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Supporting Information

Palladium-Catalyzed Reductive Cyclization of *ortho*-Vinyl Benzoic Acids to Access 1-Indanones

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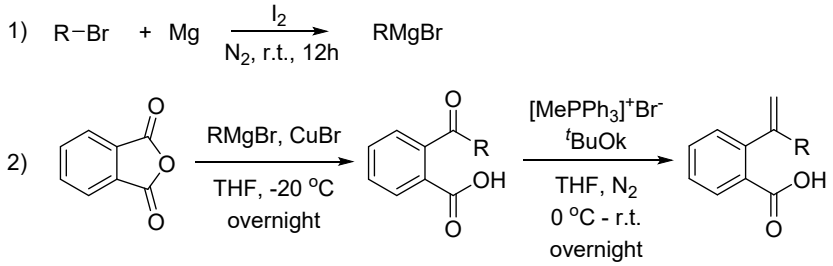
1. General Information.

The reactions were carried out in Schlenk tubes of 25 mL under N_2 atmosphere. All heating and stirring were conducted on the IKA (Model: RCT B S025). Reagents were used as received unless otherwise noted, and solvents were purified according to standard operation procedure. Column chromatography was performed using Silica Gel 60 (300–400 mesh). The reactions were monitored by GC and GC-MS. GC-MS results were recorded on GC-MS QP2010, and GC analysis was performed on GC 2010 plus. The ^{1}H, ^{13}C and ^{19}F NMR spectra were recorded on a Brucker ADVANCE III spectrometer at 400 MHz, 100 MHz, and 376 MHz, respectively, and chemical shifts were reported in parts per million (ppm) with deuterated chloroform as solvent. All solvents and reagents were purchased from Energy Chemical, Alfa Aesar, and Aladdin.

2. General Procedure for the Preparation of the Starting Material

2.1 Synthesis of 2-(1-phenylvinyl)benzoic acids (1a–21a):

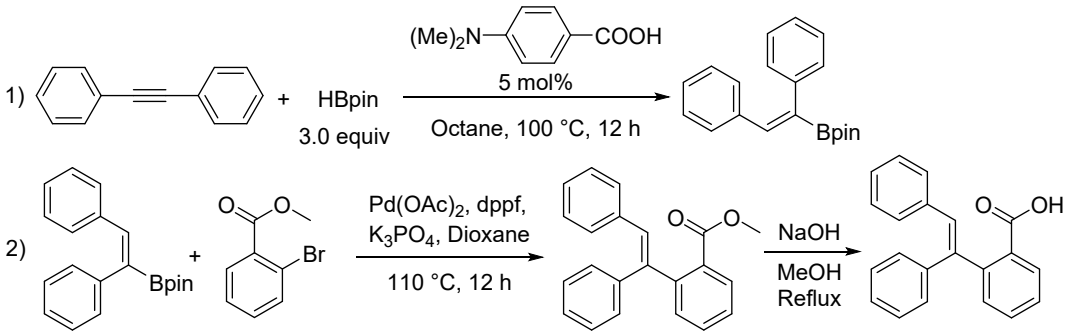


1) Add activated magnesium chip (5.5 mmol, 1.1 equiv., 132 mg) and iodine particles to a dry and anhydrous 100 mL three-necked bottle, and exchange air three times with nitrogen gas. Subsequently, ultra dry THF (0.1 mL) and half of bromobenzene (5.0 mmol, 1.0 equiv., 785 mg) were added using a syringe in a nitrogen atmosphere. Observe the reaction mixture from brown to colorless, and add the remaining bromobenzene and THF (10.0 mL). After 12 hours of reaction, until the magnesium chips were completely consumed, the corresponding phenylmagnesium bromide reagent was obtained. Finally, the concentration of the reagent was measured by titration to be approximately 1.0 M.

2) To a flame-dried flask under a nitrogen atmosphere, phthalic anhydride (1.0 equiv), copper bromide (0.07 equiv), and anhydrous THF (1.0 M) were added. The resulting suspension was cooled down to -20 °C and a solution of ArMgBr (1.1 equiv) in THF (1.0 M) was added dropwise. The reaction mixture was stirred overnight at -20 °C, then allowed to warm to room temperature, quenched with water, basified with aqueous NaOH (3.0 M) until pH 12–14 and washed with diethyl ether. The

resulting aqueous phase was acidified with aqueous HCl (2.0 M) until pH 1–2 and extracted twice with ethyl acetate. The combined organic layers were washed with water, brine, dried over Na_2SO_4, filtered, and concentrated in vacuo. The crude product was dissolved in DCM, and the solid was filtered off. The crude benzoic acid derivative was used for the next step without further purification. Potassium *tert*-butoxide (3.0 equiv) was added portionwise to a stirred suspension of methyl-triphenyl phosphine bromide (**1a**–**19a**) or ethyl-triphenyl phosphine bromide (**20a, 21a**) (3.0 equiv) in THF (1.0 M) under N_2 at room temperature. The mixture was stirred for 1 hour, and then a solution of 2-ketobenzoic acid (1.0 equiv) in THF (3.0 M) was added dropwise. The resulting reaction mixture was stirred overnight at room temperature, quenched with water, basified with aqueous NaOH (3.0 M) until pH 12–14, and washed with diethyl ether. The resulting aqueous phase was acidified with aqueous HCl (2.0 M) until pH 1–2 and extracted twice with ethyl acetate. The combined organic layers were washed with water, brine, dried over Na_2SO_4, filtered, and concentrated in vacuo. The resulting crude product was purified by flash column chromatography (SiO_2) to afford the desired unsaturated benzoic acid derivative.

2.2 Synthesis of 2-(1,2-diphenylvinyl) benzoic acid (**22a**):

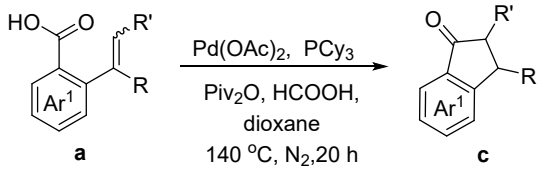


1) Diphenylacetylene (20.0 mmol) and 4-dimethylaminobenzoic acid (5 mol%) was added to a solution of pinacolborane (60.0 mmol, 3.0 equiv) in Octane (50.0 mL) at 100 °C stirred for 12 h under N_2. Purification of product vinyl-Bpin by recrystallization in *n*-hexane.

2) An oven-dried 100 mL Schlenk tube was charged with methyl 2-bromobenzoate (1.0 equiv, 20 mmol), vinyl-Bpin (2.0 equiv, 40.0 mmol), $Pd(OAc)_2$ (10 mol%, 2.0 mmol) dppf (20 mol%, 4.0 mmol), K_3PO_4 (3.0 equiv, 60.0 mmol). After charging N_2 for three times, dioxane (30.0 mL) was added. The reaction mixture was heated at 110 °C for 12 hours. After completion of the reaction, the reaction mixture was concentrated under vacuum. The desired product was isolated by column chromatography over silica gel (300–400 mesh) using petroleum ether as eluent. The crude product was purified by

PTLC eluting with petroleum ether. To a solution of the methyl ester (1.0 equiv) in MeOH (0.2 M) was added NaOH (2.0 equiv per ester) in water (0.2 M) at room temperature. The reaction mixture was allowed to stir under reflux for 12 h. Once the reaction appeared complete by TLC analysis, MeOH was evaporated from the reaction mixture, the resultant solution was cooled to 0 °C and acidified to pH 2.0 w 2.0 M aq HCl. The resultant precipitated product was collected by vacuum filtration and washed with water.

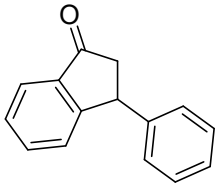
2.3 General experimental procedure for the synthesis of 1-indanones.



An oven-dried 25 mL Schlenk tube was charged with 2-(1-phenylvinyl)benzoic acids (0.2 mmol, 1.0 equiv), $Pd(OAc)_2$ (0.01 mmol, 5 mol%) and PCy_3 (0.02 mmol, 10 mol%). After charging N_2 for three times, dioxane (2.0 mL), Piv_2O (0.3 mmol, 1.5 equiv) and HCOOH (0.4 mmol, 2.0 equiv) were added. The reaction mixture was heated at 140 °C for 20 hours. After completion of the reaction, the reaction mixture was concentrated under a vacuum. The desired product was isolated by column chromatography over silica gel (300–400 mesh) using ethyl acetate/petroleum ether as eluent.

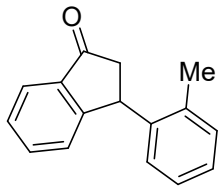
3. Characterization Data for the Products.

3-phenyl-2,3-dihydro-1*H*-inden-1-one 1c



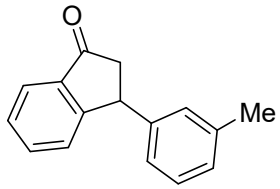
The representative general procedure mentioned above was followed. The desired product **1c** was isolated by column chromatography over silica gel and eluted with PE/EtOAc (20/1, R_f = 0.5) as a colorless liquid in 84% yield (34.53 mg) ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.81 (d, *J* = 7.7 Hz, 1H), 7.60–7.51 (m, 1H), 7.40 (t, *J* = 7.4 Hz, 1H), 7.35–7.21 (m, 4H), 7.12 (dd, *J* = 7.2, 1.7 Hz, 2H), 4.57 (dd, *J* = 8.1, 3.9 Hz, 1H), 3.22 (ddd, *J* = 19.3, 8.1, 1.1 Hz, 1H), 2.68 (ddd, *J* = 19.2, 3.9, 1.0 Hz, 1H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 206.0, 158.0, 143.7, 136.8, 135.1, 128.9, 127.9, 127.7, 127.0, 126.9, 123.4, 46.9, 44.5. This compound is known[1].

3-(*o*-tolyl)-2,3-dihydro-1*H*-inden-1-one 2c



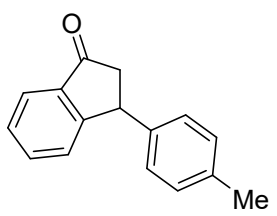
The representative general procedure mentioned above was followed. The desired product **2c** was isolated by column chromatography over silica gel and eluted with PE/EtOAc (20/1, R_f = 0.4) as a yellow liquid in 79% yield (35.08 mg). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.83 (d, *J* = 7.7 Hz, 1H), 7.59 (td, *J* = 7.5, 1.2 Hz, 1H), 7.43 (t, *J* = 7.4 Hz, 1H), 7.30 (d, *J* = 7.7 Hz, 1H), 7.22 (dd, *J* = 7.6, 1.5 Hz, 1H), 7.11 (dtd, *J* = 26.8, 7.4, 1.5 Hz, 2H), 6.77 (d, *J* = 7.7 Hz, 1H), 4.83 (dd, *J* = 8.1, 3.9 Hz, 1H), 3.25 (dd, *J* = 19.1, 8.1 Hz, 1H), 2.57 (dd, *J* = 19.1, 3.9 Hz, 1H), 2.43 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 206.2, 157.9, 137.2, 135.9, 135.1, 130.6, 127.9, 127.0, 126.8, 126.6, 123.6, 45.9, 20.0. This compound is known[1].

4-(*m*-tolyl)-2,3-dihydro-1*H*-inden-1-one 3c



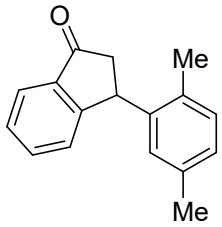
The representative general procedure mentioned above was followed. The desired product **3c** was isolated by column chromatography over silica gel and eluted with PE/EtOAc (20/1, R_f = 0.4) as a yellow liquid in 80% yield (35.52 mg). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.80 (dd, *J* = 7.7, 1.3 Hz, 1H), 7.61–7.52 (m, 1H), 7.41 (t, *J* = 7.3 Hz, 1H), 7.29 (d, *J* = 7.7 Hz, 1H), 7.23 (t, *J* = 7.9 Hz, 1H), 6.79 (dd, *J* = 8.3, 2.6 Hz, 1H), 6.71 (dd, *J* = 7.5, 1.5 Hz, 1H), 6.66 (t, *J* = 2.2 Hz, 1H), 4.55 (dd, *J* = 8.1, 3.8 Hz, 1H), 3.76 (d, *J* = 0.8 Hz, 3H), 3.27 – 3.16 (m, 1H), 2.69 (dd, *J* = 19.2, 3.8 Hz, 1H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 206.1, 160.0, 157.8, 145.3, 136.7, 135.1, 130.0, 127.9, 126.9, 123.4, 120.0, 113.7, 112.0, 55.2, 46.7, 44.4. This compound is known[2].

4-(*p*-tolyl)-2,3-dihydro-1*H*-inden-1-one 4c



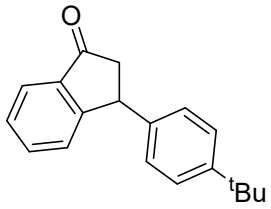
The representative general procedure mentioned above was followed. The desired product **4c** was isolated by column chromatography over silica gel and eluted with PE/EtOAc (20/1, R_f = 0.4) as a yellow liquid in 82% yield (36.41 mg).^{1}H NMR (400 MHz, $CDCl_3$) δ 7.84 (dt, *J* = 7.7, 1.0 Hz, 1H), 7.59 (td, *J* = 7.5, 1.3 Hz, 1H), 7.44 (t, *J* = 7.5 Hz, 1H), 7.30 (dd, *J* = 7.7, 1.1 Hz, 1H), 7.16 (d, *J* = 7.8 Hz, 2H), 7.08–7.02 (m, 2H), 4.58 (dd, *J* = 8.1, 3.8 Hz, 1H), 3.25 (dd, *J* = 19.2, 8.0 Hz, 1H), 2.71 (dd, *J* = 19.2, 3.8 Hz, 1H), 2.36 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 206.2, 158.2, 140.7, 136.7, 136.6, 135.1, 129.6, 127.8, 127.5, 126.9, 123.4, 46.9, 44.1, 21.1. This compound is known[1].

3-(2,5-dimethylphenyl)-2,3-dihydro-1*H*-inden-1-one 5c



The representative general procedure mentioned above was followed. The desired product **5c** was isolated by column chromatography over silica gel and eluted with PE/EtOAc (20/1, R_f = 0.5) as a colorless liquid in 78% yield (36.86 mg) ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.81 (dt, *J* = 7.6, 1.0 Hz, 1H), 7.56 (td, *J* = 7.5, 1.3 Hz, 1H), 7.41 (t, *J* = 7.5 Hz, 1H), 7.28 (dd, *J* = 7.7, 1.0 Hz, 1H), 6.88 (d, *J* = 1.9 Hz, 1H), 6.73 (d, *J* = 1.7 Hz, 2H), 4.49 (dd, *J* = 8.0, 3.8 Hz, 1H), 3.19 (dd, *J* = 19.2, 8.0 Hz, 1H), 2.68 (dd, *J* = 19.2, 3.8 Hz, 1H), 2.26 (s, 6H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 206.3, 158.2, 143.6, 138.5, 136.7, 135.1, 128.6, 127.8, 126.9, 125.4, 123.4, 46.9, 44.4, 21.3. HRMS (ESI) calcd for $C_{17}H_{17}O$ $[M+H]^+$: 237.1274, found: 237.1265.

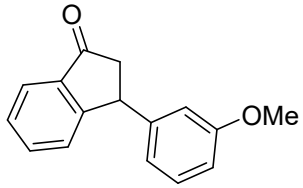
4-3-(4-(tert-butyl)phenyl)-2,3-dihydro-1*H*-inden-1-one 6c



The representative general procedure mentioned above was followed. The desired product **6c** was isolated by column chromatography over silica gel and eluted with petroleum ether/EtOAc (20/1, R_f = 0.45) as a colorless liquid in 75% yield (39.60 mg). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.80 (d, *J* = 7.7 Hz, 1H), 7.56 (dd, *J* = 8.2, 6.8 Hz, 1H), 7.40 (t, *J* = 7.4 Hz, 1H), 7.35–7.26 (m, 3H), 7.08–7.02 (m, 2H), 4.55 (dd, *J* = 8.1, 3.8 Hz, 1H), 3.21 (ddd, *J* = 19.2, 8.0, 1.1 Hz, 1H), 2.69 (ddd, *J* = 19.2, 3.9, 1.1 Hz,

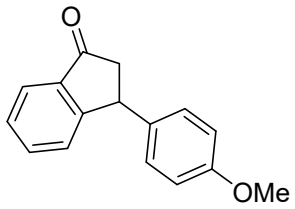
1H), 1.30 (d, *J* = 1.2 Hz, 9H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 206.4, 158.2, 149.8, 140.5, 136.7, 135.1, 127.8, 127.3, 127.0, 125.8, 123.4, 46.9, 44.0, 34.5, 31.4. This compound is known[4].

4-(3-methoxyphenyl)-2,3-dihydro-1*H*-inden-1-one 7c



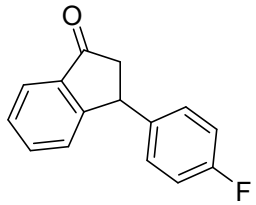
The representative general procedure mentioned above was followed. The desired product **7c** was isolated by column chromatography over silica gel and eluted with petroleum ether/EtOAc (20/1, Rf = 0.55) as a white liquid in 76% yield (36.18 mg). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.85 (d, *J* = 7.7 Hz, 1H), 7.60 (td, *J* = 7.5, 1.3 Hz, 1H), 7.45 (t, *J* = 7.4 Hz, 1H), 7.34 – 7.29 (m, 1H), 7.24 (t, *J* = 8.0 Hz, 1H), 7.12 – 7.08 (m, 1H), 6.99 – 6.94 (m, 2H), 4.58 (dd, *J* = 8.1, 3.8 Hz, 1H), 3.25 (dd, *J* = 19.2, 8.0 Hz, 1H), 2.73 (dd, *J* = 19.2, 3.8 Hz, 1H), 2.35 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 206.2, 158.1, 143.7, 138.6, 136.8, 135.1, 128.8, 128.4, 127.9, 126.9, 124.8, 123.4, 46.9, 44.5, 21.5. This compound is known[1].

3-3-(4-methoxyphenyl)-2,3-dihydro-1*H*-inden-1-one 8c



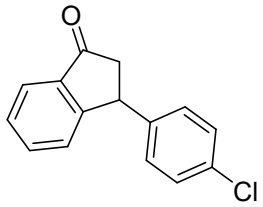
The representative general procedure mentioned above was followed. The desired product **8c** was isolated by column chromatography over silica gel and eluted with PE/EtOAc (20/1, R_f = 0.45) as a yellow liquid in 55% yield (26.18 mg). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.80 (d, *J* = 7.7 Hz, 1H), 7.57 (t, *J* = 7.5 Hz, 1H), 7.41 (t, *J* = 7.5 Hz, 1H), 7.27 (d, *J* = 7.3 Hz, 1H), 7.04 (d, *J* = 8.2 Hz, 2H), 6.85 (d, *J* = 8.4 Hz, 2H), 4.53 (dd, *J* = 8.1, 3.9 Hz, 1H), 3.79 (d, *J* = 1.2 Hz, 3H), 3.22 (dd, *J* = 19.2, 8.0 Hz, 1H), 2.65 (dd, *J* = 19.2, 3.9 Hz, 1H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 206.2, 158.6, 158.3, 136.7, 135.8, 135.1, 128.6, 127.8, 126.8, 123.3, 114.3, 55.3, 47.0, 43.7. This compound is known[1].

5-(4-fluorophenyl)-2,3-dihydro-1*H*-inden-1-one 9c



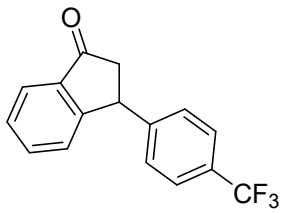
The representative general procedure mentioned above was followed. The desired product **9c** was isolated by column chromatography over silica gel and eluted with PE/EtOAc (20/1, R_f = 0.45) as a pale yellow liquid in 81% yield (36.61 mg). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.81 (d, *J* = 7.7 Hz, 1H), 7.58 (t, *J* = 7.5 Hz, 1H), 7.43 (t, *J* = 7.5 Hz, 1H), 7.25 (d, *J* = 7.7 Hz, 1H), 7.14–7.04 (m, 2H), 7.00 (t, *J* = 8.6 Hz, 2H), 4.57 (dd, *J* = 8.1, 3.9 Hz, 1H), 3.23 (dd, *J* = 19.2, 8.1 Hz, 1H), 2.64 (dd, *J* = 19.2, 3.9 Hz, 1H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 205.7, 161.8 (d, $J_{C\text{-}F}$ = 245.6 Hz), 157.7, 139.5 (d, $J_{C\text{-}F}$ = 3.3 Hz), 136.7, 135.2, 129.1 (d, $J_{C\text{-}F}$ = 8.0 Hz), 128.0, 126.8, 123.5, 115.9, 115.7, 46.9, 43.7; ^{19}F NMR (376 MHz, $CDCl_3$) δ -115.68. This compound is known[1].

3-(4-chlorophenyl)-2,3-dihydro-1*H*-inden-1-one 10c



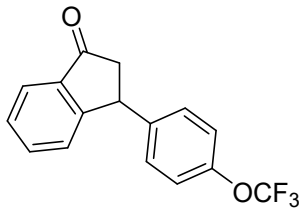
The representative general procedure mentioned above was followed. The desired product **10c** was isolated by column chromatography over silica gel and eluted with PE/EtOAc (20/1, R_f = 0.5) as a colorless liquid in 76% yield (36.90 mg).^{1}H NMR (400 MHz, $CDCl_3$) δ 7.82 (d, *J* = 7.7 Hz, 1H), 7.58 (t, *J* = 7.4 Hz, 1H), 7.43 (t, *J* = 7.5 Hz, 1H), 7.32–7.23 (m, 3H), 7.09–7.03 (m, 2H), 4.56 (dd, *J* = 8.1, 3.9 Hz, 1H), 3.23 (dd, *J* = 19.2, 8.1 Hz, 1H), 2.63 (dd, *J* = 19.2, 3.9 Hz, 1H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 205.5, 157.4, 142.2, 136.8, 135.2, 132.8, 129.1, 129.0, 128.1, 126.8, 46.7, 43.8. This compound is known[2].

4-(4-(trifluoromethyl)phenyl)-2,3-dihydro-1*H*-inden-1-one 11c



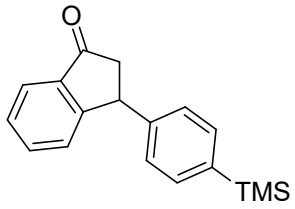
The representative general procedure mentioned above was followed. The desired product **11c** was isolated by column chromatography over silica gel and eluted with PE/EtOAc (20/1, R_f = 0.55) as a pale yellow liquid in 64% yield (35.33 mg).^{1}H NMR (400 MHz, $CDCl_3$) δ 7.84 (dt, *J* = 7.7, 1.0 Hz, 1H), 7.64–7.54 (m, 3H), 7.50–7.41 (m, 1H), 7.26 (s, 3H), 4.66 (dd, *J* = 8.2, 3.8 Hz, 1H), 3.26 (dd, *J* = 19.2, 8.2 Hz, 1H), 2.67 (dd, *J* = 19.2, 3.9 Hz, 1H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 205.2, 156.9, 147.8 (d, J_{C-F} = 1.8 Hz), 136.8, 135.3, 129.4 (q, J_{C-F} = 32.4 Hz), 128.3, 128.1, 126.8, 125.9 (q, J_{C-F} = 3.8 Hz), 125.4, 124.1 (d, J_{C-F} = 270.0 Hz) 123.7, 46.5, 44.2; ^{19}F NMR (376 MHz, $CDCl_3$) δ -62.47. This compound is known[1].

3-(4-(trifluoromethoxy)phenyl)-2,3-dihydro-1*H*-inden-1-one 12c



The representative general procedure mentioned above was followed. The desired product **12c** was isolated by column chromatography over silica gel and eluted with PE/EtOAc (20/1, R_f = 0.5) as a yellow liquid in 63% yield (36.70 mg). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.82 (d, *J* = 7.7 Hz, 1H), 7.59 (td, *J* = 7.5, 1.2 Hz, 1H), 7.44 (t, *J* = 7.5 Hz, 1H), 7.27 (dd, *J* = 7.4, 1.3 Hz, 1H), 7.16 (s, 4H), 4.61 (dd, *J* = 8.1, 3.9 Hz, 1H), 3.24 (dd, *J* = 19.2, 8.1 Hz, 1H), 2.64 (dd, *J* = 19.2, 3.9 Hz, 1H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 205.4, 157.2, 148.1 (q, J_{C-F} = 1.8 Hz), 142.5, 136.8, 135.2, 129.0, 128.2, 126.8, 123.5, 121.4, 120.46 (d, J_{C-F} = 256 Hz), 46.7, 43.8; ^{19}F NMR (376 MHz, $CDCl_3$) δ -57.91. HRMS (ESI) calcd for $C_{16}H_{12}F_3O_2$ $[M+H]^+$: 293.0784, found: 293.0798.

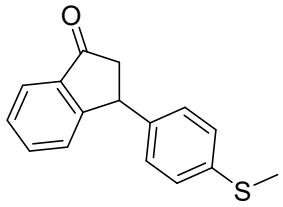
4-(4-(trimethylsilyl)phenyl)-2,3-dihydro-1*H*-inden-1-one 13c



The representative general procedure mentioned above was followed. The desired product **13c** was isolated by column chromatography over silica gel and eluted with PE/EtOAc (20/1, R_f = 0.5) as a colorless liquid in 69% yield (38.64 mg). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.71 (d, *J* = 7.7 Hz, 1H), 7.45 (td, *J* = 7.4, 1.2 Hz, 1H), 7.42–7.34 (m, 2H), 7.30 (t, *J* = 7.3 Hz, 1H), 7.17 (d, *J* = 7.7 Hz, 1H), 7.04–

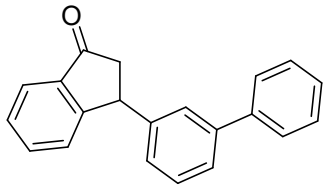
6.98 (m, 2H), 4.46 (dd, *J* = 8.1, 3.8 Hz, 1H), 3.12 (dd, *J* = 19.2, 8.1 Hz, 1H), 2.59 (dd, *J* = 19.2, 3.8 Hz, 1H), 0.15 (s, 9H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 207.1, 159.0, 145.3, 140.1, 137.9, 136.2, 135.0, 129.0, 128.1, 128.0, 124.5, 47.9, 45.5. HRMS (ESI) calcd for $C_{18}H_{21}OSi$ $[M+H]^+$: 281.1356, found: 281.1366.

3-(4-(methylthio)phenyl)-2,3-dihydro-1*H*-inden-1-one 14c



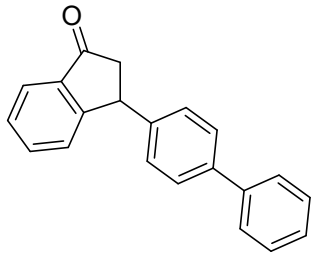
The representative general procedure mentioned above was followed. The desired product **14c** was isolated by column chromatography over silica gel and eluted with PE/EtOAc (20/1, R_f = 0.45) as a colorless liquid in 79% yield (40.13 mg). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.81 (d, *J* = 7.7 Hz, 1H), 7.57 (t, *J* = 7.5 Hz, 1H), 7.42 (t, *J* = 7.4 Hz, 1H), 7.29–7.23 (m, 1H), 7.23–7.17 (m, 2H), 7.08–7.01 (m, 2H), 4.54 (dd, *J* = 8.1, 3.8 Hz, 1H), 3.22 (ddd, *J* = 19.2, 8.0, 1.1 Hz, 1H), 2.65 (ddd, *J* = 19.2, 3.9, 1.1 Hz, 1H), 2.47 (d, *J* = 1.1 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 206.0, 157.8, 140.6, 137.1, 136.7, 135.2, 128.2, 128.0, 127.1, 126.8, 123.5, 46.8, 43.9, 15.9. HRMS (ESI) calcd for $C_{16}H_{15}OS$ $[M+H]^+$: 255.0838, found: 255.0835.

3-([1,1'-biphenyl]-3-yl)-2,3-dihydro-1*H*-inden-1-one 15c



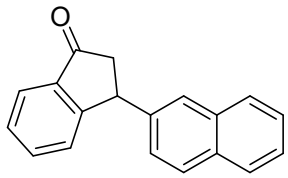
The representative general procedure mentioned above was followed. The desired product **15c** was isolated by column chromatography over silica gel and eluted with PE/EtOAc (20/1, R_f = 0.5) as a yellow liquid in 75% yield (42.60 mg). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.81 (d, *J* = 7.7 Hz, 1H), 7.59–7.26 (m, 11H), 7.10–7.04 (m, 1H), 4.61 (dd, *J* = 8.1, 3.8 Hz, 1H), 3.24 (ddd, *J* = 19.3, 8.1, 1.3 Hz, 1H), 2.74 (ddd, *J* = 19.2, 3.8, 1.2 Hz, 1H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 206.1, 157.9, 144.3, 142.0, 140.9, 136.8, 135.2, 129.4, 128.9, 128.0, 127.6, 127.2, 127.0, 126.6, 125.9, 123.5, 46.9, 44.6. HRMS (ESI) calcd for $C_{21}H_{17}O$ $[M+H]^+$: 285.1274, found: 285.1275.

