Supporting Information

Electrochemical synthesis of oxazoles via phosphine-mediated deoxygenative [3 + 2] cycloaddition of carboxylic acids

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1. General information

All commercially available reagents were directly used as received without further purification. All organic solvents applied in the reactions were pre-dried by distillation over appropriate drying reagents unless otherwise noted. The electrochemical reactions were performed on a DJS-292B potentiostat (made in China) in constant current mode. All yields of products refer to the isolated yields after chromatography.

^{1}H NMR (400 MHz), ^{13}C NMR (101 MHz) and ^{19}F NMR (376 MHz) spectra were recorded on a Bruker AV-400 spectrometer or a Quantum-I Plus 400 in Chloroform-*d* or DMSO-d_6. For ^{1}H NMR, Chloroform-*d* (δ = 7.26 ppm), DMSO-d_6 (δ = 2.50 ppm) or tetramethylsilane (TMS, δ = 0 ppm) serves as the internal standard; for ^{13}C NMR, Chloroform-*d* (δ = 77.16 ppm) or DMSO-d_6 (δ = 39.52 ppm) serves as the internal standard. Data are reported as follows: chemical shift (in ppm), multiplicity (s = singlet, d = doublet, t = triplet, q = quartet, p = quintet, hept = heptet, m = multiplet, br = broad), coupling constant (in Hz), and integration.

GC analysis was performed on a 7890B/Agilent, while GC-MS analysis was performed on a 7890A-5975C/Agilent. HR-MS spectra were recorded on a Waters Xevo G2QTOF/UPLC mass spectrometer using electrospray ionization. The cyclic voltammogram was collected with a CHI 760E Potentiostat.

Unless otherwise noted, the substrates were directly obtained from commercial sources.

Figure S1. Reaction vessel and electrode materials

Figure S2. The potentiostat

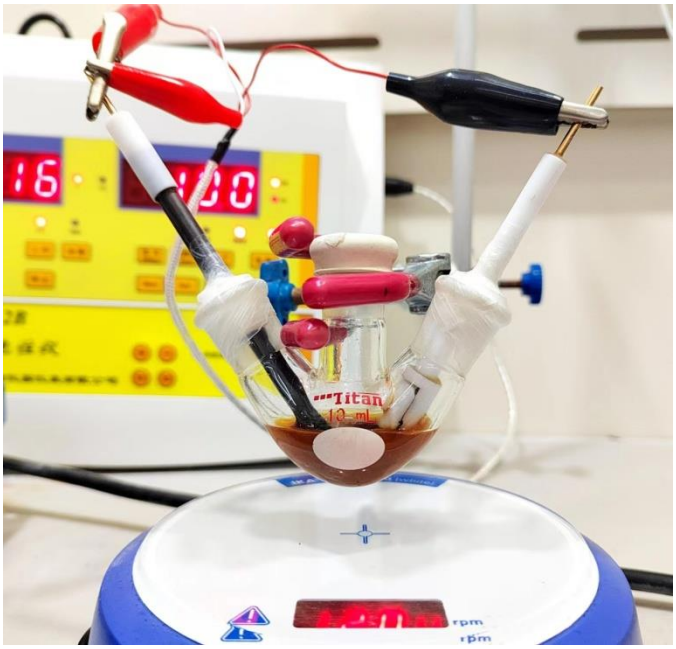
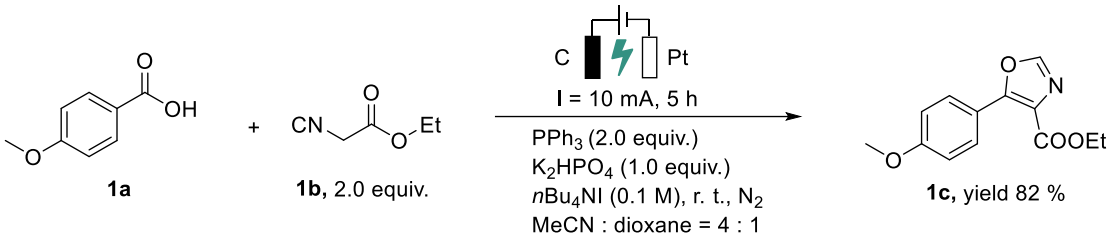


Figure S3. Reaction for standard condition

2. Experimental Procedures and Characterization Data

2.1 Conditions optimizing



Standard conditions: graphite rod anode (φ = 6 mm), Pt plate cathode (10 × 10 × 0.2, mm), **1a** (0.4 mmol), **2a** (0.8 mmol), PPh_3 (0.8 mmol), K_2HPO_4 (0.4 mmol), *n*Bu_4NI (0.1 M) in anhydrous MeCN : dioxane (4 : 1, 4.0 mL), undivided cell, constant current = 10 mA under N_2 at room temperature for 5 h (4.7 F/mol). [b] Isolated yield. NR: no reaction.

Table S1. Control experiments

Entry	Electrolyte	Yield of **3a** (%)[a]
1	No current	NR
2	No PPh_3	NR
3	No base	trace

[a]Isolated yield, NR= no reaction;

Table S2. Solvent screening

Entry	Electrode	Electrolyte	Solvent	Yield of **3a** (%)[a]
1	C/Pt	*n*Bu_4NI	MeCN	76
2	C/Pt	*n*Bu_4NI	DMF	NR
3	C/Pt	*n*Bu_4NI	THF	NR
4	C/Pt	*n*Bu_4NI	DMSO	NR
5	C/Pt	*n*Bu_4NI	DCE	NR
6	C/Pt	*n*Bu_4NI	MTBE	NR
7	C/Pt	*n*Bu_4NI	Me_2CO	55
8	C/Pt	*n*Bu_4NI	MeCN: HFIP = 4:1	NR
9	C/Pt	*n*Bu_4NI	MeCN: AcOH = 4:1	NR
10	C/Pt	*n*Bu_4NI	MeCN: MeOH = 4:1	NR
11	C/Pt	*n*Bu_4NI	MeCN: H_2O = 4:1	NR
12	C/Pt	*n*Bu_4NI	MeCN: dioxane = 4:1	80

[a]Isolated yield;

Table S3. Electrolytes screening

Entry	Electrode	Electrolyte	Solvent	Yield of **3a** (%)[a]
1	C/Pt	*n*Bu_4NI	MeCN: dioxane = 4:1	80
2	C/Pt	NH_4I	MeCN: dioxane = 4:1	Trace
3	C/Pt	*n*Bu_4NBr	MeCN: dioxane = 4:1	26

4	C/Pt	*n*Bu_4NCl	MeCN: dioxane = 4:1	67
5	C/Pt	*n*Bu_4NBF_4	MeCN: dioxane = 4:1	NR
6	C/Pt	*n*Bu_4NClO_4	MeCN: dioxane = 4:1	NR
7	C/Pt	*n*Bu_4NPF_6	MeCN: dioxane = 4:1	NR
8	C/Pt	KI	MeCN: dioxane = 4:1	36
9	C/Pt	*n*Bu_4NI (20 %)	MeCN: dioxane = 4:1	33

[a]Isolated yield;

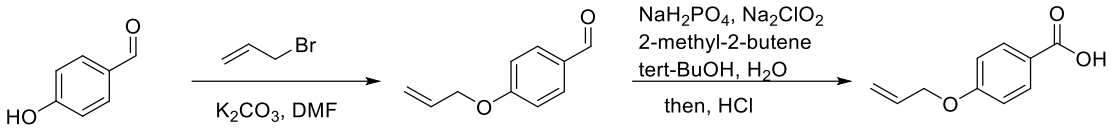
Table S4 . Electrode screening

Entry	Electrode	Electrolyte	Solvent	Yield of **3a** (%)[a]
1	C/Pt	*n*Bu_4NI	MeCN: dioxane = 4:1	80
2	C/C	*n*Bu_4NI	MeCN: dioxane = 4:1	46
3	C/Fe	*n*Bu_4NI	MeCN: dioxane = 4:1	33
4	Pt/Pt	*n*Bu_4NI	MeCN: dioxane = 4:1	56
5	Pt/C	*n*Bu_4NI	MeCN: dioxane = 4:1	49
6	RVC/Pt	*n*Bu_4NI	MeCN: dioxane = 4:1	Trace

Table S5 . Base screening

Entry	Electrode	Electrolyte	Base	Yield of **3a** (%)[a]
1	C/Pt	*n*Bu_4NI	K_2HPO_4	80
2	C/Pt	*n*Bu_4NI	KH_2PO_4	39
3	C/Pt	*n*Bu_4NI	DABCO	30
4	C/Pt	*n*Bu_4NI	Et_3N	Trace
5	C/Pt	*n*Bu_4NI	Collidine	Trace
6	C/Pt	*n*Bu_4NI	K_2CO_3	66
7	C/Pt	*n*Bu_4NI	KAcO	46
8	C/Pt	*n*Bu_4NI	Cs_2CO_3	58
9	C/Pt	*n*Bu_4NI	$NaHCO_3$	50

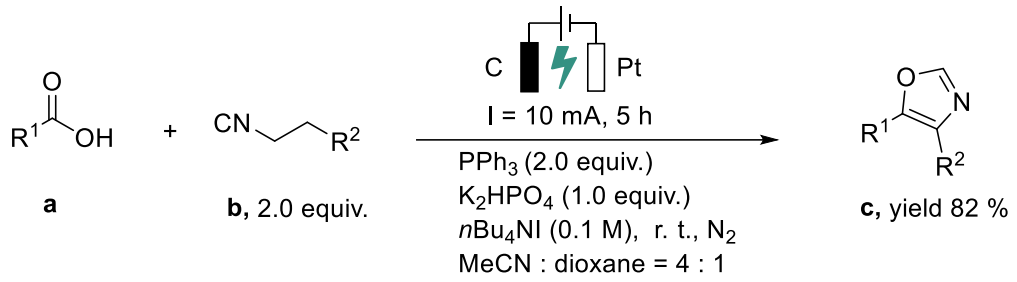
2.2 Substrates preparation



Following the modified procedure of reported literature, a 50 mL oven-dried Schlenk-tube was charged with potassium carbonate (1.25 g, 9.0 mmol), methyl 4-hydroxybenzaldehyde (3.0 mmol, 1.0 equiv.) and the flask was purged and filled with argon. DMF (15 mL, 0.2 M) was added by syringe and the mixture was stirred. The 3-bromoprop-1-ene (3.3 mmol, 1.25 equiv.) was added by syringe and the reaction mixture was stirred under argon at room temperature for 24 h. The mixture was diluted with EtOAc and water, shaken, and separated. The combined organic extracts washed with brine (100 mL), dried (Na_2SO_4), filtered and concentrated in vacuo. Purification by flash chromatography (petroleum ether/EtOAc, 40:1), afforded the corresponding corresponding ether products.

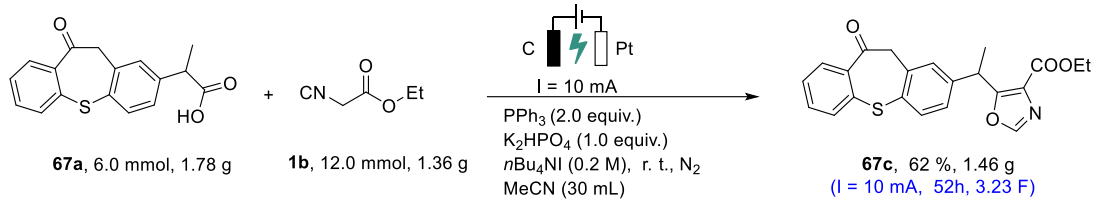
Following the general procedure of reported literature, to a solution of 4-(allyloxy)benzaldehyde (0.20 g, 1.2 mmol), NaH_2PO_4 (144 mg, 1.2 mmol), 2-methyl-2-butene (0.6 mL, 5.3 mmol) in tert-BuOH (8 mL) and water (2 mL) was added $NaClO_2$ (370 mg, 4.1 mmol) and the mixture was stirred for 50 min at room temperature. The reaction mixture was adjusted to pH of 4 by addition of 1 M HCl. The aqueous layer was extracted with CH_2Cl_2. The organic layers were combined, washed with brine, dried over anhydrous Na_2SO_4. Purification by flash chromatography, afforded the corresponding 1, 4-(allyloxy)benzoic acid **34a**.

2.3 General procedure for electrocatalysis for oxazoles



To a 25 mL three-necked flask with a magnetic stir bar was added the substrate carboxylic acid **a** (1 equiv., 0.4 mmol), PPh_3 (2 equiv., 0.4 mmol, 210 mg), K_2HPO_4 (1.0 equiv., 0.4 mmol, 70 mg) and electrolyte *n*-Bu_4NI (0.4 mmol, 148 mg, 0.1 M), followed by 4.0 mL anhydrous MeCN and isocyanide **b** (2.0 equiv, 0.8 mmol). Subsequently, the flask was equipped with a graphite rod (anode, d = 0.6 mm, length below the liquid surface = 10 mm) and a platinum plate (cathode, 10×10×0.2 mm), the distance between which was approximately 1.0 cm. All operations are performed in a glove box and the flask was filled with Ar. The constant current (10 mA) electrolysis was then performed at room temperature (Sealed tube) with vigorous stirring for the indicated time as monitored by TLC or GC-MS analysis. Upon completion, the solvent in reaction mixture was removed under vacuo. The resulting mixture was purified by column chromatography on silica gel (eluted with EtOAc/PE) to afford the desired products **c**.

2.4 Procedure for the gram-scale reactions (6.0 mmol scale)

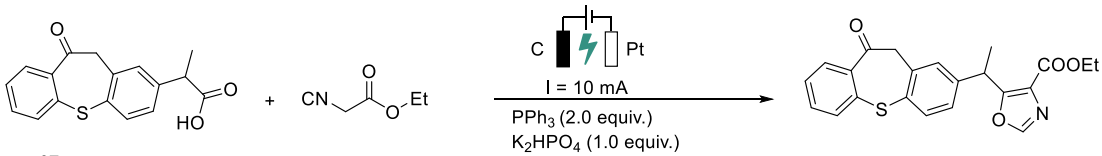


67a, 6.0 mmol, 1.78 g

1b, 12.0 mmol, 1.36 g

67c, 62 %, 1.46 g
(I = 10 mA, 52h, 3.23 F)

To a 50 mL flask with a magnetic stir bar was added the substrate carboxylic acid **67a** (1.0 equiv., 6 mmol, 1.78 g), PPh_3 (2.0 equiv., 2.4 mmol, 3.15 g), K_2HPO_4 (1.0 equiv., 6 mmol, 1.05 g) and electrolyte *n*-Bu_4NI (6 mmol, 2.21 g, 0.2 M), followed by 30 mL anhydrous MeCN and isocyanide **1b** (2.0 equiv., 12 mmol, 1.36 g). Subsequently, the flask was equipped with a graphite rod (anode, d = 0.6 mm, length below the liquid surface = 10 mm) and a platinum plate (cathode, 10×10×0.2 mm), the distance between which was approximately 1.0 cm. The constant current (10 mA) electrolysis was then performed at room temperature (sealed tube, under air) with vigorous stirring for the indicated time as monitored by TLC or GC-MS analysis. Upon completion, the solvent in reaction mixture was removed under vacuo. The resulting mixture was purified by column chromatography on silica gel (eluted with EtOAc/PE) to afford the desired products **67c**.



67a, 6.0 mmol, 1.78 g

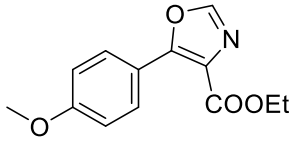
1b, 12.0 mmol, 1.36 g

67c, 53 %, 1.25 g
(I = 100 mA, 6h, 3.73 F)

To a 50 mL flask with a magnetic stir bar was added the substrate carboxylic acid **67a** (1 equiv., 6 mmol, 1.78 g), PPh_3 (2 equiv., 2.4 mmol, 3.15 g), K_2HPO_4 (1.0 equiv., 6 mmol, 1.05 g) and electrolyte *n*-Bu_4NI (6 mmol, 2.21 g, 0.1 M), followed by 60 mL anhydrous MeCN and isocyanide **1b** (2.0 equiv., 12 mmol, 1.36 g). Subsequently, the flask was equipped with a graphite plate (anode, 20×20×5 mm) and a platinum plate (cathode, 10×10×0.2 mm), the distance between which was approximately 1.0 cm. The constant current (100 mA) electrolysis was then performed at room temperature (sealed tube, under air) with vigorous stirring for the indicated time as monitored by TLC or GC-MS analysis. Upon completion, the solvent in reaction mixture was removed under vacuo. The resulting mixture was purified by column chromatography on silica gel (eluted with EtOAc/PE) to afford the desired products **67c**.

Figure S4. Gram-scale reactions for standard condition

2.5 Characterization data



1c: ethyl 5-(4-methoxyphenyl)oxazole-4-carboxylate

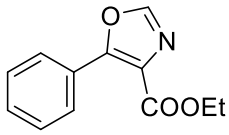
Brown yellow solid.

80.9 mg, 82% yield

^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.04 (d, *J* = 8.9 Hz, 2H), 7.83 (s, 1H), 6.95 (d, *J* = 9.0 Hz, 2H), 4.38 (q, *J* = 7.1 Hz, 2H), 3.83 (s, 3H), 1.38 (s, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 162.24, 161.31, 155.85, 148.48, 130.23, 125.35, 119.27, 113.90, 77.50, 77.18, 76.86, 61.36, 55.43, 14.34.

HRMS (ESI) calcd for $C_{13}H_{14}NO_4^+$ m/z $[M+H]^+$: 264.1236, found 264.1238.



2c: ethyl 5-phenyloxazole-4-carboxylate

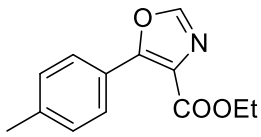
Light yellow oil.

72.3 mg, 83% yield

^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.09 – 8.03 (m, 2H), 7.90 (s, 1H), 7.49 – 7.43 (m, 3H), 4.41 (q, *J* = 7.1 Hz, 2H), 1.39 (t, *J* = 7.1 Hz, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 162.02, 155.60, 149.08, 130.56, 128.55, 128.49, 126.77, 126.69, 77.45, 77.14, 76.82, 61.50, 14.30.

HRMS (ESI) calcd for $C_{12}H_{12}NO_3^+$ m/z $[M+H]^+$: 218.0817, found 284.0814.



3c: ethyl 5-(p-tolyl)oxazole-4-carboxylate

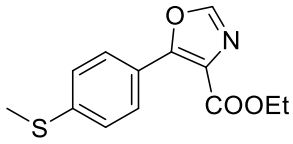
Yellow solid.

73.6 mg, 79% yield

^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.97 (d, *J* = 8.2 Hz, 2H), 7.88 (s, 1H), 7.28 (d, *J* = 8.0 Hz, 2H), 4.41 (q, *J* = 7.1 Hz, 2H), 2.41 (s, 3H), 1.41 (t, *J* = 7.1 Hz, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 162.11, 155.91, 148.82, 140.96, 129.21, 128.47, 126.12, 123.95, 77.48, 77.16, 76.84, 61.43, 21.59, 14.33.

HRMS (ESI) calcd for $C_{13}H_{14}NO_3^+$ m/z $[M+H]^+$: 232.0974, found 232.0971.



4c: ethyl 5-(4-(methylthio)phenyl)oxazole-4-carboxylate

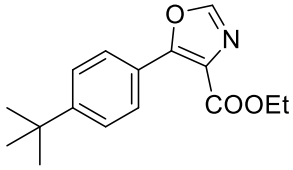
Yellow solid.

69.7 mg, 66% yield

^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.02 (d, *J* = 8.5 Hz, 2H), 7.87 (s, 1H), 7.30 (d, *J* = 8.6 Hz, 2H), 4.41 (q, *J* = 7.1 Hz, 2H), 2.51 (s, 3H), 1.41 (t, *J* = 7.1 Hz, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 162.12, 155.42, 148.76, 142.41, 128.72, 126.22, 125.47, 123.02, 77.43, 77.12, 76.80, 61.49, 15.09, 14.34.

HRMS (ESI) calcd for $C_{13}H_{14}NO_3S^+$ m/z $[M+H]^+$: 264.0694, found 264.0692.



5c: ethyl 5-(4-(tert-butyl)phenyl)oxazole-4-carboxylate

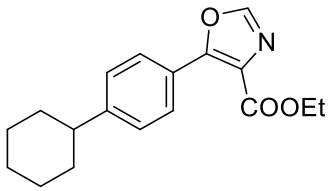
Yellow solid.

92.9 mg, 85% yield

^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.00 (d, *J* = 8.6 Hz, 2H), 7.88 (s, 1H), 7.49 (d, *J* = 8.6 Hz, 2H), 4.41 (q, *J* = 7.1 Hz, 2H), 1.41 (t, *J* = 7.1 Hz, 3H), 1.34 (s, 9H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 162.13, 155.91, 154.00, 148.86, 128.33, 126.21, 125.50, 123.92, 77.44, 77.12, 76.81, 61.43, 34.99, 31.19, 14.34

HRMS (ESI) calcd for $C_{16}H_{20}NO_3^+$ m/z $[M+H]^+$: 274.1443, found 274.1440.



6c: ethyl 5-(4-cyclohexylphenyl)oxazole-4-carboxylate

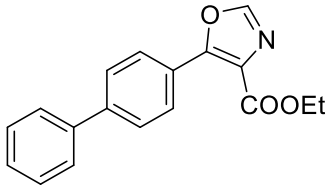
Yellow solid.

91.6 mg, 75% yield

^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.99 (d, *J* = 8.4 Hz, 2H), 7.87 (s, 1H), 7.31 (d, *J* = 8.5 Hz, 2H), 4.41 (q, *J* = 7.2 Hz, 2H), 2.61 – 2.49 (m, 1H), 1.92 – 1.81 (m, 4H), 1.78 – 1.73 (m, 1H), 1.41 (m, 7H), 1.30 – 1.24 (m, 1H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 162.14, 155.98, 150.96, 148.81, 128.56, 127.02, 126.12, 124.27, 77.44, 77.12, 76.80, 61.42, 44.62, 34.23, 26.83, 26.12, 14.33.

HRMS (ESI) calcd for $C_{18}H_{22}NO_3^+$ m/z $[M+H]^+$: 300.1600, found 300.1600.



7c: ethyl 5-([1,1'-biphenyl]-4-yl)oxazole-4-carboxylate

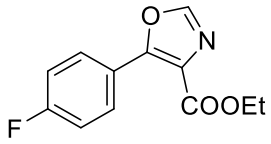
Brown solid.

60.7 mg, 52% yield

^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.17 (d, *J* = 6.6 Hz, 2H), 7.92 (s, 1H), 7.71 (d, *J* = 8.5 Hz, 2H), 7.64 (d, *J* = 6.9 Hz, 2H), 7.50 – 7.44 (m, 2H), 7.41 – 7.36 (m, 1H), 4.45 (q, *J* = 7.1 Hz, 2H), 1.43 (t, *J* = 7.1 Hz, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 162.12, 155.47, 149.06, 143.24, 140.14, 129.01, 128.97, 128.04, 127.21, 127.16, 126.72, 125.61, 77.46, 77.14, 76.82, 61.57, 14.36.

HRMS (ESI) calcd for $C_{18}H_{16}NO_3^+$ m/z $[M+H]^+$: 294.1130, found 294.1128.



8c: ethyl 5-(4-fluorophenyl)oxazole-4-carboxylate

Yellow solid.

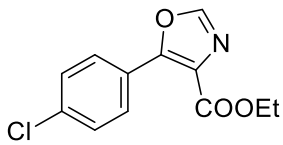
72.0 mg, 77% yield

^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.13 – 8.05 (m, 2H), 7.88 (s, 1H), 7.18 – 7.10 (m, 2H), 4.40 (q, *J* = 7.1 Hz, 2H), 1.39 (t, *J* = 7.1 Hz, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 163.90(d, *J* = 253.5 Hz), 162.02, 154.76, 148.95, 130.80 (d, *J* = 9.1 Hz), 126.46, 123.00 (d, *J* = 3.0 Hz), 115.70 (d, *J* = 21.2 Hz), 77.45, 77.14, 76.82, 61.57, 14.29.

^{19}F NMR (376 MHz, $CDCl_3$) δ -108.77.

HRMS (ESI) calcd for $C_{12}H_{11}FNO_3^+$ m/z $[M+H]^+$: 236.0723, found 236.0724.



9c: ethyl 5-(4-chlorophenyl)oxazole-4-carboxylate

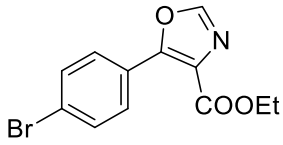
Light yellow solid.

67.1 mg, 67% yield

^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.05 (d, *J* = 8.7 Hz, 2H), 7.91 (s, 1H), 7.44 (d, *J* = 8.7 Hz, 2H), 4.41 (q, *J* = 7.1 Hz, 2H), 1.41 (t, *J* = 7.1 Hz, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 161.96, 154.55, 149.14, 136.70, 129.84, 128.85, 128.51, 125.20, 77.44, 77.12, 76.81, 61.68, 14.31.

HRMS (ESI) calcd for $C_{12}H_{11}ClNO_3^+$ m/z $[M+H]^+$:252.0427, found 254.0422.



10c: ethyl 5-(4-bromophenyl)oxazole-4-carboxylate

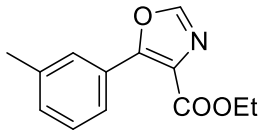
Light yellow solid.

67.7 mg, 58% yield

^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.97 (d, *J* = 8.7 Hz, 2H), 7.91 (s, 1H), 7.60 (d, *J* = 8.7 Hz, 2H), 4.41 (q, *J* = 7.1 Hz, 2H), 1.40 (t, *J* = 7.2 Hz, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 161.92, 154.55, 149.57, 131.79, 129.98, 127.07, 125.63, 125.11, 77.43, 77.11, 76.79, 61.66, 14.29.

HRMS (ESI) calcd for $C_{12}H_{11}BrNO_3^+$ m/z $[M+H]^+$: 295.9922, found 295.9926.



11c: ethyl 5-(m-tolyl)oxazole-4-carboxylate

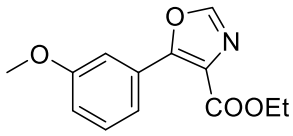
Colorless oil.

66.8 mg, 72% yield

^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.89 (s, 1H), 7.88 – 7.83 (m, 2H), 7.39 – 7.33 (m, 1H), 7.27 (d, *J* = 7.7 Hz, 1H), 4.41 (q, *J* = 7.1 Hz, 2H), 2.42 (s, 3H), 1.40 (t, *J* = 7.1 Hz, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 162.02, 155.78, 149.01, 138.19, 131.36, 129.06, 128.40, 126.69, 126.56, 125.78, 77.44, 77.12, 76.80, 61.45, 21.52, 14.31.

HRMS (ESI) calcd for $C_{13}H_{14}NO_3^+$ m/z $[M+H]^+$: 232.0974, found 232.0974.



12c: ethyl 5-(3-methoxyphenyl)oxazole-4-carboxylate

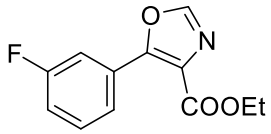
Yellow solid.

79.3 mg, 80% yield

^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.90 (s, 1H), 7.72 (s, 1H), 7.64 (d, *J* = 7.7 Hz, 1H), 7.38 (m, 1H), 7.00 (dd, *J* = 8.3, 1.7 Hz, 1H), 4.41 (q, *J* = 7.1 Hz, 2H), 3.86 (s, 3H), 1.40 (t, *J* = 7.1 Hz, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 162.01, 159.55, 155.35, 148.98, 129.59, 127.87, 126.83, 120.85, 116.68, 113.72, 77.43, 77.11, 76.79, 61.54, 55.48, 14.32.

HRMS (ESI) calcd for $C_{13}H_{14}NO_4^+$ m/z $[M+H]^+$: 248.0923, found 248.0919.



13c: ethyl 5-(3-fluorophenyl)oxazole-4-carboxylate

Yellow solid.

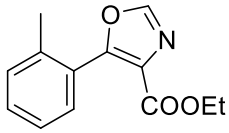
56.6 mg, 60% yield

^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.92 (s, 1H), 7.90 – 7.84 (m, 2H), 7.46 – 7.40 (m, 1H), 7.18 – 7.11 (m, 1H), 4.42 (q, *J* = 7.1 Hz, 2H), 1.41 (t, *J* = 7.1 Hz, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 162.56 (d, *J* = 45.5 Hz), 161.82, 154.10 (d, *J* = 3.0 Hz), 149.25, 130.07 (d, *J* = 8.1 Hz), 130.13, 128.60 (d, *J* = 9.1 Hz), 127.39, 124.16 (d, *J* = 6.1 Hz), 117.51 (d, *J* = 21.2 Hz), 115.51(d, *J* = 25.3 Hz), 77.44, 77.12, 76.81, 61.70, 11.64.

^{19}F NMR (376 MHz, $CDCl_3$) δ -112.02.

HRMS (ESI) calcd for $C_{12}H_{11}FNO_3^+$ m/z $[M+H]^+$: 236.2723, found 236.2720.



14c: ethyl 5-(o-tolyl)oxazole-4-carboxylate

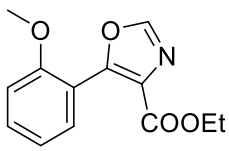
Light yellow oil.

69.3 mg, 75% yield

^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.96 (s, 1H), 7.44 (d, *J* = 7.1 Hz, 1H), 7.42 – 7.37 (m, 1H), 7.32 – 7.26 (m, 2H), 4.31 (q, *J* = 7.1 Hz, 2H), 2.28 (s, 3H), 1.28 (t, *J* = 7.1 Hz, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 161.48, 156.25, 149.90, 138.05, 130.96, 130.60, 130.45, 128.37, 126.65, 125.49, 77.43, 77.12, 76.80, 61.23, 20.55, 14.15.

HRMS (ESI) calcd for $C_{13}H_{14}NO_3^+$ m/z $[M+H]^+$: 232.0974, found 232.0974.



15c: ethyl 5-(2-methoxyphenyl)oxazole-4-carboxylate

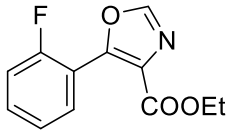
Colorless solid.

75.3 mg, 76% yield

^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.93 (s, 1H), 7.50 – 7.42 (m, 2H), 7.07 – 7.01 (m, 1H), 6.98 (d, *J* = 8.3 Hz, 1H), 4.30 (q, *J* = 7.1 Hz, 2H), 3.80 (s, 3H), 1.27 (t, *J* = 7.1 Hz, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 161.81, 157.54, 152.98, 149.87, 132.13, 131.52, 128.75, 120.29, 116.24, 111.21, 77.45, 77.13, 76.81, 61.06, 55.64, 14.20.

HRMS (ESI) calcd for $C_{13}H_{14}NO_4^+$ m/z $[M+H]^+$: 248.0923, found 248.0921.



16c: ethyl 5-(2-fluorophenyl)oxazole-4-carboxylate

Brown solid.

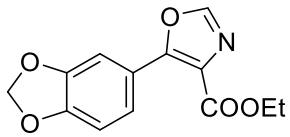
58.2 mg, 62% yield

^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.02 (s, 1H), 7.71 – 7.65 (m, 1H), 7.56 – 7.47 (m, 1H), 7.32 – 7.26 (m, 1H), 7.25 – 7.19 (m, 1H), 4.38 (q, *J* = 7.1 Hz, 2H), 1.34 (t, *J* = 7.1 Hz, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 161.35, 160.20 (d, *J* = 211.1 Hz), 150.40, 132.60 (d, *J* = 8.1 Hz), 131.35, 129.24, 124.02 (d, *J* = 4.0 Hz), 116.16 (d, *J* = 22.2 Hz), 115.56 (d, *J* = 14.1 Hz), 77.45, 77.13, 76.82, 61.43, 14.13.

^{19}F NMR (376 MHz, $CDCl_3$) δ -110.94.

HRMS (ESI) calcd for $C_{12}H_{10}FNO_3^+$ m/z $[M+H]^+$: 236.0723, found 236.0724.



17c: ethyl 5-(benzo[d][1,3]dioxol-5-yl)oxazole-4-carboxylate

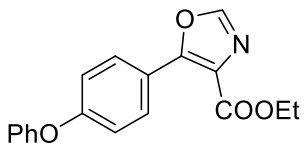
Yellow solid.

76.2 mg, 73% yield

^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.84 (s, 1H), 7.68 – 7.65 (m, 1H), 7.61 (d, *J* = 1.8 Hz, 1H), 6.89 (d, *J* = 8.3 Hz, 1H), 6.02 (s, 2H), 4.40 (q, *J* = 7.1 Hz, 2H), 1.40 (t, *J* = 7.2 Hz, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 162.16, 155.49, 149.53, 148.46, 147.81, 125.14, 123.59, 119.29, 108.78, 108.42, 101.69, 77.45, 77.13, 76.82, 61.48, 14.34.

HRMS (ESI) calcd for $C_{13}H_{12}NO_5^+$ m/z $[M+H]^+$: 262.0715, found 262.0718.



18c: ethyl 5-(4-phenoxyphenyl)oxazole-4-carboxylate

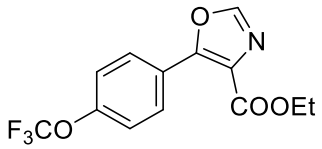
Yellow solid.

83.1 mg, 67% yield

^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.07 (d, *J* = 8.9 Hz, 2H), 7.87 (s, 1H), 7.40 – 7.35 (m, 2H), 7.18 (d, *J* = 7.4 Hz, 1H), 7.09 – 7.03 (m, 4H), 4.41 (q, *J* = 7.1 Hz, 2H), 1.41 (t, *J* = 7.1 Hz, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 162.17, 159.63, 155.95, 155.45, 148.74, 130.39, 130.05, 125.91, 124.35, 121.26, 119.94, 117.87, 77.46, 77.15, 76.83, 64.44, 13.48.

HRMS (ESI) calcd for $C_{18}H_{16}NO_4^+$ m/z $[M+H]^+$: 310.1079, found 310.1075.



19c: ethyl 5-(4-(trifluoromethoxy)phenyl)oxazole-4-carboxylate

Yellow solid.

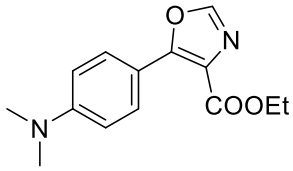
84.4 mg, 70% yield

^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.14 (d, *J* = 8.9 Hz, 2H), 7.91 (s, 1H), 7.29 (d, *J* = 8.5 Hz, 2H), 4.40 (q, *J* = 7.1 Hz, 2H), 1.39 (t, *J* = 7.1 Hz, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 161.91, 154.23, 150.54, 149.23, 130.29, 127.09, 125.28, 120.65, 77.45, 77.13, 76.81, 61.66, 14.23.

^{19}F NMR (376 MHz, $CDCl_3$) δ -57.73.

HRMS (ESI) calcd for $C_{13}H_{11}F_3NO_4^+$ m/z $[M+H]^+$: 302.0640, found 302.0636.



20c: ethyl 5-(4-(dimethylamino)phenyl)oxazole-4-carboxylate

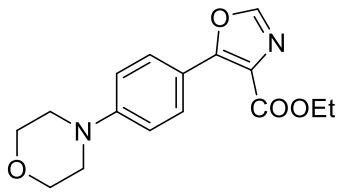
Yellow solid.

69.9 mg, 67% yield

^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.04 (d, *J* = 9.1 Hz, 2H), 7.79 (s, 1H), 6.73 (d, *J* = 9.1 Hz, 2H), 4.41 (q, *J* = 7.1 Hz, 2H), 3.03 (s, 6H), 1.41 (t, *J* = 7.1 Hz, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 162.54, 156.96, 151.58, 147.76, 129.78, 123.88, 113.65, 111.31, 77.44, 77.12, 76.80, 61.14, 40.15, 14.43.

HRMS (ESI) calcd for $C_{14}H_{17}N_2O_3^+$ m/z $[M+H]^+$: 261.1239, found 261.1235.



21c: ethyl 5-(4-morpholinophenyl)oxazole-4-carboxylate

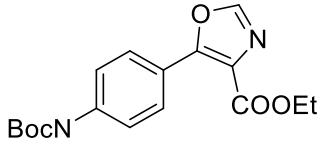
Brown yellow solid.

64.5 mg, 53% yield

^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.04 (d, *J* = 8.9 Hz, 2H), 7.82 (s, 1H), 6.94 (d, *J* = 9.0 Hz, 2H), 4.40 (q, *J* = 7.1 Hz, 2H), 3.89 – 3.82 (m, 4H), 3.30 – 3.22 (m, 4H), 1.41 (t, *J* = 7.1 Hz, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 162.37, 156.18, 152.40, 148.19, 129.79, 124.87, 117.40, 114.19, 77.44, 77.12, 76.81, 66.72, 61.29, 48.05, 14.39.

HRMS (ESI) calcd for $C_{16}H_{19}N_2O_4^+$ m/z $[M+H]^+$: 303.1345, found 303.1346.



22c: ethyl 5-(4-((tert-butoxycarbonyl)-l2-azanyl)phenyl)oxazole-4-carboxylate

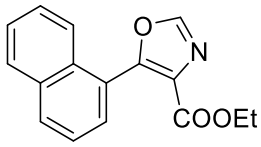
Yellow solid.

79.3 mg, 66% yield

^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.03 (d, *J* = 8.8 Hz, 2H), 7.85 (s, 1H), 7.47 (d, *J* = 8.7 Hz, 2H), 6.88 (s, 1H), 4.39 (q, *J* = 7.1 Hz, 2H), 1.50 (s, 6H), 1.38 (t, *J* = 7.1 Hz, 2H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 162.21, 155.57, 152.46, 148.62, 140.63, 129.50, 125.74, 121.08, 117.81, 81.07, 77.46, 77.14, 76.82, 61.41, 28.34, 14.32.

HRMS (ESI) calcd for $C_{17}H_{20}N_2O_5^+$ m/z $[M+H]^+$: 232.1372, found 232.1374.



23c: ethyl 5-(naphthalen-1-yl)oxazole-4-carboxylate

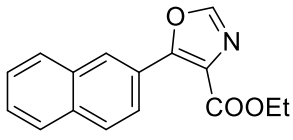
Yellow solid.

44.6 mg, 42% yield

^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.07 (s, 1H), 8.01 (d, *J* = 8.3 Hz, 1H), 7.92 (d, *J* = 6.4 Hz, 1H), 7.74 – 7.67 (m, 2H), 7.59 – 7.48 (m, 2H), 4.22 (q, *J* = 7.1 Hz, 2H), 1.10 (t, *J* = 7.1 Hz, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 161.40, 155.23, 150.33, 133.48, 131.53, 131.24, 129.81, 129.37, 128.63, 127.09, 126.41, 125.09, 124.82, 124.44, 77.45, 77.13, 76.81, 61.20, 13.94.

HRMS (ESI) calcd for $C_{16}H_{14}NO_3^+$ m/z $[M+H]^+$: 268.0974, found 268.0974.



24c: ethyl 5-(naphthalen-2-yl)oxazole-4-carboxylate

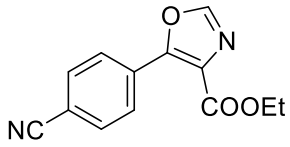
Light yellow solid.

70.7 mg, 66% yield

^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.66 (s, 1H), 8.08 (dd, *J* = 8.6, 1.8 Hz, 1H), 7.95 – 7.88 (m, 3H), 7.87 – 7.82 (m, 1H), 7.56 – 7.49 (m, 2H), 4.44 (q, *J* = 7.1 Hz, 2H), 1.42 (t, *J* = 7.1 Hz, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 162.09, 155.65, 149.17, 134.02, 132.80, 129.12, 129.01, 128.16, 127.77, 127.68, 126.90, 126.76, 124.95, 124.06, 77.49, 77.18, 76.86, 61.55, 14.36.

HRMS (ESI) calcd for $C_{16}H_{14}NO_3^+$ m/z $[M+H]^+$: 268.0974, found 268.0971.



25c: ethyl 5-(4-cyanophenyl)oxazole-4-carboxylate

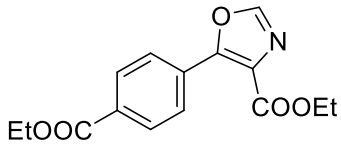
Light yellow solid.

61.2 mg, 63% yield

^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.26 (d, *J* = 8.6 Hz, 2H), 7.99 (s, 1H), 7.76 (d, *J* = 8.6 Hz, 2H), 4.44 (d, *J* = 7.1 Hz, 2H), 1.42 (t, *J* = 7.1 Hz, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 161.70, 153.24, 149.87, 132.30, 130.77, 128.92, 128.71, 118.31, 113.83, 77.43, 77.11, 76.80, 61.99, 14.28.

HRMS (ESI) calcd for $C_{13}H_{11}N_2O_3^+$ m/z $[M+H]^+$: 243.0770, found 243.0772.



26c: ethyl 5-(4-(ethoxycarbonyl)phenyl)oxazole-4-carboxylate

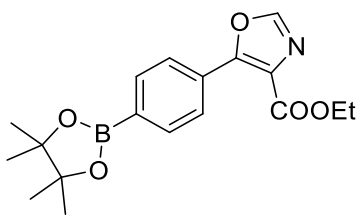
Brown yellow solid.

66.9 mg, 58% yield

^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.20 – 8.10 (m, 4H), 7.96 (s, 1H), 4.43 (q, *J* = 7.1 Hz,2H), 3.94 (s, 3H), 1.41 (t, *J* = 7.2 Hz, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 166.43, 161.81, 154.28, 150.02, 131.56, 130.74, 129.69, 128.42, 128.00, 77.43, 77.11, 76.79, 61.78, 52.46, 14.29.

HRMS (ESI) calcd for $C_{15}H_{16}NO_5^+$ m/z $[M+H]^+$: 290.1028, found 290.1026.



27c: ethyl 5-(4-(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)phenyl)oxazole-4-carboxylate

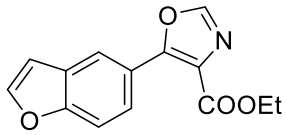
White solid.

53.9 mg, 39% yield

^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.04 (d, *J* = 8.3 Hz, 2H), 7.91 (s, 1H), 7.89 (d, *J* = 8.3 Hz, 2H), 4.40 (q, *J* = 7.2 Hz, 2H), 1.39 (t, *J* = 7.1 Hz, 3H), 1.35 (s, 12H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 161.88, 155.33, 149.27, 134.76, 129.09, 127.61, 127.19, 84.15, 77.44, 77.12, 76.80, 61.52, 24.92, 14.30.

HRMS (ESI) calcd for $C_{18}H_{23}BNO_5^+$ m/z $[M+H]^+$: 344.1669, found 344.1667.



28c: ethyl 5-(benzofuran-5-yl)oxazole-4-carboxylate

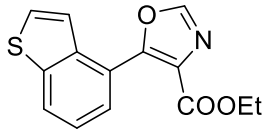
Yellow oil.

70.3 mg, 68% yield

^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.40 (d, *J* = 1.8 Hz, 1H), 7.98 (d, *J* = 8.7 Hz, 1H), 7.90 (s, 1H), 7.67 (d, *J* = 2.2 Hz, 1H), 7.58 (d, *J* = 7.8 Hz, 1H), 6.85 (s, 1H), 4.42 (q, *J* = 7.1 Hz, 2H), 1.41 (t, *J* = 7.1 Hz, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 162.21, 156.24, 155.87, 148.80, 146.16, 127.16, 125.99, 125.05, 122.38, 121.68, 111.56, 106.43, 77.45, 77.13, 76.81, 61.46, 14.33.

HRMS (ESI) calcd for $C_{14}H_{12}NO_4^+$ m/z $[M+H]^+$: 258.0766, found 258.0767.



29c: ethyl 5-(benzo[b]thiophen-4-yl)oxazole-4-carboxylate

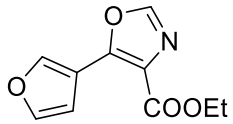
Yellow solid.

57.2 mg, 52% yield

^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.03 (s, 1H), 8.00 (d, *J* = 7.9 Hz, 2H), 7.82 (d, *J* = 7.4 Hz, 1H), 7.54 (d, *J* = 5.5 Hz, 1H), 7.47 – 7.41 (m, 1H), 7.37 (d, *J* = 5.6 Hz, 1H), 4.31 (q, *J* = 7.1 Hz, 2H), 1.25 (t, *J* = 7.1 Hz, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 161.56, 155.33, 149.78, 140.54, 137.73, 128.10, 128.02, 127.09, 125.07, 123.64, 123.07, 121.37, 77.46, 77.14, 76.82, 61.39, 14.58.

HRMS (ESI) calcd for $C_{14}H_{12}NO_3S^+$ m/z $[M+H]^+$: 274.0538, found 274.0535.



30c: ethyl 5-(furan-3-yl)oxazole-4-carboxylate

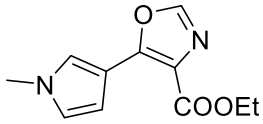
Brown oil.

61.1 mg, 74% yield

^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.51 (s, 1H), 7.81 (s, 1H), 7.50 – 7.48 (m, 1H), 6.97 (d, *J* = 2.4 Hz, 1H), 4.42 (q, *J* = 7.2 Hz, 2H), 1.42 (t, *J* = 7.1 Hz, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 162.02, 151.06, 148.40, 145.12, 143.48, 126.12, 113.75, 109.03, 77.44, 77.12, 76.80, 61.37, 14.38.

HRMS (ESI) calcd for $C_{10}H_{10}NO_4^+$ m/z $[M+H]^+$: 208.0610, found 208.0615.



31c: ethyl 5-(1-methyl-1H-pyrrol-3-yl)oxazole-4-carboxylate

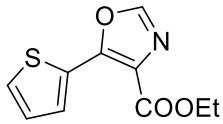
Brown yellow solid.

43.3 mg, 49% yield

^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.85 (s, 1H), 7.70 (s, 1H), 6.73 – 6.70 (m, 1H), 6.65 – 6.62 (m, 1H), 4.41 (q, *J* = 7.1 Hz, 2H), 3.71 (s, 3H), 1.43 (t, *J* = 7.1 Hz, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 162.72, 154.20, 147.03, 125.37, 122.79, 122.21, 111.03, 108.54, 77.43, 77.11, 76.79, 60.93, 36.67, 14.49.

HRMS (ESI) calcd for $C_{11}H_{13}N_2O_3^+$ m/z $[M+H]^+$: 221.0926, found 221.0927.



32c: ethyl 5-(thiophen-2-yl)oxazole-4-carboxylate

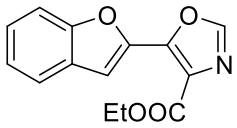
Brown yellow oil.

49.3 mg, 55% yield

^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.08 (dd, *J* = 3.8, 1.2 Hz, 1H), 7.80 (s, 1H), 7.53 (dd, *J* = 5.0, 1.2 Hz, 1H), 7.16 – 7.13 (m, 1H), 4.45 (q, *J* = 7.1 Hz, 2H), 1.43 (t, *J* = 7.1 Hz, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 161.97, 151.50, 148.17, 130.55, 129.93, 128.19, 127.84, 124.67, 77.44, 77.13, 76.81, 61.52, 14.41.

HRMS (ESI) calcd for $C_{10}H_{10}NO_3S^+$ m/z $[M+H]^+$: 224.0381, found 224.0376.



33c: ethyl 5-(benzofuran-2-yl)oxazole-4-carboxylate

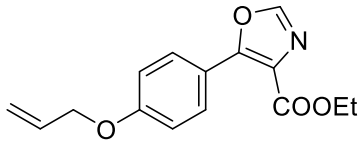
White solid.

46.6 mg, 46% yield

^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.11 (s, 1H), 7.96 (s, 1H), 7.69 (d, *J* = 5.8 Hz, 1H), 7.57 (d, *J* = 7.4 Hz, 1H), 7.43 – 7.38 (m, 1H), 7.33 – 7.27 (m, 1H), 4.49 (q, *J* = 7.1 Hz, 2H), 1.47 (t, *J* = 7.1 Hz, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 161.43, 155.20, 149.24, 147.25, 143.07, 128.10, 127.43, 126.69, 123.80, 122.49, 111.97, 111.64, 77.42, 77.10, 76.78, 61.74, 14.40.

HRMS (ESI) calcd for $C_{14}H_{12}NO_4^+$ m/z $[M+H]^+$: 258.0766, found 258.0764.



34c: ethyl 5-(4-(allyloxy)phenyl)oxazole-4-carboxylate

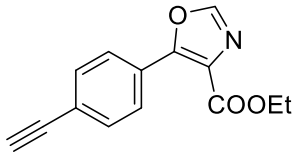
Yellow solid.

72.6 mg, 66% yield

^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.05 (d, *J* = 9.0 Hz, 2H), 7.85 (s, 1H), 6.99 (d, *J* = 9.0 Hz, 2H), 6.11 – 5.99 (m, 1H), 5.42 (dd, *J* = 17.3, 1.6 Hz, 1H), 5.31 (dd, *J* = 10.5, 1.4 Hz, 1H), 4.59 (d, *J* = 5.4 Hz, 2H), 4.41 (q, *J* = 7.1 Hz, 2H), 1.40 (t, *J* = 7.1 Hz, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 162.26, 160.34, 155.84, 149.48, 134.11, 130.22, 125.42, 120.09, 117.64, 113.70, 77.43, 77.12, 76.80, 68.90, 60.82, 14.35.

HRMS (ESI) calcd for $C_{15}H_{16}NO_4^+$ m/z $[M+H]^+$: 274.1079, found 274.1082.



35c: ethyl 5-(4-ethynylphenyl)oxazole-4-carboxylate

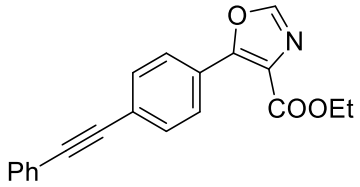
Light yellow solid.

48.3 mg, 50% yield

^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.06 (d, *J* = 8.5 Hz, 2H), 7.91 (s, 1H), 7.57 (d, *J* = 8.5 Hz, 2H), 4.41 (q, *J* = 7.2 Hz, 2H), 3.20 (s, 1H), 1.40 (t, *J* = 7.1 Hz, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 161.91, 154.64, 149.26, 132.18, 128.31, 127.29, 126.88, 124.26, 83.07, 79.46, 77.45, 77.13, 76.81, 61.65, 14.30.

HRMS (ESI) calcd for $C_{14}H_{12}NO_3^+$ m/z $[M+H]^+$: 242.0817, found 242.0821.



36c: ethyl 5-(4-(phenylethynyl)phenyl)oxazole-4-carboxylate

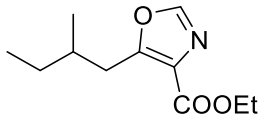
Yellow solid.

76.3 mg, 60% yield

^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.11 (d, *J* = 8.5 Hz, 2H), 7.91 (s, 1H), 7.62 (d, *J* = 8.5 Hz, 2H), 7.55 (dd, *J* = 6.7, 3.0 Hz, 2H), 7.39 – 7.33 (m, 3H), 4.42 (q, *J* = 7.2 Hz, 2H), 1.42 (t, *J* = 7.1 Hz, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 161.99, 154.86, 149.17, 131.79, 131.64, 128.72, 128.49, 128.36, 127.13, 126.26, 125.53, 122.90, 91.77, 88.95, 77.45, 77.14, 76.82, 61.64, 14.33.

HRMS (ESI) calcd for $C_{20}H_{16}NO_3^+$ m/z $[M+H]^+$: 318.1130, found 318.1132.



37c: ethyl 5-(2-methylbutyl)oxazole-4-carboxylate

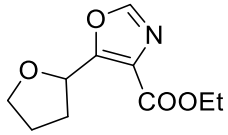
Colorless solid.

58.4 mg, 69% yield

^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.74 (s, 1H), 4.35 (q, *J* = 7.1 Hz, 2H), 3.05 – 2.83 (m, 2H), 1.89 – 1.77 (m, 1H), 1.41 – 1.33 (m, 2H), 1.26 – 1.18 (m, 0H), 0.91 – 0.86 (m, 5H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 162.19, 159.75, 149.00, 127.68, 77.43, 77.11, 76.79, 60.98, 34.42, 32.66, 29.29, 19.03, 14.82, 11.30.

HRMS (ESI) calcd for $C_{11}H_{18}NO_3^+$ m/z $[M+H]^+$: 212.1287, found 212.1289.



38c: ethyl 5-(tetrahydrofuran-2-yl)oxazole-4-carboxylate

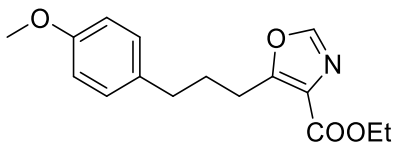
Yellow oil.

43.4 mg, 51% yield

^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.80 (s, 1H), 5.65 (t, *J* = 8.0 Hz, 1H), 4.42 – 4.34 (m, 2H), 4.11 – 4.04 (m, 1H), 3.97 – 3.91 (m, 1H), 2.38 – 2.27 (m, 1H), 2.21 – 1.99 (m, 3H), 1.38 (t, *J* = 7.1 Hz, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 161.62, 158.49, 149.64, 128.01, 77.43, 77.11, 76.79, 71.22, 69.33, 61.39, 30.55, 26.75, 14.32.

HRMS (ESI) calcd for $C_{10}H_{14}NO_4^+$ m/z $[M+H]^+$: 212.0923, found 2212.0927.



39c: ethyl 5-(3-(4-methoxyphenyl)propyl)oxazole-4-carboxylate

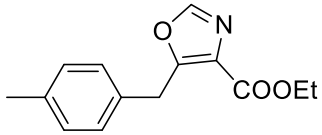
Light yellow oil.

76.6 mg, 66% yield

^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.75 (s, 1H), 7.08 (d, *J* = 8.6 Hz, 2H), 6.82 (d, *J* = 8.6 Hz, 2H), 4.35 (q, *J* = 7.1 Hz, 2H), 3.77 (s, *J* = 7.6 Hz, 3H), 3.06 (t, *J* = 7.6 Hz, 2H), 2.61 (t, *J* = 7.7 Hz, 3H), 2.03 – 1.93 (m, 2H), 1.36 (t, *J* = 7.1 Hz, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 162.12, 159.94, 157.99, 149.00, 133.32, 129.35, 127.14, 113.88, 77.45, 77.13, 76.81, 61.03, 55.31, 34.40, 29.47, 25.50, 14.34.

HRMS (ESI) calcd for $C_{16}H_{20}NO_4^+$ m/z $[M+H]^+$: 290.1392, found 290.1389.



40c: ethyl 5-(4-methylbenzyl)oxazole-4-carboxylate

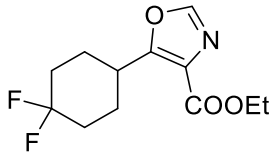
Light yellow oil.

55.5 mg, 56% yield

^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.73 (s, 1H), 7.19 – 7.09 (m, 4H), 4.41 (q, *J* = 7.2 Hz, 2H), 4.36 (s, 2H), 2.31 (s, 3H), 1.41 (t, *J* = 7.1 Hz, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 162.11, 158.17, 149.39, 136.87, 132.94, 129.51, 128.74, 127.16, 77.46, 77.14, 76.82, 61.21, 31.61, 21.11, 14.39.

HRMS (ESI) calcd for $C_{14}H_{16}NO_3^+$ m/z $[M+H]^+$: 246.1130, found 246.1127.



41c: ethyl 5-(4,4-difluorocyclohexyl)oxazole-4-carboxylate

White solid.

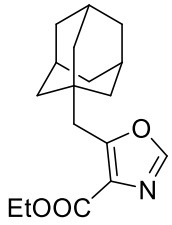
57.1 mg, 55% yield

^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.76 (s, 1H), 4.37 (q, *J* = 7.1 Hz, 2H), 3.61 – 3.52 (m, 1H), 2.23 – 2.14 (m, 2H), 1.97 – 1.76 (m, 6H), 1.38 (t, *J* = 7.1 Hz, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 162.09, 161.49, 161.46, 149.00, 126.44, 125.40, 122.49, 122.47, 120.67, 77.43, 77.12, 76.80, 61.23, 33.55, 33.42, 33.31, 33.29, 33.06, 26.81 (d, *J* = 11.1 Hz), 14.32.

^{19}F NMR (376 MHz, Chloroform-*d*) δ -92.33 (d, *J* = 237.7 Hz), -102.14 (d, *J* = 238.1 Hz).

HRMS (ESI) calcd for $C_{12}H_{16}F_2NO_3^+$ m/z $[M+H]^+$: 260.1098, found 260.1095.



42c: ethyl 5-(((3r,5r,7r)-adamantan-1-yl)methyl)oxazole-4-carboxylate

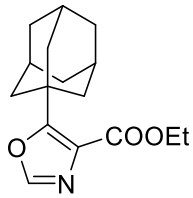
White solid.

101.9 mg, 88% yield

^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.76 (s, 1H), 4.35 (q, *J* = 7.1 Hz, 2H), 2.83 (s, 2H), 1.93 (s, 3H), 1.69 – 1.52 (m, 13H), 1.38 (t, *J* = 7.1 Hz, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 162.29, 158.53, 149.77, 128.65, 77.43, 77.11, 76.79, 60.96, 42.45, 39.74, 36.71, 35.03, 28.66, 14.36.

HRMS (ESI) calcd for $C_{17}H_{24}NO_3^+$ m/z $[M+H]^+$: 290.1756, found 290.1752.



43c: ethyl 5-((3r,5r,7r)-adamantan-1-yl)oxazole-4-carboxylate

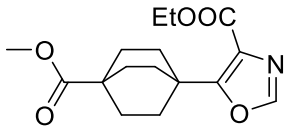
White solid.

93.6 mg, 85% yield

^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.68 (s, 1H), 4.36 (q, *J* = 7.1 Hz, 2H), 2.16 – 2.11 (m, 6H), 2.05 (s, 3H), 1.82 – 1.70 (m, 6H), 1.39 (t, *J* = 7.1 Hz, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 165.86, 162.25, 147.41, 126.05, 77.44, 77.13, 76.81, 61.17, 38.92, 37.06, 35.50, 28.18, 14.37.

HRMS (ESI) calcd for $C_{16}H_{22}NO_3^+$ m/z $[M+H]^+$: 276.1600, found 276.1598.



44c: ethyl 5-(4-(methoxycarbonyl)bicyclo[2.2.2]octan-1-yl)oxazole-4-carboxylate

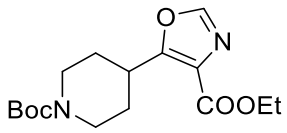
Brown solid.

75.2 mg, 61% yield

^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.68 (s, 1H), 4.34 (q, *J* = 7.1 Hz, 2H), 3.63 (s, 3H), 2.09 – 2.02 (m, 6H), 1.89 – 1.83 (m, 6H), 1.37 (t, *J* = 7.1 Hz, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 178.35, 164.65, 162.15, 147.74, 126.64, 77.45, 77.14, 76.82, 61.25, 51.82, 38.52, 33.25, 28.05, 27.92, 14.30.

HRMS (ESI) calcd for $C_{16}H_{22}NO_5^+$ m/z $[M+H]^+$: 308.1498, found 308.1495.



45c: ethyl 5-(1-(tert-butoxycarbonyl)piperidin-4-yl)oxazole-4-carboxylate

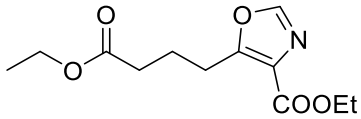
Yellow solid.

85.6 mg, 66% yield

^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.74 (s, 1H), 4.36 (q, *J* = 7.2 Hz, 2H), 4.18 (s, 2H), 3.66 – 3.57 (m, 1H), 2.81 (t, *J* = 12.5 Hz, 2H), 1.84 – 1.66 (m, 4H), 1.44 (s, 9H), 1.37 (t, *J* = 7.1 Hz, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 162.10, 161.86, 154.25, 149.00, 126.21, 79.75, 77.45, 77.13, 76.81, 61.17, 33.85, 29.58, 28.47, 14.32.

HRMS (ESI) calcd for $C_{16}H_{25}N_2O_5^+$ m/z $[M+H]^+$: 325.1763, found 325.1762.



46c: ethyl 5-(4-ethoxy-4-oxobutyl)oxazole-4-carboxylate

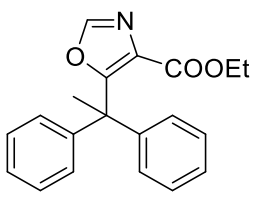
Light yellow solid.

79.8 mg, 78% yield

^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.74 (s, 1H), 4.33 (q, *J* = 7.1 Hz, 2H), 4.07 (q, *J* = 7.1 Hz, 2H), 3.08 (t, *J* = 7.4 Hz, 2H), 2.31 (t, *J* = 7.4 Hz, 2H), 2.03 – 1.94 (m, 2H), 1.35 (t, *J* = 7.1 Hz, 3H), 1.20 (t, *J* = 7.1 Hz, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 172.30, 161.97, 159.00, 149.19, 127.46, 77.47, 77.15, 76.84, 61.07, 60.51, 33.26, 25.15, 22.86, 14.30, 14.21.

HRMS (ESI) calcd for $C_{12}H_{18}NO_5^+$ m/z $[M+H]^+$: 256.1185, found 256.1182.



47c: ethyl 5-(1,1-diphenylethyl)oxazole-4-carboxylate

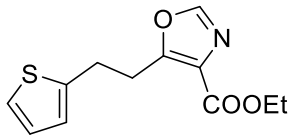
Colorless solid.

87.6 mg, 68% yield

^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.75 (s, 1H), 7.32 – 7.22 (m, 6H), 7.21 – 7.17 (m, 4H), 3.99 (q, *J* = 7.1 Hz, 2H), 2.21 (s, 3H), 1.10 (t, *J* = 7.1 Hz, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 161.69, 161.53, 148.73, 145.67, 128.58, 128.24, 127.80, 126.96, 77.52, 77.20, 76.88, 61.31, 49.95, 28.43, 13.94.

HRMS (ESI) calcd for $C_{20}H_{20}NO_3^+$ m/z $[M+H]^+$: 322.1443, found 322.1446.



48c: ethyl 5-(2-(thiophen-2-yl)ethyl)oxazole-4-carboxylate

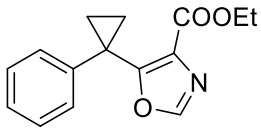
Brown oil.

68.3 mg, 68% yield

^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.76 (s, 1H), 7.12 (d, *J* = 6.3 Hz, 1H), 6.90 – 6.87 (m, 1H), 6.78 (d, *J* = 3.6 Hz, 1H), 4.36 (q, *J* = 7.1 Hz, 2H), 3.41 (t, *J* = 7.6 Hz, 2H), 3.23 (t, *J* = 7.6 Hz, 2H), 1.38 (t, *J* = 7.1 Hz, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 161.93, 158.94, 149.17, 142.35, 127.73, 126.94, 124.92, 123.81, 77.45, 77.13, 76.81, 61.15, 28.23, 27.85, 14.36.

HRMS (ESI) calcd for $C_{12}H_{14}NO_3S^+$ m/z $[M+H]^+$: 252.0694, found 252.0699.



49c: ethyl 5-(1-phenylcyclopropyl)oxazole-4-carboxylate

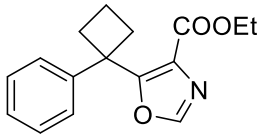
Yellow solid.

80.8 mg, 79% yield

^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.76 (s, 1H), 7.35 (d, *J* = 8.2 Hz, 2H), 7.27 (t, *J* = 7.4 Hz, 2H), 7.22 – 7.17 (m, 2H), 4.37 (q, *J* = 7.1 Hz, 3H), 1.46 (s, 4H), 1.36 (t, *J* = 7.1 Hz, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 161.40, 160.77, 149.12, 141.63, 128.54, 128.27, 127.88, 126.97, 77.48, 77.16, 76.85, 61.14, 21.51, 15.79, 14.34.

HRMS (ESI) calcd for $C_{15}H_{16}NO_3^+$ m/z $[M+H]^+$: 258.1130, found 258.127.



50c: ethyl 5-(1-phenylcyclobutyl)oxazole-4-carboxylate

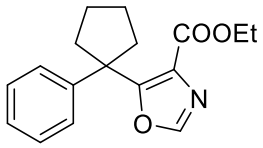
Light yellow solid.

66.3 mg, 61% yield

^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.72 (s, 1H), 7.43 (d, *J* = 8.1 Hz, 2H), 7.31 – 7.23 (m, 2H), 7.20 – 7.15 (m, 1H), 4.28 (q, *J* = 7.1 Hz, 2H), 2.95 – 2.72 (m, 4H), 2.04 – 1.82 (m, 2H), 1.31 (t, *J* = 7.1 Hz, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 164.09, 161.50, 148.16, 144.57, 128.44, 126.67, 126.28, 125.92, 77.50, 77.18, 76.86, 61.07, 46.09, 33.70, 17.20, 14.32.

HRMS (ESI) calcd for $C_{16}H_{18}NO_3^+$ m/z $[M+H]^+$: 272.1287, found 272.1286.



51c: ethyl 5-(1-phenylcyclopentyl)oxazole-4-carboxylate

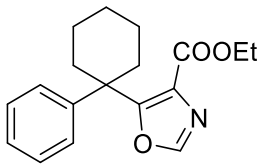
Colorless solid.

73.9 mg, 65% yield

^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.77 (s, 1H), 7.34 – 7.30 (m, 2H), 7.29 – 7.24 (m, 2H), 7.20 – 7.15 (m, 1H), 4.22 (q, *J* = 7.1 Hz, 2H), 2.64 – 2.56 (m, 2H), 2.44 – 2.36 (m, 2H), 1.79 – 1.65 (m, 4H), 1.25 (t, *J* = 7.1 Hz, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 164.06, 161.50, 147.93, 144.56, 128.16, 126.57, 126.51, 77.49, 77.17, 76.86, 61.04, 52.44, 37.91, 23.34, 14.19.

HRMS (ESI) calcd for $C_{17}H_{20}NO_3^+$ m/z $[M+H]^+$: 286.1443, found 286.1445.



52c: ethyl 5-(1-phenylcyclohexyl)oxazole-4-carboxylate

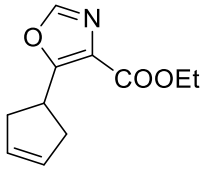
Brown yellow solid.

87.1 mg, 73% yield

^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.81 (s, 1H), 7.33 (d, *J* = 7.5 Hz, 2H), 7.30 – 7.25 (m, 2H), 7.21 – 7.15 (m, 1H), 4.26 (q, *J* = 7.2 Hz, 2H), 2.86 (d, *J* = 13.4 Hz, 2H), 2.00 (t, *J* = 12.1 Hz, 2H), 1.70 (t, *J* = 5.0 Hz, 2H), 1.64 – 1.56 (m, 1H), 1.45 – 1.33 (m, 3H), 1.30 (t, *J* = 7.2 Hz, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 162.80, 161.77, 148.28, 145.99, 128.31, 127.70, 126.51, 126.23, 77.44, 77.12, 76.81, 61.24, 45.16, 35.70, 25.72, 23.43, 14.20.

HRMS (ESI) calcd for $C_{18}H_{22}NO_3^+$ m/z $[M+H]^+$: 300.1600, found 300.1604.



53c: ethyl 5-(cyclopent-3-en-1-yl)oxazole-4-carboxylate

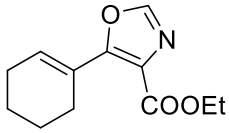
Brown yellow oil.

