Supplementary Information

Synthesis of Furoquinolines from 2-Alkenylanilines via Anodic Dearomatization and Cascade Cyclization

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Contents

1. Supplementary Methods

1.1 General Information

All reactions were performed in Schlenk tubes under nitrogen atmosphere. Flash

column chromatography was performed using silica gel (60-Å pore size, 32–63 μm, standard grade). Analytical thin–layer chromatography was performed using glass plates pre-coated with 0.25 mm 230–400 mesh silica gel impregnated with a fluorescent indicator (254 nm). Thin layer chromatography plates were visualized by exposure to ultraviolet light. Organic solutions were concentrated on rotary evaporators at ~20 Torr (house vacuum) at 35–40 °C. Commercial reagents and solvents were used as received. Nuclear magnetic resonance (NMR) spectra were recorded in parts per million from internal tetramethylsilane on the δ scale. High Resolution Mass spectra were recorded on a Waters G2-XS QTof (ESI+).

1.2 Additional Experimental Details

Electrolysis setup

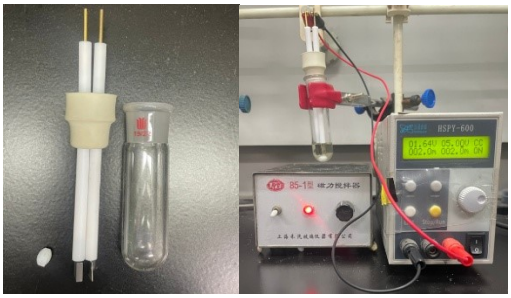


Figure S1. Electrolysis setup

Electrolysis setup for Gram-scale reaction

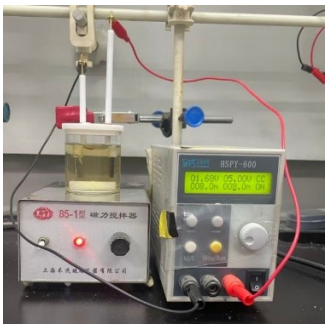
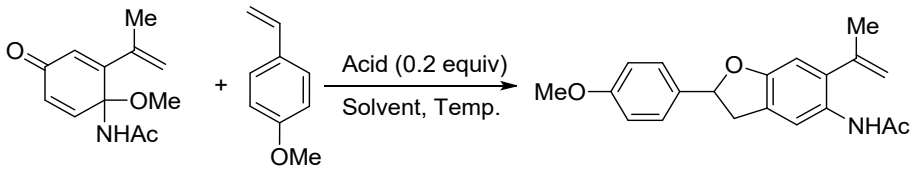


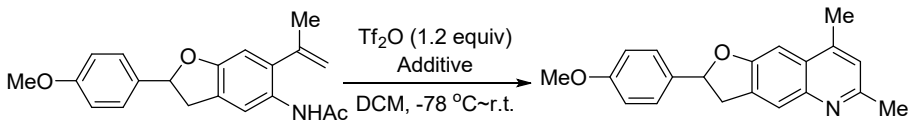
Figure S2. Electrolysis setup for Gram-scale reaction

2. Optimization of the Reaction Conditions



2m (1.2 equiv) **2m-1**

Entry	Acid (0.2 equiv)	Solvent	Temp.	Yield(%)
1	$Bi(OTf)_3$	MeCN	25 °C	35
2	PhCOOH	MeCN	25 °C	53
3	PFBA	MeCN	25 °C	58
4	TMSOTf	MeCN	25 °C	83
5	TMSOTf	$MeNO_2$	25 °C	71
6	TMSOTf	THF	25 °C	73
7	TMSOTf	1,4-dioxane	25 °C	61
8	TMSOTf	MeCN	0 °C	75
9	TMSOTf	MeCN	50 °C	82

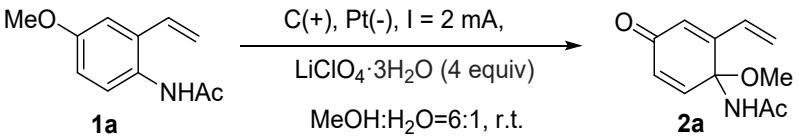


2m-1 **3z**

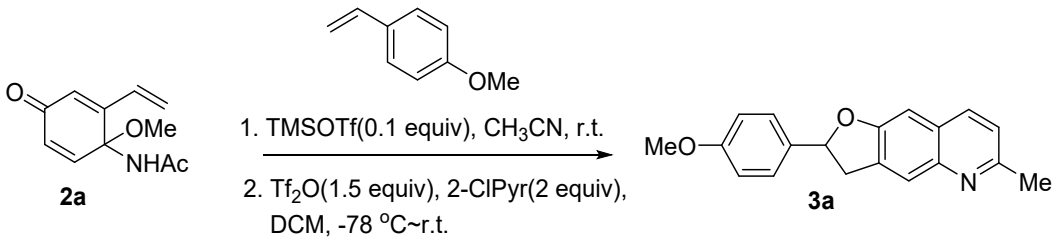
entry	Additive	Equiv	yield(%)
1	Et_3N	1.2	20
2	Pyridine	1.2	59
3	2-Bromopyridine	1.2	71
4	2-Chloropyridine	1.2	82
5	2-Chloropyridine	2.0	95

3. Experimental Procedures

Representative Procedure

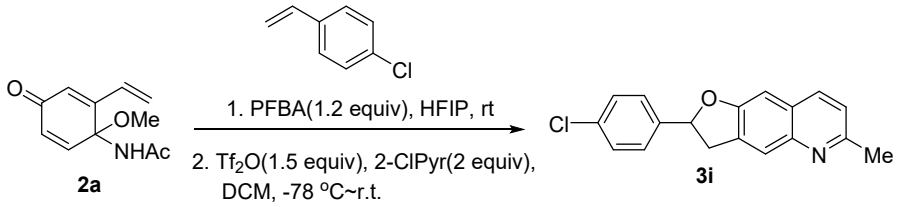


The electrolysis was carried out in an undivided cell equipped with two electrodes. A mixture of *N*-(4-methoxy-2-vinylphenyl)acetamide **1a** (19.1 mg, 0.1 mmol, 1.0 equiv), $LiClO_4 \cdot 3H_2O$ (64 mg, 0.4 mmol, 4.0 equiv) and MeOH(3.0 mL):H_2O (0.5 mL) was added to the electrochemical cell. The cell was equipped with a carbon anode (10 × 10 × 3 mm) and a platinum cathode (10 × 10 × 0.1 mm). Electrolysis was started at 25 °C with a constant current of 2 mA maintained for 4h, affording a total passed charge of 28.8 C (2.98 F/mol). After the material was consumed completely (monitored by TLC analysis), the reaction was quenched by saturated NaCl solution and extracted with CH_2Cl_2 (3 x 5 mL). The combined organic layer was dried over anhydrous Na_2SO_4 and concentrated under reduced pressure. The residue was purified by flash column chromatography on silica gel (eluent: petroleum ether/ethyl acetate = 1/1) to furnish the desired compound **2a.**

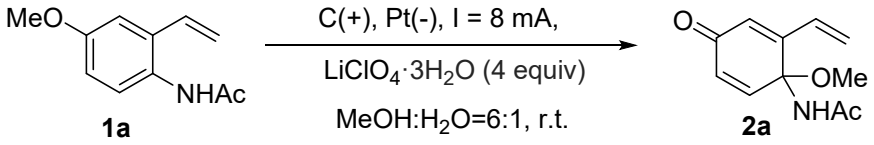


N-(1-methoxy-4-oxo-2-vinylcyclohexa-2,5-dien-1-yl)acetamide **2a** (20.7 mg, 0.1 mmol, 1.0 equiv) and 1-methoxy-4-vinylbenzene (14.7 mg, 0.11 mmol, 1.1 equiv) were dissolved in MeCN (2 mL) in a sealed tube. Trimethylsilyl trifluoromethanesulfonate(TMSOTf)(2.2 mg, 0.01 mmol, 0.1 equiv) was added to this solution. After complete consumption of the material (monitored by TLC analysis), the mixture was concentrated under reduced pressure. The residue was dissolved in dry DCM (3 mL) and cooled to -78 °C under nitrogen atmosphere. 2-Chloropyridine (22.6 mg, 0.2 mmol, 2 equiv) and trifluoromethanesulfonic anhydride(Tf_2O) (42.3 mg, 0.15 mmol, 1.5 equiv) were added dropwise to this solution via syringe. After stirring at -78 °C for 0.5 h, the reaction was allowed to warm to room temperature and stirred for an additional 2 h. Aqueous sodium hydroxide solution (0.5 mL, 1N) was added to neutralize the trifluoromethanesulfonate salts. Dichloromethane (5 mL) was added to dilute the mixture and the layers were separated. The organic layer was washed with brine (2 mL), dried over anhydrous sodium sulfate, filtered and concentrated under reduced pressure. The residue was purified by flash column chromatography on silica

gel (eluent: petroleum ether/ethyl acetate = 15/1) to afford the desired compound **3a.**

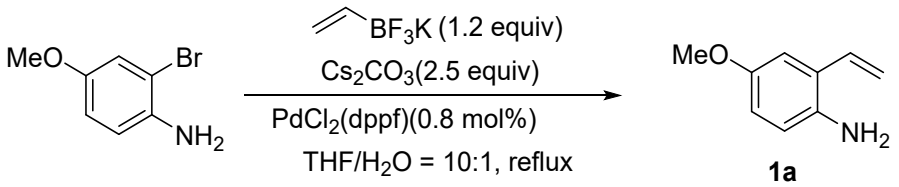


N-(1-methoxy-4-oxo-2-vinylcyclohexa-2,5-dien-1-yl)acetamide **2a** (20.7 mg, 0.1 mmol, 1.0 equiv) and 1-chloro-4-vinylbenzene (14.7 mg, 0.11 mmol, 1.1 equiv) were dissolved in hexafluoroisopropanol(HFIP) (2 mL) in a sealed tube. Pentafluorobenzoic acid (25.4 mg, 0.12 mmol, 1.2 equiv) was added to this solution. After complete consumption of the starting material(monitored by TLC analysis), the reaction was quenched with triethylamine(Et_3N). The reaction mixture was passed through a short silica gel column to remove salt using DCM as the eluent, and then concentrated under reduced pressure. The residue was dissolved in dry DCM (3 mL) and cooled to -78 °C under nitrogen atmosphere. 2-Chloropyridine(22.6mg, 0.2 mmol, 2 equiv) and trifluoromethanesulfonic anhydride (42.3mg, 0.15 mmol, 1.5 equiv) were added dropwise to this solution via syringe. After stirring at -78 °C for 0.5 h, the reaction was allowed to warm to room temperature and stirred for an additional 2 h. Aqueous sodium hydroxide solution (0.5 mL, 1N) was added to neutralize the trifluoromethanesulfonate salts. DCM (5 mL) was added to dilute the mixture and the layers were separated. The organic layer was washed with brine (2 mL), dried over anhydrous sodium sulfate, filtered and concentrated under reduced pressure. The residue was purified by flash column chromatography on silica gel (eluent: petroleum ether/ethyl acetate = 15/1) to furnish the desired compound **3i.**



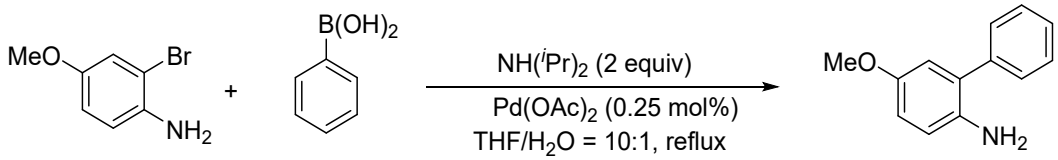
The gram-scale reaction was carried out in an undivided electrochemical cell equipped with a carbon anode (20 × 20 × 3 mm) and a platinum cathode (20 × 20 × 0.2 mm). A mixture of *N*-(4-methoxy-2-vinylphenyl)acetamide (1.00 g, 5.24 mmol), $LiClO_4·3H_2O$ (3.36 g, 20.96 mmol), and MeOH/H_2O (6:1, 80 mL) was added to the cell. Constant-current electrolysis was performed at 25 °C and 8 mA for 49 h, corresponding to a total passed charge of 1411.2 C (2.79 F/mol). After complete consumption of the starting material, as monitored by TLC, the reaction mixture was quenched with saturated aqueous NaCl and extracted with CH_2Cl_2. The combined organic extracts were dried over anhydrous Na_2SO_4, filtered, and concentrated under reduced pressure. Purification of the residue by flash column chromatography on silica gel (petroleum ether/ethyl acetate = 1:1) afforded the desired product **2a** in 89% yield.

The procedure[1] for synthesis of a series of starting material

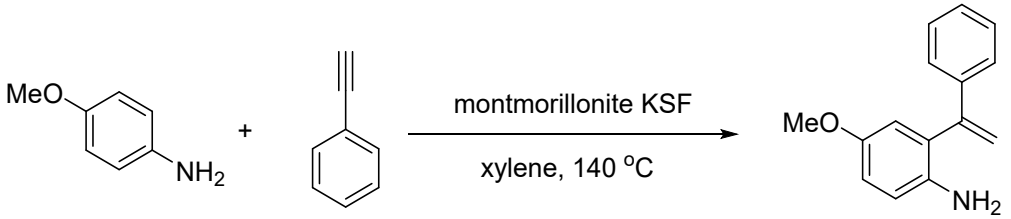


1a

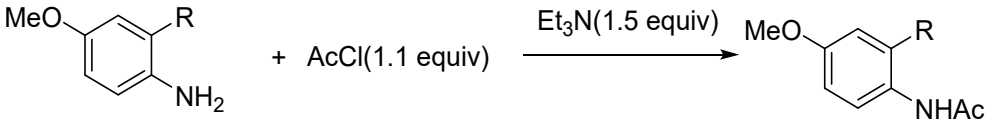
To a suspension of potassium vinyltrifluoroborate (35.6 mg, 0.24 mmol, 1.2 equiv), Cs_2CO_3 (162.6 mg, 0.50 mmol, 2.5 equiv), $PdCl_2(dppf)$ (1.2 mg, 0.0016 mmol, 0.8 mol%) and 2-bromo-4-methoxyaniline (43.0 mg, 0.20 mmol, 1.0 equiv) in THF (5 mL) was added water (0.5 mL). The reaction mixture was stirred under reflux for 16 h, then cooled to room temperature and diluted with water (5 mL) followed by extraction with ethyl acetate (EA) (5 mL × 3). The ethereal solution was washed with brine (5 mL), and then dried over anhydrous $MgSO_4$. The solvent was removed under reduced pressure and the crude product was purified by flash column chromatography on silica gel (eluent: petroleum ether/ethyl acetate = 30:1) to give the desired product **1a**.



A mixture of 2-bromo-4-methoxyaniline (43.0 mg, 0.20 mmol, 1.0 equiv), phenylboronic acid (36.6 mg, 0.30 mmol, 1.5 equiv), diisopropylamine (DIPEA, $NH(iPr)_2$) (40.5 mg, 0.40 mmol, 2.0 equiv), $Pd(OAc)_2$ (3.6 mg, 0.016 mmol, 8 mol%), THF (5 mL) and H_2O (0.5 mL) was stirred under reflux for 16 h. After complete consumption of the starting material (monitored by TLC), the mixture was cooled to room temperature and extracted with ethyl acetate (EtOAc) (5 mL × 3). The combined organic layers were washed with brine (5 mL), dried over anhydrous Na_2SO_4, filtered, and concentrated under reduced pressure. The crude product was purified by flash column chromatography on silica gel (eluent: petroleum ether/EtOAc = 30:1) to afford the desired product.

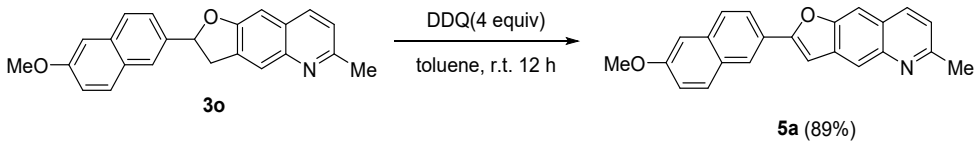


A mixture of 4-methoxyaniline (24.6 mg, 0.20 mmol, 1.0 equiv), phenylacetylene (20.4 mg, 0.20 mmol, 1.0 equiv) and montmorillonite KSF (20 mg) was added to a round-bottomed flask. Then xylene (2 mL) was added. The resulting mixture was stirred in an oil bath preheated to 140 ° C under a reflux condenser (with cold water as the coolant). After 5 h, the reaction mixture was cooled to room temperature, filtered, and the solvent was removed under reduced pressure. The residue was purified by flash column chromatography on silica gel (eluent: petroleum ether/ethyl acetate = 30:1) to afford the desired product.



To a stirred solution of arylamine (0.20 mmol, 1.0 equiv) in dichloromethane (DCM) (5 mL) was added acetyl chloride (AcCl) (15.6 mg, 0.22 mmol, 1.1 equiv) and triethylamine (Et_3N) (30.4 mg, 0.30 mmol, 1.5 equiv). The resulting mixture was stirred at 0 °C for 1 h. The reaction was then quenched with saturated aqueous NH_4Cl solution (2.0 mL), and the mixture was extracted with CH_2Cl_2 (3 × 5 mL). The combined organic layers were washed with brine (2 mL), dried over anhydrous Na_2SO_4, filtered, and concentrated under reduced pressure. The residue was purified by flash column chromatography on silica gel (eluent: petroleum ether/ethyl acetate = 1/1) to afford the desired product.

The procedure[2] for synthesis of compound 5a



2-(6-Methoxynaphthalen-2-yl)-6-methyl-2,3-dihydrofuro[2,3-*g*]quinoline 3o (17.1 mg, 0.05 mmol, 1.0 equiv) was dissolved in toluene (3 mL) in a sealed tube. DDQ (45.4 mg, 0.2 mmol, 4.0 equiv) was added, followed by additional toluene (2 mL). After full conversion (TLC), the mixture was diluted with EtOAc, filtered through a Celite pad, and concentrated under reduced pressure. The residue was purified by flash column chromatography on silica gel (eluent: PE/DCM) to afford 5a.

Supplementary References

1. a) Gao, Y.; Cai, Z.; Li, S.; Li, G. *Org. Lett.*, 2019, **21**, 3663–3669. b) Arienti, A.; Bigi, F.; Maggi, R.; Marzi, E.; Moggi, P.; Rastelli, M.; Sartori, G.; Tarantola, F. *Tetrahedron*, 1997, **53**, 3795–3804. c) Chen, Z. W.; He, Q. Q.; Guo, H.; Fan, R. H. *Chem. Commun.*, 2022, **58**, 6797.

2. Movassaghi, M.; Hill, M. D. *Org. Lett.*, 2008, *10*, 3485–3488.

4. Crystal details of compound 3a

Sample preparation: A solution of compound **3a** (0.1 mmol) in a mixed solvent of dichloromethane (1 mL) and petroleum ethe (2 mL) was placed in a vial (10 mL). The single crystal **3a** was obtained by slowly evaporating solvent at room temperature under the air conditions.

Crystal measurement: X-ray crystal structures of 3a were determined at 173 K by using D8 VENTURE MetalJet microfocal single crystal diffractometer.

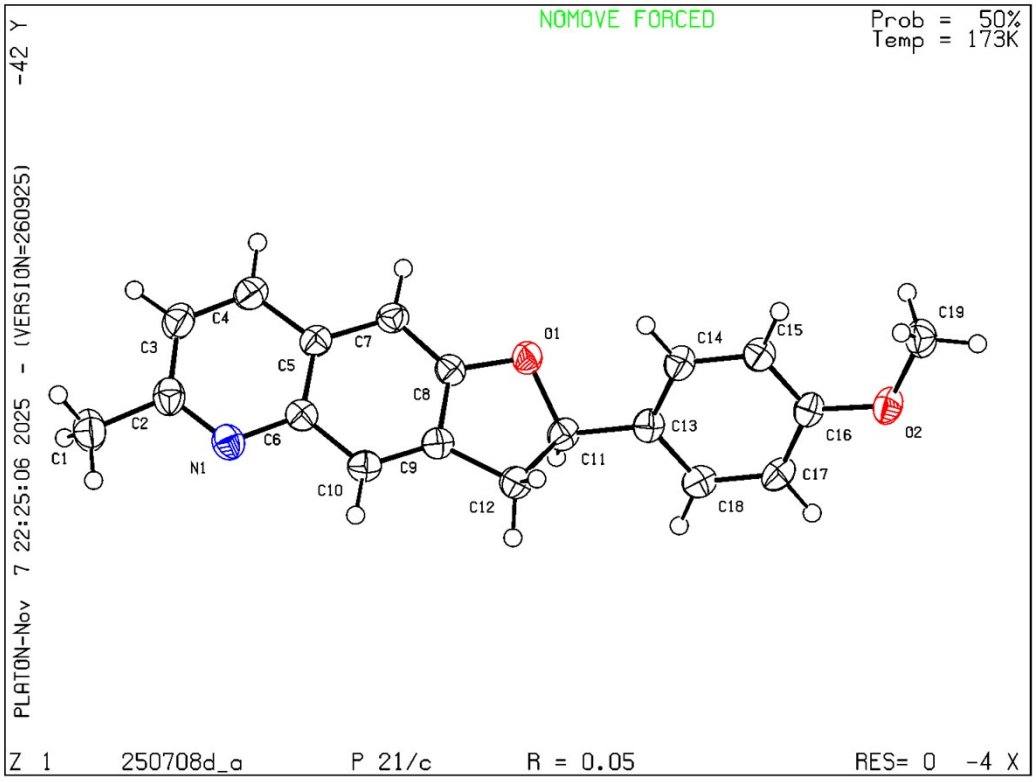


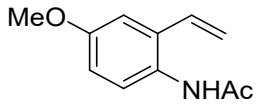
Figure 1. ORTEP diagram of compound 3a

Table 1. Crystal data and structure refinement for 3a

Identification code	250708d_a
Empirical formula	C19 H17 N O2
Formula weight	291.33
Temperature	173(2) K
Wavelength	1.34139 Å
Crystal system	Monoclinic
Space group	$P2_1/c$

Unit cell dimensions	a = 27.2942(12) Å	a= 90°.
	b = 5.7884(3) Å	b= 97.244(2)°.
	c = 9.2458(4) Å	g = 90°.
Volume	1449.08(12) Å3	
Z	4	
Density (calculated)	1.335 Mg/m3	
Absorption coefficient	0.439 mm-1	
F(000)	616	
Crystal size	0.800 x 0.450 x 0.440 mm^3	
Theta range for data collection	4.262 to 56.487°	
Index ranges	-31<=h<=33, -6<=k<=7, -11<=l<=10	
Reflections collected	14119	
Independent reflections	2884 [R(int) = 0.0531]	
Completeness to theta = 53.594°	98.8 %	
Absorption correction	Semi-empirical from equivalents	
Max. and min. transmission	0.752 and 0.509	
Refinement method	Full-matrix least-squares on F^2	
Data / restraints / parameters	2884 / 0 / 202	
Goodness-of-fit on F^2	1.104	
Final R indices [I>2sigma(I)]	R1 = 0.0528, wR2 = 0.1550	
R indices (all data)	R1 = 0.0590, wR2 = 0.1605	
Extinction coefficient	0.028(4)	
Largest diff. peak and hole	0.256 and -0.254 e.Å-3	

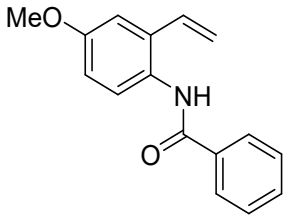
5. Characterization of data:



1a

***N*-(4-methoxy-2-vinylphenyl)acetamide (1a):**

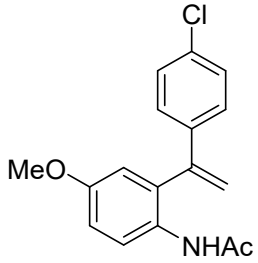
(eluent: petroleum ether : ethyl acetate = 1:1), white solid, mp: 114-116°C. ^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.91 (s, 1H), 7.24 (d, *J* = 8.8 Hz, 1H), 6.94 (d, *J* = 2.9 Hz, 1H), 6.74 – 6.67 (m, 2H), 5.60 (dd, *J* = 17.5, 1.2 Hz, 1H), 5.25 (dd, *J* = 11.0, 1.2 Hz, 1H), 3.76 (s, 3H), 2.03 (s, 3H). ^{13}C NMR (101 MHz, Chloroform-*d*) δ 169.5, 157.4, 133.4, 132.1, 127.1, 116.1, 113.6, 110.45, 55.2, 23.2. HRMS (ESI) m/z calcd for $C_{11}H_{14}NO_2$ $[M+H]^+$: 192.1019; found:192.1023.



1f

***N*-(4-methoxy-2-vinylphenyl)benzamide (1f):**

(eluent: petroleum ether : ethyl acetate = 3:1), yellow solid, mp: 121-123°C. ^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.75 – 7.73 (m, 2H), 7.54 – 7.50 (m, 1H), 7.45 – 7.41 (m, 2H), 6.85 (d, *J* = 10.1 Hz, 1H), 6.72 (br, 1H), 6.55 (d, *J* = 2.0 Hz, 1H), 6.53 – 6.33 (m, 2H), 6.07 (d, *J* = 18.8 Hz, 1H), 5.54 (d, *J* = 11.2 Hz, 1H), 3.19 (s, 3H). ^{13}C NMR (101 MHz, Chloroform-*d*) δ 185.7, 165.1, 150.6, 144.6, 133.4, 132.2, 131.5, 131.4, 128.7, 128.3, 127.0, 122.7, 81.8, 50.8. HRMS (ESI) m/z calcd for $C_{16}H_{16}NO_2$ $[M+H]^+$: 254.1176; found:254.1172.

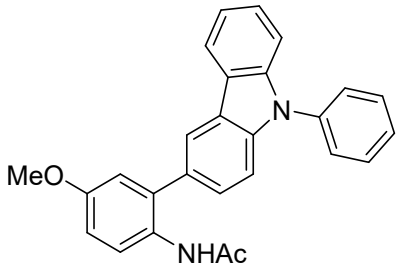


1p

***N*-(2-(1-(4-chlorophenyl)vinyl)-4-methoxyphenyl)acetamide (1p):**

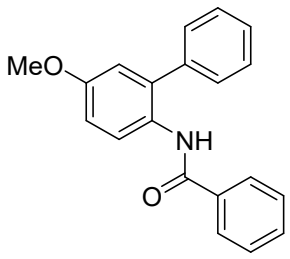
(eluent: petroleum ether : ethyl acetate = 1:1), yellow solid, mp: 117-119°C. ^{1}H NMR

(400 MHz, Chloroform-*d*) δ 7.79 (d, *J* = 8.9 Hz, 1H), 7.26 (q, *J* = 8.9 Hz, 2H), 7.22 (q, *J* = 8.9 Hz, 2H),6.93 (br, 1H), 6.89 (dd, *J* = 8.9, 3.0 Hz, 1H), 6.79 (d, *J* = 3.0 Hz, 1H), 5.80 (d, *J* = 1.1 Hz, 1H), 5.35 (d, *J* = 1.1 Hz, 1H), 3.78 (s, 3H), 1.76 (s, 3H). ^{13}C NMR (101 MHz, Chloroform-*d*) δ 168.2, 156.7, 145.4, 137.9, 134.5, 134.2, 128.8, 128.1, 127.8, 125.1, 117.4, 115.7, 113.7, 55.5, 23.7. HRMS (ESI) m/z calcd for $C_{17}H_{17}ClNO_2$ $[M+H]^+$: 302.0942; found:302.0938.



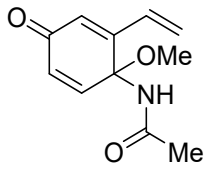
1v

***N*-(4-methoxy-2-(9-phenyl-9H-carbazol-3-yl)phenyl)acetamide (1v):**
(eluent: petroleum ether : ethyl acetate = 2:1), yellow solid, mp: 134-136°C. ^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.15 – 8.10 (m, 2H), 7.93 (d, *J* = 8.9 Hz, 1H), 7.55 – 7.42 (m, 4H), 7.40 – 7.37 (m, 4H), 7.29 – 7.21 (m, 3H), 6.86 – 6.79 (m, 2H), 3.72 (s, 3H), 1.83 (s, 3H). ^{13}C NMR (101 MHz, Chloroform-*d*) δ 168.1, 156.1, 141.2, 141.0, 137.1 135.7, 135.0, 129.8, 127.8, 127.6, 126.8, 126.2, 124.1, 122.7, 122.7, 120.7, 120.5, 120.2, 120.1, 115.7, 112.8, 110.1, 109.8, 55.3, 23.8. HRMS (ESI) m/z calcd for $C_{27}H_{23}N_2O_2$ $[M+H]^+$: 407.1754; found:407.1748.



1x

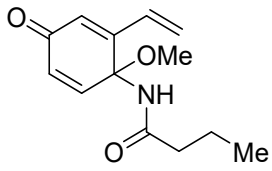
***N*-(5-methoxy-[1,1'-biphenyl]-2-yl)benzamide (1x):**
(eluent: petroleum ether : ethyl acetate = 3:1), yellow solid, mp: 129-131°C. ^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.32 (d, *J* = 9.0 Hz, 1H), 7.79 (br, 1H), 7.61 – 7.58 (m, 2H), 7.51 – 7.41 (m, 6H), 7.39 – 7.35 (m, 2H), 6.97 (dd, *J* = 9.0, 3.0 Hz, 1H), 6.86 (d, *J* = 2.9 Hz, 1H), 3.83 (s, 3H). ^{13}C NMR (101 MHz, Chloroform-*d*) δ 156.4, 138.2, 134.9, 134.5, 131.6, 130.1, 129.2, 129.1, 128.7, 128.2, 128.1, 126.8, 123.5, 115.5, 113.5, 55.6. HRMS (ESI) m/z calcd for $C_{20}H_{18}NO_2$ $[M+H]^+$: 304.1332; found:304.1328.



2a

***N*-(1-methoxy-4-oxo-2-vinylcyclohexa-2,5-dien-1-yl)acetamide(2a):**

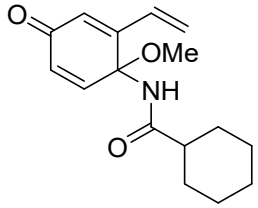
(eluent: petroleum ether : ethyl acetate = 1:1), 19.0 mg, 92%; yellow solid, mp: 134-136°C.^{1}H NMR (400 MHz, Chloroform-*d*) δ 6.82 (d, *J* = 10.1 Hz, 1H), 6.47 (d, *J* = 2.0 Hz, 1H), 6.43 – 6.36 (m, 2H), 6.09 (br, 1H), 6.03 (dd, *J* = 17.7, 1.1 Hz, 1H), 5.55 (d, *J* = 11.3 Hz, 1H), 3.12 (s, 3H), 1.96 (s, 3H). ^{13}C NMR (101 MHz, Chloroform-*d*) δ 185.6, 168.2, 150.6, 144.7, 131.4, 131.0, 128.1, 122.6, 81.2, 50.7, 23.6. HRMS (ESI) m/z calcd for $C_{11}H_{14}NO_3$ $[M+H]^+$: 208.0968; found:208.0961.



2b

***N*-(1-methoxy-4-oxo-2-vinylcyclohexa-2,5-dien-1-yl)butyramide (2b):**

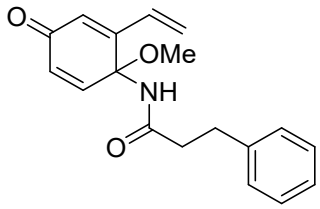
(eluent: petroleum ether : ethyl acetate = 1:1), 19.7 mg, 84%; yellow solid, mp: 129-131°C. ^{1}H NMR (400 MHz, Chloroform-*d*) δ 6.77 (d, *J* = 10.1 Hz, 1H), 6.48 (d, *J* = 2.1 Hz, 1H), 6.43 – 6.36 (m, 2H), 6.23 (br, 1H), 6.02 (d, *J* = 17.6 Hz, 1H), 5.54 (d, *J* = 11.3 Hz, 1H), 3.12 (s, 3H), 2.16 – 1.12 (m, 2H), 1.66 – 1.55 (m, 2H), 0.92 (t, *J* = 7.4 Hz, 3H). ^{13}C NMR (101 MHz, Chloroform-*d*) δ 185.7, 171.1, 150.8, 144.8, 131.4, 130.9, 127.9, 122.4, 81.1, 50.5, 38.4, 18.6, 13.5. HRMS (ESI) m/z calcd for $C_{13}H_{18}NO_3$ $[M+H]^+$: 236.1281; found:236.1276.



2c

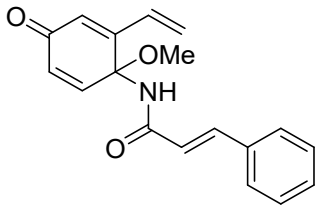
***N*-(1-methoxy-4-oxo-2-vinylcyclohexa-2,5-dien-1-yl)cyclohexanecarboxamide (2c):**

(eluent: petroleum ether : ethyl acetate = 1:1), 18.7 mg, 68%; yellow solid, mp: 121-123°C. ^{1}H NMR (400 MHz, Chloroform-*d*) δ 6.75 (d, *J* = 10.1 Hz, 1H), 6.47 (d, *J* = 2.0 Hz, 1H), 6.42 – 6.34 (m, 2H), 6.17 (br, 1H), 6.01 (dd, *J* = 17.6, 1.1 Hz, 1H), 5.53 (d, *J* = 11.3 Hz, 1H), 3.12 (s, 3H), 2.07 (tt, *J* = 11.7, 3.5 Hz, 1H), 1.83 – 1.64 (m, 5H), 1.44 – 1.15 (m, 5H). ^{13}C NMR (101 MHz, Chloroform-*d*) δ 185.6, 174.2, 150.8, 144.9, 131.4, 130.9, 128.0, 122.3, 81.1, 50.5, 45.1, 29.4, 29.1, 25.5, 25.5, 25.4. HRMS (ESI) m/z calcd for $C_{16}H_{22}NO_3$ $[M+H]^+$: 276.1594; found:276.1591.



2d

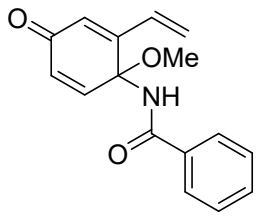
***N*-(1-methoxy-4-oxo-2-vinylcyclohexa-2,5-dien-1-yl)-3-phenylpropanamide (2d):**
(eluent: petroleum ether : ethyl acetate = 1:1), 24.3 mg, 82%; yellow solid, mp: 145-147°C. ^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.29 – 7.24 (m, 2H), 7.21 – 7.14 (m, 3H), 6.66 (d, *J* = 10.1 Hz, 1H), 6.44 – 6.37 (m, 2H), 6.30 – 6.22 (m, 2H), 5.92 (dd, *J* = 17.6, 1.1 Hz, 1H), 5.44 (dd, *J* = 11.2, 1.1 Hz, 1H), 3.06 (s, 3H), 2.89 (t, *J* = 7.6 Hz, 2H), 2.46 (t, *J* = 7.6 Hz, 2H). ^{13}C NMR (101 MHz, Chloroform-*d*) δ 185.7, 170.3, 150.7, 144.7, 140.3, 131.2, 130.8, 128.4, 128.2, 127.7, 126.2, 122.3, 81.1, 50.5, 38.0, 31.0. HRMS (ESI) m/z calcd for $C_{18}H_{20}NO_3$ $[M+H]^+$: 298.1438; found:298.1431.



2e

***N*-(1-methoxy-4-oxo-2-vinylcyclohexa-2,5-dien-1-yl)cinnamamide (2e):**
(eluent: petroleum ether : ethyl acetate = 1:1), 23.9 mg, 81%; yellow solid, mp: 149-151°C. ^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.58 (d, *J* = 15.6 Hz, 1H), 7.45 – 7.43 (m, 2H), 7.33 – 7.31 (m, 3H), 7.06 (br, 1H), 6.82 (d, *J* = 10.1 Hz, 1H), 6.53 – 6.41 (m, 4H), 6.05 (dd, *J* = 17.6, 1.1 Hz, 1H), 5.52 (dd, *J* = 11.2, 1.1 Hz, 1H), 3.14 (s, 3H). ^{13}C NMR (101 MHz, Chloroform-*d*) δ 185.8, 164.0, 151.1, 145.0, 142.1, 134.3, 131.3, 130.8,

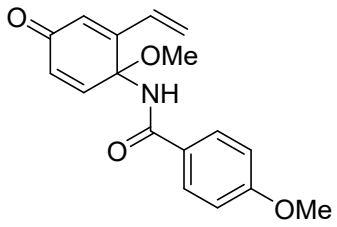
129.8, 128.6, 127.7, 127.6, 122.4, 119.6, 81.3, 50.4. HRMS (ESI) m/z calcd for $C_{18}H_{18}NO_3$ $[M+H]^+$: 296.1281; found:296.1276.



2f

***N*-(1-methoxy-4-oxo-2-vinylcyclohexa-2,5-dien-1-yl)benzamide (2f):**

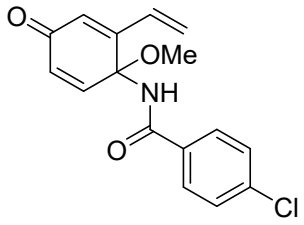
(eluent: petroleum ether : ethyl acetate = 1:1), 17.7 mg, 66%; yellow solid, mp: 151-153°C. ^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.75 – 7.72 (m, 2H), 7.55 – 7.51 (m, 1H), 7.45 – 7.41 (m, 2H), 6.86 (d, *J* = 10.1 Hz, 1H), 6.68 (br, 1H), 6.55 (d, *J* = 2.1 Hz, 1H), 6.50 – 6.32 (m, 2H), 6.07 (dd, *J* = 17.6, 1.1 Hz, 1H), 5.54 (dd, *J* = 11.3, 1.1 Hz, 1H), 3.19 (s, 3H). ^{13}C NMR (101 MHz, Chloroform-*d*) δ 185.6, 165.1, 150.6, 144.5, 133.4, 132.1, 131.5, 131.4, 128.7, 128.3, 126.9, 122.6, 81.7, 50.8. HRMS (ESI) m/z calcd for $C_{16}H_{16}NO_3$ $[M+H]^+$: 270.1125; found:270.1131.



2g

4-methoxy-*N*-(1-methoxy-4-oxo-2-vinylcyclohexa-2,5-dien-1-yl)benzamide (2g):

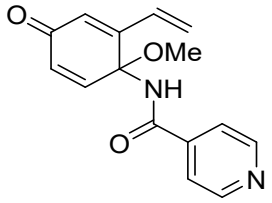
(eluent: petroleum ether : ethyl acetate = 1:1), 20.6 mg, 69%; yellow solid, mp: 151-153°C. ^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.70 (d, *J* = 8.9 Hz, 1H), 6.92 – 6.85 (m, 1H), 6.64 (br, 1H), 6.53 (s, 1H), 6.48 – 6.41 (m, 2H), 6.06 (d, *J* = 17.6 Hz, 1H), 5.53 (d, *J* = 11.3 Hz, 1H), 3.84 (s, 3H), 3.18 (3, 2H). ^{13}C NMR (101 MHz, Chloroform-*d*) δ 185.7, 164.7, 162.6, 150.7, 144.8, 131.5, 131.2, 128.8, 128.1, 125.6, 122.5, 113.9, 81.7, 55.4, 50.7. HRMS (ESI) m/z calcd for $C_{17}H_{18}NO_4$ $[M+H]^+$: 300.1230; found:300.1226.



2h

4-chloro-*N*-(1-methoxy-4-oxo-2-vinylcyclohexa-2,5-dien-1-yl)benzamide (2h):

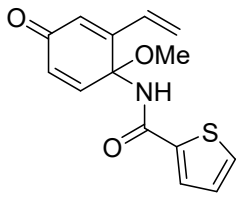
(eluent: petroleum ether : ethyl acetate = 1:1), 21.5 mg, 71%; yellow solid, mp: 162-164°C. ^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.67 (d, *J* = 8.6 Hz, 2H), 7.41 (d, *J* = 8.6 Hz, 2H), 6.83 (d, *J* = 10.1 Hz, 1H), 6.63 (br, 1H), 6.55 (d, *J* = 2.0 Hz, 1H), 6.51 – 6.37 (m, 2H), 6.05 (dd, *J* = 17.7, 1.1 Hz, 1H), 5.54 (dd, *J* = 11.3, 1.1 Hz, 1H), 3.19 (s, 3H). ^{13}C NMR (101 MHz, Chloroform-*d*) δ 185.6, 164.0, 150.4, 144.3, 138.5, 131.8, 131.5, 131.4, 130.8, 129.0, 128.4, 122.7, 81.8, 50.9. HRMS (ESI) m/z calcd for $C_{16}H_{15}ClNO_3$ $[M+H]^+$: 304.0735; found:304.0729.



2i

***N*-(1-methoxy-4-oxo-2-vinylcyclohexa-2,5-dien-1-yl)isonicotinamide (2i):**

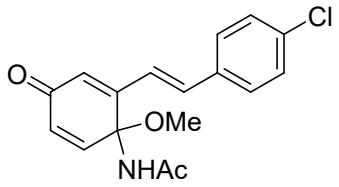
(eluent: petroleum ether : ethyl acetate = 1:1), 21.3 mg, 79%; yellow solid, mp: 138-140°C. ^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.69 – 8.68 (m, 2H), 7.63 (s, 3H), 6.74 (d, *J* = 10.1 Hz, 1H), 6.53 – 6.40 (m, 3H), 6.06 (d, *J* = 17.6 Hz, 1H), 5.54 (d, *J* = 11.3 Hz, 1H), 3.18 (s, 3H). ^{13}C NMR (101 MHz, Chloroform-*d*) δ 185.7, 163.5, 150.4, 144.3, 140.7, 131.6, 131.34, 128.3, 122.7, 121.1, 81.9, 50.8. HRMS (ESI) m/z calcd for $C_{15}H_{15}N_2O_3$ $[M+H]^+$: 271.1077; found:271.1071.



2j

***N*-(1-methoxy-4-oxo-2-vinylcyclohexa-2,5-dien-1-yl)thiophene-2-carboxamide (2j):**

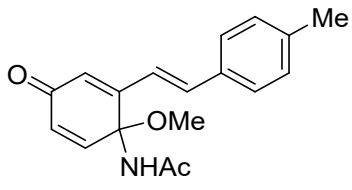
(eluent: petroleum ether : ethyl acetate = 1:1), 22.3 mg, 83%; yellow solid, mp: 147-149°C. ^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.51 – 7.49 (m, 2H), 7.09 – 7.07 (m, 1H), 6.85 (d, *J* = 10.1 Hz, 1H), 6.57 (br, 1H), 6.53 – 6.42 (m, 3H), 6.07 (dd, *J* = 17.7, 1.1 Hz, 1H), 5.55 (dd, *J* = 11.3, 1.1 Hz, 1H), 3.18 (s, 3H). ^{13}C NMR (101 MHz, Chloroform-*d*) δ 185.6, 159.6, 150.4, 144.4, 137.9, 131.4, 131.3, 130.9, 128.8, 128.2, 127.8, 122.7, 81.7, 50.8. HRMS (ESI) m/z calcd for $C_{16}H_{16}NO_3$ $[M+H]^+$: 270.1125; found:270.1131.



2k

(*E*)-*N*-(2-(4-chlorostyryl)-1-methoxy-4-oxocyclohexa-2,5-dien-1-yl)acetamide (2k):

(eluent: petroleum ether : ethyl acetate = 1:1), 22.5 mg, 71%; yellow solid, mp: 144-146°C. ^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.44 (d, *J* = 8.5 Hz, 2H), 7.37 – 7.33 (m, 3H), 6.85 (d, *J* = 10.1 Hz, 1H), 6.76 (dd, *J* = 16.4, 0.9 Hz, 1H), 6.62(br, 1H), 6.57 (d, *J* = 2.0 Hz, 1H), 6.42 (dd, *J* = 10.1, 2.0 Hz, 1H), 3.15 (s, 3H), 1.96 (s, 3H) . ^{13}C NMR (101 MHz, Chloroform-*d*) δ 185.5, 168.5, 150.6, 144.7, 135.2, 134.9, 134.4, 130.9, 129.0, 128.4, 127.5, 123.1, 81.3, 50.7, 23.5. HRMS (ESI) m/z calcd for $C_{17}H_{17}ClNO_3$ $[M+H]^+$: 318.0891; found:318.0884.

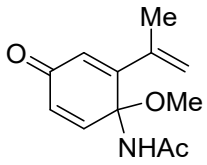


2l

(*E*)-*N*-(1-methoxy-2-(4-methylstyryl)-4-oxocyclohexa-2,5-dien-1-yl)acetamide (2l):

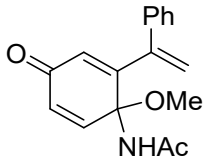
(eluent: petroleum ether : ethyl acetate = 1:1), 22.2 mg, 75%; yellow solid, mp: 126-

128°C. ^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.42 – 7.38 (m, 3H), 7.19 (d, *J* = 7.8 Hz, 1H), 6.96 (d, *J* = 10.1 Hz, 1H), 6.74 (d, *J* = 16.3 Hz, 1H), 6.57 (d, *J* = 2.0 Hz, 1H), 6.43 (dd, *J* = 10.1, 2.0 Hz, 1H), 6.20 (br, 1H), 3.15 (s, 3H), 2.37 (s, 3H), 1.96 (s, 3H). ^{13}C NMR (101 MHz, Chloroform-*d*) δ 185.5, 168.5, 150.9, 144.4, 139.7, 137.0, 133.2, 131.0, 129.6, 127.4, 127.2, 121.4, 81.5, 51.0, 23.7, 21.4. HRMS (ESI) m/z calcd for $C_{18}H_{20}NO_3$ $[M+H]^+$: 298.1438; found:298.1436.



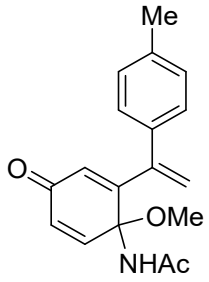
2m

***N*-(1-methoxy-4-oxo-2-(prop-1-en-2-yl)cyclohexa-2,5-dien-1-yl)acetamide (2m):** (eluent: petroleum ether : ethyl acetate = 1:1), 18.5 mg, 84%; yellow solid, mp: 131-133°C. ^{1}H NMR (400 MHz, Chloroform-*d*) δ 6.88 (d, *J* = 9.8 Hz, 1H), 6.65 (br, 1H), 6.41– 6.38 (m, 2H), 5.89 (s, 1H), 5.42 (s, 1H), 3.11 (s, 3H), 2.01 (s, 3H), 1.94 (s, 3H). ^{13}C NMR (101 MHz, Chloroform-*d*) δ 186.1, 168.5, 151.9, 146.2, 138.1, 129.6, 128.8, 121.5, 81.7, 50.5, 23.4, 21.8. HRMS (ESI) m/z calcd for $C_{12}H_{16}NO_3$ $[M+H]^+$: 222.1125; found:222.1129.



2n

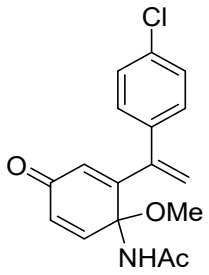
***N*-(1-methoxy-4-oxo-2-(1-phenylvinyl)cyclohexa-2,5-dien-1-yl)acetamide (2n):** (eluent: petroleum ether : ethyl acetate = 1:1), 20.4 mg, 72%; yellow solid, mp: 159-161°C. ^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.33 – 7.30 (m, 5H), 6.71 (d, *J* = 10.1 Hz, 1H), 6.42 (dd, *J* = 10.1, 2.1 Hz, 1H), 6.35 (br, 1H), 6.24 (d, *J* = 2.0 Hz, 1H), 5.96 (d, *J* = 1.4 Hz, 1H), 5.54 (d, *J* = 1.4 Hz, 1H), 3.16 (s, 3H), 1.82 (s, 3H). ^{13}C NMR (101 MHz, Chloroform-*d*) δ 186.0, 168.3, 152.2, 146.0, 145.4, 140.7, 132.2, 130.1, 128.5, 128.3, 127.9, 120.6, 82.0, 50.3, 23.2. HRMS (ESI) m/z calcd for $C_{17}H_{18}NO_3$ $[M+H]^+$: 284.1281; found:284.1286.



2o

***N*-(1-methoxy-4-oxo-2-(1-(p-tolyl)vinyl)cyclohexa-2,5-dien-1-yl)acetamide (2o):**

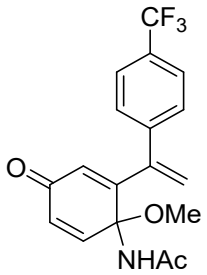
(eluent: petroleum ether : ethyl acetate = 1:1), 23.2 mg, 78%; yellow solid, mp: 164-166°C. ^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.20 (d, *J* = 7.9 Hz, 2H), 7.13 (d, *J* = 7.9 Hz, 2H), 6.75 (d, *J* = 10.1 Hz, 1H), 6.42 (dd, *J* = 10.1, 2.1 Hz, 1H), 6.24 (d, *J* = 2.1 Hz, 1H), 6.22 (br, 1H), 5.90 (d, *J* = 1.4 Hz, 1H), 5.53 (d, *J* = 1.4 Hz, 1H), 3.16 (s, 3H), 2.34 (s, 3H), 1.82 (s, 3H). ^{13}C NMR (101 MHz, Chloroform-*d*) δ 186.0, 168.3, 152.3, 145.8, 145.3, 137.8, 132.2, 130.1, 129.0, 128.4, 112.0, 82.0, 50.4, 23.3, 21.1. HRMS (ESI) m/z calcd for $C_{18}H_{20}NO_3$ $[M+H]^+$: 298.1438; found:298.1443.



2p

***N*-(2-(1-(4-chlorophenyl)vinyl)-1-methoxy-4-oxocyclohexa-2,5-dien-1-yl)acetamide (2p):**

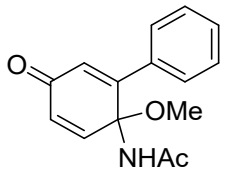
(eluent: petroleum ether : ethyl acetate = 1:1), 23.1 mg, 73%; yellow solid, mp: 167-169°C. ^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.30 – 7.24 (m, 4H), 6.61 (d, *J* = 10.1 Hz, 1H), 6.54 (br, 1H), 6.42 (dd, *J* = 10.1, 2.1 Hz, 1H), 6.17 (d, *J* = 2.1 Hz, 1H), 5.98 (d, *J* = 1.2 Hz, 1H), 5.52 (d, *J* = 1.2 Hz, 1H), 3.14 (s, 3H), 1.86 (s, 3H). ^{13}C NMR (101 MHz, Chloroform-*d*) δ 185.8, 168.3, 151.9, 146.0, 144.2, 139.2, 133.8, 132.2, 130.2, 130.0, 128.4, 120.9, 82.0, 50.2, 23.1. HRMS (ESI) m/z calcd for $C_{17}H_{17}ClNO_3$ $[M+H]^+$: 318.0891; found:318.0884.



2q

***N*-(1-methoxy-4-oxo-2-(1-(4-(trifluoromethyl)phenyl)vinyl)cyclohexa-2,5-dien-1-yl)acetamide (2q):**

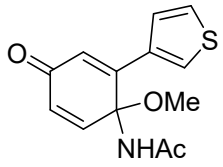
(eluent: petroleum ether : ethyl acetate = 1:1), 23.5 mg, 67%; yellow solid, mp: 172-174°C. ^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.58 (d, *J* = 8.1 Hz, 2H), 7.46 (d, *J* = 8.1 Hz, 2H), 6.61 (d, *J* = 10.1 Hz, 1H), 6.46 – 6.43 (m, 2H), 6.15 (d, *J* = 2.0 Hz, 1H), 6.08 (d, *J* = 1.1 Hz, 1H), 5.59 (d, *J* = 1.1 Hz, 1H), 3.17 (s, 3H), 1.86 (s, 3H). ^{13}C NMR (101 MHz, Chloroform-*d*) δ 185.8, 168.3, 151.7, 146.0, 144.5, 144.3, 132.4, 130.4, 130.2, 129.9, 129.2, 125.3 (q, *J* = 3.7 Hz), 121.9, 82.1, 50.3, 23.2. HRMS (ESI) m/z calcd for $C_{18}H_{17}F_3NO_3$ $[M+H]^+$: 352.1155; found:352.1165.