5-([1,1'-biphenyl]-4-yl)-2,3-dihydro-1*H*-inden-1-one 16c



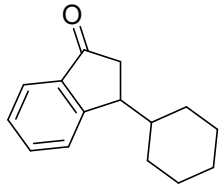
The representative general procedure mentioned above was followed. The desired product **16c** was isolated by column chromatography over silica gel and eluted with PE/EtOAc (20/1, R_f = 0.5) as a yellow liquid in 79% yield (44.87 mg). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.73 (d, *J* = 7.7 Hz, 1H), 7.52–7.40 (m, 5H), 7.32 (t, *J* = 7.5 Hz, 3H), 7.27–7.18 (m, 2H), 7.12–7.05 (m, 2H), 4.51 (dd, *J* = 8.1, 3.8 Hz, 1H), 3.15 (dd, *J* = 19.2, 8.1 Hz, 1H), 2.62 (dd, *J* = 19.2, 3.8 Hz, 1H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 206.1, 157.9, 144.3, 142.0, 140.9, 136.8, 135.2, 129.4, 128.9, 128.0, 127.6, 127.2, 127.0, 126.6, 125.9, 123.5, 46.9, 44.6. This compound is known[4]

3-(naphthalen-2-yl)-2,3-dihydro-1*H*-inden-1-one 17c



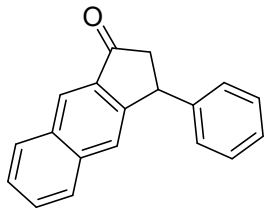
The representative general procedure mentioned above was followed. The desired product **17c** was isolated by column chromatography over silica gel and eluted with PE/EtOAc (20/1, R_f = 0.38) as a colorless liquid in 80% yield (41.32 mg).^{1}H NMR (400 MHz, $CDCl_3$) δ 7.84 (d, *J* = 7.7 Hz, 1H), 7.81–7.72 (m, 3H), 7.64 (d, *J* = 1.8 Hz, 1H), 7.52 (t, *J* = 7.4 Hz, 1H), 7.49–7.36 (m, 3H), 7.25 (d, *J* = 7.7 Hz, 1H), 7.11 (dd, *J* = 8.5, 1.8 Hz, 1H), 4.69 (dd, *J* = 8.1, 3.9 Hz, 1H), 3.26 (dd, *J* = 19.3, 8.0 Hz, 1H), 2.76 (dd, *J* = 19.2, 3.9 Hz, 1H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 206.0, 157.9, 140.9, 136.9, 135.2, 133.5, 132.5, 129.0, 128.0, 127.8, 127.7, 127.0, 126.5, 126.0, 125.5, 123.5, 46.7, 44.6. HRMS (ESI) calcd for $C_{19}H_{15}O$ $[M+H]^+$: 259.1117, found: 259.1114.

3-cyclohexyl-2,3-dihydro-1*H*-inden-1-one 18c



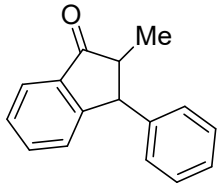
The representative general procedure mentioned above was followed. The desired product **18c** was isolated by column chromatography over silica gel and eluted with PE/EtOAc (20/1, R_f = 0.45) as a yellow liquid in 64% yield (27.40 mg). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.72 (d, *J* = 7.7 Hz, 1H), 7.59 (t, *J* = 7.4 Hz, 1H), 7.50 (d, *J* = 7.7 Hz, 1H), 7.36 (t, *J* = 7.4 Hz, 1H), 3.38 (dt, *J* = 7.5, 3.5 Hz, 1H), 2.68 (dd, *J* = 19.1, 7.7 Hz, 1H), 2.51 (dd, *J* = 19.1, 3.0 Hz, 1H), 1.91–1.62 (m, 5H), 1.35–0.84 (m, 6H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 206.9, 157.6, 137.4, 134.5, 127.4, 126.0, 123.4, 43.8, 42.0, 39.6, 31.7, 27.2, 26.6, 26.4, 26.2. HRMS (ESI) calcd for $C_{15}H_{19}O$ $[M+H]^+$: 2215.1430, found: 215.1440.

4-phenyl-2,3-dihydro-1*H*-cyclopenta[a]naphthalen-1-one 19c



The representative general procedure mentioned above was followed. The desired product **19c** was isolated by column chromatography over silica gel and eluted with PE/EtOAc (20/1, R_f = 0.45) as a colorless liquid in 78% yield (38.7 mg). ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.38 (s, 1H), 8.01 (d, *J* = 8.1 Hz, 1H), 7.76 (d, *J* = 8.1 Hz, 1H), 7.68 (s, 1H), 7.59–7.46 (m, 2H), 7.37–7.15 (m, 5H), 4.74 (dd, *J* = 8.7, 4.8 Hz, 1H), 3.34 (ddd, *J* = 19.3, 8.6, 1.2 Hz, 1H), 2.81 (ddd, *J* = 19.3, 4.7, 1.2 Hz, 1H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 206.3, 151.3, 144.4, 137.4, 134.4, 132.6, 130.4, 129.0, 128.7, 128.1, 127.8, 127.0, 126.5, 125.5, 124.2, 47.6, 44.2. This compound is known[5].

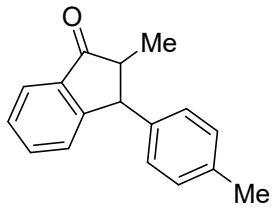
2-methyl-3-phenyl-2,3-dihydro-1*H*-inden-1-one 20c



The representative general procedure mentioned above was followed. The desired product **20c** was isolated by column chromatography over silica gel and eluted with PE/EtOAc (20/1, R_f = 0.45) as a colorless liquid in 75% yield (33.3 mg). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.82 (d, *J* = 7.8 Hz, 1H), 7.57 (t, *J* = 7.5 Hz, 1H), 7.43 (t, *J* = 7.4 Hz, 1H), 7.35 (t, *J* = 7.3 Hz, 2H), 7.30–7.22 (m, 2H), 7.17 (d, *J* = 7.3 Hz, 2H), 4.04 (d, *J* = 5.1 Hz, 1H), 2.65 (tt, *J* = 6.7, 5.1 Hz, 1H), 1.38 (d, *J* = 7.4 Hz, 3H); ^{13}C NMR

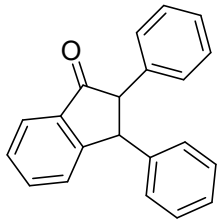
(100 MHz, $CDCl_3$) δ 207.9, 156.1, 142.8, 136.3, 135.1, 128.9, 128.0, 128.0, 127.1, 126.5, 123.6, 53.8, 53.6, 14.1. HRMS (ESI) calcd for $C_{16}H_{15}O$ $[M+H]^+$: 223.1117, found: 235.1136.

2-methyl-3-(*p*-tolyl)-2,3-dihydro-1*H*-inden-1-one 21c



The representative general procedure mentioned above was followed. The desired product **21c** was isolated by column chromatography over silica gel and eluted with PE/EtOAc (20/1, Rf = 0.50) as a white liquid in 65% yield (30.7 mg). ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.06 (dd, *J* = 7.8, 1.4 Hz, 1H), 7.67 (td, *J* = 7.5, 1.5 Hz, 1H), 7.52 (tdt, *J* = 7.6, 2.3, 1.3 Hz, 1H), 7.31 – 7.24 (m, 1H), 7.12 (s, 4H), 6.50 (q, *J* = 7.0 Hz, 1H), 2.35 (s, 3H), 2.01 (d, *J* = 7.0 Hz, 1H), 1.65 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 192.7, 144.1, 139.0, 138.0, 137.1, 134.3, 134.2, 131.3, 129.6, 129.2, 127.8, 127.2, 126.3, 125.7, 21.1, 15.8. This compound is known[8].

2,3-diphenyl-2,3-dihydro-1*H*-inden-1-one 22c



The representative general procedure mentioned above was followed. The desired product **22c** was isolated by column chromatography over silica gel and eluted with PE/EtOAc (20/1, R_f = 0.45) as a colorless liquid in 70% yield (39.76 mg). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.89 (d, *J* = 7.7 Hz, 1H), 7.65 (t, *J* = 7.5 Hz, 1H), 7.49 (t, *J* = 7.5 Hz, 1H), 7.30 (dd, *J* = 11.7, 7.0 Hz, 7H), 7.10 (t, *J* = 6.4 Hz, 4H), 4.58 (d, *J* = 4.9 Hz, 1H), 3.81 (d, *J* = 4.8 Hz, 1H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 205.3, 156.2, 142.5, 138.5, 136.2, 135.5, 128.9, 128.9, 128.4, 128.3, 127.9, 127.2, 127.2, 126.7, 124.1, 64.6, 54.9. This compound is known[7].

4. Reference

[1] Parveena, N; Sekara, G. Palladium Nanoparticles-Catalyzed Synthesis of Indanone Derivatives via Intramolecular Reductive Heck Reaction. *Adv. Synth. Catal.* **2019**, *10*, 4581−4595.

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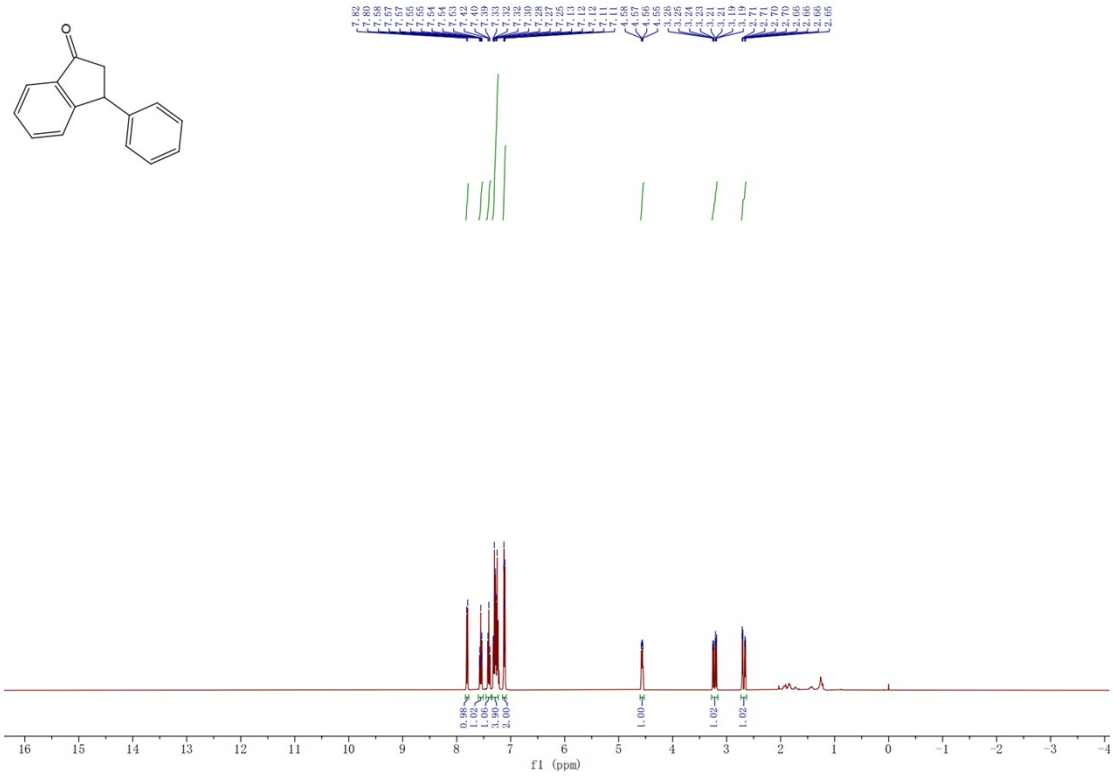
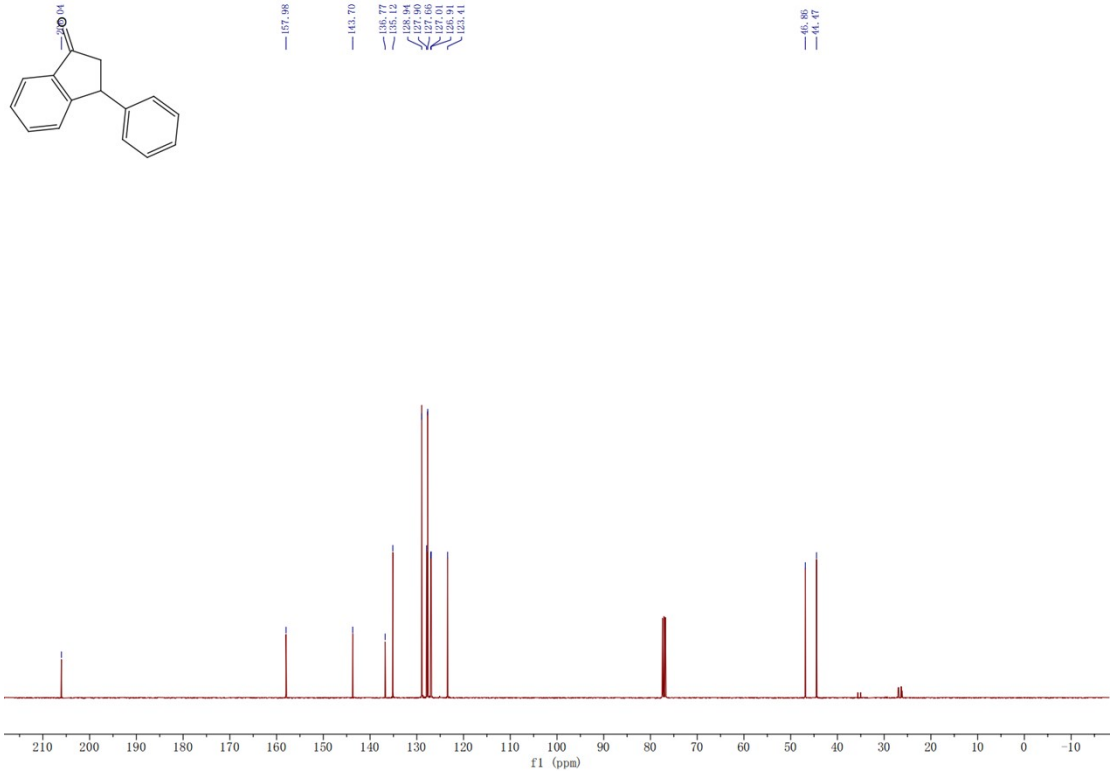
[8] Liu, Y.; Zhao, P.; Zhang, B.; Xi, C.-J. MeOTf-Catalyzed Annulation of Aldehydes and Arylalkynes Leading to 2,3-Disubstituted Indanones. *Org. Chem. Front.* **2016**, *3* , 1116-1119.

5. Copies of ^{1}H, ^{13}C and ^{19}F NMR Spectra of the Products.

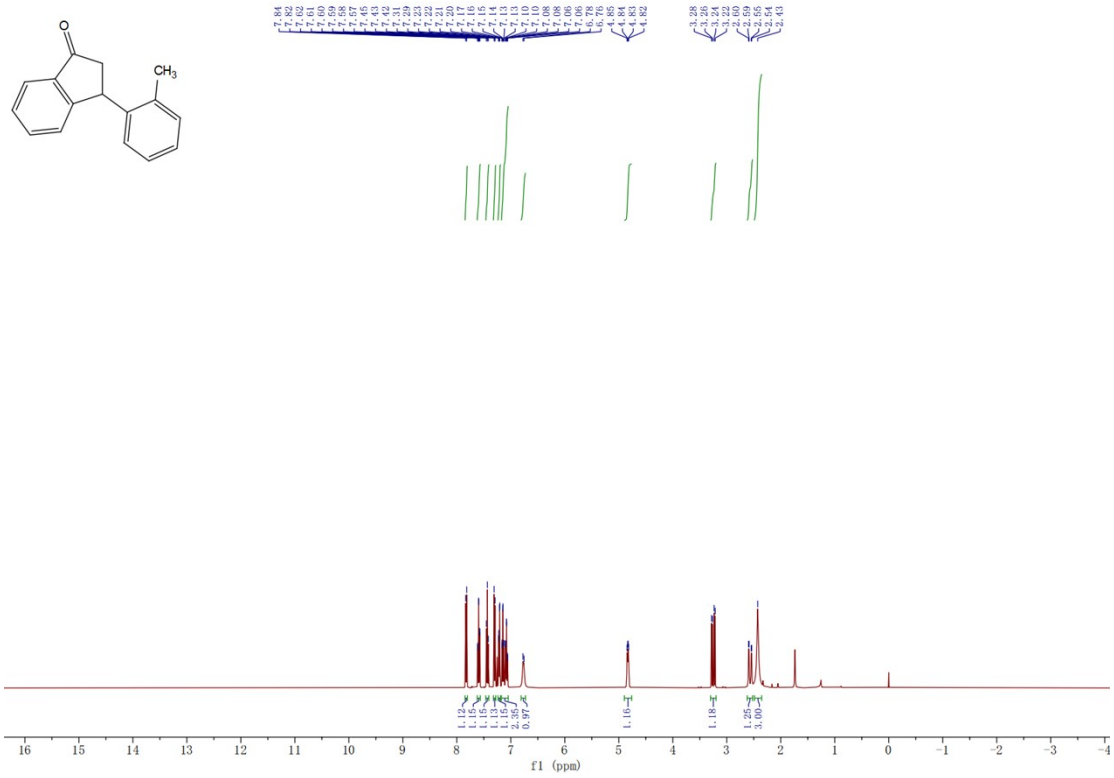
^{1}H NMR spectrum of 3-phenyl-2,3-dihydro-1*H*-inden-1-one **1c**



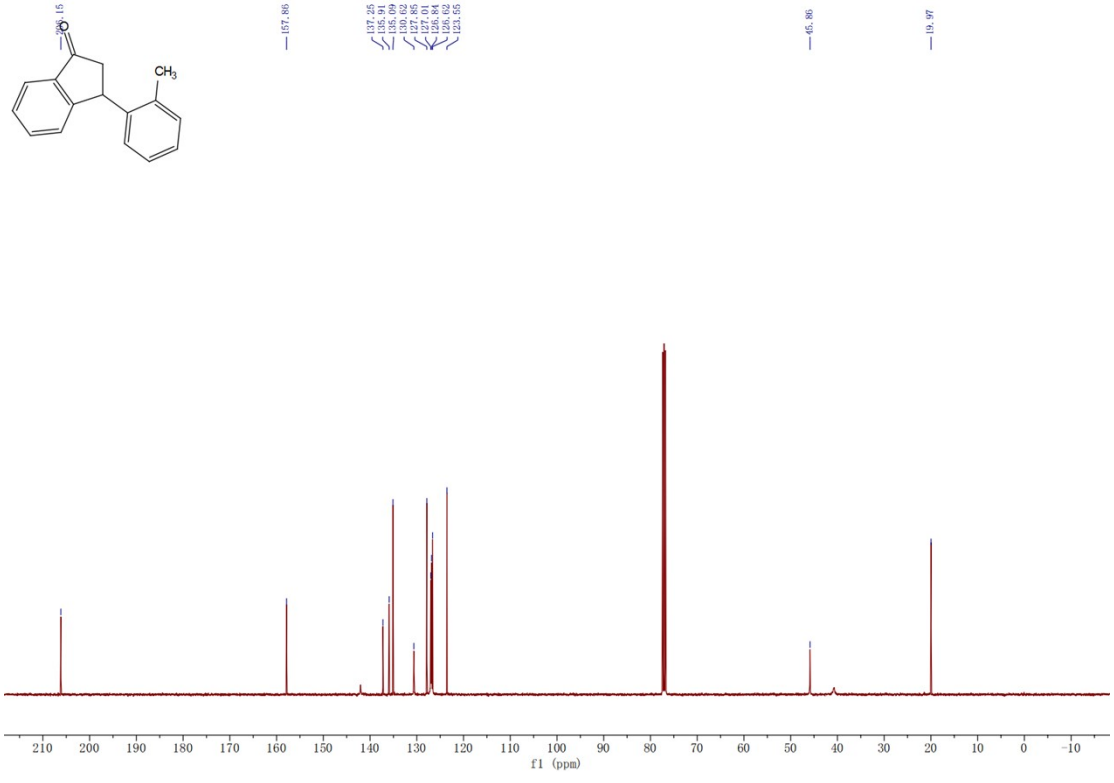
^{13}C NMR spectrum of 3-phenyl-2,3-dihydro-1*H*-inden-1-one **1c**



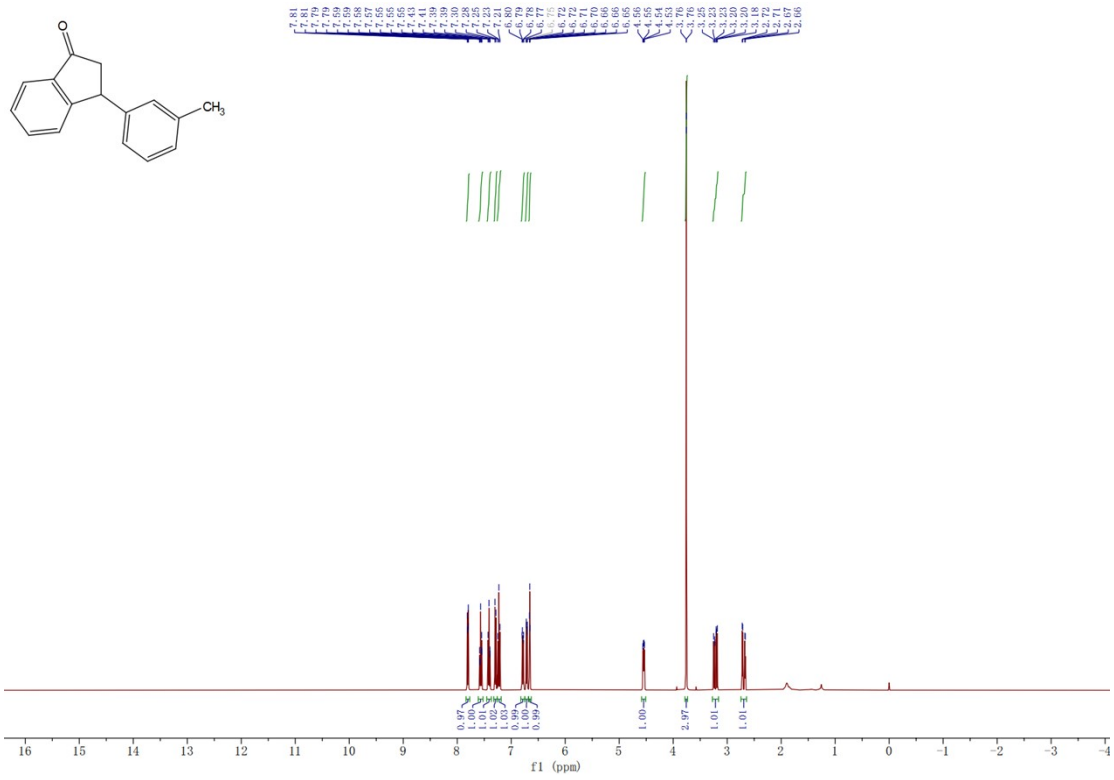
^{1}H NMR spectrum of 3-(*o*-tolyl)-2,3-dihydro-1*H*-inden-1-one **2c**



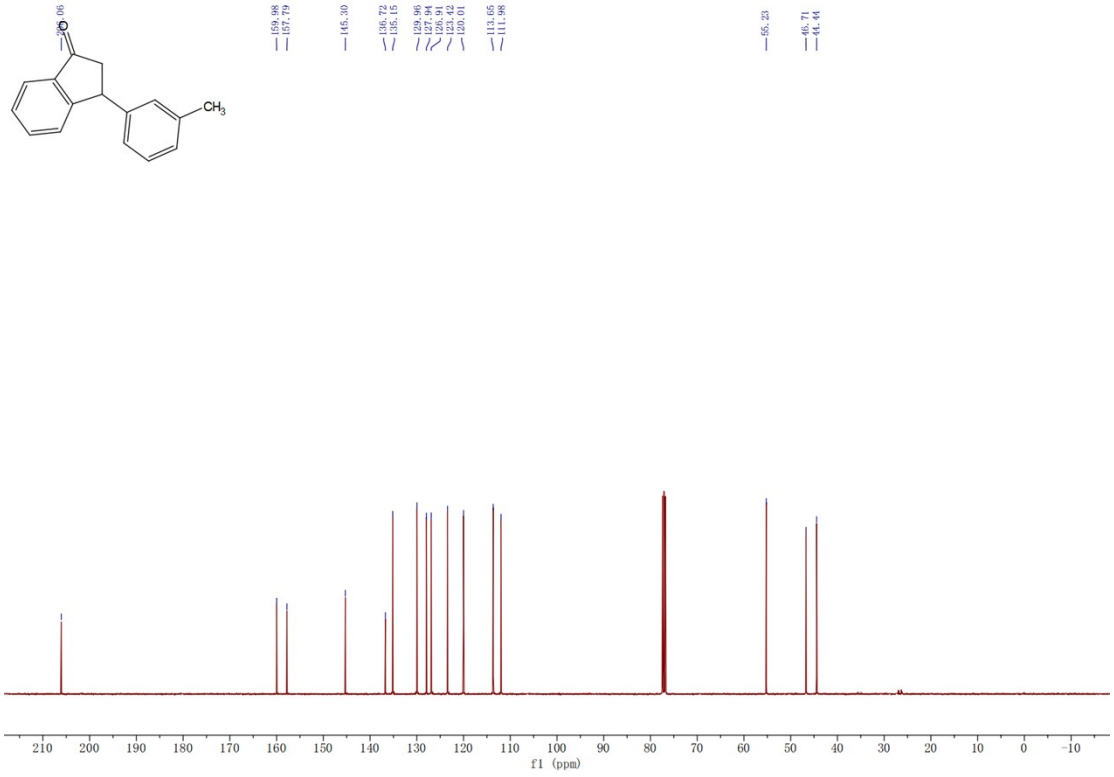
^{13}C NMR spectrum of 3-(*o*-tolyl)-2,3-dihydro-1*H*-inden-1-one **2c**



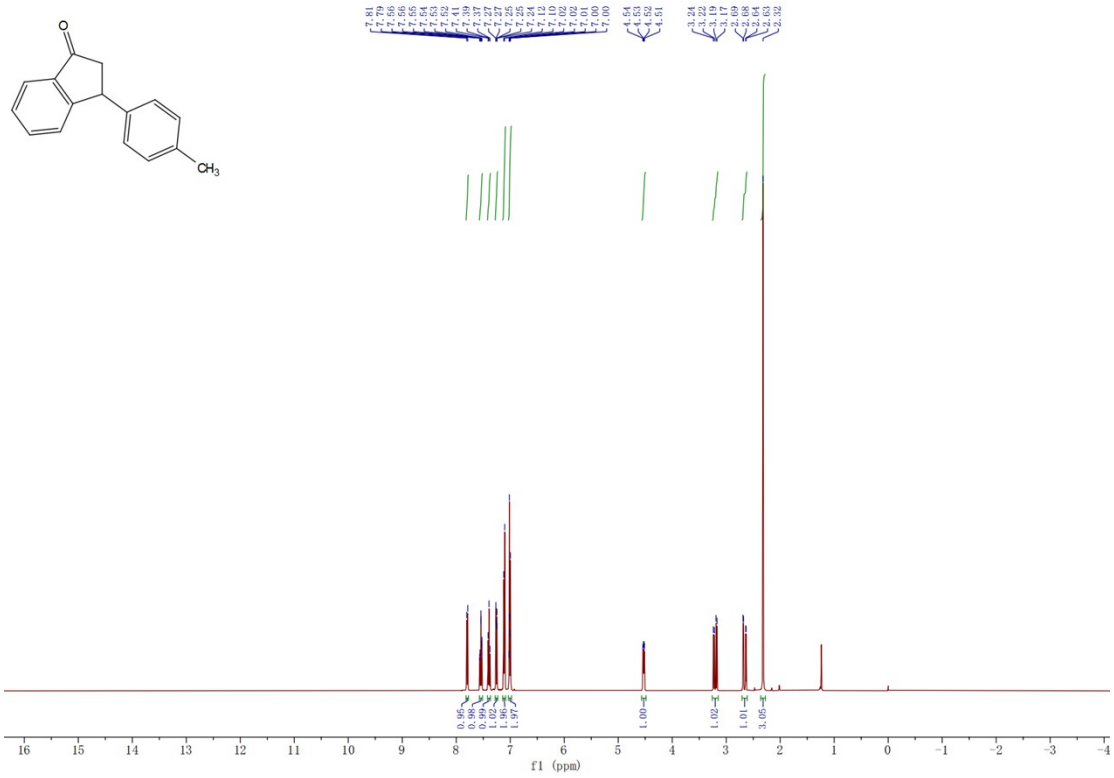
^{1}H NMR spectrum of 4-(*m*-tolyl)-2,3-dihydro-1*H*-inden-1-one **3c**



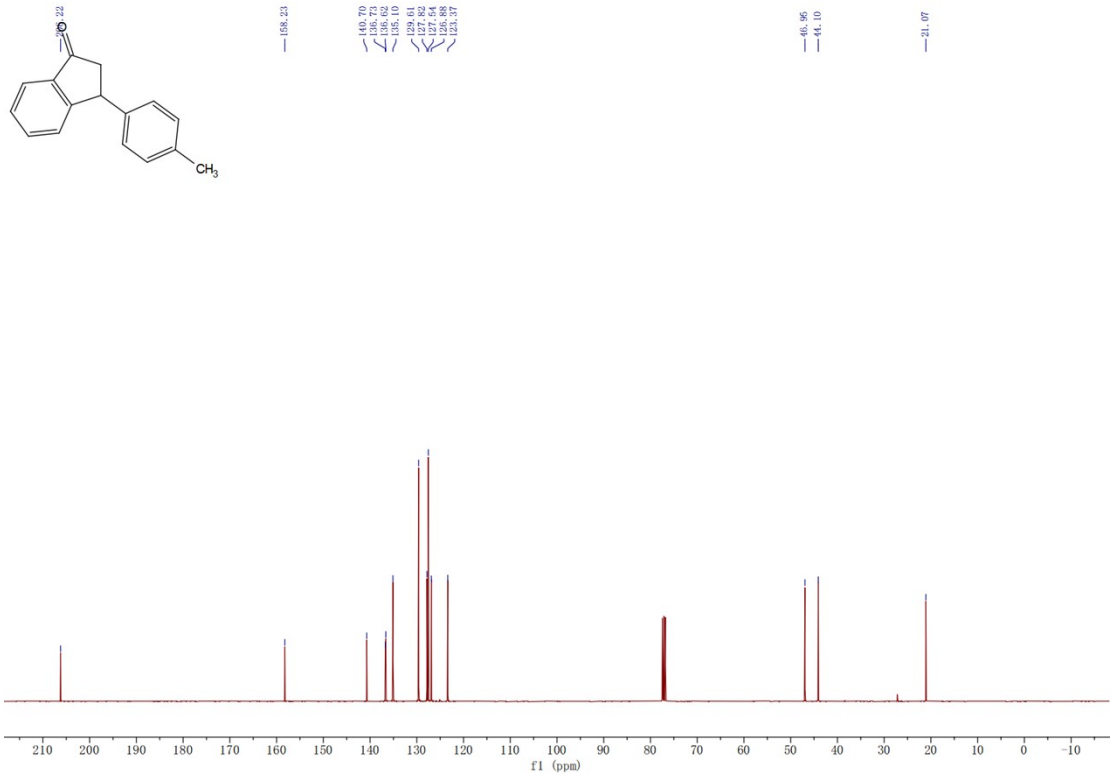
^{13}C NMR spectrum of 4-(*m*-tolyl)-2,3-dihydro-1*H*-inden-1-one **3c**



