*Supporting Information*

# C–H heteroarylation of aromatics *via* catalyst free $S_N2'$ coupling cycloaromatization

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# 1. General information

All reactions were carried out under the argon atmosphere with magnetic stirring unless otherwise noted. Reagents were purchased from commercial sources. $TsN_3$ was 75% w/w in ethyl acetate solution. All solvents were dried or distilled prior to use. DCM was distilled over $CaH_2$, THF was distilled over Na/benzophenone and PhMe was distilled over Na. Glassware was dried in an oven before use. All new compounds were characterized by NMR spectroscopy, IR spectroscopy, high-resolution mass spectroscopy (HRMS).

$^1H$ and $^{13}C$ NMR spectra were recorded on Bruker 500 spectrometer ($^1H$ at 500 MHz and $^{13}C$ at 126 MHz) and Bruker 400 spectrometer ($^1H$ at 400 MHz and $^{13}C$ at 100 MHz). Chemical shifts for $^1H$ NMR spectra are reported as δ in units of parts per million (ppm) downfield from $SiMe_4$ (δ 0.00) and relative to the signal of $SiMe_4$ (δ 0.00 singlet). $^1H$ NMR splitting patterns are designated as singlet (s), doublet (d), triplet (t), quartet (q), multiplets (m), doublet of doublet (dd). Coupling constants are reported as a *J* value in Hz. $^{13}C$ NMR spectra are reported as δ in units of parts per million (ppm) downfield from $SiMe_4$ (δ 0.00) and relative to the signal of chloroform-*d* (δ 77.00 triplet).$^{13}C$ NMR spectra were recorded on the same spectrometer with complete proton decoupling.

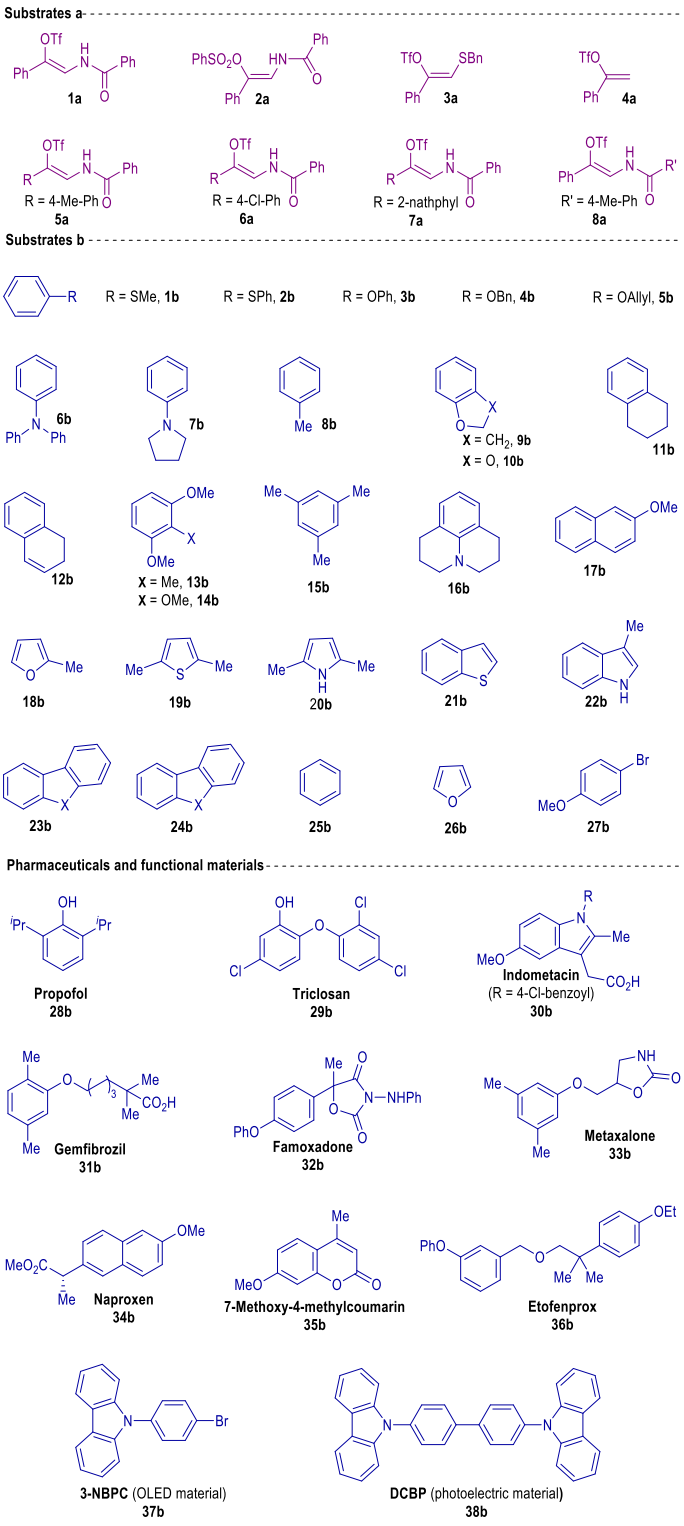
Infrared (IR) spectra were measured on Thermofisher Nicolet iN10 FM-IR spectrometer using KBr plates.

High resolution mass spectral analysis (HRMS) was recorded on a FT-ICR (Fourier transform ion cyclotron resonance) mass spectrometer by using electrospray ionization (ESI) techniques.

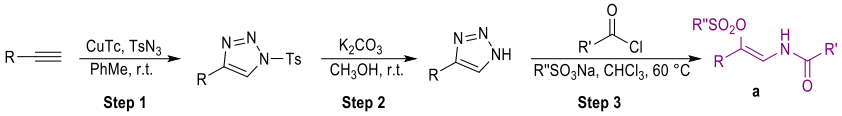
Column chromatographic was performed on 200-300 mesh silica gel and reactions were monitored by thin layer chromatography (TLC) using silica gel GF254 plates. Visualisation was by ultraviolet fluorescene (λ = 254 nm) and staining with the solution of phosphomolybdic acid in EtOH.

## 2. Preparation of substrates 1a–8a

Substrates **1a**[1], **2a**[1], **3a**[2], **4a**[3], **5a**–**8a**[1] were synthesized according to literatures. All acyl halides, sodium sulfonates, sulfonyl azides, terminal alkynes, aldehydes and arenes were commercially available. All structure of substrates as below in the figure.



Syntheses of (*Z*)-*β*-sulfonyl substituted enamides **1a**, **2a**, **5a**–**8a**

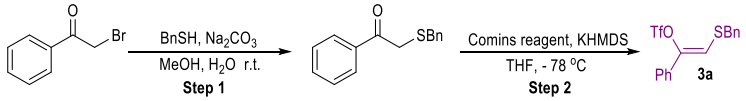



**Step 1**: Copper(I) thiophene-2-carboxylate hydrate (CuTc) (1.0 mmol, 0.1 equiv.) was added to PhMe (40.0 mL) in a 100.0 mL two-necked flask. Then terminal alkynes (10.0 mmol) and $TsN_3$ (11.0 mmol) were slowly injected into the flask. The reaction was stirred at room temperature (r.t.) for one day. After terminal alkynes were completely reacted (monitored by TLC). The reaction mixture was filtered to remove inorganic compound, the solvent was dried over and recrystallized to get *N*1-sulfonyl-1,2,3-triazoles.

**Step 2:** The resulting *N*1-sulfonyl-1,2,3-triazoles were added to $CH_3OH$ (40.0 mL) in a 100 mL round bottomed flask, and $K_2CO_3$ (50.0 mg) was added into the flask, then the reaction was stirred at room temperature for 2.0 h (monitored by TLC). The organic solvent was removed and the residue was directly purified by flash column chromatography (PE : EA = 5:1) to afford N1-H-1,2,3,-triazoles.

**Step 3**: Under argon, N1-H-1,2,3-triazoles (10.0 mmol, 1.0 equiv.) and sodium sulfonates (10.0 mmol, 1.0 equiv.) in $CHCl_3$ (30 mL) were added into a 100 mL two-necked round bottomed flask, then acyl halides (20.0 mmol, 2.0 equiv.) were added. The mixture was stirred at 60 °C in oil bath for 16.0 h. After N1-H-1,2,3-triazoles have been completely reacted, the reaction was cooled to the room temperature. Then the solvent was removed under vacuo, the crude product was directly purified by column chromatography (PE : EA = 50 : 1) to get the desired products **1a**[1], **2a**[1], **5a**–**8a** [1].

Synthesis of (*Z*)-2-(benzylthio)-1-phenylvinyl triflate **3a**

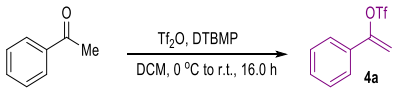



**Step 1**: Benzyl thioalcohol (2.0 mmol, 1.0 equiv.) was added dropwise to a stirred solution of *α*-bromoacetophenone (2.2 mmol, 1.1 equiv.) and sodium carbonate (4.0 mmol, 2.0 equiv.) in methanol (10.0 mL) and water (10.0 mL) and stirred for 1.0 h.

Then, the reaction mixture was poured into 10.0 mL of cold 1 M HCl. The product was filtered under vacuum and washed with 10.0 mL ice-cold methanol and 10.0 mL water. Recrystallisation from methanol and filtration gave compound 2-(benzylthio)-1-phenylethan-1-one.

**Step 2**: The solution of recrystallizd product (1.0 mmol, 1.0 equiv.) in dry THF (5 mL) was added KHMDS (1.1 mmol, 1.1 equiv.) at –78 ºC, and the mixture was stirred at the same temperature for 0.5 h. The solution was added Comins reagent (N-(5-chloro-2-pyridyl) triflimide) (1.1 mmol, 1.1 equiv.) which was dissolved in dry THF (2.0 mL) at –78 ºC, and the mixture was then stirred at the same temperature for additional 3.0 h. The reaction was quenched by saturated aqueous solution of $NH_4Cl$ (5.0 mL), and the mixture was extracted with $Et_2O$ (3 x 10.0 mL). The combined organic extracts were concentrated under vacuo, and the crude product was directly purified by column chromatography (PE : EA = 10 : 1) to get the desired product **3a**[2].

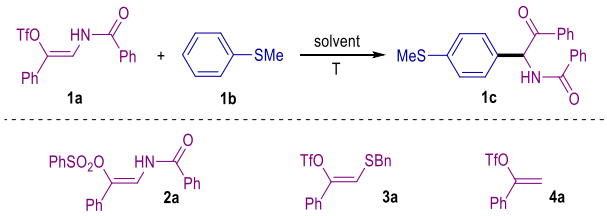
Synthesis of 1-phenylvinyl triflate **4a**




The solution of acetophenone (5.0 mmol, 1.0 equiv.) in dichloromethane (15.0 mL) was cooled to 0 ºC and then 2,6-di-tert-butyl-4-methylpyridine (DTBMP) (5.5 mmol, 1.1 equiv.) and trifluoromethanesulfonic anhydride (6.0 mmol, 1.2 equiv.) were added to the mixture. The reaction was warmed to the room temperature, stirred overnight, and the solvent was evaporated under vacuum. Petroleum ether was added and the solid pyridinium triflate was filtered off (the residue base can be recovered) which was washed with petroleum ether. The combined petroleum ether solution was washed subsequently with cool HCl (1 M) and saturated brine, and dried over with anhydrous sodium sulfate. The combined organic extracts were concentrated under vacuo, and the crude product was directly purified by column chromatography (PE : EA = 30 : 1) to get the desired product **4a**[3].

## 3. Conditions optimization

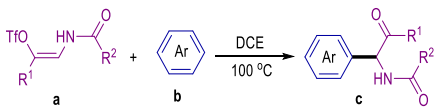
The condition optimization of aryl-substituted *aza*-1,4-dicarbonyl product **1c**[a,b]




| entry | substrate **a** | solvent | **1b** (Equiv.) | T (°C) | yield (%) |
|---|---|---|---|---|---|
| 1 | **1a** | Hexane | 2.0 | 100 | 33 |
| 2 | **1a** | $CHCl_3$ | 2.0 | 100 | 55 |
| **3** | **1a** | **DCE** | **2.0** | **100** | **83** |
| 4 | **1a** | THF | 2.0 | 100 | 28 |
| 5 | **1a** | Dioxane | 2.0 | 100 | 30 |
| 6 | **1a** | DCE | 2.0 | 80 | 52 |
| 7 | **1a** | DCE | 2.0 | 120 | 75 |
| 8 | **1a** | DCE | 1.1 | 100 | 58 |
| 9 | **1a** | DCE | 1.5 | 100 | 75 |
| 10 | **1a** | DCE | 2.5 | 100 | 82 |
| 11 | **2a** | DCE | 2.0 | 100 | N.R. |
| 12 | **3a** | DCE | 2.0 | 100 | N.R. |
| 13 | **4a** | DCE | 2.0 | 100 | N.D. |

[a]All reactions of **a** (0.1 mmol, 1.0 equiv.) and **1b** were carried out in 1.0 mL solvent for 10.0 h under air atmosphere in Schlenk tube, and the reaction was heated by oil bath. [b]Isolated yields. N.R. = No reaction. N.D. = Not detected.

### 3.1 The synthesis of 1c–42c *via* $S_N2'$ reaction



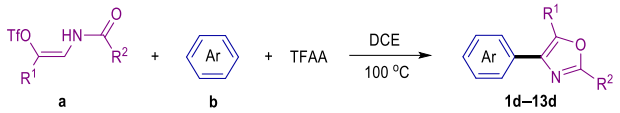

**Procedure A**: The solution of substrates **a** (0.1 mmol, 1.0 equiv.) and aromatics **b** (0.2 mmol, 2.0 equiv.) in DCE (1.0 mL) was added into a Schlenk tube (10.0 mL), then the reaction was stirred at 100 °C in oil bath for 10.0 h. Then, the reaction was cooled to the room temperature. The solvent was concentrated under *vacuo*, and the crude product was purified by column chromatography to get the desired products **1c–42c**.

**NOTE 1:** Toluene **8b,** benzene **25b** and furan **26b** (1.0 mL) were used as substrate and

solvent under the same condition to get the corresponding product **8c, 25c and 26c**.

**NOTE 2:** For the late-stage modification of pharmaceuticals (**32c–40c**) and functional materials (**41c** and **42c**), the procedure is consistent with the procedure A.

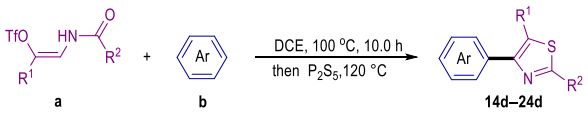
**3.2** The synthesis of aryl-oxazoles 1d–13d




**Procedure B**: The solution of substrates **a** (0.1 mmol, 1.0 equiv.), aromatics **b** (0.2 mmol, 2.0 equiv.) and trifluoroacetic anhydride (0.11 mmol, 1.1 equiv.) in DCE (1.0 mL) was added into a Schlenk tube (10.0 mL), then the reaction was stirred at 100 °C in oil bath for 12.0 h. Then, the reaction was cooled to the room temperature and was concentrated under *vacuo*, and the crude product was purified by column chromatography to get the desired products **1d–13d**.

**NOTE:** Toluene **8b** (1.0 mL) was used as substrate and solvent under the same condition to get the corresponding product **1d**.

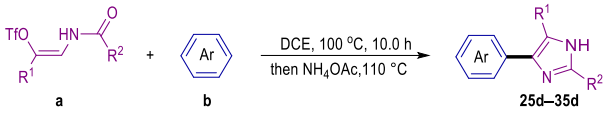
3.3 The synthesis of aryl-thiazoles 14d–24d




**Procedure C**: The solution of substrates **1a** (0.1 mmol, 1.0 equiv.) and aromatics **b** (0.2 mmol, 2.0 equiv.) in DCE (1.0 mL) was added into a Schlenk tube (10.0 mL), then the reaction was stirred at 100 °C in oil bath for 10.0 h. Then the reaction mixture was cooled to room temperature and phosphorus pentasulfide (0.3 mmol, 3.0 equiv.) was added. The resulting reaction system was stirred at 120 °C in oil bath for 12.0 h once again. Finally, the reaction was cooled to the room temperature and the solvent was removed under *vacuo*, and the crude product was purified by column chromatography to get the desired products **14d–24d**.

**NOTE:** Toluene **8b** (1.0 mL) was used as substrate and solvent under the same condition to get the corresponding product **14d**.

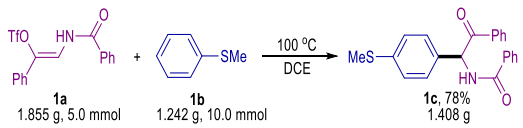
### 3.4 The synthesis of aryl-imidazoles 25d–35d




**Procedure D**: The solution of substrates **1a** (0.1 mmol, 1.0 equiv.) and arenes **b** (0.2 mmol, 2.0 equiv.) in DCE (1.0 mL) was added into a Schlenk tube (10.0 mL), then the reaction was stirred at 100 °C in oil bath for 10.0 h. Then the reaction mixture was cooled to room temperature and ammonium acetate (0.3 mmol, 3.0 equiv.) was added. The resulting reaction system was stirred at 110 °C in oil bath for 10.0 h once again. Finally, the reaction was cooled to the room temperature and the solvent was removed under *vacuo*, and the crude product was purified by column chromatography to get the desired products **25d–35d**.

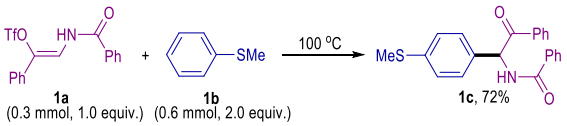
**NOTE:** Toluene **8b** (1.0 mL) was used as substrate and solvent under the same condition to get the corresponding product **25d**.

## 4. Gram-scale reaction




According to the procedure A, the gram-scale reaction of **1a** (1.855 g, 5.0 mmol, 1.0 equiv.) and **1b** (1.242 g, 10.0 mmol) was performed to get desired product **1c** (1.408 g) in 78% yield.

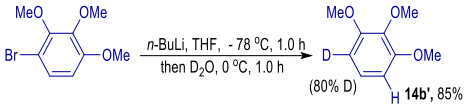
## 5. Solvent free reaction



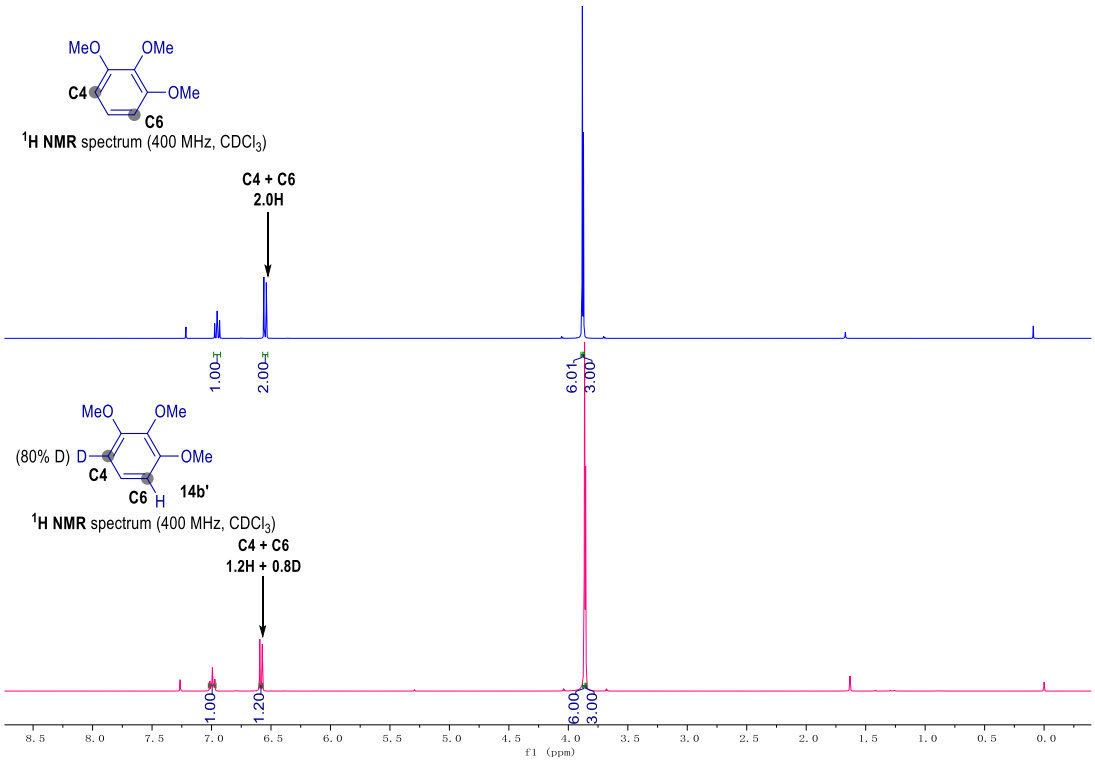
The substrate **1a** (0.3 mmol, 1.0 equiv.) and thioanisole **1b** (0.6 mmol, 2.0 equiv.) were added into a Schlenk tube (10.0 mL). The reaction was stirred at 100 ºC in oil bath for 10.0 h. Then, the reaction was cooled to the room temperature. The residue thioanisole was removed under *vacuo*, and the crude product was purified by column chromatography (PE : EA = 7:1) to get desired product **1c** (78.2 mg) in 72% yield.

## 6. Mechanistic study

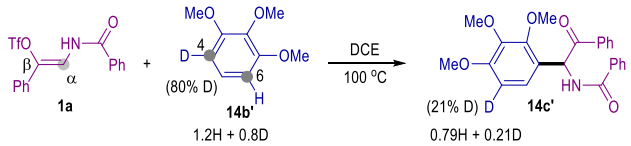
6.1 The preparation of **deuterated substrate 14b'**



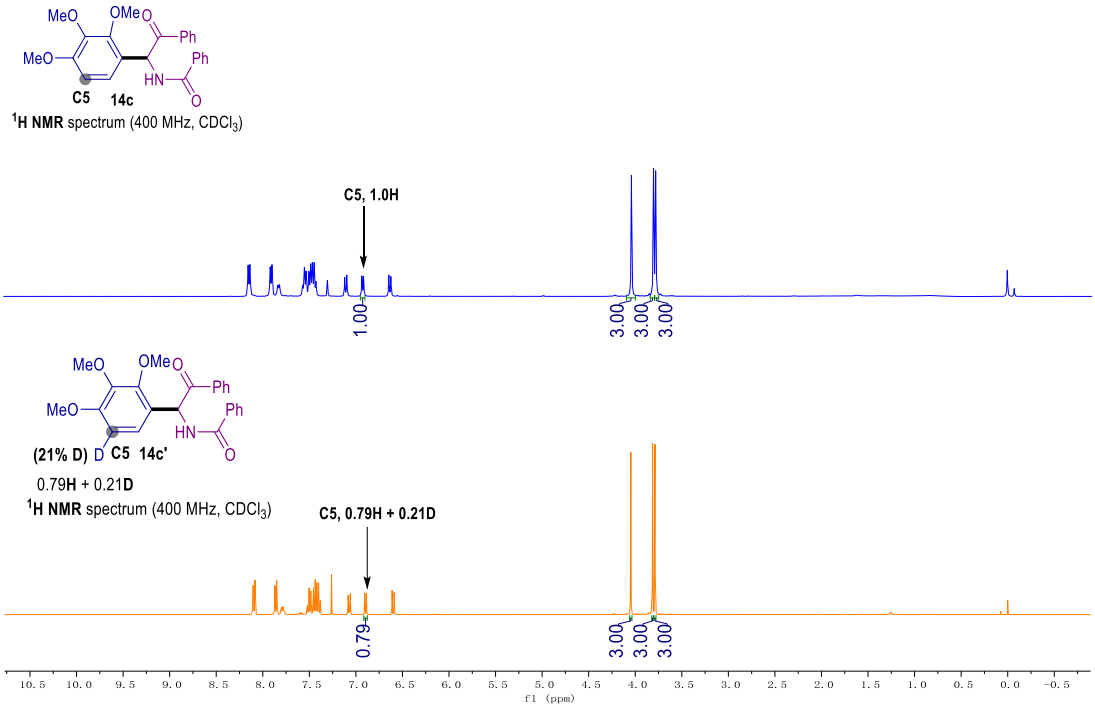

1-Bromo-2,3,4-trimethoxybenzene (2.0 mmol, 1.0 equiv.) was added to THF (10.0 mL) with a 50.0 mL two-necked flask under argon atmosphere. Then *n*-BuLi (2.2 mmol, 1.1 equiv.) was added dropwise at –78 ºC. The resulting mixture was stirred at –78 ºC for 1.0 h, and $D_2O$ (1.0 mL) was added dropwise. The mixture was stirred at 0 ºC for 1.0 h, and 10 mL of water was added. Then the aqueous layer was extracted with ethyl acetate (3 x 10.0 mL). The combined organic extracts were washed with brine, dried over anhydrous sodium sulfate, filtered, and concentrated under vacuo, the crude product was directly purified by column chromatography (PE : EA = 50 : 1) to afford deuterated product **14b'** (85% yield, 80% D).




## 6.2 KIE experiment

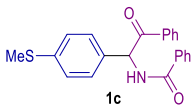



The reaction of **1a** (0.1 mmol, 1.0 equiv.) and **14b'** (0.2 mmol, 2.0 equiv.) was performed under our standard reaction condition. For the calculation of the KIE value, the H/D ratio was determined by NMR spectroscopy. The control experiment shown that the H/D ratio of product **14c'** (0.79H/0.21D) is higher than 0.6H/0.4D, namely deuterium atom has a higher reaction rate than hydrogen atom. This result exhibited an inverse ($k_H/k_D < 1$) KIE and strongly correspond with the $S_N2'$ mechanism.



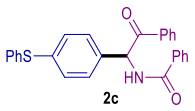

## 7. Characterization data for key compounds

N-(1-(4-(methylthio)phenyl)-2-oxo-2-phenylethyl)benzamide (**1c**)




According to procedure A, the title product **1c** (30.0 mg) was isolated by column chromatography (PE : EA = 7:1) as a yellow amorphous solid in 83% yield. **$^1$H NMR (400 MHz, CDCl$_3$)** δ 8.01 (d, *J* = 7.2 Hz, 2H), 7.84 (d, *J* = 7.2 Hz, 2H), 7.75 (d, *J* = 6.8 Hz, 1H), 7.57 – 7.49 (m, 2H), 7.46 – 7.38 (m, 6H), 7.18 (d, *J* = 8.4 Hz, 2H), 6.70 (d, *J* = 6.8 Hz, 1H), 2.42(s, 3H); **$^{13}$C NMR (100 MHz, CDCl$_3$)** δ 195.7, 166.4, 139.2, 134.3, 134.0, 133.9, 133.9, 131.7, 129.2, 128.8, 128.8, 128.6, 127.2, 127.0, 58.5, 15.5; **IR(cm$^{-1}$)**: ν 3414, 2919, 1688, 1654, 1480, 1447, 1246, 1094; **HRMS**: m/z: $[M+H]^+$ calculated for $C_{22}H_{20}NO_2S^+$, 362.1209, found 362.1205.

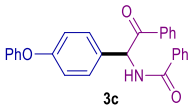
N-(2-oxo-2-phenyl-1-(4-(phenylthio)phenyl)ethyl)benzamide (**2c**)




According to procedure A, the title product **2c** (31.8 mg) was isolated by column chromatography (PE : EA = 10:1) as a yellow amorphous solid in 75% yield. **$^1$H NMR (400 MHz, CDCl$_3$)** δ 8.01 (d, *J* = 7.2 Hz, 2H), 7.85 (d, *J* = 7.2 Hz, 2H), 7.77 (d, *J* = 7.2 Hz, 1H), 7.58 – 7.49 (m, 3H), 7.46 – 7.42

(m, 5H), 7.39 – 7.34 (m, 3H), 7.29 (d, $J$ = 7.2 Hz, 2H), 7.19 (d, $J$ = 8.0 Hz, 2H), 6.71 (d, $J$ = 7.2 Hz, 1H); **$^{13}$C NMR (100 MHz, CDCl$_3$)** δ 195.6, 166.4, 137.4, 135.5, 134.2, 134.0, 133.9, 132.4, 131.8, 130.2, 129.3, 129.2, 129.0, 128.8, 128.6, 128.5, 127.8, 127.2, 58.4; **IR (cm$^{-1}$)**: ν 3407, 3058, 1686, 1650, 1512, 1477, 1447, 1178; **HRMS**: m/z: $[M+H]^+$ calculated for $C_{27}H_{22}NO_2S^+$, 424.1365, found 424.1361.

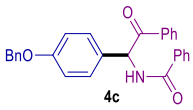
N-(2-oxo-1-(4-phenoxyphenyl)-2-phenylethyl)benzamide (**3c**)



3c

According to procedure A, the title product **3c** (29.4 mg) was isolated by column chromatography (PE : EA = 10:1) as a white amorphous solid in 72% yield. **$^1$H NMR (400 MHz, CDCl$_3$)** δ 8.03 (d, $J$ = 7.2 Hz, 2H), 7.86 (d, $J$ = 7.2 Hz, 2H), 7.81 (d, $J$ = 6.8 Hz, 1H), 7.56 – 7.48 (m, 2H), 7.45 – 7.41 (m, 6H), 7.29 (t, $J$ = 8.0 Hz, 2H), 7.09 (t, $J$ = 7.2 Hz, 1H), 6.97 – 6.90 (m, 4H), 6.75 (d, $J$ = 6.8 Hz, 1H); **$^{13}$C NMR (100 MHz, CDCl$_3$)** δ 195.8, 166.4, 157.6, 156.3, 134.2, 133.9, 133.8, 131.7, 131.6, 130.0, 129.7, 129.2, 128.7, 128.5, 127.1, 123.7, 119.4, 118.9, 58.2; **IR (cm$^{-1}$)**: ν 3374, 1683, 1646, 1588, 1504, 1447, 1350, 1243, 1169; **HRMS**: m/z: $[M+H]^+$ calculated for $C_{27}H_{22}NO_3^+$, 408.1594, found 408.1586.

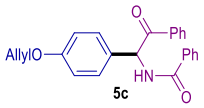
N-(1-(4-(benzyloxy)phenyl)-2-oxo-2-phenylethyl)benzamide (**4c**)



4c

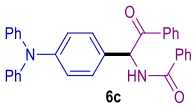
According to procedure A, the title product **4c** (29.5 mg) was isolated by column chromatography (PE : EA = 10:1) as a white amorphous solid in 70% yield. **$^1$H NMR (400 MHz, CDCl$_3$)** δ 8.02 (d, $J$ = 7.2 Hz, 2H), 7.85 (d, $J$ = 7.2 Hz, 2H), 7.72 (d, $J$ = 7.2 Hz, 1H), 7.55 – 7.48 (m, 2H), 7.45 – 7.40 (m, 5H), 7.39 – 7.29 (m, 6H), 6.92 (d, $J$ = 8.8 Hz, 2H), 6.70 (d, $J$ = 7.2 Hz, 1H), 4.98 (s, 2H); **$^{13}$C NMR (100 MHz, CDCl$_3$)** δ 195.9, 166.3, 158.8, 136.6, 134.3, 134.0, 133.8, 131.7, 129.6, 129.5, 129.2, 128.7, 128.6, 128.5, 128.0, 127.4, 127.1, 115.5, 70.0, 58.3; **IR (cm$^{-1}$)**: ν 3411, 3061, 2925, 1686, 1654, 1508, 1480, 1244, 1177; **HRMS**: m/z: $[M+H]^+$ calculated for $C_{28}H_{24}NO_3^+$, 422.1740, found 422.1750.

N-(1-(4-(allyloxy)phenyl)-2-oxo-2-phenylethyl)benzamide (**5c**)



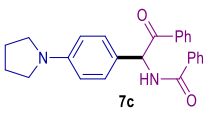

According to procedure A, the title product **5c** (25.2 mg) was isolated by column chromatography (PE : EA = 10:1) as a white amorphous solid in 68% yield. **$^1$H NMR (400 MHz, CDCl$_3$)** δ 8.02 (d, *J* = 7.2 Hz, 2H), 7.85 (d, *J* = 7.2 Hz, 2H), 7.71 (d, *J* = 6.4 Hz, 1H), 7.55 – 7.49 (m, 2H), 7.45 – 7.38 (m, 6H), 6.85 (d, *J* = 8.8 Hz, 2H), 6.70 (d, *J* = 7.2 Hz, 1H), 6.04 – 5.95 (m, 1H), 5.36 (d, *J* = 17.2 Hz, 1H), 5.25 (d, *J* = 10.4 Hz, 1H), 4.46 (d, *J* = 5.2 Hz, 2H); **$^{13}$C NMR (100 MHz, CDCl$_3$)** δ 195.9, 166.3, 158.6, 134.3, 134.0, 133.8, 133.0, 131.7, 129.6, 129.4, 129.2, 129.1, 128.7, 128.5, 127.1, 117.8, 115.4, 68.8, 58.3; **IR (cm$^{-1}$)**: ν 3411, 3062, 2922, 1650, 1508, 1482, 1244, 1108; **HRMS**: m/z: $[M+H]^+$ calculated for $C_{24}H_{22}NO_3^+$, 372.1594, found 372.1584.

N-(1-(4-(diphenylamino)phenyl)-2-oxo-2-phenylethyl)benzamide (**6c**)




According to procedure A, the title product **6c** (35.2 mg) was isolated by column chromatography (PE : EA = 7:1) as a white amorphous solid in 73% yield. **$^1$H NMR (400 MHz, CDCl$_3$)** δ 8.06 (d, *J* = 7.2 Hz, 2H), 7.87 (d, *J* = 7.2 Hz, 2H), 7.70 (d, *J* = 7.2 Hz, 1H), 7.59 – 7.43 (m, 6H), 7.30 (d, *J* = 8.0 Hz, 2H) , 7.22 (t, *J* = 8.0 Hz, 4H), 7.04 – 6.96 (m, 8H), 6.70 (d, *J* = 7.2 Hz, 1H); **$^{13}$C NMR (100 MHz, CDCl$_3$)** δ 195.8, 166.3, 147.9, 147.3, 134.4, 134.0, 133.8, 131.7, 130.1, 129.3, 129.2, 129.1, 128.8, 128.6, 127.2, 124.9, 123.3, 123.0, 58.2; **IR (cm$^{-1}$)**: ν 3415, 3060, 1655, 1594, 1507, 1490, 1273, 696; **HRMS**: m/z: $[M+Na]^+$ calculated for $C_{33}H_{26}N_2NaO_2^+$, 505.1887, found 505.1890.

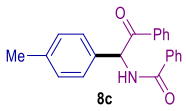
N-(2-oxo-2-phenyl-1-(4-(pyrrolidin-1-yl)phenyl)ethyl)benzamide (**7c**)




According to procedure A, the title product **7c** (30.0 mg) was isolated by column chromatography (PE : EA = 7:1) as a white amorphous solid in 78% yield. **$^1$H NMR (400 MHz, CDCl$_3$)** δ 8.03 (d, *J* = 8.0 Hz, 2H), 7.84 (d, *J* = 7.2 Hz, 2H), 7.62 (d, *J* = 7.2 Hz, 1H), 7.51 – 7.45 (m, 2H), 7.43 – 7.37 (m, 4H), 7.31 (d, *J* = 8.0 Hz, 2H), 6.66 (d, *J* = 7.2 Hz, 1H), 6.48 (d, *J* = 8.0 Hz, 2H), 3.20 (t, *J* = 6.0 Hz, 4H), 1.95 – 1.92 (m, 4H); **$^{13}$C NMR (100 MHz, CDCl$_3$)** δ

196.0, 166.3, 147.7, 134.6, 134.2, 133.4, 131.5, 129.3, 129.1, 128.6, 128.4, 127.1, 123.1, 112.0, 58.6, 47.4, 25.4; **IR (cm$^{-1}$)**: ν 3411, 3326, 3060, 2964, 1686, 1611, 1521, 1178; **HRMS**: m/z: $[M+H]^+$ calculated for $C_{25}H_{25}N_2O_2^+$, 385.1911, found 385.1918.

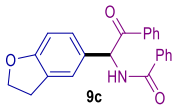
N-(2-oxo-2-phenyl-1-(p-tolyl)ethyl)benzamide (**8c**)



8c

According to procedure A, the title product **8c** (32.2 mg) was isolated by column chromatography (PE : EA = 15:1) as a white amorphous solid in 98% yield. **$^1$H NMR (400 MHz, CDCl$_3$)** δ 8.02 (d, *J* = 7.2 Hz, 2H), 7.84 (d, *J* = 7.2 Hz, 2H), 7.71 (d, *J* = 6.8 Hz, 1H), 7.55 – 7.48 (m, 2H), 7.45 – 7.40 (m, 4H), 7.37 (d, *J* = 8.0 Hz, 2H), 7.13 (d, *J* = 8.0 Hz, 2H), 6.72 (d, *J* = 6.8 Hz, 1H), 2.27 (s, 3H); **$^{13}$C NMR (100 MHz, CDCl$_3$)** δ 196.0, 166.3, 138.3, 134.4, 134.3, 134.1, 133.8, 131.6, 129.9, 129.2, 128.7, 128.5, 128.2, 127.2, 58.7, 21.1; **IR (cm$^{-1}$)**: ν 3328, 3057, 2922, 1682, 1638, 1579, 1513, 1353; **HRMS**: m/z: $[M+H]^+$ calculated for $C_{22}H_{20}NO_2^+$, 330.1488, found 330.1481.

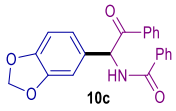
N-(1-(2,3-dihydrobenzofuran-5-yl)-2-oxo-2-phenylethyl)benzamide (**9c**)



9c

According to procedure A, the title product **9c** (29.7 mg) was isolated by column chromatography (PE : EA = 7:1) as a white amorphous solid in 83% yield. **$^1$H NMR (400 MHz, CDCl$_3$)** δ 8.03 (d, *J* = 7.2 Hz, 2H), 7.85 (d, *J* = 7.2 Hz, 2H), 7.72 (d, *J* = 6.8 Hz, 1H), 7.56 – 7.49 (m, 2H), 7.46 – 7.42 (m, 4H), 7.32 (s, 1H), 7.21 (d, *J* = 7.2 Hz, 1H), 6.72 – 6.67 (m, 2H), 4.52 (t, *J* = 8.8 Hz, 2H), 3.15 (t, *J* = 8.8 Hz, 2H); **$^{13}$C NMR (100 MHz, CDCl$_3$)** δ 195.9, 166.3, 160.3, 134.3, 134.0, 133.7, 131.7, 129.2, 129.1, 128.7, 128.5, 128.4, 128.2, 127.1, 125.0, 109.8, 71.4, 58.5, 29.5; **IR (cm$^{-1}$)**: ν 3407, 3059, 2918, 1689, 1642, 1483, 1447, 1240; **HRMS**: m/z: $[M+H]^+$ calculated for $C_{23}H_{20}NO_3^+$, 358.1437, found 358.1433.

N-(1-(benzo[d][1,3]dioxol-5-yl)-2-oxo-2-phenylethyl)benzamide (**10c**)

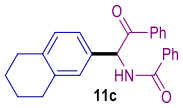


10c

According to procedure A, the title product **10c** (32.0 mg) was isolated by column chromatography (PE : EA = 7:1) as a white amorphous solid

in 89% yield. **$^1$H NMR (400 MHz, $CDCl_3$)** δ 8.02 (d, *J* = 7.2 Hz, 2H), 7.85 (d, *J* = 7.2 Hz, 2H), 7.72 (d, *J* = 7.2 Hz, 1H), 7.57 – 7.49 (m, 2H), 7.44 (t, *J* = 8.0 Hz, 4H), 7.00 – 6.95 (m, 2H), 6.74 (d, *J* = 8.0 Hz, 1H), 6.65 (d, *J* = 7.2 Hz, 1H), 5.90 (d, *J* = 7.2 Hz, 2H); **$^{13}$C NMR (100 MHz, $CDCl_3$)** δ 195.6, 166.3, 148.2, 147.7, 134.2, 133.9, 131.7, 130.9, 129.1, 128.8, 128.7, 128.6, 127.1, 122.2, 108.9, 108.6, 101.3, 58.5; **IR (cm$^{-1}$)**: ν 3408, 2921, 1687, 1650, 1485, 1445, 1345, 1250, 1038, 694; **HRMS**: m/z: $[M+H]^+$ calculated for $C_{22}H_{18}NO_4^+$, 360.1230, found 360.1220.

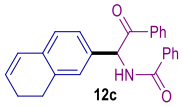
N-(2-oxo-2-phenyl-1-(5,6,7,8-tetrahydronaphthalen-2-yl)ethyl)benzamide (**11c**)



11c

According to procedure A, the title product **11c** (22.9 mg) was isolated by column chromatography (PE : EA = 10:1) as a white amorphous solid in 62% yield. **$^1$H NMR (400 MHz, $CDCl_3$)** δ 8.04 (d, *J* = 7.2 Hz, 2H), 7.84 (d, *J* = 7.2 Hz, 2H), 7.65 (d, *J* = 7.2 Hz, 1H), 7.55 – 7.48 (m, 2H), 7.43 (t, *J* = 8.0 Hz, 4H), 7.20 – 7.15 (m, 2H), 7.00 (d, *J* = 8.0 Hz, 1H), 6.69 (d, *J* = 7.2 Hz, 1H), 2.70 – 2.68 (m, 4H), 1.74 – 1.71 (m, 4H); **$^{13}$C NMR (100 MHz, $CDCl_3$)** δ 196.0, 166.3, 138.2, 137.6, 134.5, 134.1, 133.7, 131.6, 130.7, 130.0, 129.2, 128.8, 128.7, 128.5, 127.2, 125.4, 58.7, 29.3, 29.1, 23.0, 22.9; **IR (cm$^{-1}$)**: ν 3411, 3059, 2927, 2856, 1650, 1512, 1481, 1259, 689; **HRMS**: m/z: $[M+H]^+$ calculated for $C_{25}H_{24}NO_2^+$, 370.1801, found 370.1791.

N-(1-(7,8-dihydronaphthalen-2-yl)-2-oxo-2-phenylethyl)benzamide (**12c**)

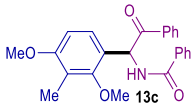


12c

According to procedure A, the title product **12c** (30.1 mg) was isolated by column chromatography (PE : EA = 10:1) as a white amorphous solid in 82% yield. **$^1$H NMR (400 MHz, $CDCl_3$)** δ 8.09 (d, *J* = 7.2 Hz, 2H), 7.88 (d, *J* = 7.2 Hz, 2H), 7.58 (t, *J* = 7.2 Hz, 2H), 7.52 – 7.44 (m, 5H), 7.12 – 7.07 (m, 2H), 7.04 – 7.00 (m, 2H), 6.67 (s, 1H), 6.39 (d, *J* = 7.2 Hz, 1H), 2.82 – 2.67 (m, 2H), 2.45 – 2.26 (m, 2H); **$^{13}$C NMR (100 MHz, $CDCl_3$)** δ 196.1, 166.7, 135.8, 134.6, 134.5, 134.0, 133.4, 131.8, 130.1, 129.0, 128.9, 128.8, 128.6, 127.6, 127.2, 127.1, 126.6, 126.5, 59.8, 27.9, 24.2; **IR (cm$^{-1}$)**: ν 3319, 3060, 2928, 2831, 1646, 1482, 1248, 1107,

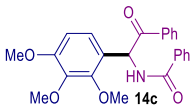
757; **HRMS**: m/z: $[M+H]^+$ calculated for $C_{25}H_{22}NO_2^+$, 368.1645, found 368.1641.

N-(1-(2,4-dimethoxy-3-methylphenyl)-2-oxo-2-phenylethyl)benzamide (**13c**)



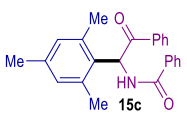

According to procedure A, the title product **13c** (31.6 mg) was isolated by column chromatography (PE : EA = 7:1) as a white amorphous solid in 81% yield. **$^1$H NMR (400 MHz, $CDCl_3$)** δ 8.11 (d, *J* = 7.2 Hz, 2H), 7.86 (d, *J* = 7.2 Hz, 2H), 7.70 (d, *J* = 6.8 Hz, 1H), 7.48 (d, *J* = 7.2 Hz, 2H), 7.44 – 7.37 (m, 4H), 7.18 (d, *J* = 8.8 Hz, 1H), 6.97 (d, *J* = 7.2 Hz, 1H), 6.57 (d, *J* = 8.8 Hz, 1H), 3.96 (s, 3H), 3.74 (s, 3H), 2.14 (s, 3H); **$^{13}$C NMR (100 MHz, $CDCl_3$)** δ 196.2, 166.5, 159.1, 157.0, 134.4, 134.3, 133.5, 131.6, 130.1, 129.1, 128.5, 127.1, 126.4, 122.5, 120.5, 106.6, 61.5, 55.5, 54.0, 9.5; **IR ($cm^{-1}$)**: ν 3330, 2937, 2600, 1658, 1473, 1106, 1003, 798; **HRMS**: m/z: $[M+H]^+$ calculated for $C_{24}H_{24}NO_4^+$, 390.1699, found 390.1696.

N-(2-oxo-2-phenyl-1-(2,3,4-trimethoxyphenyl)ethyl)benzamide (**14c**)




According to procedure A, the title product **14c** (36.2 mg) was isolated by column chromatography (PE : EA = 5:1) as a white amorphous solid in 89% yield. **$^1$H NMR (400 MHz, $CDCl_3$)** δ 8.09 (d, *J* = 7.2 Hz, 2H), 7.86 (d, *J* = 7.2 Hz, 2H), 7.77 (d, *J* = 6.8 Hz, 1H), 7.51 (t, *J* = 7.2 Hz, 2H), 7.46 – 7.38 (m, 4H), 7.07 (d, *J* = 8.8 Hz, 1H), 6.89 (d, *J* = 7.2 Hz, 1H), 6.60 (d, *J* = 8.8 Hz, 1H), 4.05 (s, 3H), 3.81 (s, 3H), 3.79 (s, 3H); **$^{13}$C NMR (100 MHz, $CDCl_3$)** δ 195.9, 166.3, 154.0, 151.4, 142.3, 134.3, 133.5, 131.6, 129.0, 128.5, 127.1, 123.6, 123.4, 107.6, 61.3, 60.6, 55.9, 54.3; **IR ($cm^{-1}$)**: ν 3408, 2934, 1655, 1493, 1448, 1279, 1099, 798, 691; **HRMS**: m/z: $[M+H]^+$ calculated for $C_{24}H_{24}NO_5^+$, 406.1649, found 406.1632.

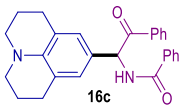
N-(1-mesityl-2-oxo-2-phenylethyl)benzamide (**15c**)




According to procedure A, the title product **15c** (27.2 mg) was isolated by column chromatography (PE : EA = 10:1) as a white amorphous solid in 76% yield. **$^1$H NMR (400 MHz, $CDCl_3$)** δ 7.86 (d, *J* = 7.2 Hz,

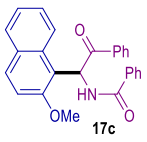
2H), 7.79 (d, *J* = 7.2 Hz, 2H), 7.57 (d, *J* = 6.8 Hz, 1H), 7.50 – 7.42 (m, 4H), 7.34 (t, *J* = 8.0 Hz, 2H), 6.83 (s, 2H), 6.66 (d, *J* = 6.8 Hz, 1H), 2.50 (s, 6H), 2.21 (s, 3H); **$^{13}$C NMR (100 MHz, CDCl$_3$)** δ 197.6, 166.7, 138.1, 137.2, 135.3, 134.2, 133.3, 131.6, 131.3, 130.7, 128.6, 128.5, 128.4, 127.2, 57.9, 20.8, 20.7; **IR (cm$^{-1}$)**: ν 3397, 2920, 1697, 1658, 1479, 1227, 852, 689, 597; **HRMS**: m/z: $[M+H]^+$ calculated for $C_{24}H_{24}NO_2^+$, 358.1801, found 358.1802.

N-(2-oxo-2-phenyl-1-(2,3,6,7-tetrahydro-1H,5H-pyrido[3,2,1-ij]quinolin-9-yl)ethyl)benzamide (**16c**)



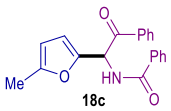

According to procedure A, the title product **16c** (29.6 mg) was isolated by column chromatography (PE : EA = 10:1) as a white amorphous solid in 72% yield. **$^1$H NMR (400 MHz, CDCl$_3$)** δ 8.05 (d, *J* = 7.2 Hz, 2H), 7.84 (d, *J* = 7.2 Hz, 2H), 7.53 – 7.46 (m, 3H), 7.42 (t, *J* = 7.2 Hz, 4H), 6.85 (s, 2H), 6.57 (d, *J* = 7.2 Hz, 1H), 3.08 (t, *J* = 5.6 Hz, 4H), 2.68 (t, *J* = 6.4 Hz, 4H), 1.92 – 1.86 (m, 4H); **$^{13}$C NMR (100 MHz, CDCl$_3$)** δ 196.1, 166.2, 142.9, 134.8, 134.2, 133.4, 131.5, 129.2, 128.6, 128.4, 127.2, 126.8, 123.0, 121.9, 58.4, 49.8, 27.6, 21.7; **IR (cm$^{-1}$)**: ν 3322, 2926, 1650, 1514, 1447, 1312, 1160, 713, 691; **HRMS**: m/z: $[M+H]^+$ calculated for $C_{27}H_{27}N_2O_2^+$, 411.2067, found 411.2064.

