Supporting Information

Visible Light-Induced Aerobic Oxidation of Alkene Catalyzed by Thiobenzoic Acid in Water

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1. General Remarks

All reagents and starting materials were purchased from commercial sources and used as supplied, unless otherwise illustrated. All solvents were purified according to the established procedures. Column chromatography was performed with silica gel (Merck, 300-400 mesh) and preparative thin layer chromatography (GF 254). ^{1}H NMR spectra were recorded on Bruker Avance 400 MHz spectrometers. Chemical shifts were reported in ppm referenced to 7.26 ppm of chloroform-*d*. ^{13}C NMR spectra were recorded on Bruker Avance 101 MHz spectrometers, and were fully decoupled by broad band proton decoupling. Chemical shifts were reported in ppm referenced to the center line of a triplet at 77.16 ppm of chloroform-*d*. HRMS was recorded on a commercial apparatus (ESI Source, TOF). The UV-Vis spectra has been recorded on a UV-6000T spectrometer. Fluorescence quenching experiment was recorded using a Edinburgh FLS1000. Cyclic voltammetry was performed on an CHi660 electrochemical analyzer. Electron paramagnetic resonance (EPR) spectra was recorded on a Bruker A300 spectrometer.

2. Setup for photocatalytic reactions

The photochemical setup is depicted in Fig. S1. Reaction Set-up for Irradiation of Mixture with Blue LED: A commercially available Blue LED (30W, λ = 400–450 nm) purchased from Yi Tongchuang Technology Co., LTD: model 30w-30v-4240-B as the reaction light source. All the reactions were run in a 25 mL Quartz tubes equipped with magnetic stirring bar. The distance between the lamp and the Quartz tubes was set 6 cm. All the reactions were stirred at the speed of 300 rpm with external fan cooling so that the ambient temperature of the reaction vessel did not exceed 35 °C.

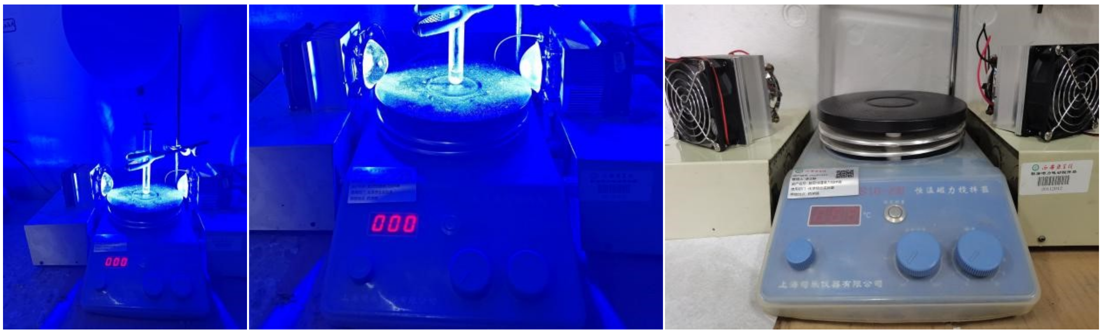
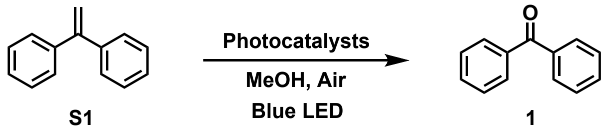
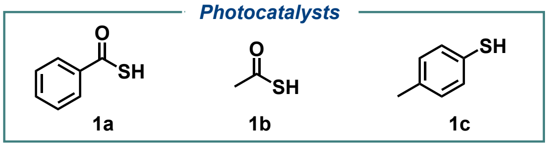


Fig. S1 LED reaction setup for photocatalytic reactions.

3. Optimization Results of the Reaction Conditions

Table S1. Effect of the photocatalysts on the reaction[a,b]

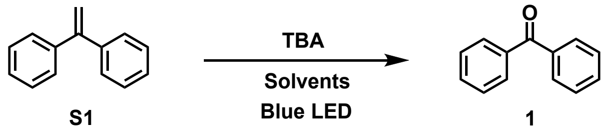




Entry	Photocatalysts	Atmosphere	Yield (%)[b]
1	**1a**	Air	60
2	**1b**	Air	32
3	**1c**	Air	27

[a] Reaction conditions: 1,1-diphenylethylene **S1** (0.1 mmol, 18 uL), photocatalysts (8 mol%), MeOH (1.0 mL), 30 W blue LED, 24 h. [b] Isolated yields.

Table S2. Optimization of Reaction Conditions[a,b]

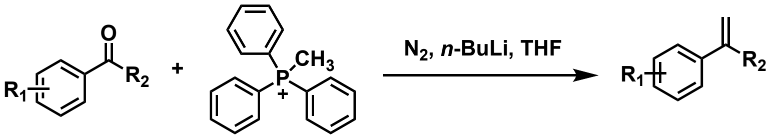


Entry	Photocatalyst	Solvents	Atmosphere	Yield (%)[b]
1	TBA (1 uL)	MeOH	Air	60
2	TBA (1 uL)	DCE	Air	52
3	TBA (1 uL)	Acetone	Air	43
4	TBA (1 uL)	CH_3CN	Air	51
5	TBA (1 uL)	THF	Air	42
6	TBA (1 uL)	1,4-dioxane	Air	39
7	TBA (1 uL)	DMF	Air	36
8	TBA (1 uL)	H_2O	Air	55
9	TBA (1 uL)	H_2O	O_2	73
10	TBA (3 uL)	H_2O	O_2	75
11	TBA (1 uL)	H_2O (0.5 mL)	O_2	85
12[c]	TBA (1 uL)	H_2O (0.5 mL)	O_2	Trace
13	TBA (1 uL)	H_2O (0.5 mL)	N_2	NR

[a] Reaction conditions: 1,1-diphenylethylene **S1** (0.1 mmol, 18 uL), TBA (X mol%), Solvents (1.0 mL), 30 W blue LED, 24 h. [b] Isolated yields. [c] In darkness.

4. Experimental Procedures

4.1. General Procedure for the Synthesis of Alkene Substrates[1]



To a flame-dried 100 mL round-bottom flask, Ph_3PMeBr (2.4 mmol, 857 mg) was added. Under nitrogen atmosphere, 8 mL of tetrahydrofuran and 1 mL of *n*-BuLi (12 mmol, 2.4 M) were added at 0 °C. After 1 h, ketone (2 mmol) was added at room temperature. When the raw materials are exhausted, the reaction was quenched with ammonium chloride solution, extracted with petroleum ether (10 mL × 3), dried over anhydrous sodium sulfate, and then purified by flash column chromatography (petroleum ether) to afford the different alkene.

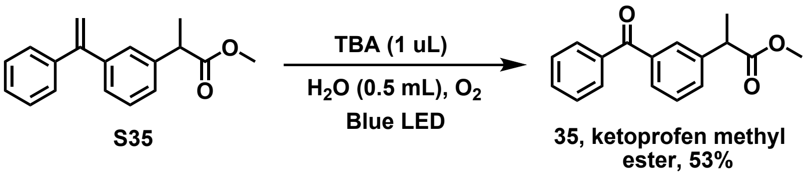
4.2 General Procedures for the Cleavage of Alkene using Blue LED

An oven-dried 25 mL Quartz tubes equipped with magnetic stirring bar were charged with thiobenzoic acid (8 mol%, 1 uL) and alkene (0.1 mmol) in H_2O (0.5 mL) with an O_2 atmosphere. The resulting mixture was stirred for 24–48 h under 30 W blue LED irradiation (the progress can be monitored *via* TLC). After cooling to room temperature, the mixture was diluted with dichloromethane, the volatiles were removed under vacuum and the residue was purified by preparative thin layer chromatography (petroleum ether/ethyl acetate 20:1) to give pure product.

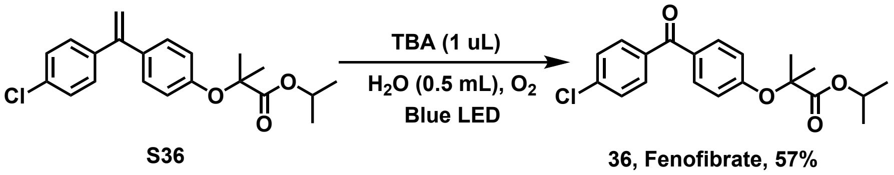
4.3 General Procedure for Gram Scale Experiment

An oven-dried 25 mL Quartz tubes equipped with magnetic stirring bar were charged with thiobenzoic acid (8 mol%, 66 uL) and 1,1-diphenylethylene **S1** (6 mmol, 1.1 mL) in H_2O (3.0 mL) with an ambient air at room temperature. The resulting mixture was stirred for 72 h under 30 W blue LED irradiation (the progress can be monitored TLC). After cooling to room temperature, the mixture was diluted with dichloromethane, then the volatiles were removed under vacuum and the crude mixture was purified by column chromatography (silica gel, petroleum ether/ethyl acetate 20:1) to afford the pure product.

4.4 The Product Derivatization



An oven-dried 25 mL Quartz tubes equipped with magnetic stirring bar were charged with thiobenzoic acid (8 mol%, 1 uL) and methyl 2-(3-(1-phenylvinyl)-phenyl)propanoate **S35** (0.1 mmol, 26.6 mg) in H_2O (0.5 mL) with an O_2 atmosphere. The resulting mixture was stirred for 30 h under 30 W blue LED irradiation (the progress can be monitored *via* TLC). After cooling to room temperature, the mixture was diluted with dichloromethane, the volatiles were removed under vacuum and the residue was purified by preparative thin layer chromatography (petroleum ether/ethyl acetate 10:1) to give pure product ketoprofen methyl ester **35** (14.3 mg, 53%).



An oven-dried 25 mL Quartz tubes equipped with magnetic stirring bar were charged with thiobenzoic acid (8 mol%, 1 uL) and isopropyl 2-(4-(1-(4-chloro-phenyl)vinyl)phenoxy)-2-methylpropanoate **S36** (0.1 mmol, 35.8 mg) in H_2O (0.5 mL) with an O_2 atmosphere. The resulting mixture was stirred for 30 h under 30 W blue LED irradiation (the progress can be monitored *via* TLC). After cooling to room temperature, the mixture was diluted with dichloromethane, the volatiles were removed under vacuum and the residue was purified by preparative thin layer chromatography (petroleum ether/ethyl acetate 10:1) to give pure product fenofibrate **36** (20.5 mg, 57%).

5. Mechanism Research

5.1 Radical trapped experiments

A mixture of thiobenzoic acid (8 mol%, 1 uL), 1,1-diphenylethylene **S1** (0.1 mmol, 18 uL), H_2O (0.5 mL) and 2,2,6,6-tetramethyl-1-piperidyloxy (TEMPO, 0.2 mmol)/ butyleret hydroxy-toluene (BHT, 0.2 mmol) was added to a 25 mL Quartz tubes with an O_2 atmosphere at room temperature, then the contents were stirred at 30 W blue LED irradiation for 24 h. The reaction mixture was cooled down to room temperature and isolated by preparative thin layer chromatography.

A mixture of thiobenzoic acid (8 mol%, 1 uL)，1,1-diphenylethylene **S1** (0.1 mmol, 18 uL), H_2O (0.5 mL) and 1,4-diazabicyclo[2.2.2]octane (DABCO, 0.2 mmol)/ sodium azide (NaN_3, 0.2 mmol) was added to a 25 mL Quartz tubes with an ambient air at room temperature, then the contents were stirred at 30 W blue LED irradiation for 24 h.The reaction mixture was cooled down to room temperature and isolated by preparative thin layer chromatography.

A mixture of thiobenzoic acid (8 mol%, 1 uL), 1,1-diphenylethylene **S1** (0.1 mmol, 18 uL), H_2O (0.5 mL) and benzoquinone (0.2 mmol) and 2,2-diphenyl-1- picrylhydrazyl (DPPH, 0.2 mmol) was added to a 25 mL Quartz tubes with an ambient air at room temperature, then the contents were stirred at 30 W blue LED irradiation for 24 h. The reaction mixture was cooled down to room temperature and isolated by preparative thin layer chromatography.

5.2 General procedure for on/off light experiment

An oven-dried 25 mL Quartz tubes equipped with magnetic stirring bar were charged with thiobenzoic acid (8 mol%, 1 uL)，1,1-diphenylethylene **S1** (0.1 mmol, 18 uL) and H_2O (0.5 mL) was added to the sealed reaction vessel by syringe. The resulting mixture was stirred for 4 h under 30 W blue LED irradiation. Then, the resulting mixture was stirred for 4 h without 30 W blue LED irradiation. The reaction mixture was cooled down to room temperature and isolated by preparative thin layer chromatography.

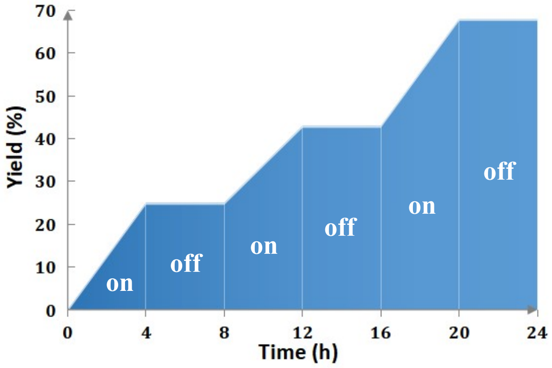


Fig. S2 On/off experiments.

5.3 Electron Paramagnetic Resonance (EPR) study

An oven-dried 25 mL Quartz tubes equipped with magnetic stirring bar were charged with TBA (8 mol%, 1 uL) and **S1** (0.1 mmol) in H_2O (0.5 mL) with an O_2 atmosphere. The resulting mixture was stirred for 1 h under 30 W blue LED irradiation, followed by the addition of 11.3 mg DPMO. Then, this reaction solution was taken out by capillary and was analyzed by EPR at room temperature (Fig. S3). A signal of the trapping radical was captured, the spectrum and hyperfine coupling constants of which are in good consistent with the literature values for the adduct of $O_2^{\bullet-}$ with DMPO (g = 2.0057, α^N = 14.4 G).[2-5] These results illustrate that $O_2^{\bullet-}$ generated from molecular oxygen is the active species in this photocatalytic reaction.

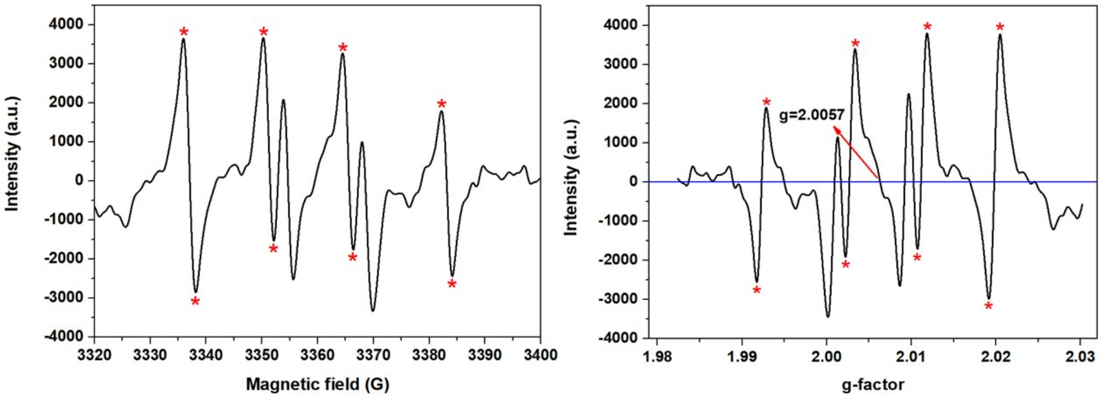


Fig. S3 EPR spectra of a solution of TBA (8 mol%), **S1** (0.1 mmol) and DMPO (0.1 mmol) in air-saturated H_2O under blue LED irradiation for 1 h.

5.4 UV-Vis absorption spectra

Optical absorption spectra of the reaction components under optimized conditions, recorded in methanol in 1 mm path quartz cuvettes using a UV-6000T spectrometer. The UV-vis absorption of the each component in dilute MeOH solution (0.01 M) were obtained as shown in Fig. S4 and Fig. S5. And the UV-vis spectroscopy indicated that the maximum absorption wavelength of **1a** was found to be 420 nm. Moreover, the UV-vis absorption of **1a·Et₃N** (obtained by dissolving **1a** and **Et₃N** in a 1:1 ratio) was obtained as shown in Fig. S6.

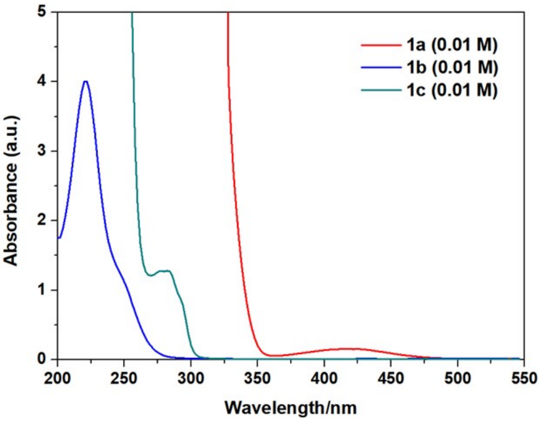


Fig. S4 UV-vis absorption spectra of **1a**, **1b** and **1c** (0.01 M) in MeOH.

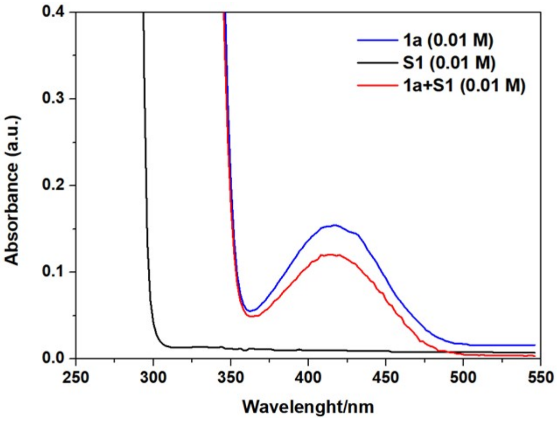


Fig. S5 UV-vis absorption spectra of **1a**, **S1**, **1a+S1** (0.01 M) in MeOH.

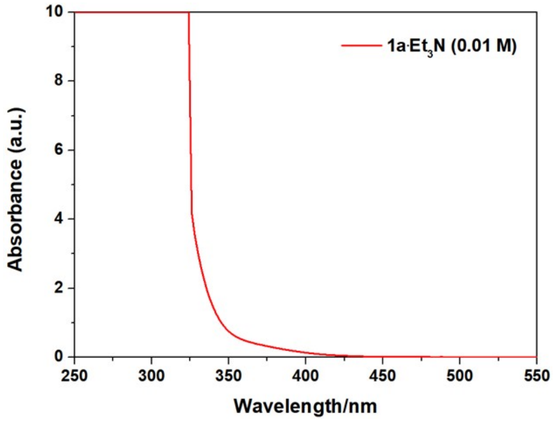


Fig. S6 UV-vis absorption spectra of **1a·Et$_3$N** (0.01 M) in MeOH.

5.5 General procedure for Cyclic Voltammetry (CV) Experiments

Cyclic voltammetry and square wave voltammetry were performed on an CHi660 electrochemical analyzer. The voltammetric cell consisted of a glassy carbon electrode, a platinum wire, and an Ag/AgCl reference electrode. Potentials are quoted with the following notation: E_p^C refers to the cathodic peak potential, E_p^A refers to the anodic peak potential. The measurements were carried out using a sample solution of a concentration of 0.1 M tetrabutylammonium hexafluorophosphate (TBAPF$_6$)/CH$_3$CN as a supporting electrolyte. The scan rate is 0.1 V/s, ranging from -0.6 V to 0.8 V. One irreversible oxidation observed at +0.09 V (Fig. S7).

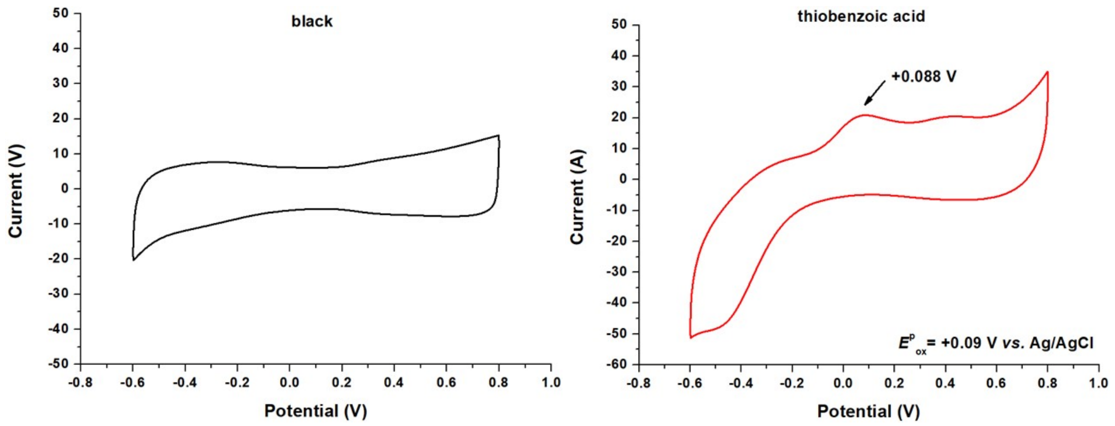


Fig. S7 Cyclic voltammogram for catalyst **1a** [0.5 M] in [0.1 M] $TBAPF_6$ in CH_3CN.

5.6 Evaluation of the Excited State Potential of TBA 1a

Using the data collected from the cyclic voltammetry studies (Section 5.5) and from the absorption spectra (Section 5.4) of the TBA **1a**, we could estimate the redox potential of the excited state $[\mathbf{1a}^{-}]^{*}$ employing the following Equation 1:[6-8]

$$E(\mathbf{1a}^{\cdot}/[\mathbf{1a}^{-}]^{*}) = E(\mathbf{1a}^{\cdot}/\mathbf{1a}^{-}) - E_{0\text{-}0}([\mathbf{1a}^{-}]^{*}/\mathbf{1a}^{-}) \text{ [Eq. 1]}$$

Since the electrochemical oxidation of the $\mathbf{1a}^{-}$ is irreversible (Fig. S7), the irreversible peak potential E_p^{Anode} was used for $E(\mathbf{1a}^{\cdot}/\mathbf{1a}^{-})$. $E_{0\text{-}0}([\mathbf{1a}^{-}]^{*}/\mathbf{1a}^{-})$, which is the excited state energy of the anion of the catalyst **1a**, was estimated spectroscopically from the position of the long wavelength tail of the absorption spectrum recorded in methanol (420 nm, Fig. S5).

For the catalyst **1a**, the E_p^{anode}, which provides the $E(\mathbf{1a}^{\cdot}/\mathbf{1a}^{-})$, is 0.09 V (Fig. S7), while the position of the long wavelength tail of the absorption spectrum corresponds to 420 nm (Figure S5), which translates into an $E_{0\text{-}0}([\mathbf{1a}^{-}]^{*}/\mathbf{1a}^{-})$ of 2.952 eV.

$$E_{0\text{-}0}([\mathbf{1a}^{-}]^{*}/\mathbf{1a}^{-}) = hc/\lambda = 6.626\times10^{-34}\times3.0\times10^{8}/420\times10^{-9}\text{ J} = 4.733\times10^{-19}\text{ J}$$

$$E_{0\text{-}0}([\mathbf{1a}^{-}]^{*}/\mathbf{1a}^{-}) = 4.733\times10^{-19}\text{ J}/1.602\times10^{-19}\text{ J} = 2.952\text{V}$$

$$E(\mathbf{1a}^{\cdot}/[\mathbf{1a}^{-}]^{*}) = 0.09\text{V} - 2.952\text{ V} = -2.86\text{V } (vs\ \text{Ag/Ag}^{+})$$

5.7 Emission Spectra and Stern-Volmer quenching Studies

5.7.1 Emission Spectra of 1a, 1b and 1c

Emission intensities were recorded using a Edinburgh FLS1000. The fluorescence quenching spectra of **1a**, **1b** and **1c** (0.01 M) in methanol was shown in Fig. S8. And the emission intensity of TBA **1a** solutions was observed at 550 nm. The solutions were irradiated at 420 nm and fluorescence was measured from 450 nm to 790 nm.

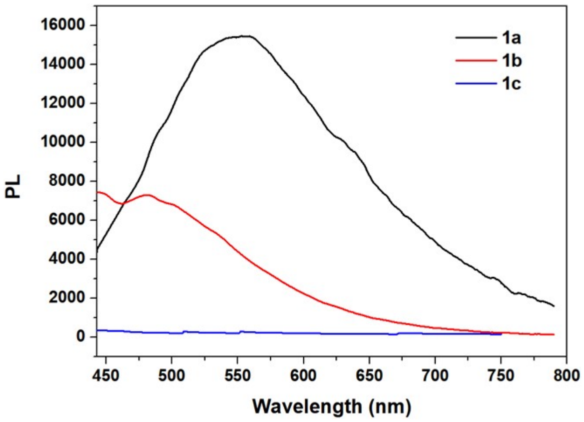


Fig. S8 Fluorescence emission spectra of **1a**, **1b** and **1c** (0.01 M) in MeOH.

5.7.2 Emission Spectra of [1a$^-$]*

Emission intensities were recorded using a Edinburgh FLS1000. A 0.01 M solution of **1a·Et$_3$N** (obtained by dissolving **1a** and **Et$_3$N** in a 1:1 ratio) in methanol were placed in a 10 mm light path quartz fluorescence cuvette.[9] The excitation wavelength was fixed at 400 nm, while the emission light was acquired from 480 nm to 800 nm.

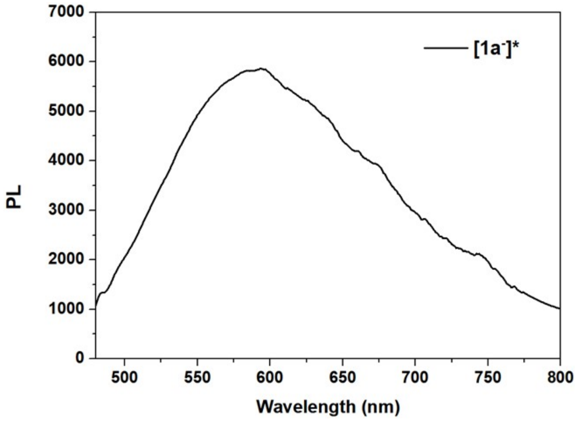


Fig. S9 Normalized emission of [**1a**$^-$]* upon 400 nm irradiation in MeOH.

5.7.3 Stern-Volmer Quenching Studies using S1 as the quencher

A 0.01 M solution of **S1** in methanol was prepared, and 25 uL of this stock solution were added to the solution of catalyst salt **1a·Et$_3$N**, prepared as described above. After each addition, an absorption spectrum and an emission spectrum of the solution were recorded. The excitation wavelength was fixed at 400 nm, while the emission light was acquired from 480 nm to 800 nm. The results shown in Fig. S10 and S11 indicate that the excited state of [**1a**$^-$]* does not interact directly with **S1**, since the slope of the quenching is minimal.

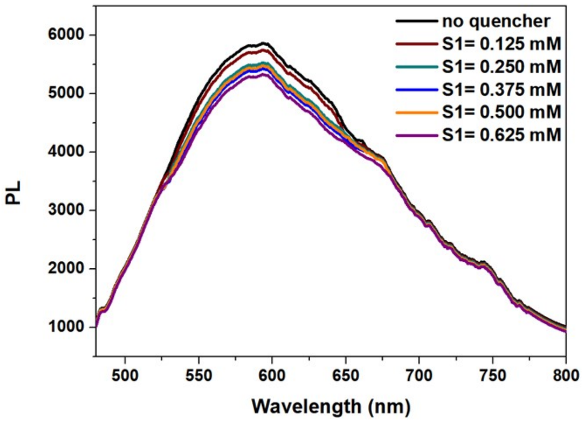


Fig. S10 Quenching of the emission of [**1a**$^-$]* (0.01M in MeOH) in the presence of increasing amounts of **S1**.

The Stern-Volmer plot, reported in Figure S11, shows a linear correlation between the amounts of **S1** and the ratio I^0/I.

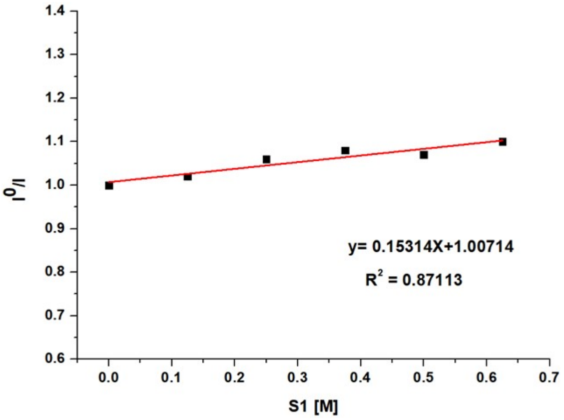


Fig. S11 Stern–Volmer plots for the fluorescence quenching of [**1a**$^-$]* (0.01 M in MeOH) with **S1**.

5.7.4 Stern-Volmer Quenching Studies using oxygen bubbling as the quencher

The excitation wavelength of **1a·Et$_3$N** (0.01 M in MeOH) was fixed at 400 nm, while the emission light was acquired from 480 nm to 800 nm. Bubbling of oxygen in the cuvette containing **1a·Et$_3$N** in MeOH, causes a constant decrease of the fluorescence, which is caused by the quench of the catalyst by the oxygen, forming superoxide radical anion.[10]

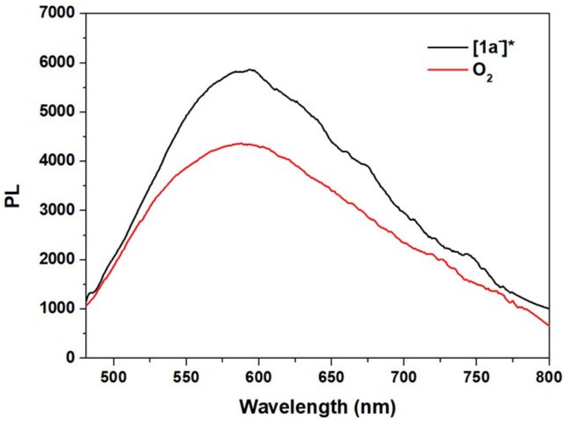
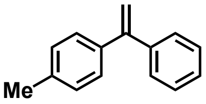


Fig. S12 Quenching of the emission of [**1a**$^-$]* (0.01M in MeOH) in the presence of oxygen bubbling.

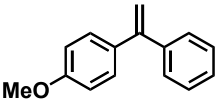
6. Characterization Data of Material

1-Methyl-4-(1-phenylvinyl)benzene (S2)



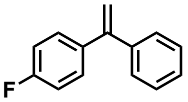
Colourless oil (201.8 mg, 52%). ^{1}H NMR (400 MHz, CDCl$_3$) δ 7.39 – 7.32 (m, 5H), 7.28 (t, *J* = 1.5 Hz, 1H), 7.25 (d, *J* = 1.8 Hz, 1H), 7.17 (d, *J* = 7.9 Hz, 2H), 5.46 (d, *J* = 1.3 Hz, 1H), 5.43 (d, *J* = 1.3 Hz, 1H), 2.40 (s, 3H). ^{13}C NMR (101 MHz, CDCl$_3$) 150.1, 141.8, 138.8, 137.6, 129.0, 128.4, 128.3, 128.2, 127.8, 113.7, 21.3.

1-Methoxy-4-(1-phenylvinyl)benzene (S3)



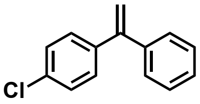
Colourless oil (176.5 mg, 42%). ^{1}H NMR (400 MHz, CDCl$_3$) δ 7.36 – 7.30 (m, 5H), 7.30 – 7.26 (m, 2H), 6.89 – 6.84 (m, 2H), 5.40 (d, *J* = 1.3 Hz, 1H), 5.35 (d, *J* = 1.3 Hz, 1H), 3.83 (s, 3H). ^{13}C NMR (101 MHz, CDCl$_3$) δ 159.5, 149.6, 141.9, 134.1, 129.5, 128.4, 128.2, 127.8, 113.6, 113.1, 55.4.

1-Fluoro-4-(1-phenylvinyl)benzene (S5)



Colourless oil (178.3 mg, 45%). ^{1}H NMR (400 MHz, CDCl$_3$) δ 7.36 – 7.31 (m, 7H), 7.07 – 7.01 (m, 2H), 5.46 (d, *J* = 0.8 Hz, 1H), 5.44 (d, *J* = 0.9 Hz, 1H). ^{13}C NMR (101 MHz, CDCl$_3$) 162.7 (d, *J* = 246.8 Hz), 149.3, 141.5, 137.7 (d, *J* = 3.3 Hz), 130.0 (d, *J* = 8.0 Hz), 128.4 (d, *J* = 4.3 Hz), 128.0, 115.3, 115.2 (d, *J* = 21.4 Hz), 114.3.

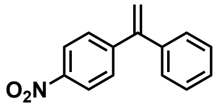
1-Chloro-4-(1-phenylvinyl)benzene (S6)



Colourless oil (196.9 mg, 46%). ^{1}H NMR (400 MHz, CDCl$_3$) δ 7.37 – 7.34 (m, 5H), 7.33 – 7.31 (m, 2H), 7.30 – 7.28 (m, 2H), 5.49 (d, *J*

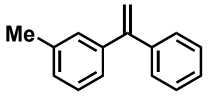
= 1.1 Hz, 1H), 5.47 (d, *J* = 1.1 Hz, 1H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 149.1, 141.1, 140.1, 133.7, 129.7, 128.5, 128.4, 128.3, 128.0, 114.8.

1-Nitro-4-(1-phenylvinyl)benzene (S8)



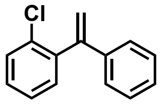
Colourless oil (166.6 mg, 37%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.21 – 8.18 (m, 2H), 7.52 – 7.48 (m, 2H), 7.39 – 7.35 (m, 3H), 7.32 – 7.28 (m, 2H), 5.63 (d, *J* = 0.7 Hz, 1H), 5.59 (d, *J* = 0.7 Hz, 1H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 148.5, 148.2, 147.4, 140.2, 129.1, 128.6, 128.5, 128.3, 123.7, 117.4.

1-Methyl-3-(1-phenylvinyl)benzene (S9)



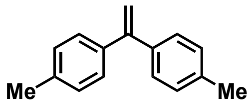
Colourless oil (194.1 mg, 50%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.39 – 7.32 (m, 5H), 7.25 (dd, *J* = 9.8, 5.1 Hz, 1H), 7.20 – 7.14 (m, 3H), 5.47 (s, 2H), 2.37 (s, 3H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 150.3, 141.7, 141.6, 137.9, 129.1, 128.6, 128.4, 128.3, 128.2, 127.8, 125.6, 114.3, 21.6.

1-Chloro-2-(1-phenylvinyl)benzene (S12)



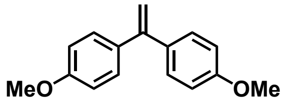
Colourless oil (179.8 mg, 42%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.44 – 7.39 (m, 1H), 7.36 – 7.27 (m, 8H), 5.85 (d, *J* = 1.0 Hz, 1H), 5.31 (d, *J* = 1.0 Hz, 1H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 147.6, 140.8, 139.9, 133.4, 131.7, 129.8, 129.0, 128.4, 127.9, 126.8 126.5, 116.3.

4,4'-(Ethene-1,1-diyl)bis(methylbenzene) (S13)



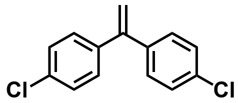
Colourless oil (237.3 mg, 57%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.17 – 7.14 (m, 4H), 7.07 – 7.04 (m, 4H), 5.30 (s, 2H), 2.28 (s, 6H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 149.9, 138.9, 137.6, 129.0, 128.3, 113.1, 21.3.

4,4'-(Ethene-1,1-diyl)bis(methoxybenzene) (S14)



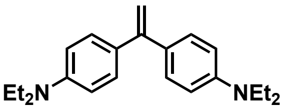
Colourless oil (182.5 mg, 38%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.29 – 7.26 (m, 4H), 6.88 – 6.84 (m, 4H), 5.29 (s, 2H), 3.83 (s, 6H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 159.4, 149.1, 134.4, 129.6, 113.6, 111.8, 55.4.

4,4'-(Ethene-1,1-diyl)bis(chlorobenzene) (S15)



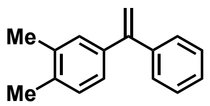
Colourless oil (223.2 mg, 45%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.35 – 7.32 (m, 4H), 7.28 – 7.26 (m, 3H), 7.25 (d, *J* = 2.3 Hz, 1H), 5.47 (s, 2H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 148.1, 139.6, 134.0, 129.6, 128.6, 115.2.

4,4'-(ethene-1,1-diyl)bis(*N,N*-diethylaniline) (S16)



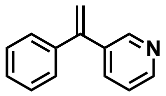
Colourless oil (296.5 mg, 46%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.27 (d, *J* = 8.6 Hz, 4H), 6.65 (d, *J* = 8.4 Hz, 4H), 5.17 (s, 2H), 3.38 (q, *J* = 7.0 Hz, 8H), 1.19 (t, *J* = 7.1 Hz, 12H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 149.7, 147.4, 129.6, 111.2, 108.2, 44.5, 12.8.

1,2-Dimethyl-4-(1-phenylvinyl)benzene (S17)



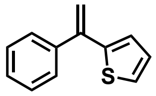
Colourless oil (245.6 mg, 59%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.27 – 7.18 (m, 5H), 7.03 (s, 1H), 7.01 – 6.96 (m, 2H), 5.32 (d, *J* = 1.4 Hz, 1H), 5.29 (d, *J* = 1.4 Hz, 1H), 2.17 (s, 3H), 2.14 (s, 3H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 150.2, 141.9, 139.2, 136.4, 136.3, 129.6, 128.4, 128.2, 127.7, 125.9, 113.7, 19.9, 19.6.

3-(1-Phenylvinyl)pyridine (S18)



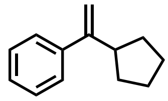
Colorless oil (108.7 mg, 30%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.64 (d, *J* = 1.0 Hz, 1H), 8.56 (d, *J* = 3.8 Hz, 1H), 7.62 – 7.58 (m, 1H), 7.37 – 7.29 (m, 5H), 7.27 – 7.23 (m, 1H), 5.57 (d, *J* = 0.9 Hz, 1H), 5.50 (d, *J* = 0.9 Hz, 1H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 149.3, 148.9, 147.0, 140.4, 137.2, 135.6, 128.5, 128.2, 128.1, 123.1, 115.9.

2-(1-Phenylvinyl)thiophene (S19)



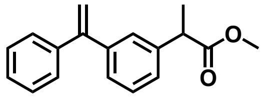
Colourless oil (130.2 mg, 35%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.54 – 7.45 (m, 2H), 7.44 – 7.36 (m, 3H), 7.31 – 7.26 (m, 1H), 7.02 (dd, *J* = 5.1, 3.6 Hz, 1H), 6.96 (dd, *J* = 3.6, 1.2 Hz, 1H), 5.63 (d, *J* = 0.9 Hz, 1H), 5.29 (d, *J* = 0.9 Hz, 1H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 144.9, 143.5, 141.2, 128.5, 128.3, 127.4, 126.6, 125.2, 113.8.

(1-Cyclopentylvinyl)benzene (S21)



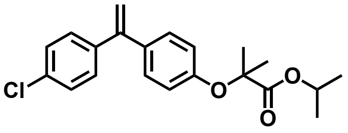
Colourless oil (172.2 mg, 50%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.43 – 7.38 (m, 2H), 7.37 – 7.32 (m, 2H), 7.30 – 7.26 (m, 1H), 5.20 (s, 1H), 5.10 (t, *J* = 1.3 Hz, 1H), 3.03 – 2.95 (m, 1H), 1.96 – 1.88 (m, 2H), 1.79 – 1.71 (m, 2H), 1.70 – 1.61 (m, 2H), 1.53 – 1.42 (m, 2H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 153.1, 143.3, 128.2, 127.1, 126.7, 110.2, 44.7, 32.3, 25.0.

Methyl 2-(3-(1-phenylvinyl)phenyl)propanoate (S35)



Colorless oil (165.1 mg, 31%). ^{1}H NMR (400 MHz, CDCl$_3$) δ 7.45 – 7.36 (m, 6H), 7.36 – 7.32 (m, 2H), 7.32 – 7.28 (m, 1H), 5.54 (s, 2H), 3.79 (q, *J* = 7.2 Hz, 1H), 3.70 (s, 3H), 1.57 (d, *J* = 7.2 Hz, 3H). ^{13}C NMR (101 MHz, CDCl$_3$) δ 175.0, 149.9, 141.9, 141.4, 140.6, 128.5, 128.3 (d, *J* = 7.8 Hz), 127.9, 127.6, 127.3, 126.8, 114.6, 52.1, 45.5, 18.7.

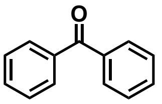
Isopropyl 2-(4-(1-(4-chlorophenyl)vinyl)phenoxy)-2-methylpropanoate (S36)



Colorless oil (486.9 mg, 68%). ^{1}H NMR (400 MHz, CDCl$_3$) δ 7.31 – 7.25 (m, 4H), 7.23 – 7.19 (m, 2H), 6.86 – 6.82 (m, 2H), 5.41 (d, *J* = 1.1 Hz, 1H), 5.34 (d, *J* = 1.1 Hz, 1H), 5.12 (dq, *J* = 6.3 Hz, 1H), 1.65 (d, *J* = 6.1 Hz, 6H), 1.25 (d, *J* = 6.3 Hz, 6H). ^{13}C NMR (101 MHz, CDCl$_3$) δ 173.7, 155.6, 148.4, 140.2, 134.5, 133.6, 129.7, 129.0, 128.4, 118.5, 113.7, 79.2, 69.0, 25.5, 21.6.

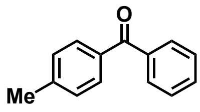
7. Characterization Data of Products

Benzophenone (1)



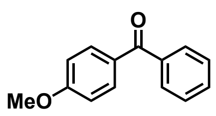
Colourless oil (15.5 mg, 85%). ^{1}H NMR (400 MHz, CDCl$_3$) δ 7.84 – 7.78 (m, 4H), 7.59 (t, *J* = 7.4 Hz, 2H), 7.49 (t, *J* = 7.6 Hz, 4H). ^{13}C NMR (101 MHz, CDCl$_3$) δ 196.9, 137.7, 132.5, 130.2, 128.4.

Phenyl(*p*-tolyl)methanone (2)



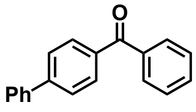
Colourless oil (17.3 mg, 88%). ^{1}H NMR (400 MHz, CDCl$_3$) δ 7.80 – 7.77 (m, 2H), 7.74 – 7.71 (m, 2H), 7.62 – 7.53 (m, 1H), 7.53– 7.43 (m, 2H), 7.30 – 7.27 (m, 2H), 2.44 (s, 3H). ^{13}C NMR (101 MHz, CDCl$_3$) δ 196.6, 143.3, 138.0, 135.0, 132.2, 130.4, 130.0, 129.1, 128.3, 21.7.

(4-Methoxyphenyl)(phenyl)methanone (3)



Colourless oil (14.2 mg, 67%). ^{1}H NMR (400 MHz, CDCl$_3$) δ 7.85 – 7.81 (m, 2H), 7.78 – 7.74 (m, 2H), 7.59 – 7.54 (m, 1H), 7.52 – 7.43 (m, 2H), 6.99 – 6.94 (m, 2H), 3.89 (s, 3H). ^{13}C NMR (101 MHz, CDCl$_3$) δ 195.6, 163.3, 138.4, 132.7, 132.0, 130.2, 129.8, 128.3, 113.7, 55.6.

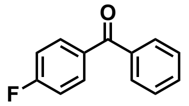
[1,1'-Biphenyl]-4-yl(phenyl)methanone (4)



White solid (18.0 mg, 70%). ^{1}H NMR (400 MHz, CDCl$_3$) δ 7.92 – 7.88 (m, 2H), 7.87 – 7.83 (m, 2H), 7.73 – 7.70 (m, 2H), 7.67 – 7.58 (m, 3H), 7.53 – 7.47 (m, 4H), 7.44 – 7.39 (m, 1H). ^{13}C NMR (101

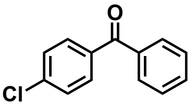
MHz, $CDCl_3$) δ 196.5, 145.4, 140.1, 137.9, 136.4, 132.5, 130.9, 130.1, 129.1, 128.4, 128.3, 127.4, 127.1.

(4-Fluorophenyl)(phenyl)methanone (5)



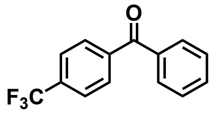
Colourless oil (14.4 mg, 72%). ^1H NMR (400 MHz, $CDCl_3$) δ 7.88 – 7.82 (m, 2H), 7.80 – 7.75 (m, 2H), 7.62 – 7.57 (m, 1H), 7.51 – 7.46 (m, 2H), 7.19 – 7.13 (m, 2H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 195.4, 165.5 (d, J = 254.1 Hz), 137.6, 133.9 (d, J = 3.1 Hz), 132.8 (d, J = 9.2 Hz), 132.6, 130.0, 128.5, 115.7.