2r

***N*-(2-methoxy-5-oxo-2,5-dihydro-[1,1'-biphenyl]-2-yl)acetamide (2r):**

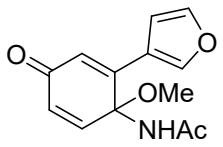
(eluent: petroleum ether : ethyl acetate = 1:1), 20.8 mg, 81%; yellow solid, mp: 183-185°C. ^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.63 – 7.61 (m, 2H), 7.44 – 7.37 (m, 3H), 6.78 (d, *J* = 10.1 Hz, 1H), 6.57 (d, *J* = 2.0 Hz, 1H), 6.45 (dd, *J* = 10.1, 2.0 Hz, 1H), 6.34 (br, 1H), 3.28 (s, 3H), 1.74 (s, 3H). ^{13}C NMR (101 MHz, Chloroform-*d*) δ 185.6, 168.3, 152.9, 145.3, 135.4, 130.3, 123.0, 129.7, 128.5, 127.7, 82.2, 50.4, 23.0. HRMS (ESI) m/z calcd for $C_{15}H_{16}NO_3$ $[M+H]^+$:258.1125; found:258.1131.



2s

***N*-(1-methoxy-4-oxo-2-(thiophen-3-yl)cyclohexa-2,5-dien-1-yl)acetamide (2t):**

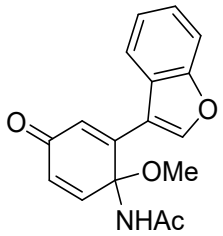
(eluent: petroleum ether : ethyl acetate = 1:1), 24.5 mg, 93%; yellow solid, mp: 178-180°C. ^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.95 (dd, *J* = 2.9, 1.4 Hz, 1H), 7.42 – 7.28 (m, 2H), 7.02 (d, *J* = 10.1 Hz, 1H), 6.70 (d, *J* = 2.0 Hz, 1H), 6.45 (dd, *J* = 10.1, 2.0 Hz, 1H), 6.39 (br, 1H), 3.19 (s, 3H), 1.86 (s, 3H). ^{13}C NMR (101 MHz, Chloroform-*d*) δ 185.6, 168.5, 147.5, 144.9, 135.1, 130.3, 127.7, 126.9, 126.6, 126.2, 81.8, 50.8, 23.5. HRMS (ESI) m/z calcd for $C_{13}H_{14}NO_3S$ $[M+H]^+$: 264.0689; found:264.0693.



2t

***N*-(2-(furan-3-yl)-1-methoxy-4-oxocyclohexa-2,5-dien-1-yl)acetamide (2t):**

(eluent: petroleum ether : ethyl acetate = 1:1), 20.0 mg, 81%; yellow solid, mp: 174-176°C.^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.56 (d, *J* = 1.8 Hz, 1H), 7.09 – 7.06 (m, 2H), 6.88 (d, *J* = 2.1 Hz, 1H), 6.54 (dd, *J* = 3.5, 1.8 Hz, 1H), 6.45 (dd, *J* = 10.2, 2.1 Hz, 1H), 6.23 (br, 1H), 3.13 (s, 3H), 1.94 (s, 3H). ^{13}C NMR (101 MHz, Chloroform-*d*) δ 185.1, 168.7, 148.0, 144.9, 144.3, 142.0, 130.6, 124.2, 115.0, 112.6, 80.6, 50.9, 23.6. HRMS (ESI) m/z calcd for $C_{13}H_{14}NO_4$ $[M+H]^+$: 248.0917; found:248.0924.

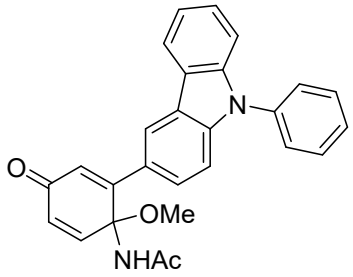


2u

***N*-(2-(benzofuran-3-yl)-1-methoxy-4-oxocyclohexa-2,5-dien-1-yl)acetamide (2u):**

(eluent: petroleum ether : ethyl acetate = 1:1), 26.4 mg, 89%; yellow solid, mp: 187-

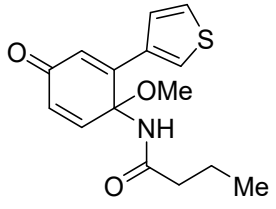
189°C. ^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.29 (s, 1H), 7.87 (dd, *J* = 7.5, 2.0 Hz, 1H), 7.57 (dd, *J* = 7.5, 1.4 Hz, 1H), 7.42 – 7.33 (m, 2H), 7.13 (d, *J* = 10.2 Hz, 1H), 6.98 (d, *J* = 2.0 Hz, 1H), 6.51 (dd, *J* = 10.2, 2.0 Hz, 1H), 6.26 (br, 1H), 3.24 (s, 3H), 1.85 (s, 3H). ^{13}C NMR (101 MHz, Chloroform-*d*) δ 185.1, 168.7, 155.3, 146.4, 145.7, 144.9, 130.6, 128.6, 125.5, 125.0, 124.0, 121.2, 115.0, 112.0, 81.7, 51.1, 23.7. HRMS (ESI) m/z calcd for $C_{17}H_{16}NO_4$ $[M+H]^+$: 298.1074; found:298.1076.



2v

***N*-(1-methoxy-4-oxo-2-(9-phenyl-9H-carbazol-3-yl)cyclohexa-2,5-dien-1-yl)acetamide (2v):**

(eluent: petroleum ether : ethyl acetate = 1:1), 38.4 mg, 91%; yellow solid, mp: 182-184°C. ^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.16 – 8.13 (m, 2H), 7.66 – 7.40 (m, 10H), 7.31 (t, *J* = 7.3 Hz, 1H), 6.92 (d, *J* = 10.1 Hz, 1H), 6.64 (s, 1H), 6.45 (d, *J* = 10.2 Hz, 1H), 6.07 (s, 1H), 3.28 (s, 3H), 1.70 (s, 3H). ^{13}C NMR (101 MHz, Chloroform-*d*) δ 185.6, 168.4, 153.3, 145.2, 141.7, 140.8, 137.1, 132.8, 130.1, 130.1, 130.0, 127.9, 126.9, 126.9, 124.7, 122.6, 120.6, 120.4, 119.5, 110.0, 109.5, 82.41, 50.6, 23.4. HRMS (ESI) m/z calcd for $C_{27}H_{23}N_2O_3$ $[M+H]^+$: 423.1703; found:432.1712.

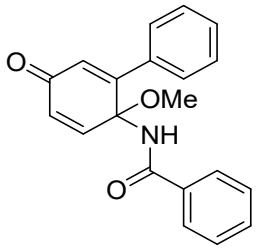


2w

***N*-(2-methoxy-5-oxo-2,5-dihydro-[1,1'-biphenyl]-2-yl)benzamide (2w):**

(eluent: petroleum ether : ethyl acetate = 1:1), 25.0 mg, 86%; yellow solid, mp: 189-191°C. ^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.92 (dd, *J* = 2.9, 1.4 Hz, 1H), 7.42 – 7.28 (m, 2H), 6.96 (d, *J* = 10.1 Hz, 1H), 6.70 (d, *J* = 2.0 Hz, 1H), 6.46 (dd, *J* = 10.1, 2.0 Hz,

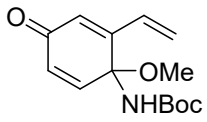
1H), 6.20 (br, 1H), 3.21 (s, 3H), 2.09 – 1.95 (m, 2H), 1.51 – 1.42 (m, 3H), 0.75 (t, *J* = 7.4 Hz, 3H). ^{13}C NMR (101 MHz, Chloroform-*d*) δ 185.6, 171.3, 147.6, 144.9, 135.3, 130.4, 127.8, 126.8, 126.7, 126.2, 81.8, 50.8, 38.5, 18.6, 13.2. HRMS (ESI) m/z calcd for $C_{15}H_{18}NO_3S$ $[M+H]^+$: 292.1002; found:292.1013.



2x

***N*-(2-methoxy-5-oxo-2,5-dihydro-[1,1'-biphenyl]-2-yl)benzamide (2x):**

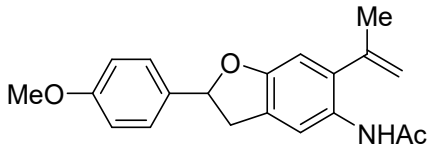
(eluent: petroleum ether : ethyl acetate = 1:1), 16.6 mg, 52%; yellow solid, mp: 188-190°C. ^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.69 – 7.65 (m, 2H), 7.48 – 7.36 (m, 6H), 7.33 – 7.29 (m, 2H), 6.87 (d, *J* = 10.1 Hz, 1H), 6.65 (d, *J* = 2.0 Hz, 1H), 6.62 (br, 1H), 6.54 (dd, *J* = 10.1, 2.0 Hz, 1H), 3.37 (s, 3H). ^{13}C NMR (101 MHz, Chloroform-*d*) δ 185.7, 165.5, 153.0, 145.3, 135.5, 133.5, 131.9, 130.7, 130.3, 129.8, 128.7, 128.6, 127.9, 126.8, 82.8, 50.7. HRMS (ESI) m/z calcd for $C_{20}H_{18}NO_3$ $[M+H]^+$: 320.1281; found:320.1284.



2z

tert-butyl (1-methoxy-4-oxo-2-vinylcyclohexa-2,5-dien-1-yl)carbamate(2z):

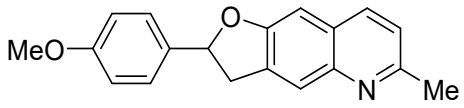
(eluent: petroleum ether : ethyl acetate = 1:1), 21.0 mg, 79%; yellow oil. ^{1}H NMR (400 MHz, Methanol-d_4) δ 6.77 (d, *J* = 10.1 Hz, 1H), 6.52 – 6.44 (m, 2H), 6.35 (dd, *J* = 10.1, 2.1 Hz, 1H), 6.09 (dd, *J* = 17.7, 1.3 Hz, 1H), 5.56 (dd, *J* = 11.3, 1.3 Hz, 1H), 3.10 (s, 3H), 1.35 (s, 9H). ^{13}C NMR (101 MHz, Methanol-d_4) δ 187.9, 154.7, 148.1, 133.1, 131.2, 128.1, 123.0, 82.2, 51.0, 28.5, 28.4. HRMS (ESI) m/z calcd for $C_{14}H_{119}NNaO_4$ $[M+H]^+$: 288.1206; found:288.1211.



2m-1

***N*-(2-(4-methoxyphenyl)-6-(prop-1-en-2-yl)-2,3-dihydrobenzofuran-5-yl)acetamide (2m-1):**

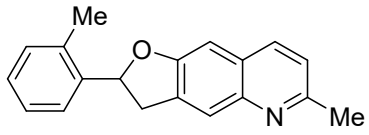
(eluent: petroleum ether : ethyl acetate = 20:1), 26.8 mg, 83%; yellow solid, mp: 121-123°C. ^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.89 (s, 1H), 7.37 (br, 1H), 7.32 (d, *J* = 8.8 Hz, 2H), 6.90 – 6.88 (m, 2H), 6.61 (s, 1H), 5.68 (t, *J* = 8.8 Hz, 1H), 5.32 (s, 1H), 4.99 (s, 1H), 3.79 (s, 3H), 3.55 (dd, *J* = 15.9, 9.3 Hz, 1H), 3.20 (dd, *J* = 16.0, 8.3 Hz, 1H), 2.12 (s, 3H), 2.03 (s, 3H). ^{13}C NMR (101 MHz, Chloroform-*d*) δ 168.2, 159.6, 156.3, 143.4, 135.1, 133.7, 127.4, 127.0, 126.3, 119.4, 116.5, 114.1, 108.2, 94.6, 55.3, 38.3, 24.4, 24.3. HRMS (ESI) m/z calcd for $C_{20}H_{22}NO_3[M+H]^+$: 324.1594; found:324.1603.



3a

2-(4-methoxyphenyl)-6-methyl-2,3-dihydrofuro[2,3-*g*]quinoline (3a):

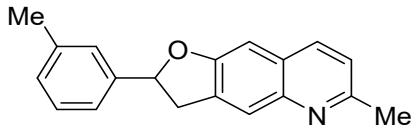
(eluent: petroleum ether : ethyl acetate = 15:1), 25.3 mg, 87%; yellow solid, mp: 113-115°C. ^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.89 (d, *J* = 8.4 Hz, 1H), 7.81 (s, 1H), 7.34 (d, *J* = 8.7 Hz, 2H), 7.18 (d, *J* = 8.4 Hz, 1H), 7.03 (s, 1H), 6.90 (d, *J* = 8.6 Hz, 2H), 5.79 (t, *J* = 8.3 Hz, 1H), 3.80 – 3.73 (m, 4H), 3.40 (dd, *J* = 16.5, 7.8 Hz, 1H), 2.69 (s, 3H). ^{13}C NMR (101 MHz, Chloroform-*d*) δ 159.6, 157.7, 155.7, 144.6, 135.1, 133.4, 133.2, 127.3, 124.2, 121.5, 114.1, 102.7, 84.6, 55.3, 38.0, 24.9. HRMS (ESI) m/z calcd for $C_{19}H_{18}NO_2[M+H]^+$: 292.1332; found:292.1325.



3b

6-methyl-2-(o-tolyl)-2,3-dihydrofuro[2,3-*g*]quinoline (3b):

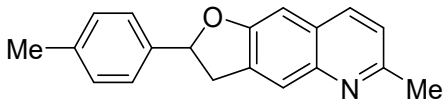
(eluent: petroleum ether : ethyl acetate = 15:1), 20.3 mg, 74%; yellow solid, mp: 117-119°C. ^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.94 (d, *J* = 8.4 Hz, 1H), 7.86 (s, 1H), 7.29 – 7.22 (m, 5H), 7.14 (d, *J* = 7.4 Hz, 1H), 7.08 (s, 1H), 5.83 (t, *J* = 8.3 Hz, 1H), 3.82 (dd, *J* = 16.5, 9.0 Hz, 2H), 3.41 (dd, *J* = 16.5, 7.7 Hz, 2H), 2.71 (s, 3H), 2.36 (s, 3H). ^{13}C NMR (101 MHz, Chloroform-*d*) δ 158.0, 155.6, 141.2, 138.5, 135.6, 133.6, 129.1, 128.7, 127.4, 126.4, 124.0, 122.9, 121.7, 102.9, 84.9, 38.2, 24.7, 21.5. HRMS (ESI) m/z calcd for $C_{19}H_{18}NO$ $[M+H]^+$: 276.1383; found:276.1386.



3c

6-methyl-2-(m-tolyl)-2,3-dihydrofuro[2,3-*g*]quinoline (3c):

(eluent: petroleum ether : ethyl acetate = 15:1), 14.3 mg, 52%; yellow solid, mp: 103-105°C. ^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.94 (d, *J* = 8.4 Hz, 1H), 7.82 (s, 1H), 7.45 (d, *J* = 6.1 Hz, 1H), 7.22 – 7.19 (m, 4H), 7.11 (s, 1H), 6.05 (dd, *J* = 9.1, 7.6 Hz, 1H), 3.86 (dd, *J* = 16.4, 9.1 Hz, 1H), 3.29 (dd, *J* = 16.4, 7.6 Hz, 1H), 2.70 (s, 3H), 2.39 (s, 3H). ^{13}C NMR (101 MHz, Chloroform-*d*) δ 158.0, 155.7, 144.5, 139.7, 135.3, 134.3, 133.2, 130.7, 127.9, 127.4, 126.4, 124.8, 124.3, 121.7, 102.8, 82.2, 37.3, 24.8, 19.3. HRMS (ESI) m/z calcd for $C_{19}H_{18}NO$ $[M+H]^+$: 276.1383; found:276.1377.

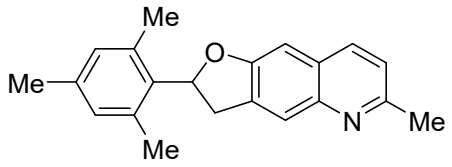


3d

6-methyl-2-(p-tolyl)-2,3-dihydrofuro[2,3-*g*]quinoline (3d):

(eluent: petroleum ether : ethyl acetate = 15:1), 22.3 mg, 81%; yellow solid, mp: 126-128°C. ^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.91 (d, *J* = 8.4 Hz, 1H), 7.81 (s, 1H), 7.31 (d, *J* = 8.1 Hz, 2H), 7.18 (dd, *J* = 8.2, 2.5 Hz, 3H), 7.05 (s, 1H), 5.82 (t, *J* = 8.3 Hz, 1H), 3.79 (dd, *J* = 16.5, 8.9 Hz, 1H), 3.39 (dd, *J* = 16.4, 7.7 Hz, 1H), 2.69 (s, 3H), 2.35 (s, 3H). ^{13}C NMR (101 MHz, Chloroform-*d*) δ 157.85, 155.67, 144.52, 138.26, 138.08, 135.19, 133.36, 129.36, 127.29, 125.79, 124.18, 121.58, 102.78, 84.71, 38.11,

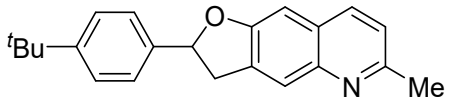
24.85, 21.14. HRMS (ESI) m/z calcd for $C_{19}H_{18}NO$ $[M+H]^+$: 276.1383; found:276.1376.



3e

2-mesityl-6-methyl-2,3-dihydrofuro[2,3-*g*]quinoline (3e):

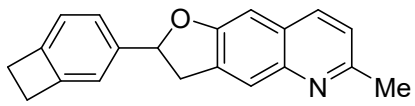
(eluent: petroleum ether : ethyl acetate = 15:1), 19.3 mg, 63%; yellow solid, mp: 126-128°C. ^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.90 (d, *J* = 8.4 Hz, 1H), 7.82 (s, 1H), 7.19 (d, *J* = 8.4 Hz, 1H), 7.02 (s, 1H), 6.87 (s, 2H), 6.23 (t, *J* = 9.9 Hz, 1H), 3.68 (dd, *J* = 16.8, 9.5 Hz, 1H), 3.44 (dd, *J* = 16.8, 10.2 Hz, 1H), 2.69 (s, 3H), 2.31 (s, 6H), 2.28 (s, 3H). ^{13}C NMR (101 MHz, Chloroform-*d*) δ 157.9, 155.6, 144.5, 137.6, 136. 6, 135.1, 133.7, 132.9, 130.1, 127.4, 124.1, 121.6, 102.9, 82.0, 35.8, 24.9, 20.8, 20.4. HRMS (ESI) m/z calcd for $C_{21}H_{22}NO$ $[M+H]^+$: 304.1696; found:304.1691.



3f

2-(4-(tert-butyl)phenyl)-6-methyl-2,3-dihydrofuro[2,3-*g*]quinoline (3f):

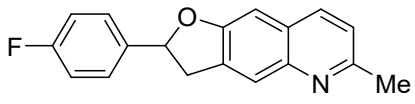
(eluent: petroleum ether : ethyl acetate = 15:1), 25.3 mg, 80%; yellow solid, mp: 132-134°C. ^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.91 (d, *J* = 8.4 Hz, 1H), 7.82 (s, 1H), 7.41 – 7.34 (m, 4H), 7.19 (d, *J* = 8.4 Hz, 1H), 7.05 (s, 1H), 5.83 (t, *J* = 8.3 Hz, 1H), 3.80 (dd, *J* = 16.4, 8.9 Hz, 1H), 3.43 (dd, *J* = 16.4, 7.7 Hz, 1H), 2.70 (s, 3H), 1.32 (s, 9H). ^{13}C NMR (101 MHz, Chloroform-*d*) δ 157.9, 155.7, 151.4, 144.5, 138.2, 135.2, 133.4, 127.3, 125.6, 124.2, 121.6, 102.8, 84.6, 37.9, 34.6, 31.3, 24.8. HRMS (ESI) m/z calcd for $C_{22}H_{24}NO$ $[M+H]^+$: 318.1852; found:318.1859.



3g

2-(bicyclo[4.2.0]octa-1,3,5-trien-3-yl)-6-methyl-2,3-dihydrofuro[2,3-*g*]quinoline (3g):

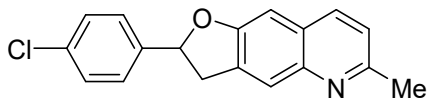
(eluent: petroleum ether : ethyl acetate = 15:1), 20.7 mg, 72%; yellow solid, mp: 141-143°C. ^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.91 (d, *J* = 8.4 Hz, 1H), 7.80 (s, 1H), 7.24 (dd, *J* = 7.7, 1.5 Hz, 1H), 7.18 (d, *J* = 8.4 Hz, 1H), 7.12 (s, 1H), 7.04 (t, *J* = 3.8 Hz, 2H), 5.80 (dd, *J* = 8.9, 7.6 Hz, 1H), 3.80 (dd, *J* = 16.5, 8.9 Hz, 1H), 3.39 (dd, *J* = 16.5, 7.6 Hz, 1H), 3.16 (s, 4H), 2.69 (s, 3H). ^{13}C NMR (101 MHz, Chloroform-*d*) δ 157.9, 155.7, 146.3, 146.0, 144.6, 140.0, 135.1, 133.4, 127.3, 124.7, 124.2, 122.7, 121.6, 120.0, 102.7, 85.5, 38.4, 29.4, 29.4, 24.9. HRMS (ESI) m/z calcd for $C_{20}H_{18}NO$ $[M+H]^+$: 288.1383; found:288.1383.



3h

2-(4-fluorophenyl)-6-methyl-2,3-dihydrofuro[2,3-*g*]quinoline (3h):

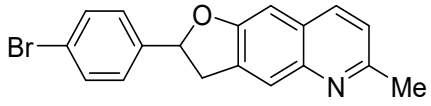
(eluent: petroleum ether : ethyl acetate = 15:1), 18.9 mg, 68%; yellow solid, mp: 146-148°C. ^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.90 (d, *J* = 8.4 Hz, 1H), 7.81 (s, 1H), 7.38 (dd, *J* = 8.6, 5.4 Hz, 2H), 7.18 (d, *J* = 8.4 Hz, 1H), 7.07 – 7.03 (m, 3H), 5.81 (t, *J* = 8.3 Hz, 1H), 3.80 (dd, *J* = 16.4, 8.9 Hz, 1H), 3.37 (d, *J* = 16.4, 7.7 Hz, 1H), 2.69 (s, 3H). ^{13}C NMR (101 MHz, Chloroform-*d*) δ 163.8 (d, $^{1}J_{C\text{-}F}$ = 246.8 Hz), 161.3 (d, $^{1}J_{C\text{-}F}$ = 246.8 Hz), 157.5, 155.8, 144.6, 137.1 (d, $^{3}J_{C\text{-}F}$ = 3.2 Hz), 137.1 (d, $^{3}J_{C\text{-}F}$ = 3.2 Hz), 135.1, 132.79, 127.6 (d, $^{4}J_{C\text{-}F}$ = 8.3 Hz), 127.5 (d, $^{4}J_{C\text{-}F}$ = 8.3 Hz), 127.2, 124.3, 121.6, 115.7 (d, $^{2}J_{C\text{-}F}$ = 21.6 Hz), 115.5 (d, $^{2}J_{C\text{-}F}$ = 21.6 Hz), 102.9, 84.0, 38.2, 24.8. HRMS (ESI) m/z calcd for $C_{18}H_{15}FNO$ $[M+H]^+$: 280.1132; found:280.1137.



3i

2-(4-chlorophenyl)-6-methyl-2,3-dihydrofuro[2,3-*g*]quinoline (3i):

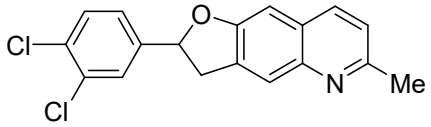
(eluent: petroleum ether : ethyl acetate = 15:1), 20.6 mg, 70%; yellow solid, mp: 163-165°C. ^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.92 (d, *J* = 8.4 Hz, 1H), 7.81 (d, *J* = 1.6 Hz, 1H), 7.35 (s, 4H), 7.20 (d, *J* = 8.4 Hz, 1H), 7.07 (s, 1H), 5.82 (dd, *J* = 8.9, 7.6 Hz, 1H), 3.82 (dd, *J* = 16.4, 8.9 Hz, 1H), 3.34 (dd, *J* = 16.4, 7.6 Hz, 0H), 2.69 (s, 3H). ^{13}C NMR (101 MHz, Chloroform-*d*) δ 157.6, 155.9, 144.6, 139.9, 135.2, 134.0, 132.7, 128.9, 127.3, 127.1, 124.3, 121.7, 103.0, 83.9, 38.2, 24.9. HRMS (ESI) m/z calcd for $C_{18}H_{15}ClNO$ $[M+H]^+$: 296.0837; found:296.0831.



3j

2-(4-bromophenyl)-6-methyl-2,3-dihydrofuro[2,3-*g*]quinoline (3ar):

(eluent: petroleum ether : ethyl acetate = 15:1), 24.4 mg, 72%; yellow solid, mp: 163-165°C. ^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.92 (d, *J* = 8.4 Hz, 1H), 7.81 (s, 1H), 7.50 (d, *J* = 8.1 Hz, 2H), 7.29 (d, *J* = 8.1 Hz, 2H), 7.20 (d, *J* = 8.4 Hz, 1H), 7.07 (s, 1H), 5.80 (t, *J* = 8.3 Hz, 1H), 3.82 (dd, *J* = 16.4, 9.0 Hz, 1H), 3.34 (dd, *J* = 16.5, 7.5 Hz, 1H), 2.69 (s, 3H). ^{13}C NMR (101 MHz, Chloroform-*d*) δ 157.6, 155.9, 144.6, 140.4, 135.2, 132.6, 131.8, 127.4, 127.3, 124.3, 122.1, 121.7, 103.0, 83.9, 38.1, 24.9. HRMS (ESI) m/z calcd for $C_{18}H_{15}BrNO$ $[M+H]^+$: 340.0332; found:340.0328.

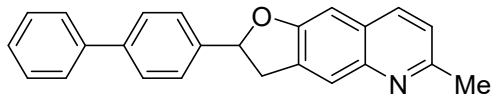


3k

2-(3,4-dichlorophenyl)-6-methyl-2,3-dihydrofuro[2,3-*g*]quinoline (3k):

(eluent: petroleum ether : ethyl acetate = 15:1), 22.4 mg, 68%; yellow solid, mp: 176-178°C. ^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.94 (d, *J* = 8.4 Hz, 1H), 7.84 (s, 1H),

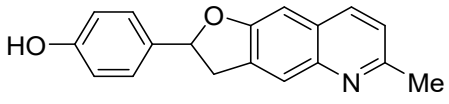
7.52 (d, *J* = 2.1 Hz, 1H), 7.45 (d, *J* = 8.3 Hz, 1H), 7.25 – 7.21 (m, 2H), 7.10 (s, 1H), 5.80 (dd, *J* = 9.0, 7.4 Hz, 1H), 3.85 (dd, *J* = 16.4, 9.0 Hz, 1H), 3.34 (dd, *J* = 16.4, 7.4 Hz, 1H), 2.71 (s, 3H). ^{13}C NMR (101 MHz, Chloroform-*d*) δ 157.4, 156.0, 144.5, 141.7, 135.4, 132.9, 132.3, 132.2, 130.7, 127.7, 127.3, 125.0, 124.3, 121.8, 103.2, 83.1, 38.1, 24.8. HRMS (ESI) m/z calcd for $C_{18}H_{14}Cl_2NO$ $[M+H]^+$: 330.0447; found:330.0453.



3l

2-([1,1'-biphenyl]-4-yl)-6-methyl-2,3-dihydrofuro[2,3-*g*]quinoline (3l):

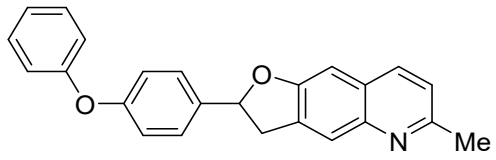
(eluent: petroleum ether : ethyl acetate = 15:1), 27.9 mg, 83%; yellow solid, mp: 158-160°C. ^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.92 (d, *J* = 8.4 Hz, 1H), 7.82 (s, 1H), 7.39 (d, *J* = 8.6 Hz, 2H), 7.33 (t, *J* = 7.9 Hz, 2H), 7.20 (d, *J* = 8.4 Hz, 1H), 7.11 (t, *J* = 7.4 Hz, 1H), 7.06 (s, 1H), 7.01 (d, *J* = 8.4 Hz, 5H), 5.83 (t, *J* = 8.3 Hz, 1H), 3.81 (dd, *J* = 16.4, 8.9 Hz, 1H), 3.42 (dd, *J* = 16.4, 7.7 Hz, 1H), 2.70 (s, 3H). ^{13}C NMR (101 MHz, Chloroform-*d*) δ 157.7, 157.3, 157.0, 155.8, 144.6, 135.9, 135.2, 133.1, 129.8, 127.4, 127.3, 124.3, 123.4, 121.6, 118.9, 102.9, 84.4, 38.1, 24.9. HRMS (ESI) m/z calcd for $C_{24}H_{20}NO$ $[M+H]^+$: 338.1539; found:338.1541.



3m

4-(6-methyl-2,3-dihydrofuro[2,3-*g*]quinolin-2-yl)phenol (3m):

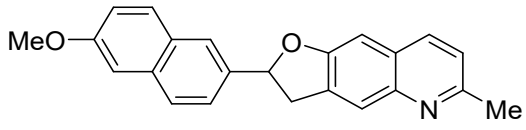
(eluent: petroleum ether : ethyl acetate = 15:1), 16.8 mg, 61%; yellow solid, mp: 168-170°C. ^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.93 (d, *J* = 8.4 Hz, 1H), 7.81 (s, 1H), 7.51 (d, *J* = 8.7 Hz, 2H), 7.29 (d, *J* = 8.7 Hz, 2H), 7.21 (d, *J* = 8.4 Hz, 1H), 7.10 (s, 1H), 5.88 (t, *J* = 8.2 Hz, 1H), 3.87 (dd, *J* = 17.8, 9.1 Hz, 1H), 3.36 (dd, *J* = 17.8, 7.5 Hz, 1H), 2.70 (s, 3H). ^{13}C NMR (101 MHz, Chloroform-*d*) δ 157.4, 156.1, 149.1, 144.7, 142.1, 135.2, 132.2, 127.6, 127.3, 124.6, 121.8, 121.7, 103.1, 83.3, 38.2, 24.9. HRMS (ESI) m/z calcd for $C_{18}H_{16}NO_2$ $[M+H]^+$: 278.1176; found:278.1181.



3n

6-methyl-2-(4-phenoxyphenyl)-2,3-dihydrofuro[2,3-*g*]quinoline (3n):

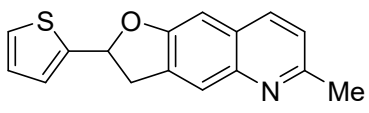
(eluent: petroleum ether : ethyl acetate = 15:1), 31.4 mg, 89%; yellow solid, mp: 166-168°C. ^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.88 (d, *J* = 8.4 Hz, 1H), 7.81 (s, 1H), 7.37 (d, *J* = 8.3 Hz, 2H), 7.32 – 7.30 (m, 2H), 7.17 (d, *J* = 8.4 Hz, 1H), 7.09 (t, *J* = 7.4 Hz, 1H), 7.04 (s, 1H), 7.00 (d, *J* = 8.1 Hz, 4H), 5.81 (t, *J* = 8.3 Hz, 1H), 3.78 (dd, *J* = 17.1, 8.3 Hz, 1H), 3.39 (dd, *J* = 16.4, 7.7 Hz, 1H), 2.68 (s, 3H). ^{13}C NMR (101 MHz, Chloroform-*d*) δ 157.6, 157.3, 156.9, 155.7, 144.6, 135.9, 135.0, 133.0, 129.7, 127.4, 127.2, 124.3, 123.4, 121.6, 118.9, 118.9, 102.8, 84.3, 38.0, 24.9. HRMS (ESI) m/z calcd for $C_{24}H_{20}NO_2$ $[M+H]^+$: 354.1489; found:354.1483.



3o

2-(6-methoxynaphthalen-2-yl)-6-methyl-2,3-dihydrofuro[2,3-*g*]quinoline (3o):

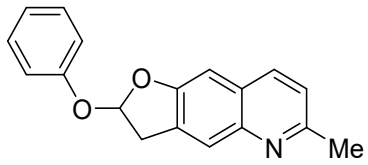
(eluent: petroleum ether : ethyl acetate = 15:1), 28.6 mg, 84%; yellow solid, mp: 171-173°C. ^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.91 (d, *J* = 8.4 Hz, 1H), 7.83 (s, 1H), 7.79 – 7.78 (m, 1H), 7.75 – 7.70 (m, 1H), 7.45 (dd, *J* = 8.4, 1.8 Hz, 1H), 7.19 – 7.11 (m, 3H), 7.08 (s, 1H), 5.96 (t, *J* = 8.3 Hz, 1H), 7.90 – 7.81 (m, 4H), 3.47 (dd, *J* = 16.5, 7.8 Hz, 1H), 2.69 (s, 3H). ^{13}C NMR (101 MHz, Chloroform-*d*) δ 158.0, 157.9, 155.8, 144.7, 136.3, 135.2, 134.5, 133.3, 129.5, 128.6, 127.6, 127.4, 124.9, 124.3, 124.1, 121.7, 119.2, 105.8, 102.9, 85.0, 55.3, 38.2, 24.9. HRMS (ESI) m/z calcd for $C_{23}H_{20}NO_2$ $[M+H]^+$: 342.1489; found:342.1483.



3p

6-methyl-2-(thiophen-2-yl)-2,3-dihydrofuro[2,3-*g*]quinoline (3p):

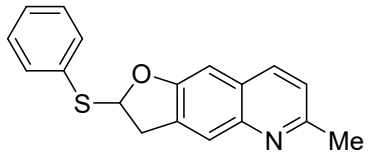
(eluent: petroleum ether : ethyl acetate = 15:1), 16.3 mg, 59%; yellow solid, mp: 103-105°C. ^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.89 (d, *J* = 8.4 Hz, 1H), 7.83 (s, 1H), 7.29 (d, *J* = 5.1 Hz, 1H), 7.17 (d, *J* = 8.4 Hz, 1H), 7.13 (d, *J* = 3.5 Hz, 1H), 7.03 (s, 1H), 7.00 – 6.98 (m, 1H), 6.05 (t, *J* = 8.0 Hz, 1H), 3.81 (dd, *J* = 16.4, 8.7 Hz, 1H), 3.54 (dd, *J* = 16.4, 7.4 Hz, 1H), 2.68 (s, 3H). ^{13}C NMR (101 MHz, Chloroform-*d*) δ 157.0, 155.9, 144.7, 143.9, 135.2, 132.7, 127.3, 126.9, 125.8, 125.5, 124.3, 121.7, 103.3, 80.5, 38.3, 24.9. HRMS (ESI) m/z calcd for $C_{16}H_{14}NOS$ $[M+H]^+$: 278.1176; found:278.1168.



3q

6-methyl-2-phenoxy-2,3-dihydrofuro[2,3-*g*]quinoline (3q):

(eluent: petroleum ether : ethyl acetate = 15:1), 12.0 mg, 43%; yellow solid, mp: 141-43°C. ^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.94 – 7.91 (m, 2H), 7.34 (dd, *J* = 8.6, 7.3 Hz, 2H), 7.21 (d, *J* = 8.5 Hz, 1H), 7.15 (d, *J* = 8.0 Hz, 2H), 7.11 (s, 1H), 7.07 (t, *J* = 7.4 Hz, 1H), 6.45 (dd, *J* = 6.4, 1.9 Hz, 1H), 3.73 (dd, *J* = 17.3, 6.4 Hz, 1H), 3.57 – 3.53 (m, 1H), 2.71 (s, 3H). ^{13}C NMR (101 MHz, Chloroform-*d*) δ 156.6, 156.2, 156.1, 144.6, 135.6, 131.1, 129.6, 127.1, 124.4, 122.7, 121.7, 116.7, 104.1, 104.0, 36.9, 24.8. HRMS (ESI) m/z calcd for $C_{18}H_{16}NO_2$ $[M+H]^+$: 278.1176; found:278.1169.

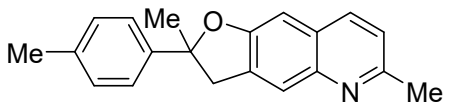


3r

6-methyl-2-(phenylthio)-2,3-dihydrofuro[2,3-*g*]quinoline (3r):

(eluent: petroleum ether : ethyl acetate = 15:1), 15.8 mg, 54%; yellow solid, mp: 142-15°C. ^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.91 (d, *J* = 8.4 Hz, 1H), 7.81 (s, 1H), 7.60 – 7.57 (m, 2H), 7.36 – 7.29 (m, 3H), 7.19 (d, *J* = 8.4 Hz, 1H), 7.08 (s, 1H), 6.27 (dd, *J* = 8.7, 4.8 Hz, 1H), 3.85 (dd, *J* = 17.3, 8.7 Hz, 1H), 3.41 (d, *J* = 4.8 Hz, 0H), 2.69 (s, 3H). ^{13}C NMR (101 MHz, Chloroform-*d*) δ 156.2, 156.1, 144.5, 135.3, 133.3, 132.1,

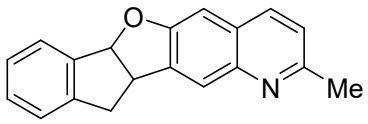
132.1, 129.0, 127.9, 127.2, 124.1, 121.7, 104.1, 89.8, 36.5, 24.8. HRMS (ESI) m/z calcd for $C_{18}H_{16}NOS$ $[M+H]^+$: 294.0947; found:294.0941.



3s

2,6-dimethyl-2-(p-tolyl)-2,3-dihydrofuro[2,3-*g*]quinoline (3s):

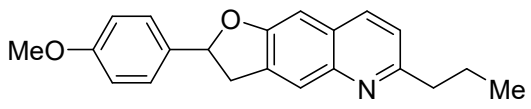
(eluent: petroleum ether : ethyl acetate = 15:1), 16.7 mg, 58%; yellow solid, mp: 119-121°C. ^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.89 (d, *J* = 8.4 Hz, 1H), 7.75 (s, 1H), 7.38 (d, *J* = 8.3 Hz, 2H), 7.16 – 7.14 (m, 3H), 7.07 (s, 1H), 3.56 (q, *J* = 16.1 Hz, 1H), 2.67 (s, 3H), 2.32 (s, 3H), 1.80 (s, 3H). ^{13}C NMR (101 MHz, Chloroform-*d*) δ 157.2, 155.5, 144.5, 143.1, 136.9, 135.0, 133.5, 129.0, 127.3, 124.4, 124.4, 121.4, 103.0, 90.0, 44.4, 29.2, 24.8, 20.9. HRMS (ESI) m/z calcd for $C_{20}H_{20}NO$ $[M+H]^+$: 290.1539; found:290.1532.



3t

2-methyl-6a,11a-dihydro-11H-indeno[2',1':4,5]furo[2,3-*g*]quinoline (3t):

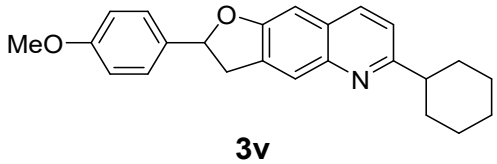
(eluent: petroleum ether : ethyl acetate = 15:1), 3.1 mg, 11%; yellow solid, mp: 135-137°C. ^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.90 (s, 1H), 7.86 (d, *J* = 8.4 Hz, 1H), 7.58 (dd, *J* = 5.3, 3.5 Hz, 1H), 7.30 – 7.22 (m, 4H), 7.15 (d, *J* = 8.4 Hz, 1H), 6.96 (s, 1H), 6.32 (d, *J* = 8.0 Hz, 1H), 4.47 (t, *J* = 8.3 Hz, 1H), 3.65 (dd, *J* = 16.5, 8.7 Hz, 1H), 3.33 (dd, *J* = 16.5, 2.4 Hz, 1H), 2.68 (s, 3H). ^{13}C NMR (101 MHz, Chloroform-*d*) δ 157.4, 155.6, 144.2, 142.3, 140.3, 138.2, 135.3, 129.5, 127.5, 127.4, 125.9, 125.2, 124.2, 121.6, 103.4, 91.4, 44.7, 39.3, 24.7. HRMS (ESI) m/z calcd for $C_{19}H_{18}NO$ $[M+H]^+$: 276.1383; found:276.1388.



3u

2-(4-methoxyphenyl)-6-propyl-2,3-dihydrofuro[2,3-*g*]quinoline (3u):

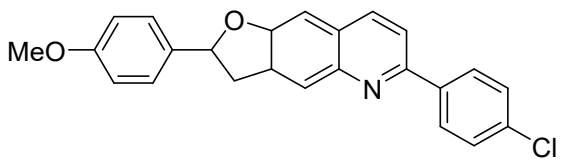
(eluent: petroleum ether : ethyl acetate = 15:1), 27.4 mg, 86%; yellow solid, mp: 165-167°C. ^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.92 (d, *J* = 8.4 Hz, 1H), 7.84 (s, 1H), 7.34 (d, *J* = 8.7 Hz, 2H), 7.19 (d, *J* = 8.4 Hz, 1H), 7.04 (s, 1H), 6.90 (d, *J* = 8.7 Hz, 2H), 5.79 (t, *J* = 8.3 Hz, 1H), 3.81 – 3.73 (m, 4H), 3.39 (dd, *J* = 16.5, 7.8 Hz, 1H), 2.92 – 2.88 (m, 2H), 1.87 – 1.78 (m, 2H), 1.01 (t, *J* = 7.3 Hz, 3H). ^{13}C NMR (101 MHz, Chloroform-*d*) δ 159.7, 159.6, 157.7, 144.6, 135.1, 133.3, 133.2, 127.5, 127.3, 124.4, 120.9, 114.1, 102.7, 84.6, 55.3, 40.9, 38.0, 23.3, 13.9. HRMS (ESI) m/z calcd for $C_{21}H_{22}NO_2$ $[M+H]^+$: 320.1645; found:320.1638.



3v

6-cyclohexyl-2-(4-methoxyphenyl)-2,3-dihydrofuro[2,3-*g*]quinoline (3v):

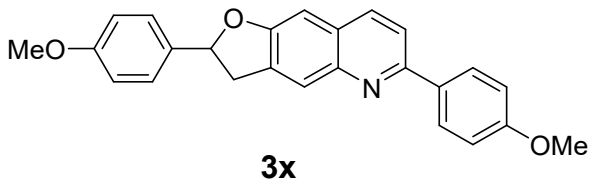
(eluent: petroleum ether : ethyl acetate = 15:1), 29.8 mg, 78%; yellow solid, mp: 106-108°C. ^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.93 (d, *J* = 8.5 Hz, 1H), 7.84 (s, 1H), 7.33 (d, *J* = 8.7 Hz, 2H), 7.22 (d, *J* = 8.5 Hz, 1H), 7.03 (s, 1H), 6.89 (d, *J* = 8.7 Hz, 1H), 5.78 (t, *J* = 8.2 Hz, 1H), 3.79 – 3.72 (m, 3H), 3.38 (dd, *J* = 17.2, 8.5 Hz, 1H), 2.86 (tt, *J* = 11.9, 3.5 Hz, 1H), 2.02 – 1.99 (m, 2H), 1.88 (dt, *J* = 12.7, 3.2 Hz, 2H), 1.80 – 1.75 (m, 1H), 1.60 (qd, *J* = 12.3, 3.2 Hz, 2H), 1.46 (qt, *J* = 12.7, 3.2 Hz, 2H), 1.37 – 1.26 (m, 1H). ^{13}C NMR (101 MHz, Chloroform-*d*) δ 163.8, 159.6, 157.7, 144.5, 135.2, 133.3, 133.1, 127.7, 127.3, 124.5, 119.1, 114.1, 102.7, 84.6, 55.3, 47.2, 38.0, 33.0, 32.9, 26.6, 26.1. HRMS (ESI) m/z calcd for $C_{24}H_{26}NO_2$ $[M+H]^+$: 384.1594; found:384.1596.



3w

6-(4-chlorophenyl)-2-(4-methoxyphenyl)-2,3,3a,9a-tetrahydrofuro[2,3-*g*]quinoline (3w):

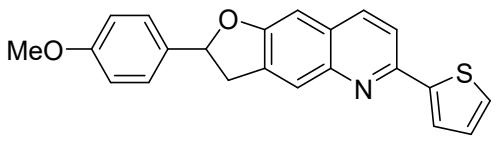
(eluent: petroleum ether : ethyl acetate = 15:1), 29.2 mg, 75%; yellow solid, mp: 139-141°C. ^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.07 (d, *J* = 8.3 Hz, 3H), 7.94 (s, 1H), 7.74 (d, *J* = 8.6 Hz, 1H), 7.47 (d, *J* = 8.1 Hz, 2H), 7.36 (d, *J* = 8.2 Hz, 2H), 7.09 (s, 1H), 6.92 (d, *J* = 8.2 Hz, 2H), 5.83 (t, *J* = 8.3 Hz, 1H), 3.84 – 3.77 (m, 4H), 3.43 (dd, *J* = 16.5, 7.7 Hz, 1H). ^{13}C NMR (101 MHz, Chloroform-*d*) δ 159.7, 158.5, 153.1, 145.1, 138.3, 135.6, 134.9, 134.0, 133.1, 128.9, 128.4, 128.3, 127.4, 125.4, 118.2, 114.1, 102.7, 84.8, 55.3, 38.0. HRMS (ESI) m/z calcd for $C_{24}H_{21}ClNO_2$ $[M+H]^+$: 390.1255; found:390.1248.



3x

2,6-bis(4-methoxyphenyl)-2,3-dihydrofuro[2,3-*g*]quinoline (3x):

(eluent: petroleum ether : ethyl acetate = 15:1), 31.4 mg, 82%; yellow solid, mp: 131-133°C.^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.09 (d, *J* = 8.4 Hz, 2H), 8.03 (d, *J* = 8.6 Hz, 1H), 7.92 (s, 1H), 7.73 (d, *J* = 8.6 Hz, 1H), 7.36 (d, *J* = 8.3 Hz, 2H), 7.07 (s, 1H), 7.03 (d, *J* = 8.3 Hz, 2H), 6.91 (d, *J* = 8.2 Hz, 2H), 5.82 (t, *J* = 8.3 Hz, 1H), 3.88 (s, 1H), 3.81 – 3.76 (m, 4H), 3.42 (dd, *J* = 16.5, 7.8 Hz, 1H). ^{13}C NMR (101 MHz, Chloroform-*d*) δ 160.4, 159.7, 158.1, 154.2, 145.1, 135.4, 133.6, 133.2, 132.6, 128.5, 127.8, 127.4, 125.2, 118.2, 114.2, 114.1, 102.7, 84.7, 55.4, 55.3, 38.0. HRMS (ESI) m/z calcd for $C_{25}H_{22}NO_3$ $[M+H]^+$: 384.1594; found:384.1599.

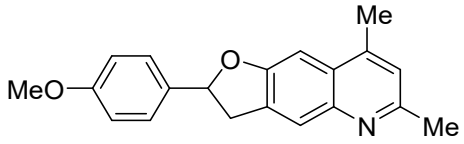


3y

2-(4-methoxyphenyl)-6-(thiophen-2-yl)-2,3-dihydrofuro[2,3-*g*]quinoline (3y):

(eluent: petroleum ether : ethyl acetate = 15:1), 26.2 mg, 73%; yellow solid, mp: 153-155°C. ^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.98 (d, *J* = 8.6 Hz, 1H), 7.88 (s, 1H), 7.70 (d, *J* = 8.6 Hz, 1H), 7.66 (dd, *J* = 3.7, 1.1 Hz, 1H), 7.41 (dd, *J* = 5.0, 1.1 Hz, 1H),

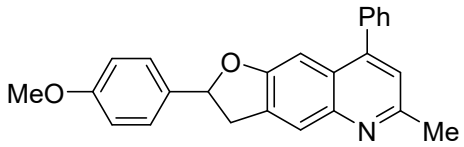
7.35 (d, *J* = 8.7 Hz, 2H), 7.13 (dd, *J* = 5.1, 3.7 Hz, 1H), 7.04 (s, 1H), 6.91 (d, *J* = 8.7 Hz, 2H), 5.81 (t, *J* = 8.3 Hz, 1H), 3.81 – 3.75 (m, 4H), 3.40 (dd, *J* = 16.5, 7.8 Hz, 1H). ^{13}C NMR (101 MHz, Chloroform-*d*) δ 159.7, 158.2, 149.7, 145.7, 144.8, 135.3, 133.8, 133.1, 128.2, 127.9, 127.6, 127.3, 125.0, 124.8, 117.3, 114.1, 102.9, 84.8, 55.3, 37.9. HRMS (ESI) m/z calcd for $C_{22}H_{18}NO_2S$ $[M+H]^+$: 360.1053; found:360.1061.



3z

2-(4-methoxyphenyl)-6,8-dimethyl-2,3-dihydrofuro[2,3-*g*]quinoline (3z):

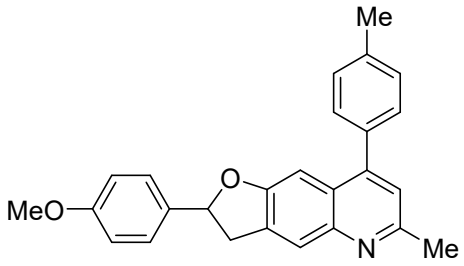
(eluent: petroleum ether : ethyl acetate = 15:1), 21.6 mg, 71%; yellow solid, mp: 132-134°C. ^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.86 (s, 1H), 7.35 (d, *J* = 8.3 Hz, 2H), 7.21 (s, 1H), 7.07 (s, 1H), 6.91 (d, *J* = 8.6 Hz, 2H), 5.82 (t, *J* = 8.3 Hz, 1H), 3.81 – 3.75 (m, 4H), 3.41 (dd, *J* = 16.4, 7.7 Hz, 1H), 2.66 (s, 3H), 2.59 (s, 3H). ^{13}C NMR (101 MHz, Chloroform-*d*) δ 159.7, 157.9, 155.2, 147.4, 133.3, 128.6, 127.3, 124.4, 114.1, 99.5, 84.7, 55.3, 38.0, 24.8, 19.1. HRMS (ESI) m/z calcd for $C_{20}H_{20}NO_2$ $[M+H]^+$: 306.1489; found:306.1495.



3aa

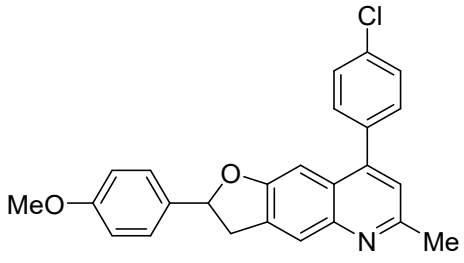
2-(4-methoxyphenyl)-6-methyl-8-phenyl-2,3-dihydrofuro[2,3-*g*]quinoline (3aa):

(eluent: petroleum ether : ethyl acetate = 15:1), 27.1 mg, 74%; yellow solid, mp: 148-150°C. ^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.90 (s, 1H), 7.49 – 7.44 (m, 5H), 7.32 (d, *J* = 8.7 Hz, 2H), 7.15 (d, *J* = 1.7 Hz, 2H), 6.88 (d, *J* = 8.7 Hz, 2H), 5.77 (t, *J* = 8.3 Hz, 1H), 3.81 – 3.75 (m, 4H), 3.41 (dd, *J* = 18.2, 7.8 Hz, 1H), 2.72 (s, 3H). ^{13}C NMR (101 MHz, Chloroform-*d*) δ 159.7, 158.1, 155.2, 147.6, 145.0, 138.5, 133.3, 133.2, 129.4, 128.5, 128.2, 127.3, 126.0, 124.5, 121.9, 114.1, 101.3, 84.6, 55.3, 37.9, 24.8. HRMS (ESI) m/z calcd for $C_{25}H_{22}NO_2$ $[M+H]^+$: 368.1645; found:368.1653.



