Supporting Information

Enantioselective Synthesis of Axially Chiral Carbamates and Amides with Carbon Dioxide via Copper Catalysis

Bangxiong Kang, Lu Wang, Xihu Sun, Hongjian Liu, Zhonglin Wen, Yanwei Ren, Chaorong Qi* and Huanfeng Jiang*

Key Lab of Functional Molecular Engineering of Guangdong Province, School of Chemistry and Chemical Engineering, South China University of Technology,
Guangzhou 510640, China

E-mail: crqi@scut.edu.cn or jianghf@scut.edu.cn

List of contents

A. General methods

All cyclic diaryliodonium salts **1** were synthesized according to previously described methods.[1] Ligand **L1-L8** were purchased from DAICEL CHIRAL TECHNOLOGIES (CHINA) CO. LTD. Other reagents were obtained from commercial suppliers (Aldrich, TCI, Across, etc.) and used without further purification. ^{1}H and ^{13}C NMR spectra were recorded with a Bruker AV 400 spectrometer using $CDCl_3$ or DMSO-*d6* as solvent and TMS as an internal standard. Reference values for residual solvents were taken as δ = 7.26 ppm ($CDCl_3$), 2.50 ppm (DMSO-*d6*) for ^{1}H NMR; δ = 77.00 ppm ($CDCl_3$), δ = 40.00 ppm (DMSO-*d6*) for ^{13}C NMR. Multiplicity was indicated as follows: s (singlet), d (doublet), t (triplet), q (quartet), m (multiplet). Coupling constants were given in Hertz (Hz). IR spectra were obtained as potassium bromide pellets between two potassium bromide pellets with a spectrometer. The data of HRMS was determined on a high-resolution mass spectrometer (LCMS-IT-TOF). X-ray structural analyses were conducted on an x-ray analysis instrument. Reactions were monitored by thin-layer chromatography (TLC) using UV light. Chiral HPLC analyses were performed on an Aglient 1200 system.

B. General procedure for the synthesis of axially chiral carbamates

To a 25 mL oven-dried Schlenk tube equipped with a magnetic stirring bar was added **1** (0.10 mmol), $Cu(OTf)_2$ (36.0 mg, 0.01 mmol), **L6** (36.0 mg, 0.01 mmol) and Na_2CO_3 (15.9 mg, 0.15 mmol) successively. The Schlenk tube was capped with a rubber septum, evacuated and backfilled with 1 atm CO_2. This evacuation/backfill sequence was repeated three times. Then, a solution of **2** in anhydrous 1,4-dioxane (0.167 M, 1.5 mL, 0.25 mmol) was added to the vessel by syringe through the rubber septum cap. The mixture was then stirred at 40 ℃ in an oil bath for 12 h. After the reaction was completed, the reaction mixture was cooled to room temperature, filtered through a plug of celite and washed with ethyl acetate. The filtrate was concentrated under vacuum and the residue was purified by column chromatography on silica gel using petroleum ether/ethyl acetate as the eluent to give the desired product.

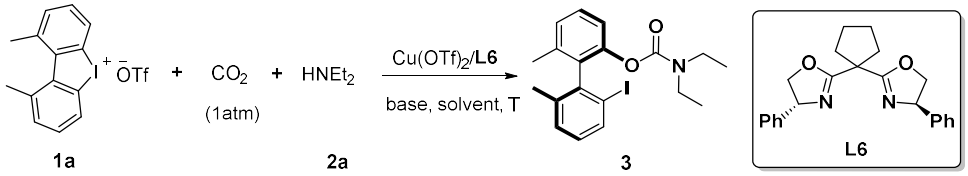
C. General procedure for the synthesis of axially chiral amides

To a 25 mL oven-dried Schlenk tube equipped with a magnetic stirring bar was added **1** (0.10 mmol), $Cu(OTf)_2$ (36.0 mg, 0.01 mmol), **L6** (36.0 mg, 0.01 mmol), Na_2CO_3 (15.9 mg, 0.15 mmol) successively. The Schlenk tube was capped with a rubber septum, evacuated and backfilled with 1 atm of CO_2. This evacuation/backfill sequence was repeated three times. Then, a solution of **2** in anhydrous tetrahydrofuran (0.125 M, 2.0 mL, 0.25 mmol) was added to the vessel by syringe

through the rubber septum cap. The mixture was stirred at 40 ℃ in an oil bath for 12 h. Then, the reaction mixture was cooled to room temperature, evacuated and backfilled with nitrogen; this evacuation/backfill sequence was also repeated three times. After the reaction mixture was cooled to 0 °C, a solution of *n*-butyl lithium in hexane (2.5 M, 0.2 mL, 0.5 mmol) was added dropwise to the above mixture by a syringe. Then, the reaction mixture was allowed to warm to room temperature and stirred for 12 h. After the reaction was completed, the reaction mixture was quenched with 2 M HCl aqueous solution (6 mL), and extracted with ethyl acetate (10 mL × 3). The combined organic layers were washed with brine, dried over anhydrous Na_2SO_4, filtered and concentrated under vacuum. The residue was purified by column chromatography on silica gel using petroleum ether/ethyl acetate as the eluent to give the desired product.

D. Optimization of the reaction conditions

Table S1. The influence of different solvents, bases and temperatures on the reaction[a]



1a 2a 3

Entry	Catalyst	Base	Solvent	Yield (%)[b]	*ee* (%)[c]
1	$Cu(OTf)_2$	Na_2CO_3	1,4-dioxane	95 (92)	99
2	$Cu(OTf)_2$	Na_2CO_3	THF	94	99
3	$Cu(OTf)_2$	Na_2CO_3	DCM	65	98
4	$Cu(OTf)_2$	Na_2CO_3	MeCN	86	98
5	$Cu(OTf)_2$	Na_2CO_3	Toluene	70	98
6	$Cu(OTf)_2$	DABCO	1,4-dioxane	56	82
7	$Cu(OTf)_2$	Et_2ONa	1,4-dioxane	63	97
8	$Cu(OTf)_2$	*t*-BuOK	1,4-dioxane	64	93
9	$Cu(OTf)_2$	Cs_2CO_3	1,4-dioxane	58	97
10[d]	$Cu(OTf)_2$	Na_2CO_3	1,4-dioxane	81	98
11[e]	$Cu(OTf)_2$	Na_2CO_3	1,4-dioxane	77	97
12[f]	$Cu(OTf)_2$	Na_2CO_3	1,4-dioxane	90	98
13[g]	$Cu(OTf)_2$	Na_2CO_3	1,4-dioxane	95	98
14	$CuSO_4$	Na_2CO_3	1,4-dioxane	89	95
15	$Cu(OAc)_2$	Na_2CO_3	1,4-dioxane	84	96

[a] Reaction conditions: **1a** (0.10 mmol), **2a** (0.25 mmol), CO_2 (1 atm), base (1.5 equiv), $Cu(OTf)_2$ (0.01 mmol), L6 (0.01 mmol), solvent (anhydrous, 1.5 mL), 40 ℃, 12 h. [b]Yields were determined by ^1H NMR using dibromomethane as internal standard. The number in parentheses is isolated yield. [c]Determined by chiral HPLC. [d]60 ℃. [e]100 ℃. [f]Base (2 equiv). [g]Base (1 equiv).

E. Gram-scale synthesis of compound 3

To a 100 mL oven-dried two-necked round flask containing a magnetic stir bar was added **1a** (5.0 mmol), $Cu(OTf)_2$ (0.5 mmol), **L6** (0.5 mmol) and Na_2CO_3 (7.5 mmol) successively. The side-neck

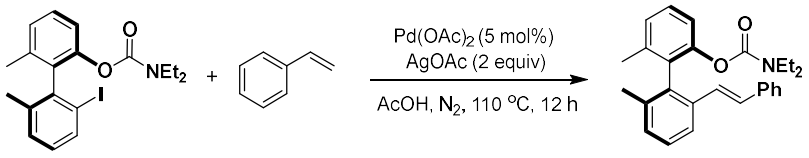
was capped with a rubber septum and the central neck is connected with a CO_2 balloon via a 3-way value. Then, the flask was evacuated and backfilled with CO_2 through the 3-way value. Subsequently, a solution of diethylamine (**2a**) in anhydrous 1,4-dioxane (0.25 M, 50 mL, 12.5 mmol) was added to the flask by syringe through the rubber septum cap on the side-neck. The mixture was stirred at 40 ℃ in an oil bath for 12 h. After the reaction was completed, the reaction mixture was filtered through a plug of celite and washed with ethyl acetate. The filtrate was concentrated under vacuum and the residue was purified by column chromatography on silica gel using petroleum ether/ethyl acetate (20:1) as the eluent to give the product **3** as a light yellow oil (1.94 g, 92%, 96% ee).

F. Gram-scale synthesis of compound 61

To a 50 mL oven-dried two-necked round flask containing a magnetic stir bar was added **1a** (1.7 mmol), $Cu(OTf)_2$ (0.17 mmol), **L6** (0.255 mmol) and Na_2CO_3 (1.7 mmol) successively. The side-neck was capped with a rubber septum and the central neck is connected with a CO_2 balloon via a 3-way value. Then, the flask was evacuated and backfilled with CO_2 through the 3-way value. Subsequently, a solution of Sitagliptin in anhydrous MeCN (0.213 M, 20 mL, 4.25 mmol) was added to the flask by syringe through the rubber septum cap on the side-neck. The mixture was stirred at 40 ℃ in an oil bath for 12 h. After the reaction was completed, the reaction mixture was filtered through a plug of celite and washed with ethyl acetate. The filtrate was concentrated under vacuum and the residue was purified by column chromatography on silica gel using petroleum ether/ethyl acetate (2:1) as the eluent to give the product **61** as a light yellow oil (0.99 g, 77%, 97% de).

G. Procedures for the synthesis of compounds 91-104

a) **Procedure for the synthesis of compound 91**[ref.1a]

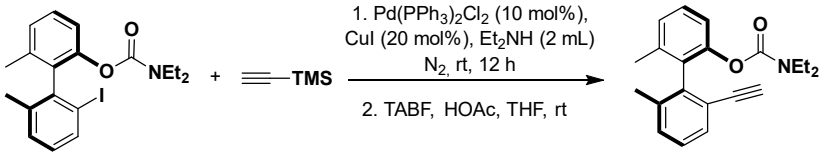


3 **91**, 68%, 99% ee

To a solution of styrene (12.5 mg, 0.12 mmol) in AcOH (2.0 mL) was added the mixture of **3** (0.1 mmol, 99% ee), $Pd(OAc)_2$ (1.2 mg, 0.005 mmol), AgOAc (33.4 mg, 0.2 mmol) successively. The resulting mixture was stirred at 110 °C in an oil bath for 12 h under an atmosphere of N_2. After the

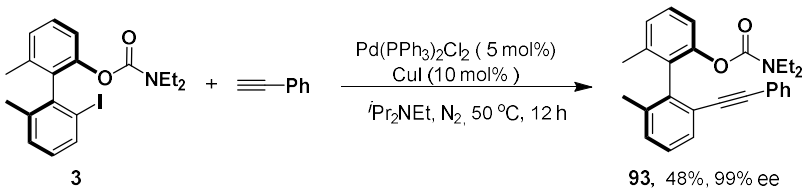
reaction was completed, the reaction mixture was cooled to room temperature, washed with water and then extracted with ethyl acetate (10 mL×3). The combined organic phase was dried over anhydrous Na_2SO_4, and then filtered. After removing the solvent under vacuum, the crude product was purified by column chromatography on silica gel using petroleum ether/ethyl acetate (20:1) as the eluent to give the desired product as a light yellow oil **91** (27.2 mg, 68%, 99% ee).

b) Procedure for the synthesis of compound 92 *ref.2*



To a solution of **3** (0.1 mmol, 99% ee) and trimethylsilylacetylene (24.5 mg, 0.25 mmol) in Et_2NH (2.0 mL) was added the mixture of $Pd(PPh_3)_2Cl_2$ (7.1 mg, 0.01 mmol) and CuI (3.8 mg, 0.02 mmol) successively. The resulting mixture was stirred at room temperature for 12 h under an atmosphere of N_2. After the reaction was completed, the reaction mixture was cooled to room temperature, washed with water and then extracted with ethyl acetate (10 mL×3). The combined organic phase was dried over anhydrous Na_2SO_4, and then filtered. After removing the solvent under vacuum, the crude product was purified by column chromatography on silica gel using petroleum ether/ethyl acetate (20:1) as the eluent to give a light yellow oil (21.2 mg). Then, the light yellow oil was treated with HOAc (0.1 mL) and TBAF (0.2 mL) in THF (2.0 mL) at room temperature for 4 h. The reaction mixture was washed with water and then extracted with ethyl acetate (10 mL×3). The combined organic phase was dried over anhydrous Na_2SO_4, and then filtered. After removing the solvent under vacuum, the crude product was purified by column chromatography on silica gel using petroleum ether/ethyl acetate (20:1) as the eluent to give the desired product **92** as a light yellow oil (15.8 mg, 54%, 99% ee).

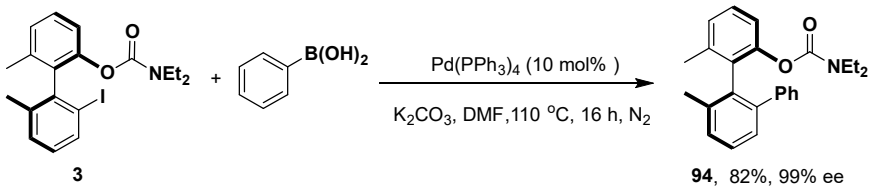
c) Procedure for the synthesis of compound 93 *ref.2*



To a solution of phenylacetylene (12.3 mg, 0.12 mmol) in *N*,*N*-diisopropylethylamine (2.0 mL) was added the mixture of **3** (0.1 mmol, 99% ee), $Pd(PPh_3)_2Cl_2$ (3.6 mg, 0.005 mmol) and CuI (2.0 mg, 0.01 mmol) successively. The resulting mixture was stirred at 100 °C in an oil bath for 12 h

under an atmosphere of N_2. After the reaction was completed, the reaction mixture was cooled to room temperature, washed with water and then extracted with ethyl acetate (10 mL×3). The combined organic phase was dried over anhydrous Na_2SO_4, and then filtered. After removing the solvent under vacuum, the crude product was purified by column chromatography on silica gel using petroleum ether/ethyl acetate (20:1) as the eluent to give the desired product **93** as a light yellow oil (19.1 mg, 48%, 99% ee).

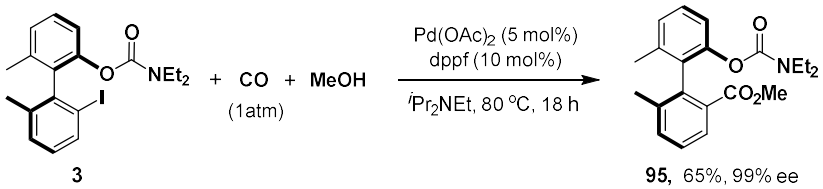
d) Procedure for the synthesis of compound 94 *ref.1a*



3 **94**, 82%, 99% ee

To a solution of **3** (0.1 mmol, 99% ee) in DMF (2.0 mL) was added the mixture of phenylboronic acid (18.3 mg, 0.15 mmol), $Pd(PPh_3)_4$ (11.6 mg, 0.01 mmol) and K_2CO_3 (20.8 mg, 0.15 mmol) successively. The resulting mixture was stirred at 110 °C in an oil bath for 16 h under an atmosphere of N_2. After the reaction was completed, the reaction mixture was cooled to room temperature, washed with water and then extracted with ethyl acetate (10 mL×3). The combined organic phase was dried over anhydrous Na_2SO_4, and then filtered. After removing the solvent under vacuum, the crude product was purified by column chromatography on silica gel using petroleum ether/ethyl acetate (20:1) as the eluent to give the desired product **94** as a light yellow oil (30.6 mg, 82%, 99% ee).

e) Procedure for the synthesis of compound 95 *ref.4*

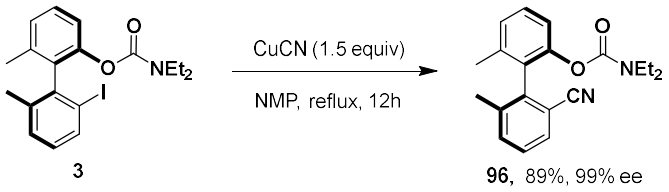


3 **95**, 65%, 99% ee

To a 25 mL oven-dried Schlenk tube equipped with a magnetic stirring bar was added **3** (0.1 mmol), $Pd(OAc)_2$ (1.2 mg, 0.005 mmol), 1,1'-ferrocenediyl-bis(diphenylphosphine) (dppf) (5.6 mg, 0.01 mmol), methanol (2.0 mL) and *N*,*N*-diisopropylethylamine (25.9 mg, 0.2 mmol) successively. The tube was then evacuated and refilled with CO (1 atm) three times. The resulting mixture was stirred at 80 °C in an oil bath for 18 h. After the reaction was completed, the reaction mixture was cooled to room temperature, washed with water and then extracted with ethyl acetate (10 mL×3). The combined organic phase was dried over anhydrous Na_2SO_4, and then filtered.

After removing the solvent under vacuum, the crude product was purified by column chromatography on silica gel using petroleum ether/ethyl acetate (10:1) as the eluent to give the desired product as a light yellow oil **95** (23.1 mg, 65%, 99% ee).

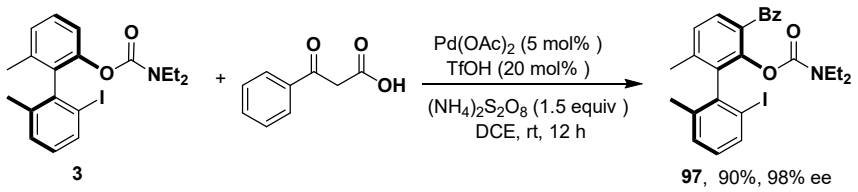
f) Procedure for the synthesis of compound 96 *ref.3*



3 **96**, 89%, 99% ee

To a solution of **3** (0.1 mmol, 99% ee) in NMP (2 ml) was added CuCN (13.4mg, 0.15 mmol). The resulting mixture was heated at reflux in an oil bath for 12 h under an atmosphere of N_2. After the reaction was completed, the reaction mixture was cooled to room temperature, washed with water and then extracted with ethyl acetate (10 mL×3). The combined organic phase was dried over anhydrous Na_2SO_4, and then filtered. After removing the solvent under vacuum, the crude product was purified by column chromatography on silica gel using petroleum ether/ethyl acetate (10:1) as the eluent to give the desired product **96** as a light yellow oil (28.6 mg, 89%, 99% ee).

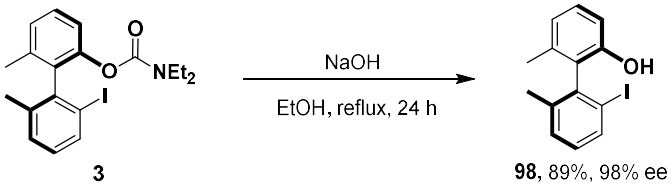
g) Procedure for the synthesis of compound 97 *ref.7*



3 **97**, 90%, 98% ee

To a 25 mL oven-dried Schlenk tube was charged with **3** (0.1 mmol, 99% ee), phenylglyoxylic acid (19.7 mg, 0.12 mmol), $Pd(OAc)_2$ (1.2 mg, 0.005 mmol), $(NH_4)_2S_2O_8$ (34.2 mg, 0.15 mmol), DCE (2.0 mL) and TfOH (2 μL, 0.02 mmol) successively. The tube was then sealed and the reaction mixture was stirred at room temperature for 12 h. After the reaction was completed, the reaction mixture was cooled to room temperature, washed with water and then extracted with ethyl acetate (10 mL×3). The combined organic phase was dried over anhydrous Na_2SO_4, and then filtered. After removing the solvent under vacuum, the crude product was purified by column chromatography on silica gel using petroleum ether/ethyl acetate (20:1) as the eluent to give the desired product **97** as a white solid (47.4 mg, 90%, 98% ee).

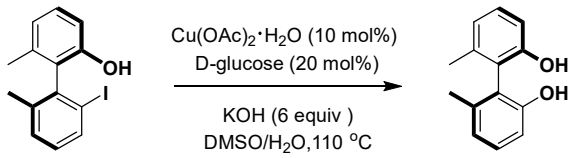
h) Procedure for the synthesis of compound 98 *ref.5*



3 **98**, 89%, 98% ee

To a solution of **3** (0.1 mmol, 99% ee) in EtOH (2.0 mL) was added NaOH (1 mmol). The resulting mixture was heated under reflux in an oil bath for 24 h. After the reaction was completed, the reaction mixture was cooled to room temperature, quenched with 2 M HCl aqueous solution and then extracted with ethyl acetate (10 mL×3). The combined organic phase was washed with water, dried over anhydrous Na_2SO_4, and then filtered. After removing the solvent under vacuum, the crude product was purified by column chromatography on silica gel using petroleum ether/ethyl acetate (20:1) as the eluent to give the desired product **98** as a light yellow oil (28.8 mg, 89%, 98% ee).

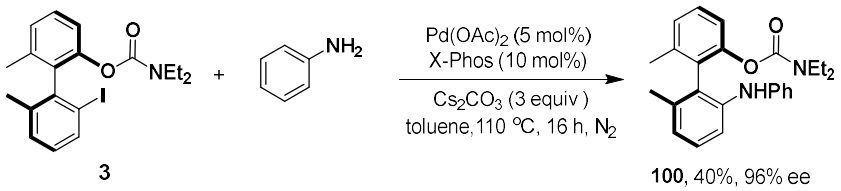
i) Procedure for the synthesis of compound 99 *ref.1a*



98, 98% ee **99**, 60%, 97% ee

To a solution of **98** (0.1 mmol, 98% ee) in DMSO/H_2O (2 mL, v/v = 1:1) was added the mixture of $Cu(OAc)_2{\cdot}H_2O$ (2.0 mg, 0.01 mmol), D-glucose (3.6 mg, 0.02 mmol), KOH (33.7 mg, 0.6 mmol) successively. The resulting mixture was stirred at 110 °C in an oil bath for 12 h. After the reaction was completed, the reaction mixture was cooled to room temperature, quenched with 2 M HCl aqueous solution, and then extracted with ethyl acetate (10 mL×3). The combined organic phase was washed with water, dried over anhydrous Na_2SO_4, and then filtered. After removing the solvent under vacuum, the crude product was purified by column chromatography on silica gel using petroleum ether/ethyl acetate (20:1) as the eluent to give the desired product **99** as a white solid (12.8 mg, 60%, 97% ee).

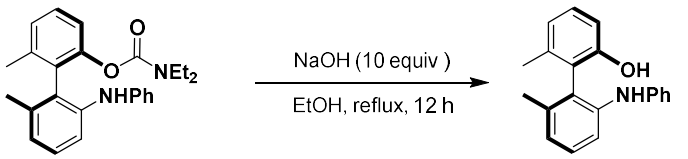
j) Procedure for the synthesis of compound 100 *ref.6*



3 **100**, 40%, 96% ee

To a solution of **3** (0.1 mmol, 99% ee) in toluene (2.0 mL) was added the mixture of aniline (14 μL, 0.15 mmol), $Pd(OAc)_2$ (1.13 mg, 0.005 mmol) and Cs_2CO_3 (97.7 mg, 0.30 mmol) successively. The resulting mixture was stirred at 110 °C in an oil bath for 16 h under an atmosphere of N_2. After the reaction was completed, the reaction mixture was cooled to room temperature, washed with water and then extracted with ethyl acetate (10 mL×3). The combined organic phase was dried over anhydrous Na_2SO_4, and then filtered. After removing the solvent under vacuum, the crude product was purified by column chromatography on silica gel using petroleum ether/ethyl acetate (20:1) as the eluent to give the desired product **100** as a light yellow oil (15.5 mg, 40%, 96% ee).

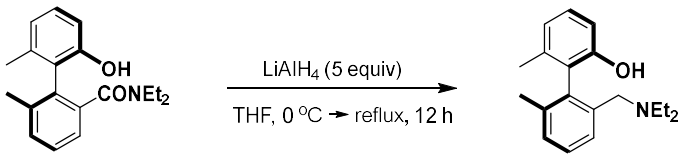
k) Procedure for the synthesis of compound 101 *ref.5*



100 **101**, 80%, 99% ee

To a solution of **100** (0.1 mmol) in EtOH (2.0 mL) was added NaOH (10 equiv). The resulting mixture was heated under reflux in an oil bath for 12 h. After the reaction was completed, the reaction mixture was cooled to room temperature, quenched with 2 M HCl aqueous solution, and then extracted with ethyl acetate (10 mL×3). The combined organic phase was washed with water, dried over anhydrous Na_2SO_4, and then filtered. After removing the solvent under vacuum, the crude product was purified by column chromatography on silica gel using petroleum ether/ethyl acetate (20:1) as the eluent to give the desired product **101** as a white solid (23.1 mg, 80%, 99% ee).

l) Procedure for the synthesis of compound 102

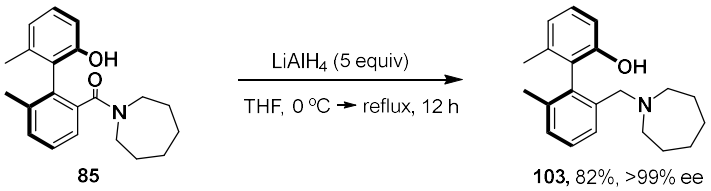


74 **102**, 97%, 52% ee

To a 25 mL oven-dried Schlenk tube containing a magnetic stir bar was added **74** (0.1 mmol, 99% ee) and THF (2 mL) successively. Then, a solution of $LiAlH_4$ in THF (2.5 M, 0.2 mL, 0.5mmol) was added dropwise to the above mixture by a syringe under an atmosphere of N_2 at 0 °C. After the addition, the resulting mixture was allowed to warm to room temperature, and then heated under reflux for 12 h. After the reaction was completed, saturated NH_4Cl aqueous solution was

added to quench the reaction and followed by extraction of an organic layer with EtOAc (3 ×10 mL). The combined organic phase was washed with water, dried over anhydrous Na_2SO_4, and then filtered. After removing the solvent under vacuum, the crude product was purified by column chromatography on silica gel using petroleum ether/ethyl acetate (10:1) as the eluent to give the desired product **102** as a colorless liquid (27.4 mg, 97%, 52% ee).

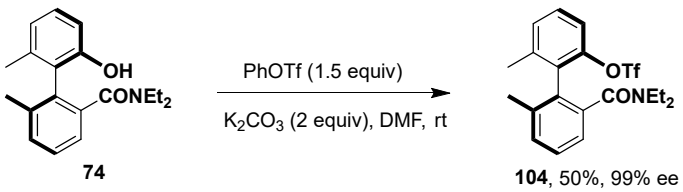
m) Procedure for the synthesis of compound 103



85 **103,** 82%, >99% ee

To a 25 mL oven-dried Schlenk tube containing a magnetic stir bar was added **85** (0.1 mmol, 99% ee) and THF (2 mL) successively. Then, a solution of $LiAlH_4$ in THF (2.5 M, 0.2 mL, 0.5mmol) was added dropwise to the above mixture by a syringe under an atmosphere of N_2 at 0 °C. After the addition, the resulting mixture was allowed to warm to room temperature, and then heated under reflux for 12 h. After the reaction was completed, saturated NH_4Cl aqueous solution was added to quench the reaction and followed by extraction of an organic layer with EtOAc (3 ×10 mL). The combined organic phase was washed with water, dried over anhydrous Na_2SO_4, and then filtered. After removing the solvent under vacuum, the crude product was purified by column chromatography on silica gel using petroleum ether/ethyl acetate (10:1) as the eluent to give the desired product **103** as a as light yellow oil (25.3 mg, 82%, >99% ee).

n) Procedure for the synthesis of compound 104 *ref.8*

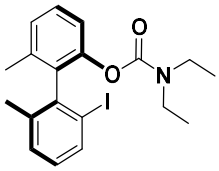


74 **104**, 50%, 99% ee

To a solution of **74** (0.1 mmol, 99% ee) in DMF (2 mL) was added the mixture of phenyl trifluoromethanesulfonate (0.15 mmol) and K_2CO_3 (0.2 mmol). The reaction mixture was stirred at room temperature for 6 h. After the reaction was completed, the reaction was diluted with water, and extracted with EtOAc (3 ×10 mL). The organic phase was dried over anhydrous Na_2SO_4 and then filtered. After removing the solvent under vacuum, the crude product was purified by column chromatography on silica gel using petroleum ether/ethyl acetate (20:1) as the eluent to give the desired product **104** as a white solid (21.4 mg, 50%, 99% ee).

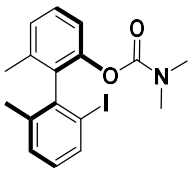
H. Analytical data

(*R*)-2'-Iodo-6,6'-dimethyl-[1,1'-biphenyl]-2-yl diethylcarbamate (3)



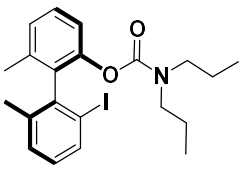
Eluent: 20:1 petroleum ether / ethyl acetate; light yellow oil, 41.8mg, 99% yield, 99% ee. HPLC conditions: Chiralpak OD-H, isopropanol/hexanes = 2:98, flow: 0.8 mL/min, λ = 254 nm, t_r = 8.351 min (major), 8.989 min (minor). $[\alpha]^{25}_D$ = -48.75 (c 0.28, CH_2Cl_2). ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.75 (d, J = 8.0 Hz, 1H), 7.33 (t, J = 8.0 Hz, 1H), 7.21 (d, J = 7.6 Hz, 2H), 7.14 (d, J = 7.6 Hz, 1H), 6.92 (t, J = 7.6 Hz, 1H), 3.21 – 3.16 (m, 2H), 3.02 – 2.86 (m, 2H), 2.05 (s, 3H), 1.99 (s, 3H), 1.02 (t, J = 7.2 Hz, 3H), 0.74 (t, J = 6.8 Hz, 3H). ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$): δ 153.3, 148.3, 141.6, 138.8, 137.0, 136.3, 136.2, 129.7, 129.0, 128.4, 126.5, 120.3, 101.2, 41.9, 41.5, 21.2, 19.4, 13.5, 13.1. HRMS-ESI (*m/z*): calcd for $C_{19}H_{23}INO_2$ $[M + H]^+$: 424.0768, found 424.0763.

(*R*)-2'-Iodo-6,6'-dimethyl-[1,1'-biphenyl]-2-yl dimethylcarbamate (4)



Eluent: 20:1 petroleum ether / ethyl acetate; light yellow oil, 21.7 mg, 55% yield, 95% ee. HPLC conditions: Chiralpak INC, isopropanol/hexanes = 3: 97, flow: 1.0 mL/min, λ = 254 nm, t_r = 11.606 min (major), 11.036 min (minor). $[\alpha]^{25}_D$ = -56.71 (c 0.16, CH_2Cl_2). ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.76 (d, J = 7.6 Hz, 1H), 7.34 (t, J = 7.6 Hz, 1H), 7.22 (t, J = 7.2 Hz, 2H), 7.15 (d, J = 7.2 Hz, 1H), 6.94 (t, J = 7.6 Hz, 1H), 2.81 (s, 3H), 2.54 (s, 3H), 2.04 (s, 3H), 2.00 (s, 3H). ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$): δ 154.0, 148.3, 141.4, 138.7, 137.0, 136.2(2), 136.1(9), 129.6, 129.0, 128.4, 126.7, 120.3, 101.1, 36.4, 35.8, 21.2, 19.3. HRMS-ESI (*m/z*): calcd for $C_{17}H_{18}INO_2$ $[M + H]^+$: 396.0455, found 396.0456.

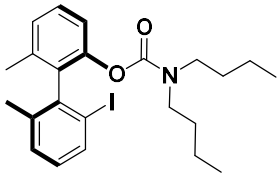
(*R*)-2'-Iodo-6,6'-dimethyl-[1,1'-biphenyl]-2-yl dipropylcarbamate (5)



Eluent: 20:1 petroleum ether / ethyl acetate; light yellow oil, 42.8 mg, 95% yield, 98% ee. HPLC conditions: Chiralpak AD-H, isopropanol/hexane = 1:99, flow: 0.6 mL/min, λ = 254 nm, t_r = 12.278 min (major), 14.186 min (minor). $[\alpha]^{25}_D$= -59.34 (c 0.18, CH_2Cl_2). ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.75 (d, J = 8.0 Hz, 1H), 7.33 (t, J = 8.0 Hz, 1H), 7.20 (t, J = 8.4 Hz, 2H), 7.13 (d, J = 7.6 Hz, 1H), 6.93 (t, J = 7.6 Hz, 1H), 3.11 (t, J = 7.2 Hz, 2H), 2.91 – 2.84 (m, 1H), 2.78 – 2.71 (m, 1H), 2.03 (s, 3H), 1.98 (s, 3H), 1.49 – 1.44 (m, 2H), 1.24 – 1.16 (m, 1H),

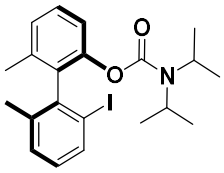
1.07 – 0.98 (m, 1H), 0.80 (t, J = 7.2 Hz, 3H), 0.67 (t, J = 7.2 Hz, 3H). $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$): δ 153.8, 148.3, 141.6, 138.7, 136.9, 136.3, 136.2, 129.7, 128.9, 128.3, 126.5, 120.5, 101.2, 49.3, 49.1, 21.5, 21.2, 21.1, 19.4, 11.2, 11.0. HRMS-ESI (*m/z*): calcd for $C_{21}H_{27}INO_2$ $[M + H]^+$: 452.1081, found 452.1080.

