Supporting Information

Phosphine mediated formal [5+1] aminobenzannulations of Morita-Baylis-Hillman carbonates with isocyanates

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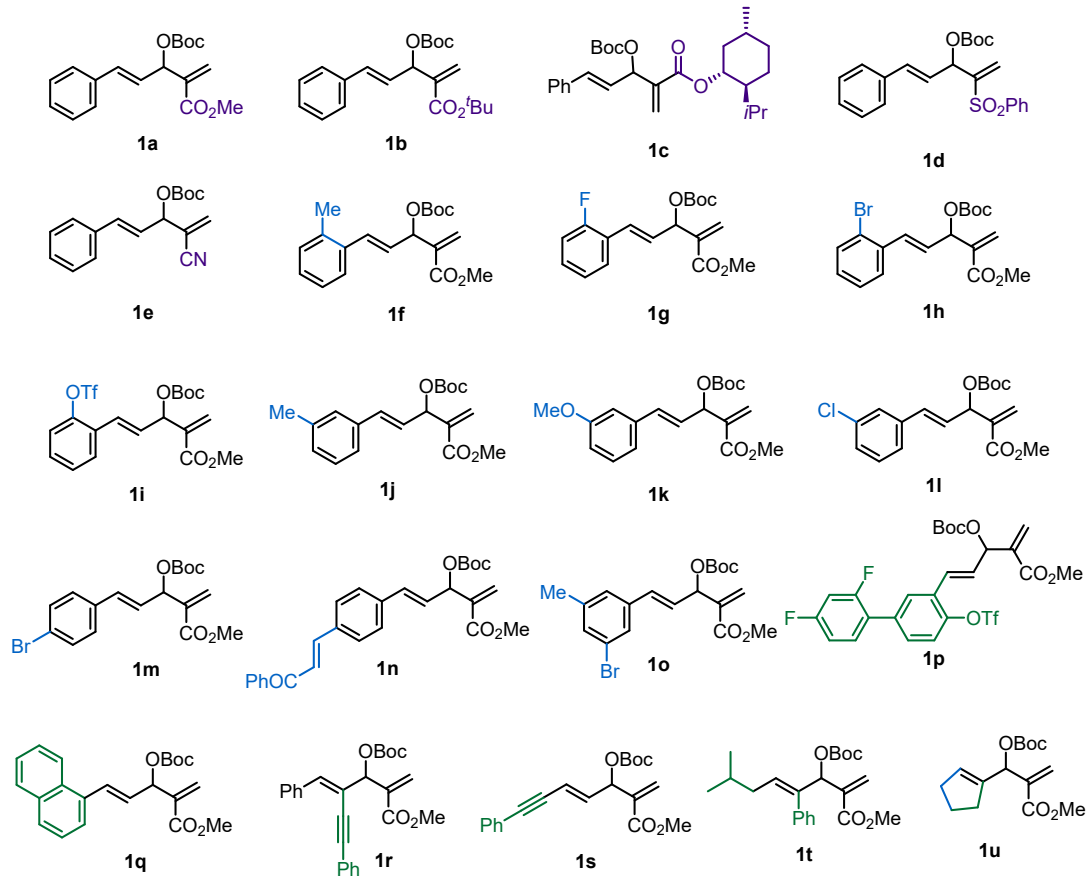
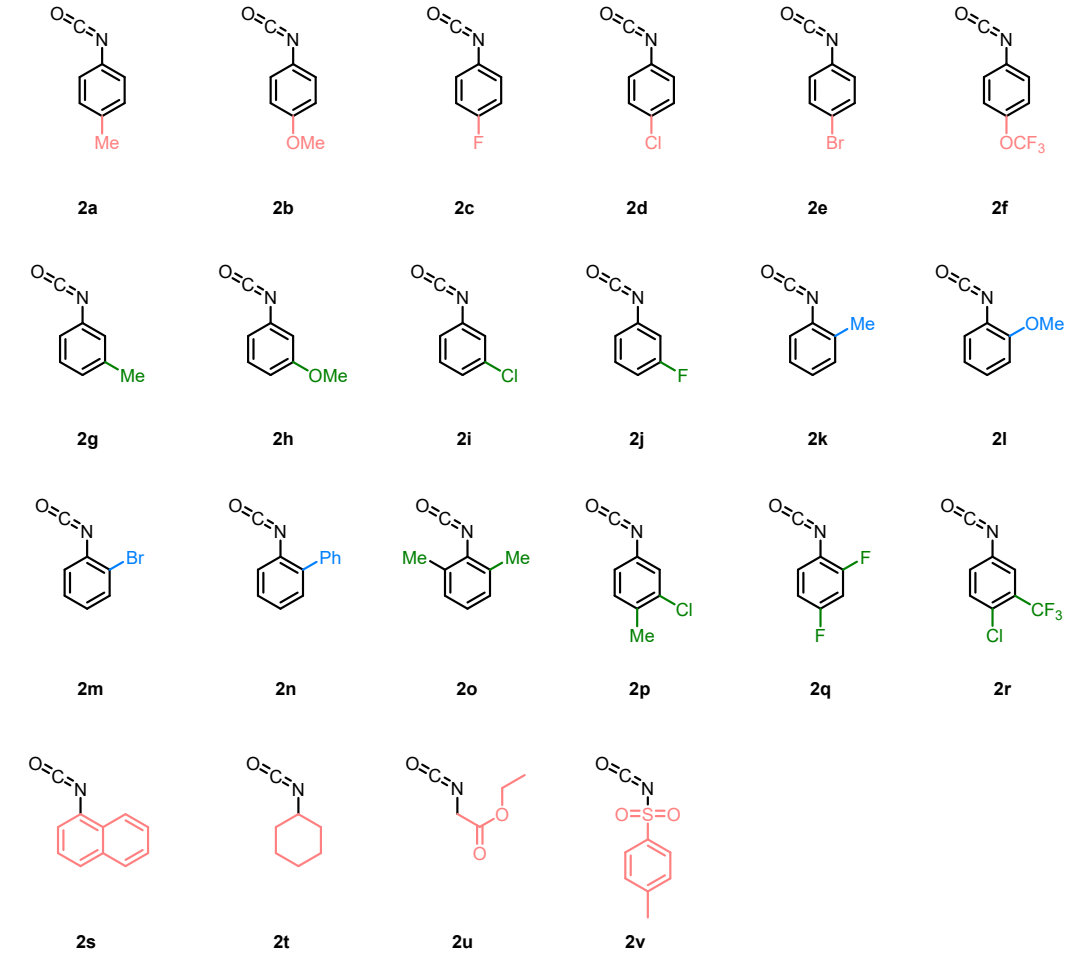
1. General Information

Commercial reagents and solvents were used as received without further purification, unless otherwise stated. Yields referred to isolated compounds through preparative TLC. ^{1}H NMR, ^{13}C NMR, ^{19}F NMR spectra were recorded on a Bruker Avance 400 (400 MHz) spectrometer. Chemical shifts for protons are reported in ppm and are referenced to the tetramethylsilane (TMS) and NMR solvent peak (Chloroform-*d*: δ 7.26 ppm). Chemical shifts for carbons are reported in ppm and are referenced to the carbon resonances of the NMR solvent peak (Chloroform-*d*: δ 77.0 ppm). Multiplicity was indicated as follows: s (singlet), d (doublet), t (triplet), q (quartet), h (heptet) and m (multiplet). High resolution mass spectrometry (HRMS) was obtained on Q Exactive Focus or Agilent 6520 Q-TOF LC/MS with ESI resource. Melting points were measured on a RY-I apparatus and reported uncorrected.

2. The Substrates Examined in This Report

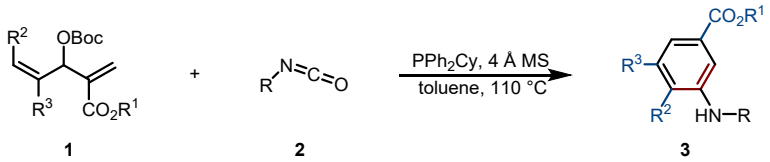
Table S1. The Substrates Examined in This Report





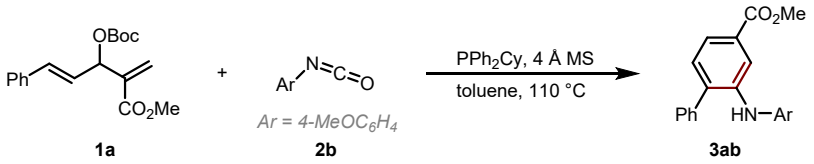
The MBH carbonate derivatives **1a**–**1u** were reported by our previous work[1]. The isocyanates were commercially available.

3. General Procedure A for the Synthesis of arylamines 3



To a 10 mL glass vial was added MBH carbonate **1** (0.10 mmol, 1.0 equiv), isocyanate **2** (0.12 mmol, 1.2 equiv), PPh_2Cy (0.11 mmol, 1.1 equiv), 4 Å MS (200 mg) and 1.0 mL of toluene. The resulting suspension was stirred at 110 °C until the complete consumption of the starting materials monitored by TLC. The reaction mixture was concentrated and the residue was purified by silica gel flash column chromatography to afford corresponding products **3**.

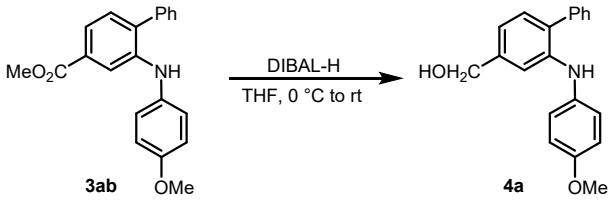
4. General Procedure for the Scale-Up Reaction of 3ab



To an oven-dried 100 mL round-bottom flask was added MBH carbonate **1a** (3.77 mmol), isocyanate **2b** (5.65 mmol, 1.2 equiv), PPh_2Cy (4.15 mmol, 1.1 equiv), 4 Å MS (7.5 g) and toluene (16.0 mL). Then the reaction was warm up to 110 ℃ and stirred for 4 h. After the removal of the 4 Å MS and solvent, the residue was purified by column chromatography (petroleum ether/ethyl acetate = 15:1) to afford product **3ab** as a yellow solid (742.6 mg, 59% yield).

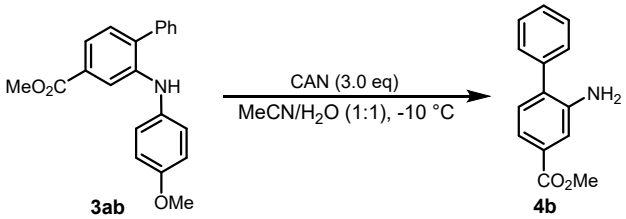
5. Synthetic Transformations

Scheme S1. The reduction reaction



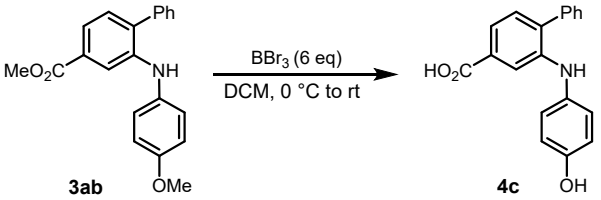
To a stirred solution of **3ab** (0.1 mmol, 1.0 eq.) in 1 mL anhydrous THF was added DIBAL-H (0.3 mmol, 3.0 eq.) at 0 ℃ under the protection of N_2. The mixture was stirred at room temperature and extracted with ethyl acetate (1 mL×3). The organic phases were combined, washed with 5% ammonia aqueous solution (2 mL) and saturated NaCl aqueous solution (2 mL) in turn, dried with Na_2SO_4 and concentrated in vacuo. The crude product was purified by flash chromatography (petroleum ether/ethyl acetate = 5:1) to provide the desired product **4a** as a yellow solid (30.3 mg, 99% yield, mp: 130-132 ℃).

Scheme S2. The deprotection of *p*-methoxyphenyl group.



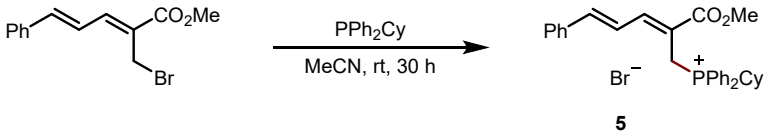
To a stirred solution of **3ab** (33.4 mg, 0.1 mmol, 1.0 eq.) in acetonitrile (1 mL) was added H_2O (1 mL) solution of CAN (164.5 mg, 0.3 mmol, 3.0 eq.) at 0 ℃ under the protection of N_2. And the mixture was stirred for 10 min and then extracted with ethyl acetate (1 mL×3). The organic phases were combined, washed with 5% $NaHSO_3$ aqueous solution (2 mL) and saturated NaCl aqueous solution (2 mL) in turn, dried with Na_2SO_4 and concentrated in vacuo. The crude product was purified by flash chromatography (petroleum ether/ethyl acetate = 3:1) to provide the desired product **4b** as a white solid (10.0 mg, 44% yield, mp: 46-48 ℃).

Scheme S3. The deprotection of methyl group.

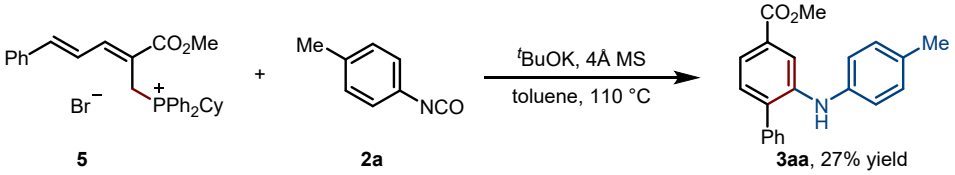


To a stirred solution of **3ab** (0.1 mmol, 1.0 eq.) in 1 mL anhydrous DCM was added BBr_3 (0.6 mmol, 6.0 eq.) at 0 ℃ under the protection of N_2. The mixture was stirred 1 h at room temperature. The organic phases washed with H_2O (2 mL) and saturated NaCl aqueous solution (2 mL) in turn, dried with Na_2SO_4 and concentrated in vacuo. The crude product was purified by flash chromatography (petroleum ether/ethyl acetate = 1:1) to provide the desired product **4c** as a yellow solid (29.0 mg, 95% yield, mp: 46-48 ℃).

6. Mechanism verification experiment



MBH bromide (3.2 mmol) and PPh_2Cy (3.2 mmol, 1.0 equiv) were dissolved in 10 mL MeCN and stirred for 30 h. Then the mixture was concentrated in vacuo. The crude product was recrystallized to provide the desired phosphonium salt **5** as a white solid (1.23 g, 70% yield).



To a 10 mL glass vial was added phosphonium salt **5** (0.1 mmol, 1.0 equiv), isocyanate **2a** (0.12 mmol, 1.2 equiv), ^{t}BuOK (12.3 mg, 0.11 mmol, 1.1 eq), 4 Å MS (100 mg) and 1.0 mL of toluene. The resulting suspension was stirred at 110 °C until the complete consumption of the starting materials monitored by TLC. After filtration and evaporation, the residue was purified by silica gel flash column chromatography (petroleum ether: ethyl acetate = 5:1) to afford corresponding product **3aa** (8.6 mg, 27% yield).

7. X-Ray Crystallography Data of 3ag

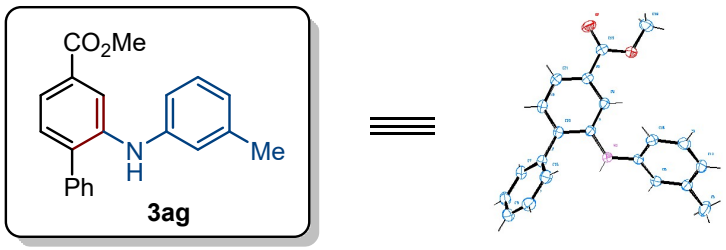


Figure S1. ORTEP diagram of **3ag** (CCDC: 2260766). Thermal ellipsoids are shown at the 50% probability level. A colorless stick-shaped crystal of **3ag** for X-ray diffraction was obtained by slowly

volatilizing a saturated solution of **3ag** in hexane/dichloromethane (10:1).

Table S2. Crystal data and structure refinement for **3ag**.

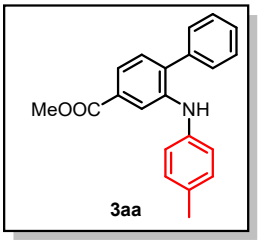
Identification code	**3ag**
Empirical formula	$C_{21}H_{19}NO_2$
Formula weight	317.37
Temperature/K	298.30
Crystal system	orthorhombic
Space group	Pbca
a/Å	8.7871(6)
b/Å	15.5197(10)
c/Å	24.4352(17)
α/°	90
β/°	90
γ/°	90
Volume/Å3	3332.3(4)
Z	8
ρcalcg/cm3	1.265
μ/mm-1	0.081
F(000)	1344.0
Crystal size/mm3	0.200 × 0.180 × 0.120
Radiation	MoKα (λ = 0.71073)
2Θ range for data collection/°	5.25 to 52.766
Index ranges	-10 ≤ h ≤ 10, -18 ≤ k ≤ 19, -29 ≤ l ≤ 30
Reflections collected	33641
Independent reflections	3394 [Rint = 0.0621, Rsigma = 0.0347]
Data/restraints/parameters	3394/0/220
Goodness-of-fit on F2	1.054
Final R indexes [I>=2σ (I)]	R1 = 0.0402, wR2 = 0.0986
Final R indexes [all data]	R1 = 0.0632, wR2 = 0.1108
Largest diff. peak/hole / e Å-3	0.18/-0.20

8. References

[1] Cai, W.; Huang, Y. Metal Free Dötz-Type Aminobenzannulation Reaction via 1,1-Dipoles Cross-Coupling. *Angew. Chem., Int. Ed.* **2023,** *62*, e202310133.

9. Characterization Data

Methyl 2-(*p*-tolylamino)-[1,1'-biphenyl]-4-carboxylate (3aa)



The reaction was performed according to ***General Procedure*** with **1a** (0.1 mmol, 1.0 equiv) and **2a** (0.12 mmol, 1.2 equiv) to give **3aa** as yellow solid (19.3 mg, 61% yield, mp: 110-112 ℃). R_f = 0.5 (petroleum ether/ethyl acetate = 10:1).

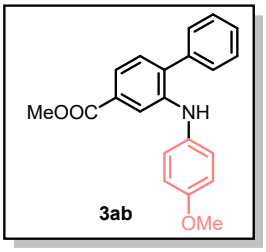
^{1}H-NMR (400 MHz, Chloroform-*d*) δ 7.93 (d, *J* = 1.7 Hz, 1H), 7.59 (dd, *J* = 7.9, 1.7 Hz, 1H), 7.46 (d, *J* = 4.4 Hz, 4H), 7.39 (q, *J* = 4.4 Hz, 1H), 7.25 (s, 1H), 7.10 (d, *J* = 8.1 Hz, 2H), 6.99 (d, *J* = 8.3 Hz, 2H), 5.61 (s, 1H), 3.88 (s, 3H), 2.31 (s, 3H).

^{13}C-NMR (101 MHz, Chloroform-*d*) δ 134.5, 131.6, 130.6, 129.9, 128.9, 127.8, 120.9, 119.6, 116.5, 51.9, 20.6.

HRMS (ESI) m/z calcd for $C_{21}H_{19}NO_2$ $[M + H]^+$: 318.1494; Found: 318.1498.

IR (KBr): 3032, 3020, 2985, 2898, 1717, 1650, 1542, 1520, 762, 755 cm^{-1}.

Methyl 2-((4-methoxyphenyl)amino)-[1,1'-biphenyl]-4-carboxylate (3ab)



The reaction was performed according to ***General Procedure*** with **1a** (0.1 mmol, 1.0 equiv) and **2b** (0.1 mmol, 1.2 equiv) to give **3ab** as white solid (20.3 mg, 61% yield, mp: 115-116 ℃). R_f = 0.5 (petroleum ether/ethyl acetate = 5:1).

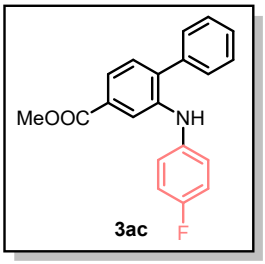
^{1}H NMR (400 MHz, Chloroform-*d*) δ = 7.74 (d, *J*=1.8, 1H), 7.40 (q, *J*=7.2, 5.4, 6H), 7.25 (d, *J*=3.1, 1H), 7.10 – 6.97 (m, 2H), 6.87 (d, *J*=8.5, 2H), 5.58 (s, 1H), 3.87 (s, 3H), 3.80 (s, 3H).

^{13}C NMR (101 MHz, Chloroform-*d*) δ 167.2, 155.9, 142.7, 138.3, 135.0, 133.6, 130.7, 130.2, 129.2, 129.1, 128.0, 123.3, 120.3, 115.1, 114.9, 55.6, 52.1.

HRMS (ESI) m/z calcd for $C_{21}H_{19}NO_3$ $[M + H]^+$: 334.1443; Found: 334.1447.

IR (KBr): 3500, 3030, 2890, 2880, 1716, 1646, 1567, 1299, 749 cm^{-1}.

Methyl 2-((4-fluorophenyl)amino)-[1,1'-biphenyl]-4-carboxylate (3ac)



The reaction was performed according to ***General Procedure*** with **1a** (0.1 mmol, 1.0equiv) and **2c** (0.12 mmol, 1.2 equiv) to give **3ac** as white solid (18.7 mg, 58% yield, mp: 77-79 °C). R_f = 0.5 (petroleum ether/ethyl acetate = 5:1).

^{1}H-NMR (400 MHz, Chloroform-*d*) δ = 7.83 (d, *J*=1.7, 1H), 7.60 (dd, *J*=7.9, 1.7, 1H), 7.52 – 7.37 (m, 6H), 7.27 (d, *J*=12.0, 2H), 7.09 – 6.89 (m, 5H), 5.60 (s, 1H), 3.89 (s, 3H).

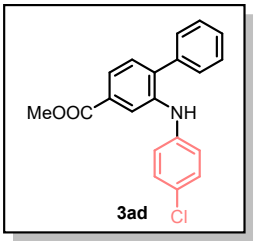
^{13}C NMR (101 MHz, Chloroform-*d*) δ = 167.1, 158.6 (d, *J*=241.1), 141.4, 138.3 (d, *J*=2.8), 138.0, 134.6, 130.8, 130.2, 129.1, 129.0, 128.1, 121.8 (d, *J*=7.7), 121.3, 116.2 (d, *J*=2.2), 116.0, 52.1.

^{19}F NMR (376 MHz, Chloroform-*d*) δ = -120.68.

HRMS (ESI) m/z calcd for $C_{20}H_{16}FNO_2$ $[M + H]^+$: 322.1243; Found: 322.1248.

IR (KBr): 3501, 2995, 2952, 1718, 1646, 1567, 1217, 830, 750 cm^{-1}.

Methyl 2-((4-chlorophenyl)amino)-[1,1'-biphenyl]-4-carboxylate (3ad)



The reaction was performed according to ***General Procedure*** with **1a** (0.1 mmol, 1.0 equiv) and **2d** (0.12 mmol, 1.2 equiv) to give **3ad** as white solid (14.4 mg, 43% yield, mp: 44-46 °C). R_f = 0.5 (petroleum ether/ethyl acetate = 5:1).

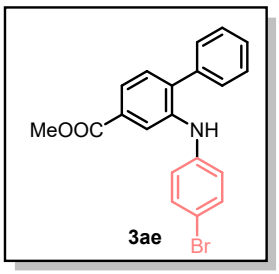
^{1}H-NMR (400 MHz, Chloroform-*d*) δ = 7.95 (d, *J*=1.6, 1H), 7.66 (dd, *J*=7.9, 1.7, 1H), 7.49 – 7.37 (m, 5H), 7.31 (d, *J*=7.8, 1H), 7.28 – 7.19 (m, 2H), 6.97 (d, *J*=8.8, 2H), 5.62 (s, 1H), 3.90 (s, 3H).

^{13}C-NMR (101 MHz, Chloroform-*d*) δ 166.9, 141.4, 140.2, 137.9, 135.8, 131.0, 130.2, 129.5, 129.1, 129.0, 128.2, 126.5, 122.3, 119.8, 118.0, 52.2.

HRMS (ESI) m/z calcd for $C_{20}H_{16}ClNO_2$, $[M + H]^+$: 338.0948; Found: 338.0951.

IR (KBr): 3547, 3027, 2951, 2890, 1717, 1670, 1586, 1276, 749 cm^{-1}.

Methyl 2-((4-bromophenyl)amino)-[1,1'-biphenyl]-4-carboxylate (3ae)



The reaction was performed according to ***General Procedure*** with **1a** (0.1 mmol, 1.0 equiv) and **2e** (0.12 mmol, 1.2 equiv) to give **3ae** as white solid (19.7 mg, 52% yield, mp: 61-63 ℃). R_f = 0.7 (petroleum ether/ethyl acetate = 3:1).

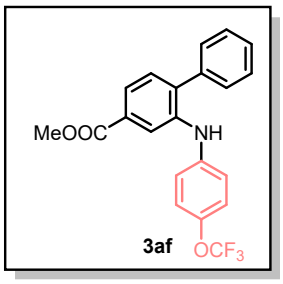
^{1}H-NMR (400 MHz, Chloroform-*d*) δ = 7.97 (d, *J*=2.8, 1H), 7.71 – 7.63 (m, 1H), 7.46 – 7.39 (m, 4H), 7.33 (ddd, *J*=18.8, 8.4, 3.0, 4H), 6.91 (dd, *J*=8.9, 3.0, 2H), 5.61 (s, 1H), 3.90 (s, 3H).

^{13}C-NMR (101 MHz, Chloroform-*d*) δ 166.9, 142.0, 139.9, 137.9, 136.0, 132.4, 131.0, 130.2, 129.1, 129.0, 128.2, 122.5, 119.9, 118.3, 52.2.

HRMS (ESI) m/z calcd for $C_{20}H_{16}NO_2$, $[M + H]^+$: 382.0443; Found: 382.0444.

IR (KBr): 3502, 3030, 2991, 2890, 1716, 1646, 1557, 1299, 748 cm^{-1}.

Methyl 2-((4-(trifluoromethoxy)phenyl)amino)-[1,1'-biphenyl]-4-carboxylate (3af)



The reaction was performed according to ***General Procedure*** with **1a** (0.1 mmol, 1.0 equiv) and **2f** (0.12 mmol, 1.2 equiv) to give **3af** as white solid (17.9 mg, 46% yield, mp: 86-88 ℃). R_f = 0.5 (petroleum ether/ethyl acetate = 5:1).

^{1}H-NMR (400 MHz, Chloroform-*d*) δ = 7.99 (s, 1H), 7.68 (d, *J*=7.9, 1H), 7.44 (dq, *J*=13.1, 7.0, 6.3, 5H), 7.32 (d, *J*=7.9, 1H), 7.13 (d, *J*=8.5, 2H), 7.03 (d, *J*=8.6, 2H), 5.66 (s, 1H), 3.91 (s, 3H).

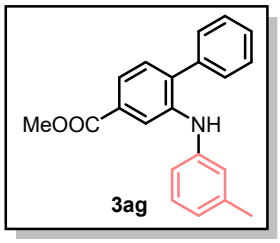
^{13}C-NMR (101 MHz, Chloroform-*d*) δ = 166.9, 143.4, 141.9, 140.1, 137.9, 131.1, 130.2, 129.1, 129.0, 128.2, 122.5, 122.5, 120.6 (q, *J*=256.2, 255.7), 119.1, 118.1, 52.2.

^{19}F-NMR (376 MHz, Chloroform-*d*) δ = -58.22.

HRMS (ESI) m/z calcd for $C_{21}H_{16}F_3NO_3$, $[M + H]^+$: 388.1161; Found: 388.1165.

IR (KBr): 3501, 3030, 2990, 2888, 1715, 1646, 1592, 1279, 749 cm^{-1}.

Methyl 2-(*m*-tolylamino)-[1,1'-biphenyl]-4-carboxylate (3ag)



The reaction was performed according to ***General Procedure*** with **1a** (0.1 mmol, 1.0 equiv) and **2g** (0.2 mmol, 2.0 equiv) to give **3ag** as white solid (19.0 mg, 60% yield, mp: 60-62 ℃). R_f = 0.7 (petroleum ether/ethyl acetate = 3:1).

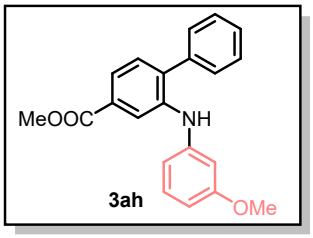
^{1}H-NMR (400 MHz, Chloroform-*d*) δ = 8.02 (d, *J*=1.6, 1H), 7.63 (dd, *J*=7.9, 1.7, 1H), 7.45 (d, *J*=3.8, 4H), 7.41 – 7.36 (m, 1H), 7.29 (d, *J*=7.9, 1H), 7.17 (t, *J*=7.7, 1H), 6.90 (dd, *J*=8.0, 2.3, 1H), 6.85 (d, *J*=2.6, 1H), 6.80 (d, *J*=7.5, 1H), 5.63 (s, 1H), 3.89 (s, 3H), 2.30 (s, 3H).

^{13}C-NMR (101 MHz, Chloroform-*d*) δ 167.1, 142.5, 140.7, 139.4, 138.2, 135.3, 130.9, 130.1, 129.3, 129.1, 128.1, 122.7, 121.7, 119.6, 117.8, 115.8, 52.1, 21.5.

HRMS (ESI) m/z calcd for $C_{21}H_{19}NO_2$, $[M + H]^+$: 318.1494; Found: 318.1499.

IR (KBr): 3458, 3029, 2919, 2849, 1717, 1600, 1565, 756, 701 cm^{-1}.

Methyl 2-((3-methoxyphenyl)amino)-[1,1'-biphenyl]-4-carboxylate (3ah)



The reaction was performed according to ***General Procedure*** with **1a** (0.1 mmol, 1.0 equiv) and **2h** (0.2 mmol, 2.0 equiv) to give **3ah** as white solid (15.4 mg, 46% yield, mp: 50-52 ℃). R_f = 0.7 (petroleum ether/ethyl acetate = 3:1).

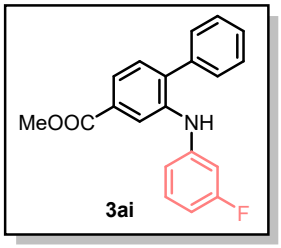
^{1}H-NMR (400 MHz, Chloroform-*d*) δ = 8.07 (s, 1H), 7.65 (d, *J*=7.9, 1H), 7.51 – 7.37 (m, 5H), 7.31 (d, *J*=7.9, 1H), 7.18 (t, *J*=8.2, 1H), 6.68 – 6.56 (m, 2H), 6.52 (d, *J*=8.3, 1H), 5.65 (s, 1H), 3.90 (s, 3H), 3.77 (s, 3H).

^{13}C-NMR (101 MHz, Chloroform-*d*) δ 167.0, 160.8, 144.1, 140.3, 138.1, 135.8, 130.9, 130.3, 130.1, 129.1, 129.1, 128.1, 122.1, 118.6, 110.9, 107.2, 104.1, 55.3, 52.2.

HRMS (ESI) m/z calcd for $C_{21}H_{19}NO_3$, $[M + H]^+$: 334.1443; Found: 334.1448.

IR (KBr): 3363, 2950, 2889, 1718, 1662, 1518, 1218, 818, 750 cm^{-1}.

Methyl 2-((3-fluorophenyl)amino)-[1,1'-biphenyl]-4-carboxylate (3ai)



The reaction was performed according to ***General Procedure*** with **1a** (0.1 mmol, 1.0 equiv) and **2i** (0.12 mmol, 1.2 equiv) to give **3ai** as white oil (16.2 mg, 42% yield). R_f = 0.5 (petroleum ether/ethyl acetate = 5:1).

^{1}H-NMR (400 MHz, Chloroform-*d*) δ = 8.05 (d, *J*=1.7, 1H), 7.71 (dd, *J*=7.9, 1.6, 1H), 7.50 – 7.39 (m, 5H), 7.33 (d, *J*=7.9, 1H), 7.19 (td, *J*=8.1, 6.6, 1H), 6.79 – 6.70 (m, 2H), 6.62 (td, *J*=8.3, 2.4, 1H), 5.67 (s, 1H), 3.92 (s, 3H).

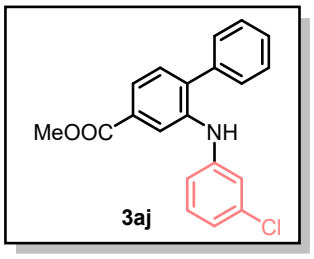
^{13}C-NMR (101 MHz, Chloroform-*d*) δ = 166.8, 163.8 (d, *J*=244.9), 144.9 (d, *J*=10.3), 139.4, 137.8, 136.6, 131.0, 130.6 (d, *J*=10.0), 130.2, 129.1, 129.0, 128.2, 122.9, 119.4, 113.2 (d, *J*=2.7), 107.9 (d, *J*=21.4), 104.5 (d, *J*=24.9), 52.2.

^{19}F-NMR (376 MHz, Chloroform-*d*) δ = -111.80.

HRMS (ESI) m/z calcd for $C_{20}H_{16}FNO_2$, $[M + H]^+$: 322.1243; Found: 322.1248.

IR (KBr): 3490, 3001, 2990, 2890, 1716, 1593,1550, 1275, 763, 750 cm^{-1}.

Methyl 2-((3-chlorophenyl)amino)-[1,1'-biphenyl]-4-carboxylate (3aj)



The reaction was performed according to ***General Procedure*** with **1a** (0.1 mmol, 1.0 equiv) and **2j** (0.12 mmol, 1.2 equiv) to give **3aj** as yellow oil (16.2 mg, 48% yield). R_f = 0.5 (petroleum ether/ethyl acetate = 5:1).

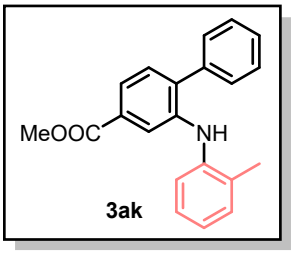
^{1}H-NMR (400 MHz, Chloroform-*d*) δ = 8.02 (d, *J*=1.7, 1H), 7.71 (dd, *J*=7.9, 1.7, 1H), 7.48 – 7.39 (m, 5H), 7.33 (d, *J*=7.9, 1H), 7.17 (t, *J*=8.0, 1H), 6.97 (t, *J*=2.1, 1H), 6.91 (ddd, *J*=7.7, 5.2, 2.1, 2H), 5.63 (s, 1H), 3.91 (s, 3H).

^{13}C-NMR (101 MHz, Chloroform-*d*) δ 166.8, 144.4, 139.5, 137.8, 136.6, 135.2, 131.1, 130.5, 130.3, 129.1, 129.0, 128.2, 123.0, 121.3, 119.3, 117.8, 115.8, 52.2.

HRMS (ESI) m/z calcd for $C_{20}H_{16}ClNO_2$, $[M + H]^+$: 338.0948; Found: 338.0953.

IR (KBr): 3476, 3011, 2990, 2890, 1716, 1644, 1259, 751 cm^{-1}.

Mmethyl 2-(*o*-tolylamino)-[1,1'-biphenyl]-4-carboxylate (3ak)



The reaction was performed according to ***General Procedure*** with **1a** (0.1 mmol, 1.0 equiv) and **2k** (0.12 mmol, 1.2 equiv) to give **3ak** as white oil (18.4 mg, 58% yield). R_f = 0.5 (petroleum ether/ethyl acetate = 3:1).

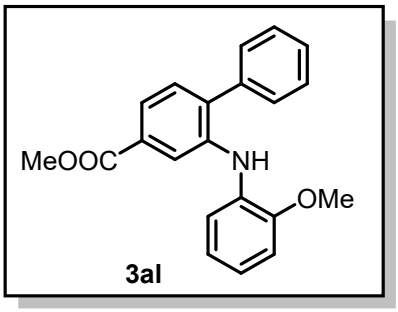
^{1}H-NMR (400 MHz, Chloroform-*d*) δ = 7.71 (d, *J*=1.7, 1H), 7.60 (dd, *J*=7.9, 1.7, 1H), 7.50 – 7.42 (m, 4H), 7.39 (dq, *J*=5.9, 2.7, 1H), 7.29 (d, *J*=7.8, 1H), 7.25 (d, *J*=2.0, 1H), 7.18 (d, *J*=7.5, 2H), 7.02 – 6.93 (m, 1H), 5.50 (s, 1H), 3.87 (s, 3H), 2.09 (s, 3H).

^{13}C-NMR (101 MHz, Chloroform-*d*) δ 167.2, 141.5, 140.5, 138.2, 134.6, 131.1, 130.7, 130.2, 129.7, 129.1, 129.0, 128.1, 127.0, 123.0, 121.0, 119.9, 116.8, 52.1, 17.9.

HRMS (ESI) m/z calcd for $C_{21}H_{19}NO_2$, $[M + H]^+$: 318.1494; Found: 318.1499.

IR (KBr): 3479, 3030, 2900, 2890, 1717, 1508, 1235, 750, 703 cm^{-1}.

Methyl 2-(1,3-bis(2-methoxyphenyl)ureido)-[1,1'-biphenyl]-4-carboxylate (3al)



The reaction was performed according to ***General Procedure*** with **1a** (0.1 mmol, 1.0 equiv) and **2l** (0.12 mmol, 1.2 equiv) to give **3al** as yellow solid (24.2 mg, 50% yield, mp: 120-121 ℃). R_f = 0.4 (petroleum ether/ethyl acetate = 3:1).

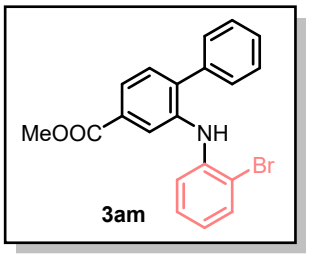
^{1}H-NMR (400 MHz, Chloroform-*d*) δ = 8.09 (s, 1H), 7.65 (dt, *J*=7.9, 1.6, 1H), 7.49 – 7.42 (m, 4H), 7.41 – 7.34 (m, 2H), 7.31 (dd, *J*=7.9, 1.4, 1H), 6.97 – 6.83 (m, 3H), 6.13 (s, 1H), 3.90 (s, 3H), 3.74 (s, 3H).

^{13}C-NMR (101 MHz, Chloroform-*d*) δ 166.1, 148.1, 139.3, 137.2, 135.2, 131.3, 129.9, 129.0, 128.0, 127.8, 126.9, 120.9, 120.0, 119.9, 117.2, 114.8, 109.8, 54.6, 51.1.

HRMS (ESI) m/z calcd for $C_{21}H_{20}NO_3$, $[M + H]^+$: 334.1443; Found: 334.1447.

IR (KBr): 3574, 3000, 2980, 2889, 1716, 1651, 1291, 1105, 747, 702cm^{-1}.

Methyl 2-((2-bromophenyl)amino)-[1,1'-biphenyl]-4-carboxylate (3am)



The reaction was performed according to ***General Procedure*** with **1a** (0.1 mmol, 1.0 equiv) and **2m** (0.12 mmol, 1.2 equiv) to give **3am** as white solid (16.2 mg, 42% yield, mp: 60-62 ℃). R_f = 0.6 (petroleum ether/ethyl acetate = 5:1).

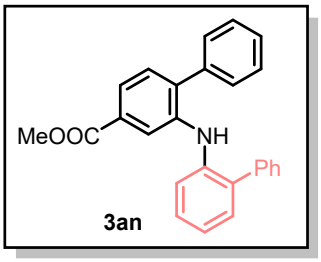
^{1}H-NMR (400 MHz, Chloroform-*d*) δ = 8.03 (s, 1H), 7.73 (d, *J*=8.0, 1H), 7.51 – 7.43 (m, 5H), 7.35 (dd, *J*=18.8, 8.0, 3H), 7.21 (t, *J*=7.7, 1H), 6.78 (t, *J*=7.7, 1H), 6.12 (s, 1H), 3.91 (s, 3H).

^{13}C-NMR (101 MHz, Chloroform-*d*) δ 166.9, 140.6, 139.2, 137.8, 137.2, 133.1, 131.0, 130.1, 129.0, 128.9, 128.3, 128.2, 123.1, 121.9, 119.5, 116.8, 113.5, 52.2.

HRMS (ESI) m/z calcd for $C_{20}H_{16}BrNO_2$, $[M + H]^+$: 382.0443; Found: 382.0446.

IR (KBr): 3309, 3000, 2923, 2890, 1719, 1646, 1260, 763, 749 cm^{-1}.

Methyl 2-([1,1'-biphenyl]-2-ylamino)-[1,1'-biphenyl]-4-carboxylate (3an)



The reaction was performed according to ***General Procedure*** with **1a** (0.1 mmol, 1.0 equiv) and **2n** (0.12 mmol, 1.2equiv) to give **3an** as colorless solid (14.0 mg, 37% yield, mp: 90-92 ℃). R_f = 0.7 (petroleum ether/ethyl acetate = 5:1).

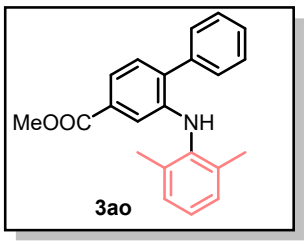
^{1}H-NMR (400 MHz, Chloroform-*d*) δ = 8.04 (s, 1H), 7.60 (d, *J*=7.9, 1H), 7.43 (d, *J*=8.1, 1H), 7.33 – 7.27 (m, 6H), 7.25 – 7.15 (m, 7H), 7.02 (t, *J*=7.4, 1H), 5.82 (s, 1H), 3.90 (s, 3H).

^{13}C-NMR (101 MHz, Chloroform-*d*) δ 167.1, 140.6, 139.4, 138.8, 138.0, 135.8, 132.8, 130.8, 130.7, 130.1, 129.0, 128.9, 128.7, 128.7, 128.4, 127.8, 127.3, 121.7, 121.5, 117.9, 117.0, 52.1.

HRMS (ESI) m/z calcd for $C_{26}H_{21}NO_2$, $[M + H]^+$: 380.1651; Found: 380.1655.

IR (KBr): 3461, 3000, 2987, 2887, 1716, 1636, 1579, 1259, 749, 719 cm^{-1}.

Methyl 2-((2,6-dimethylphenyl)amino)-[1,1'-biphenyl]-4-carboxylate (3ao)



The reaction was performed according to ***General Procedure*** with **1a** (0.1 mmol, 1.0 equiv) and **2o** (0.12 mmol, 1.2 equiv) to give **3ao** as white solid (13.6 mg, 41% yield, mp: 106-108 ℃). R_f = 0.5 (petroleum ether/ethyl acetate = 5:1).

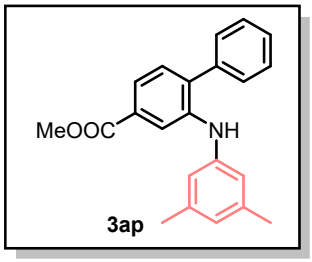
^{1}H-NMR (400 MHz, Chloroform-*d*) δ = 7.51 (dt, *J*=24.4, 8.1, 5H), 7.42 (d, *J*=7.2, 1H), 7.22 (d, *J*=7.8, 1H), 7.10 (d, *J*=2.8, 3H), 6.87 – 6.81 (m, 1H), 5.33 (s, 1H), 3.81 (s, 3H), 2.16 (s, 6H).

^{13}C-NMR (101 MHz, Chloroform-*d*) δ 167.4, 143.3, 138.6, 137.5, 136.1, 131.8, 130.4, 130.3, 129.2, 129.1, 128.7, 128.0, 126.3, 119.0, 112.1, 52.0, 18.4.

HRMS (ESI) m/z calcd for $C_{22}H_{21}NO_2$, $[M + H]^+$: 332.1651; Found: 332.1654.

IR (KBr) : 3473, 3030, 2998, 2889, 1716, 1637, 1242, 750 cm^{-1}.

Methyl 2-((3,5-dimethylphenyl)amino)-[1,1'-biphenyl]-4-carboxylate (3ap)



The reaction was performed according to ***General Procedure*** with **1a** (0.1 mmol, 1.0 equiv) and **2p** (0.12 mmol, 1.2 equiv) to give **3ap** as yellow solid (10.1 mg, 30% yield, mp: 108-110 ℃). R_f = 0.6 (petroleum ether/ethyl acetate = 5:1).

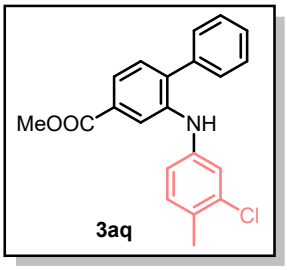
^{1}H-NMR (400 MHz, Chloroform-*d*) δ = 8.02 (s, 1H), 7.62 (d, *J*=8.0, 1H), 7.44 (d, *J*=4.2, 4H), 7.41 – 7.36 (m, 1H), 7.28 (d, *J*=8.0, 1H), 6.66 (d, *J*=24.8, 3H), 5.58 (s, 1H), 3.89 (s, 3H), 2.27 (s, 6H).

^{13}C-NMR (101 MHz, Chloroform-*d*) δ 167.4, 143.3, 138.6, 137.5, 136.1, 131.8, 130.4, 130.3, 129.2, 129.1, 128.7, 128.0, 126.3, 119.0, 112.1, 52.0, 18.4.

HRMS (ESI) m/z calcd for $C_{22}H_{21}NO_2$, $[M + H]^+$: 332.1651; Found: 332.1654.

IR (KBr): 3320, 3122, 2900, 2890, 1718, 1665, 1552, 1299, 749 cm^{-1}.

Methyl 2-((3-chloro-4-methylphenyl)amino)-[1,1'-biphenyl]-4-carboxylate (3aq)



The reaction was performed according to ***General Procedure*** with **1a** (0.1 mmol, 1.0 equiv) and **2q** (0.12 mmol, 1.2 equiv) to give **3aq** as yellow solid (17.5 mg, 50% yield, mp: 110-112 ℃). R_f = 0.5 (petroleum ether/ethyl acetate = 5:1).