3ab

2-(4-methoxyphenyl)-6-methyl-8-(p-tolyl)-2,3-dihydrofuro[2,3-*g*]quinoline (3ab): (eluent: petroleum ether : ethyl acetate = 15:1), 28.6 mg, 75%; yellow solid, mp: 153-155°C. ^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.87 (s, 1H), 7.38 – 7.27 (m, 6H), 7.18 (s, 1H), 7.12 (s, 1H), 6.87 (d, *J* = 8.7 Hz, 2H), 5.75 (t, *J* = 8.3 Hz, 1H), 3.79 – 3.73 (m, 4H), 3.39 (dd, *J* = 16.5, 7.8 Hz, 1H), 2.71 (s, 3H), 2.42 (s, 3H). ^{13}C NMR (101 MHz, Chloroform-*d*) δ 159.5, 157.9, 155.1, 147.4, 145.1, 137.9, 135.5, 133.2, 133.0, 129.2, 129.1, 127.2, 125.9, 124.5, 121.7, 114.0, 101.2, 84.5, 55.2, 37.9, 24.8, 21.2. HRMS (ESI) m/z calcd for $C_{26}H_{24}NO_2$ $[M+H]^+$: 382.1802; found:382.1798.

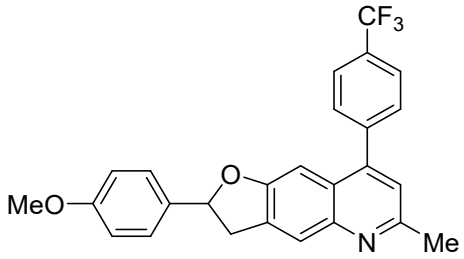


3ac

8-(4-chlorophenyl)-2-(4-methoxyphenyl)-6-methyl-2,3-dihydrofuro[2,3-*g*]quinoline (3ac):

(eluent: petroleum ether : ethyl acetate = 15:1), 25.3 mg, 63%; yellow solid, mp: 163-165°C. ^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.89 (s, 1H), 7.46 (d, *J* = 8.5 Hz, 2H), 7.41 (d, *J* = 8.5 Hz, 2H), 7.32 (d, *J* = 8.7 Hz, 2H), 7.11 (s, 1H), 7.07 (s, 1H), 6.89 (d, *J* = 8.7 Hz, 2H), 5.78 (t, *J* = 8.3 Hz, 1H), 3.828 – 3.75 (m, 4H), 3.41 (dd, *J* = 16.5, 7.7 Hz, 1H), 2.72 (s, 3H). ^{13}C NMR (101 MHz, Chloroform-*d*) δ 159.6, 158.2, 155.2, 146.2, 145.0, 136.9, 134.3, 133.4, 133.1, 130.6, 128.7, 127.2, 125.7, 124.6, 121.8, 114.1, 100.8, 84.6, 55.3, 37.8, 24.8. HRMS (ESI) m/z calcd for $C_{25}H_{21}ClNO_2$ $[M+H]^+$:

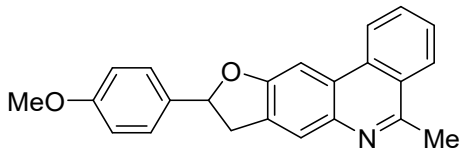
402.1255; found:402.1263.



3ad

2-(4-methoxyphenyl)-6-methyl-8-(4-(trifluoromethyl)phenyl)-2,3-dihydrofuro[2,3-*g*]quinoline (3ad):

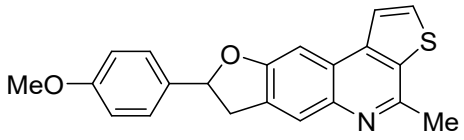
(eluent: petroleum ether : ethyl acetate = 15:1), 29.6 mg, 66%; yellow solid, mp: 173-175°C. ^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.92 (s, 1H), 7.76 (d, *J* = 8.0 Hz, 2H), 7.60 (d, *J* = 7.9 Hz, 2H), 7.32 (d, *J* = 8.7 Hz, 2H), 7.14 (s, 1H), 7.02 (s, 1H), 6.89 (d, *J* = 8.7 Hz, 2H), 5.79 (t, *J* = 8.3 Hz, 1H), 3.83 – 3.77 (m, 4H), 3.42 (dd, *J* = 16.6, 7.7 Hz, 1H), 2.74 (s, 3H). ^{13}C NMR (101 MHz, Chloroform-*d*) δ 159.7, 158.4, 155.2, 146.0, 145.0, 142.2, 133.7, 133.1, 130.6, 130.3, 129.8, 127.3, 125.5 (q, *J* = 3.6 Hz), 124.7, 121.8, 114.1, 100.7, 84.8, 55.33, 37.9, 24.8. HRMS (ESI) m/z calcd for $C_{26}H_{21}F_3NO_2$ $[M+H]^+$: 436.1519; found:436.1523.



4a

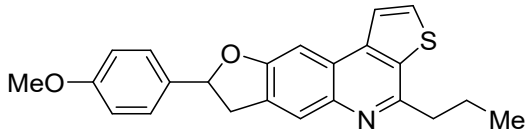
9-(4-methoxyphenyl)-5-methyl-8,9-dihydrofuro[2,3-*b*]phenanthridine (4a):

(eluent: petroleum ether : ethyl acetate = 15:1), 29.7 mg, 87%; yellow solid, mp: 141-143°C. ^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.47 (d, *J* = 8.3 Hz, 1H), 8.17 (d, *J* = 8.2 Hz, 1H), 7.88 (d, *J* = 30.7 Hz, 1H), 7.78 (t, *J* = 7.6 Hz, 1H), 7.66 (d, *J* = 9.3 Hz, 1H), 7.38 (d, *J* = 8.7 Hz, 2H), 6.91 (d, *J* = 8.8 Hz, 2H), 5.85 (t, *J* = 8.4 Hz, 1H), 3.83 – 3.77 (m, 4H), 3.43 (dd, *J* = 17.6, 7.9 Hz, 1H), 3.00 (s, 3H). ^{13}C NMR (101 MHz, Chloroform-*d*) δ 159.6, 158.7, 155.5, 139.3, 133.4, 132.5, 130.7, 130.1, 127.3, 127.1, 126.4, 125.6, 125.1, 124.5, 122.5, 114.1, 99.5, 84.8, 55.3, 38.0, 22.8. HRMS (ESI) m/z calcd for $C_{23}H_{20}NO_2$ $[M+H]^+$: 342.1489; found:342.1496.



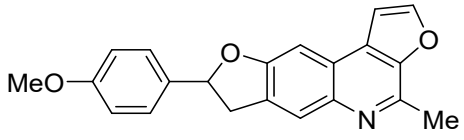
4b

8-(4-methoxyphenyl)-4-methyl-7,8-dihydrofuro[2,3-*g*]thieno[2,3-*c*]quinoline (4b): (eluent: petroleum ether : ethyl acetate = 15:1), 32 mg, 92%; yellow solid, mp: 162-164°C. ^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.92 (s, 1H), 7.79 (d, *J* = 5.3 Hz, 1H), 7.67 (d, *J* = 5.3 Hz, 1H), 7.47 (s, 1H), 7.35 (d, *J* = 8.4 Hz, 2H), 6.89 (d, *J* = 8.7 Hz, 2H), 5.81 (t, *J* = 8.4 Hz, 1H), 3.79 – 3.73 (m, 4H), 3.40 (dd, *J* = 16.2, 7.9 Hz, 1H), 2.86 (s, 3H). ^{13}C NMR (101 MHz, Chloroform-*d*) δ 159.5, 158.1, 149.7, 141.0, 141.0, 133.3, 133.0, 130.7, 129.8, 127.2, 124.8, 124.0, 122.2, 114.0, 99.9, 84.7, 55.2, 37.9, 23.7. HRMS (ESI) m/z calcd for $C_{21}H_{18}NO_2S$ $[M+H]^+$: 348.1053; found:348.1059.



4c

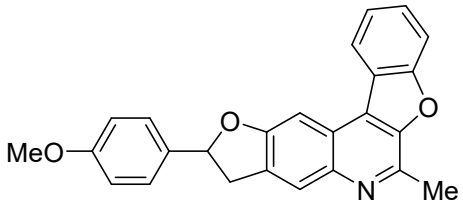
8-(4-methoxyphenyl)-4-propyl-7,8-dihydrofuro[2,3-*g*]thieno[2,3-*c*]quinoline (4c): (eluent: petroleum ether : ethyl acetate = 15:1), 30.7 mg, 82%; yellow solid, mp: 146-148°C. ^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.95 (s, 1H), 7.44 (d, *J* = 5.1 Hz, 1H), 7.33 (d, *J* = 8.7 Hz, 2H), 7.13 (d, *J* = 5.1 Hz, 1H), 6.89 (d, *J* = 8.7 Hz, 2H), 6.76 (s, 1H), 5.71 (t, *J* = 8.8 Hz, 1H), 3.79 (s, 3H), 3.59 (dd, *J* = 16.0, 9.3 Hz, 1H), 3.23 (dd, *J* = 16.0, 8.4 Hz, 1H), 2.20 (t, *J* = 7.5 Hz, 2H), 1.66 (h, *J* = 7.4 Hz, 2H), 0.95 (t, *J* = 7.4 Hz, 3H). ^{13}C NMR (101 MHz, Chloroform-*d*) δ 171.1, 159.5, 156.4, 138.8, 133.5, 128.2, 128.0, 127.3, 126.9, 126.5, 123.4, 119.7, 114.0, 110.0, 84.6, 55.2, 39.4, 38.2, 18.9, 13.7. HRMS (ESI) m/z calcd for $C_{23}H_{22}NO_2S$ $[M+H]^+$: 376.1366; found:376.1369.



4d

8-(4-methoxyphenyl)-4-methyl-7,8-dihydrodifuro[2,3-c:2',3'-*g*]quinoline (3va):

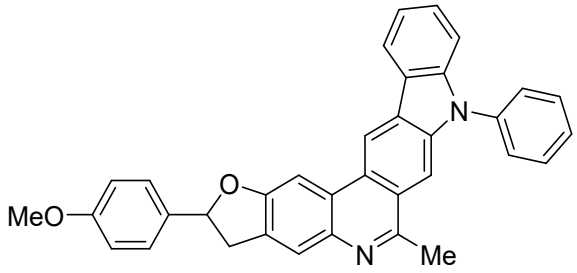
(eluent: petroleum ether : ethyl acetate = 15:1), 27.4 mg, 83%; yellow solid, mp: 148-150°C. ^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.91 (s, 1H), 7.74 – 7.73 (m, 1H), 7.35 – 7.29 (m, 3H), 7.10 – 7.19 (m, 1H), 6.88 (d, *J* = 8.3 Hz, 2H), 5.79 (t, *J* = 8.4 Hz, 1H), 7.77 – 7.71 (m, 4H), 3.38 (dd, *J* = 16.2, 7.9 Hz, 1H), 2.84 (s, 3H). ^{13}C NMR (101 MHz, Chloroform-*d*) δ 159.6, 158.2, 148.5, 146.2, 142.4, 140.3, 133.4, 130.4, 128.5, 127.4, 125.0, 123.5, 114.1, 105.6, 99.8, 84.9, 55.3, 38.0, 19.2. HRMS (ESI) m/z calcd for $C_{21}H_{18}NO_3$ $[M+H]^+$: 332.1281; found:332.1295 .



4e

2-(4-methoxyphenyl)-6-methyl-2,3-dihydrobenzofuro[2,3-*c*]furo[2,3-*g*]quinoline (4e):

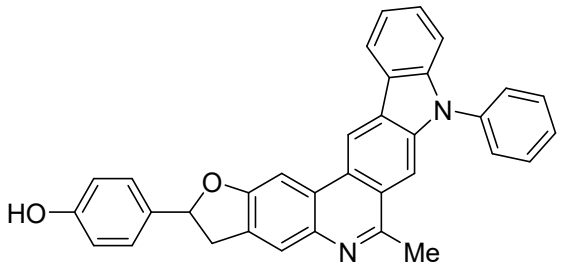
(eluent: petroleum ether : ethyl acetate = 15:1), 34.7 mg, 91%; yellow solid, mp: 178-180°C. ^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.22 (d, *J* = 7.8 Hz, 1H), 7.94 (s, 1H), 7.69 – 7.67 (m, 2H), 7.55 (t, *J* = 7.8 Hz, 1H), 7.46 – 7.42 (m, 1H), 7.38 (d, *J* = 8.7 Hz, 2H), 6.91 (d, *J* = 8.7 Hz, 2H), 5.85 (t, *J* = 8.3 Hz, 1H), 4.35 – 3.56 (m, 4H), 3.42 (dd, *J* = 16.2, 7.9 Hz, 1H), 2.92 (s, 3H). ^{13}C NMR (101 MHz, Chloroform-*d*) δ 159.6, 158.6, 155.9, 149.0, 142.8, 140.6, 133.2, 130.5, 128.0, 127.3, 125.3, 124.0, 123.7, 123.5, 123.2, 122.7, 114.1, 112.4, 99.6, 85.0, 55.3, 37.9, 19.3. HRMS (ESI) m/z calcd for $C_{25}H_{20}NO_3$ $[M+H]^+$: 382.1438; found: 382.1447.



4f

2-(4-methoxyphenyl)-6-methyl-8-phenyl-3,8-dihydro-2H-furo[2,3-*b*]indolo[2,3-*j*]phenanthridine (4f):

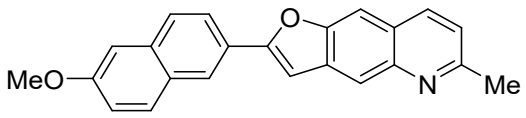
(eluent: petroleum ether : ethyl acetate = 15:1), 43.5 mg, 86%; yellow solid, mp: 189-191°C. ^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.77 (s, 1H), 8.24 (d, *J* = 8.6 Hz, 1H), 8.18 (s, 1H), 7.81 (s, 1H), 7.65 – 7.58 (m, 5H), 7.54 – 7.44 (m, 2H), 7.40 – 7.30 (m, 4H), 6.87 (d, *J* = 8.8 Hz, 2H), 5.72 (t, *J* = 8.4 Hz, 1H), 3.76 (s, 3H), 3.67 (dd, *J* = 16.0, 9.0 Hz, 1H), 3.33 (dd, *J* = 16.0, 7.8 Hz, 1H), 3.10 (s, 3H). ^{13}C NMR (101 MHz, Chloroform-*d*) δ 159.5, 158.0, 155.9, 142.9, 142.4, 138.9, 137.1, 133.5, 131.2, 130.1, 129.7, 127.9, 127.3, 127.2, 127.1, 124.97, 124.7, 124.4, 123.1, 120.8, 120.5, 120.3, 118.0, 114.0, 109.8, 100.3 84.7 55.2, 37.9, 23.5. HRMS (ESI) m/z calcd for $C_{35}H_{27}N_2O_2$ $[M+H]^+$: 507.2067; found:507.2075 .



4g

4-(6-methyl-8-phenyl-3,8-dihydro-2H-furo[2,3-*b*]indolo[2,3-*j*]phenanthridin-2-yl)phenol (4g):

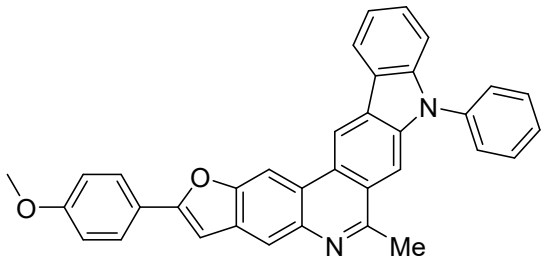
(eluent: petroleum ether : ethyl acetate = 15:1), 21.7 mg, 79%; yellow solid, mp: 163-165°C. ^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.90 (s, 1H), 8.33 – 8.28 (m, 2H), 7.89 (s, 1H), 7.78 (s, 1H), 7.72 – 7.64 (m, 4H), 7.59 – 7.51 (m, 4H), 7.47 – 7.33 (m, 2H), 7.44 – 7.36 (m, 2H), 7.28 – 7.25 (m, 2H), 5.86 (t, *J* = 8.3 Hz, 1H), 3.85 (dd, *J* = 16.0, 9.3 Hz, 1H), 3.35 (dd, *J* = 16.0, 7.4 Hz, 1H), 3.16 (s, 3H). ^{13}C NMR (101 MHz, Chloroform-*d*) δ 157.9, 156.5, 149.1, 143.2, 142.7, 142.4, 137.2, 131.3, 130.3, 130.0, 128.8, 128.2, 127.6, 127.3, 125.3, 125.0, 124.8, 123.1, 121.7, 120.9, 120.7, 120.4, 118.3, 117.2, 110.0, 100.6, 100.1, 83.5, 38.3.HRMS (ESI) m/z calcd for $C_{34}H_{25}N_2O_2$ $[M+H]^+$: 493.1911; found: 493.1902.



5a

2-(6-methoxynaphthalen-2-yl)-6-methylfuro[2,3-*g*]quinoline (5a):

(eluent: petroleum ether : dichloromethane = 2:1), 15.1 mg, 89%; yellow solid, mp: 153-155°C. ^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.37 (s, 1H), 8.23 (s, 1H), 8.15 (d, *J* = 8.5 Hz, 1H), 7.93 (dd, *J* = 8.5, 1.8 Hz, 1H), 7.94 – 7.80 (m, 3H), 7.25 – 7.16 (m, 3H), 3.95 (s, 3H), 2.77 (s, 3H). ^{13}C NMR (101 MHz, Chloroform-*d*) δ 159.6, 158.6, 157.4, 153.3, 136.6, 135.1, 133.61, 130.1, 129.2, 128.8, 127.5, 125.0, 124.7, 124.3, 123.5, 120.7, 119.6, 118.5, 106.1, 106.0, 101.0, 55.4, 25.2.HRMS (ESI) m/z calcd for $C_{23}H_{18}NO_2$ $[M+H]^+$: 340.1332; found: 340.1337.



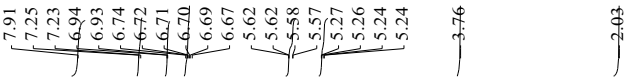
5b

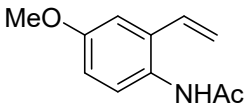
2-(4-methoxyphenyl)-6-methyl-8-phenyl-8H-furo[2,3-b]indolo[2,3-j]phenanthridine (5):

(eluent: petroleum ether : dichloromethane = 2:1), 21.6 mg, 86%; yellow solid, mp: 194-196°C. ^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.90 (s, 1H), 8.38 (d, *J* = 6.2 Hz, 2H), 8.31 (d, *J* = 7.7 Hz, 1H), 8.21 (s, 1H), 7.81 – 7.73 (m, 4H), 7.70 –7.68 (m, 2H), 7.63 (t, *J* = 7.3 Hz, 1H), 7.51 (t, *J* = 7.6 Hz, 1H), 7.44 – 7.37 (m, 2H), 7.96 – 7.70 (m, 3H), 3.86 (s, 3H), 3.20 (s, 3H). ^{13}C NMR (101 MHz, Chloroform-*d*) δ 160.4, 158.2, 157.6, 153.5, 143.1, 142.9, 137.2, 132.0, 131.1, 130.4, 129.9, 128.2, 127.4, 127.4, 126.7, 124.3, 123.1, 122.9, 121.7, 120.8, 120.7, 119.77, 119.2, 118.6, 114.3, 110.0, 102.2, 100.5, 99.7, 55.4, 23.5. HRMS (ESI) m/z calcd for $C_{35}H_{25}N_2O_2$ $[M+H]^+$: 505.1911; found:505.1936.

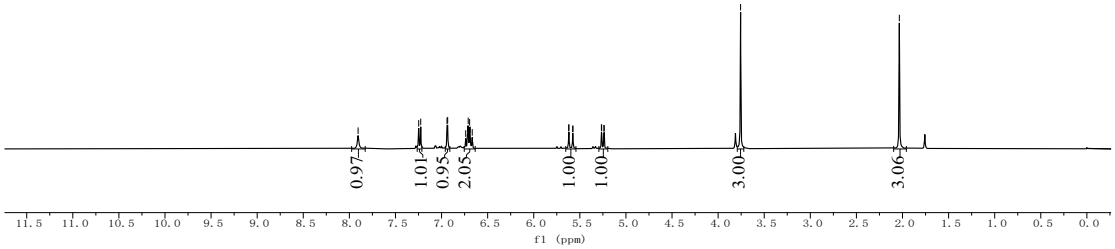
1a

acomeH.15.fid — 1H

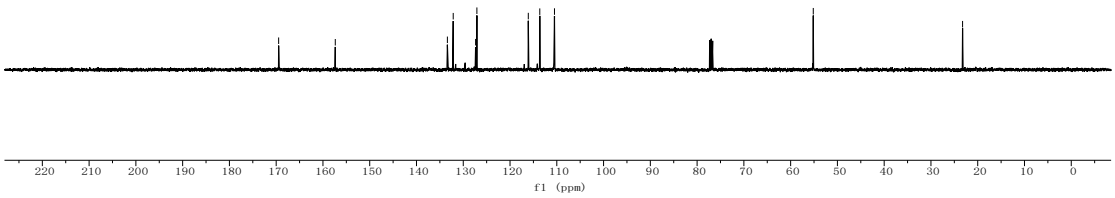




1a

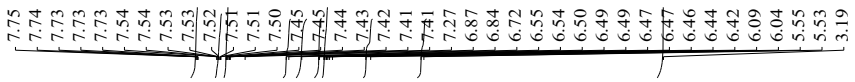


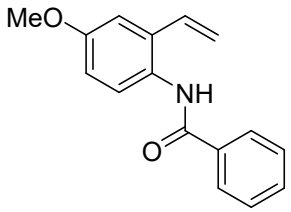
acomec.15.fid — 13C



1f

F-699H.16.fid — 1H





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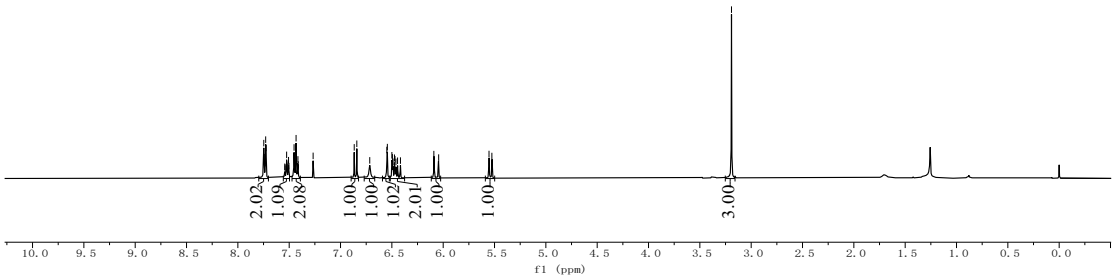
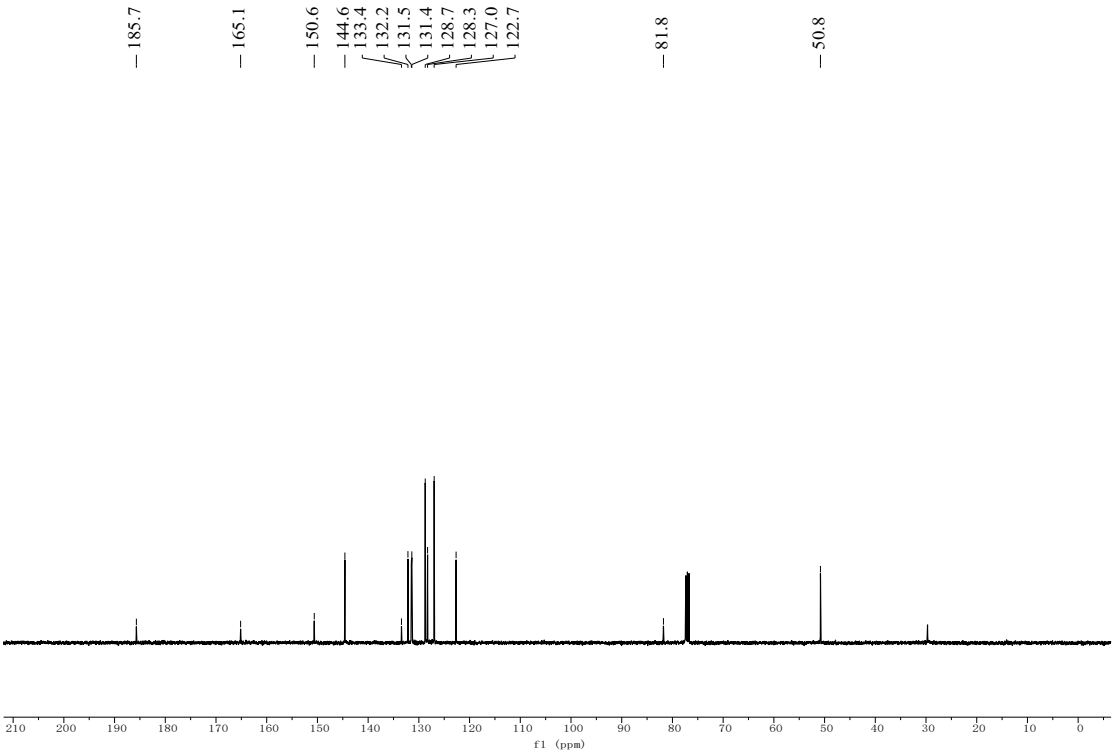
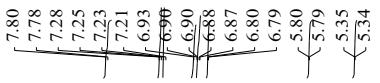


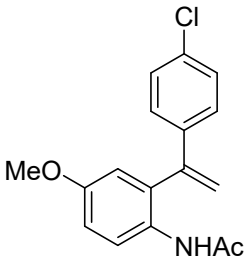
F-699 cccc.15.fid — 13C



1p

Cl Ac tong H.16.fid — 1H





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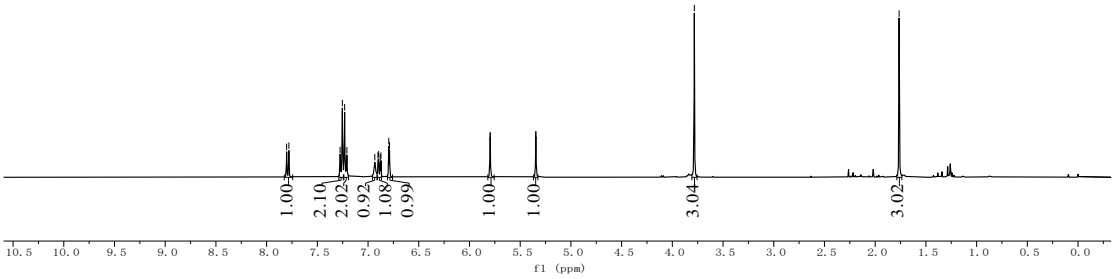
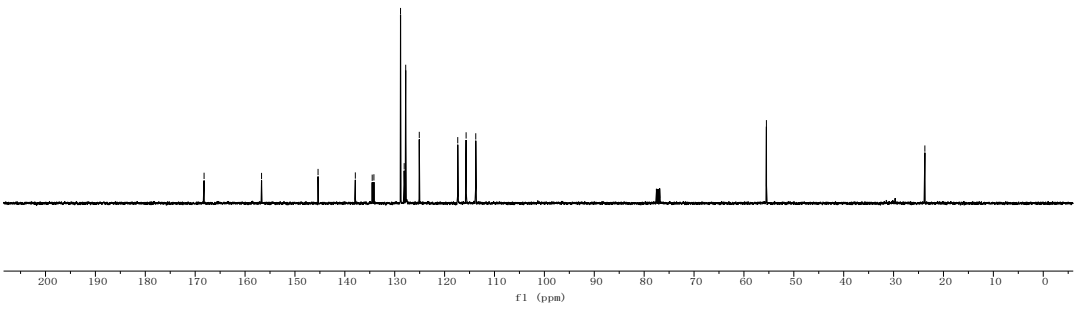
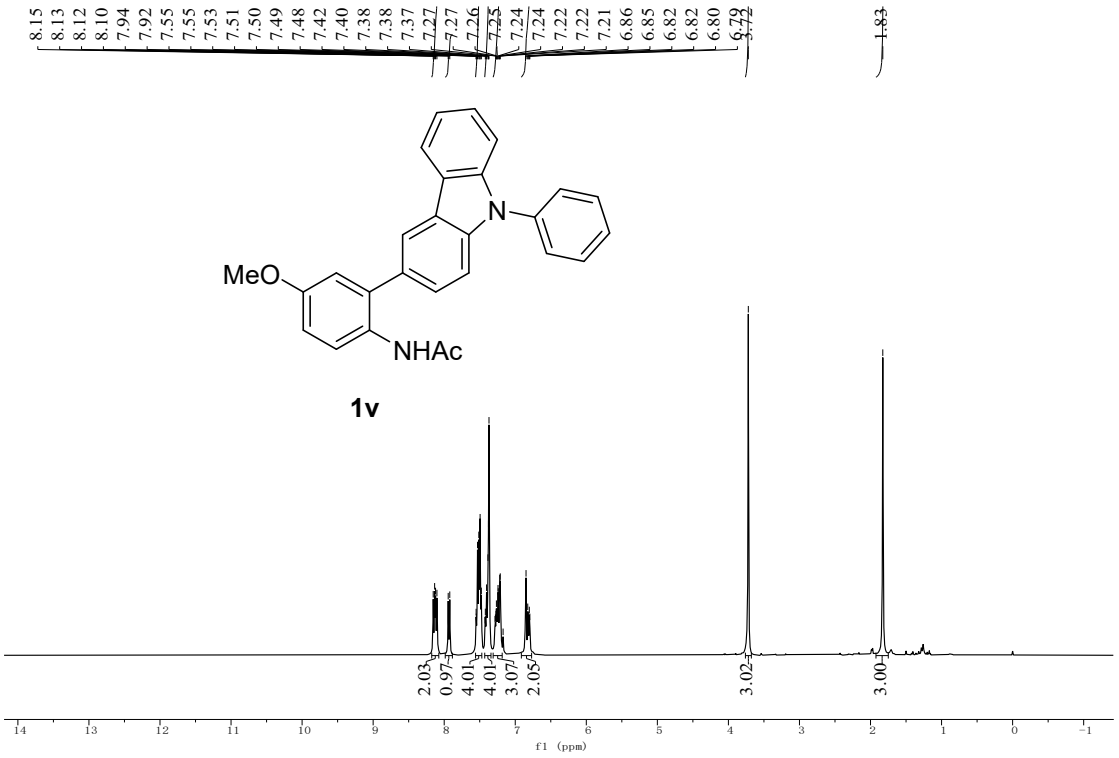


Cl Ac C.15.fid — 13C



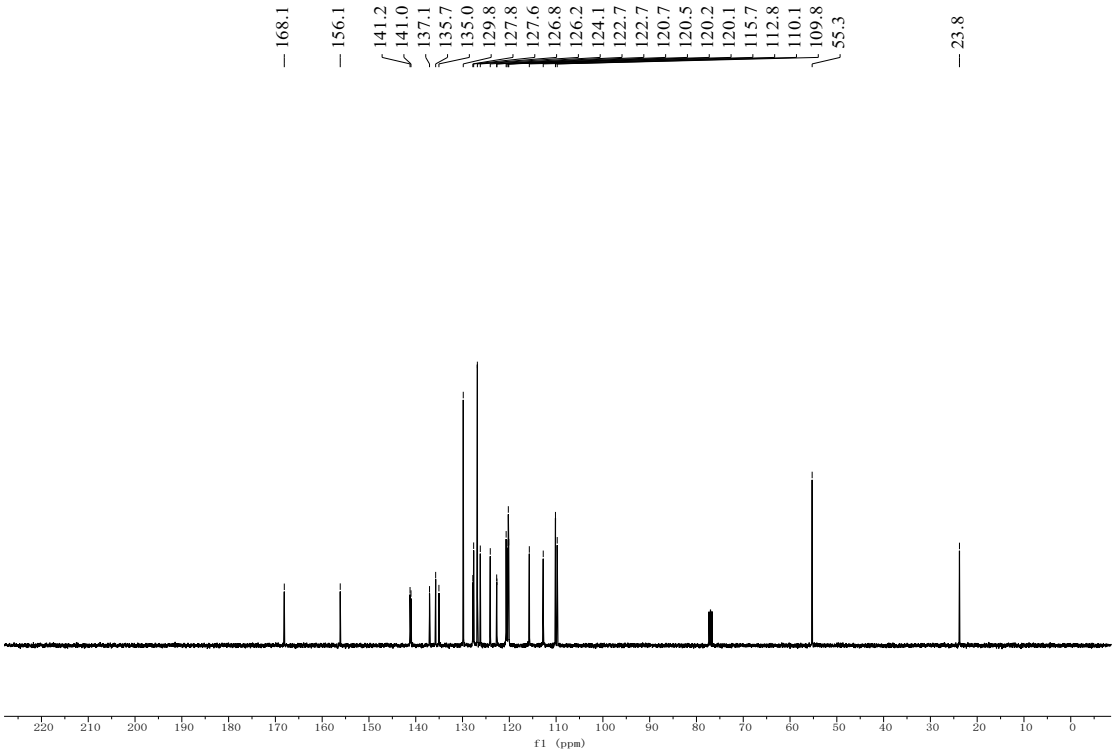
1v

F KA AC H.15.fid — 1H



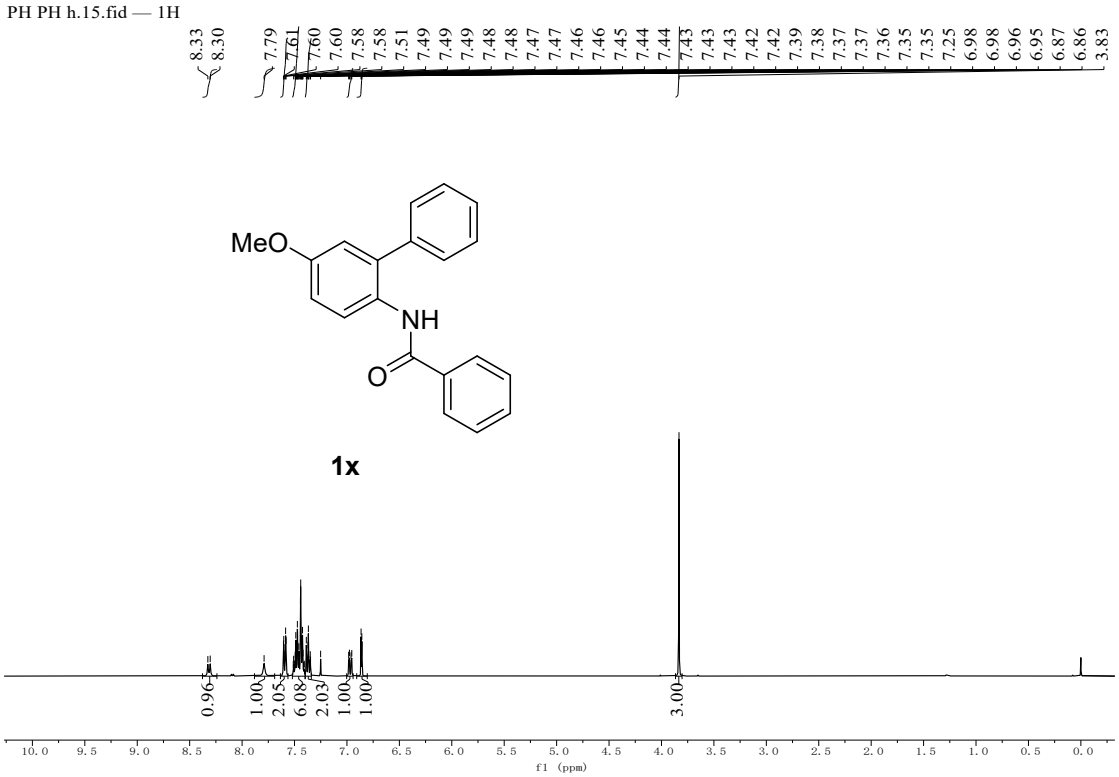
1v

F KA AC CC.15.fid — 13C

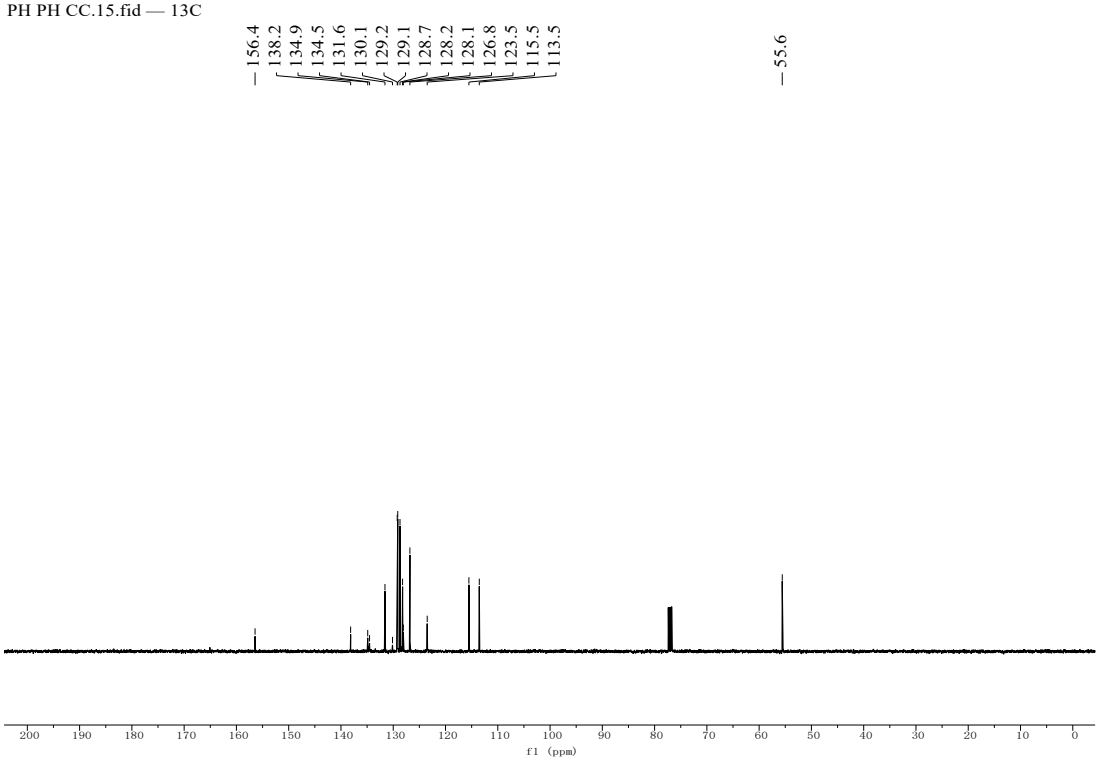


1x

PH PH h.15.fid — 1H

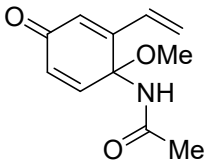


PH PH CC.15.fid — 13C

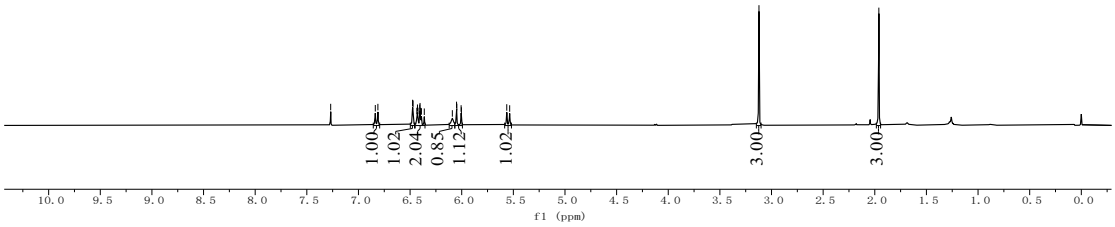


2a

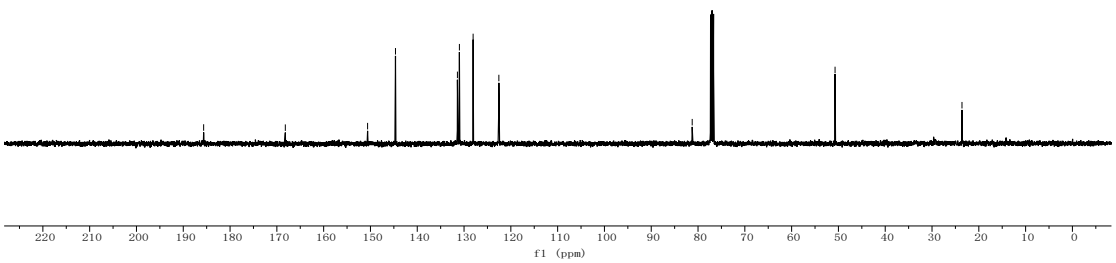
549.17.fid — F-549



2a

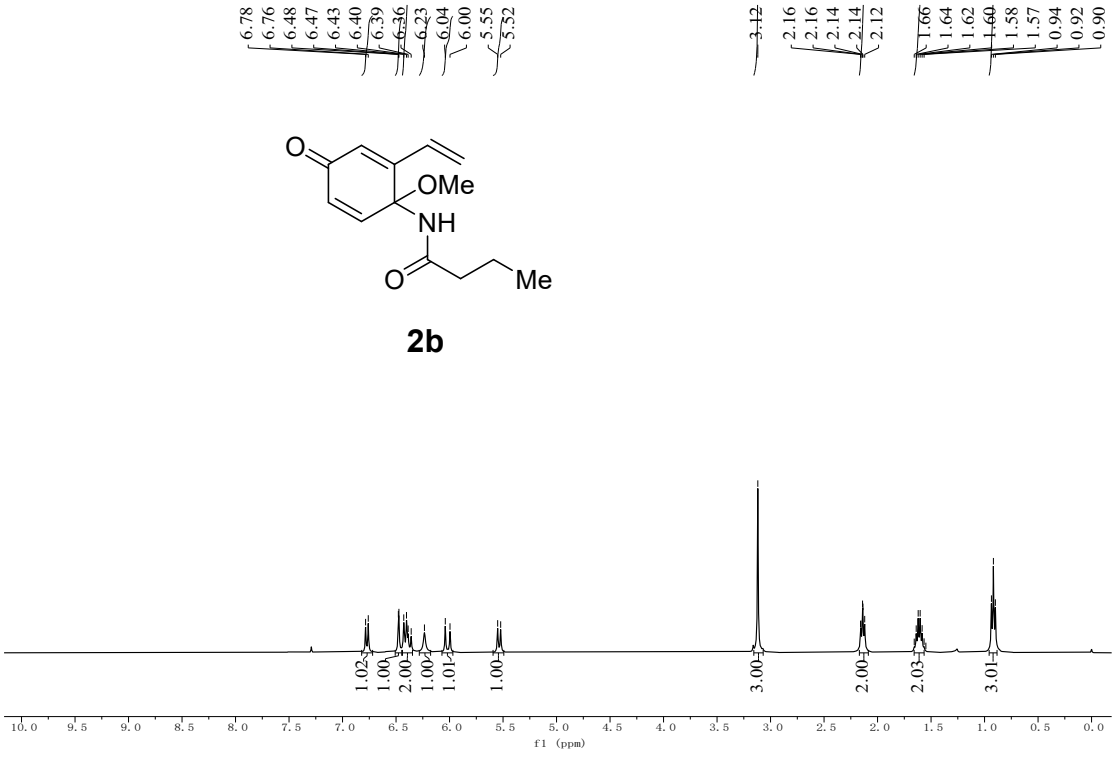


F-549c.14.fid — 13C F-549c

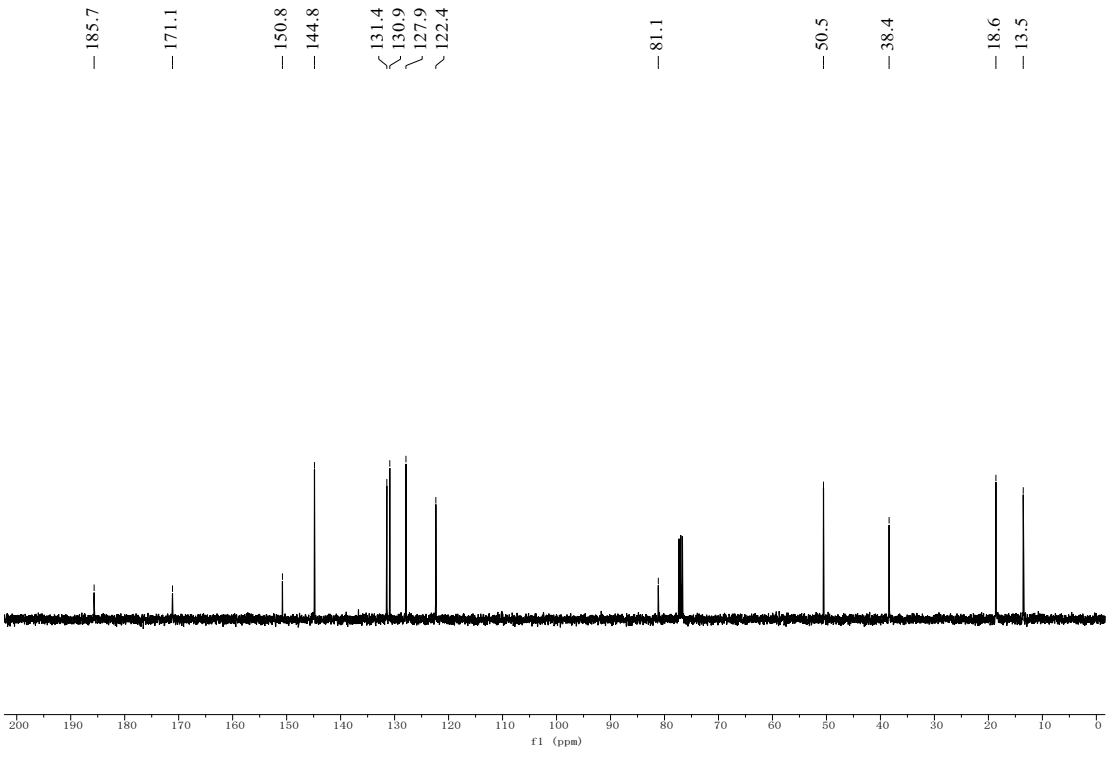


2b

2b H.15.fid — 1H

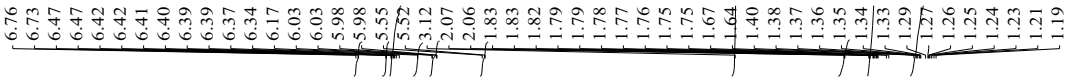


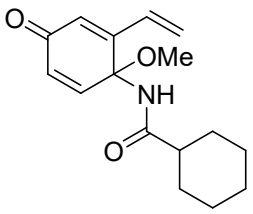
2b cc.15.fid — 13C



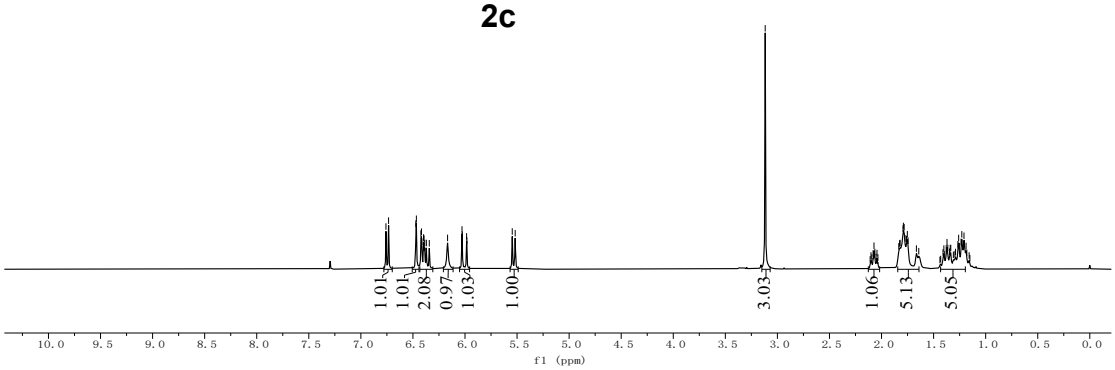
2c

F baohu liu O H.15.fid — 1H

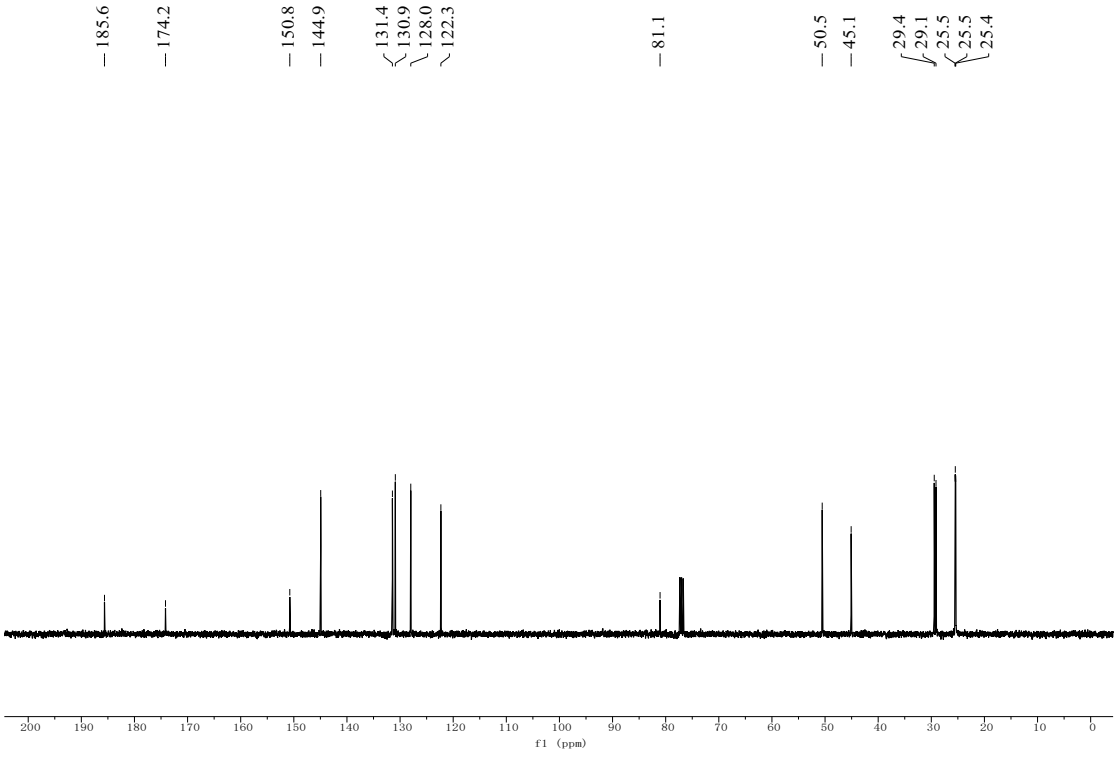




2c

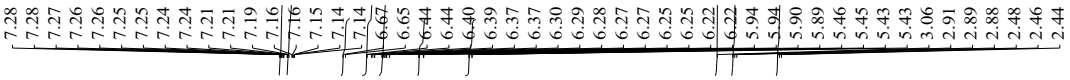


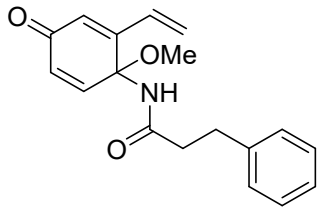
F baohu liu O cc.15.fid — 13C



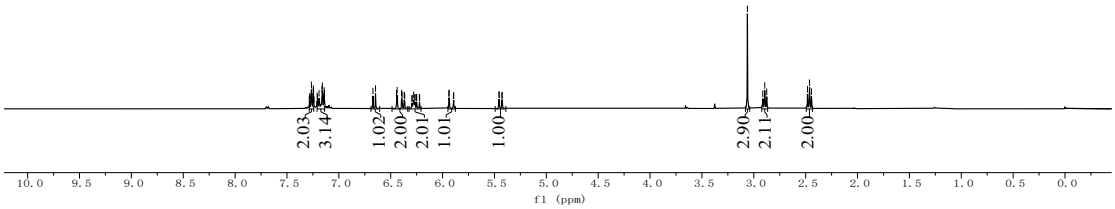
2d

F-725 H.15.fid — 1H

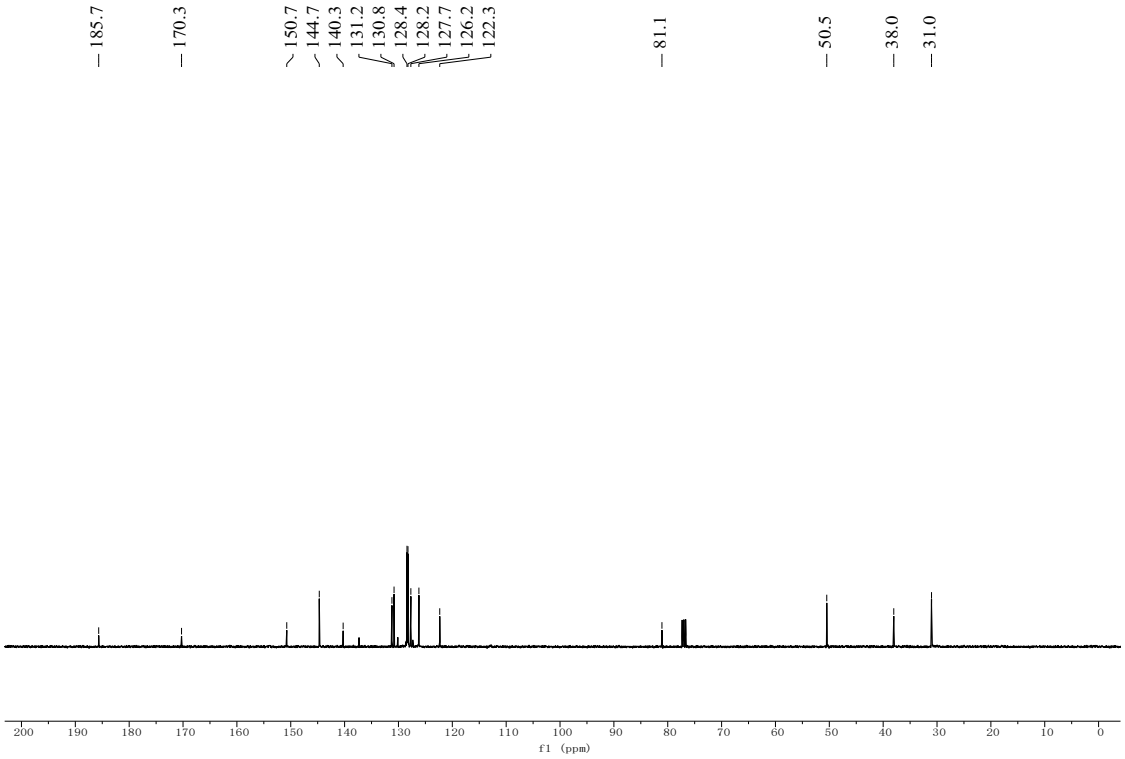




2d

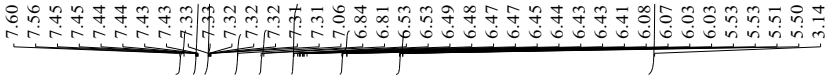


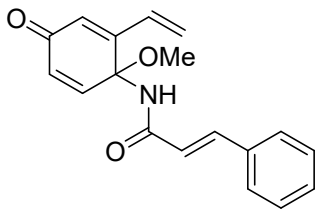
F-725 c.15.fid — 13C



2e

F b rougui O HH.15.fid — 1H





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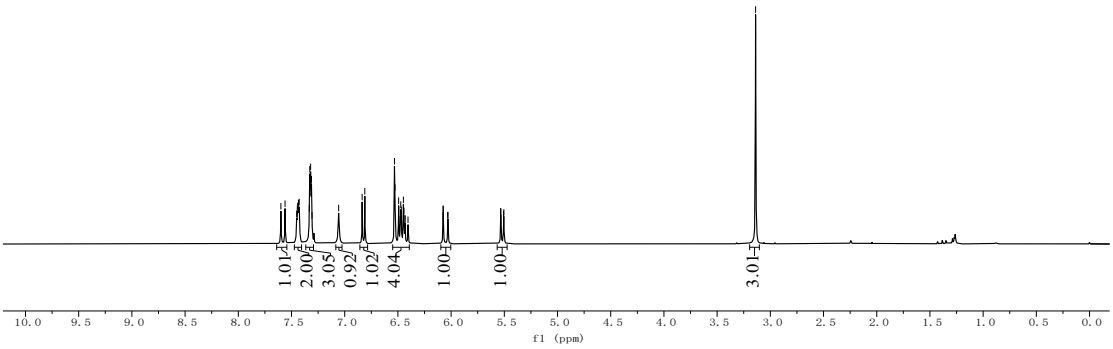
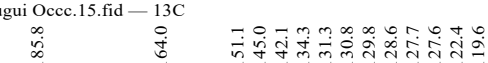
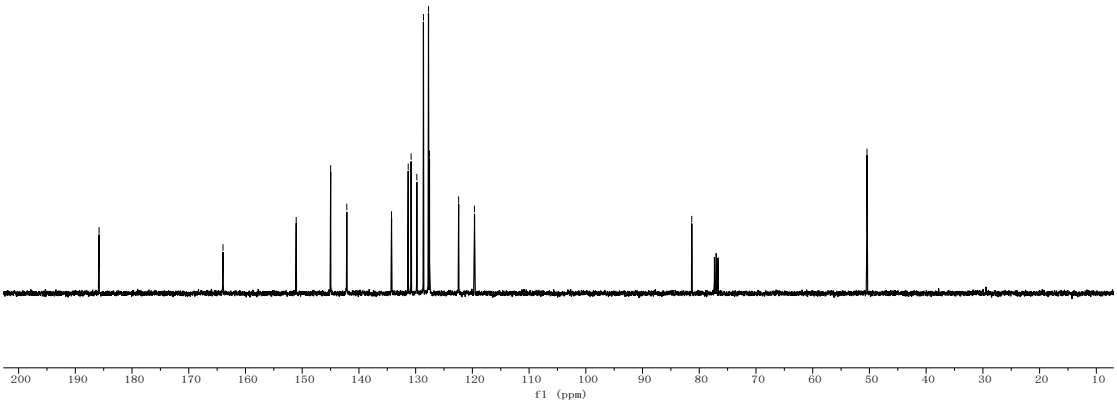