(*R*)-2'-Iodo-6,6'-dimethyl-[1,1'-biphenyl]-2-yl diisopropylcarbamate (6)



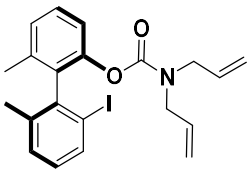
Eluent: 10:1 petroleum ether / ethyl acetate; light yellow oil, 22.1 mg, 49% yield, 98% ee. HPLC conditions: Chiralpak OD-H, isopropanol/hexanes = 1:99, flow: 0.6 mL/min, λ = 254 nm, t_r = 29.180 min (major), 27.905 min (minor). $[\alpha]^{25}_D$ = -57.63 (c 0.20, CH_2Cl_2). ^1H NMR (400 MHz, $CDCl_3$): δ 7.74 (d, J = 8.0 Hz, 1H), 7.32 (t, J = 8.0 Hz, 1H), 7.20 (d, J = 8.4 Hz, 1H), 7.15 – 7.12 (m, 2H), 6.91 (t, J = 7.6 Hz, 1H), 3.71 (s, 2H), 2.06 (s, 3H), 1.98 (s, 3H), 1.18 – 1.07 (m, 6H), 0.86 (s, 6H). $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$): δ 152.5, 148.4, 141.6, 139.0, 137.0, 136.5, 136.3, 129.7, 129.0, 128.3, 126.5, 120.8, 101.5, 46.4, 45.9, 21.2, 20.7, 20.5, 20.4, 20.3, 19.4. HRMS-ESI (*m/z*): calcd for $C_{21}H_{27}INO_2$ $[M + H]^+$: 452.1081, found 452.1084.

(*R*)-2'-Iodo-6,6'-dimethyl-[1,1'-biphenyl]-2-yl diallylcarbamate (7)



Eluent: 20:1 petroleum ether / ethyl acetate; light yellow oil, 38.0 mg, 85% yield, 98% ee. HPLC conditions: Chiralpak OD-H and AD-H, isopropanol/hexanes = 1:99, flow: 0.6 mL/min, λ = 254 nm, t_r = 32.429 min (major), 35.268 min (minor). $[\alpha]^{25}_D$ = -56.32 (c 0.26, CH_2Cl_2). ^1H NMR (400 MHz, $CDCl_3$): δ 7.76 (d, J = 8.0 Hz, 1H), 7.34 (t, J = 8.0 Hz, 1H), 7.24 – 7.19 (m, 2H), 7.18 (d, J = 8.8 Hz, 1H), 6.95 (t, J = 8.0 Hz, 1H), 5.69 – 5.60 (m, 1H), 5.34 – 5.26 (m, 1H), 5.09 (d, J = 10.4 Hz, 1H), 5.01 – 4.90 (m, 3H), 3.78 (d, J = 4.8 Hz, 2H), 3.49 (d, J = 5.2 Hz, 2H), 2.04 (s, 3H), 2.00 (s, 3H). $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$): δ 153.5, 148.2, 141.4, 138.8, 137.1, 136.4, 136.3, 132.9, 129.7, 129.0, 128.4, 126.8, 120.4, 116.9, 116.6, 101.1, 48.8, 48.7, 21.2, 19.3. HRMS-ESI (*m/z*): calcd for $C_{21}H_{23}INO_2$ $[M + H]^+$: 448.0768, found 448.0770.

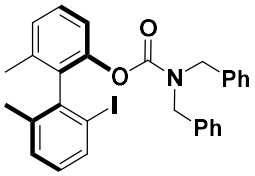
(*R*)-2'-Iodo-6,6'-dimethyl-[1,1'-biphenyl]-2-yl dibutylcarbamate (8)



Eluent: 20:1 petroleum ether / ethyl acetate; light yellow oil**,** 41.2 mg, 86% yield, 94% ee. HPLC conditions: Chiralpak RR, isopropanol/hexanes = 1:99, flow: 0.6 mL/min, λ = 254 nm, t_r = 12.214

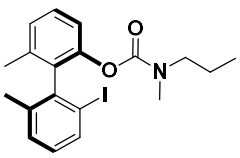
min (major), 13.438 min (minor). $[\alpha]^{25}_D$ = -54.79 (c 0.19, CH_2Cl_2). ^1H NMR (400 MHz, $CDCl_3$): δ 7.78 (d, J = 7.6 Hz, 1H), 7.35 (t, J = 7.6 Hz, 1H), 7.24 (d, J = 7.6 Hz, 1H), 7.20 (d, J = 7.6 Hz, 1H), 7.16 (d, J = 7.6 Hz, 1H), 6.96 (t, J = 7.6 Hz, 1H), 3.17 (td, J = 7.2, 3.2 Hz, 2H), 2.97 – 2.90 (m, 1H), 2.85 – 2.78 (m, 1H), 2.06 (s, 3H), 2.00 (s, 3H), 1.48 – 1.40 (m, 2H), 1.28 – 1.19 (m, 3H), 1.16 – 1.09 (m, 3H), 0.91 (t, J = 7.2 Hz, 3H), 0.85 (t, J = 6.8 Hz, 3H). $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$): δ 153.8, 148.3, 141.6, 138.7, 136.9, 136.3(0), 136.2(6), 129.7, 128.9, 128.4, 126.5, 120.5, 101.2, 47.2, 47.1, 30.4, 29.9, 21.2, 20.0, 19.8, 19.4, 13.8. HRMS-ESI (*m/z*): calcd for $C_{23}H_{31}INO_2$ $[M + H]^+$: 480.1394, found 480.1394.

(*R*)-2'-Iodo-6,6'-dimethyl-[1,1'-biphenyl]-2-yl dibenzylcarbamate (9)



Eluent: 10:1 petroleum ether / ethyl acetate; light yellow oil, 41.8mg, 76% yield, 99% ee. HPLC conditions: Chiralpak AD-H, isopropanol/hexanes = 1:99, flow: 0.8 mL/min, λ = 254 nm, t_r = 52.213 min (major), 49.923 min (minor). $[\alpha]^{25}_D$ = -40.06 (c 0.31, CH_2Cl_2). ^1H NMR (400 MHz, $CDCl_3$): δ 7.74 (d, J = 8.0 Hz, 1H), 7.38 (t, J = 8.0 Hz, 1H), 7.33 – 7.27 (m, 4H), 7.25 – 7.22 (m, 4H), 7.19 (d, J = 7.6 Hz, 1H), 7.06 (d, J = 6.0 Hz, 2H), 6.97 – 6.93 (m, 3H), 4.38 (q, J = 14.8 Hz, 2H), 4.07 (q, J = 15.6 Hz, 2H), 2.07 (s, 3H), 2.02 (s, 3H). $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$): δ 154.4, 148.2, 141.3, 138.9, 137.3, 136.9, 136.5, 136.4, 129.8, 129.1, 128.6, 128.5(2), 128.4(8), 127.9, 127.8, 127.3, 127.3, 127.1, 120.5, 100.0, 49.1, 49.0, 21.3, 19.4. HRMS-ESI (*m/z*): calcd for $C_{29}H_{27}INO_2$ $[M + H]^+$: 548.8081, found 548.8082.

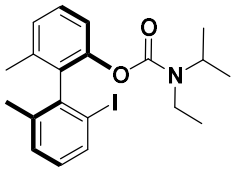
(*R*)-2'-Iodo-6,6'-dimethyl-[1,1'-biphenyl]-2-yl methyl(propyl)carbamate (10)



Eluent: 20:1 petroleum ether / ethyl acetate; light yellow oil, 33.8mg, 80% yield, 98% ee. HPLC conditions: Chiralpak OJ-H, isopropanol/hexanes = 1:99, flow: 0.5 mL/min, λ = 254 nm, t_r = 13.810 min (major), 16.844 min (minor). $[\alpha]^{25}_D$ = -58.19 (c 0.18, CH_2Cl_2). ^1H NMR (400 MHz, $CDCl_3$): δ 7.76 (d, J = 8.4 Hz, 1H), 7.33 (t, J = 7.6 Hz, 1H), 7.21 (t, J = 7.2 Hz, 2H), 7.16 – 7.13 (m, 1H), 6.93 (t, J = 8.0 Hz, 1H), 3.22 – 2.50 (m, 5H), 2.04 (s, 3H), 2.00 – 1.98 (m, 3H), 1.44 – 0.97 (m, 2H), 0.77 (t, J = 7.2 Hz, 1H), 0.64 (t, J = 7.2 Hz, 2H). $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$): δ 153.8, 148.3, 148.2, 141.6, 141.4, 138.8, 138.6, 137.0, 136.3, 136.2, 129.6, 128.9, 128.4(0), 128.3(7), 126.7, 126.5, 120.6, 120.1, 101.1(4), 101.1(1), 50.8, 50.5, 34.7, 33.7, 21.3, 21.2, 20.7, 20.3, 19.3, 10.9, 10.8.

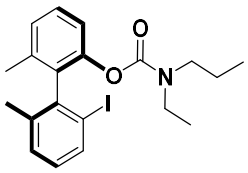
HRMS-ESI (*m/z*): calcd for $C_{19}H_{23}INO_2$ $[M + H]^+$: 424.0768 , found 424.0767.

(*R*)-2'-Iodo-6,6'-dimethyl-[1,1'-biphenyl]-2-yl ethyl(propyl)carbamate (11)



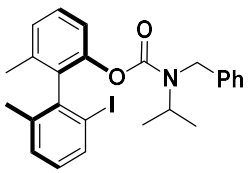
Eluent: 20:1 petroleum ether / ethyl acetate; light yellow oil, 32.3 mg, 74% yield, 98% ee. HPLC conditions: Chiralpak OD-H and AD-H, isopropanol/hexanes = 1:99, flow: 0.8 mL/min, λ = 254 nm, t_r = 19.120 min (major), 21.559 min (minor). $[\alpha]^{25}_D$ = -57.02 (c 0.24, CH_2Cl_2). ^1H NMR (400 MHz, $CDCl_3$): δ 7.75 (d, *J* = 8.0 Hz, 1H), 7.33 (t, *J* = 8.0 Hz, 1H), 7.22 – 7.19 (m, 2H), 7.14 (d, *J* = 7.6 Hz, 1H), 6.92 (t, *J* = 7.6 Hz, 1H), 3.22 – 3.08 (m, 2H), 3.02 – 2.71 (m, 2H), 2.04 (s, 3H), 1.98 (s, 3H), 1.48 – 1.43 (m, 1H), 1.24 – 1.16 (m, 1H), 1.02 (t, *J* = 6.8 Hz, 2H), 0.82 – 0.65 (m, 4H). $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$): δ 153.4, 148.3, 141.6, 138.7, 136.9, 136.3, 136.2, 129.7, 128.9, 128.4, 126.5, 120.4, 101.2, 48.7, 48.6, 42.4, 42.0, 21.6, 21.2, 19.4, 13.3, 13.0, 11.1. HRMS-ESI (*m/z*): calcd for $C_{20}H_{25}INO_2$ $[M + H]^+$: 438.0924 , found 438.0924.

(*R*)-2'-Iodo-6,6'-dimethyl-[1,1'-biphenyl]-2-yl benzyl(isopropyl)carbamate (12)



Eluent: 20:1 petroleum ether / ethyl acetate; light yellow oil, 41.9 mg, 84% yield, 99% ee. HPLC conditions: Chiralpak AD-H, isopropanol/hexanes = 4:96, flow: 0.8 mL/min, λ = 254 nm, t_r = 10.353 min (major), 10.915 min (minor). $[\alpha]^{25}_D$ = -61.89 (c 0.31, CH_2Cl_2). ^1H NMR (400 MHz, $CDCl_3$): δ 7.76 (t, *J* = 8.4 Hz, 1H), 7.38 – 7.27 (m, 2H), 7.25 – 7.11 (m, 6H), 7.02 – 6.93 (m, 2H), 4.46 – 4.29 (m, 1H), 4.12 – 3.90 (m, 2H), 2.09 – 1.99 (m, 6H), 1.07 – 1.00 (m, 3H), 0.90 – 0.74 (m, 3H). $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$): δ 154.5, 148.3, 141.4, 139.2, 138.9, 137.1, 136.4, 129.7, 129.0, 128.5, 128.2, 127.1, 126.8, 126.7, 126.6, 120.6, 120.5, 101.3, 48.9, 47.0, 21.3, 20.8, 20.0, 19.4. HRMS-ESI (*m/z*): calcd for $C_{25}H_{27}INO_2$ $[M + H]^+$: 500.1081, found 500.1080.

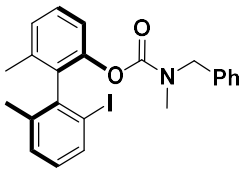
(*R*)-2'-Iodo-6,6'-dimethyl-[1,1'-biphenyl]-2-yl ethyl(isopropyl)carbamate (13)



Eluent: 20:1 petroleum ether / ethyl acetate; light yellow oil, 30.6 mg, 70% yield, 92% ee. HPLC conditions: Chiralpak OD-H, isopropanol/hexanes = 2:98, flow: 0.5 mL/min, λ = 254 nm, t_r = 11.247 min (major), 12.092 min (minor). $[\alpha]^{25}_D$ = -53.93 (c 0.28, CH_2Cl_2). ^1H NMR (400 MHz, $CDCl_3$): δ 7.75 (d, *J* = 8.0 Hz, 1H), 7.33 (t, *J* = 7.6 Hz, 1H), 7.20 (d, *J* = 7.6 Hz,

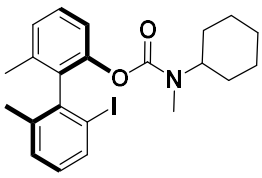
2H), 7.14 (d, *J* = 7.6 Hz, 1H), 6.92 (t, *J* = 7.6 Hz, 1H), 4.17 – 3.84 (m, 1H), 3.20 – 3.04 (m, 1H), 2.89 – 2.70 (m, 1H), 2.05 (s, 3H), 1.99 (s, 3H), 1.02 – 0.93 (m, 6H), 0.79 – 0.76 (m, 3H). $^{13}C\{^{1}H\}$ NMR (100 MHz, $CDCl_3$): δ 153.4, 148.4, 141.6, 138.8, 136.9, 136.3, 129.6, 128.9, 128.4, 126.5, 120.5, 101.3, 99.9, 47.8, 37.3, 21.2, 20.7, 20.3, 19.4, 15.3. HRMS-ESI (*m/z*): calcd for $C_{20}H_{25}INO_2$ $[M + H]^+$: 438.0924 , found 438.0923.

(*R*)-2'-Iodo-6,6'-dimethyl-[1,1'-biphenyl]-2-yl benzyl(methyl)carbamate (14)



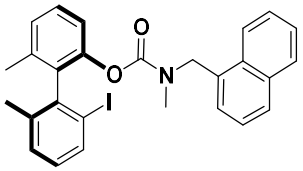
Eluent: 20:1 petroleum ether / ethyl acetate; light yellow oil, 36.1 mg, 78% yield, >99% ee. HPLC conditions: Chiralpak INC, isopropanol/hexanes = 5:95, flow: 0.6 mL/min, λ = 254 nm, t_r = 15.920 min (major), 16.605 min (minor). $[\alpha]^{25}_D$ = -53.14 (c 0.21, CH_2Cl_2). ^1H NMR (400 MHz, $CDCl_3$): δ 7.76 – 7.71 (m, 1H), 7.38 – 7.34 (m, 1H), 7.34 – 7.28 (m, 1H), 7.23 – 7.16 (m, 5H), 7.03 (d, *J* = 6.4 Hz, 1H), 6.95 – 6.86 (m, 2H), 4.52 – 4.06 (m, 2H), 2.77 (s, 1.4 H), 2.49 (s, 1.6 H), 2.06 (s, 3H), 2.02 – 1.99 (m, 3H). $^{13}C\{^{1}H\}$ NMR (100 MHz, $CDCl_3$): δ 154.4, 153.8, 148.2, 141.3(3), 141.2(6), 138.8, 138.6, 137.1(3), 137.0(8), 136.9, 136.8, 136.5, 136.4, 136.3, 136.1, 129.7, 129.1, 129.0, 128.5, 128.4(4), 128.3(8), 127.5, 127.2, 127.0, 126.7, 101.1, 52.4, 33.9, 33.4, 21.3, 21.2, 19.3(5), 19.3(3). HRMS-ESI (*m/z*): calcd for $C_{23}H_{23}INO_2$ $[M + H]^+$: 472.0768 , found 472.0771.

(*R*)-2'-Iodo-6,6'-dimethyl-[1,1'-biphenyl]-2-yl cyclohexyl(methyl)carbamate (15)



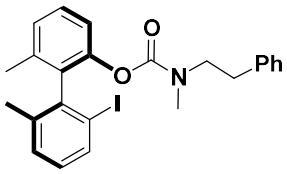
Eluent: 10:1 petroleum ether / ethyl acetate; light yellow oil, 31.9 mg, 69% yield, 95% ee. HPLC conditions: Chiralpak INC, isopropanol/hexanes = 7:93, flow: 1 mL/min, λ = 254 nm, t_r = 5.925 min (major), 6.443 min (minor). $[\alpha]^{25}_D$= -44.40 (c 0.25, CH_2Cl_2). ^1H NMR (400 MHz, $CDCl_3$): δ 7.75 (d, *J* = 7.6 Hz, 1H), 7.34 (t, *J* = 8.0 Hz, 1H), 7.22 – 7.19 (m, 2H), 7.15 (d, *J* = 7.6 Hz, 1H), 6.92 (t, *J* = 8.0 Hz, 1H), 3.83 – 3.45 (m, 1H), 2.70 (s, 2 H), 2.34 (s, 1 H), 2.03 (s, 3H), 1.98 (s, 3H), 1.73 – 1.56 (m, 4H), 1.49 – 1.17 (m, 4H), 1.13 – 0.95 (m, 2H). $^{13}C\{^{1}H\}$ NMR (100 MHz, $CDCl_3$): δ 153.6, 148.2, 141.6, 138.7, 136.9, 136.3, 129.7, 128.9, 128.4, 126.6, 120.7, 120.5, 101.1, 55.5, 55.0, 30.3, 30.0, 28.5, 25.7, 25.4, 21.3, 19.3. HRMS-ESI (*m/z*): calcd for $C_{22}H_{27}INO_2$ $[M + H]^+$: 464.1081, found 464.1080.

(*R*)-2'-Iodo-6,6'-dimethyl-[1,1'-biphenyl]-2-yl methyl(naphthalen-1-ylmethyl)carbamate (16)



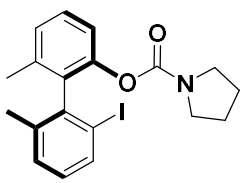
Eluent: 20:1 petroleum ether / ethyl acetate; light yellow oil, 44.3 mg, 85% yield, 96% ee. HPLC conditions: Chiralpak AD-H, isopropanol/hexanes = 3:97, flow: 1.0 mL/min, λ = 254 nm, t_r = 16.709 min (major), 17.838 min (minor). $[\alpha]^{25}_D$ = -49.36 (c 0.31, CH_2Cl_2). ^{1}H NMR (400 MHz, $CDCl_3$): δ 8.01 (d, J = 8.0 Hz, 1H), 7.88 – 7.86 (m, 1H), 7.80 – 7.72 (m, 2H), 7.53 – 7.28 (m, 5H), 7.21 – 7.00 (m, 3H), 6.94 – 6.65 (m, 1H), 4.94 – 4.58 (m, 2H), 2.84 (s, 1.2 H), 2.51 (s, 1.8 H), 2.07 – 1.96 (m, 6H). ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$): δ 154.2, 154.0, 148.3, 141.4, 141.2, 138.8, 138.4, 137.2, 136.5, 136.3, 133.8, 133.7, 132.2, 132.1, 131.6, 131.1, 129.7, 129.6, 129.0, 128.9, 128.7, 128.6, 128.5, 128.2, 127.8, 127.0, 126.7, 126.5, 126.2, 125.8, 125.7, 125.5, 125.2, 124.1, 123.5, 122.8, 120.6, 119.8, 101.2, 100.9, 50.4, 50.1, 34.5, 33.4, 21.3, 19.4. HRMS-ESI (*m/z*): calcd for $C_{27}H_{25}INO_2$ $[M + H]^+$: 522.0924 , found 522.0930.

(R)-2'-Iodo-6,6'-dimethyl-[1,1'-biphenyl]-2-yl methyl(phenethyl)carbamate (17)



Eluent: 20:1 petroleum ether / ethyl acetate; light yellow oil, 30.1 mg, 62% yield, 95% ee. HPLC conditions: Chiralpak INC, isopropanol/hexanes = 3:97, flow: 1.0 mL/min, λ = 254 nm, t_r = 12.538 min (major), 11.416 min (minor). $[\alpha]^{25}_D$ = -44.81 (c 0.24, CH_2Cl_2). ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.79 – 7.71 (m, 1H), 7.34 (t, J = 8.0 Hz, 1H), 7.29 – 7.27 (m, 1H), 7.25 – 7.11 (m, 6H), 7.06 (d, J = 6.8 Hz, 1H), 6.98 – 6.85 (m, 1H), 3.45 – 3.02 (m, 2H), 2.73 – 2.27 (m, 5H), 2.08 – 2.05 (m, 3H), 2.00 (s, 3H). ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$): δ 153.8, 153.7, 148.2, 148.1, 141.5, 141.4, 138.9, 138.8, 138.7, 137.1, 137.0, 136.4(1), 136.3(5), 136.3, 136.2, 129.8, 129.7, 129.1, 129.0, 128.9, 128.8, 128.4(2), 128.3(5), 126.8, 126.7, 126.2, 120.5, 120.4, 101.2(2), 101.1(6), 51.2, 51.1, 35.5, 34.6, 34.2, 33.8, 21.3, 21.2, 19.4. HRMS-ESI (*m/z*): calcd for $C_{24}H_{25}INO_2$ $[M + H]^+$: 486.0924, found 486.0923.

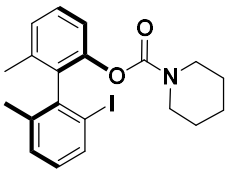
(*R*)-2'-Iodo-6,6'-dimethyl-[1,1'-biphenyl]-2-yl pyrrolidine-1-carboxylate (18)



Eluent: 20:1 petroleum ether / ethyl acetate; white solid, 31.2 mg, 74% yield, 96% ee. mp: 70-71 ^{o}C. HPLC conditions: Chiralpak INC, isopropanol/hexanes = 7:93, flow: 1.0 mL/min, λ = 254 nm, t_r = 10.574 min (major), 11.335 min (minor). $[\alpha]^{25}_D$ = -42.58 (c 0.26, CH_2Cl_2). ^{1}H

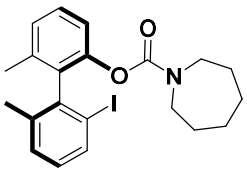
NMR (400 MHz, $CDCl_3$): δ 7.75 (d, J = 7.6 Hz, 1H), 7.33 (t, J = 8.0 Hz, 1H), 7.25 – 7.21 (m, 2H), 7.14 (d, J = 7.6 Hz, 1H), 6.93 (t, J = 7.6 Hz, 1H), 3.33 – 3.20 (m, 2H), 3.04 – 2.99 (m, 1H), 2.82 – 2.76 (m, 1H), 2.05 (s, 3H), 2.00 (s, 3H), 1.76 – 1.61 (m, 4H). $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$): δ 152.3, 148.3, 141.6, 138.8, 137.0, 136.2(2), 136.1(8), 129.6, 128.9, 128.5, 126.6, 120.3, 101.2, 46.0, 45.7, 25.5, 24.8, 21.3, 19.4. HRMS-ESI (*m/z*): calcd for $C_{19}H_{21}INO_2$ $[M + H]^+$: 422.0611, found 422.0609.

(*R*)-2'-Iodo-6,6'-dimethyl-[1,1'-biphenyl]-2-yl piperidine-1-carboxylate (19)



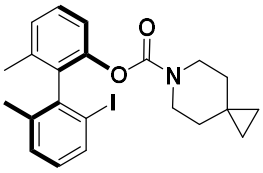
Eluent: 20:1 petroleum ether / ethyl acetate; white solid, 21.8 mg, 50% yield, >99% ee. mp: 90-91 ºC. HPLC conditions: Chiralpak OD-H, isopropanol/hexanes = 0.5:99.5, flow: 0.5 mL/min, λ = 254 nm, t_r = 37.774 min (major), 33.173 min (minor). $[\alpha]^{25}_D$ = -33.33 (c 0.13, CH_2Cl_2). ^1H NMR (400 MHz, $CDCl_3$): δ 7.76 (d, J = 7.6 Hz, 1H), 7.33 (t, J = 8.0 Hz, 1H), 7.22 (d, J = 7.6 Hz, 1H), 7.19-7.14 (m, 2H), 6.93 (t, J = 7.6 Hz, 1H), 3.41 – 3.35 (m, 1H), 3.23 – 3.11 (m, 2H), 3.05 – 2.99 (m, 1H), 2.05 (s, 3H), 1.99 (s, 3H), 1.48 – 1.42 (m, 3H), 1.33 – 1.21 (m, 2H), 1.02 – 0.89 (m, 1H). $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$): δ 152.8, 148.3, 141.5, 138.9, 137.0, 136.4, 136.3, 129.6, 128.9, 128.5, 126.7, 120.6, 101.2, 45.3, 45.0, 25.5, 24.2, 21.2, 19.3. HRMS-ESI (*m/z*): calcd for $C_{20}H_{23}INO_2$ $[M + H]^+$: 436.0768, found 436.0768.

(*R*)-2'-Iodo-6,6'-dimethyl-[1,1'-biphenyl]-2-yl azepane-1-carboxylate (20)



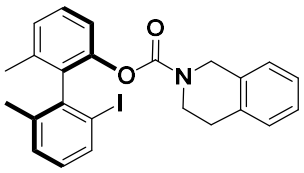
Eluent: 20:1 petroleum ether / ethyl acetate; light yellow oil, 37.7 mg, 84% yield, 98% ee. HPLC conditions: Chiralpak AD-H, isopropanol/hexanes = 1:99, flow: 0.6 mL/min, λ = 254 nm, t_r = 19.936 min (major), 23.159 min (minor). $[\alpha]^{25}_D$ = -39.39 (c 0.30, CH_2Cl_2). ^1H NMR (400 MHz, $CDCl_3$): δ 7.75 (d, J = 7.6 Hz, 1H), 7.33 (t, J = 7.6 Hz, 1H), 7.22 – 7.18 (m, 2H), 7.15 (d, J = 7.2 Hz, 1H), 6.92 (t, J = 7.6 Hz, 1H), 3.49 – 3.43 (m, 1H), 3.26 – 3.18 (m, 2H), 3.02 – 2.95 (m, 1H), 2.05 (s, 3H), 1.98 (s, 3H), 1.61 – 1.58 (m, 2H), 1.46 – 1.38 (m, 1H), 1.33 – 1.25 (m, 3H), 1.21 – 1.06 (m, 2H). $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$): δ 153.7, 148.3, 141.6, 138.8, 137.0, 136.3(3), 136.3(1), 129.7, 129.0, 128.4, 126.6, 120.5, 101.2, 47.2, 46.9, 28.0, 27.9, 27.0, 26.5, 21.3, 19.4. HRMS-ESI (*m/z*): calcd for $C_{21}H_{25}INO_2$ $[M + H]^+$: 450.0924, found 450.0924.

(*R*)-2'-Iodo-6,6'-dimethyl-[1,1'-biphenyl]-2-yl 6-azaspiro[2.5]octane-6-carboxylate (21)



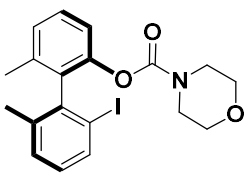
Eluent: 5:1 petroleum ether / ethyl acetate; white solid, 17.5 mg, 38% yield, 98% ee. mp: 90-92 °C. HPLC conditions: Chiralpak OD-H, isopropanol/hexanes = 5:95, flow: 1.0 mL/min, λ = 254 nm, t_r = 7.302 min (major), 8.162 min (minor). $[\alpha]^{25}_D$ = -46.75 (c 0.15, CH_2Cl_2). ^1H NMR (400 MHz, $CDCl_3$): δ 7.76 (d, J = 7.6 Hz, 1H), 7.34 (t, J = 7.6 Hz, 1H), 7.24 – 7.19 (m, 2H), 7.15 (d, J = 7.6 Hz, 1H), 6.94 (t, J = 8.0 Hz, 1H), 3.50 – 3.43 (m, 1H), 3.32 – 3.20 (m, 2H), 3.14 – 3.07 (m, 1H), 2.06 (s, 3H), 2.00 (s, 3H), 1.26 – 1.16 (m, 2H), 0.96 – 0.82 (m, 2H), 0.25 (s, 4H). $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$): δ 152.9, 148.3, 141.5, 138.9, 137.0, 136.4, 136.3, 129.7, 129.0, 128.5, 126.8, 120.6, 101.2, 44.3, 44.1, 34.7, 21.2, 19.3, 17.4, 11.3. HRMS-ESI (*m/z*): calcd for $C_{22}H_{25}INO_2$ $[M+H]^+$: 462.0924, found 462.0921.

(*R*)-2'-Iodo-6,6'-dimethyl-[1,1'-biphenyl]-2-yl 3,4-dihydroisoquinoline-2(1*H*)-carboxylate (22)



Eluent: 20:1 petroleum ether / ethyl acetate; light yellow oil, 35.7 mg, 74% yield, 94% ee. HPLC conditions: Chiralpak AD-H, isopropanol/hexanes = 10:90, flow: 0.8 mL/min, λ = 254 nm, t_r = 8.721 min (major), 10.127 min (minor). $[\alpha]^{25}_D$ = -16.77 (c 0.32, CH_2Cl_2). ^1H NMR (400 MHz, $CDCl_3$): δ 7.79 – 7.48 (m, 1H), 7.36 (t, J = 8.0 Hz, 1H), 7.24 – 7.15 (m, 4H), 7.14 – 6.62 (m, 4H), 4.53 (s, 1H), 4.24 (s, 1H), 3.70 – 3.43 (m, 1H), 3.34 (t, J = 4.8 Hz, 1H), 2.74 – 2.36 (m, 2H), 2.04 (s, 3H), 2.00 (s, 3H). $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$): δ 153.0, 152.9, 138.8, 138.7, 137.1(4), 137.1(2), 136.2(7), 136.2(6), 136.1(5), 136.1(3), 134.3, 134.2, 133.0, 132.9, 129.7, 129.5, 129.0, 128.9, 128.6(1), 128.5(5), 128.5, 126.9, 126.3(4), 126.2(9), 126.2(3), 126.2(0), 126.1, 126.0, 120.4, 45.8, 41.8, 41.5, 28.7, 28.4, 21.2(3), 21.1(7), 19.3. HRMS-ESI (*m/z*): calcd for $C_{24}H_{23}INO_2$ $[M+H]^+$: 484.0768 , found 484.0765.

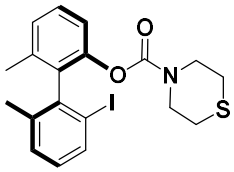
(*R*)-2'-Iodo-6,6'-dimethyl-[1,1'-biphenyl]-2-yl morpholine-4-carboxylate (23)



Eluent: 20:1 petroleum ether / ethyl acetate; white solid, 36.3 mg, 83% yield, 95% ee. mp: 109-110 °C. HPLC conditions: Chiralpak AD-H, isopropanol/hexanes = 3:97, flow: 1.0 mL/min, λ = 254 nm, t_r = 12.068 min (major), 10.957 min (minor). $[\alpha]^{25}_D$ = -40.89 (c 0.33, CH_2Cl_2). ^1H NMR (400 MHz, $CDCl_3$): δ 7.77 (d, J = 7.6 Hz, 1H), 7.35 (t, J = 7.6 Hz, 1H), 7.25 – 7.24 (m, 1H),

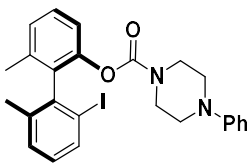
7.20 – 7.17 (m, 2H), 6.96 (t, *J* = 8.0 Hz, 1H), 3.62 – 3.55 (m, 1H), 3.45 – 3.31 (m, 4H), 3.11 (s, 3H), 2.05 (s, 3H), 2.01 (s, 3H). $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$): δ 152.7, 148.0, 141.3, 138.9, 137.2, 136.4, 136.3, 129.7, 129.2, 128.6, 127.1, 120.5, 101.1, 66.6, 66.2, 44.6, 44.1, 21.2, 19.3. HRMS-ESI (*m/z*): calcd for $C_{19}H_{21}INO_3$ $[M + H]^+$: 438.0561 , found 438.0562.

(*R*)-2'-Iodo-6,6'-dimethyl-[1,1'-biphenyl]-2-yl thiomorpholine-4-carboxylate（24）



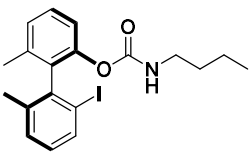
Eluent: 20:1 petroleum ether / ethyl acetate; light yellow oil, 38.9 mg, 86% yield, >99% ee. HPLC conditions: Chiralpak OD-H, isopropanol/hexanes = 2:98, flow: 0.6 mL/min, λ = 254 nm, t_r = 15.747 min (major), 17.065 min (minor). $[\alpha]^{25}_D$ = -33.43 (c 0.36, CH_2Cl_2). ^1H NMR (400 MHz, $CDCl_3$): δ 7.78 (d, *J* = 8.0 Hz, 1H), 7.30 (t, *J* = 8.0 Hz, 1H), 7.25 (d, *J* = 8.0 Hz, 1H), 7.05 – 7.00 (m, 2H), 6.93 (t, *J* = 8.0 Hz, 1H), 3.44 (t, *J* = 4.4 Hz, 4H), 2.94 – 2.89 (m, 2H), 2.77 – 2.72 (m, 2H), 2.05 (s, 3H), 1.96 (s, 3H). $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$): δ 152.5, 148.0, 141.3, 139.0, 137.2, 136.4, 136.3, 129.8, 129.2, 128.6, 127.1, 120.5, 101.1, 47.0, 46.5, 27.1, 26.9, 21.2, 19.3. HRMS-ESI (*m/z*): calcd for $C_{19}H_{21}INO_2S$ $[M + H]^+$: 454.0332, found 454.0331.