(4-Chlorophenyl)(phenyl)methanone (6)



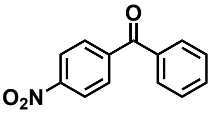
White solid (14.7 mg, 68%). ^1H NMR (400 MHz, $CDCl_3$) δ 7.79 – 7.72 (m, 4H), 7.63 – 7.58 (m, 1H), 7.52 – 7.44 (m, 4H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 195.6, 139.0, 137.4, 136.0, 132.8, 131.6, 130.1, 128.8, 128.5.

Phenyl(4-(trifluoromethyl)phenyl)methanone (7)



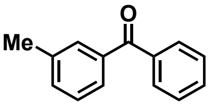
White solid (14.8 mg, 59%). ^1H NMR (400 MHz, $CDCl_3$) δ 7.90 (d, J = 8.0 Hz, 2H), 7.83 – 7.79 (m, 2H), 7.76 (d, J = 8.1 Hz, 2H), 7.66 – 7.61 (m, 1H), 7.54 – 7.49 (m, 2H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 195.7, 140.9, 136.9, 133.9 (q, J = 32.3 Hz), 133.2, 130.3, 130.2, 128.7, 125.5 (q, J = 3.7 Hz), 123.8 (q, J = 272.7 Hz).

(4-Nitrophenyl)(phenyl)methanone (8)



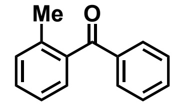
White solid (13.6 mg, 60%). ^1H NMR (400 MHz, $CDCl_3$) δ 8.37 – 8.32 (m, 2H), 7.96 – 7.92 (m, 2H), 7.82 – 7.78 (m, 2H), 7.68 – 7.63 (m, 1H), 7.56 – 7.50 (m, 2H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 194.9, 149.9, 143.0, 136.4, 133.6, 130.8, 130.2, 128.8, 123.7.

Phenyl(*m*-tolyl)methanone (9)



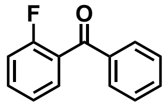
Colourless oil (15.1 mg, 77%). ^1H NMR (400 MHz, $CDCl_3$) δ 7.80 – 7.78 (m, 2H), 7.65 – 7.63 (m, 1H), 7.61 – 7.55 (m, 2H), 7.50 – 7.45 (m, 2H), 7.44 – 7.32 (m, 2H), 2.42 (s, 3H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 196.8, 138.1, 137.7, 137.6, 133.2, 132.3, 130.4, 130.0, 128.2, 128.1, 127.3, 21.3.

Phenyl(*o*-tolyl)methanone (10)



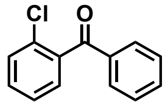
Colourless oil (12.8 mg, 65%). ^{1}H NMR (400 MHz, CDCl$_3$) δ 7.83 – 7.79 (m, 2H), 7.60 – 7.56 (m, 1H), 7.48 – 7.43 (m, 2H), 7.42 – 7.35 (m, 1H), 7.34 – 7.21 (m, 3H), 2.34 (s, 3H). ^{13}C NMR (101 MHz, CDCl$_3$) δ 198.8, 138.7, 137.9, 136.9, 133.3, 131.1, 130.4, 130.2, 128.63, 128.58, 125.3, 20.1.

(2-Fluorophenyl)(phenyl)methanone (11)



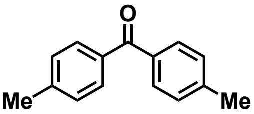
Colourless oil (12.6 mg, 63%). ^{1}H NMR (400 MHz, CDCl$_3$) δ 7.87 – 7.80 (m, 2H), 7.61 – 7.49 (m, 3H), 7.49 – 7.44 (m, 2H), 7.29 – 7.21 (m, 1H), 7.19 – 7.12 (m, 1H). ^{13}C NMR (101 MHz, CDCl$_3$) δ 193.6, 160.2 (d, J = 252.5 Hz), 137.5, 133.5, 133.2 (d, J = 8.2 Hz), 130.9 (d, J = 2.8 Hz), 129.9, 128.6, 127.2 (d, J = 14.7 Hz), 124.4 (d, J = 3.6 Hz), 116.4 (d, J = 21.6 Hz).

(2-Chlorophenyl)(phenyl)methanone (12)



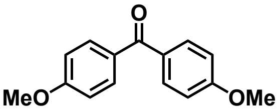
Colourless oil (12.5 mg, 58%). ^{1}H NMR (400 MHz, CDCl$_3$) δ 7.84 – 7.80 (m, 2H), 7.63 – 7.58 (m, 1H), 7.49 – 7.42 (m, 4H), 7.40 – 7.36 (m, 2H). ^{13}C NMR (101 MHz, CDCl$_3$) δ 195.4, 138.7, 136.6, 133.8, 131.4, 131.3, 130.2, 129.2, 128.7, 126.8.

Di-*p*-tolylmethanone (13)



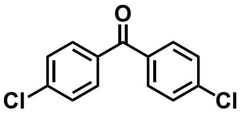
White solid (17.5 mg, 83%). ^{1}H NMR (400 MHz, CDCl$_3$) δ 7.65 – 7.60 (m, 4H), 7.19 (dd, J = 8.4, 0.5 Hz, 4H), 2.36 (s, 6H). ^{13}C NMR (101 MHz, CDCl$_3$) δ 196.3, 143.0, 135.3, 130.3, 129.0, 21.7.

Bis(4-methoxyphenyl)methanone (14)



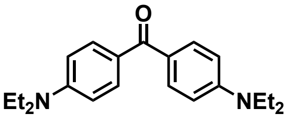
Colourless oil (13.1 mg, 54%). ^{1}H NMR (400 MHz, CDCl$_3$) δ 7.81 – 7.79 (m, 2H), 7.78 – 7.77 (m, 2H), 6.98 – 6.96 (m, 2H), 6.96 – 6.94 (m, 2H), 3.89 (s, 6H). ^{13}C NMR (101 MHz, CDCl$_3$) δ 194.6, 162.9, 132.3, 130.8, 113.6, 55.6.

Bis(4-chlorophenyl)methanone (15)



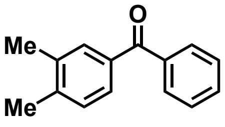
White solid (15.2 mg, 61%). ^{1}H NMR (400 MHz, CDCl$_3$) δ 7.75 – 7.71 (m, 4H), 7.49 – 7.45 (m, 4H). ^{13}C NMR (101 MHz, CDCl$_3$) δ 194.3, 139.2, 135.6, 131.4, 128.9.

Bis(4-(diethylamino)phenyl)methanone (16)



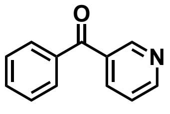
White solid (12.7 mg, 39%). ^{1}H NMR (400 MHz, CDCl$_3$) δ 7.79 – 7.72 (m, 2H), 6.65 (d, *J* = 8.9 Hz, 2H), 3.42 (q, *J* = 7.1 Hz, 4H), 1.24 – 1.18 (m, 6H). ^{13}C NMR (101 MHz, CDCl$_3$) δ 193.6, 150.4, 132.6, 125.7, 110.1, 44.6, 12.7.

(3,4-Dimethylphenyl)(phenyl)methanone (17)



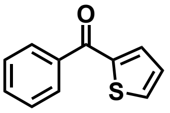
Colourless oil (16.0 mg, 76%). ^{1}H NMR (400 MHz, CDCl$_3$) δ 7.82 – 7.75 (m, 2H), 7.62 (s, 1H), 7.60 – 7.52 (m, 2H), 7.50 – 7.45 (m, 2H), 7.23 (d, *J* = 7.8 Hz, 1H), 2.35 (s, 3H), 2.33 (s, 3H). ^{13}C NMR (101 MHz, CDCl$_3$) δ 196.9, 142.1, 138.2, 136.9, 135.4, 132.2, 131.3, 130.1, 129.6, 128.3, 128.2, 20.2, 19.9.

Phenyl(pyridin-3-yl)methanone (18)



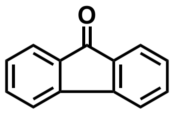
Colourless oil (7.9 mg, 43%). ^{1}H NMR (400 MHz, CDCl$_3$) δ 8.99 (dd, *J* = 2.1, 0.7 Hz, 1H), 8.81 (dd, *J* = 4.9, 1.7 Hz, 1H), 7.86 – 7.77 (m, 1H), 7.56 – 7.47 (m, 2H), 7.65 – 7.61 (m, 1H), 7.53 – 7.48 (m, 2H), 7.47 – 7.42 (m, 1H). ^{13}C NMR (101 MHz, CDCl$_3$) δ 194.6, 152.7, 150.7, 137.0, 136.5, 133.0, 129.8, 128.5, 123.2.

Phenyl(thiophen-2-yl)methanone (19)



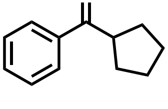
Colourless oil (12.5 mg, 66%). ^{1}H NMR (400 MHz, CDCl$_3$) δ 7.90 – 7.83 (m, 2H), 7.72 (dd, *J* = 5.0, 1.1 Hz, 1H), 7.65 (dd, *J* = 3.8, 1.1 Hz, 1H), 7.62 – 7.57 (m, 1H), 7.55 – 7.45 (m, 2H), 7.16 (dd, *J* = 5.0, 3.8 Hz, 1H). ^{13}C NMR (101 MHz, CDCl$_3$) δ 188.3, 143.7, 138.2, 135.0, 134.3, 132.4, 129.3, 128.5, 128.1.

9*H*-Fluoren-9-one (20)



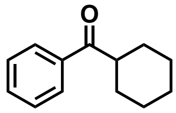
Colourless oil (14.0 mg, 78%). ^{1}H NMR (400 MHz, CDCl$_3$) δ 7.68 – 7.64 (m, 2H), 7.54 – 7.46 (m, 4H), 7.32 – 7.27 (m, 2H). ^{13}C NMR (101 MHz, CDCl$_3$) δ 194.0, 144.5, 134.8, 134.2, 129.2, 124.4, 120.4.

Cyclopentyl(phenyl)methanone (21)



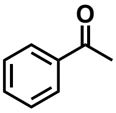
Colourless oil (12.2 mg, 70%). ^{1}H NMR (400 MHz, CDCl$_3$) δ 7.96 – 7.89 (m, 2H), 7.50 – 7.42 (m, 1H), 7.41 – 7.34 (m, 2H), 3.70 – 3.59 (m, 1H), 1.90 – 1.81 (m, 4H), 1.71 – 1.55 (m, 4H). ^{13}C NMR (101 MHz, CDCl$_3$) δ 202.5, 136.8, 132.5, 128.4, 128.3, 46.2, 29.8, 26.2.

Cyclohexyl(phenyl)methanone (22)



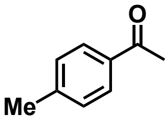
Colourless oil (13.4 mg, 71%). ^{1}H NMR (400 MHz, CDCl$_3$) δ 7.98 – 7.92 (m, 2H), 7.57 – 7.52 (m, 1H), 7.49 – 7.43 (m, 2H), 3.31 – 3.21 (m, 1H), 1.93 – 1.81 (m, 4H), 1.78 – 1.70 (m, 1H), 1.55 – 1.34 (m, 4H), 1.33 – 1.22 (m, 1H). ^{13}C NMR (101 MHz, CDCl$_3$) δ 204.0, 136.5, 132.9, 128.7, 128.4, 45.8, 29.6, 26.1, 26.0.

Acetophenone (23)



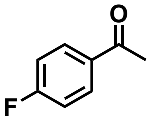
Colourless oil (8.2 mg, 68%). ^{1}H NMR (400 MHz, CDCl$_3$) δ 7.99 – 7.93 (m, 2H), 7.59 – 7.53 (m, 1H), 7.49 – 7.43 (m, 2H), 2.61 (s, 3H). ^{13}C NMR (101 MHz, CDCl$_3$) δ 198.3, 137.3, 133.2, 128.7, 128.4, 26.7.

1-(*p*-Tolyl)ethan-1-one (24)



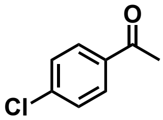
Colourless oil (9.4 mg, 70%). ^{1}H NMR (400 MHz, CDCl$_3$) δ 7.88 (d, J = 8.2 Hz, 2H), 7.28 (d, J = 8.0 Hz, 2H), 2.60 (s, 3H), 2.43 (s, 3H). ^{13}C NMR (101 MHz, CDCl$_3$) δ 197.5, 143.7, 134.6, 129.1, 128.3, 26.3, 21.4.

1-(4-Fluorophenyl)ethan-1-one (25)



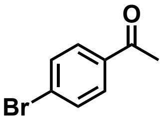
Colourless oil (8.6 mg, 62%). ^{1}H NMR (400 MHz, CDCl$_3$) δ 8.01 – 7.94 (m, 2H), 7.16 – 7.09 (m, 2H), 2.59 (d, J = 0.7 Hz, 3H). ^{13}C NMR (101 MHz, CDCl$_3$) δ 196.6, 165.9 (d, J = 254.6 Hz), 133.7 (d, J = 2.9 Hz), 131.1 (d, J = 9.4 Hz), 115.9, 26.7.

1-(4-Chlorophenyl)ethan-1-one (26)



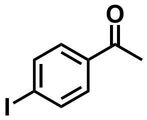
Colourless oil (8.2 mg, 53%). ^{1}H NMR (400 MHz, CDCl$_3$) δ 7.90 (d, J = 7.8 Hz, 2H), 7.44 (d, J = 7.8 Hz, 2H), 2.59 (s, 3H). ^{13}C NMR (101 MHz, CDCl$_3$) δ 196.9, 139.7, 135.6, 129.8, 129.0, 26.7.

1-(4-Bromophenyl)ethan-1-one (27)



White solid (11.5 mg, 58%). ^{1}H NMR (400 MHz, CDCl$_3$) δ 7.83 – 7.77 (m, 2H), 7.61 – 7.55 (m, 2H), 2.57 (s, 3H). ^{13}C NMR (101 MHz, CDCl$_3$) δ 1971, 135.9, 132.0, 129.9, 128.4, 26.6.

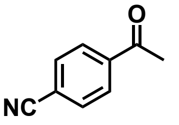
1-(4-Iodophenyl)ethan-1-one (28)



White solid (12.3 mg, 50%). ^{1}H NMR (400 MHz, CDCl$_3$) δ 7.83 (d, J = 8.5 Hz, 2H), 7.66 (d, J = 8.5 Hz, 2H), 2.57 (s, 3H). ^{13}C NMR (101 MHz,

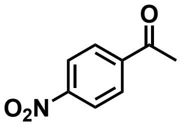
$CDCl_3$) δ 197.4, 138.0, 136.5, 129.9, 101.2, 26.6.

4-Acetylbenzonitrile (29)



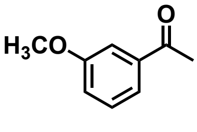
White solid (7.4 mg, 51%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.02 (dd, *J* = 5.0, 3.6 Hz, 2H), 7.78 – 7.74 (m, 2H), 2.63 (s, 3H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 196.6, 140.0, 132.6, 128.8, 118.0, 116.5, 26.9.

1-(4-Nitrophenyl)ethan-1-one (30)



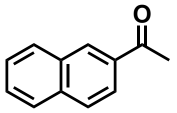
White solid (10.4 mg, 63%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.33 – 8.28 (m, 2H), 8.13 – 8.08 (m, 2H), 2.68 – 2.66 (m, 3H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 196.4, 150.5, 141.5, 129.4, 124.0, 27.1.

1-(3-Methoxyphenyl)ethan-1-one (31)



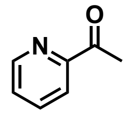
Colourless oil (9.1 mg, 61%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.54 – 7.50 (m, 1H), 7.49 – 7.44 (m, 1H), 7.35 (t, *J* = 7.9 Hz, 1H), 7.12 – 7.06 (m, 1H), 3.84 (s, 3H), 2.58 (s, 3H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 198.1, 159.9, 138.6, 129.7, 121.3, 119.8, 112.5, 55.6, 26.8.

1-(Naphthalen-2-yl)ethan-1-one (32)



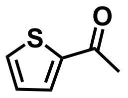
Colourless oil (11.0 mg, 65%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.47 (s, 1H), 8.04 (dd, *J* = 8.6, 1.7 Hz, 1H), 7.97 (d, *J* = 8.0 Hz, 1H), 7.92 – 7.87 (m, 2H), 7.63 – 7.54 (m, 2H), 2.73 (s, 3H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 198.2, 135.7, 134.6, 132.6, 130.3, 129.7, 128.6, 128.5, 127.9, 126.9, 124.0, 26.8.

1-(Pyridin-2-yl)ethan-1-one (33)



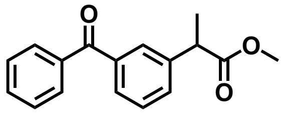
Colourless oil (5.5 mg, 45%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.61 – 8.54 (m, 1H), 7.97 – 7.91 (m, 1H), 7.75 – 7.70 (m, 1H), 7.41 – 7.32 (m, 1H), 2.65 – 2.61 (m, 3H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 200.0, 153.5, 148.9, 136.8, 127.0, 121.5, 25.7.

1-(Thiophen-2-yl)ethan-1-one (34)



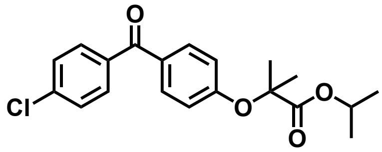
Colourless oil (6.9 mg, 55%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.67 – 7.61 (m, 1H), 7.60 – 7.54 (m, 1H), 7.10 – 7.02 (m, 1H), 2.52 – 2.46 (m, 3H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 190.7, 144.5, 133.8, 132.5, 128.1, 26.8.

Methyl 2-(3-benzoylphenyl)propanoate (35, ketoprofen methyl ester)



Colorless oil (14.3 mg, 53%). ^{1}H NMR (400 MHz, CDCl$_3$) δ 7.82 – 7.78 (m, 2H), 7.75 (s, 1H), 7.67 (d, *J* = 7.6 Hz, 1H), 7.61 – 7.52 (m, 2H), 7.52 – 7.40 (m, 3H), 3.80 (q, *J* = 7.2 Hz, 1H), 3.67 (s, 3H), 1.53 (d, *J* = 7.2 Hz, 3H). ^{13}C NMR (101 MHz, CDCl$_3$) δ 196.0, 174.2, 140.7, 137.7, 137.3, 132.3, 131.3, 129.8, 128.9, 128.8, 128.4, 128.1, 51.9, 45.0, 18.3.

Isopropyl 2-(4-(4-chlorobenzoyl)phenoxy)-2-methylpropanoate (36, fenofibrate)



Colorless oil (20.5 mg, 57%). ^{1}H NMR (400 MHz, CDCl$_3$) δ 7.76 – 7.66 (m, 4H), 7.46 – 7.42 (m, 2H), 6.88 – 6.83 (m, 2H), 5.07 (dq, *J* = 12.5, 6.3 Hz, 1H), 1.65 (s, 6H), 1.20 (t, *J* = 4.6 Hz, 6H). ^{13}C NMR (101 MHz, CDCl$_3$) δ 194.4, 173.2, 159.9, 138.5, 136.6, 132.1, 131.3, 130.3, 128.7, 117.4, 79.6, 69.5, 25.5, 21.6.

8. References

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[7] Kavarnos, G. J. Energetics of photoinduced electron transfer, in fundamentals of photoinduced electron transfer, VCH: New-York, Weinheim, 1993, pp 29−37.

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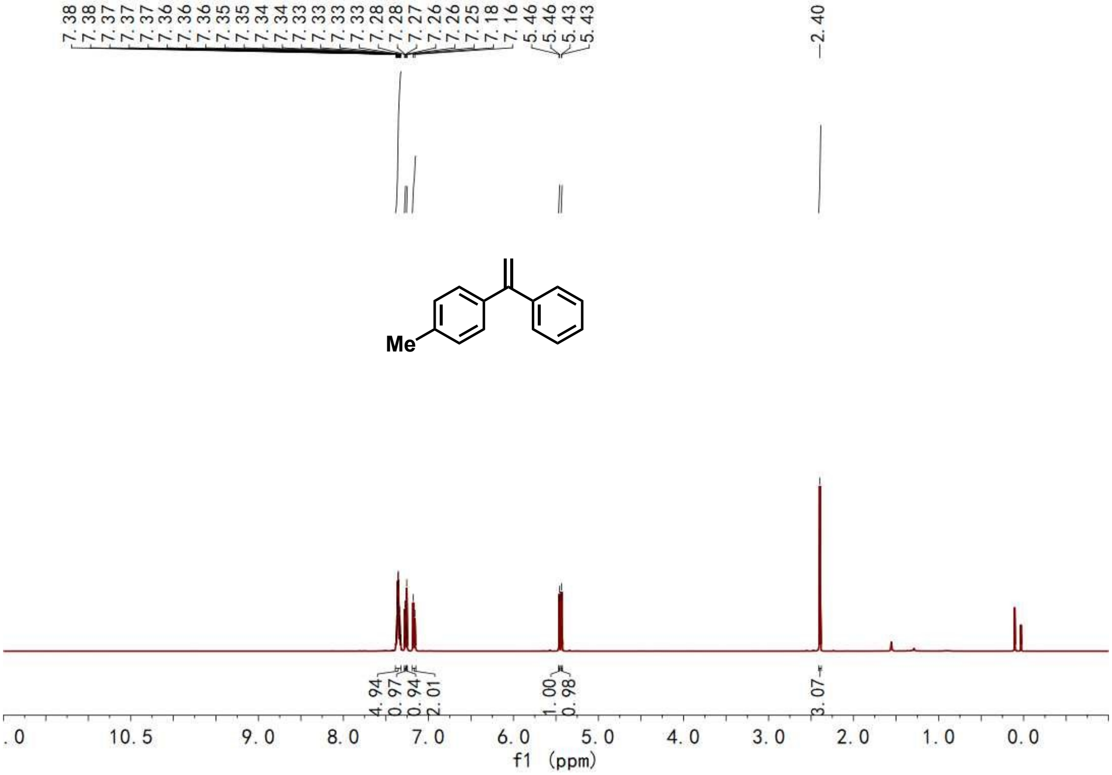
[9] E. L. Saux, E. Georgiou, I. A. Dmitriev, W. C. Hartley and P. Melchiorre, Photochemical organocatalytic functionalization of pyridines *via* pyridinyl radicals, *J. Am. Chem. Soc.,* 2023, **145**, 47−52.

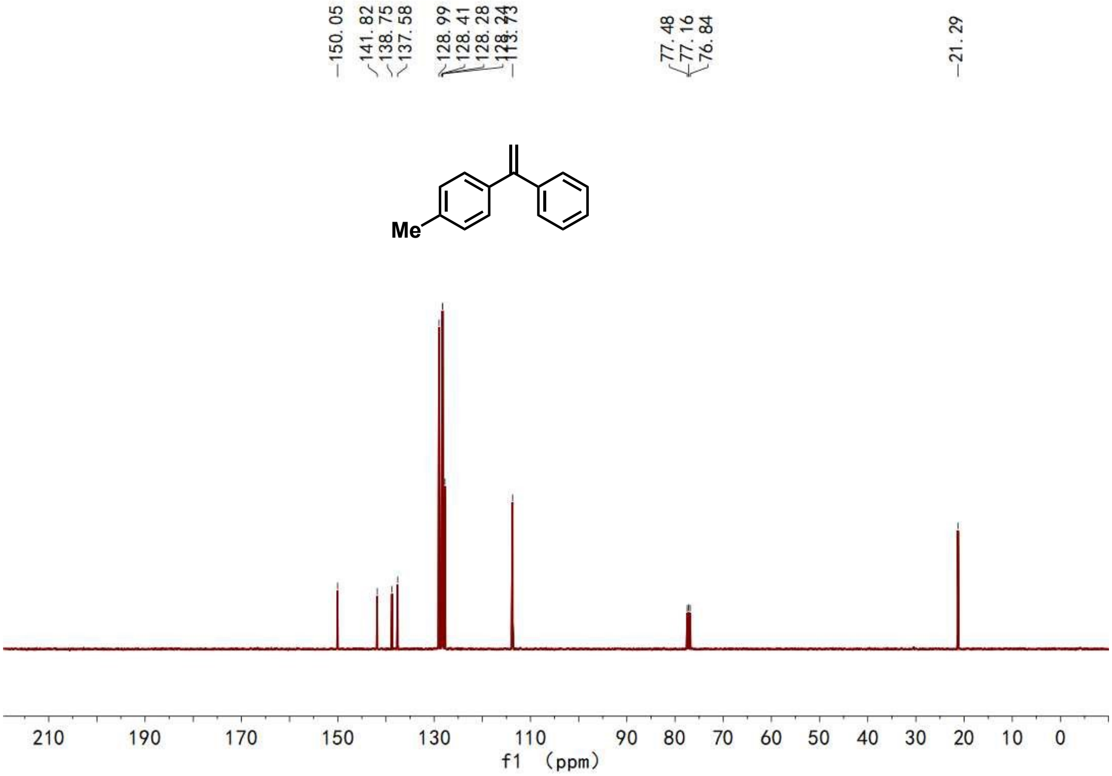
[10] F. Cheng, L. Fan, Q. Lv, X. Chen and B. Yu, Alkyl radicals from diacyl peroxides: metal-/base-/additive-free photocatalytic alkylation of *N*-heteroaromatics, *Green Chem.,* 2023, **25**, 7971−7977.

9. NMR spectra

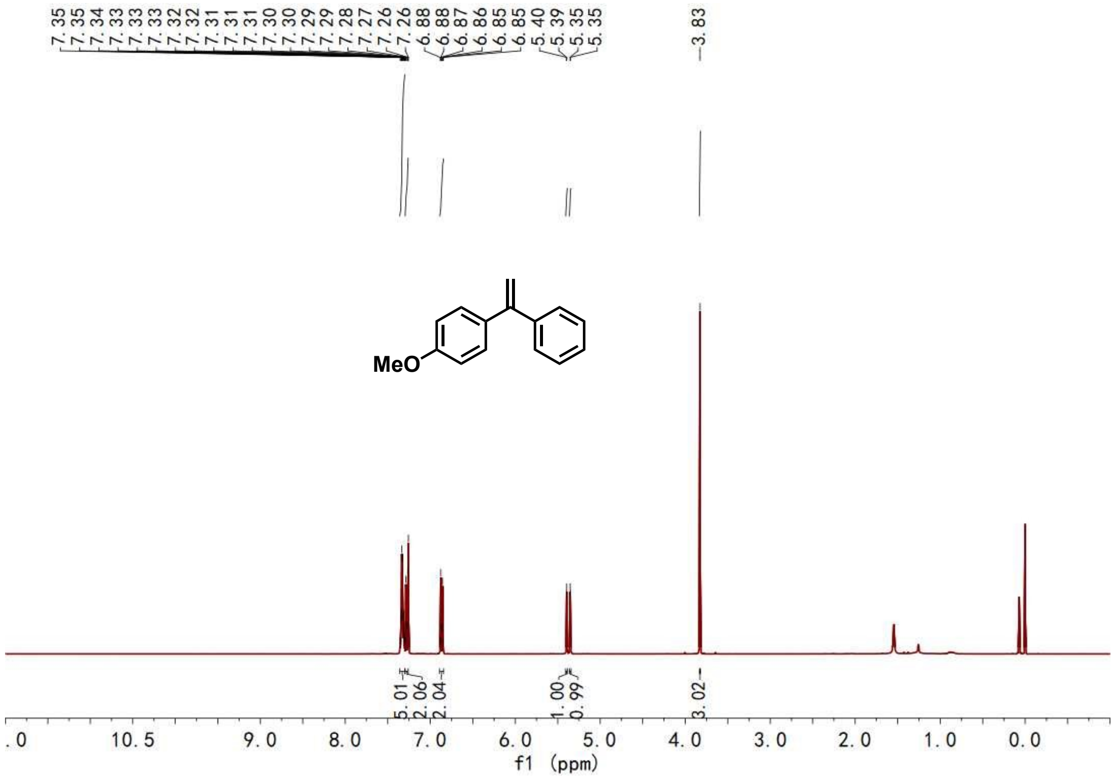
1-Methyl-4-(1-phenylvinyl)benzene (S2): ^{1}H NMR (400 MHz, CDCl$_3$)



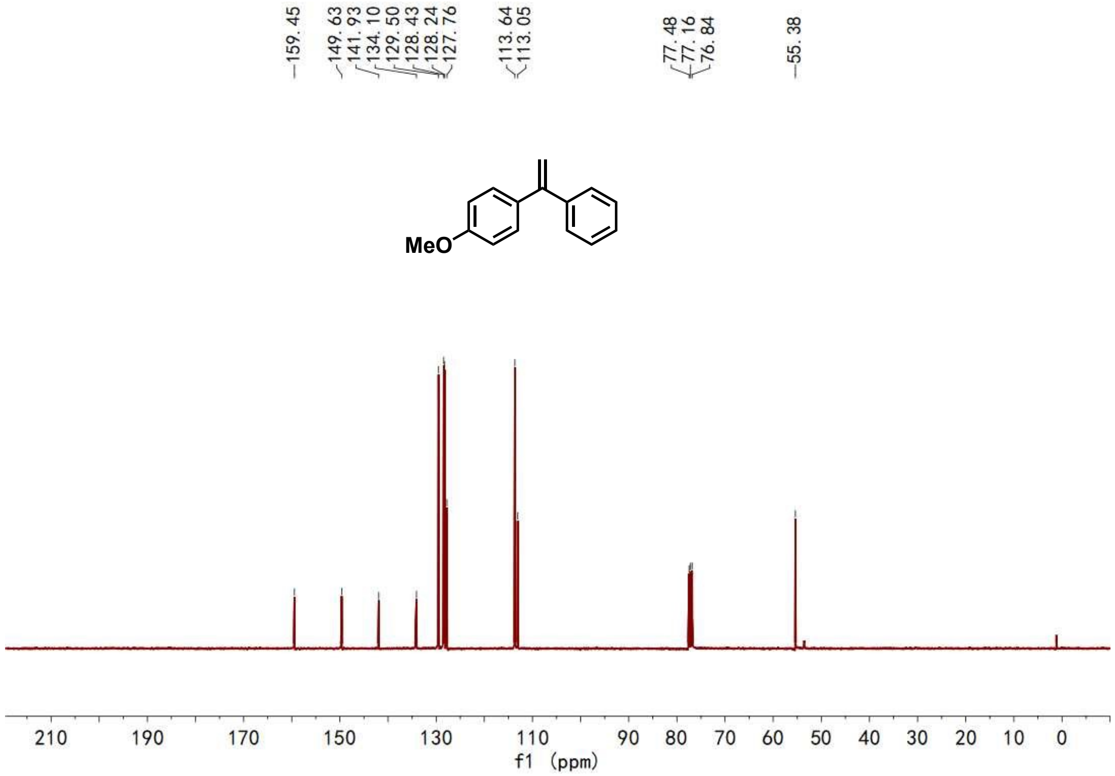
1-Methyl-4-(1-phenylvinyl)benzene (S2): ^{13}C NMR (101 MHz, CDCl$_3$)



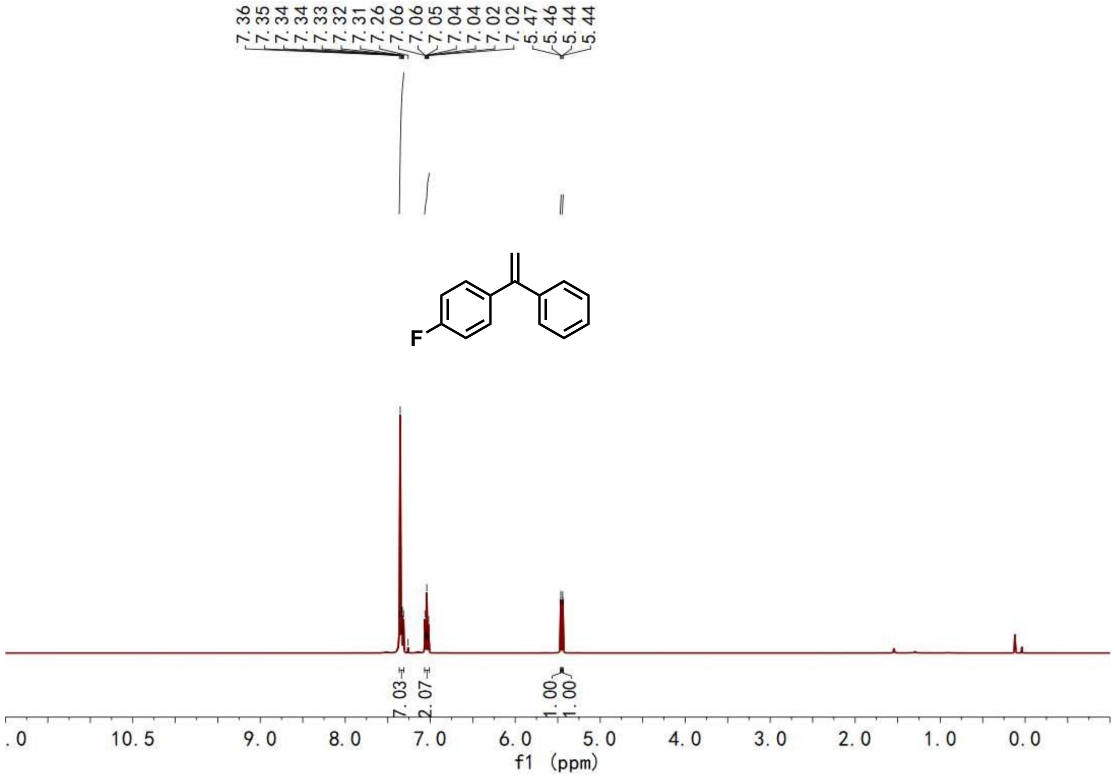
1-Methoxy-4-(1-phenylvinyl)benzene (S3): ^{1}H NMR (400 MHz, CDCl$_3$)



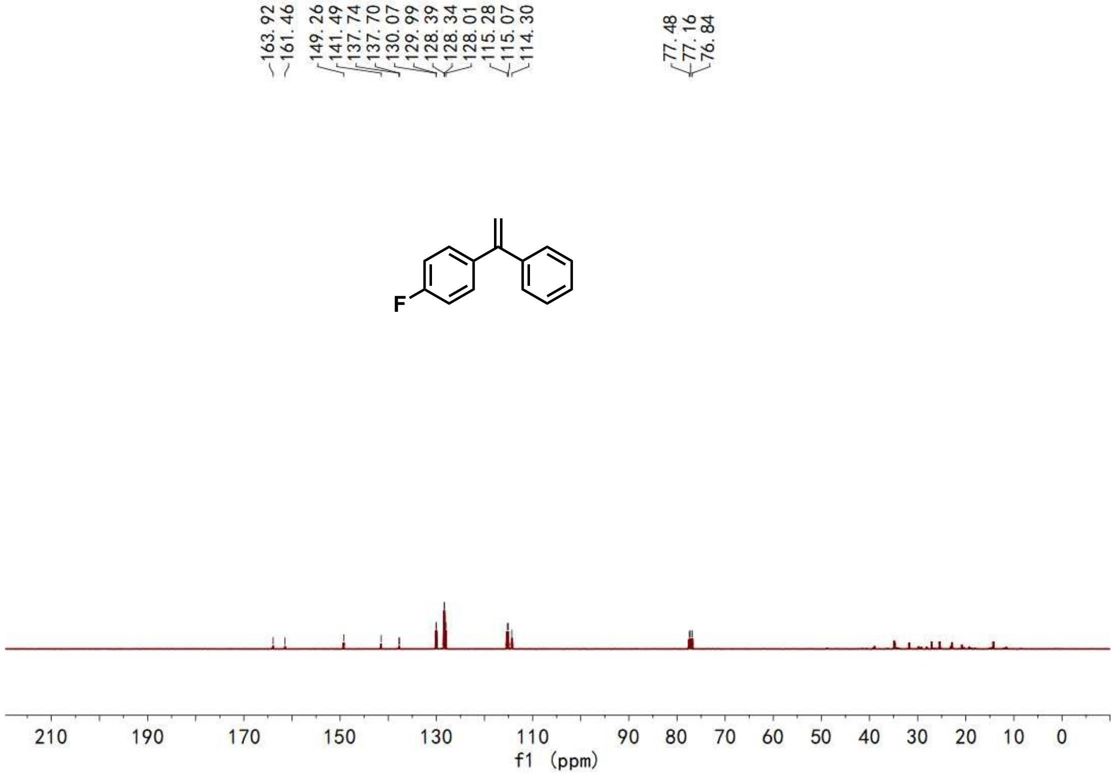
1-Methoxy-4-(1-phenylvinyl)benzene (S3): ^{13}C NMR (101 MHz, CDCl$_3$)



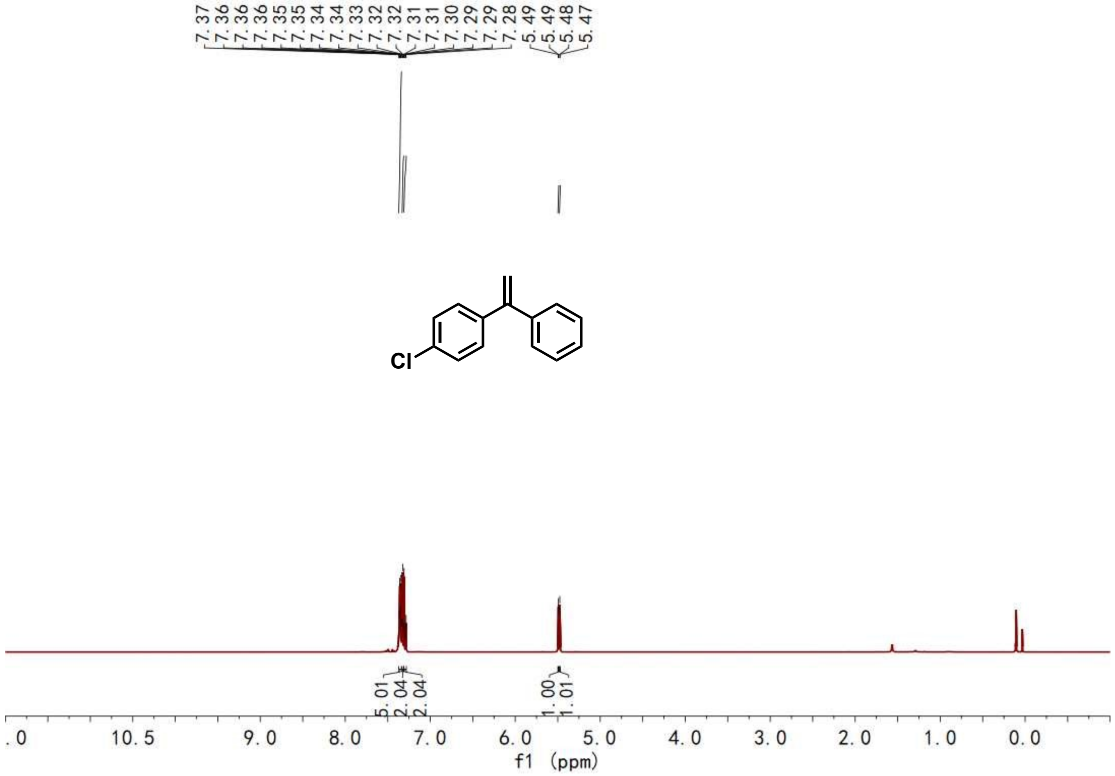
1-Fluoro-4-(1-phenylvinyl)benzene (S5): ^{1}H NMR (400 MHz, CDCl$_3$)



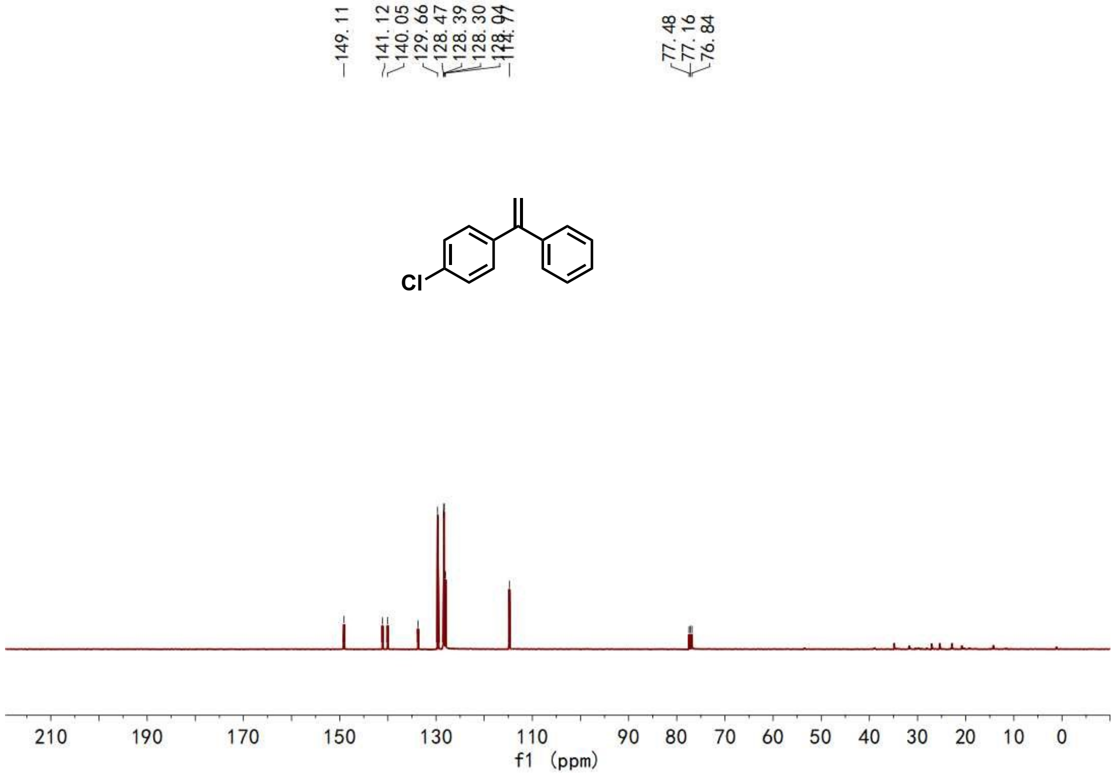
1-Fluoro-4-(1-phenylvinyl)benzene (S5): ^{13}C NMR (101 MHz, CDCl$_3$)



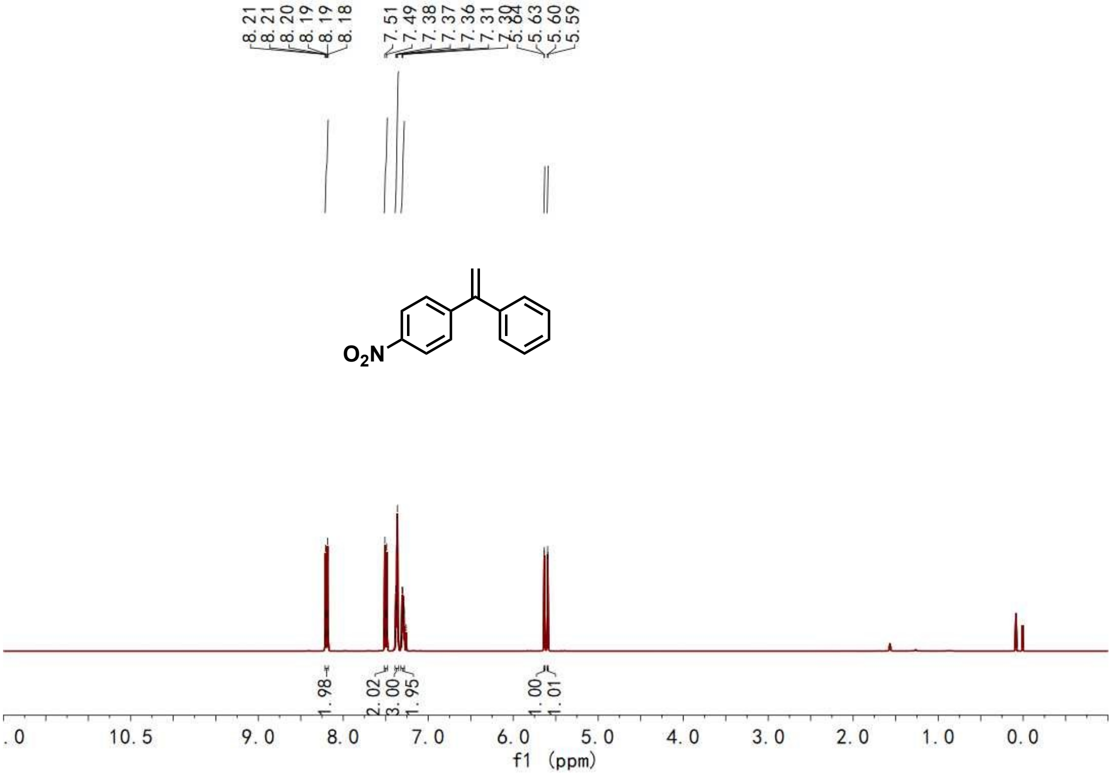
1-Chloro-4-(1-phenylvinyl)benzene (S6): ^{1}H NMR (400 MHz, $CDCl_3$)



