# Cp*Rh(III) and Cp*Ir(III)-Catalysed Redox-Neutral C-H Arylation with Quinone Diazides: Quick and Facile Synthesis of Arylated Phenols

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## Supporting Information

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# 1. General information

Unless otherwise noted, all reactions were carried out at room temperature under an atmosphere of nitrogen with flame-dried glassware. If reaction was not conducted at room temperature, reaction temperatures are reported as the temperature of the bath surrounding the vessel unless otherwise stated. The dry solvents used were purified by distillation over the drying agents indicated in parentheses and were transferred under nitrogen: THF (Na-benzophenone), 1,2-dichloroethane ($CaH_2$), dichloromethane ($CaH_2$). Anhydrous $CF_3CH_2OH$, $CH_3CN$, DMF and MeOH were purchased from Acros Organics and stored under nitrogen atmosphere. Commercially available chemicals were obtained from commercial suppliers and used without further purification unless otherwise stated.

Proton NMR ($^1H$) were recorded at 400 MHz, and Carbon NMR ($^{13}C$) at 101 MHz NMR spectrometer unless otherwise stated. The following abbreviations are used for the multiplicities: s: singlet, d: doublet, t: triplet, q: quartet, m: multiplet, br s: broad singlet for proton spectra. Coupling constants (*J*) are reported in Hertz (Hz).

High-resolution mass spectra (HRMS) were recorded on a BRUKER VPEXII spectrometer with EI and ESI mode unless otherwise stated.

Analytical thin layer chromatography was performed on Polygram SIL G/$UV_{254}$ plates. Visualization was accomplished with short wave UV light, or $KMnO_4$ staining solutions followed by heating. Flash column chromatography was performed using silica gel (200-300 mesh) with solvents distilled prior to use.

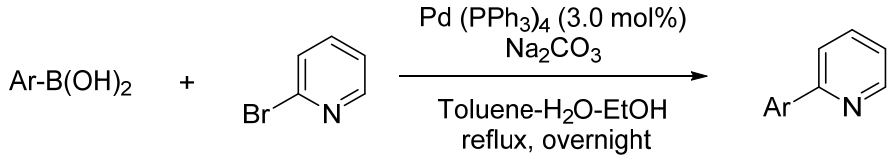
No attempts were made to optimize yields for substrate synthesis.

## 2. Synthesis of substrates 1, 2 and 6

The substrates of arylpyridines, heteroarylpyridines, arylpyrimidines and heteroarylpyrimidines were prepared accroding to the procedure reported by Iwasawa.[1] Quinone diazides derivatives **2** were prepared following the procedure reported by Baran.[2] Phenylpyrazoles derivatives were commercially available. 1-(Pyrimidin-2-yl)-1*H*-indole derivatives **6** were prepared following the procedure reported by Lygin.[3] All the characteristic data are consistent with the data reported before.[4-10]

**Preparation and characterization of arylpyridines and heteroarylpyridines**

**General procedure A:**

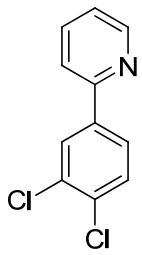



**8** **9** **1**

To a stirred solution of 2-bromopyridine **9** (0.5 g, 3.2 mmol) in toluene (12 mL), ethanol (2.3 mL) and $H_2O$ (12 mL) was added $Na_2CO_3$ (2.5 g, 23.6 mmol) followed by $Pd(PPh_3)_4$ (0.1 g, 0.1 mmol) and arylboronic acid **8** (4.2 mmol) under $N_2$ in 100 mL two-necked flask. The mixture was refluxed overnight, and then cooled to room temperature. To the reaction mixture were added $H_2O$ and $CH_2Cl_2$, then extracted with $CH_2Cl_2$ three times, and the combined organic layer was washed with brine and dried over $Na_2SO_4$. After removal of the solvent under reduced pressure, the residue was purified by silica-gel column chromatography to give the compound **1.**

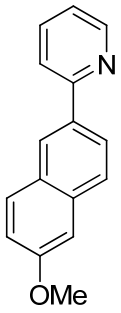
**Characterization of substrates 1**

**2-(3,4-dichlorophenyl)pyridine (1g)**



Following general procedure A, compound **1g** was obtained in 84% yield (0.6 g, 2.7 mmol) as a white solid after column chromatography (eluent = Petroleum ether/EtOAc 16:1 v/v). $\mathbf{R_F}$ (Petroleum ether/EtOAc 16:1): 0.22. $^1$H NMR (400 MHz, $CDCl_3$) $\delta$ 8.66 (d, $J$ = 4.8 Hz, 1H), 8.10 (d, $J$ = 2.1 Hz, 1H), 7.80 (dd, $J$ = 8.4, 2.1 Hz, 1H), 7.74 (td, $J$ = 7.7, 1.7 Hz, 1H), 7.66 (d, $J$ = 7.9 Hz, 1H), 7.51 (d, $J$ = 8.4 Hz, 1H), 7.24 (dd, $J$ = 3.9, 2.2 Hz, 1H). $^{13}$C NMR (101 MHz, $CDCl_3$) $\delta$ 155.0, 150.0, 139.4, 137.1, 133.2, 133.2, 130.8, 128.9, 126.0, 123.0, 120.5. **ESI-MS**: calculated $C_{11}H_8Cl_2N$ $[M+H]^+$, 224.0028; Found 224.0017.

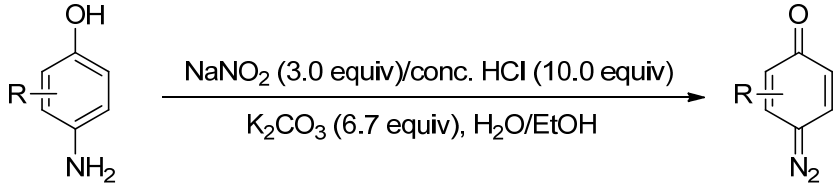
**2-(6-methoxynaphthalen-2-yl)pyridine (1o)**



Following general procedure A, compound **1o** was obtained in 63% yield (0.48 g, 2.0 mmol) as a white solid after column chromatography (eluent = Petroleum ether/EtOAc 16:1 v/v). $\mathbf{R_F}$ (Petroleum ether/EtOAc 16:1): 0.23. $^1$H NMR (400 MHz, $CDCl_3$) $\delta$ 8.73 (d, $J$ = 4.8 Hz, 1H), 8.42 (d, $J$ = 1.2 Hz, 1H), 8.11 (dd, $J$ = 8.6, 1.8 Hz, 1H), 7.88 – 7.81 (m, 3H), 7.77 (td, $J$ = 7.7, 1.8 Hz, 1H), 7.23 (ddd, $J$ = 7.3, 4.8, 1.1 Hz, 1H), 7.20 – 7.15 (m, 2H), 3.94 (s, 3H). $^{13}$C NMR (101 MHz, $CDCl_3$) $\delta$ 158.2, 157.4, 149.7, 136.8, 134.9, 134.5, 130.2, 129.0, 127.2, 126.1, 125.0, 121.8, 120.5, 119.2, 105.6, 55.3. **ESI-MS**: calculated $C_{16}H_{14}NO$ $[M+H]^+$, 236.1070; Found 236.1067.

**Preparation and characterization of quinone diazides 2**

**General procedure B:**




**10** **2**

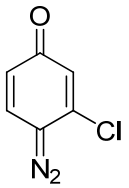
***Caution***: *Quinone diazides are potential explosives. Many of these compounds are sensitive to heat, light, shock and metal catalysts. Therefore, precaution should be*

*taken in preparation, storage and use.*

To a stirred solution of aminophenol **10** (10.0 mmol, 1.0 equiv) in EtOH (60 mL) was slowly added HCl (8.4 mL, 12 N, 100 mmol, 10.0 equiv) at 0 ºC. This mixture was stirred at 0 ºC for 10 min, then an ice-cold solution of $NaNO_2$ (2.07 g, 30 mmol, 3.0 equiv) in $H_2O$ (4 mL) was added dropwise over 10 min. The resulting mixture was stirred for another 2 h at 0 ºC, then diluted with cold $CH_2Cl_2$ (200 mL) followed by addition 30 g of ice. The mixture was stirred vigorously while a cold solution of $K_2CO_3$ (9.2 g, 67 mmol, 6.7 equiv) in $H_2O$ (10 mL) was added. The organic layers were then separated, and the aqueous layer was extracted with $CH_2Cl_2$ (100 mL). The combined organic layer was washed with brine (100 mL), and dried over $Na_2SO_4$. Evaporation *in vacuo* resulted in a black solid. This solid was kept anhydrous at -25 ºC and used without further purification.

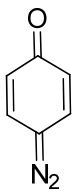
## Characterization of substrates 2

### 3-chloro-4-diazocyclohexa-2,5-dienone(2a)



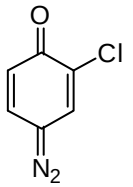

Following general procedure B, compound **2a** was obtained in 91% yield (1.40 g, 9.1 mmol) as a gray solid. $^1$H NMR (400 MHz, $CDCl_3$) $\delta$ 7.13 (d, $J$ = 9.3 Hz, 1H), 6.74 (d, $J$ = 1.6 Hz, 1H), 6.25 (dd, $J$ = 9.3, 1.6 Hz, 1H). $^{13}$C NMR (101 MHz, $CDCl_3$) $\delta$ 176.8, 147.1, 124.6, 124.1, 117.0, 84.5. **EI-MS**: calculated $C_6H_3ClN_2O$, 153.9928; Found 153.9929.

### 4-diazocyclohexa-2,5-dienone (2b)



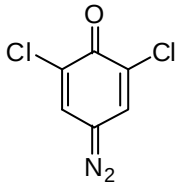

Following general procedure B, compound **2b** was obtained in 16% yield (0.19 g, 1.6 mmol) as a gray solid. $^1$H NMR (400 MHz, $CDCl_3$) δ 7.43 (d, $J$ = 9.7 Hz, 2H), 6.47 (d, $J$ = 9.7 Hz, 2H). $^{13}$C NMR (101 MHz, $CDCl_3$) δ 182.6, 130.3, 129.6, 127.2. **EI-MS**: calculated $C_6H_4N_2O$, 120.0318; Found 120.0319.

### 2-chloro-4-diazocyclohexa-2,5-dienone (2c)



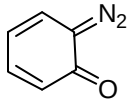
Following general procedure B, compound **2c** was obtained in 31% yield (0.48 g, 3.1 mmol) as a black solid. $^{1}$H NMR (400 MHz, $CDCl_3$) δ 7.65 (d, *J* = 2.8 Hz, 1H), 7.45 (dd, *J* = 9.7, 2.8 Hz, 1H), 6.47 (d, *J* = 9.7 Hz, 1H). $^{13}$C NMR (101 MHz, $CDCl_3$) δ 176.1, 129.7, 129.3, 127.3, 125.8, 74.9. **EI-MS**: calculated $C_6H_3ClN_2O$, 153.9928; Found 153.9926.

**2,6-dichloro-4-diazocyclohexa-2,5-dienone (2d)**



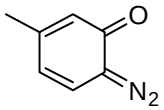
Following general procedure B, compound **2d** was obtained in 45% yield (0.85 g, 4.5 mmol) as a gray solid. $^{1}$H NMR (400 MHz, DMSO-$d_6$) δ 8.25 (s, 2H). $^{13}$C NMR (101 MHz, DMSO-$d_6$) δ 169.0, 129.8, 124.9, 78.4. **EI-MS**: calculated $C_6H_2Cl_2N_2O$, 187.9539; Found 187.9538.

**6-diazocyclohexa-2,4-dienone (2e)**



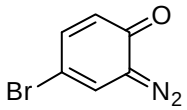
Following general procedure B, compound **2e** was obtained in 67% yield (0.8 g, 6.7 mmol) as a gray solid. $^{1}$H NMR (400 MHz, $CDCl_3$) δ 7.36 – 7.26 (m, 1H), 7.22 (d, *J* = 8.7 Hz, 1H), 6.69 (d, *J* = 9.4 Hz, 1H), 6.37 – 6.24 (m, 1H). $^{13}$C NMR (101 MHz, $CDCl_3$) δ 177.6, 138.8, 124.0, 123.7, 115.7, 88.1. **EI-MS**: calculated $C_6H_4N_2O$, 120.0318; Found 120.0316.

**6-diazo-3-methylcyclohexa-2,4-dienone (2f)**



Following general procedure B, compound **2f** was obtained in 82% yield (1.10 g, 8.2 mmol) as a black solid. $^{1}$H NMR (400 MHz, $CDCl_3$) *δ* 7.04 (d, *J* = 8.9 Hz, 1H), 6.43 (s, 1H), 6.08 (d, *J* = 8.9 Hz, 1H), 2.17 (s, 3H). $^{13}$C NMR (101 MHz, $CDCl_3$) δ 178.6, 150.9, 123.4, 122.9, 118.3, 83.2, 22.8. **EI-MS**: calculated $C_7H_6N_2O$, 134.0475; Found 134.0474.

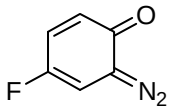
**4-bromo-6-diazocyclohexa-2,4-dienone (2g)**



Following general procedure B, compound **2g** was obtained in 80% yield (1.60 g, 8.0 mmol) as a gray solid. $^{1}$H NMR (400 MHz, $CDCl_3$)

δ 7.35 (d, *J* = 2.1 Hz, 1H), 7.31 (dd, *J* = 9.8, 2.3 Hz, 1H), 6.62 (d, *J* = 9.7 Hz, 1H). $^{13}$C NMR (101 MHz, $CDCl_3$) δ 175.4, 142.2, 125.6, 123.7, 104.9, 90.2. **EI-MS**: calculated $C_6H_3BrN_2O$, 197.9423; Found 197.9420.

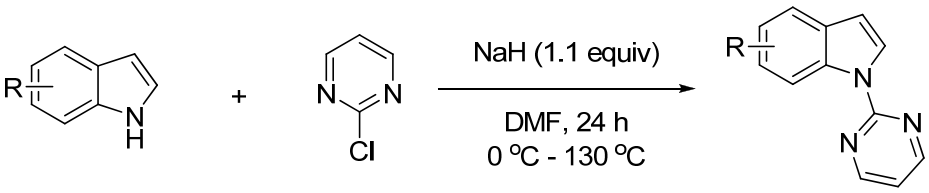
**6-diazo-4-fluorocyclohexa-2,4-dienone (2h)**




Following general procedure B, compound **2h** was obtained in 43% yield (0.60 g, 4.3 mmol) as a black solid. $^1$H NMR (400 MHz, $CDCl_3$) δ 7.27 (ddd, *J* = 9.7, 8.3, 3.0 Hz, 1H), 7.07 (dd, *J* = 7.2, 3.0 Hz, 1H), 6.97 (dd, *J* = 9.8, 4.4 Hz, 1H). $^{13}$C NMR (101 MHz, $CDCl_3$) δ 167.9, 152.8 (*J* = 242.7 Hz), 128.2 (*J* = 28.0 Hz), 120.8 (*J* = 8.5 Hz), 104.8 (*J* = 27.9 Hz), 101.7 (*J* = 14.1 Hz). **EI-MS**: calculated $C_6H_3FN_2O$, 138.0224; Found 138.0227.

**Preparation and characterization of 1-(pyrimidin-2-yl)-1*H*-indole derivatives 6**

**General procedure C:**

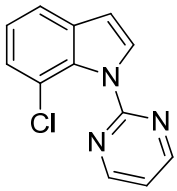



**12** **13** **6**

To a stirred solution of indole **12** (10.0 mmol) in DMF (25 mL) was added NaH (60% dispersion in mineral oil, 440 mg, 11.0 mmol) in portions at 0 °C. After stirring for 30 min at 0 °C, 2-chloropyrimidine **13** (1.37 g, 12.0 mmol) was added and the mixture was stirred at 130 °C for 24 h. Then, the reaction mixture was cooled to ambient temperature, poured into $H_2O$ (300 mL) and extracted with EtOAc (4×75 mL). The combined organic phase was dried over $Na_2SO_4$. After filtration and evaporation of the solvents under reduced pressure, the crude product was purified by column chromatography on silica gel to give the target compound **6**.

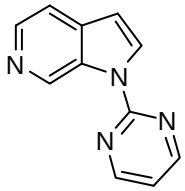
**Characterization of substrates 6**

**7-chloro-1-(pyrimidin-2-yl)-1*H*-indole (6h)**



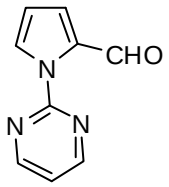
Following general procedure C, compound **6h** was obtained in 31% yield (0.71 g, 3.1 mmol) as a white solid after column chromatography (eluent = Petroleum ether/EtOAc 8:1 v/v). $\mathbf{R_F}$ (Petroleum ether/EtOAc 8:1): 0.26. $^1$H NMR (400 MHz, $CDCl_3$) δ 8.77 (d, *J* = 4.8 Hz, 2H), 7.72 (d, *J* = 3.5 Hz, 1H), 7.55 (dd, *J* = 7.8, 0.9 Hz, 1H), 7.30 (dd, *J* = 7.7, 0.7 Hz, 1H), 7.16 (m, 2H), 6.71 (d, *J* = 3.5 Hz, 1H). $^{13}$C NMR (101 MHz, $CDCl_3$) δ 158.2, 157.4, 133.6, 132.1, 130.7, 125.4, 122.7, 119.8, 119.2, 118.2, 106.4. **ESI-MS**: calculated $C_{12}H_9ClN_3$ $[M+H]^+$, 230.0480; Found 230.0478.

**1-(pyrimidin-2-yl)-1*H*-pyrrolo[2,3-c]pyridine (6j)**



Following general procedure C, compound **6j** was obtained in 76% yield (1.5 g, 7.6 mmol) as a white solid after column chromatography (eluent = Petroleum ether/EtOAc 2:1 v/v). $\mathbf{R_F}$ (Petroleum ether/EtOAc 2:1): 0.28. $^1$H NMR (400 MHz, $CDCl_3$) δ 10.07 (s, 1H), 8.75 (d, *J* = 4.8 Hz, 2H), 8.56 – 8.28 (m, 2H), 7.54 (d, *J* = 5.3 Hz, 1H), 7.13 (t, *J* = 4.8 Hz, 1H), 6.70 (d, *J* = 3.6 Hz, 1H). $^{13}$C NMR (101 MHz, $CDCl_3$) δ 158.4, 157.1, 141.4, 138.8, 136.4, 132.5, 128.8, 117.0, 115.3, 105.8. **ESI-MS**: calculated $C_{11}H_9N_4$ $[M+H]^+$, 197.0822; Found 197.0828.

**1-(pyrimidin-2-yl)-1*H*-pyrrole-2-carbaldehyde (7b)**



Following general procedure C, compound **7b** was obtained in 52% yield (0.91 g, 5.2 mmol) as a yellow solid after column chromatography (eluent = Petroleum ether/EtOAc 6:1 v/v). $\mathbf{R_F}$ (Petroleum ether/EtOAc 6:1): 0.25. $^1$H NMR (400 MHz, $CDCl_3$) δ 10.58 (s, 1H), 8.70 (d, *J* = 4.8 Hz, 2H), 7.94 (s, 1H), 7.26 (d, *J* = 2.0 Hz, 1H), 7.21 (t, *J* = 4.8 Hz, 1H), 6.38 (t, *J* = 3.1 Hz, 1H). $^{13}$C NMR (101 MHz, $CDCl_3$) δ 183.2, 158.5, 156.4, 134.4, 127.3, 121.2, 118.5, 111.7. **ESI-MS**: calculated $C_9H_7N_3ONa$ $[M+Na]^+$, 196.0481; Found 196.0484.

## 3. General procedure and characterization of products

**General procedure D**

To a 15 mL-schlenk tube charged with a stirring bar, was added substrates **1** (0.2 mmol, 1.0 equiv), 3-chloro-4-diazocyclohexa-2,5-dienone **2a** (46.2 mg, 0.3 mmol, 1.5 equiv), $[Cp^*RhCl_2]_2$ (3.1 mg, 0.005 mmol, 2.5 mol%), $AgSbF_6$ (13.7 mg, 0.04 mmol, 0.2 equiv), PivOH (2.0 mg, 0.02 mmol, 0.1 equiv) and DCM (1.0 mL). No special precautions were taken to exclude moisture and air. The reaction was allowed to stir at 50 $^oC$ until the complete consumption of **1** as monitored by TLC analysis (typically 12 h). The reaction mixture was then diluted with EtOAc (20 mL) and washed with brine. The aqueous phase was extracted with EtOAc again. The organic layers were combined, washed with brine and dried over $Na_2SO_4$. The pure product was purified by flash column chromatography on silica with an appropriate solvent to afford the pure product .

**General procedure E**

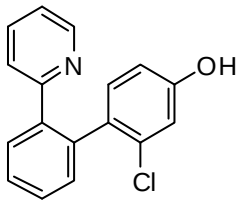
To a 15 mL-schlenk tube charged with a stirring bar, was added substrates **1** (0.2 mmol, 1.0 equiv), 3-chloro-4-diazocyclohexa-2,5-dienone **2a** (77.0 mg, 0.5 mmol, 2.5 equiv), $[Cp^*IrCl_2]_2$ (4.0 mg, 0.005 mmol, 2.5 mol%), $AgSbF_6$ (6.9 mg, 0.02 mmol, 0.1 equiv), PivOH (2.0 mg, 0.02 mmol, 0.1 equiv) and DCE (1.0 mL). No special precautions were taken to exclude moisture and air. The reaction was allowed to stir at 50 $^oC$ until the complete consumption of **1** as monitored by TLC analysis (typically 12 h). The reaction mixture was then diluted with EtOAc (20 mL) and washed with brine. The aqueous phase was extracted with EtOAc again. The organic layers were combined, washed with brine and dried over $Na_2SO_4$. The pure product was purified by flash column chromatography on silica with an appropriate solvent to afford the pure product .

**General procedure F**

To a 15 mL-schlenk tube charged with a stirring bar, was added 1-(pyrimidin-2-yl)-1*H*-indole derivatives **6** (0.2 mmol, 1.0 equiv), 3-chloro-4-diazocyclohexa-2,5-dienone **2a** (46.2 mg, 0.3 mmol, 1.5 equiv), $[Cp^*IrCl_2]_2$ (4.0 mg, 0.005 mmol, 2.5 mol%), $AgSbF_6$ (10.3 mg, 0.03 mmol, 0.15 equiv), PivOH (20.4 mg, 0.2 mmol, 1.0 equiv) and nitromethane (1.0 mL). No special precautions were taken to exclude moisture and air. The reaction was allowed to stir at 40 °C until the complete consumption of **6** as monitored by TLC analysis (typically 12 h). The reaction mixture was then diluted with EtOAc (20 mL) and washed with brine. The aqueous phase was extracted with EtOAc again. The organic layers were combined, washed with brine and dried over $Na_2SO_4$. The pure product was purified by flash column chromatography on silica with an appropriate solvent to afford the pure product .

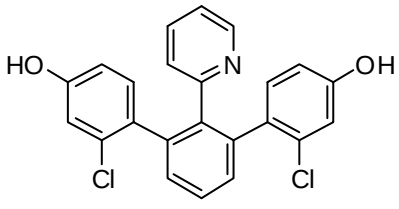
## Characterization of products

### 2-chloro-2'-(pyridin-2-yl)-[1,1'-biphenyl]-4-ol (3aa)




Following general procedure D, the product **3aa** was obtained in 73% yield (41.5 mg, 0.147 mmol) as a brown solid after column chromatography (eluent = Petroleum ether/EtOAc 4:1 v/v). $\mathbf{R_F}$ (Petroleum ether/EtOAc 4:1): 0.21. $^1$H NMR (400 MHz, $CDCl_3$) δ 8.44 (d, *J* = 4.7 Hz, 1H), 7.74 (td, *J* = 7.8, 1.7 Hz, 1H), 7.47 (dd, *J* = 5.5, 3.8 Hz, 3H), 7.37 (d, *J* = 7.9 Hz, 1H), 7.24 (dd, *J* = 5.0, 1.9 Hz, 2H), 7.00 (d, *J* = 2.1 Hz, 1H), 6.90 (d, *J* = 8.2 Hz, 1H), 6.82 (dd, *J* = 8.2, 2.1 Hz, 1H). $^{13}$C NMR (101 MHz, $CDCl_3$) δ 159.0, 156.0, 147.0, 139.1, 138.0, 136.9, 134.1, 132.7, 132.2, 130.8, 130.0, 129.2, 128.2, 124.3, 122.8, 120.7, 119.9. **ESI-MS**: calculated $C_{17}H_{13}ClNO$ $[M+H]^+$, 282.0680; Found 282.0682.

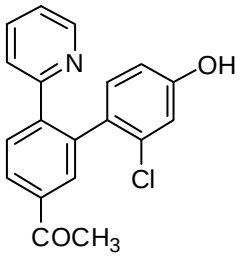
### 2,2''-dichloro-2'-(pyridin-2-yl)-[1,1':3',1''-terphenyl]-4,4''-diol (3aa')




Following general procedure D, the product **3aa'**

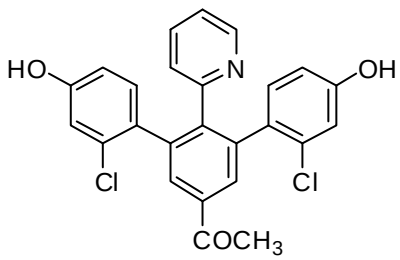
was obtained in 17% yield (14.2 mg, 0.034 mmol), Following general procedure E, The product **3aa'** was obtained in 80% yield (65.3 mg, 0.160 mmol) as a brown solid after column chromatography (eluent = Petroleum ether/EtOAc 4:1 v/v). $\mathbf{R_F}$ (Petroleum ether/EtOAc 4:1): 0.23. $^1$H NMR (400 MHz, MeOD-$d_4$) δ 8.14 (d, *J* = 4.6 Hz, 1H), 7.50 (t, *J* = 7.7 Hz, 1H), 7.43 (t, *J* = 7.7 Hz, 1H), 7.35 (d, *J* = 7.6 Hz, 2H), 7.12 (d, *J* = 7.8 Hz, 1H), 7.02 (dd, *J* = 7.0, 5.4 Hz, 1H), 6.90 (d, *J* = 8.0 Hz, 2H), 6.68 – 6.61 (m, 4H), 3.35 (s, 2H). $^{13}$C NMR (101 MHz, MeOD-$d_4$) δ 159.7, 156.2, 147.8, 141.0, 138.8, 136.8, 134.3, 133.5, 131.3, 129.0, 128.7, 127.4, 122.8, 120.0, 116.5. **ESI-MS**: calculated $C_{23}H_{16}Cl_2NO_2$ $[M+H]^+$, 408.0553; Found 408.0535.

**1-(2'-chloro-4'-hydroxy-6-(pyridin-2-yl)-[1,1'-biphenyl]-3-yl)ethanone (3ba)**




Following general procedure D, the product **3ba** was obtained in 52% yield (33.6 mg, 0.104 mmol) as a brown solid after column chromatography (eluent = Petroleum ether/EtOAc 2:1 v/v). $\mathbf{R_F}$ (Petroleum ether/EtOAc 2:1): 0.17. $^1$H NMR (400 MHz, $CDCl_3$) δ 8.49 (d, *J* = 5.0 Hz, 1H), 8.06 (dd, *J* = 8.0, 1.8 Hz, 1H), 7.80 (ddd, *J* = 9.5, 5.9, 1.7 Hz, 2H), 7.57 (d, *J* = 8.0 Hz, 1H), 7.41 (d, *J* = 7.9 Hz, 1H), 7.31 (ddd, *J* = 7.6, 5.0, 1.0 Hz, 1H), 7.02 (d, *J* = 2.0 Hz, 1H), 6.92 (d, *J* = 8.1 Hz, 1H), 6.86 (dd, *J* = 8.2, 2.1 Hz, 1H), 2.62 (s, 3H). $^{13}$C NMR (101 MHz, $CDCl_3$) δ 197.6, 158.0, 155.9, 147.4, 143.3, 138.2, 137.6, 137.3, 134.7, 132.8, 132.0, 130.4, 130.0, 127.7, 124.3, 123.4, 121.0, 120.1, 26.9. **ESI-MS**: calculated $C_{19}H_{15}ClNO_2$ $[M+H]^+$, 324.0786; Found 324.0774.

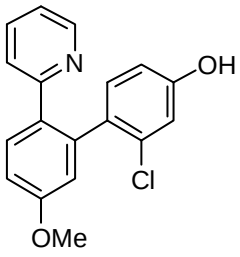
**1-(2,2''-dichloro-4,4''-dihydroxy-2'-(pyridin-2-yl)-[1,1':3',1''-terphenyl]-5'-yl)eth anone (3ba')**




Following general procedure D, the product **3ba'** was obtained in 27% yield (24.3 mg, 0.054 mmol), Following general procedure E, The product **3ba'** was obtained in 60% yield (53.9 mg, 0.120 mmol) as

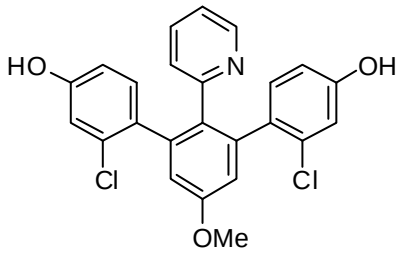
a brown solid after column chromatography (eluent = Petroleum ether/EtOAc 3:1 v/v). **$R_F$** (Petroleum ether/EtOAc 2:1): 0.31. $^1$H NMR (400 MHz, MeOD-$d_4$) δ 8.17 (d, *J* = 4.8 Hz, 1H), 7.95 (s, 2H), 7.46 (t, *J* = 7.7 Hz, 1H), 7.13 (d, *J* = 7.8 Hz, 1H), 7.09 – 7.02 (m, 1H), 6.93 (d, *J* = 8.6 Hz, 2H), 6.66 (d, *J* = 6.4 Hz, 4H), 2.64 (s, 3H). $^{13}$C NMR (101 MHz, MeOD-$d_4$) δ 199.9, 158.9, 156.3, 148.1, 145.5, 139.6, 137.6, 136.9, 134.8, 133.5, 131.1, 127.8, 127.3, 123.1, 120.1, 116.5, 26.9. **ESI-MS**: calculated $C_{25}H_{18}Cl_2NO_3$ $[M+H]^+$, 450.0658; Found 450.0645.

**2-chloro-5'-methoxy-2'-(pyridin-2-yl)-[1,1'-biphenyl]-4-ol (3ca)**




Following general procedure D, the product **3ca** was obtained in 77% yield (48.3 mg, 0.155 mmol) as a brown solid after column chromatography (eluent = Petroleum ether/EtOAc 3:1 v/v). **$R_F$** (Petroleum ether/EtOAc 2:1): 0.32. $^1$H NMR (400 MHz, $CDCl_3$) δ 8.43 (d, *J* = 5.0 Hz, 1H), 7.72 (td, *J* = 7.8, 1.8 Hz, 1H), 7.37 (dd, *J* = 15.9, 8.2 Hz, 2H), 7.22 (ddd, *J* = 7.5, 5.1, 1.0 Hz, 1H), 7.01 (dd, *J* = 8.5, 2.5 Hz, 2H), 6.94 (d, *J* = 8.1 Hz, 1H), 6.84 (dd, *J* = 8.2, 2.1 Hz, 1H), 6.77 (d, *J* = 2.7 Hz, 1H), 3.84 (s, 3H). $^{13}$C NMR (101 MHz, $CDCl_3$) δ 160.0, 158.8, 156.1, 146.9, 138.4, 137.9, 134.2, 132.1, 131.9, 131.4, 131.0, 124.2, 122.3, 120.7, 120.1, 117.6, 114.2, 55.5. **ESI-MS**: calculated $C_{18}H_{15}ClNO_2$ $[M+H]^+$, 312.0786; Found 312.0777.

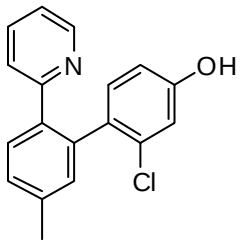
**2,2''-dichloro-5'-methoxy-2'-(pyridin-2-yl)-[1,1':3',1''-terphenyl]-4,4''-diol (3ca')**




Following general procedure D, the product **3ca'** was obtained in 22% yield (19.3 mg, 0.044 mmol), Following general procedure E, The product **3ca'** was obtained in 57% yield (50.3 mg, 0.114 mmol) as a brown solid after column chromatography (eluent = Petroleum ether/EtOAc 4:1 v/v). **$R_F$** (Petroleum ether/EtOAc 4:1): 0.22. $^1$H NMR (400 MHz, MeOD-$d_4$) δ 8.12 (d, *J* = 4.8 Hz, 1H), 7.39 (t, *J* = 7.7 Hz, 1H), 7.07 (d, *J* = 7.8 Hz, 1H), 7.03 – 6.95 (m, 1H), 6.90 (d, *J* = 5.6 Hz, 4H), 6.68 – 6.60 (m, 4H), 3.83 (s, 3H). $^{13}$C NMR (101 MHz, MeOD-$d_4$) δ 160.3, 159.6, 156.2, 147.8, 140.2, 136.8,

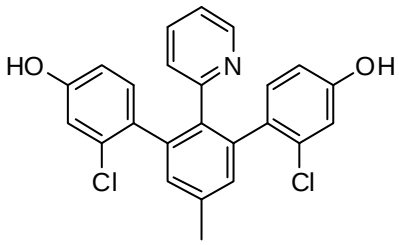
134.4, 133.9, 133.5, 128.7, 127.7, 122.6, 120.0, 116.7, 116.6, 55.8. **ESI-MS**: calculated $C_{24}H_{18}Cl_2NO_3$ $[M+H]^+$, 438.0658; Found 438.0653.

**2-chloro-5'-methyl-2'-(pyridin-2-yl)-[1,1'-biphenyl]-4-ol (3da)**



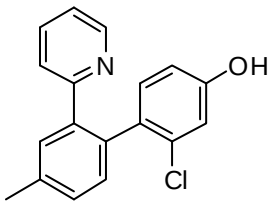

Following general procedure D, the product **3da** was obtained in 47% yield (27.9 mg, 0.094 mmol) as a brown solid after column chromatography (eluent = Petroleum ether/EtOAc 4:1 v/v). $\mathbf{R_F}$ (Petroleum ether/EtOAc 4:1): 0.25. $^1$H NMR (400 MHz, MeOD-$d_4$) δ 8.44 (dd, *J* = 4.9, 0.6 Hz, 1H), 7.52 (td, *J* = 7.8, 1.8 Hz, 1H), 7.46 (d, *J* = 7.8 Hz, 1H), 7.27 (dd, *J* = 7.8, 1.1 Hz, 1H), 7.22 – 7.13 (m, 2H), 7.06 (d, *J* = 7.9 Hz, 1H), 6.93 (d, *J* = 8.1 Hz, 1H), 6.74 (dd, *J* = 8.1, 2.1 Hz, 1H), 6.70 (d, *J* = 2.0 Hz, 1H), 2.40 (s, 3H). $^{13}$C NMR (101 MHz, MeOD-$d_4$) δ 160.6, 156.5, 149.2, 139.5, 138.3, 137.8, 137.5, 134.6, 133.5, 132.8, 130.7, 129.4, 128.7, 125.8, 122.8, 120.4, 116.6, 21.2. **ESI-MS**: calculated $C_{18}H_{15}ClNO$ $[M+H]^+$, 296.0837; Found 296.0827.

**2,2''-dichloro-5'-methyl-2'-(pyridin-2-yl)-[1,1':3',1''-terphenyl]-4,4''-diol (3da')**



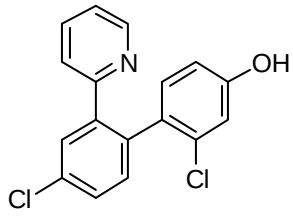

Following general procedure D, the product **3da'** was obtained in 25% yield (21.5 mg, 0.050 mmol), Following general procedure E, The product **3da'** was obtained in 91% yield (76.5 mg, 0.182 mmol) as a brown solid after column chromatography (eluent = Petroleum ether/EtOAc 4:1 v/v). $\mathbf{R_F}$ (Petroleum ether/EtOAc 4:1): 0.28. $^1$H NMR (400 MHz, MeOD-$d_4$) δ 8.12 (d, *J* = 4.6 Hz, 1H), 7.39 (t, *J* = 7.7 Hz, 1H), 7.17 (s, 2H), 7.09 (d, *J* = 7.8 Hz, 1H), 7.01 – 6.96 (m, 1H), 6.88 (d, *J* = 8.1 Hz, 2H), 6.69 – 6.60 (m, 4H), 2.41 (s, 3H). $^{13}$C NMR (101 MHz, MeOD-$d_4$) δ 159.7, 156.2, 147.8, 139.0, 138.7, 138.2, 136.8, 134.2, 133.5, 131.9, 128.8, 127.5, 122.6, 120.0, 116.5, 21.2. **ESI-MS**: calculated $C_{24}H_{18}Cl_2NO_2$ $[M+H]^+$, 422.0709; Found 422.0696.

**2-chloro-4'-methyl-2'-(pyridin-2-yl)-[1,1'-biphenyl]-4-ol (3ea)**



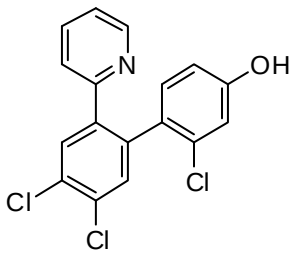

Following general procedure D, the product **3ea** was obtained in 69% yield (40.7 mg, 0.138 mmol)as a brown solid after column chromatography (eluent = Petroleum ether /EtOAc 4:1 v/v). $\mathbf{R_F}$ (Petroleum ether /EtOAc 4:1): 0.30. $^1$H NMR (400 MHz, $CDCl_3$) δ 8.45 (d, *J* = 4.5 Hz, 1H), 7.73 (t, *J* = 7.7 Hz, 1H), 7.37 (d, *J* = 7.9 Hz, 1H), 7.27 (q, *J* = 8.7 Hz, 3H), 7.13 (d, *J* = 7.6 Hz, 1H), 6.99 (s, 1H), 6.90 (d, *J* = 8.1 Hz, 1H), 6.82 (d, *J* = 8.1 Hz, 1H), 2.44 (s, 3H). $^{13}$C NMR (101 MHz, $CDCl_3$) δ 159.1, 156.0, 147.0, 139.0, 138.0, 137.9, 134.0, 133.9, 132.6, 132.3, 130.7, 130.6, 129.9, 124.3, 122.7, 120.6, 119.8, 21.2. **ESI-MS**: calculated $C_{18}H_{15}ClNO$ $[M+H]^+$,296.0837; Found 296.0829.

**2,4'-dichloro-2'-(pyridin-2-yl)-[1,1'-biphenyl]-4-ol (3fa)**




Following general procedure D, the product **3fa** was obtained in 58% yield (37.0 mg, 0.116 mmol)as a brown solid after column chromatography (eluent = Petroleum ether /EtOAc 4:1 v/v). $\mathbf{R_F}$ (Petroleum ether /EtOAc 4:1): 0.39. $^1$H NMR (400 MHz, $CDCl_3$) δ 8.47 (d, *J* = 4.7 Hz, 1H), 7.77 (t, *J* = 7.7 Hz, 1H), 7.45 (d, *J* = 8.9 Hz, 2H), 7.38 (d, *J* = 7.8 Hz, 1H), 7.32 – 7.27 (m, 1H), 7.19 (d, *J* = 7.9 Hz, 1H), 6.99 (s, 1H), 6.85 (dd, *J* = 17.9, 8.1 Hz, 2H). $^{13}$C NMR (101 MHz, $CDCl_3$) δ 157.7, 155.9, 147.3, 140.6, 138.2, 135.5, 134.5, 134.0, 134.0, 132.0, 129.8, 129.6, 129.1, 124.3, 123.2, 120.9, 120.0. **ESI-MS**: calculated $C_{17}H_{12}Cl_2NO$ $[M+H]^+$, 316.0290; Found 316.0280.

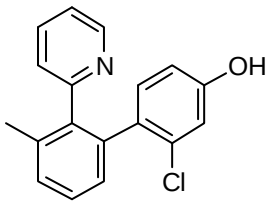
**2,4',5'-trichloro-2'-(pyridin-2-yl)-[1,1'-biphenyl]-4-ol (3ga)**




Following general procedure D, the product **3ga** was obtained in 83% yield (58.2 mg, 0.166 mmol)as a brown solid after column chromatography (eluent = Petroleum ether /EtOAc 4:1 v/v). $\mathbf{R_F}$ (Petroleum ether /EtOAc 4:1): 0.36. $^1$H NMR (400 MHz, $CDCl_3$) δ 8.46 (d, *J* = 4.8 Hz, 1H), 7.78 (t, *J* = 7.7 Hz, 1H), 7.56 (s, 1H), 7.36 (t, *J* = 3.6 Hz, 2H), 7.33 – 7.28 (m, 1H), 6.98 (s,

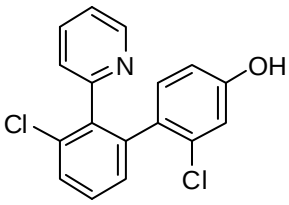
1H), 6.86 (dd, *J* = 18.4, 8.2 Hz, 2H). $^{13}$C NMR (101 MHz, $CDCl_3$) δ 156.8, 155.8, 147.4, 138.9, 138.3, 136.9, 134.9, 134.3, 133.2, 132.2, 131.9, 131.5, 128.5, 124.2, 123.4, 121.0, 120.2. **ESI-MS**: calculated $C_{17}H_9Cl_3NO$ $[M-H]^-$, 347.9755; Found 347.9745.

**2-chloro-3'-methyl-2'-(pyridin-2-yl)-[1,1'-biphenyl]-4-ol (3ha)**



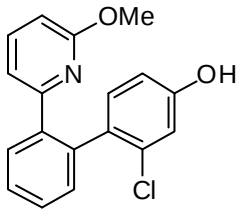

Following general procedure D, the product **3ha** was obtained in 63% yield (37.0 mg, 0.126 mmol)as a brown solid after column chromatography (eluent = Petroleum ether /EtOAc 4:1 v/v). $\mathbf{R_F}$ (Petroleum ether /EtOAc 4:1): 0.32. $^1$H NMR (400 MHz, $CDCl_3$) δ 8.49 (d, *J* = 4.3 Hz, 1H), 7.65 (t, *J* = 7.5 Hz, 1H), 7.38 (t, *J* = 7.5 Hz, 1H), 7.32 (d, *J* = 7.5 Hz, 1H), 7.24 – 7.19 (m, 1H), 7.16 (d, *J* = 7.5 Hz, 1H), 7.09 (d, *J* = 7.3 Hz, 1H), 6.91 (d, *J* = 8.0 Hz, 1H), 6.86 (s, 1H), 6.77 (d, *J* = 7.9 Hz, 1H), 2.15 (s, 3H). $^{13}$C NMR (101 MHz, $CDCl_3$) δ 158.4, 154.8, 148.0, 139.3, 139.3, 137.1, 136.9, 136.1, 133.9, 131.5, 130.1, 129.0, 128.8, 125.15, 122.8, 120.6, 119.3, 20.6. **ESI-MS**: calculated $C_{18}H_{15}ClNO$ $[M+H]^+$, 296.0837; Found 296.0830.

**2,3'-dichloro-2'-(pyridin-2-yl)-[1,1'-biphenyl]-4-ol (3ia)**



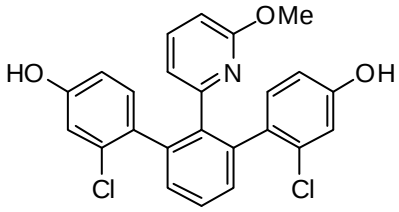

Following general procedure D, the product **3ia** was obtained in 95% yield (60.0 mg, 0.190 mmol)as a brown solid after column chromatography (eluent = Petroleum ether /EtOAc 4:1 v/v). $\mathbf{R_F}$ (Petroleum ether /EtOAc 4:1): 0.38. $^1$H NMR (400 MHz, $CDCl_3$) δ 8.46 (d, *J* = 4.3 Hz, 1H), 7.70 (t, *J* = 7.6 Hz, 1H), 7.52 (d, *J* = 8.0 Hz, 1H), 7.39 (t, *J* = 7.9 Hz, 1H), 7.33 (d, *J* = 7.4 Hz, 1H), 7.25 (s, 1H), 7.15 (d, *J* = 7.6 Hz, 1H), 6.94 – 6.82 (m, 2H), 6.78 (d, *J* = 8.0 Hz, 1H). $^{13}$C NMR (101 MHz, $CDCl_3$) δ 156.0, 155.0, 147.6, 139.5, 137.8, 137.2, 134.4, 133.2, 131.3, 130.3, 129.9, 129.4, 126.0, 123.5, 120.8, 120.0. **ESI-MS**: calculated $C_{17}H_{12}Cl_2NO$ $[M+H]^+$, 316.0290; Found 316.0278.

**2-chloro-2'-(6-methoxypyridin-2-yl)-[1,1'-biphenyl]-4-ol (3ja)**



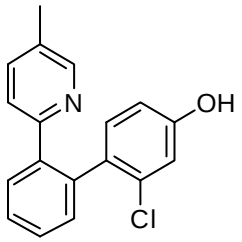

Following general procedure D, the product **3ja** was obtained in 89% yield (55.4 mg, 0.178 mmol)as a brown solid after column chromatography (eluent = Petroleum ether /EtOAc 4:1 v/v). $\mathbf{R_F}$ (Petroleum ether /EtOAc 4:1): 0.31. $^1$H NMR (400 MHz, $CDCl_3$) δ 7.61 – 7.43 (m, 4H), 7.33 – 7.27 (m, 1H), 7.12 (s, 1H), 6.95 (d, *J* = 8.1 Hz, 1H), 6.85 (t, *J* = 7.1 Hz, 2H), 6.63 (d, *J* = 8.3 Hz, 1H), 3.82 (s, 3H). $^{13}$C NMR (101 MHz, $CDCl_3$) δ 163.3, 156.5, 154.1, 140.1, 139.3, 135.2, 133.9, 131.8, 131.4, 130.4, 129.1, 129.0, 128.5, 120.9, 117.7, 116.8, 109.6, 53.8. **ESI-MS**: calculated $C_{18}H_{13}ClNO_2$ $[M-H]^-$, 310.0640; Found 310.0632.

**2,2''-dichloro-2'-(6-methoxypyridin-2-yl)-[1,1':3',1''-terphenyl]-4,4''-diol (3ja')**




Following general procedure D, the product **3ja'** was obtained in 9% yield (7.9 mg, 0.018 mmol)as a brown solid after column chromatography (eluent = Petroleum ether /EtOAc 4:1 v/v). $\mathbf{R_F}$ (Petroleum ether /EtOAc 4:1): 0.27. $^1$H NMR (400 MHz, MeOD-$d_4$) δ 7.49 (t, *J* = 7.6 Hz, 1H), 7.35 (d, *J* = 7.6 Hz, 2H), 7.23 (t, *J* = 7.8 Hz, 1H), 6.86 (d, *J* = 8.1 Hz, 2H), 6.69 (s, 2H), 6.65 (d, *J* = 8.2 Hz, 2H), 6.54 (d, *J* = 7.3 Hz, 1H), 6.36 (d, *J* = 8.3 Hz, 1H), 3.56 (s, 3H). $^{13}$C NMR (101 MHz, MeOD-$d_4$) δ 164.1, 157.1, 156.4, 141.4, 138.8, 138.7, 134.1, 133.3, 131.5, 129.3, 128.6, 119.9, 119.8, 116.4, 108.9, 53.6. **ESI-MS**: calculated $C_{24}H_{16}Cl_2NO_3$ $[M-H]^-$, 436.0513; Found 436.0506.

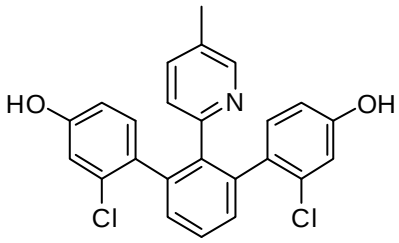
**2-chloro-2'-(5-methylpyridin-2-yl)-[1,1'-biphenyl]-4-ol (3ka)**




Following general procedure D, the product **3ka** was obtained in 83% yield (49.0 mg, 0.166 mmol) as a brown solid after column chromatography (eluent = Petroleum ether/EtOAc 4:1 v/v). $\mathbf{R_F}$ (Petroleum ether/EtOAc 4:1): 0.24. $^1$H NMR (400 MHz, $CDCl_3$) δ 8.28 (s, 1H), 7.56 (dd, *J* = 8.0, 1.6 Hz, 1H), 7.49 – 7.41 (m, 3H), 7.29 (d, *J* = 8.0 Hz, 1H), 7.25 – 7.21 (m, 1H), 7.02 (d, *J* = 2.1 Hz, 1H), 6.91 (d, *J* = 8.1 Hz, 1H), 6.84 (dd, *J* = 8.2, 2.1 Hz, 1H), 2.33 (s, 3H). $^{13}$C NMR (101 MHz, $CDCl_3$) δ 156.2, 156.1, 147.2,

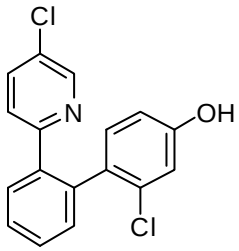
139.1, 138.7, 137.0, 134.1, 132.7, 132.6, 132.2, 131.1, 129.9, 129.0, 128.1, 123.8, 120.6, 120.1, 18.2. **ESI-MS**: calculated $C_{18}H_{15}ClNO$ $[M+H]^+$, 296.0837; Found 296.0828.

**2,2''-dichloro-2'-(5-methylpyridin-2-yl)-[1,1':3',1''-terphenyl]-4,4''-diol (3ka')**



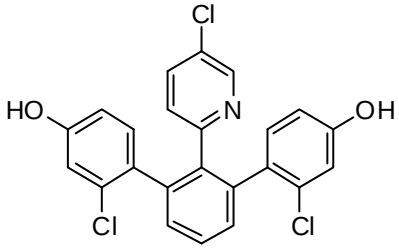

Following general procedure E, the product **3ka'** was obtained in 66% yield (55.6 mg, 0.132 mmol) as a brown solid after column chromatography (eluent = dichloromethane v/v). $\mathbf{R_F}$ (dichloromethane): 0.23. $^1$H NMR (400 MHz, MeOD-$d_4$) δ 8.00 (s, 1H), 7.51 – 7.44 (m, 1H), 7.33 (d, *J* = 7.6 Hz, 2H), 7.26 (dd, *J* = 8.0, 1.5 Hz, 1H), 7.01 (d, *J* = 7.9 Hz, 1H), 6.88 (d, *J* = 8.1 Hz, 2H), 6.67 (d, *J* = 1.9 Hz, 2H), 6.64 (dd, *J* = 8.1, 1.9 Hz, 2H), 2.15 (s, 3H). $^{13}$C NMR (101 MHz, MeOD-$d_4$) δ 156.7, 156.3, 148.0, 140.8, 139.0, 137.6, 134.3, 133.5, 132.8, 131.3, 128.9, 126.8, 120.0, 116.6, 18.0. **ESI-MS**: calculated $C_{24}H_{18}Cl_2NO_2$ $[M+H]^+$, 422.0709; Found 422.0705.

**2-chloro-2'-(5-chloropyridin-2-yl)-[1,1'-biphenyl]-4-ol (3la)**




Following general procedure D, the product **3la** was obtained in 60% yield (38.0 mg, 0.120 mmol) as a brown solid after column chromatography (eluent = Petroleum ether/EtOAc 6:1 v/v). $\mathbf{R_F}$ (Petroleum ether/EtOAc 4:1): 0.35. $^1$H NMR (400 MHz, $CDCl_3$) δ 8.45 (s, 1H), 7.66 (d, *J* = 8.3 Hz, 1H), 7.50 (d, *J* = 2.7 Hz, 3H), 7.26 (t, *J* = 8.3 Hz, 2H), 6.97 (s, 1H), 6.91 (d, *J* = 8.1 Hz, 1H), 6.86 (d, *J* = 8.2 Hz, 1H). $^{13}$C NMR (101 MHz, $CDCl_3$) δ 157.0, 146.8, 146.8, 138.5, 137.3, 136.2, 134.4, 132.4, 132.0, 131.3, 130.0, 129.5, 128.5, 124.9, 121.0, 119.1, 119.0. **ESI-MS**: calculated $C_{17}H_{12}Cl_2NO$ $[M+H]^+$, 316.0290; Found 316.0282.

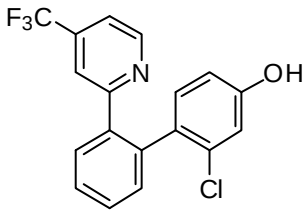
**2,2''-dichloro-2'-(5-chloropyridin-2-yl)-[1,1':3',1''-terphenyl]-4,4''-diol (3la')**




Following general procedure D, the product **3la'** was

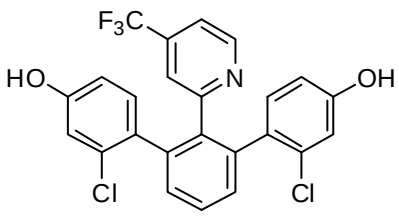
obtained in 30% yield (26.7 mg, 0.060 mmol) as a brown solid after column chromatography (eluent = Petroleum ether/EtOAc 6:1 v/v). $\mathbf{R_F}$ (Petroleum ether/EtOAc 4:1): 0.20. $^1$H NMR (400 MHz, MeOD-$d_4$) δ 8.12 (d, *J* = 2.2 Hz, 1H), 7.57 – 7.48 (m, 1H), 7.46 (dd, *J* = 8.4, 2.5 Hz, 1H), 7.35 (d, *J* = 7.7 Hz, 2H), 7.07 (d, *J* = 8.4 Hz, 1H), 6.94 (d, *J* = 8.0 Hz, 2H), 6.70 (dd, *J* = 8.1, 1.9 Hz, 2H), 6.66 (d, *J* = 1.8 Hz, 2H). $^{13}$C NMR (101 MHz, MeOD-$d_4$) δ 158.5, 156.2, 146.8, 140.1, 138.9, 136.3, 134.5, 133.6, 131.3, 131.0, 129.3, 128.5, 128.4, 120.1, 116.3. **ESI-MS**: calculated $C_{23}H_{15}Cl_3NO_2$ $[M+H]^+$, 442.0163; Found 442.0169.

**2-chloro-2'-(4-(trifluoromethyl)pyridin-2-yl)-[1,1'-biphenyl]-4-ol (3ma)**




Following general procedure D, the product **3ma** was obtained in 76% yield (53.1 mg, 0.152 mmol) as a brown solid after column chromatography (eluent = Petroleum ether/EtOAc 4:1 v/v). $\mathbf{R_F}$ (Petroleum ether/EtOAc 4:1): 0.28. $^1$H NMR (400 MHz, MeOD-$d_4$) δ 8.71 (d, *J* = 5.1 Hz, 1H), 7.71 – 7.62 (m, 1H), 7.53 – 7.44 (m, 3H), 7.39 (ddd, *J* = 6.4, 3.4, 1.6 Hz, 1H), 7.32 (s, 1H), 7.02 (dt, *J* = 8.1, 1.7 Hz, 1H), 6.81 (ddd, *J* = 8.1, 3.6, 1.7 Hz, 1H), 6.69 (dd, *J* = 3.5, 1.7 Hz, 1H). $^{19}$F NMR (376 MHz, MeOD-$d_4$) δ -66.6. $^{13}$C NMR (101 MHz, MeOD-$d_4$) δ 162.2, 156.2, 151.0, 140.0, 139.1 (q, *J* = 33.9 Hz), 138.3, 135.1, 133.4, 132.2, 130.5, 130.3, 128.9, 128.0, 124.1 (q, *J* = 272.4 Hz), 121.1 (q, *J* = 3.5 Hz), 120.6, 118.2 (q, *J* = 3.3 Hz), 116.3. **ESI-MS**: calculated $C_{18}H_{12}ClF_3NO$ $[M+H]^+$, 350.0554; Found 350.0543.

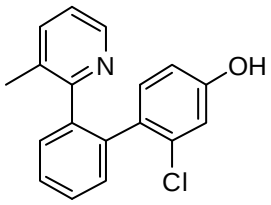
**2,2''-dichloro-2'-(4-(trifluoromethyl)pyridin-2-yl)-[1,1':3',1''-terphenyl]-4,4''-diol (3ma')**




Following general procedure D, the product **3ma'** was obtained in 22% yield (21.5 mg, 0.044 mmol) as a brown solid after column chromatography (eluent = Petroleum ether/EtOAc 4:1 v/v). $\mathbf{R_F}$ (Petroleum ether/EtOAc 4:1): 0.25. $^1$H NMR (400 MHz, MeOD-$d_4$) δ 8.34 (d, *J* = 5.2 Hz, 1H), 7.55 (dd, *J* = 8.0, 7.3 Hz, 1H), 7.38 (d, *J* = 7.7 Hz, 3H), 7.28 (dd, *J* = 5.2, 1.1 Hz, 1H),

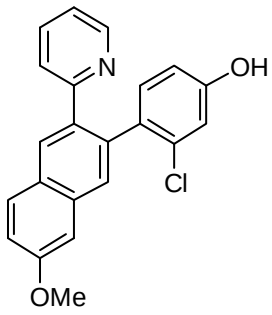
6.97 (d, *J* = 7.7 Hz, 2H), 6.71 (dd, *J* = 8.1, 1.8 Hz, 2H), 6.62 (d, *J* = 1.8 Hz, 2H). $^{19}$F NMR (376 MHz, MeOD-d$_4$) δ -66.5. $^{13}$C NMR (101 MHz, MeOD-d$_4$) δ 161.8, 156.1, 149.3, 140.1, 138.9, 138.2 (q, *J* = 33.7 Hz), 134.7, 133.6, 131.3, 129.7, 128.2, 124.1 (q, *J* = 272.6 Hz), 123.4 (q, *J* = 3.6 Hz), 120.1, 117.8 (q, *J* = 3.3 Hz), 116.1. **ESI-MS**: calculated $C_{24}H_{13}Cl2F_3NO_2$ [M-H]$^-$, 474.0281; Found 474.0270.

**2-chloro-2'-(3-methylpyridin-2-yl)-[1,1'-biphenyl]-4-ol (3na)**



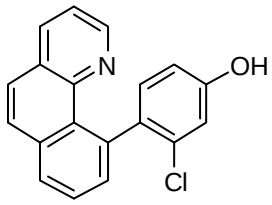

Following general procedure D, the product **3na** was obtained in 58% yield (34.1 mg, 0.116 mmol) as a brown solid after column chromatography (eluent = dichloromethane/EtOAc 20:1 v/v). **R$_F$** (dichloromethane/EtOAc 20:1): 0.24. $^1$H NMR (400 MHz, CDCl$_3$) δ 7.61 – 7.55 (m, 1H), 7.53 – 7.44 (m, 3H), 7.32 – 7.27 (m, 1H), 6.94 (d, *J* = 8.1 Hz, 1H), 6.92 (d, *J* = 2.0 Hz, 1H), 6.88 – 6.79 (m, 2H), 6.63 (d, *J* = 8.3 Hz, 1H), 3.81 (s, 3H). $^{13}$C NMR (101 MHz, CDCl$_3$) δ 158.3, 155.2, 144.7, 139.4, 138.7, 136.9, 134.1, 132.1, 131.9, 131.3, 130.4, 129.2, 128.8, 127.8, 123.3, 120.7, 119.9, 19.4. **ESI-MS**: calculated $C_{18}H_{15}ClNO$ [M+H]$^+$, 296.0837; Found 296.0830.

**3-chloro-4-(7-methoxy-3-(pyridin-2-yl)naphthalen-2-yl)phenol (3oa)**



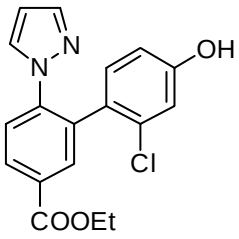

Following general procedure D, the product **3oa** was obtained in 86% yield (62.2 mg, 0.172 mmol) as a brown solid after column chromatography (eluent = Petroleum ether /EtOAc 3:1 v/v). **R$_F$** (Petroleum ether /EtOAc 2:1): 0.44. $^1$H NMR (400 MHz, CDCl$_3$) δ 8.46 (d, *J* = 4.6 Hz, 1H), 7.86 (s, 1H), 7.79 (d, *J* = 8.9 Hz, 1H), 7.73 (t, *J* = 7.7 Hz, 1H), 7.62 (s, 1H), 7.44 (d, *J* = 7.8 Hz, 1H), 7.25 (t, *J* = 6.2 Hz, 1H), 7.20 (d, *J* = 9.0 Hz, 1H), 7.12 (s, 1H), 7.02 (s, 1H), 6.99 (d, *J* = 8.1 Hz, 1H), 6.85 (d, *J* = 8.1 Hz, 1H), 3.91 (s, 3H). $^{13}$C NMR (101 MHz, CDCl$_3$) δ 159.0, 158.7, 156.1, 147.1, 138.0, 135.1, 135.1, 134.6, 134.2, 132.4, 130.8, 130.6, 129.5, 128.2, 124.4, 122.5, 120.6, 120.0, 119.8, 105.5, 55.5. **ESI-MS**: calculated $C_{22}H_{17}ClNO_2$ [M+H]$^+$, 362.0942; Found 362.0932.

**4-(benzo[*h*]quinolin-10-yl)-3-chlorophenol (3pa)**



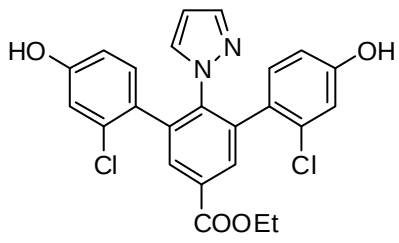

Following general procedure D, the product **3pa** was obtained in 88% yield (53.9 mg, 0.176 mmol) as a brown solid after column chromatography (eluent = Petroleum ether /EtOAc 8:1 v/v). $\mathbf{R_F}$ (Petroleum ether /EtOAc 6:1): 0.31. $^1$H NMR (400 MHz, $CDCl_3$) δ 8.64 (d, *J* = 4.1 Hz, 1H), 8.18 (d, *J* = 7.9 Hz, 1H), 7.98 (d, *J* = 7.9 Hz, 1H), 7.88 (d, *J* = 8.8 Hz, 1H), 7.72 (dd, *J* = 8.0, 6.2 Hz, 2H), 7.52 – 7.42 (m, 2H), 7.13 (s, 1H), 7.02 – 6.90 (m, 2H). $^{13}$C NMR (101 MHz, $CDCl_3$) δ 155.6, 147.6, 146.3, 136.2, 135.5, 134.8, 133.7, 133.4, 133.2, 131.4, 129.6, 129.1, 128.9, 127.9, 127.5, 125.8, 121.7, 120.6, 117.5. **ESI-MS**: calculated $C_{19}H_{13}ClNO$ $[M+H]^+$, 306.0680; Found 306.0669.

**Ethyl 2'-chloro-4'-hydroxy-6-(1*H*-pyrazol-1-yl)-[1,1'-biphenyl]-3-carboxylate (4ca)**




Following general procedure D, the product **4ca** was obtained in 37% yield (25.3 mg, 0.074 mmol) as a brown solid after column chromatography (eluent = Petroleum ether /EtOAc 4:1 v/v). $\mathbf{R_F}$ (Petroleum ether /EtOAc 4:1): 0.37. $^1$H NMR (400 MHz, $CDCl_3$) δ 8.12 (d, *J* = 8.3 Hz, 1H), 8.02 (s, 1H), 7.65 – 7.49 (m, 2H), 7.35 (s, 1H), 6.97 (d, *J* = 7.9 Hz, 1H), 6.90 (d, *J* = 9.6 Hz, 2H), 6.30 (s, 1H), 4.39 (q, *J* = 7.1 Hz, 2H), 1.39 (t, *J* = 7.1 Hz, 3H). $^{13}$C NMR (101 MHz, $CDCl_3$) δ 165.7, 154.9, 142.3, 140.8, 135.1, 134.2, 132.4, 131.6, 130.8, 130.3, 125.6, 125.3, 121.2, 118.3, 107.5, 61.6, 14.4. **ESI-MS**: calculated $C_{18}H_{14}ClN_2O_3$ $[M-H]^-$, 341.0698; Found 341.0685.

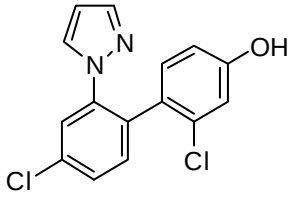
**ethyl 2,2''-dichloro-4,4''-dihydroxy-2'-(1*H*-pyrazol-1-yl)-[1,1':3',1''-terphenyl]-5'-carboxylate (4ca')**




Following general procedure D, the product **4ca'** was obtained in 22% yield (20.3 mg, 0.044 mmol), Following general procedure E, The product **4ca'**

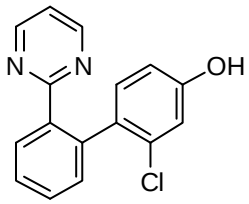
was obtained in 91% yield (85.0mg, 0.182 mmol) as a brown solid after column chromatography (eluent = Petroleum ether /EtOAc 4:1 v/v). $\mathbf{R_F}$ (Petroleum ether /EtOAc 4:1): 0.22. $^1$H NMR (400 MHz, MeOD-$d_4$) δ 8.05 (s, 2H), 7.34 (s, 1H), 7.28 (s, 1H), 6.87 (d, *J* = 8.0 Hz, 2H), 6.75 (s, 2H), 6.68 (d, *J* = 7.8 Hz, 2H), 6.06 (s, 1H), 4.39 (q, *J* = 7.0 Hz, 2H), 1.39 (t, *J* = 7.0 Hz, 3H). $^{13}$C NMR (101 MHz, MeOD-$d_4$) δ 166.9, 156.6, 142.9, 140.3, 138.1, 135.2, 133.8, 132.9, 132.4, 131.4, 125.0, 120.1, 116.3, 106.4, 62.5, 14.5. **ESI-MS**: calculated $C_{24}H_{19}Cl_2N_2O_4$ $[M+H]^+$, 469.0716; Found 469.0703.

**2,4'-dichloro-2'-(1*H*-pyrazol-1-yl)-[1,1'-biphenyl]-4-ol (4da)**



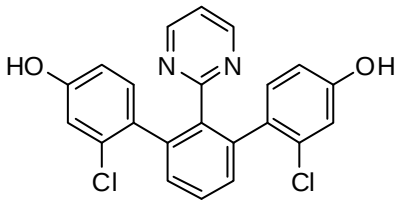

Following general procedure D, the product **4da** was obtained in 32% yield (19.7 mg, 0.064 mmol) as a brown solid after column chromatography (eluent = Petroleum ether /EtOAc 8:1 v/v). $\mathbf{R_F}$ (Petroleum ether /EtOAc 8:1): 0.28. $^1$H NMR (400 MHz, $CDCl_3$) δ 7.55 (s, 1H), 7.47 (s, 1H), 7.42 (d, *J* = 8.3 Hz, 1H), 7.35 (s, 1H), 7.25 (d, *J* = 10.2 Hz, 1H), 6.88 (d, *J* = 12.6 Hz, 3H), 6.30 (s, 1H). $^{13}$C NMR (101 MHz, $CDCl_3$) δ 154.9, 140.6, 139.8, 135.1, 134.7, 133.9, 131.5, 131.5, 130.8, 129.0, 126.2, 125.6, 121.3, 119.1, 107.6. **ESI-MS**: calculated $C_{15}H_9Cl_2N_2O$ $[M-H]^-$, 303.0097; Found 303.0092.