(*R*)-2'-Iodo-6,6'-dimethyl-[1,1'-biphenyl]-2-yl 4-phenylpiperazine-1-carboxylate (25)



Eluent: 10:1 petroleum ether / ethyl acetate; light yellow oil, 35.3 mg, 69% yield, 97% ee. HPLC conditions: Chiralpak AD-H, isopropanol/hexanes = 2:98, flow: 1.0 mL/min, λ = 254 nm, t_r = 19.535 min (major), 20.633 min (minor). $[\alpha]^{25}_D$ = -28.19 (c 0.34, CH_2Cl_2). ^1H NMR (400 MHz, $CDCl_3$): δ 7.75 (d, *J* = 8.0 Hz, 1H), 7.35 (t, *J* = 8.0 Hz, 1H), 7.29 – 7.26 (m, 1H), 7.25 – 7.24 (m, 1H), 7.21 – 7.16 (m, 3H), 6.92 – 6.84 (m, 4H), 3.59 – 3.43 (m, 2H), 3.28 (s, 2H), 3.10 (s, 1H), 2.89 – 2.83 (m, 2H), 2.52 (s, 1H), 2.04 (s, 3H), 1.99 (s, 3H). $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$): δ 152.6, 150.9, 148.0, 141.3, 138.9, 137.1, 136.3, 129.7, 129.2, 129.1, 128.6, 127.0, 120.5, 116.7, 101.1, 49.4, 49.1, 44.1, 43.7, 21.2, 19.3. HRMS-ESI (*m/z*): calcd for $C_{25}H_{26}IN_2O_2$ $[M+H]^+$: 513.1033, found 513.1038.

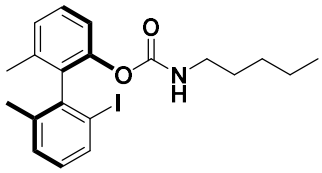
(*R*)-2'-Iodo-6,6'-dimethyl-[1,1'-biphenyl]-2-yl butylcarbamate (26)



Eluent: 10:1 petroleum ether / ethyl acetate; white solid, 30.0 mg, 71% yield, 97% ee. mp: 80-81 °C. HPLC conditions: Chiralpak INC, isopropanol/hexanes = 10:90, flow: 1.0 mL/min, λ = 254 nm, t_r = 6.440

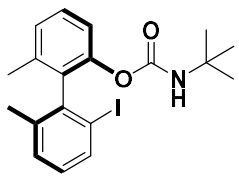
min (major), 5.965 min (minor). $[\alpha]^{25}_{D}$ = -46.78 (c 0.30, CH_2Cl_2). ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.76 (d, J = 7.6 Hz, 1H), 7.33 (t, J = 8.0 Hz, 1H), 7.23 (d, J = 7.6 Hz, 1H), 7.16 (t, J = 8.0 Hz, 2H), 6.94 (t, J = 8.0 Hz, 1H), 4.62– 4.52 (m, 1H), 3.10 – 2.83 (m, 2H), 2.05 (s, 3H), 1.98 (s, 3H), 1.39 – 1.11 (m, 4H), 0.89 – 0.80 (m, 3H). ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$): δ 154.1, 147.9, 141.2, 138.8, 137.2, 136.5, 136.3, 129.7, 129.0, 128.5, 126.9, 120.5, 101.0, 40.6, 31.7, 21.2, 19.6, 19.4, 13.7. HRMS-ESI (*m/z*): calcd for $C_{19}H_{23}INO_2$ $[M + H]^+$: 424.0768, found 424.0763.

(*R*)-2'-Iodo-6,6'-dimethyl-[1,1'-biphenyl]-2-yl pentylcarbamate (27)



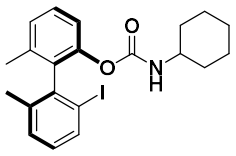
Eluent: 10:1 petroleum ether / ethyl acetate; white solid, 29.3 mg, 67% yield, 90% ee. mp: 57-58 °C. HPLC conditions: Chiralpak INC, isopropanol/hexanes = 10:90, flow: 1.0 mL/min, λ = 254 nm, t_r = 6.398 min (major), 5.916 min (minor). $[\alpha]^{25}_{D}$ = -45.45 (c 0.29, CH_2Cl_2). ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.76 (d, J = 7.6 Hz, 1H), 7.33 (t, J = 8.0 Hz, 1H), 7.22 (d, J = 7.6 Hz, 1H), 7.15 (t, J = 7.6 Hz, 2H), 6.94 (t, J = 8.0 Hz, 1H), 4.63 – 4.50 (m, 1H), 3.09 – 2.81 (m, 2H), 2.05 (s, 3H), 1.98 (s, 3H), 1.41 – 1.15 (m, 6H), 0.88 (t, J = 7.2 Hz, 3H). ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$): δ 154.0, 147.9, 141.2, 138.8, 137.2, 136.5, 136.3, 129.7, 129.0, 128.5, 126.9, 120.5, 101.0, 40.9, 29.3, 28.6, 22.2, 21.2, 19.4, 13.9. HRMS-ESI (*m/z*): calcd for $C_{20}H_{25}INO_2$ $[M+H]^+$ 438.0924, found 438.0919.

(*R*)-2'-Iodo-6,6'-dimethyl-[1,1'-biphenyl]-2-yl tert-butylcarbamate (28)



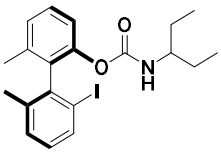
Eluent: 10:1 petroleum ether / ethyl acetate; white solid, 31.3 mg, 74% yield, 97% ee. mp: 61-63 °C. HPLC conditions: Chiralpak OD-H, isopropanol/hexanes = 1:99, flow: 0.6 mL/min, λ = 254 nm, t_r = 14.800 min (major), 13.779 min (minor). $[\alpha]^{25}_{D}$= -51.94 (c 0.31, CH_2Cl_2). ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.76 (d, J = 8.0 Hz, 1H), 7.32 (t, J = 8.0 Hz, 1H), 7.23 (d, J = 7.6 Hz, 1H), 7.16 – 7.11 (m, 2H), 6.94 (t, J = 7.6 Hz, 1H), 4.53 (s, 1H), 2.06 (s, 3H), 1.99 (s, 3H), 1.19 (s, 9H). ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$): δ 152.2, 147.9, 141.2, 138.9, 137.2, 136.7, 136.3, 129.7, 128.9, 128.4, 126.9, 120.8, 101.1, 50.4, 28.5, 21.2, 19.4. HRMS-ESI (*m/z*): calcd for $C_{19}H_{23}INO_2$ $[M + H]^+$: 424.0768, found 424.0760.

(*R*)-2'-Iodo-6,6'-dimethyl-[1,1'-biphenyl]-2-yl cyclohexylcarbamate (29)



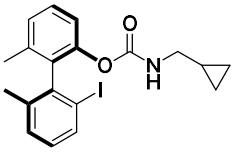
Eluent: 20:1 petroleum ether / ethyl acetate; light yellow oil, 38.3 mg, 85% yield, 96% ee. HPLC conditions: Chiralpak INC, isopropanol/hexanes = 3:97, flow: 1.0 mL/min, λ = 254 nm, t_r = 9.833 min (major), 10.594 min (minor). $[\alpha]^{25}_D$ = -44.65 (c 0.38, CH_2Cl_2). ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.76 (d, J = 7.6 Hz, 1H), 7.33 (t, J = 7.6 Hz, 1H), 7.23 – 7.12 (m, 3H), 6.94 (t, J = 8.0 Hz, 1H), 4.51 – 4.34 (m, 1H), 3.40 – 2.96 (m, 1H), 2.05 (s, 3H), 1.98 (s, 3H), 1.89 – 1.70 (m, 2H), 1.62-1.54 (m, 2H), 1.33-0.91 (m, 6H). ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$): δ 153.2, 148.0, 141.1, 138.8, 137.2, 136.5, 136.3, 129.7, 129.0, 128.5, 126.9, 120.6, 101.1, 49.8, 33.3, 32.9, 25.4, 24.9, 24.7, 21.2. HRMS-ESI (*m/z*): calcd for $C_{21}H_{25}INO_2$ $[M + H]^+$: 450.0924, found 450.0917.

(*R*)-2'-Iodo-6,6'-dimethyl-[1,1'-biphenyl]-2-yl pentan-3-ylcarbamate (30)



Eluent: 20:1 petroleum ether / ethyl acetate; white solid, 33.2 mg, 76% yield, 96% ee. mp: 88-89 °C. HPLC conditions: Chiralpak INC, isopropanol/hexanes = 5:95, flow: 1.0 mL/min, λ = 254 nm, t_r = 5.339 min (major), 5.739 min (minor). $[\alpha]^{25}_D$ = -51.86 (c 0.32, CH_2Cl_2). ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.76 (d, J = 7.6 Hz, 1H), 7.33 (t, J = 7.6 Hz, 1H), 7.22 – 7.12 (m, 3H), 6.93 (t, J = 7.6 Hz, 2H), 4.33 – 4.12 (m, 1H), 3.39 – 2.98 (m, 1H), 2.05 (s, 3H), 1.99 (s, 3H), 1.50 – 1.16 (m, 4H), 0.85 (t, J = 7.6 Hz, 3H), 0.69 (t, J = 7.2 Hz, 3H). ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$): δ 153.9, 147.9, 141.2, 138.8, 137.2, 136.7, 136.3, 129.7, 129.0, 128.4, 126.9, 120.8, 101.0, 54.1, 27.6, 27.4, 21.2, 19.4, 10.1, 9.8. HRMS-ESI (*m/z*): calcd for $C_{20}H_{25}INO_2$ $[M + H]^+$: 438.0924, found 438.0919.

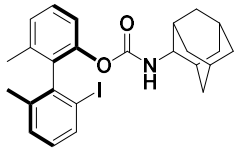
(*R*)-2'-Iodo-6,6'-dimethyl-[1,1'-biphenyl]-2-yl (cyclopropylmethyl)carbamate (31)



Eluent: 20:1 petroleum ether / ethyl acetate; white solid, 31.2 mg, 74% yield, 96% ee. mp: 75-77 °C. HPLC conditions: Chiralpak INC, isopropanol/hexanes = 7:93, flow: 1.0 mL/min, λ = 254 nm, t_r = 8.367 min (major), 7.809 min (minor). $[\alpha]^{25}_D$= -45.83 (c 0.31, CH_2Cl_2). ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.76 (d, J = 8.0 Hz, 1H), 7.33 (t, J = 7.6 Hz, 1H), 7.23 (d, J = 7.6 Hz, 1H), 7.15 (t, J = 6.8 Hz, 2H), 6.94 (t, J = 6.8 Hz, 1H), 4.75 – 4.58 (m, 1H), 2.97 – 2.65 (m, 2H), 2.05 (s, 3H), 1.98 (s, 3H), 0.87 – 0.81 (m, 1H), 0.44-0.33(m, 2H), 0.11 – 0.10 (m, 2H). ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$): δ 154.0, 148.0, 141.2, 138.8, 137.3, 136.4, 136.3, 129.7, 129.0, 128.5, 126.9, 120.4, 101.0, 45.8,

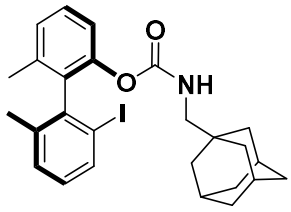
21.2, 19.4, 10.8, 3.1. HRMS-ESI (*m/z*): calcd for $C_{19}H_{21}INO_2$ $[M + H]^+$: 422.0611 , found 422.0606.

(*R*)-2'-iodo-6,6'-dimethyl-[1,1'-biphenyl]-2-yl ((1*R*,2*S*,5*S*)-adamantan-2-yl)carbamate (32)



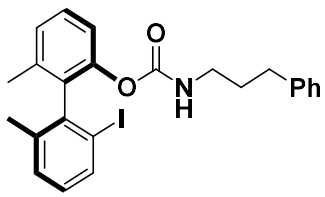
Eluent: 20:1 petroleum ether / ethyl acetate; light yellow oil, 42.1 mg, 84% yield, 91% ee. HPLC conditions: Chiralpak INC, isopropanol/hexanes = 2:98, flow: 1.0 mL/min, λ = 254 nm, t_r = 13.286 min (major), 14.205 min (minor). $[\alpha]^{25}_D$ = -35.11 (c 0.41, CH_2Cl_2). ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.76 (d, J = 8.0 Hz, 1H), 7.33 (t, J = 8.0 Hz, 1H), 7.22 – 7.12 (m, 3H), 6.93 (t, J = 7.6 Hz, 1H), 4.90 (t, J = 8.0 Hz, 1H), 3.67 – 3.31 (m, 1H), 2.05 (s, 3H), 1.99 (s, 3H), 1.81 – 1.47 (m, 14H). ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$): δ 153.7, 153.2, 148.0, 147.7, 141.3, 141.1, 138.9, 138.6, 137.2, 136.7, 136.3(4), 136.2(9), 129.7, 129.0, 128.5, 127.0, 120.7, 101.1, 55.8, 54.9, 37.4, 37.2, 37.0, 36.9, 31.9, 31.8, 31.6, 31.5, 31.3, 31.2, 27.0(3), 26.9(8), 21.2, 19.3. HRMS-ESI (*m/z*): calcd for $C_{25}H_{29}INO_2$ $[M + H]^+$: 502.1237, found 502.1230.

(R)-2'-iodo-6,6'-dimethyl-[1,1'-biphenyl]-2-yl (((1S,3R)-adamantan-1-yl)methyl)carbamate (33)



Eluent: 20:1 petroleum ether / ethyl acetate; light yellow oil, 44.3 mg, 86% yield, 98% ee. HPLC conditions: Chiralpak AD-H, isopropanol/hexanes = 5:95, flow: 1.0 mL/min, λ = 254 nm, t_r = 10.229 min (major), 9.503 min (minor). $[\alpha]^{25}_D$ = -42.26 (c 0.43, CH_2Cl_2). ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.76 (d, J = 8.0 Hz, 1H), 7.33 (t, J = 7.6 Hz, 1H), 7.22 – 7.10 (m, 3H), 6.94 (t, J = 7.6 Hz, 1H), 4.68 – 4.56 (m, 1H), 2.05 (s, 3H), 1.99 (s, 3H), 1.93 – 1.88 (m, 2H), 1.70 – 1.67 (m, 4H), 1.58 – 1.51 (m, 3H), 1.34 – 1.19 (m, 6H). ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$): δ 154.5, 147.9, 141.2, 138.9, 137.2, 136.7, 136.3, 129.7, 128.9, 128.5, 127.0, 120.7, 101.1, 52.6, 39.7, 39.5, 36.8(0), 36.7(5), 33.8, 28.1, 21.2, 19.3. HRMS-ESI (*m/z*): calcd for $C_{26}H_{31}INO_2$ $[M + H]^+$: 516.1394, found 516.1390.

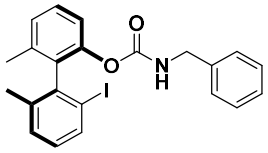
(*R*)-2'-Iodo-6,6'-dimethyl-[1,1'-biphenyl]-2-yl (3-phenylpropyl)carbamate (34)



Eluent: 20:1 petroleum ether / ethyl acetate; white solid, 31.0 mg, 64% yield, 95% ee. mp: 58-59 °C. HPLC conditions: Chiralpak INC, isopropanol/hexanes = 10:90, flow: 1.0 mL/min, λ = 254 nm, t_r = 7.848 min (major), 9.436 min (minor). $[\alpha]^{25}_D$ = -35.83 (c 0.25,

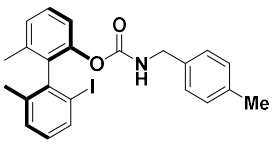
CH_2Cl_2). ^1H NMR (400 MHz, $CDCl_3$): δ 7.78 – 7.69 (m, 1H), 7.36 – 7.27 (m, 3H), 7.22 – 7.12 (m, 6H), 6.94 – 6.82 (m, 1H), 4.69 – 4.59 (m, 1H), 3.15 – 3.10 (m, 2H), 2.54 – 3.40 (m, 2H), 2.06 (s, 3H), 1.99 (s, 3H), 1.75 – 1.68 (m, 2H). $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$): δ 154.1, 147.8, 141.3, 141.1, 138.8, 137.3, 136.5, 136.3, 129.7, 129.0, 128.5, 128.4, 128.3, 127.0, 125.9, 120.5, 101.0, 40.4, 32.7, 31.2, 21.2, 19.4. HRMS-ESI (*m/z*): calcd for $C_{24}H_{25}INO_2$ $[M + H]^+$: 486.0924, found 486.0917.

(*R*)-2'-Iodo-6,6'-dimethyl-[1,1'-biphenyl]-2-yl benzylcarbamate (35)



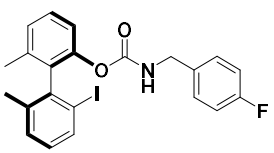
Eluent: 20:1 petroleum ether / ethyl acetate; white solid, 40.2 mg, 88% yield, 99% ee. mp: 95-96 °C. HPLC conditions: Chiralpak INC, isopropanol/hexanes = 7:93, flow: 1.0 mL/min, λ = 254 nm, t_r = 11.666 min (major), 10.230 min (minor). $[\alpha]^{25}_D$ = -42.18 (c 0.40, CH_2Cl_2). ^1H NMR (400 MHz, $CDCl_3$): δ 7.76 (d, *J* = 7.6 Hz, 1H), 7.35 (t, *J* = 8.0 Hz, 1H), 7.32 – 7.27 (m, 2H), 7.24 (d, J = 7.6 Hz, 2H), 7.19 – 7.16 (m, 2H), 7.10 – 6.94 (m, 3H), 5.01 – 4.73 (m, 1H), 4.35 – 4.00 (m, 2H), 2.04 (s, 3H), 2.00 (s, 3H). $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$): δ 154.2, 147.8, 141.1, 138.8, 138.1, 137.4, 136.6, 136.4, 129.7, 129.0, 128.5, 127.4, 127.2, 127.1, 120.5, 101.0, 44.8, 21.2, 19.4. HRMS-ESI (*m/z*): calcd for $C_{22}H_{21}INO_2$ $[M + H]^+$: 458.0611, found 458.0606.

(*R*)-2'-Iodo-6,6'-dimethyl-[1,1'-biphenyl]-2-yl (4-methylbenzyl)carbamate (36)



Eluent: 20:1 petroleum ether / ethyl acetate; white solid, 37.2 mg, 79% yield, 98% ee. mp: 94-95 °C. HPLC conditions: Chiralpak INC, isopropanol/hexanes = 10:90, flow: 1.0 mL/min, λ = 254 nm, t_r = 9.252 min (major), 8.522 min (minor). $[\alpha]^{25}_D$ = -45.98 (c 0.36, CH_2Cl_2). ^1H NMR (400 MHz, $CDCl_3$): δ 7.76 (d, *J* = 7.6 Hz, 1H), 7.35 (t, *J* = 7.6 Hz, 1H), 7.25 – 7.17 (m, 3H), 7.10 (t, *J* = 7.6 Hz, 2H), 7.00 – 6.88 (m, 3H), 4.95 – 4.69 (m, 1H), 4.30 – 3.96 (m, 2H), 2.34 (s, 3H), 2.06 (s, 3H), 2.00 (s, 3H). $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$): δ 154.1, 147.8, 141.1, 138.8, 137.3, 137.0, 136.5, 136.3, 135.0, 129.7, 129.2, 129.0, 128.5, 127.2, 127.1, 120.5, 101.0, 44.6, 21.2, 21.1, 19.4. HRMS-ESI (*m/z*): calcd for $C_{23}H_{23}INO_2$ $[M + H]^+$: 472.0768 , found 472.0764.

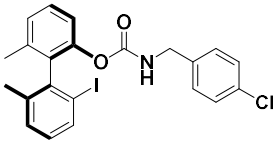
(*R*)-2'-Iodo-6,6'-dimethyl-[1,1'-biphenyl]-2-yl (4-fluorobenzyl)carbamate (37)



Eluent: 20:1 petroleum ether / ethyl acetate; white solid, 34.2 mg, 72% yield, 98% ee. mp: 109-110 °C. HPLC conditions: Chiralpak INC,

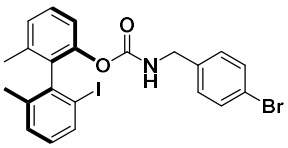
isopropanol/hexanes = 10:90, flow: 1.0 mL/min, λ = 254 nm, t_r = 7.459 min (major), 6.821 min (minor). $[\alpha]^{25}_D$ = -41.11 (c 0.34, CH_2Cl_2). ^1H NMR (400 MHz, $CDCl_3$): δ 7.78 (d, J = 8.0 Hz, 1H), 7.37 (t, J = 8.0 Hz, 1H), 7.25 – 7.17 (m, 3H), 7.09 – 6.96 (m, 5H), 5.04 – 4.79 (m, 1H), 4.33 – 4.01 (m, 2H), 2.05 (s, 3H), 2.01 (s, 3H). $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$): δ 162.1 (d, J = 244.0 Hz), 154.2, 147.7, 141.1, 138.8, 137.4, 136.5, 136.4, 133.9 (d, J = 2.9 Hz), 129.7, 129.0, 128.9 (d, J = 8.1 Hz), 128.6, 127.2, 120.5, 115.3(d, J = 21.3 Hz), 101.0, 44.1, 21.2, 19.4. ^{19}F NMR (376 MHz, $CDCl_3$): δ -115.23 (s). HRMS-ESI (*m/z*): calcd for $C_{22}H_{20}FINO_2$ $[M + H]^+$: 476.0517, found 476.0510.

(*R*)-2'-Iodo-6,6'-dimethyl-[1,1'-biphenyl]-2-yl (4-chlorobenzyl)carbamate (38)



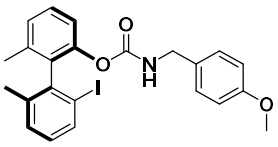
Eluent: 20:1 petroleum ether / ethyl acetate; white solid, 38.2 mg, 78% yield, 98% ee. mp: 111-112 °C. HPLC conditions: Chiralpak INC, isopropanol/hexanes = 10:90, flow: 1.0 mL/min, λ = 254 nm, t_r = 7.548 min (major), 6.882 min (minor). $[\alpha]^{25}_D$ = -45.48 (c 0.38, CH_2Cl_2). ^1H NMR (400 MHz, $CDCl_3$): δ 7.76 (d, J = 7.6 Hz, 1H), 7.34 (t, J = 8.0 Hz, 1H), 7.24 – 7.13 (m, 5H), 7.01 – 6.88 (m, 3H), 5.05 – 4.93 (m, 1H), 4.30 – 3.97 (m, 2H), 2.03 (s, 3H), 1.99 (s, 3H). $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$): δ 154.2, 147.7, 141.0, 138.8, 137.4, 136.7, 136.5, 136.4, 133.1, 129.7, 129.0, 128.6(0), 128.5(5), 128.5, 127.2, 120.5, 101.0, 44.1, 21.2, 19.3. HRMS-ESI (*m/z*): calcd for $C_{22}H_{20}ClINO_2$ $[M + H]^+$: 492.0222 , found 492.0213.

(*R*)-2'-Iodo-6,6'-dimethyl-[1,1'-biphenyl]-2-yl (4-bromobenzyl)carbamate (39)



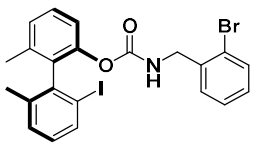
Eluent: 20:1 petroleum ether / ethyl acetate; white solid, 44.9 mg, 84% yield, 98% ee. mp: 127-129 °C. HPLC conditions: Chiralpak INC, isopropanol/hexanes = 10:90, flow: 1.0 mL/min, λ = 254 nm, t_r = 7.862 min (major), 7.122 min (minor). $[\alpha]^{25}_D$ = -40.83 (c 0.48, CH_2Cl_2). ^1H NMR (400 MHz, $CDCl_3$): δ 7.76 (d, J = 8.0 Hz, 1H), 7.42 – 7.33 (m, 3H), 7.22 – 7.14 (m, 3H), 6.98 – 6.83(m, 3H), 5.01 – 4.78 (m, 1H), 4.30 – 3.92 (m, 2H), 2.02 (s, 3H), 1.99 (s, 3H). $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$): δ 154.2, 147.7, 141.0, 138.8, 137.4, 137.2, 136.6, 136.4, 131.6, 129.7, 129.1, 128.9, 128.6, 127.3, 121.2, 120.5, 101.0, 44.2, 21.2, 19.4. HRMS-ESI (*m/z*): calcd for $C_{22}H_{20}BrINO_2$ $[M + H]^+$: 535.9717, found 535.9710.

(*R*)-2'-Iodo-6,6'-dimethyl-[1,1'-biphenyl]-2-yl (4-methoxybenzyl)carbamate (40)



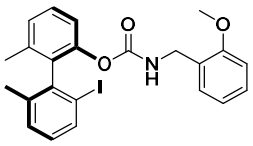
Eluent: 20:1 petroleum ether / ethyl acetate; white solid, 35.6 mg, 73% yield, 98% ee. mp: 108-109 °C. HPLC conditions: Chiralpak INC, isopropanol/hexanes = 10:90, flow: 1.0 mL/min, λ = 254 nm, t_r = 12.691 min (major), 11.418 min (minor). $[\alpha]^{25}_D$ = -46.11 (c 0.35, CH_2Cl_2). ^1H NMR (400 MHz, $CDCl_3$): δ 7.76 (d, J = 7.6 Hz, 1H), 7.35 (t, J = 7.6 Hz, 1H), 7.23 – 7.16 (m, 3H), 7.04 – 6.93 (m, 3H), 4.96 – 4.70 (m, 1H), 4.27 – 3.94 (m, 2H), 3.80 (s, 3H), 2.05 (s, 3H), 1.99 (s, 3H). $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$): δ 158.9, 154.1, 147.8, 141.1, 138.7, 137.3, 136.5, 136.3, 130.2, 129.7, 129.0, 128.6, 128.5, 127.1, 120.5, 113.9, 101.0, 55.3, 44.4, 21.2, 19.3. HRMS-ESI (*m/z*): calcd for $C_{23}H_{23}INO_3$ $[M + H]^+$: 487.0717, found 487.0710.

(*R*)-2'-Iodo-6,6'-dimethyl-[1,1'-biphenyl]-2-yl (2-bromobenzyl)carbamate (41)



Eluent: 20:1 petroleum ether / ethyl acetate; white solid, 39.0 mg, 73% yield, 97% ee. mp: 123-125 °C. HPLC conditions: Chiralpak INC, isopropanol/hexanes = 10:90, flow: 1.0 mL/min, λ= 254 nm, t_r = 10.140 min (major), 9.243 min (minor). $[\alpha]^{25}_D$ = -27.89 (c 0.38, CH_2Cl_2). ^1H NMR (400 MHz, $CDCl_3$): δ 7.75 (d, J = 8.0 Hz, 1H), 7.52 (d, J = 8.0 Hz, 1H), 7.34 (t, J = 8.0 Hz, 1H), 7.25 (t, J = 6.8 Hz, 1H), 7.18 – 7.11(m, 5H), 6.93 (t, J = 8.4 Hz, 1H), 5.17 – 4.99 (m, 1H), 4.38 – 4.07 (m, 2H), 1.99 (s, 3H), 1.98 (s, 3H). $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$): δ 154.1, 147.8, 140.9, 138.7, 137.3, 137.1, 136.6, 136.3, 132.6, 129.6(9), 129.6(7), 129.0(2), 128.9(9), 128.5, 127.5, 127.2, 123.4, 120.6, 100.9, 45.2, 21.1, 19.3. HRMS-ESI (*m/z*): calcd for $C_{22}H_{20}BrINO_2$ $[M + H]^+$: 535.9717, found 535.9714.

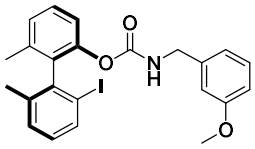
(*R*)-2'-Iodo-6,6'-dimethyl-[1,1'-biphenyl]-2-yl (2-methoxybenzyl)carbamate (42)



Eluent: 20:1 petroleum ether / ethyl acetate; light yellow oil, 29.2 mg, 60% yield, 97% ee. HPLC conditions: Chiralpak INC, isopropanol/hexanes = 10:90, flow: 1.0 mL/min, λ = 254 nm, t_r = 22.637 min (major), 19.918 min (minor). $[\alpha]^{25}_D$ = -27.90 (c 0.28, CH_2Cl_2). ^1H NMR (400 MHz, $CDCl_3$): δ 7.78 – 7.72 (m, 1H), 7.33 (t, J = 7.6 Hz, 1H), 7.27 (d, J = 7.2 Hz, 1H), 7.24 – 7.07 (m, 4H), 6.92 – 6.83 (m, 3H), 5.14 – 5.04 (m, 1H), 4.26 – 3.97 (m, 2H), 3.79 (s, 3H), 2.06 (s, 3H), 1.97 (s, 3H). $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$): δ 157.2, 154.2, 147.9, 141.1, 138.8, 137.2, 136.5, 136.2, 129.7,

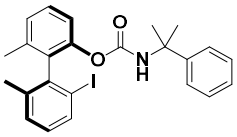
129.1, 128.9, 128.7, 128.4, 126.9, 126.2, 120.6, 120.4, 110.0, 101.0, 55.1, 40.7, 21.1, 19.4. HRMS-ESI (*m/z*): calcd for $C_{23}H_{23}INO_3$ [M + H]$^+$: 487.0717, found 487.0711.

(*R*)-2'-Iodo-6,6'-dimethyl-[1,1'-biphenyl]-2-yl (3-methoxybenzyl)carbamate (43)



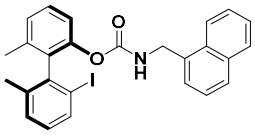
Eluent: 20:1 petroleum ether / ethyl acetate; light yellow oil, 38.0 mg, 78% yield, 98% ee. HPLC conditions: Chiralpak INC, isopropanol/hexanes = 10:90, flow: 1.0 mL/min, λ = 254 nm, t_r = 12.792 min (major), 11.407 min (minor). $[\alpha]^{25}_D$ = -43.40 (c 0.37, CH_2Cl_2). ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.76 (d, *J* = 8.0 Hz, 1H), 7.35 (t, *J* = 8.0 Hz, 1H), 7.23 – 7.17 (m, 4H), 6.94 (t, *J* = 8.0 Hz, 1H), 6.80 (d, *J* = 8.4 Hz, 1H), 6.70 – 6.61 (m, 2H), 5.02 – 4.79 (m, 1H), 4.30 – 3.95 (m, 2H), 3.79 (s, 3H), 2.04 (s, 3H), 2.00 (s, 3H). ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$): δ 159.7, 154.1, 147.8, 141.0, 139.6, 138.7, 137.3, 136.5, 136.3, 129.7, 129.6, 129.0, 128.5, 127.1, 120.4, 119.5, 112.9, 112.8, 101.0, 55.2, 44.9, 21.2, 19.3. HRMS-ESI (*m/z*): calcd for $C_{23}H_{23}INO_3$ [M + H]$^+$: 487.0717, found 487.0712.

(*R*)-2'-Iodo-6,6'-dimethyl-[1,1'-biphenyl]-2-yl (2-phenylpropan-2-yl)carbamate (44)



Eluent: 20:1 petroleum ether / ethyl acetate; white solid, 38.8 mg, 80% yield, 98% ee. mp: 105-106 °C.HPLC conditions: Chiralpak INC, isopropanol/hexanes = 10:90, flow: 0.5 mL/min, λ = 254 nm, t_r = 10.561 min (major), 10.237 min (minor). $[\alpha]^{25}_D$ = -58.99 (c 0.28, CH_2Cl_2). ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.82 (d, *J* = 7.6 Hz, 1H), 7.32 – 7.28 (m, 4H), 7.23 – 7.19 (m, 3H), 7.15 – 7.09 (m, 2H), 7.02 (t, *J* = 7.6 Hz, 1H), 5.03 (s, 1H), 1.98 (s, 3H),1.97 (s, 3H), 1.61 (s, 3H), 1.53 (s, 3H). ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$): δ 152.0, 147.7, 146.5, 141.2, 139.0, 137.2, 136.3, 129.8, 129.0, 128.4, 128.2, 127.0, 126.6, 124.7, 120.9, 101.2, 55.3, 29.6, 28.4, 21.1, 19.4. HRMS-ESI (*m/z*): calcd for $C_{24}H_{25}INO_2$ [M + H]$^+$: 486.0924, found 486.0921.

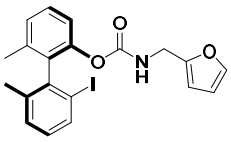
(*R*)-2'-Iodo-6,6'-dimethyl-[1,1'-biphenyl]-2-yl (naphthalen-1-ylmethyl)carbamate (45)



Eluent: 10:1 petroleum ether / ethyl acetate; white solid, 44.1 mg, 87% yield, 98% ee. mp: 73-75 °C. HPLC conditions: Chiralpak INC, isopropanol/hexanes = 10:90, flow: 1.0 mL/min, λ = 254 nm, t_r = 13.425 min (major), 11.861 min (minor). $[\alpha]^{25}_D$ = -37.76 (c 0.43, CH_2Cl_2). ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.92 – 7.86 (m, 2H), 7.80 (d, *J* = 8.4 Hz, 1H), 7.72 (d, *J* = 8.0 Hz, 1H), 7.56 – 7.51 (m, 2H), 7.41 –

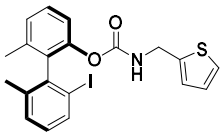
7.35 (m, 2H), 7.23 – 7.13 (m, 4H), 6.88 (t, *J* = 7.6 Hz, 1H), 5.02 – 4.90 (m, 1H), 4.38 – 4.39 (m, 2H), 2.04 (s, 3 H), 2.01 (s, 3 H). $^{13}C\{^{1}H\}$ NMR (100 MHz, $CDCl_3$): δ 153.9, 147.8, 141.0, 138.6, 137.3, 136.5, 136.3, 133.7, 133.2, 131.1, 129.7, 128.9, 128.7, 128.5, 128.4, 127.1, 126.5, 125.8, 125.7, 125.3, 123.1, 120.5, 100.9, 43.0, 21.2, 19.3. HRMS-ESI (*m/z*): calcd for $C_{26}H_{23}INO_2$ $[M + H]^+$: 508.0768, found 508.0761.