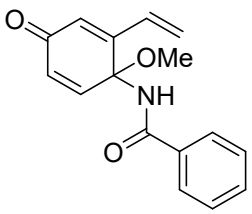
F b rougui Occc.15.fid — 13C





2f

FB ph O H.16.fid — 1H



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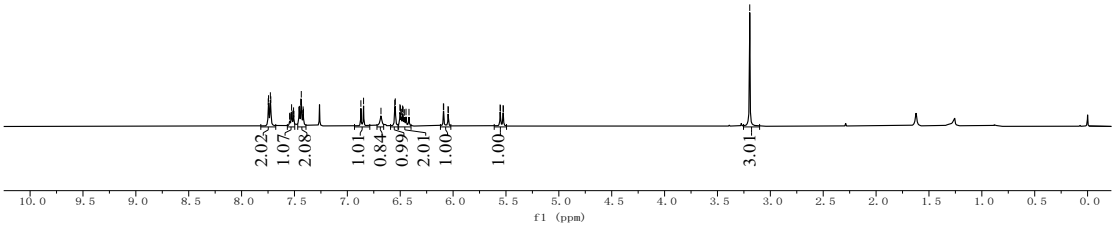
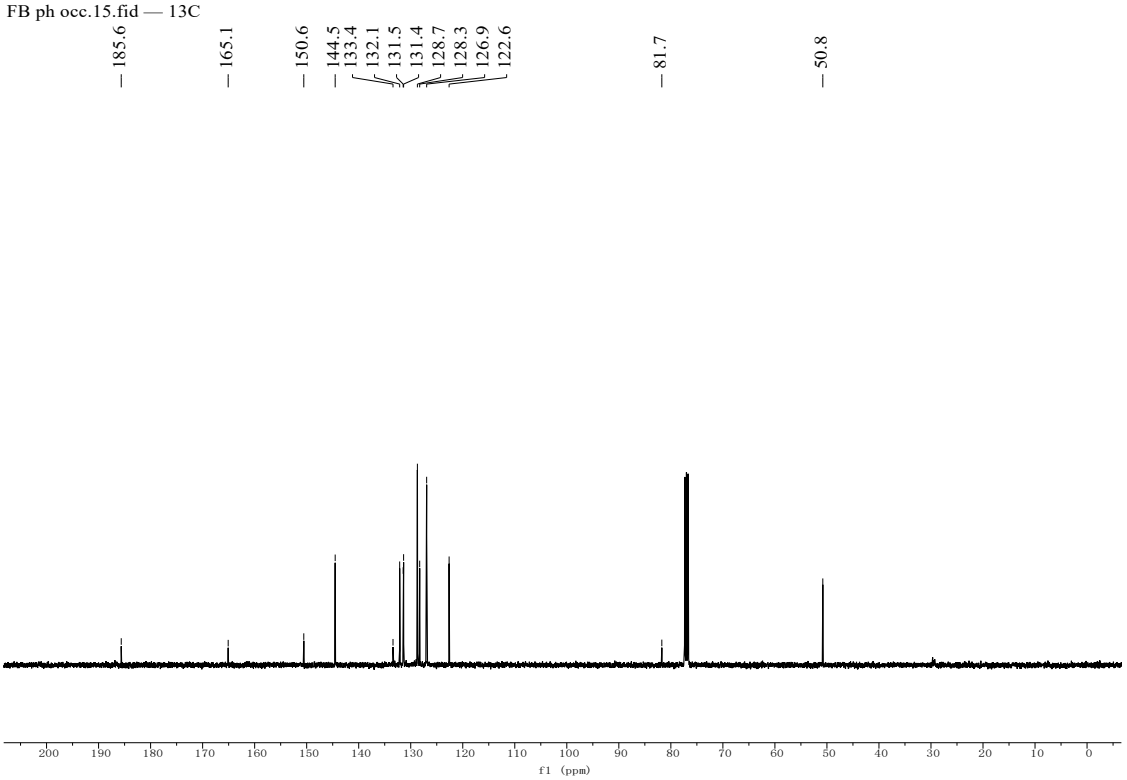
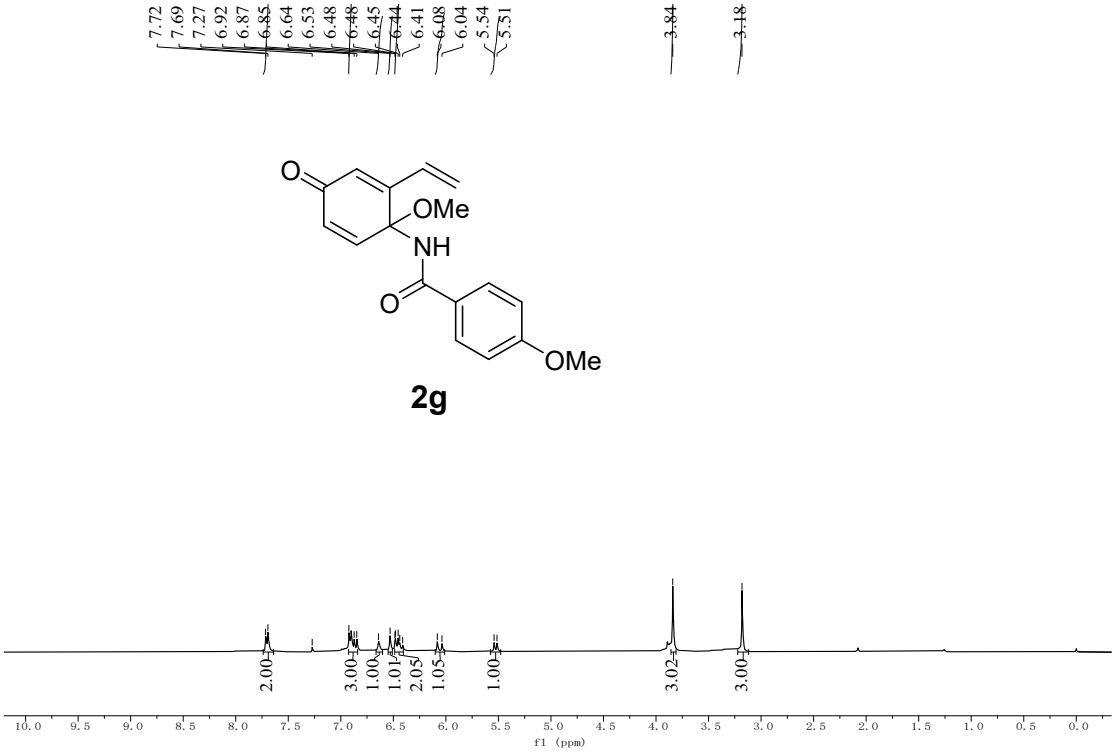


FB ph occ.15.fid — 13C

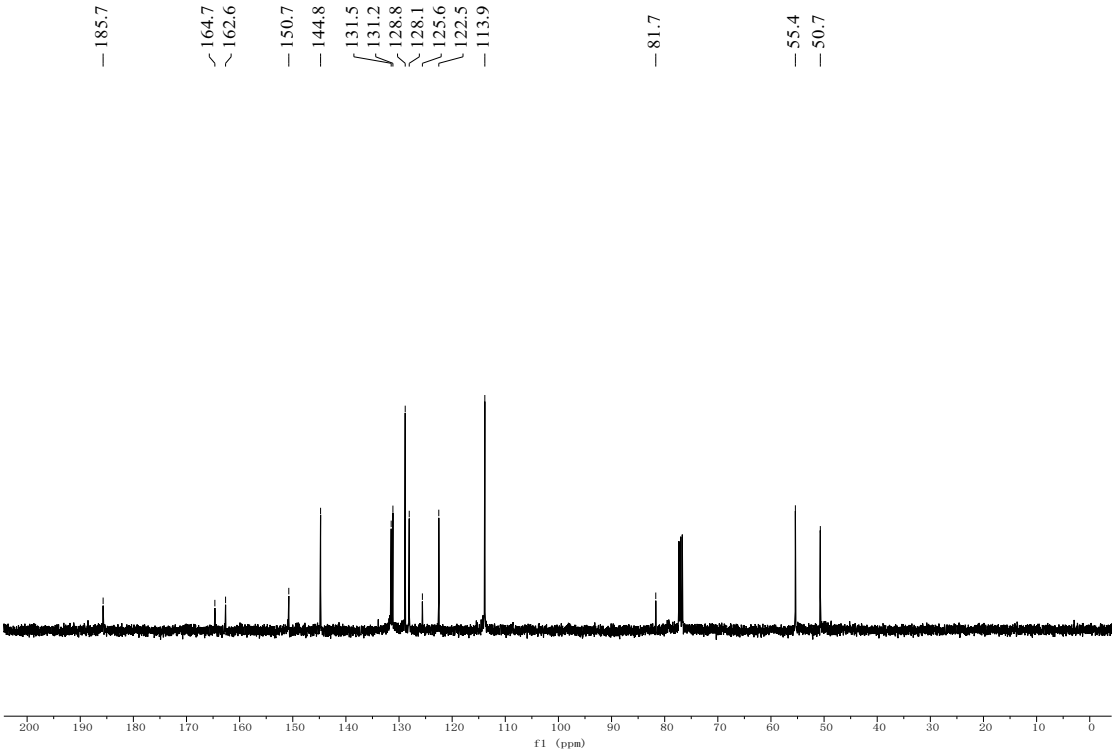


2g

F 2bphomeH.15.fid — 1H

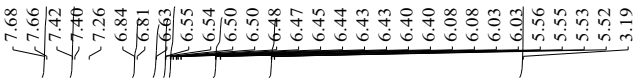


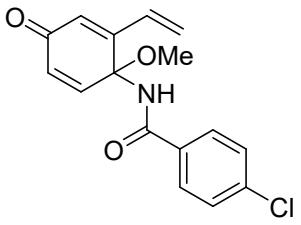
F 2bphomeC.15.fid — 13C



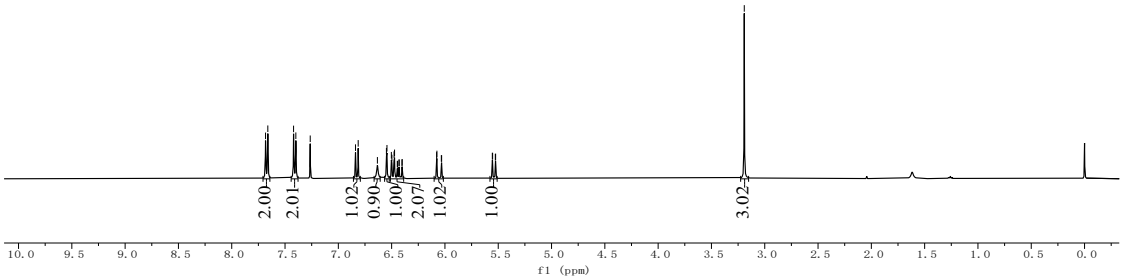
2h

F-D9.15.fid — 1H

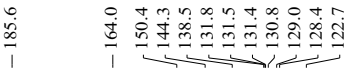


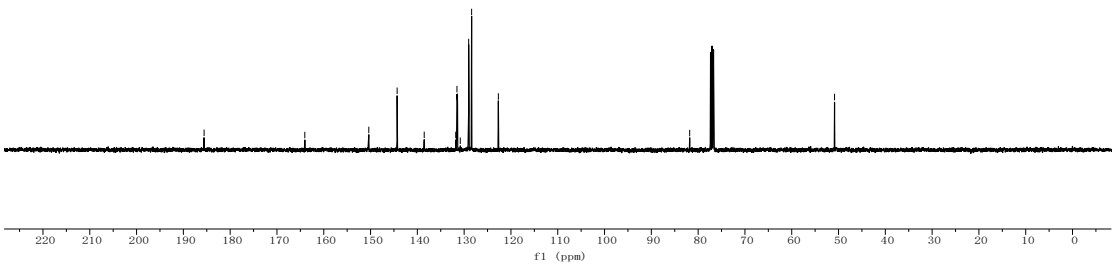


2h



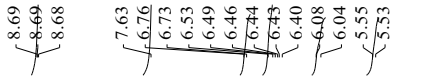
F -d9 C.15.fid — 13C

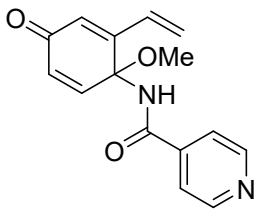




2i

dui N O H.15.fid — 1H





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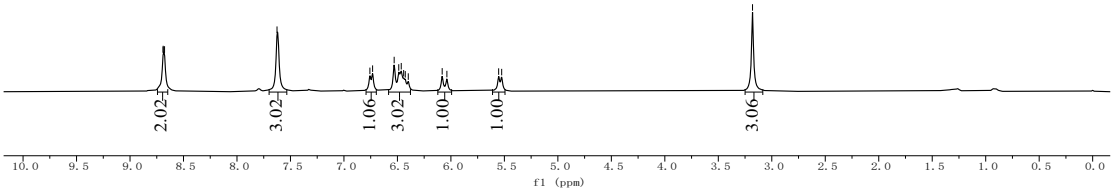
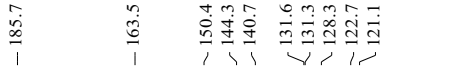
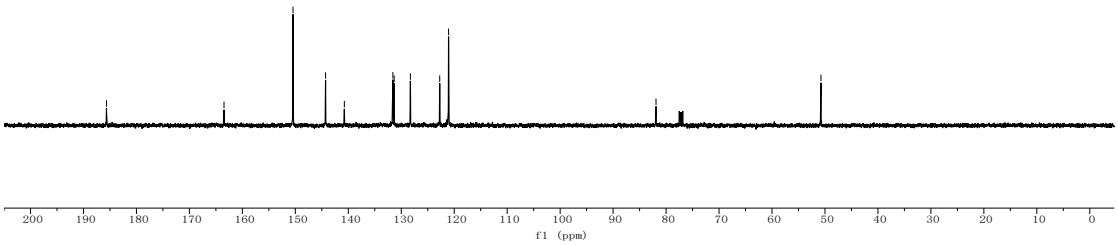


dui N O C.15.fid — 13C





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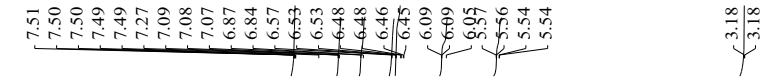

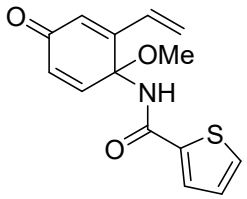

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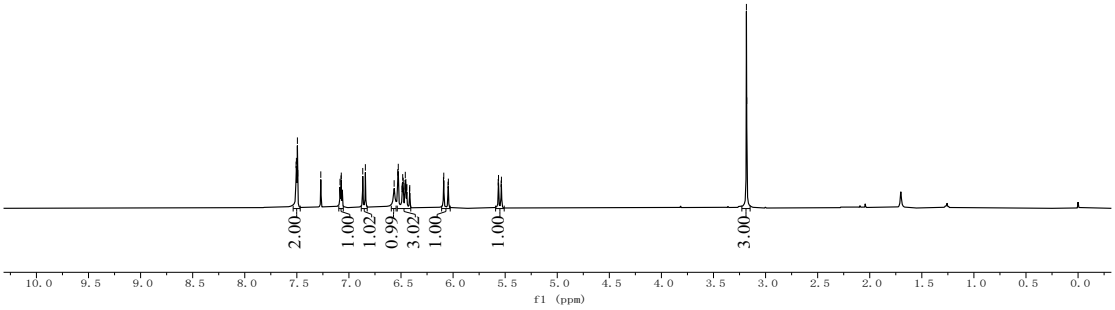

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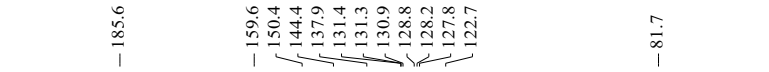

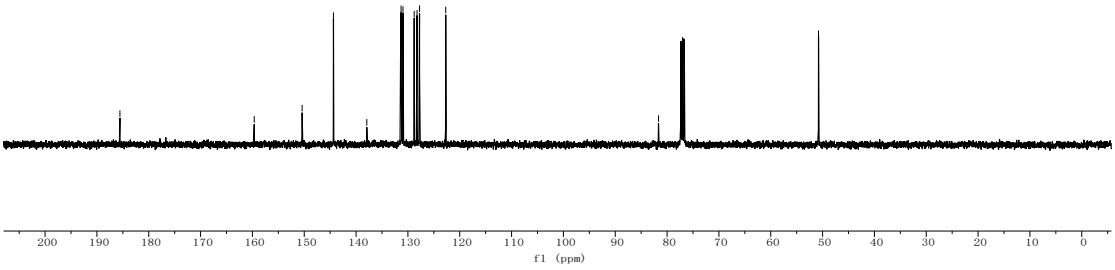

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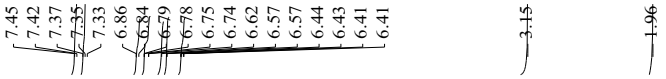
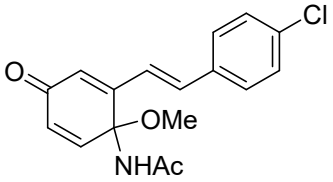
F-709 H.15.fid — 1H





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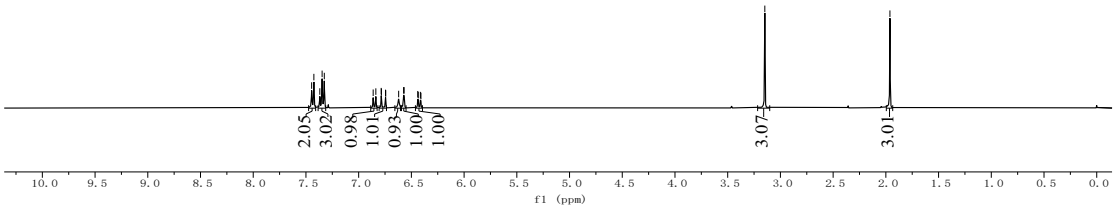
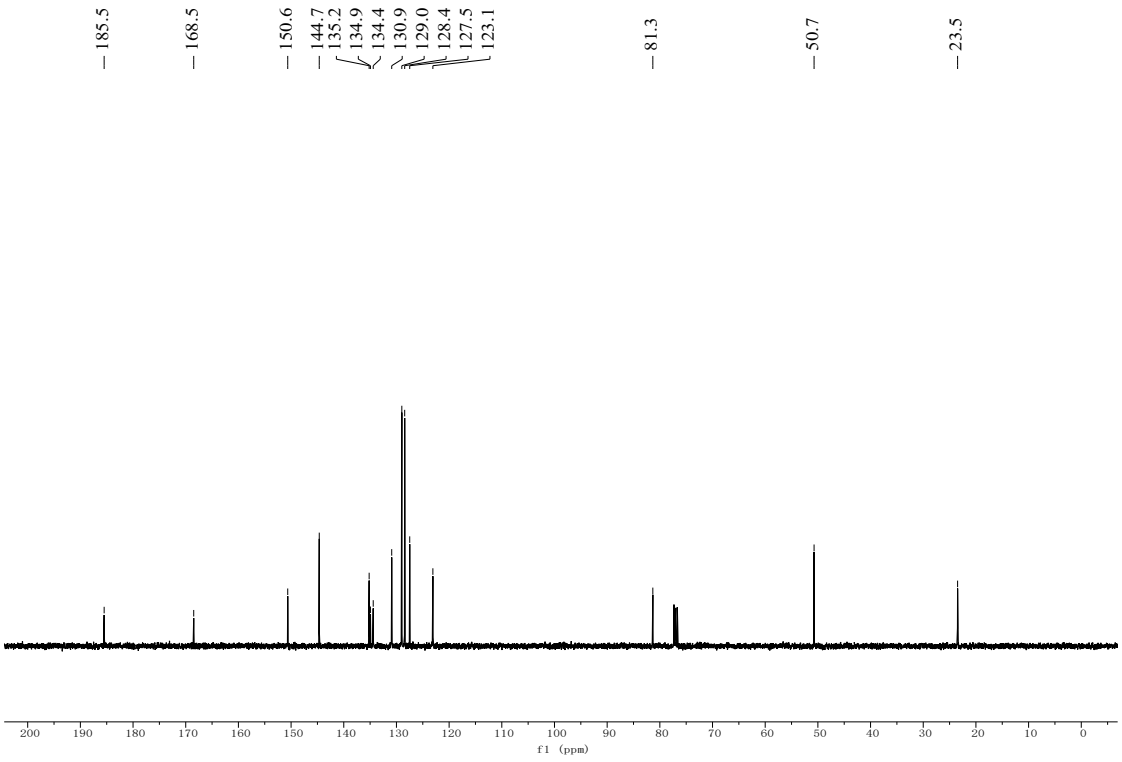


F-709 C.15.fid — 13C



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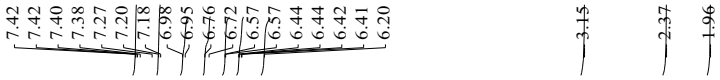
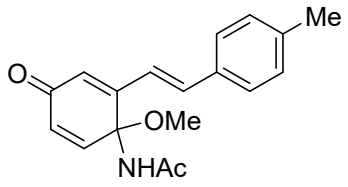
R2 Phme O.16.fid — 1H





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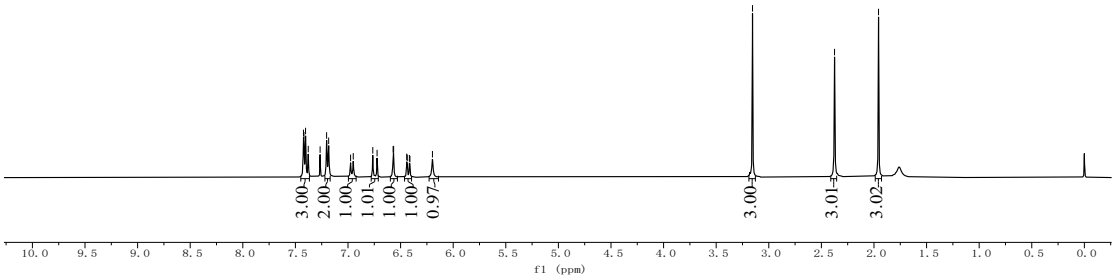
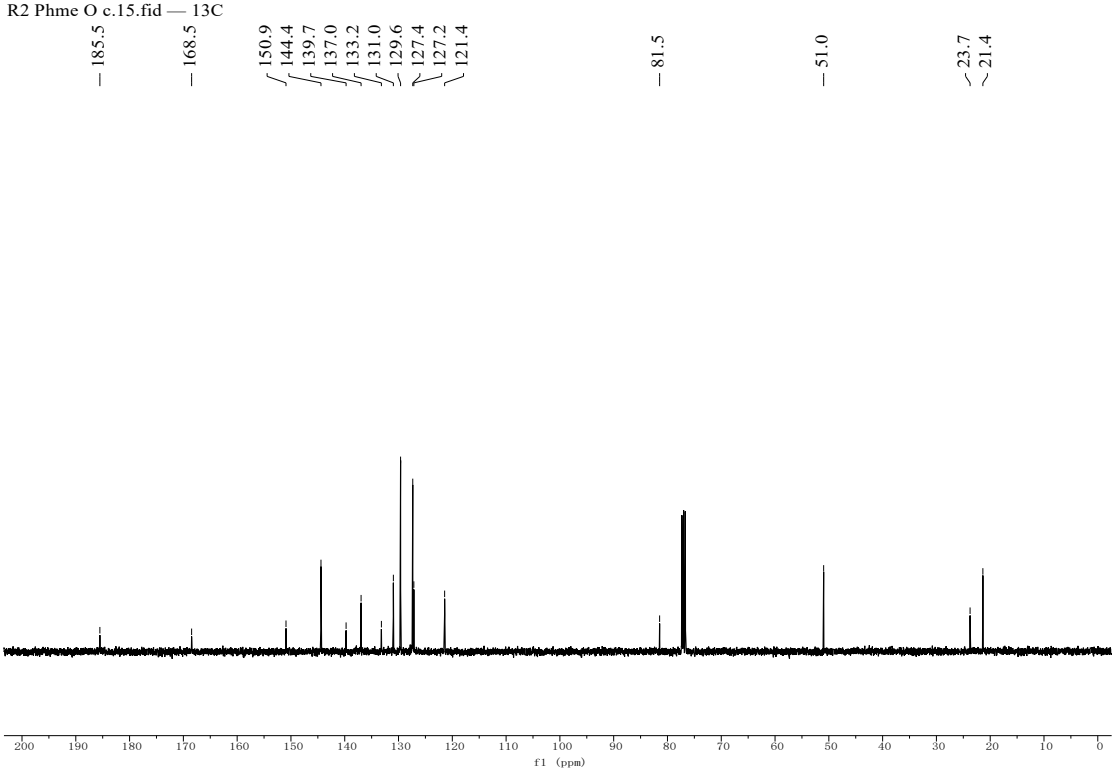


R2 Phme O c.15.fid — 13C



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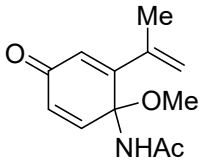

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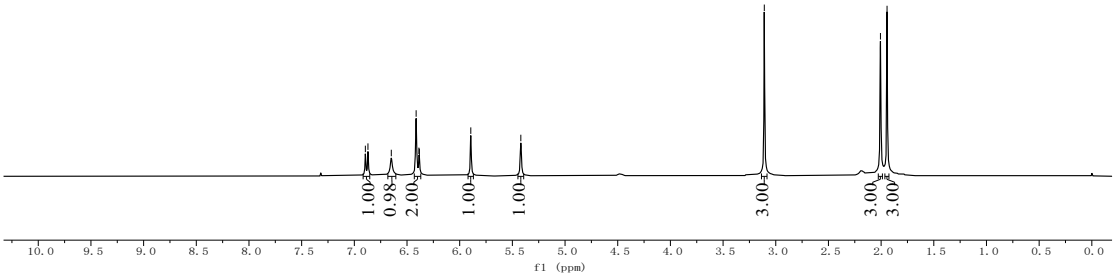
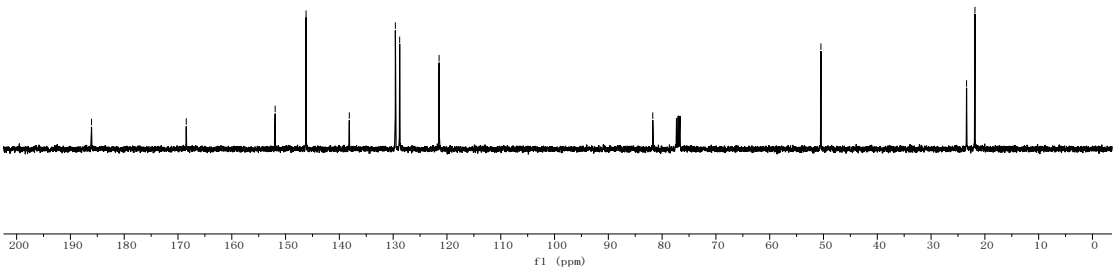


F-Ac MeR3[O] C.15.fid — 13C



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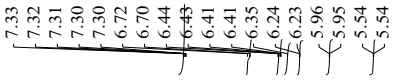
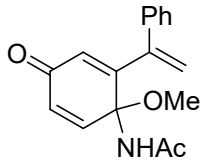
F-720 H.15.fid — 1H





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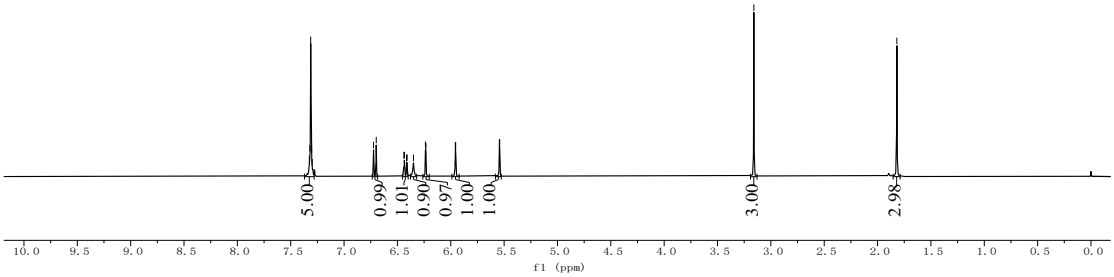
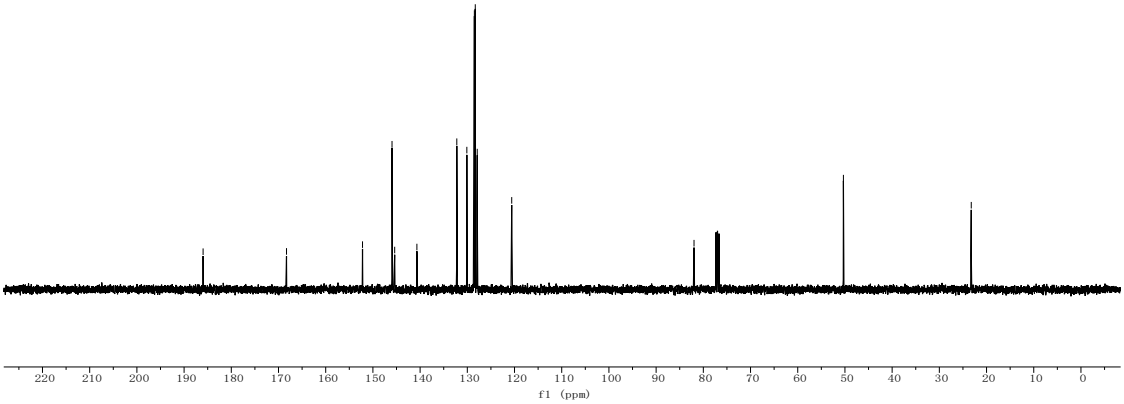
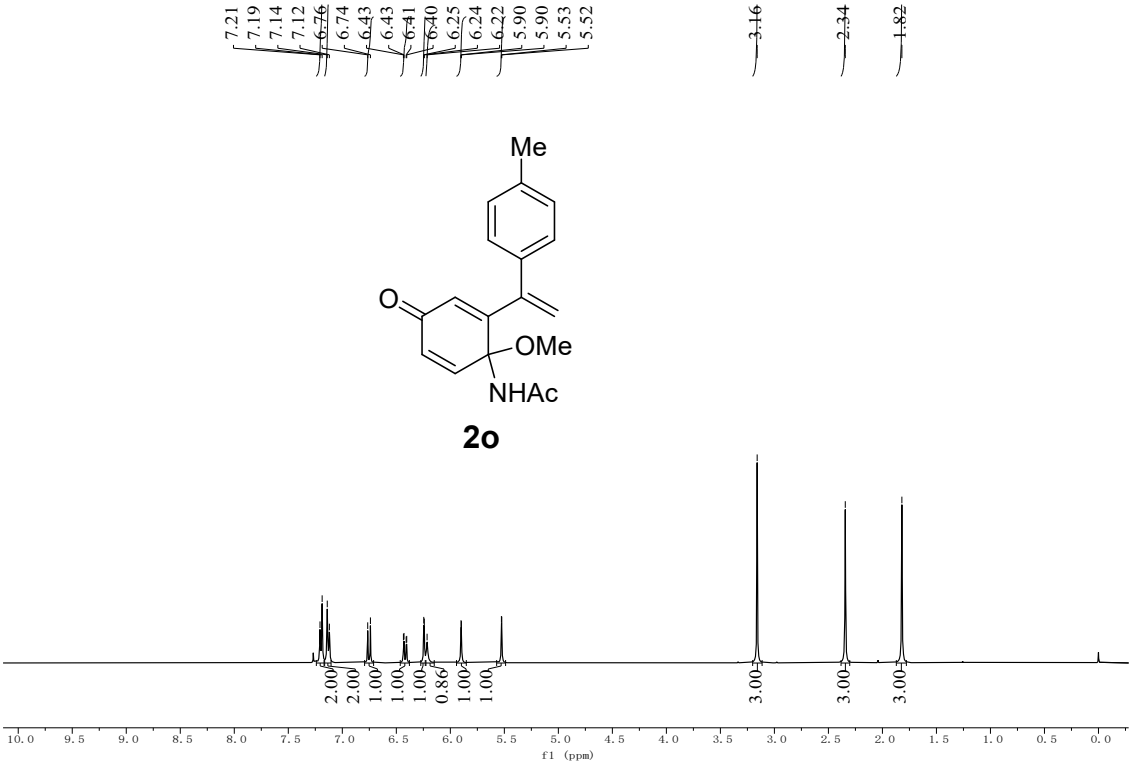


F-720 c.15.fid — 13C



2o

F-Ac PhMeR3[O] HH.15.fid — 1H



2o

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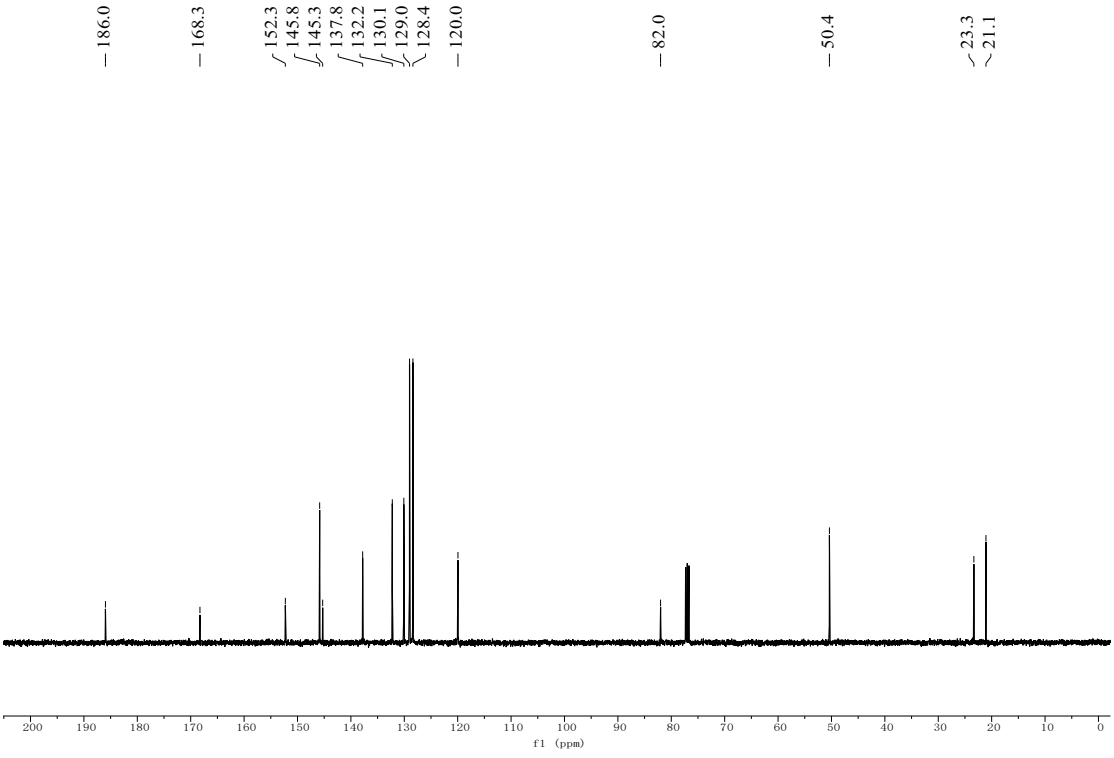
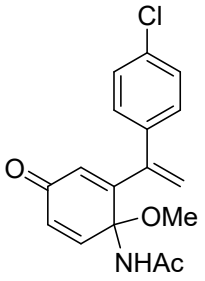
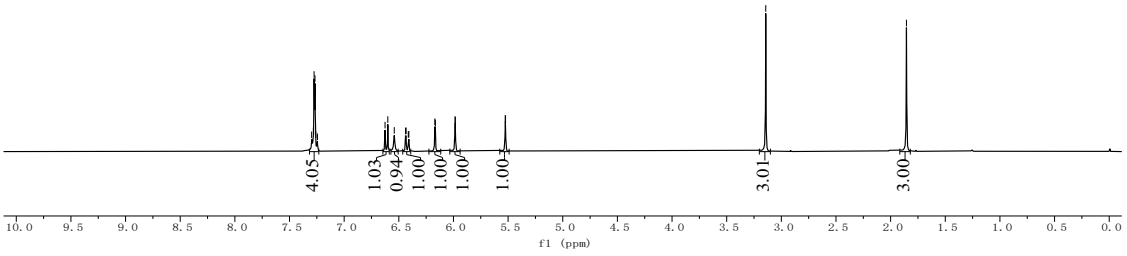


2p

F-710 H.15.fid — 1H



2p



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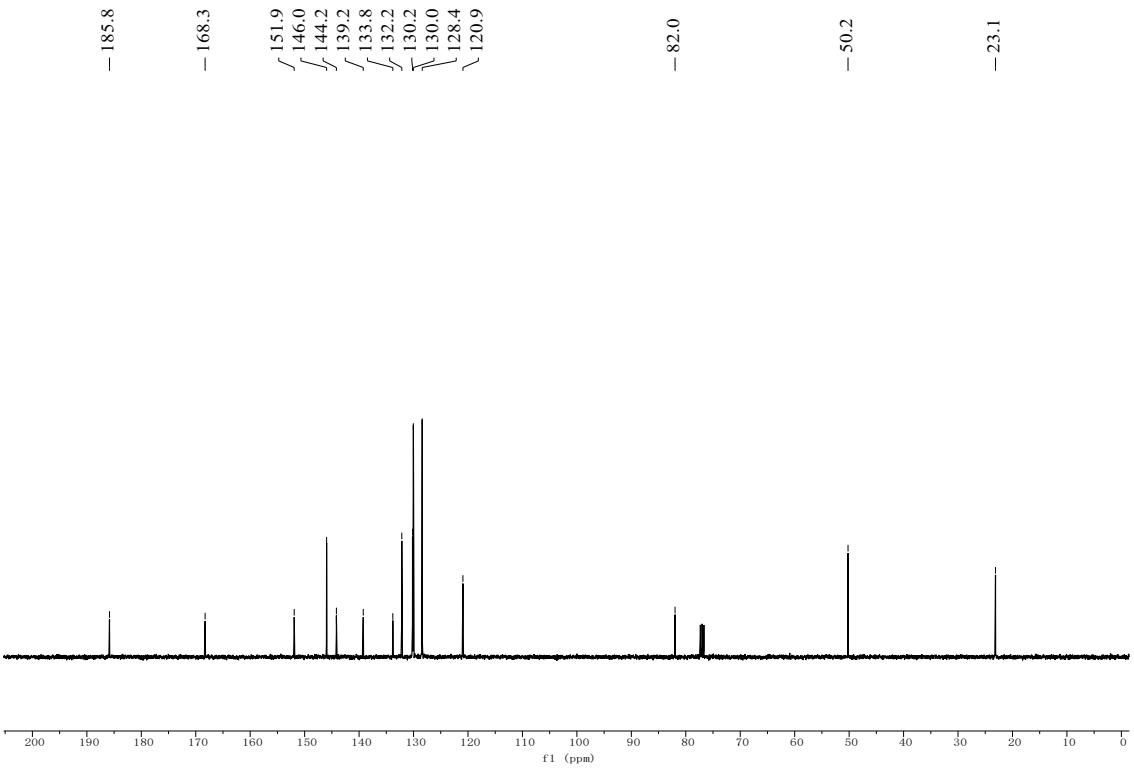
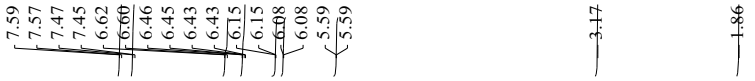
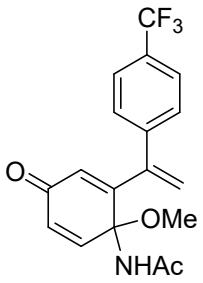


2q

F-677 H.15.fid — 1H





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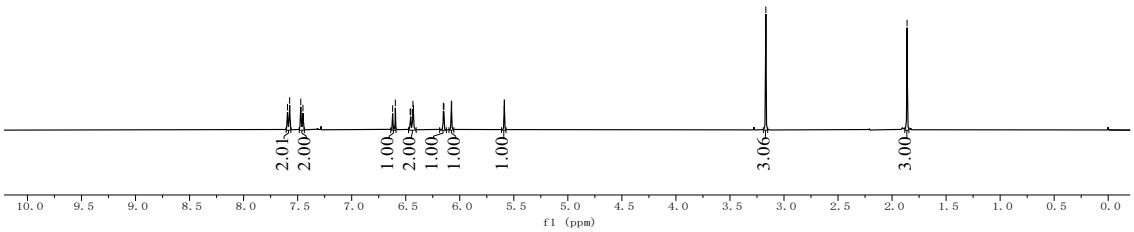
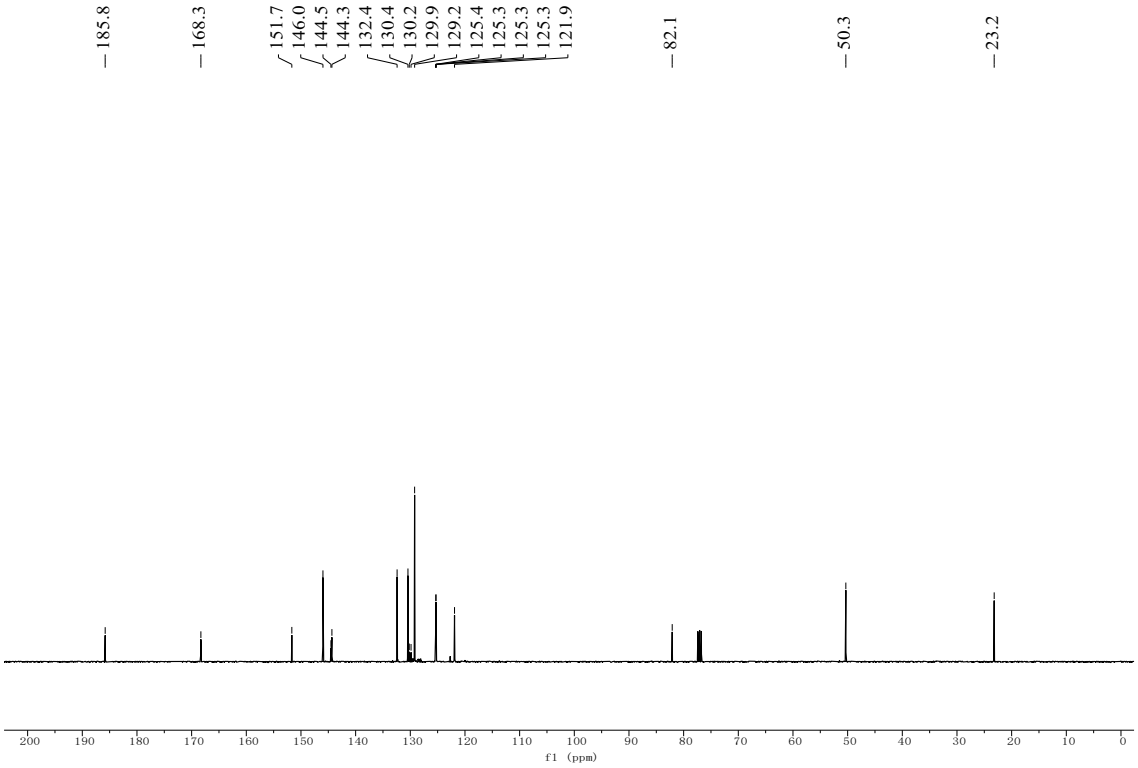


F-677 C.15.fid — 13C



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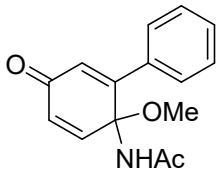
R ph H.15.fid — 1H