**2-chloro-2'-(pyrimidin-2-yl)-[1,1'-biphenyl]-4-ol (5aa)**



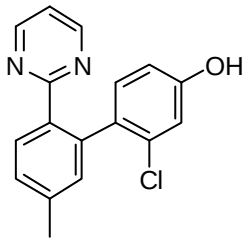

Following general procedure D, the product **5aa** was obtained in 38% yield (21.5 mg, 0.076 mmol) as a brown solid after column chromatography (eluent = Petroleum ether /EtOAc 2:1 v/v). $\mathbf{R_F}$ (Petroleum ether /EtOAc 2:1): 0.25. $^1$H NMR (400 MHz, $CDCl_3$) δ 8.74 (d, *J* = 5.0 Hz, 2H), 7.93 – 7.77 (m, 1H), 7.57 – 7.50 (m, 2H), 7.26 (dt, *J* = 7.4, 4.2 Hz, 2H), 7.02 (d, *J* = 2.0 Hz, 1H), 6.92 (d, *J* = 8.1 Hz, 1H), 6.86 (dd, *J* = 8.2, 2.1 Hz, 1H). $^{13}$C NMR (101 MHz, $CDCl_3$) δ 166.6, 157.0, 155.4, 138.0, 136.9, 134.2, 132.7, 132.3, 130.5, 130.3, 130.2, 128.4, 120.9, 119.4, 119.3. **ESI-MS**: calculated $C_{16}H_{12}ClN_2O$ $[M+H]^+$, 283.0633; Found 283.0621.

**2,2''-dichloro-2'-(pyrimidin-2-yl)-[1,1':3',1''-terphenyl]-4,4''-diol (5aa')**



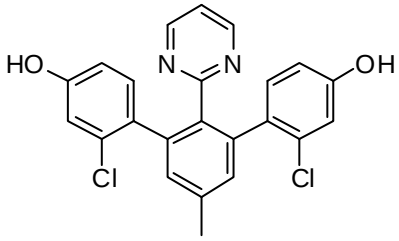

Following general procedure D, the product **5aa'** was obtained in 37% yield (30.6 mg, 0.074 mmol), Following general procedure E, the product **5aa'** was obtained in 99% yield (80.9 mg, 0.198 mmol) as a brown solid after column chromatography (eluent = Petroleum ether/EtOAc 2:1 v/v). $\mathbf{R_F}$ (Petroleum ether/EtOAc 2:1): 0.33. $^1$H NMR (400 MHz, MeOD-d$_4$) δ 8.43 (d, *J* = 4.8 Hz, 2H), 7.55 (t, *J* = 7.6 Hz, 1H), 7.40 (d, *J* = 7.7 Hz, 2H), 7.11 (t, *J* = 4.8 Hz, 1H), 6.96 (d, *J* = 8.1 Hz, 2H), 6.68 (d, *J* = 8.2 Hz, 2H), 6.65 (s, 2H). $^{13}$C NMR (101 MHz, MeOD-d$_4$) δ 168.3, 157.0, 156.3, 139.7, 138.8, 134.4, 133.5, 131.4, 129.7, 128.3, 120.1, 119.9, 116.3. **ESI-MS**: calculated $C_{22}H_{15}Cl_2N_2O_2$ $[M+H]^+$, 409.0505; Found 409.0501.

**2-chloro-5'-methyl-2'-(pyrimidin-2-yl)-[1,1'-biphenyl]-4-ol (5ba)**




Following general procedure D, the product **5ba** was obtained in 71% yield (42.0 mg, 0.142 mmol) as a brown solid after column chromatography (eluent = Petroleum ether /EtOAc 2:1 v/v). $\mathbf{R_F}$ (Petroleum ether /EtOAc 2:1): 0.22. $^1$H NMR (400 MHz, $CDCl_3$) δ 8.71 (d, *J* = 4.9 Hz, 2H), 7.75 (d, *J* = 7.9 Hz, 1H), 7.33 (d, *J* = 7.9 Hz, 1H), 7.21 (t, *J* = 4.9 Hz, 1H), 7.06 (s, 1H), 7.01 (s, 1H), 6.91 (d, *J* = 8.1 Hz, 1H), 6.85 (d, *J* = 8.2 Hz, 1H), 2.42 (s, 3H). $^{13}$C NMR (101 MHz, $CDCl_3$) δ 166.6, 156.9, 155.5, 140.4, 136.8, 135.3, 134.1, 133.3, 132.3, 130.6, 129.1, 120.9, 119.3, 119.1, 21.3. **ESI-MS**: calculated $C_{17}H_{14}ClN_2O$ $[M+H]^+$, 297.0789; Found 297.0776.

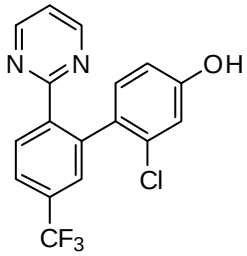
**2,2''-dichloro-5'-methyl-2'-(pyrimidin-2-yl)-[1,1':3',1''-terphenyl]-4,4''-diol (5ba')**




Following general procedure D, the product **5ba'** was obtained in 25% yield (21.2 mg, 0.050 mmol),

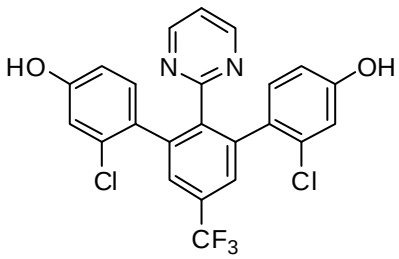
Following general procedure E, the product **5ba'** was obtained in 83% yield (70.3 mg, 0.166 mmol) as a brown solid after column chromatography (eluent = Petroleum ether/EtOAc 3:1 v/v). $\mathbf{R_F}$ (Petroleum ether/EtOAc 2:1): 0.40. $^1$H NMR (400 MHz, MeOD-d4) δ 8.40 (d, *J* = 4.9 Hz, 2H), 7.22 (s, 2H), 7.09 (t, *J* = 5.0 Hz, 1H), 6.95 (d, *J* = 8.1 Hz, 2H), 6.68 (d, *J* = 8.4 Hz, 2H), 6.63 (s, 2H), 2.44 (s, 3H). $^{13}$C NMR (101 MHz, MeOD-d4) δ 168.4, 157.0, 156.2, 139.8, 138.7, 137.0, 134.3, 133.5, 132.0, 128.5, 120.1, 119.7, 116.4, 21.3. **ESI-MS**: calculated $C_{23}H_{17}Cl_2N_2O_2$ $[M+H]^+$, 423.0662; Found 423.0649.

**2-chloro-2'-(pyrimidin-2-yl)-5'-(trifluoromethyl)-[1,1'-biphenyl]-4-ol (5ca)**




Following general procedure D, the product **5ca** was obtained in 56% yield (39.2 mg, 0.112 mmol) as a brown solid after column chromatography (eluent = Petroleum ether /EtOAc 2:1 v/v). $\mathbf{R_F}$ (Petroleum ether /EtOAc 2:1): 0.26. $^1$H NMR (400 MHz, MeOD-d4) δ 8.68 (d, *J* = 4.9 Hz, 2H), 7.98 (d, *J* = 8.1 Hz, 1H), 7.79 (d, *J* = 8.1 Hz, 1H), 7.67 (s, 1H), 7.34 (t, *J* = 4.9 Hz, 1H), 7.11 (d, *J* = 8.2 Hz, 1H), 6.84 (d, *J* = 8.1 Hz, 1H), 6.64 (s, 1H). $^{19}$F NMR (376 MHz, MeOD-d4) δ -64.1. $^{13}$C NMR (101 MHz, MeOD-d4) δ 167.7, 158.2, 156.1, 143.4, 139.8, 135.1, 133.0, 132.3 (q, *J* = 32.4 Hz), 131.8, 129.1 (q, *J* = 3.8 Hz), 127.5, 125.5 (q, *J* = 271.6 Hz), 125.1 (q, *J* = 3.8 Hz), 120.7, 120.7, 116.0. **ESI-MS**: calculated $C_{17}H_{11}ClF_3N_2O$ $[M+H]^+$, 351.0507; Found 351.0492.

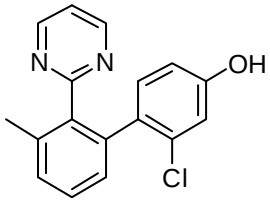
**2,2''-dichloro-2'-(pyrimidin-2-yl)-5'-(trifluoromethyl)-[1,1':3',1''-terphenyl]-4,4''-diol (5ca')**




Following general procedure D, the product **5ca'** was obtained in 19% yield (18.4 mg, 0.038 mmol), Following general procedure E, the product **5ca'** was obtained in 28% yield (27.2 mg, 0.056 mmol) as a brown solid after column chromatography (eluent = Petroleum ether/EtOAc 3:1 v/v). $\mathbf{R_F}$ (Petroleum ether/EtOAc 2:1): 0.34. $^1$H NMR

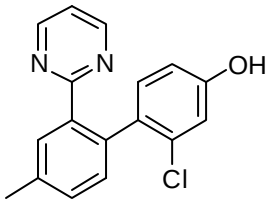
(400 MHz, MeOD-$d_4$) δ 8.47 (d, *J* = 4.9 Hz, 2H), 7.69 (s, 2H), 7.16 (t, *J* = 4.9 Hz, 1H), 6.95 (d, *J* = 7.9 Hz, 2H), 6.69 (d, *J* = 9.2 Hz, 4H). $^{19}$F NMR (376 MHz, MeOD-$d_4$) δ -64.0. $^{13}$C NMR (101 MHz, MeOD-$d_4$) δ 167.3, 157.2, 156.3, 143.1, 140.1, 135.1, 133.4, 131.4 (q, *J* = 32.6 Hz), 127.9 (q, *J* = 3.2 Hz), 126.9, 125.4 (q, *J* = 271.8 Hz), 120.3, 120.2, 116.4. **ESI-MS**: calculated $C_{23}H_{14}N_2O_2F_3Cl_2$ $[M+H]^+$, 477.0379; Found 477.0360.

**2-chloro-3'-methyl-2'-(pyrimidin-2-yl)-[1,1'-biphenyl]-4-ol (5da)**



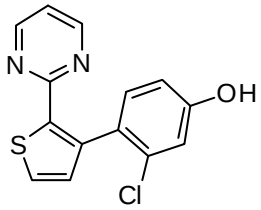

Following general procedure D, the product **5da** was obtained in 98% yield (58.1 mg, 0.196 mmol) as a brown solid after column chromatography (eluent = Petroleum ether /EtOAc 4:1 v/v). $\mathbf{R_F}$ (Petroleum ether /EtOAc 2:1): 0.31. $^1$H NMR (400 MHz, $CDCl_3$) δ 8.70 (d, *J* = 4.9 Hz, 2H), 7.98 (s, 1H), 7.40 (t, *J* = 7.6 Hz, 1H), 7.33 (d, *J* = 7.6 Hz, 1H), 7.20 (t, *J* = 4.9 Hz, 1H), 7.10 (d, *J* = 7.5 Hz, 1H), 6.92 – 6.85 (m, 1H), 6.76 (d, *J* = 8.1 Hz, 1H), 2.19 (s, 3H). $^{13}$C NMR (101 MHz, $CDCl_3$) δ 167.2, 156.7, 154.3, 138.4, 136.4, 136.1, 133.9, 131.8, 130.4, 129.3, 129.1, 128.9, 120.8, 119.5, 118.5, 20.2. **ESI-MS**: calculated $C_{17}H_{14}ClN_2O$ $[M+H]^+$, 297.0789; Found 297.0783.

**2-chloro-4'-methyl-2'-(pyrimidin-2-yl)-[1,1'-biphenyl]-4-ol (5ea)**



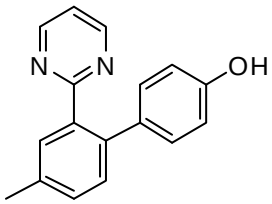

Following general procedure D, the product **5ea** was obtained in 86% yield (51.2 mg, 0.172 mmol) as a brown solid after column chromatography (eluent = Petroleum ether /EtOAc 4:1 v/v). $\mathbf{R_F}$ (Petroleum ether /EtOAc 2:1): 0.31. $^1$H NMR (400 MHz, $CDCl_3$) δ 9.15 (s, 1H), 8.70 (d, *J* = 4.9 Hz, 2H), 7.65 (s, 1H), 7.33 (d, *J* = 7.8 Hz, 1H), 7.21 (t, *J* = 4.8 Hz, 1H), 7.14 (d, *J* = 7.8 Hz, 1H), 6.97 (s, 1H), 6.89 (d, *J* = 8.1 Hz, 1H), 6.83 (d, *J* = 8.2 Hz, 1H), 2.45 (s, 3H). $^{13}$C NMR (101 MHz, $CDCl_3$) δ 166.7, 156.9, 155.4, 138.2, 137.7, 134.0, 133.9, 132.6, 132.4, 131.0, 130.9, 130.1, 120.8, 119.3, 119.1, 21.1. **ESI-MS**: calculated $C_{17}H_{12}ClN_2O$ $[M-H]^-$, 295.0644; Found 295.0641.

**3-chloro-4-(2-(pyrimidin-2-yl)thiophen-3-yl)phenol (5fa)**



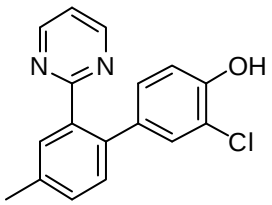

Following general procedure D, the product **5fa** was obtained in 80% yield (46.1 mg, 0.160 mmol) as a brown solid after column chromatography (eluent = Petroleum ether /EtOAc 4:1 v/v). $\mathbf{R_F}$ (Petroleum ether /EtOAc 4:1): 0.29. $^1$H NMR (400 MHz, $CDCl_3$) δ 10.00 (s, 1H), 8.73 (d, *J* = 4.1 Hz, 2H), 7.56 (d, *J* = 4.3 Hz, 1H), 7.18 (d, *J* = 3.9 Hz, 1H), 7.15 (s, 1H), 7.11 (d, *J* = 8.2 Hz, 1H), 7.00 (d, *J* = 4.3 Hz, 1H), 6.96 (d, *J* = 8.2 Hz, 1H). $^{13}$C NMR (101 MHz, $CDCl_3$) δ 161.5, 157.4, 155.9, 139.0, 137.1, 134.8, 134.2, 132.5, 129.3, 125.7, 121.1, 120.7, 118.5. **ESI-MS**: calculated $C_{14}H_8ClN_2OS$ $[M-H]^-$, 287.0051; Found 287.0044.

**4'-methyl-2'-(pyrimidin-2-yl)-[1,1'-biphenyl]-4-ol (5eb)**




Following general procedure D, the product **5eb** was obtained in 58% yield (30.4mg, 0.116 mmol) as a brown solid after column chromatography (eluent = Petroleum ether /EtOAc 2:1 v/v). $\mathbf{R_F}$ (Petroleum ether /EtOAc 2:1): 0.21. $^1$H NMR (400 MHz, $CDCl_3$) δ 8.67 (d, *J* = 4.9 Hz, 2H), 7.51 (s, 1H), 7.30 (d, *J* = 8.0 Hz, 2H), 7.15 (t, *J* = 4.8 Hz, 1H), 6.85 (d, *J* = 8.3 Hz, 2H), 6.43 (d, *J* = 8.4 Hz, 2H), 2.41 (s, 3H). $^{13}$C NMR (101 MHz, $CDCl_3$) δ 168.5, 156.9, 155.2, 138.3, 137.3, 136.8, 132.9, 131.1, 130.6, 130.5, 130.3, 118.7, 115.3, 21.1. **ESI-MS**: calculated $C_{17}H_{15}N_2O$ $[M+H]^+$, 263.1179; Found 263.1170.

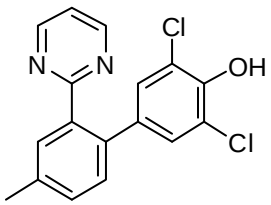
**3-chloro-4'-methyl-2'-(pyrimidin-2-yl)-[1,1'-biphenyl]-4-ol (5ec)**




Following general procedure D, the product **5ec** was obtained in 75% yield (44.7mg, 0.150 mmol) as a brown solid after column chromatography (eluent = Petroleum ether /EtOAc 2:1 v/v). $\mathbf{R_F}$ (Petroleum ether /EtOAc 2:1): 0.26. $^1$H NMR (400 MHz, $CDCl_3$) δ 8.67 (d, *J* = 4.9 Hz, 2H), 7.59 (s, 1H), 7.31 (s, 2H), 7.14 (dd, *J* = 5.2, 3.6 Hz, 2H), 6.82 (dd, *J* = 8.4, 2.0 Hz, 1H), 6.78 (d, *J* = 8.4 Hz, 1H), 2.44 (s, 3H). $^{13}$C NMR (101 MHz, $CDCl_3$) δ 168.1, 157.0, 150.1, 137.8, 137.5, 136.9, 135.0, 131.3,

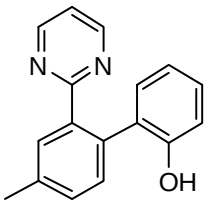
130.6, 130.4, 129.5, 129.3, 119.6, 118.6, 115.7, 21.1. **ESI-MS**: calculated $C_{17}H_{12}ClN_2O$ $[M-H]^-$, 295.0644; Found 295.0641.

**3,5-dichloro-4'-methyl-2'-(pyrimidin-2-yl)-[1,1'-biphenyl]-4-ol (5ed)**



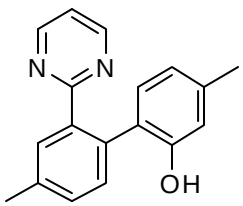

Following general procedure D, the product **5ed** was obtained in 85% yield (56.6mg, 0.170 mmol) as a brown solid after column chromatography (eluent = Petroleum ether /EtOAc 4:1 v/v). $\mathbf{R_F}$ (Petroleum ether /EtOAc 4:1): 0.23. $^1$H NMR (400 MHz, $CDCl_3$) δ 8.69 (d, *J* = 4.9 Hz, 2H), 7.62 (s, 1H), 7.29 (q, *J* = 8.1 Hz, 2H), 7.16 (t, *J* = 4.9 Hz, 1H), 7.00 (s, 2H), 2.44 (s, 3H). $^{13}$C NMR (101 MHz, $CDCl_3$) δ 167.6, 157.0, 146.5, 138.0, 137.8, 135.8, 135.2, 131.4, 130.5, 130.5, 128.9, 120.6, 118.8, 21.2. **ESI-MS**: calculated $C_{17}H_{11}Cl_2N_2O$ $[M-H]^-$, 329.0254; Found 329.0249.

**4'-methyl-2'-(pyrimidin-2-yl)-[1,1'-biphenyl]-2-ol (5ee)**




Following general procedure D, the product **5ee** was obtained in 43% yield (22.4mg, 0.086 mmol) as a brown solid after column chromatography (eluent = Petroleum ether /EtOAc 2:1 v/v). $\mathbf{R_F}$ (Petroleum ether /EtOAc 2:1): 0.26. $^1$H NMR (400 MHz, $CDCl_3$) δ 8.70 (d, *J* = 4.9 Hz, 2H), 7.63 (d, *J* = 10.5 Hz,1H), 7.34 (d, *J* = 7.8 Hz, 1H), 7.23 – 7.16 (m, 3H), 7.01 – 6.95 (m, 2H), 6.86 (t, *J* = 7.4 Hz, 1H), 2.46 (s, 3H). $^{13}$C NMR (101 MHz, $CDCl_3$) δ 167.0, 156.8, 154.4, 137.9, 137.8, 135.0, 132.6, 131.6, 131.5, 130.9, 130.8, 128.9, 120.7, 119.2, 118.7, 21.1. **ESI-MS**: calculated $C_{17}H_{15}N_2O$ $[M+H]^+$, 263.1179; Found 263.1173.

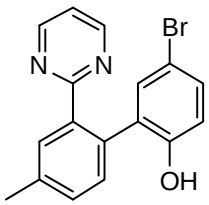
**4,4'-dimethyl-2'-(pyrimidin-2-yl)-[1,1'-biphenyl]-2-ol (5ef)**




Following general procedure D, the product **5ef** was obtained in 98% yield (54.4mg, 0.196 mmol) as a brown solid after column chromatography (eluent = Petroleum ether /EtOAc 2:1 v/v). $\mathbf{R_F}$ (Petroleum ether /EtOAc 2:1): 0.29. $^1$H NMR (400 MHz, $CDCl_3$) δ 8.69 (d, *J* = 5.0 Hz, 2H), 7.63 (s, 1H), 7.33 (d, *J* = 7.8 Hz, 1H), 7.22 – 7.12 (m, 2H),

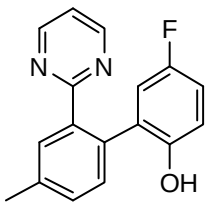
6.87 (d, *J* = 7.7 Hz, 1H), 6.81 (s, 1H), 6.68 (d, *J* = 7.6 Hz, 1H), 2.45 (s, 3H), 2.30 (s, 3H). $^{13}$C NMR (101 MHz, $CDCl_3$) δ 167.0, 156.8, 154.2, 138.9, 137.9, 137.6, 135.1, 132.8, 131.4, 130.8, 130.7, 128.4, 121.5, 119.3, 119.1, 21.1, 21.1. **ESI-MS**: calculated $C_{18}H_{15}N_2O$ $[M-H]^-$, 275.1190; Found 275.1183.

**5-bromo-4'-methyl-2'-(pyrimidin-2-yl)-[1,1'-biphenyl]-2-ol (5eg)**



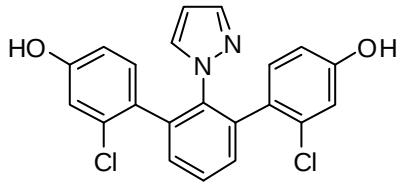

Following general procedure D, the product **5eg** was obtained in 53% yield (36.1mg, 0.106 mmol) as a brown solid after column chromatography (eluent = Petroleum ether /EtOAc 5:2 v/v). $\mathbf{R_F}$ (Petroleum ether /EtOAc 2:1): 0.29. $^1$H NMR (400 MHz, $CDCl_3$) δ 8.72 (d, *J* = 5.0 Hz, 2H), 7.66 (s, 1H), 7.35 (d, *J* = 7.8 Hz, 1H), 7.29 (dd, *J* = 8.6, 2.5 Hz, 1H), 7.23 (t, *J* = 5.0 Hz, 1H), 7.16 (d, *J* = 7.8 Hz, 1H), 7.11 (d, *J* = 2.5 Hz, 1H), 6.87 (d, *J* = 8.6 Hz, 1H), 2.46 (s, 3H). $^{13}$C NMR (101 MHz, $CDCl_3$) δ 166.6, 156.9, 154.0, 138.4, 137.6, 134.0, 133.7, 133.7, 132.5, 131.8, 131.0, 131.0, 120.8, 119.4, 112.7, 21.2. **ESI-MS**: calculated $C_{17}H_{12}BrN_2O$ $[M-H]^-$, 339.0138; Found 339.0128.

**5-fluoro-4'-methyl-2'-(pyrimidin-2-yl)-[1,1'-biphenyl]-2-ol (5eh)**



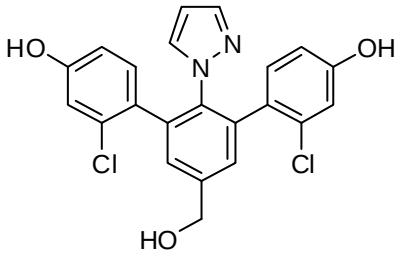

Following general procedure D, the product **5eh** was obtained in 65% yield (36.7mg, 0.130 mmol) as a brown solid after column chromatography (eluent = Petroleum ether /EtOAc 4:1 v/v). $\mathbf{R_F}$ (Petroleum ether /EtOAc 4:1): 0.26. $^1$H NMR (400 MHz, $CDCl_3$) δ 8.72 (d, *J* = 5.0 Hz, 2H), 7.65 (s, 1H), 7.34 (dd, *J* = 7.8, 1.1 Hz, 1H), 7.22 (t, *J* = 5.0 Hz, 1H), 7.18 (d, *J* = 7.8 Hz, 1H), 6.96 – 6.83 (m, 2H), 6.70 (dd, *J* = 9.0, 2.9 Hz, 1H), 2.46 (s, 3H). $^{19}$F NMR (376 MHz, $CDCl_3$) δ -124.2. $^{13}$C NMR (101 MHz, $CDCl_3$) δ 166.7, 156.9, 156.8 (d, *J* = 239.6 Hz), 150.7 (d, *J* = 2.3 Hz), 138.3, 137.6, 134.1, 132.7 (d, *J* = 7.8 Hz), 132.3, 131.0, 130.9, 119.8 (d, *J* = 8.4 Hz), 119.3, 117.7 (d, *J* = 22.9 Hz), 115.2 (d, *J* = 22.5 Hz), 21.1. **ESI-MS**: calculated $C_{17}H_{14}FN_2O$ $[M+H]^+$, 281.1085; Found 281.1077.

**2,2''-dichloro-2'-(1*H*-pyrazol-1-yl)-[1,1':3',1''-terphenyl]-4,4''-diol (4aa')**



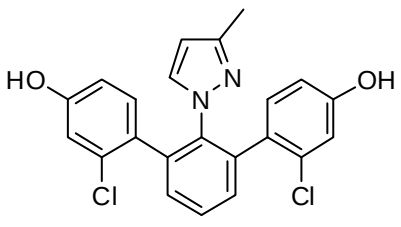

Following general procedure E, the product **4aa'** was obtained in 76% yield (60.5 mg, 0.152 mmol) as a brown solid after column chromatography (eluent = Petroleum ether /EtOAc 4:1 v/v). $\mathbf{R_F}$ (Petroleum ether /EtOAc 4:1): 0.21. $^1$H NMR (400 MHz, MeOD-d$_4$) δ 7.54 (t, *J* = 7.5 Hz, 1H), 7.42 (d, *J* = 7.5 Hz, 2H), 7.35 (s, 1H), 7.24 (s, 1H), 6.87 (d, *J* = 8.1 Hz, 2H), 6.74 (s, 2H), 6.65 (d, *J* = 8.2 Hz, 2H), 6.01 (d, *J* = 1.3 Hz, 1H). $^{13}$C NMR (101 MHz, MeOD-d$_4$) δ 156.6, 139.9, 139.4, 137.9, 134.8, 134.0, 132.6, 132.1, 129.7, 125.9, 120.1, 116.4, 106.1. **ESI-MS**: calculated $C_{21}H_{13}Cl2N_2O_2$ $[M-H]^-$,395.0360; Found 395.0364.

**2,2''-dichloro-5'-(hydroxymethyl)-2'-(1H-pyrazol-1-yl)-[1,1':3',1''-terphenyl]-4,4''-diol (4ba')**




Following general procedure E, the product **4ba'** was obtained in 92% yield (78.4 mg, 0.184 mmol) as a brown solid after column chromatography (eluent = Petroleum ether /EtOAc 1:1 v/v). $\mathbf{R_F}$ (Petroleum ether /EtOAc 1:1): 0.22. $^1$H NMR (400 MHz, MeOD-d$_4$) δ 7.42 (s, 2H), 7.34 (d, *J* = 1.2 Hz, 1H), 7.24 (s, 1H), 6.88 (d, *J* = 8.2 Hz, 2H), 6.73 (s, 2H), 6.66 (d, *J* = 8.1 Hz, 2H), 6.01 (s, 1H), 4.73 (s, 2H). $^{13}$C NMR (101 MHz, MeOD-d$_4$) δ 156.5, 143.4, 139.8, 138.3, 137.8, 134.8, 134.0, 132.6, 130.1, 125.9, 120.0, 116.3, 105.9, 64.4. **ESI-MS**: calculated $C_{21}H_{12}Cl_2N_2O_2$ $[M-H]^-$, 425.0465; Found 425.0460.

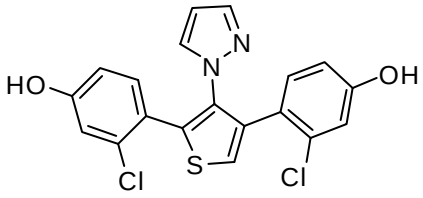
**2,2''-dichloro-2'-(3-methyl-1*H*-pyrazol-1-yl)-[1,1':3',1''-terphenyl]-4,4''-diol (4ea')**




Following general procedure E, the product **4ea'** was obtained in 75% yield (61.6mg, 0.150 mmol) as a brown solid after column chromatography (eluent = Petroleum ether /EtOAc 4:1 v/v). $\mathbf{R_F}$ (Petroleum ether /EtOAc 4:1): 0.21. $^1$H NMR (400 MHz, MeOD-d$_4$) δ 7.52 (t, *J* = 7.6 Hz, 1H),

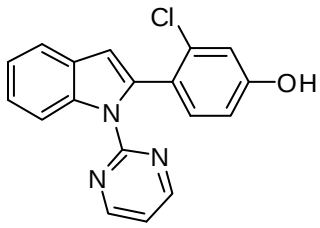
7.40 (d, *J* = 7.7 Hz, 2H), 7.21 (s, 1H), 6.89 (d, *J* = 8.1 Hz, 2H), 6.75 (s, 2H), 6.67 (d, *J* = 8.1 Hz, 2H), 5.79 (s, 1H), 2.00 (s, 3H). $^{13}$C NMR (101 MHz, MeOD-d$_4$) δ 156.5, 149.4, 139.4, 137.9, 134.7, 134.7, 132.6, 132.0, 129.4, 126.0, 119.9, 116.4, 105.8, 12.9. **ESI-MS**: calculated $C_{22}H_{15}Cl2N_2O_2$ [M-H]$^-$, 409.0516; Found 409.0507.

**4,4'-(3-(1*H*-pyrazol-1-yl)thiophene-2,4-diyl)bis(3-chlorophenol) (4fa')**



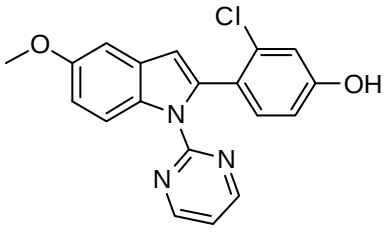

Following general procedure E, the product **4fa'** was obtained in 91% yield (73.4mg, 0.182 mmol) as a brown solid after column chromatography (eluent = Petroleum ether /EtOAc 4:1 v/v). $\mathbf{R_F}$ (Petroleum ether /EtOAc 4:1): 0.19. $^1$H NMR (400 MHz, DMSO-d$_6$) δ 10.51 (s, 1H), 9.99 (s, 1H), 7.69 (s, 1H), 7.49 (s, 2H), 6.90 (s, 1H), 6.83 (s, 1H), 6.79 – 6.57 (m, 4H), 6.24 (s, 1H). $^{13}$C NMR (101 MHz, DMSO-d$_6$) δ 156.0, 155.8, 139.8, 134.8, 133.6, 133.1, 132.3, 132.0, 131.9, 131.1, 131.1, 124.4, 120.6, 118.8, 118.4, 117.7, 115.4, 115.1, 106.1. **ESI-MS**: calculated $C_{19}H_{11}Cl_2N_2O_2S$ [M-H]$^-$, 400.9924; Found 400.9911.

**3-chloro-4-(1-(pyrimidin-2-yl)-1*H*-indol-2-yl)phenol (6aa)**



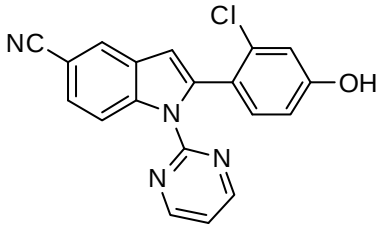

Following general procedure F, the product **6aa** was obtained in 66% yield (42.7mg, 0.132 mmol) as a brown solid after column chromatography (eluent = Petroleum ether /EtOAc 8:1 v/v). $\mathbf{R_F}$ (Petroleum ether /EtOAc 2:1): 0.44. $^1$H NMR (400 MHz, CDCl3) δ 8.69 (d, J = 4.8 Hz, 2H), 8.16 (d, J = 8.3 Hz, 1H), 7.99 (s, 1H), 7.65 (d, J = 7.7 Hz, 1H), 7.34 (t, J = 7.6 Hz, 1H), 7.29 (d, J = 7.5 Hz, 1H), 7.16 (t, J = 4.8 Hz, 1H), 7.08 – 7.03 (m, 2H), 6.88 (dd, J = 8.1, 1.7 Hz, 1H), 6.69 (s, 1H). $^{13}$C NMR (101 MHz, $CDCl_3$) δ 158.4, 157.1, 155.9, 137.2, 135.5, 135.0, 133.1, 129.0, 124.1, 122.6, 121.4, 120.9, 120.8, 118.4, 118.0, 113.3, 110.8. **ESI-MS**: calculated $C_{18}H_{11}ClN_3O$ [M-H]$^-$, 320.0596; Found 320.0589.

**3-chloro-4-(5-methoxy-1-(pyrimidin-2-yl)-1*H*-indol-2-yl)phenol (6ba)**



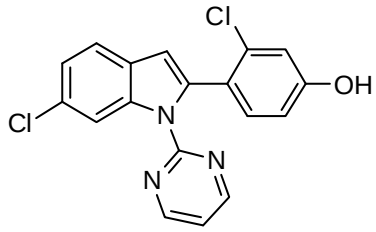

Following general procedure F, the product **6ba** was obtained in 32% yield (22.4mg, 0.064 mmol) as a brown solid after column chromatography (eluent = Petroleum ether /EtOAc 6:1 v/v). $\mathbf{R_F}$ (Petroleum ether /EtOAc 2:1): 0.39. $^1$H NMR (400 MHz, $CDCl_3$) δ 8.66 (d, *J* = 4.9 Hz, 2H), 8.09 (d, *J* = 9.1 Hz, 1H), 7.99 (s, 1H), 7.13 (t, *J* = 4.9 Hz, 1H), 7.09 (d, *J* = 2.5 Hz, 1H), 7.05 (dd, *J* = 6.1, 5.2 Hz, 2H), 6.96 (dd, *J* = 9.1, 2.6 Hz, 1H), 6.88 (dd, *J* = 8.2, 2.1 Hz, 1H), 6.61 (s, 1H), 3.88 (s, 3H). $^{13}$C NMR (101 MHz, $CDCl_3$) δ 158.4, 157.2, 156.0, 155.9, 135.5, 133.1, 132.1, 129.8, 121.6, 120.8, 118.4, 117.7, 114.6, 113.6, 110.9, 102.7, 55.9. **ESI-MS**: calculated $C_{19}H_{13}ClN_3O_2$ $[M-H]^-$, 350.0702; Found 350.0691.

**2-(2-chloro-4-hydroxyphenyl)-1-(pyrimidin-2-yl)-1*H*-indole-5-carbonitrile (6ca)**




Following general procedure F, the product **6ca** was obtained in 22% yield (15.6mg, 0.044 mmol) as a brown solid after column chromatography (eluent = Petroleum ether /EtOAc 2:1 v/v). $\mathbf{R_F}$ (Petroleum ether /EtOAc 2:1): 0.27. $^1$H NMR (400 MHz, $CDCl_3$) δ 8.75 (d, *J* = 4.9 Hz, 2H), 8.20 (d, *J* = 8.7 Hz, 1H), 7.99 (s, 1H), 7.56 (d, *J* = 8.8 Hz, 2H), 7.28 (t, *J* = 5.3 Hz, 1H), 7.08 (d, *J* = 8.2 Hz, 1H), 7.02 (s, 1H), 6.92 (d, *J* = 8.2 Hz, 1H), 6.75 (s, 1H). $^{13}$C NMR (101 MHz, $CDCl_3$) δ 158.7, 156.6, 155.5, 138.7, 137.8, 136.1, 132.9, 128.8, 126.9, 125.9, 121.2, 120.4, 120.1, 118.9, 118.5, 114.3, 110.1, 105.6. **ESI-MS**: calculated $C_{19}H_{10}ClN_4O$ $[M-H]^-$, 345.0549; Found 345.0535.

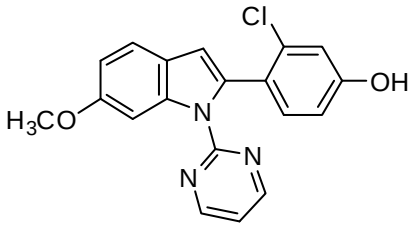
**3-chloro-4-(6-chloro-1-(pyrimidin-2-yl)-1*H*-indol-2-yl)phenol (6da)**




Following general procedure F, the product **6da** was obtained in 87% yield (62.3mg, 0.174 mmol) as a brown solid after column chromatography (eluent = Petroleum ether /EtOAc 4:1 v/v). $\mathbf{R_F}$ (Petroleum ether /EtOAc 2:1): 0.29. $^1$H NMR (400 MHz, $CDCl_3$) δ 8.71 (d, J = 4.8 Hz, 2H), 8.20 (s, 1H), 7.79 (s, 1H), 7.55 (d, J = 8.4 Hz, 1H), 7.22 (dd, J = 9.8, 4.9 Hz, 2H), 7.07 – 7.02

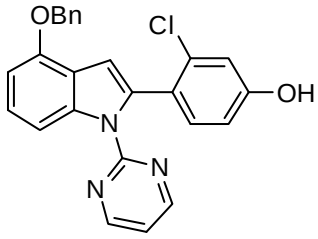
(m, 2H), 6.89 (d, J = 8.2 Hz, 1H), 6.66 (s, 1H). $^{13}$C NMR (101 MHz, $CDCl_3$) δ 158.6, 157.8, 156.9, 155.7, 137.5, 135.8, 132.9, 130.0, 127.5, 123.2, 121.6, 121.0, 120.9, 118.4, 118.3, 113.7, 110.5. **ESI-MS**: calculated $C_{18}H_{10}Cl_2N_3O$ $[M-H]^-$, 354.0206; Found 354.0199.

**3-chloro-4-(6-methoxy-1-(pyrimidin-2-yl)-1*H*-indol-2-yl)phenol (6ea)**



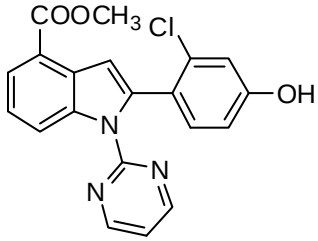

Following general procedure F, the product **6ea** was obtained in 58% yield (40.7mg, 0.116 mmol) as a brown solid after column chromatography (eluent = Petroleum ether /EtOAc 2:1 v/v). $\mathbf{R_F}$ (Petroleum ether /EtOAc 2:1): 0.36. $^1$H NMR (400 MHz, $CDCl_3$) δ 8.69 (d, *J* = 4.9 Hz, 2H), 7.79 – 7.71 (m, 2H), 7.52 (d, *J* = 8.6 Hz, 1H), 7.16 (t, *J* = 4.9 Hz, 1H), 7.03 (d, *J* = 2.4 Hz, 1H), 7.01 (s, 1H), 6.93 (dd, *J* = 8.6, 2.2 Hz, 1H), 6.86 (dd, *J* = 8.2, 2.0 Hz, 1H), 6.63 (s, 1H), 3.88 (s, 3H). $^{13}$C NMR (101 MHz, $CDCl_3$) δ 158.5, 157.8, 157.3, 155.9, 138.2, 135.3, 133.7, 132.9, 123.1, 121.5, 121.3, 120.6, 118.1, 117.8, 111.8, 110.8, 97.6, 55.8. **ESI-MS**: calculated $C_{19}H_{13}ClN_3O_2$ $[M-H]^-$, 350.0702; Found 350.0693.

**4-(4-(benzyloxy)-1-(pyrimidin-2-yl)-1*H*-indol-2-yl)-3-chlorophenol (6fa)**



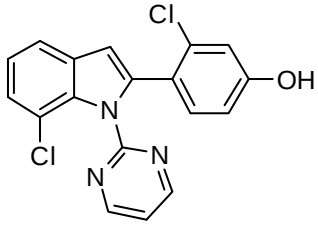

Following general procedure F, the product **6fa** was obtained in 57% yield (49.2mg, 0.114 mmol) as a brown solid after column chromatography (eluent = Petroleum ether /EtOAc 6:1 v/v). $\mathbf{R_F}$ (Petroleum ether /EtOAc 2:1): 0.43. $^1$H NMR (400 MHz, CDCl3) δ 8.68 (d, J = 2.9 Hz, 2H), 7.88 (s, 1H), 7.76 (d, J = 8.3 Hz, 1H), 7.51 (d, J = 7.3 Hz, 2H), 7.40 (t, J = 7.1 Hz, 2H), 7.37 – 7.32 (m, 1H), 7.28 – 7.20 (m, 1H), 7.14 (d, J = 2.8 Hz, 1H), 7.08 – 7.00 (m, 2H), 6.92 – 6.84 (m, 2H), 6.76 (d, J = 7.7 Hz, 1H), 5.25 (s, 2H). $^{13}$C NMR (101 MHz, $CDCl_3$) δ 158.4, 157.2, 155.8, 152.3, 138.6, 137.3, 135.3, 133.5, 133.1, 128.6, 128.0, 127.4, 125.0, 121.3, 120.7, 120.0, 118.2, 118.0, 108.0, 106.7, 104.1, 70.1. **ESI-MS**: calculated $C_{25}H_{17}ClN_3O_2$ $[M-H]^-$, 426.1015; Found 426.1005.

**methyl2-(2-chloro-4-hydroxyphenyl)-1-(pyrimidin-2-yl)-1*H*-indole-4-carboxylate (6ga)**



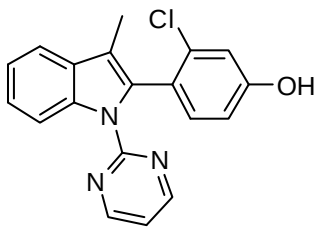

Following general procedure F, the product **6ga** was obtained in 36% yield (27.3 mg, 0.072 mmol) as a brown solid after column chromatography (eluent = Petroleum ether /EtOAc 4:1 v/v). $\mathbf{R_F}$ (Petroleum ether /EtOAc 2:1): 0.30. $^1$H NMR (400 MHz, CDCl3) δ 8.69 (d, J = 4.8 Hz,2H), 8.33 (d, J = 8.3 Hz, 1H), 8.01 (d, J = 7.6 Hz, 1H), 7.79 (s, 1H), 7.44 – 7.32 (m,2H), 7.18 (t, J = 4.8 Hz, 1H), 7.14 (s, 1H), 7.00 (s, 1H), 6.89 (d, J = 8.2 Hz, 1H), 3.98 (s, 3H). $^{13}$C NMR (101 MHz, CDCl3) δ 167.6, 158.5, 156.9, 155.6, 137.9, 137.2, 135.7, 132.8, 128.7, 125.6, 123.3, 121.7, 120.9, 120.91 118.4, 118.2, 118.0, 111.0, 52.0. **ESI-MS**: calculated $C_{20}H_{13}ClN_3O_3$ [M-H]$^-$, 378.0651; Found 378.0642.

**3-chloro-4-(7-chloro-1-(pyrimidin-2-yl)-1*H*-indol-2-yl)phenol (6ha)**




Following general procedure F, the product **6ha** was obtained in 59% yield (42.1mg, 0.118 mmol) as a brown solid after column chromatography (eluent = Petroleum ether /EtOAc 4:1 v/v). $\mathbf{R_F}$ (Petroleum ether /EtOAc 2:1): 0.32. $^1$H NMR (400 MHz, $CDCl_3$) δ 8.75 (d, *J* = 4.8 Hz, 2H), 8.60 (s, 1H), 7.58 (d, *J* = 7.7 Hz, 1H), 7.31 (t, *J* = 4.8 Hz, 1H), 7.25 (d, *J* = 4.0 Hz, 1H), 7.16 (dd, *J* = 7.8, 4.7 Hz, 2H), 7.03 (s, 1H), 6.87 (d, *J* = 8.1 Hz, 1H), 6.65 (s, 1H). $^{13}$C NMR (101 MHz, $CDCl_3$) δ 158.4, 157.8, 155.8, 138.6, 136.3, 134.8, 133.0, 132.0, 124.9, 122.9, 121.4, 120.2, 119.8, 119.7, 119.6, 118.0, 108.1. **ESI-MS**: calculated $C_{18}H_{10}Cl_2N_3O$ [M-H]$^-$, 354.0206; Found 354.0201.

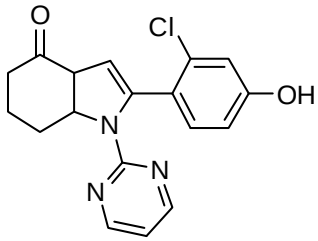
**3-chloro-4-(3-methyl-1-(pyrimidin-2-yl)-1*H*-indol-2-yl)phenol (6ia)**




Following general procedure F, the product **6ia** was obtained in 53% yield (35.8 mg, 0.106 mmol) as a brown solid after column chromatography (eluent = Petroleum

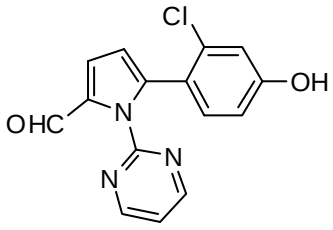
ether /EtOAc 6:1 v/v). **$R_F$** (Petroleum ether /EtOAc 4:1): 0.45. $^1$H NMR (400 MHz, $CDCl_3$) δ 8.63 (d, *J* = 4.9 Hz, 2H), 8.22 (d, *J* = 8.1 Hz, 1H), 7.71 (s, 1H), 7.64 – 7.61 (m, 1H), 7.39 – 7.34 (m, 1H), 7.30 (td, *J* = 7.5, 1.1 Hz, 1H), 7.09 (dd, *J* = 7.6, 3.4 Hz, 2H), 6.97 (d, *J* = 8.1 Hz, 1H), 6.90 (dd, *J* = 8.2, 2.1 Hz, 1H), 2.14 (s, 3H). $^{13}$C NMR (101 MHz, $CDCl_3$) δ 158.3, 157.2, 156.5, 136.8, 135.4, 133.3, 130.5, 130.1, 124.4, 122.2, 120.8, 120.6, 119.1, 118.3, 118.2, 117.4, 113.22, 9.47. **ESI-MS**: calculated $C_{19}H_{13}ClN_3O$ $[M-H]^-$, 334.0753; Found 334.0744.

**3-chloro-4-(1-(pyrimidin-2-yl)-3a,4,5,6,7,7a-hexahydro-1*H*-indol-2-yl)phenol (7aa)**




Following general procedure F, the product **7aa** was obtained in 84% yield (57.6 mg, 0.168 mmol) as a brown solid after column chromatography (eluent = Petroleum ether /EtOAc 1:3 v/v). **$R_F$** (Petroleum ether /EtOAc 1:3): 0.37. $^1$H NMR (400 MHz, DMSO-$d_6$) δ 8.77 (d, *J* = 4.8 Hz, 2H), 7.47 (t, *J* = 4.7 Hz, 1H), 7.24 (d, *J* = 8.2 Hz, 1H), 6.85 (d, *J* = 8.1 Hz, 1H), 6.61 (s, 0H), 6.47 (s, 1H), 2.98 (t, *J* = 5.6 Hz, 2H), 2.43 (t, *J* = 5.8 Hz, 2H), 2.08 – 2.02 (m, 2H). $^{13}$C NMR (101 MHz, DMSO-$d_6$) δ 193.3, 158.5, 156.6, 154.9, 145.2, 132.3, 132.1, 131.2, 120.9, 119.8, 119.8, 119.0, 114.5, 107.2, 37.4, 23.6, 23.4. **ESI-MS**: calculated $C_{18}H_{13}ClN_3O_2$ $[M-H]^-$, 338.0702; Found 338.0694.

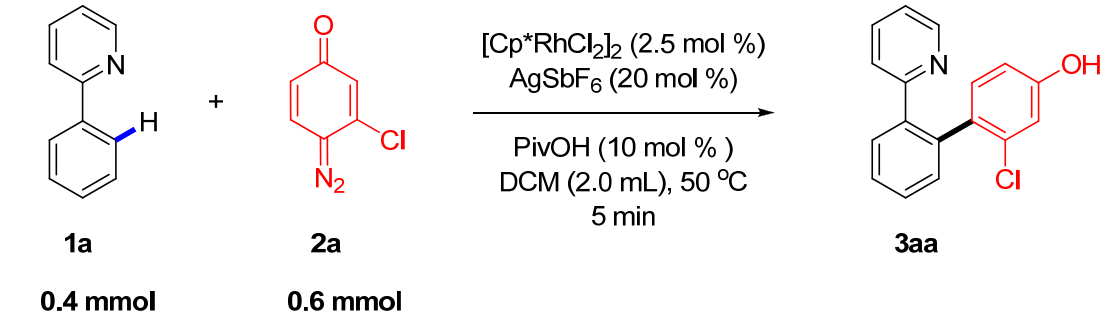
**5-(2-chloro-4-hydroxyphenyl)-1-(pyrimidin-2-yl)-1*H*-pyrrole-2-carbaldehyde (7ba)**




Following general procedure F, the product **7ba** was obtained in 27% yield (16.1 mg, 0.054 mmol) as a brown solid after column chromatography (eluent = Petroleum ether /EtOAc 3:1 v/v). **$R_F$** (Petroleum ether /EtOAc 2:1): 0.26. $^1$H NMR (400 MHz, CDCl3) δ 10.22 (s, 1H), 9.47 (s, 1H), 8.56 (d, J = 4.6 Hz, 2H), 7.65 (d, J = 8.3 Hz, 1H), 7.30 (d, J = 8.6 Hz, 2H), 7.08 (t, J = 4.6 Hz, 1H), 6.92 (s, 1H), 6.67 (s, 1H). $^{13}$C NMR (101 MHz, $CDCl_3$) δ 178.9, 164.3, 160.1, 149.6, 134.7,

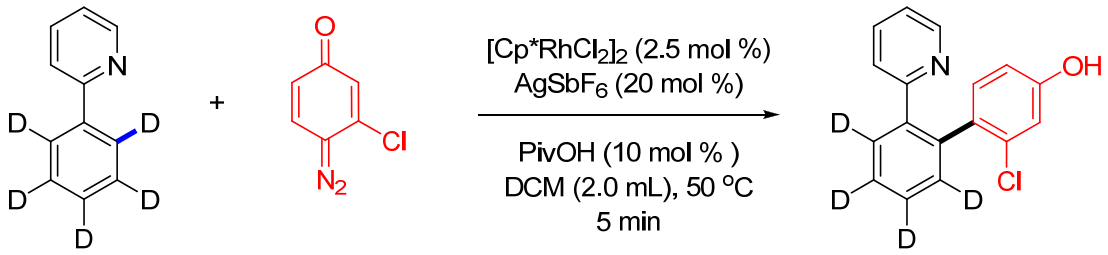
134.4, 133.4, 129.3, 126.6, 124.2, 122.3, 121.4, 117.3, 111.2. **ESI-MS**: calculated $C_{15}H_9ClN_3O_2$ $[M-H]^-$, 298.0389; Found 298.0384.

## 4. Kinetic isotope effect experiments




**1a** **2a** **3aa**

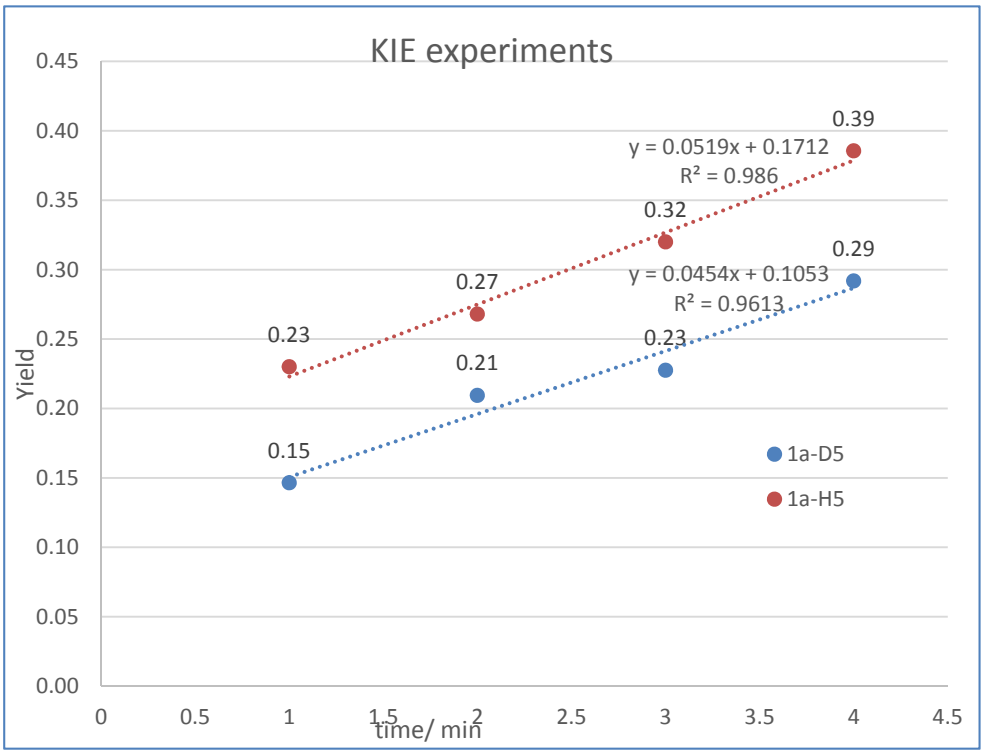
**0.4 mmol** **0.6 mmol**



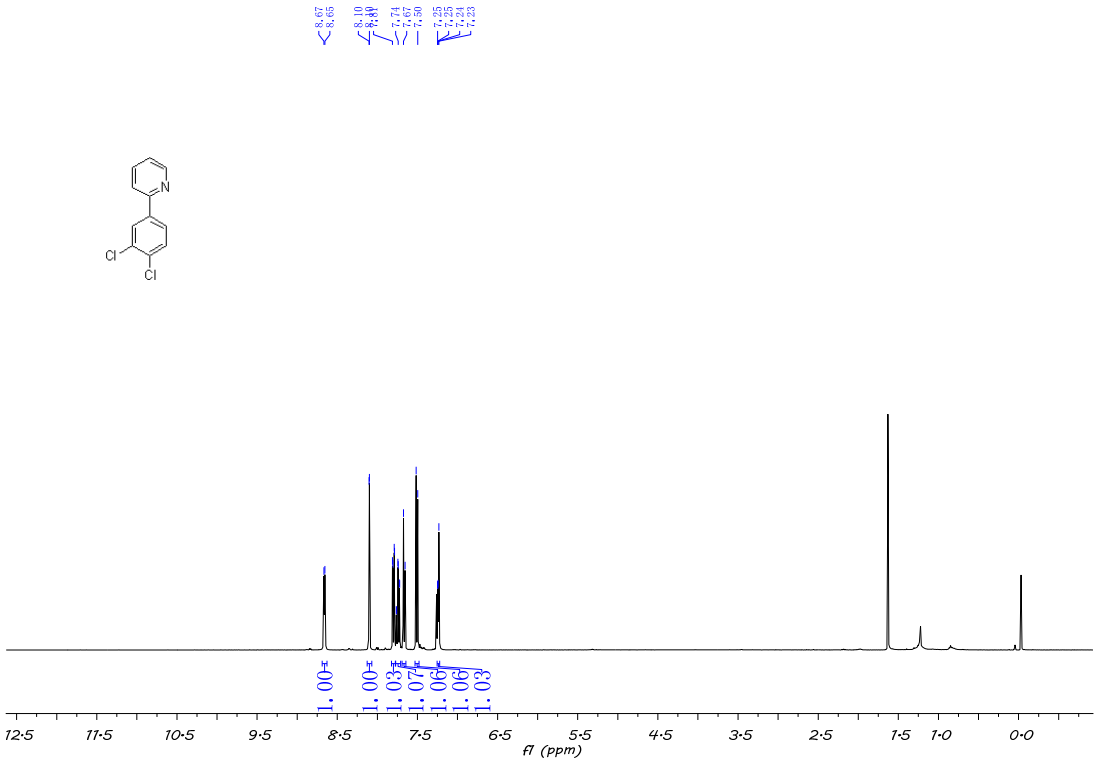

**[D5]-1a** **2a** **[D4]-3aa**

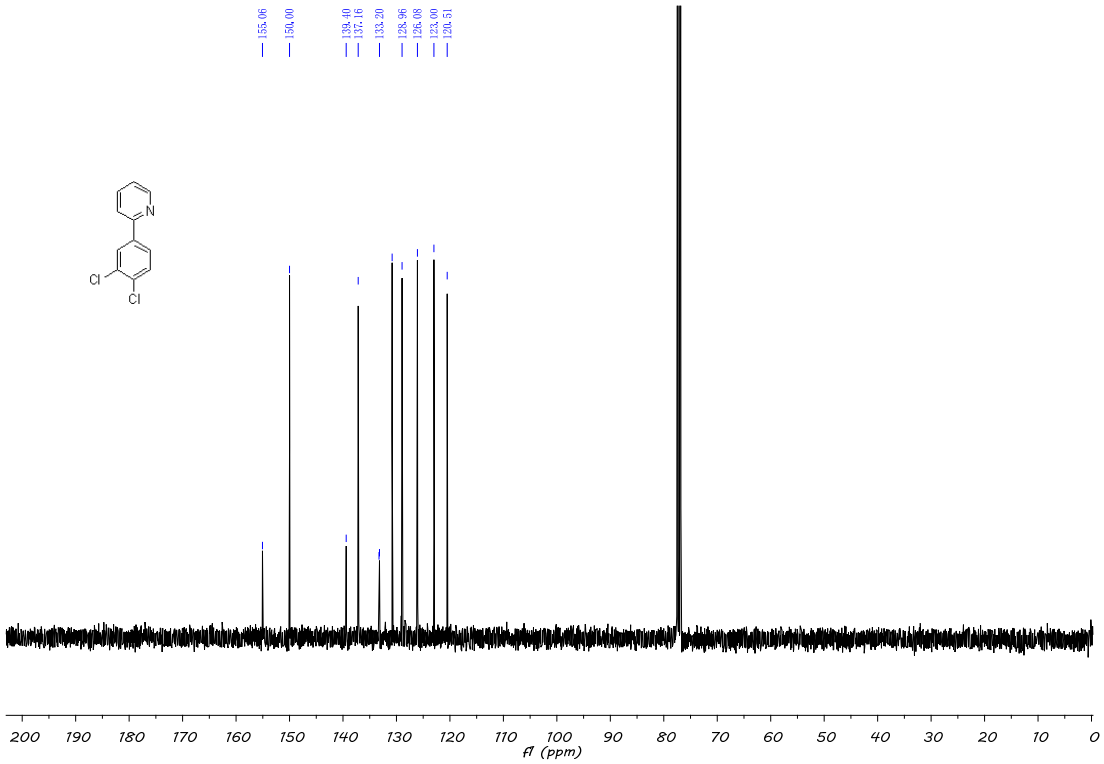
**0.4 mmol** **0.6 mmol**

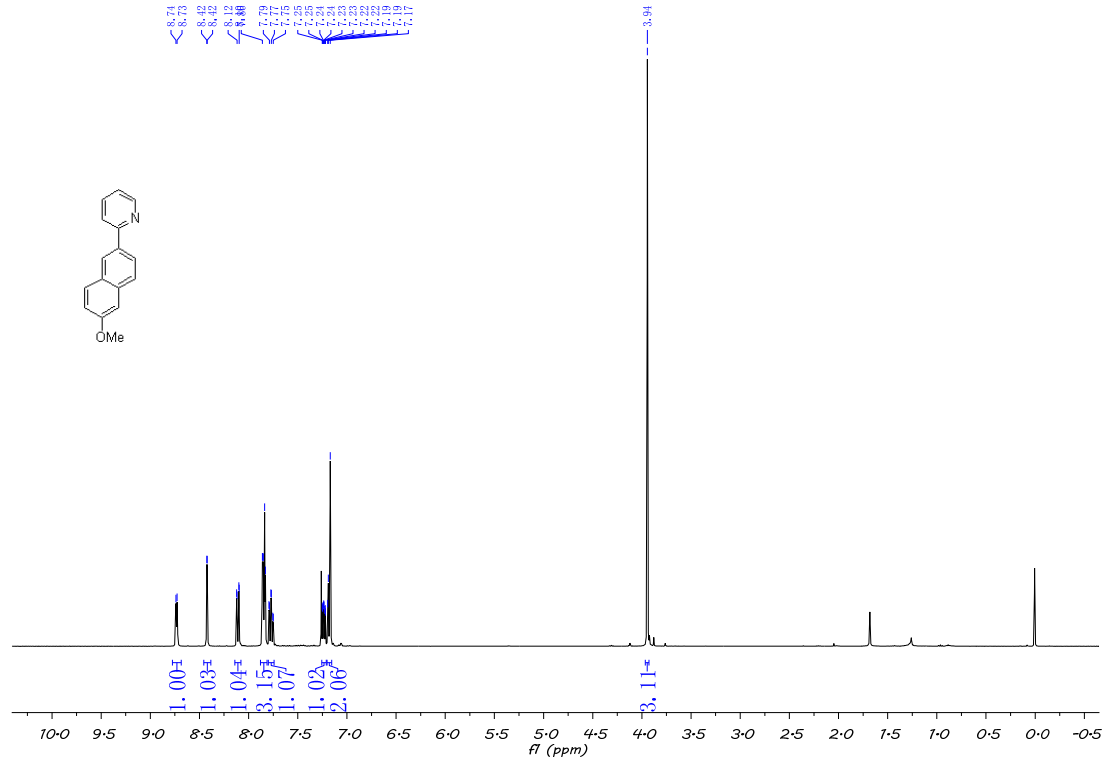
Following general procedure D, to a 15 mL-schlenk tube charged with a stirring bar, were added 2-phenylpyridine **1a** (62.1 mg, 0.4 mmol, 1.0 equiv), 3-chloro-4-diazocyclohexa-2,5-dienone **2a** (92.7 mg, 0.6 mmol, 1.5 equiv), $[Cp^*RhCl_2]_2$ (6.2 mg, 0.01 mmol, 2.5 mol%), $AgSbF_6$ (27.4 mg, 0.08 mmol, 0.2 equiv), PivOH (4.0 mg, 0.04 mmol, 0.1 equiv), 1-iodo-4-methoxybenzene (93.6 mg, 0.4 mmol, 1.0 equiv, internal standard) and DCM (2.0 mL). No special precautions were taken to exclude moisture and air. In another reaction vessel, [$D_5$]-**1a** (64.1 mg, 0.4 mmol, 1.0 equiv) was used instead of **1a**. The two reactions were allowed to stir at 50 °C. An aliquot of each reaction mixture was taken at the time of 1 min, 2 min, 3 min, and 4 min. The corresponding yield of each product was determined by $^1$H NMR. A kinetic isotope effect value $K_H/K_D$ = 1.1 was obtained

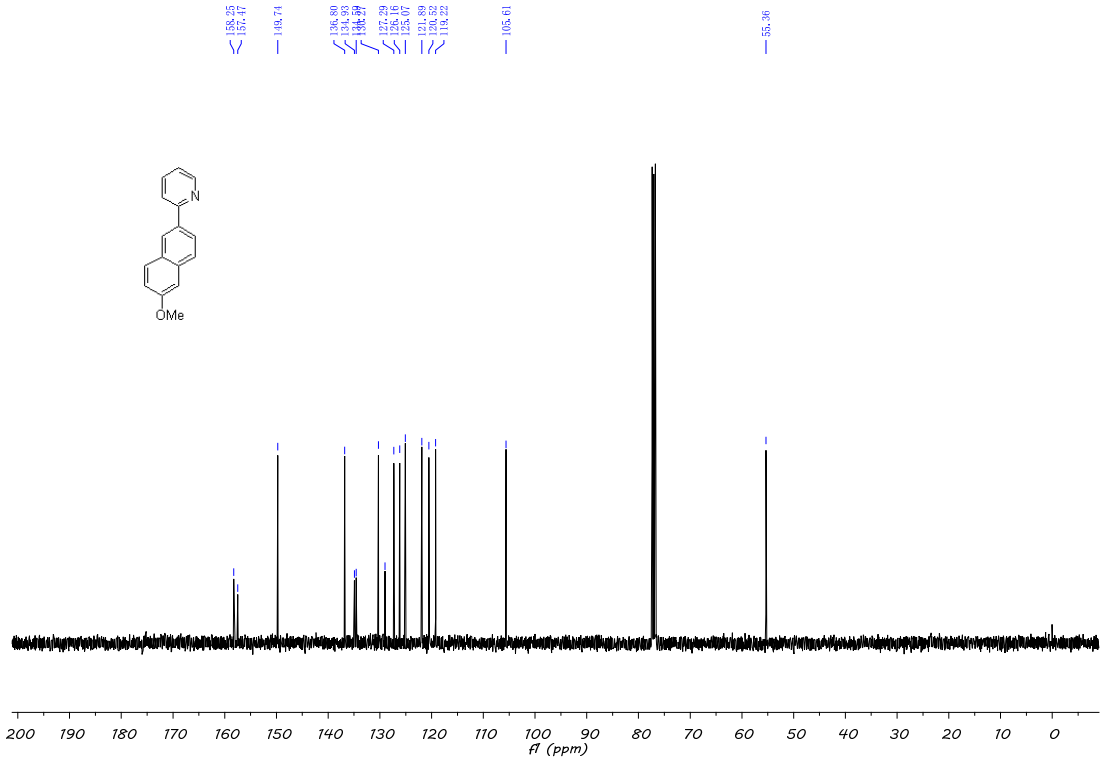

KIE experiments
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
Yield
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
time/ min
0.39
y = 0.0519x + 0.1712
R² = 0.986
0.32
0.29
y = 0.0454x + 0.1053
R² = 0.9613
0.27
0.23
0.23
0.21
0.15
1a-D5
1a-H5