N-(1-(2-methoxynaphthalen-1-yl)-2-oxo-2-phenylethyl)benzamide (**17c**)



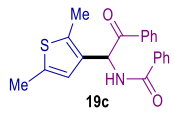

According to procedure A, the title product **17c** (24.9 mg) was isolated by column chromatography (PE : EA = 10:1) as a white amorphous solid in 63% yield. **$^1$H NMR (400 MHz, CDCl$_3$)** δ 8.56 (d, *J* = 8.0 Hz, 1H), 7.85 – 7.75 (m, 6H), 7.67 – 7.60 (m, 2H), 7.45 – 7.32 (m, 6H), 7.20 – 7.11 (m, 3H), 3.81 (s, 3H); **$^{13}$C NMR (100 MHz, CDCl$_3$)** δ 197.0, 167.0, 155.2, 134.9, 134.3, 132.8, 132.2, 131.5, 131.0, 129.6, 128.8, 128.4, 128.2, 128.1, 128.0, 127.2, 123.9, 122.9, 119.4, 113.3, 56.2, 53.5; **IR (cm$^{-1}$)**: ν 3423, 2934, 2840, 1697, 1650, 1513, 1446, 1253, 813, 709; **HRMS**: m/z: $[M+H]^+$ calculated for $C_{26}H_{22}NO_3^+$, 396.1594, found 396.1588.

N-(1-(5-methylfuran-2-yl)-2-oxo-2-phenylethyl)benzamide (**18c**)



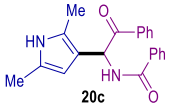

According to procedure A, the title product **18c** (25.5 mg) was isolated by column chromatography (PE : EA = 7:1) as a white amorphous solid in 80% yield. **$^1$H NMR (400 MHz, $CDCl_3$)** δ 8.13 – 8.06 (m, 3H), 7.89 (d, *J* = 7.2 Hz, 2H), 7.63 – 7.57 (m, 2H), 7.49 – 7.43 (m, 4H), 6.87 (d, *J* = 7.2 Hz,1H), 6.33 (d, *J* = 3.2 Hz, 1H), 5.88 (d, *J* = 3.2 Hz, 1H), 2.19 (s, 3H); **$^{13}$C NMR (100 MHz, $CDCl_3$)** δ 193.2, 166.4, 153.0, 147.4, 134.2, 133.9, 133.8, 131.8, 129.0, 128.7, 128.6, 127.2, 110.5, 107.0, 52.7, 13.6; **IR (cm$^{-1}$)**: ν 3425, 1693, 1601, 1580, 1517, 1483, 1449, 1223, 1024, 790; **HRMS**: m/z: $[M+H]^+$ calculated for $C_{20}H_{18}NO_3^+$, 320.1281, found 320.1282.

N-(1-(2,5-dimethylthiophen-3-yl)-2-oxo-2-phenylethyl)benzamide (**19c**)




According to procedure A, the title product **19c** (34.2 mg) was isolated by column chromatography (PE : EA = 15:1) as a white amorphous solid in 98% yield. **$^1$H NMR (400 MHz, $CDCl_3$)** δ 7.96 (d, *J* = 7.2 Hz, 2H), 7.85 (d, *J* = 7.2 Hz, 2H), 7.56 (t, *J* = 7.2 Hz, 2H), 7.50 (d, *J* = 7.2 Hz, 1H), 7.45 (t, *J* = 7.2 Hz, 4H), 6.66 (d, *J* = 7.2 Hz, 1H), 6.44 (s, 1H), 2.68 (s, 3H), 2.29 (s, 3H); **$^{13}$C NMR (100 MHz, $CDCl_3$)** δ 196.1, 166.4, 137.1, 135.5, 134.5, 133.8, 131.7, 131.4, 130.1, 128.7, 128.5, 128.4, 127.2, 124.2, 53.1, 15.1, 13.3; **IR (cm$^{-1}$)**: ν 3414, 2921, 1655, 1491, 1276, 1096, 1013, 798, 712; **HRMS**: m/z: $[M+H]^+$ calculated for $C_{21}H_{20}NO_2S^+$, 350.1209, found 350.1208.

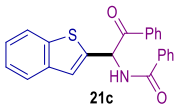
N-(1-(2,5-dimethyl-1H-pyrrol-3-yl)-2-oxo-2-phenylethyl)benzamide (**20c**)




According to procedure A, the title product **20c** (24.6 mg) was isolated by column chromatography (PE : EA = 10:1) as a white amorphous solid in 74% yield. **$^1$H NMR (400 MHz, $CDCl_3$)** δ 8.00 (d, *J* = 7.2 Hz, 2H), 7.84 (d, *J* = 7.2 Hz, 2H), 7.56 – 7.47 (m, 3H), 7.44 – 7.40 (m, 5H), 6.59 (d, *J* = 7.2 Hz, 1H), 5.66 (s, 1H), 2.43 (s, 3H), 2.11 (s, 3H); **$^{13}$C NMR (100 MHz, $CDCl_3$)** δ 196.3, 166.3, 135.0, 134.3, 133.2, 131.4, 128.8, 128.5, 128.4, 127.1, 126.3, 124.5, 114.7, 105.1,

52.1, 12.9, 11.4; **IR (cm$^{-1}$)**: ν 3313, 3060, 1686, 1642, 1513, 1482, 1447, 688; **HRMS**: m/z: $[M+Na]^+$ calculated for $C_{21}H_{20}N_2NaO_2^+$, 355.1417, found 355.1421.

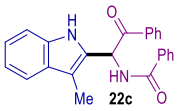
N-(1-(benzo[b]thiophen-2-yl)-2-oxo-2-phenylethyl)benzamide (**21c**)



21c

According to procedure A, the title product **21c** (27.1 mg) was isolated by column chromatography (PE : EA = 7:1) as a white amorphous solid in 73% yield. **$^1$H NMR (400 MHz, CDCl$_3$)** δ 8.26 (d, *J* = 8.0 Hz, 1H), 8.01 (d, *J* = 8.0 Hz, 2H), 7.87 – 7.83 (m, 3H), 7.55 – 7.48 (m, 4H), 7.43 – 7.38 (m, 5H), 7.36 (s, 1H), 7.26 – 7.25 (m, 1H); **$^{13}$C NMR (100 MHz, CDCl$_3$)** δ 195.8, 166.8, 140.6, 137.2, 134.4, 134.0, 133.8, 131.9, 131.6, 128.9, 128.8, 128.6, 127.2, 126.9, 125.1, 125.0, 123.0, 122.3, 52.7; **IR (cm$^{-1}$)**: ν 3311, 3058, 1691, 1646, 1511, 1480, 1339, 761; **HRMS**: m/z: $[M+Na]^+$ calculated for $C_{23}H_{17}NNaO_2S^+$, 394.0872, found 394.0874.

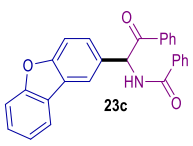
N-(1-(3-methyl-1H-indol-2-yl)-2-oxo-2-phenylethyl)benzamide (**22c**)



22c

According to procedure A, the title product **22c** (28.7 mg) was isolated by column chromatography (PE : EA = 5:1) as a white amorphous solid in 78% yield. **$^1$H NMR (400 MHz, CDCl$_3$)** δ 8.94 (s, 1H), 8.06 (d, *J* = 7.2 Hz, 2H), 7.89 (d, *J* = 6.4 Hz, 1H), 7.82 (d, *J* = 7.2 Hz, 2H), 7.55 – 7.46 (m, 3H), 7.42 – 7.38 (m, 4H), 7.25 – 7.24 (m, 1H), 7.14 (t, *J* = 7.2 Hz, 1H), 7.07 – 7.03 (m, 1H), 6.98 (d, *J* = 6.4 Hz, 1H), 2.28 (s, 3H); **$^{13}$C NMR (100 MHz, CDCl$_3$)** δ 195.0, 167.1, 135.9, 134.2, 134.1, 133.4, 132.0, 129.0, 128.9, 128.8, 128.7, 128.6, 127.1, 122.8, 119.4, 119.0, 111.1, 110.4, 52.4, 8.6; **IR (cm$^{-1}$)**: ν 3388, 3059, 1687, 1638, 1482, 1448, 1263, 711; **HRMS**: m/z: $[M+Na]^+$ calculated for $C_{24}H_{20}N_2NaO_2^+$, 391.1417, found 391.1430.

N-(1-(dibenzo[b,d]furan-2-yl)-2-oxo-2-phenylethyl)benzamide (**23c**)

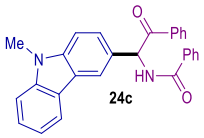


23c

According to procedure A, the title product **23c** (34.1 mg) was isolated by column chromatography (PE : EA = 7:1) as a white amorphous solid in 84% yield. **$^1$H NMR (400 MHz, CDCl$_3$)** δ 8.09 – 8.05 (m, 3H), 7.93 – 7.86 (m, 4H), 7.59 (d, *J* = 8.0 Hz, 1H), 7.51 – 7.47 (m, 4H), 7.44 – 7.38 (m,

5H), 7.31 (t, $J$ = 7.2 Hz, 1H), 6.92 (d, $J$ = 7.2 Hz, 1H); **$^{13}$C NMR (100 MHz, CDCl$_3$)** δ 195.9, 166.4, 156.6, 155.9, 134.2, 133.9, 133.8, 131.9, 131.7, 129.2, 128.8, 128.6, 127.5, 127.4, 127.2, 125.1, 123.7, 122.9, 120.9, 120.8, 112.4, 111.7, 58.9; **IR (cm$^{-1}$)**: ν 3408, 3058, 2924, 1650, 1510, 1448, 1198, 1024, 799; **HRMS**: m/z: $[M+H]^+$ calculated for $C_{27}H_{20}NO_3^+$, 406.1437, found 406.1425.

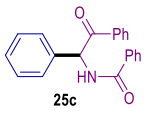
N-(1-(9-methyl-9H-carbazol-3-yl)-2-oxo-2-phenylethyl)benzamide (**24c**)



24c

According to procedure A, the title product **24c** (26.0 mg) was isolated by column chromatography (PE : EA = 5:1) as a white amorphous solid in 62% yield. **$^1$H NMR (400 MHz, CDCl$_3$)** δ 8.19 (s, 1H), 8.08 (d, $J$ = 7.2 Hz, 3H), 7.86 (d, $J$ = 7.2 Hz, 2H), 7.81 (d, $J$ = 7.2 Hz, 1H), 7.62 (d, $J$ = 8.0 Hz, 1H), 7.51 – 7.42 (m, 5H), 7.40 – 7.34 (m, 4H), 7.22 (t, $J$ = 7.2 Hz, 1H), 6.94 (d, $J$ = 7.2 Hz, 1H), 3.79 (s, 3H); **$^{13}$C NMR (100 MHz, CDCl$_3$)** δ 196.1, 166.4, 141.3, 140.7, 134.5, 134.1, 133.6, 131.6, 130.1, 129.2, 128.7, 128.5, 127.6, 127.2, 126.0, 123.4, 122.4, 120.6, 120.4, 119.2, 109.2, 108.5, 59.3, 29.1; **IR (cm$^{-1}$)**: ν 3408, 2925, 1654, 1510, 1482, 1447, 1325, 1248, 689; **HRMS**: m/z: $[M+H]^+$ calculated for $C_{28}H_{23}N_2O_2^+$, 419.1754, found 419.1757.

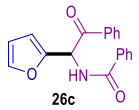
N-(2-oxo-1,2-diphenylethyl)benzamide (**25c**)



25c

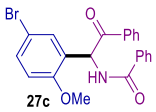
According to procedure A, the title product **25c** (13.5 mg) was isolated by column chromatography (PE : EA = 7:1) as a white amorphous solid in 42% yield. **$^1$H NMR (400 MHz, CDCl$_3$)** δ 8.06 – 8.00 (m, 2H), 7.88 – 7.83 (m, 2H), 7.75 (d, $J$ = 7.2 Hz, 1H), 7.56 – 7.40 (m, 8H), 7.36 – 7.28 (m, 3H), 6.76 (d, $J$ = 7.2 Hz, 1H); **IR (cm$^{-1}$)**: ν 3328, 2922, 1682, 1638, 1579, 1513, 1485, 1448, 689; **HRMS**: m/z: $[M+H]^+$ calculated for $C_{21}H_{18}NO_2^+$, 316.1332, found 316.1327. This is a known compound[7].

N-(1-(furan-2-yl)-2-oxo-2-phenylethyl)benzamide (**26c**)



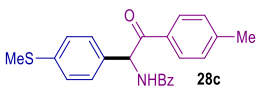
According to procedure A, the title product **26c** (19.8 mg) was isolated by column chromatography (PE : EA = 7:1) as a white amorphous solid in 65% yield. **$^1$H NMR (400 MHz, CDCl$_3$)** δ 8.07 (d, *J* = 7.2 Hz, 2H), 7.88 (d, *J* = 7.2 Hz, 2H), 7.63 – 7.43 (m, 7H), 7.34 – 7.31 (m, 1H), 6.90 (d, *J* = 7.2 Hz, 1H), 6.45 (d, *J* = 7.2 Hz, 1H), 6.32 – 6.30 (m, 1H); **$^{13}$C NMR (100 MHz, CDCl$_3$)** δ 193.03, 166.55, 149.32, 143.01, 134.07, 131.87, 130.10, 129.01, 128.75, 128.56, 128.40, 127.22, 110.91, 109.53, 52.58; **IR (cm$^{-1}$)**: ν 3462, 2922, 1696, 1604, 1486, 1447, 1238, 1105, 699; **HRMS**: m/z: $[M+H]^+$ calculated for $C_{19}H_{16}NO_3^+$, 306.1124, found 316.1120.

N-(1-(5-bromo-2-methoxyphenyl)-2-oxo-2-phenylethyl)benzamide (**27c**)



According to procedure A, the title product **27c** (23.0 mg) was isolated by column chromatography (PE : EA = 7:1) as a white amorphous solid in 54% yield. **$^1$H NMR (400 MHz, CDCl$_3$)** δ 8.03 (d, *J* = 7.6 Hz, 2H), 7.86 (d, *J* = 7.6 Hz, 2H), 7.75 – 7.68 (m, 1H), 7.58 – 7.38 (m, 7H), 7.32 (d, *J* = 8.4 Hz, 1H), 6.89 (d, *J* = 6.8 Hz, 1H), 6.74 (d, *J* = 8.4 Hz, 1H), 3.88 (s, 3H); **$^{13}$C NMR (100 MHz, CDCl$_3$)** δ 195.7, 166.4, 155.8, 134.20 , 133.74 , 133.60 , 132.52 , 132.02 , 131.75 , 130.12 , 128.79 , 128.56 , 128.42 , 127.19 , 113.46 , 113.34 , 56.08 , 53.87; **IR (cm$^{-1}$)**: ν 3422, 2923, 1650, 1597, 1514, 1482, 1448, 1263, 1026; **HRMS**: m/z: $[M+H]^+$ calculated for $C_{22}H_{19}BrNO_3^+$, 424.0542, found 424.0535.

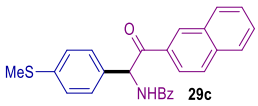
N-(1-(4-(methylthio)phenyl)-2-oxo-2-(p-tolyl)ethyl)benzamide (**28c**)



According to procedure A, the title product **28c** (30.8 mg) was isolated by column chromatography (PE : EA = 7:1) as a white amorphous solid in 82% yield. **$^1$H NMR (400 MHz, CDCl$_3$)** δ 7.91 (d, *J* = 8.0 Hz, 2H), 7.84 (d, *J* = 7.2 Hz, 2H), 7.79 (d, *J* = 7.2 Hz, 1H), 7.50 (d, *J* = 7.2 Hz, 1H), 7.46 – 7.38 (m, 4H), 7.22 (d, *J* = 8.0 Hz, 2H), 7.17 (d, *J* = 8.0 Hz, 2H), 6.67 (d, *J* = 7.2 Hz, 1H), 2.42 (s, 3H), 2.38 (s, 3H); **$^{13}$C NMR (100 MHz, CDCl$_3$)** δ 195.2, 166.3, 145.1, 139.0, 134.2, 133.9, 131.7, 131.6, 129.5, 129.3, 128.7, 128.6, 127.1, 126.9, 58.3, 21.7, 15.4;

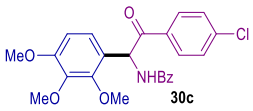
**IR (cm$^{-1}$)**: ν 3408, 3059, 1651, 1480, 1282, 1177, 1095, 711; **HRMS**: m/z: $[M+H]^+$ calculated for $C_{23}H_{22}NO_2S^+$, 376.1366, found 376.1369.

N-(1-(4-(methylthio)phenyl)-2-(naphthalen-2-yl)-2-oxoethyl)benzamide (**29c**)



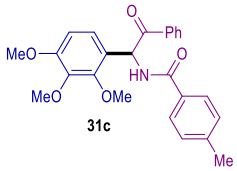

According to procedure A, the title product **29c** (32.1 mg) was isolated by column chromatography (PE : EA = 7:1) as a white amorphous solid in 78% yield. **$^1$H NMR (400 MHz, CDCl$_3$)** δ 8.58 (s, 1H), 8.04 (d, *J* = 8.0 Hz, 1H), 7.94 (d, *J* = 8.0 Hz, 1H), 7.88 – 7.82 (m, 5H), 7.63 – 7.51 (m, 3H), 7.46 (t, *J* = 7.2 Hz, 4H), 7.18 (d, *J* = 8.0 Hz, 2H), 6.87 (d, *J* = 7.2 Hz, 1H), 2.40 (s, 3H); **$^{13}$C NMR (100 MHz, CDCl$_3$)** δ 195.6, 166.4, 139.2, 135.9, 134.0, 133.9, 132.3, 131.8, 131.5, 131.4, 129.8, 129.1, 128.8, 128.7, 128.6, 127.8, 127.2, 127.0, 126.9, 124.2, 58.5, 15.4; **IR (cm$^{-1}$)**: ν 3411, 2920, 1685, 1647, 1509, 1482, 1095, 711; **HRMS**: m/z: $[M+Na]^+$ calculated for $C_{26}H_{21}NNaO_2S^+$, 434.1185, found 434.1189.

N-(2-(4-chlorophenyl)-2-oxo-1-(2,3,4-trimethoxyphenyl)ethyl)benzamide (**30c**)




According to procedure A, the title product **30c** (33.0 mg) was isolated by column chromatography (PE : EA = 5:1) as a white amorphous solid in 75% yield. **$^1$H NMR (400 MHz, CDCl$_3$)** δ 8.04 (d, *J* = 8.8 Hz, 2H), 7.85 (d, *J* = 7.2 Hz, 2H), 7.74 (d, *J* = 7.2 Hz, 1H), 7.51 (t, *J* = 7.2 Hz, 1H), 7.44 (t, *J* = 7.2 Hz, 2H), 7.37 (d, *J* = 8.8 Hz, 2H), 7.03 (d, *J* = 8.8 Hz, 1H), 6.85 (d, *J* = 7.2 Hz, 1H), 6.60 (d, *J* = 8.8 Hz, 1H), 4.06 (s, 3H), 3.82 (s, 3H), 3.80 (s, 3H); **$^{13}$C NMR (100 MHz, CDCl$_3$)** δ 194.8, 166.3, 154.1, 151.3, 142.4, 140.0, 134.1, 132.6, 131.7, 130.4, 128.9, 128.5, 127.1, 123.4, 123.0, 107.7, 61.4, 60.7, 55.9, 54.2; **IR (cm$^{-1}$)**: ν 3408, 2941, 2836, 1693, 1592, 1280, 1098, 798; **HRMS**: m/z: $[M+H]^+$ calculated for $C_{24}H_{23}ClNO_5^+$, 440.1259, found 440.1249.

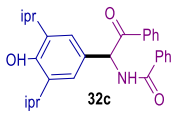
4-methyl-N-(2-oxo-2-phenyl-1-(2,3,4-trimethoxyphenyl)ethyl)benzamide (**31c**)



31c

According to procedure A, the title product **31c** (31.9 mg) was isolated by column chromatography (PE : EA = 7:1) as a white amorphous solid in 76% yield. **$^1$H NMR (400 MHz, $CDCl_3$)** δ 8.01 (d, *J* = 8.0 Hz, 2H), 7.68 (d, *J* = 8.0 Hz, 3H), 7.42 (t, *J* = 7.2 Hz, 1H), 7.32 (t, *J* = 7.2 Hz, 2H), 7.15 (d, *J* = 7.2 Hz, 2H), 6.99 (d, *J* = 8.8 Hz, 1H), 6.81 (d, *J* = 7.2 Hz, 1H), 6.52 (d, *J* = 8.8 Hz, 1H), 4.00 (s, 3H), 3.73 (s, 3H), 3.70 (s, 3H), 2.31 (s, 3H); **$^{13}$C NMR (100 MHz, $CDCl_3$)** δ 196.0, 166.2, 153.9, 151.4, 142.3, 142.0, 134.3, 133.5, 131.4, 129.1, 129.0, 128.5, 127.1, 123.6, 123.5, 107.6, 61.3, 60.6, 55.8, 54.2, 21.4; **IR ($cm^{-1}$)**: ν 3408, 2940, 2835, 1921, 1417, 1210, 1099, 1012, 800; **HRMS**: m/z: $[M+H]^+$ calculated for $C_{25}H_{26}NO_5^+$, 420.1805, found 420.1798.

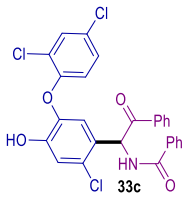
N-(1-(4-hydroxy-3,5-diisopropylphenyl)-2-oxo-2-phenylethyl)benzamide (**32c**)



32c

According to procedure A, the title product **32c** (31.6 mg) was isolated by column chromatography (PE : EA = 5:1) as a white amorphous solid in 76% yield. **$^1$H NMR (400 MHz, $CDCl_3$)** δ 8.01 (d, *J* = 7.2 Hz, 2H), 7.85 (d, *J* = 7.2 Hz, 2H), 7.58 (d, *J* = 7.2 Hz, 1H), 7.53 – 7.47 (m, 2H), 7.44 – 7.38 (m, 4H), 7.12 (s, 2H), 6.71 (d, *J* = 7.2 Hz, 1H), 3.11 – 3.04 (m, 2H), 1.21 (d, *J* = 6.8 Hz, 6H), 1.18 (d, *J* = 6.8 Hz, 6H); **$^{13}$C NMR (100 MHz, $CDCl_3$)** δ 196.5, 166.5, 150.2, 134.8, 134.5, 134.2, 133.5, 131.6, 129.0, 128.7, 128.6, 128.5, 127.2, 123.7, 58.9, 27.3, 22.6, 22.5; **IR ($cm^{-1}$)**: ν 3322, 2953, 1652, 1564, 1479, 1277, 1191, 875, 812; **HRMS**: m/z: $[M+H]^+$ calculated for $C_{27}H_{30}NO_3^+$, 416.2220, found 416.2225.

N-(1-(2-chloro-5-(2,4-dichlorophenoxy)-4-hydroxyphenyl)-2-oxo-2-phenylethyl)benzamide (**33c**)

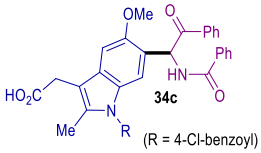


33c

According to procedure A, the title product **33c** (29.5 mg) was isolated by column chromatography (PE : EA = 4:1) as a white amorphous solid in 56% yield. **$^1$H NMR (400 MHz, $CD_3OCD_3$)** δ 8.26 (d, *J* = 7.2 Hz, 1H), 7.85 (d, *J* = 7.2 Hz, 2H), 7.75 (d, *J* = 7.2 Hz, 2H), 7.48 (t, *J* = 7.2

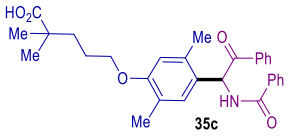
Hz, 1H), 7.39 – 7.36 (m, 4H), 7.29 (t, *J* = 8.0 Hz, 2H), 7.07 – 7.04 (m, 1H), 7.02 (s, 1H), 6.94 – 6.90 (m, 2H), 6.52 (d, *J* = 8.8 Hz, 1H); **$^{13}$C NMR (100 MHz, $CD_3OCD_3$)** δ 195.4, 166.3, 152.2, 149.7, 141.6, 135.3, 134.0, 133.5, 131.6, 129.9, 128.8, 128.4, 128.3, 128.3, 128.0, 127.5, 127.5, 126.3, 124.0, 122.5, 118.4, 118.1, 55.9; **IR (cm$^{-1}$)**: ν 3405, 2924, 1643, 1505, 1473, 1448, 1292, 1234, 1099, 711; **HRMS**: m/z: $[M+H]^+$ calculated for $C_{27}H_{19}Cl_3NO_4^+$, 526.0374, found 526.0380.

2-(6-(1-benzamido-2-oxo-2-phenylethyl)-1-(4-chlorobenzoyl)-5-methoxy-2-methyl-1H-indol-3-yl)acetic acid (**34c**)




According to procedure A, the title product **34c** (39.9 mg) was isolated by column chromatography (PE : EA = 1:1) as a white amorphous solid in 67% yield. **$^1$H NMR (400 MHz, $CDCl_3$)** δ 7.97 (d, *J* = 7.2 Hz, 2H), 7.76 (d, *J* = 7.2 Hz, 2H), 7.56 – 7.33 (m, 10H), 7.25 (s, 1H), 6.94 – 6.88 (m, 2H), 6.82 (s, 1H), 3.95 (s, 3H), 3.63 (s, 2H), 2.36 (s, 3H); **$^{13}$C NMR (100 MHz, $CDCl_3$)** δ 195.8, 174.9, 168.0, 166.2, 153.3, 139.5, 138.9, 136.9, 134.4, 133.9, 133.5, 133.3, 131.6, 131.2, 130.5, 129.1, 128.8, 128.5, 128.4, 127.1, 122.0, 114.9, 111.5, 100.5, 56.3, 54.1, 29.8, 13.1; **IR (cm$^{-1}$)**: ν 3406, 3064, 2924, 1686, 1481, 1324, 1226, 1089, 753; **HRMS**: m/z: $[M+H]^+$ calculated for $C_{33}H_{28}ClN_2O_6^+$, 583.1630, found 583.1632.

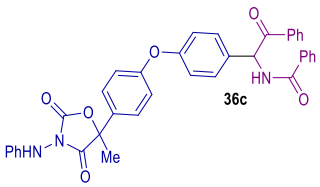
5-(4-(1-benzamido-2-oxo-2-phenylethyl)-2,5-dimethylphenoxy)-2,2-dimethylpentanoic acid (**35c**)




According to procedure A, the title product **35c** (31.7 mg) was isolated by column chromatography (PE : EA = 2:1) as a white amorphous solid in 65% yield. **$^1$H NMR (400 MHz, $CDCl_3$)** δ 7.91 (d, *J* = 7.2 Hz, 2H), 7.84 (d, *J* = 7.2 Hz, 2H), 7.52 – 7.47 (m, 2H), 7.44 – 7.35 (m, 5H), 6.90 (s, 1H), 6.76 (d, *J* = 7.2 Hz, 1H), 6.63 (s, 1H), 3.89 (t, J = 6.0 Hz, 2H), 2.66 (s, 3H), 2.06 (s, 3H), 1.80 – 1.66 (m, 4H), 1.22 (s, 6H); **$^{13}$C NMR (100 MHz, $CDCl_3$)** δ 197.0, 183.5, 166.5, 157.0, 135.4, 135.0, 134.0, 133.4, 131.6, 129.8, 128.7, 128.6,

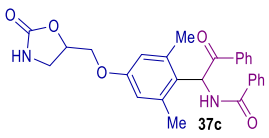
128.5, 127.2, 126.3, 125.1, 113.7, 67.9, 55.9, 41.8, 36.8, 25.1, 25.0, 24.9, 19.8, 15.7; **IR (cm$^{-1}$)**: ν 3334, 3061, 2954, 1697, 1650, 1511, 1477, 1277, 1245, 707; **HRMS**: m/z: $[M+H]^+$ calculated for $C_{30}H_{34}NO_5^+$, 488.2431, found 488.2428.

N-(1-(4-(4-(5-methyl-2,4-dioxo-3-(phenylamino)oxazolidin-5-yl)phenoxy)phenyl)-2-oxo-2-phenylethyl)benzamide (**36c**)




According to procedure A, the title product **36c** (32.4 mg) was isolated by column chromatography (PE : EA = 3:1) as a white amorphous solid in 53% yield. **$^1$H NMR (400 MHz, CDCl$_3$)** δ 7.98 (d, *J* = 7.2 Hz, 2H), 7.83 (d, *J* = 7.2 Hz, 2H), 7.72 (d, *J* = 7.2 Hz, 1H), 7.54 – 7.49 (m, 4H), 7.45 – 7.35 (m, 8H), 7.17 (t, *J* = 7.2 Hz, 1H), 7.03 (t, *J* = 7.2 Hz, 4H), 6.68 – 6.63 (m, 3H), 6.23 – 6.20 (m, 1H), 1.96 (s, 3H); **$^{13}$C NMR (100 MHz, CDCl$_3$)** δ 195.7, 171.8, 166.3, 158.6, 156.1, 152.6, 144.3, 134.1, 134.0, 133.8, 131.8, 130.0, 130.0, 129.7, 129.2, 128.8, 128.6, 127.1, 126.0, 124.1, 119.6, 119.6, 118.6, 114.5, 85.1, 58.2, 25.5; **IR (cm$^{-1}$)**: ν 3371, 2922, 1827, 1759, 1656, 1508, 1448, 1242, 692; **HRMS**: m/z: $[M+H]^+$ calculated for $C_{37}H_{30}N_3O_6^+$, 612.2129, found 612.2139.

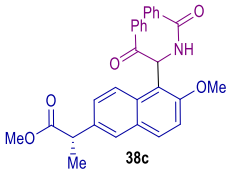
N-(1-(2,6-dimethyl-4-((2-oxooxazolidin-5-yl)methoxy)phenyl)-2-oxo-2-phenylethyl)benzamide (**37c**)




According to procedure A, the title product **37c** (28.0 mg) was isolated by column chromatography (PE : EA = 1:1) as a white amorphous solid in 61% yield. **$^1$H NMR (400 MHz, CDCl$_3$)** δ 7.90 (d, *J* = 7.2 Hz, 2H), 7.86 (d, *J* = 7.2 Hz, 2H), 7.72 (d, *J* = 7.2 Hz, 1H), 7.49 – 7.43 (m, 4H), 7.34 (d, *J* = 7.2 Hz, 2H), 6.83 (d, *J* = 7.2 Hz, 1H), 6.69 (s, 1H), 6.48 (s, 1H), 5.71 – 5.64 (m, 1H), 4.91 (s, 1H), 4.27 (d, *J* = 10.4 Hz, 1H), 3.99 (d, *J* = 10.4 Hz, 1H), 3.82 – 3.71 (m, 2H), 2.64 (s, 3H), 2.23 (s, 3H),; **$^{13}$C NMR (100 MHz, CDCl$_3$)** δ 196.9, 166.6, 159.4, 155.8, 139.4, 138.4, 134.9, 134.0, 133.3, 131.6, 130.0, 128.6, 128.2, 127.3, 125.7, 122.6, 110.7, 74.0, 67.7, 54.5, 42.3, 21.4, 20.3; **IR (cm$^{-1}$)**: ν 3415, 2923, 1759,

1655, 1483, 1447, 1236, 1085, 692; **HRMS**: m/z: $[M+H]^+$ calculated for $C_{27}H_{27}N_2O_5^+$, 459.1914, found 459.1897.

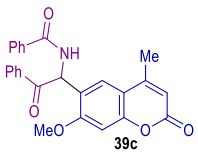
Methyl(2S)-2-(5-(1-benzamido-2-oxo-2-phenylethyl)-6-methoxynaphthalen-2-yl)propanoate (**38c**)



38c

According to procedure A, the title product **38c** (36.6 mg) was isolated by column chromatography (PE : EA = 5:1) as a white amorphous solid in 76% yield. **$^1$H NMR (400 MHz, $CDCl_3$)** δ 8.52 (d, *J* = 8.8 Hz, 1H), 7.84 (t, *J* = 7.2 Hz, 4H), 7.75 (d, *J* = 8.8 Hz, 1H), 7.68 (s, 1H), 7.59 (d, *J* = 8.0 Hz, 2H), 7.47 (d, *J* = 7.2 Hz, 1H), 7.43 – 7.36 (m, 4H), 7.22 (t, *J* = 8.0 Hz, 2H), 7.14 (d, *J* = 8.0 Hz, 1H), 3.88 (q, *J* = 7.2 Hz, 1H), 3.83 (s, 3H), 3.69 (d, *J* = 1.6 Hz, 3H), 1.59 (d, *J* = 3.2 Hz, 3H); **$^{13}$C NMR (100 MHz, $CDCl_3$)** δ 197.0, 174.9, 167.0, 155.2, 135.9, 134.9, 134.3, 132.9, 131.5, 131.4, 130.9, 129.7, 128.4, 128.2, 128.1, 128.0, 127.3, 126.9, 123.5, 119.4, 113.6, 56.3, 53.6, 52.1, 45.1, 18.6; **IR ($cm^{-1}$)**: ν 2925, 1687, 1597, 1507, 1426, 1326, 1176, 1073, 708; **HRMS**: m/z: $[M+Na]^+$ calculated for $C_{30}H_{27}NNaO_5^+$, 504.1781, found 504.1792.

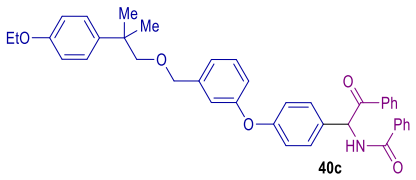
N-(1-(7-methoxy-4-methyl-2-oxo-2H-chromen-6-yl)-2-oxo-2-phenylethyl)benzamide (**39c**)



39c

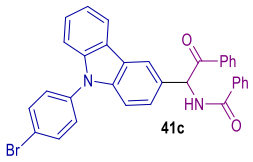
According to procedure A, the title product **39c** (20.6 mg) was isolated by column chromatography (PE : EA = 4:1) as a white amorphous solid in 48% yield. **$^1$H NMR (400 MHz, $CDCl_3$)** δ 8.12 (d, *J* = 7.2 Hz, 1H), 8.01 (d, *J* = 7.2 Hz, 2H), 7.87 (d, *J* = 7.2 Hz, 2H), 7.48 – 7.42 (m, 5H), 7.37 – 7.33 (m, 2H), 7.27 (d, *J* = 7.2 Hz, 1H), 6.86 (d, *J* = 9.2 Hz, 1H), 6.13 (s, 1H), 4.05 (s, 3H), 2.33 (s, 3H); **$^{13}$C NMR (100 MHz, $CDCl_3$)** δ 195.3, 166.3, 160.0, 159.8, 152.6, 152.4, 134.9, 134.1, 133.3, 131.6, 128.5, 128.4, 128.3, 127.3, 125.8, 114.3, 113.8, 112.4, 107.9, 56.7, 51.1, 18.7; **IR($cm^{-1}$)**: ν 3414, 3062, 2924, 1709, 1658, 1509, 1479, 1288, 710; **HRMS**: m/z: $[M+H]^+$ calculated for $C_{26}H_{22}NO_5^+$, 428.1492, found 428.1488.

N-(1-(4-(3-((2-(4-ethoxyphenyl)-2-methylpropoxy)methyl)phenoxy)phenyl)-2-oxo-2-phenylethyl)benzamide (**40c**)




According to procedure A, the title product **40c** (31.3 mg) was isolated by column chromatography (PE : EA = 7:1) as a white amorphous solid in 51% yield. **$^1$H NMR (400 MHz, $CDCl_3$)** δ 8.01 (d, *J* = 7.2 Hz, 2H), 7.82 (d, *J* = 7.2 Hz, 2H), 7.63 (d, *J* = 7.2 Hz, 1H), 7.50 – 7.45 (m, 2H), 7.41 (t, *J* = 7.0 Hz, 3H), 7.32 (t, *J* = 7.2 Hz, 4H), 7.24 – 7.17 (m, 2H), 7.09 (t, *J* = 7.2 Hz, 1H), 6.98 (d, *J* = 7.2 Hz, 2H), 6.94 – 6.85 (m, 4H), 6.72 (d, *J* = 8.8 Hz, 1H), 4.36 (s, 2H), 4.11 – 4.04 (m, 1H), 4.00 – 3.93 (m, 1H), 3.37 (s, 2H), 1.44 (t, *J* = 7.2 Hz, 3H), 1.27 (d, *J* = 4.0 Hz, 6H); **$^{13}$C NMR (100 MHz, $CDCl_3$)** δ 196.3, 166.5, 157.2, 157.1, 154.3, 140.9, 140.1, 134.9, 134.4, 133.1, 131.5, 130.1, 129.7, 129.5, 128.8, 128.5, 128.4, 128.3, 127.9, 127.3, 127.1, 124.8, 123.2, 121.9, 118.9, 117.6, 117.5, 111.7, 80.1, 72.7, 64.0, 55.6, 38.6, 26.1, 26.0, 14.8; **IR ($cm^{-1}$)**: ν 3436, 2963, 1693, 1658, 1581, 1484, 1446, 1252, 690; **HRMS**: m/z: $[M+H]^+$ calculated for $C_{40}H_{40}NO_5^+$, 614.2901, found 614.2878.

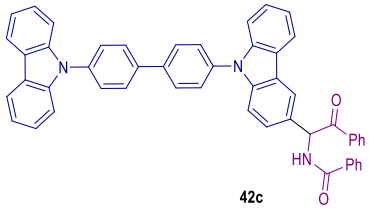
N-(1-(9-(4-bromophenyl)-9H-carbazol-3-yl)-2-oxo-2-phenylethyl)benzamide (**41c**)




According to procedure A, the title product **41c** (34.2 mg) was isolated by column chromatography (PE : EA = 10:1) as a white amorphous solid in 61% yield. **$^1$H NMR (400 MHz, $CDCl_3$)** δ 8.24 (s, 1H), 8.10 (t, *J* = 8.0 Hz, 3H), 7.88 (t, *J* = 7.2 Hz, 3H), 7.69 (d, *J* = 8.0 Hz, 2H), 7.55 (d, *J* = 8.8 Hz, 1H), 7.49 (t, *J* = 7.2 Hz, 2H), 7.44 – 7.34 (m, 7H), 7.29 (t, *J* = 8.0 Hz, 3H), 6.95 (d, *J* = 7.2 Hz, 1H); **$^{13}$C NMR (100 MHz, $CDCl_3$)** δ 196.0, 166.4, 141.0, 140.3, 136.4, 134.3, 134.0, 133.7, 133.1, 131.7, 130.1, 129.3, 129.1, 128.7, 128.6, 128.5, 128.4, 127.2, 126.5, 126.4, 124.1, 123.0, 121.1, 120.6, 120.5, 120.4, 110.4, 109.6, 59.2; **IR ($cm^{-1}$)**: ν 3411, 2923, 1685, 1650, 1494, 1233, 1183, 1069, 711; **HRMS**: m/z: $[M+H]^+$ calculated for $C_{33}H_{24}BrN_2O_2^+$, 559.1015, found 559.1008.

N-(1-(9-(4'-(9H-carbazol-9-yl)-[1,1'-biphenyl]-4-yl)-9H-carbazol-3-yl)-2-oxo-2-

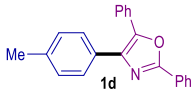
phenylethyl)benzamide (**42c**)



42c

According to procedure A, the title product **42c** (41.2 mg) was isolated by column chromatography (PE : EA = 7:1) as a white amorphous solid in 57% yield. **$^1$H NMR (400 MHz, CDCl$_3$)** δ 8.28 (s, 1H), 8.16 (t, *J* = 7.2 Hz, 3H), 8.11 (d, *J* = 7.2 Hz, 2H), 7.90 – 7.86 (m, 7H), 7.70 (d, *J* = 8.0 Hz, 2H), 7.63 – 7.58 (m, 3H), 7.52 – 7.48 (m, 4H), 7.46 – 7.39 (m, 9H), 7.34 – 7.29 (m, 3H), 6.97 (d, *J* = 7.2 Hz, 1H); **$^{13}$C NMR (100 MHz, CDCl$_3$)** δ 196.0, 166.4, 141.2, 140.8, 140.6, 139.5, 139.1, 137.3, 136.8, 134.4, 134.1, 133.7, 131.7, 129.3, 128.9, 128.7, 128.5, 128.5, 128.4, 127.5, 127.4, 127.4, 127.2, 126.5, 126.3, 126.0, 124.1, 123.5, 123.1, 120.6, 120.5, 120.4, 120.1, 110.7, 109.9, 109.8, 59,2; **IR (cm$^{-1}$)**: ν 3420, 2923, 1658, 1600, 1505, 1451, 1334, 1231, 749; **HRMS**: m/z: $[M+H]^+$ calculated for $C_{51}H_{36}N_3O_2^+$, 722.2802, found 722.2815.

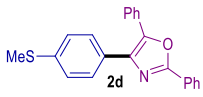
2,5-diphenyl-4-(p-tolyl)oxazole (**1d**)



1d

According to procedure B, the title product **1d** (29.8 mg) was isolated by column chromatography (PE : EA = 100:1) as yellow oil in 96% yield. **$^1$H NMR (500 MHz, CDCl$_3$)** δ 8.14 (d, *J* = 7.5 Hz, 2H), 7.66 (d, *J* = 7.5 Hz, 2H), 7.61 (d, *J* = 7.5 Hz, 2H), 7.43 (q, *J* = 7.5 Hz, 3H), 7.30 (d, *J* = 7.5 Hz, 1H), 7.19 (d, *J* = 7.5 Hz, 2H), 2.37 (s, 3H). This is a known compound[4].

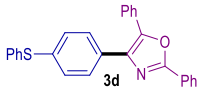
4-(4-(methylthio)phenyl)-2,5-diphenyloxazole (**2d**)



2d

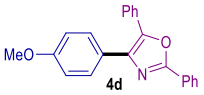
According to procedure B, the title product **2d** (27.8 mg) was isolated by column chromatography (PE : EA = 100:1) as yellow oil in 81% yield. **$^1$H NMR (500 MHz, CDCl$_3$)** δ 8.15 (d, *J* = 7.5 Hz, 2H), 7.69 – 7.65 (m, 4H), 7.50 – 7.45 (m, 3H), 7.40 (t, *J* = 7.5 Hz, 2H), 7.35 (d, *J* = 7.5 Hz, 1H), 7.28 (d, *J* = 7.5 Hz, 2H), 2.52 (s, 3H); **$^{13}$C NMR (125 MHz, CDCl$_3$)** δ 160.1, 145.4, 138.7, 136.3, 130.8, 130.3, 129.2, 129.0, 128.7, 128.6, 128.5, 128.4, 127.3, 126.6, 126.4, 15.6; **IR (cm$^{-1}$)**: ν 3052, 1726, 1603, 1501, 1326, 1094, 964, 766; **HRMS**: m/z: $[M+H]^+$ calculated for $C_{22}H_{18}NOS^+$, 344.1104, found 344.1116.

2,5-diphenyl-4-(4-(phenylthio)phenyl)oxazole (**3d**)



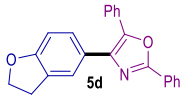

According to procedure B, the title product **3d** (30.5 mg) was isolated by column chromatography (PE : EA = 100:1) as yellow oil in 74% yield. **$^1$H NMR (500 MHz, CDCl$_3$)** δ 8.14 (d, *J* = 7.5 Hz, 2H), 7.67 (d, *J* = 7.5 Hz, 4H), 7.47 (d, *J* = 5.5 Hz, 3H), 7.40 (t, *J* = 7.5 Hz, 4H), 7.35 – 7.31 (m, 5H), 7.27 (d, *J* = 7.5 Hz, 1H); **$^{13}$C NMR (125 MHz, CDCl$_3$)** δ 160.2, 145.7, 136.1, 136.0, 135.1, 131.4, 131.1, 130.7, 130.4, 129.2, 128.8, 128.8, 128.7, 128.7, 128.6, 127.3, 127.2, 126.6, 126.4; **IR (cm$^{-1}$)**: ν 3058, 1701, 1589, 1249, 1083, 966, 690; **HRMS**: m/z: $[M+H]^+$ calculated for $C_{27}H_{20}NOS^+$, 406.1260, found 406.1249.

4-(4-methoxyphenyl)-2,5-diphenyloxazole (**4d**)



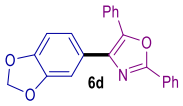

According to procedure B, the title product **4d** (25.5 mg) was isolated by column chromatography (PE : EA = 100:1) as a white amorphous solid in 78% yield. **$^1$H NMR (500 MHz, CDCl$_3$)** δ 8.15 (d, *J* = 7.5 Hz, 2H), 7.69 – 7.65 (m, 4H), 7.49 – 7.47 (m, 3H), 7.39 (t, *J* = 7.5 Hz, 2H), 7.33 (d, *J* = 7.5 Hz, 1H), 6.95 (d, *J* = 7.5 Hz, 2H), 3.85 (s, 3H). This is a known compound[4].

4-(2,3-dihydrobenzofuran-5-yl)-2,5-diphenyloxazole (**5d**)



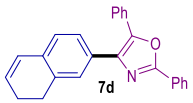

According to procedure B, the title product **5d** (25.8 mg) was isolated by column chromatography (PE : EA = 100:1) as colorless oil in 76% yield. **$^1$H NMR (400 MHz, CDCl$_3$)** δ 8.15 (d, *J* = 7.2 Hz, 2H), 7.69 (d, *J* = 7.2 Hz, 2H), 7.58 (s, 1H), 7.51 – 7.43 (m, 4H), 7.38 (t, *J* = 7.2 Hz, 2H), 7.33 (d, *J* = 7.2 Hz, 1H), 6.80 (d, *J* = 7.2 Hz, 1H), 4.62 (t, *J* = 8.8 Hz, 2H), 3.24 (t, *J* = 8.8 Hz, 2H); **$^{13}$C NMR (100 MHz, CDCl$_3$)** δ 160.2, 159.9, 144.6, 137.0, 130.2, 129.2, 128.7, 128.6, 128.3, 128.2, 127.5, 127.4, 126.4, 126.3, 125.0, 124.8, 109.3, 71.5, 29.6; **IR (cm$^{-1}$)**: ν 2922, 1696, 1604, 1486, 1238, 1105, 981, 699; **HRMS**: m/z: $[M+H]^+$ calculated for $C_{23}H_{18}NO_2^+$, 340.1332, found 340.1317.

4-(benzo[d][1,3]dioxol-5-yl)-2,5-diphenyloxazole (**6d**)



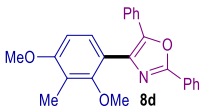

According to procedure B, the title product **6d** (28.7 mg) was isolated by column chromatography (PE : EA = 100:1) as colorless oil in 84% yield. **$^1$H NMR (400 MHz, CDCl$_3$)** δ 8.14 (d, *J* = 6.0 Hz, 2H), 7.68 (d, *J* = 6.0 Hz, 2H), 7.50 – 7.45 (m, 3H), 7.40 (t, *J* = 6.0 Hz, 2H), 7.34 (d, *J* = 6.0 Hz, 1H), 7.23 (d, *J* = 6.0 Hz, 1H), 7.19 (s, 1H), 6.85 (d, *J* = 6.0 Hz, 1H), 6.00 (s, 2H); **$^{13}$C NMR (100 MHz, CDCl$_3$)** δ 159.9, 147.8, 147.6, 145.0, 136.5, 130.3, 129.0, 128.8, 128.7, 128.5, 127.3, 126.5, 126.4, 126.3, 122.1, 108.7, 108.6, 101.2; **IR (cm$^{-1}$)**: ν 1731, 1656, 1481, 1447, 1238, 1102, 1039, 879, 704; **HRMS**: m/z: $[M+H]^+$ calculated for $C_{22}H_{16}NO_3^+$, 342.1124, found 342.1119.

4-(7,8-dihydronaphthalen-2-yl)-2,5-diphenyloxazole (**7d**)




According to procedure B, the title product **7d** (26.9 mg) was isolated by column chromatography (PE : EA = 100:1) as a white amorphous solid in 77% yield. **$^1$H NMR (400 MHz, CDCl$_3$)** δ 8.14 (d, *J* = 7.2 Hz, 2H), 7.73 (d, *J* = 7.2 Hz, 2H), 7.52 – 7.36 (m, 7H), 7.21 – 7.10 (m, 4H), 2.92 (t, *J* = 8.0 Hz, 2H), 2.65 (d, *J* = 8.0 Hz, 2H); **$^{13}$C NMR (100 MHz, CDCl$_3$)** δ 159.9, 145.8, 137.3, 135.2, 134.2, 130.8, 130.3, 129.3, 128.8, 128.7, 128.6, 128.5, 127.5, 127.4, 127.3, 127.2, 126.7, 126.6, 126.5, 28.1, 25.7; **IR (cm$^{-1}$)**: ν 2925, 1691, 1599, 1486, 1448, 1241, 1109, 690; **HRMS**: m/z: $[M+H]^+$ calculated for $C_{25}H_{20}NO^+$, 350.1539, found 350.1548.

