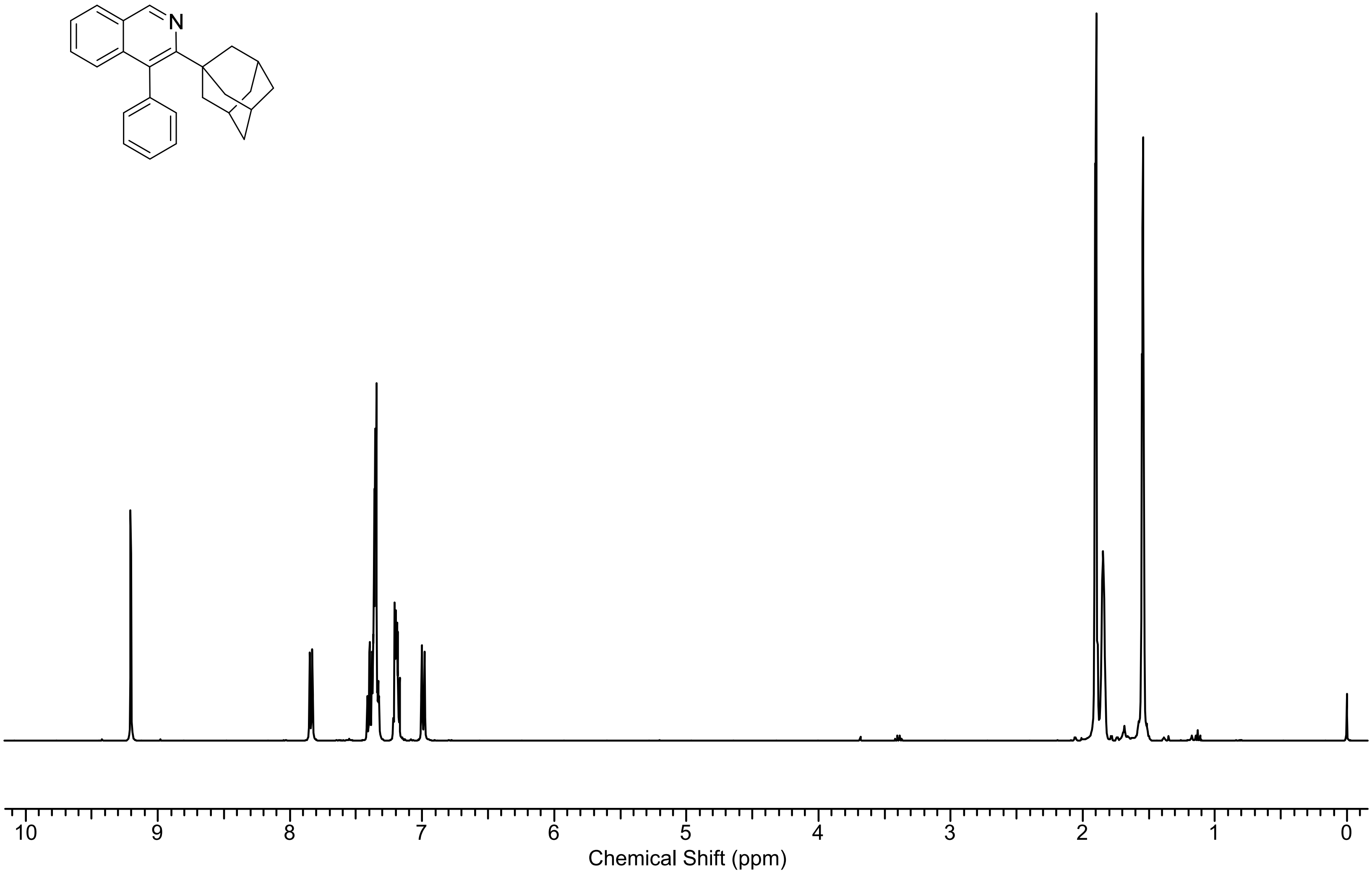
3-*iso*Butyl-4-(4-methoxyphenyl)isoquinoline **(6i)**



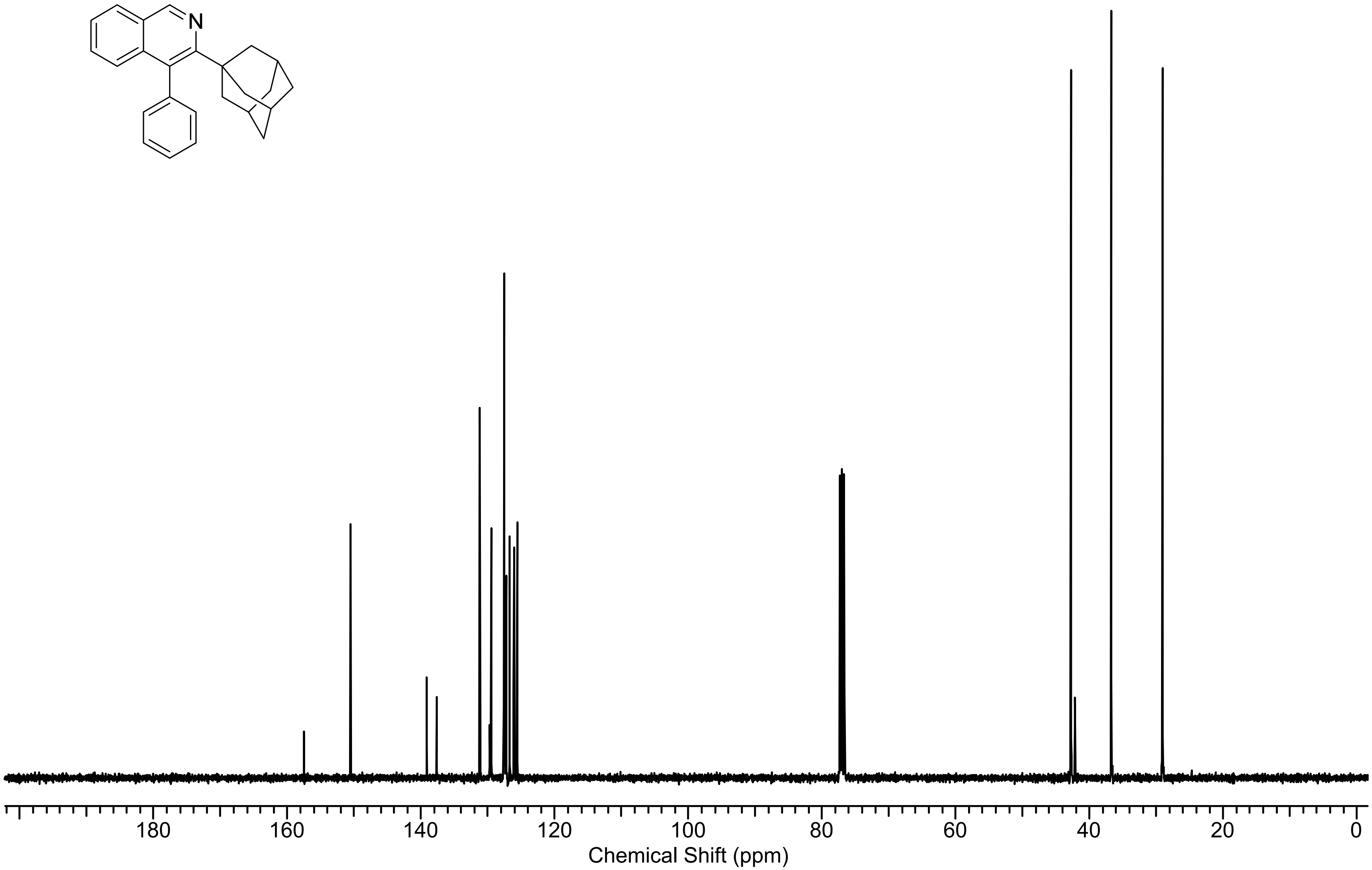
3-*iso*Butyl-4-(4-methoxyphenyl)isoquinoline **(6i)**



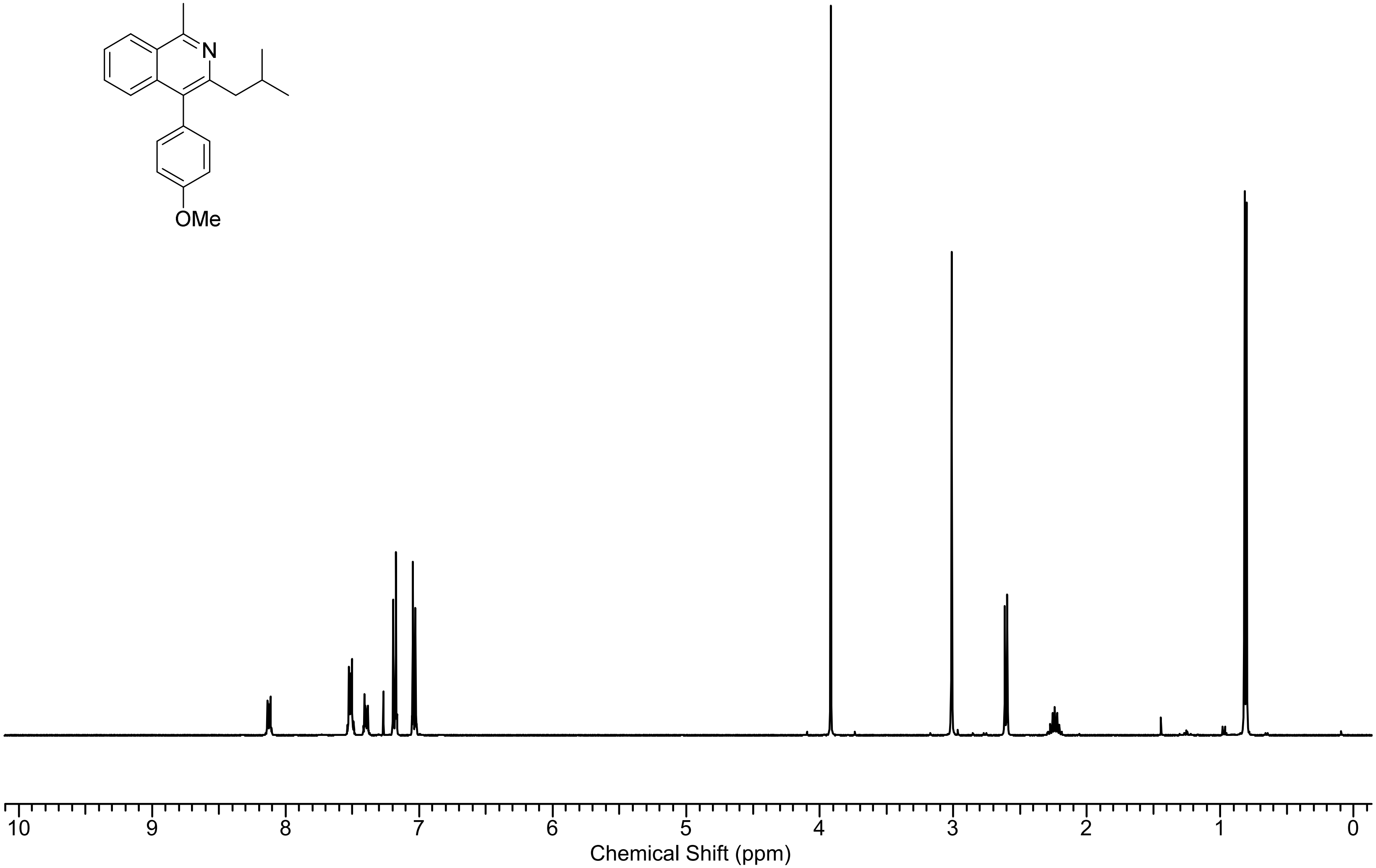
3-(Adamantan-1-yl)-4-phenylisoquinoline **(6j)**