54.6 mg, 66% yield

^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.72 (s, 1H), 5.75 – 5.71 (m, 2H), 4.35 (q, *J* = 7.1 Hz, 2H), 4.30 – 4.22 (m, 1H), 2.77 (dd, *J* = 14.5, 9.4 Hz, 2H), 2.54 (dd, *J* = 13.8, 6.7 Hz, 2H), 1.36 (t, *J* = 7.1 Hz, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 163.29, 162.26, 148.73, 129.33, 126.39, 77.51, 77.19, 76.88, 61.08, 38.15, 33.89, 14.40.

HRMS (ESI) calcd for $C_{11}H_{14}NO_3^+$ m/z $[M+H]^+$: 208.0974, found 208.0976.



54c: ethyl 5-(cyclohex-1-en-1-yl)oxazole-4-carboxylate

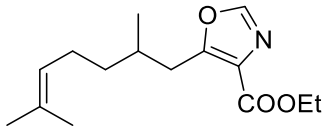
Brown yellow oil.

34.6 mg, 39% yield

^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.72 (s, 1H), 6.92 – 6.87 (m, 1H), 4.36 (q, *J* = 7.1 Hz, 2H), 2.46 – 2.39 (m, 2H), 2.31 – 2.24 (m, 2H), 1.77 – 1.71 (m, 2H), 1.70 – 1.63 (m, 2H), 1.39 (t, *J* = 7.1 Hz, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 162.30, 157.65, 147.87, 135.48, 125.45, 125.15, 77.41, 77.09, 76.77, 61.19, 25.95, 25.80, 22.28, 21.52, 14.34.

HRMS (ESI) calcd for $C_{12}H_{16}NO_3^+$ m/z $[M+H]^+$: 222.1130, found 222.1130.



55c: ethyl 5-(2,6-dimethylhept-5-en-1-yl)oxazole-4-carboxylate

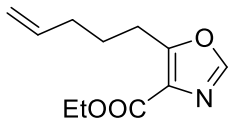
Light yellow oil.

92.8 mg, 88% yield

^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.73 (s, 1H), 5.05 – 4.99 (m, 1H), 4.33 (q, *J* = 7.1 Hz, 2H), 3.03 – 2.84 (m, 2H), 2.03 – 1.87 (m, 3H), 1.63 (s, 3H), 1.55 (s, 3H), 1.35 (t, *J* = 7.2 Hz, 3H), 1.33 – 1.15 (m, 2H), 0.87 (d, *J* = 6.7 Hz, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 162.13, 159.55, 149.02, 131.61, 127.75, 124.21, 77.47, 77.15, 76.83, 60.95, 36.71, 32.94, 32.44, 25.72, 25.41, 19.37, 17.66, 14.32.

HRMS (ESI) calcd for $C_{15}H_{24}NO_3^+$ m/z $[M+H]^+$: 266.1756, found 266.1752.



56c: ethyl 5-(pent-4-en-1-yl)oxazole-4-carboxylate

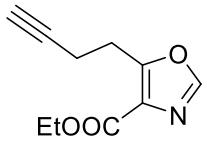
Colorless oil.

46.6 mg, 56% yield

^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.78 (s, 1H), 5.87 – 5.74 (m, 1H), 5.09 – 4.97 (m, 2H), 4.39 (q, *J* = 7.1 Hz, 2H), 3.08 (t, *J* = 7.8 Hz, 2H), 2.17 – 2.08 (m, 2H), 1.81 (p, *J* = 7.5 Hz, 2H), 1.41 (t, *J* = 7.1 Hz, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 162.62, 159.52, 149.55, 137.51, 127.10, 115.50, 77.45, 77.13, 76.81, 61.02, 33.09, 26.85, 25.32, 14.34.

HRMS (ESI) calcd for $C_{11}H_{16}NO_3^+$ m/z $[M+H]^+$: 210.1130, found 210.1128.



57c: ethyl 5-(but-3-yn-1-yl)oxazole-4-carboxylate

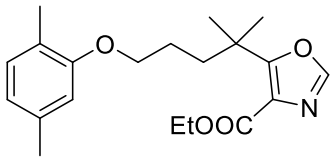
Yellow solid.

45.2 mg, 59% yield

^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.77 (s, 1H), 4.37 (q, *J* = 7.2 Hz, 2H), 3.28 (t, *J* = 7.3 Hz, 2H), 2.59 (td, *J* = 7.3, 2.7 Hz, 2H), 1.96 (t, *J* = 2.7 Hz, 1H), 1.38 (t, *J* = 7.1 Hz, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 162.93, 158.29, 150.10, 127.88, 81.84, 77.43, 77.11, 76.80, 69.77, 61.19, 25.31, 17.13, 14.33.

HRMS (ESI) calcd for $C_{10}H_{12}NO_3^+$ m/z $[M+H]^+$: 194.0817, found 194.0822.



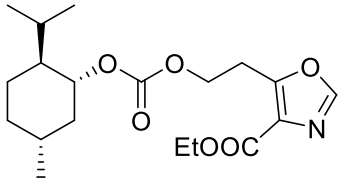
58c: ethyl 5-(5-(2,5-dimethylphenoxy)-2-methylpentan-2-yl)oxazole-4-carboxylate

Colorless oil.

80.2 mg, 58% yield

^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.72 (s, 1H), 6.98 (d, *J* = 7.4 Hz, 1H), 6.64 (d, *J* = 7.4 Hz, 1H), 6.56 (s, 1H), 4.37 (q, *J* = 7.1 Hz, 2H), 3.87 (t, *J* = 6.3 Hz, 2H), 2.29 (s, 3H), 2.15 (s, 3H), 2.09 – 2.01 (m, 2H), 1.67 – 1.57 (m, 2H), 1.48 (s, 6H), 1.41 (t, *J* = 7.1 Hz, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 165.04, 162.10, 156.95, 147.70, 136.49, 130.34, 126.67, 123.58, 120.73, 111.92, 77.47, 77.15, 76.83, 67.84, 61.26, 37.26, 36.76, 26.22, 25.29, 21.46, 15.81, 14.33.
HRMS (ESI) calcd for $C_{20}H_{28}NO_4^+$ m/z $[M+H]^+$: 346.2018, found 346.2014.



59c: ethyl 5-(2-(((((1R,2S,5R)-2-isopropyl-5-methylcyclohexyl)oxy)carbonyl)oxy)ethyl)oxazole-4-carboxylate

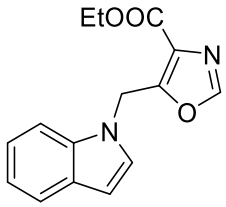
Colorless oil.

111.7 mg, 76% yield

^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.73 (s, 1H), 4.71 – 4.61 (m, 1H), 4.36 (q, *J* = 7.1 Hz, 2H), 3.36 (td, *J* = 7.4, 1.7 Hz, 2H), 2.69 (t, *J* = 7.5 Hz, 2H), 1.97 – 1.88 (m, 1H), 1.78 – 1.69 (m, 1H), 1.69 – 1.59 (m, 2H), 1.50 – 1.40 (m, 1H), 1.37 (t, *J* = 7.1 Hz, 3H), 1.34 – 1.26 (m, 1H), 1.07 – 0.89 (m, 2H), 0.88 – 0.83 (m, 6H), 0.80 (s, 1H), 0.71 (d, *J* = 6.9 Hz, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 171.23, 161.37, 158.16, 148.37, 127.47, 77.44, 77.13, 76.81, 74.76, 61.16, 46.97, 40.84, 34.21, 32.68, 31.39, 26.29, 23.41, 22.03, 21.70, 20.77, 16.31, 14.32.

HRMS (ESI) calcd for $C_{19}H_{30}NO_6^+$ m/z $[M+H]^+$: 368.2073, found 368.2074.



60c: ethyl 5-((1H-indol-1-yl)methyl)oxazole-4-carboxylate

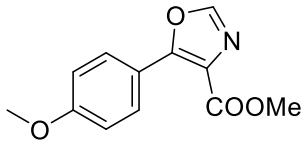
Brown solid.

71.1 mg, 66% yield

^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.74 (s, 1H), 7.63 (d, *J* = 6.9 Hz, 1H), 7.52 (d, *J* = 7.4 Hz, 1H), 7.27 – 7.22 (m, 2H), 7.16 – 7.10 (m, 1H), 6.55 (d, *J* = 3.3 Hz, 1H), 5.71 (s, 2H), 4.50 (q, *J* = 7.1 Hz, 2H), 1.47 (t, *J* = 7.1 Hz, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 161.74, 153.76, 150.17, 136.12, 128.74, 128.66, 128.14, 122.23, 121.16, 120.07, 109.49, 102.71, 77.46, 77.14, 76.82, 61.79, 40.30, 14.39.

HRMS (ESI) calcd for $C_{15}H_{15}N_2O_3^+$ m/z $[M+H]^+$: 271.1083, found 271.1084.



61c: methyl 5-(4-methoxyphenyl)oxazole-4-carboxylate

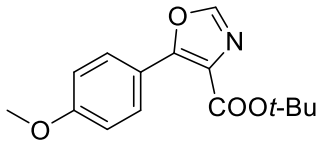
Yellow solid.

76.1 mg, 82% yield

^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.06 (d, *J* = 9.0 Hz, 2H), 7.84 (s, 1H), 6.98 (d, *J* = 9.0 Hz, 2H), 3.93 (s, 2H), 3.85 (s, 2H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 162.67, 161.40, 156.02, 148.02, 130.19, 125.08, 119.18, 113.98, 77.45, 77.13, 76.81, 54.93, 52.30.

HRMS (ESI) calcd for $C_{12}H_{12}NO_4^+$ m/z $[M+H]^+$: 234.0766, found 234.0768.



62c: tert-butyl 5-(4-methoxyphenyl)oxazole-4-carboxylate

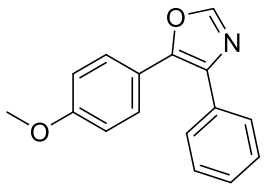
White solid.

82.5 mg, 75% yield

^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.96 (d, J = 8.9 Hz, 2H), 7.82 (s, 1H), 6.97 (d, J = 8.9 Hz, 2H), 3.84 (s, 3H), 1.59 (s, 9H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 161.44, 161.12, 155.12, 148.46, 130.31, 126.71, 119.63, 113.82, 82.22, 77.45, 77.13, 76.81, 55.41, 28.28.

HRMS (ESI) calcd for $C_{15}H_{18}NO_4^+$ m/z $[M+H]^+$: 276.1236, found 276.1235.



63c: 5-(4-methoxyphenyl)-4-phenyloxazole

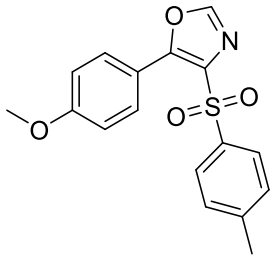
Brown yellow solid.

46.5 mg, 46% yield

^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.92 (s, 1H), 7.66 (d, *J* = 6.7 Hz, 2H), 7.54 (d, *J* = 8.9 Hz, 2H), 7.40 – 7.29 (m, 3H), 6.91 (d, *J* = 8.9 Hz, 2H), 3.84 (s, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 160.08, 149.44, 145.97, 133.60, 132.39, 128.64, 128.47, 128.05, 127.80, 121.32, 114.25, 77.41, 77.09, 76.77, 55.39.

HRMS (ESI) calcd for $C_{16}H_{14}NO_2^+$ m/z $[M+H]^+$: 252.1025, found 252.1028.



64c: 5-(4-methoxyphenyl)-4-tosyloxazole

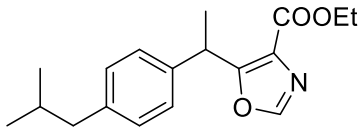
White solid.

73.0 mg, 55% yield

^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.95 (d, *J* = 9.0 Hz, 2H), 7.89 (d, *J* = 8.4 Hz, 2H), 7.80 (s, 1H), 7.31 (d, *J* = 8.0 Hz, 2H), 7.01 (d, *J* = 8.9 Hz, 2H), 3.88 (s, 3H), 2.41 (s, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 161.73, 152.99, 148.76, 144.94, 137.41, 134.24, 130.78, 129.86, 128.23, 118.00, 114.15, 77.43, 77.11, 76.79, 55.50, 21.74.

HRMS (ESI) calcd for $C_{17}H_{16}NO_4S^+$ m/z $[M+H]^+$: 330.0800, found 330.0795.



65c: ethyl 5-(1-(4-isobutylphenyl)ethyl)oxazole-4-carboxylate

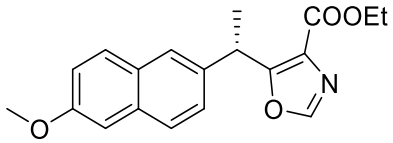
Yellow solid.

97.7 mg, 81% yield

^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.76 (s, 1H), 7.25 (d, *J* = 8.1 Hz, 2H), 7.08 (d, *J* = 8.2 Hz, 2H), 5.05 (d, *J* = 7.3 Hz, 1H), 4.46 – 4.33 (m, 2H), 2.43 (d, *J* = 7.2 Hz, 2H), 1.90 – 1.76 (m, 1H), 1.66 (d, *J* = 7.3 Hz, 3H), 1.40 (t, *J* = 7.2 Hz, 3H), 0.88 (d, *J* = 6.6 Hz, 6H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 162.14, 161.93, 149.11, 140.61, 138.84, 129.44, 127.14, 125.92, 77.47, 77.16, 76.84, 61.12, 45.06, 35.93, 30.23, 22.43, 19.22, 13.85.

HRMS (ESI) calcd for $C_{18}H_{24}NO_3^+$ m/z $[M+H]^+$: 302.1756, found 302.1756.



66c: ethyl (S)-5-(1-(6-methoxynaphthalen-2-yl)ethyl)oxazole-4-carboxylate

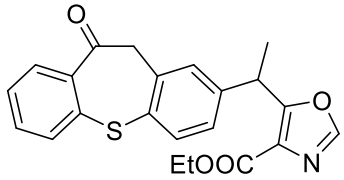
Light yellow solid.

102.1 mg, 79% yield

^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.77 (s, 1H), 7.72 – 7.66 (m, 3H), 7.44 (dd, *J* = 8.6, 1.8 Hz, 1H), 7.14 (dd, *J* = 9.0, 2.5 Hz, 1H), 7.09 (d, *J* = 2.5 Hz, 1H), 5.21 (q, *J* = 7.3 Hz, 1H), 4.47 – 4.34 (m, 2H), 3.90 (s, 3H), 1.75 (d, *J* = 7.3 Hz, 3H), 1.41 (t, *J* = 7.1 Hz, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 162.16, 161.84, 157.75, 149.19, 136.73, 133.67, 129.35, 128.96, 127.28, 126.33, 126.09, 125.67, 119.14, 105.64, 77.44, 77.12, 76.80, 61.20, 55.37, 36.25, 19.16, 14.40.

HRMS (ESI) calcd for $C_{19}H_{20}NO_4^+$ m/z $[M+H]^+$: 326.1392, found 326.1392.



67c: ethyl 5-(1-(10-oxo-10,11-dihydrodibenzo[b,f]thiepin-2-yl)ethyl)oxazole-4-carboxylate

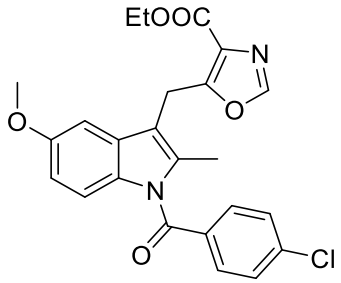
Brown yellow solid.

118.8 mg, 76% yield

^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.18 (dd, *J* = 7.9, 1.7 Hz, 1H), 7.77 (s, 1H), 7.57 (d, *J* = 7.9 Hz, 2H), 7.43 – 7.37 (m, 2H), 7.32 – 7.26 (m, 1H), 7.18 (dd, *J* = 8.0, 2.0 Hz, 1H), 5.06 (q, *J* = 7.3 Hz, 1H), 4.41 – 4.35 (m, 2H), 4.34 (s, 2H), 1.64 (d, *J* = 7.3 Hz, 3H), 1.39 (t, *J* = 7.1 Hz, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 191.38, 161.96, 160.74, 149.33, 144.24, 140.20, 138.10, 136.14, 133.34, 132.62, 131.61, 131.59, 130.95, 128.33, 126.95, 126.47, 126.36, 77.45, 77.13, 76.81, 61.72, 52.15, 36.75, 19.71, 15.37.

HRMS (ESI) calcd for $C_{22}H_{20}NO_4S^+$ m/z $[M+H]^+$: 394.1113, found 394.1117.



68c: ethyl 5-((1-(4-chlorobenzoyl)-5-methoxy-2-methyl-1H-indol-3-yl)methyl)oxazole-4-carboxylate

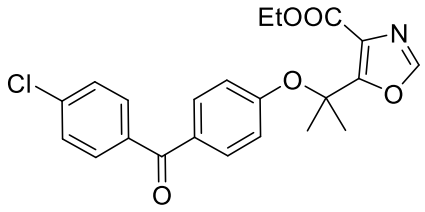
Brown solid.

69.7 mg, 39% yield

^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.72 (s, 1H), 7.65 (d, *J* = 8.5 Hz, 2H), 7.46 (d, *J* = 8.5 Hz, 2H), 7.12 (d, *J* = 2.6 Hz, 1H), 6.81 (d, *J* = 9.0 Hz, 1H), 6.66 (d, *J* = 2.6 Hz, 1H), 4.49 – 4.43 (m, 4H), 3.81 (s, 3H), 2.48 (s, 3H), 1.44 (t, *J* = 7.1 Hz, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 168.39, 162.35, 157.26, 156.11, 149.36, 139.42, 135.58, 133.86, 131.25, 130.78, 130.47, 129.21, 127.08, 114.97, 114.06, 111.84, 101.45, 77.44, 77.12, 76.81, 61.40, 56.45, 20.94, 14.43, 13.36.

HRMS (ESI) calcd for $C_{24}H_{22}ClN_2O_5^+$ m/z $[M+H]^+$: 453.1217, found 453.1217.



69c: ethyl 5-(2-(4-(4-chlorobenzoyl)phenoxy)propan-2-yl)oxazole-4-carboxylate

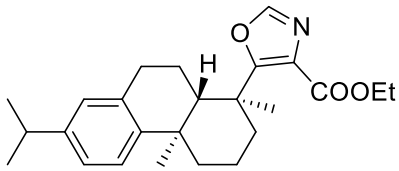
Light yellow solid.

81.2 mg, 49% yield

^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.85 (s, 1H), 7.68 – 7.62 (m, 4H), 7.41 (d, *J* = 8.5 Hz, 2H), 6.70 (d, *J* = 8.8 Hz, 2H), 4.33 (q, *J* = 7.2 Hz, 2H), 1.92 (s, 6H), 1.35 (t, *J* = 7.1 Hz, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 194.38, 161.03, 159.39, 158.24, 148.80, 138.52, 136.27, 132.81, 132.01, 130.70, 128.61, 118.24, 115.48, 77.45, 77.14, 76.82, 76.74, 61.72, 27.09, 14.19.

HRMS (ESI) calcd for $C_{22}H_{22}ClNO_5^+$ m/z $[M+H]^+$: 414.1108, found 414.112.



70c: 4-((ethylperoxy)-l2-methyl)-5-((1S,4aR,10aS)-7-isopropyl-1,4a-dimethyl-1,2,3,4,4a,9,10,10a-octahydrophenanthren-1-yl)oxazole

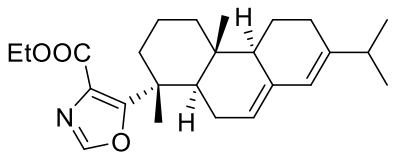
Brown oil.

103.6 mg, 66% yield

^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.74 (s, 1H), 7.18 (d, *J* = 8.2 Hz, 1H), 6.99 (d, *J* = 8.2 Hz, 1H), 6.83 (s, 1H), 4.37 – 4.19 (m, 3H), 2.85 – 2.75 (m, 2H), 2.74 – 2.63 (m, 1H), 2.60 – 2.54 (m, 1H), 2.43 – 2.29 (m, 2H), 1.91 – 1.66 (m, 5H), 1.52 (s, 3H), 1.34 (t, *J* = 7.1 Hz, 3H), 1.28 (s, 3H), 1.21 (d, *J* = 6.9 Hz, 6H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 166.59, 162.35, 147.58, 146.91, 145.65, 134.55, 126.88, 126.53, 124.28, 124.02, 77.45, 77.14, 76.82, 61.34, 45.57, 42.07, 37.83, 37.37, 35.84, 33.50, 30.26, 25.67, 24.03, 21.39, 18.80, 17.85, 14.91.

HRMS (ESI) calcd for $C_{25}H_{34}NO_3^+$ m/z $[M+H]^+$: 396.2539, found 396.2540.



71c: ethyl 5-((1R,4aR,4bR,10aR)-7-isopropyl-1,4a-dimethyl-1,2,3,4,4a,4b,5,6,10,10a-decahydrophenanthren-1-yl)oxazole-4-carboxylate

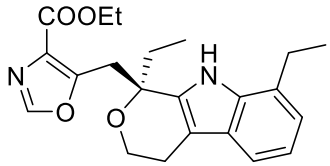
Yellow oil.

79.7 mg, 50% yield

^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.70 (s, 1H), 5.72 (s, 1H), 5.27 (t, *J* = 2.4, 1H), 4.39 – 4.31 (m, 2H), 2.48 (td, *J* = 13.0, 4.3 Hz, 2H), 2.23 – 2.15 (m, 1H), 2.14 – 1.96 (m, 5H), 1.90 – 1.80 (m, 2H), 1.71 – 1.56 (m, 3H), 1.48 (s, 3H), 1.42 – 1.36 (m, 5H), 1.01 – 0.97 (m, 6H), 0.87 (s, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 167.07, 162.33, 147.41, 145.56, 135.77, 125.97, 122.36, 120.62, 77.43, 77.11, 76.79, 61.30, 50.63, 45.66, 40.96, 37.55, 35.97, 35.20, 34.93, 27.44, 25.63, 22.48, 21.44, 20.87, 18.30, 18.17, 14.37, 14.29.

HRMS (ESI) calcd for $C_{25}H_{36}NO_3^+$ m/z $[M+H]^+$: 398.2695, found 398.2694.



72c: ethyl (S)-5-((1,8-diethyl-1,3,4,9-tetrahydropyrano[3,4-b]indol-1-yl)methyl)oxazole-4-carboxylate

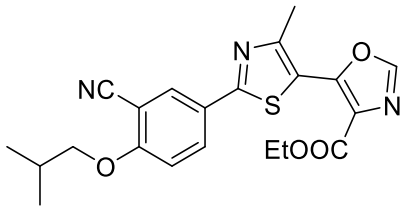
Yellow solid.

67.2 mg, 44% yield

^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.33 (s, 1H), 7.76 (s, 1H), 7.31 (d, *J* = 7.7 Hz, 1H), 7.08 – 6.97 (m, 2H), 4.42 – 4.27 (m, 2H), 4.08 (t, *J* = 6.4 Hz, 2H), 3.83 (d, *J* = 14.8 Hz, 1H), 3.56 (d, *J* = 14.7 Hz, 1H), 2.91 – 2.67 (m, 4H), 2.11 – 2.01 (m, 1H), 1.92 – 1.81 (m, 1H), 1.38 – 1.32 (m, 6H), 0.88 (t, *J* = 7.3 Hz, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 162.98, 156.69, 149.71, 134.87, 134.85, 128.73, 126.59, 126.43, 120.46, 119.79, 115.92, 109.47, 77.43, 77.34, 77.11, 76.80, 61.33, 60.93, 34.56, 32.26, 23.85, 22.14, 14.17, 13.84, 7.82.

HRMS (ESI) calcd for $C_{22}H_{27}N_2O_4^+$ m/z $[M+H]^+$: 383.1971, found 383.1967.



73c: ethyl 5-(2-(3-cyano-4-isobutoxyphenyl)-4-methylthiazol-5-yl)oxazole-4-carboxylate

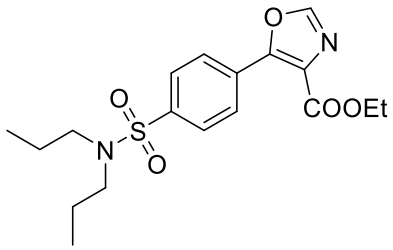
Yellow solid.

70.1 mg, 43% yield

^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.19 (d, *J* = 2.3 Hz, 1H), 8.09 (d, *J* = 8.8 Hz, 1H), 7.96 (s, 1H), 7.00 (d, *J* = 8.9 Hz, 1H), 4.43 (q, *J* = 7.1 Hz, 2H), 3.89 (d, *J* = 6.5 Hz, 2H), 2.64 (s, 3H), 2.26 – 2.12 (m, 1H), 1.41 (t, *J* = 7.1 Hz, 3H), 1.08 (d, *J* = 6.7 Hz, 6H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 166.69, 162.32, 161.58, 156.71, 149.47, 148.79, 132.46, 131.96, 127.73, 126.08, 116.51, 115.53, 112.64, 102.98, 77.43, 77.12, 76.80, 75.71, 61.76, 28.22, 19.12, 17.98, 14.36.

HRMS (ESI) calcd for $C_{21}H_{22}N_3O_4S^+$ m/z $[M+H]^+$: 412.1331, found 412.1335.



74c: ethyl 5-(4-(N,N-dipropylsulfamoyl)phenyl)oxazole-4-carboxylate

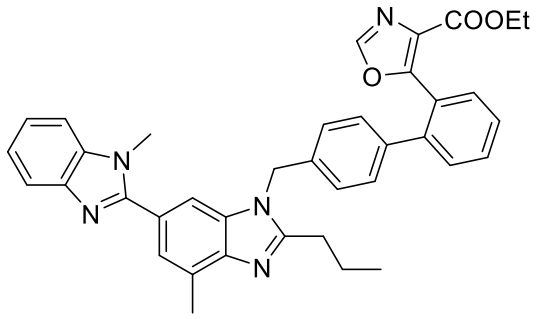
Light yellow solid.

90.3 mg, 60% yield

^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.24 (d, *J* = 8.6 Hz, 1H), 7.97 (s, 1H), 7.88 (d, *J* = 8.5 Hz, 2H), 4.42 (q, *J* = 7.1 Hz, 2H), 3.09 (t, *J* = 8.0 Hz, 4H), 1.60 – 1.48 (m, 4H), 1.40 (t, *J* = 7.1 Hz, 3H), 0.86 (t, *J* = 7.4 Hz, 6H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 161.80, 153.64, 149.74, 141.65, 130.22, 128.94, 128.25, 127.15, 77.46, 77.14, 76.82, 61.86, 50.13, 22.11, 14.27, 11.22.

HRMS (ESI) calcd for $C_{18}H_{25}N_2O_5S^+$ m/z $[M+H]^+$: 381.1484, found 381.1480.



75c: ethyl 5-(4'-((1,7'-dimethyl-2'-propyl-1H,3'H-[2,5'-bibenzo[d]imidazol]-3'-yl)methyl)-[1,1'-biphenyl]-2-yl)oxazole-4-carboxylate

Yellow solid.

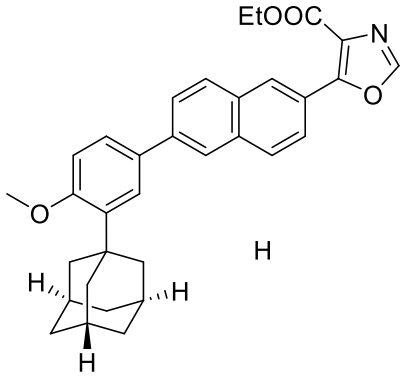
195.3 mg, 80% yield

^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.80 – 7.75 (m, 1H), 7.68 (s, 1H), 7.58 – 7.49 (m, 2H), 7.45 – 7.37 (m, 4H), 7.37 – 7.33 (m, 1H), 7.29 – 7.27 (m, 1H), 7.08 (d, *J* = 8.1 Hz, 2H), 6.95 (d, *J* = 8.0 Hz, 2H), 5.36 (s, 2H), 4.17 (q, *J* = 7.1 Hz, 2H), 3.80 (s, 2H), 2.87 (t, *J* = 8.0 Hz, 2H), 2.75 (s, 3H), 1.88 – 1.76 (m, 2H), 1.18 (t, *J* = 7.1 Hz, 2H), 1.01 (t, *J* = 7.3 Hz, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 161.18, 156.52, 155.87, 154.71, 149.82, 143.13, 142.82, 141.76, 140.25, 136.70, 135.12, 134.97, 131.59, 130.85, 130.05, 129.46, 129.21, 128.54, 127.26, 126.17,

125.72, 123.96, 123.85, 122.64, 122.45, 119.52, 109.66, 109.01, 77.48, 77.16, 76.84, 61.13, 46.97, 31.93, 29.83, 21.86, 17.00, 14.14, 14.10.

HRMS (ESI) calcd for $C_{38}H_{36}N_5O_3^+$ m/z $[M+H]^+$: 610.2818, found 610.2822.



76c: ethyl 5-(6-(3-((3r,5r,7r)-adamantan-1-yl)-4-methoxyphenyl)naphthalen-2-yl)oxazole-4-carboxylate

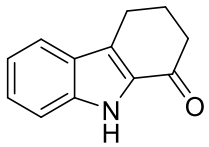
White solid.

117.9 mg, 58% yield

^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.70 (s, 1H), 8.12 (d, *J* = 8.7 Hz, 1H), 8.02 – 7.94 (m, 4H), 7.80 (d, *J* = 8.5 Hz, 1H), 7.61 (d, *J* = 2.3 Hz, 1H), 7.56 (d, *J* = 8.3 Hz, 1H), 7.00 (d, *J* = 8.4 Hz, 1H), 4.47 (q, *J* = 7.1 Hz, 2H), 3.91 (s, 3H), 2.19 (s, 6H), 2.11 (s, 3H), 1.81 (s, 6H), 1.44 (t, *J* = 7.1 Hz, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 162.18, 158.93, 155.83, 149.06, 140.81, 139.06, 134.46, 132.69, 131.59, 129.40, 128.87, 128.28, 126.76, 126.58, 125.98, 125.75, 125.25, 124.75, 123.61, 112.17, 77.41, 77.09, 76.77, 61.56, 55.24, 40.66, 37.27, 37.19, 29.17, 14.38.

HRMS (ESI) calcd for $C_{33}H_{34}NO_4^+$ m/z $[M+H]^+$: 508.2488, found 508.2489.



f: 2,3,4,9-tetrahydro-1H-carbazol-1-one

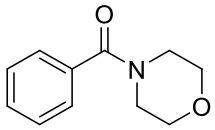
Light yellow solid.

26.7 mg, 36% yield.

^{1}H NMR (400 MHz, Chloroform-*d*) δ 9.46 (s, 1H), 7.66 (d, *J* = 8.1 Hz, 1H), 7.46 (d, *J* = 8.3 Hz, 1H), 7.40 – 7.34 (m, 1H), 7.18 – 7.12 (m, 1H), 3.02 (t, *J* = 6.1 Hz, 2H), 2.72 – 2.65 (m, 2H), 2.32 – 2.24 (m, 2H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 191.73, 138.10, 131.31, 129.75, 127.11, 125.91, 121.42, 120.42, 112.75, 77.43, 77.12, 76.80, 38.34, 25.07, 21.49.

HRMS (ESI) calcd for $C_{12}H_{12}NO^+$ m/z $[M+H]^+$: 186.0919, found 186.0923.



h: morpholino(phenyl)methanone

Colorless oil.

63.7 mg, 87% yield.

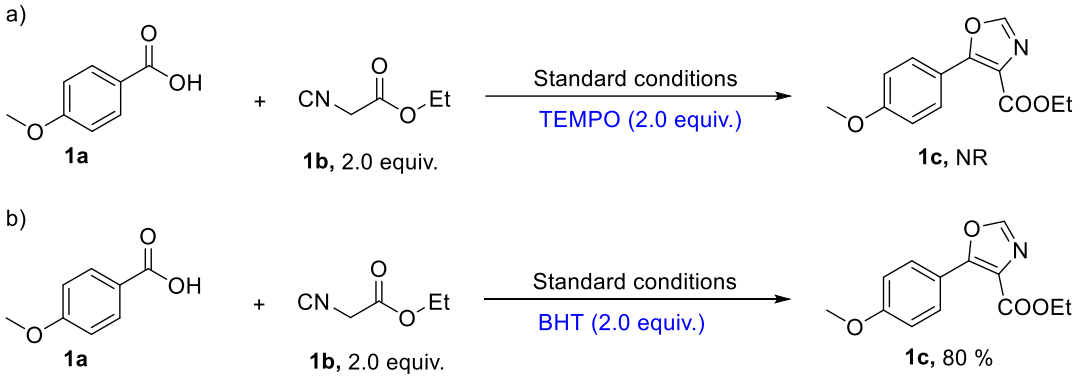
^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.42 – 7.34 (m, 7H), 3.82 – 3.35 (m, 8H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 170.52, 135.34, 129.95, 128.63, 127.14, 77.48, 77.16, 76.85, 66.94.

HRMS (ESI) calcd for $C_{11}H_{14}NO_2^+$ m/z $[M+H]^+$: 192.1025, found 192.1021.

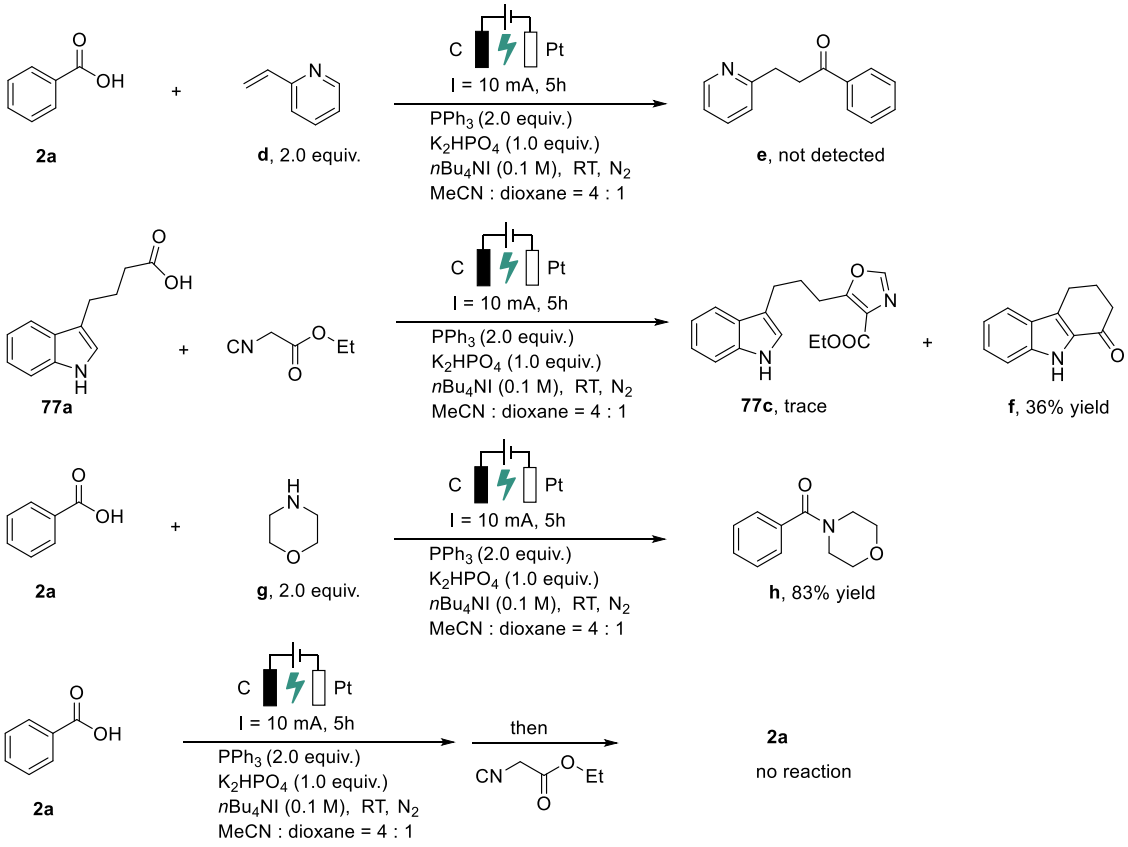
3. Mechanism Study Experiments

3.1 Radical quenching experiments



Under standard reaction conditions, **1a** (1.0 equiv., 0.4 mmol) was selected as the substrate for validation. For reaction **a**), TEMPO (2.0 equiv., 0.8 mmol) was added as an additive, no target product was detected (monitored by TLC or GC-MS analysis) after 5 hours. For reaction b), BHT (2.0 equiv., 0.8 mmol) was added as an additive, the substrate was transformed completely and the **1c** was separated in 80% yield after 6 hours.

3.2 Control experiments



According to Zhu's work, 2-vinylpyridine was found to be the acceptors of acyl radical. So, 2-vinylpyridine was added without isocyanides presence. Unfortunately, the ketone was not observed under standard conditions. The intramolecular acyl addition reaction of 4-(1H-indol-3-yl)butanoic acid happened, while the intermolecular cycloaddition was completely inhibited. Furthermore, when morpholine, a common nucleophile, was added, the corresponding amide product was obtained in a 83% yield , indicating that the key intermediates are not acyl radicals but are more likely the cationic species. Furthermore, the "step-by-step" experiment demonstrated that the electrochemical single electron transfer oxidation to generate the electrophilic intermediates and the following two-electron process with the nucleophilic site of isocyanides are simultaneous in this reaction system.

3.3 Cyclic voltammetry studies

The cyclic voltammogram was collected with a CHI 760E Potentiostat. The potential ($E_{1/2}p$) of each compound was obtained using Origin.

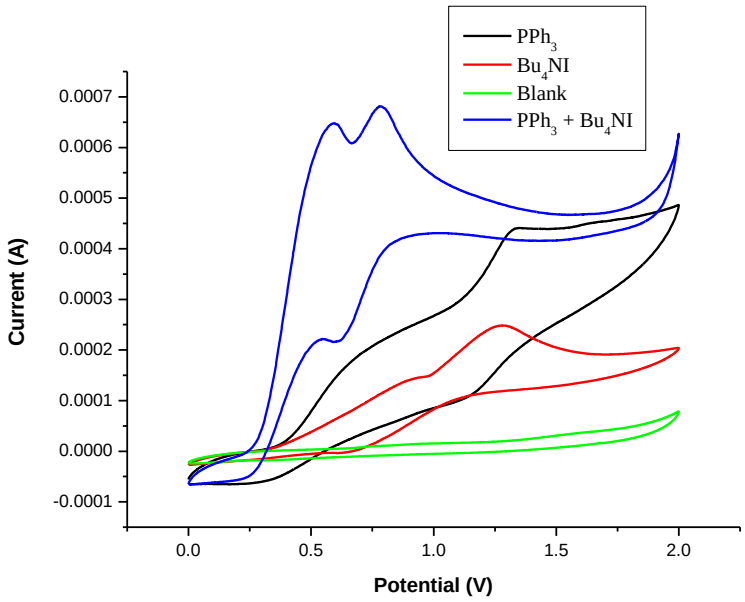


Figure 5. Cyclic voltammograms of PPh_3 and *n*-Bu_4NI in 0.1 M *n*-Bu_4NBF_4 (CH_3CN), using a glassy carbon working electrode and plainum sheet and saturated calomel electrode (SCE) as counter electrode and reference electrodes at a 100 mV s^{-1} scan rat. The sample was prepared with 0.1 mmol of target molecule.

The $E_{1/2}$ vs SCE of PPh_3 in MeCN is 0.84 V and the $E_{1/2}$ vs SCE of *n*-Bu_4NI in MeCN is 0.65 V and 0.83 V, suggesting that *n*-Bu_4NI are more susceptible to oxidation when compared with PPh_3. Treatment *n*-Bu_4NI with same amount of PPh_3 (0.1 M) results in a dramatic increase of anodic peak of *n*-Bu_4NI. This result suggests that the active species I^+ arising from the oxidation of I^- can be readily intercepted by PPh_3 to form an intermediator $Ph_3P^-I^+$. The in-situ generated $Ph_3P^-I^+$ is regarded as the active species in the activation process of carboxylic acid.

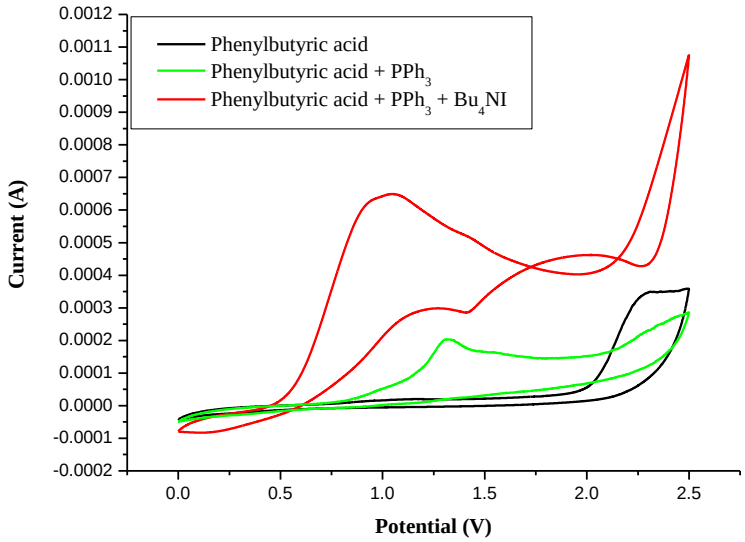
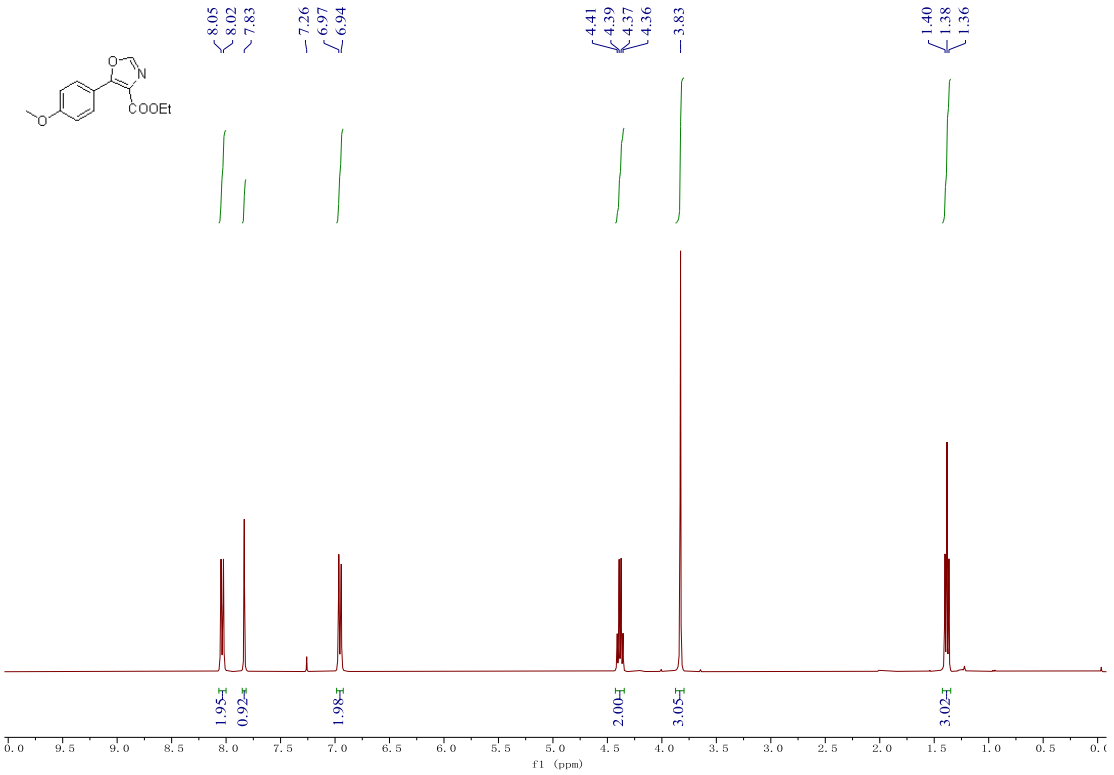


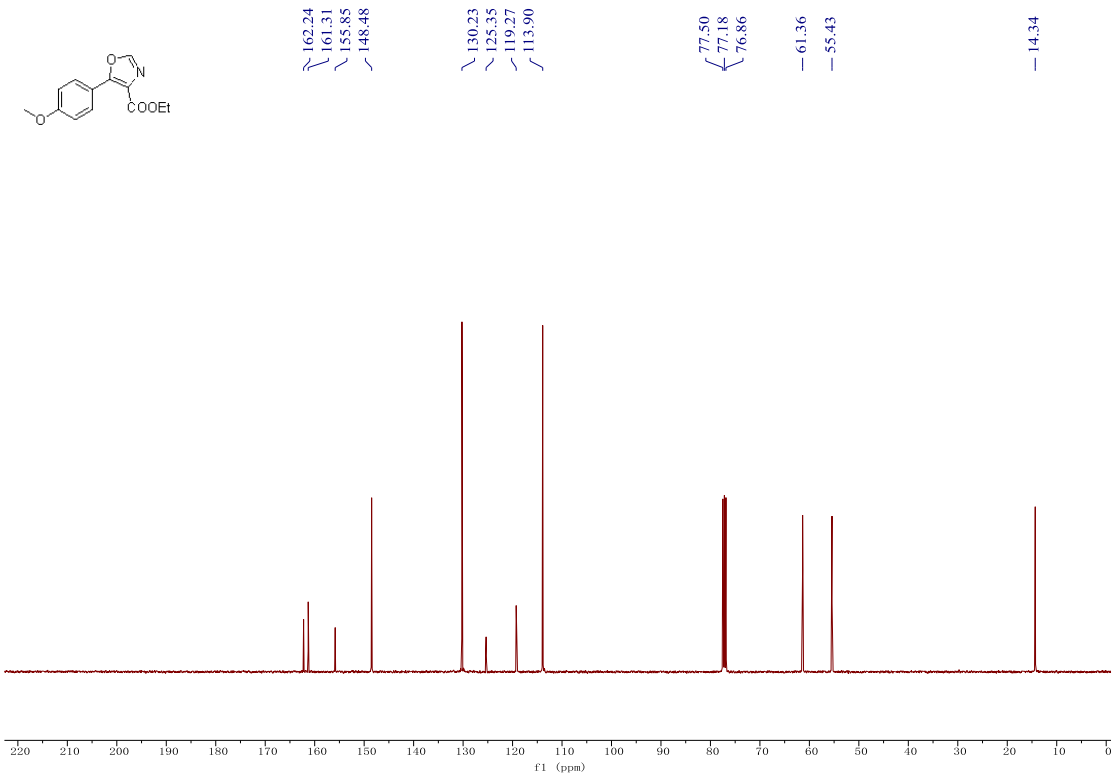
Figure 6. Cyclic voltammograms of PPh_3 and *n*-Bu_4NI in 0.1 M *n*-Bu_4NBF_4 (CH_3CN), using a glassy carbon working electrode and plainum sheet and saturated calomel electrode (SCE) as counter electrode and reference electrodes at a 100 mV s^{-1} scan rat. The sample for carboxylic acids was prepared with 0.05 mmol and others were prepared with 0.1 mmol.

The $E_{1/2}$ vs SCE of phenylbutyric acid in MeCN is 2.10 V, suggesting that the corresponding carboxylic acids are more harder to oxidation than both *n*-Bu_4NI and PPh_3.