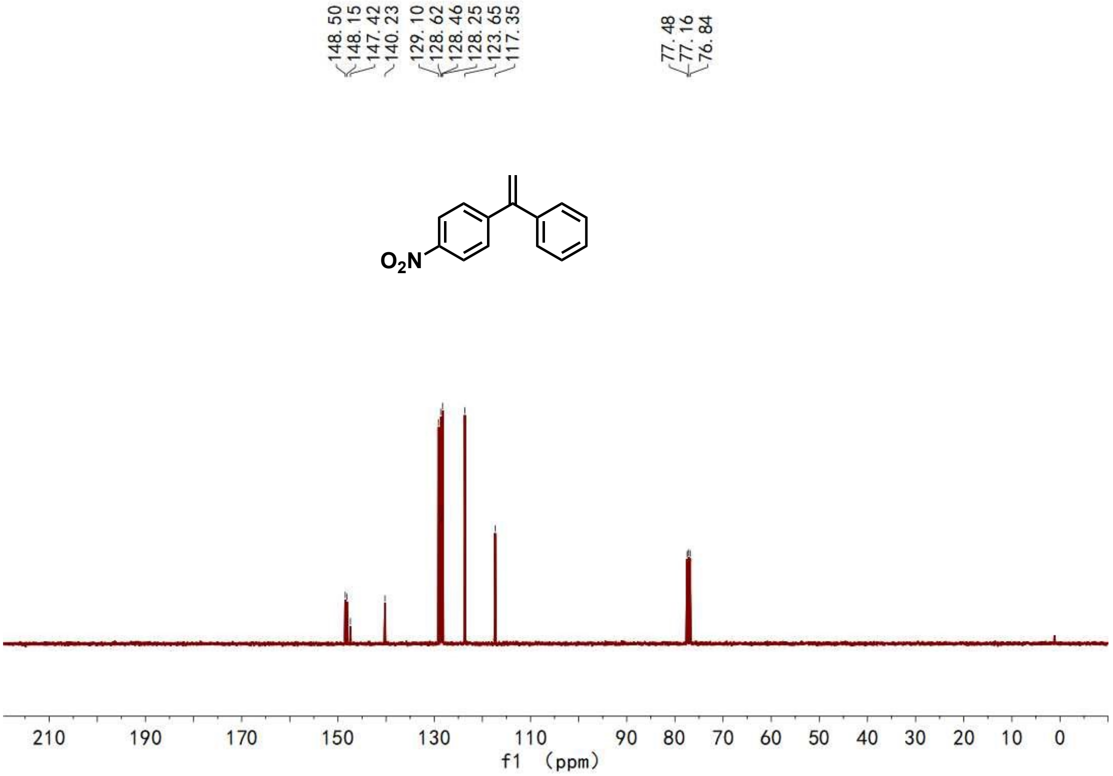
1-Chloro-4-(1-phenylvinyl)benzene (S6): ^{13}C NMR (101 MHz, $CDCl_3$)



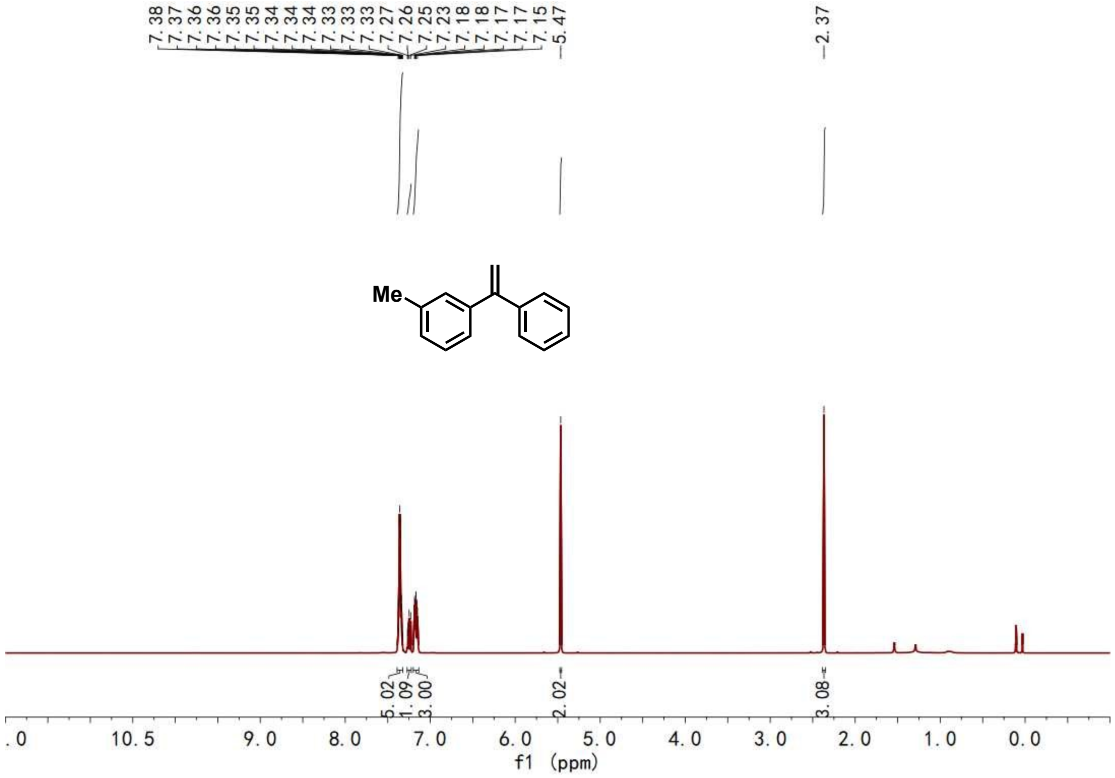
1-Nitro-4-(1-phenylvinyl)benzene (S8): ^{1}H NMR (400 MHz, $CDCl_3$)



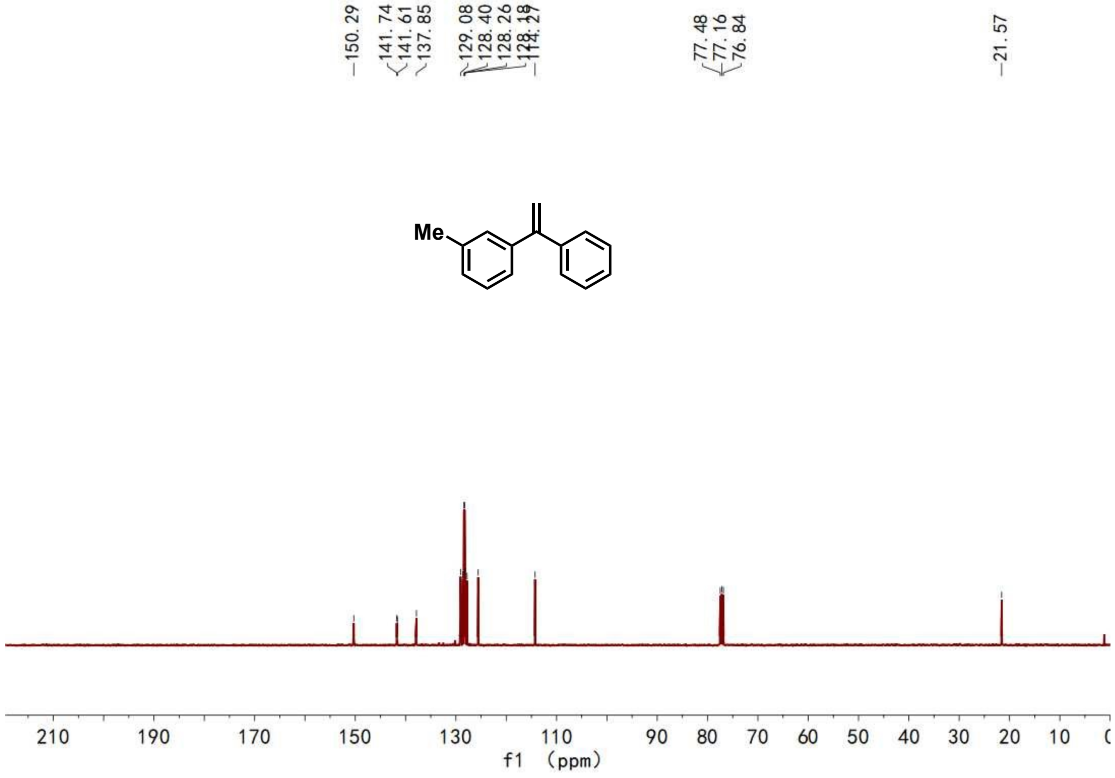
1-Nitro-4-(1-phenylvinyl)benzene (S8): ^{13}C NMR (101 MHz, $CDCl_3$)



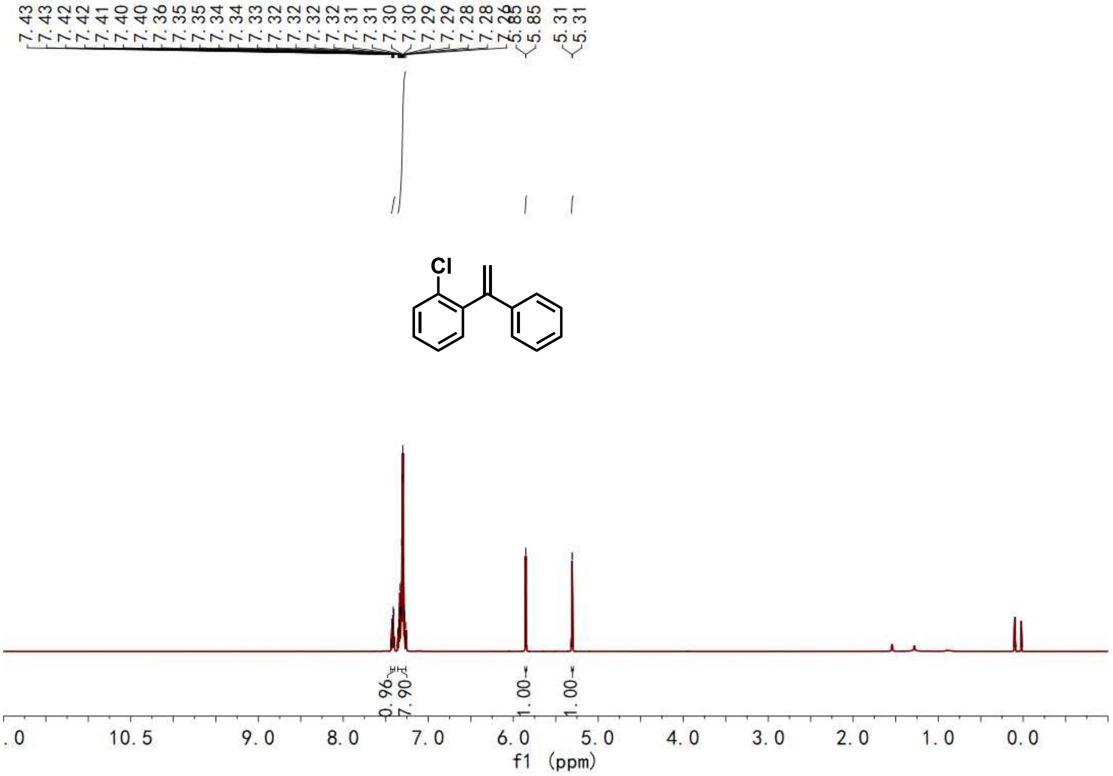
1-Methyl-3-(1-phenylvinyl)benzene (S9): ^{1}H NMR (400 MHz, CDCl$_3$)



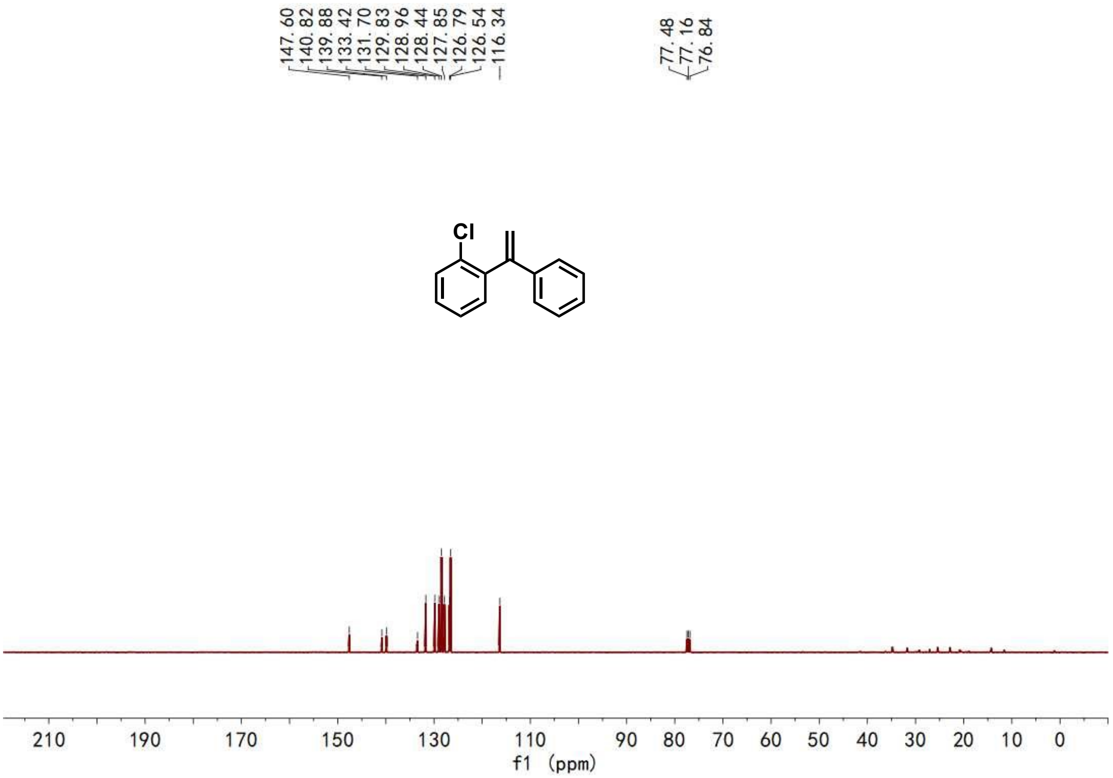
1-Methyl-3-(1-phenylvinyl)benzene (S9): ^{13}C NMR (101 MHz, CDCl$_3$)



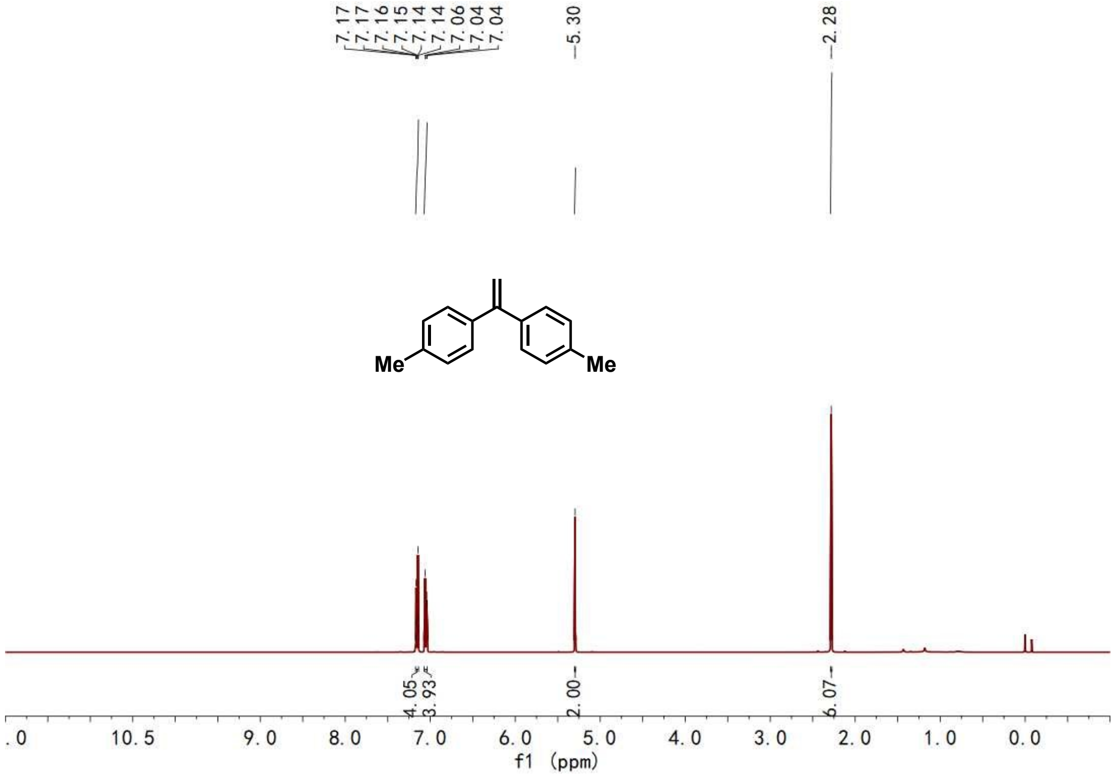
1-Chloro-2-(1-phenylvinyl)benzene (S12): ^{1}H NMR (400 MHz, CDCl$_3$)



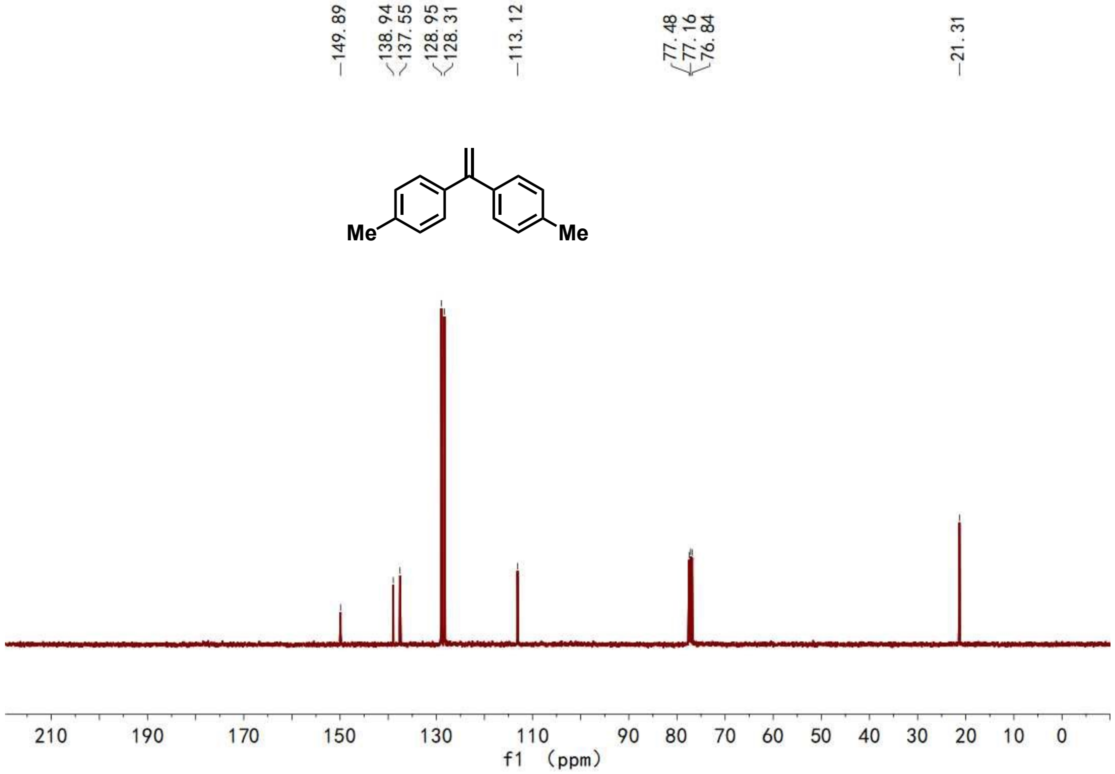
1-Chloro-2-(1-phenylvinyl)benzene (S12): ^{13}C NMR (101 MHz, CDCl$_3$)



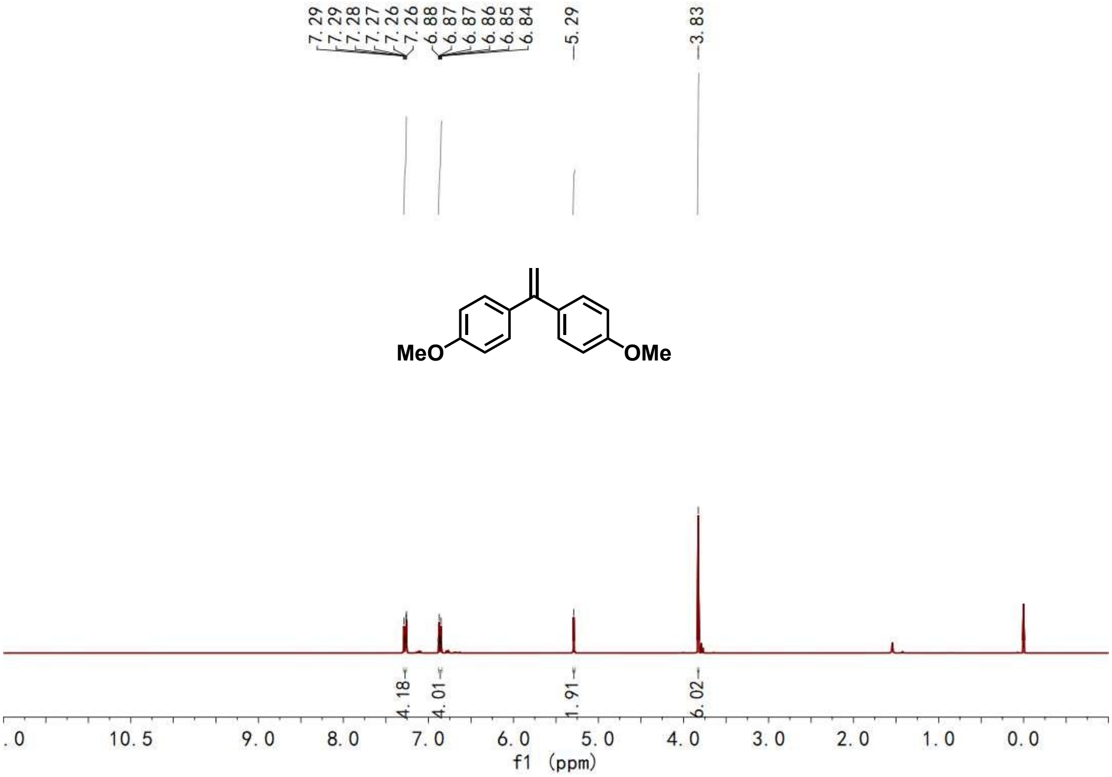
4,4'-(Ethene-1,1-diyl)bis(methylbenzene) (S13): ^{1}H NMR (400 MHz, CDCl$_3$)



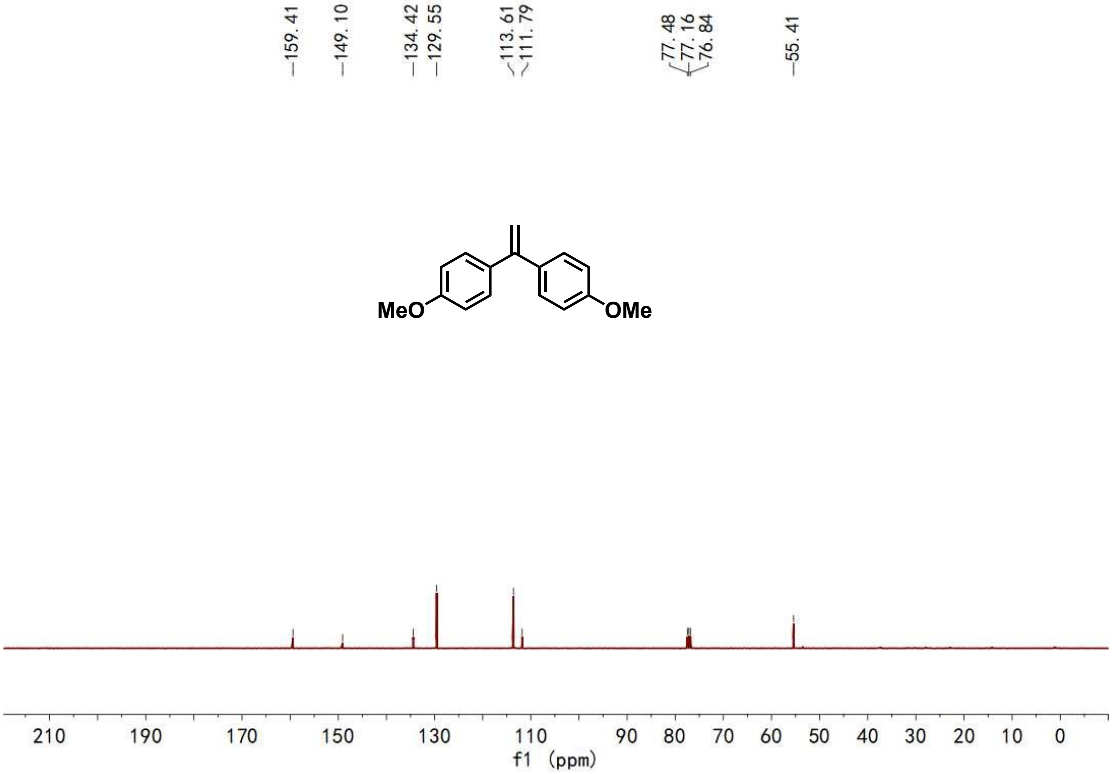
4,4'-(Ethene-1,1-diyl)bis(methylbenzene) (S13): ^{13}C NMR (101 MHz, CDCl$_3$)



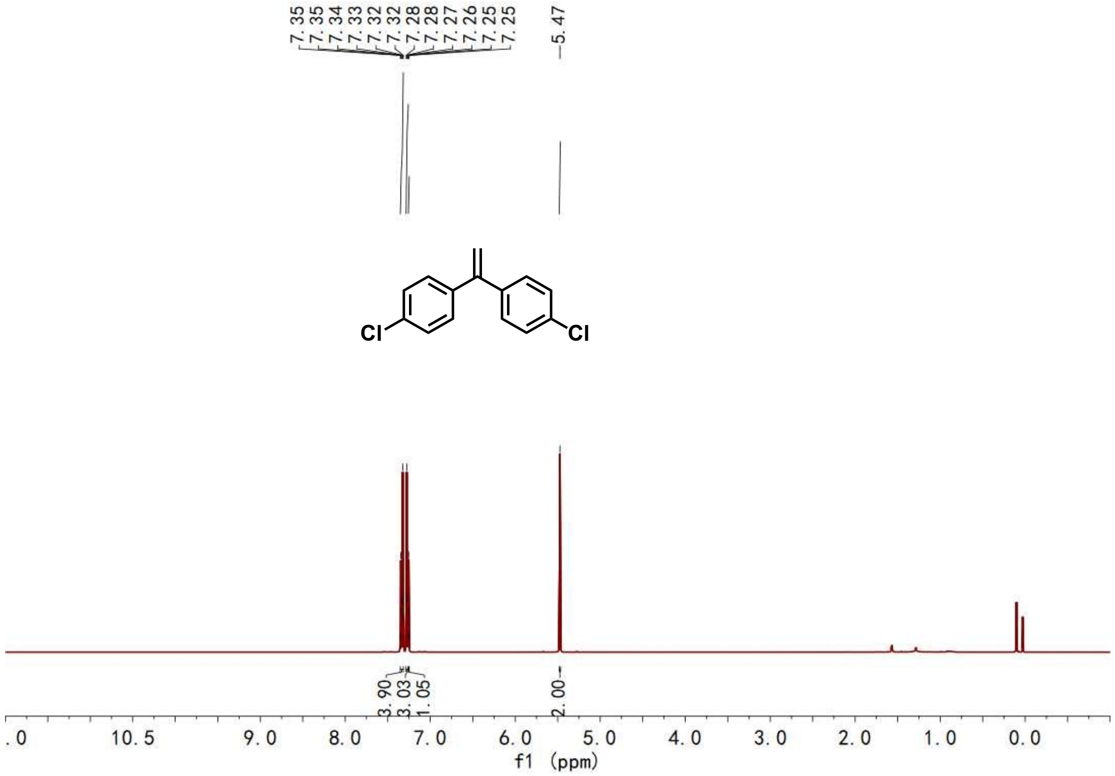
4,4'-(Ethene-1,1-diyl)bis(methoxybenzene) (S14): ^{1}H NMR (400 MHz, CDCl$_3$)



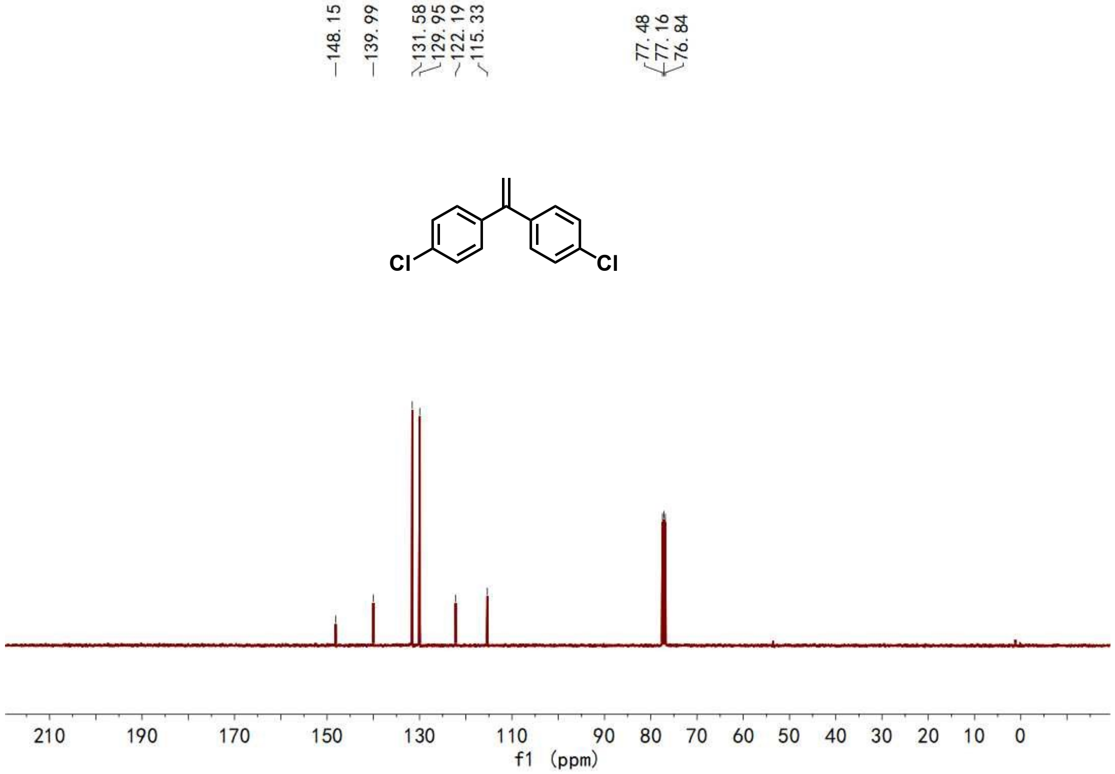
4,4'-(Ethene-1,1-diyl)bis(methoxybenzene) (S14): ^{13}C NMR (101 MHz, CDCl$_3$)



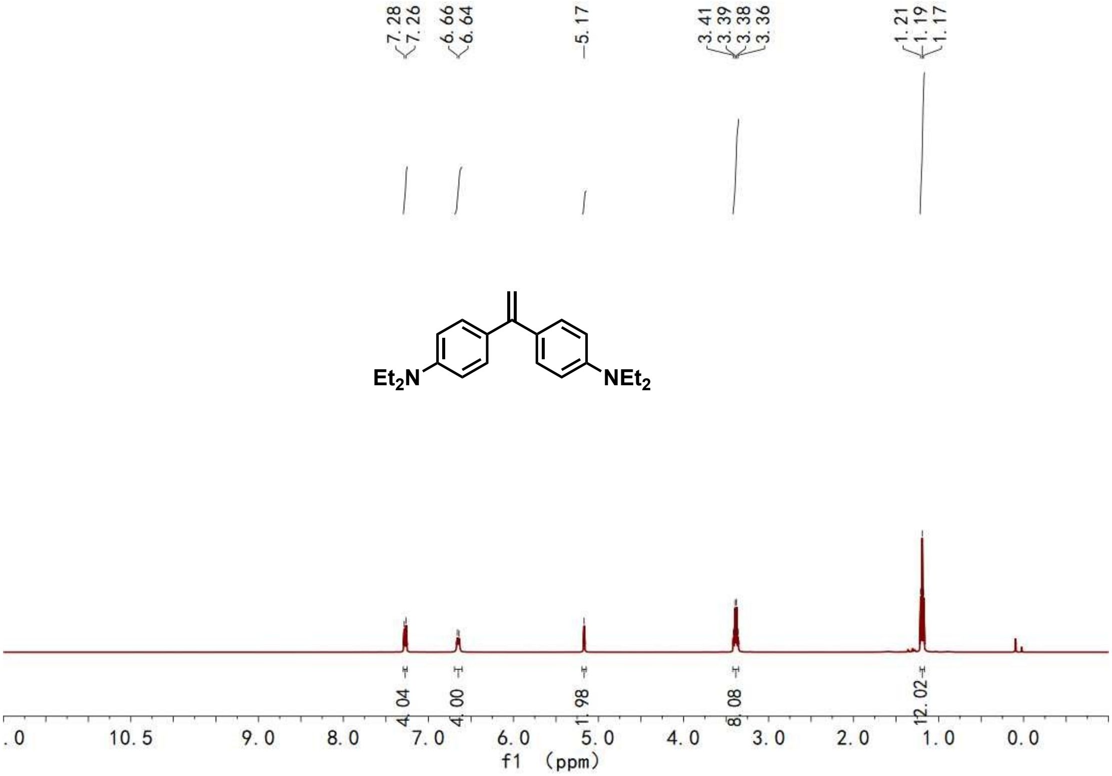
4,4'-(Ethene-1,1-diyl)bis(chlorobenzene) (S15): ^{1}H NMR (400 MHz, CDCl$_3$)



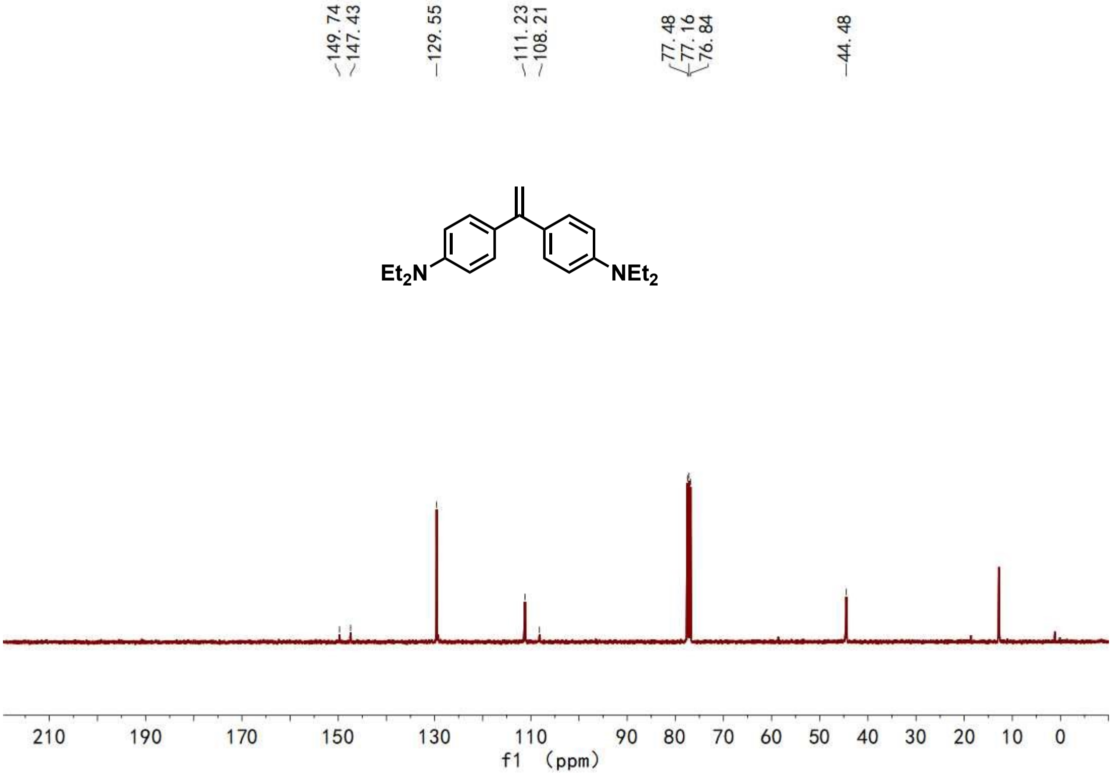
4,4'-(Ethene-1,1-diyl)bis(chlorobenzene) (S15): ^{13}C NMR (400 MHz, CDCl$_3$)



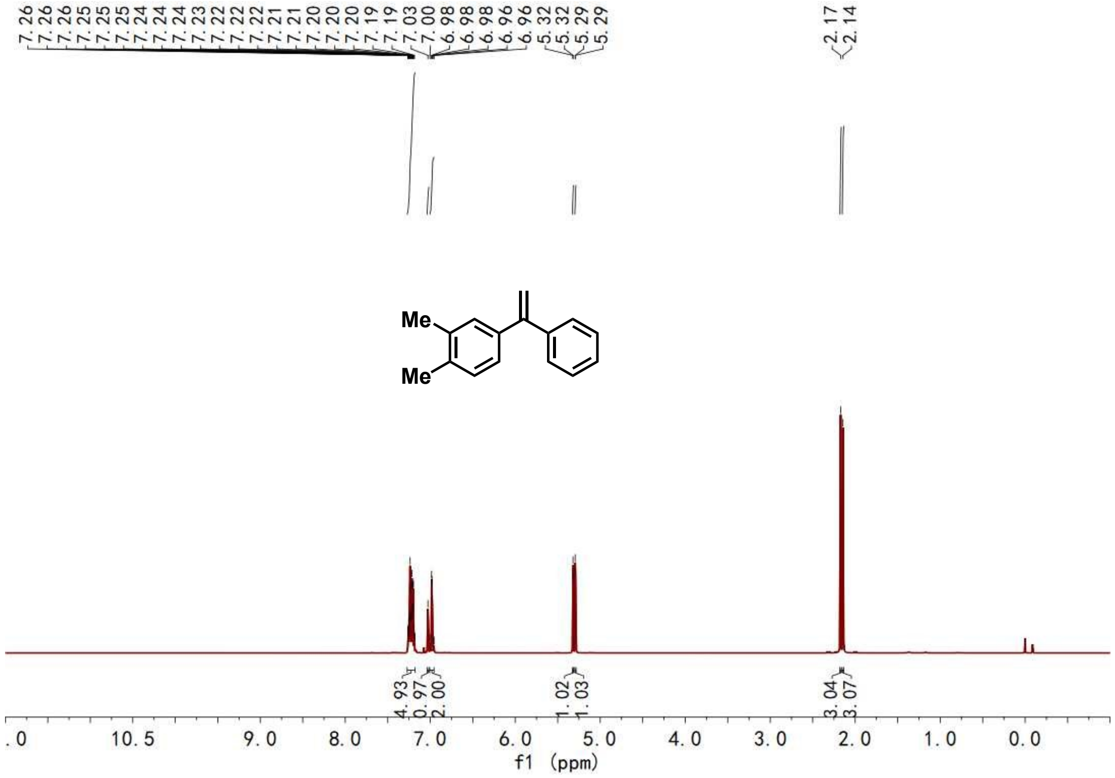
4,4'-(ethene-1,1-diyl)bis(*N,N*-diethylaniline) (S16): ^{1}H NMR (400 MHz, $CDCl_3$)



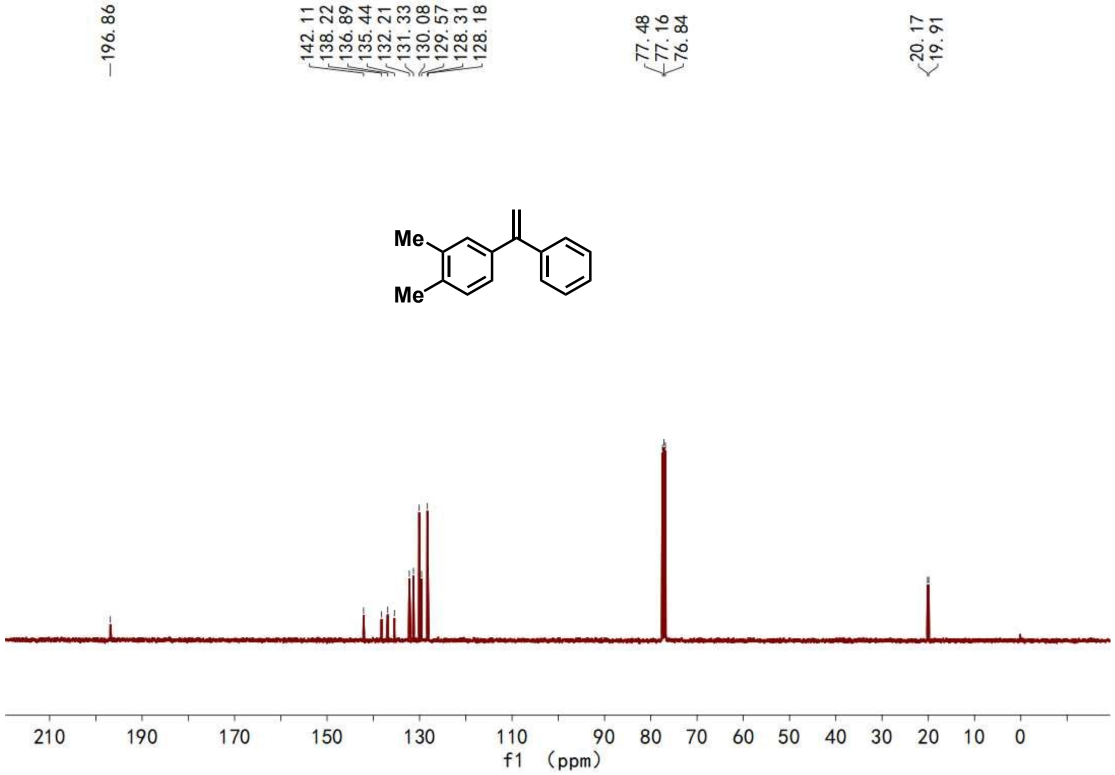
4,4'-(ethene-1,1-diyl)bis(*N,N*-diethylaniline) (S16): ^{13}C NMR (101 MHz, $CDCl_3$)



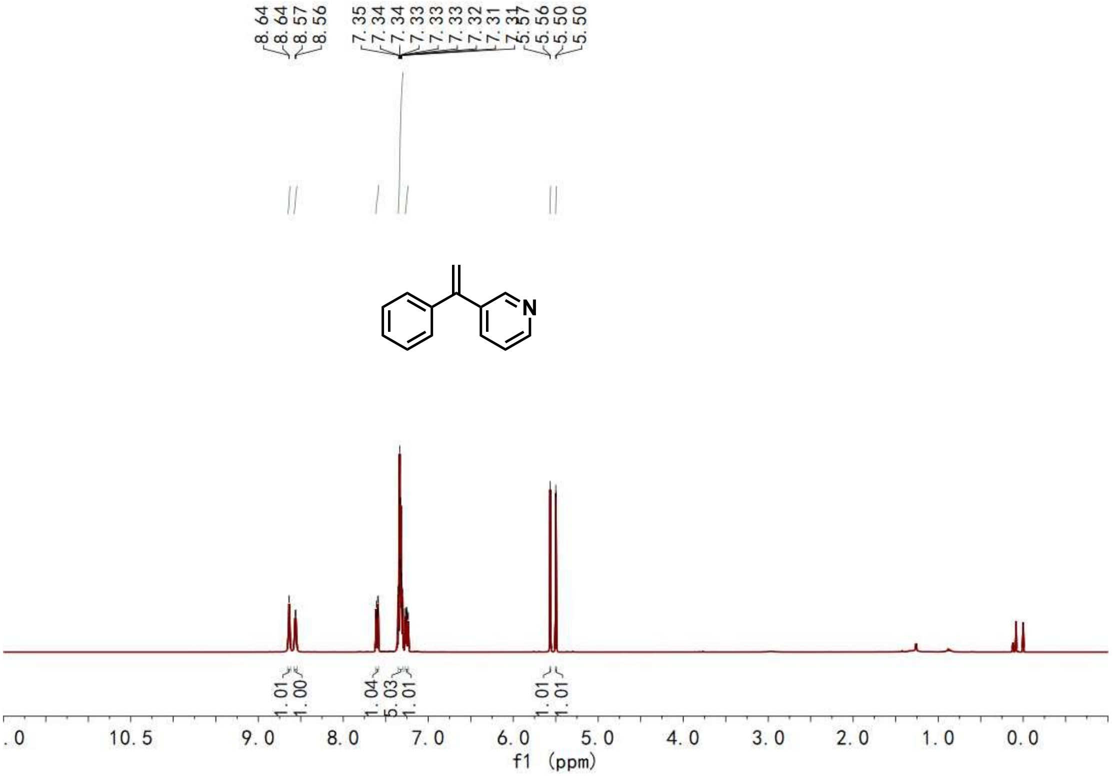
1,2-Dimethyl-4-(1-phenylvinyl)benzene (S17): ^{1}H NMR (400 MHz, CDCl$_3$)