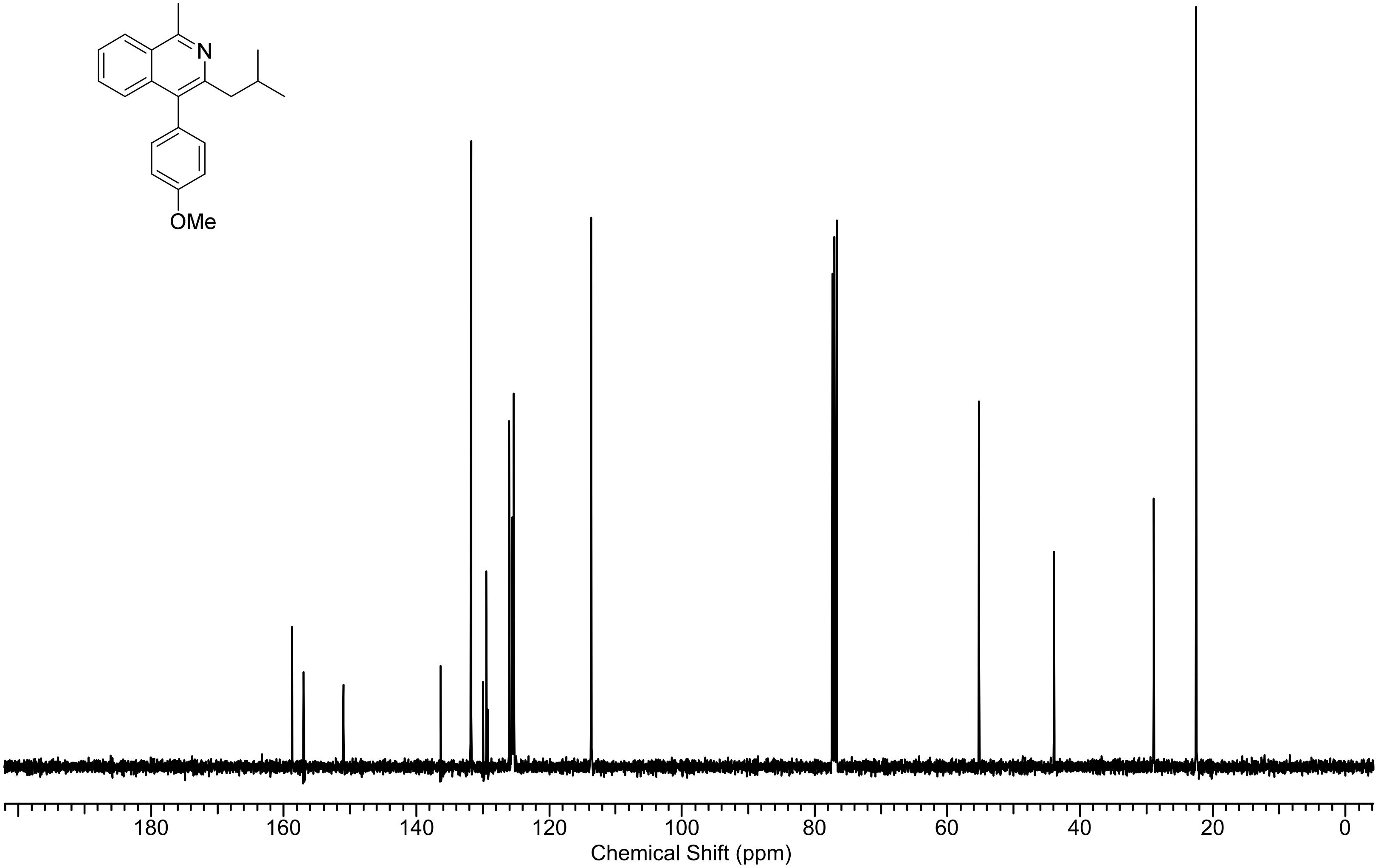
3-(Adamantan-1-yl)-4-phenylisoquinoline **(6j)**



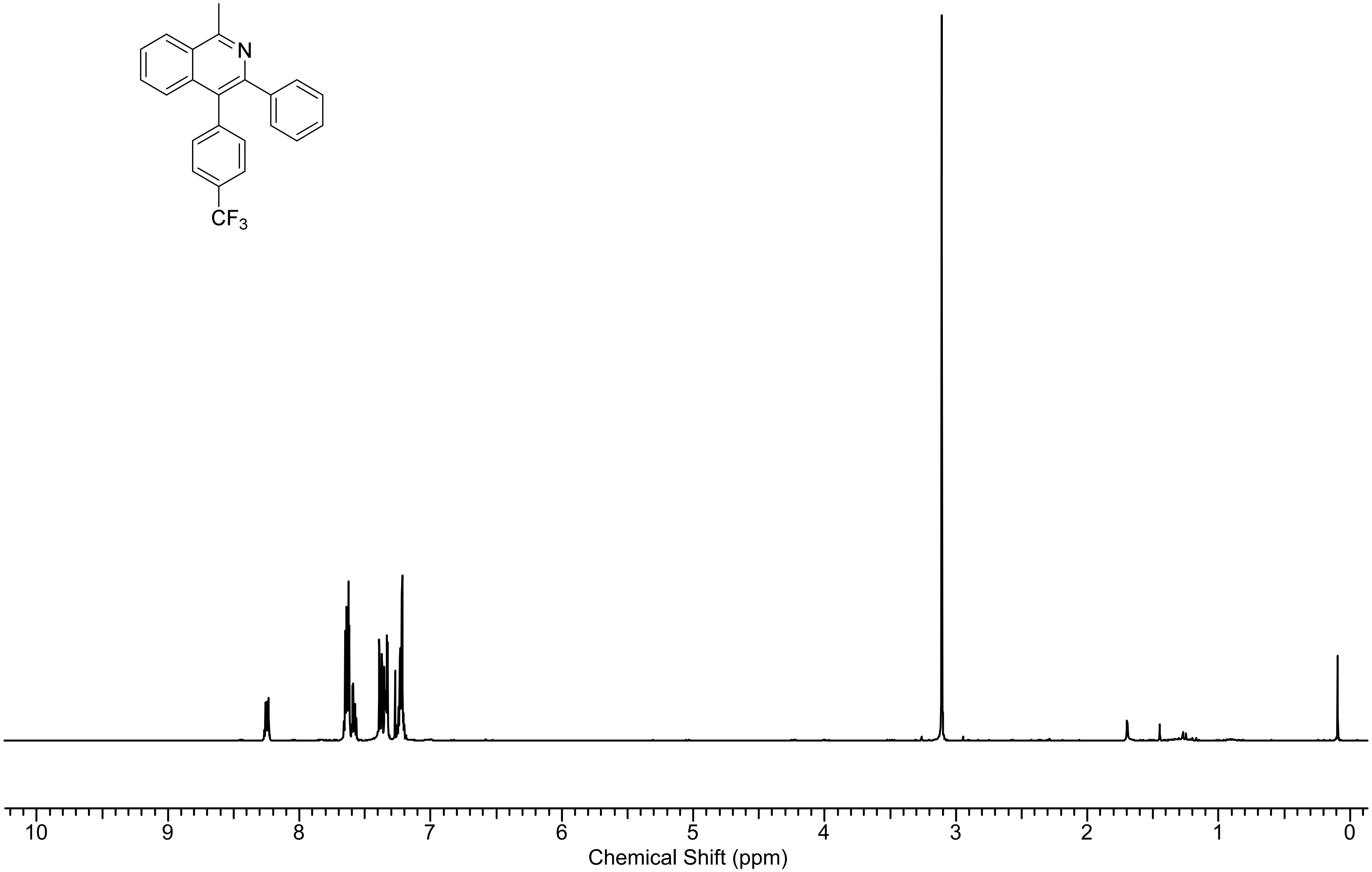
3-*iso*Butyl-4-(4-methoxyphenyl)-1-methylisoquinoline **(6k)**