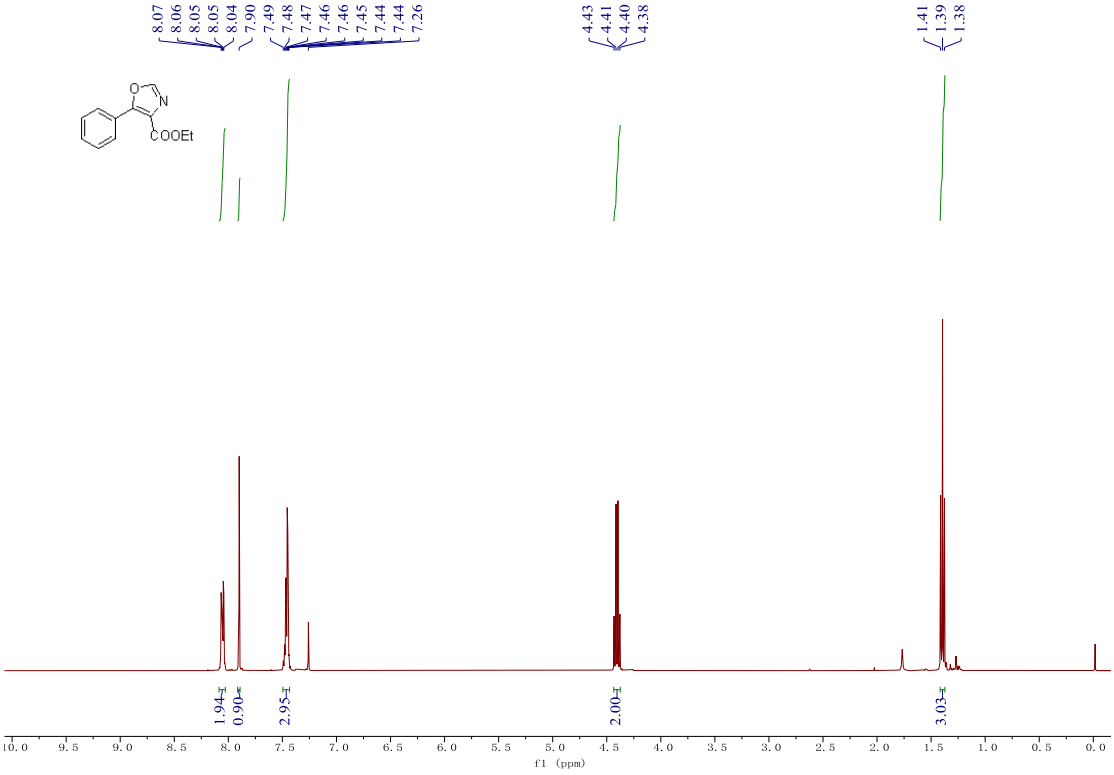
4. NMR Spectra

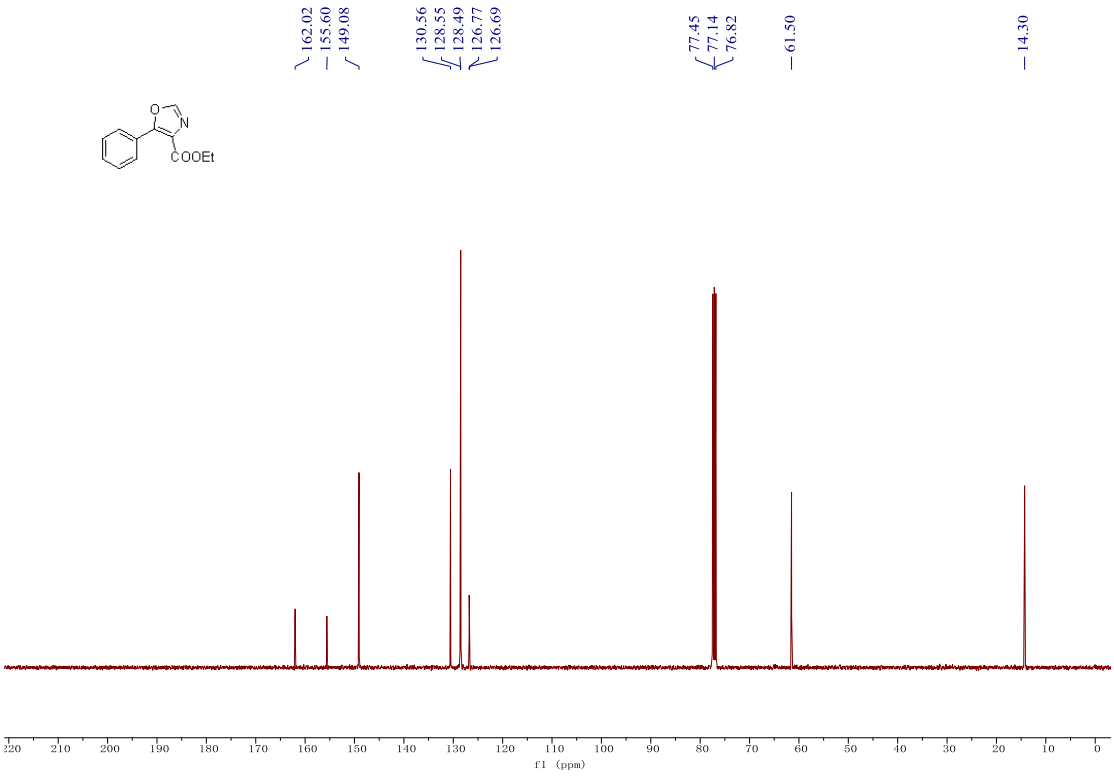
1c ^{1}H NMR and ^{13}C NMR



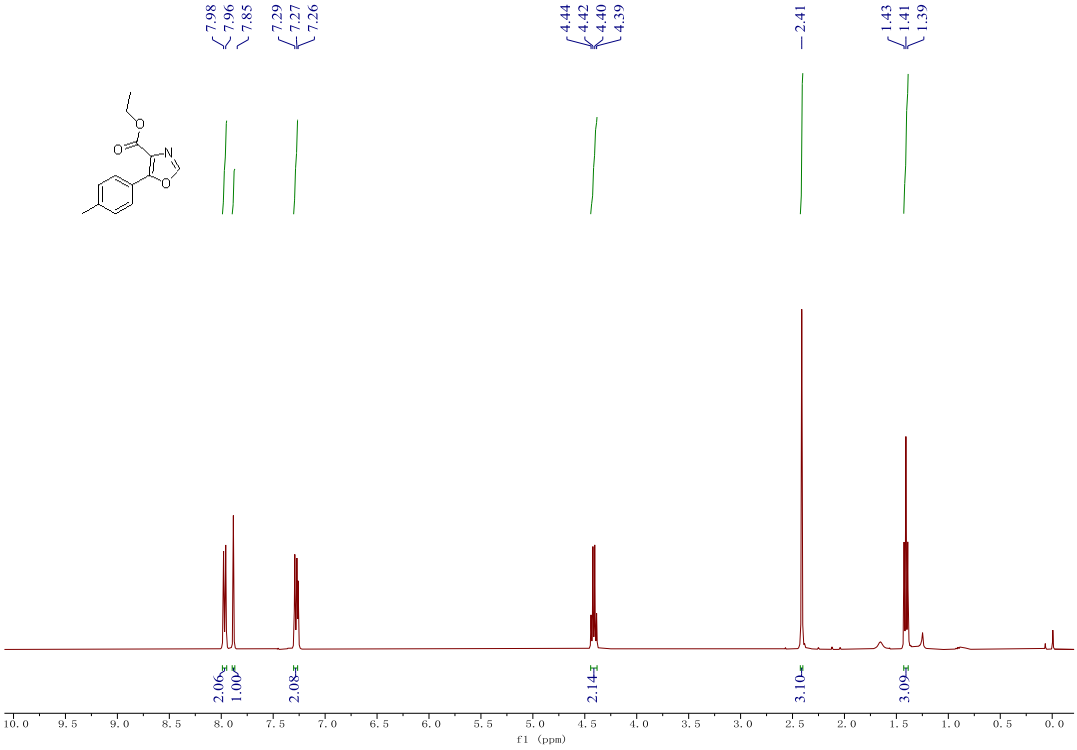


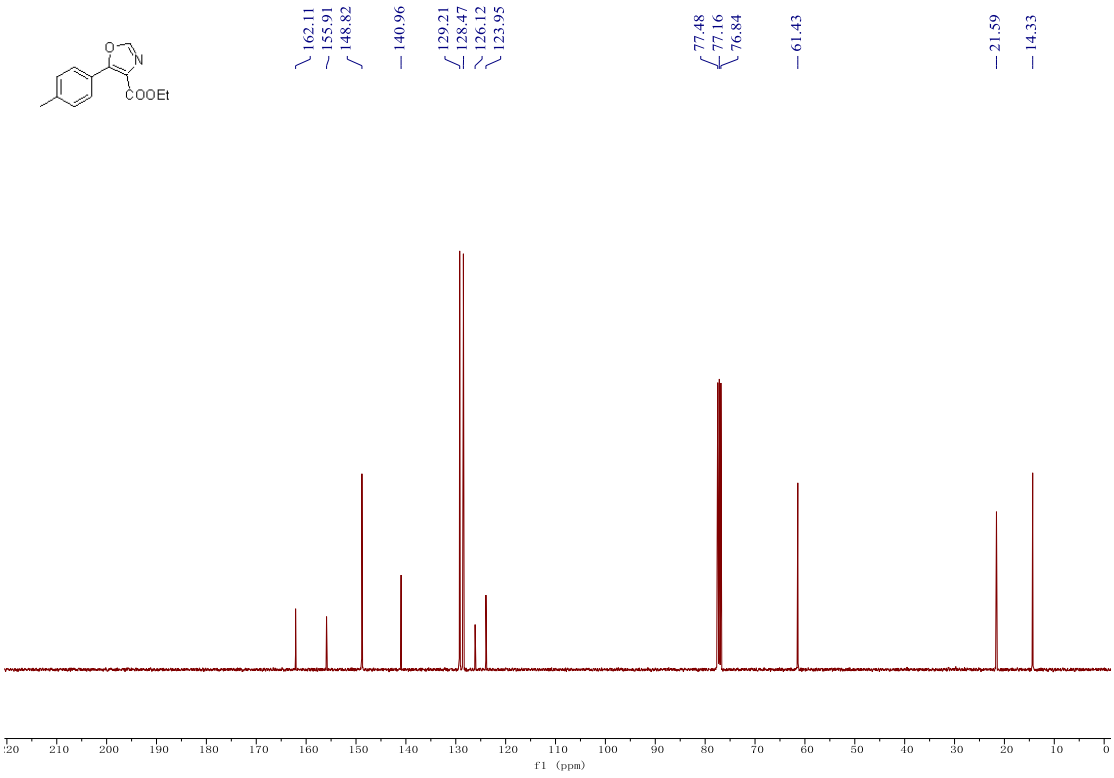
2c ^{1}H NMR and ^{13}C NMR



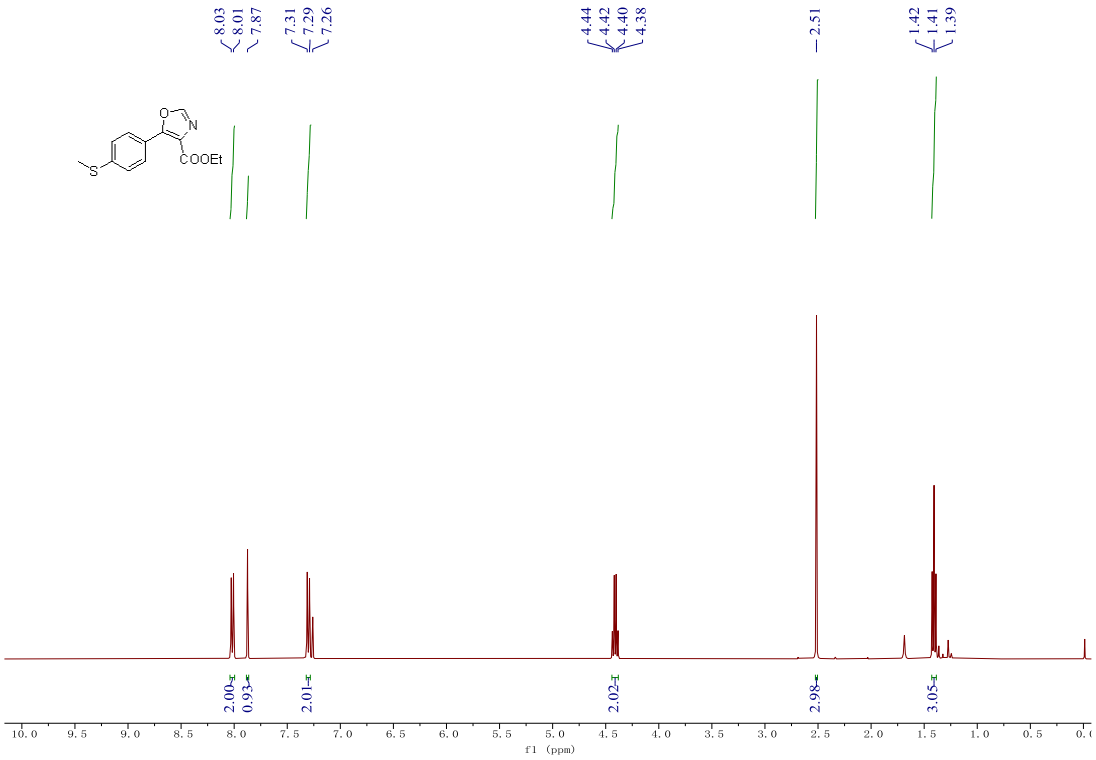


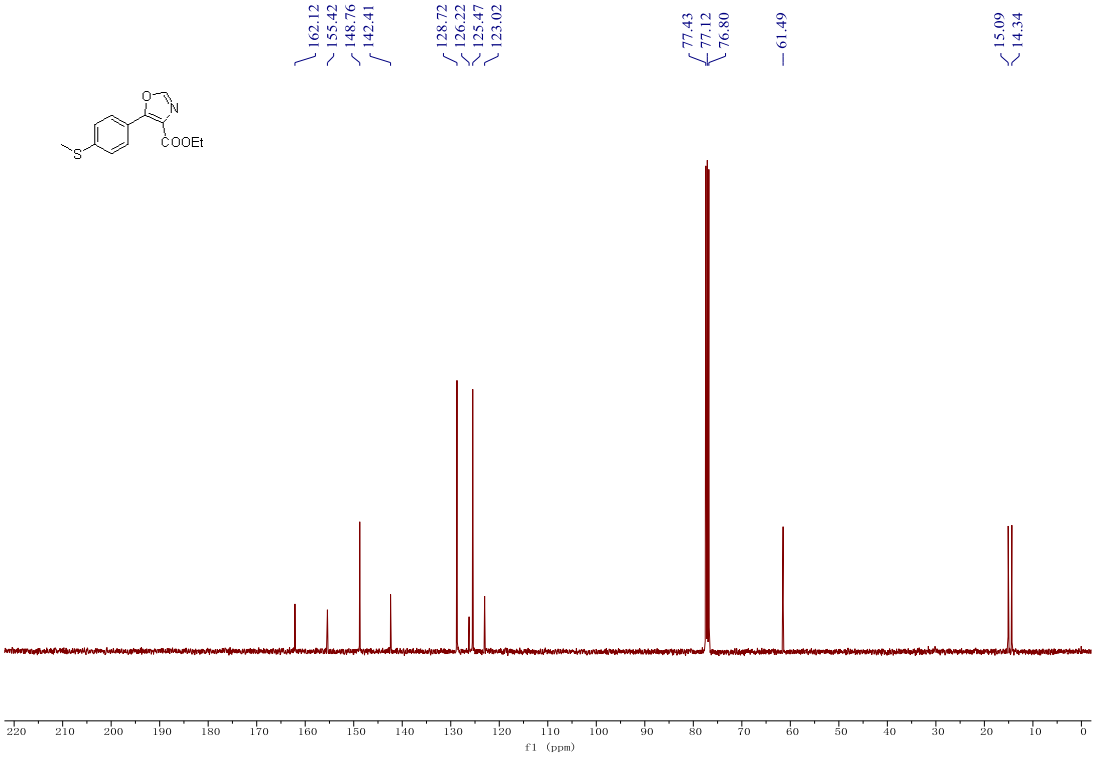
3c ^{1}H NMR and ^{13}C NMR



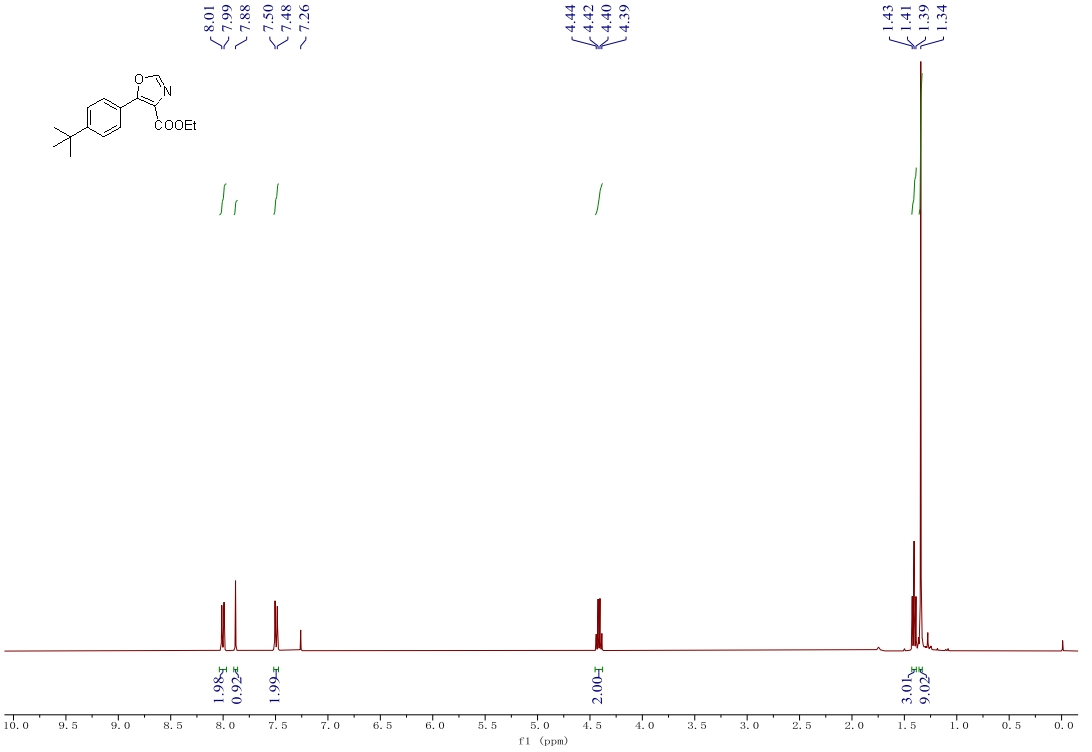


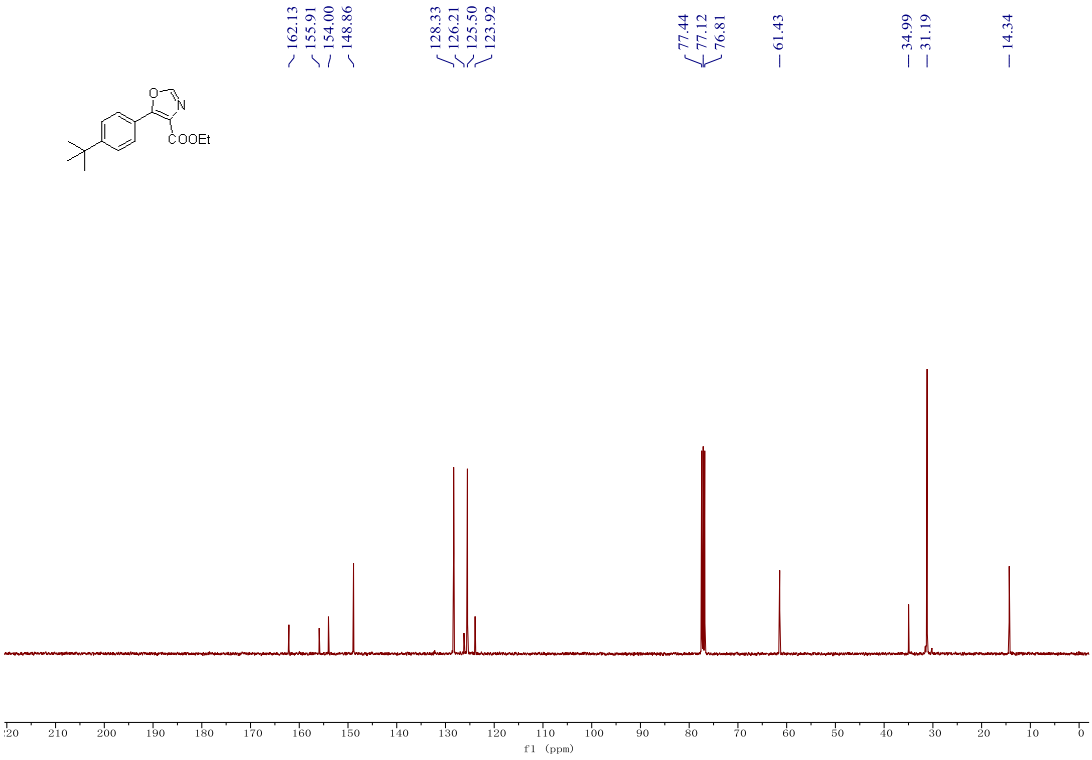
4c ^{1}H NMR and ^{13}C NMR



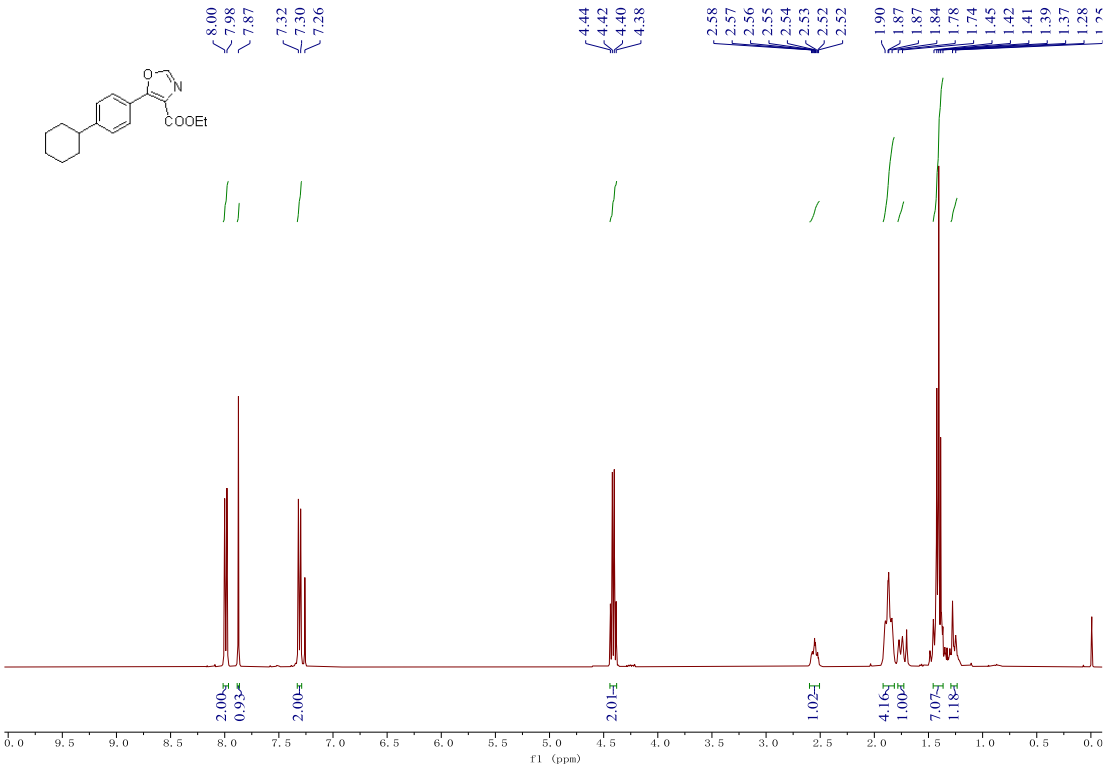


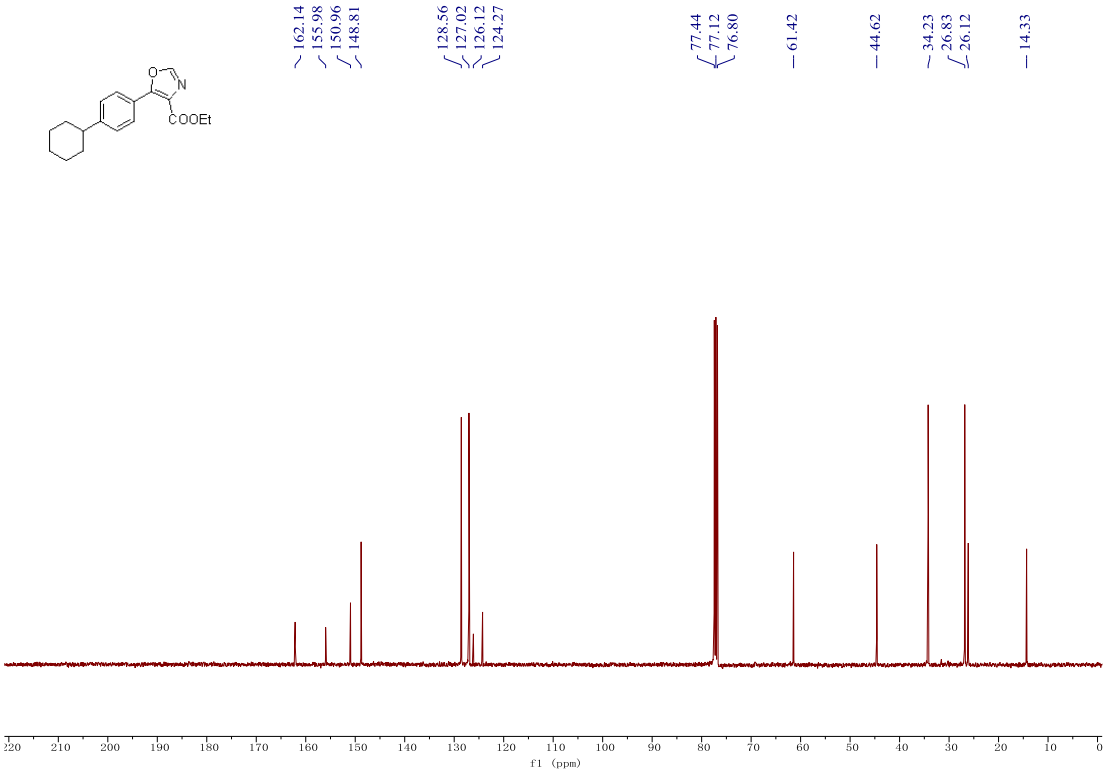
5c ^{1}H NMR and ^{13}C NMR



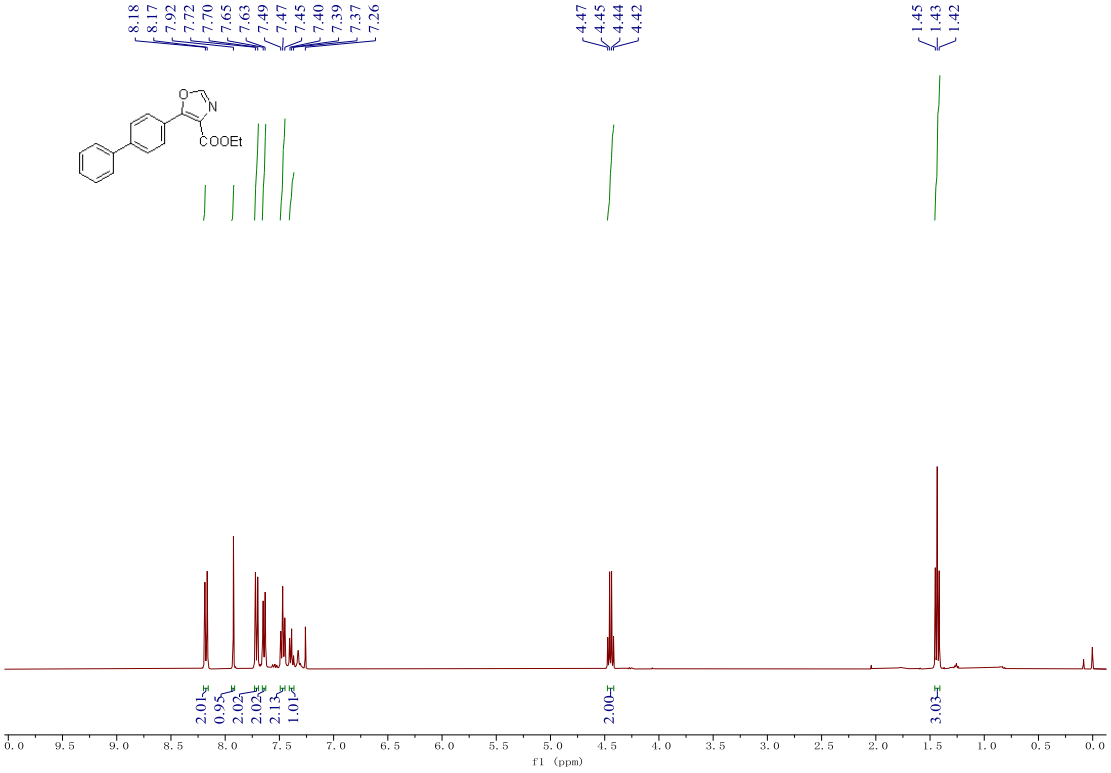


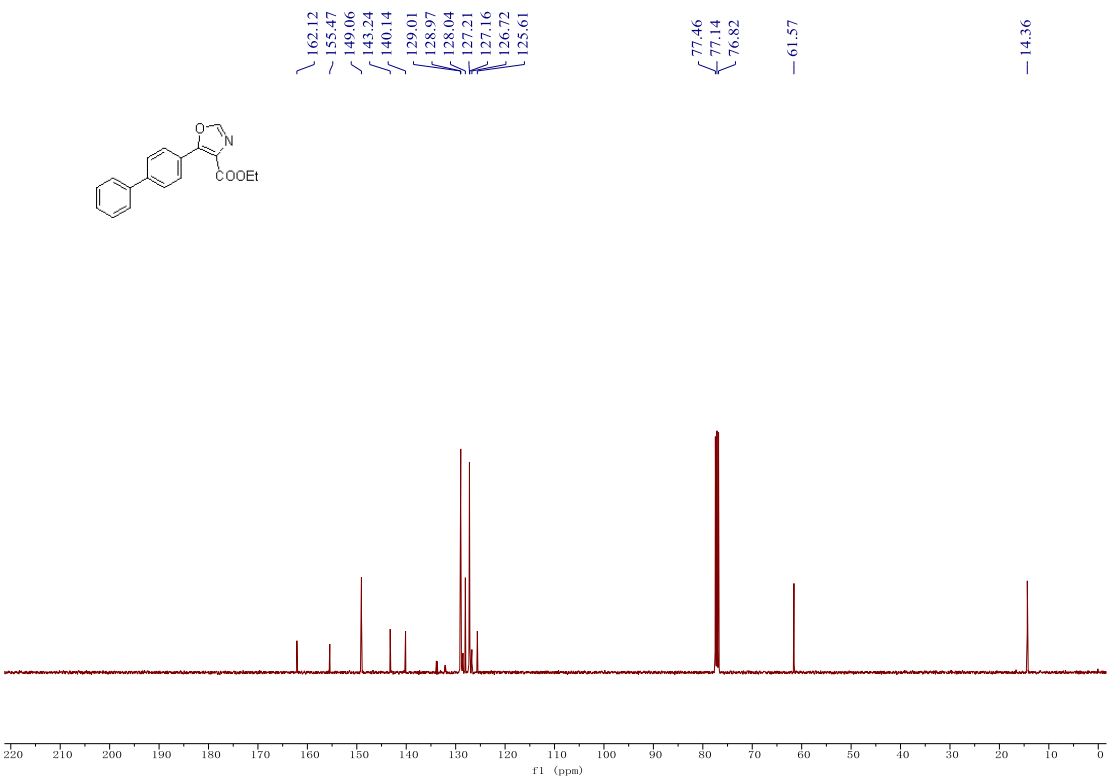
6c ^{1}H NMR and ^{13}C NMR



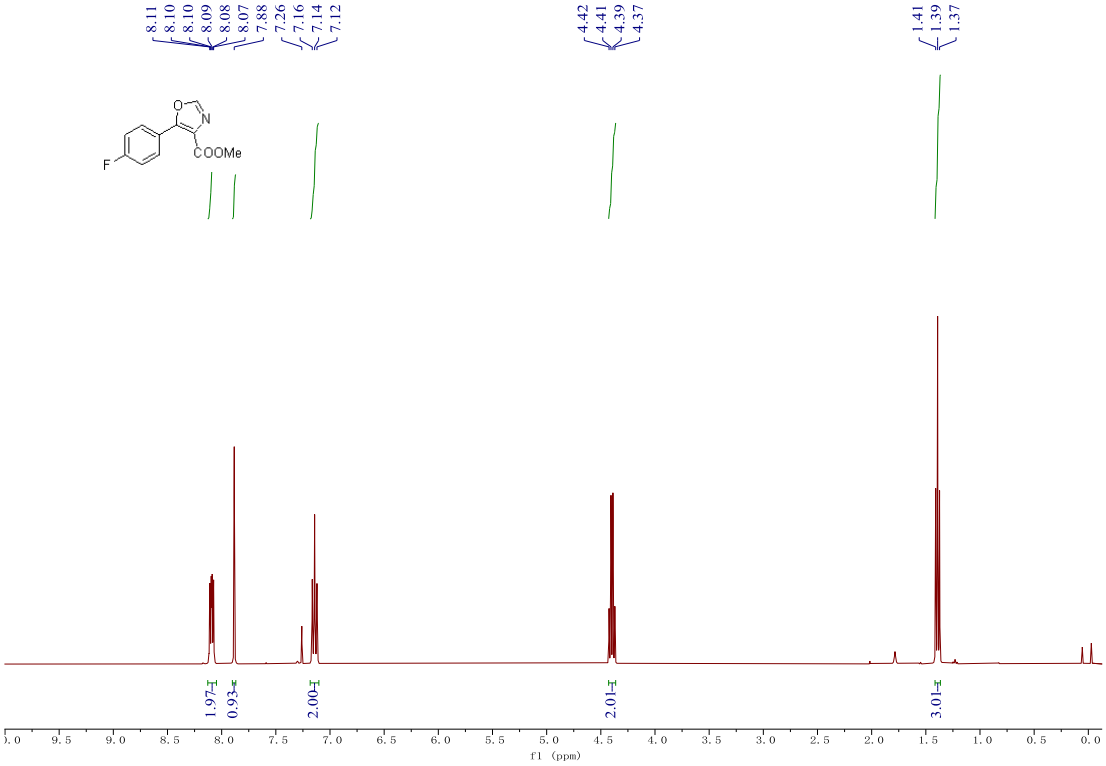


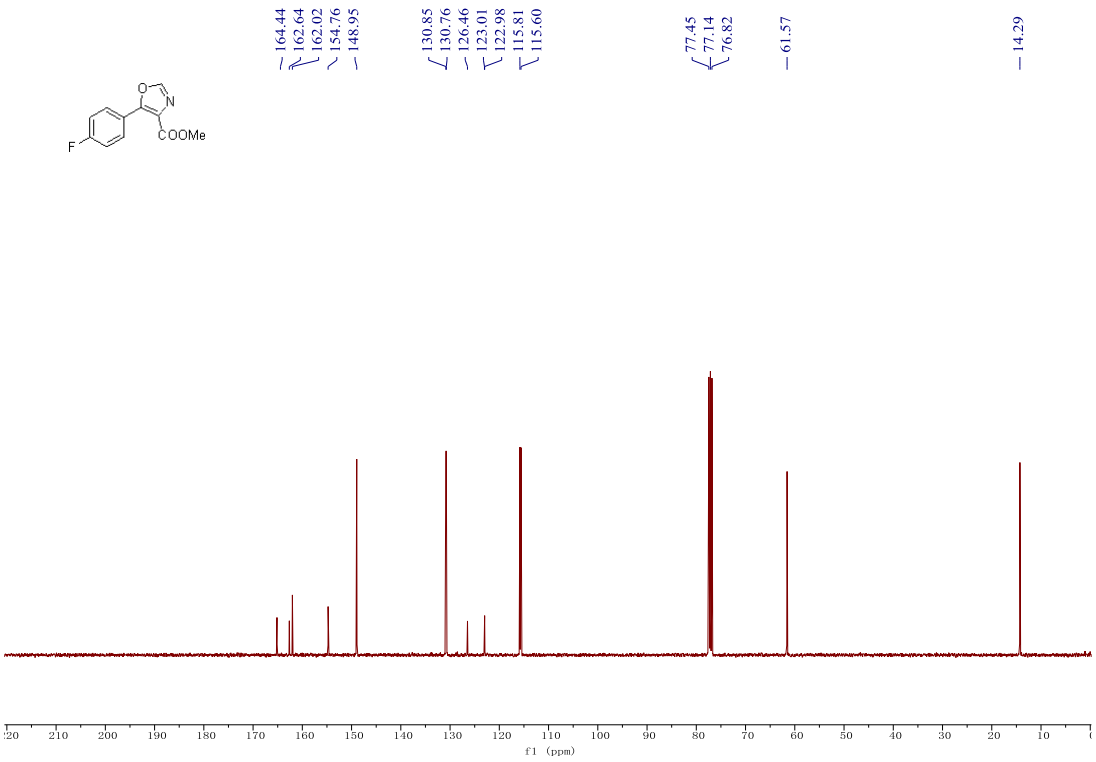
7c ^{1}H NMR and ^{13}C NMR

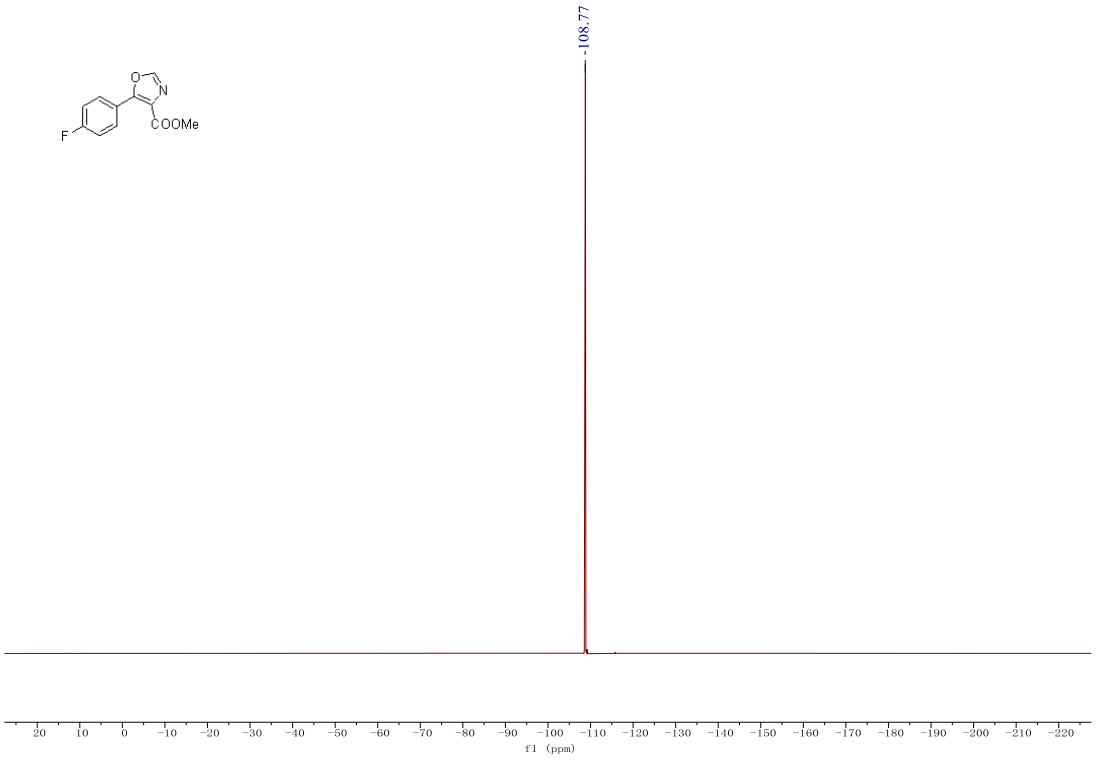




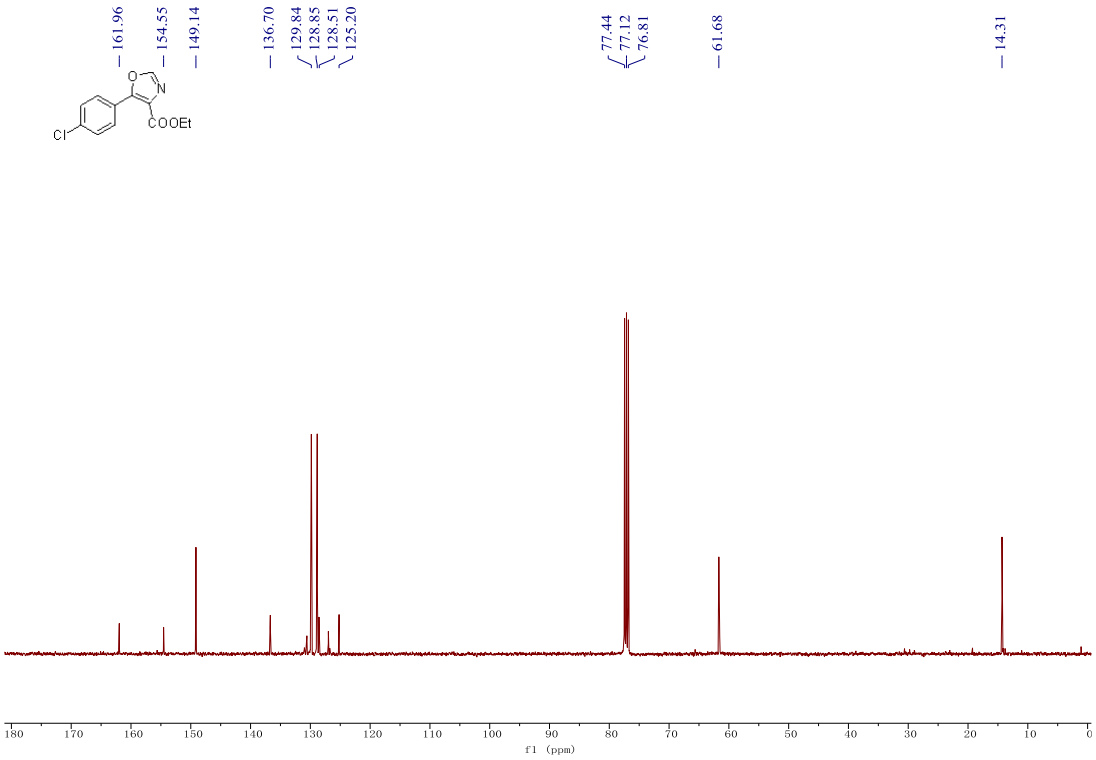
8c ^{1}H NMR, ^{13}C NMR and ^{19}F NMR

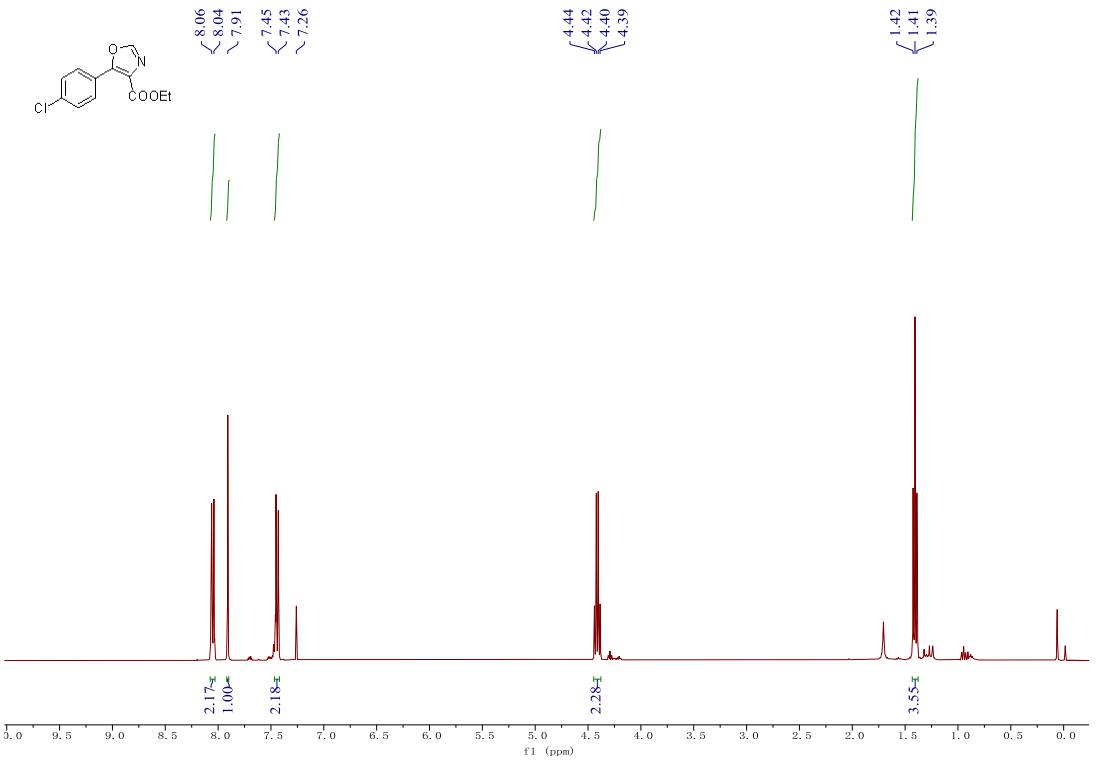




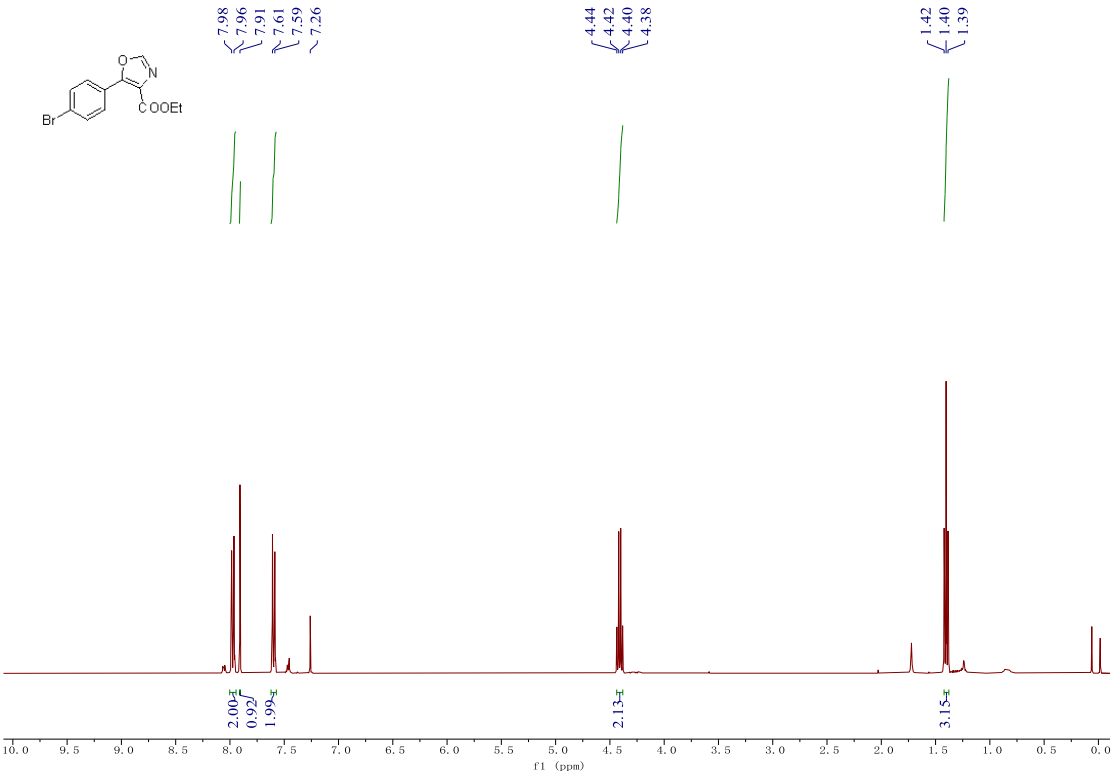

-108.77
O
N
COOMe
F
20 10 0 −10 −20 −30 −40 −50 −60 −70 −80 −90 −100 −110 −120 −130 −140 −150 −160 −170 −180 −190 −200 −210 −220
f1 (ppm)

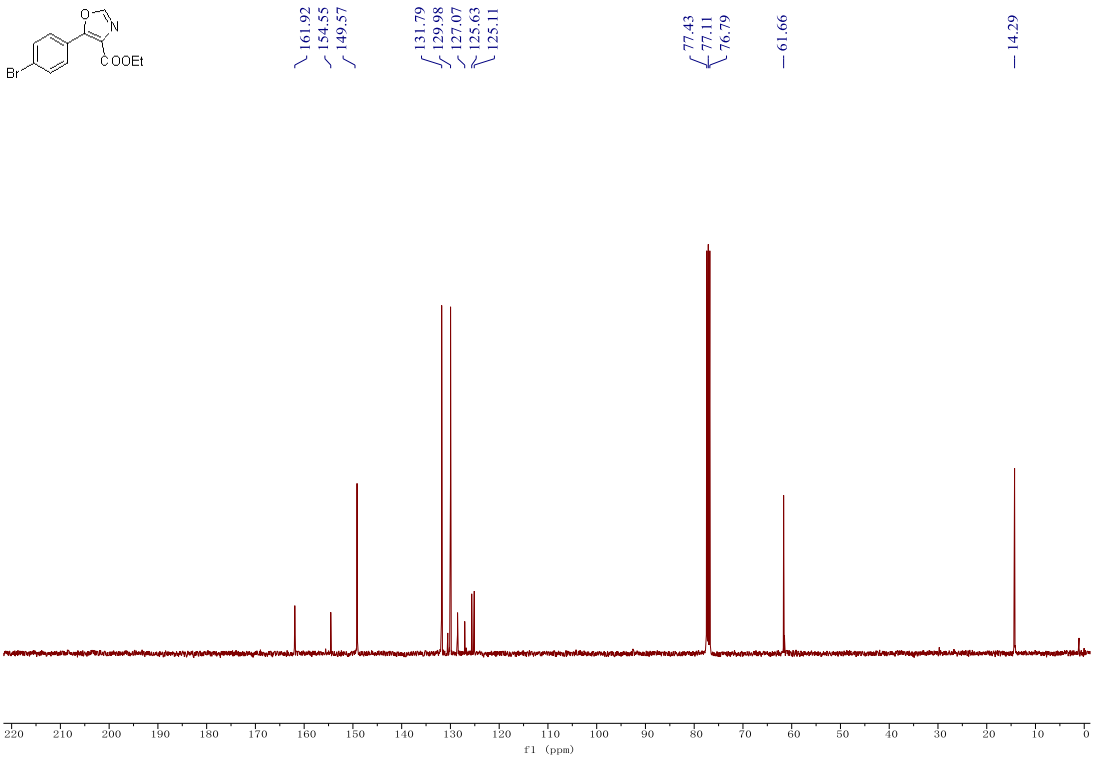
9c ^{1}H NMR and ^{13}C NMR



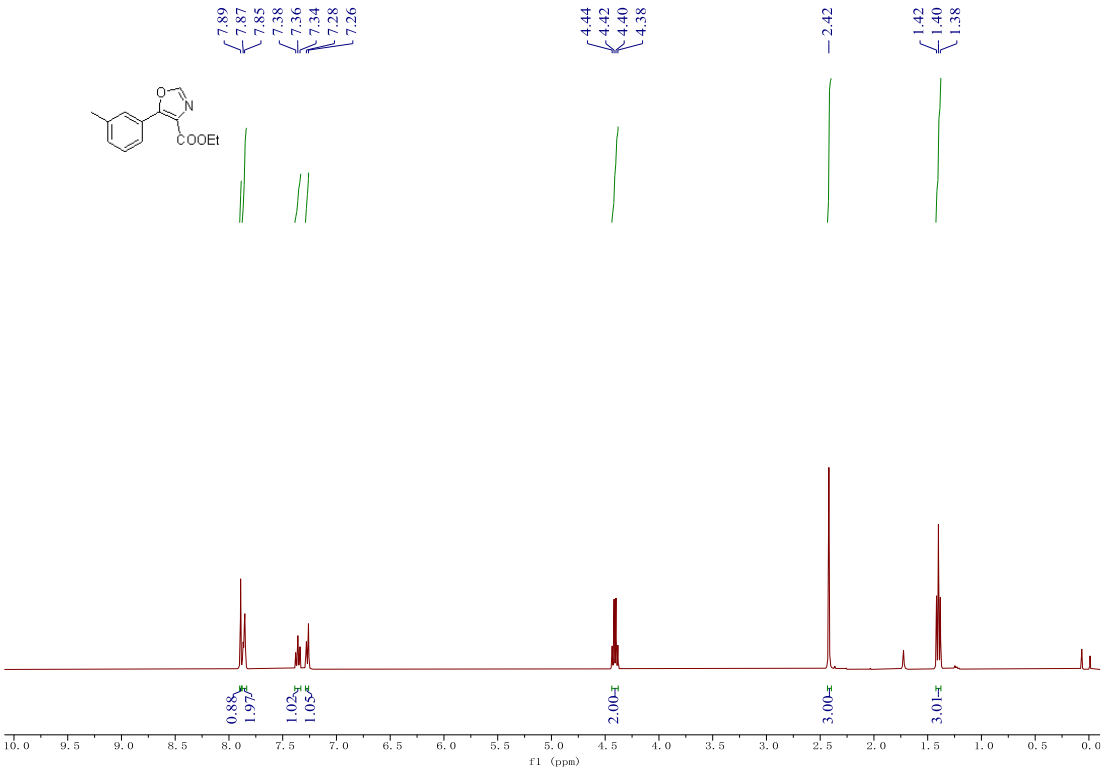


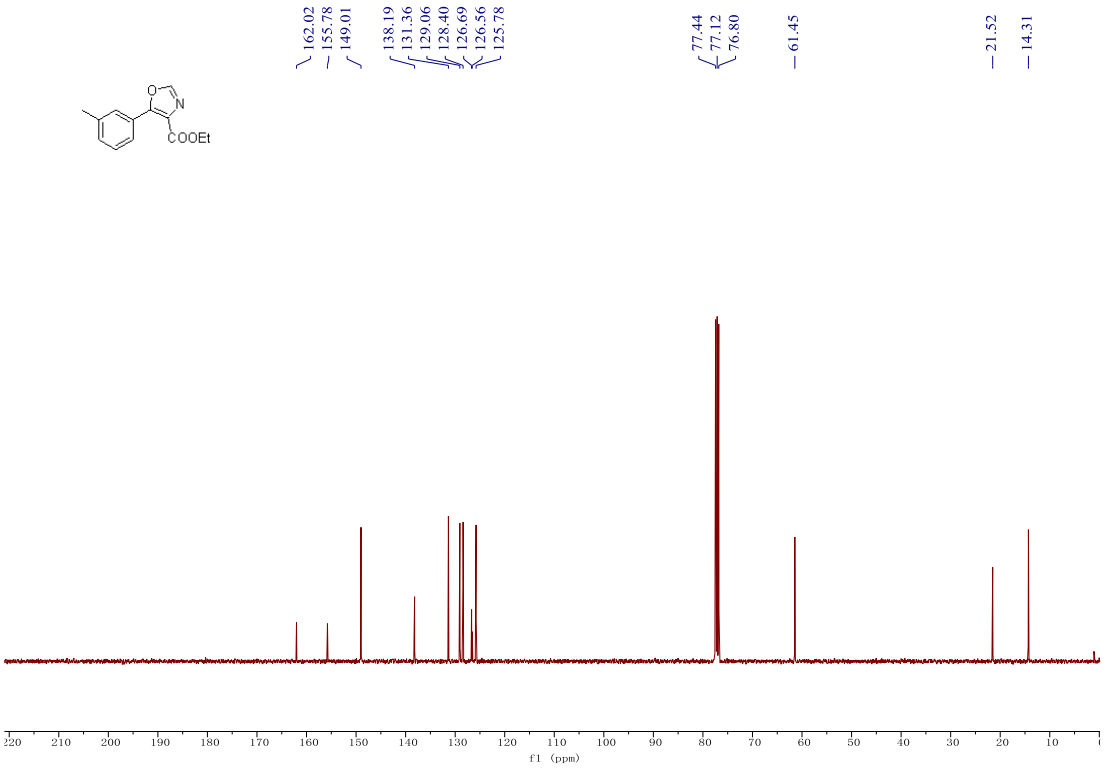
10c ^{1}H NMR and ^{13}C NMR



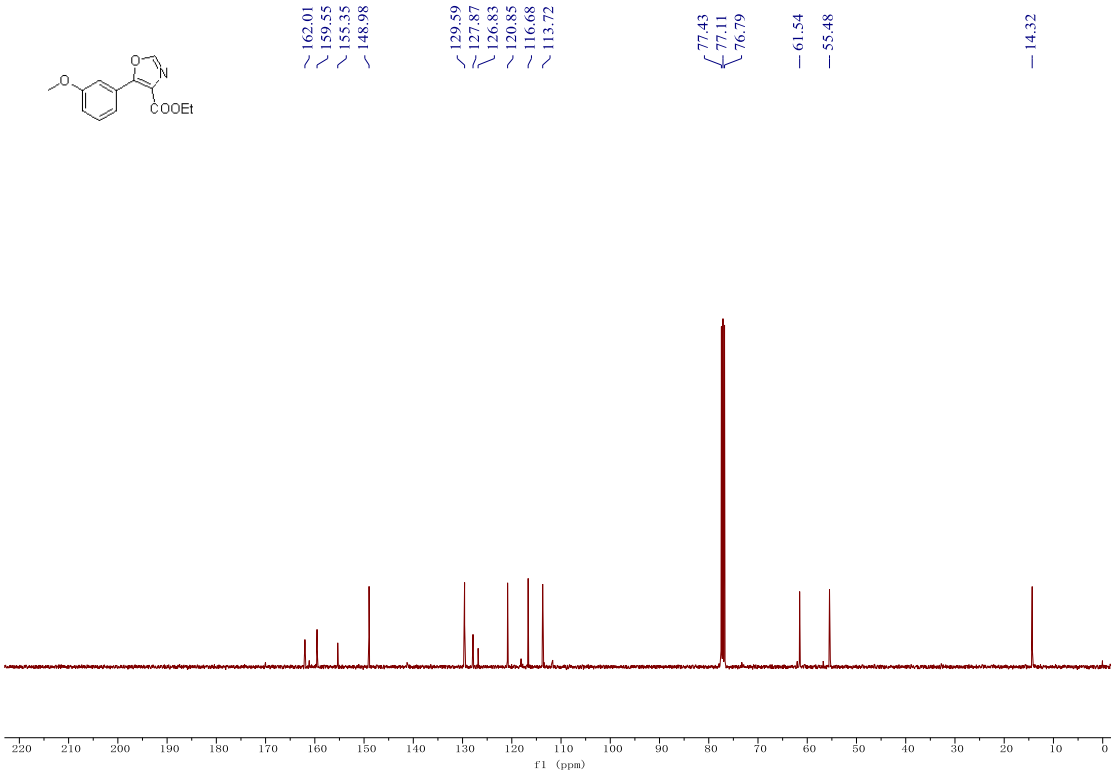


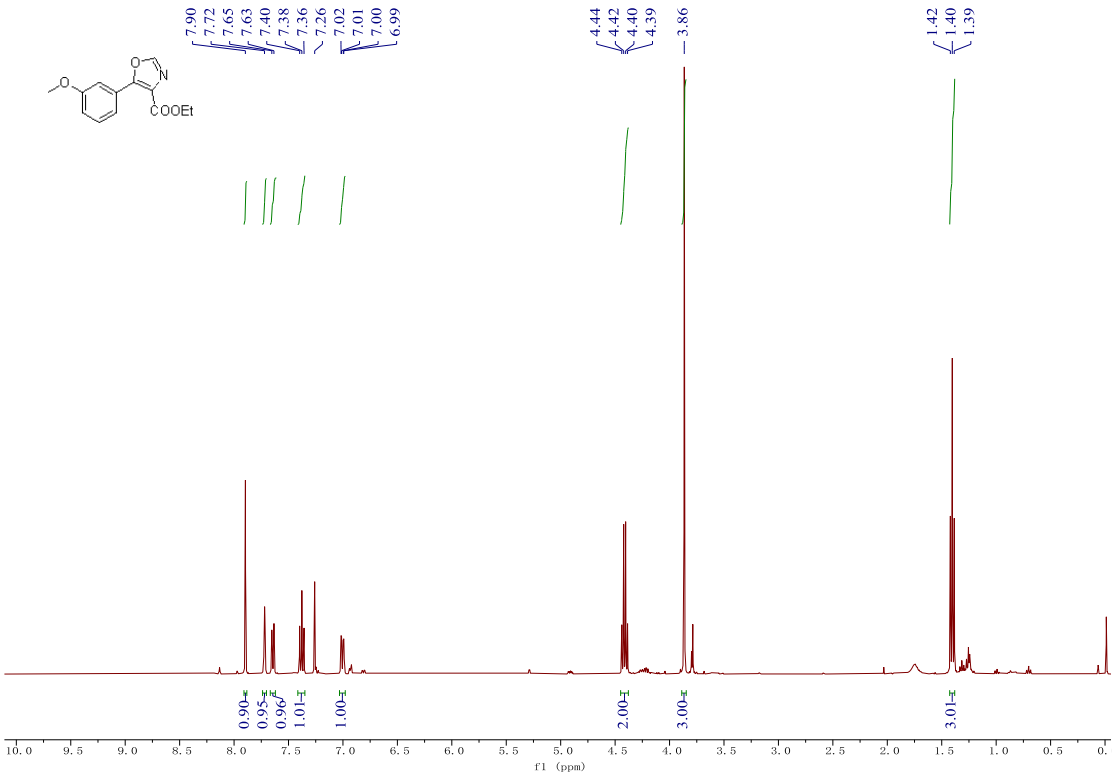
11c ^{1}H NMR and ^{13}C NMR



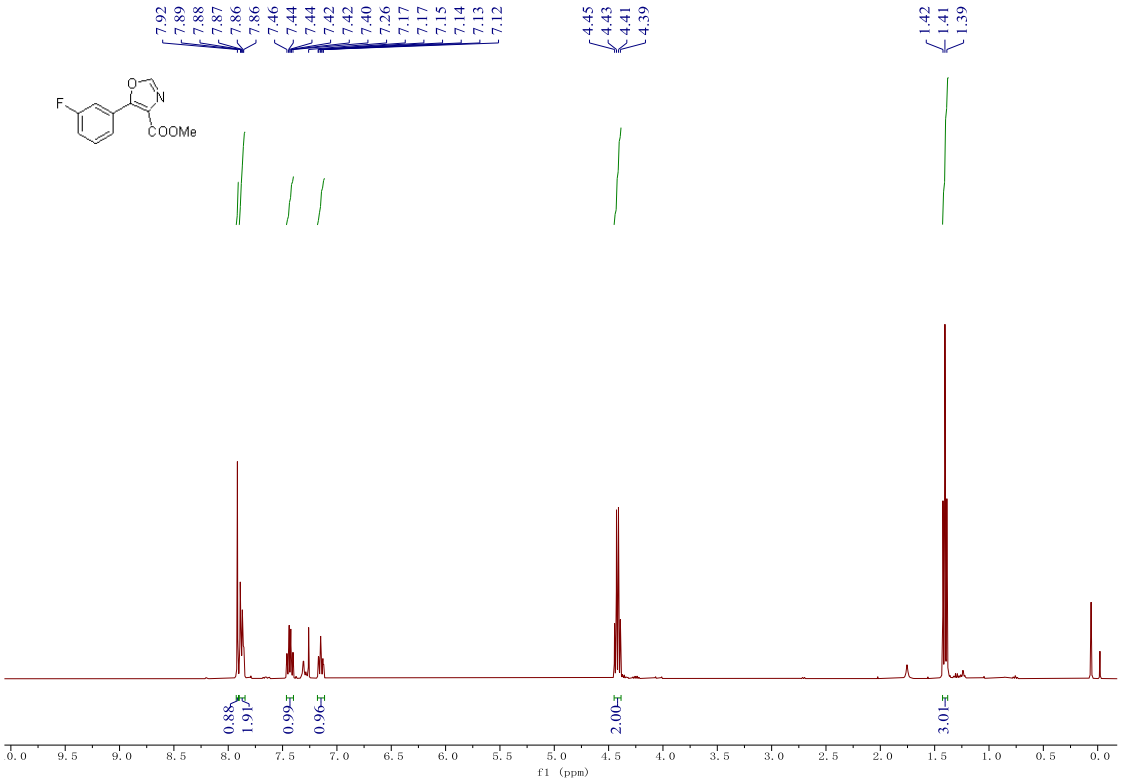


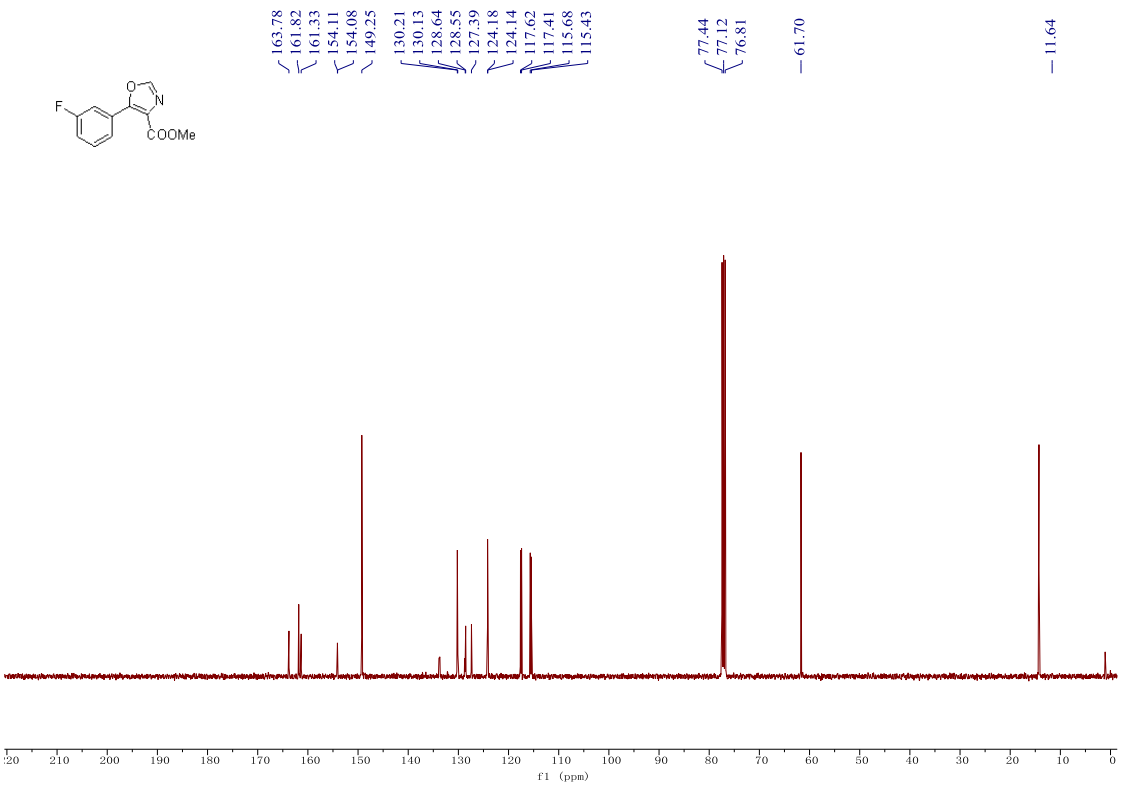
12c ^{1}H NMR and ^{13}C NMR

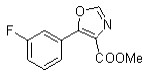




13c ^{1}H NMR, ^{13}C NMR and ^{19}F NMR

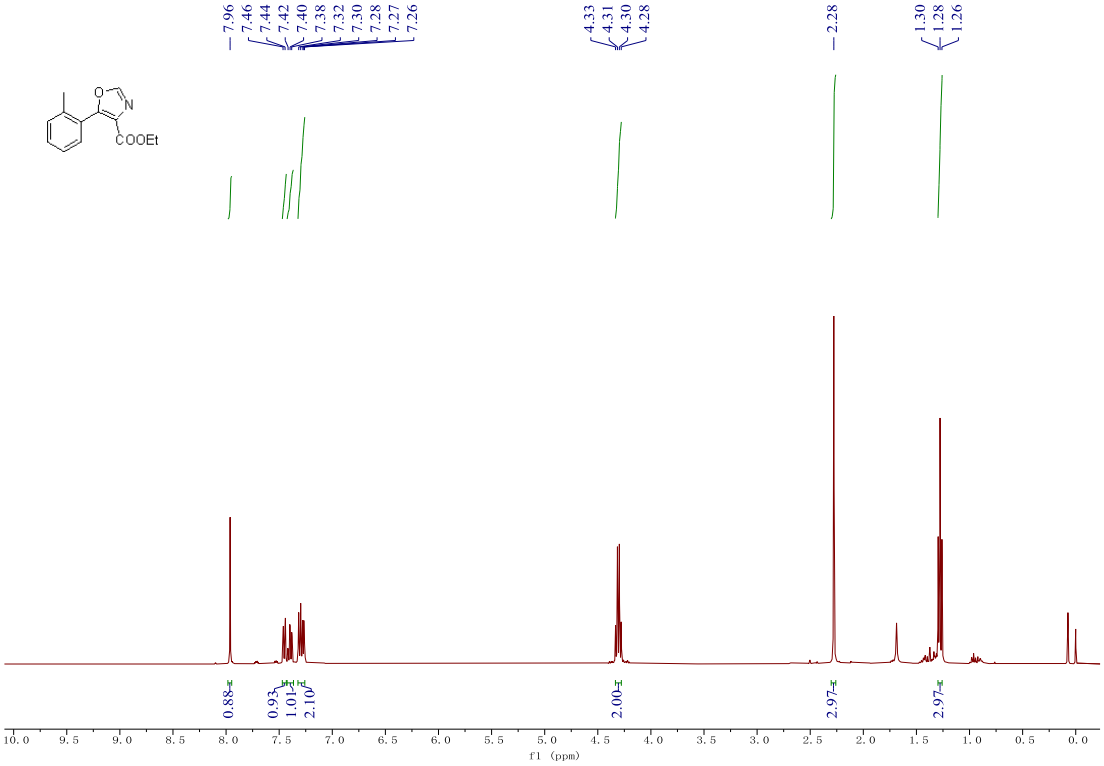

7.92
7.89
7.88
7.87
7.86
7.86
7.46
7.44
7.44
7.42
7.42
7.40
7.26
7.17
7.17
7.15
7.14
7.13
7.12
4.45
4.43
4.41
4.39
1.42
1.41
1.39
F
O
N
COOMe
0.88
1.91
0.99
0.96
2.00
3.01
f1 (ppm)

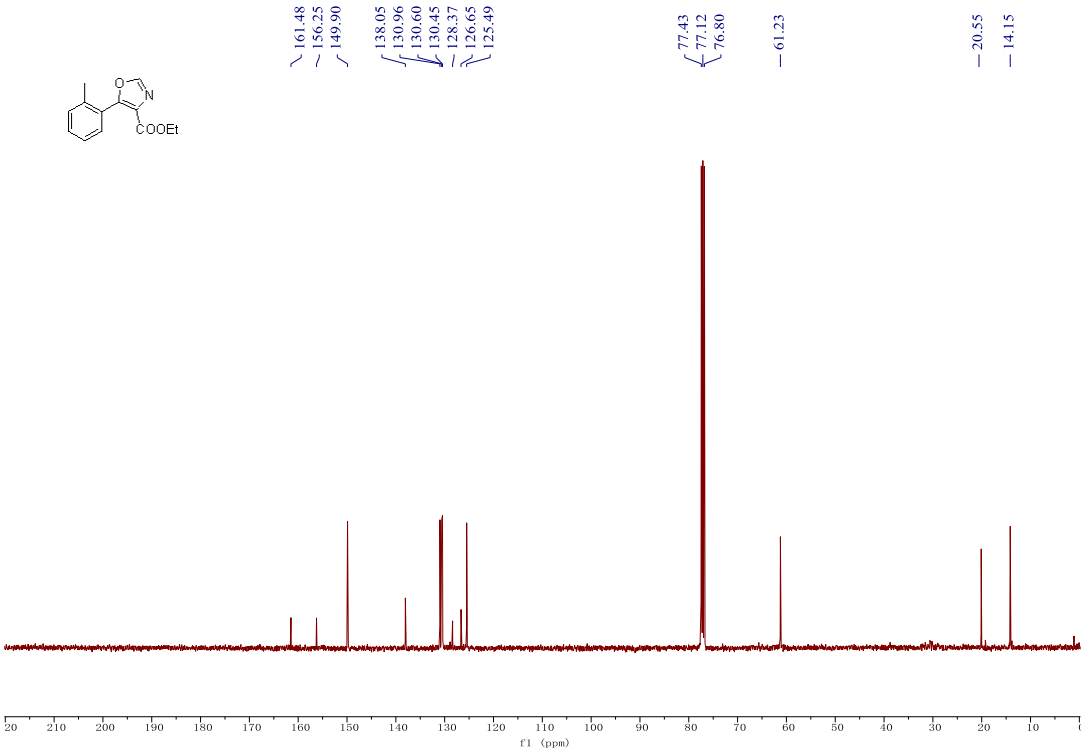

163.78
161.82
161.33
154.11
154.08
149.25
130.21
130.13
128.64
128.55
127.39
124.18
124.14
117.62
117.41
115.68
115.43
77.44
77.12
76.81
61.70
11.64
F
O
N
COOMe
f1 (ppm)


F
O
N
COOMe

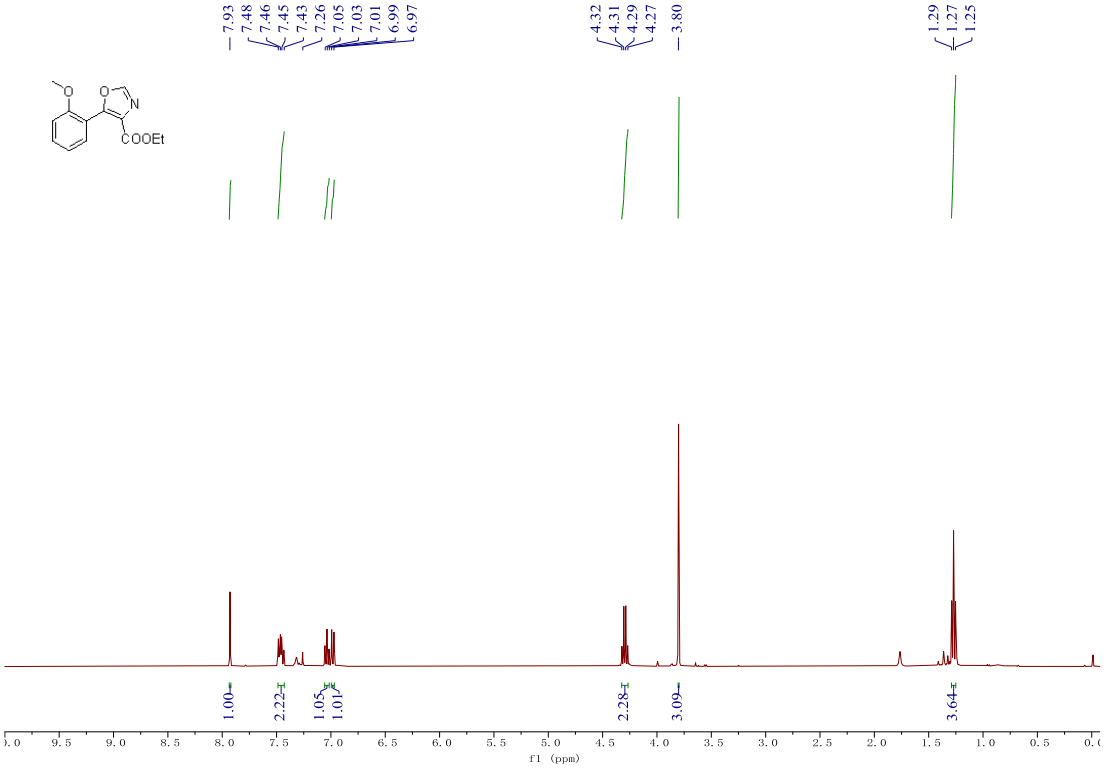
-112.02
20 10 0 -10 -20 -30 -40 -50 -60 -70 -80 -90 -100 -110 -120 -130 -140 -150 -160 -170 -180 -190 -200 -210 -220
f1 (ppm)

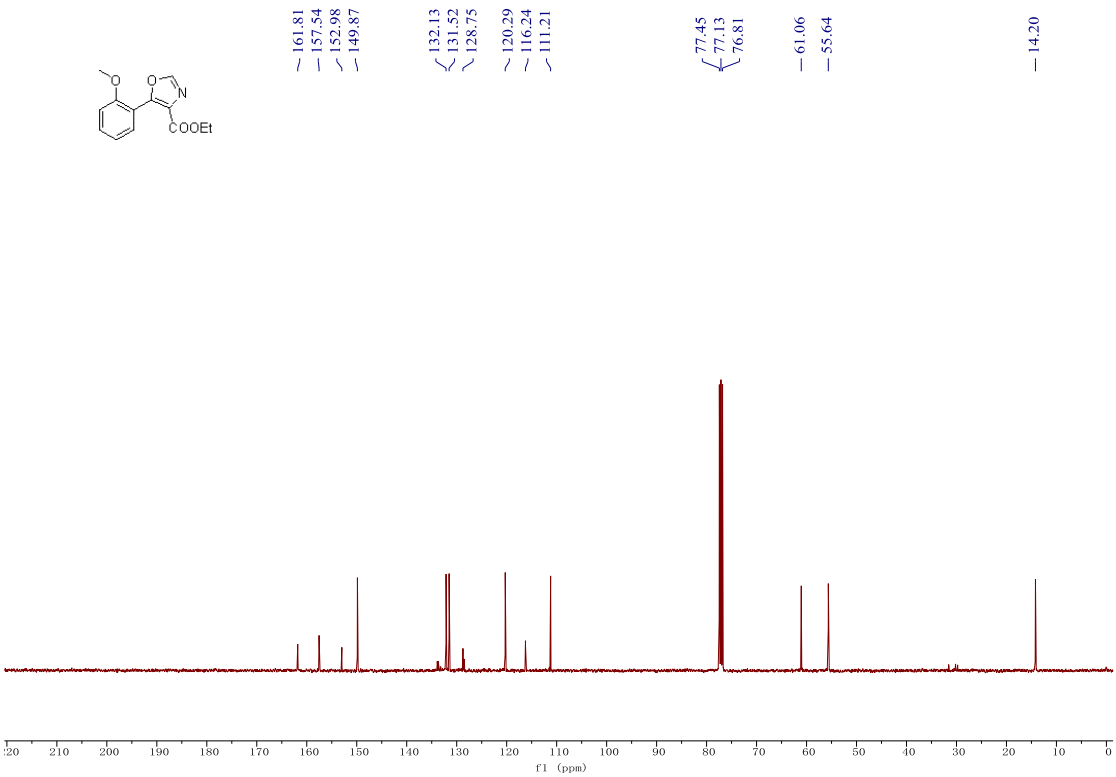
14c ^{1}H NMR and ^{13}C NMR



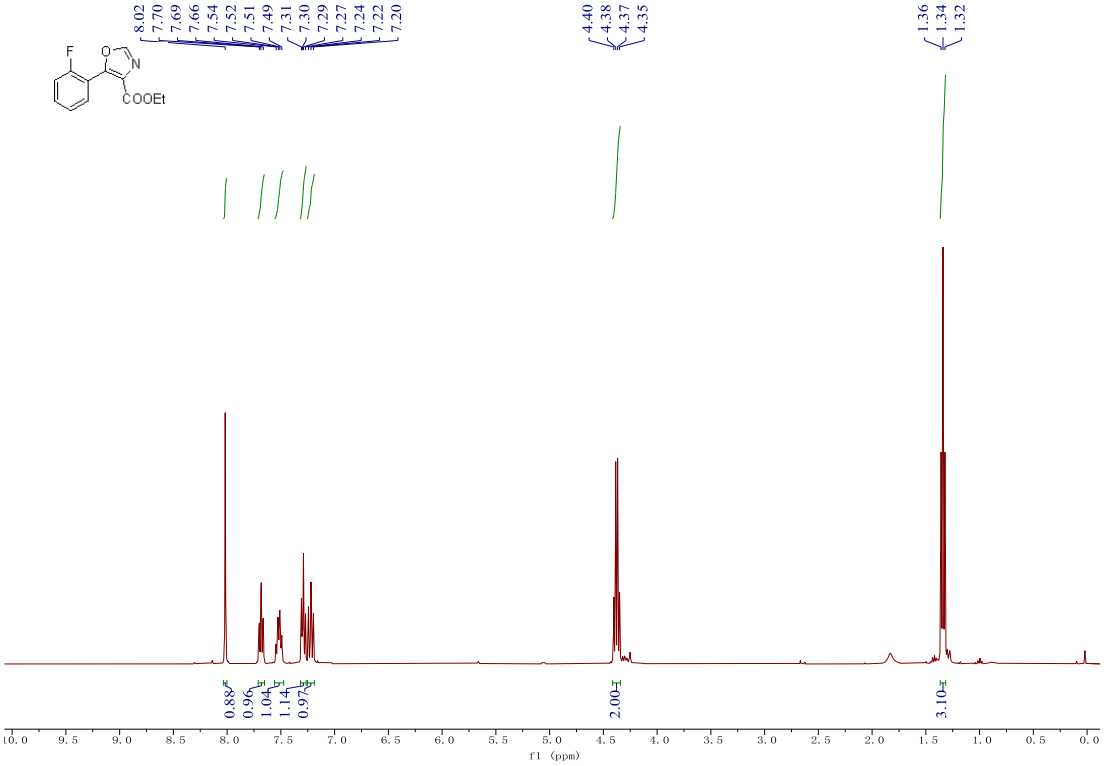


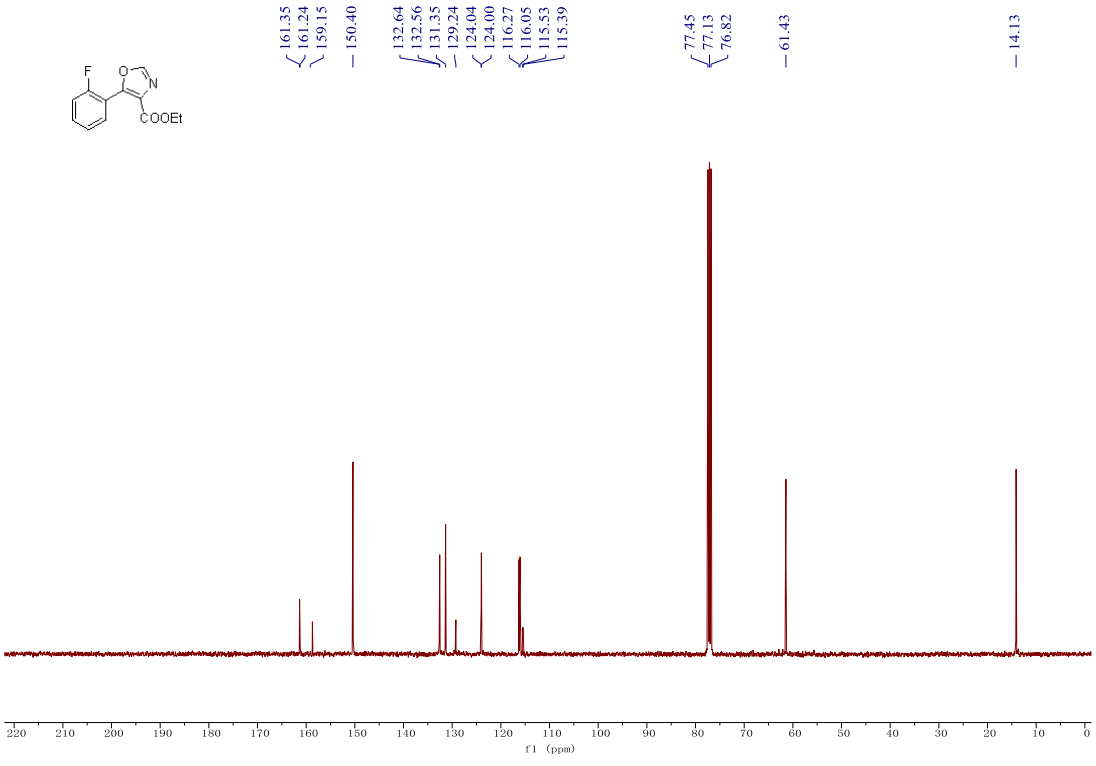
15c ^{1}H NMR and ^{13}C NMR

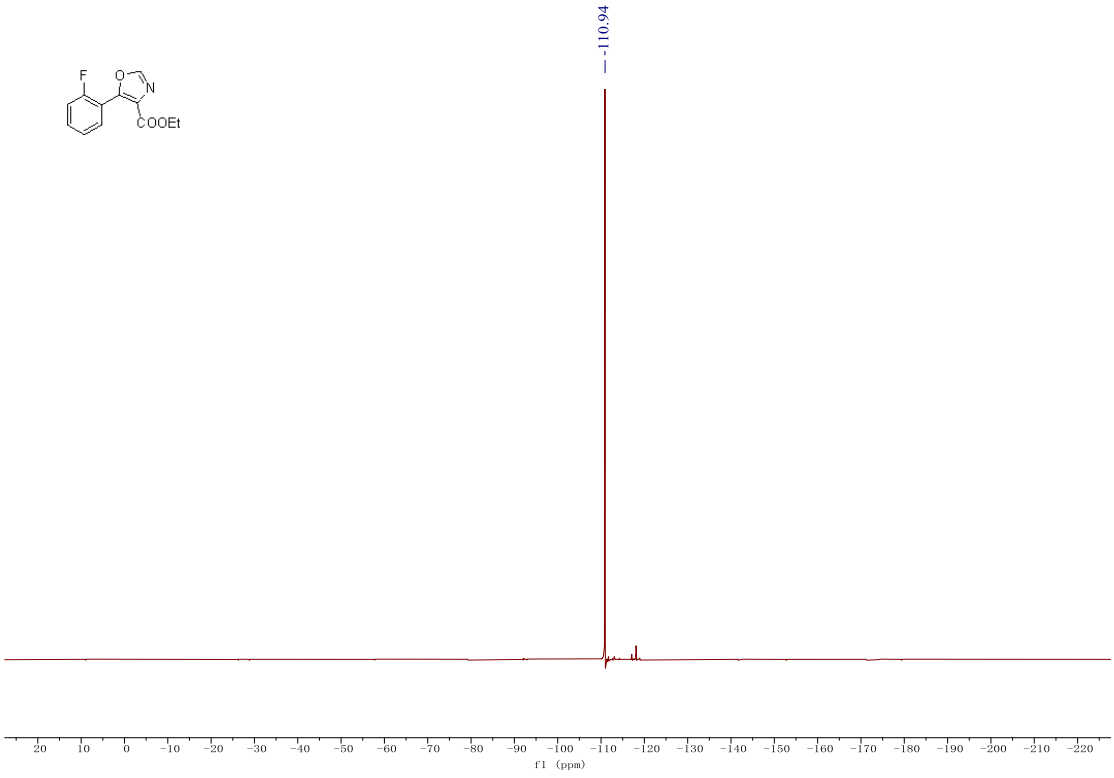




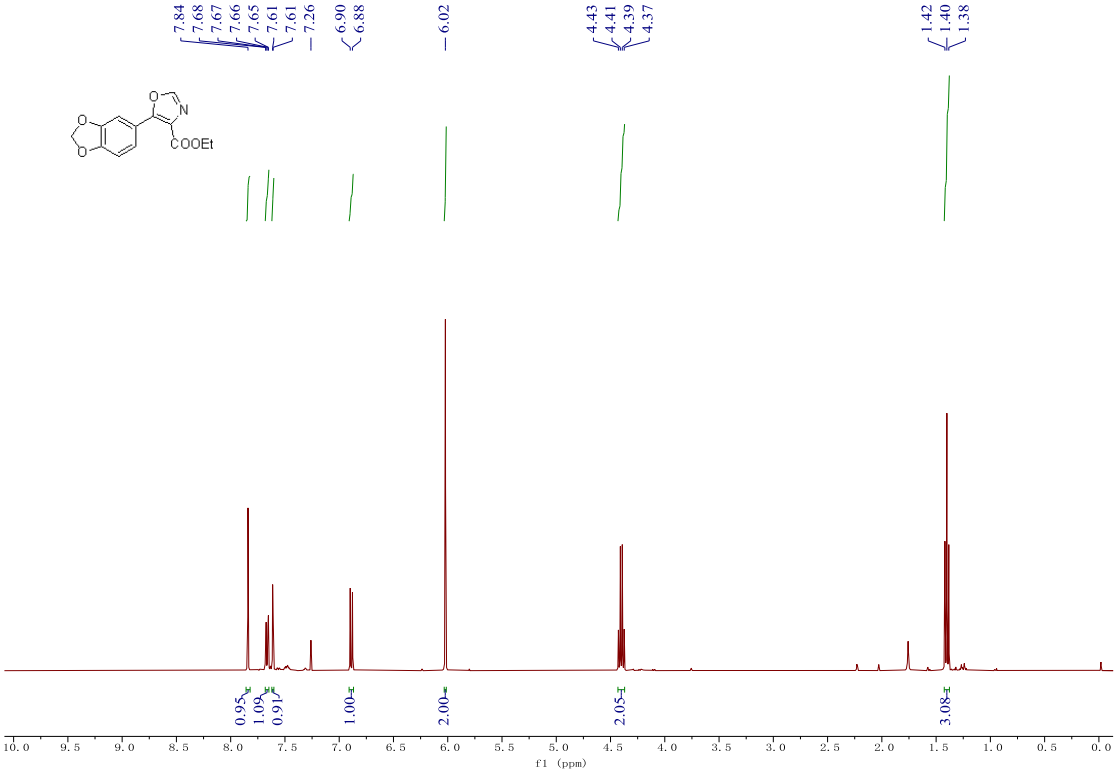
16c ^{1}H NMR, ^{13}C NMR and ^{19}F NMR

