Electronic Supplementary Material (ESI) for Organic Chemistry Frontiers.

Supporting Information

Electrochemical *α*–Methoxymethylation and Aminomethylation of Propiophenones with Methanol as the Green C1 Source

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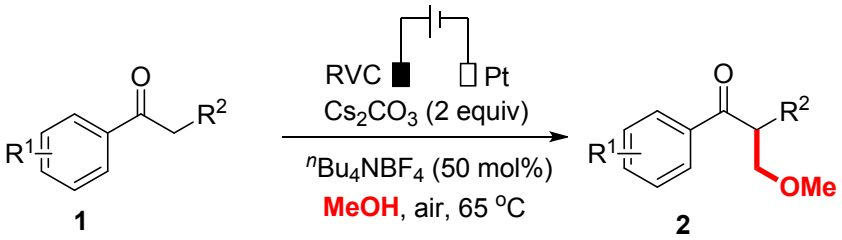
1. General Information

Unless otherwise noted, all reagents and solvents were obtained commercially and used without further purification. Column chromatography on silica gel (300-400 mesh) was carried out using technical grade 60-90 ^{o}C petroleum ether and analytical grade EtOAc (without further purification). The anode electrode is RVC (reticulated vitreous carbon) electrode (1.5 cm×1.5 cm×0.3 mm) and cathode electrode is Pt plate (1 cm × 1 cm). ^{1}H and ^{13}C spectra were recorded with Bruker Avance III HD (400 MHz) or Bruker Avance (500 MHz) spectrometer with tetramethylsilane as an internal standard. Chemical shifts were reported in ppm and coupling constants (*J*) in Hz. ^{1}H NMR spectra were referenced to $CDCl_3$ (7.26 ppm) or CD_3OD (3.31 ppm), and ^{13}C-NMR spectra were referenced to $CDCl_3$ (77.0 ppm) or CD_3OD (49.15 ppm). Peak multiplicities were designated by the following abbreviations: s, singlet; d, doublet; t, triplet; m, multiplet; brs, broad singlet. High resolution mass spectra (HRMS) were recorded on the Exactive Mass Spectrometer (Thermo Scientific, USA) equipped with ESI or APCI ionization source. Cyclic voltammograms were recorded on a CHI 660E potentiostat. Potentiostat was purchased from Shanghai Xinrui Company. http://www.shxr17.com. All devices of the electrolysis were purchased according to the Pan's group (Ref. 13 in the manuscript).

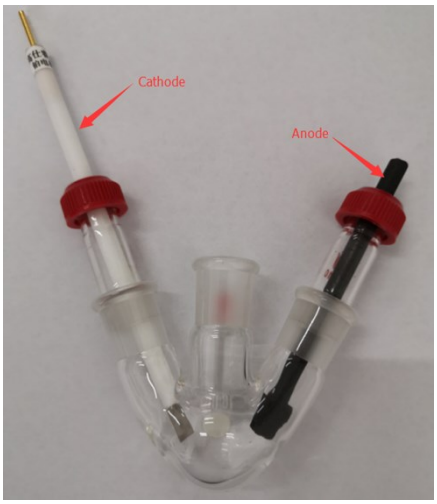
2. Experimental procedure

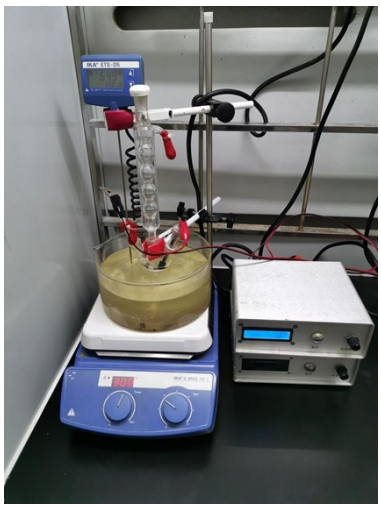
2.1 Synthesis of *α*–methoxymethylation derivative of propiophenones



The propiophenones **1** (0.5 mmol, 1.0 equiv), Cs_2CO_3 (1.0 mmol, 2.0 equiv) and $^nBu_4NBF_4$ (0.25 mmol, 0.5 equiv) were placed in a 10 mL three-necked round-bottomed flask. The flask was equipped with a condenser, a RVC (100 PPI, 1 cm x 1 cm x 1.2 cm) anode and a platinum plate (1 cm x 1 cm) cathode. CH_3OH (6.0 mL) were added. The electrolysis was carried out under air atmosphere at 65 °C using a constant current of 10 mA until complete consumption of the substrate (monitored by TLC, about 3 h). The reaction mixture was concentrated and the residue was chromatographed through silica gel eluting with ethyl acetate/petroleum ether to give the products **2**.

The pictures of reaction set-up were shown in Figure S1. Reticulated vitreous carbon was purchased from Good fellow Company. http://www. goodfellow.com/. Cathode: Pt electrode was purchased from Gaoss Union Company. http://www. gaossunion.cn.china.cn/.





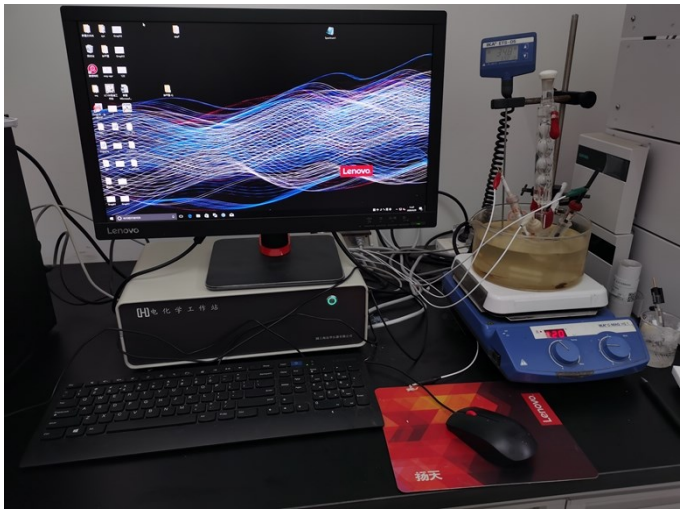
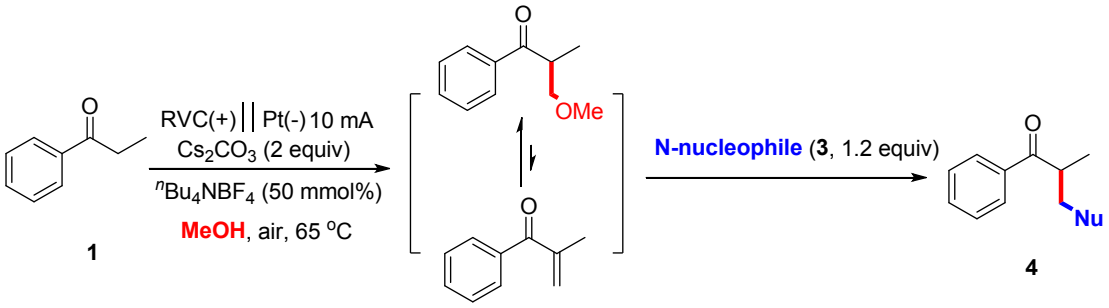


Figure S1. Electrolysis setup

2.2 Synthesis of *α*–aminomethylation derivative of propiophenones



The first step of the reaction was consistent with the process of *α*–methoxymethylation of propiophenones. Then the power was turned off and the nucleophilic reagents **3** (1.2 equiv) was added to the mixture solution and was continue stirred until complete consumption of the substrate **3** (monitored by TLC, about 2 h). The reaction mixture was concentrated and the residue was chromatographed through silica gel eluting with ethyl acetate/petroleum ether to give the products **4**.

2.3 Chronopotentiometry E-t Curve

The curves of potential vs time during electrolysis were recorded on a CHI 660E potentiostat. Typical spectrometer parameters are shown as follows, Anodic current: 0.01A, Cathodic current: 0 A, High E Limit (V): 3 V, Low E Limit (V): -3 V, Anodic time: 10800 second, Cathodic time: 10 second, Data Storage Intvl (sec): 2.

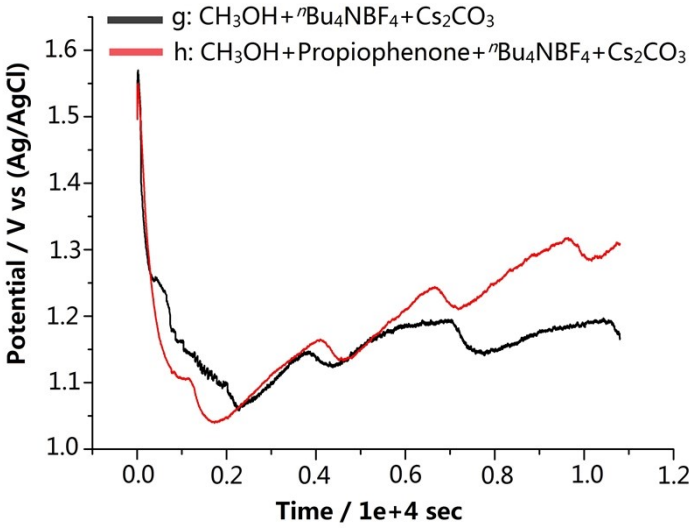
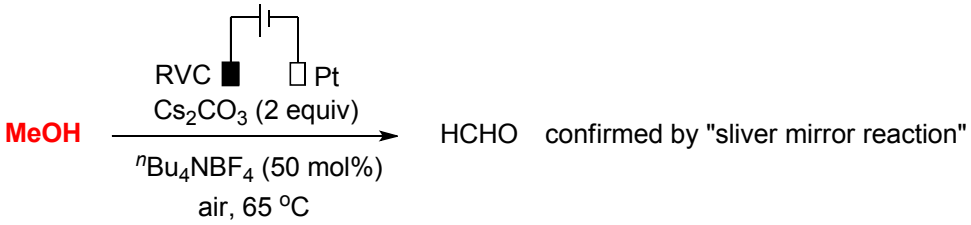


Figure S2. Potential vs Time during Electrolysis. g: $^{n}Bu_4NBF_4$ (0.25 mmol) + Cs_2CO_3 (2 mmol) + MeOH (12 mL); h: Propiophenone (1 mmol) + $^{n}Bu_4NBF_4$ (0.25 mmol) + Cs_2CO_3 (2 mmol) + MeOH (12 mL). Glassy carbon disk (3 mm diameter), Pt plate, and Ag/AgCl (in saturated KCl solution) as working electrode, auxiliary electrode and reference electrode, respectively, reflux (65 °C, oil bath temperature); 3 h (Anodic current = 0.01 A, Cathodic current = 0 A).

2.4 Procedure for control experiments

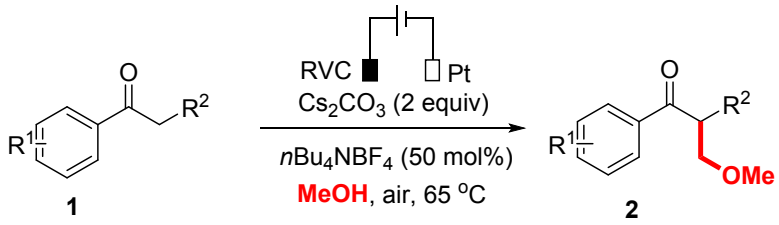
Using silver mirror reaction to detect the *in situ* formed formaldehyde:

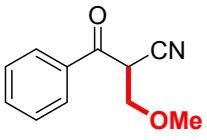


2.0 equiv Cs_2CO_3 and 0.5 equiv $^{n}Bu_4NBF_4$ were added in 6 mL MeOH and stirred 1 h under the standard conditions. Next, a small amount of the reaction mixture was dropped into the fresh silver ammonia solution in test tube. Shaking the tube slightly and placing it in water-bath at 40 °C for a few minutes, a layer of metallic silver was observed adhering to the inner wall of the tube (Figure S3).

Figure S3. Sliver mirror reaction

2.5 Other non-reactive substrates





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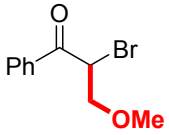
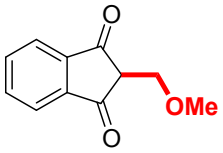
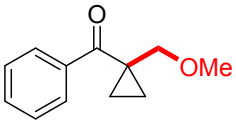


2s, 0%



2t, 0%



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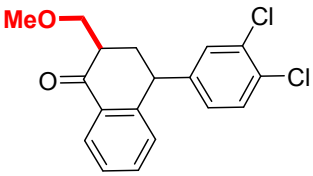
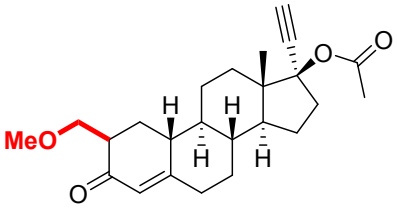


2v, 0%



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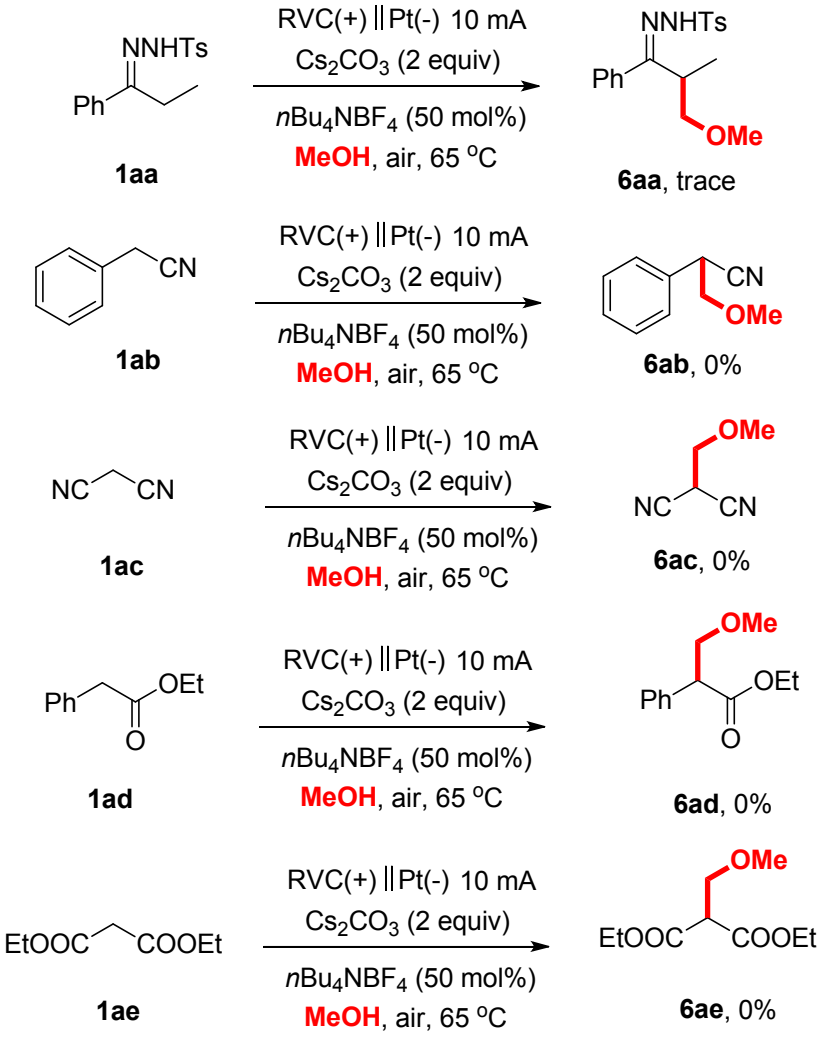
NNHTs
Ph
1aa
RVC(+) || Pt(-) 10 mA
Cs2CO3 (2 equiv)
nBu4NBF4 (50 mol%)
MeOH, air, 65 °C
NNHTs
Ph
OMe
6aa, trace
CN
1ab
RVC(+) || Pt(-) 10 mA
Cs2CO3 (2 equiv)
nBu4NBF4 (50 mol%)
MeOH, air, 65 °C
CN
OMe
6ab, 0%
NC
CN
1ac
RVC(+) || Pt(-) 10 mA
Cs2CO3 (2 equiv)
nBu4NBF4 (50 mol%)
MeOH, air, 65 °C
OMe
NC
CN
6ac, 0%
Ph
OEt
O
1ad
RVC(+) || Pt(-) 10 mA
Cs2CO3 (2 equiv)
nBu4NBF4 (50 mol%)
MeOH, air, 65 °C
OMe
Ph
OEt
O
6ad, 0%
EtOOC
COOEt
1ae
RVC(+) || Pt(-) 10 mA
Cs2CO3 (2 equiv)
nBu4NBF4 (50 mol%)
MeOH, air, 65 °C
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EtOOC
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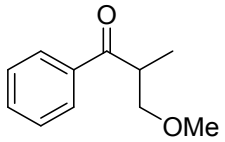
6ae, 0%

^{1}H, ^{13}C NMR and MS Data of all products

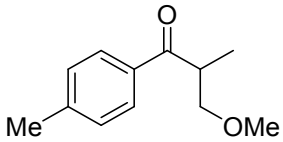
3-Methoxy-2-methyl-1-phenylpropan-1-one (**2a)**



This compound is known and the spectroscopic data match previous reported (*Org. Lett.* **2018**, *20*, 6774-6779.).

Colorless oil, 90% yield, **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.99-7.94 (m, 2H), 7.57-7.52 (m, 1H), 7.46 (d, *J* = 7.9 Hz, 2H), 3.80-3.72 (m, 2H), 3.47-3.42 (m, 1H), 3.31 (s, 3H), 1.20 (d, *J* = 6.8 Hz, 3H) ppm; **^{13}C NMR** (125 MHz, $CDCl_3$) δ 202.6, 136.6, 132.9, 128.5, 128.3, 74.9, 59.0, 41.2, 14.8 ppm.

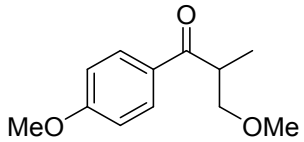
3-Methoxy-2-methyl-1-(p-tolyl)propan-1-one (**2b)**



This compound is known and the spectroscopic data match previous reported (*Org. Lett.* **2018**, *20*, 6774-6779.).

Colorless oil, 88% yield, **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.88 (d, *J* = 8.2 Hz, 2H), 7.26 (d, *J* = 8.0 Hz, 2H), 3.80-3.70 (m, 2H), 3.50-3.40 (m, 1H), 3.31 (s, 3H), 2.40 (s, 3H), 1.19 (d, *J* = 6.7 Hz, 3H) ppm; **^{13}C NMR** (100 MHz, $CDCl_3$) δ 202.2, 143.7, 134.1, 129.2, 128.4, 75.0, 59.0, 41.0, 21.5, 14.8 ppm.