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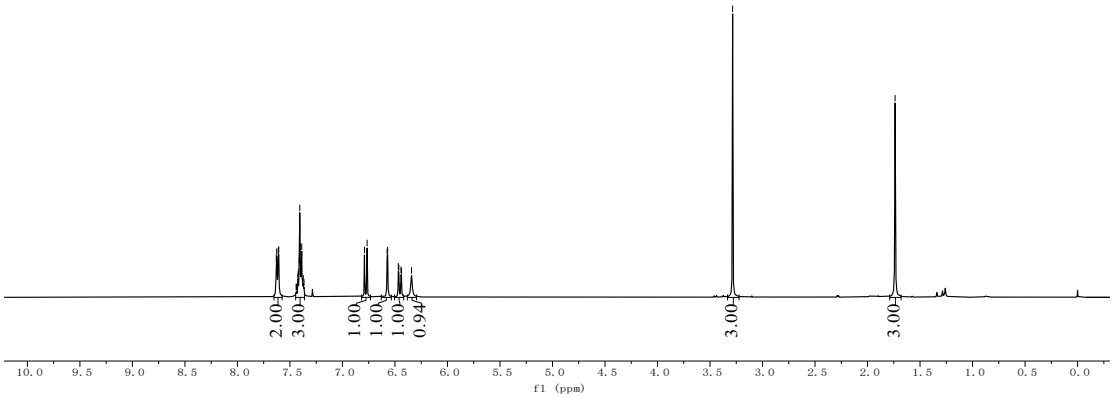
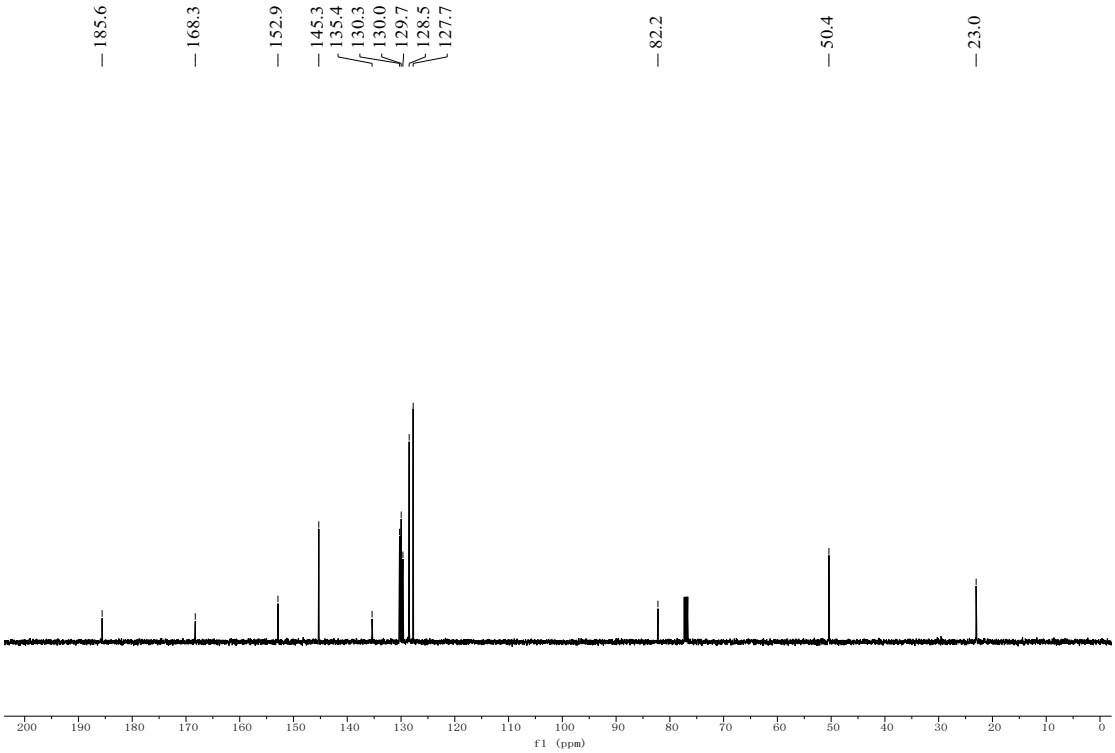
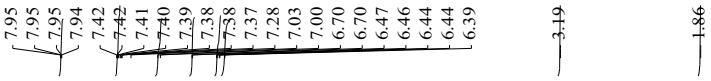


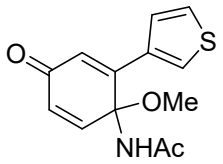
R ph c.15.fid — 13C



2s

F-S ac O H.15.fid — 1H





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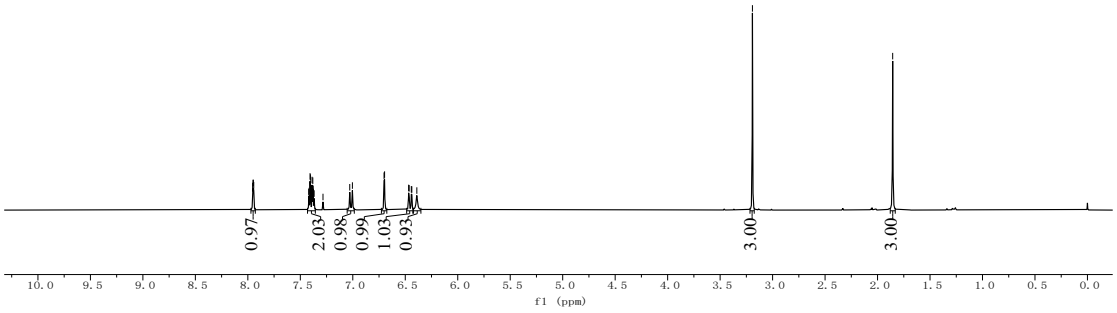

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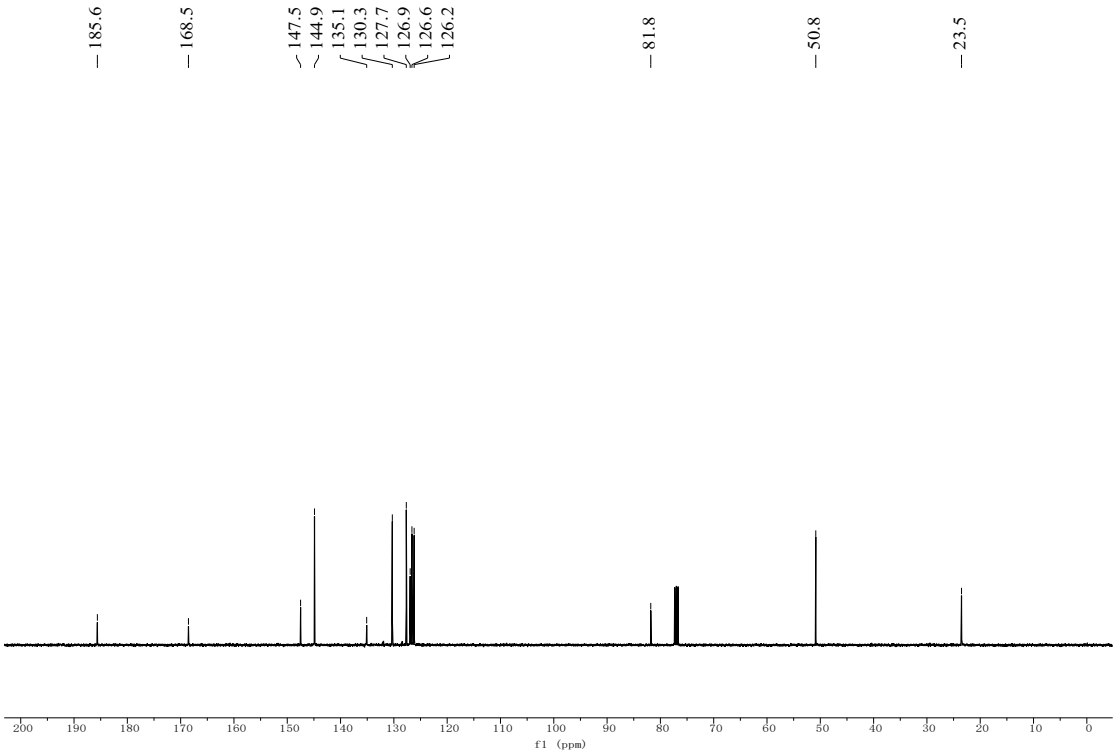
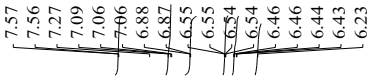
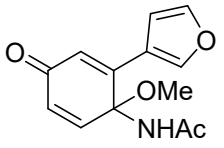


2t

F-11090 1o AC O H.15.fid — 1H





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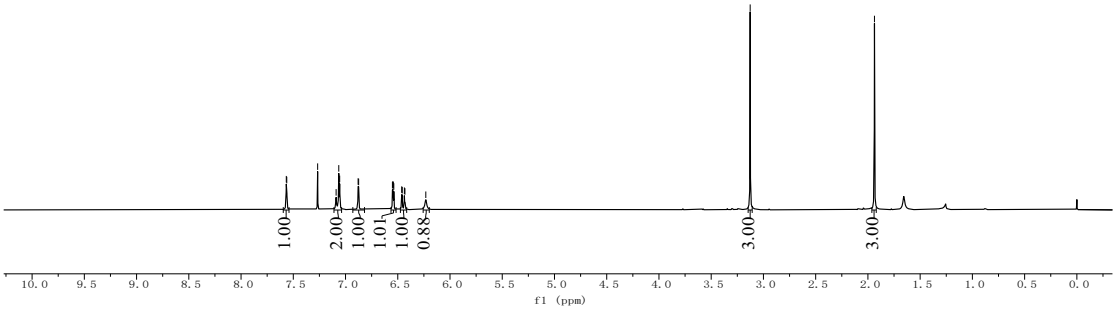
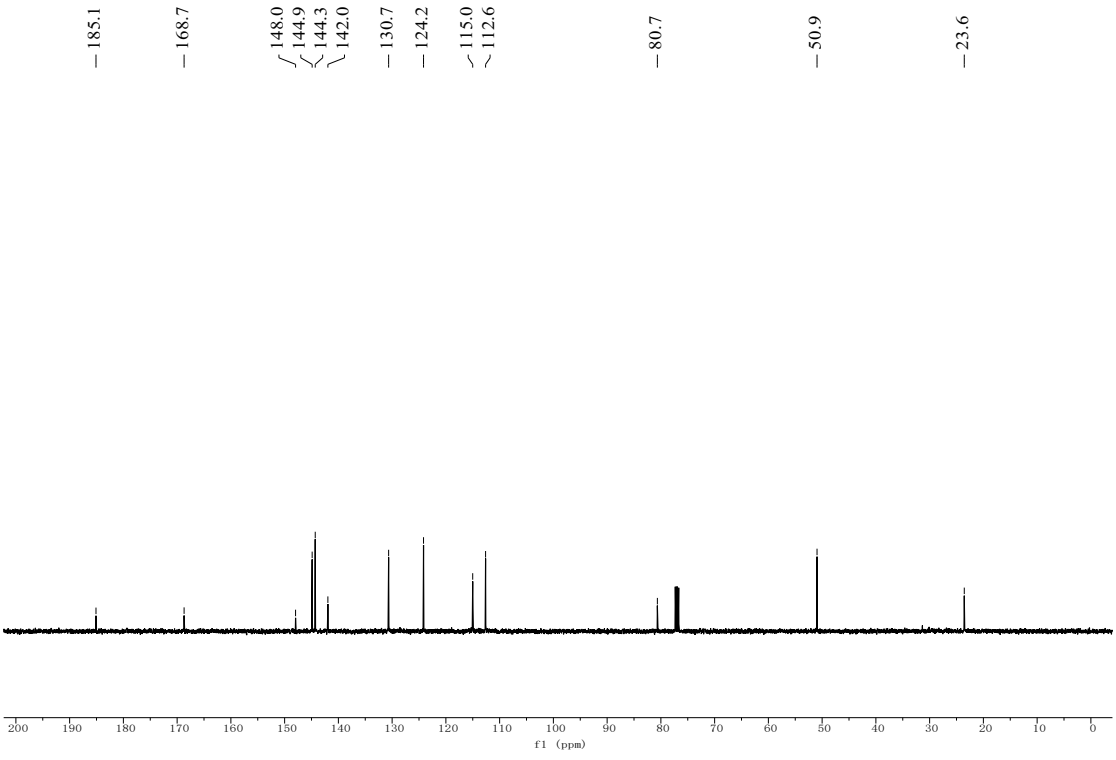


F-11090 1o AC O c111.17.fid — 13C



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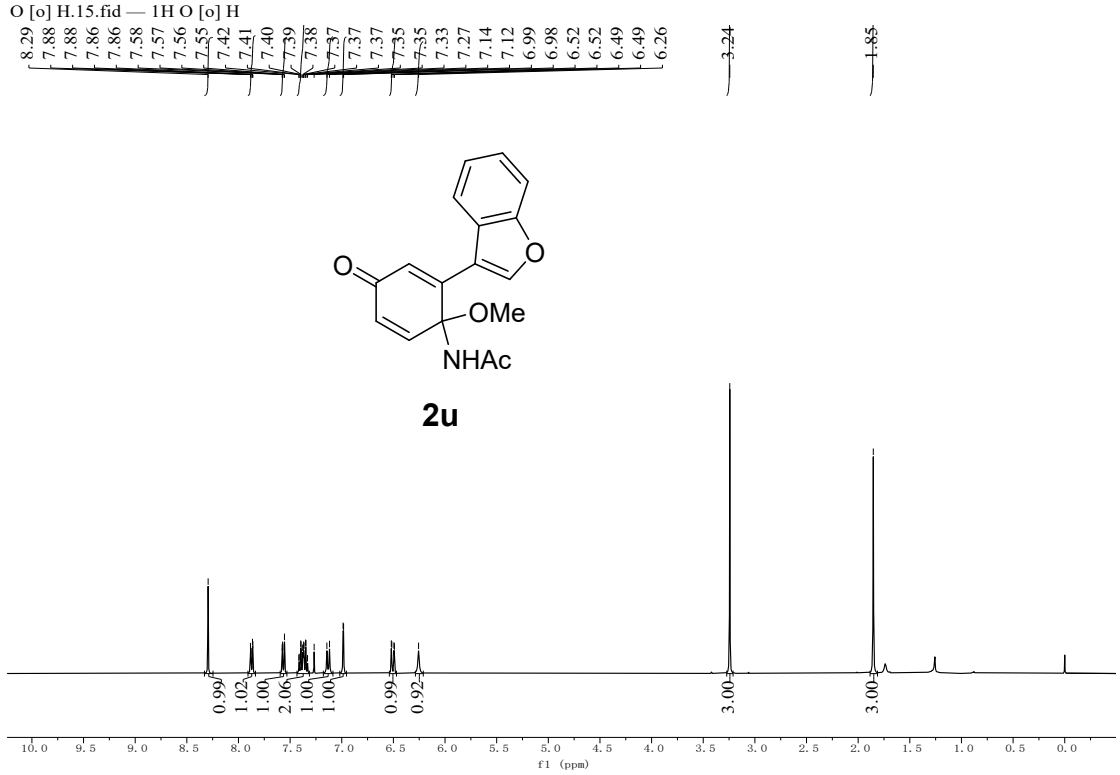
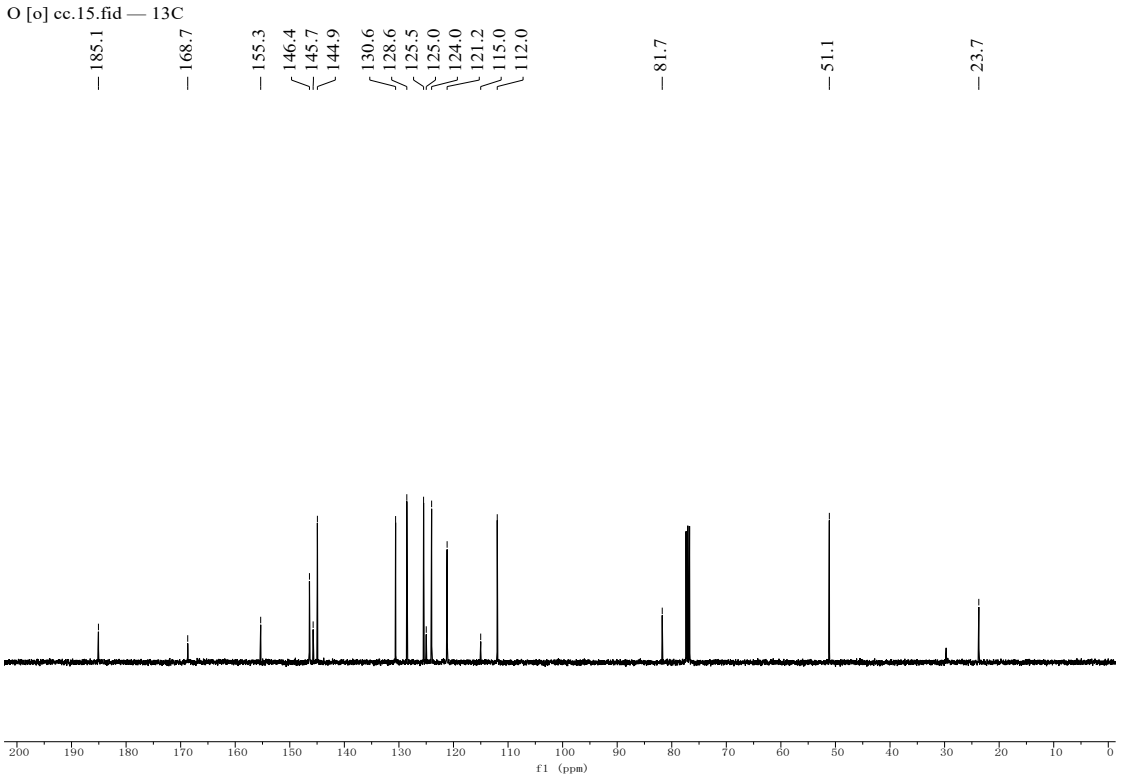
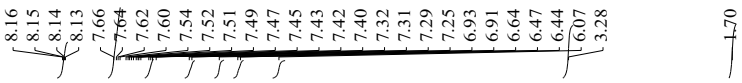
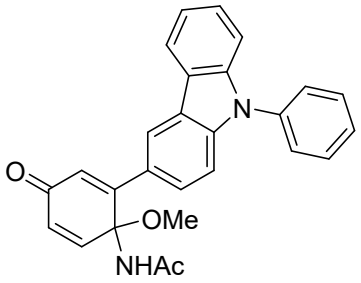

O [o] H.15.fid — 1H O [o] H
8.29
7.88
7.88
7.86
7.86
7.58
7.57
7.56
7.55
7.42
7.41
7.40
7.39
7.38
7.37
7.37
7.37
7.35
7.35
7.33
7.27
7.14
7.12
6.99
6.98
6.52
6.52
6.49
6.49
6.26
3.24
1.85
O
O
OMe
NHAc
2u
0.99
1.02
1.00
2.06
1.00
1.00
0.99
0.92
3.00
3.00
10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)


O [o] cc.15.fid — 13C
185.1
168.7
155.3
146.4
145.7
144.9
130.6
128.6
125.5
125.0
124.0
121.2
115.0
112.0
81.7
51.1
23.7
200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

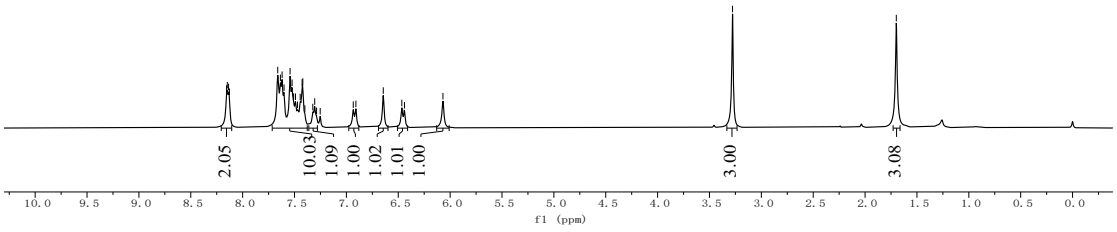
2v

F ka O H.15.fid — 1H

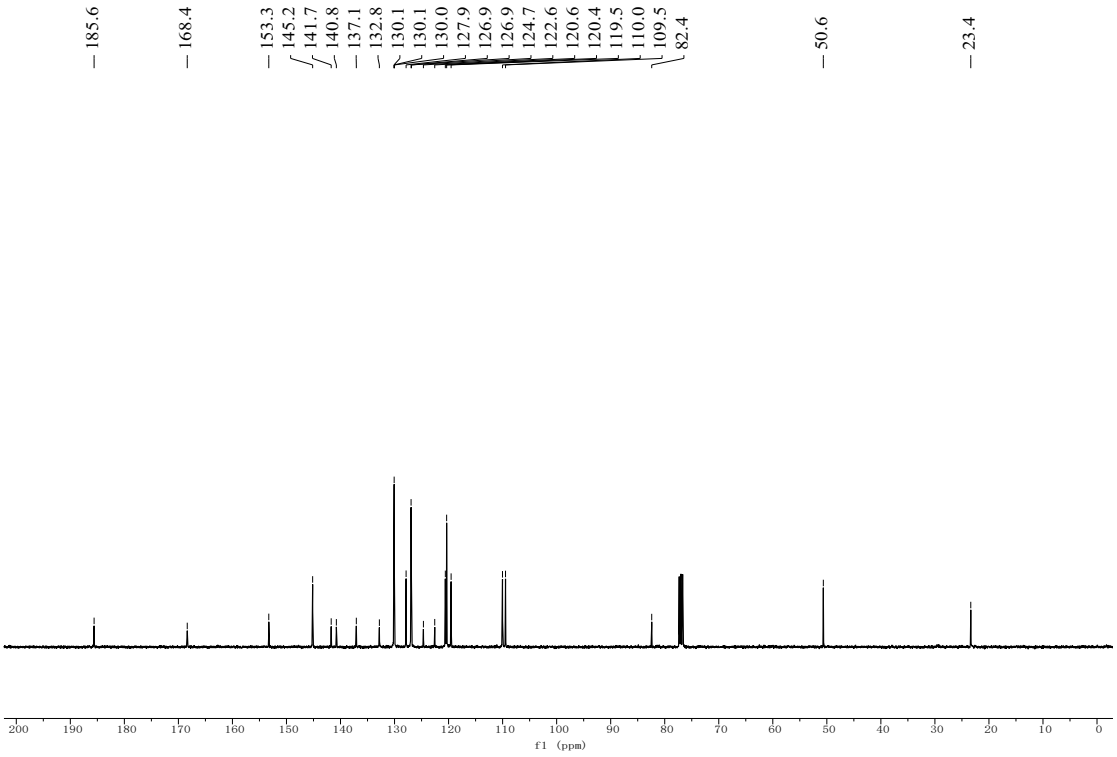




2v

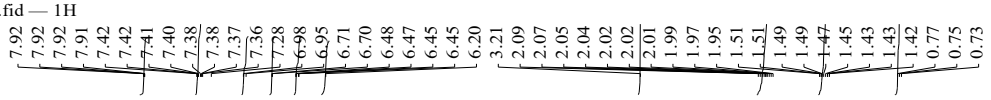


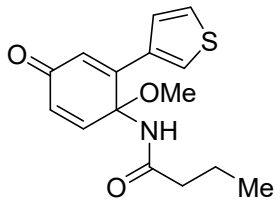
F ka O ccc.15.fid — 13C



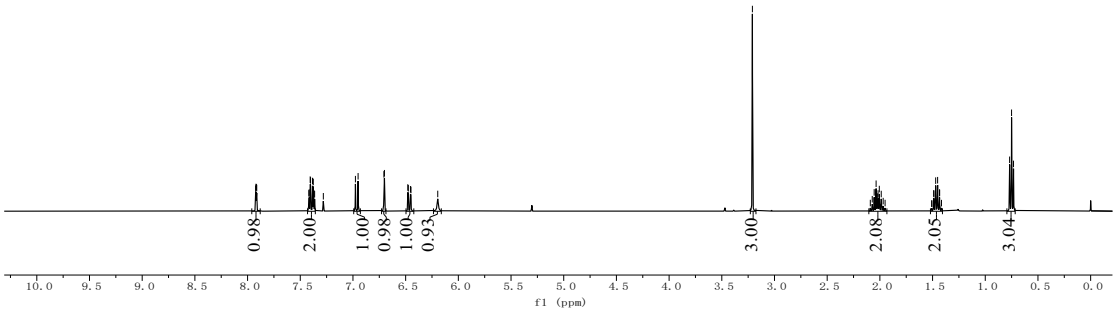
2w

F-722 s H.15.fid — 1H

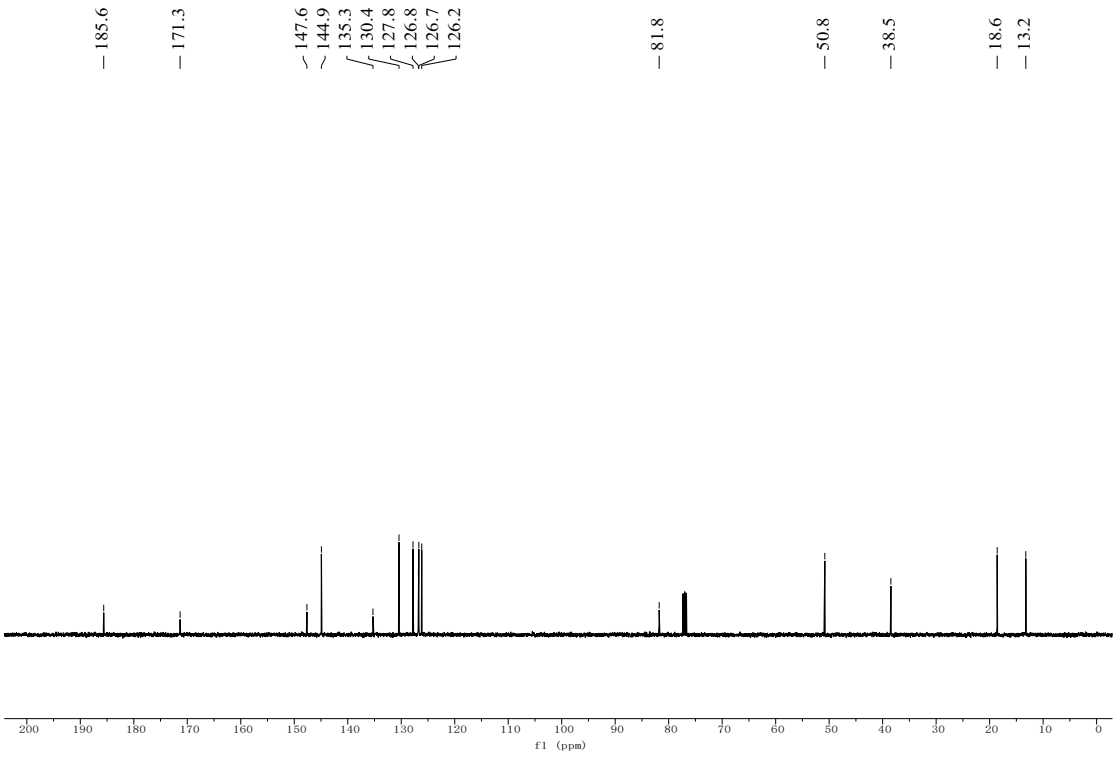




2w

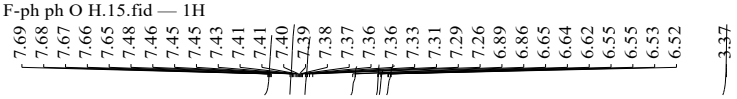


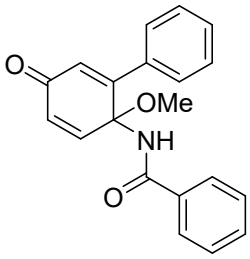
F-722 s c.15.fid — 13C



2x

F-ph ph O H.15.fid — 1H





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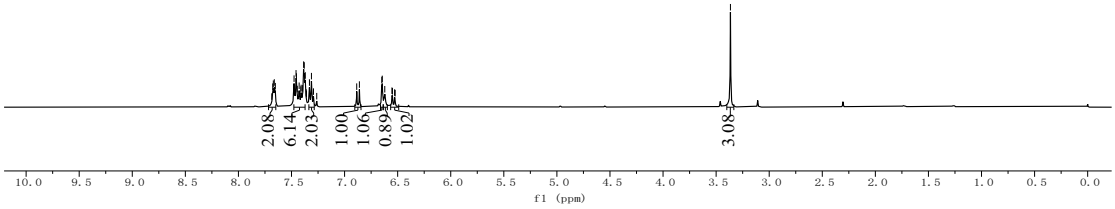
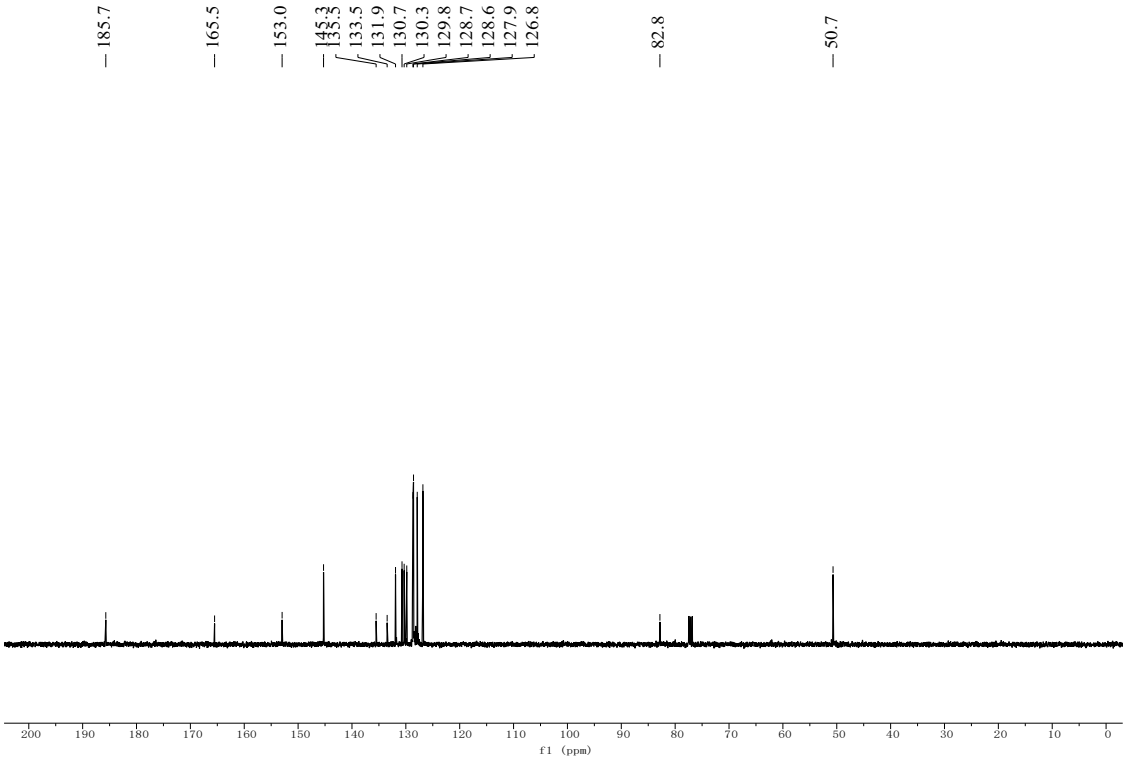


F-phph Oc 2.15.fid — 13C



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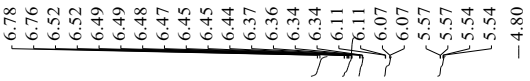

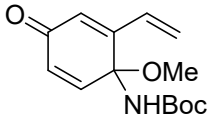

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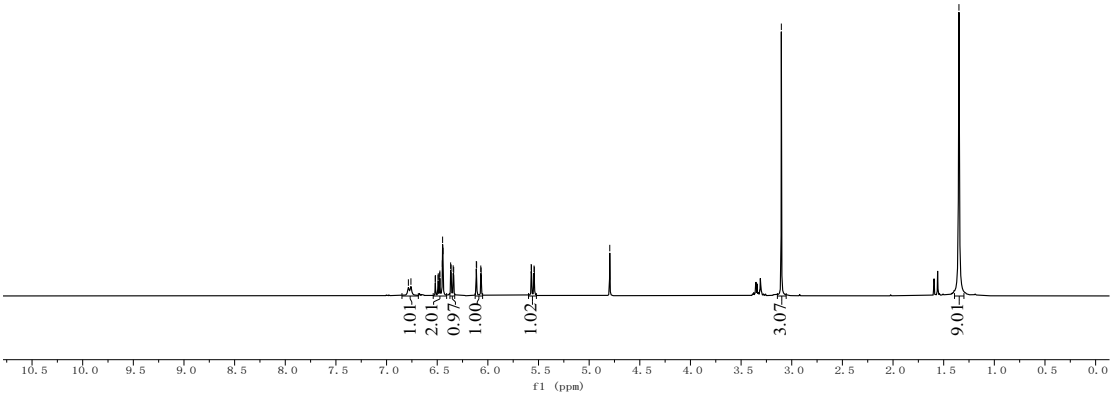

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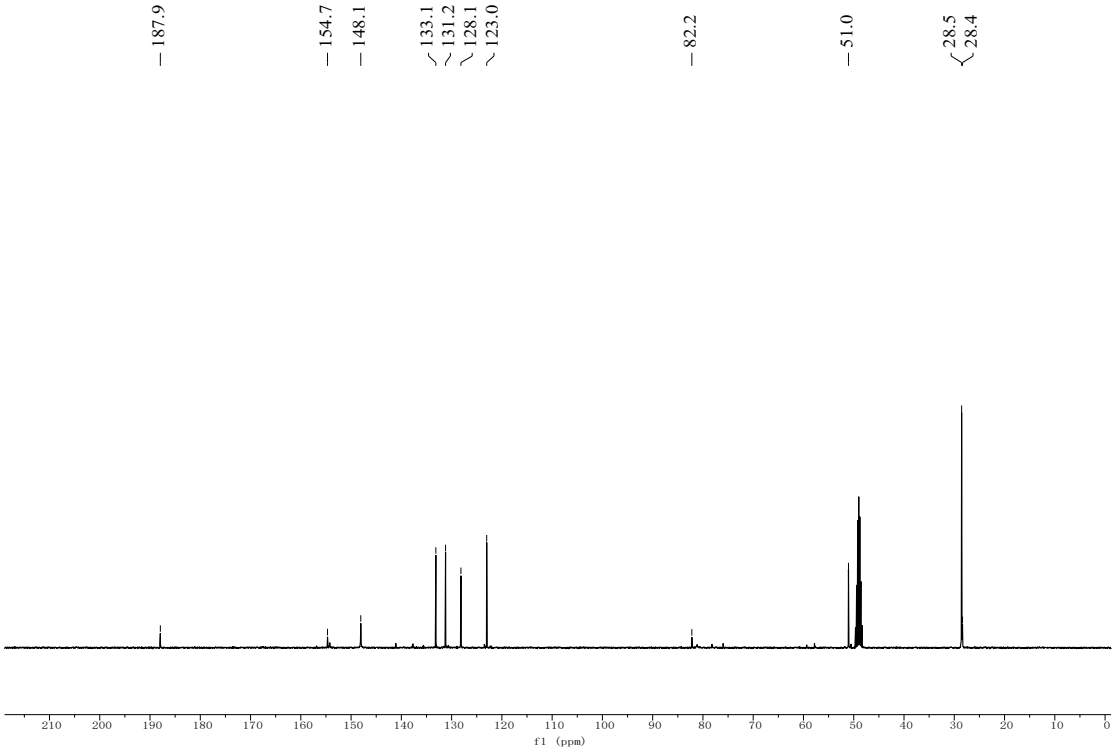

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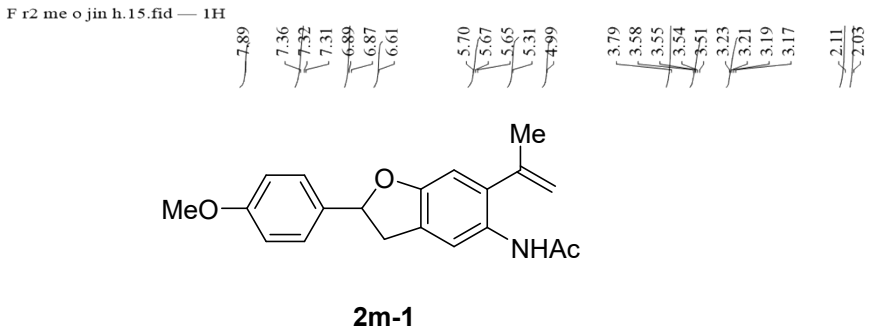
F r2 me o jin h.15.fid — 1H
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7.32
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5.65
5.31
4.99
3.79
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Me
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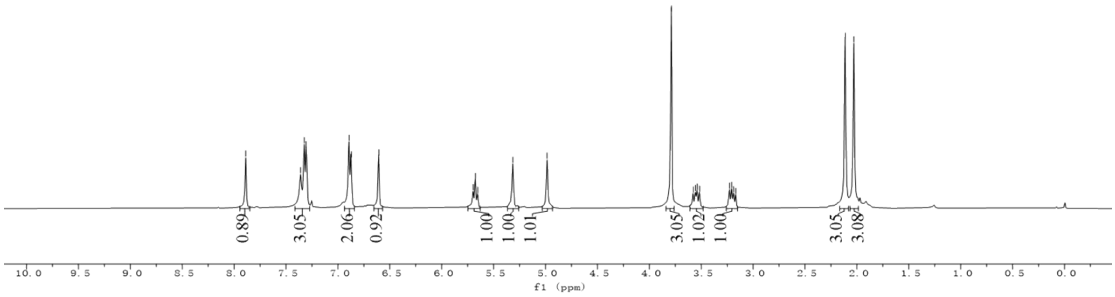
MeO
NHAc

2m-1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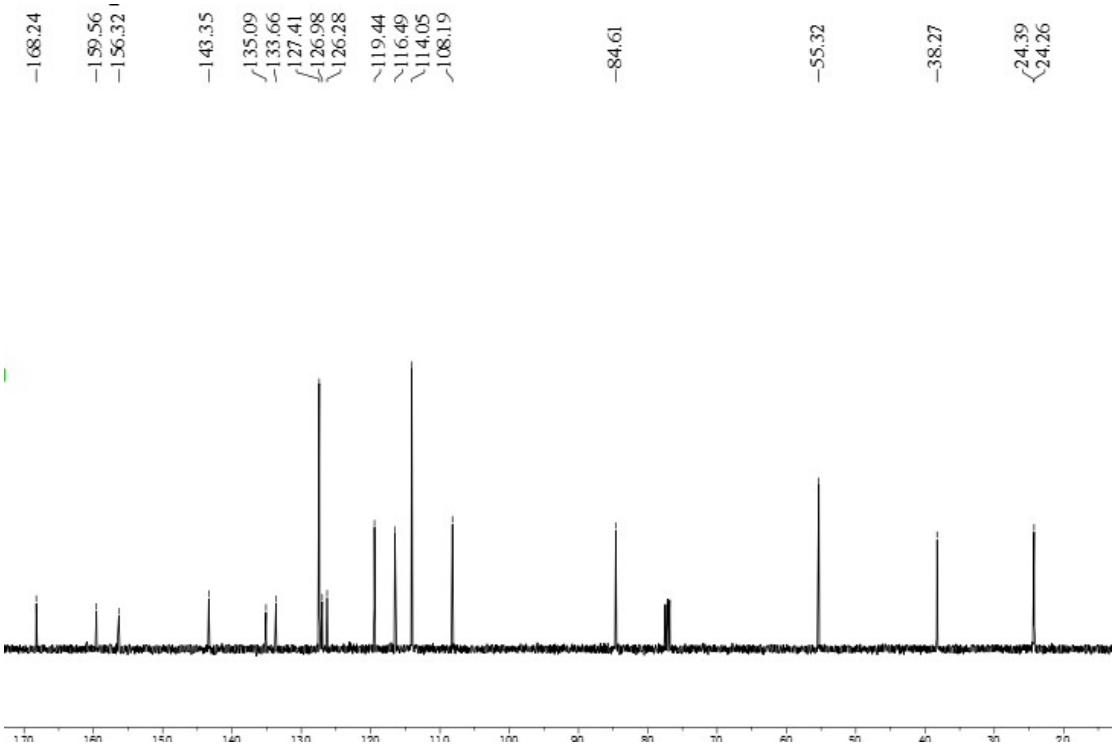
3.08
f1 (ppm)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126.98
126.28
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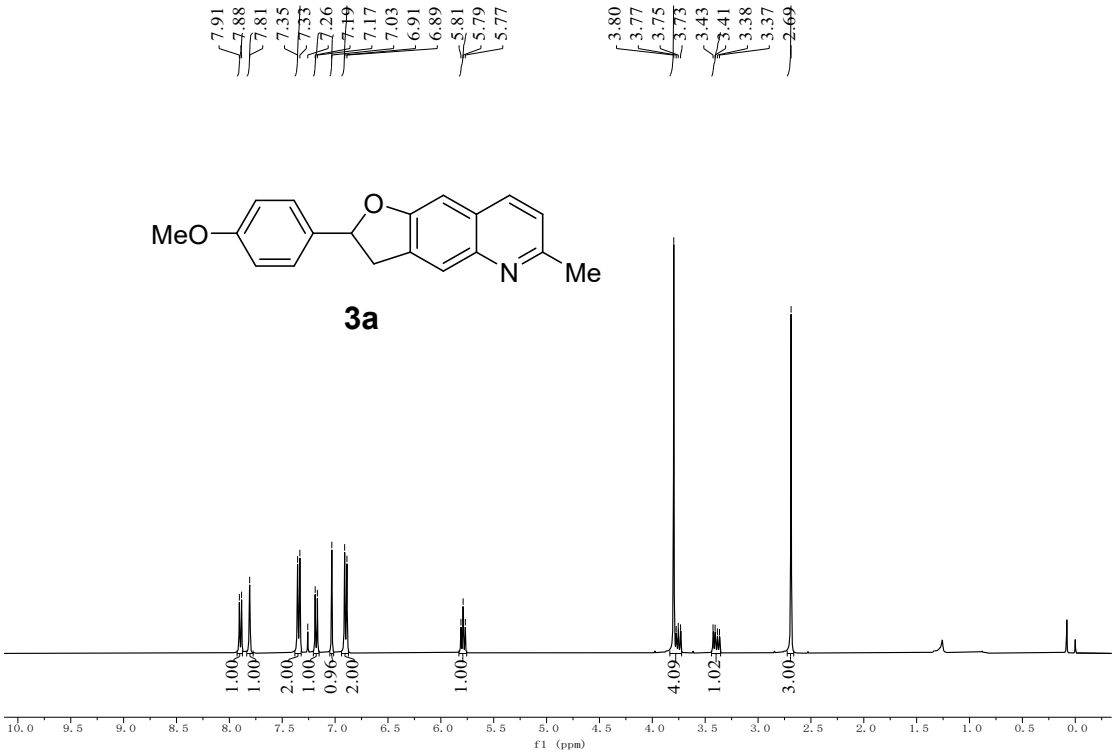
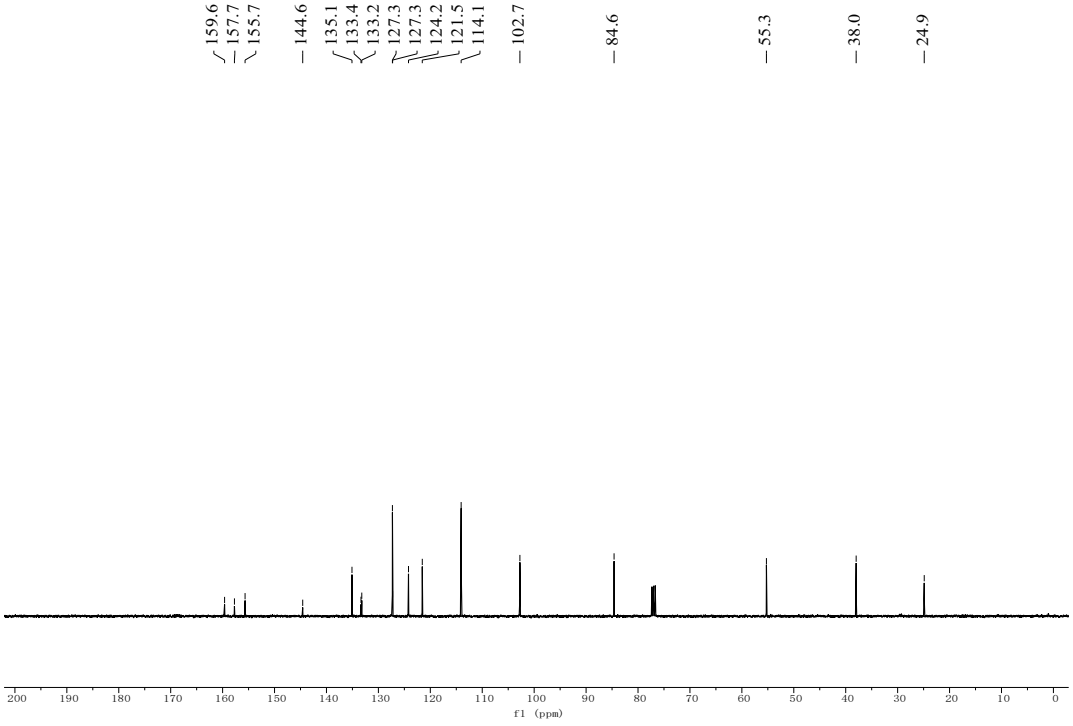
84.61
55.32
38.27
24.39
24.26

3a

omeme.17.fid — omeme

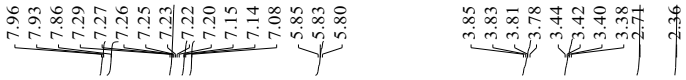


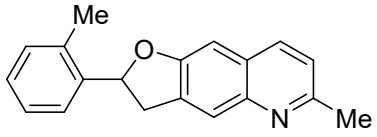
omememecc.14.fid — omeme c



3b

F lin Me xi guan H.15.fid — 1H





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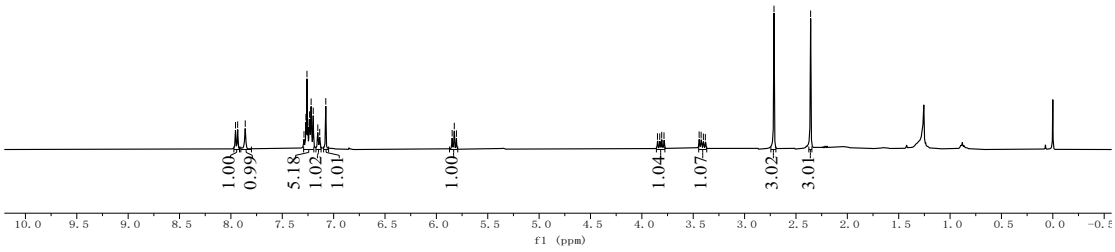
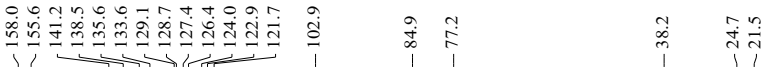
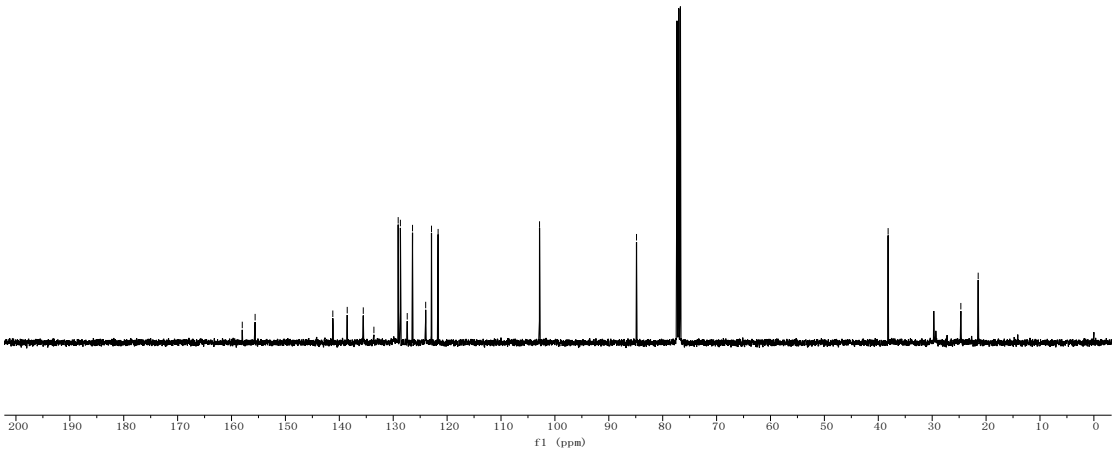


F lin Me xi guan CC.15.fid — 13C





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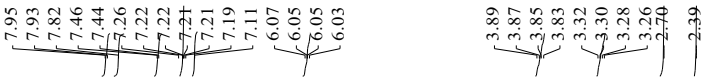
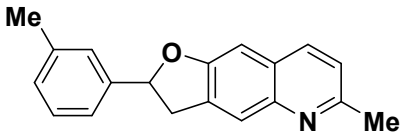
F-o Me xi guan HH.15.fid — 1H





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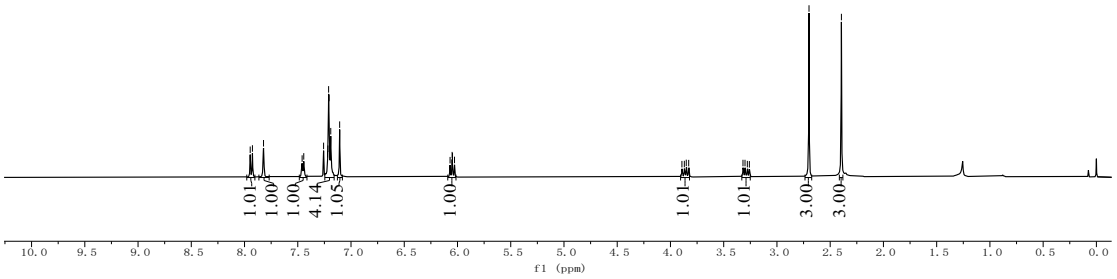
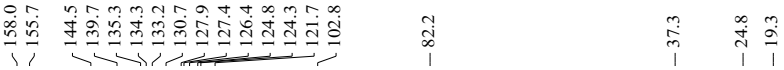
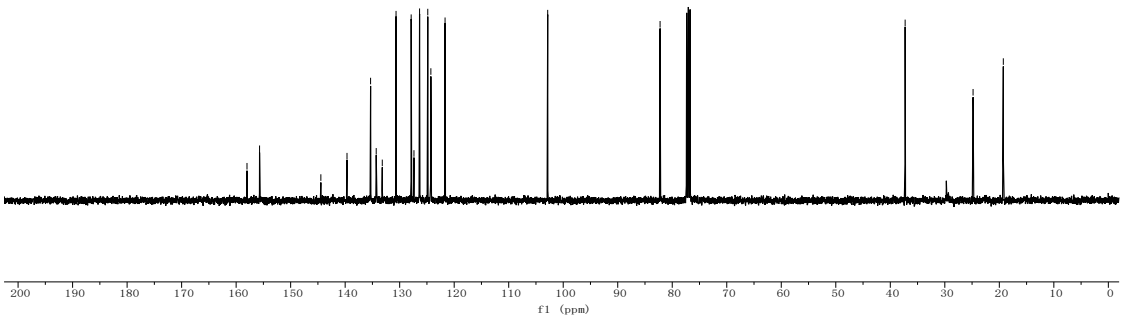


F-o Me xi guan CC.15.fid — 13C





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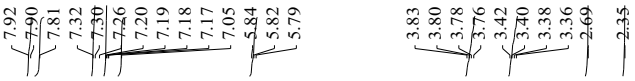
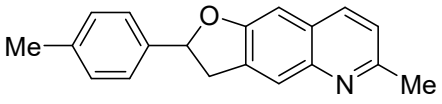
F-646 H.15.fid — 1H





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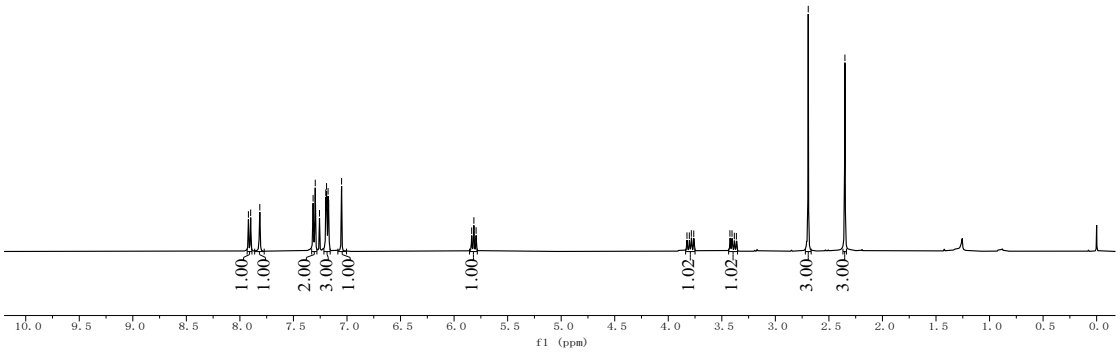