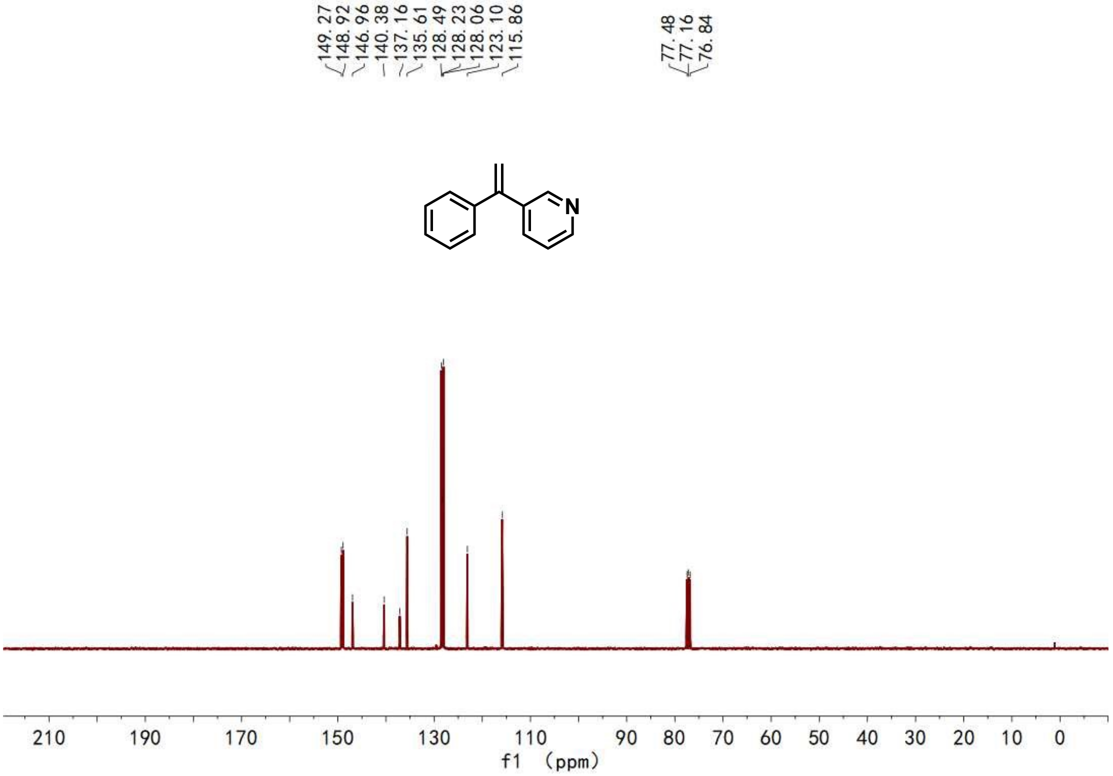
1,2-Dimethyl-4-(1-phenylvinyl)benzene (S17): ^{13}C NMR (101 MHz, CDCl$_3$)



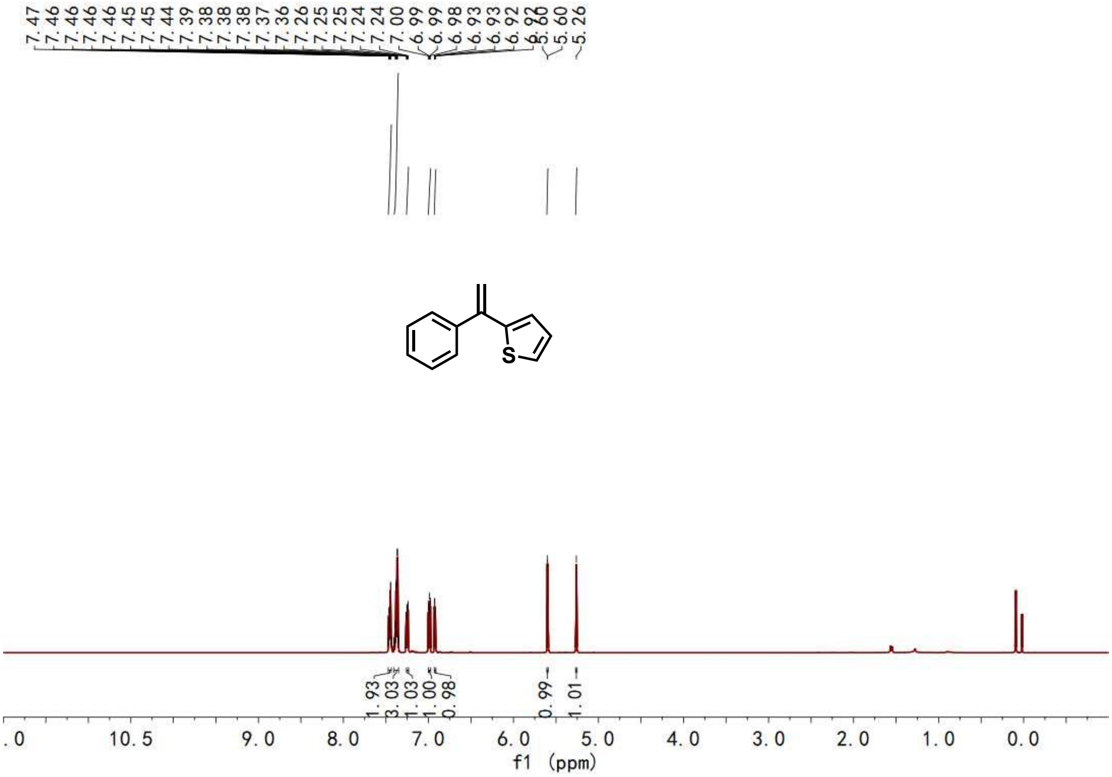
3-(1-Phenylvinyl)pyridine (S18): ^{1}H NMR (400 MHz, $CDCl_3$)



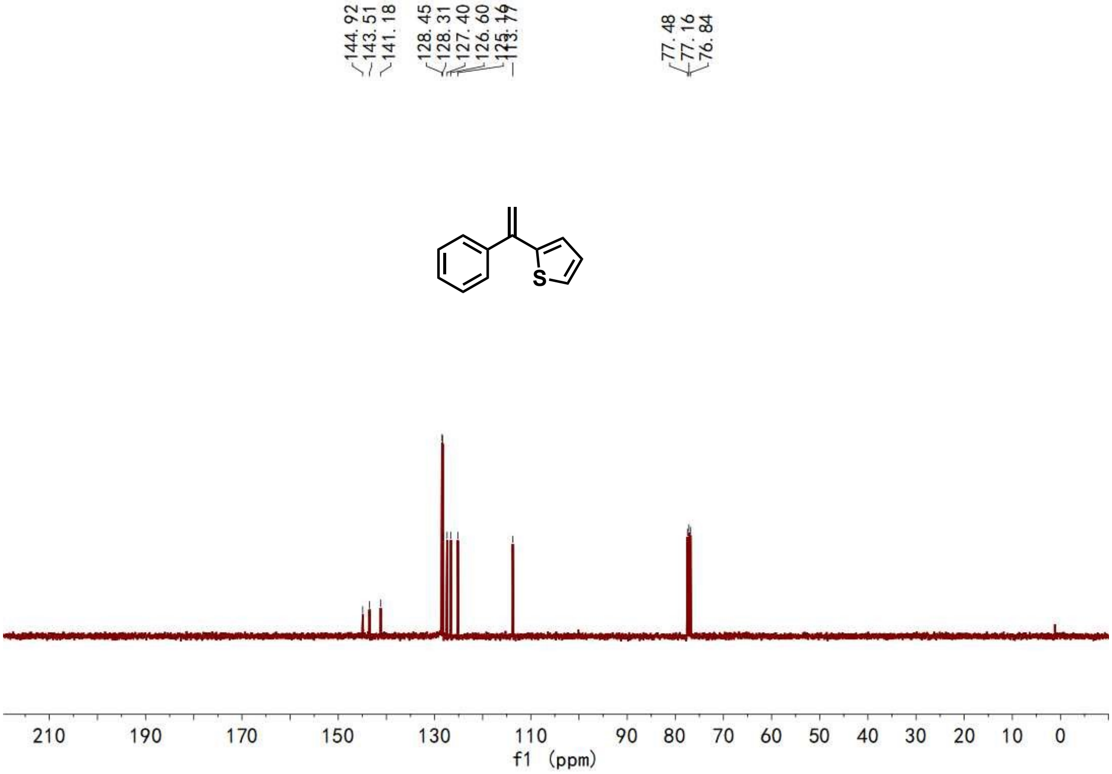
3-(1-Phenylvinyl)pyridine (S18): ^{13}C NMR (101 MHz, $CDCl_3$)



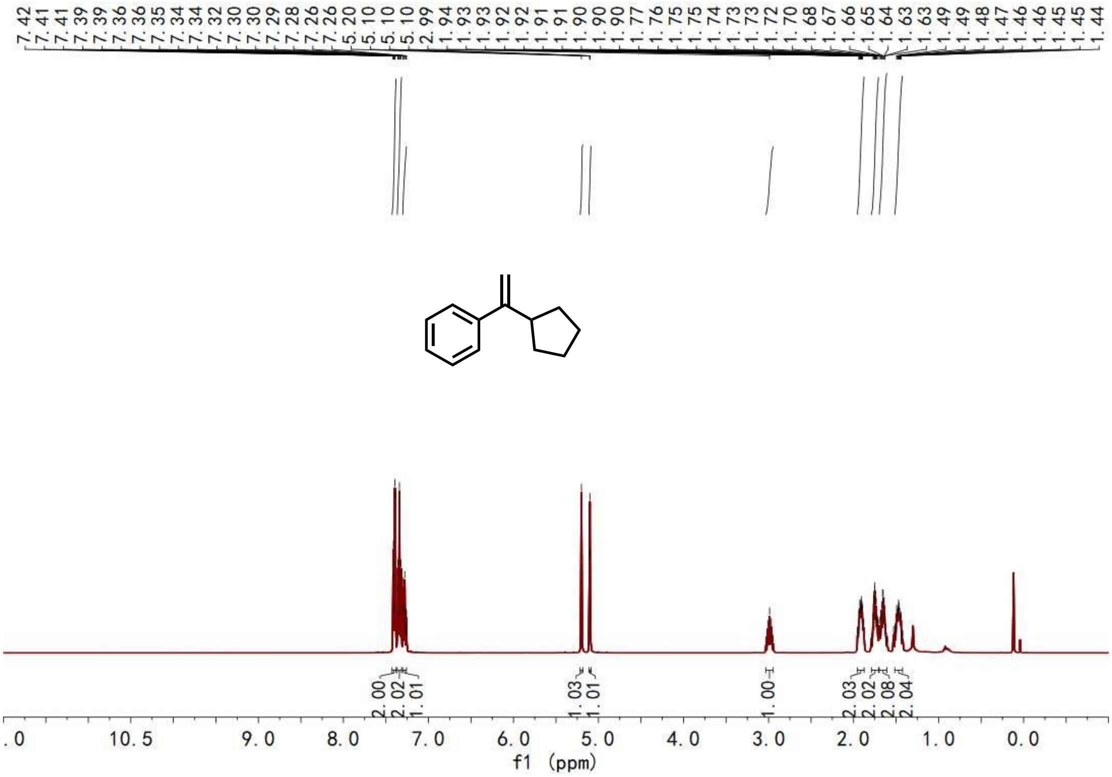
2-(1-Phenylvinyl)thiophene (S19): ^{1}H NMR (400 MHz, CDCl$_3$)



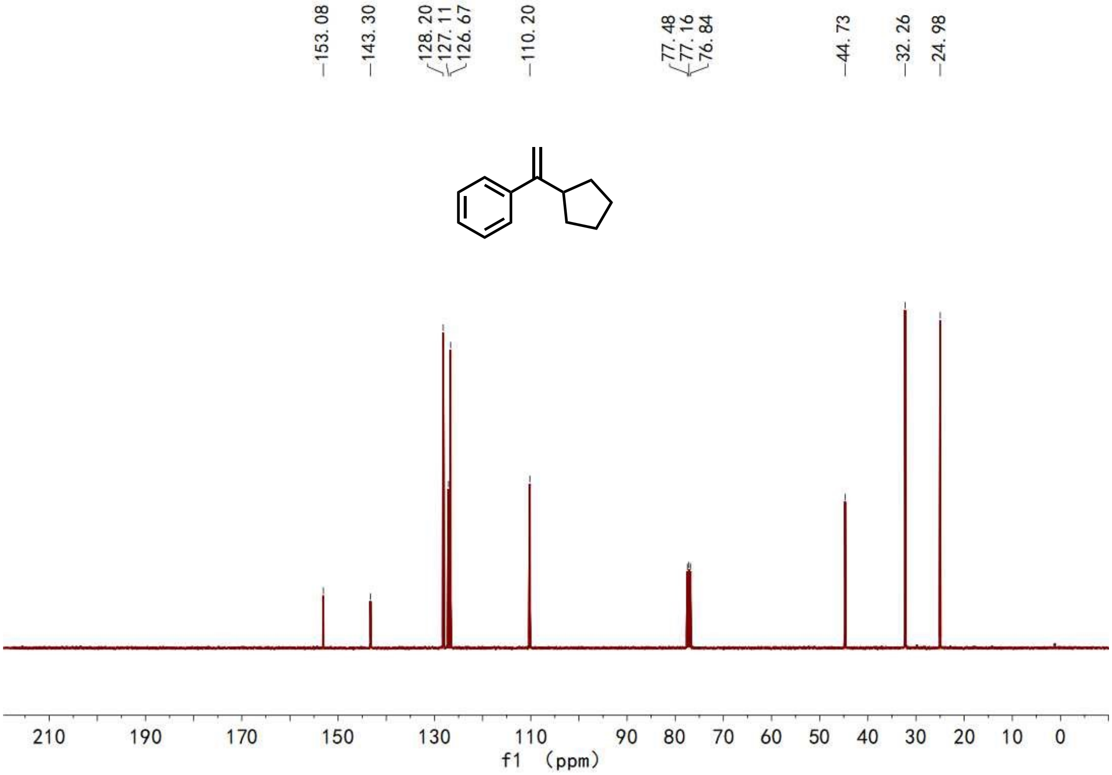
2-(1-Phenylvinyl)thiophene (S19): ^{13}C NMR (101 MHz, CDCl$_3$)



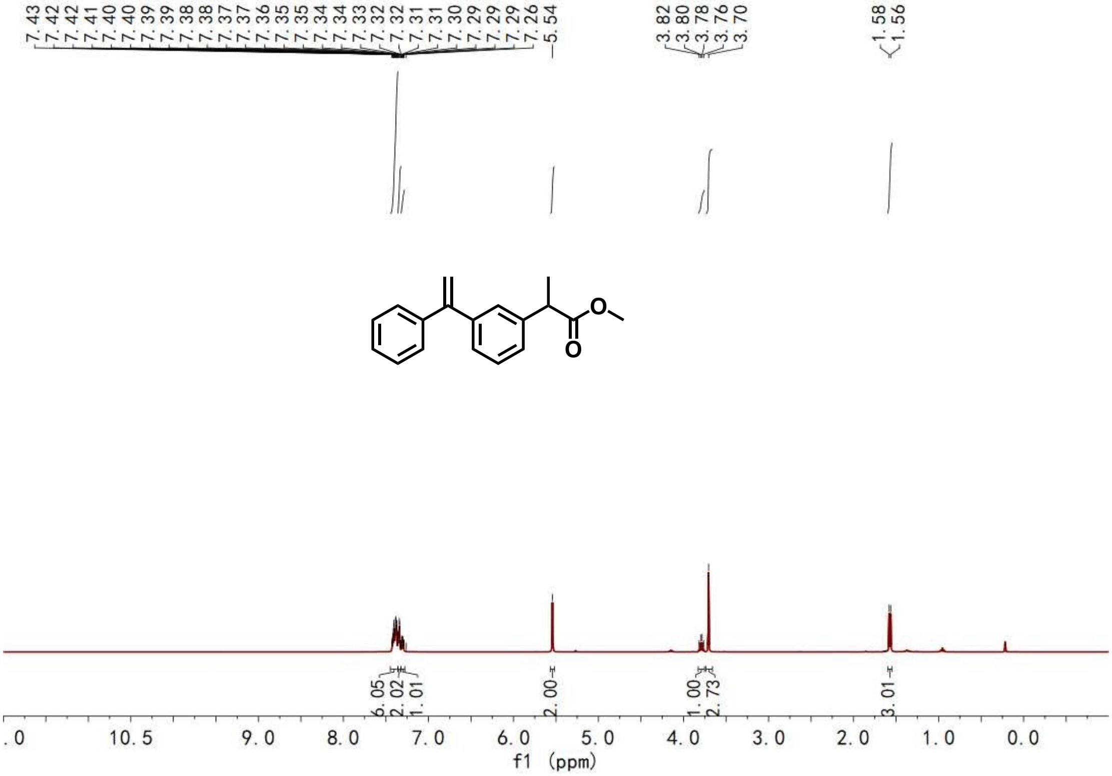
(1-Cyclopentylvinyl)benzene (S21): ^{1}H NMR (400 MHz, CDCl$_3$)



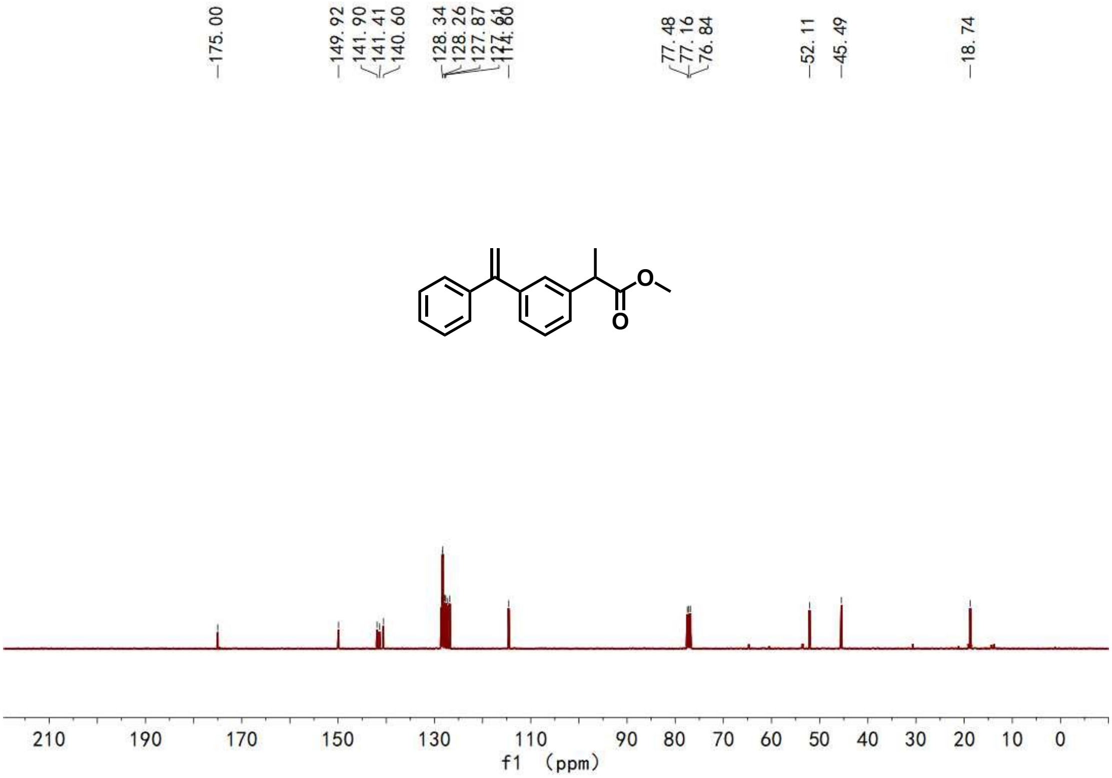
(1-Cyclopentylvinyl)benzene (S21): ^{13}C NMR (101 MHz, CDCl$_3$)



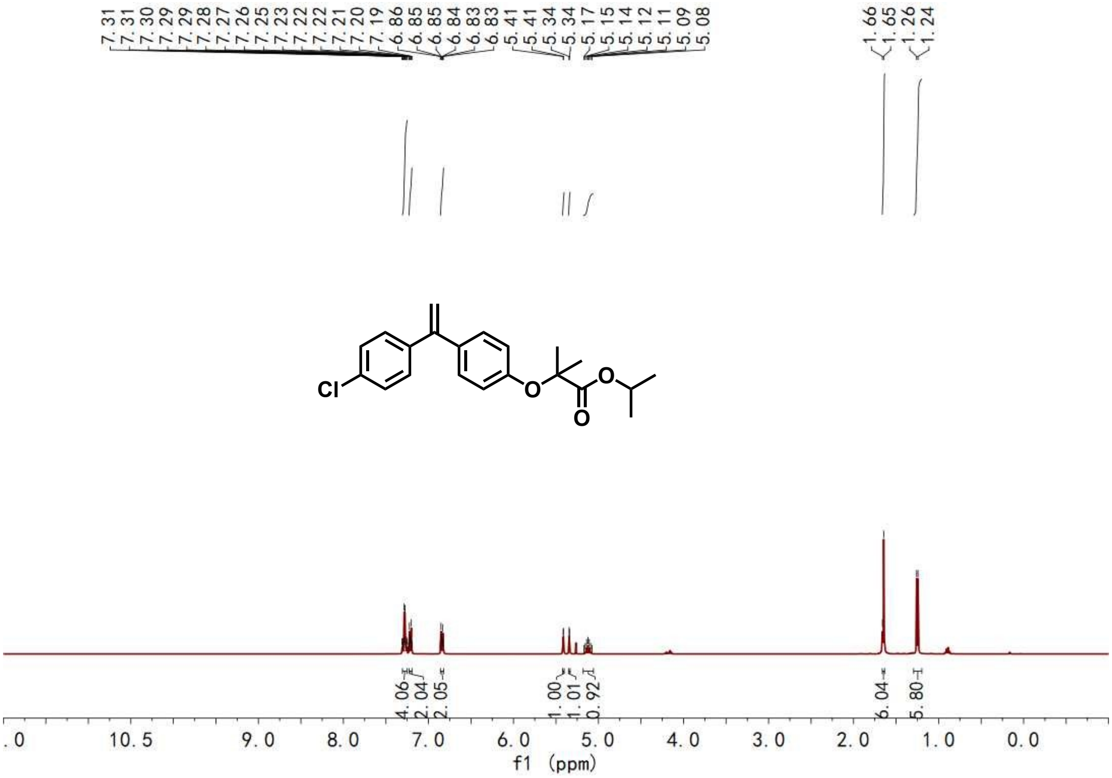
Methyl 2-(3-(1-phenylvinyl)phenyl)propanoate (S35): ^{1}H NMR (400 MHz, CDCl$_3$)



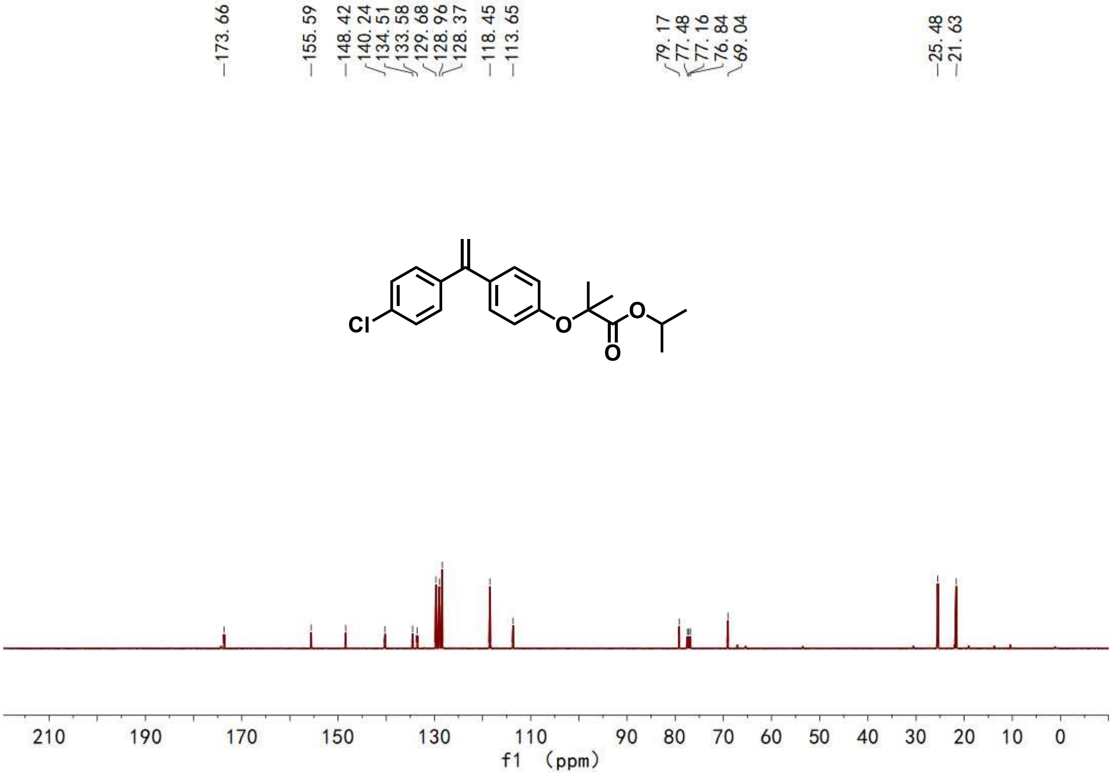
Methyl 2-(3-(1-phenylvinyl)phenyl)propanoate (S35): ^{13}C NMR (101 MHz, CDCl$_3$)



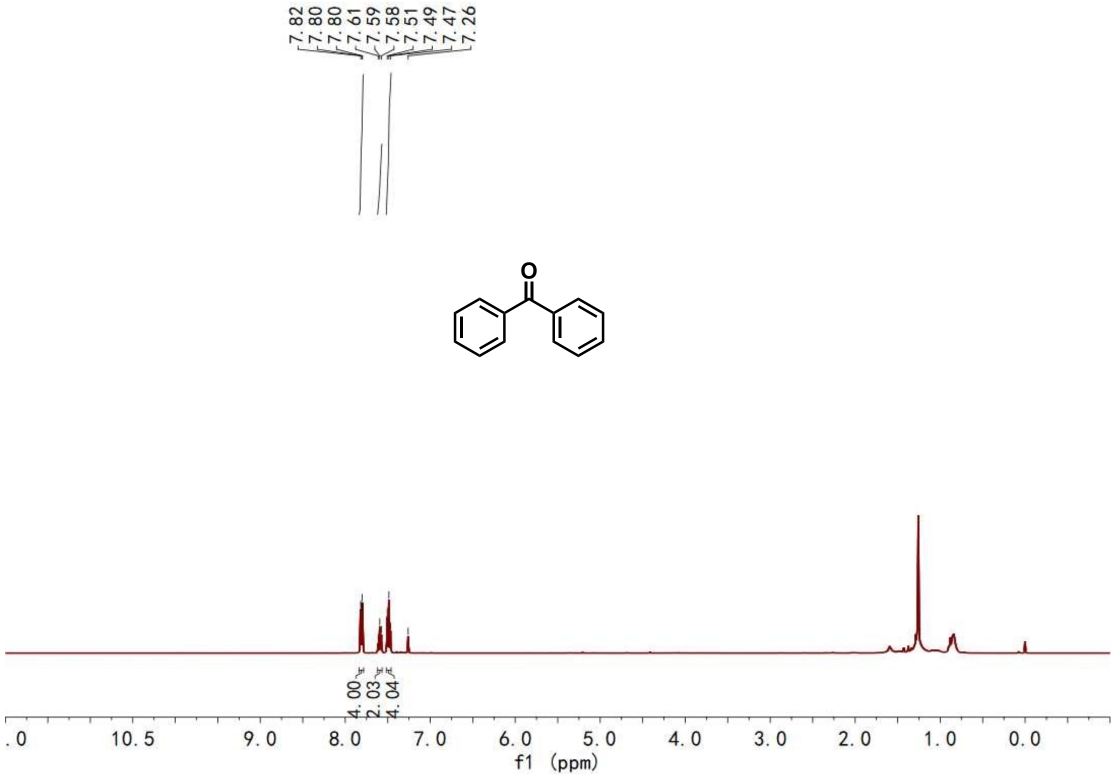
Isopropyl 2-(4-(1-(4-chlorophenyl)vinyl)phenoxy)-2-methylpropanoate (S36): ^{1}H NMR (400 MHz, CDCl$_3$)



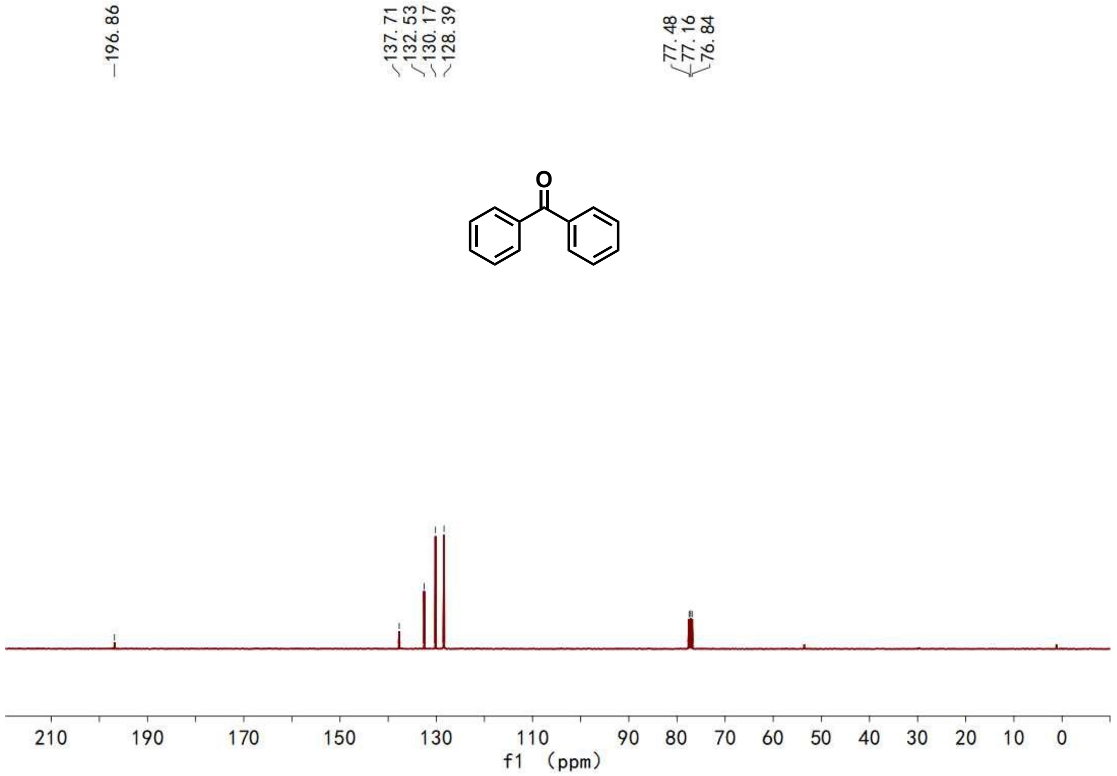
Isopropyl 2-(4-(1-(4-chlorophenyl)vinyl)phenoxy)-2-methylpropanoate (S36): ^{13}C NMR (101 MHz, CDCl$_3$)



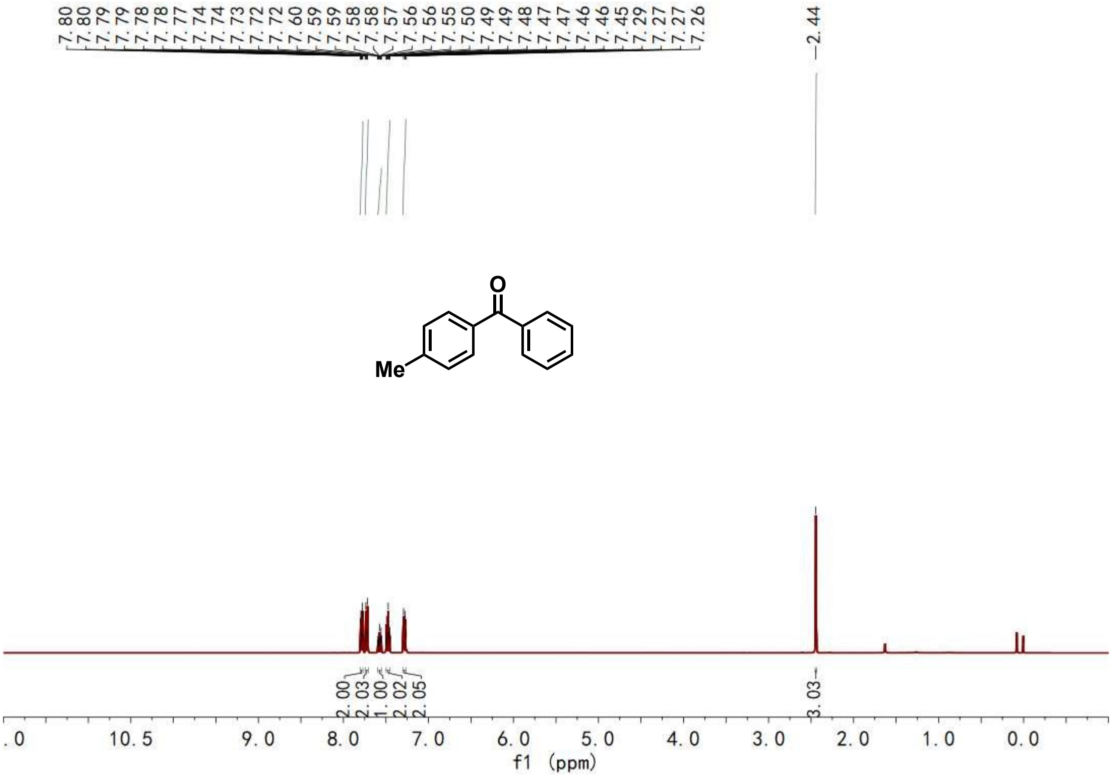
Benzophenone (1): ^{1}H NMR (400 MHz, $CDCl_3$)



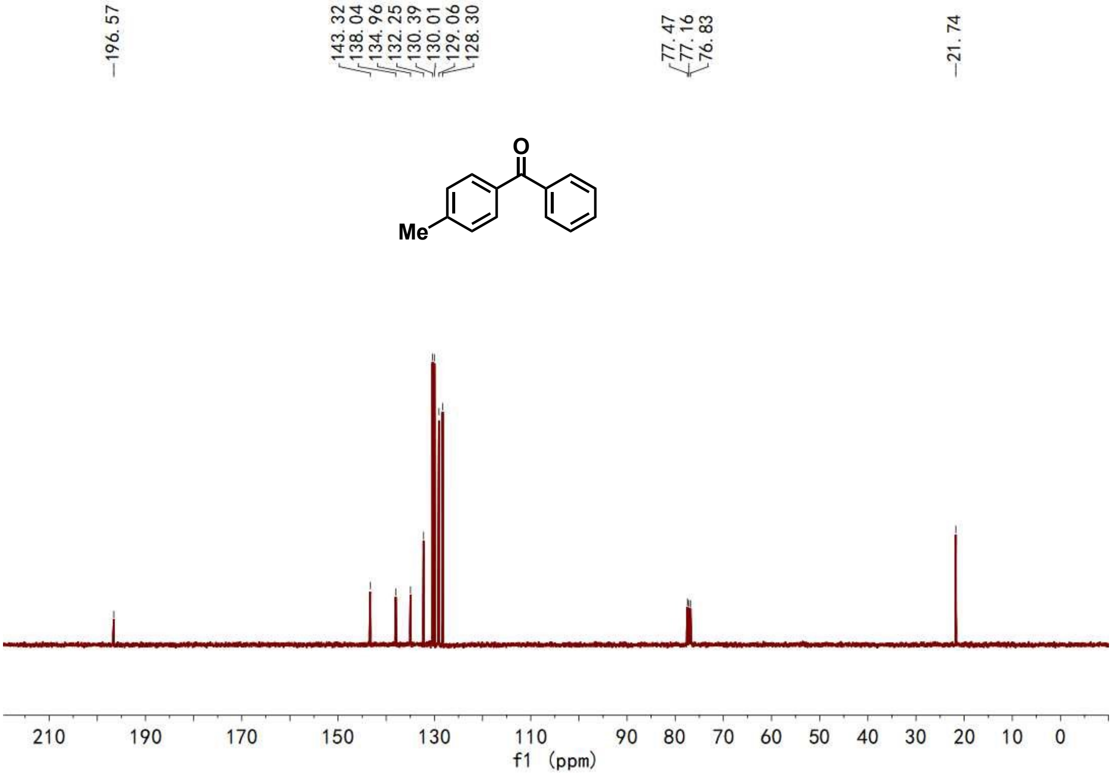
Benzophenone (1): ^{13}C NMR (101 MHz, $CDCl_3$)



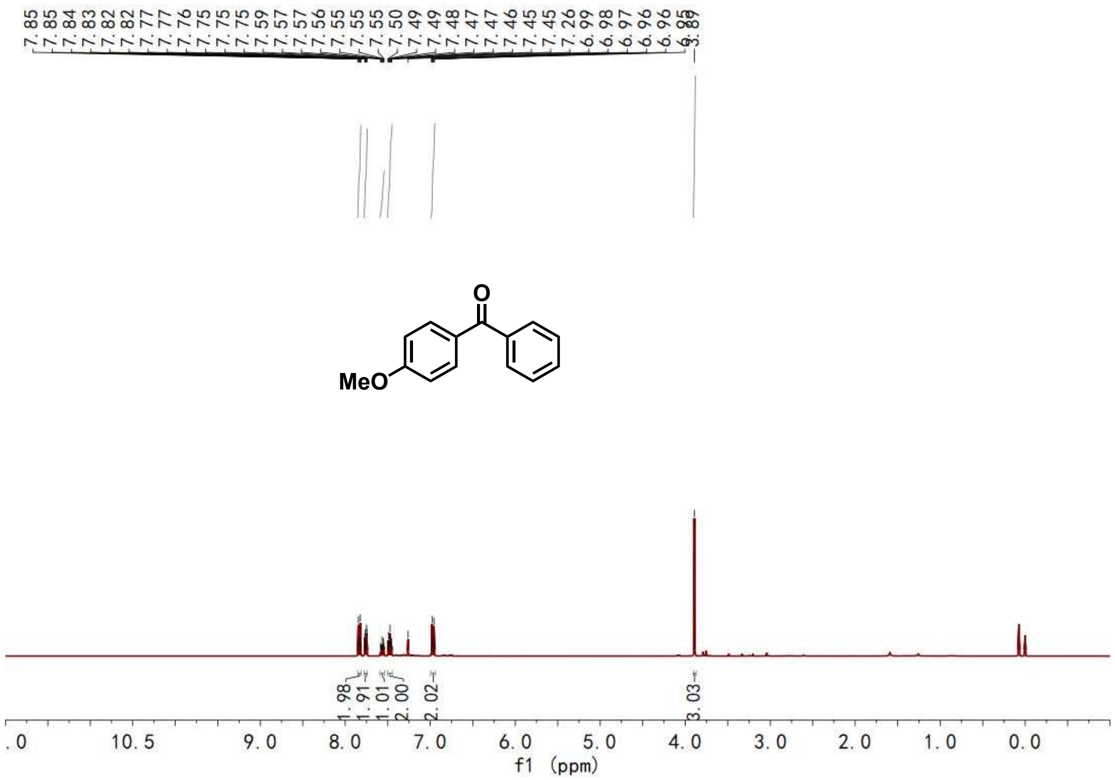
Phenyl(*p*-tolyl)methanone (2): ^{1}H NMR (400 MHz, $CDCl_3$)



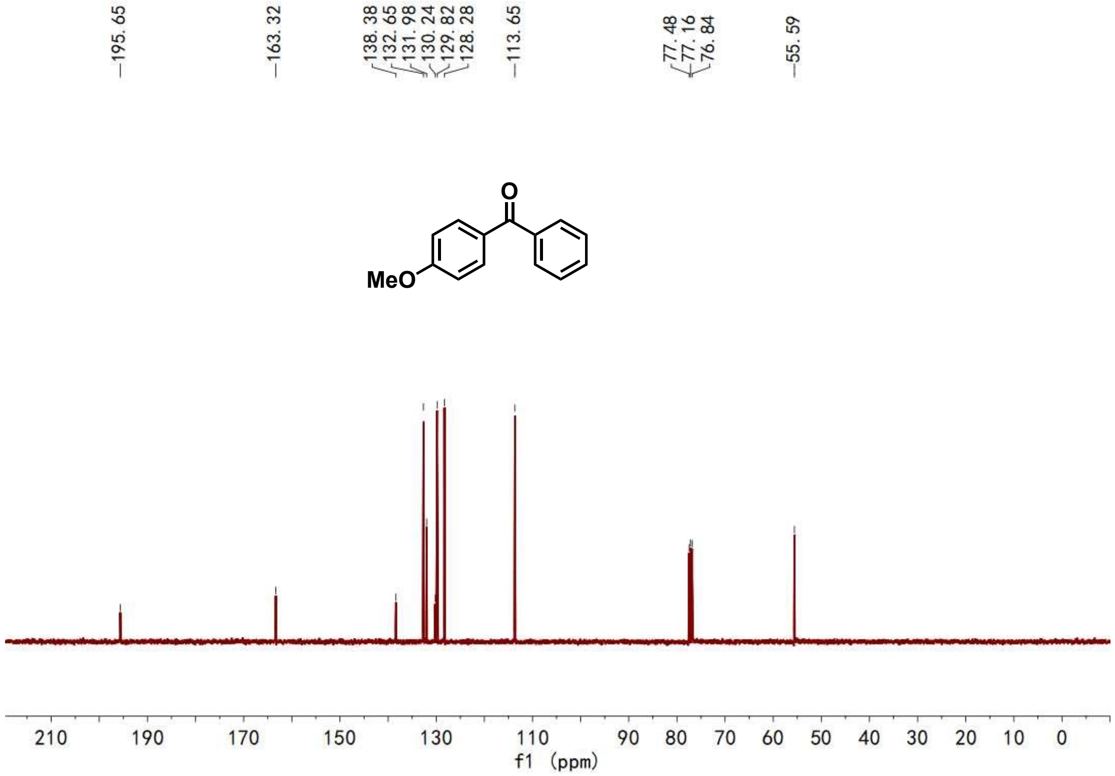
Phenyl(*p*-tolyl)methanone (2): ^{13}C NMR (101 MHz, $CDCl_3$)



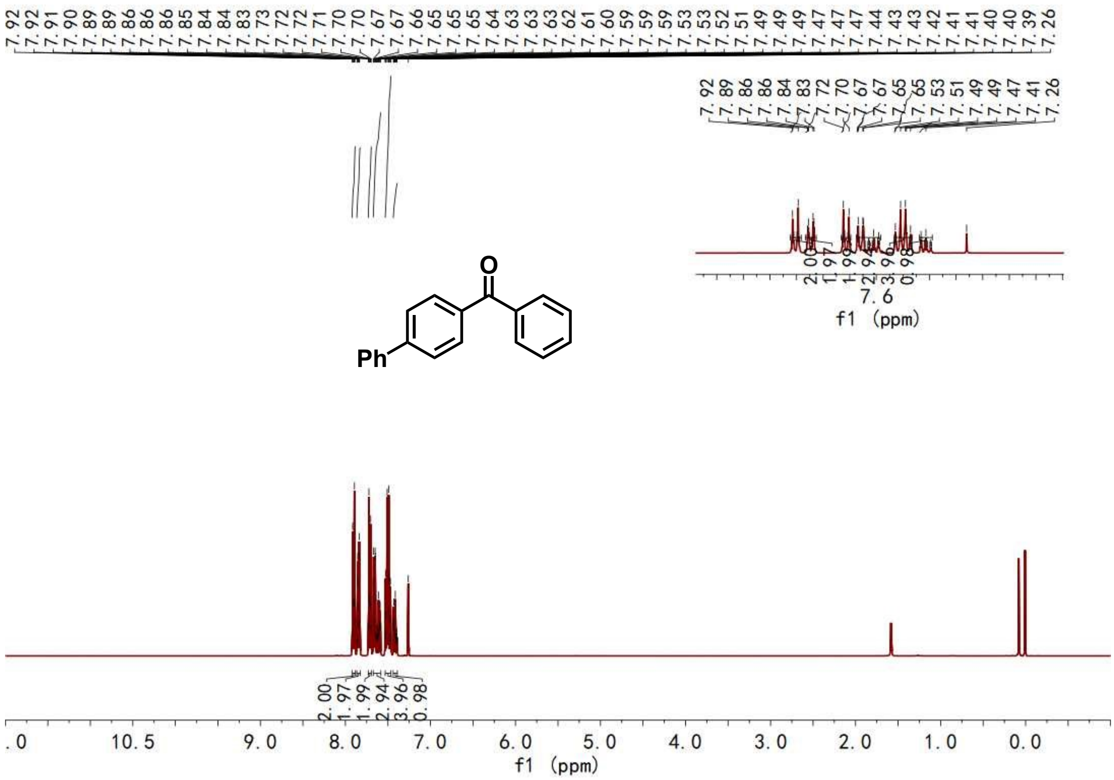
(4-Methoxyphenyl)(phenyl)methanone (3): ^{1}H NMR (400 MHz, CDCl$_3$)