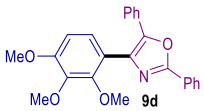
4-(2,4-dimethoxy-3-methylphenyl)-2,5-diphenyloxazole (**8d**)




According to procedure B, the title product **8d** (29.0 mg) was isolated by column chromatography (PE : EA = 75:1) as a white amorphous solid in 78% yield. **$^1$H NMR (400 MHz, CDCl$_3$)** δ 8.18 (d, *J* = 6.0 Hz, 2H), 7.57 (d, *J* = 6.0 Hz, 2H), 7.48 (q, *J* = 6.0 Hz, 3H), 7.31 (t, *J* = 6.0 Hz, 2H), 7.28 – 7.24 (m, 2H), 6.73 (d, *J* = 6.0 Hz, 1H), 3.89 (s, 3H), 3.58 (s, 3H), 2.22 (s, 3H); **$^{13}$C NMR (100 MHz, CDCl$_3$)** δ 159.5, 159.4, 157.7, 146.1, 134.3, 130.2, 128.9, 128.8, 128.7, 128.5, 127.9, 127.5, 126.4, 125.1, 120.4, 119.0, 106.3, 61.1, 55.7, 9.07; **IR (cm$^{-}$**

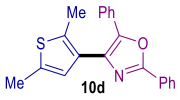
**1**): ν 2933, 1603, 1486, 1447, 1271, 1110, 703; **HRMS**: m/z: $[M+H]^+$ calculated for $C_{24}H_{22}NO_3^+$, 372.1594, found 372.1585.

2,5-diphenyl-4-(2,3,4-trimethoxyphenyl)oxazole (**9d**)



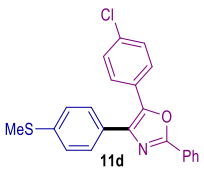

According to procedure B, the title product **9d** (33.0 mg) was isolated by column chromatography (PE : EA =75:1) as a white amorphous solid in 85% yield. **$^1$H NMR (400 MHz, CDCl$_3$)** δ 8.17 (d, *J* = 7.2 Hz, 2H), 7.56 (d, *J* = 7.2 Hz, 2H), 7.50 – 7.46 (m, 3H), 7.32 (t, *J* = 7.2 Hz, 2H), 7.27 (d, *J* = 7.2 Hz, 1H), 7.18 (d, *J* = 8.0 Hz, 1H), 6.77 (d, *J* = 8.0 Hz, 1H), 3.93 (s, 3H) , 3.91 (s, 3H) , 3.70 (s, 3H); **$^{13}$C NMR (100 MHz, CDCl$_3$)** δ 159.6, 156.4, 152.3, 146.3, 142.6, 133.4, 130.2, 128.9, 128.7, 128.4, 127.9, 127.5, 126.4, 125.7, 125.3, 119.9, 107.6, 61.3, 61.0, 56.1; **IR (cm$^{-1}$)**: ν 1634, 1487, 1412, 1384, 1293, 1101, 1021, 769; **HRMS**: m/z: $[M+H]^+$ calculated for $C_{24}H_{22}NO_4^+$, 388.1543, found 388.1544.

4-(2,5-dimethylthiophen-3-yl)-2,5-diphenyloxazole (**10d**)




According to procedure B, the title product **10d** (30.5 mg) was isolated by column chromatography (PE : EA = 200:1) as yellow oil in 92% yield. **$^1$H NMR (500 MHz, CDCl$_3$)** δ 8.15 (d, *J* = 7.5 Hz, 2H), 7.61 (d, *J* = 7.5 Hz, 2H), 7.47 (q, *J* = 7.5 Hz, 3H), 7.37 (t, *J* = 7.5 Hz, 2H), 7.29 (t, *J* = 7.5 Hz, 1H), 6.78 (s, 1H), 2.45 (s, 3H), 2.24 (s, 3H); **$^{13}$C NMR (125 MHz, CDCl$_3$)** δ 159.7, 145.9, 136.6, 135.9, 132.5, 130.3, 129.0, 128.8, 128.7, 128.6, 128.0, 127.4, 126.5, 126.4, 125.2, 15.2, 12.2 ; **IR (cm$^{-1}$)**: ν 1697, 1599, 1486, 1260, 1136, 1027, 805, 699; **HRMS**: m/z: $[M+H]^+$ calculated for $C_{21}H_{18}NOS^+$, 332.1104, found 332.1106.

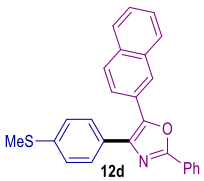
5-(4-chlorophenyl)-4-(4-(methylthio)phenyl)-2-phenyloxazole (**11d**)




According to procedure B, the title product **11d** (28.0 mg) was isolated by column chromatography (PE : EA = 100:1) as yellow oil in 74% yield. **$^1$H NMR (500 MHz, CDCl$_3$)** δ 8.14 (s, 2H), 7.62 (t, *J* = 6.0 Hz, 4H), 7.48 (s, 3H), 7.36 (d, *J* = 7.5 Hz, 2H), 7.29 (d, *J* = 7.5

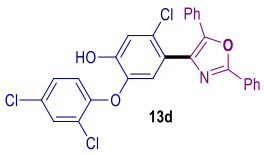
Hz, 2H), 2.53 (s, 3H); **$^{13}$C NMR (125 MHz, $CDCl_3$)** δ 160.1, 145.3, 136.2, 130.3, 129.2, 128.9, 128.7, 128.7, 128.5, 128.4, 127.3, 126.5, 126.4, 126.3, 125.0, 15.6. **IR (cm$^{-1}$)**: ν 3448, 2923, 1700, 1589, 1487, 1249, 1093, 718; **HRMS**: m/z: $[M+H]^+$ calculated for $C_{22}H_{17}ClNOS^+$, 378.0714, found 378.0707.

4-(4-(methylthio)phenyl)-5-(naphthalen-2-yl)-2-phenyloxazole (**12d**)



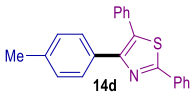

According to procedure B, the title product **12d** (29.6 mg) was isolated by column chromatography (PE : EA = 100:1) as yellow oil in 75% yield. **$^1$H NMR (500 MHz, $CDCl_3$)** δ 8.20 (s, 3H), 7.85 – 7.82 (m, 3H), 7.70 (t, *J* = 9.0 Hz, 3H), 7.52 – 7.50 (m, 5H), 7.29 (d, *J* = 8.0 Hz, 2H), 2.53 (s, 3H); **$^{13}$C NMR (125 MHz, $CDCl_3$)** δ 160.3, 145.5, 138.8, 138.6, 133.2, 133.1, 130.4, 129.2, 128.8, 1285, 128.4, 128.3, 127.7, 127.3, 126.7, 126.6, 126.5, 126.4, 126.3, 125.7, 124.1, 15.6; **IR (cm$^{-1}$)**: ν 2924, 1690, 1686, 1487, 1241, 1082, 965, 766, 691; **HRMS**: m/z: $[M+H]^+$ calculated for $C_{26}H_{20}NOS^+$, 394.1260, found 394.1254.

5-chloro-2-(2,4-dichlorophenoxy)-4-(2,5-diphenyloxazol-4-yl)phenol (**13d**)




According to procedure B, the title product **13d** (22.4 mg) was isolated by column chromatography (PE : EA =10:1) as a white amorphous solid in 44% yield. **$^1$H NMR (400 MHz, $CDCl_3$)** δ 8.14 (d, *J* = 7.2 Hz, 2H), 8.08 (d, *J* = 8.0 Hz, 2H), 7.66 – 7.62 (m, 1H), 7.54 – 7.49 (m, 5H), 7.39 – 7.34 (m, 2H), 7.29 – 7.28 (m, 1H), 7.15 (s, 1H), 7.00 (d, *J* = 8.0 Hz, 1H); **$^{13}$C NMR (100 MHz, $CDCl_3$)** δ 167.2, 151.9, 151.0, 143.5, 140.4, 133.8, 132.3, 130.5, 129.8, 129.5, 128.9, 128.8, 128.7, 128.1, 127.5, 126.5, 126.4, 126.3, 124.6, 121.0, 119.9, 114.4, 113.1; **IR (cm$^{-1}$)**: ν 3609, 3061, 1649, 1605, 1473, 1388, 892, 769, 705; **HRMS**: m/z: $[M+H]^+$ calculated for $C_{27}H_{17}Cl_3NO_3^+$, 508.0269, found 508.0285.

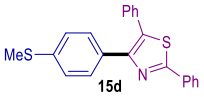
2,5-diphenyl-4-(p-tolyl)thiazole (**14d**)




According to procedure C, the title product **14d** (26.5 mg) was isolated by column chromatography (PE : EA = 20:1) as a white amorphous solid in 81% yield. **$^1$H NMR (400 MHz, $CDCl_3$)** δ 8.01

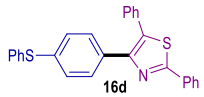
(d, *J* = 6.8 Hz, 2H), 7.54 (d, *J* = 8.0 Hz, 2H), 7.46 – 7.35 (m, 8H), 7.18 (d, *J* = 8.0 Hz, 2H), 2.49 (s, 3H). This is a known compound[5].

4-(4-(methylthio)phenyl)-2,5-diphenylthiazole (**15d**)



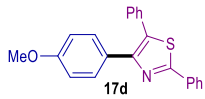

According to procedure C, the title product **15d** (26.0 mg) was isolated by column chromatography (PE : EA = 25:1) as a white amorphous solid in 72% yield. **$^1$H NMR (400 MHz, CDCl$_3$)** δ 8.01 (d, *J* = 6.8 Hz, 2H), 7.50 – 7.40 (m, 6H), 7.36 – 7.31 (m, 4H), 7.12 (d, *J* = 7.6 Hz, 2H), 2.35(s, 3H); **$^{13}$C NMR (100 MHz, CDCl$_3$)** δ 165.3, 150.9, 137.6, 133.7, 132.4, 132.2, 132.1, 129.9, 129.6, 129.0, 128.9, 128.7, 128.3, 128.1 ,126.4, 21.3; **IR (cm$^{-1}$)**: ν 1598, 1477, 1442, 1253, 1181, 1071, 980, 759; **HRMS**: m/z: $[M+Na]^+$ calculated for $C_{22}H_{18}NS_2^+$, 360.0875, found 360.0871.

2,5-diphenyl-4-(4-(phenylthio)phenyl)thiazole (**16d**)




According to procedure C, the title product **16d** (25.7 mg) was isolated by column chromatography (PE : EA = 50:1) as a white amorphous solid in 61% yield. **$^1$H NMR (400 MHz, CDCl$_3$)** δ 8.01 (d, *J* = 6.8 Hz, 2H), 7.54 (d, *J* = 8.4 Hz, 2H), 7.48 – 7.42 (m, 3H), 7.41 – 7.31 (m, 8H), 7.29 – 7.24 (m, 4H); **$^{13}$C NMR (100 MHz, CDCl$_3$)** δ 165.6, 149.9, 135.6, 135.3, 133.6, 133.5, 133.3, 131.9, 131.4, 130.4, 130.1, 129.7, 129.6, 129.2 ,128.9, 128.8, 128.3, 127.2, 126.4; **IR (cm$^{-1}$)**: ν 3057, 1637, 1474, 1439, 1260, 980, 760, 668; **HRMS**: m/z: $[M+H]^+$ calculated for $C_{27}H_{20}NS_2^+$, 422.1031, found 422.1032.

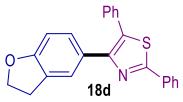
4-(4-methoxyphenyl)-2,5-diphenylthiazole (**17d**)




According to procedure C, the title product **17d** (25.4 mg) was isolated by column chromatography (PE : EA = 20:1) as a white amorphous solid in 74% yield. **$^1$H NMR (400 MHz, CDCl$_3$)** δ 8.01 (d, *J* = 6.8 Hz, 2H), 7.54 (d, *J* = 6.8 Hz, 2H) , 7.46 – 7.39 (m, 5H), 7.35 – 7.31 (m, 3H), 6.84 (d, *J* = 8.4 Hz, 2H), 3.81(s, 3H); **$^{13}$C NMR (100 MHz, CDCl$_3$)** δ 165.3, 159.3,

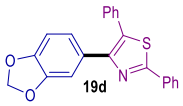
150.6, 133.7, 132.3, 131.8, 130.4, 129.9, 129.6, 128.9, 128.8, 128.1, 127.6, 126.4, 113.7, 55.3; **IR (cm$^{-1}$)**: ν 3060, 1609, 1508, 1478, 1249, 1175, 1031, 761, 694; **HRMS**: m/z: $[M+H]^+$ calculated for $C_{22}H_{18}NOS^+$, 344.1104, found 344.1105.

4-(2,3-dihydrobenzofuran-5-yl)-2,5-diphenylthiazole (**18d**)



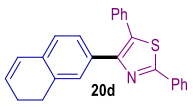

According to procedure C, the title product **18d** (22.4 mg) was isolated by column chromatography (PE : EA = 25:1) as a white amorphous solid in 63% yield. **$^1$H NMR (400 MHz, CDCl$_3$)** δ 8.01 (d, *J* = 6.8 Hz, 2H), 7.52(s, 1H) , 7.47 – 7.40 (m, 5H), 7.35 – 7.31 (m, 3H), 7.25(s, 1H), 6.69 (d, *J* = 8.4 Hz, 1H), 4.59 (t, *J* = 8.8 Hz, 2H), 3.19(t, *J* = 8.8 Hz, 2H); **$^{13}$C NMR (100 MHz, CDCl$_3$)** δ 165.2, 159.9, 151.0, 133.7, 132.4, 131.5, 129.9, 129.5, 129.3, 128.9, 128.7, 127.9, 127.5, 127.1, 126.4 ,125.9, 109.0, 71.4, 29.6 ; **IR (cm$^{-1}$)**: ν 3059, 1612, 1473, 1442, 1233, 1169, 982, 760; **HRMS**: m/z: $[M+H]^+$ calculated for $C_{23}H_{18}NOS^+$, 356.1104, found 356.1111.

4-(benzo[d][1,3]dioxol-5-yl)-2,5-diphenylthiazole (**19d**)




According to procedure C, the title product **19d** (26.8 mg) was isolated by column chromatography (PE : EA = 25:1) as a white amorphous solid in 75% yield. **$^1$H NMR (400 MHz, CDCl$_3$)** δ 8.01 (d, *J* = 6.8 Hz, 2H), 7.45 – 7.34 (m, 8H), 7.10 – 7.07 (m, 2H), 6.75 (d, *J* = 8.4 Hz, 1H), 5.96 (s, 2H); **$^{13}$C NMR (100 MHz, CDCl$_3$)** δ 165.3, 150.3, 147.5, 147.3, 133.6, 132.1, 130.0, 129.6, 129.0, 128.9, 128.8, 128.2, 126.7, 126.4, 123.1, 109.6, 108.2, 101.0; **IR (cm$^{-1}$)**: ν 3061, 1613, 1475, 1443, 1234, 1038, 760, 690; **HRMS**: m/z: $[M+H]^+$ calculated for $C_{22}H_{16}NO_2S^+$, 358.0896, found 358.0897.

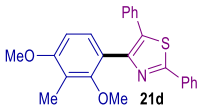
4-(7,8-dihydronaphthalen-2-yl)-2,5-diphenylthiazole (**20d**)




According to procedure C, the title product **20d** (26.7 mg) was isolated by column chromatography (PE : EA = 50:1) as a white amorphous solid in 73% yield. **$^1$H NMR (400 MHz, CDCl$_3$)** δ 8.00 (d, *J* = 6.8 Hz,

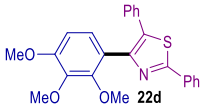
2H), 7.53 – 7.51 (m, 2H), 7.45 – 7.36 (m, 6H), 7.14 – 7.12 (m, 3H), 7.02 – 7.00 (m, 2H), 2.84 (t, $J$ = 8.0 Hz, 2H), 2.55 (t, $J$ = 8.0 Hz, 2H); **$^{13}$C NMR (100 MHz, CDCl$_3$)** δ 165.1, 151.6, 135.1, 134.4, 133.9, 133.6, 132.9, 132.4, 130.0, 129.6, 129.6, 128.9, 128.6, 128.2, 127.6, 127.1, 126.7, 126.5, 126.4, 28.3, 26.5; **IR (cm$^{-1}$)**: ν 2960, 1718, 1617, 1486, 1233, 1107, 981, 821, 695; **HRMS**: m/z: $[M+H]^+$ calculated for $C_{25}H_{20}NS^+$, 366.1311 found 366.1303.

4-(2,4-dimethoxy-3-methylphenyl)-2,5-diphenylthiazole (**21d**)



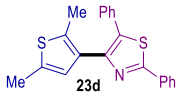

According to procedure C, the title product **21d** (26.4 mg) was isolated by column chromatography (PE : EA = 20:1) as a white amorphous solid in 68% yield. **$^1$H NMR (400 MHz, CDCl$_3$)** δ 8.01 (d, $J$ = 6.8 Hz, 2H), 7.46 – 7.40 (m, 3H), 7.32 – 7.30 (m, 2H), 7.26 – 7.23 (m, 3H), 7.14 (d, $J$ = 8.4 Hz, 1H), 6.64 (d, $J$ = 8.4 Hz, 1H) , 3.85 (s, 3H), 3.60 (s, 3H) , 2.17 (s, 3H) ; **$^{13}$C NMR (100 MHz, CDCl$_3$)** δ 164.5, 159.0, 157.6, 148.9, 134.3, 133.8, 132.3, 129.8, 129.0, 128.8, 128.5, 128.4, 127.6, 126.4, 121.6, 120.1, 106.0, 60.9, 55.6, 9.1; **IR (cm$^{-1}$)**: ν 3058, 1600, 1474, 1403, 1270, 1228, 1109, 760, 690; **HRMS**: m/z: $[M+H]^+$ calculated for $C_{24}H_{22}NO_2S^+$, 388.1366, found 388.1367.

2,5-diphenyl-4-(2,3,4-trimethoxyphenyl)thiazole (**22d**)



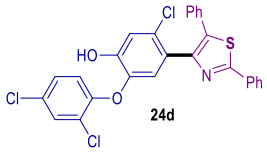

According to procedure C, the title product **22d** (30.3 mg) was isolated by column chromatography (PE : EA = 20:1) as a white amorphous solid in 75% yield. **$^1$H NMR (400 MHz, CDCl$_3$)** δ 8.00 (d, $J$ = 6.8 Hz, 2H), 7.45 – 7.40 (m, 3H), 7.33 – 7.22 (m, 5H), 7.11 (d, $J$ = 8.4 Hz, 1H), 6.70 (d, $J$ = 8.4 Hz, 1H) , 3.89 (s, 3H), 3.82 (s, 3H) , 3.82 (s, 3H) ; **$^{13}$C NMR (100 MHz, CDCl$_3$)** δ 164.8, 154.1, 152.1, 148.1, 142.5, 134.5, 133.8, 132.4, 129.8, 128.8, 128.5, 128.5, 127.7, 126.4, 126.0, 122.4, 107.3, 60.9, 60.8, 56.0; **IR (cm$^{-1}$)**: ν 3062, 1680, 1579, 1470, 1352, 1150, 709, 687; **HRMS**: m/z: $[M+H]^+$ calculated for $C_{24}H_{22}NO_3S^+$, 404.1315, found 404.1318.

4-(2,5-dimethylthiophen-3-yl)-2,5-diphenylthiazole (**23d**)



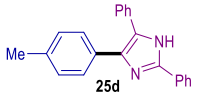

According to procedure C, the title product **23d** (28.5 mg) was isolated by column chromatography (PE : EA = 50:1) as a white amorphous solid in 82% yield. **$^1$H NMR (400 MHz, CDCl$_3$)** δ 8.00 (d, *J* = 6.8 Hz, 2H), 7.46 – 7.40 (m, 3H), 7.37 – 7.27 (m, 5H), 6.68 (s, 1H), 2.40 (s, 3H), 2.09 (s, 3H); **$^{13}$C NMR (100 MHz, CDCl$_3$)** δ 165.0, 147.1, 135.9, 135.5, 133.8, 133.7, 132.3, 131.6, 129.9, 128.8, 128.7, 128.6, 127.8, 127.0, 126.4, 15.2, 14.1; **IR (cm$^{-1}$)**: ν 3060, 1692, 1598, 1442, 1383, 1030, 760, 690; **HRMS**: m/z: $[M+H]^+$ calculated for $C_{21}H_{18}NS_2^+$, 348.0875, found 348.0878.

5-chloro-2-(2,4-dichlorophenoxy)-4-(2,5-diphenylthiazol-4-yl)phenol (**24d**)



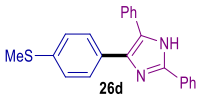

According to procedure C, the title product **24d** (21.0 mg) was isolated by column chromatography (PE : EA = 7:1) as a white amorphous solid in 40% yield. **$^1$H NMR (400 MHz, CDCl$_3$)** δ 7.94 (d, *J* = 6.8 Hz, 2H), 7.44 – 7.42 (m, 3H), 7.36 (s, 1H), 7.31 – 7.29 (m, 3H), 7.23 – 7.21 (m, 2H), 7.16 (s, 1H), 7.06 (d, *J* = 6.8 Hz, 1H), 6.75 – 6.73 (m, 2H); **$^{13}$C NMR (100 MHz, CDCl$_3$)** δ 163.9, 160.0, 150.8, 147.0, 142.1, 134.0, 132.8, 130.8, 130.6, 130.3, 129.6, 129.3, 128.8, 128.6, 128.4, 128.1, 127.0, 126.5, 126.0, 125.9, 125.3, 122.3, 120.7; **IR (cm$^{-1}$)**: ν 3605, 3060, 1609, 1478, 1441, 1249, 1175, 761; **HRMS**: m/z: $[M+H]^+$ calculated for $C_{27}H_{17}Cl_3NO_2S^+$, 524.0040, found 524.0032.

2,5-diphenyl-4-(p-tolyl)-1H-imidazole (**25d**)



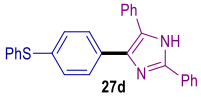

According to procedure C, the title product **25d** (29.2 mg) was isolated by column chromatography (PE : EA = 5:1) as a white amorphous solid in 94% yield. **$^1$H NMR (400 MHz, CDCl$_3$)** δ 7.91 (d, *J* = 7.2 Hz, 2H), 7.58 (d, *J* = 7.2 Hz, 2H), 7.47 – 7.29 (m, 8H), 7.16 (d, *J* = 7.2 Hz, 2H), 2.37 (s, 3H). This is a known compound[6].

4-(4-(methylthio)phenyl)-2,5-diphenyl-1H-imidazole (**26d**)



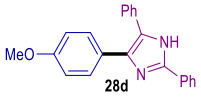

According to procedure C, the title product **26d** (25.5 mg) was isolated by column chromatography (PE : EA = 5:1) as a white amorphous solid in 74% yield. **$^1$H NMR (400 MHz, CDCl$_3$)** δ 7.84 (d, *J* = 7.2 Hz, 2H), 7.47 (d, *J* = 7.2 Hz, 2H), 7.40 – 7.28 (m, 8H), 7.15 – 7.13 (m, 2H), 2.46 (s, 3H); **$^{13}$C NMR (100 MHz, CDCl$_3$)** δ 146.1, 137.4, 129.7, 128.7, 128.6, 128.5, 128.3, 128.1, 127.8, 127.4, 126.3, 125.3, 15.6; **IR (cm$^{-1}$)**: ν 3414, 3058, 1602, 1486, 1404, 1261, 1098, 772, 695; **HRMS**: m/z: $[M+H]^+$ calculated for $C_{22}H_{19}N_2S^+$, 343.1263, found 343.1264.

2,5-diphenyl-4-(4-(phenylthio)phenyl)-1H-imidazole (**27d**)



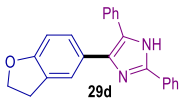

According to procedure C, the title product **27d** (35.2 mg) was isolated by column chromatography (PE : EA = 5:1) as a white amorphous solid in 87% yield. **$^1$H NMR (400 MHz, CDCl$_3$)** δ 7.85 (d, *J* = 7.2 Hz, 2H), 7.47 (t, *J* = 7.2 Hz, 4H), 7.41 – 7.27 (m, 11H), 7.24 – 7.20 (m, 2H) ; **$^{13}$C NMR (100 MHz, CDCl$_3$)** δ 146.2, 131.1, 130.9, 129.7, 129.2, 128.8, 128.7, 128.3, 127.9, 127.7, 127.1, 125.3; **IR (cm$^{-1}$)**: ν 3415, 3059, 1649, 1479, 1445, 1261, 1089, 1026, 692; **HRMS**: m/z: $[M+H]^+$ calculated for $C_{27}H_{21}N_2S^+$, 405.1420, found 405.1422.

4-(4-methoxyphenyl)-2,5-diphenyl-1H-imidazole (**28d**)




According to procedure C, the title product **28d** (25.5 mg) was isolated by column chromatography (PE : EA = 5:1) as a white amorphous solid in 78% yield. **$^1$H NMR (400 MHz, CDCl$_3$)** δ 7.92 (d, *J* = 7.2 Hz, 2H), 7.56 (d, *J* = 7.2 Hz, 2H), 7.54 – 7.31 (m, 8H), 6.89 (d, *J* = 8.4 Hz, 2H), 3.83 (s, 3H). This is a known compound[6].

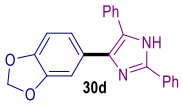
4-(2,3-dihydrobenzofuran-5-yl)-2,5-diphenyl-1H-imidazole (**29d**)




According to procedure C, the title product **29d** (24.8 mg) was isolated by column chromatography (PE : EA = 5:1) as a white amorphous solid in 73% yield. **$^1$H NMR (400 MHz, CDCl$_3$)** δ 7.87 (d, *J* = 7.2 Hz, 2H),

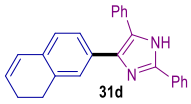
7.54 (d, $J$ = 7.2 Hz, 2H), 7.42 – 7.28 (m, 6H), 7.25 – 7.19 (m, 2H), 6.72 (d, $J$ = 7.2 Hz, 1H), 4.57 (t, $J$ = 8.8Hz, 2H), 3.15 (t, $J$ = 8.8Hz, 2H) ; **$^{13}$C NMR (100 MHz, CDCl$_3$)** δ 159.7, 145.6, 129.9, 128.8, 128.6, 128.5, 128.1, 127.5, 127.4, 127.1, 125.2, 124.8, 109.3, 71.4, 29.6; **IR (cm$^{-1}$)**: ν 3421, 3059, 1650, 1488, 1232, 1107, 982, 772, 696; **HRMS**: m/z: $[M+H]^+$ calculated for $C_{23}H_{19}N_2O^+$, 339.1492, found 339.1493.

4-(benzo[d][1,3]dioxol-5-yl)-2,5-diphenyl-1H-imidazole (**30d**)



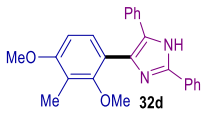

According to procedure C, the title product **30d** (32.0 mg) was isolated by column chromatography (PE : EA = 5:1) as a white amorphous solid in 94% yield. **$^1$H NMR (400 MHz, CDCl$_3$)** δ 7.89 (d, $J$ = 7.2 Hz, 2H), 7.54 (d, $J$ = 7.2 Hz, 2H), 7.44 (t, $J$ = 7.2 Hz, 2H), 7.39 – 7.33 (m, 3H), 7.29 (d, $J$ = 7.2 Hz, 1H), 7.03 (d, $J$ = 8.0Hz, 2H), 6.79 (d, $J$ = 8.0Hz, 1H), 5.97 (s, 2H); **$^{13}$C NMR (100 MHz, CDCl$_3$)** δ 147.7, 147.0, 145.7, 129.8, 128.9, 128.8, 128.6, 127.8, 127.4, 125.2, 121.7, 108.6, 108.5, 101.1; **IR (cm$^{-1}$)**: ν 3422, 3061, 1604, 1483, 1460, 1231, 1038, 696; **HRMS**: m/z: $[M+H]^+$ calculated for $C_{22}H_{17}N_2O_2^+$, 341.1284, found 341.1280.

4-(7,8-dihydronaphthalen-2-yl)-2,5-diphenyl-1H-imidazole (**31d**)



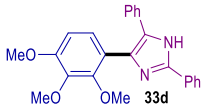

According to procedure C, the title product **31d** (28.6 mg) was isolated by column chromatography (PE : EA = 5:1) as a white amorphous solid in 82% yield.**$^1$H NMR (400 MHz, CDCl$_3$)** δ 7.88 (d, $J$ = 7.2 Hz, 2H), 7.59 (d, $J$ = 7.2 Hz, 2H), 7.43 – 7.34 (m, 5H), 7.31 (d, $J$ = 7.2 Hz, 1H), 7.15 – 7.11 (m, 3H), 7.00 (d, $J$ = 7.2 Hz, 1H), 6.81 (s, 1H), 2.81 (t, $J$ = 8.0 Hz, 2H) , 2.48 (t, $J$ = 8.0 Hz, 2H); **$^{13}$C NMR (100 MHz, CDCl$_3$)** δ 145.7, 134.9, 134.4, 129.8, 128.9, 128.8, 128.4, 128.3, 127.8, 127.5, 127.3, 127.0, 126.6, 126.3, 125.4, 125.3, 125.2; **IR (cm$^{-1}$)**: ν 3442, 2922, 1641, 1485, 1446, 1231, 1108, 1038, 695; **HRMS**: m/z: $[M+H]^+$ calculated for $C_{25}H_{21}N_2^+$, 349.1699, found 349.1693.

4-(2,4-dimethoxy-3-methylphenyl)-2,5-diphenyl-1H-imidazole (**32d**)




According to procedure C, the title product **32d** (29.0 mg) was isolated by column chromatography (PE : EA = 5:1) as a white amorphous solid in 78% yield. **$^1$H NMR (400 MHz, CDCl$_3$)** δ 7.91 (d, *J* = 7.2 Hz, 2H), 7.69 (d, *J* = 7.2 Hz, 2H), 7.44 (t, *J* = 7.2 Hz, 2H), 7.36 – 7.29 (m, 3H), 7.22 (d, *J* = 7.2 Hz , 1H), 7.16 (d, *J* = 8.8 Hz, 1H), 6.57 (d, *J* = 8.8 Hz, 1H), 3.83 (s, 3H) , 3.62 (s, 3H) , 2.21 (s, 3H); **$^{13}$C NMR (100 MHz, CDCl$_3$)** δ 158.6, 156.1 145.5, 130.1, 128.9, 128.6, 128.5, 128.3, 127.8, 126.8, 125.1, 120.2, 106.5, 60.5, 55.7, 8.9; **IR (cm$^{-1}$)**: ν 3423, 3061, 1604, 1484, 1407, 1270, 1110, 774, 695; **HRMS**: m/z: $[M+H]^+$ calculated for $C_{24}H_{23}N_2O_2^+$, 371.1759, found 371.1754.

2,5-diphenyl-4-(2,3,4-trimethoxyphenyl)-1H-imidazole (**33d**)



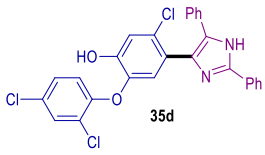

According to procedure C, the title product **33d** (32.5 mg) was isolated by column chromatography (PE : EA =5:1) as a white amorphous solid in 84% yield. **$^1$H NMR (400 MHz, CDCl$_3$)** δ 7.92 (d, *J* = 7.2 Hz, 2H), 7.71 – 7.61 (m, 2H), 7.45 (t, *J* = 7.2 Hz, 2H), 7.39 – 7.31 (m, 3H), 7.39 – 7.25 (m, 1H), 7.05 (d, *J* = 8.8 Hz, 1H), 6.59 (d, *J* = 8.8 Hz, 1H), 3.93 (s, 3H) , 3.87 (s, 3H), 3.81 (s, 3H); **$^{13}$C NMR (100 MHz, CDCl$_3$)** δ 153.5, 150.9, 145.4, 142.6, 130.1, 128.9, 128.7, 128.4, 128.0, 127.0, 125.2, 125.0, 107.9, 61.3, 61.1, 56.0; **IR (cm$^{-1}$)**: ν 3415, 3060, 1655, 1594, 1507, 1327, 1273, 696; **HRMS**: m/z: $[M+H]^+$ calculated for $C_{24}H_{23}N_2O_3^+$, 387.1703, found 387.1707.

4-(2,5-dimethylthiophen-3-yl)-2,5-diphenyl-1H-imidazole (**34d**)


According to procedure C, the title product **34d** (30.0 mg) was isolated by column chromatography (PE : EA = 7:1) as a white amorphous solid in 91% yield. **$^1$H NMR (500 MHz, CDCl3)** δ 8.16 (d, *J* = 7.5 Hz, 2H), 7.62 (d, *J* = 7.5 Hz, 2H), 7.47 (d, *J* = 7.5 Hz, 3H), 7.38 (t, *J* = 7.5 Hz, 2H), 7.31 (d, *J* = 7.5 Hz, 1H), 6.78 (s, 1H), 2.46 (s, 3H), 2.24 (s, 3H); **$^{13}$C NMR (125 MHz, CDCl3)** δ 159.7, 145.9, 136.6, 135.9, 132.5, 130.3, 129.0, 128.8, 128.7, 128.6, 128.0, 127.3, 126.5, 126.4, 125.2, 15.2, 14.2; **IR (cm-1)**: ν 3448, 2957, 1654, 1460, 1384, 1244, 773, 695;

**HRMS**: m/z: [M+H]+ calculated for $C_{21}H_{19}N_2S^+$, 331.1264, found 331.1266.

5-chloro-2-(2,4-dichlorophenoxy)-4-(2,5-diphenyl-1H-imidazol-4-yl)phenol (**35d**)



35d

According to procedure C, the title product **35d** (22.9 mg) was isolated by column chromatography (PE : EA =5:1) as a white amorphous solid in 45% yield. **$^1$H NMR (400 MHz, $CDCl_3$)** δ 7.98 (d, *J* = 7.2 Hz, 2H), 7.81 – 7.79 (m, 3H), 7.63 – 7.60 (m, 1H), 7.55 – 7.52 (m, 3H), 7.38 (d, *J* = 7.2 Hz, 2H), 7.23 – 7.20 (m, 1H), 7.10 (d, *J* = 8.8 Hz, 1H), 6.99 (d, *J* = 8.8 Hz, 1H), 6.75 (d, *J* = 8.8 Hz, 1H); **$^{13}$C NMR (100 MHz, $CDCl_3$)** δ 163.4, 158.0, 141.5, 136.9, 134.0, 132.8, 132.0, 131.2, 130.8, 130.1, 129.6, 129.1, 128.5, 128.0, 127.8, 127.1, 126.1, 125.9, 125.9, 125.8, 125.8, 125.3, 122.6; **IR (cm-1)**: ν 3605, 3415, 3063, 1647, 1473, 1256, 1099, 695; **HRMS**: m/z: $[M+H]^+$ calculated for $C_{27}H_{18}Cl_3N_2O_2^+$, 507.0434, found 507.0428.

## 8. References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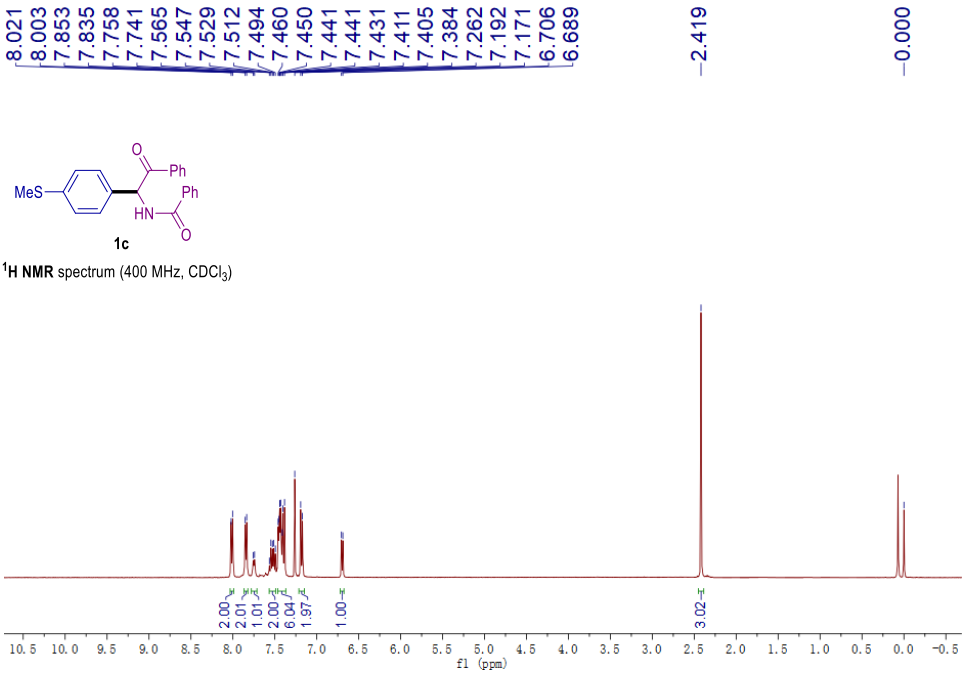
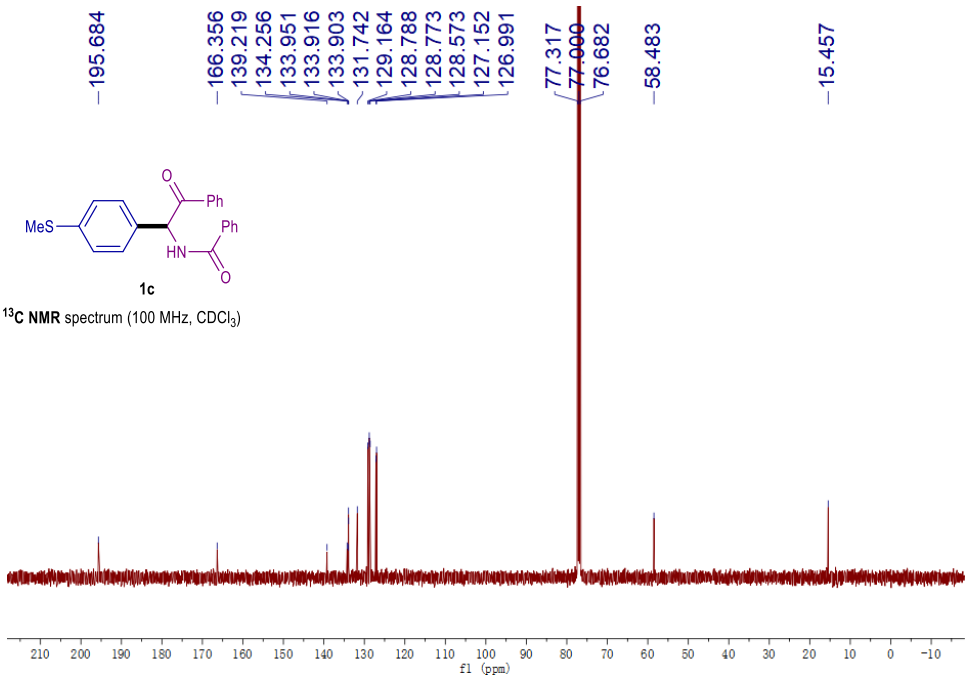
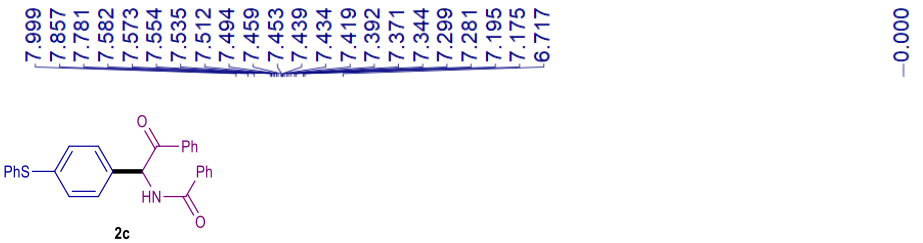
# 9. Copies of NMR spectra




**$^{1}$H NMR** spectrum (400 MHz, $CDCl_3$)




**$^{13}$C NMR** spectrum (100 MHz, $CDCl_3$)

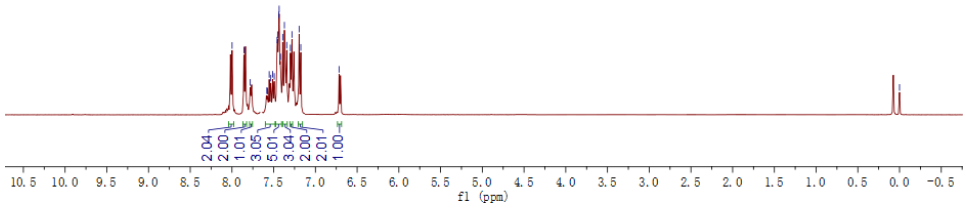




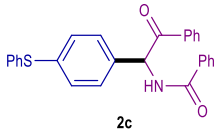


**2c**

$^{1}$**H NMR** spectrum (400 MHz, $CDCl_3$)

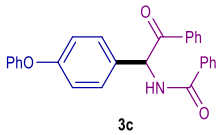






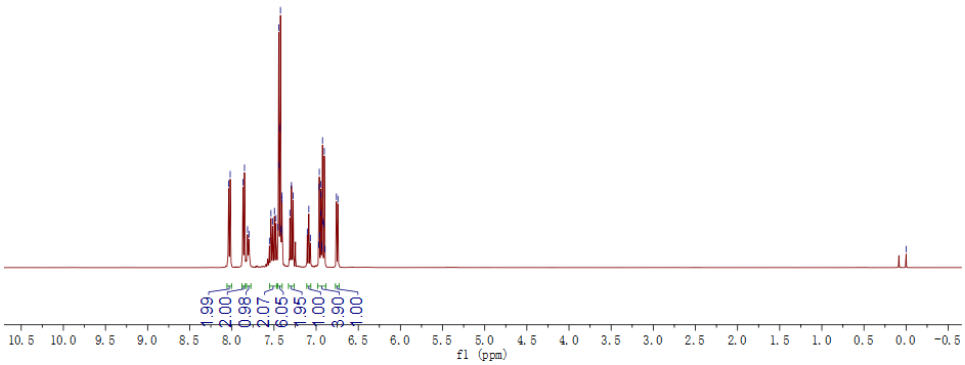

**2c**

$^{13}$**C NMR** spectrum (100 MHz, $CDCl_3$)

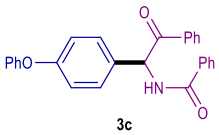




**3c**

**$^{1}$H NMR** spectrum (400 MHz, $CDCl_3$)

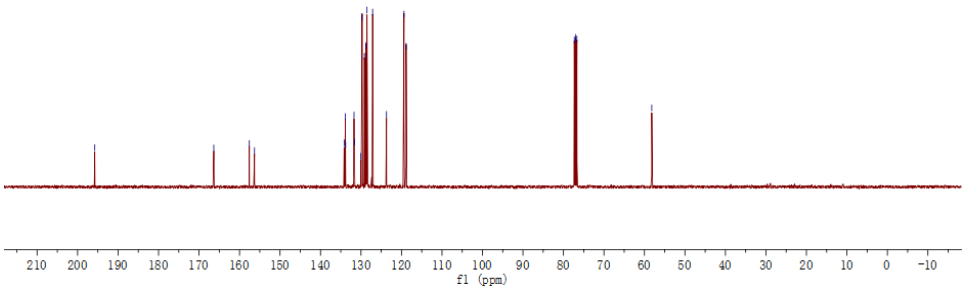


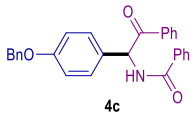





**3c**

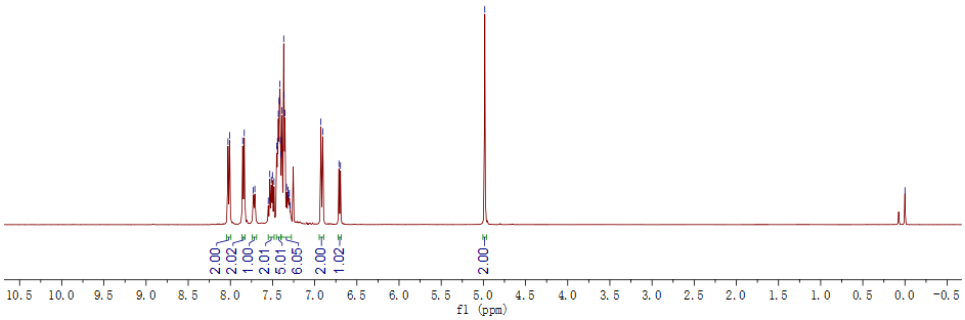
**$^{13}$C NMR** spectrum (100 MHz, $CDCl_3$)



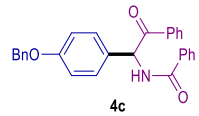




**4c**

**$^{1}$H NMR** spectrum (400 MHz, $CDCl_3$)

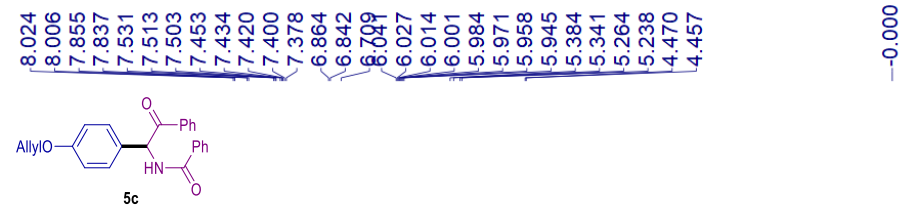







**4c**

**$^{13}$C NMR** spectrum (100 MHz, $CDCl_3$)

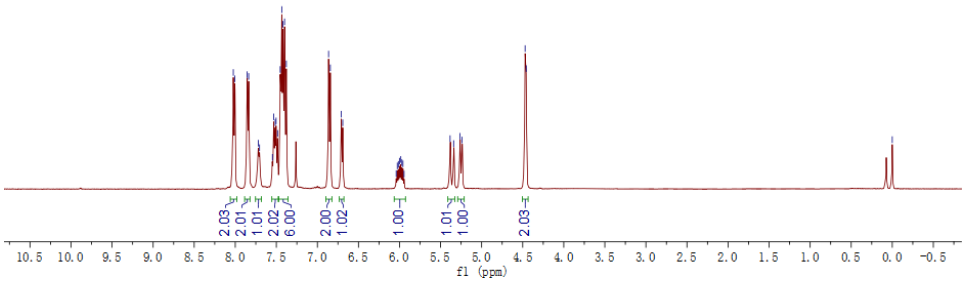


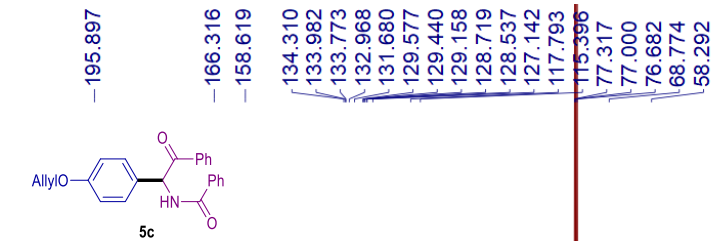




**5c**

**$^{1}$H NMR** spectrum (400 MHz, $CDCl_3$)



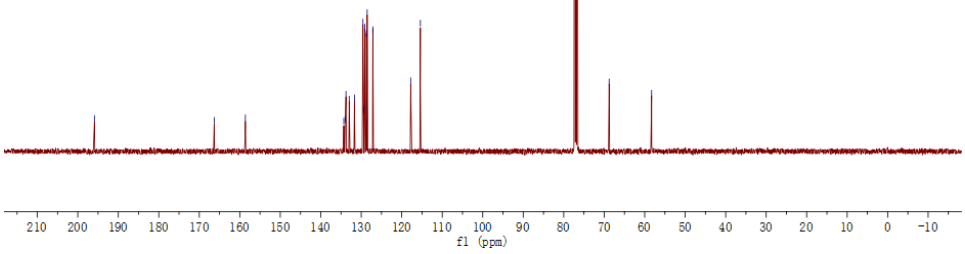



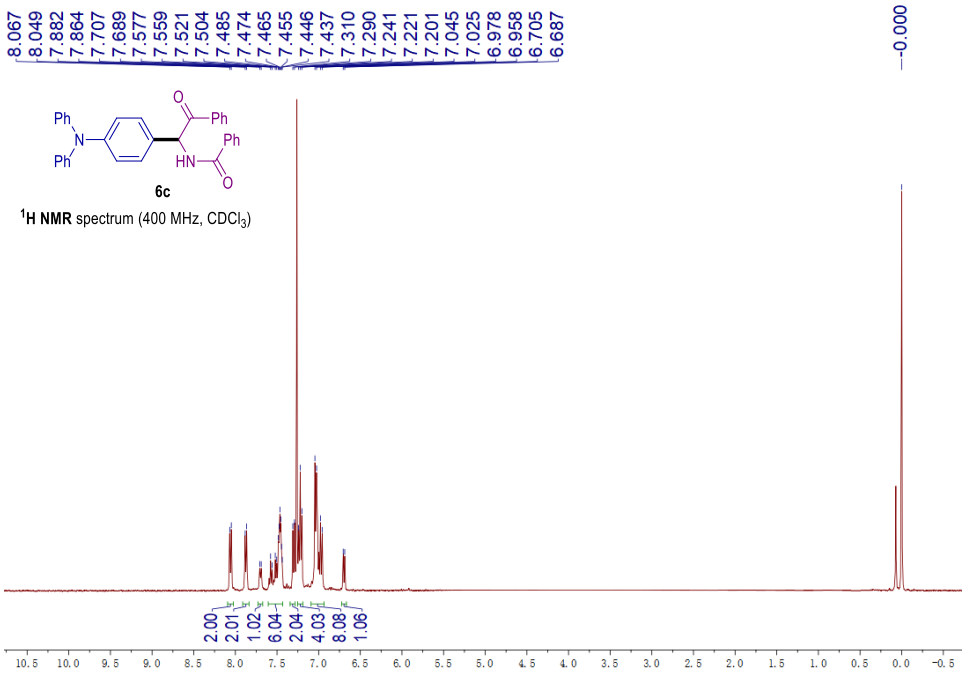




**5c**

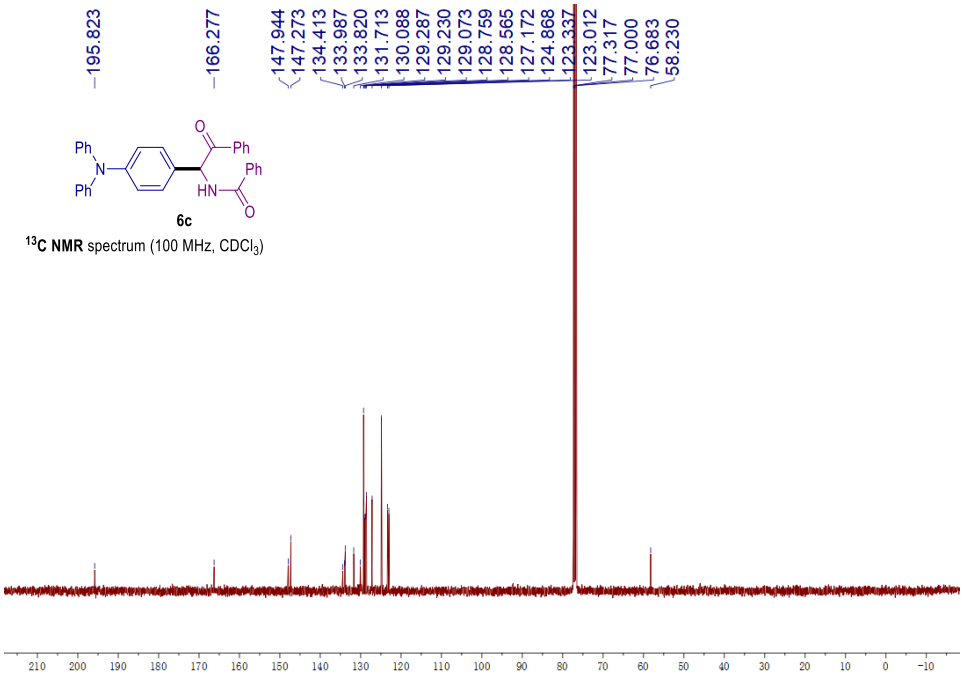
**$^{13}$C NMR** spectrum (100 MHz, $CDCl_3$)