(*R*)-2'-Iodo-6,6'-dimethyl-[1,1'-biphenyl]-2-yl (furan-2-ylmethyl)carbamate (46)



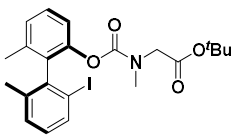
Eluent: 20:1 petroleum ether / ethyl acetate; light yellow oil, 35.8 mg, 80% yield, 99% ee. HPLC conditions: Chiralpak INC, isopropanol/hexanes = 10:90, flow: 1.0 mL/min, λ = 254 nm, t_r = 9.250 min (major), 8.492 min (minor). $[\alpha]^{25}_D$ = -39.38 (c 0.35, CH_2Cl_2). ^1H NMR (400 MHz, $CDCl_3$): δ 7.75 (d, *J* = 7.6 Hz, 1H), 7.34 (t, *J* = 7.6 Hz, 2H), 7.21 – 7.15 (m, 3H), 6.94 (d, *J* = 8.0 Hz, 1H), 6.30 – 6.26 (m, 1H), 6.10 – 6.00 (m, 1H), 5.00 – 4.80 (m, 1H), 4.26 – 3.84 (m, 2H), 2.03 (s, 3H), 1.98 (s, 3H). $^{13}C\{^{1}H\}$ NMR (100 MHz, $CDCl_3$): δ 153.9, 151.2, 147.8, 142.1, 141.0, 138.7, 137.3, 136.4, 136.3, 129.7, 129.0, 128.5, 127.1, 120.4, 110.3, 107.2, 100.9, 38.0, 21.2, 19.4. HRMS-ESI (*m/z*): calcd for $C_{20}H_{19}INO_3$ $[M + H]^+$: 448.0404 , found 448.0398.

(*R*)-2'-Iodo-6,6'-dimethyl-[1,1'-biphenyl]-2-yl (thiophen-2-ylmethyl)carbamate (47)



Eluent: 20:1 petroleum ether / ethyl acetate; light yellow oil, 36.6 mg, 79% yield, 98% ee. HPLC conditions: Chiralpak INC, isopropanol/hexanes = 10:90, flow: 1.0 mL/min, λ = 254 nm, t_r = 8.790 min (major), 8.008 min (minor). $[\alpha]^{25}_D$ = -44.10 (c 0.36, CH_2Cl_2). ^1H NMR (400 MHz, $CDCl_3$): δ 7.75 (d, *J* = 7.6 Hz, 1H), 7.35 (t, *J* = 7.6 Hz, 1H), 7.21 – 7.16 (m, 4H), 6.96 – 6.91 (m, 2H), 6.84 – 6.74 (m, 1H), 5.05 – 4.78 (m, 1H), 4.49 – 4.05 (m, 2H), 2.04 (s, 3H), 1.99 (s, 3H). $^{13}C\{^{1}H\}$ NMR (100 MHz, $CDCl_3$): δ 153.8, 147.8, 141.0, 140.8, 138.7, 137.3, 136.4, 136.3, 129.8, 129.0, 128.5, 127.1, 126.8, 125.7, 125.0, 120.4, 100.9, 39.8, 21.2, 19.4. HRMS-ESI (*m/z*): calcd for $C_{20}H_{19}INO_2S$ $[M+H]^+$: 464.0176, found 464.0172.

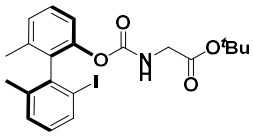
***Tert*-butyl (*R*)-*N*-(((2'-iodo-6,6'-dimethyl-[1,1'-biphenyl]-2-yl)oxy)carbonyl)-*N*-methylglycinate (48)**



Eluent: 10:1 petroleum ether / ethyl acetate;light yellow oil, 25.7 mg, 67% yield, 98% ee). HPLC conditions: Chiralpak AD-H, isopropanol/hexanes = 2:98, flow: 1.0 mL/min, λ = 254 nm, t_r = 11.388 min (major), 12.275 min

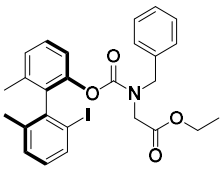
(minor). $[\alpha]^{25}_D$ = -45.02 (c 0.25, CH_2Cl_2). ^1H NMR (400 MHz, $CDCl_3$): δ 7.76 (d, J =7.6 Hz, 1H), 7.33 (td, J = 8.0, 2.4 Hz, 1H), 7.23 (t, J = 8.4 Hz, 2H), 7.15 (m, 1H), 6.95 (t, J = 7.6 Hz, 1H), 3.79 (s, 1H), 3.56 – 3.34 (m, 1H), 2.89 (s, 1.4H), 2.60 (s, 1.6H), 2.03 (s, 3H), 1.99 (d, J = 8.4 Hz, 3H), 1.43 (s, 9H). $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$): δ 168.1, 153.7, 148.1, 141.2, 138.6, 137.0, 136.2, 135.9, 129.7, 129.0, 128.4, 126.7, 120.2, 101.0, 81.6, 51.4, 51.1, 35.9, 35.1, 28.0, 21.2, 19.4. HRMS-ESI (*m/z*): calcd for $C_{22}H_{27}INO_4$ $[M + H]^+$: 496.0979, found 496.0972.

***Tert*-butyl (*R*)-(((2'-iodo-6,6'-dimethyl-[1,1'-biphenyl]-2-yl)oxy)carbonyl)glycinate (49)**



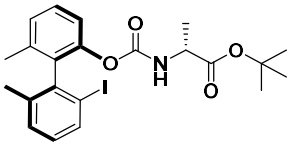
Eluent: 10:1 petroleum ether / ethyl acetate; light yellow oil, 35.1mg, 73% yield, 98% ee. HPLC conditions: Chiralpak AD-H, isopropanol/hexanes = 5:95, flow: 1.0 mL/min, λ = 254 nm, t_r = 17.573 min (major), 21.320 min (minor). $[\alpha]^{25}_D$ = -39.88 (c 0.34, CH_2Cl_2). ^1H NMR (400 MHz, $CDCl_3$): δ 7.76 (d, J = 7.6 Hz, 1H), 7.33 (t, J = 7.6 Hz, 1H), 7.23 (t, J = 7.6 Hz, 1H), 7.16 (d, J = 7.6 Hz, 2H), 6.94 (t, J = 8.0 Hz, 1H), 5.15 – 4.92 (m, 1H), 3.83 – 3.27 (m, 2H), 2.03 (s, 3H), 1.98 (s, 3H), 1.45 (s, 9H). $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$): δ 168.6, 153.9, 147.8, 141.0, 138.6, 137.4, 136.4, 136.2, 129.7, 129.1, 128.5, 127.0, 120.2, 100.9, 82.2, 43.4, 28.0, 21.2, 19.4. HRMS-ESI (*m/z*): calcd for $C_{21}H_{25}INO_4$ $[M + H]^+$: 482.0823, found 482.0815.

Ethyl (*R*)-*N*-benzyl-*N*-(((2'-iodo-6,6'-dimethyl-[1,1'-biphenyl]-2-yl)oxy)carbonyl)glycinate (50)



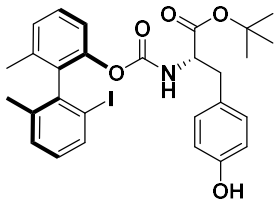
Eluent: 10:1 petroleum ether / ethyl acetate; light yellow oil, 39.1 mg, 72% yield, >99% ee. HPLC conditions: Chiralpak AD-H, isopropanol/hexanes = 2:98, flow: 0.8 mL/min, λ = 254 nm, t_r = 31.458 min (major), 33.772 min (minor). $[\alpha]^{25}_D$ = -49.36 (c 0.39, CH_2Cl_2). ^1H NMR (400 MHz, $CDCl_3$): δ 7.74 (dd, J = 10.8, 8.0 Hz, 1H), 7.36 (t, J = 7.6 Hz, 1H), 7.32 – 7.27 (m, 2H), 7.25 – 7.20 (m, 3H), 7.18 (d, J = 7.6 Hz, 1H), 7.03 (dd, J = 7.2, 2.0 Hz, 1H), 6.95 (td, J = 7.6, 3.2 Hz, 1H), 6.86 – 6.82 (m, 1H), 4.61 – 4.08 (m, 4H), 3.87 – 3.75 (m, 1H), 3.56 – 3.33 (m, 1H), 2.05 (s, 3H), 2.00 (s, 3H), 1.23 (dt, J = 7.6, 3.2 Hz, 1H). $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$): δ 169.0, 154.0, 148.0, 141.2, 138.8, 137.2, 136.5, 136.4, 136.1, 129.8, 129.1, 128.6, 128.5, 128.0, 127.8, 127.5, 127.1, 127.0, 120.4, 100.9, 61.1, 51.3, 47.3, 21.2, 19.4, 14.2. HRMS-ESI (*m/z*): calcd for $C_{26}H_{27}INO_4$ $[M + H]^+$: 544.0979, found 544.0980.

***Tert*-butyl ((((*R*)-2'-iodo-6,6'-dimethyl-[1,1'-biphenyl]-2-yl)oxy)carbonyl)-L-alaninate (51)**



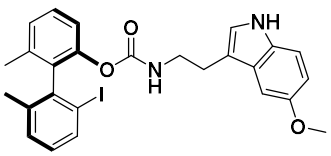
Eluent: 20:1 petroleum ether / ethyl acetate; light yellow oil, 36.6 mg, 74% yield, >99:1 dr. HPLC conditions: Chiralpak INC, isopropanol/hexanes = 10:90, flow: 1.0 mL/min, λ = 254 nm, t_r = 6.398 min (major), 7.089 min (minor). $[\alpha]^{25}_D$ = -55.08 (c 0.33, CH_2Cl_2). ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.76 (d, J = 7.6 Hz, 1H), 7.32 (t, J = 8.0 Hz, 1H), 7.16 (td, J = 21.6, 7.4 Hz, 3H), 6.94 (t, J = 7.6 Hz, 1H), 5.26 – 5.11 (m, 1H), 4.17 – 3.54 (m, 1H), 2.05 (s, 3H), 1.98 (s, 3H), 1.44 (s, 9H), 1.20 – 1.08 (m, 3H). ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$): δ 171.7, 153.2, 147.9, 140.9, 138.7, 137.3, 136.5, 136.4, 129.7, 129.0, 128.5, 127.1, 120.4, 101.0, 82.0, 50.1, 27.9, 21.1, 19.3, 18.6. HRMS-ESI (*m/z*): calcd for $C_{22}H_{27}INO_4$ $[M+H]^+$: 496.0979 , found 496.0970.

***Tert*-butyl ((((*R*)-2'-iodo-6,6'-dimethyl-[1,1'-biphenyl]-2-yl)oxy)carbonyl)-L-tyrosinate (52)**



Eluent: 10:1 petroleum ether / ethyl acetate; light yellow oil, 41.7 mg, 71% yield, 98.5:1.5 dr. HPLC conditions: Chiralpak AD-H, isopropanol/hexanes = 10:90, flow: 1.0 mL/min, λ = 254 nm, t_r = 47.311 min (major), 43.102 min (minor). $[\alpha]^{25}_D$ = -50.52 (c 0.48, CH_2Cl_2). ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.78 – 7.71 (m, 1H), 7.38 – 7.30 (m, 1H), 7.23 (d, J = 7.6 Hz, 1H), 7.20 – 7.09 (m, 2H), 6.97 (t, J = 7.6 Hz, 1H), 6.88 – 6.60 (m, 4H), 5.26 – 5.06 (m, 1H), 4.43 – 4.12 (m, 1H), 2.98 – 2.29 (m, 2H), 2.10 (s, 1H), 2.01 (s, 3H), 1.98 (s, 3H), 1.39 (s, 9H). ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$): δ 170.2, 154.8, 153.3, 147.6, 141.0, 138.5, 137.4, 136.5, 136.3, 130.6, 129.7, 129.1, 128.4, 127.4, 127.1, 120.3, 115.3, 100.8, 82.4, 55.3, 37.3, 27.9, 21.3, 19.4. HRMS-ESI (*m/z*): calcd for $C_{28}H_{29}INO_5$ $[M + H]^+$: 586.1096, found 586.1094.

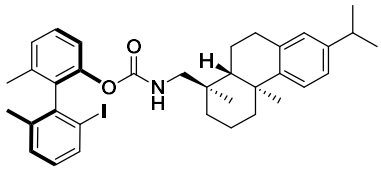
(*R*)-2'-Iodo-6,6'-dimethyl-[1,1'-biphenyl]-2-yl (2-(5-methoxy-1*H*-indol-3-yl)ethyl)carbamate (53)



Eluent: 20:1 petroleum ether / ethyl acetate; yellow oil, 30.2 mg, 56% yield, 90% ee. HPLC conditions: Chiralpak INC, isopropanol/hexanes = 15:85, flow: 1.0 mL/min, λ = 254 nm, t_r = 19.509 min (major), 16.235 min (minor). $[\alpha]^{25}_D$ = -29.07 (c 0.29, CH_2Cl_2). ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.96 (s, 1H), 7.75 (d, J = 7.6 Hz, 1H), 7.34 (t, J = 8.0 Hz, 1H), 7.25 – 7.13 (m, 4H), 6.99 – 6.91 (m, 2H), 6.88 – 6.81 (m, 2H), 4.80 – 4.55 (m, 1H), 3.85 (s, 3H), 3.41 – 3.16 (m, 2H), 2.84 – 2.46 (m, 2H), 2.06 (s, 3H), 1.98 (s, 3H). ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$): δ 154.1, 154.0,

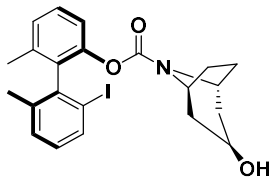
147.9, 141.2, 138.8, 137.3, 136.4, 136.3, 131.4, 129.7, 129.0, 128.5, 127.5, 127.0, 122.9, 120.4, 112.3, 112.2, 111.9, 101.1, 100.5, 56.0, 41.0, 25.5, 21.2, 19.4. HRMS-ESI (*m/z*): calcd for $C_{26}H_{26}IN_2O_3$ $[M + H]^+$: 541.0983, found 541.0976.

(*R*)-2'-Iodo-6,6'-dimethyl-[1,1'-biphenyl]-2-yl (((1*R*,4a*S*,10a*R*)-7-isopropyl-1,4a-dimethyl-1,2,3,4,4a,9,10,10a-octahydrophenanthren-1-yl)methyl)carbamate (54)



Eluent: 10:1 petroleum ether / ethyl acetate; light yellow oil (48.9 mg, 77% yield, 97:3 dr. HPLC conditions: Chiralpak AD-H, isopropanol/hexanes = 5:95, flow: 1.0 mL/min, λ = 254 nm, t_r = 7.091 min (major), 7.786 min (minor). $[\alpha]^{25}_D$ = -28.43 (c 0.49, CH_2Cl_2). ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.64 (t, J = 8.0 Hz, 1H), 7.32 (t, J = 8.0 Hz, 1H), 7.20 – 7.10 (m, 3H), 7.03 (t, J = 8.4 Hz, 1H), 6.90 (s, 1H), 6.82 – 6.73 (m, 2H), 4.67 – 4.51 (m, 1H), 3.18 – 3.13 (m, 1H), 2.90 – 2.73 (m, 5H), 2.28 – 2.25 (m, 1H), 1.97 (s, 3H), 1.85 (s, 3H), 1.73 – 1.63 (m, 4H), 1.35 – 1.27 (m, 2H), 1.26 (s, 3H), 1.24 (s, 3H), 1.19 (s, 3H), 1.18 – 1.08 (m, 2H), 0.87 (s, 3H). ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$): δ 154.3, 147.7, 147.2, 145.6, 141.0, 138.5, 137.2, 136.5, 136.1, 134.8, 129.6, 128.9, 128.4, 126.9, 123.9, 123.7, 120.6, 100.7, 51.3, 44.1, 38.1, 37.5, 37.2, 35.6, 33.5, 29.8, 25.3, 24.1, 24.0, 21.0, 19.3, 18.8, 18.7, 18.4. HRMS-ESI (*m/z*): calcd for $C_{35}H_{43}INO_2$ $[M + H]^+$: 636.2333, found 636.2327.

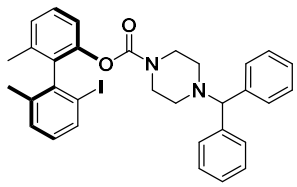
(*R*)-2'-Iodo-6,6'-dimethyl-[1,1'-biphenyl]-2-yl (1*R*,3*R*,5*S*)-3-hydroxy-8-azabicyclo[3.2.1]octane-8-carboxylate (55)



Eluent: 10:1 petroleum ether / ethyl acetate; white solid, 13.2 mg, 30% yield, 95:5 dr. mp: 89-90 °C. HPLC conditions: Chiralpak INC, isopropanol/hexanes = 5:95, flow: 1.0 mL/min, λ = 254 nm, t_r = 23.040 min (major), 21.307 min (minor). $[\alpha]^{25}_D$ = -28.03 (c 0.13, CH_2Cl_2). ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.76 (d, J = 8.0 Hz, 1H), 7.34 (t, J = 8.0 Hz, 1H), 7.23 – 7.12 (m, 3H), 7.21 (q, J = 7.2 Hz, 1H), 4.18 – 4.13 (m, 1H), 3.96 (s, 1H), 3.82 – 3.71 (m, 1H), 2.07 (s, 3H), 2.03 (s, 1H), 1.98 (s, 3H), 1.90 – 175 (m, 2H), 1.71 – 1.42 (m, 4H), 1.33 – 1.25 (m, 1H), 0.92 – 1.86 (dt, J = 14.8, 4.0 Hz, 1H). ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$): δ 150.9, 150.8, 148.0, 147.9, 141.6(1), 141.5(8), 139.1, 138.9, 137.1, 136.6, 136.4, 136.3, 136.1, 129.6, 129.5, 129.0, 128.5, 128.4, 126.9, 126.7, 120.7, 120.5, 101.5, 101.0, 65.0, 53.3(5), 53.3(0), 52.8, 52.7, 38.4, 38.3, 37.9(3), 37.9(0),

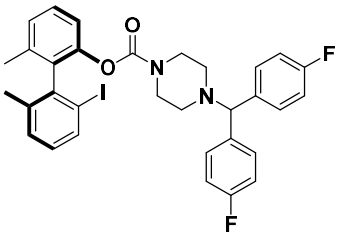
28.5, 28.3, 27.5, 21.2(4), 21.1(7), 19.4, 19.3. HRMS-ESI (*m/z*): calcd for $C_{22}H_{25}INO_3$ $[M + H]^+$: 478.0874, found 478.0869.

(*R*)-2'-Iodo-6,6'-dimethyl-[1,1'-biphenyl]-2-yl 4-benzhydrylpiperazine-1-carboxylate (56)



Eluent: 10:1 petroleum ether / ethyl acetate; white solid, 30.2 mg, 50% yield, 97% ee. mp: 143-145 °C. HPLC conditions: Chiralpak AS-H, isopropanol/hexanes = 3:97, flow: 0.5 mL/min, λ = 254 nm, t_r = 12.523 min (major), 15.127 min (minor). $[\alpha]^{25}_D$ = -27.14 (c 0.28, CH_2Cl_2). ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.72 (d, J = 8.0 Hz, 1H), 7.38 – 7.34 (m, 5H), 7.32 – 7.27 (m, 4H), 7.22 – 7.15 (m, 5H), 6.92 (t, J = 7.6 Hz, 1H), 4.14 (s, 1H), 3.44 – 3.32 (m, 2H), 3.14 (s, 2H), 2.33 (s, 1H), 2.14 – 2.09 (m, 2H), 2.03 (s, 3H), 1.99 (s, 3H), 1.80 (s, 1H). ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$): δ 152.6, 148.1, 142.2, 142.1, 141.3, 138.8, 137.0, 136.4, 136.3, 129.7, 129.1, 128.5(3), 128.5(0), 127.9, 127.8, 127.1, 126.9, 120.6, 101.1, 99.9, 75.9, 51.4, 51.3, 44.4, 44.0, 21.2, 19.3. HRMS-ESI (*m/z*): calcd for $C_{32}H_{32}IN_2O_2$ $[M + H]^+$: 603.1503, found 603.1497.

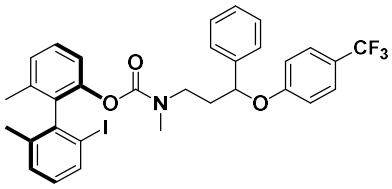
(*R*)-2'-Iodo-6,6'-dimethyl-[1,1'-biphenyl]-2-yl 4-(bis(4-fluorophenyl)methyl)piperazine-1-carboxylate (57)



Eluent: 2:1 petroleum ether / ethyl acetate; white solid, 38.3 mg, 60% yield, 98% ee. mp: 162-165 °C. HPLC conditions: Chiralpak OD-H, isopropanol/hexanes = 5:95, flow: 0.5 mL/min, λ = 254 nm, t_r = 18.596 min (major), 19.822 min (minor). $[\alpha]^{25}_D$ = -28.49 (c 0.34, CH_2Cl_2). ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.72 (d, J = 7.6 Hz, 1H), 7.36 – 7.28 (m, 5H), 7.21 (d, J = 7.6 Hz, 1H), 7.18 – 7.15 (m, 2H), 6.98 (t, J = 8.4 Hz, 4H), 6.91 (t, J = 7.6 Hz, 1H), 4.12 (s, 1H), 3.37 (s, 2H), 3.13 (s, 2H), 2.29 (s, 2H), 2.12 – 2.05 (m, 2H), 2.02 (s, 3H), 1.99 (s, 3H), 1.79 – 1.75 (m, 1H). ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$): δ 161.8 (d, J = 244.0 Hz), 152.6, 148.1, 141.4, 138.9, 137.7, 137.6, 137.1, 136.3(1), 136.2(9), 129.7, 129.2(1) (d, J = 7.7 Hz), 129.2(0) (d, J = 2.6 Hz), 129.0, 128.5, 126.9, 120.6, 115.5 (d, J = 21.0 Hz), 101.1, 74.2, 51.2, 44.3, 31.6, 22.6, 21.2, 19.3. ^{19}F NMR (376 MHz, $CDCl_3$): δ -115.27 (s). HRMS-ESI (*m/z*): calcd for $C_{32}H_{30}F_2IN_2O_2$ $[M + H]^+$: 639.1315, found 639.1309.

(*R*)-2'-Iodo-6,6'-dimethyl-[1,1'-biphenyl]-2-yl

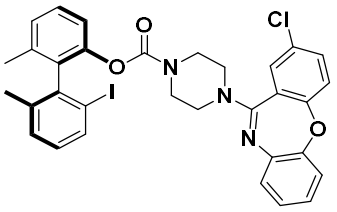
methyl(3-phenyl-3-(4-(trifluoromethyl)phenoxy)propyl)carbamate (58)



Eluent: 2:1 petroleum ether / ethyl acetate; light yellow oil, 51.4 mg, 78% yield, 97% ee. HPLC conditions: Chiralpak AD-H, isopropanol/hexanes = 3:97, flow: 1.0 mL/min, λ = 254 nm, t_r = 13.629 min (major), 18.316 min (minor). $[\alpha]^{25}_D$ = -20.64 (c 0.44, CH_2Cl_2). ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.74 – 7.52 (m, 1H), 7.43 (d, J = 8.8 Hz, 2H), 7.37 – 7.27 (m, 6H), 7.16 – 7.05 (m, 3H), 6.91 – 6.67 (m, 3H), 5.12 – 5.00 (m, 1H), 3.43 – 2.97 (m, 2H), 2.83 (d, J = 7.2 Hz, 1.6H), 2.53 (s, 1.4H), 2.05 – 1.98 (m, 7H), 1.90 – 1.68 (m, 1H). ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$): δ 160.2, 153.8, 148.2, 148.0, 141.4(2), 141.4(0), 138.7, 138.6, 137.1, 137.0, 136.3, 136.2, 128.7(9), 128.7(8), 128.7 (q, J = 48.0 Hz), 126.7 (q, J = 3.0 Hz), 125.9, 125.7 (d, J = 7.2 Hz), 123.0, 120.3 (d, J = 14.8 Hz), 115.7, 101.1, 78.2, 77.9, 46.3, 46.1, 36.6, 36.5, 35.3, 35.2, 21.3, 19.3(3), 19.3(2). ^{19}F NMR (376 MHz, $CDCl_3$): δ -61.53(s). HRMS-ESI (*m/z*): calcd for $C_{32}H_{30}F_3INO_3$ $[M + H]^+$: 660.1217, found 660.1214.

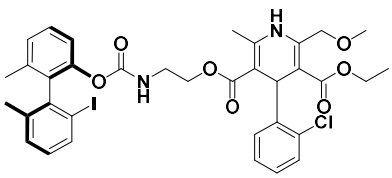
(*R*)-2'-Iodo-6,6'-dimethyl-[1,1'-biphenyl]-2-yl

4-(2-chlorodibenzo[*b*,*f*][1,4]oxazepin-11-yl)piperazine-1-carboxylate (59)



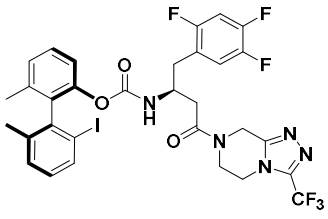
Eluent: 2:1 petroleum ether / ethyl acetate; light yellow oil, 60 mg, 90% yield, 97% ee. HPLC conditions: Chiralpak OD-H, isopropanol/hexanes = 5:95, flow: 0.5 mL/min, λ = 254 nm, t_r = 30.385 min (major), 28.019 min (minor). $[\alpha]^{25}_D$ = -18.50 (c 0.60, CH_2Cl_2). ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.78 (d, J = 7.6 Hz, 1H), 7.43 – 7.34 (m, 2H), 7.25 – 7.23 (m, 2H), 7.21 – 7.18 (m, 3H), 7.16 – 7.08 (m, 3H), 7.04 – 6.96 (m, 2H), 3.54 – 2.82 (m, 8H), 2.06 (s, 3H), 2.01 (s, 3H). ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$): δ 159.3, 158.6, 152.8, 148.0, 141.3, 139.0, 137.2, 136.4(4), 136.3(9), 132.8, 130.4, 129.8, 129.3, 128.9, 128.6, 127.2, 127.1, 125.9, 125.0, 122.8, 120.6, 120.1, 101.1, 53.9, 53.3, 44.0, 43.6, 21.2, 19.3. HRMS-ESI (*m/z*): calcd for $C_{32}H_{28}ClIN_3O_3$ $[M+H]^+$: 664.0858, found 664.0857.

3-Ethyl 5-(2-(((((*R*)-2'-iodo-6,6'-dimethyl-[1,1'-biphenyl]-2-yl)oxy)carbonyl)amino)ethyl) 4-(2-chlorophenyl)-2-(methoxymethyl)-6-methyl-1,4-dihydropyridine-3,5-dicarboxylate (60)



Eluent: 5:1 petroleum ether / ethyl acetate; light yellow oil, 65.2 mg, 86% yield, 97% ee. HPLC conditions: Chiralpak AD-H, isopropanol/hexanes = 5:95, flow: 1.0 mL/min, λ= 254 nm, t_r = 49.505 min (major), 43.524 min (minor). $[\alpha]^{25}_D$ = -26.18 (c 0.64, CH_2Cl_2). ^1H NMR (400 MHz, $CDCl_3$): δ 7.75 (t, J = 7.6 Hz, 1H), 7.39 – 7.36 (m, 1H), 7.32 (t, J = 8.0 Hz, 1H), 7.24 – 7.22 (m, 3H), 7.17 – 7.11 (m, 3H), 7.06 – 7.02 (m, 1H), 6.95 – 6.91 (m, 1H), 5.41 (s, 1H), 5.06 – 4.96 (m, 1H), 4.74 – 4.59 (m, 2H), 4.07 – 4.03 (m, 2H), 3.61 (s, 3H), 3.56 – 3.25 (m, 4H), 2.29 – 2.25 (m, 3H), 2.04 (s, 3H), 1.99 (s, 3H), 1.19 (t, J = 6.8 Hz, 3H). $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$): δ 168.0, 167.1, 154.6, 147.7, 145.8, 145.1, 144.4, 141.0, 138.6(8), 138.6(6), 137.4, 136.3, 132.2, 131.3(8), 131.3(7), 129.7, 129.2, 129.1, 128.4, 127.3, 127.2, 126.8(3), 126.8(1), 120.2, 103.7, 101.3, 100.9, 70.6, 68.0, 59.7, 50.7, 40.7, 37.0, 21.1, 19.3, 19.2, 14.2. HRMS-ESI (*m/z*): calcd for $C_{35}H_{37}ClIN_2O_7$ $[M + H]^+$: 759.1328 , found 759.1323.

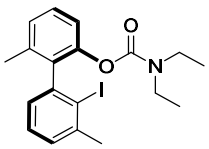
(*R*)-2'-Iodo-6,6'-dimethyl-[1,1'-biphenyl]-2-yl ((*S*)-4-oxo-4-(3-(trifluoromethyl)-5,6-dihydro-[1,2,4]triazolo[4,3-*a*]pyrazin-7(8*H*)-yl)-1-(2,4,5-trifluorophenyl)butan-2-yl)carbamate (61)



Eluent: 2:1 petroleum ether / ethyl acetate; light yellow oil, 68.9 mg, 91% yield, 98:2 dr. HPLC conditions: Chiralpak INC, isopropanol/hexanes = 15:85, flow: 1.0 mL/min, λ = 254 nm, t_r = 36.126 min (major), 30.073 min (minor). $[\alpha]^{25}_D$ = -7.69 (c 0.66, CH_2Cl_2). ^1H NMR (400 MHz, $CDCl_3$): δ 7.68 – 7.62 (m, 1H), 7.29 (t, J = 7.6 Hz, 1H), 7.20 – 7.14 (m, 2H), 6.99 – 6.79 (m, 4H), 5.70 – 5.46 (m, 1H), 5.05 – 4.78 (m, 2H), 4.17 – 4.14 (m, 2H), 4.10 – 3.98 (m, 2H), 3.93 – 3.82 (m, 1H), 2.91 – 2.29 (m, 4H), 2.00 (s, 3H), 1.94 (s, 3H), 1.19 (d, J = 6.4 Hz, 2H). $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$): δ 169.4, 169.1, 155.9 (dd, J = 243.5, 9.8 Hz), 153.4(d, J = 13.6 Hz), 150.3, 149.6, 147.4 (q, J = 14.1 Hz), 145.1 (d, J = 10.3 Hz), 144.0-142.5 (m), 140.8 (t, J = 12.4 Hz), 138.5, 138.3, 137.2, 136.1, 136.0, 129.4, 128.8, 128.2, 127.0, 121.1 (d, J = 19.5 Hz), 119.9, 119.2, 118.8 (d, J = 14.5 Hz), 118.0 (q, J = 270 Hz), 105.1 (t, J = 21.7 Hz), 100.5, 64.0, 63.8, 48.7, 48.5, 42.5, 43.0, 42.1, 41.4, 38.8, 37.7, 36.3, 32.3, 32.2, 25.0, 20.9, 19.1.

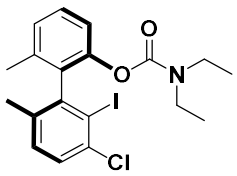
^{19}F NMR (376 MHz, $CDCl_3$): δ -62.95 (d, J = 52.9 Hz, 3F), -119.13 – -119.96 (m, 1F), -134.78 – -135.36 (m, 1F), -142.01 – -142.56 (m, 1F). HRMS-ESI (*m/z*): calcd for $C_{31}H_{26}FIN_5O_3$ [M + e]$^-$: 757.0985, found 757.0983.

(*R*)-2'-Iodo-3',6-dimethyl-[1,1'-biphenyl]-2-yl diethylcarbamate (62)



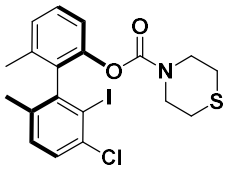
Eluent: 20:1 petroleum ether / ethyl acetate; light yellow oil, 21.1 mg, 50% yield, 84% ee. HPLC conditions: Chiralpak OD-H, isopropanol/hexanes = 2:98, flow: 1.0 mL/min, λ = 254 nm, t_r = 8.410 min (major), 7.441 min (minor). $[\alpha]^{25}_D$ = -68.03 (c 0.12, CH_2Cl_2). ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.32 (t, J = 8.0 Hz, 1H), 7.24 (t, J = 7.6 Hz, 1H), 7.19 – 7.17 (m, 1H), 7.13 (d, J = 7.6 Hz, 2H), 7.00 – 6.98 (m, 1H), 3.19 – 3.02 (m, 3H), 2.89 – 2.80 (m, 1H), 2.51 (s, 3H), 2.01 (s, 3H), 0.99 (t, J = 7.2 Hz, 3H), 0.69 (t, J = 6.8 Hz, 3H). ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$): δ 153.6, 148.6, 143.2, 142.0, 138.2, 137.4, 128.3, 128.2, 127.8, 127.5, 126.7, 120.1, 107.3, 41.9, 41.5, 29.5, 19.9, 13.3, 13.2. HRMS-ESI (*m/z*): calcd for $C_{19}H_{23}INO_2$ [M + H]$^+$: 424.0768, found 424.0768.