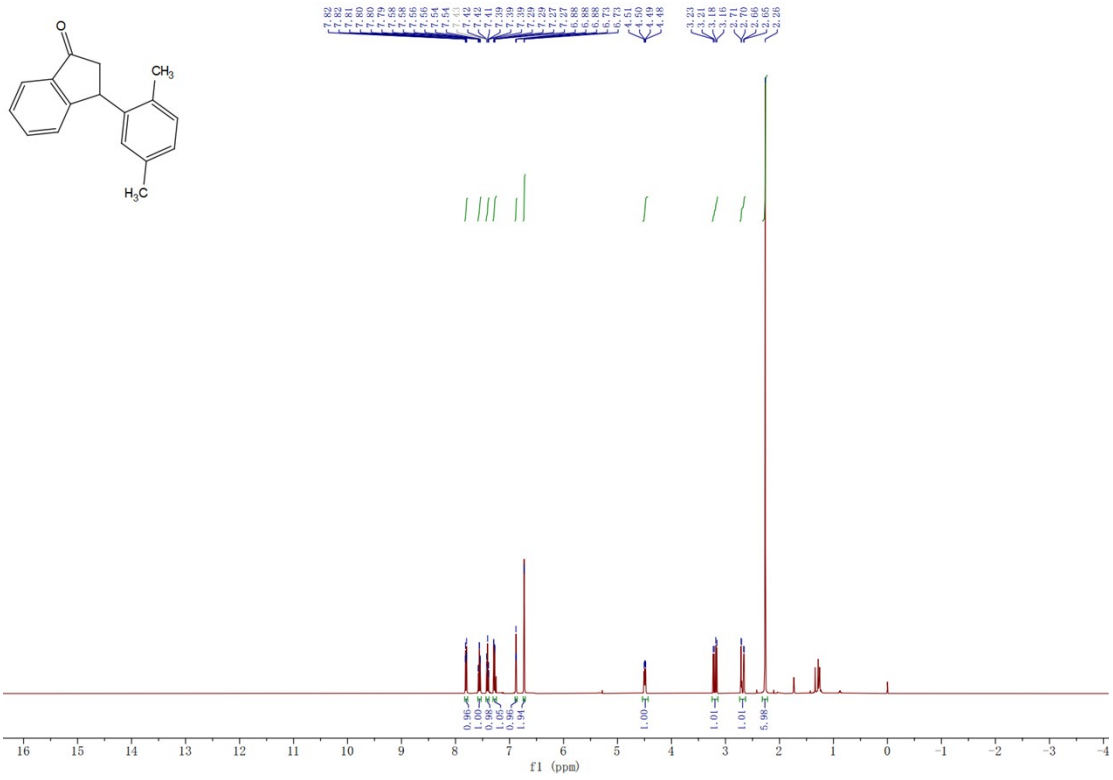
^{1}H NMR spectrum of 4-(*p*-tolyl)-2,3-dihydro-1*H*-inden-1-one **4c**



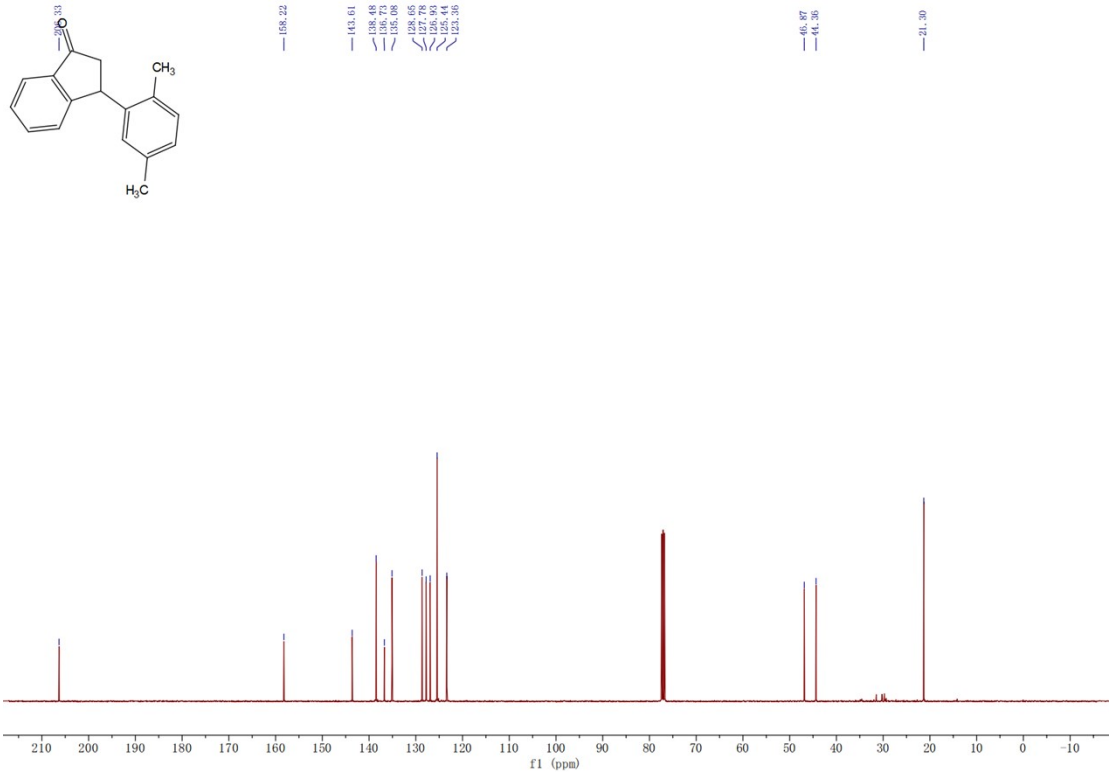
^{13}C NMR spectrum of 4-(*p*-tolyl)-2,3-dihydro-1*H*-inden-1-one **4c**



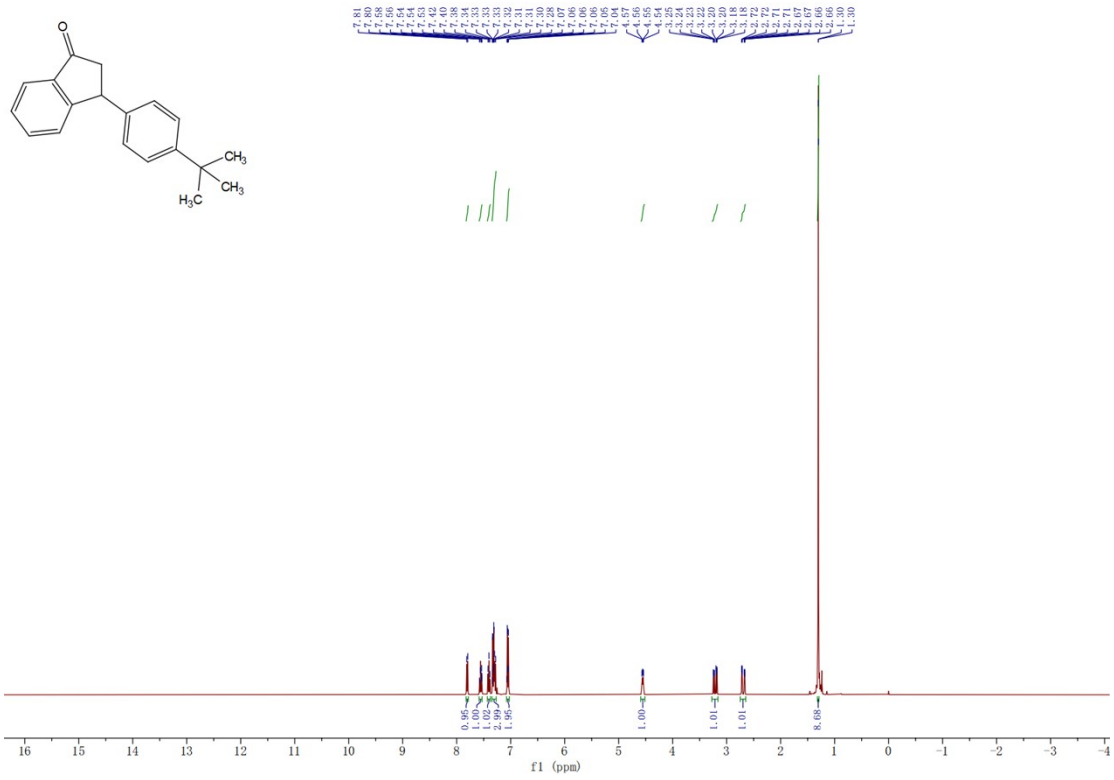
^{1}H NMR spectrum of 3-(2,5-dimethylphenyl)-2,3-dihydro-1*H*-inden-1-one **5c**



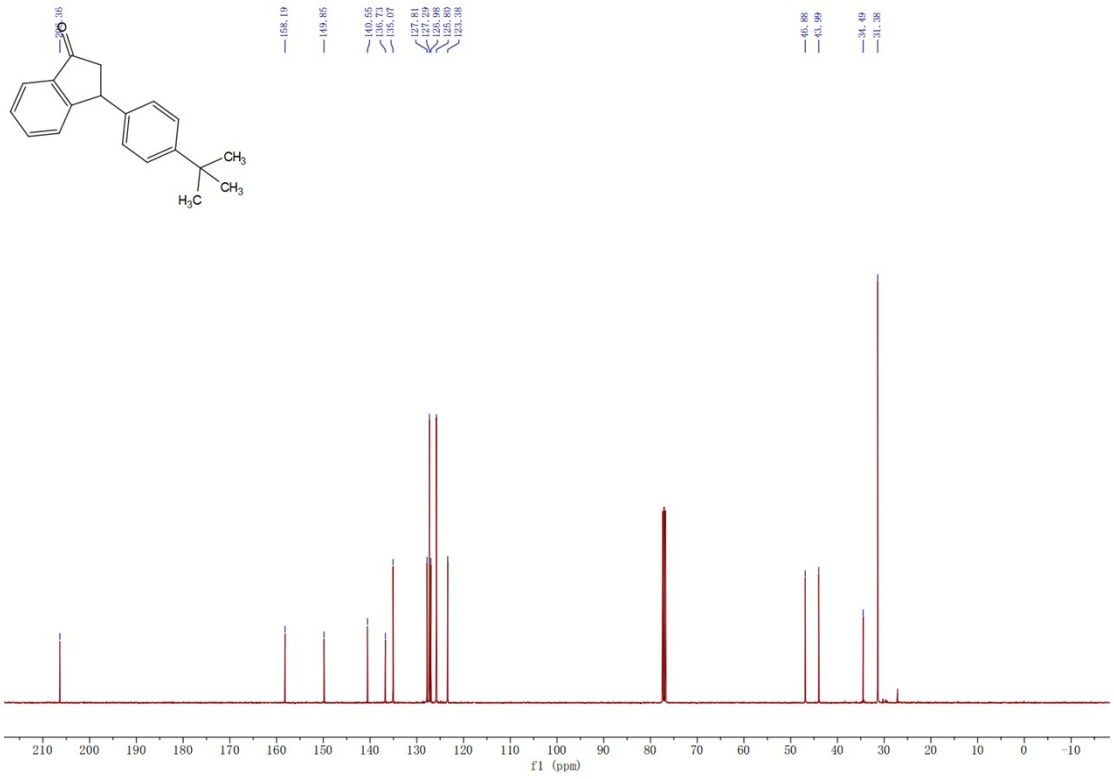
^{13}C NMR spectrum of 3-(2,5-dimethylphenyl)-2,3-dihydro-1*H*-inden-1-one **5c**



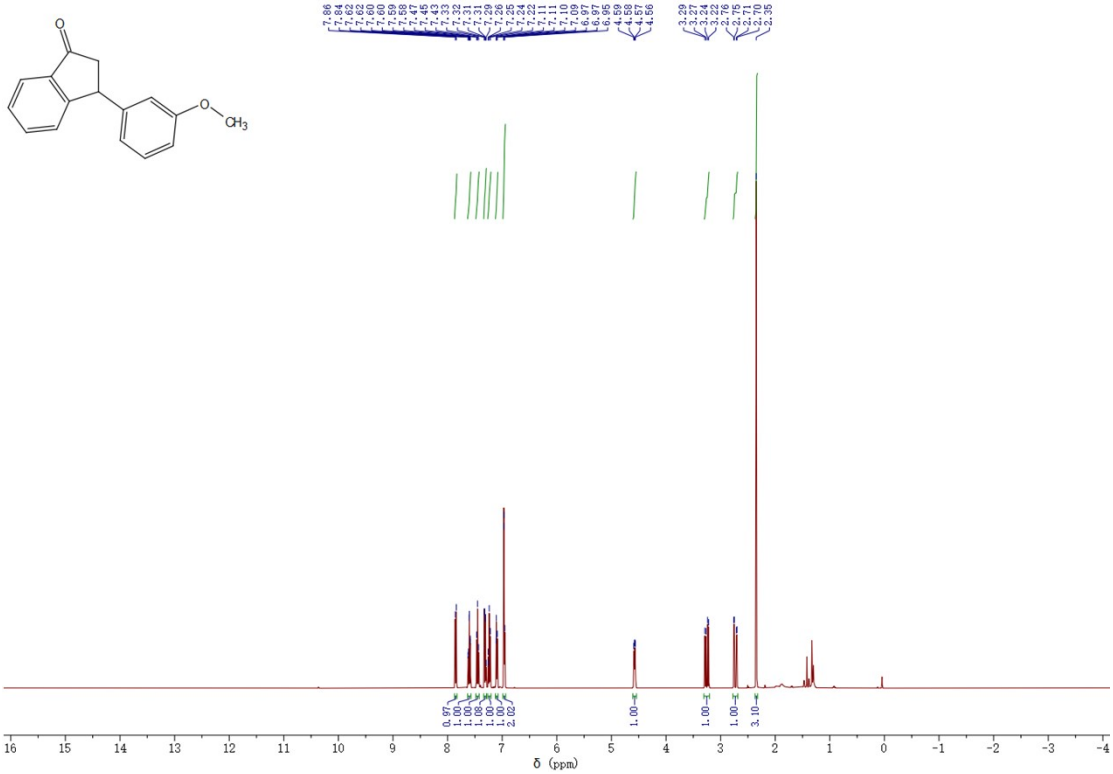
^{1}H NMR spectrum of 4-3-(4-(tert-butyl)phenyl)-2,3-dihydro-1*H*-inden-1-one **6c**



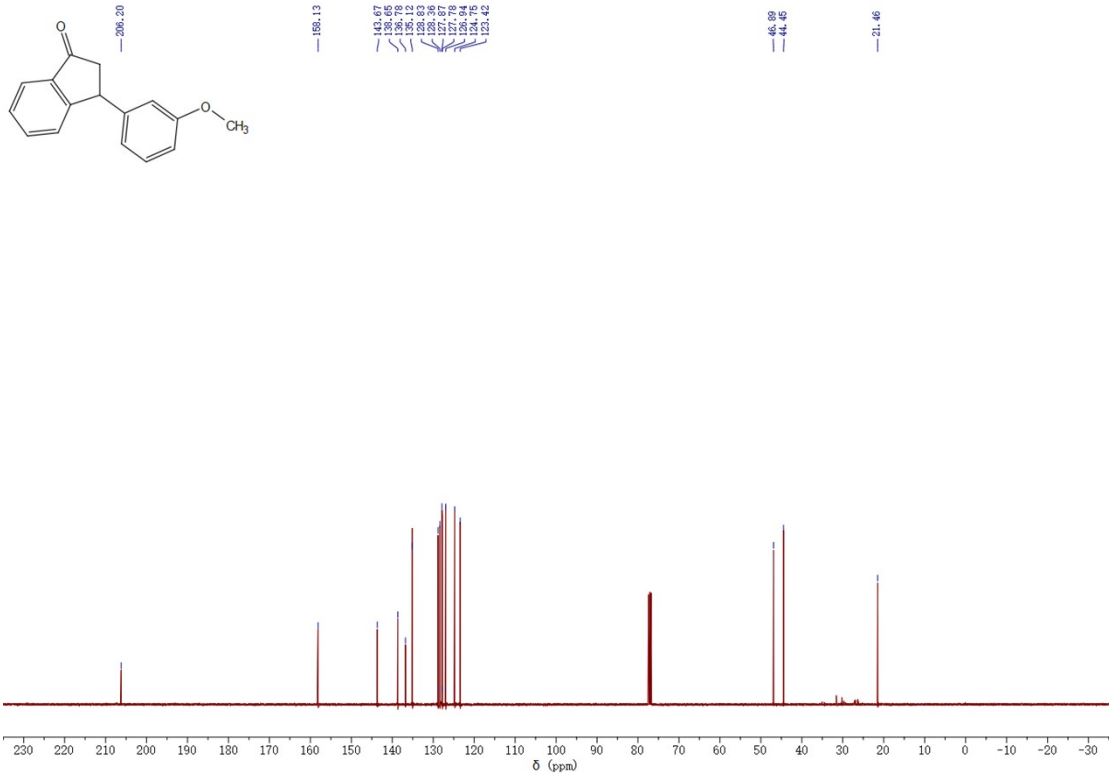
^{13}C NMR spectrum of 4-3-(4-(tert-butyl)phenyl)-2,3-dihydro-1*H*-inden-1-one **6c**



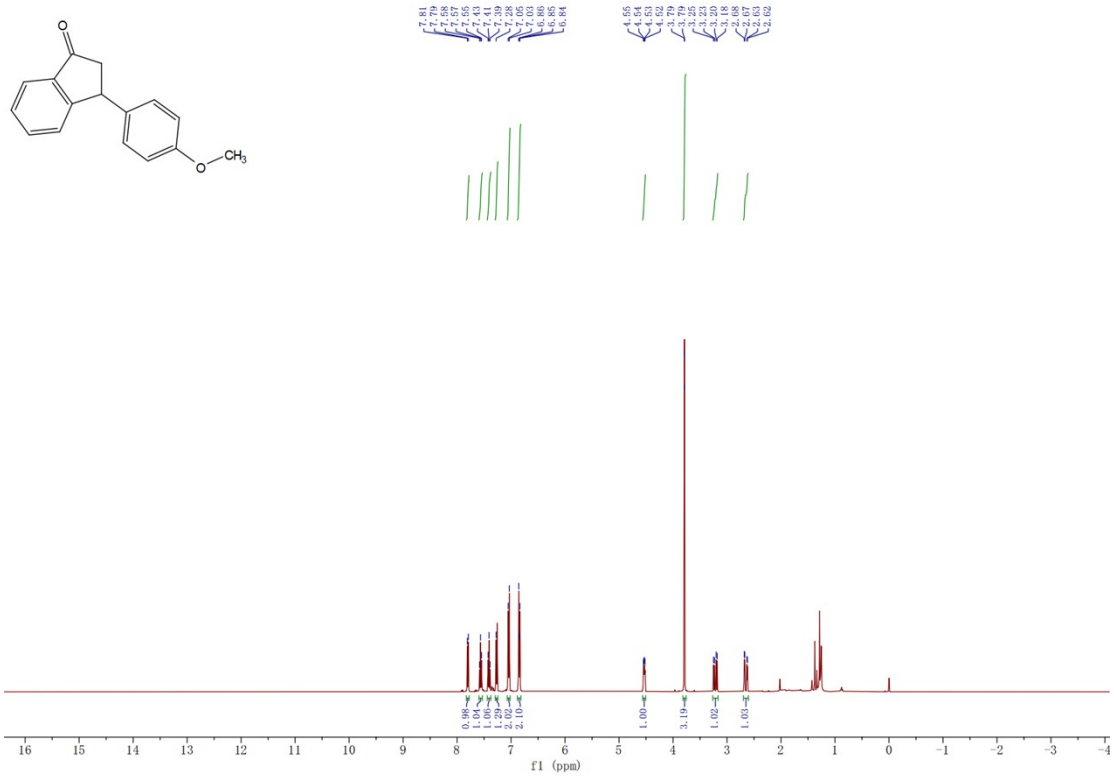
^{1}H NMR spectrum of 4-(3-methoxyphenyl)-2,3-dihydro-1*H*-inden-1-one **7c**



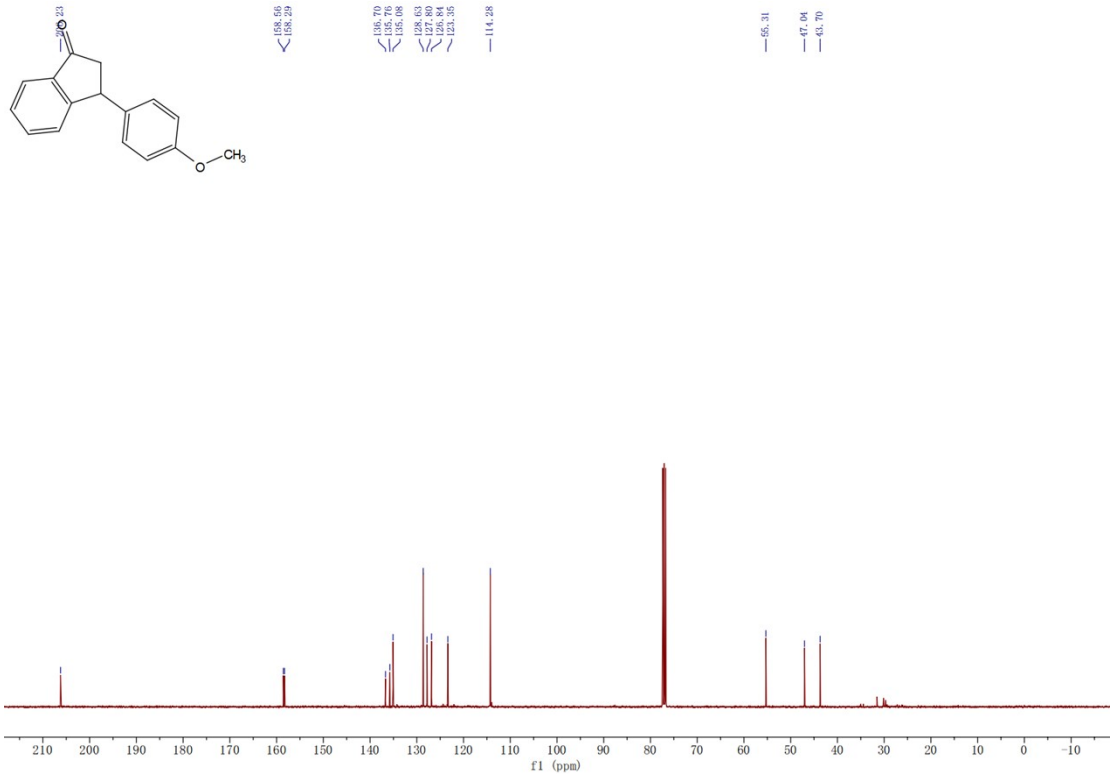
^{13}C NMR spectrum of 3-(3-methoxyphenyl)-2,3-dihydro-1*H*-inden-1-one **7c**



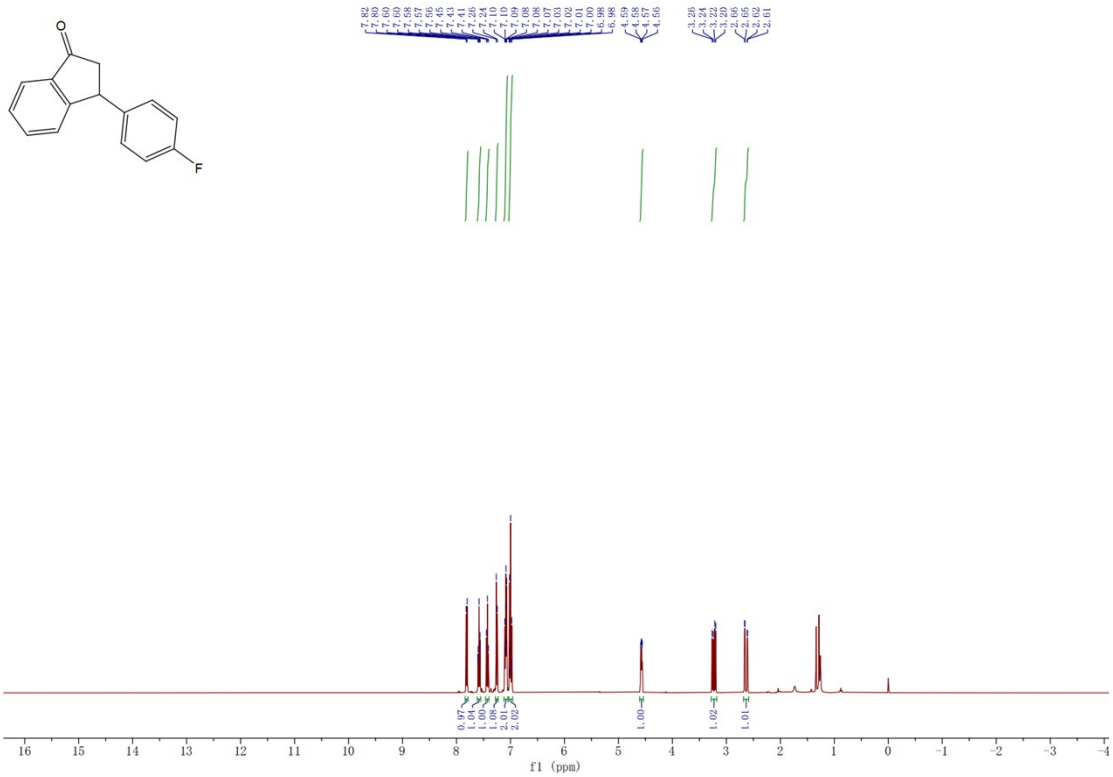
^{1}H NMR spectrum of 4-3-(4-methoxyphenyl)-2,3-dihydro-1*H*-inden-1-one **8c**



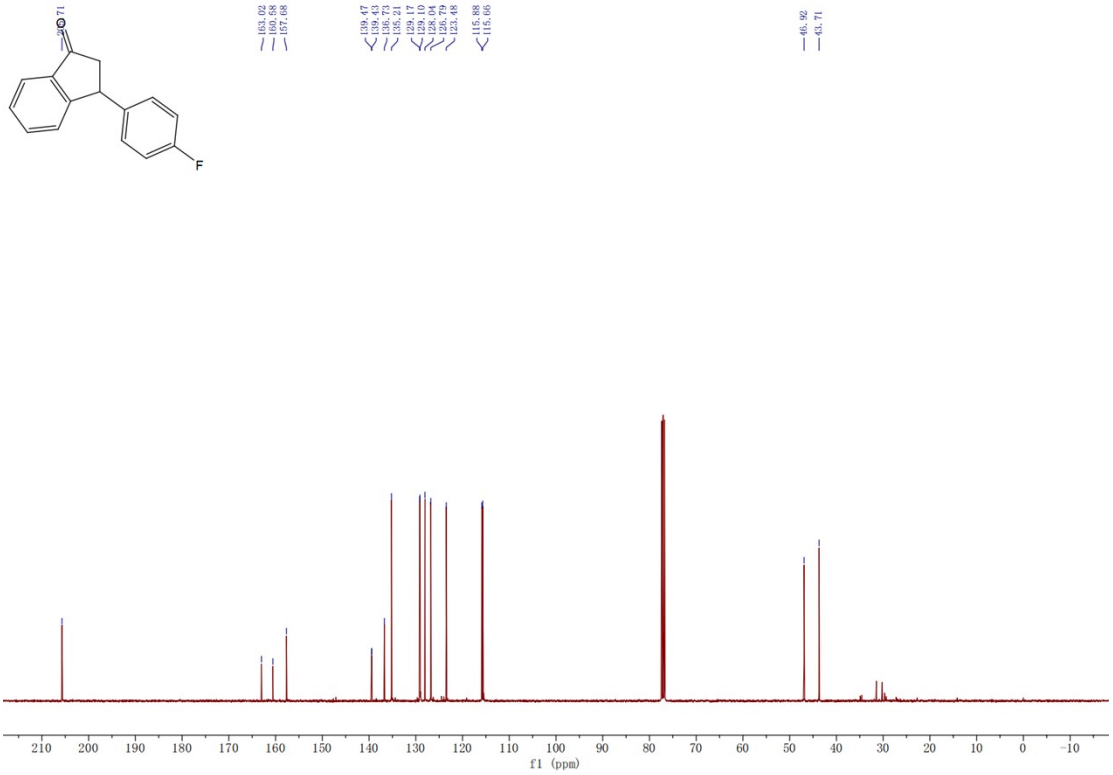
^{13}C NMR spectrum of 4-3-(4-methoxyphenyl)-2,3-dihydro-1*H*-inden-1-one **8c**