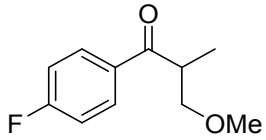
3-Methoxy-1-(4-methoxyphenyl)-2-methylpropan-1-one (**2c)**



This compound is known and the spectroscopic data match previous reported (*Org. Lett.* **2018**, *20*, 6774-6779.).

Colorless oil, 85% yield, **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.94 (d, *J* = 8.9 Hz, 2H), 6.91 (d, *J* = 8.9 Hz, 2H), 3.83 (s, 3H), 3.75-3.68 (m, 2H), 3.45-3.35 (m, 1H), 3.29 (s, 3H), 1.21-1.13 (m, 3H) ppm； **^{13}C NMR** (100 MHz, $CDCl_3$) δ 201.0, 163.4, 130.6, 129.5, 113.7, 75.0, 58.9, 55.3, 40.7, 14.9 ppm.

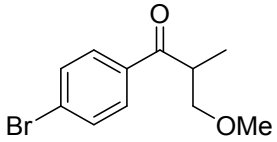
1-(4-Fluorophenyl)-3-methoxy-2-methylpropan-1-one (**2d**)



This compound is known and the spectroscopic data match previous reported (*Org. Lett.* **2018**, *20*, 6774-6779.).

Pale yellow oil, 81% yield, **^{1}H NMR** (400 MHz, $CDCl_3$) δ 8.03-7.96 (m, 2H), 7.16-7.08 (m, 2H), 3.76-3.69 (m, 2H), 3.49-3.41 (m, 1H), 3.31 (s, 3H), 1.19 (d, *J* = 6.4 Hz, 3H) ppm; **^{13}C NMR** (100 MHz, $CDCl_3$) δ 201.2, 167.0, 164.5, 133.1 (d, *J* = 3.0 Hz), 131.0 (d, *J* = 9.3 Hz), 115.8, 115.6, 75.0, 59.1, 41.2, 14.7 ppm.

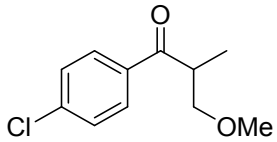
1-(4-Bromophenyl)-3-methoxy-2-methylpropan-1-one (**2e**)



This compound is known and the spectroscopic data match previous reported (*Org. Lett.* **2018**, *20*, 6774-6779.).

Colorless oil, 85% yield, **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.82 (d, *J* = 8.5 Hz, 2H), 7.58 (d, *J* = 8.5 Hz, 2H), 3.74-3.66 (m, 2H), 3.46-3.39 (m, 1H), 3.28 (s, 3H), 1.16 (d, *J* = 6.4 Hz, 3H) ppm; **^{13}C NMR** (100 MHz, $CDCl_3$) δ 201.7, 135.4, 131.8, 129.9, 128.1, 74.9, 59.0, 41.2, 14.6 ppm.

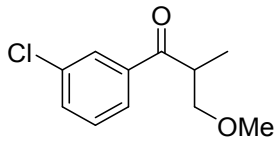
1-(4-Chlorophenyl)-3-methoxy-2-methylpropan-1-one (**2f**)



This compound is known and the spectroscopic data match previous reported (*Org. Lett.* **2018**, *20*, 6774-6779.).

Colorless oil, 82% yield, **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.94-7.86 (m, 2H), 7.45-7.40 (m, 2H), 3.76-3.65 (m, 2H), 3.48-3.40 (m, 1H), 3.30 (s, 3H), 1.20-1.16 (m, 3H) ppm; **^{13}C NMR** (100 MHz, $CDCl_3$) δ 201.6, 139.4, 135.0, 129.8, 128.9, 74.9, 59.1, 41.2, 14.7 ppm.

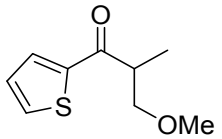
1-(3-Chlorophenyl)-3-methoxy-2-methylpropan-1-one (**2g**)



This compound is known and the spectroscopic data match previous reported (*Org. Lett.* **2018**, *20*, 6774-6779.).

Colorless oil, 83% yield, **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.94-7.90 (m, 1H), 7.85-7.79 (m, 1H), 7.53-7.48 (m, 1H), 7.39 (t, *J* = 7.9 Hz, 1H), 3.74-3.67 (m, 2H), 3.48-3.40 (m, 1H), 3.29 (s, 3H), 1.17 (d, *J* = 6.6 Hz, 3H) ppm; **^{13}C NMR** (100 MHz, $CDCl_3$) δ 201.5, 138.3, 134.9, 132.8, 129.9, 128.4, 126.4, 74.8, 59.0, 41.4, 14.6 ppm.

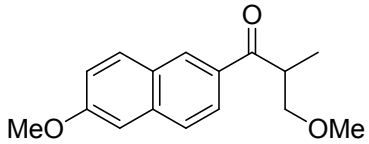
3-Methoxy-2-methyl-1-(thiophen-2-yl)propan-1-one (**2i**)



This compound is known and the spectroscopic data match previous reported (*Org. Lett.* **2018**, *20*, 6774-6779.).

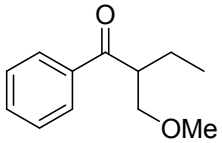
Colorless oil, 80% yield, **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.75 (d, *J* = 3.8 Hz, 1H), 7.63 (d, *J* = 4.9 Hz, 1H), 7.14-7.09 (m, 1H), 3.76-3.69 (m, 1H), 3.65-3.53 (m, 1H), 3.46-3.40 (m, 1H), 3.30 (s, 3H), 1.21 (d, *J* = 6.9 Hz, 3H) ppm; **^{13}C NMR** (100 MHz, $CDCl_3$) δ 195.3, 144.1, 133.9, 132.0, 128.1, 74.8, 59.0, 43.0, 14.9 ppm.

3-Methoxy-1-(6-methoxynaphthalen-2-yl)-2-methylpropan-1-one (**2j**)



Colorless oil, 82% yield, **^{1}H NMR** (400 MHz, $CDCl_3$) δ 8.42 (s, 1H), 8.05-7.96 (m, 1H), 7.82 (d, *J* = 8.9 Hz, 1H), 7.74 (d, *J* = 8.6 Hz, 1H), 7.20-7.15 (m, 1H), 7.12 (s, 1H), 3.96-3.86 (m, 4H), 3.84-3.76 (m, 1H), 3.54-3.44 (m, 1H), 3.32 (s, 3H), 1.25 (d, *J* = 6.9 Hz, 3H) ppm; **^{13}C NMR** (10 MHz, $CDCl_3$) δ 202.2, 159.6, 137.2, 131.9, 131.1, 129.8, 127.8, 127.0, 124.8, 119.5, 75.1, 59.0, 55.2, 40.9, 14.9 ppm. **HRMS** (m/z) (ESI): calcd for $C_{16}H_{19}O_3$ $[M+H]^+$: 259.1329; found: 259.1331.

2-(Methoxymethyl)-1-phenylbutan-1-one (**2k**)

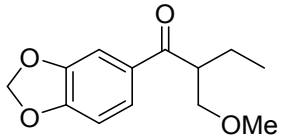


This compound is known and the spectroscopic data match previous reported (*Org. Lett.* **2018**, *20*, 6774-6779.).

Pale yellow oil, 85% yield, **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.97 (d, *J* = 7.4 Hz, 2H), 7.54 (t, *J* = 7.3 Hz, 1H), 7.45 (t, *J* = 7.6 Hz, 2H), 3.76-3.64 (m, 2H), 3.54-3.48 (m, 1H), 3.29 (s, 3H), 1.84-1.70 (m, 1H), 1.66-1.54 (m, 1H), 0.89 (t, *J* = 7.5 Hz, 3H)

ppm; **^{13}C NMR** (100 MHz, $CDCl_3$) δ 202.9, 132.9, 128.5, 128.2, 73.7, 59.0, 48.0, 22.8, 11.6 ppm.

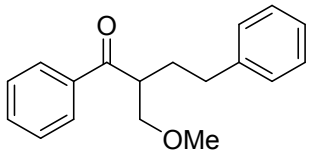
1-(Benzo[d][1,3]dioxol-5-yl)-2-(methoxymethyl)butan-1-one (**2l**)



This compound is known and the spectroscopic data match previous reported (*Org. Lett.* **2018**, *20*, 6774-6779.).

Colorless oil, 70% yield, **^{1}H NMR** (400 MHz, $CDCl_3$) δ7.60-7.54 (m, 1H), 7.45 (d, *J* = 1.4 Hz, 1H), 6.83 (d, *J* = 8.2 Hz, 1H), 6.01 (s, 2H), 3.67 (t, *J* = 8.2 Hz, 1H), 3.61-3.53 (m, 1H), 3.50-3.44 (m, 1H), 3.27 (s, 3H), 1.78-1.66 (m, 1H), 1.62-1.50 (m, 1H), 0.86 (t, *J* = 7.5 Hz, 3H) ppm; **^{13}C NMR** (100 MHz, $CDCl_3$) δ 200.9, 151.7, 148.2, 132.6, 124.6, 108.1, 107.8, 101.8, 74.0, 59.0, 47.8, 23.0, 11.7 ppm.

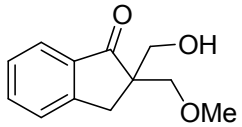
2-(Methoxymethyl)-1,4-diphenylbutan-1-one (**2m**)



This compound is known and the spectroscopic data match previous reported (*Org. Lett.* **2018**, *20*, 6774-6779.).

Colorless oil, 68% yield, **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.89 (d, *J* = 7.4 Hz, 2H), 7.54 (t, *J* = 7.4 Hz, 1H), 7.43 (t, *J* = 7.6 Hz, 2H), 7.24 (t, *J* = 7.3 Hz, 2H), 7.17 (t, *J* = 7.2 Hz, 1H), 7.11 (d, *J* = 7.2 Hz, 2H), 3.85-3.65 (m, 2H), 3.60-3.45 (m, 1H), 3.28 (s, 3H), 2.71-2.50 (m, 2H), 2.18-2.03 (m, 1H), 1.94-1.79 (m, 1H) ppm; **^{13}C NMR** (100 MHz, $CDCl_3$) δ 202.5, 141.4, 137.4, 133.0, 128.4 (dd, *J* = 13.7, 6.9 Hz), 125.9, 74.1, 59.0, 45.9, 33.4, 31.2 ppm.

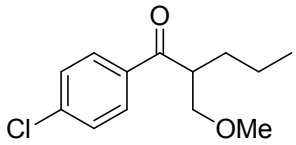
2-(Hydroxymethyl)-2-(methoxymethyl)-2,3-dihydro-1H-inden-1-one (**2n**)



Colorless oil, 65% yield, **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.72 (d, *J* = 7.7 Hz, 1H), 7.63-7.57 (m, 1H), 7.47 (d, *J* = 7.7 Hz, 1H), 7.36 (t, *J* = 7.4 Hz, 1H), 3.77 (s, 2H), 3.70 (d, *J* = 8.9 Hz, 1H), 3.61 (d, *J* = 8.9 Hz, 1H), 3.32-3.26 (m, 4H), 3.09 (d, *J* = 17.4 Hz, 1H), 2.72 (s, 1H) ppm; **^{13}C NMR** (125 MHz, $CDCl_3$) δ 208.3, 154.0, 136.06 (s),

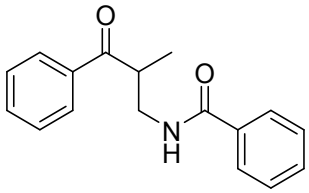
135.3, 127.4, 126.7, 124.1, 75.2, 65.7, 59.5, 55.7, 34.0 ppm. **HRMS** (m/z) (ESI): calcd for $C_{12}H_{15}O_3$ $[M+H]^+$: 207.1016; found: 207.1025.

1-(4-Chlorophenyl)-2-(methoxymethyl)pentan-1-one (**2o**)



Colorless oil, 70% yield, **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.96–7.87 (m, 2H), 7.49–7.38 (m, 2H), 3.71–3.66 (m, 2H), 3.53–3.47 (m, 1H), 3.27 (s, 3H), 1.72–1.65 (m, 1H), 1.53–1.44 (m, 1H), 1.27 (q, *J* = 7.55 Hz, 2H), 0.87 (t, *J* = 7.34 Hz, 3H) ppm; **^{13}C NMR** (100 MHz, $CDCl_3$) δ 202.1, 139.4, 136.1, 129.8, 128.9, 74.3, 59.1, 46.6, 31.9, 20.6, 14.2 ppm. **HRMS** (m/z) (ESI): calcd for $C_{13}H_{18}ClO_2$ $[M+H]^+$: 241.0990; found: 241.0989.

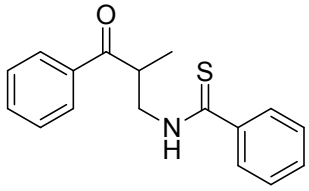
N-(2-methyl-3-oxo-3-phenylpropyl)benzamide (**4a**)



This compound is known and the spectroscopic data match previous reported (*Org. Lett.* **2018**, *20*, 6774-6779.).

Colorless oil, 60% yield, **^{1}H NMR** (400 MHz, MeOD) δ 8.06-8.00 (m, 2H), 7.74-7.68 (m, 2H), 7.61-7.55 (m, 1H), 7.52-7.45 (m, 3H), 7.43-7.37 (m, 2H), 4.09-3.97 (m, 1H), 3.74-3.65 (m, 1H), 3.52-3.43 (m, 1H), 1.23 (d, *J* = 7.0 Hz, 3H) ppm; **^{13}C NMR** (100 MHz, MeOD) δ 204.9, 170.6, 137.8, 134.4, 132.6, 129.8, 129.5 (d, *J* = 2.5 Hz), 128.2, 44.2 41.6, 15.9 ppm.

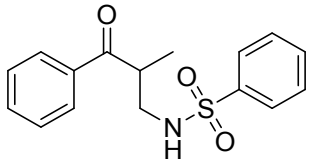
N-(2-methyl-3-oxo-3-phenylpropyl)benzothioamide (**4b**)



Colorless oil, 62% yield, **^{1}H NMR** (400 MHz, MeOD) δ 8.09-8.02 (m, 2H), 7.63-7.56 (m, 3H), 7.53-7.45 (m, 2H), 7.44-7.38 (m, 1H), 7.36-7.28 (m, 2H), 4.48-4.36 (m, 1H), 4.10-4.00 (m, 1H), 3.95-3.85 (m, 1H), 1.25 (d, *J* = 7.0 Hz, 3H) ppm; **^{13}C NMR** (100 MHz, MeOD) δ 204.9, 201.3, 143.3, 137.8, 134.6, 131.7, 129.9, 129.6, 129.1, 128.1,

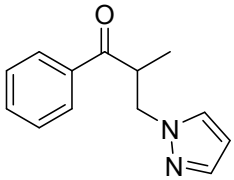
50.2, 39.7, 15.9 ppm. **HRMS** (m/z) (ESI): calcd for $C_{17}H_{18}NOS$ $[M+H]^+$: 284.1104; found: 284.1110.

N-(2-methyl-3-oxo-3-phenylpropyl)benzenesulfonamide (**4c**)



Colorless oil, 70% yield, **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.85 (d, *J* = 7.6 Hz, 4H), 7.60-7.52 (m, 2H), 7.51-7.41 (m, 4H), 5.16 (s, 1H), 3.77-3.60 (m, 1H), 3.32-3.23 (m, 1H), 3.22-3.14 (m, 1H), 1.18 (d, *J* = 7.3 Hz, 3H) ppm; **^{13}C NMR** (100 MHz, $CDCl_3$) δ 203.1, 140.2, 135.4, 133.6, 132.6, 129.2, 128.8, 128.4, 126.9, 45.2, 41.4, 16.0 ppm. **HRMS** (m/z) (ESI): calcd for $C_{16}H_{18}NO_3S$ $[M+H]^+$: 304.1002; found: 304.1005.

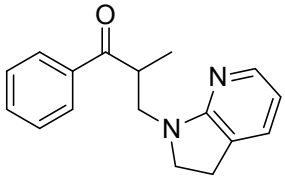
2-Methyl-1-phenyl-3-(1H-pyrazol-1-yl)propan-1-one (**4d**)



This compound is known and the spectroscopic data match previous reported (*Org. Lett.* **2018**, *20*, 6774-6779.).

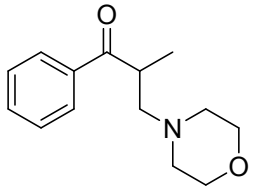
Colorless oil, 80% yield, **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.89 (d, *J* = 7.5 Hz, 2H), 7.56-7.34 (m, 5H), 6.13 (s, 1H), 4.64-4.52 (m, 1H), 4.27-4.13 (m, 2H), 1.19 (d, *J* = 6.6 Hz, 3H) ppm; **^{13}C NMR** (100 MHz, $CDCl_3$) δ 202.2, 139.8, 133.4, 130.4, 128.7, 128.4, 105.1), 54.1, 41.9, 16.1 ppm.

3-(2,3-Dihydro-1H-pyrrolo[2,3-b]pyridin-1-yl)-2-methyl-1-phenylpropan-1-one (**4e**)



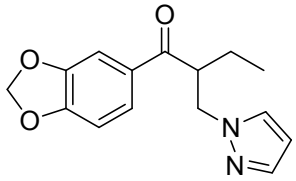
Colorless oil, 68% yield, **^{1}H NMR** (400 MHz, MeOD) δ 7.98-7.90 (m, 2H), 7.69 (d, *J* = 4.9 Hz, 1H), 7.57-7.50 (m, 1H), 7.46-7.38 (m, 2H), 7.14-7.08 (m, 1H), 6.43-6.35 (m, 1H), 4.12-3.98 (m, 1H), 3.51 (d, *J* = 7.2 Hz, 2H), 3.46-3.34 (m, 2H), 2.86-2.64 (m, 2H), 1.19 (d, *J* = 7.0 Hz, 3H) ppm; **^{13}C NMR** (100 MHz, MeOD) δ 205.3, 164.0, 145.5, 138.0, 134.3, 132.3, 129.8, 129.3, 125.2, 113.3, 51.9, 50.4, 40.8, 26.6, 16.2 ppm. **HRMS** (m/z) (ESI): calcd for $C_{17}H_{19}N_2O$ $[M+H]^+$: 267.1492; found: 267.1496.