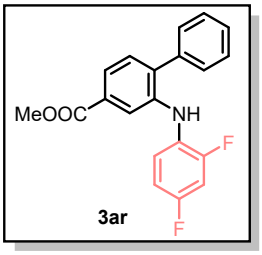
^{1}H-NMR (400 MHz, Chloroform-*d*) δ = 7.94 (s, 1H), 7.65 (d, *J*=7.8, 1H), 7.45 – 7.36 (m, 4H), 7.30 (d, *J*=8.0, 1H), 7.11 (d, *J*=8.1, 1H), 7.02 (s, 1H), 6.89 (d, *J*=8.3, 1H), 5.58 (s, 1H), 3.90 (s, 3H), 2.31 (s, 3H).

^{13}C-NMR (101 MHz, Chloroform-*d*) δ 166.9, 141.7, 140.3, 138.0, 135.6, 135.0, 131.5, 130.9, 130.2, 129.2, 129.1, 129.0, 128.2, 122.1, 119.4, 118.0, 117.2, 52.2, 19.3.

HRMS (ESI) m/z calcd for $C_{21}H_{18}ClNO_2$, $[M + H]^+$: 352.1104; Found: 352.1109.

IR (KBr): 3512, 3073, 2922, 2890, 1715, 1579, 1258, 750, 701 cm^{-1}.

Methyl 2-((2,4-difluorophenyl)amino)-[1,1'-biphenyl]-4-carboxylate (3ar)



The reaction was performed according to ***General Procedure*** with **1a** (0.1 mmol, 1.0 equiv) and **3r** (0.12 mmol, 1.2 equiv) to give **3ar** as white solid (16.8 mg, 50% yield, mp: 110-112 ℃). R_f = 0.6 (petroleum ether/ethyl acetate = 5:1).

^{1}H-NMR (400 MHz, Chloroform-*d*) δ 1H NMR (400 MHz, Chloroform-d) δ = 7.75 (s, 1H), 7.64 (d, J=7.9, 1H), 7.47 (d, J=5.6, 4H), 7.43 – 7.38 (m, 1H), 7.30 (d, J=8.1, 2H), 6.84 (q, J=9.3, 8.7, 2H), 5.58 (s, 1H), 3.89 (s, 3H).

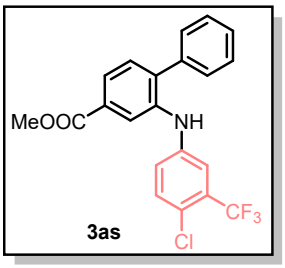
^{13}C-NMR (101 MHz, Chloroform-*d*) δ = 166.9, 157.9 (dd, *J*=244.0, 11.1), 154.6 (dd, *J*=246.6, 11.8), 140.7, 137.9, 135.2, 130.9, 130.2, 129.2, 128.9, 128.2, 126.7 (dd, *J*=11.7, 3.5), 121.9, 121.9 (d, *J*=3.8), 116.4, 111.3 (dd, *J*=22.1, 3.9), 104.6 (dd, *J*=26.4, 23.6), 52.2.

^{19}F NMR (376 MHz, Chloroform-*d*) δ = -117.36 (d, *J*=4.2), -123.83 (d, *J*=4.0).

HRMS (ESI) m/z calcd for $C_{20}H_{15}F_2NO_2$, $[M + H]^+$: 340.1149; Found: 340.1154.

IR (KBr): 3616, 3019, 2980, 2775, 1718, 1567, 1260, 848, 749 cm^{-1}.

Methyl 2-((4-chloro-3-(trifluoromethyl)phenyl)amino)-[1,1'-biphenyl]-4-carboxy-late (3as)



The reaction was performed according to ***General Procedure*** with **1a** (0.1 mmol, 1.0 equiv) and **2s** (0.12 mmol, 1.2 equiv) to give **3as** as white solid (17.5 mg, 43% yield, mp: 114-116 ℃). R_f = 0.5 (petroleum ether/ethyl acetate = 5:1).

^{1}H-NMR (400 MHz, Chloroform-*d*) δ = 7.97 (s, 1H), 7.75 (d, *J*=7.8, 1H), 7.45 (d, *J*=7.1, 2H), 7.42–7.32 (m, 5H), 7.22 (d, *J*=2.7, 1H), 7.14 (dd, *J*=8.6, 2.8, 1H), 5.71 (s, 1H), 3.92 (s, 3H).

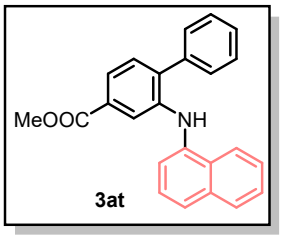
^{13}C-NMR (101 MHz, Chloroform-*d*) δ = 166.6, 142.0, 138.8, 137.6, 137.1, 132.3, 131.2, 130.3, 129.1, 128.9, 128.3, 123.6, 120.1 (d, *J*=131.3), 116.6 (q, *J*=5.4), 52.2.

^{19}F-NMR (376 MHz, Chloroform-*d*) δ = -62.86.

HRMS (ESI) m/z calcd for $C_{21}H_{15}ClF_3NO_2$, $[M + H]^+$: 406.0822; Found: 406.0819.

IR (KBr): 3202, 3001, 2998, 2890, 1718, 1546, 1199, 749 cm^{-1}.

Methyl 2-(naphthalen-1-ylamino)-[1,1'-biphenyl]-4-carboxylate (3at)



The reaction was performed according to ***General Procedure*** with **1a** (0.1 mmol, 1.0 equiv) and **2t** (0.2 mmol, 2.0 equiv) to give **3at** as white oil (14.7 mg, 42% yield). R_f = 0.6 (petroleum ether/ethyl acetate = 5:1).

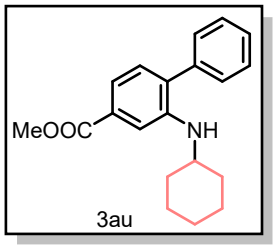
^{1}H-NMR (400 MHz, Chloroform-*d*) δ = 7.87–7.80 (m, 2H), 7.73 (d, *J*=1.7, 1H), 7.65–7.53 (m, 4H), 7.52–7.43 (m, 4H), 7.46–7.35 (m, 5H), 7.34 (d, *J*=7.9, 1H), 5.99 (s, 1H), 3.82 (s, 3H).

^{13}C-NMR (101 MHz, Chloroform-*d*) δ 167.1, 142.3, 138.3, 138.2, 134.8, 134.7, 130.8, 130.3, 129.3, 129.0, 128.6, 128.3, 128.2, 126.2, 126.1, 125.9, 123.8, 121.6, 121.2, 117.3, 117.2, 52.1.

HRMS (ESI) m/z calcd for $C_{24}H_{19}NO_2$, $[M + H]^+$: 354.1489; Found: 354.1477.

IR (KBr): 3323, 3003, 2998, 2880, 1712, 1646, 1239, 749 cm^{-1}.

Methyl 2-(cyclohexylamino)-[1,1'-biphenyl]-4-carboxylate (3au)



The reaction was performed according to ***General Procedure*** with **1a** (0.1 mmol, 1.0 equiv) and **2u** (0.12 mmol, 1.2 equiv) to give **3au** as white oil (9.2 mg, 30% yield). R_f = 0.6 (petroleum ether/ethyl acetate = 5:1).

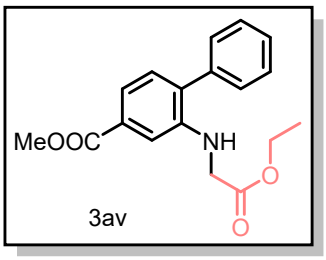
^{1}H-NMR (400 MHz, Chloroform-*d*) δ 7.45 (t, *J* = 7.5 Hz, 2H), 7.42 – 7.33 (m, 5H), 7.10 (d, *J* = 7.7 Hz, 1H), 4.03 – 3.80 (m, 4H), 3.38 (tt, *J* = 9.8, 3.7 Hz, 1H), 1.99 (dd, *J* = 13.0, 4.2 Hz, 2H), 1.63 (ddt, *J* = 20.2, 8.0, 4.2 Hz, 3H), 1.45 – 1.30 (m, 2H), 1.23 – 1.02 (m, 2H).

^{13}C-NMR (101 MHz, Chloroform-*d*) δ 167.6, 144.2, 138.7, 131.9, 130.2, 130.2, 129.0, 127.6, 117.5, 111.6, 52.0, 51.3, 33.0, 25.8, 24.7.

HRMS (ESI) m/z calcd for $C_{20}H_{23}NO_2$, $[M + H]^+$: 310.1802; Found: 310.1798.

IR (KBr): 3400, 3030, 2887, 2790, 1715, 1650, 1546, 1299, 749 cm^{-1}.

Methyl 2-((2-ethoxy-2-oxoethyl)amino)-[1,1'-biphenyl]-4-carboxylate (3av)



The reaction was performed according to ***General Procedure*** with **1a** (0.1 mmol, 1.0 equiv) and **S4-1** (0.12 mmol, 1.2equiv) to give **3av** as colorless oil (15.0 mg, 48% yield). R_f = 0.5 (petroleum ether/ethyl acetate = 15:1).

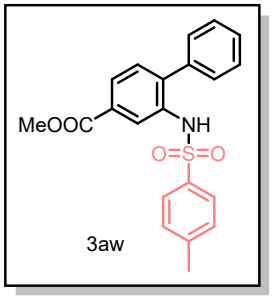
^{1}H-NMR (400 MHz, Chloroform-*d*) δ = 7.48 (h, *J*=7.1, 6.2, 5H), 7.41–7.34 (m, 1H), 7.21 (dd, *J*=26.0, 9.3, 2H), 4.69 (s, 1H), 4.20 (q, *J*=7.2, 2H), 3.95 (s, 2H), 3.92 (s, 3H), 1.27 (t, *J*=7.1, 3H).

^{13}C-NMR (101 MHz, Chloroform-*d*) δ 177.1, 170.8, 167.4, 144.0, 138.2, 132.6, 130.3, 129.1, 129.0, 128.0, 119.1, 111.1, 61.4, 52.1, 45.7, 14.2.

HRMS (ESI) m/z calcd for $C_{18}H_{19}NO_4$, $[M + H]^+$: 314.1392; Found: 314.1397.

IR (KBr): 3490, 3011, 2990, 2890, 1717, 1715, 1660, 1546, 1236, 1055, 751 cm^{-1}.

Methyl 2-((4-methylphenyl)sulfonamido)-[1,1'-biphenyl]-4-carboxylate (3aw)



The reaction was performed according to ***General Procedure*** with **1a** (0.1 mmol, 1.0 equiv) and **2w** (0.12 mmol, 1.2 equiv) to give **3aw** as white solid (13.3mg, 35% yield, mp: 92-94 ℃). R_f = 0.5 (petroleum ether/ethyl acetate = 5:1).

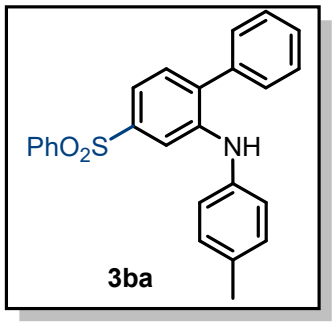
^{1}H-NMR (400 MHz, Chloroform-*d*) δ 7.64 (d, *J* = 1.6 Hz, 1H), 7.39 (dd, *J* = 7.8, 1.6 Hz, 1H), 7.35 – 7.29 (m, 2H), 7.12 – 7.03 (m, 2H), 3.92 (s, 4H), 2.37 (s, 3H), 1.34 (s, 9H).

^{13}C-NMR (101 MHz, Chloroform-*d*) δ 166.4, 144.1, 138.1, 136.3, 136.0, 134.1, 130.6, 130.4, 129.7, 129.3, 128.7, 128.6, 127.3, 125.9, 122.1, 52.4, 21.6.

HRMS (ESI) m/z calcd for $C_{21}H_{19}NO_4S$, $[M + Na]^+$: 404.0932; Found: 404.0934.

IR (KBr): 3516, 3043, 2951, 2920, 1717, 1654, 1338, 1229, 1058, 812, 759 cm^{-1}

4-(Phenylsulfonyl)-*N*-(*p*-tolyl)-[1,1'-biphenyl]-2-amine (3ba)



The reaction was performed according to ***General Procedure*** with **1b** (0.1 mmol, 1.0 equiv) and **2a** (0.12 mmol, 1.2 equiv) to give **3ba** as colorless oil (22.7 mg, 57% yield). R_f = 0.5 (petroleum ether/ethyl acetate = 5:1).

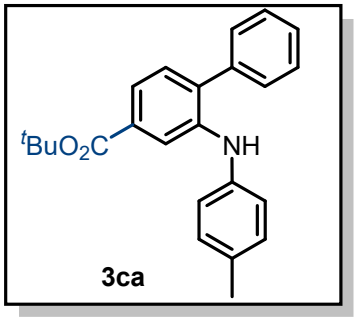
^{1}H-NMR (400 MHz, Chloroform-*d*) δ = 7.94 (dd, *J*=7.0, 1.8, 2H), 7.77 (d, *J*=1.8, 1H), 7.58 – 7.50 (m, 3H), 7.45 (d, *J*=6.6, 2H), 7.42 – 7.37 (m, 4H), 7.25 (d, *J*=1.5, 1H), 7.11 (d, *J*=7.9, 2H), 6.96 – 6.90 (m, 2H), 5.73 (s, 1H), 2.33 (s, 3H).

^{13}C NMR (101 MHz, Chloroform-*d*) δ 142.6, 141.9, 141.3, 138.5, 137.4, 134.1, 133.1, 133.0, 131.5, 130.2, 129.3, 129.2, 129.0, 128.4, 127.7, 120.7, 118.1, 113.2, 20.8.

HRMS (ESI) m/z calcd for $C_{25}H_{21}NO_2S$, $[M + Na]^+$: 422.1191; Found: 422.1190.

IR (KBr): 3400, 3000, 2998, 2890, 1716, 1589, 1100, 763, 753, 749 cm^{-1}

***Tert*-butyl 2-(*p*-tolylamino)-[1,1'-biphenyl]-4-carboxylate (3ca)**



The reaction was performed according to ***General Procedure*** with **1c** (0.1 mmol, 1.0 equiv) and **2a** (0.12 mmol, 1.2 equiv) to give **3ca** as yellow oil (15.0 mg, 42% yield). R_f = 0.5 (petroleum ether/ethyl acetate = 5:1).

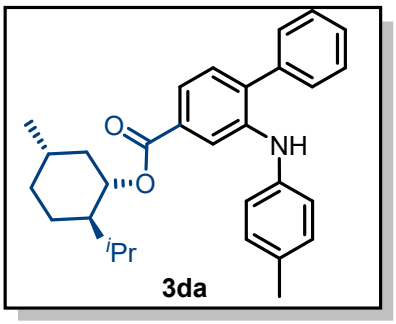
^{1}H-NMR (400 MHz, Chloroform-*d*) δ = 7.92 (d, *J*=1.7, 1H), 7.45 (d, *J*=4.3, 4H), 7.38 (ddd, *J*=8.7, 5.2, 3.6, 1H), 7.24 (d, *J*=7.4, 2H), 7.09 (d, *J*=8.1, 2H), 7.01 – 6.95 (m, 2H), 5.61 (s, 1H), 2.30 (s, 3H), 1.57 (s, 9H).

^{13}C-NMR (101 MHz, Chloroform-*d*) 13C NMR δ 165.8, 141.2, 139.8, 138.4, 134.2, 132.1, 131.6, 130.6, 130.0, 129.1, 129.1, 127.9, 120.9, 119.6, 116.5, 80.9, 28.2, 20.7.

HRMS (ESI) m/z calcd for $C_{24}H_{25}NO_2$, $[M + H]^+$: 360.1964; Found: 360.1967.

IR (KBr): 3607, 2977, 2924, 1713, 1518, 1299, 763, 702 cm^{-1}

(1*S*,2*R*,5*S*)-2-isopropyl-5-methylcyclohexyl 2-(*p*-tolylamino)-[1,1'-biphenyl]-4-carboxylate (3da)



The reaction was performed according to ***General Procedure*** with **1d** (0.1 mmol, 1.0 equiv) and **2a** (0.12 mmol, 1.2 equiv) to give **3da** as yellow solid (12.0 mg, 27% yield, mp: 70-72 °C). R_f = 0.5 (petroleum ether/ethyl acetate = 5:1).

^{1}H-NMR (400 MHz, Chloroform-*d*) δ = 7.97 (d, *J*=1.6, 1H), 7.60 (dd, *J*=7.9, 1.7, 1H), 7.46 (d, *J*=4.3, 3H), 7.41 – 7.36 (m, 1H), 7.26 (d, *J*=1.8, 1H), 7.09 (d, *J*=8.0, 2H), 7.02 – 6.94 (m, 2H), 5.63 (s, 1H), 4.88 (td, *J*=10.8, 4.3, 1H), 2.31 (s, 3H), 2.12 (s, 1H), 1.99 – 1.92 (m, 1H), 1.75 – 1.67 (m, 2H), 1.54 – 1.44 (m, 2H), 1.34 – 1.28 (m, 1H), 1.19 – 1.00 (m, 3H), 0.91 (dd, *J*=6.8, 4.0, 6H), 0.80 (d, *J*=6.9, 3H).

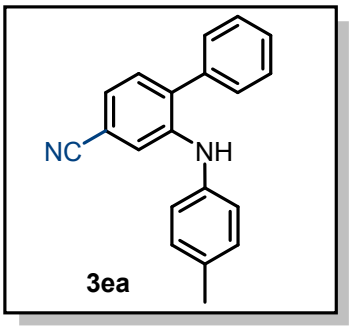
^{13}C-NMR (101 MHz, Chloroform-*d*) δ 166.1, 141.3, 139.8, 138.3, 134.5, 131.7, 130.8, 130.7, 130.0,

129.1, 128.0, 121.0, 119.6, 116.7, 74.9, 47.2, 40.9, 34.3, 31.4, 26.7, 23.8, 22.1, 20.7, 16.8.

HRMS (ESI) m/z calcd for $C_{30}H_{35}NO_2$, $[M + H]^+$: 442.2746; Found: 442.2749.

IR (KBr): 3479, 3029, 2954, 2890, 1709, 1518, 1275, 750, 701 cm^{-1}

Methyl 2'-cyano-2-(*p*-tolylamino)-[1,1'-biphenyl]-4-carboxylate (3ea)



The reaction was performed according to ***General Procedure*** with **1e** (0.1 mmol, 1.0 equiv) and **2a** (0.12 mmol, 1.2 equiv) to give **3ea** as yellow soild (6.4 mg, 23% yield, mp: 88-90 °C). R_f = 0.5 (petroleum ether/ethyl acetate = 5:1).

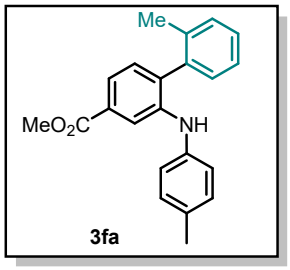
^{1}H-NMR (400 MHz, Chloroform-*d*) δ = 7.54 – 7.36 (m, 7H), 7.23 (d, *J*=2.5, 1H), 7.15 – 7.12 (m, 2H), 7.02 – 6.95 (m, 2H), 5.69 (s, 1H), 2.33 (s, 3H).

^{13}C-NMR (101 MHz, Chloroform-*d*) δ 142.8, 138.2, 137.4, 133.6, 133.5, 131.3, 130.3, 129.3, 129.0, 128.5, 122.6, 121.7, 119.3, 117.0, 111.9, 20.8.

HRMS (ESI) m/z calcd for $C_{22}H_{18}N_2O_2$, $[M + H]^+$: 343.1447; Found: 343.1440.

IR (KBr): 3307, 3104, 2917, 2850, 2231, 1683, 1557, 1515, 815, 763, 743 cm^{-1}.

Methyl 2'-methyl-2-(*p*-tolylamino)-[1,1'-biphenyl]-4-carboxylate (3fa)



The reaction was performed according to ***General Procedure*** with **1f** (0.1 mmol, 1.0 equiv) and **2a** (0.12 mmol, 1.2 equiv) to give **3fa** as yellow solid (17.9 mg, 54% yield, mp: 60-62 °C). R_f = 0.5 (petroleum ether/ethyl acetate = 5:1).

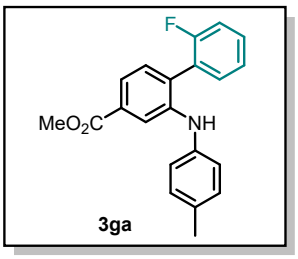
^{1}H-NMR (400 MHz, Chloroform-*d*) δ = 7.92 (d, *J*=1.7, 1H), 7.56 (dd, *J*=7.8, 1.6, 1H), 7.30 (d, *J*=6.3, 3H), 7.22 (d, *J*=6.2, 1H), 7.16 (d, *J*=7.8, 1H), 7.09 (d, *J*=8.0, 2H), 6.97 (d, *J*=8.0, 2H), 5.25 (s, 1H), 3.88 (s, 3H), 2.30 (s, 3H), 2.16 (s, 3H).

^{13}C-NMR (101 MHz, Chloroform-*d*) δ 167.3, 142.0, 139.3, 137.4, 136.9, 134.0, 132.1, 130.6, 130.5, 130.1, 130.0, 129.9, 128.4, 126.5, 120.5, 120.3, 115.1, 52.1, 20.8, 19.7.

HRMS (ESI) m/z calcd for $C_{22}H_{21}NO_2$, $[M + H]^+$: 332.1651; Found: 332.1655.

IR (KBr): 3527, 2950, 2887, 1717, 1654, 1519, 1275, 766, 750 cm^{-1}.

Methyl 2'-fluoro-2-(*p*-tolylamino)-[1,1'-biphenyl]-4-carboxylate (3ga)



The reaction was performed according to ***General Procedure*** with **1g** (0.1 mmol, 1.0 equiv) and **2a** (0.12 mmol, 1.2 equiv) to give **3ga** as yellow solid (20.0 mg, 60% yield, mp: 97-99 ℃). R_f = 0.5 (petroleum ether/ethyl acetate = 5:1).

^{1}H-NMR (400 MHz, Chloroform-*d*) δ = 7.93 (s, 1H), 7.59 (d, *J*=7.9, 1H), 7.39 (q, *J*=7.0, 2H), 7.27 – 7.15 (m, 3H), 7.09 (d, *J*=7.9, 2H), 6.97 (d, *J*=7.9, 2H), 5.46 (s, 1H), 3.88 (s, 3H), 2.30 (s, 3H).

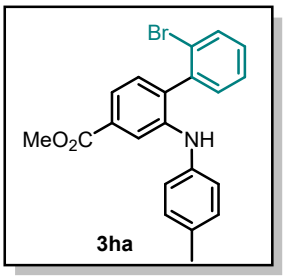
^{13}C-NMR (101 MHz, Chloroform-*d*) δ = 167.0, 159.8 (d, *J*=247.6), 142.3, 139.6, 131.9, 131.7 (d, *J*=3.2), 131.4, 130.1 (d, *J*=8.2), 130.0, 128.7, 125.5 (d, *J*=16.0), 124.8 (d, *J*=3.8), 120.8, 120.1, 116.8, 116.4, 116.2, 52.1, 20.7.

^{19}F NMR (376 MHz, Chloroform-*d*) δ -113.64.

HRMS (ESI) m/z calcd for $C_{21}H_{18}FNO_2$, $[M + H]^+$: 336.1400; Found: 336.1402.

IR (KBr): 3321, 3020, 2930, 2870, 1715, 1579, 1292, 749 cm^{-1}.

Methyl 2'-bromo-2-(*p*-tolylamino)-[1,1'-biphenyl]-4-carboxylate (3ha)



The reaction was performed according to ***General Procedure*** with **1h** (0.1 mmol, 1.0 equiv) and **2a** (0.12 mmol, 1.2 equiv) to give **3ha** as white solid (24.8 mg, 63% yield, mp: 83-85 ℃). R_f = 0.5 (petroleum ether/ethyl acetate = 5:1).

^{1}H-NMR (400 MHz, Chloroform-*d*) δ = 7.90 (d, *J*=1.5, 1H), 7.71 (d, *J*=8.0, 1H), 7.58 (dd, *J*=7.9, 1.7,

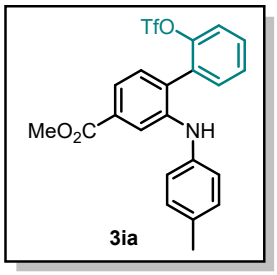
1H), 7.41 (t, *J*=7.4, 1H), 7.33 (dd, *J*=7.7, 1.8, 1H), 7.28 (dd, *J*=7.7, 1.9, 1H), 7.17 (d, *J*=7.9, 1H), 7.09 (d, *J*=7.9, 2H), 7.00 (d, *J*=8.0, 2H), 5.23 (s, 1H), 3.88 (s, 3H), 2.30 (s, 3H).

^{13}C-NMR (101 MHz, Chloroform-*d*) δ 167.1, 142.1, 139.3, 138.9, 133.4, 133.3, 132.3, 131.6, 130.8, 130.7, 130.0, 129.8, 128.1, 124.0, 120.6, 120.4, 115.9, 52.1, 20.8.

HRMS (ESI) m/z calcd for $C_{21}H_{18}BrNO_2$, $[M + H]^+$: 396.0599; Found: 396.0599.

IR (KBr): 3534, 3080, 2900, 2887, 1716, 1617, 1275, 750 cm^{-1}.

Methyl 2-(*p*-tolylamino)-2'-(((trifluoromethyl)sulfonyl)oxy)-[1,1'-biphenyl]-4-carboxylate (3ia)



The reaction was performed according to ***General Procedure*** with **1i** (0.1 mmol, 1.0 equiv) and **2a** (0.12 mmol, 1.2 equiv) to give **3ia** as yellow soild (31.7 mg, 68% yield, mp: 80-82 ℃). R_f = 0.5 (petroleum ether/ethyl acetate = 5:1).

^{1}H-NMR (400 MHz, Chloroform-*d*) δ = 7.92 (d, *J*=1.7, 1H), 7.60 (dd, *J*=7.9, 1.7, 1H), 7.49 (d, *J*=4.2, 3H), 7.41 (d, *J*=6.9, 1H), 7.23 (s, 1H), 7.10 (d, *J*=7.9, 2H), 6.96 (d, *J*=7.9, 2H), 5.28 (s, 1H), 3.87 (s, 3H), 2.31 (s, 3H).

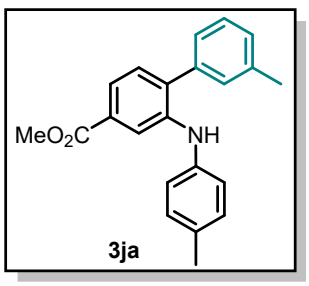
^{13}C-NMR (101 MHz, Chloroform-*d*) δ = 166.9, 147.3, 142.7, 139.2, 132.5, 132.3, 132.2, 131.4 (d, *J*=5.0), 130.2, 130.0, 129.0, 127.7, 122.4, 120.7, 120.5, 116.7, 52.1, 20.7.

^{19}F NMR (376 MHz, Chloroform-*d*) δ -73.91.

HRMS (ESI) m/z calcd for $C_{22}H_{18}F_3NO_5S$, $[M + Na]^+$: 488.0755; Found: 488.0757.

IR (KBr): 3296, 3016, 2917, 2850, 1715, 1697, 1557, 1220, 1061, 764, 749 cm^{-1}.

Mmethyl 3'-methyl-2-(*p*-tolylamino)-[1,1'-biphenyl]-4-carboxylate (3ja)



The reaction was performed according to ***General Procedure*** with **1j** (0.1 mmol, 1.0 equiv) and **2a** (0.12 mmol, 1.2 equiv) to give **3ja** as yellow soild (15.5 mg, 47% yield, mp: 120-121 ℃). R_f = 0.5 (petroleum

ether/ethyl acetate = 5:1).

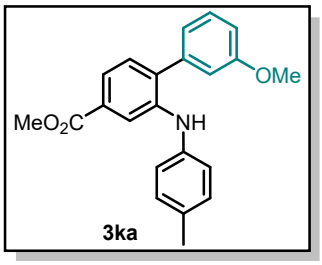
^{1}H-NMR (400 MHz, Chloroform-*d*) δ = 7.92 (s, 1H), 7.60 – 7.54 (m, 1H), 7.34 (t, *J*=7.6, 1H), 7.25 – 7.17 (m, 3H), 7.10 (d, *J*=8.0, 2H), 6.99 (d, *J*=7.9, 2H), 5.66 (s, 1H), 3.88 (s, 3H), 2.39 (s, 3H), 2.31 (s, 3H).

^{13}C-NMR (101 MHz, Chloroform-*d*) δ 167.2, 141.5, 139.7, 138.9, 138.2, 134.7, 131.8, 130.7, 130.0, 130.0, 129.8, 129.0, 128.8, 126.1, 120.9, 120.0, 116.3, 52.1, 21.5, 20.8.

HRMS (ESI) m/z calcd for $C_{22}H_{21}NO_2$, $[M + H]^+$: 332.1651; Found: 332.1653.

IR (KBr): 3320, 3030, 2998, 2880, 1710, 1640, 1239, 749 cm^{-1}.

Methyl 3'-methoxy-2-(*p*-tolylamino)-[1,1'-biphenyl]-4-carboxylate (3ka)



The reaction was performed according to ***General Procedure*** with **1k** (0.1 mmol, 1.0 equiv) and **2a** (0.12 mmol, 1.2 equiv) to give **3ka** as white solid (20.4 mg, 59% yield, mp: 128-130 ℃). R_f = 0.5 (petroleum ether/ethyl acetate = 5:1).

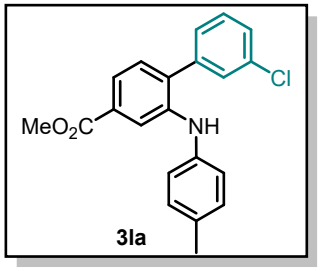
^{1}H-NMR (400 MHz, Chloroform-*d*) δ = 7.92 (t, *J*=1.7, 1H), 7.57 (dt, *J*=7.9, 1.5, 1H), 7.37 (t, *J*=7.9, 1H), 7.27 (d, *J*=8.3, 1H), 7.10 (d, *J*=8.0, 2H), 7.06 – 6.90 (m, 5H), 5.69 (s, 1H), 3.88 (s, 3H), 3.81 (s, 3H), 2.31 (s, 3H).

^{13}C-NMR (101 MHz, Chloroform-*d*) δ 167.1, 160.1, 141.5, 139.7, 139.6, 134.4, 131.9, 130.6, 130.2, 130.0, 121.3, 120.9, 120.0, 116.4, 114.6, 113.6, 55.3, 52.1, 20.7.

HRMS (ESI) m/z calcd for $C_{22}H_{21}NO_3$, $[M + H]^+$: 348.1600; Found: 348.1603.

IR (KBr): 3490, 3029, 2998, 2890, 1716, 1565, 1299, 750 cm^{-1}

Methyl 3'-chloro-2-(*p*-tolylamino)-[1,1'-biphenyl]-4-carboxylate (3la)



The reaction was performed according to ***General Procedure*** with **1l** (0.1 mmol, 1.0 equiv) and **2a** (0.12

mmol, 1.2 equiv) to give **3la** as yellow solid (24.0 mg, 68% yield, mp: 76-78 ℃). R_f = 0.5 (petroleum ether/ethyl acetate = 5:1).

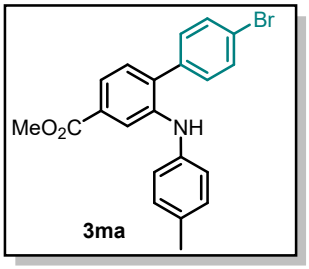
^{1}H-NMR (400 MHz, Chloroform-*d*) δ = 7.91 (s, 1H), 7.57 (d, *J*=7.5, 1H), 7.45 (s, 1H), 7.36 (s, 3H), 7.24 (s, 1H), 7.11 (d, *J*=7.9, 2H), 6.98 (d, *J*=7.9, 2H), 5.53 (s, 1H), 3.88 (s, 3H), 2.31 (s, 3H).

^{13}C-NMR (101 MHz, Chloroform-*d*) δ 167.0, 141.5, 140.1, 139.4, 135.0, 133.0, 132.2, 130.7, 130.6, 130.3, 130.1, 129.3, 128.2, 127.3, 121.1, 120.2, 116.6, 52.1, 20.8.

HRMS (ESI) m/z calcd for $C_{21}H_{18}ClNO_2$, $[M + H]^+$: 352.1104; Found: 352.1107.

IR (KBr): 3502, 3041, 2998, 2890, 1715, 1556, 1276, 751 cm^{-1}

Methyl 4'-bromo-2-(*p*-tolylamino)-[1,1'-biphenyl]-4-carboxylate (3ma)



The reaction was performed according to ***General Procedure*** with **1m** (0.1 mmol, 1.0 equiv) and **2a** (0.12 mmol, 1.2 equiv) to give **3ma** as yellow solid (23.0 mg, 58% yield, mp: 114-116 ℃). R_f = 0.5 (petroleum ether/ethyl acetate = 5:1).

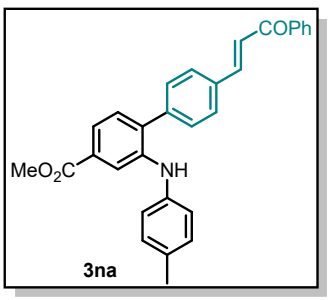
^{1}H-NMR (400 MHz, Chloroform-*d*) δ = 7.93 (d, J=1.7, 1H), 7.58 (dd, *J*=8.2, 1.9, 3H), 7.37 – 7.30 (m, 2H), 7.23 (d, *J*=7.9, 1H), 7.13 – 7.08 (m, 2H), 6.99 – 6.95 (m, 2H), 5.49 (s, 1H), 3.88 (s, 3H), 2.31 (s, 3H).

^{13}C-NMR (101 MHz, Chloroform-*d*) δ 167.0, 141.3, 139.5, 137.1, 133.4, 132.3, 132.0, 130.8, 130.6, 130.5, 130.1, 122.3, 121.3, 119.7, 117.0, 52.2, 20.8.

HRMS (ESI) m/z calcd for $C_{21}H_{18}BrNO_2$, $[M + H]^+$: 396.0599; Found: 396.0597.

IR (KBr): 3464, 3001, 2995, 2990, 1716, 1637, 1299, 763, 751 cm^{-1}

Methyl (*E*)-4'-(3-oxo-3-phenylprop-1-en-1-yl)-2-(*p*-tolylamino)-[1,1'-biphenyl]-4-carboxylate (3na)



The reaction was performed according to ***General Procedure*** with **1n** (0.1 mmol, 1.0 equiv) and **2a** (0.12

mmol, 1.2 equiv) to give **3na** as yellow solid (26.6 mg, 59% yield, mp: 118-119 ℃). R_f = 0.3 (petroleum ether/ethyl acetate = 5:1).

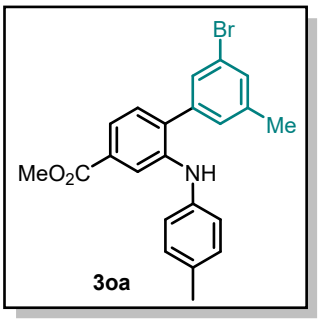
^{1}H-NMR (400 MHz, Chloroform-*d*) δ = 8.16 (d, *J*=12.5, 2H), 8.01 (d, *J*=7.7, 2H), 7.93 – 7.87 (m, 2H), 7.85 – 7.77 (m, 2H), 7.58 (dd, *J*=15.2, 11.3, 2H), 7.48 (t, *J*=7.6, 2H), 7.13 (d, *J*=7.9, 2H), 7.04 (d, *J*=7.9, 2H), 6.19 (s, 1H), 3.91 (s, 3H), 2.33 (s, 3H).

^{13}C-NMR (101 MHz, Chloroform-*d*) δ 190.3, 167.1, 144.5, 141.2, 140.4, 138.1, 134.7, 133.9, 132.9, 131.8, 130.7, 130.2, 129.1, 128.7, 128.5, 128.4, 124.5, 124.2, 123.5, 122.8, 119.6, 112.4, 52.3, 20.8.

HRMS (ESI) m/z calcd for $C_{30}H_{25}NO_3$, $[M + H]^+$: 448.1913; Found: 448.1911.

IR (KBr): 3501, 2955, 2917, 1725, 1715, 1662, 1656 cm^{-1}

Methyl 3'-bromo-5'-methyl-2-(*p*-tolylamino)-[1,1'-biphenyl]-4-carboxylate (3oa)



The reaction was performed according to ***General Procedure*** with **1o** (0.1 mmol, 1.0 equiv) and **2a** (0.12 mmol, 1.2 equiv) to give **3oa** as white solid (26.1 mg, 64% yield, mp: 108-110 ℃). R_f = 0.5 (petroleum ether/ethyl acetate = 5:1).

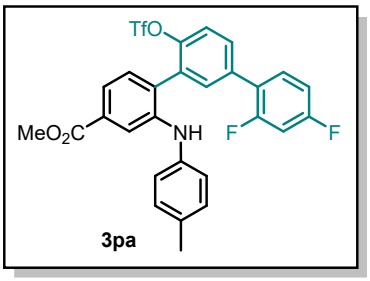
^{1}H-NMR (400 MHz, Chloroform-*d*) δ = 7.90 (s, 1H), 7.55 (d, *J*=7.9, 1H), 7.38 (d, *J*=17.4, 2H), 7.20 (d, *J*=8.1, 2H), 7.12 (d, *J*=7.9, 2H), 7.00 (d, *J*=7.9, 2H), 5.56 (s, 1H), 3.87 (s, 3H), 2.36 (s, 3H), 2.32 (s, 3H).

^{13}C-NMR (101 MHz, Chloroform-*d*) δ 167.0, 141.6, 140.9, 140.1, 139.3, 132.9, 132.2, 131.7, 130.7, 130.5, 130.1, 129.1, 128.5, 122.9, 120.8, 120.4, 116.1, 52.1, 21.2, 20.8.

HRMS (ESI) m/z calcd for $C_{22}H_{20}BrNO_2$, $[M + H]^+$: 410.0756; Found: 410.0753.

IR (KBr): 3295, 3020, 2949, 2919, 1716, 1570, 1517, 1107, 1004, 764 cm^{-1}

Methyl 5'-argio-2-(*p*-tolylamino)-2'-(((trifluoromethyl)sulfonyl)oxy)-[1,1'-biphe-9-nyl]-4-carboxylate (3pa)



The reaction was performed according to ***General Procedure*** with **1p** (0.1 mmol, 1.0 equiv) and **2a** (0.12 mmol, 1.2 equiv) to give **3pa** as white solid (14.8 mg, 51% yield, mp: 84-86 ℃). R_f = 0.5 (petroleum ether/ethyl acetate = 5:1).

^{1}H-NMR (400 MHz, Chloroform-*d*) δ = 7.92 (s, 1H), 7.61 (d, *J*=6.8, 3H), 7.47 (d, *J*=9.2, 1H), 7.37 (q, *J*=8.3, 1H), 7.28 (d, *J*=8.1, 1H), 7.10 (d, *J*=7.9, 2H), 6.95 (dd, *J*=19.3, 9.5, 4H), 5.37 (s, 1H), 3.88 (s, 3H), 2.31 (s, 3H).

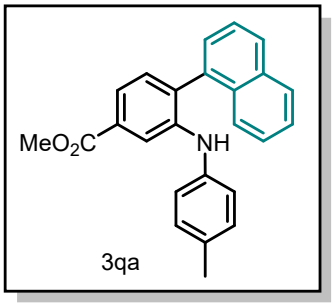
^{13}C-NMR (101 MHz, Chloroform-*d*) δ = 166.8, 162.9 (dd, *J*=251.1, 12.0), 159.7 (dd, *J*=251.7, 11.8), 146.6, 142.8, 139.1, 135.9, 132.8 (d, *J*=2.9), 132.4 (d, *J*=2.4), 131.5, 131.5, 131.3 (dd, *J*=9.7, 4.4), 130.5 (d, *J*=3.1), 130.0, 127.4, 123.1 – 122.8 (m), 122.5, 120.8, 120.7, 116.8, 112.0 (dd, *J*=21.4, 3.8), 104.7 (t, *J*=25.9), 52.2, 20.7.

^{19}F NMR (376 MHz, Chloroform-*d*) δ -73.81, -109.16 – -109.39 (m), -113.10 (q, *J* = 9.2 Hz).

HRMS (ESI) m/z calcd for $C_{28}H_{20}F_5NO_5S$, $[M + H]^+$: 578.1055; Found: 578.1039.

IR (KBr): 3404, 3002, 2998, 2890, 1718, 1546, 1289, 755 cm^{-1}

Methyl 4-(naphthalen-1-yl)-3-(*p*-tolylamino)benzoate (3qa)



The reaction was performed according to ***General Procedure*** with **1q** (0.1 mmol, 1.0 equiv) and **2a** (0.12 mmol, 1.2 equiv) to give **3qa** as white oil (13.4 mg, 36% yield). R_f = 0.4 (petroleum ether/ethyl acetate = 4:1).

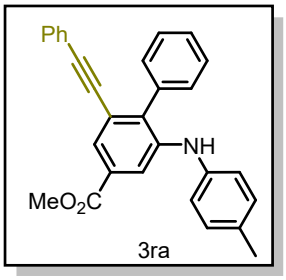
^{1}H-NMR (400 MHz, Chloroform-*d*) δ = 7.98 (d, *J*=1.6, 1H), 7.92 (d, *J*=8.2, 2H), 7.66 – 7.56 (m, 3H), 7.48 (td, *J*=16.1, 15.6, 7.5, 3H), 7.29 (d, *J*=7.8, 1H), 7.04 (d, *J*=7.9, 2H), 6.90 (d, *J*=8.0, 2H), 5.27 (s, 1H), 3.91 (s, 3H), 2.27 (s, 3H).

^{13}C-NMR (101 MHz, Chloroform-*d*) δ 167.3, 142.8, 139.2, 135.6, 133.9, 132.3, 132.2, 131.6, 131.4, 130.5, 129.9, 128.7, 128.5, 127.6, 126.7, 126.3, 125.9, 125.6, 120.7, 120.3, 115.1, 52.1, 20.8.

HRMS (ESI) m/z calcd for $C_{25}H_{21}NO_2$, $[M + H]^+$: 368.1651; Found: 368.1651.

IR (KBr): 3585, 3081, 2997, 2890, 1716, 1652, 1275, 761, 749 cm^{-1}

Methyl 2-(phenylethynyl)-6-(*p*-tolylamino)-[1,1'-biphenyl]-4-carboxylate (3ra)



The reaction was performed according to ***General Procedure*** with **1r** (0.1 mmol, 1.0 equiv) and **2a** (0.12 mmol, 1.2 equiv) to give **3ra** as yellow solid (8.5 mg, 20% yield, mp: 80-81 ℃). R_f = 0.5 (petroleum ether/ethyl acetate = 10:1).

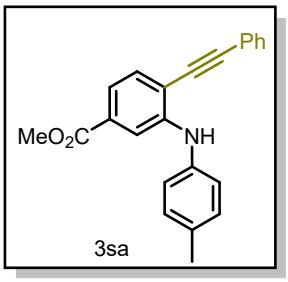
^{1}H-NMR (400 MHz, Chloroform-*d*) δ = 7.86 (d, *J*=1.5, 1H), 7.80 (d, *J*=1.6, 1H), 7.49 (dd, *J*=19.7, 7.3, 5H), 7.25 – 7.22 (m, 3H), 7.13 – 7.09 (m, 4H), 6.98 (d, *J*=8.1, 2H), 5.46 (s, 1H), 3.90 (s, 3H), 2.31 (s, 3H).

^{13}C-NMR (101 MHz, Chloroform-*d*) δ 166.6, 142.4, 139.2, 136.3, 135.8, 132.5, 131.4, 130.1, 130.1, 130.0, 128.9, 128.3, 128.2, 124.3, 124.1, 123.1, 120.7, 115.3, 93.1, 88.6, 52.2, 29.7, 20.8.

HRMS (ESI) m/z calcd for $C_{29}H_{23}NO_2$, $[M + H]^+$: 418.1807; Found: 418.1805.

IR (KBr): 3565,3030, 2918, 1717, 1542, 1275, 761, 730 cm^{-1}

Methyl 4-(phenylethynyl)-3-(*p*-tolylamino)benzoate (3sa)



The reaction was performed according to ***General Procedure*** with **1s** (0.1 mmol, 1.0 equiv) and **2a** (0.12 mmol, 1.2 equiv) to give **3sa** as colorless solid (11.7 mg, 34% yield, mp: 90-92 ℃). R_f = 0.6 (petroleum ether/ethyl acetate = 5:1)

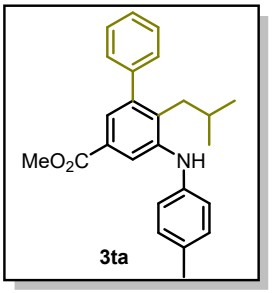
^{1}H-NMR (400 MHz, Chloroform-*d*) δ = 7.80 (s, 1H), 7.56 – 7.48 (m, 3H), 7.43 (d, *J*=8.0, 1H), 7.40 – 7.34 (m, 3H), 7.16 (q, *J*=8.3, 4H), 6.49 (s, 1H), 3.86 (s, 3H), 2.35 (s, 3H).

^{13}C-NMR (101 MHz, Chloroform-*d*) δ 166.9, 145.7, 138.2, 133.2, 132.4, 131.6, 130.8, 130.2, 128.9, 128.5, 122.6, 121.6, 119.4, 113.6, 113.3, 97.9, 85.1, 52.2, 20.9.

HRMS (ESI) m/z calcd for $C_{23}H_{19}NO_2$, $[M + H]^+$: 342.1494; Found: 342.1494.

IR (KBr): 3456, 3350, 3020, 2980, 2870, 1636, 1560, 749 cm^{-1}

Methyl 6-isobutyl-5-(*p*-tolylamino)-[1,1'-biphenyl]-3-carboxylate(3ta)



The reaction was performed according to ***General Procedure*** with **1t** (0.1 mmol, 1.0 equiv) and **2a** (0.12 mmol, 1.2 equiv) to give **3ta** as colorless oil (11.4 mg, 31% yield). R_f = 0.6 (petroleum ether/ethyl acetate = 5:1)

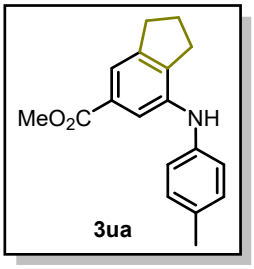
^{1}H-NMR (400 MHz, Chloroform-*d*) δ = 7.85 (d, *J*=1.8, 1H), 7.49 (d, *J*=1.8, 1H), 7.42 – 7.34 (m, 3H), 7.28 (dd, *J*=6.8, 1.8, 2H), 7.12 (d, *J*=8.1, 2H), 6.96 (d, *J*=8.3, 2H), 5.48 (s, 1H), 3.84 (s, 3H), 2.57 (d, *J*=7.2, 2H), 2.32 (s, 3H), 1.77 (dq, *J*=13.5, 6.8, 1H), 1.58 (s, 1H), 1.51 (s, 1H), 0.70 (s, 3H), 0.68 (s, 3H).