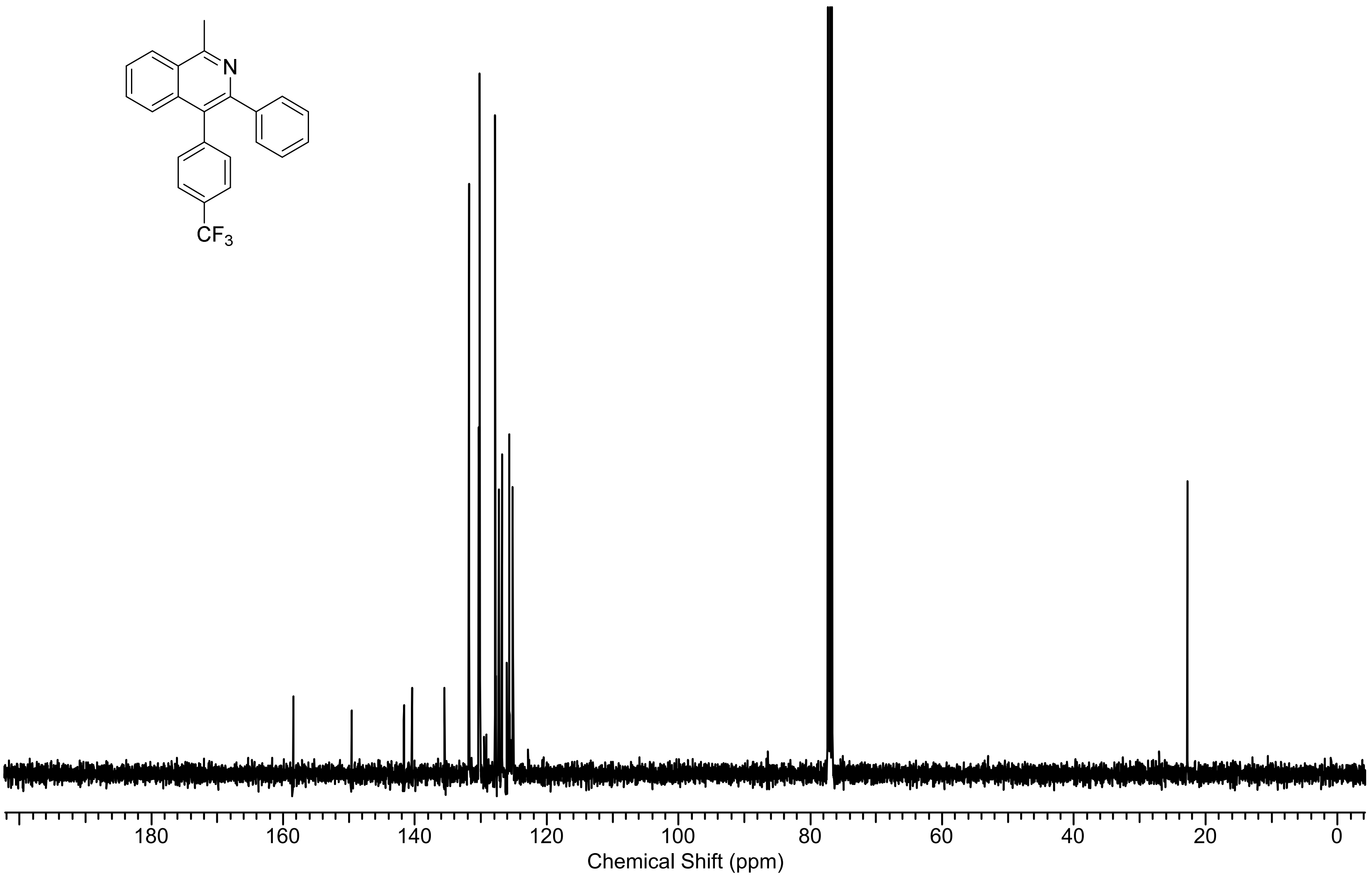
3-*iso*Butyl-4-(4-methoxyphenyl)-1-methylisoquinoline **(6k)**



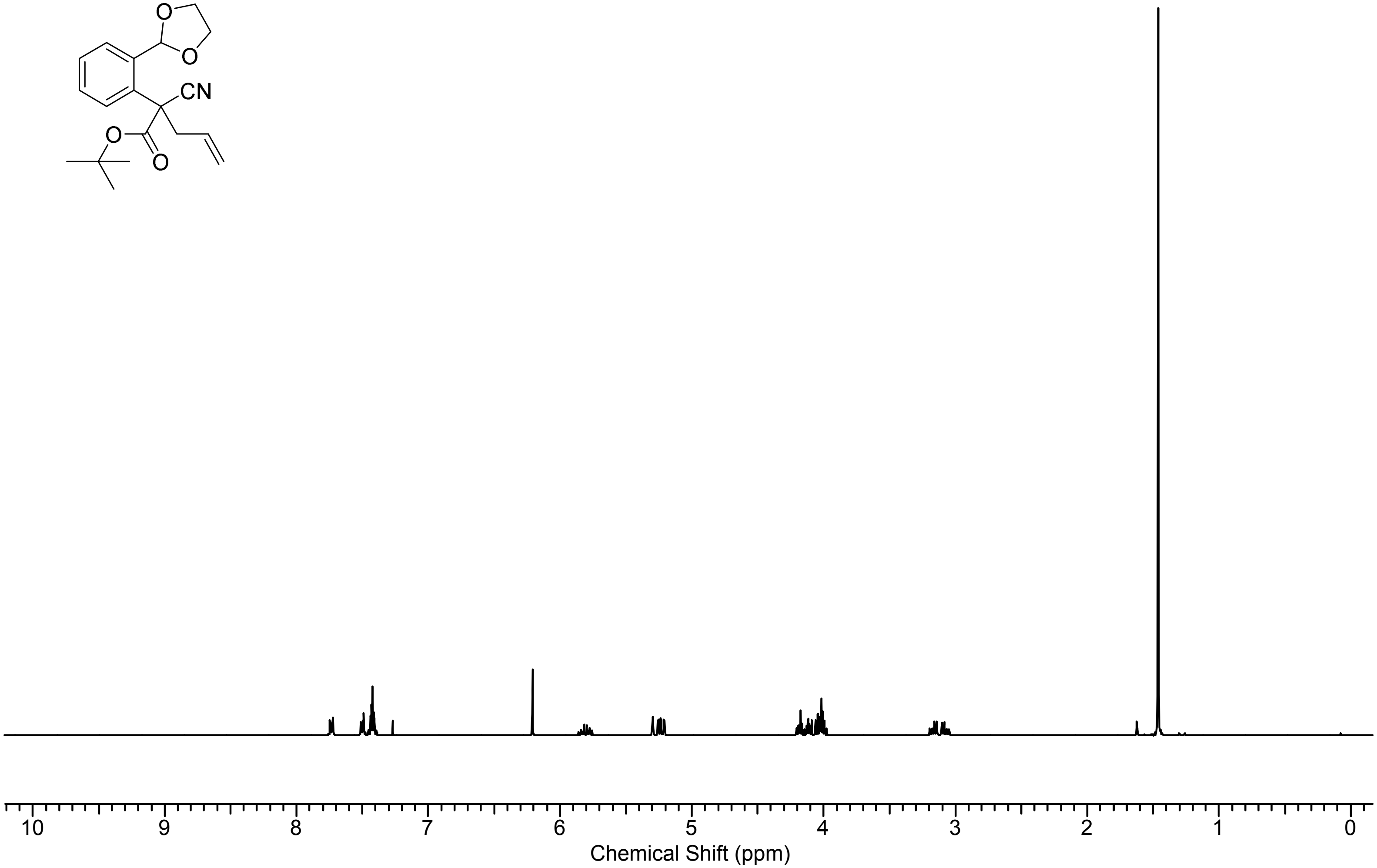
1-Methyl-3-phenyl-4-(4-(trifluoromethyl)phenyl)isoquinoline **(6l)**



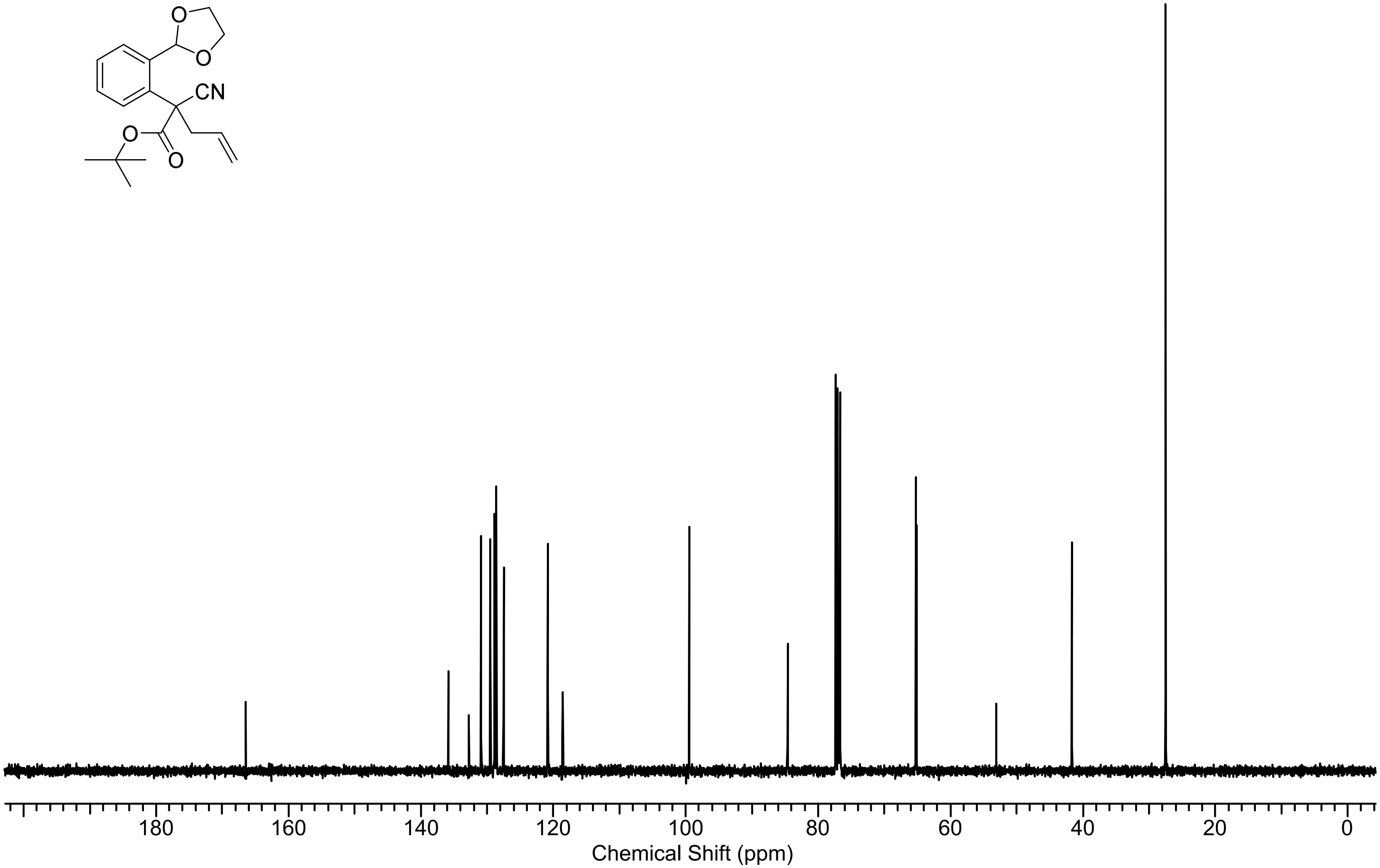
1-Methyl-3-phenyl-4-(4-(trifluoromethyl)phenyl)isoquinoline **(6l)**