2-Methyl-3-morpholino-1-phenylpropan-1-one (**4f**)



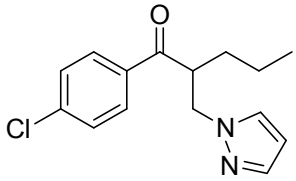
Colorless oil, 75% yield, **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.95 (d, *J* = 7.5 Hz, 2H), 7.55 (t, *J* = 7.3 Hz, 1H), 7.46 (t, *J* = 7.6 Hz, 2H), 3.79-3.68 (m, 1H), 3.64-3.55 (m, 4H), 2.92-2.80 (m, 1H), 2.47-2.38 (m, 5H), 1.19 (d, *J* = 7.0 Hz, 3H) ppm; **^{13}C NMR** (100 MHz, $CDCl_3$) δ 203.7, 136.9, 132.9, 128.6, 128.2, 66.9, 61.9, 54.0, 38.4, 16.5 ppm. **HRMS** (m/z) (ESI): calcd for $C_{14}H_{20}O_2N$ $[M+H]^+$: 234.1489; found: 234.1496.

2-((1*H*-pyrazol-1-yl)methyl)-1-(benzo[*d*][1,3]dioxol-5-yl)butan-1-one (**4g**)



Colorless oil, 73% yield, **^{1}H NMR** (600 MHz, DMSO-d_6) δ 7.65–7.62 (m, 1H), 7.57–7.53 (m,1H), 7. 39–7.34 (m, 2H), 7. 00–6.98 (m, 1H), 6. 13 (t, *J* = 2.02 Hz, 1H), 6.11(s, 2H), 4. 41 (q, *J* = 5.39 Hz, 1H), 4.23 (q, *J* = 7.69 Hz, 1H), 4. 09–4.03 (m, 1H), 1.61–1.56 (m, 1H), 1. 53–1.46 (m, 1H), 0. 78 (t, *J* = 7.47 Hz, 3H) ppm; **^{13}C NMR** (150 MHz, DMSO-d_6) δ 199.6, 151.7, 147.9, 138.7, 131.3, 130.4, 124.7, 108.1, 107.4, 104.9, 102.1, 52.1, 47.0, 23.4, 10.9 ppm. **HRMS** (m/z) (ESI): calcd for $C_{15}H_{15}N_2O_3$ $[M-H]^-$: 271.1088; found: 271.1100.

2-((1*H*-pyrazol-1-yl)methyl)-1-(4-chlorophenyl)pentan-1-one (**4h**)

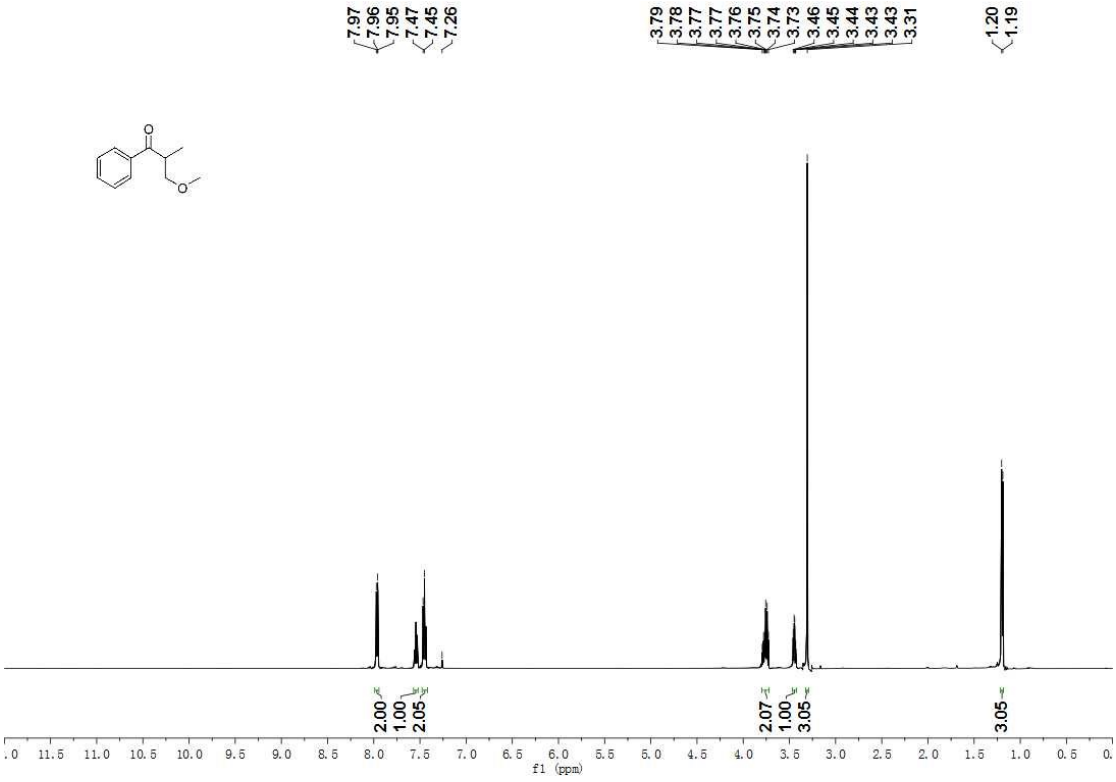


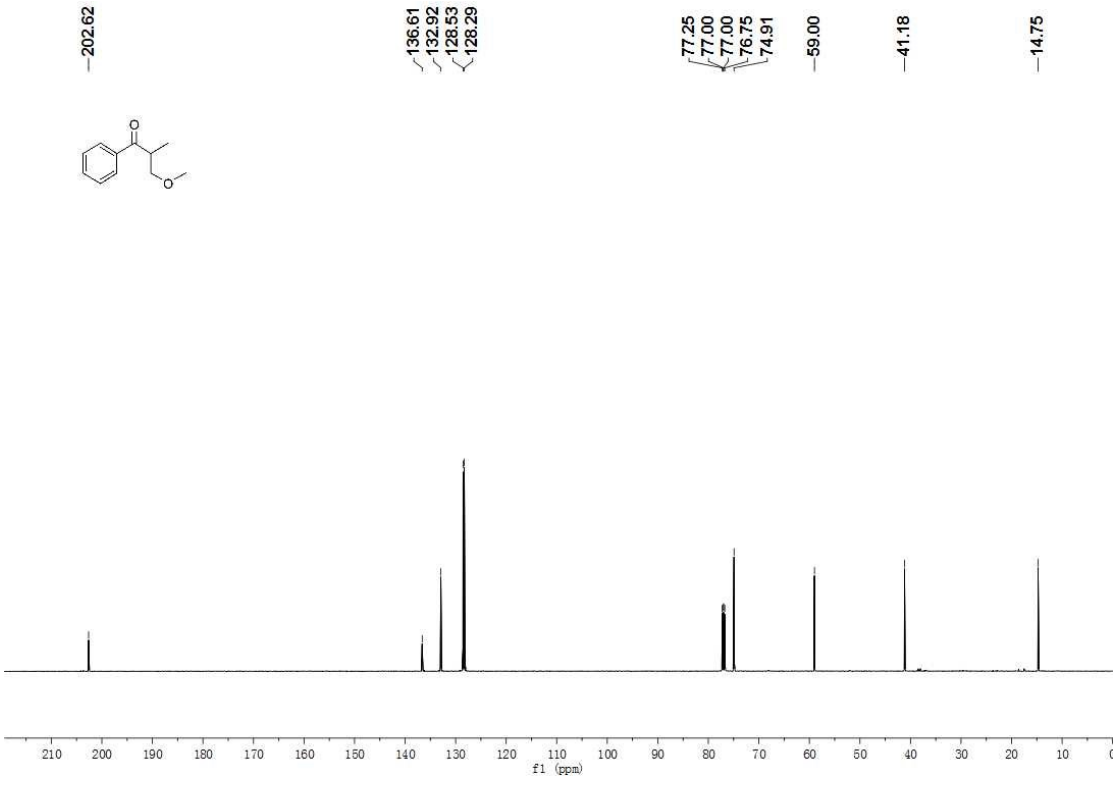
Colorless oil, 65% yield, **^{1}H NMR** (600 MHz, DMSO-d_6) δ 7.91–7.87 (m, 2H), 7.67–7.63 (m, 1H), 7.57–7.53 (m, 2H), 7. 35–7. 33 (m, 1H), 6.12 (t, *J* = 1.99 Hz, 1H), 4. 46–4. 41 (m, 1H), 4. 31–4. 25 (m, 1H), 4. 20–4. 13 (m, 1H), 1.59–1.53(m, 1H), 1.47–1.41 (m, 1H),1. 22–1. 17 (m, 2H), 0. 78 (t, *J* = 7.39 Hz, 3H) ppm; **^{13}C NMR**

(150 MHz, DMSO-d_6) δ 201.0, 138.7, 138.3, 135.3, 130.4, 129.9, 128.9, 105.0, 52.3, 46.0, 32.3, 19.5, 14.0 ppm. **HRMS** (m/z) (ESI): calcd for $C_{15}H_{18}ClN_2O_2[M+H]^+$: 277.1102; found: 277.1103.

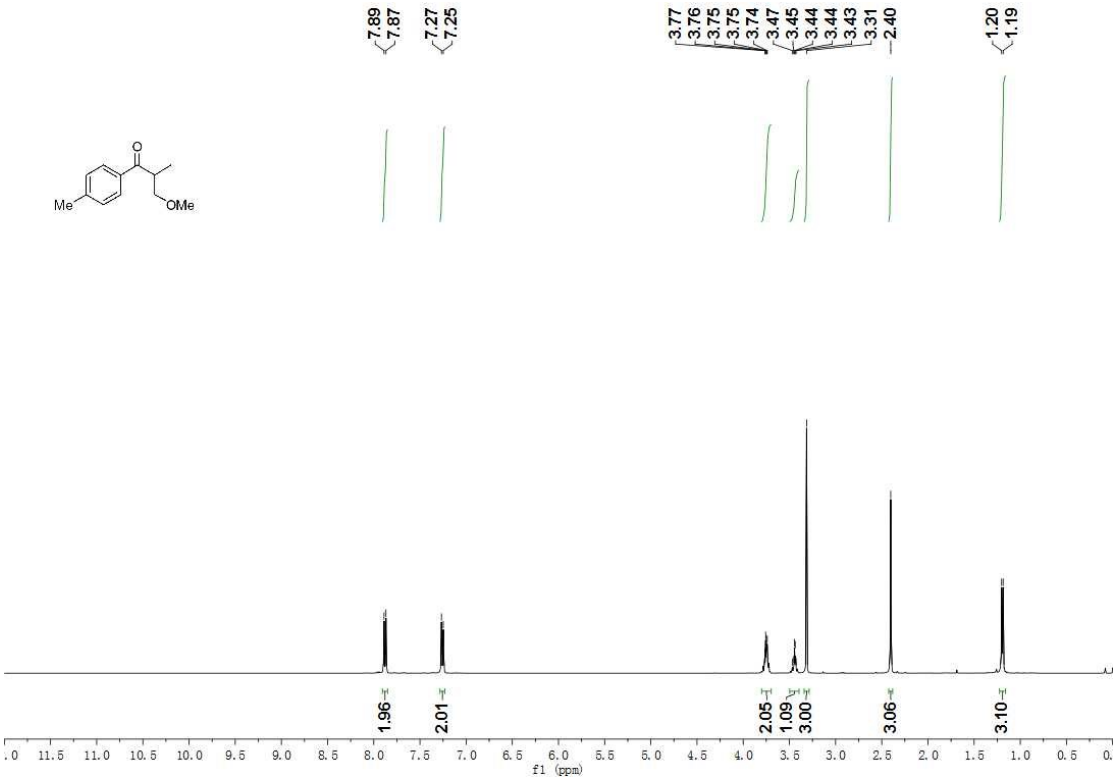
3. Copies of ^{13}C and ^{1}H NMR spectra for all products

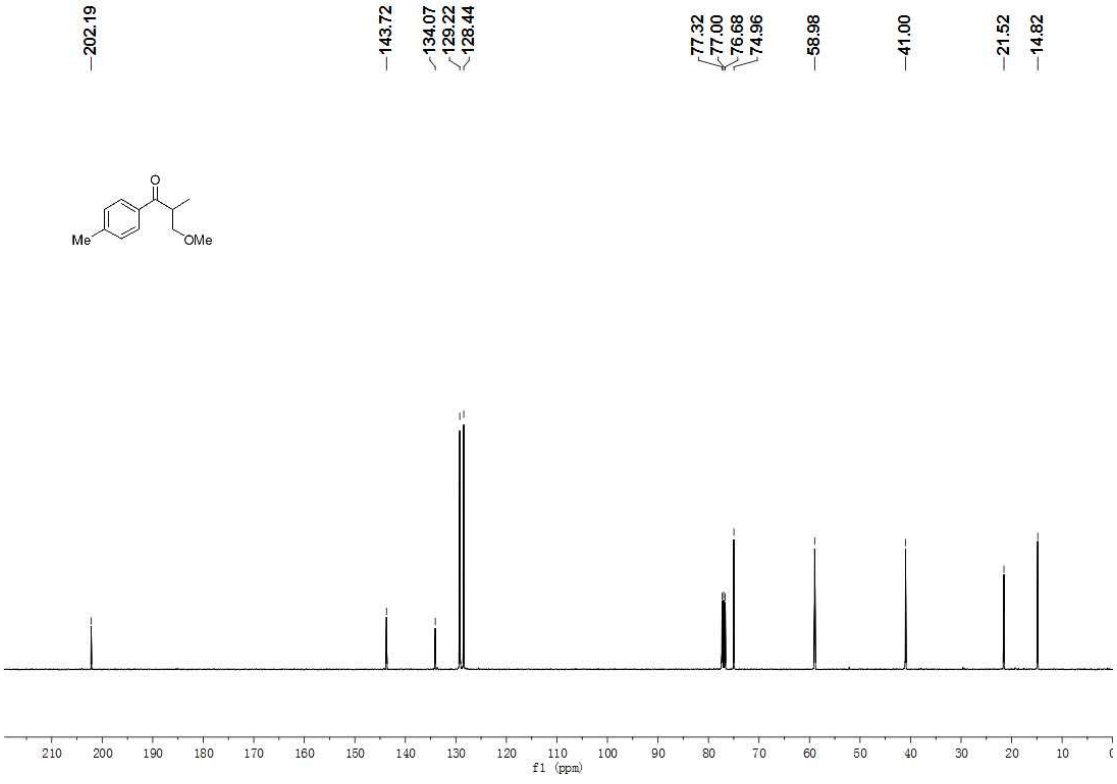
3-Methoxy-2-methyl-1-phenylpropan-1-one **(2a)**



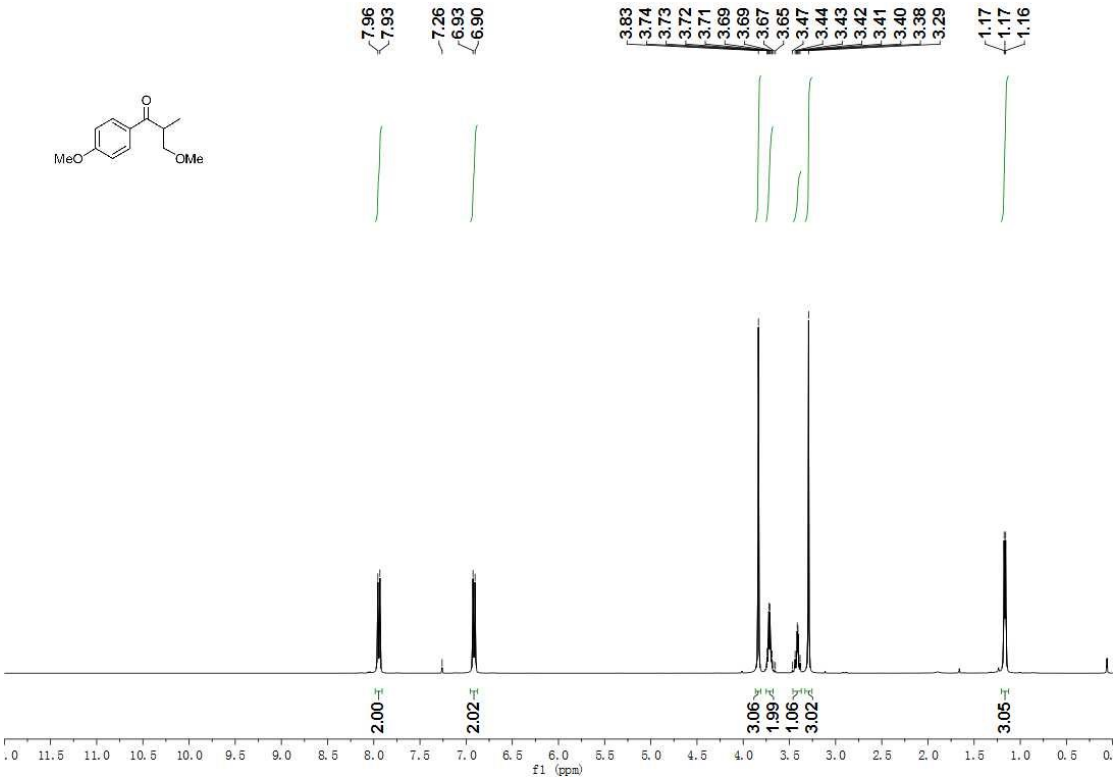


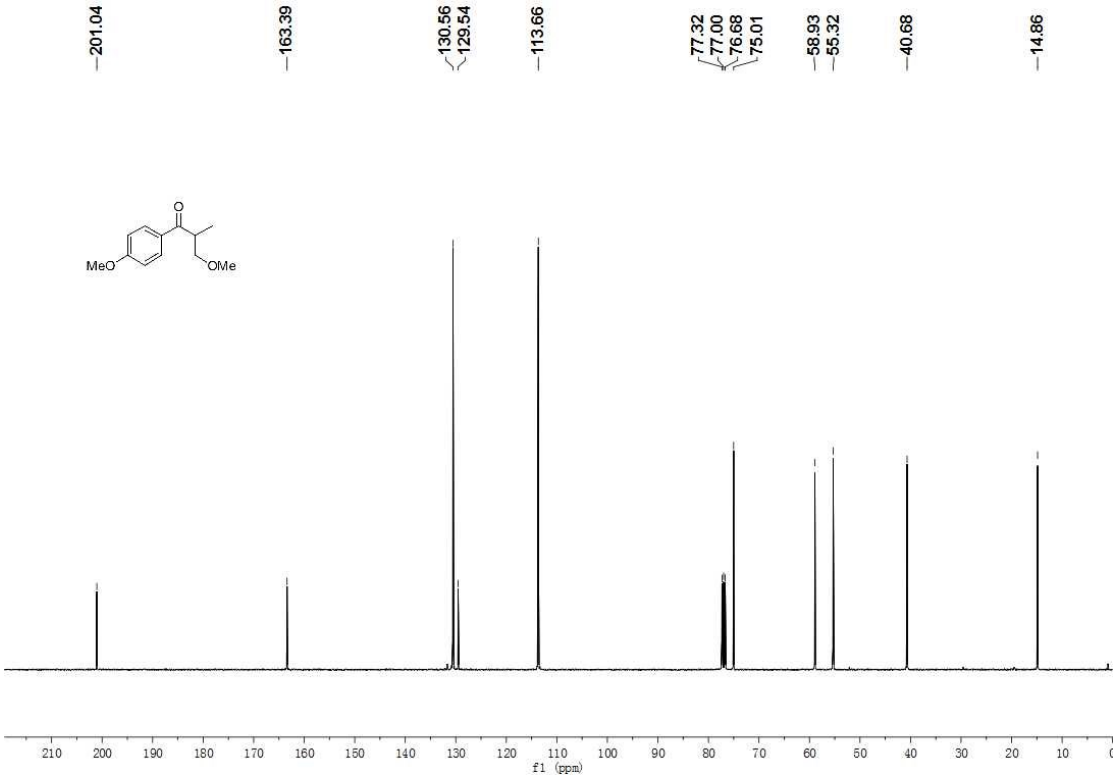
3-Methoxy-2-methyl-1-(p-tolyl)propan-1-one (**2b**)