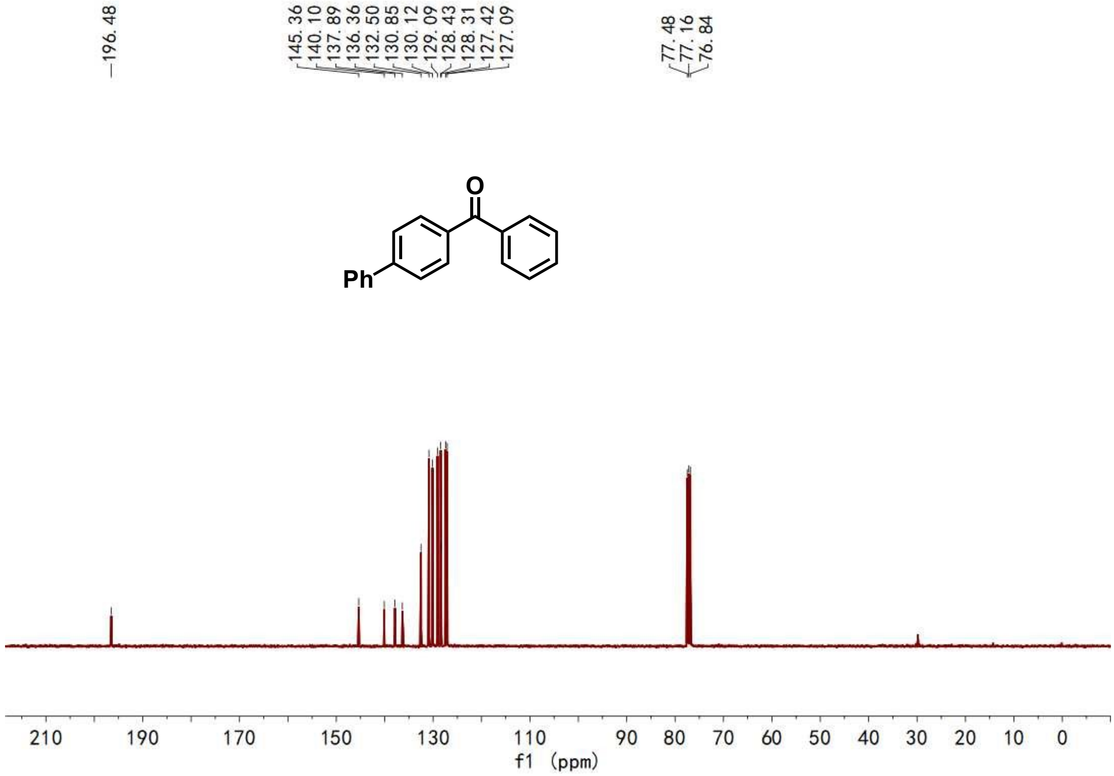
(4-Methoxyphenyl)(phenyl)methanone (3): ^{13}C NMR (101 MHz, CDCl$_3$)



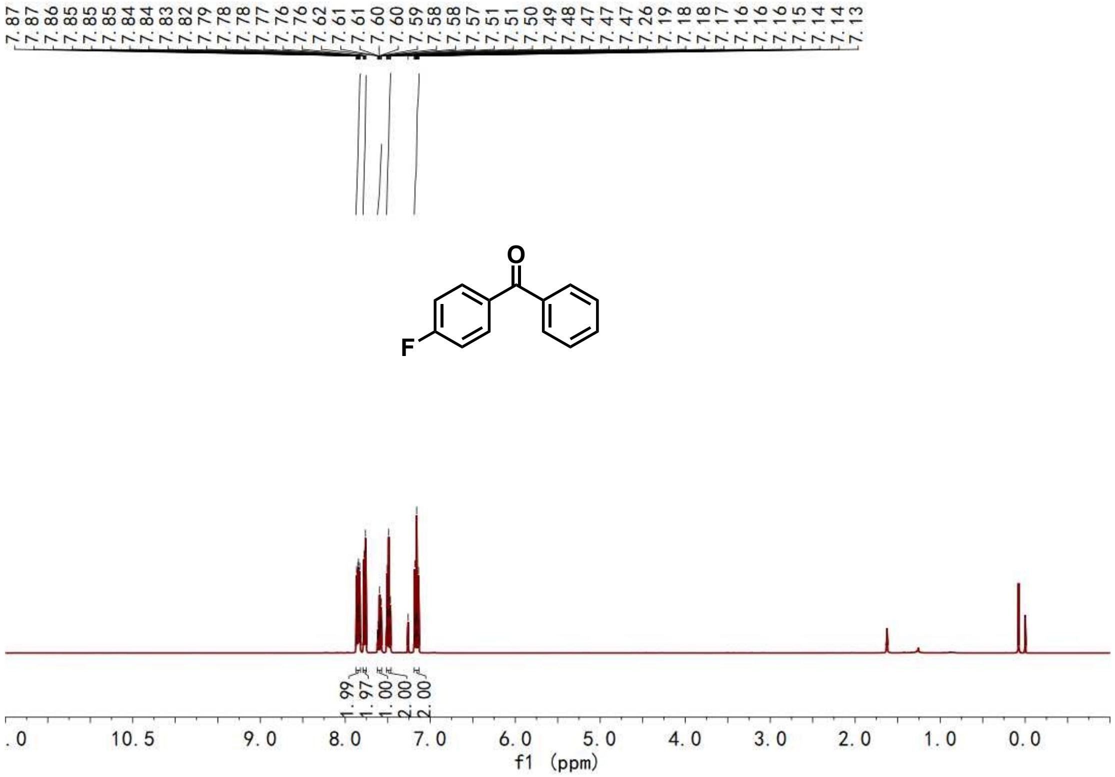
[1,1'-Biphenyl]-4-yl(phenyl)methanone (4): ^{1}H NMR (400 MHz, CDCl$_3$)



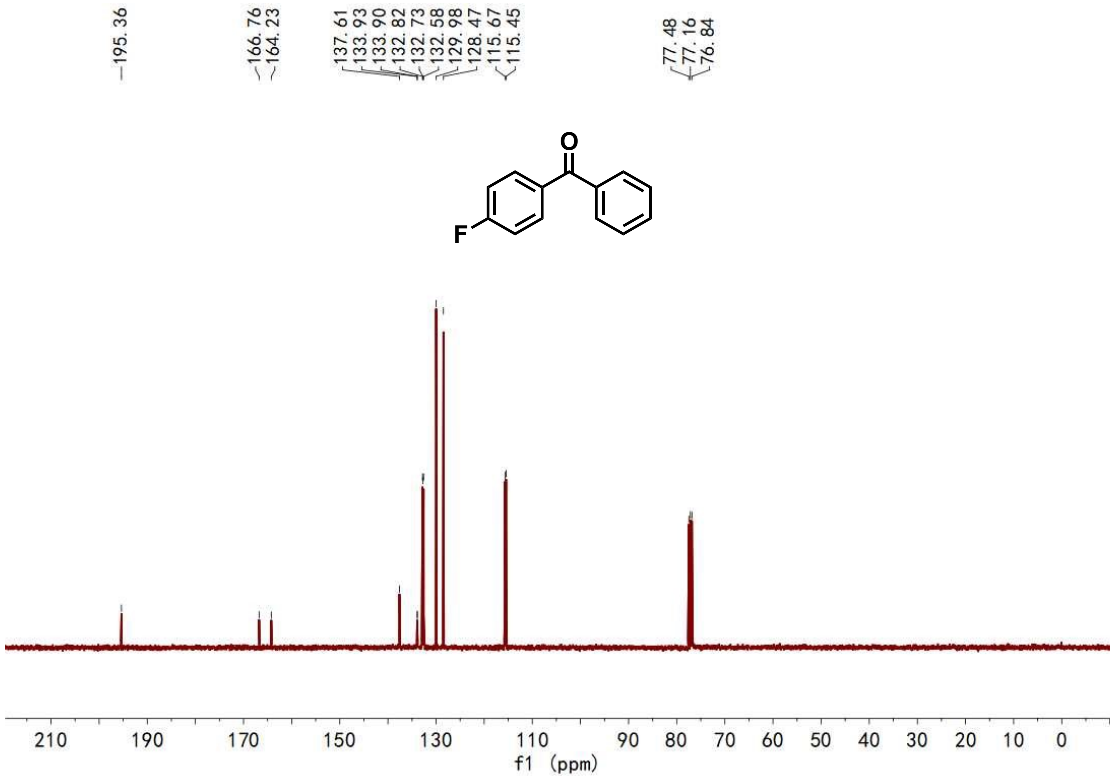
[1,1'-Biphenyl]-4-yl(phenyl)methanone (4): ^{13}C NMR (101 MHz, CDCl$_3$)



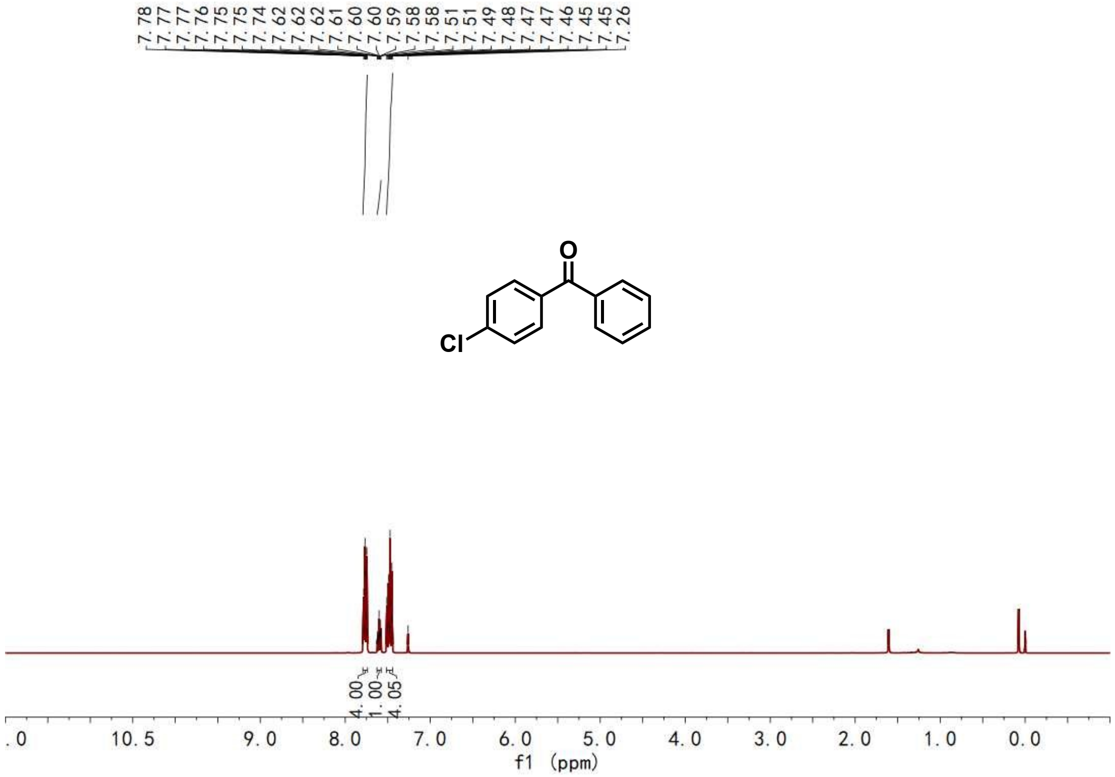
(4-Fluorophenyl)(phenyl)methanone (5): ^{1}H NMR (400 MHz, CDCl$_3$)



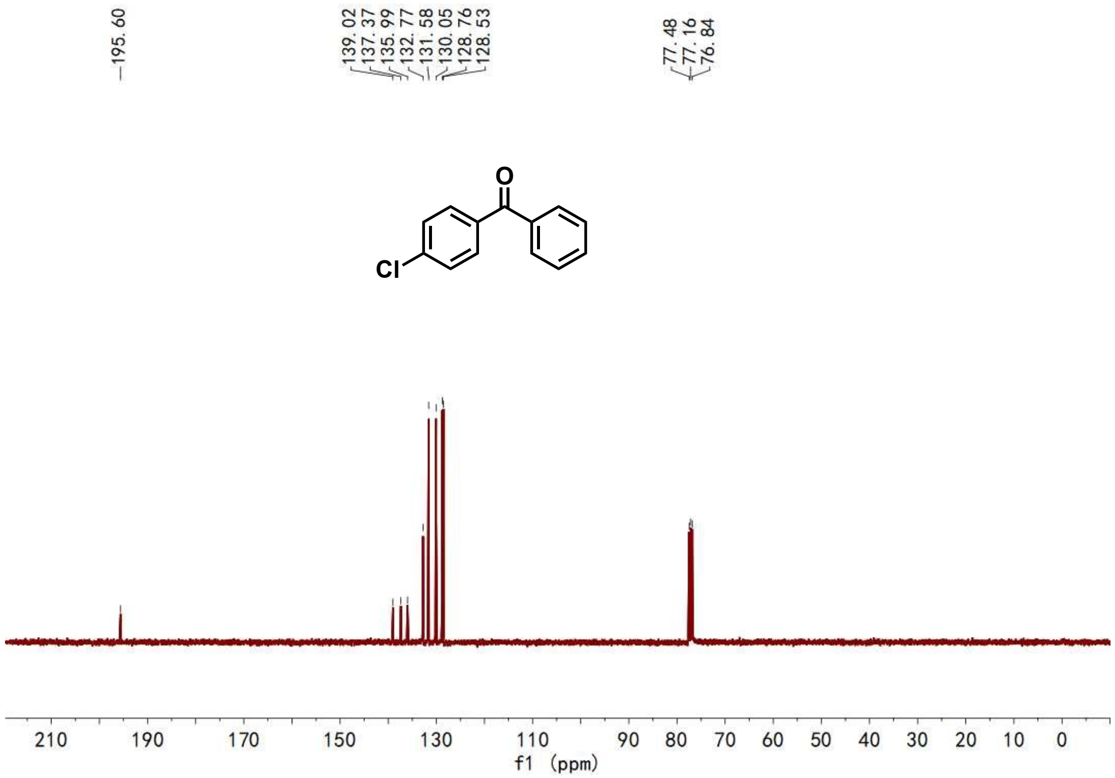
(4-Fluorophenyl)(phenyl)methanone (5): ^{13}C NMR (101 MHz, CDCl$_3$)



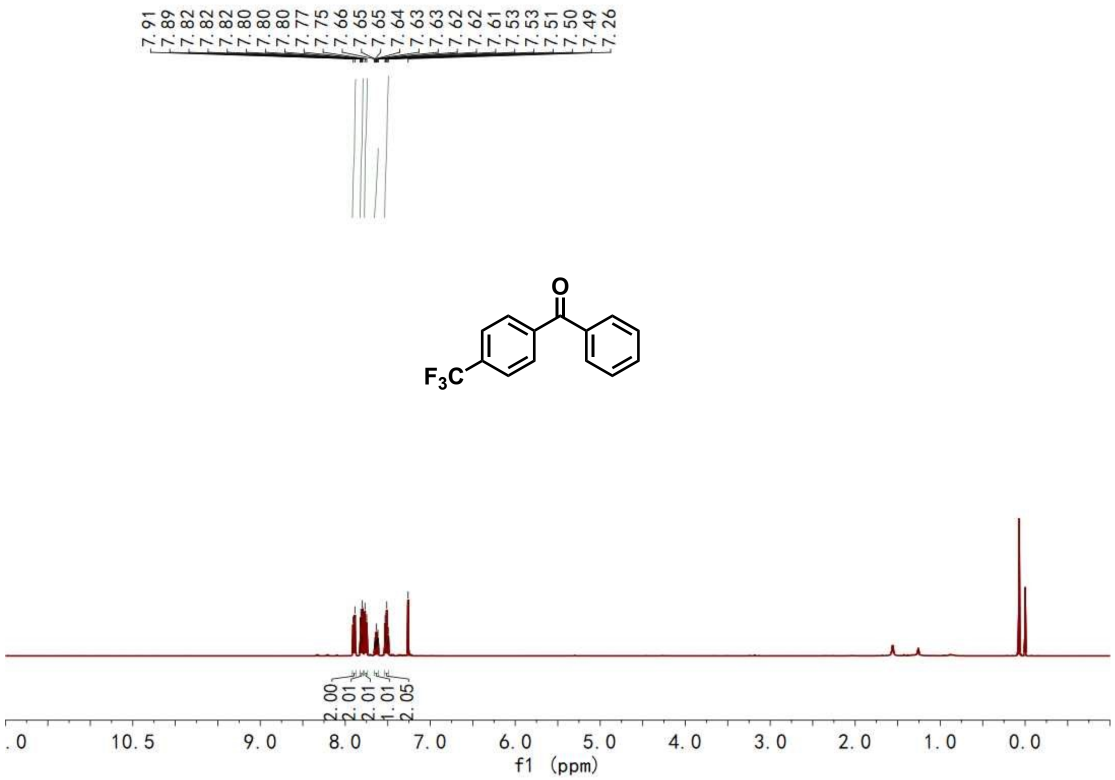
(4-Chlorophenyl)(phenyl)methanone (6): ^{1}H NMR (400 MHz, $CDCl_3$)



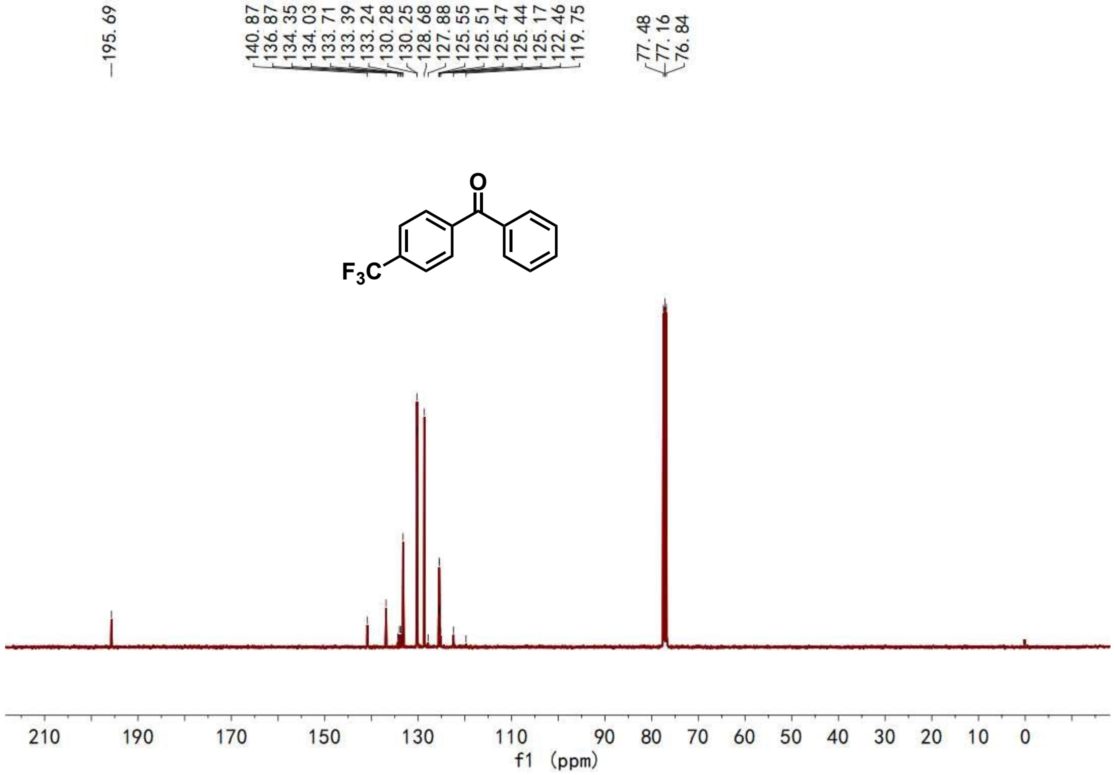
(4-Chlorophenyl)(phenyl)methanone (6): ^{13}C NMR (101 MHz, $CDCl_3$)



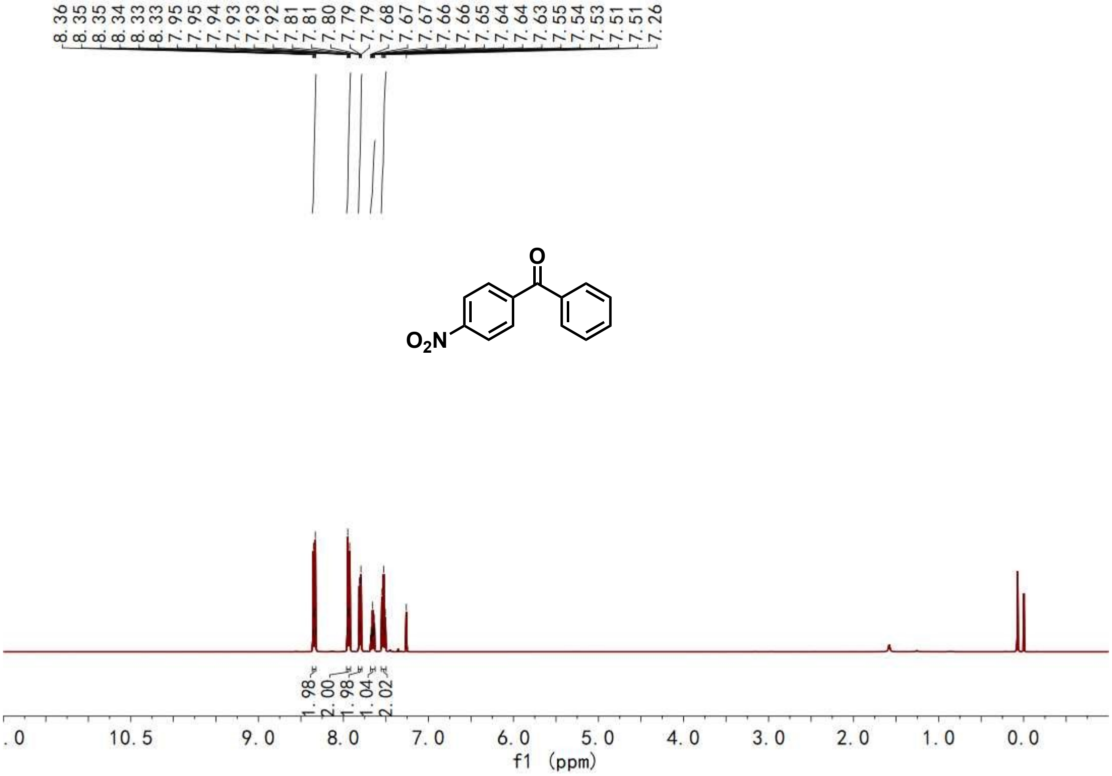
Phenyl(4-(trifluoromethyl)phenyl)methanone (7): ^{1}H NMR (400 MHz, CDCl$_3$)



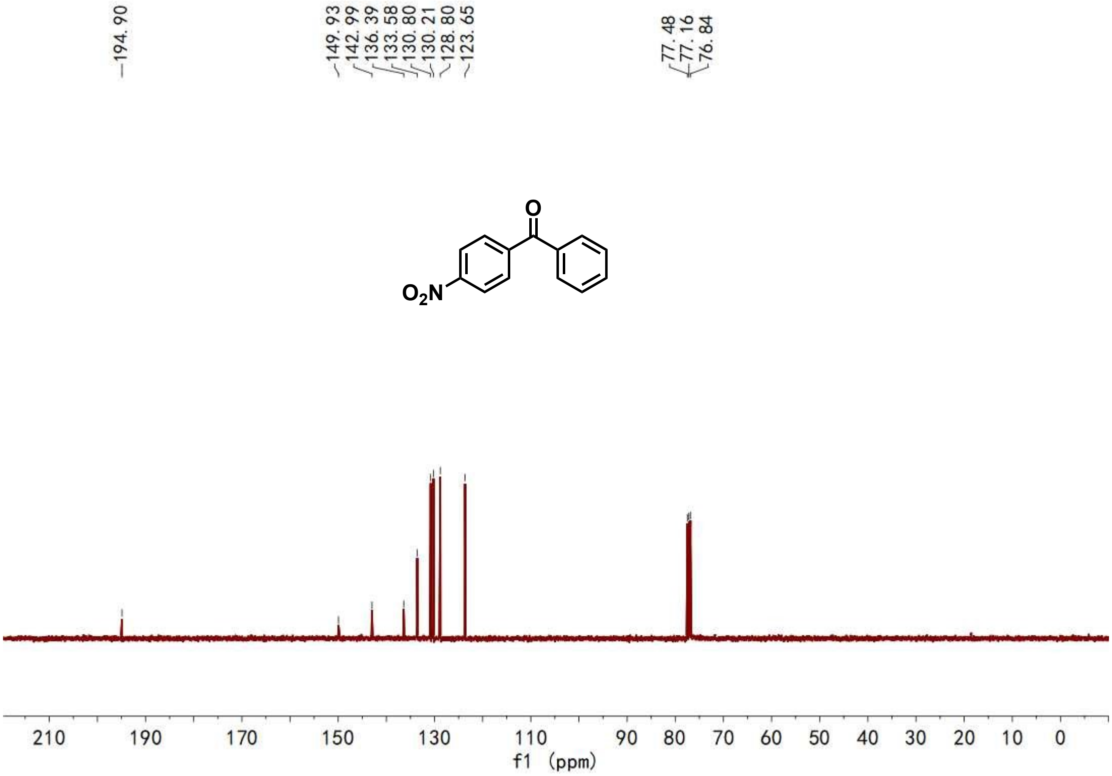
Phenyl(4-(trifluoromethyl)phenyl)methanone (7): ^{13}C NMR (101 MHz, CDCl$_3$)



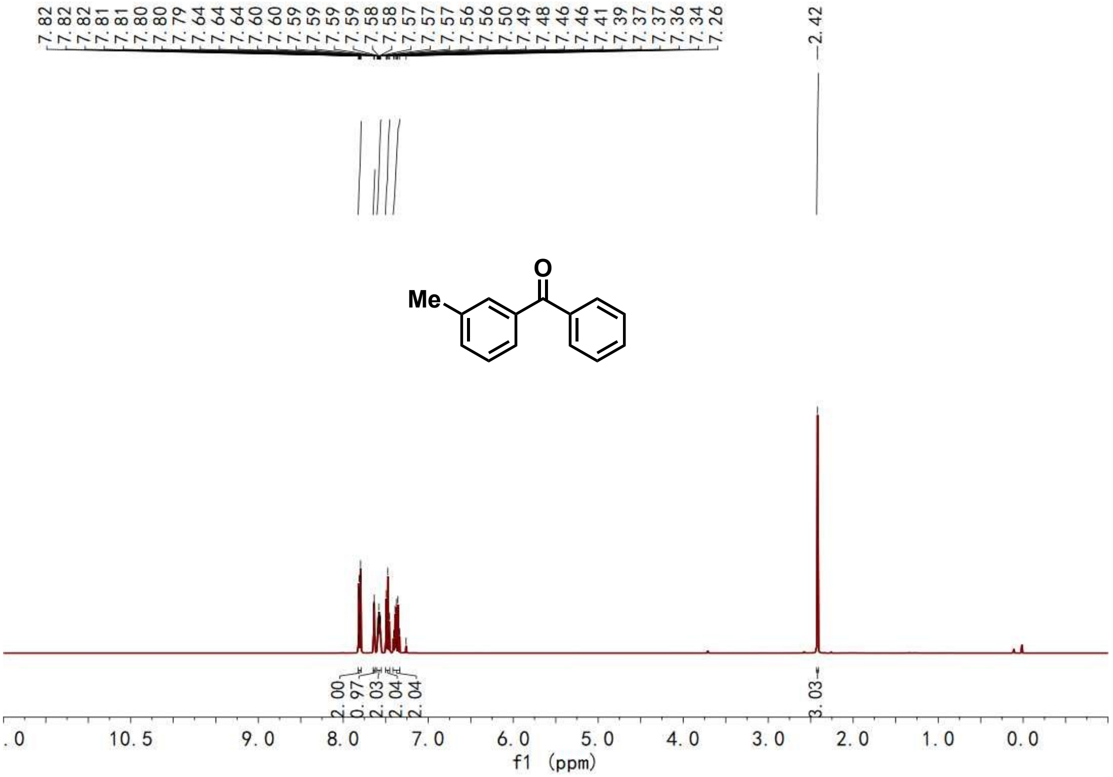
(4-Nitrophenyl)(phenyl)methanone (8): ^{1}H NMR (400 MHz, CDCl$_3$)



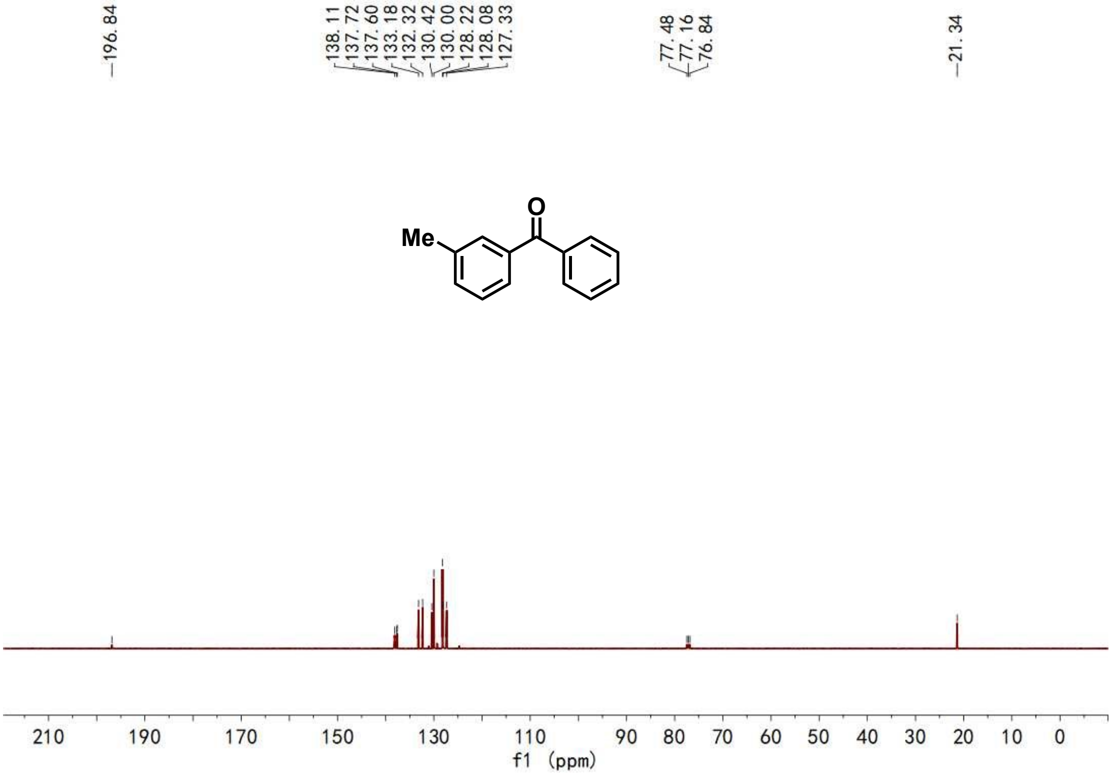
(4-Nitrophenyl)(phenyl)methanone (8): ^{13}C NMR (101 MHz, CDCl$_3$)



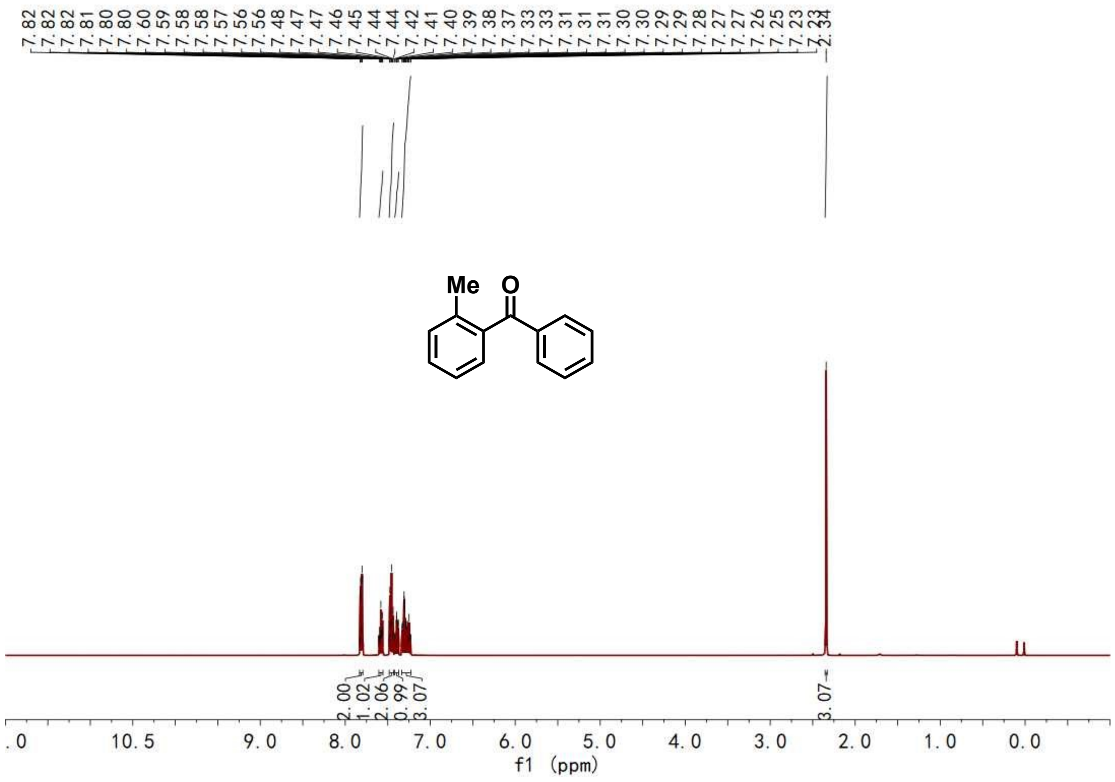
Phenyl(*m*-tolyl)methanone (9): ^{1}H NMR (400 MHz, CDCl$_3$)



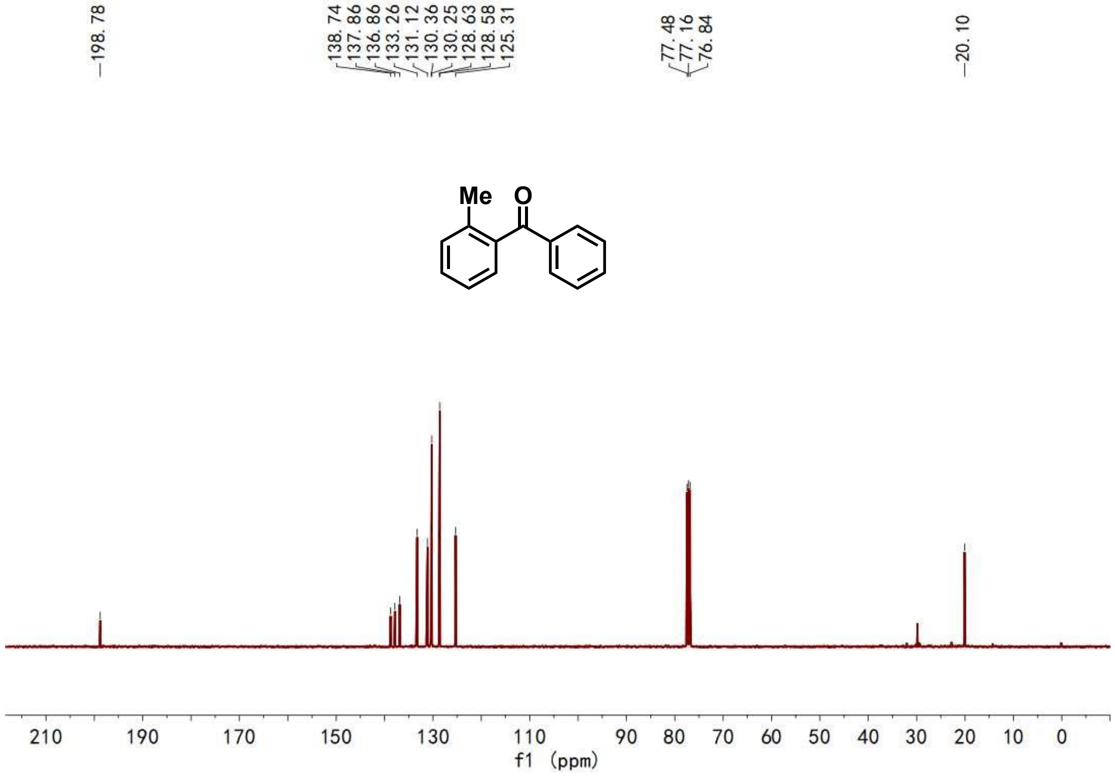
Phenyl(*m*-tolyl)methanone (9): ^{13}C NMR (101 MHz, CDCl$_3$)



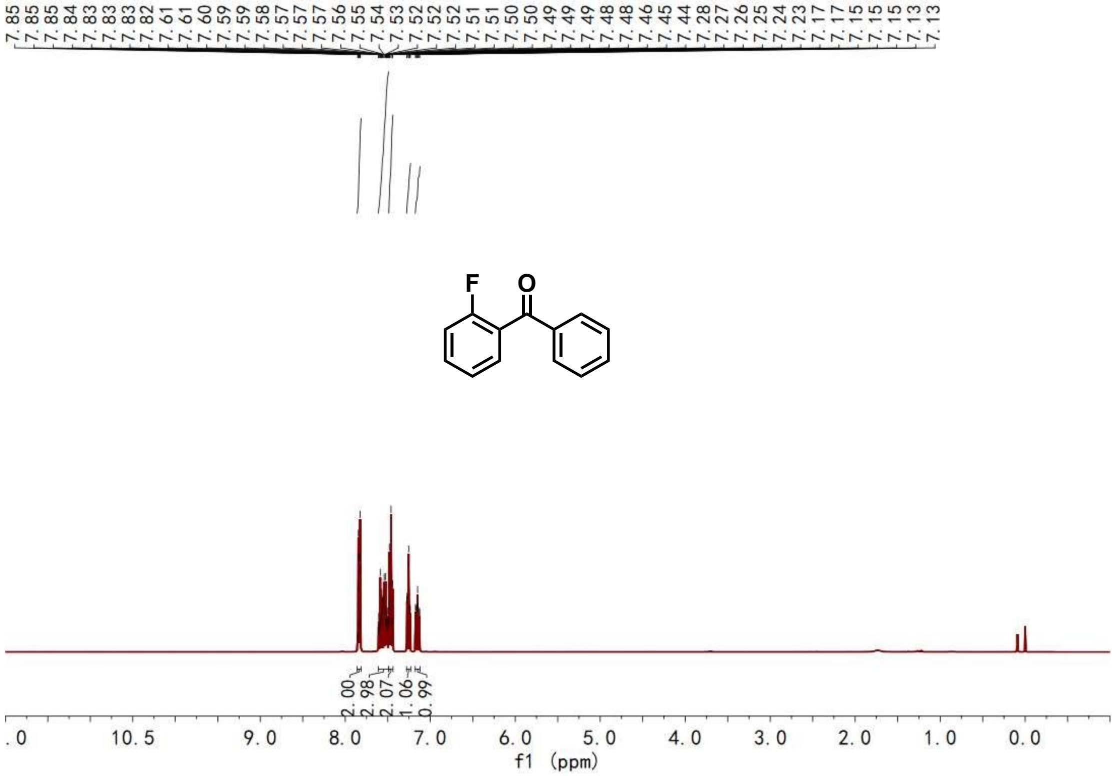
Phenyl(*o*-tolyl)methanone (10): ^{1}H NMR (400 MHz, CDCl$_3$)



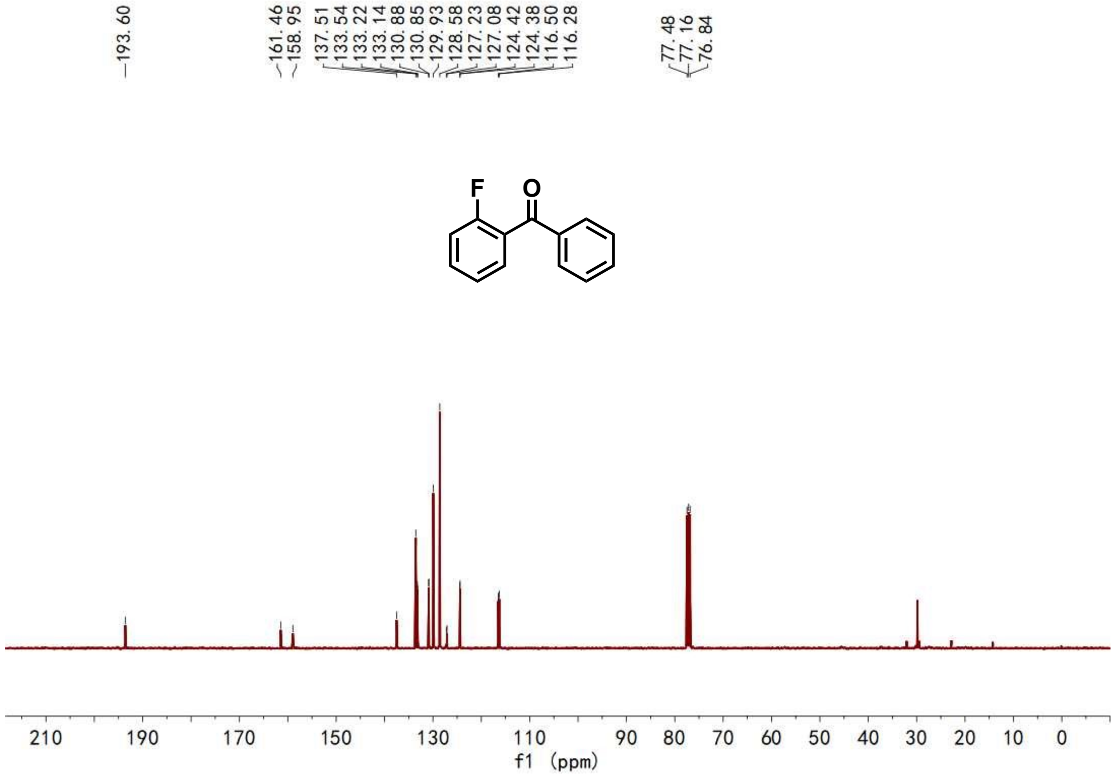
Phenyl(*o*-tolyl)methanone (10): ^{13}C NMR (400 MHz, CDCl$_3$)