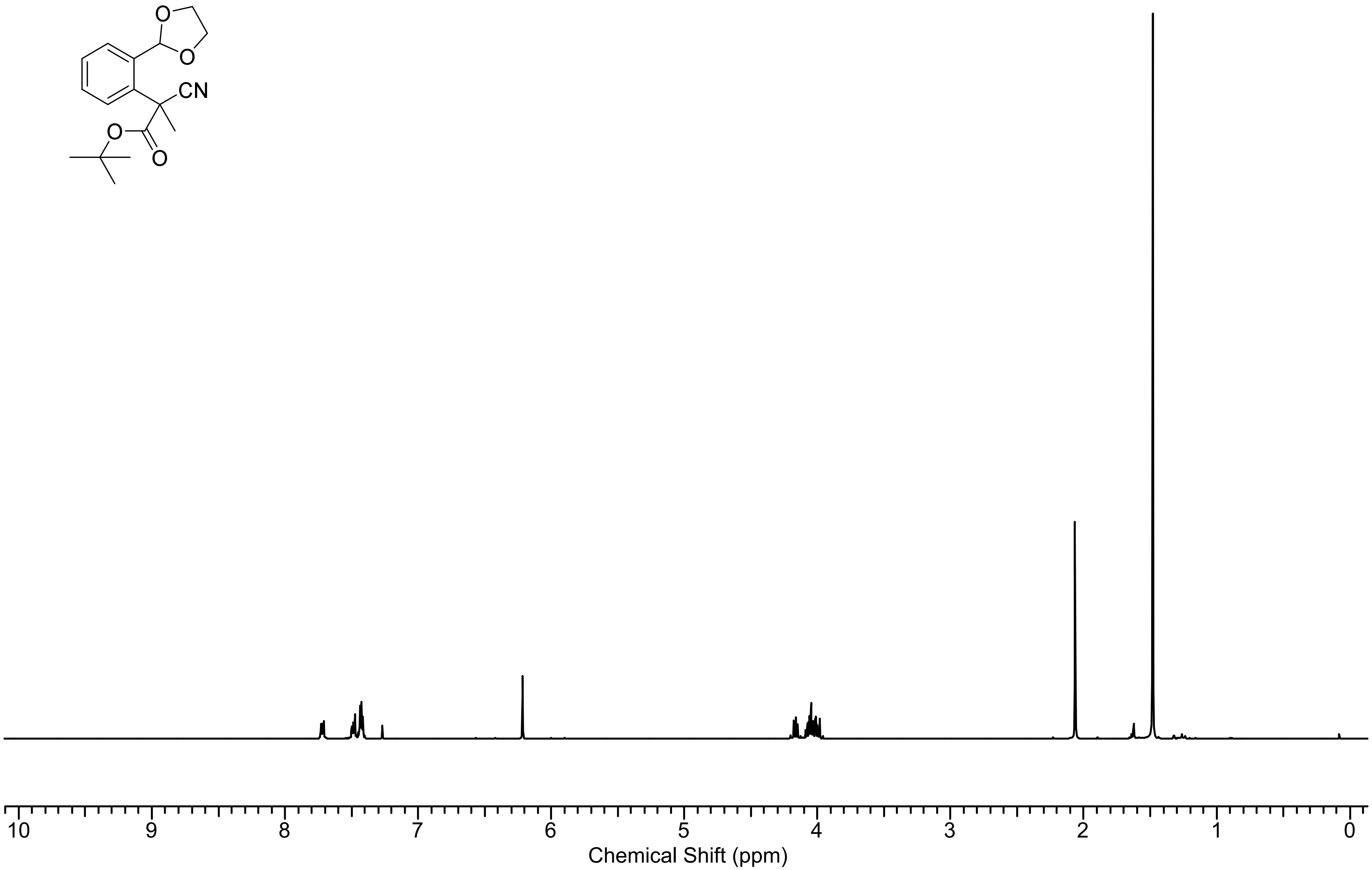
tert-Butyl 2-(2-(1,3-dioxolan-2-yl)phenyl)-2-cyanopent-4-enoate **(7a)**



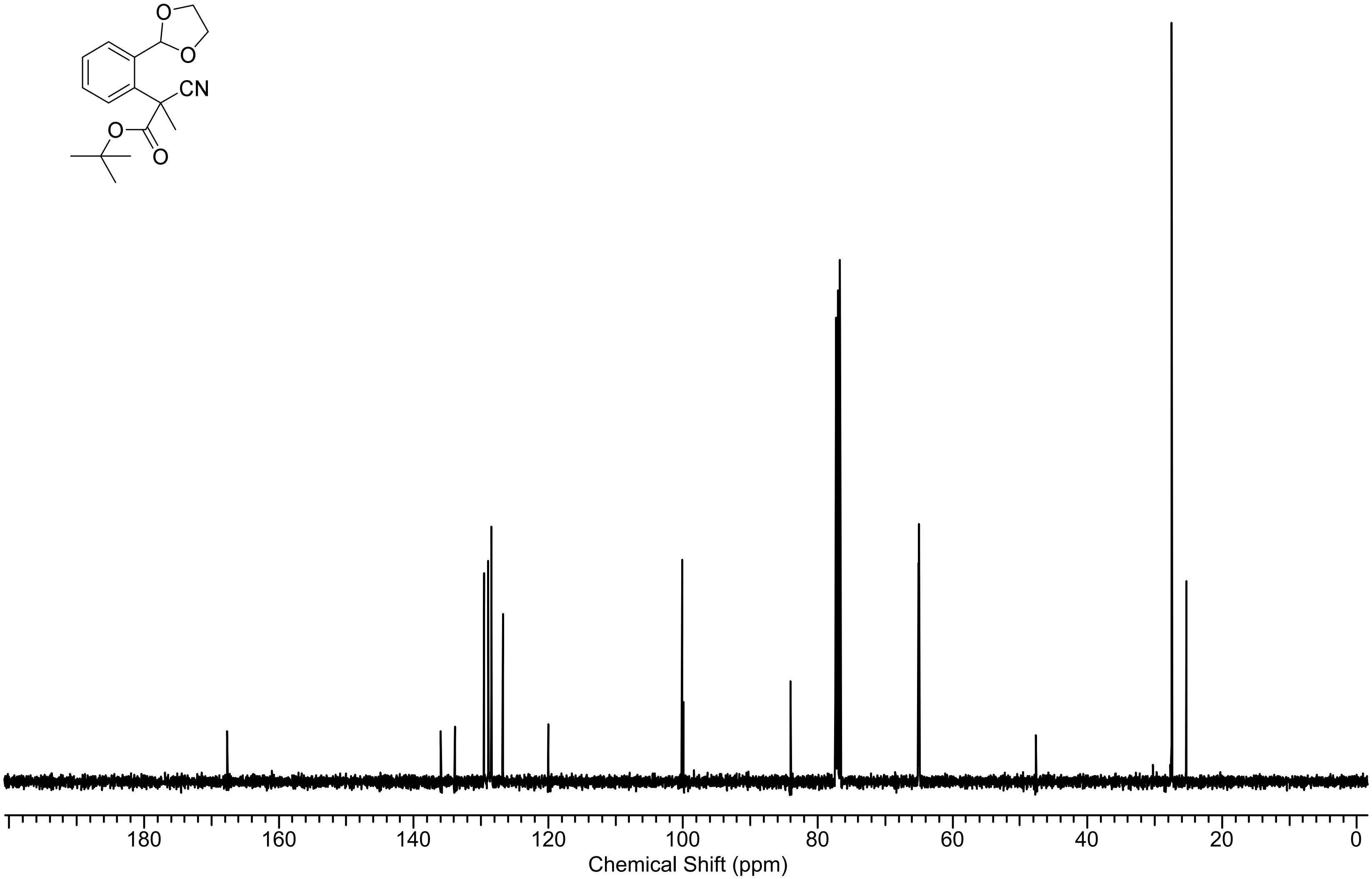
tert-Butyl 2-(2-(1,3-dioxolan-2-yl)phenyl)-2-cyanopent-4-enoate **(7a)**



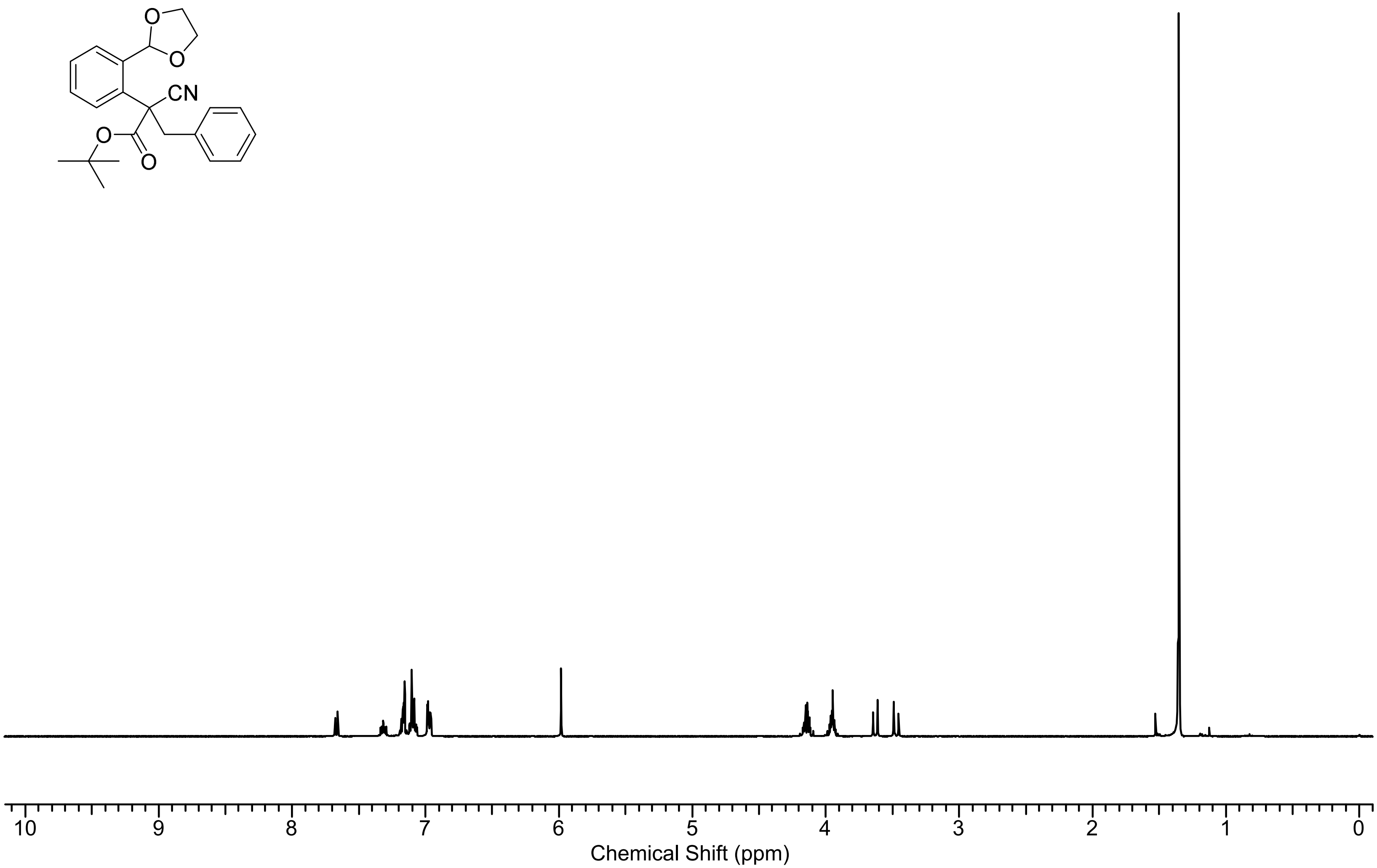
tert-Butyl 2-(2-(1,3-dioxolan-2-yl)phenyl)-2-cyanopropanoate **(7b)**