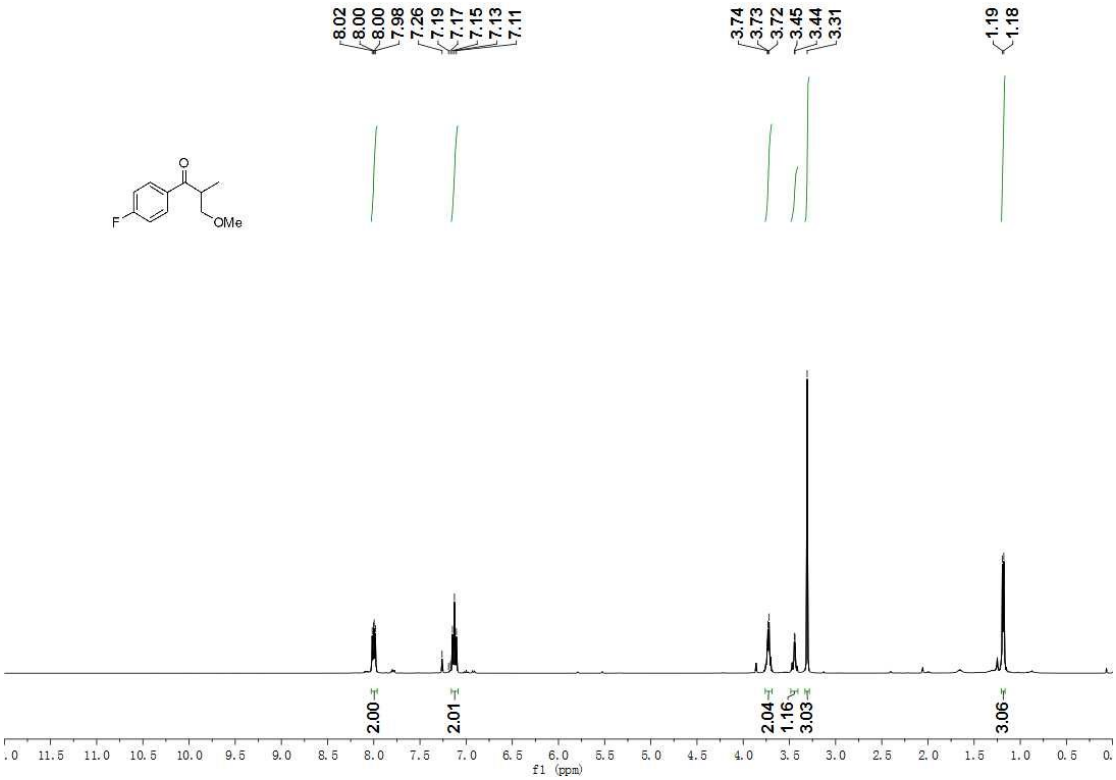


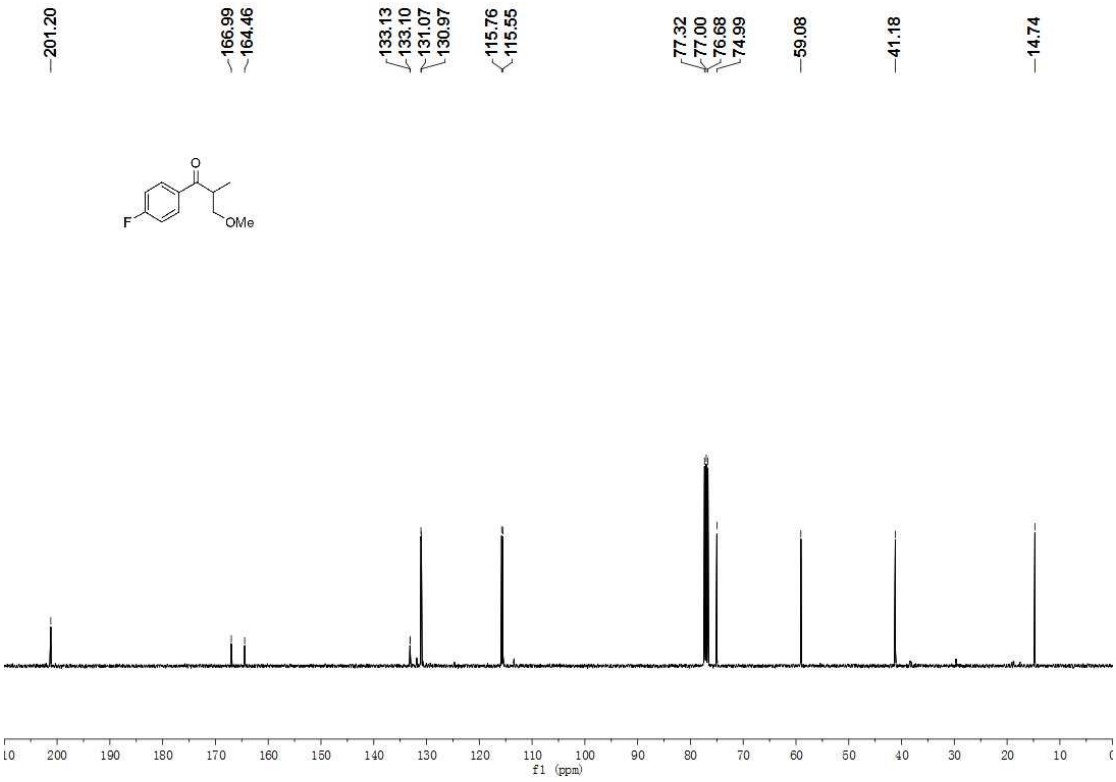
3-Methoxy-1-(4-methoxyphenyl)-2-methylpropan-1-one (**2c**)



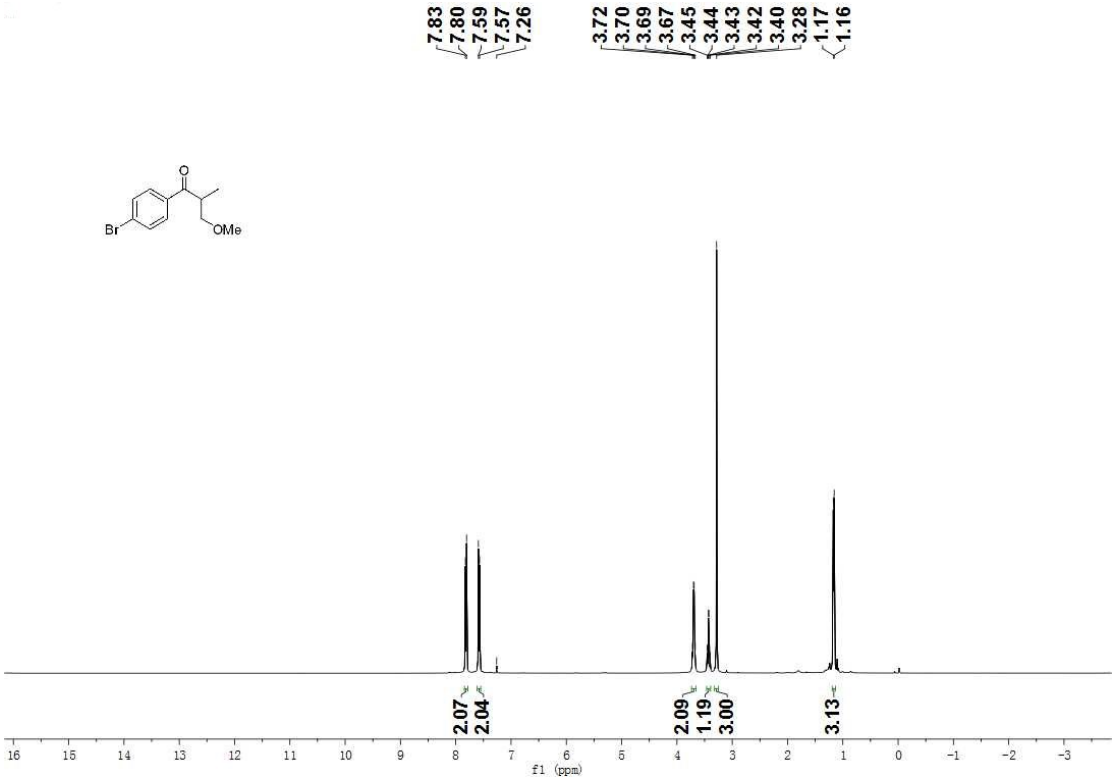


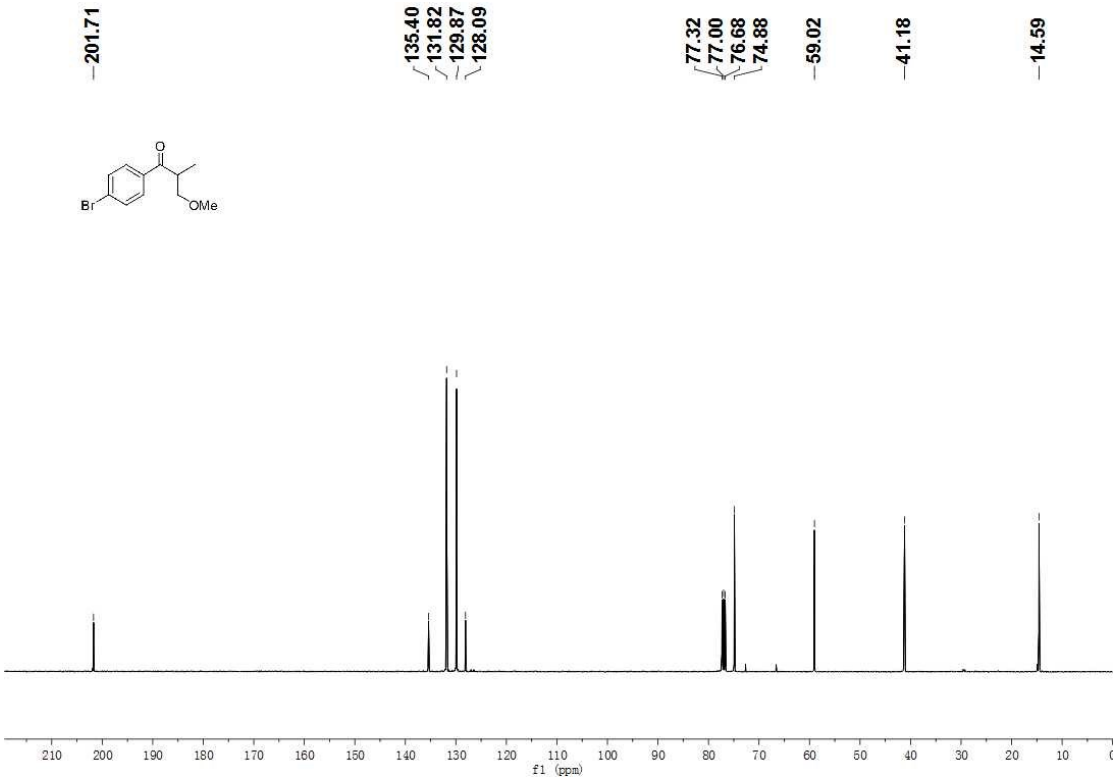
1-(4-Fluorophenyl)-3-methoxy-2-methylpropan-1-one (**2d**)



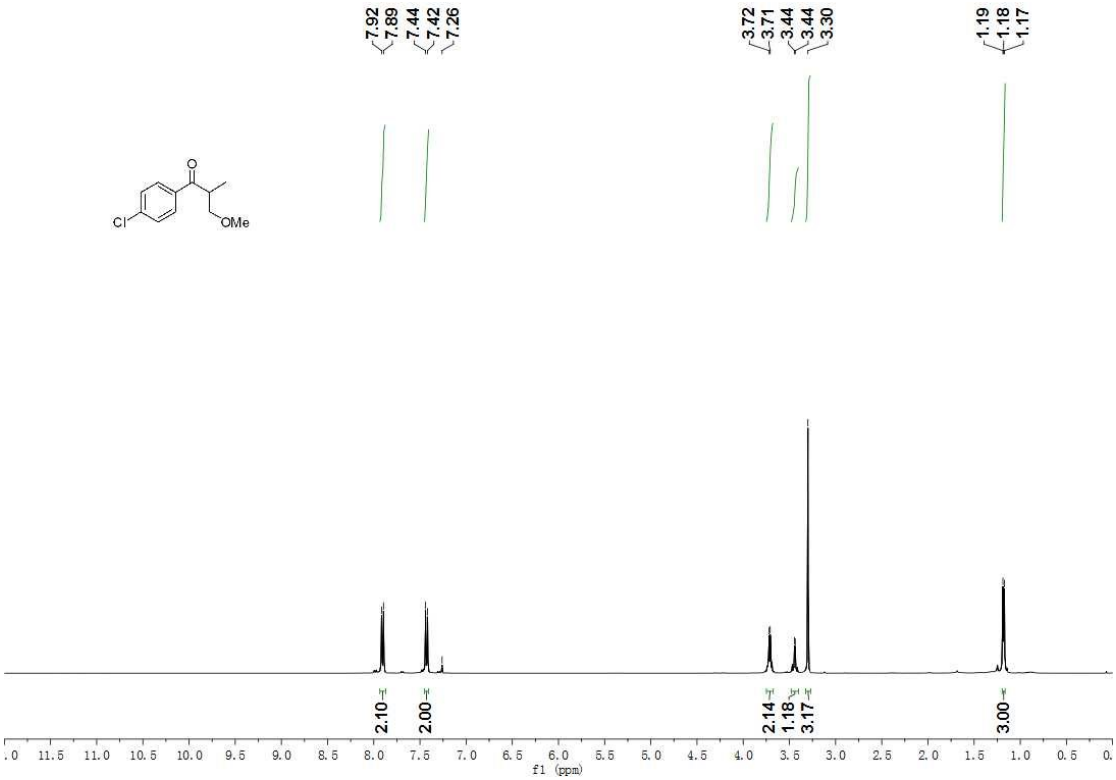


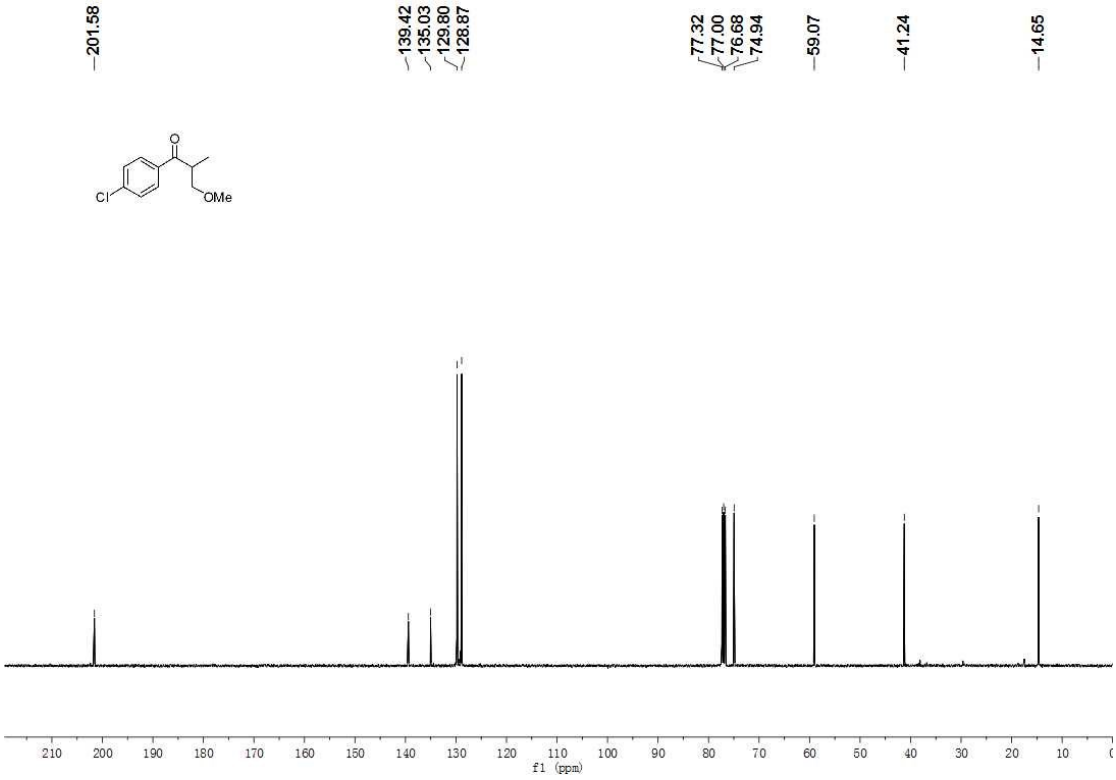
1-(4-Bromophenyl)-3-methoxy-2-methylpropan-1-one (**2e**)