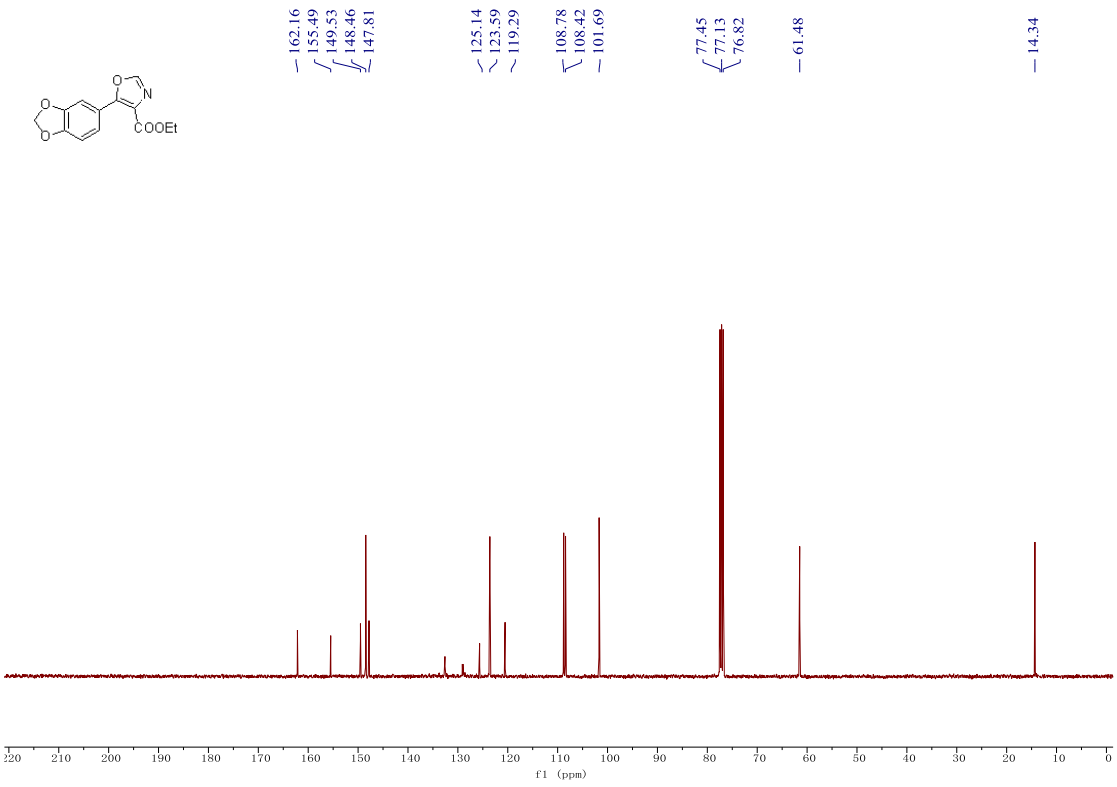




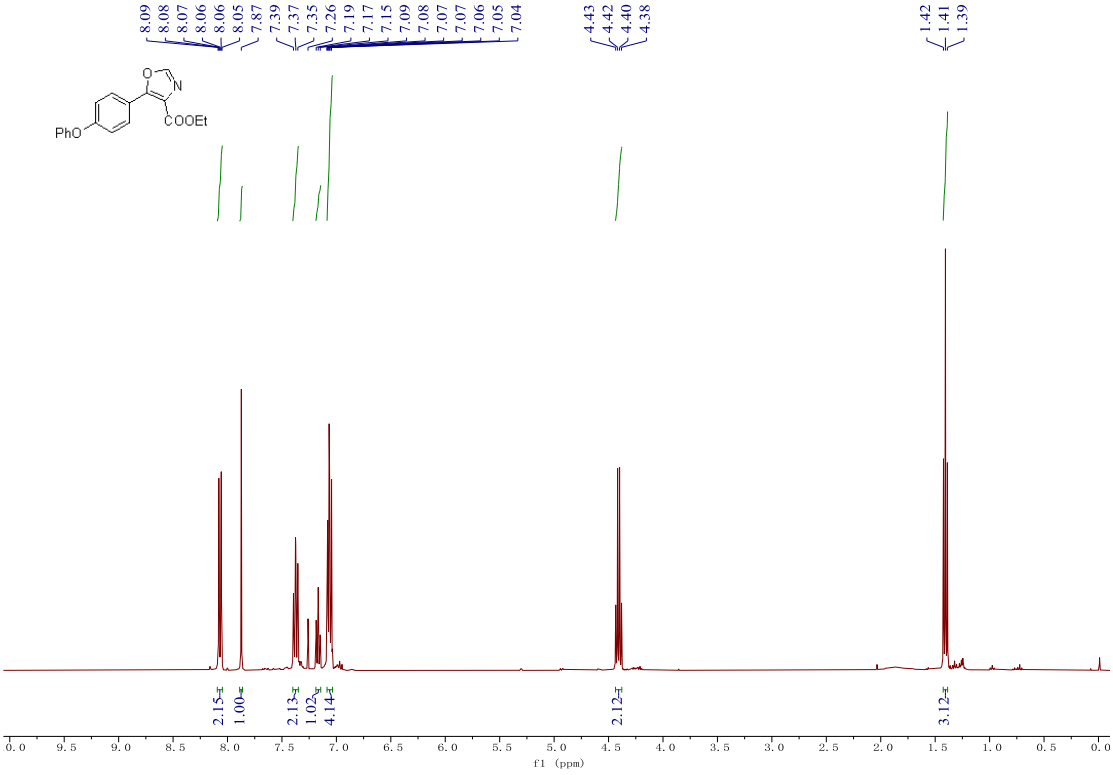

F
O
N
COOEt
-110.94
20 10 0 -10 -20 -30 -40 -50 -60 -70 -80 -90 -100 -110 -120 -130 -140 -150 -160 -170 -180 -190 -200 -210 -220
f1 (ppm)

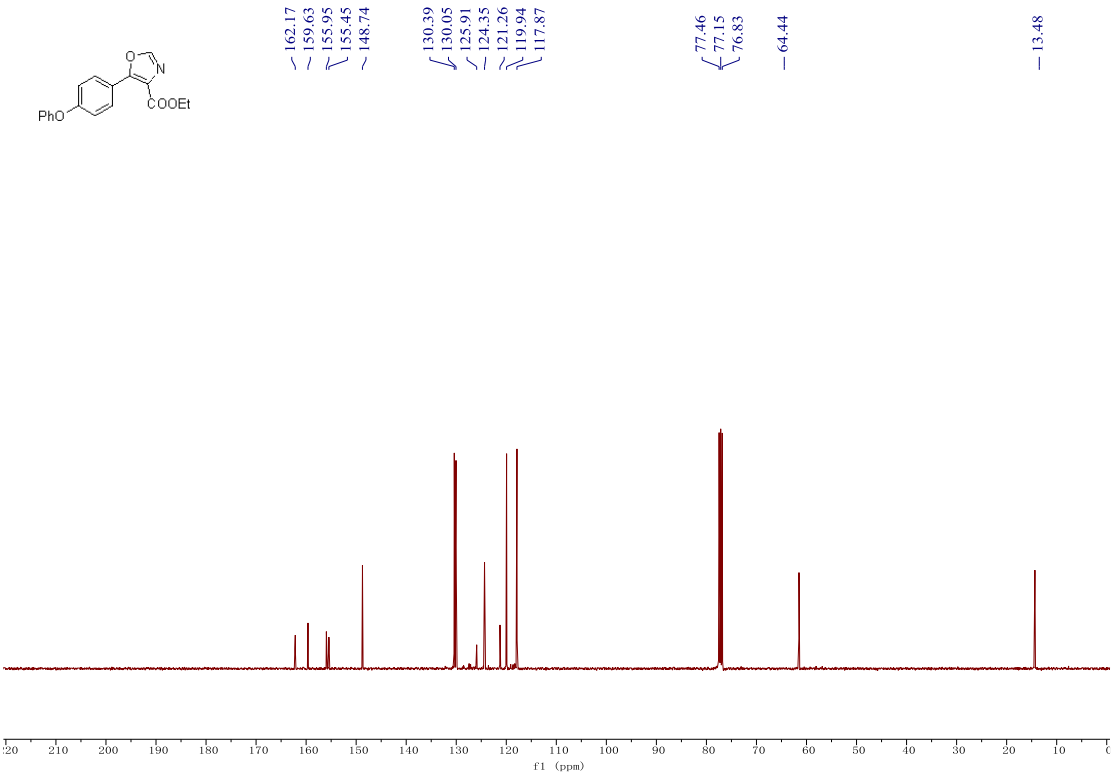
17c ^{1}H NMR and ^{13}C NMR



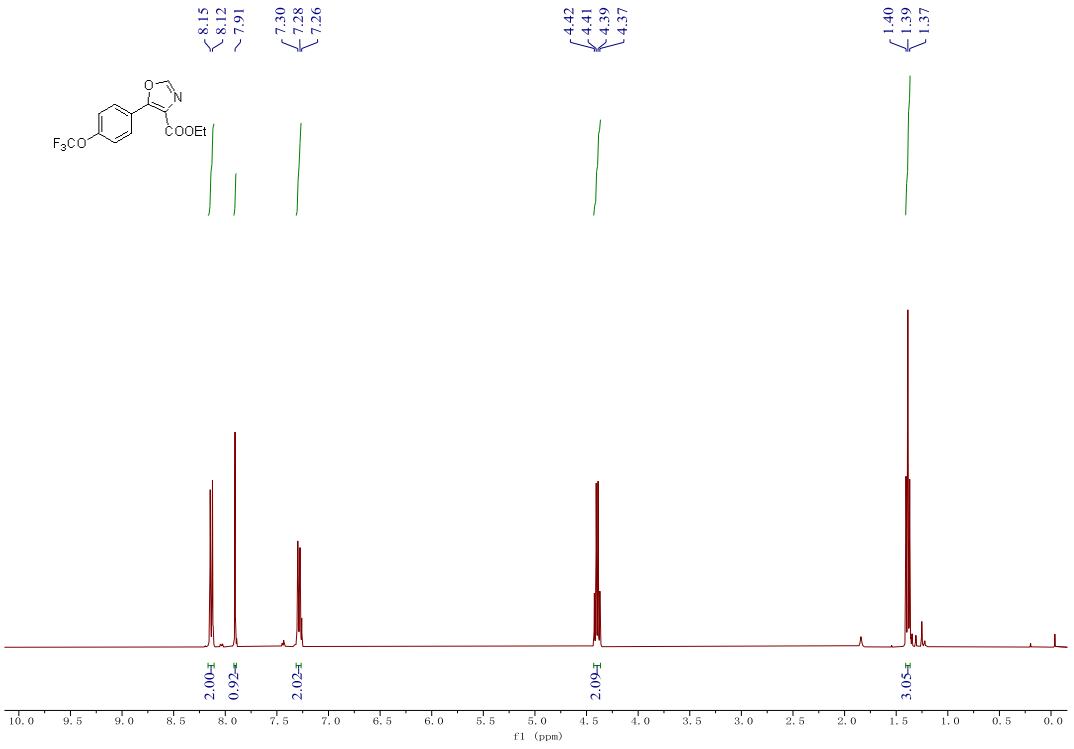


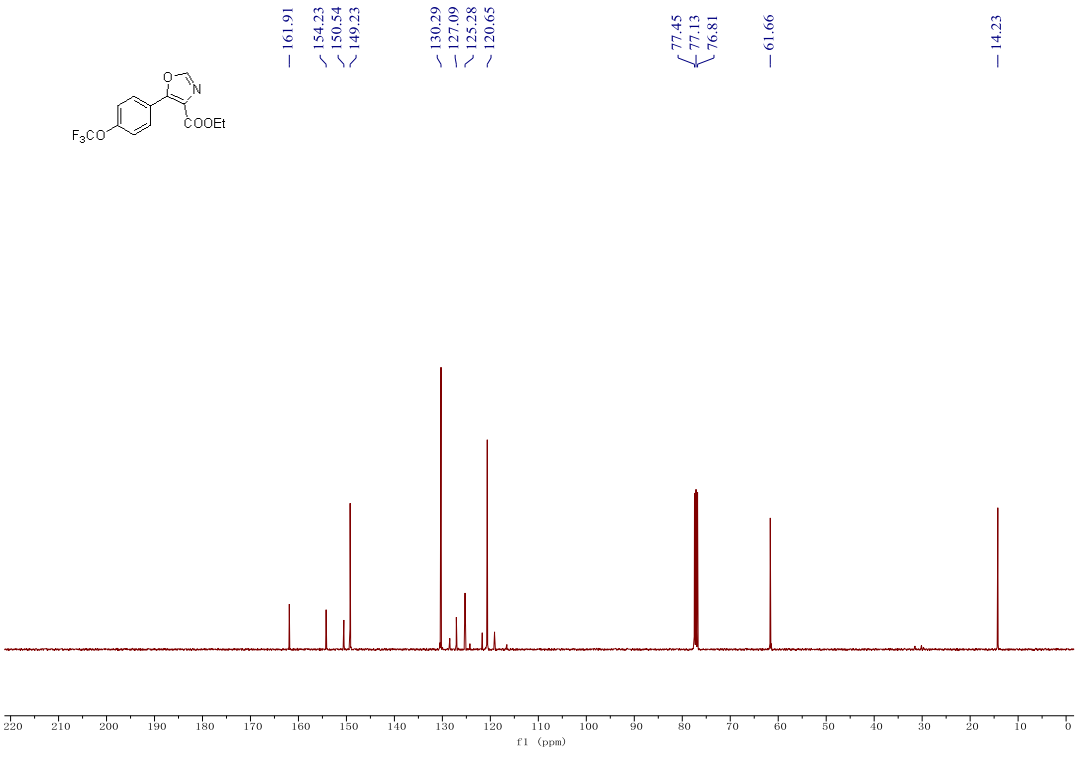
18c ^{1}H NMR and ^{13}C NMR

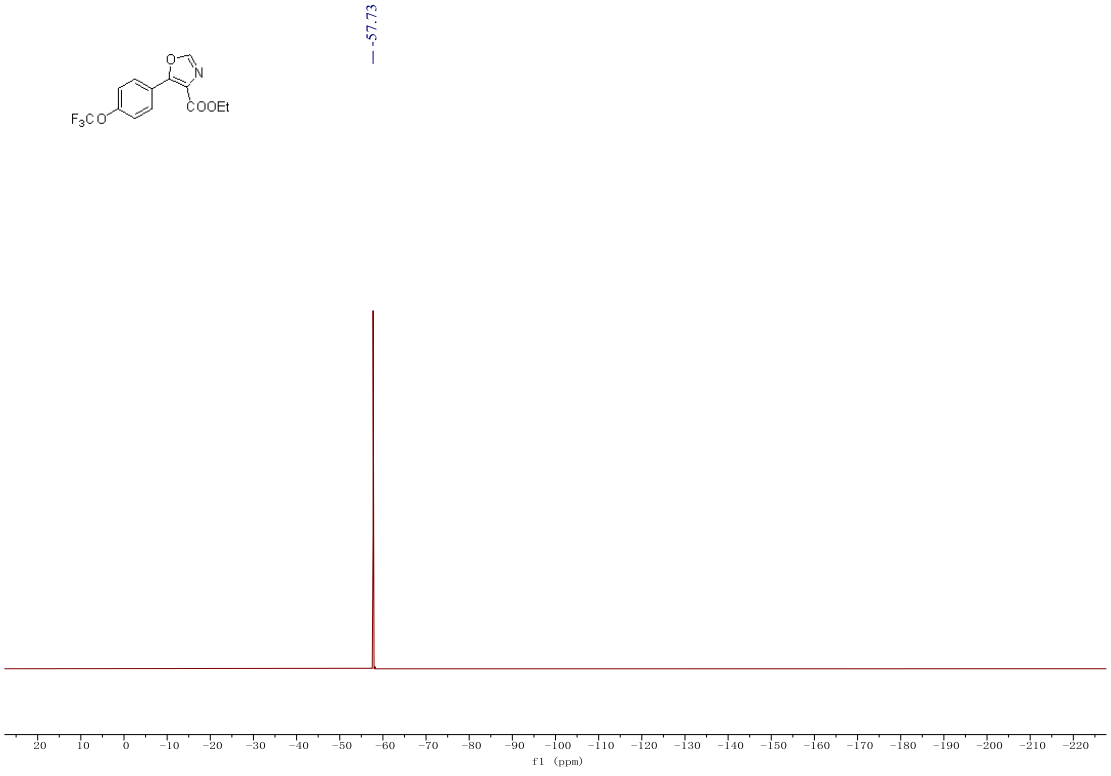




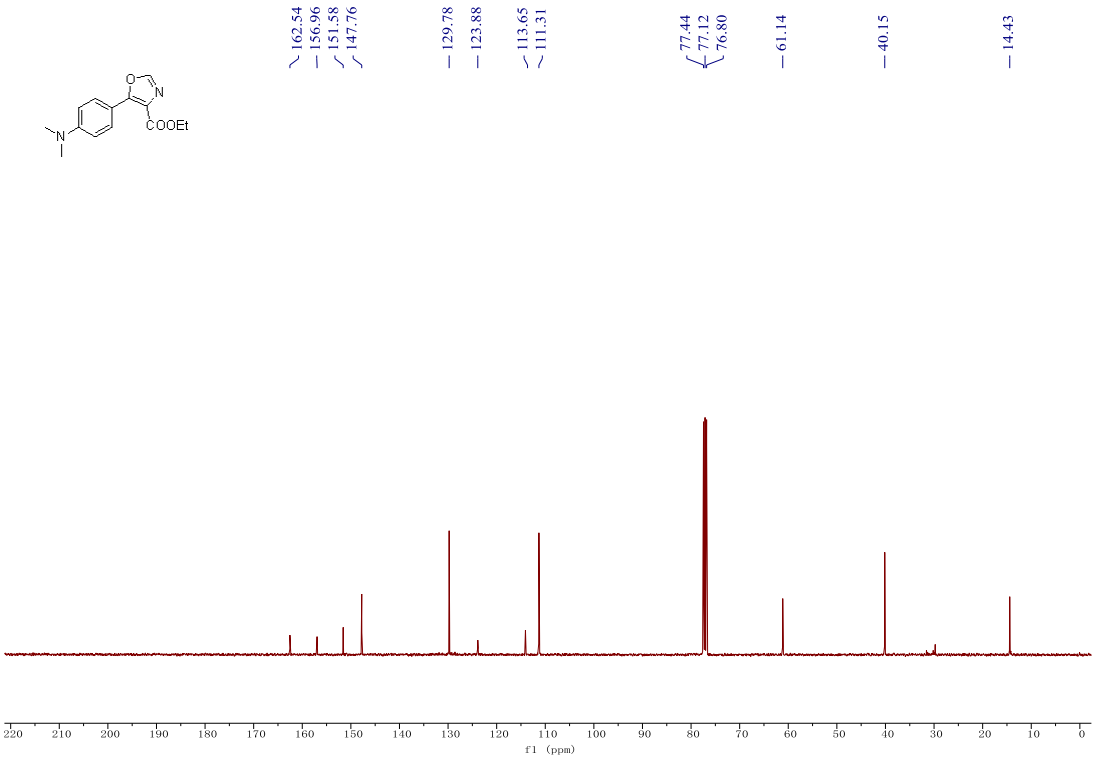
19c ^{1}H NMR, ^{13}C NMR and ^{19}F NMR

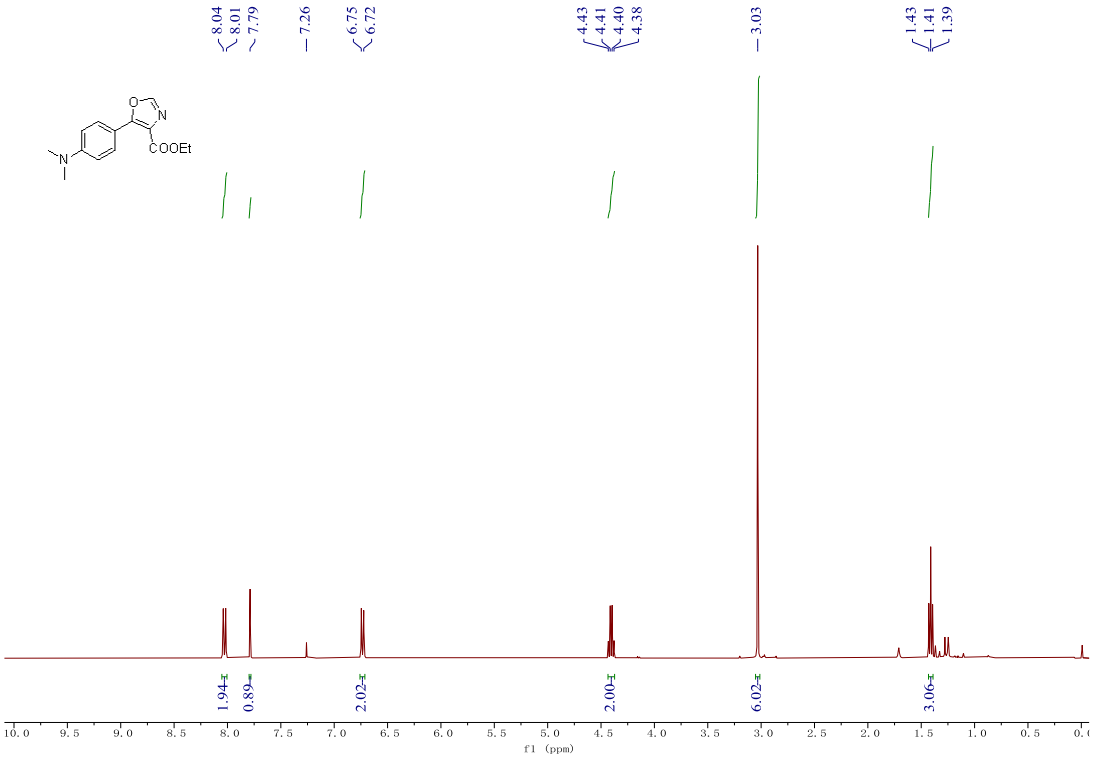




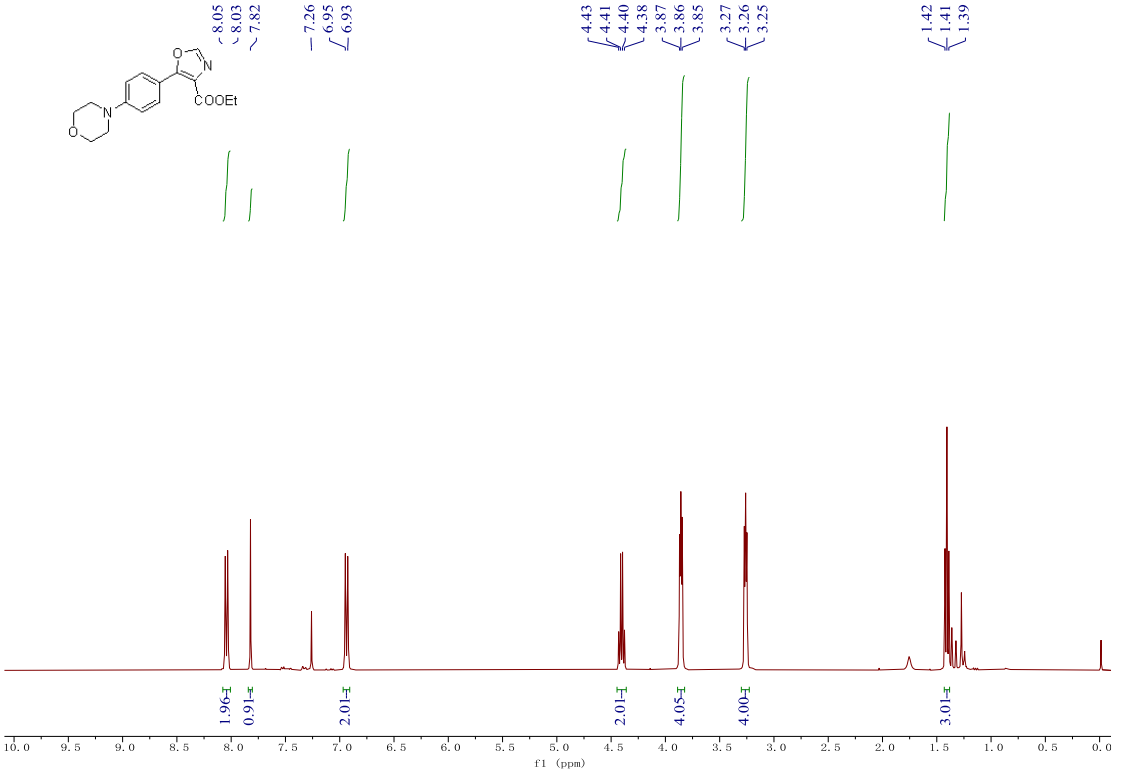

-57.73
O
N
COOEt
F3CO
20 10 0 −10 −20 −30 −40 −50 −60 −70 −80 −90 −100 −110 −120 −130 −140 −150 −160 −170 −180 −190 −200 −210 −220
f1 (ppm)