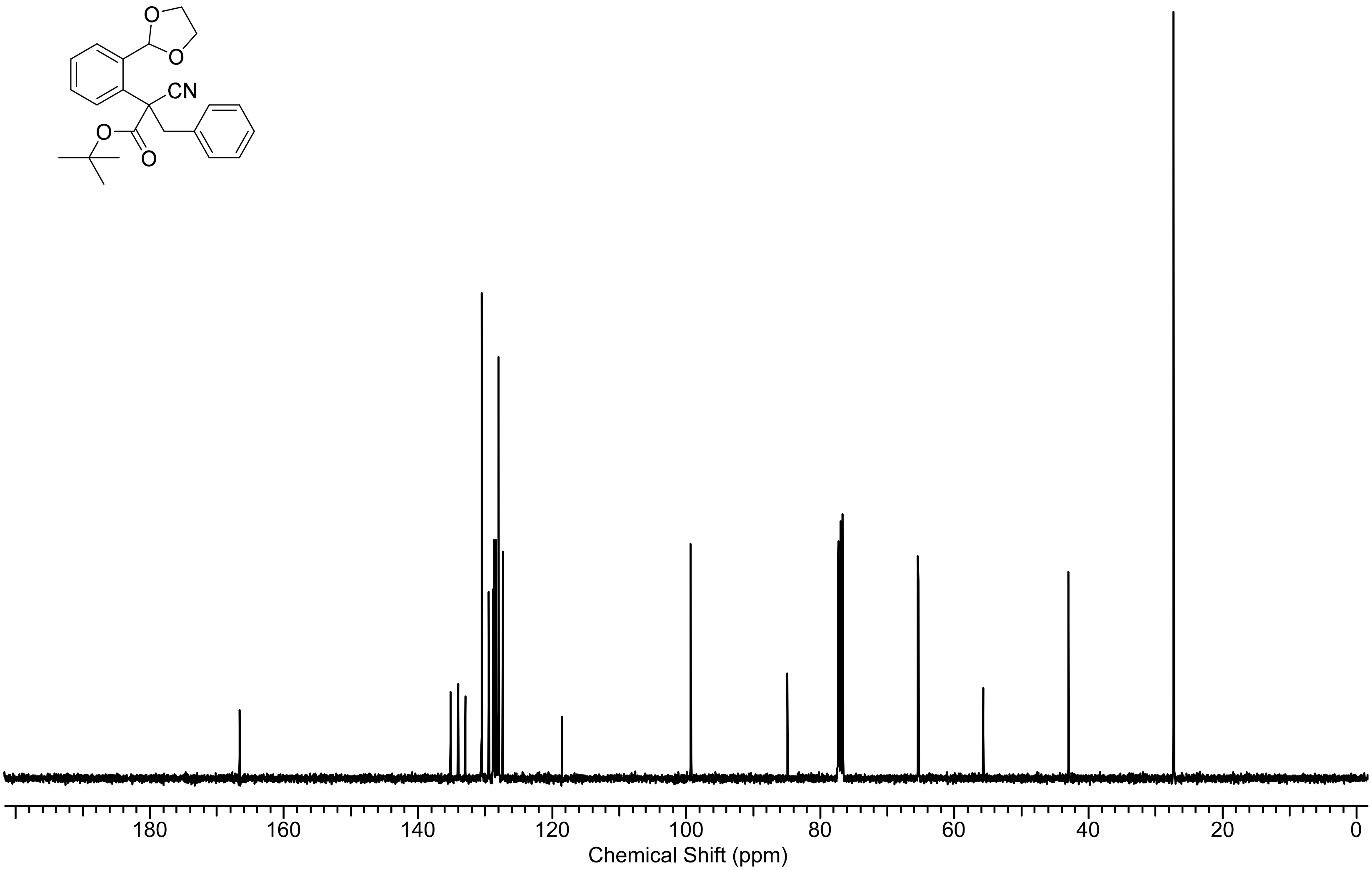
tert-Butyl 2-(2-(1,3-dioxolan-2-yl)phenyl)-2-cyanopropanoate **(7b)**



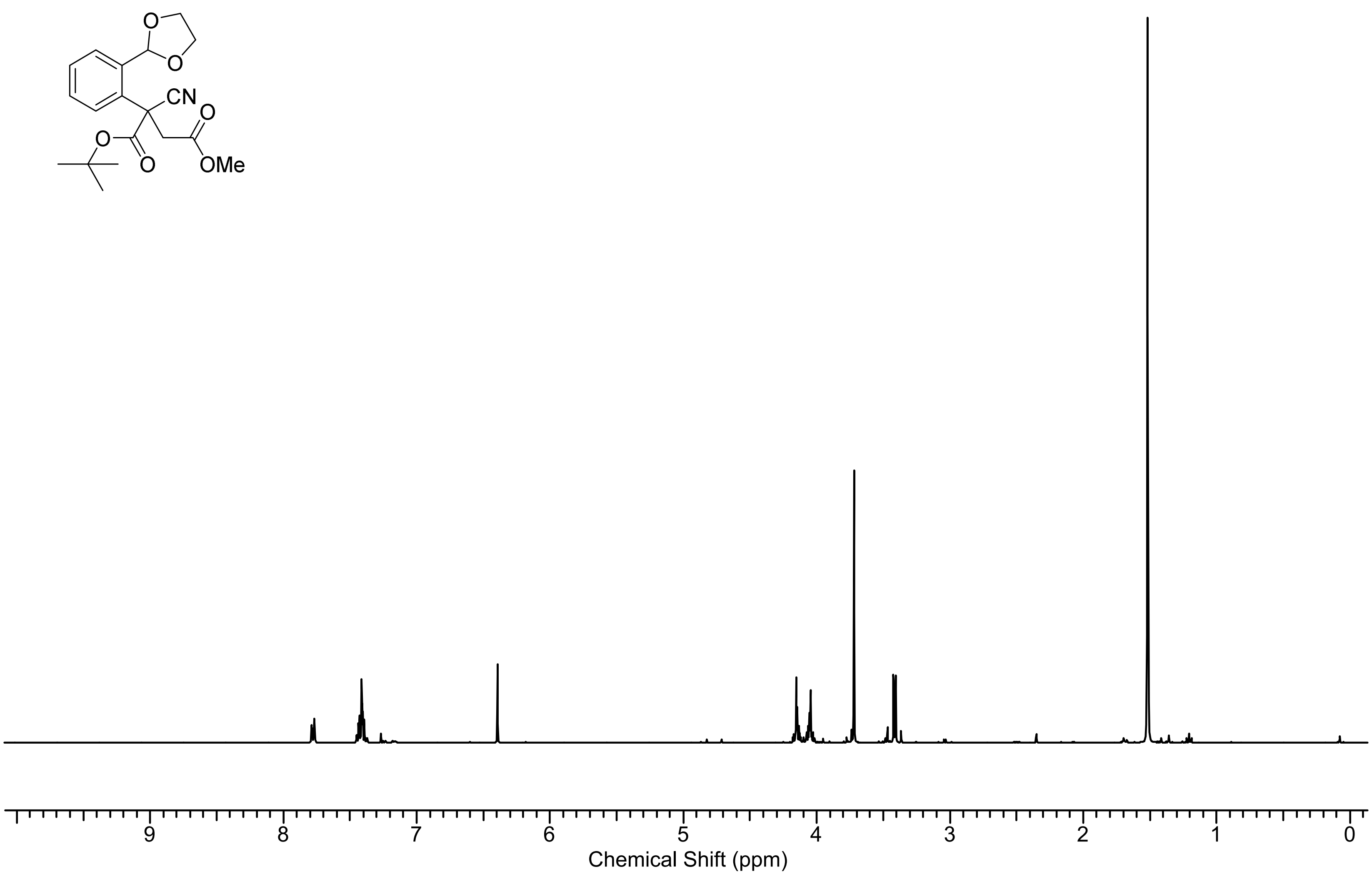
tert-Butyl 2-(2-(1,3-dioxolan-2-yl)phenyl)-2-cyano-3-phenylpropanoate **(7c)**