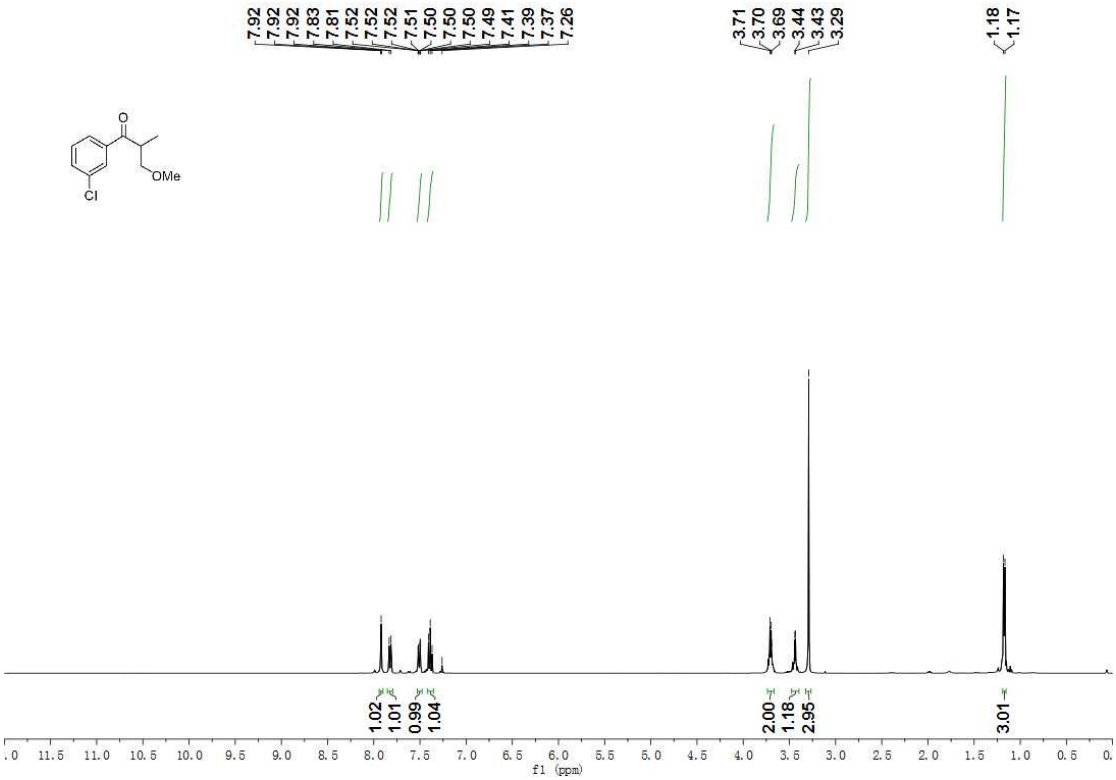


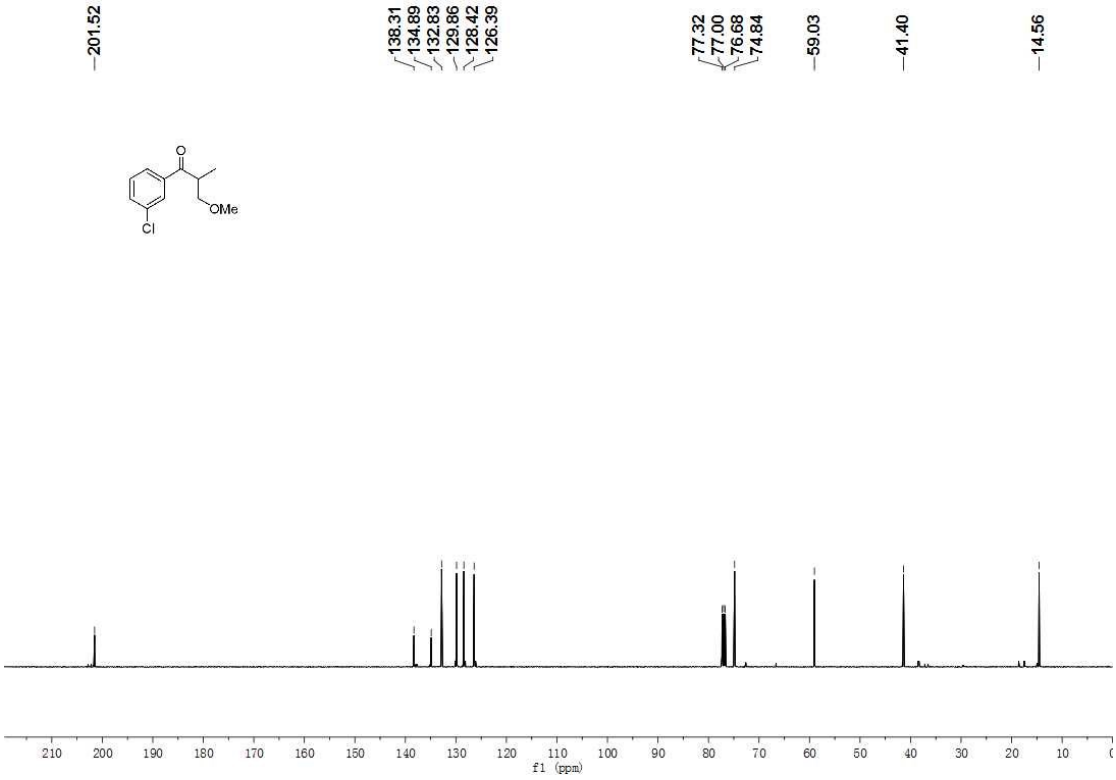
1-(4-Chlorophenyl)-3-methoxy-2-methylpropan-1-one (**2f**)



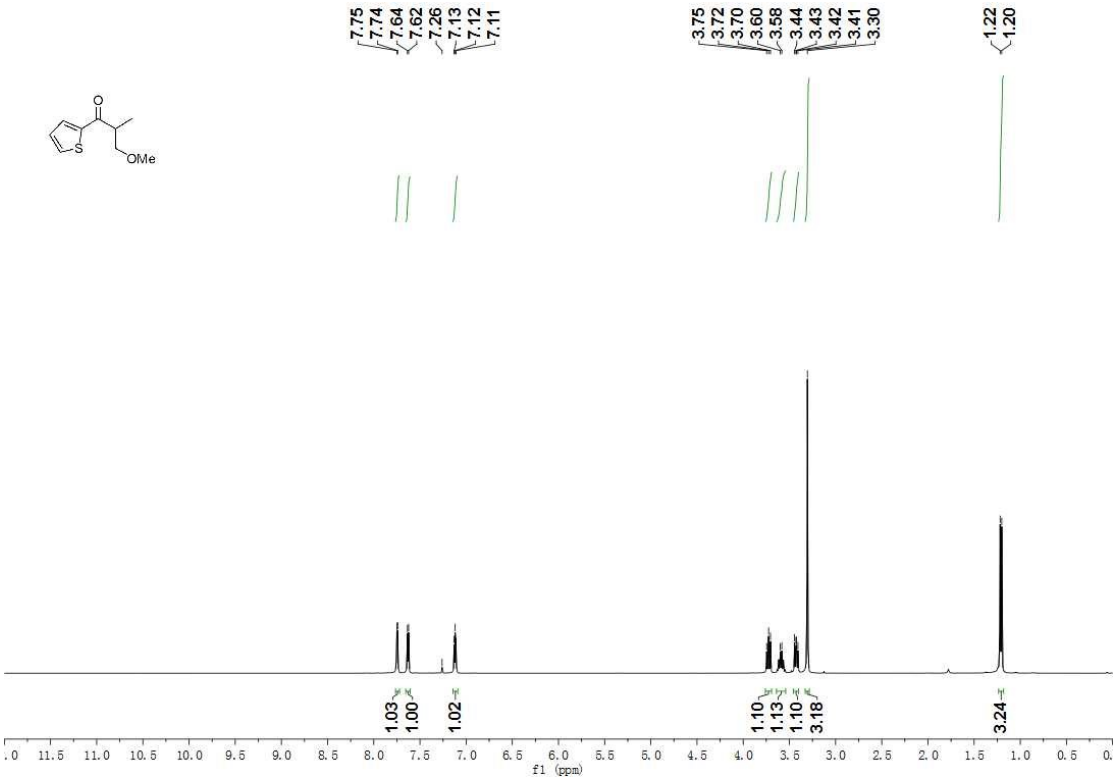


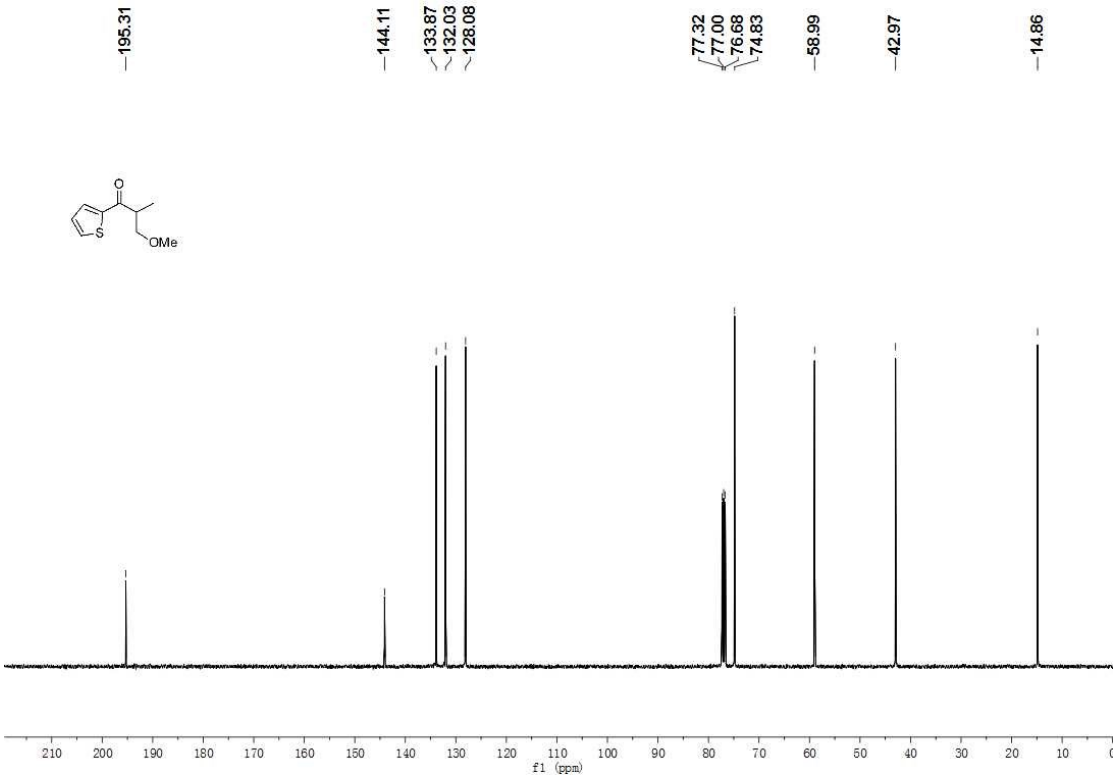
1-(3-Chlorophenyl)-3-methoxy-2-methylpropan-1-one (**2g**)



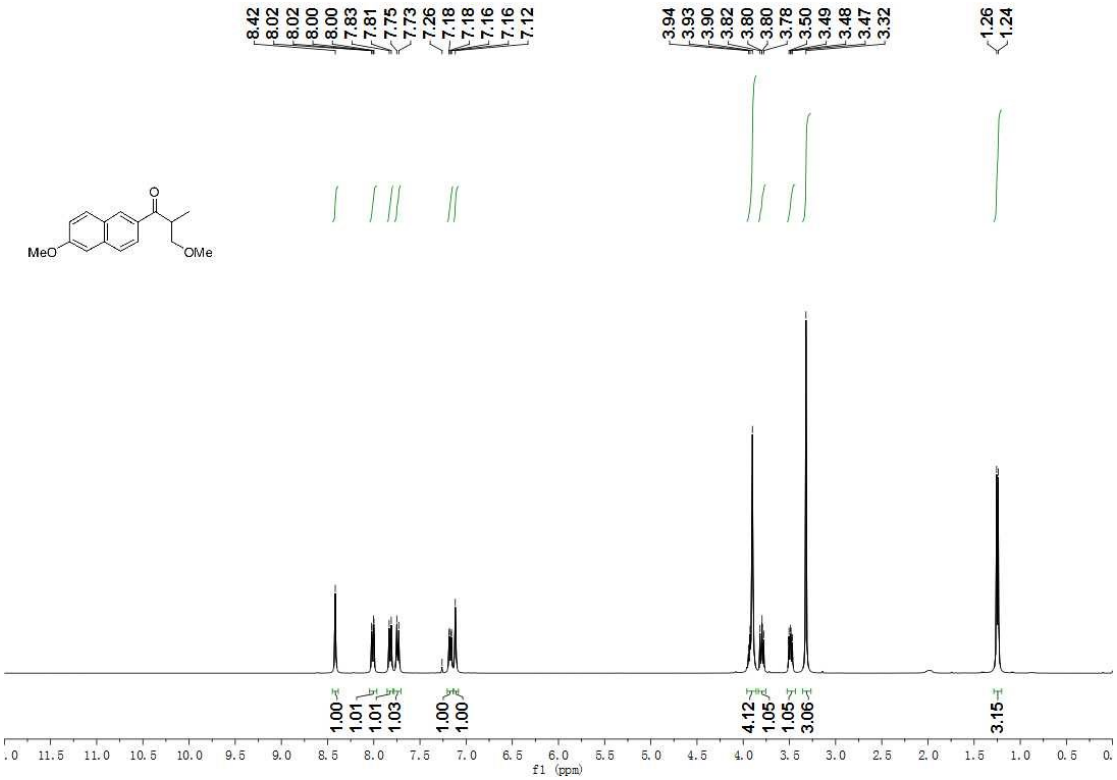


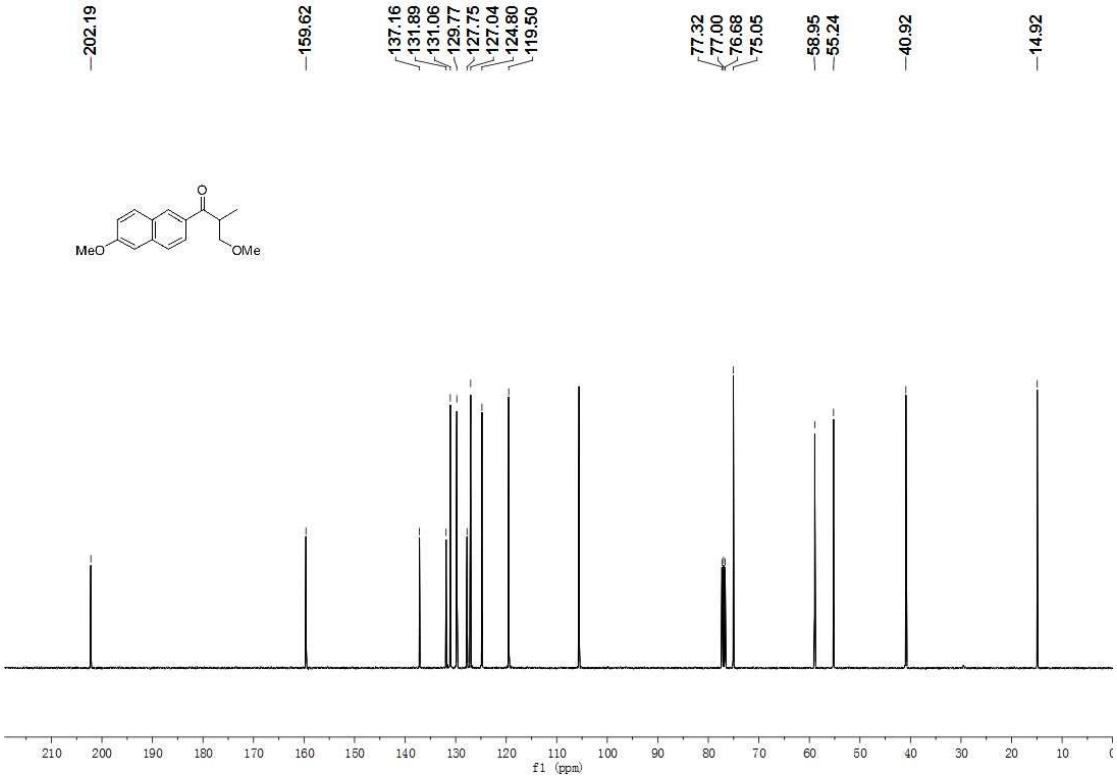
3-Methoxy-2-methyl-1-(thiophen-2-yl) propan-1-one (**2i**)



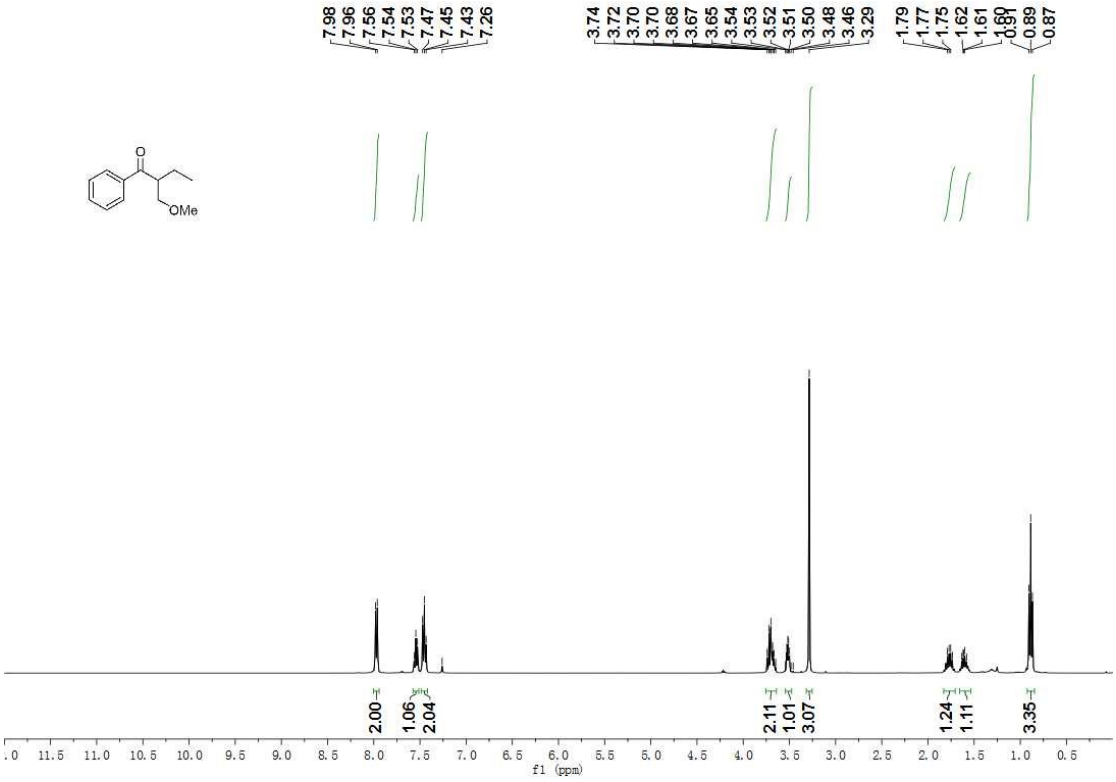


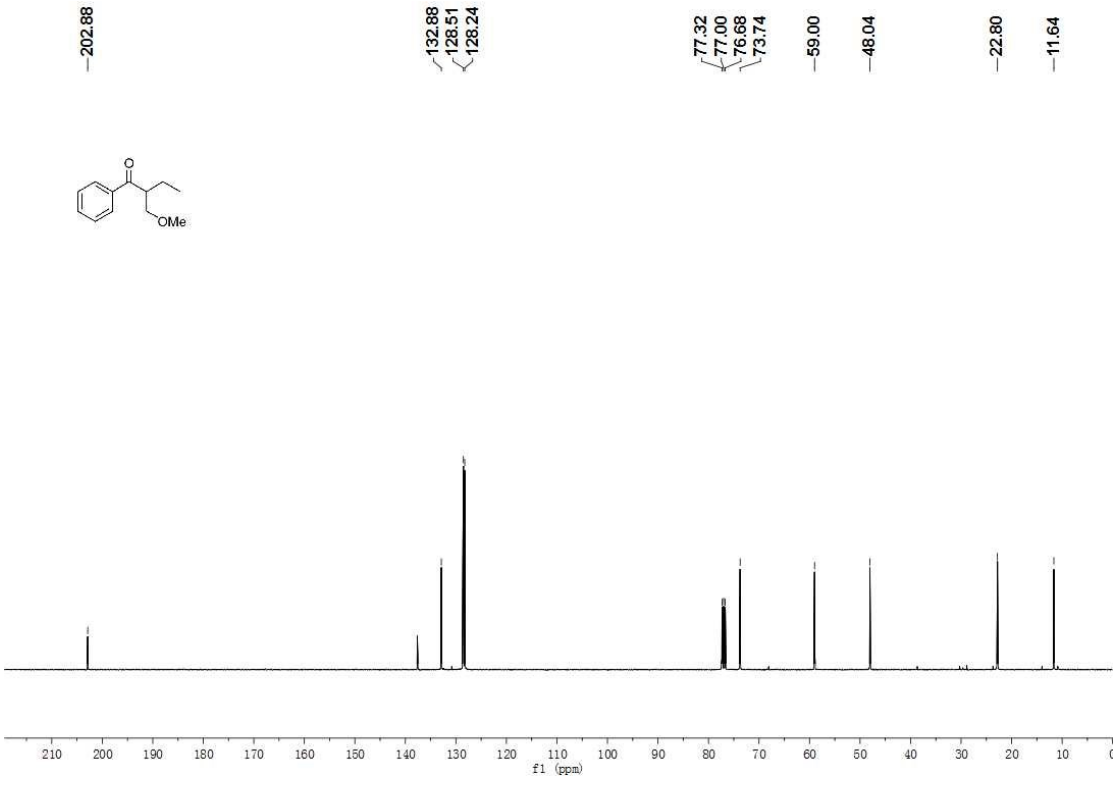
3-Methoxy-1-(6-methoxynaphthalen-2-yl)-2-methylpropan-1-one (**2j**)