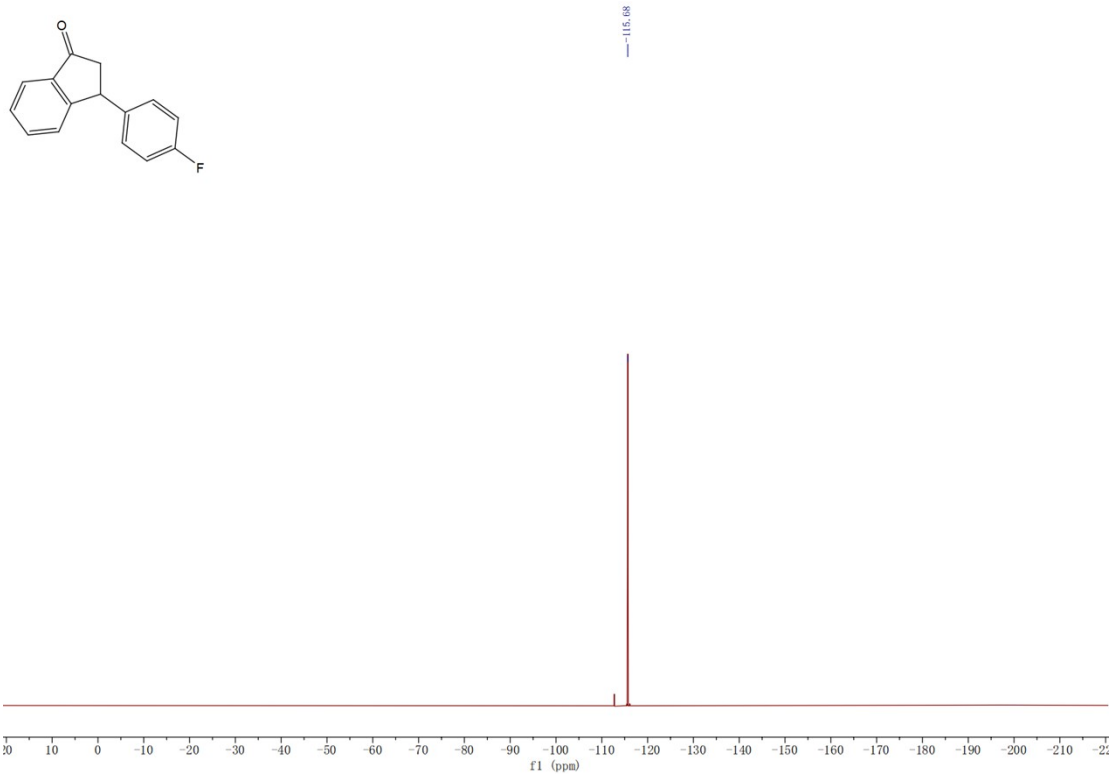
^{1}H NMR spectrum of 4-(4-fluorophenyl)-2,3-dihydro-1*H*-inden-1-one **9c**



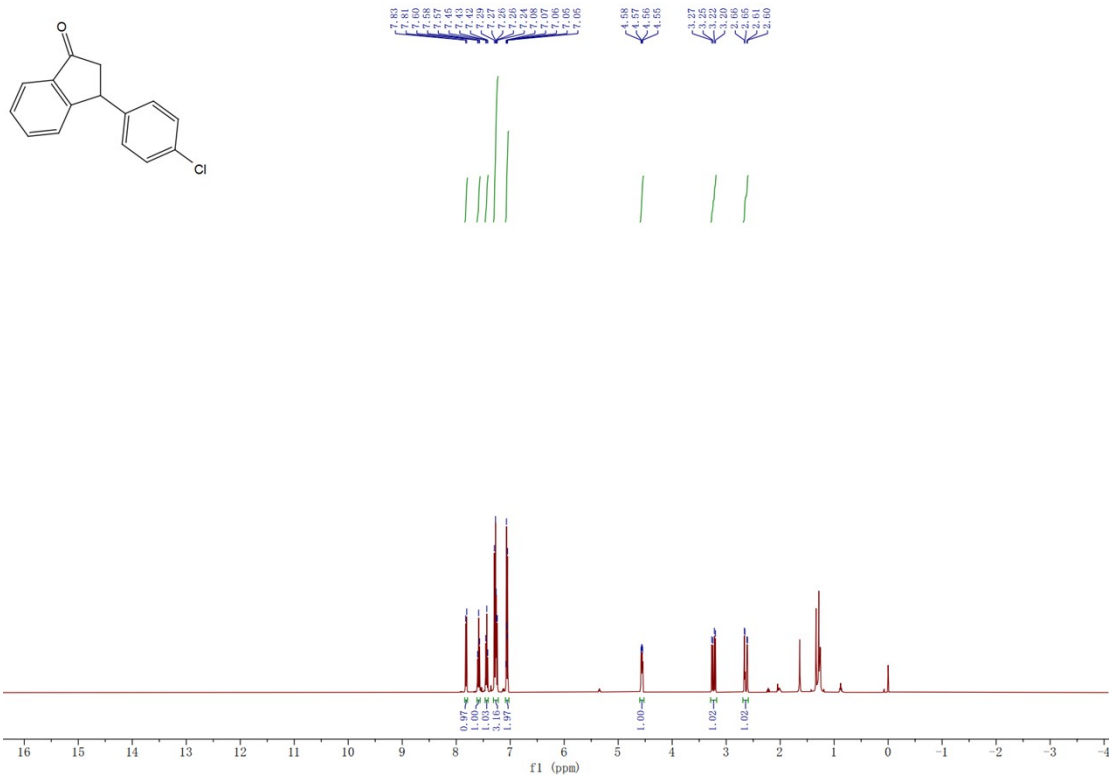
^{13}C NMR spectrum of 4-(4-fluorophenyl)-2,3-dihydro-1*H*-inden-1-one **9c**



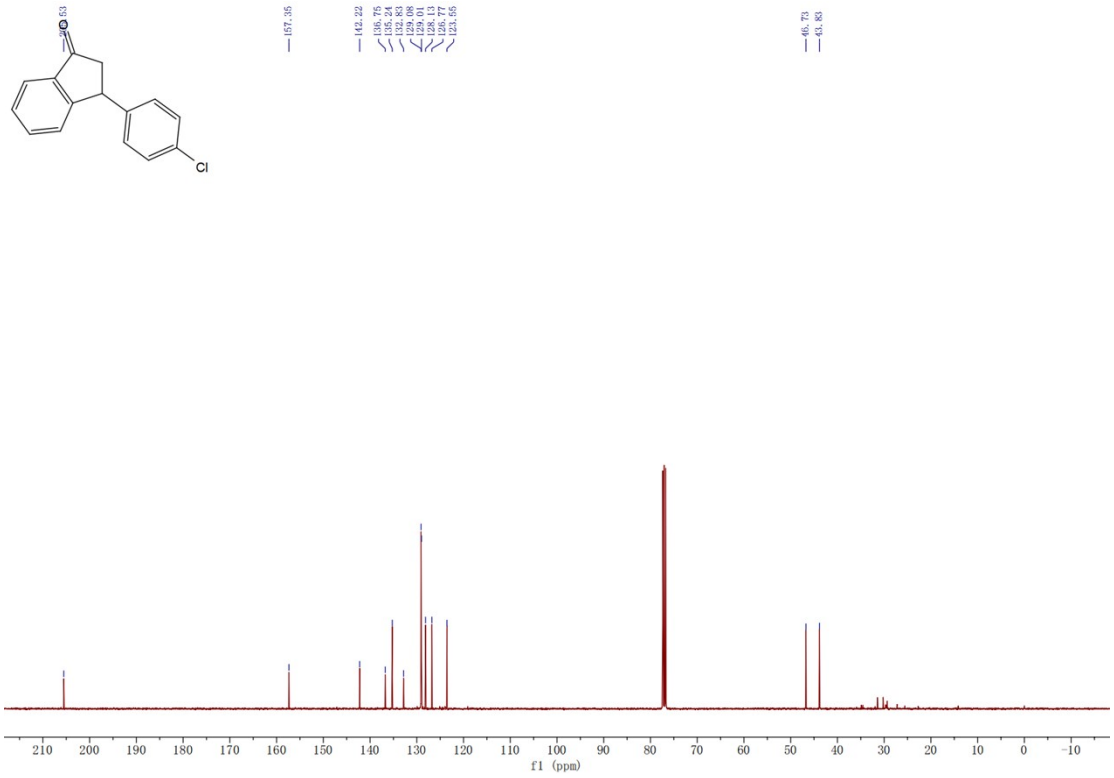
^{19}F NMR spectrum of 4-(4-fluorophenyl)-2,3-dihydro-1*H*-inden-1-one **9c**



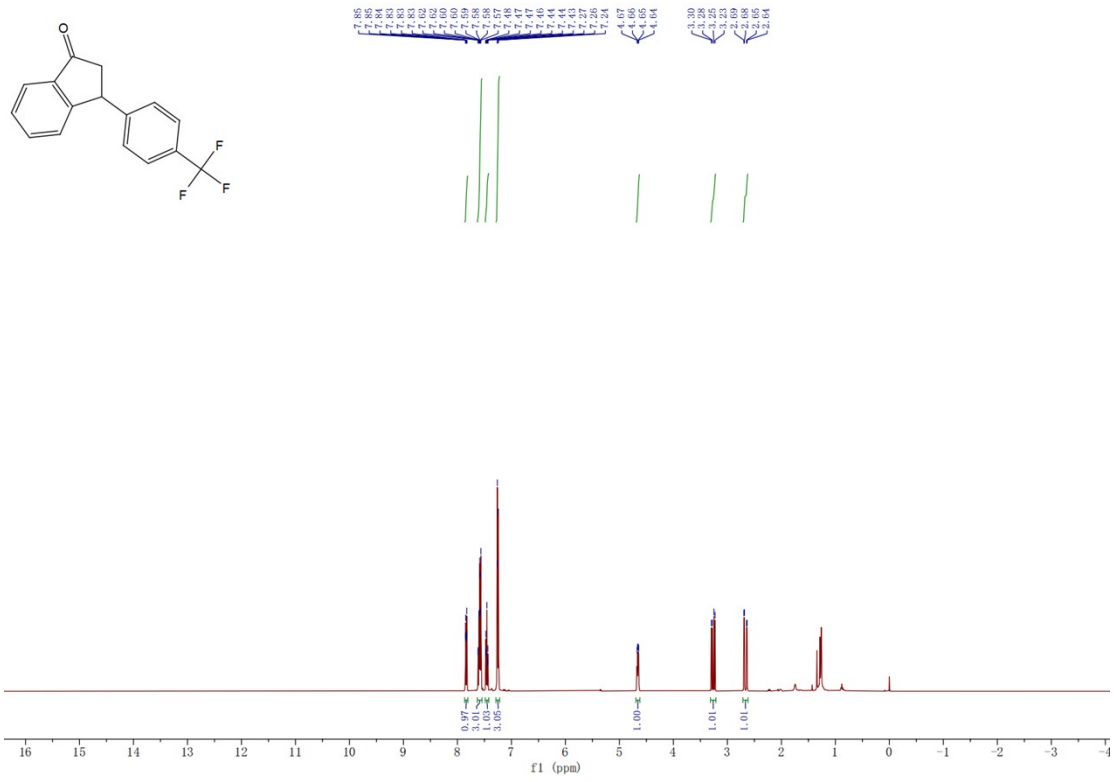
^{1}H NMR spectrum of 3-(4-chlorophenyl)-2,3-dihydro-1*H*-inden-1-one **10c**



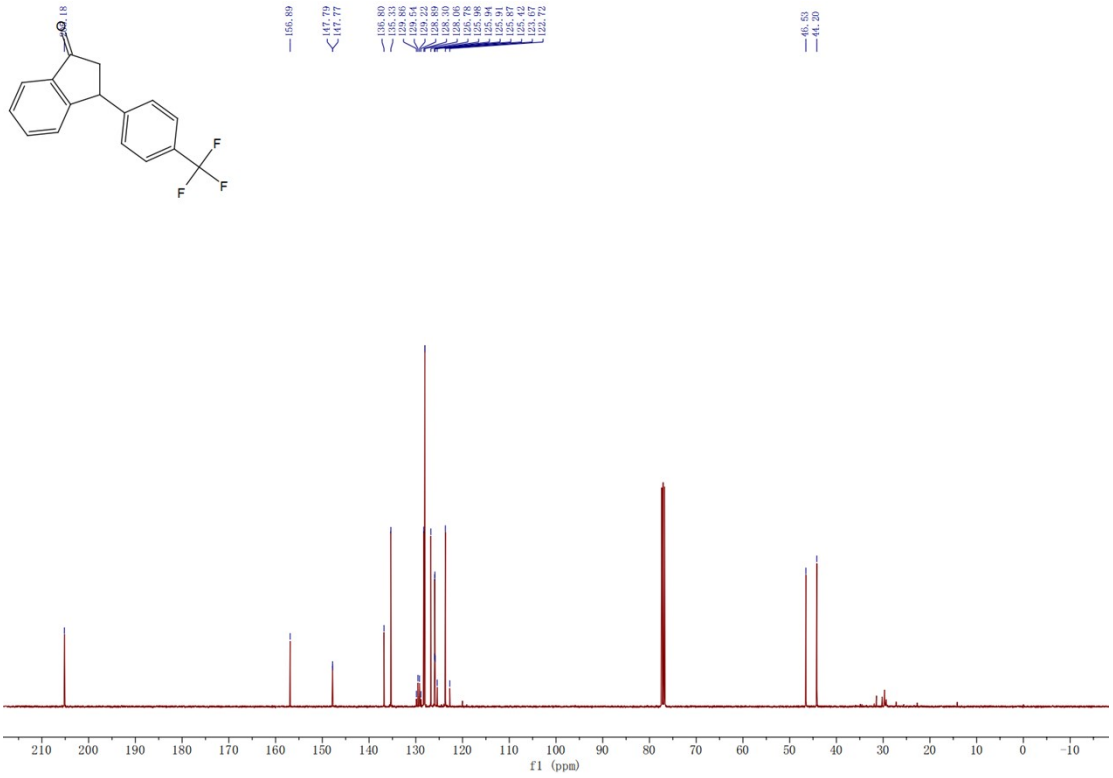
^{13}C NMR spectrum of 3-(4-chlorophenyl)-2,3-dihydro-1*H*-inden-1-one **10c**



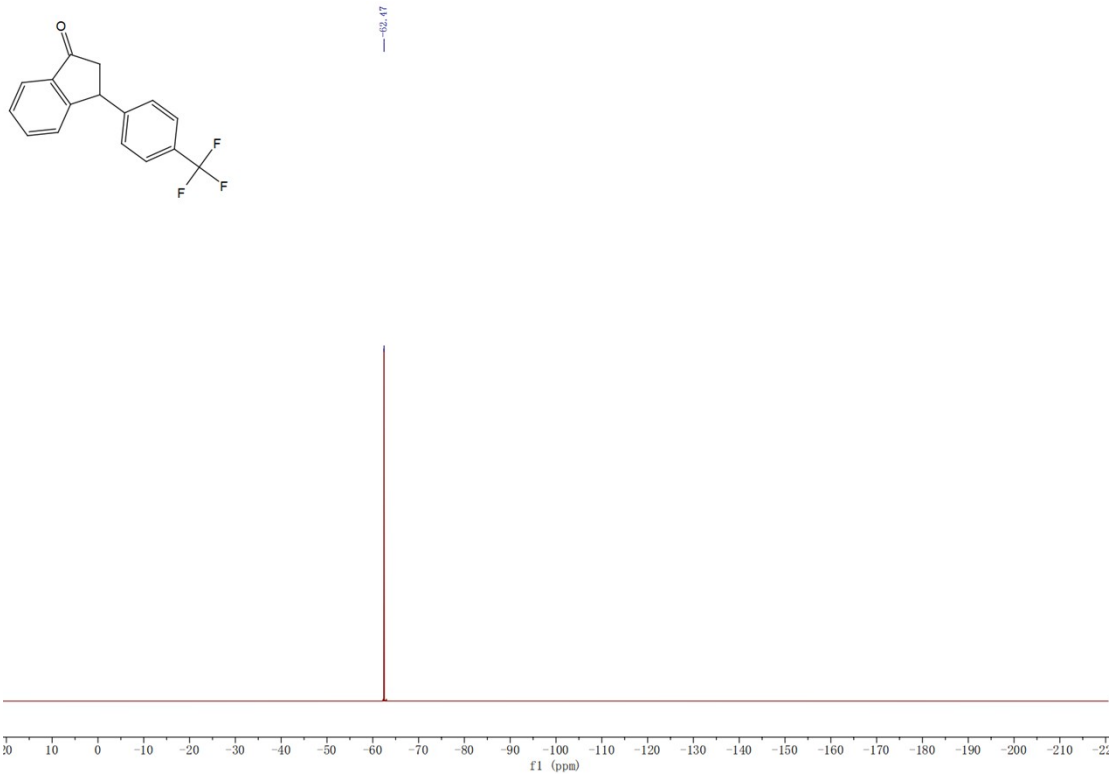
^{1}H NMR spectrum of 4-(4-(trifluoromethyl)phenyl)-2,3-dihydro-1*H*-inden-1-one **11c**



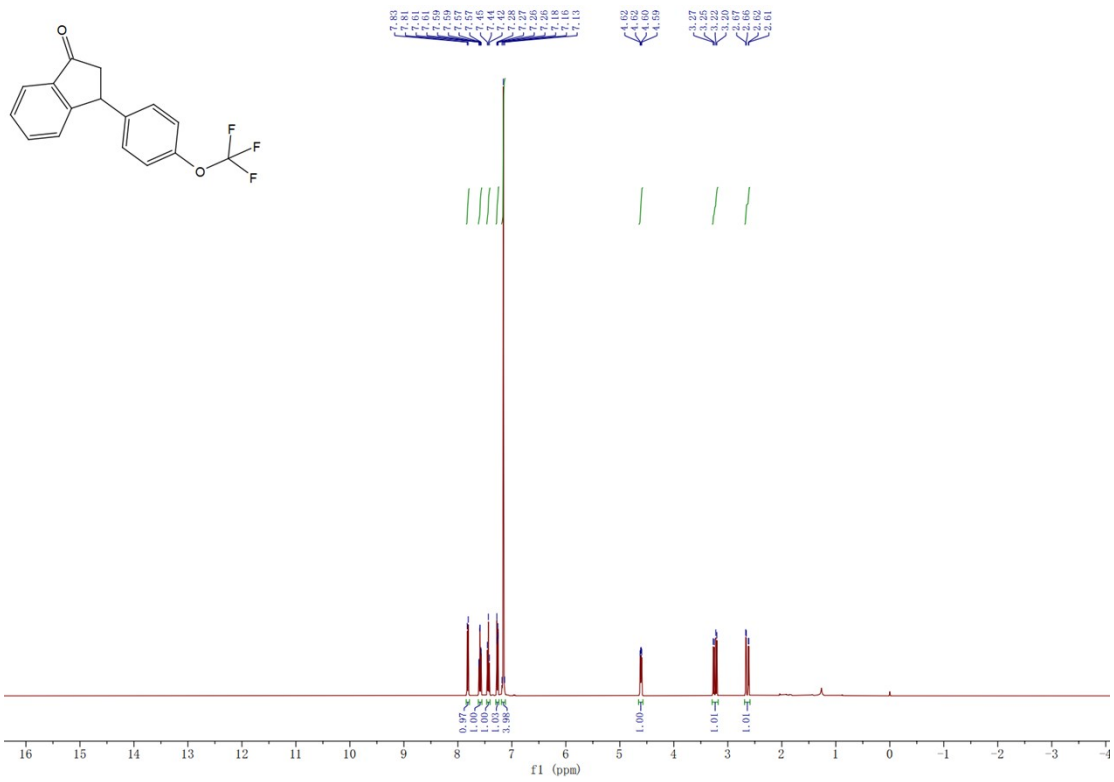
^{13}C NMR spectrum of 4-(4-(trifluoromethyl)phenyl)-2,3-dihydro-1*H*-inden-1-one **11c**



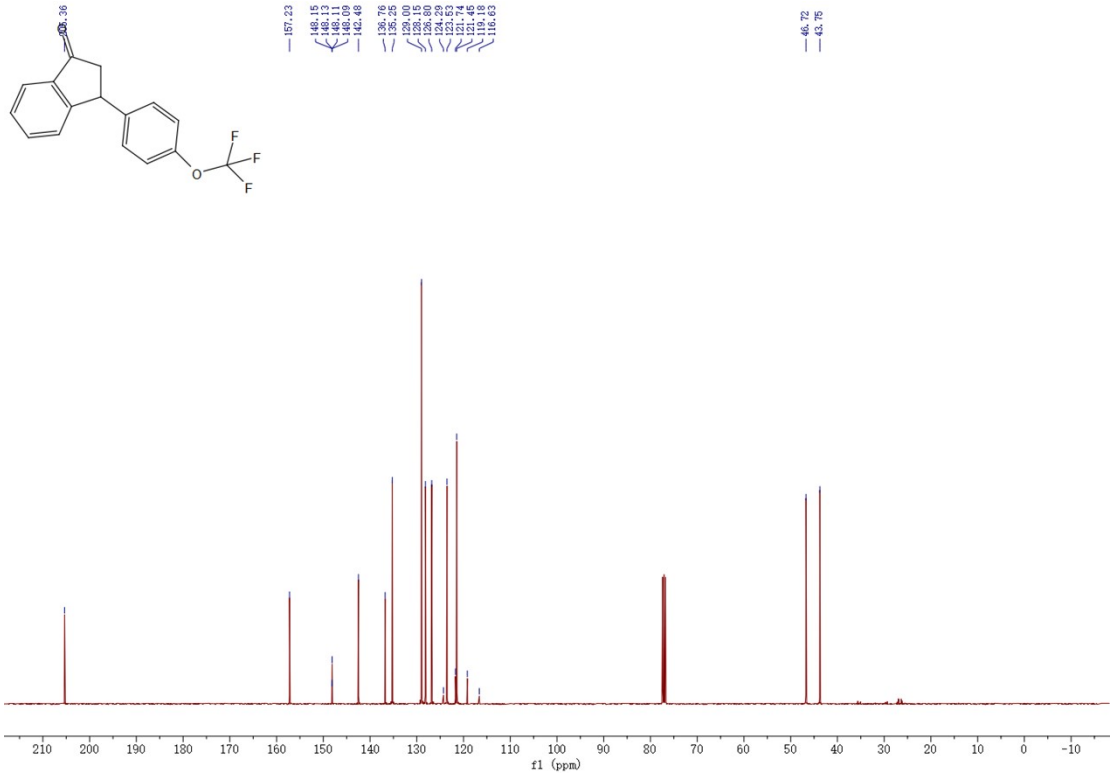
^{19}F NMR spectrum of 4-(4-(trifluoromethyl)phenyl)-2,3-dihydro-1*H*-inden-1-one **11c**



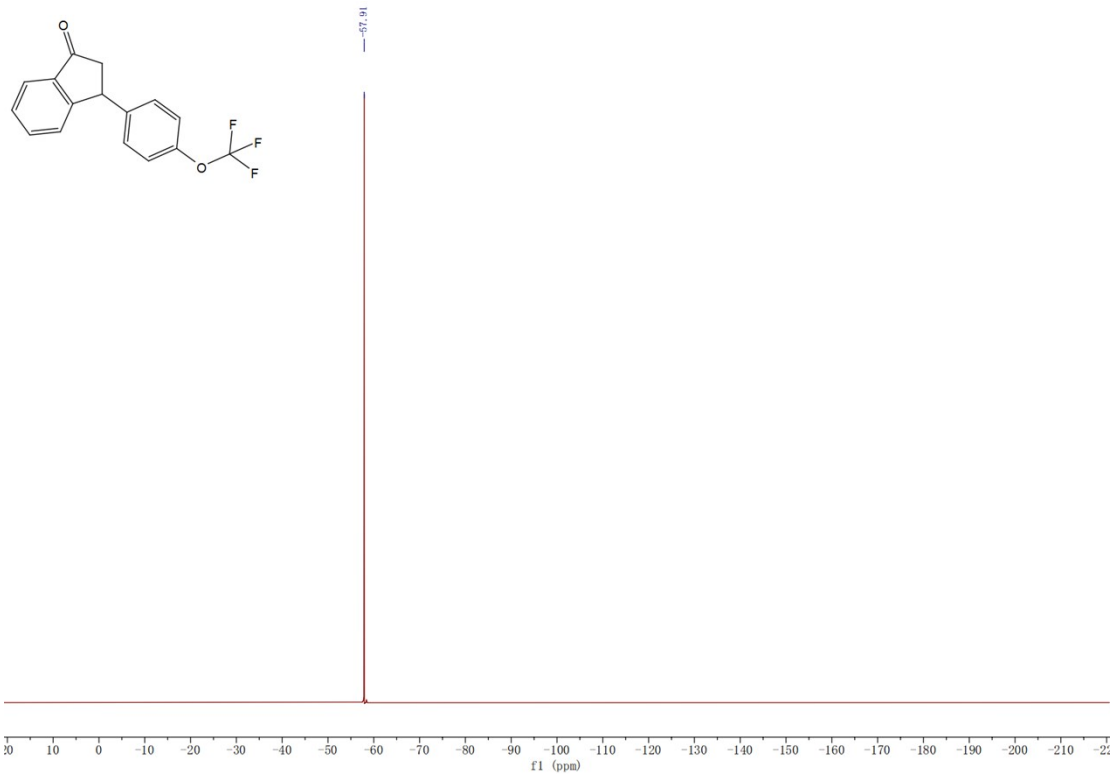
^{1}H NMR spectrum of 3-(4-(trifluoromethoxy)phenyl)-2,3-dihydro-1*H*-inden-1-one **12c**



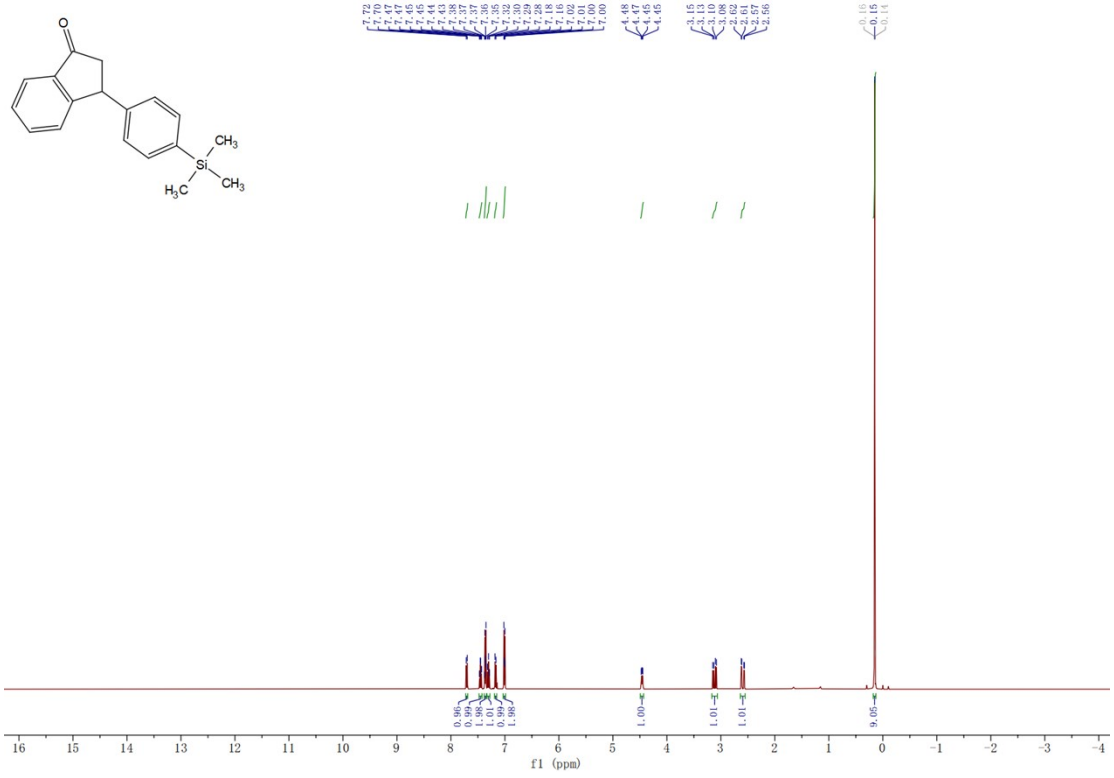
^{13}C NMR spectrum of 3-(4-(trifluoromethoxy)phenyl)-2,3-dihydro-1*H*-inden-1-one **12c**



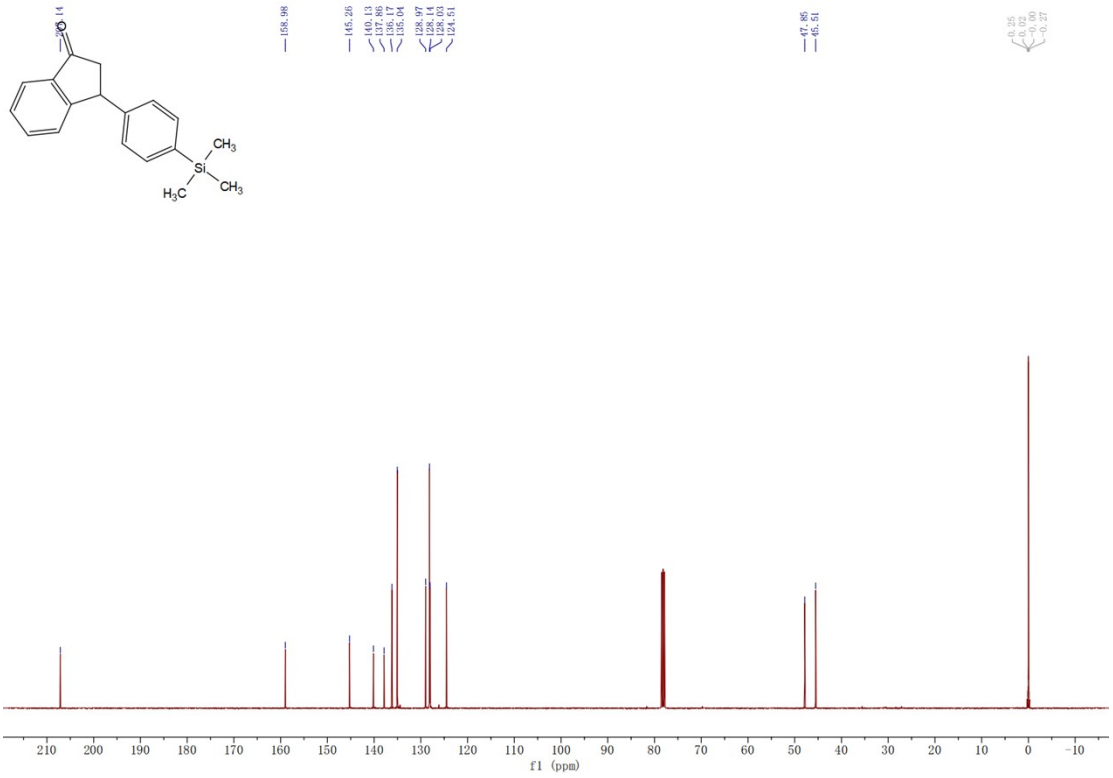
^{19}F NMR spectrum of 3-(4-(trifluoromethoxy)phenyl)-2,3-dihydro-1*H*-inden-1-one **12c**