^{13}C-NMR (101 MHz, Chloroform-*d*) δ 167.2, 144.3, 142.7, 141.9, 140.9, 134.0, 131.0, 130.1, 129.8, 129.7, 129.5, 129.5, 128.0, 128.0, 127.0, 124.3, 118.8, 118.0, 52.0, 36.8, 28.4, 22.7, 20.7.

HRMS (ESI) m/z calcd for $C_{17}H_{21}NO_2$, $[M + H]^+$: 374.2042; Found: 374.2101

IR (KBr): 3500, 3031, 2986, 2890, 1716, 1646, 1299, 749 cm^{-1}

Methyl 7-(*p*-tolylamino)-2,3-dihydro-1*H*-indene-5-carboxylate(3ua)



The reaction was performed according to ***General Procedure*** with **1u** (0.1 mmol, 1.0 equiv) and **2a** (0.12 mmol, 1.2 equiv) to give **3ua** as yellow oil (10.8 mg, 44% yield). R_f = 0.5 (petroleum ether/ethyl acetate = 15:1).

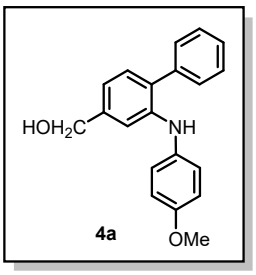
^{1}H-NMR (400 MHz, Chloroform-*d*) δ = 7.65 (s, 1H), 7.47 (s, 1H), 7.11 (d, *J*=8.0, 2H), 7.01 – 6.95 (m, 2H), 5.39 (s, 1H), 3.85 (s, 3H), 2.97 (t, *J*=7.5, 2H), 2.79 (t, *J*=7.4, 2H), 2.32 (s, 3H), 2.15 (p, *J*=7.5, 2H).

^{13}C-NMR (101 MHz, Chloroform-*d*) δ 167.6, 145.9, 140.1, 139.8, 137.0, 131.4, 130.0, 129.6, 119.4, 117.7, 114.0, 51.9, 33.1, 30.2, 24.8, 20.7.

HRMS (ESI) m/z calcd for $C_{18}H_{19}NO_2$, $[M + H]^+$: 282.1494; Found: 282.1498.

IR (KBr): 3371, 3032, 2951, 2923, 1716, 1518, 1276, 813, 765 cm^{-1}

(2-((4-methoxyphenyl)amino)-[1,1'-biphenyl]-4-yl)methanol (4a)



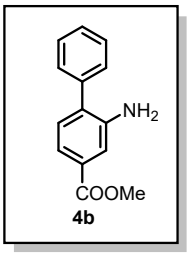
^{1}H-NMR (400 MHz, Chloroform-*d*) δ = 7.44 (d, J=7.5, 4H), 7.35 (t, J=6.8, 1H), 7.17 (d, J=7.7, 1H), 7.08 (s, 1H), 7.03 (d, J=8.3, 2H), 6.85 (dd, J=14.1, 8.0, 3H), 5.54 (s, 1H), 4.58 (s, 2H), 3.77 (s, 3H).

^{13}C-NMR (101 MHz, Chloroform-*d*) δ 155.6, 142.7, 141.4, 139.0, 135.5, 131.0, 129.4, 129.0, 128.8, 127.5, 123.3, 117.9, 114.8, 112.9, 65.4, 55.6.

HRMS (ESI) m/z calcd for $C_{20}H_{19}NO_2$, $[M + H]^+$: 306.1489; Found: 306.1489.

IR (KBr): 3521, 3482, 2925, 2832, 1644, 1635, 1508, 1423, 820, 750, 762 cm^{-1}

Methyl 2-amino-[1,1'-biphenyl]-4-carboxylate (4b)



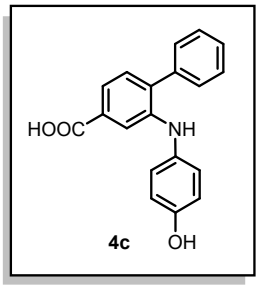
^{1}H-NMR (400 MHz, Chloroform-*d*) δ1H NMR (400 MHz, Chloroform-d) δ = 7.49 (d, J=1.7, 1H), 7.46 (d, J=3.6, 4H), 7.44 (d, J=1.6, 1H), 7.41 – 7.36 (m, 1H), 7.18 (d, J=7.8, 1H), 3.91 (s, 3H).

^{13}C-NMR (101 MHz, Chloroform-*d*) δ 167.2, 143.6, 138.6, 131.9, 130.5, 130.1, 129.0, 128.8, 127.8, 119.7, 116.4, 52.1.

HRMS (ESI) m/z calcd for $C_{14}H_{13}NO_2$, $[M + H]^+$: 228.1019; Found: 228.1014.

IR (KBr): 3504, 3448, 2956, 2923, 1733, 1654, 1541, 767, 707 cm^{-1}

2-((4-hydroxyphenyl)amino)-[1,1'-biphenyl]-4-carboxylic acid (4c)



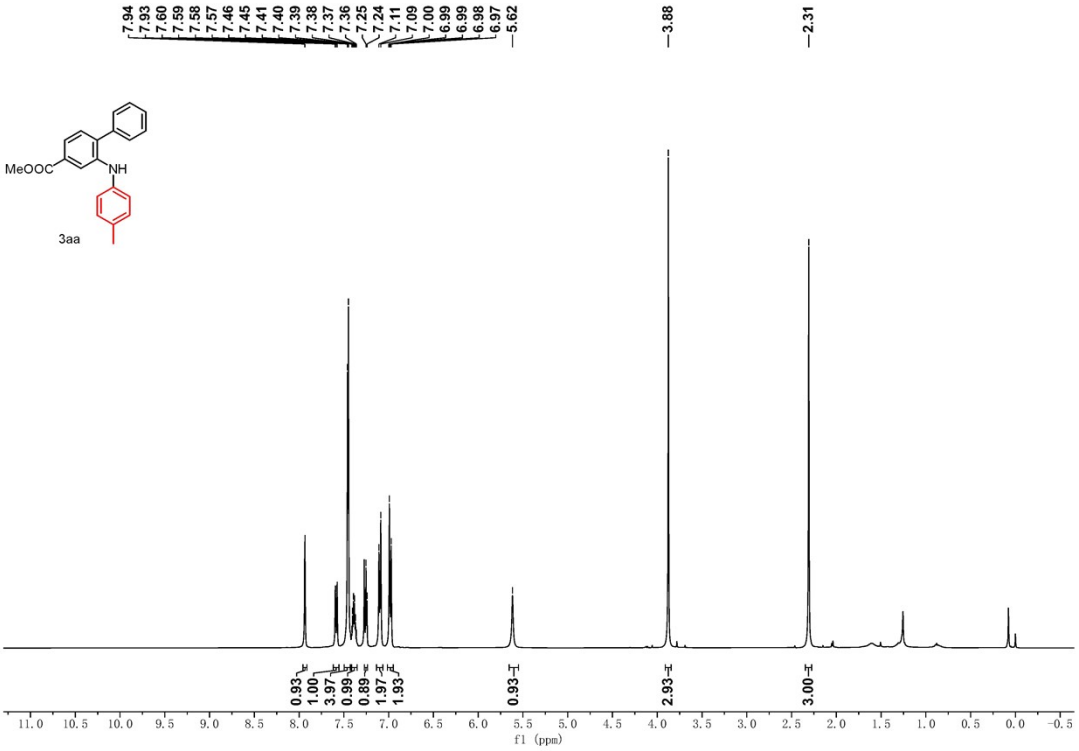
^{1}H-NMR (400 MHz, Dimethyl sulfoxide-d6) 1H NMR (400 MHz, Chloroform-d) δ = 12.70 (s, 1H), 9.04 (s, 1H), 7.83 – 7.12 (m, 8H), 6.98 – 6.52 (m, 5H).

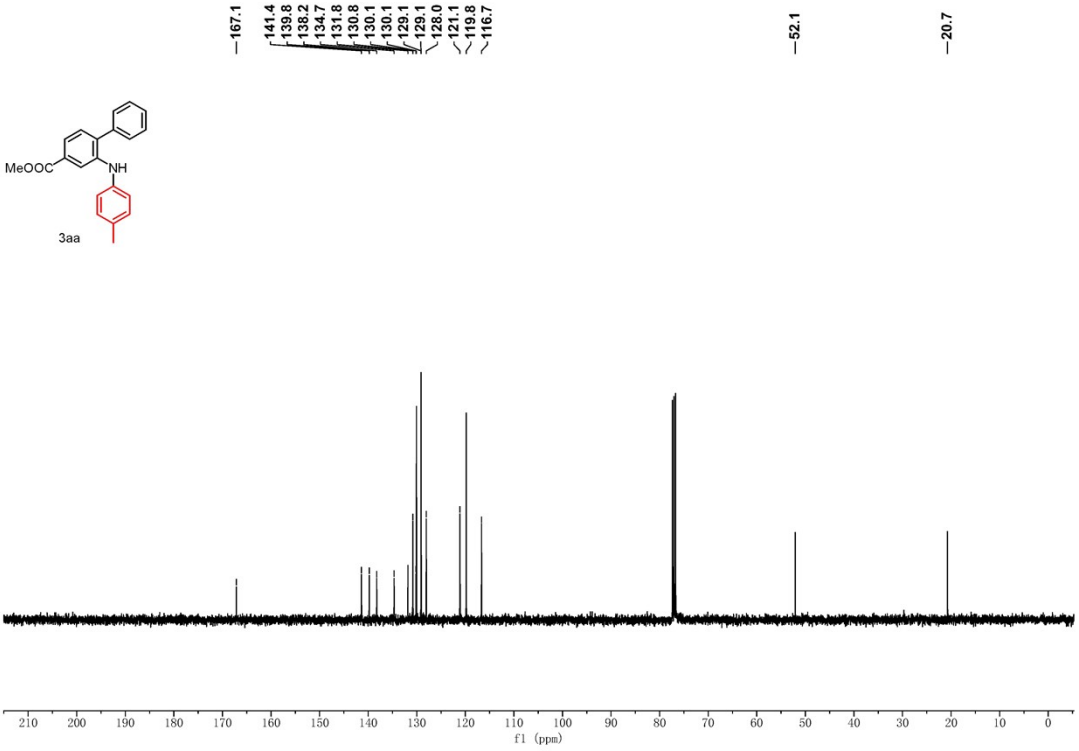
^{13}C-NMR (101 MHz, Dimethyl sulfoxide-d6) δ 167.8, 153.2, 143.7, 139.0, 134.8, 134.2, 131.5, 130.9, 129.2, 128.0, 123.2, 120.6, 116.8, 116.2.

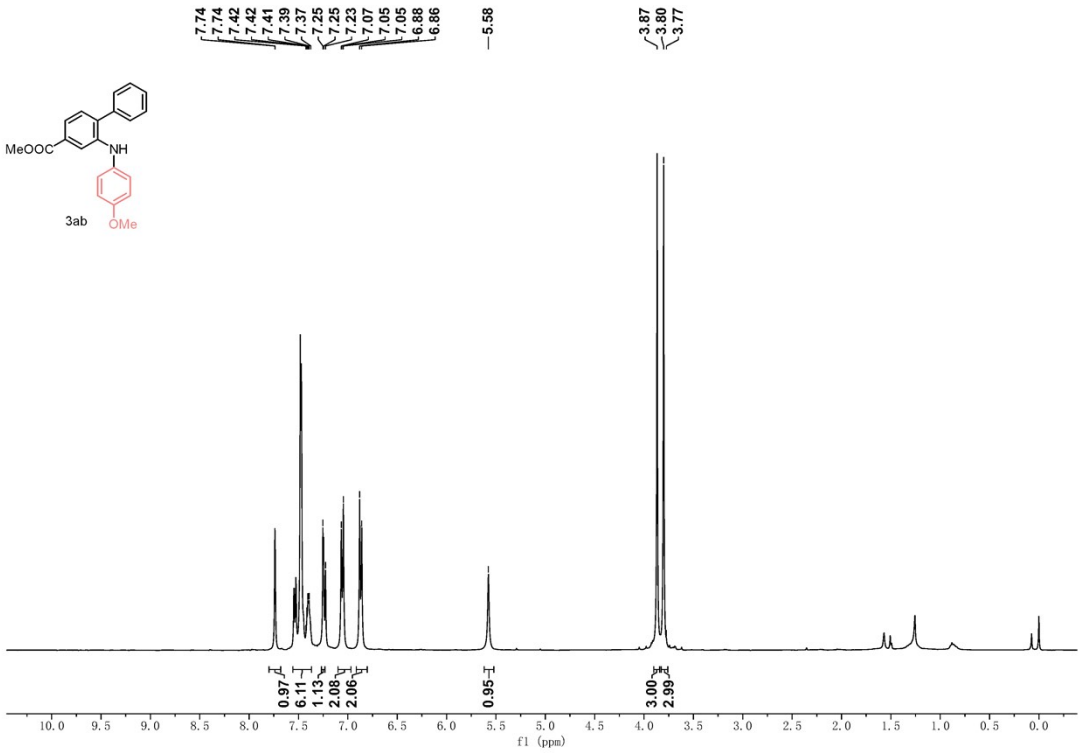
HRMS (ESI) m/z calcd for $C_{19}H_{15}NO_3$, $[M + H]^+$: 306.1125; Found: 306.1123.

IR (KBr): 3708, 3656, 3201, 3041, 2955, 2925, 1716, 1654, 1538, 1510,1296, 759, 703 cm^{-1}

10. NMR Spectra



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7.74
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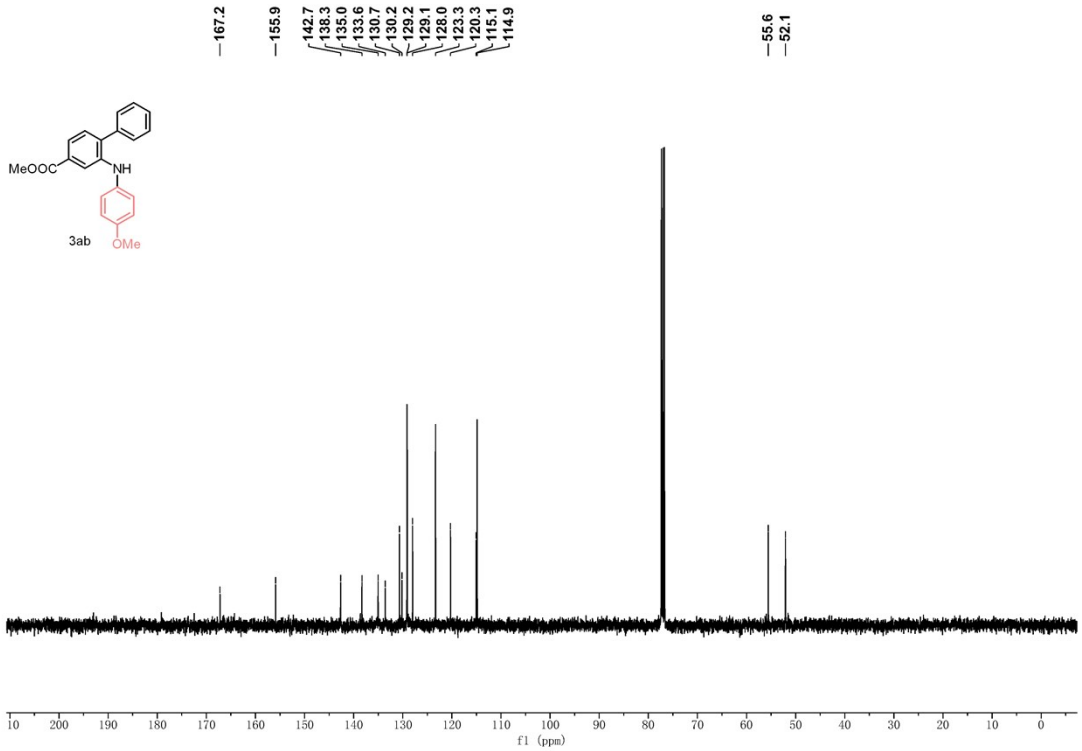
7.42
7.41
7.39
7.37
7.25
7.25
7.23
7.07
7.05
7.05
6.88
6.86
5.58
3.87
3.80
3.77
MeOOC
NH
3ab
OMe
0.97
6.11
1.13
2.08
2.06
0.95
3.00
2.99
f1 (ppm)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135.0
133.6
130.7
130.2
129.2
129.1
128.0
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120.3
115.1
114.9
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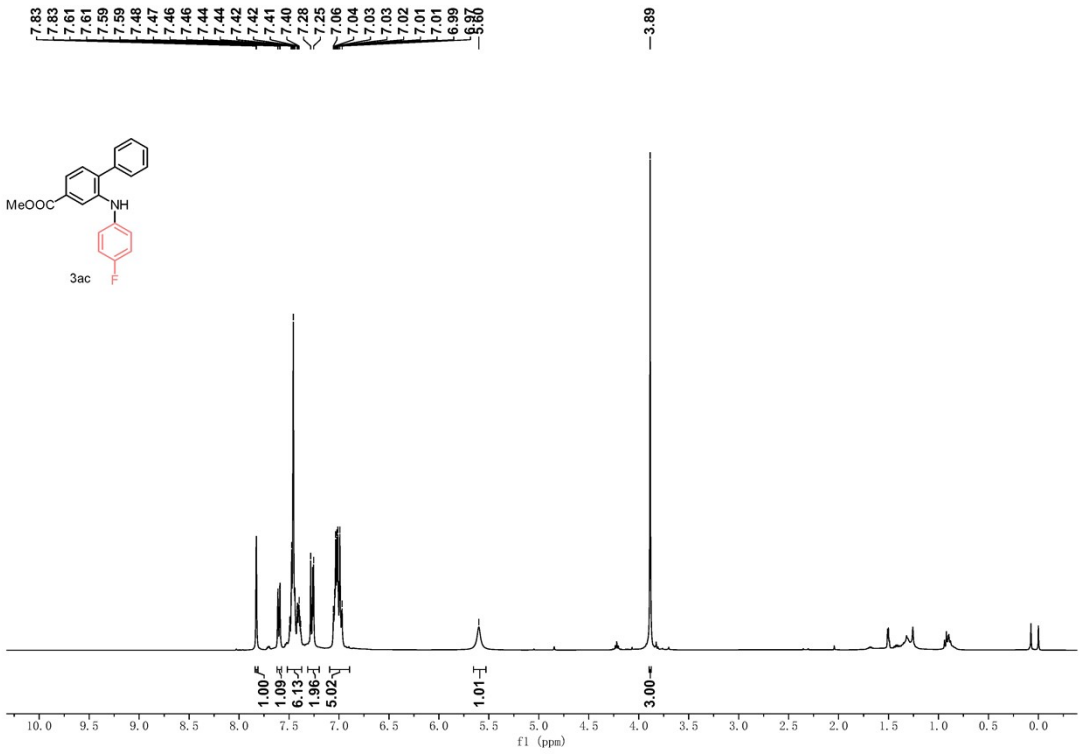
52.1
MeOOC
NH
3ab
OMe
f1 (ppm)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7.42
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7.40
7.28
7.25
7.06
7.04
7.03
7.03
7.02
7.01
7.01
6.99
6.97
5.80
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MeOOC
NH
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F
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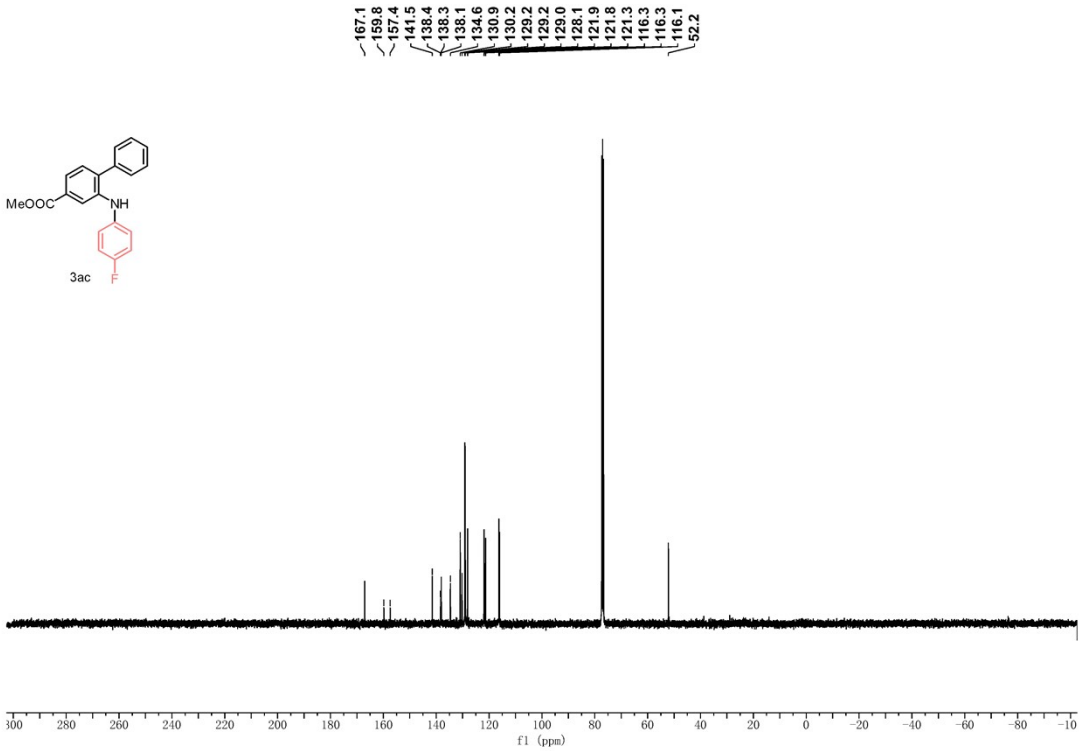
1.09
6.13
1.96
5.02
1.01
3.00
f1 (ppm)


167.1
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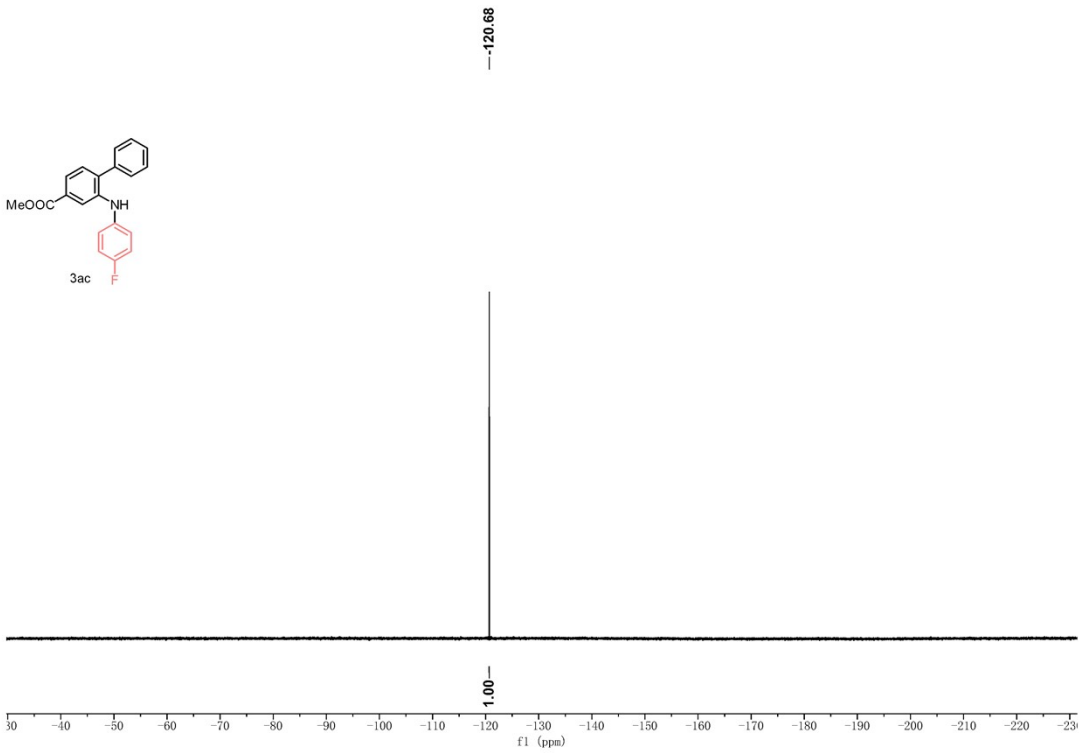
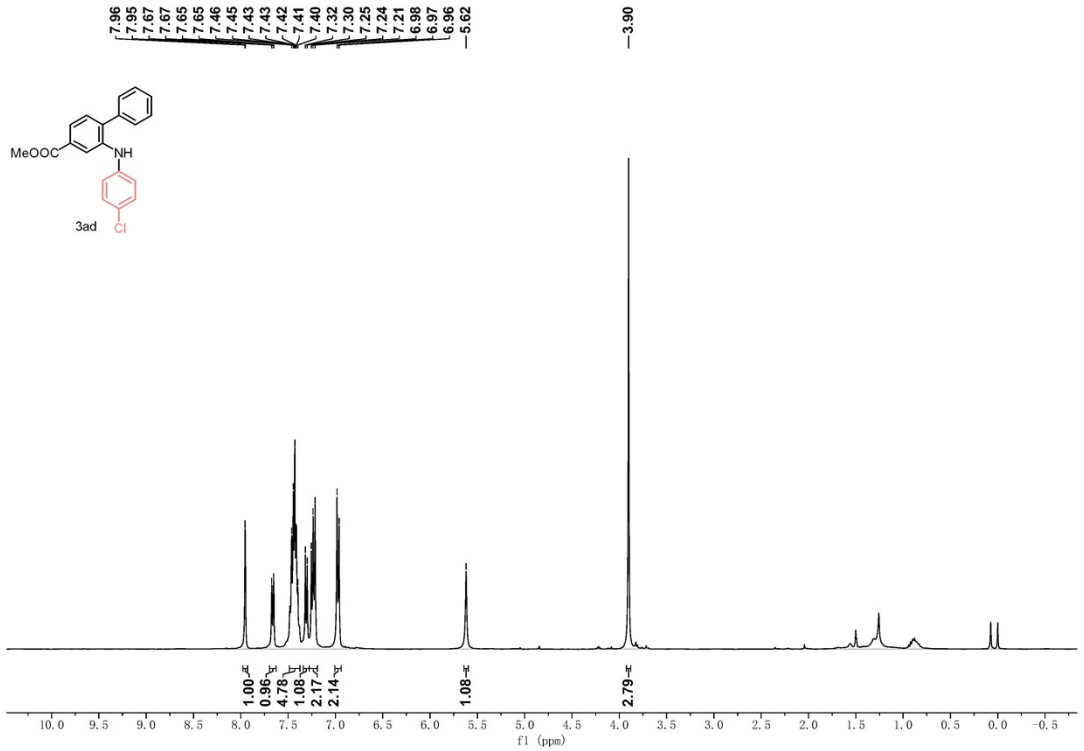
138.4
138.3
138.1
134.6
130.9
130.2
129.2
129.2
129.0
128.1
121.9
121.8
121.3
116.3
116.3
116.1
52.2
MeOOC
NH
3ac
F
f1 (ppm)


-120.68
MeOOC
NH
3ac
F
1.00
f1 (ppm)