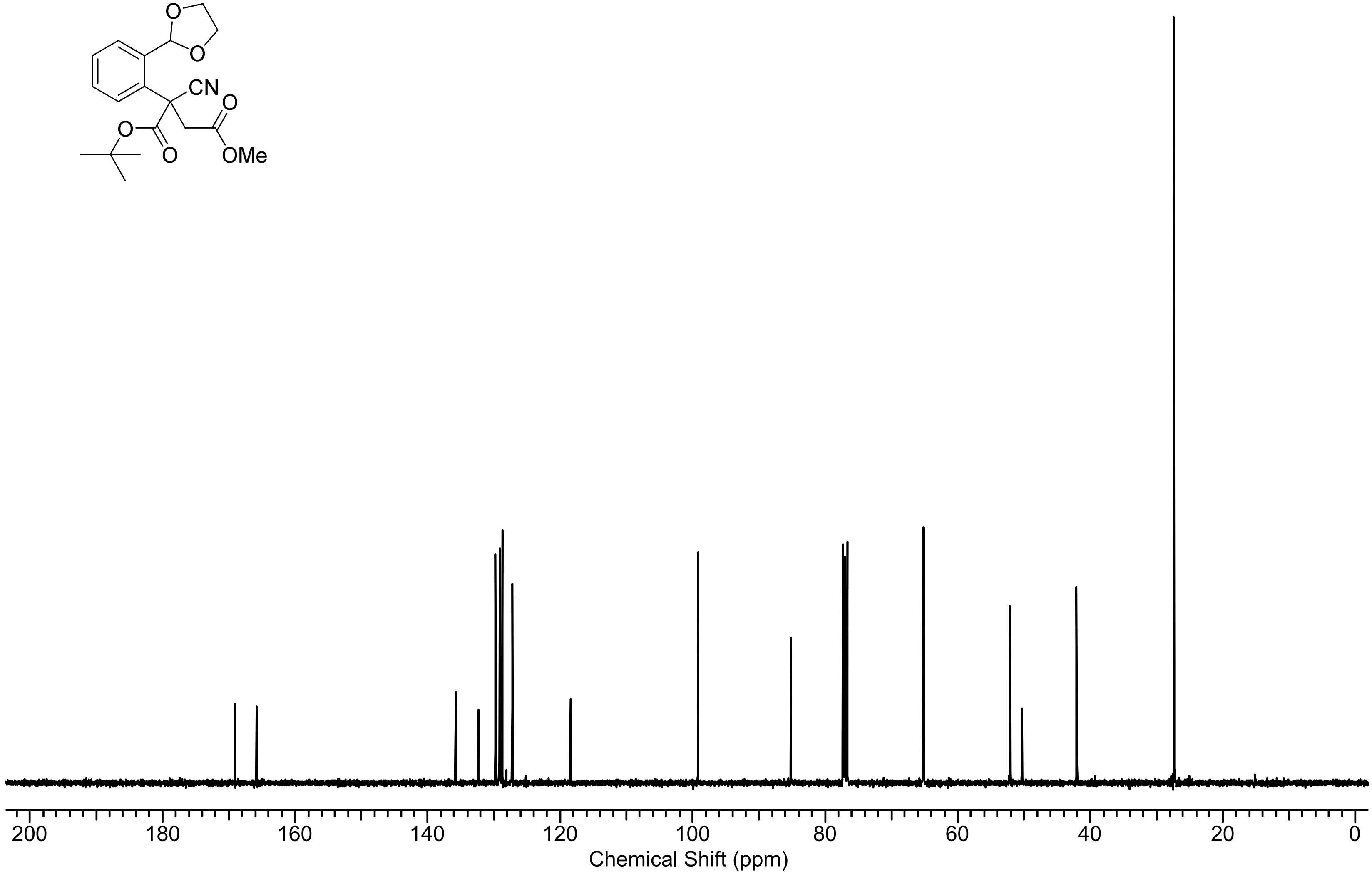
tert-Butyl 2-(2-(1,3-dioxolan-2-yl)phenyl)-2-cyano-3-phenylpropanoate **(7c)**



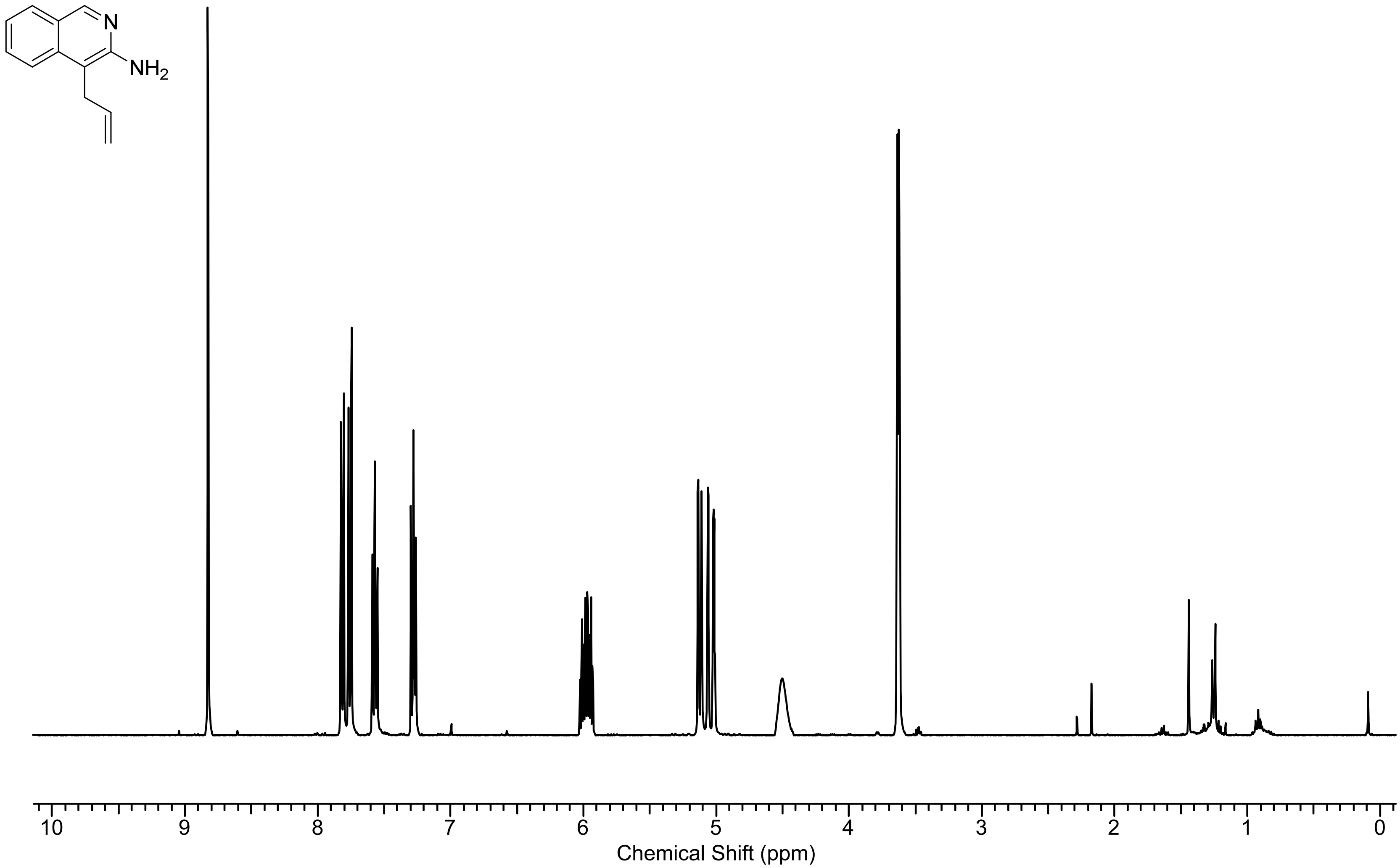
1-*tert*-Butyl 4-methyl 2-(2-(1,3-dioxolan-2-yl)phenyl)-2-cyanosuccinate **(7d)**



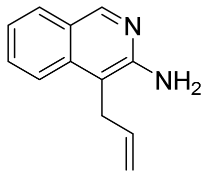
1-*tert*-Butyl 4-methyl 2-(2-(1,3-dioxolan-2-yl)phenyl)-2-cyanosuccinate **(7d)**