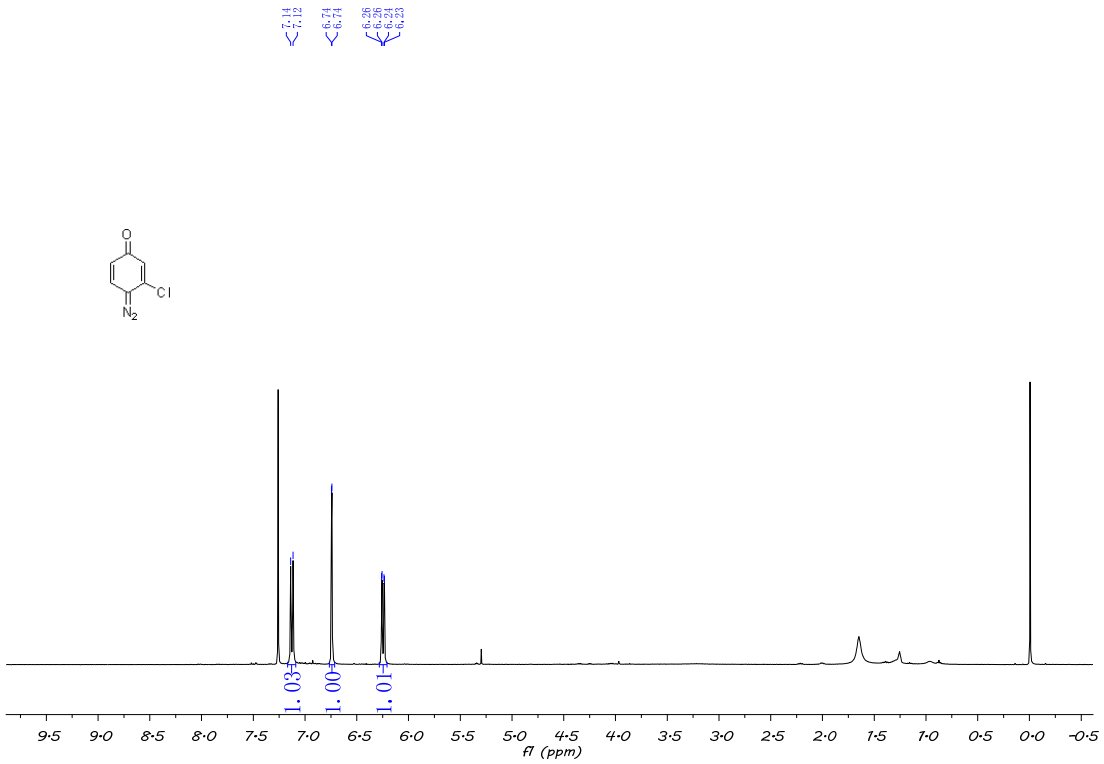
# 5. Characteristic spectra

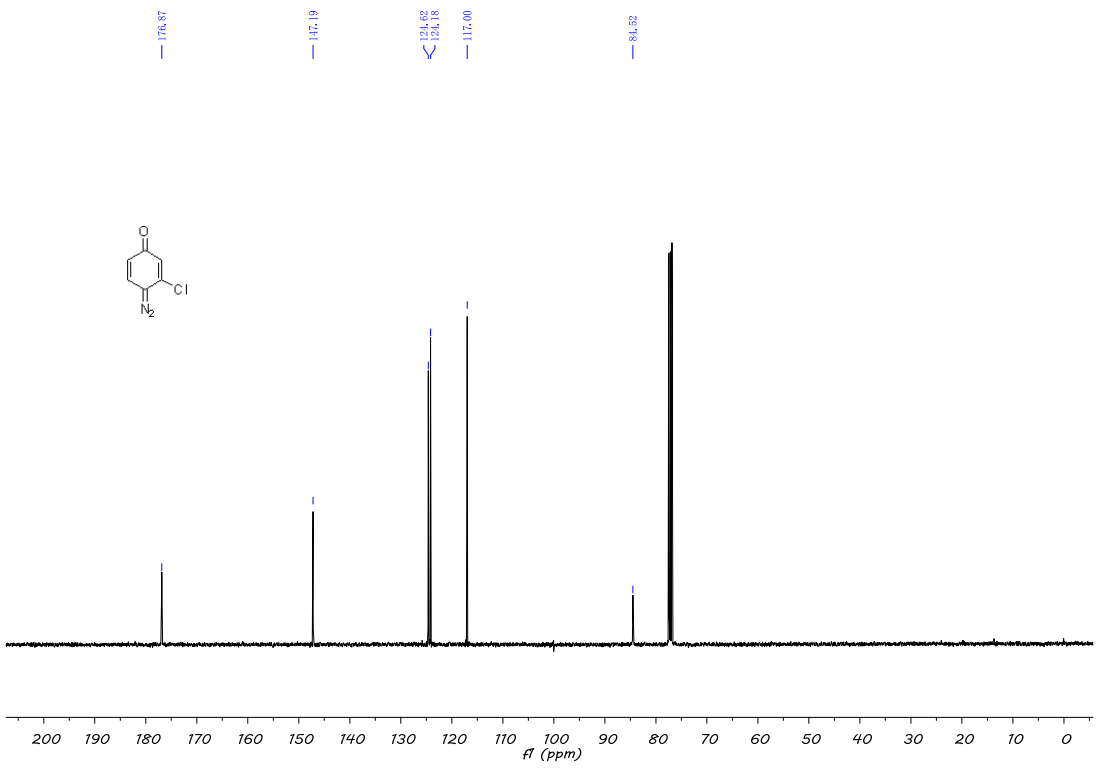


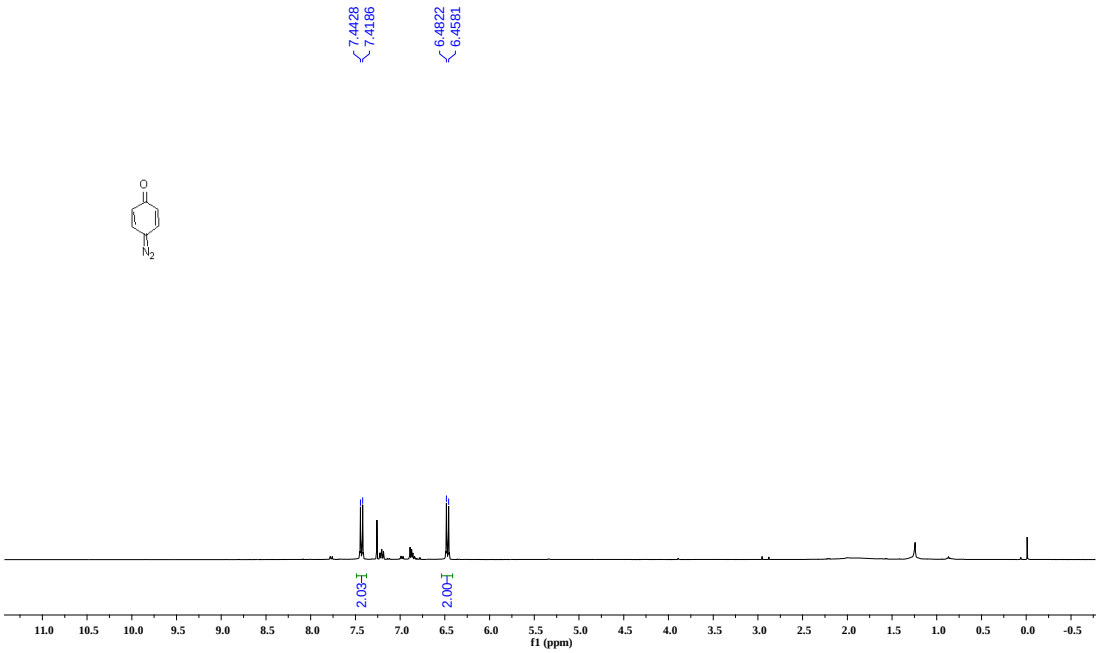



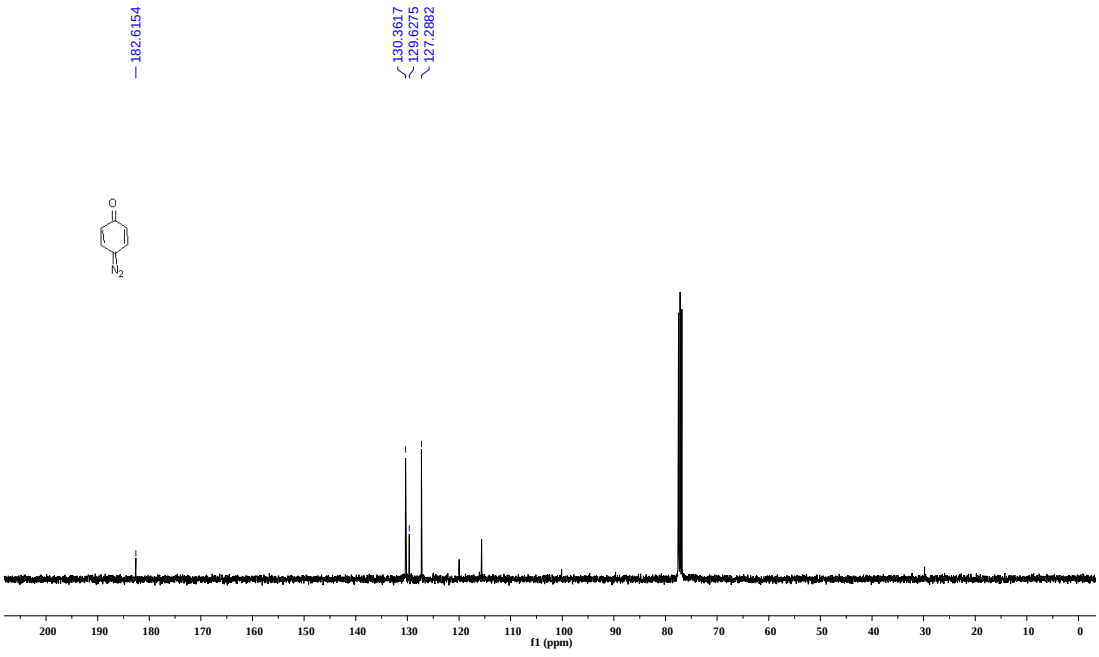

8.74
8.73
8.42
8.42
8.12
7.79
7.77
7.75
7.25
7.24
7.23
7.22
7.19
7.17
3.94
N
OMe
1.00
1.03
1.04
3.15
1.07
1.02
2.06
3.11
f1 (ppm)


158.25
157.47
149.74
136.80
134.93
127.29
126.16
125.07
121.89
120.52
119.22
105.61
55.36
N
OMe
f1 (ppm)


7.14
7.12
6.74
6.74
6.26
6.26
6.24
6.23
O
Cl
N2
1.03
1.00
1.01
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 -0.5
f1 (ppm)


176.87
147.19
124.62
124.18
117.00
84.52
O
Cl
N2
200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)


7.4428
7.4186
6.4822
6.4581
O
N2
2.03
2.00
11.0 10.5 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 -0.5
f1 (ppm)


182.6154
130.3617
129.6275
127.2882
O
N2
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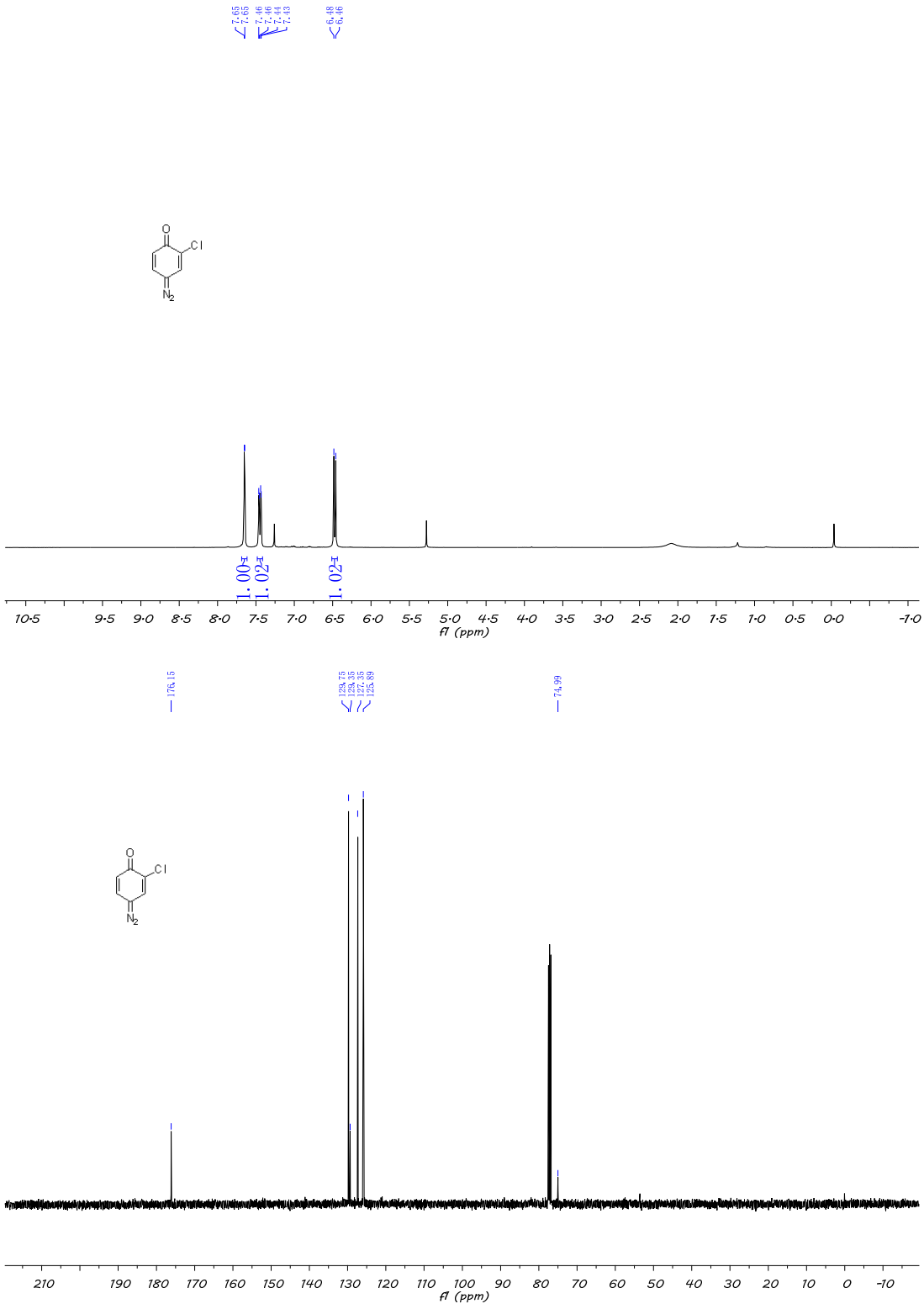
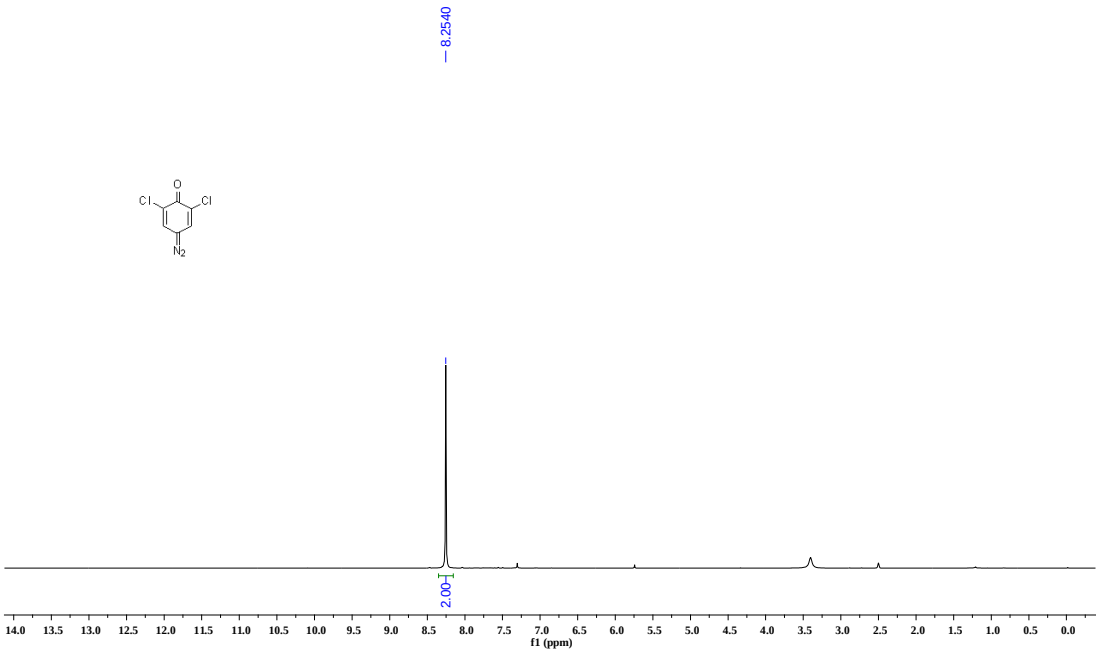
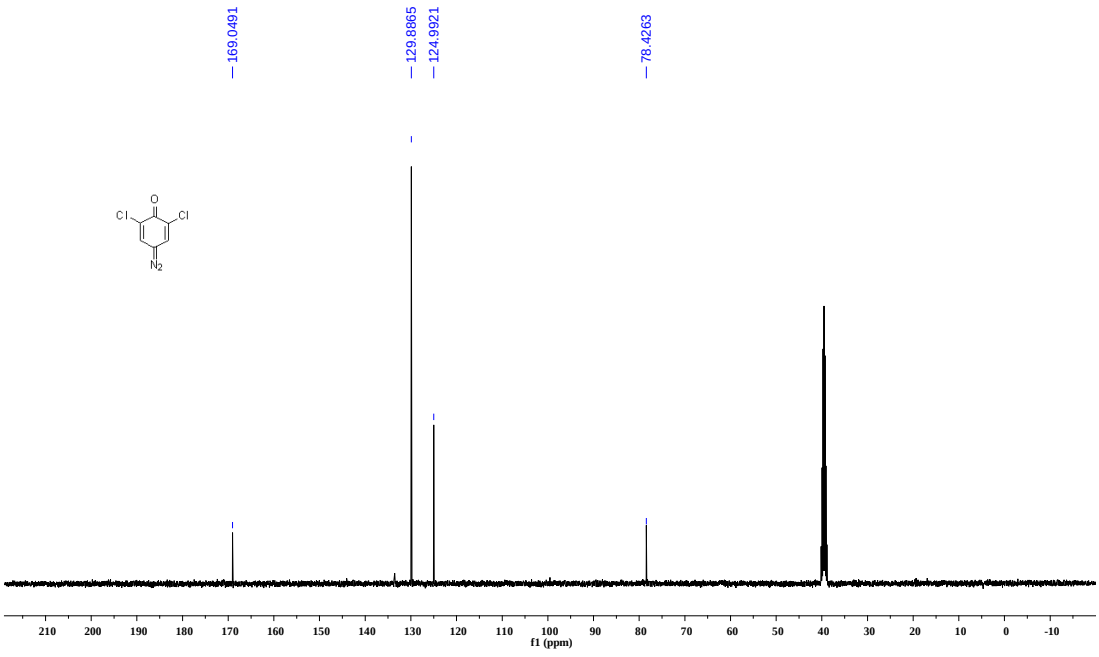
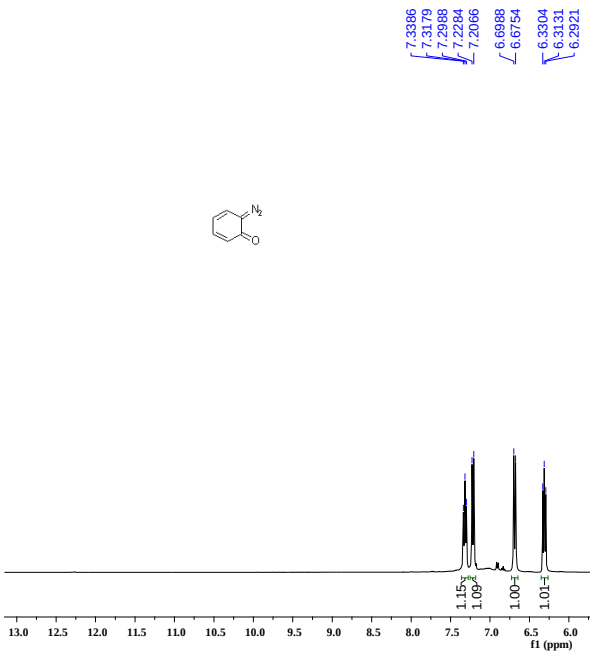
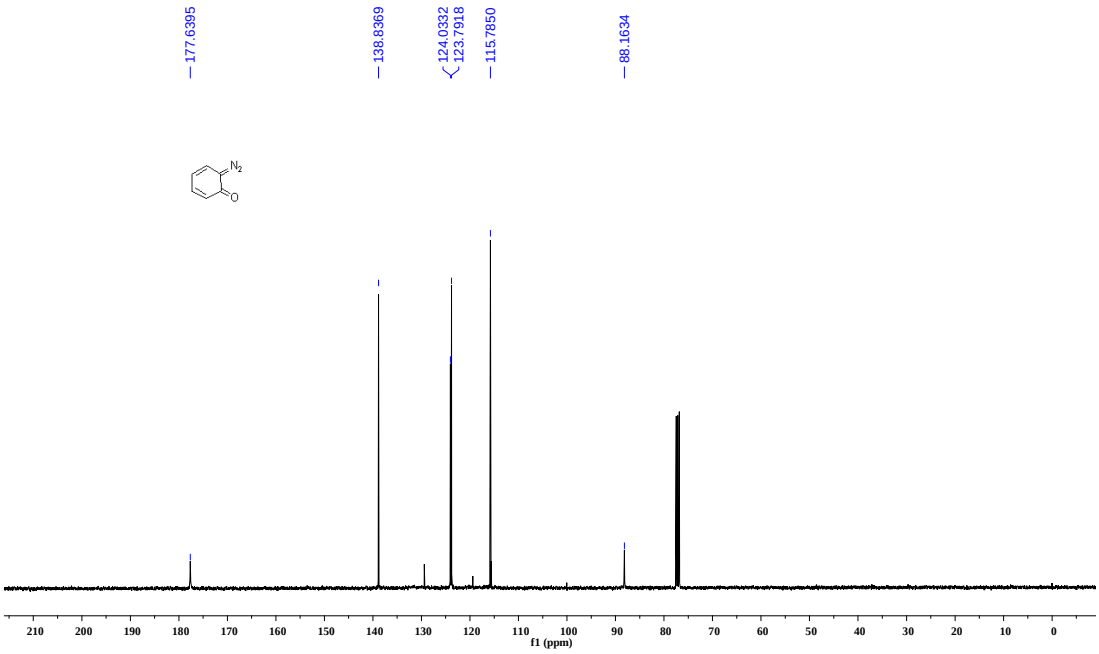
f1 (ppm)

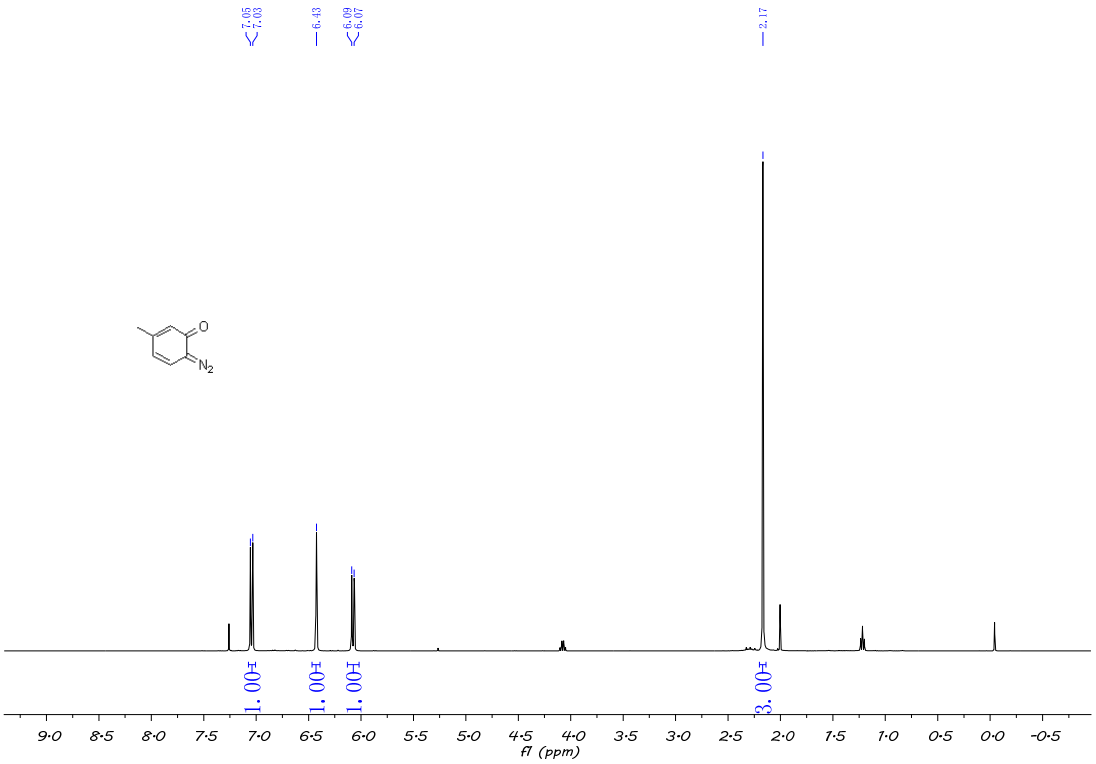

7.65
7.65
7.46
7.46
7.44
7.43
6.48
6.46
O
Cl
N2
1.00
1.02
1.02
10.5
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-1.0
f1 (ppm)
176.15
129.75
129.35
127.35
126.89
74.99
O
Cl
N2
210
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
-10
f1 (ppm)

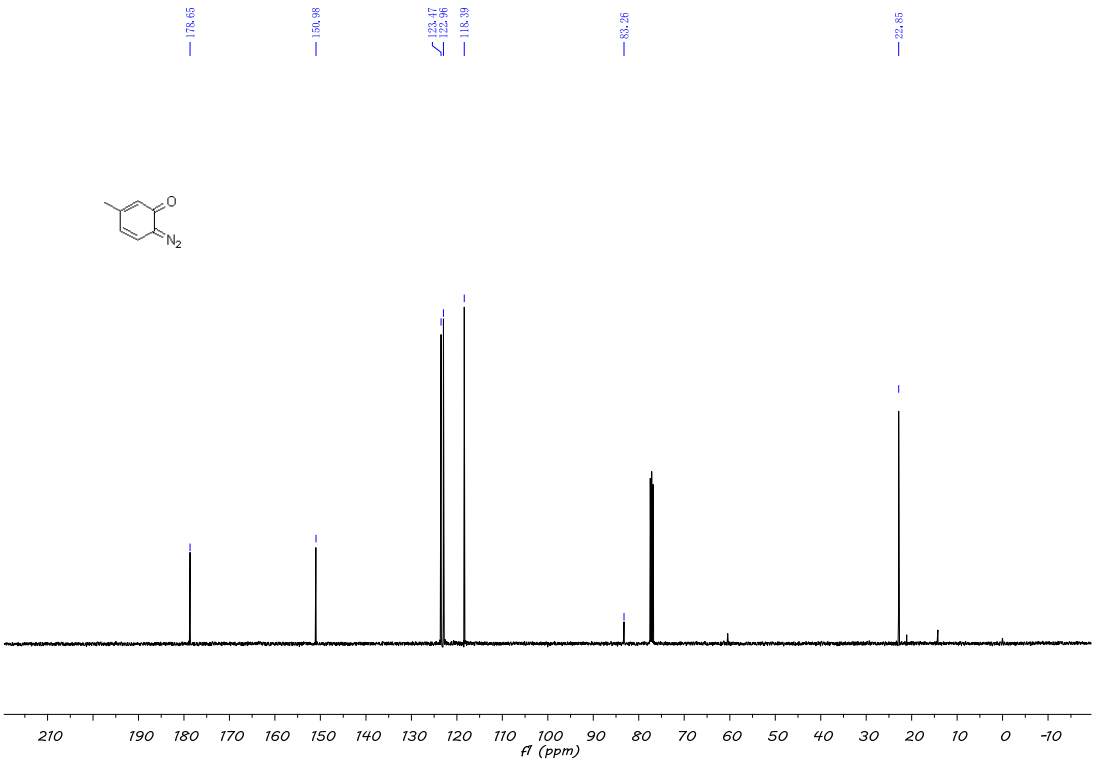

8.2540
2.00
14.0 13.5 13.0 12.5 12.0 11.5 11.0 10.5 10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)

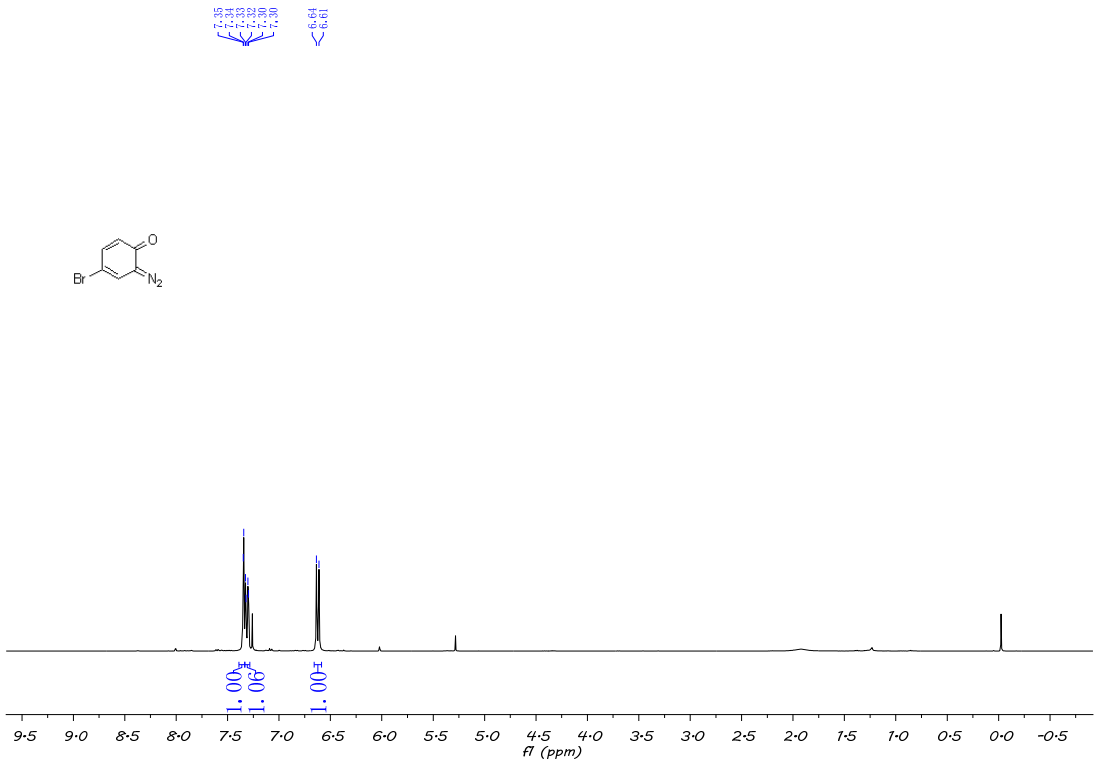

169.0491
129.8865
124.9921
78.4263
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)

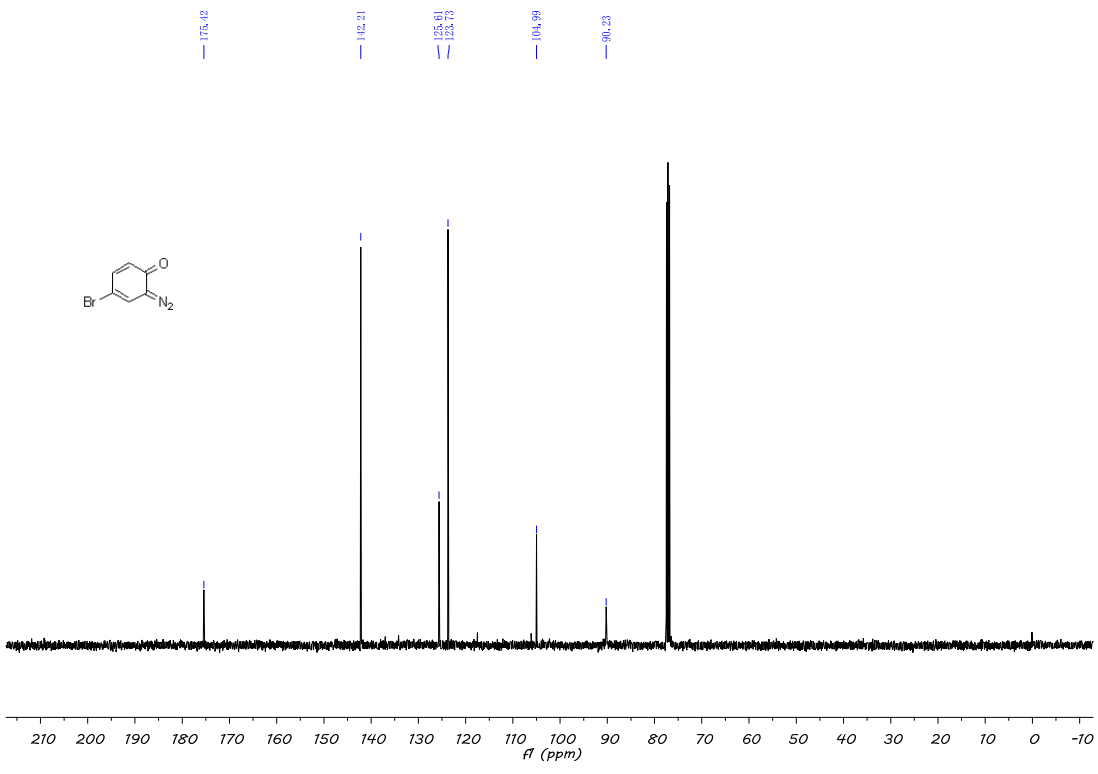

7.3386
7.3179
7.2988
7.2284
7.2066
6.6988
6.6754
6.3304
6.3131
6.2921
N2
O
1.15
1.09
1.00
1.01
13.0 12.5 12.0 11.5 11.0 10.5 10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5
f1 (ppm)


177.6395
138.8369
124.0332
123.7918
115.7850
88.1634
N2
O
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)


7.05
7.03
6.43
6.09
6.07
2.17
O
N2
1.00
1.00
1.00
3.00
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 -0.5
f1 (ppm)

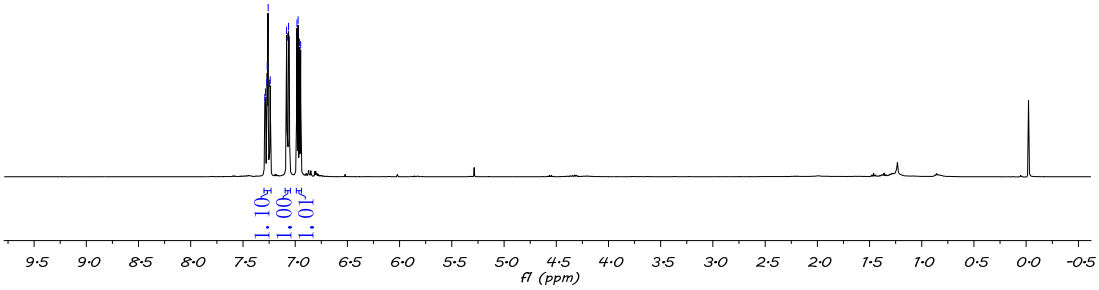

178.65
150.98
123.47
122.96
118.39
83.26
22.85
O
N2
210 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)


7.35
7.34
7.33
7.32
7.30
7.30
6.64
6.61
O
Br
N2
1.00
1.06
1.00
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 -0.5
f1 (ppm)


176.42
142.21
125.61
123.73
104.99
90.23
O
Br
N2
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)


7.29
7.28
7.27
7.27
7.26
7.26
7.25
7.24
7.08
7.07
7.06
6.98
6.97
6.96
6.95

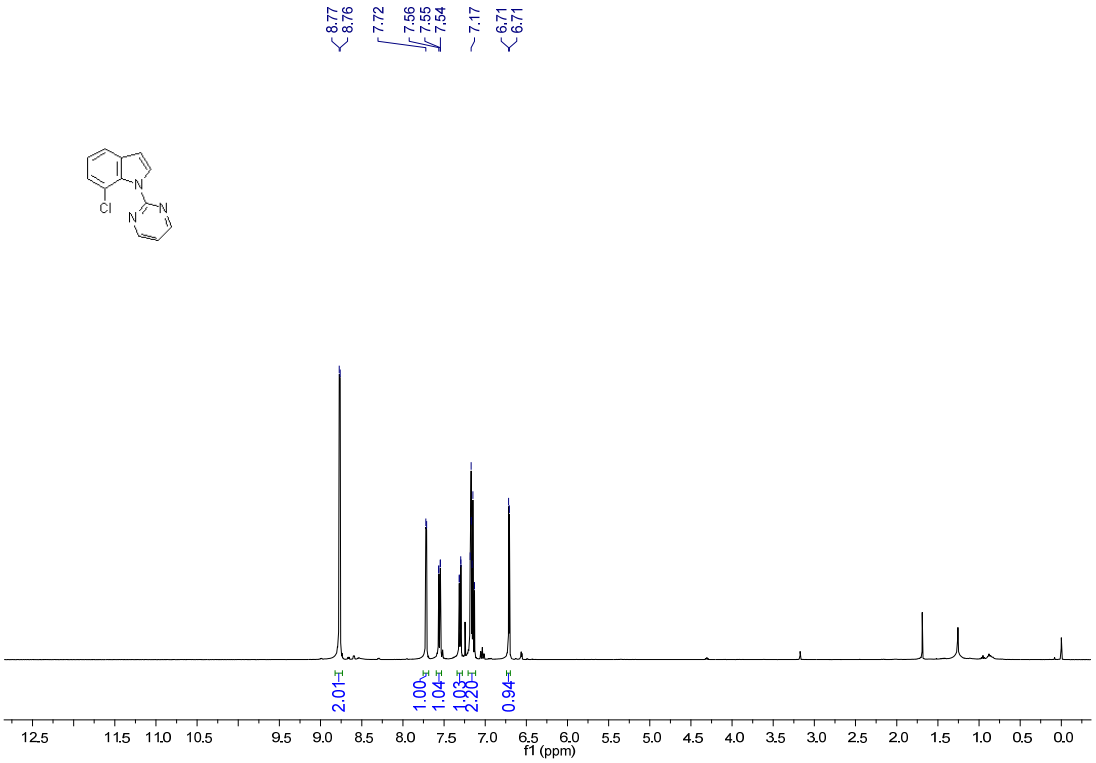

O
F
N2

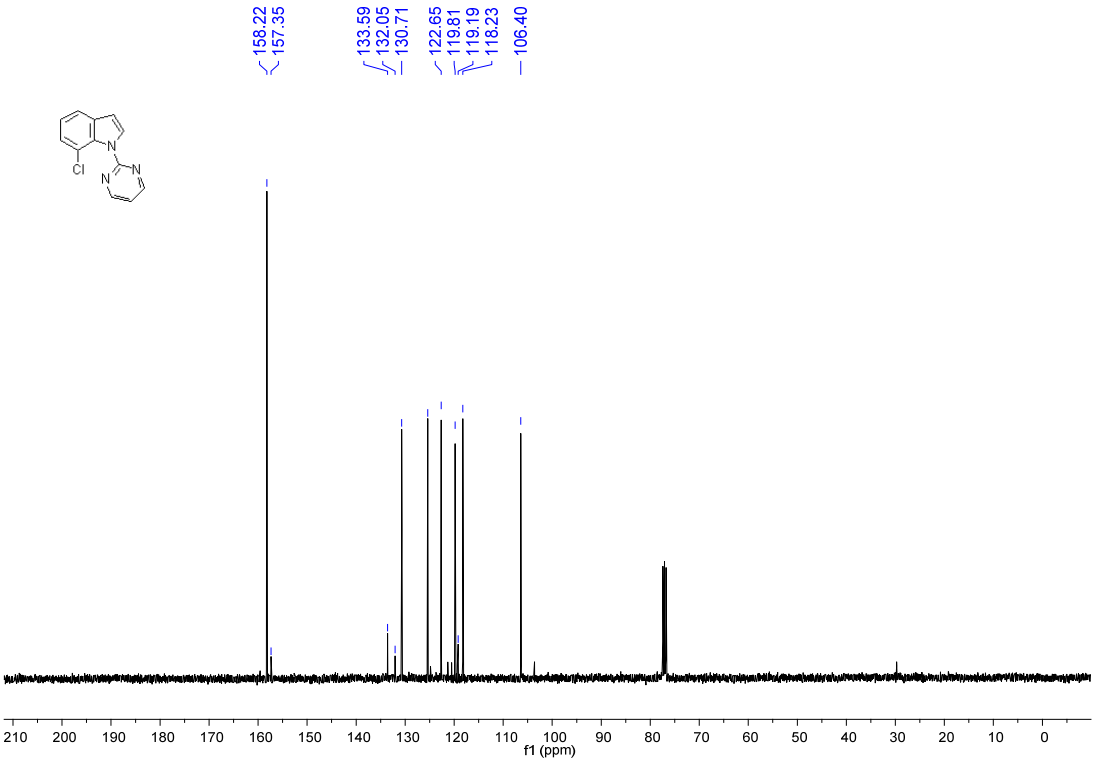

1.10
1.00
1.01
9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5
f1 (ppm)

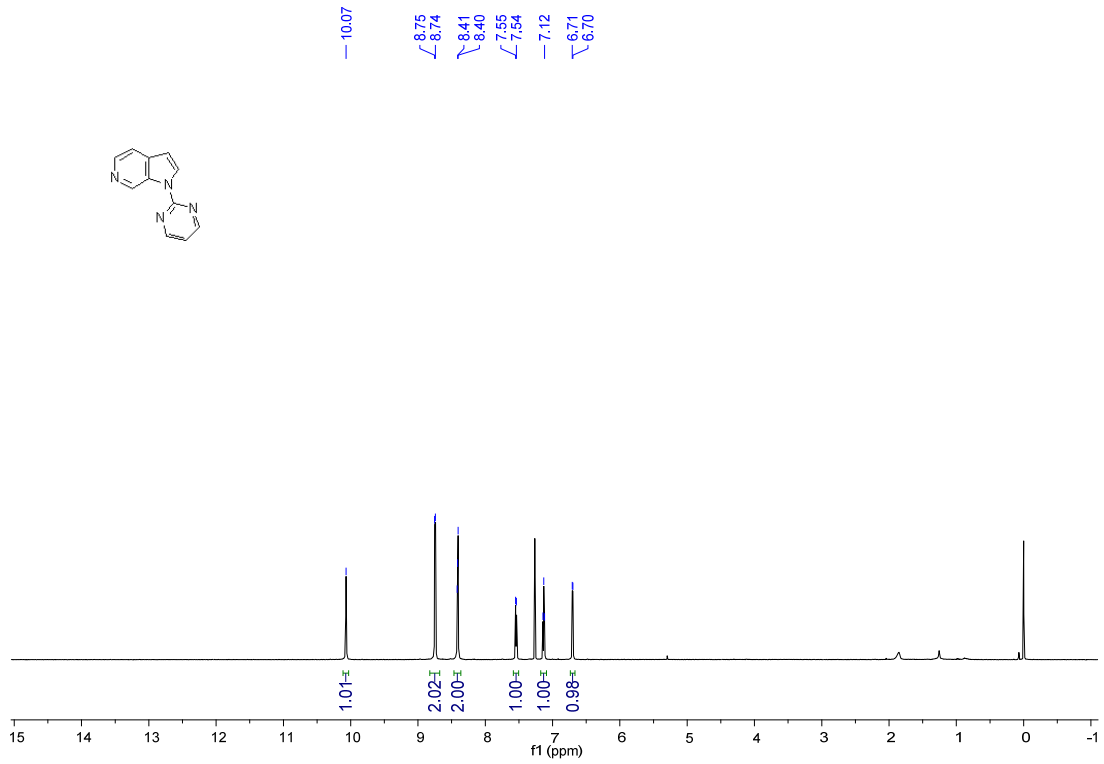

167.94
154.08
151.67
128.41
128.13
120.85
120.77
105.02
104.74
101.80
101.66

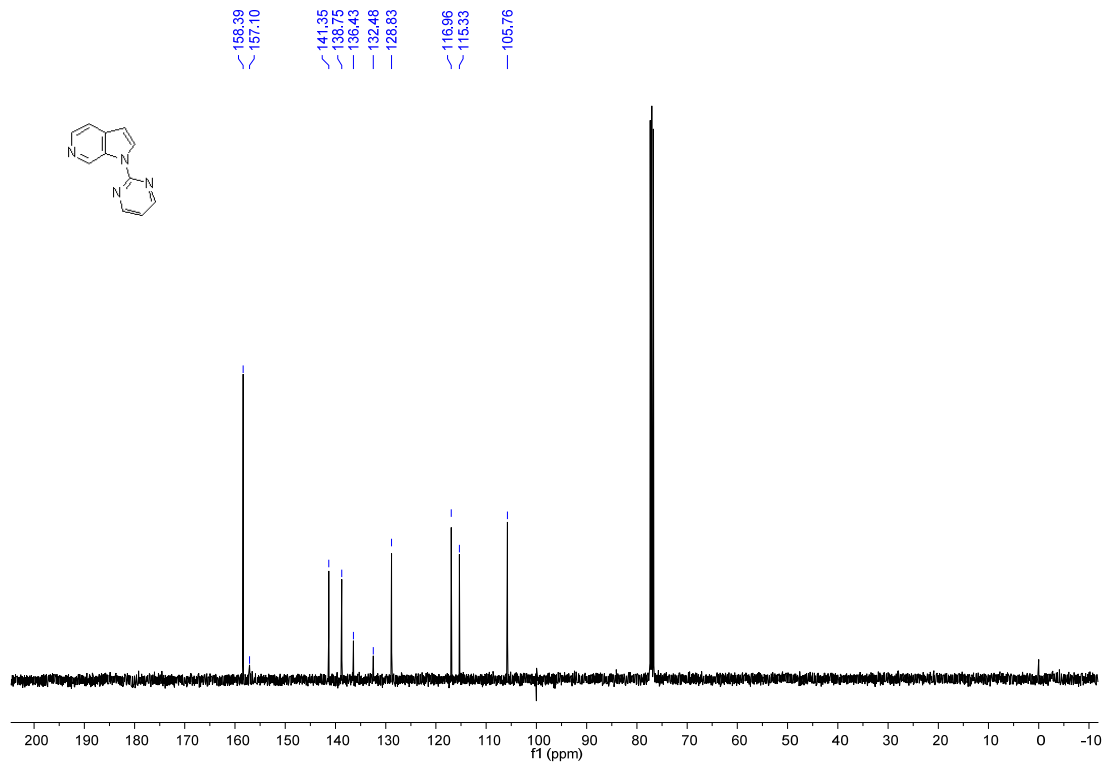

O
F
N2

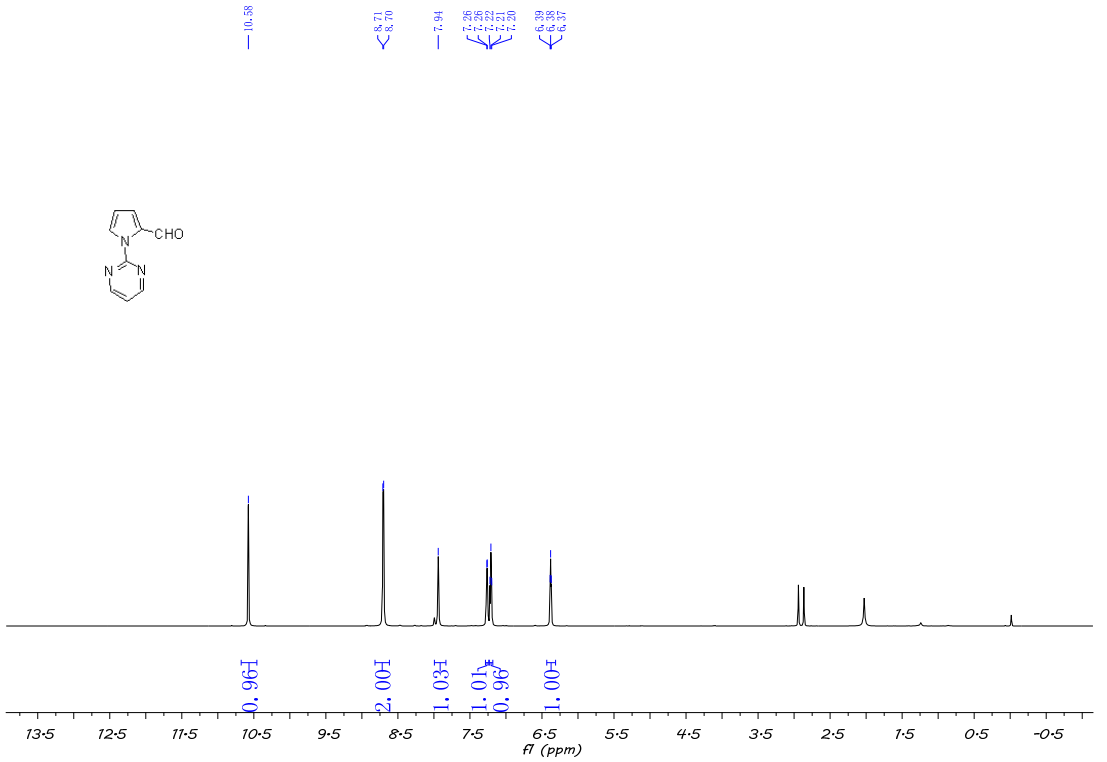

200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)

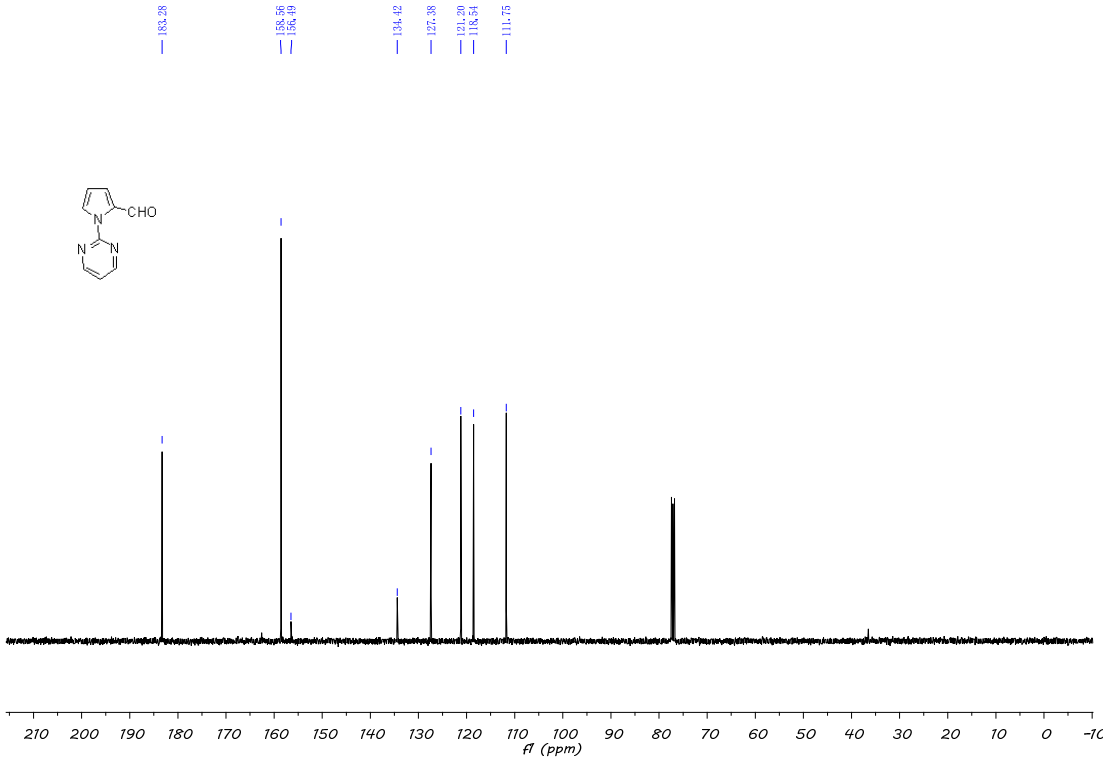

8.77
8.76
7.72
7.56
7.55
7.54
7.17
6.71
6.71
Cl
N
N
N
2.01
1.00
1.04
1.03
2.20
0.94
12.5
11.5
11.0
10.5
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)

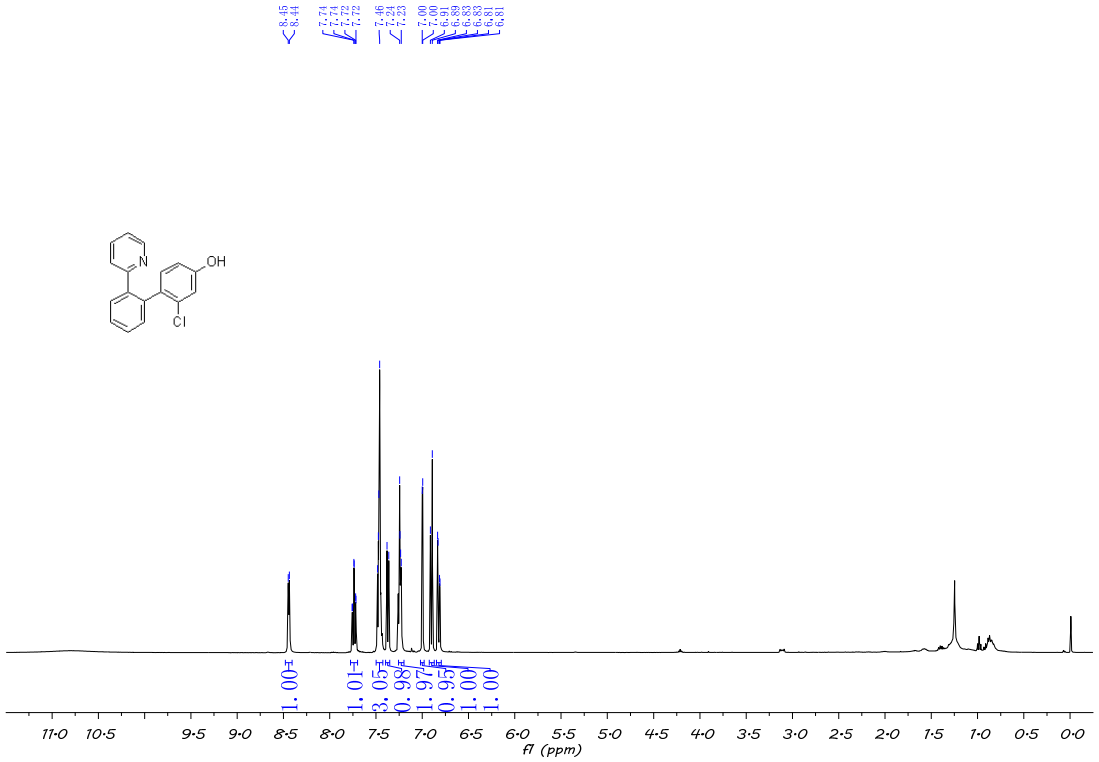

158.22
157.35
133.59
132.05
130.71
122.65
119.81
119.19
118.23
106.40
Cl
N
N
N
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

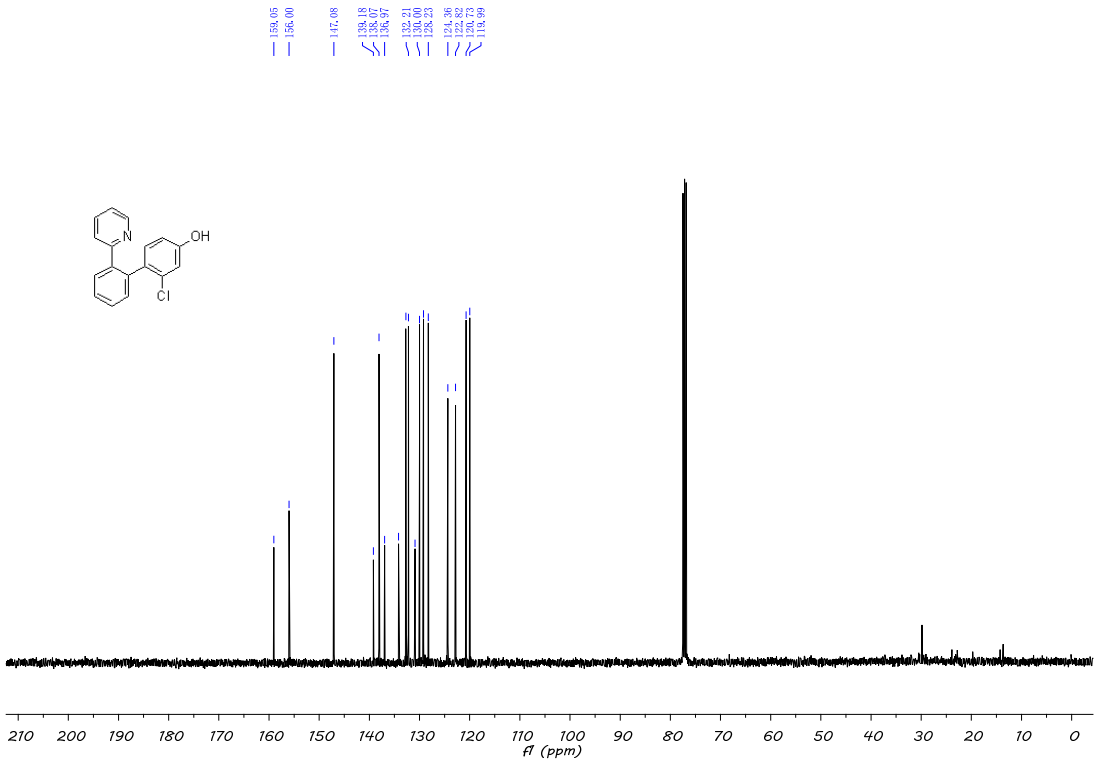

10.07
8.75
8.74
8.41
8.40
7.55
7.54
7.12
6.71
6.70
1.01
2.02
2.00
1.00
1.00
0.98
f1 (ppm)

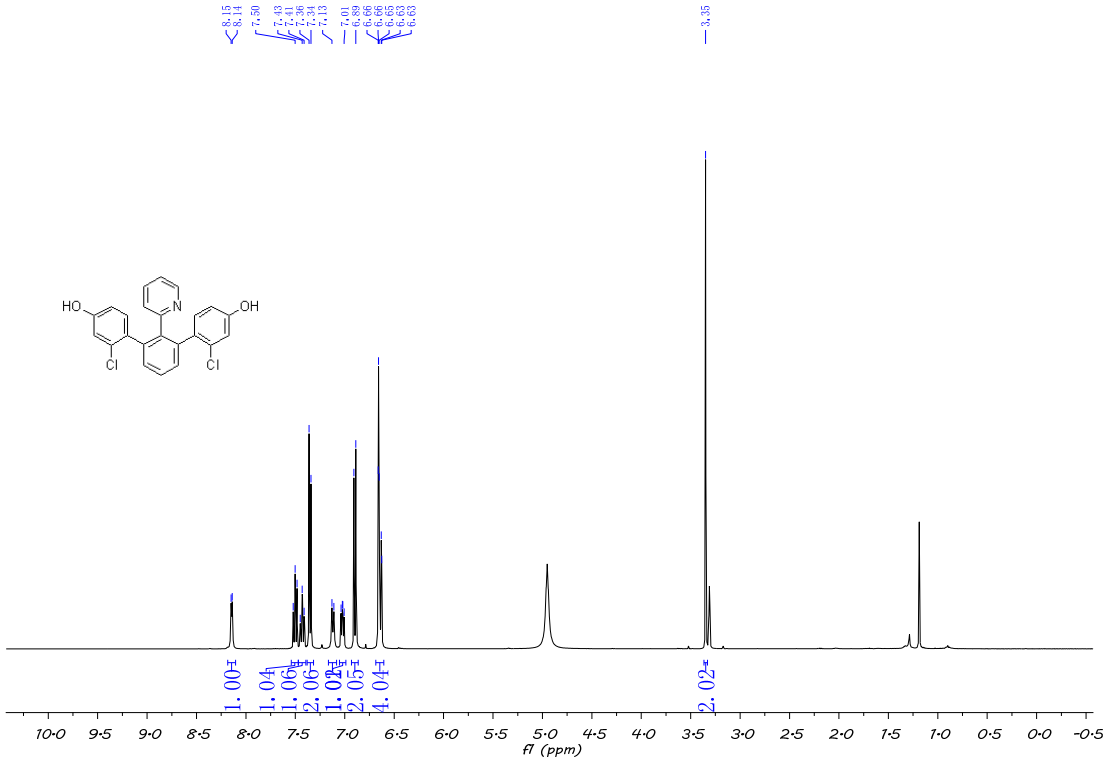

158.39
157.10
141.35
138.75
136.43
132.48
128.83
116.96
115.33
105.76
f1 (ppm)

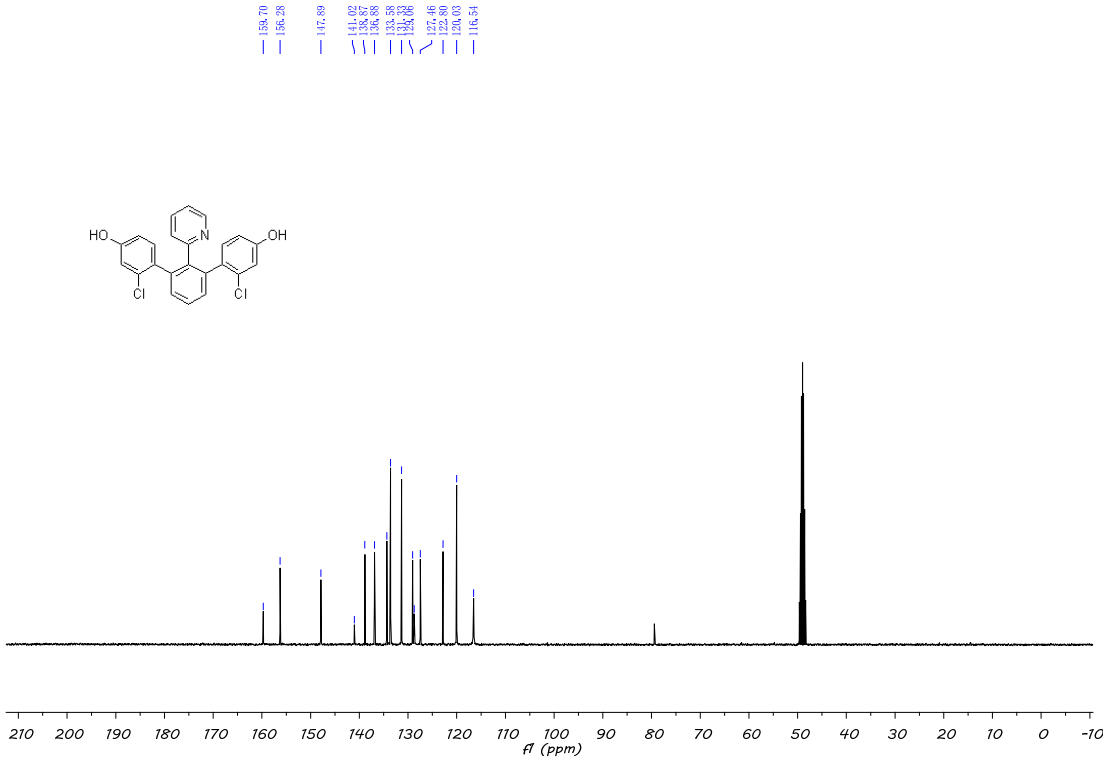

10.58
8.71
8.70
7.94
7.26
7.26
7.22
7.21
7.20
6.39
6.38
6.37
CHO
0.96
2.00
1.03
1.01
0.98
1.00
f1 (ppm)

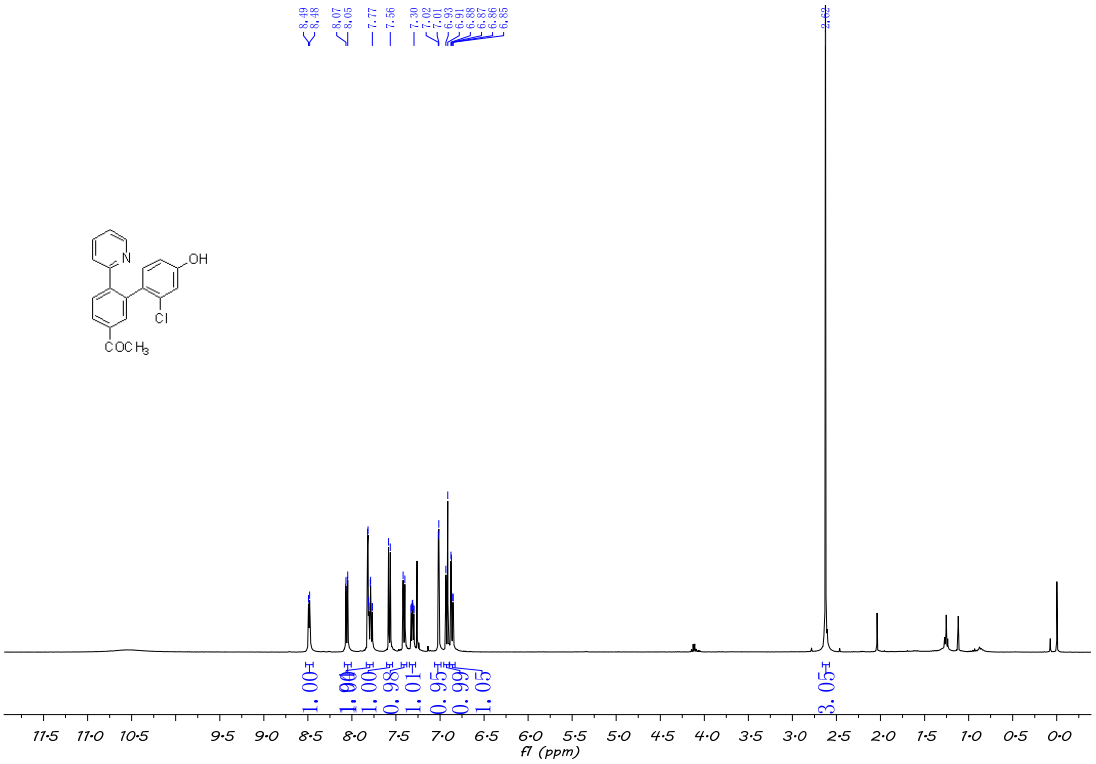

183.28
158.56
156.49
134.42
127.38
121.20
118.54
111.75
CHO
f1 (ppm)