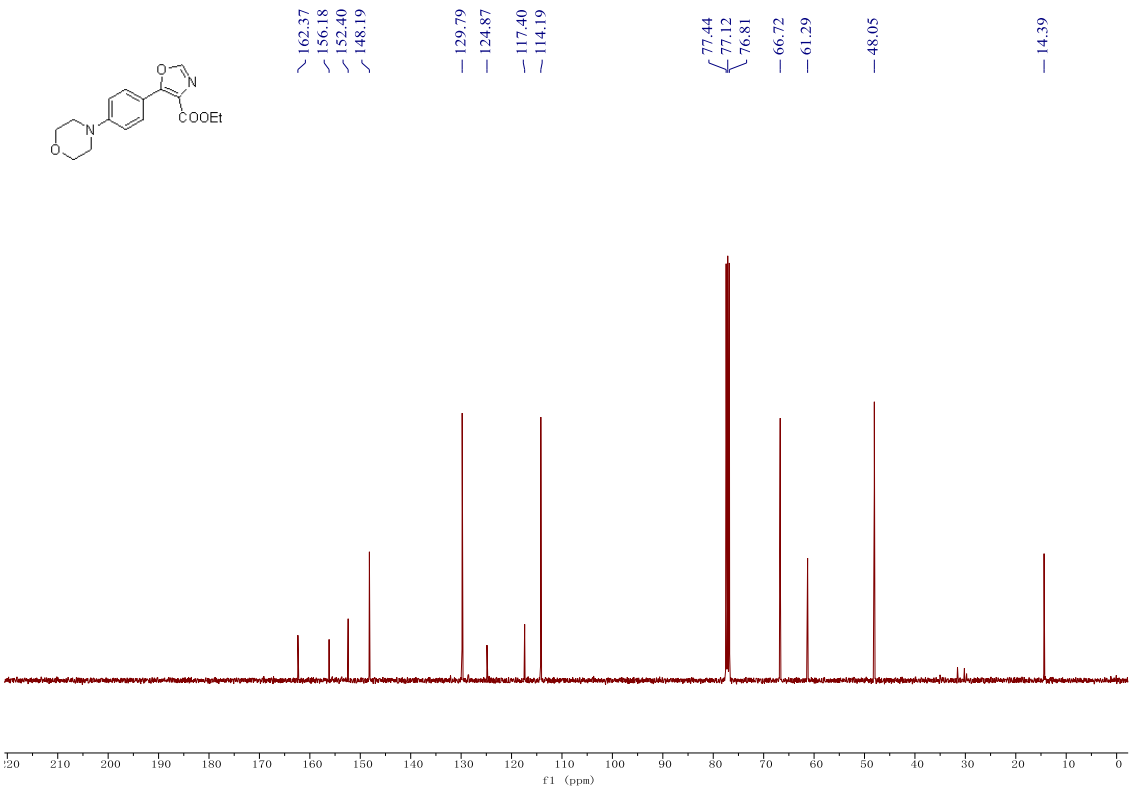
20c ^{1}H NMR and ^{13}C NMR



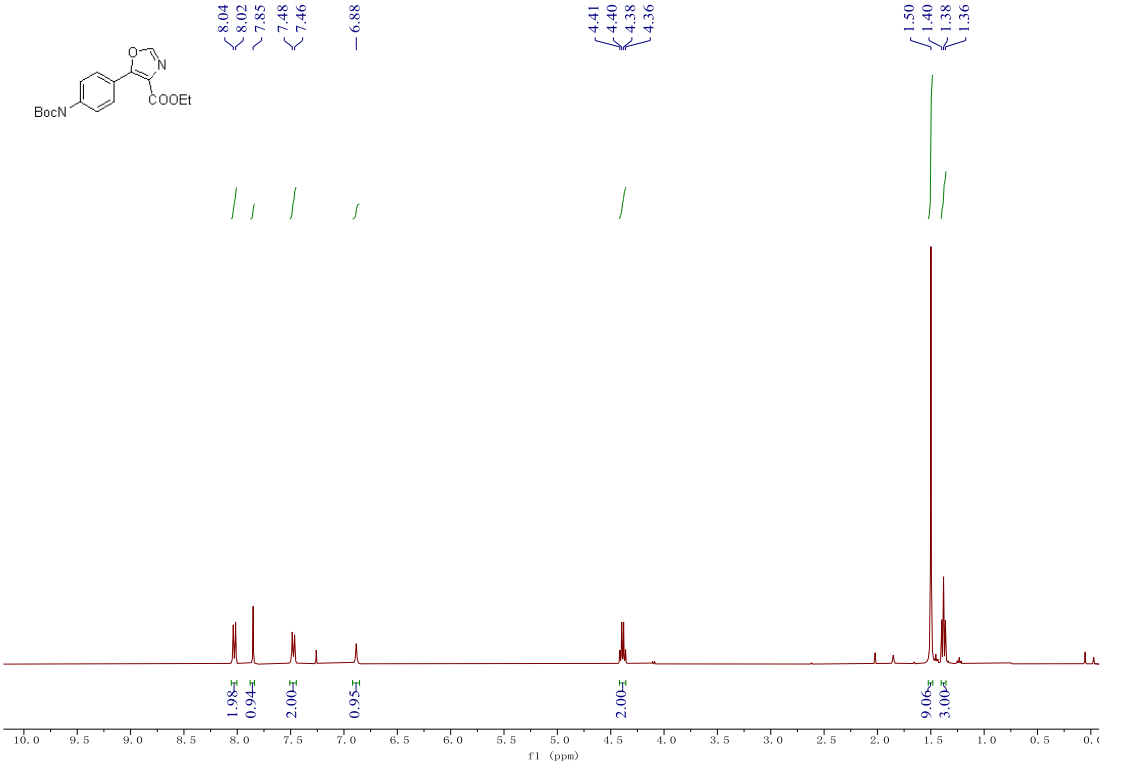


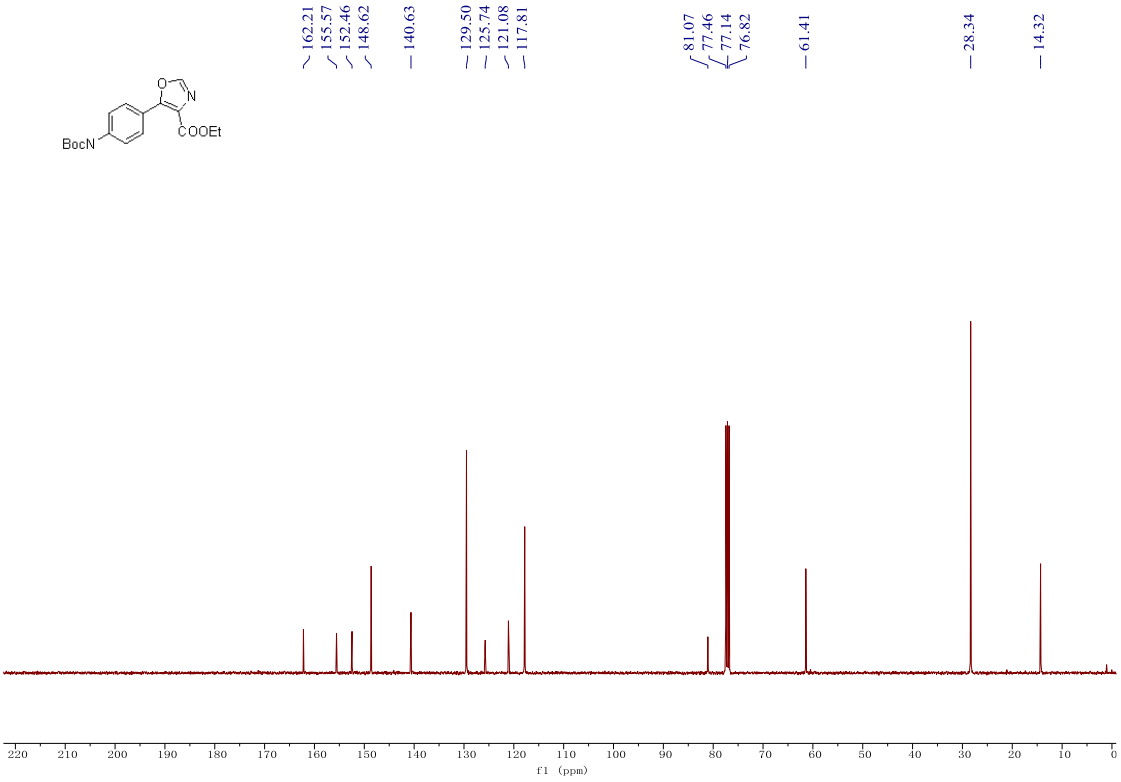
21c ^{1}H NMR and ^{13}C NMR



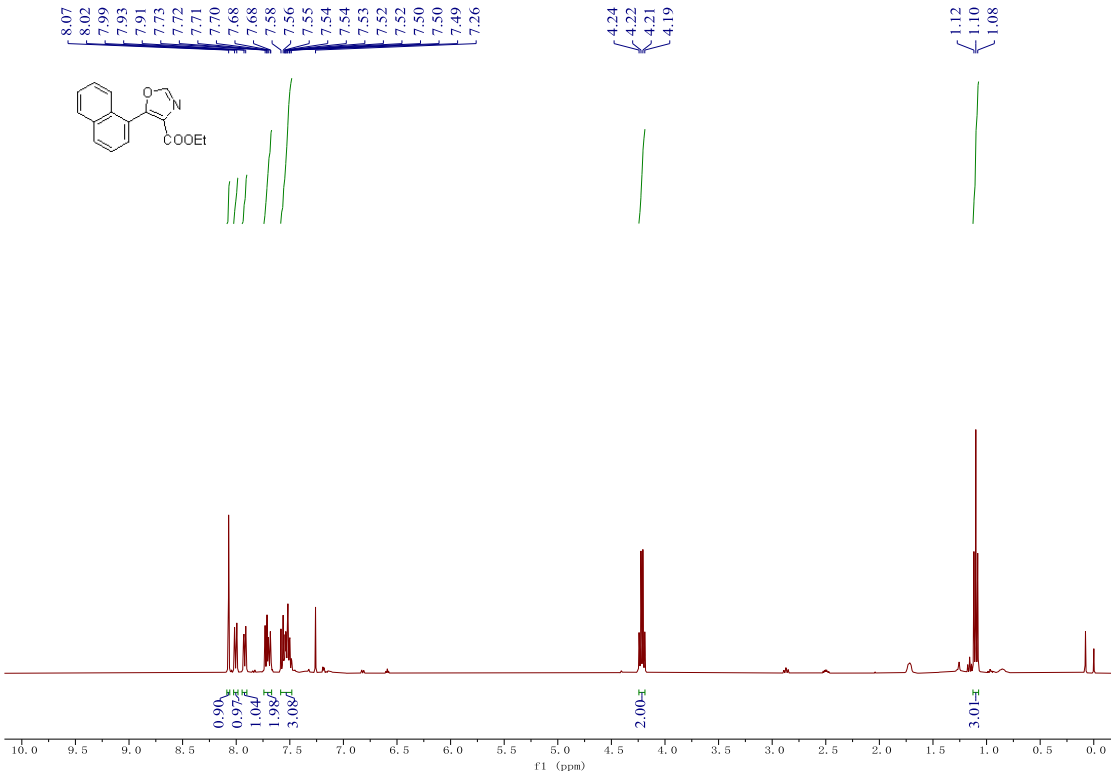


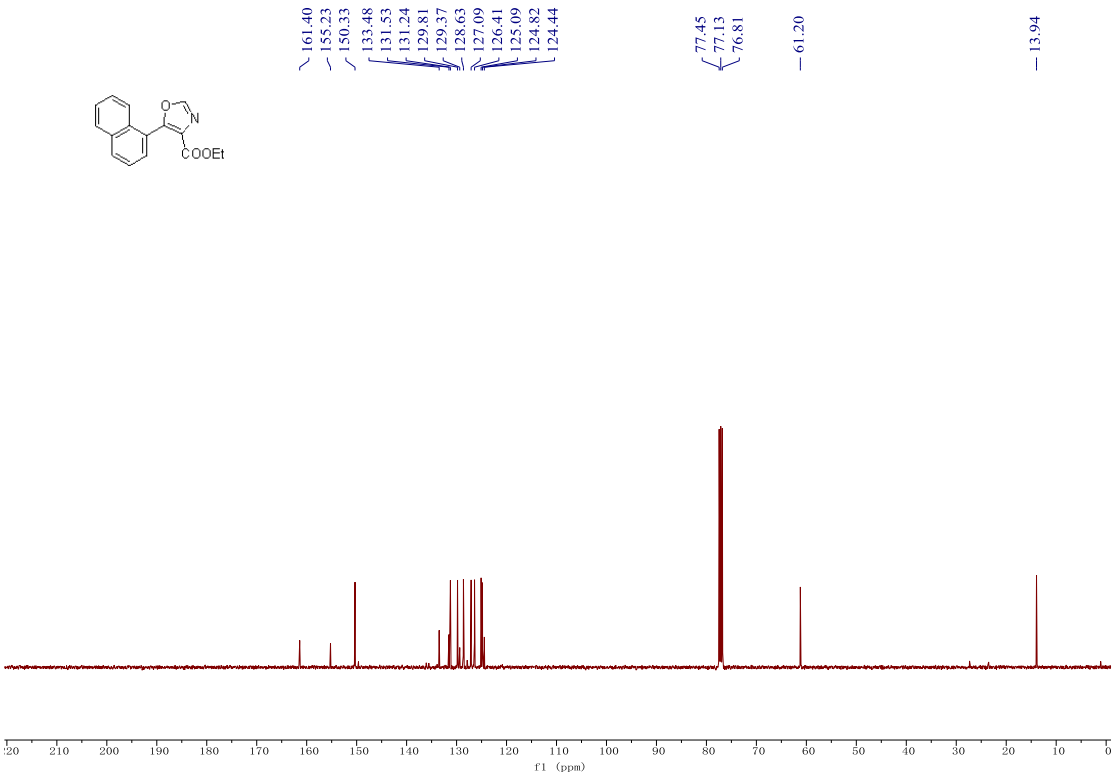
22c ^{1}H NMR and ^{13}C NMR



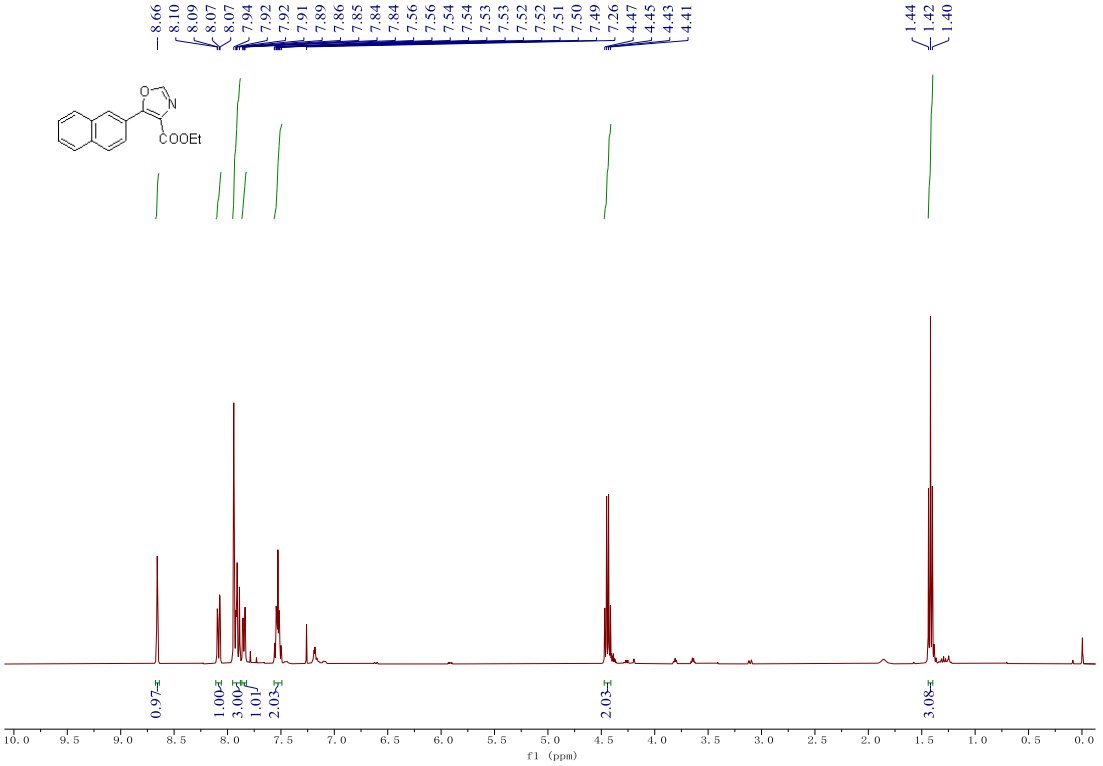


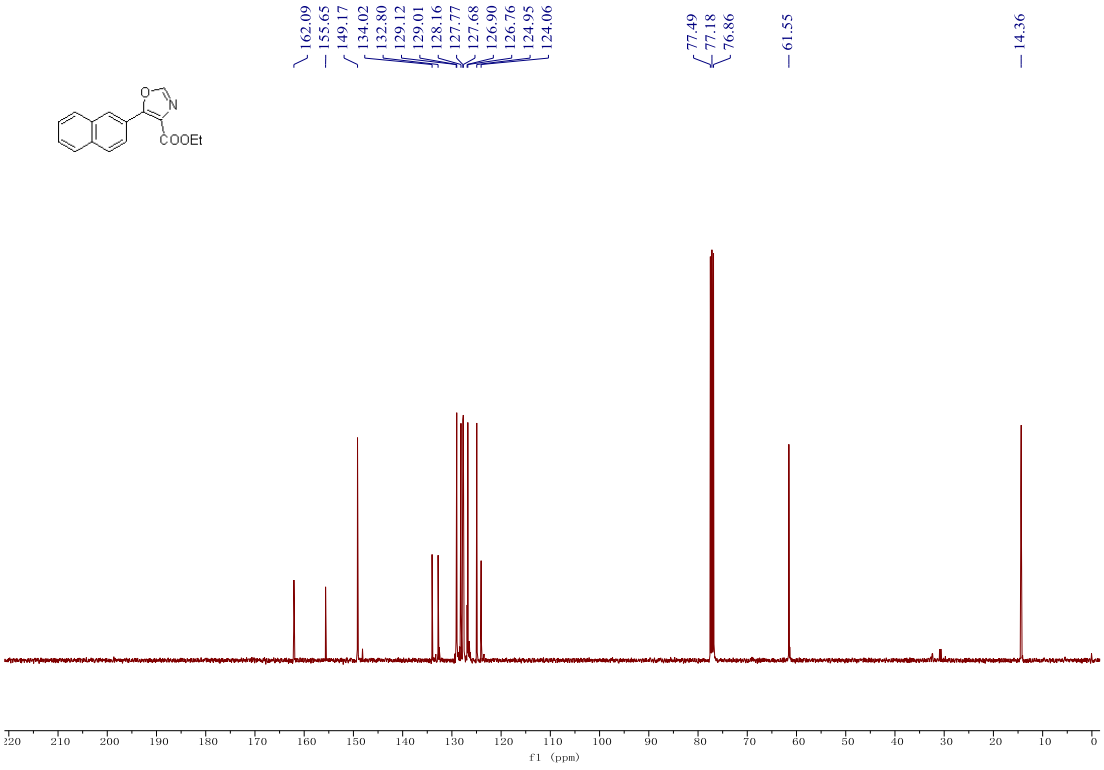
23c ^{1}H NMR and ^{13}C NMR



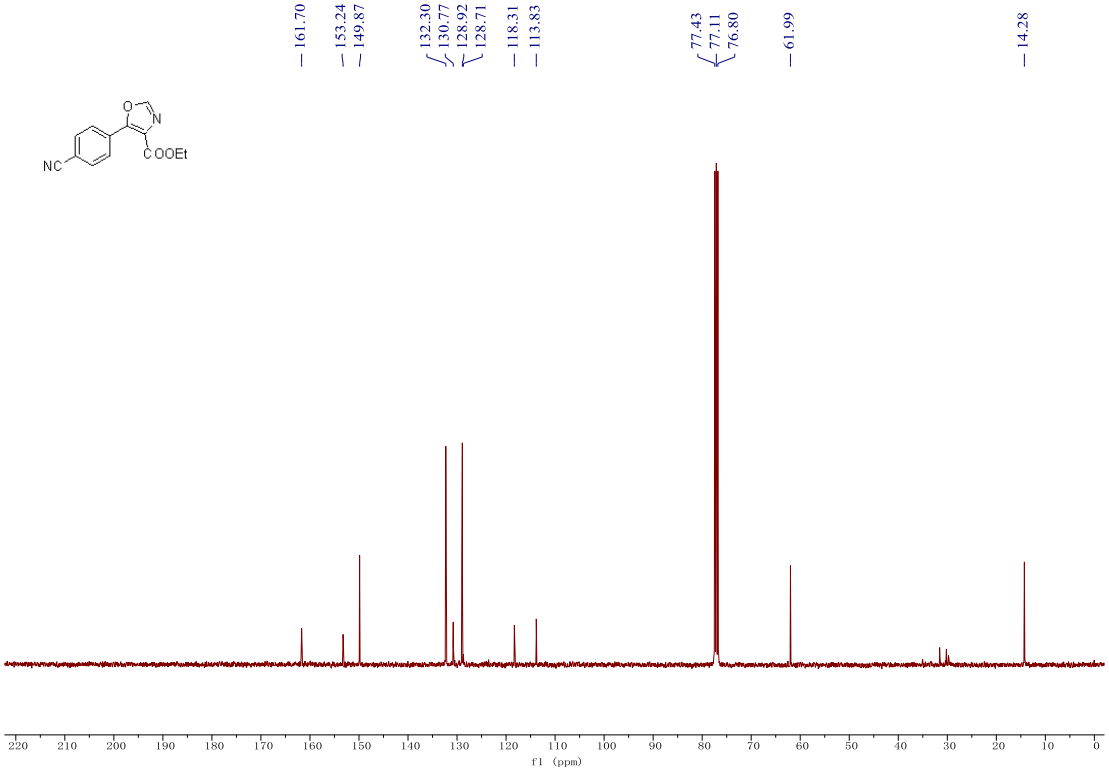


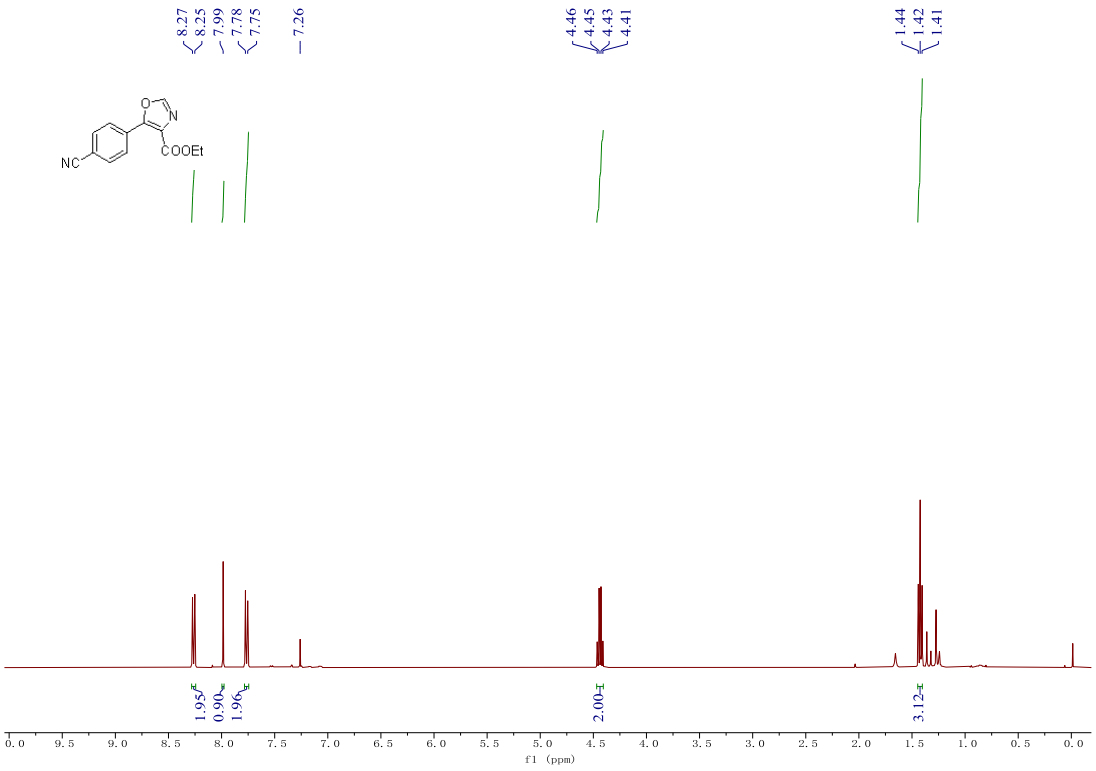
24c ^{1}H NMR and ^{13}C NMR



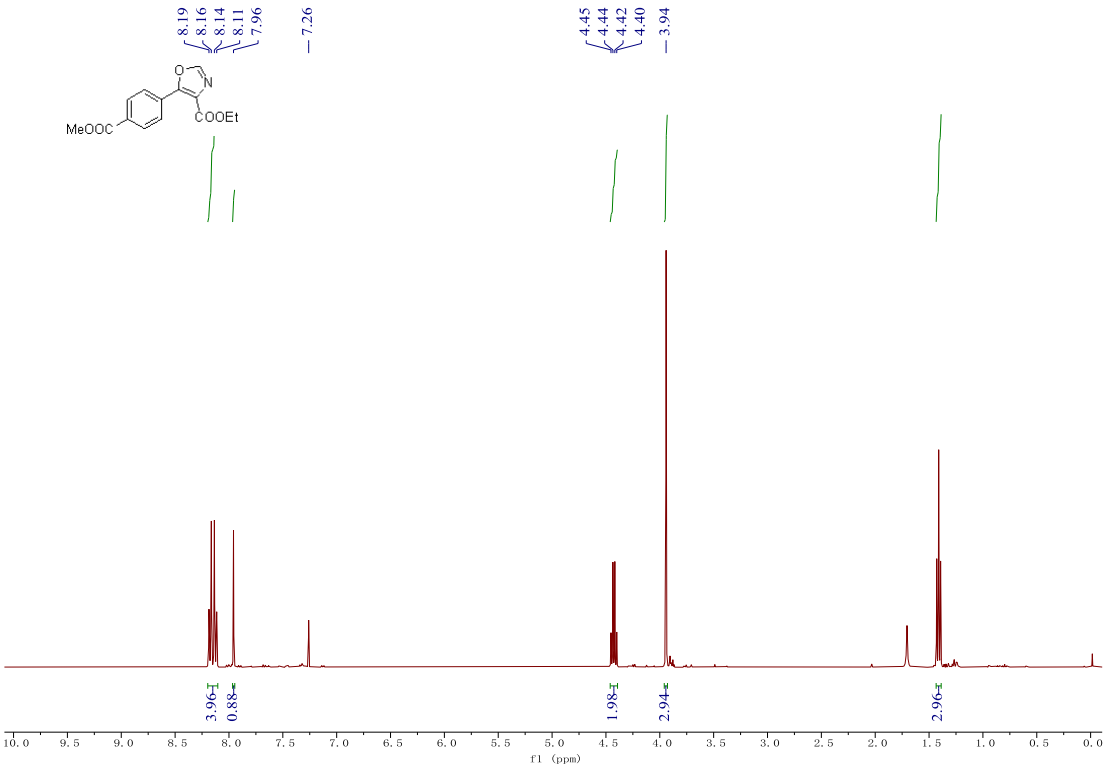


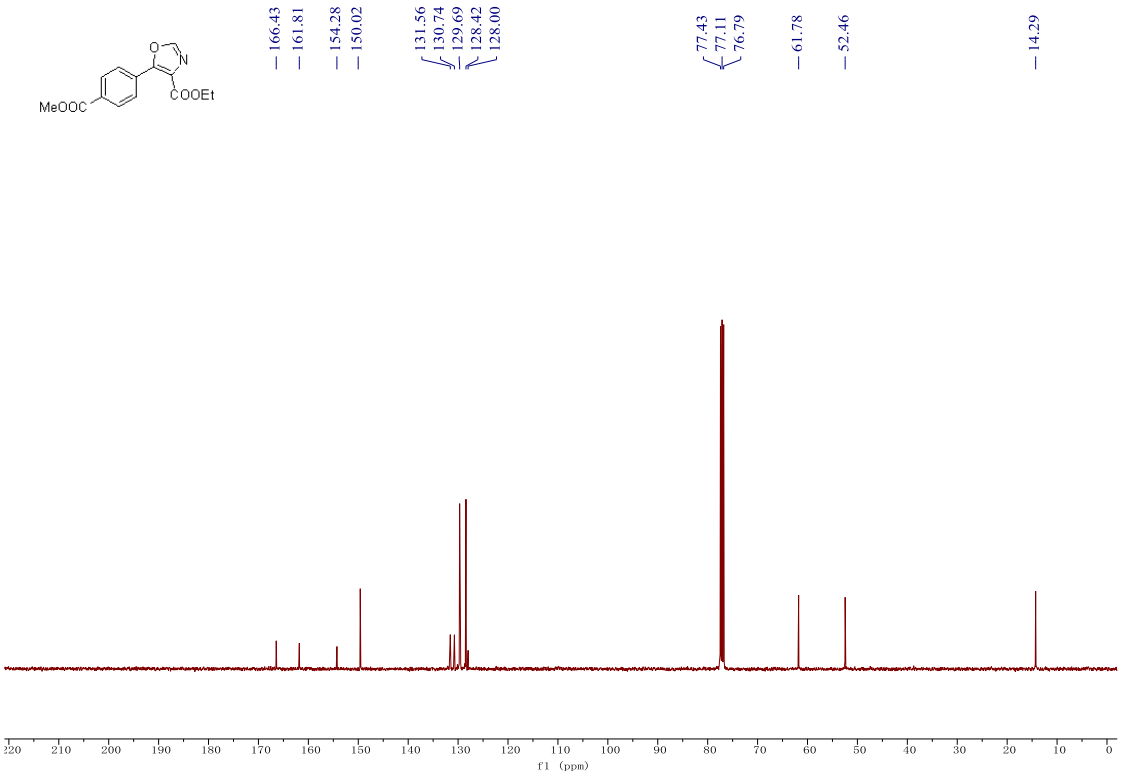
25c ^{1}H NMR and ^{13}C NMR



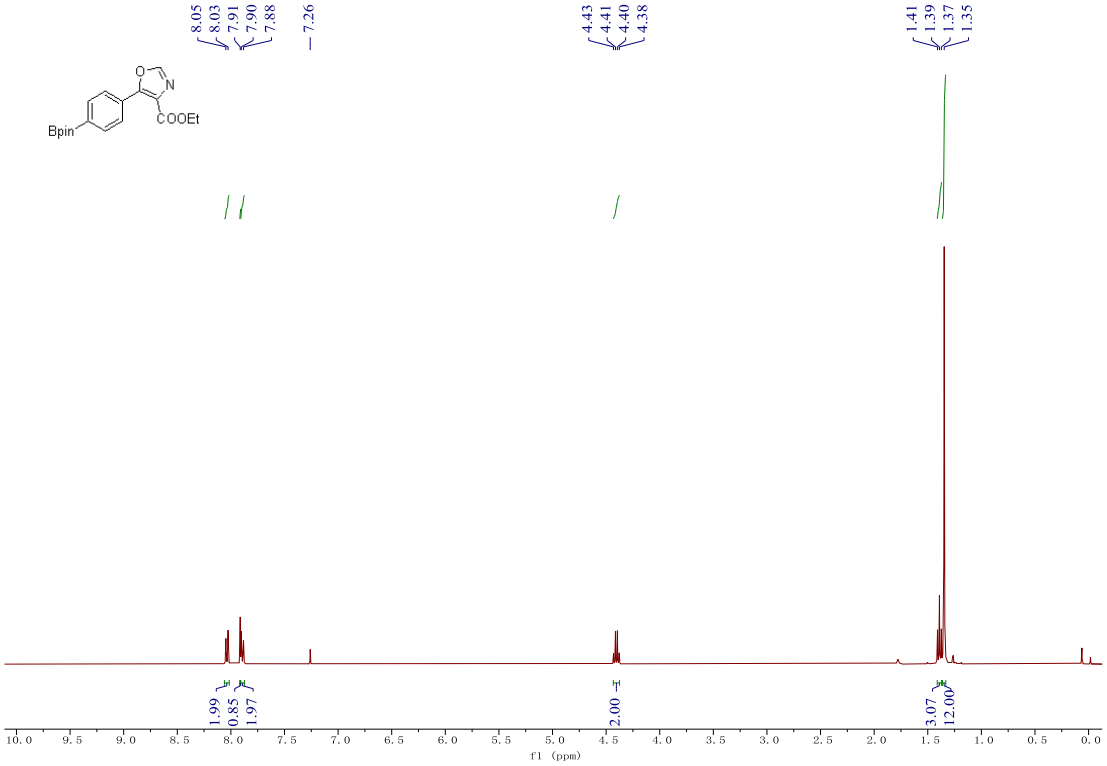


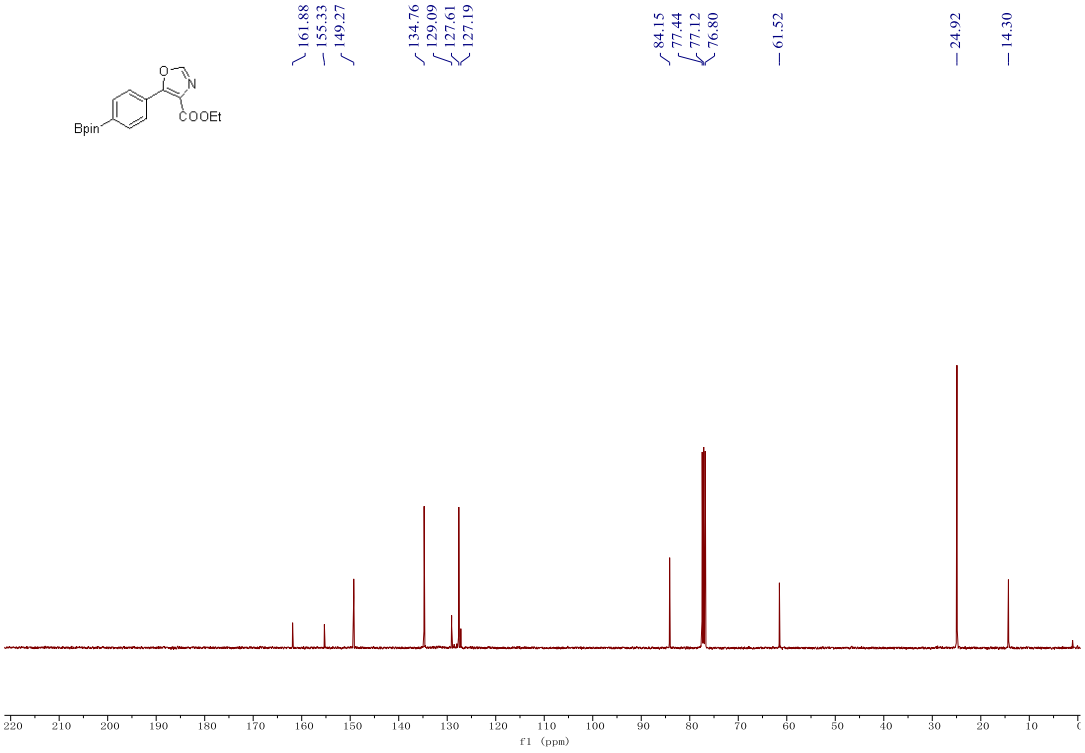
26c ^{1}H NMR and ^{13}C NMR



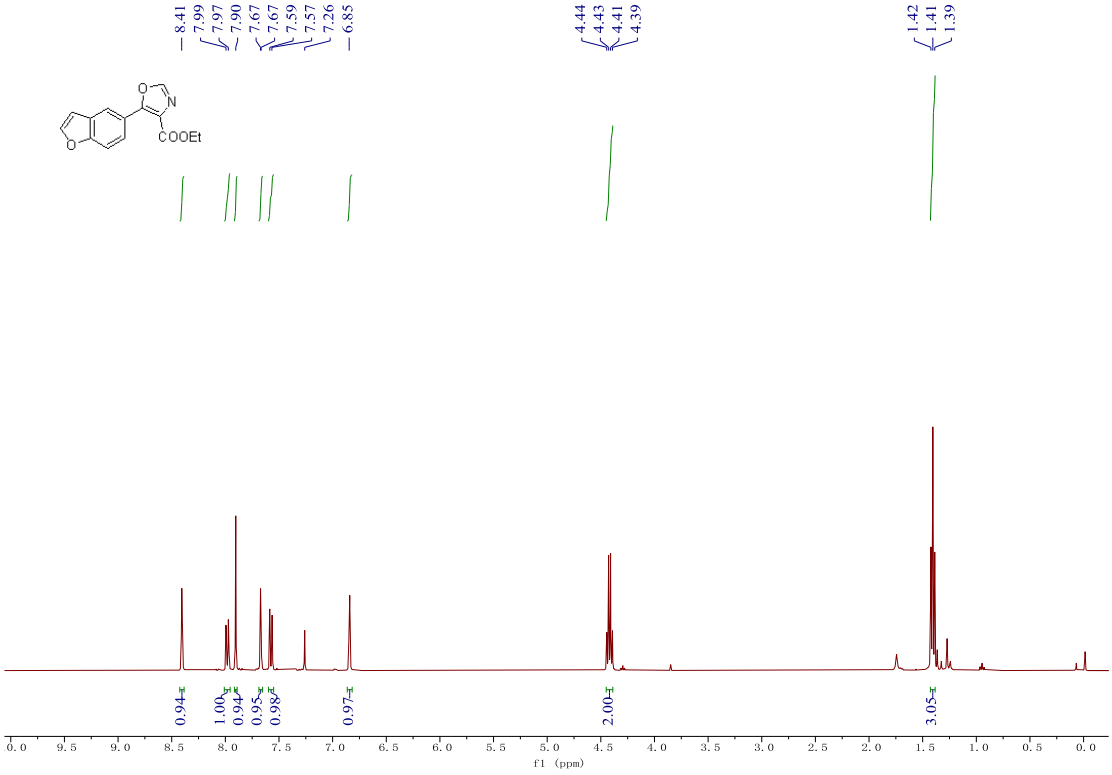


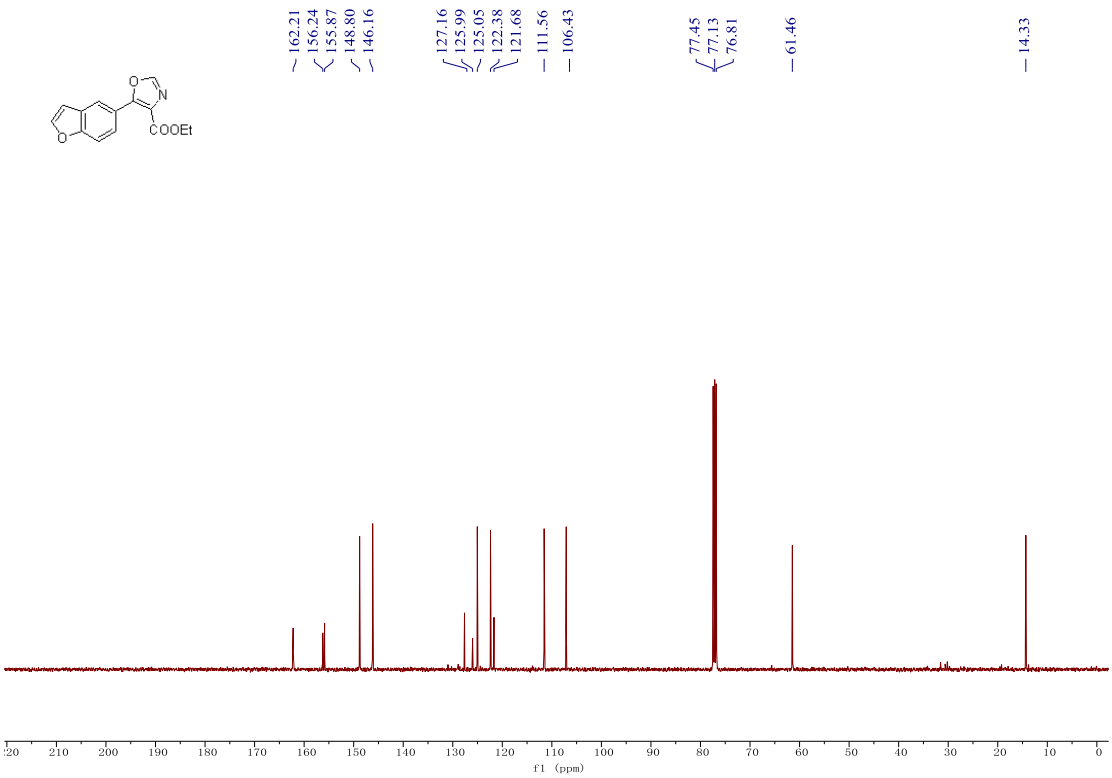
27c ^{1}H NMR and ^{13}C NMR



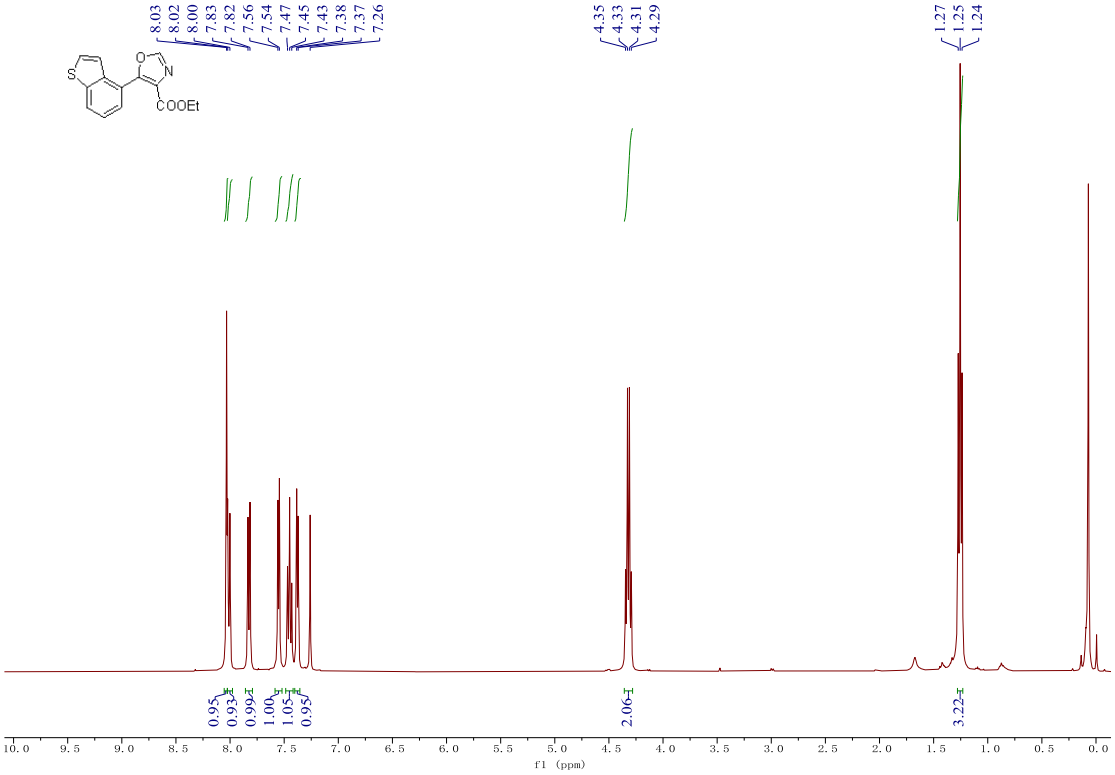


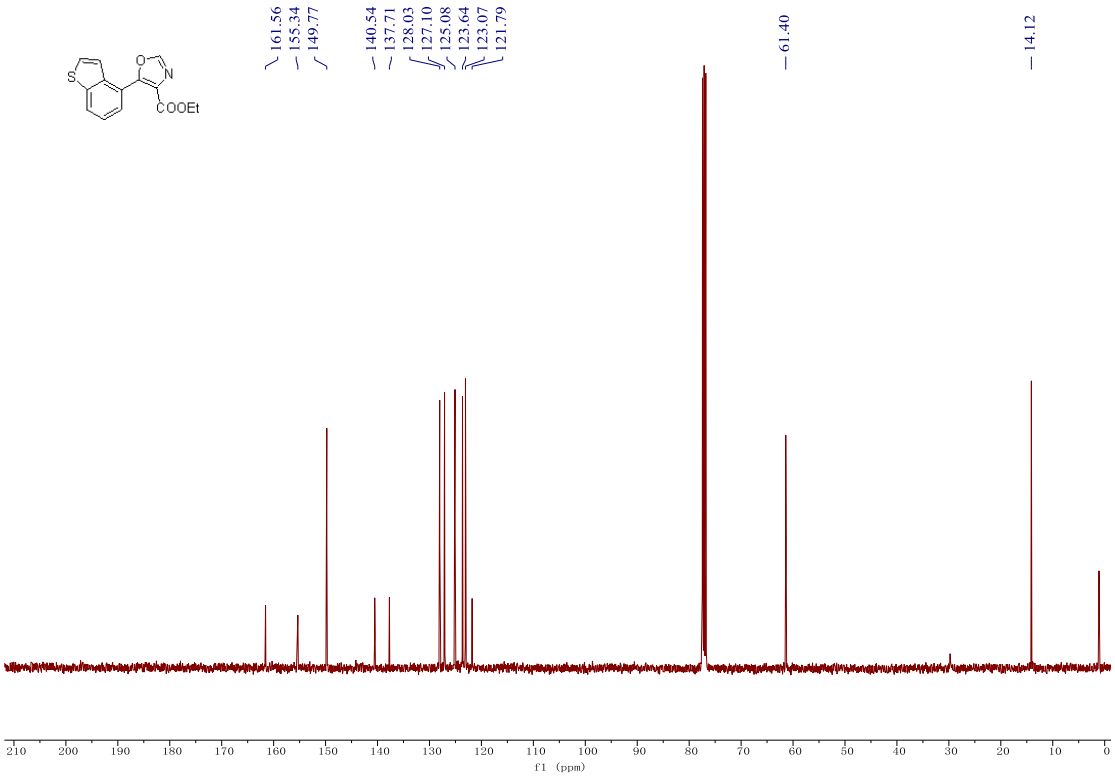
28c ^{1}H NMR and ^{13}C NMR



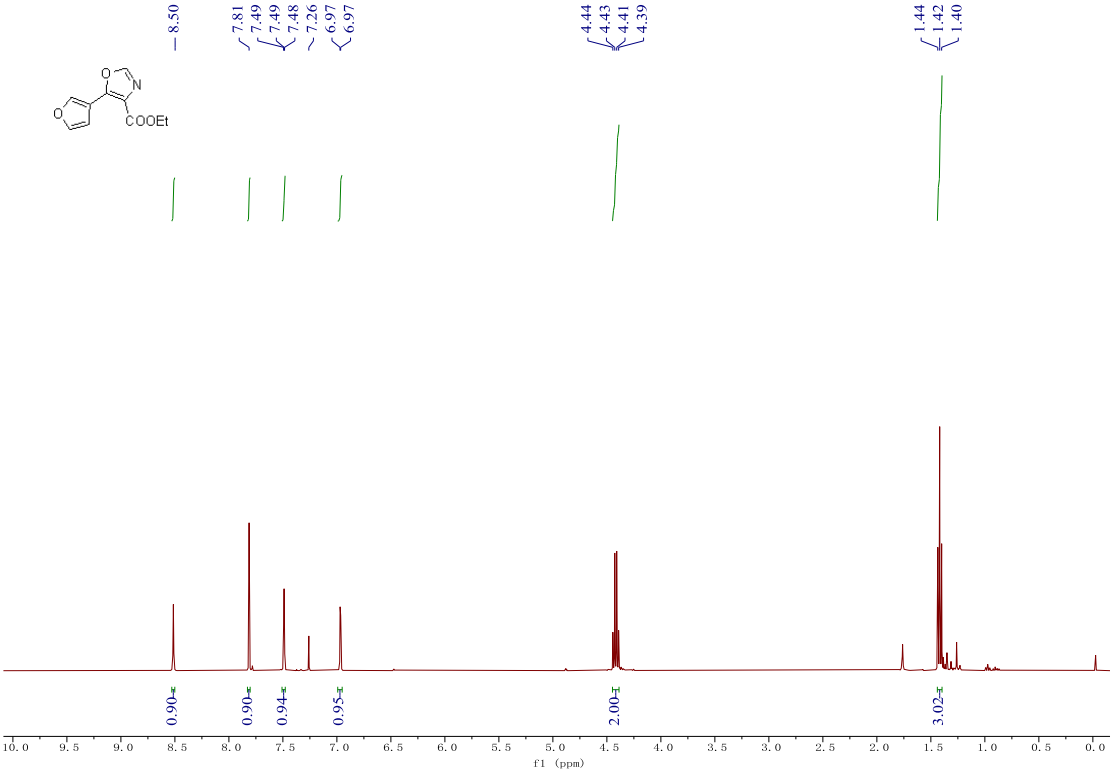


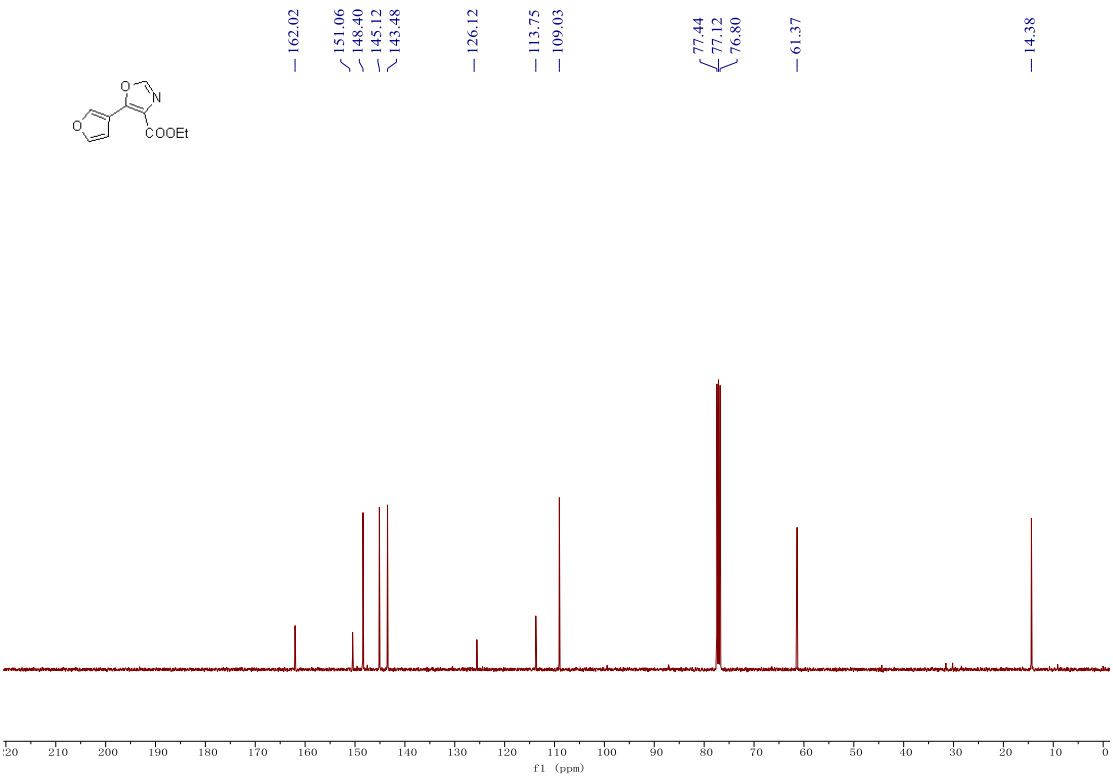
29c ^{1}H NMR and ^{13}C NMR



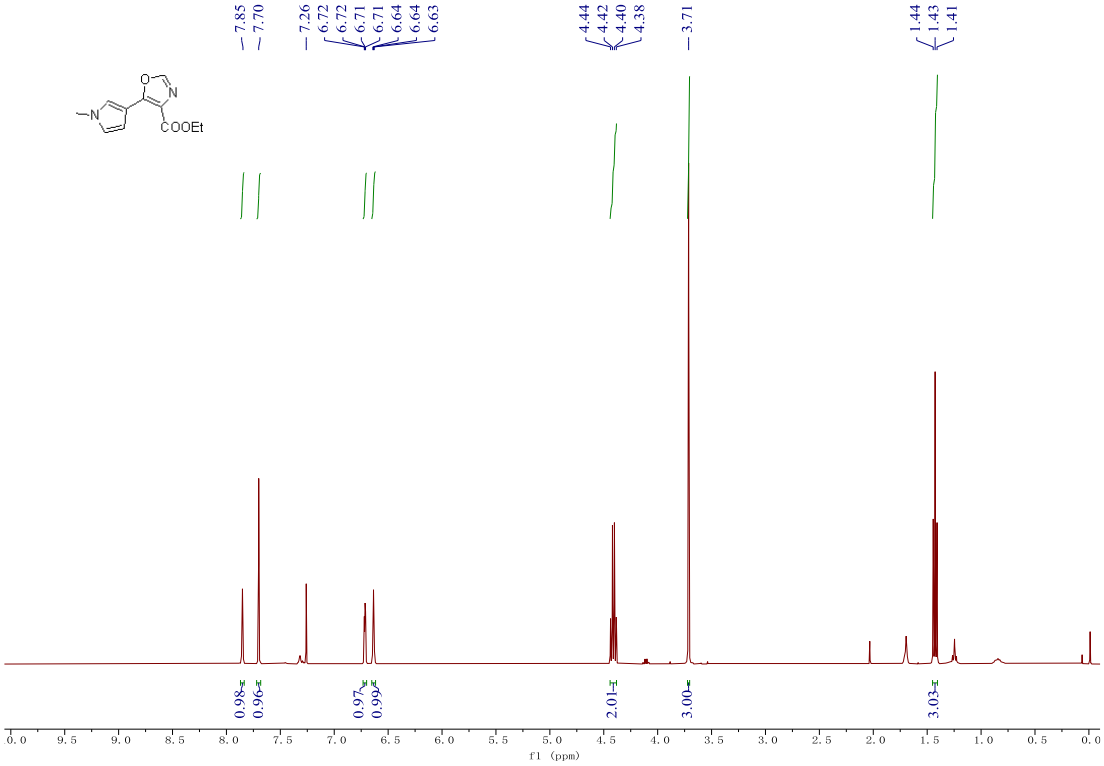


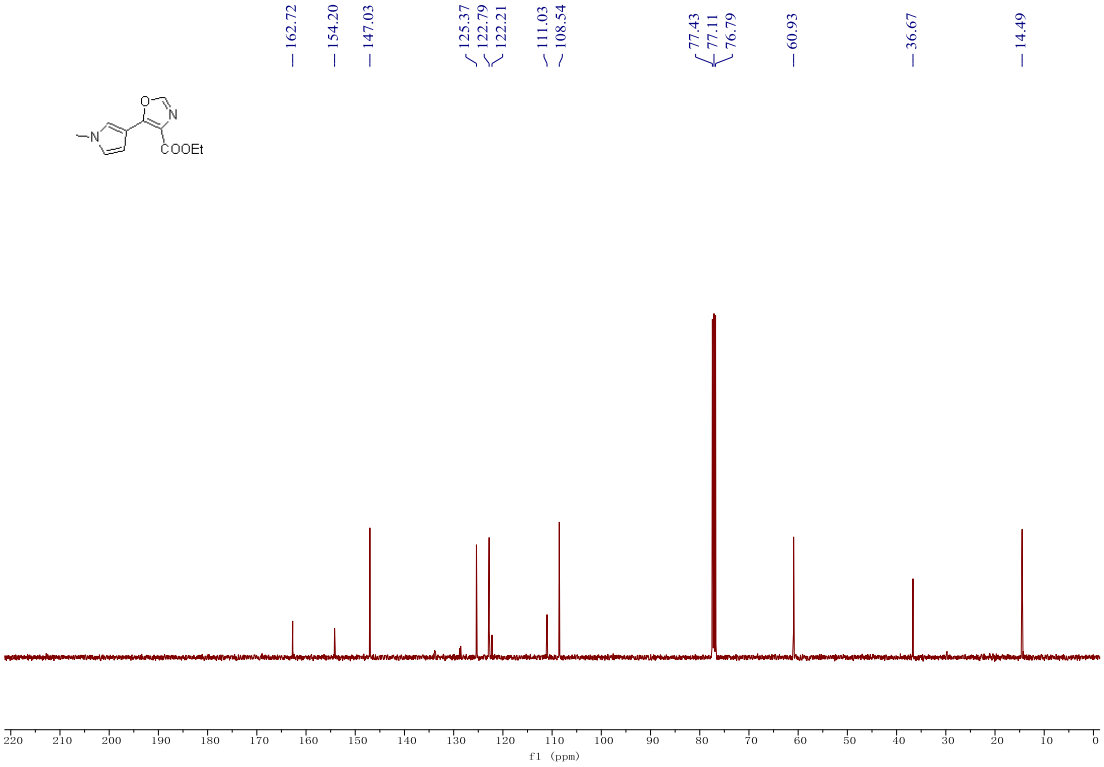
30c ^{1}H NMR and ^{13}C NMR



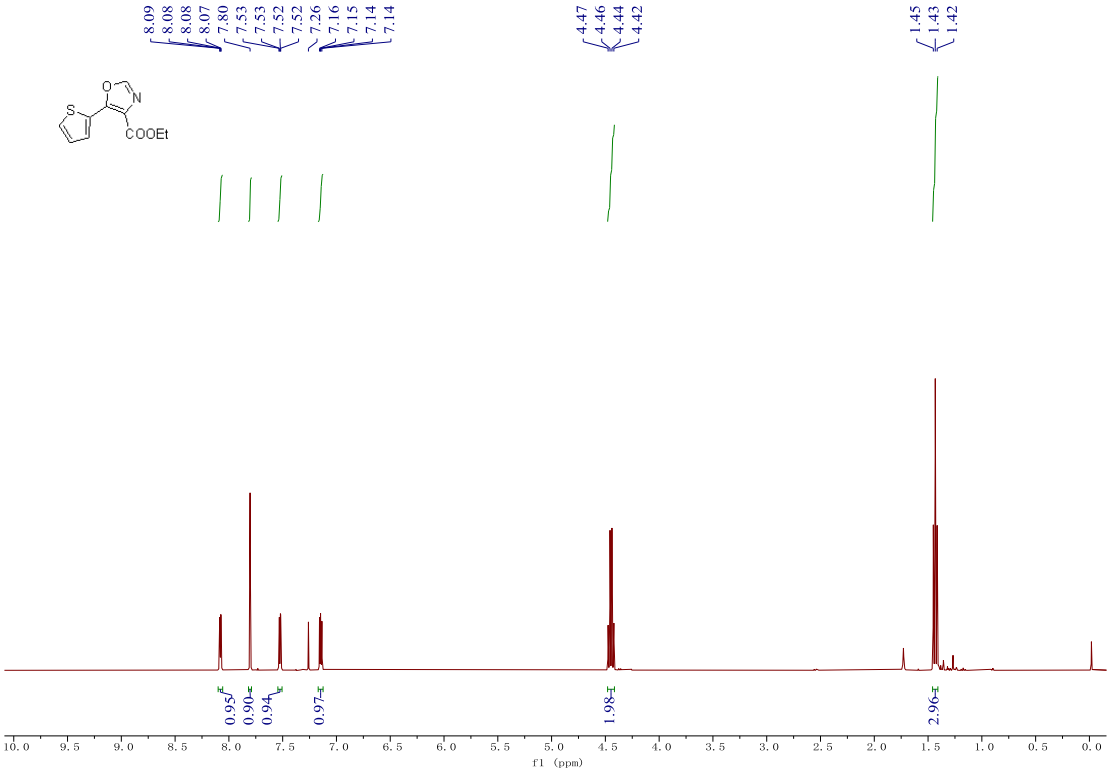


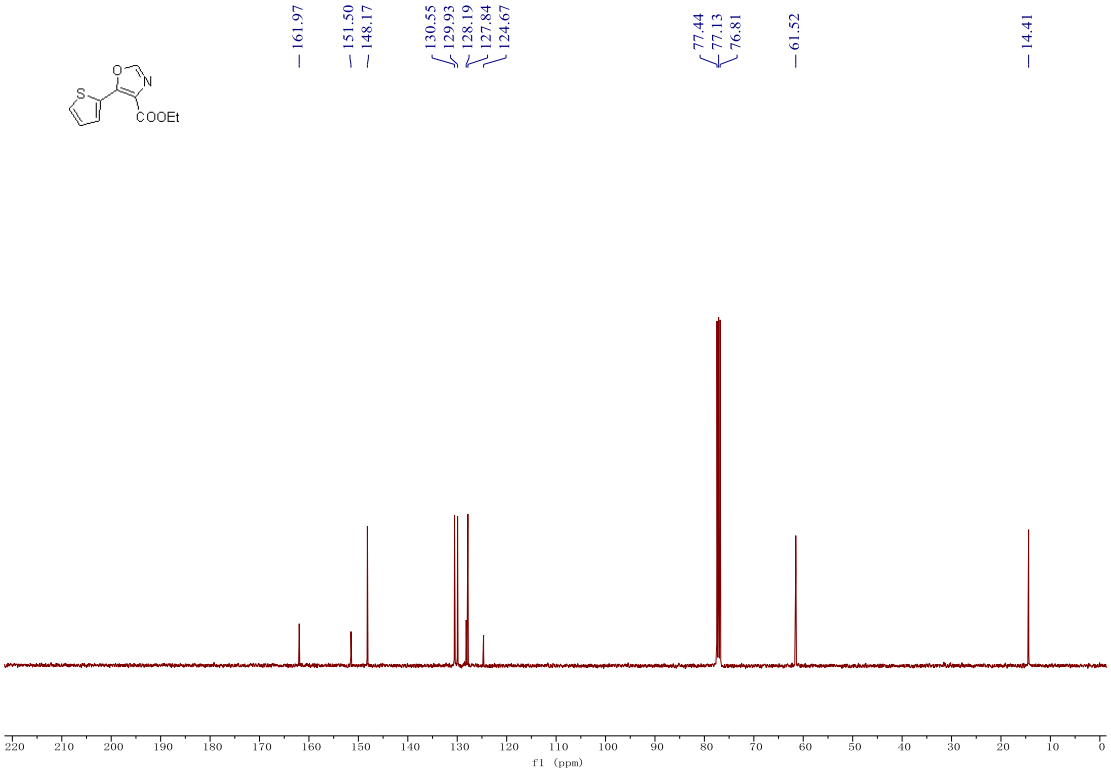
31c ^{1}H NMR and ^{13}C NMR



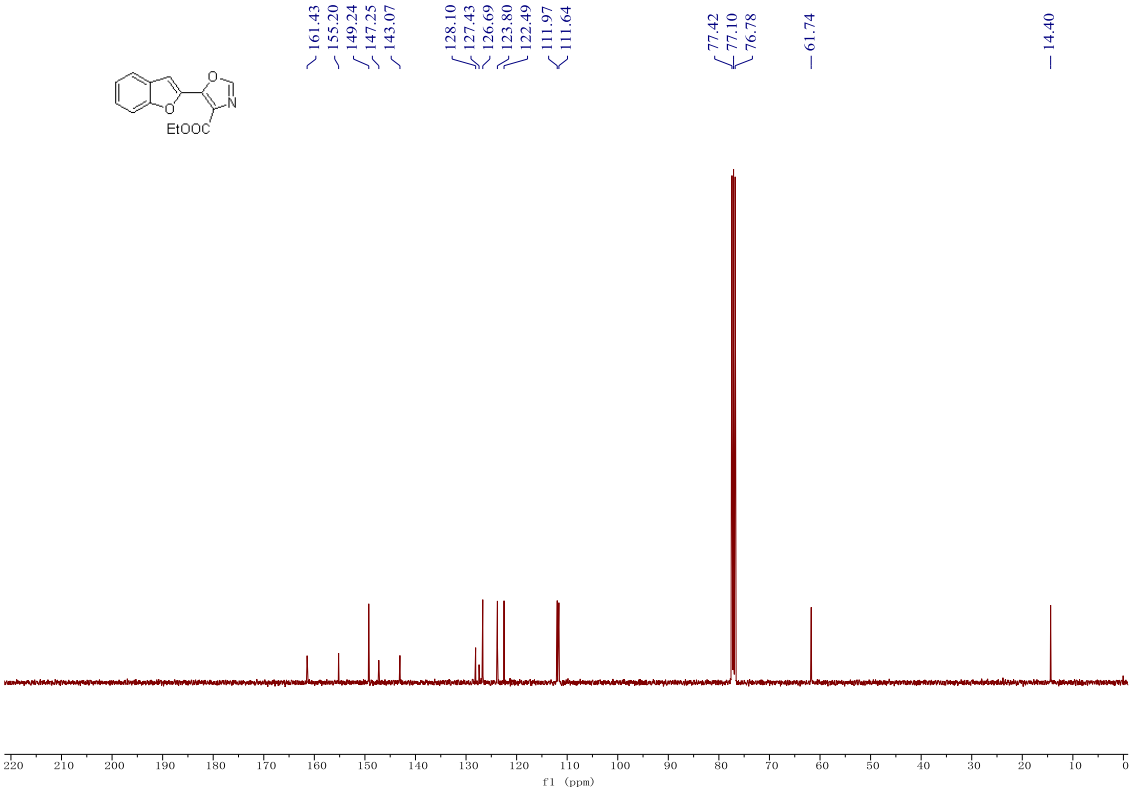


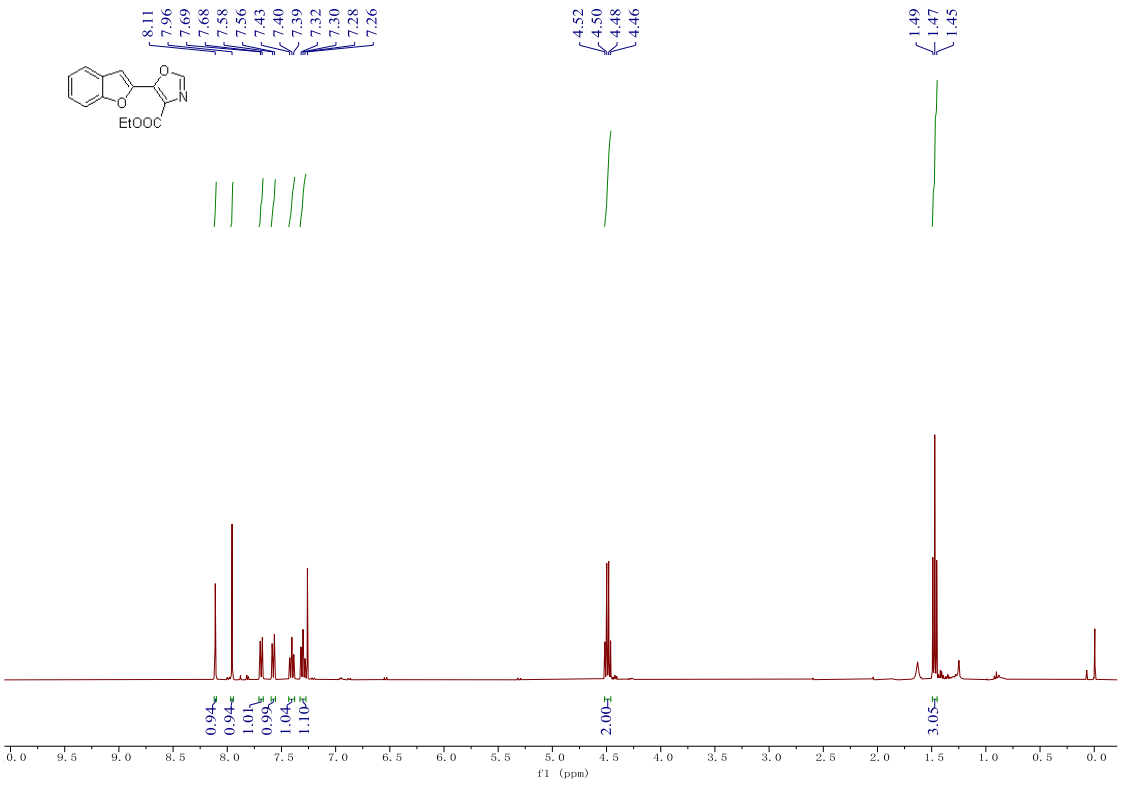
32c ^{1}H NMR and ^{13}C NMR



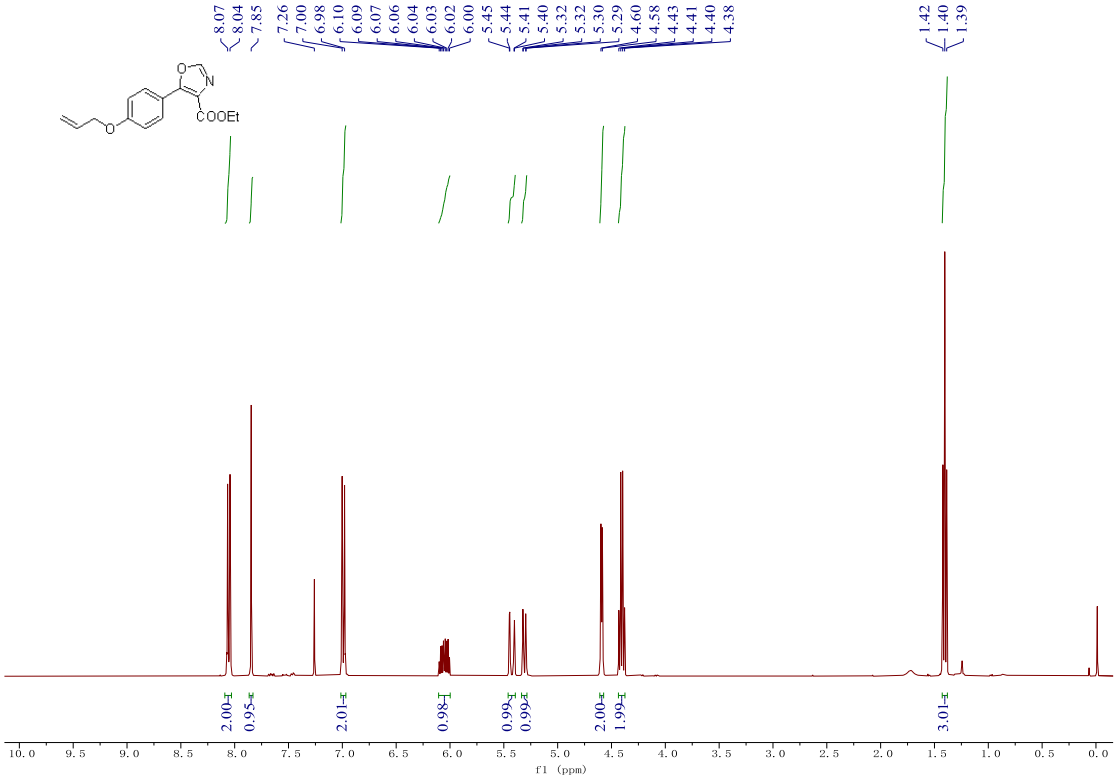


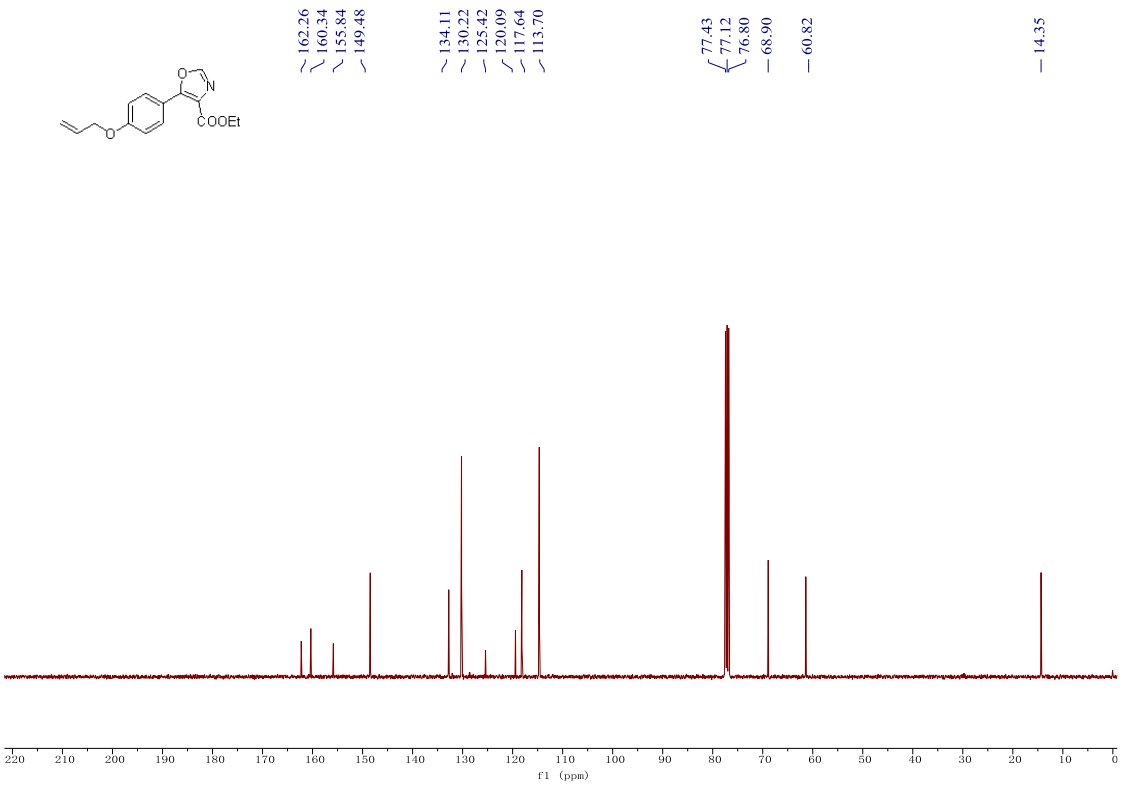
33c ^{1}H NMR and ^{13}C NMR



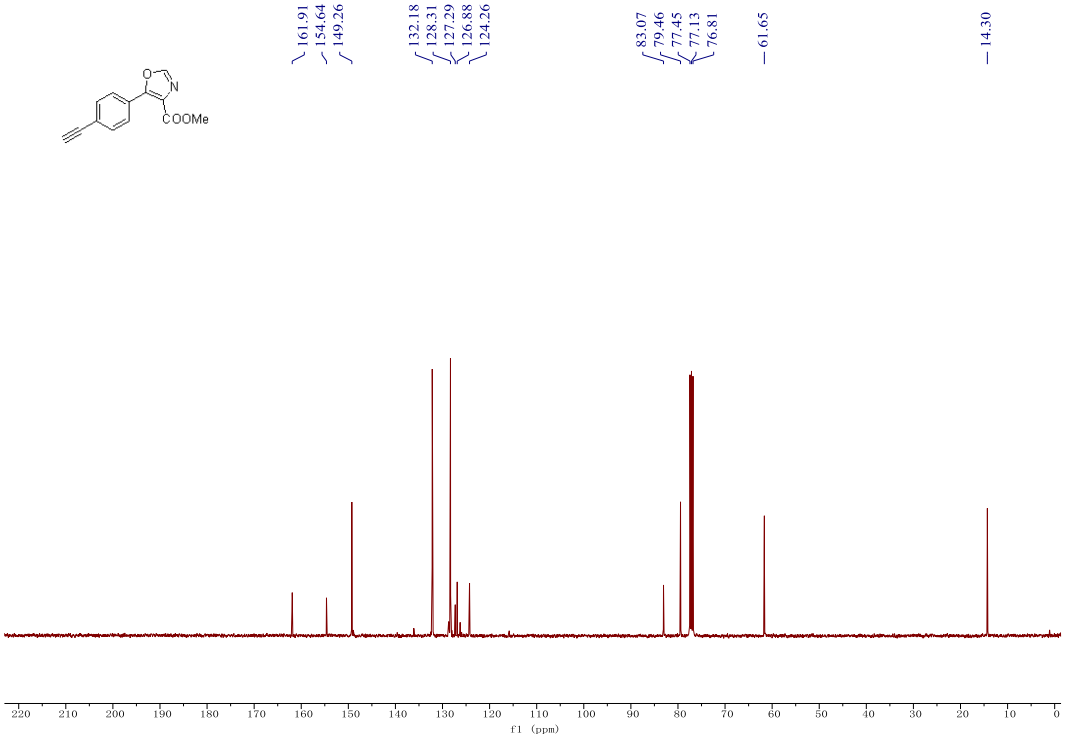


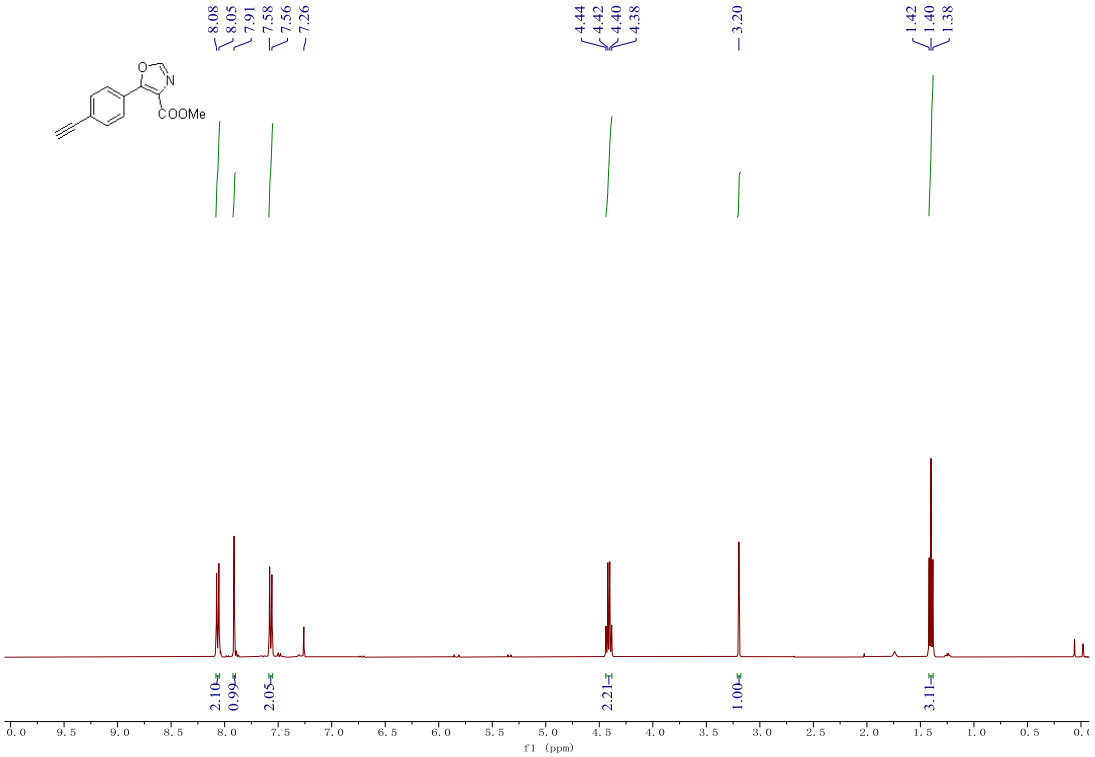
34c ^{1}H NMR and ^{13}C NMR



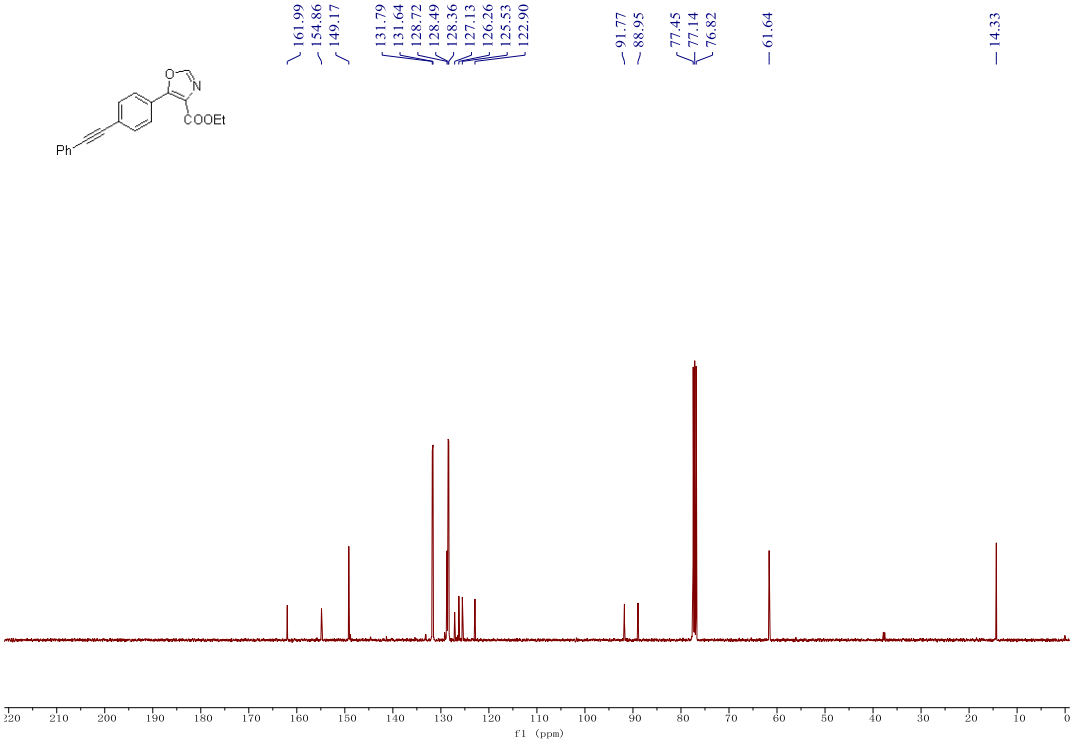


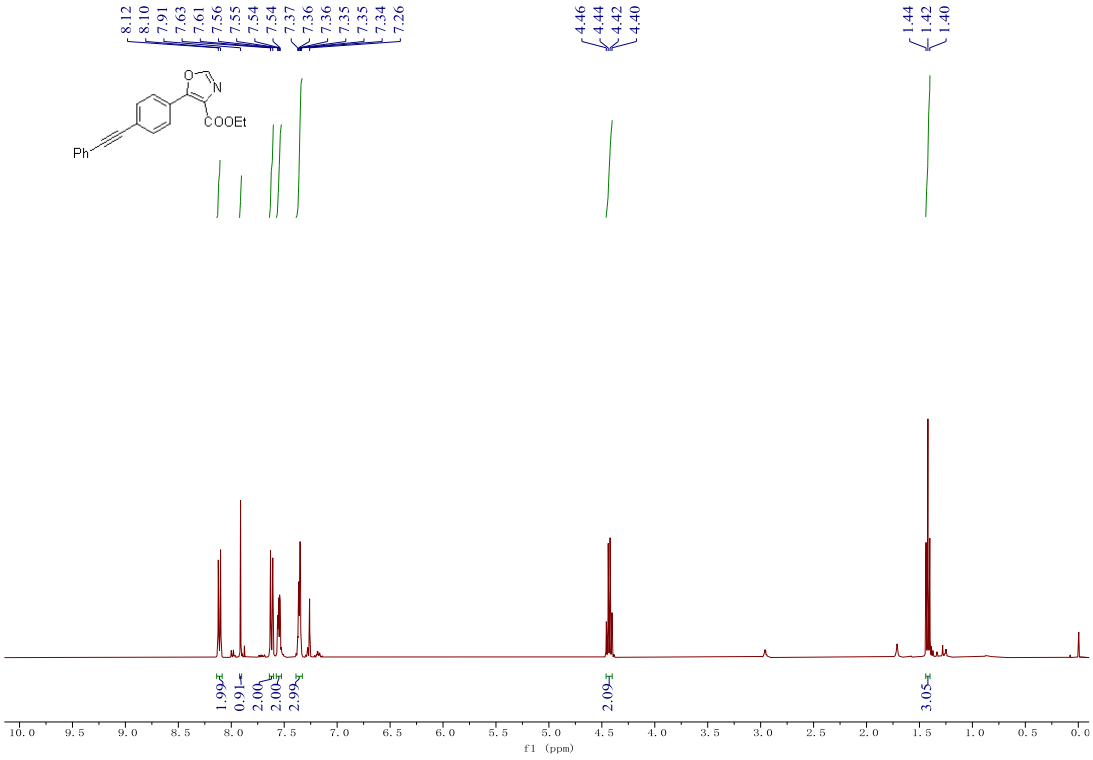
35c ^{1}H NMR and ^{13}C NMR



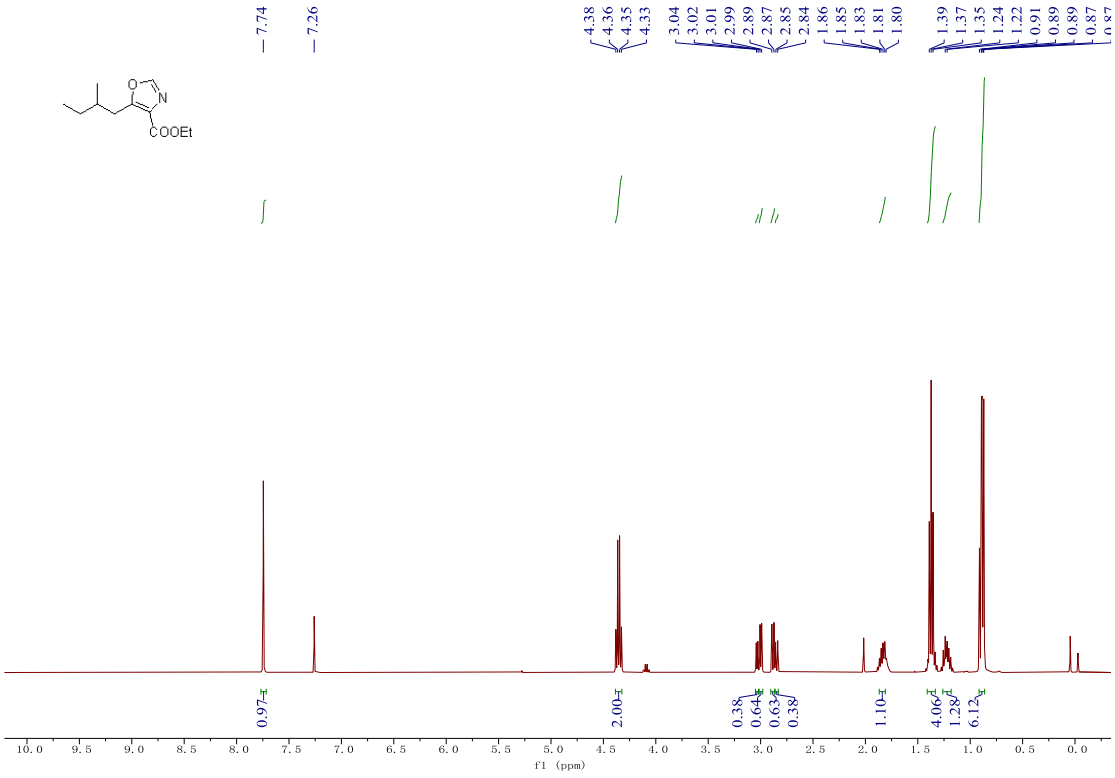


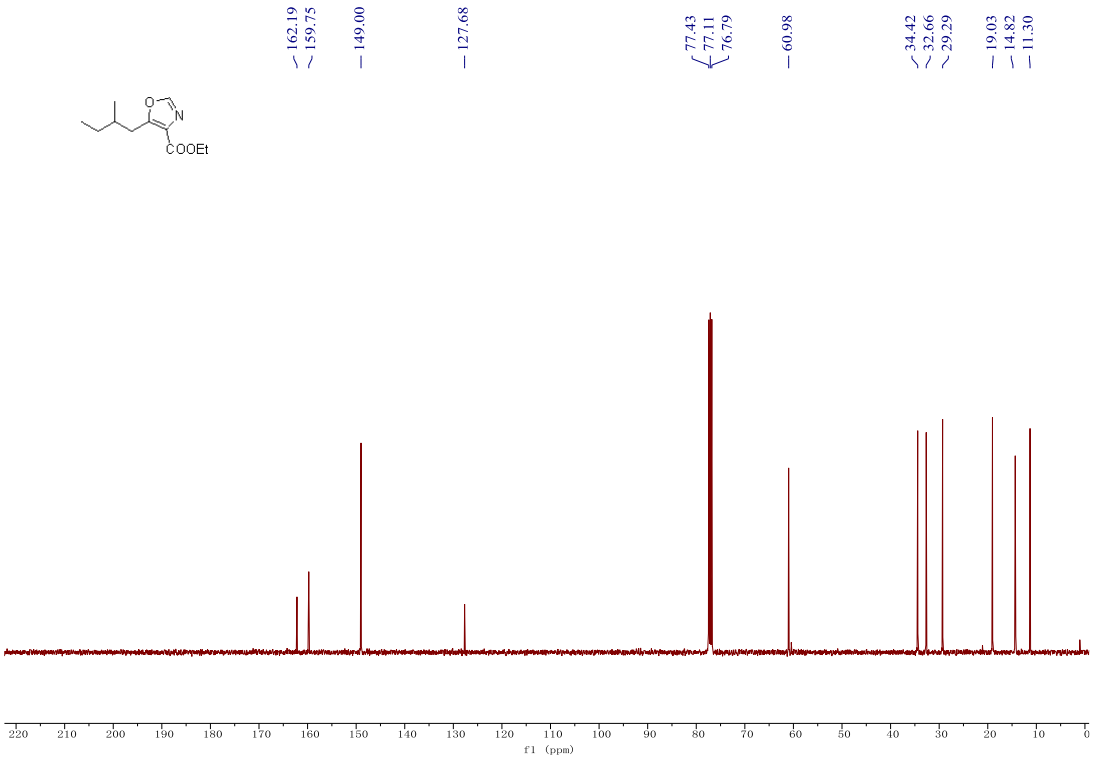
36c ^{1}H NMR and ^{13}C NMR



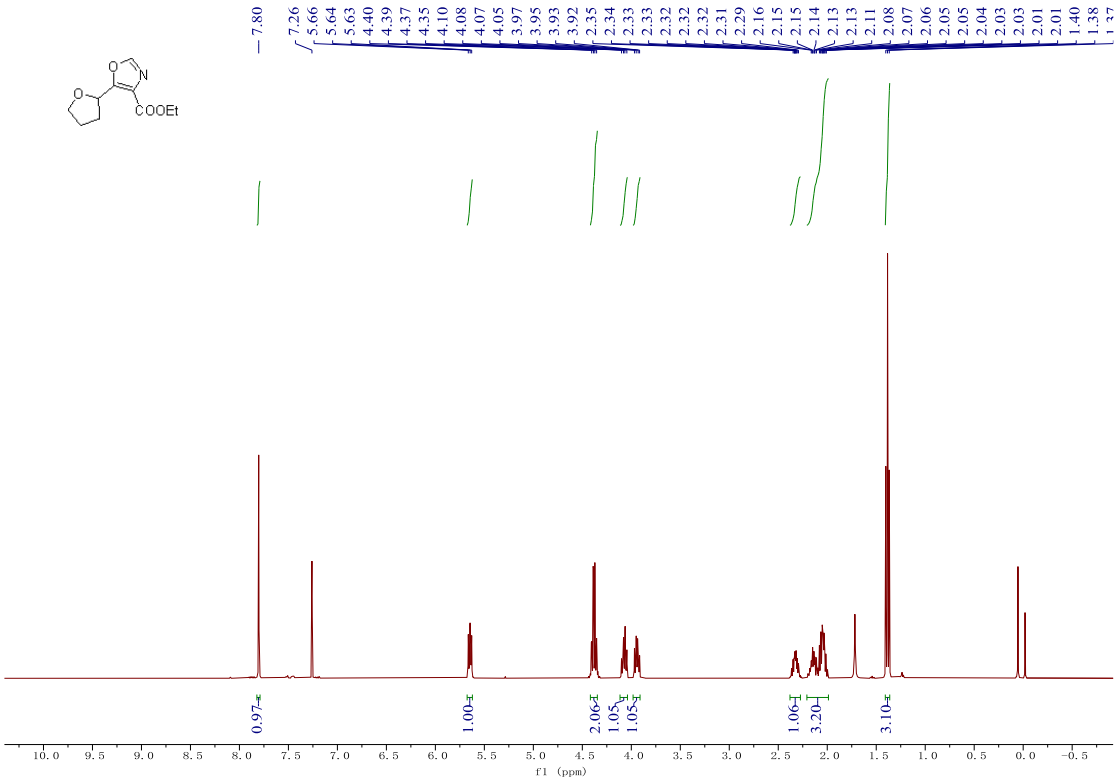


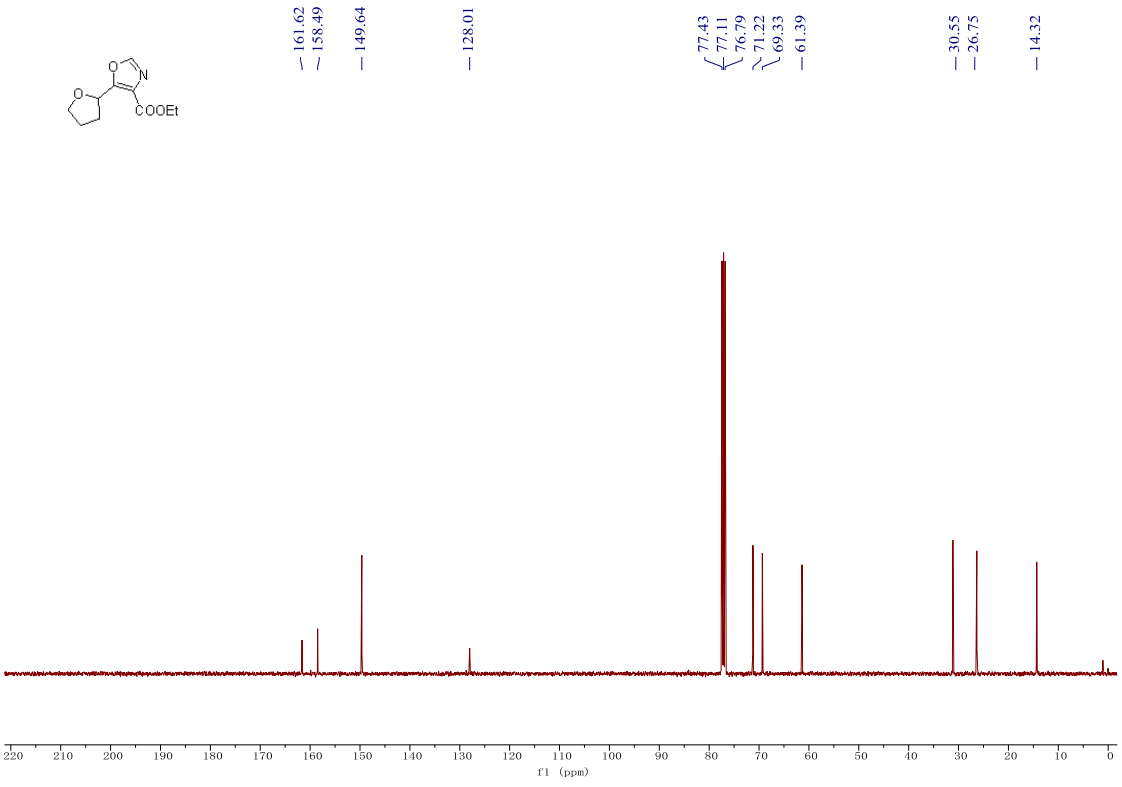
37c ^{1}H NMR and ^{13}C NMR



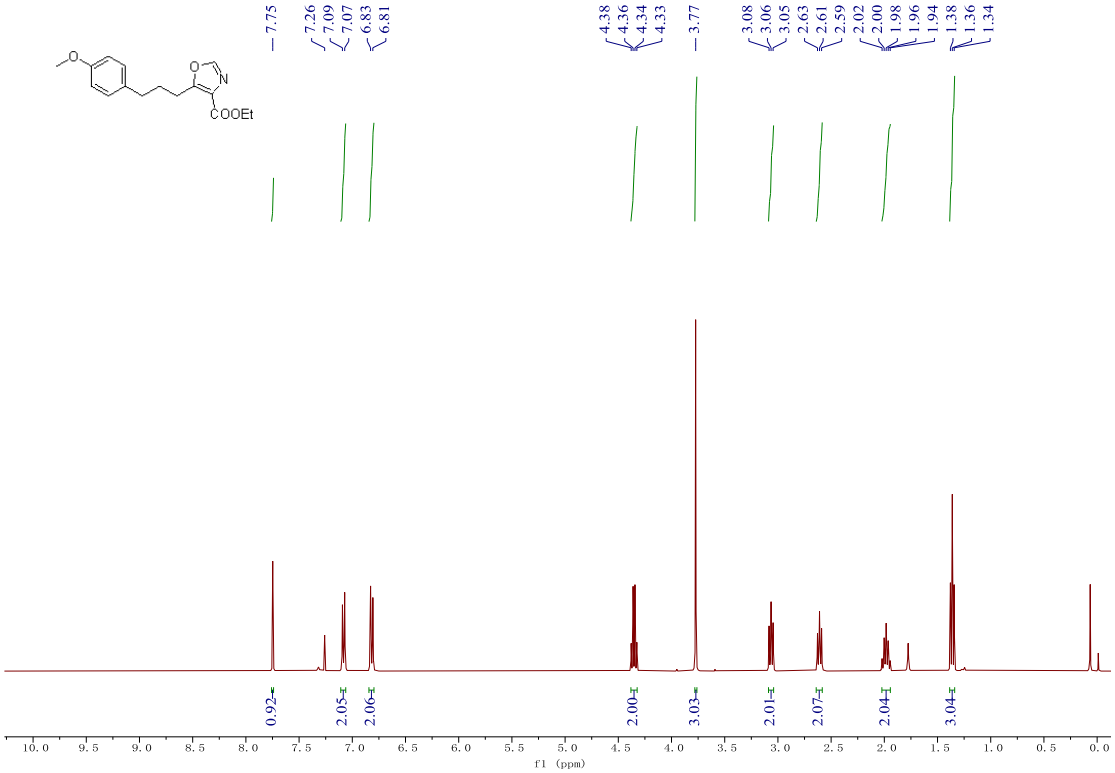


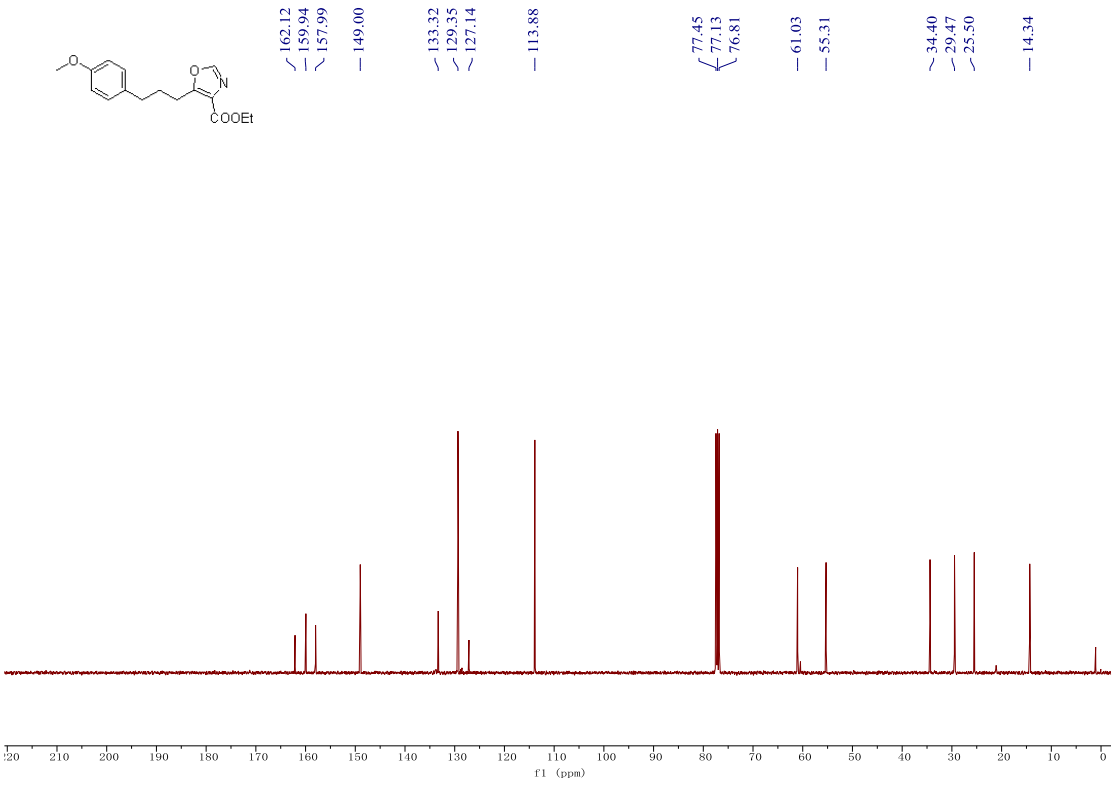
38c ^{1}H NMR and ^{13}C NMR



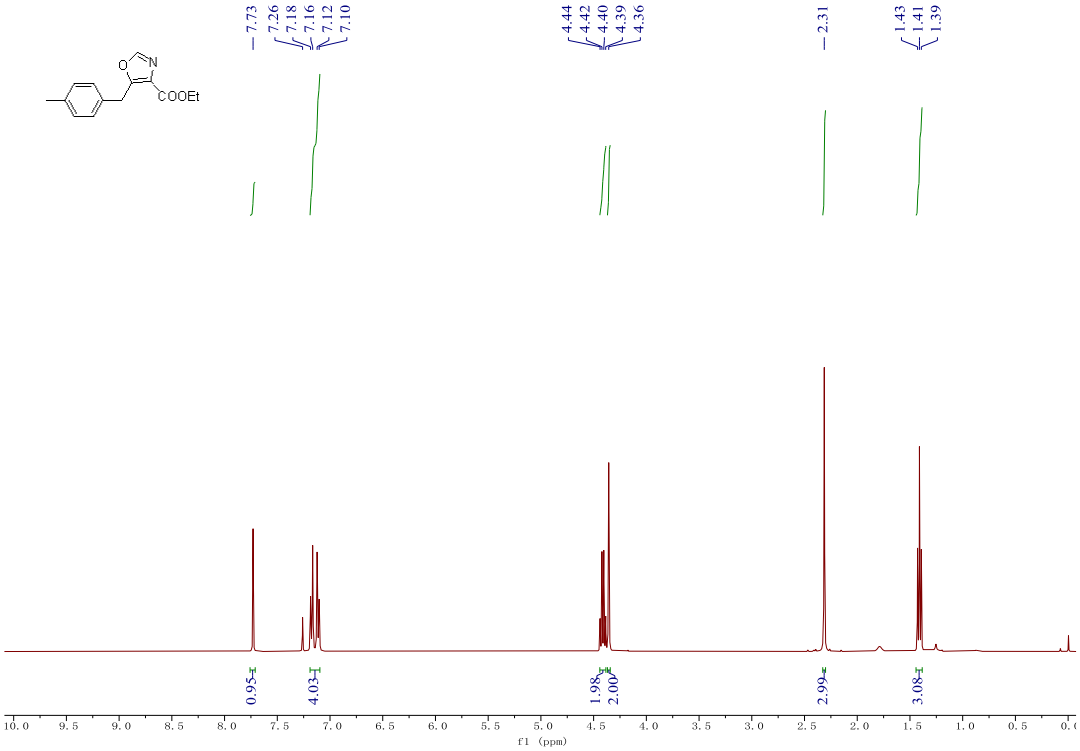


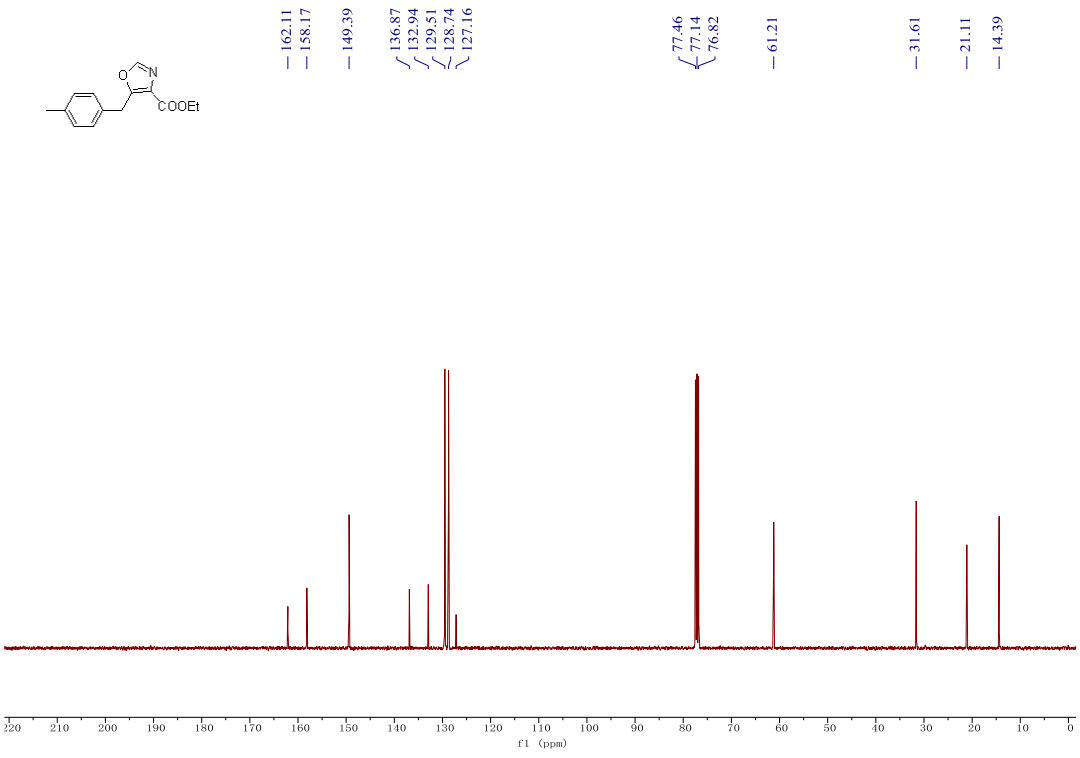
39c ^{1}H NMR and ^{13}C NMR



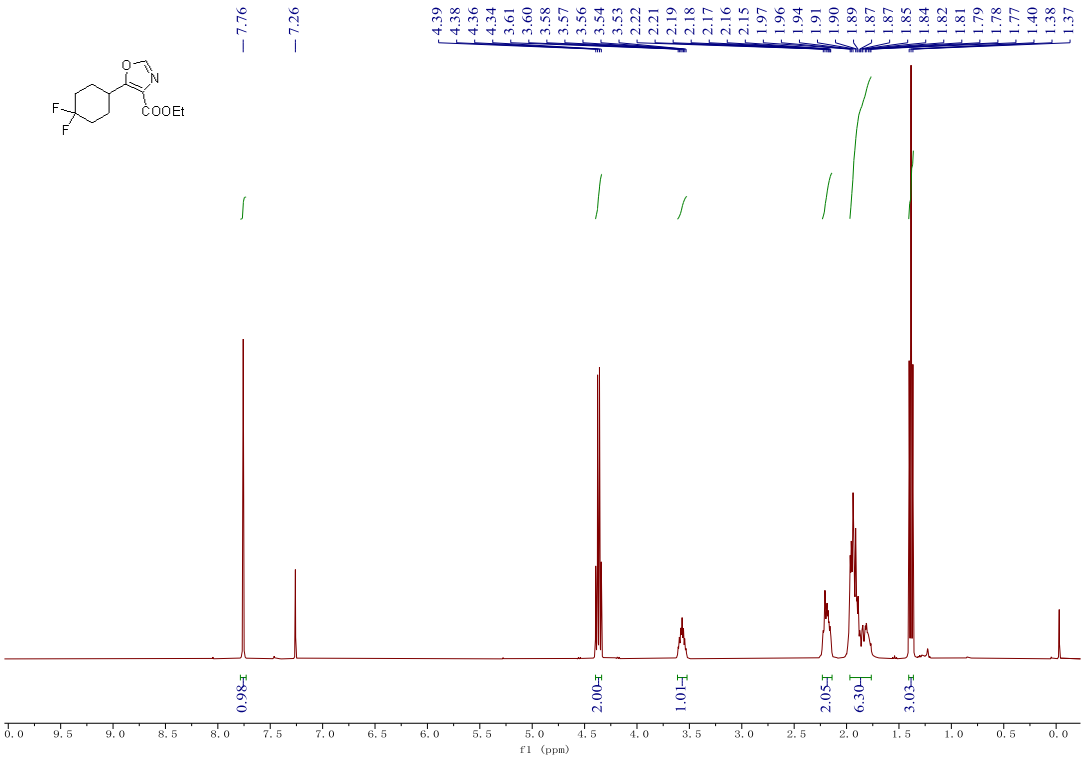


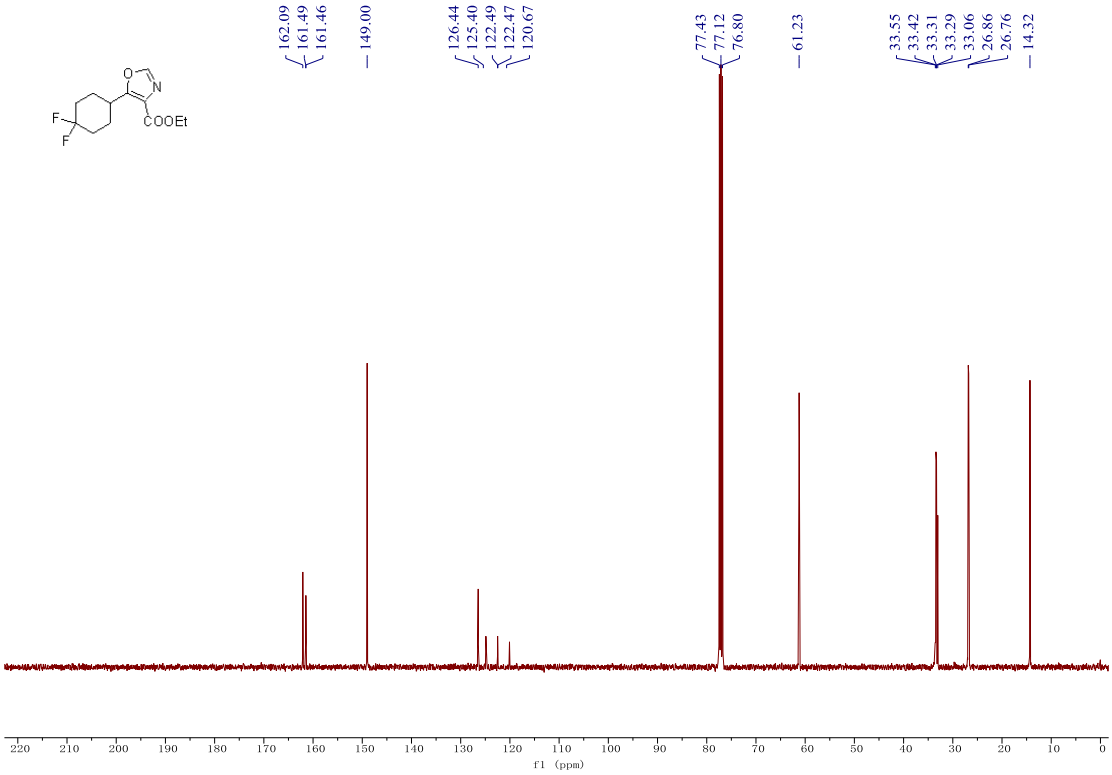
40c ^{1}H NMR and ^{13}C NMR

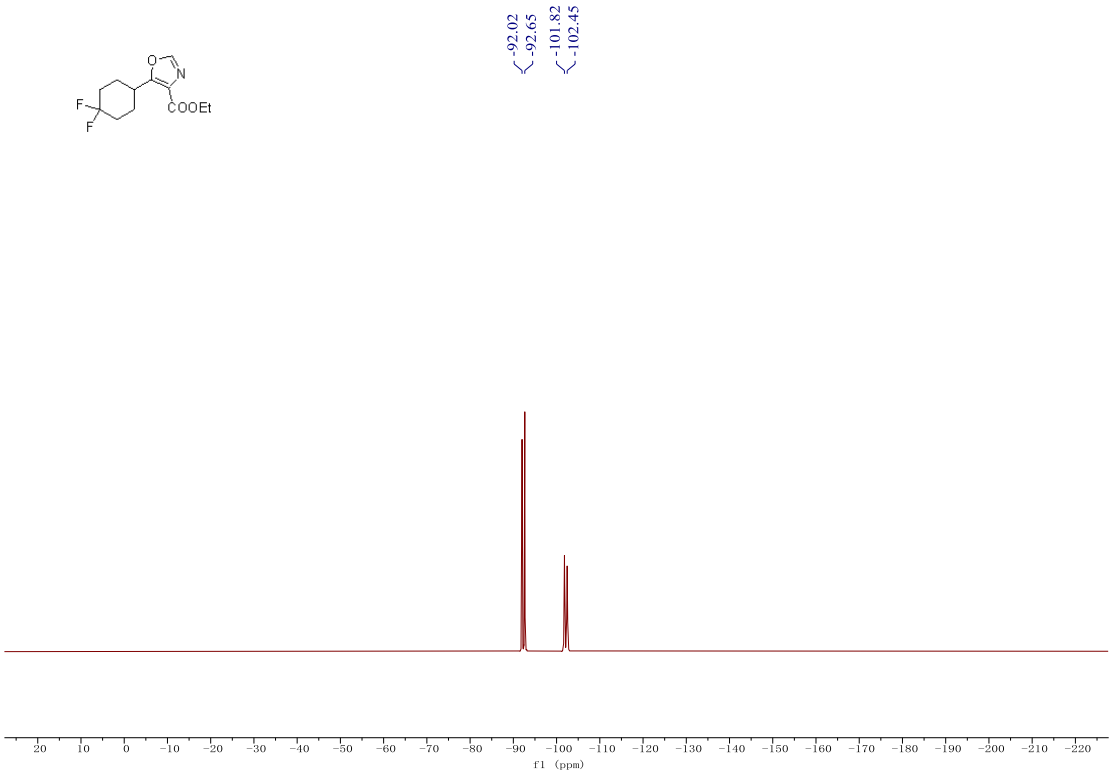




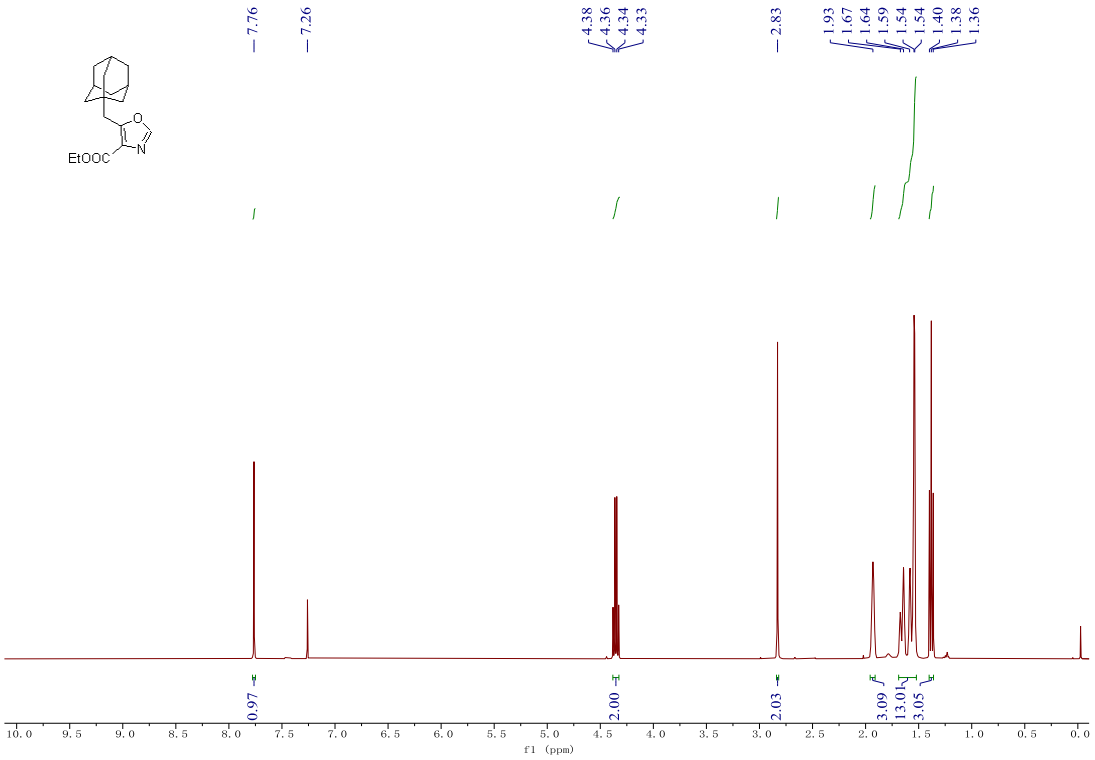
41c ^{1}H NMR, ^{13}C NMR and ^{19}F NMR