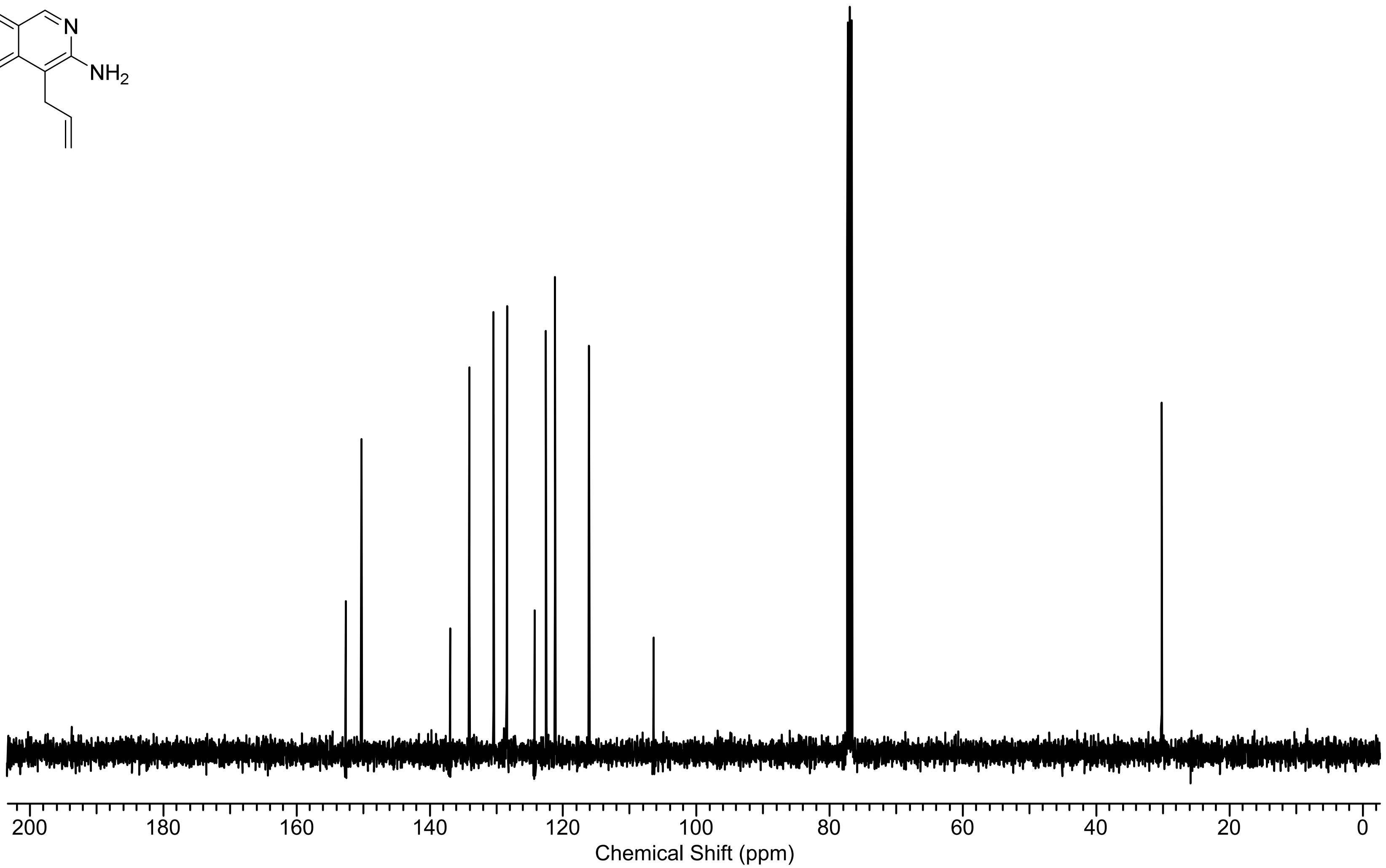


4-Allylisoquinolin-3-amine **(8a)**

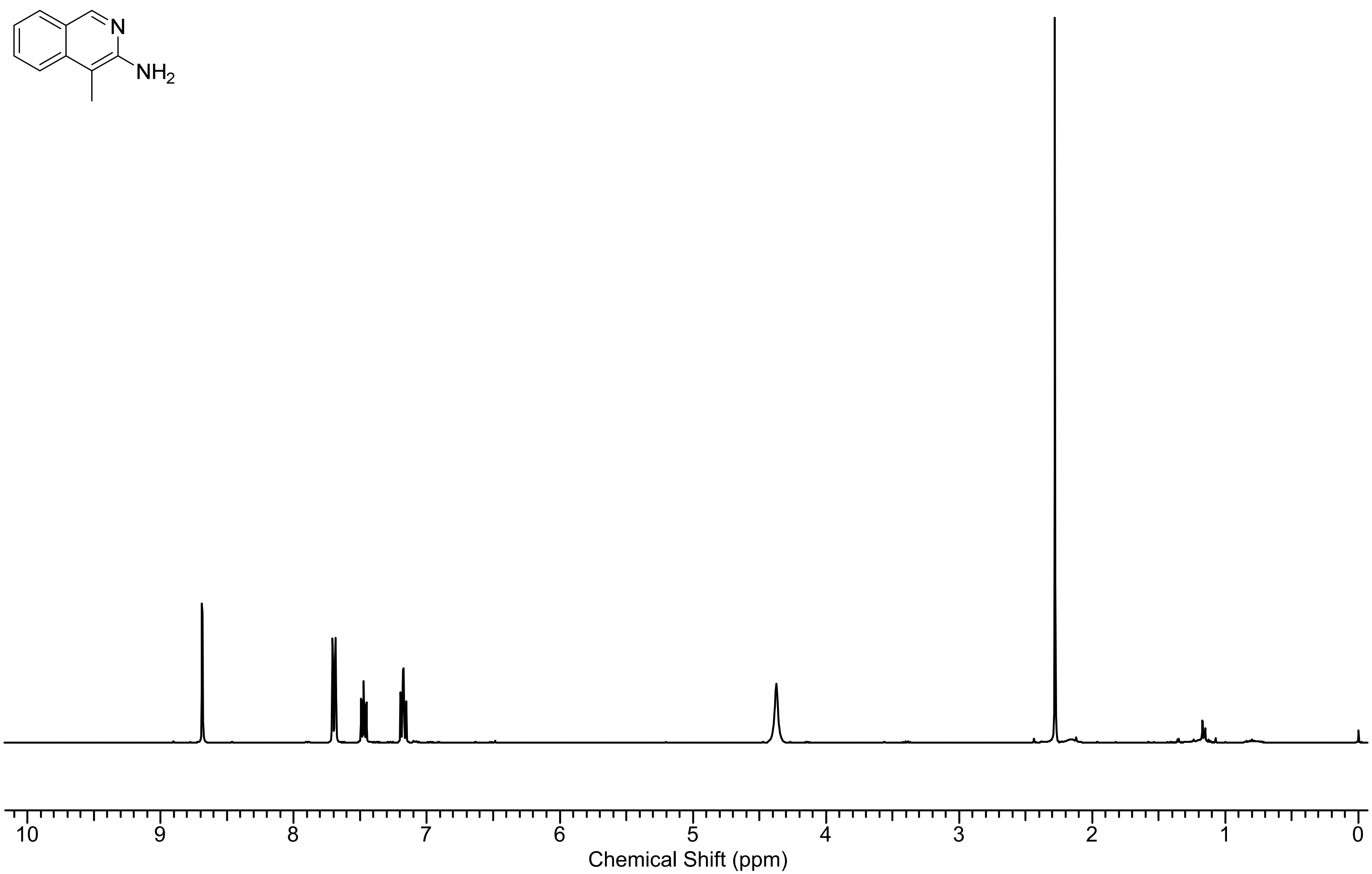


4-Allylisoquinolin-3-amine **(8a)**

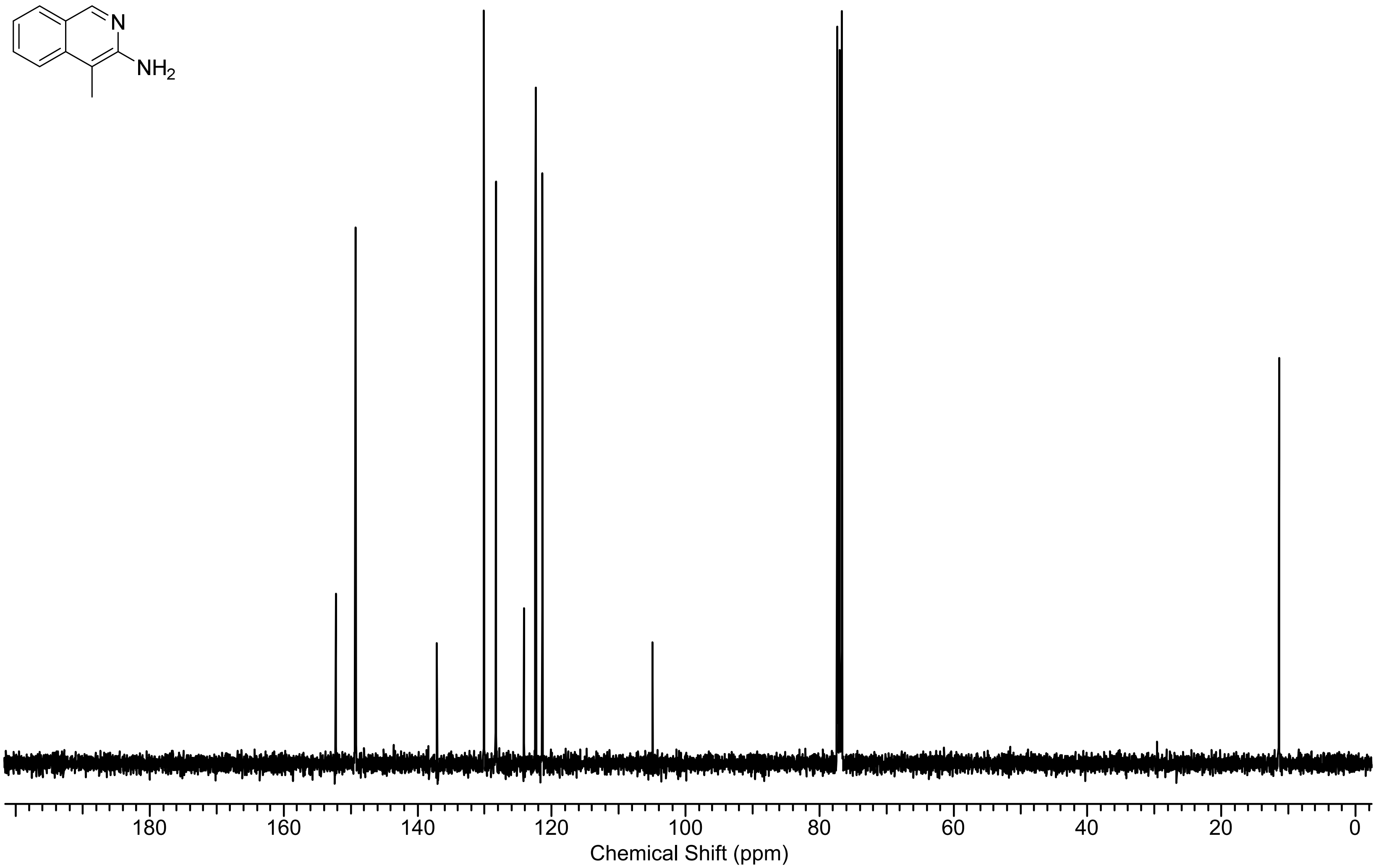




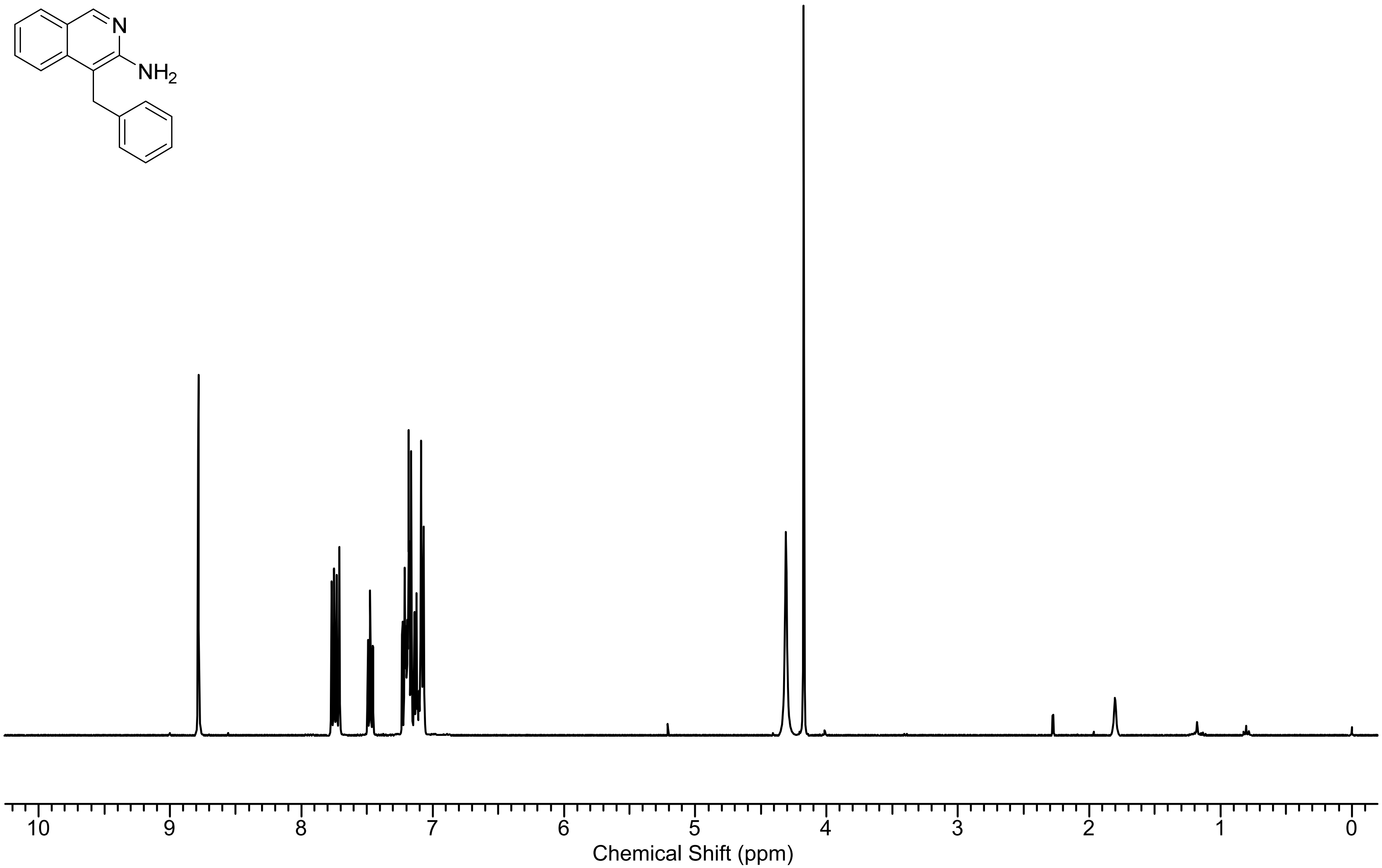
4-Methylisoquinolin-3-amine **(8b)**