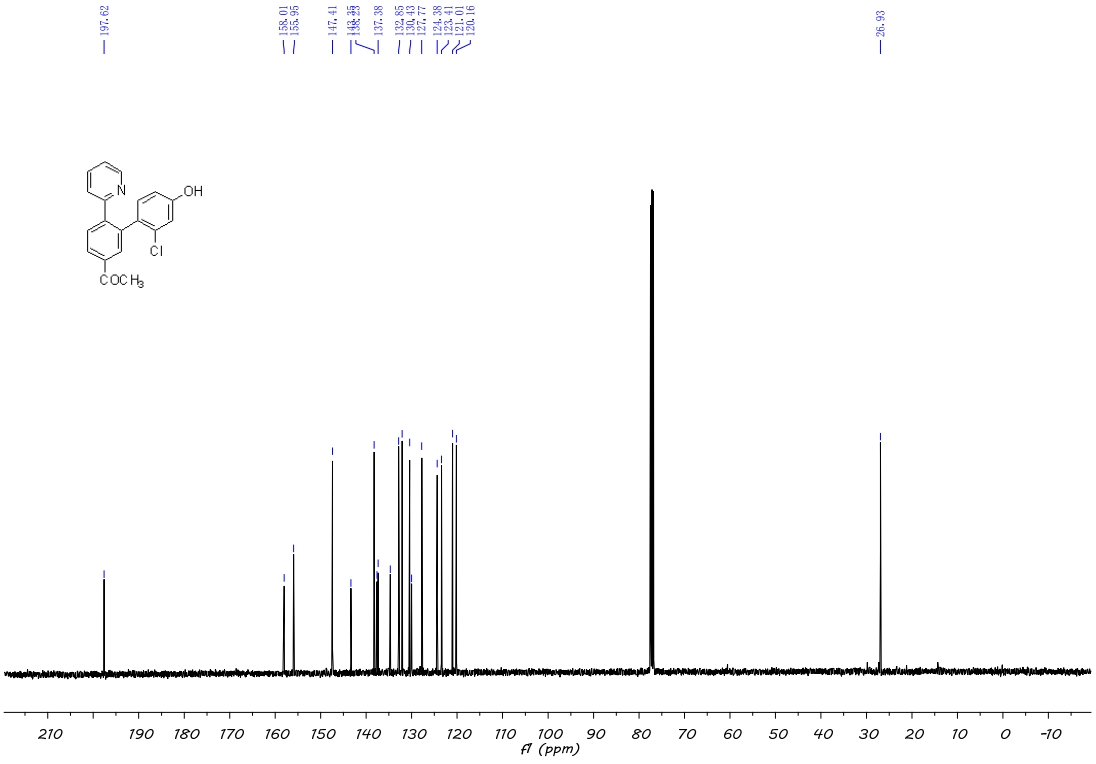

8.45
8.44
7.74
7.74
7.72
7.72
7.46
7.24
7.23
7.00
7.00
6.91
6.89
6.88
6.83
6.83
6.81
6.81
OH
Cl
1.00
1.01
3.05
0.98
1.97
0.95
1.00
1.00
f1 (ppm)

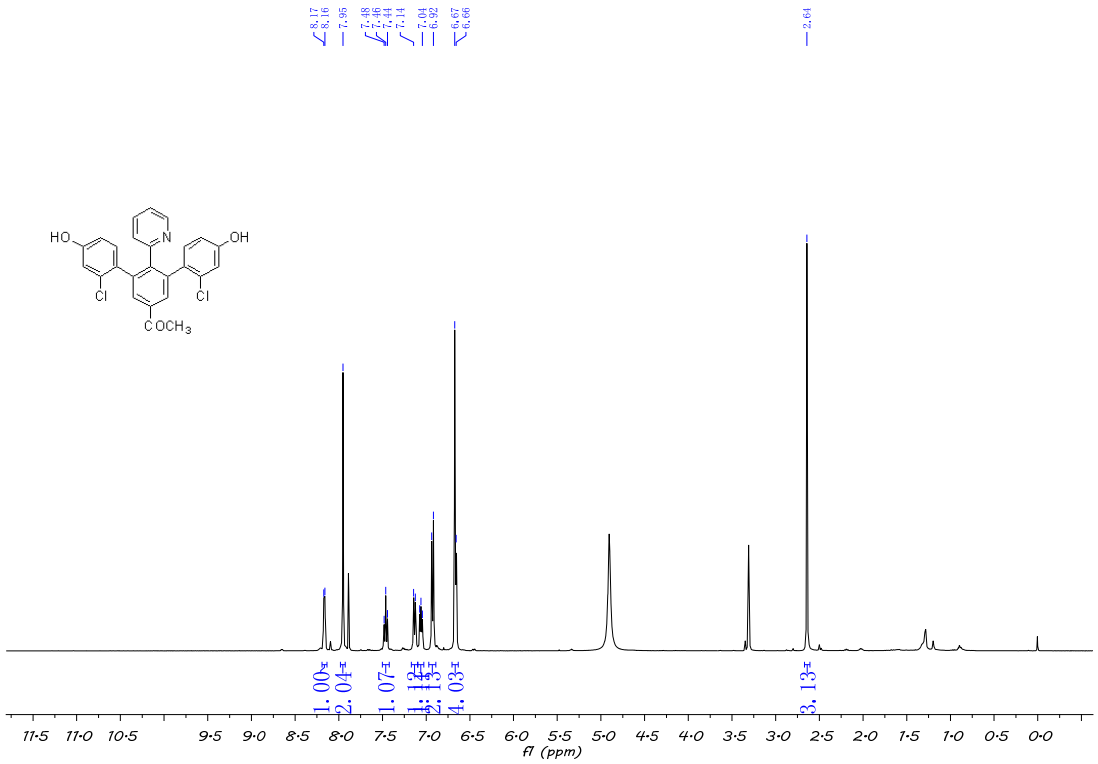

159.05
156.00
147.08
138.18
138.07
136.97
132.21
130.00
128.23
124.36
122.82
120.73
118.99
OH
Cl
f1 (ppm)

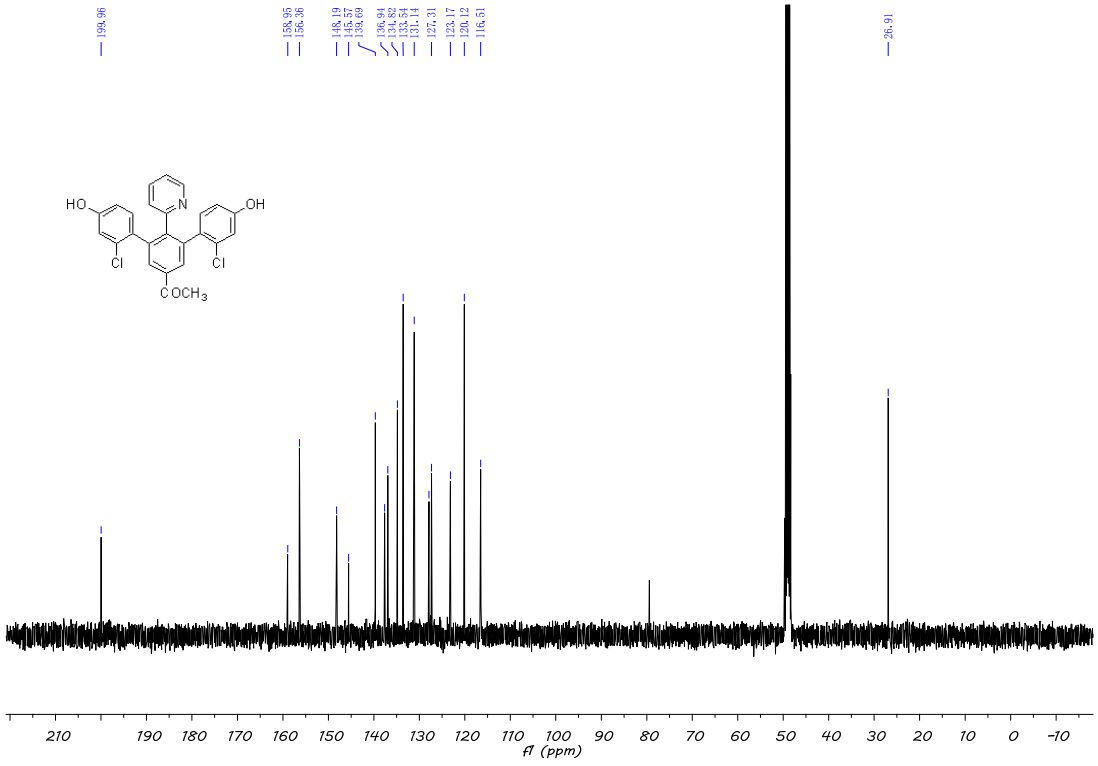

8.15
8.14
7.50
7.43
7.41
7.36
7.34
7.13
7.01
6.88
6.66
6.66
6.65
6.63
6.63
3.35
HO
OH
N
Cl
Cl
1.00
1.04
1.06
2.06
1.02
2.05
4.04
2.02
10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5
f1 (ppm)

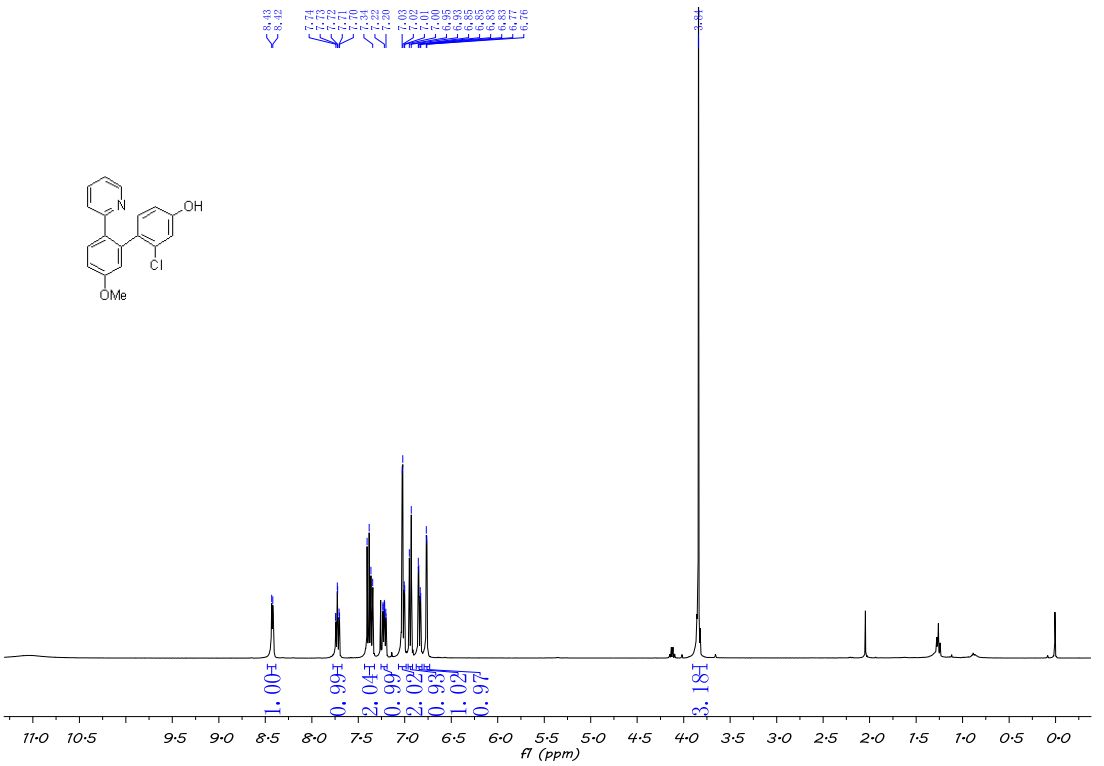

158.70
156.28
147.89
141.02
138.87
136.88
133.58
131.53
129.68
127.46
122.80
120.03
116.54
HO
OH
N
Cl
Cl
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)

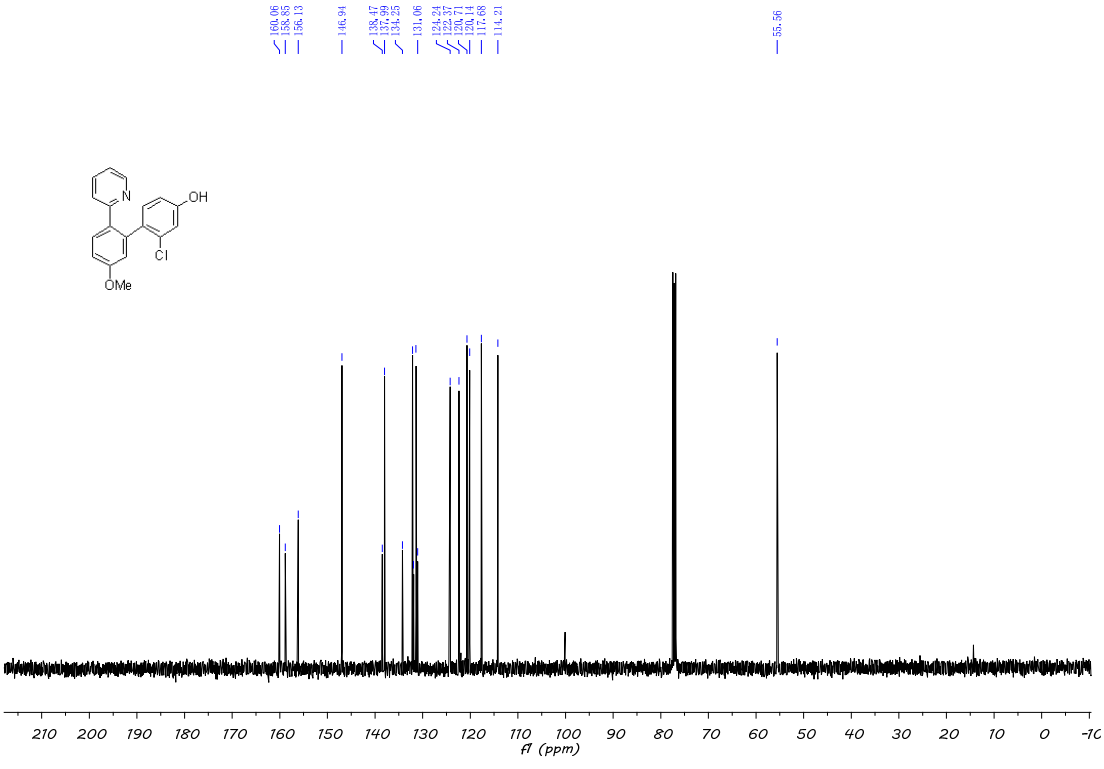

8.49
8.48
8.07
8.05
7.77
7.56
7.30
7.02
7.01
6.93
6.91
6.88
6.87
6.86
6.85
2.62
OH
N
Cl
COCH3
1.00
1.00
1.00
0.98
1.01
0.95
0.99
1.05
3.05
11·5 11·0 10·5 9·5 9·0 8·5 8·0 7·5 7·0 6·5 6·0 5·5 5·0 4·5 4·0 3·5 3·0 2·5 2·0 1·5 1·0 0·5 0·0
f1 (ppm)

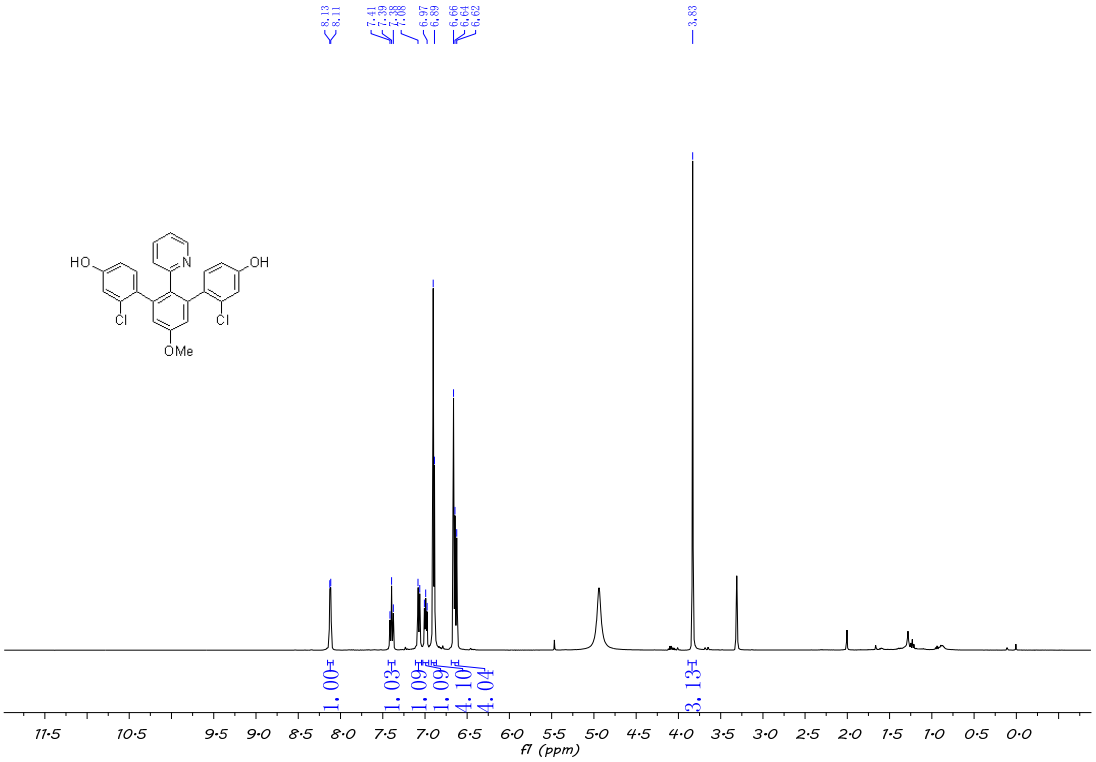

197.62
158.01
155.95
147.41
138.35
137.38
130.85
130.43
127.77
124.38
124.41
121.01
120.16
26.93
OH
N
Cl
COCH3
210 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)

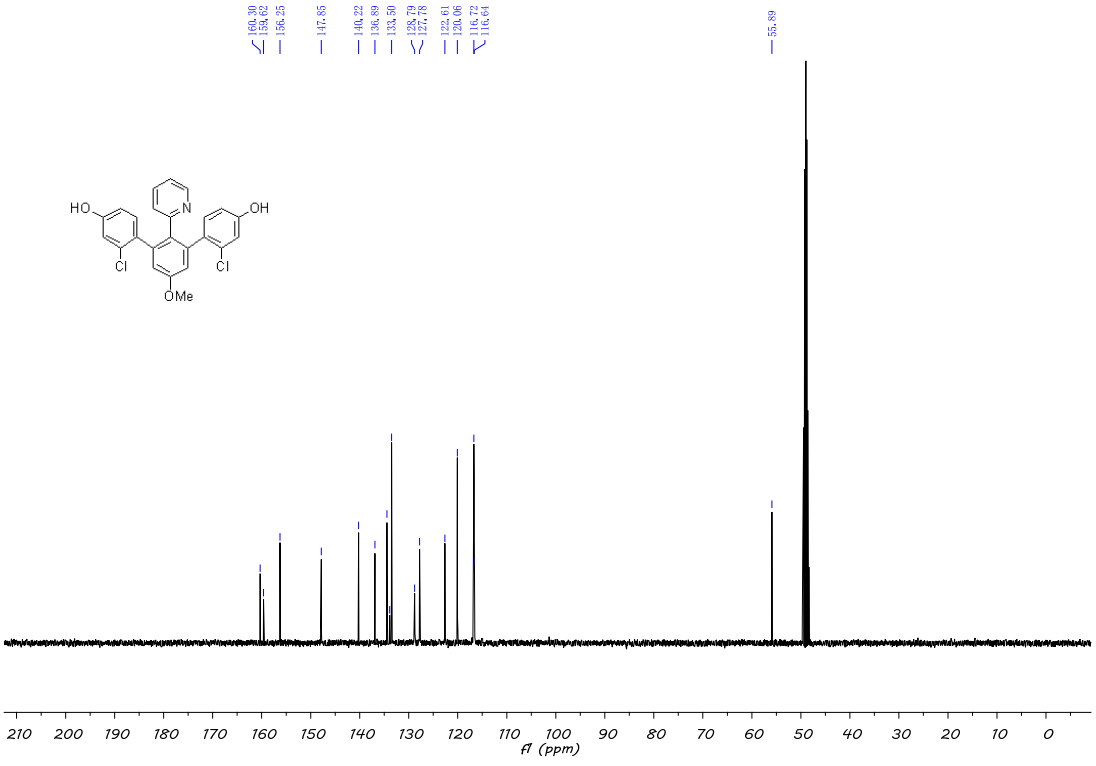

8.17
8.16
7.95
7.48
7.46
7.44
7.14
7.04
6.92
6.67
6.66
2.64
HO
OH
Cl
Cl
COCH3
1.00
2.04
1.07
1.13
1.13
2.13
4.03
3.13
f1 (ppm)

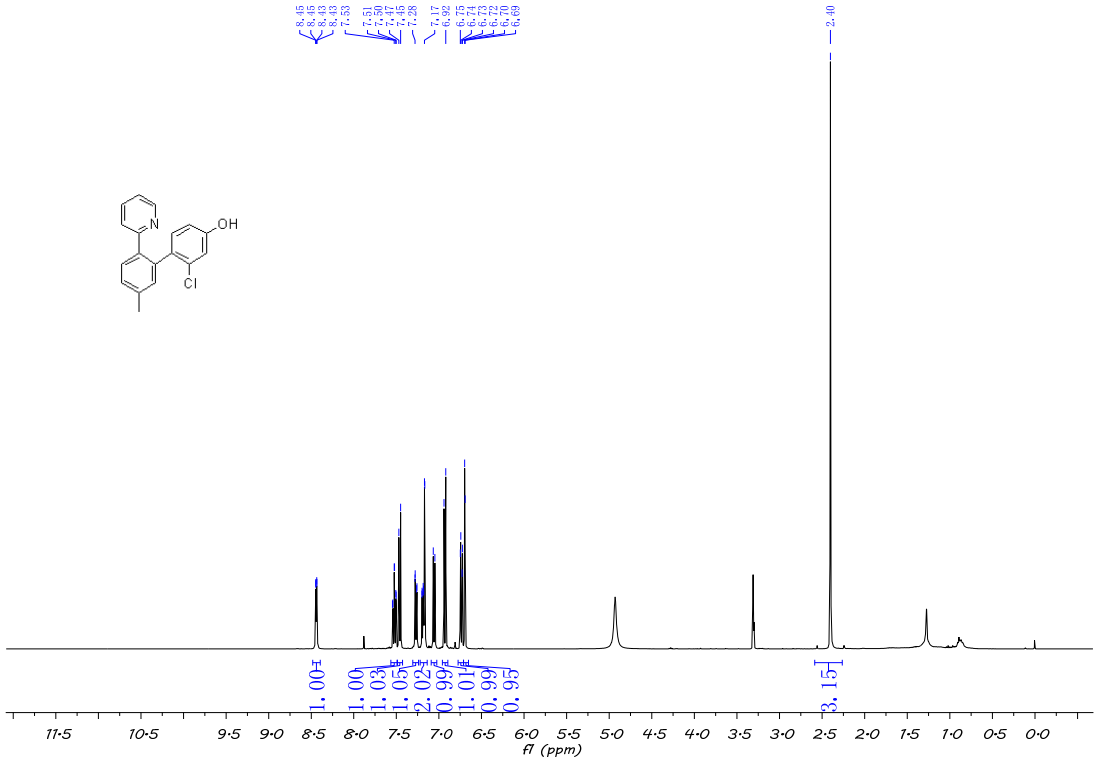

199.96
158.95
156.36
148.19
145.57
139.69
136.94
134.82
133.54
131.14
127.31
123.17
120.12
116.51
26.91
HO
OH
Cl
Cl
COCH3
f1 (ppm)

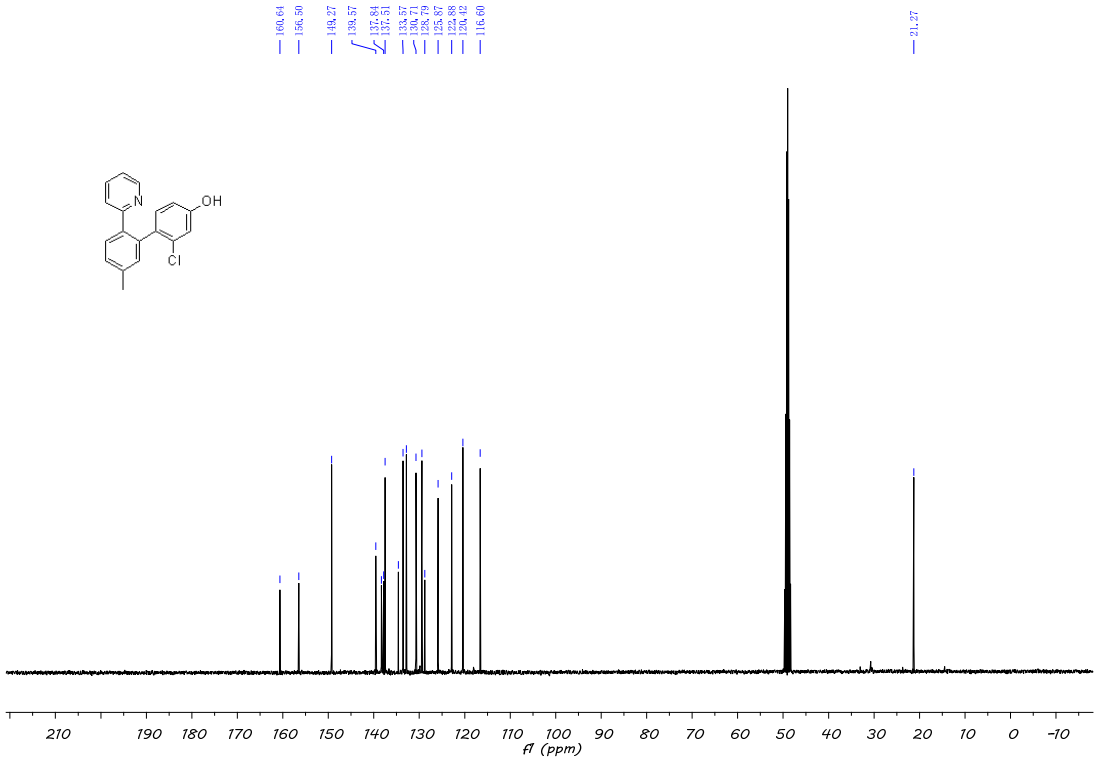

8.43
8.42
7.74
7.73
7.72
7.71
7.70
7.34
7.22
7.20
7.03
7.02
7.01
7.00
6.95
6.93
6.85
6.85
6.83
6.83
6.77
6.76
3.84
N
OH
Cl
OMe
1.00
0.99
2.04
0.99
2.02
0.93
1.02
0.97
3.18
11.0 10.5 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)

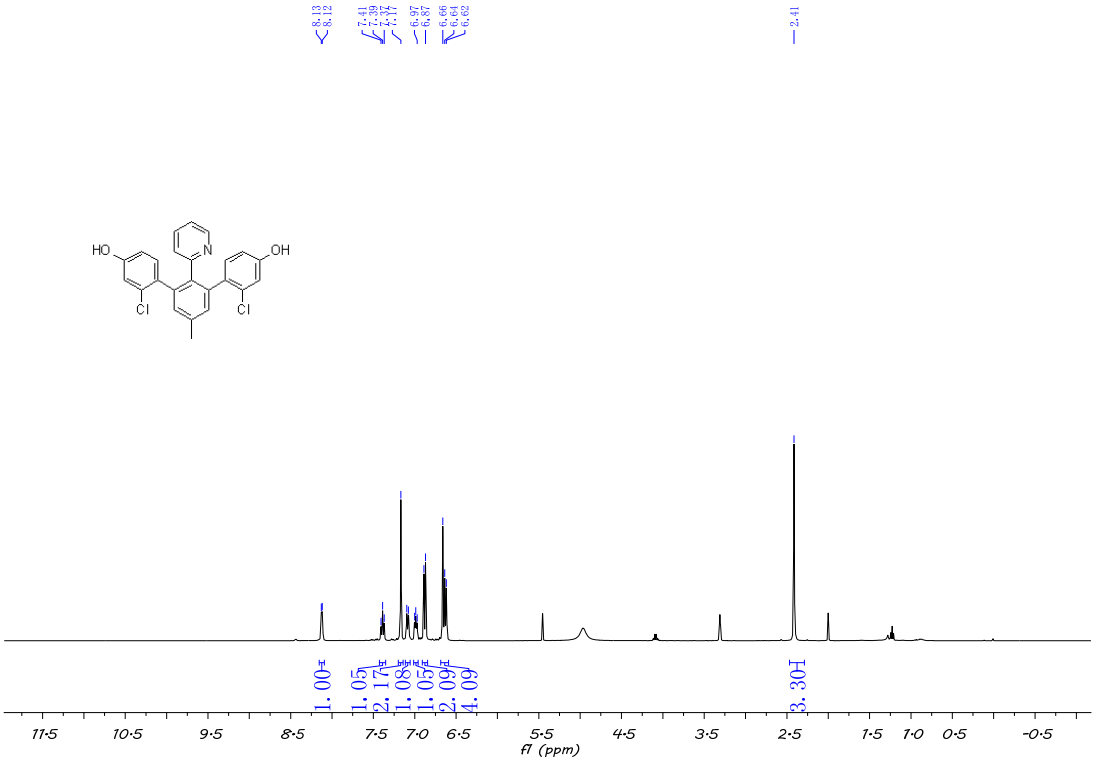

160.06
158.85
156.13
146.94
138.47
137.89
134.25
131.06
124.24
122.37
120.71
120.14
117.68
114.21
55.56
N
OH
Cl
OMe
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

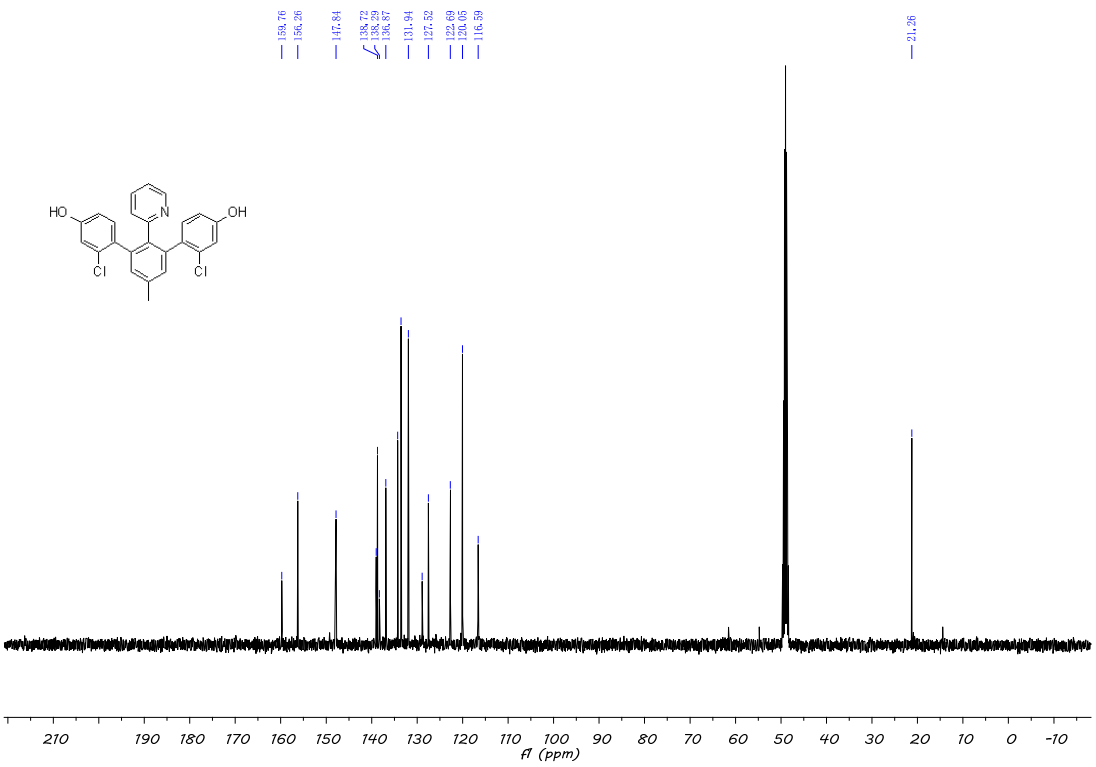

8.13
8.11
7.41
7.39
7.38
7.08
6.97
6.89
6.66
6.64
6.62
3.83
HO
OH
Cl
Cl
N
OMe
1.00
1.03
1.09
1.09
4.10
4.04
3.13
f1 (ppm)

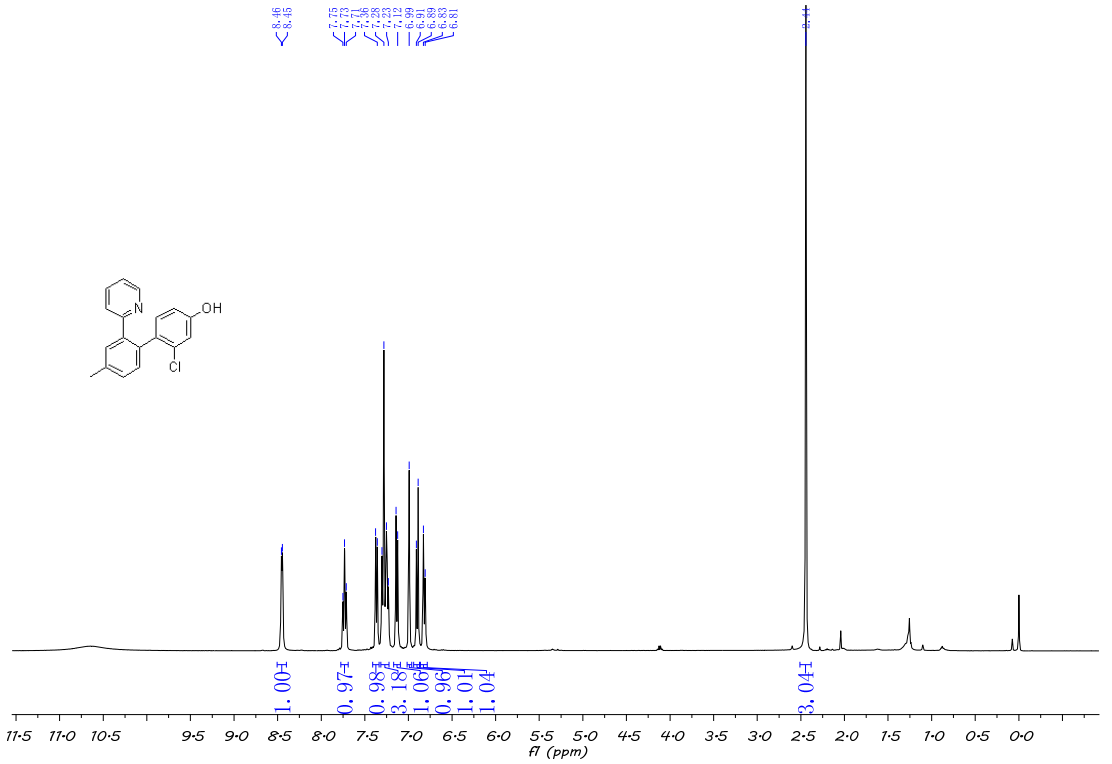

160.30
158.62
156.25
147.85
140.22
136.89
133.50
128.79
127.78
122.61
120.06
116.72
116.64
55.89
HO
OH
Cl
Cl
N
OMe
f1 (ppm)

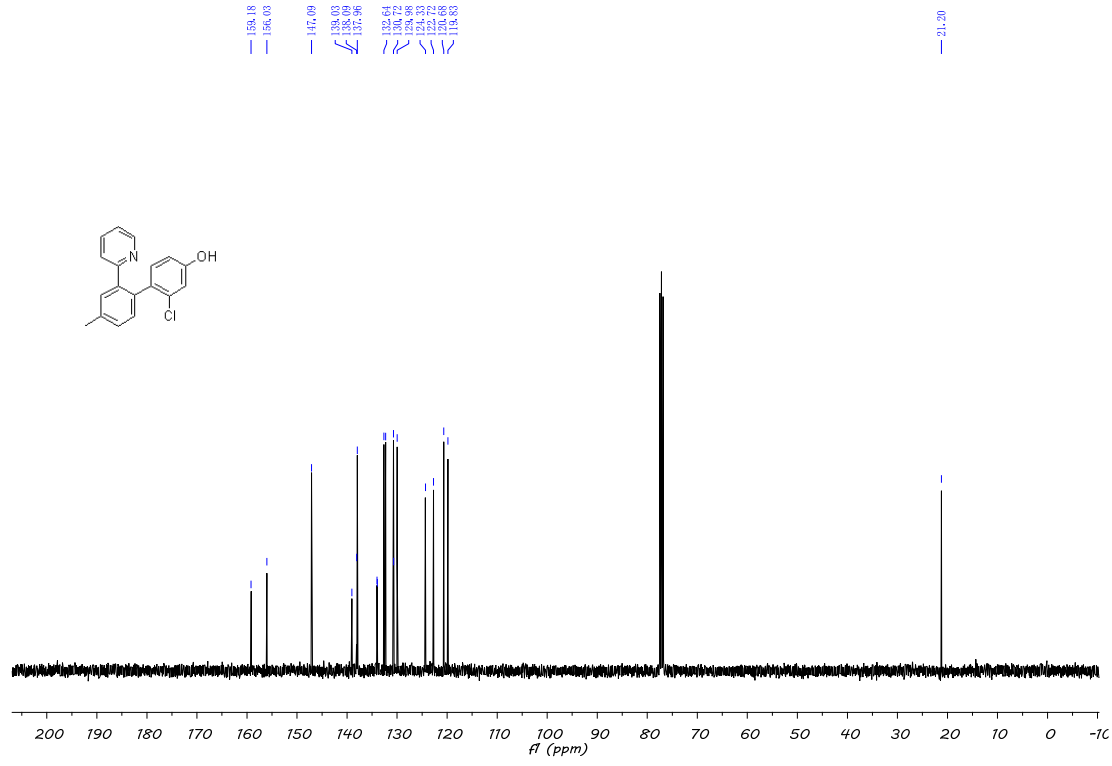

8.45
8.45
8.43
8.43
7.53
7.51
7.50
7.47
7.45
7.28
7.17
6.92
6.75
6.74
6.73
6.72
6.70
6.69
2.40
OH
Cl
1.00
1.00
1.03
1.05
2.02
0.99
1.01
0.99
0.95
3.15
f1 (ppm)

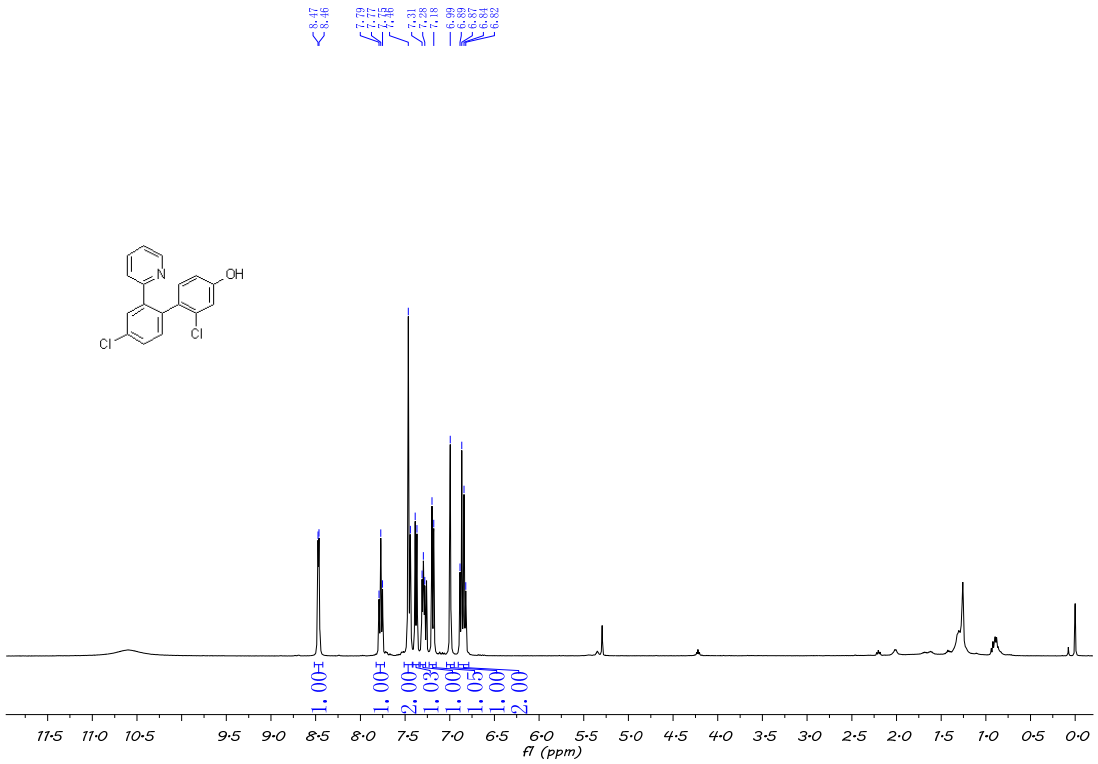

160.64
156.50
148.27
139.57
137.84
137.51
134.57
130.71
128.79
125.87
122.88
120.42
116.60
21.27
OH
Cl
f1 (ppm)

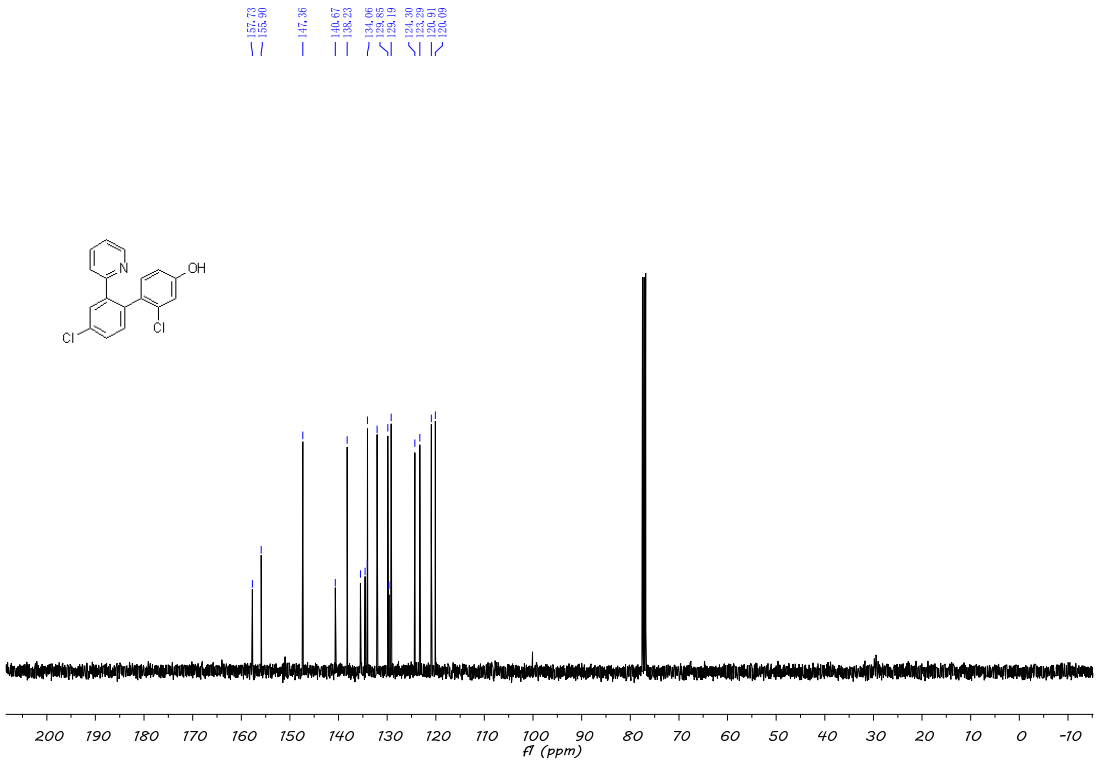

8.13
8.12
7.41
7.39
7.17
7.17
6.67
6.67
6.66
6.64
6.62
2.41
HO
OH
Cl
Cl
N
1.00
1.05
2.17
1.08
1.05
2.09
4.09
3.30
11.5
10.5
9.5
8.5
7.5
7.0
6.5
5.5
4.5
3.5
2.5
1.5
1.0
0.5
-0.5
f1 (ppm)

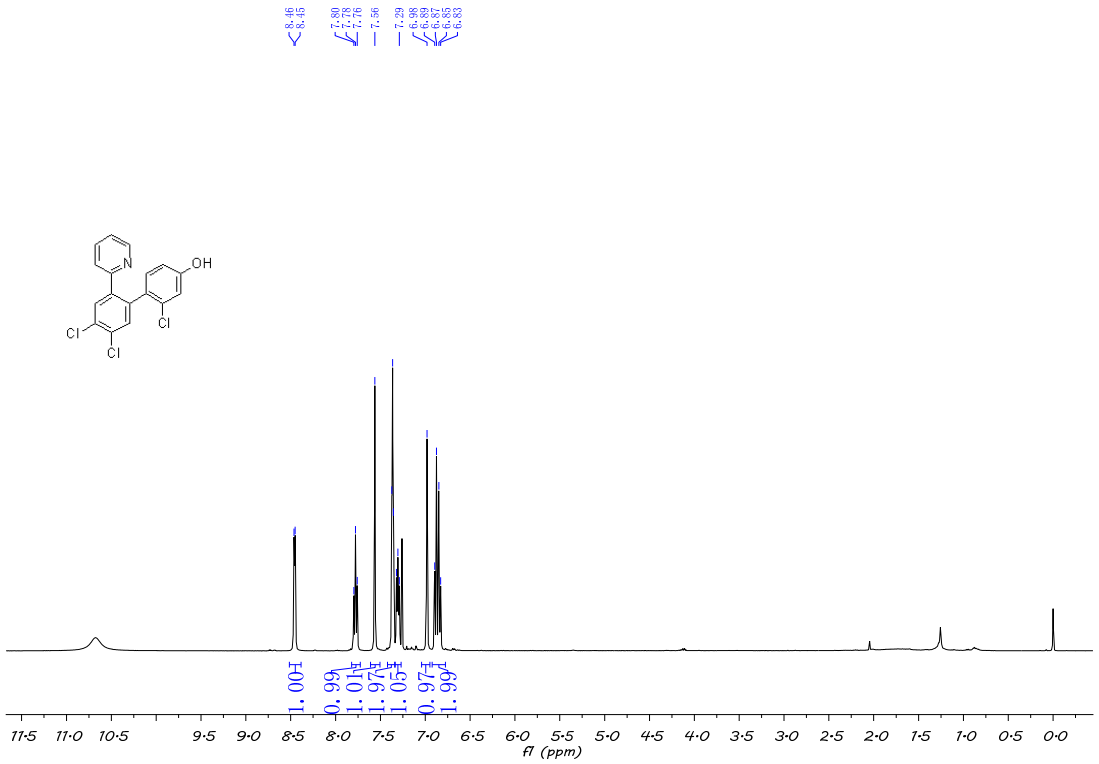

159.76
156.26
147.84
138.72
138.29
136.87
131.94
127.52
122.69
120.05
116.59
21.26
HO
OH
Cl
Cl
N
210
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
-10
f1 (ppm)

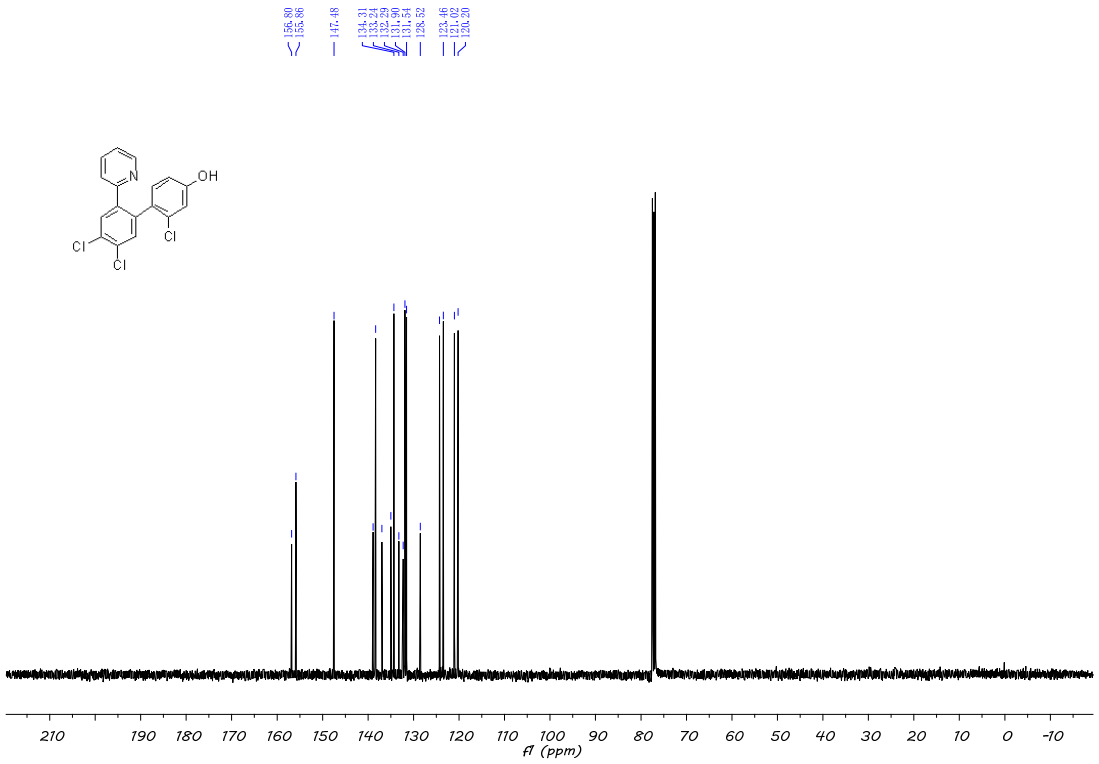

8.46
8.45
7.75
7.73
7.71
7.38
7.36
7.23
7.12
6.99
6.91
6.89
6.83
6.81
6.44
OH
Cl
1.00
0.97
0.98
3.18
1.06
0.96
1.01
1.04
3.04
f1 (ppm)

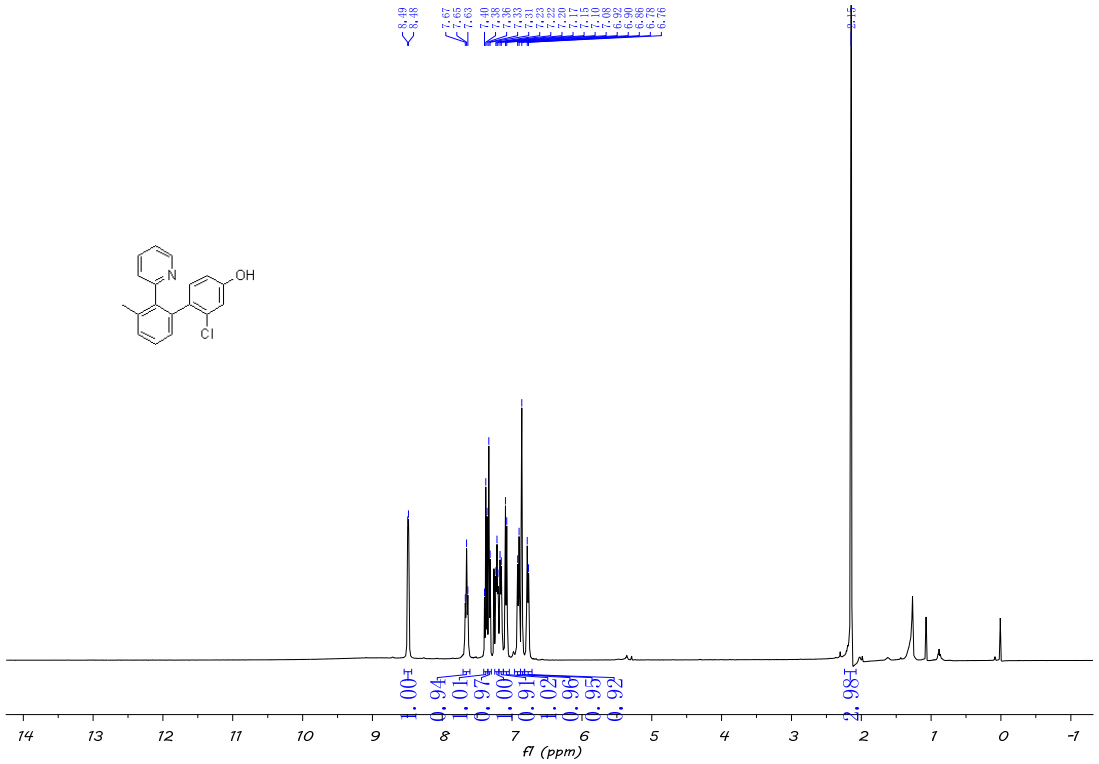

158.18
156.03
147.09
139.03
138.09
137.96
132.64
130.72
124.98
123.33
122.72
120.66
118.83
21.20
OH
Cl
f1 (ppm)

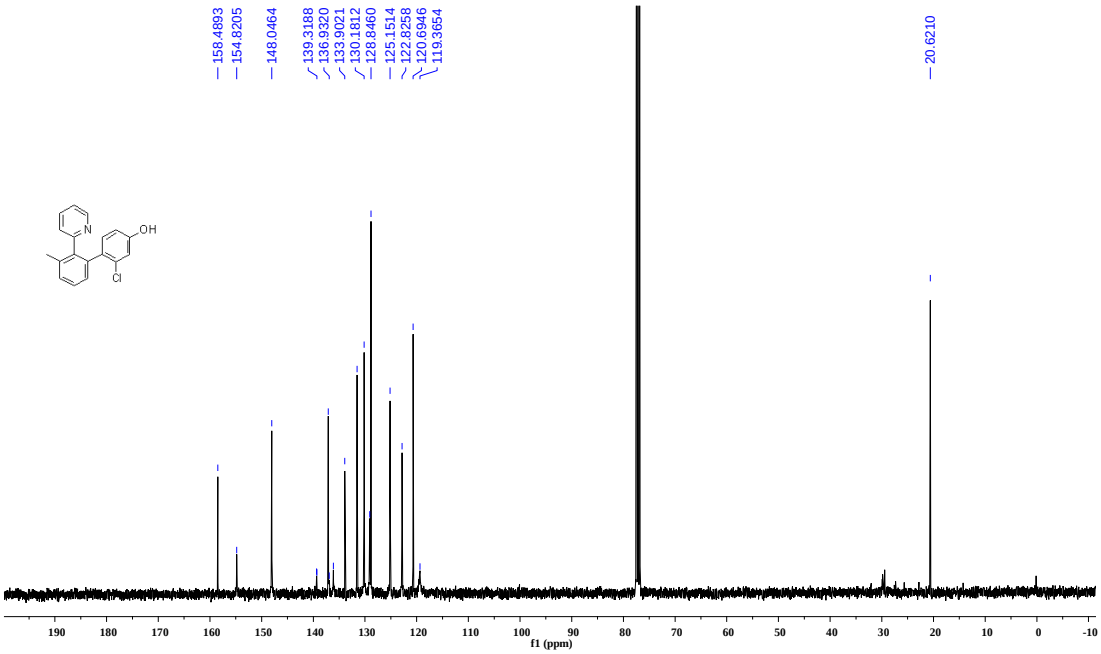

8.47
8.46
7.79
7.77
7.50
7.46
7.31
7.28
7.18
6.99
6.89
6.87
6.84
6.82
OH
N
Cl
Cl
1.00
1.00
2.00
1.03
1.00
1.03
1.00
2.00
11.5 11.0 10.5 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)

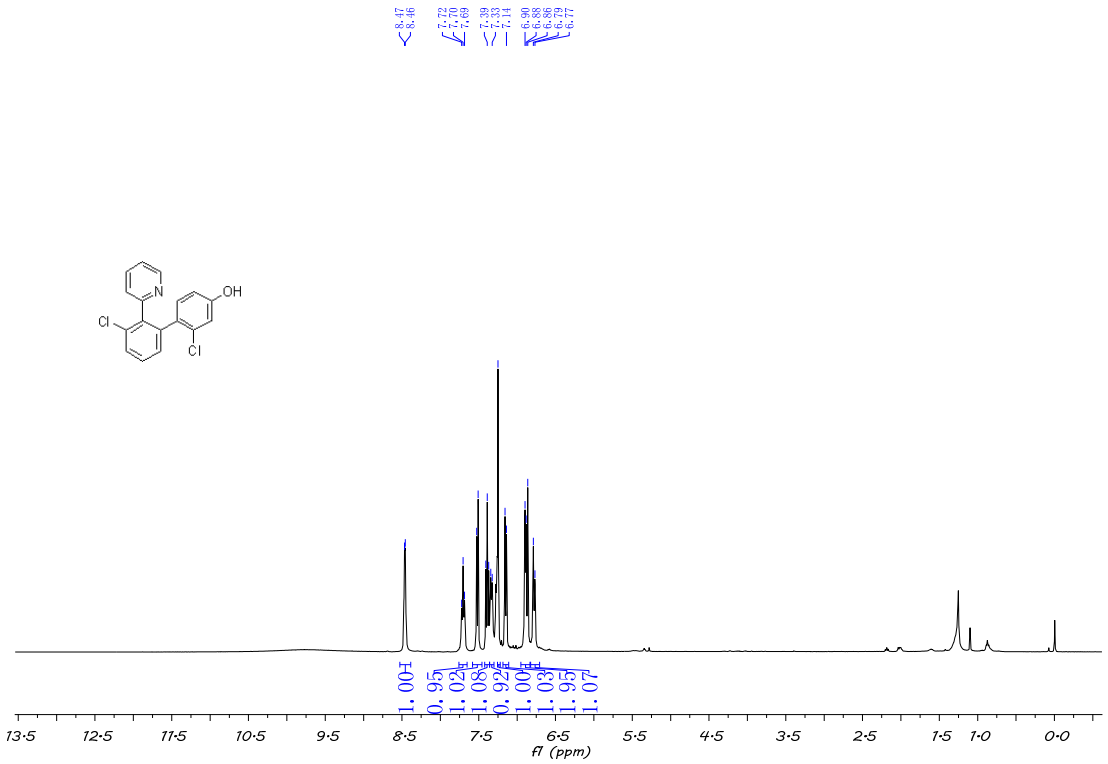

157.73
155.90
147.36
140.67
138.23
134.06
129.85
129.19
124.30
123.29
120.91
120.09
OH
N
Cl
Cl
200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)

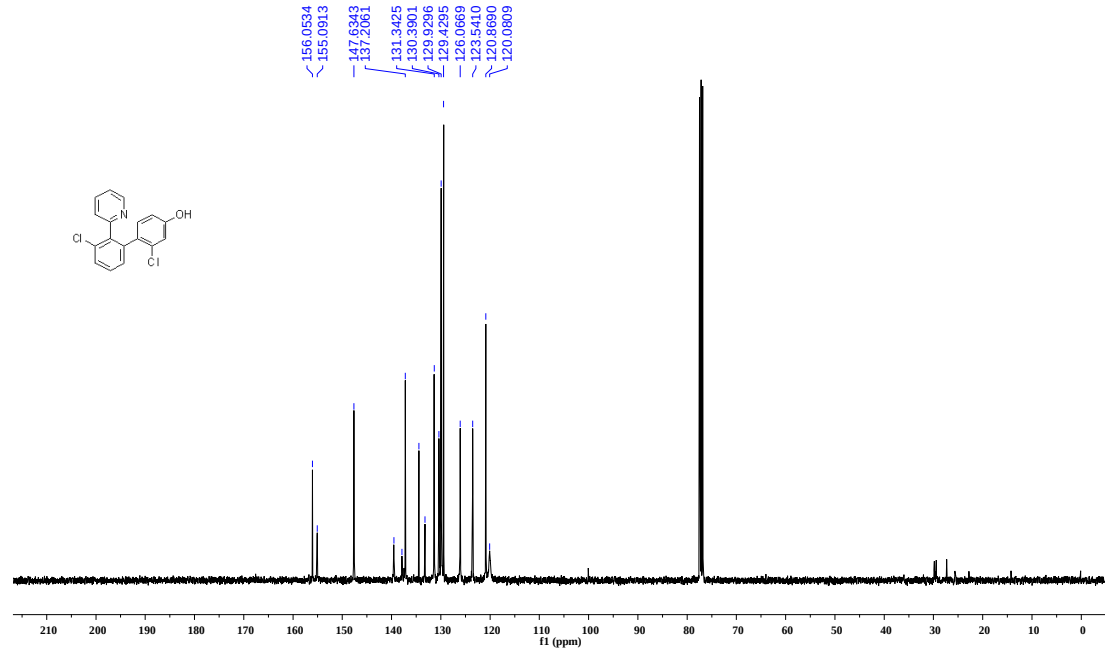

8.46
8.45
7.80
7.78
7.76
7.56
7.29
6.88
6.89
6.87
6.85
6.83
OH
Cl
Cl
Cl
1.00
0.99
1.01
1.97
1.05
0.97
1.99
11·5 11·0 10·5 9·5 9·0 8·5 8·0 7·5 7·0 6·5 6·0 5·5 5·0 4·5 4·0 3·5 3·0 2·5 2·0 1·5 1·0 0·5 0·0
f1 (ppm)


158.80
158.86
147.48
134.31
133.24
132.29
131.90
131.54
126.52
123.46
121.02
120.20
OH
Cl
Cl
Cl
210 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)


8.49
8.48
7.67
7.65
7.63
7.40
7.38
7.36
7.33
7.31
7.23
7.22
7.20
7.17
7.15
7.10
7.08
6.92
6.90
6.88
6.78
6.76
2.46
OH
Cl
1.00
0.94
1.01
0.97
1.00
0.91
1.02
0.96
0.95
0.92
2.98
f1 (ppm)


158.4893
154.8205
148.0464
139.3188
136.9320
133.9021
130.1812
128.8460
125.1514
122.8258
120.6946
119.3654
20.6210
OH
Cl
f1 (ppm)


8.47
8.46
7.72
7.70
7.69
7.39
7.33
7.14
6.90
6.88
6.86
6.79
6.77
N
OH
Cl
Cl
1.00
0.95
1.02
1.08
0.92
1.00
1.03
1.93
1.07
13·5
12·5
11·5
10·5
9·5
8·5
7·5
6·5
5·5
4·5
3·5
2·5
1·5
1·0
0·0
f1 (ppm)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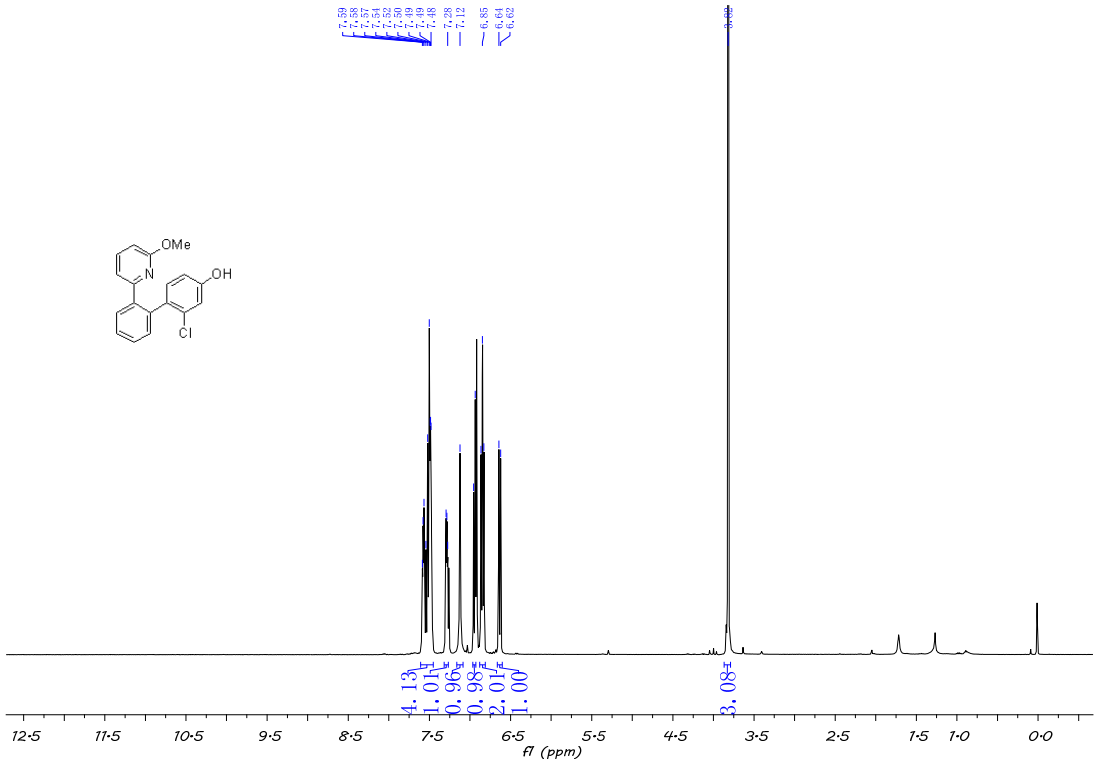
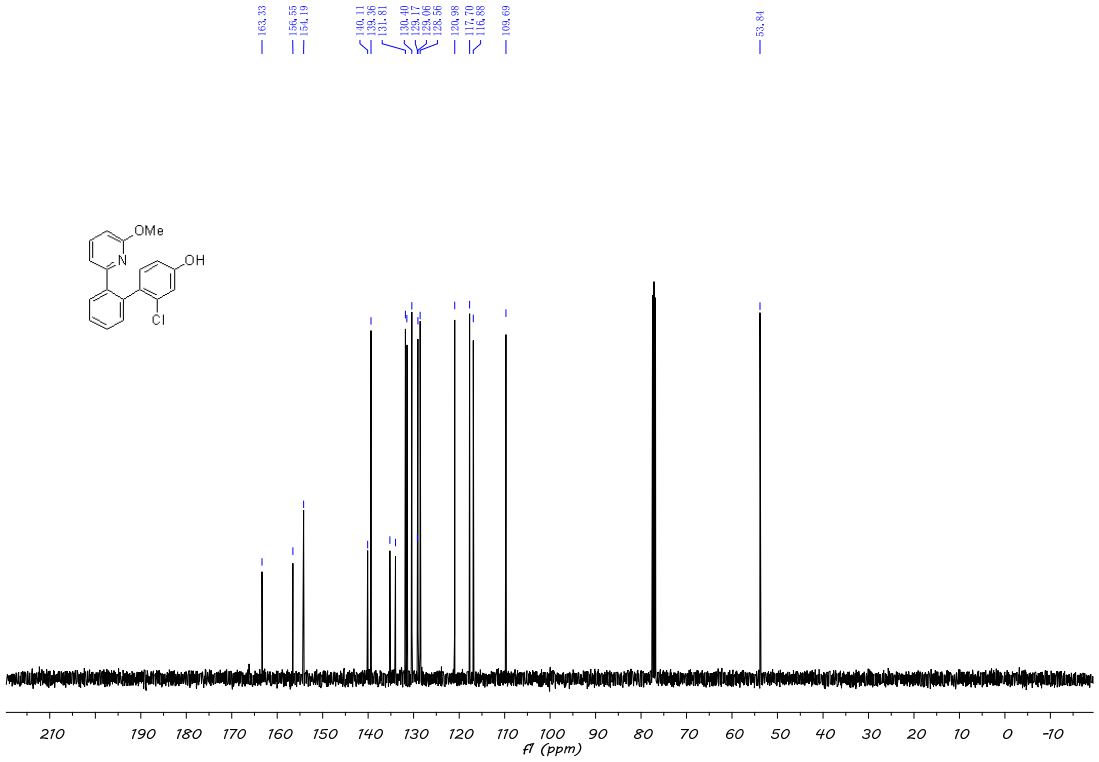
155.0913
147.6343
137.2061
131.3425
130.3901
129.9296
129.4295
126.0669
123.5410
120.8690
120.0809
N
OH
Cl
Cl
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)