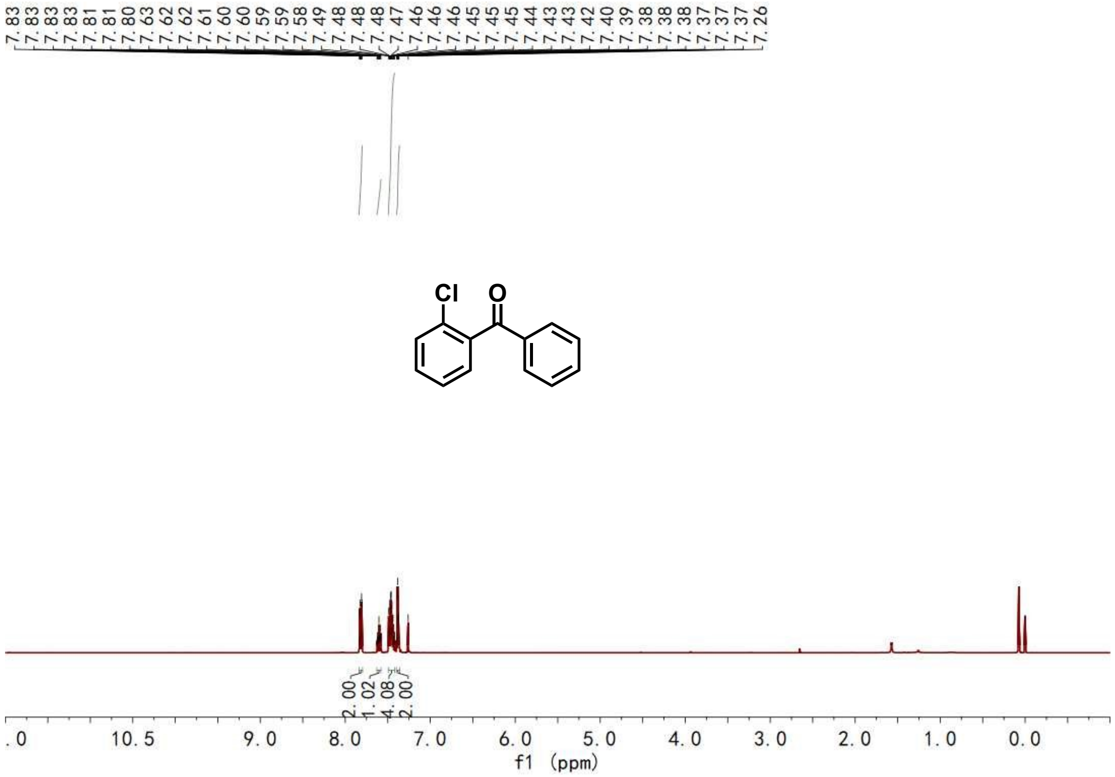
(2-Fluorophenyl)(phenyl)methanone (11): ^{1}H NMR (400 MHz, CDCl$_3$)



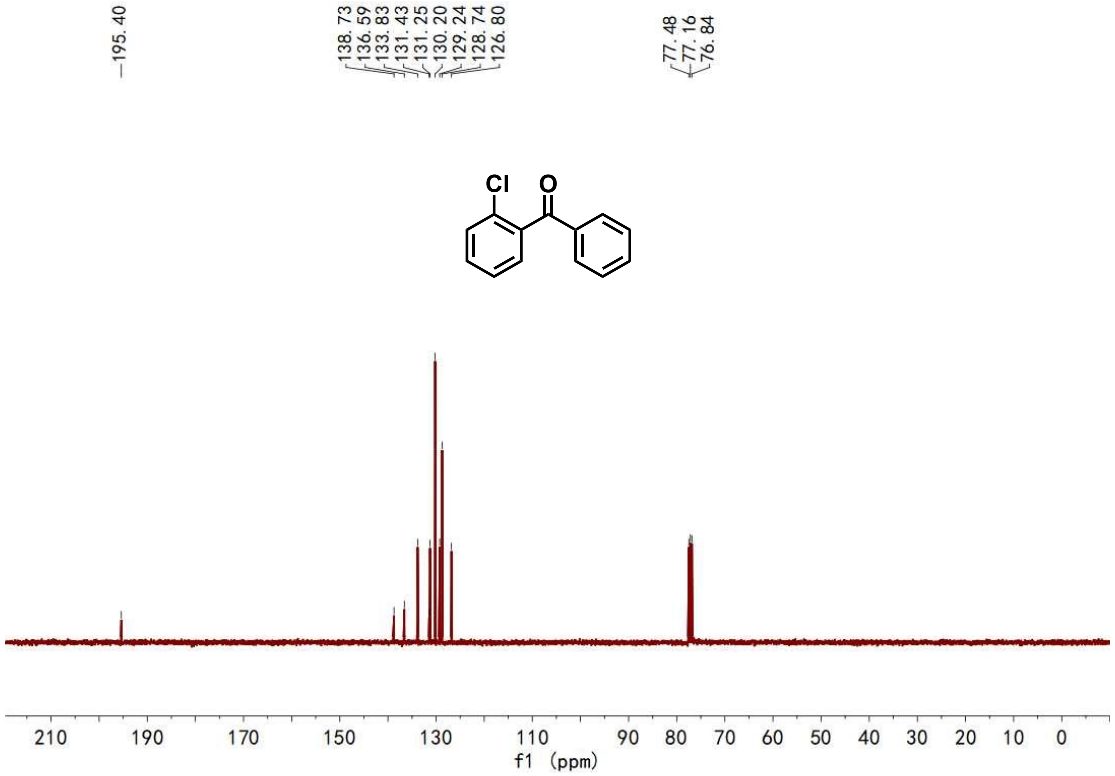
(2-Fluorophenyl)(phenyl)methanone (11): ^{13}C NMR (101 MHz, CDCl$_3$)



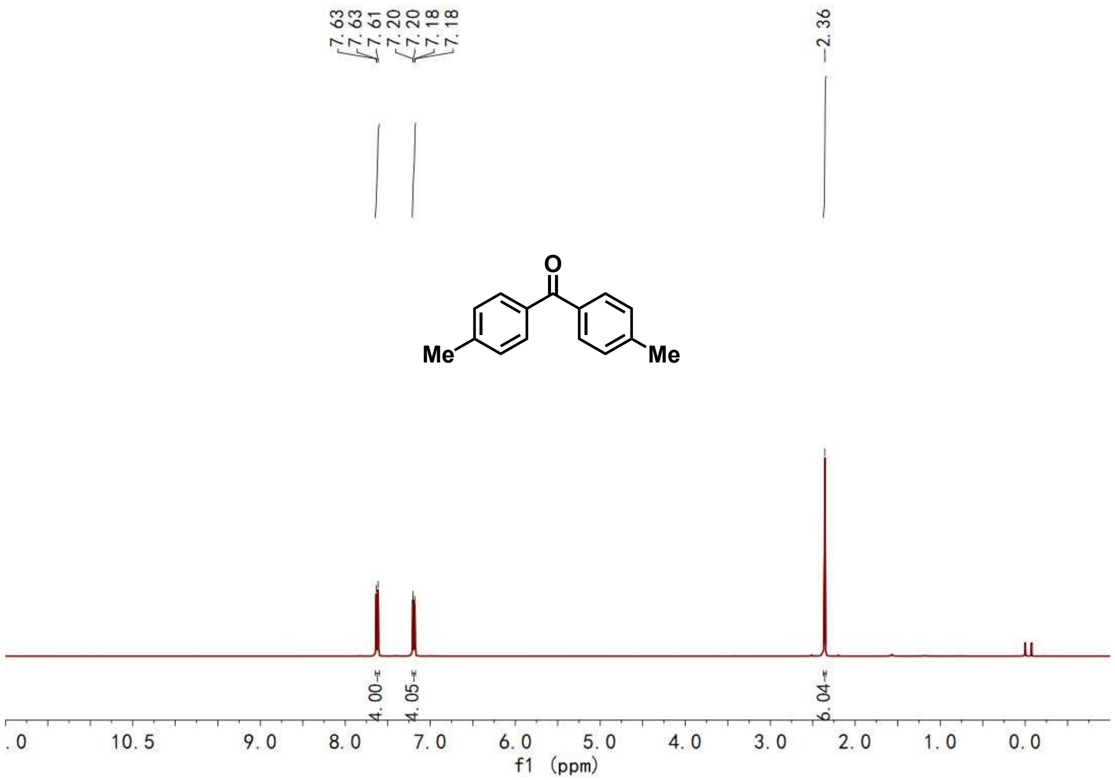
(2-Chlorophenyl)(phenyl)methanone (12): ^{1}H NMR (400 MHz, CDCl$_3$)



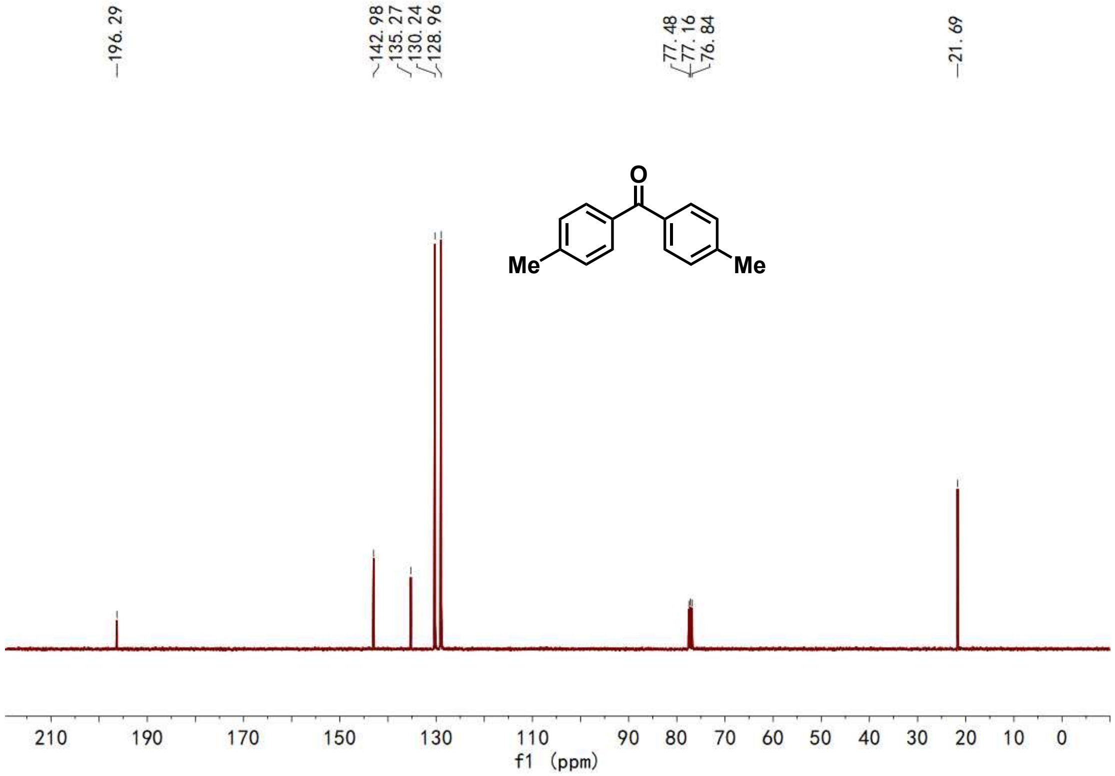
(2-Chlorophenyl)(phenyl)methanone (12): ^{13}C NMR (101 MHz, CDCl$_3$)



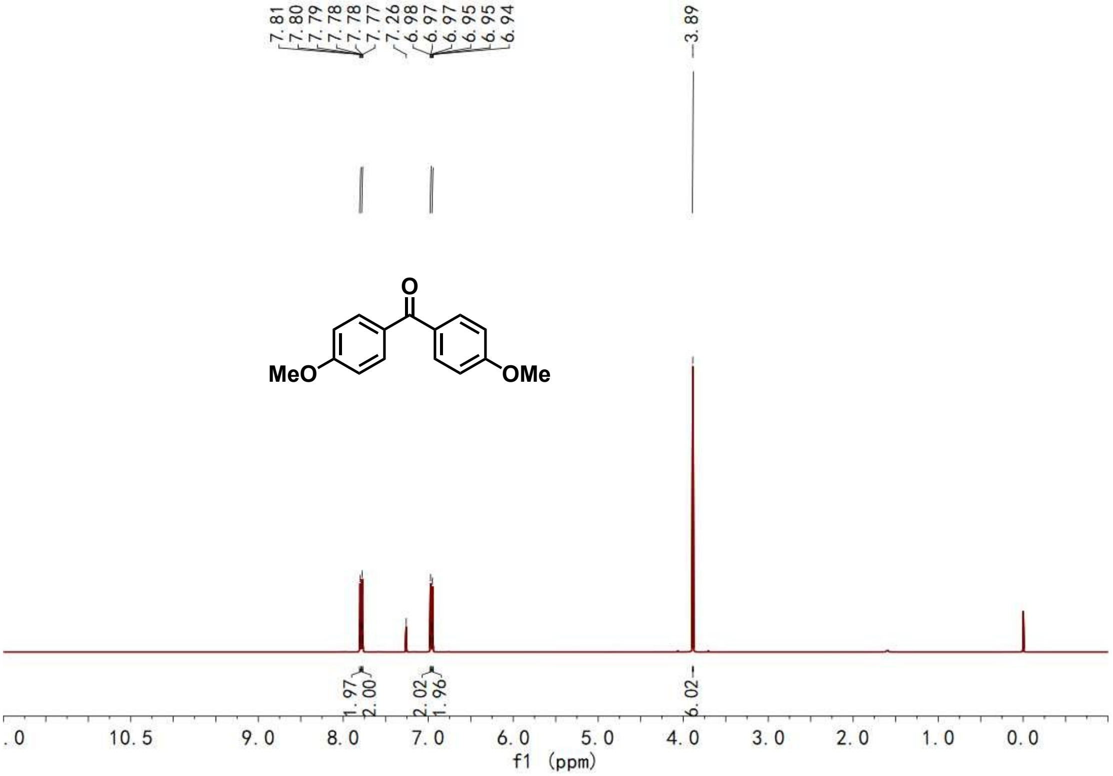
Di-*p*-tolylmethanone (13): ^{1}H NMR (400 MHz, CDCl$_3$)



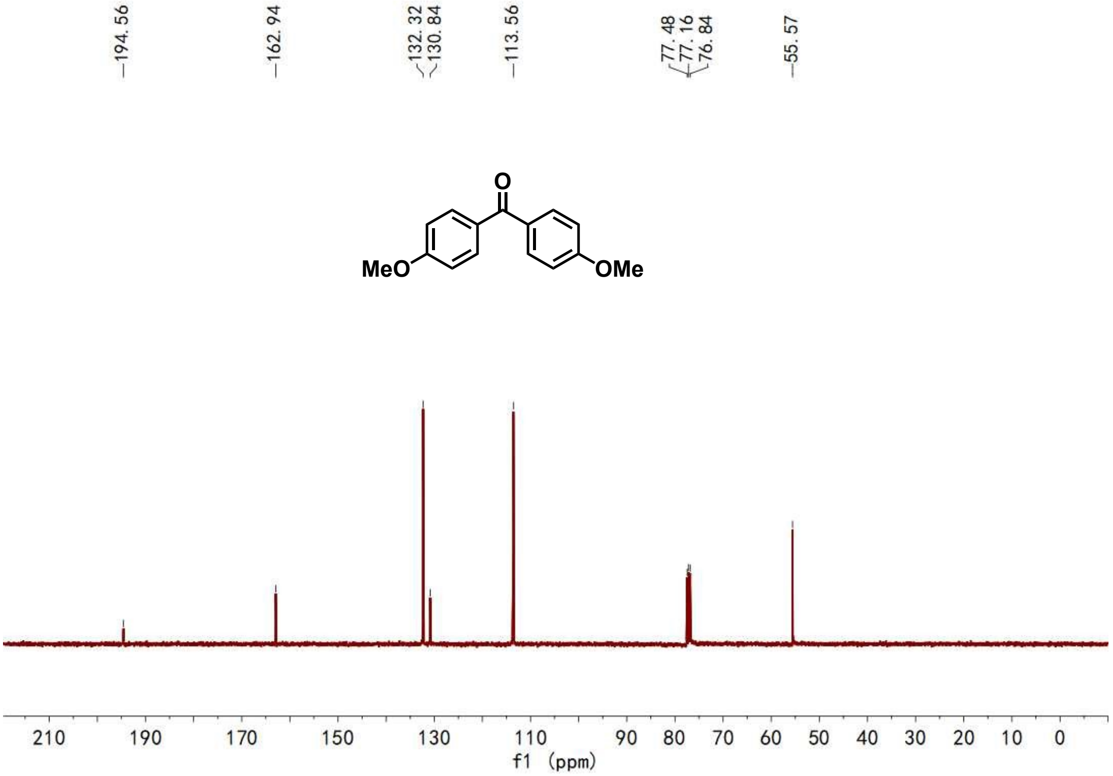
Di-*p*-tolylmethanone (13): ^{13}C NMR (101 MHz, CDCl$_3$)



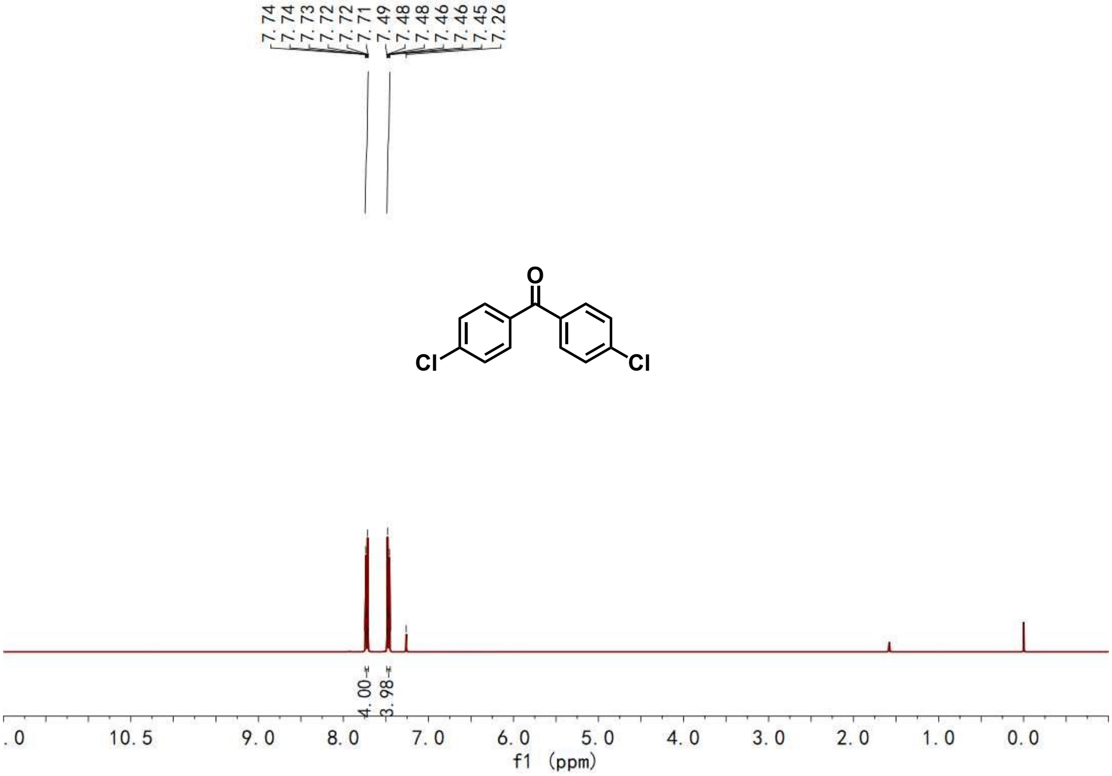
Bis(4-methoxyphenyl)methanone (14): ^{1}H NMR (400 MHz, CDCl$_3$)



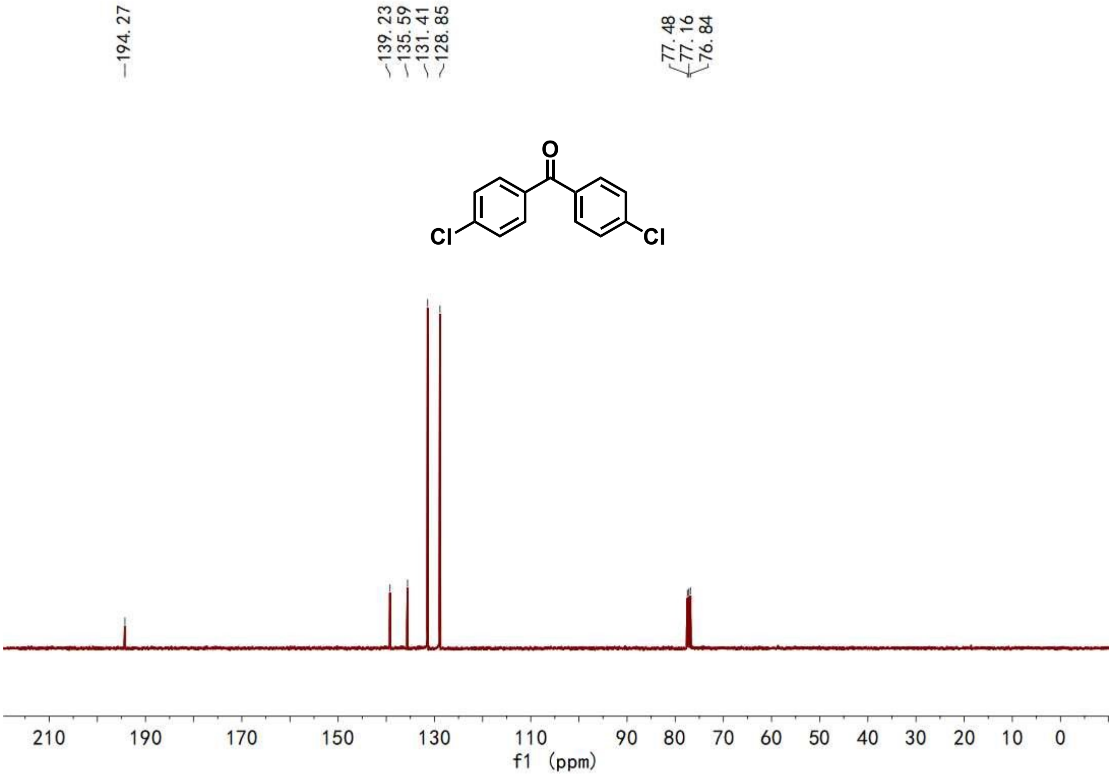
Bis(4-methoxyphenyl)methanone (14): ^{13}C NMR (101 MHz, CDCl$_3$)



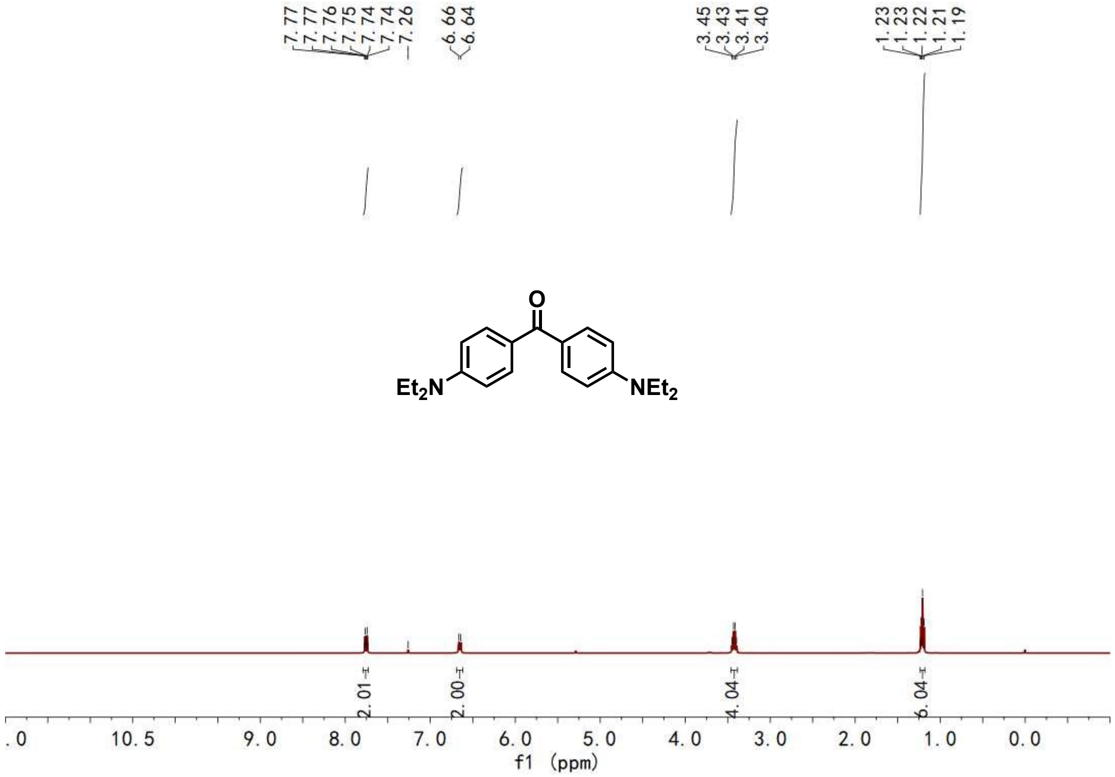
Bis(4-chlorophenyl)methanone (15): ^{1}H NMR (400 MHz, CDCl$_3$)



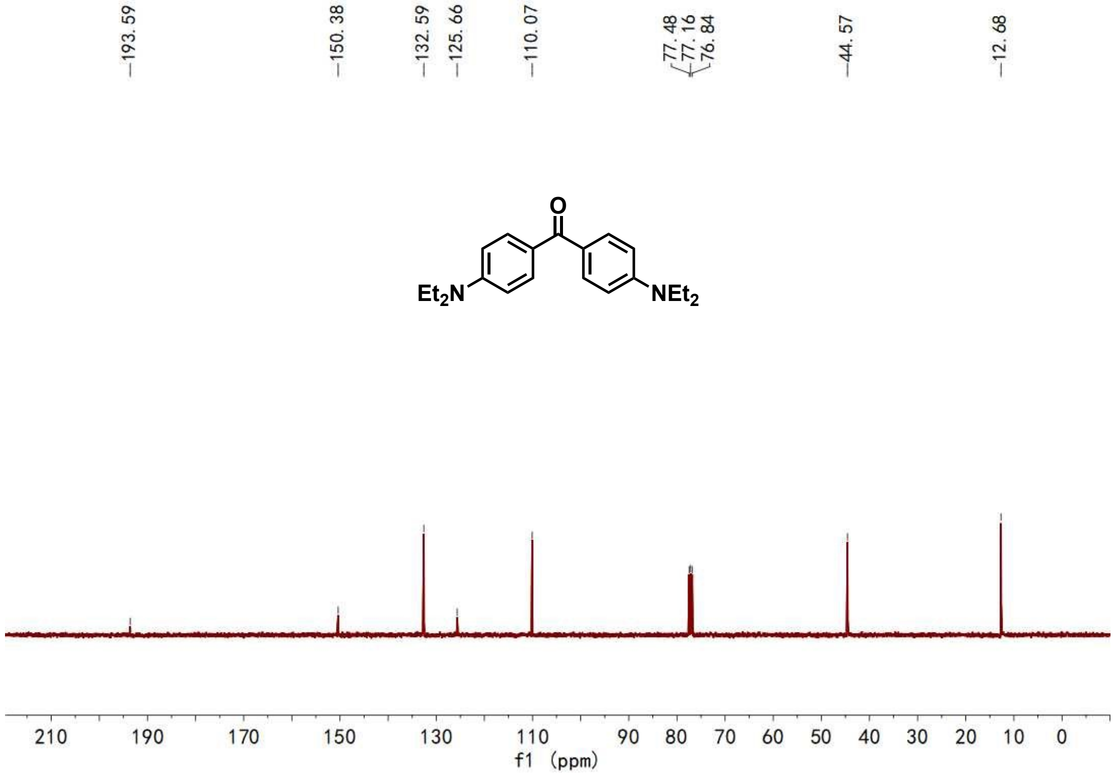
Bis(4-chlorophenyl)methanone (15): ^{13}C NMR (101 MHz, CDCl$_3$)



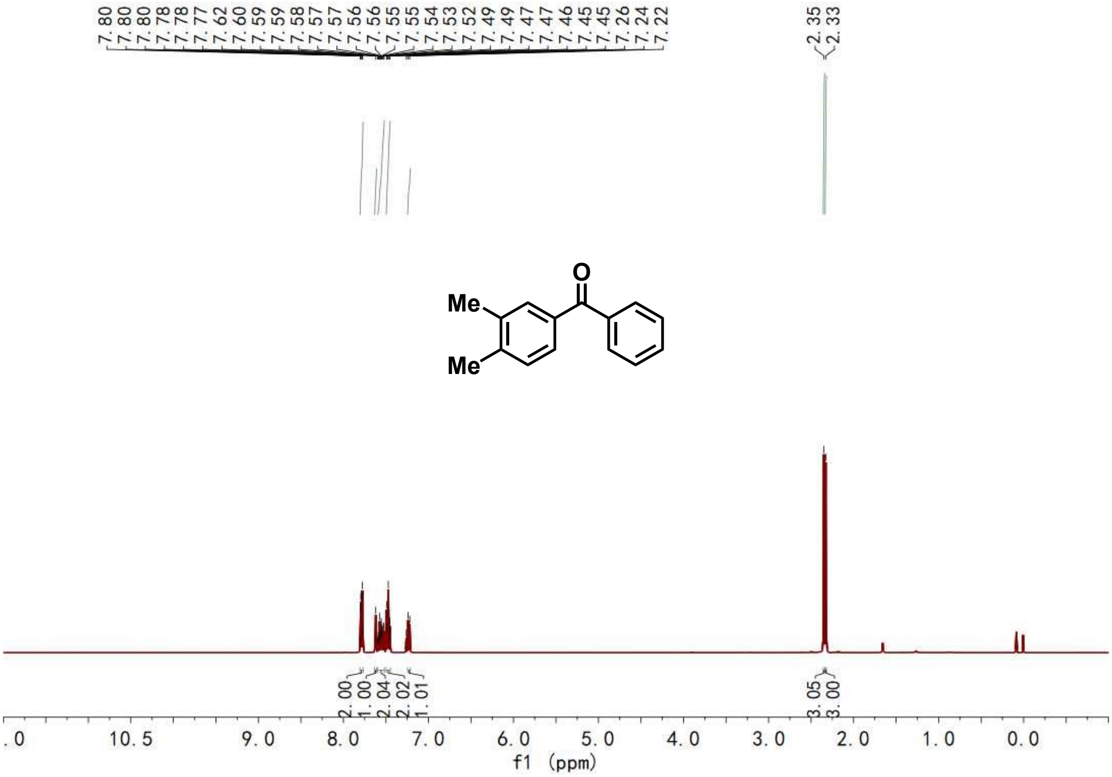
Bis(4-(diethylamino)phenyl)methanone (16): ^{1}H NMR (400 MHz, $CDCl_3$)



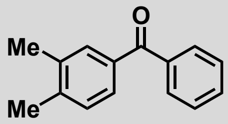
Bis(4-(diethylamino)phenyl)methanone (16): ^{13}C NMR (101 MHz, $CDCl_3$)



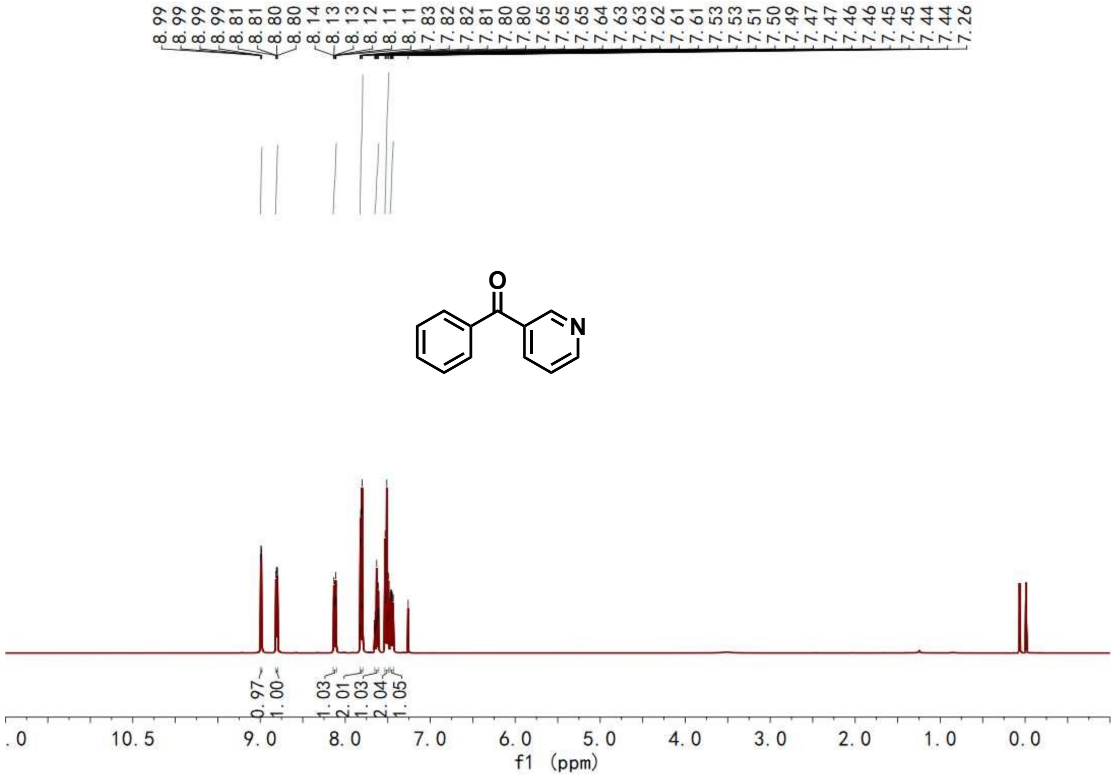
(3,4-Dimethylphenyl)(phenyl)methanone (17): ^{1}H NMR (400 MHz, CDCl$_3$)



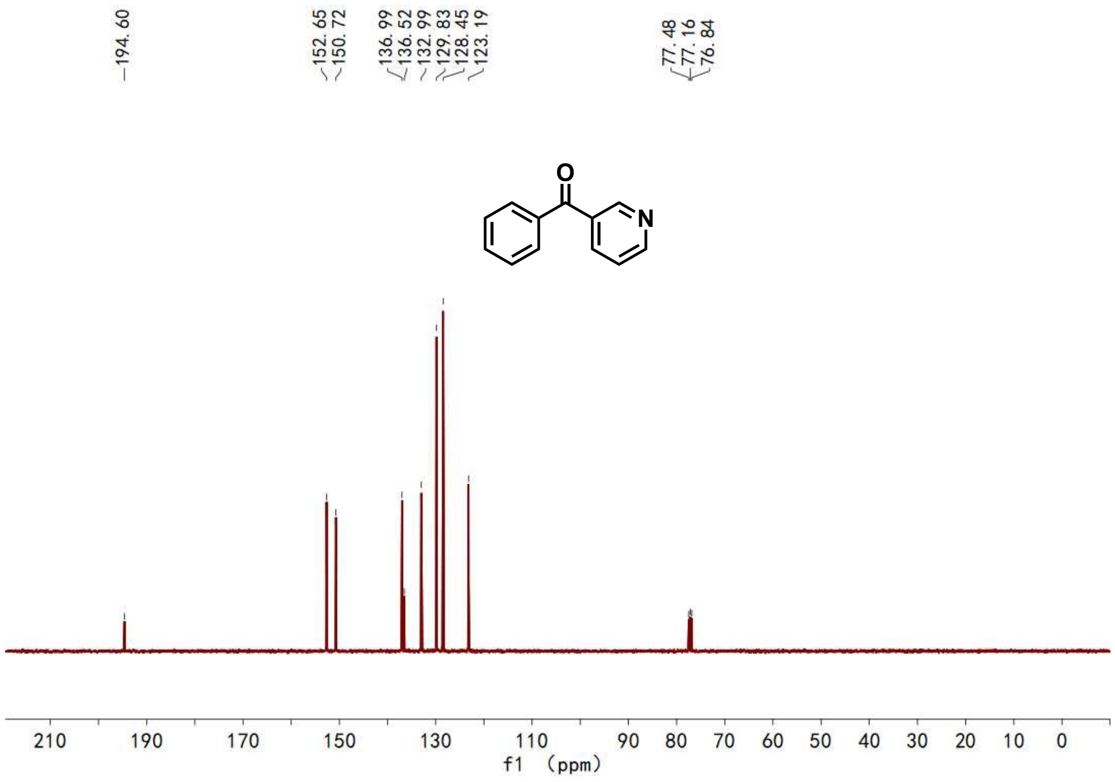
(3,4-Dimethylphenyl)(phenyl)methanone (17): ^{13}C NMR (101 MHz, CDCl$_3$)



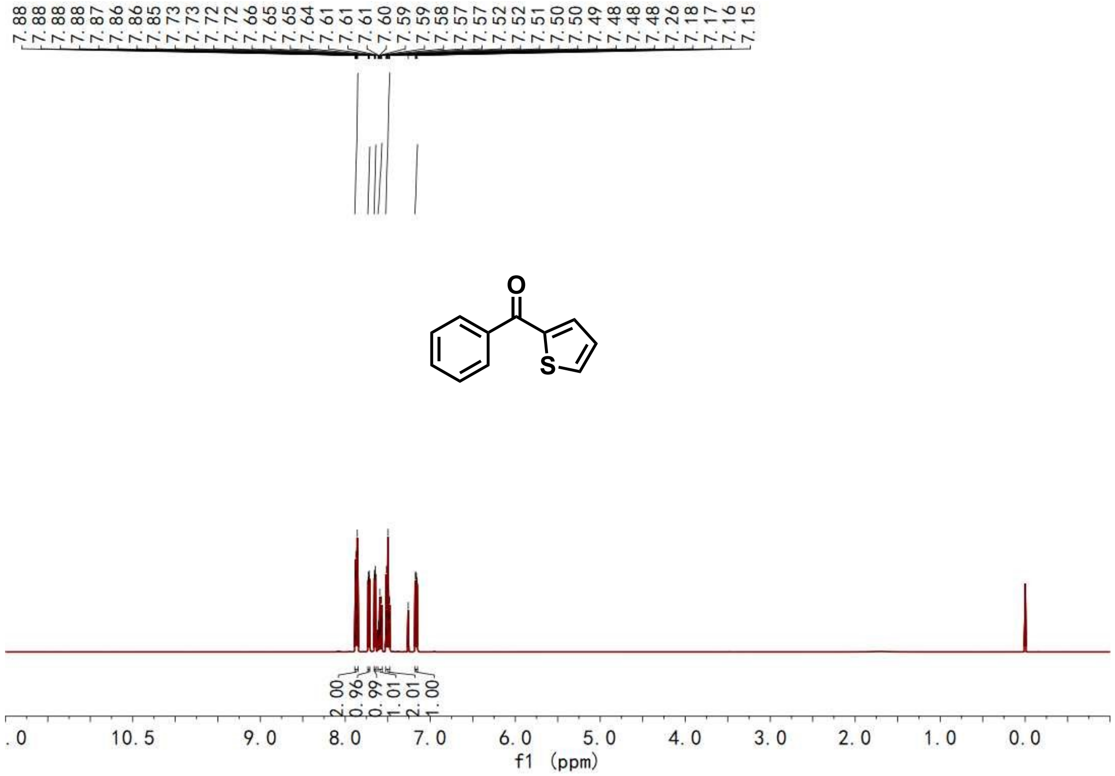
Phenyl(pyridin-3-yl)methanone (18): ^{1}H NMR (400 MHz, CDCl$_3$)



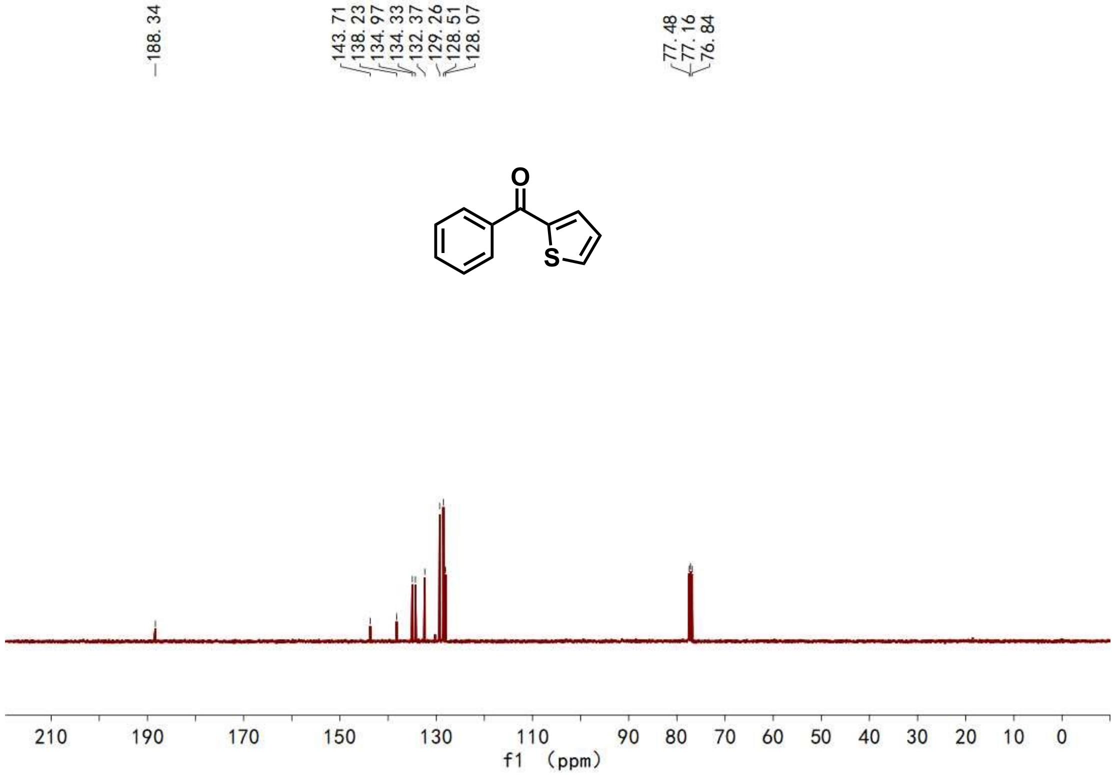
Phenyl(pyridin-3-yl)methanone (18): ^{13}C NMR (101 MHz, CDCl$_3$)



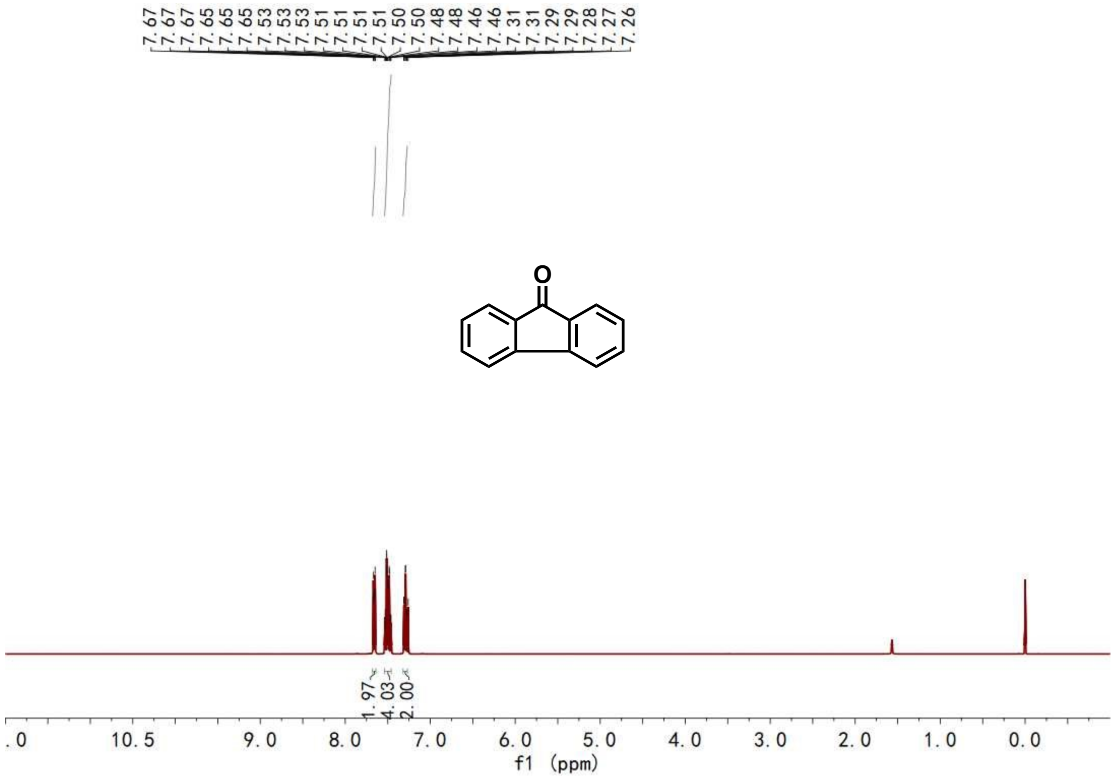
Phenyl(thiophen-2-yl)methanone (19): ^{1}H NMR (400 MHz, CDCl$_3$)