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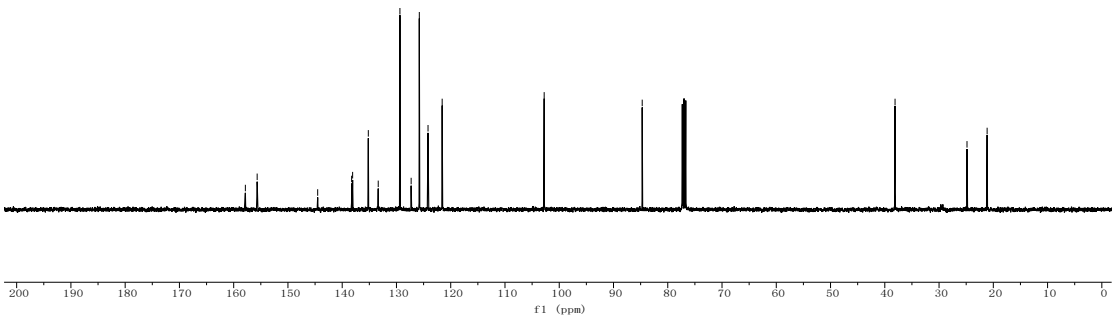

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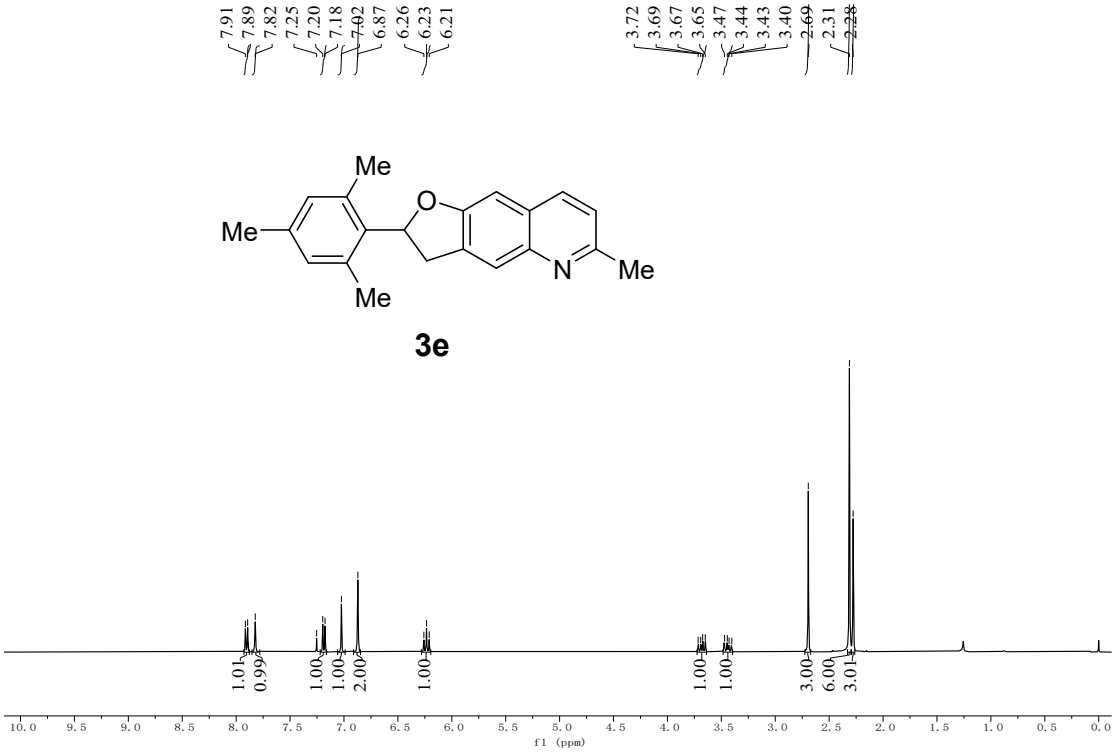

3e

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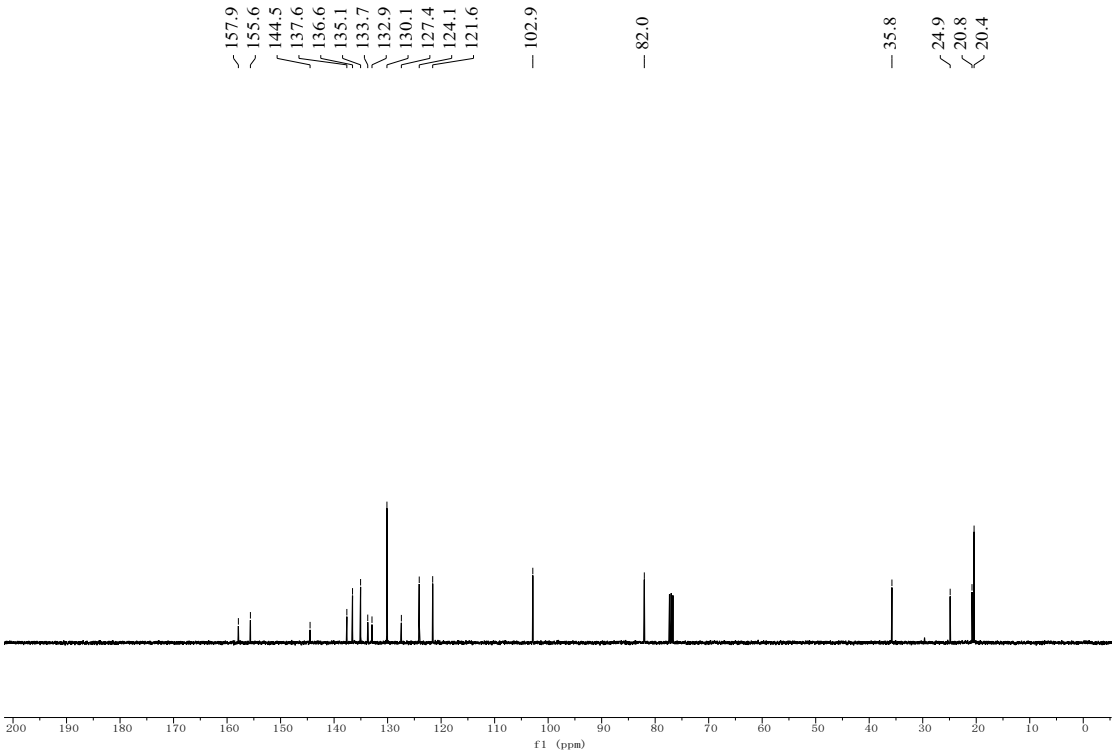
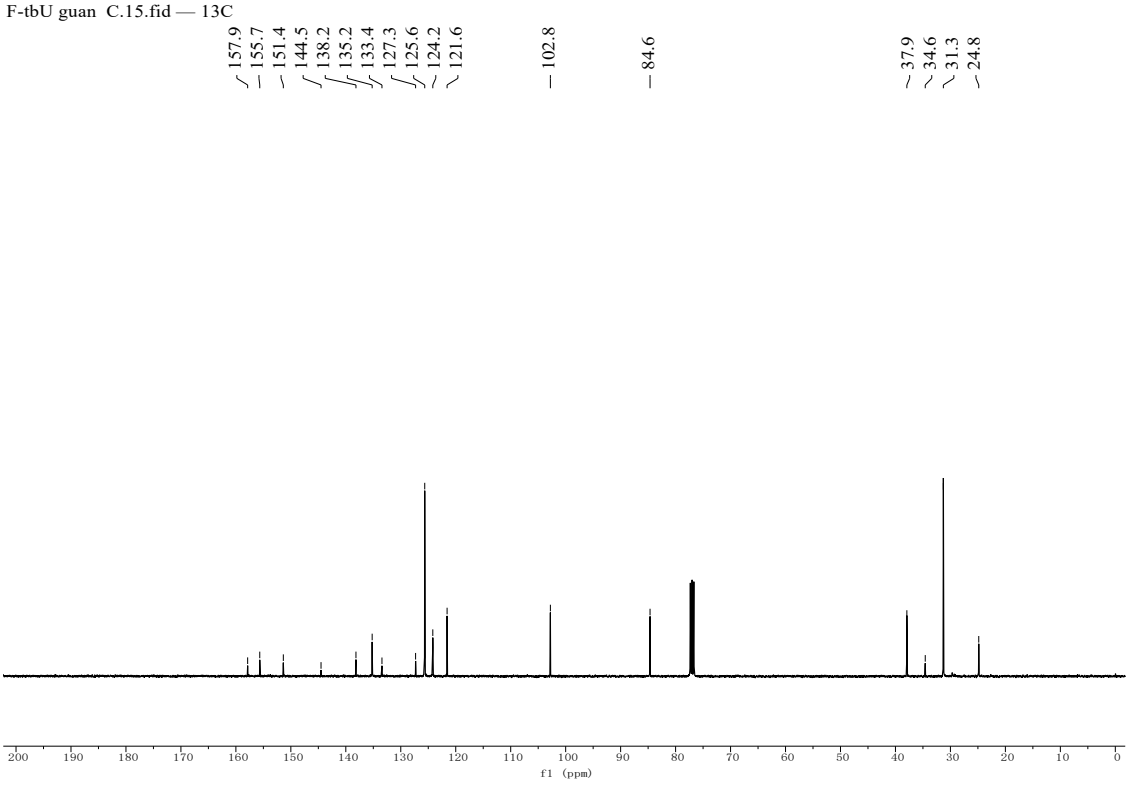


3f

F-tbU guanHHH.15.fid — 1H

3f

F-tbU guan C.15.fid — 13C



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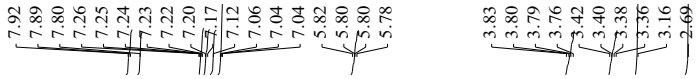
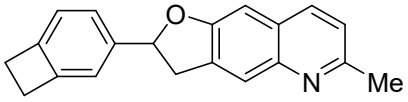
4HUANXI H.15.fid — 1H





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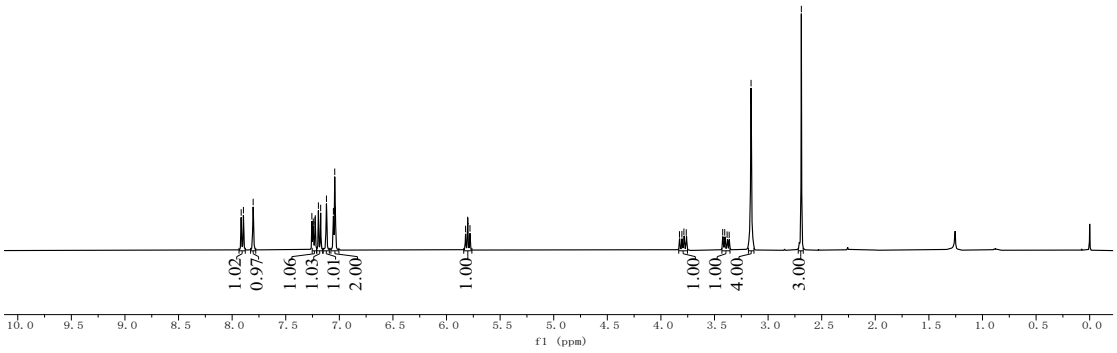

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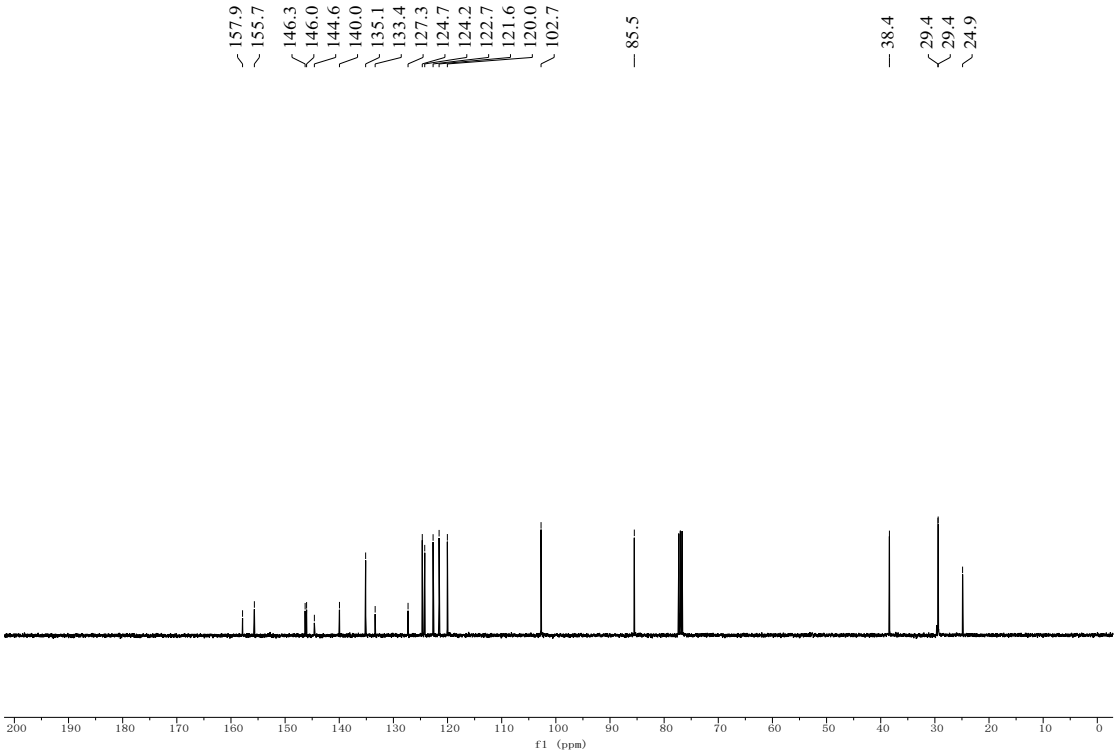
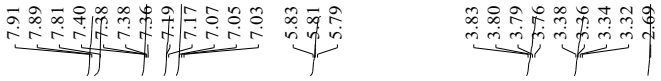
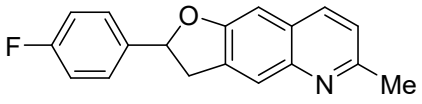


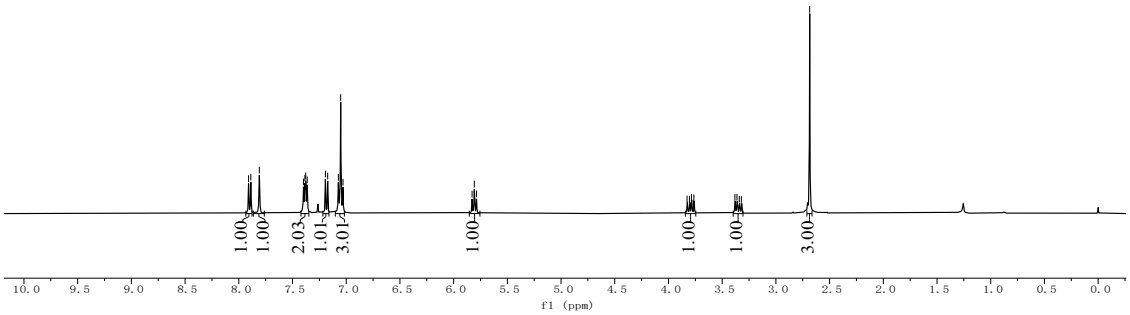
3h

F-679 H.15.fid — 1H

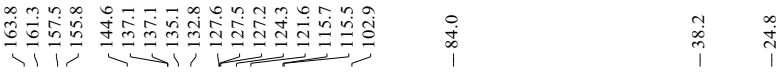


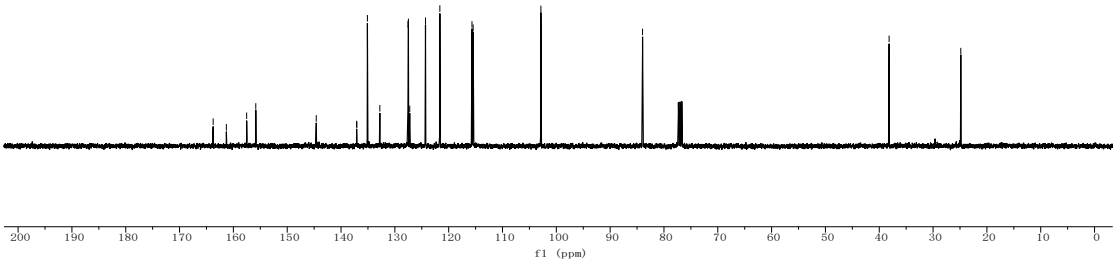


3h



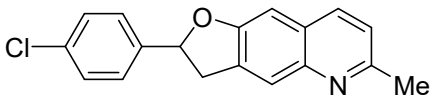
F-679 C.15.fid — 13C





3i

F-645 H.15.fid — 1H



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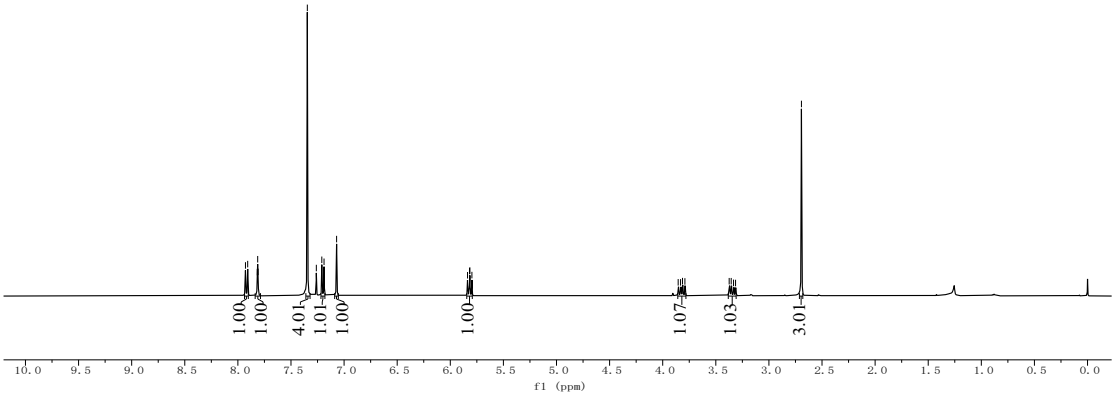

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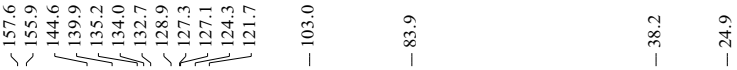
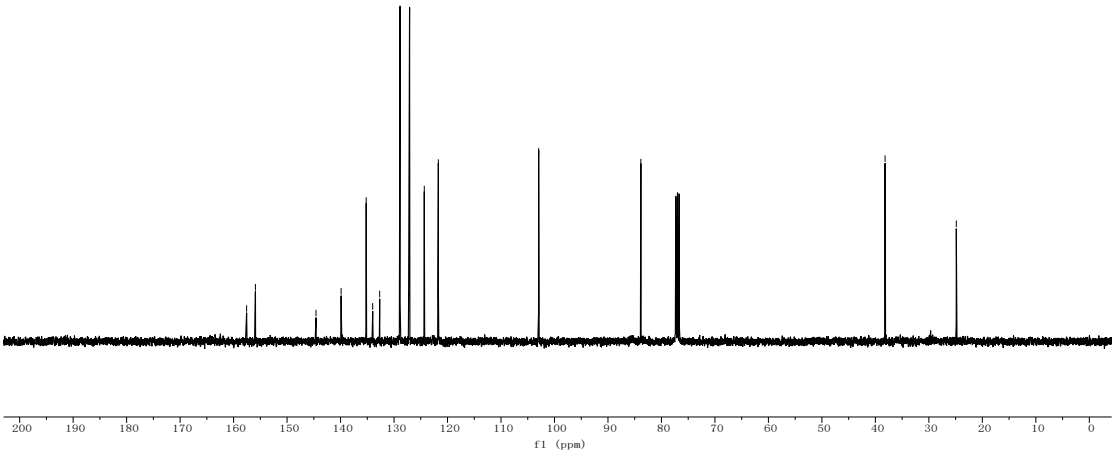
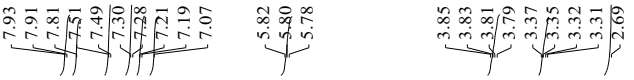
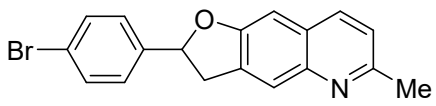




3j

Br guan HH.15.fid — 1H





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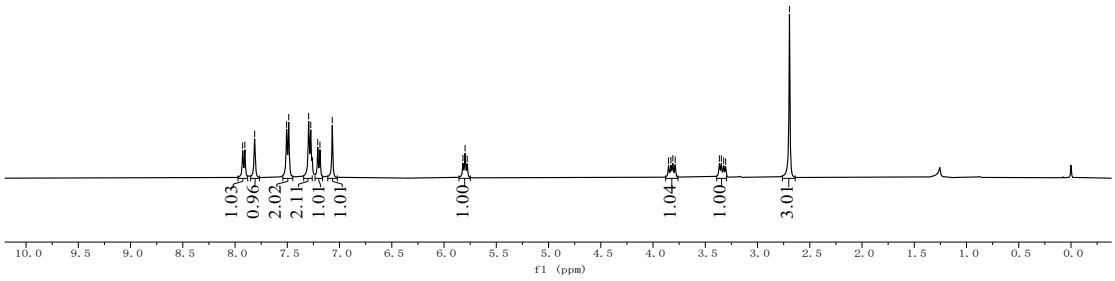

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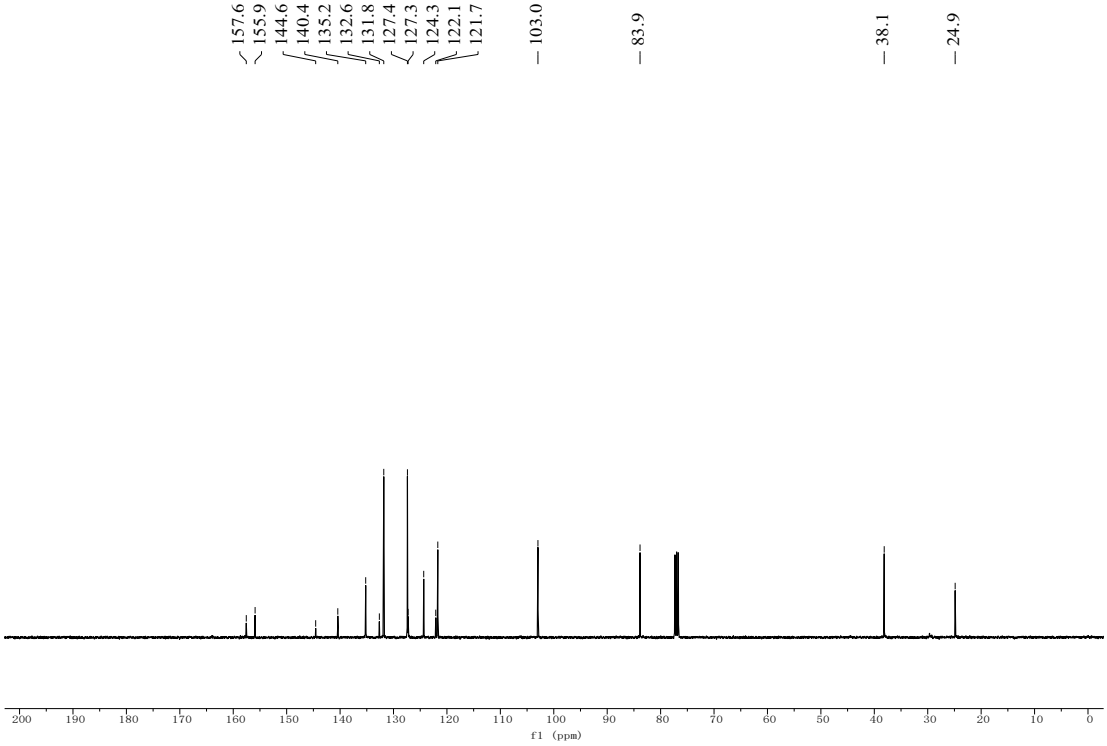
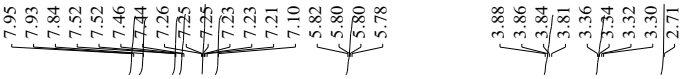
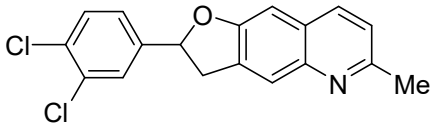


3k

F 2Cl guan H.15.fid — 1H





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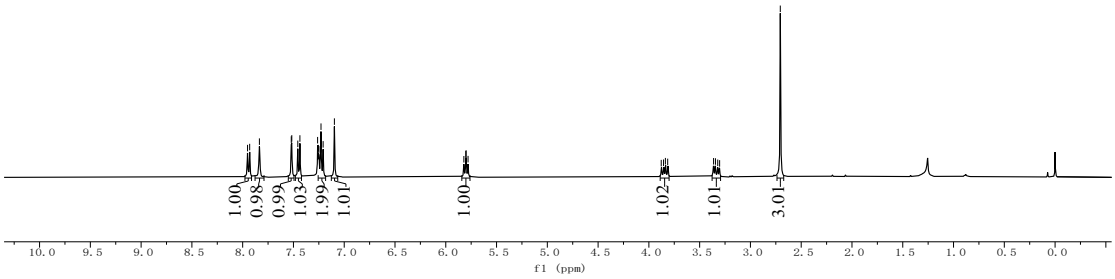
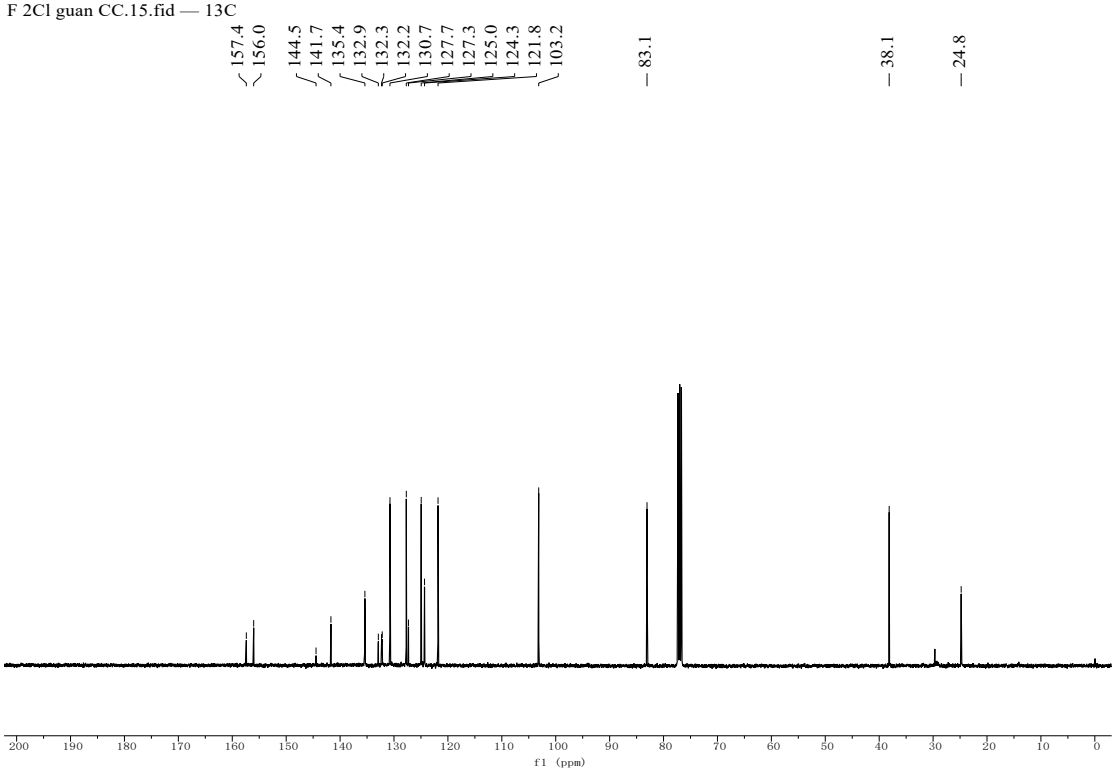
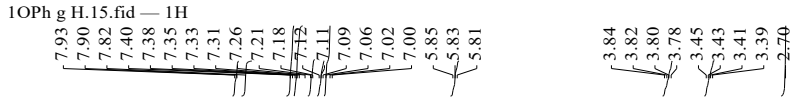


F 2Cl guan CC.15.fid — 13C



3l


1OPh g H.15.fid — 1H
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7.18
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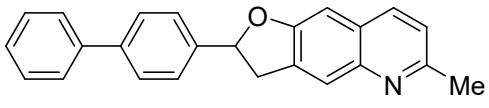
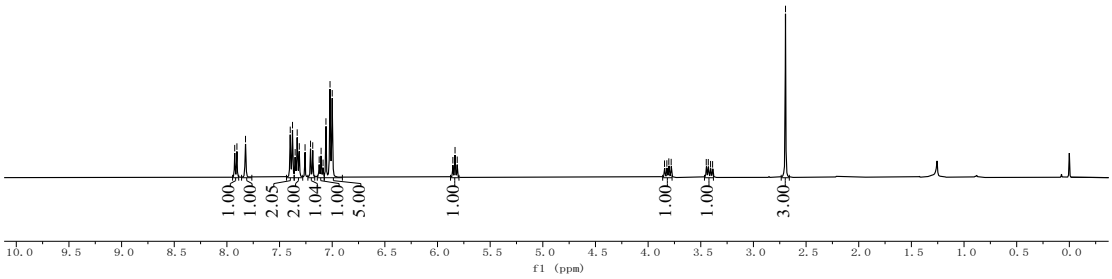

O
N
Me

3l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6.0
5.5
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2.5
2.0
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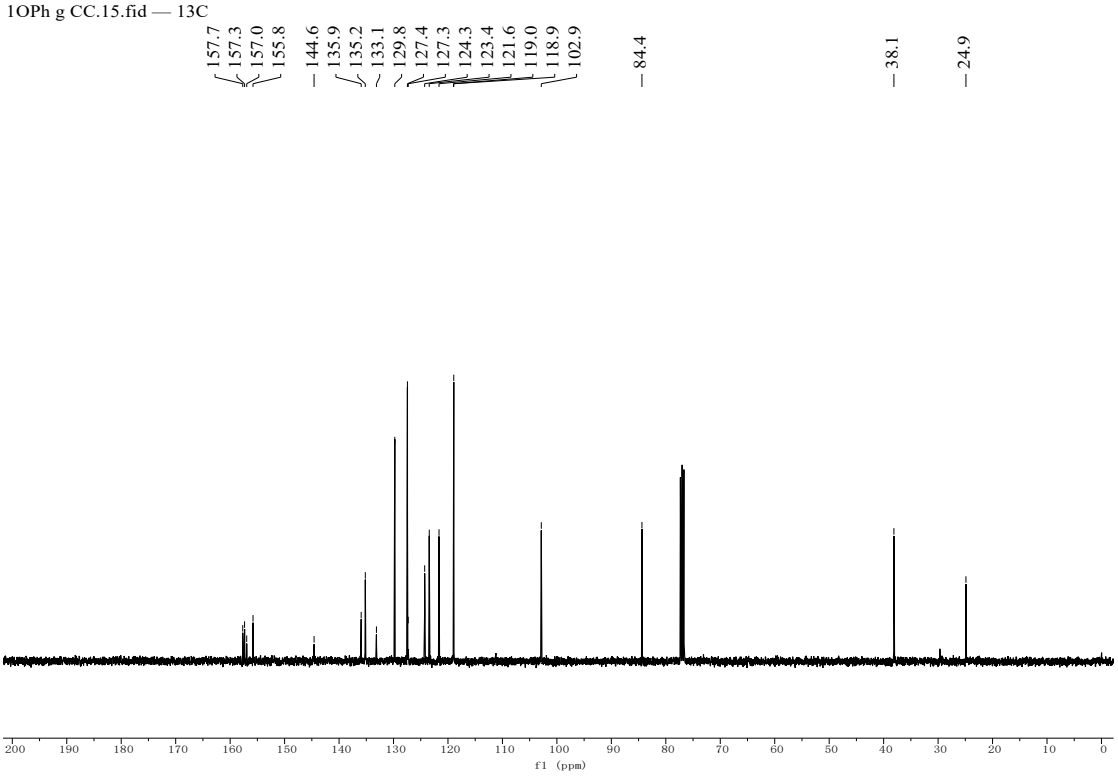
1.0
0.5
0.0
f1 (ppm)


1OPh g CC.15.fid — 13C
157.7
157.3
157.0
155.8
144.6
135.9
135.2
133.1
129.8
127.4
127.3
124.3
123.4
121.6
119.0
118.9
102.9
84.4
38.1
24.9
200
190
180
170
160
150
140
130
120
110
100
90
80
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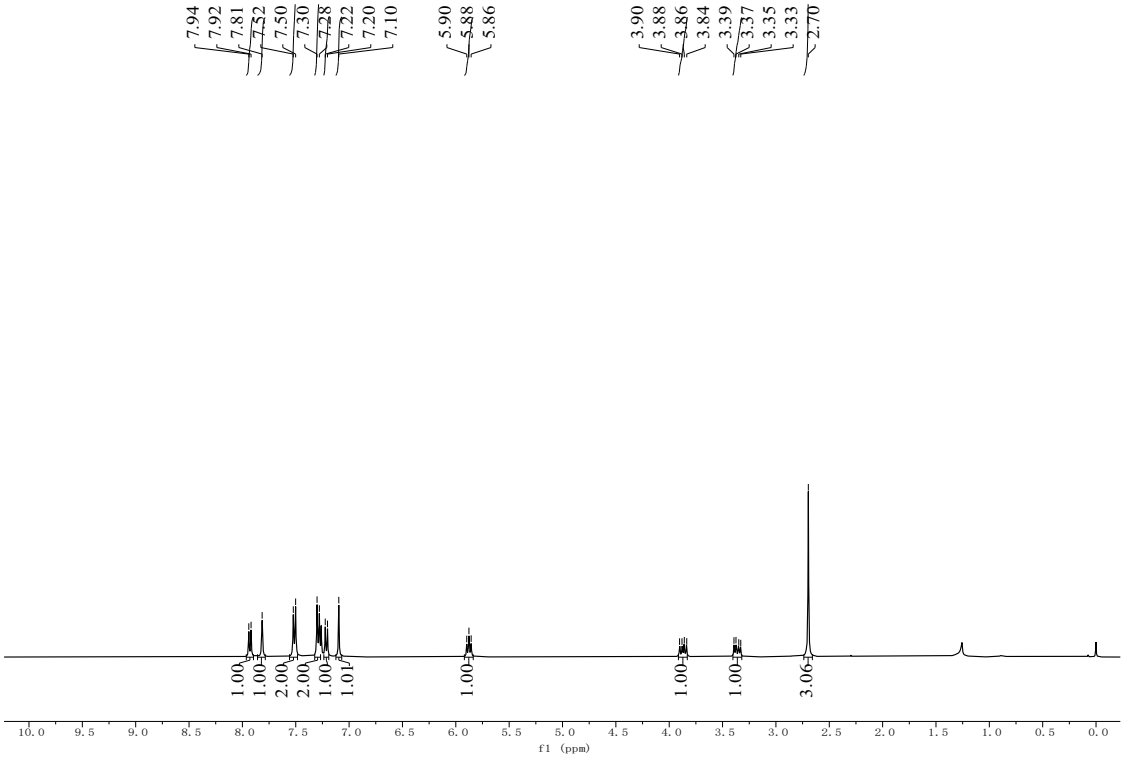
20
10
0
f1 (ppm)

3m

F-otBu guan H.15.fid — 1H F-otBu guan H



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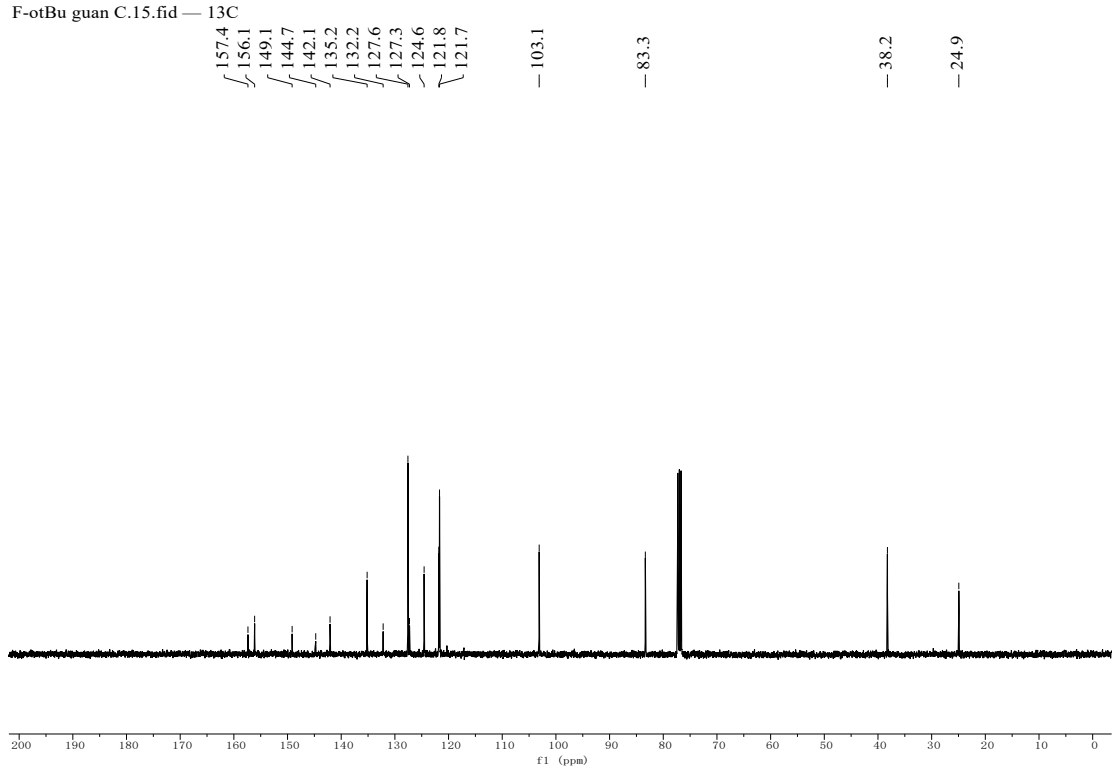

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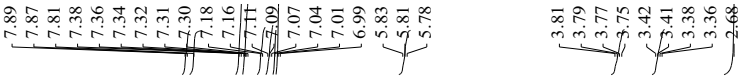

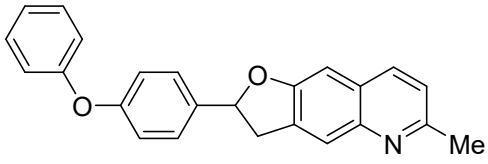

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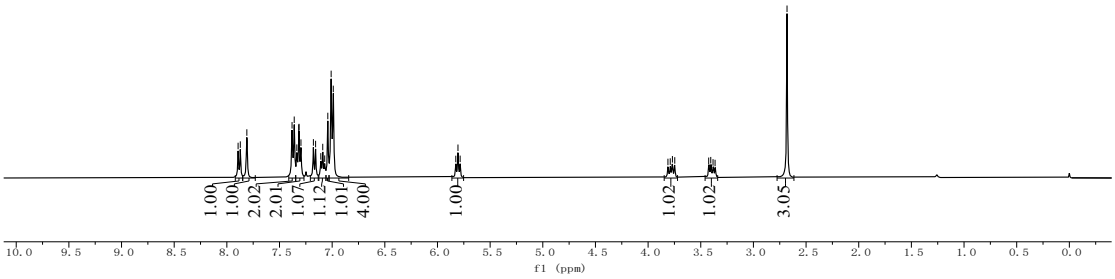
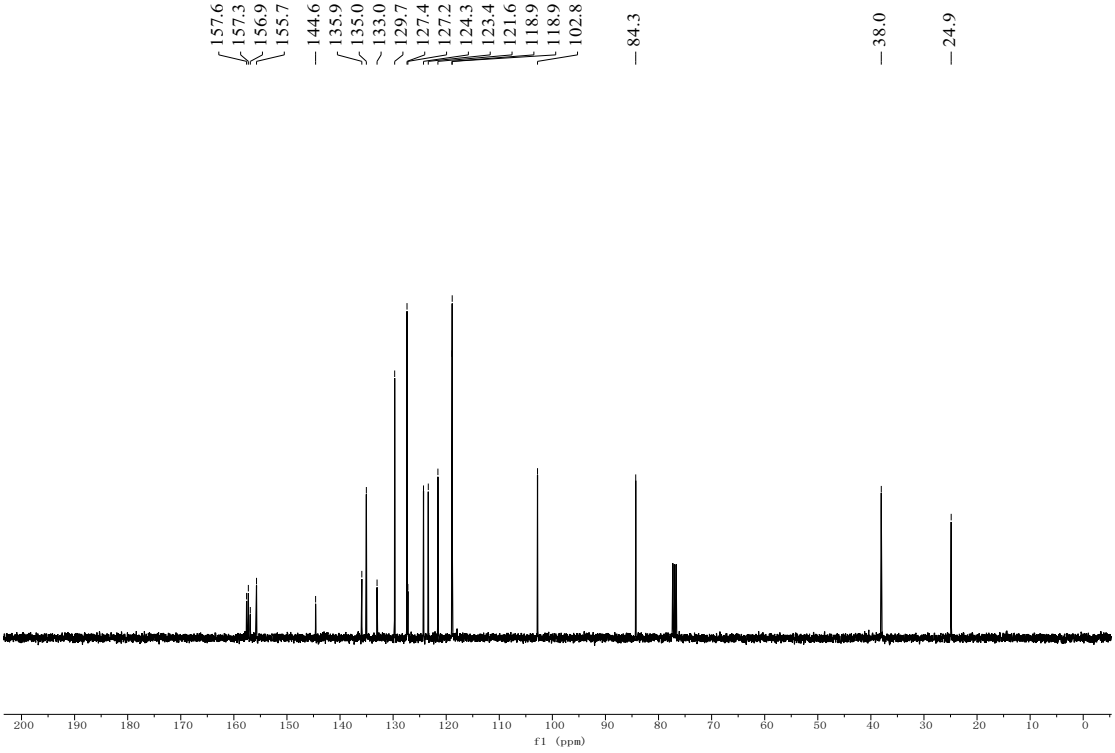
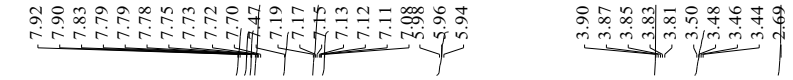


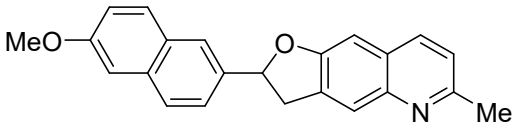
F phoph guan CCC.15.fid — 13C



3o

F-753 H.15.fid — 1H





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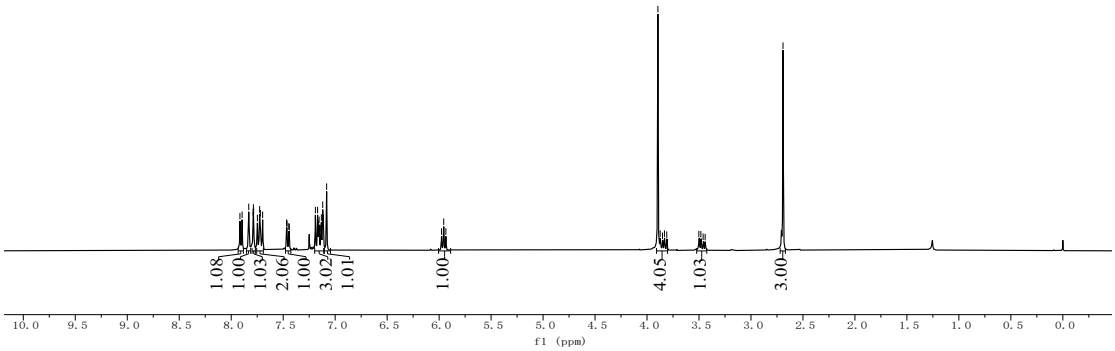

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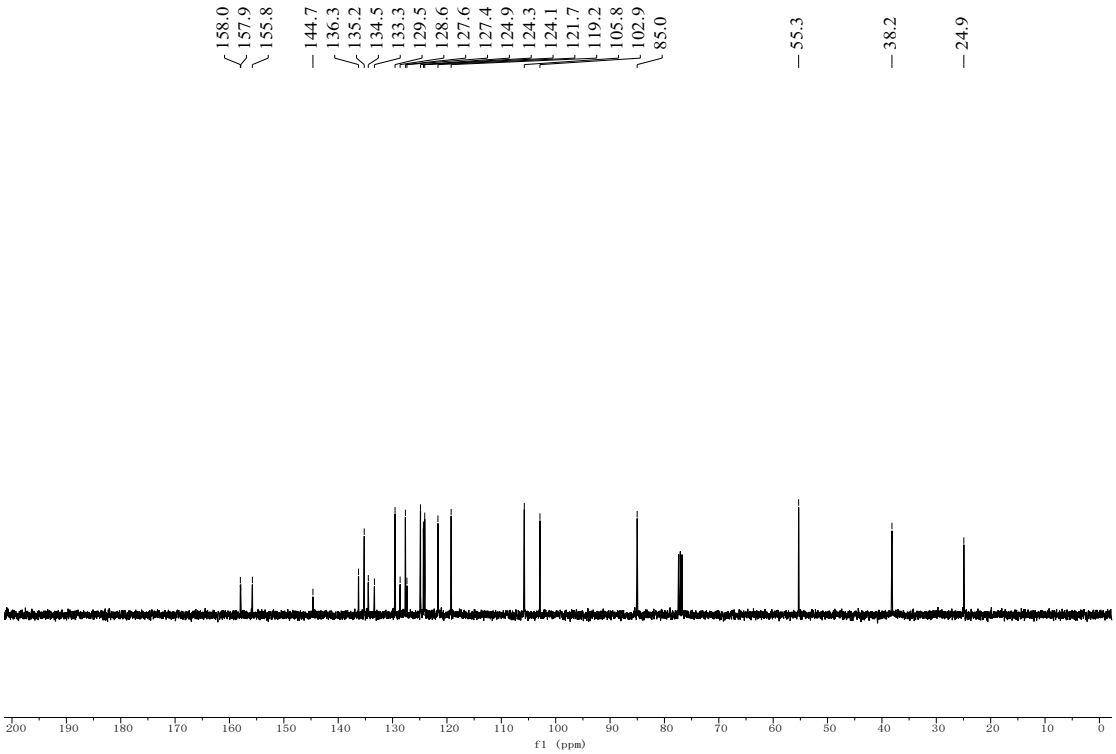
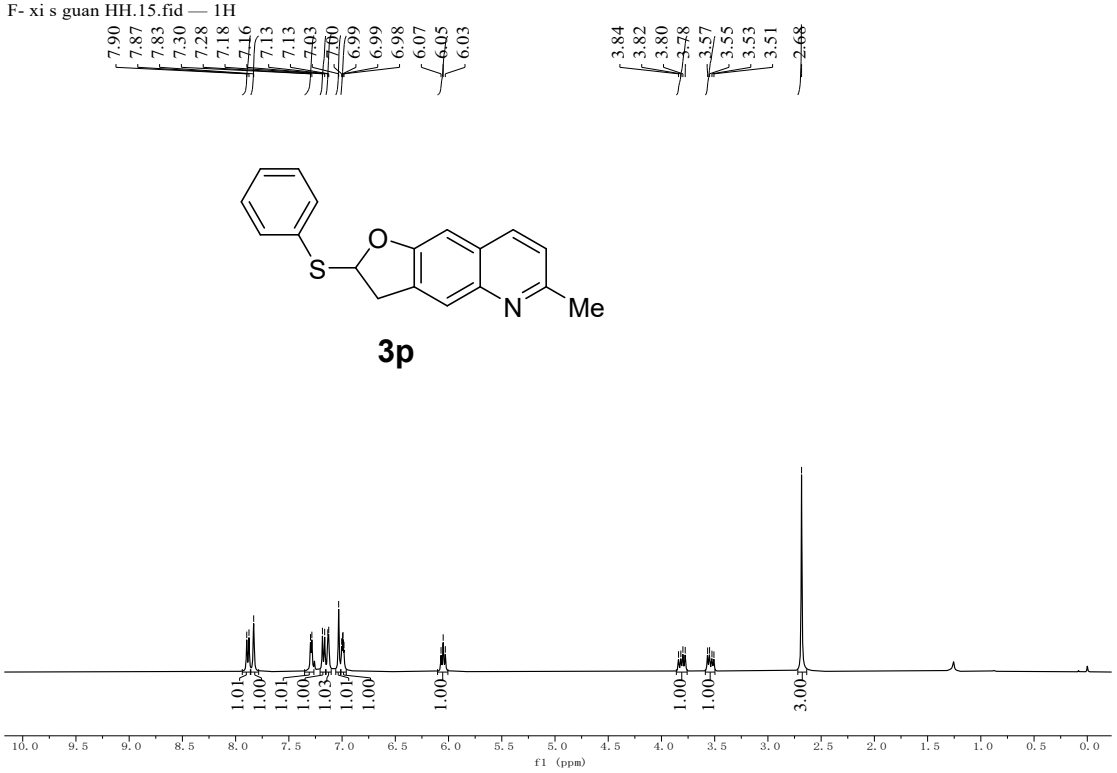
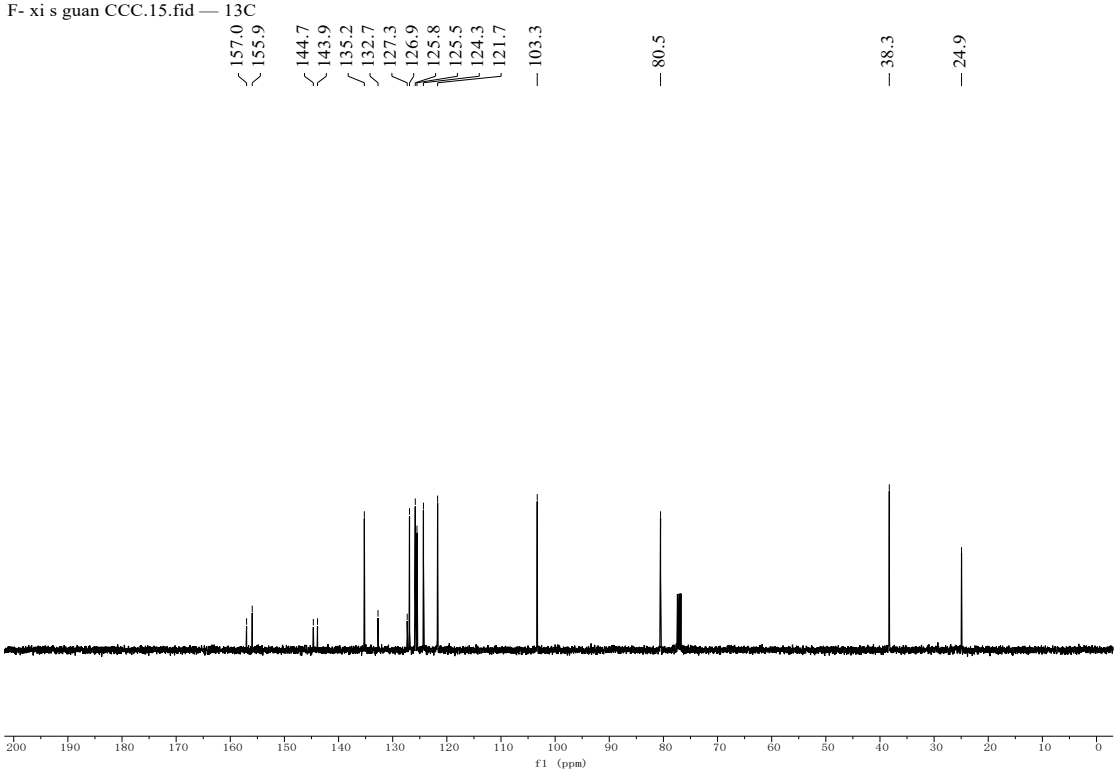