7.59
7.58
7.57
7.54
7.53
7.50
7.49
7.48
7.28
7.12
6.85
6.64
6.62
3.882
OMe
N
OH
Cl
4.13
1.01
0.96
0.98
2.01
1.00
3.08
12.5
11.5
10.5
9.5
8.5
7.5
6.5
5.5
4.5
3.5
2.5
1.5
1.0
0.0
f1 (ppm)


163.33
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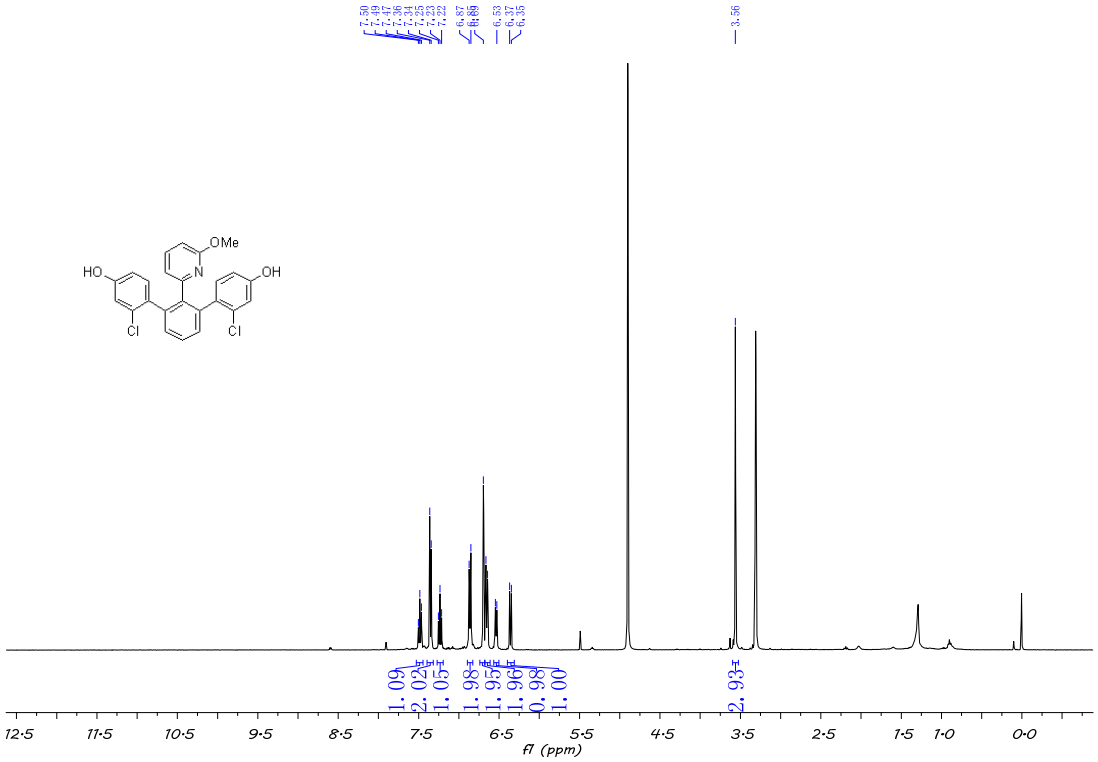
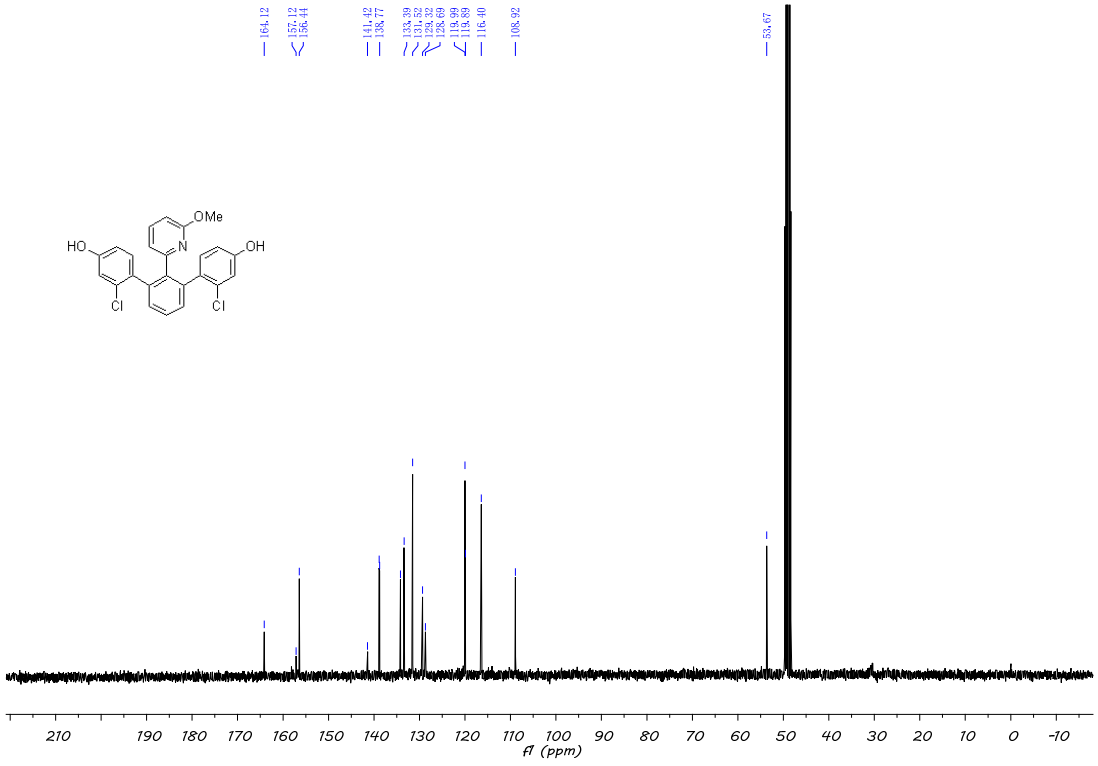
129.17
128.06
126.56
120.98
117.70
116.88
109.69
53.84
OMe
N
OH
Cl
210
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
-10
f1 (ppm)


7.50
7.49
7.47
7.36
7.34
7.25
7.23
7.22
6.87
6.85
6.53
6.37
6.35
3.56
OMe
HO
OH
Cl
Cl
1.09
2.02
1.05
1.98
1.95
1.96
0.98
1.00
2.93
f1 (ppm)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133.39
131.52
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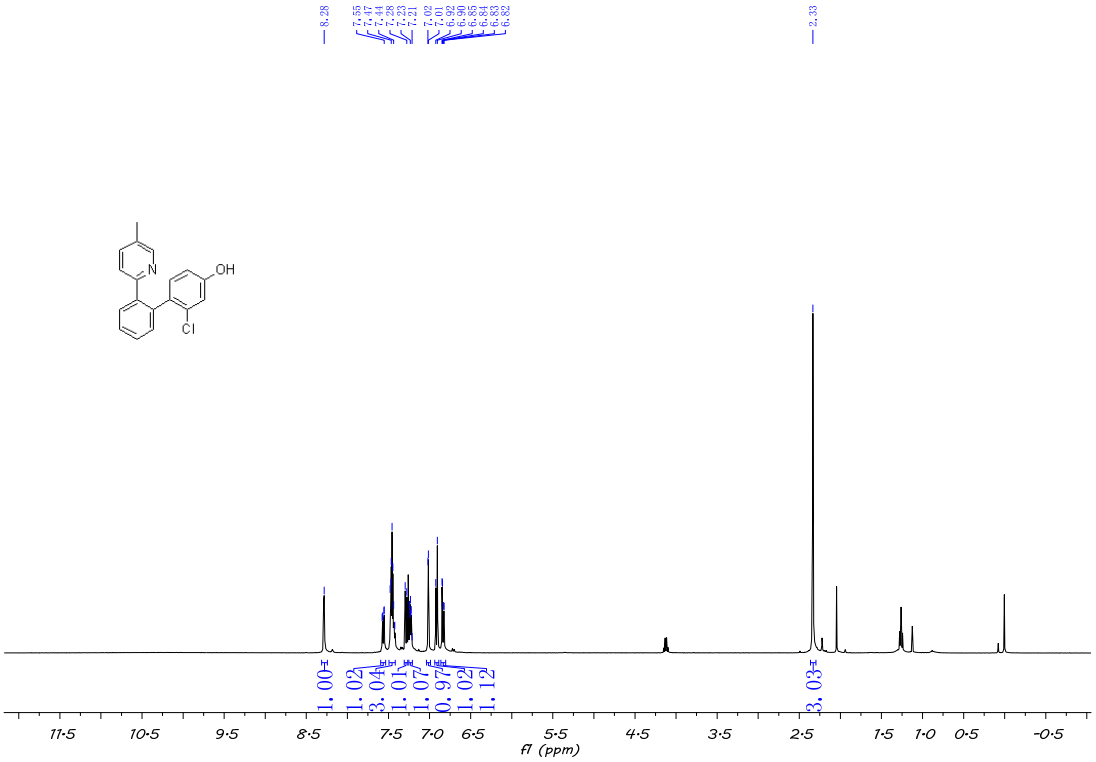
119.99
119.89
116.40
108.92
53.67
OMe
HO
OH
Cl
Cl
f1 (ppm)


8.28
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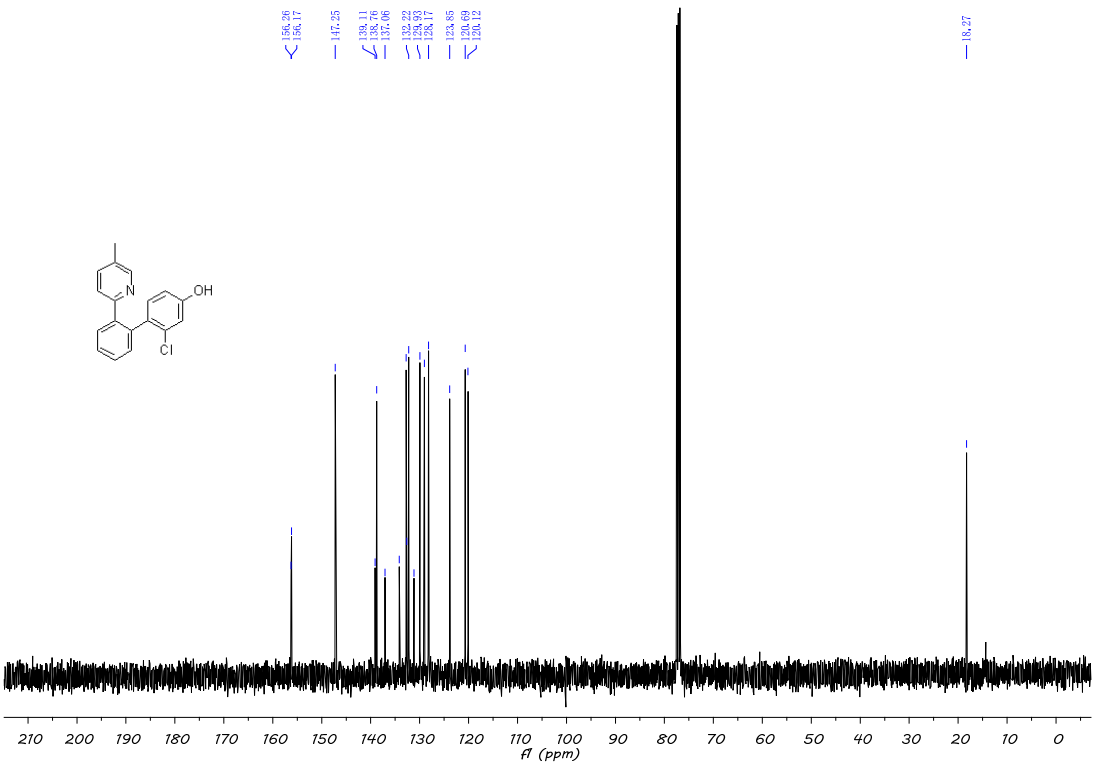
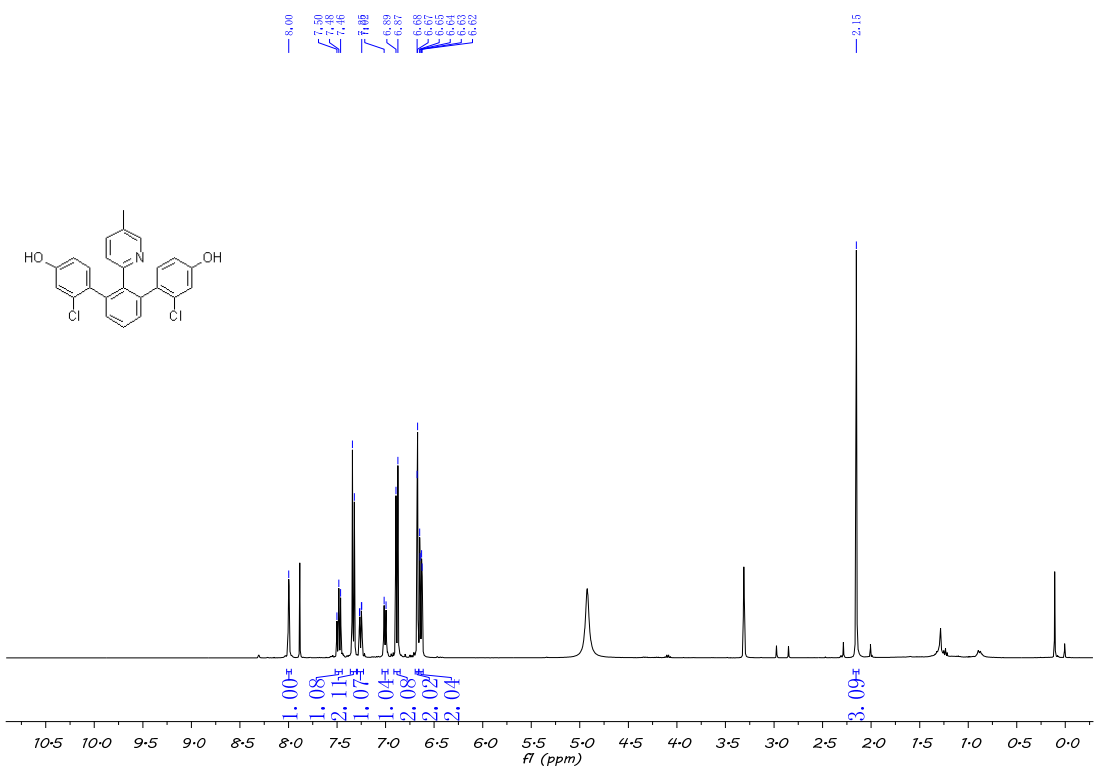
7.47
7.44
7.28
7.23
7.21
7.02
7.00
6.92
6.90
6.85
6.84
6.83
6.82
2.33
OH
Cl
1.00
1.02
3.04
1.01
1.07
0.97
1.02
1.12
3.03
f1 (ppm)


156.26
156.17
147.25
139.11
138.76
137.06
132.22
129.93
128.17
123.85
120.69
120.12
18.27
OH
Cl
f1 (ppm)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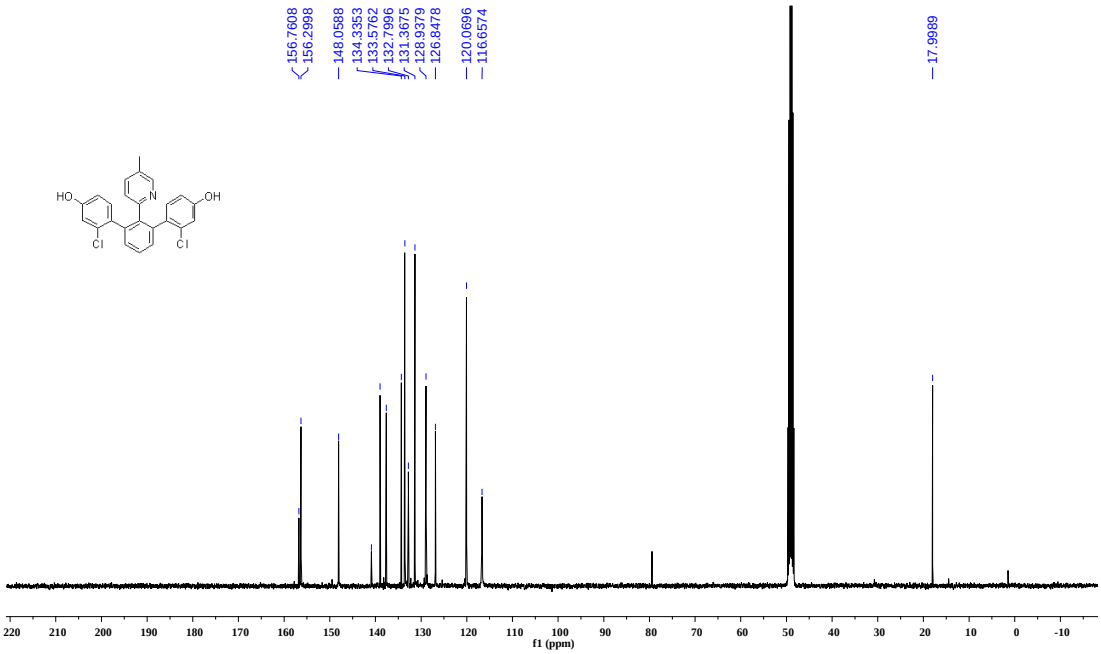
7.50
7.48
7.46
6.89
6.87
6.68
6.67
6.65
6.64
6.63
6.62
2.15
HO
OH
Cl
Cl
1.00
1.08
2.11
1.07
1.04
2.08
2.02
2.04
3.09
f1 (ppm)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133.5762
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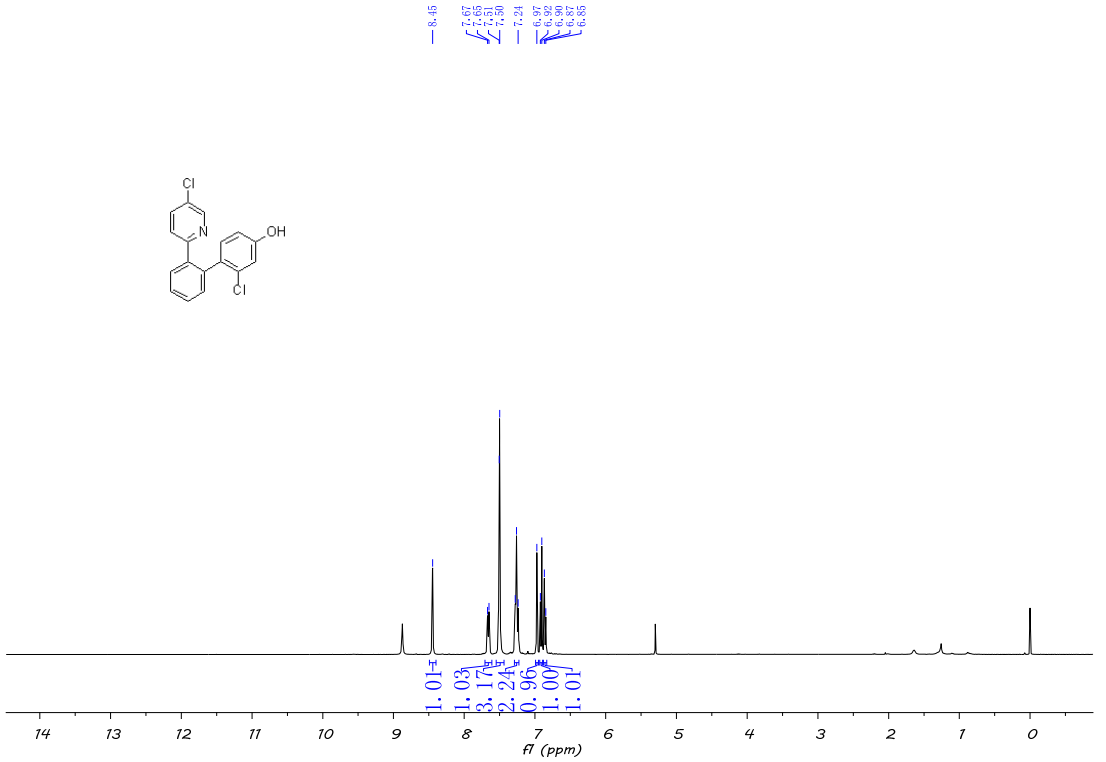
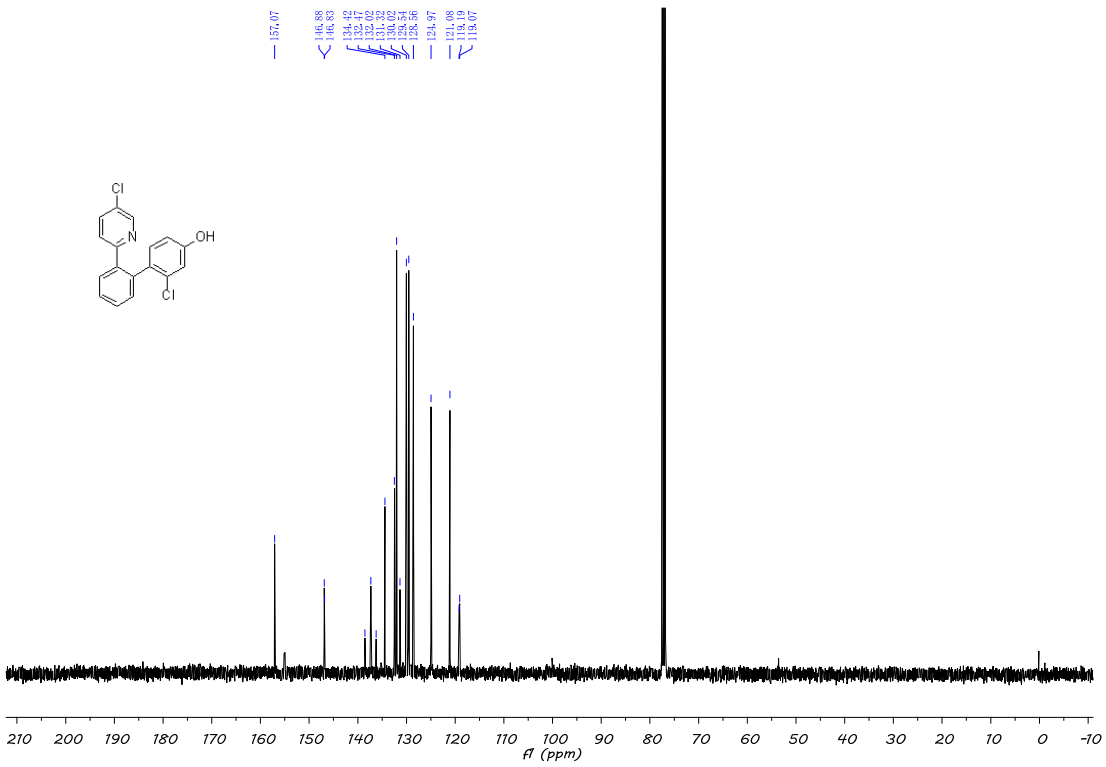
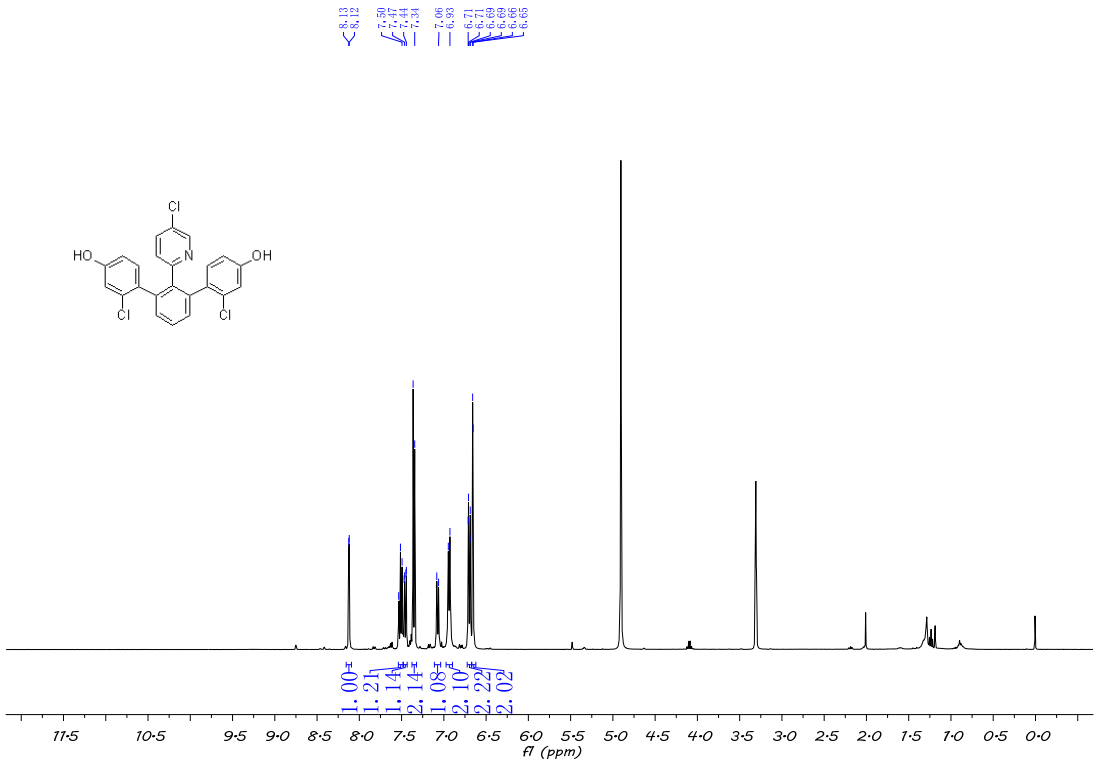
126.8478
120.0696
116.6574
17.9989
HO
OH
Cl
Cl
f1 (ppm)


8.45
7.67
7.65
7.51
7.50
7.24
6.97
6.92
6.90
6.87
6.85
Cl
N
OH
Cl
1.01
1.03
3.17
2.24
0.96
1.00
1.01
14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
f1 (ppm)


157.07
146.88
146.83
134.42
132.47
132.02
131.32
130.02
128.54
128.46
124.97
121.08
119.19
118.07
Cl
N
OH
Cl
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)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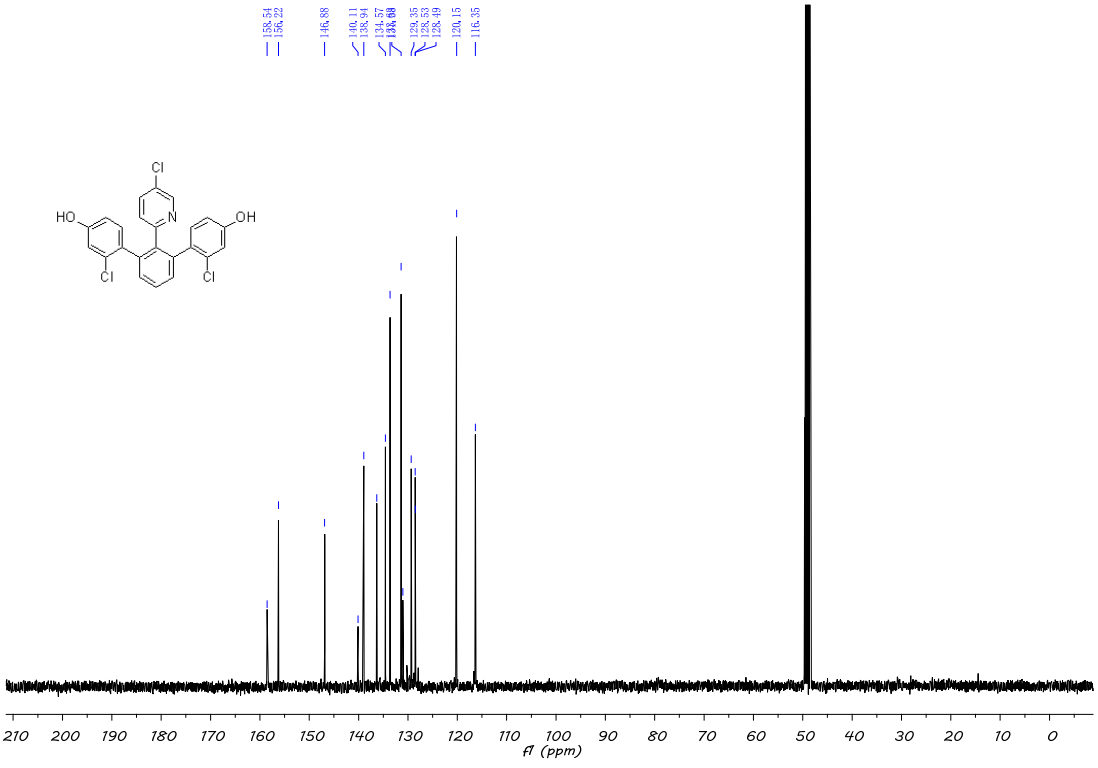
8.12
7.50
7.47
7.44
7.31
7.06
6.93
6.71
6.71
6.69
6.69
6.65
6.65
Cl
HO
OH
Cl
Cl
N
1.00
1.21
1.14
2.14
1.08
2.10
2.22
2.02
f1 (ppm)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156.22
146.88
140.11
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134.57
129.35
128.53
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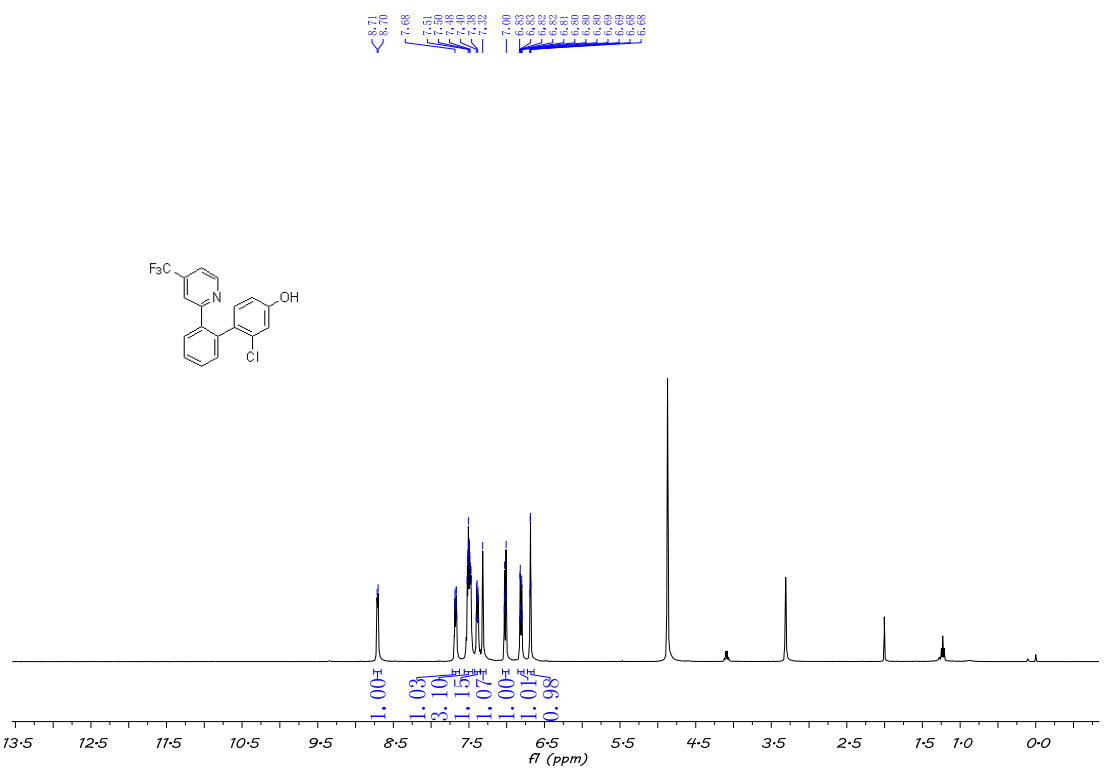
120.15
116.35
Cl
HO
OH
Cl
Cl
N
f1 (ppm)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7.40
7.38
7.32
7.00
6.83
6.83
6.82
6.81
6.80
6.80
6.80
6.69
6.69
6.68
6.68
F3C
N
OH
Cl
1.00
1.03
3.10
1.15
1.07
1.00
1.01
0.98
13.5
12.5
11.5
10.5
9.5
8.5
7.5
6.5
5.5
4.5
3.5
2.5
1.5
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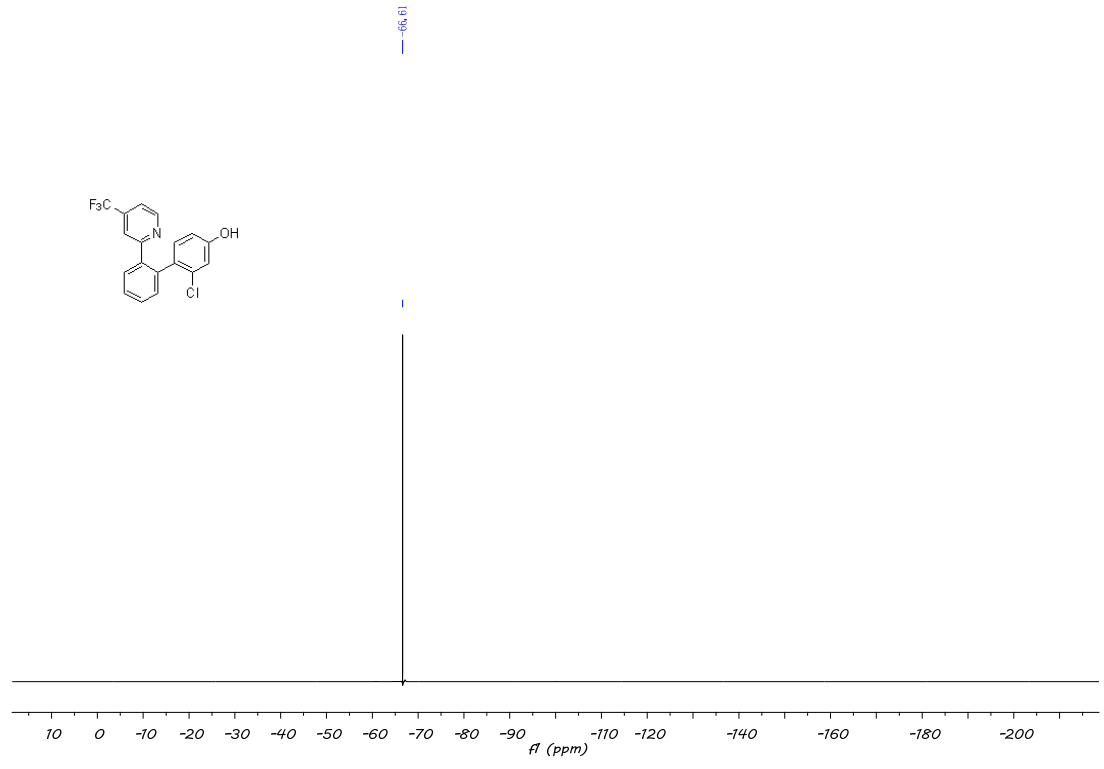
0.0
f1 (ppm)


-66.61
F3C
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OH
Cl
10
0
-10
-20
-30
-40
-50
-60
-70
-80
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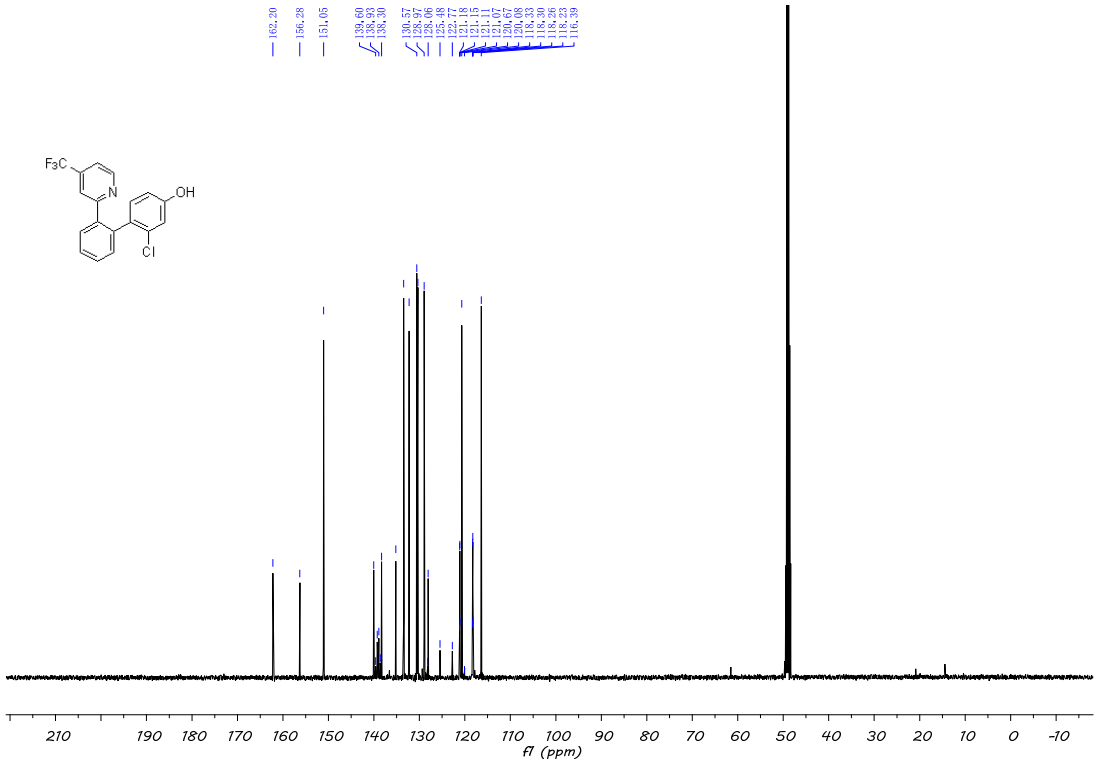
-120
-140
-160
-180
-200
f1 (ppm)


162.20
156.28
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128.97
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122.77
121.18
121.15
121.11
121.07
120.67
120.08
118.33
118.30
118.26
118.23
116.39
F3C
N
OH
Cl
210
190
180
170
160
150
140
130
120
110
100
90
80
70
60
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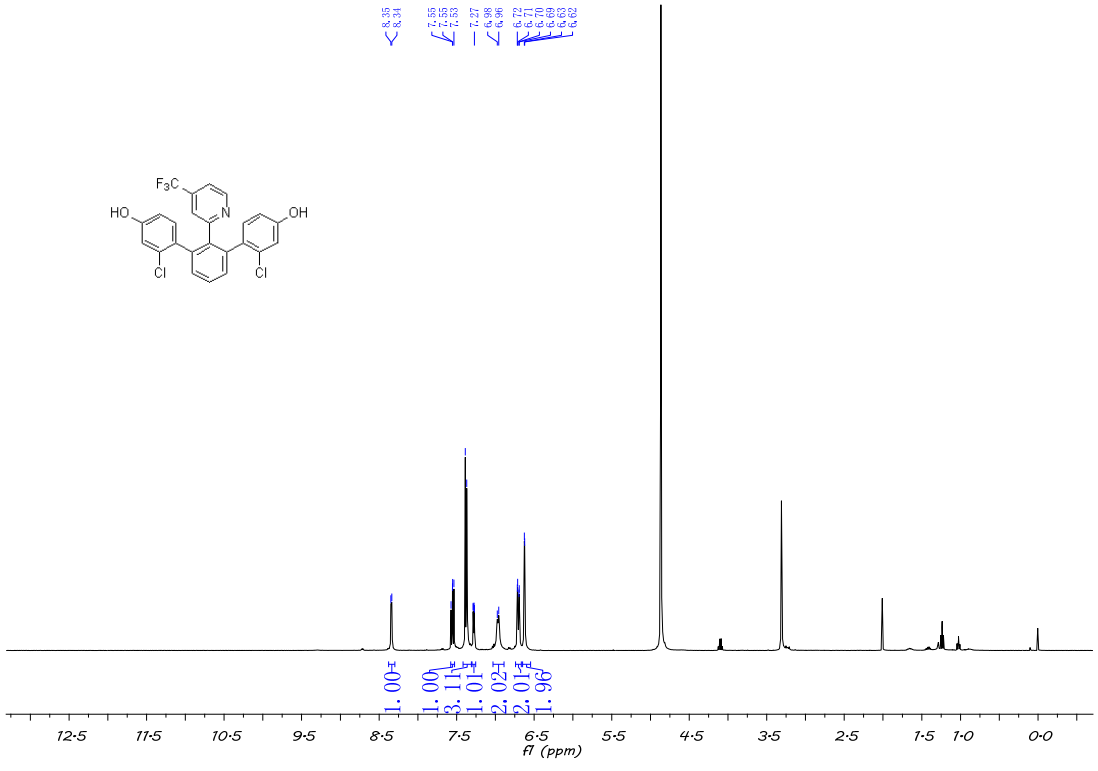
40
30
20
10
0
-10
f1 (ppm)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8.34
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7.55
7.53
7.27
6.98
6.96
6.72
6.71
6.70
6.69
6.63
6.62
F3C
N
HO
OH
Cl
Cl
1.00
1.00
3.11
1.01
2.02
2.01
1.96
12.5
11.5
10.5
9.5
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6.5
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4.5
3.5
2.5
1.5
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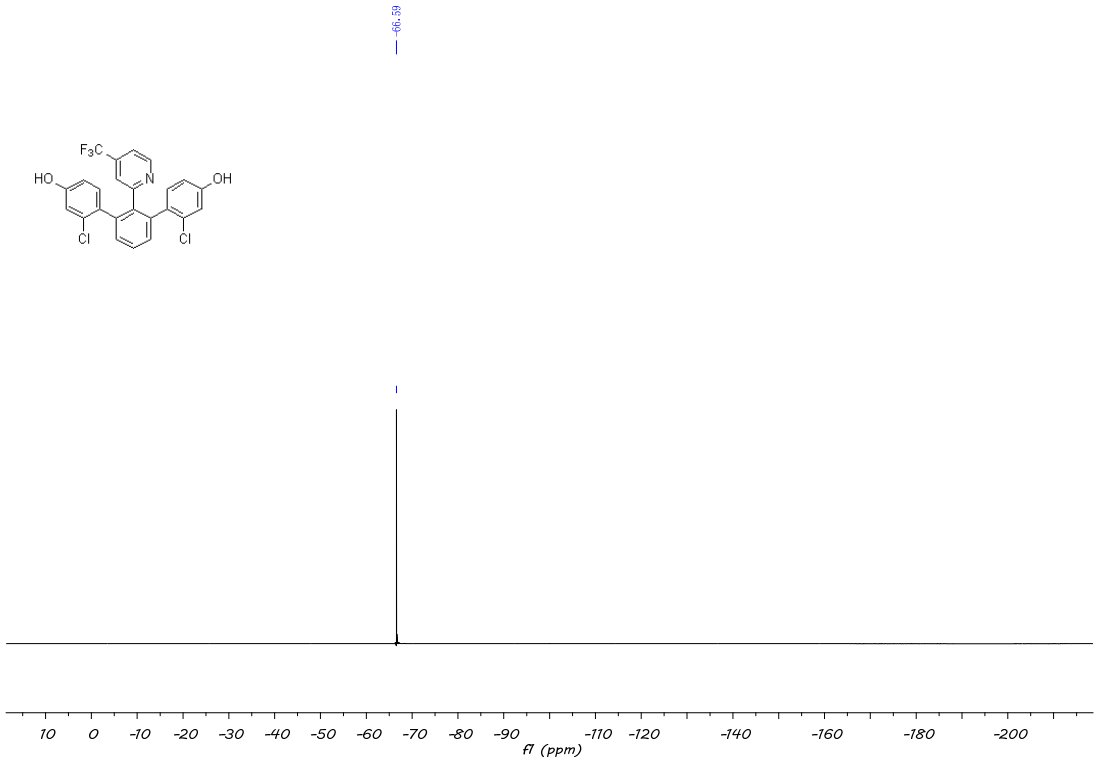
0.0
f1 (ppm)


-66.59
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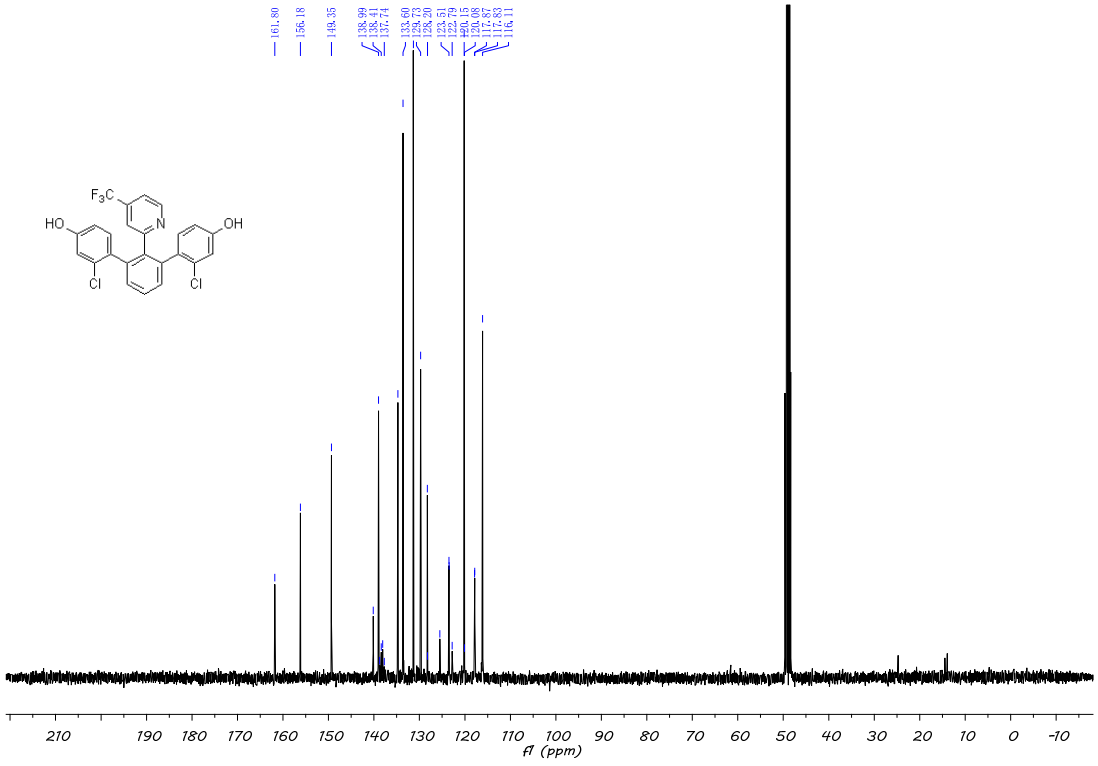
N
HO
OH
Cl
Cl
10 0 -10 -20 -30 -40 -50 -60 -70 -80 -90 -110 -120 -140 -160 -180 -200
f1 (ppm)


161.80
156.18
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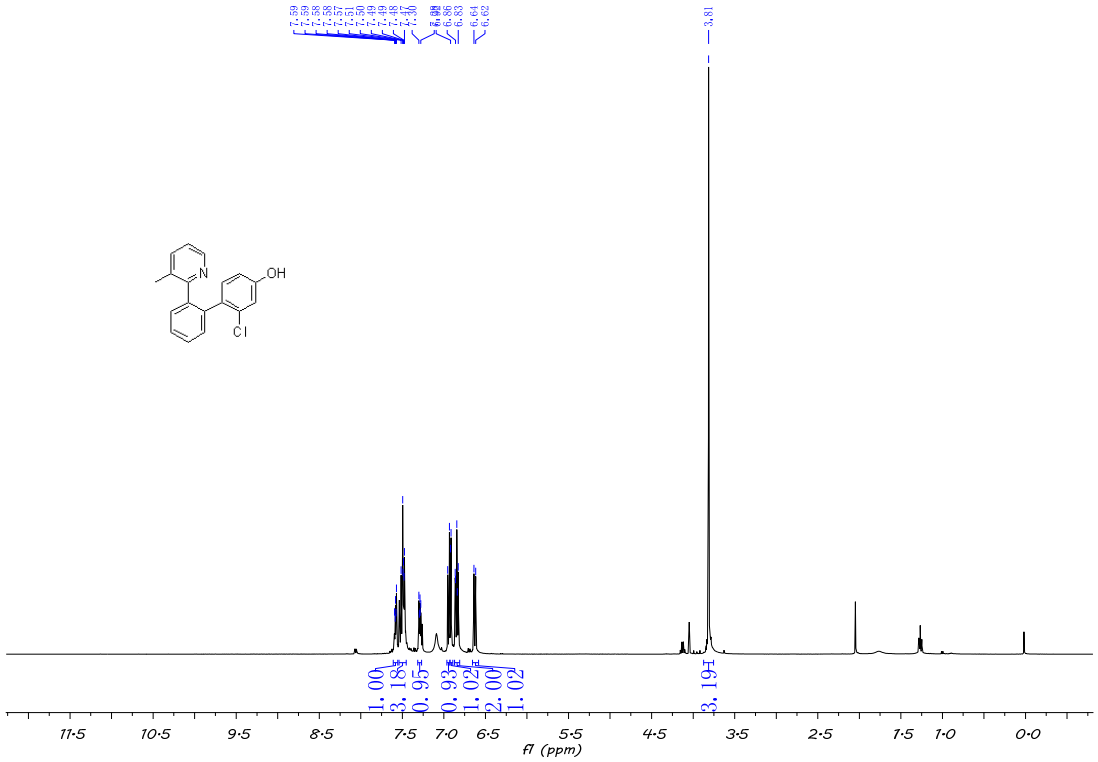
138.99
138.41
137.74
133.60
128.73
128.20
125.51
122.79
120.15
120.08
117.87
117.63
116.11
F3C
N
HO
OH
Cl
Cl
210 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)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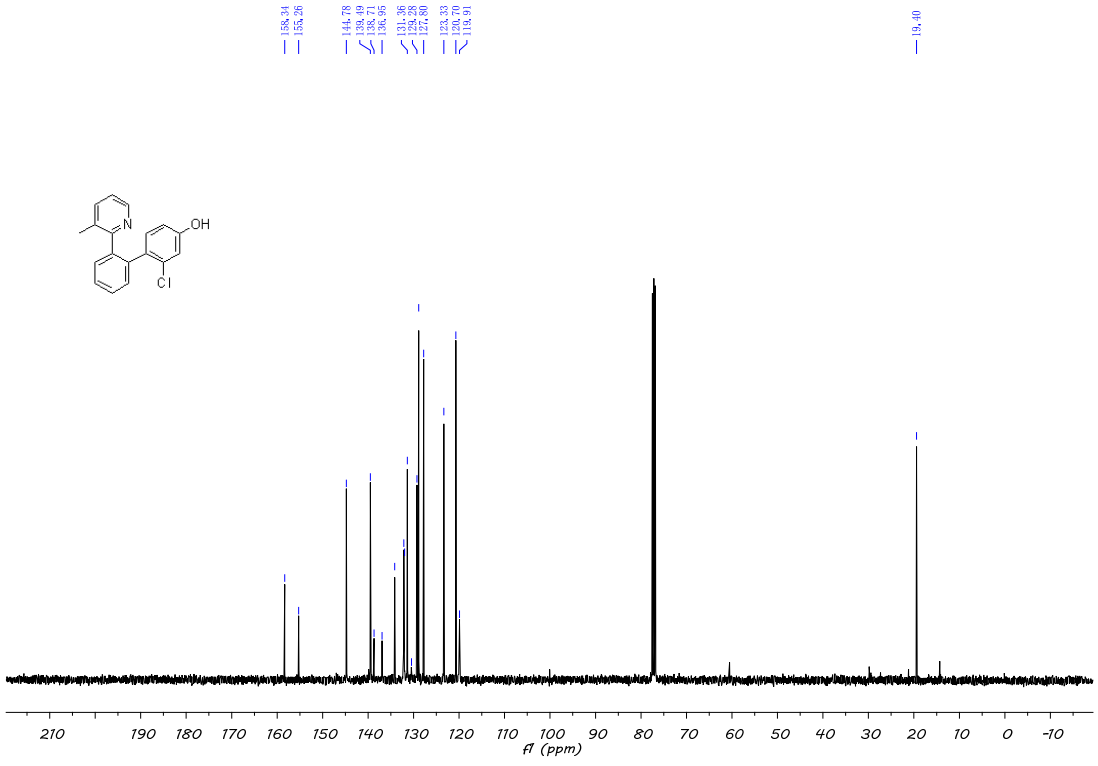
7.59
7.58
7.58
7.57
7.51
7.50
7.49
7.49
7.48
7.47
7.46
6.86
6.83
6.64
6.62
3.81
N
OH
Cl
1.00
3.18
0.95
0.93
1.02
2.00
1.02
3.19
11.5
10.5
9.5
8.5
7.5
7.0
6.5
5.5
4.5
3.5
2.5
1.5
1.0
0.0
f1 (ppm)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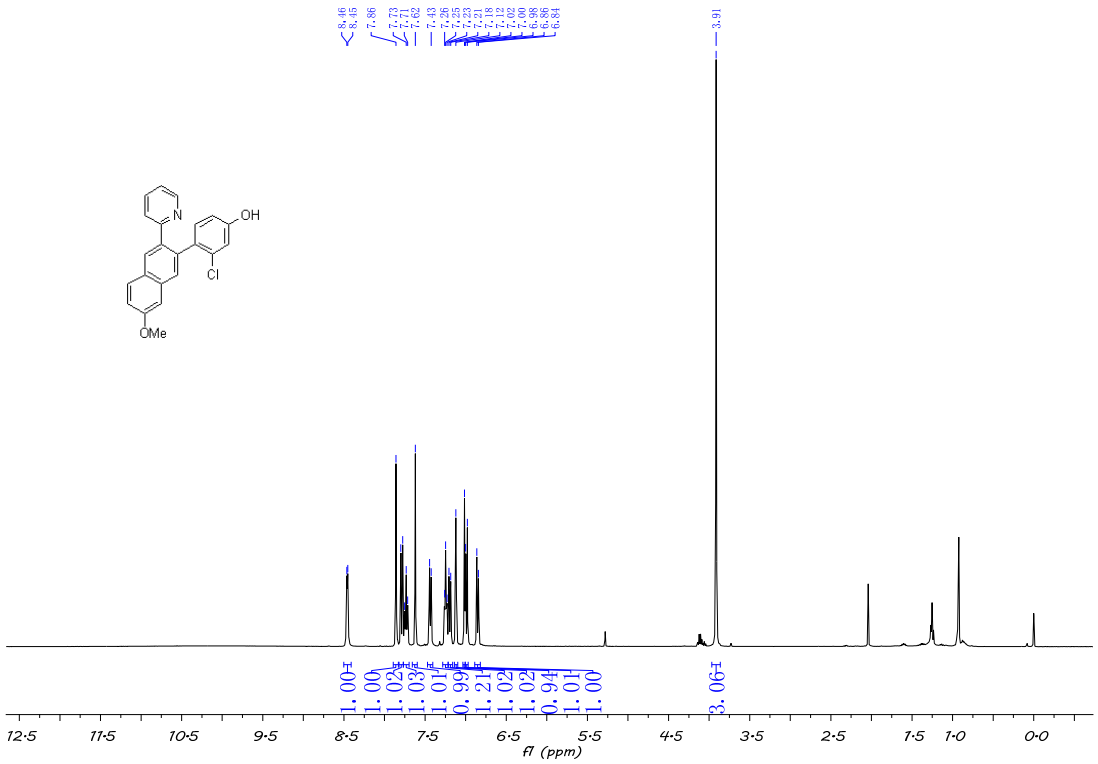
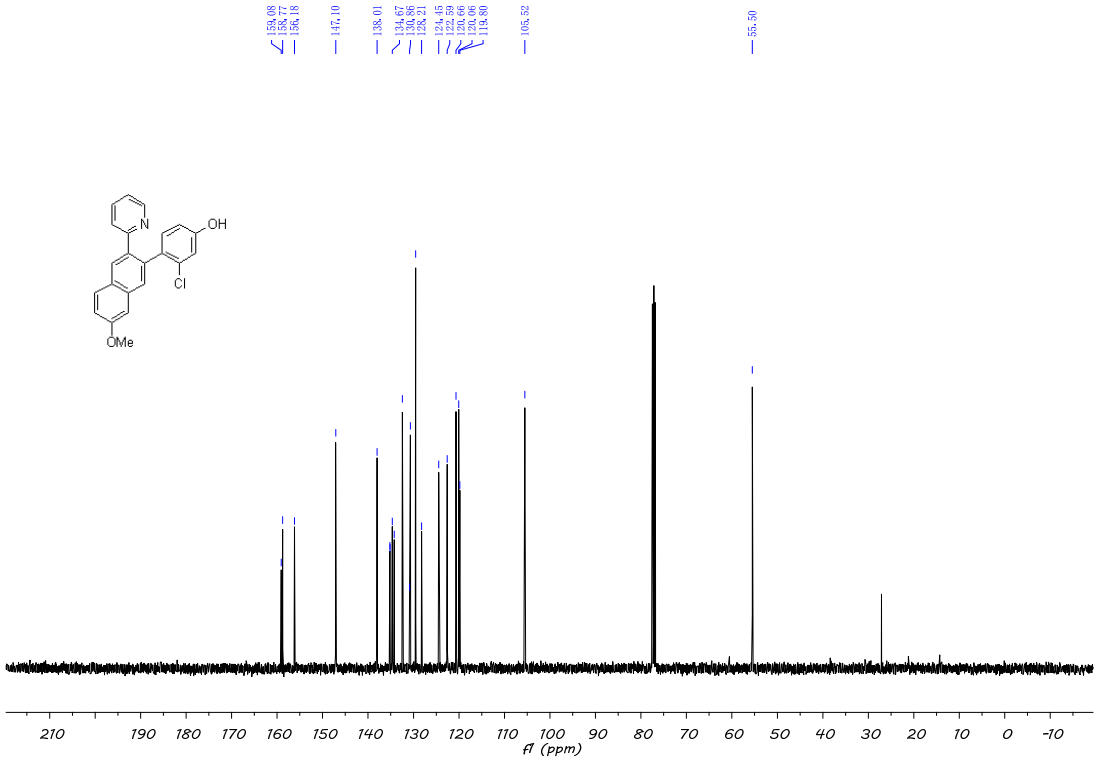
155.26
144.78
138.49
138.27
136.95
131.36
129.28
127.80
120.33
119.70
118.91
19.40
N
OH
Cl
210
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
-10
f1 (ppm)


8.46
8.45
7.86
7.73
7.71
7.62
7.43
7.26
7.25
7.23
7.21
7.18
7.12
7.02
7.00
6.98
6.86
6.84
3.91
OH
Cl
OMe
1.00
1.00
1.02
1.03
1.01
0.99
1.21
1.02
1.02
0.94
1.01
1.00
3.06
12.5
11.5
10.5
9.5
8.5
7.5
6.5
5.5
4.5
3.5
2.5
1.5
1.0
0.0
f1 (ppm)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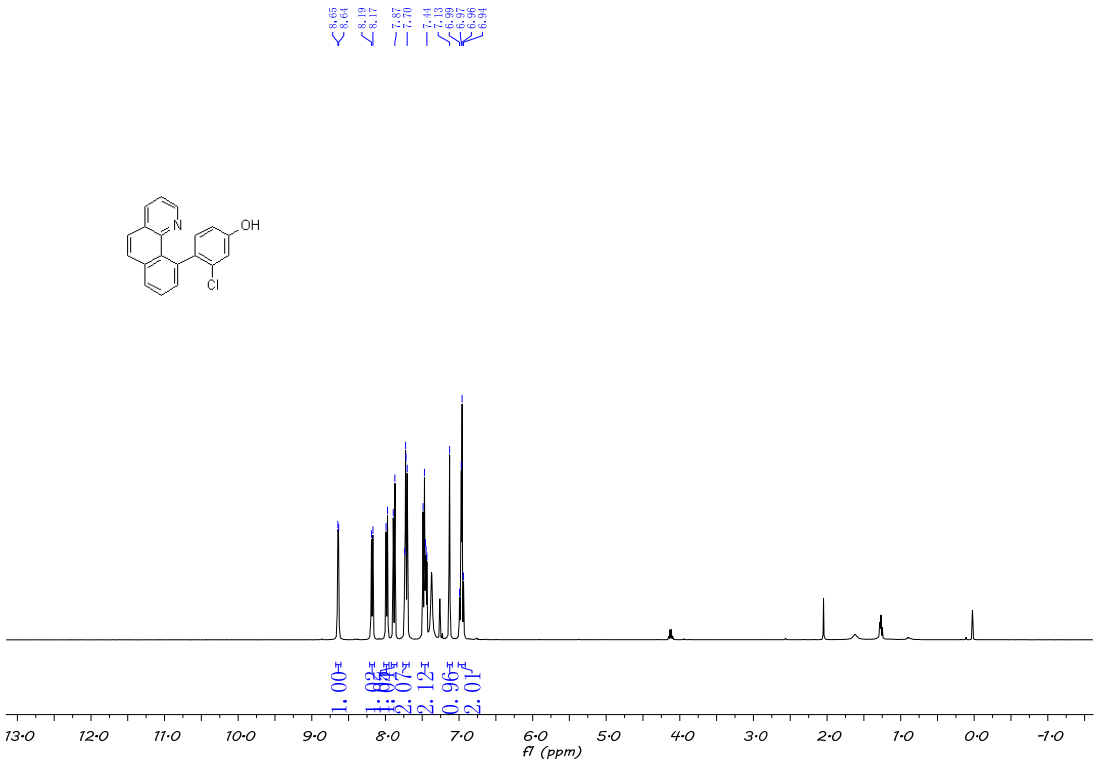
158.77
156.18
147.10
138.01
134.67
130.86
128.21
124.45
122.59
120.66
120.06
118.80
105.52
55.50
OH
Cl
OMe
210
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
-10
f1 (ppm)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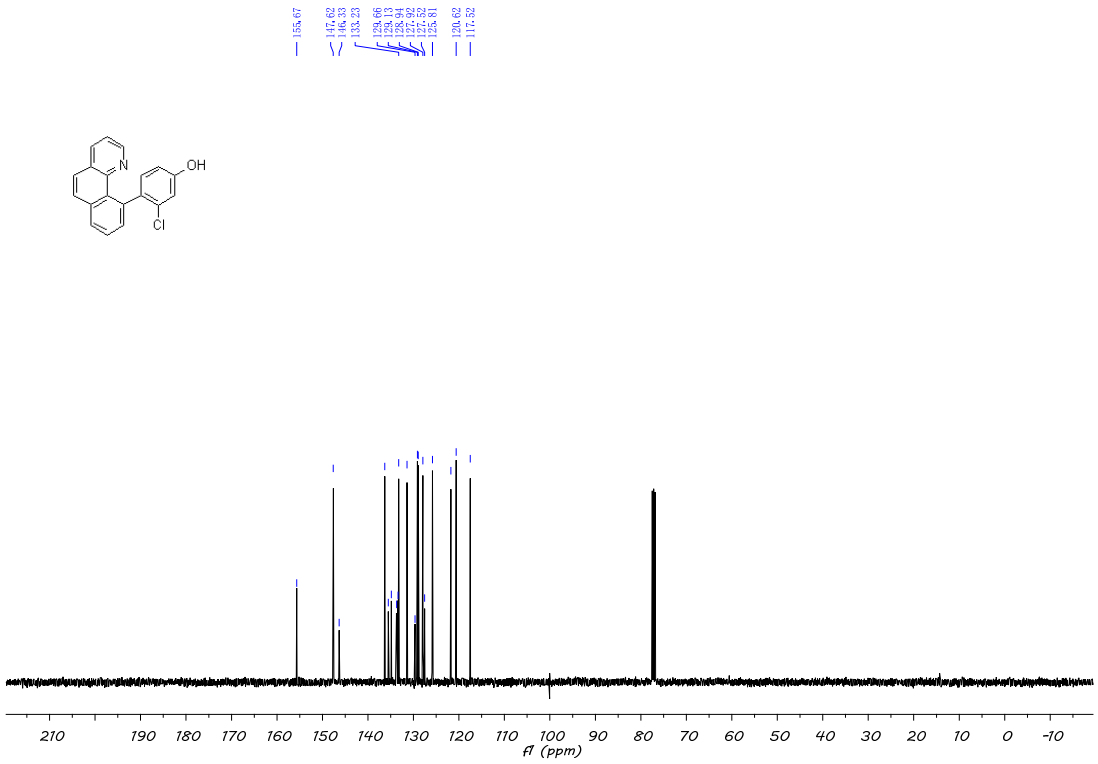
8.64
8.19
8.17
7.87
7.70
7.44
7.13
6.99
6.97
6.96
6.94
OH
Cl
1.00
1.02
1.84
3.07
2.12
0.96
2.01
f1 (ppm)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147.62
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128.13
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127.52
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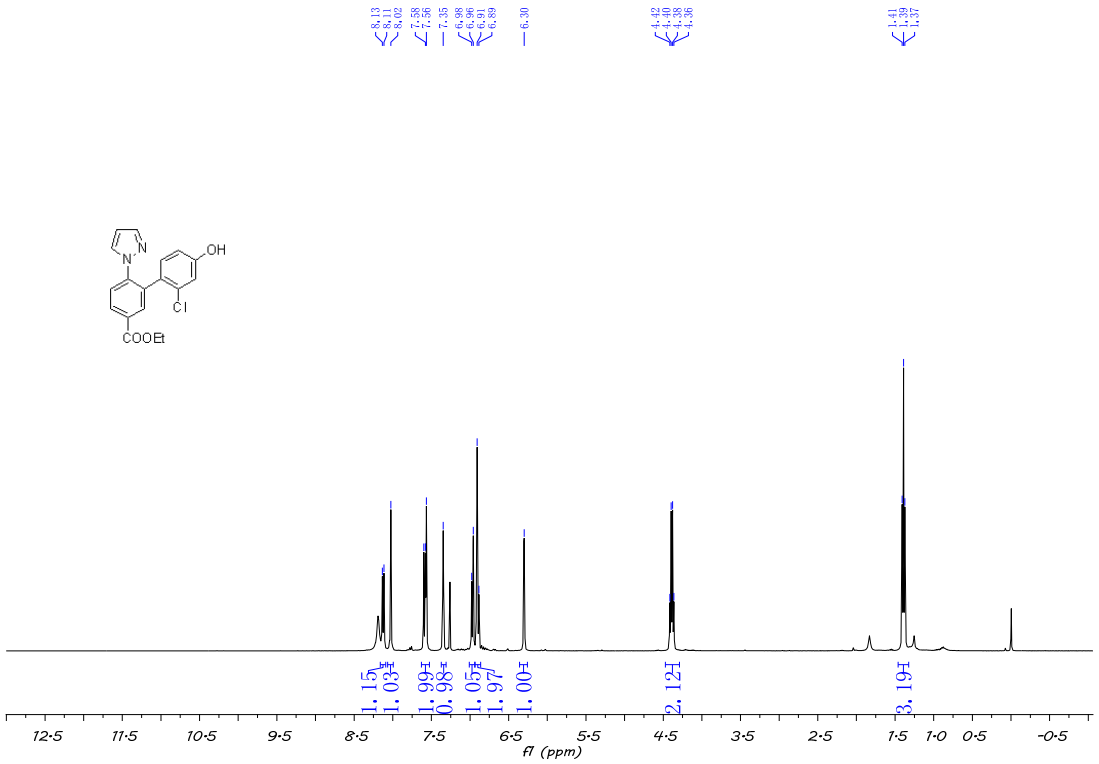
120.62
117.32
OH
Cl
f1 (ppm)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8.11
8.02
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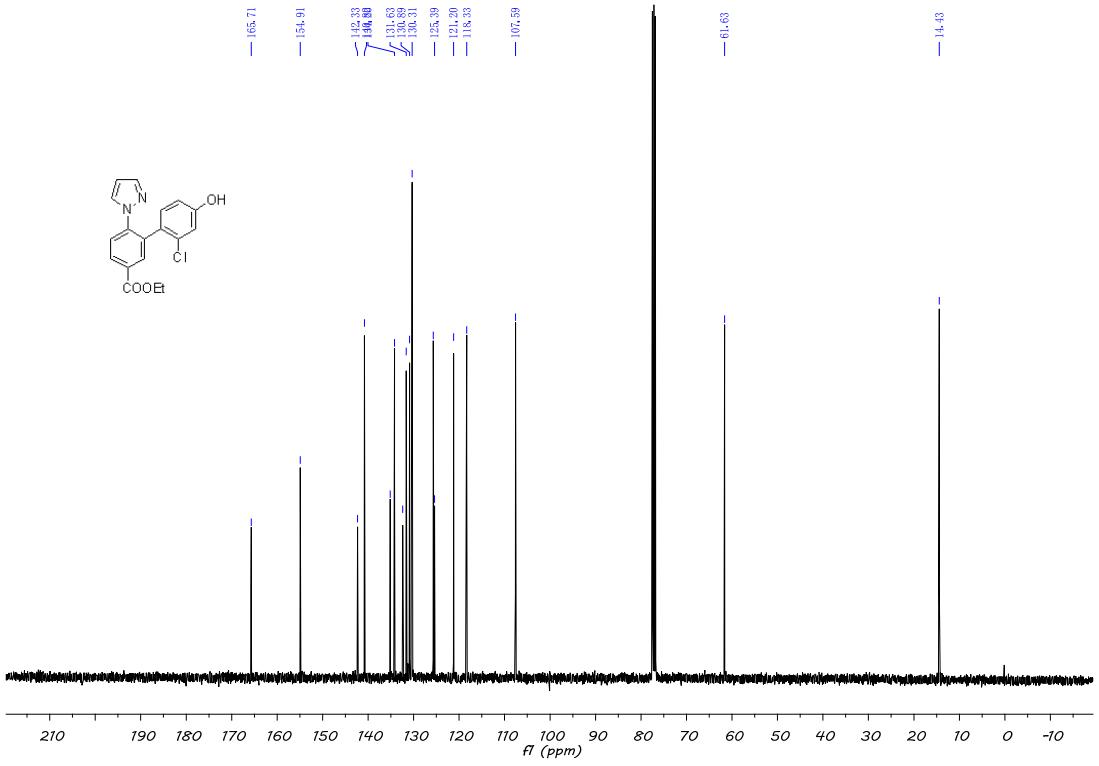
7.56
7.35
6.98
6.96
6.91
6.89
6.30
4.42
4.40
4.38
4.36
1.41
1.39
1.37
OH
Cl
COOEt
1.15
1.03
1.99
0.98
1.05
1.97
1.00
2.12
3.19
f1 (ppm)