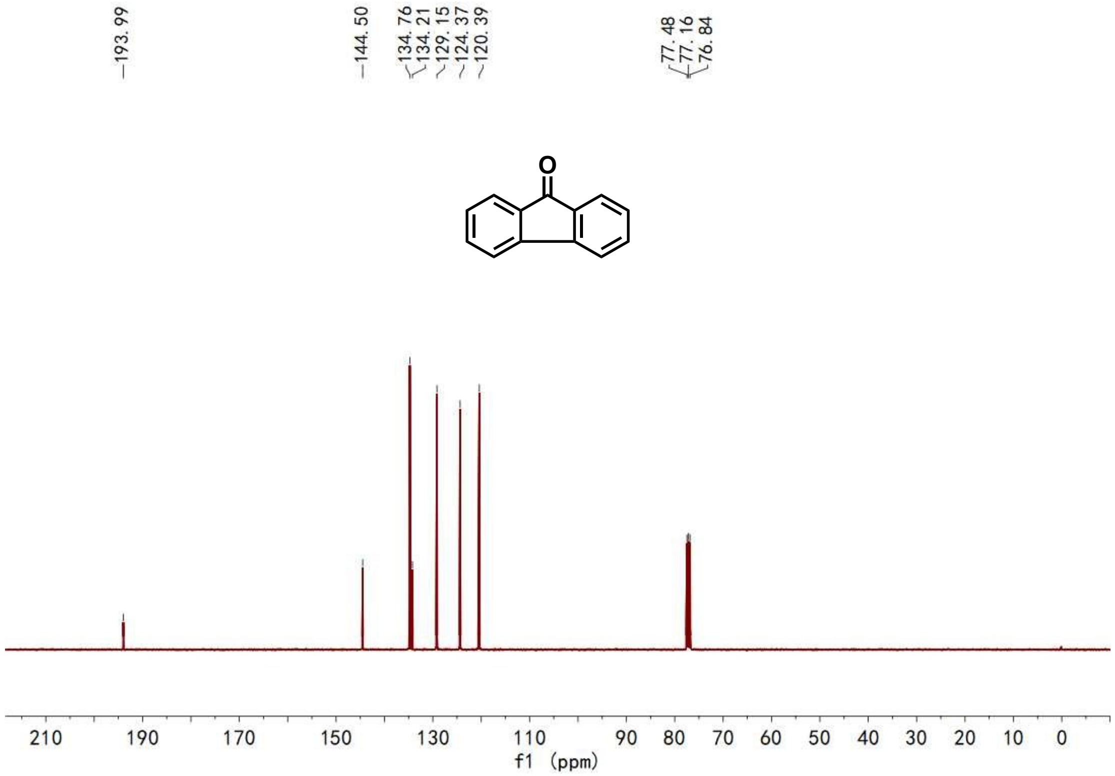
Phenyl(thiophen-2-yl)methanone (19): ^{13}C NMR (101 MHz, CDCl$_3$)



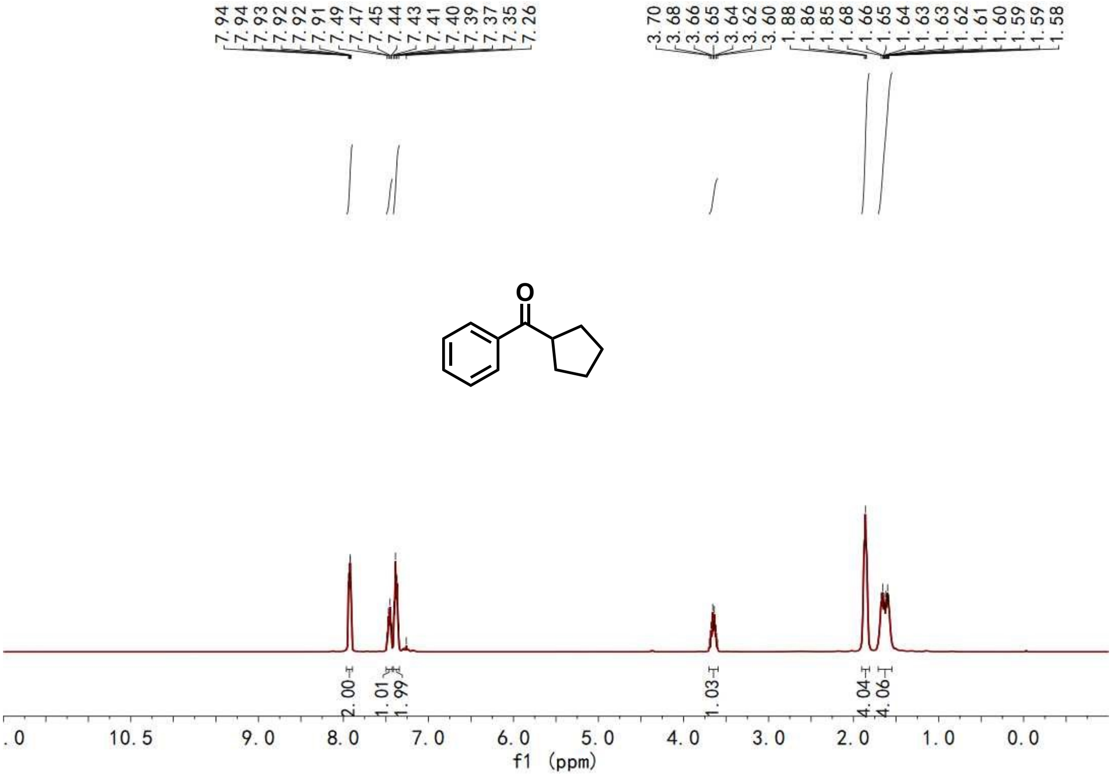
9*H*-Fluoren-9-one (20): ^{1}H NMR (400 MHz, CDCl$_3$)



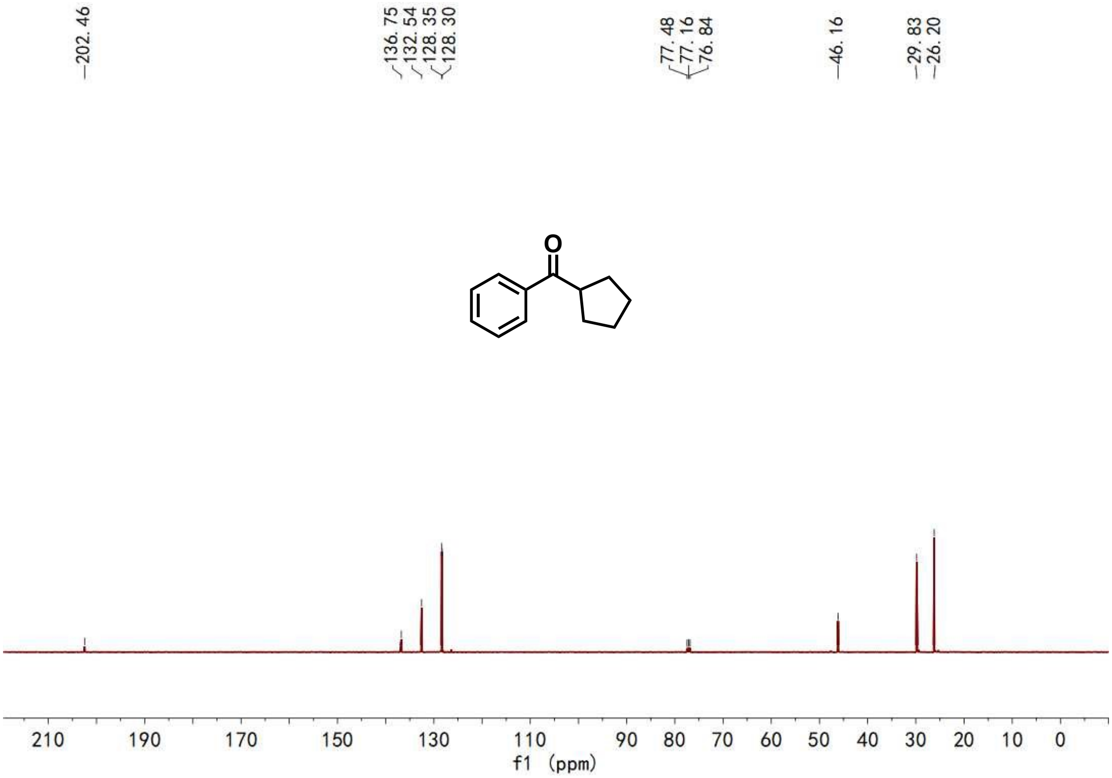
9*H*-Fluoren-9-one (20): ^{13}C NMR (101 MHz, CDCl$_3$)



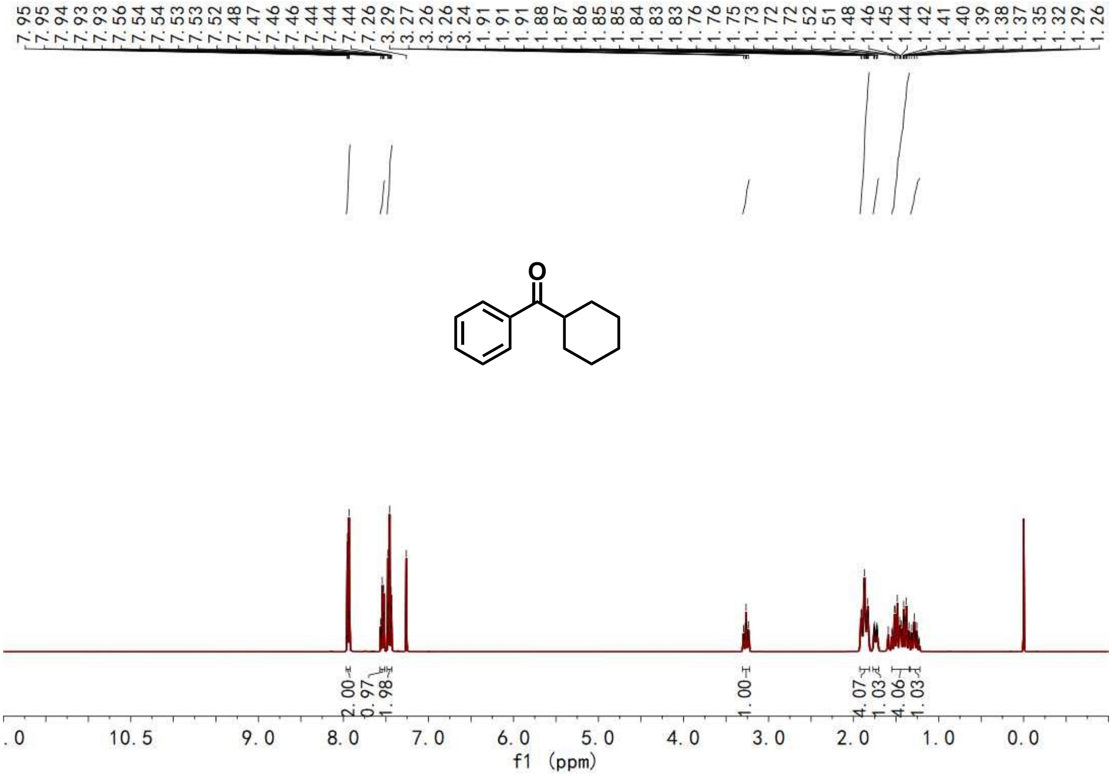
Cyclopentyl(phenyl)methanone (21): ^{1}H NMR (400 MHz, CDCl$_3$)



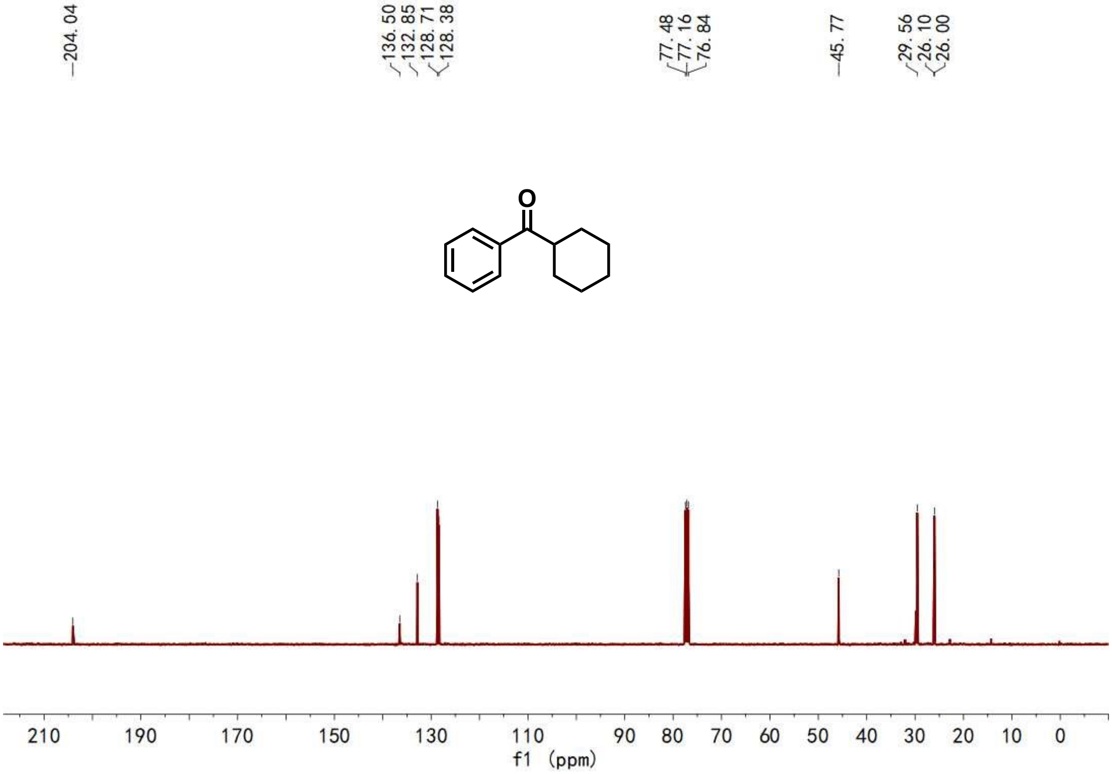
Cyclopentyl(phenyl)methanone (21): ^{13}C NMR (101 MHz, CDCl$_3$)



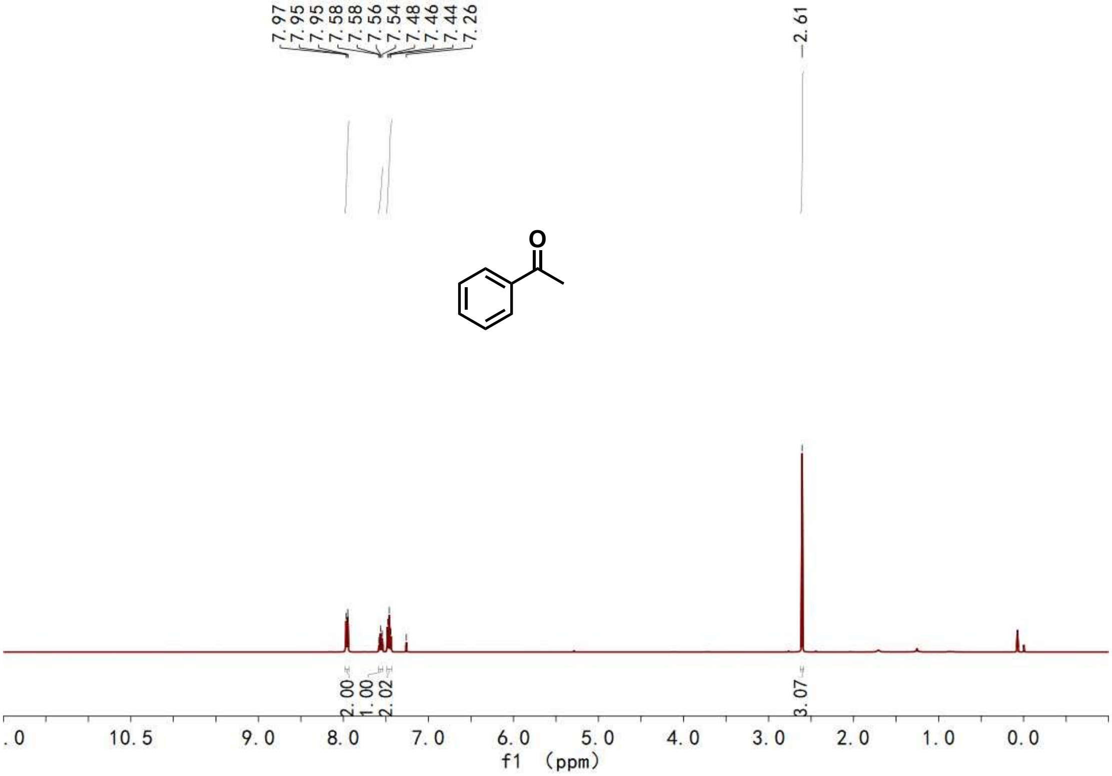
Cyclohexyl(phenyl)methanone (22): ^{1}H NMR (400 MHz, $CDCl_3$)



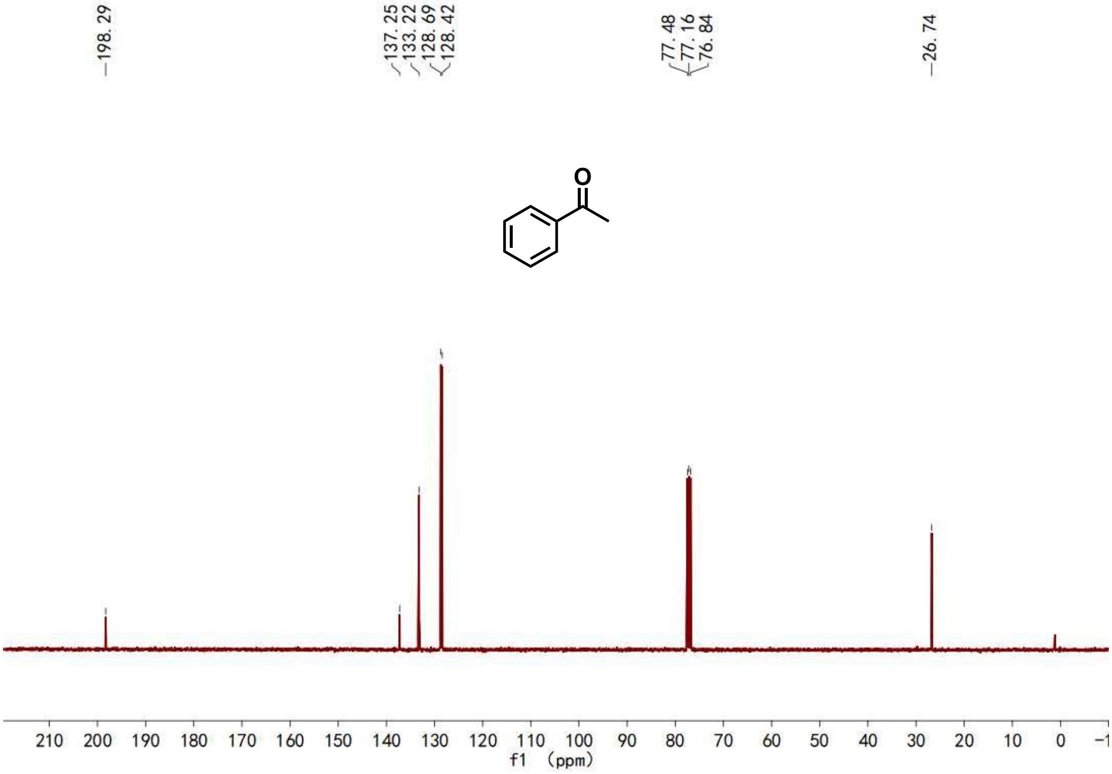
Cyclohexyl(phenyl)methanone (22): ^{13}C NMR (101 MHz, $CDCl_3$)



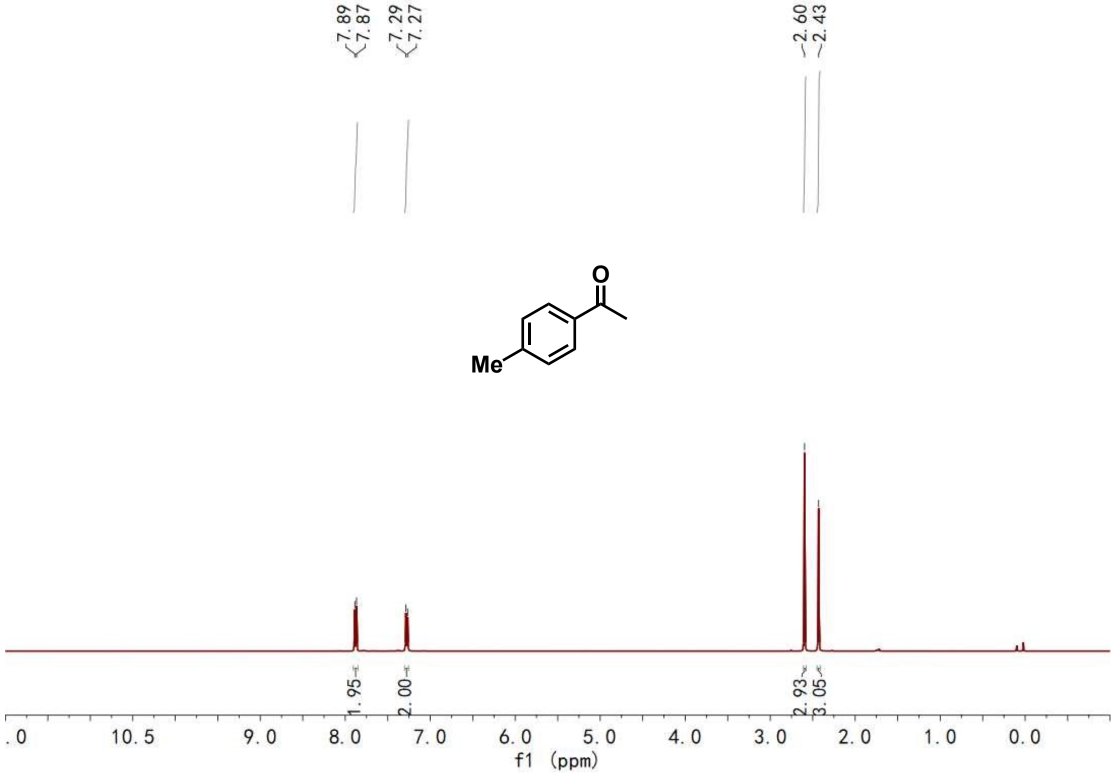
Acetophenone (23): ^{1}H NMR (400 MHz, CDCl$_3$)



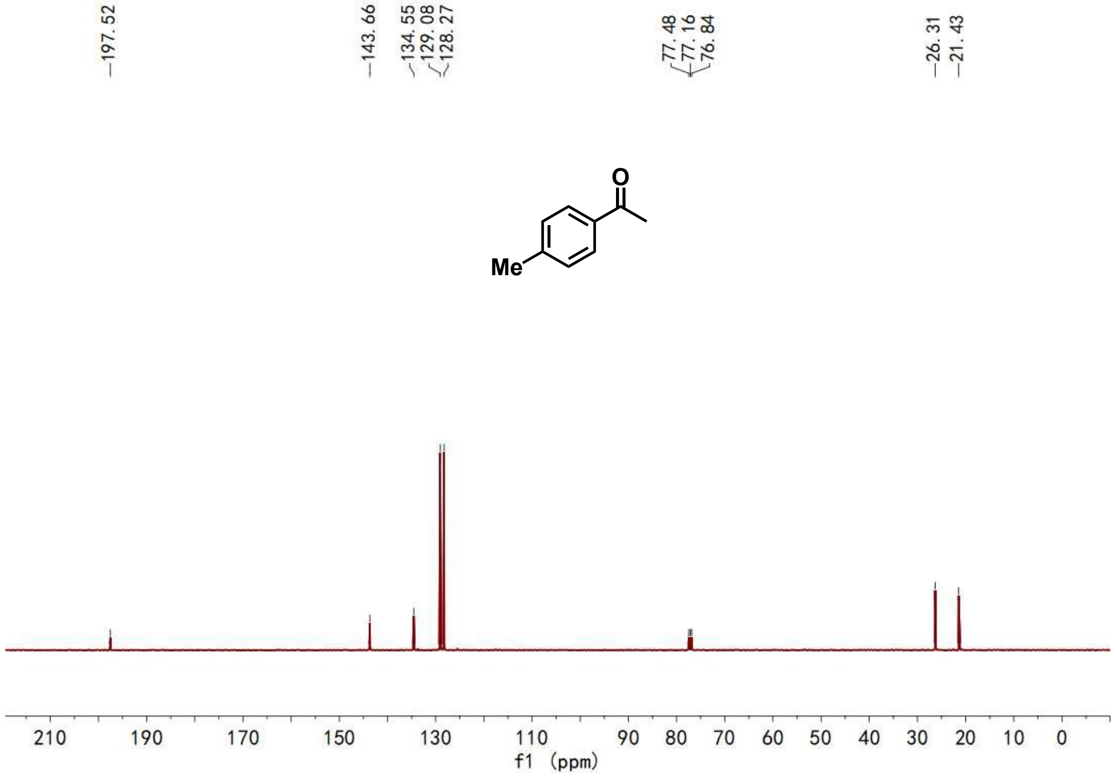
Acetophenone (23): ^{13}C NMR (101 MHz, CDCl$_3$)



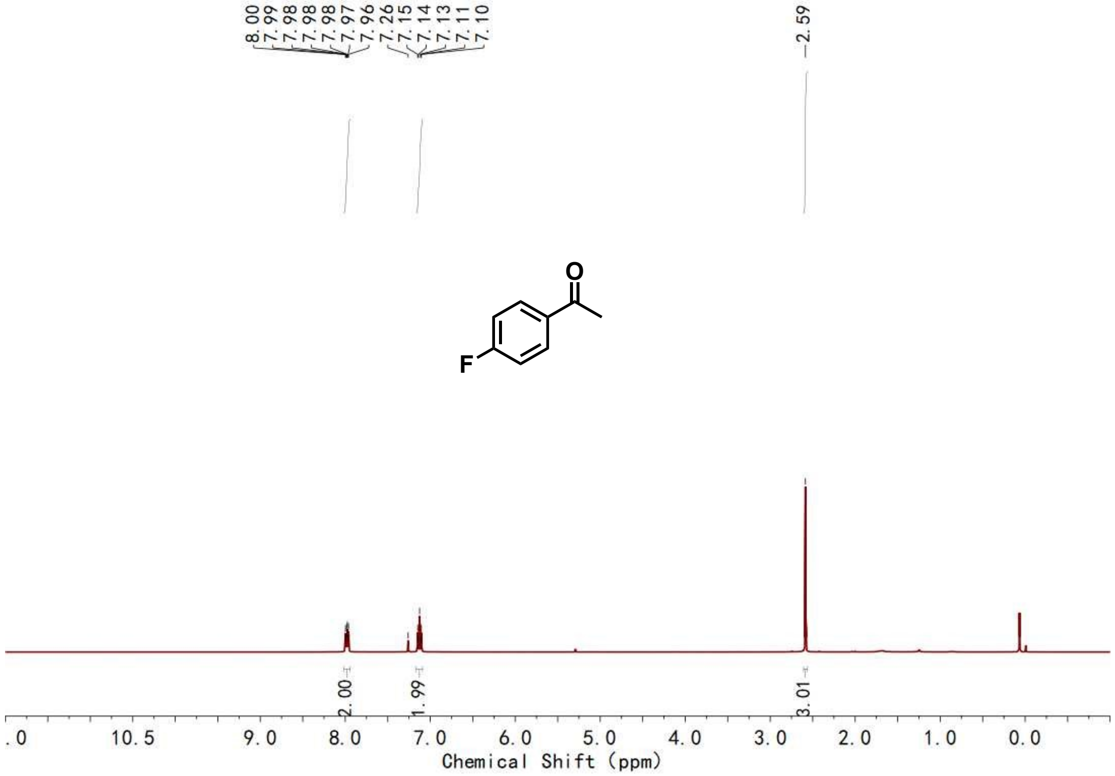
1-(*p*-Tolyl)ethan-1-one (24): ^{1}H NMR (400 MHz, CDCl$_3$)



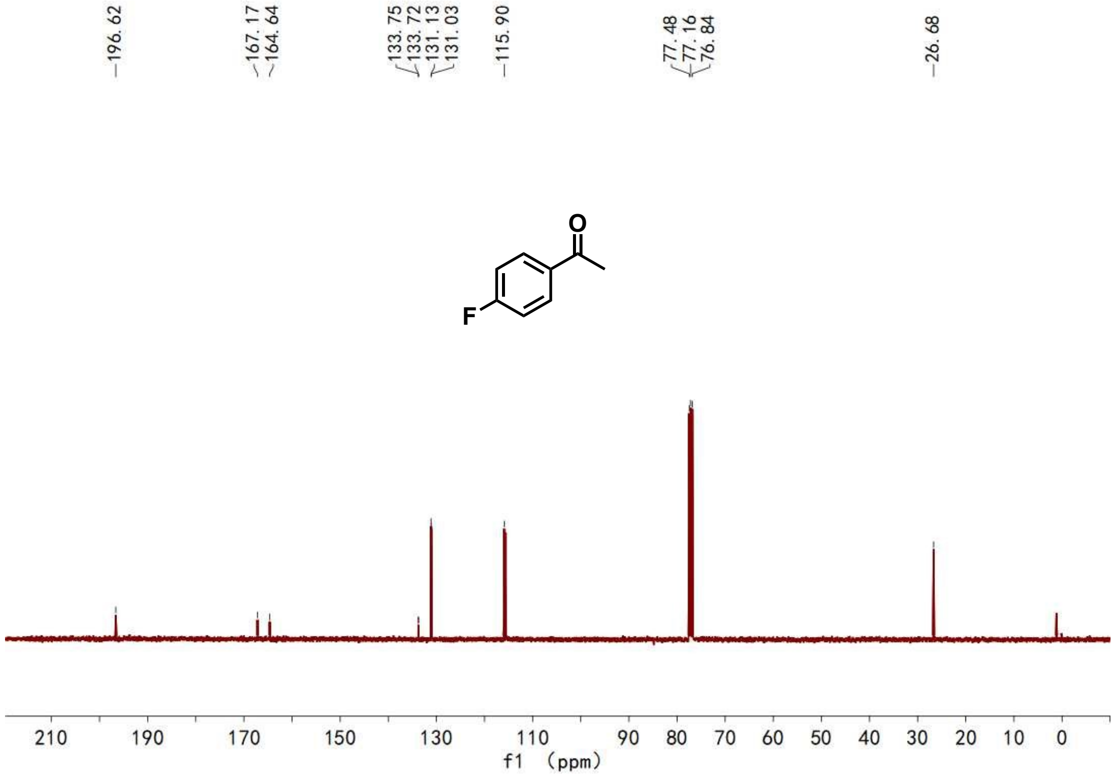
1-(*p*-Tolyl)ethan-1-one (24): ^{13}C NMR (101 MHz, CDCl$_3$)



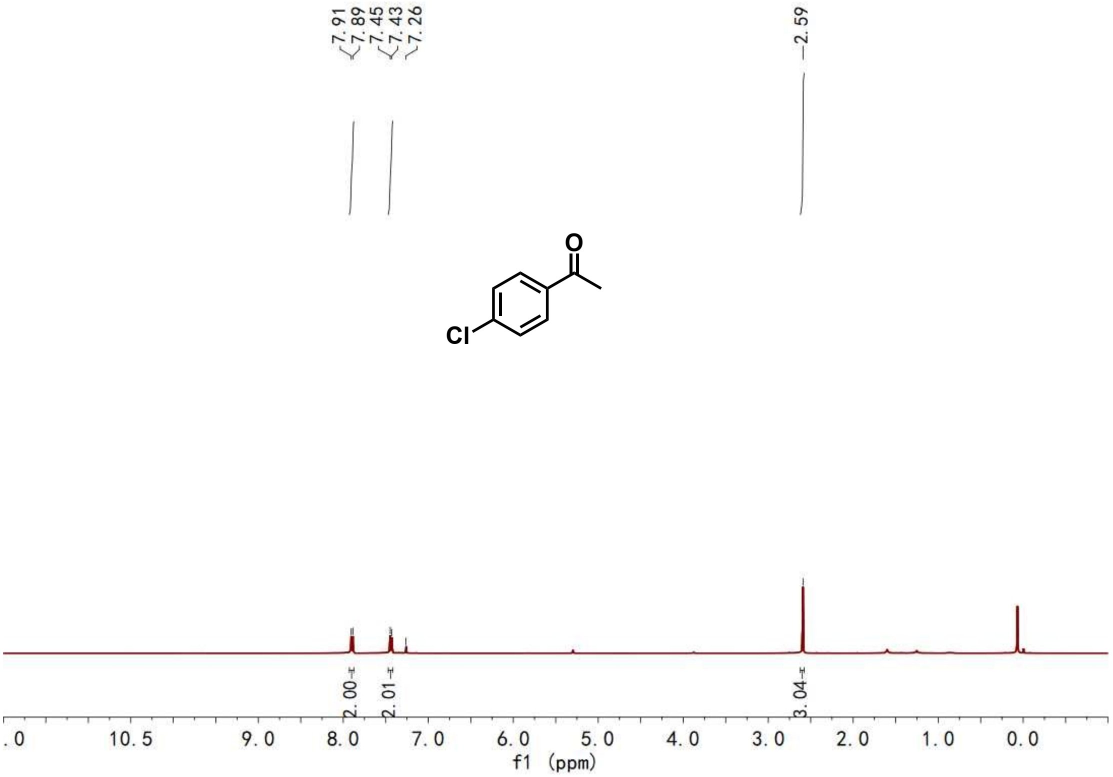
1-(4-Fluorophenyl)ethan-1-one (25): ^{1}H NMR (400 MHz, CDCl$_3$)



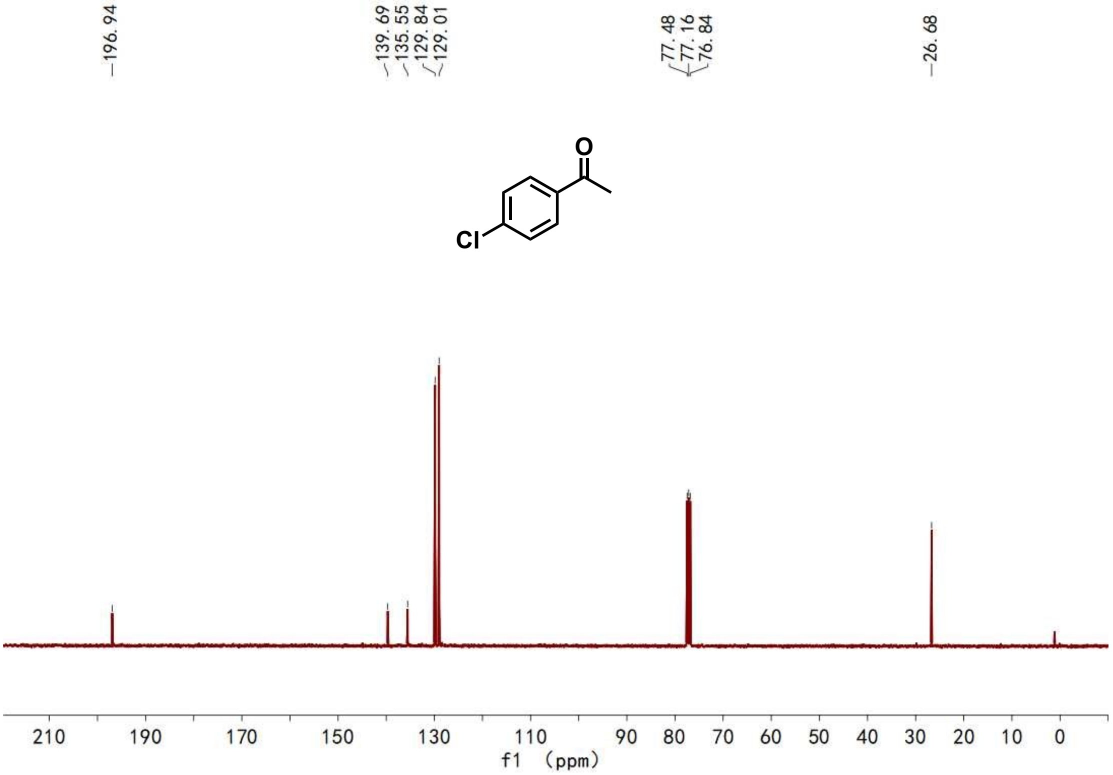
1-(4-Fluorophenyl)ethan-1-one (25): ^{13}C NMR (101 MHz, CDCl$_3$)



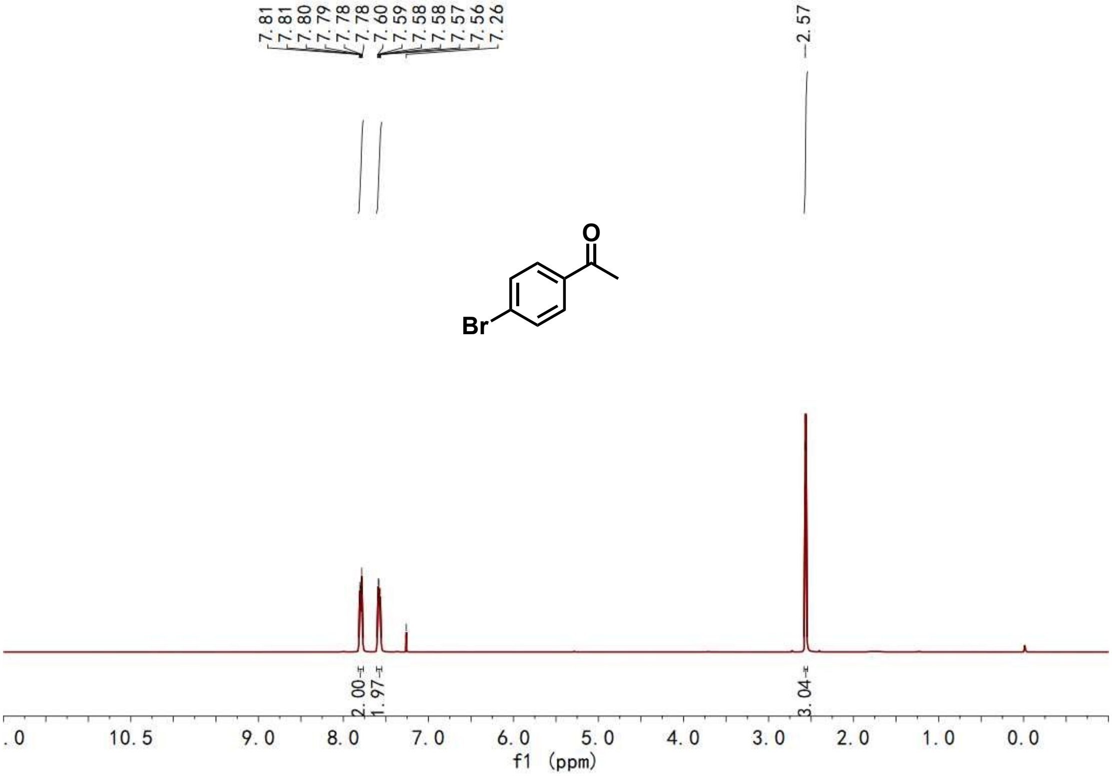
1-(4-Chlorophenyl)ethan-1-one (26): ^{1}H NMR (400 MHz, CDCl$_3$)



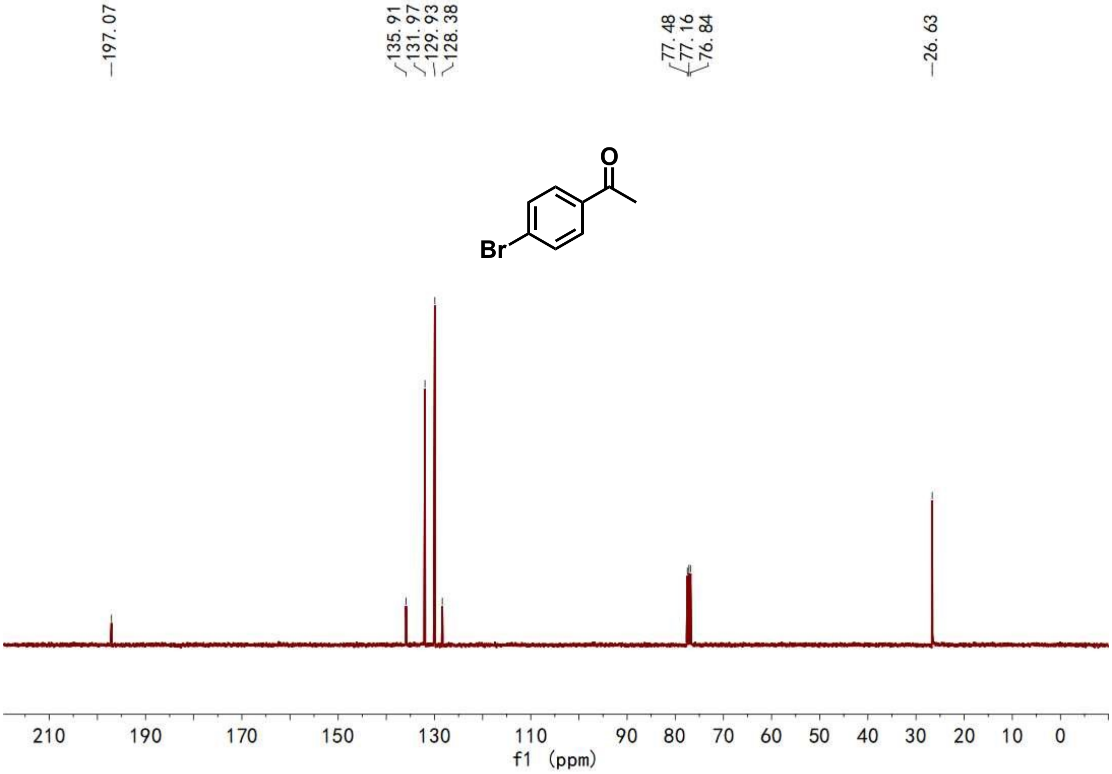
1-(4-Chlorophenyl)ethan-1-one (26): ^{13}C NMR (101 MHz, CDCl$_3$)



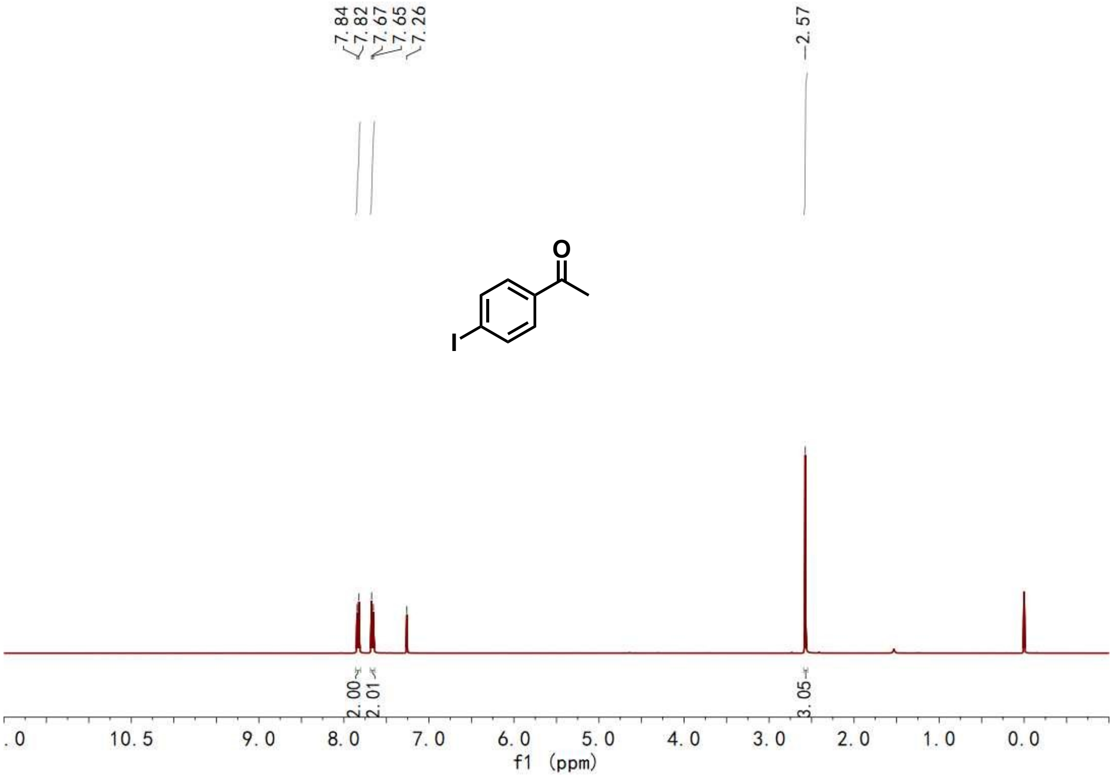
1-(4-Bromophenyl)ethan-1-one (27): ^{1}H NMR (400 MHz, $CDCl_3$)