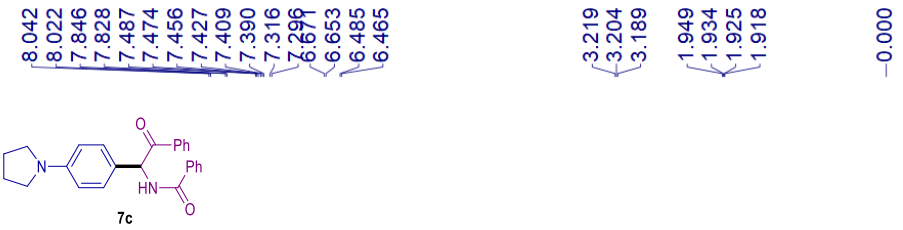

**6c**

**$^{1}$H NMR** spectrum (400 MHz, $CDCl_3$)




**6c**

**$^{13}$C NMR** spectrum (100 MHz, $CDCl_3$)

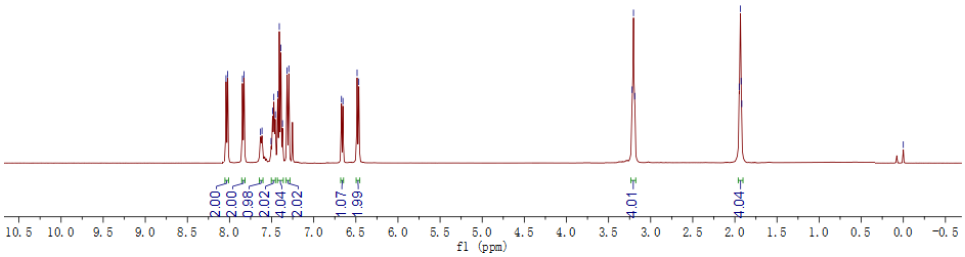




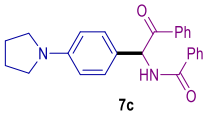


**7c**

$^{1}$**H NMR** spectrum (400 MHz, $CDCl_3$)

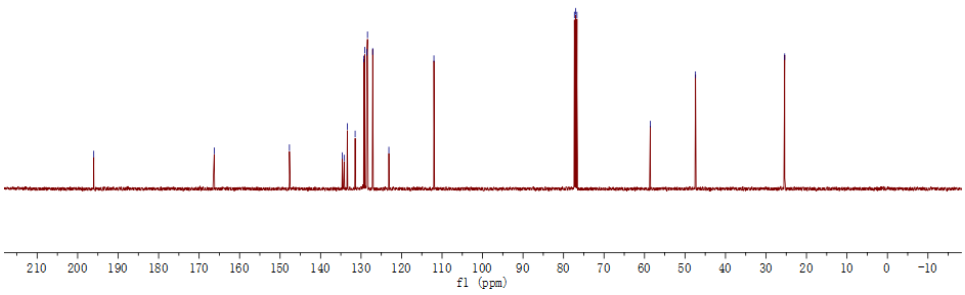


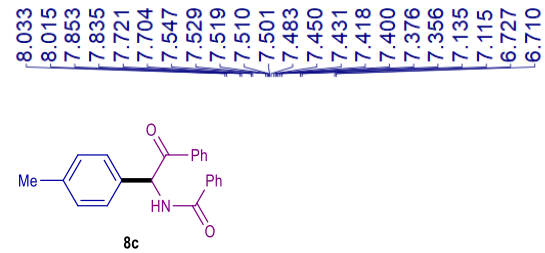





**7c**

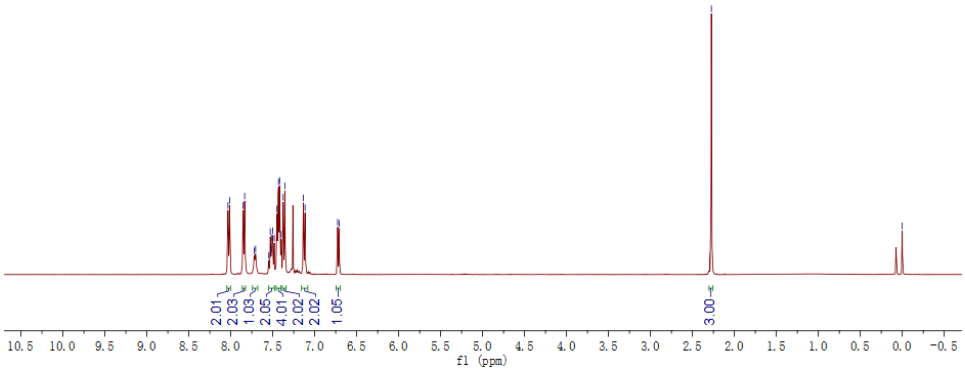
$^{13}$**C NMR** spectrum (100 MHz, $CDCl_3$)

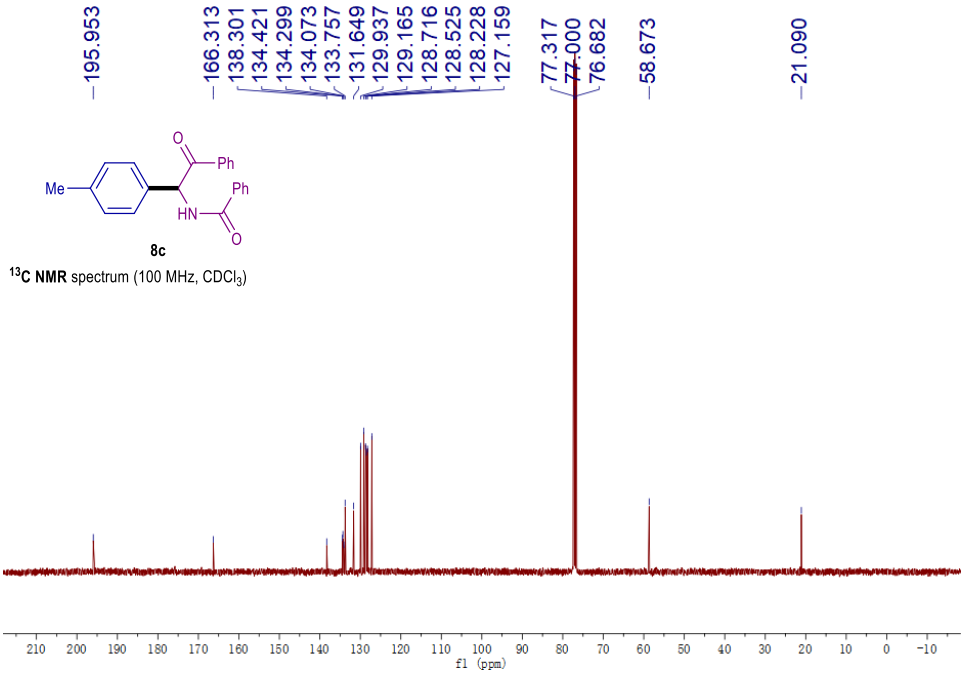





**8c**

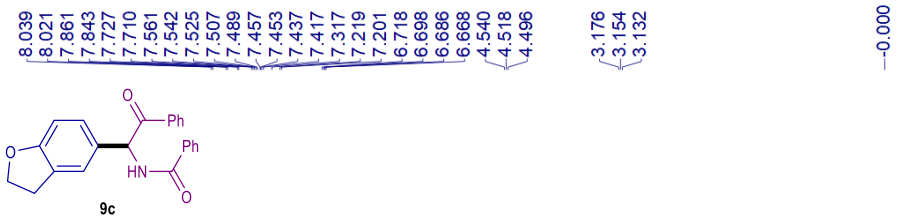
**$^1$H NMR** spectrum (400 MHz, $CDCl_3$)



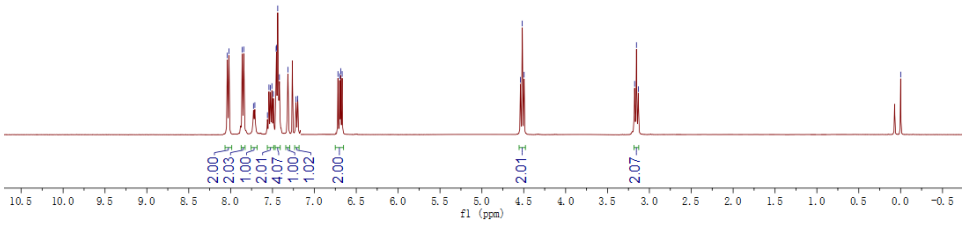

**8c**

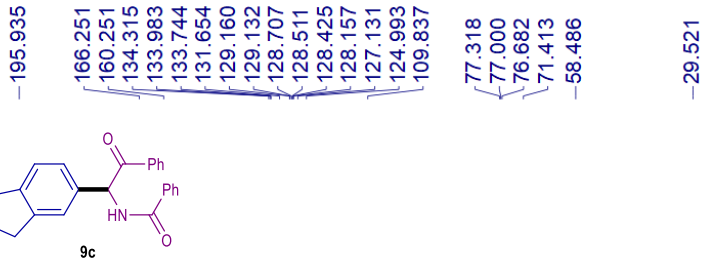
**$^{13}$C NMR** spectrum (100 MHz, $CDCl_3$)




**9c**

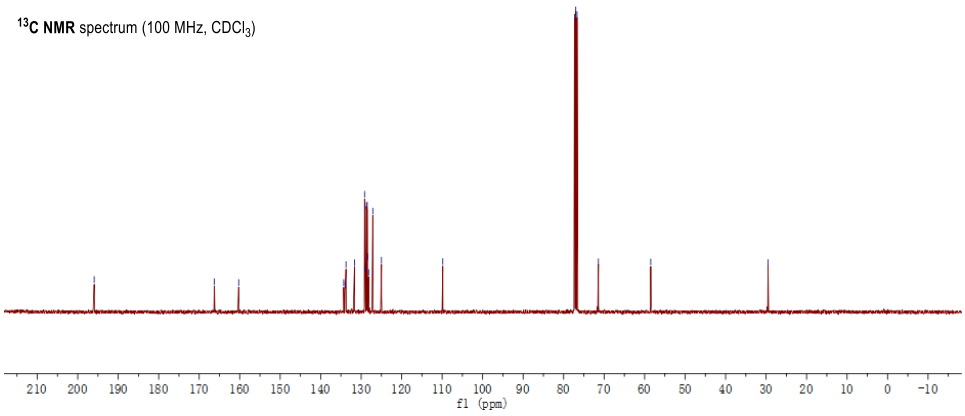
**$^{1}$H NMR** spectrum (400 MHz, $CDCl_3$)

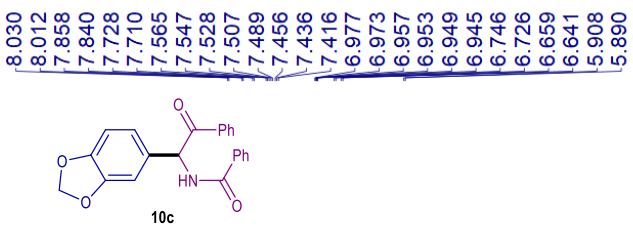



**9c**

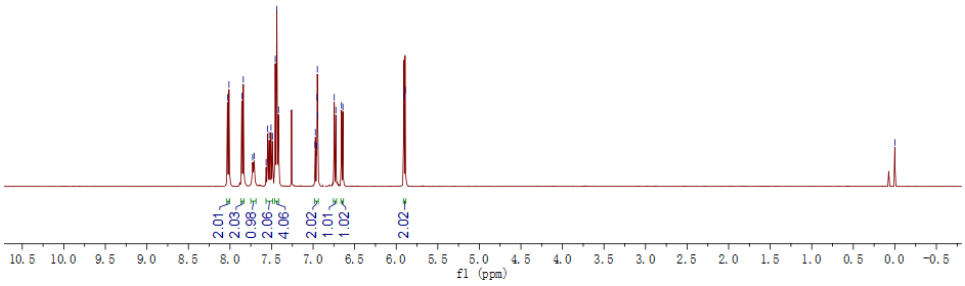
**$^{13}$C NMR** spectrum (100 MHz, $CDCl_3$)

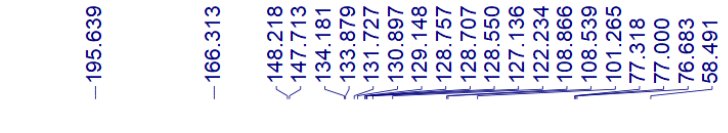


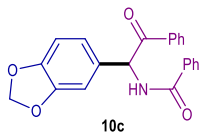



**10c**

**$^{1}$H NMR** spectrum (400 MHz, $CDCl_3$)

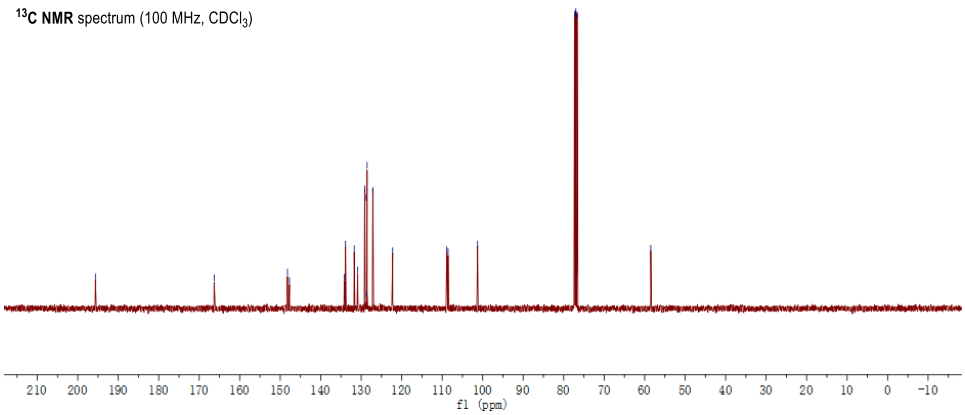


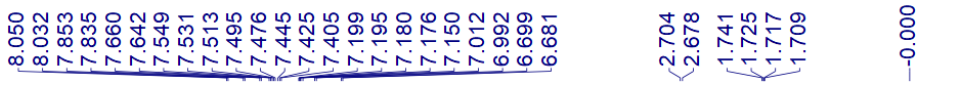



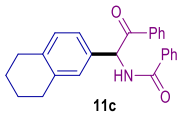




**10c**

**$^{13}$C NMR** spectrum (100 MHz, $CDCl_3$)

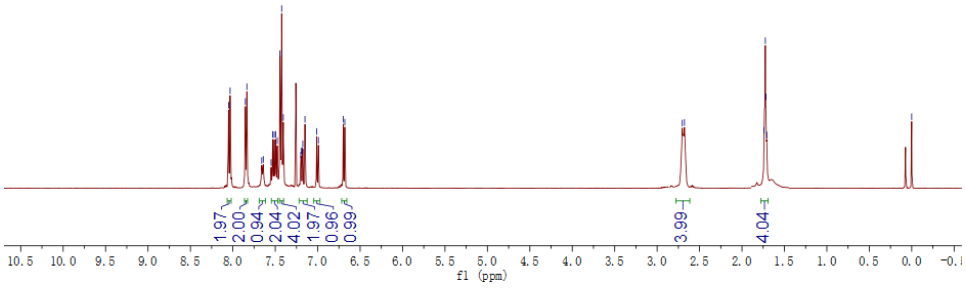




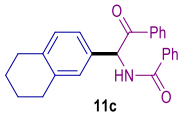




**11c**

$^{1}$**H NMR** spectrum (400 MHz, $CDCl_3$)

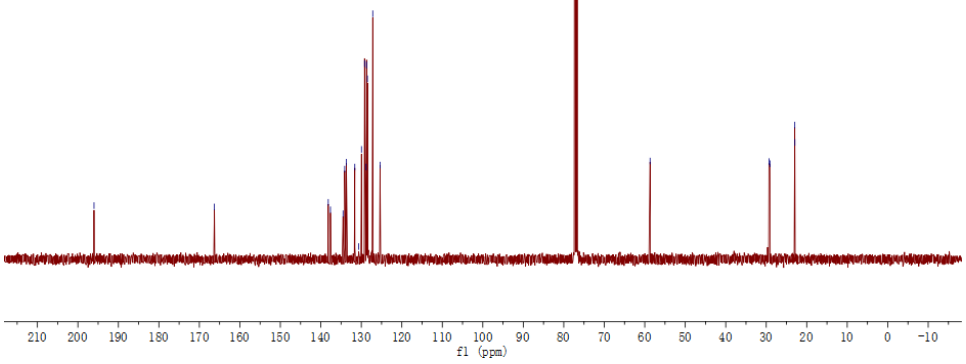


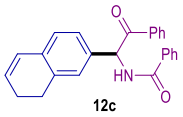





**11c**

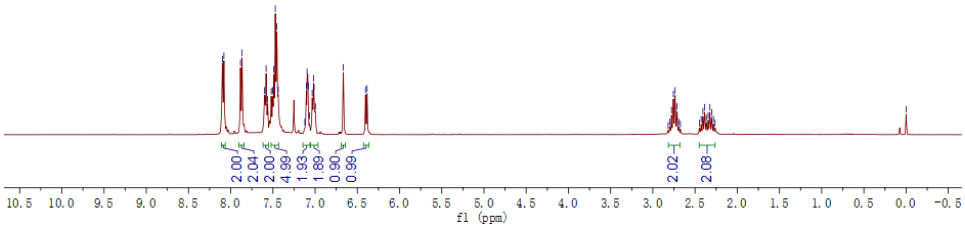
$^{13}$**C NMR** spectrum (100 MHz, $CDCl_3$)

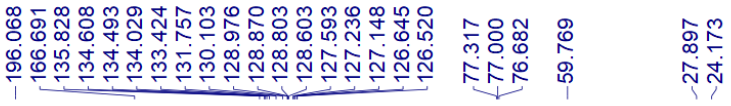


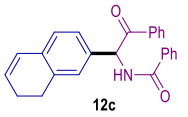




**12c**

**$^{1}$H NMR** spectrum (400 MHz, $CDCl_3$)

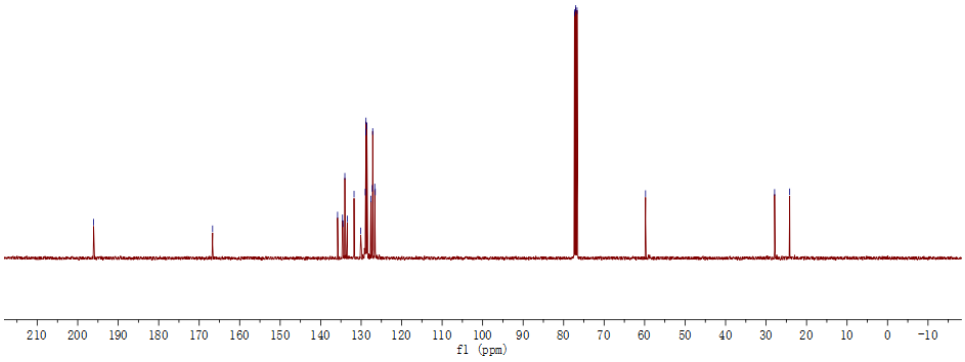


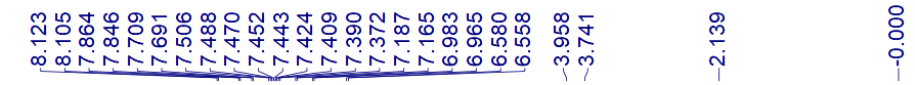



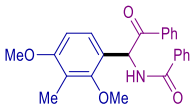




**12c**

**$^{13}$C NMR** spectrum (100 MHz, $CDCl_3$)

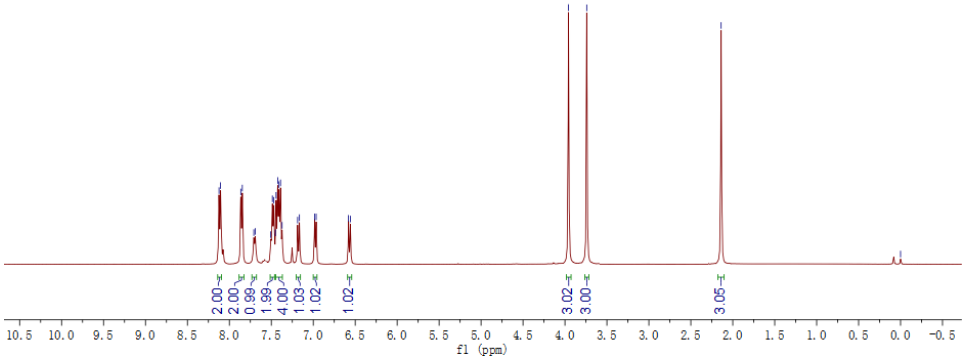




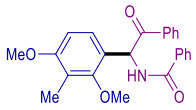




**13c**

**$^{1}$H NMR** spectrum (400 MHz, $CDCl_3$)

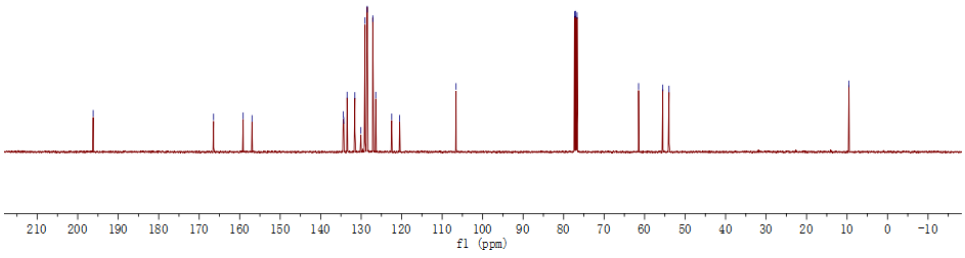


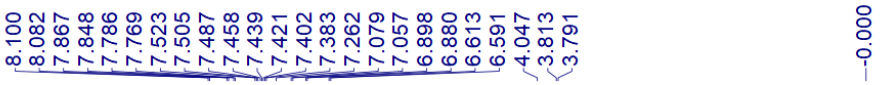


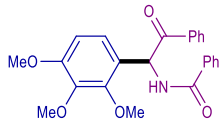



**13c**

**$^{13}$C NMR** spectrum (100 MHz, $CDCl_3$)

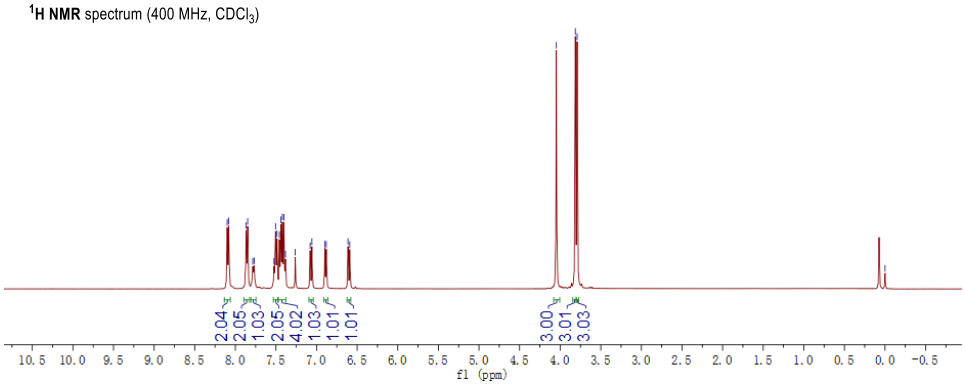


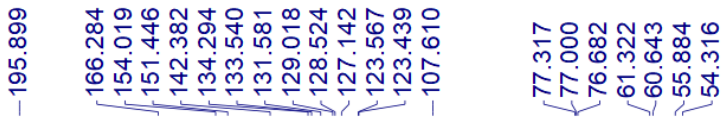


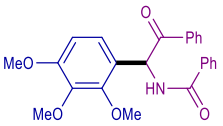




**14c**

**$^{1}$H NMR** spectrum (400 MHz, $CDCl_3$)

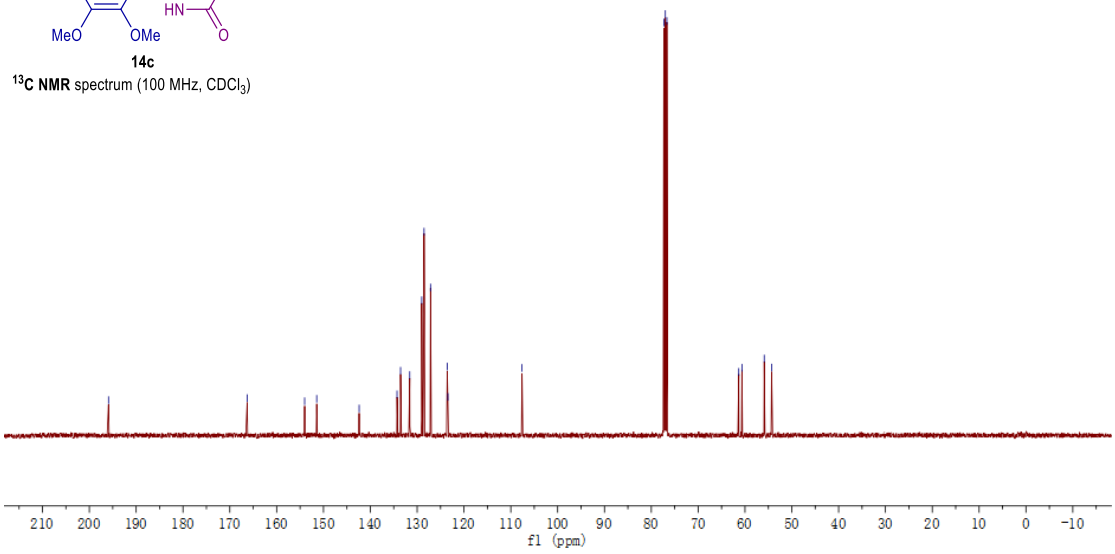


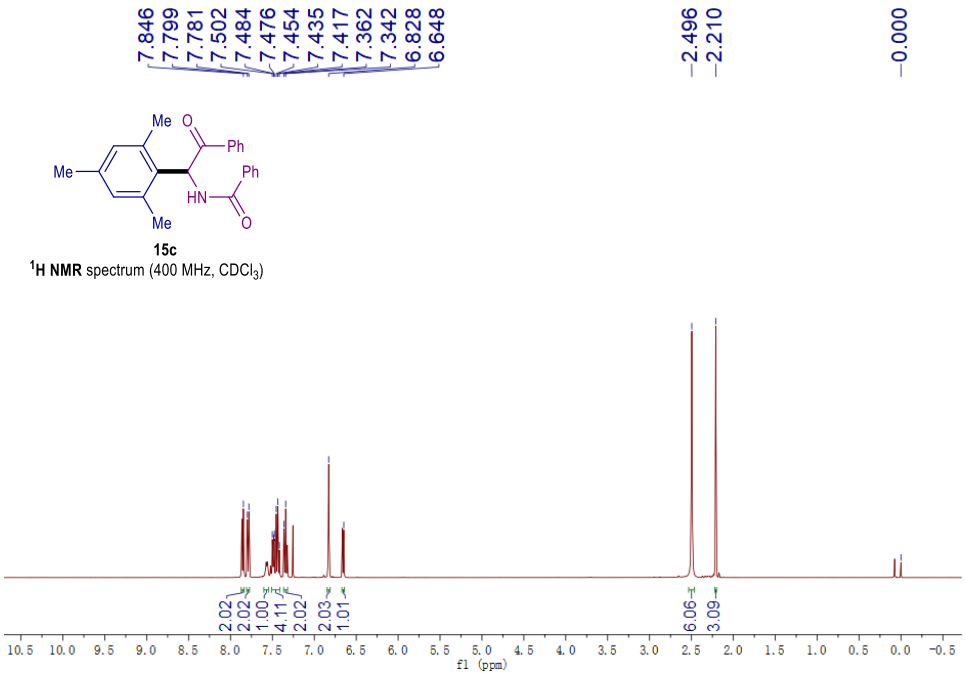




**14c**

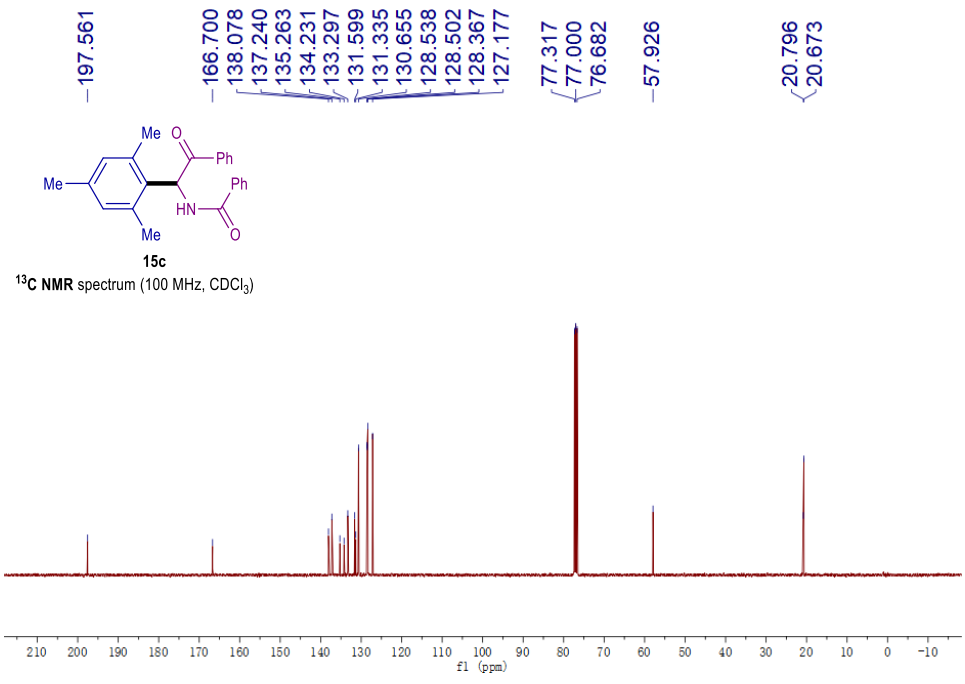
**$^{13}$C NMR** spectrum (100 MHz, $CDCl_3$)





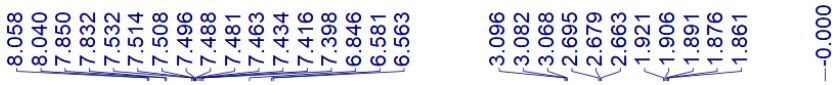

**15c**

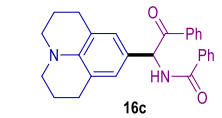
**$^{1}$H NMR** spectrum (400 MHz, $CDCl_3$)




**15c**

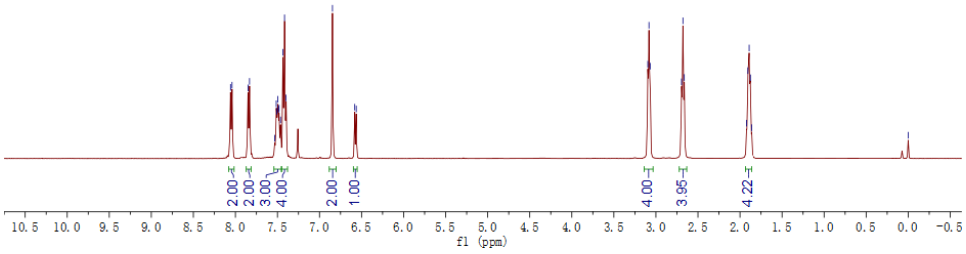
**$^{13}$C NMR** spectrum (100 MHz, $CDCl_3$)

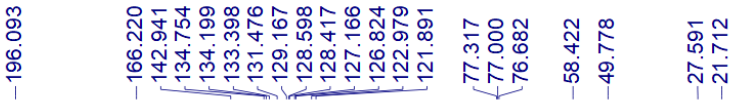


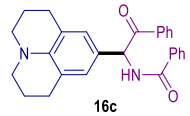




**16c**

**$^{1}$H NMR** spectrum (400 MHz, $CDCl_3$)

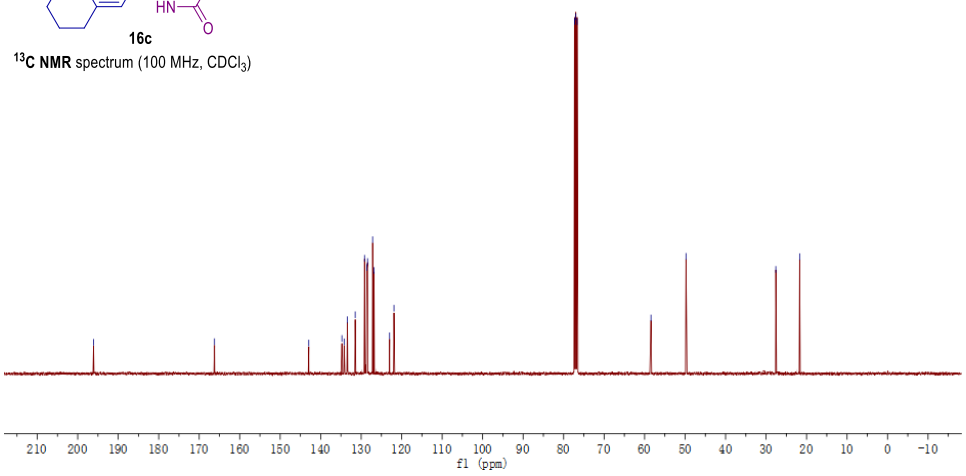


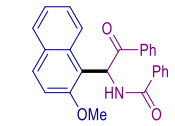




**16c**

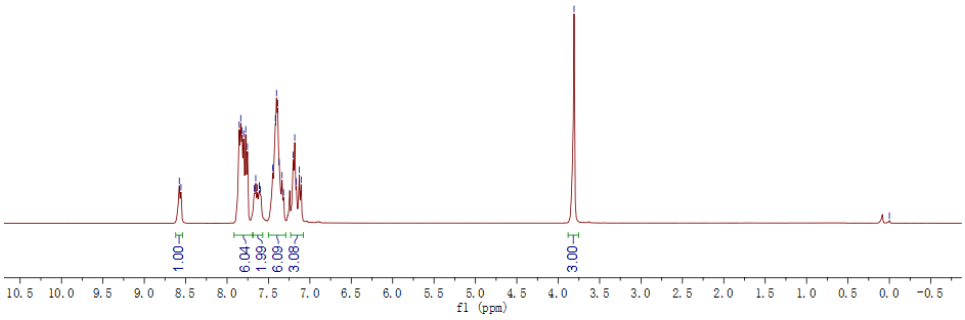
**$^{13}$C NMR** spectrum (100 MHz, $CDCl_3$)

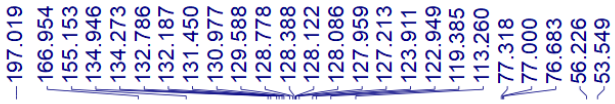


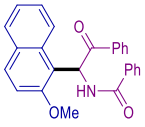




**17c**

**$^{1}$H NMR** spectrum (400 MHz, $CDCl_3$)

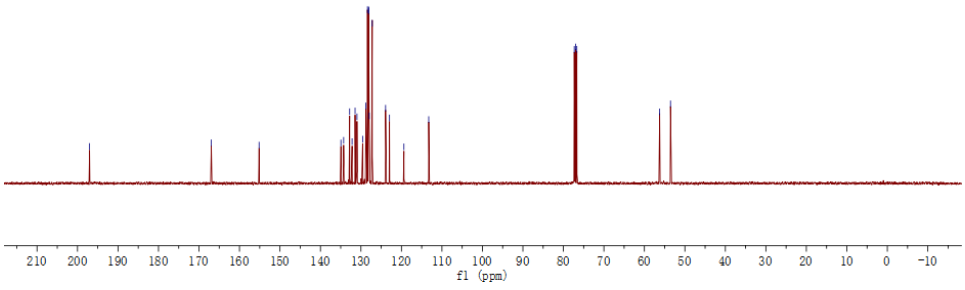


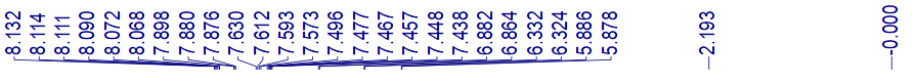



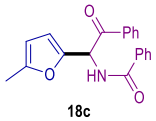




**17c**

**$^{13}$C NMR** spectrum (100 MHz, $CDCl_3$)

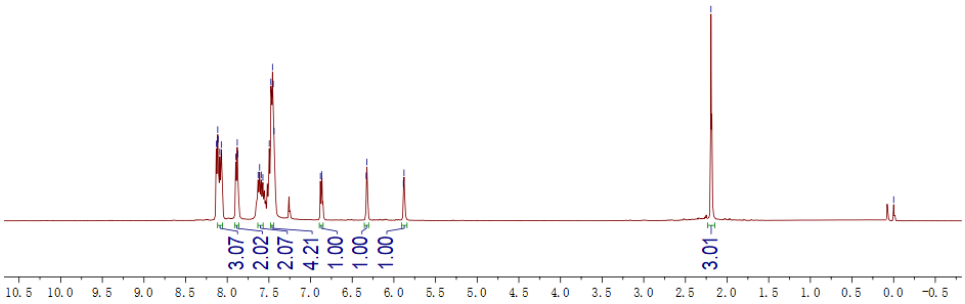


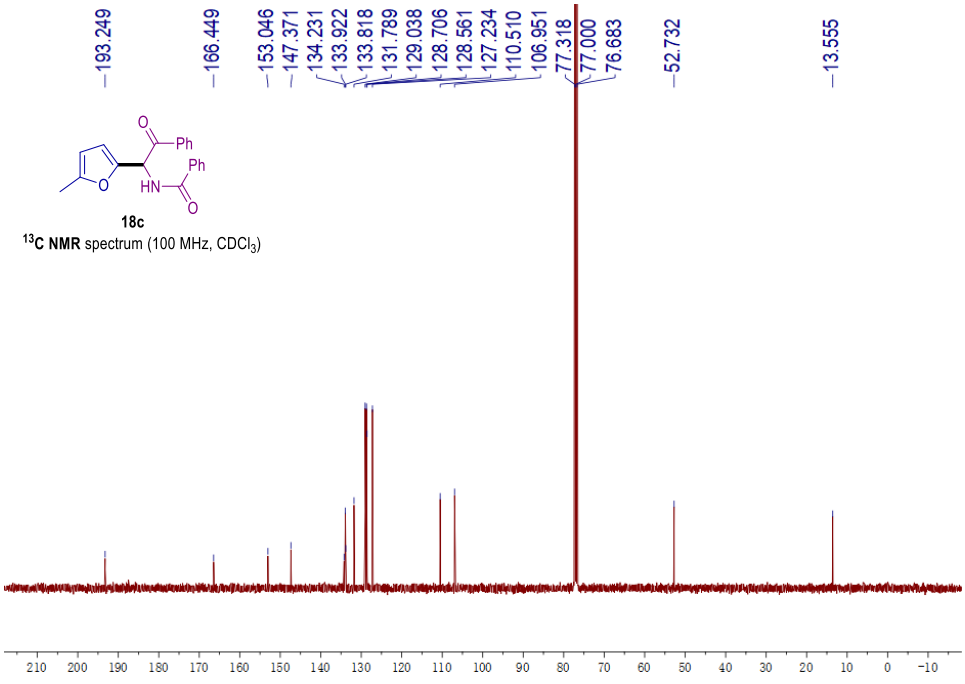



**18c**

**$^{1}$H NMR** spectrum (400 MHz, $CDCl_3$)



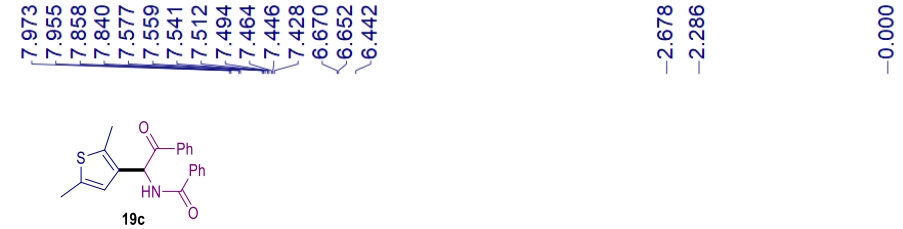







**18c**

**$^{13}$C NMR** spectrum (100 MHz, $CDCl_3$)

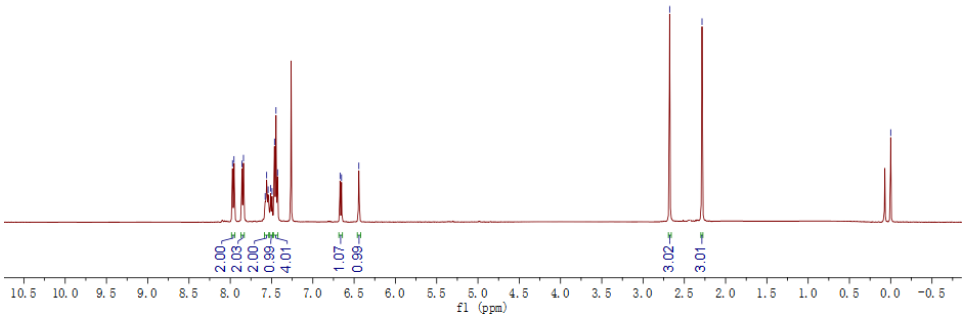


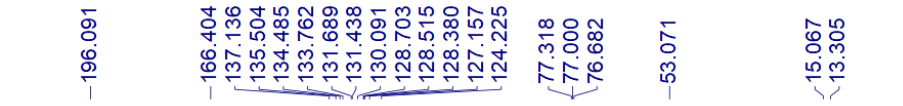


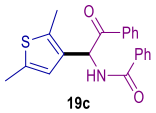


**19c**

**$^{1}$H NMR** spectrum (400 MHz, $CDCl_3$)

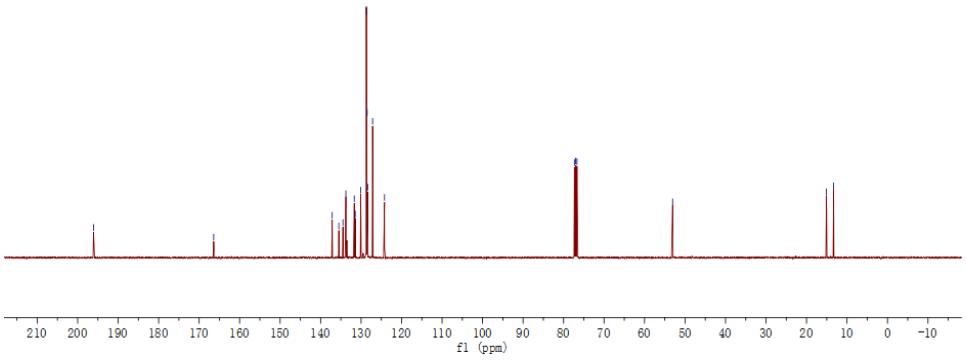


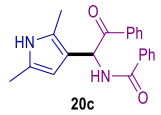




**19c**

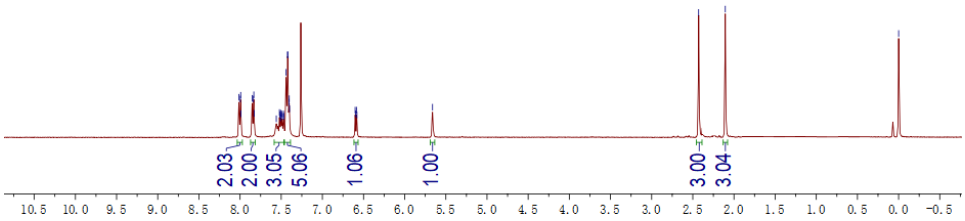
**$^{13}$C NMR** spectrum (100 MHz, $CDCl_3$)

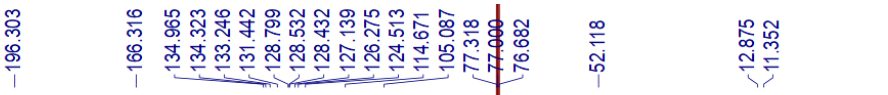


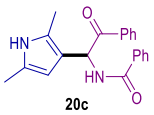




**20c**

$^{1}$**H NMR** spectrum (400 MHz, $CDCl_3$)

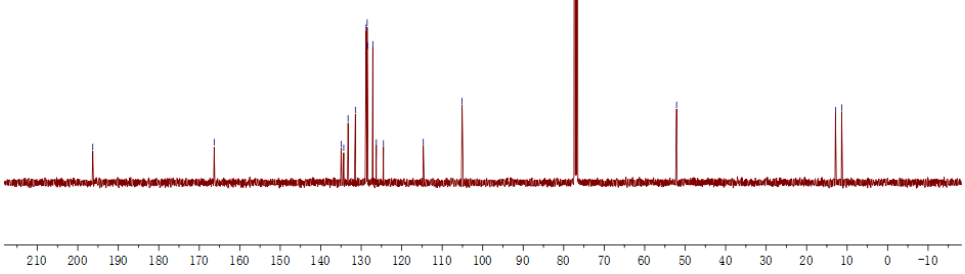


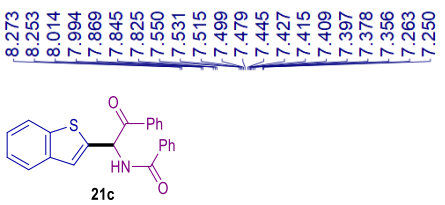




**20c**

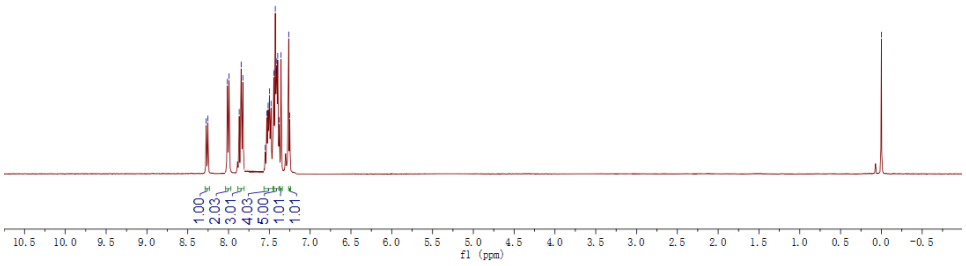
$^{13}$**C NMR** spectrum (100 MHz, $CDCl_3$)

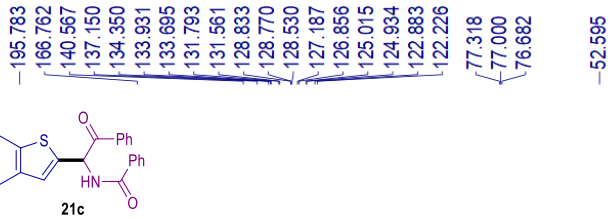





**21c**

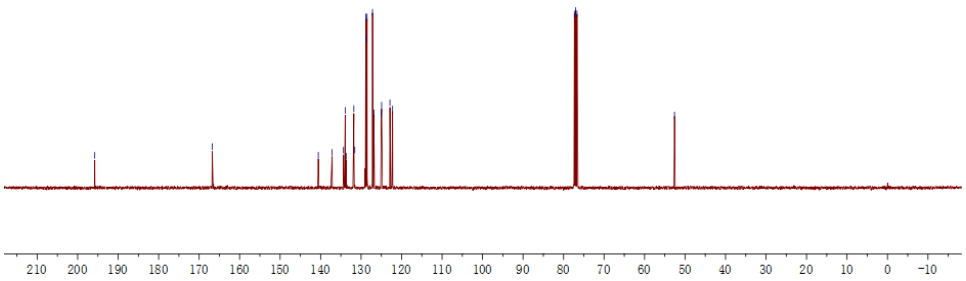
**$^{1}$H NMR** spectrum (400 MHz, $CDCl_3$)