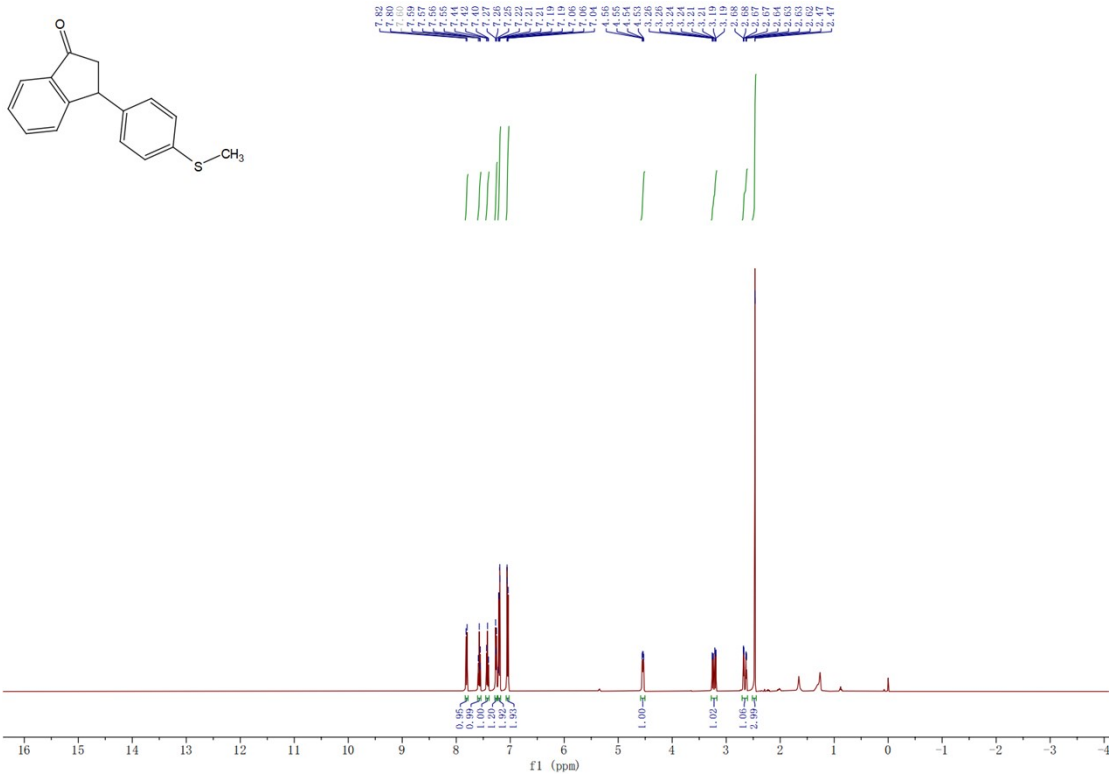
^{1}H NMR spectrum of 4-(4-(trimethylsilyl)phenyl)-2,3-dihydro-1*H*-inden-1-one **13c**



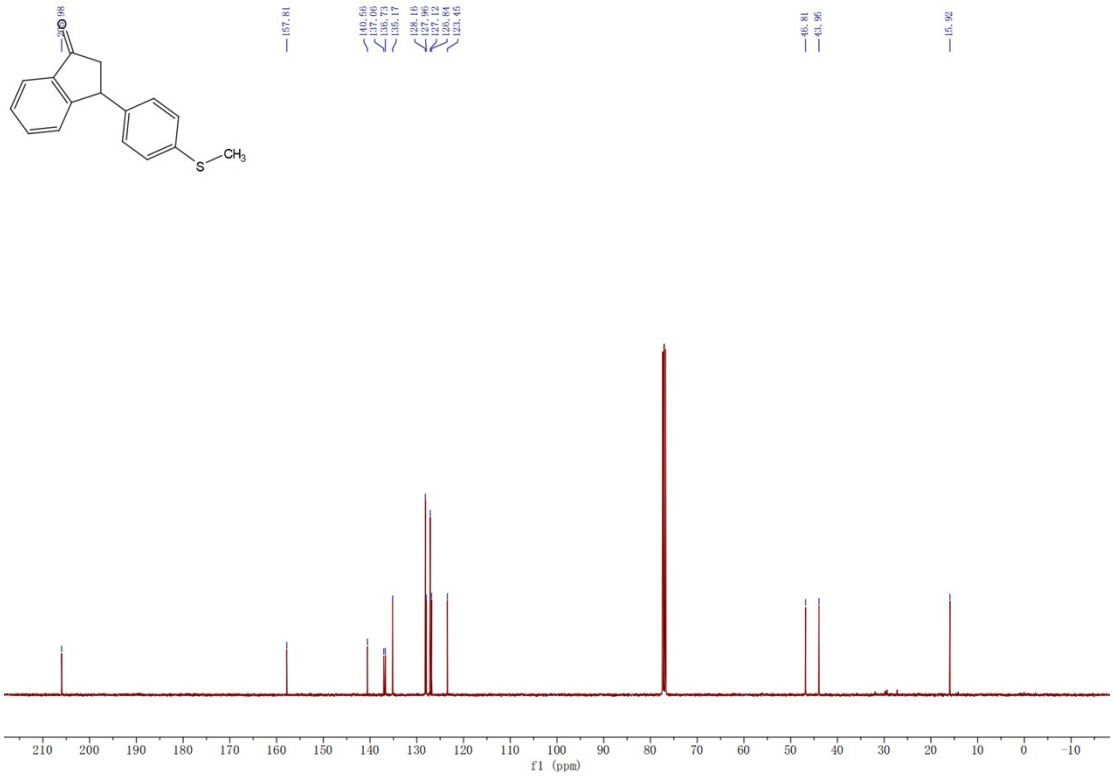
^{13}C NMR spectrum of 4-(4-(trimethylsilyl)phenyl)-2,3-dihydro-1*H*-inden-1-one **13c**



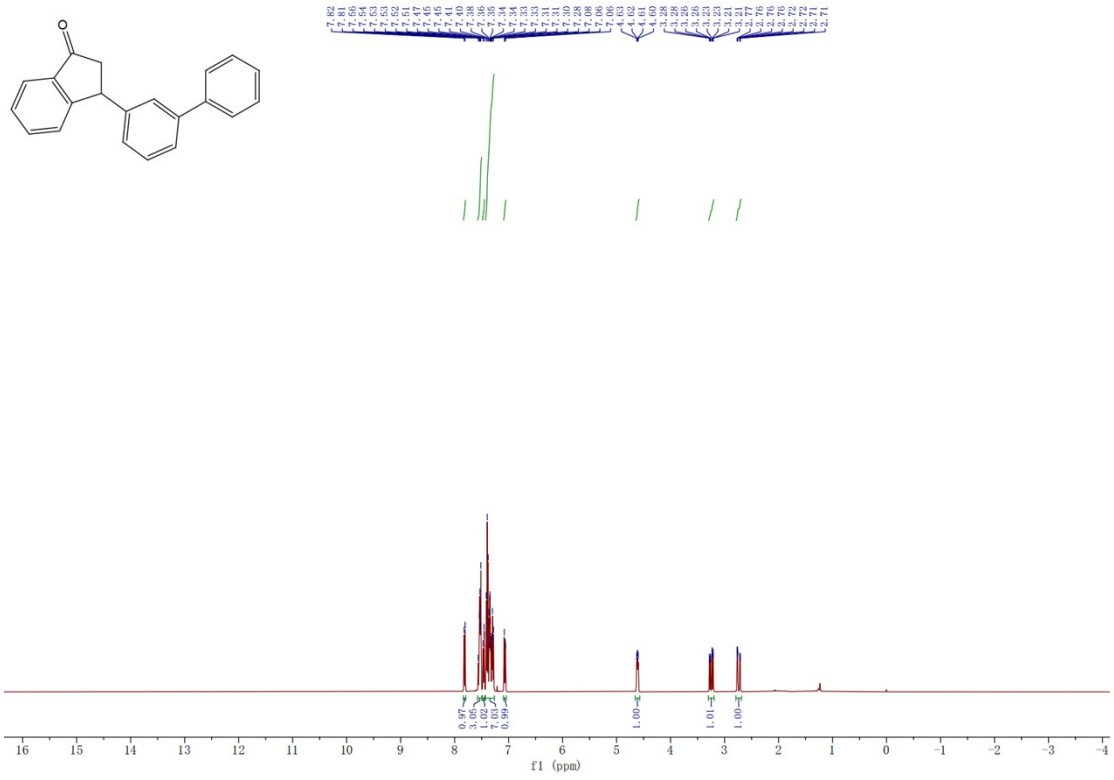
^{1}H NMR spectrum of 3-(4-(methylthio)phenyl)-2,3-dihydro-1*H*-inden-1-one **14c**



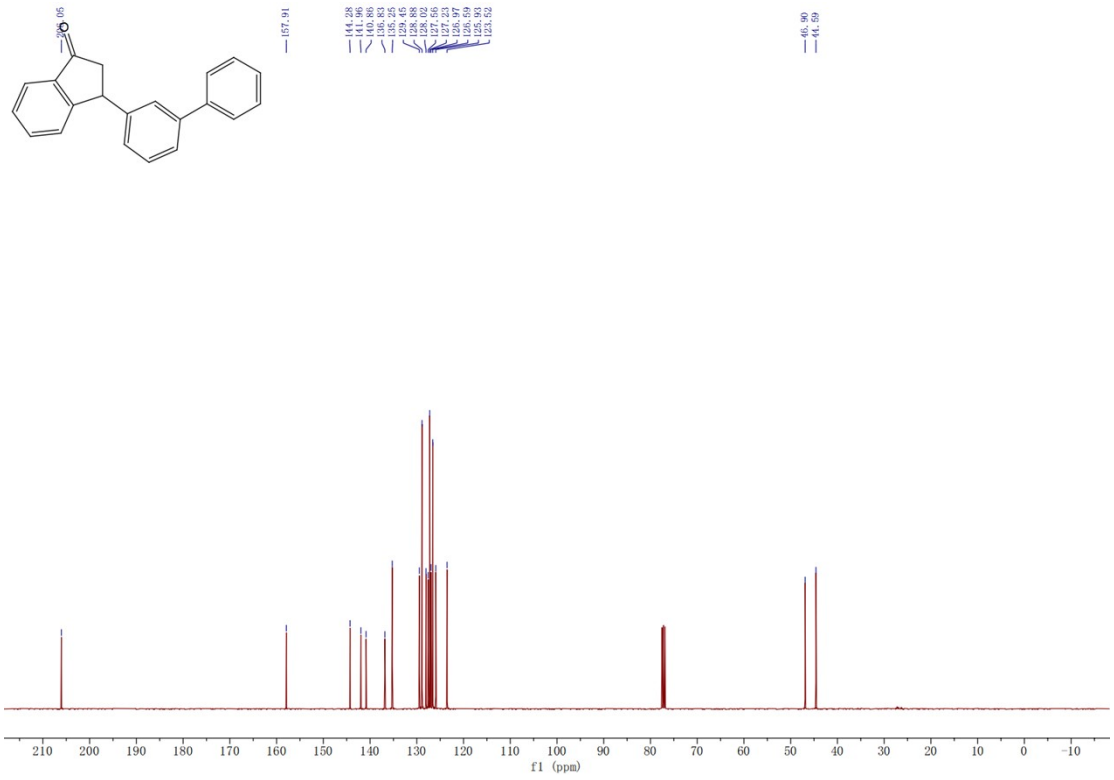
^{13}C NMR spectrum of 3-(4-(methylthio)phenyl)-2,3-dihydro-1*H*-inden-1-one **14c**



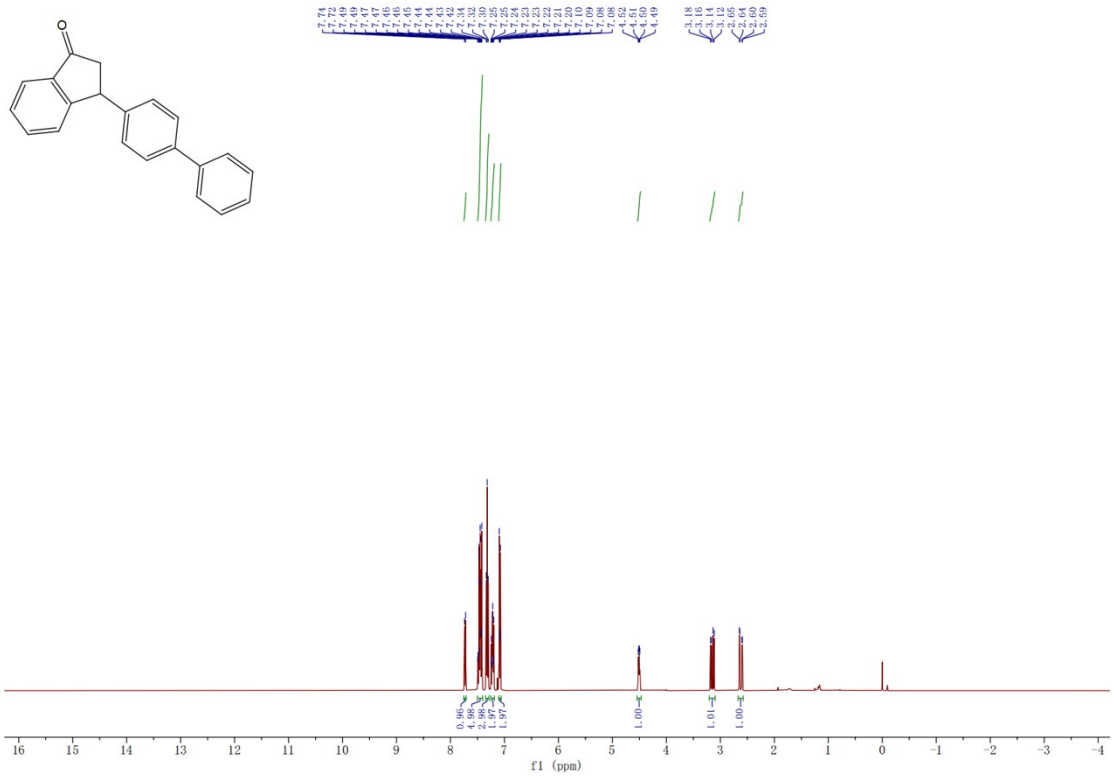
^{1}H NMR spectrum of 3-([1,1'-biphenyl]-3-yl)-2,3-dihydro-1*H*-inden-1-one **15c**



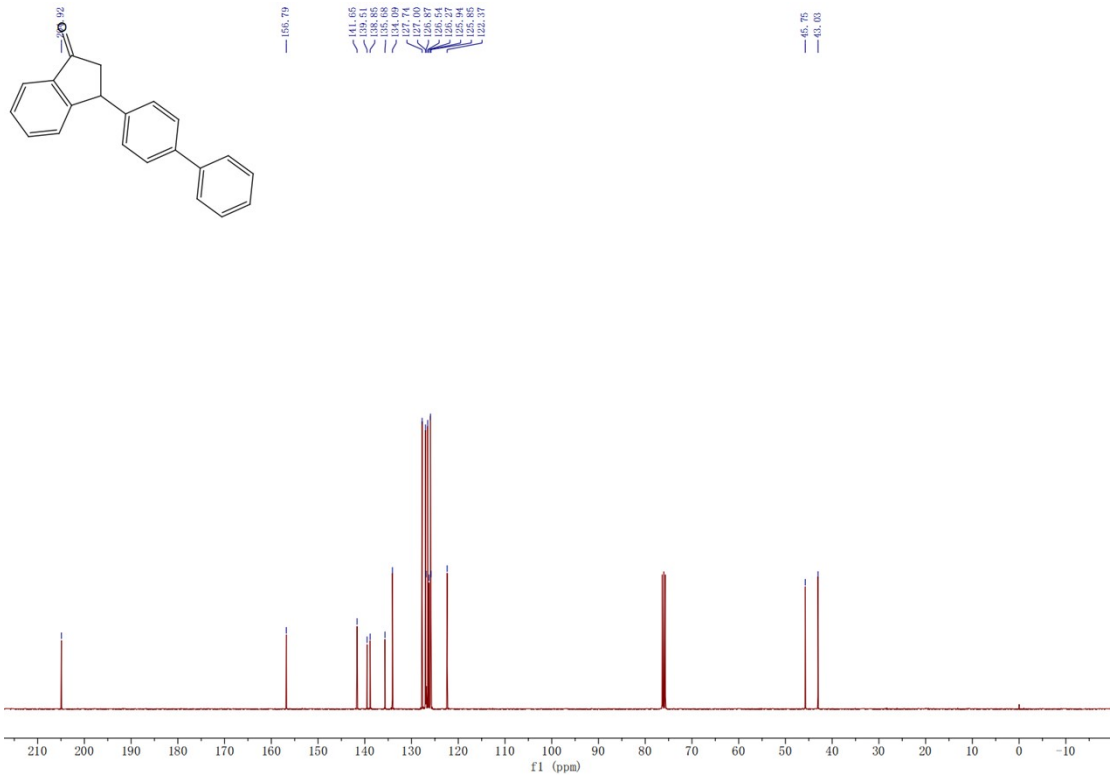
^{13}C NMR spectrum of 3-([1,1'-biphenyl]-3-yl)-2,3-dihydro-1*H*-inden-1-one **15c**



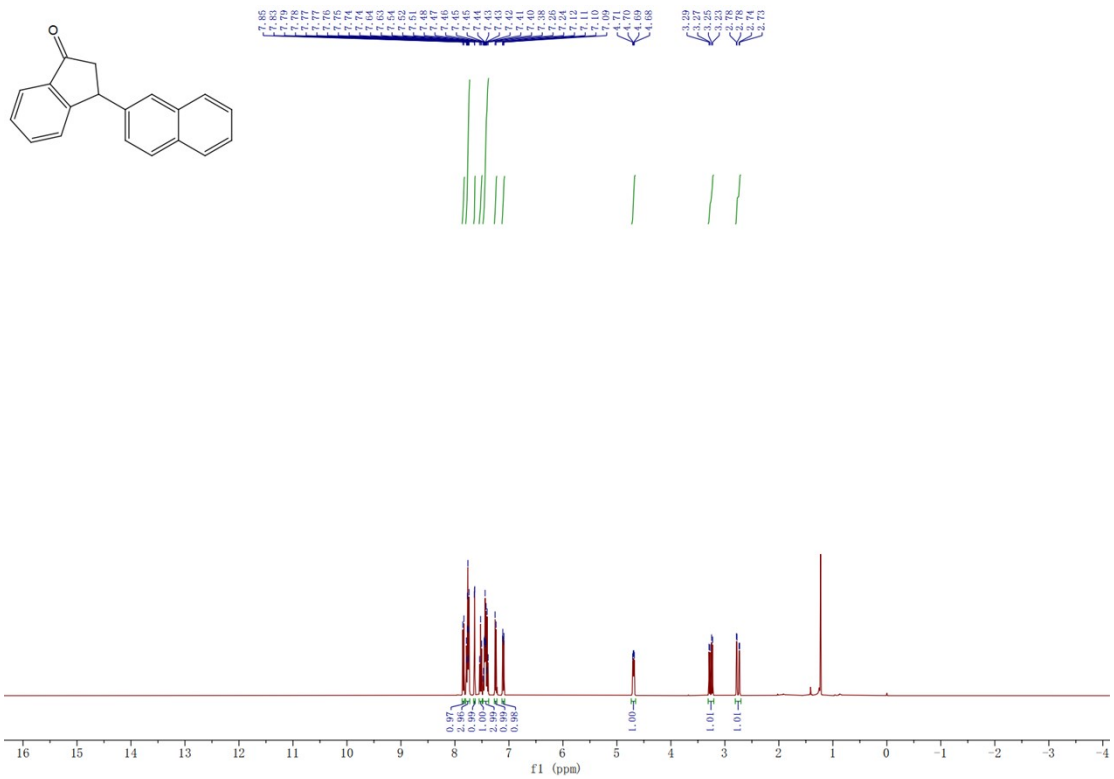
^{1}H NMR spectrum of 3-([1,1'-biphenyl]-4-yl)-2,3-dihydro-1*H*-inden-1-one **16c**



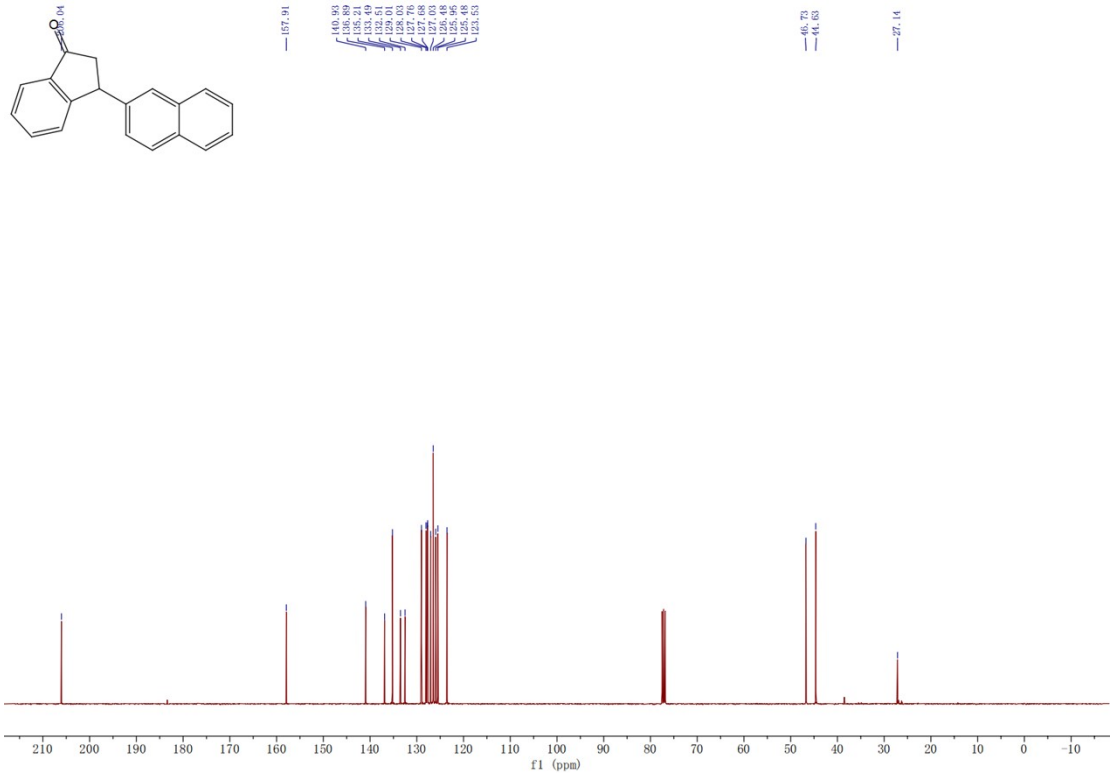
^{13}C NMR spectrum of 3-([1,1'-biphenyl]-4-yl)-2,3-dihydro-1*H*-inden-1-one **16c**



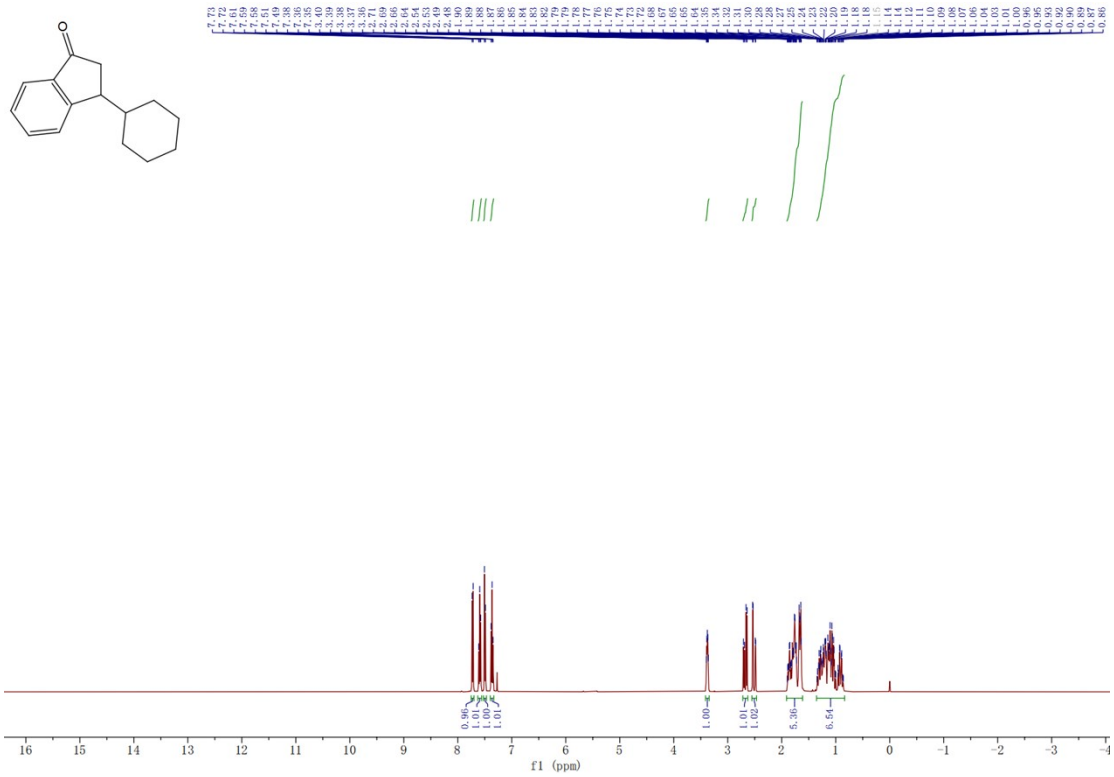
^{1}H NMR spectrum of 3-(naphthalen-2-yl)-2,3-dihydro-1*H*-inden-1-one **17c**



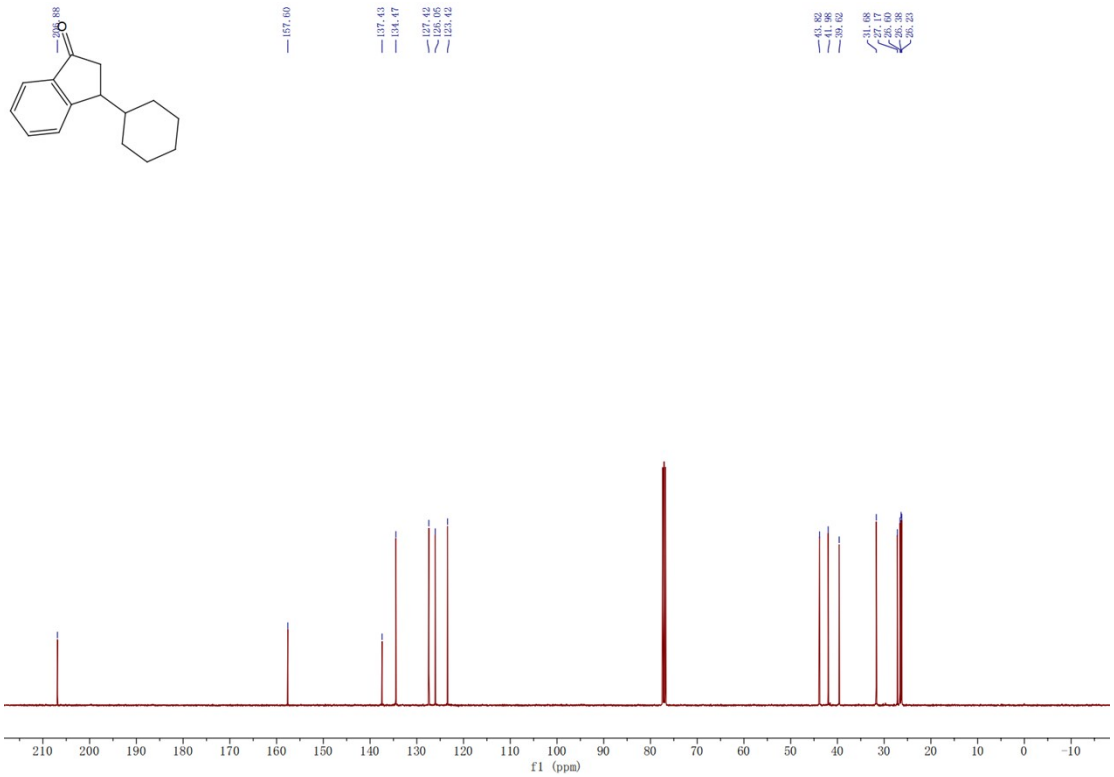
^{13}C NMR spectrum of 3-(naphthalen-2-yl)-2,3-dihydro-1*H*-inden-1-one **17c**