(*R*)-3'-Chloro-2'-iodo-6,6'-dimethyl-[1,1'-biphenyl]-2-yl diethylcarbamate (63)



Eluent: 20:1 petroleum ether / ethyl acetate; light yellow oil, 39.7 mg, 87% yield, 96% ee. HPLC conditions: Chiralpak AD-H, isopropanol/hexanes = 1:99, flow: 0.6 mL/min, λ = 254 nm, t_r = 15.102 min (major), 18.584 min (minor). $[\alpha]^{25}_D$ = -89.09 (c 0.22, CH_2Cl_2). ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.34 (t, J = 7.6 Hz, 2H), 7.22 (d, J = 7.6 Hz, 1H), 7.16 (t, J = 8.8 Hz, 2H), 3.19 (q, J = 7.2 Hz, 2H), 3.06 – 2.99 (m, 1H), 2.91 – 2.84 (m, 1H), 2.02 (s, 3H), 1.98 (s, 3H), 1.02 (t, J = 7.2 Hz, 3H), 0.73 (t, J = 7.2 Hz, 3H). ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$): δ 153.1, 148.0, 144.4, 136.7, 136.5(9), 136.5(6), 136.3, 130.8, 128.6, 127.8, 126.6, 120.4, 105.2, 41.9, 41.5, 20.8, 19.2, 13.4, 13.2. HRMS-ESI (*m/z*): calcd for $C_{19}H_{22}ClINO_2$ [M + H]$^+$: 458.0378, found 458.0377.

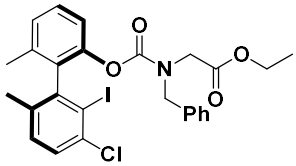
(*R*)-3'-chloro-2'-iodo-6,6'-dimethyl-[1,1'-biphenyl]-2-yl thiomorpholine-4-carboxylate (64)



Eluent: 20:1 petroleum ether / ethyl acetate; white solid, 39.0 mg, 80% yield, 77% ee. HPLC conditions: Chiralpak INC , isopropanol/hexanes = 5:95, flow: 1.0 mL/min, λ = 254 nm, tr = 7.058 min (major), 7.569 min (minor). $[\alpha]^{25}_D$ = -70.28 (c 0.35, CH_2Cl_2). ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.37 (q, J =

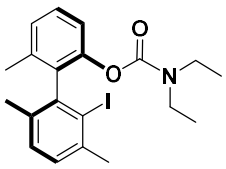
8.0 Hz, 2H), 7.23 – 7.15 (m, 3H), 3.80 – 3.27 (m, 4H), 2.48 – 2.14 (m, 3H), 2.03 (s, 3H), 1.99 (s, 3H), 1.92 – 1.83 (m, 1H). $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$): δ 152.4, 147.7, 144.2, 136.9, 136.8, 136.8, 136.5, 130.8, 128.9, 128.1, 127.2, 120.6, 105.3, 47.1, 46.5, 27.1, 26.8, 20.8, 19.2. HRMS (ESI) calcd for C19H20ClINO2S $[M+H]^+$: 487.9942, found 487.9944.

Ethyl (*R*)-*N*-benzyl-*N*-(((3'-chloro-2'-iodo-6,6'-dimethyl-[1,1'-biphenyl]-2-yl)oxy)carbonyl)glycinate (65)



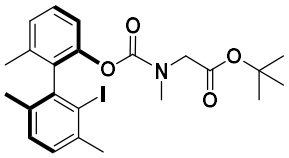
Eluent: 10:1 petroleum ether / ethyl acetate; light yellow oil, 41.6 mg, 72% yield, >99% ee. HPLC conditions: Chiralpak AD-H, isopropanol/hexanes = 5:95, flow: 0.8 mL/min, λ = 254 nm, t_r = 16.126 min (major), 17.411 min (minor). $[\alpha]^{25}_D$ = -70.82 (c 0.38, CH_2Cl_2). ^1H NMR (400 MHz, $CDCl_3$): δ 7.39 – 7.27 (m, 4H), 7.25 – 7.24 (m, 2H), 7.19 – 7.16 (m, 2H), 7.09 – 7.06 (m, 1H), 6.84 – 6.82 (m, 1H), 4.50 (s, 1H), 4.20 – 4.18 (m, 1H), 4.15 – 4.08 (m, 2H), 3.87 – 3.78 (m, 1H), 3.46 (s, 1H), 2.02 (s, 3H), 1.98 (s, 3H), 1.23 (td, *J* = 7.2, 2.0 Hz, 1H). $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$): δ 169.0, 168.8, 154.0, 153.9, 147.8, 147.7, 144.1, 136.9, 136.8(2), 136.7(7), 136.6(3), 136.5(9), 136.5(0), 136.4(7), 136.4, 136.3, 136.1, 130.9(4), 130.8(7), 128.8, 128.7, 128.6(1), 128.5(9), 128.1, 128.0, 127.8, 127.6(2), 127.5(7), 127.2, 127.1, 120.5, 120.3, 105.0, 104.8, 61.2, 61.1, 51.4, 51.3, 47.6, 47.2, 20.9, 20.8, 19.3, 19.2, 14.2, 14.1. HRMS-ESI (*m/z*): calcd for $C_{26}H_{26}ClINO_4$ $[M + H]^+$: 578.0590, found 578.0588.

(*R*)-2'-Iodo-3',6,6'-trimethyl-[1,1'-biphenyl]-2-yl diethylcarbamate (66)



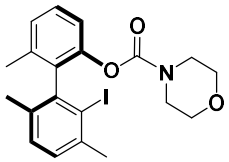
Eluent: 20:1 petroleum ether / ethyl acetate; light yellow oil, 31.5 mg, 72% yield, 98% ee. HPLC conditions: Chiralpak OD-H, isopropanol/hexanes = 1:99, flow: 0.8 mL/min, λ = 254 nm, t_r = 9.432 min (major), 10.782 min (minor). $[\alpha]^{25}_D$ = -58.05 (c 0.27, CH_2Cl_2). ^1H NMR (400 MHz, $CDCl_3$): δ 7.33 (t, *J* = 8.0 Hz, 1H), 7.22 (d, *J* = 8.4 Hz, 1H), 7.14 (d, *J* =7.6 Hz, 1H), 7.10 (s, 2H), 3.20 – 3.15 (m, 2H), 3.01 – 2.78 (m, 2H), 2.46 (s, 3H), 2.00 (s, 3H), 1.97 (s, 3H), 1.01 (t, *J* = 7.2 Hz, 3H), 0.67 (t, *J* = 7.2 Hz, 3H). $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$): δ 153.3, 148.3, 142.1, 139.4, 137.2, 136.9, 135.4, 129.5, 128.4, 128.2, 126.5, 120.3, 108.0, 41.9, 41.5, 29.4, 20.9, 19.4, 13.3, 13.2. HRMS-ESI (*m/z*): calcd for C_{20} $H_{25}INO_2$ $[M+H]^+$: 438.0924, found 438.0924.

Tert-butyl (*R*)-*N*-(((2'-iodo-3',6,6'-trimethyl-[1,1'-biphenyl]-2-yl)oxy)carbonyl)-*N*- methylglycinate (67)



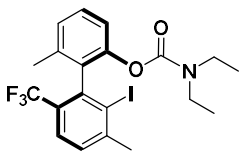
Eluent: 10:1 petroleum ether / ethyl acetate; light yellow oil, 42.2 mg, 83% yield, 98% ee. HPLC conditions: Chiralpak INC, isopropanol/hexanes = 5:95, flow: 1.0 mL/min, λ = 254 nm, t_r = 12.261 min (major), 11.263 min (minor). $[\alpha]^{25}_D$ = -53.55 (c 0.42, CH_2Cl_2). ^1H NMR (400 MHz, $CDCl_3$): δ 7.33 (t, J = 8.0 Hz, 1H), 7.25 – 7.22 (m, 1H), 7.16 – 7.10 (m, 3H), 3.84 – 3.72 (m, 1H), 3.47 – 3.25 (m, 1H), 2.88 (s, 1.5H), 2.55 (s, 1.5H), 2.48 (s, 3H), 1.98 – 1.96 (m, 6H), 1.43 (d, J = 3.6 Hz, 9H). $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$): δ 168.2, 168.1, 154.3, 153.7, 148.1, 148.0, 141.9, 141.8, 139.4, 139.3, 137.1, 137.0(4), 136.9(7), 136.9, 135.3(4), 135.2(7), 129.5(4), 129.4(9), 128.5, 128.4, 128.3, 128.2, 126.8, 126.7, 120.2, 120.0, 107.8, 107.7, 99.9, 99.7, 81.7, 81.6, 51.4, 51.1, 35.9, 35.1, 29.4, 28.1, 28.0, 20.9(2), 20.8(9), 19.4, 19.3. HRMS-ESI (*m/z*): calcd for $C_{23}H_{29}INO_4$ $[M+H]^+$ 510.1136, found 510.1130.

(*R*)-2'-Iodo-3',6,6'-trimethyl-[1,1'-biphenyl]-2-yl morpholine-4-carboxylate (68)



Eluent: 20:1 petroleum ether / ethyl acetate; light yellow oil (34.7 mg, 77%, 94% ee). HPLC conditions: Chiralpak AD-H , isopropanol/hexanes = 3:97, flow: 0.5 mL/min, λ= 254 nm, t_r = 20.669 min (major), 19.224 min (minor). $[\alpha]^{25}_D$= -58.26 (c 0.32, CH_2Cl_2). ^1H NMR (400 MHz, $CDCl_3$): δ 7.35 (d, J = 7.6 Hz, 1H), 7.19 – 7.12 (m, 4H), 3.56 (s, 1H), 3.40 – 3.33 (m, 4H), 3.06 (s, 3H), 2.47 (s, 3H), 2.01 (s, 3H), 1.98 (s, 3H). $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$): δ 152.6, 148.0, 141.8, 139.5, 137.4, 137.1, 135.7, 129.5, 128.6, 128.4, 127.1, 120.5, 107.8, 66.6, 66.2, 44.7, 44.0, 29.4, 20.8, 19.3. HRMS-ESI (*m/z*): calcd for $C_{20}H_{23}INO_3$ $[M+H]^+$: 452.0717, found 452.0712.

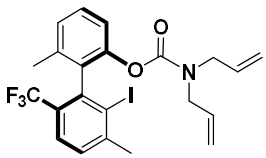
(*R*)-2'-Iodo-3',6'-dimethyl-6-(trifluoromethyl)-[1,1'-biphenyl]-2-yl diethylcarbamate (69)



Eluent: 20:1 petroleum ether / ethyl acetate; light yellow oil, 32.9 mg, 67% yield, 92% ee. HPLC conditions: Chiralpak AD-H, isopropanol/hexanes = 2:98, flow: 1.0 mL/min, λ= 254 nm, t_r = 5.573 min (major), 6.438 min (minor). $[\alpha]^{25}_D$ = -78.03 (c 0.31, CH_2Cl_2). ^1H NMR (400 MHz, $CDCl_3$): δ 7.65 – 7.62 (m, 2H), 7.57 – 7.53 (m, 1H), 7.12 (q, J = 7.6 Hz, 2H), 3.20 (q, J = 7.2 Hz, 2H), 2.97 – 2.88 (m, 1H), 2.80 – 2.71 (m, 1H), 2.46 (s, 3H), 1.99 (s, 3H), 1.04 (t, J = 7.2 Hz, 3H), 0.66 (t, J = 7.2 Hz, 3H). $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$): δ 152.6, 149.1, 139.5, 139.1, 136.0 (q, J = 2.0 Hz),

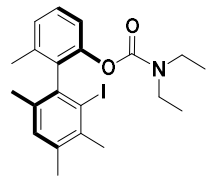
129.3, 129.2 (q, J = 29.7 Hz), 129.0, 128.8, 126.9, 123.3 (q, J = 273.0 Hz), 122.9 (q, J = 5.0 Hz), 107.9(3), 107.9(2), 42.0, 41.5, 29.3, 21.1, 13.2, 13.1. ^{19}F NMR (376 MHz, $CDCl_3$): δ -60.43 (s). HRMS-ESI (*m/z*): calcd for $C_{20}H_{22}F_3INO_2$ $[M + H]^+$: 492.0642, found 492.0643.

(*R*)-2'-Iodo-3',6'-dimethyl-6-(trifluoromethyl)-[1,1'-biphenyl]-2-yl diallylcarbamate (70)



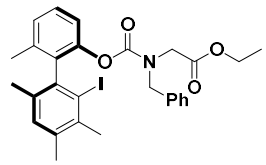
Eluent: 20:1 petroleum ether / ethyl acetate; light yellow oil, 38.1 mg, 74% yield, 90% ee. HPLC conditions: Chiralpak AD-H, isopropanol/hexanes = 3:97, flow: 1.0 mL/min, λ = 254 nm, t_r = 5.134 min (major), 5.696 min (minor). $[\alpha]^{25}_D$ = -92.18 (c 0.36, CH_2Cl_2). ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.66 – 7.62 (m, 2H), 7.56 (t, J = 8.0 Hz, 1H), 7.13 (q, J = 7.6 Hz, 2H), 5.72 – 5.62 (m, 1H), 5.23 – 5.15(m, 1H), 5.14 – 5.02 (m, 2H), 4.93 – 4.88 (m, 2H), 3.84 – 3.72 (m, 2H), 3.47 – 3.28 (m, 2H), 2.46 (s, 3H), 1.99 (s, 3H). ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$): δ 152.9, 149.0, 139.3, 139.2, 136.0 (q, J = 2.0 Hz), 135.9, 132.6 (d, J = 1.1 Hz), 129.4, 129.2 (q, J = 30.0 Hz), 129.0, 128.8, 127.0, 123.3 (q, J = 273.0 Hz), 123.2(q, J = 5.1 Hz), 117.2, 116.7, 107.9, 49.0, 48.6, 29.3, 21.1. ^{19}F NMR (376 MHz, $CDCl_3$): δ -60.45(s). HRMS-ESI (*m/z*): calcd for $C_{22}H_{22}F_3INO_2$ $[M + H]^+$: 516.0642, found 516.0643.

(*R*)-2'-Iodo-3',4',6,6'-tetramethyl-[1,1'-biphenyl]-2-yl diethylcarbamate (71)



Eluent: 20:1 petroleum ether / ethyl acetate; light yellow oil, 28.4 mg, 63% yield, 96% ee. HPLC conditions: Chiralpak OD-H, isopropanol/hexanes = 1:99, flow: 0.5 mL/min, λ = 254 nm, t_r = 17.236 min (major), 20.386 min (minor). $[\alpha]^{25}_D$ = -50.19 (c 0.26, CH_2Cl_2). ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.31 (d, J = 8.0 Hz, 1H), 7.21 (d, J = 8.0 Hz, 1H), 7.12 (d, J = 7.6 Hz, 1H), 6.99 (s, 1H), 3.17 (q, J = 6.8 Hz, 2H), 3.01 – 2.80 (m, 2H), 2.46 (s, 3H), 2.35 (s, 3H), 1.98 (s, 3H), 1.97 (s, 3H), 1.01 (t, J = 7.2 Hz, 3H), 0.66 (t, J = 6.8 Hz, 3H). ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$): δ 153.3, 148.4, 139.9, 137.7, 137.3, 137.1, 135.8, 135.2, 131.5, 128.1, 126.4, 120.3, 109.5, 41.8, 41.4, 26.1, 21.7, 20.8, 19.4, 13.2. HRMS-ESI (*m/z*): calcd for $C_{21}H_{27}INO_2$ $[M + H]^+$: 452.1081, found 452.1082.

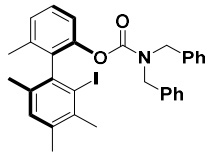
Ethyl (*R*)-*N*-benzyl-*N*-(((2'-iodo-3',4',6,6'-tetramethyl-[1,1'-biphenyl]-2-yl)oxy)carbonyl) glycinate (72)



Eluent: 10:1 petroleum ether / ethyl acetate; light yellow oil, 39.9 mg, 70% yield, 95% ee. HPLC conditions: Chiralpak INC, isopropanol/hexanes = 10:90, flow: 1.0 mL/min, λ = 254 nm, t_r = 13.034

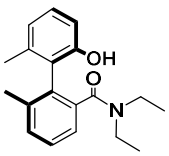
min (major), 12.059 min (minor). $[\alpha]^{25}_D$ = -64.58 (c 0.37, CH_2Cl_2). ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.34 (d, J = 8.0 Hz, 1H), 7.29 – 7.27 (m, 2H), 7.25 – 7.20 (m, 1H), 7.18 – 7.14 (m, 2H), 7.05 – 7.01 (m, 2H), 6.75 (t, J = 7.2 Hz, 1H), 4.63 – 4.47 (m, 1H), 4.40 – 4.11 (m, 1H), 4.13 – 4.06 (m, 2H), 3.92 – 3.69 (m, 2H), 3.46 – 3.23 (m, 2H), 2.45 (s, 3H), 2.35 (s, 3H), 1.98 (s, 3H), 1.96 (s, 3H), 1.22 (t, J = 7.2 Hz, 3H). ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$): δ 169.2, 169.1, 154.1, 154.0, 148.1(2), 148.0(8), 139.6, 137.5, 137.4, 136.5, 136.3, 136.0, 135.2, 135.1, 131.7, 131.6, 128.5, 128.4, 128.3, 128.2, 127.8(4), 127.7(6), 127.5, 127.3, 127.0, 126.8, 120.4, 120.0, 109.2(3), 109.1(6), 61.1, 61.0, 51.2, 51.1, 47.3, 47.1, 26.1(5), 26.1(1), 21.9, 21.8, 20.8(5), 20.7(7), 19.5, 19.4, 14.2, 14.1. HRMS-ESI (*m/z*): calcd for $C_{28}H_{31}INO_4$ $[M + H]^+$: 572.1292, found 572.1290.

(*R*)-2'-Iodo-3',4',6,6'-tetramethyl-[1,1'-biphenyl]-2-yl dibenzylcarbamate (73)



Eluent: 20:1 petroleum ether / ethyl acetate; light yellow oil, 46 mg, 80% yield, 99% ee. HPLC conditions: Chiralpak AD-H, isopropanol/hexanes = 2:98, flow: 1.0 mL/min, λ = 254 nm, t_r = 6.956 min (major), 6.570 min (minor). $[\alpha]^{25}_D$ = -73.30 (c 0.43, CH_2Cl_2). ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.37 (d, J = 8.0 Hz, 1H), 7.34 – 7.27 (m, 4H), 7.24 (d, J = 8.4 Hz, 3H), 7.19 (d, J = 7.6 Hz, 1H), 7.11 (d, J = 6.4 Hz, 2H), 7.01 (s, 1H), 6.90 (d, J = 7.6 Hz, 2H), 4.34 (q, J = 15.6 Hz, 2H), 4.07 (q, J = 15.6 Hz, 2H), 2.38 (s, 3H), 2.37 (s, 3H), 2.01 (s, 3H), 1.99 (s, 3H). ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$): δ 154.4, 148.3, 139.6, 137.8, 137.5, 137.4, 137.0, 136.9, 135.9, 135.2, 131.7, 128.5, 128.4, 128.2, 128.0, 127.7, 127.3, 127.2, 126.9, 120.3, 109.3, 48.9, 48.8, 26.1, 21.9, 20.9, 19.4. HRMS-ESI (*m/z*): calcd for $C_{31}H_{31}INO_2$ $[M + H]^+$: 576.1394, found 576.1393.

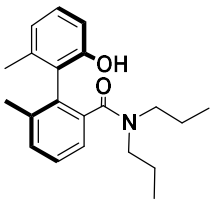
(*R*)-*N*,*N*-Diethyl-2'-hydroxy-6,6'-dimethyl-[1,1'-biphenyl]-2-carboxamide (74)



Eluent: 10:1 petroleum ether / ethyl acetate; white solid, 23.8 mg, 80% yield, 99% ee. mp: 133-134 °C. HPLC conditions: Chiralpak AD-H, isopropanol/hexanes = 10:90, flow: 1.0 mL/min, λ = 254 nm, t_r = 9.252 min (major), 8.695 min (minor). $[\alpha]^{25}_D$ = -114.46 (c 0.16, CH_2Cl_2). ^{1}H NMR (400 MHz, DMSO-*d6*): δ 9.09 (s, 1H), 7.28 – 7.24 (m, 2H), 7.07 (d, J = 5.6 Hz, 1H), 6.99 (t, J = 8.0 Hz, 1H), 6.68 – 6.62 (m, 2H), 3.52 – 3.48 (m, 1H), 3.34 – 3.31 (m, 1H), 2.81 – 2.72 (m, 2H), 1.94 (s, 3H), 1.89 (s, 3H), 0.91 (t, J = 6.4 Hz, 3H), 0.54 (t, J = 6.8 Hz, 3H). ^{13}C{^{1}H} NMR (100 MHz, DMSO-*d6*): δ 169.6,

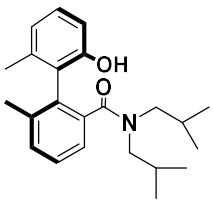
154.8, 138.7, 138.3, 137.4, 134.9, 129.6, 128.4, 127.3, 125.3, 123.2, 120.7, 112.6, 42.3, 20.6, 19.9, 14.2, 12.1. HRMS-ESI (*m/z*): calcd for $C_{19}H_{24}NO_2$ $[M+H]^+$: 298.1802, found 298.1797.

(*R*)-2'-Hydroxy-6,6'-dimethyl-*N*,*N*-dipropyl-[1,1'-biphenyl]-2-carboxamide (75)



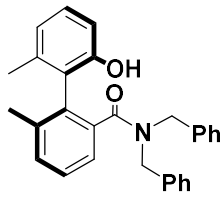
Eluent: 10:1 petroleum ether / ethyl acetate; white solid, 24.3 mg, 84% yield, 97% ee. mp: 159-161 °C. HPLC conditions: Chiralpak INC, isopropanol/hexanes = 10:90, flow: 1.0 mL/min, λ = 254 nm, t_r = 12.171 min (major), 15.813 min (minor). $[\alpha]^{25}_D$ = -99.25 (c 0.27, CH_2Cl_2). ^{1}H NMR (400 MHz, DMSO-*d6*): δ 9.12 (s, 1H), 7.28 – 7.24 (m, 2H), 7.04 (d, *J* = 5.6 Hz, 1H), 6.98 (t, *J* = 8.0 Hz, 1H), 6.67 (d, *J* = 8.0 Hz, 1H), 6.62 (d, *J* = 7.6 Hz, 1H), 3.54 – 3.48 (m, 1H), 3.31 – 3.26 (m, 1H), 2.69 – 2.60 (m, 2H), 1.93 (s, 3H), 1.88 (s, 3H), 1.47 – 1.26 (m, 2H), 1.09 – 0.88 (m, 2H), 0.65 (t, *J* = 7.2 Hz, 3H), 0.51 (t, *J* = 7.6 Hz, 3H). ^{13}C{^{1}H} NMR (100 MHz, DMSO-*d6*): δ 170.2, 154.8, 138.7, 138.4, 137.3, 134.8, 129.6, 128.4, 127.2, 125.4, 123.7, 120.7, 112.7, 49.7, 44.8, 21.5, 20.7, 20.0, 19.8, 11.5, 11.4. HRMS-ESI (*m/z*): calcd for $C_{21}H_{28}NO_2$ $[M+H]^+$ 326.2115, found 326.2107.

(*R*)-*N*,*N*-Dibutyl-2'-hydroxy-6,6'-dimethyl-[1,1'-biphenyl]-2-carboxamide (76)



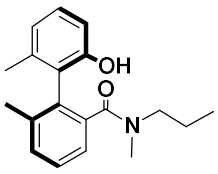
Eluent: 10:1 petroleum ether / ethyl acetate; white solid, 18.7 mg, 53% yield, >99% ee. mp: 197-199 °C. HPLC conditions: Chiralpak INC, isopropanol/hexanes = 10:90, flow: 1.0 mL/min, λ = 254 nm, t_r = 7.888 min (major), 13.372 min (minor). $[\alpha]^{25}_D$ = -92.61 (c 0.18, CH_2Cl_2). ^{1}H NMR (400 MHz, DMSO-*d6*): δ 9.18 (s, 1H), 7.26 (d, *J* = 4.4 Hz, 2H), 7.03 – 6.96 (m, 2H), 6.69 (d, *J* = 8.0 Hz, 1H), 6.62 (d, *J* = 7.2 Hz, 1H), 3.62 (dd, *J* = 13.2, 7.6 Hz, 1H), 3.24 (dd, *J* = 14.4, 10.4 Hz, 1H), 2.60 (dd, *J* = 14.8, 5.2 Hz, 1H), 2.40 (dd, *J* = 13.2, 7.2 Hz, 1H), 1.91 (s, 3H), 1.87 (s, 3H), 1.81 – 1.72 (m, 1H), 1.56 – 1.46 (m, 1H), 0.71 (d, *J* = 6.8 Hz, 3H), 0.66 (d, *J* = 6.8 Hz, 3H), 0.52 (d, *J* = 6.4 Hz, 3H), 0.35 (d, *J* = 6.8 Hz, 3H). ^{13}C{^{1}H} NMR (100 MHz, DMSO-*d6*): δ 171.1, 154.7, 138.5, 137.2, 134.6, 129.6, 128.6, 127.1, 125.5, 125.2, 121.0, 113.0, 55.4, 50.4, 26.3, 25.9, 20.8, 20.6(4), 20.5(7), 20.0(4), 20.0(2), 19.9. HRMS-ESI (*m/z*): calcd for $C_{23}H_{32}NO_2$ $[M + H]^+$: 354.2428, found 354.2426.

(*R*)-*N*,*N*-Dibenzyl-2'-hydroxy-6,6'-dimethyl-[1,1'-biphenyl]-2-carboxamide (77)



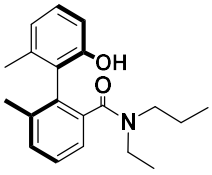
Eluent: 2:1 petroleum ether / ethyl acetate; white solid, 24.0 mg, 57% yield, 98% ee. mp: 138-139 °C. HPLC conditions: Chiralpak INC, isopropanol/hexanes = 10:90, flow: 0.8 mL/min, λ = 254 nm, t_r = 22.905 min (major), 21.151 min (minor). $[\alpha]^{25}_D$ = -144.40 (c 0.23, CH_2Cl_2). ^1H NMR (400 MHz, DMSO-*d6*): *δ* 9.29 (s, 1H), 7.37 – 7.24 (m, 7H), 7.16 – 7.08 (m, 5H), 6.80 (dd, *J* = 13.6, 7.2 Hz, 2H), 6.40 (d, *J* = 7.2 Hz, 2H), 5.26 (d, *J* = 15.6 Hz, 1H), 4.80 (d, *J* = 16.6 Hz, 1H), 3.66 (d, *J* = 16.8 Hz, 1H), 3.50 (d, *J* = 15.6 Hz, 1H), 2.00 (s, 3H), 1.96 (s, 3H). $^{13}C\{^1H\}$ NMR (100 MHz, DMSO-*d6*): *δ* 171.4, 154.9, 138.8, 137.7, 137.4, 137.1, 136.8, 134.9, 130.1, 129.2, 128.9, 127.9, 127.6, 127.3(3), 127.3(0), 127.1, 125.4, 124.0, 121.3, 113.3, 51.0, 45.7, 20.7, 20.0. HRMS-ESI (*m/z*): calcd for $C_{29}H_{28}NO_2$ $[M + H]^+$: 422.2115, found 422.2106.

(*R*)-2'-Hydroxy-*N*,6,6'-trimethyl-*N*-propyl-[1,1'-biphenyl]-2-carboxamide (78)



Eluent: 2:1 petroleum ether / ethyl acetate; white solid, 21.7 mg, 73% yield, 98% ee. mp: 122-123 °C. HPLC conditions: Chiralpak INC, isopropanol/hexanes = 10:90, flow: 1 mL/min, λ = 254 nm, t_r = 6.942 min (major), 10.591 min (minor). $[\alpha]^{25}_D$ = -88.63 (c 0.21, CH_2Cl_2). ^1H NMR (400 MHz, DMSO-*d6*): *δ* 9.09 (s, 1H), 7.29 – 7.25 (m, 2H), 7.05 – 6.97 (m, 2H), 6.70 – 6.63 (m, 2H), 3.28 – 3.25 (m, 1H), 2.82 – 2.80 (m, 1H), 2.71 (s, 3H), 1.94 (s, 3H), 1.90 (s, 3H), 1.42 – 1.08 (m, 2H), 0.70 – 0.54 (m, 3H). $^{13}C\{^1H\}$ NMR (100 MHz, DMSO-*d6*): *δ* 170.5, 170.2, 154.7, 154.6, 138.6, 138.4, 137.5, 137.4, 135.0, 134.9, 129.8, 128.5, 128.4, 127.4, 127.2, 125.6, 124.0, 123.7, 120.8, 112.9, 112.8, 52.2, 47.8, 36.9, 31.8, 21.3, 20.6, 20.0, 19.8, 11.4, 11.2. HRMS-ESI (*m/z*): calcd for $C_{19}H_{24}NO_2$ $[M + H]^+$: 298.1802, found 298.1797.

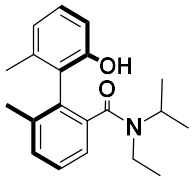
(*R*)-*N*-Ethyl-2'-hydroxy-6,6'-dimethyl-*N*-propyl-[1,1'-biphenyl]-2-carboxamide (79)



Eluent: 5:1 petroleum ether / ethyl acetate; white solid, 23.9 mg, 77% yield, 98% ee. mp: 140-142 °C. HPLC conditions: Chiralpak INC, isopropanol/hexanes = 10:90, flow: 1 mL/min, λ = 254 nm, t_r=14.339 min (major), 16.948 min (minor). $[\alpha]^{25}_D$ = -93.13 (c 0.23, CH_2Cl_2). ^1H NMR (400 MHz, DMSO-*d6*): *δ* 9.11 (s, 1H), 7.29 – 7.24 (m, 2H), 7.07 – 6.97 (m, 2H), 6.68 – 6.62 (m, 2H), 3.59 – 3.22 (m, 2H), 2.81 – 2.67 (m, 2H), 1.95 (s, 3H), 1.89 (s, 3H), 1.45 – 1.28 (m, 1H),

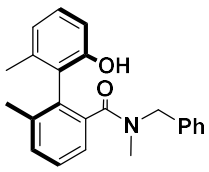
1.13 – 1.05 (m, 1H), 0.93 – 0.64 (m, 3H), 0.54 – 0.48 (m, 3H). $^{13}C\{^{1}H\}$ NMR (100 MHz, DMSO-*d6*): δ 170.5, 170.2, 154.7, 154.6, 138.6, 138.4, 137.5, 135.0, 134.9, 129.8(2), 129.7(5), 128.5, 128.4, 127.4, 127.2, 125.6, 124.0, 123.7, 120.8, 112.9, 112.7, 52.2, 47.8, 36.9, 31.8, 21.3, 20.6, 20.0, 19.8, 11.4, 11.2. HRMS-ESI (*m/z*): calcd for $C_{20}H_{26}NO_2$ $[M + H]^+$: 312.1958, found 312.1951.

(*R*)-*N*-Ethyl-2'-hydroxy-*N*-isopropyl-6,6'-dimethyl-[1,1'-biphenyl]-2-carboxamide (80)



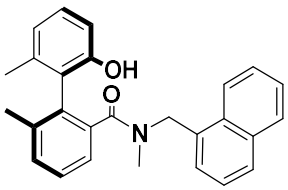
Eluent: 5:1 petroleum ether / ethyl acetate; white solid, 20.6 mg, 66% yield, 94% ee. mp: 174-176 °C. HPLC conditions: Chiralpak INC, isopropanol/hexanes = 3:97, flow: 1.0 mL/min, λ = 254 nm, t_r = 22.029 min (major), 26.795 min (minor). $[\alpha]^{25}_D$ = -58.74 (c 0.21, CH_2Cl_2). ^1H NMR (400 MHz, DMSO-*d6*): δ 9.15 (s, 1H), 7.27 – 7.25 (m, 2H), 7.10 – 6.97 (m, 2H), 6.69 – 6.61 (m, 2H), 4.13 – 3.78 (m, 1H), 3.30 – 3.23 (m, 1H), 2.84 – 2.67 (m, 1H), 1.95 (s, 3H), 1.92 (d, 3H), 0.98 – 0.89 (m, 6H), 0.68 – 0.60 (m, 3H). $^{13}C\{^{1}H\}$ NMR (100 MHz, DMSO-*d6*): δ 169.6, 154.7, 138.7, 138.6, 137.4, 134.5, 129.5, 128.4, 127.3, 125.3, 123.4, 120.6, 112.4, 49.0, 34.1, 21.5, 21.1, 20.7, 20.0, 14.5. HRMS-ESI (*m/z*): calcd for $C_{20}H_{26}NO_2$ $[M + H]^+$: 312.1958, found 312.1951.