165.71
154.91
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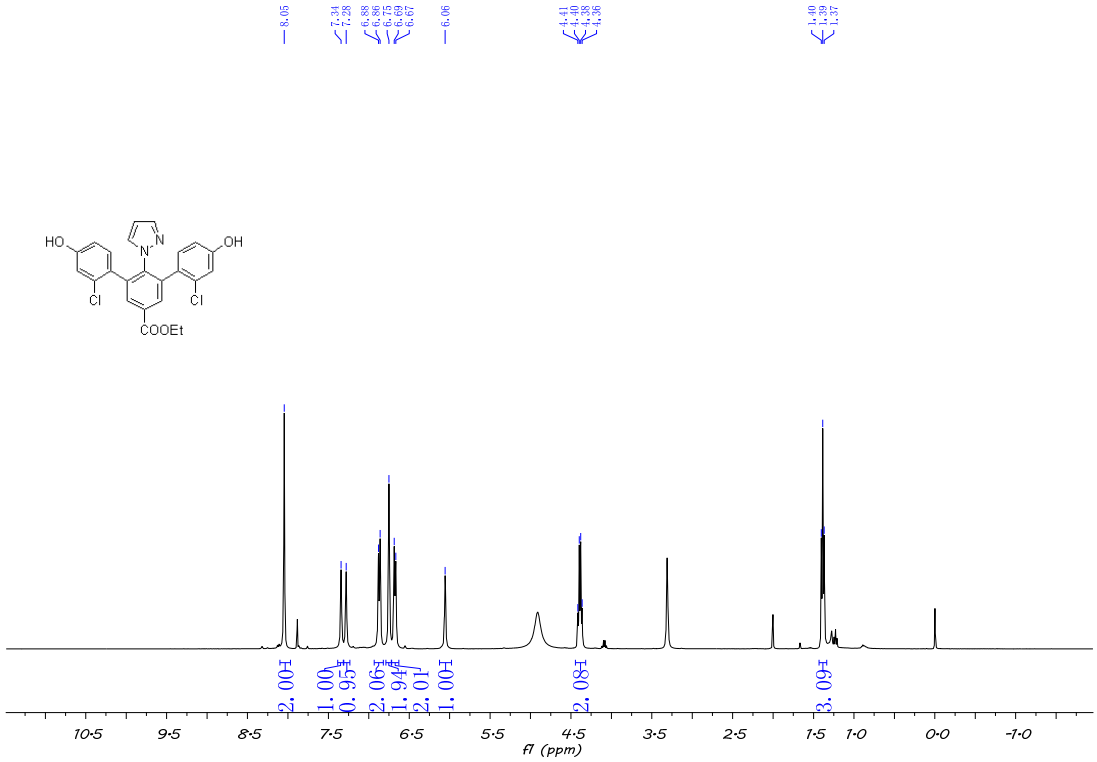
125.39
121.20
118.33
107.59
61.63
14.43
OH
Cl
COOEt
f1 (ppm)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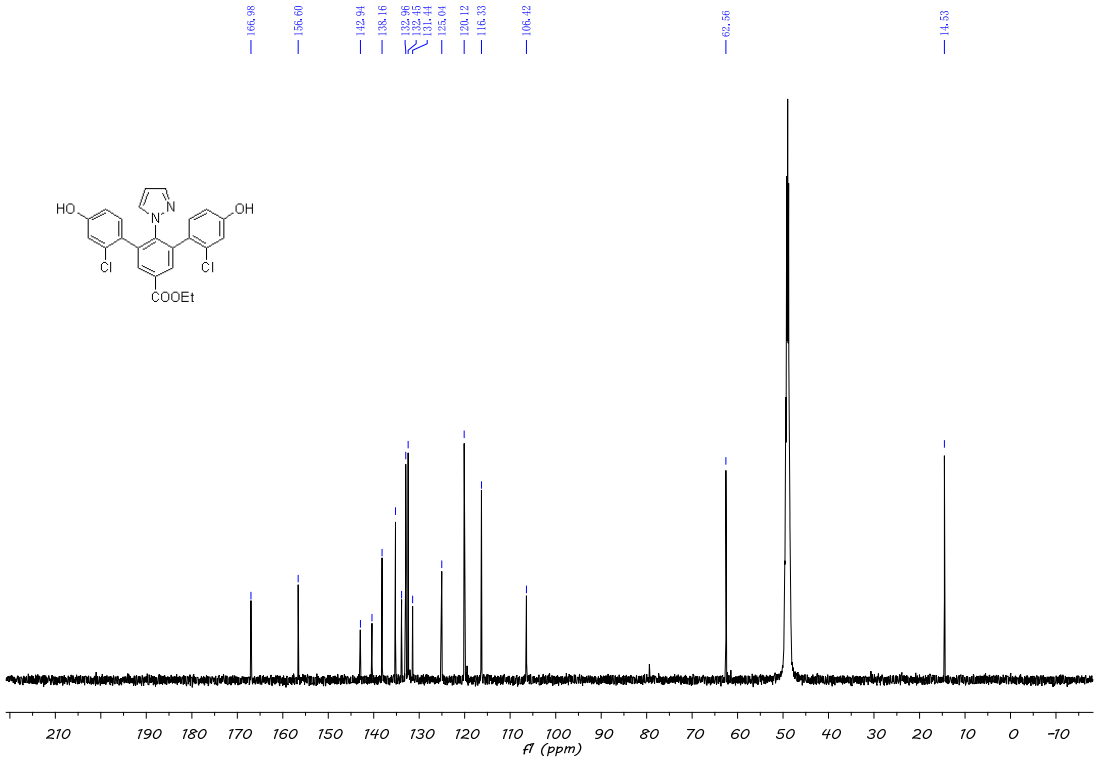
6.88
6.86
6.75
6.69
6.67
6.06
4.41
4.40
4.38
4.36
1.40
1.39
1.37
HO
OH
Cl
Cl
COOEt
2.00
1.00
0.95
2.06
1.94
2.01
1.00
2.08
3.09
f1 (ppm)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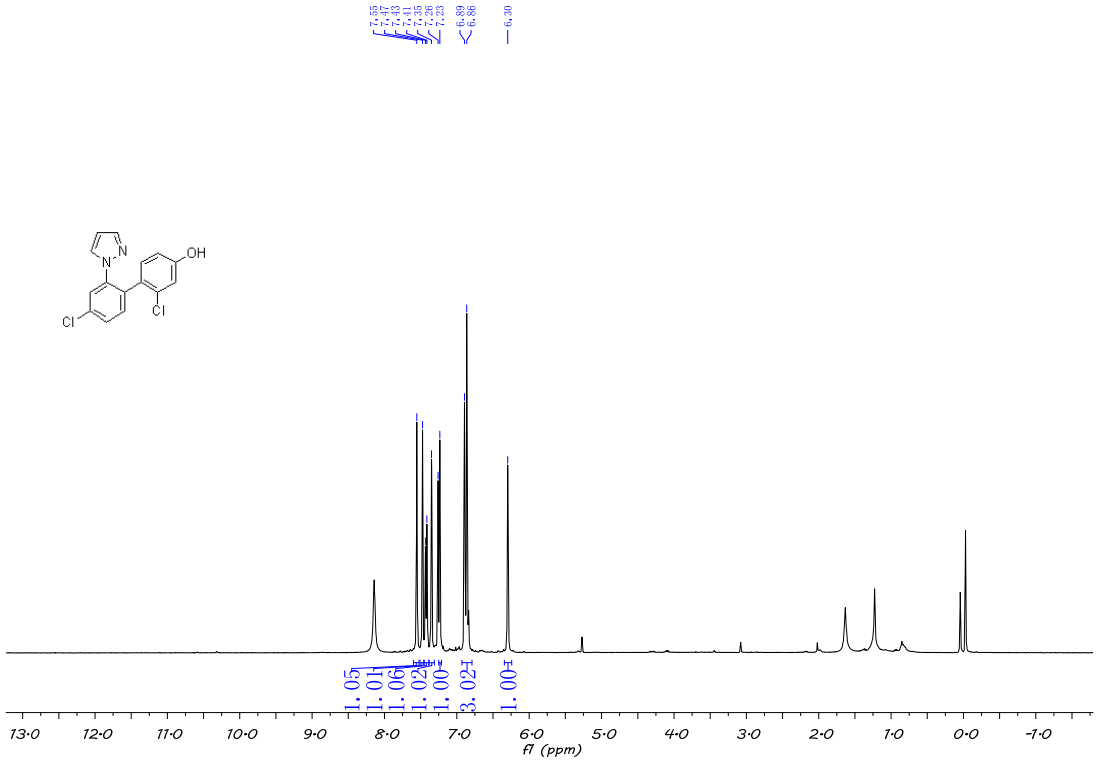
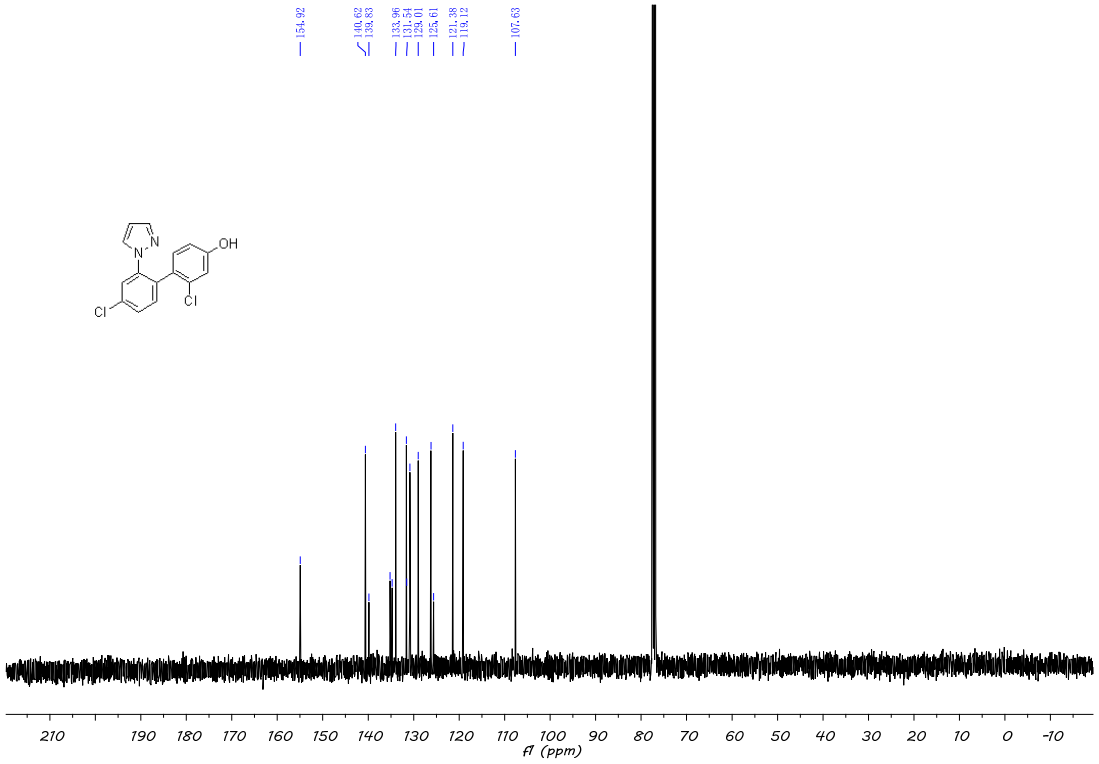
138.16
132.96
132.45
131.44
125.04
120.12
116.33
106.42
62.56
14.53
HO
OH
Cl
Cl
COOEt
f1 (ppm)


7.55
7.47
7.43
7.41
7.35
7.28
7.23
6.89
6.86
6.30
OH
Cl
Cl
1.05
1.01
1.06
1.02
1.00
3.02
1.00
13·0
12·0
11·0
10·0
9·0
8·0
7·0
6·0
5·0
4·0
3·0
2·0
1·0
0·0
-1·0
f1 (ppm)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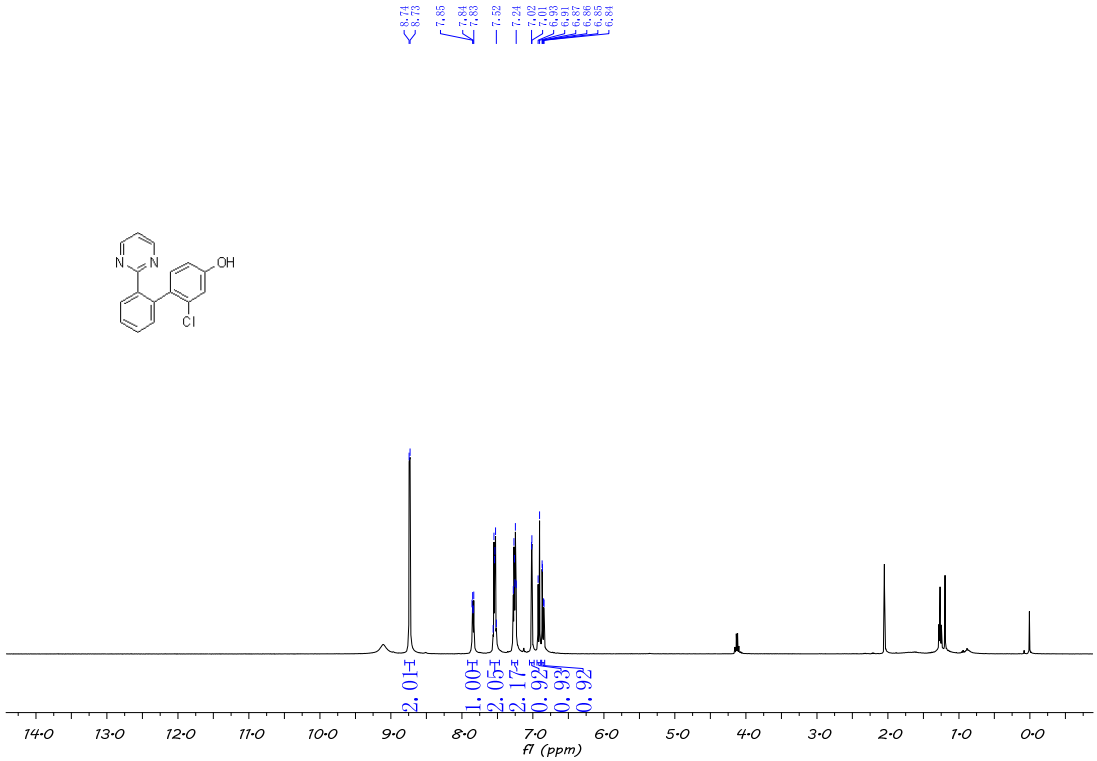
140.62
139.83
133.96
131.54
128.01
125.61
121.38
119.12
107.63
OH
Cl
Cl
210
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
-10
f1 (ppm)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8.73
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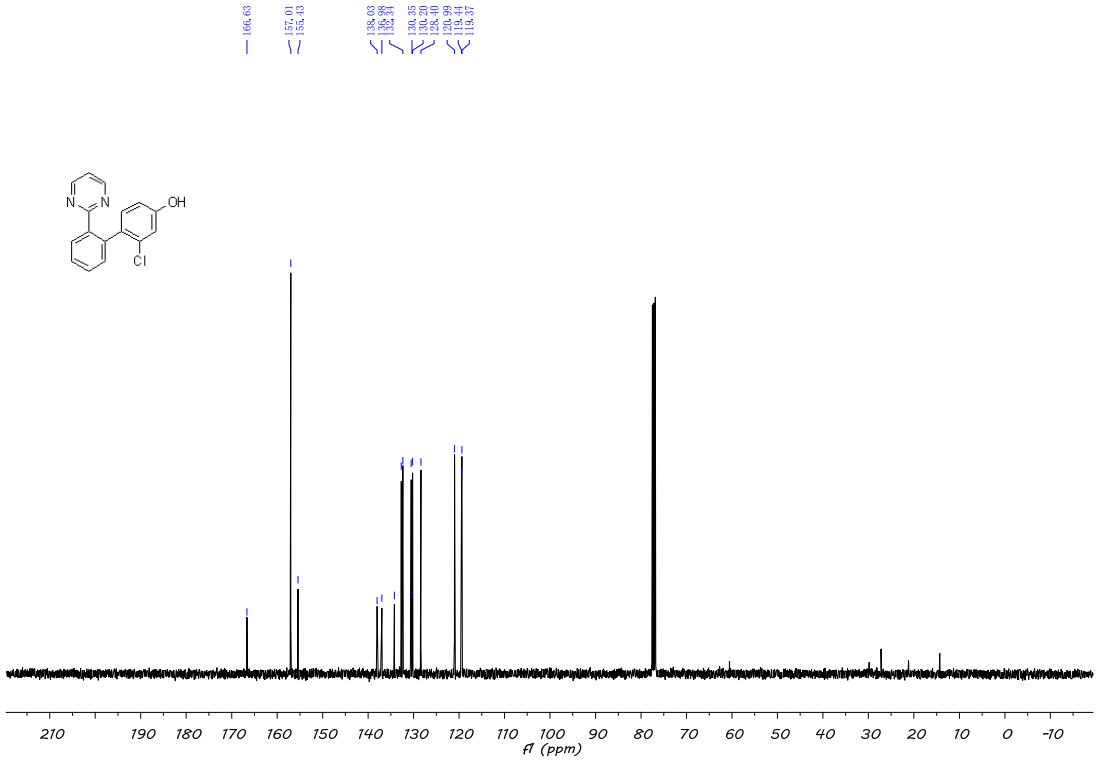
7.84
7.83
7.52
7.24
7.02
7.01
6.93
6.91
6.87
6.86
6.85
6.84
OH
Cl
2.01
1.00
2.05
2.17
0.92
0.93
0.92
14.0
13.0
12.0
11.0
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
f1 (ppm)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130.34
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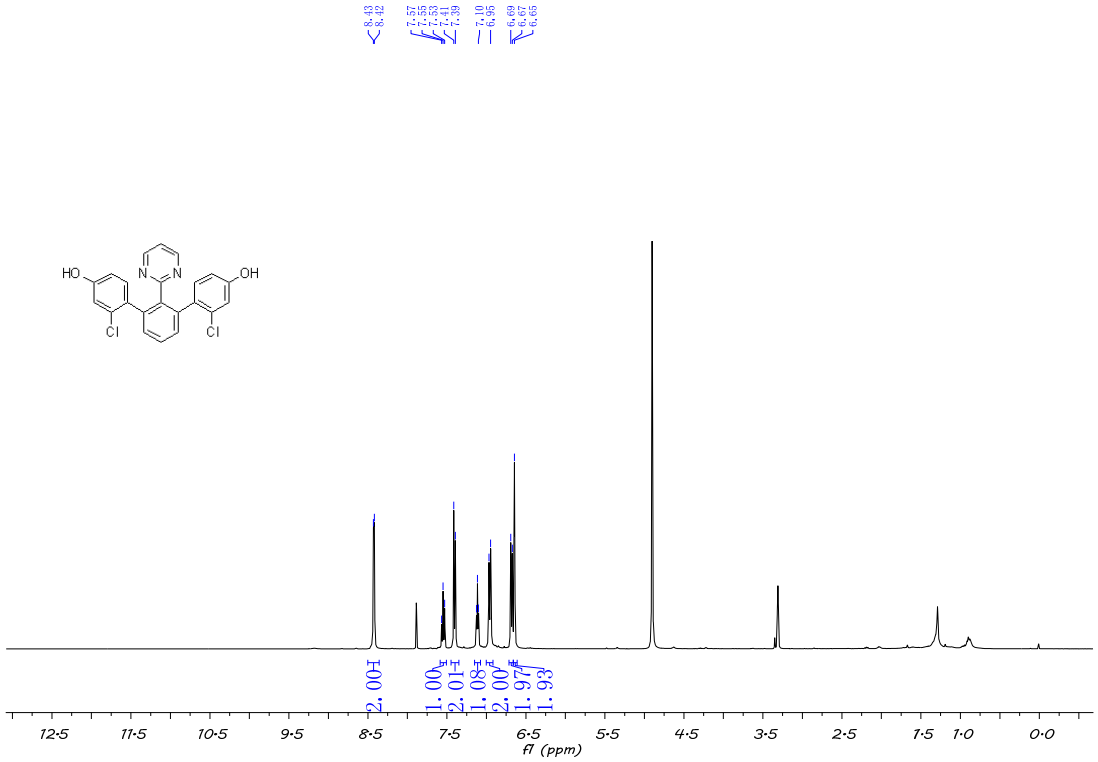
130.20
126.40
120.99
118.44
118.37
OH
Cl
210
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
-10
f1 (ppm)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7.41
7.39
7.10
6.95
6.69
6.67
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OH
Cl
Cl
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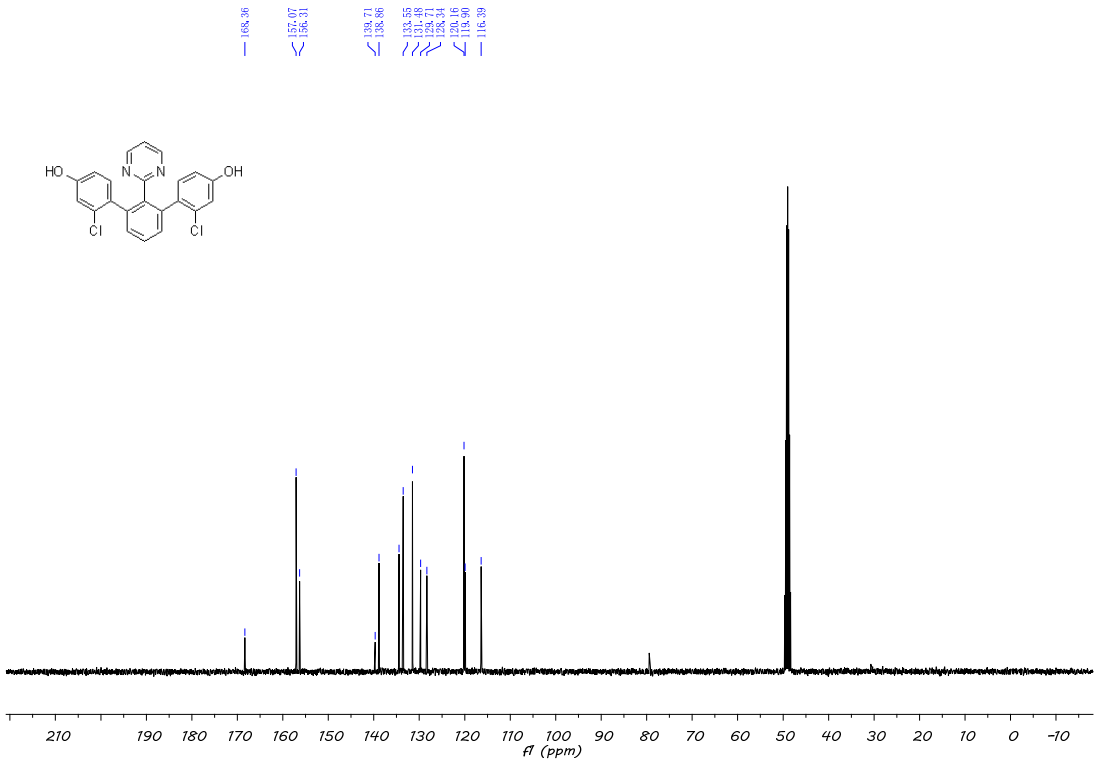
1.00
2.01
1.08
2.00
1.97
1.93
f1 (ppm)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120.16
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116.39
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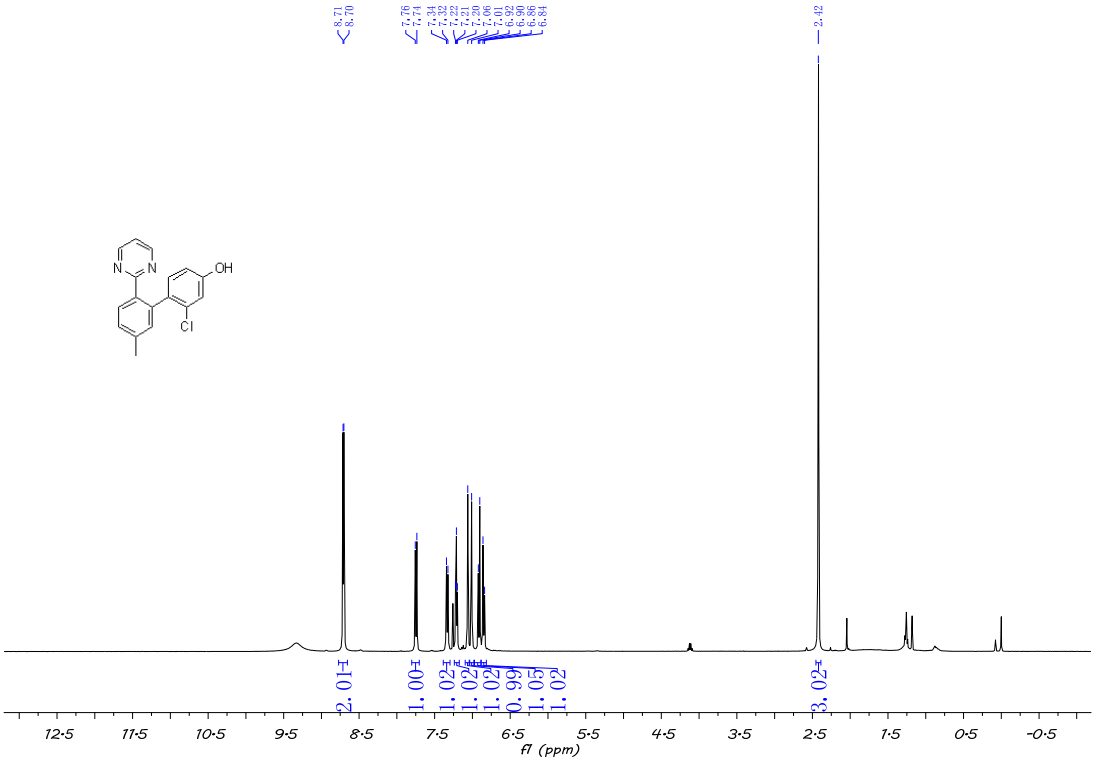
OH
Cl
Cl
f1 (ppm)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8.70
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7.74
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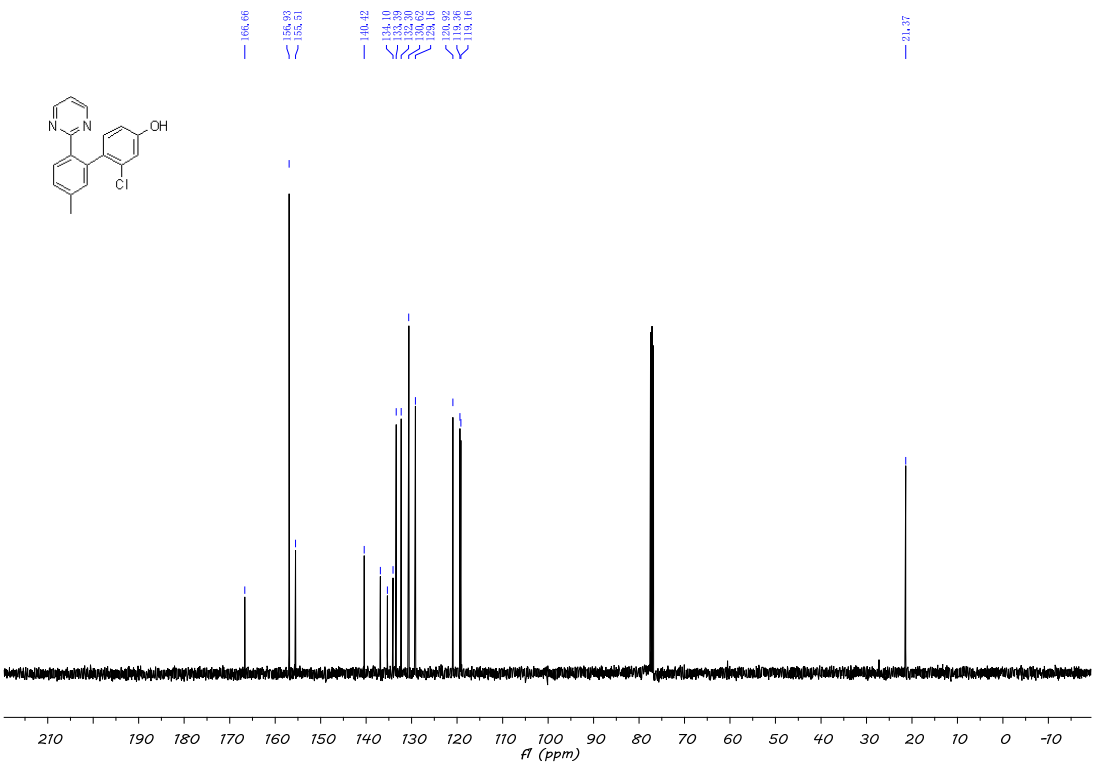
7.32
7.23
7.21
7.20
7.06
7.01
6.92
6.90
6.86
6.84
2.42
N
N
OH
Cl
2.01
1.00
1.02
1.02
1.02
0.99
1.05
1.02
3.02
12.5
11.5
10.5
9.5
8.5
7.5
6.5
5.5
4.5
3.5
2.5
1.5
0.5
-0.5
f1 (ppm)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154.31
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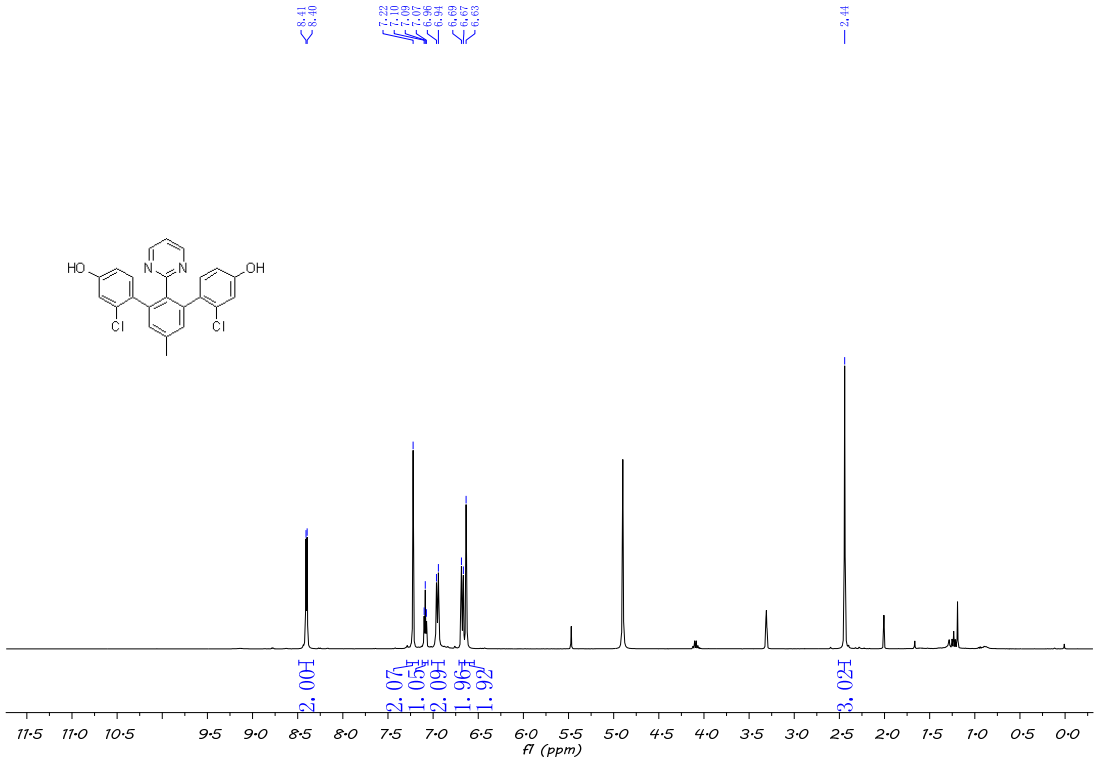
134.10
133.39
132.30
130.62
129.16
120.92
119.36
118.16
21.37
N
N
OH
Cl
210
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
-10
f1 (ppm)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7.09
7.07
6.96
6.94
6.69
6.67
6.63
2.44
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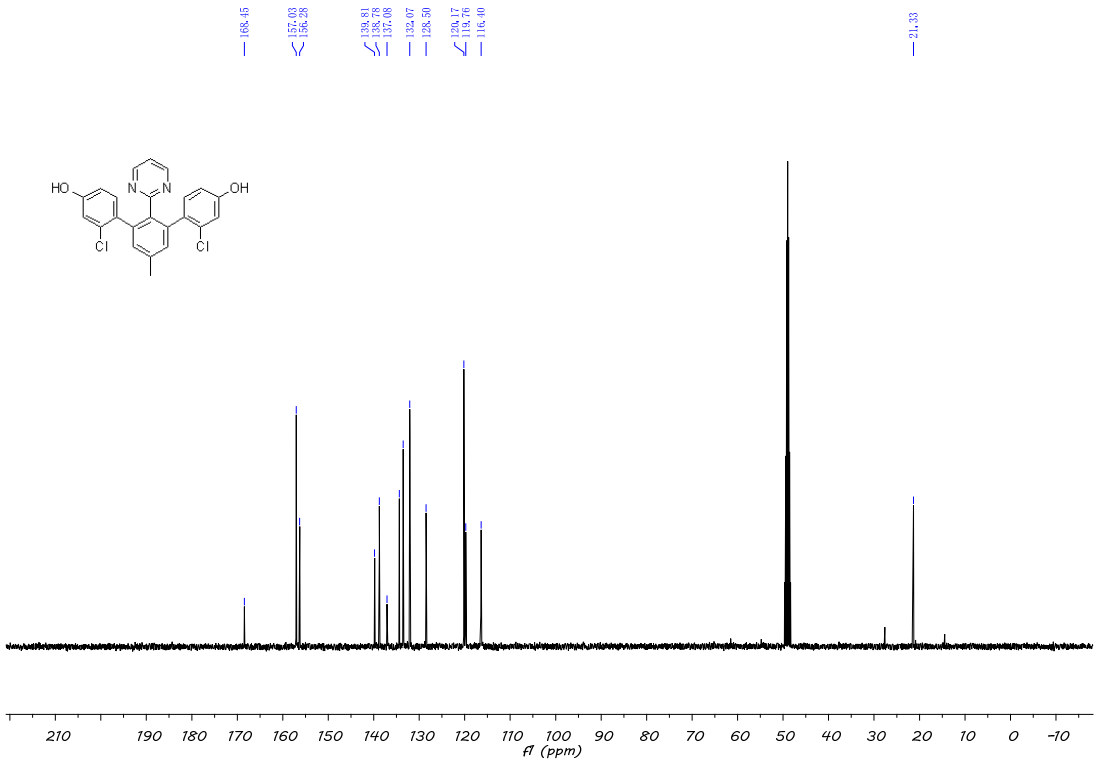
OH
Cl
Cl
2.00
2.07
1.05
2.09
1.96
1.92
3.02
f1 (ppm)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157.03
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139.81
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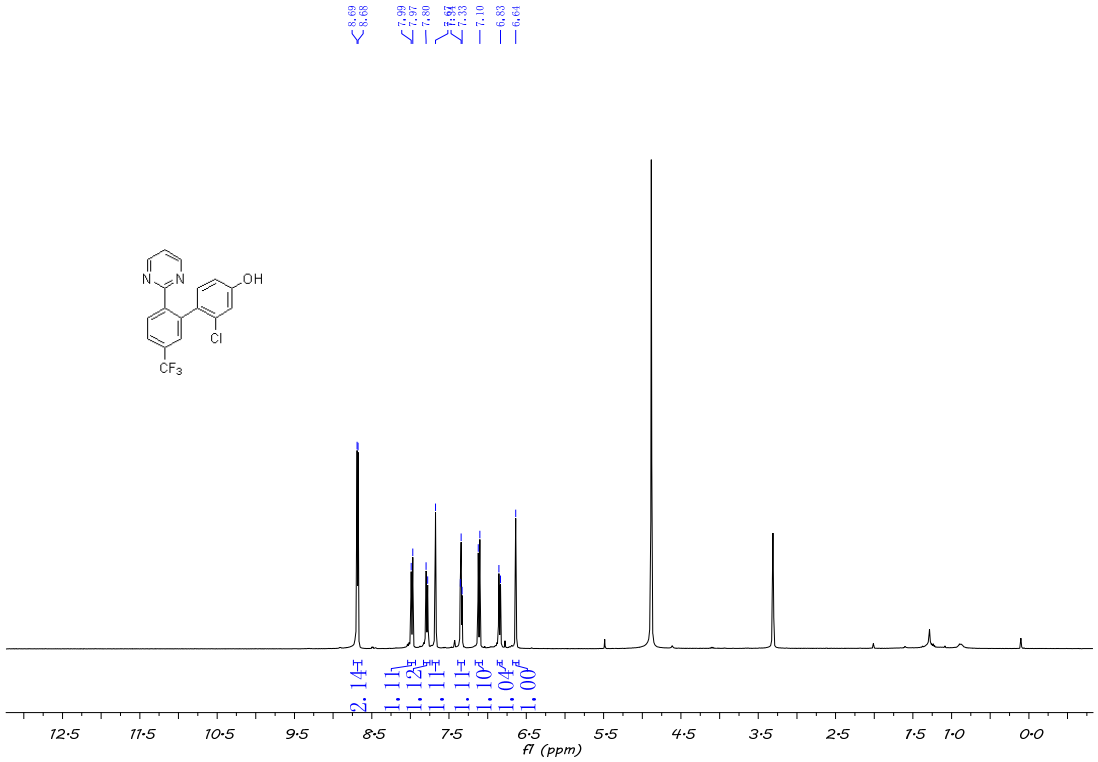
132.07
128.50
120.17
119.76
116.40
21.33
HO
OH
Cl
Cl
f1 (ppm)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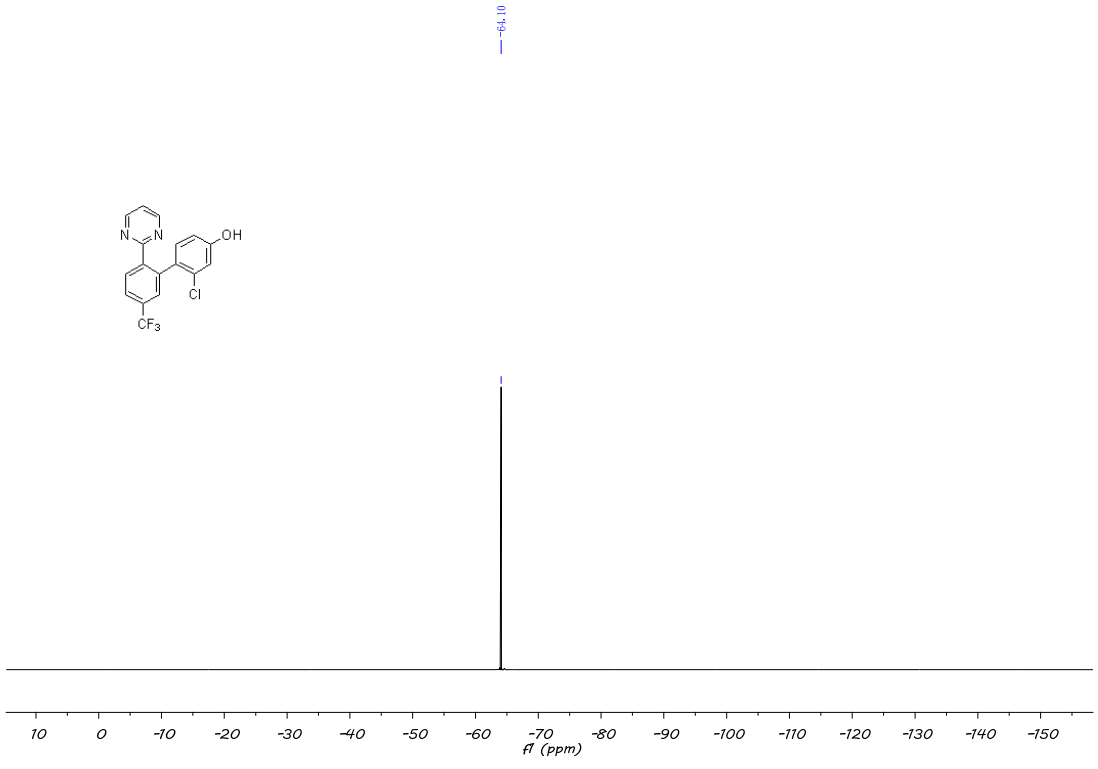
8.68
7.99
7.97
7.80
7.34
7.33
7.10
6.63
6.64
N
N
OH
Cl
CF3
2.14
1.11
1.12
1.11
1.10
1.04
1.00
12.5
11.5
10.5
9.5
8.5
7.5
6.5
5.5
4.5
3.5
2.5
1.5
1.0
0.0
f1 (ppm)


-64.10
N
N
OH
Cl
CF3
10
0
-10
-20
-30
-40
-50
-60
-70
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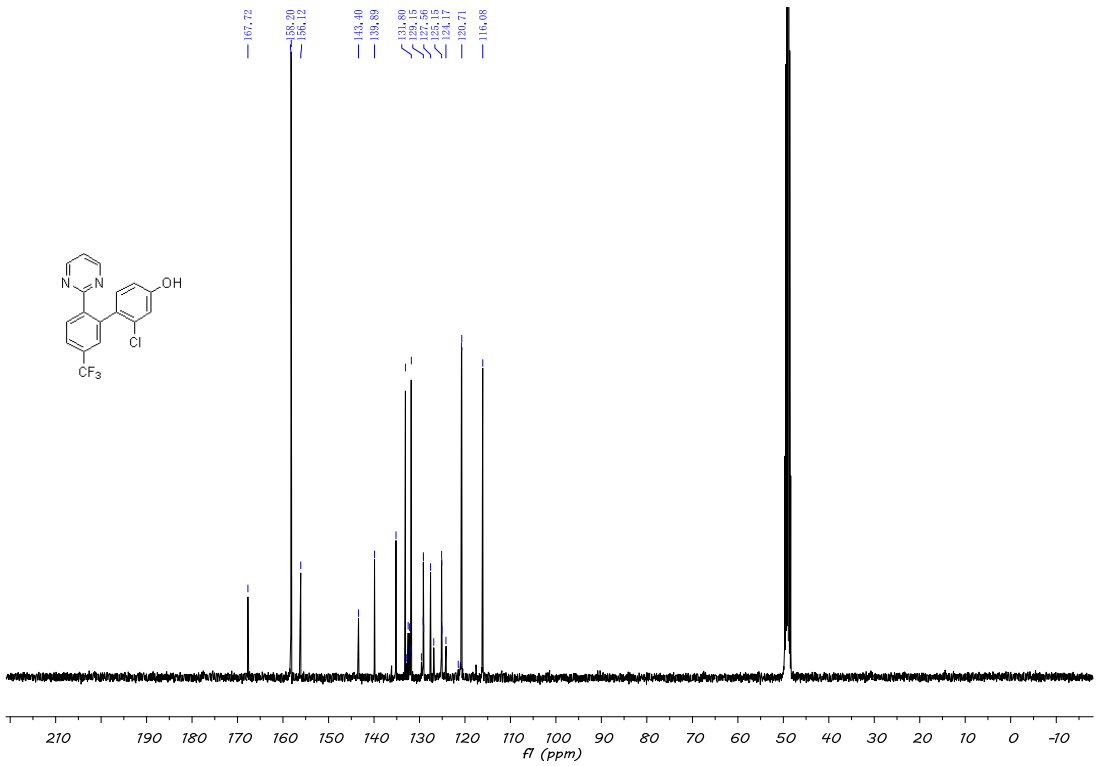
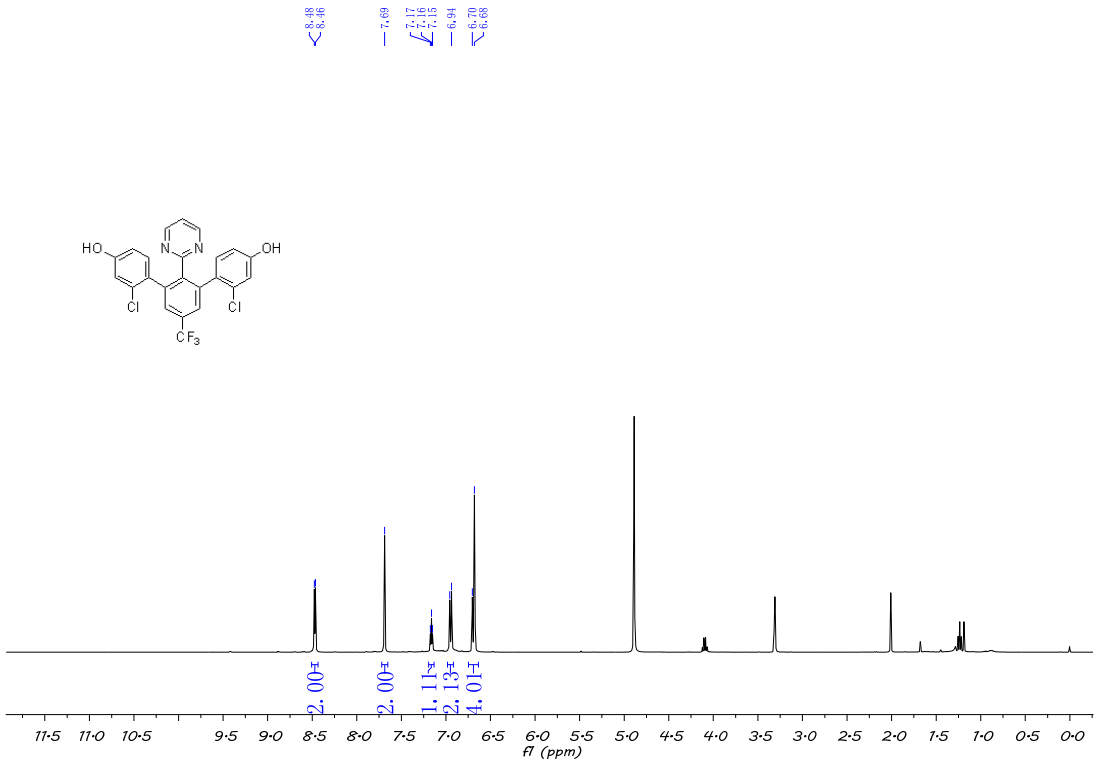
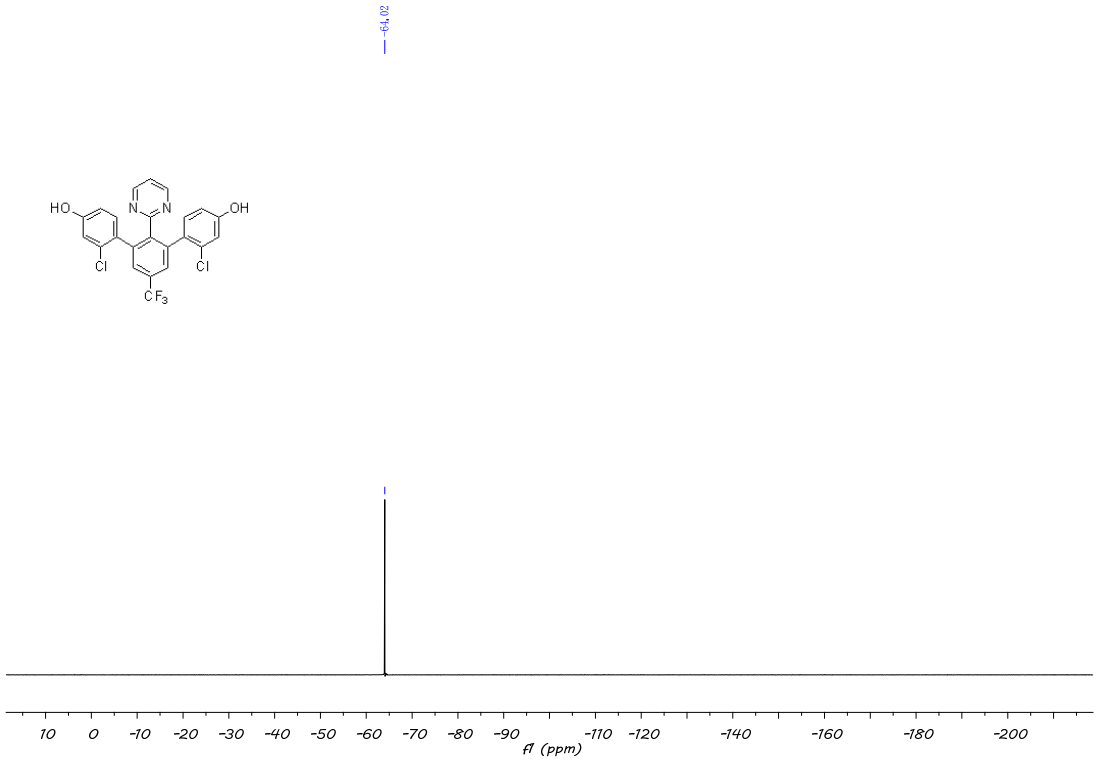
-90
-100
-110
-120
-130
-140
-150
f1 (ppm)


167.72
158.20
156.12
143.40
139.89
131.80
129.15
127.56
125.15
124.17
120.71
116.08
OH
Cl
CF3
210
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
-10
f1 (ppm)


8.48
8.46
7.69
7.17
7.16
7.15
6.94
6.70
6.68
HO
OH
N
N
Cl
Cl
CF3
2.00
2.00
1.11
2.13
4.01
11.5 11.0 10.5 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)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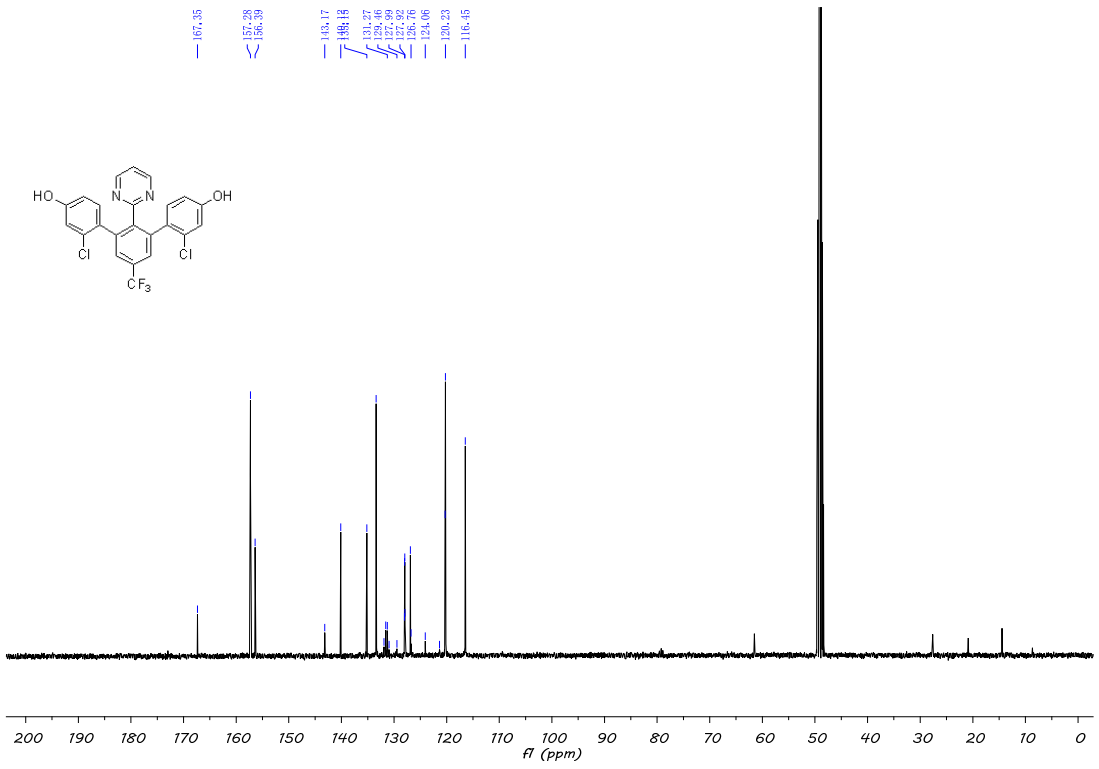
HO
OH
N
N
Cl
Cl
CF3
10 0 -10 -20 -30 -40 -50 -60 -70 -80 -90 -110 -120 -140 -160 -180 -200
f1 (ppm)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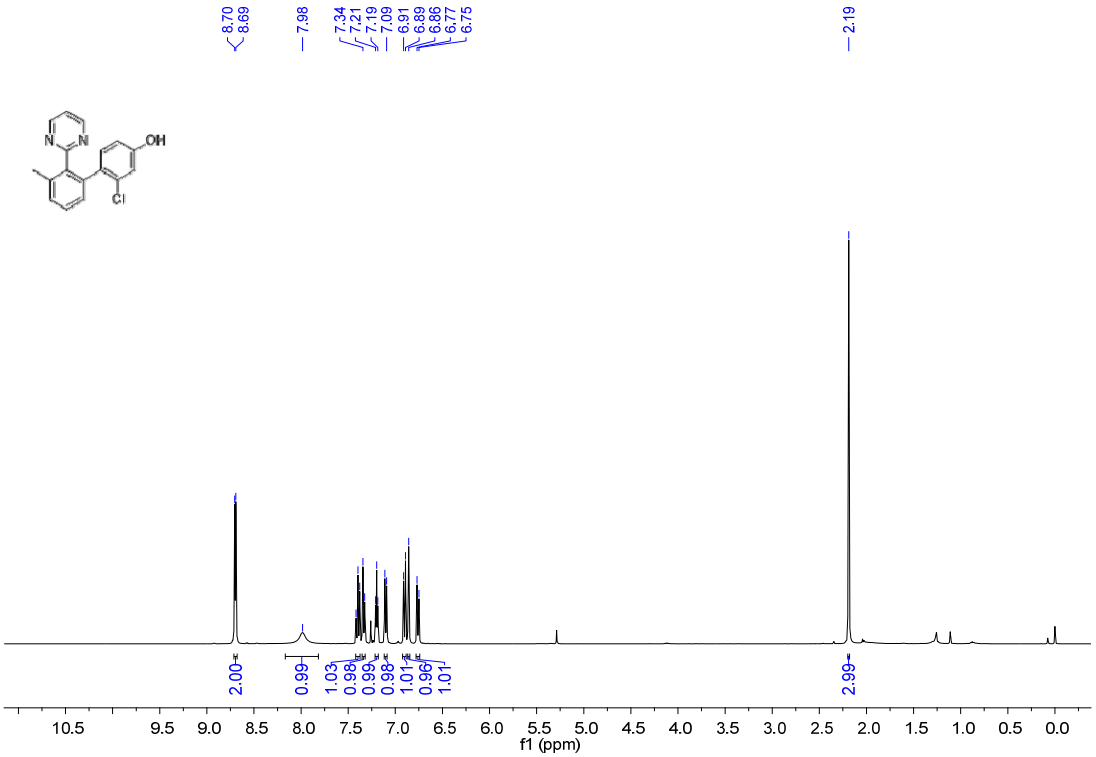
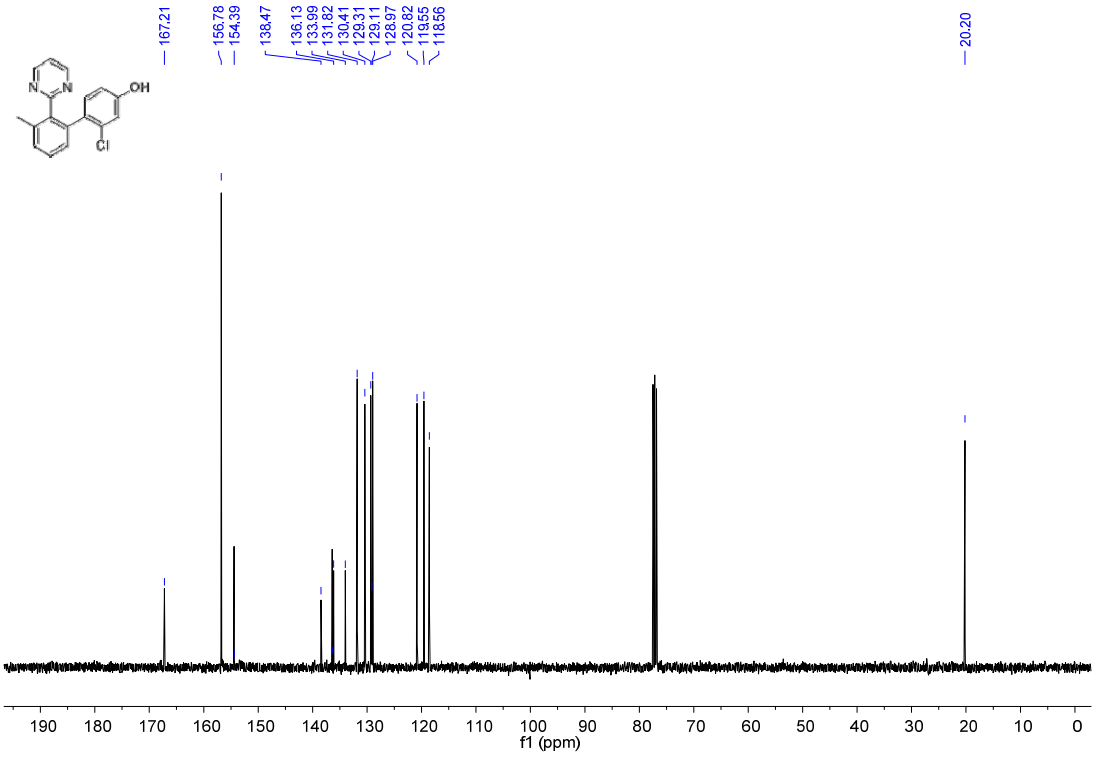
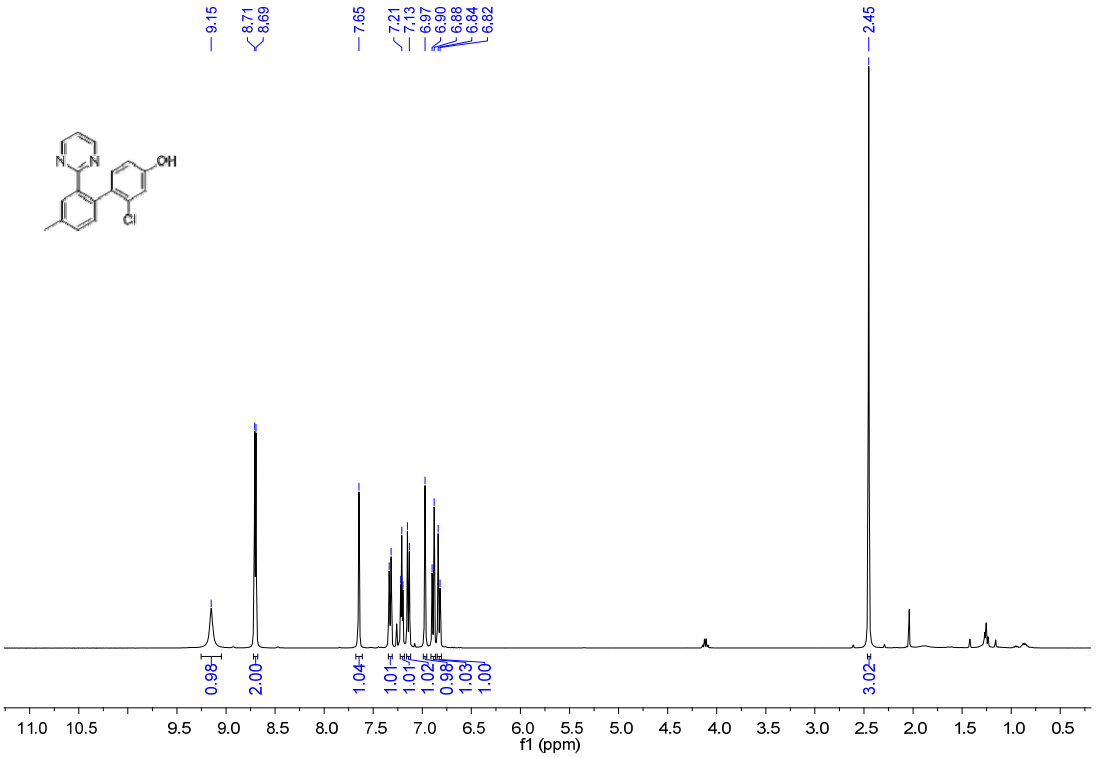
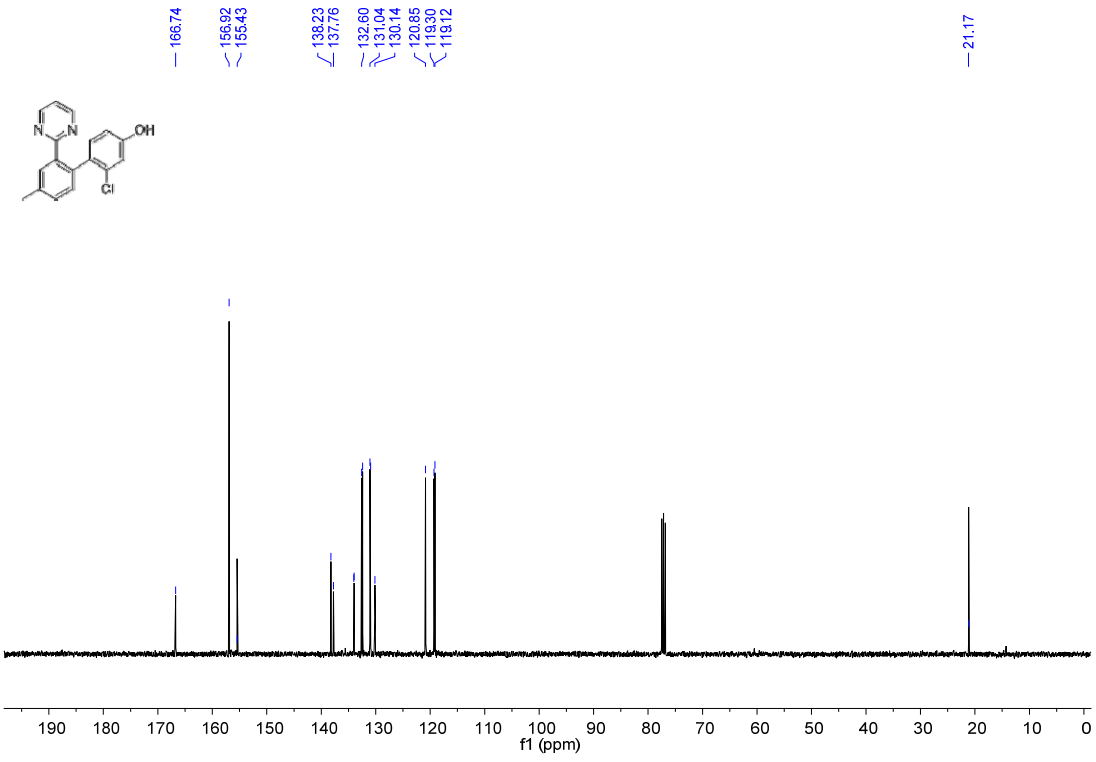
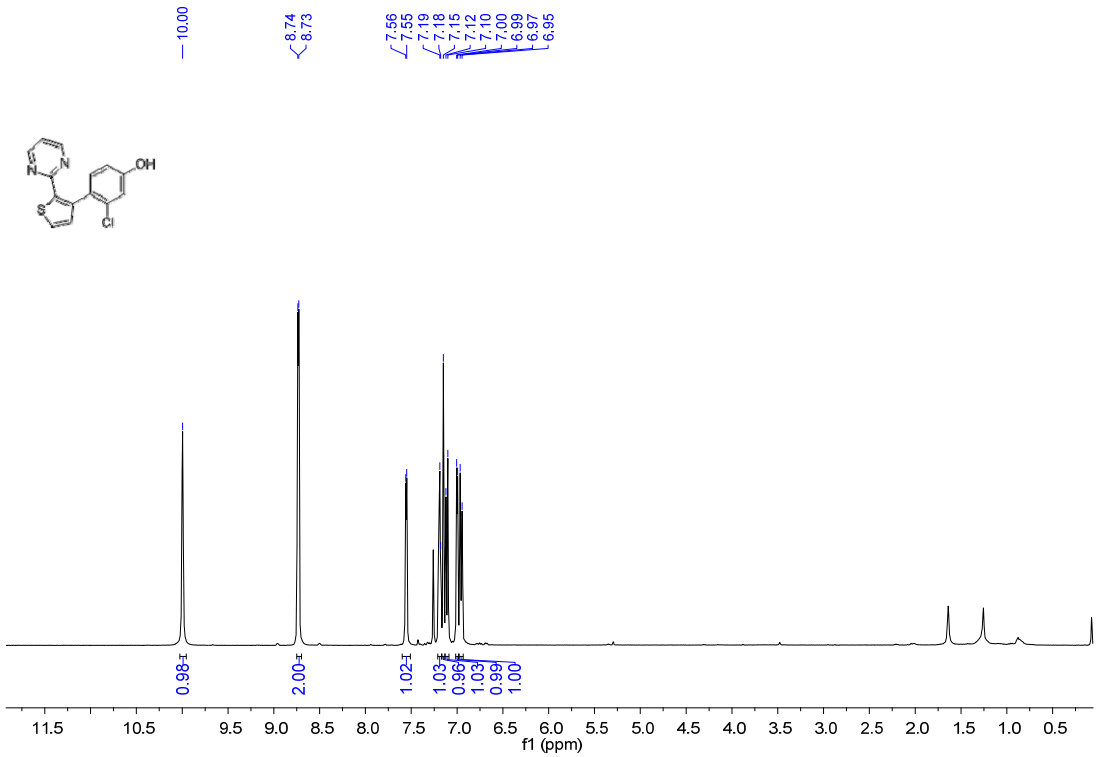
157.28
156.39
143.17
138.13
131.27
129.46
127.99
127.52
126.76
124.06
120.23
116.45
HO
OH
Cl
Cl
CF3
N
N
200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