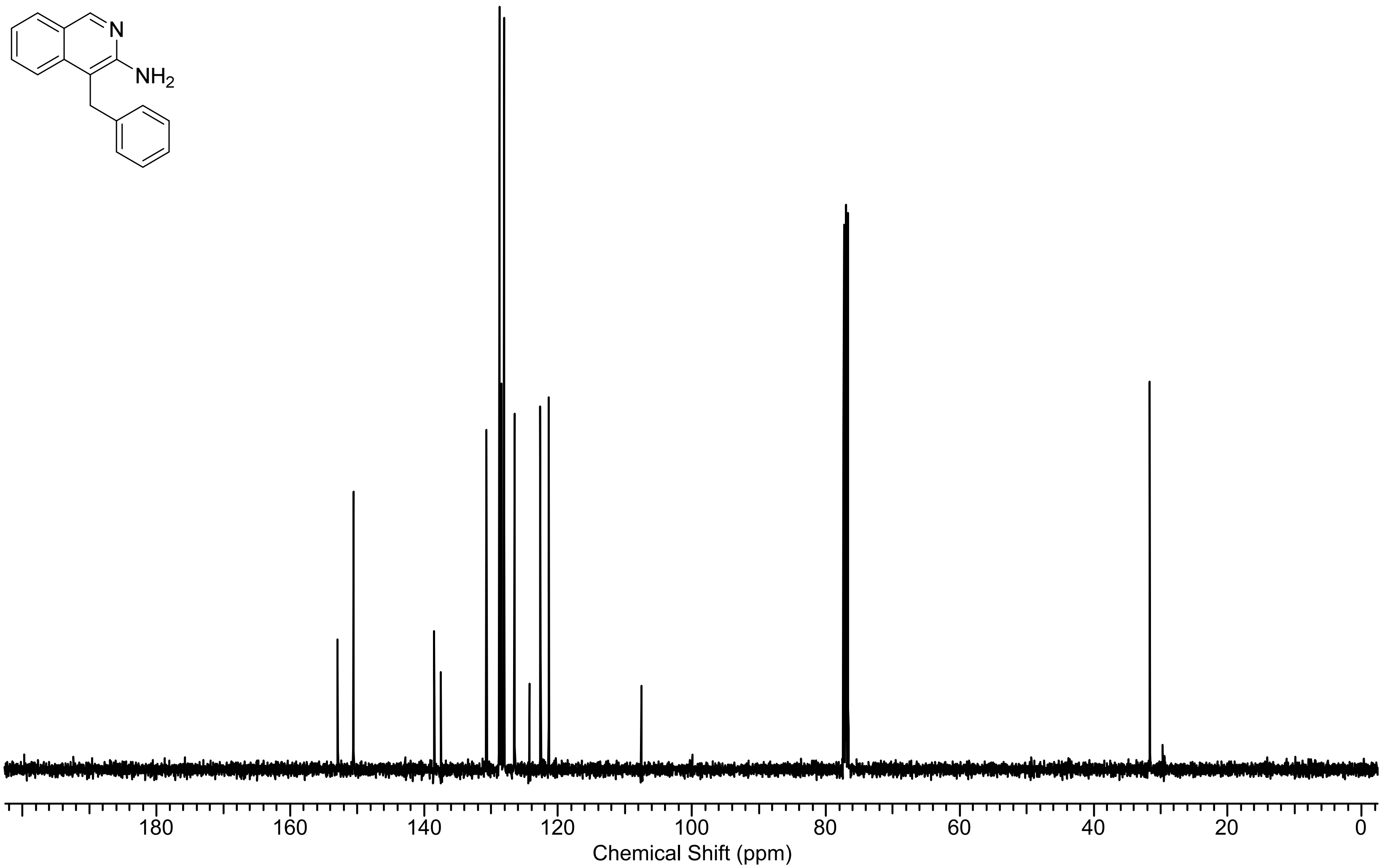
4-Methylisoquinolin-3-amine **(8b)**



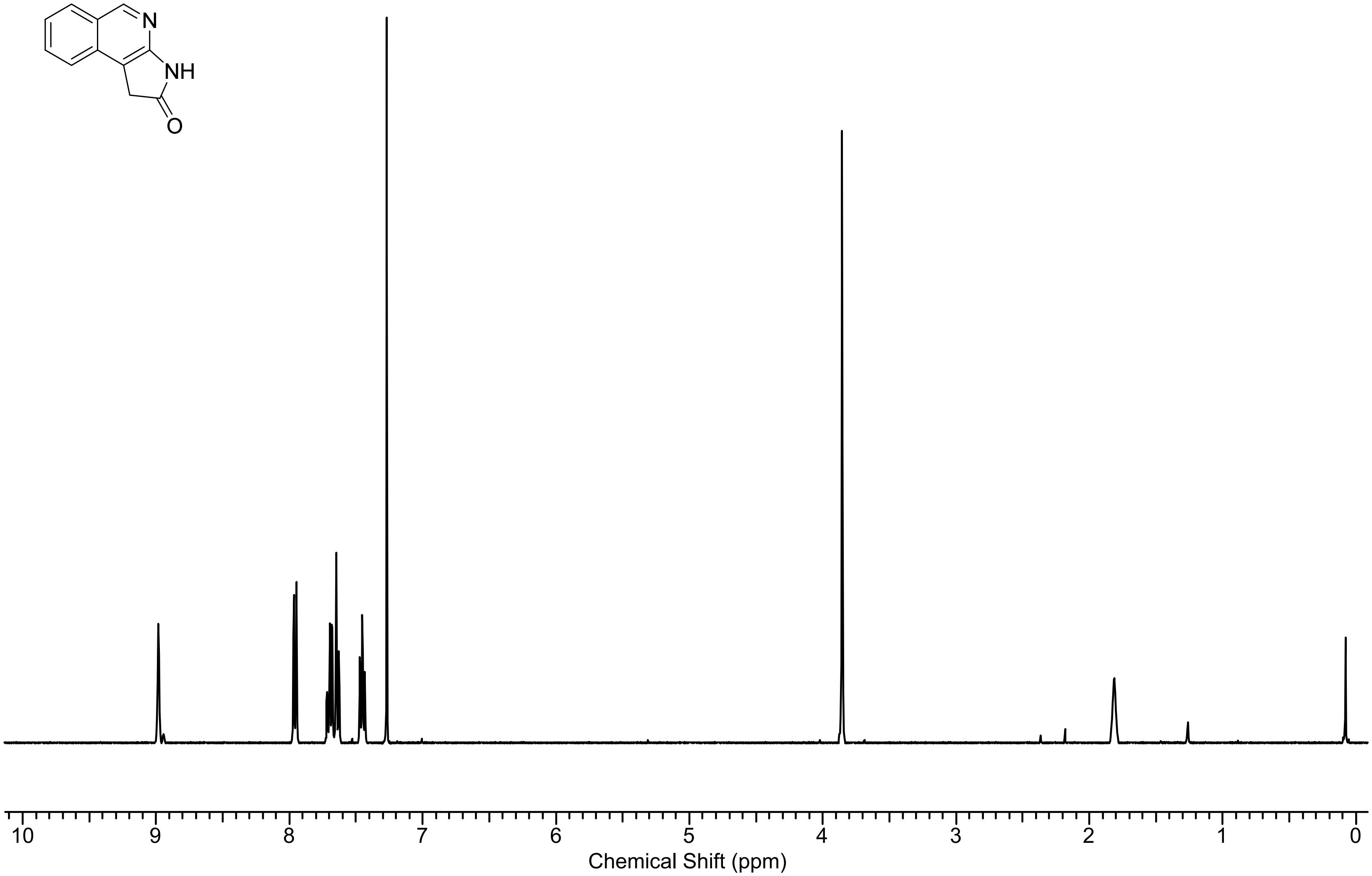
4-Benzylisoquinolin-3-amine **(8c)**



4-Benzylisoquinolin-3-amine **(8c)**



1H-Pyrrolo[2,3-c]isoquinolin-2(3H)-one **(8d)**



1H-Pyrrolo[2,3-c]isoquinolin-2(3H)-one **(8d)**