3p

F- xi s guan HH.15.fid — 1H



F- xi s guan CCC.15.fid — 13C



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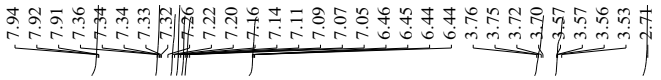

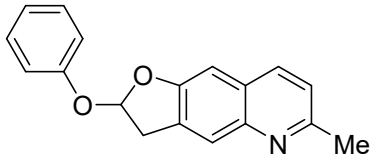

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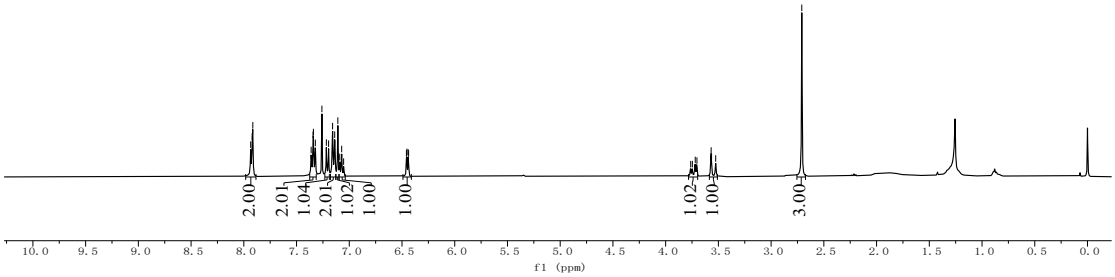

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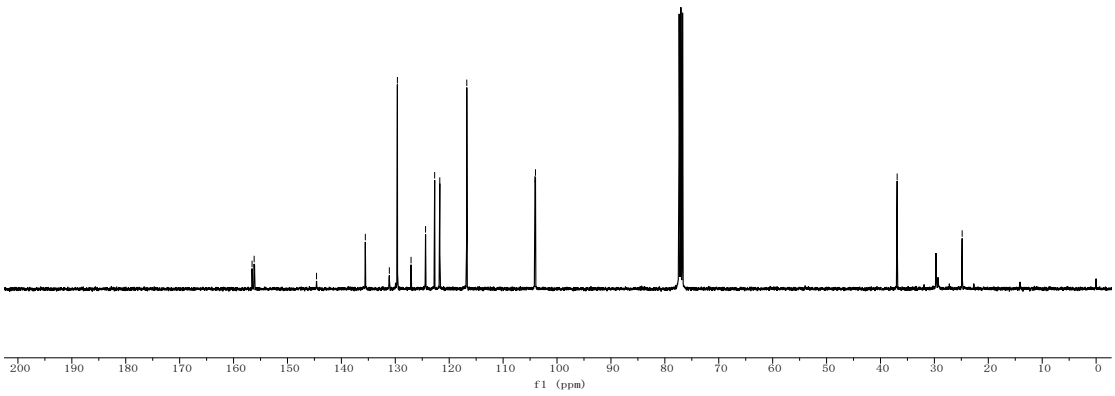

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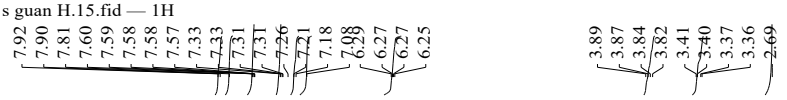

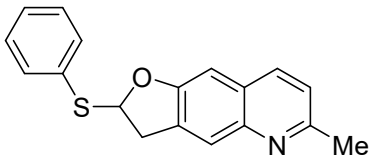

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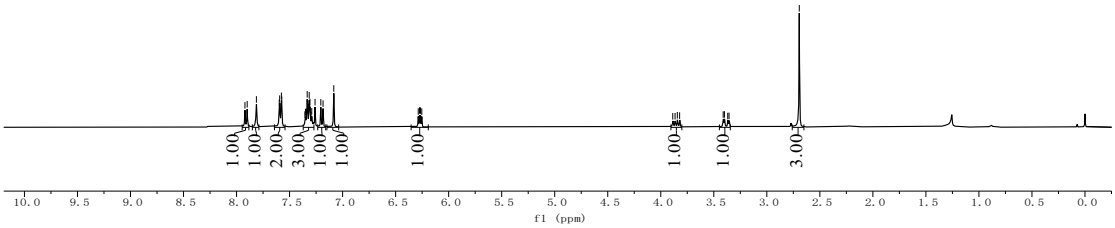
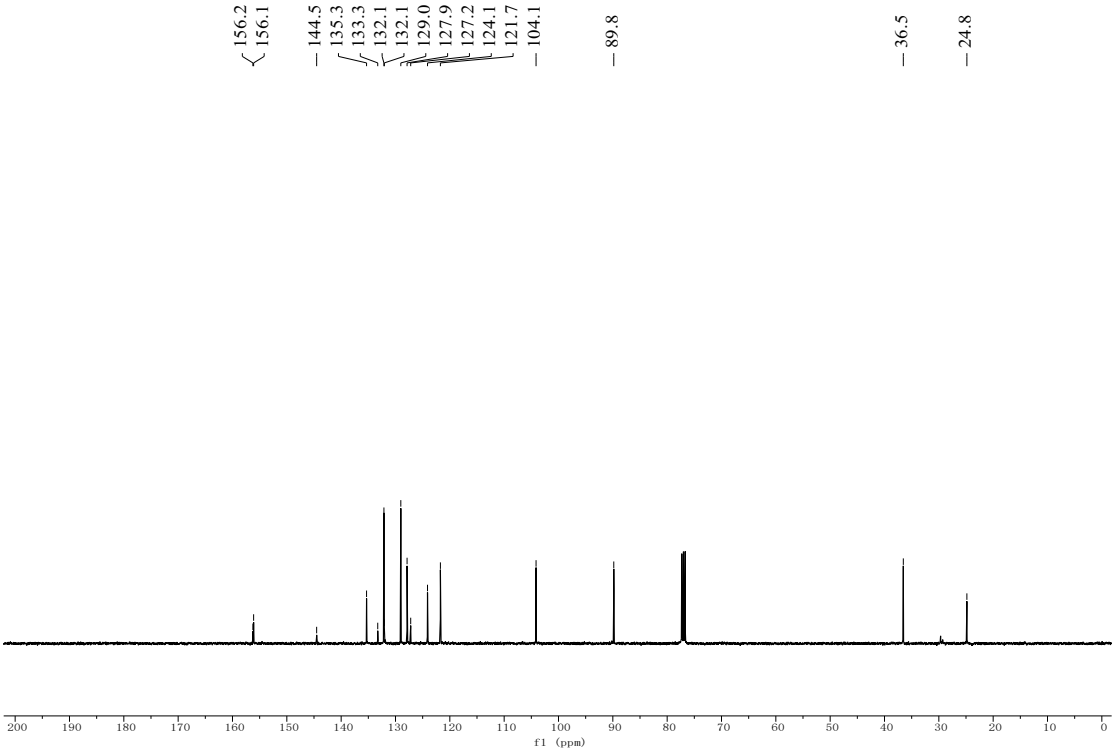


F- s g CC.15.fid — 13C



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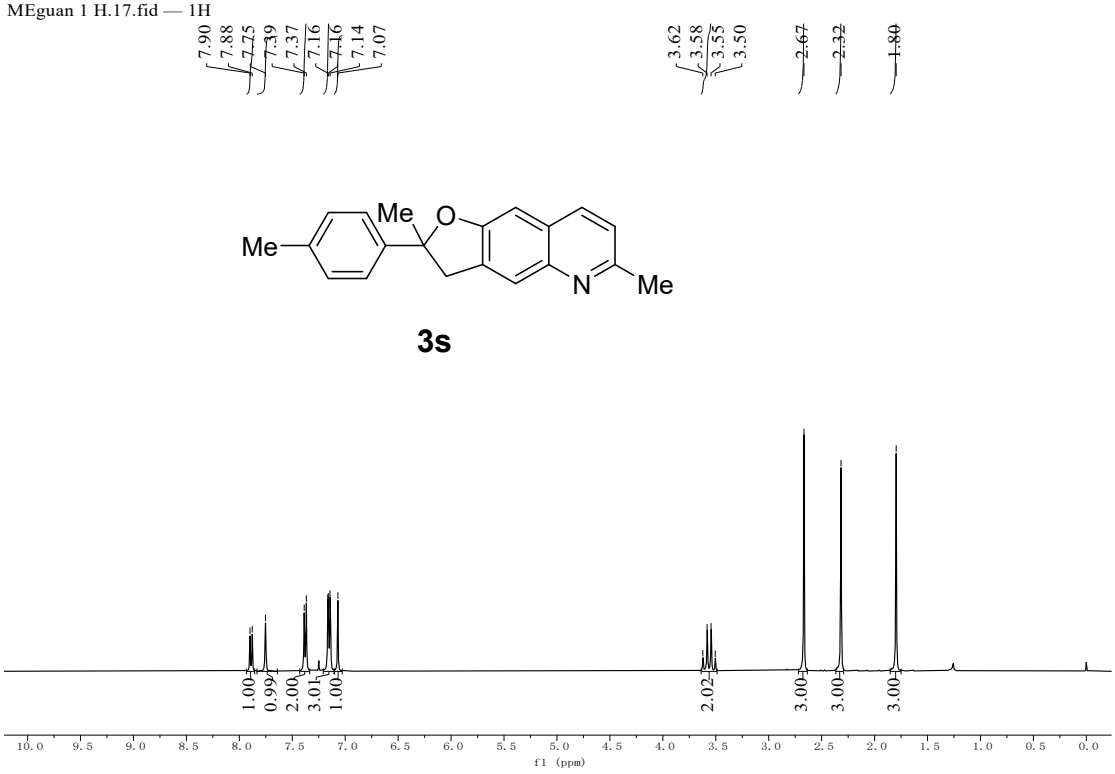
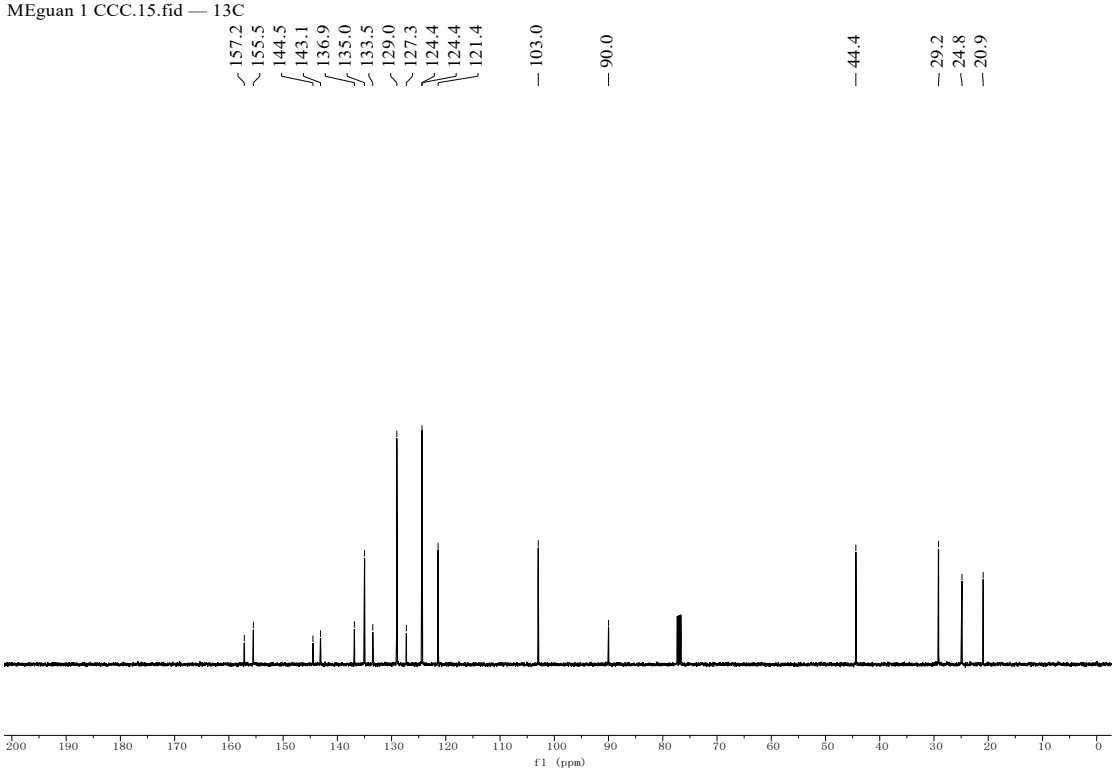
MEguan 1 H.17.fid — 1H



MEguan 1 CCC.15.fid — 13C



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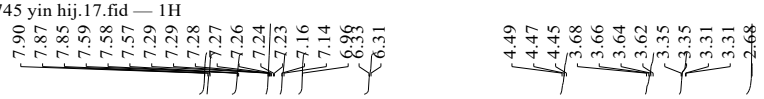
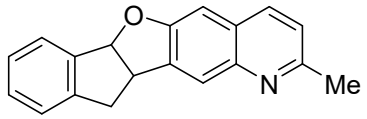
F-745 yin hij.17.fid — 1H





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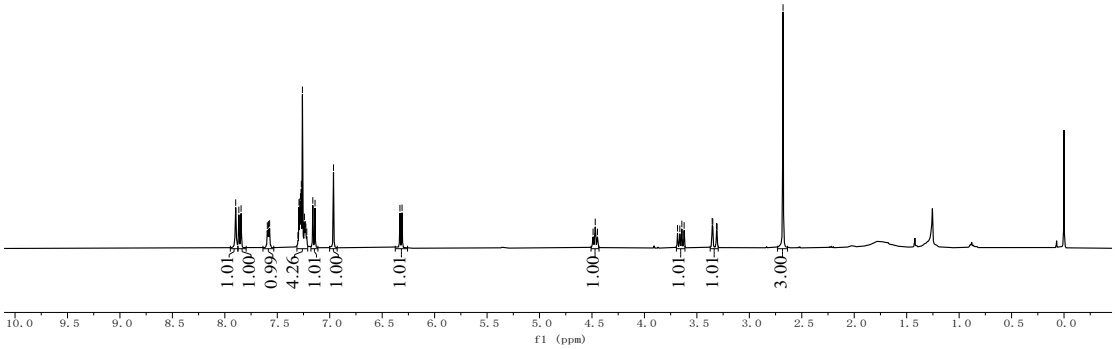
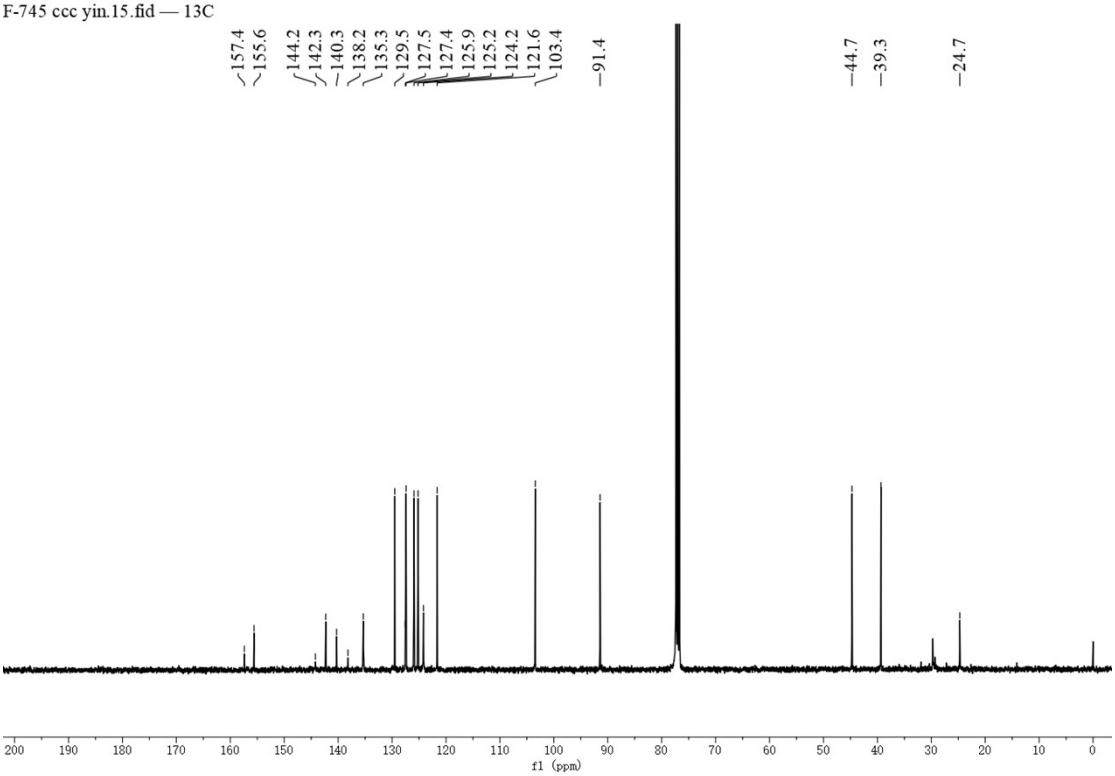


F-745 ccc yin.15.fid — 13C



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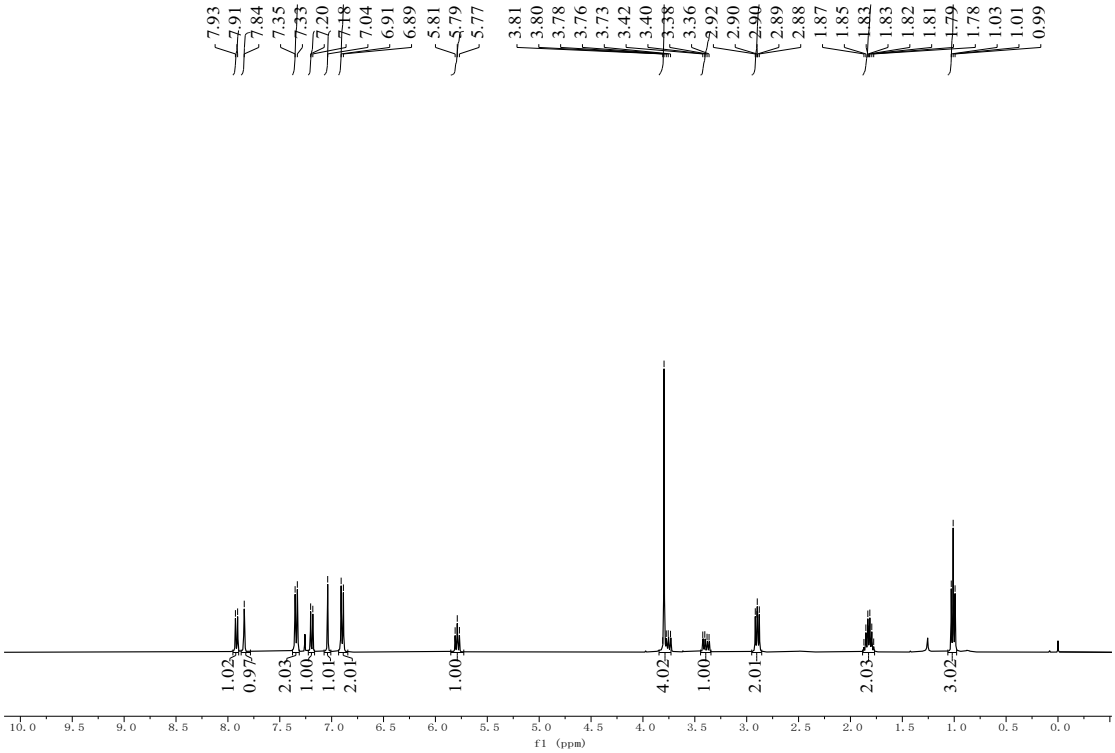
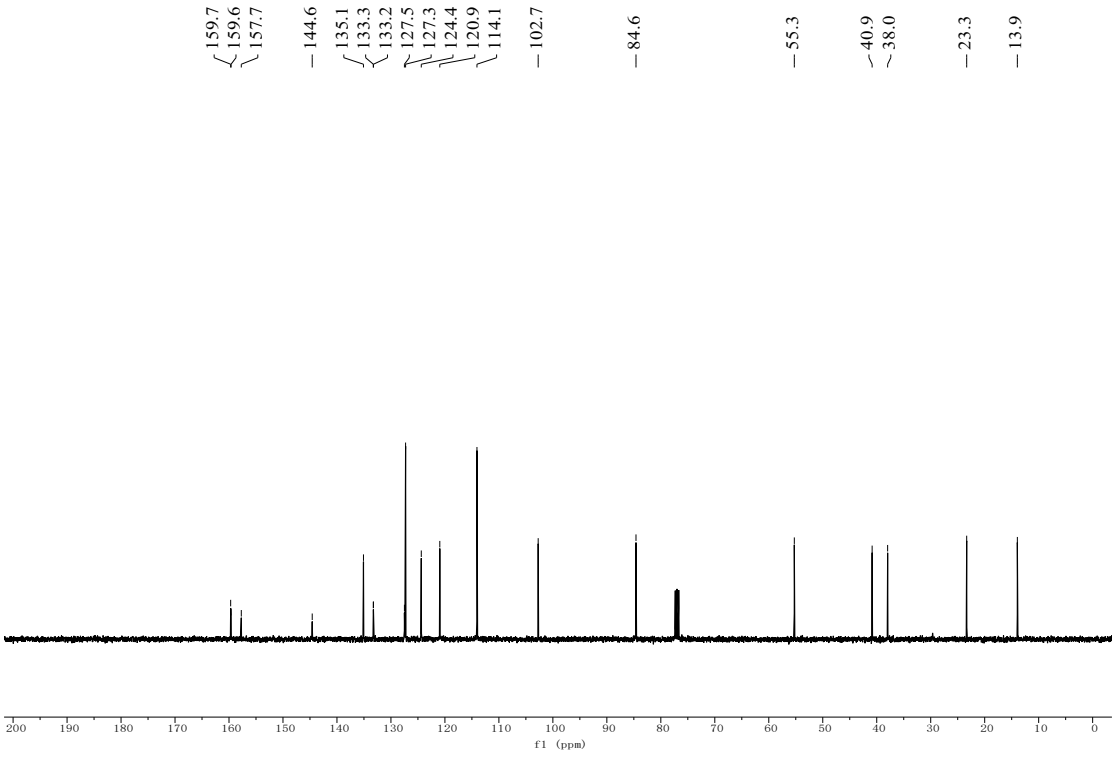
F-708 H.15.fid — 1H

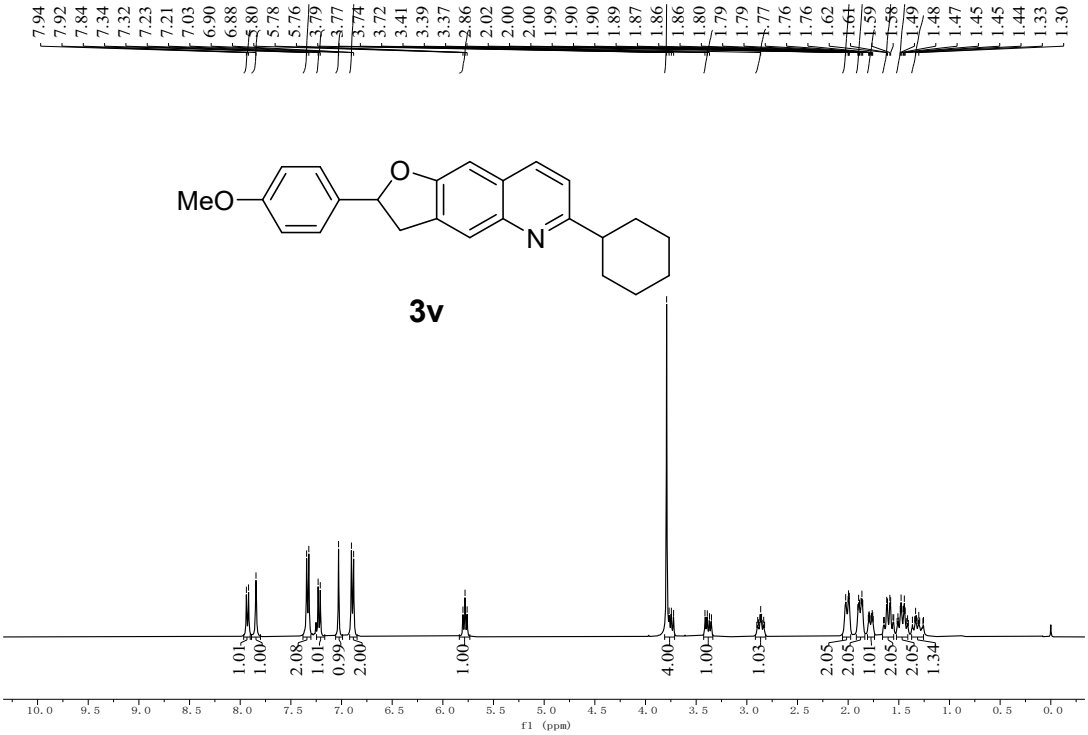


F-708 c.15.fid — 13C

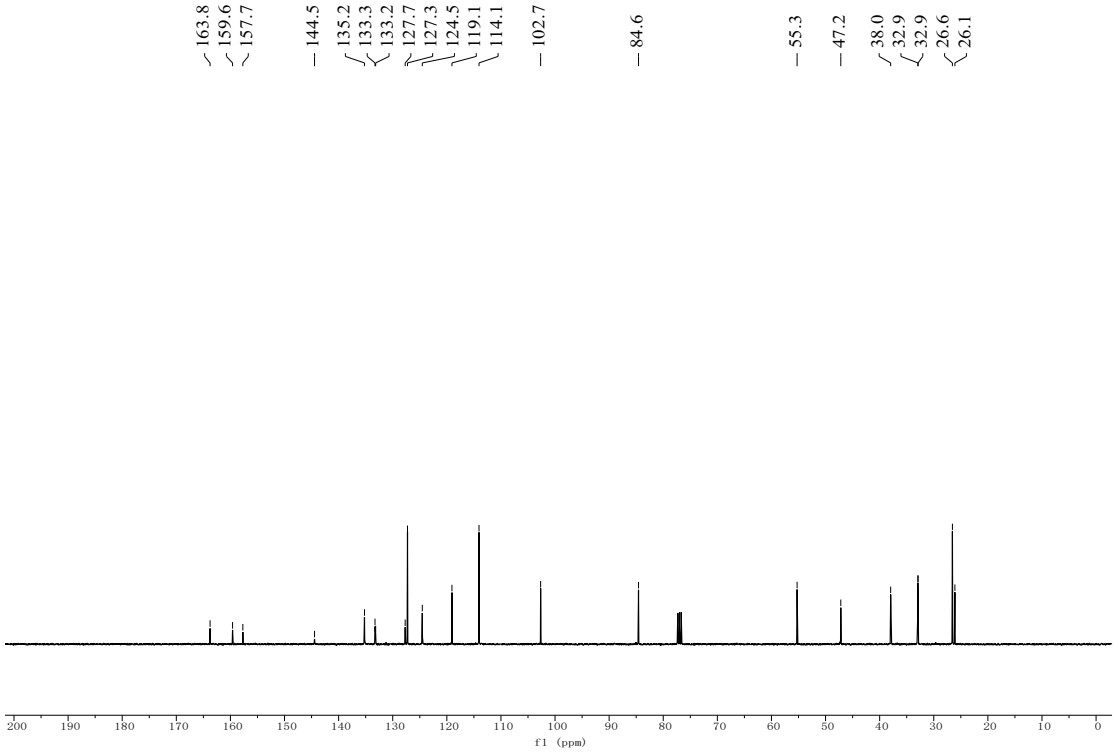


3v

F bao 6 guan HH.15.fid — 1H



F bao 6 guan cc.15.fid — 13C



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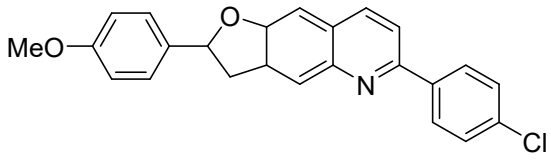
F phcl bao H HH.15.fid — 1H



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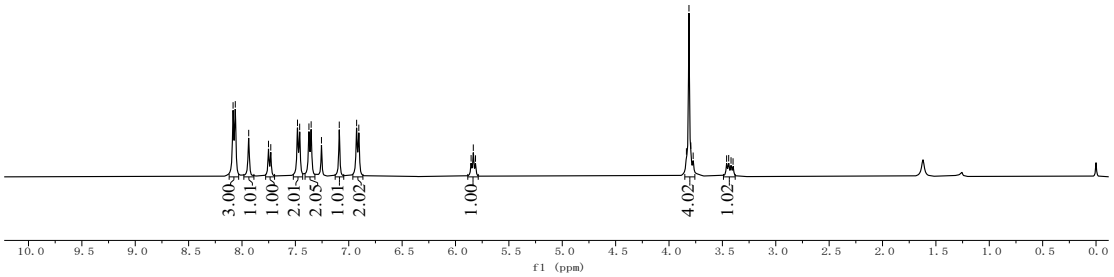
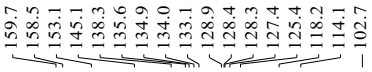
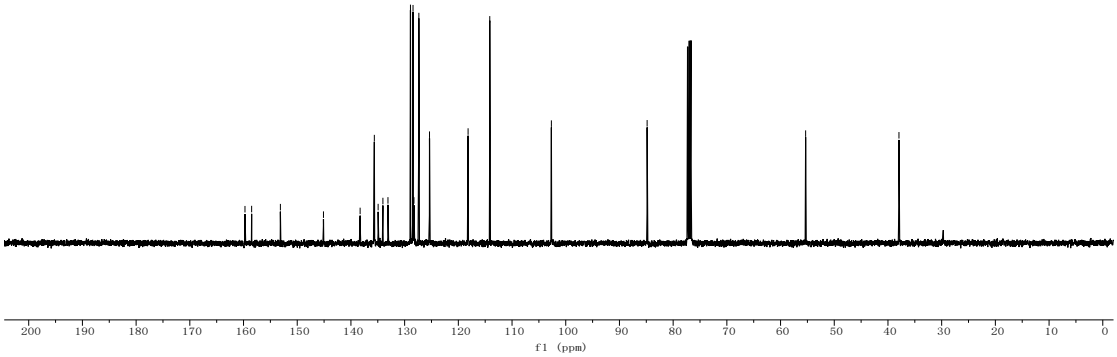


F ph cl bao CCC.15.fid — 13C





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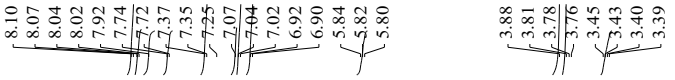

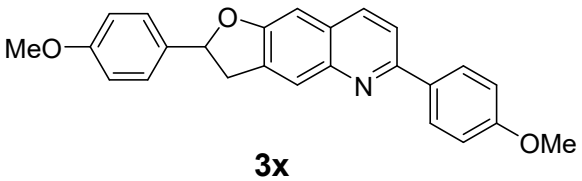

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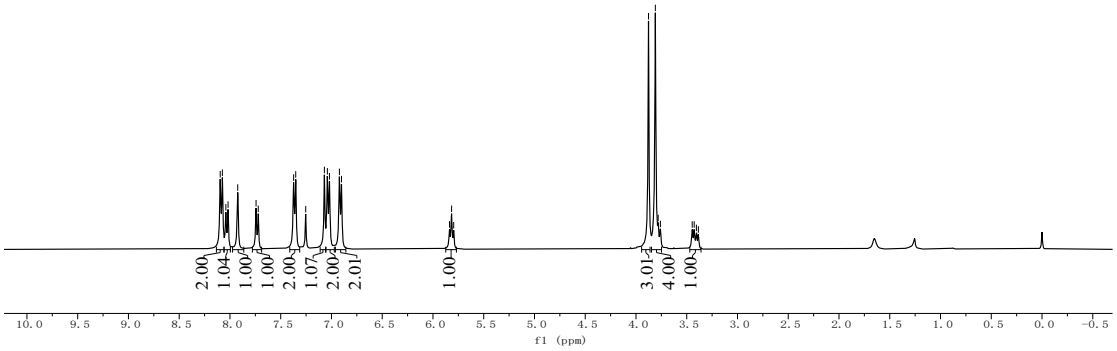

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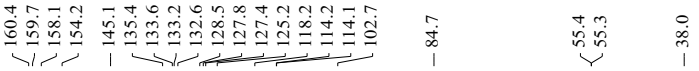

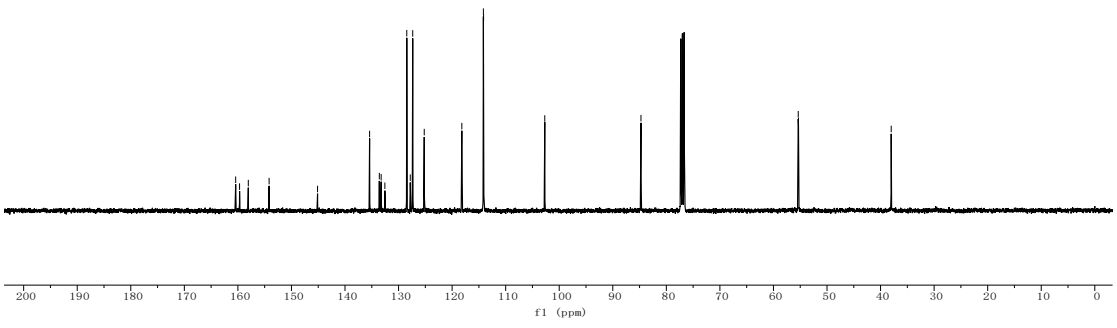

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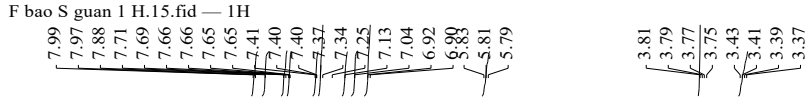
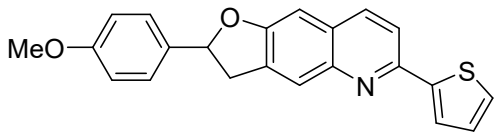
F bao S guan 1 H.15.fid — 1H





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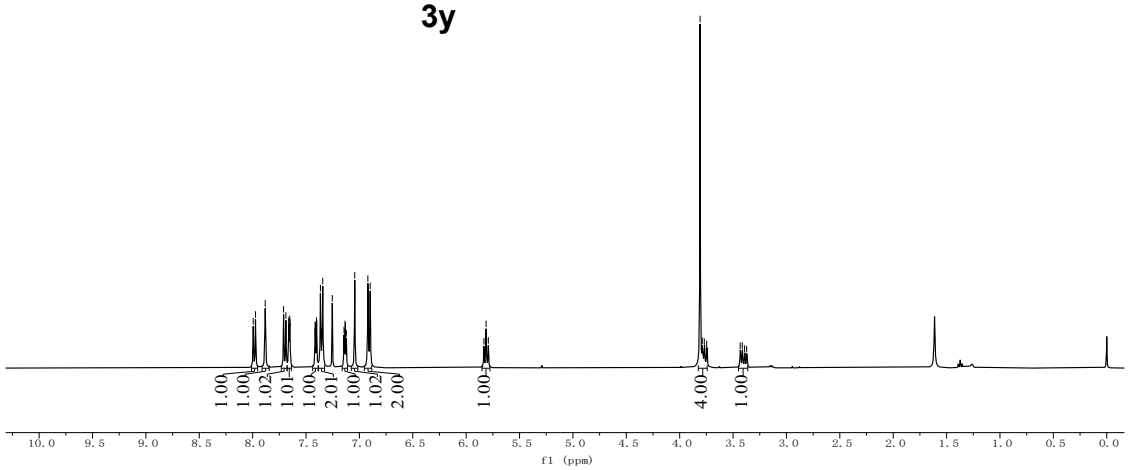

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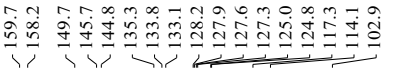
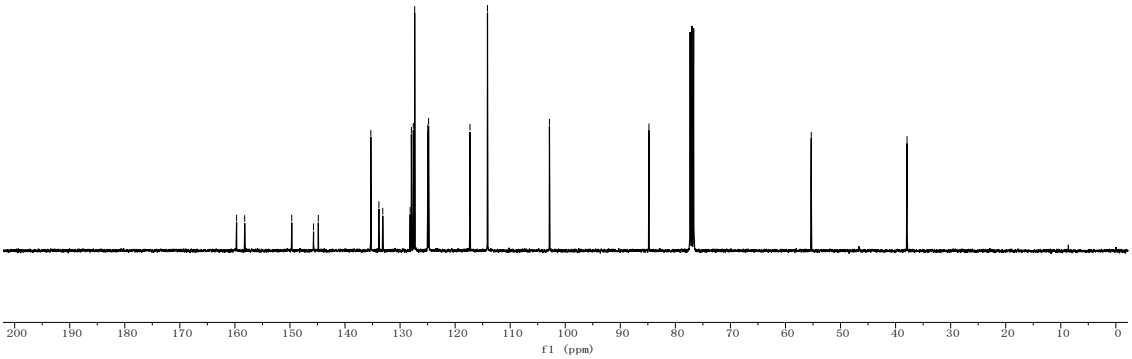
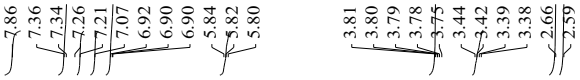
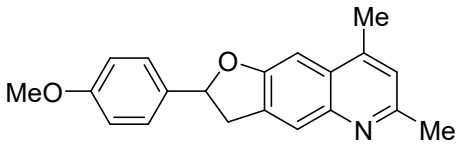




3z

2me H.15.fid — 1H





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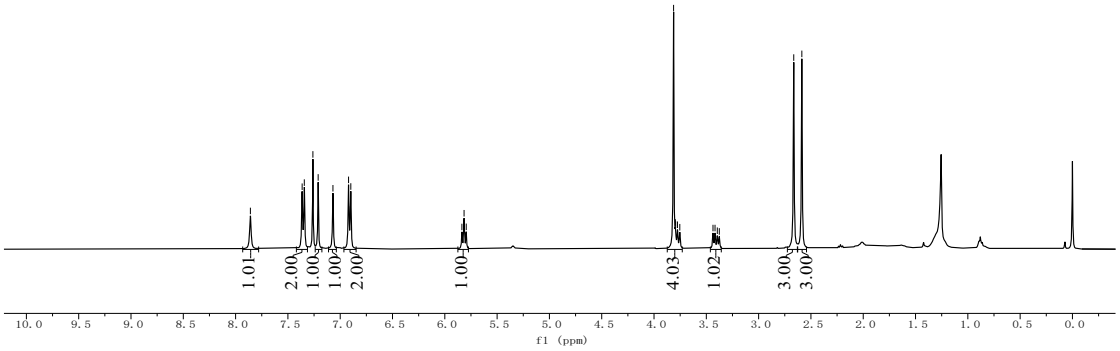

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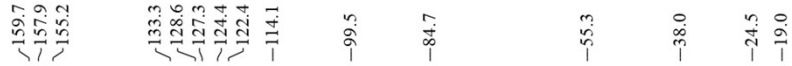
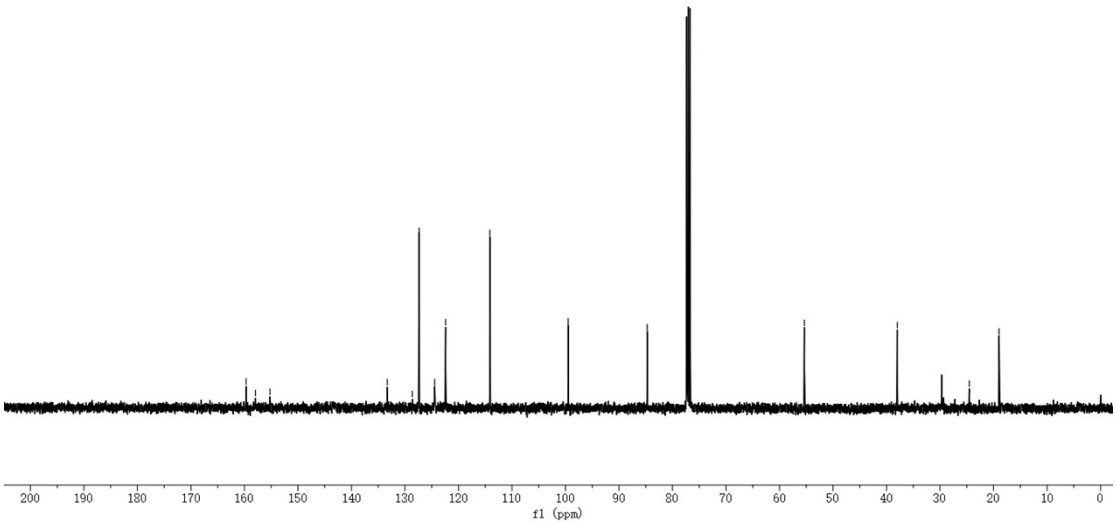
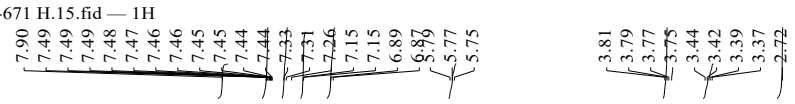
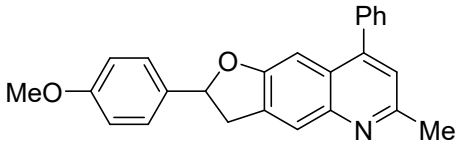




3aa

F-671 H.15.fid — 1H





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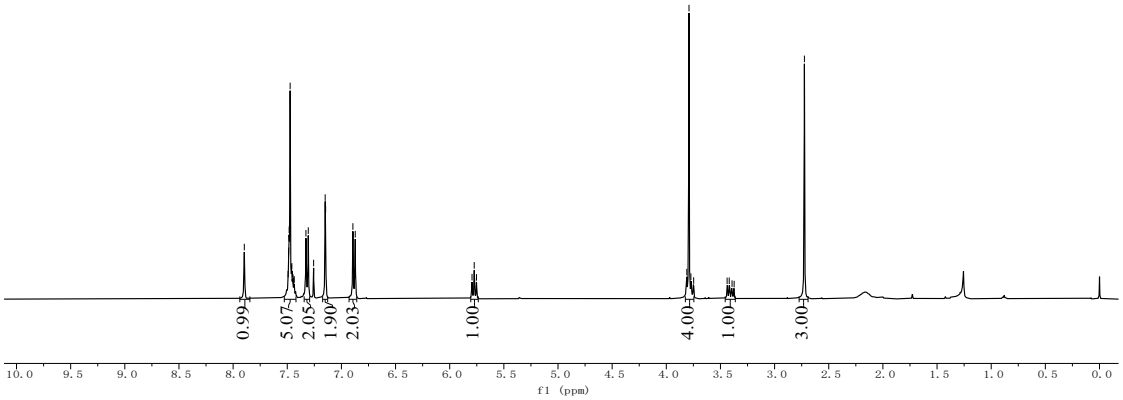
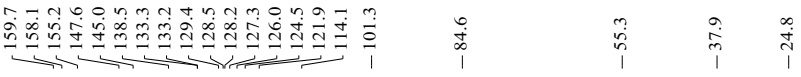
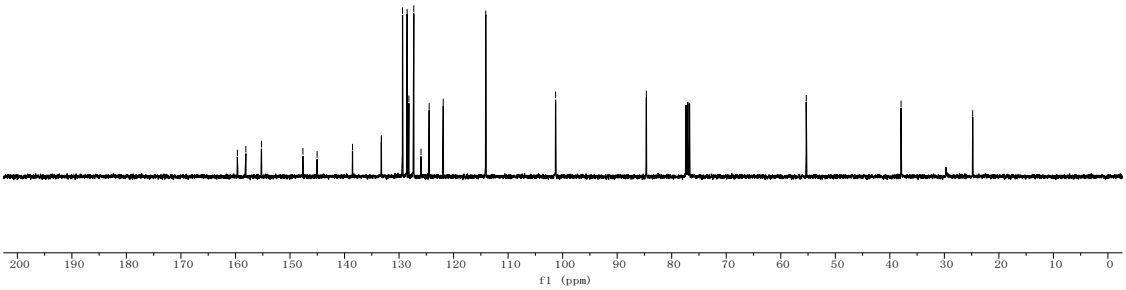


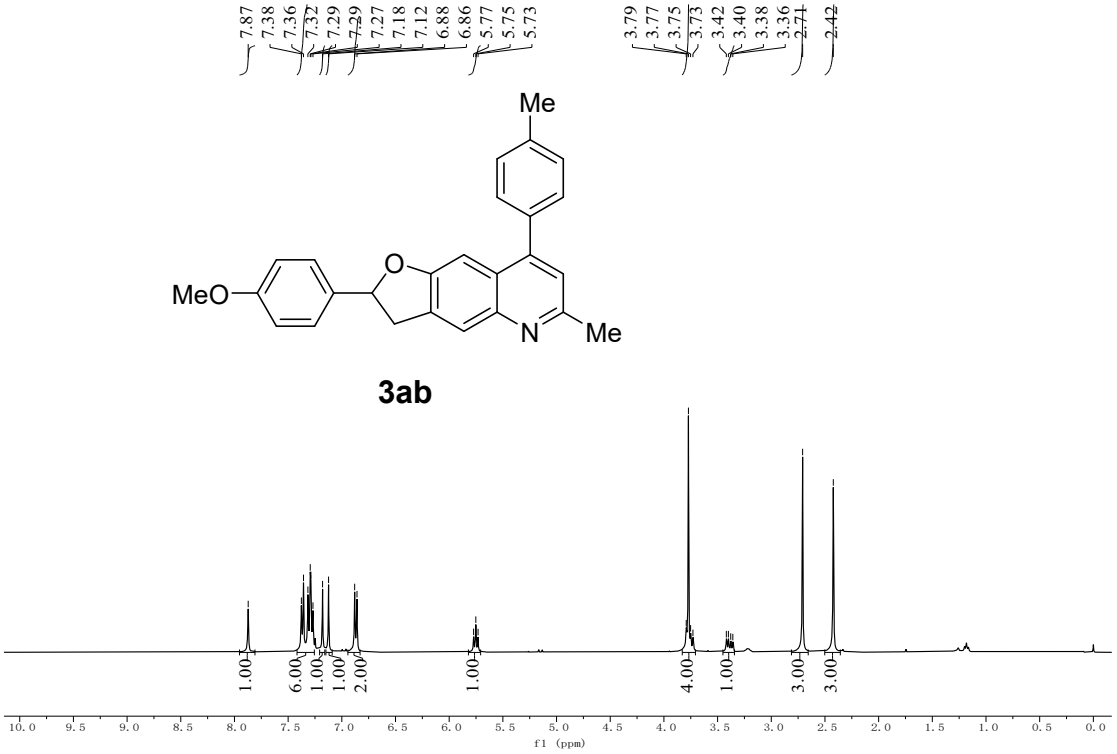
F-671 C.15.fid — 13C



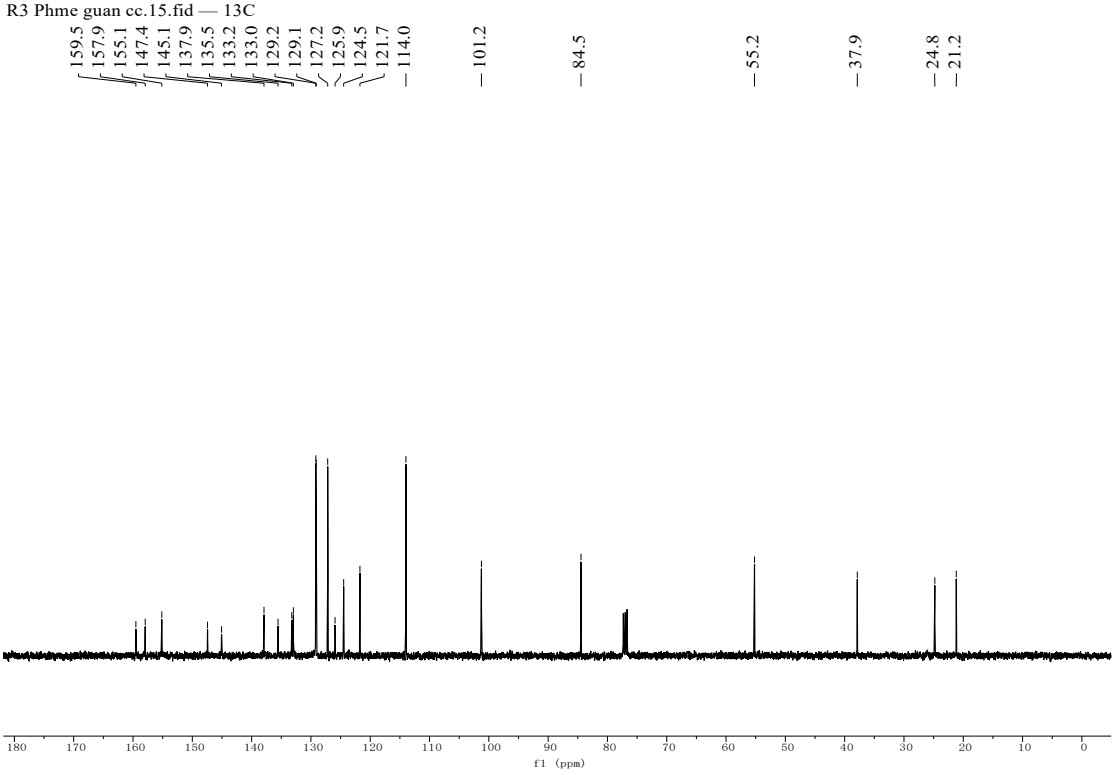


3ab

R3 Phme guan HH.15.fid — 1H



R3 Phme guan cc.15.fid — 13C



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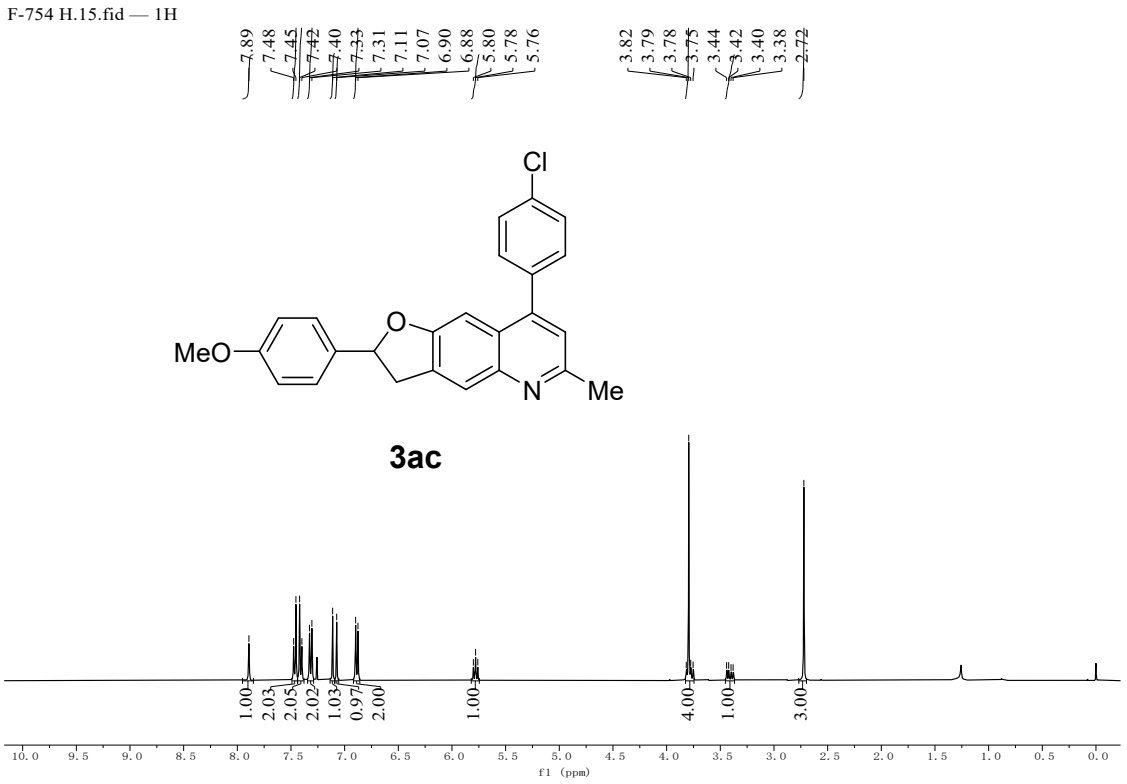
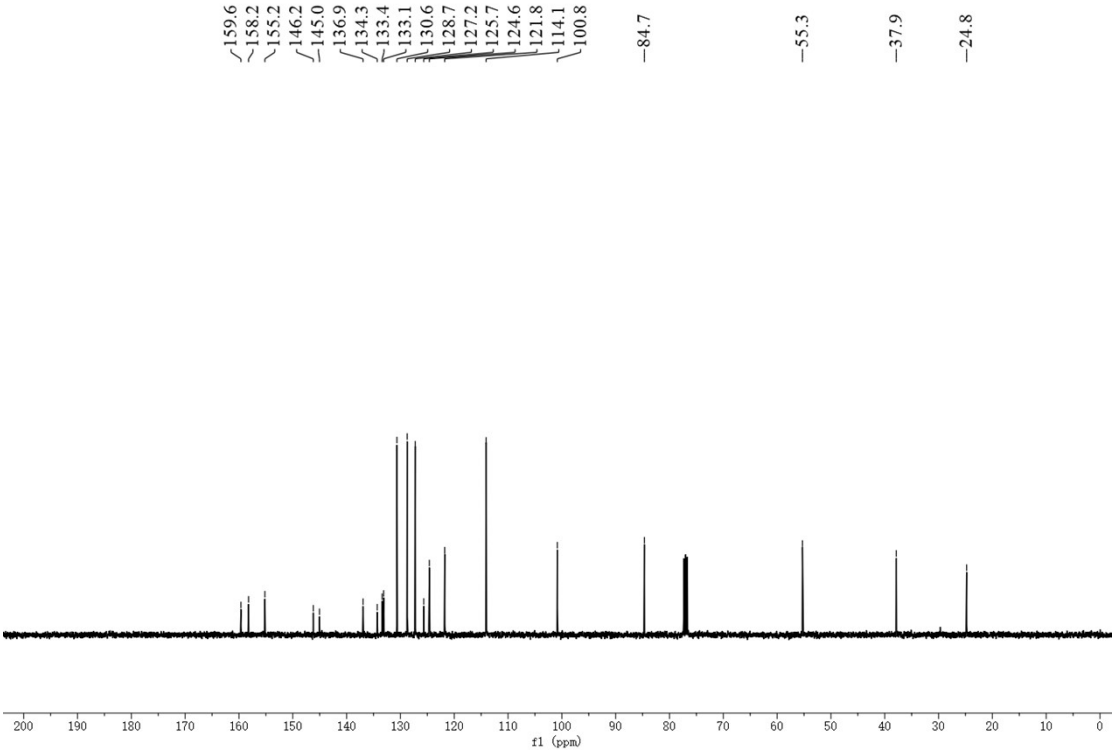
F-754 H.15.fid — 1H