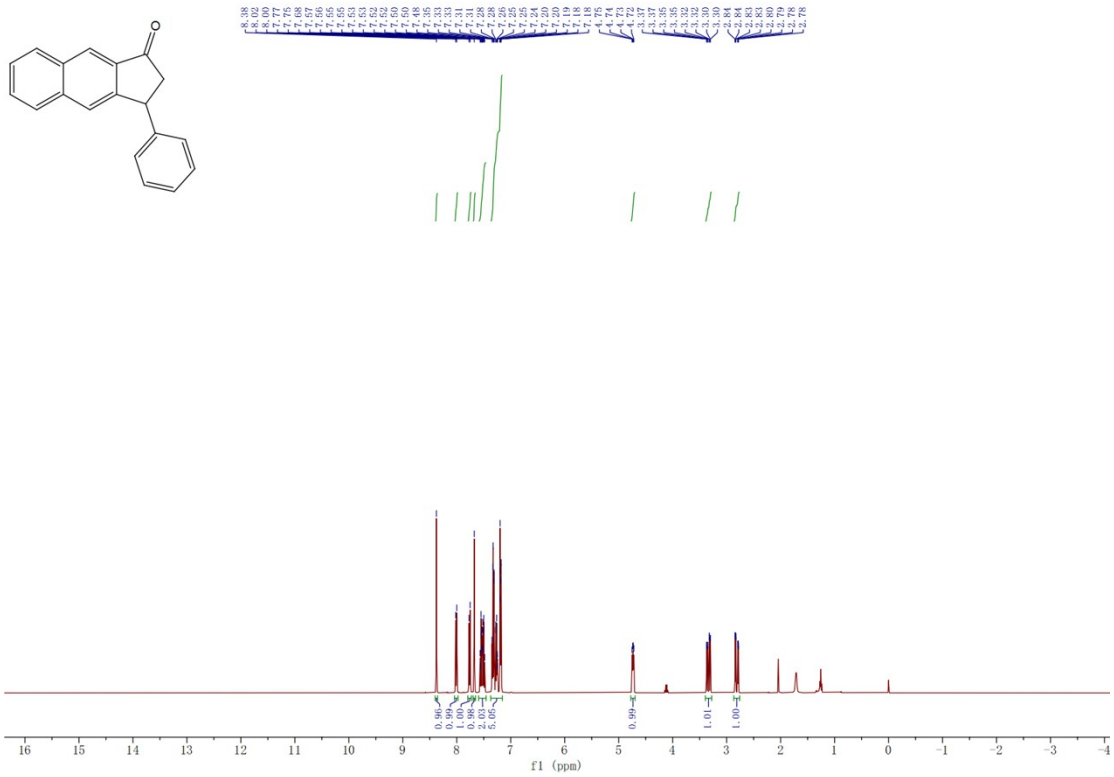
^{1}H NMR spectrum of 3-cyclohexyl-2,3-dihydro-1*H*-inden-1-one **18c**



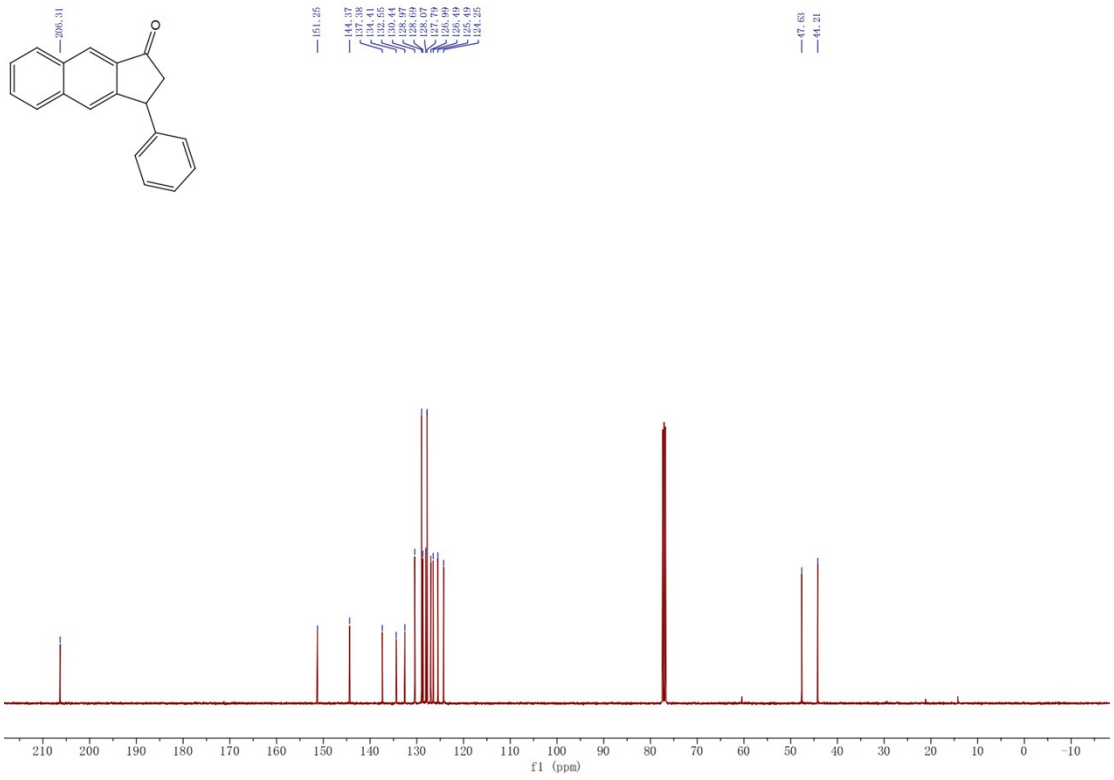
^{13}C NMR spectrum of 3-cyclohexyl-2,3-dihydro-1*H*-inden-1-one **18c**



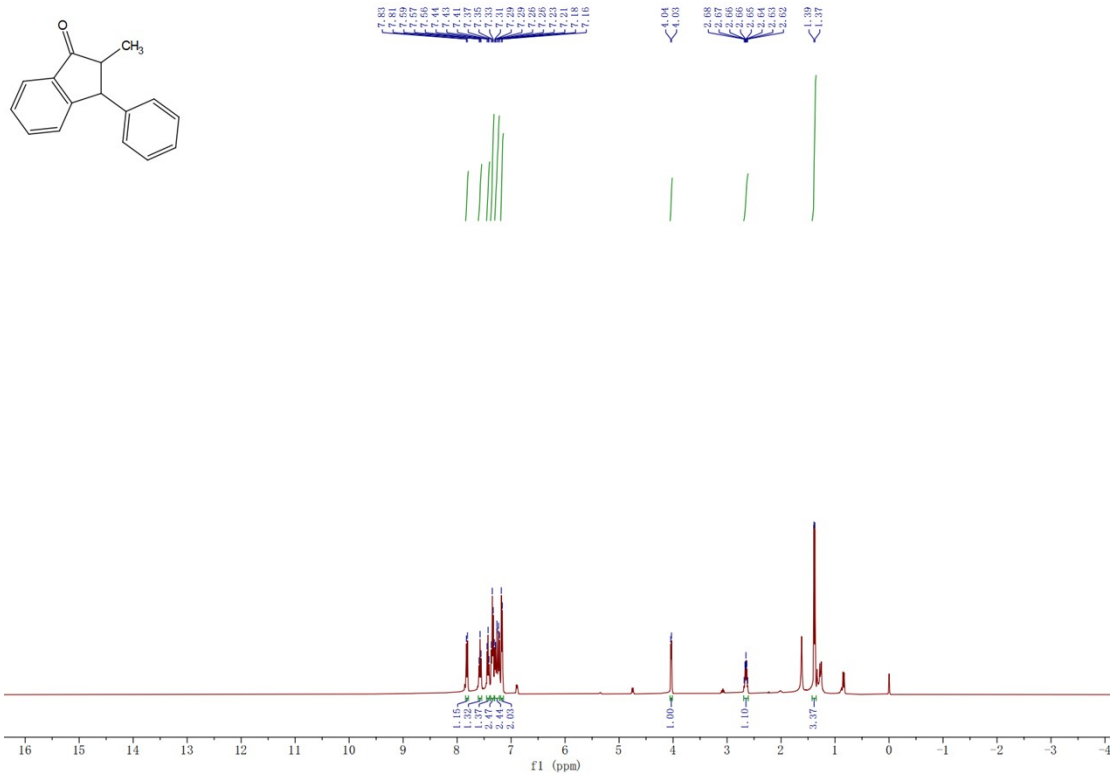
^{1}H NMR spectrum of 3-phenyl-2,3-dihydro-1*H*-cyclopenta[*b*]naphthalen-1-one **19c**



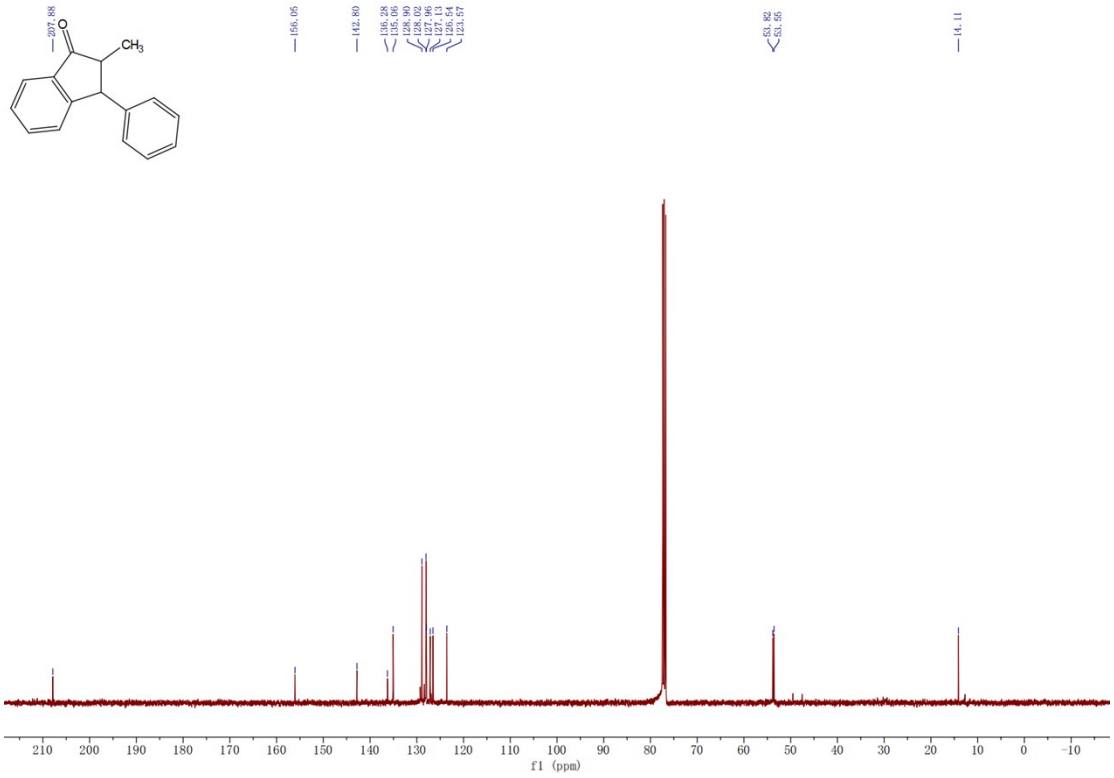
^{13}C NMR spectrum of 3-phenyl-2,3-dihydro-1*H*-cyclopenta[*b*]naphthalen-1-one **19c**



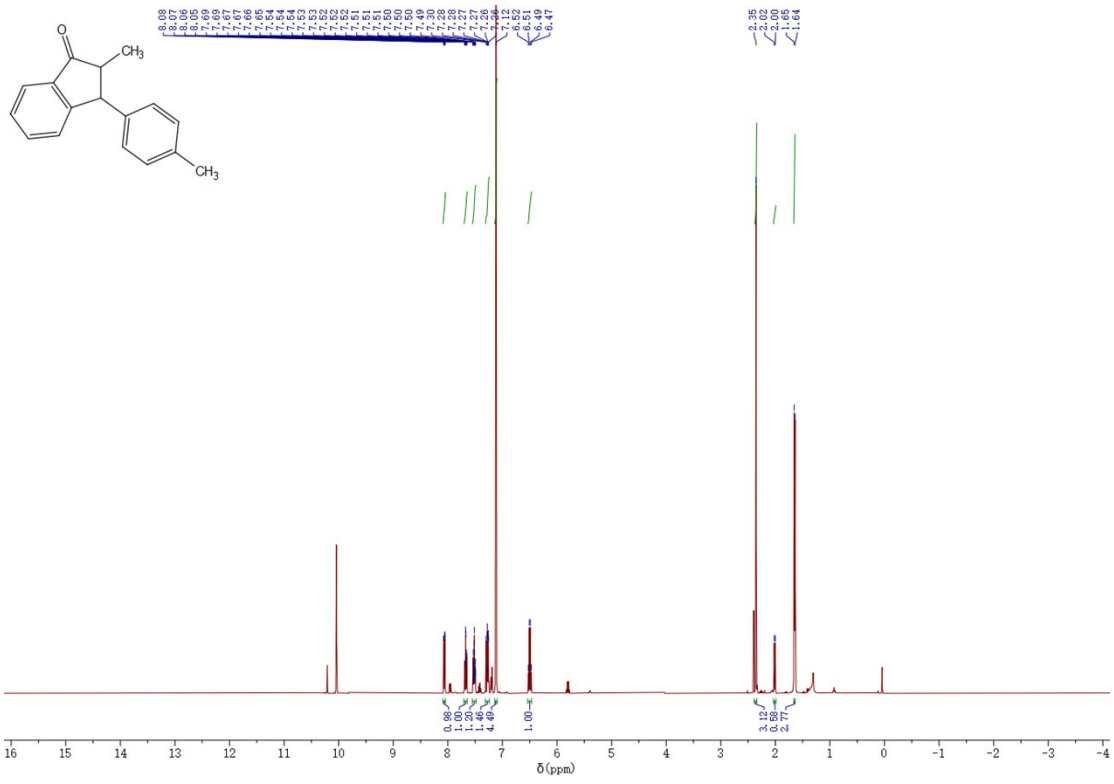
^{1}H NMR spectrum of 2-methyl-3-phenyl-2,3-dihydro-1*H*-inden-1-one **20c**



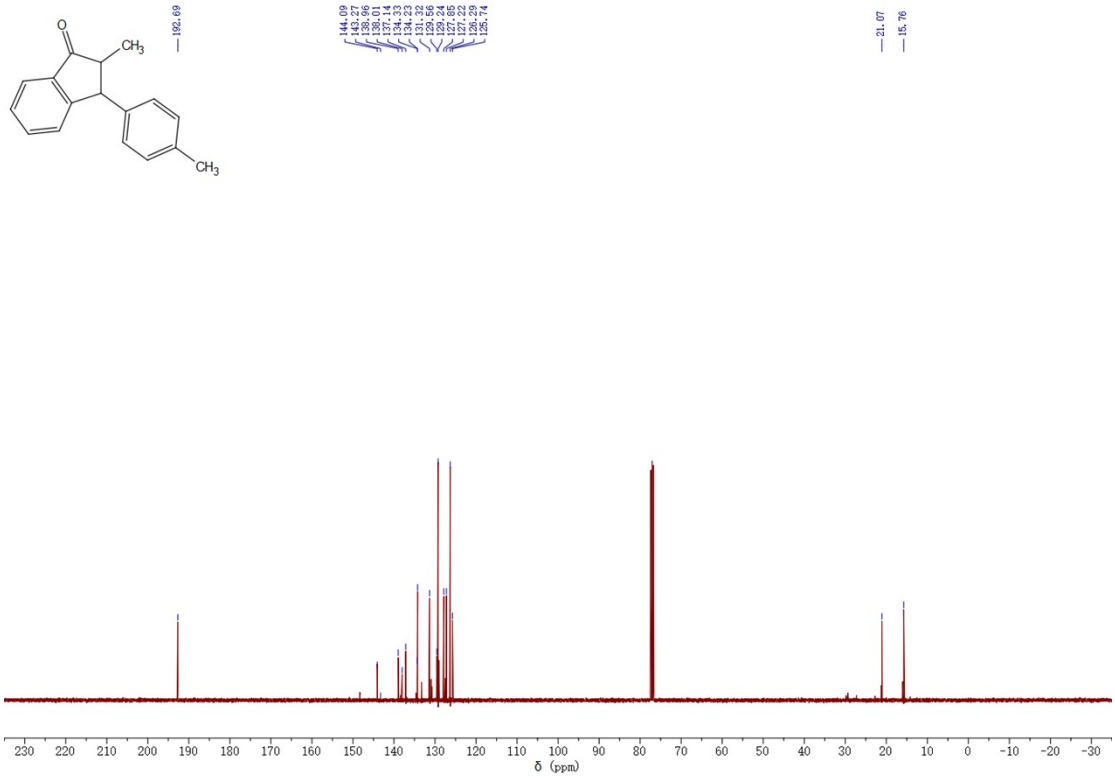
^{13}C NMR spectrum of 2-methyl-3-phenyl-2,3-dihydro-1*H*-inden-1-one **20c**



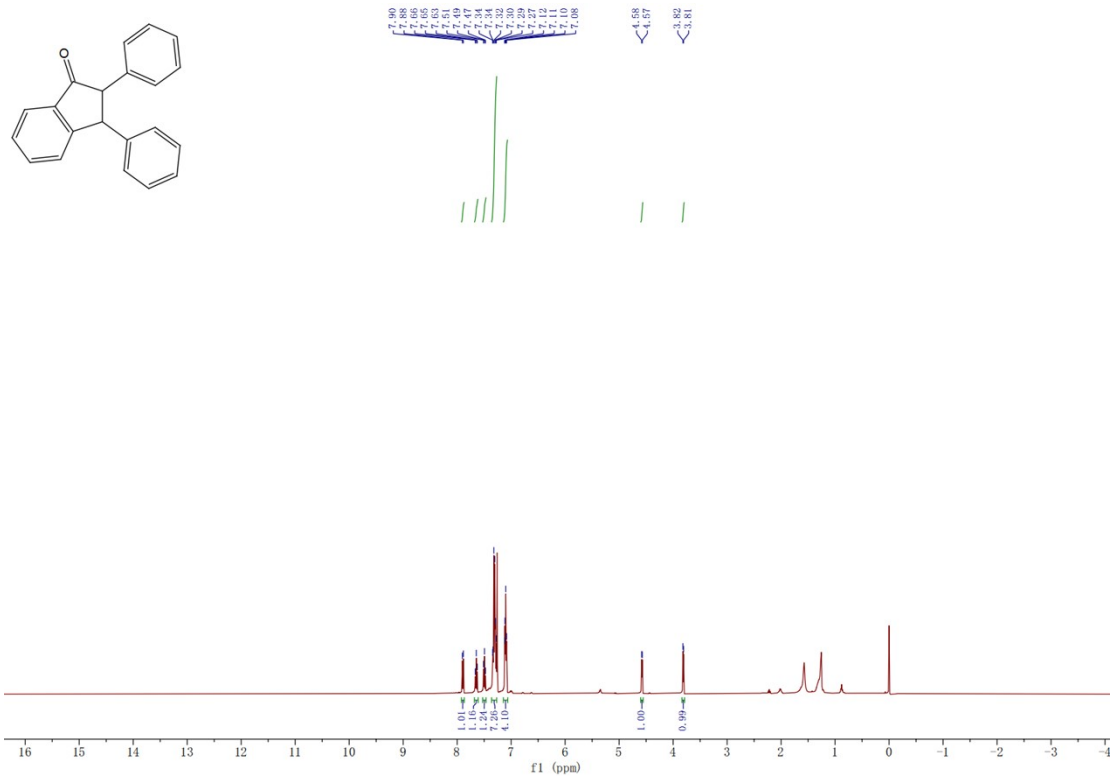
^{1}H NMR spectrum of 2-methyl-3-(*p*-tolyl)-2,3-dihydro-1*H*-inden-1-one **21c**



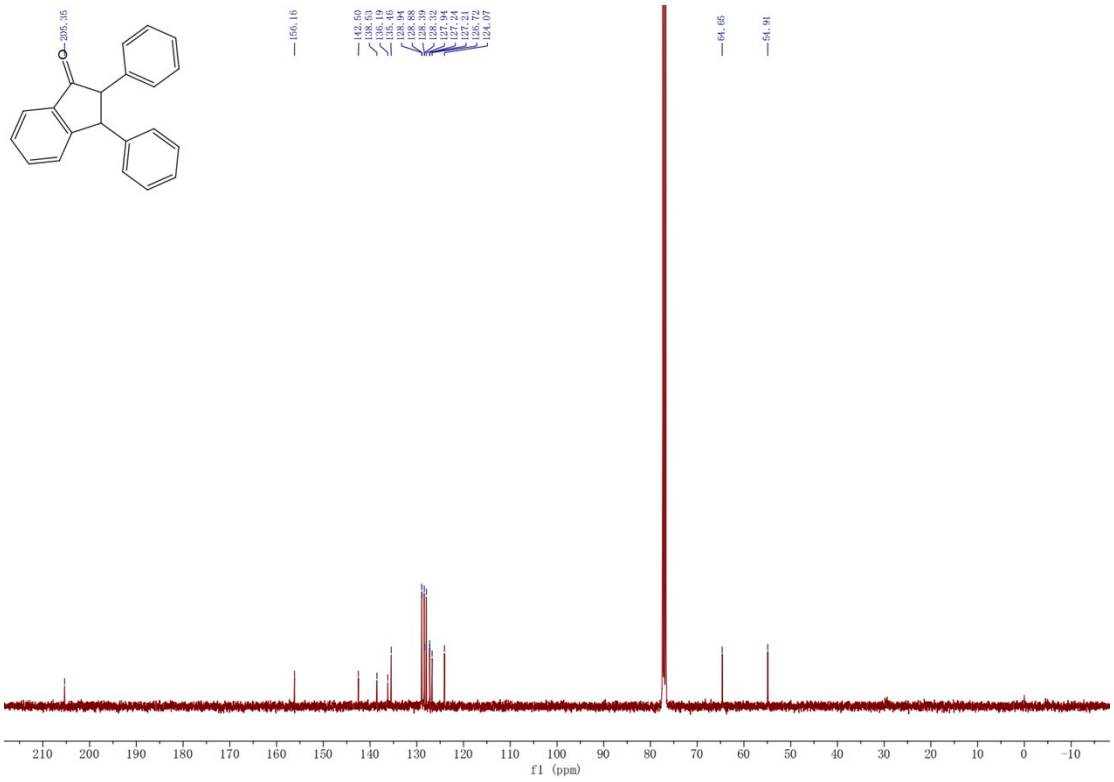
^{13}C NMR spectrum of 2-methyl-3-(*p*-tolyl)-2,3-dihydro-1*H*-inden-1-one **21c**



^{1}H NMR spectrum of 2,3-diphenyl-2,3-dihydro-1*H*-inden-1-one **22c**

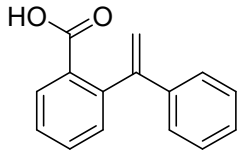


^{13}C NMR spectrum of 2,3-diphenyl-2,3-dihydro-1*H*-inden-1-one **20c**



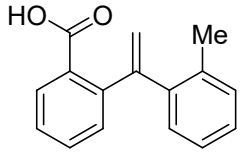
6. Characteristic data of raw materials.

2-(1-phenylvinyl)benzoic acid 1a



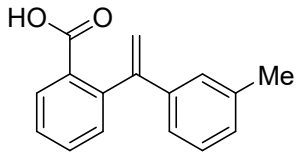
The raw material used is a white solid. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.91 (d, *J* = 7.7 Hz, 1H), 7.54 (t, *J* = 7.5 Hz, 1H), 7.45 – 7.32 (m, 2H), 7.21 (s, 5H), 5.64 (s, 1H), 5.20 (s, 1H).

2-(1-(*o*-tolyl)vinyl)benzoic acid 2a



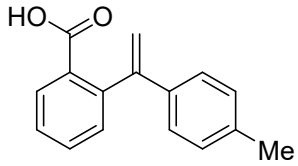
The raw material used is a white solid. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.76 (d, *J* = 7.6 Hz, 1H), 7.51 – 7.45 (m, 1H), 7.40 – 7.31 (m, 2H), 7.15 – 7.03 (m, 4H), 5.52 (s, 1H), 5.39 (s, 1H), 2.19 (s, 3H).

2-(1-(*m*-tolyl)vinyl)benzoic acid 3a



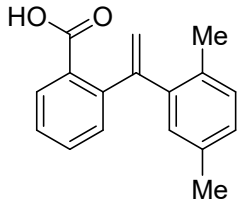
The raw material used is a white solid. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.92 (dd, *J* = 7.8, 1.7 Hz, 1H), 7.55 (tt, *J* = 7.5, 1.6 Hz, 1H), 7.45 – 7.34 (m, 2H), 7.19 – 7.12 (m, 1H), 6.81 – 6.74 (m, 3H), 5.67 (s, 1H), 5.22 (s, 1H), 3.74 (d, *J* = 1.2 Hz, 3H).

2-(1-(*p*-tolyl)vinyl)benzoic acid 4a



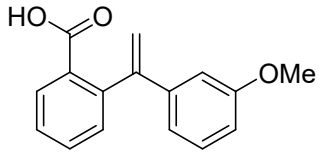
The raw material used is a white solid. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.91 (dd, *J* = 7.8, 1.5 Hz, 1H), 7.54 (td, *J* = 7.6, 1.5 Hz, 1H), 7.44 – 7.31 (m, 2H), 7.13 – 7.01 (m, 4H), 5.62 (s, 1H), 5.15 (s, 1H), 2.29 (s, 3H).

3-(1-(2,5-dimethylphenyl)vinyl)benzoic acid 5a



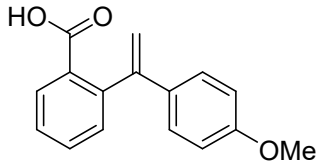
The raw material used is a white solid. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.90 (d, *J* = 7.7 Hz, 1H), 7.55 (q, *J* = 8.3, 7.5 Hz, 1H), 7.38 (dd, *J* = 32.1, 7.3 Hz, 3H), 6.84 (d, *J* = 8.9 Hz, 3H), 5.62 (s, 1H), 5.16 (s, 1H), 2.22 (s, 6H).

2-(1-(3-methoxyphenyl)vinyl)benzoic acid 7a



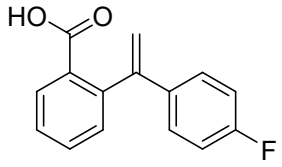
The raw material used is a white solid. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.91 (d, *J* = 7.7 Hz, 1H), 7.58 – 7.52 (m, 1H), 7.45 – 7.33 (m, 2H), 7.12 (t, *J* = 7.5 Hz, 1H), 7.06 – 6.97 (m, 3H), 5.65 (s, 1H), 5.19 (s, 1H), 2.27 (s, 3H).

2-(1-(4-methoxyphenyl)vinyl)benzoic acid 8a



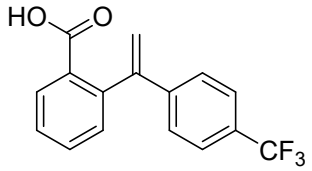
The raw material used is a white solid. ^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.88 (d, *J* = 7.7 Hz, 1H), 7.47 (dd, *J* = 8.4, 6.6 Hz, 1H), 7.37 – 7.29 (m, 2H), 7.13 (dd, *J* = 8.7, 1.7 Hz, 2H), 6.77 – 6.72 (m, 2H), 5.54 (s, 1H), 5.08 (s, 1H), 3.67 (d, *J* = 1.6 Hz, 3H).

2-(1-(4-fluorophenyl)vinyl)benzoic acid 9a



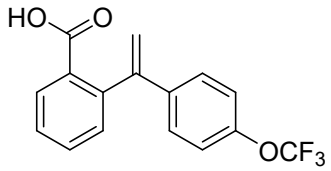
The raw material used is a white solid. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.93 (d, *J* = 7.8 Hz, 1H), 7.57 (dd, *J* = 8.3, 6.8 Hz, 1H), 7.47 – 7.34 (m, 2H), 7.17 (ddt, *J* = 8.5, 4.5, 2.2 Hz, 2H), 6.92 (td, *J* = 8.7, 1.3 Hz, 2H), 5.60 (s, 1H), 5.20 (s, 1H).

2-(1-(4-(trifluoromethyl)phenyl)vinyl)benzoic acid 11a



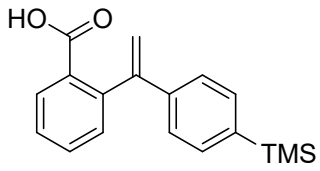
The raw material used is a white solid. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.96 (d, *J* = 7.8 Hz, 1H), 7.60 (t, *J* = 7.5 Hz, 1H), 7.48 (t, *J* = 7.1 Hz, 3H), 7.33 (dd, *J* = 25.1, 7.8 Hz, 3H), 5.72 (s, 1H), 5.31 (s, 1H).

2-(1-(4-(trifluoromethoxy)phenyl)vinyl)benzoic acid 12a



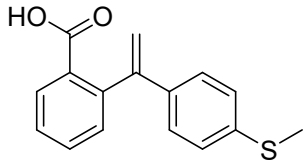
The raw material used is a white solid. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.95 (d, *J* = 7.8 Hz, 1H), 7.62 – 7.55 (m, 1H), 7.45 (dd, *J* = 8.5, 6.8 Hz, 1H), 7.36 (d, *J* = 7.6 Hz, 1H), 7.27 – 7.19 (m, 2H), 7.08 (d, *J* = 8.3 Hz, 2H), 5.65 (s, 1H), 5.24 (s, 1H).

3-2-(1-(4-(trimethylsilyl)phenyl)vinyl)benzoic acid 13a



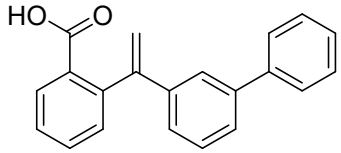
The raw material used is a white solid. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.71 (dd, *J* = 7.8, 1.5 Hz, 1H), 7.33 (tt, *J* = 7.5, 1.5 Hz, 1H), 7.23 – 7.10 (m, 4H), 7.01 – 6.96 (m, 2H), 5.47 (s, 1H), 4.99 (s, 1H).