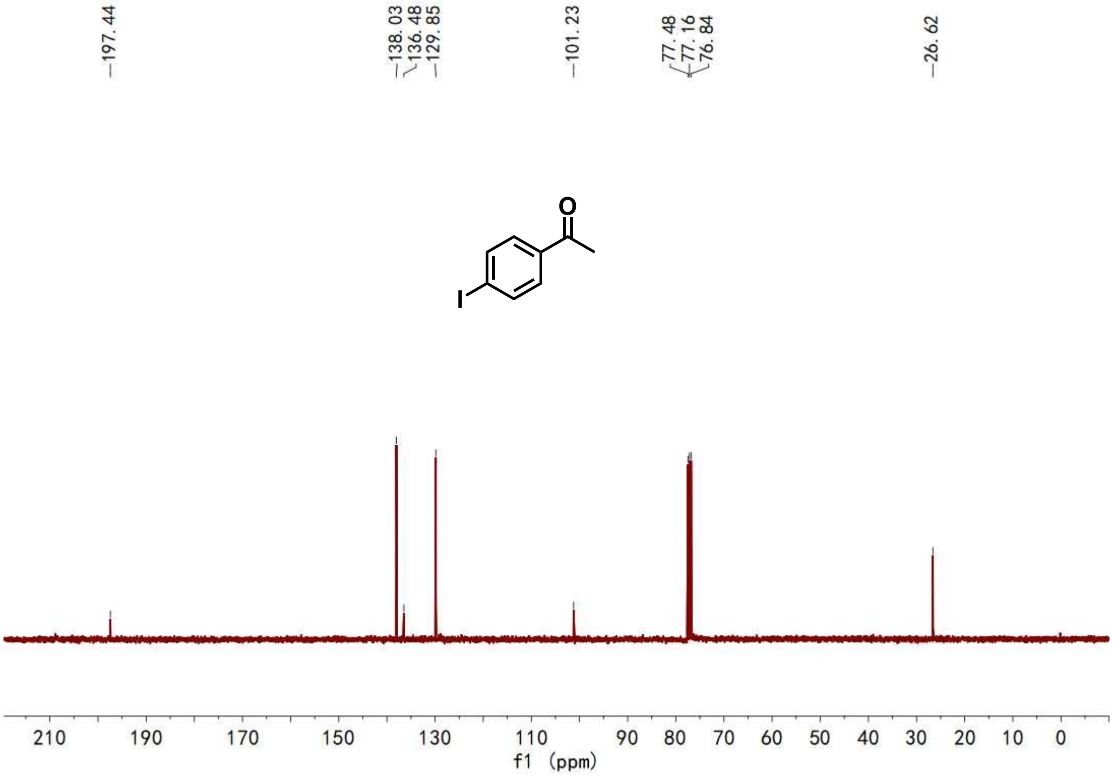
1-(4-Bromophenyl)ethan-1-one (27): ^{13}C NMR (101 MHz, $CDCl_3$)



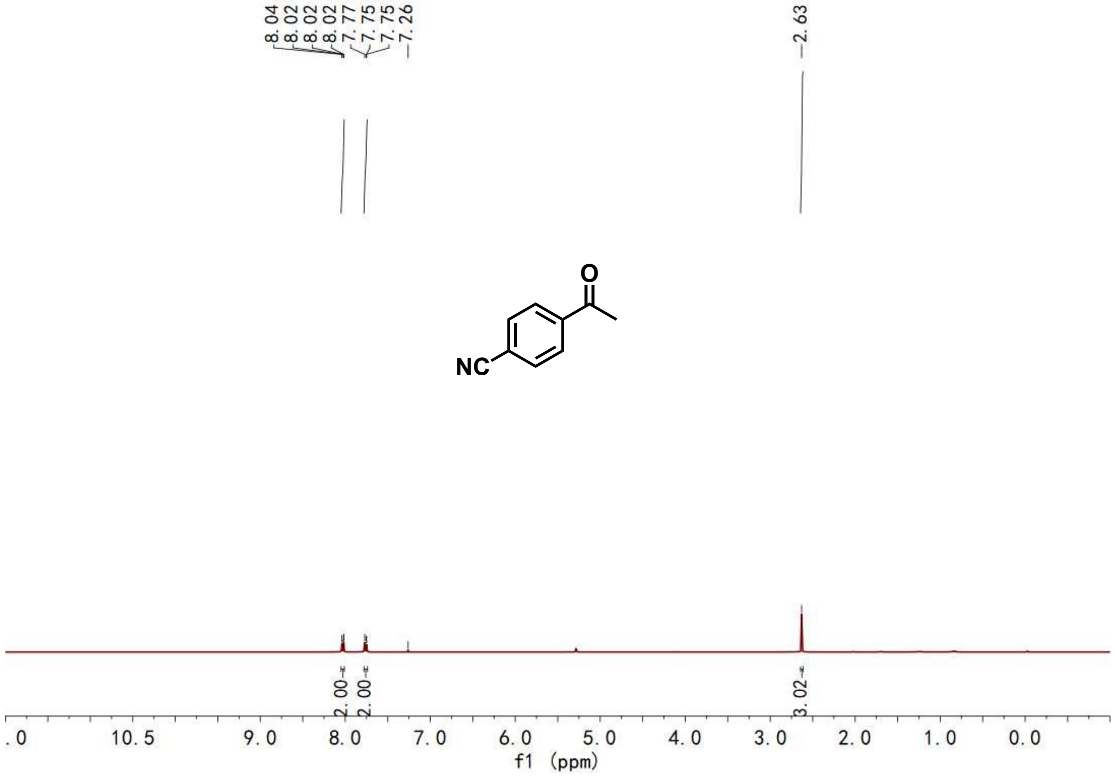
1-(4-Iodophenyl)ethan-1-one (28): ^{1}H NMR (400 MHz, CDCl$_3$)



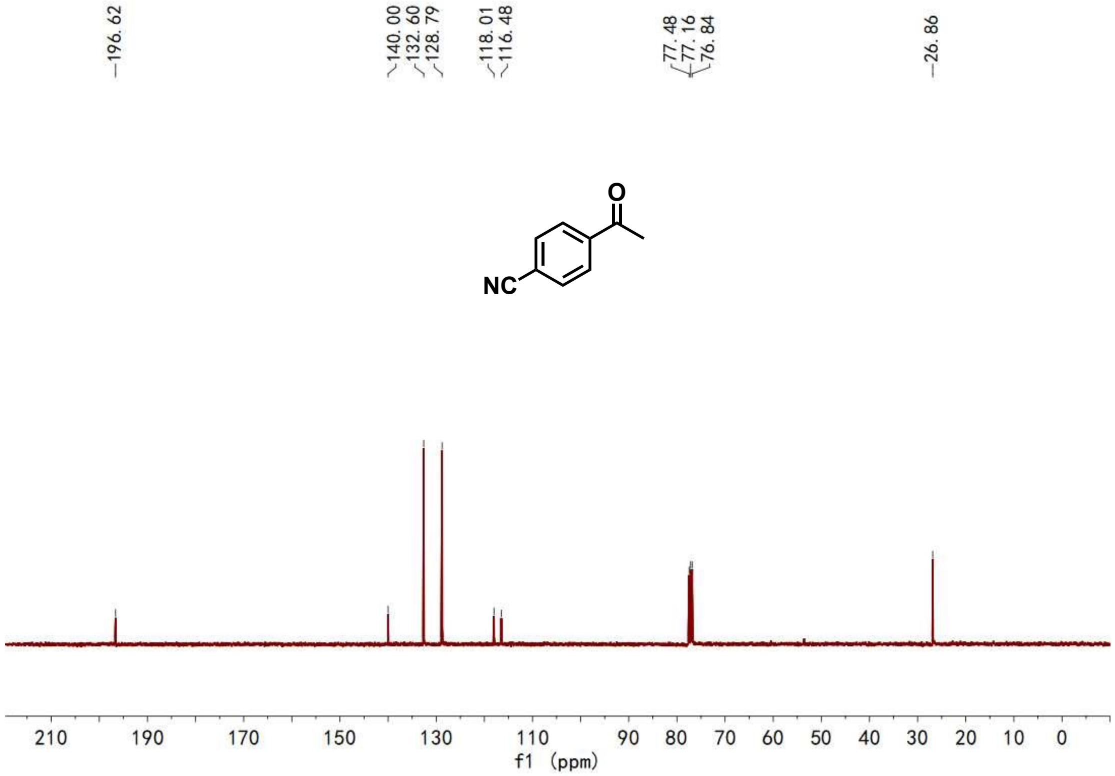
1-(4-Iodophenyl)ethan-1-one (28): ^{13}C NMR (101 MHz, CDCl$_3$)



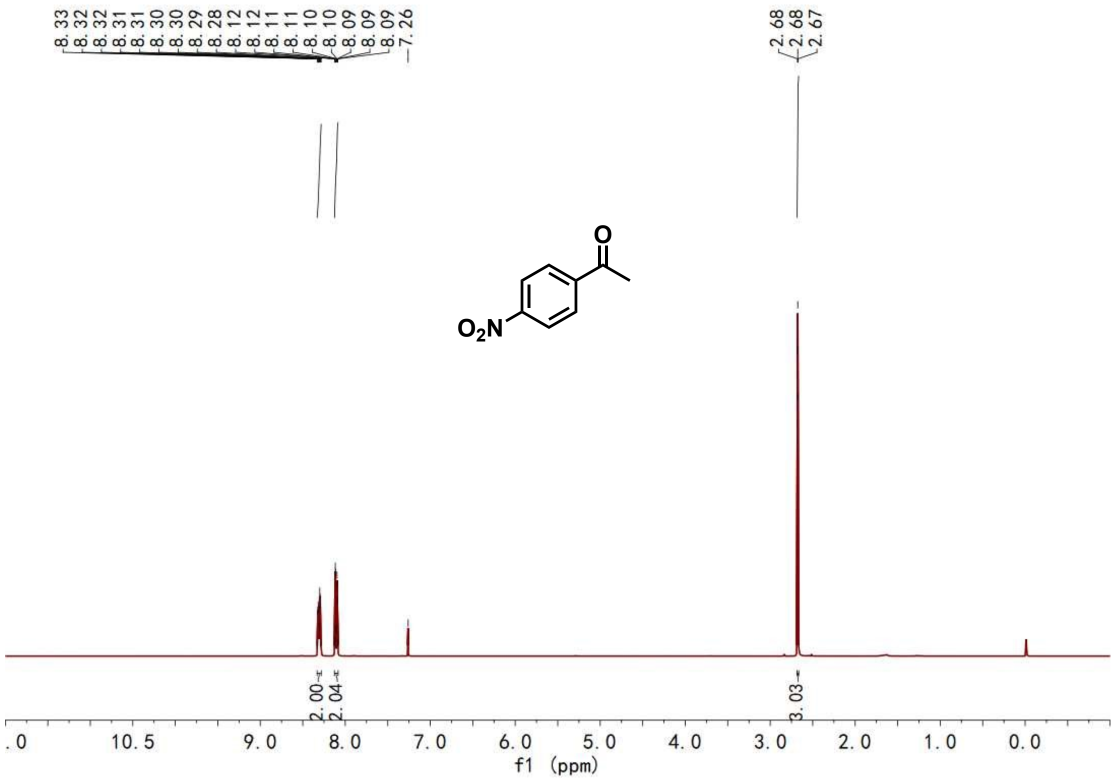
4-Acetylbenzonitrile (29): ^{1}H NMR (400 MHz, CDCl$_3$)



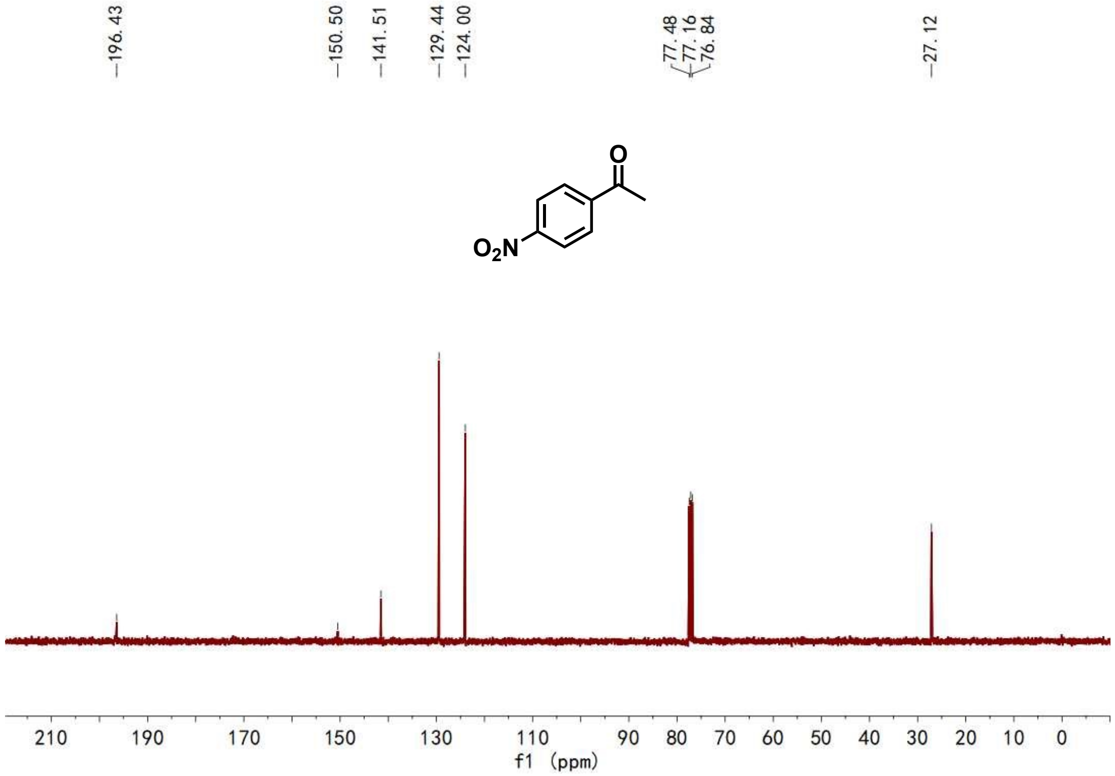
4-Acetylbenzonitrile (29): ^{13}C NMR (101 MHz, CDCl$_3$)



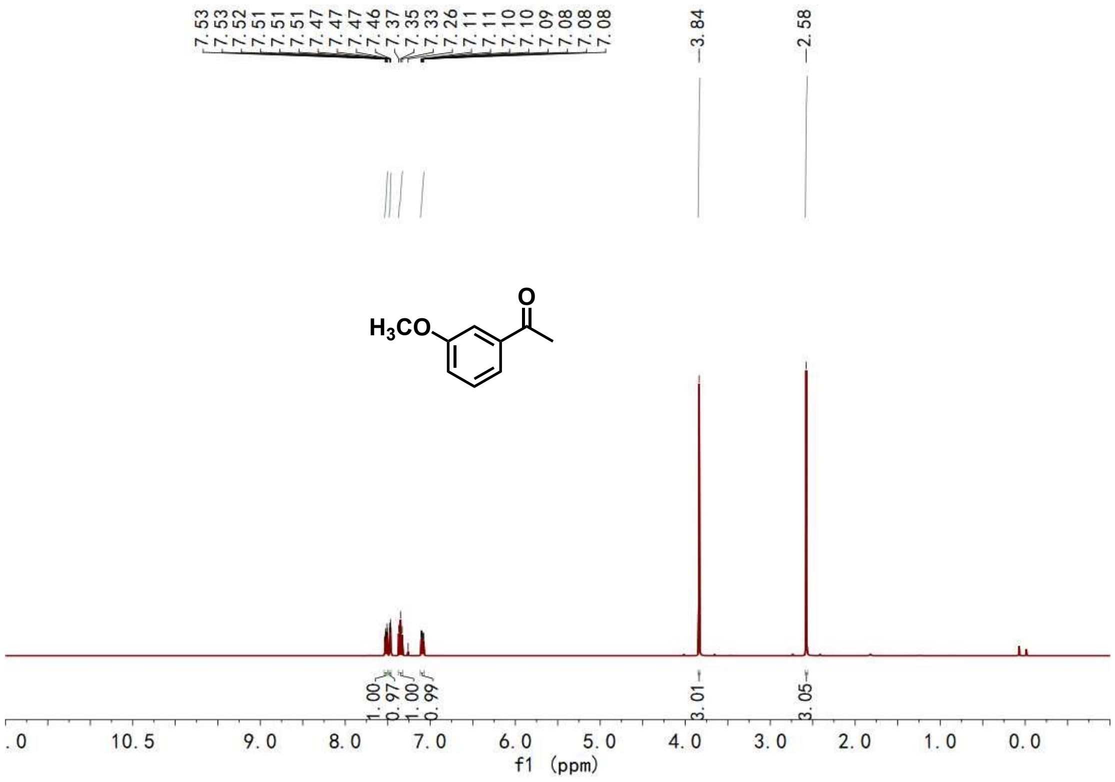
1-(4-Nitrophenyl)ethan-1-one (30): ^{1}H NMR (400 MHz, CDCl$_3$)



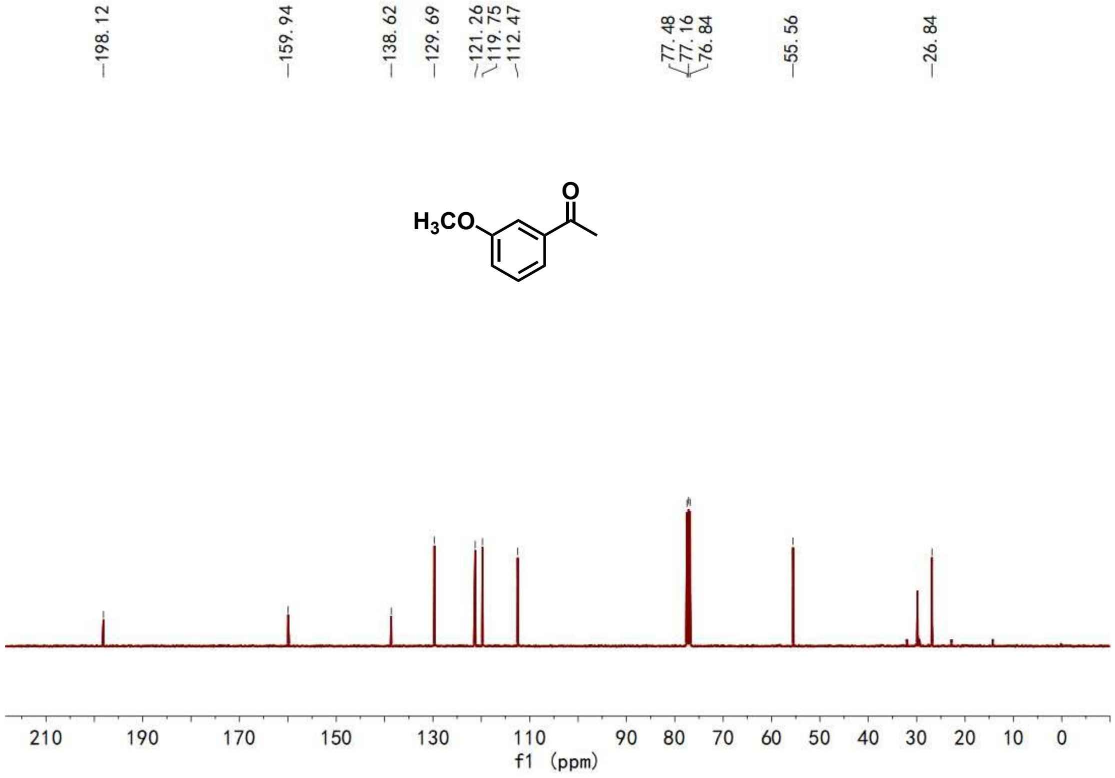
1-(4-Nitrophenyl)ethan-1-one (30): ^{13}C NMR (101 MHz, CDCl$_3$)



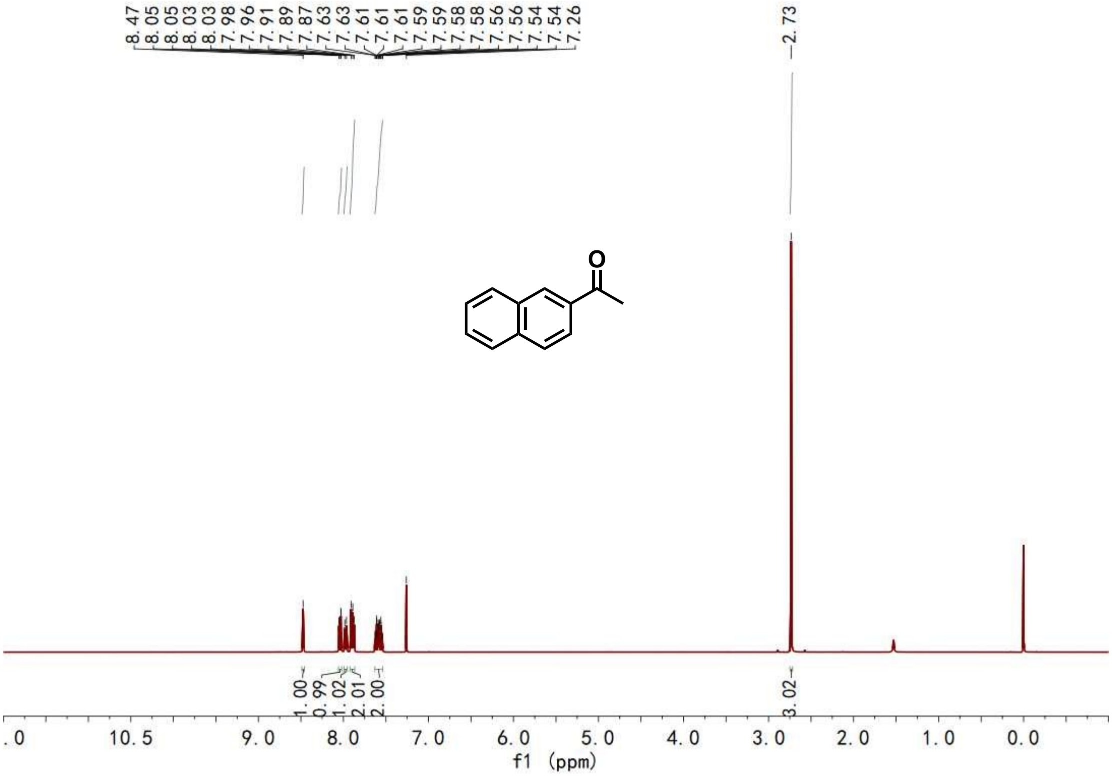
1-(3-Methoxyphenyl)ethan-1-one (31): ^{1}H NMR (400 MHz, CDCl$_3$)



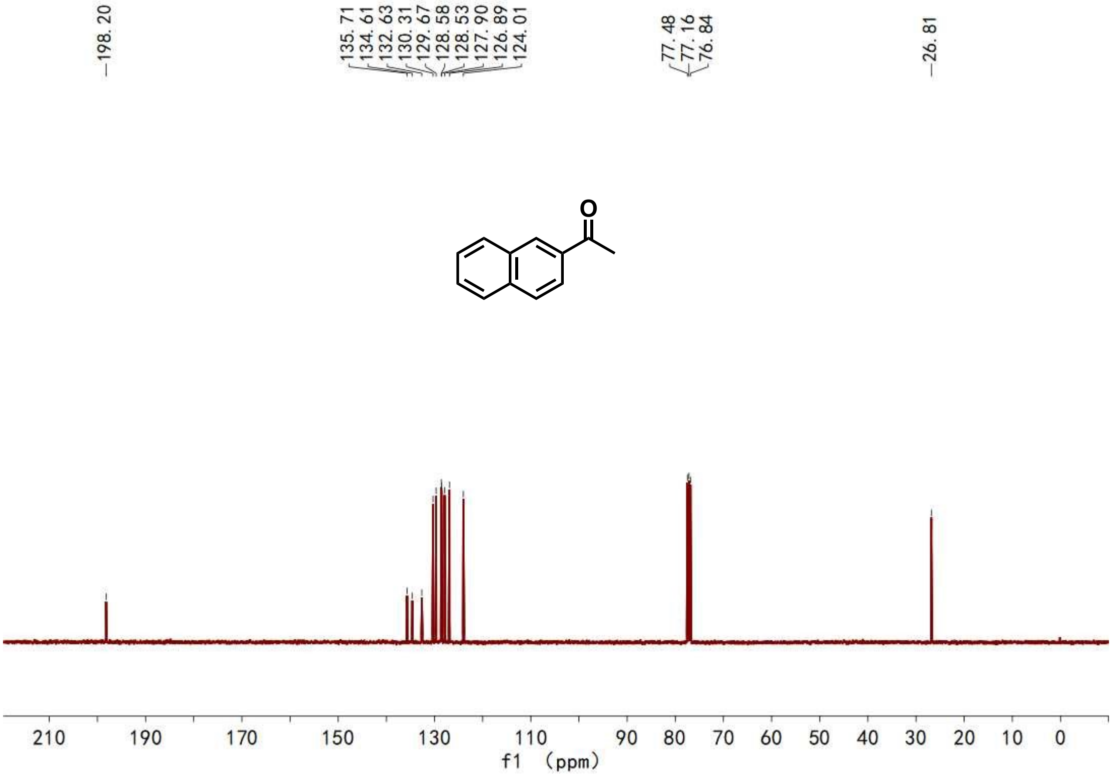
1-(3-Methoxyphenyl)ethan-1-one (31): ^{13}C NMR (101 MHz, CDCl$_3$)



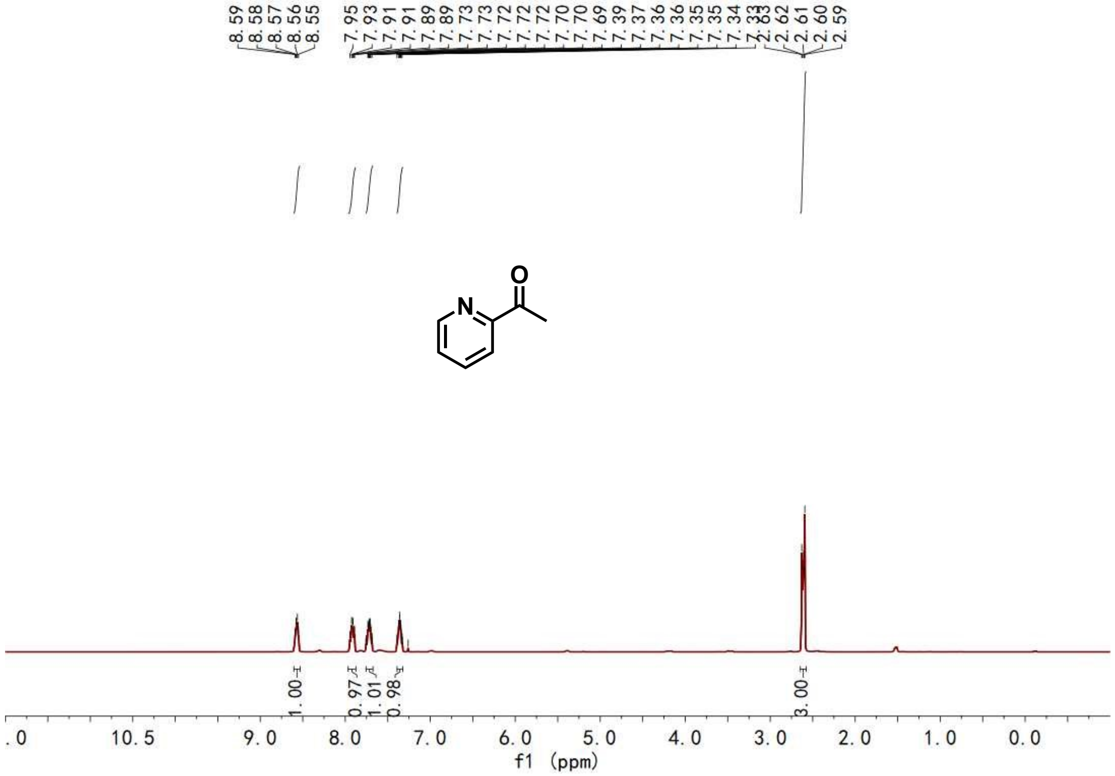
1-(Naphthalen-2-yl)ethan-1-one (32): ^{1}H NMR (400 MHz, CDCl$_3$)



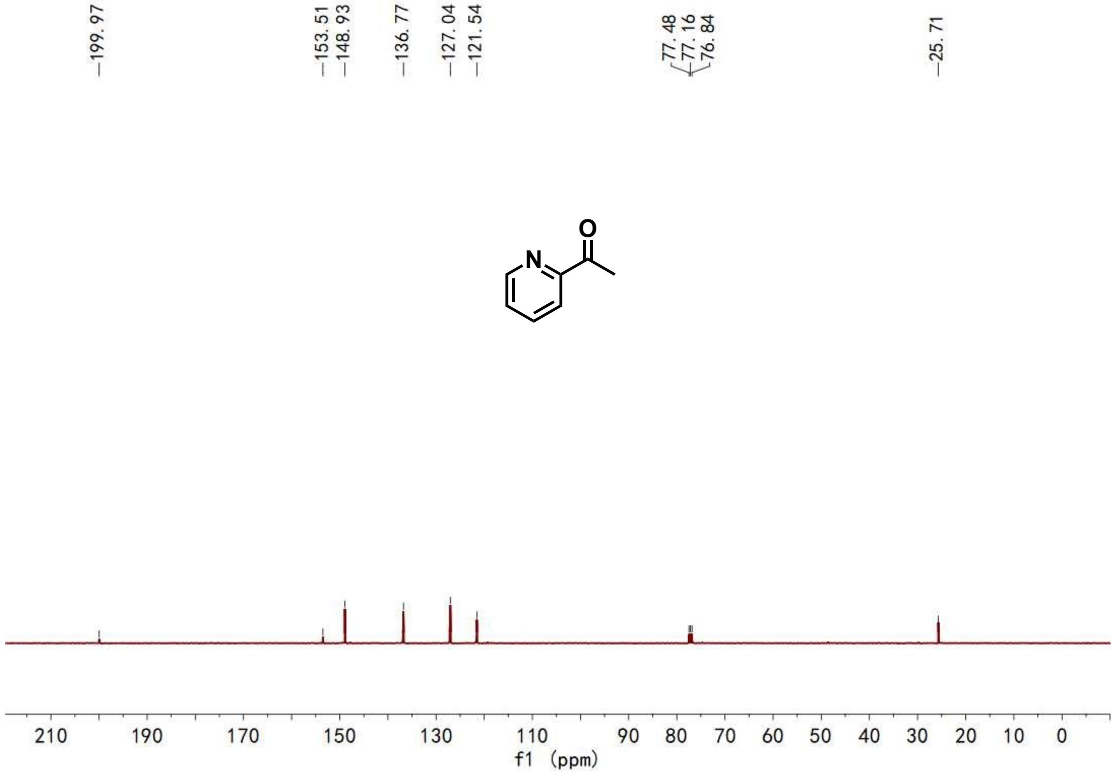
1-(Naphthalen-2-yl)ethan-1-one (32): ^{13}C NMR (101 MHz, CDCl$_3$)



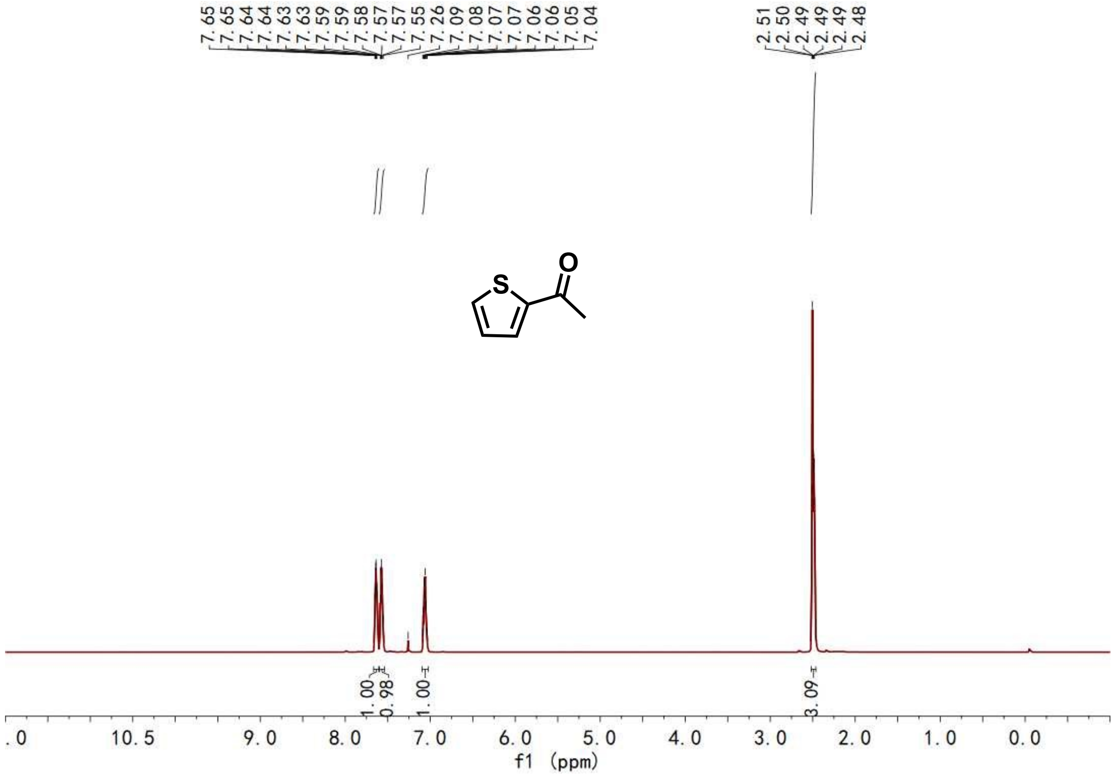
1-(Pyridin-2-yl)ethan-1-one (33): ^{1}H NMR (400 MHz, $CDCl_3$)



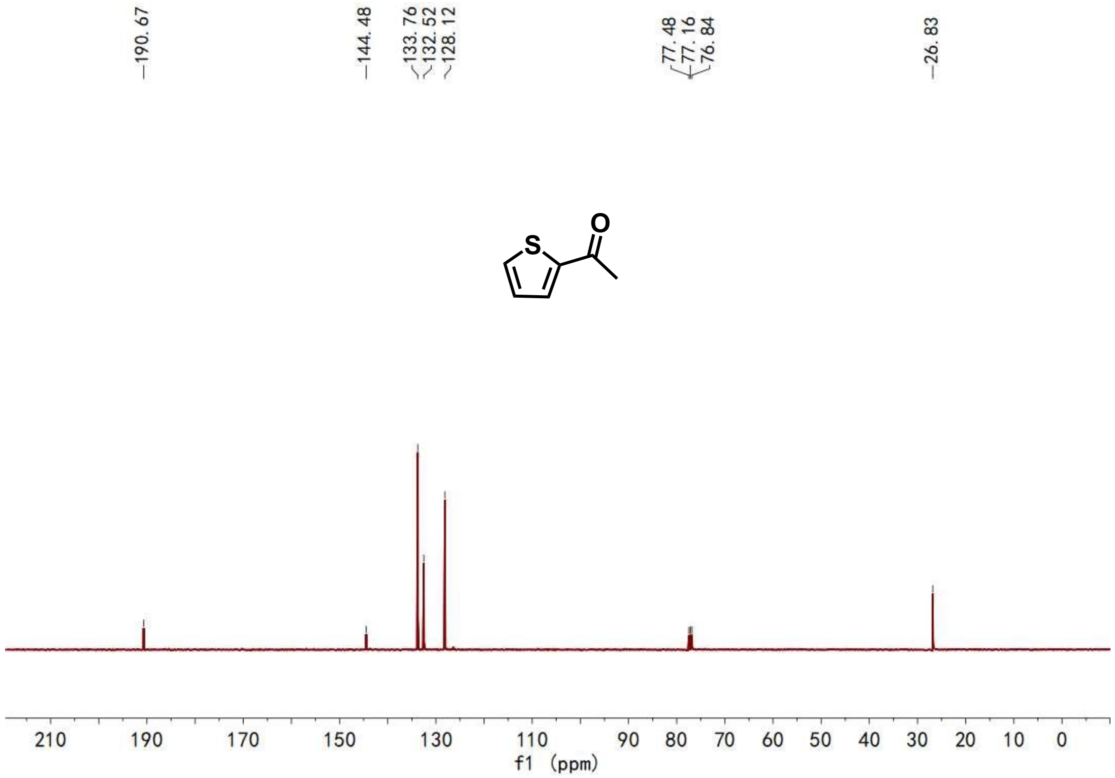
1-(Pyridin-2-yl)ethan-1-one (33): ^{13}C NMR (101 MHz, $CDCl_3$)



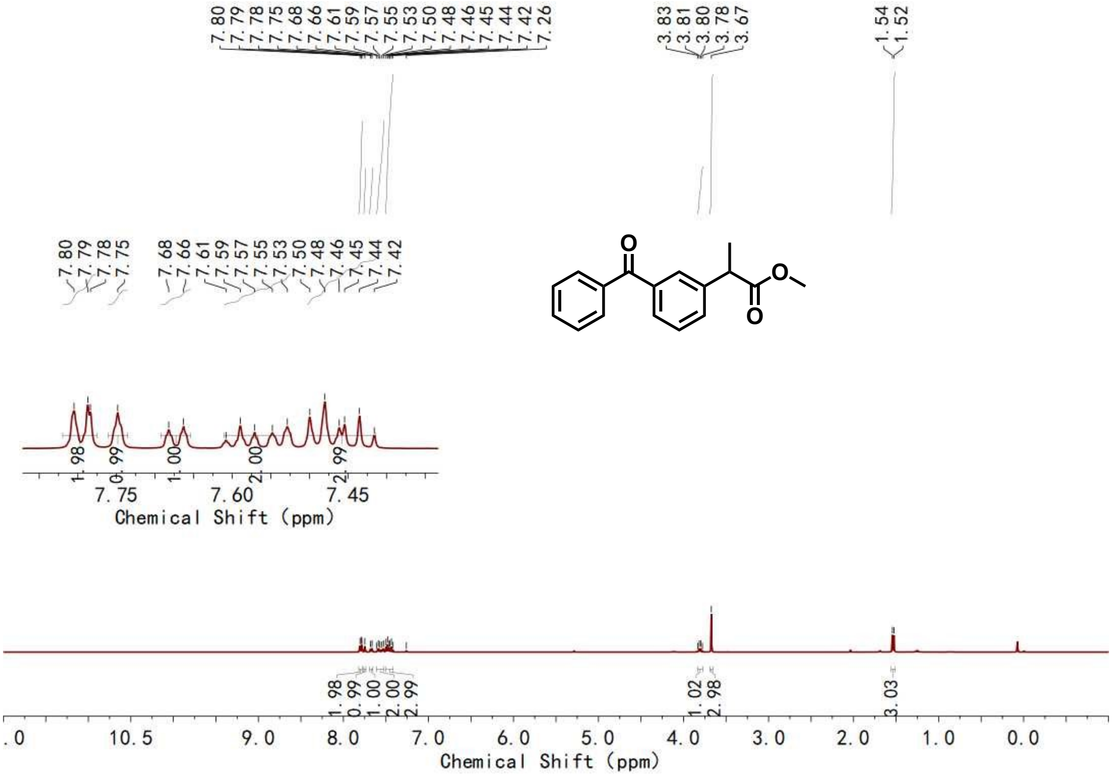
1-(Thiophen-2-yl)ethan-1-one (34): ^{1}H NMR (400 MHz, CDCl$_3$)



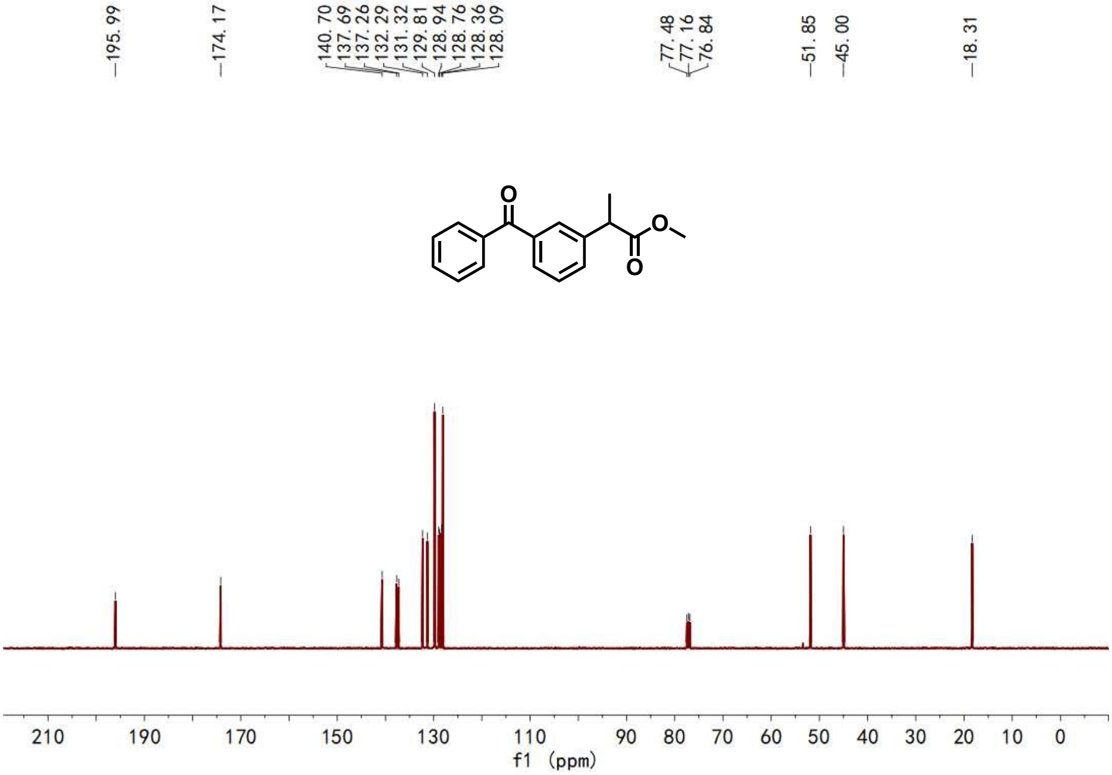
1-(Thiophen-2-yl)ethan-1-one (34): ^{13}C NMR (101 MHz, CDCl$_3$)



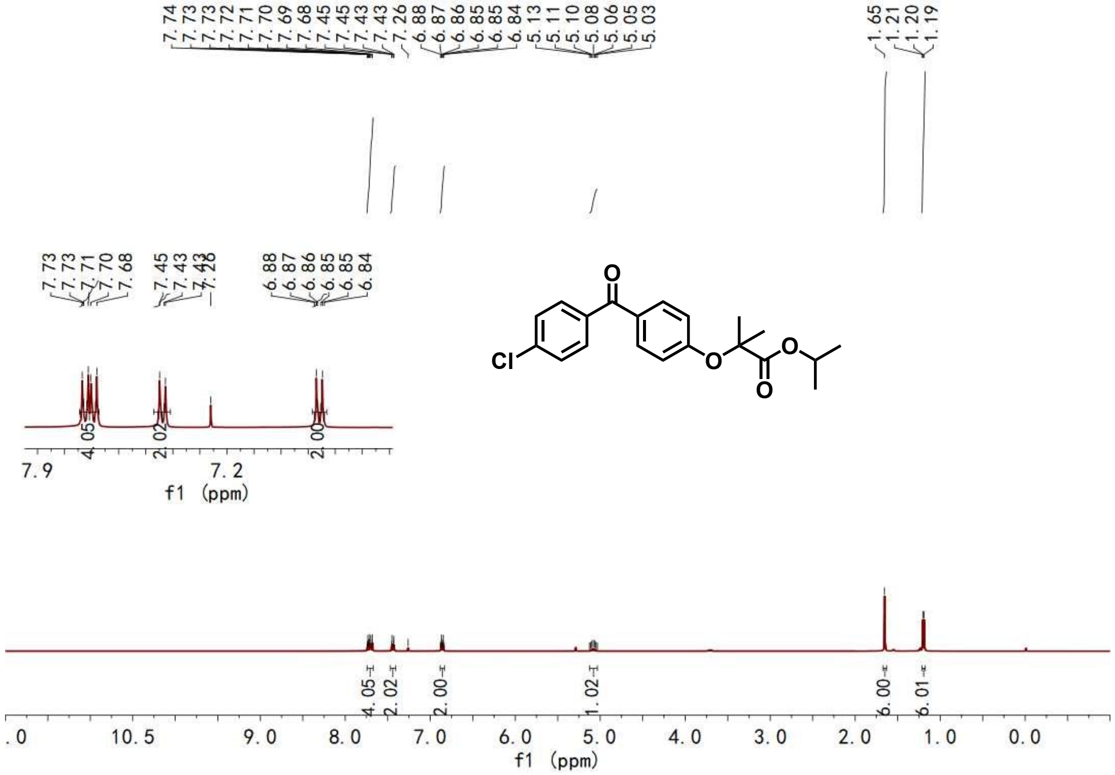
Methyl 2-(3-benzoylphenyl)propanoate (35, ketoprofen methyl ester) : ^{1}H NMR (400 MHz, CDCl$_3$)



Methyl 2-(3-benzoylphenyl)propanoate (35, ketoprofen methyl ester) : ^{13}C NMR (101 MHz, CDCl$_3$)



Isopropyl 2-(4-(4-chlorobenzoyl)phenoxy)-2-methylpropanoate (36, fenofibrate): ^{1}H NMR (400 MHz, CDCl$_3$)



Isopropyl 2-(4-(4-chlorobenzoyl)phenoxy)-2-methylpropanoate (36, fenofibrate): ^{13}C NMR (101 MHz, CDCl$_3$)