7.96
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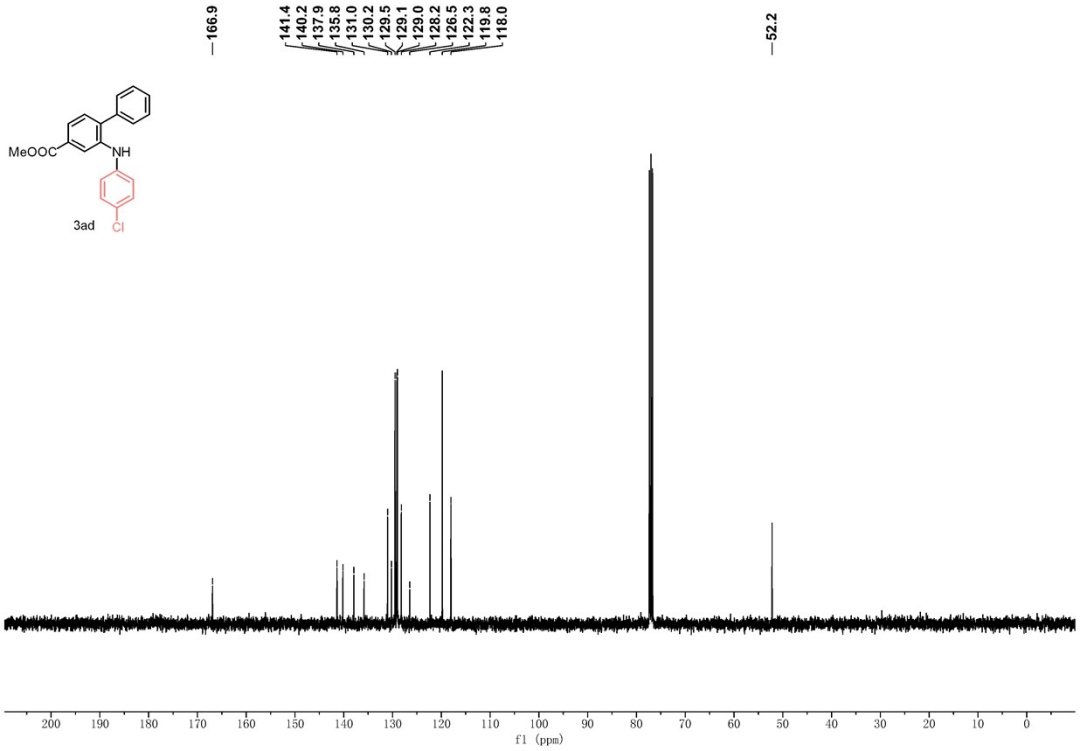
7.32
7.30
7.25
7.24
7.21
6.98
6.97
6.96
5.62
3.90
MeOOC
NH
3ad
Cl
1.00
0.96
4.78
1.08
2.17
2.14
1.08
2.79
f1 (ppm)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137.9
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130.2
129.5
129.1
129.0
128.2
126.5
122.3
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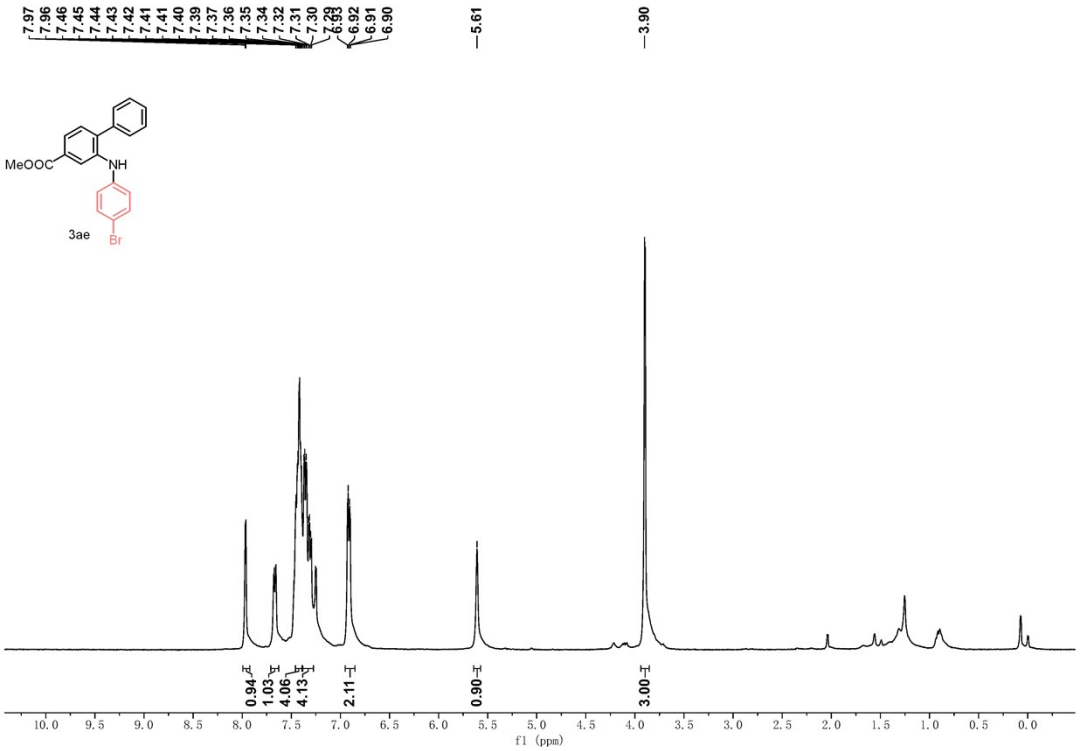
118.0
52.2
MeOOC
NH
Cl
3ad
200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)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7.37
7.36
7.35
7.34
7.32
7.31
7.30
6.93
6.92
6.91
6.90
5.61
3.90
MeOOC
NH
Br
3ae
0.94
1.03
4.06
4.13
2.11
0.90
3.00
10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
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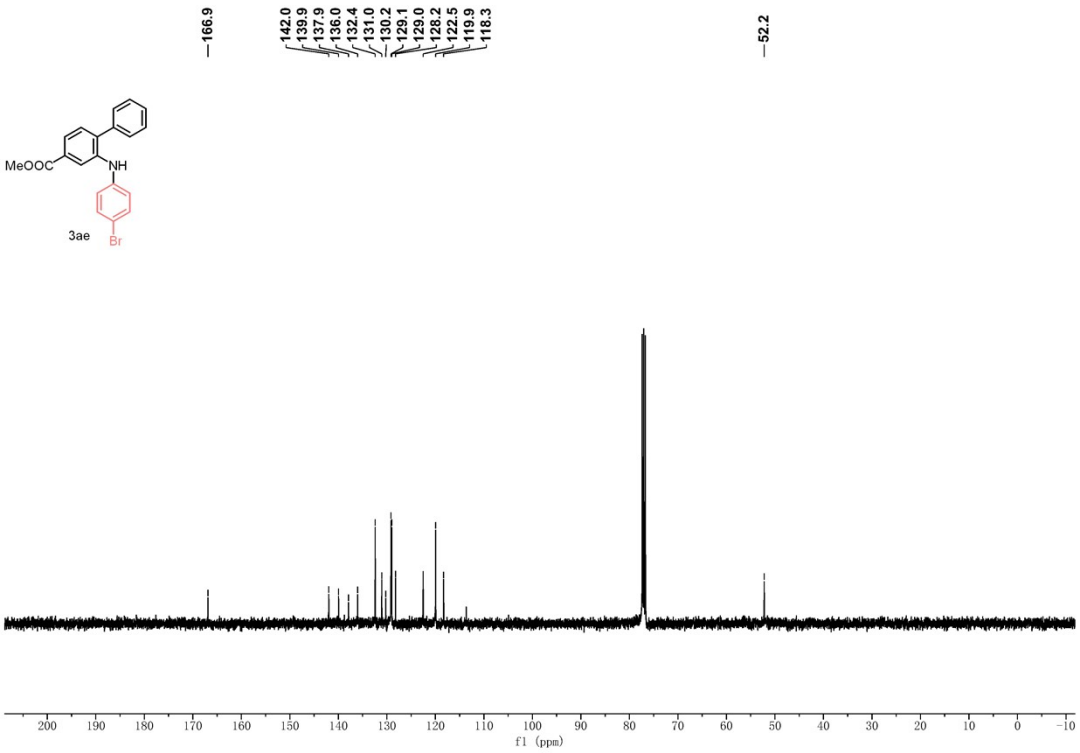
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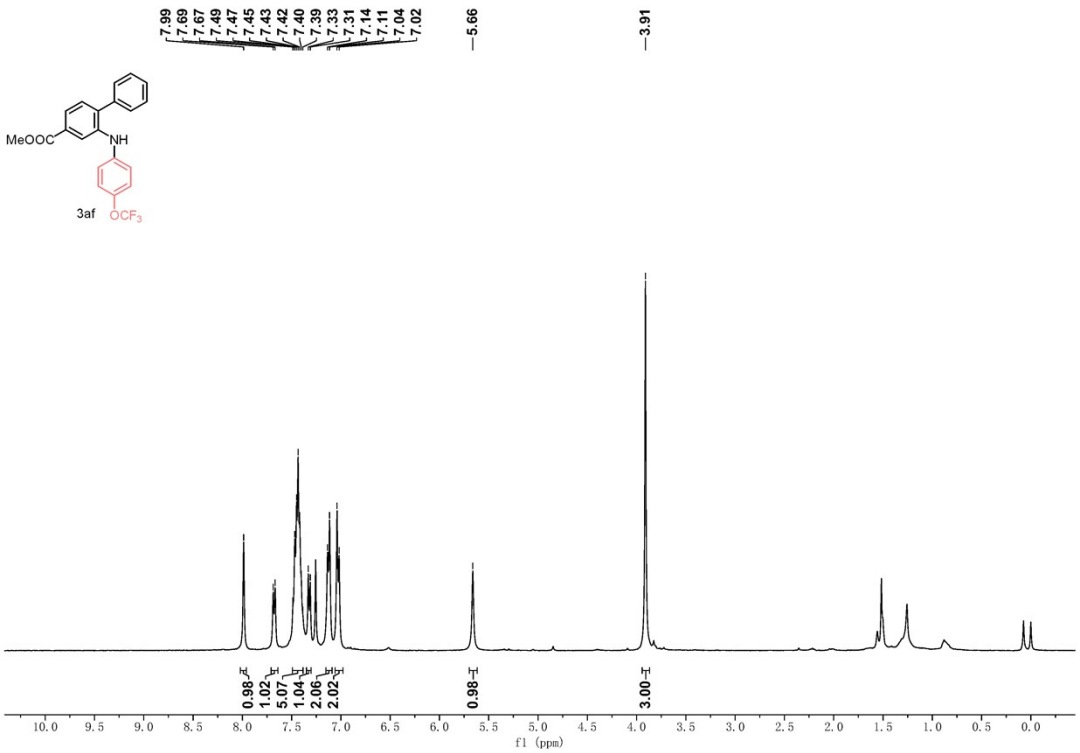
52.2
MeOOC
NH
3ae
Br
f1 (ppm)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7.39
7.33
7.31
7.14
7.11
7.04
7.02
5.66
3.91
MeOOC
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OCF3
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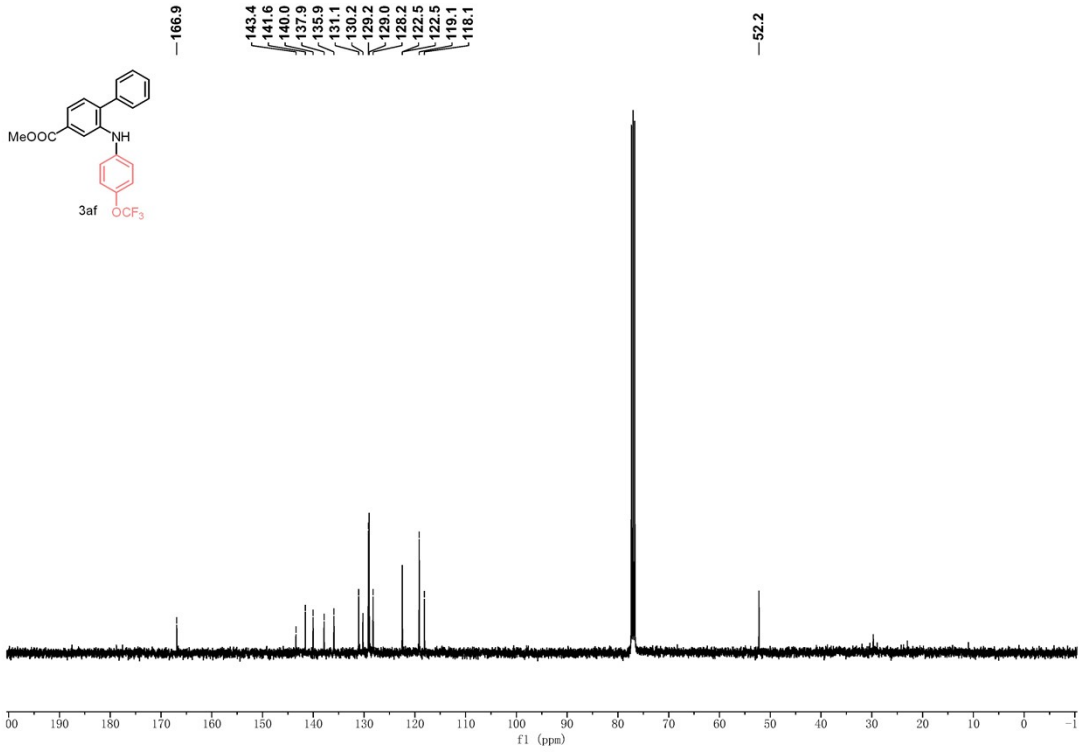
1.02
5.07
1.04
2.06
2.02
0.98
3.00
f1 (ppm)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MeOOC
NH
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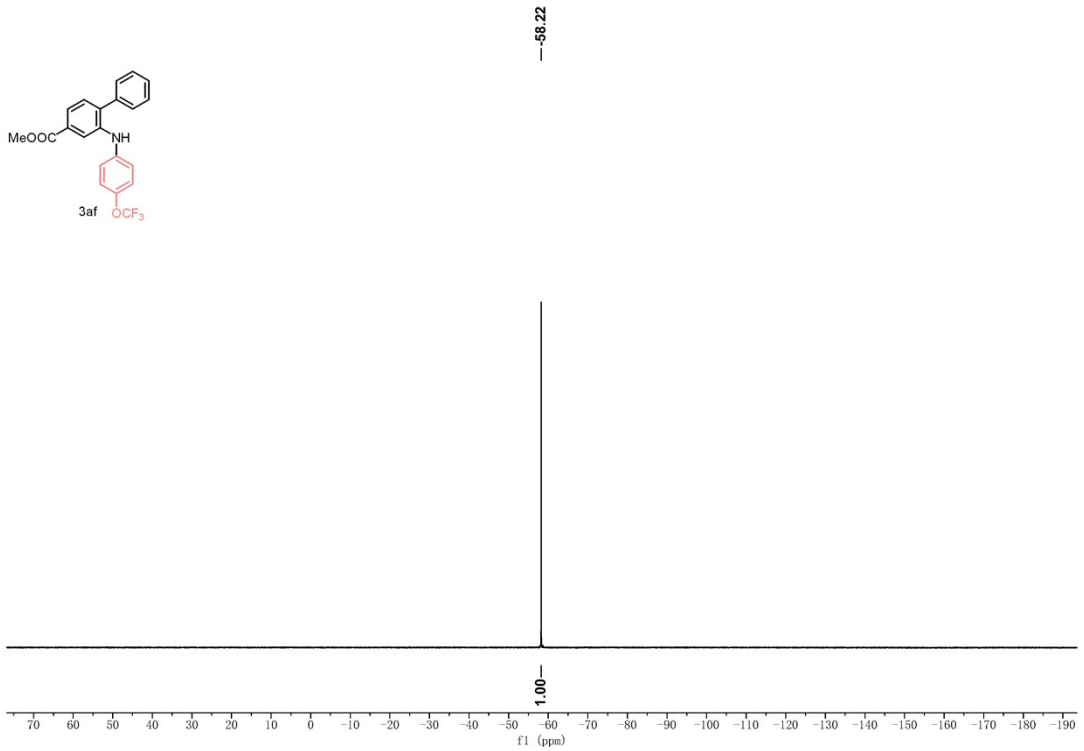
OCF3
f1 (ppm)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1.00
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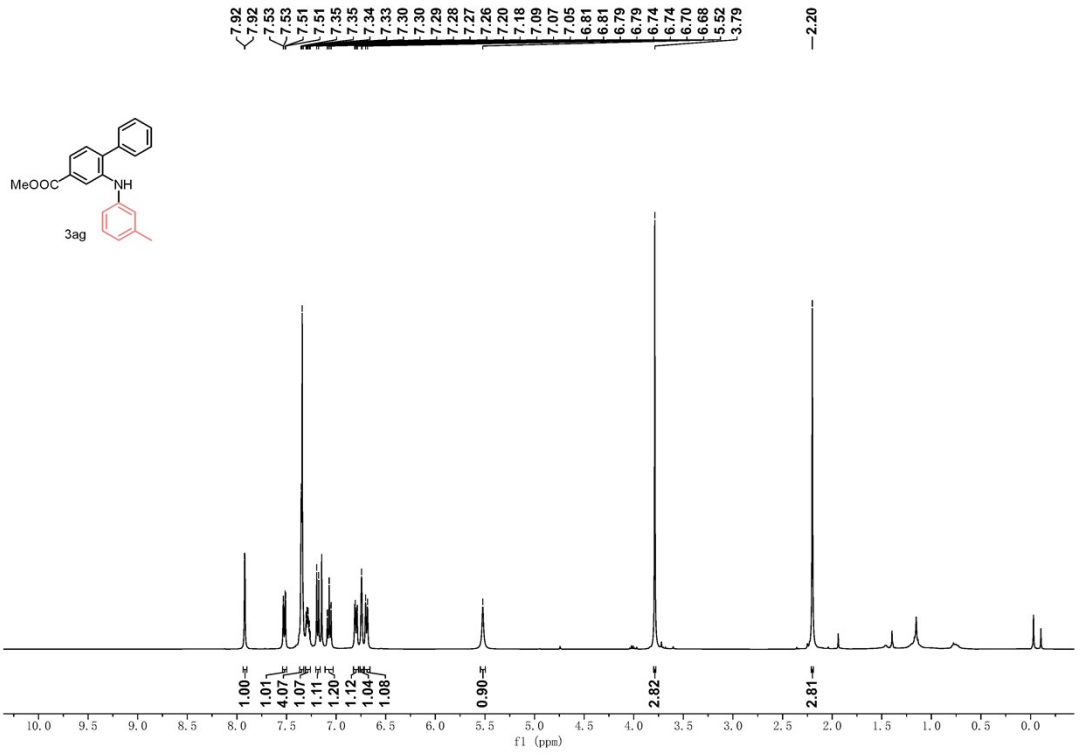
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7.51
7.35
7.34
7.33
7.30
7.30
7.29
7.28
7.27
7.26
7.20
7.18
7.09
7.07
7.05
6.81
6.81
6.79
6.79
6.74
6.70
6.68
5.52
3.79
2.20
MeOOC
NH
3ag
1.00
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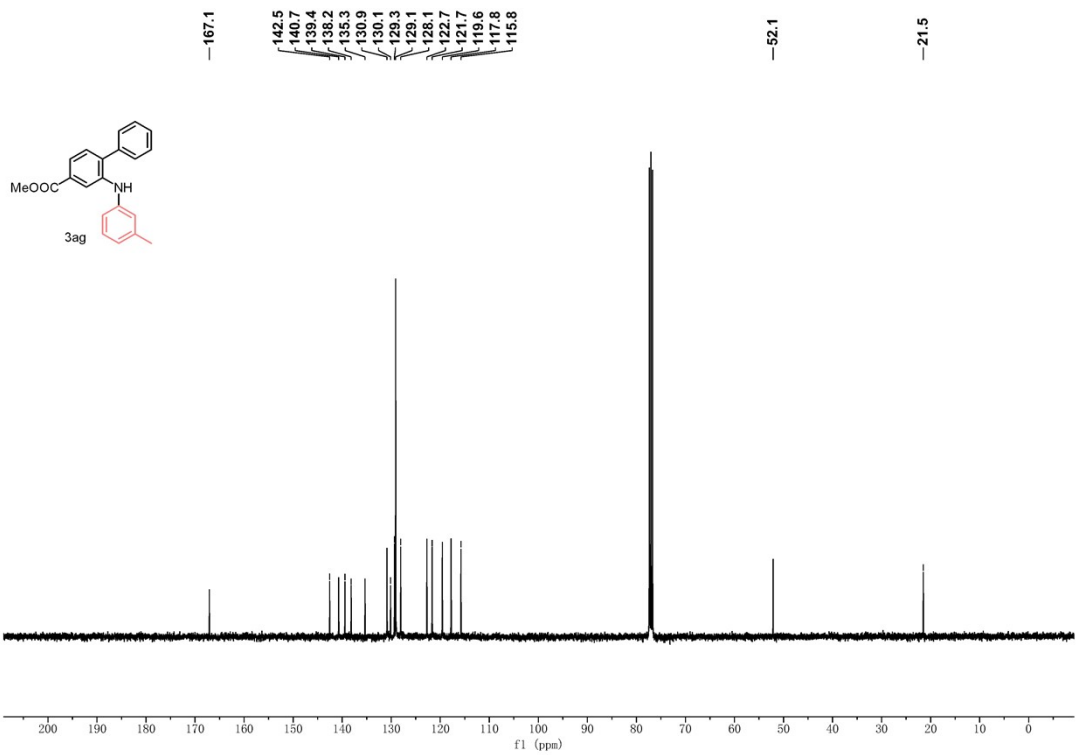
f1 (ppm)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119.6
117.8
115.8
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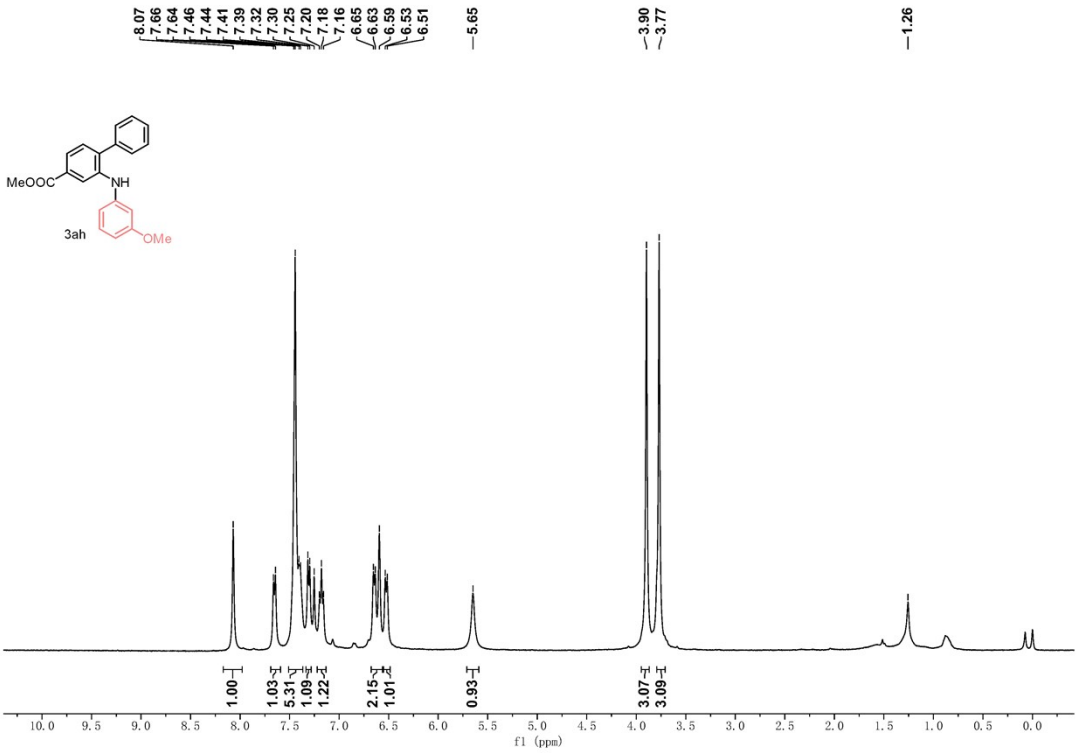
21.5
MeOOC
NH
3ag
f1 (ppm)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7.46
7.44
7.41
7.39
7.32
7.30
7.25
7.20
7.18
7.16
6.65
6.63
6.59
6.53
6.51
5.65
3.90
3.77
1.26
MeOOC
NH
3ah
OMe
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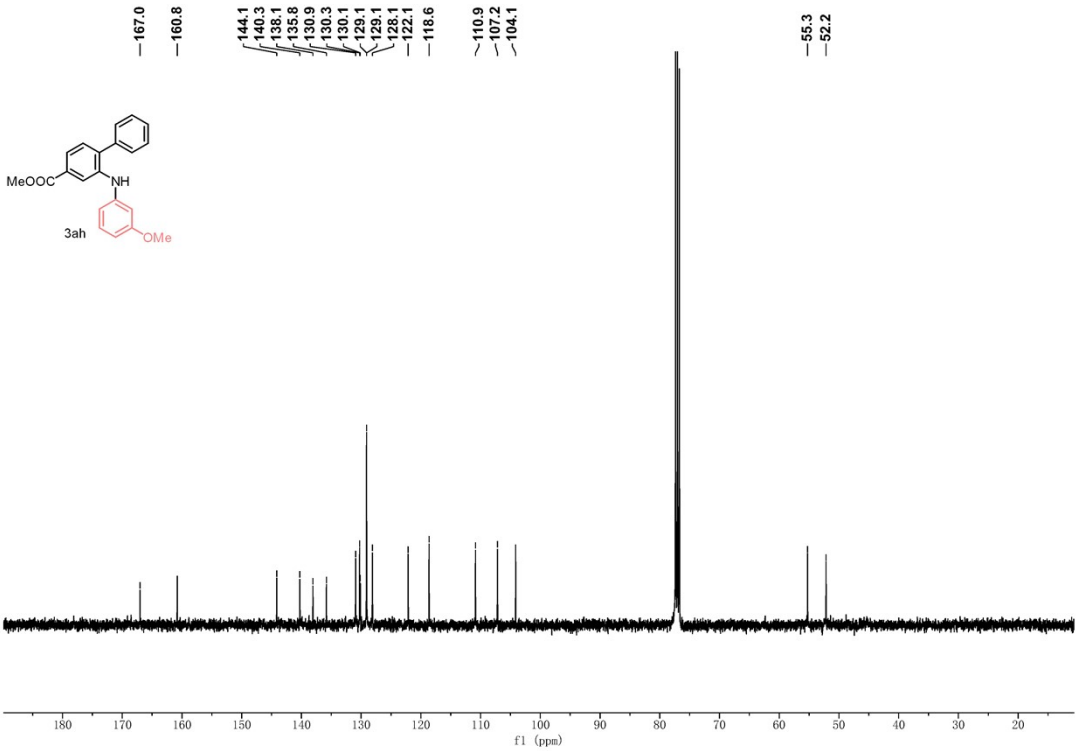
5.31
1.09
1.22
2.15
1.01
0.93
3.07
3.09
f1 (ppm)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160.8
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135.8
130.9
130.3
130.1
129.1
129.1
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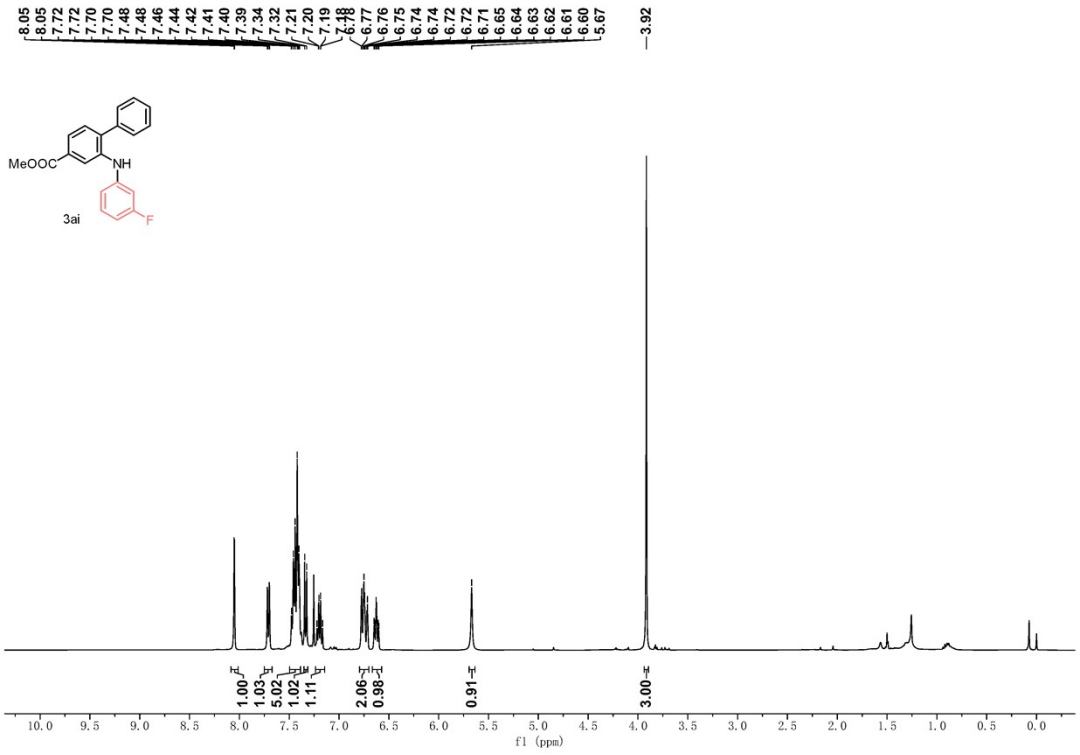
110.9
107.2
104.1
55.3
52.2
MeOOC
NH
3ah
OMe
f1 (ppm)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8.05
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7.72
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7.48
7.46
7.44
7.42
7.41
7.40
7.39
7.34
7.32
7.21
7.20
7.19
6.77
6.76
6.75
6.74
6.74
6.72
6.72
6.71
6.65
6.64
6.63
6.62
6.61
6.60
5.67
3.92
MeOOC
NH
F
3ai
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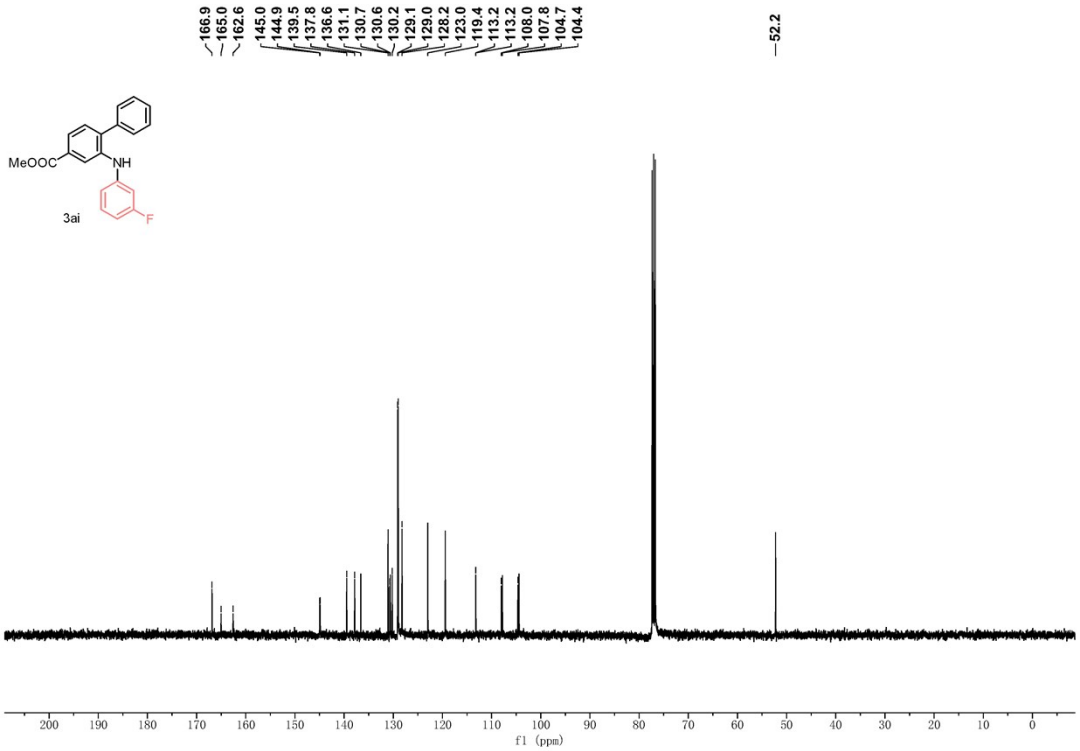
1.03
5.02
1.02
1.11
2.06
0.98
0.91
3.00
f1 (ppm)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130.2
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129.0
128.2
123.0
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113.2
108.0
107.8
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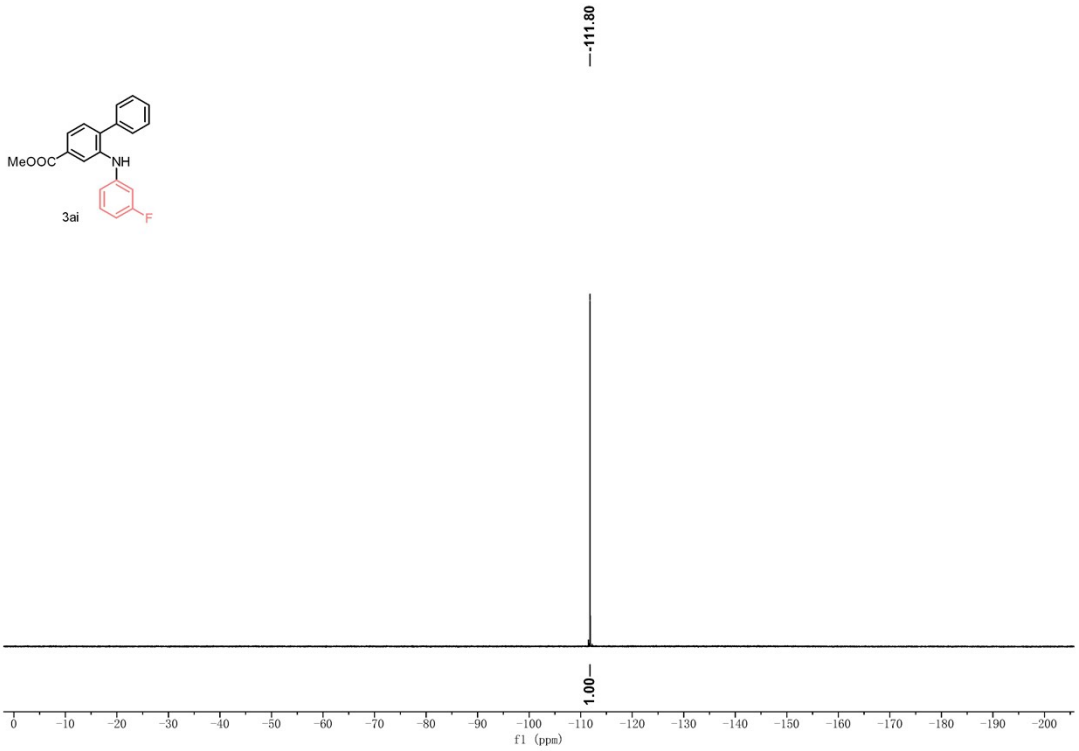
104.4
52.2
MeOOC
NH
F
3ai
f1 (ppm)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3ai
1.00
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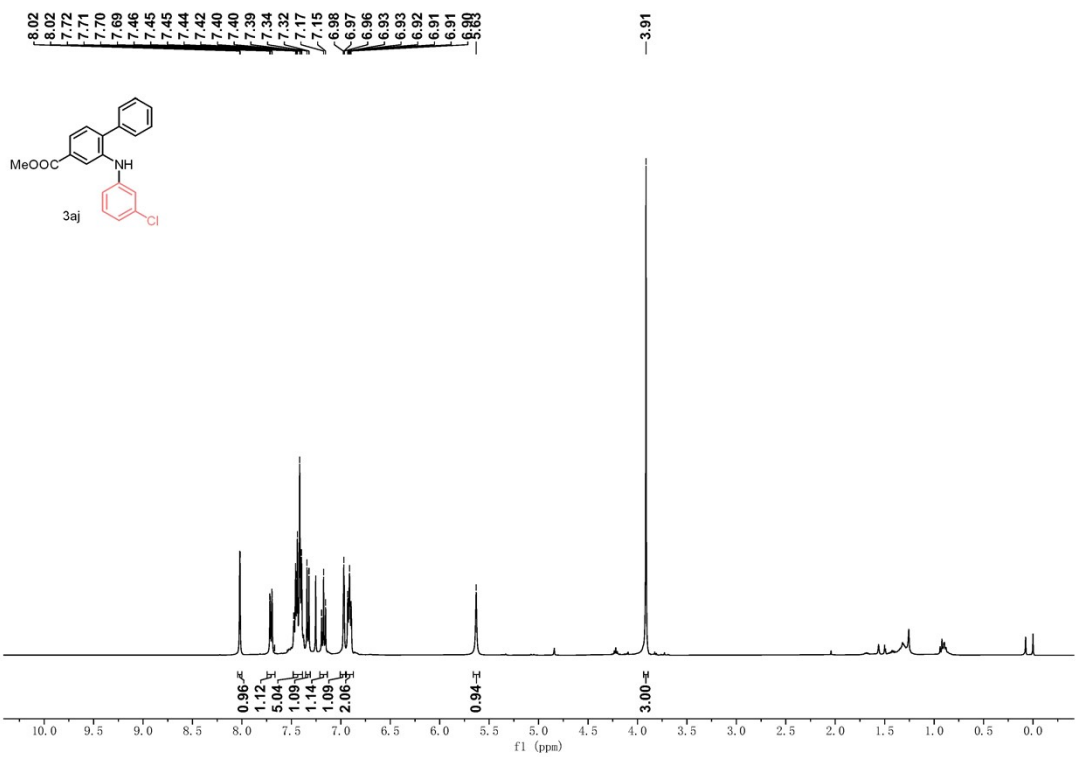
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8.02
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7.46
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7.45
7.44
7.42
7.40
7.40
7.39
7.34
7.32
7.17
7.15
6.98
6.97
6.96
6.93
6.93
6.92
6.91
6.91
6.90
5.63
3.91
MeOOC
NH
Cl
3aj
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1.12
5.04
1.09
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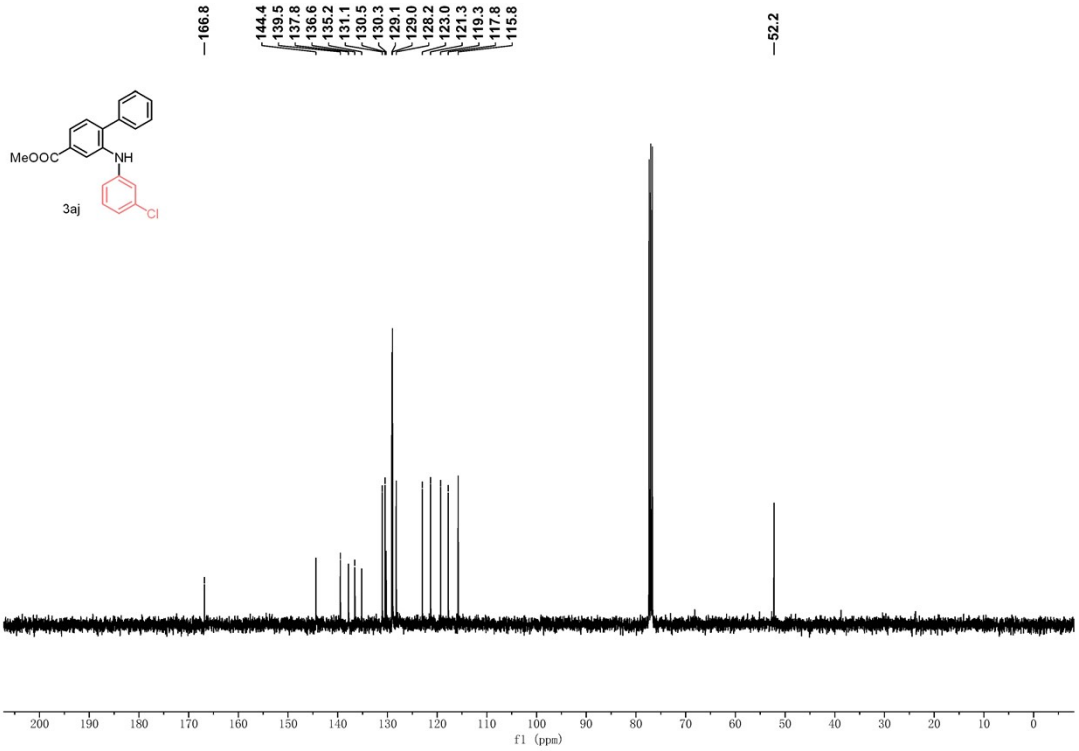
2.06
0.94
3.00
f1 (ppm)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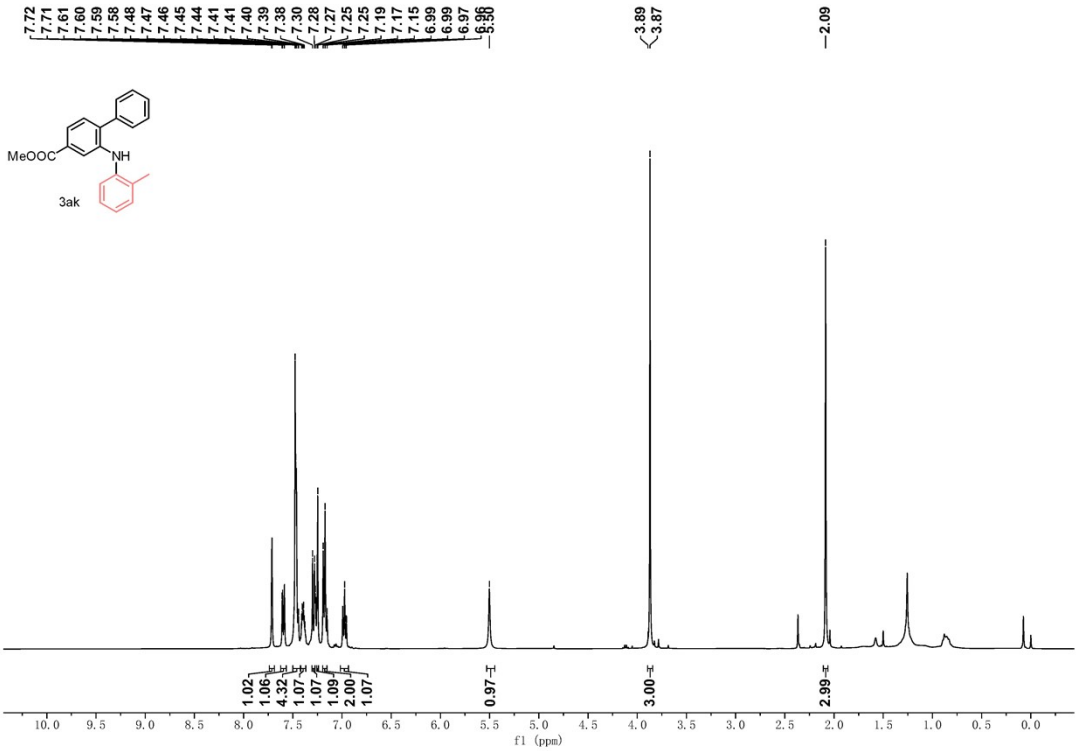
117.8
115.8
52.2
MeOOC
NH
Cl
3aj
f1 (ppm)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7.41
7.41
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7.39
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7.25
7.25
7.19
7.17
7.15
6.99
6.99
6.97
6.96
5.50
3.89
3.87
2.09
MeOOC
NH
3ak
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1.07
1.07
1.09
2.00
1.07
0.97
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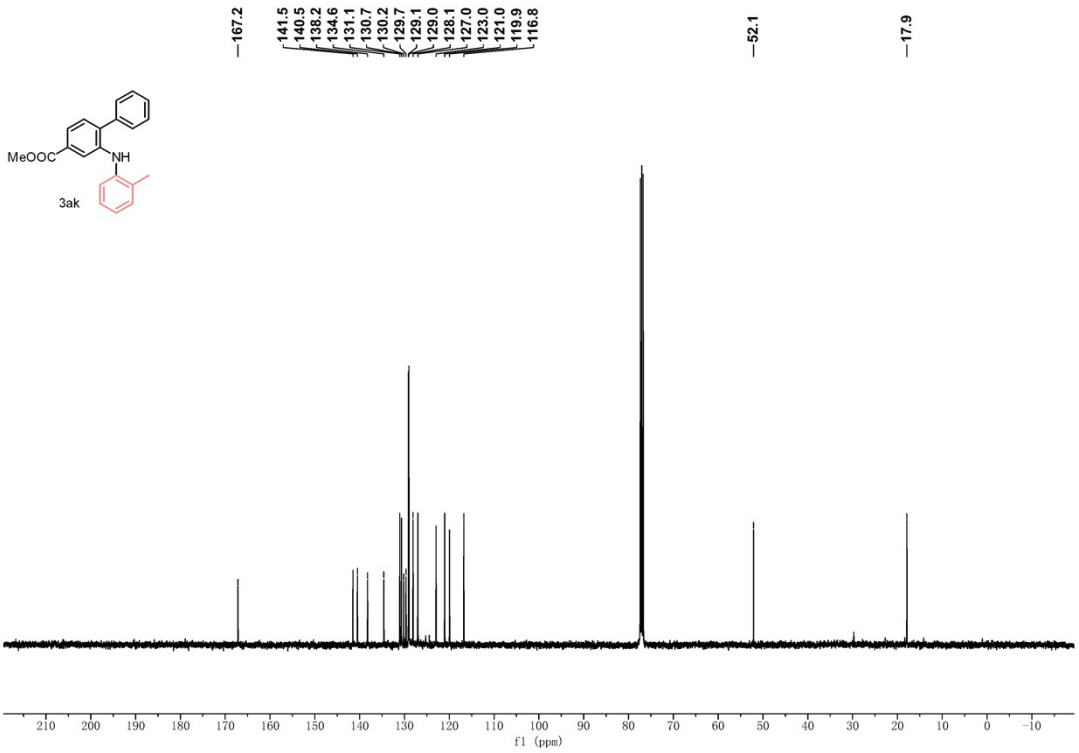
2.99
f1 (ppm)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130.2
129.7
129.1
129.0
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17.9
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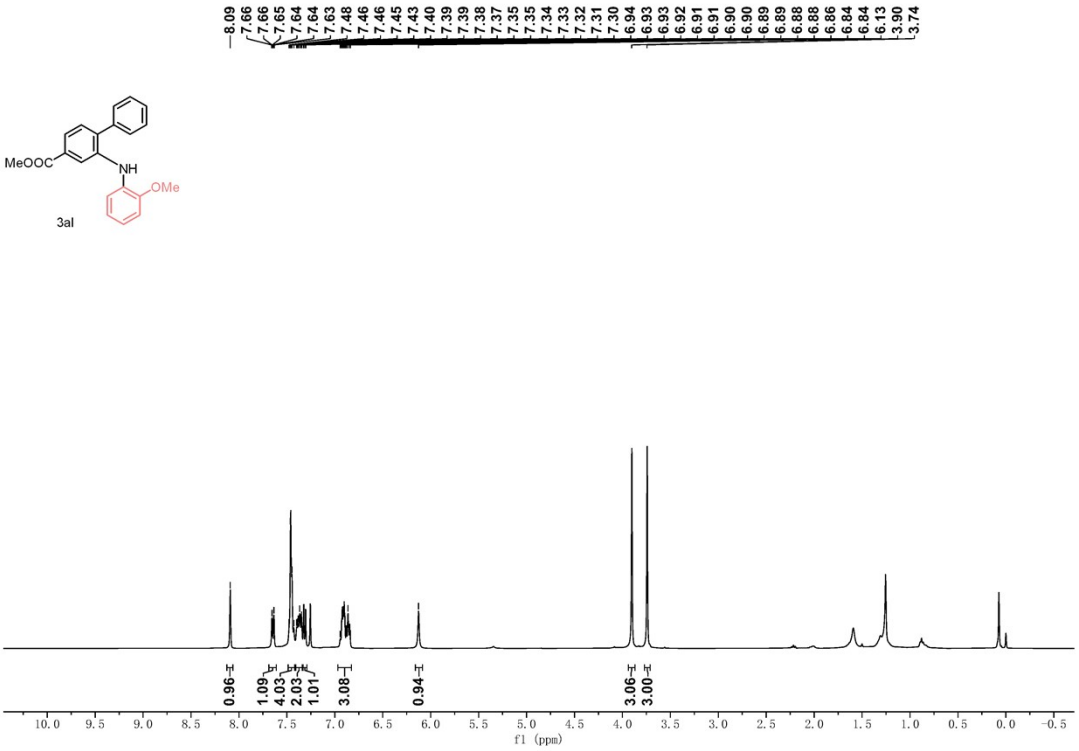
NH
3ak
f1 (ppm)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6.89
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6.88
6.86
6.84
6.84
6.13
3.90
3.74
MeOOC
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OMe
3al
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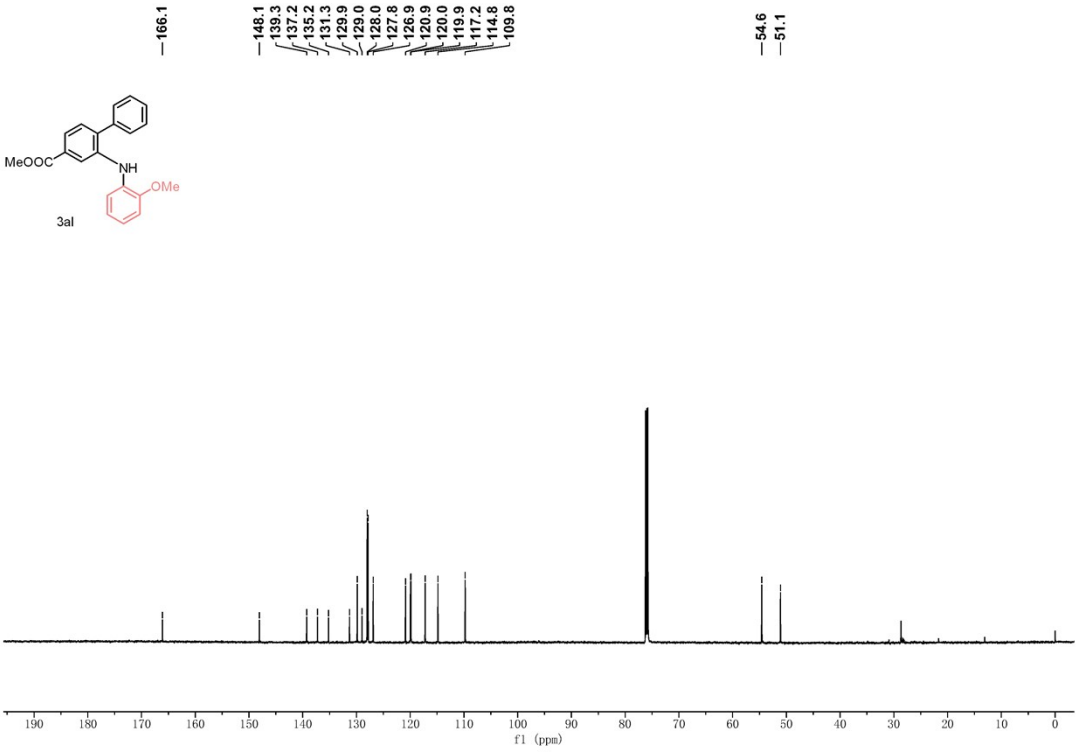
3.00
f1 (ppm)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117.2
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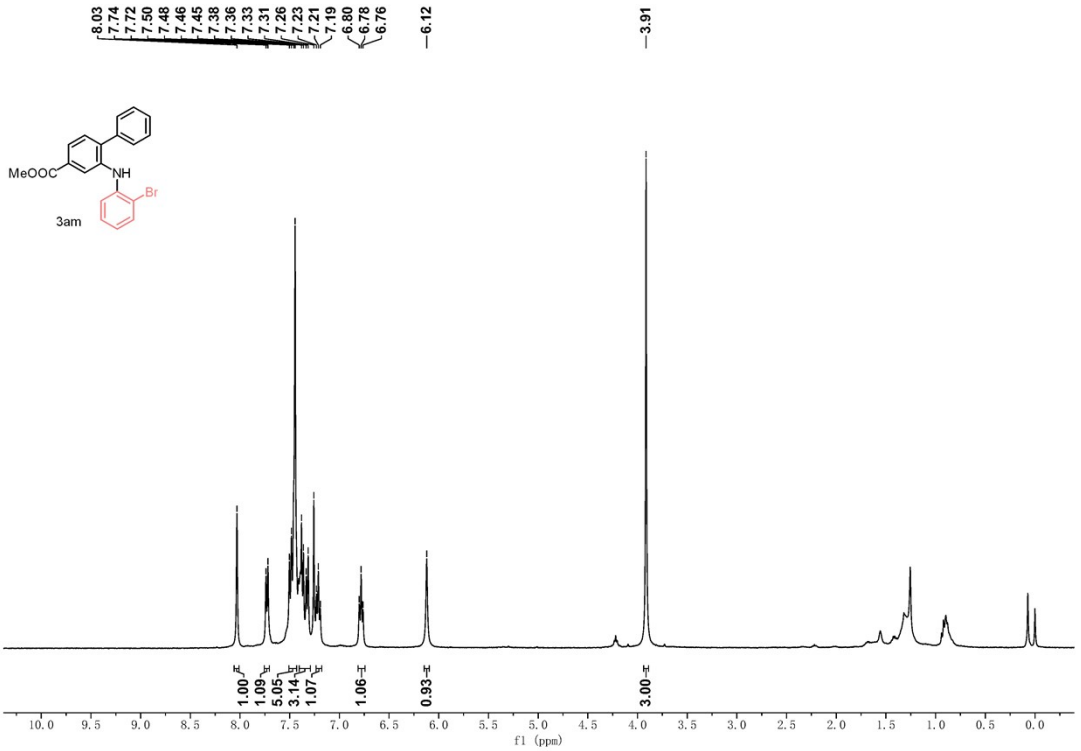
MeOOC
NH
OMe
3al
f1 (ppm)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7.19
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6.78
6.76
6.12
3.91
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Br
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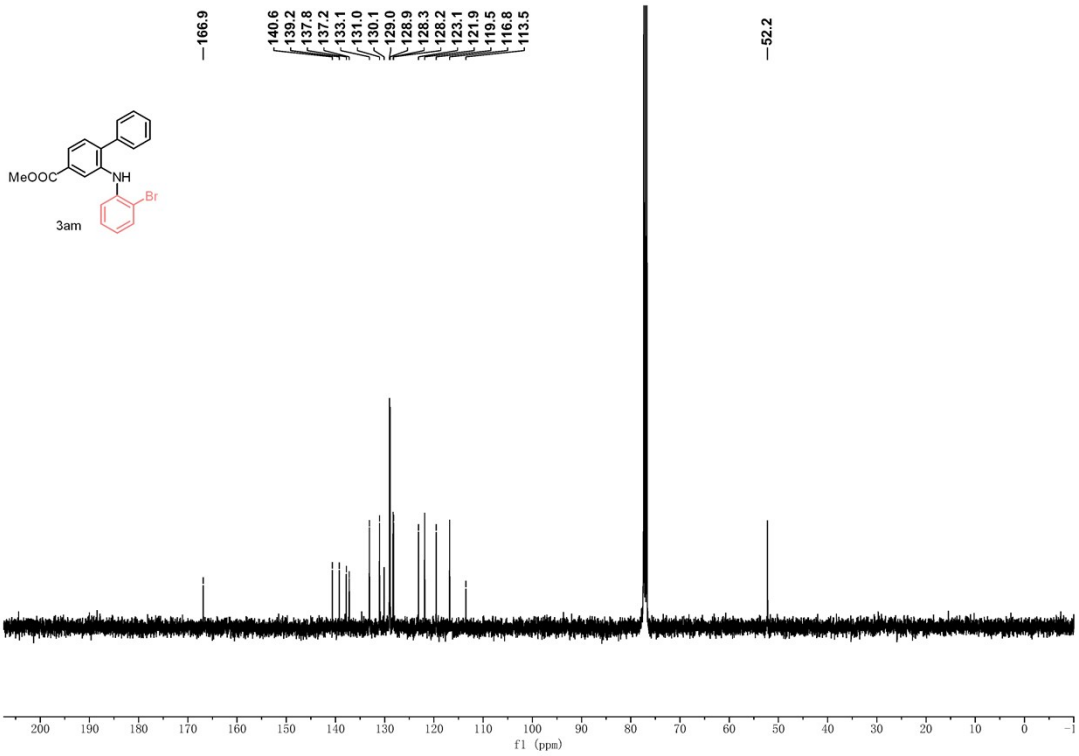