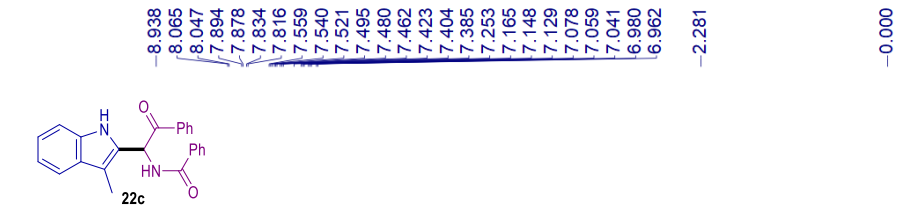



**21c**

**$^{13}$C NMR** spectrum (100 MHz, $CDCl_3$)



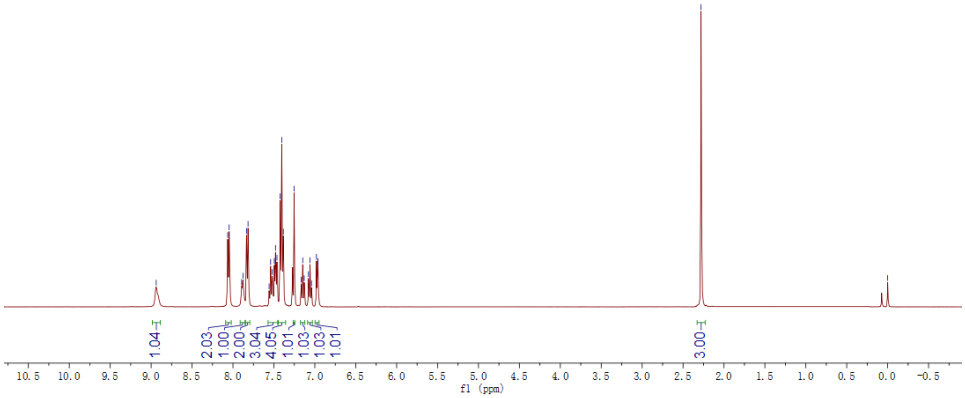




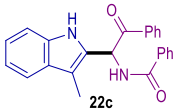


22c

**$^{1}$H NMR** spectrum (400 MHz, $CDCl_3$)

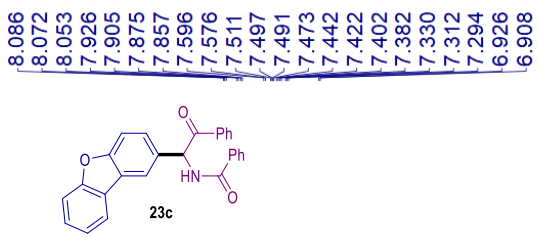






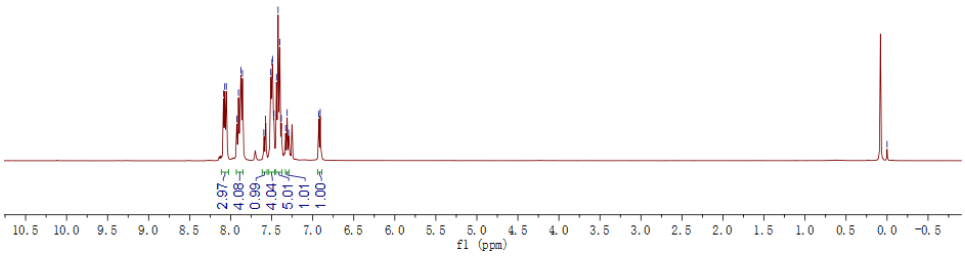

22c

**$^{13}$C NMR** spectrum (100 MHz, $CDCl_3$)




**23c**

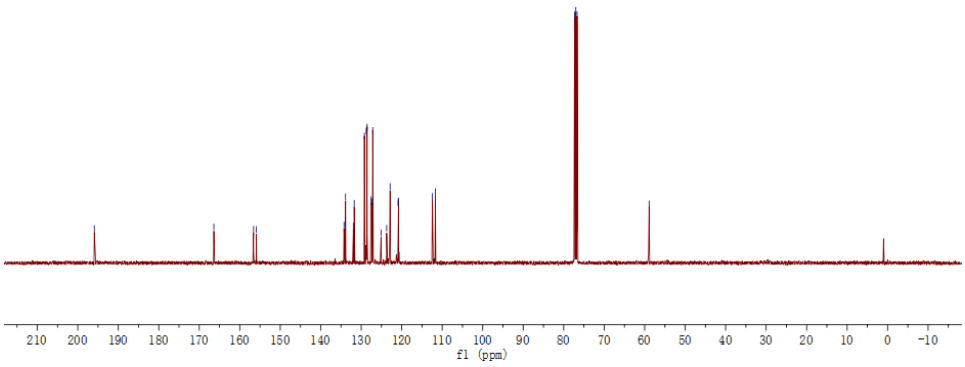
$^{1}$**H NMR** spectrum (400 MHz, $CDCl_3$)

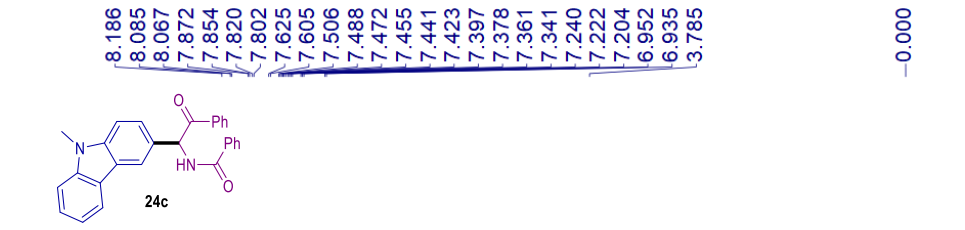




**23c**

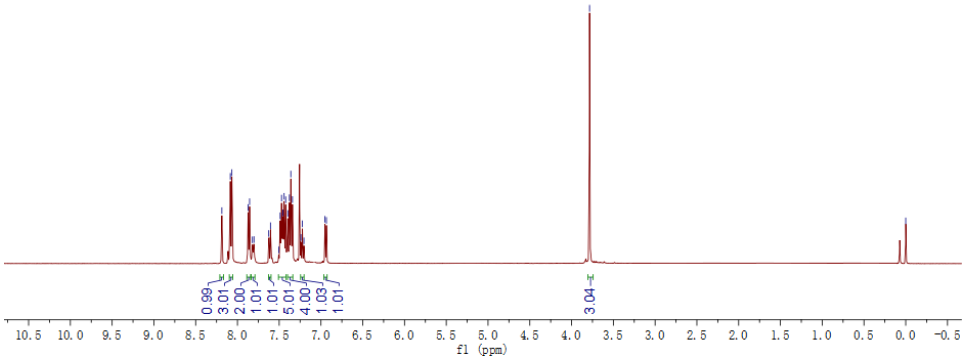
$^{13}$**C NMR** spectrum (100 MHz, $CDCl_3$)

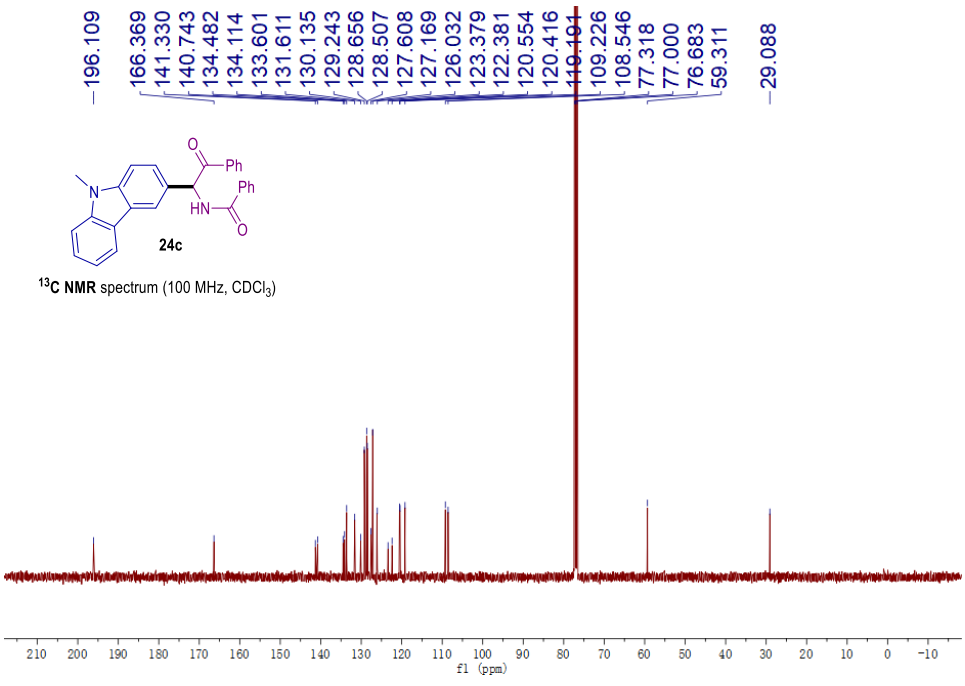





**24c**

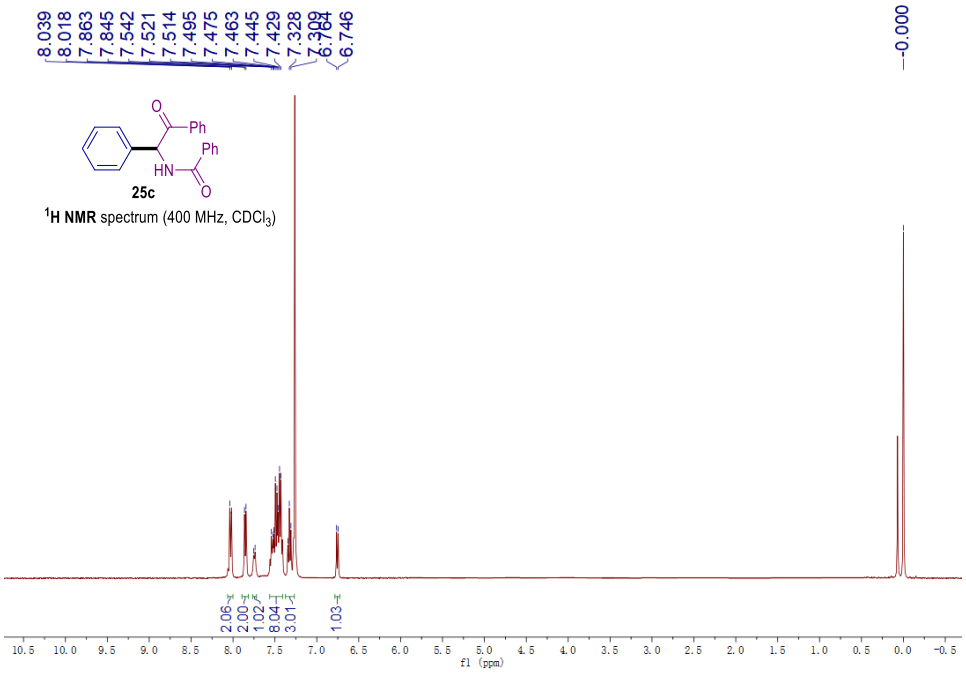
$^{1}$**H NMR** spectrum (400 MHz, $CDCl_3$)



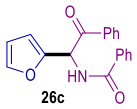




**24c**

$^{13}$**C NMR** spectrum (100 MHz, $CDCl_3$)

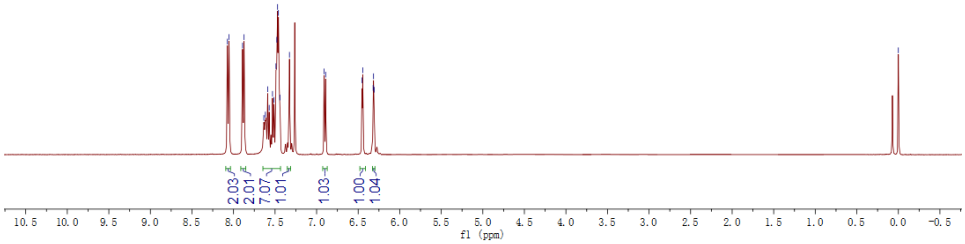


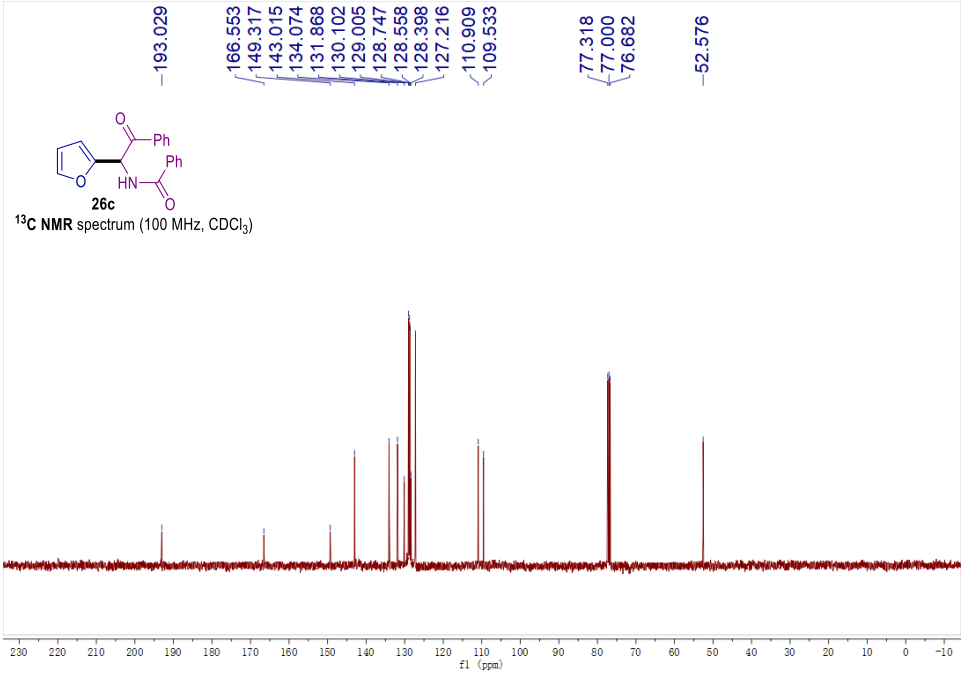

**$^1$H NMR** spectrum (400 MHz, $CDCl_3$)


**26c**

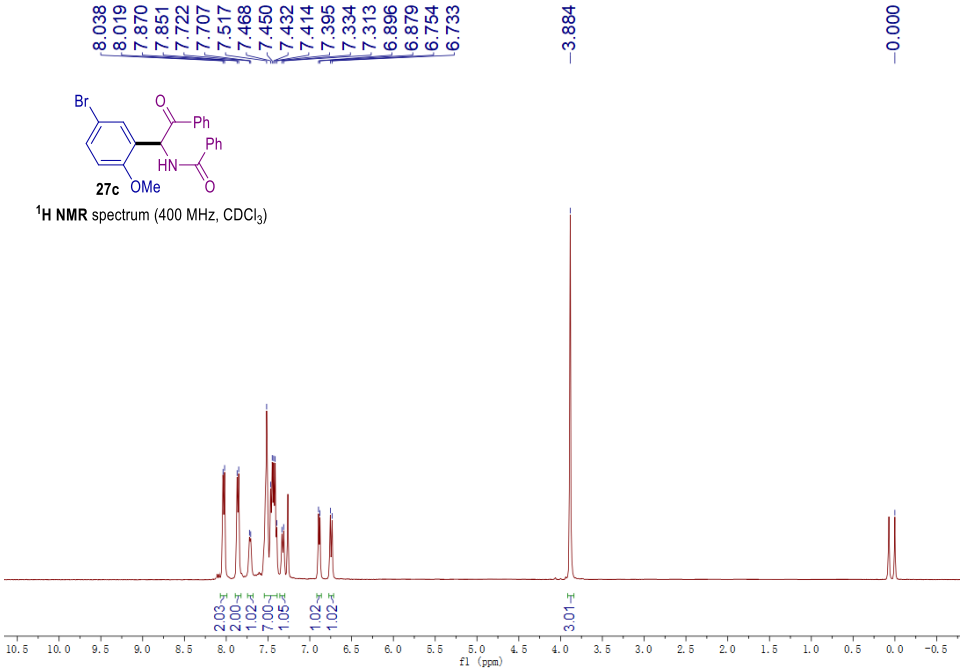
$^{1}$**H NMR** spectrum (400 MHz, $CDCl_3$)



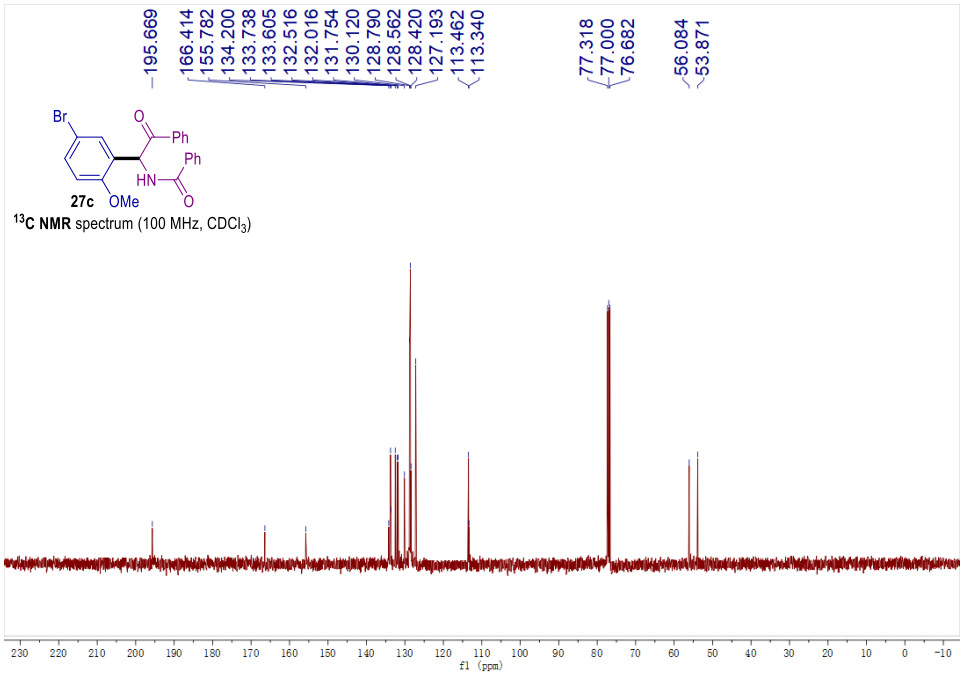




**26c**

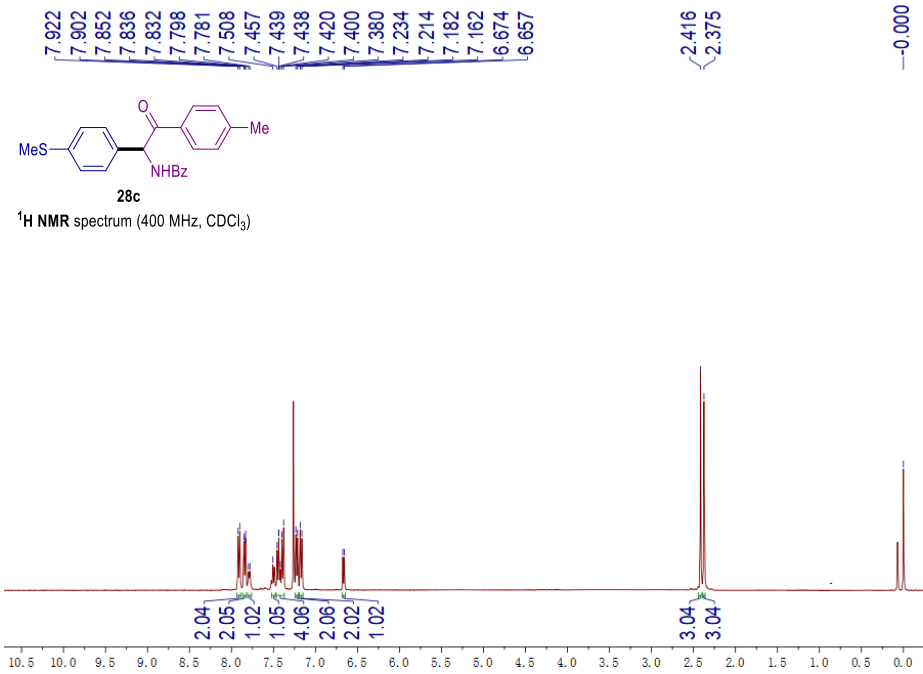
$^{13}$**C NMR** spectrum (100 MHz, $CDCl_3$)




**$^{1}$H NMR** spectrum (400 MHz, $CDCl_3$)

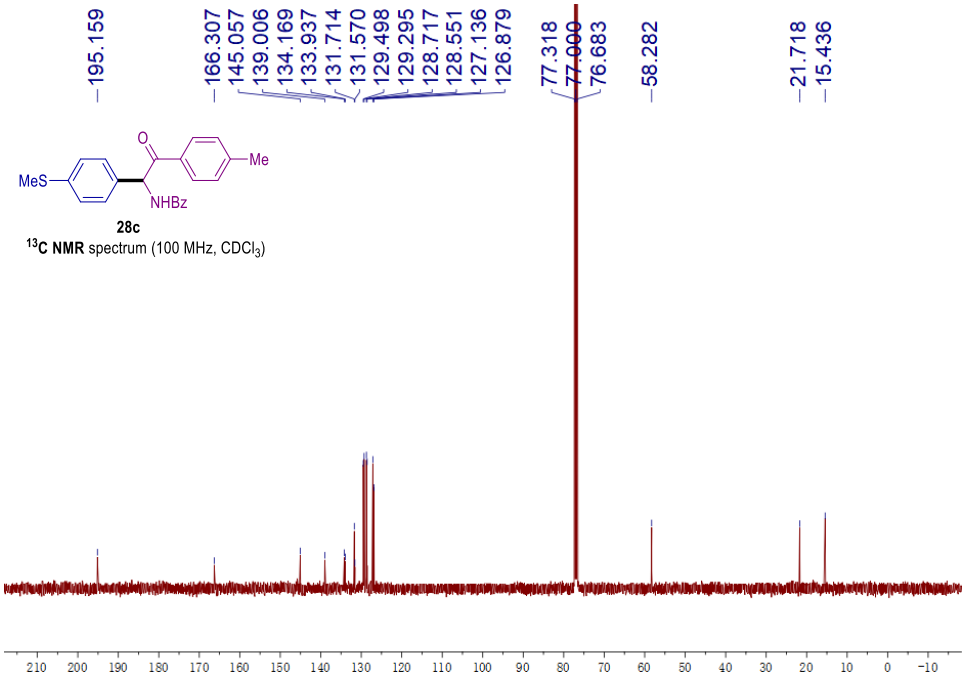



**$^{13}$C NMR** spectrum (100 MHz, $CDCl_3$)



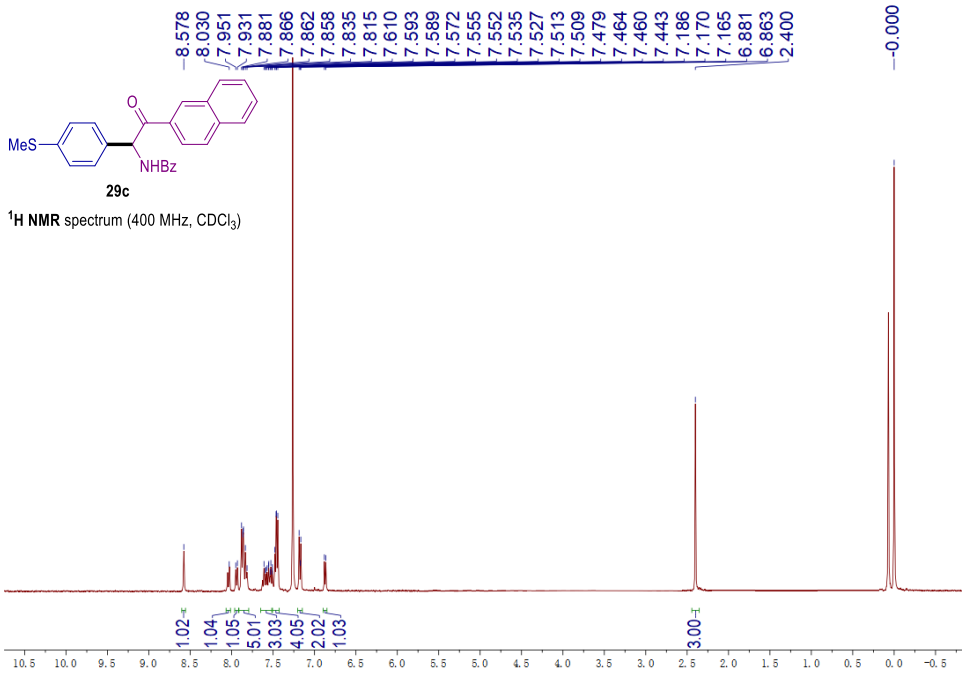

**28c**

**$^{1}$H NMR** spectrum (400 MHz, $CDCl_3$)



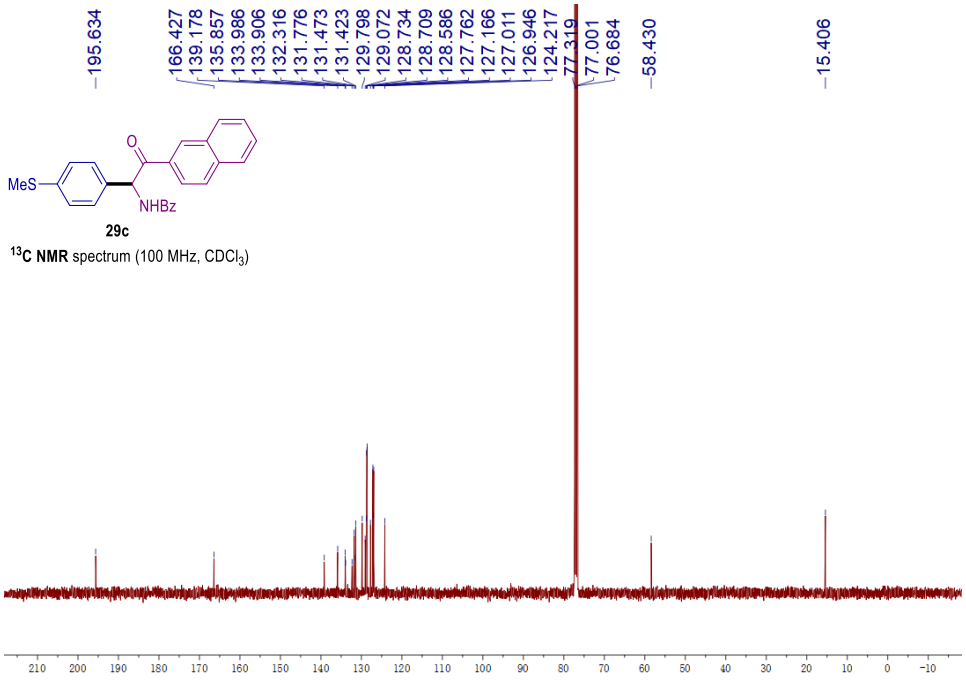

**28c**

**$^{13}$C NMR** spectrum (100 MHz, $CDCl_3$)



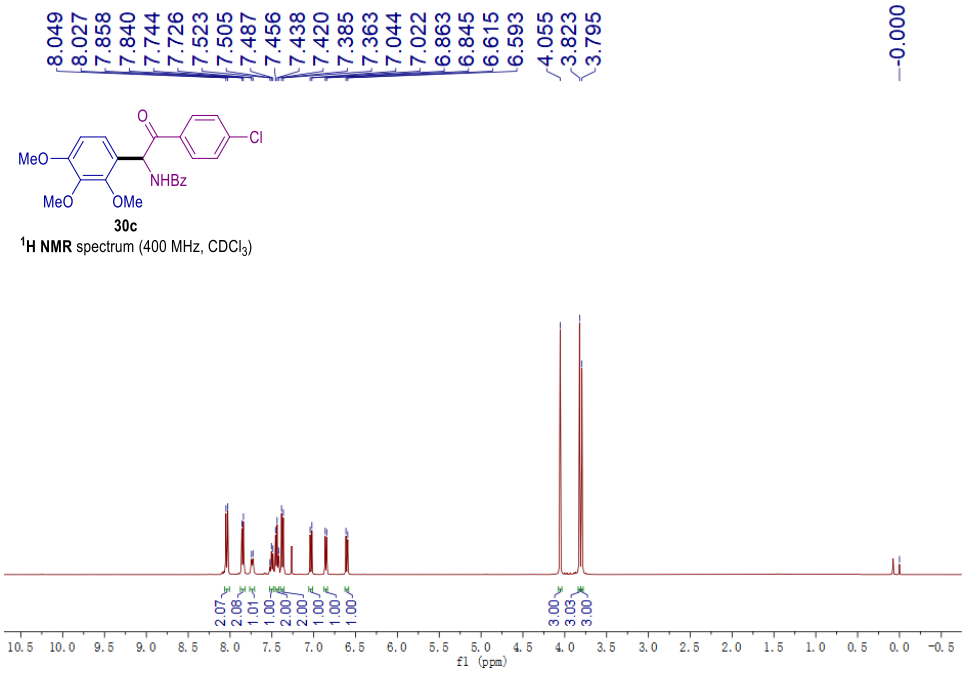

**29c**

**$^{1}$H NMR** spectrum (400 MHz, $CDCl_3$)



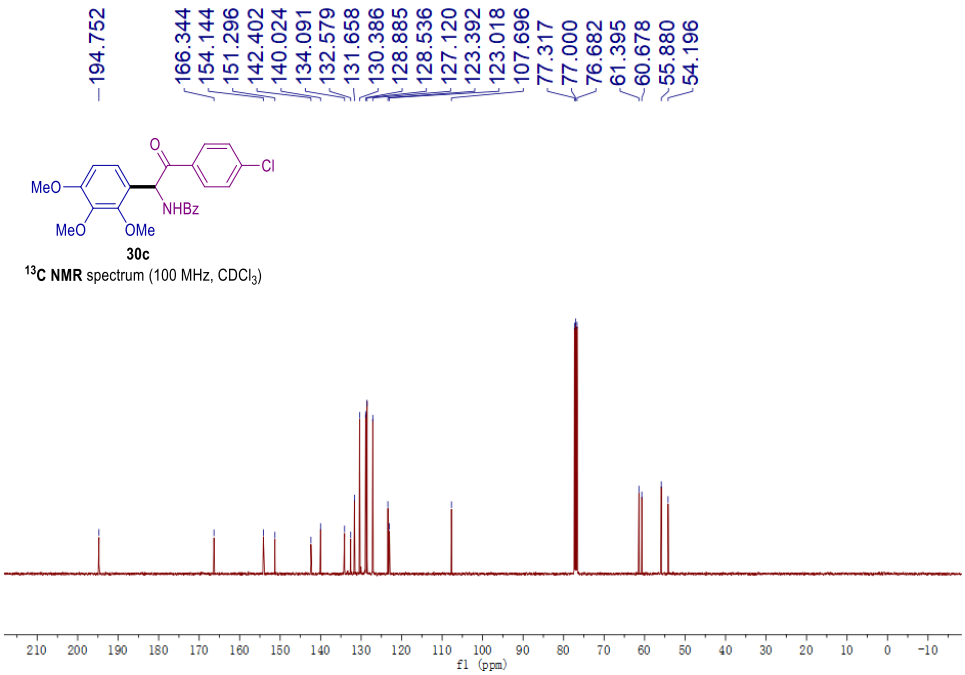

**29c**

**$^{13}$C NMR** spectrum (100 MHz, $CDCl_3$)



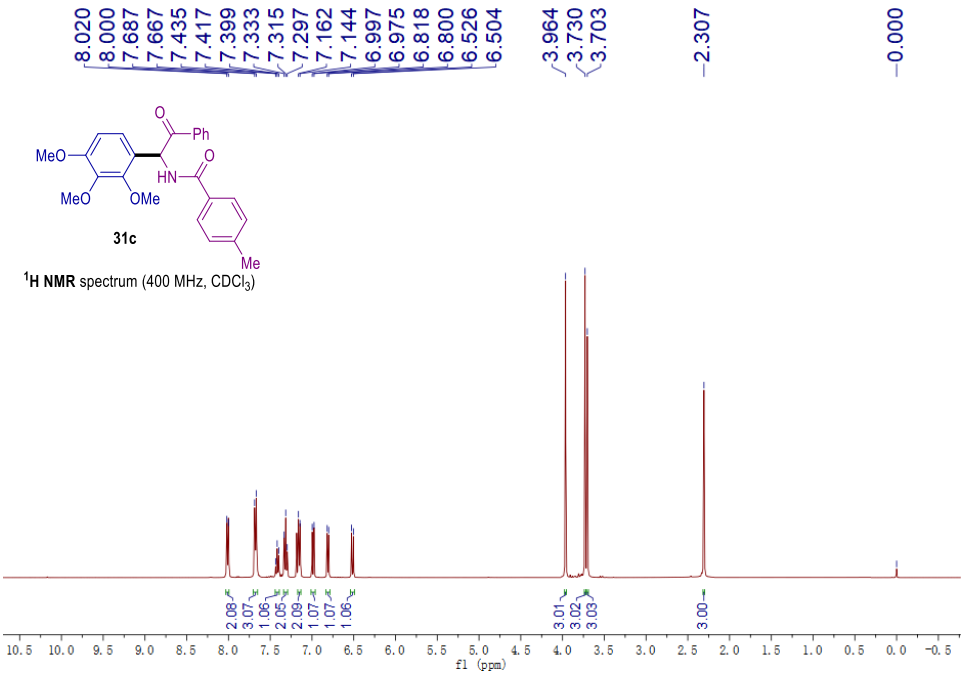

**30c**

**$^{1}$H NMR** spectrum (400 MHz, $CDCl_3$)



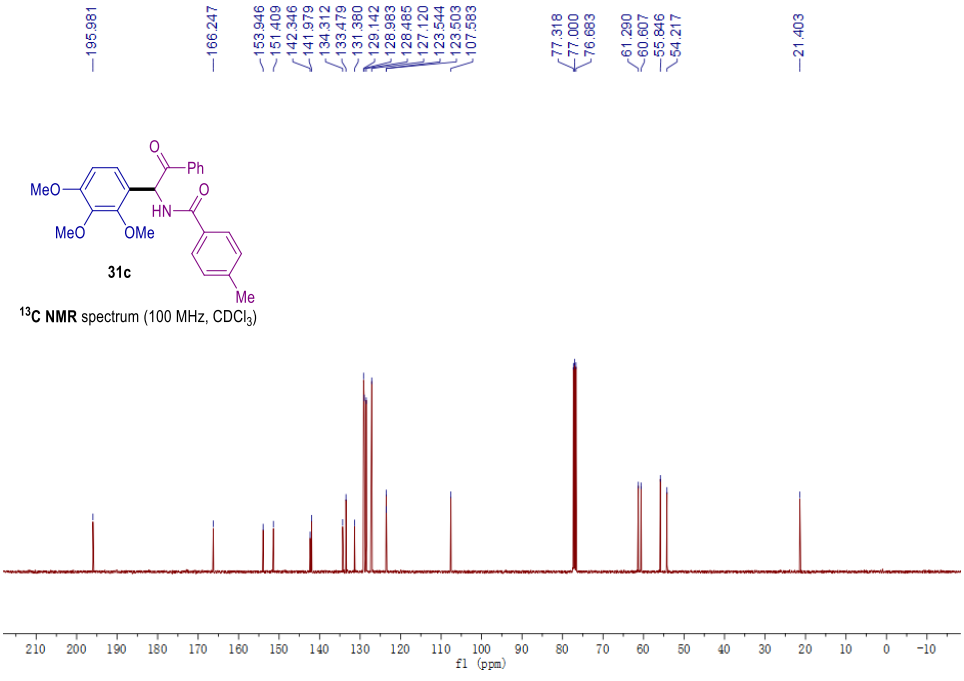

**30c**

**$^{13}$C NMR** spectrum (100 MHz, $CDCl_3$)



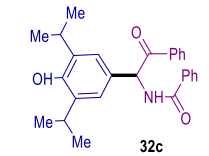

**31c**

**$^{1}$H NMR** spectrum (400 MHz, $CDCl_3$)



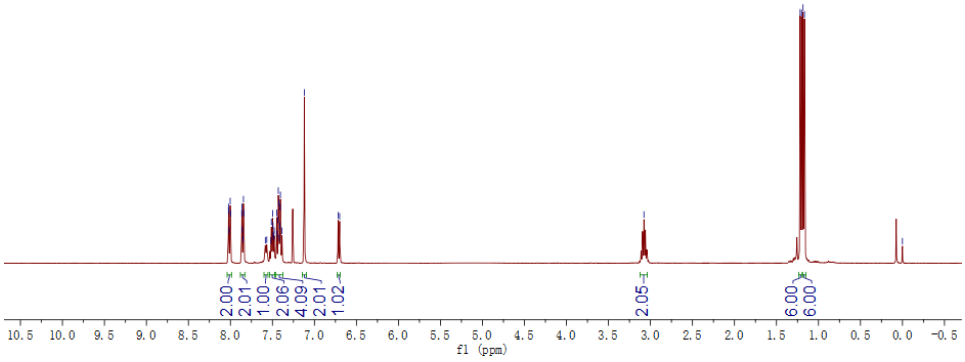

**31c**

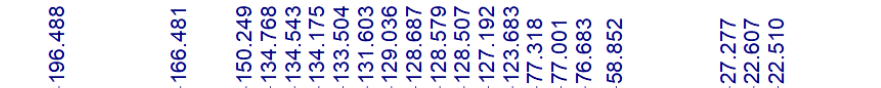
**$^{13}$C NMR** spectrum (100 MHz, $CDCl_3$)

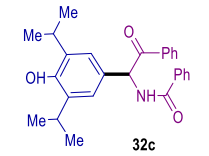




**32c**

$^{1}$**H NMR** spectrum (400 MHz, $CDCl_3$)

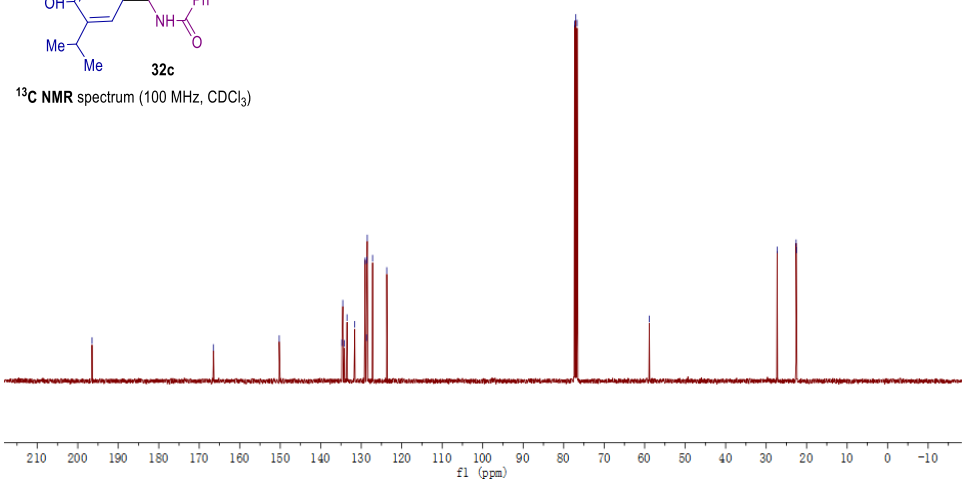


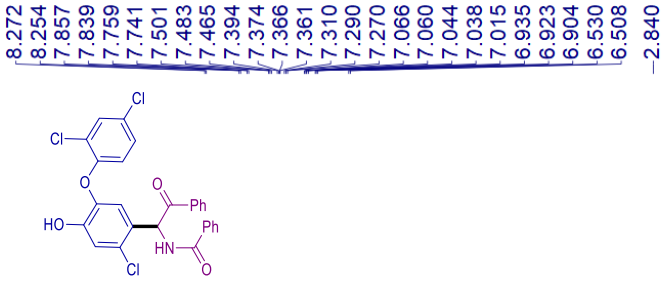




**32c**

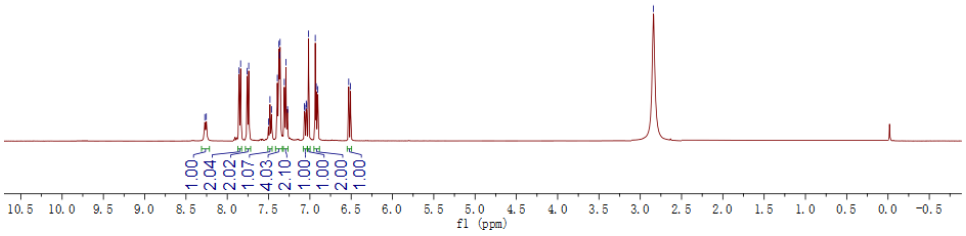
$^{13}$**C NMR** spectrum (100 MHz, $CDCl_3$)

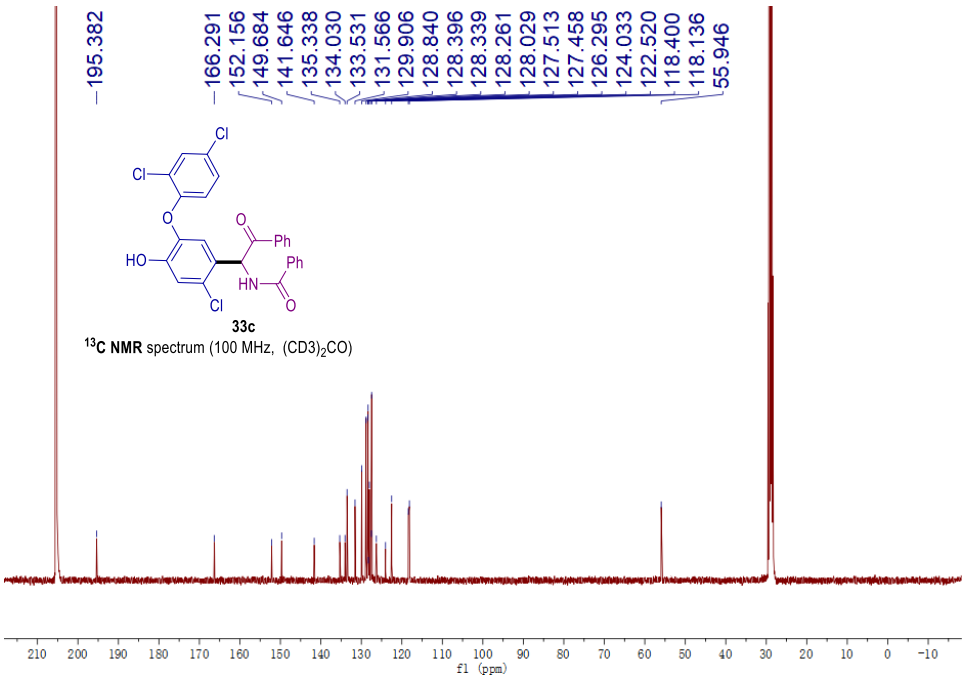





**33c**

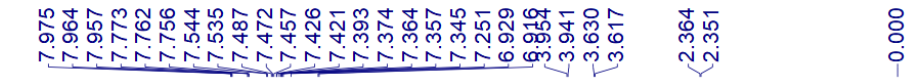
$^{1}$**H NMR** spectrum (400 MHz, $(CD3)_2CO$)

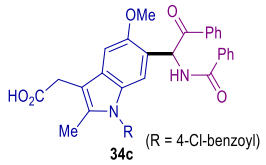



**33c**

$^{13}$**C NMR** spectrum (100 MHz, $(CD3)_2CO$)

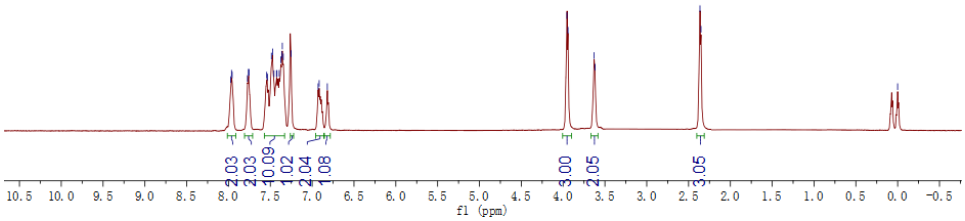


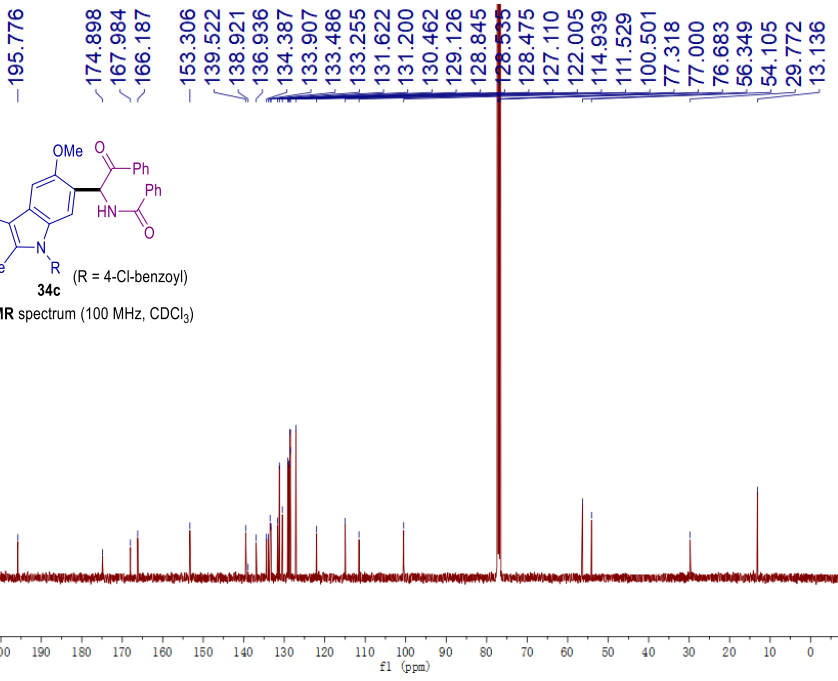




(R = 4-Cl-benzoyl)

**34c**

**$^{1}$H NMR** spectrum (400 MHz, $CDCl_3$)



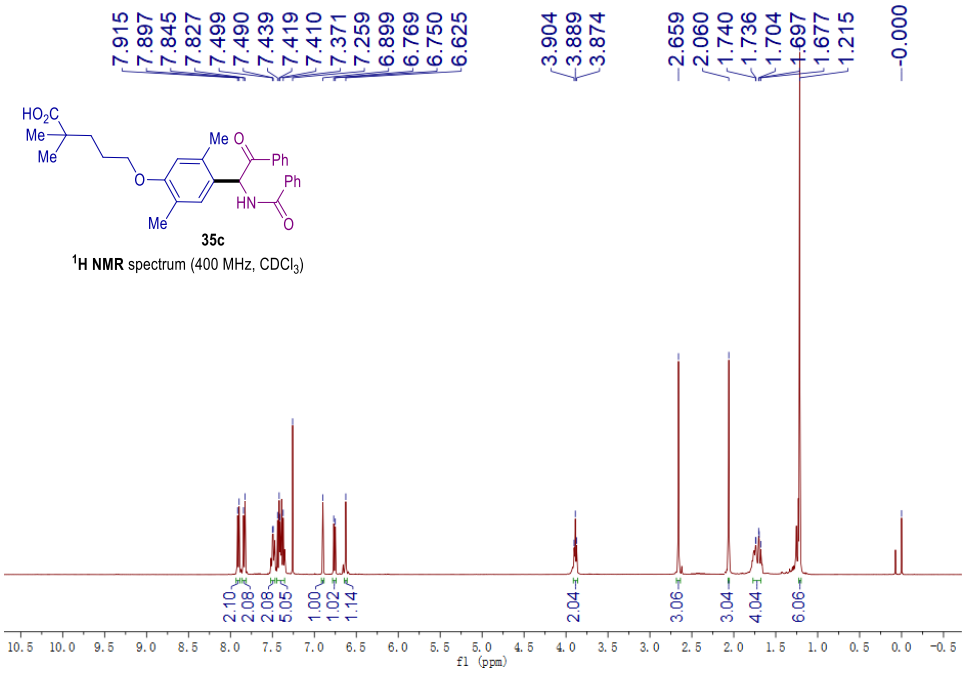




(R = 4-Cl-benzoyl)