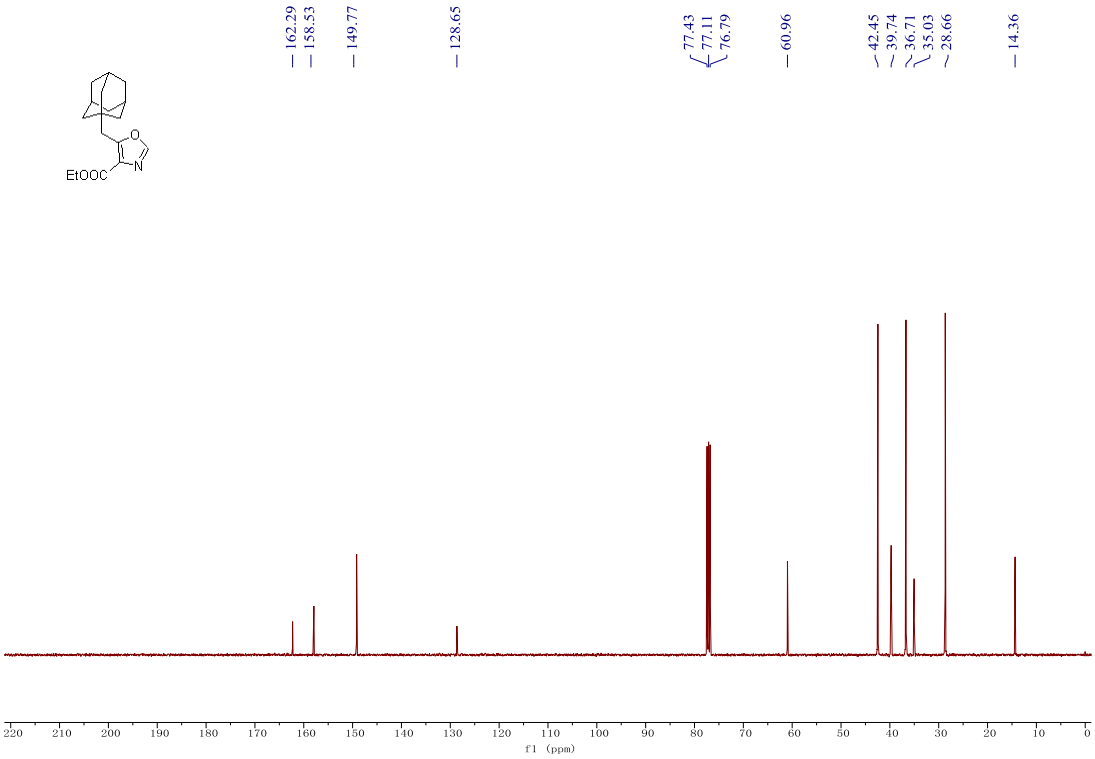




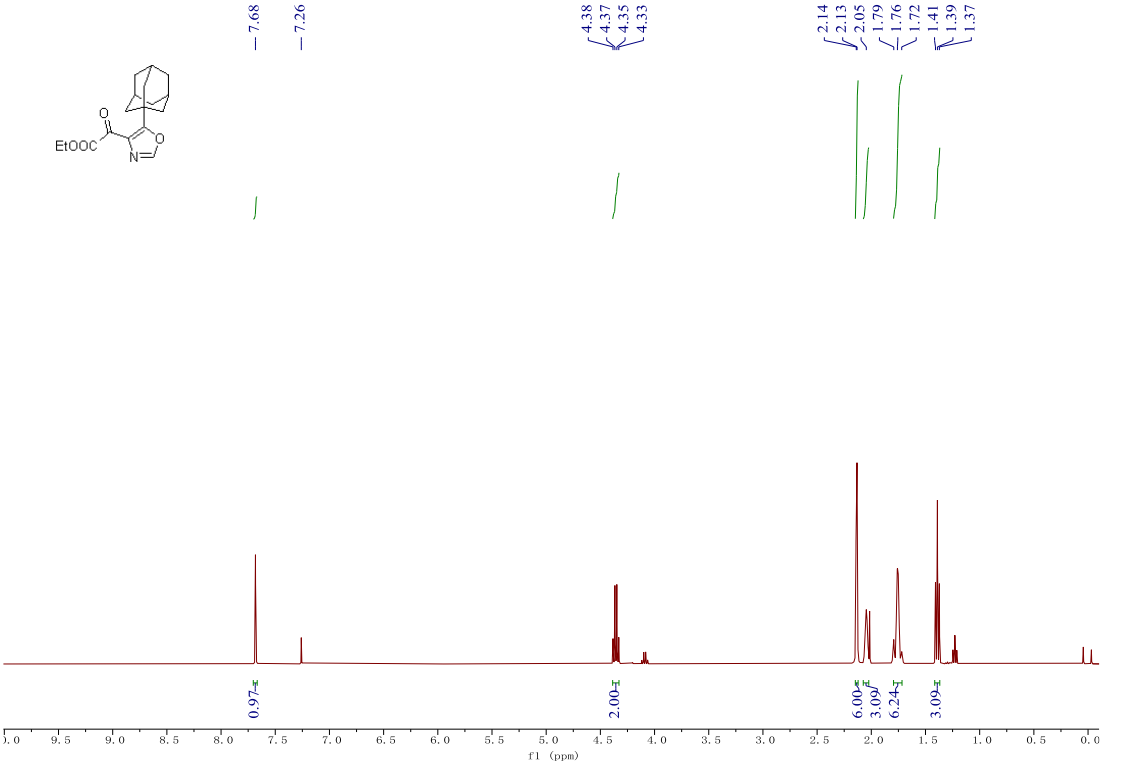

-92.02
-92.65
-101.82
-102.45
F
F
O
N
COOEt
20 10 0 -10 -20 -30 -40 -50 -60 -70 -80 -90 -100 -110 -120 -130 -140 -150 -160 -170 -180 -190 -200 -210 -220
f1 (ppm)