1.07
1.06
0.93
3.00
f1 (ppm)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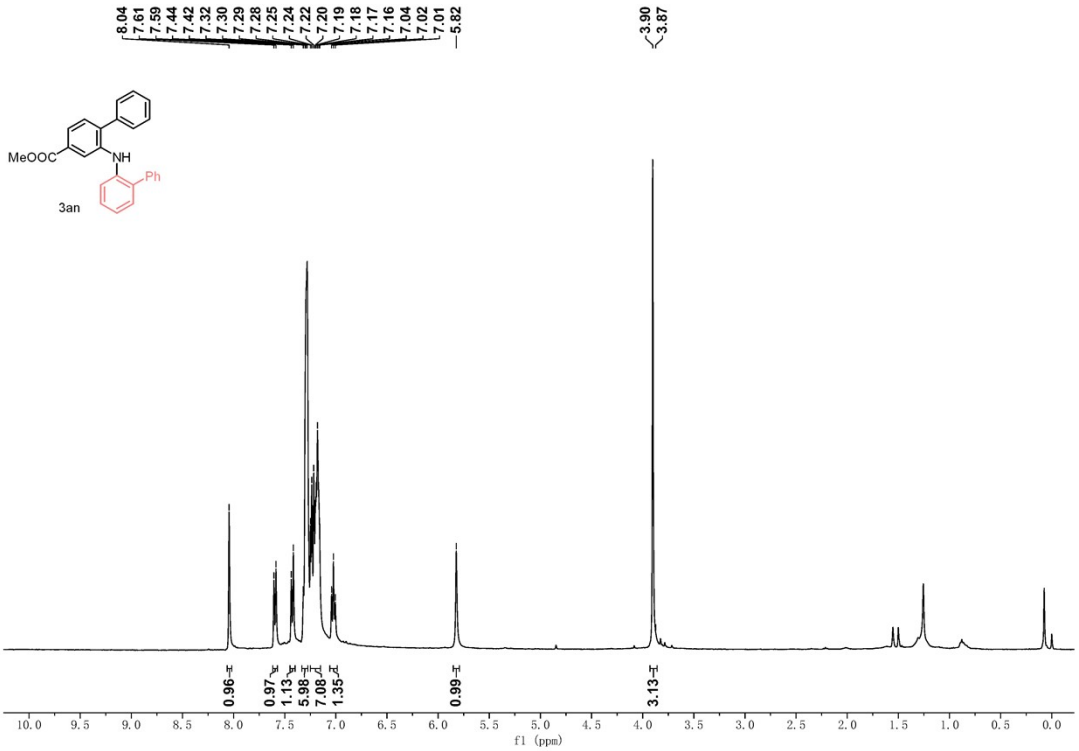
119.5
116.8
113.5
52.2
MeOOC
NH
Br
3am
f1 (ppm)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7.19
7.18
7.17
7.16
7.04
7.02
7.01
5.82
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3.87
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NH
Ph
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5.98
7.08
1.35
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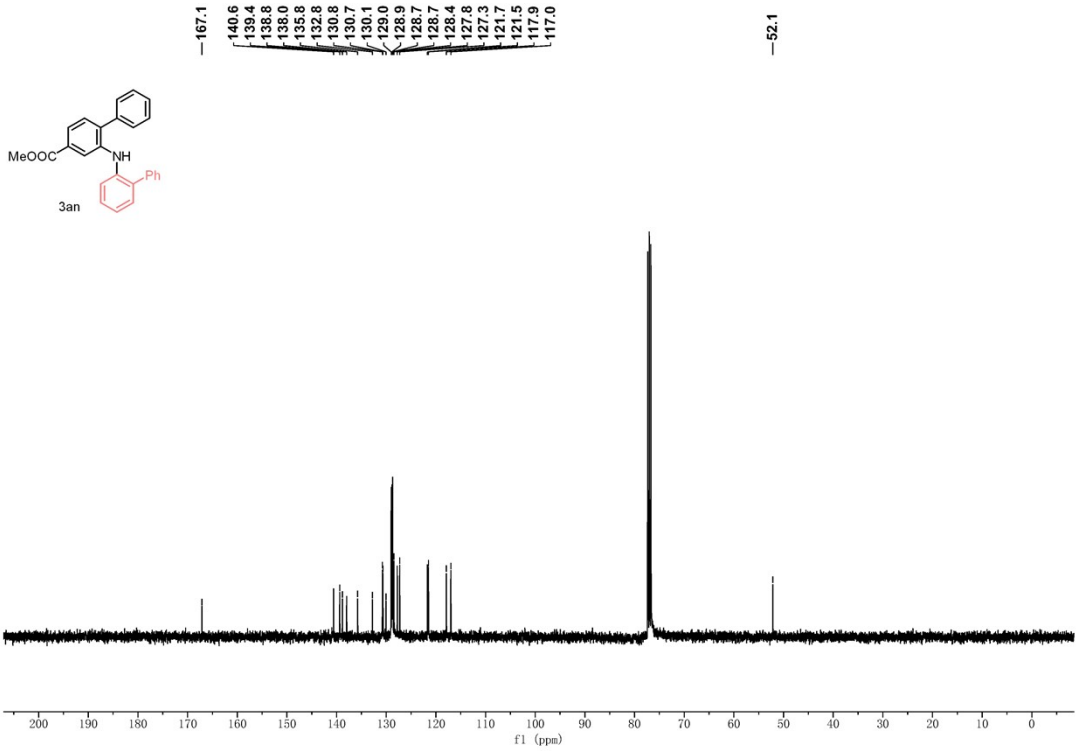
3.13
f1 (ppm)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128.9
128.7
128.7
128.4
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121.7
121.5
117.9
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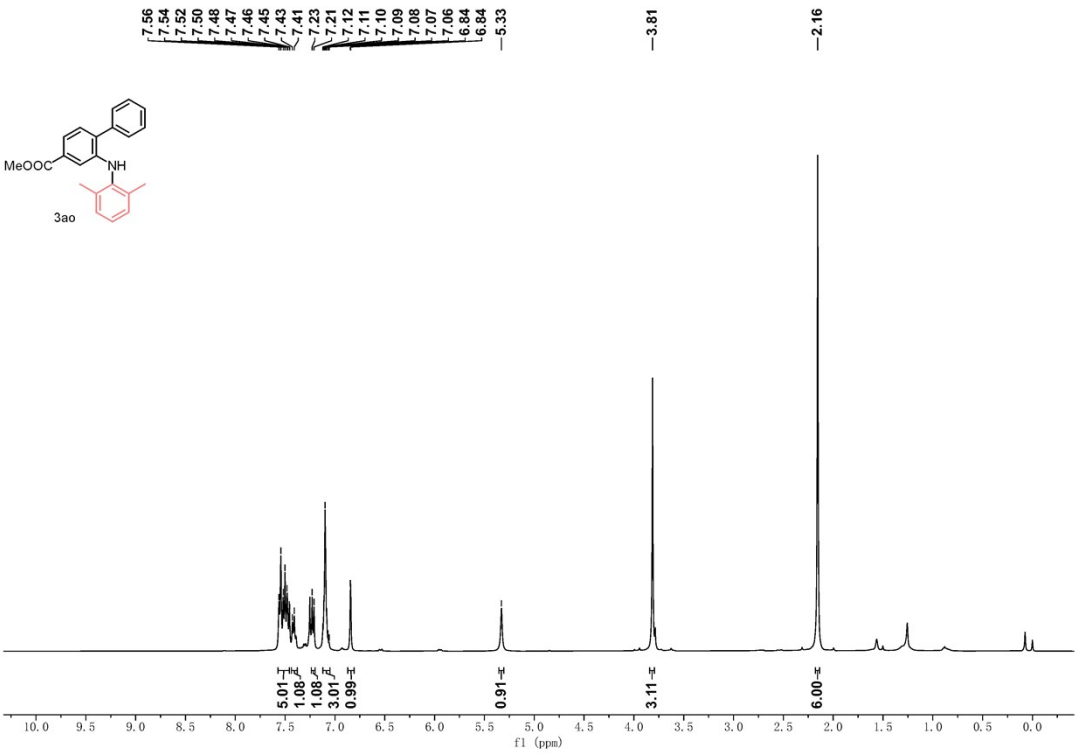
MeOOC
NH
Ph
3an
f1 (ppm)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7.11
7.10
7.09
7.08
7.07
7.06
6.84
6.84
5.33
3.81
2.16
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1.08
3.01
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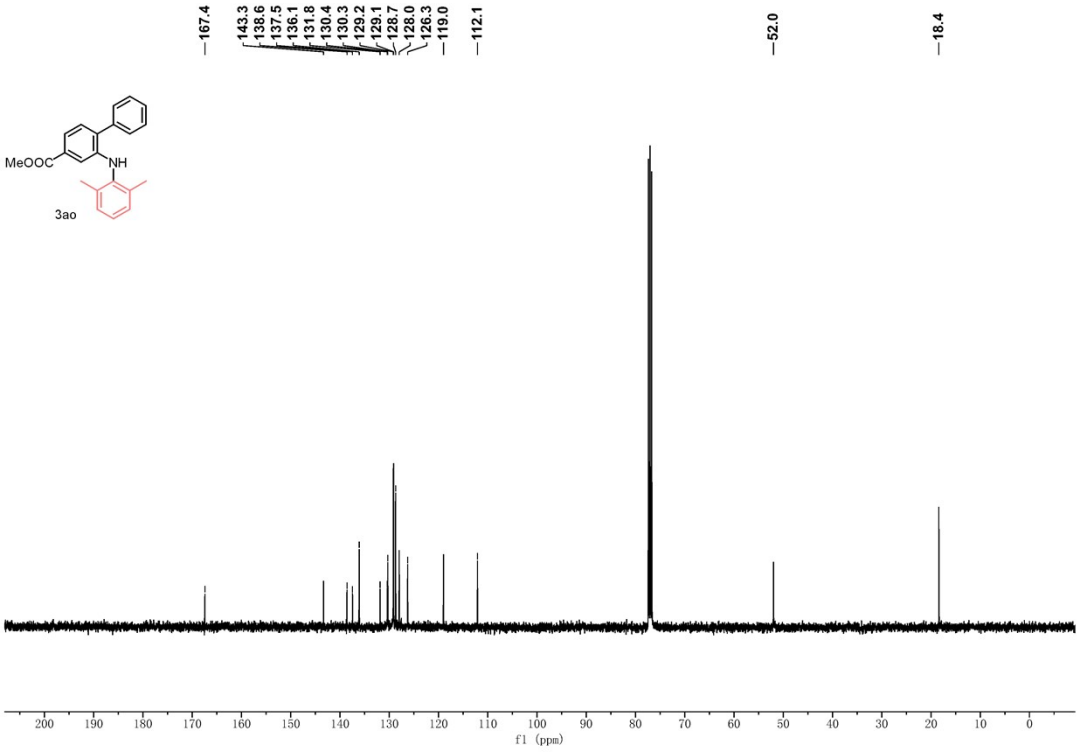
0.91
3.11
6.00
f1 (ppm)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126.3
119.0
112.1
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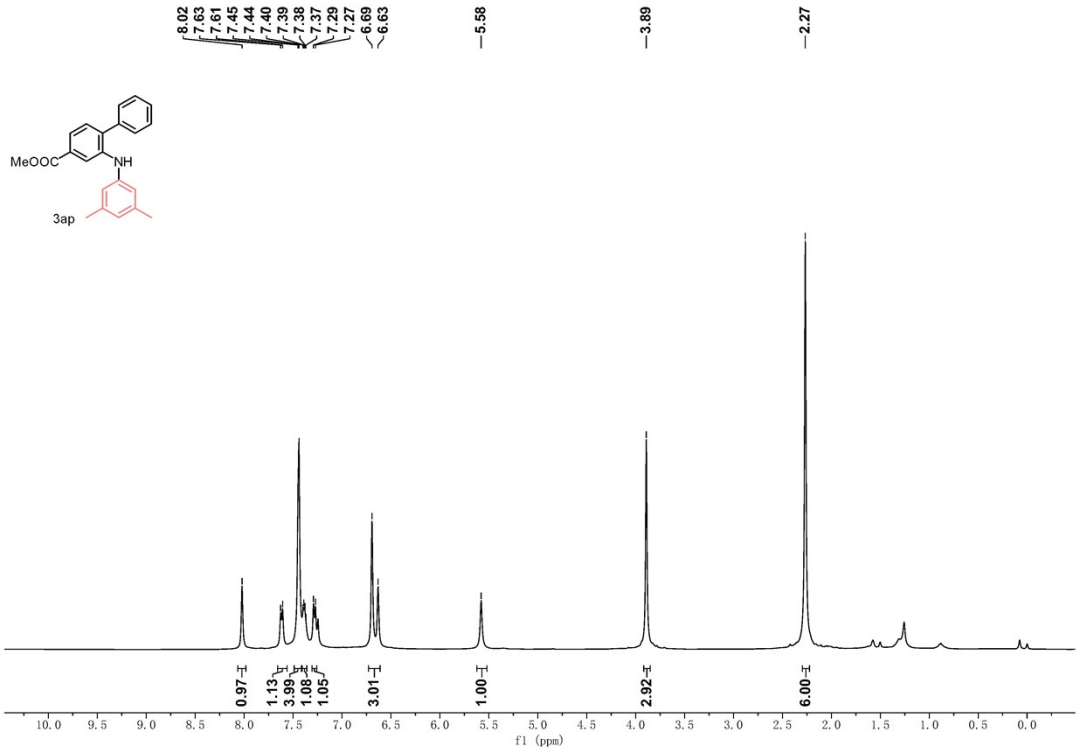
18.4
MeOOC
NH
3ao
f1 (ppm)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7.27
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6.63
5.58
3.89
2.27
MeOOC
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1.05
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1.00
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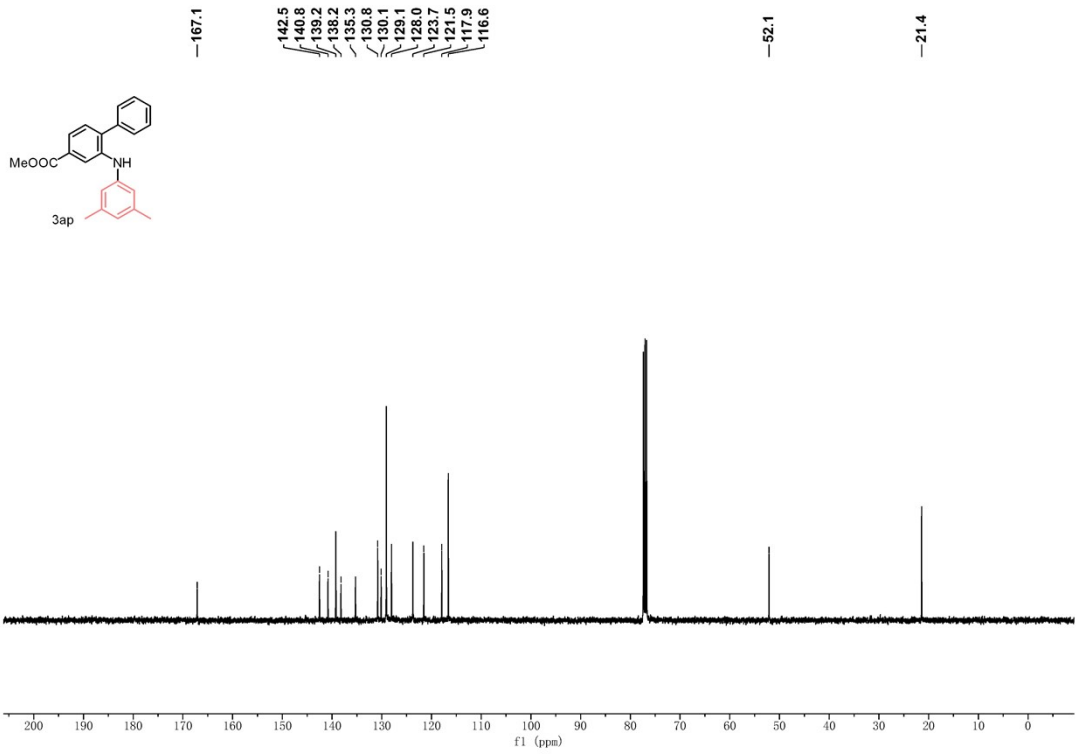
6.00
f1 (ppm)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130.1
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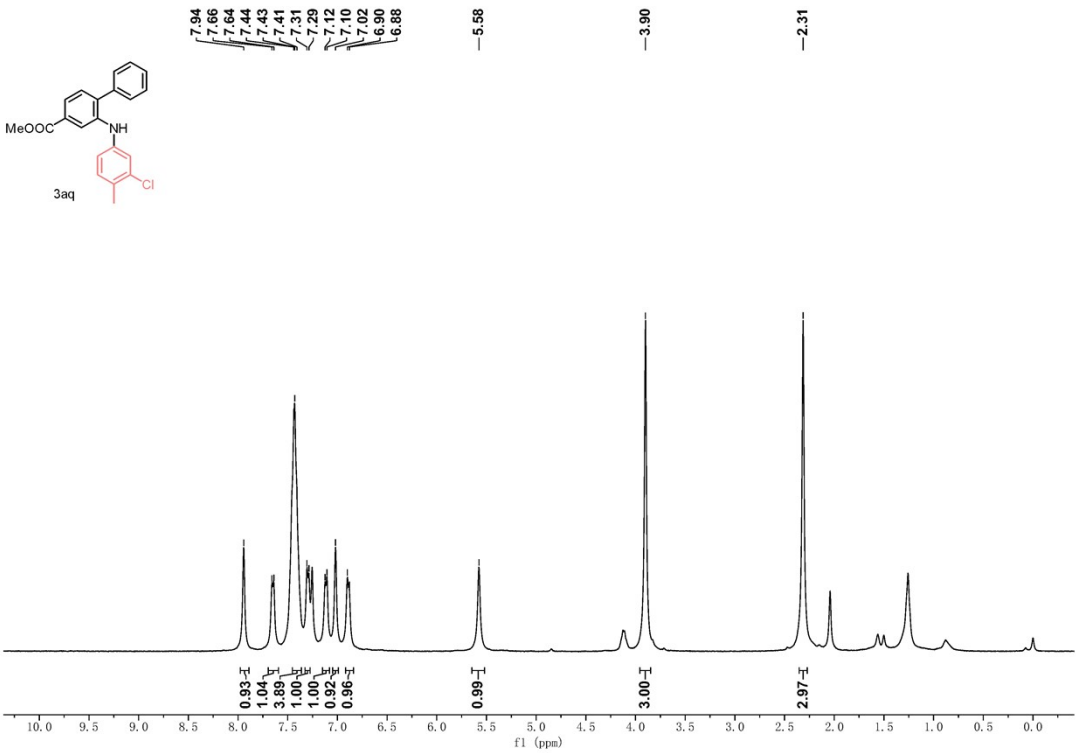
123.7
121.5
117.9
116.6
52.1
21.4
MeOOC
NH
3ap
f1 (ppm)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7.29
7.12
7.10
7.02
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6.88
5.58
3.90
2.31
MeOOC
NH
Cl
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1.00
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0.99
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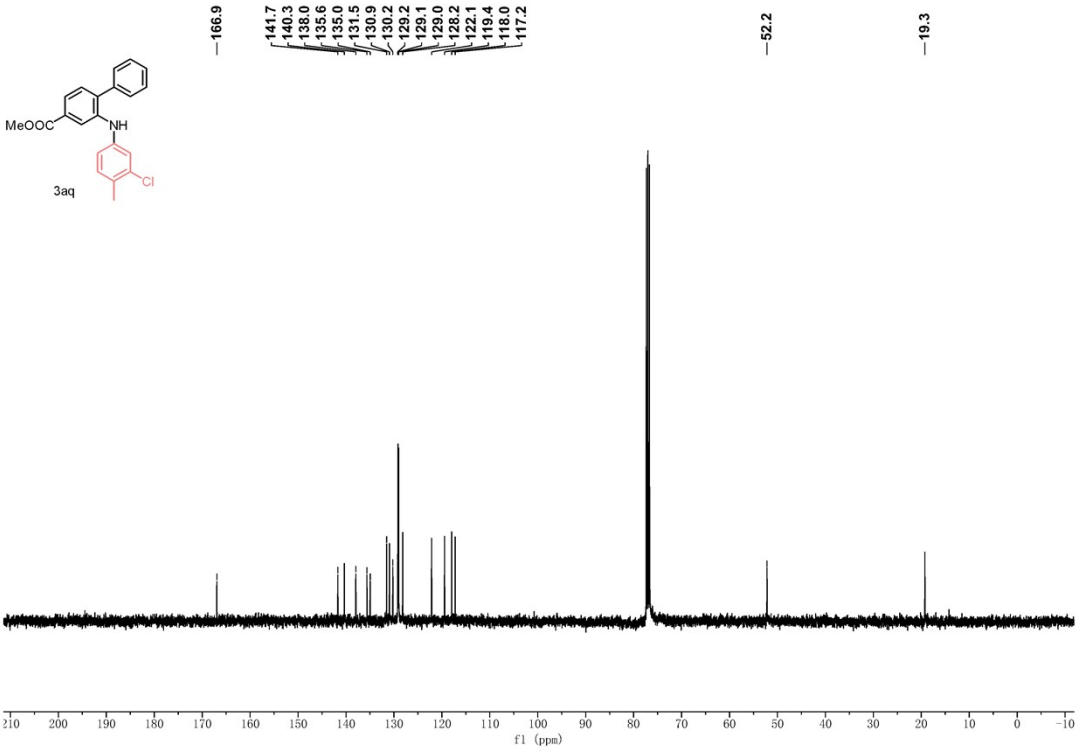
2.97
f1 (ppm)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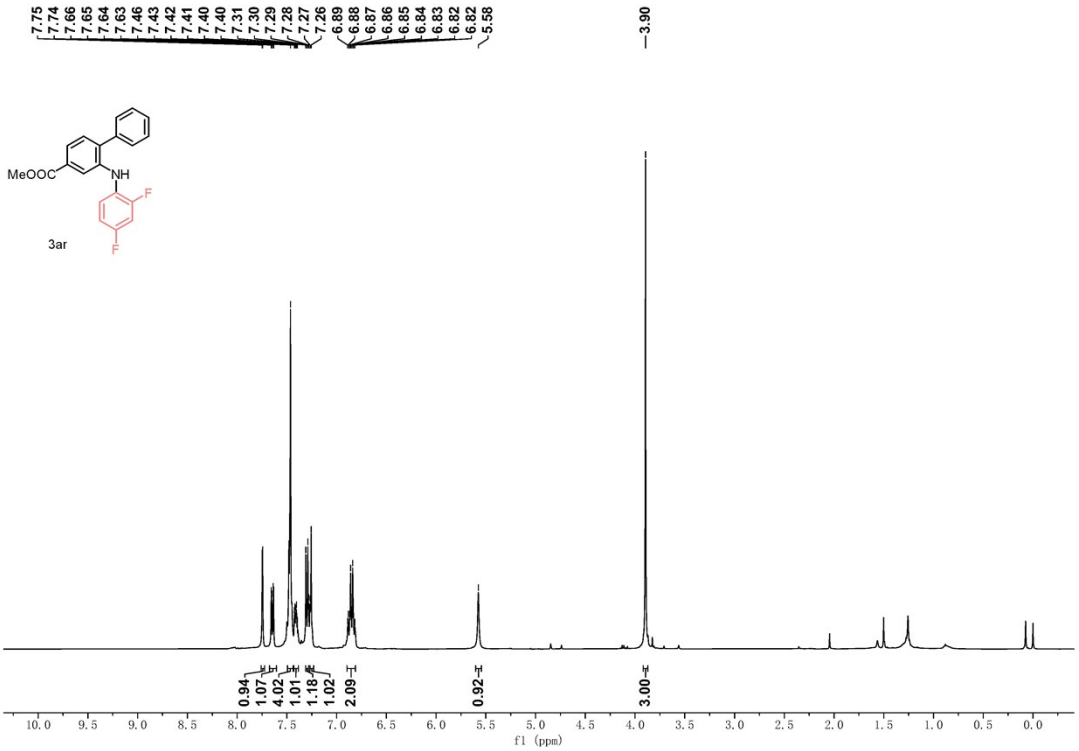
129.1
129.0
128.2
122.1
119.4
118.0
117.2
52.2
19.3
MeOOC
NH
Cl
3aq
f1 (ppm)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7.43
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7.41
7.40
7.40
7.31
7.30
7.29
7.28
7.27
7.26
6.89
6.88
6.87
6.86
6.85
6.84
6.83
6.82
6.82
5.58
3.90
MeOOC
NH
F
F
3ar
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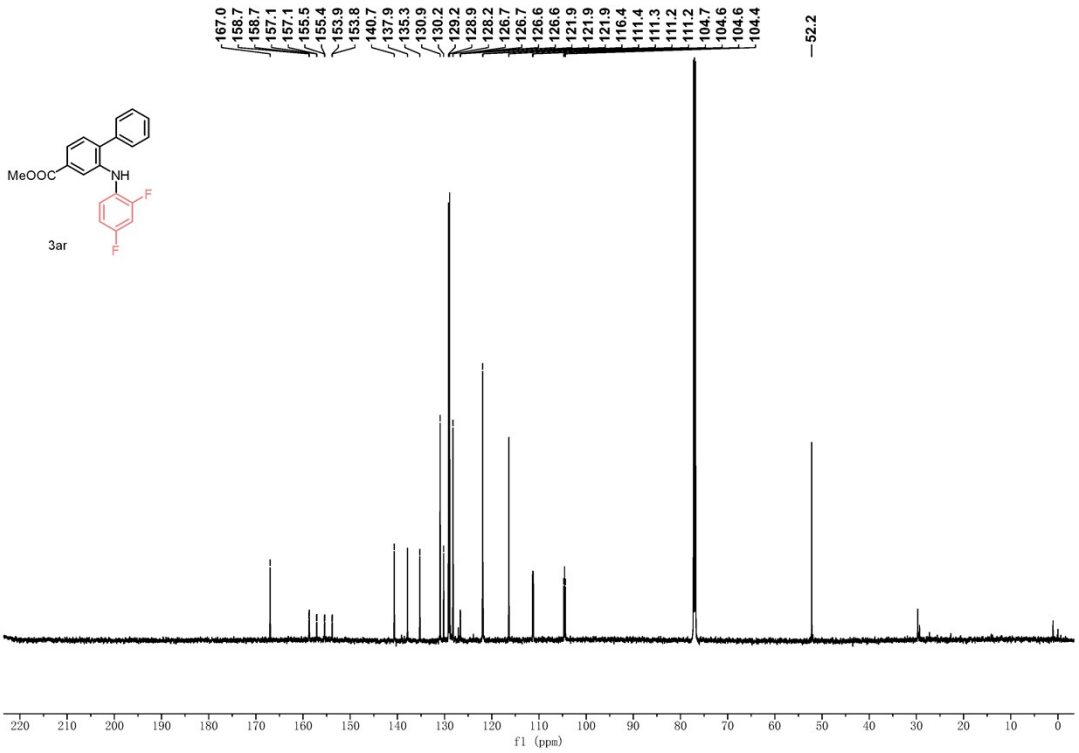
1.07
4.02
1.01
1.18
1.02
2.09
0.92
3.00
f1 (ppm)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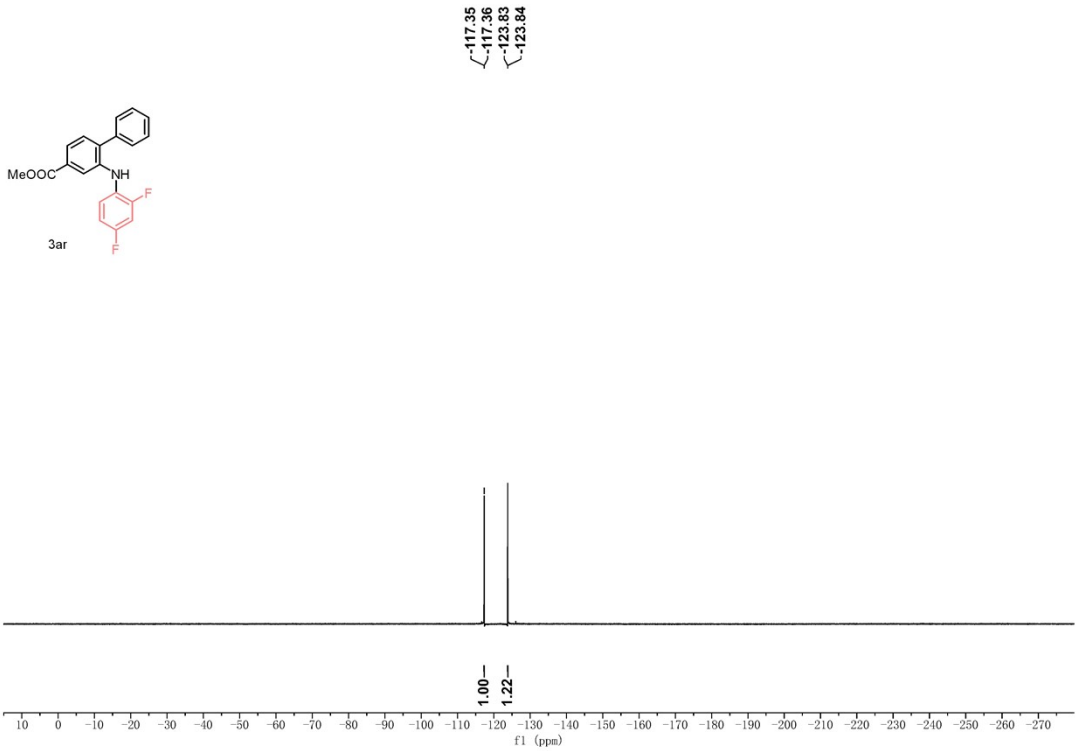
155.4
153.9
153.8
140.7
137.9
135.3
130.9
130.2
129.2
128.9
128.2
126.7
126.7
126.6
126.6
121.9
121.9
121.9
116.4
111.4
111.3
111.2
111.2
104.7
104.6
104.6
104.4
52.2
MeOOC
NH
F
F
3ar
f1 (ppm)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-123.84
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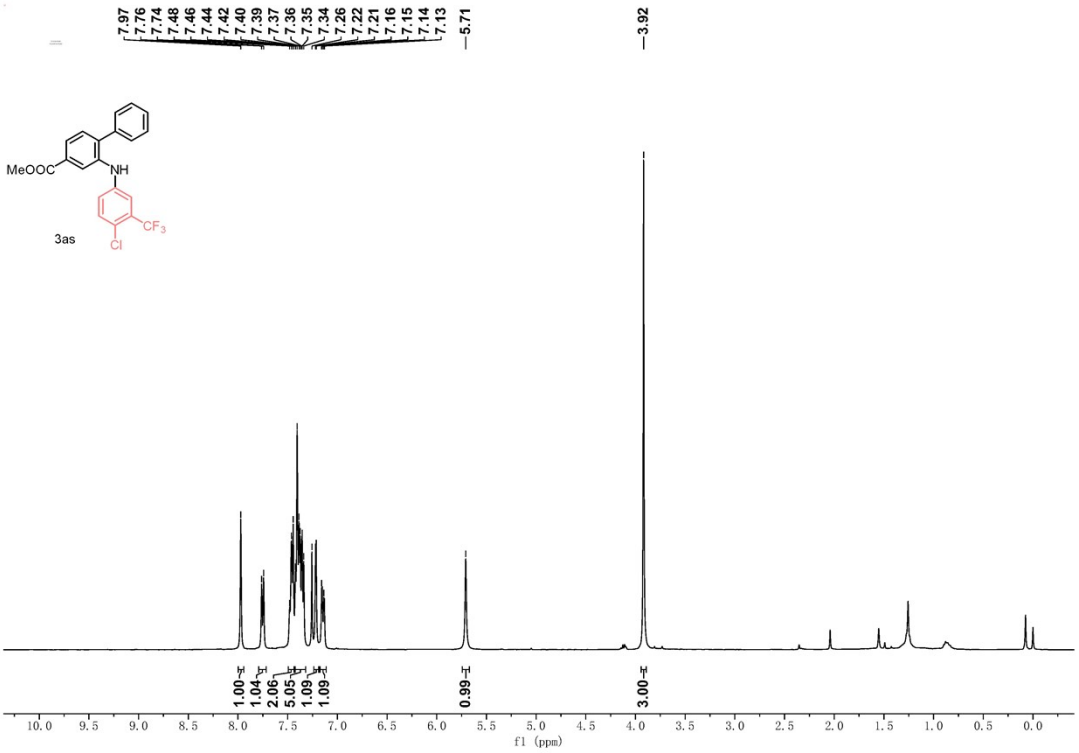
NH
F
F
3ar
1.00
1.22
f1 (ppm)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7.35
7.34
7.26
7.22
7.21
7.16
7.15
7.14
7.13
5.71
3.92
MeOOC
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CF3
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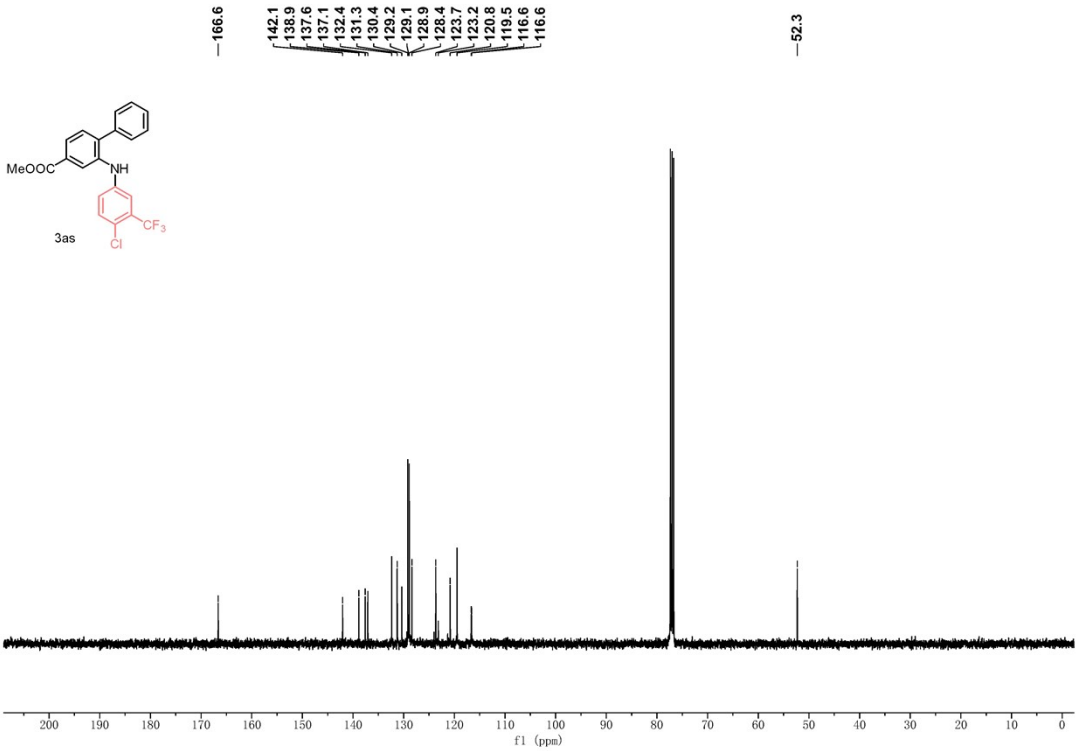
2.06
5.05
1.09
1.09
0.99
3.00
f1 (ppm)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130.4
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129.1
128.9
128.4
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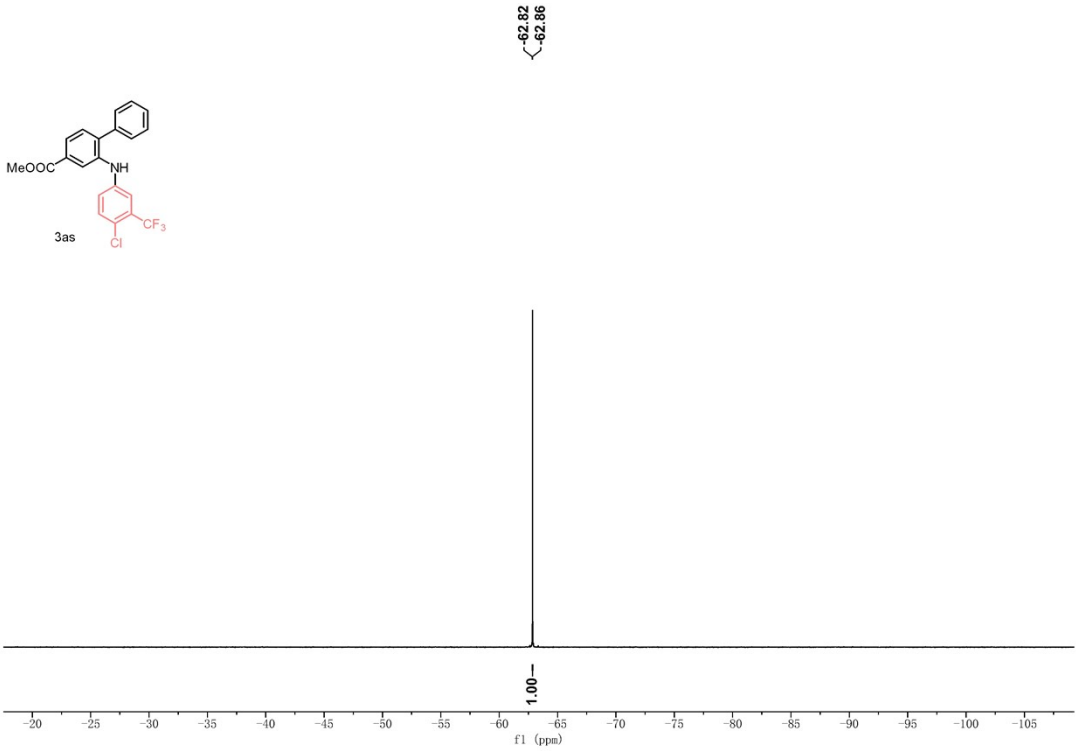
120.8
119.5
116.6
116.6
52.3
MeOOC
NH
CF3
Cl
3as
f1 (ppm)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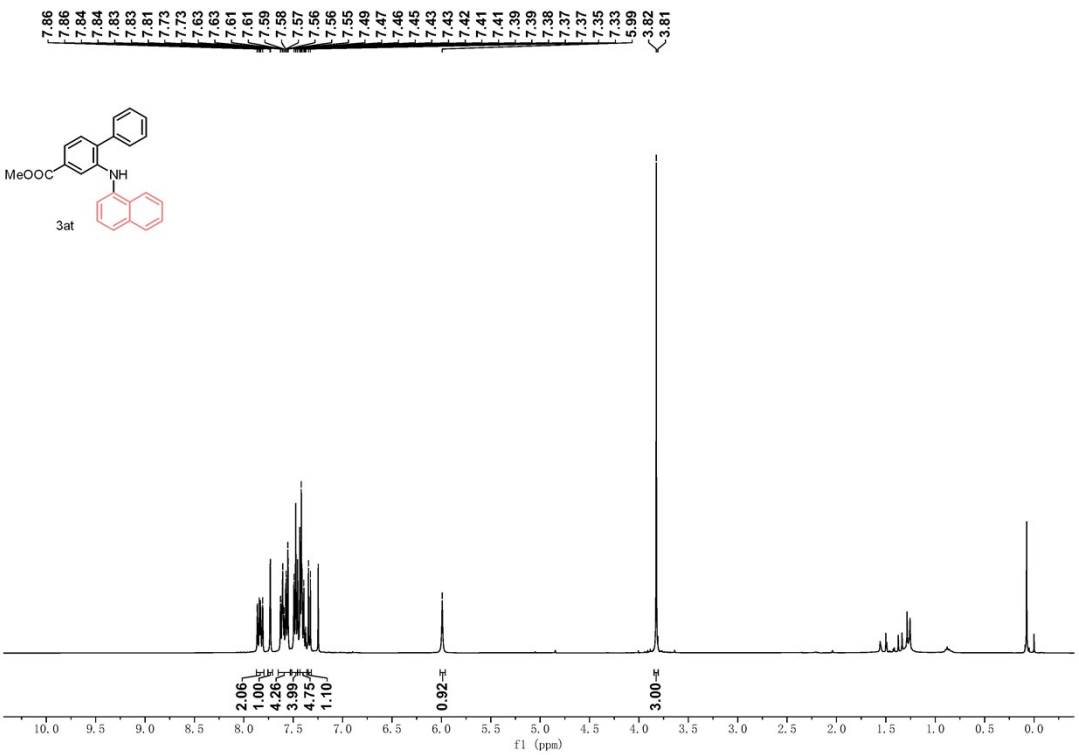
f1 (ppm)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7.59
7.58
7.57
7.56
7.56
7.55
7.49
7.47
7.46
7.45
7.43
7.43
7.42
7.41
7.41
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7.39
7.38
7.37
7.37
7.35
7.33
5.99
3.82
3.81
MeOOC
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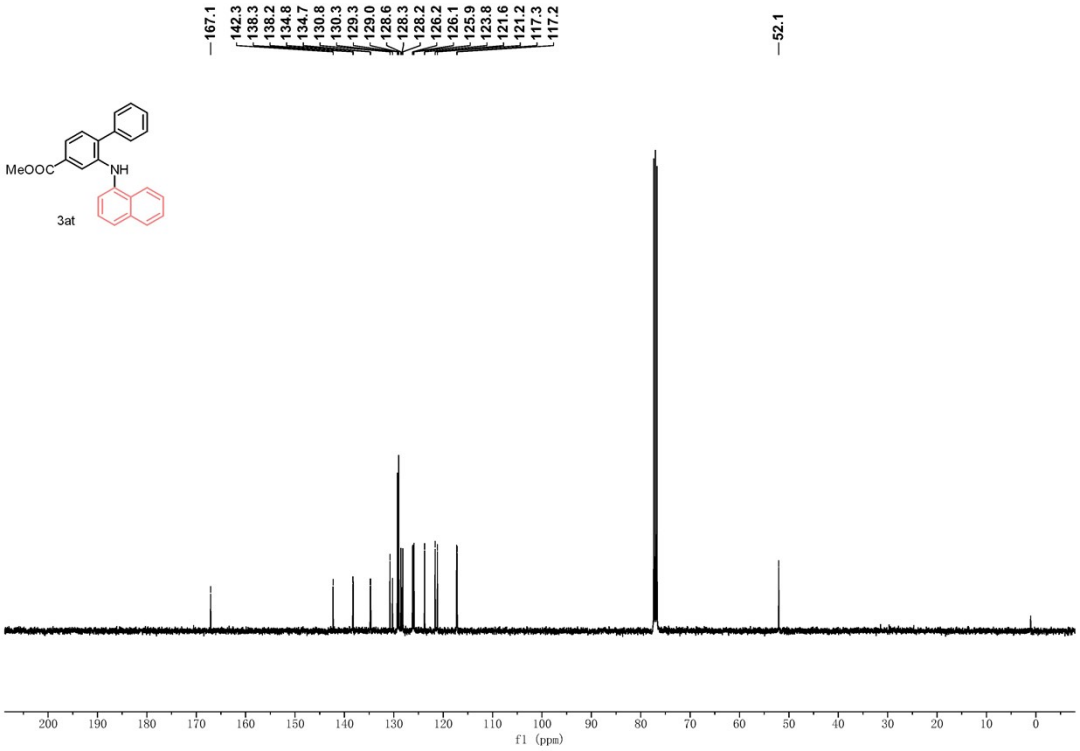
4.26
3.99
4.75
1.10
0.92
3.00
f1 (ppm)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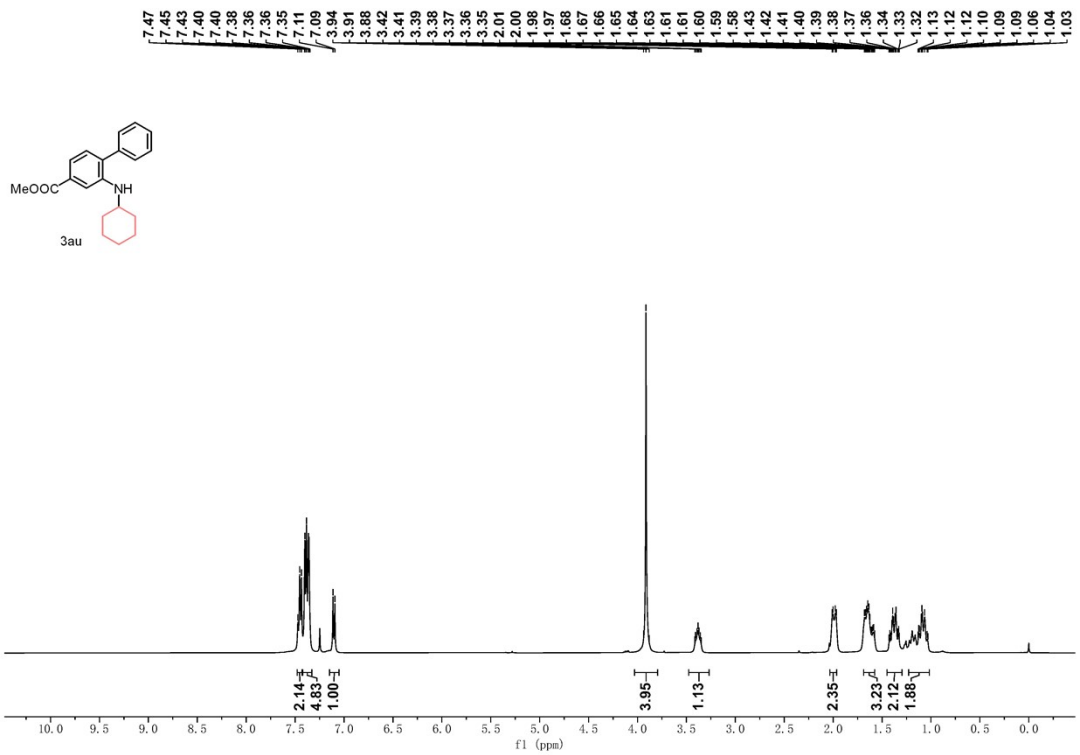
130.3
129.3
129.0
128.6
128.3
128.2
126.2
126.1
125.9
123.8
121.6
121.2
117.3
117.2
52.1
MeOOC
NH
3at
f1 (ppm)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7.38
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7.36
7.35
7.11
7.09
3.94
3.91
3.88
3.42
3.41
3.39
3.38
3.37
3.36
3.35
2.01
2.00
1.98
1.97
1.68
1.67
1.66
1.65
1.64
1.63
1.61
1.61
1.60
1.59
1.58
1.43
1.42
1.41
1.40
1.39
1.38
1.37
1.36
1.34
1.33
1.32
1.13
1.12
1.12
1.10
1.09
1.09
1.06
1.04
1.03
MeOOC
NH
3au
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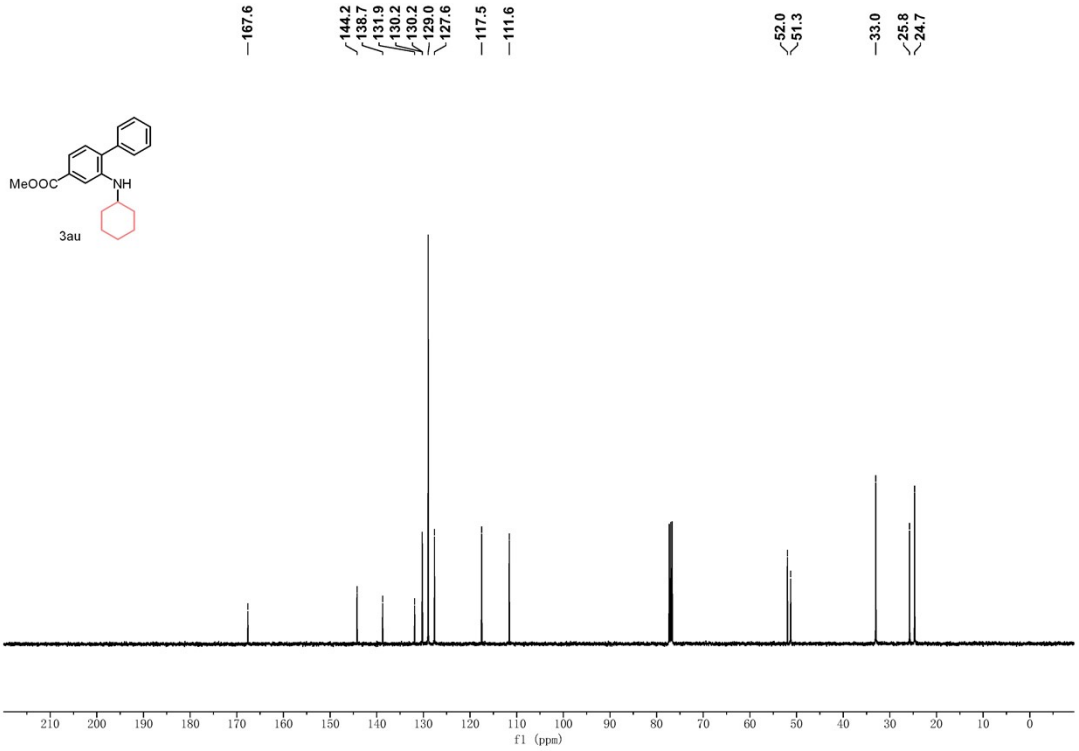
4.83
1.00
3.95
1.13
2.35
3.23
2.12
1.88
f1 (ppm)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144.2
138.7
131.9
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130.2
129.0
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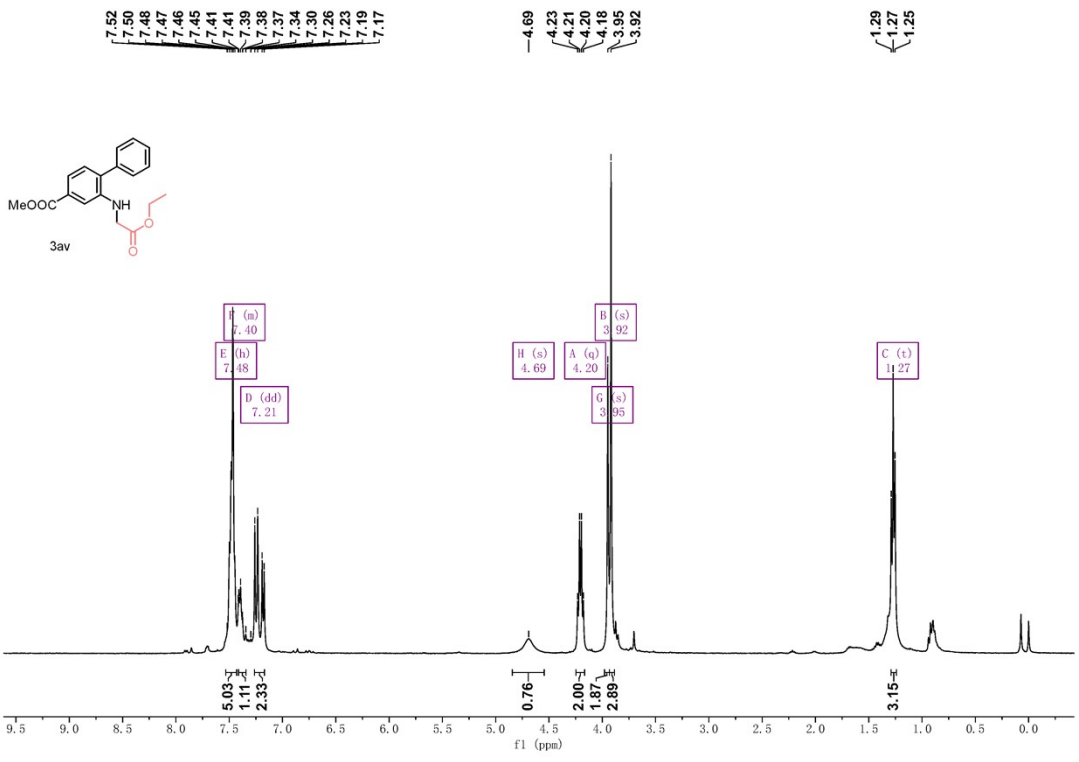
51.3
33.0
25.8
24.7
MeOOC
NH
3au
f1 (ppm)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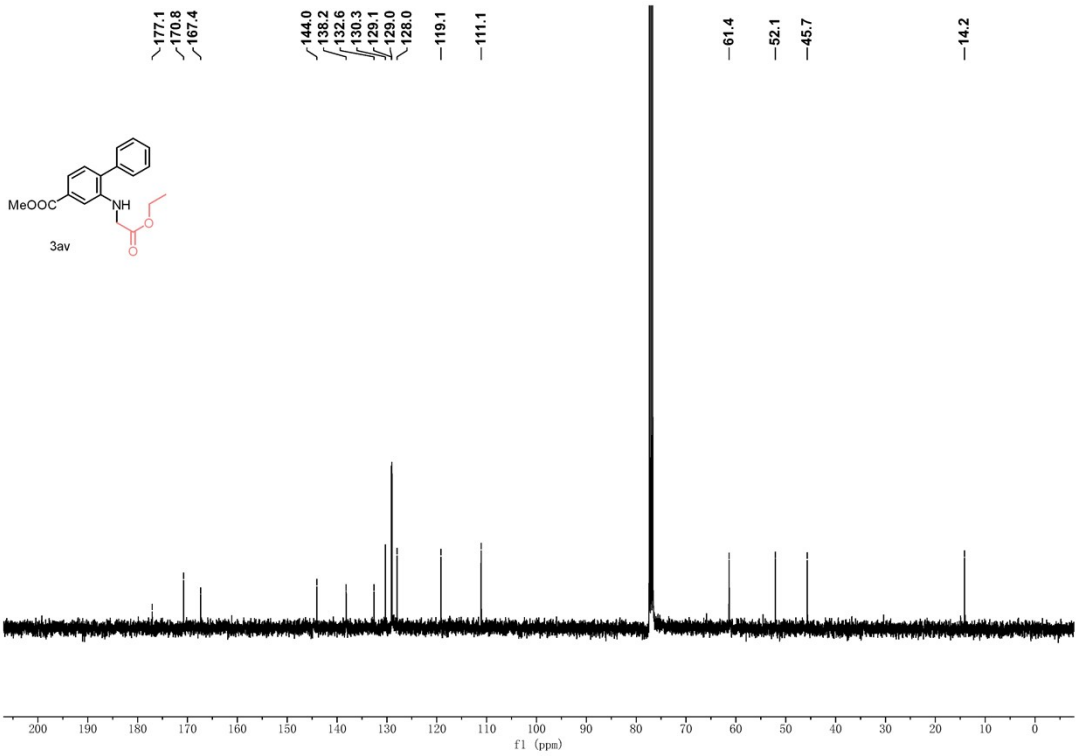
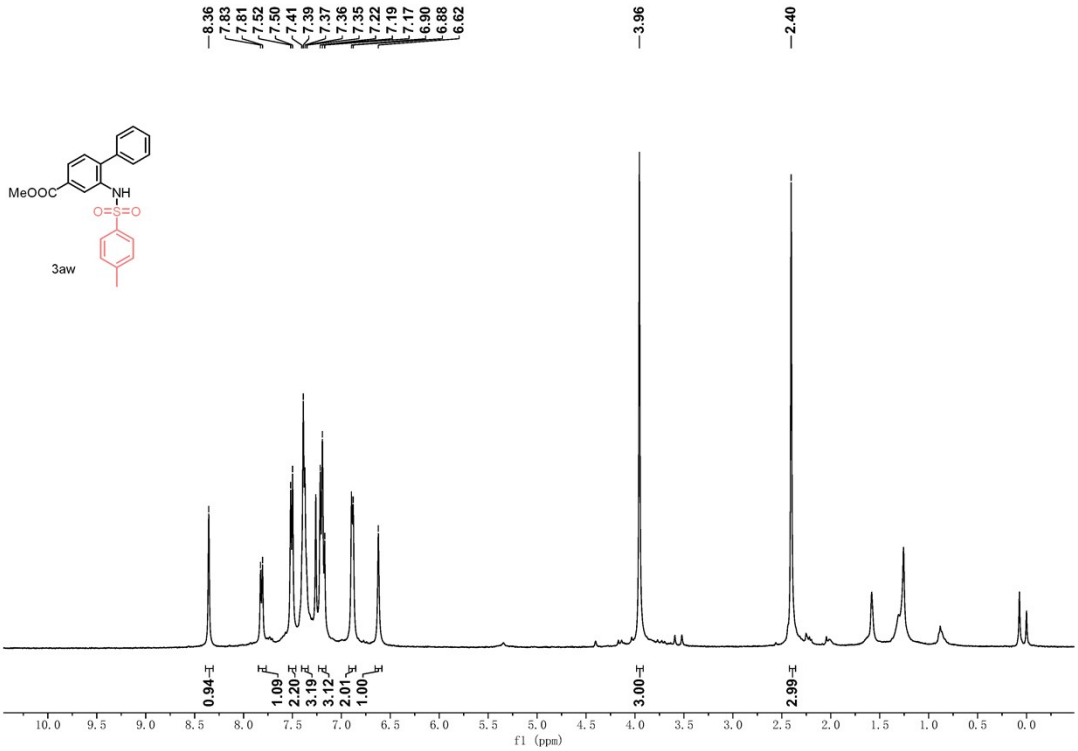
7.46
7.45
7.41
7.41
7.39
7.38
7.37
7.34
7.30
7.26
7.23
7.19
7.17
4.69
4.23
4.21
4.20
4.18
3.95
3.92
1.29
1.27
1.25
MeOOC
NH
O
O
3av
F (m) 7.40
E (h) 7.48
D (dd) 7.21
H (s) 4.69
A (q) 4.20
B (s) 3.92
G (s) 3.95
C (t) 1.27
5.03
1.11
2.33
0.76
2.00
1.87
2.89
3.15
f1 (ppm)