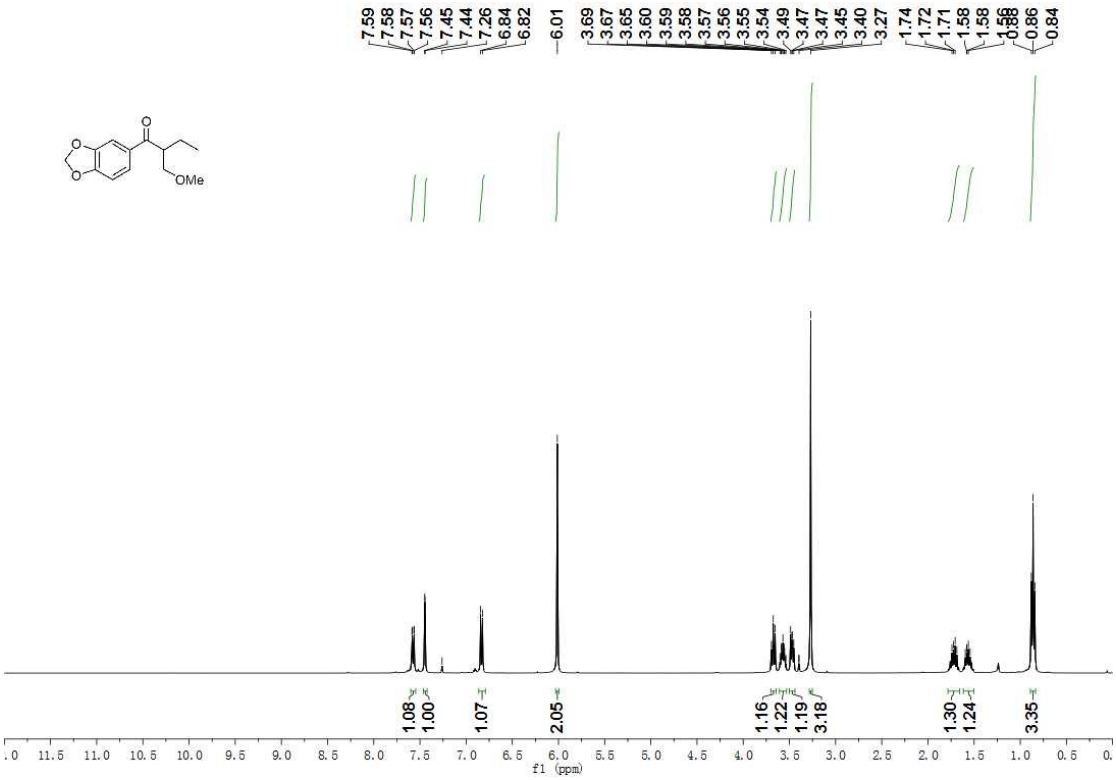


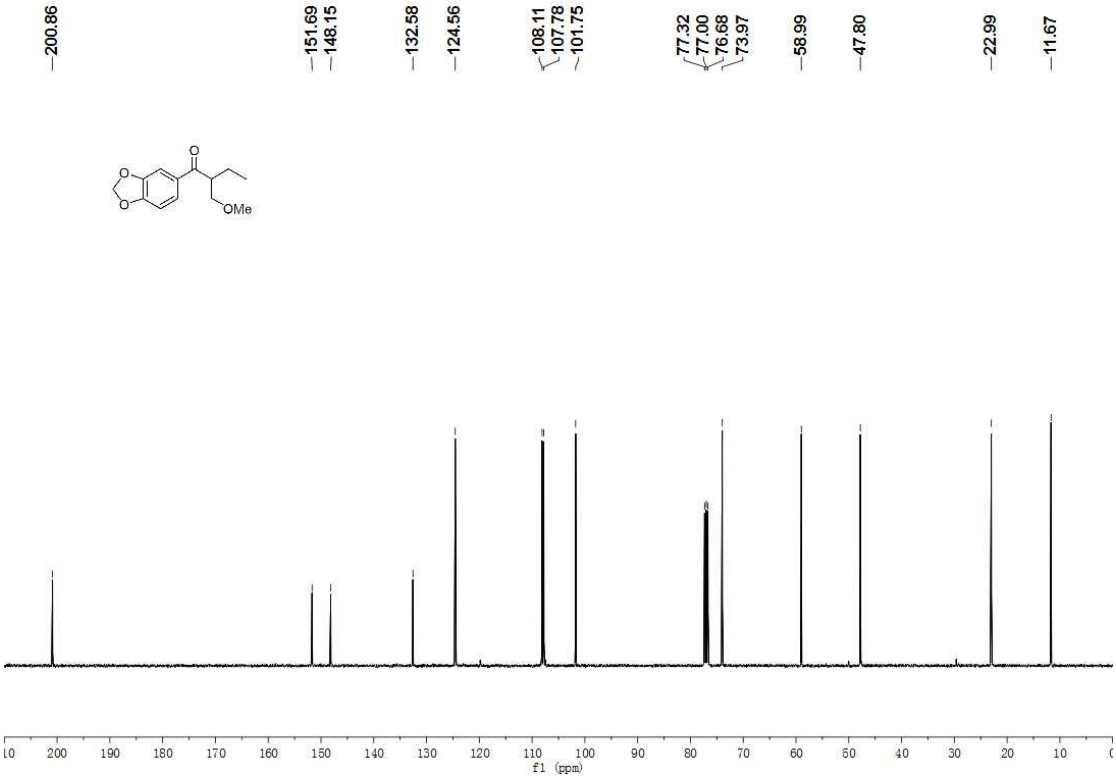
2-(Methoxymethyl)-1-phenylbutan-1-one (**2k**)



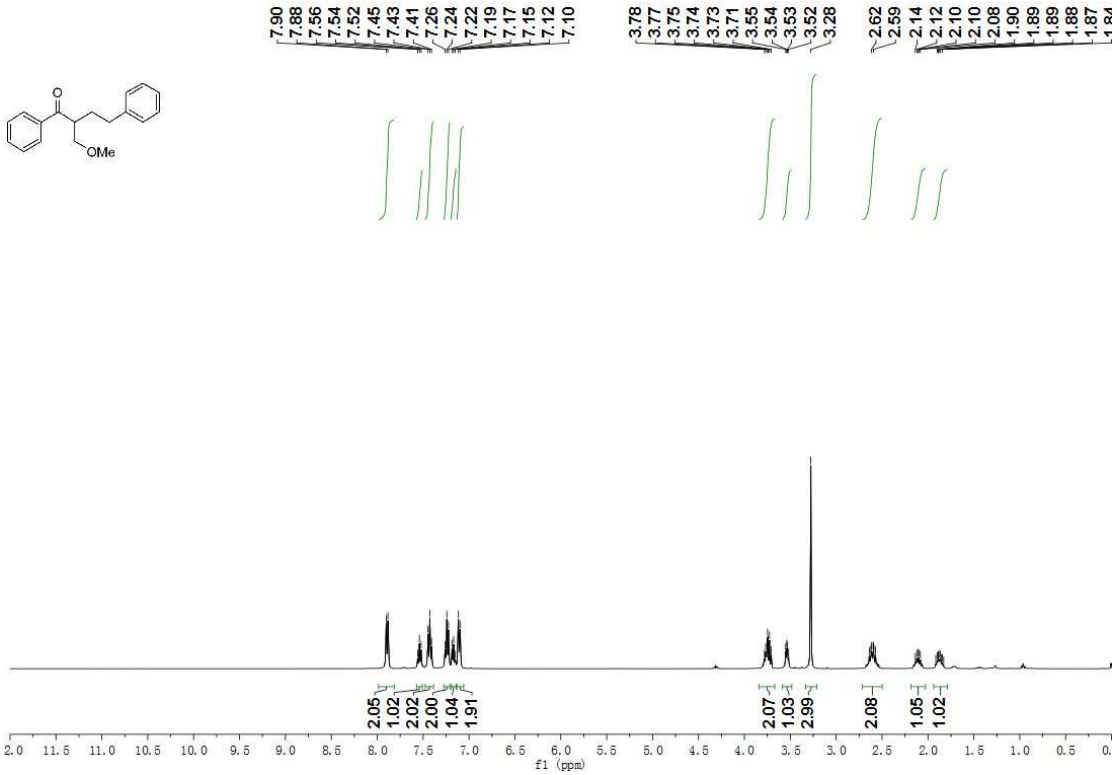


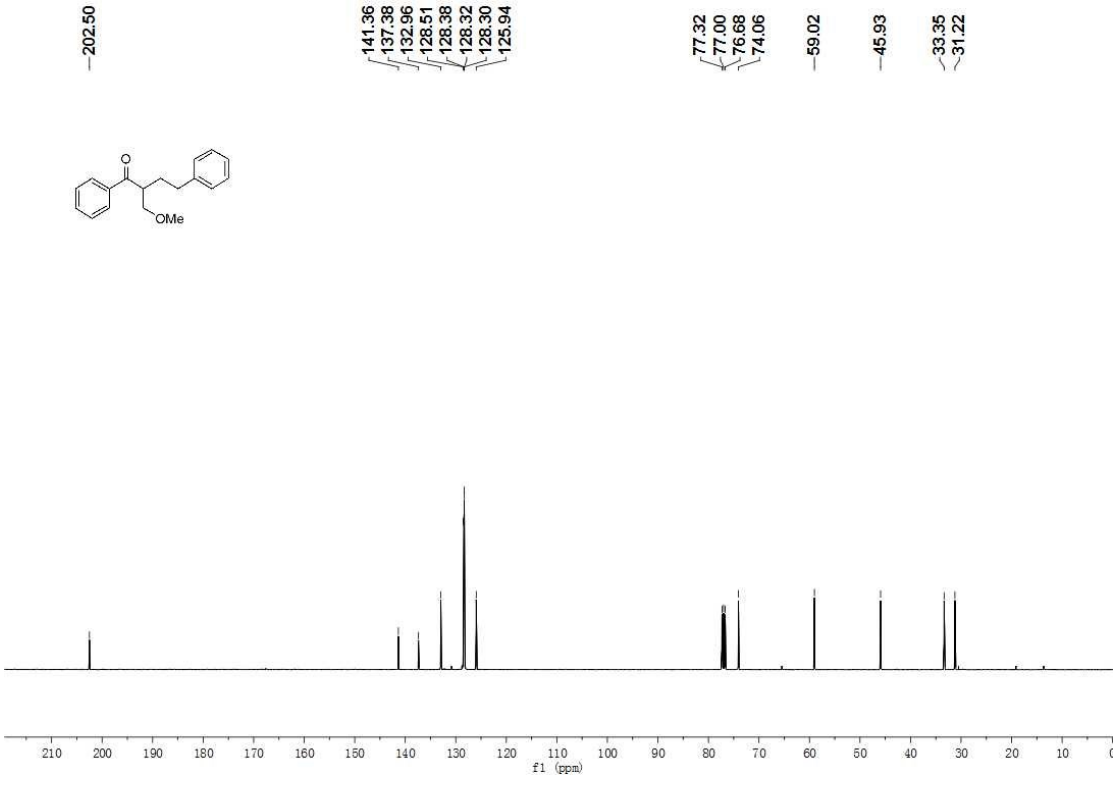
1-(Benzo[d][1, 3]dioxol-5-yl)-2-(methoxymethyl)butan-1-one (**2l**)



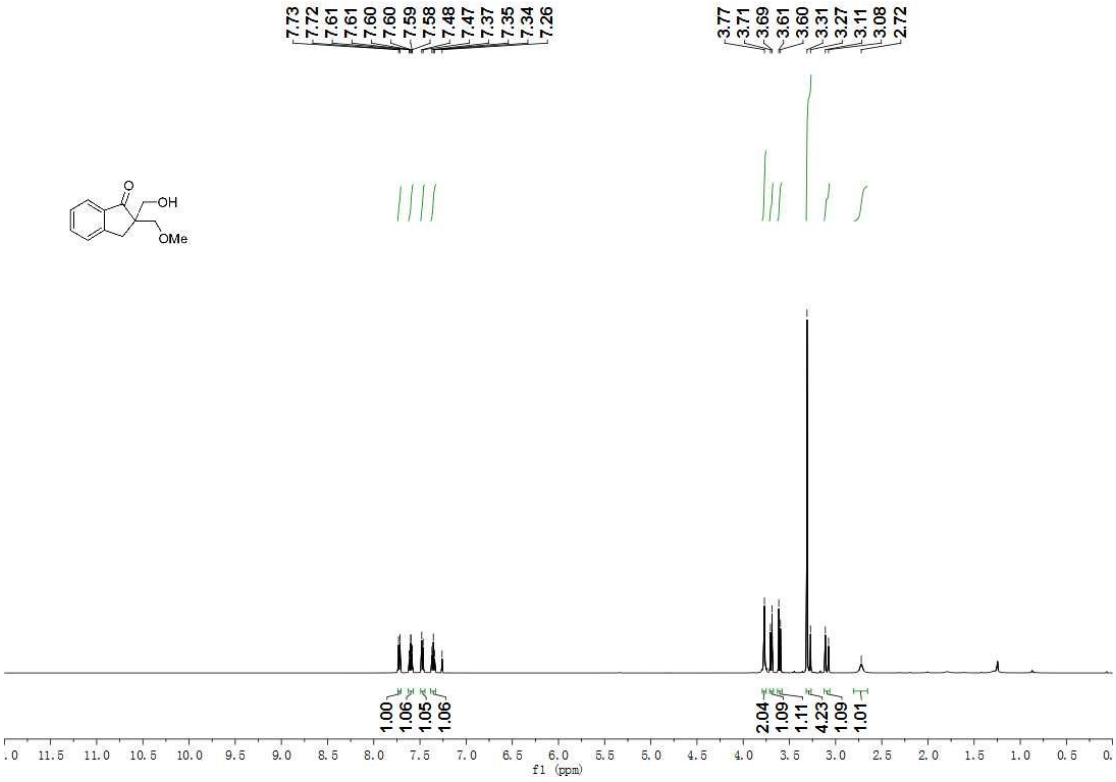


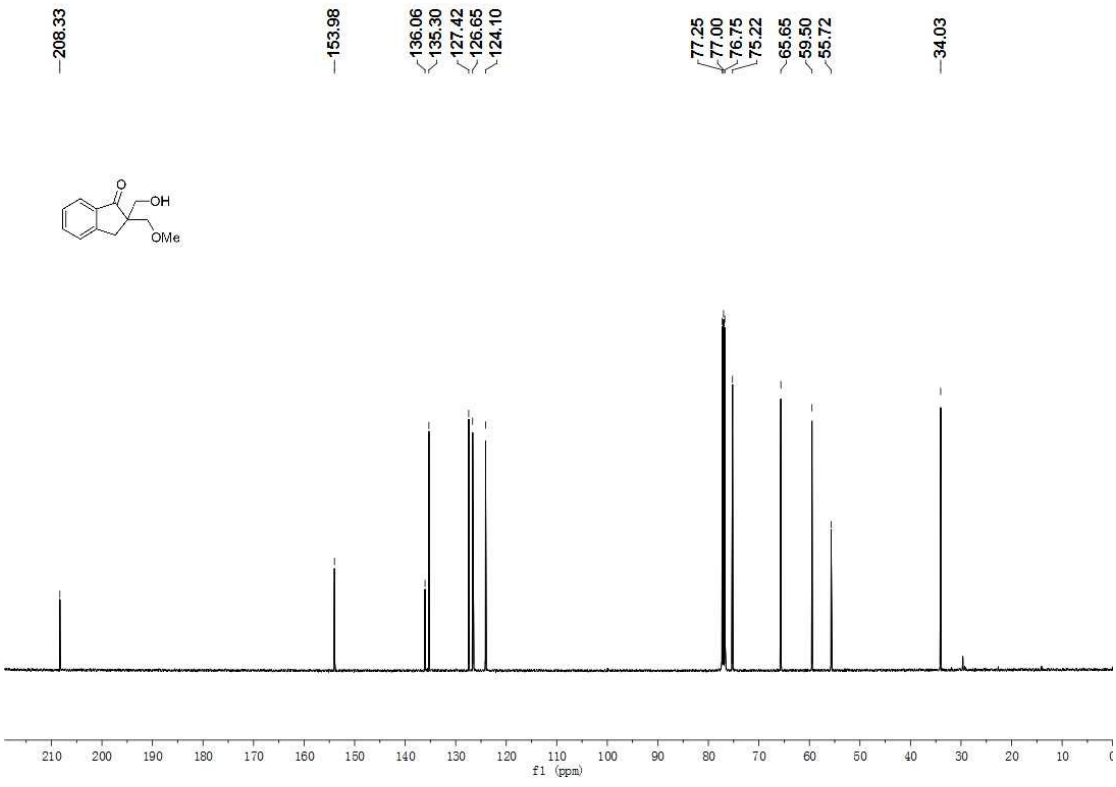
2-(Methoxymethyl)-1,4-diphenylbutan-1-one (**2m**)