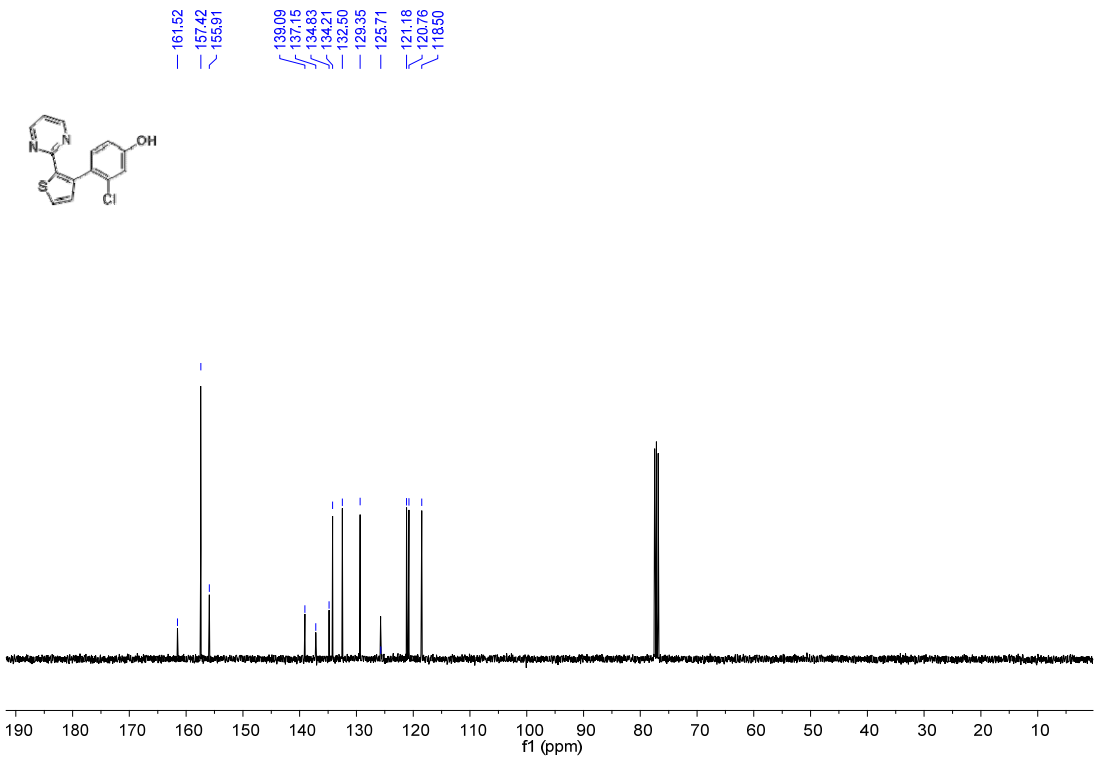

8.70
8.69
7.98
7.34
7.21
7.19
7.09
6.91
6.89
6.86
6.77
6.75
2.19
OH
Cl
2.00
0.99
1.03
0.98
0.99
0.98
1.01
0.96
1.01
2.99
10.5
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)

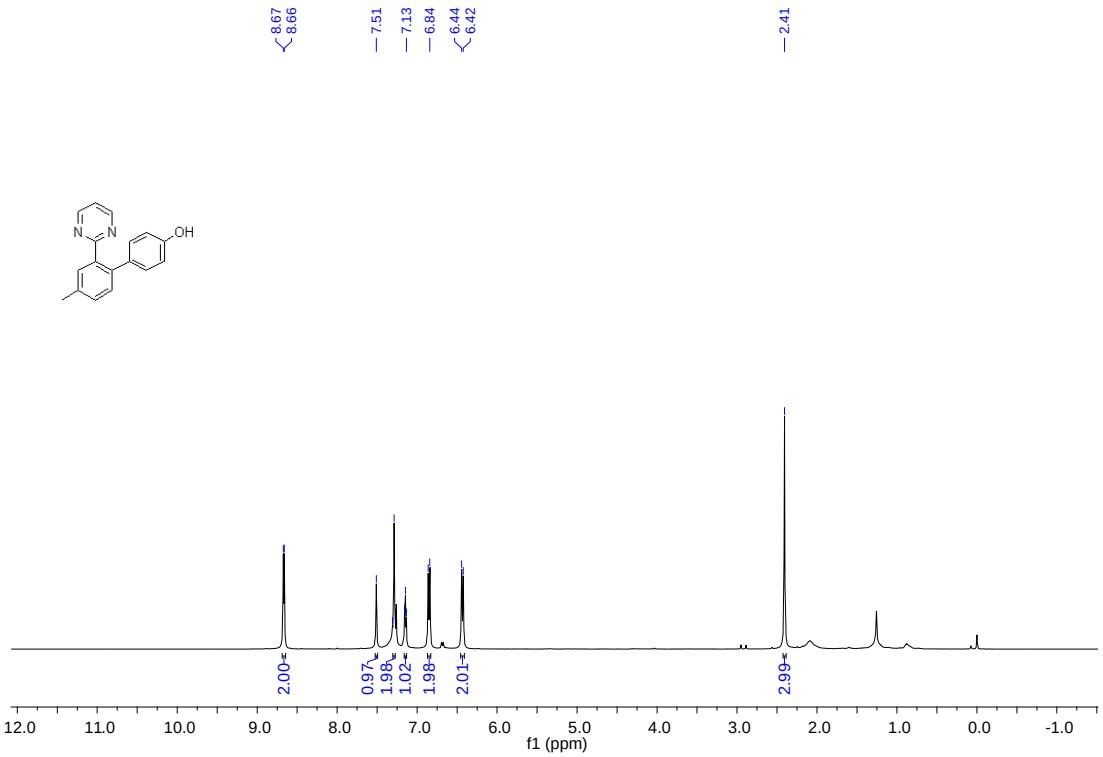

167.21
156.78
154.39
138.47
136.13
133.99
131.82
130.41
129.31
129.11
128.97
120.82
119.55
118.56
20.20
OH
Cl
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

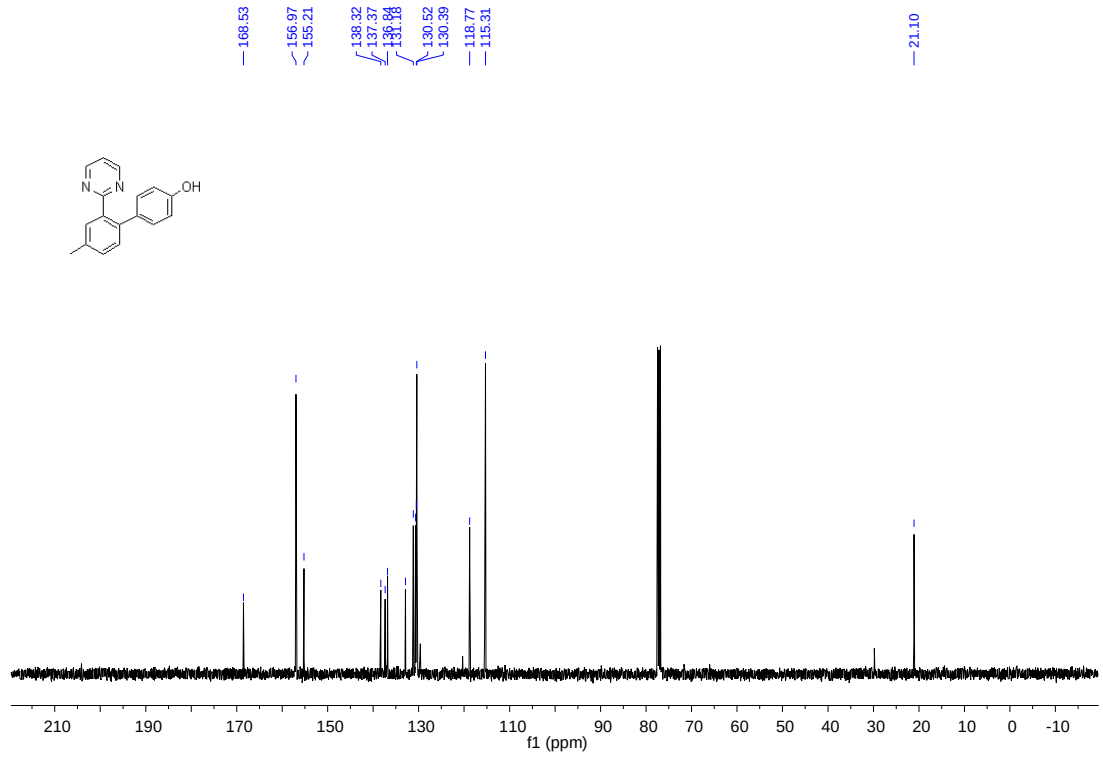

9.15
8.71
8.69
7.65
7.21
7.13
6.97
6.90
6.88
6.84
6.82
2.45
OH
Cl
0.98
2.00
1.04
1.01
1.01
1.02
0.98
1.03
1.00
3.02
11.0 10.5 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5
f1 (ppm)

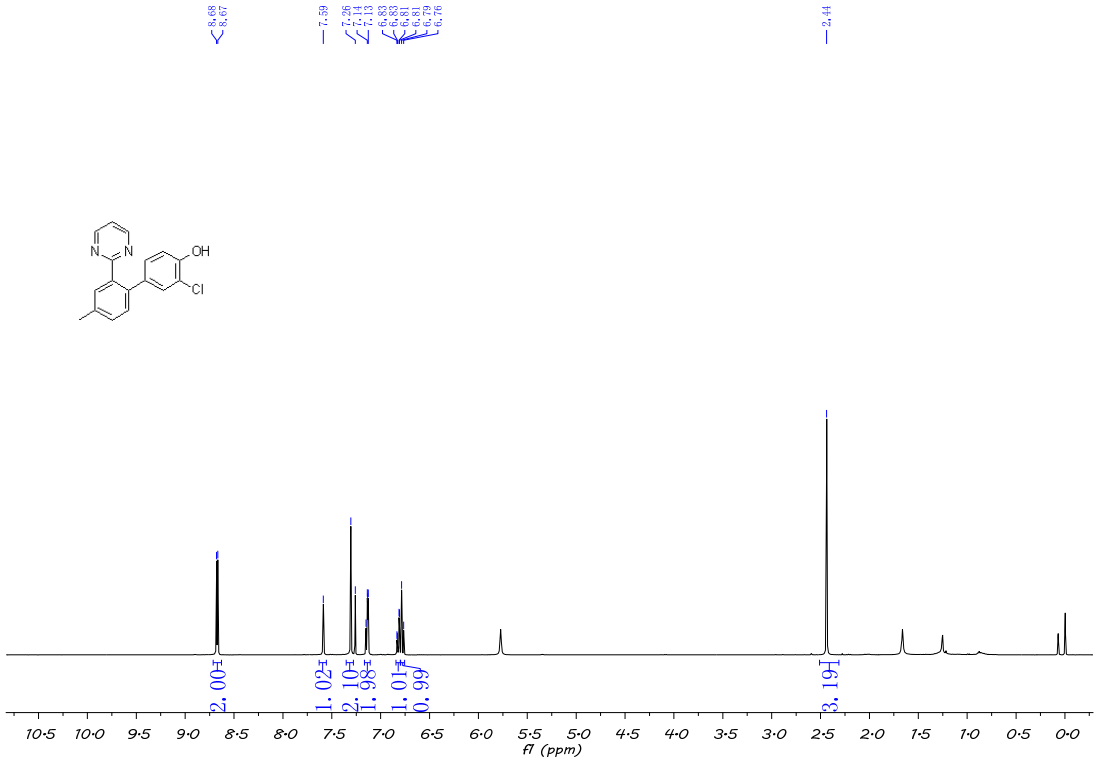

166.74
156.92
155.43
138.23
137.76
132.60
131.04
130.14
120.85
119.30
119.12
21.17
OH
Cl
190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

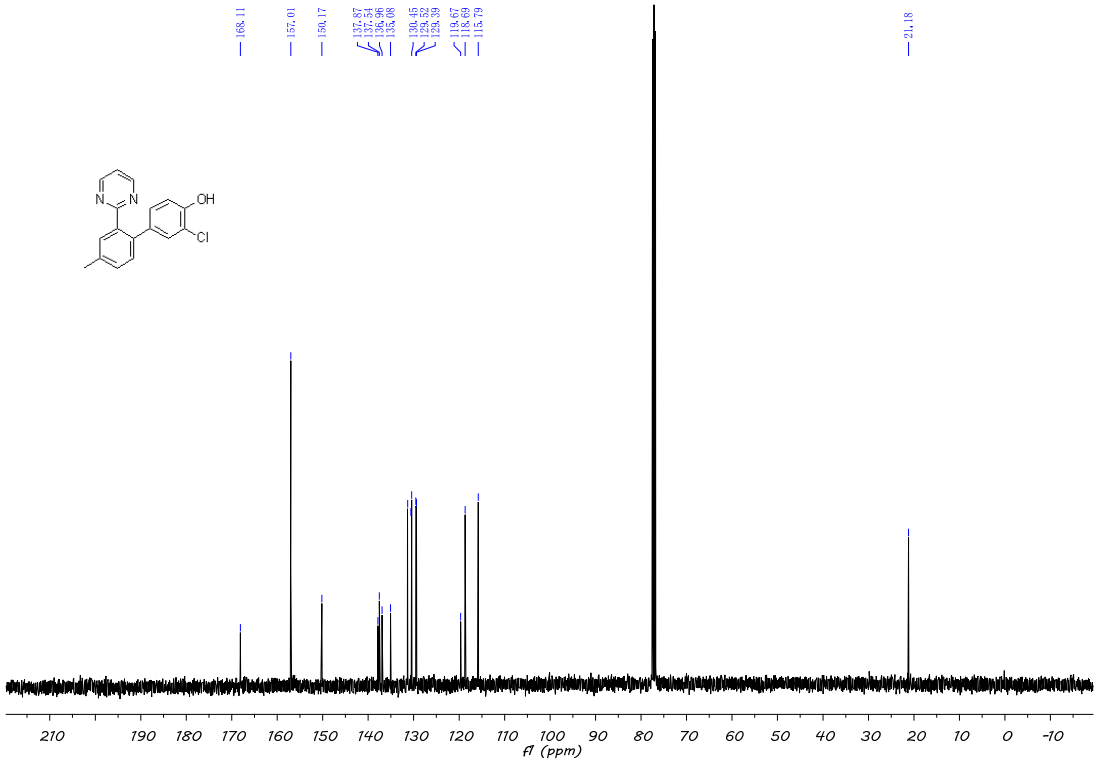

10.00
8.74
8.73
7.56
7.55
7.19
7.18
7.15
7.12
7.10
7.00
6.99
6.97
6.95
OH
Cl
0.98
2.00
1.02
1.03
0.96
1.03
0.99
1.00
11.5
10.5
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
f1 (ppm)

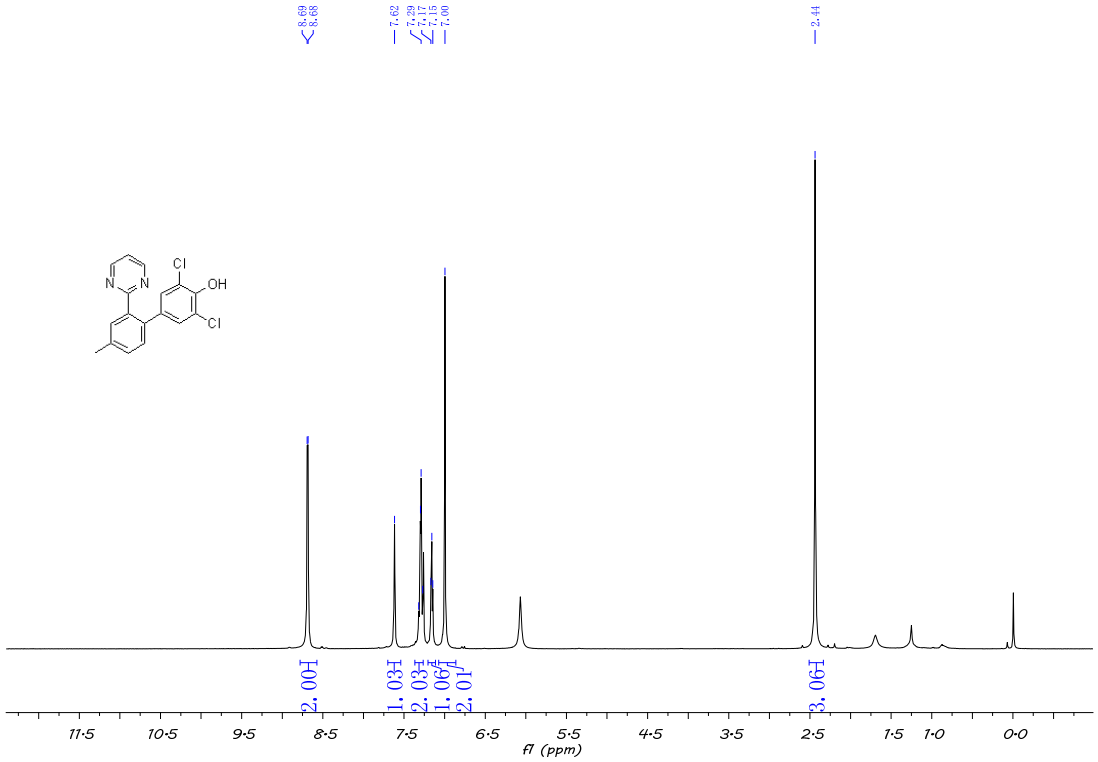

161.52
157.42
155.91
139.09
137.15
134.83
134.21
132.50
129.35
125.71
121.18
120.76
118.50
OH
Cl
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
f1 (ppm)

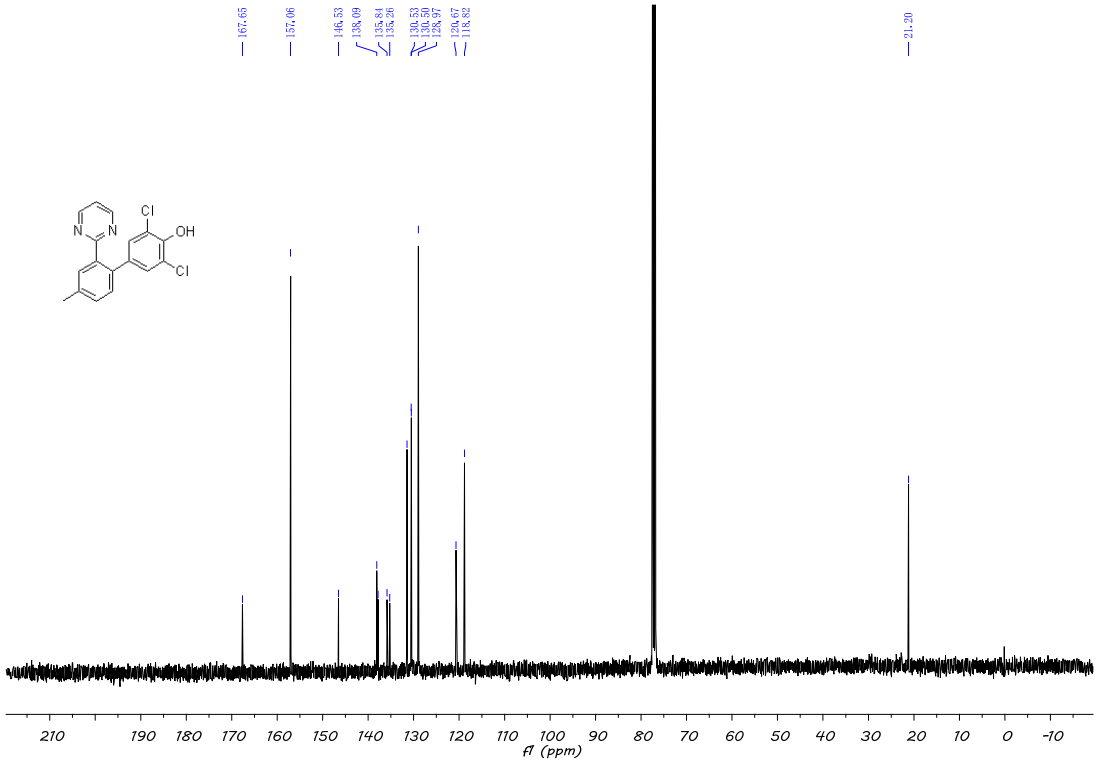

8.67
8.66
7.51
7.13
6.84
6.44
6.42
2.41
OH
2.00
0.97
1.98
1.02
1.98
2.01
2.99
12.0
11.0
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
-1.0
f1 (ppm)

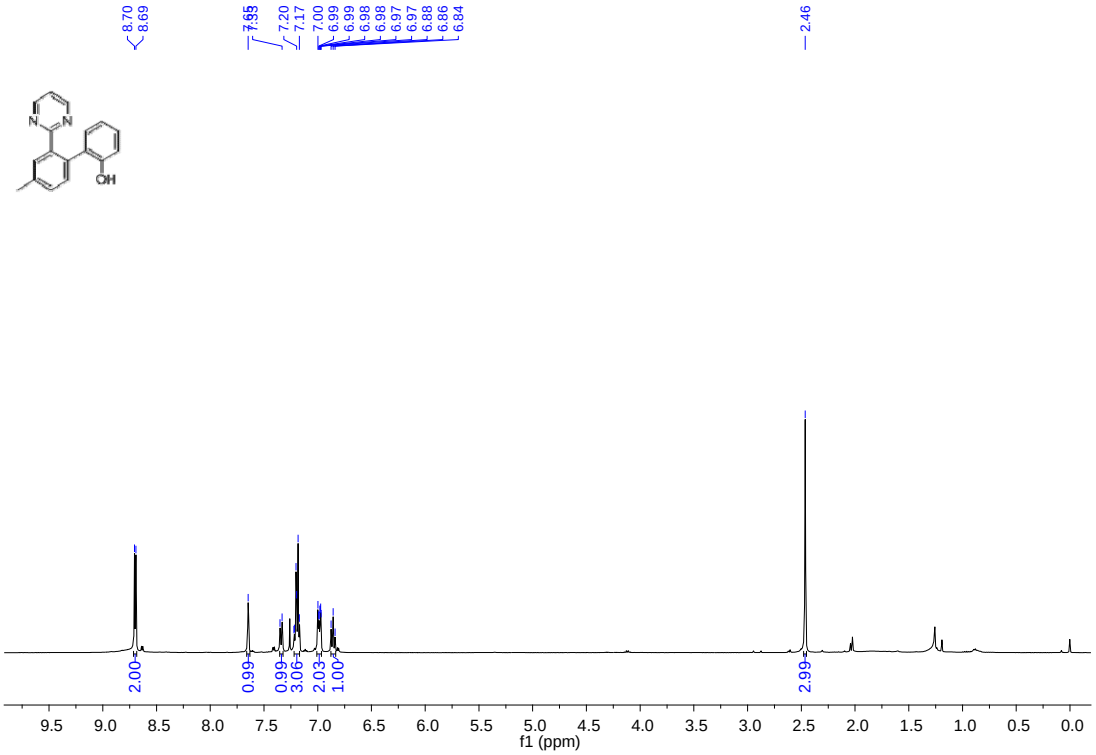

168.53
156.97
155.21
138.32
137.37
136.84
131.18
130.52
130.39
118.77
115.31
21.10
OH
210
190
170
150
130
110
90
80
70
60
50
40
30
20
10
0
-10
f1 (ppm)

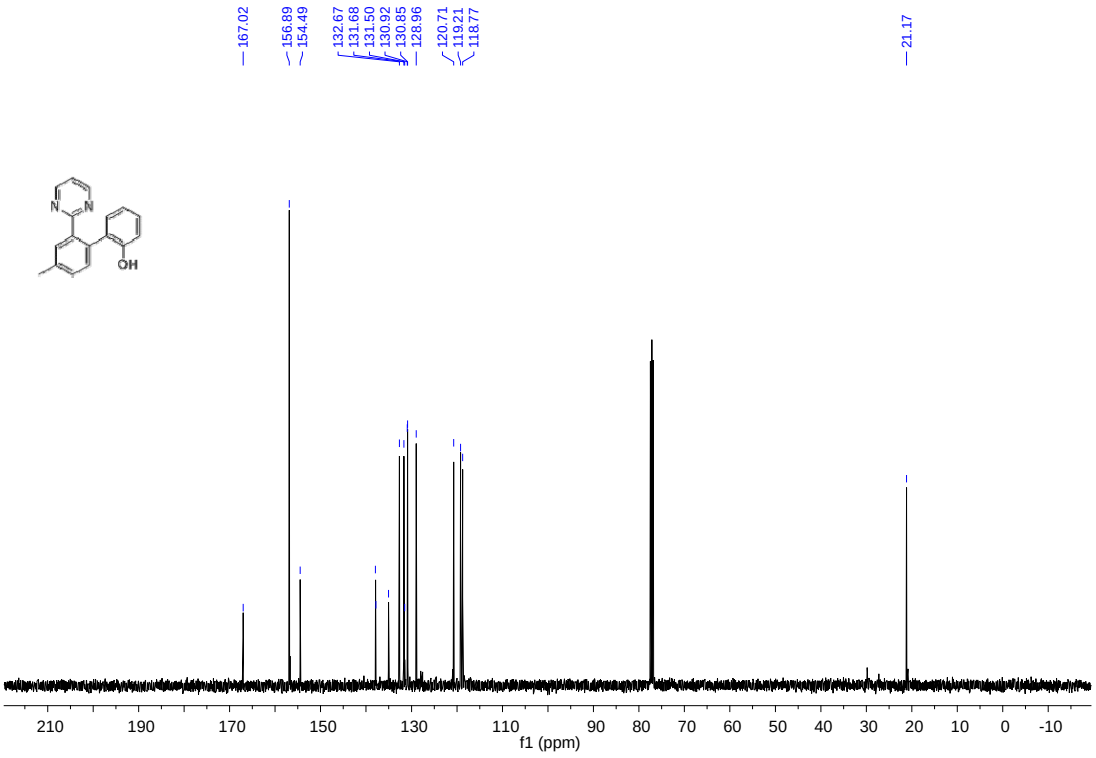

8.68
8.67
7.59
7.26
7.14
7.13
6.83
6.83
6.81
6.79
6.76
2.44
OH
Cl
2.00
1.02
2.10
1.98
1.01
0.99
3.19
f1 (ppm)


168.11
157.01
150.17
137.87
137.54
136.96
135.08
130.45
129.52
129.39
119.67
118.69
115.79
21.18
OH
Cl
f1 (ppm)


8.69
8.68
7.62
7.29
7.17
7.15
7.00
2.44
Cl
OH
Cl
2.00
1.03
2.03
1.06
2.01
3.06
f1 (ppm)


167.65
157.06
146.53
138.09
135.84
135.26
130.53
130.50
126.97
120.67
118.82
21.20
Cl
OH
Cl
f1 (ppm)


8.70
8.69
7.20
7.17
7.00
6.99
6.99
6.98
6.98
6.97
6.97
6.88
6.86
6.84
2.46
OH
2.00
0.99
0.99
3.06
2.03
1.00
2.99
f1 (ppm)


167.02
156.89
154.49
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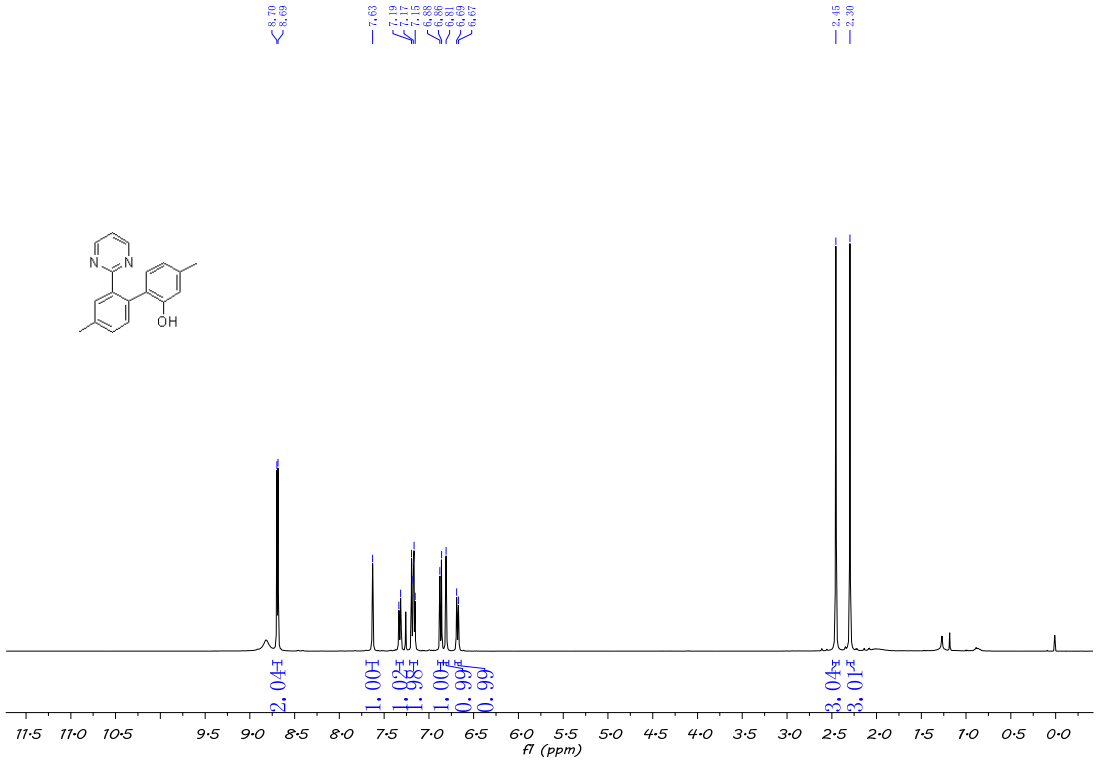
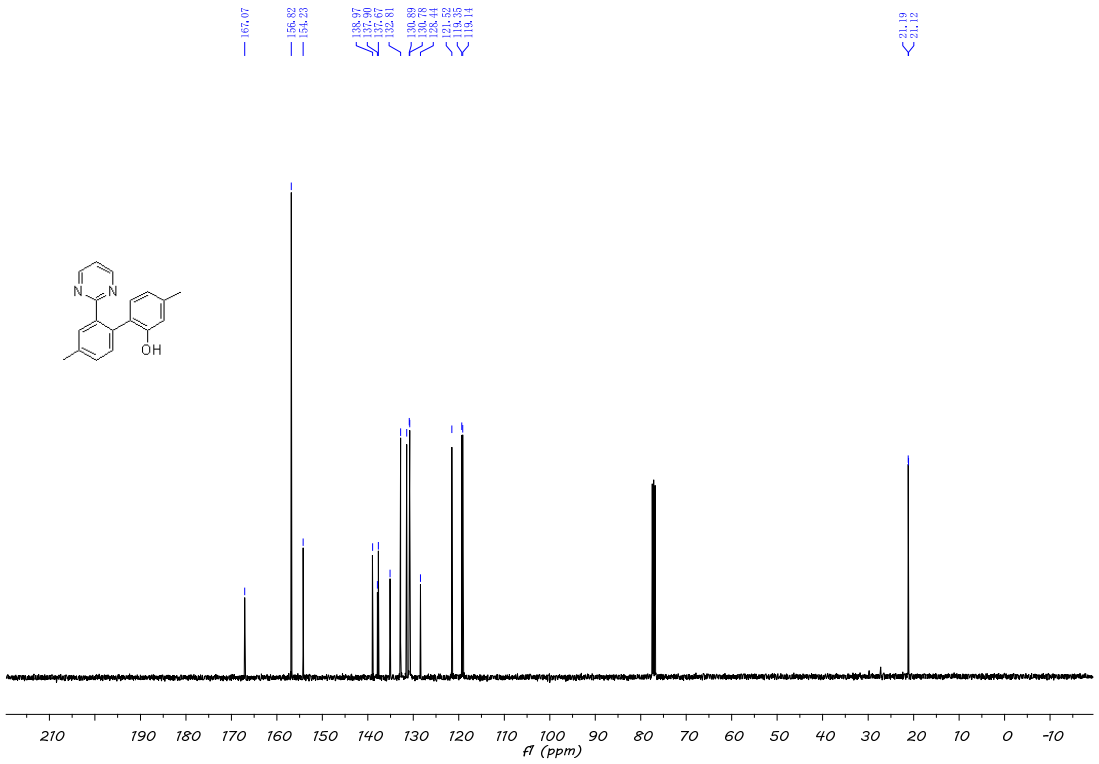
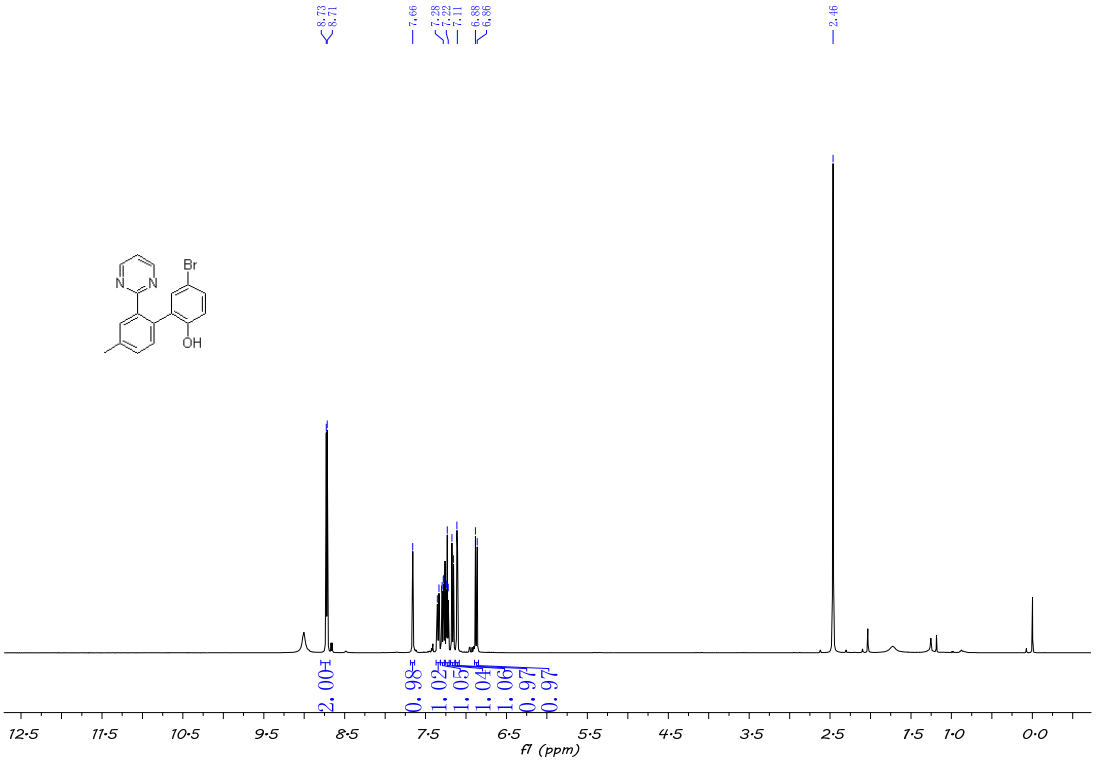
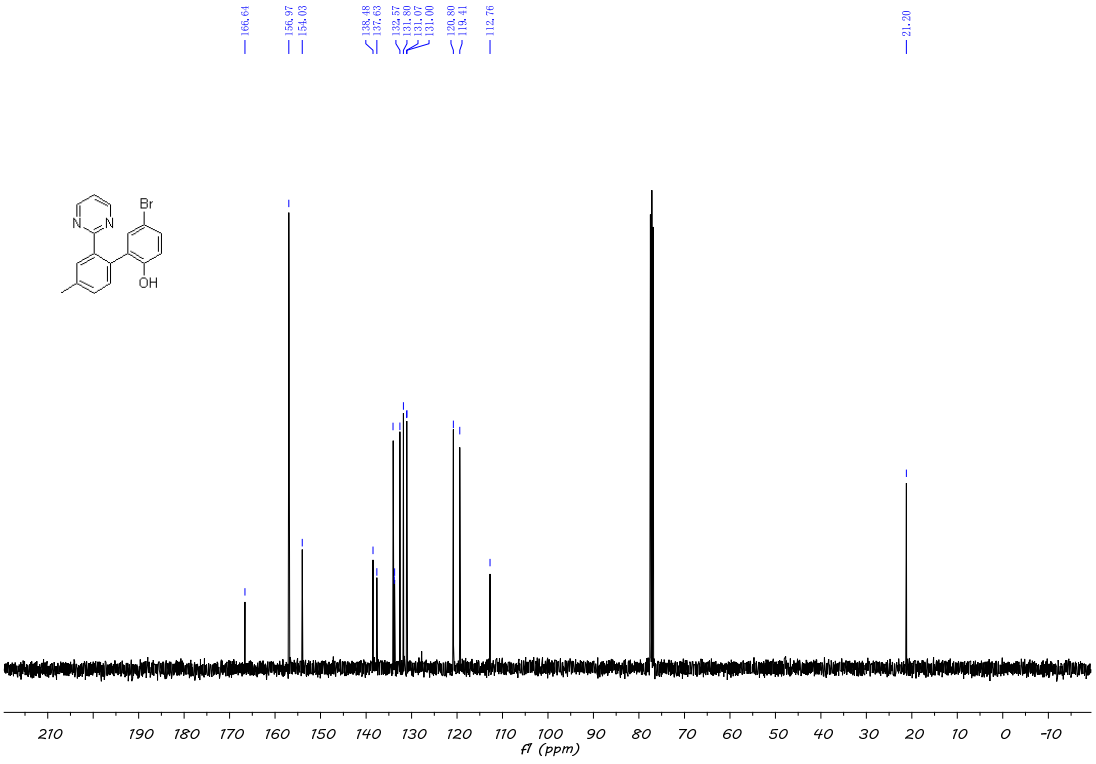
131.68
131.50
130.92
130.85
128.96
120.71
119.21
118.77
21.17
OH
f1 (ppm)


8.70
8.69
7.63
7.19
7.17
7.15
6.88
6.86
6.81
6.69
6.67
2.45
2.30
OH
2.04
1.00
1.02
1.98
1.00
0.99
0.99
3.04
3.01
11.5 11.0 10.5 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)


167.07
156.82
154.23
138.97
137.90
137.67
132.81
130.89
130.78
126.44
121.52
118.35
118.14
21.19
21.12
OH
210 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)


8.73
8.71
7.66
7.28
7.22
7.11
6.88
6.86
2.46
Br
N
N
OH
2.00
0.98
1.02
1.05
1.04
1.06
0.97
0.97
12.5
11.5
10.5
9.5
8.5
7.5
6.5
5.5
4.5
3.5
2.5
1.5
1.0
0.0
f1 (ppm)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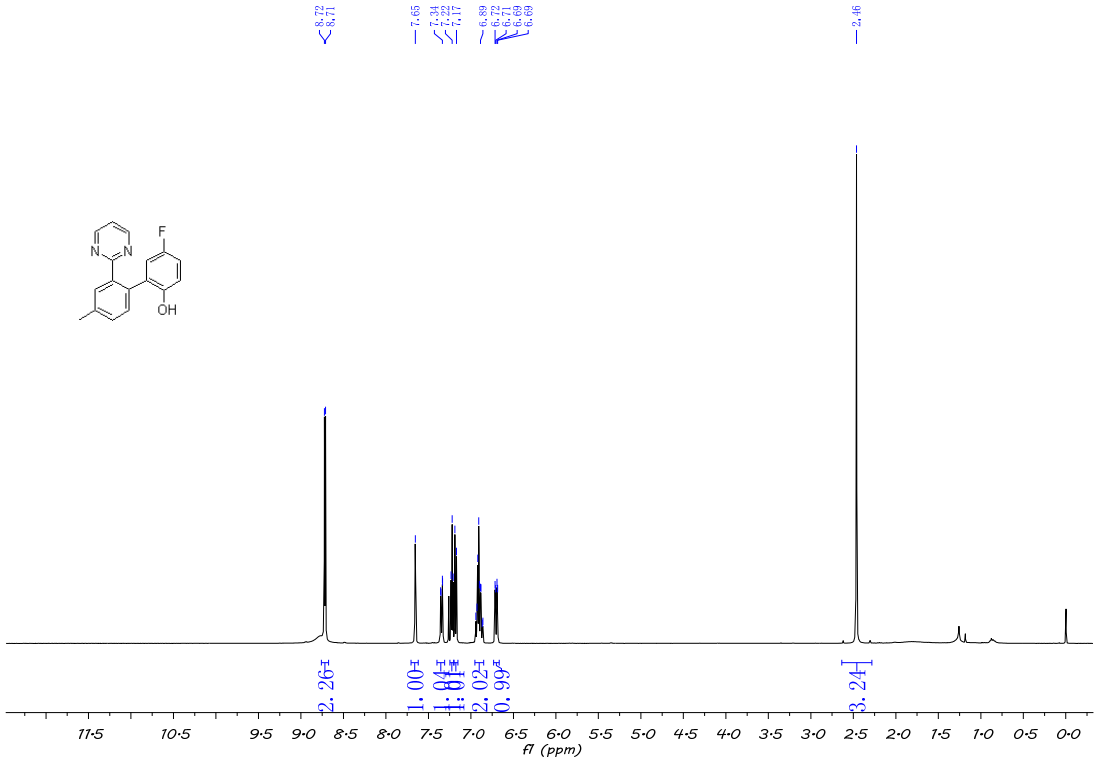
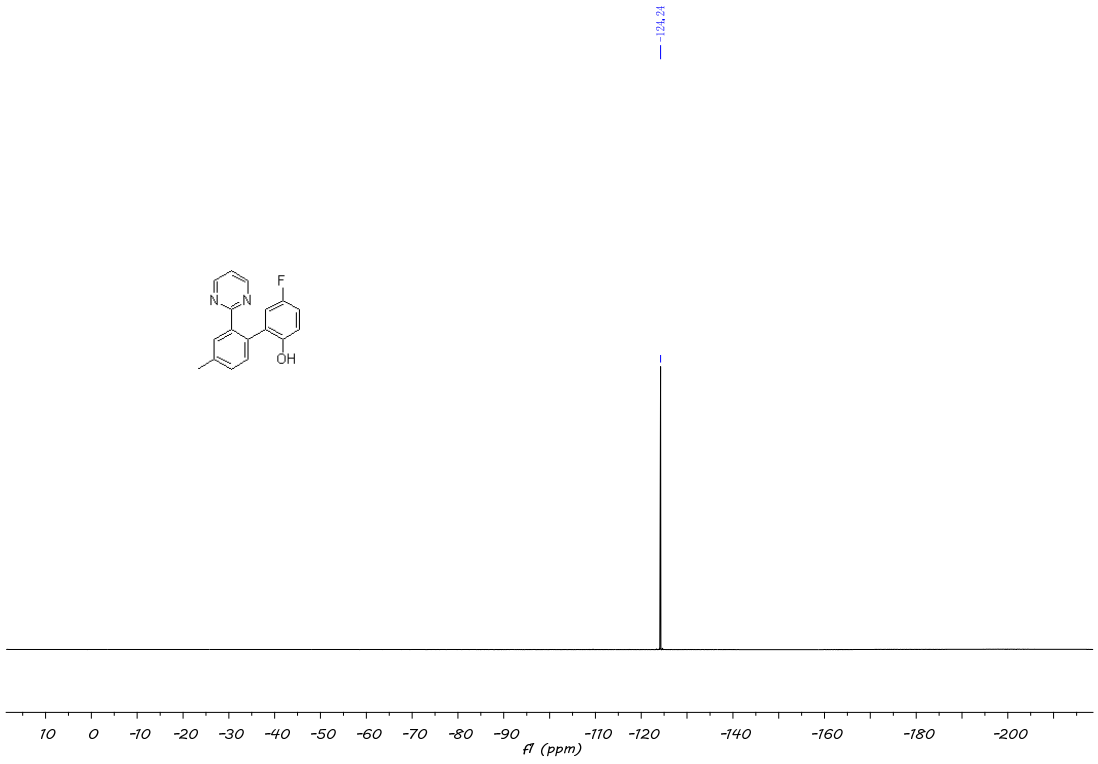
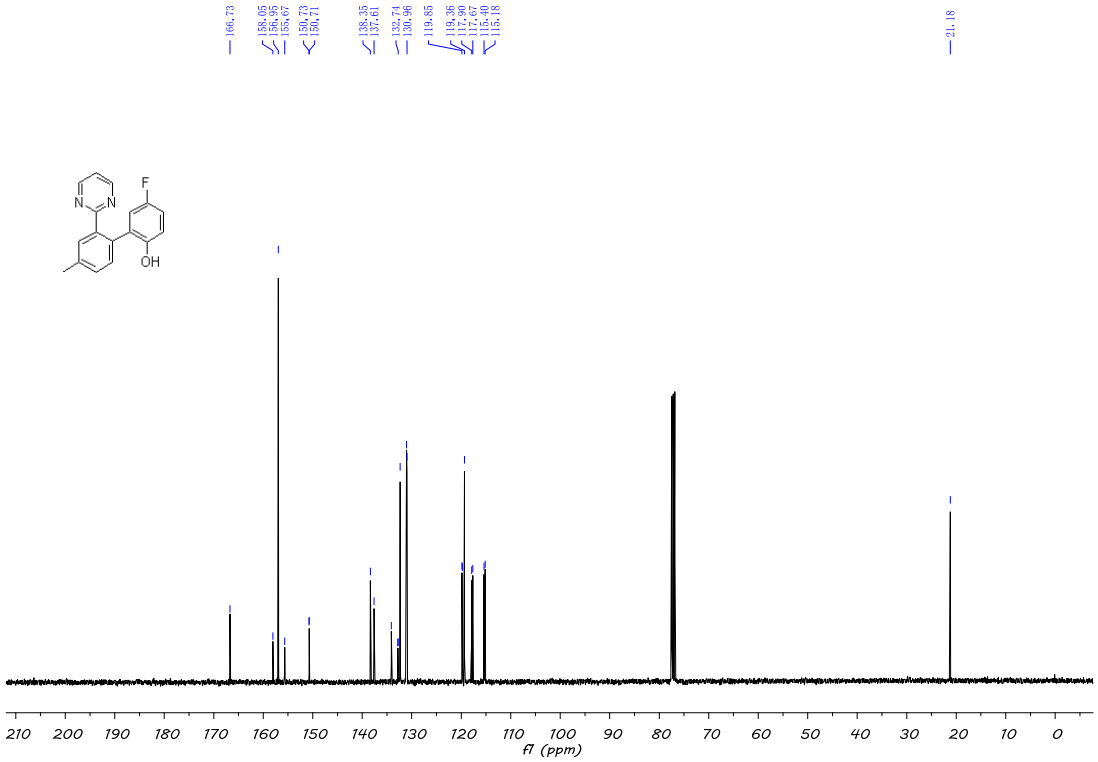
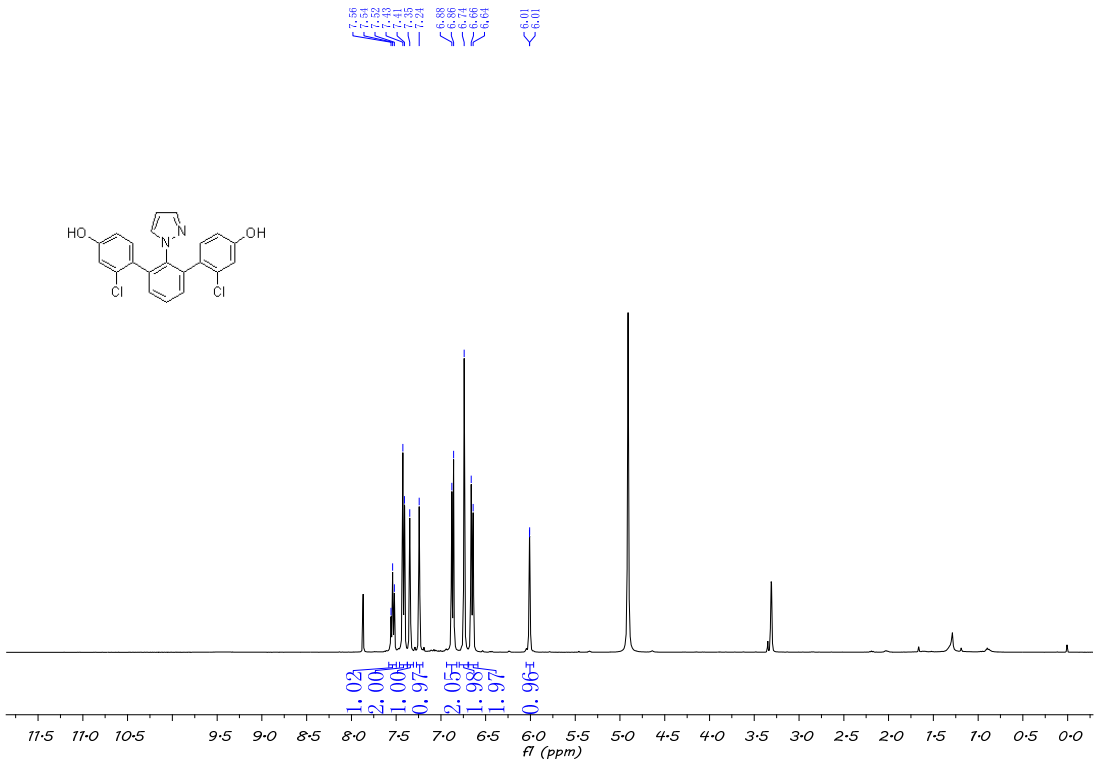
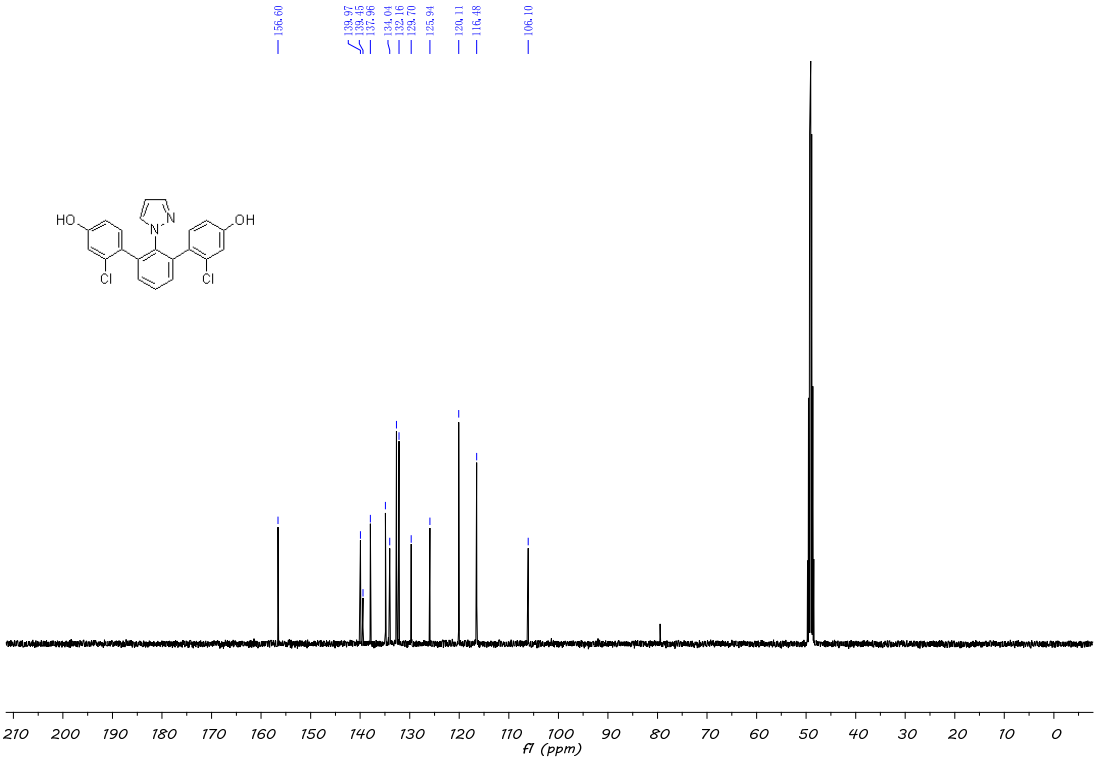
132.57
131.80
131.07
131.00
120.80
119.41
112.76
21.20
Br
N
N
OH
210
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
-10
f1 (ppm)


8.72
8.71
7.65
7.34
7.22
7.17
6.89
6.72
6.71
6.69
6.69
2.46
F
N
N
OH
2.26
1.00
1.04
1.01
2.02
0.99
3.24
f1 (ppm)


-124.24
F
N
N
OH
f1 (ppm)


166.73
158.05
156.95
155.67
150.73
150.71
138.35
137.61
132.74
130.96
119.85
119.36
117.90
117.67
115.40
115.18
21.18
F
N
N
OH
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)


7.56
7.54
7.52
7.43
7.41
7.35
7.24
6.88
6.86
6.74
6.66
6.64
6.01
6.01
HO
OH
Cl
Cl
1.02
2.00
1.00
0.97
2.05
1.98
1.97
0.96
f1 (ppm)


156.60
138.97
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131.96
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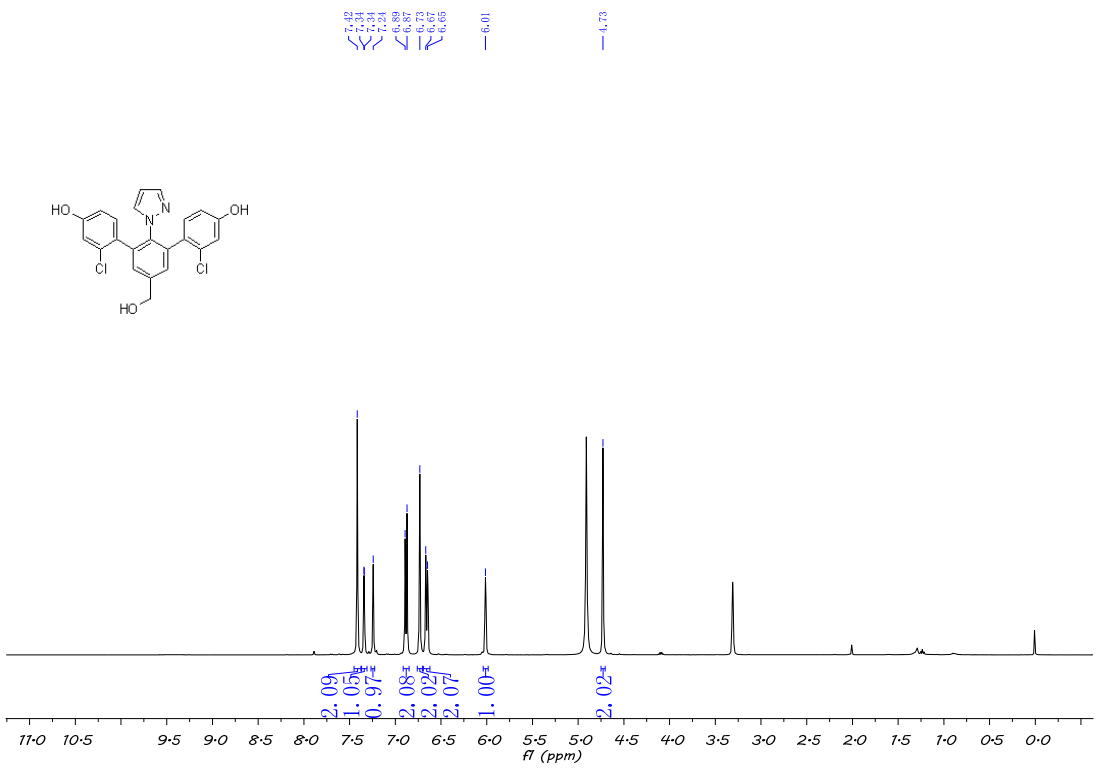
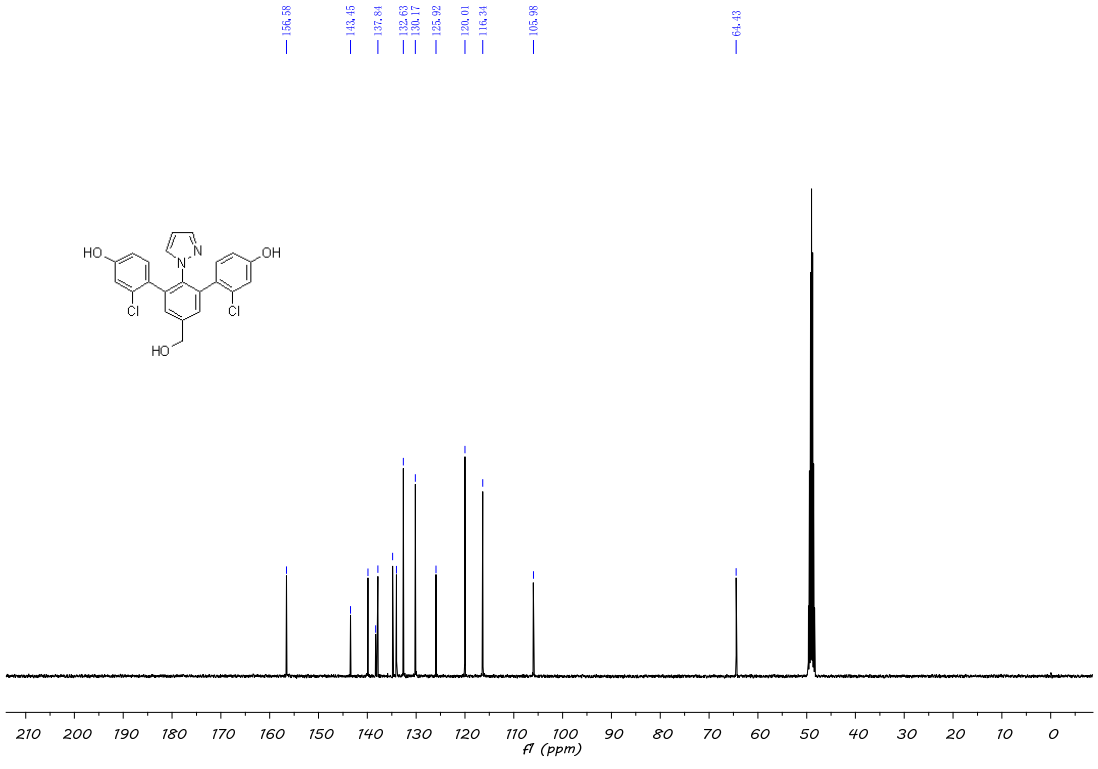
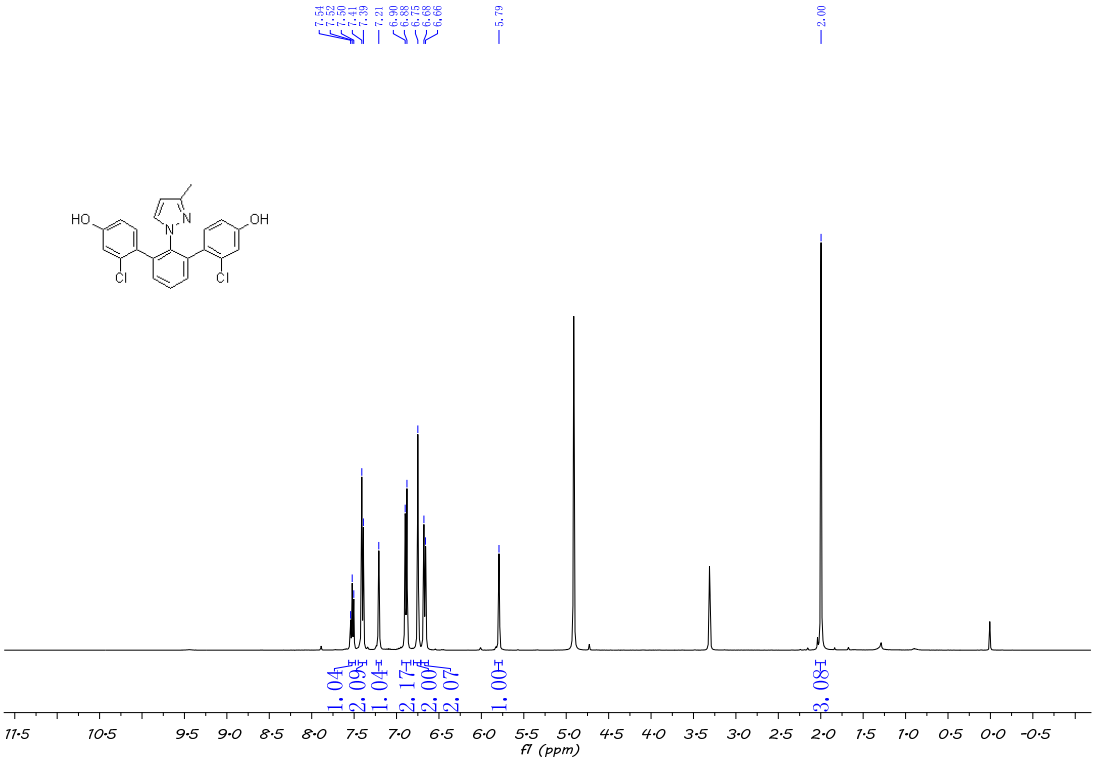
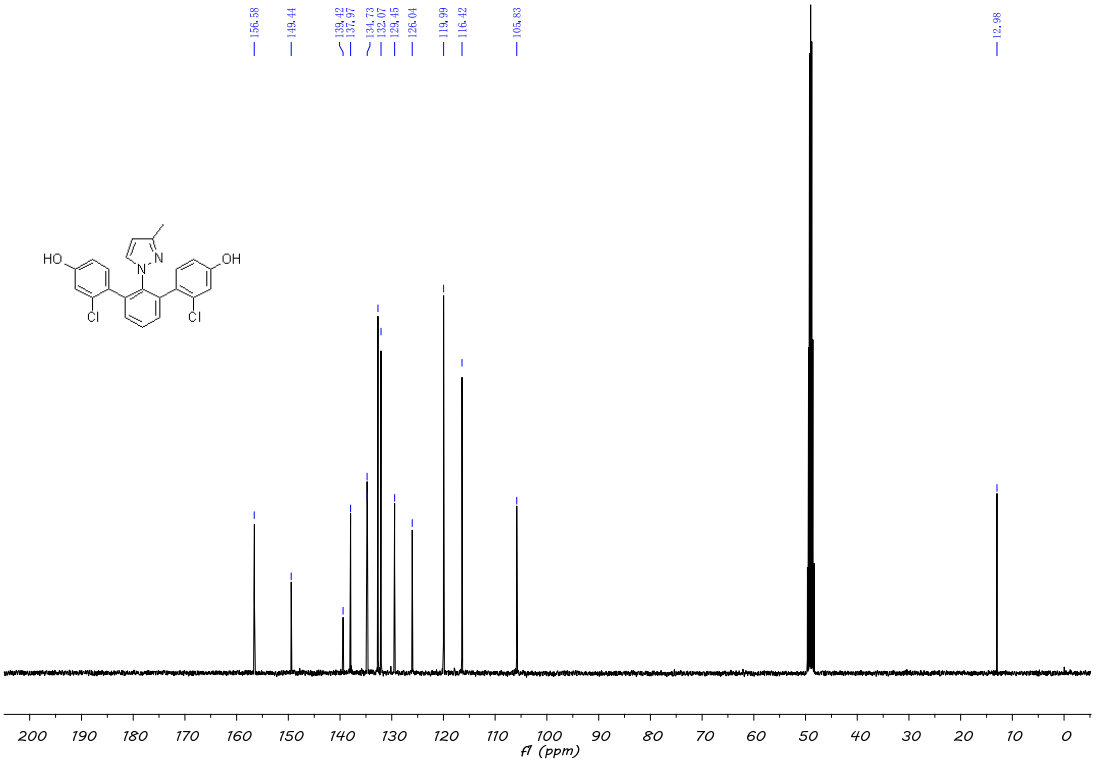
132.15
129.70
125.94
120.11
116.48
106.10
HO
OH
Cl
Cl
f1 (ppm)