177.1
170.8
167.4
144.0
138.2
132.6
130.3
129.1
129.0
128.0
119.1
111.1
61.4
52.1
45.7
14.2
MeOOC
NH
O
O
3av
200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)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7.81
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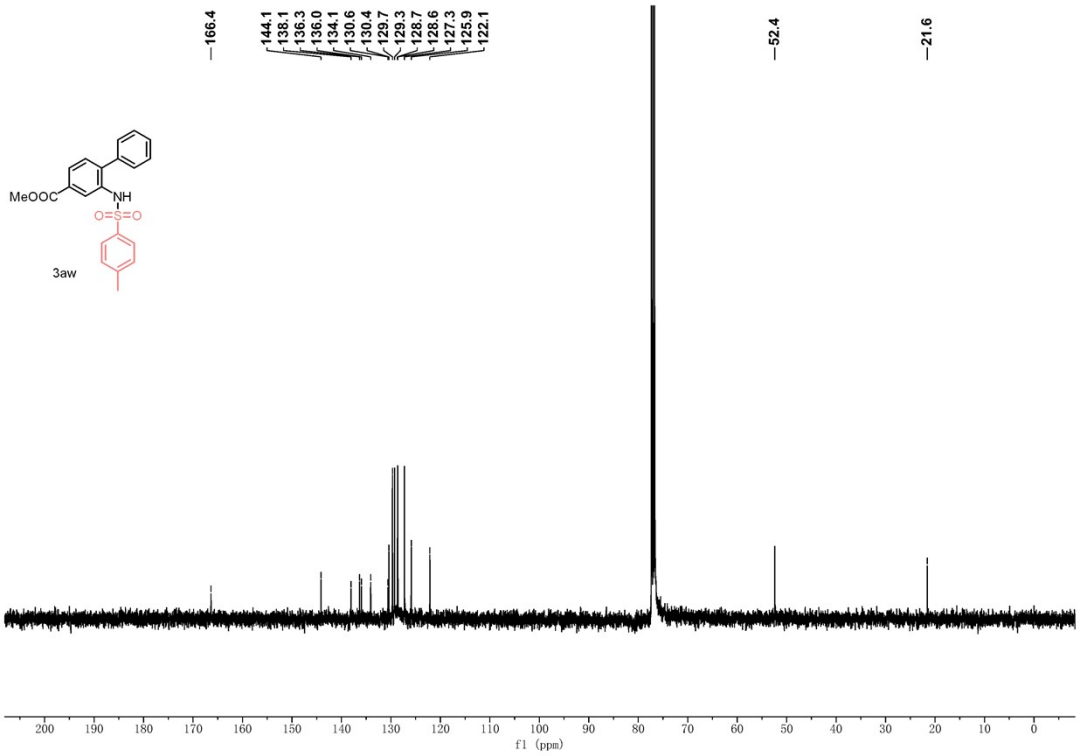
7.41
7.39
7.37
7.36
7.35
7.22
7.19
7.17
6.90
6.88
6.62
3.96
2.40
MeOOC
NH
O=S=O
3aw
0.94
1.09
2.20
3.19
3.12
2.01
1.00
3.00
2.99
10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)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134.1
130.6
130.4
129.7
129.3
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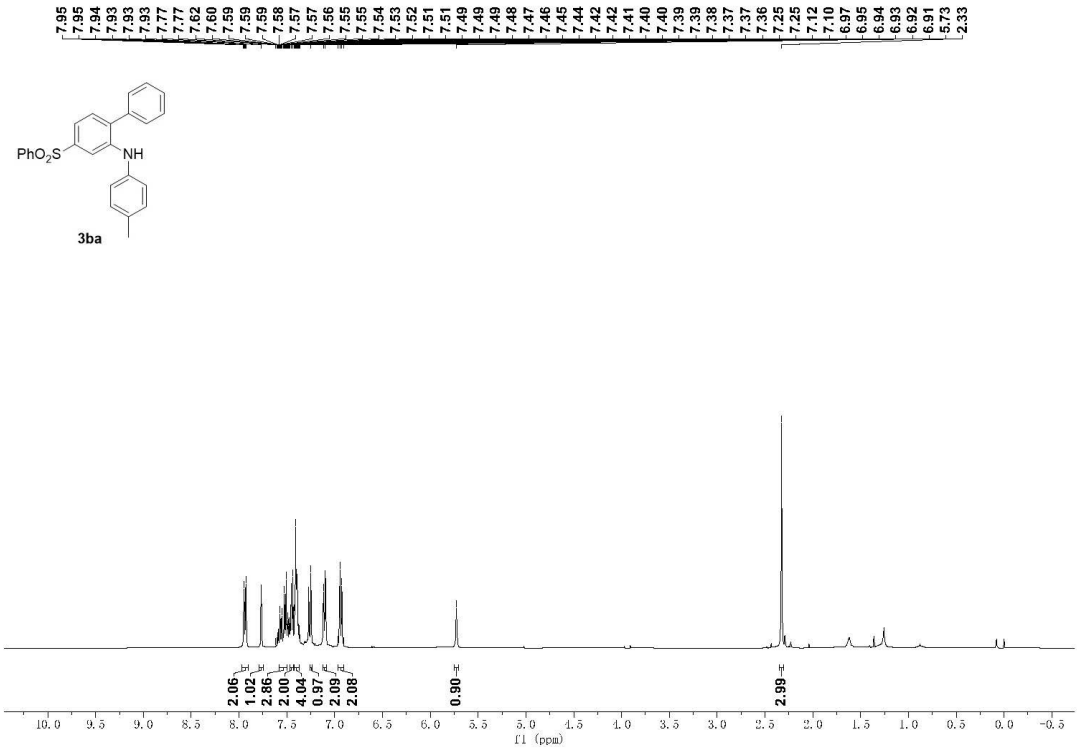
127.3
125.9
122.1
52.4
21.6
MeOOC
NH
O=S=O
3aw
f1 (ppm)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7.42
7.41
7.40
7.40
7.39
7.39
7.38
7.37
7.37
7.36
7.25
7.25
7.12
7.10
6.97
6.95
6.94
6.93
6.92
6.91
5.73
2.33
PhO2S
NH
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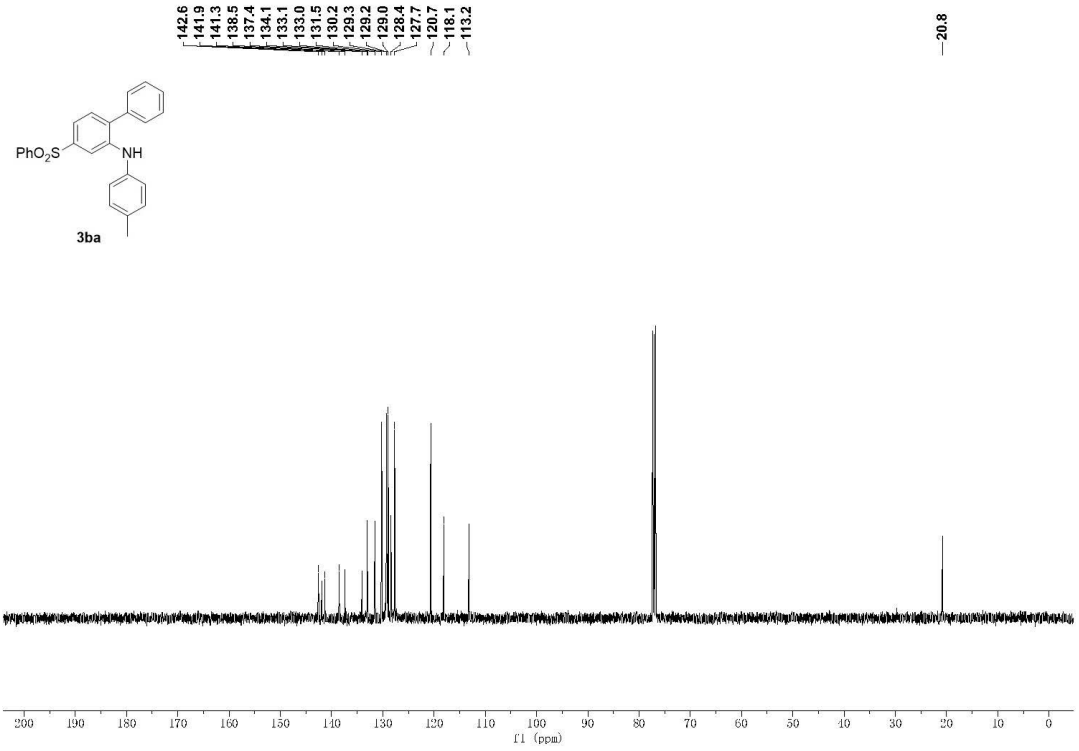
2.86
2.00
4.04
0.97
2.09
2.08
0.90
2.99
f1 (ppm)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133.1
133.0
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130.2
129.3
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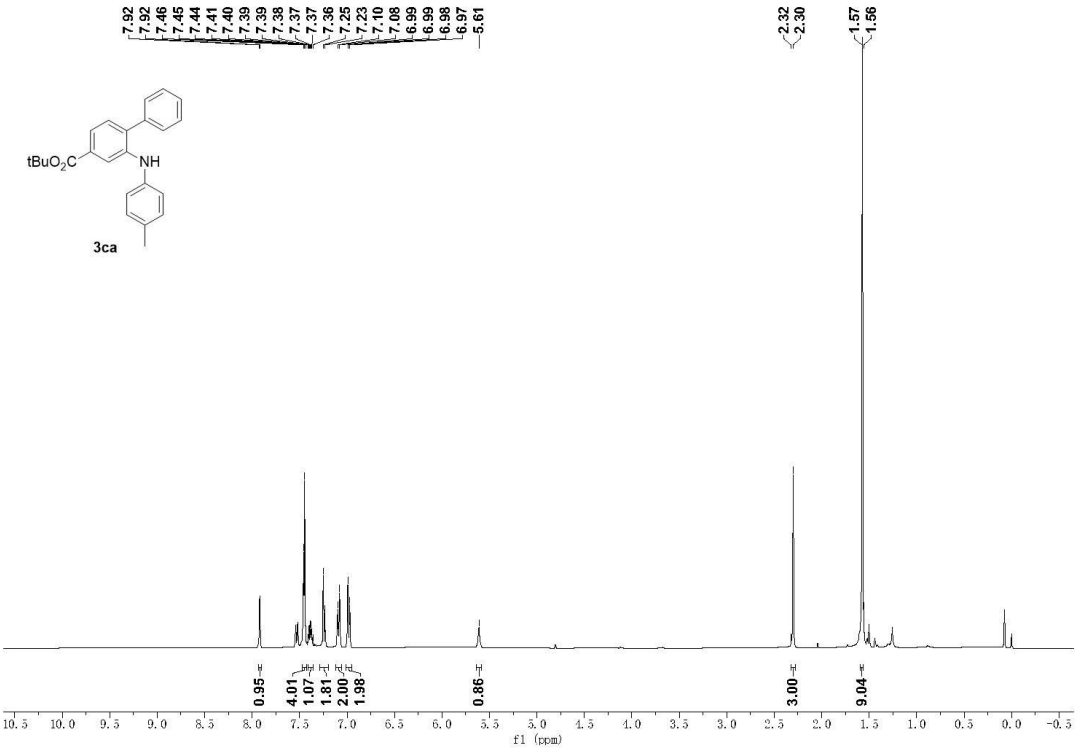
20.8
PhO2S
NH
3ba
f1 (ppm)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7.39
7.38
7.37
7.37
7.36
7.25
7.23
7.10
7.08
6.99
6.99
6.98
6.97
5.61
2.32
2.30
1.57
1.56
tBuO2C
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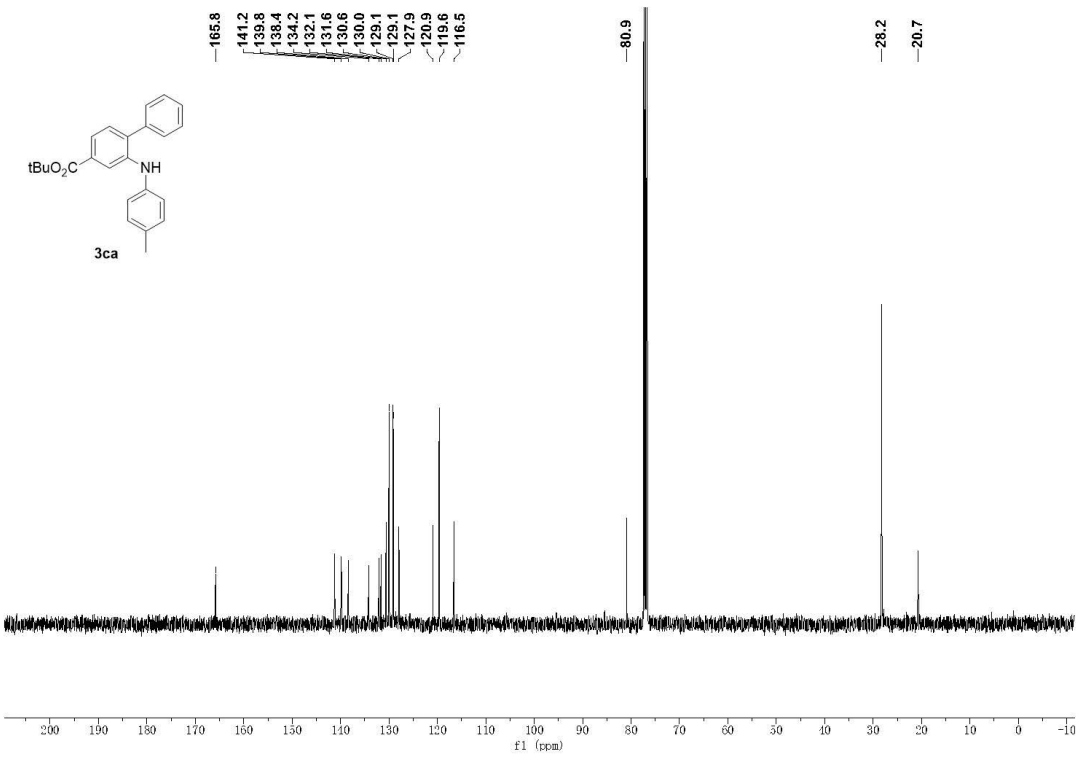
0.86
3.00
9.04
f1 (ppm)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132.1
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130.6
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129.1
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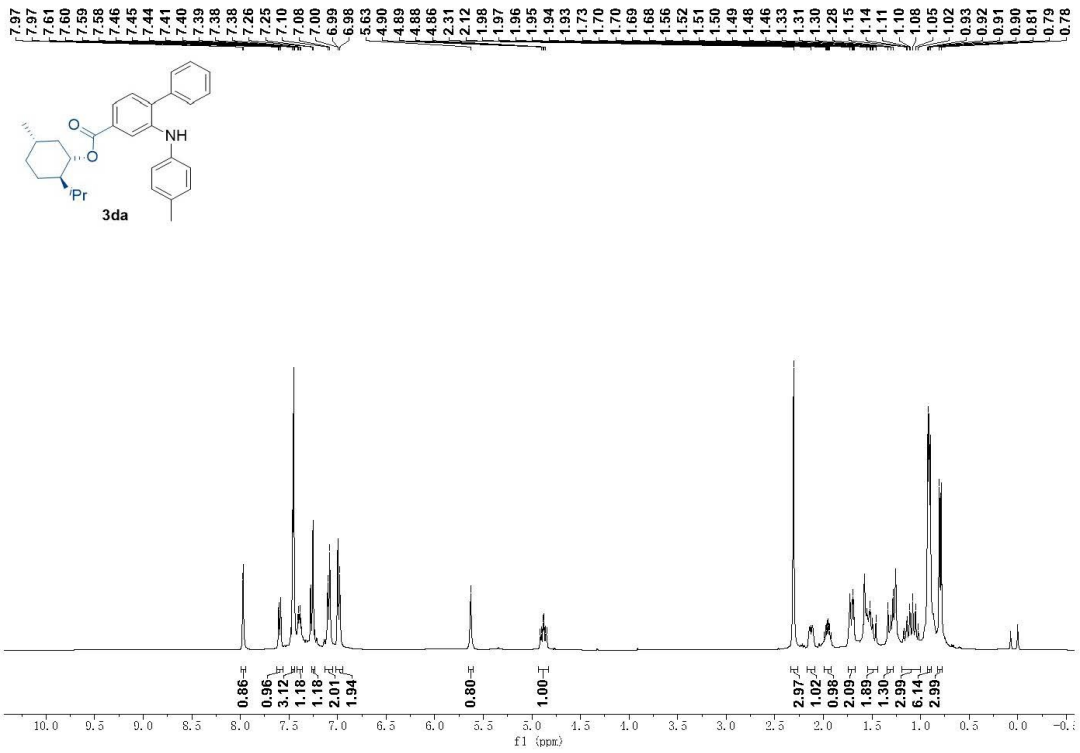
119.6
116.5
80.9
28.2
20.7
tBuO2C
NH
3ca
f1 (ppm)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7.40
7.39
7.38
7.38
7.26
7.25
7.10
7.08
7.00
6.99
6.98
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1.96
1.95
1.94
1.93
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1.49
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1.33
1.31
1.30
1.28
1.15
1.14
1.11
1.10
1.08
1.05
1.02
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0.91
0.90
0.81
0.79
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NH
iPr
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2.99
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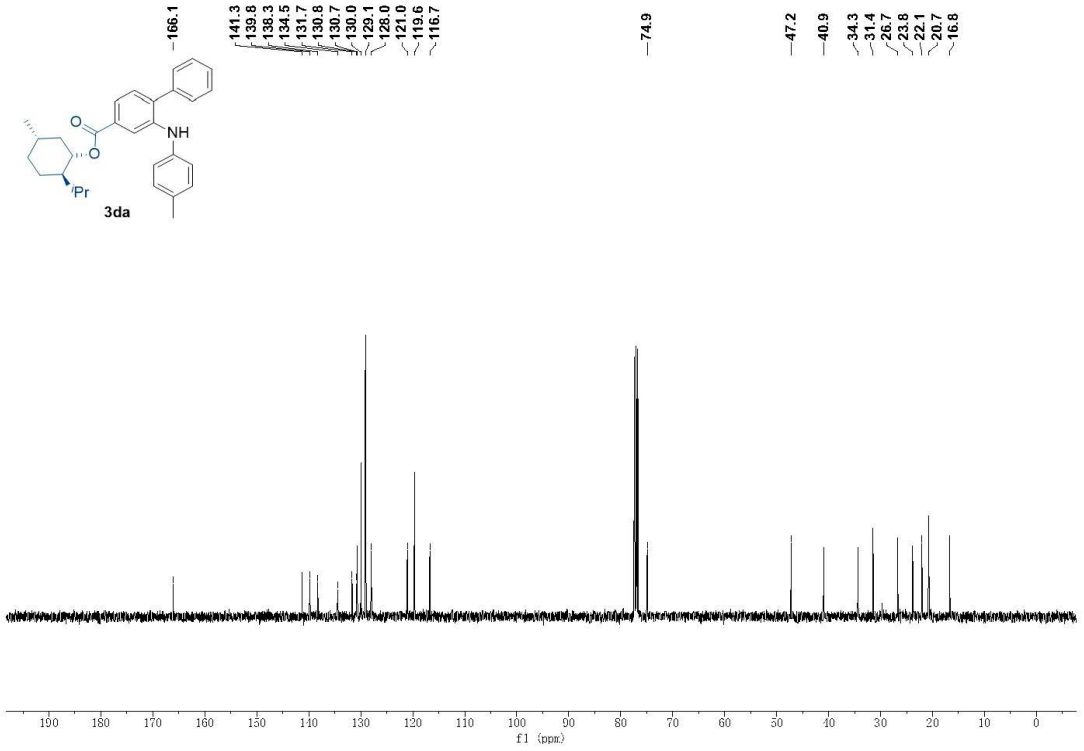
2.99
f1 (ppm)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130.7
130.0
129.1
128.0
121.0
119.6
116.7
74.9
47.2
40.9
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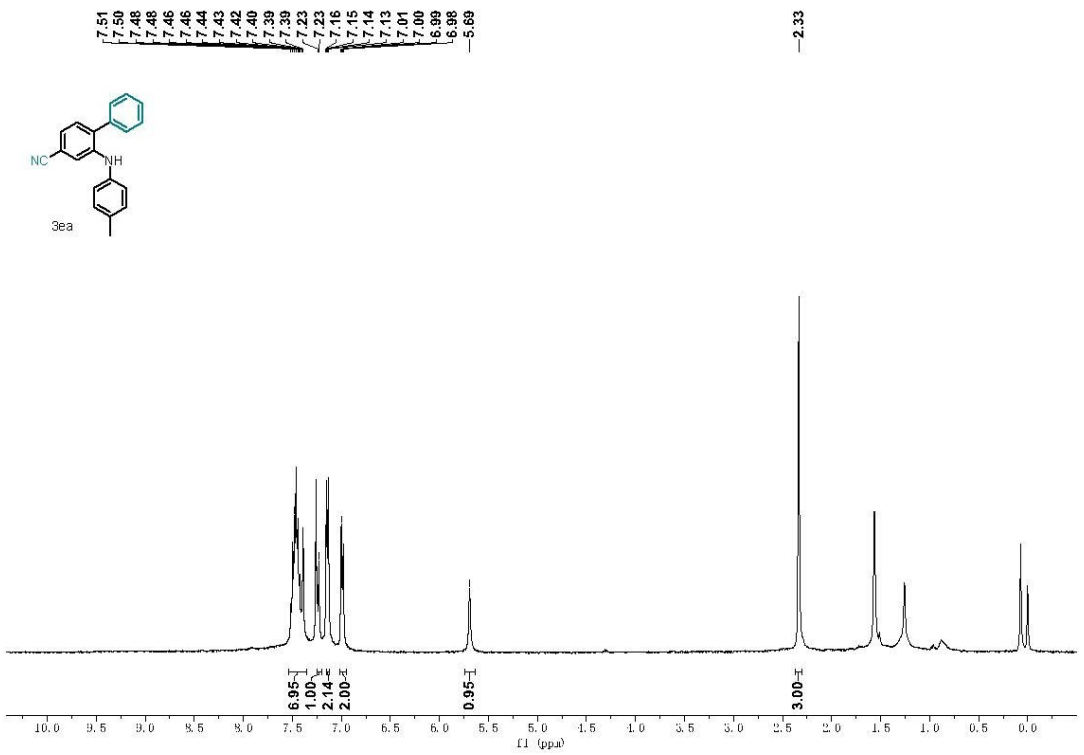
26.7
23.8
22.1
20.7
16.8
NH
O
O
iPr
3da
f1 (ppm)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7.16
7.15
7.14
7.13
7.01
7.00
6.99
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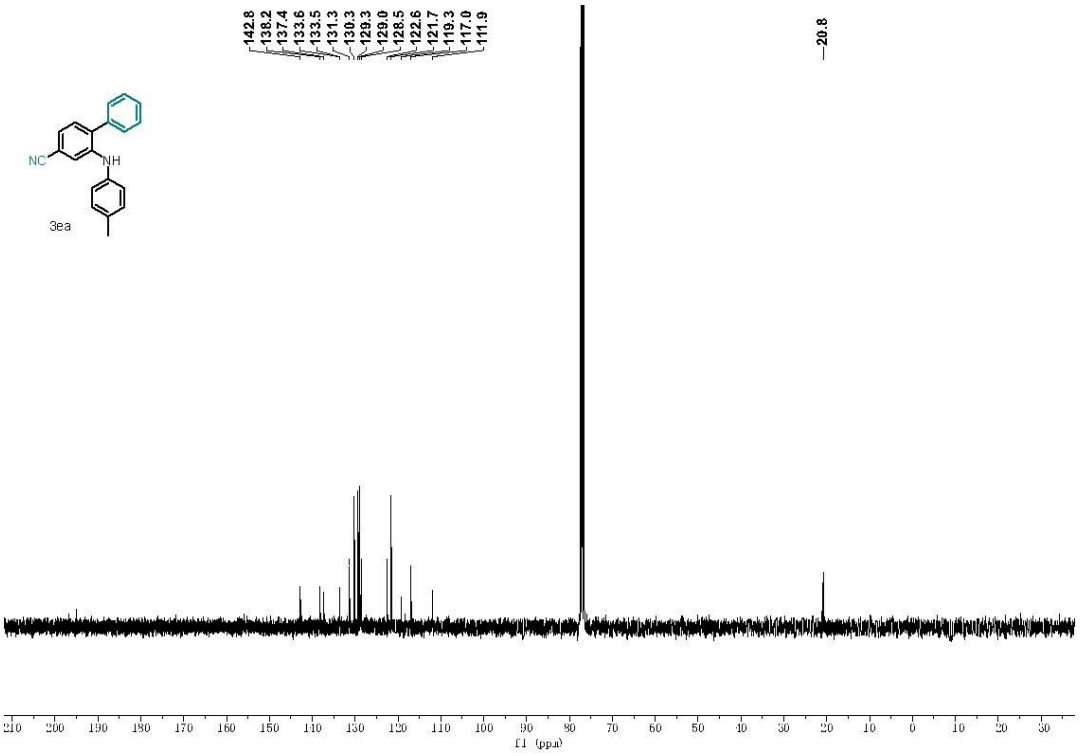
1.00
2.14
2.00
0.95
3.00
f1 (ppm)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130.3
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121.7
119.3
117.0
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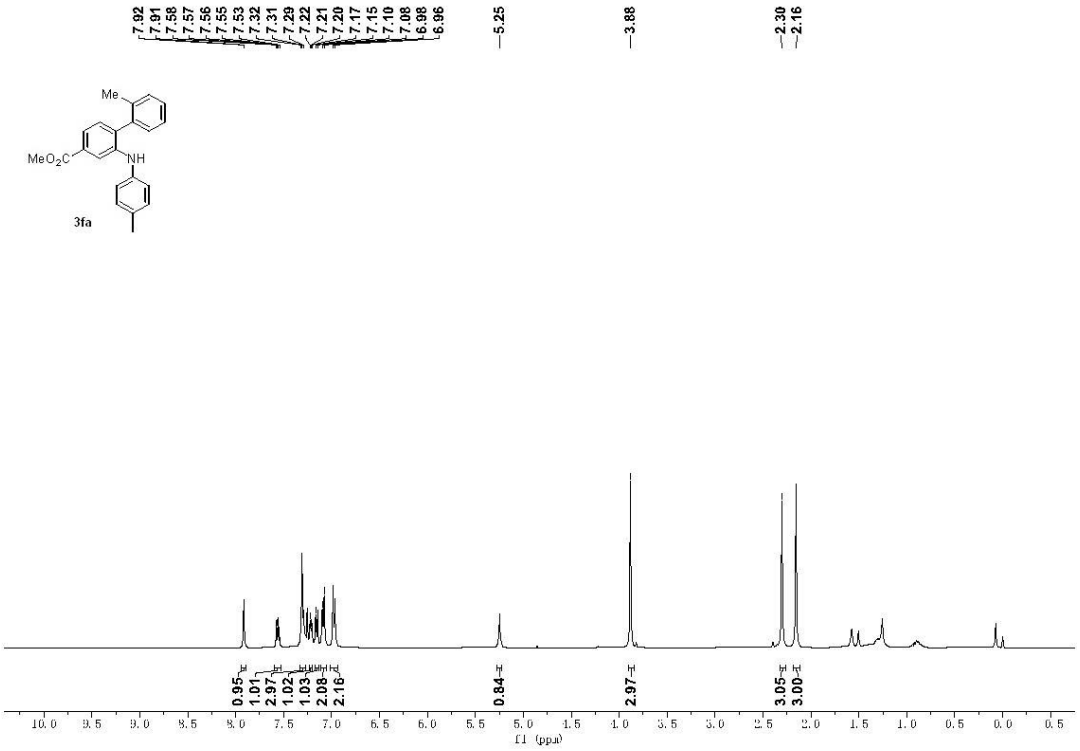
20.8
NC
NH
3ea
f1 (ppm)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7.29
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7.21
7.20
7.17
7.15
7.10
7.08
6.98
6.96
5.25
3.88
2.30
2.16
Me
MeO2C
NH
3fa
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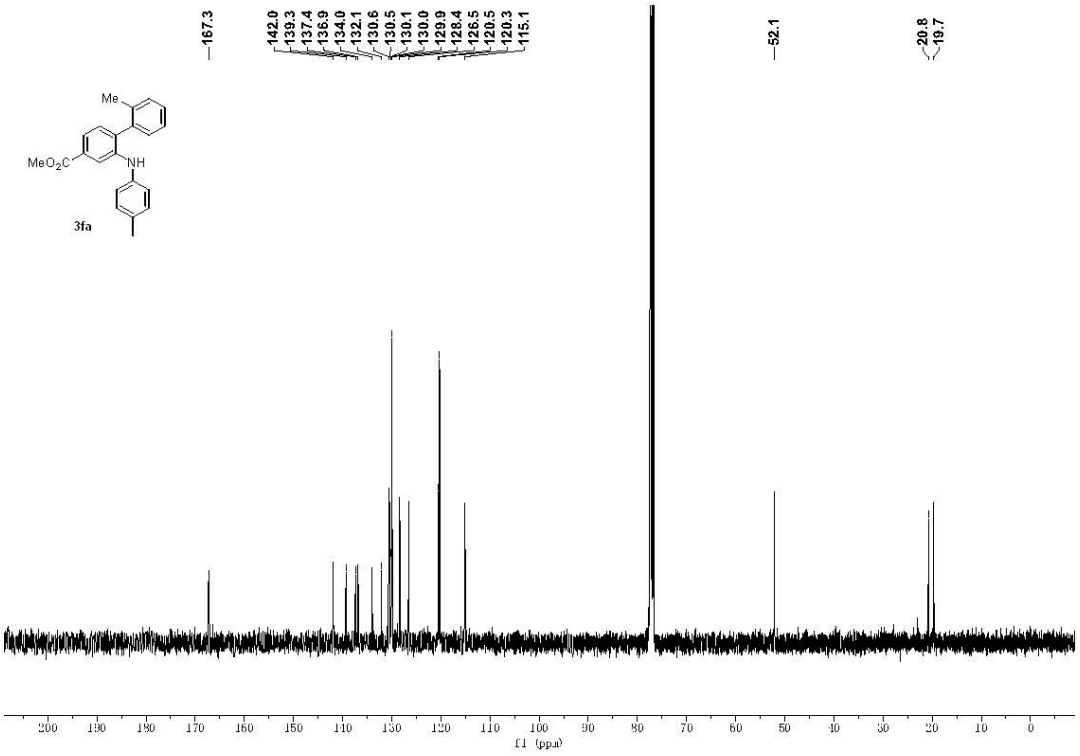
1.02
1.03
2.08
2.16
0.84
2.97
3.05
3.00
f1 (ppm)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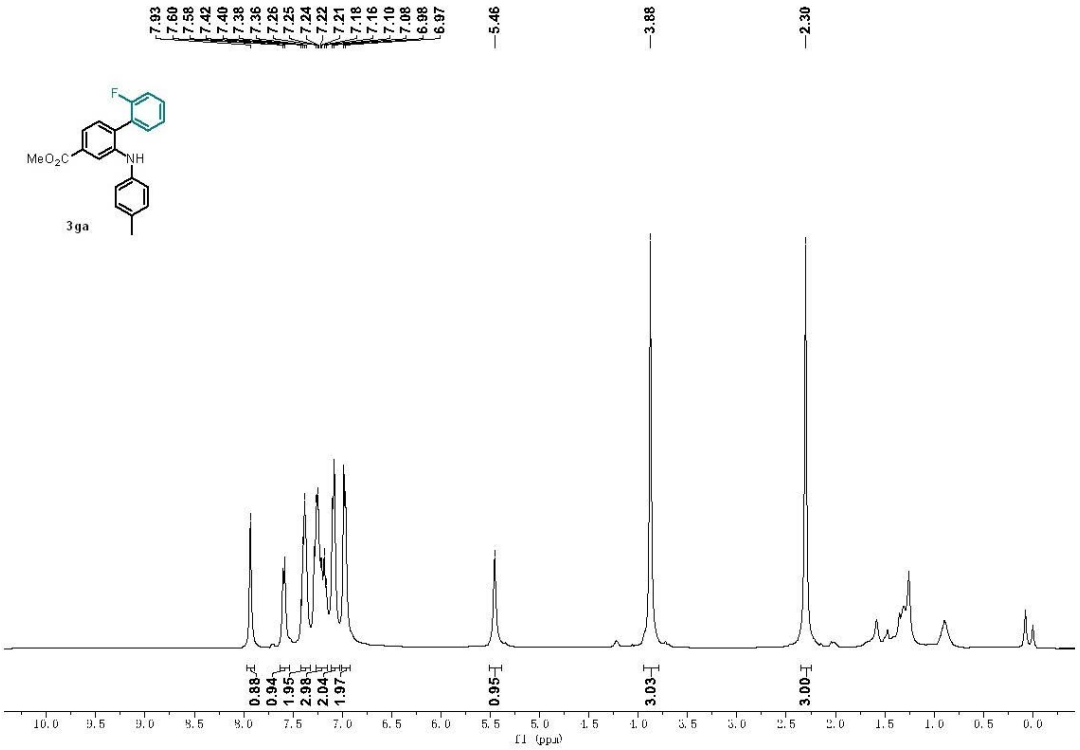
134.0
132.1
130.6
130.5
130.1
130.0
129.9
128.4
126.5
120.5
120.3
115.1
52.1
20.8
19.7
Me
MeO2C
NH
3fa
f1 (ppm)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7.24
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7.21
7.18
7.16
7.10
7.08
6.98
6.97
5.46
3.88
2.30
F
MeO2C
NH
3ga
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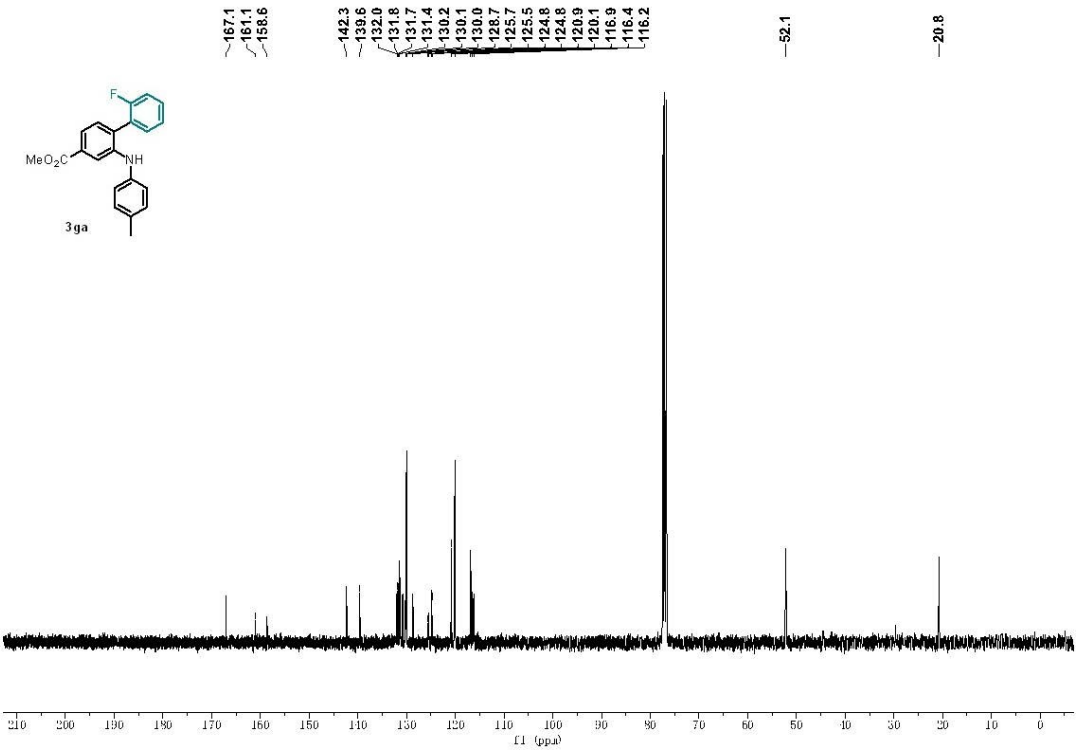
0.94
1.95
2.98
2.04
1.97
0.95
3.03
3.00
f1 (ppm)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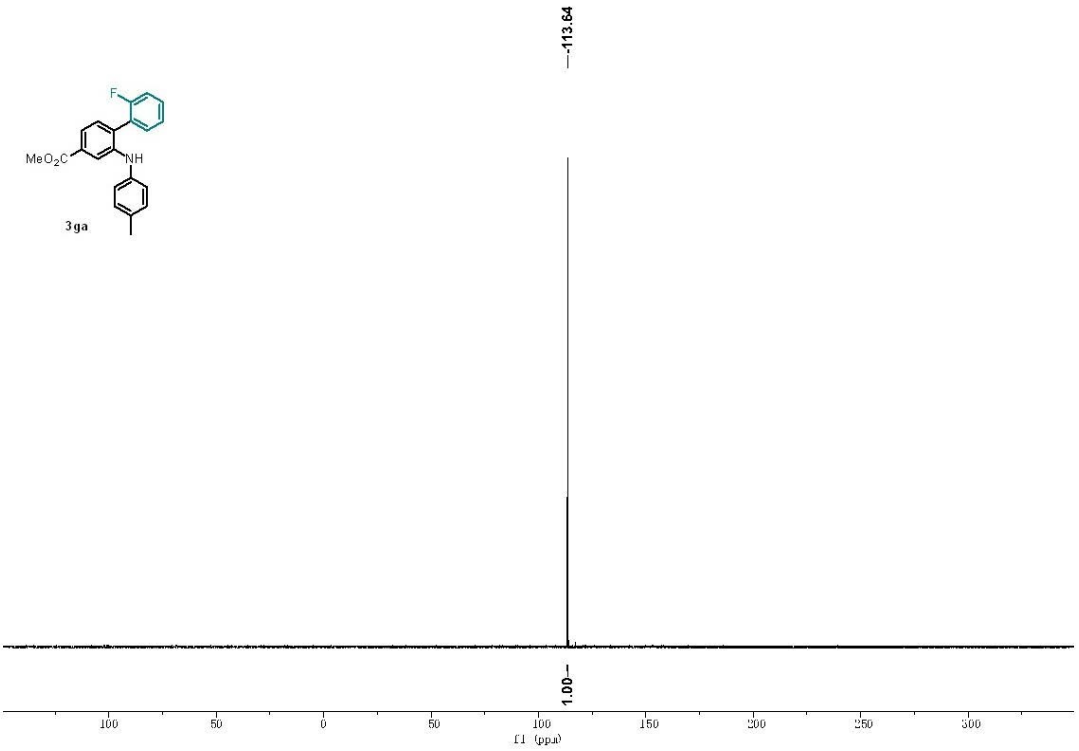
128.7
125.7
125.5
124.8
124.8
120.9
120.1
116.9
116.4
116.2
52.1
20.8
F
MeO2C
NH
3ga
f1 (ppm)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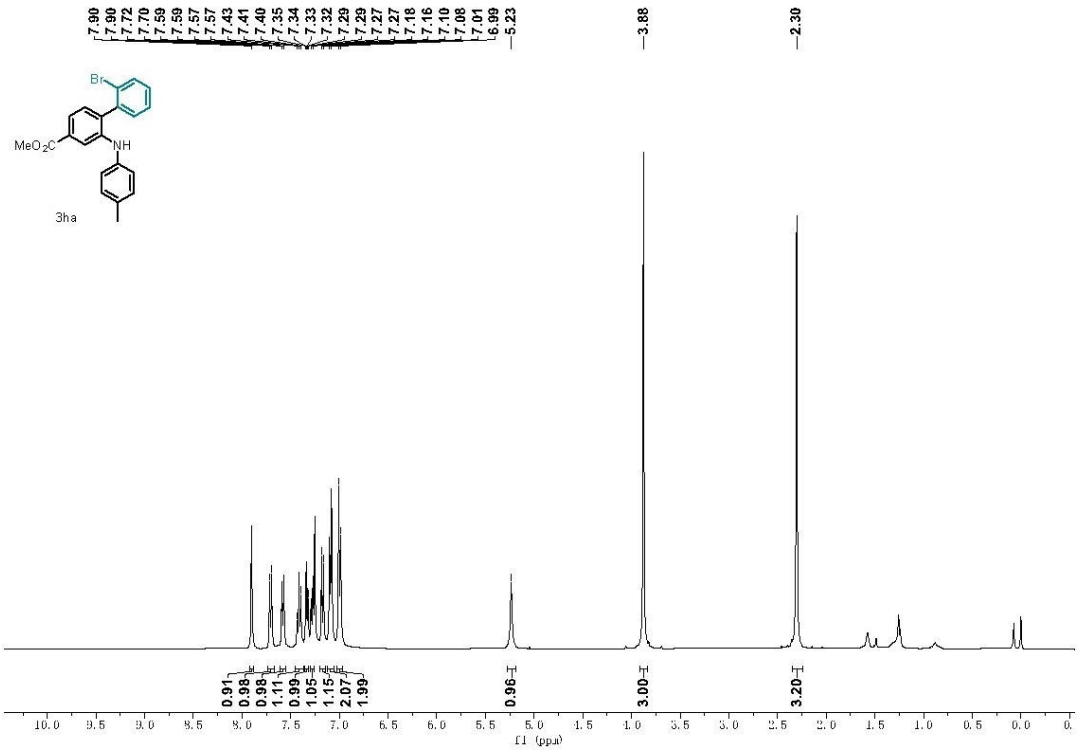
f1 (ppm)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7.33
7.32
7.29
7.29
7.27
7.27
7.18
7.16
7.10
7.08
7.01
6.99
5.23
3.88
2.30
Br
MeO2C
NH
3ha
0.91
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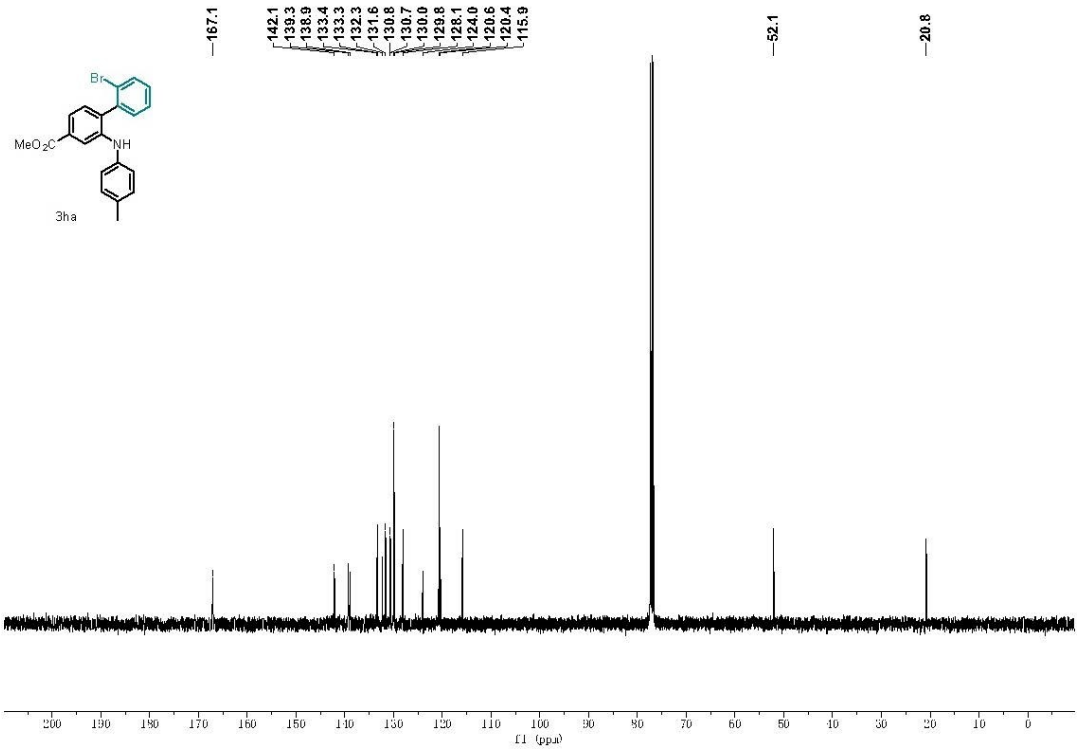
3.20
f1 (ppm)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131.6
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130.7
130.0
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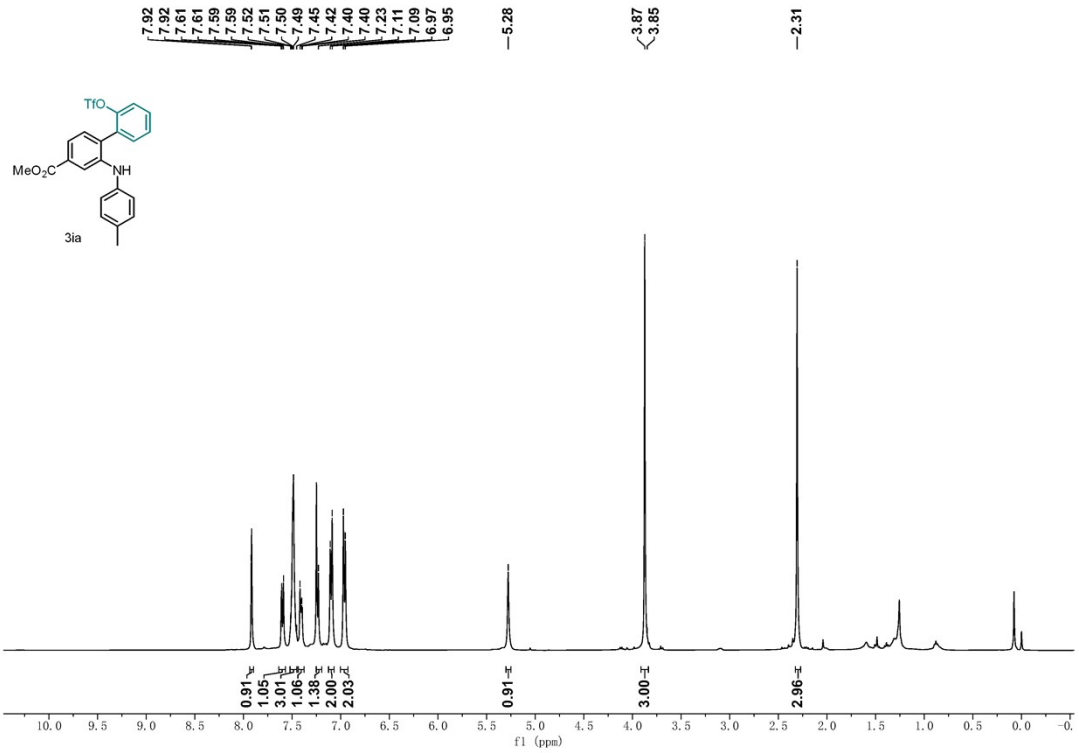
120.4
115.9
52.1
20.8
Br
MeO2C
NH
3ha
f1 (ppm)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7.45
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7.40
7.40
7.23
7.11
7.09
6.97
6.95
5.28
3.87
3.85
2.31
TfO
MeO2C
NH
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3.01
1.06
1.38
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0.91
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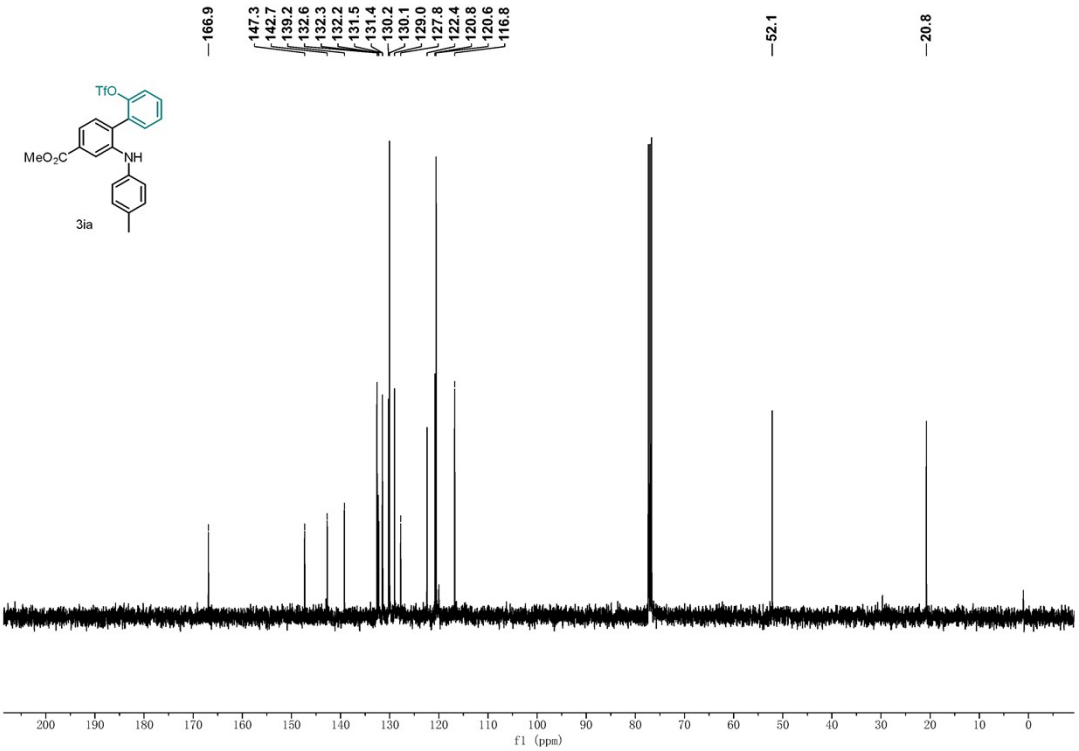
2.96
f1 (ppm)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130.1
129.0
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120.6
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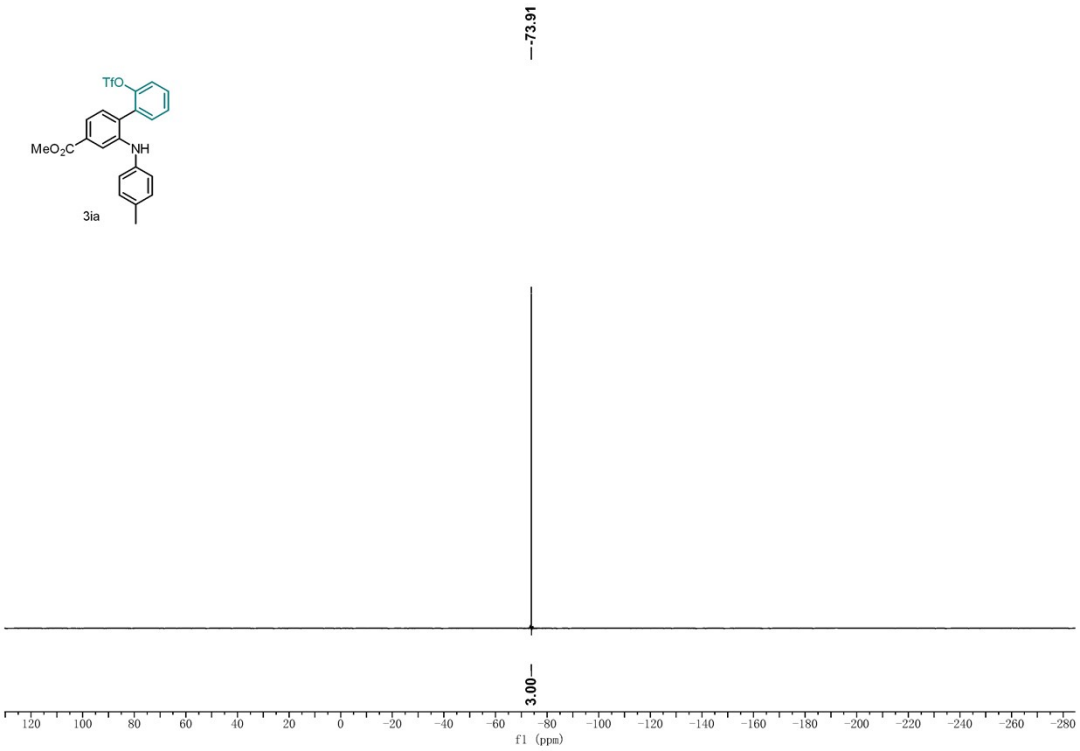
52.1
20.8
TfO
MeO2C
NH
3ia
f1 (ppm)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TfO
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NH
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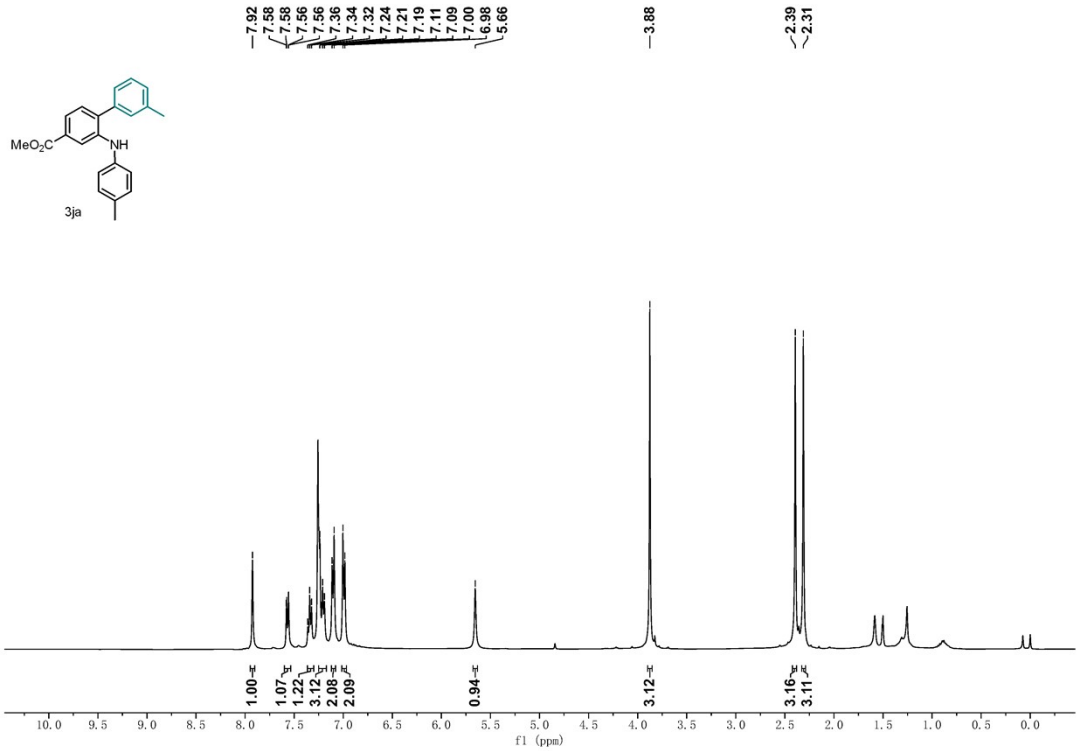
3.00
120 100 80 60 40 20 0 -20 -40 -60 -80 -100 -120 -140 -160 -180 -200 -220 -240 -260 -280
f1 (ppm)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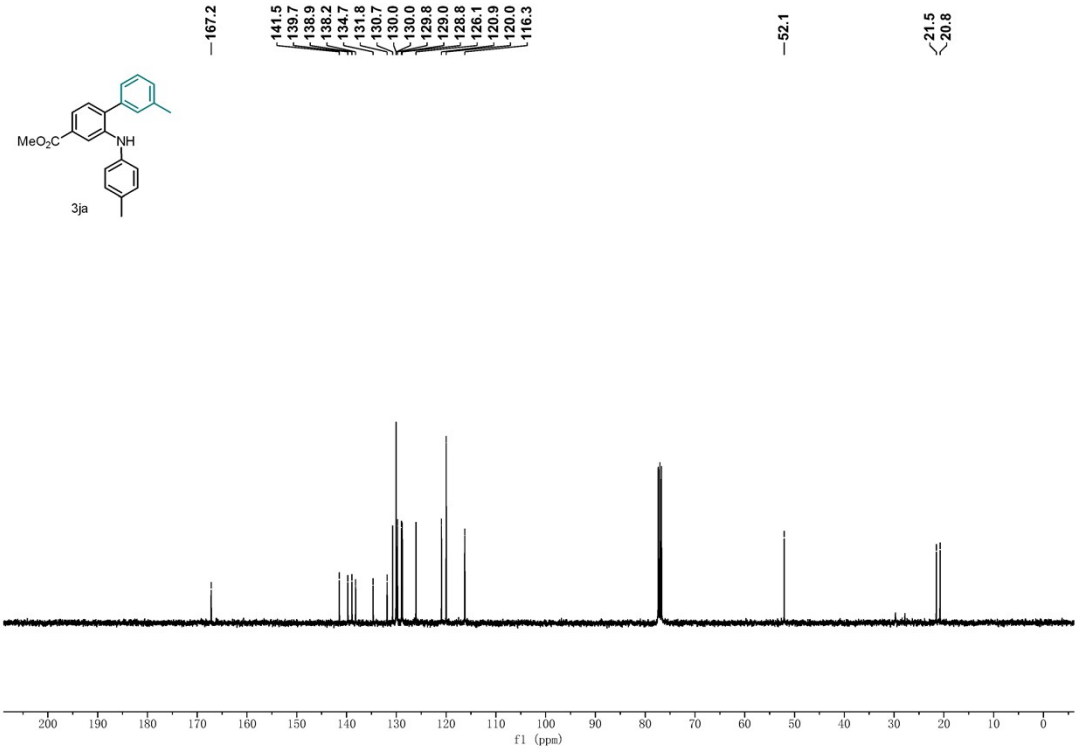
7.21
7.19
7.11
7.09
7.00
6.98
5.66
3.88
2.39
2.31
MeO2C
NH
3ja
1.00
1.07
1.22
3.12
2.08
2.09
0.94
3.12
3.16
3.11
10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)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20.8
MeO2C