2-(1-(4-(methylthio)phenyl)vinyl)benzoic acid 14a



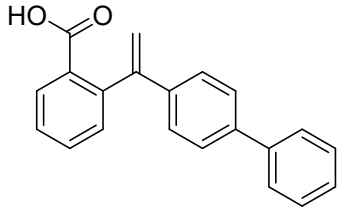
The raw material used is a white solid. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.94 (d, *J* = 7.8 Hz, 1H), 7.56 (t, *J* = 7.5 Hz, 1H), 7.46 – 7.33 (m, 2H), 7.14 (s, 4H), 5.66 (s, 1H), 5.18 (s, 1H), 2.44 (d, *J* = 1.3 Hz, 3H).

2-(1-([1,1'-biphenyl]-3-yl)vinyl)benzoic acid 15a



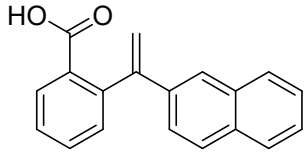
The raw material used is a white solid. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.89 (d, *J* = 7.7 Hz, 1H), 7.59 – 7.48 (m, 3H), 7.45 – 7.35 (m, 6H), 7.34 – 7.25 (m, 3H), 7.16 (dd, *J* = 7.7, 1.6 Hz, 1H), 5.70 (s, 1H), 5.25 (s, 1H).

2-(1-([1,1'-biphenyl]-4-yl)vinyl)benzoic acid 16a



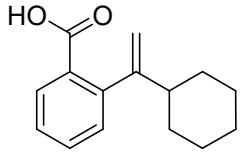
The raw material used is a white solid. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.92 (d, *J* = 7.8 Hz, 1H), 7.56 (dd, *J* = 15.1, 7.6 Hz, 3H), 7.43 (dt, *J* = 24.0, 7.9 Hz, 6H), 7.30 – 7.24 (m, 3H), 5.71 (s, 1H), 5.22 (s, 1H).

2-**(1-(naphthalen-2-yl)vinyl)benzoic acid 17a**



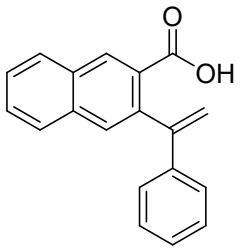
The raw material used is a white solid. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.90 (d, *J* = 7.8 Hz, 1H), 7.77 – 7.63 (m, 3H), 7.58 (td, *J* = 7.5, 1.4 Hz, 1H), 7.51 (dd, *J* = 8.5, 1.9 Hz, 1H), 7.47 – 7.35 (m, 5H), 5.74 (s, 1H), 5.26 (s, 1H).

3-(1-cyclohexylvinyl)benzoic acid 18a



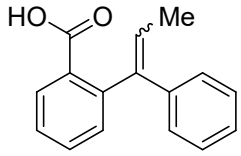
The raw material used is a white solid. ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.00 (d, *J* = 7.8 Hz, 1H), 7.49 (t, *J* = 7.5 Hz, 1H), 7.36 (t, *J* = 7.6 Hz, 1H), 7.20 (d, *J* = 7.6 Hz, 1H), 5.09 (s, 1H), 4.89 (s, 1H), 1.90 – 1.62 (m, 6H), 1.22 (q, *J* = 11.1, 9.6 Hz, 5H).

4-(1-phenylvinyl)-2-naphthoic acid 19a



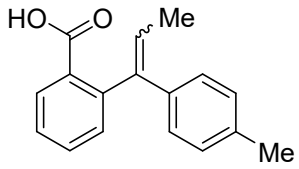
The raw material used is a white solid. ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.52 (s, 1H), 7.96 (d, *J* = 8.1 Hz, 1H), 7.93 – 7.85 (m, 2H), 7.60 (dt, *J* = 23.5, 7.2 Hz, 2H), 7.26 – 7.23 (m, 5H), 5.73 (s, 1H), 5.38 (s, 1H).

2-(1-phenylprop-1-en-1-yl)benzoic acid 20a



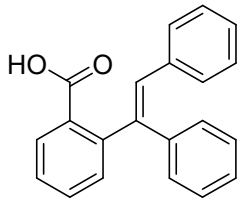
The raw material used is a white solid. ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.05 (d, *J* = 7.8 Hz, 1H), 7.58 (t, *J* = 7.5 Hz, 1H), 7.44 (dt, *J* = 18.7, 7.5 Hz, 1H), 7.32 (t, *J* = 7.4 Hz, 1H), 7.22 (dd, *J* = 8.9, 6.9 Hz, 4H), 7.19 – 7.13 (m, 4H), 6.18 (qd, *J* = 6.9, 1.2 Hz, 1H), 5.85 – 5.79 (m, 1H), 1.87 (dd, *J* = 7.1, 1.3 Hz, 1H), 1.59 (dd, *J* = 6.9, 1.3 Hz, 3H).

2-(1-(p-tolyl)prop-1-en-1-yl)benzoic acid 21a



The raw material used is a white solid. ^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.97 (d, *J* = 7.8 Hz, 1H), 7.50 (t, *J* = 7.5 Hz, 1H), 7.36 (tt, *J* = 17.8, 8.8 Hz, 2H), 7.27 – 7.07 (m, 3H), 6.97 (d, *J* = 3.9 Hz, 5H), 6.08 (q, *J* = 6.9 Hz, 1H), 2.22 (s, 4H), 1.80 (d, *J* = 7.0 Hz, 1H), 1.50 (d, *J* = 6.9 Hz, 3H).

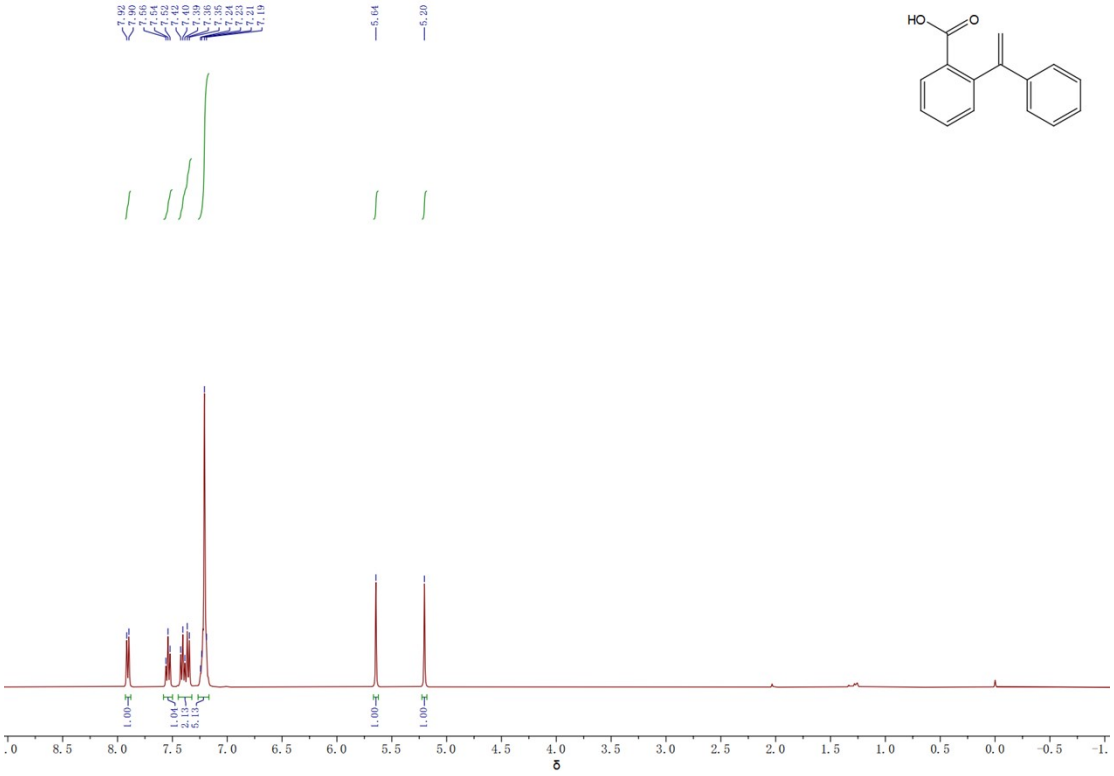
(E)-2-(1,2-diphenylvinyl)benzoic acid 22a



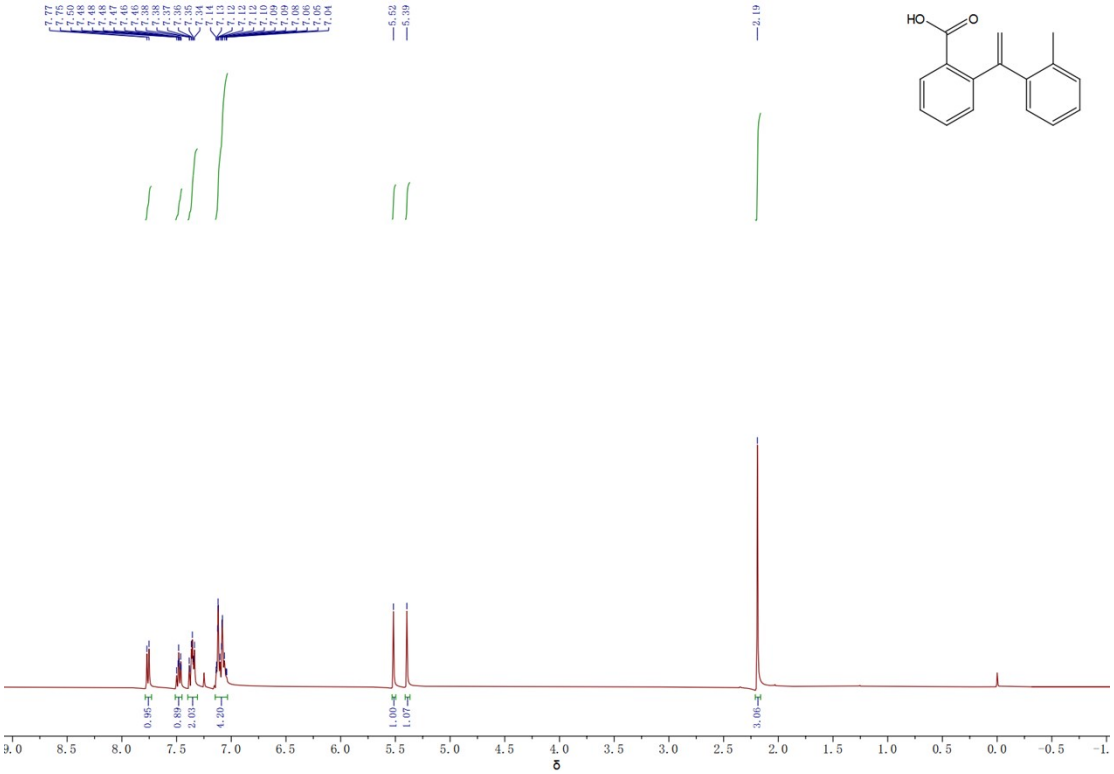
The raw material used is a white solid. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.79 (d, *J* = 7.7 Hz, 1H), 7.47 (t, *J* = 7.5 Hz, 1H), 7.36 (s, 2H), 7.15 – 7.04 (m, 11H), 6.59 (s, 1H).

7. Copies of ^{1}H NMR Spectra of the Products.

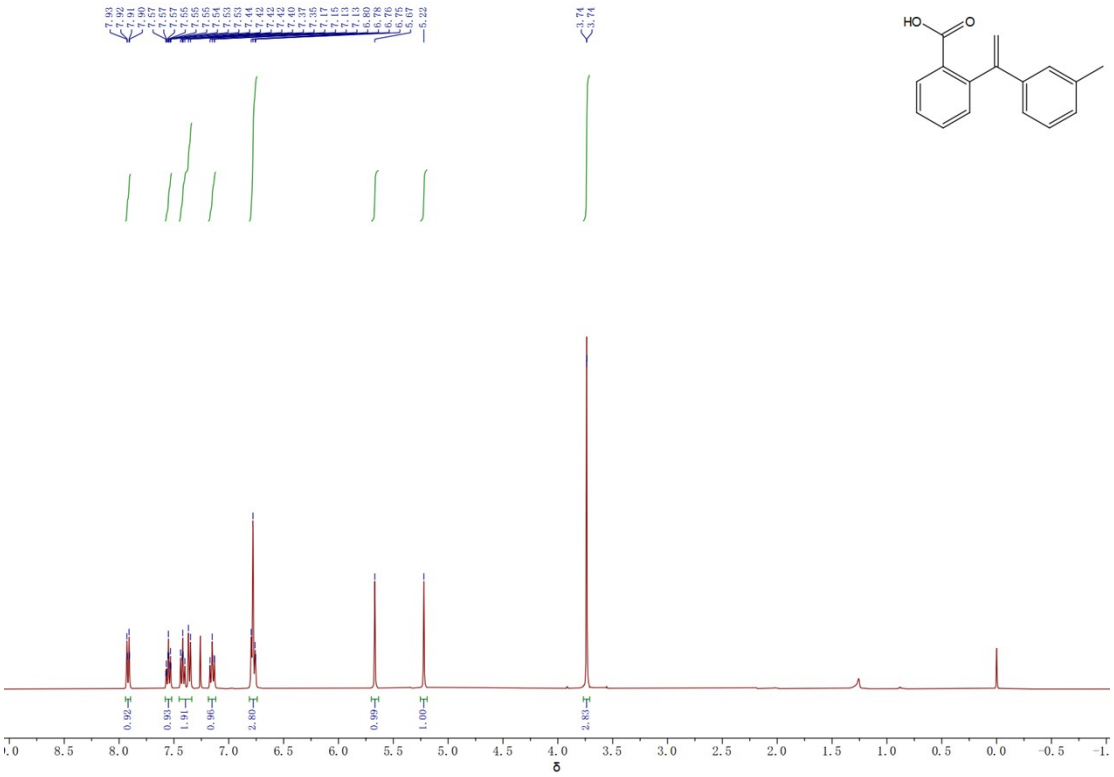
^{1}H NMR spectrum of 2-(1-phenylvinyl)benzoic acid **1a**.



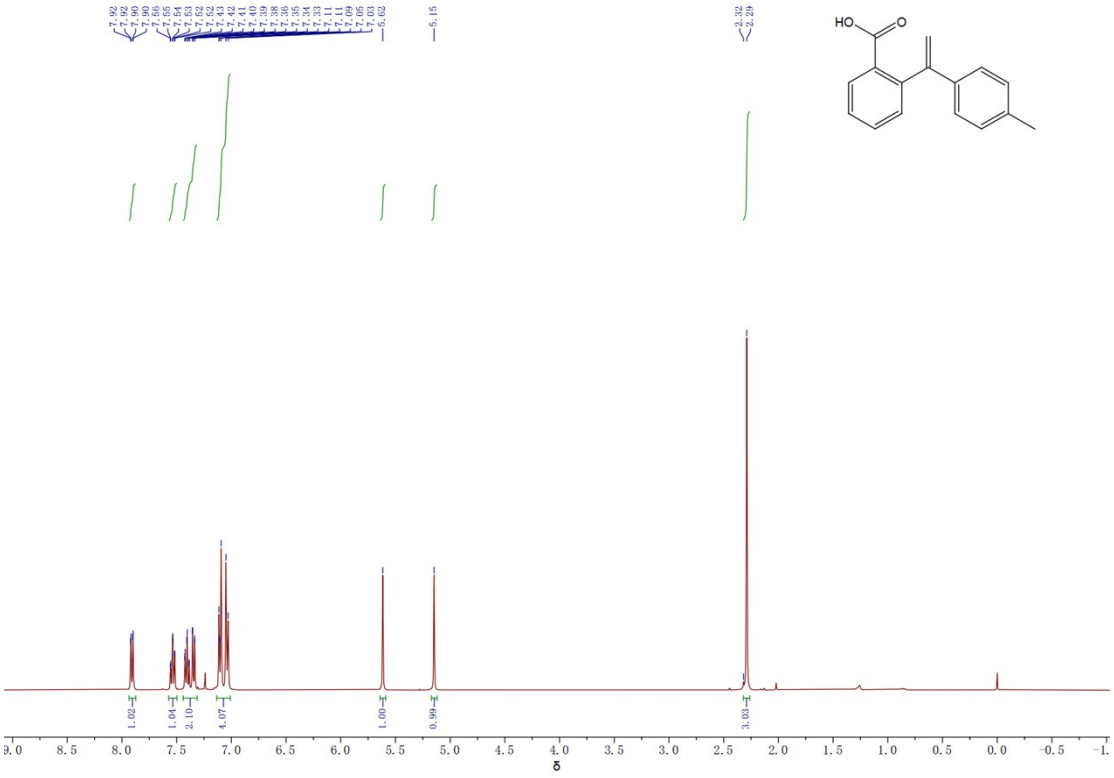
^{1}H NMR spectrum of 2-(1-(*o*-tolyl)vinyl)benzoic acid **2a**.



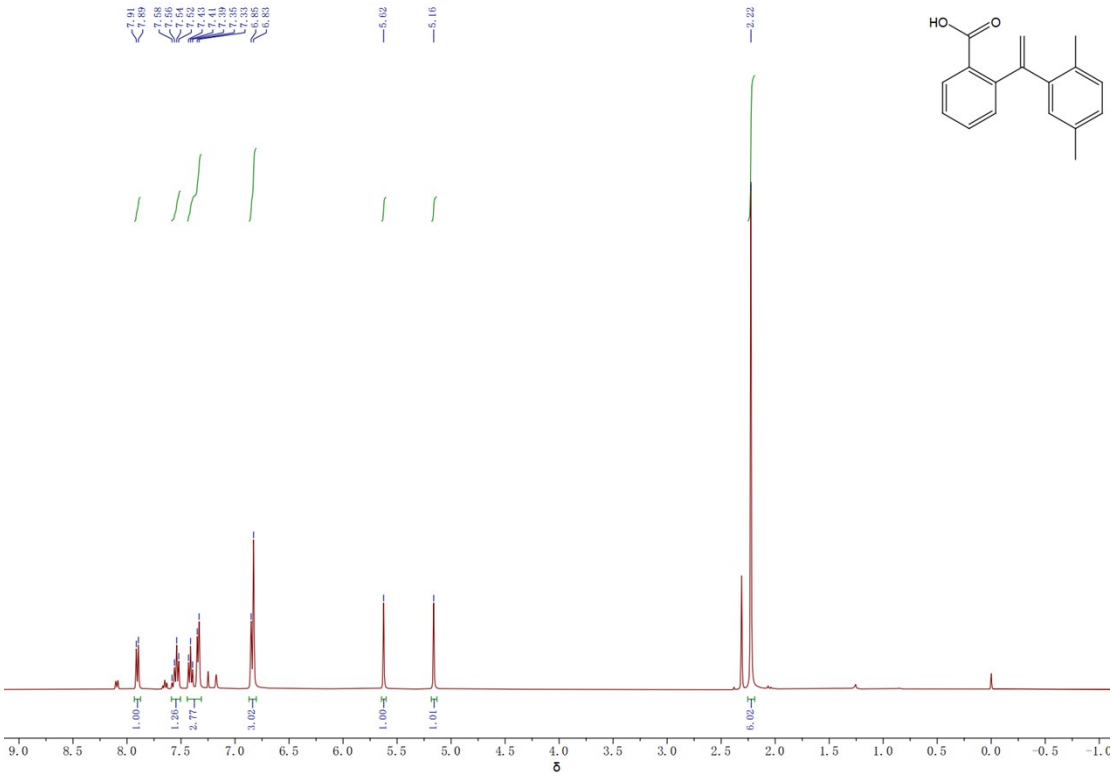
^{1}H NMR spectrum of 2-(1-(*m*-tolyl)vinyl)benzoic acid **3a**.



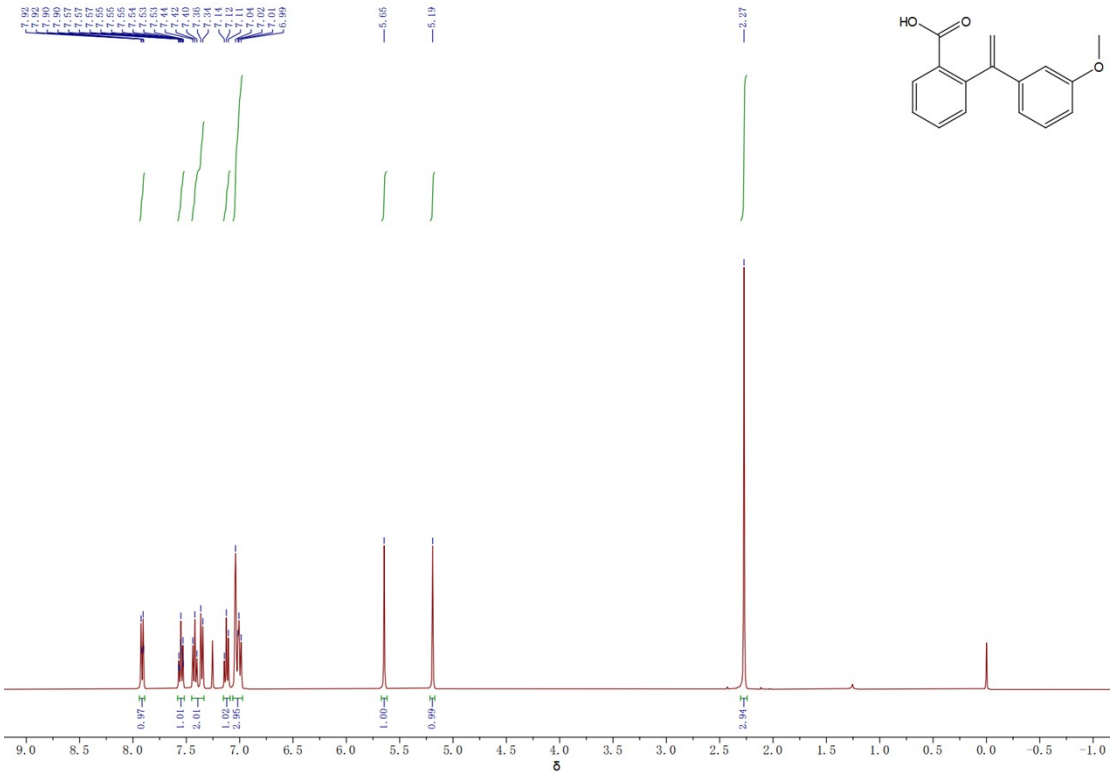
^{1}H NMR spectrum of 2-(1-(*p*-tolyl)vinyl)benzoic acid **4a**.



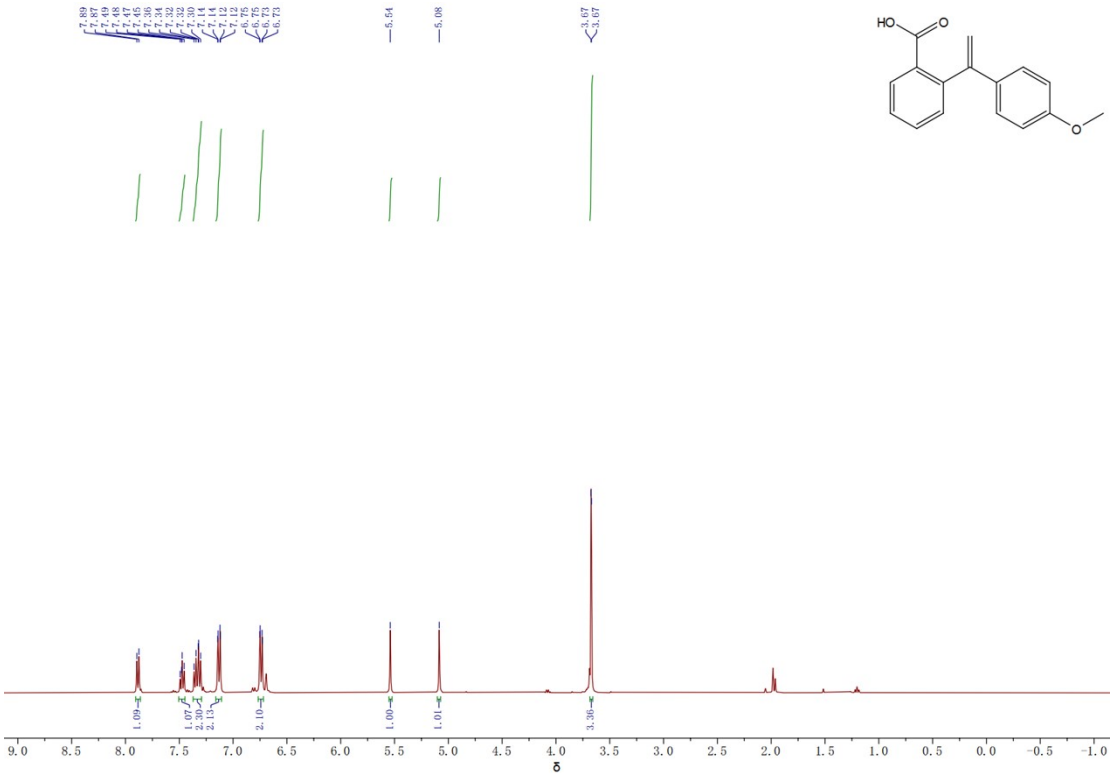
^{1}H NMR spectrum of 3-(1-(2,5-dimethylphenyl)vinyl)benzoic acid **5a**.



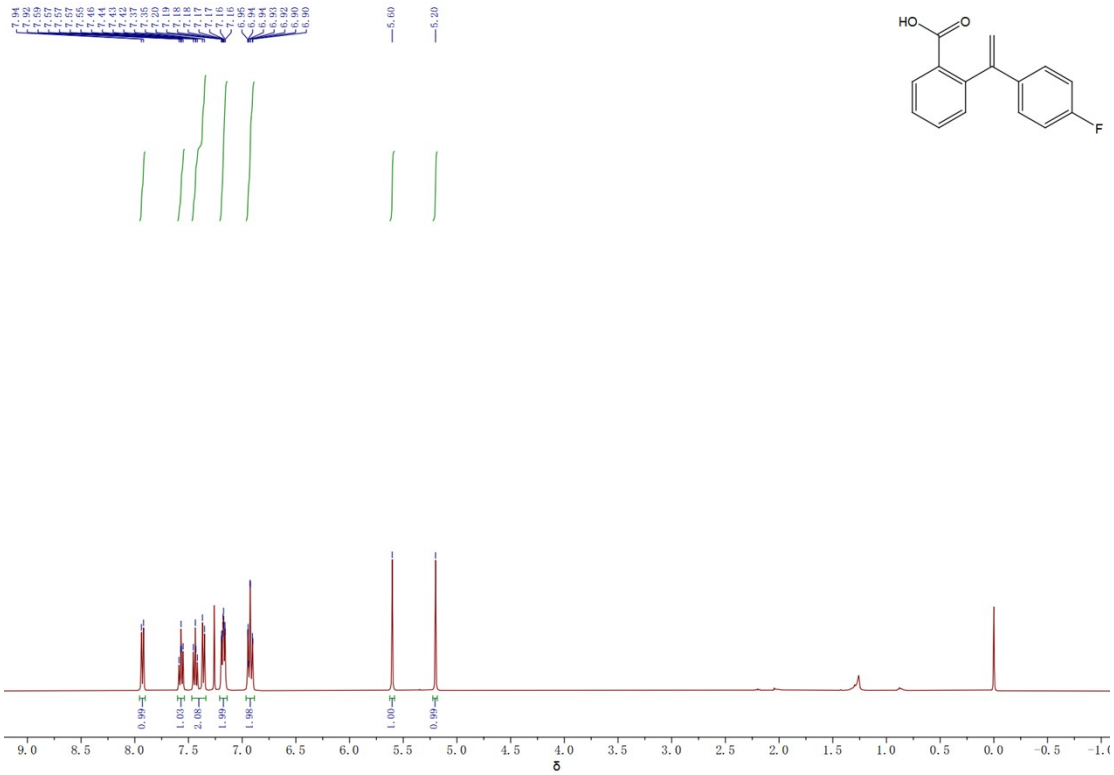
^{1}H NMR spectrum of 2-(1-(3-methoxyphenyl)vinyl)benzoic acid **7a**.



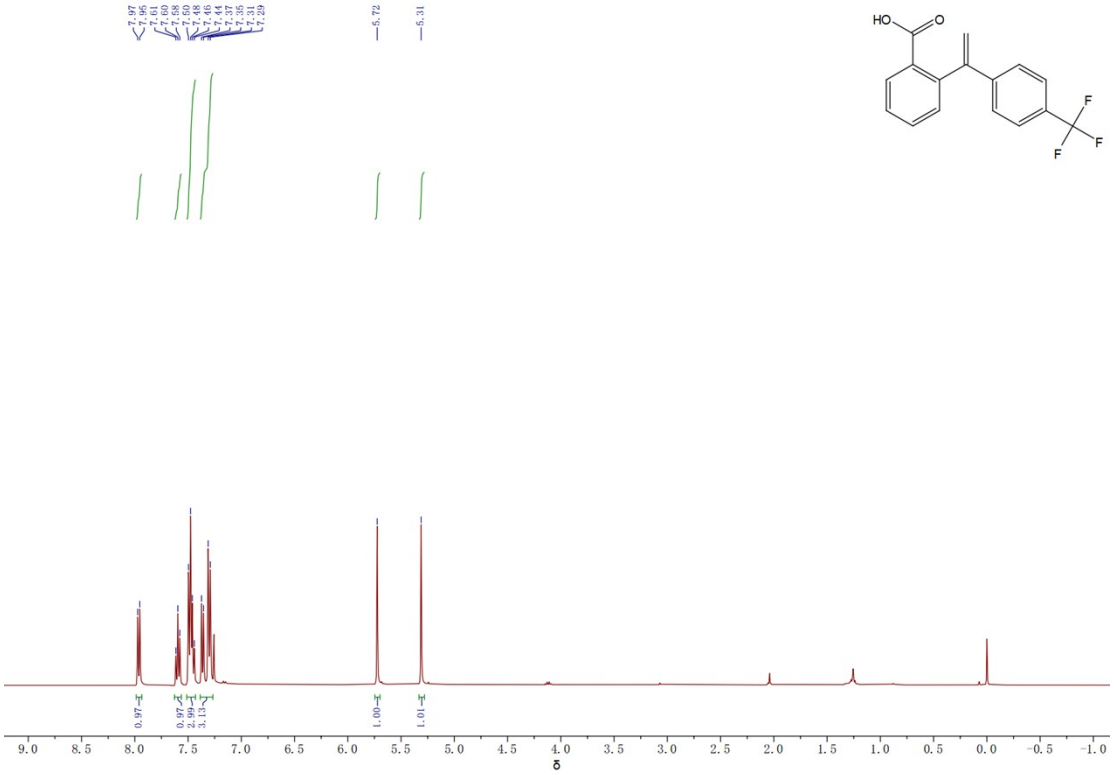
^{1}H NMR spectrum of 2-(1-(4-methoxyphenyl)vinyl)benzoic acid **8a**.