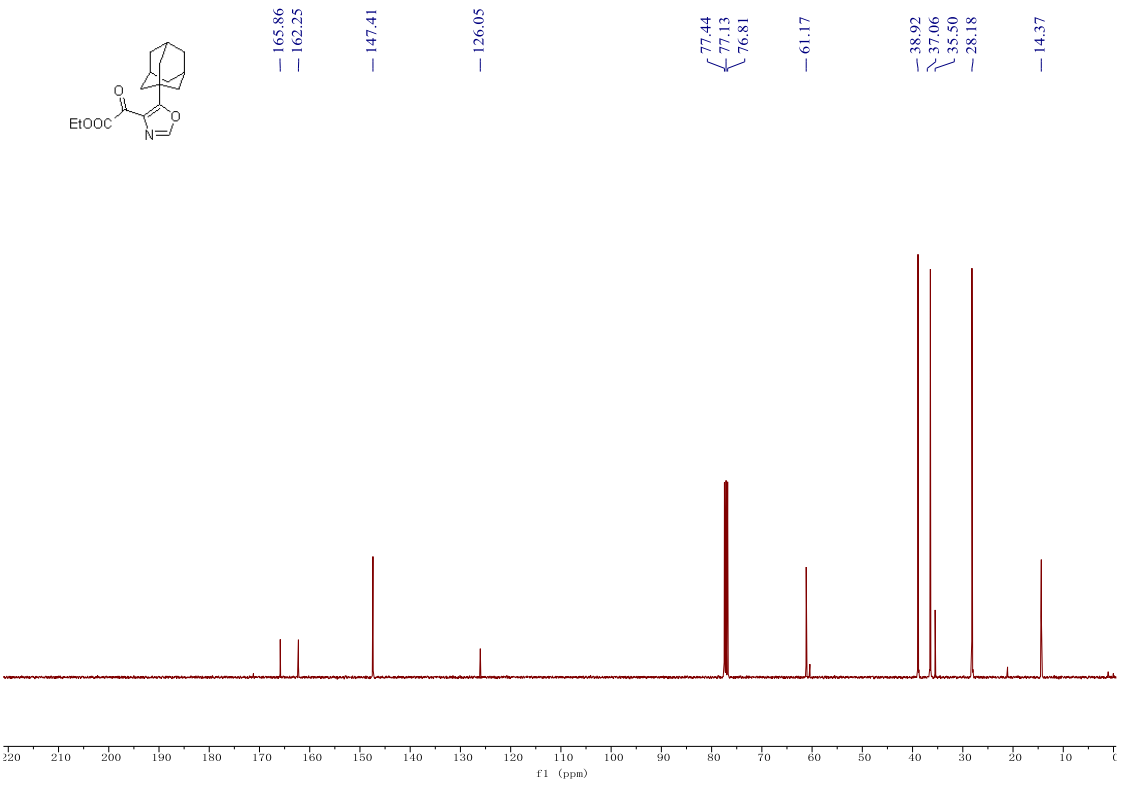
42c ^{1}H NMR and ^{13}C NMR



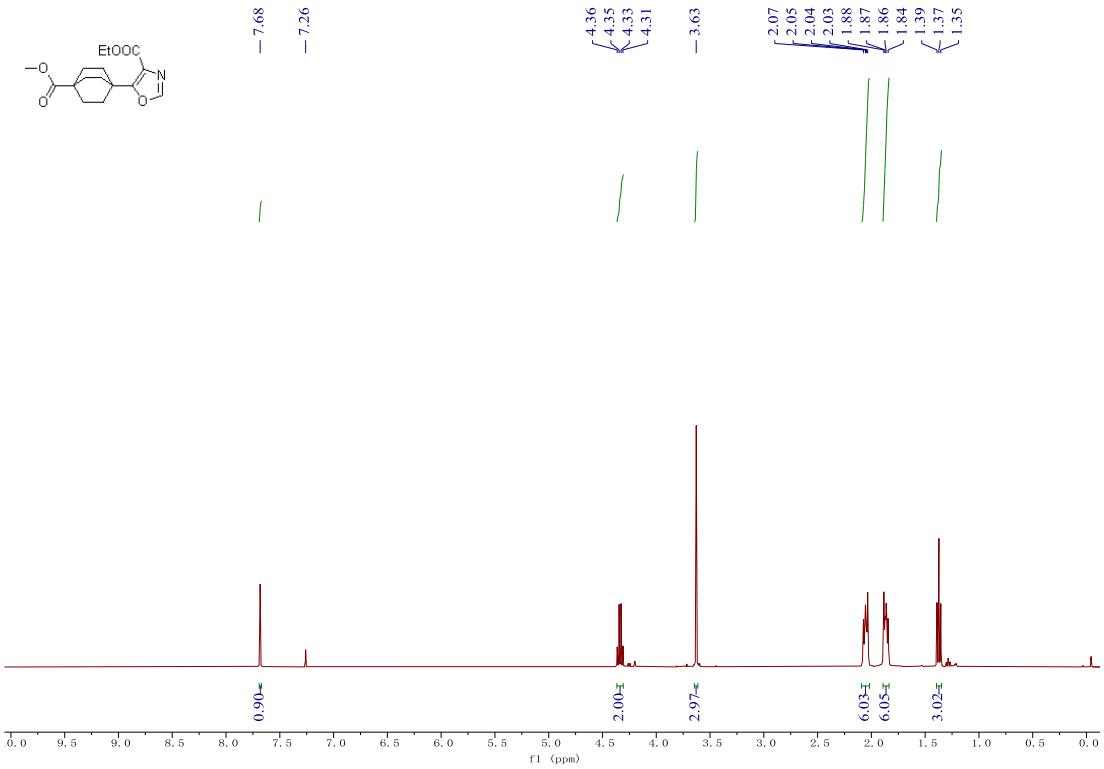


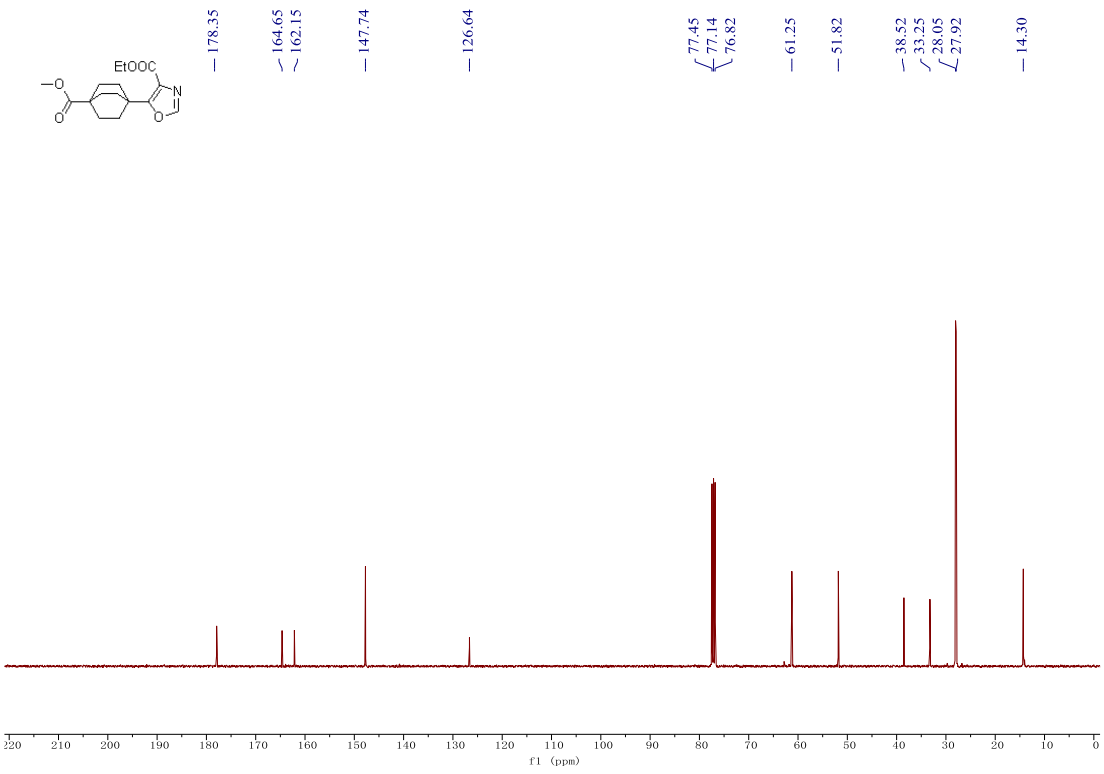
43c ^{1}H NMR and ^{13}C NMR



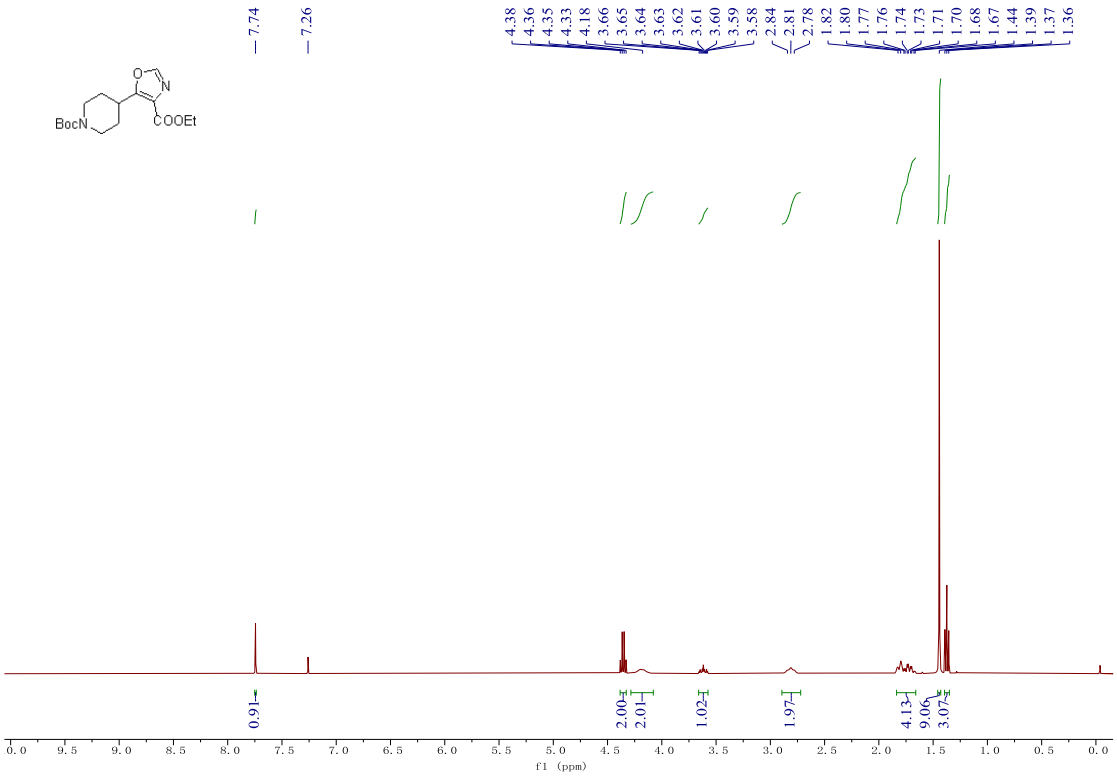


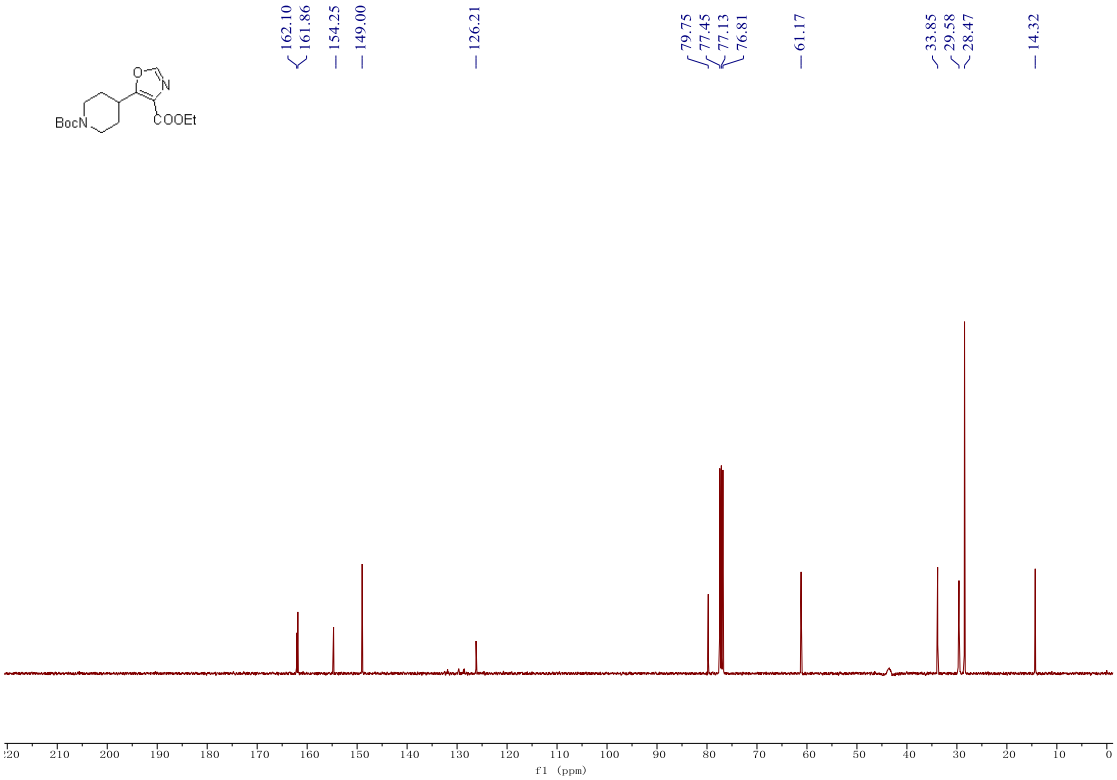
44c ^{1}H NMR and ^{13}C NMR



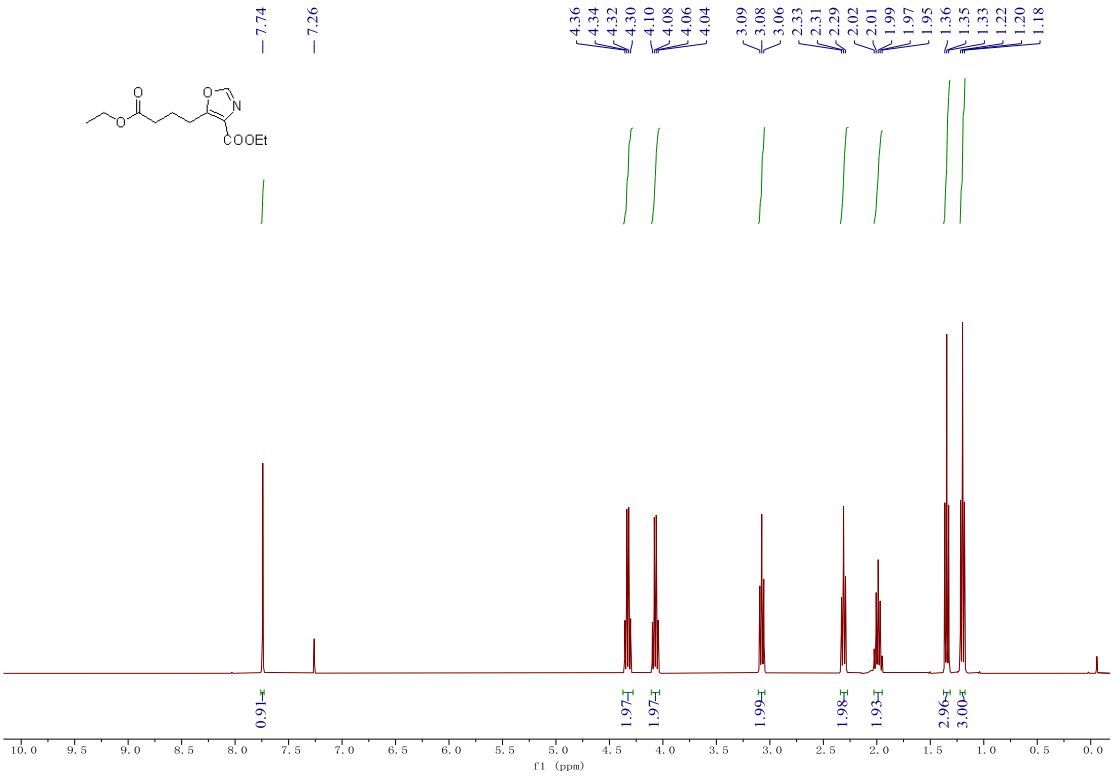


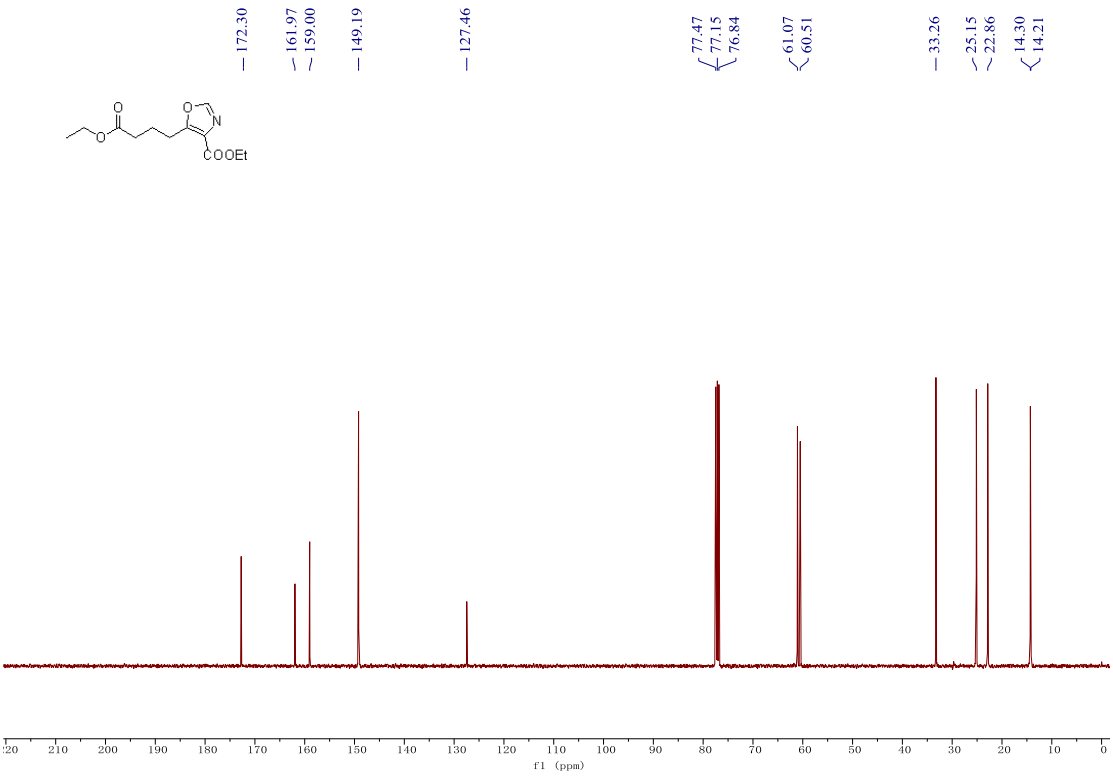
45c ^{1}H NMR and ^{13}C NMR



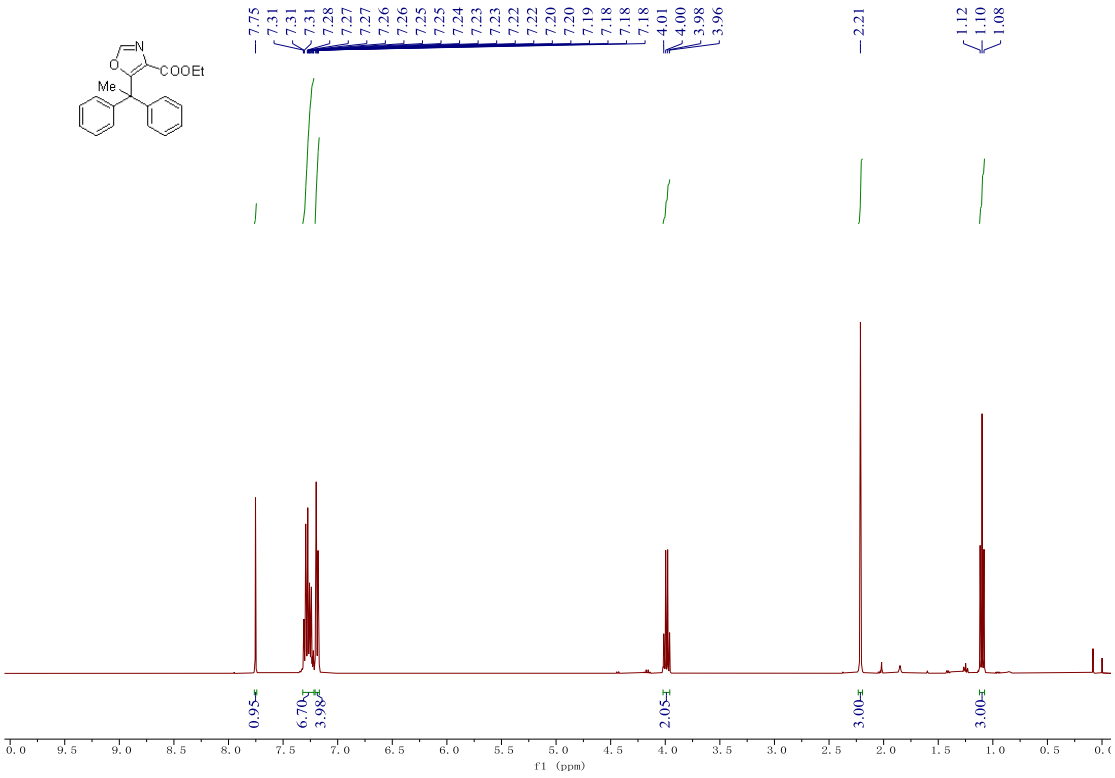


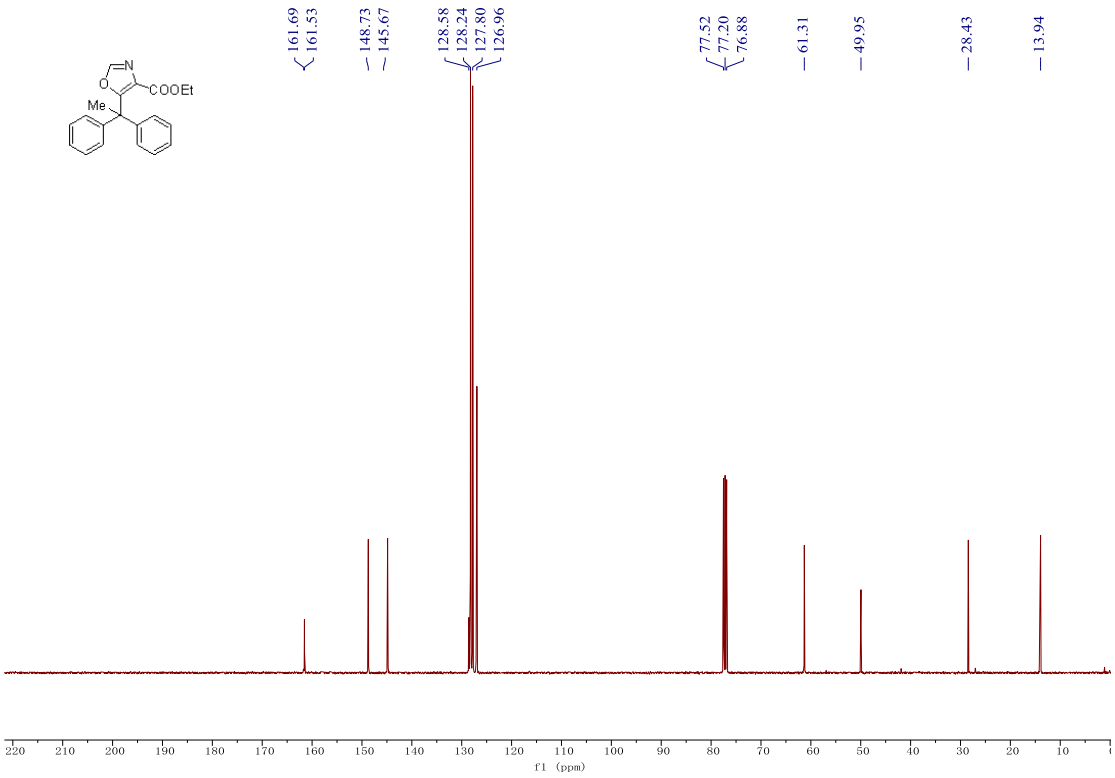
46c ^{1}H NMR and ^{13}C NMR



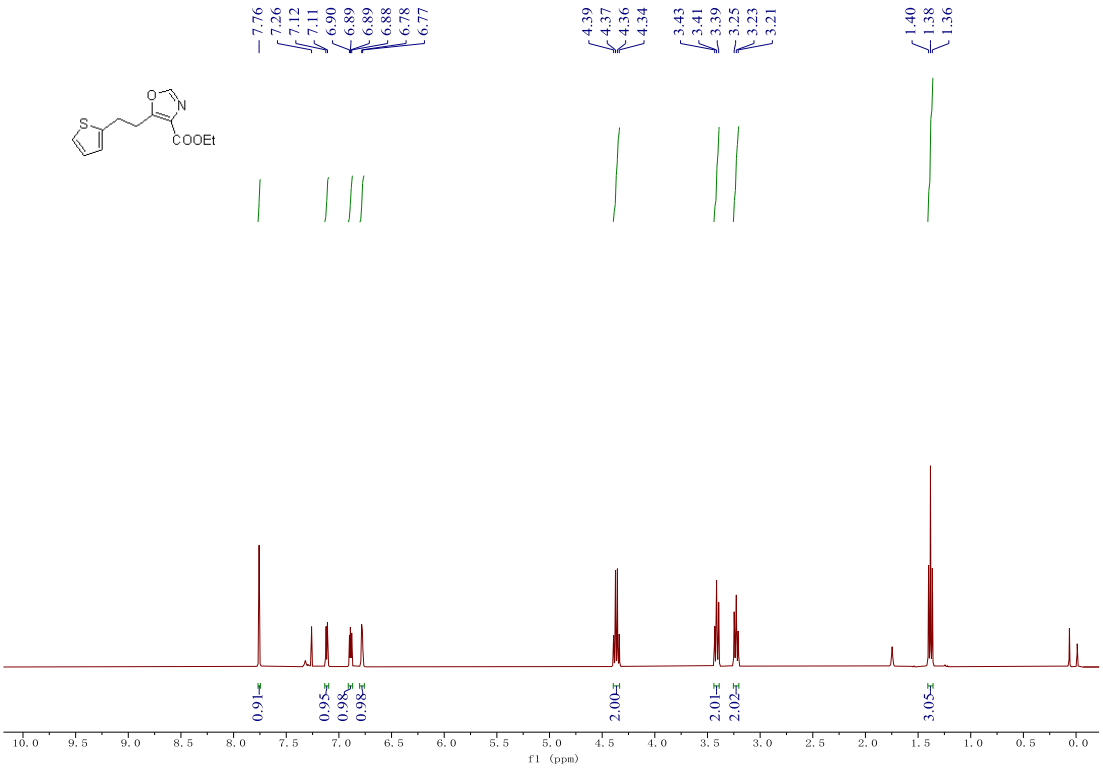


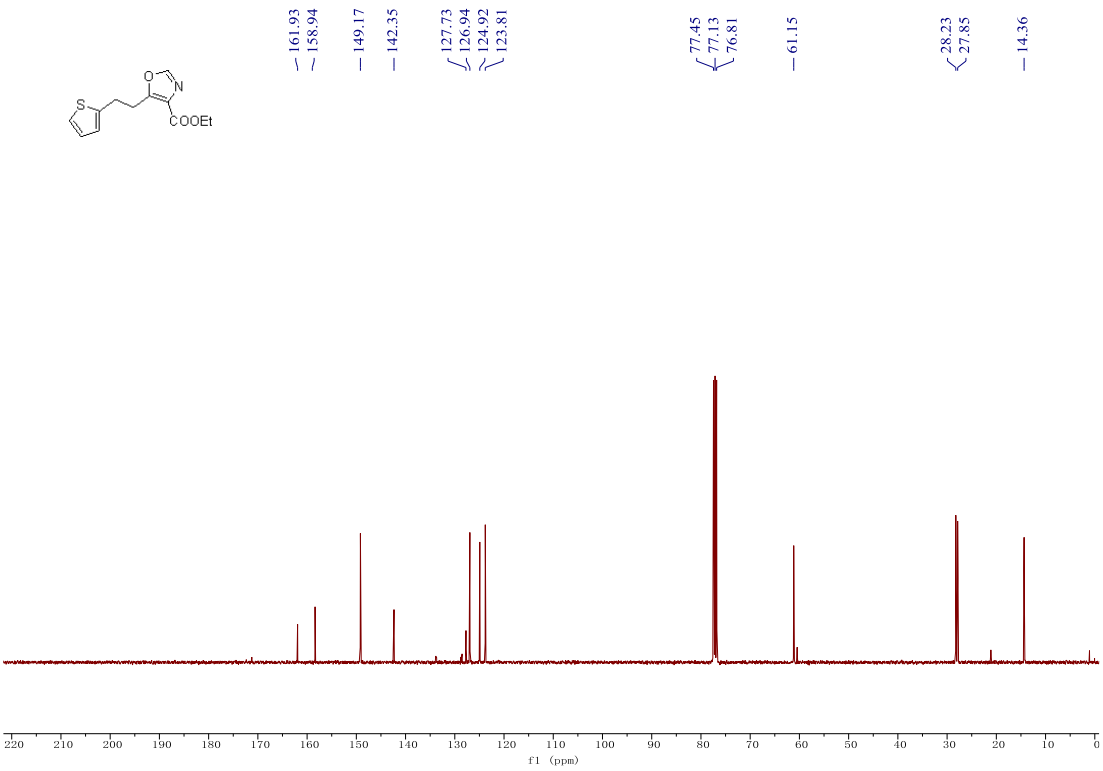
47c ^{1}H NMR and ^{13}C NMR



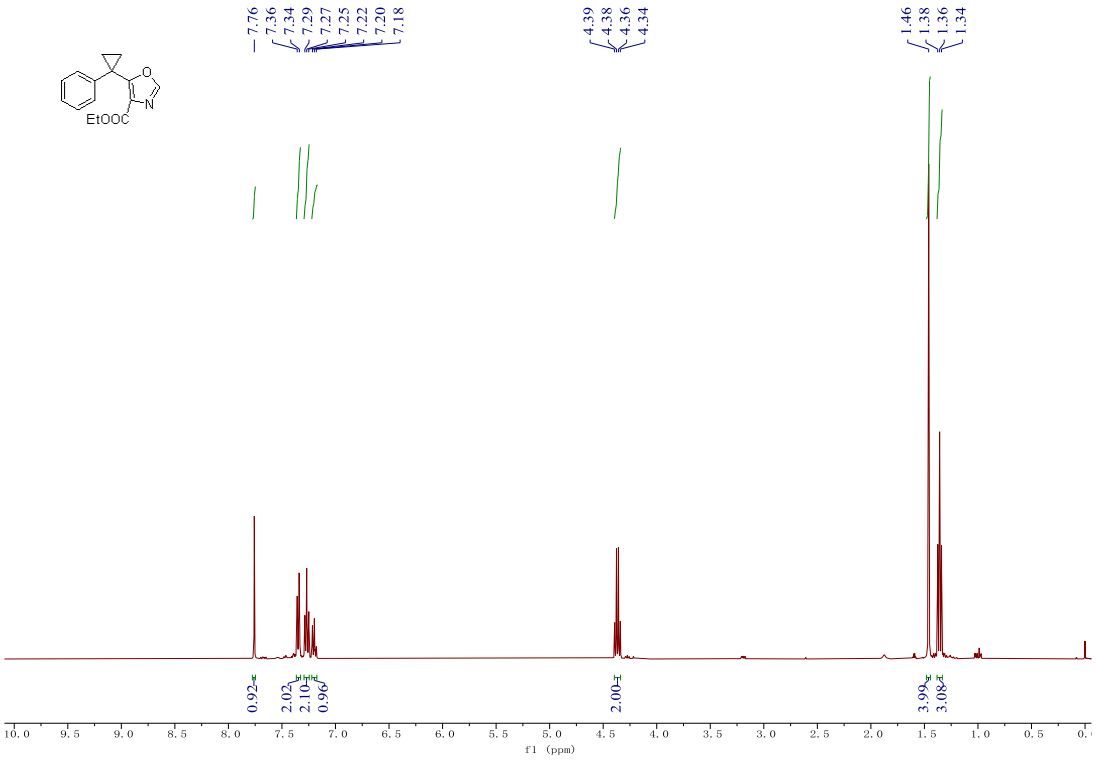


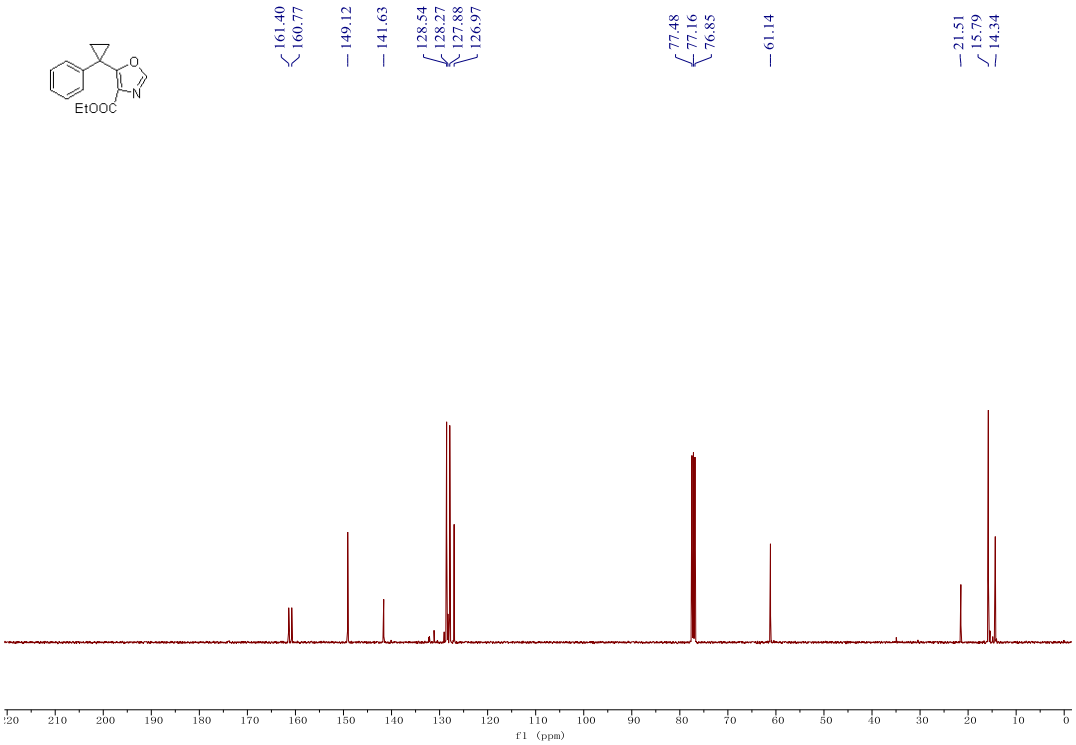
48c ^{1}H NMR and ^{13}C NMR



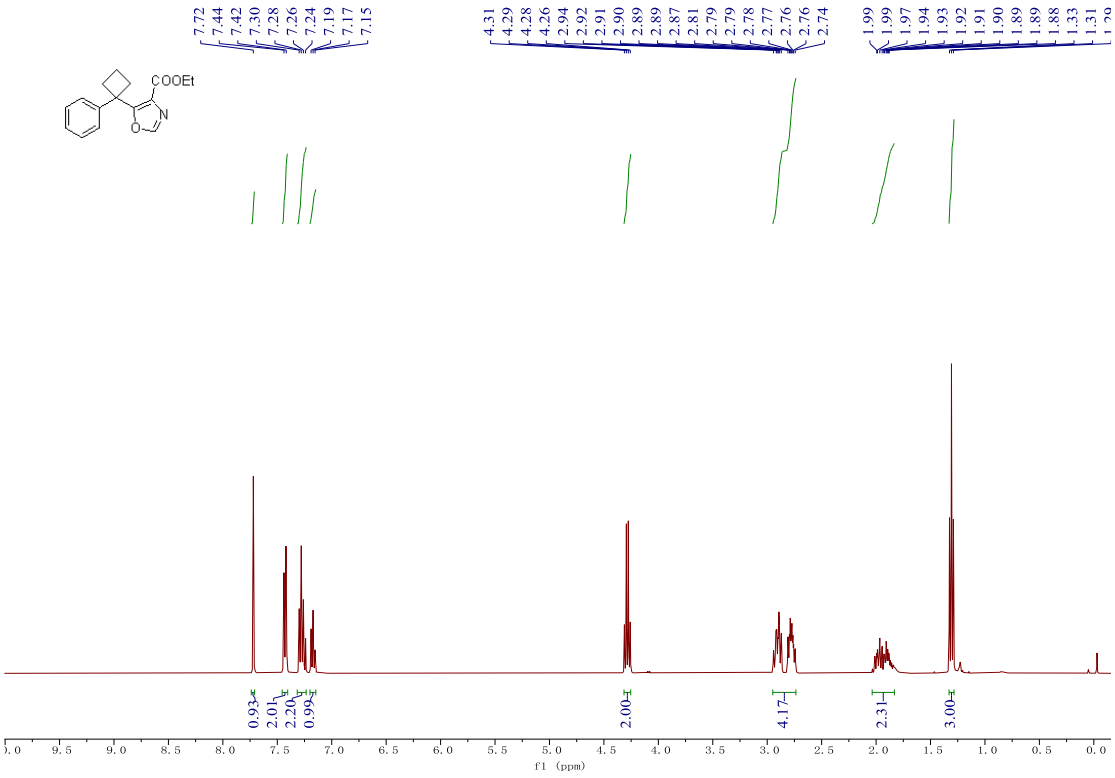


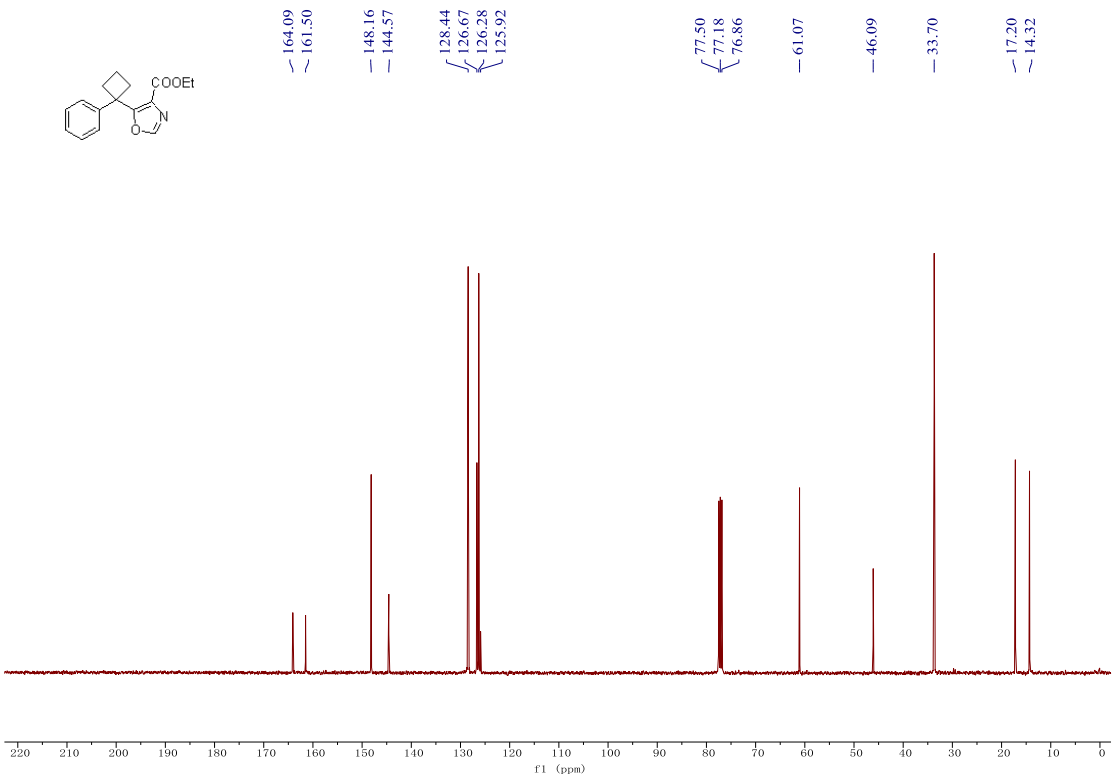
49c ^{1}H NMR and ^{13}C NMR



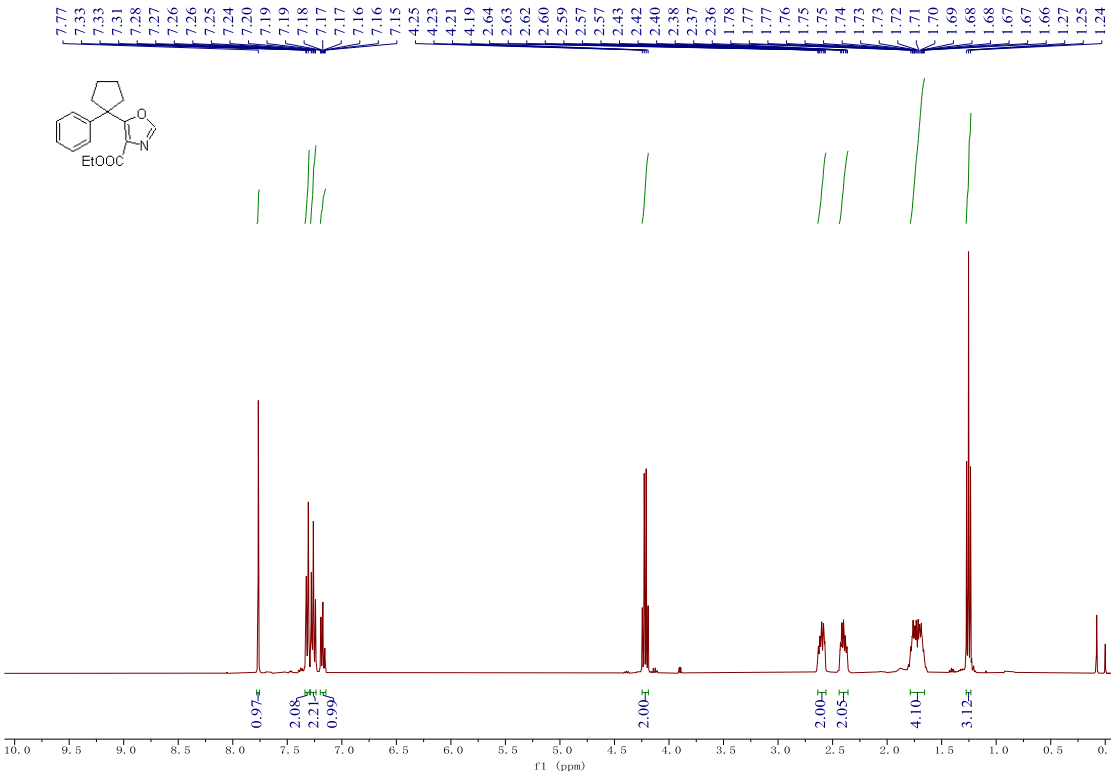


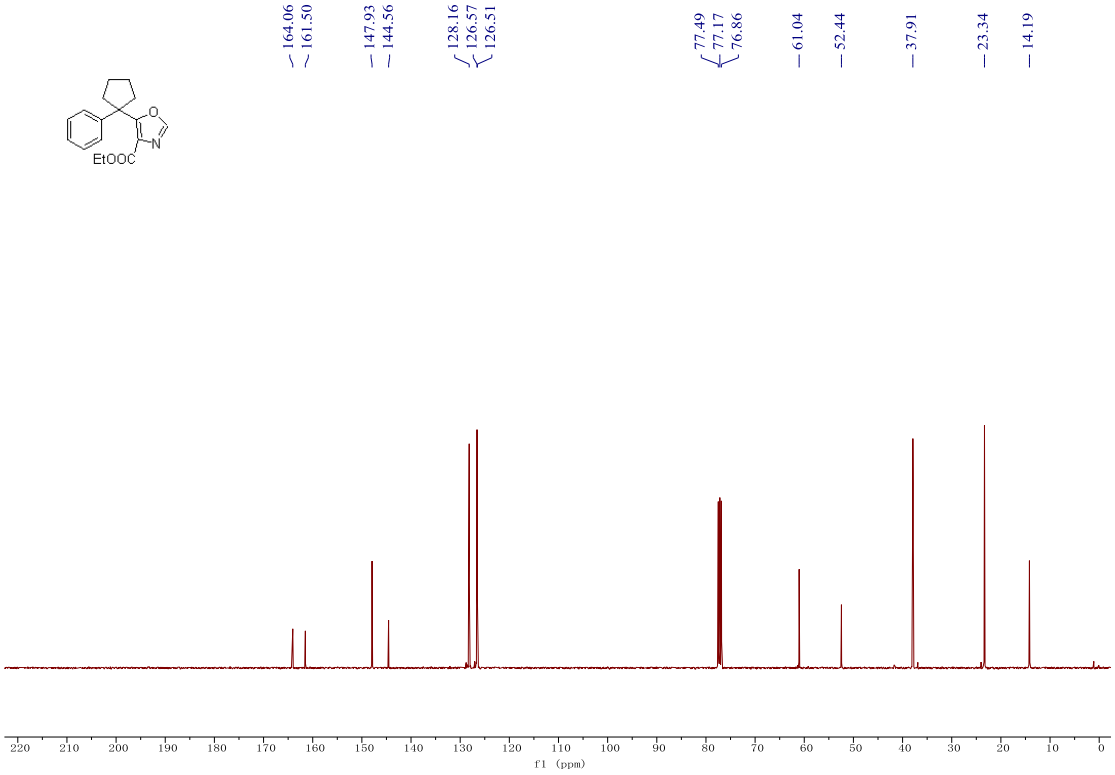
50c ^{1}H NMR and ^{13}C NMR



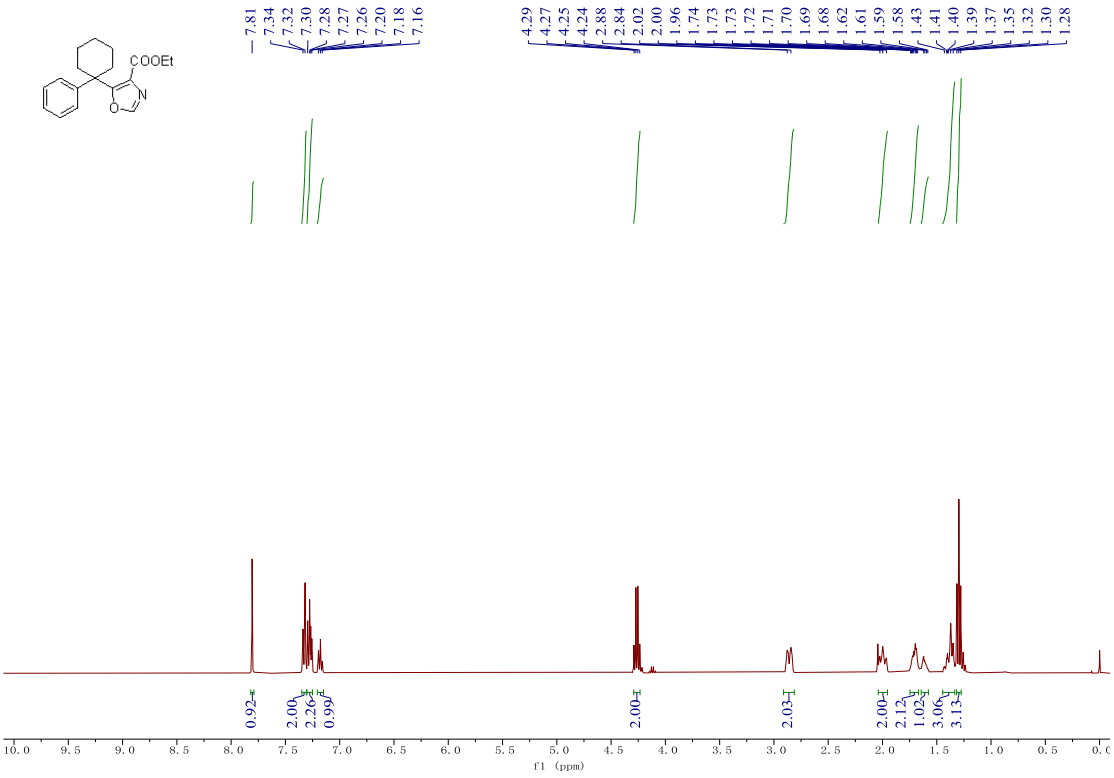


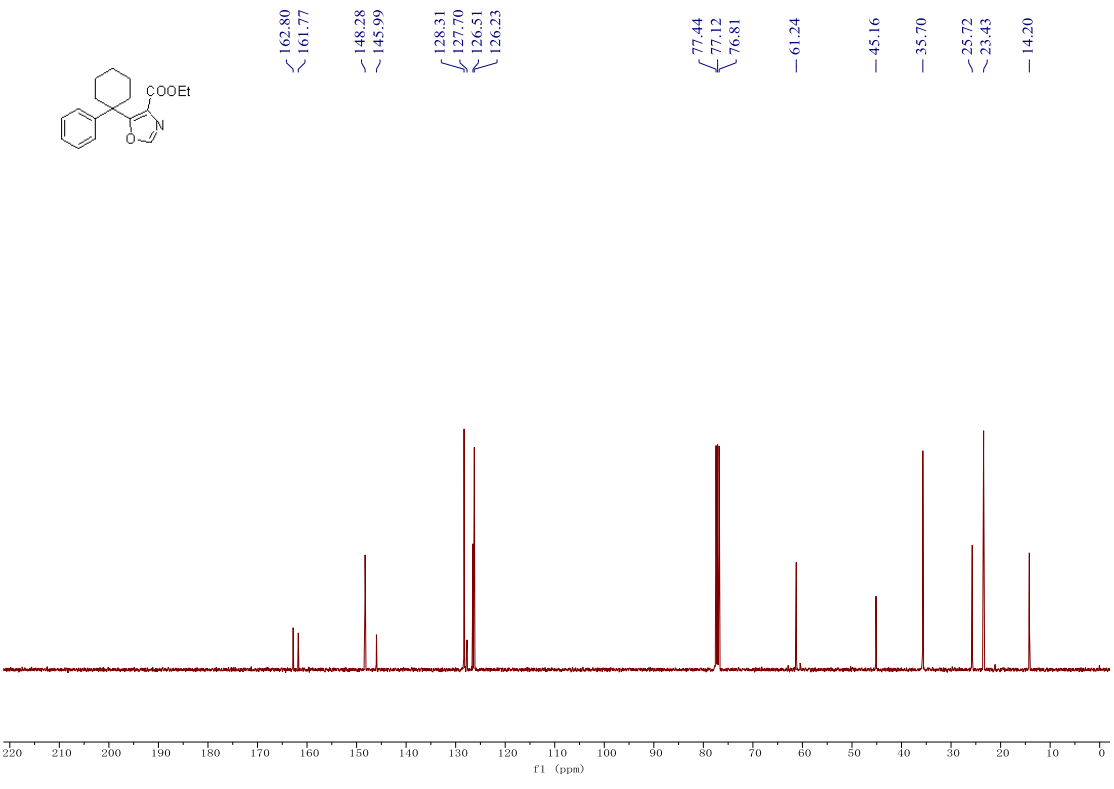
51c ^{1}H NMR and ^{13}C NMR



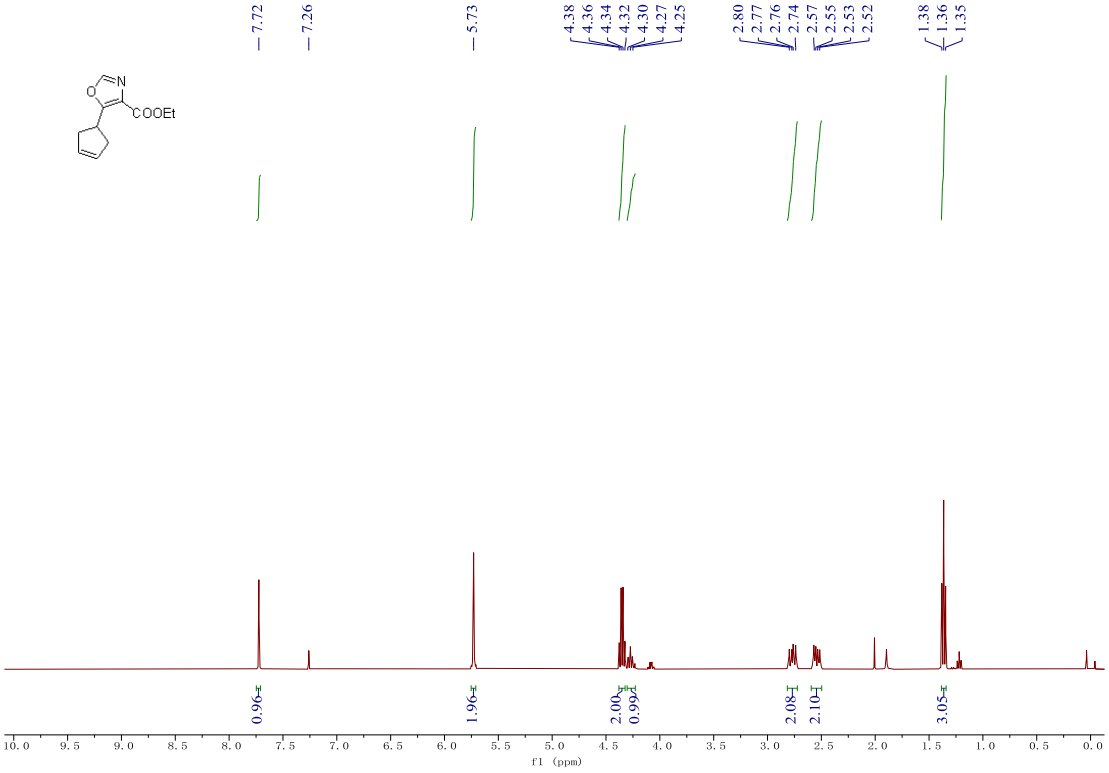


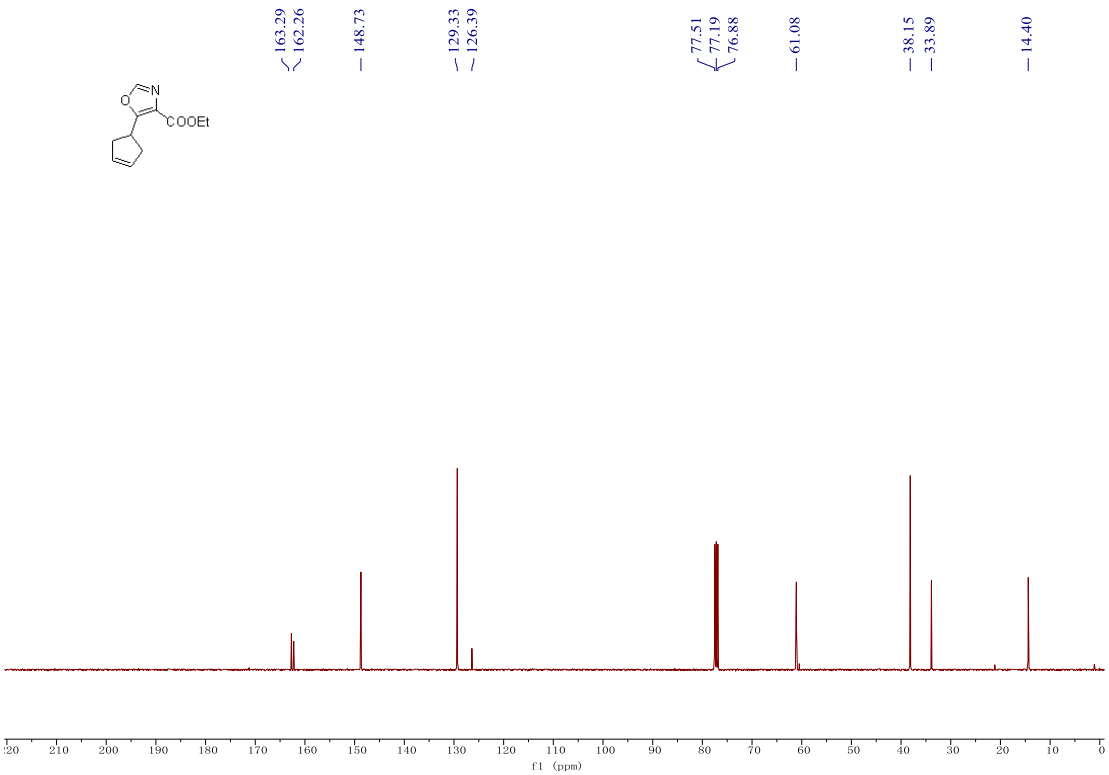
52c ^{1}H NMR and ^{13}C NMR



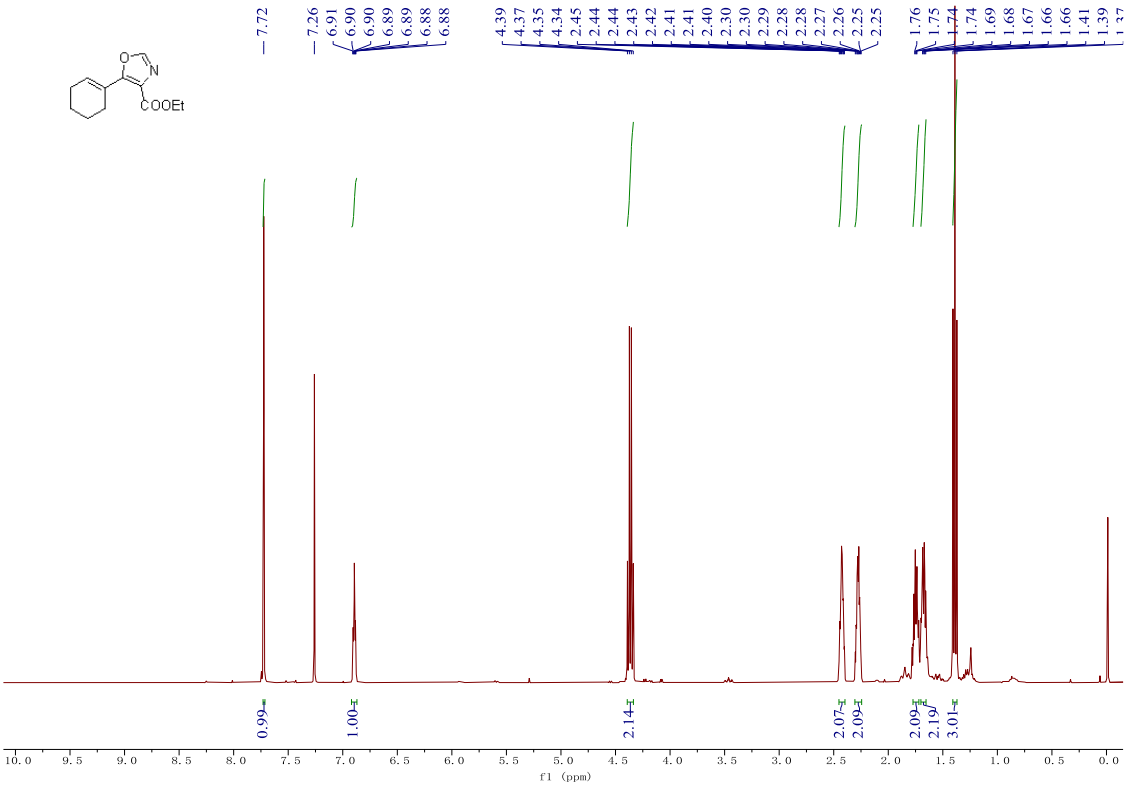


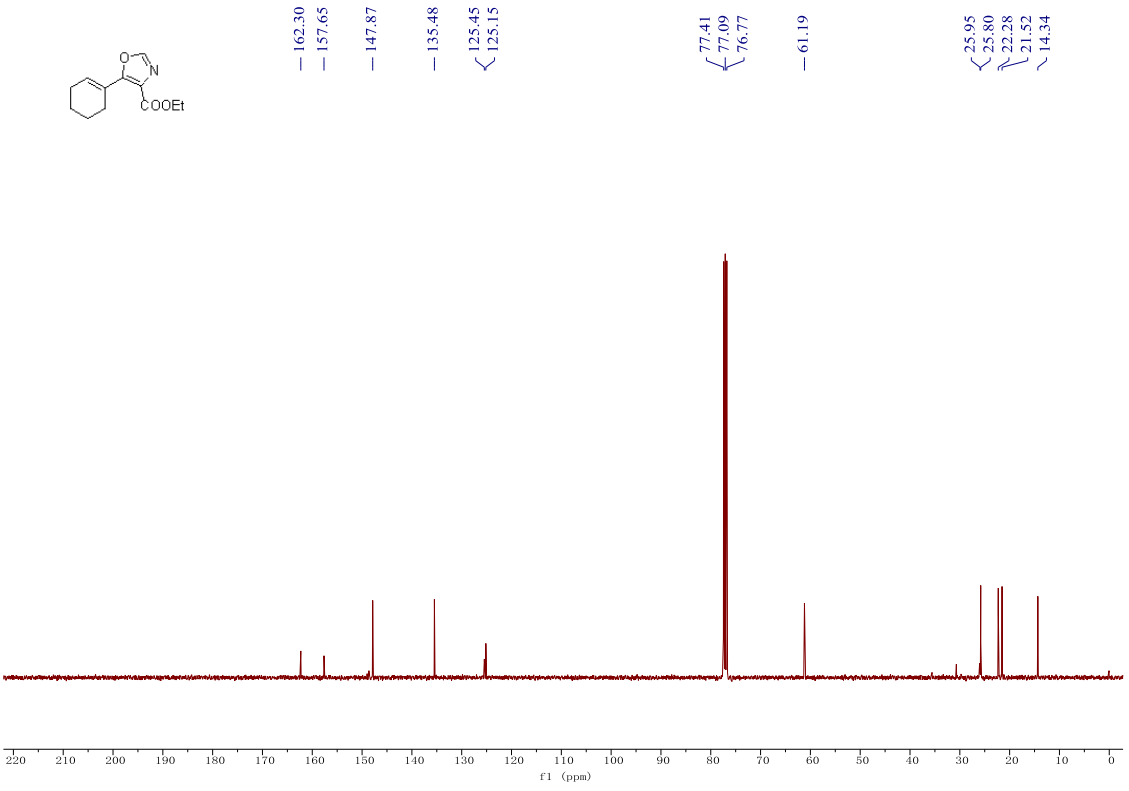
53c ^{1}H NMR and ^{13}C NMR



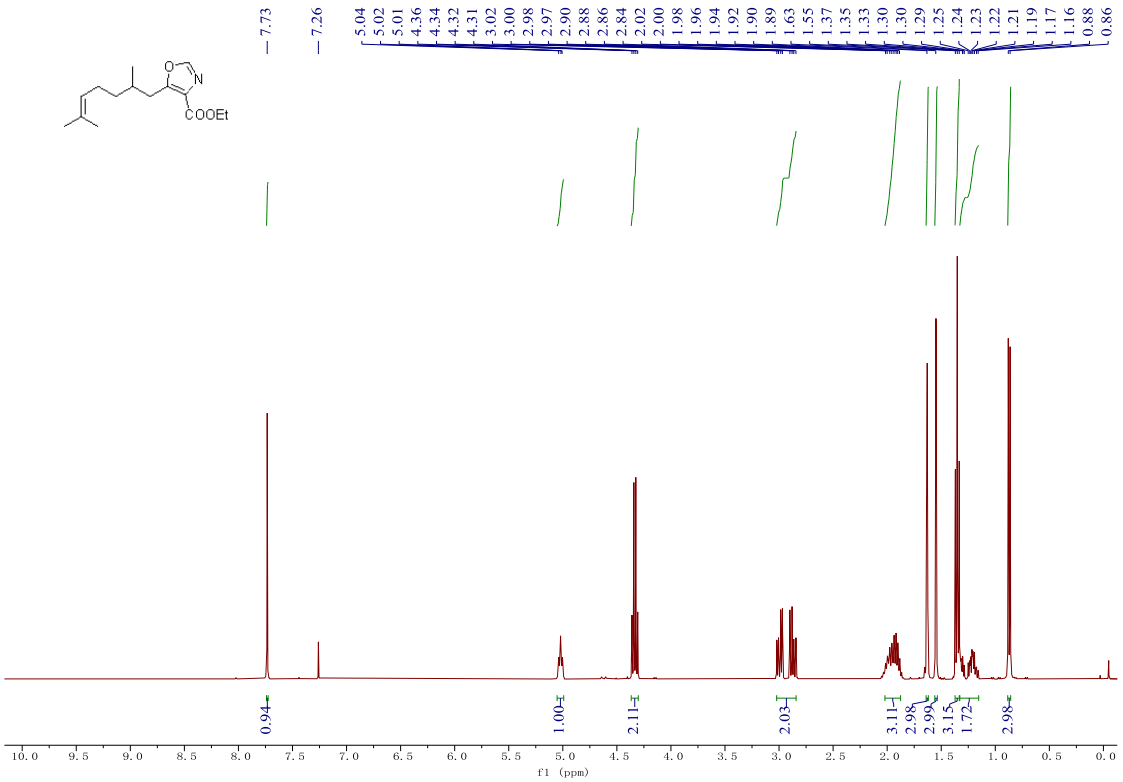


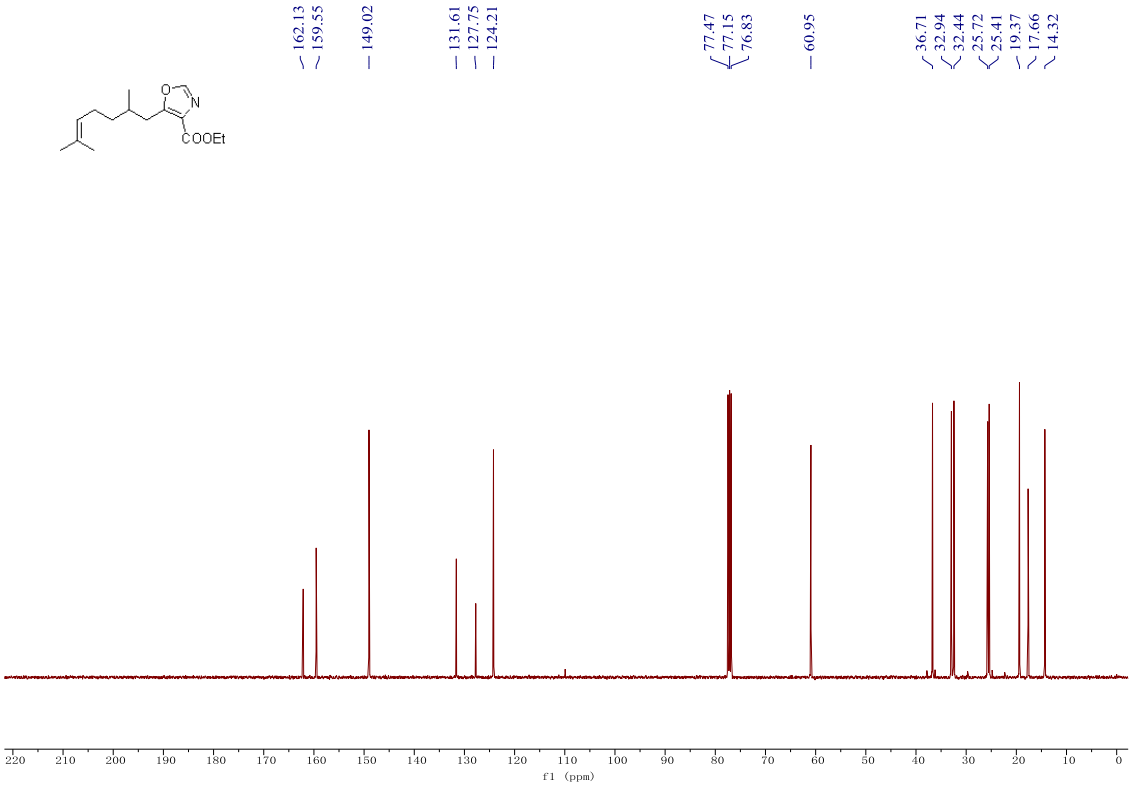
54c ^{1}H NMR and ^{13}C NMR



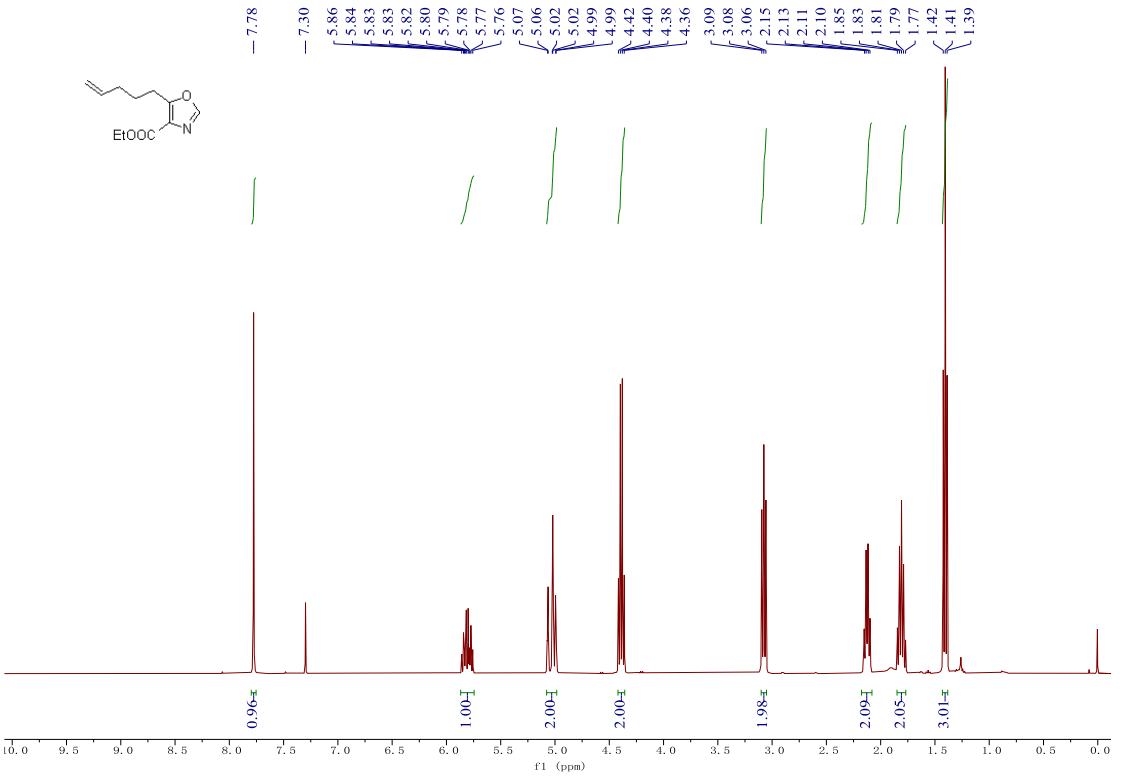


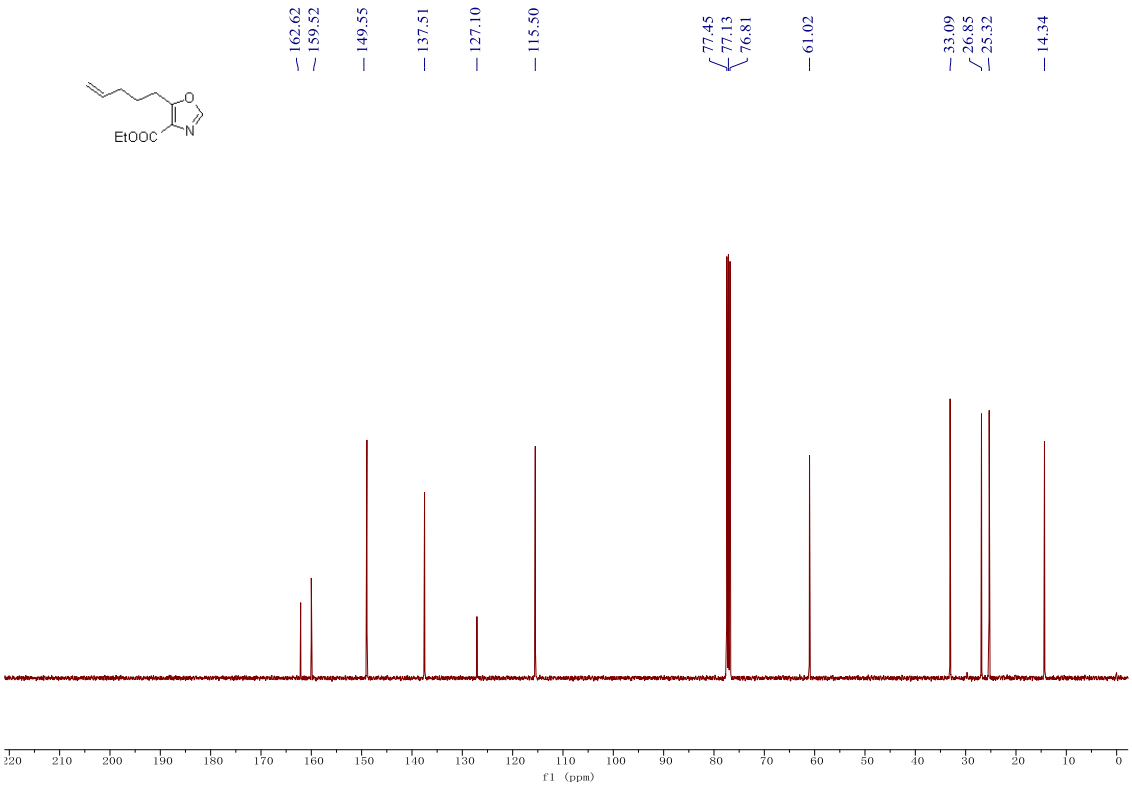
55c ^{1}H NMR and ^{13}C NMR





56c ^{1}H NMR and ^{13}C NMR





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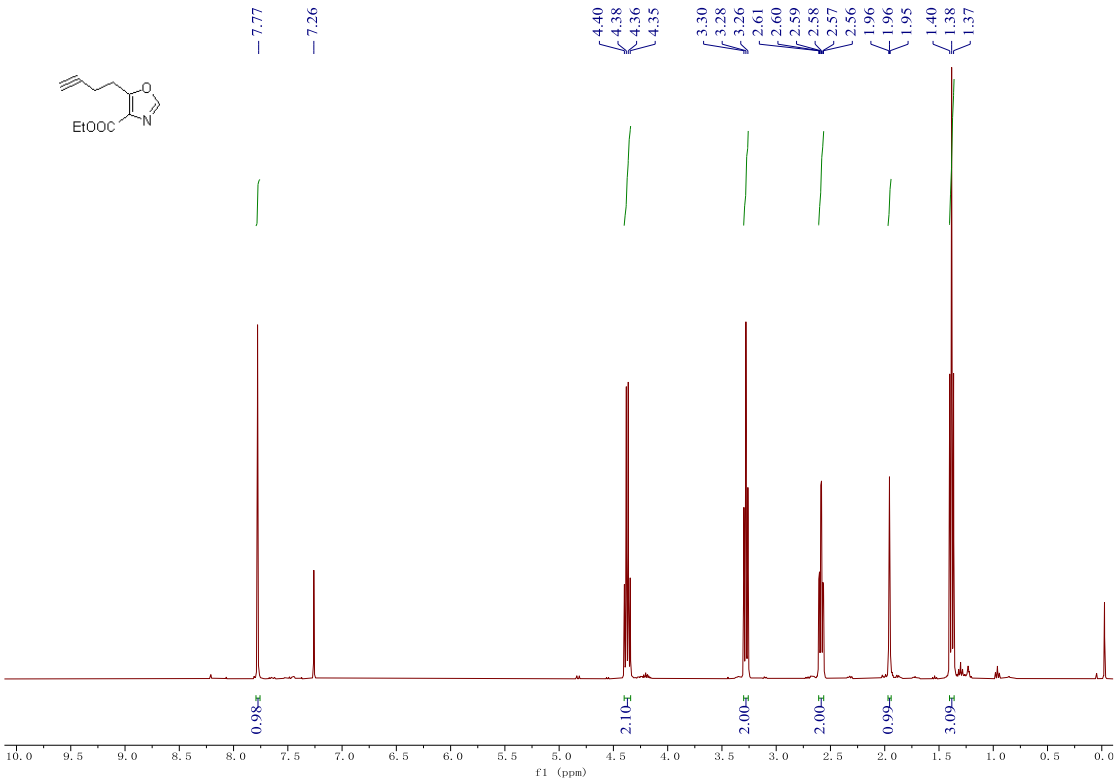
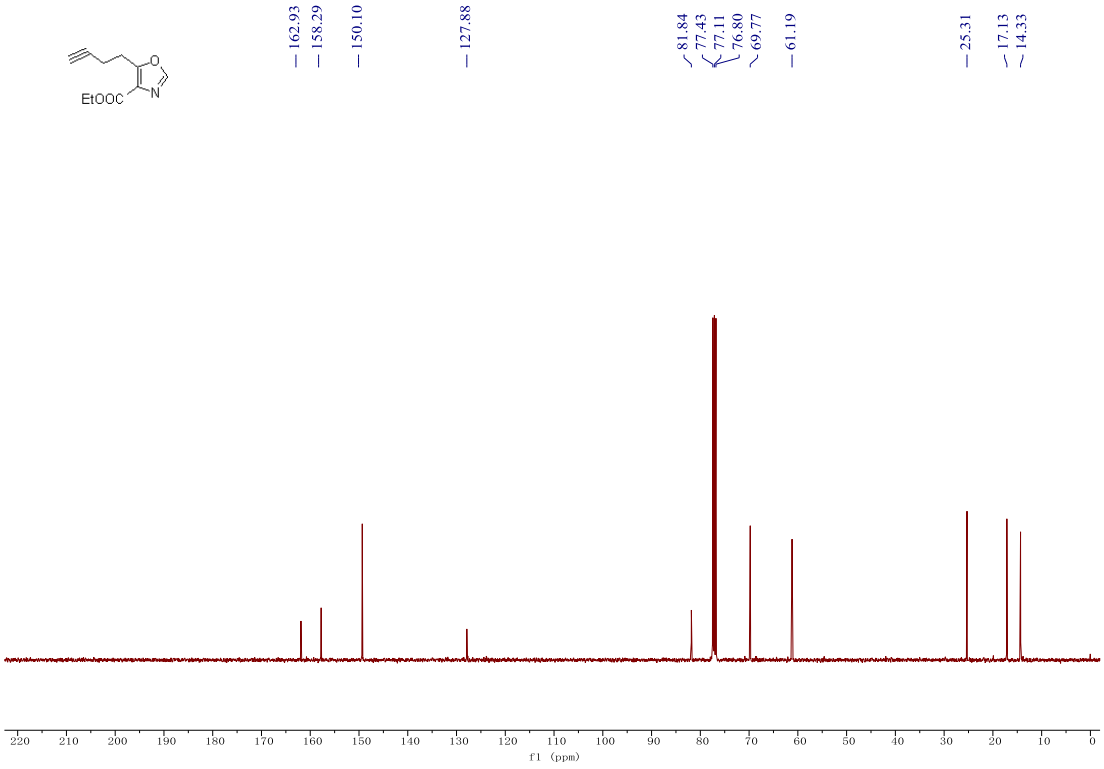
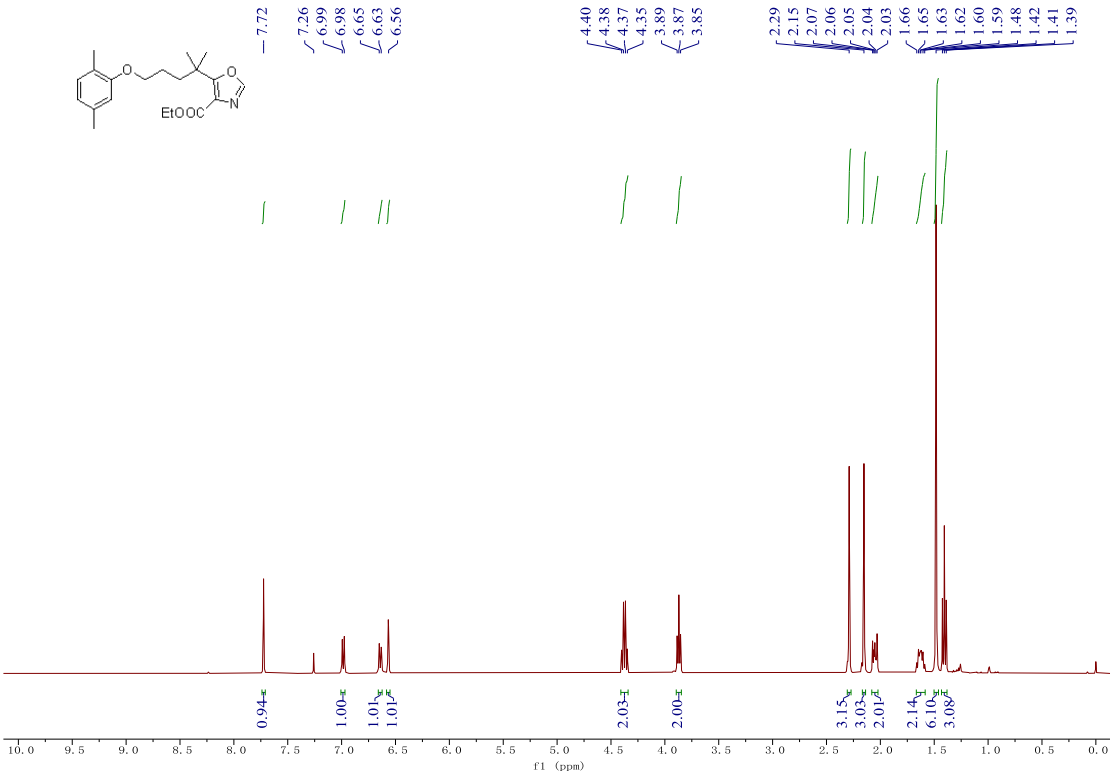
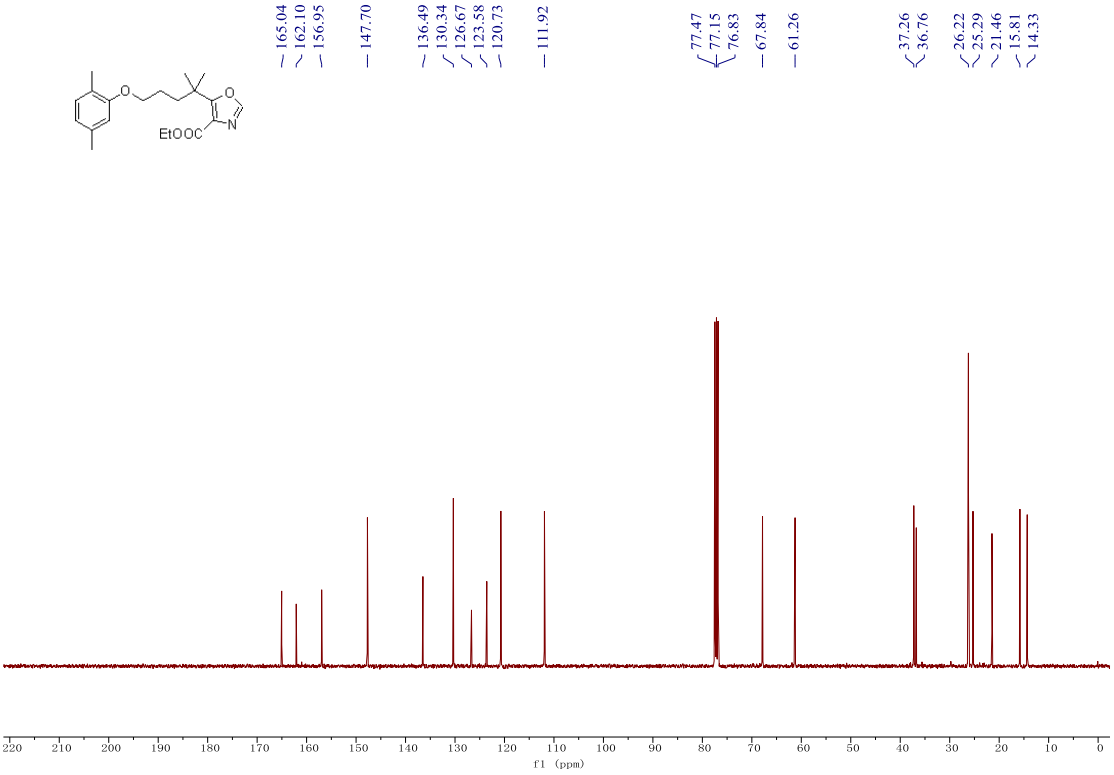


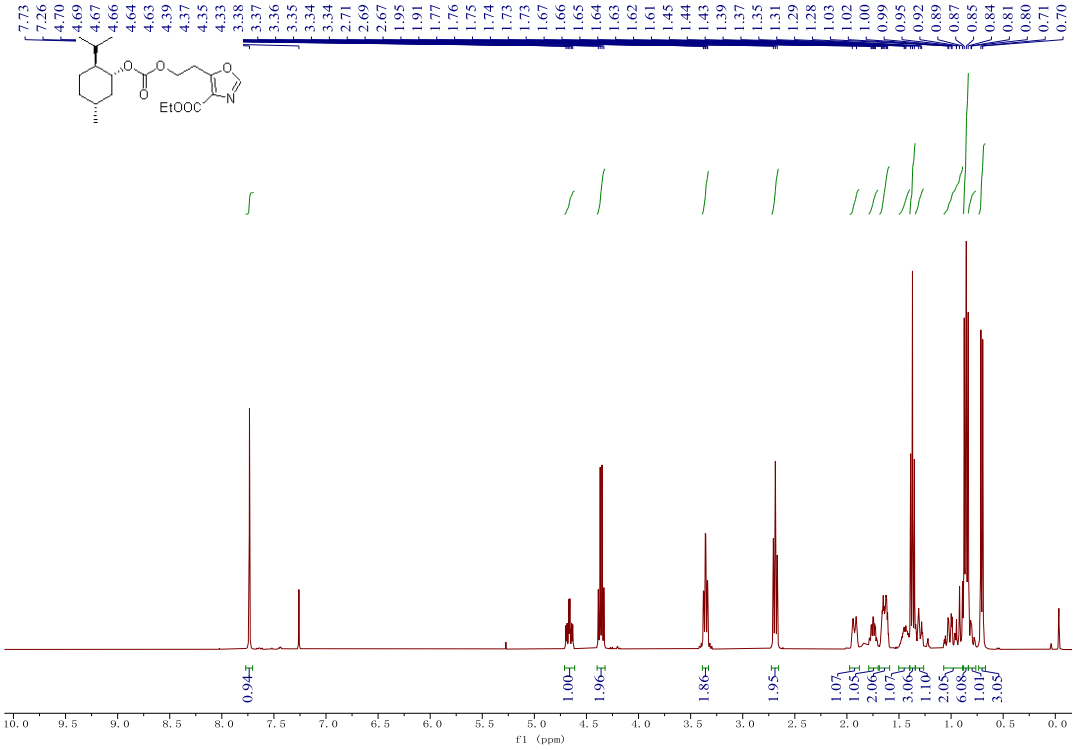


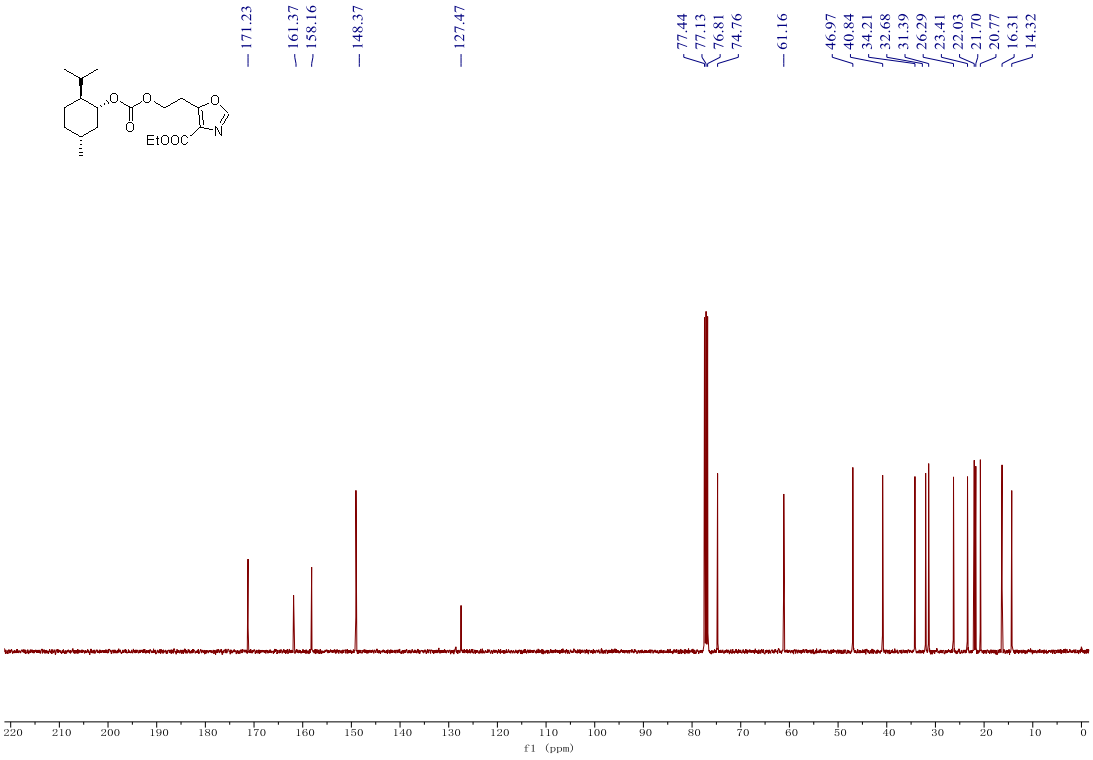
58c ^{1}H NMR and ^{13}C NMR





59c ^{1}H NMR and ^{13}C NMR





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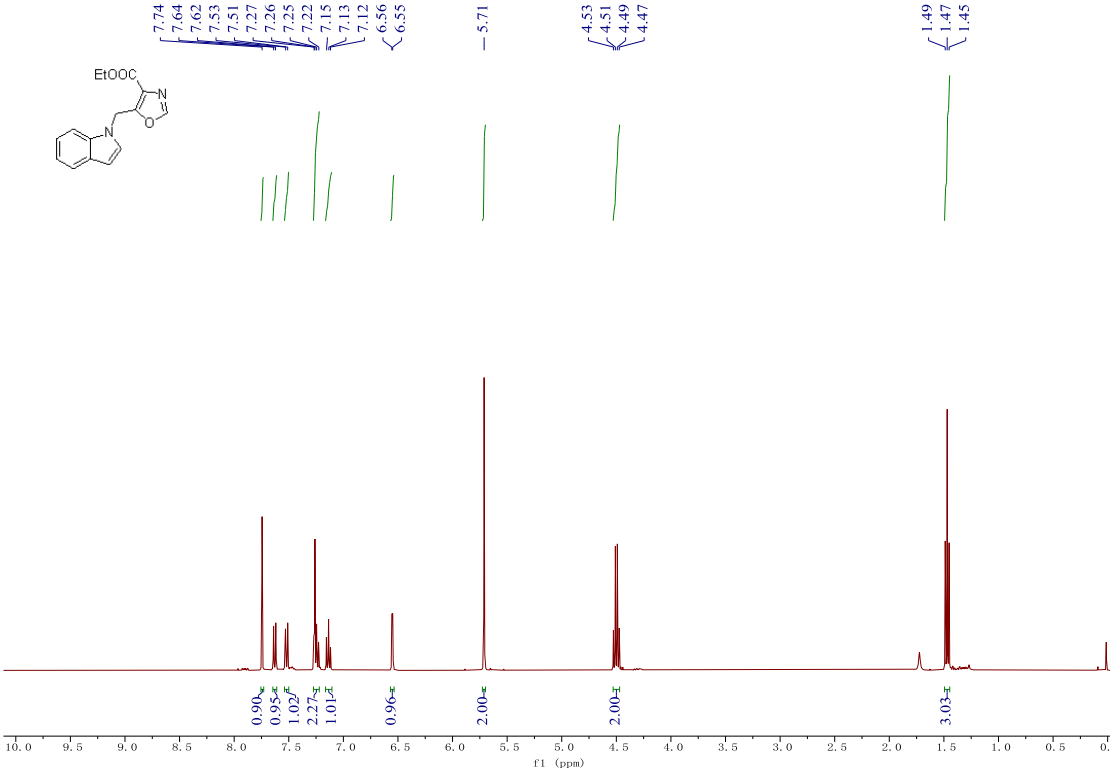
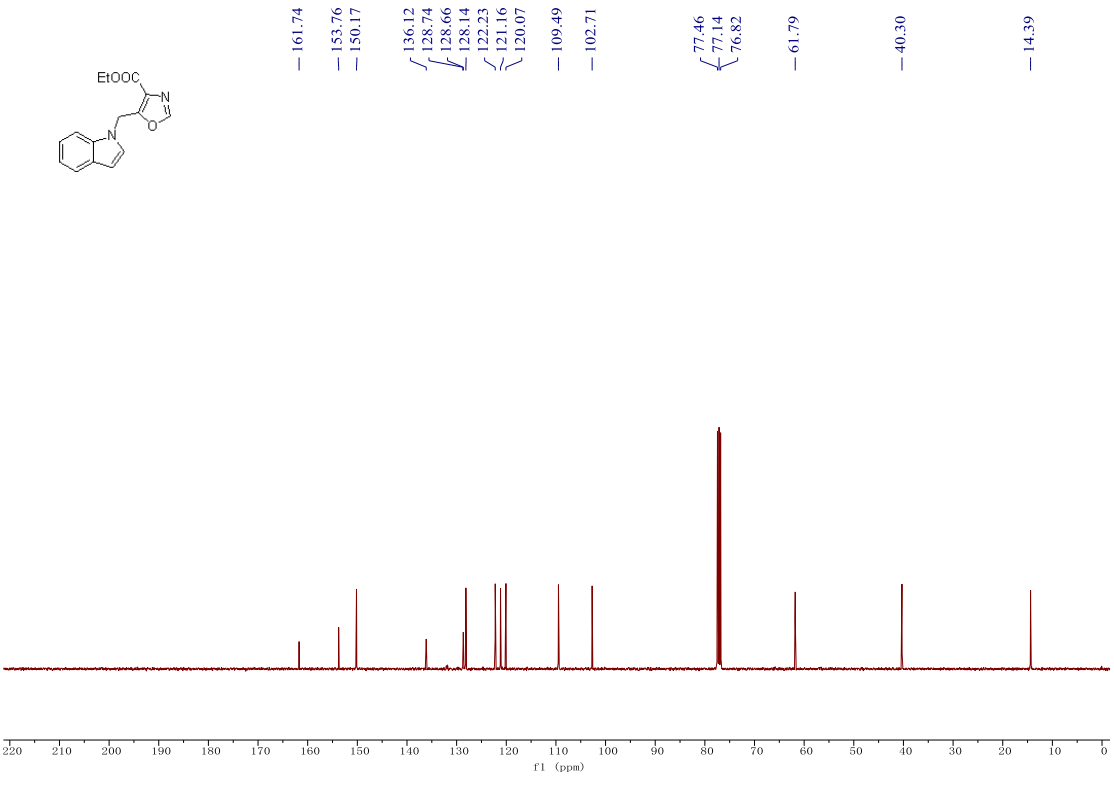
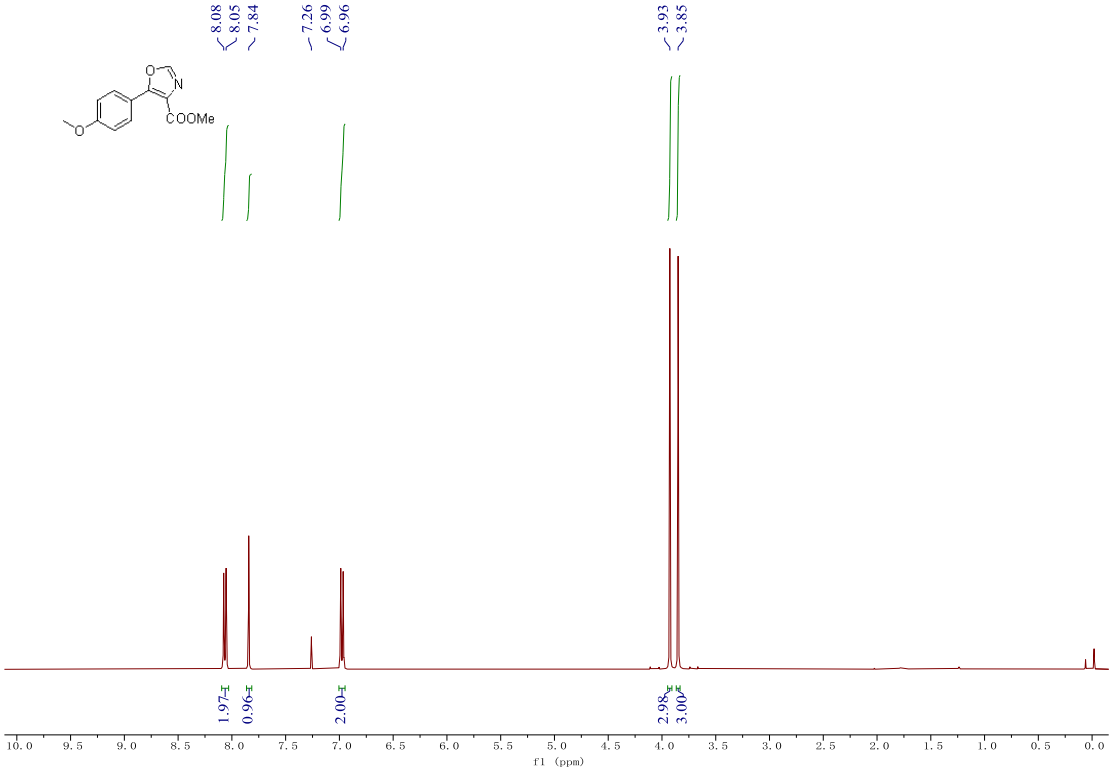
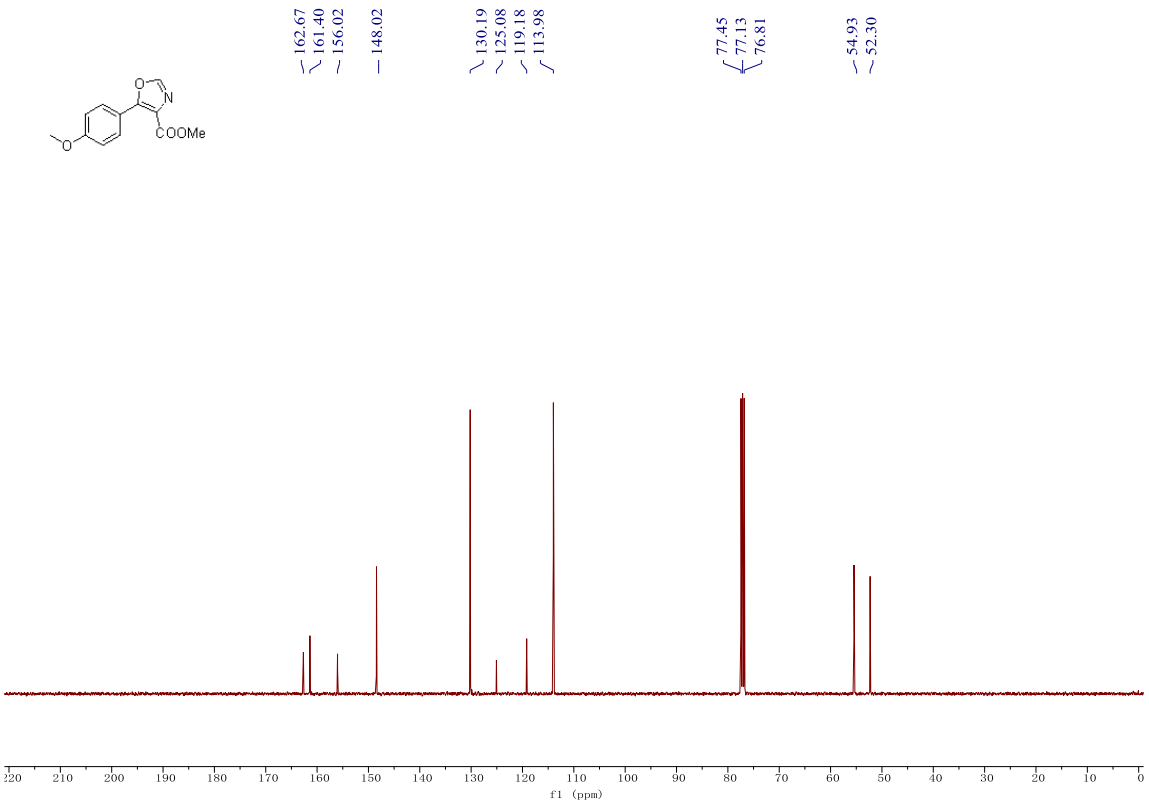




61c ^{1}H NMR and ^{13}C NMR





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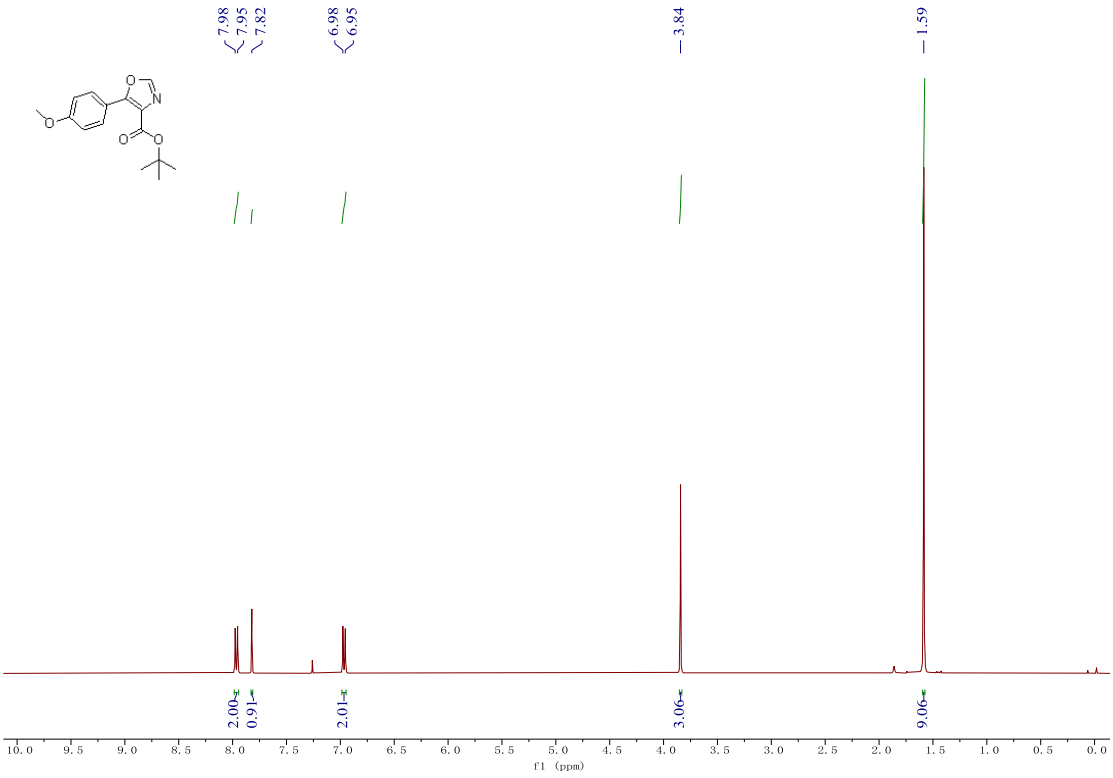
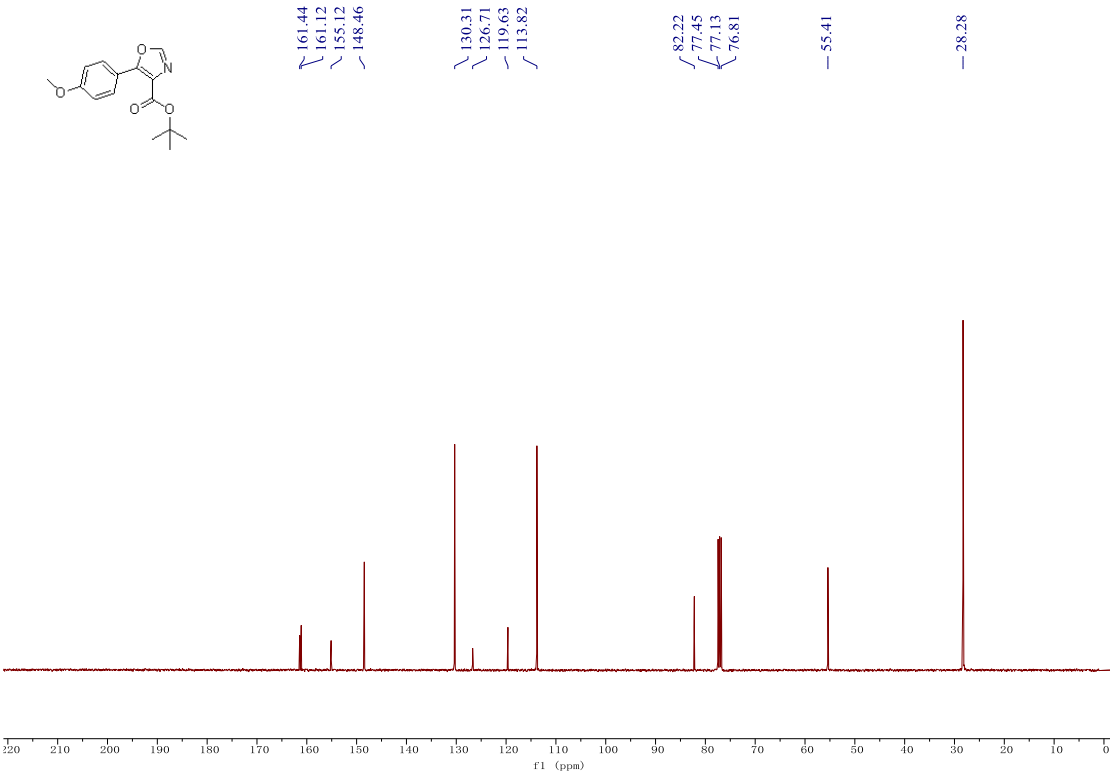
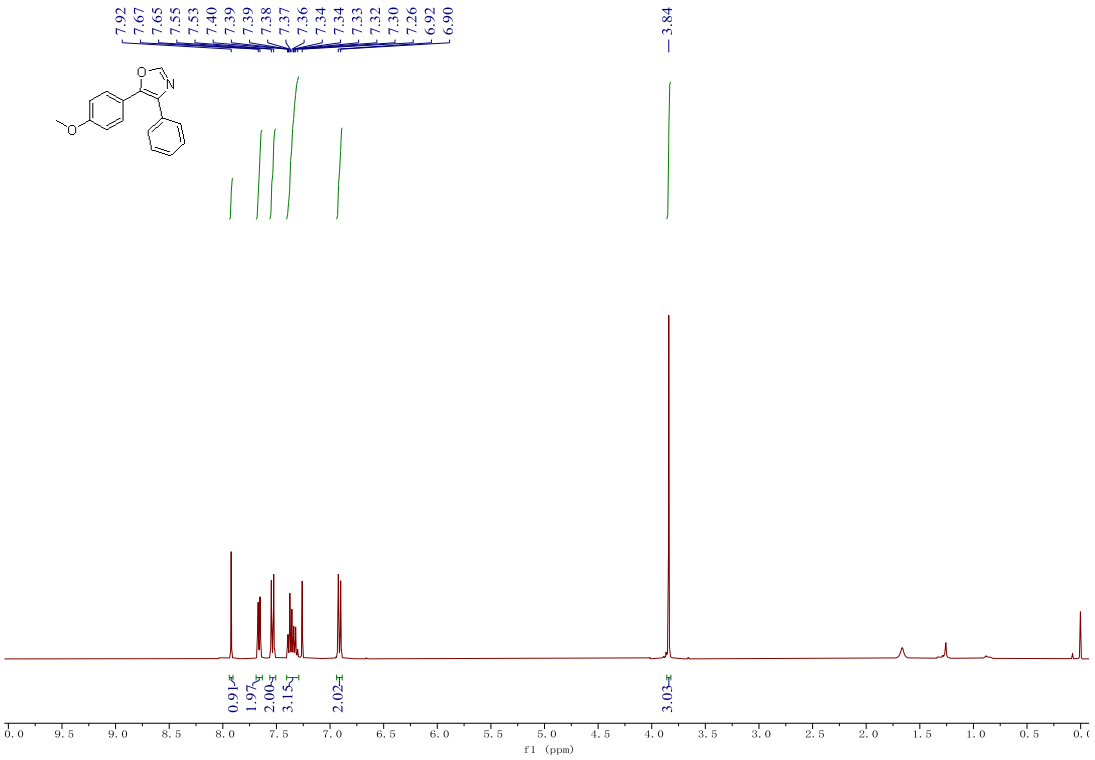
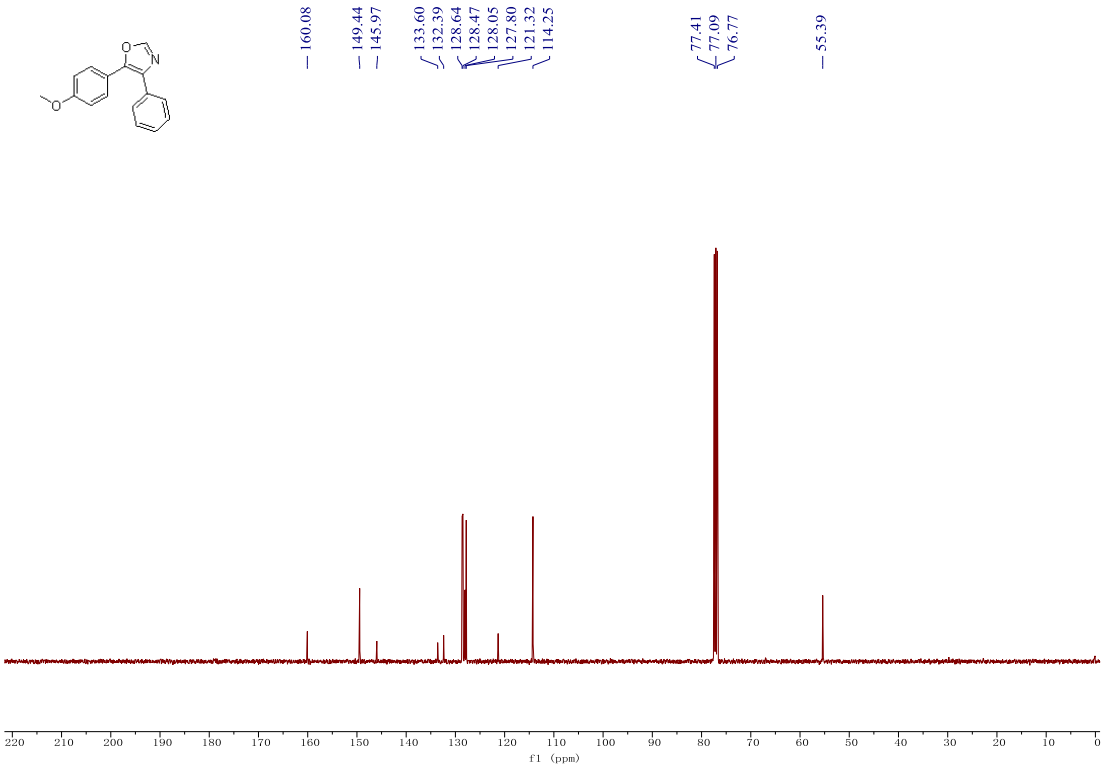