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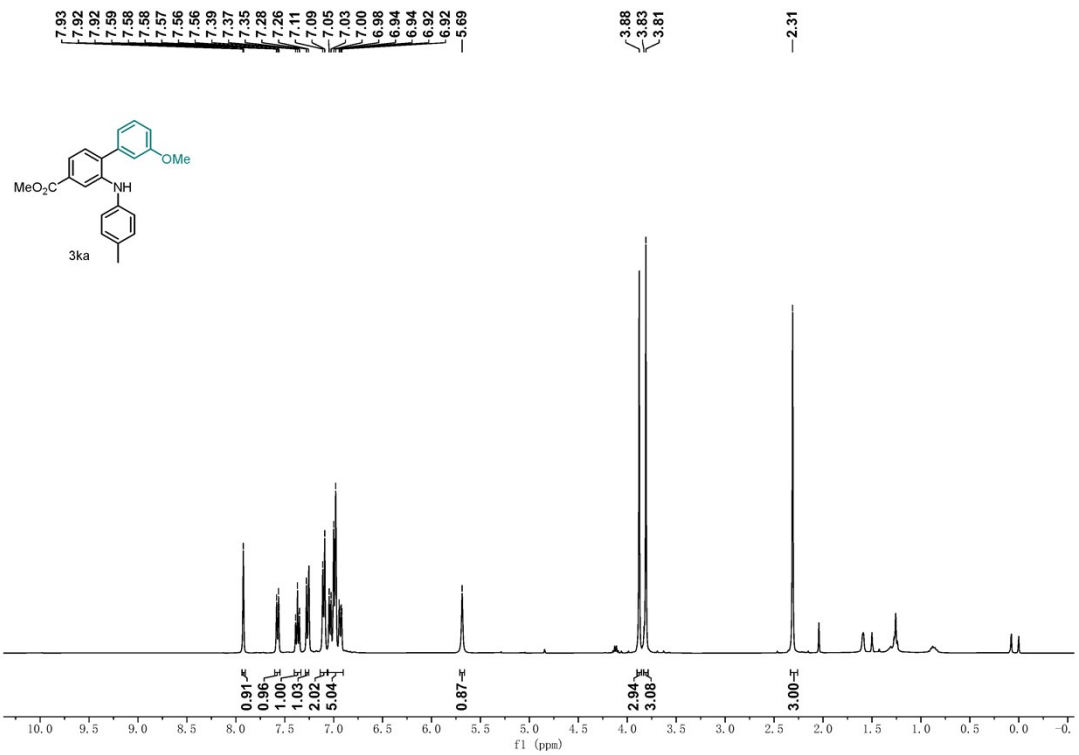
3ja
f1 (ppm)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6.94
6.94
6.92
6.92
5.69
3.88
3.83
3.81
2.31
OMe
MeO2C
NH
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1.03
2.02
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2.94
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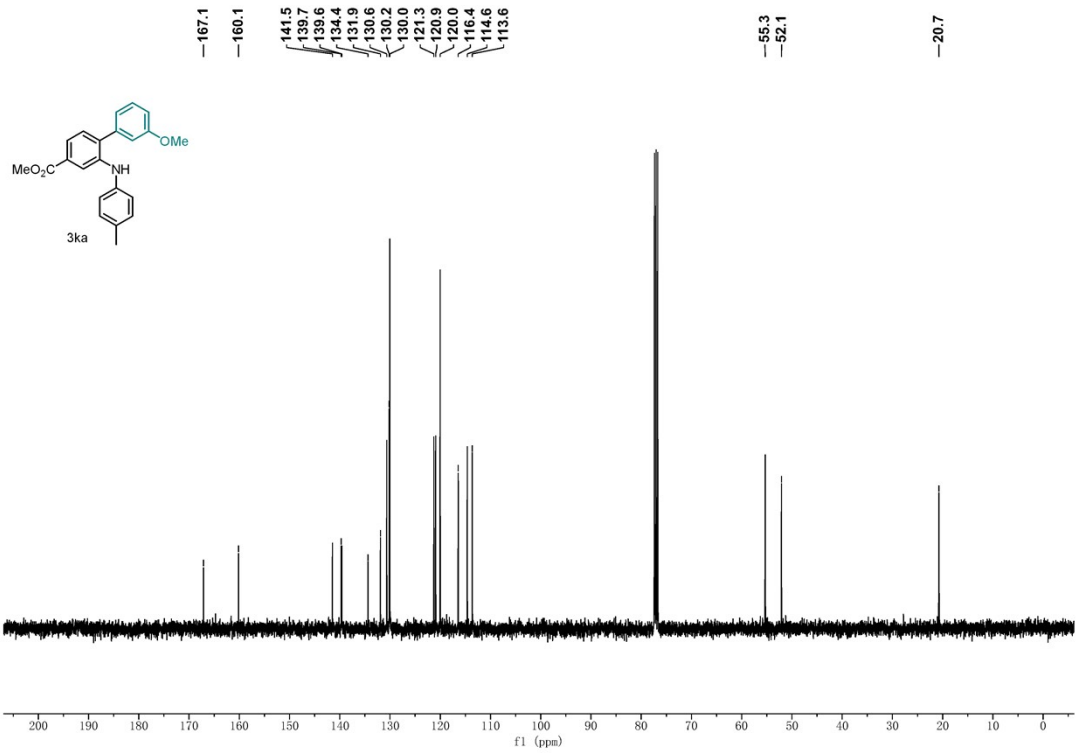
3.00
f1 (ppm)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120.9
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114.6
113.6
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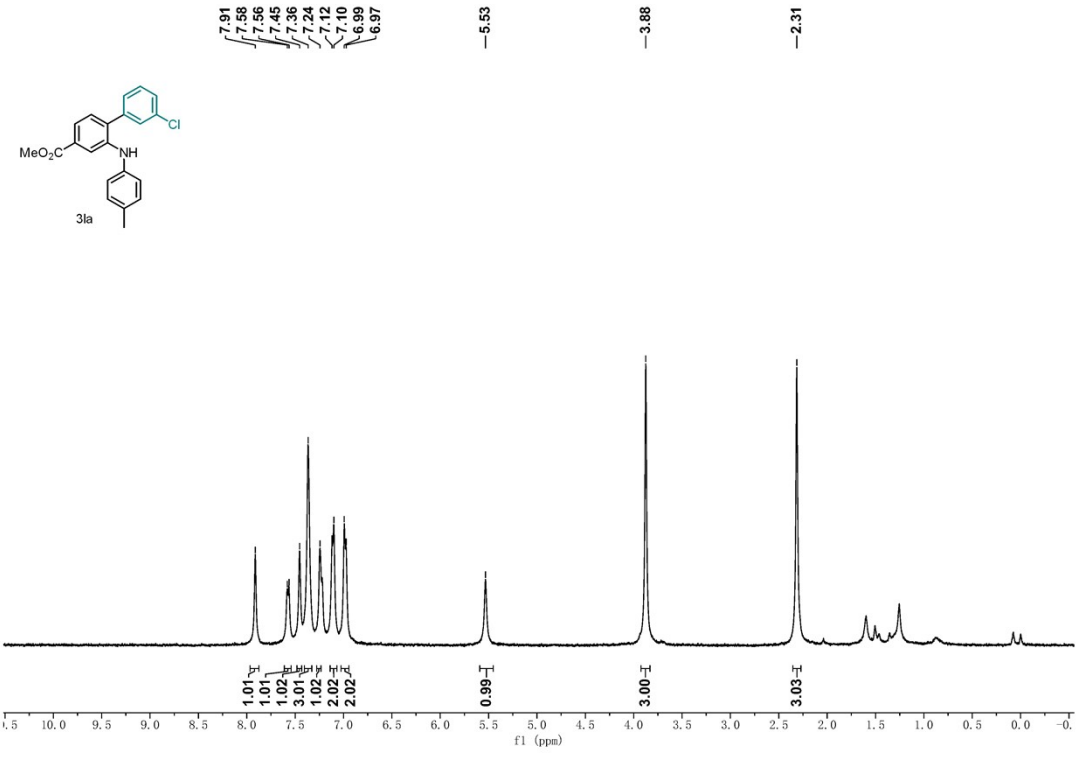
OMe
MeO2C
NH
3ka
f1 (ppm)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5.53
3.88
2.31
Cl
MeO2C
NH
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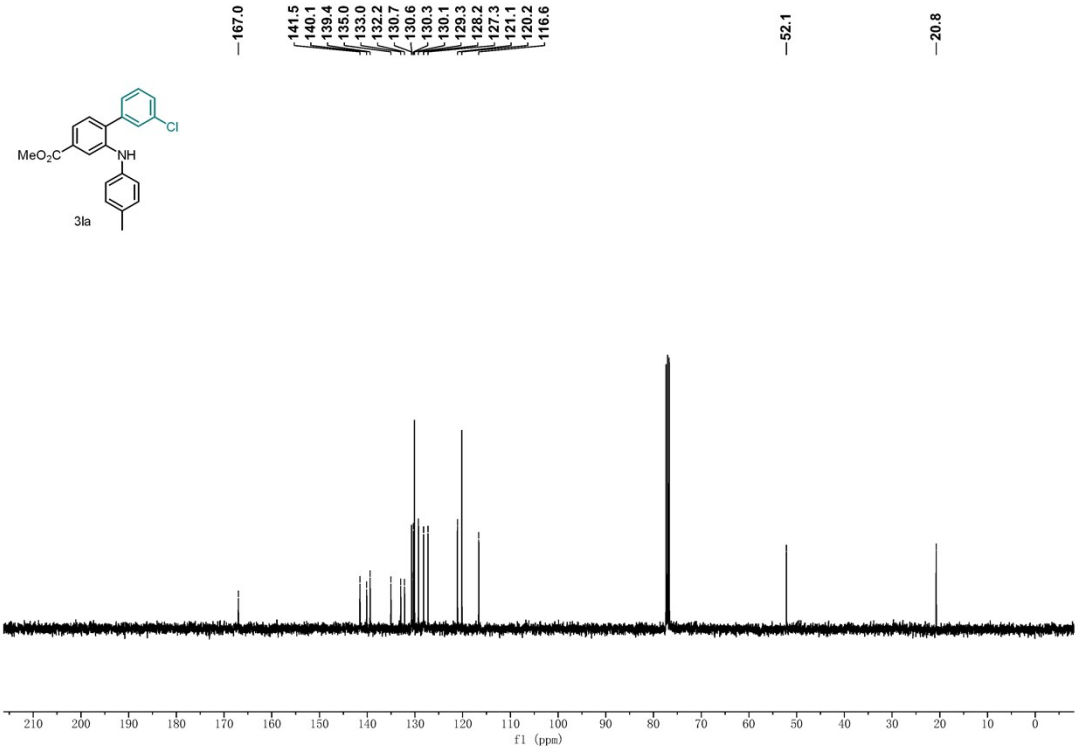
1.02
3.01
1.02
2.02
2.02
0.99
3.00
3.03
f1 (ppm)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130.1
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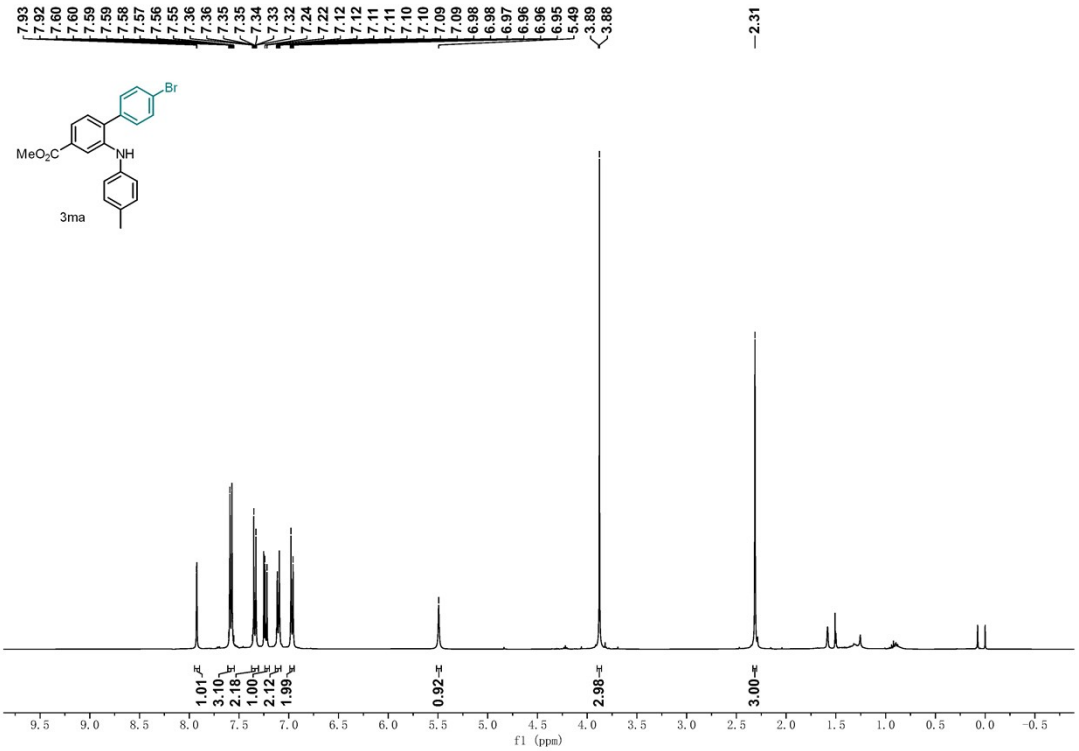
121.1
120.2
116.6
52.1
20.8
Cl
MeO2C
NH
3la
f1 (ppm)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7.11
7.10
7.10
7.09
7.09
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6.98
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3.88
2.31
Br
MeO2C
NH
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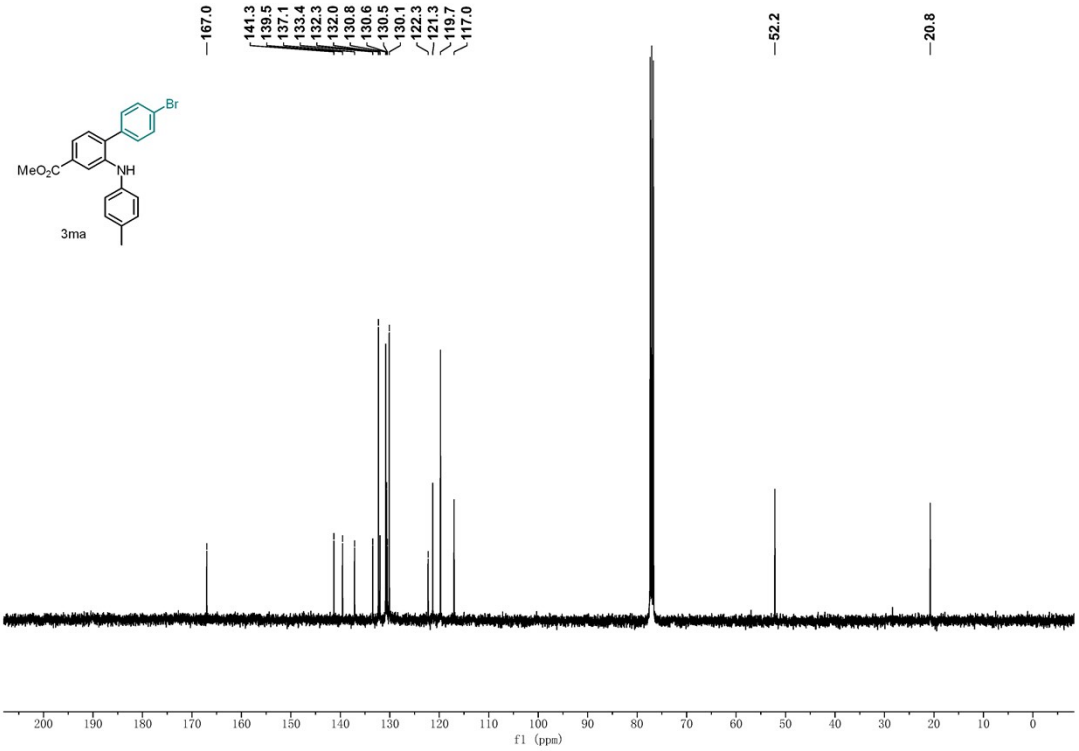
2.18
1.00
2.12
1.99
0.92
2.98
3.00
f1 (ppm)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130.6
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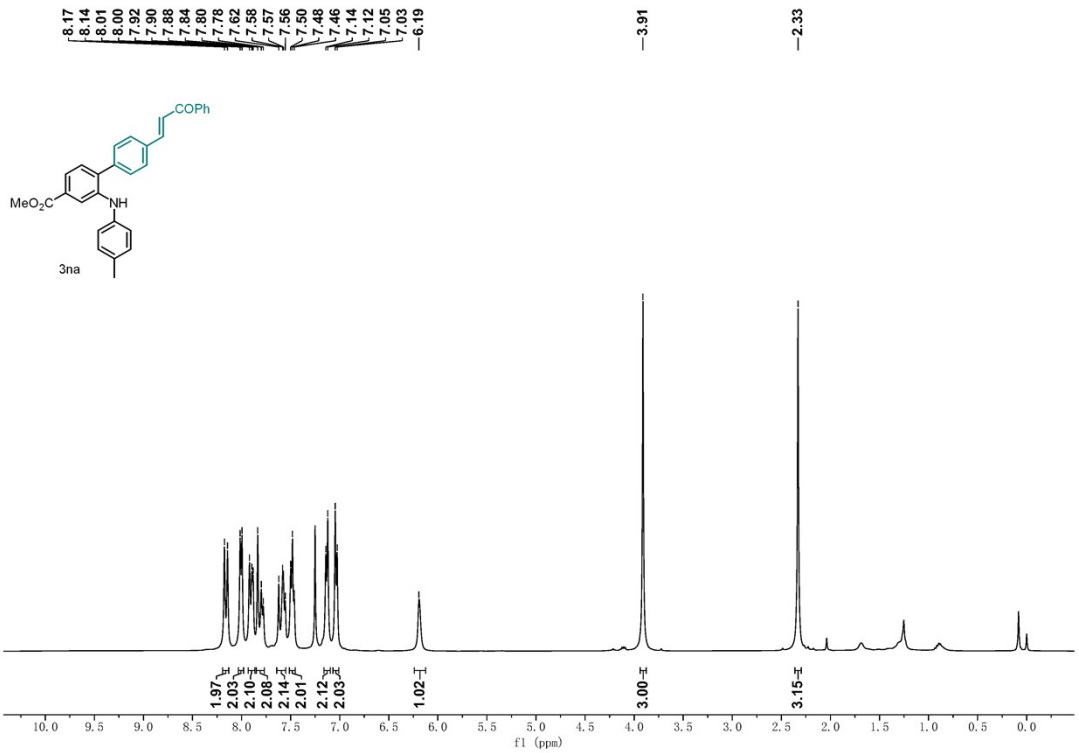
121.3
119.7
117.0
52.2
20.8
Br
MeO2C
NH
3ma
f1 (ppm)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7.56
7.50
7.48
7.46
7.14
7.12
7.05
7.03
6.19
3.91
2.33
COPh
MeO2C
NH
3na
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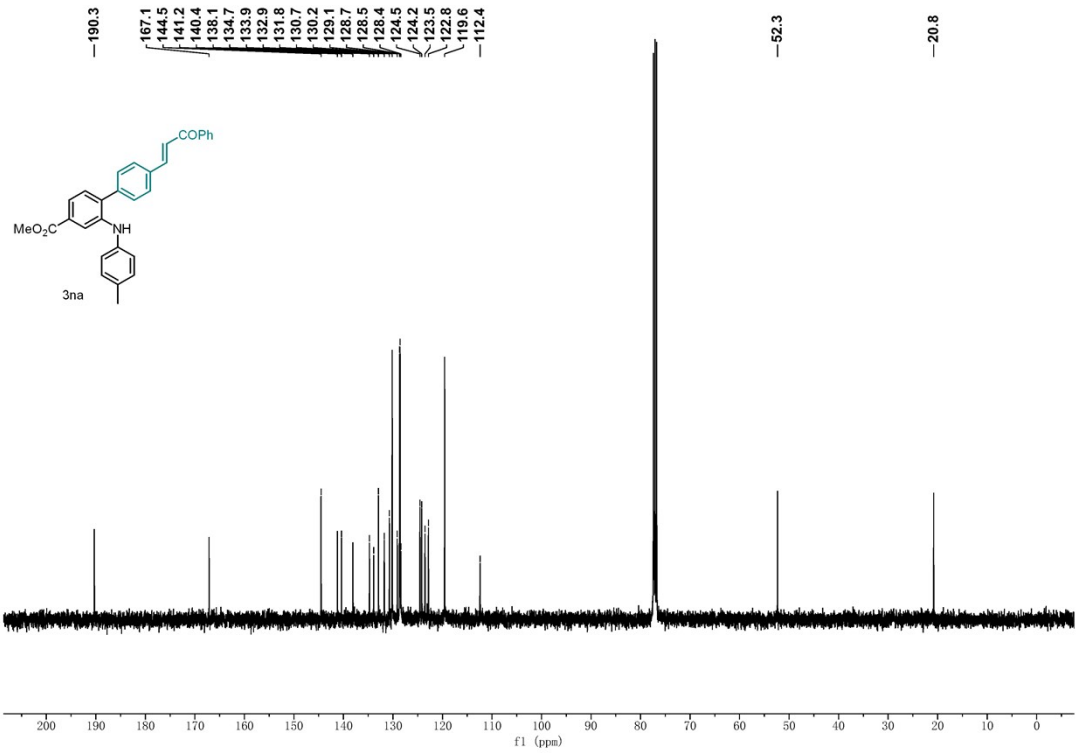
2.10
2.08
2.14
2.01
2.12
2.03
1.02
3.00
3.15
f1 (ppm)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132.9
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130.2
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128.7
128.5
128.4
124.5
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122.8
119.6
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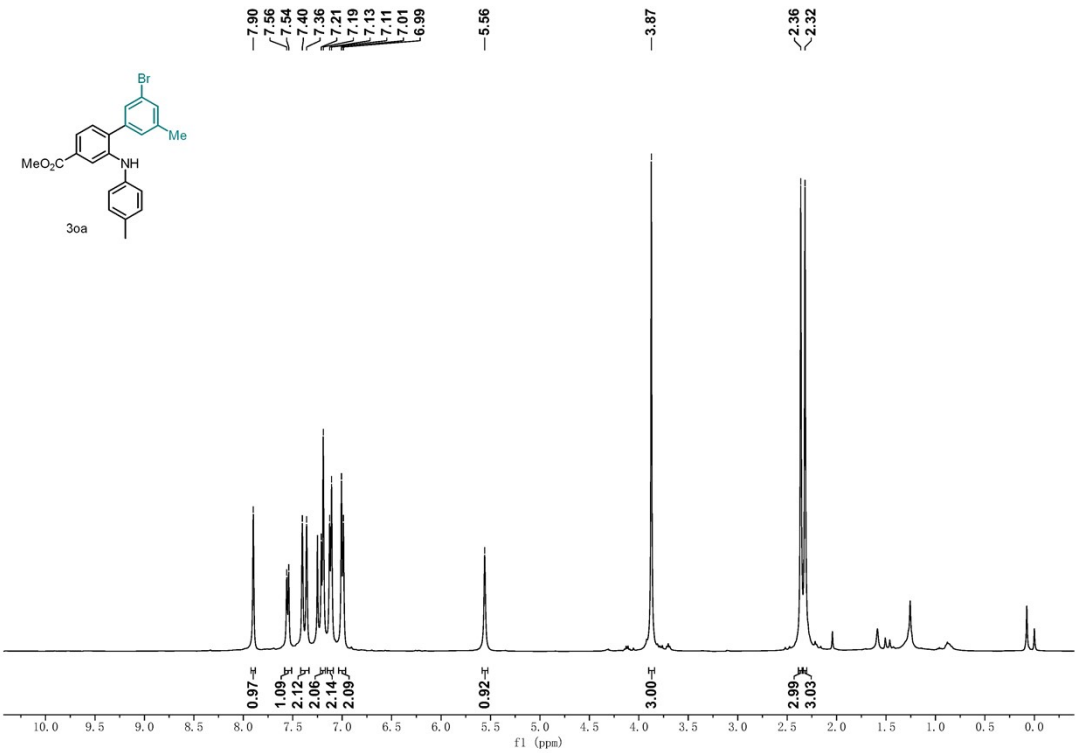
20.8
COPh
MeO2C
NH
3na
f1 (ppm)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2.36
2.32
Br
Me
MeO2C
NH
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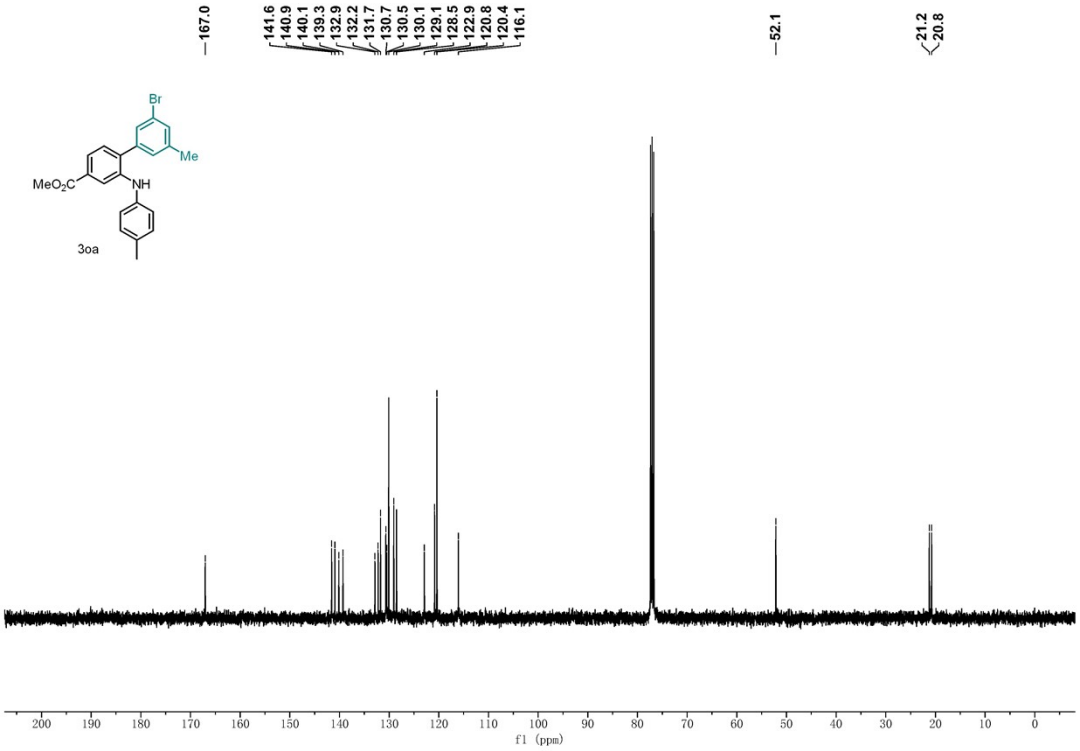
2.12
2.06
2.14
2.09
0.92
3.00
2.99
3.03
f1 (ppm)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130.1
129.1
128.5
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120.4
116.1
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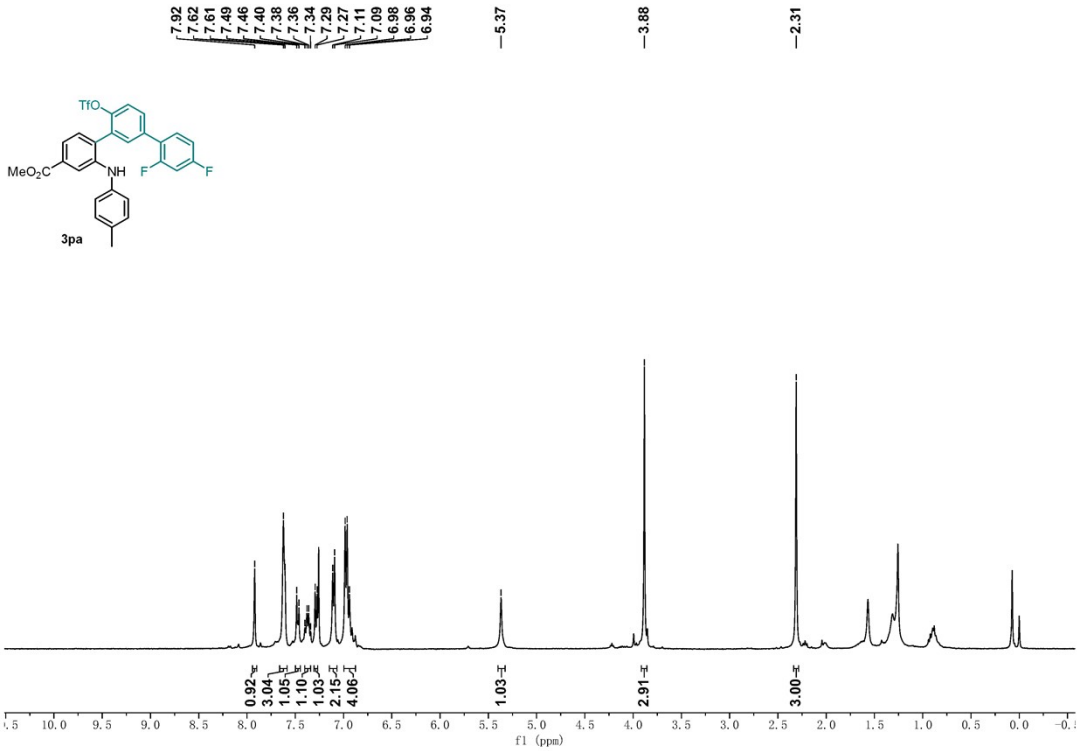
21.2
20.8
Br
Me
MeO2C
NH
3oa
f1 (ppm)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7.11
7.09
6.98
6.96
6.94
5.37
3.88
2.31
TfO
MeO2C
NH
F
F
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1.10
1.03
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4.06
1.03
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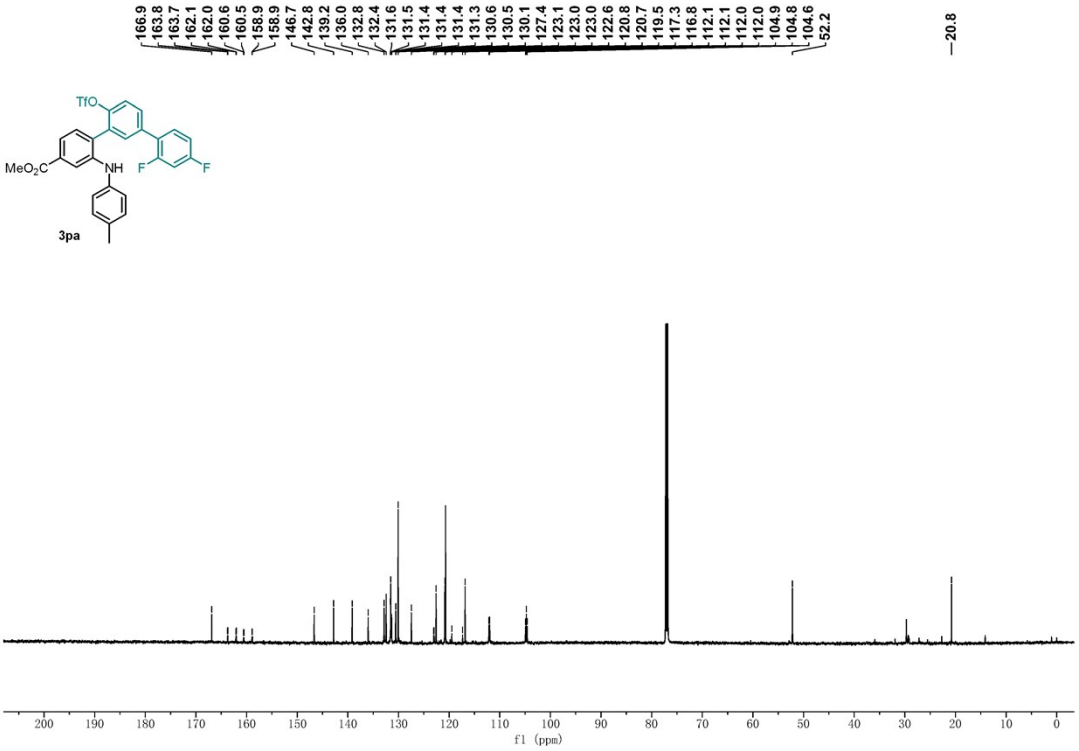
3.00
f1 (ppm)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132.4
131.6
131.5
131.4
131.4
131.4
131.3
130.6
130.5
130.1
127.4
123.1
123.0
123.0
122.6
120.8
120.7
119.5
117.3
116.8
112.1
112.1
112.0
112.0
104.9
104.8
104.6
52.2
20.8
TfO
MeO2C
NH
F
F
3pa
200
190
180
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110
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90
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70
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50
40
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10
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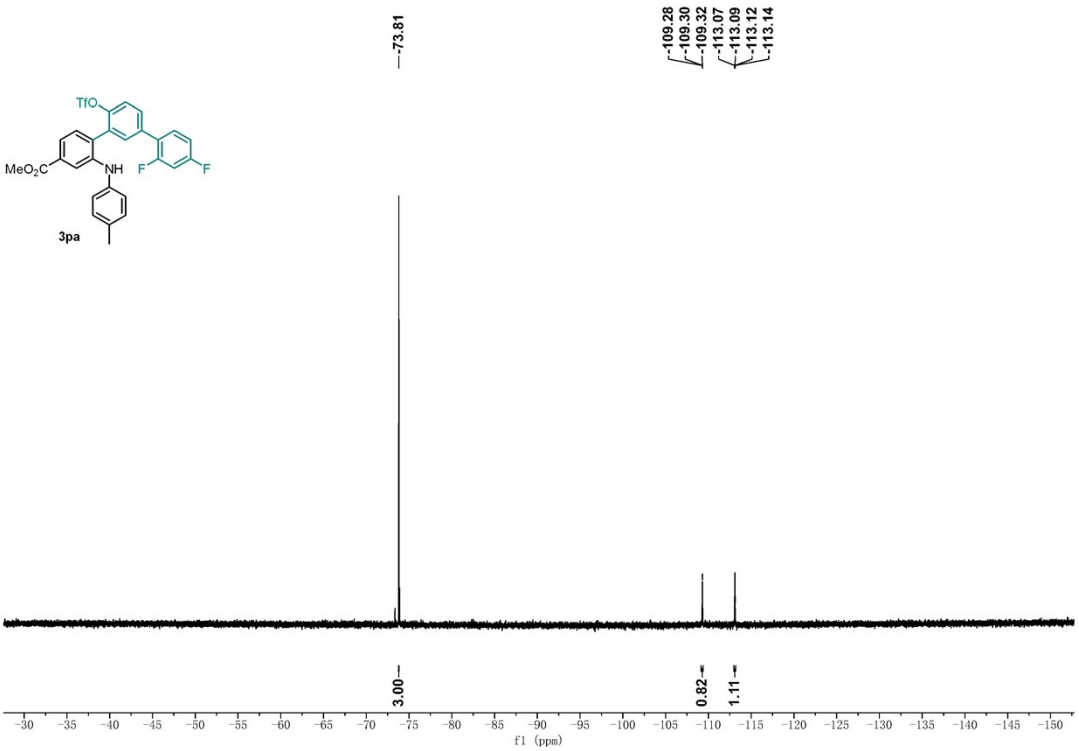
f1 (ppm)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-113.14
TfO
MeO2C
NH
F
F
3pa
3.00
0.82
1.11
−30
−35
−40
−45
−50
−55
−60
−65
−70
−75
−80
−85
−90
−95
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−110
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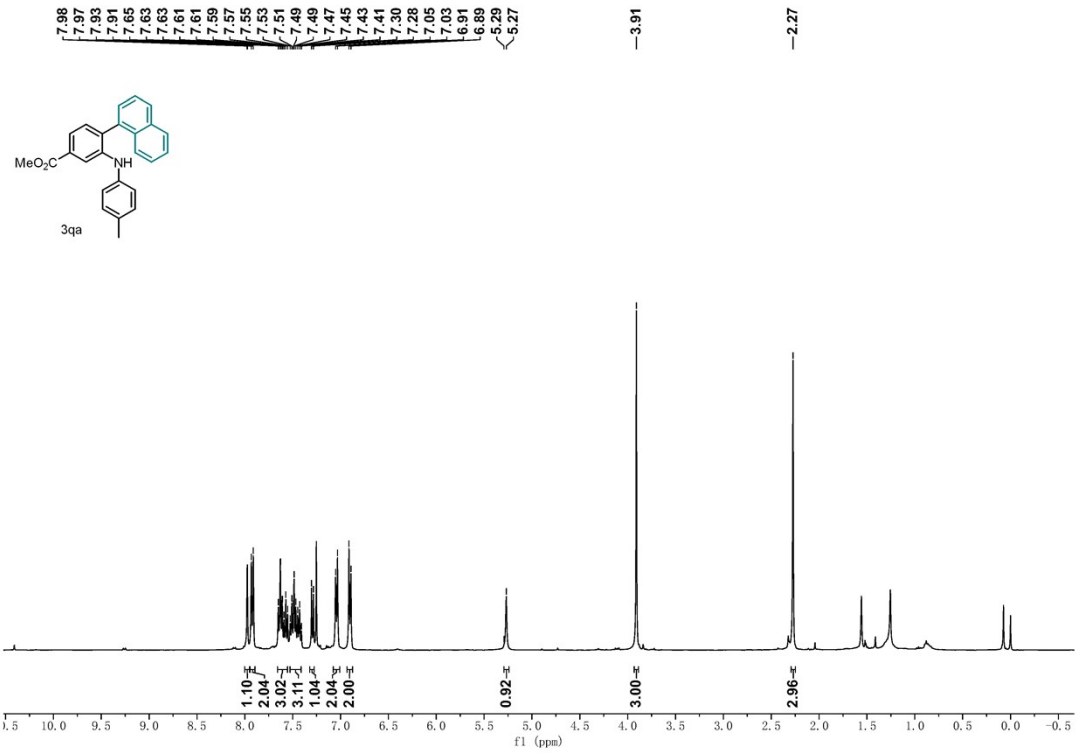
−120
−125
−130
−135
−140
−145
−150
f1 (ppm)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7.49
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7.41
7.30
7.28
7.05
7.03
6.91
6.89
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3.91
2.27
MeO2C
NH
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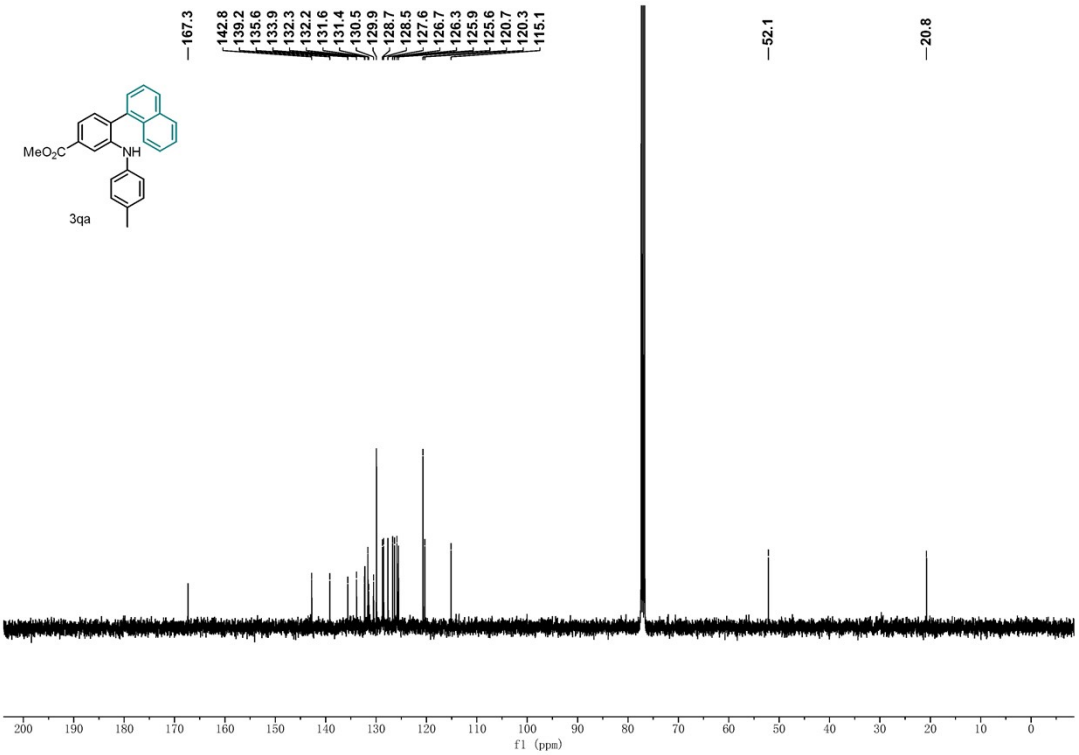
3.02
3.11
1.04
2.04
2.00
0.92
3.00
2.96
f1 (ppm)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126.7
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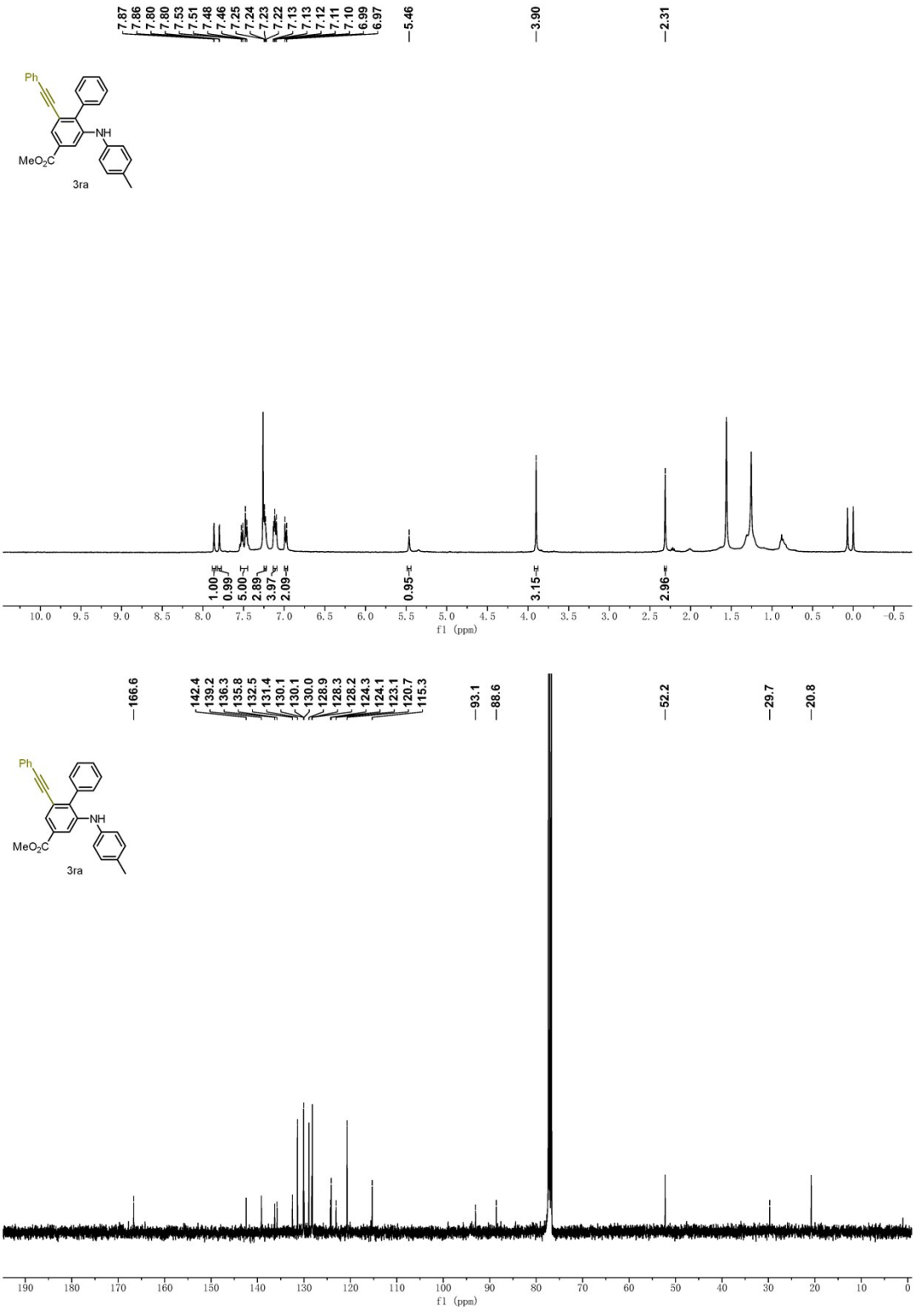
20.8
MeO2C
NH
3qa
f1 (ppm)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7.12
7.11
7.10
6.99
6.97
5.46
3.90
2.31
Ph
NH
MeO2C
3ra
1.00
0.99
5.00
2.89
3.97
2.09
0.95
3.15
2.96
f1 (ppm)
166.6
142.4
139.2
136.3
135.8
132.5
131.4
130.1
130.1
130.0
128.9
128.3
128.2
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123.1
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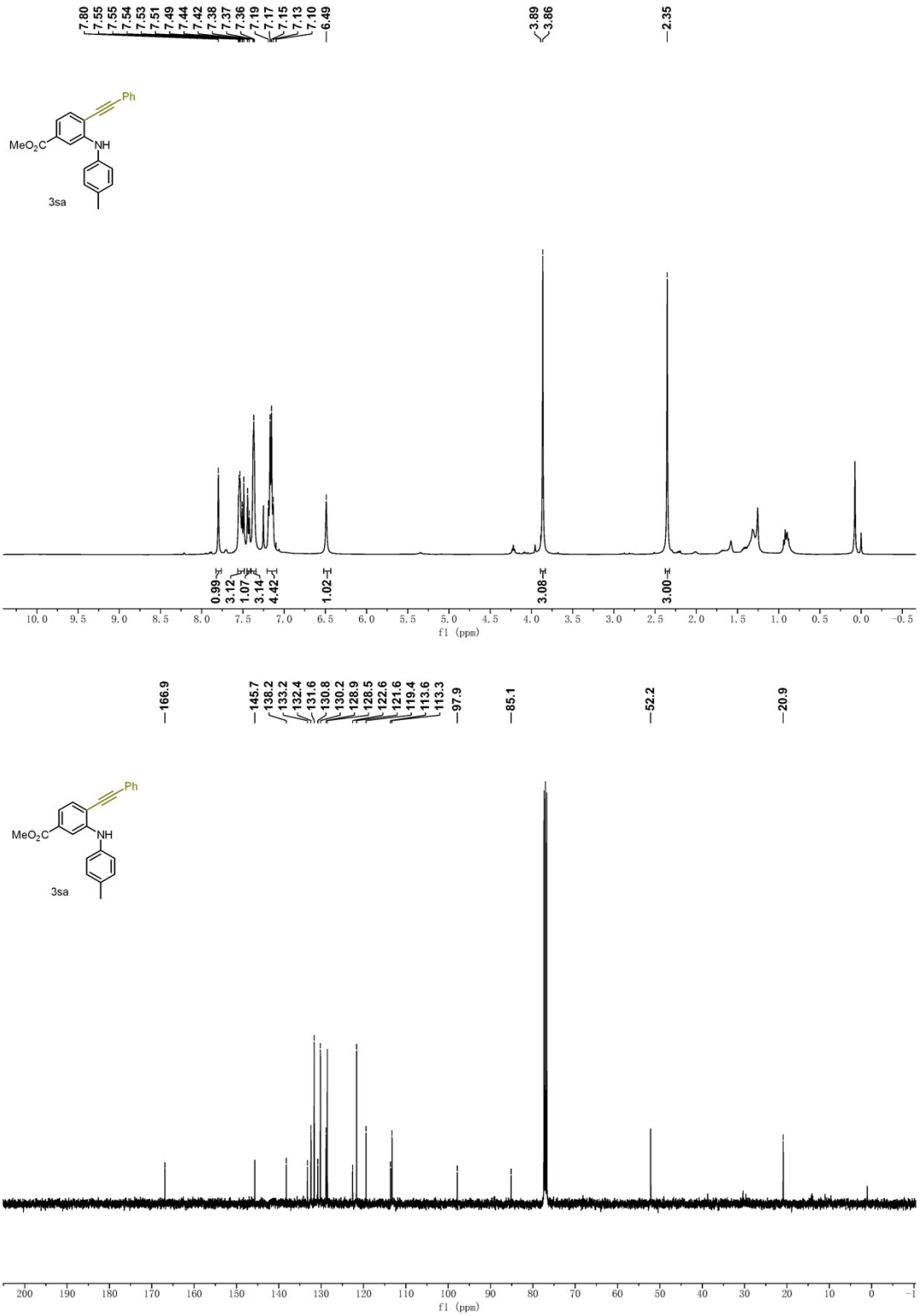
115.3
93.1
88.6
52.2
29.7
20.8
f1 (ppm)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7.36
7.19
7.17
7.15
7.13
7.10
6.49
3.89
3.86
2.35
Ph
MeO2C
NH
3sa
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1.07
3.14
4.42
1.02
3.08
3.00
f1 (ppm)
166.9
145.7
138.2
133.2
132.4
131.6
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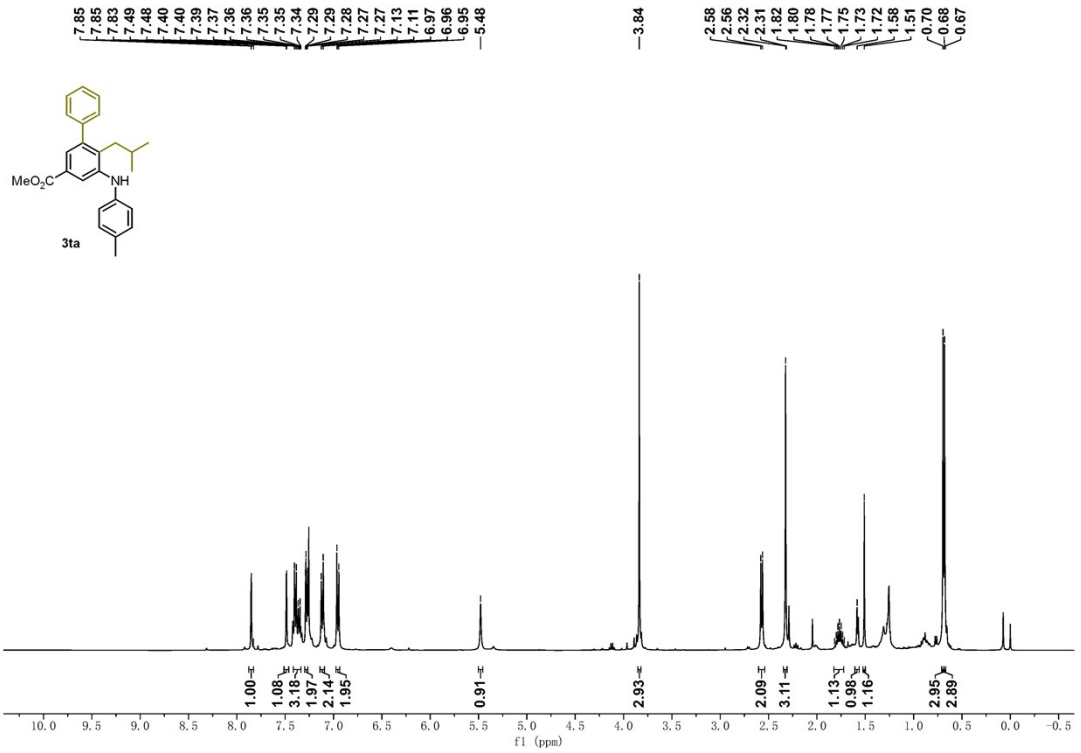
NH
3sa
f1 (ppm)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7.29
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7.27
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7.11
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MeO2C
NH
3ta
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1.08
3.18
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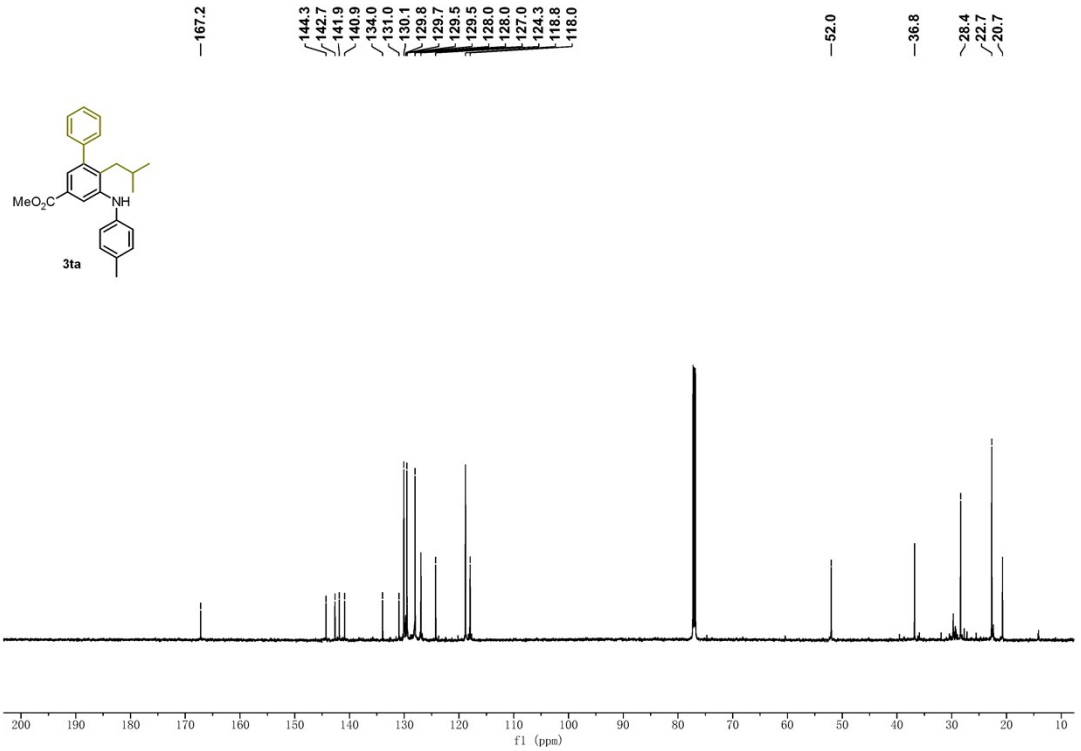
f1 (ppm)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128.0
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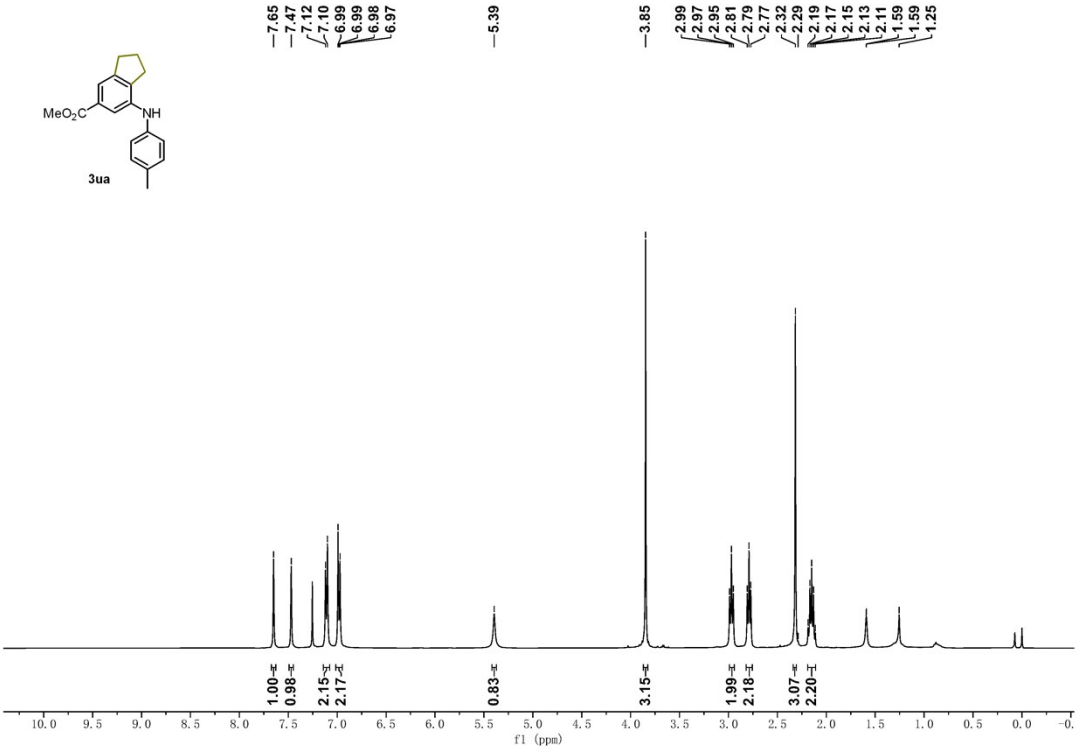
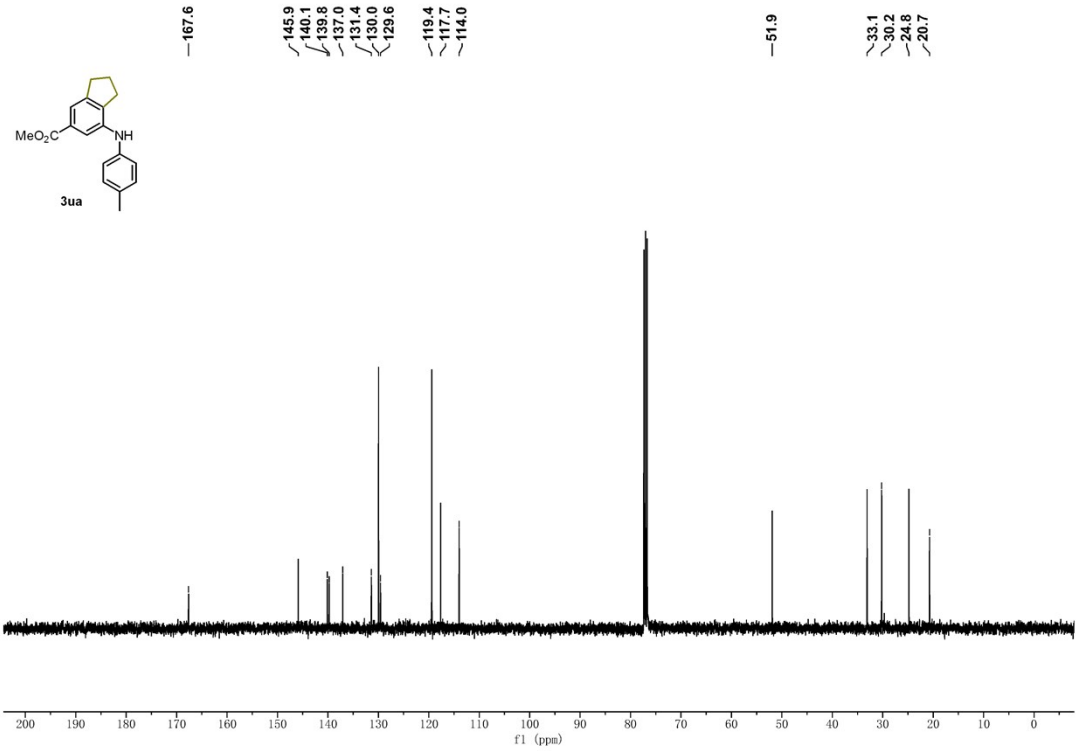
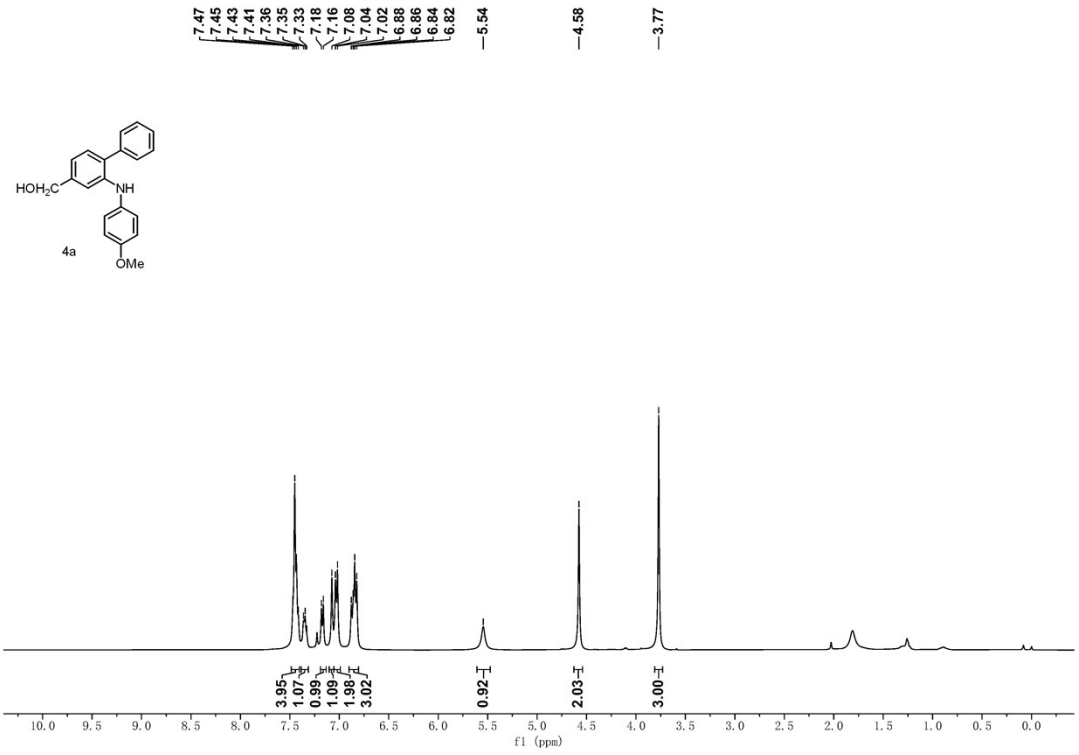
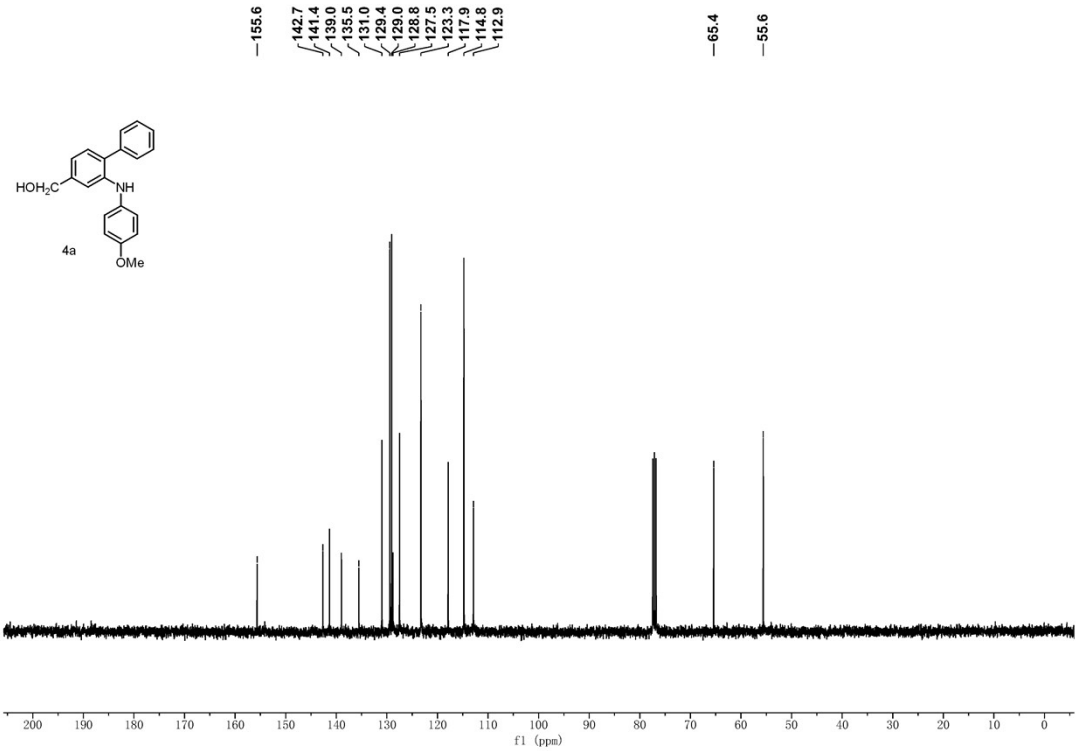
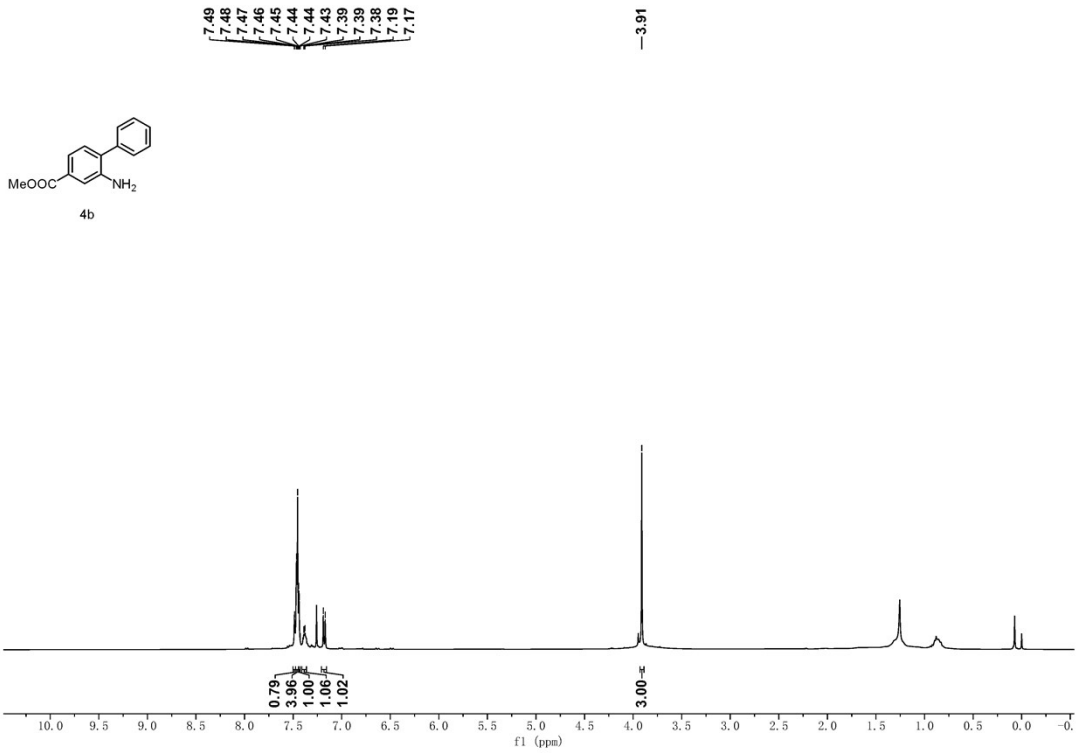
124.3
118.8
118.0
52.0
36.8
28.4
22.7
20.7
MeO2C
NH
3ta
f1 (ppm)