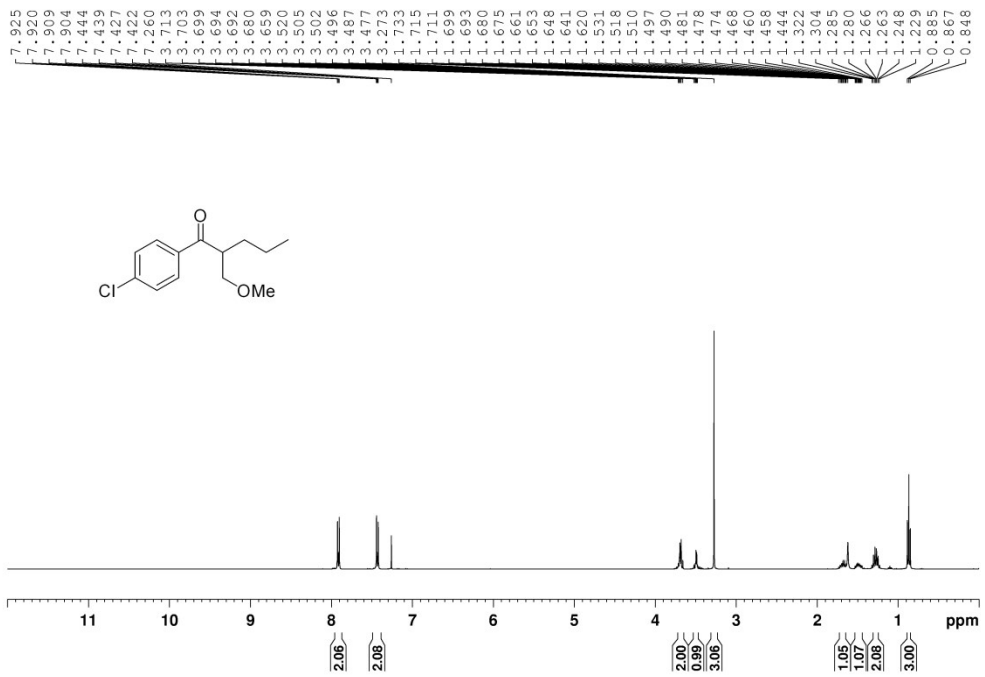


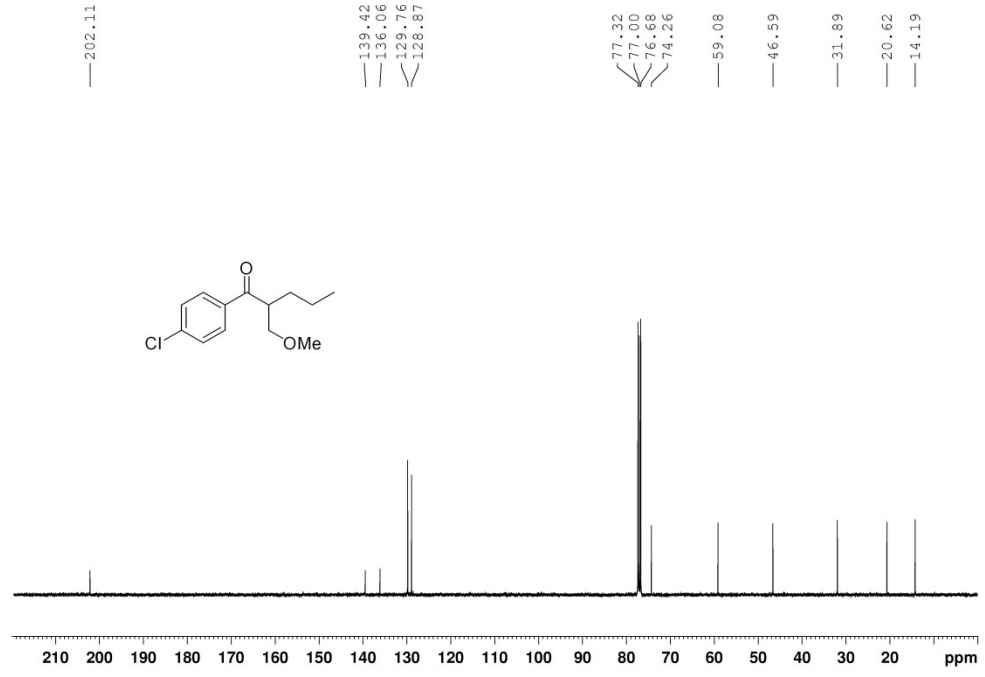
2-(Hydroxymethyl)-2-(methoxymethyl)-2,3-dihydro-1H-inden-1-one (**2n**)



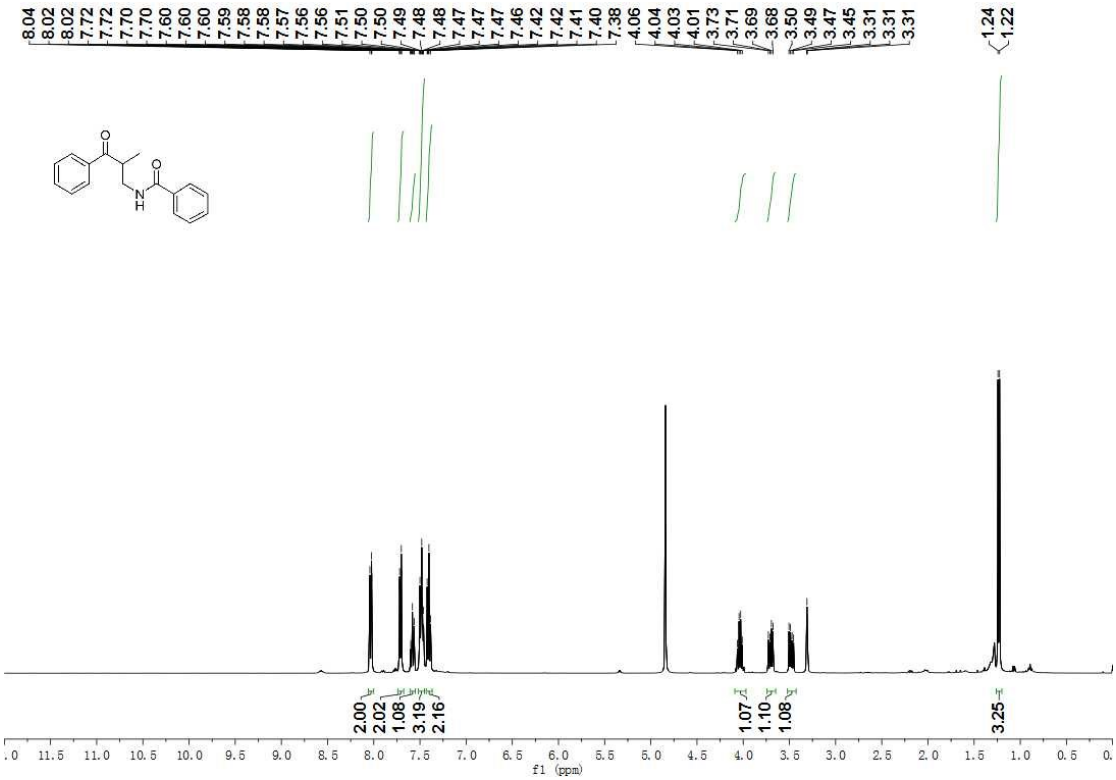


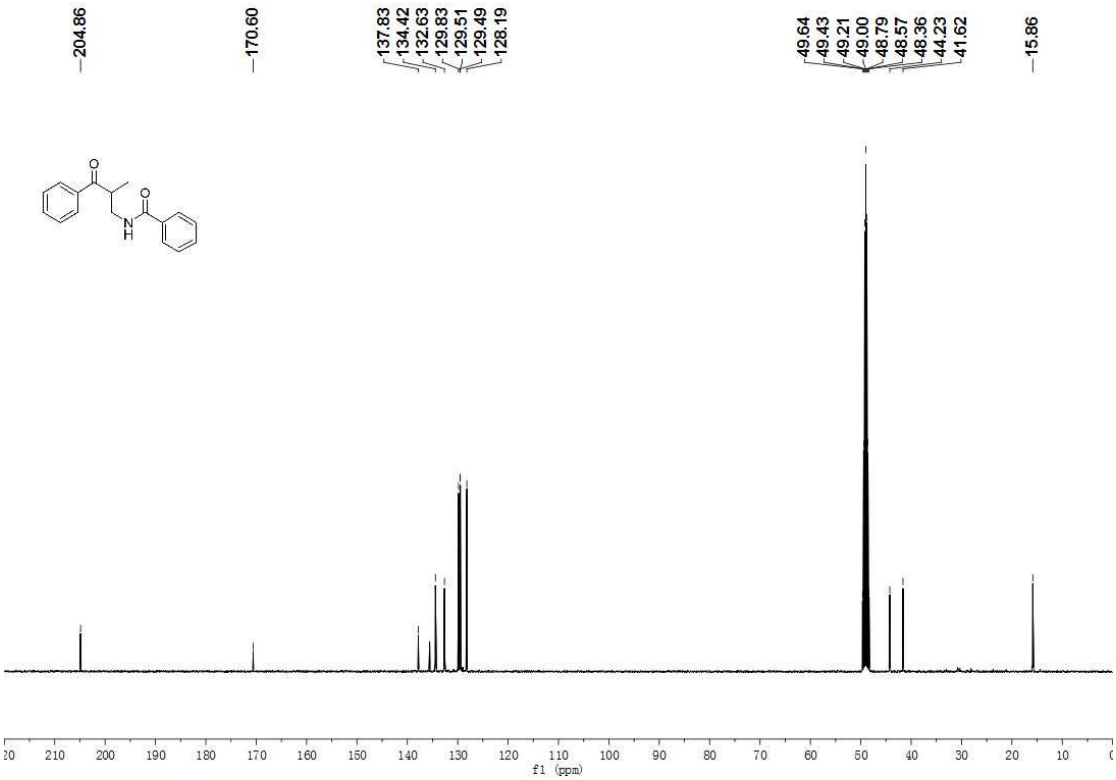
1-(4-Chlorophenyl)-2-(methoxymethyl)pentan-1-one (**2o**)



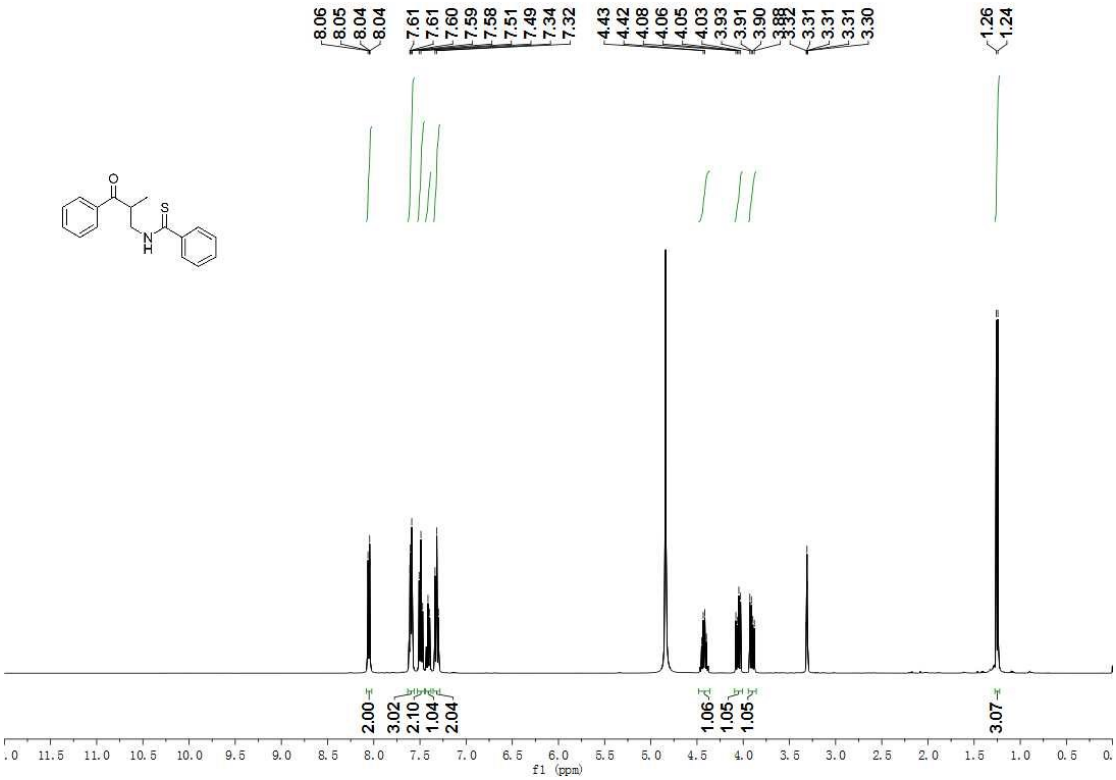


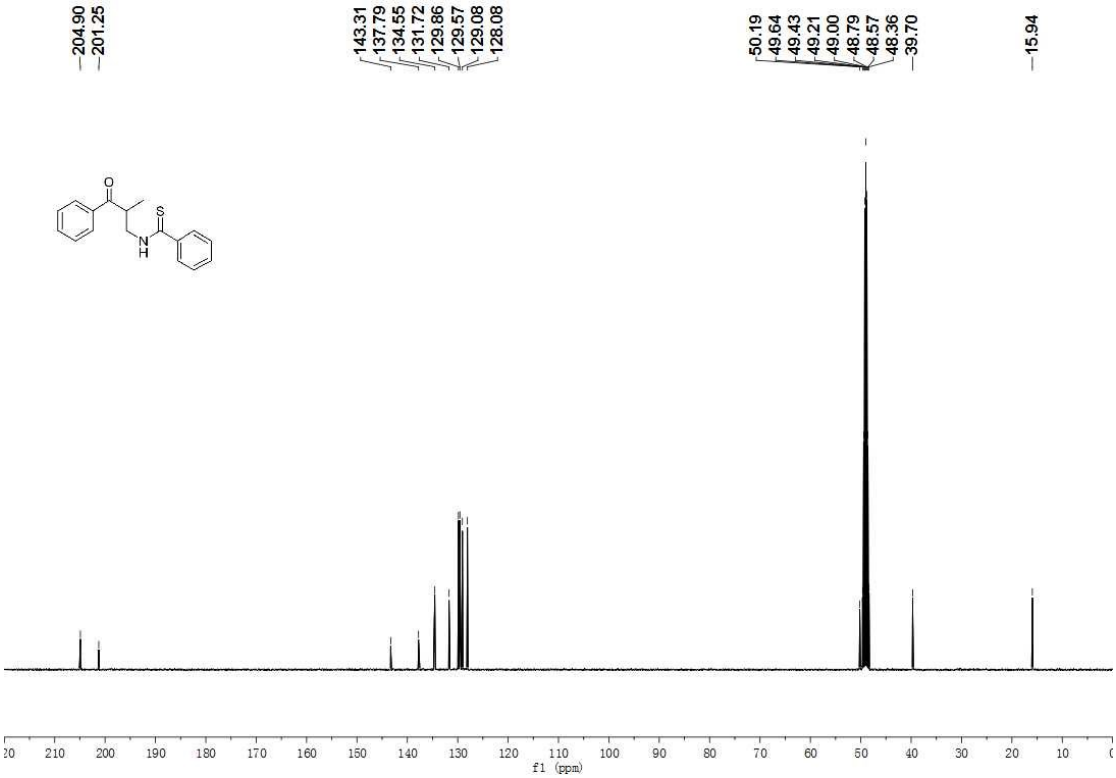
N-(2-methyl-3-oxo-3-phenylpropyl)benzamide (**4a**)



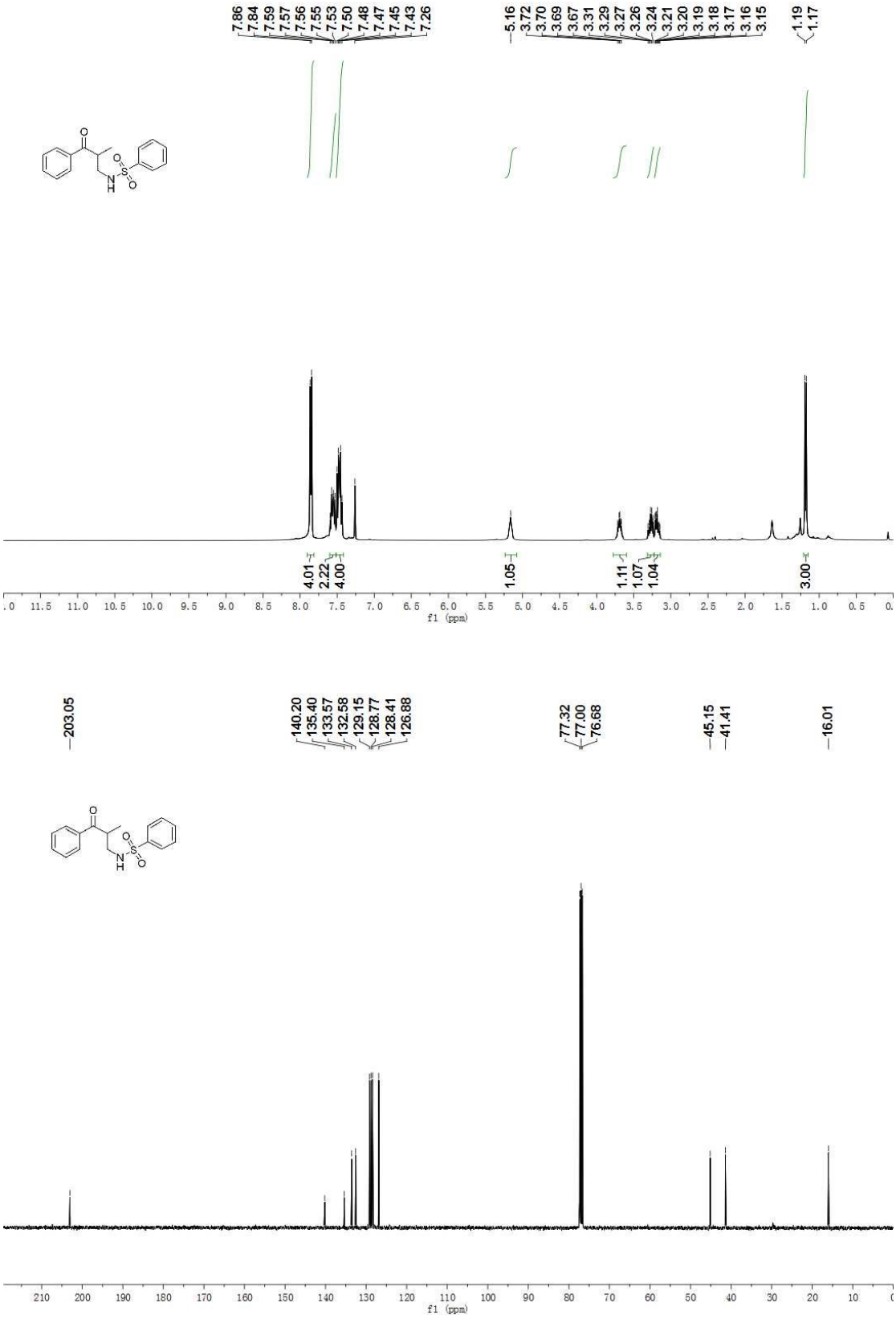


N-(2-methyl-3-oxo-3-phenylpropyl)benzothioamide (**4b**)