(*R*)-*N*-benzyl-2'-hydroxy-*N*,6,6'-trimethyl-[1,1'-biphenyl]-2-carboxamide (81)



Eluent: 5:1 petroleum ether / ethyl acetate; light yellow oil, 25.2 mg, 73% yield, 97% ee. HPLC conditions: Chiralpak INC, isopropanol/hexanes = 10:90, flow: 1 mL/min, λ = 254 nm, t_r = 17.764 min (major), 20.736 min (minor). $[\alpha]^{25}_D$ = -103.28 (c 0.24, CH_2Cl_2). ^1H NMR (400 MHz, DMSO-*d6*): δ 9.11 (s, 1H), 7.35 – 7.31 (m, 2H), 7.17 – 7.05 (m, 5H), 6.77 – 6.70 (m, 2H), 6.63 (d, *J* = 6.0 Hz, 2H), 5.09 – 4.67 (m, 1H), 3.88 – 3.50 (m, 1H), 2.66 (s, 3H), 1.96 (s, 3H), 1.94 (s, 3H). $^{13}C\{^{1}H\}$ NMR (100 MHz, DMSO-*d6*): δ 170.7, 155.0, 137.6, 135.0, 130.0, 129.1, 128.8, 128.6, 127.6, 127.3, 127.1, 125.5, 123.8, 121.0, 113.1, 49.3, 36.5, 20.7, 20.0. HRMS-ESI (*m/z*): calcd for $C_{23}H_{24}NO_2$ $[M + H]^+$: 346.1802, found 346.1796.

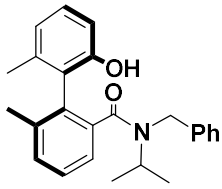
(*R*)-2'-Hydroxy-*N*,6,6'-trimethyl-*N*-(naphthalen-1-ylmethyl)-[1,1'-biphenyl]-2-carboxamide (82)



Eluent: 5:1 petroleum ether / ethyl acetate; white solid, 23.7 mg, 60% yield, 96% ee. mp: 179-181 °C. HPLC conditions: Chiralpak INC, isopropanol/hexanes = 20:80, flow: 1 mL/min, λ = 254 nm, t_r = 7.485

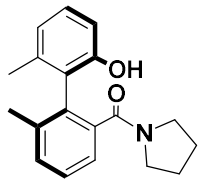
min (major), 11.722 min (minor). $[\alpha]^{25}_D$ = -103.98 (c 0.23, CH_2Cl_2). ^1H NMR (400 MHz, DMSO-*d6*): δ 9.24 (s, 1H), 7.95 – 7.82 (m, 2H), 7.77 (d, *J* = 8.4 Hz, 1H), 7.53 – 7.48 (m, 2H), 7.34 – 7.05 (m, 5H), 6.87 – 6.71 (m, 2H), 6.52 (d, *J* = 6.0 Hz, 1H), 5.21 – 5.17 (m, 1H), 4.68 – 4.47 (m, 1H), 2.77 (s, 3H), 1.97 (s, 3H), 1.96 (s, 3H). $^{13}C\{^1H\}$ NMR (100 MHz, DMSO-*d6*): δ 170.8, 155.0, 137.7, 135.1, 133.7, 132.5, 131.3, 130.8, 130.1, 129.0, 128.8, 127.6, 127.5, 126.8, 126.2, 124.2, 123.9, 123.4, 121.1, 113.1, 47.7, 37.1, 20.7, 20.0. HRMS-ESI (*m/z*): calcd for $C_{27}H_{26}NO_2$ $[M + H]^+$: 396.1958, found 396.1952.

(*R*)-*N*-Benzyl-2'-hydroxy-*N*-isopropyl-6,6'-dimethyl-[1,1'-biphenyl]-2-carboxamide (83)



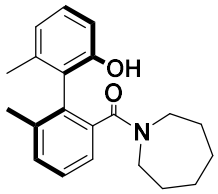
Eluent: 5:1 petroleum ether / ethyl acetate; white solid, 18.7 mg, 50% yield, >99% ee. mp: 151-152 °C. HPLC conditions: Chiralpak INC, isopropanol/hexanes = 10:90, flow: 1 mL/min, λ = 254 nm, t_r = 18.458 min (major), 22.276 min (minor). $[\alpha]^{25}_D$ = -91.53 (c 0.18, CH_2Cl_2). ^1H NMR (400 MHz, DMSO-*d6*): δ 9.26 (s, 1H), 7.32 – 7.31 (m, 2H), 7.21 – 7.16 (m, 2H), 7.05 – 7.02 (m, 3H), 6.76 (t, *J* = 8.4 Hz, 3H), 6.46 (d, *J* = 6.4 Hz, 2H), 4.78 (d, *J* = 16.4 Hz, 1H), 4.08 – 4.01 (m, 2H), 1.98 (s, 3H), 1.95 (s, 3H), 1.03 (d, *J* = 6.8 Hz, 3H), 0.72 (d, *J* = 6.4 Hz, 3H). $^{13}C\{^1H\}$ NMR (100 MHz, DMSO-*d6*): δ 170.9, 155.1, 139.9, 138.9, 138.4, 137.5, 134.6, 129.7, 128.8, 128.3, 127.5, 126.3, 126.0, 125.4, 123.4, 121.0, 112.8, 49.6, 42.9, 21.5, 20.8, 20.7, 20.0. HRMS-ESI (*m/z*): calcd for $C_{25}H_{28}NO_2$ $[M + H]^+$: 374.2115, found 374.2110.

(*R*)-(2'-Hydroxy-6,6'-dimethyl-[1,1'-biphenyl]-2-yl)(pyrrolidin-1-yl)methanone (84)



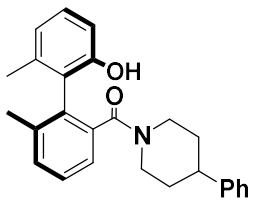
Eluent: 2:1 petroleum ether / ethyl acetate; light yellow oil, 11.8 mg, 40% yield, 93% ee. HPLC conditions: Chiralpak INC, isopropanol/hexanes = 20:80, flow: 1.0 mL/min, λ = 254 nm, t_r = 17.027 min (major), 12.501 min (minor). $[\alpha]^{25}_D$ = -64.42 (c 0.11, CH_2Cl_2). ^1H NMR (400 MHz, DMSO-*d6*): δ 9.08 (s, 1H), 7.30 – 7.24 (m, 2H), 7.11 (dd, *J* = 6.8, 1.6 Hz, 1H), 6.99 (t, *J* = 7.6 Hz, 1H), 6.67 (dd, *J* = 16.8, 8.0 Hz, 2H), 3.48 – 3.43 (m, 1H), 3.25 – 3.19 (m, 1H), 3.02 – 2.95 (m, 2H), 1.92 (s, 3H), 1.90 (s, 3H), 1.73 – 1.65 (m, 3H), 1.60 – 1.53 (m, 1H). $^{13}C\{^1H\}$ NMR (100 MHz, DMSO-*d6*): δ 168.7, 154.6, 139.0, 138.5, 137.4, 134.9, 130.0, 128.3, 127.4, 125.7, 123.7, 120.8, 112.8, 48.2, 45.1, 26.0, 24.4, 20.6, 20.0. HRMS-ESI (*m/z*): calcd for $C_{19}H_{22}NO_2$ $[M+H]^+$: 296.1645, found 296.1639.

(*R*)-Azepan-1-yl(2'-hydroxy-6,6'-dimethyl-[1,1'-biphenyl]-2-yl)methanone (85)



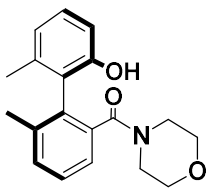
Eluent: 5:1 petroleum ether / ethyl acetate; white solid, 23.6 mg, 73% yield, 96% ee. mp: 153-155 °C. HPLC conditions: Chiralpak INC, isopropanol/hexanes = 10:90, flow: 1 mL/min, λ = 254 nm, t_r = 30.997 min (major), 25.120 min (minor). $[\alpha]^{25}_D$ = -101.75 (c 0.23, CH_2Cl_2). ^{1}H NMR (400 MHz, DMSO-*d6*): *δ* 9.11 (s, 1H), 7.27 – 7.24 (m, 2H), 7.05 – 6.98 (m, 2H), 6.69 – 6.63 (m, 2H), 3.35 – 3.29 (m, 2H), 3.17 – 3.08 (m, 2H), 1.91 (s, 6H), 1.54 – 1.31 (m, 8H). ^{13}C{^{1}H} NMR (100 MHz, DMSO-*d6*): *δ* 170.2, 154.6, 138.7, 138.5, 137.4, 134.8, 129.7, 128.4, 127.3, 125.5, 123.9, 120.8, 112.8, 48.8, 44.5, 29.0, 28.3, 27.8, 26.1, 20.7, 20.0. HRMS-ESI (*m/z*): calcd for $C_{21}H_{26}NO_2$ $[M+H]^+$: 324.1958, found 324.1953.

(*R*)-(2'-Hydroxy-6,6'-dimethyl-[1,1'-biphenyl]-2-yl)(4-phenylpiperidin-1-yl)methanone (86)



Eluent: 2:1 petroleum ether / ethyl acetate; white solid,15.4 mg, 40% yield, 95% ee. mp: 224-225 °C. HPLC conditions: Chiralpak INC, isopropanol/hexanes = 3:97, flow: 1 mL/min, λ = 254 nm, t_r = 43.383 min (major), 40.196 min (minor). $[\alpha]^{25}_D$ = -117.89 (c 0.19, CH_2Cl_2). ^{1}H NMR (400 MHz, DMSO-*d6*): *δ* 9.20 (s, 0.6H), 9.10 (s, 0.4H), 7.32 – 7.18 (m, 6H), 7.16 – 7.00 (m, 3H), 6.77 – 6.65 (m, 2H), 4.39 (d, *J* = 12.8 Hz, 1H), 3.66 (t, *J* = 10.8 Hz, 1H), 2.97 – 2.36 (m, 3H), 1.96 – 1.92 (m, 6H), 1.74 – 0.81 (m, 4H). ^{13}C{^{1}H} NMR (100 MHz, DMSO-*d6*): *δ* 168.9, 168.8, 154.8, 154.6, 146.3, 146.1, 138.7, 138.5, 138.1, 137.9, 137.5, 137.4, 134.9, 134.7, 129.9, 129.7, 128.8, 128.5, 128.4, 127.4, 127.2, 127.1, 126.6(4), 126.6(0), 125.6, 125.5, 124.0, 123.8, 120.8, 112.8, 112.5, 48.0, 46.9, 42.4, 41.9, 41.7, 41.5, 33.6, 33.5, 33.2, 20.7, 20.6, 20.0, 19.9. HRMS-ESI (*m/z*): calcd for $C_{26}H_{28}NO_2$ $[M + H]^+$: 386.2115, found 386.2108.

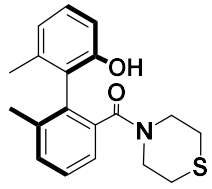
(*R*)-(2'-Hydroxy-6,6'-dimethyl-[1,1'-biphenyl]-2-yl)(morpholino)methanone (87)



Eluent: 2:1 petroleum ether / ethyl acetate; white solid, 20.8 mg, 67% yield, 93% ee. mp: 154-155 °C. HPLC conditions: Chiralpak INC, isopropanol/hexanes = 10:90, flow: 1 mL/min, λ= 254 nm, t_r = 19.346 min (major), 17.063 min (minor). $[\alpha]^{25}_D$ = -69.31 (c 0.20, CH_2Cl_2). ^{1}H NMR (400 MHz, DMSO-*d6*): *δ* 9.16 (s, 1H), 7.28 (q, *J* = 7.6 Hz, 2H), 7.09 – 7.01 (m, 2H), 6.69 (dd, *J* = 22.8, 8.0 Hz, 2H), 3.58 – 3.48 (m, 3H), 3.25 – 3.01 (m, 5H), 1.93 (s, 3H), 1.90 (s, 3H). ^{13}C{^{1}H} NMR

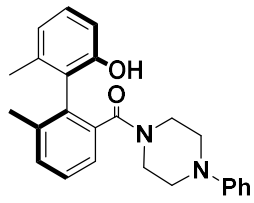
(100 MHz, DMSO-*d6*): δ 169.1, 154.6, 138.5, 137.6, 137.2, 135.0, 130.1, 128.6, 127.5, 125.4, 124.0, 120.9, 112.7, 66.8, 66.5, 47.2, 41.6, 20.6, 20.0. HRMS-ESI (*m/z*): calcd for $C_{19}H_{22}NO_3$ [M + H]$^+$: 312.1594, found 312.1589.

(*R*)-(2'-Hydroxy-6,6'-dimethyl-[1,1'-biphenyl]-2-yl)(thiomorpholino)methanone (88)



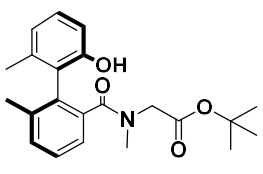
Eluent: 5:1 petroleum ether / ethyl acetate; white solid, 23.2 mg, 71% yield, 96% ee. mp: 158-160 °C. HPLC conditions: Chiralpak INC, isopropanol/hexanes = 10:90, flow: 1 mL/min, λ = 254 nm, t_r = 21.155 min (major), 14.706 min (minor). $[\alpha]^{25}_D$ = -67.26 (c 0.22, CH_2Cl_2). ^{1}H NMR (400 MHz, DMSO-*d6*): δ 9.15 (s, 1H), 7.31 – 7.25 (m, 2H), 7.11 (d, *J* = 6.8 Hz, 1H), 7.02 (t, *J* = 7.6 Hz, 1H), 6.68 (dd, *J* = 23.2, 8.0 Hz, 2H), 3.70 – 3.66 (m, 1H), 3.49 – 3.41 (m, 2H), 3.34 – 3.28 (m, 1H), 2.58 – 2.46 (m, 2H), 2.41 – 2.36 (m, 1H), 2.24 – 2.19 (m, 1H), 1.92 (s, 3H), 1.89 (s, 3H). ^{13}C{^{1}H} NMR (100 MHz, DMSO-*d6*): δ 169.3, 154.5, 138.6, 137.6, 137.3, 134.9, 130.0, 128.6, 127.4, 125.4, 123.9, 120.9, 112.7, 49.5, 43.5, 27.5, 27.3, 20.5, 19.9. HRMS-ESI (*m/z*): calcd for $C_{19}H_{22}NO_2S$ [M + H]$^+$: 328.1366, found 328.1360.

(*R*)-(2'-Hydroxy-6,6'-dimethyl-[1,1'-biphenyl]-2-yl)(4-phenylpiperazin-1-yl)methanone (89)



Eluent: 2:1 petroleum ether / ethyl acetate; white solid, 27.8 mg, 72% yield, 90% ee. mp: 209-210 °C. HPLC conditions: Chiralpak INC, isopropanol/hexanes = 10:90, flow: 1 mL/min, λ = 254 nm, t_r = 32.850 min (major), 24.301 min (minor). $[\alpha]^{25}_D$ = -116.48 (c 0.27, CH_2Cl_2). ^{1}H NMR (400 MHz, DMSO-*d6*): δ 9.19 (s, 1H), 7.30 (q, *J* = 7.6 Hz, 2H), 7.20 (t, *J* = 7.6 Hz, 2H), 7.11 (d, *J* = 6.0 Hz, 1H), 7.00 (t, *J* = 7.6 Hz, 1H), 6.90 (d, *J* = 8.0 Hz, 2H), 6.80 (t, *J* = 7.2 Hz, 1H), 6.70 – 6.65 (m, 2H), 3.63 – 3.60 (m, 2H), 3.38 – 3.08 (m, 5H), 2.79 (t, *J* = 8.8 Hz, 1H), 2.59 (t, *J* = 8.8 Hz, 1H), 1.95 (s, 3H), 1.93 (s, 3H). ^{13}C{^{1}H} NMR (100 MHz, DMSO-*d6*): δ 169.0, 154.6, 151.4, 138.6, 137.6, 137.5, 135.1, 130.1, 129.5, 128.6, 127.5, 125.5, 124.0, 120.9, 119.9, 116.6, 112.8, 49.5, 49.0, 46.6, 41.1, 20.6, 20.0. HRMS-ESI (*m/z*): calcd for $C_{25}H_{27}N_2O_2$ [M + H]$^+$: 387.2067, found 387.2059.

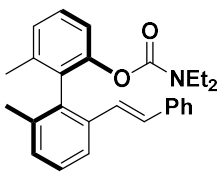
***Tert*-Butyl (*R*)-*N*-(2'-hydroxy-6,6'-dimethyl-[1,1'-biphenyl]-2-carbonyl)-*N*-methylglycinate (90)**



Eluent: 2:1 petroleum ether / ethyl acetate; light yellow oil, 22.9 mg, 62% yield, >99% ee. HPLC conditions: Chiralpak INC,

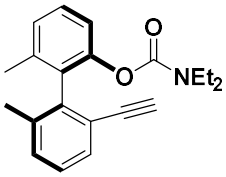
isopropanol/hexanes = 7:93, flow: 1 mL/min, λ = 254 nm, t_r = 7.785 min (major), 10.382 min (minor). $[\alpha]^{25}_D$ = -91.82 (c 0.22, CH_2Cl_2). ^{1}H NMR (400 MHz, DMSO-*d6*): δ 9.21 (s, 0.6H), 9.05 (s, 0.4H), 7.32 – 7.21 (m, 2H), 7.11 – 6.96 (m, 2H), 6.70 – 6.63 (m, 2H), 4.20 – 4.05 (m, 2H), 3.55 (t, *J* = 16.0 Hz, 1H), 2.80 (s, 1.2H), 2.70 (s, 1.8H), 1.91 (d, *J* = 4.4 Hz, 3H), 1.88 (s, 3H), 1.39 (d, *J* = 3.2 Hz, 9H). ^{13}C{^{1}H} NMR (100 MHz, DMSO-*d6*): δ 171.0, 170.9, 169.3, 168.5, 154.7, 154.5, 138.5, 138.3, 137.6, 137.5, 137.3, 137.2, 135.2, 134.9, 130.3, 130.2, 128.6, 128.4, 127.4, 127.2, 125.5, 125.3, 124.0, 123.3, 120.9, 120.8, 113.0, 112.9, 81.7, 81.3, 53.3, 49.5, 38.3, 33.7, 28.2, 28.1, 20.5, 19.9. HRMS-ESI (*m/z*): calcd for $C_{22}H_{28}NO_4$ $[M + H]^+$: 370.2013, found 370.2006.

(*R*, *E*)-2',6-Dimethyl-6'-styryl-[1,1'-biphenyl]-2-yl diethylcarbamate (91)



Eluent: 20:1 petroleum ether / ethyl acetate; light yellow oil, 27.2 mg, 68% yield, 99% ee. HPLC conditions: Chiralpak AD-H, isopropanol/hexanes = 10:90, flow: 1.0 mL/min, λ = 254 nm, t_r = 4.053 min (major), 3.661 min (minor). $[\alpha]^{25}_D$ = -64.17 (c 0.24, CH_2Cl_2). ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.59 (d, *J* = 8.0 Hz, 1H), 7.34 – 7.27 (m, 4H), 7.24 (d, *J* = 7.6 Hz, 2H), 7.21 – 7.13 (m, 4H), 6.95 (d, *J* = 16.4 Hz, 1H), 6.76 (d, *J* = 16.4 Hz, 1H), 3.13 (q, *J* = 6.8 Hz, 1H), 2.88 (q, *J* = 6.8 Hz, 1H), 2.00 (s, 3H), 1.94 (s, 3H), 0.95 (t, *J* = 6.8 Hz, 3H), 0.70 (t, *J* = 6.8 Hz, 3H). ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$): δ 153.6, 148.9, 138.0, 137.7, 137.1, 136.3, 135.7, 132.1, 129.0, 128.9, 128.5, 128.0, 127.4(4), 127.4(3), 127.2, 126.7, 126.6, 122.4, 120.5, 41.8, 41.4, 20.0, 19.6, 13.4, 13.0. HRMS-ESI (*m/z*): calcd for $C_{27}H_{30}NO_2$ $[M + H]^+$: 400.2271, found 400.2272.

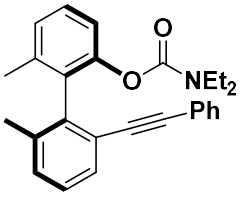
(*R*)-2'-Ethynyl-6,6'-dimethyl-[1,1'-biphenyl]-2-yl diethylcarbamate (92)



Eluent: 20:1 petroleum ether / ethyl acetate; light yellow oil, 15.8 mg, 54% yield, 99% ee. HPLC conditions: Chiralpak OD-H, isopropanol/hexanes = 2:98, flow: 0.5 mL/min, λ = 254 nm, t_r = 13.932 min (major), 14.745 min (minor). $[\alpha]^{25}_D$ = -13.43 (c 0.07, CH_2Cl_2). ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.41 (d, *J* = 7.6 Hz, 1H), 7.29 (t, *J* = 8.0 Hz, 1H), 7.24 (d, *J* = 7.2 Hz, 1H), 7.21 – 7.17 (m, 2H), 7.14 (d, *J* = 7.2 Hz, 1H), 3.22 – 3.11 (m, 2H), 2.98 – 2.87 (m, 2H), 2.82 (s, 1H), 2.02 (s, 6H), 0.99 (t, *J* = 6.0 Hz, 3H), 0.73 (t, *J* = 6.4 Hz, 3H). ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$): δ 153.4, 148.8, 139.7, 137.5, 132.1, 130.3, 130.1, 128.0, 127.1, 126.3, 122.4, 120.0, 100.0, 82.3, 79.1, 41.7, 41.4,

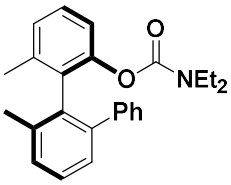
19.8, 19.4, 13.4, 13.1. HRMS-ESI (*m/z*): calcd for $C_{21}H_{24}NO_2$ $[M + H]^+$: 322.1802, found 322.1801.

(*R*)-2',6-Dimethyl-6'-(phenylethynyl)-[1,1'-biphenyl]-2-yl diethylcarbamate (93)



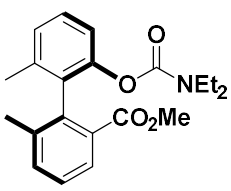
Eluent: 20:1 petroleum ether / ethyl acetate; light yellow oil, 19.1 mg, 48% yield, 99% ee. HPLC conditions: Chiralpak AD-H, isopropanol/hexanes = 2:98, flow: 1.0 mL/min, λ = 254 nm, t_r = 7.438 min (major), 6.911 min (minor). $[\alpha]^{25}_D$ = -131.07 (c 0.10, CH_2Cl_2). ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.43 (t, J = 5.2 Hz, 1H), 7.33 (t, J = 7.6 Hz, 1H), 7.24 – 7.19 (m, 6H), 7.15 (d, J = 7.6 Hz, 1H), 7.09 – 7.06 (m, 2H), 3.23 – 3.10 (m, 2H), 2.97 – 2.87 (m, 2H), 2.08 (s, 3H), 2.05 (s, 3H), 0.99 (t, J = 7.2 Hz, 3H), 0.72 (t, J = 6.8 Hz, 3H). ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$): δ 153.5, 149.1, 139.6, 137.8, 137.4, 132.5, 131.4, 129.8, 128.8, 128.0, 127.8(3), 127.7(6), 127.2, 126.2, 123.6, 123.5, 119.9, 91.8, 88.5, 41.7, 41.4, 19.9, 19.5, 13.4, 13.1. HRMS-ESI (*m/z*): calcd for $C_{27}H_{28}NO_2$ $[M + H]^+$: 398.2115, found 398.2111.

(*R*)-6,6'-Dimethyl-[1,1':2',1''-terphenyl]-2-yl diethylcarbamate (94)



Eluent: 20:1 petroleum ether / ethyl acetate; light yellow oil, 30.6 mg, 82% yield, 99% ee. HPLC conditions: Chiralpak OD-H, isopropanol/hexanes = 2:98, flow: 0.5 mL/min, λ = 254 nm, t_r = 12.144 min (major), 13.904 min (minor). $[\alpha]^{25}_D$ = -92.31 (c 0.23, CH_2Cl_2). ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.34 – 7.28 (m, 1H), 7.26 – 7.21 (m, 2H), 7.17 – 7.12 (m, 6H), 7.10 – 7.08 (m, 1H), 6.91 – 6.89 (m, 1H), 3.27 – 3.19 (m, 2H), 3.05 – 2.91 (m, 2H), 2.04 (s, 3H), 1.84 (s, 3H), 1.07 (t, J = 6.8 Hz, 3H), 0.73 (t, J = 6.8 Hz, 3H). ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$): δ 153.5, 149.2, 141.7, 138.8, 137.3, 137.2, 137.0, 136.3, 135.0, 132.3, 129.7, 128.8(4), 128.7(9), 128.4, 127.5, 127.4(5), 127.4(1), 127.3(7), 126.4, 126.1, 119.9, 101.2, 42.0, 41.5, 20.2, 19.7, 13.4, 13.2. HRMS-ESI (*m/z*): calcd for C_{25} H_{28} NO_2 $[M + H]^+$: 374.2115 found 374.2113.

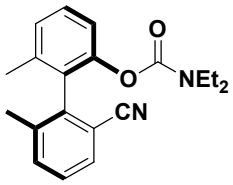
Methyl (*R*)-2'-((diethylcarbamoyl)oxy)-6,6'-dimethyl-[1,1'-biphenyl]-2-carboxylate (95)



Eluent: 10:1 petroleum ether / ethyl acetate; light yellow oil, 23.1 mg, 65% yield, 99% ee. HPLC conditions: Chiralpak AD-H, isopropanol/hexanes = 10:90, flow: 1.0 mL/min, λ = 254 nm, t_r = 4.611 min (major), 4.295 min (minor). $[\alpha]^{25}_D$ = -70.37 (c 0.11, CH_2Cl_2). ^{1}H NMR (400 MHz, $CDCl_3$): δ

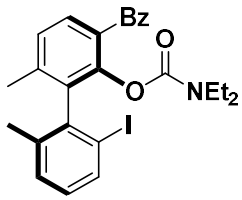
7.75 (d, *J* = 8.0 Hz, 1H), 7.41 (d, *J* = 7.6 Hz, 1H), 7.30 (t, *J* = 7.6 Hz, 1H), 7.25 (d, *J* = 7.6 Hz, 1H), 7.11 (d, *J* = 8.0 Hz, 2H), 3.57 (s, 3H), 3.16 – 3.11 (m, 2H), 2.88 – 2.83 (m, 2H), 2.01 (s, 3H), 2.00 (s, 3H), 0.97 (t, *J* = 6.4 Hz, 3H), 0.68 (t, *J* = 6.4 Hz, 3H). $^{13}C\{^{1}H\}$ NMR (100 MHz, $CDCl_3$): δ 167.8, 153.5, 148.1, 138.1, 137.4, 137.0, 133.3, 132.6, 131.2, 127.6, 127.4, 127.2, 126.1, 119.9, 51.8, 41.8, 41.3, 19.8, 19.6, 13.4, 13.1. HRMS-ESI (*m/z*): calcd for $C_{21}H_{26}NO_4$ $[M + H]^+$: 356.1856, found 356.1855.

(*R*)-2'-Cyano-6,6'-dimethyl-[1,1'-biphenyl]-2-yl diethylcarbamate (96)



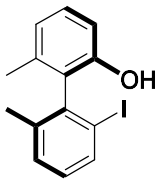
Eluent: 10:1 petroleum ether / ethyl acetate; light yellow oil, 28.6 mg, 89% yield, 99% ee). HPLC conditions: Chiralpak INC, isopropanol/hexanes = 10:90, flow: 1.0 mL/min, λ = 254 nm, t_r = 14.323 min (major), 16.822 min (minor). $[\alpha]^{25}_D$ = -62.87 (c 0.24, CH2Cl2). ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.57 (d, *J* = 8.0 Hz, 1H), 7.48 (d, *J* = 8.0 Hz, 1H), 7.34 (q, *J* = 8.0 Hz, 2H), 7.18 (d, *J* = 8.0 Hz, 2H), 3.18 – 3.10 (m, 2H), 3.08 – 2.88 (m, 2H), 2.09 (s, 3H), 2.03 (s, 3H), 0.96 (t, *J* = 6.8 Hz, 3H), 0.76 (t, *J* = 7.2 Hz, 3H). $^{13}C\{^{1}H\}$ NMR (100 MHz, $CDCl_3$): δ 153.2, 148.8, 140.4, 139.1, 137.2, 134.2, 130.1, 129.3, 127.9, 126.9, 120.4, 117.9, 113.8, 41.8, 41.5, 19.6, 19.4, 13.5, 13.1. HRMS-ESI (*m/z*): calcd for $C_{20}H_{23}N_2O_2$ $[M + H]^+$: 323.1754, found 323.1752.

(*R*)-3-Benzoyl-2'-iodo-6,6'-dimethyl-[1,1'-biphenyl]-2-yl diethylcarbamate (97)



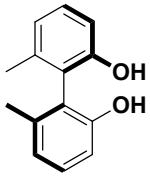
Eluent: 20:1 petroleum ether / ethyl acetate; white solid, 47.4 mg, 90% yield, 98% ee. HPLC conditions: Chiralpak INC, isopropanol/hexanes = 10:90, flow: 1 mL/min, λ = 254 nm, t_r = 50.045 min (major), 46.525 min (minor). $[\alpha]^{25}_D$ = -16.25 (c 0.16, CH_2Cl_2). ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.86 – 7.84 (m, 2H), 7.77 (d, *J* = 7.6 Hz, 1H), 7.57 (d, *J* = 7.6 Hz, 1H), 7.50 (t, *J* = 7.2 Hz, 1H), 7.40 (t, *J* = 7.6 Hz, 2H), 7.27 (d, *J* = 7.6 Hz, 1H), 7.22 (d, *J* = 7.2 Hz, 1H), 6.93 (t, *J* = 7.6 Hz, 1H), 2.98 – 2.85 (m, 2H), 2.71 – 2.62 (m, 1H) 2.54 – 2.45 (m, 1H), 2.06 (s, 3H), 2.05 (s, 3H), 0.78 (t, *J* = 6.8 Hz, 3H), 0.45 (t, *J* = 6.8 Hz, 3H). $^{13}C\{^{1}H\}$ NMR (100 MHz, $CDCl_3$): δ 194.6, 152.2, 146.2, 140.9, 140.9, 138.8, 138.0, 137.3, 136.4, 132.3, 130.9, 130.0, 129.8, 129.2, 128.0, 126.6, 101.0, 41.9, 41.2, 21.3, 19.7, 13.1, 13.0. HRMS-ESI (*m/z*): calcd for $C_{26}H_{27}INO_3$ $[M + H]^+$: 528.1030, found 528.1025.

(*R*)-2'-Iodo-6,6'-dimethyl-[1,1'-biphenyl]-2-ol (98)



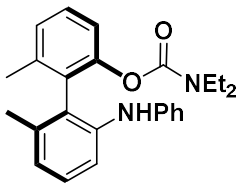
Eluent: 20:1 petroleum ether / ethyl acetate; light yellow oil, 28.8 mg, 89% yield, 98% ee. HPLC conditions: Chiralpak OD-H, isopropanol/hexanes = 1:99, flow: 1 mL/min, λ = 254 nm, t_r = 25.976 min (major), 23.645 min (minor). $[\alpha]^{25}_D$ = +8.79 (c 0.39, CH_2Cl_2). ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.85 (d, J = 8.0 Hz, 1H), 7.33 (d, J = 7.6 Hz, 1H), 7.23 (t, J = 7.6 Hz, 1H), 7.02 (t, J = 7.6 Hz, 1H), 6.88 (dd, J = 14.8, 7.2 Hz, 2H), 4.45 (s, 1H), 2.09 (s, 3H), 1.95 (s, 3H). ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$): δ 151.8, 139.7, 139.6, 137.3, 136.7, 130.4, 130.2, 130.1, 129.1, 122.2, 113.0, 102.4, 21.2, 19.5. HRMS-ESI (*m/z*): calcd for $C_{14}H_{12}IO$ $[M-H]^-$: 322.9938, found 322.9938.

(*R*)-6,6'-Dimethyl-[1,1'-biphenyl]-2,2'-diol (99)



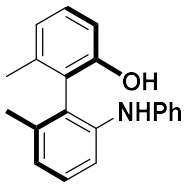
Eluent: 20:1 petroleum ether / ethyl acetate; white solid, 12.8 mg, 60% yield, 97% ee. HPLC conditions: Chiralpak OD-H, isopropanol/hexanes = 15:85, flow: 1 mL/min, λ = 254 nm, t_r = 5.868 min (major), 9.122 min (minor). $[\alpha]^{25}_D$ = +50 (c 0.06, CH_2Cl_2). ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.23 (t, J = 8.0 Hz, 2H), 6.89 (t, J = 8.8 Hz, 2H), 4.74 (s, 2H), 1.99 (s, 6H). ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$): δ 153.8, 138.9, 130.1, 122.5, 119.6, 113.2, 19.5. HRMS-ESI (*m/z*): calcd for $C_{14}H_{13}O_2$ $[M - H]^-$: 213.0921, found 213.0917.

(*R*)-2',6-Dimethyl-6'-(phenylamino)-[1,1'-biphenyl]-2-yl diethylcarbamate (100)



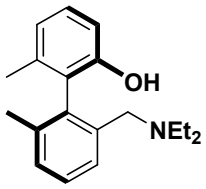
Eluent: 20:1 petroleum ether / ethyl acetate; light yellow oil, 15.5 mg, 40% yield, 96% ee. HPLC conditions: Chiralpak INC, isopropanol/hexanes = 3:97, flow: 1.0 mL/min, λ = 254 nm, t_r = 4.384 min (major), 4.141 min (minor). $[\alpha]^{25}_D$ = -51.67 (c 0.06, CH_2Cl_2). ^{1}H NMR (400 MHz, DMSO-*d6*): δ 7.32 (t, J = 7.6 Hz, 1H), 7.21 (d, J = 7.6 Hz, 1H), 7.18 – 7.10 (m, 4H), 7.09 (d, J = 8.0 Hz, 1H), 6.89 – 6.84 (m, 3H), 6.77 (t, J = 7.6 Hz, 1H), 6.11 (s, 1H), 3.20 – 2.92 (m, 4H), 1.93 (s, 3H), 1.86 (s, 3H), 0.86 (t, J = 6.8 Hz, 3H), 0.75 (t, J = 7.2 Hz, 3H). ^{13}C{^{1}H} NMR (100 MHz, DMSO-*d6*): δ 154.5, 149.9, 144.1, 141.8, 138.6, 137.6, 131.5, 129.6, 128.8, 128.5, 127.8, 126.9, 123.0, 121.2, 120.2, 117.4, 115.2, 42.1, 41.8, 40.6, 40.4, 40.2, 40.0, 39.8, 39.6, 39.4, 20.2, 19.6, 13.8, 13.4. HRMS-ESI (*m/z*): calcd for $C_{25}H_{29}N_2O_2$ $[M+H]^+$ 389.2224, found 389.2219.