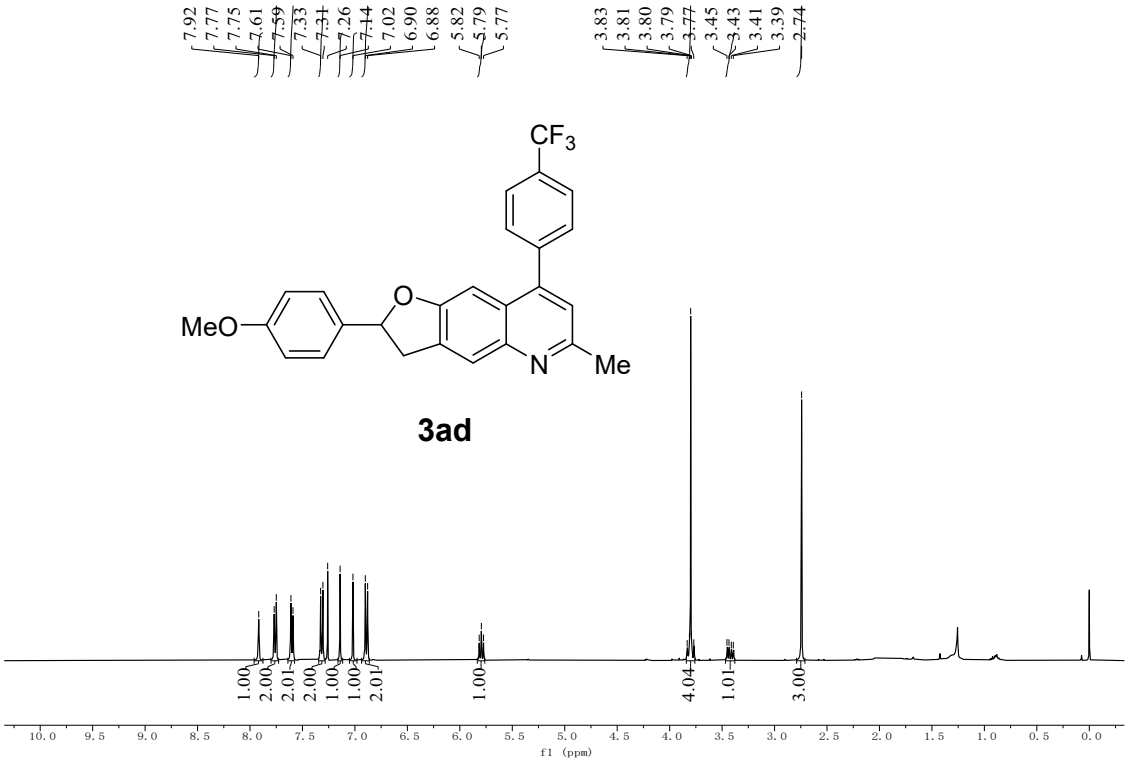


F-754 C.15.fid — 13C

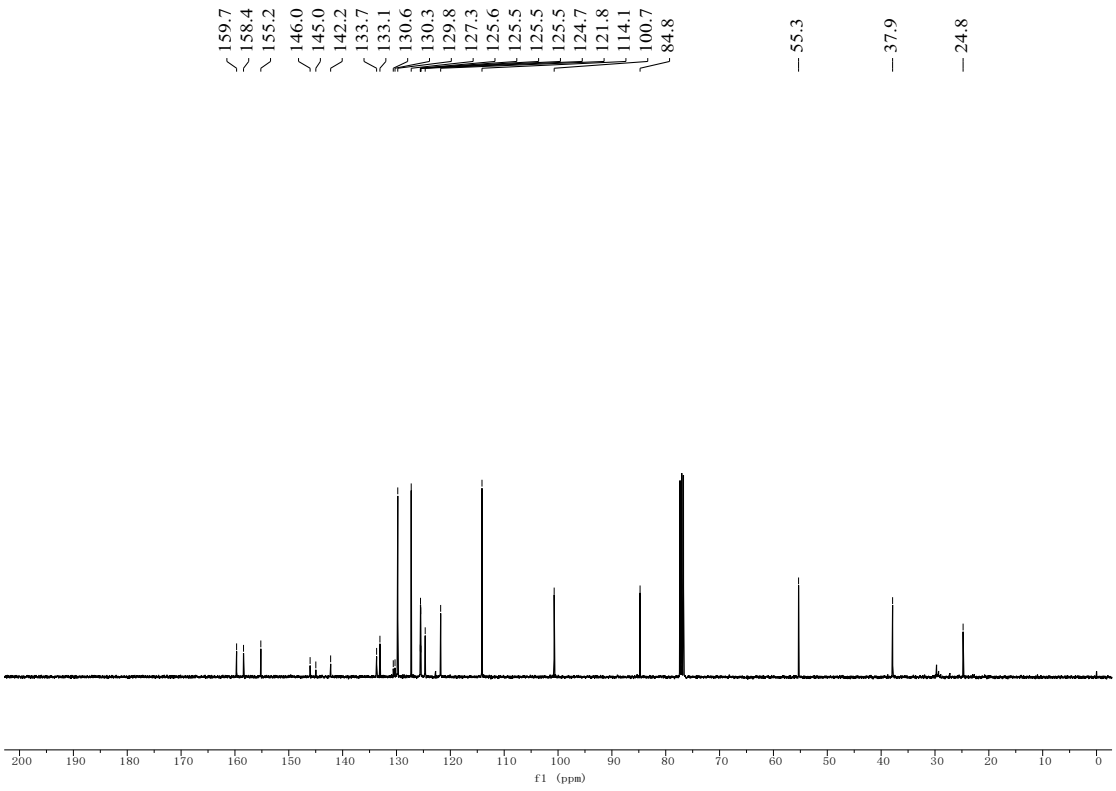


3ad

F-686 H.15.fid — 1H

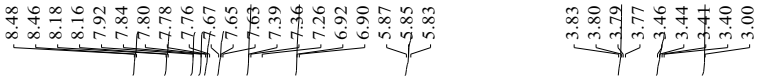


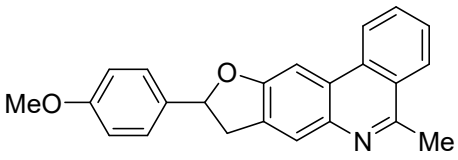
F-686 2h c.15.fid — 13C



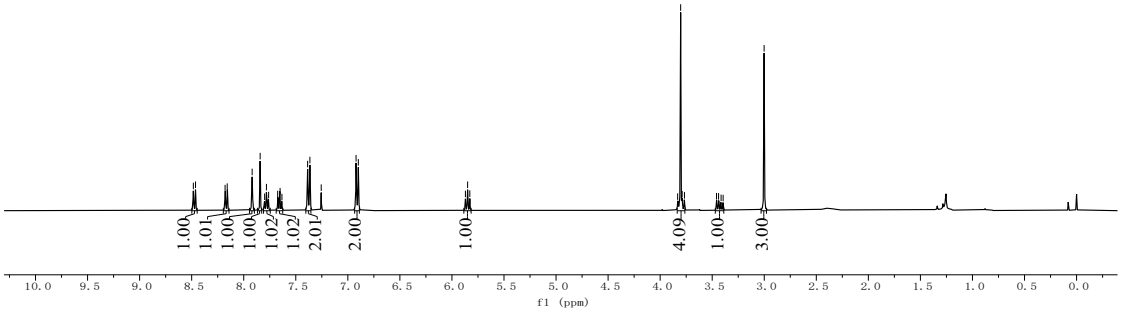
4a

Ph guan hou H.15.fid — 1H

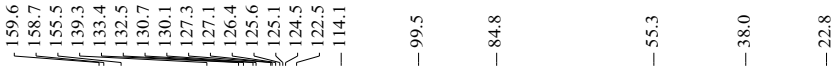


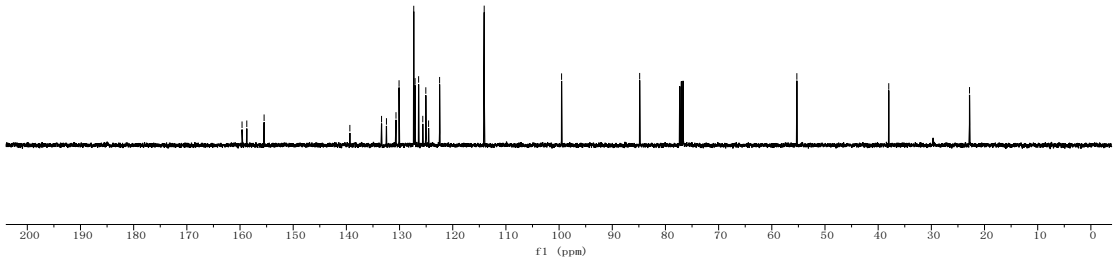


4a



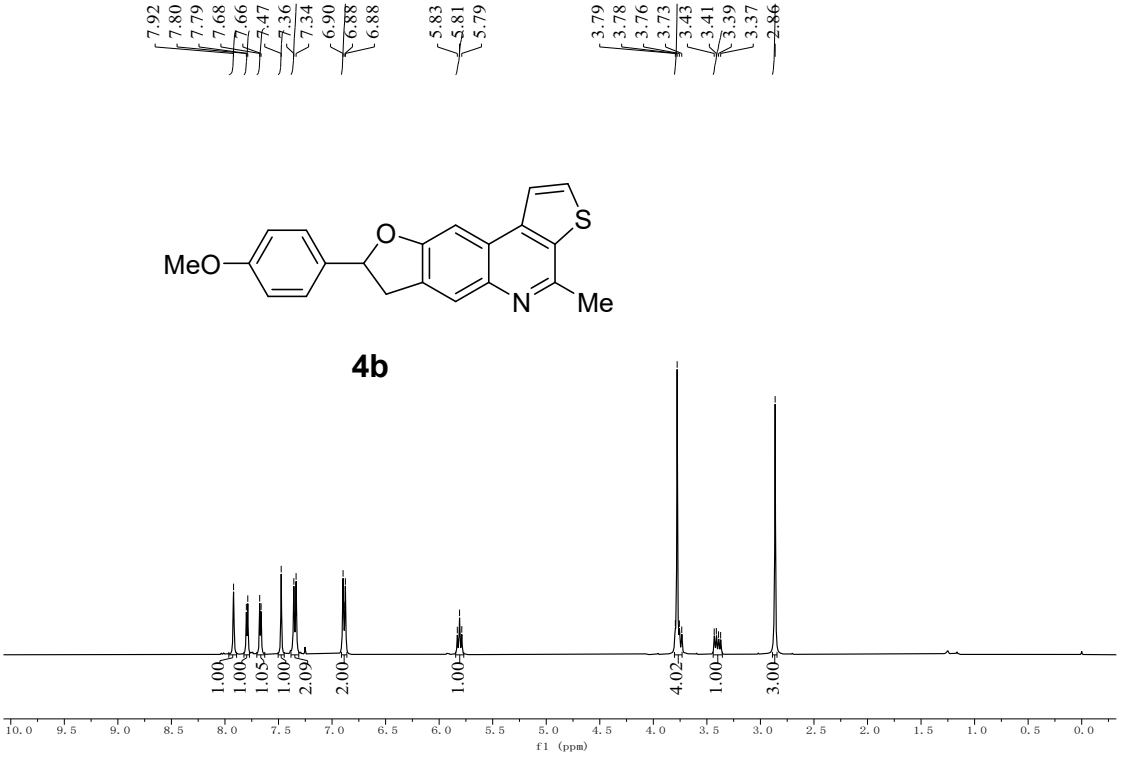
Ph guan hou CCC.15.fid — 13C



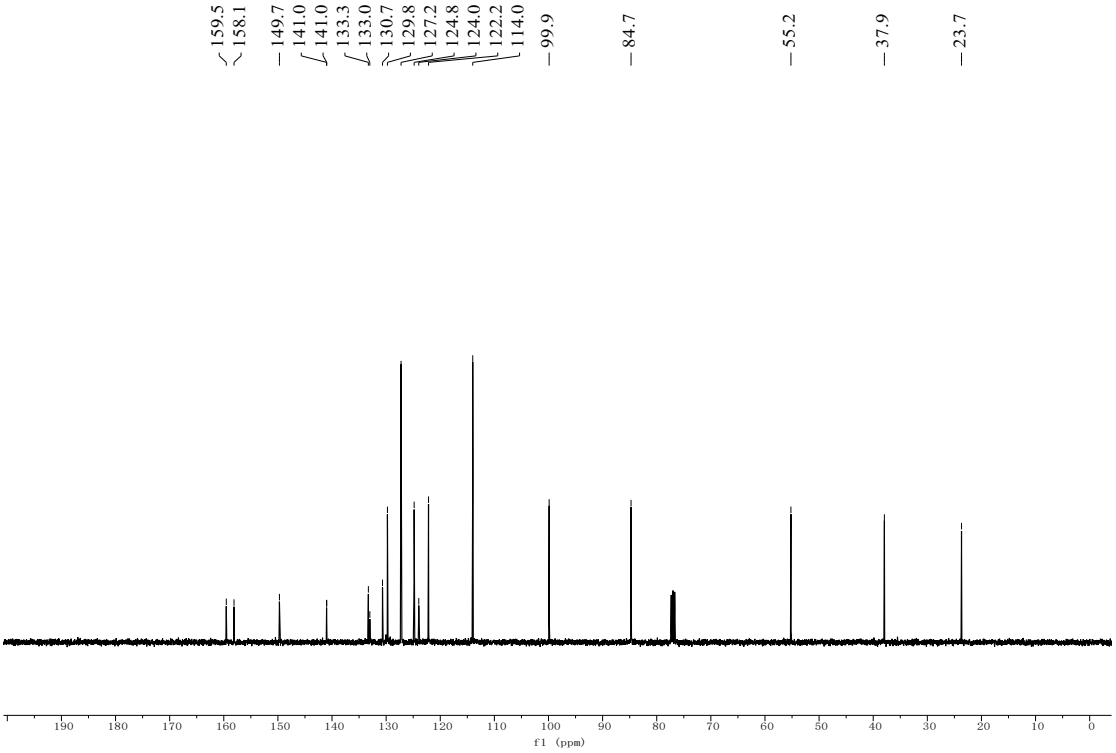


4b

F-S Ac H.15.fid — 1H

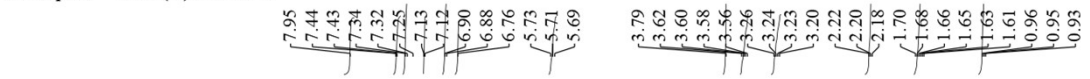


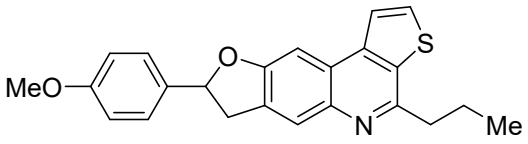
F-S Ac c.15.fid — 13C



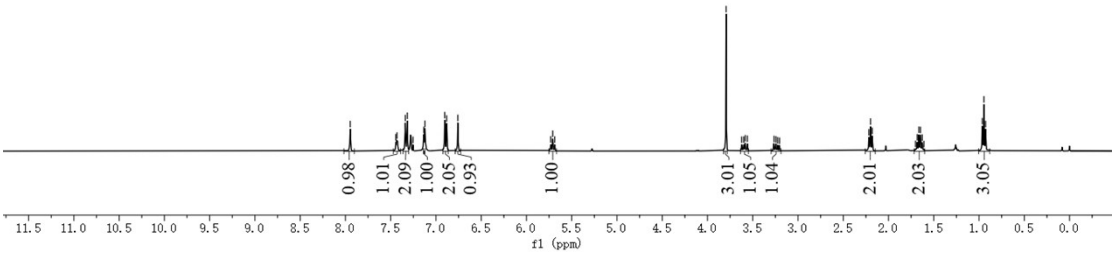
4c

Desktop/S3 — 10-fi-(-1)-o-sc=cc=c

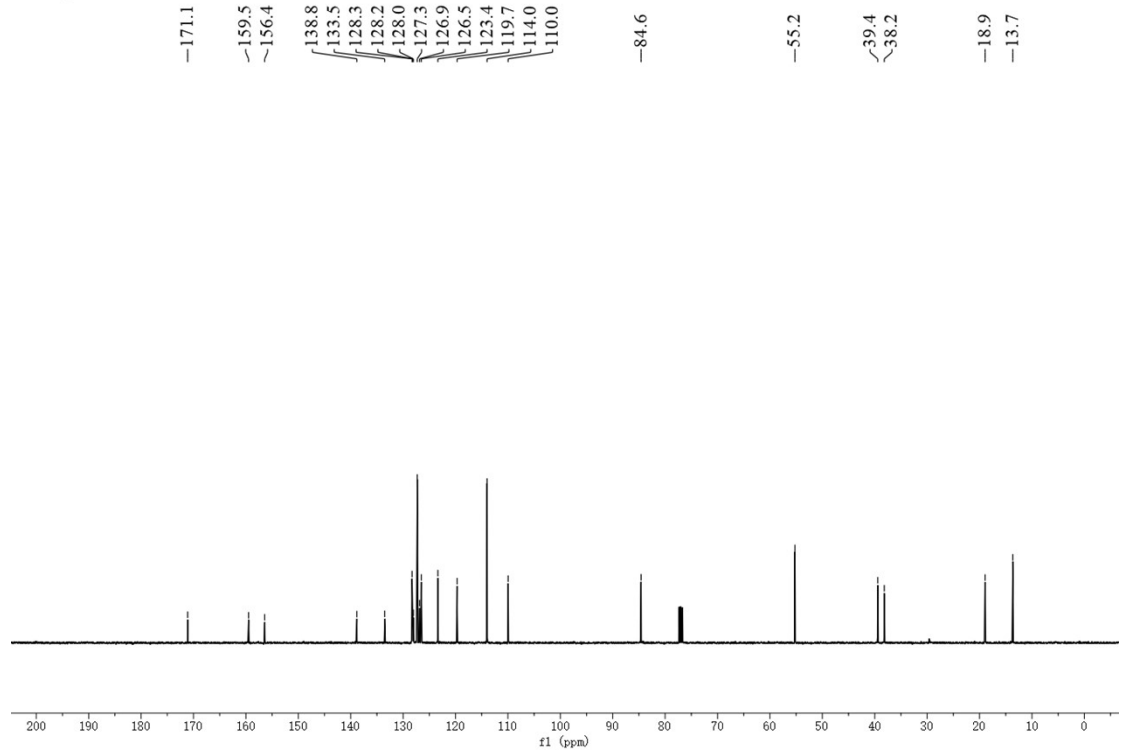




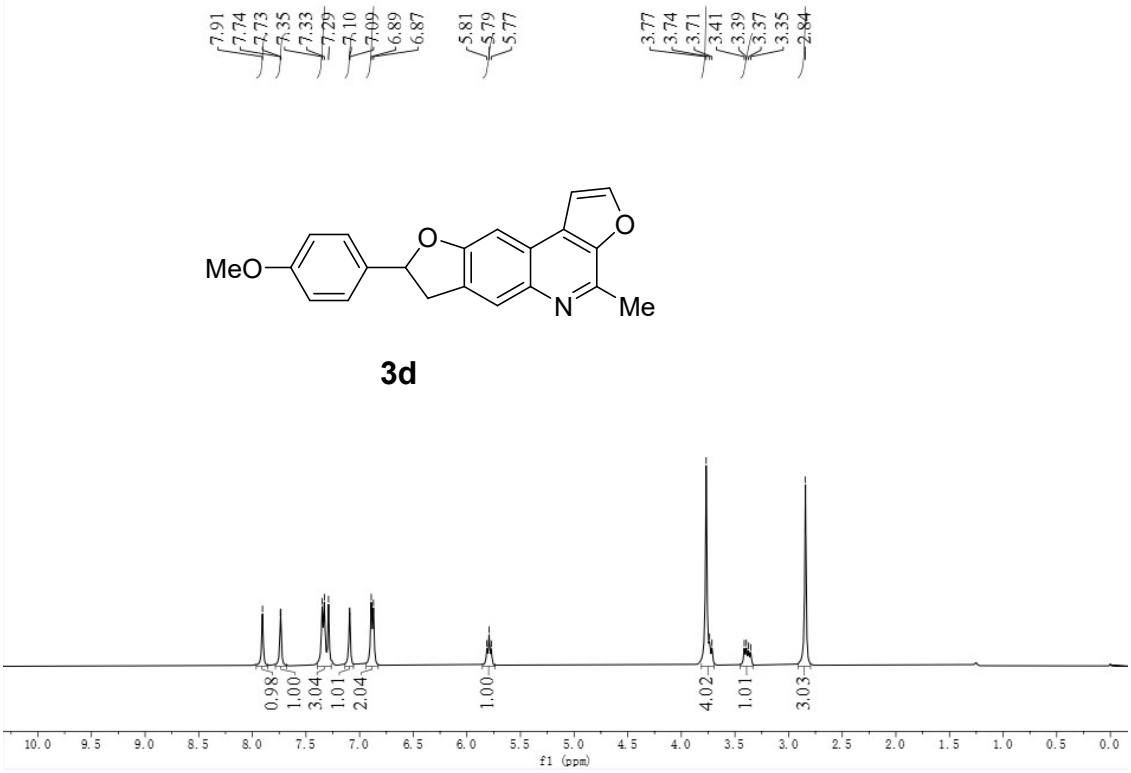
4c



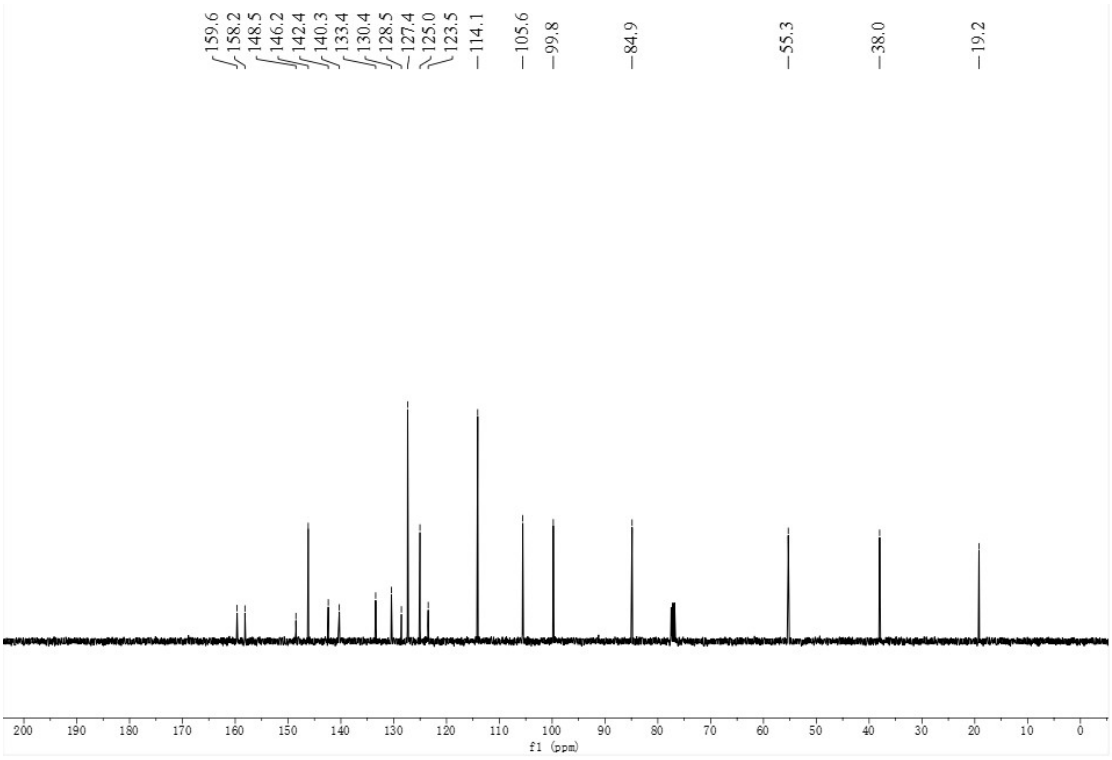
Desktop/S3C — 13C



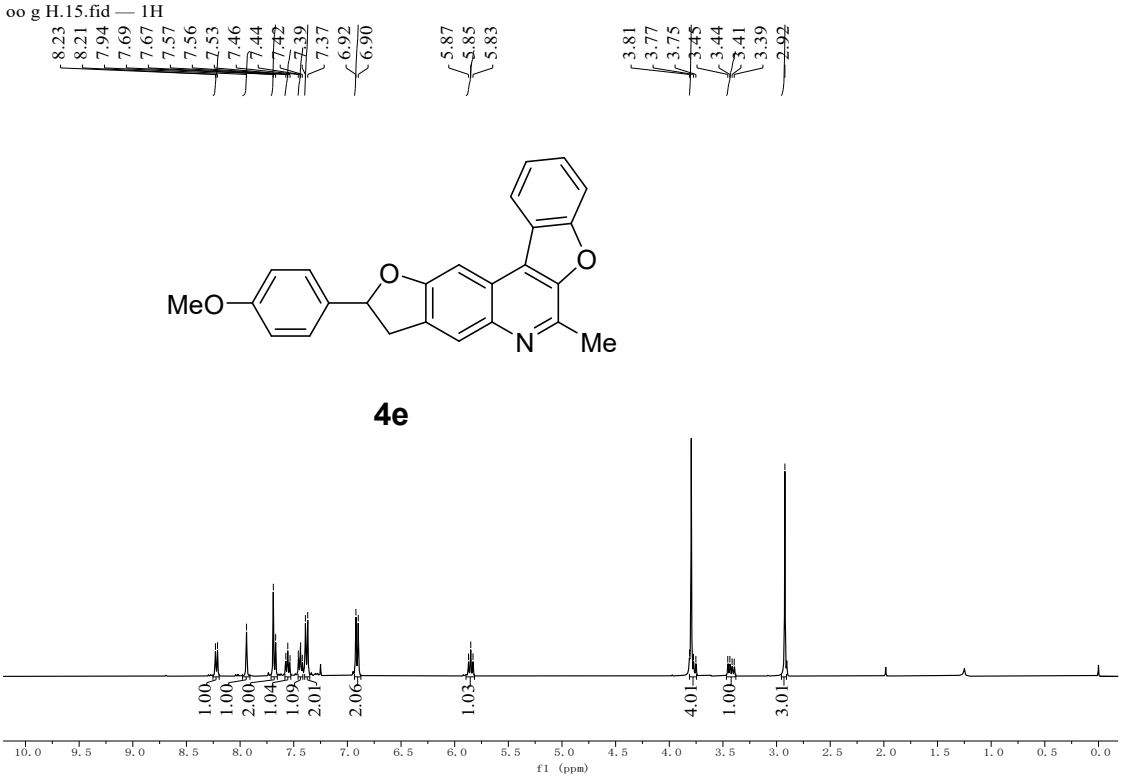
4d

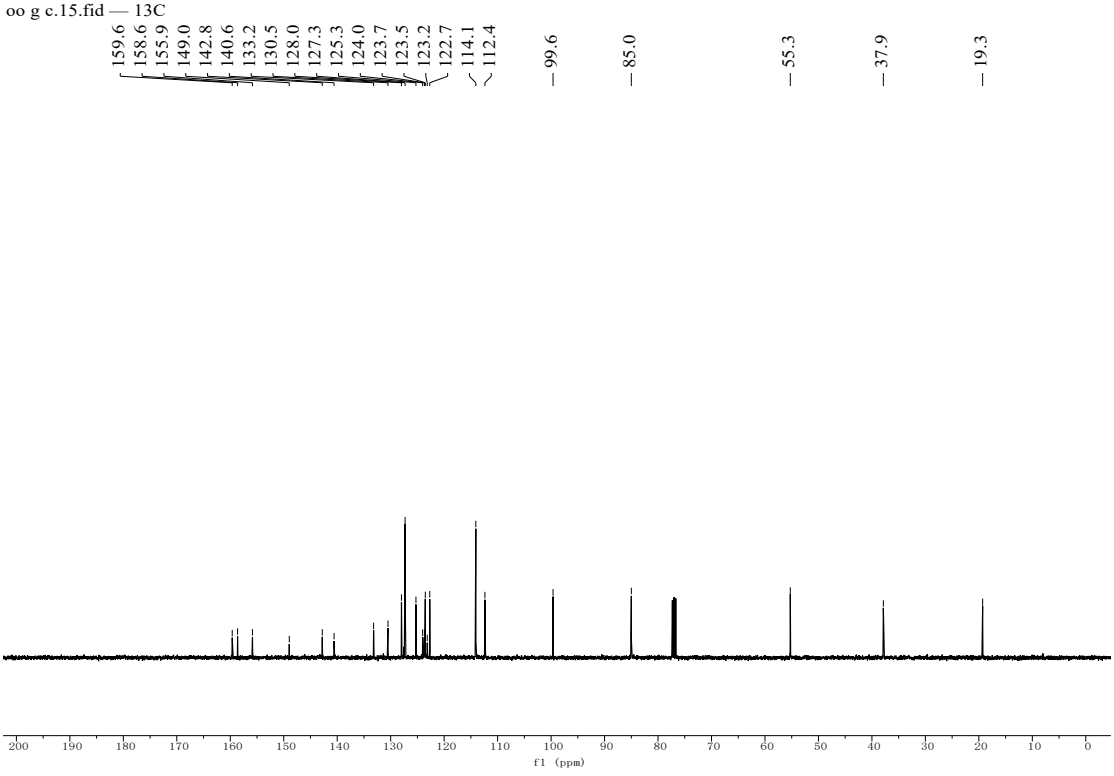

7.91
7.74
7.73
7.35
7.33
7.29
7.10
7.09
6.89
6.87
5.81
5.79
5.77
3.77
3.74
3.71
3.41
3.39
3.37
3.35
2.84
MeO
O
O
N
Me
0.98
1.00
3.04
1.01
2.04
1.00
4.02
1.01
3.03
f1 (ppm)

3d


159.6
158.2
148.5
146.2
142.4
140.3
133.4
130.4
128.5
127.4
125.0
123.5
114.1
105.6
99.8
84.9
55.3
38.0
19.2
f1 (ppm)

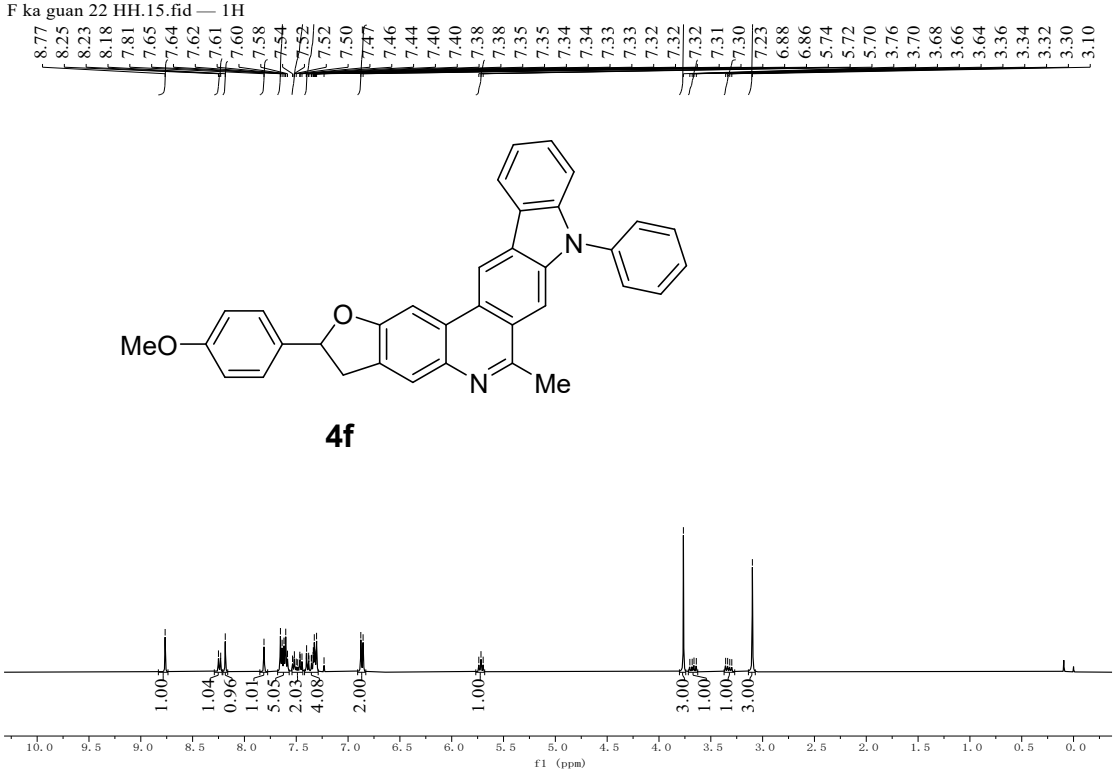
4e


oo g H.15.fid — 1H
8.23
8.21
7.94
7.69
7.67
7.57
7.56
7.53
7.46
7.44
7.42
7.39
7.37
6.92
6.90
5.87
5.85
5.83
3.81
3.77
3.75
3.45
3.44
3.41
3.39
2.92
MeO
O
O
N
Me
4e
1.00
1.00
2.00
1.04
1.09
2.01
2.06
1.03
4.01
1.00
3.01
10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)

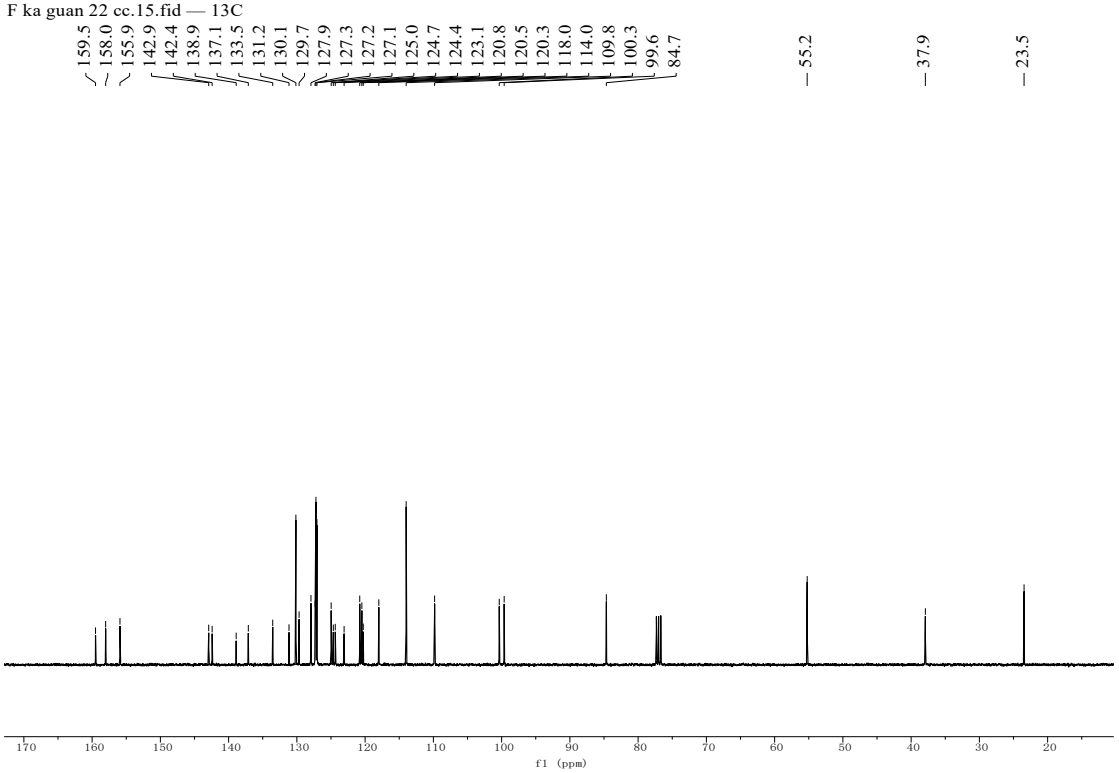

oo g c.15.fid — 13C
159.6
158.6
155.9
149.0
142.8
140.6
133.2
130.5
128.0
127.3
125.3
124.0
123.7
123.5
123.2
122.7
114.1
112.4
99.6
85.0
55.3
37.9
19.3
200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

4f

F ka guan 22 HH.15.fid — 1H

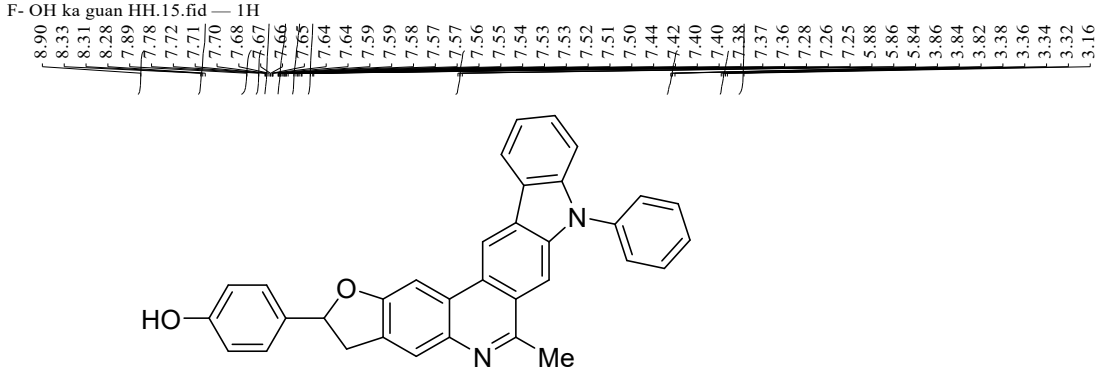


F ka guan 22 cc.15.fid — 13C

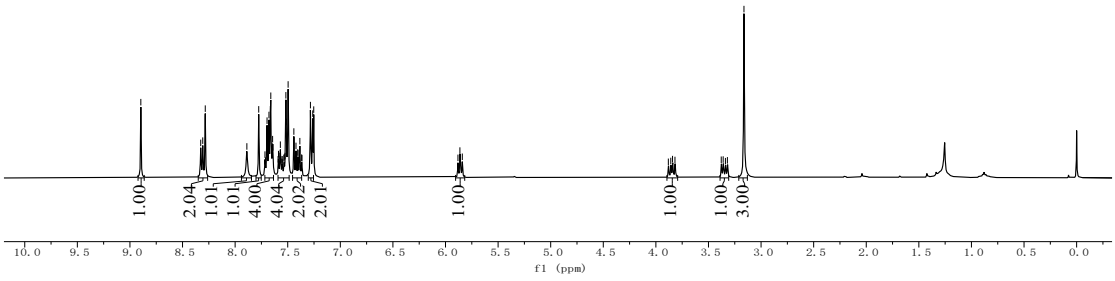


4g

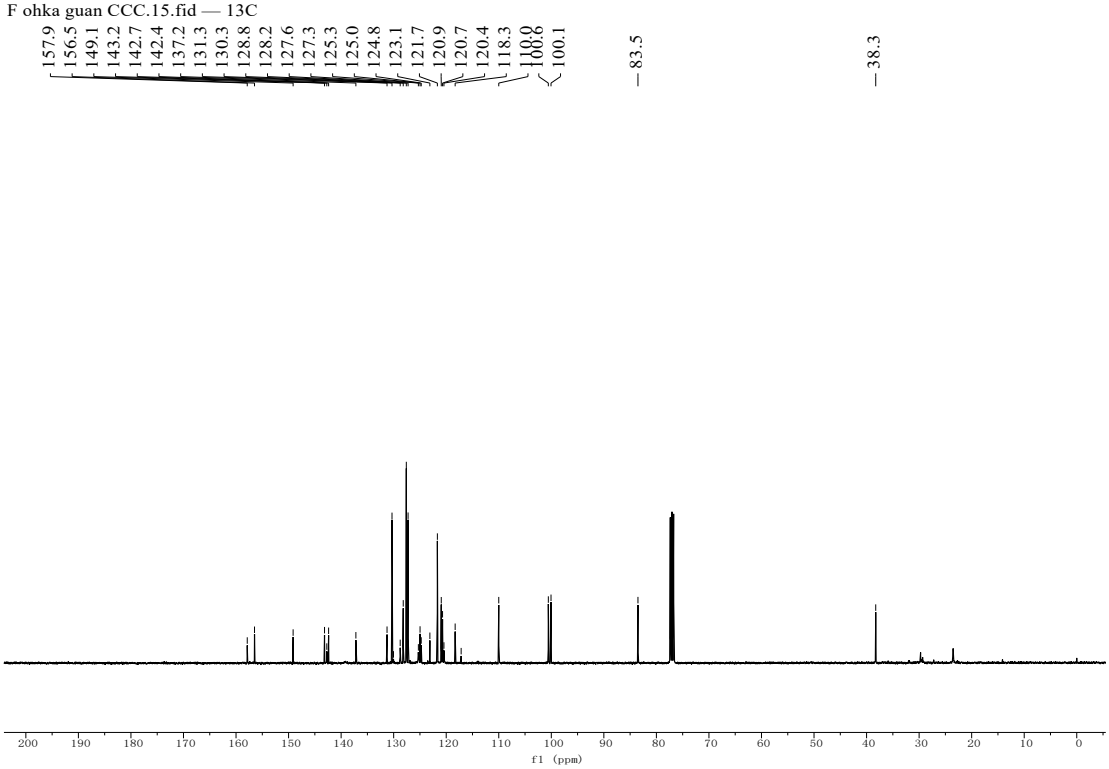
F- OH ka guan HH.15.fid — 1H



4g

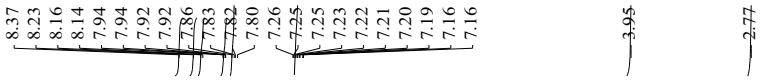


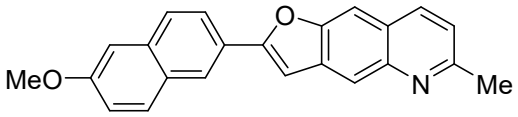
F ohka guan CCC.15.fid — 13C



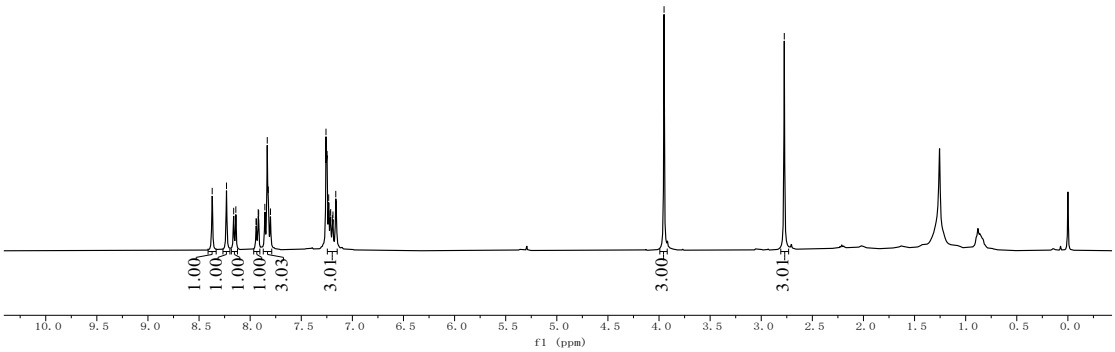
5a

F omenai H.15.fid — 1H

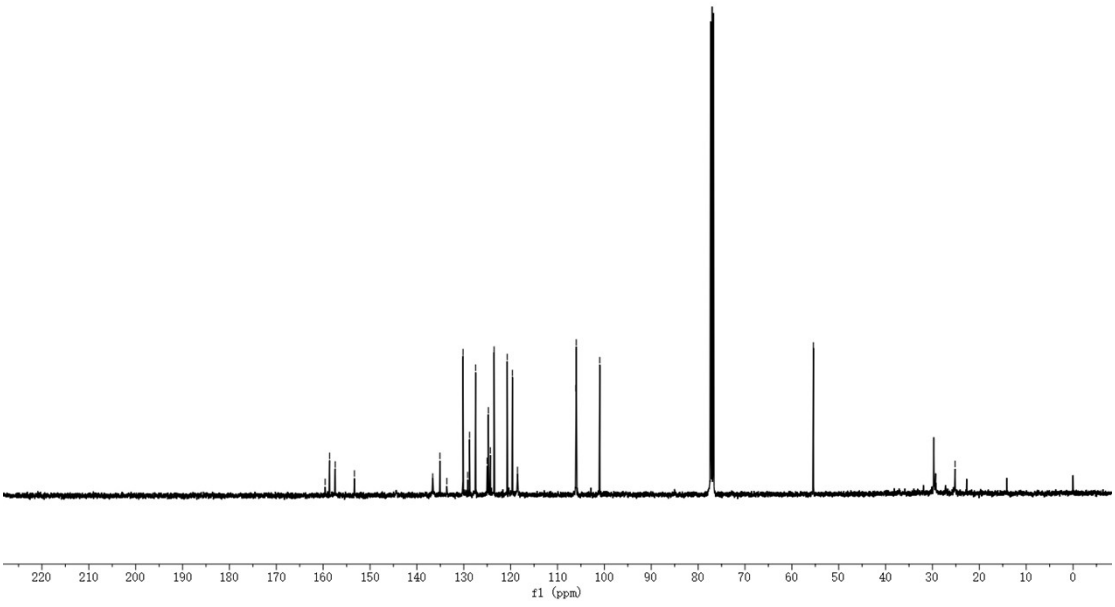




5a

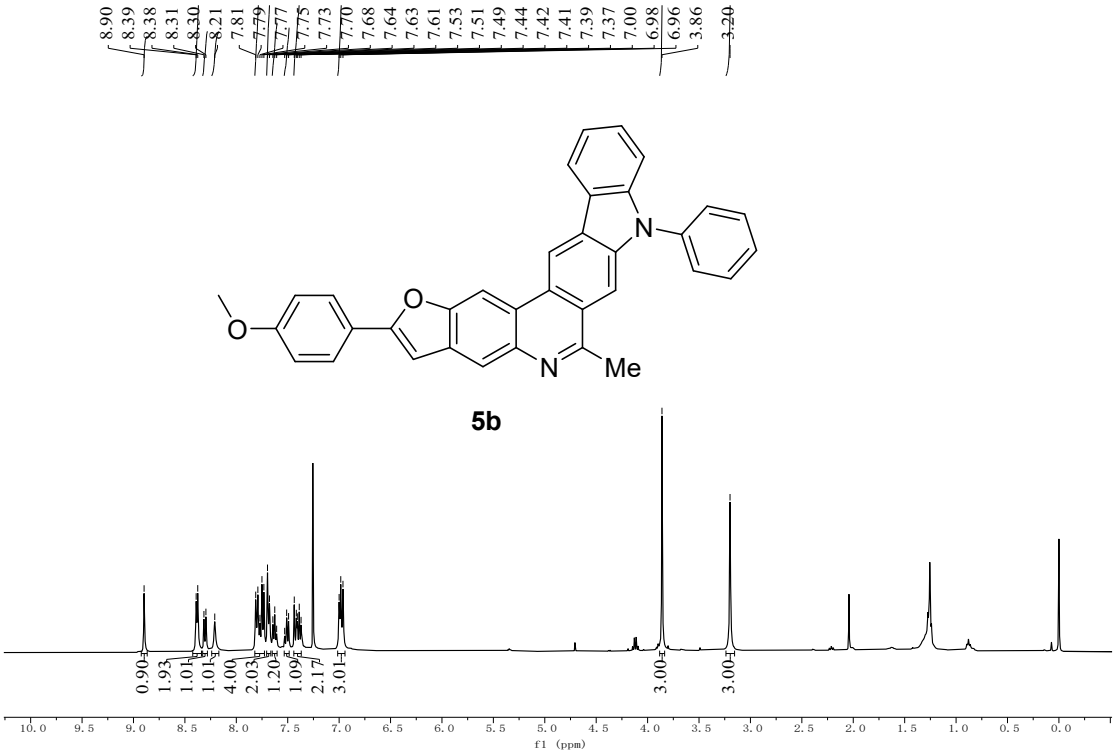


F-ome nai cc.15.fid — 13C



5b

F ka 2 cu.15.fid — 1H



F-ka cc.15.fid — 13C