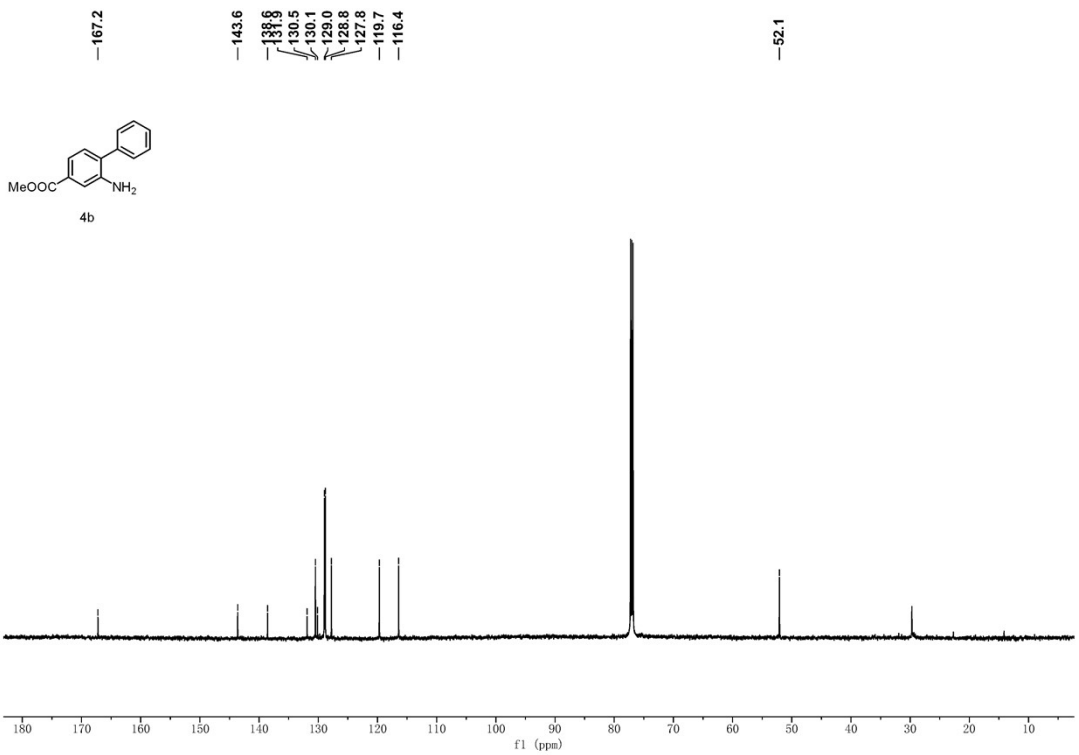

7.65
7.47
7.12
7.10
6.99
6.99
6.98
6.97
5.39
3.85
2.99
2.97
2.95
2.81
2.79
2.77
2.32
2.29
2.19
2.17
2.15
2.13
2.11
1.59
1.59
1.25
MeO2C
NH
3ua
1.00
0.98
2.15
2.17
0.83
3.15
1.99
2.18
3.07
2.20
f1 (ppm)

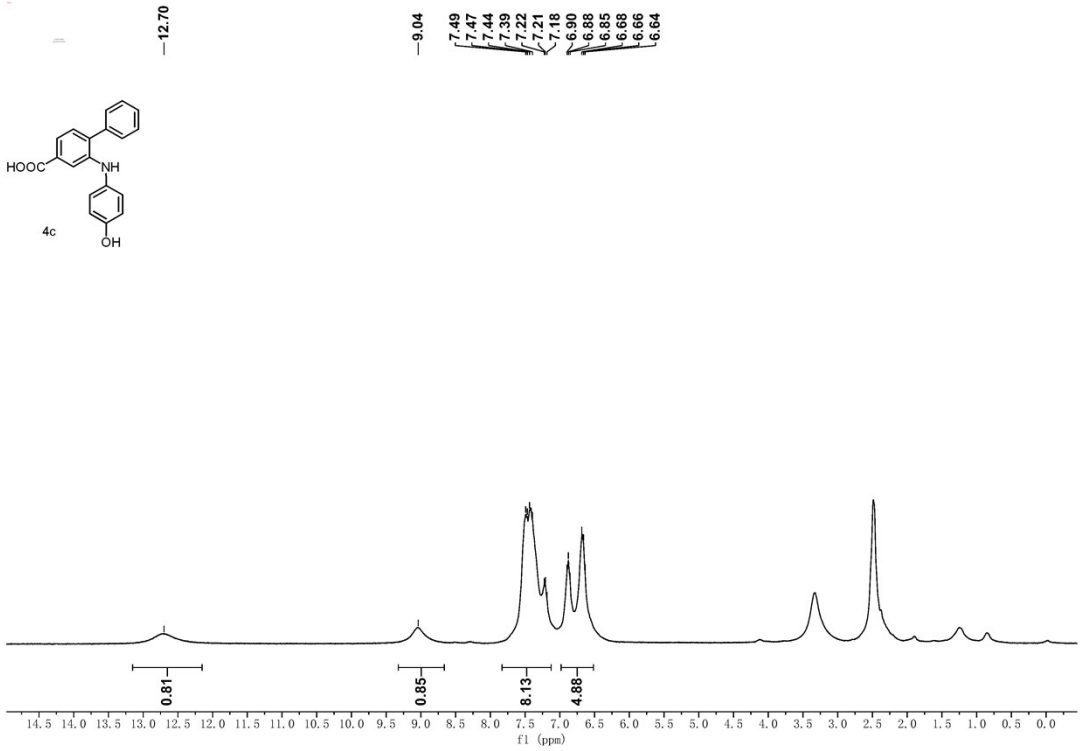

167.6
145.9
140.1
139.8
137.0
131.4
130.0
129.6
119.4
117.7
114.0
51.9
33.1
30.2
24.8
20.7
MeO2C
NH
3ua
f1 (ppm)

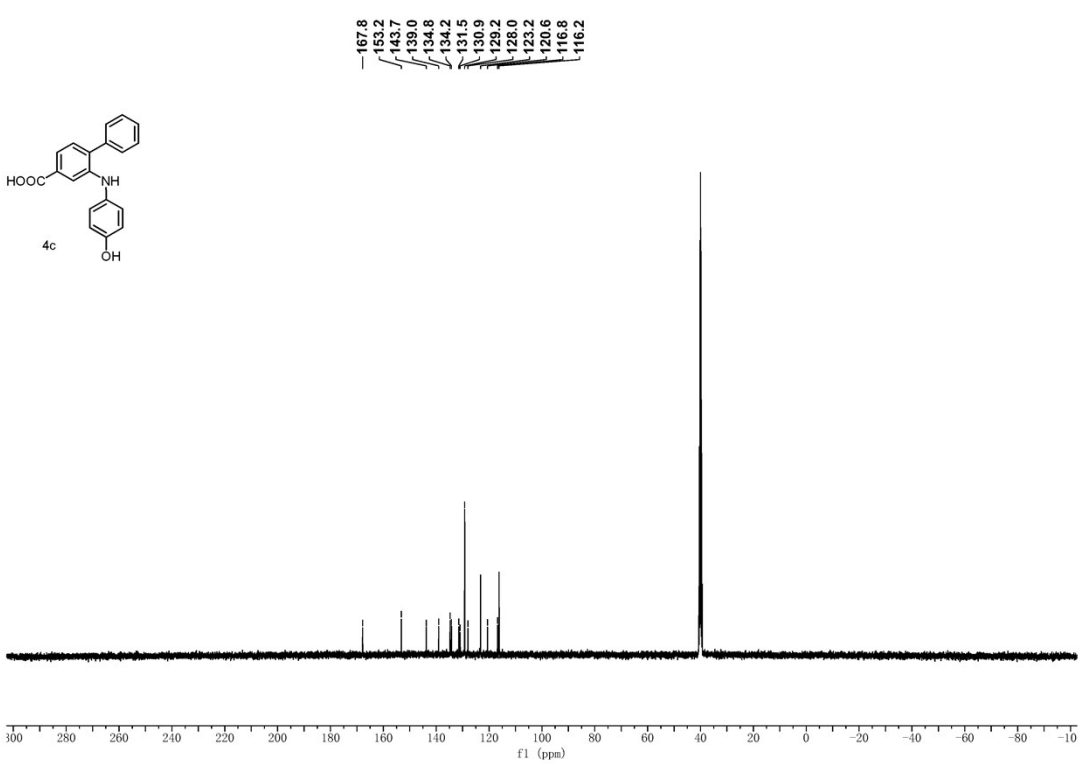

7.47
7.45
7.43
7.41
7.36
7.35
7.33
7.18
7.16
7.08
7.04
7.02
6.88
6.86
6.84
6.82
5.54
4.58
3.77
HOH2C
NH
OMe
4a
3.95
1.07
0.99
1.09
1.98
3.02
0.92
2.03
3.00
f1 (ppm)


155.6
142.7
141.4
139.0
135.5
131.0
129.4
129.0
128.8
127.5
123.3
117.9
114.8
112.9
65.4
55.6
HOH2C
NH
OMe
4a
f1 (ppm)


7.49
7.48
7.47
7.46
7.45
7.44
7.44
7.43
7.39
7.39
7.38
7.19
7.17
3.91
MeOOC
NH2
4b
0.79
3.96
1.00
1.06
1.02
3.00
f1 (ppm)


167.2
143.6
138.6
131.9
130.5
130.1
129.0
128.8
127.8
119.7
116.4
52.1
MeOOC
NH2
4b
f1 (ppm)


12.70
9.04
7.49
7.47
7.44
7.39
7.22
7.21
7.18
6.90
6.88
6.85
6.68
6.66
6.64
HOOC
NH
OH
4c
0.81
0.85
8.13
4.88
f1 (ppm)


167.8
153.2
143.7
139.0
134.8
134.2
131.5
130.9
129.2
128.0
123.2
120.6
116.8
116.2
HOOC
NH
OH
4c
f1 (ppm)