(*R*)-2',6-Dimethyl-6'-(phenylamino)-[1,1'-biphenyl]-2-ol (101)



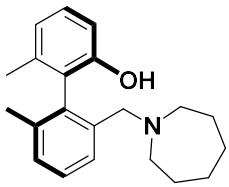
Eluent: 20:1 petroleum ether / ethyl acetate; white solid, 23.1 mg, 80% yield, 99% ee. HPLC conditions: Chiralpak AD-H, isopropanol/hexanes = 10:90, flow: 1 mL/min, λ = 254 nm, t_r = 5.614 min (major), 6.549 min (minor). $[\alpha]^{25}_D$ = +7.14 (c 0.04, CH_2Cl_2). ^{1}H NMR (400 MHz, DMSO-*d6*): δ 9.09 (s, 1H), 7.14 – 7.10 (m, 4H), 7.07 (t, *J* = 7.6 Hz, 1H), 6.93 (d, *J* = 8.0 Hz, 2H), 6.87 (dd, *J* = 6.0, 2.4 Hz, 1H), 6.79 – 6.74 (m, 3H), 5.93 (s, 1H), 1.89 (s, 3H), 1.85 (s, 3H). ^{13}C{^{1}H} NMR (100 MHz, DMSO-*d6*): δ 155.4, 144.8, 141.3, 138.0, 137.9, 129.4, 129.0, 128.6, 127.6, 124.1, 123.0, 121.2, 119.9, 117.3, 116.2, 113.6, 20.3, 19.9. HRMS-ESI (*m/z*): calcd for $C_{20}H_{20}NO$ $[M + H]^+$: 290.1539, found 290.1535.

(*R*)-2'-((Diethylamino)methyl)-6,6'-dimethyl-[1,1'-biphenyl]-2-ol (102)



Eluent: 10:1 petroleum ether / ethyl acetate; colorless liquid, 27.4 mg, 97% yield, 52% ee. HPLC conditions: Chiralpak OJ-H, isopropanol/hexanes = 3:97, flow: 1.0 mL/min, λ = 254 nm, t_r = 3.344 min (major), 3.752 min (minor). $[\alpha]^{25}_D$ = -23.37 (c 0.47, CH_2Cl_2). ^{1}H NMR (400 MHz, DMSO-*d6*): δ 9.32 (s, 1H), 7.33 (d, *J* = 7.2 Hz, 1H), 7.21 – 7.14 (m, 2H), 7.05 (t, *J* = 7.6 Hz, 1H), 6.76 (t, *J* = 7.2 Hz, 2H), 3.12 (s, 2H), 2.32 (q, *J* = 7.2 Hz, 4H), 1.86 (s, 3H), 1.78 (s, 3H), 0.80 (t, *J* = 7.2 Hz, 6H). ^{13}C{^{1}H} NMR (100 MHz, DMSO-*d6*): δ 154.6, 137.9, 137.2, 136.3, 128.6, 128.3, 127.3, 127.0, 126.9, 121.2, 114.3, 55.5, 46.5, 20.1, 20.0, 11.7. HRMS-ESI (*m/z*): calcd for $C_{19}H_{26}NO$ $[M + H]^+$: 284.2009, found 284.2005.

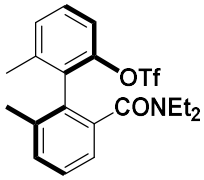
(*R*)-2'-(Azepan-1-ylmethyl)-6,6'-dimethyl-[1,1'-biphenyl]-2-ol (103)



Eluent: 10:1 petroleum ether / ethyl acetate; light yellow oil, 25.3 mg, 82% yield, >99% ee. HPLC conditions: Chiralpak INC, isopropanol/hexanes = 3:97, flow: 1.0 mL/min, λ = 254 nm, t_r = 5.281 min (major), 4.862 min (minor). $[\alpha]^{25}_D$ = -34.92 (c 0.13, CH_2Cl_2). ^{1}H NMR (400 MHz, DMSO-*d6*): δ 9.29 (s, 1H), 7.37 (d, *J* = 7.2 Hz, 1H), 7.21 (t, *J* = 7.2 Hz, 1H), 7.16 (d, *J* = 7.2 Hz, 1H), 7.06 (t, *J* = 7.6 Hz, 1H), 6.77 – 6.75 (m, 2H), 3.21 (q, *J* = 14.4 Hz, 2H), 2.45 (s, 4H), 1.86 (s, 3H), 1.77 (s, 3H), 1.51 (s, 8H). ^{13}C{^{1}H} NMR (100 MHz, DMSO-*d6*): δ 154.5, 137.8, 137.1, 136.4, 128.6,

128.3, 127.0, 126.5, 121.2, 114.1, 60.2, 55.6, 27.7, 26.8, 20.1, 20.0. HRMS-ESI (*m/z*): calcd for $C_{21}H_{28}NO$ $[M + H]^+$: 310.2165, found 310.2156.

(*R*)-2'-(Diethylcarbamoyl)-6,6'-dimethyl-[1,1'-biphenyl]-2-yl trifluoromethanesulfonate (104)



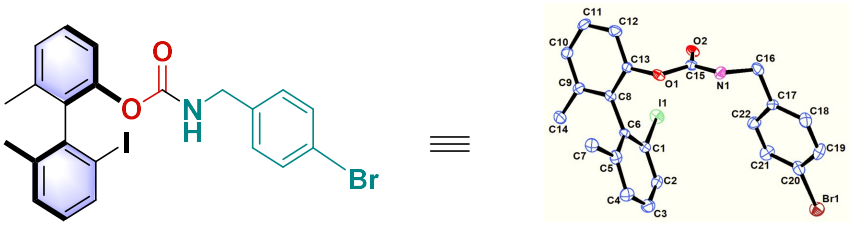
Eluent: 20:1 petroleum ether / ethyl acetate; white solid, 21.4 mg, 50% yield, 99% ee. HPLC conditions: Chiralpak INC, isopropanol/hexanes = 2:98, flow: 1.0 mL/min, λ = 254 nm, t_r = 10.279 min (major), 9.05 min (minor). $[\alpha]^{25}_D$ = -60.0 (c 0.08, CH_2Cl_2). ^1H NMR (400 MHz, $CDCl_3$): δ 7.36 – 7.33 (m, 2H), 7.29 (d, J = 7.6 Hz, 2H), 7.18 – 7.15 (m, 1H), 7.10 (d, J = 7.6 Hz, 1H), 3.66 – 3.56 (m, 1H), 3.44 – 3.36 (m, 1H), 3.08 – 2.92 (m, 2H), 2.15 (s, 3H), 2.09 (s, 3H), 1.13 (t, J = 6.8 Hz, 3H), 0.78 (t, J = 6.8 Hz, 3H). $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$): δ 169.2, 147.1, 138.1, 137.0, 132.0, 131.5, 130.6, 129.5, 129.0, 128.0, 122.8, 119.8, 117.5, 116.7, 42.7, 37.9, 20.1, 19.5, 13.9, 11.7. ^{19}F NMR (376 MHz, $CDCl_3$): δ -74.77 (s). HRMS-ESI (*m/z*): calcd for $C_{20}H_{23}F_3NO_4S$ $[M + H]^+$: 430.1294, found 430.1293.

I. Crystal data and structure refinement

23 *X-ray* stucture of **23**

Table S2. Crystal data and structure refinements for **23**

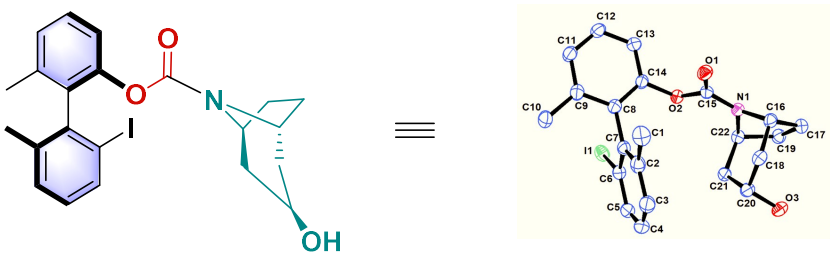
Compound	**23**
Empirical formula	$C_{19}H_{20}INO_3$
Formula weight	437.26
Temperature/K	170.0
Crystal system	Monoclinic
Space group	$P2_1$
a/Å	7.9482(3)
b/Å	8.5150(3)
c/Å	14.1656(6)
α/°	90
β/°	105.8200(10)
γ/°	90
Volume/Å^3	922.40(6)
Z	2
Density (calculated)/g•cm^{-3}	1.574
μ/mm^{-1}	1.752
F(000)	436.0
Crystal size/mm^3	0.08 × 0.05 × 0.04
Radiation	MoKα (λ = 0.71073)
2Θ range for data collection/°	5.328 to 52.806
Index ranges	-9 ≤ h ≤ 9, -10 ≤ k ≤ 10, -16 ≤ l ≤ 17
Reflections collected	10652
Independent reflections	3631 [R_{int} = 0.0344, R_{sigma} = 0.0420]
Data/restraints/parameters	3631/1/219
Goodness-of-fit on F^2	1.099
Final R indexes [I>=2σ (I)]	R_1 = 0.0283, wR_2 = 0.0515
Final R indexes [all data]	R_1 = 0.0376, wR_2 = 0.0574
Largest diff. peak/hole/e Å^{-3}	0.44/-0.73
Flack parameter	-0.047(13)



39 *X-ray* stucture of **39**

Table S3. Crystal data and structure refinements for **39**

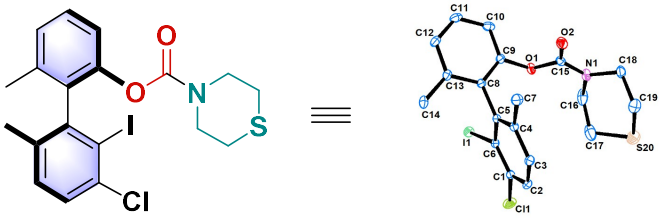
Compound	**39**
Empirical formula	$C_{22}H_{19}BrINO_2$
Formula weight	536.19
Temperature/K	150
Crystal system	monoclinic
Space group	$P2_1$
a/Å	12.4830(18)
b/Å	8.0886(9)
c/Å	21.009(3)
α/°	90
β/°	93.942(4)
γ/°	90
Volume/Å^3	2116.3(5)
Z	4
Density (calculated)/g•cm^{-3}	1.683
μ/mm^{-1}	3.417
F(000)	1048.0
Crystal size/mm^3	0.09 × 0.05 × 0.04
Radiation	MoKα (λ = 0.71073)
2Θ range for data collection/°	3.918 to 50.684
Index ranges	-14 ≤ h ≤ 14, -9 ≤ k ≤ 9, -25 ≤ l ≤ 25
Reflections collected	16502
Independent reflections	6454 [R_{int} = 0.0843, R_{sigma} = 0.0970]
Data/restraints/parameters	6454/1/491
Goodness-of-fit on F^2	1.032
Final R indexes [I>=2σ (I)]	R_1 = 0.0546, wR_2 = 0.1246
Final R indexes [all data]	R_1 = 0.0790, wR_2 = 0.1418
Largest diff. peak/hole/e Å^{-3}	1.38/-0.94
Flack parameter	0.028(16)



55 *X-ray* stucture of **55**

Table S4. Crystal data and structure refinements for **55**

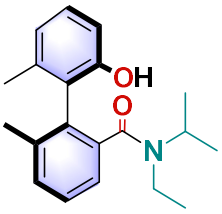
Compound	**55**
Empirical formula	$C_{22}H_{24}INO_3$
Formula weight	477.32
Temperature/K	150
Crystal system	monoclinic
Space group	$P2_1/c$
a/Å	18.1680(6)
b/Å	14.5103(5)
c/Å	15.8483(5)
α/°	90
β/°	99.0800(10)
γ/°	90
Volume/Å^3	4125.6(2)
Z	8
Density (calculated)/g•cm^{-3}	1.537
μ/mm^{-1}	1.574
F(000)	1920.0
Crystal size/mm^3	0.16 × 0.08 × 0.04
Radiation	MoKα (λ = 0.71073)
2Θ range for data collection/°	3.828 to 52.798
Index ranges	-22 ≤ h ≤ 22, -18 ≤ k ≤ 16, -19 ≤ l ≤ 19
Reflections collected	30574
Independent reflections	8338 [R_{int} = 0.0505, R_{sigma} = 0.0472]
Data/restraints/parameters	8338/579/531
Goodness-of-fit on F^2	1.084
Final R indexes [I>=2σ (I)]	R_1 = 0.0446, wR_2 = 0.0947
Final R indexes [all data]	R_1 = 0.0624, wR_2 = 0.1034
Largest diff. peak/hole/e Å^{-3}	0.45/-0.34



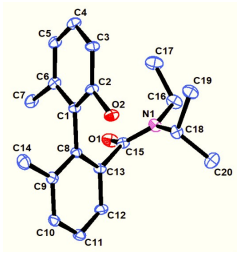
64 *X-ray* structure of **64**

Table 5. Crystal data and structure refinements for (*R*)-64

Compound	**64**
Empirical formula	$C_{19}H_{19}ClINO_2S$
Formula weight	487.76
Temperature/K	170.0
Crystal system	monoclinic
Space group	$P2_1$
a/Å	8.7600(3)
b/Å	10.9737(3)
c/Å	10.8434(4)
α/°	90
β/°	105.8870(10)
γ/°	90
Volume/Å^3	1002.56(6)
Z	2
Density (calculated)/g•cm^{-3}	1.616
μ/mm^{-1}	1.846
F(000)	484.0
Crystal size/mm^3	0.25 × 0.15 × 0.08
Radiation	MoKα (λ = 0.71073)
2Θ range for data collection/°	5.32 to 52.792
Index ranges	-8 ≤ h ≤ 10, -13 ≤ k ≤ 11, -13 ≤ l ≤ 13
Reflections collected	7712
Independent reflections	3621 [R_{int} = 0.0245, R_{sigma} = 0.0371]
Data/restraints/parameters	3621/1/228
Goodness-of-fit on F^2	1.063
Final R indexes [I>=2σ (I)]	R_1 = 0.0242, wR_2 = 0.0459
Final R indexes [all data]	R_1 = 0.0276, wR_2 = 0.0482
Largest diff. peak/hole/e Å^{-3}	0.38/-0.61
Flack parameter	0.032(12)



80



X-ray stucture of **80**

Table S5. Crystal data and structure refinements for **80**

Compound	**80**
Empirical formula	$C_{20}H_{25}NO_2$
Formula weight	311.41
Temperature/K	150.0
Crystal system	trigonal
Space group	$P3_2$
a/Å	24.3390(16)
b/Å	24.3390(16)
c/Å	7.9076(6)
α/°	90
β/°	90
γ/°	120
Volume/Å^3	4056.8(6)
Z	9
ρ_{calc}g/cm^3	1.147
μ/mm^{-1}	0.073
F(000)	1512.0
Crystal size/mm^3	0.12 × 0.07 × 0.04
Radiation	MoKα (λ = 0.71073)
2Θ range for data collection/°	3.864 to 52.722
Index ranges	-13 ≤ h ≤ 29, -30 ≤ k ≤ 28, -9 ≤ l ≤ 8
Reflections collected	11341
Independent reflections	8498 [R_{int} = 0.0664, R_{sigma} = 0.1321]
Data/restraints/parameters	8498/1129/641
Goodness-of-fit on F^2	1.101
Final R indexes [I>=2σ (I)]	R_1 = 0.0722, wR_2 = 0.1285
Final R indexes [all data]	R_1 = 0.1366, wR_2 = 0.1671
Largest diff. peak/hole / e Å^{-3}	0.26/-0.28

References

(1) (a)Zhu, K.; Xu, K.; Fang, Q.; Wang, Y.; Tang, B. C.; Zhang, F. Z. *ACS Catal*. **2019**, *9*, 4951. (b) Xu, S. B.; Zhao, K.; Gu, Z. H. *Adv. Synth. Catal*. **2018**, *360*, 3877. (c) Zhao, K.; Duan, L. H.; Xu, S. B.; Jiang, J. L.; Fu, Y.; Gu. Z. H. *Chem*. **2018**, *4*, 599.

(2) Duan, L. H.; Wang, Z. G.; Zhao, K.; Gu, Z. H. *Chem. Commun*., **2021**, *57*, 3881.

(3) Xie, H.; Yang, S.; Zhang, C. X.; Ding, M. R.; Liu, M.; Guo, J.; Zhang, F.Z. *J. Org. Chem.* **2017**, *82*, 5250.

(4) (a) Li, S.; Cai, L.; Ji, H.; Yang, L.; Li, J. *Nat. Commun.* **2016**, *7*, 10443. (b) Wang, L.; Shi, F. X.; Qi, C. R.; Xu,W. J.; Xiong, W. F.; Kang, B.X.; Jiang. H. F. *Chem. Sci.*, **2021**, *12*, 11821.

(5) Sanz, R.; Pilar Castroviejo, M.; Fernandez, Y.; Fananas, F. J. *J. Org. Chem.* **2005**, *70*, 6548.

(6) Dong, Y.; Guo, X.; Yu, Y.; Liu, G.; *Mol. Diversity*, **2013**, *17*, 1.

(7) Sharma, S.; Kim, A.; Park, E.; Park, J.; Kim, M.; Kwak, J. H.; Lee, S. H.; Jung, Y. H.; Kim, I. S. *Adv. Synth. Catal.*, **2013**, *355*, 667.

(8) (a) Gou, B. B.; Tang, Y.; Lin, Y. H.; Yu, L.; Jian, Q. S.; Sun, H. R.; Chen, J.; Zhou, L. *Angew. Chem. Int. Ed*. **2022**, *61*, e202208174. (b) Ke, J.; Zu, B.; Guo, Y. H.; Li, Y. Z.; He, C. *Org. Lett*. **2021**, *23*, 329.