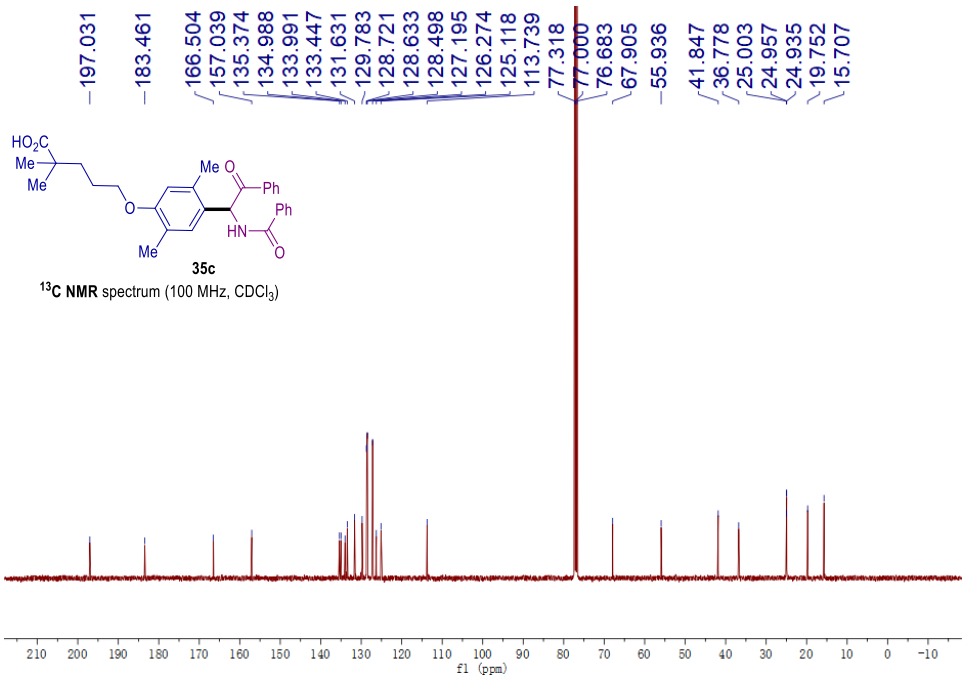
**34c**

**$^{13}$C NMR** spectrum (100 MHz, $CDCl_3$)




**35c**

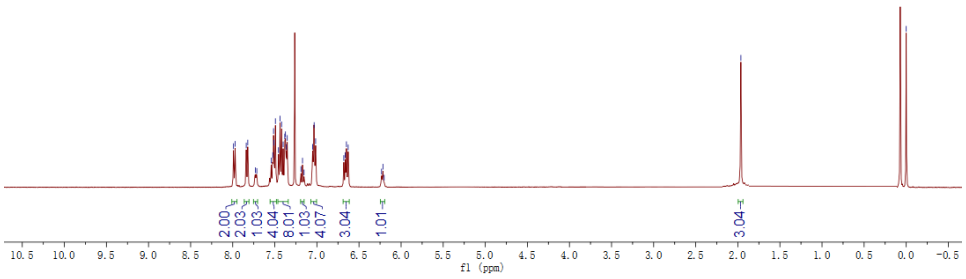
**$^{1}$H NMR** spectrum (400 MHz, $CDCl_3$)

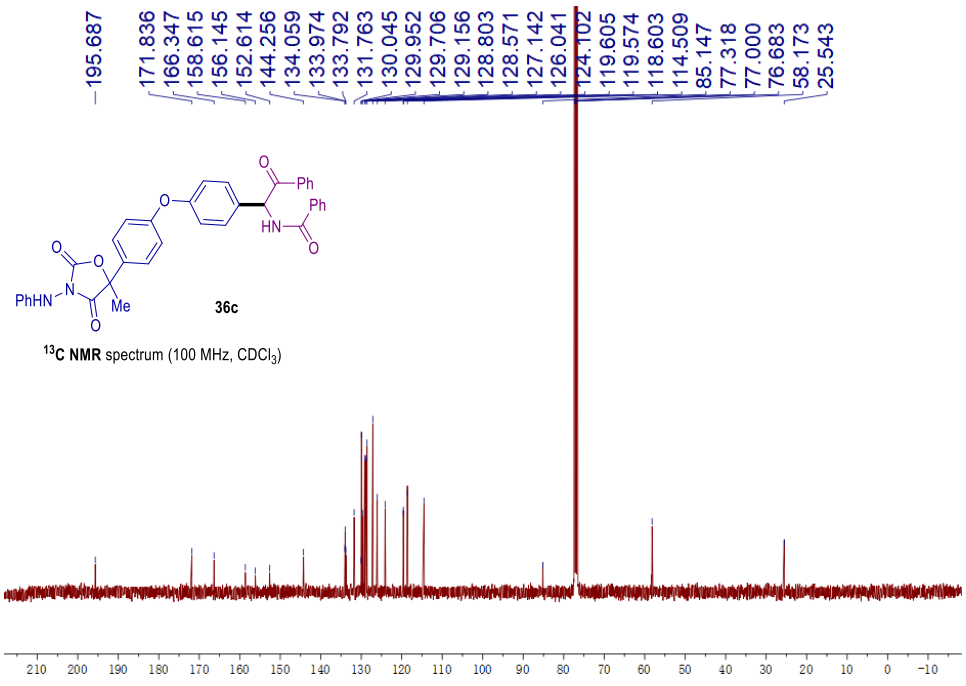



**35c**

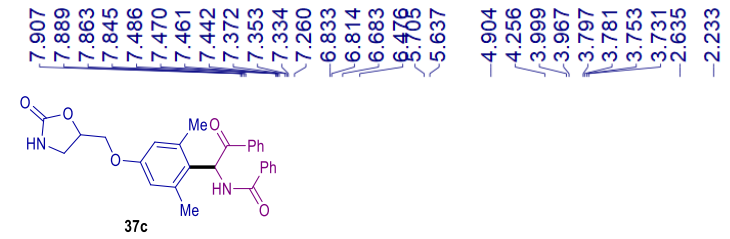
**$^{13}$C NMR** spectrum (100 MHz, $CDCl_3$)


$^{1}$**H NMR** spectrum (400 MHz, $CDCl_3$)

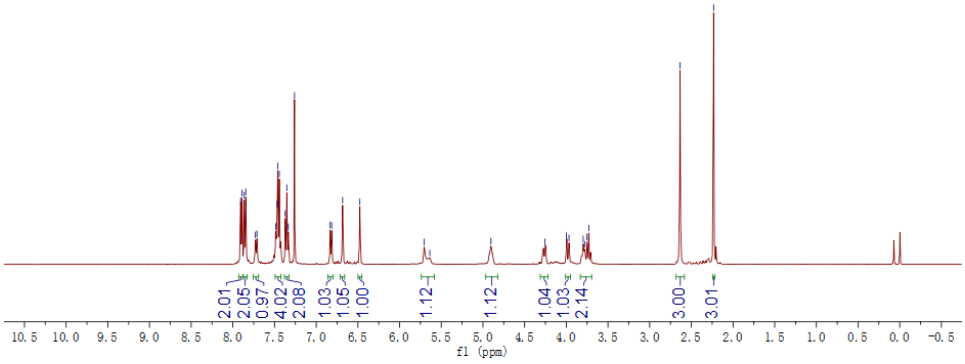


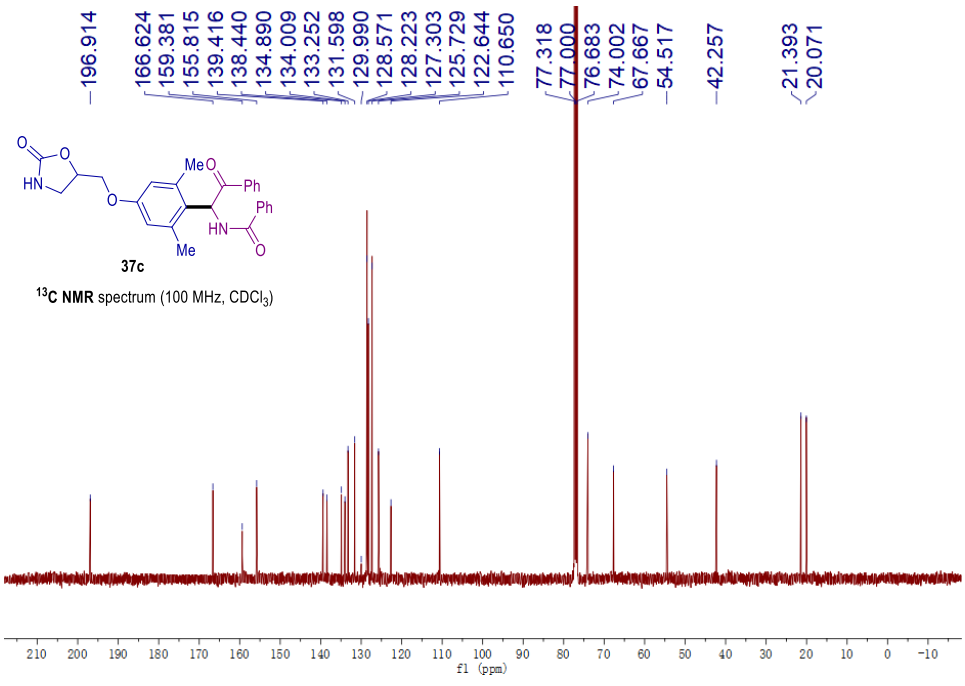




$^{13}$**C NMR** spectrum (100 MHz, $CDCl_3$)

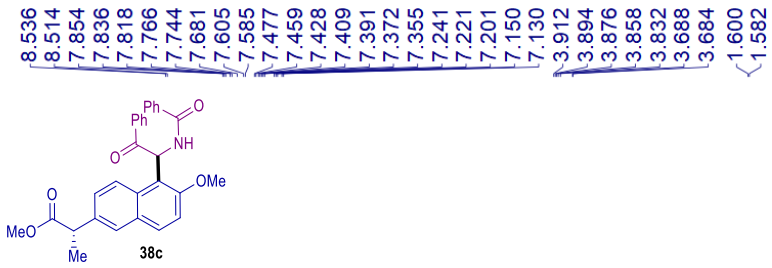



**$^{1}$H NMR** spectrum (400 MHz, $CDCl_3$)



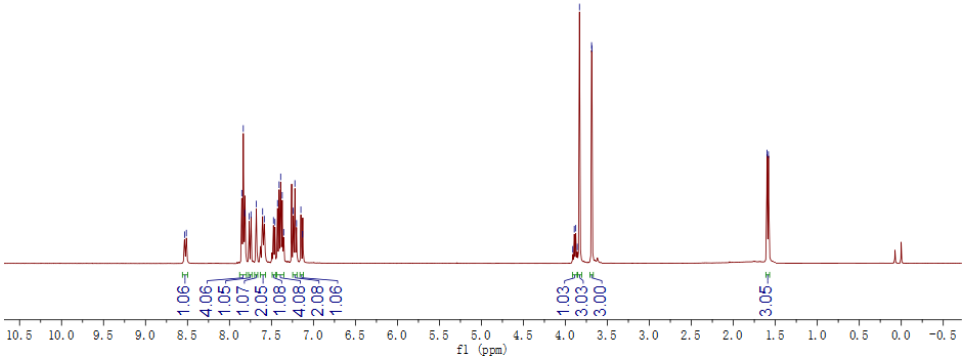



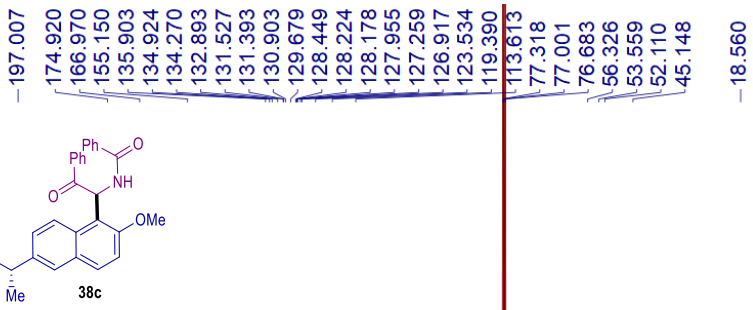

**$^{13}$C NMR** spectrum (100 MHz, $CDCl_3$)




**38c**

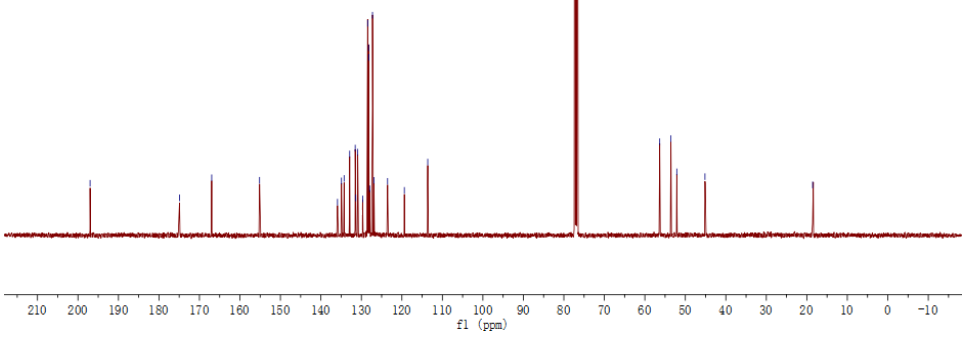
**$^{1}$H NMR** spectrum (400 MHz, $CDCl_3$)

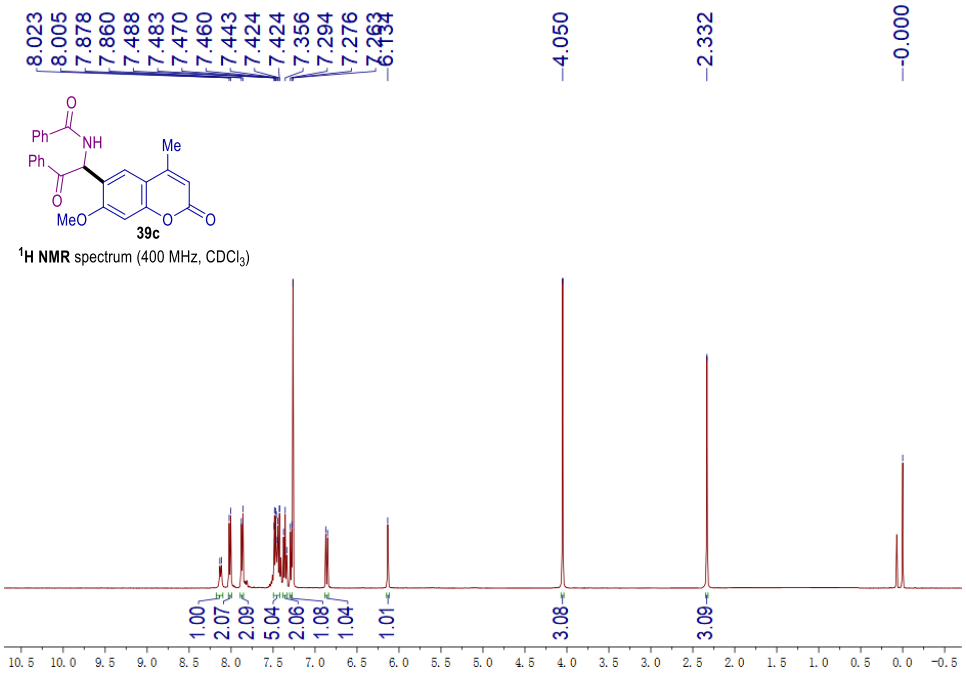


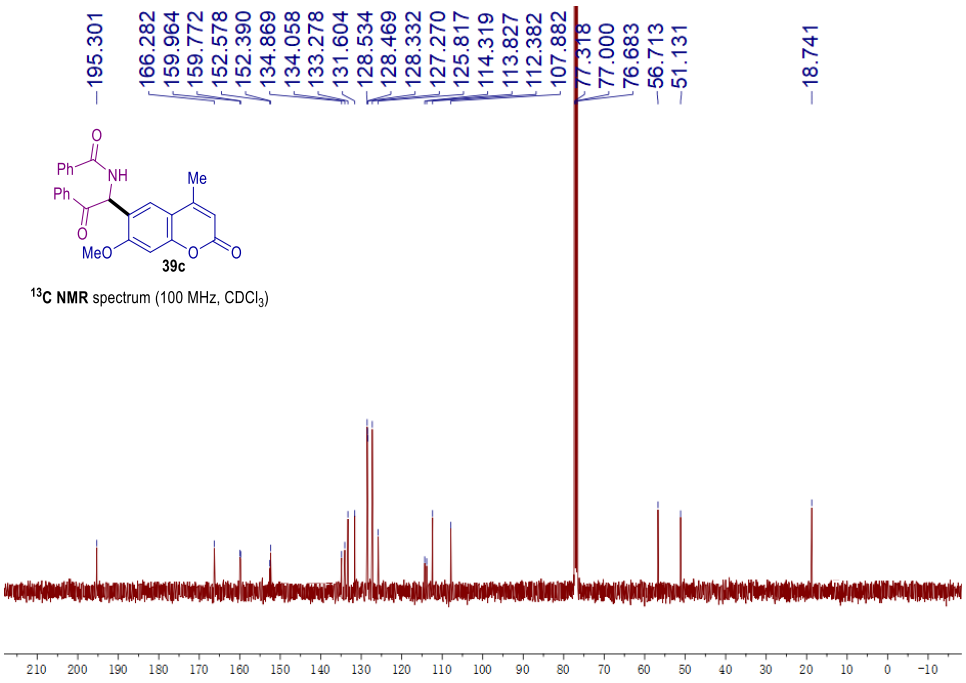

**38c**

**$^{13}$C NMR** spectrum (100 MHz, $CDCl_3$)

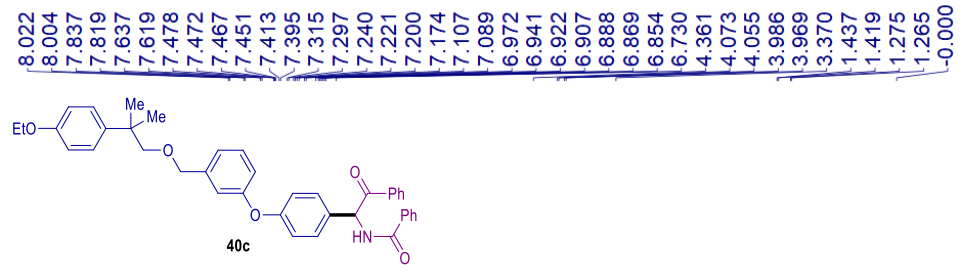





$^{1}$**H NMR** spectrum (400 MHz, $CDCl_3$)

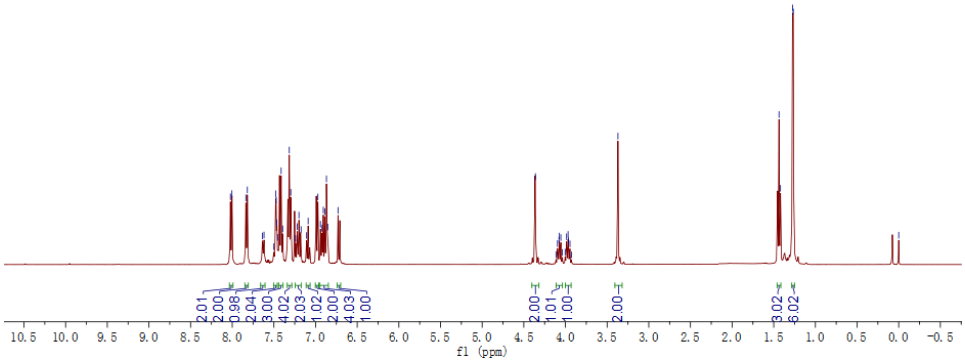


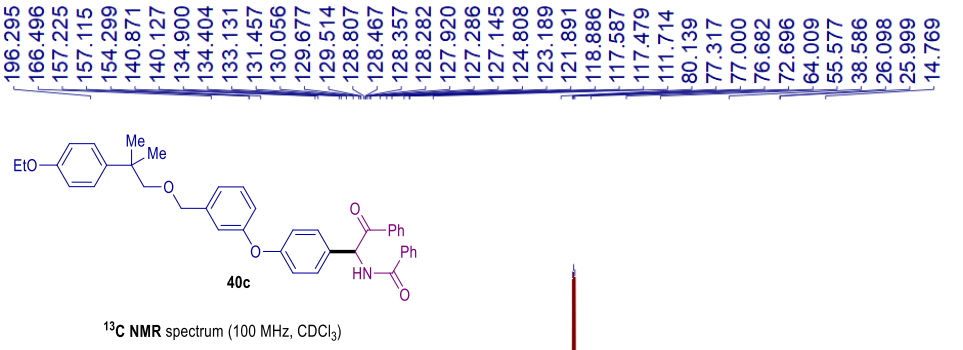

$^{13}$**C NMR** spectrum (100 MHz, $CDCl_3$)




40c

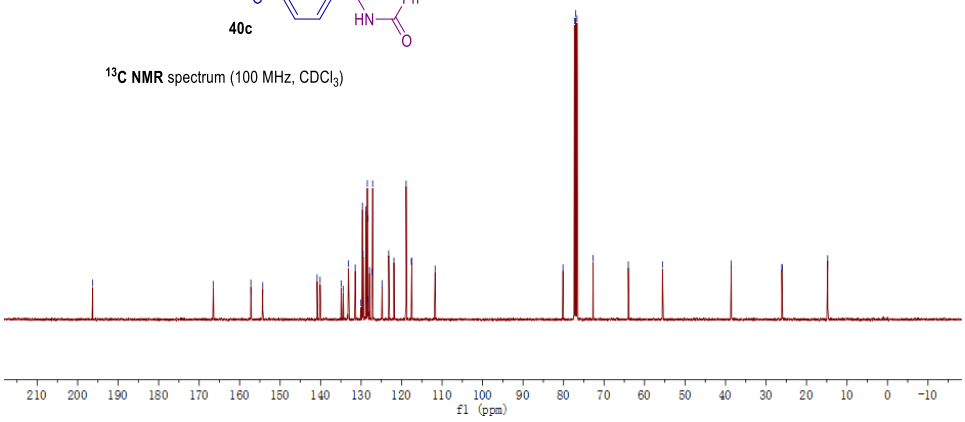
**$^{1}$H NMR** spectrum (400 MHz, $CDCl_3$)

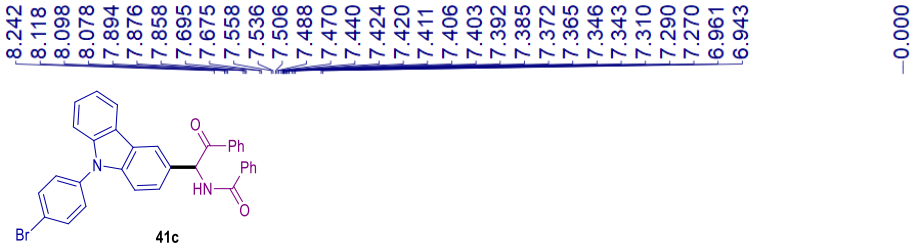



40c

**$^{13}$C NMR** spectrum (100 MHz, $CDCl_3$)



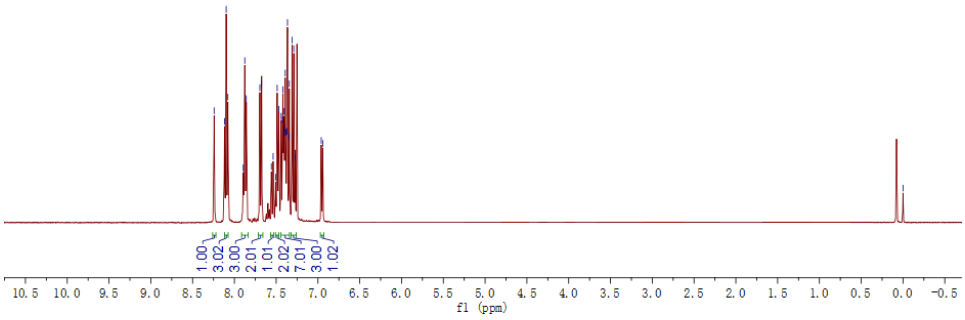


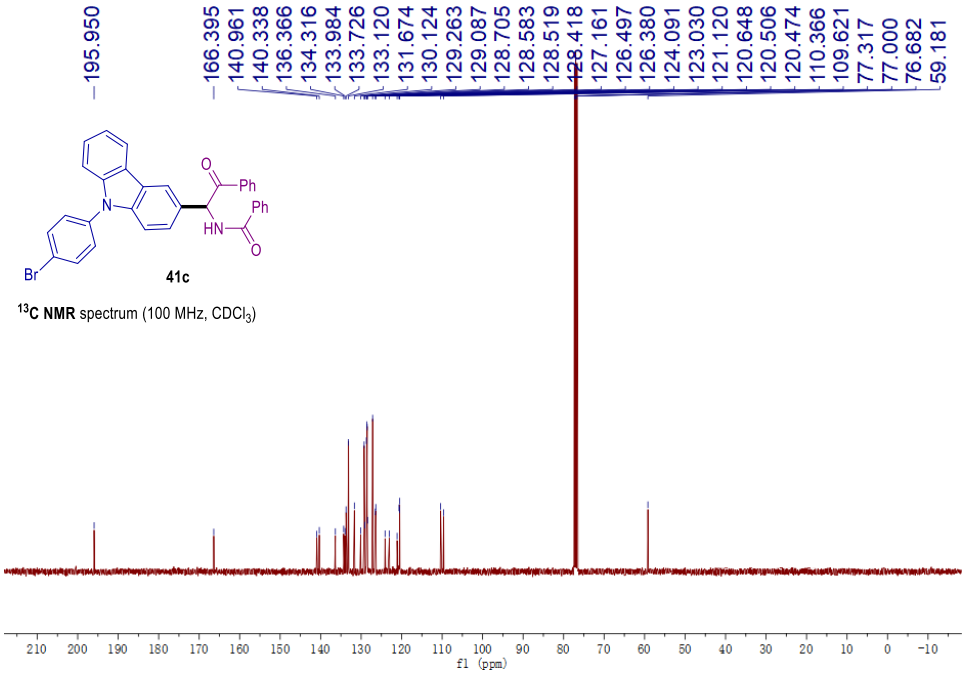




41c

**$^{1}$H NMR** spectrum (400 MHz, $CDCl_3$)



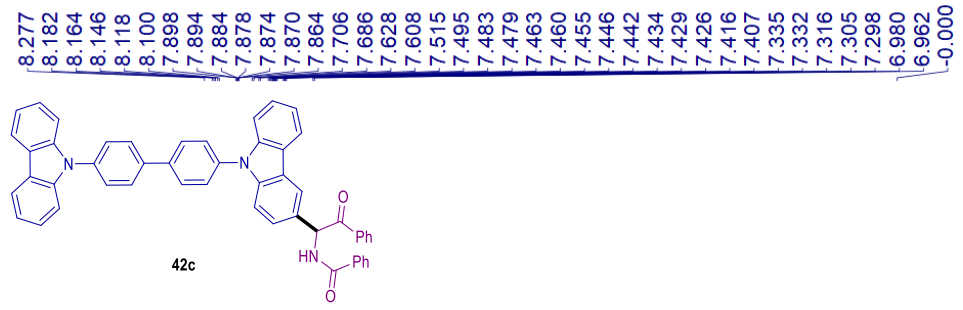







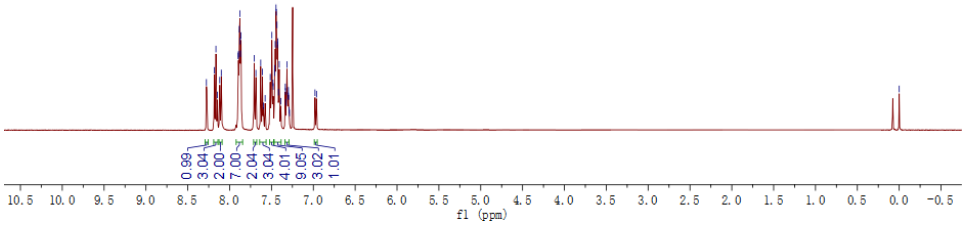
41c

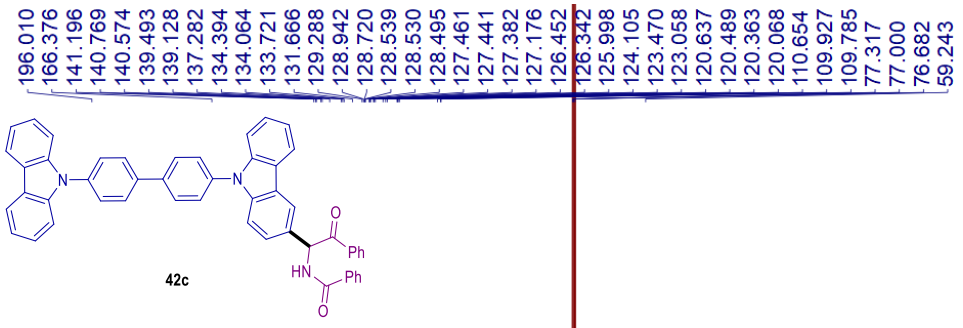
**$^{13}$C NMR** spectrum (100 MHz, $CDCl_3$)




42c

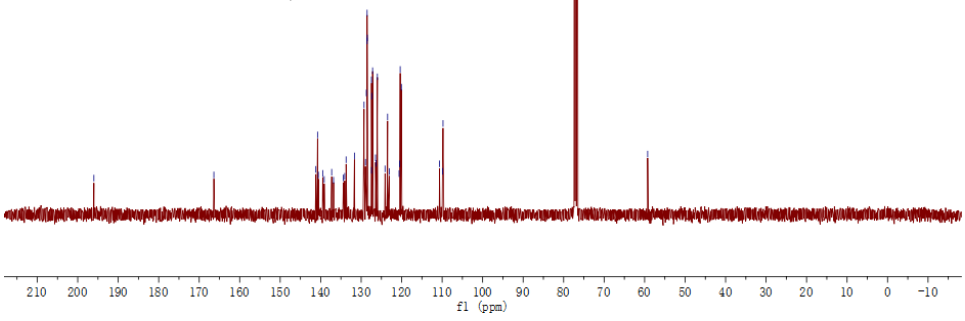
**$^{1}$H NMR** spectrum (400 MHz, $CDCl_3$)

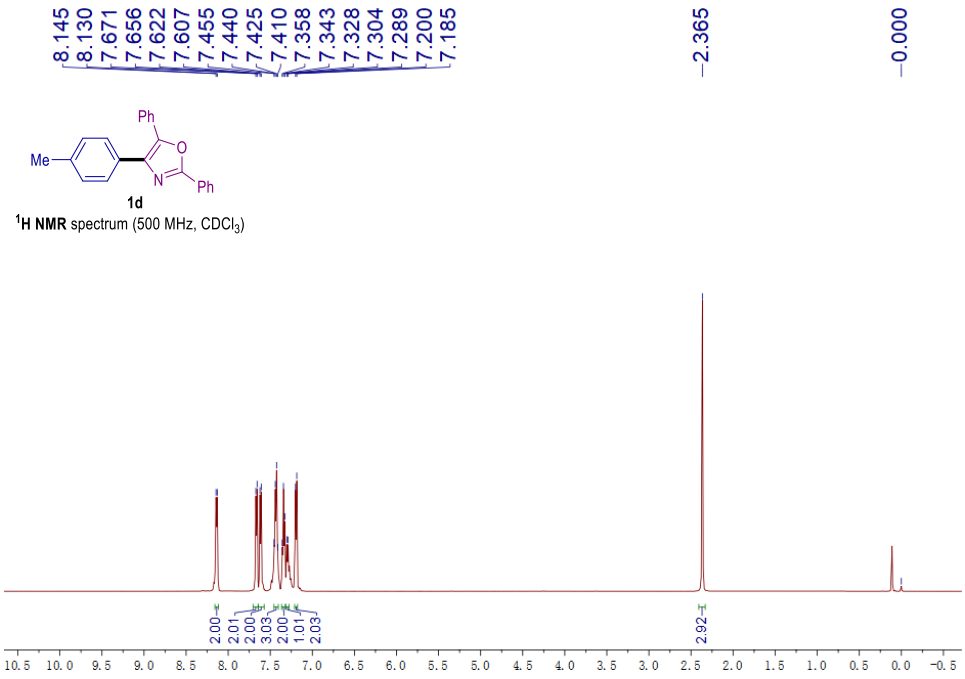



42c

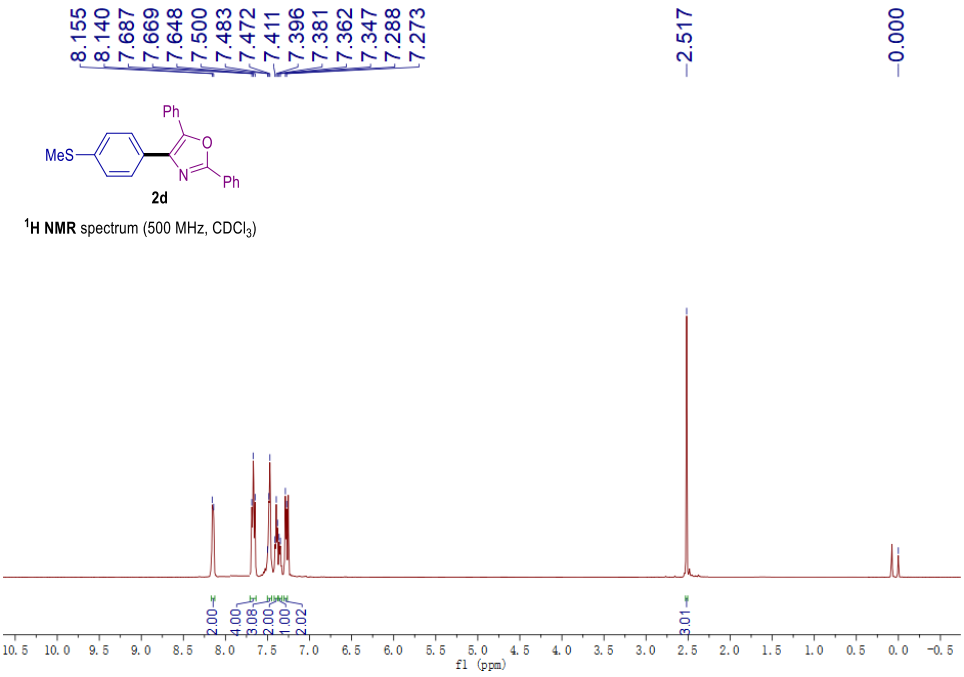
**$^{13}$C NMR** spectrum (100 MHz, $CDCl_3$)



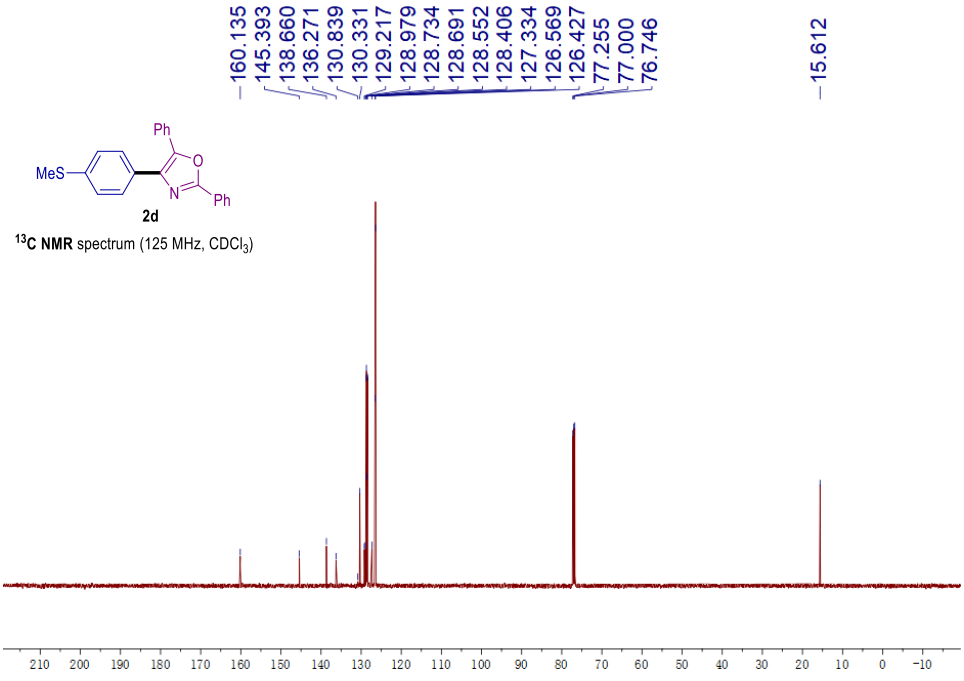



**1d**

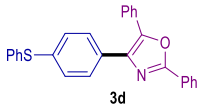
$^1$**H NMR** spectrum (500 MHz, $CDCl_3$)




$^{1}$**H NMR** spectrum (500 MHz, $CDCl_3$)

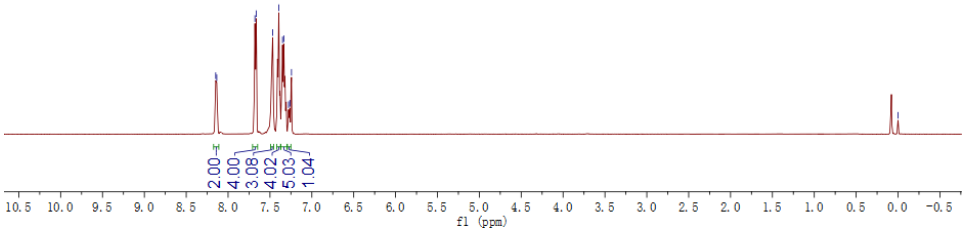


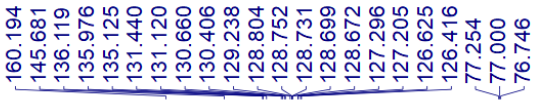

$^{13}$**C NMR** spectrum (125 MHz, $CDCl_3$)

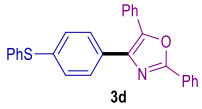




**3d**

**$^{1}$H NMR** spectrum (500 MHz, $CDCl_3$)

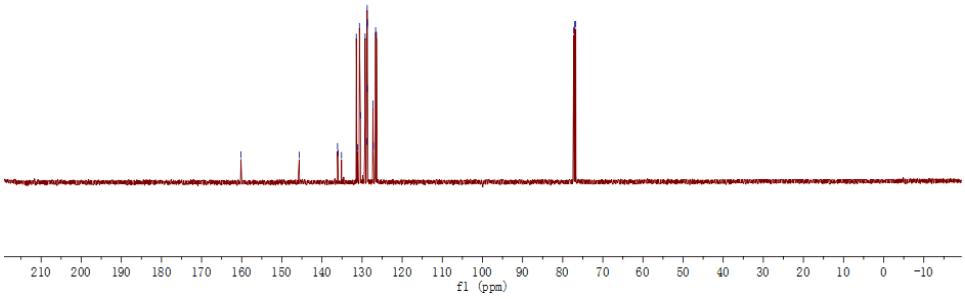


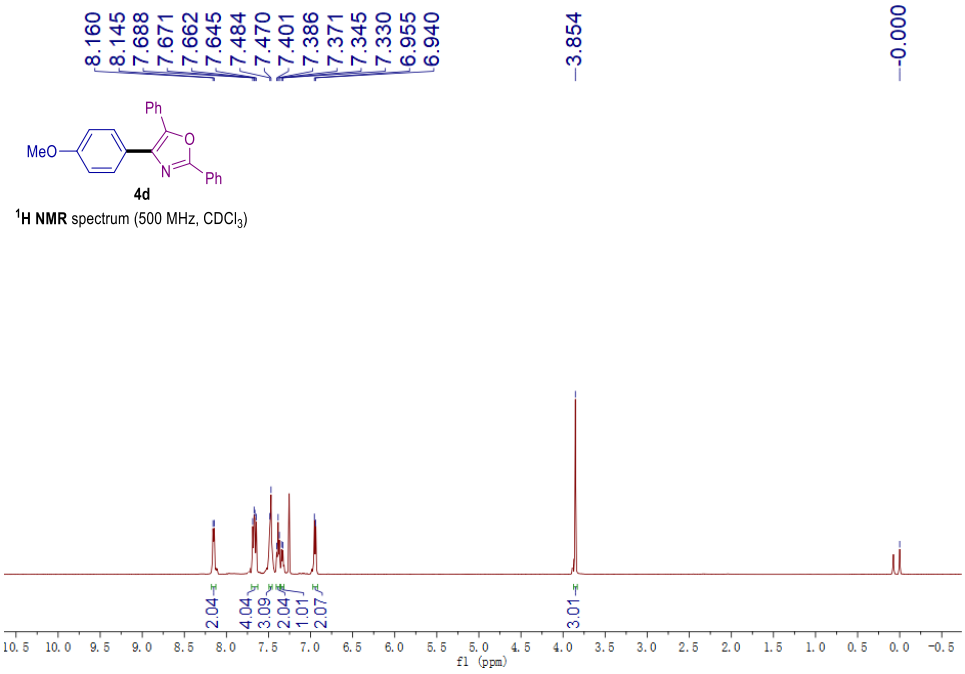




**3d**

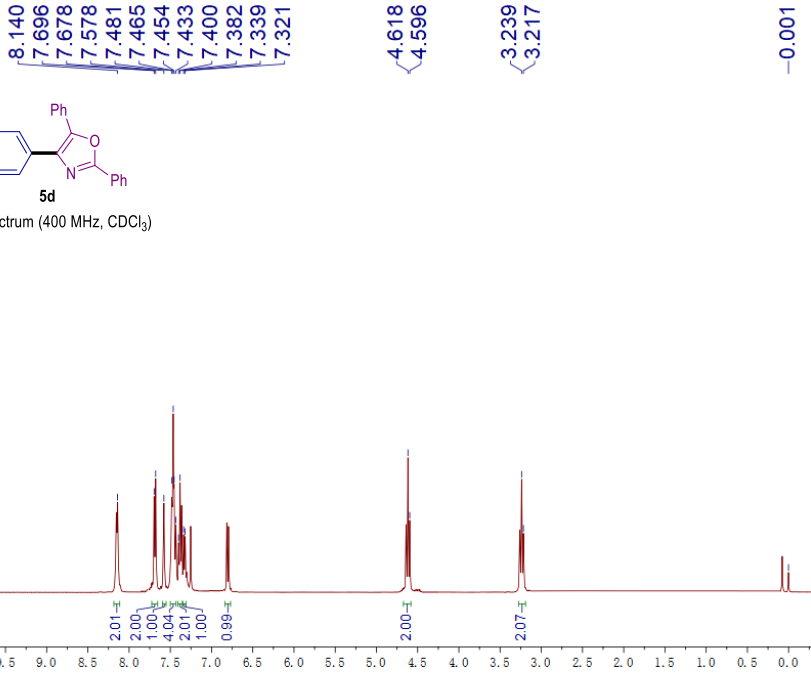
**$^{13}$C NMR** spectrum (125 MHz, $CDCl_3$)



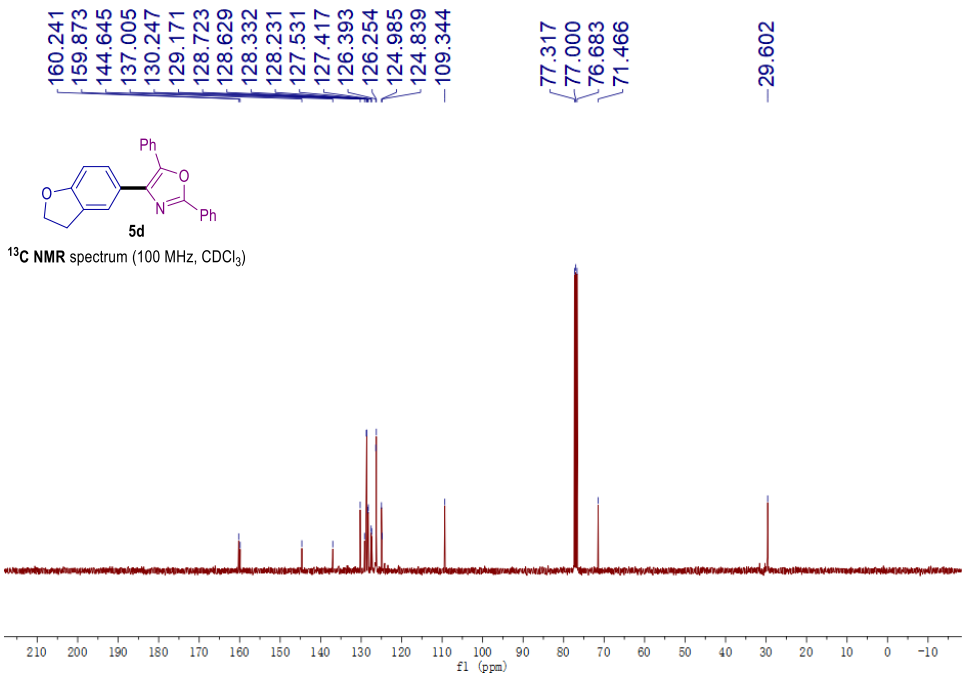



**4d**

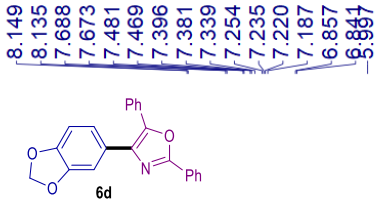
$^{1}$**H NMR** spectrum (500 MHz, $CDCl_3$)




$^{1}$**H NMR** spectrum (400 MHz, $CDCl_3$)

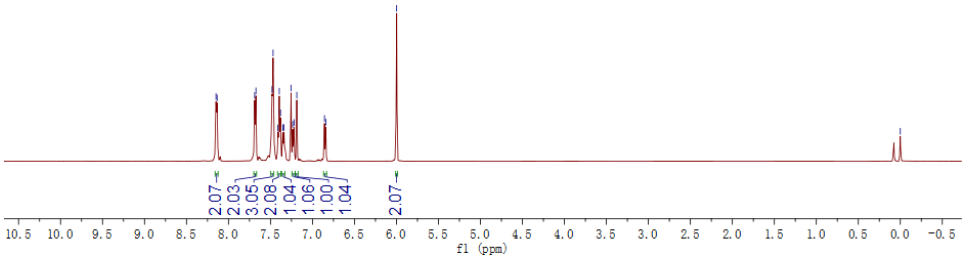


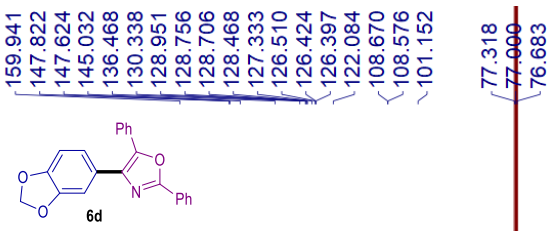

$^{13}$**C NMR** spectrum (100 MHz, $CDCl_3$)




**6d**

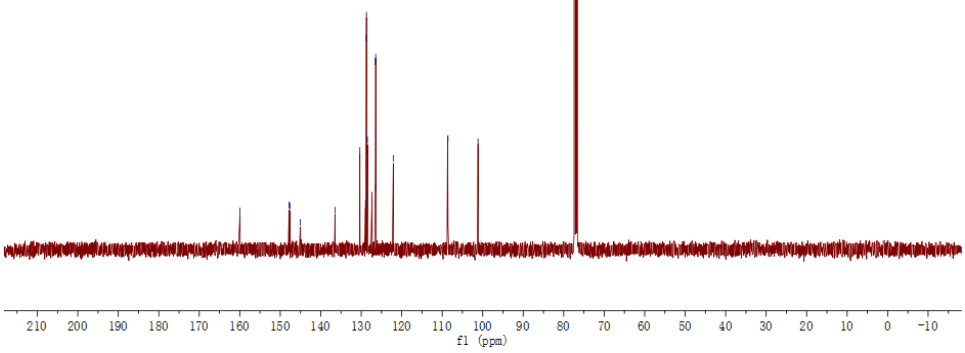
$^{1}$**H NMR** spectrum (400 MHz, $CDCl_3$)

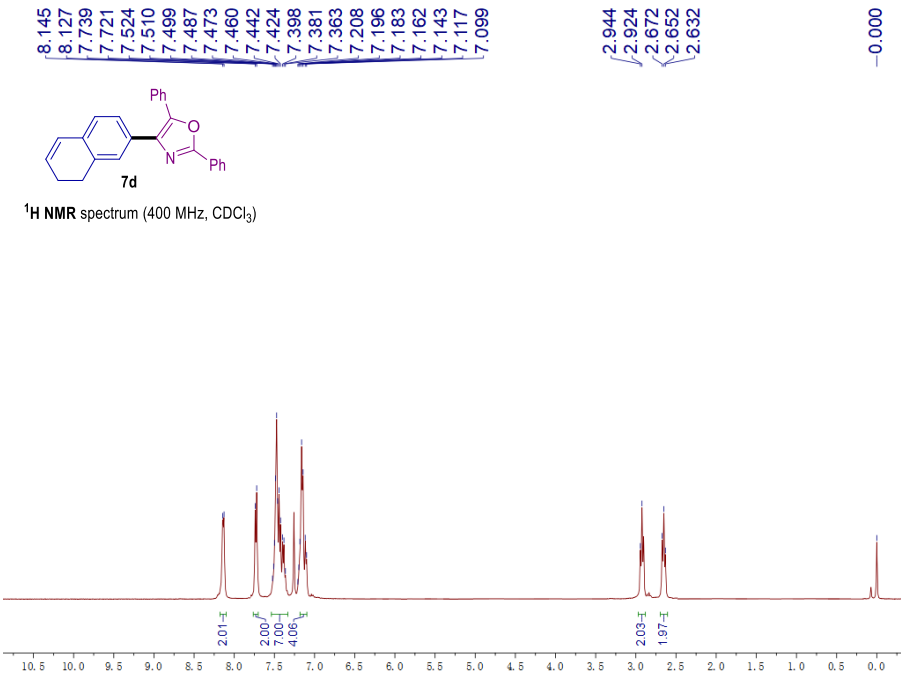


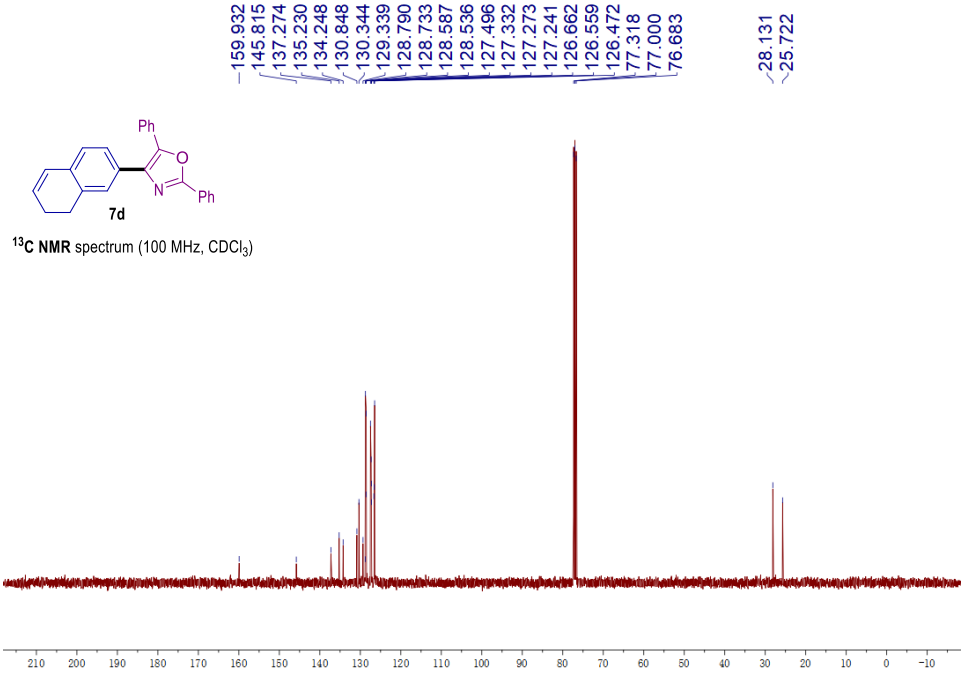

**6d**

$^{13}$**C NMR** spectrum (100 MHz, $CDCl_3$)