7.42
7.34
7.34
7.24
6.89
6.87
6.73
6.67
6.65
6.01
4.73
HO
OH
Cl
Cl
HO
2.09
1.05
0.97
2.08
2.02
2.07
1.00
2.02
11·0 10·5 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)


156.58
143.45
137.84
132.63
130.17
125.92
120.01
116.34
105.98
64.43
HO
OH
Cl
Cl
HO
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)


7.54
7.52
7.50
7.41
7.39
7.21
6.90
6.88
6.75
6.68
6.66
5.79
2.00
HO
OH
Cl
Cl
1.04
2.09
1.04
2.17
2.00
2.07
1.00
3.08
f1 (ppm)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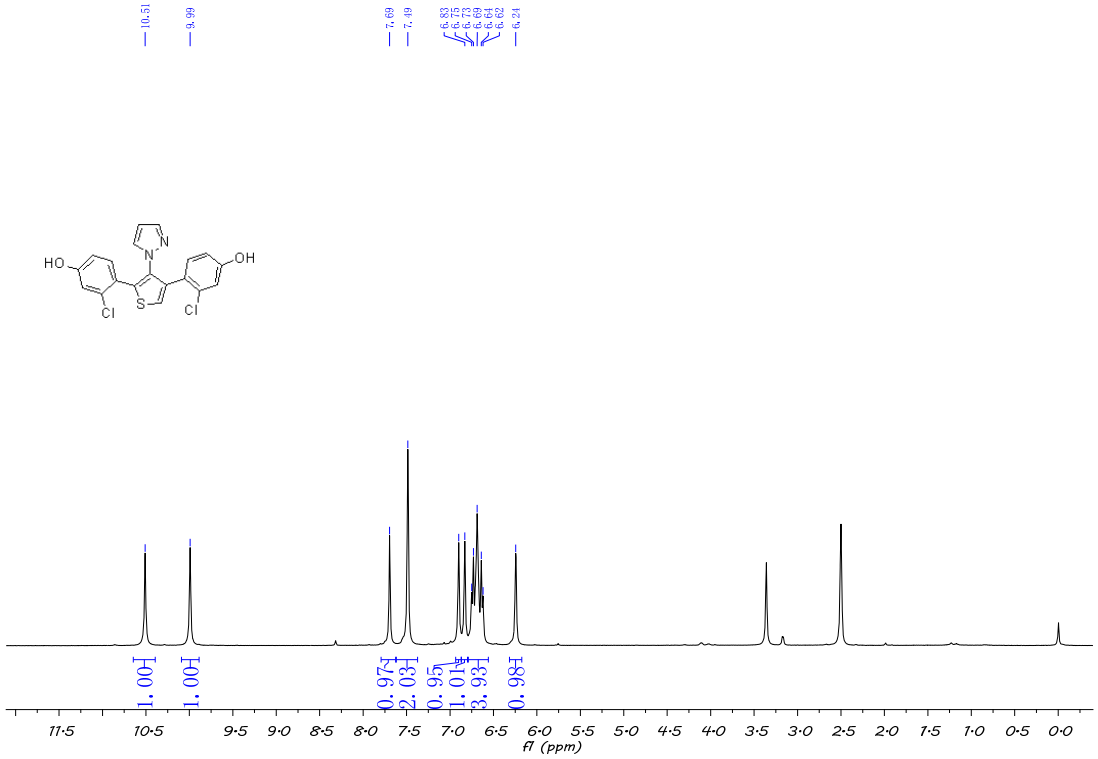
149.44
139.42
137.97
134.73
132.07
129.45
126.04
119.99
116.42
105.83
12.98
HO
OH
Cl
Cl
f1 (ppm)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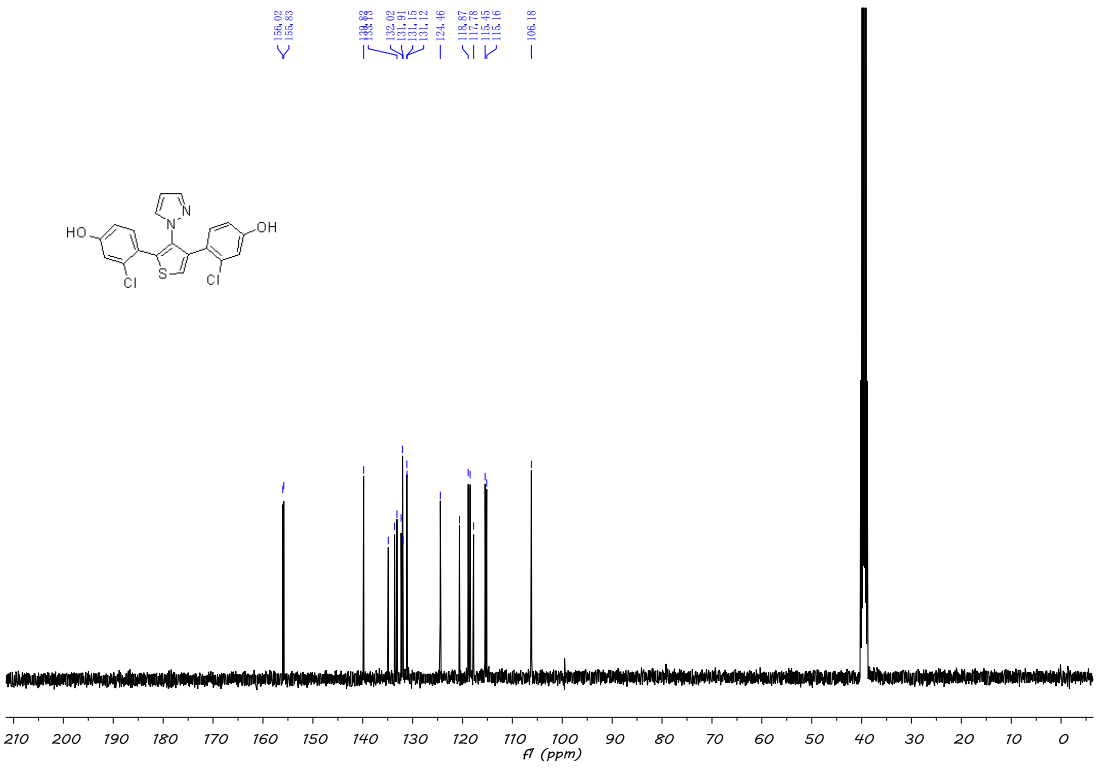
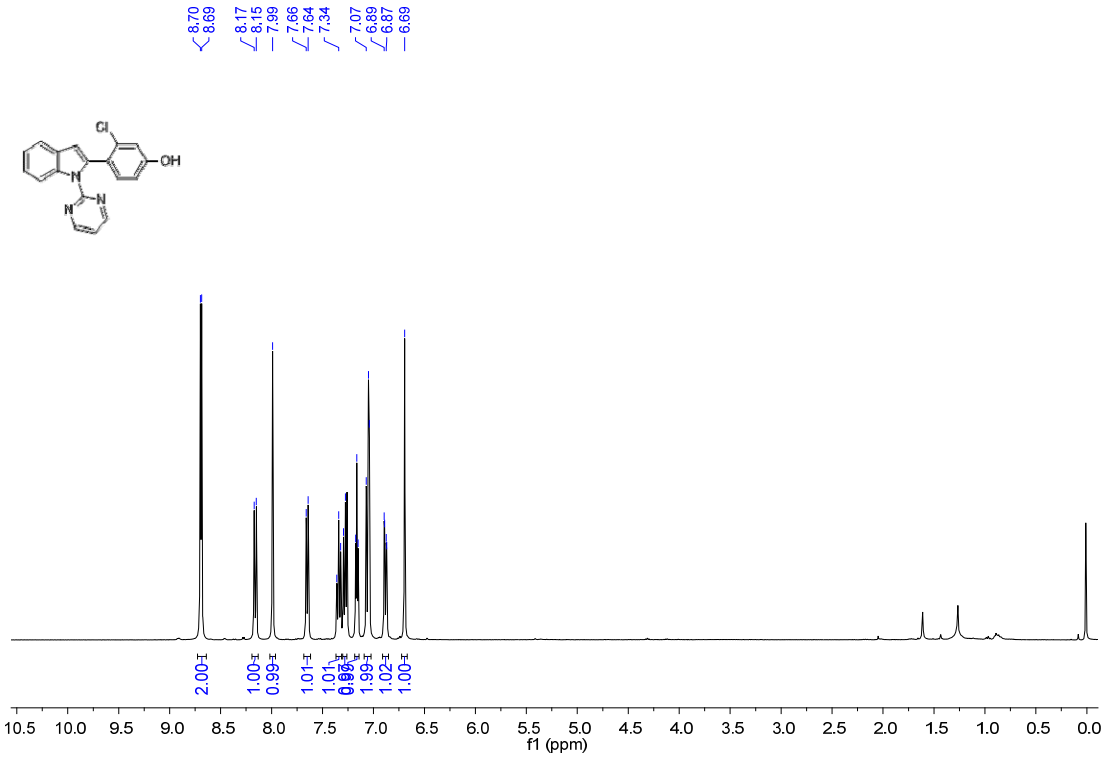
7.69
7.49
6.83
6.75
6.73
6.69
6.64
6.62
6.24
HO
OH
Cl
Cl
N
S
1.00
1.00
0.97
2.03
0.95
1.01
3.93
0.98
11.5
10.5
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)


156.02
155.83
132.02
131.91
131.15
131.12
124.46
118.87
117.78
115.45
115.16
106.18
HO
OH
Cl
Cl
N
S
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)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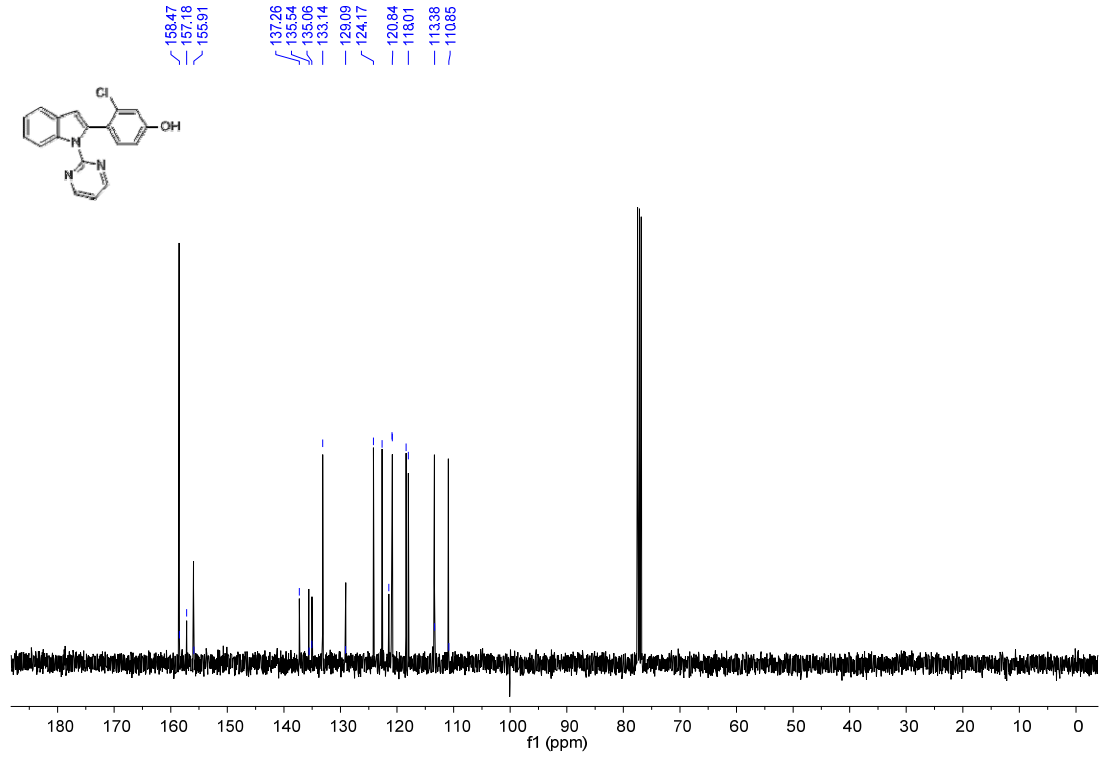
8.69
8.17
8.15
7.99
7.66
7.64
7.34
7.07
6.89
6.87
6.69
Cl
OH
N
N
2.00
1.00
0.99
1.01
1.01
1.99
1.02
1.00
10.5 10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)


158.47
157.18
155.91
137.26
135.54
135.06
133.14
129.09
124.17
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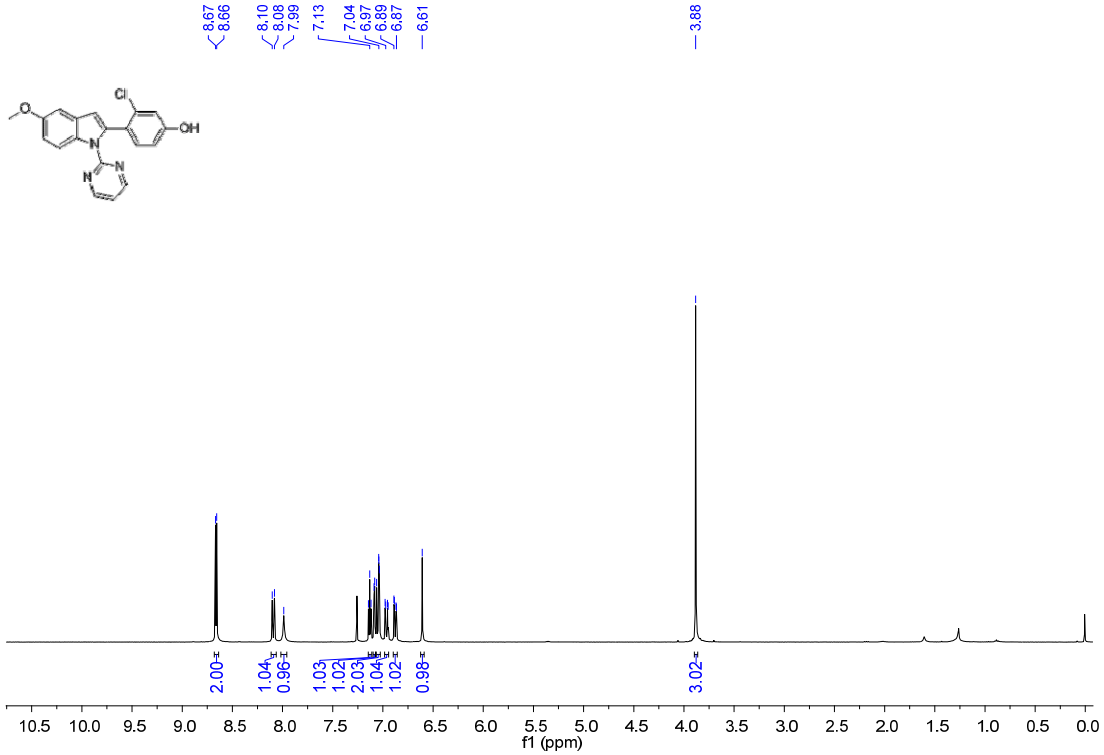
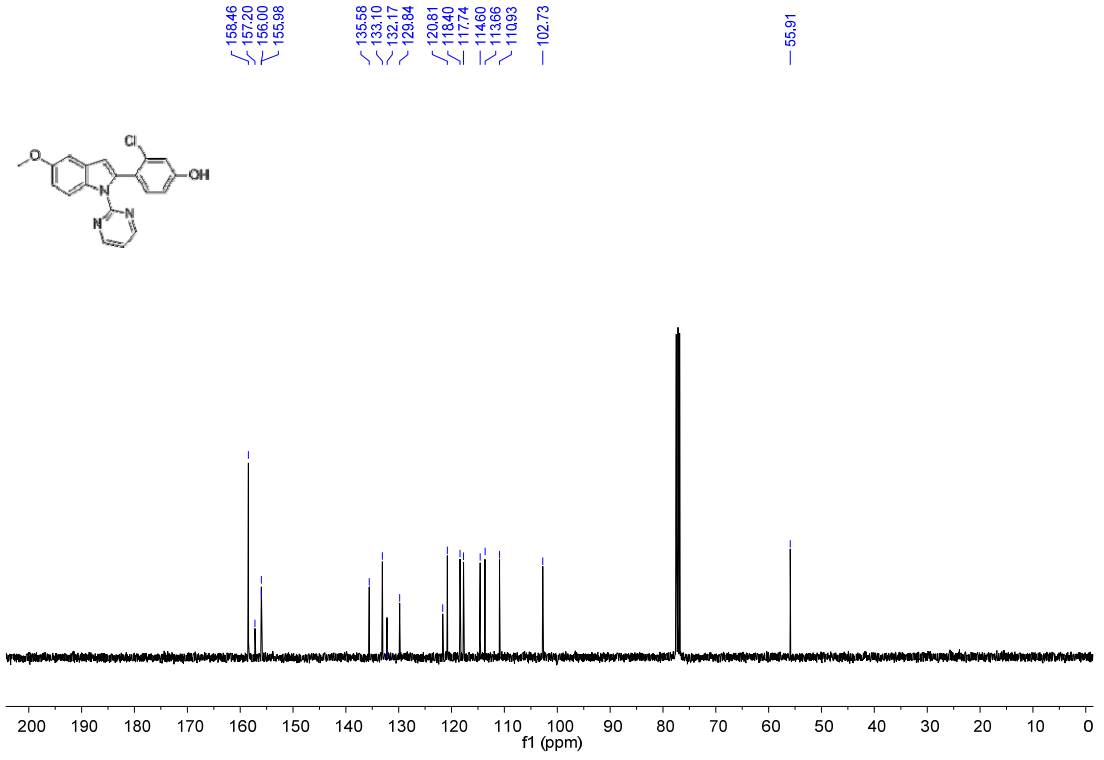
118.01
113.38
110.85
Cl
OH
N
N
180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)


8.67
8.66
8.10
8.08
7.99
7.13
7.04
6.97
6.89
6.87
6.61
3.88
Cl
OH
O
N
N
N
2.00
1.04
0.96
1.03
1.02
2.03
1.04
1.02
0.98
3.02
10.5 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)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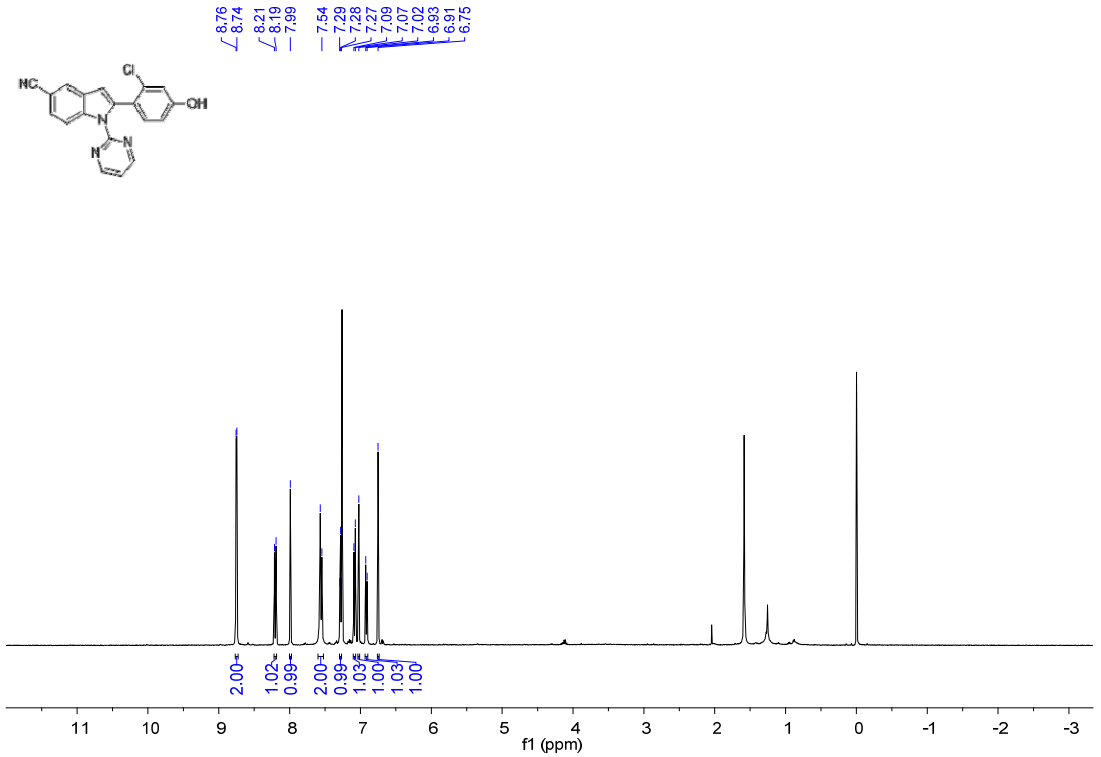
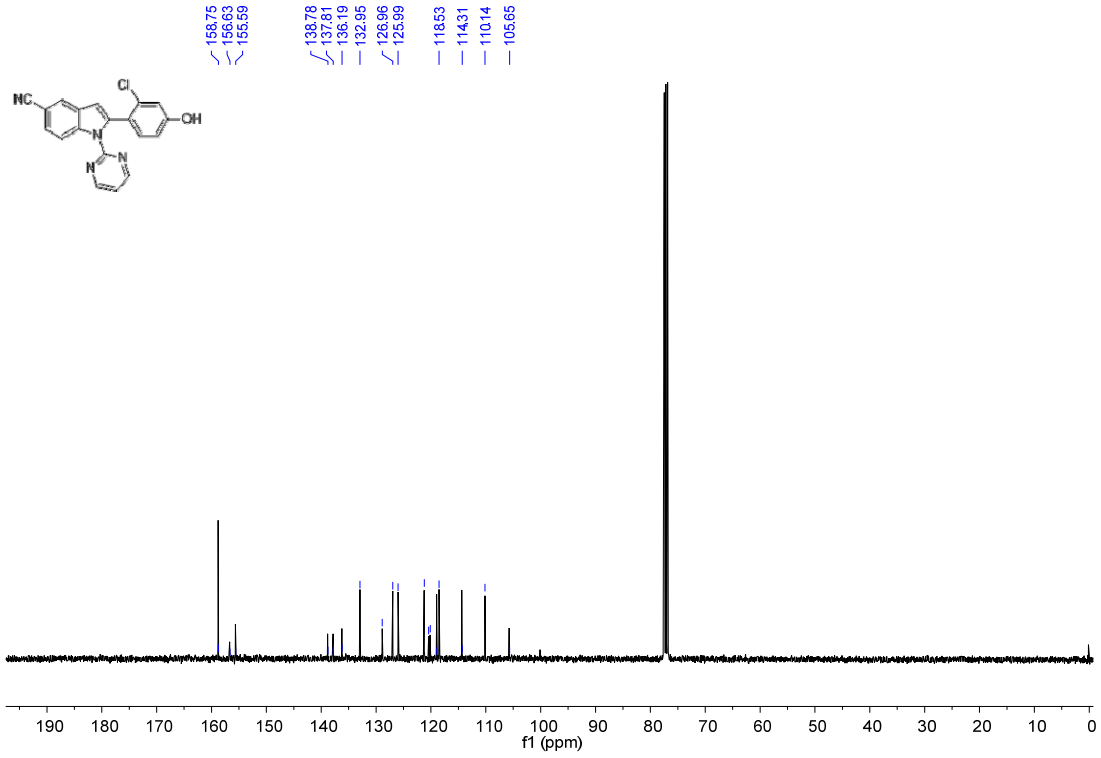
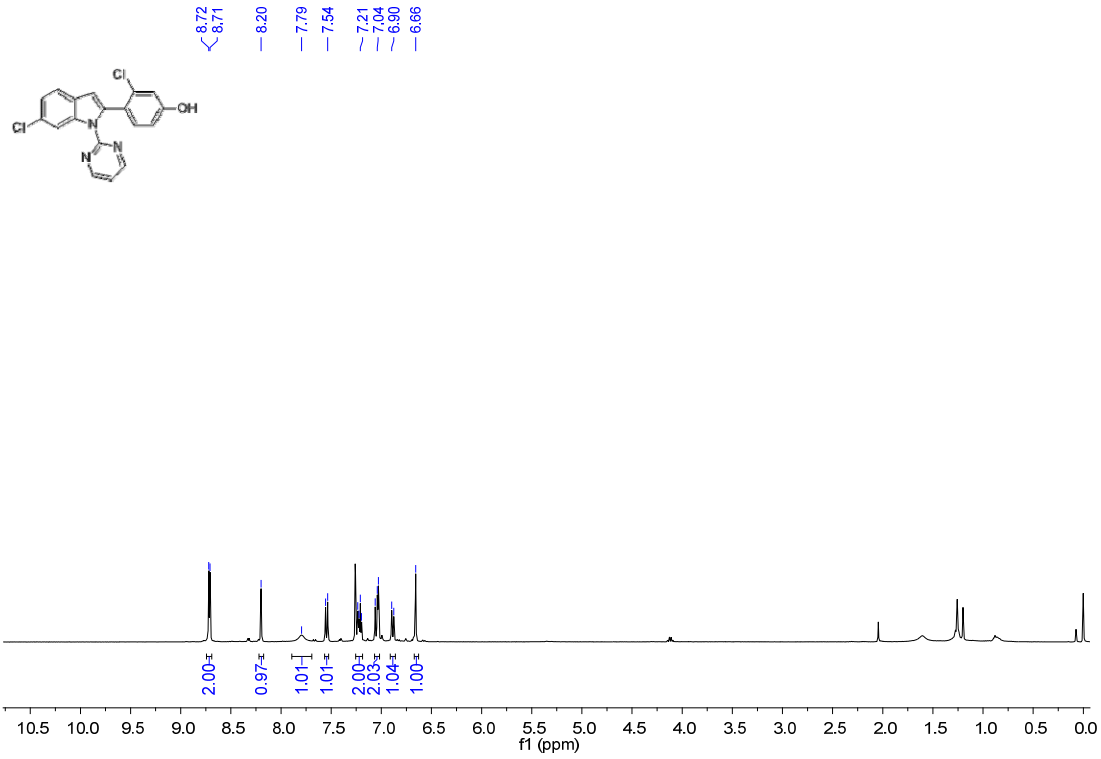
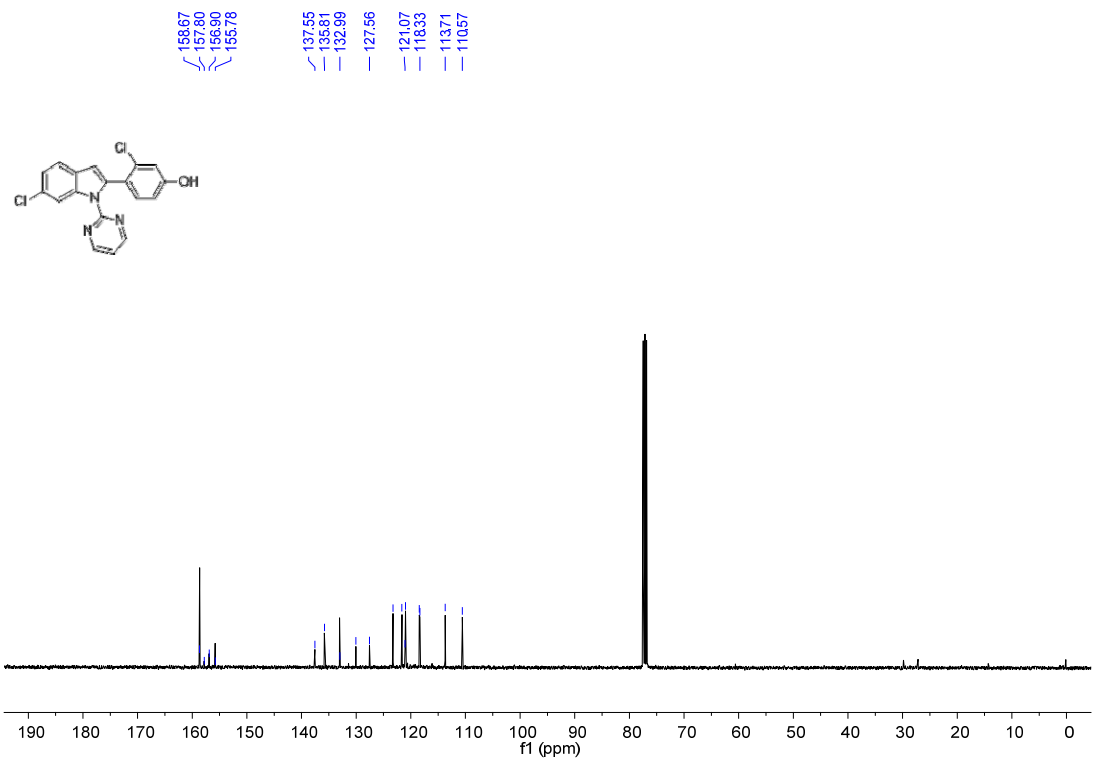
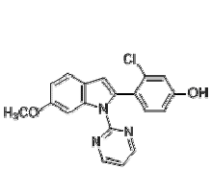
157.20
156.00
155.98
135.58
133.10
132.17
129.84
120.81
118.40
117.74
114.60
113.66
110.93
102.73
55.91
Cl
OH
O
N
N
N
200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)


8.76
8.74
8.21
8.19
7.99
7.54
7.29
7.28
7.27
7.09
7.07
7.02
6.93
6.91
6.75
HC
Cl
OH
N
N
2.00
1.02
0.99
2.00
0.99
1.03
1.00
1.03
1.00
11 10 9 8 7 6 5 4 3 2 1 0 -1 -2 -3
f1 (ppm)

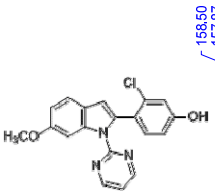

158.75
156.63
155.59
138.78
137.81
136.19
132.95
126.96
125.99
118.53
114.31
110.14
105.65
HC
Cl
OH
N
N
190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)


8.72
8.71
8.20
7.79
7.54
7.21
7.04
6.90
6.66
Cl
OH
Cl
N
N
2.00
0.97
1.01
1.01
2.00
2.03
1.04
1.00
f1 (ppm)

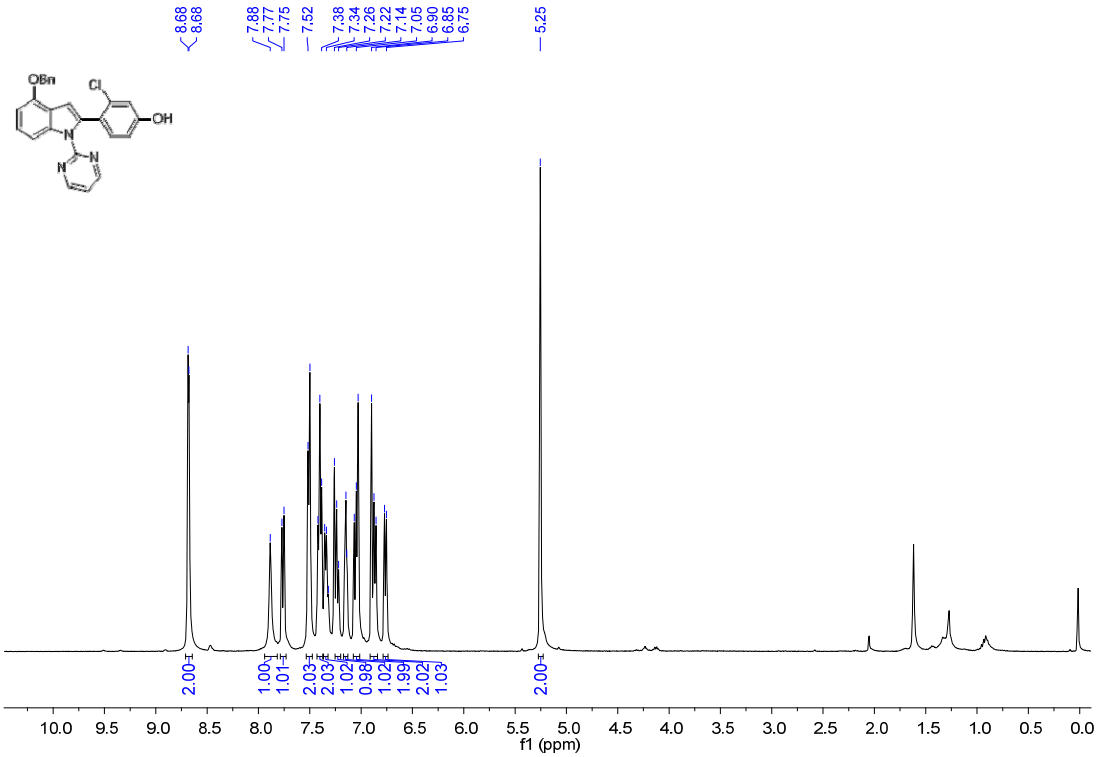

158.67
157.80
156.90
155.78
137.55
135.81
132.99
127.56
121.07
118.33
113.71
110.57
Cl
OH
Cl
N
N
f1 (ppm)

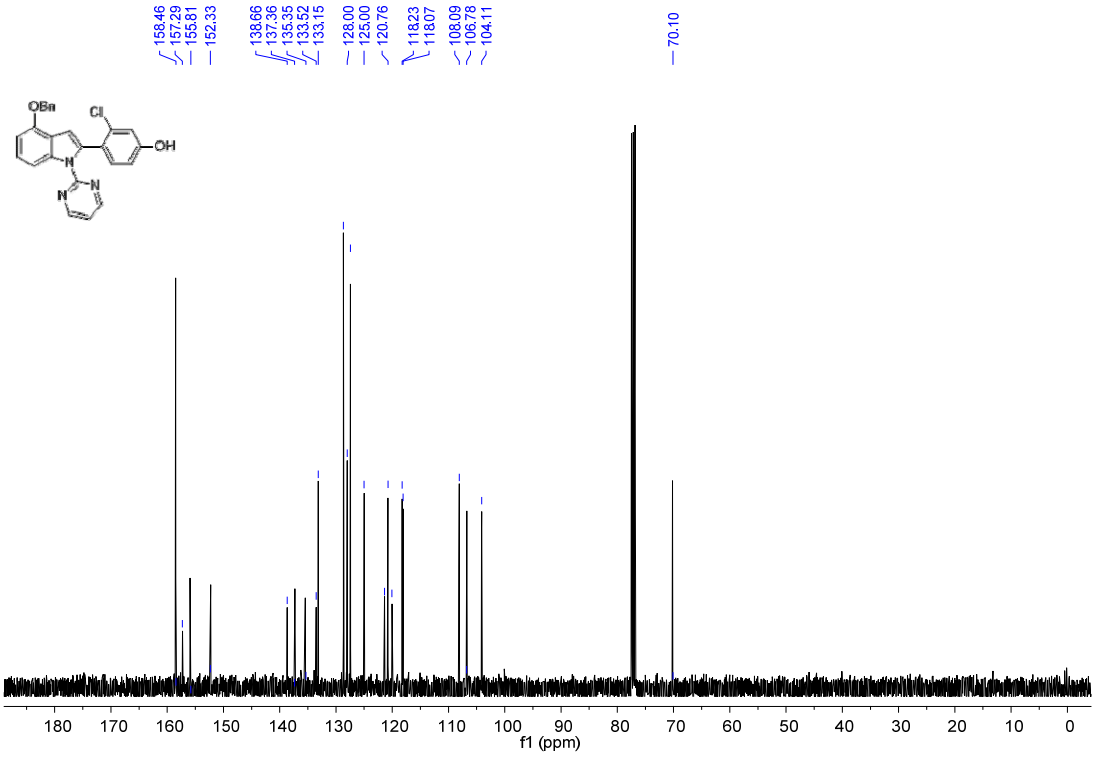

Cl
OH
H3CO
N
N
N

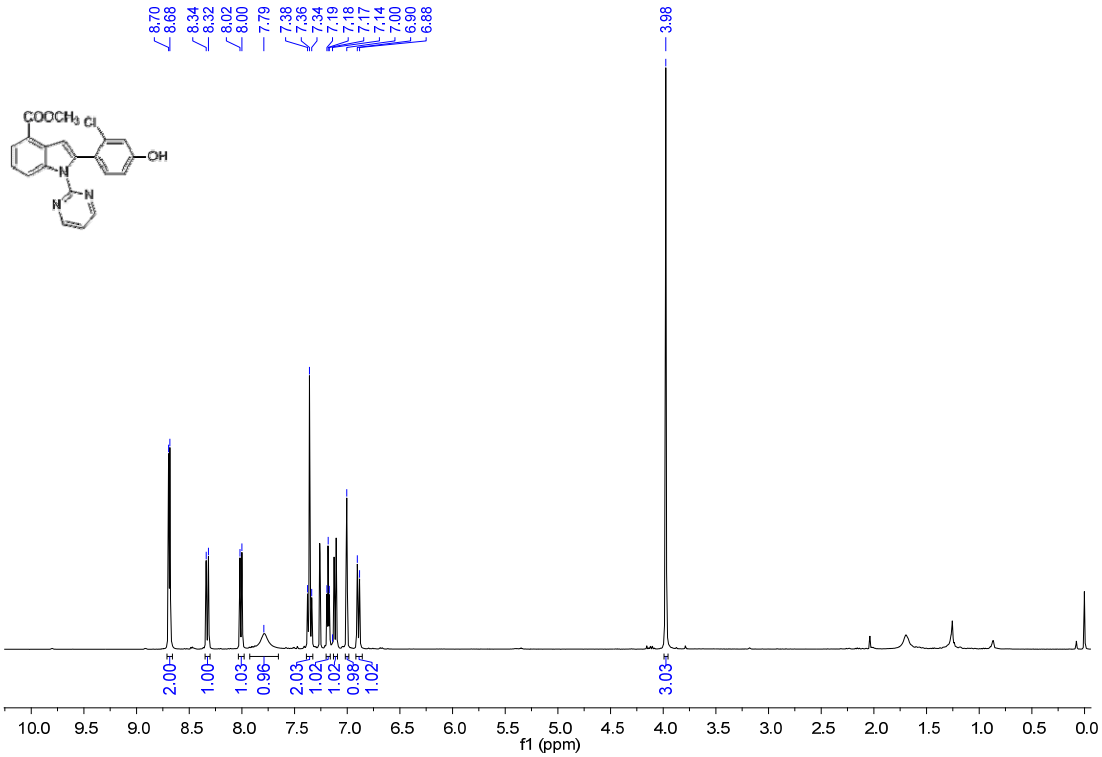

8.69
8.68
7.76
7.75
7.74
7.53
6.94
6.87
6.84
6.63
3.88
2.00
2.01
1.01
1.01
1.00
3.06
10.5
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)

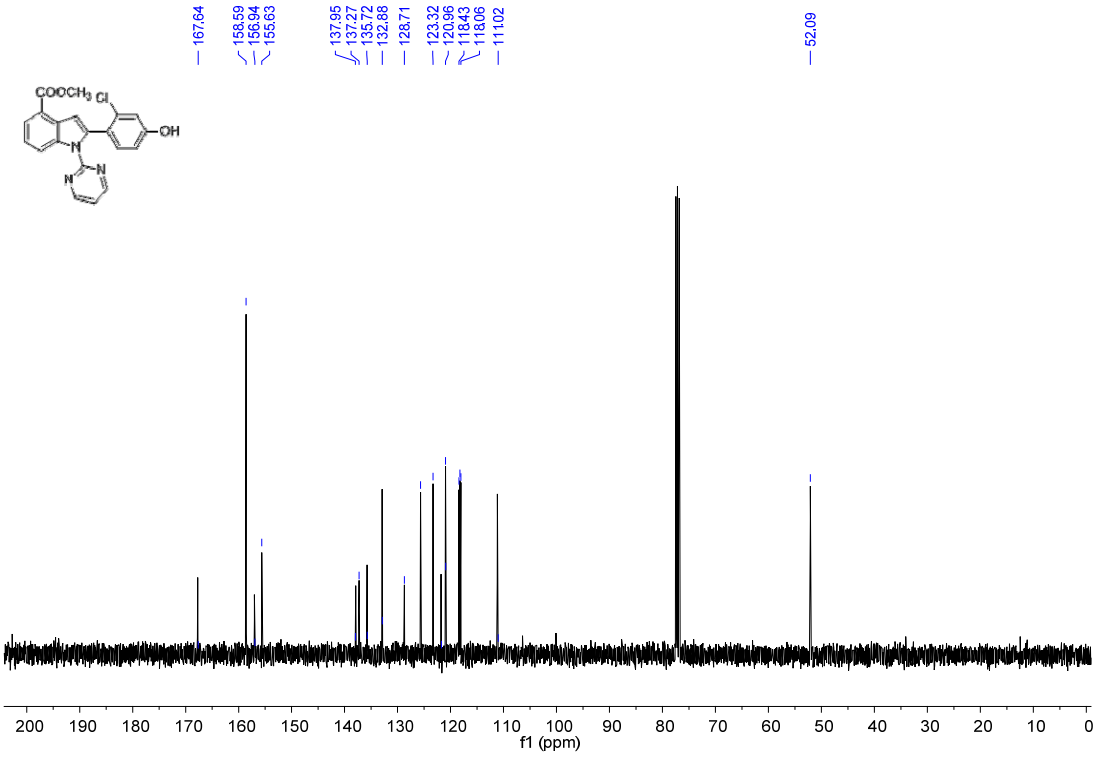

Cl
OH
H3CO
N
N
N

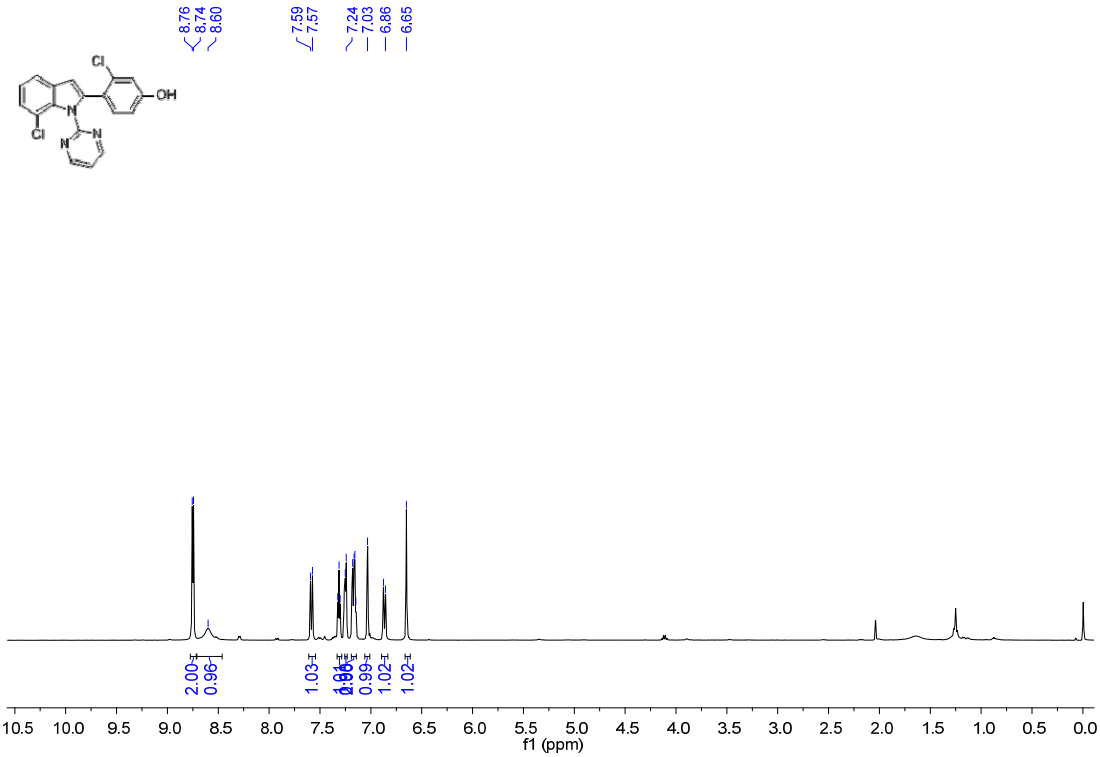

158.50
157.87
157.33
155.90
138.24
135.36
133.71
132.95
121.39
120.65
118.12
117.88
111.84
110.84
97.69
55.88
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

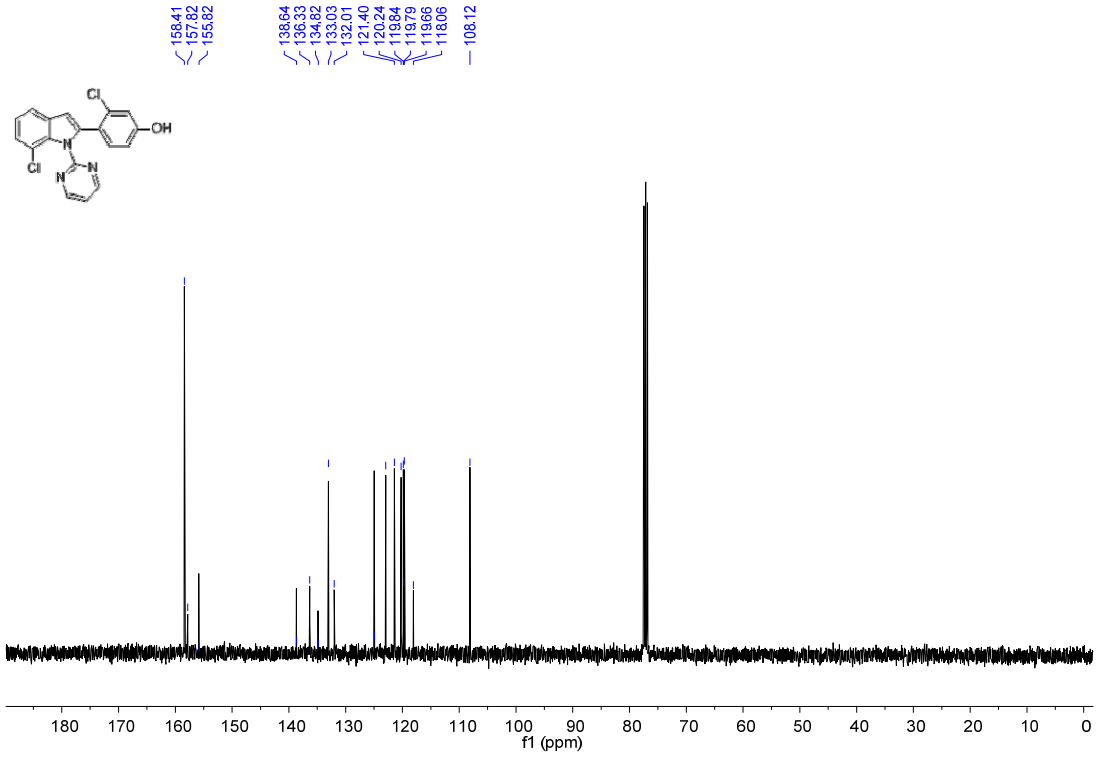

8.68
8.68
7.88
7.77
7.75
7.52
7.38
7.34
7.26
7.22
7.14
7.05
6.90
6.85
6.75
5.25
OBn
Cl
OH
N
N
N
2.00
1.00
1.01
2.03
2.03
1.02
0.98
1.02
1.99
2.02
1.03
2.00
10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)

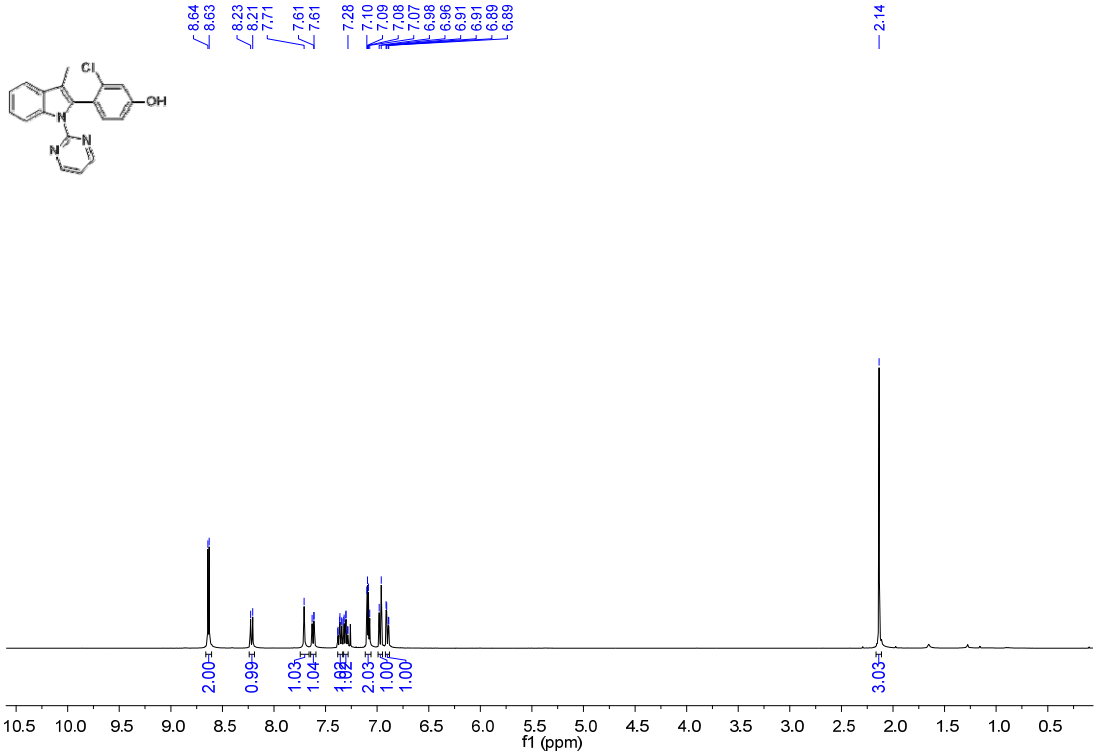

158.46
157.29
155.81
152.33
138.66
137.36
135.35
133.52
133.15
128.00
125.00
120.76
118.23
118.07
108.09
106.78
104.11
70.10
OBn
Cl
OH
N
N
N
180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)


8.70
8.68
8.34
8.32
8.02
8.00
7.79
7.38
7.36
7.34
7.19
7.18
7.17
7.14
7.00
6.90
6.88
3.98
COOCH3
Cl
OH
N
N
2.00
1.00
1.03
0.96
2.03
1.02
1.02
0.98
1.02
3.03
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)


167.64
158.59
156.94
155.63
137.95
137.27
135.72
132.88
128.71
123.32
120.96
118.43
118.06
111.02
52.09
COOCH3
Cl
OH
N
N
200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)


8.76
8.74
8.60
7.59
7.57
7.24
7.03
6.86
6.65
Cl
OH
Cl
N
N
2.00
0.96
1.03
0.99
1.02
1.02
10.5 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)


158.41
157.82
155.82
138.64
136.33
134.82
133.03
132.01
121.40
120.24
119.84
119.79
119.66
118.06
108.12
Cl
OH
Cl
N
N
180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)


8.64
8.63
8.23
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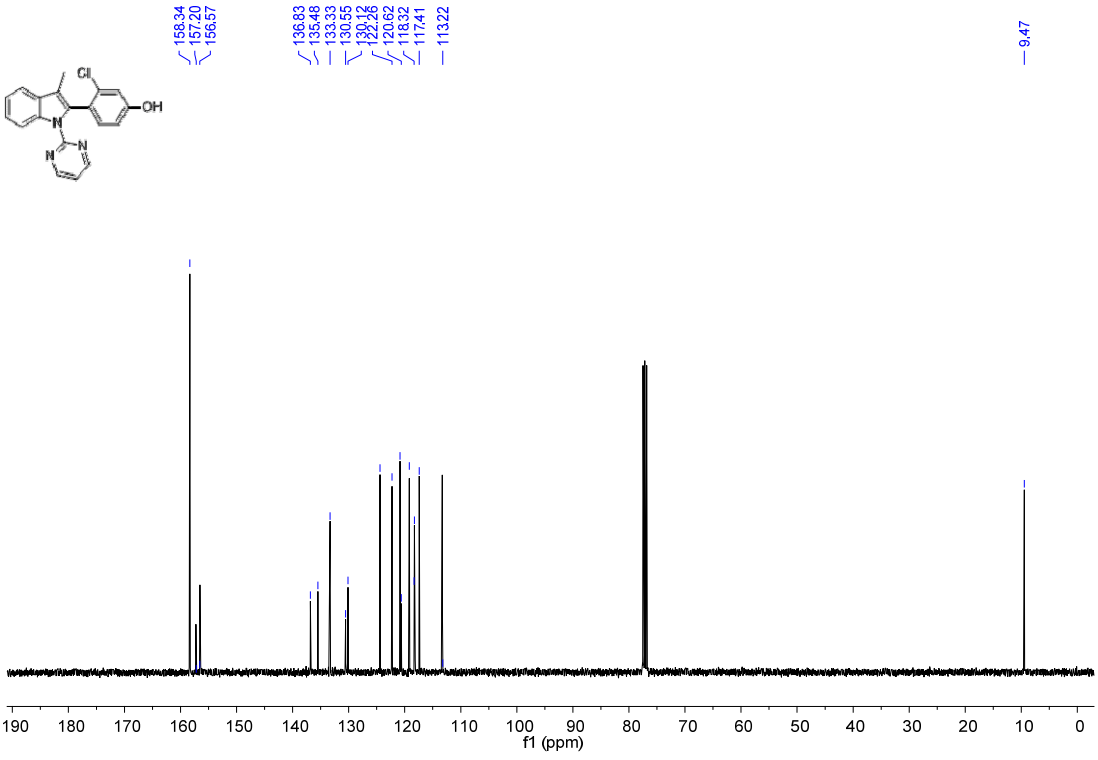
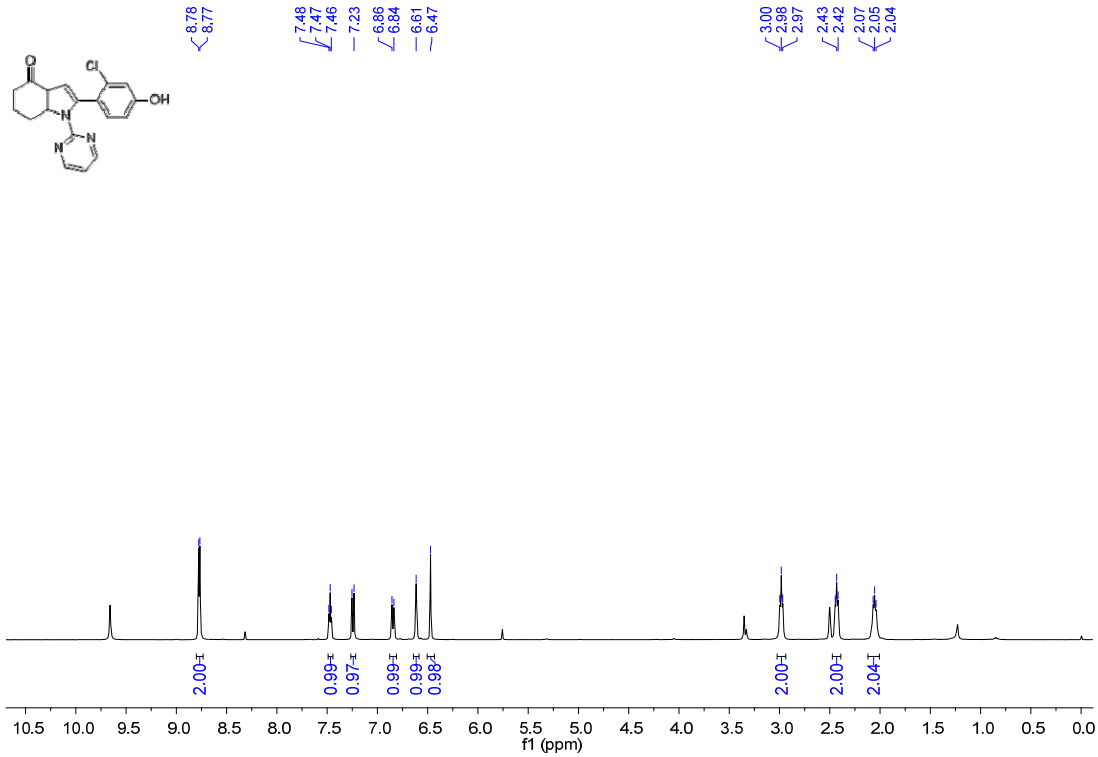
7.61
7.61
7.28
7.10
7.09
7.08
7.07
6.98
6.96
6.91
6.91
6.89
6.89
2.14
Cl
OH
N
N
N
2.00
0.99
1.03
1.04
2.03
1.00
3.03
10.5 10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5
f1 (ppm)


158.34
157.20
156.57
136.83
135.48
133.33
130.55
122.26
120.62
118.32
117.41
113.22
9.47
Cl
OH
N
N
N
190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)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8.77
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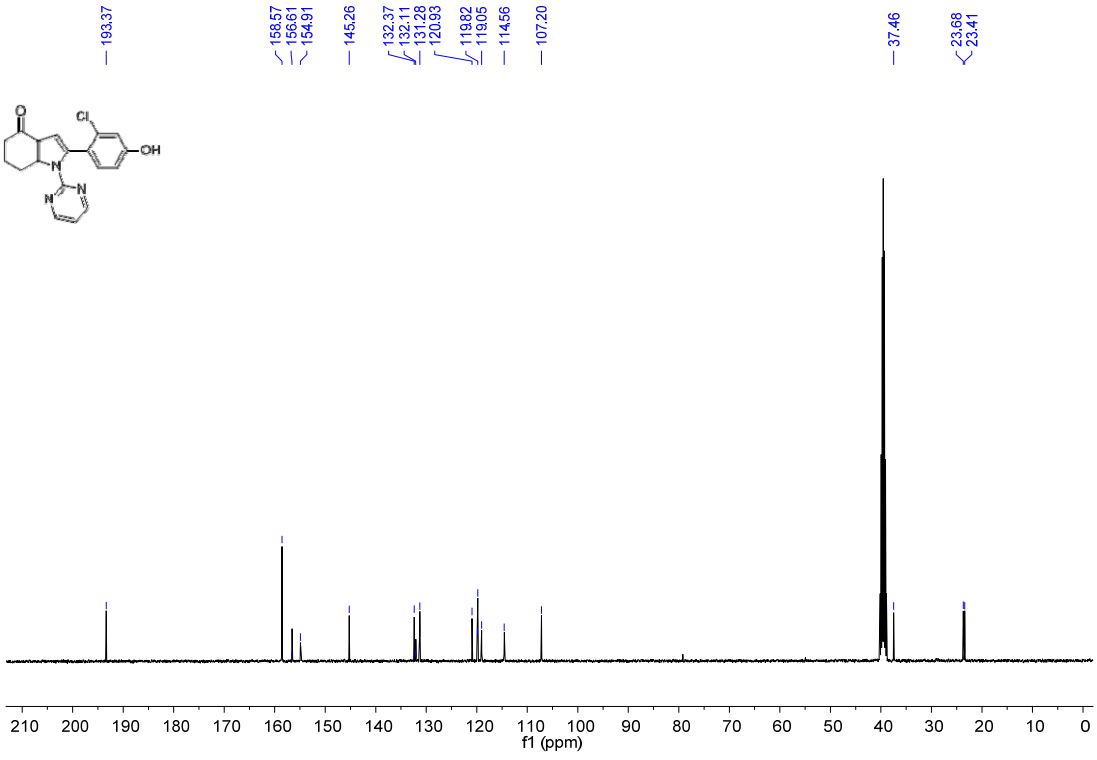
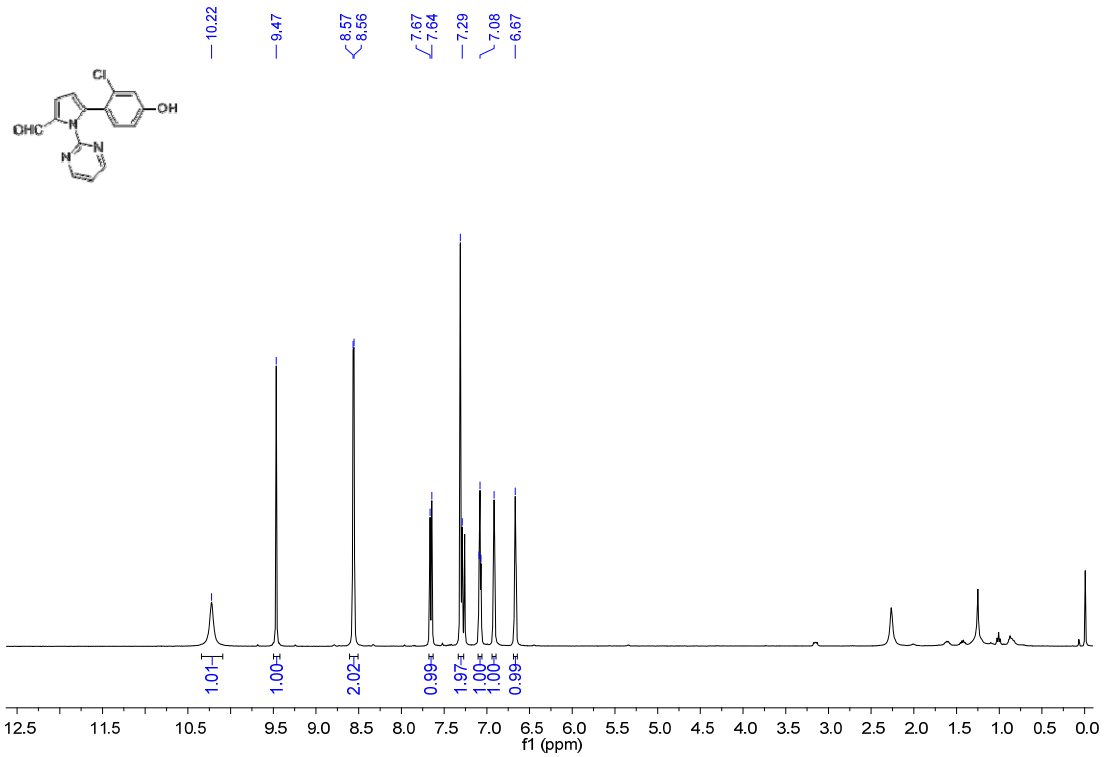
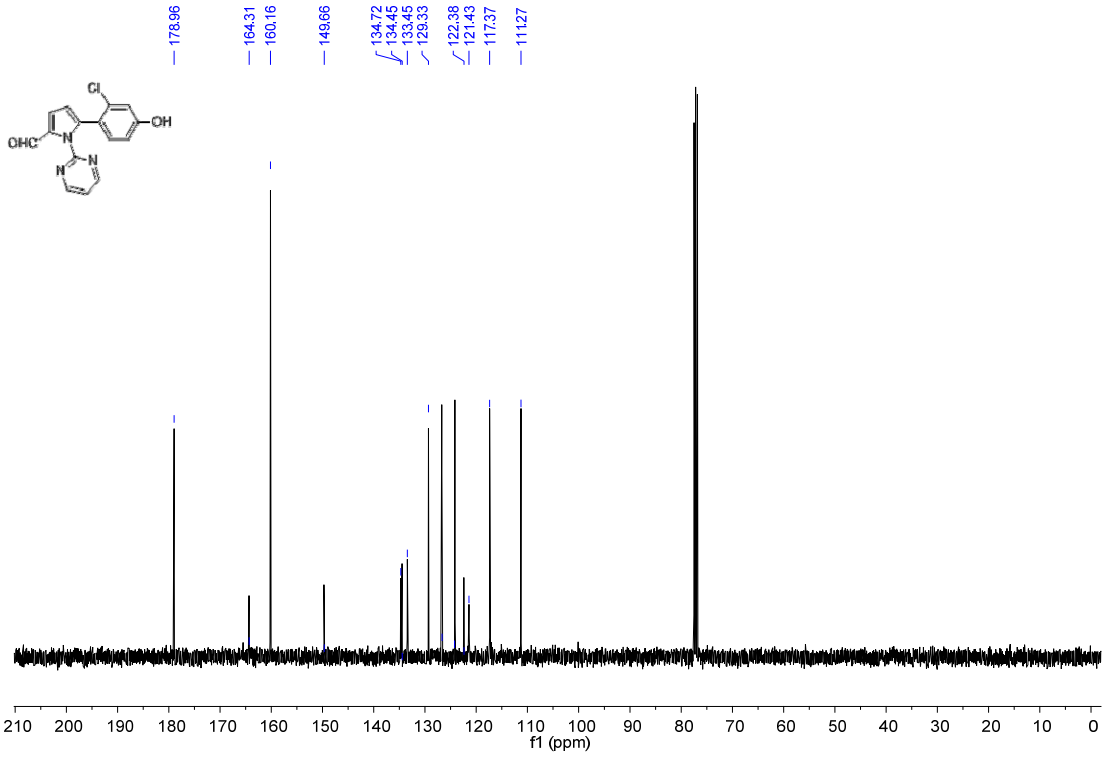
7.47
7.46
7.23
6.86
6.84
6.61
6.47
3.00
2.98
2.97
2.43
2.42
2.07
2.05
2.04
Cl
OH
O
N
N
N
2.00
0.99
0.97
0.99
0.99
0.98
2.00
2.00
2.04
10.5 10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)


193.37
158.57
156.61
154.91
145.26
132.37
132.11
131.28
120.93
119.82
119.05
114.56
107.20
37.46
23.68
23.41
Cl
OH
O
N
N
N
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)


10.22
9.47
8.57
8.56
7.67
7.64
7.29
7.08
6.67
Cl
OH
OHC
N
N
1.01
1.00
2.02
0.99
1.97
1.00
1.00
0.99
12.5 11.5 10.5 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)


178.96
164.31
160.16
149.66
134.72
134.45
133.45
129.33
122.38
121.43
117.37
111.27
Cl
OH
OHC
N
N
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

## 6. Reference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