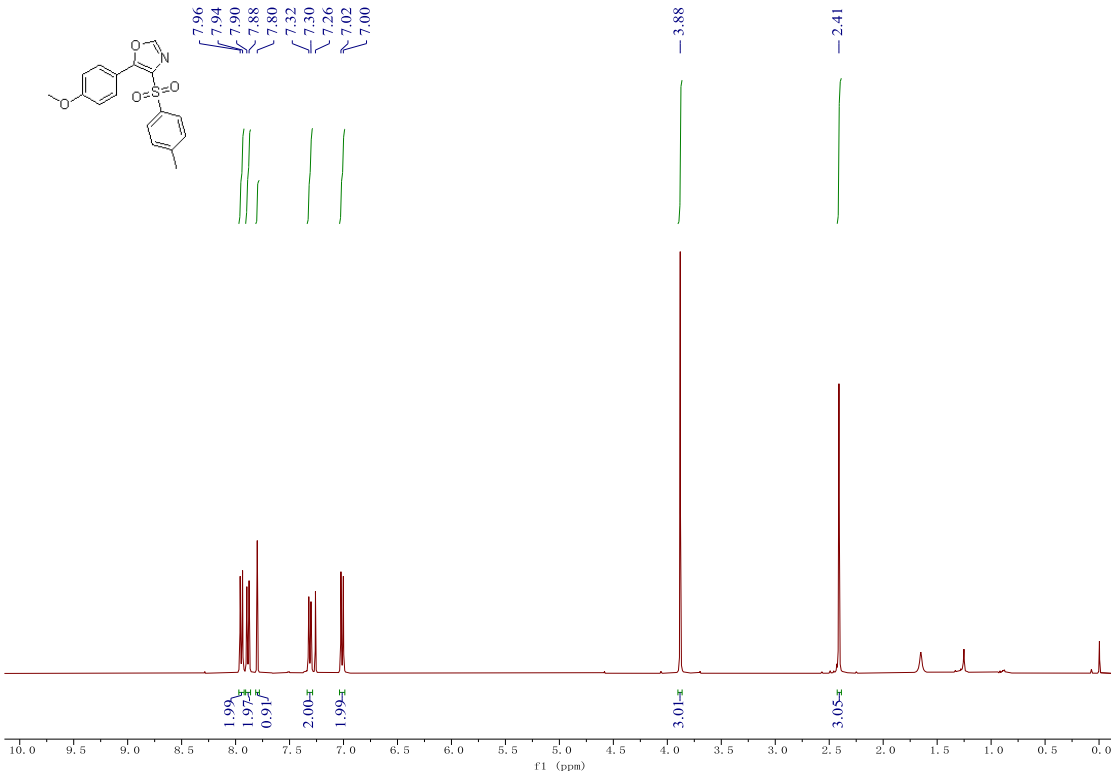


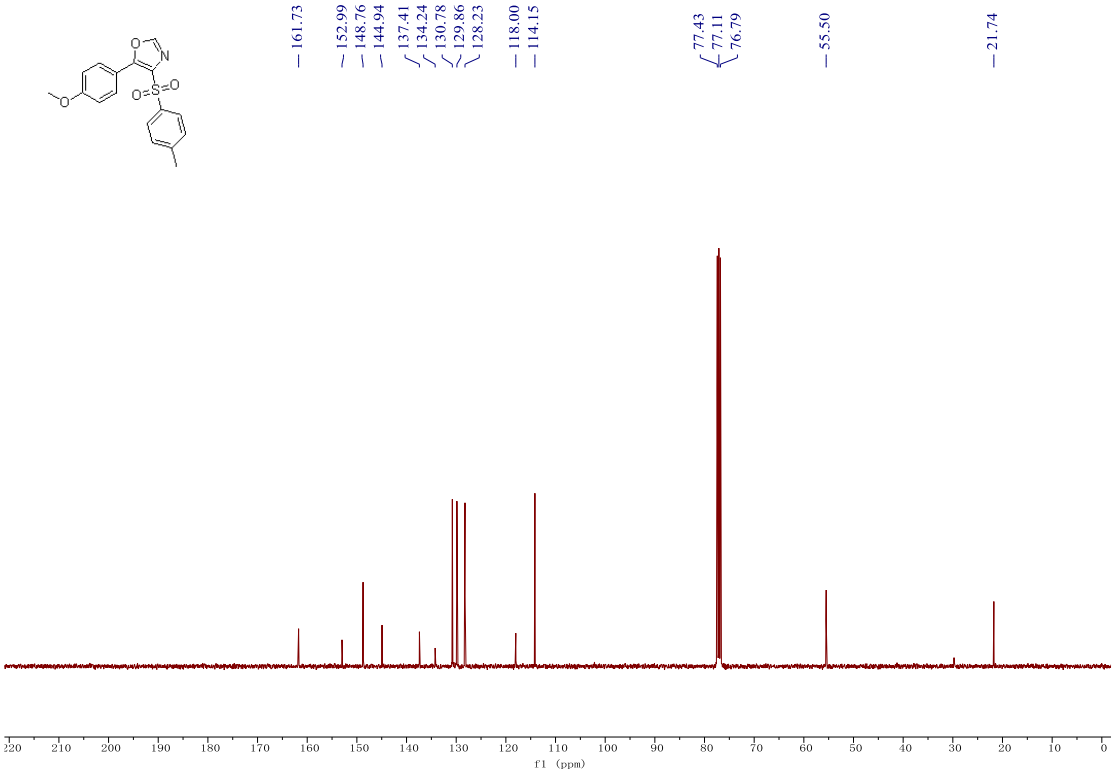
63c ^{1}H NMR and ^{13}C NMR



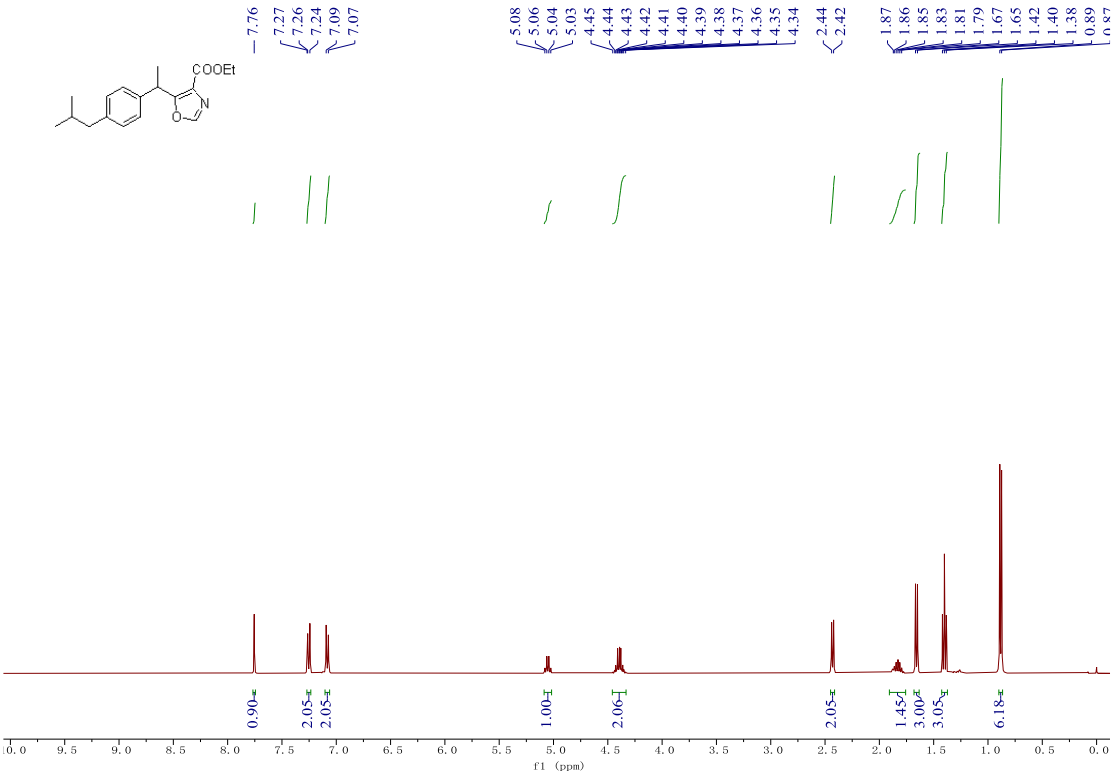


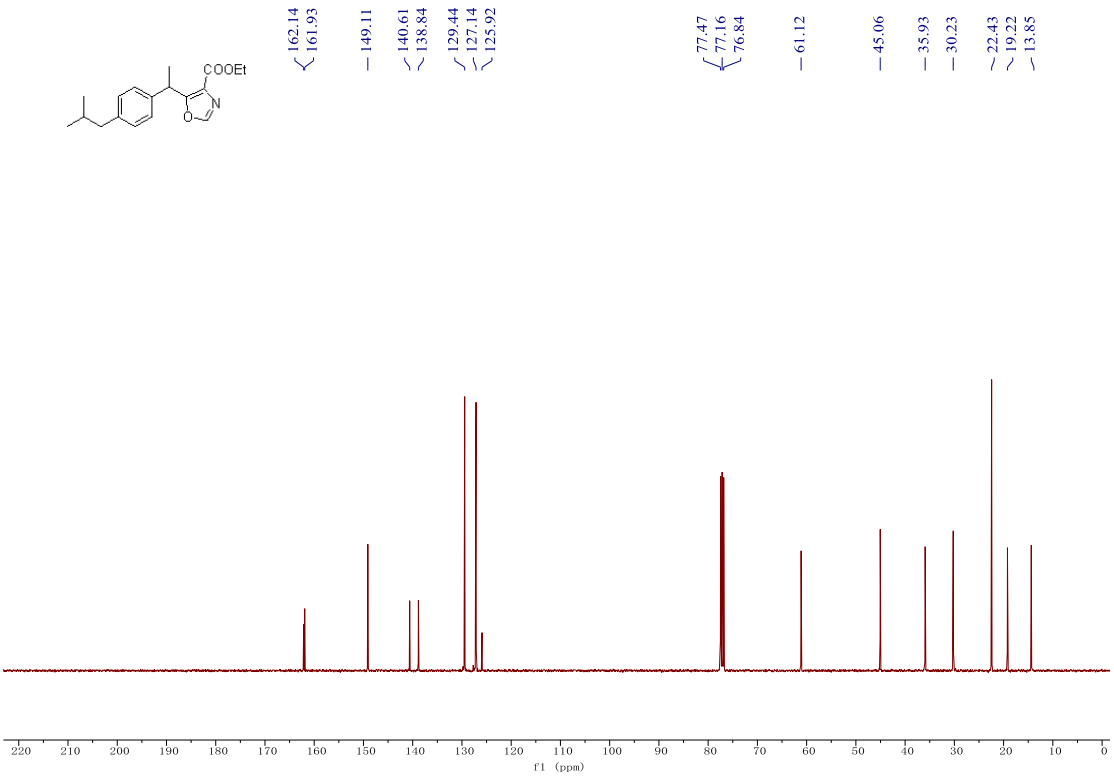
64c ^{1}H NMR and ^{13}C NMR



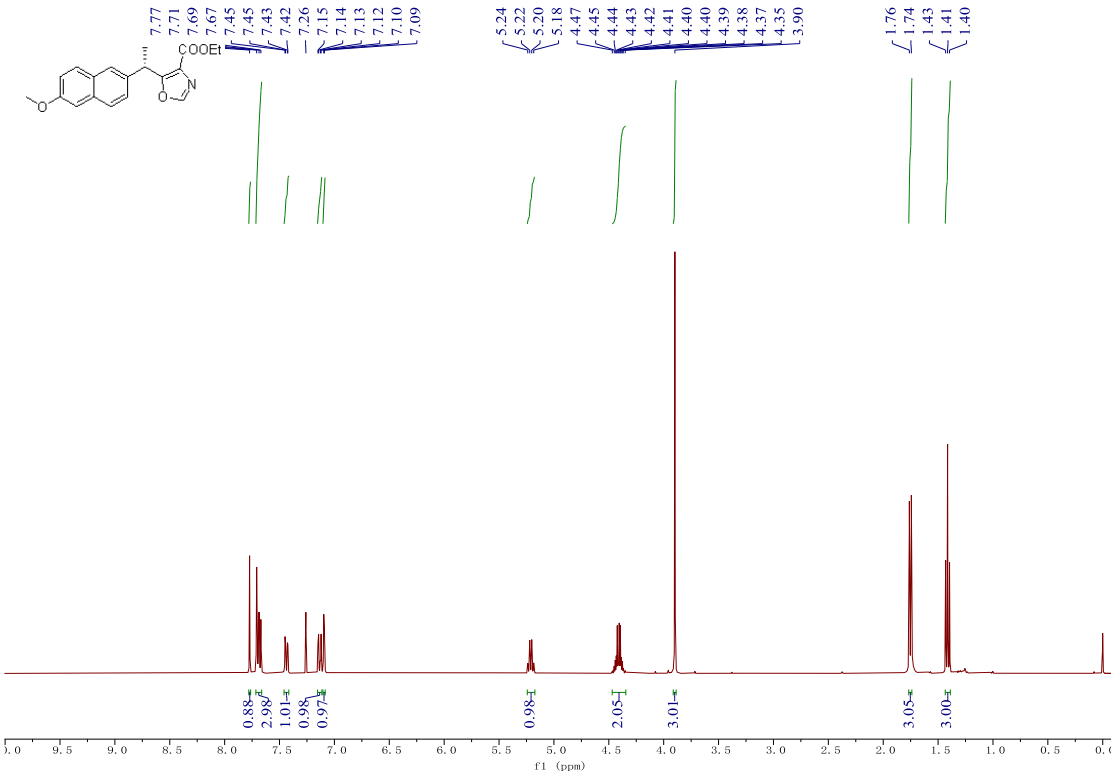


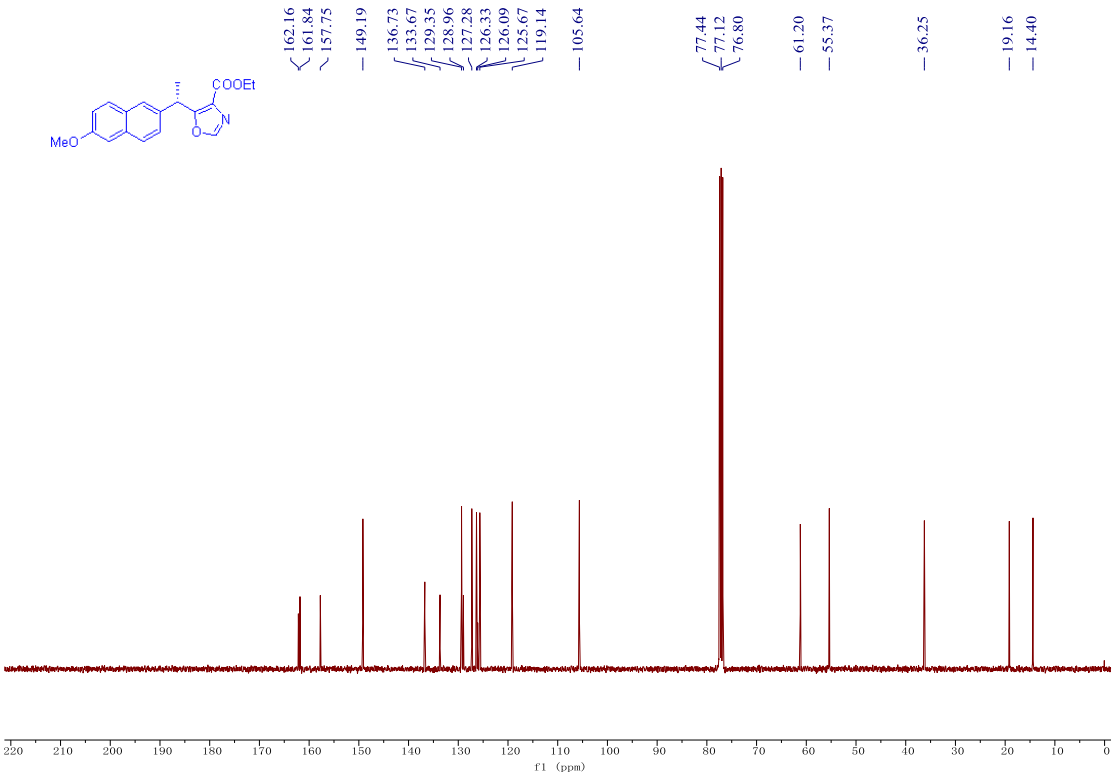
65c ^{1}H NMR and ^{13}C NMR





66c ^{1}H NMR and ^{13}C NMR





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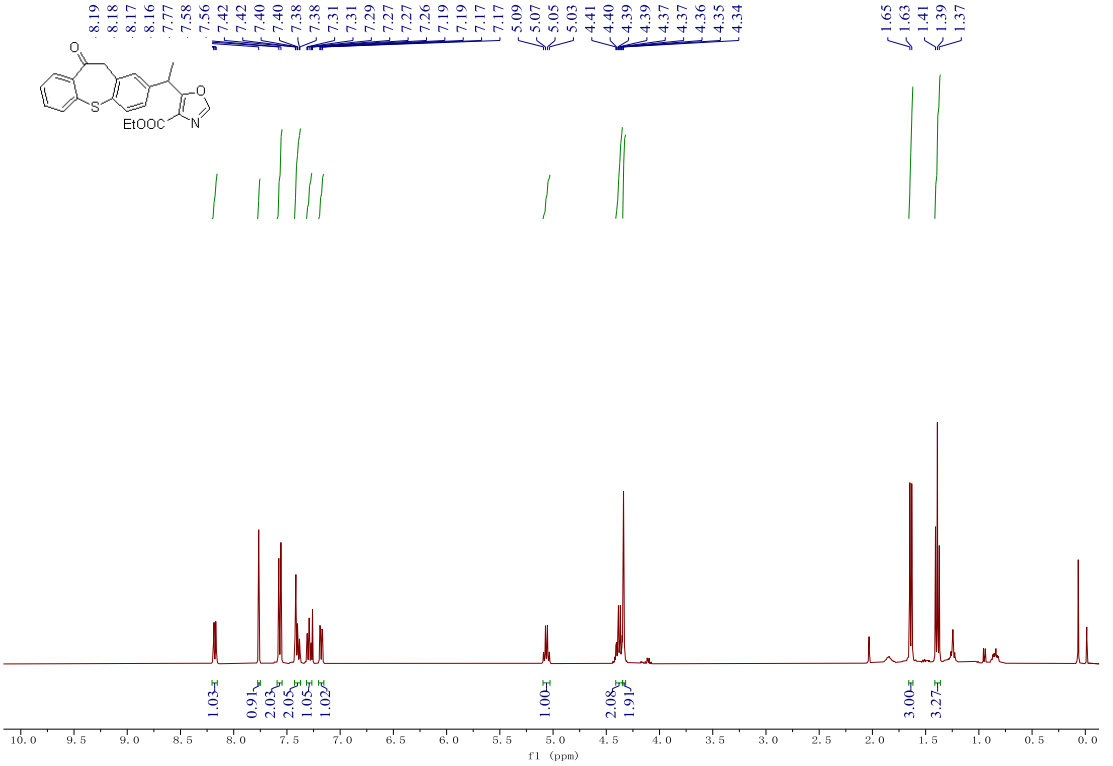
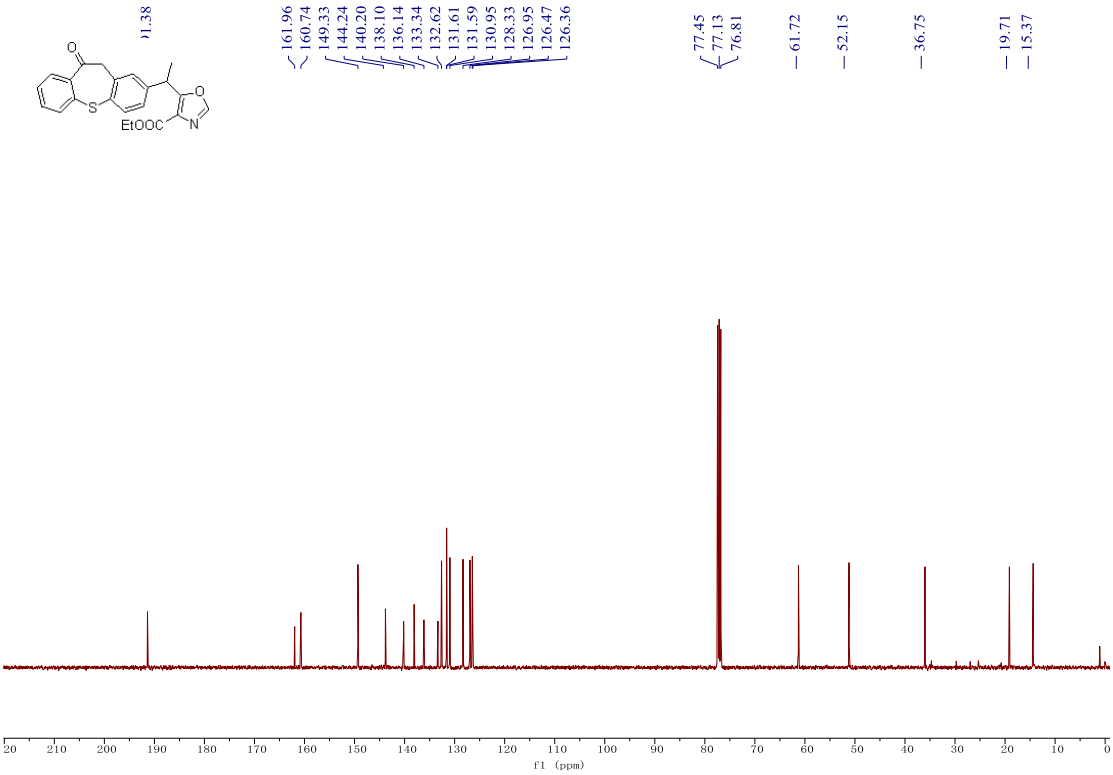
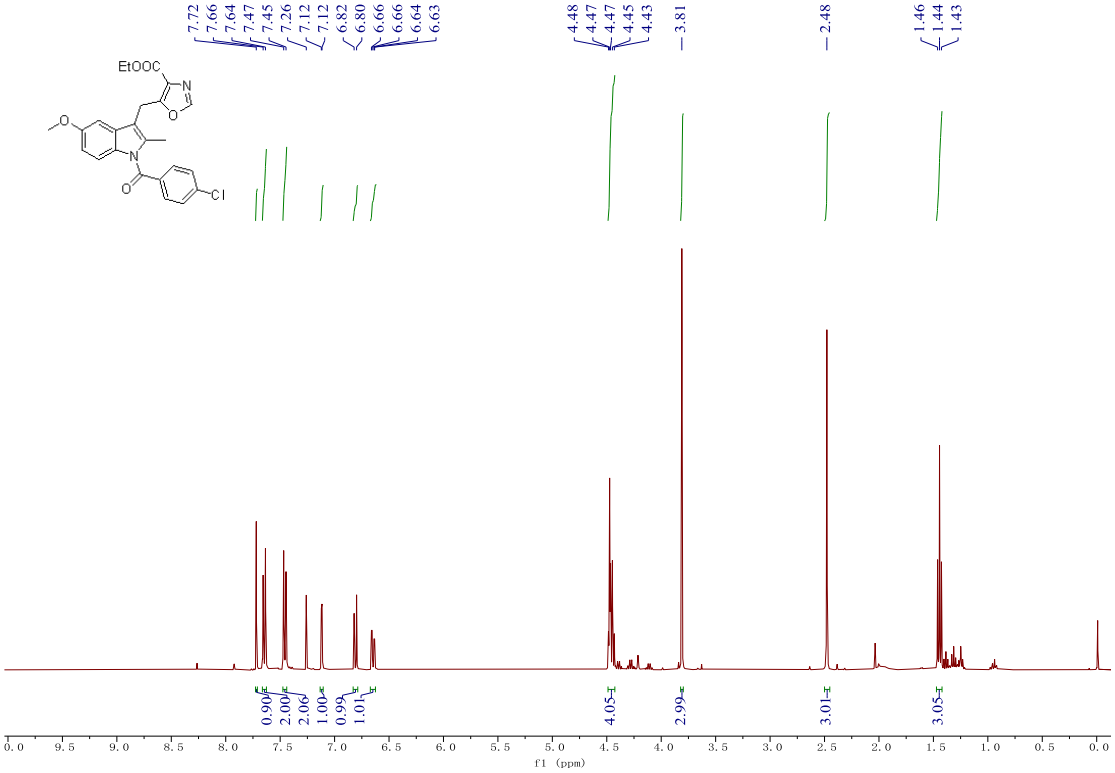
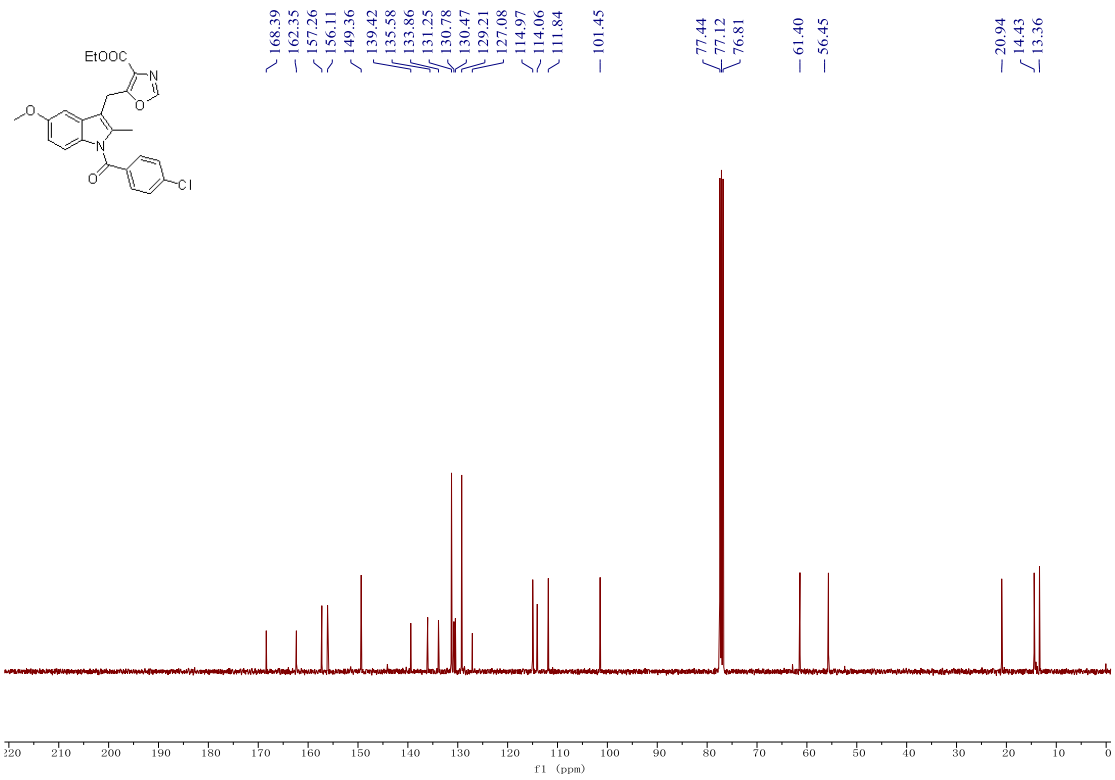




68c ^{1}H NMR and ^{13}C NMR





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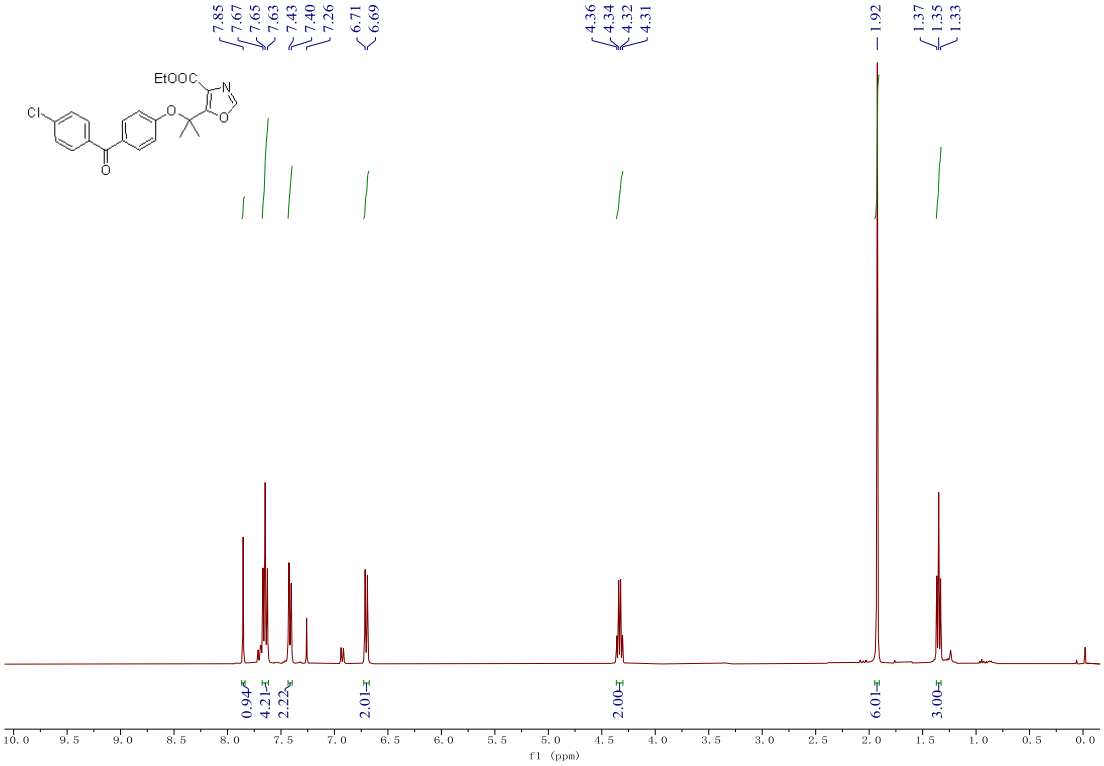

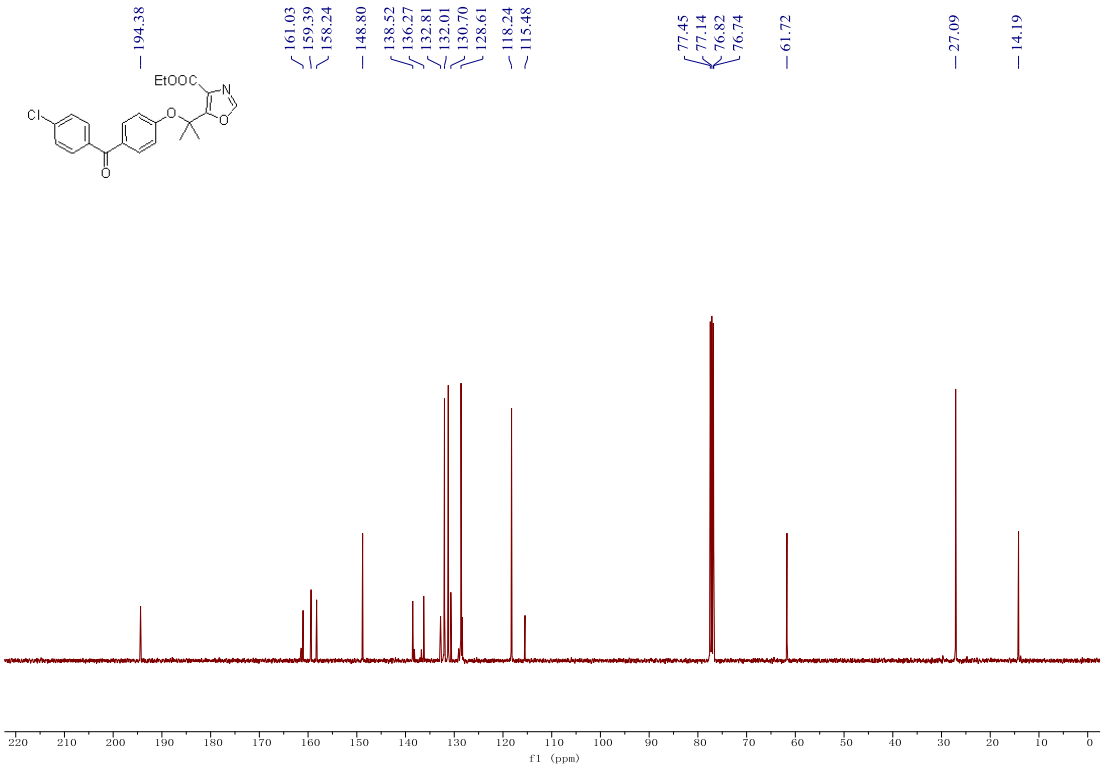

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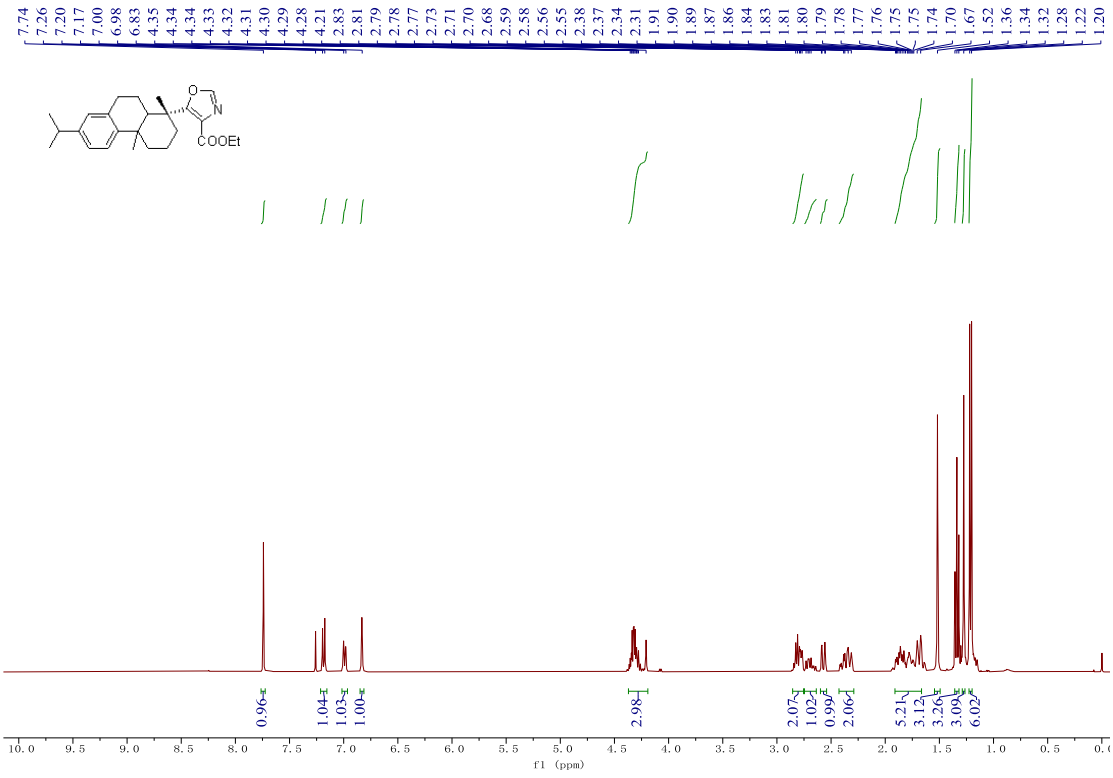

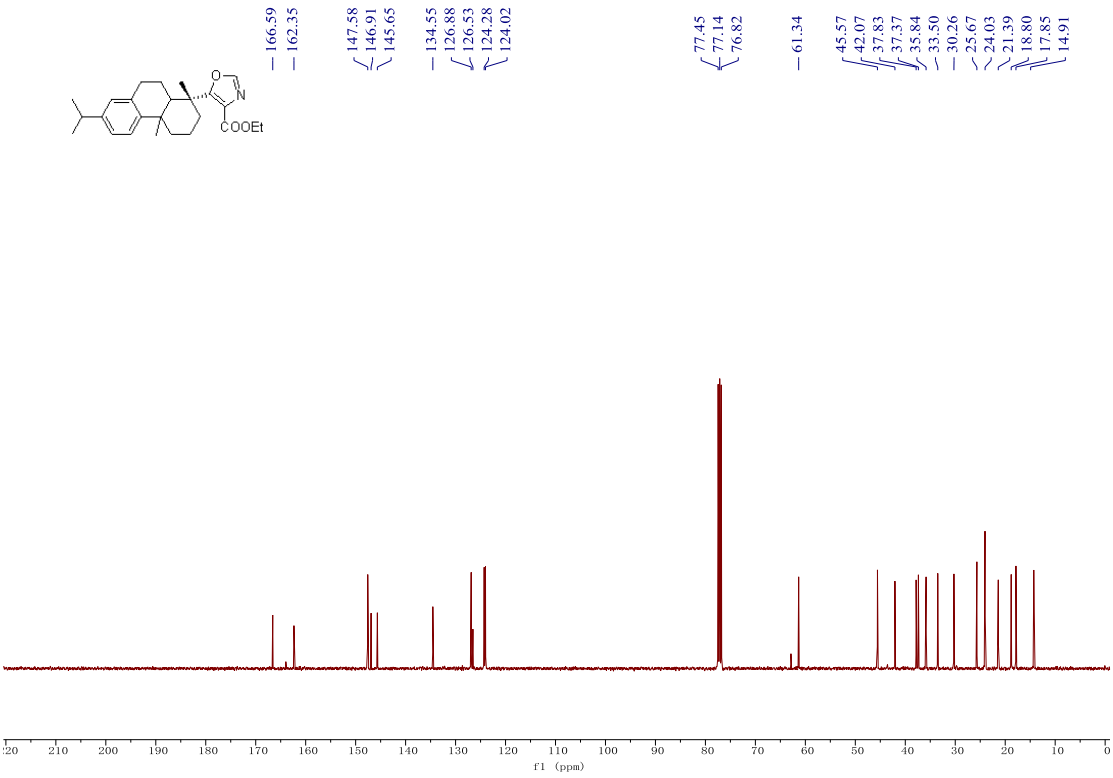

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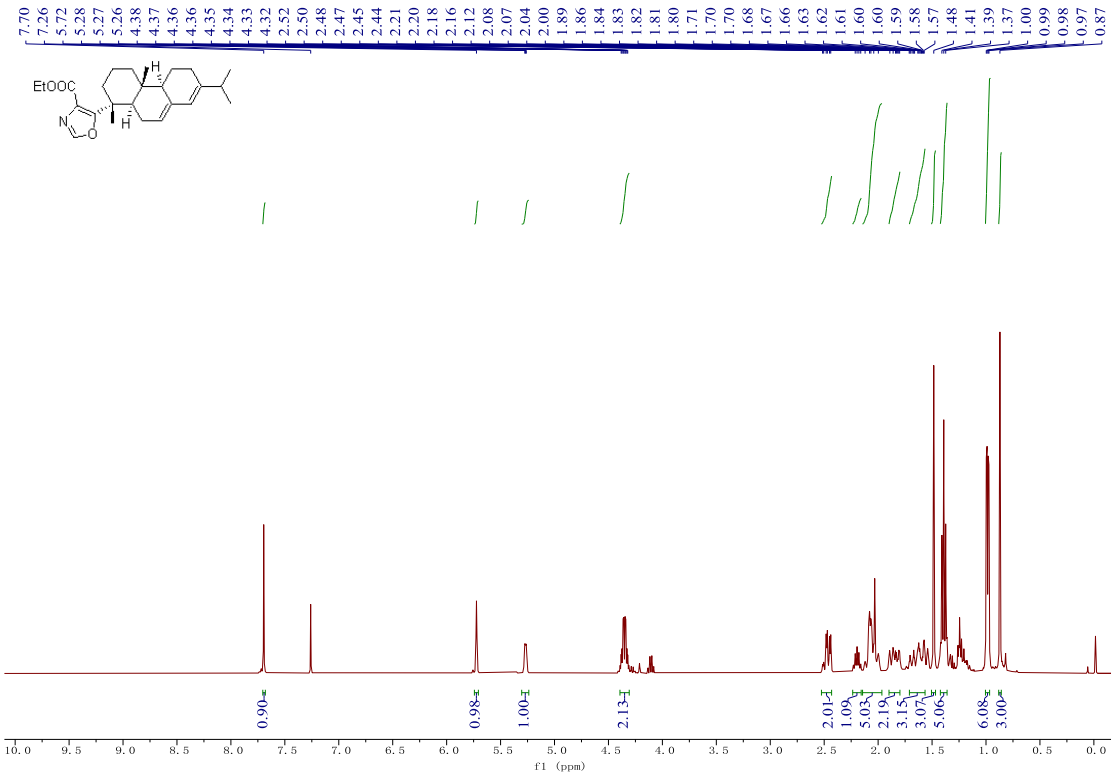
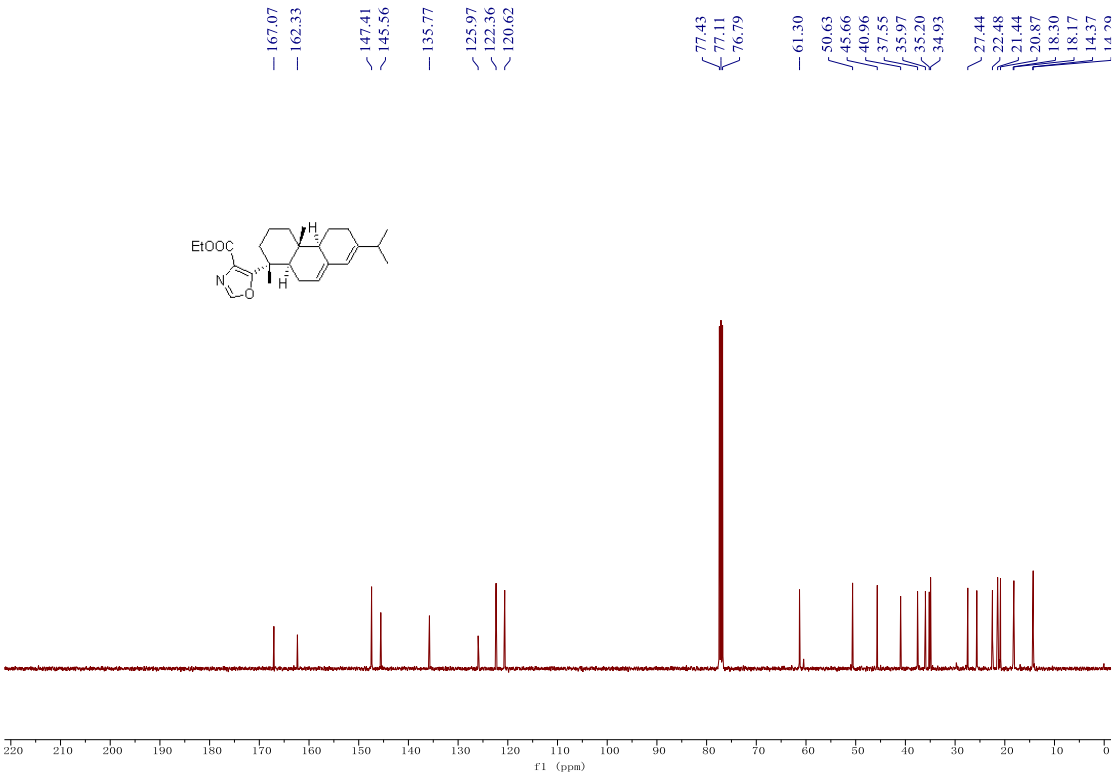
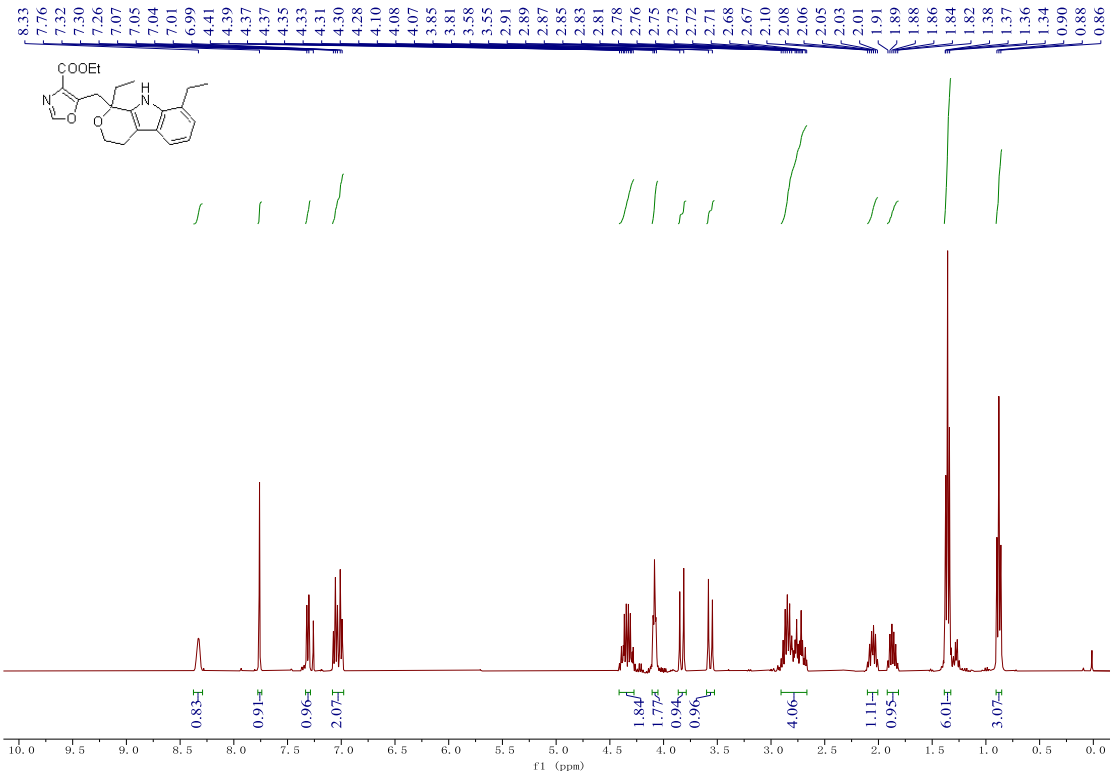
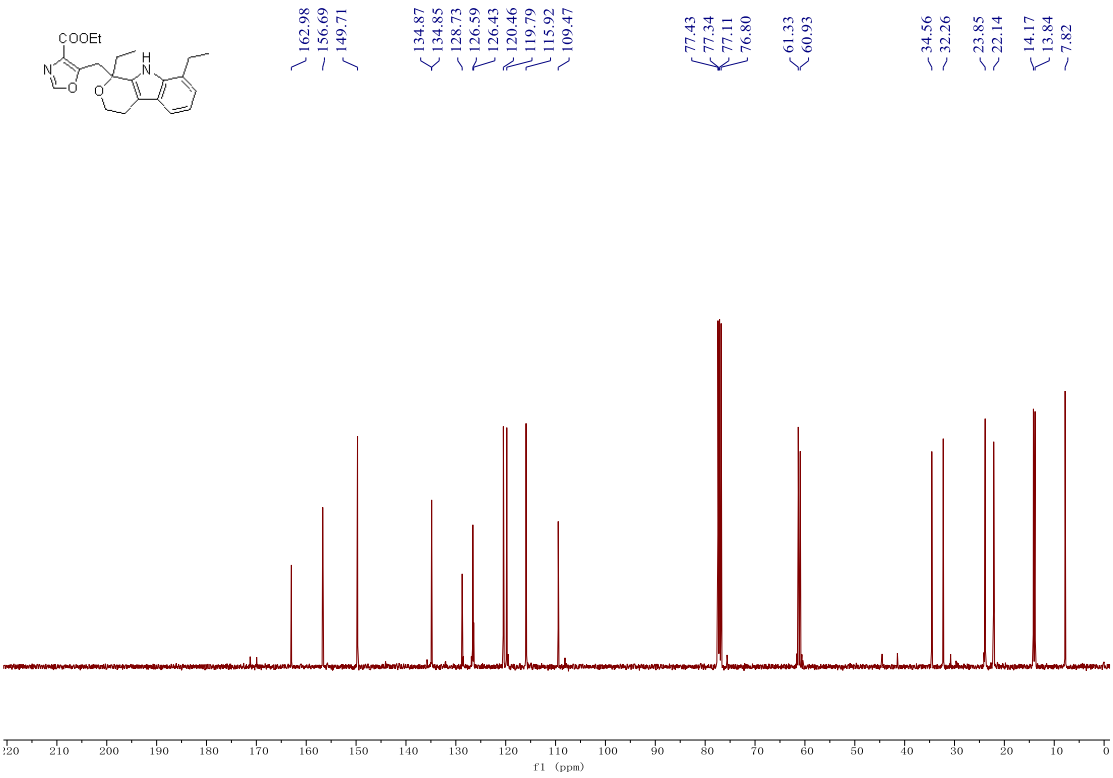


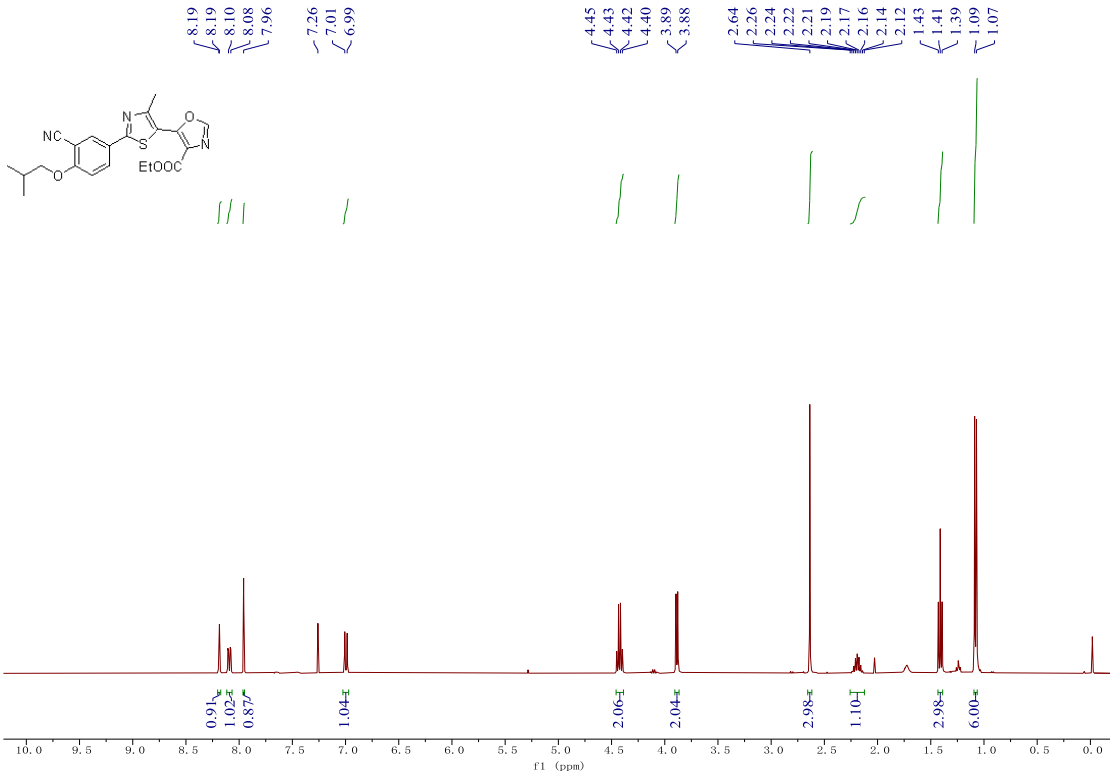


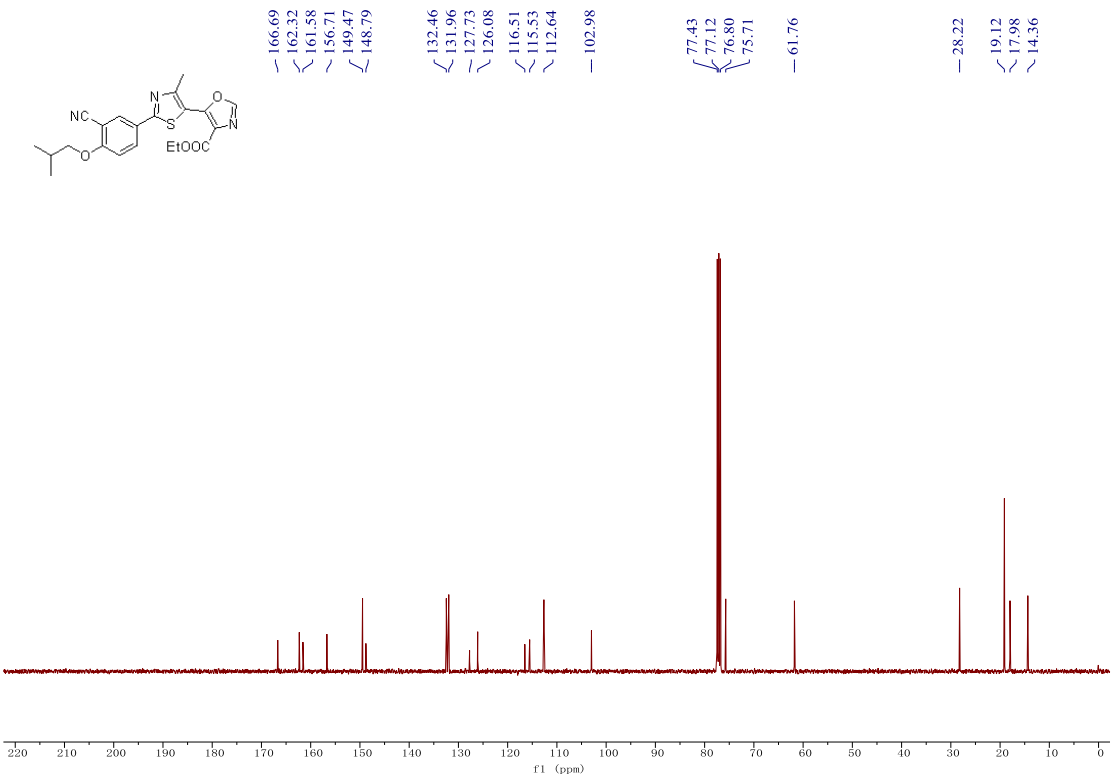
72c ^{1}H NMR and ^{13}C NMR



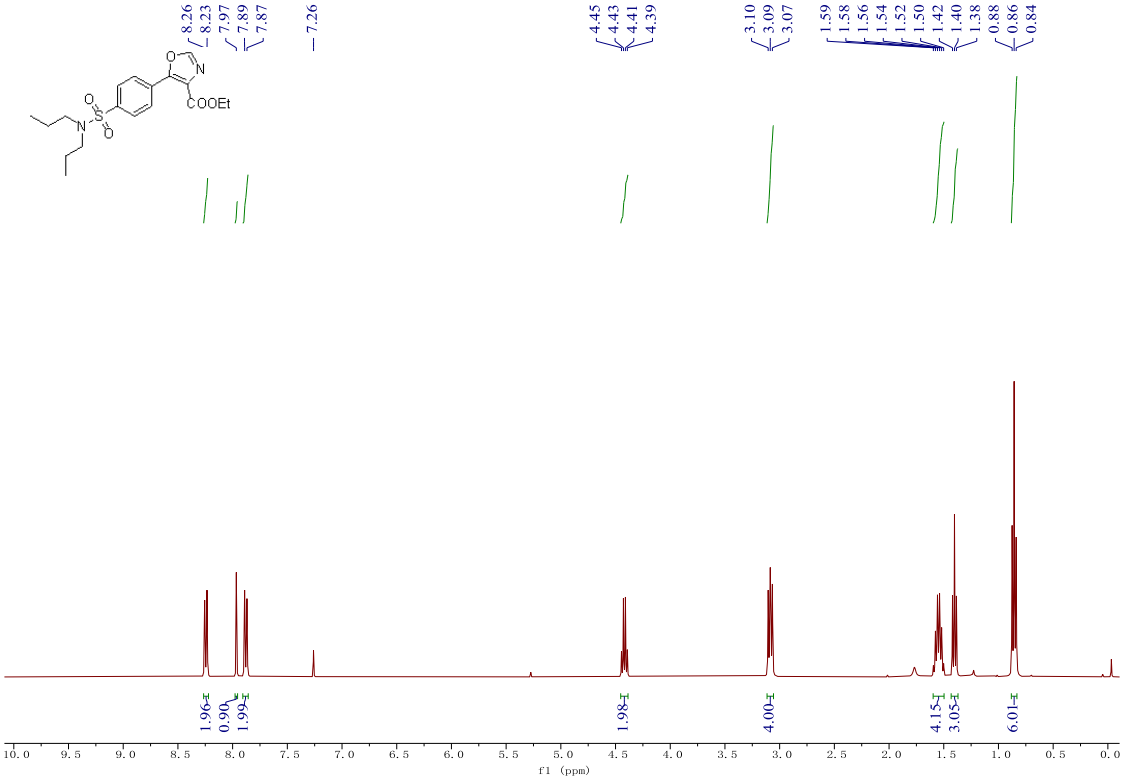


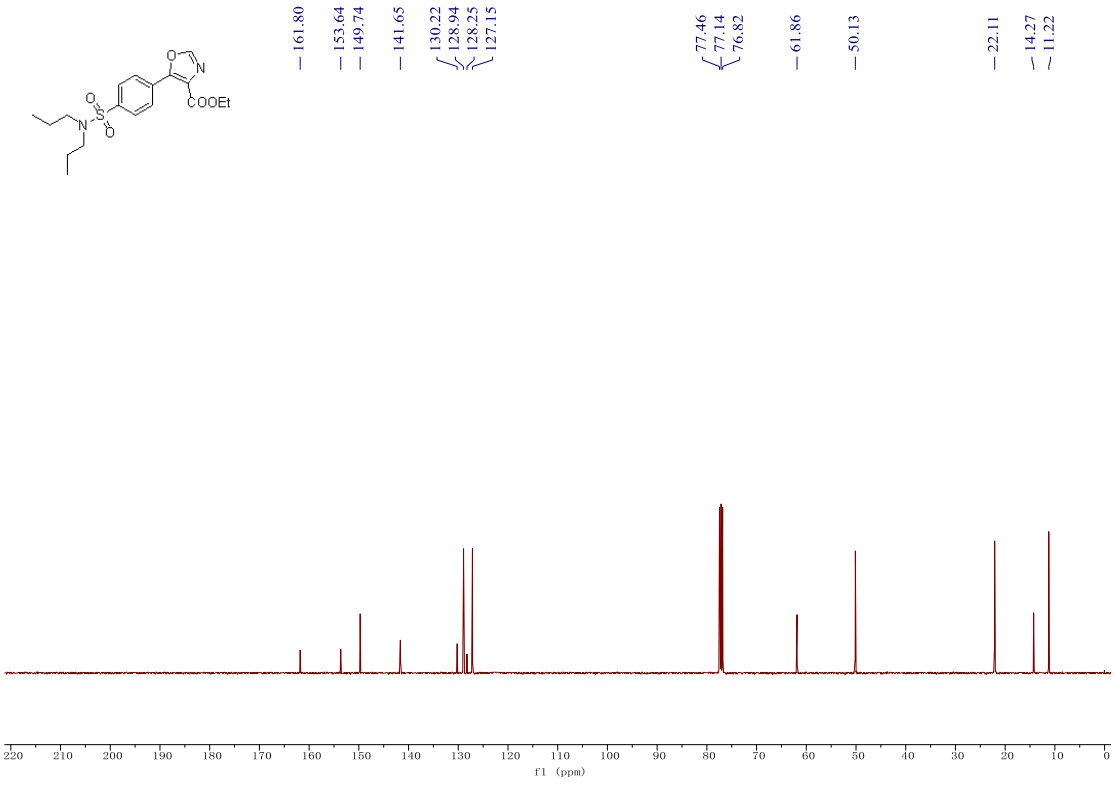
73c ^{1}H NMR and ^{13}C NMR



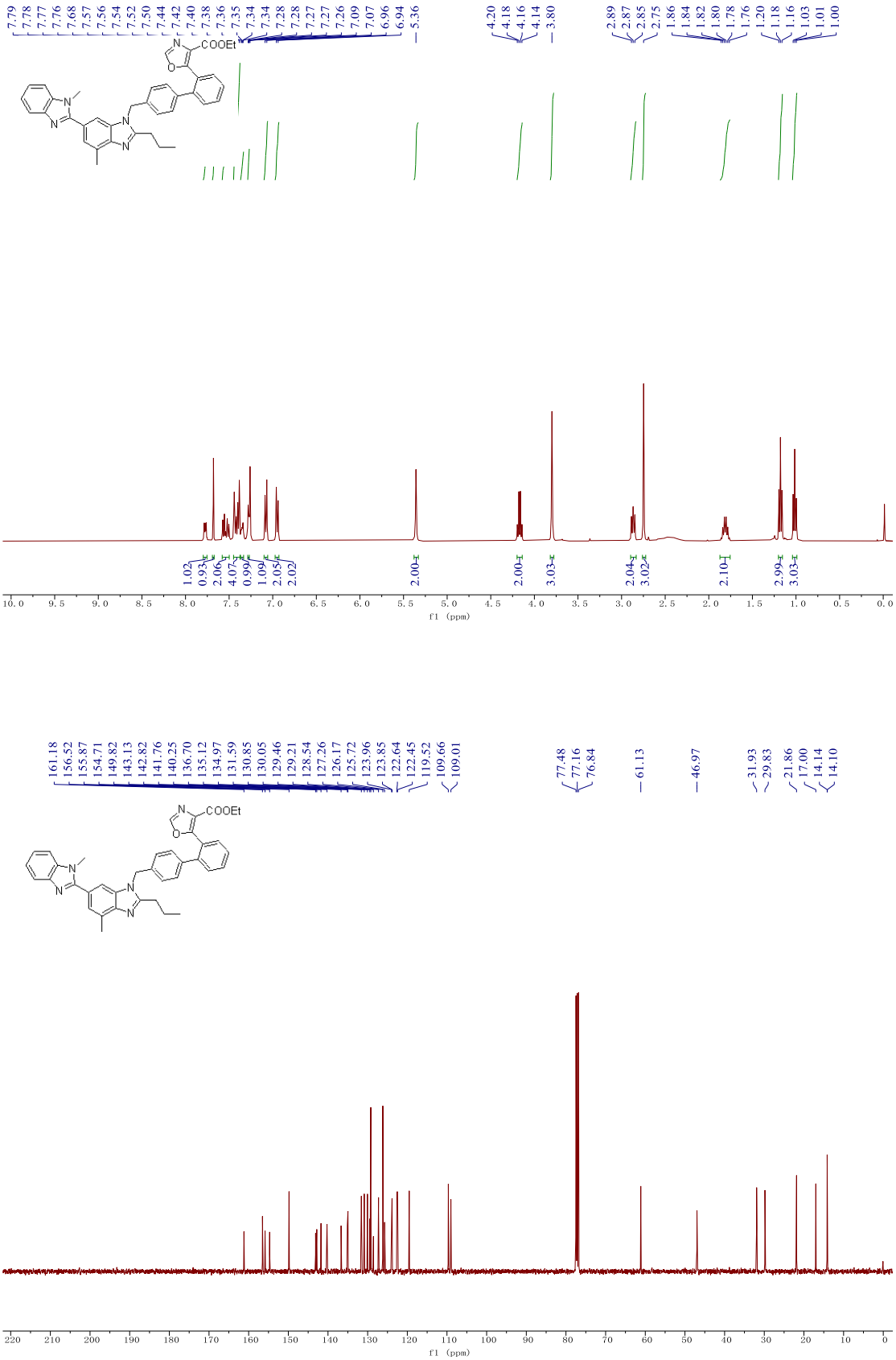


74c ^{1}H NMR and ^{13}C NMR

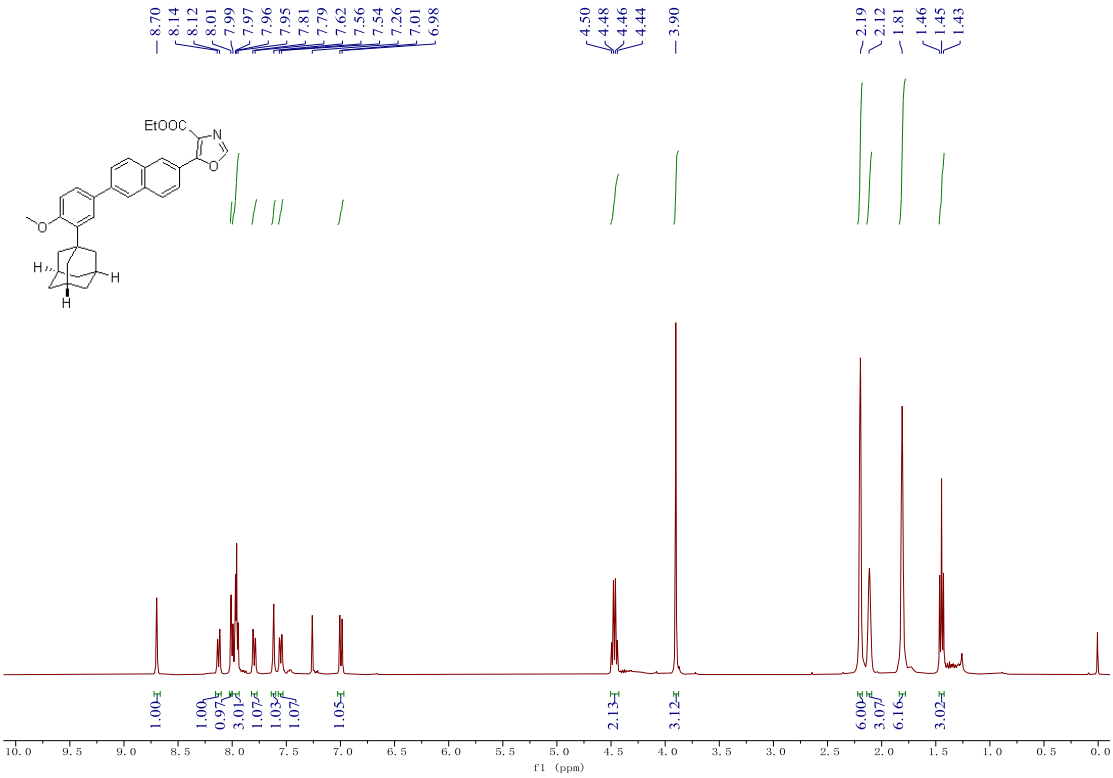


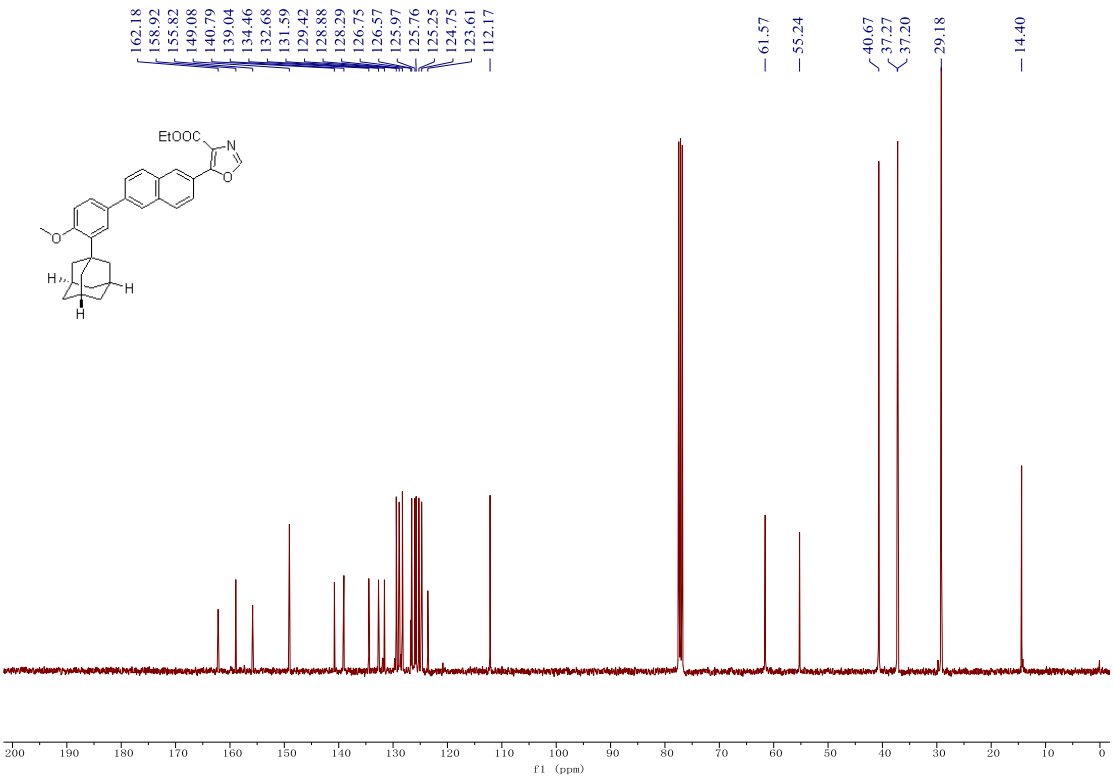


75c ^{1}H NMR and ^{13}C NMR

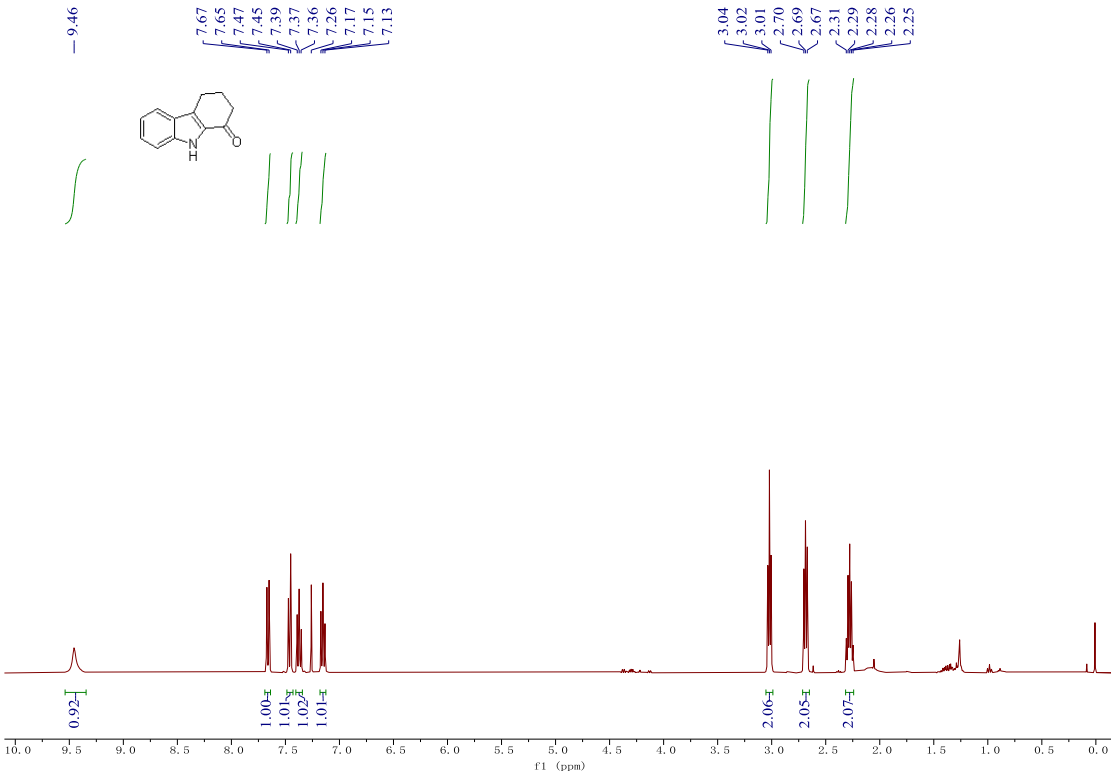


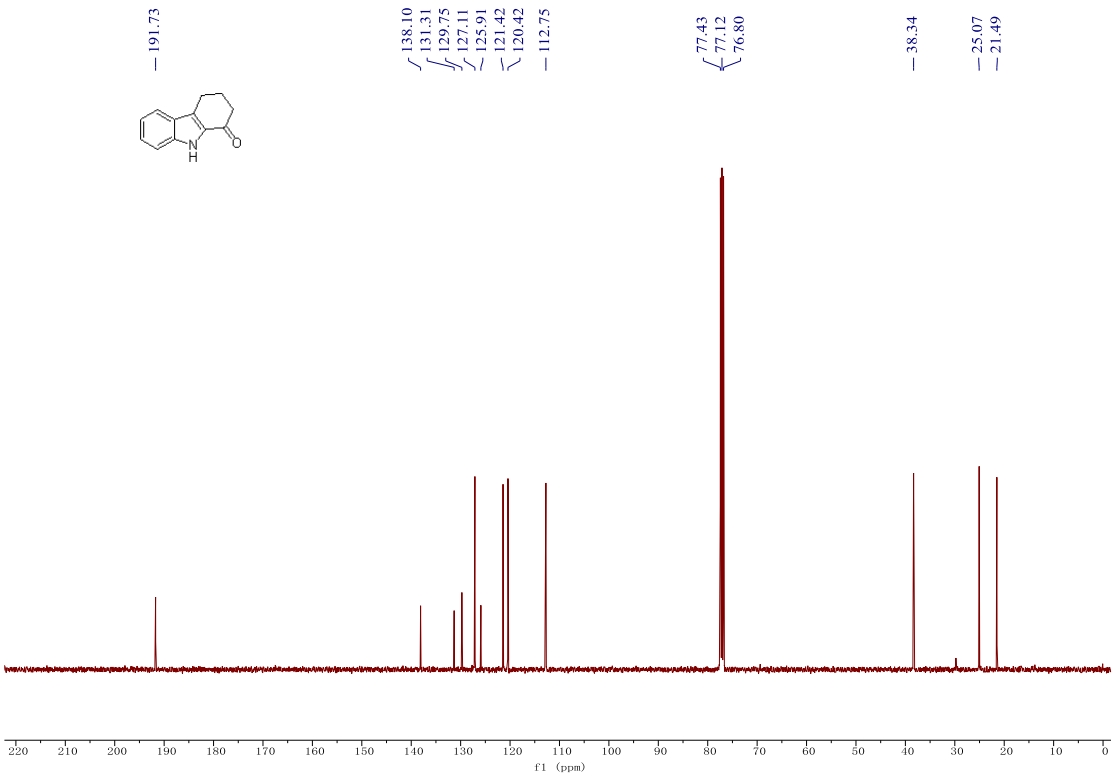
76c ^{1}H NMR and ^{13}C NMR





f ^{1}H NMR and ^{13}C NMR





h . ^{1}H NMR and ^{13}C NMR