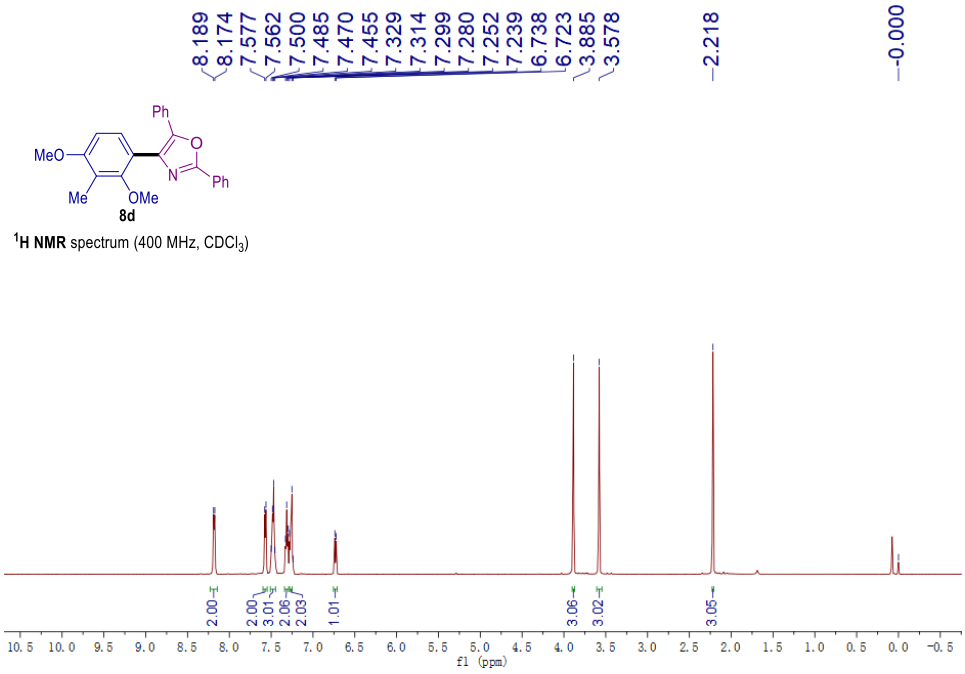




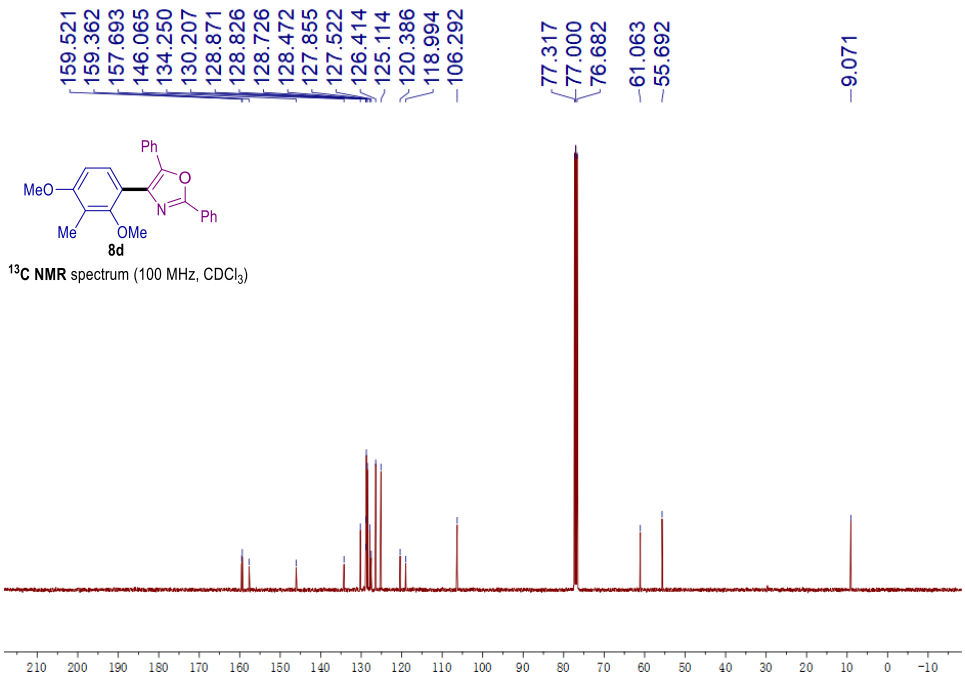

$^{1}$**H NMR** spectrum (400 MHz, $CDCl_3$)



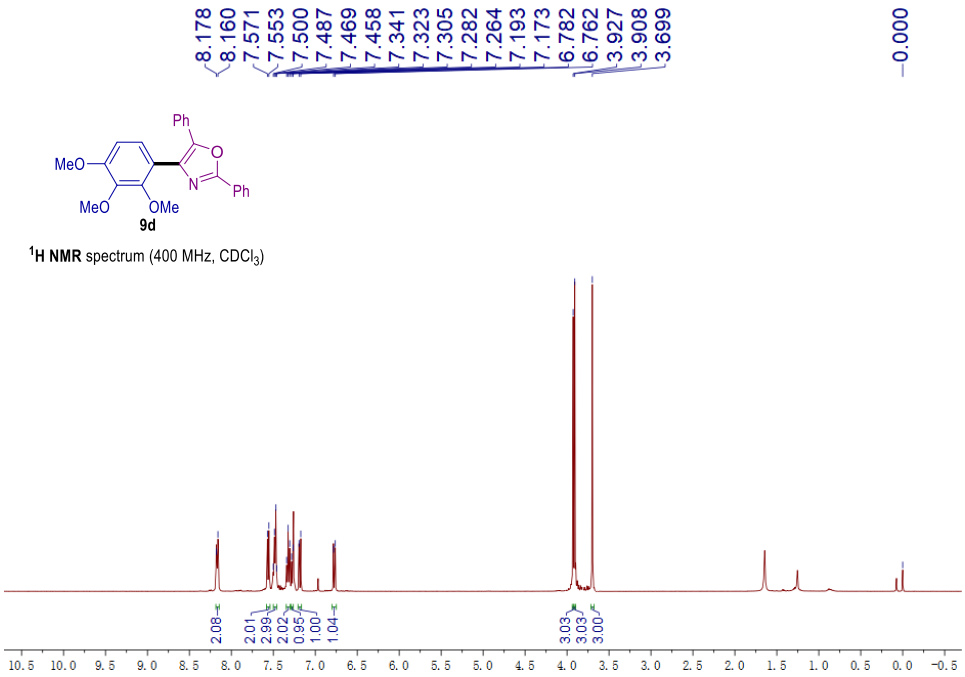

$^{13}$**C NMR** spectrum (100 MHz, $CDCl_3$)



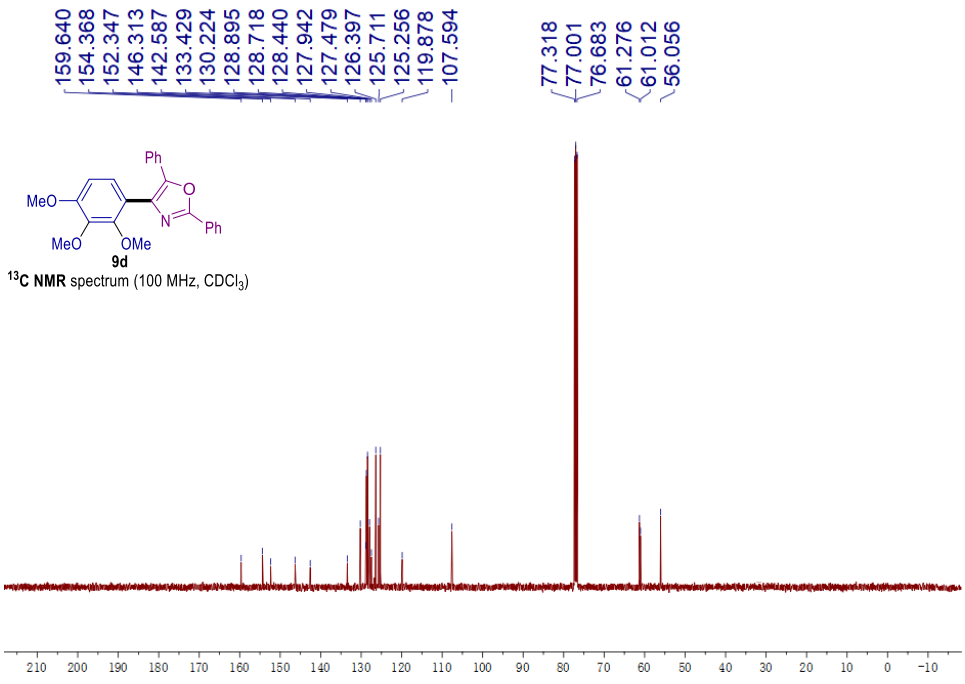

**$^{1}$H NMR** spectrum (400 MHz, $CDCl_3$)



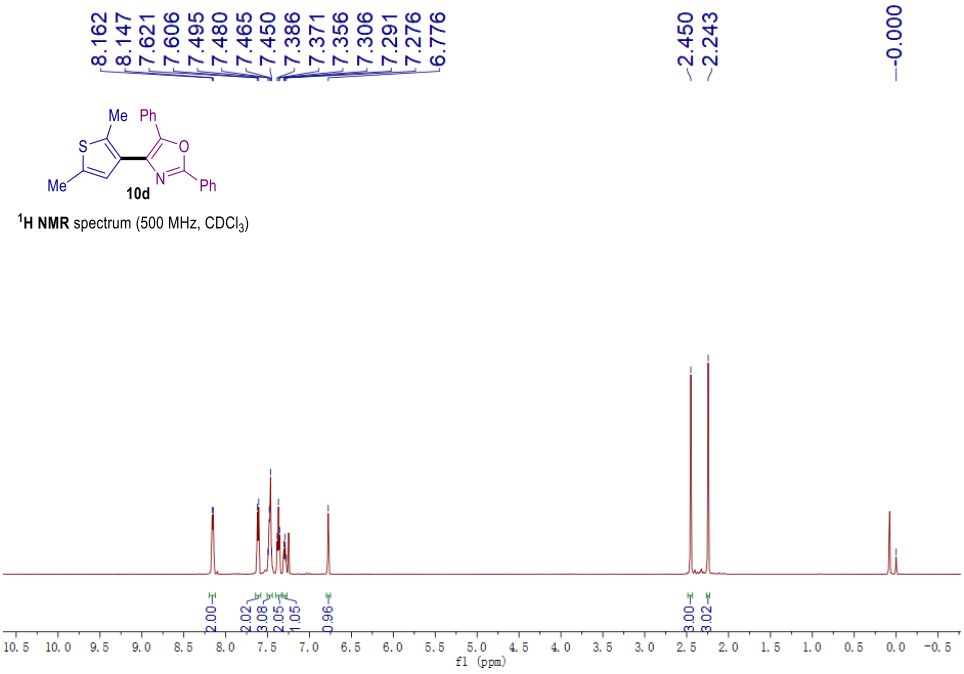

**$^{13}$C NMR** spectrum (100 MHz, $CDCl_3$)



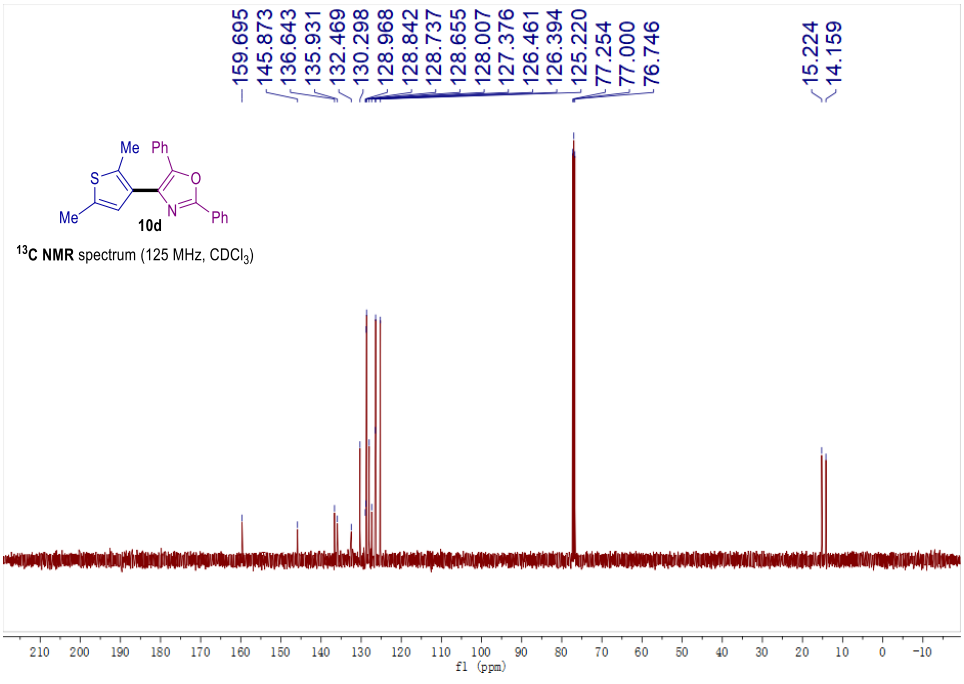

$^{1}$**H NMR** spectrum (400 MHz, $CDCl_3$)



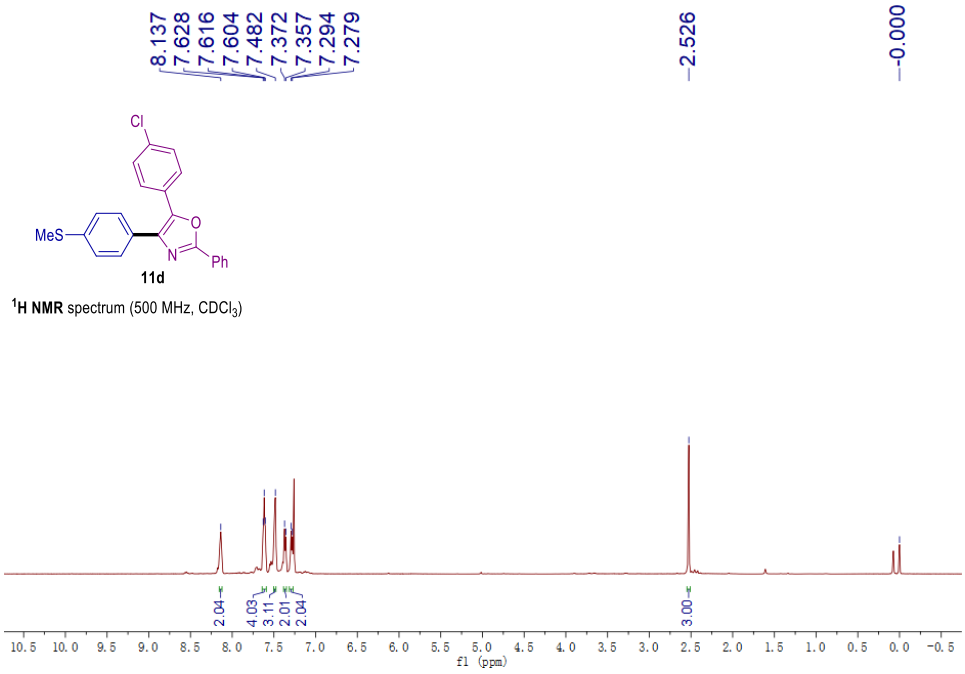

$^{13}$**C NMR** spectrum (100 MHz, $CDCl_3$)



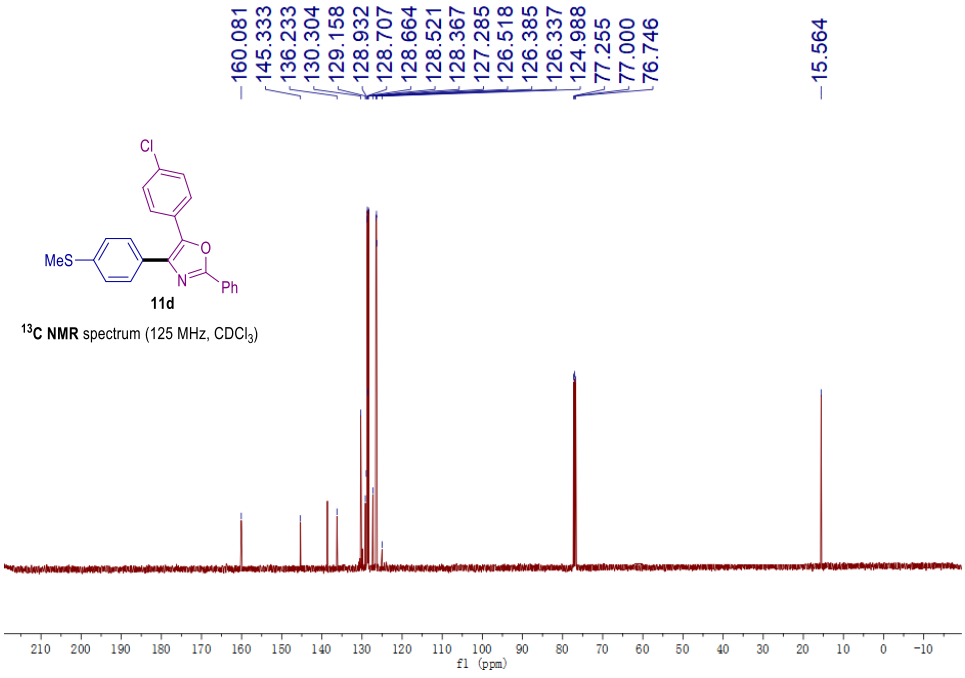

**$^{1}$H NMR** spectrum (500 MHz, $CDCl_3$)



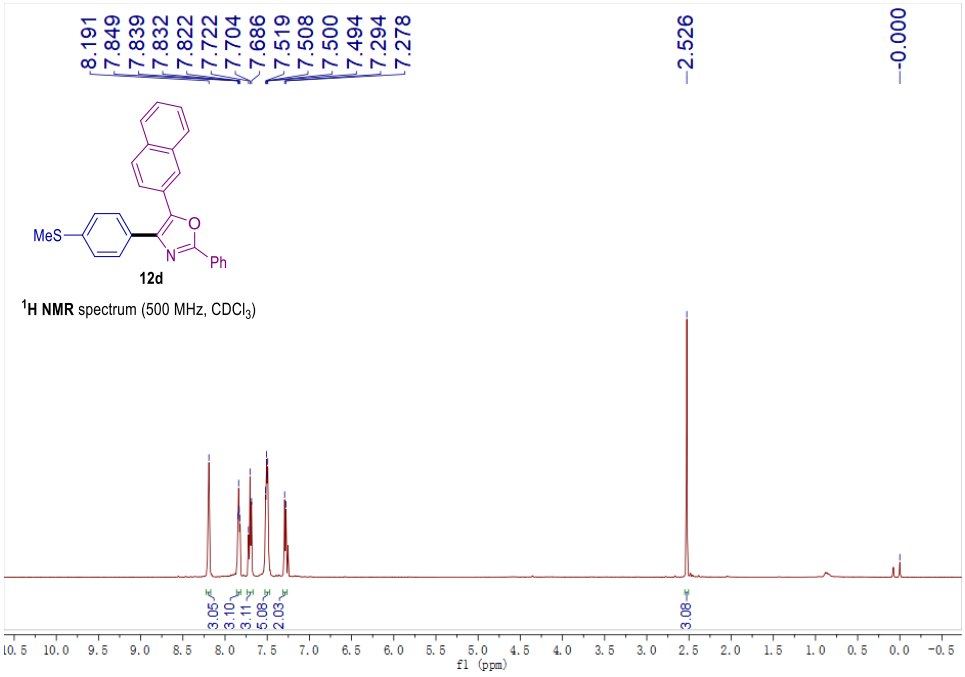

**$^{13}$C NMR** spectrum (125 MHz, $CDCl_3$)




$^{1}$**H NMR** spectrum (500 MHz, $CDCl_3$)

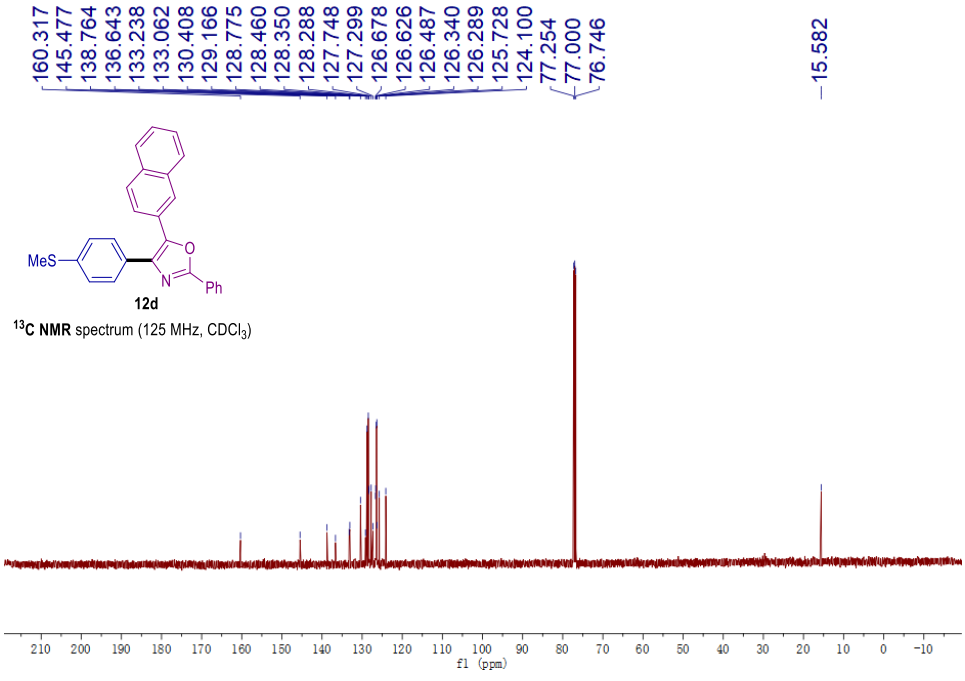



$^{13}$**C NMR** spectrum (125 MHz, $CDCl_3$)




**12d**

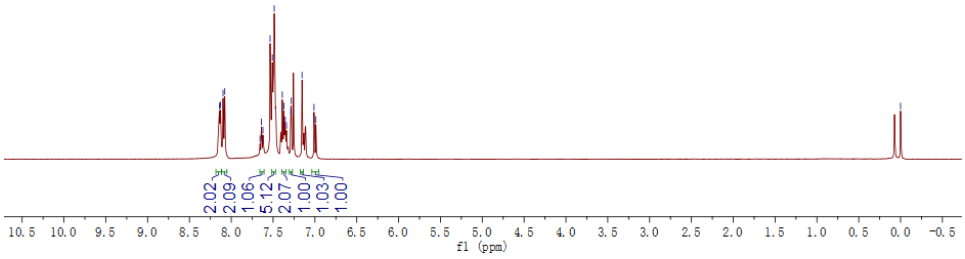
**$^{1}$H NMR** spectrum (500 MHz, $CDCl_3$)

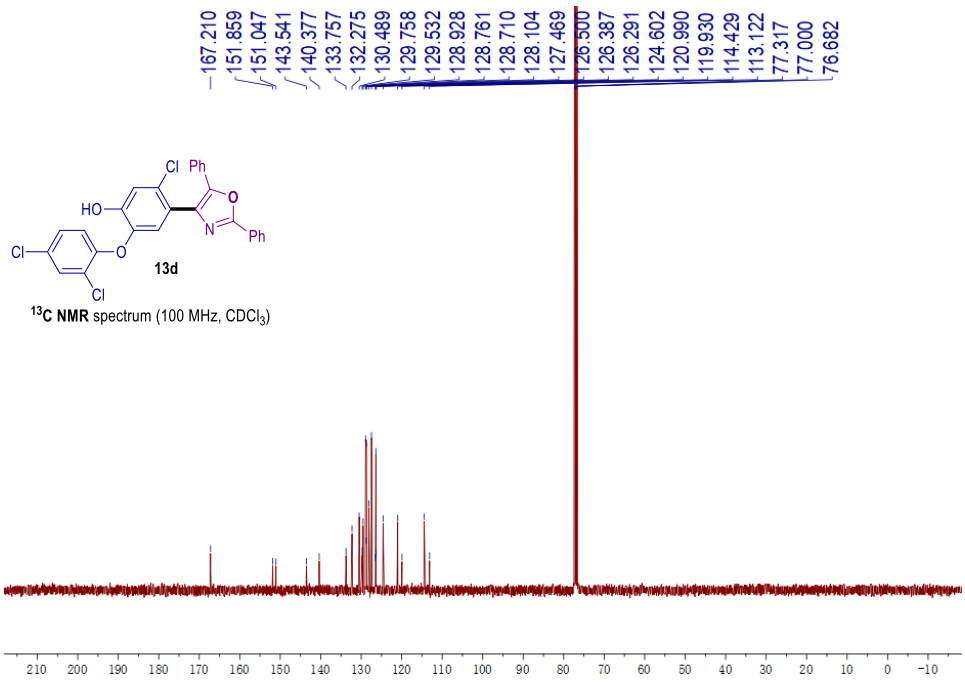



**12d**

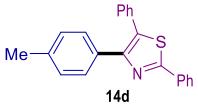
**$^{13}$C NMR** spectrum (125 MHz, $CDCl_3$)


**$^{1}$H NMR** spectrum (400 MHz, $CDCl_3$)



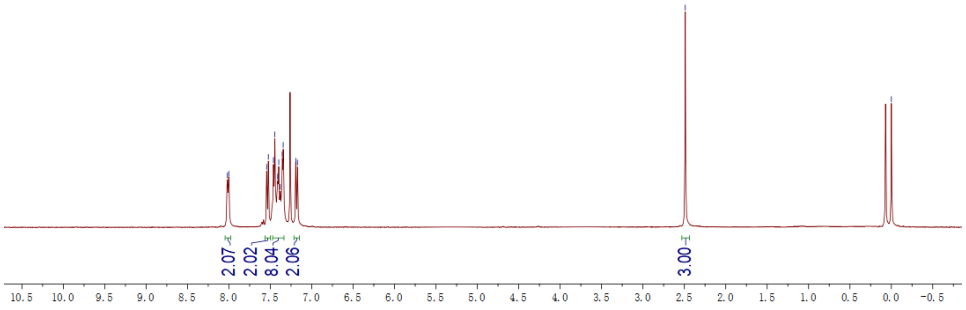



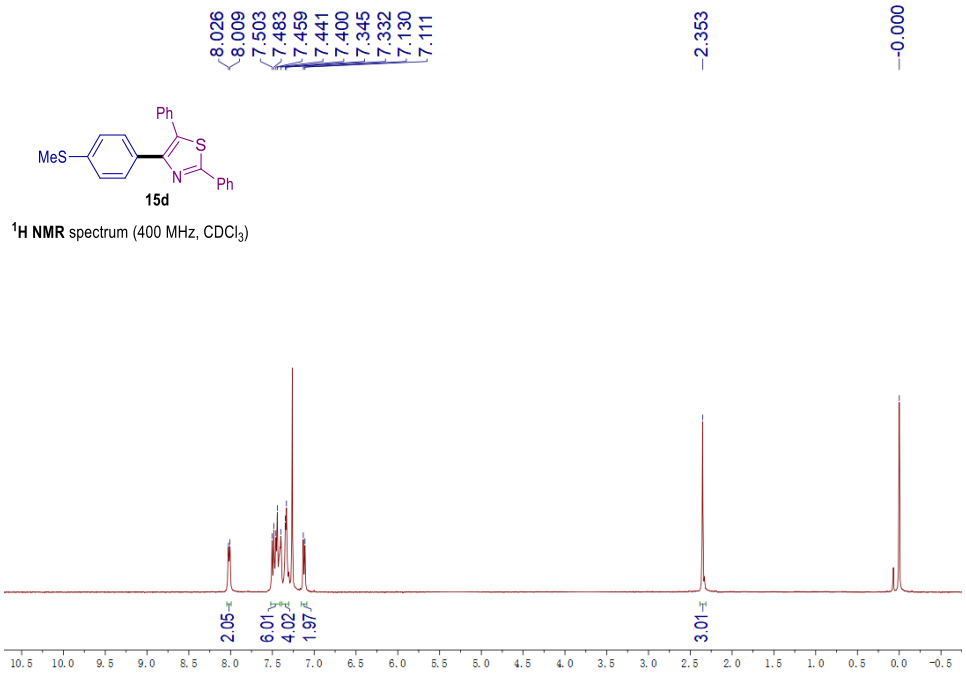

**$^{13}$C NMR** spectrum (100 MHz, $CDCl_3$)


**14d**

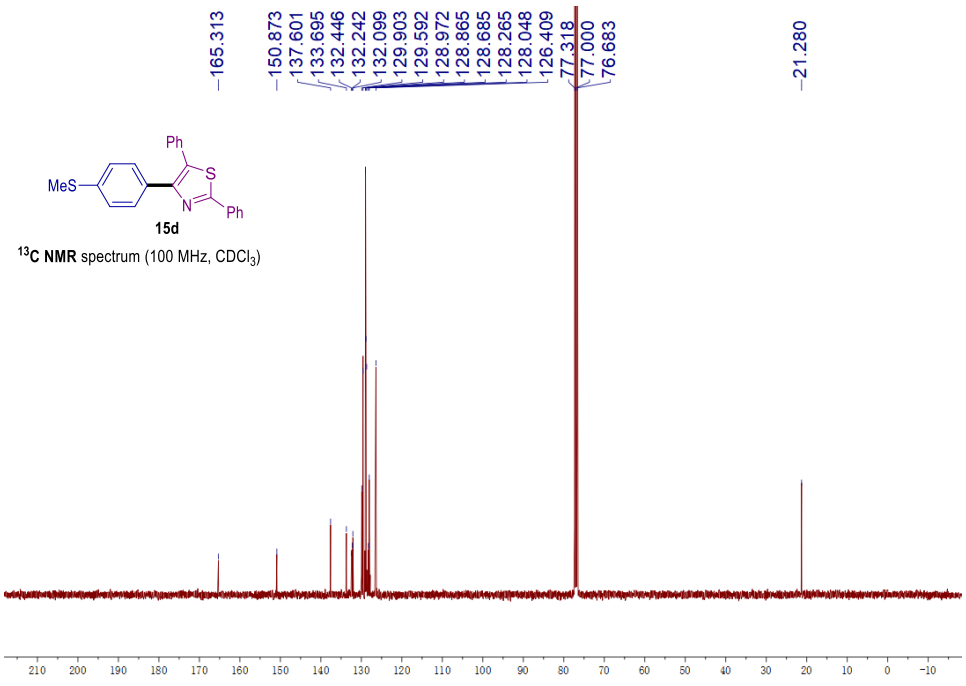
$^{1}$**H NMR** spectrum (400 MHz, $CDCl_3$)





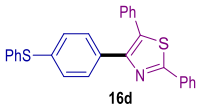

**15d**

**$^{1}$H NMR** spectrum (400 MHz, $CDCl_3$)



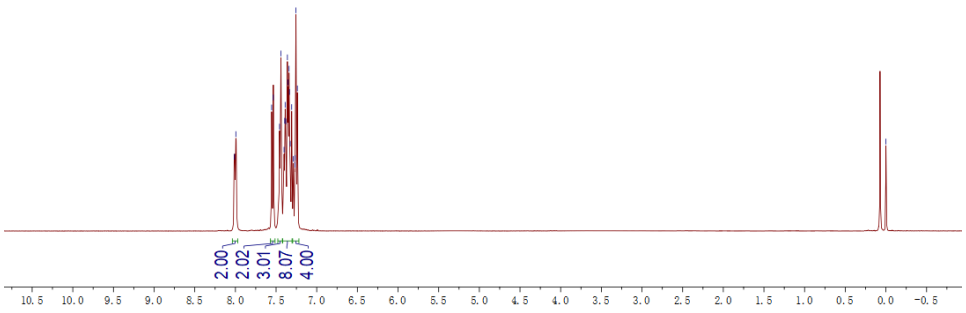

**15d**

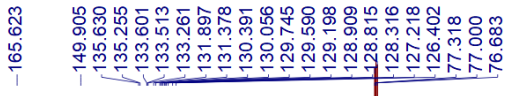
**$^{13}$C NMR** spectrum (100 MHz, $CDCl_3$)

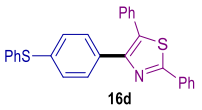




**16d**

$^{1}$**H NMR** spectrum (400 MHz, $CDCl_3$)

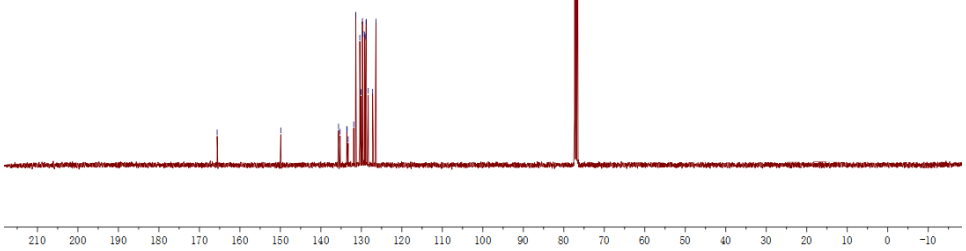


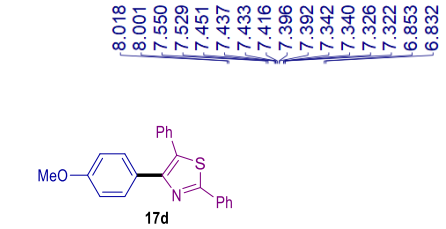




**16d**

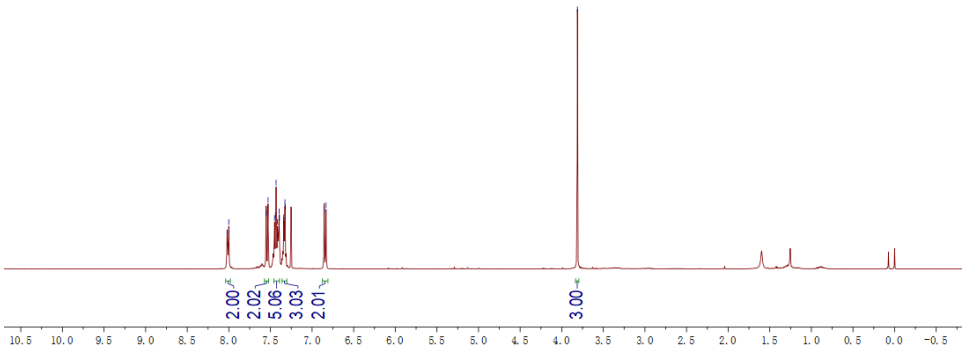
$^{13}$**C NMR** spectrum (100 MHz, $CDCl_3$)

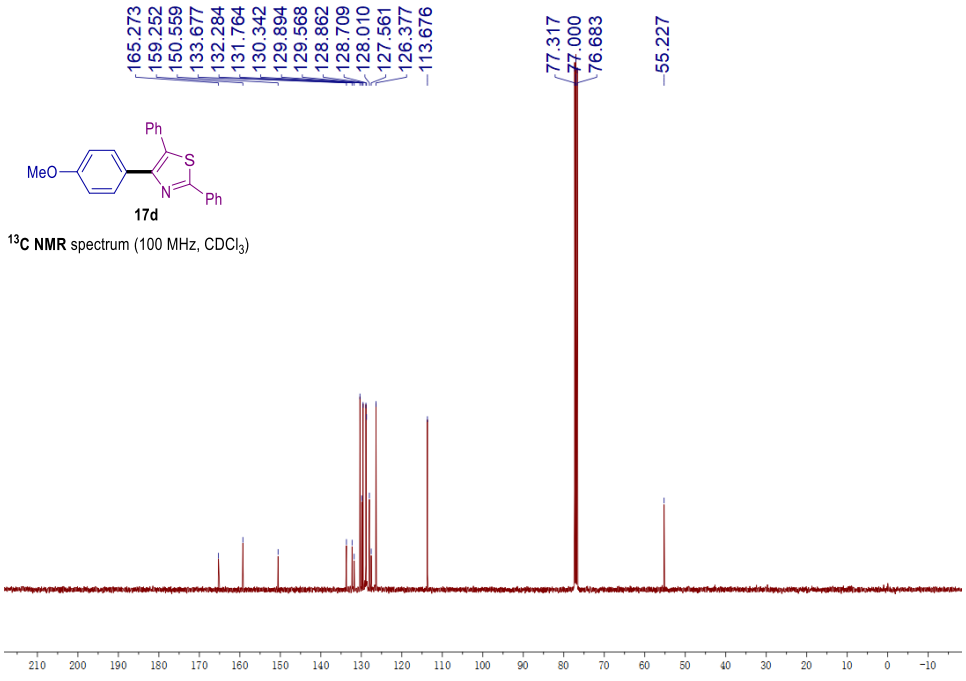





**17d**

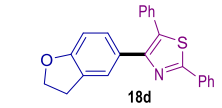
**$^{1}$H NMR** spectrum (400 MHz, $CDCl_3$)



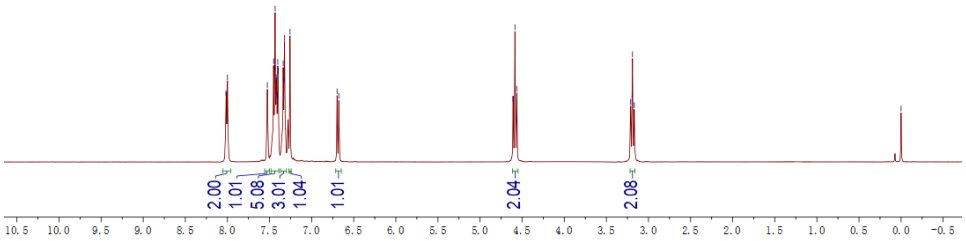

**17d**

**$^{13}$C NMR** spectrum (100 MHz, $CDCl_3$)

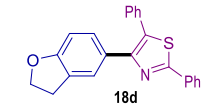




**18d**

$^{1}$**H NMR** spectrum (400 MHz, $CDCl_3$)

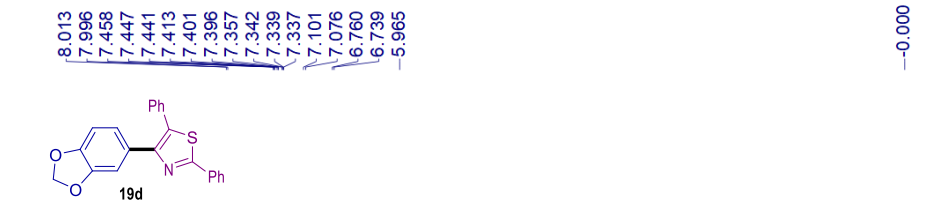







**18d**

$^{13}$**C NMR** spectrum (100 MHz, $CDCl_3$)

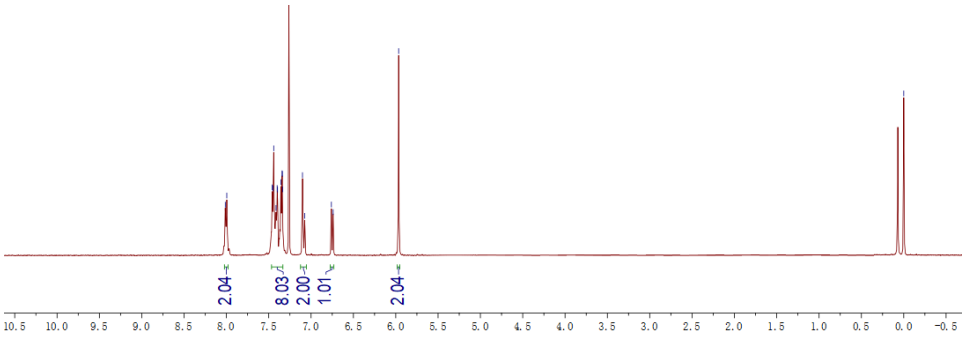




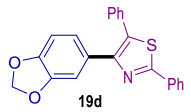


**19d**

$^{1}$**H NMR** spectrum (400 MHz, $CDCl_3$)

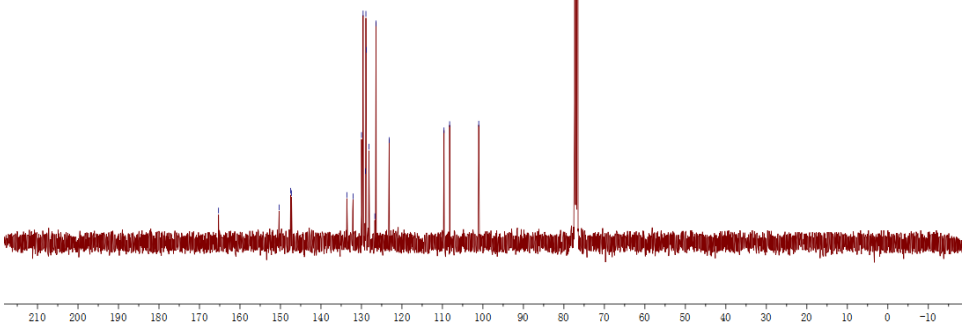


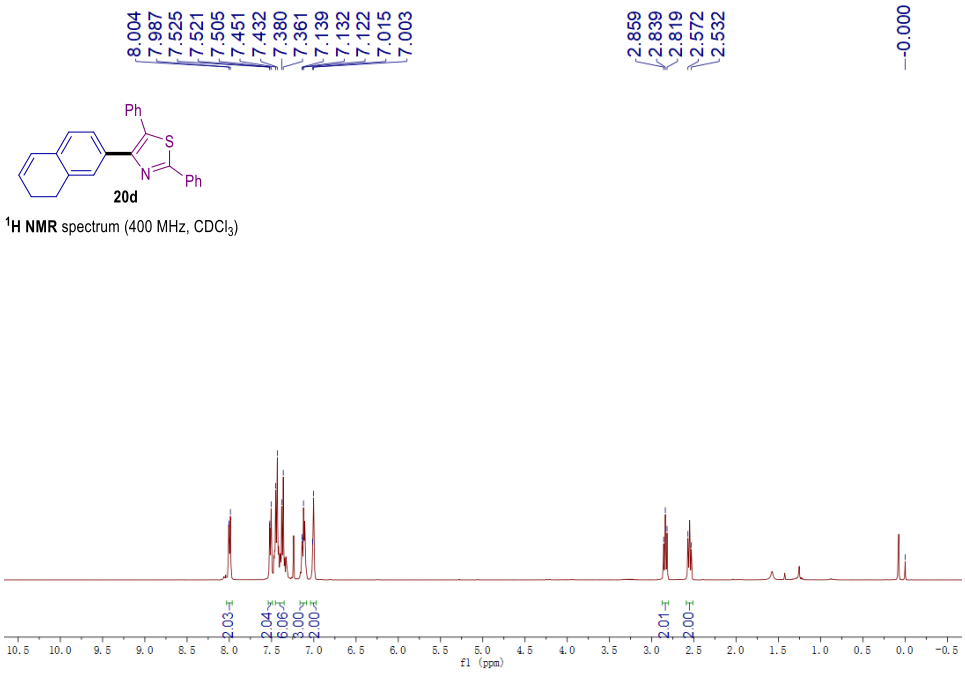




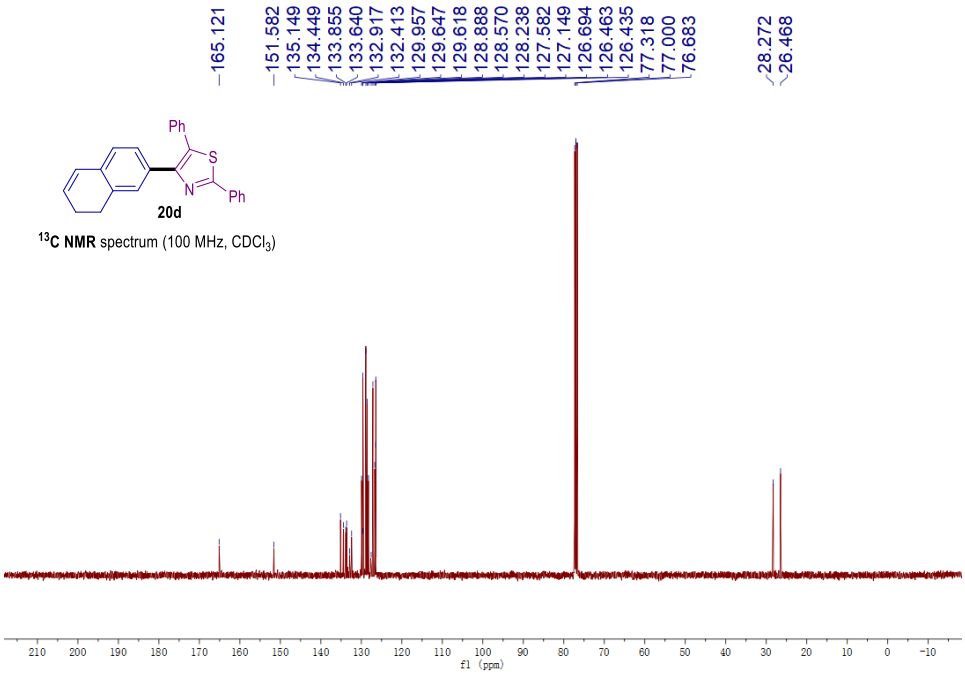

**19d**

$^{13}$**C NMR** spectrum (100 MHz, $CDCl_3$)

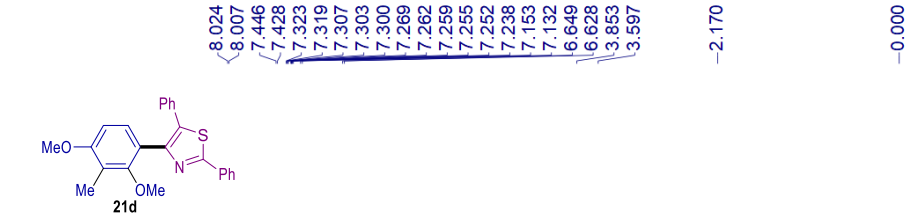





**$^{1}$H NMR** spectrum (400 MHz, $CDCl_3$)




**$^{13}$C NMR** spectrum (100 MHz, $CDCl_3$)

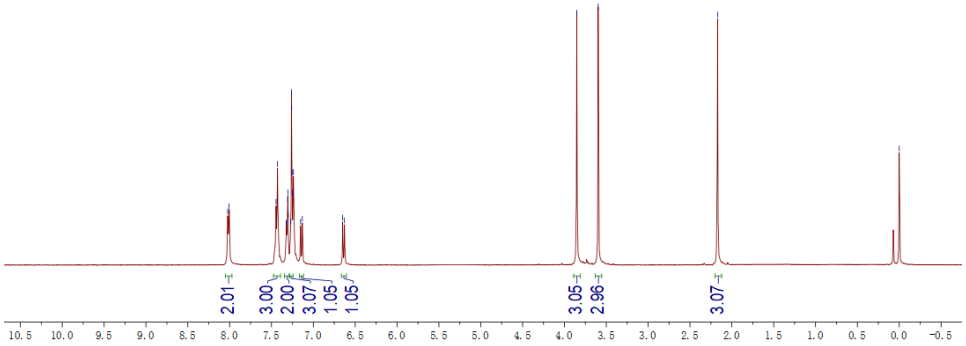




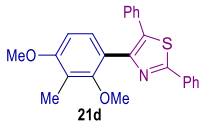


**21d**

$^{1}$**H NMR** spectrum (400 MHz, $CDCl_3$)