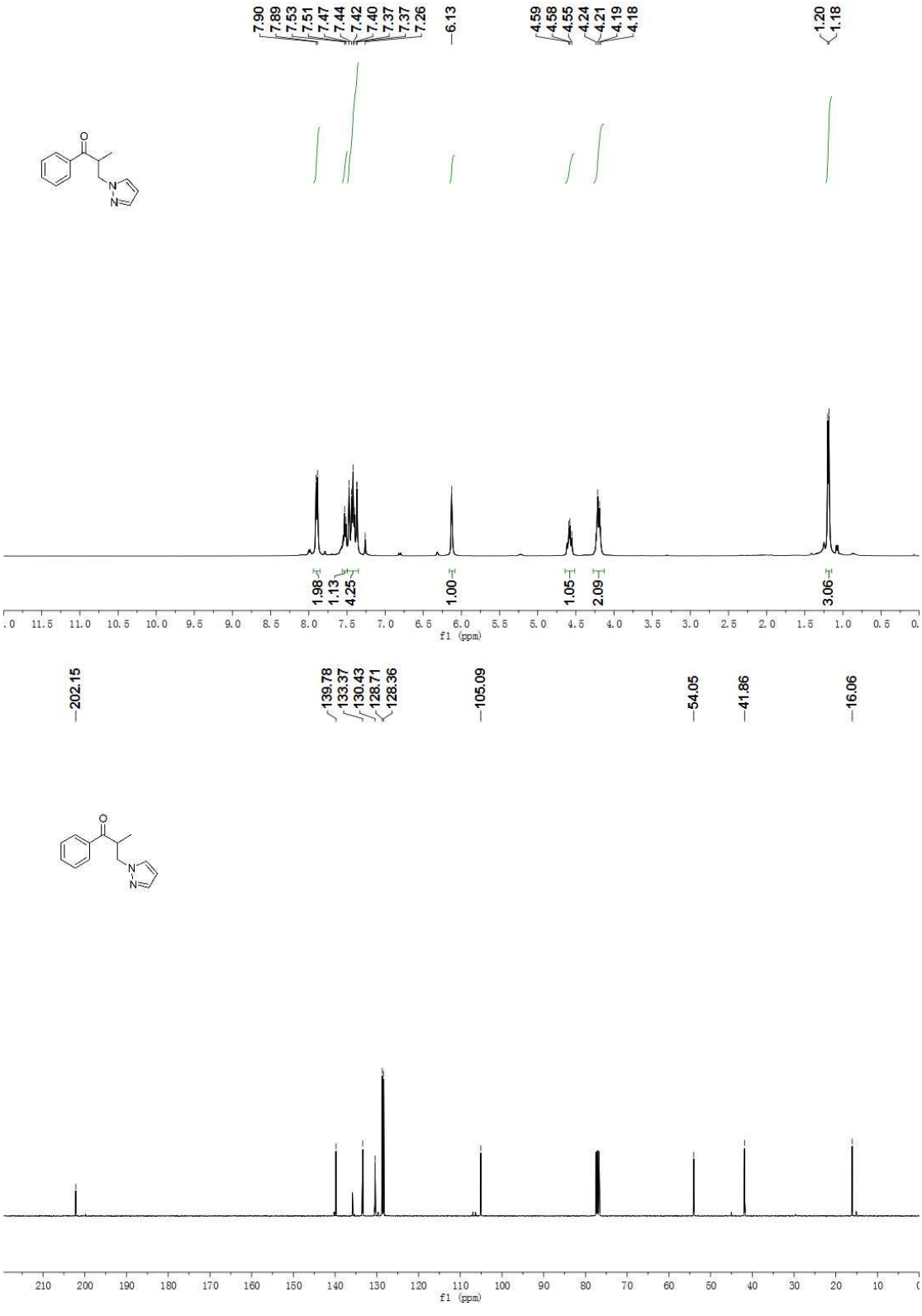




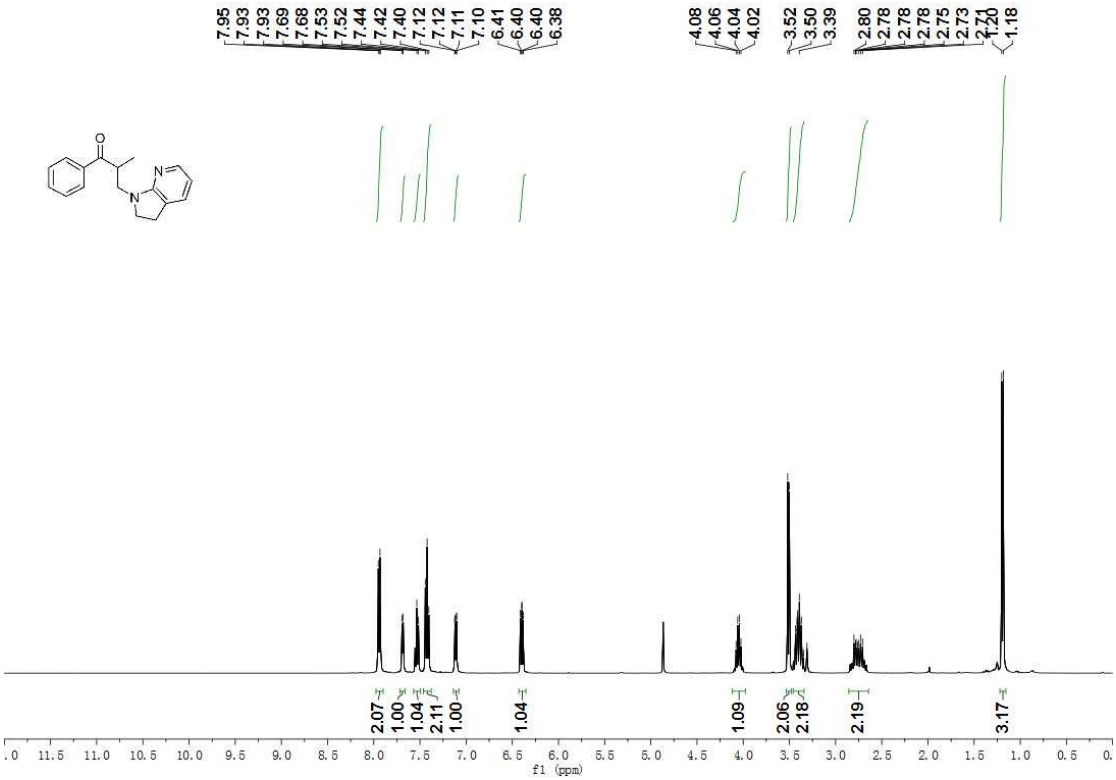
N-(2-methyl-3-oxo-3-phenylpropyl)benzenesulfonamide (**4c**)

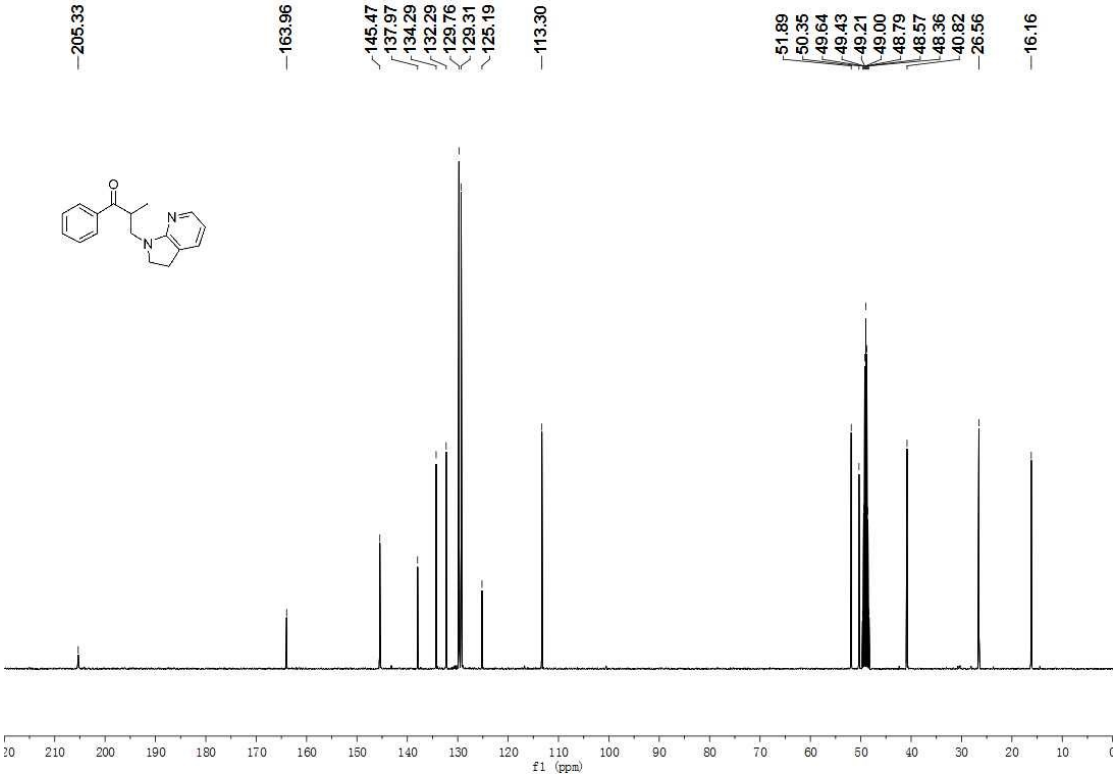


2-Methyl-1-phenyl-3-(1H-pyrazol-1-yl)propan-1-one (**4d**)

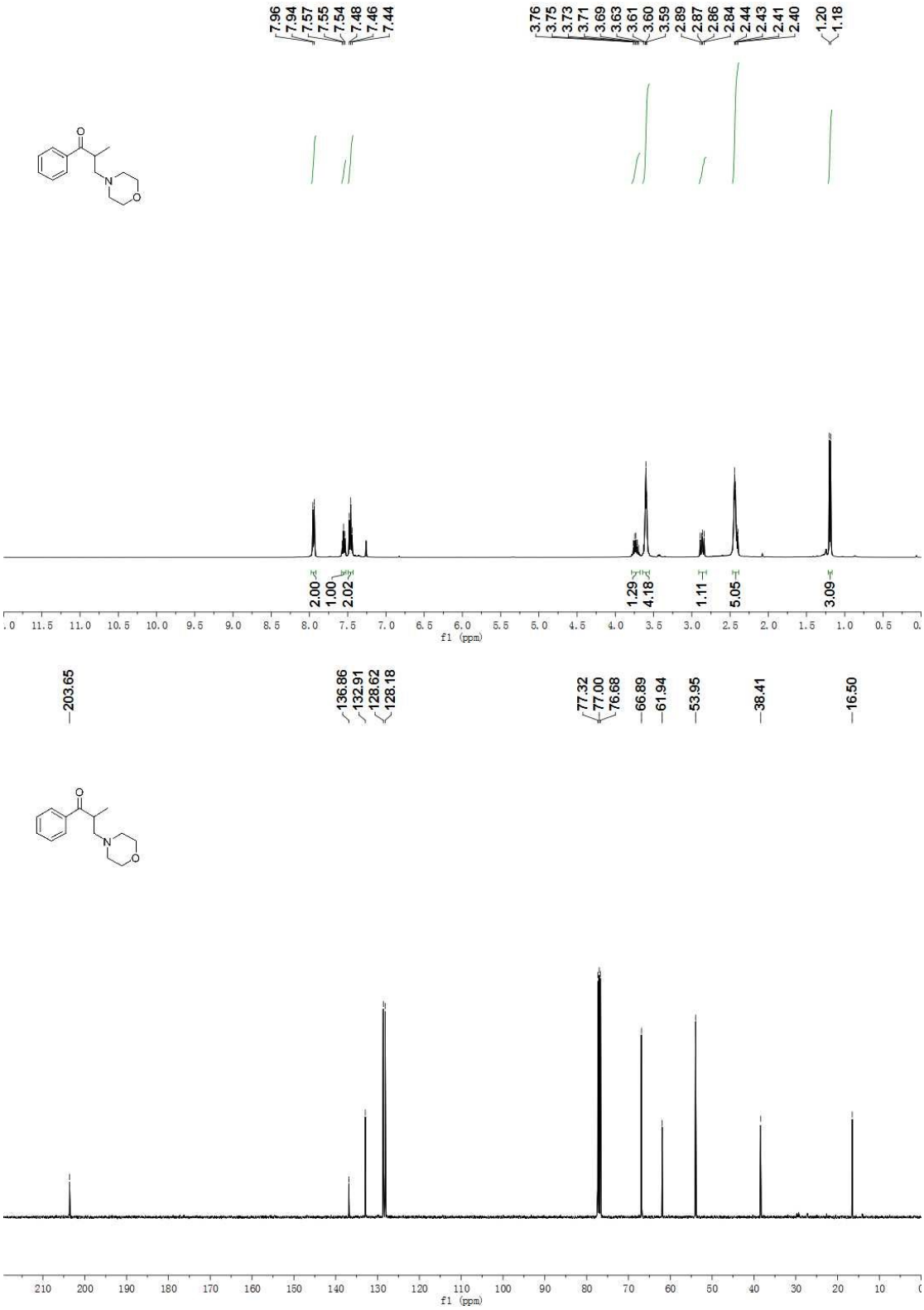


3-(2,3-Dihydro-1H-pyrrolo[2,3-b]pyridin-1-yl)-2-methyl-1-phenylpropan-1-one (**4e**)

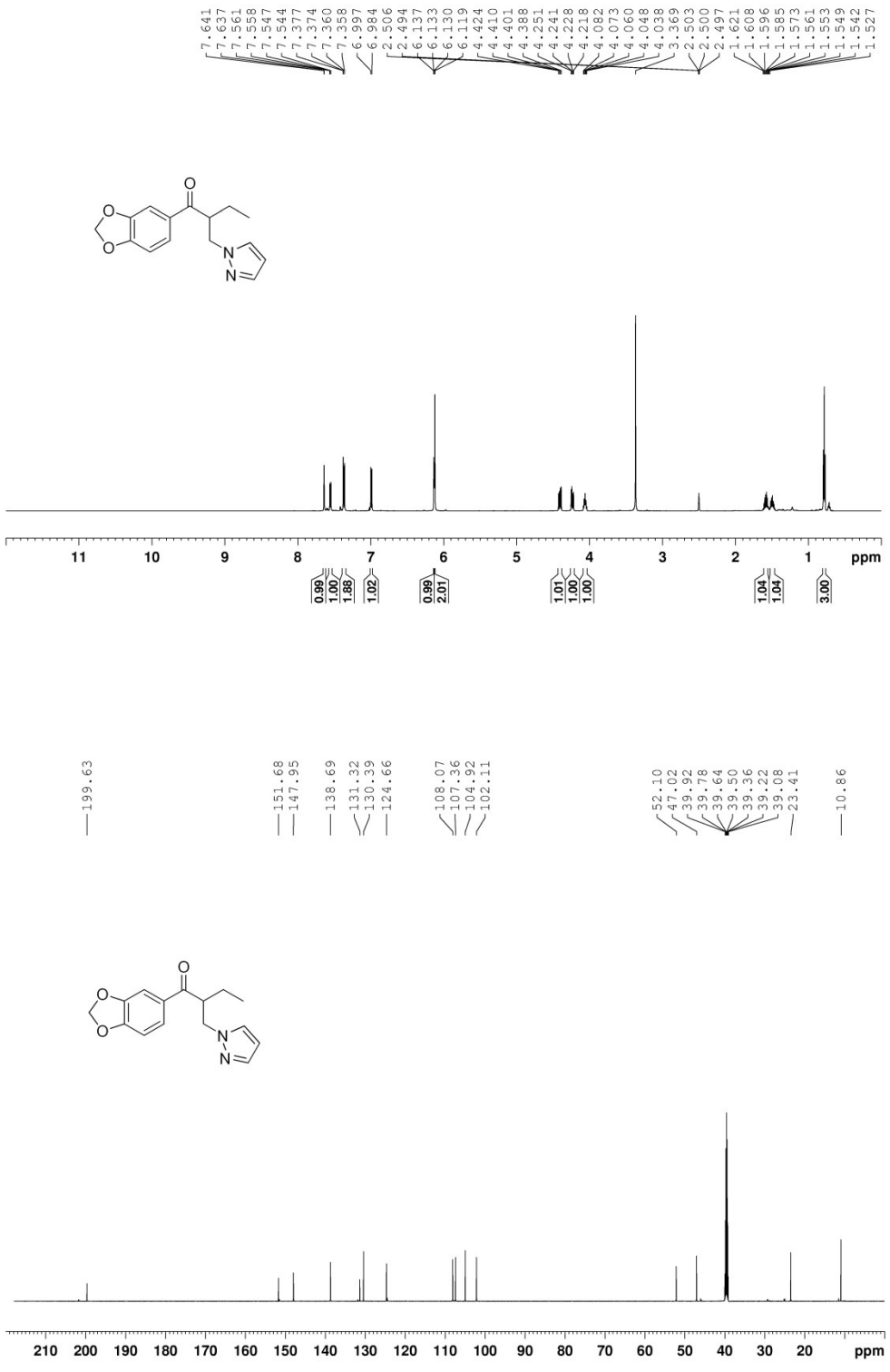




2-Methyl-3-morpholino-1-phenylpropan-1-one (**4f**)



2-((1*H*-pyrazol-1-yl)methyl)-1-(benzo[*d*][1,3]dioxol-5-yl)butan-1-one (**4g**)



2-((1*H*-pyrazol-1-yl)methyl)-1-(4-chlorophenyl)pentan-1-one (**4h**)