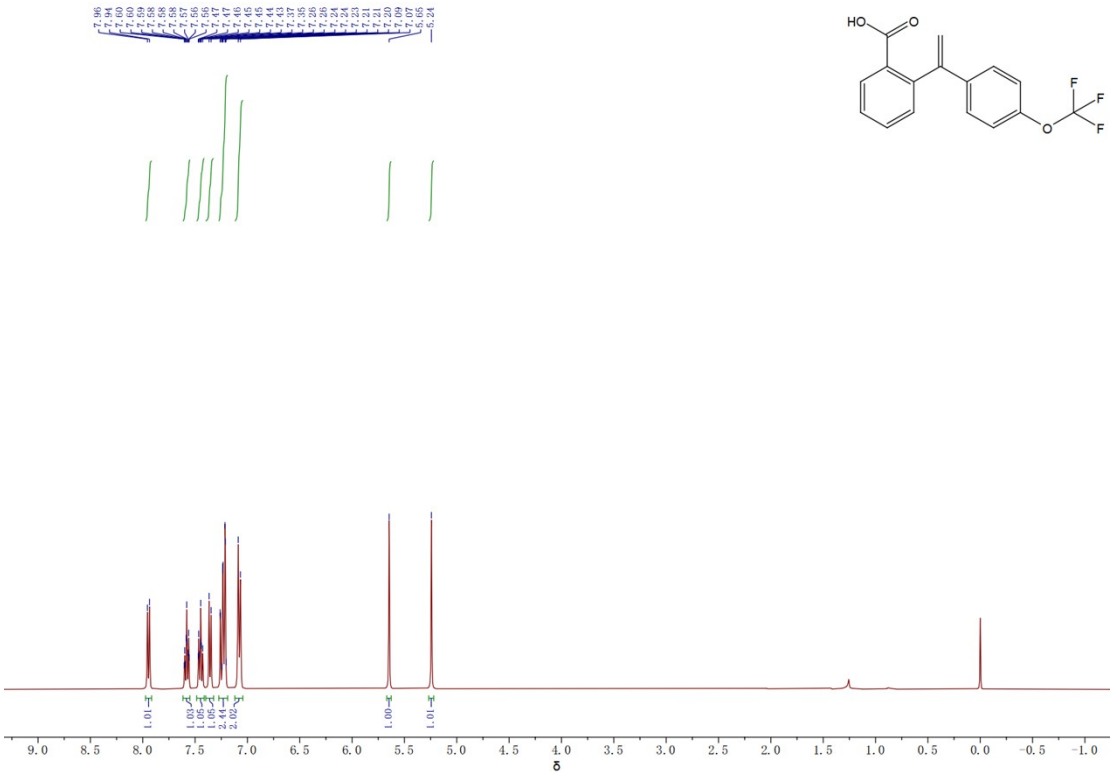
^{1}H NMR spectrum of 2-(1-(4-fluorophenyl)vinyl)benzoic acid **9a**.



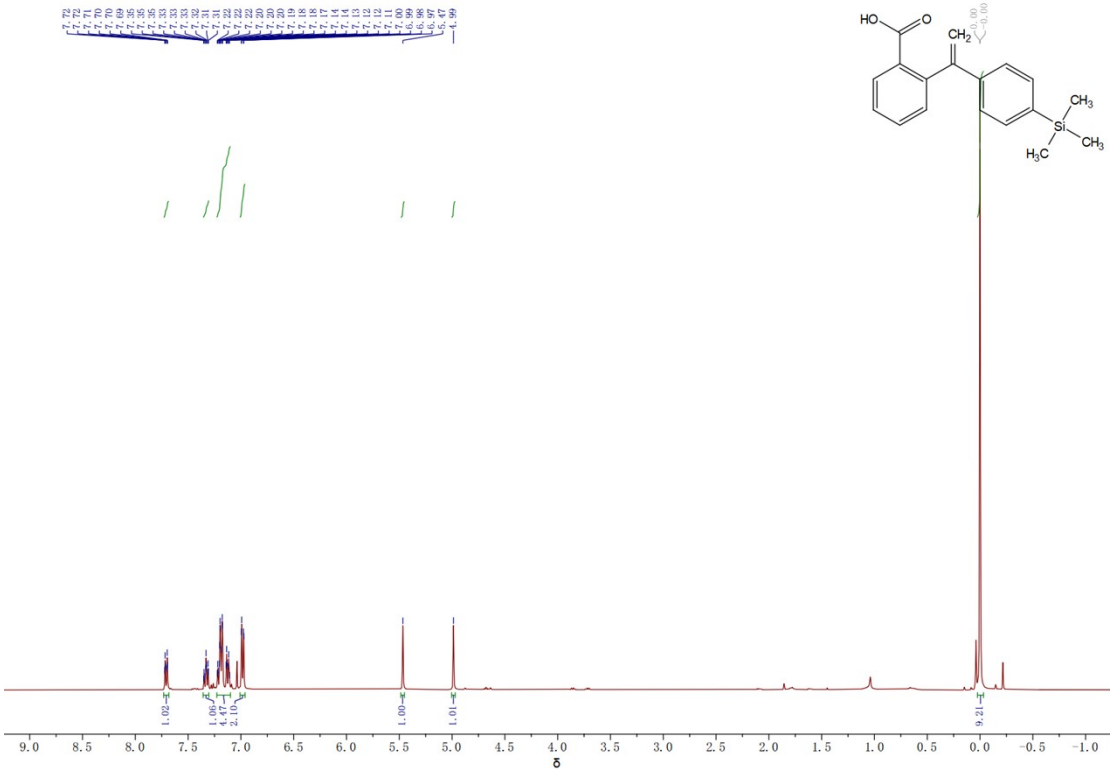
^{1}H NMR spectrum of 2-(1-(4-(trifluoromethyl)phenyl)vinyl)benzoic acid **11a**.



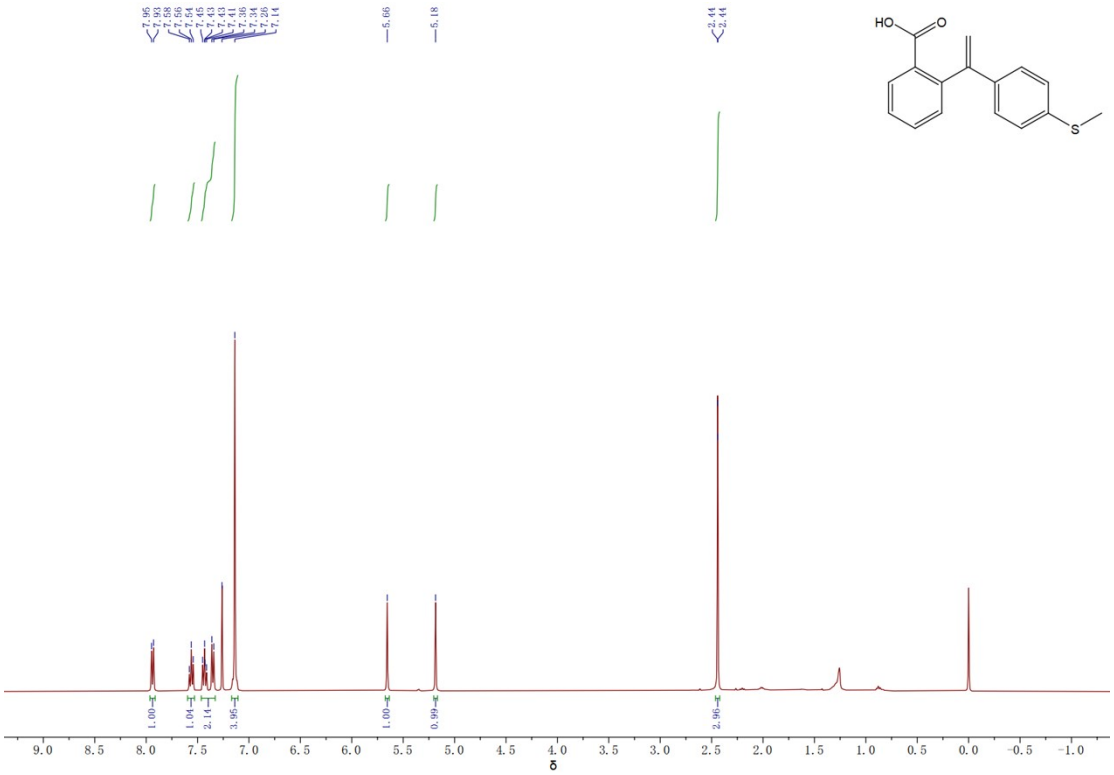
^{1}H NMR spectrum of 2-(1-(4-(trifluoromethoxy)phenyl)vinyl)benzoic acid **12a**.



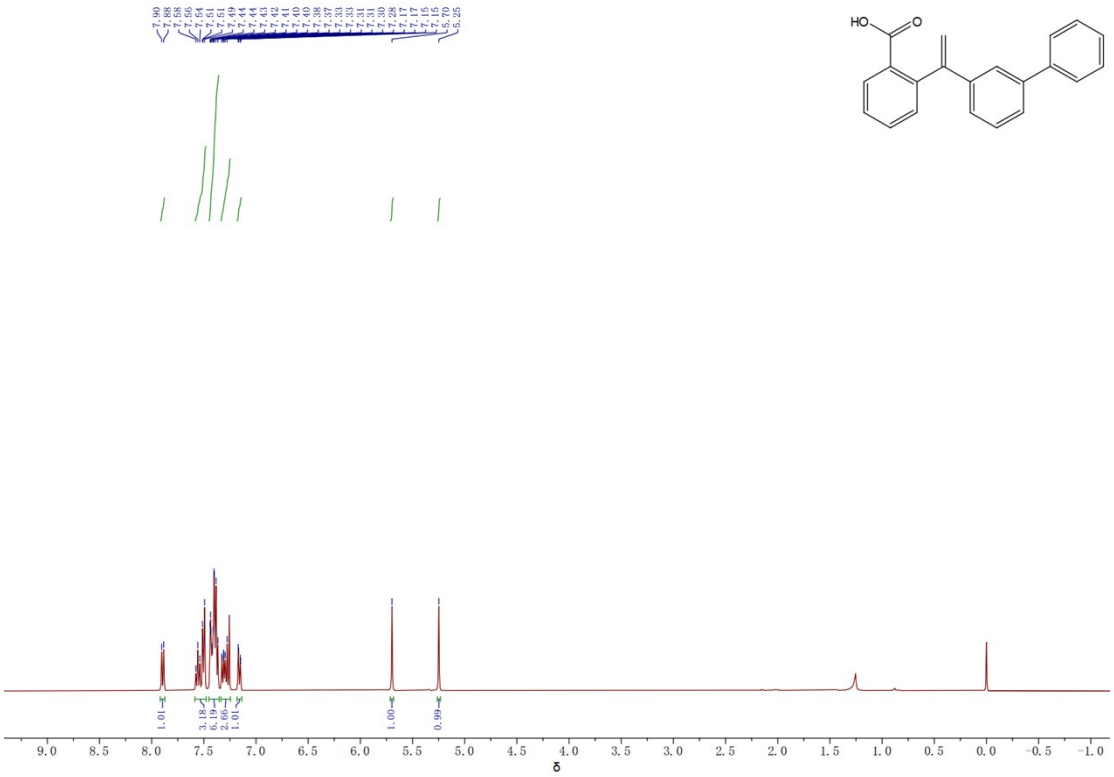
^{1}H NMR spectrum of 3-2-(1-(4-(trimethylsilyl)phenyl)vinyl)benzoic acid **13a**.



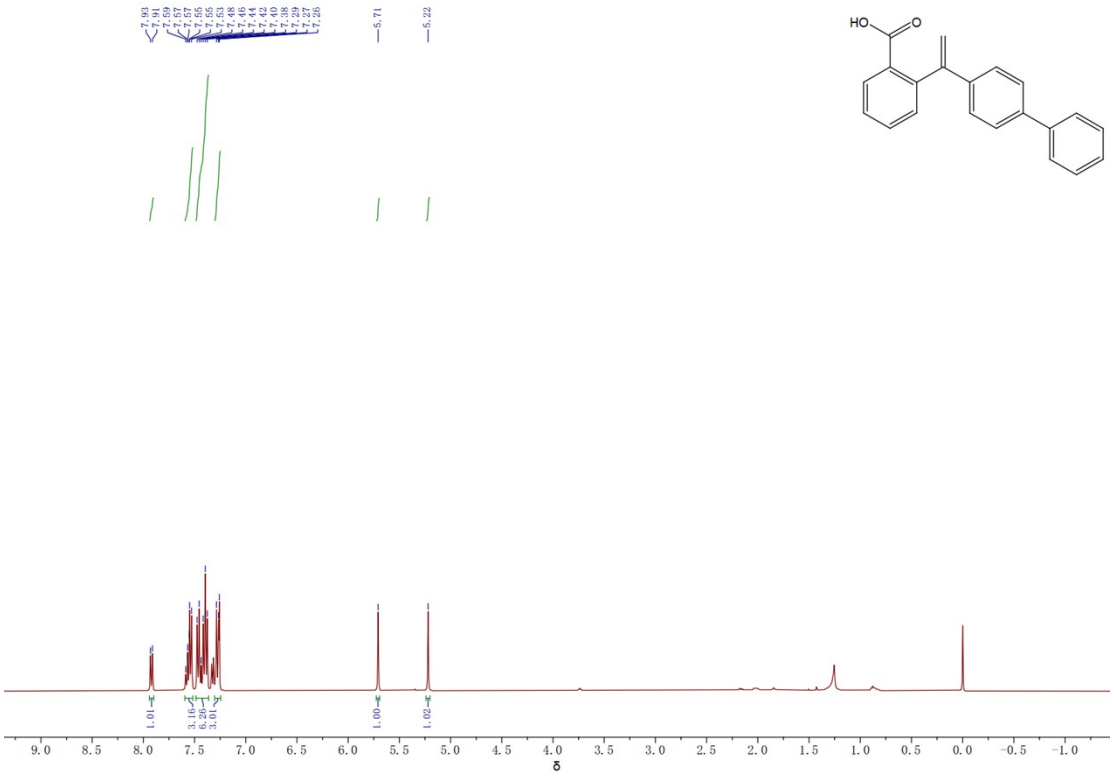
^{1}H NMR spectrum of 2-(1-(4-(methylthio)phenyl)vinyl)benzoic acid **14a**.



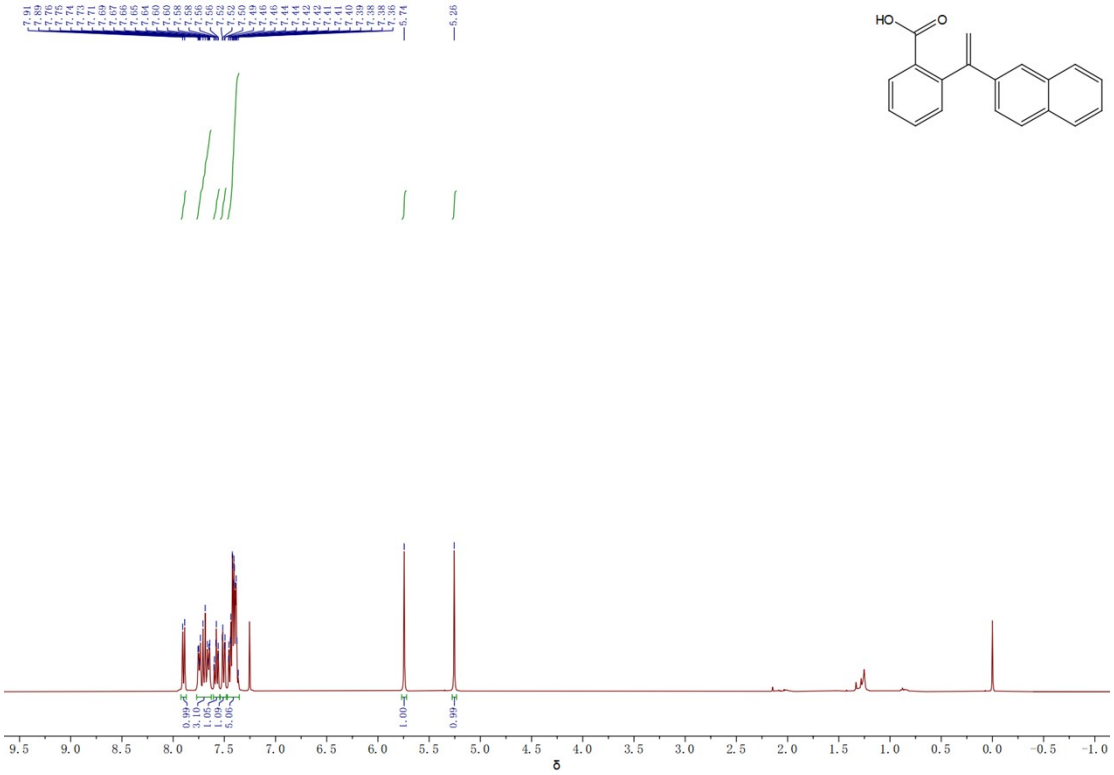
^{1}H NMR spectrum of 2-(1-([1,1'-biphenyl]-3-yl)vinyl)benzoic acid **15a**.



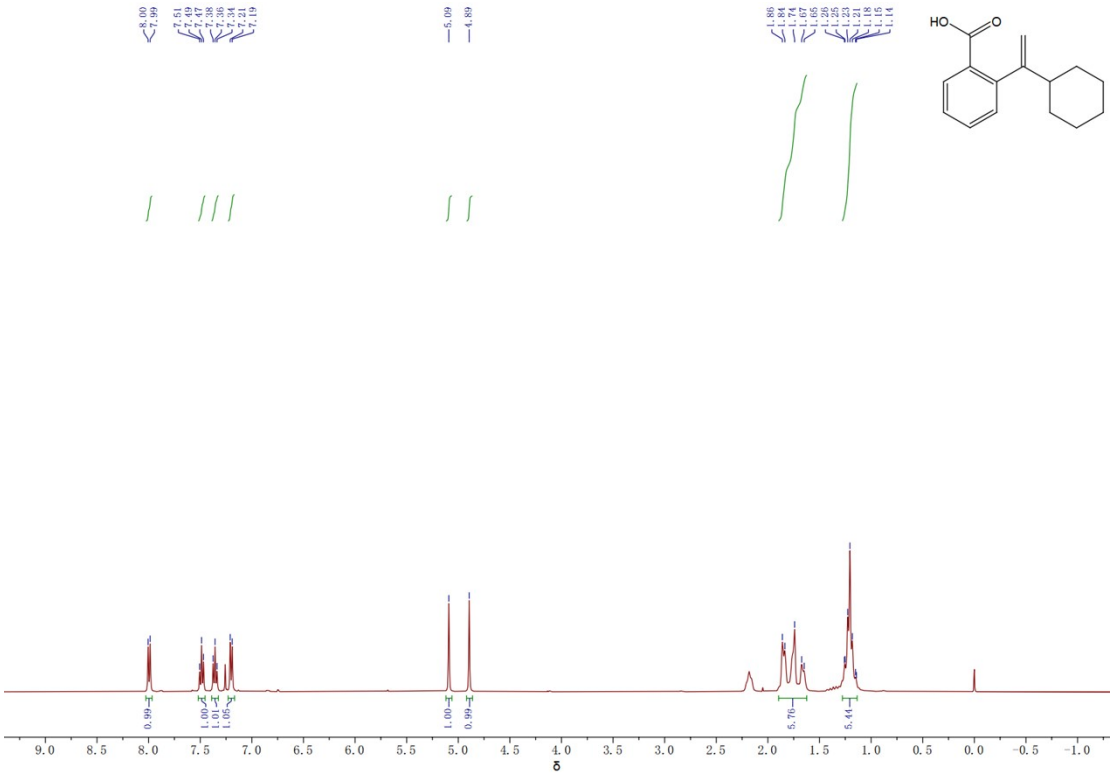
^{1}H NMR spectrum of 2-(1-([1,1'-biphenyl]-4-yl)vinyl)benzoic acid **16a**.



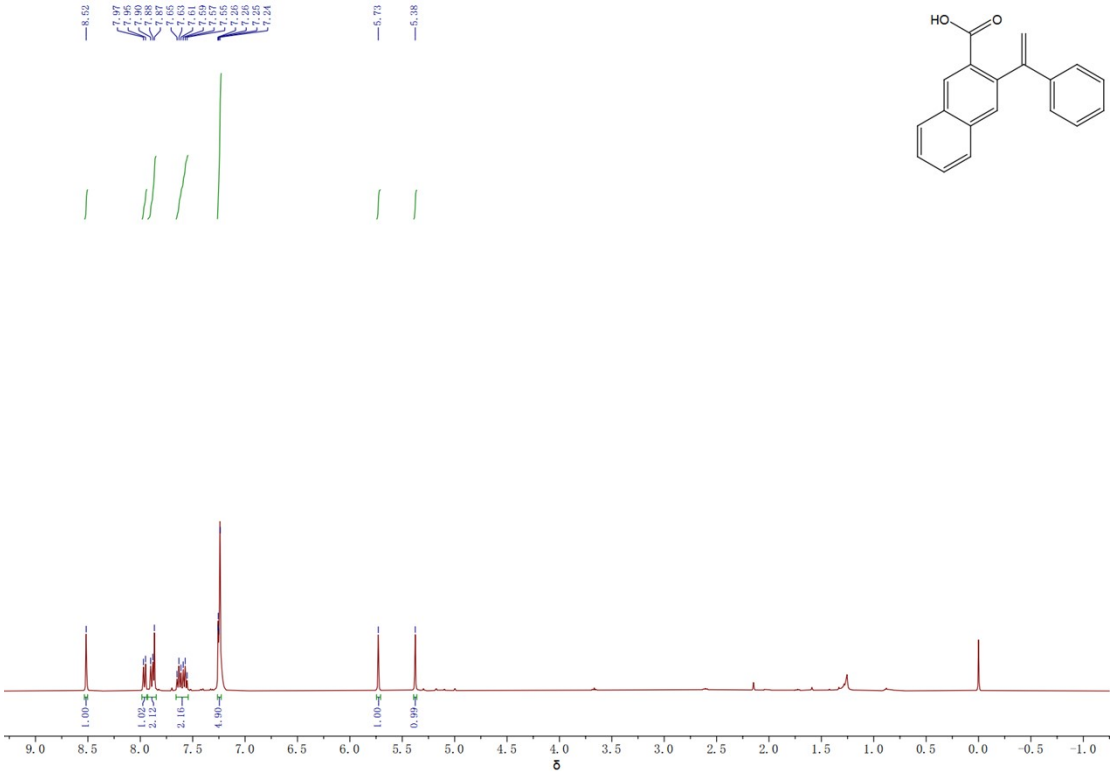
^{1}H NMR spectrum of 2-(1-(naphthalen-2-yl)vinyl)benzoic acid **17a**.



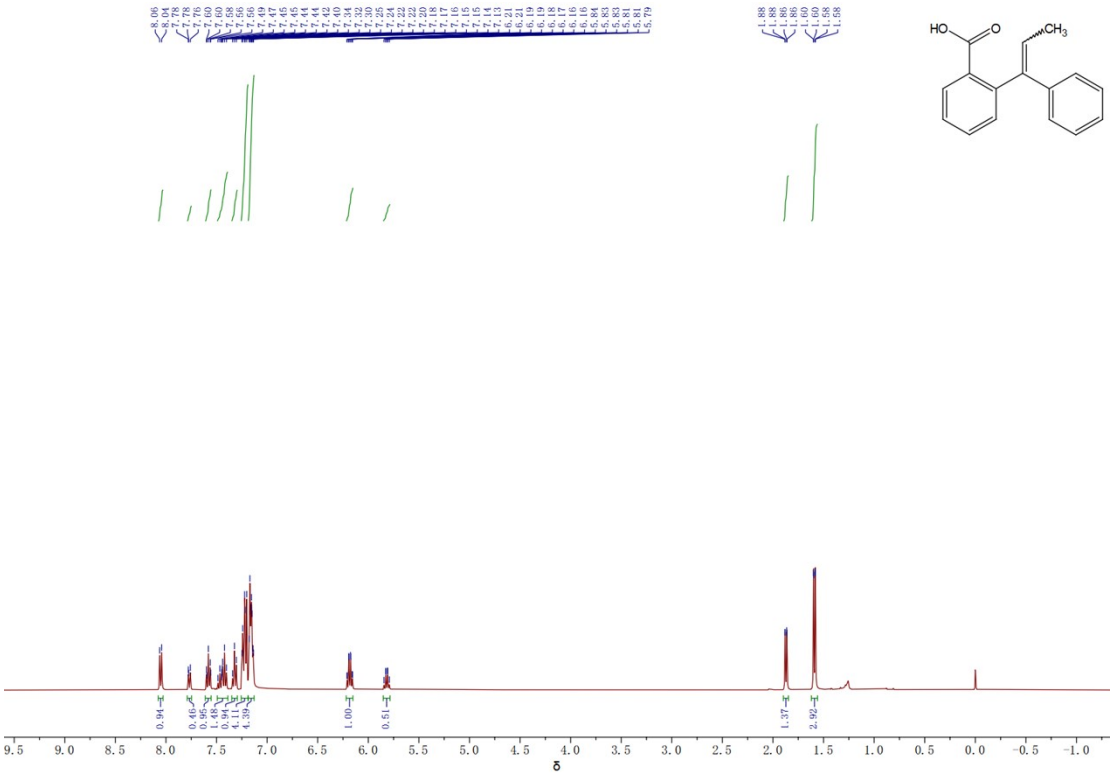
^{1}H NMR spectrum of 3-(1-cyclohexylvinyl)benzoic acid **18a**.



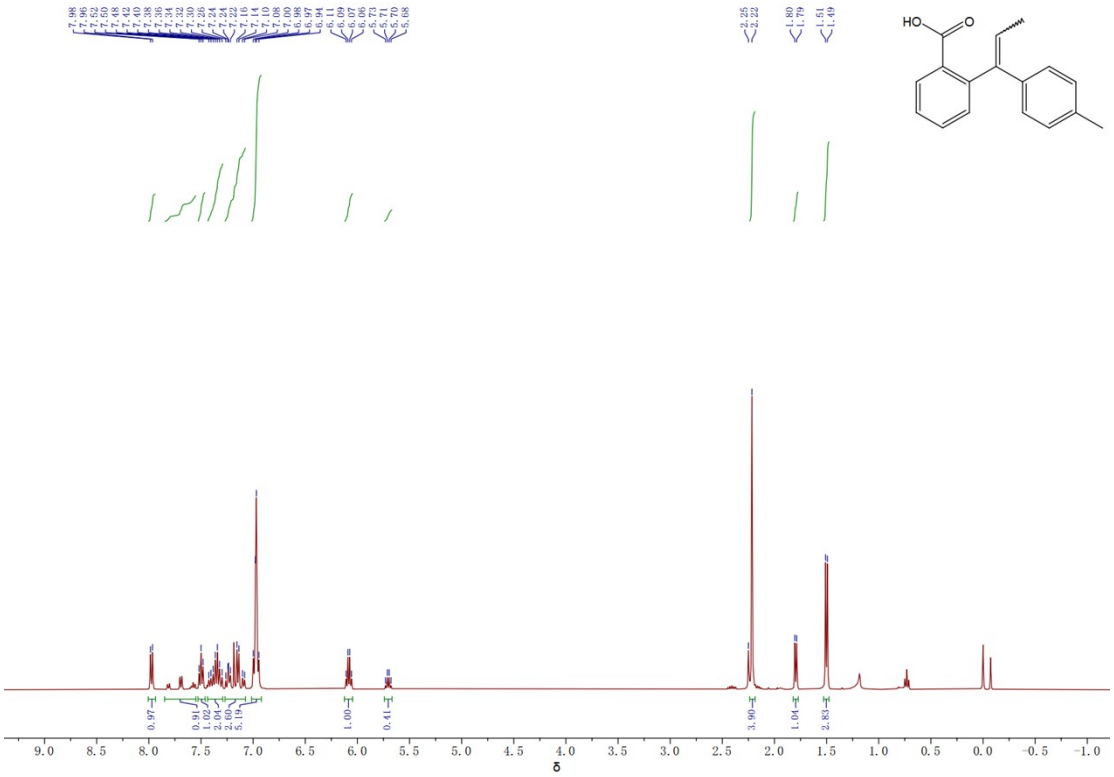
^{1}H NMR spectrum of 4-(1-phenylvinyl)-2-naphthoic acid **19a**.



^{1}H NMR spectrum of 2-(1-phenylprop-1-en-1-yl)benzoic acid **20a**.



^{1}H NMR spectrum of 2-(1-(p-tolyl)prop-1-en-1-yl)benzoic acid **21a**.



^{1}H NMR spectrum of (E)-2-(1,2-diphenylvinyl)benzoic acid **22a**.