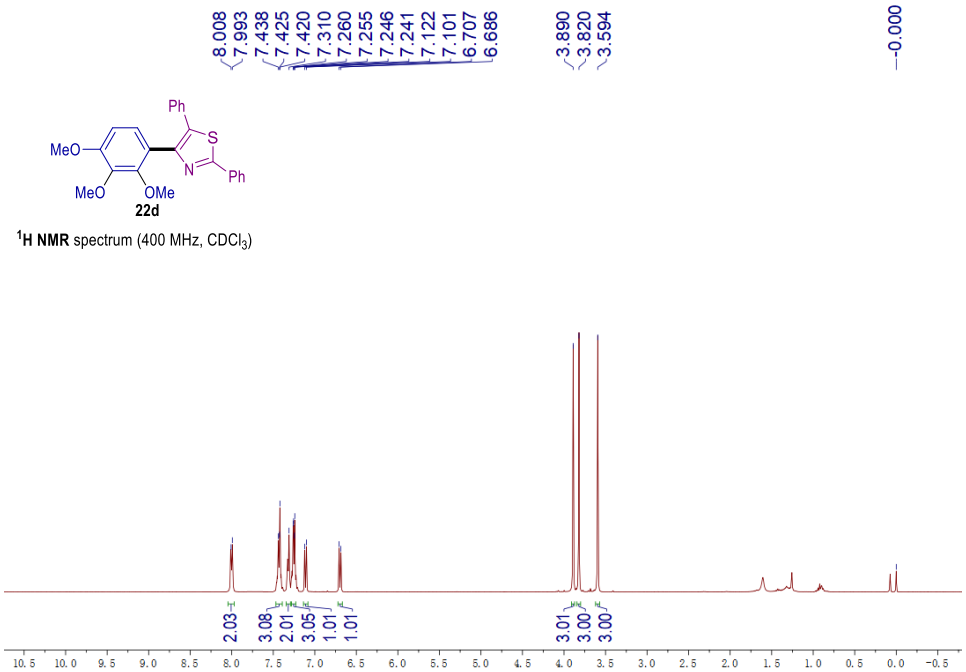




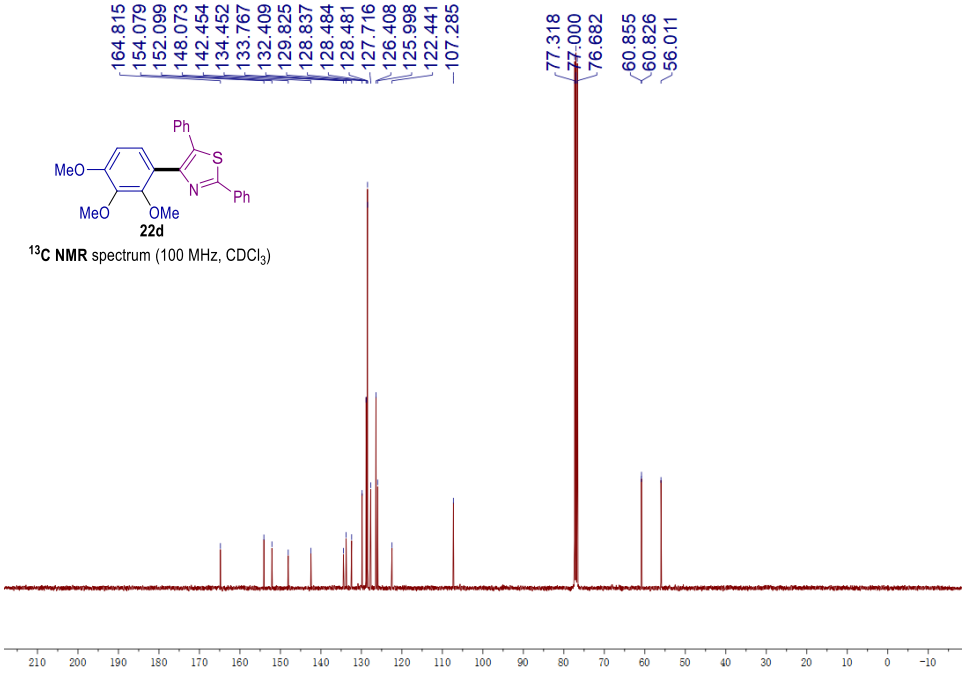



**21d**

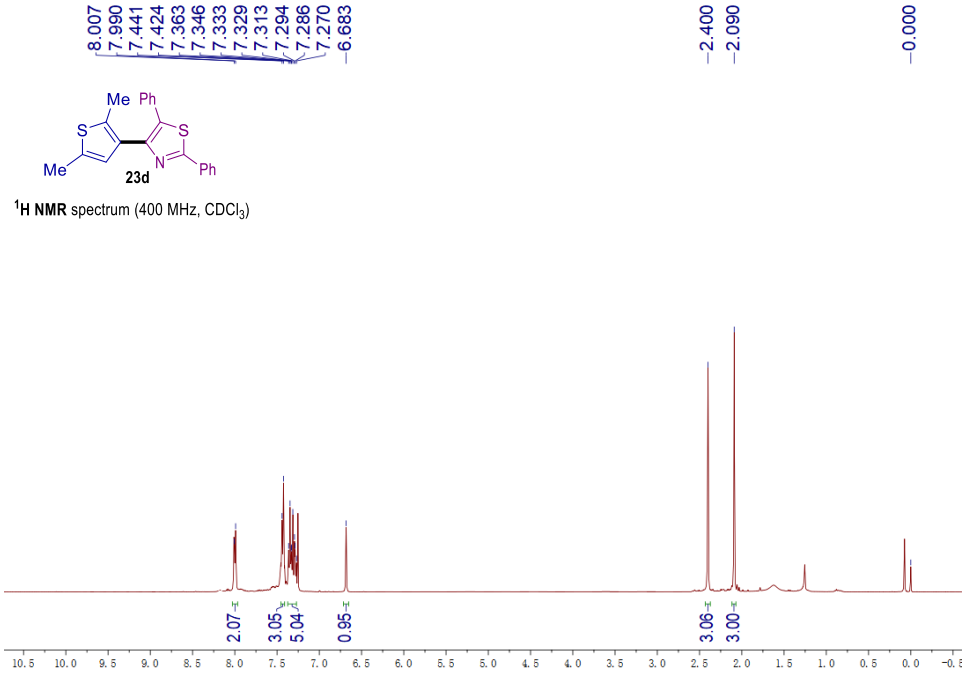
$^{13}$**C NMR** spectrum (100 MHz, $CDCl_3$)



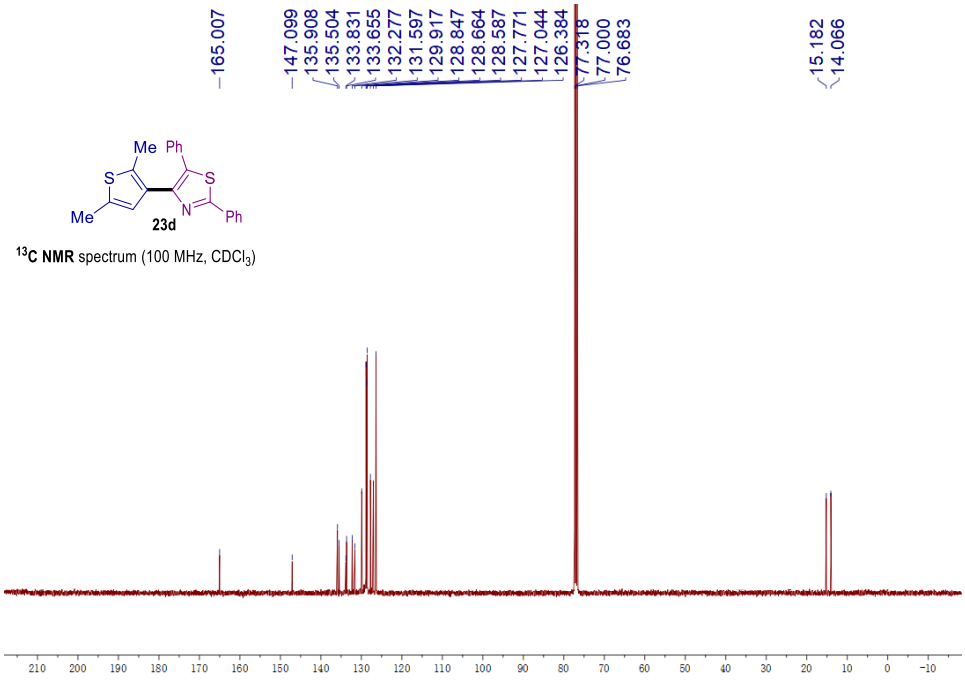

**$^{1}$H NMR** spectrum (400 MHz, $CDCl_3$)



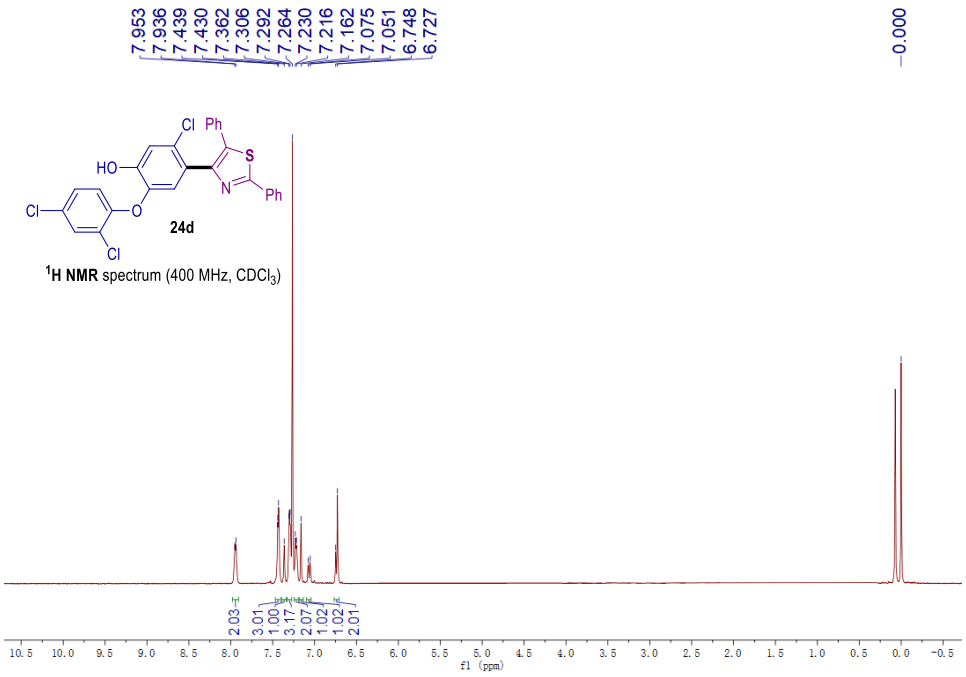

**$^{13}$C NMR** spectrum (100 MHz, $CDCl_3$)



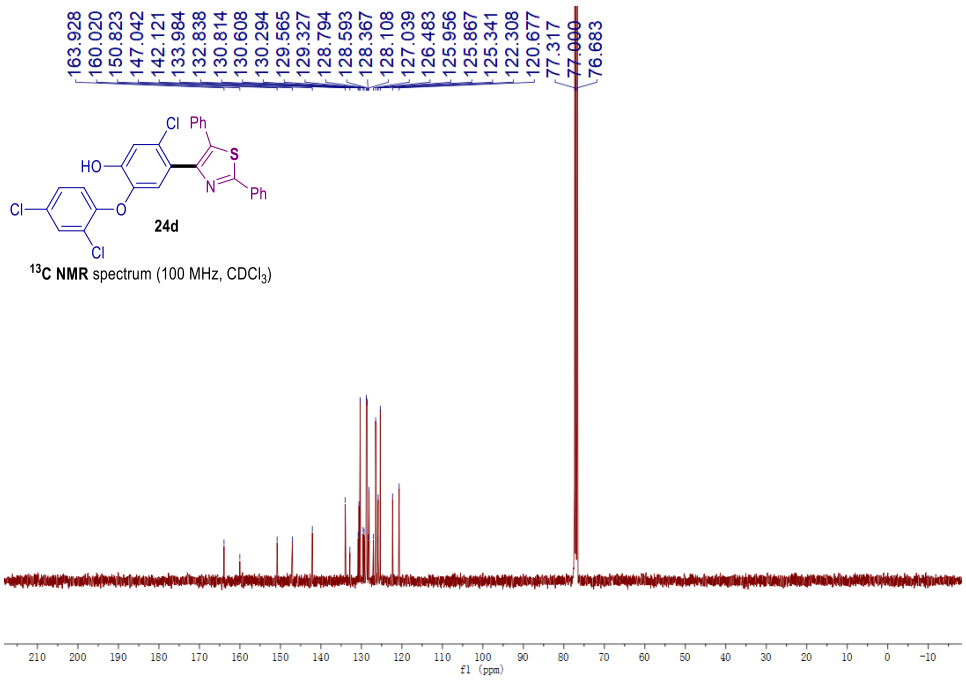

$^{1}$**H NMR** spectrum (400 MHz, $CDCl_3$)



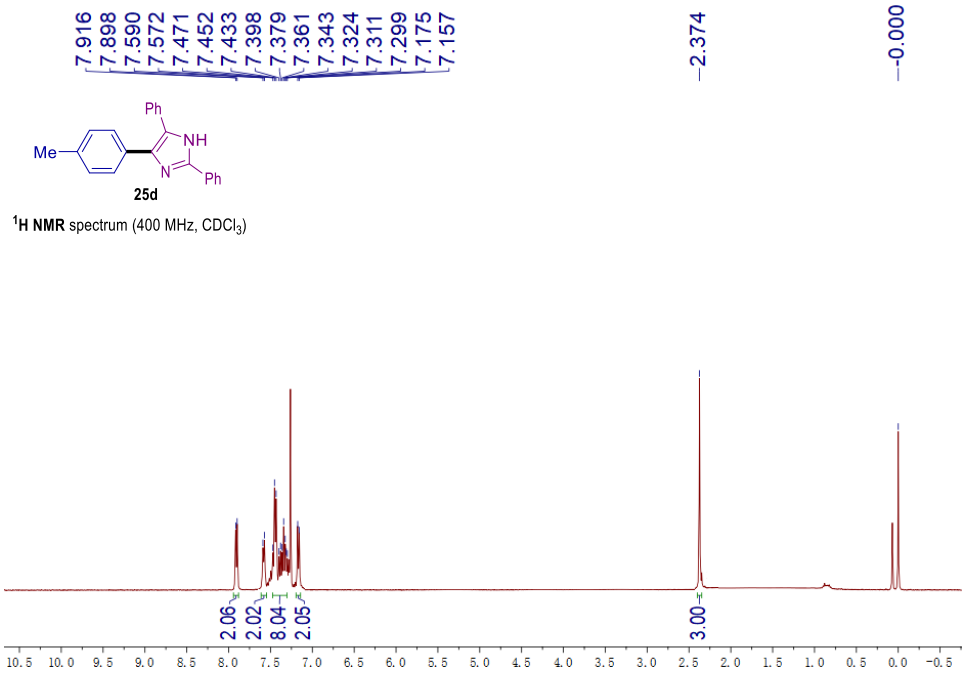

$^{13}$**C NMR** spectrum (100 MHz, $CDCl_3$)



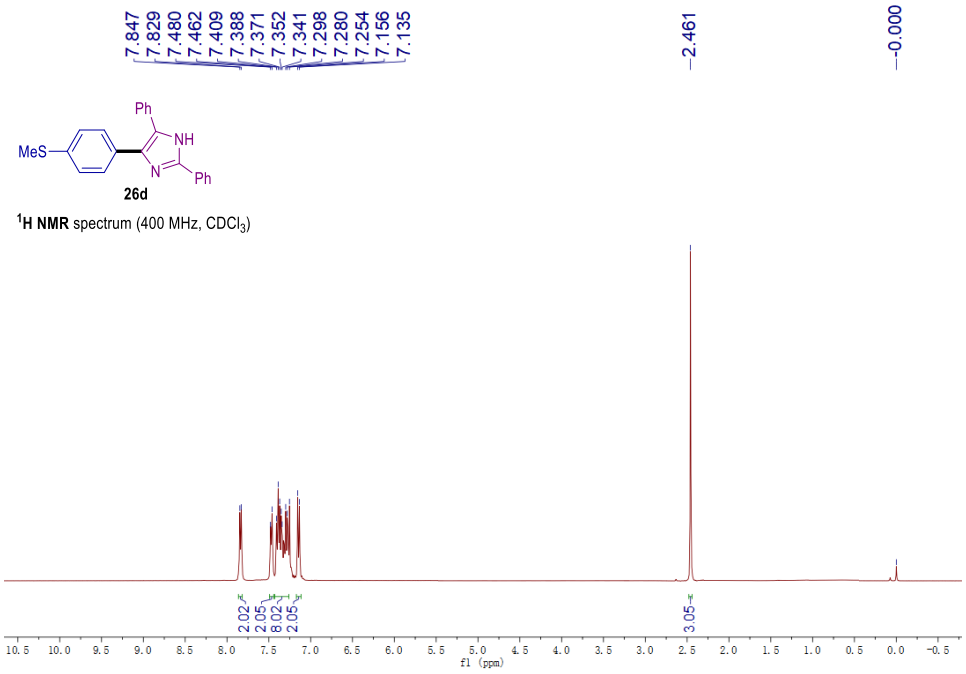

**$^{1}$H NMR** spectrum (400 MHz, $CDCl_3$)




**$^{13}$C NMR** spectrum (100 MHz, $CDCl_3$)

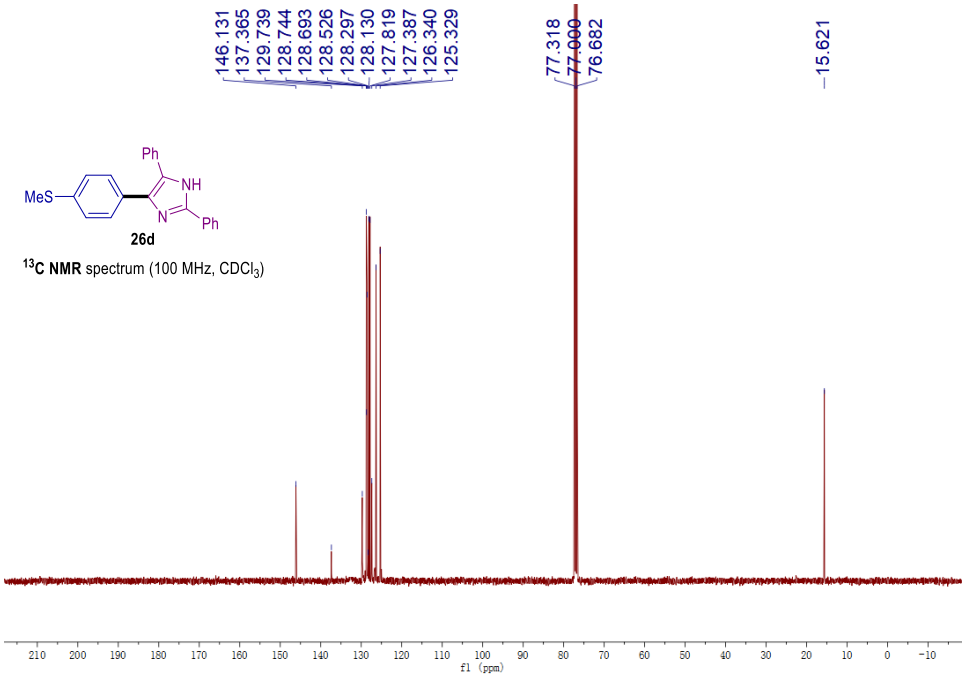



**$^1$H NMR** spectrum (400 MHz, $CDCl_3$)



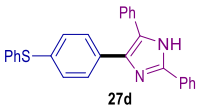

**26d**

**$^{1}$H NMR** spectrum (400 MHz, $CDCl_3$)



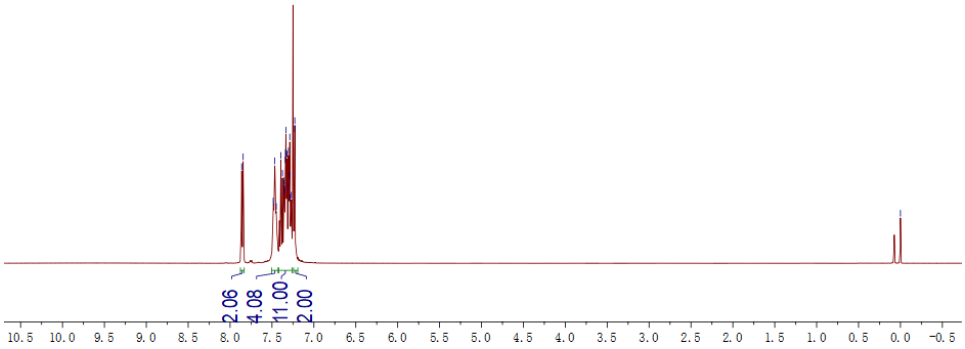

**26d**

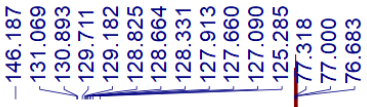
**$^{13}$C NMR** spectrum (100 MHz, $CDCl_3$)

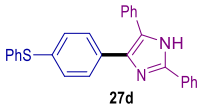




**27d**

$^{1}$**H NMR** spectrum (400 MHz, $CDCl_3$)

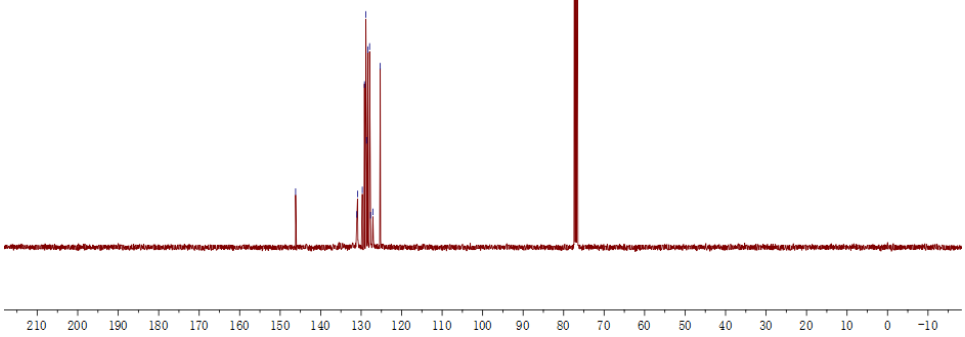


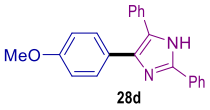




**27d**

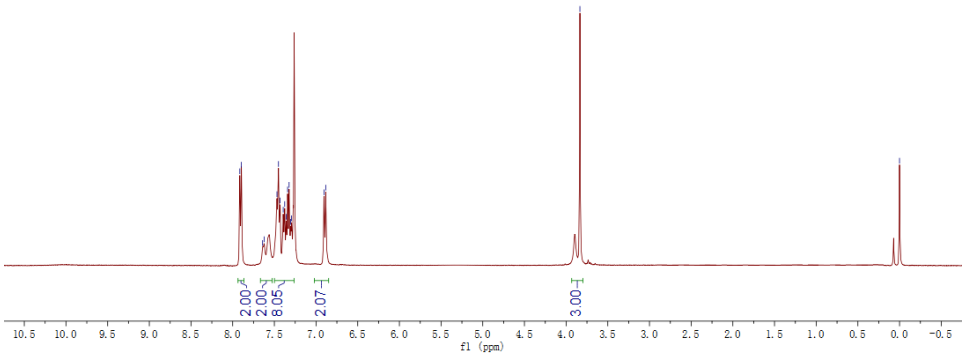
$^{13}$**C NMR** spectrum (100 MHz, $CDCl_3$)

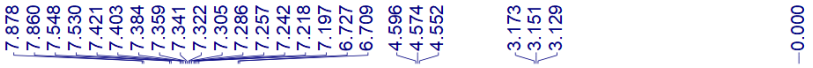


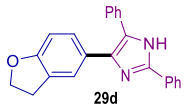




**28d**

$^{1}$**H NMR** spectrum (400 MHz, $CDCl_3$)

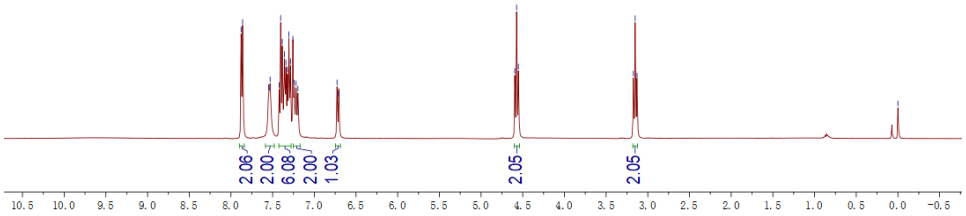


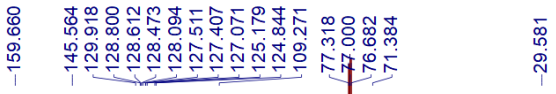


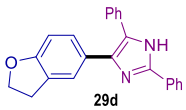




**29d**

$^{1}$**H NMR** spectrum (400 MHz, $CDCl_3$)

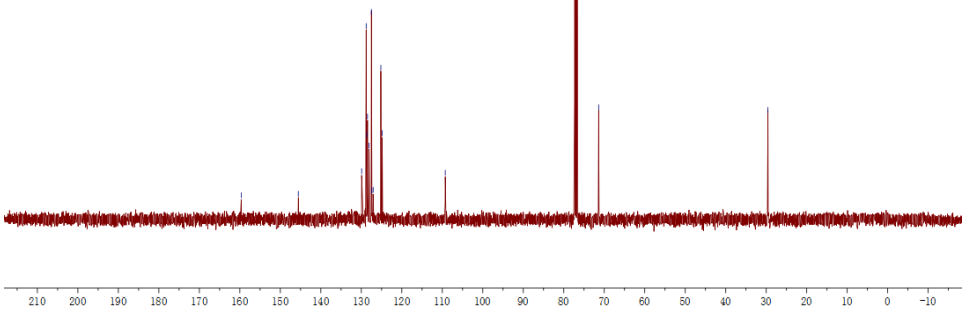


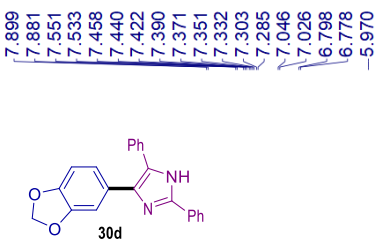



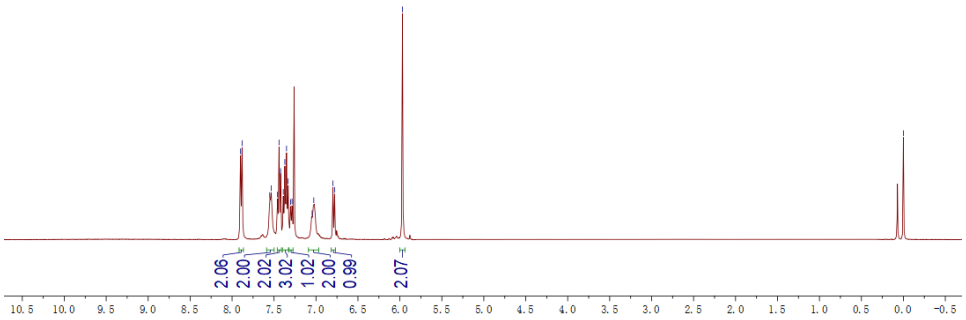

**29d**

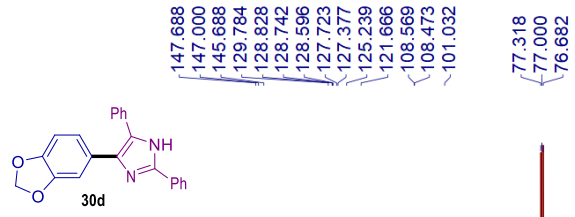
$^{13}$**C NMR** spectrum (100 MHz, $CDCl_3$)



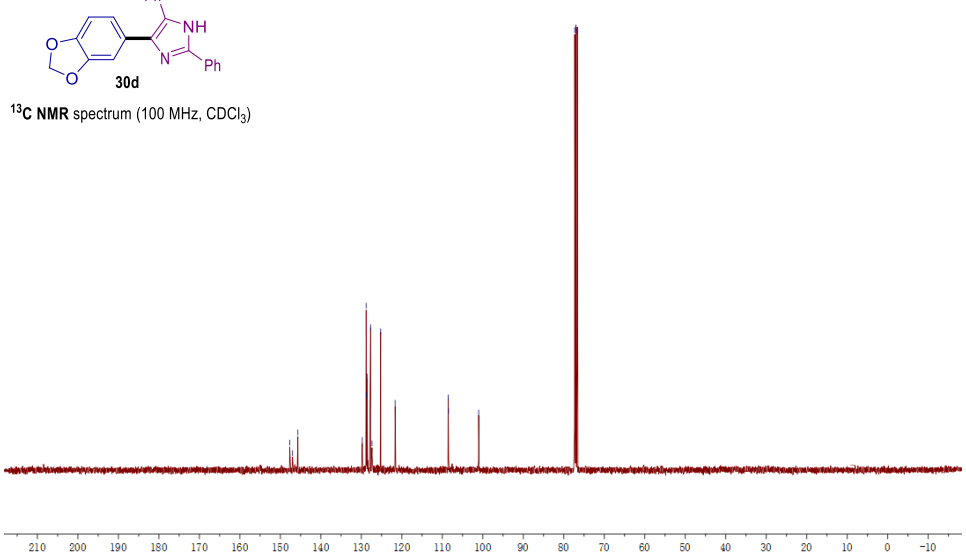


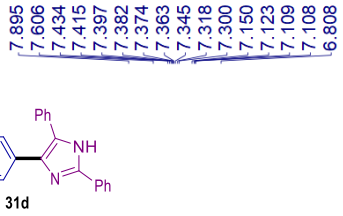

**$^{1}$H NMR** spectrum (400 MHz, $CDCl_3$)



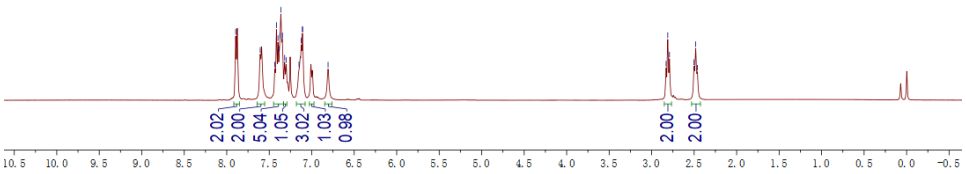

**$^{13}$C NMR** spectrum (100 MHz, $CDCl_3$)

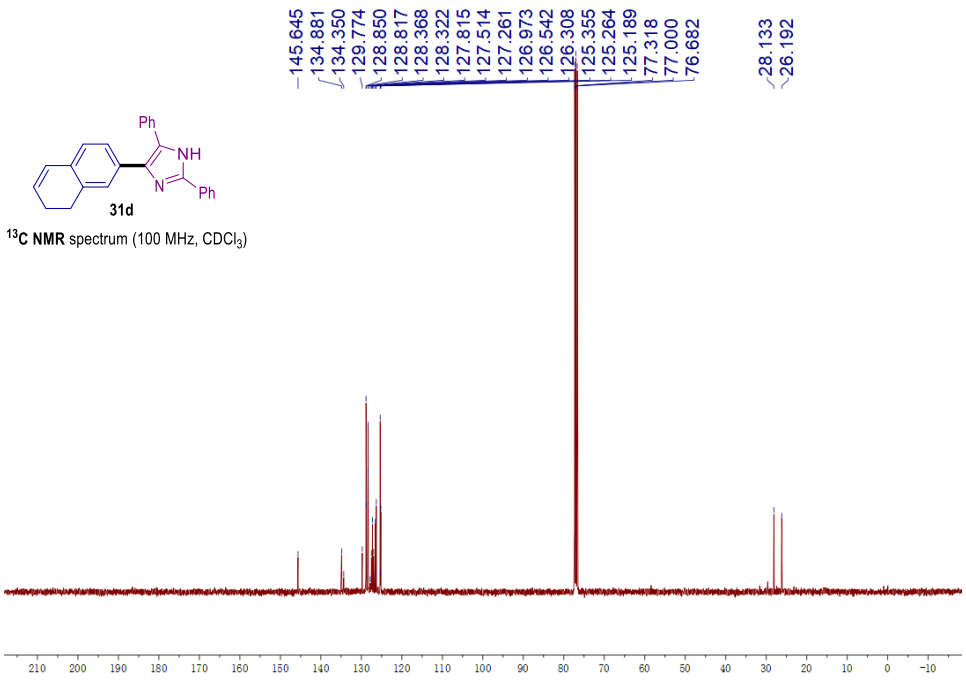





**31d**

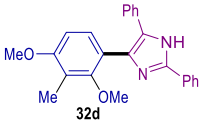
$^{1}$**H NMR** spectrum (400 MHz, $CDCl_3$)



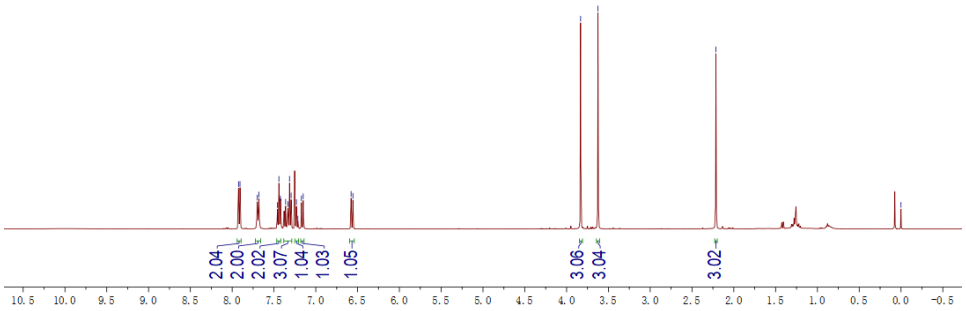

**31d**

$^{13}$**C NMR** spectrum (100 MHz, $CDCl_3$)

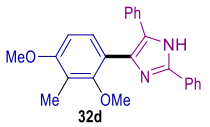




**32d**

$^{1}$**H NMR** spectrum (400 MHz, $CDCl_3$)

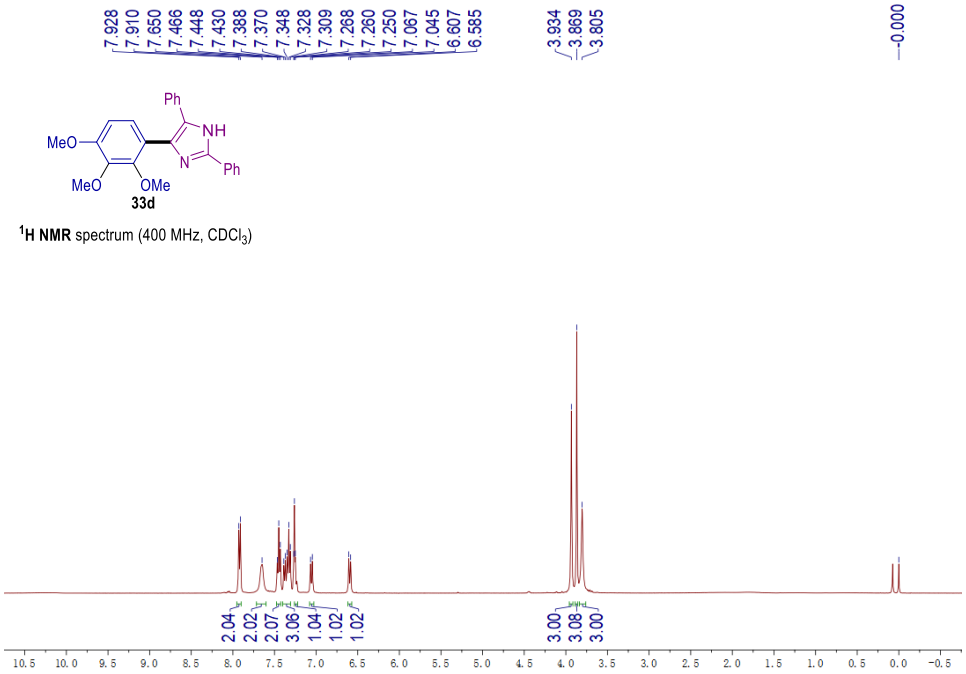




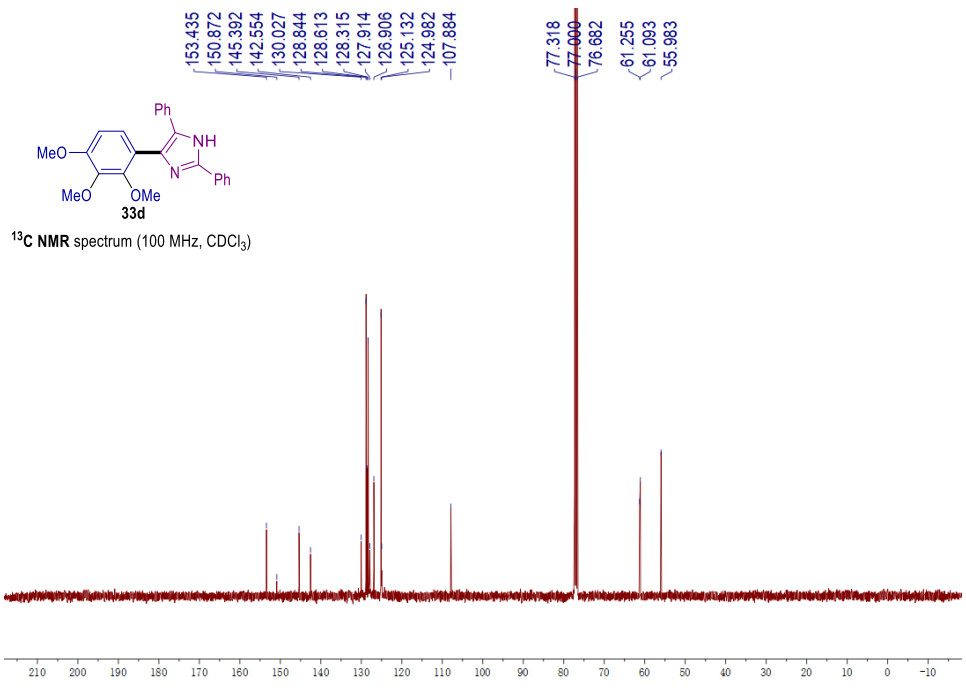



**32d**

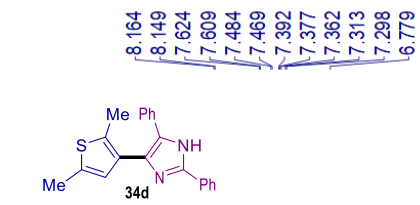
$^{13}$**C NMR** spectrum (100 MHz, $CDCl_3$)



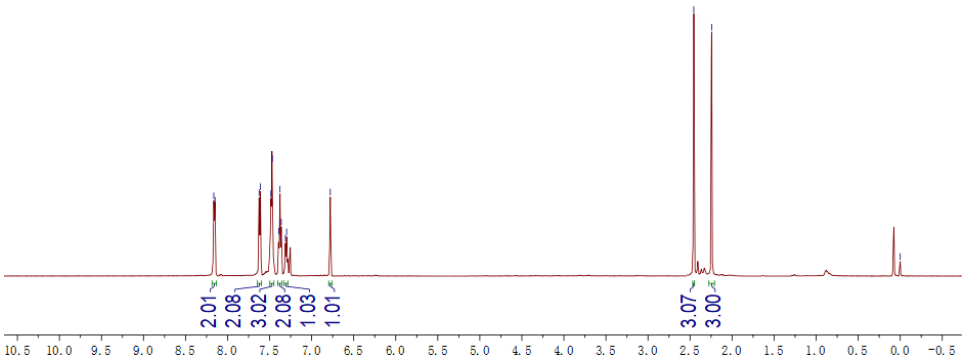

**$^{1}$H NMR** spectrum (400 MHz, $CDCl_3$)

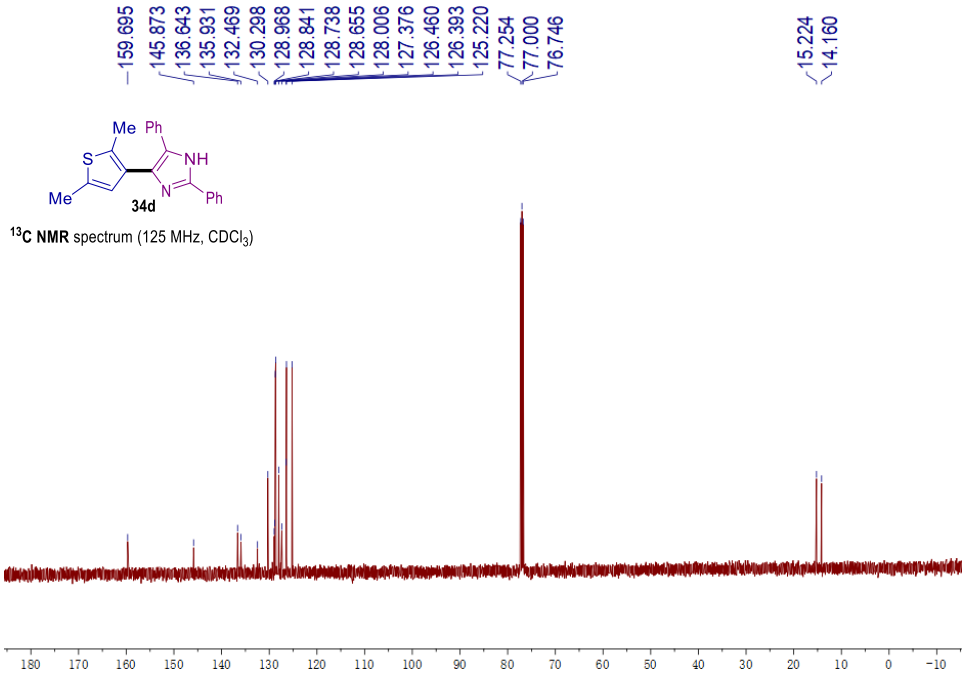



**$^{13}$C NMR** spectrum (100 MHz, $CDCl_3$)

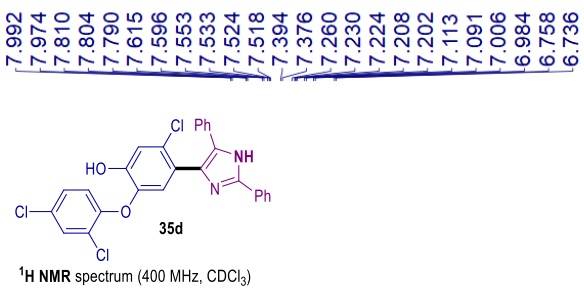



$^{1}$**H NMR** spectrum (500 MHz, $CDCl_3$)

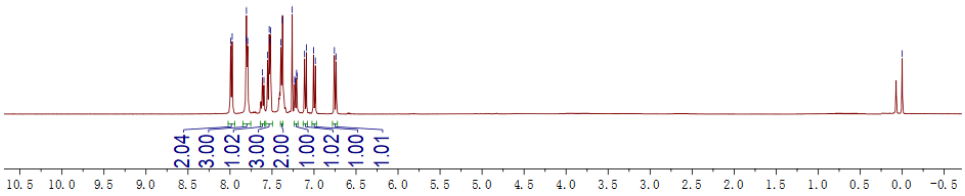


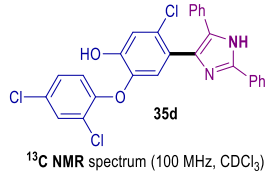

$^{13}$**C NMR** spectrum (125 MHz, $CDCl_3$)



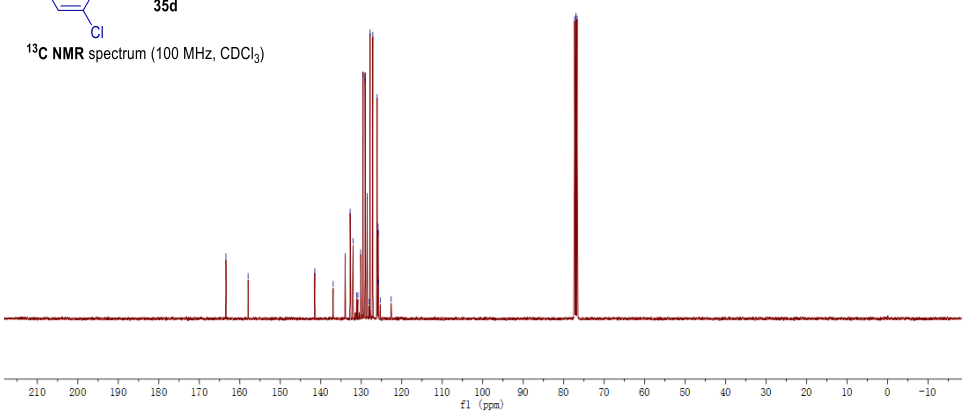

$^{1}$**H NMR** spectrum (400 MHz, $CDCl_3$)

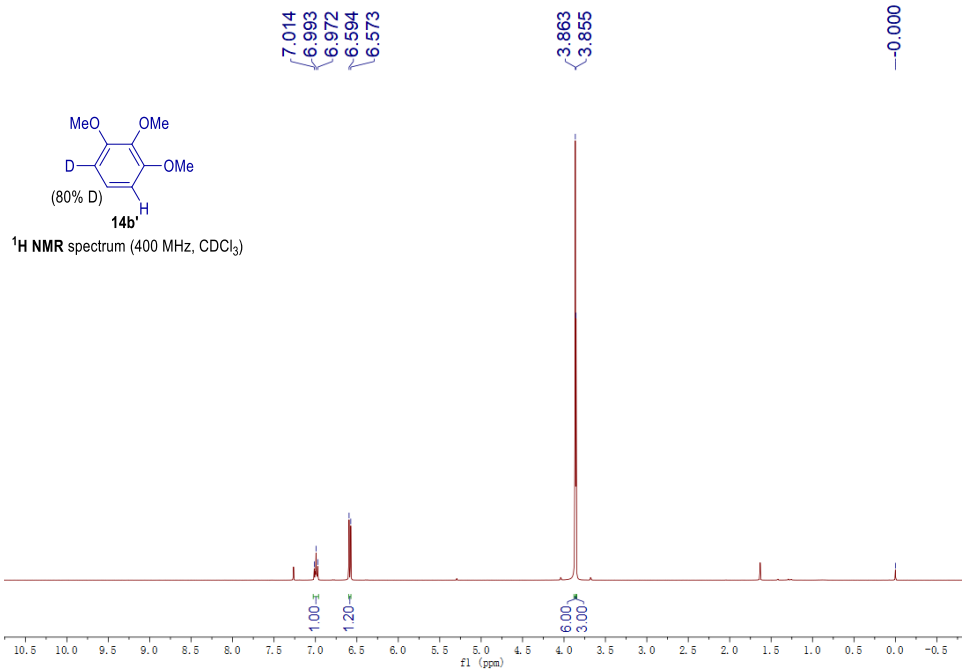




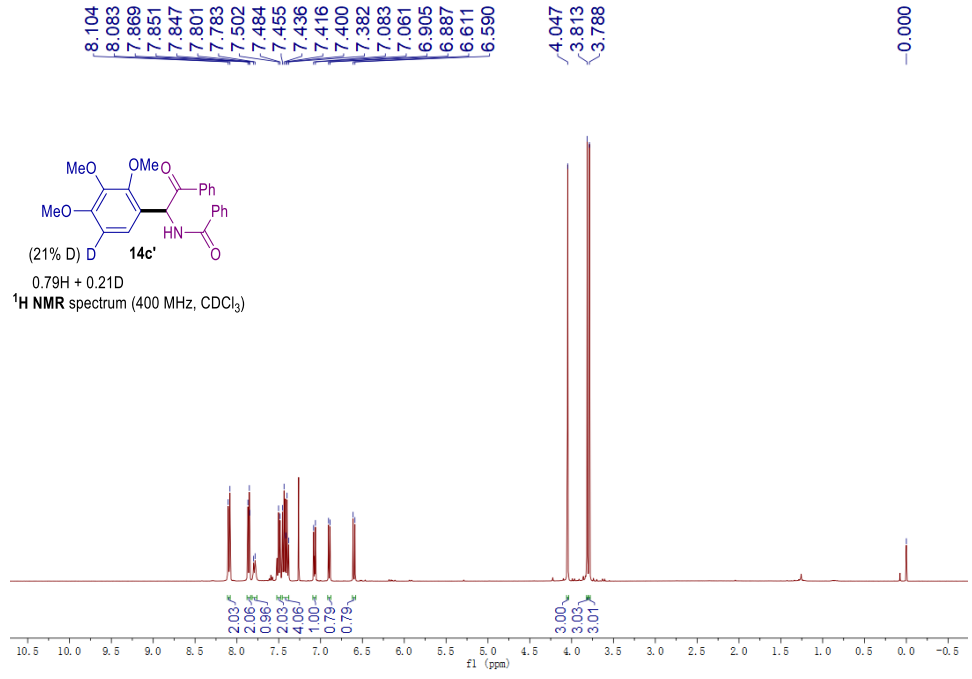



$^{13}$**C NMR** spectrum (100 MHz, $CDCl_3$)






**$^1$H NMR** spectrum (400 MHz, $CDCl_3$)




0.79H + 0.21D

**$^1$H NMR** spectrum (400 MHz, $CDCl_3$)