J. Copies of NMR spectroscopies

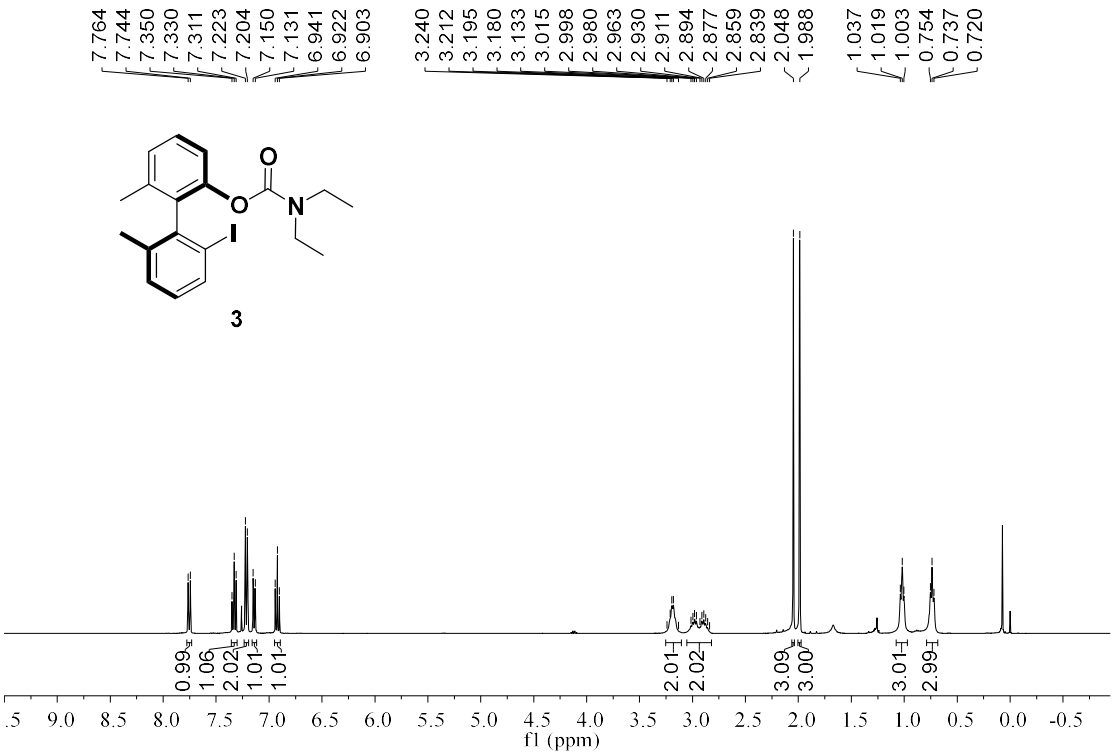


Figure S1. ^{1}H NMR Spectrum of **3**

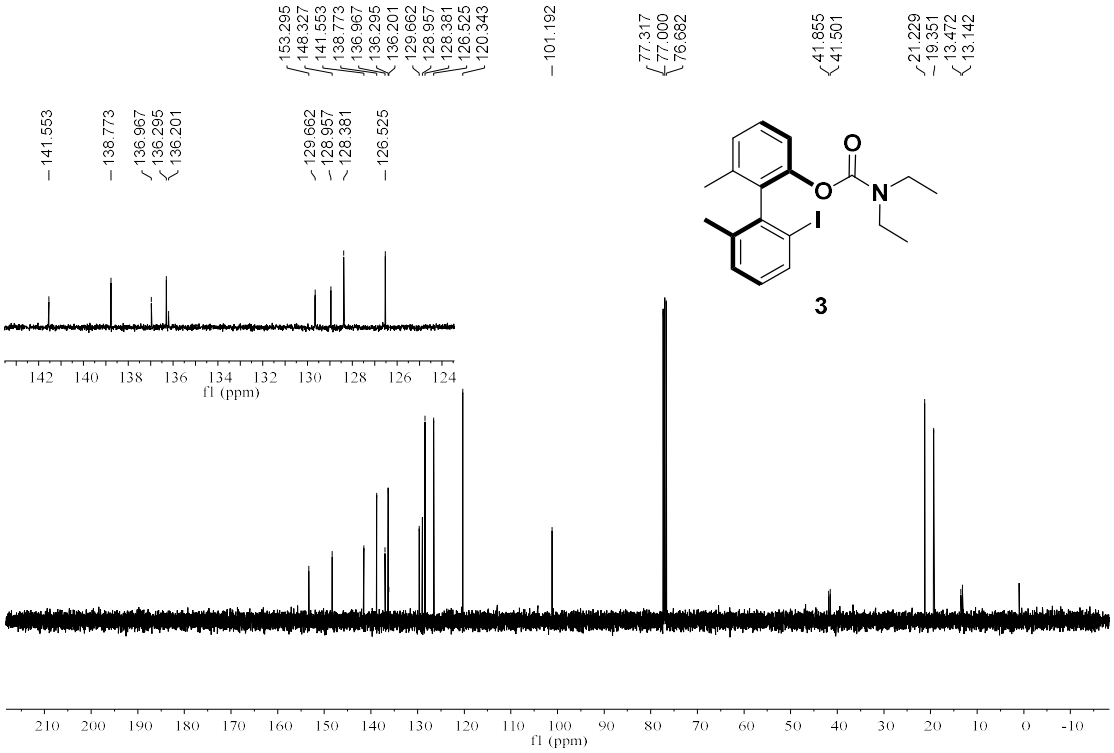


Figure S2. ^{13}C NMR Spectrum of **3**

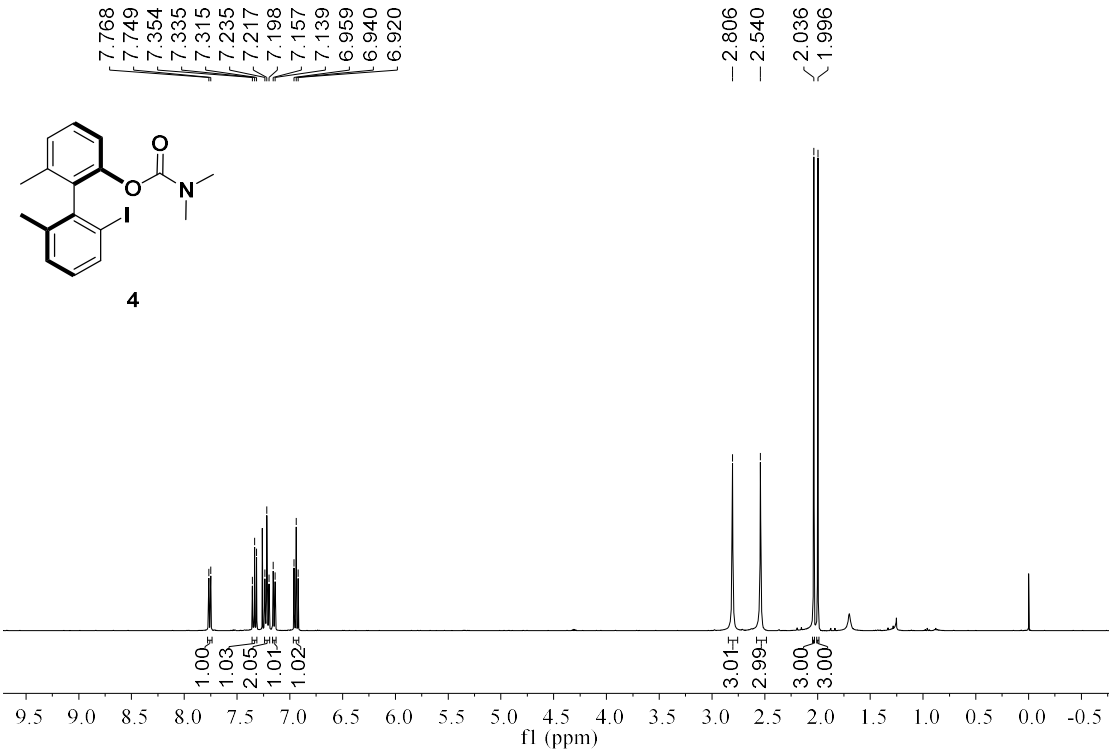


Figure S3. ^{1}H NMR Spectrum of **4**

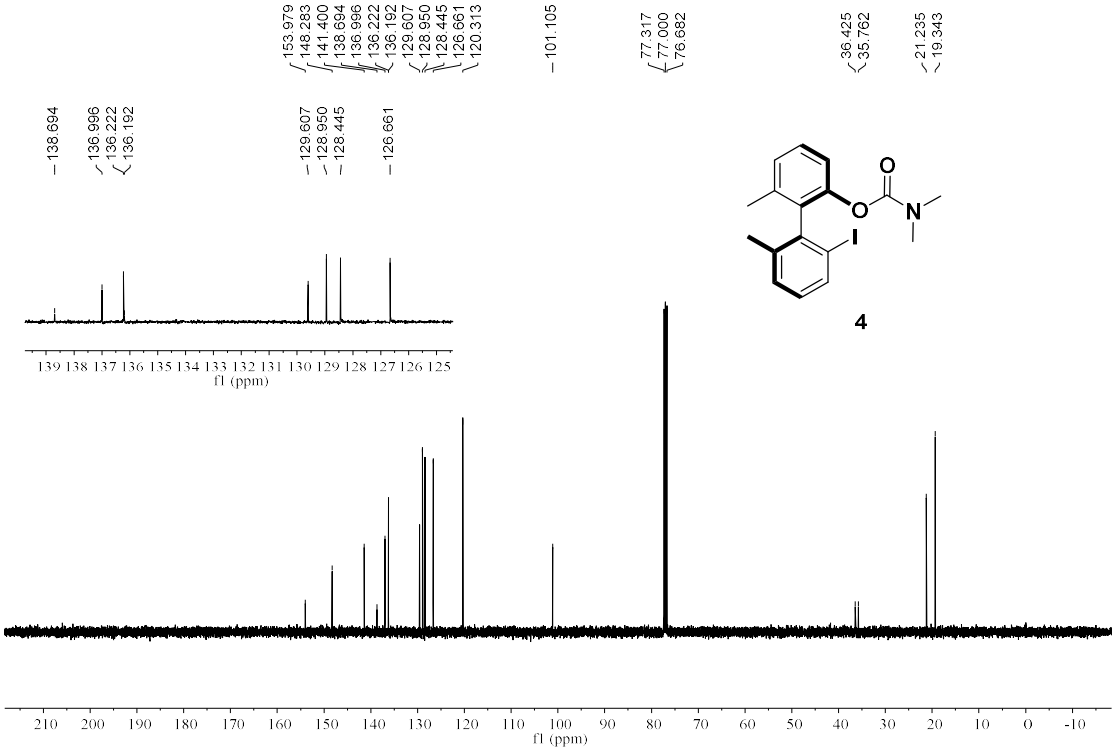


Figure S4. ^{13}C NMR Spectrum of **4**

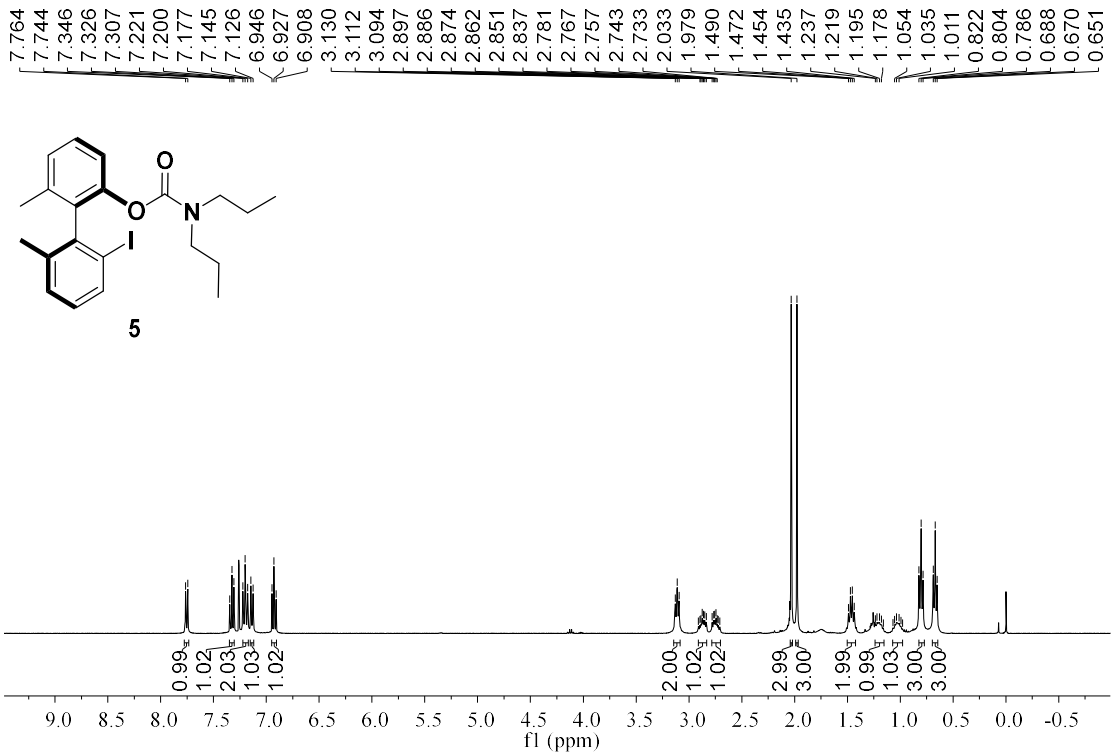


Figure S5. ^{1}H NMR Spectrum of **5**

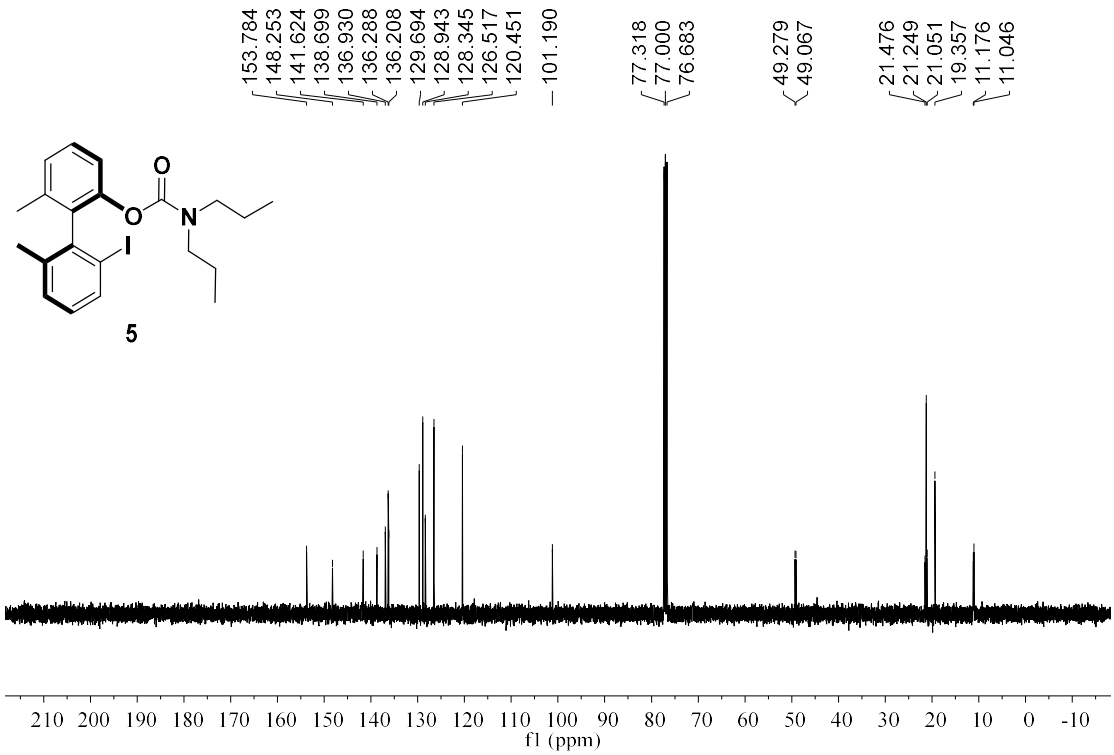


Figure S6. ^{13}C NMR Spectrum of **5**

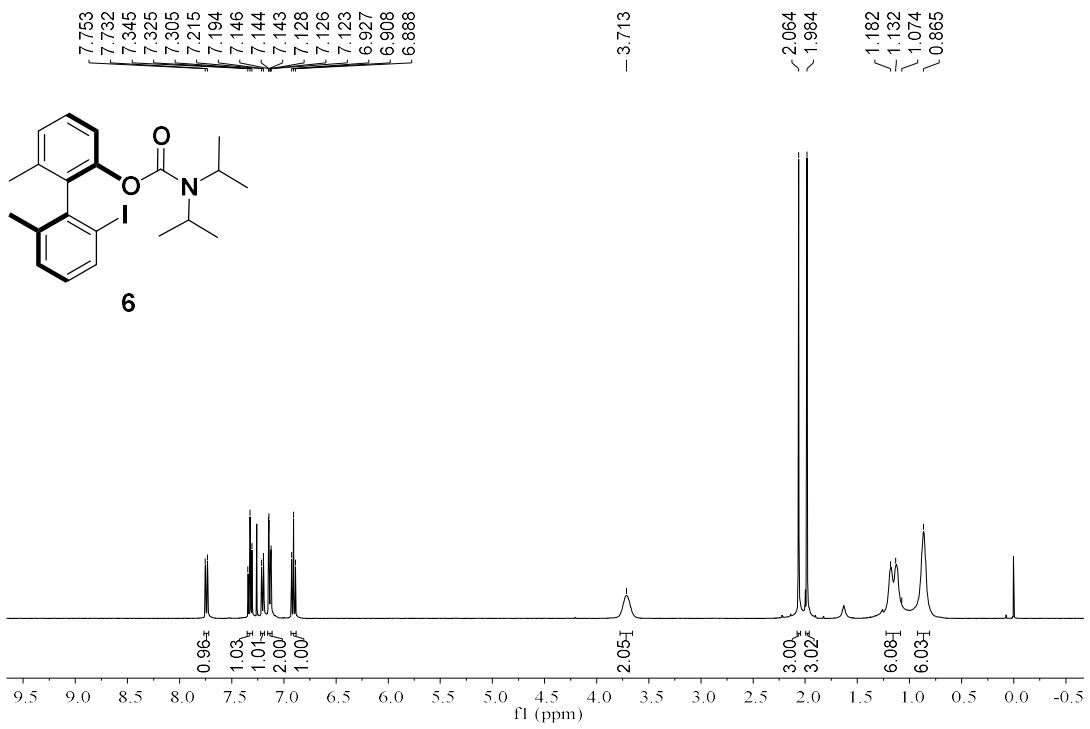


Figure S7. ^{1}H NMR Spectrum of **6**

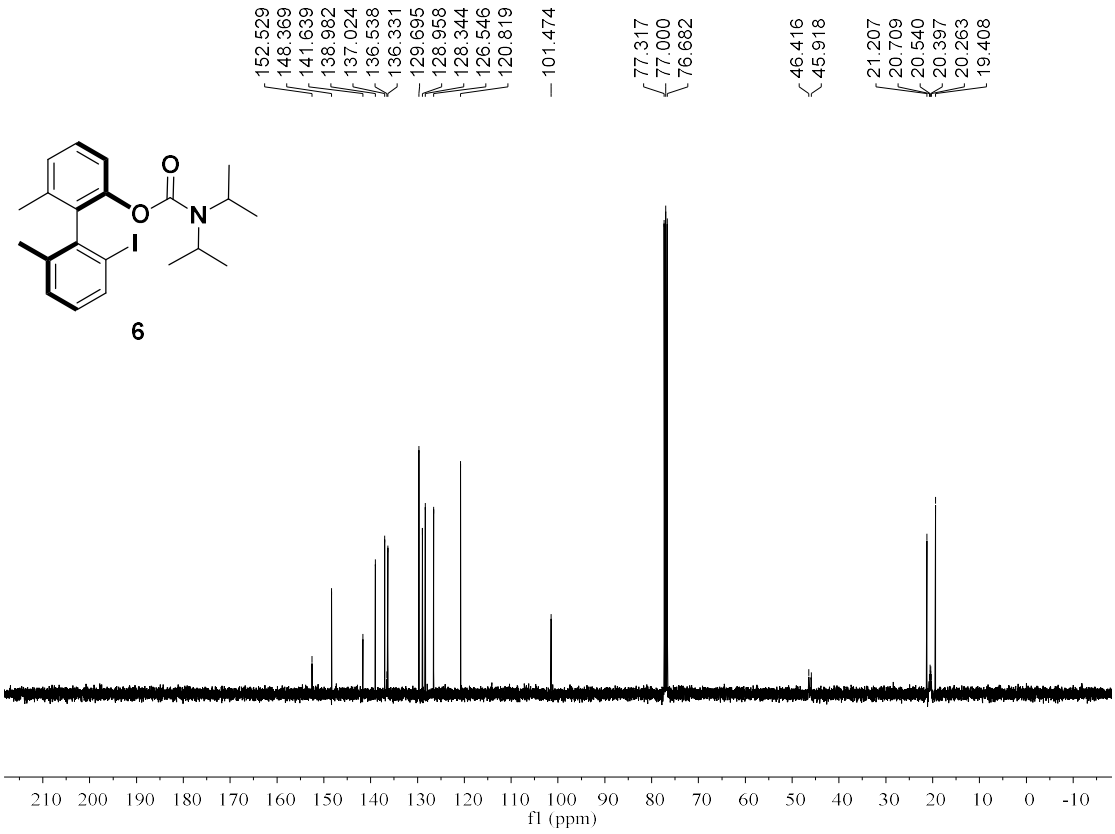


Figure S8. ^{13}C NMR Spectrum of **6**

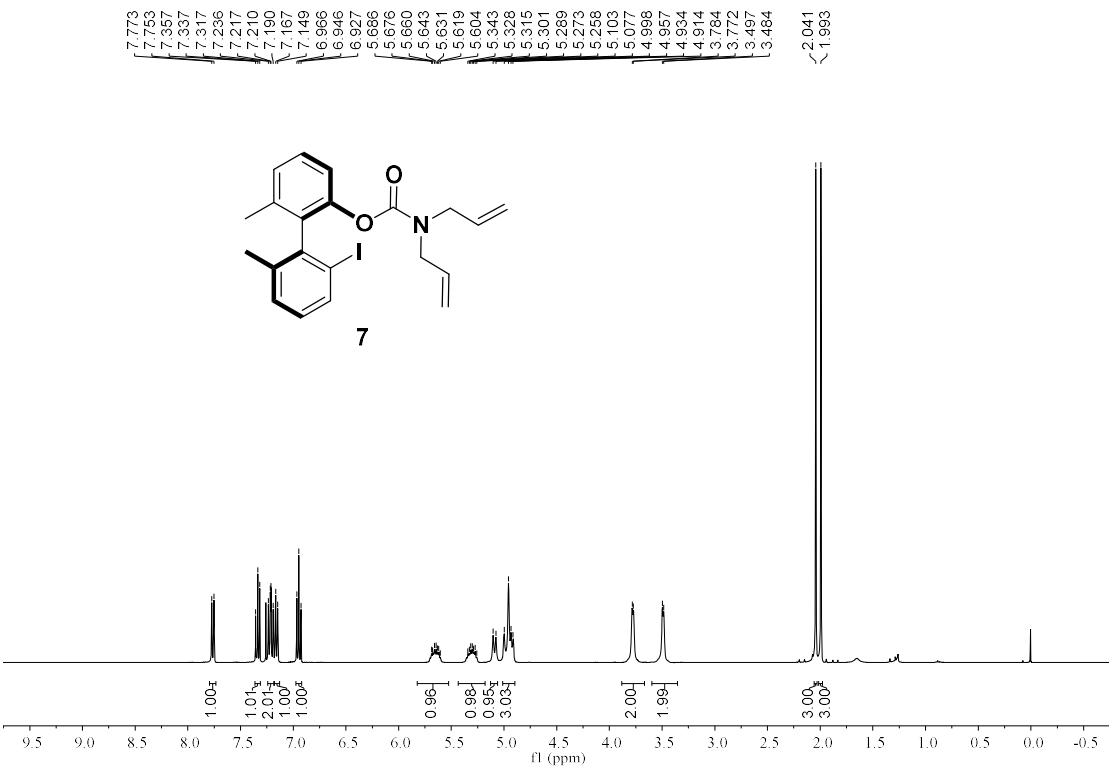


Figure S9. ^{1}H NMR Spectrum of **7**

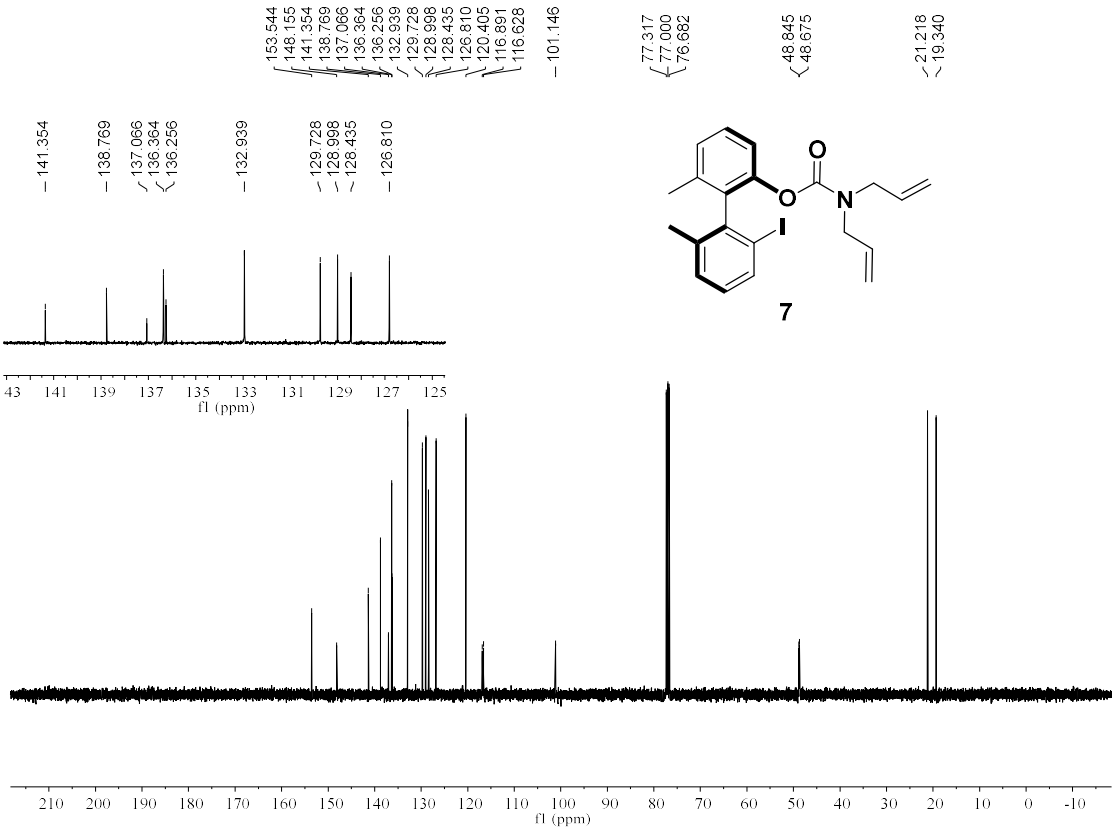


Figure S10. ^{13}C NMR Spectrum of **7**

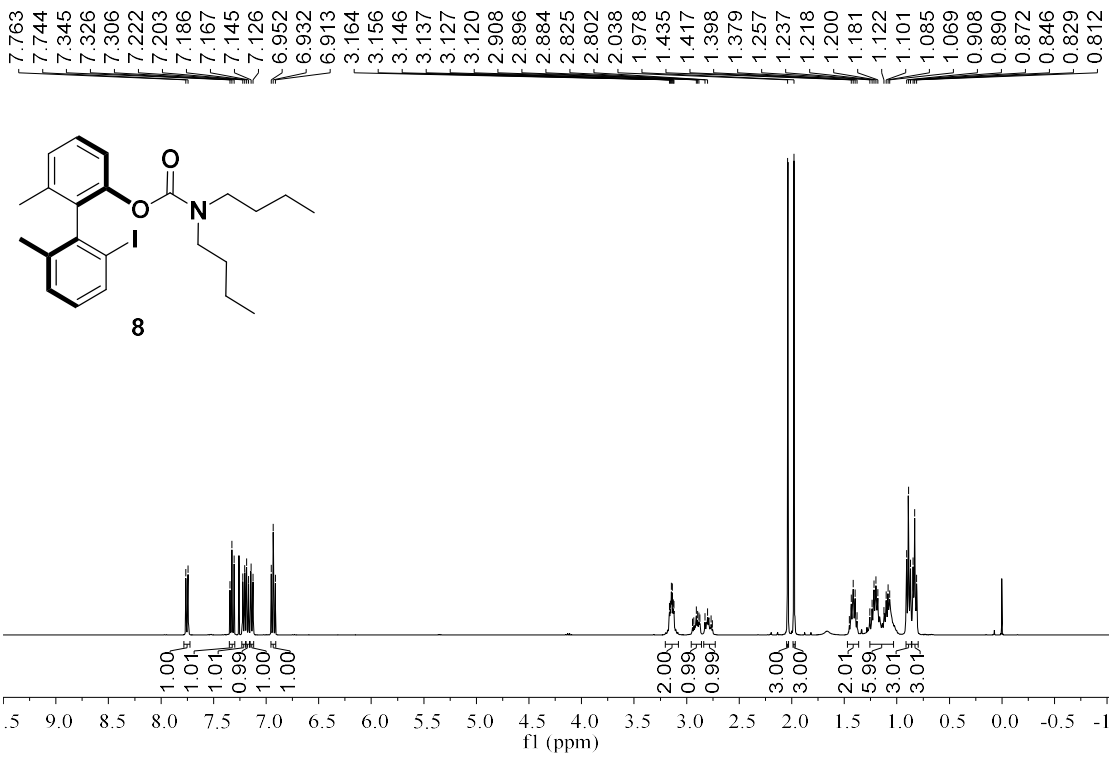


Figure S11. ^{1}H NMR Spectrum of **8**

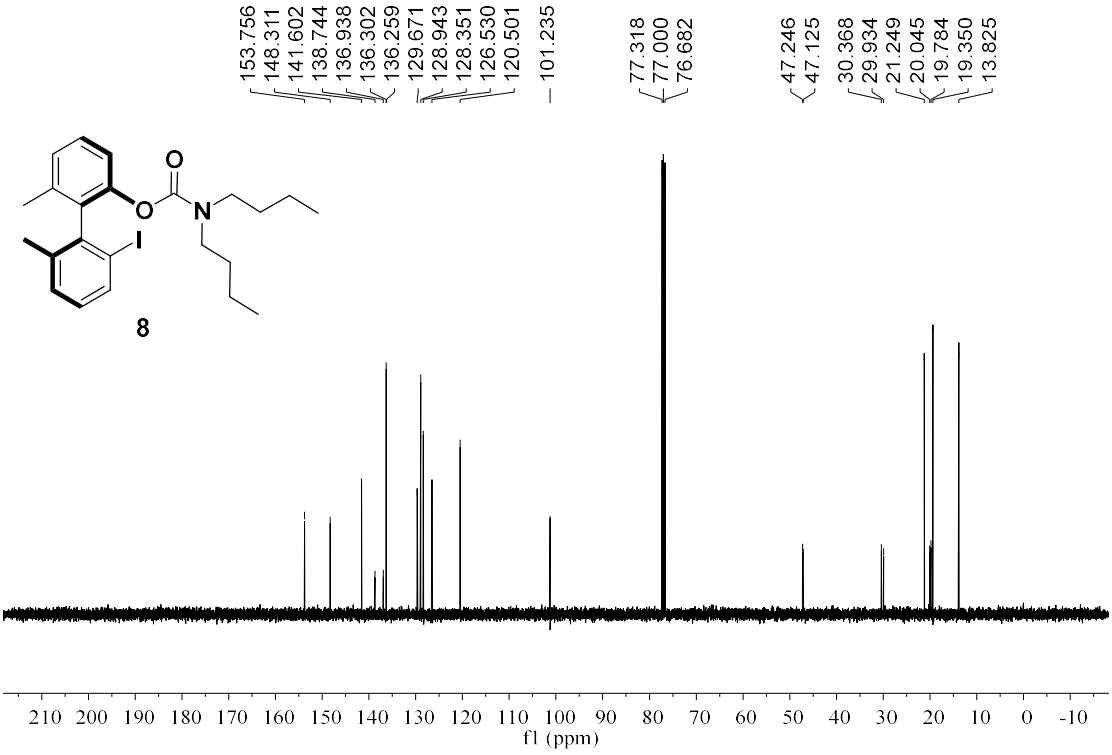


Figure S12. ^{13}C NMR Spectrum of **8**

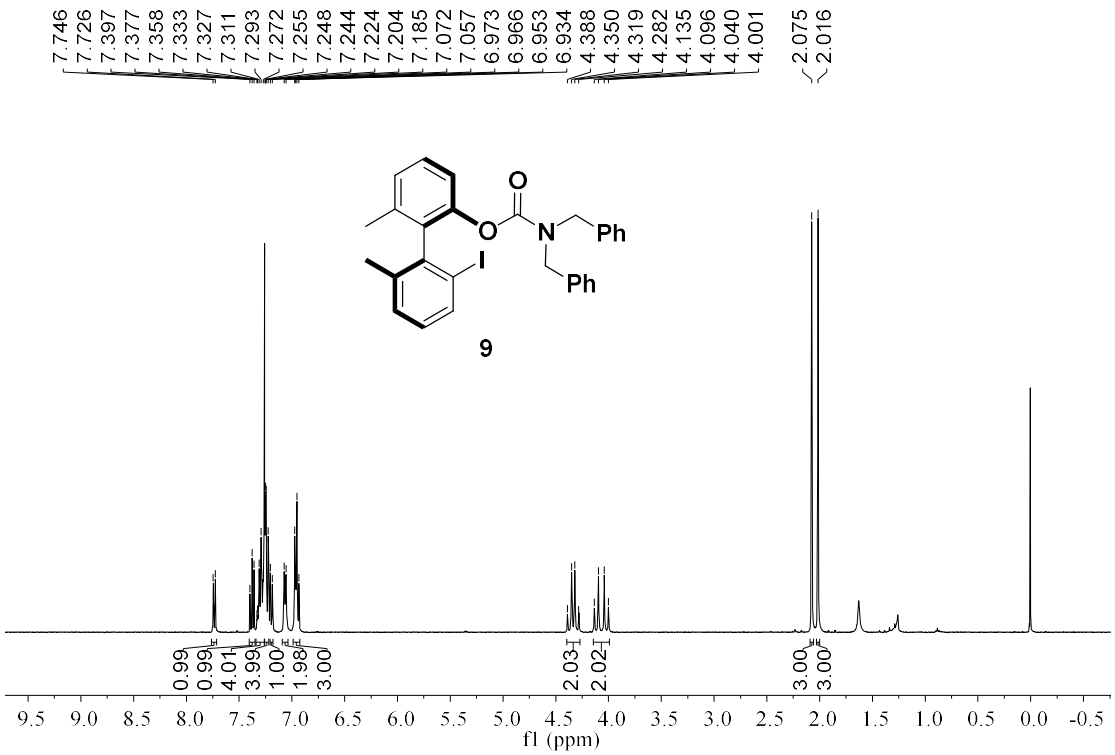


Figure S13. ^{1}H NMR Spectrum of **9**

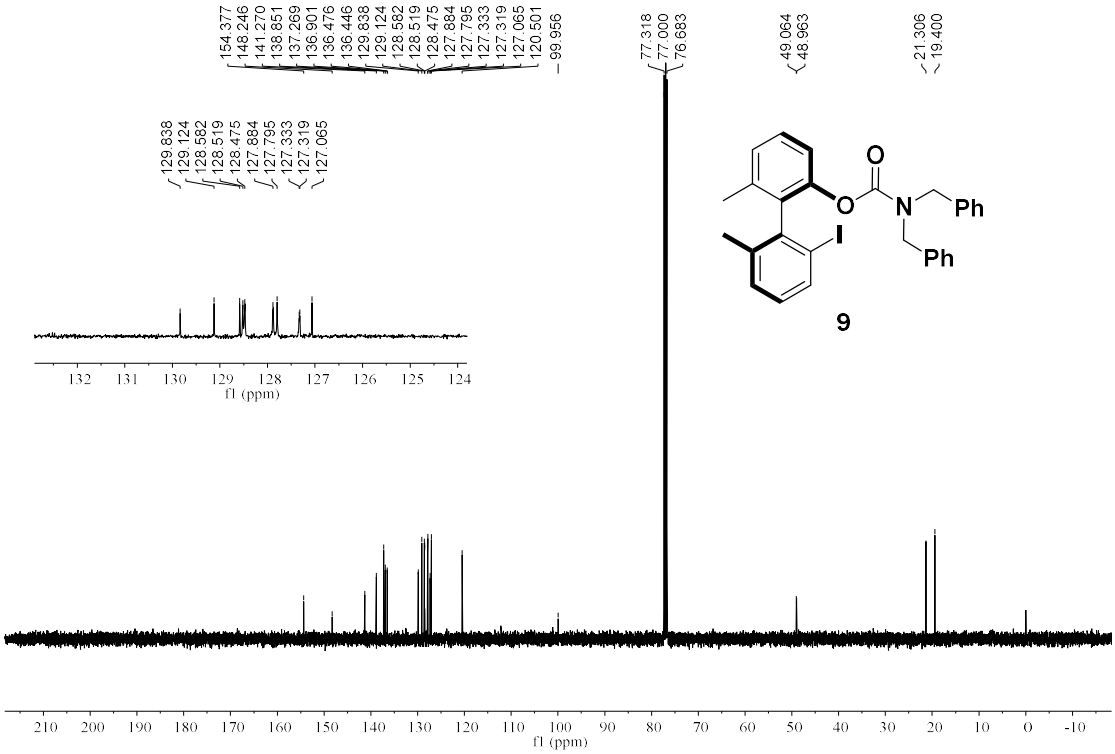


Figure S14. ^{13}C NMR Spectrum of **9**

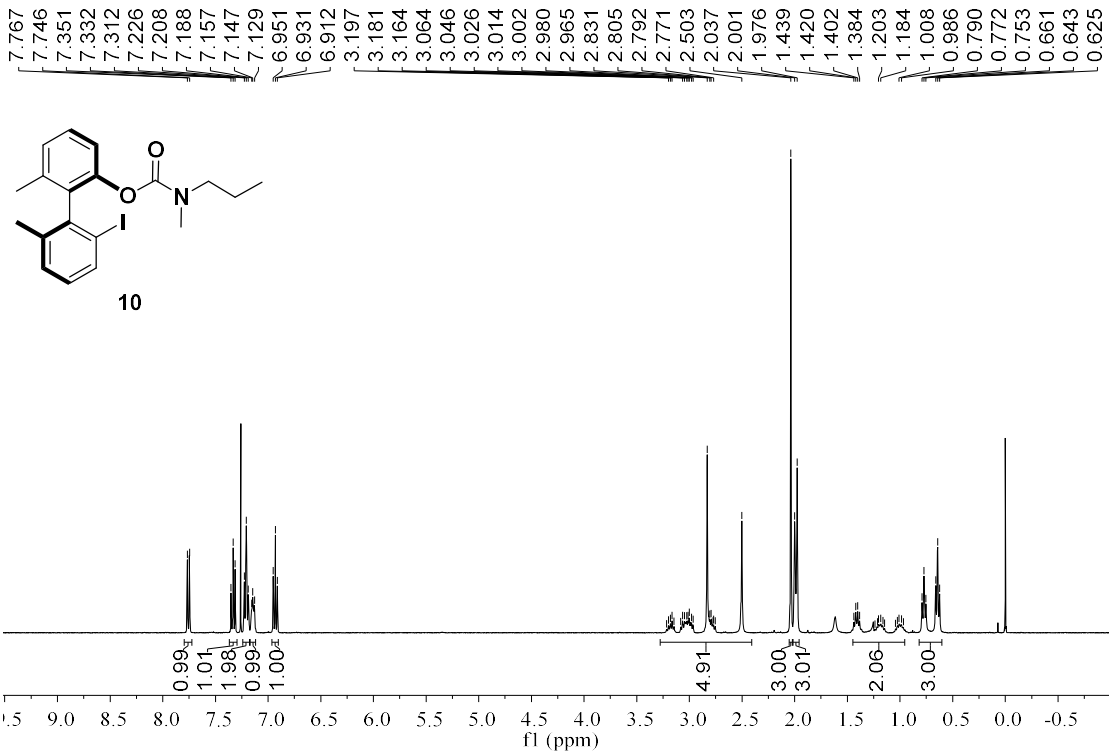


Figure S15. ^{1}H NMR Spectrum of **10**

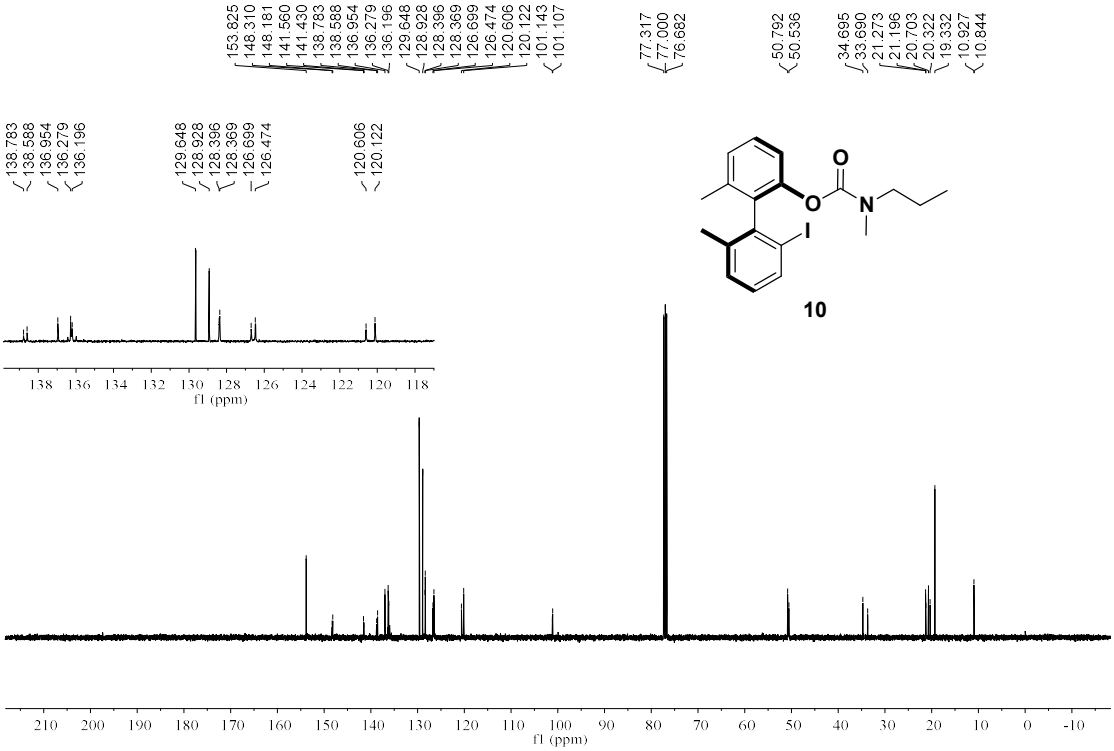


Figure S16. ^{13}C NMR Spectrum of **10**

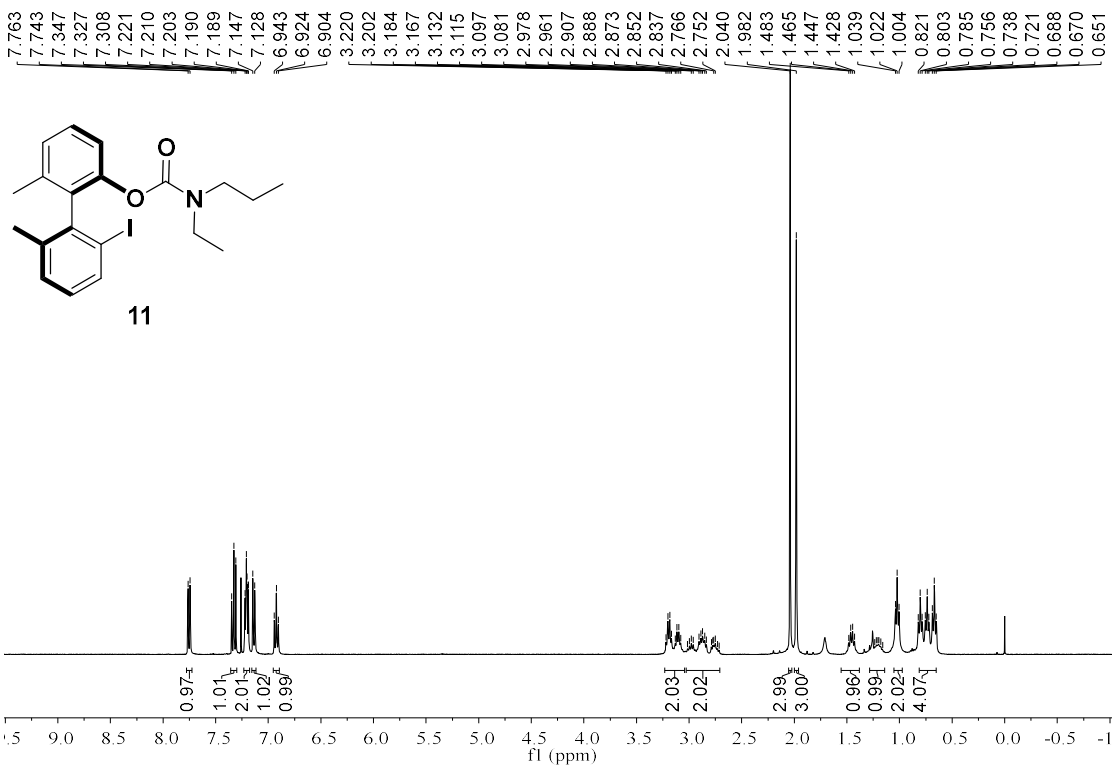


Figure S17. ^{1}H NMR Spectrum of **11**

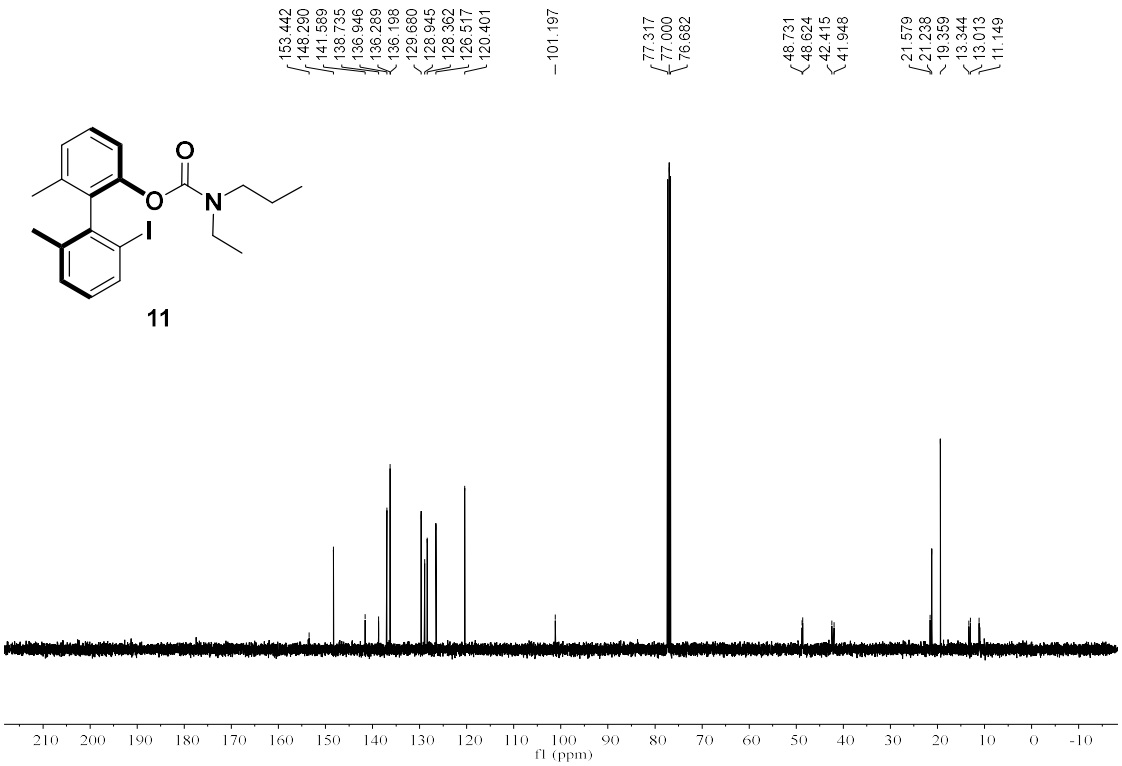


Figure S18. ^{13}C NMR Spectrum of **11**

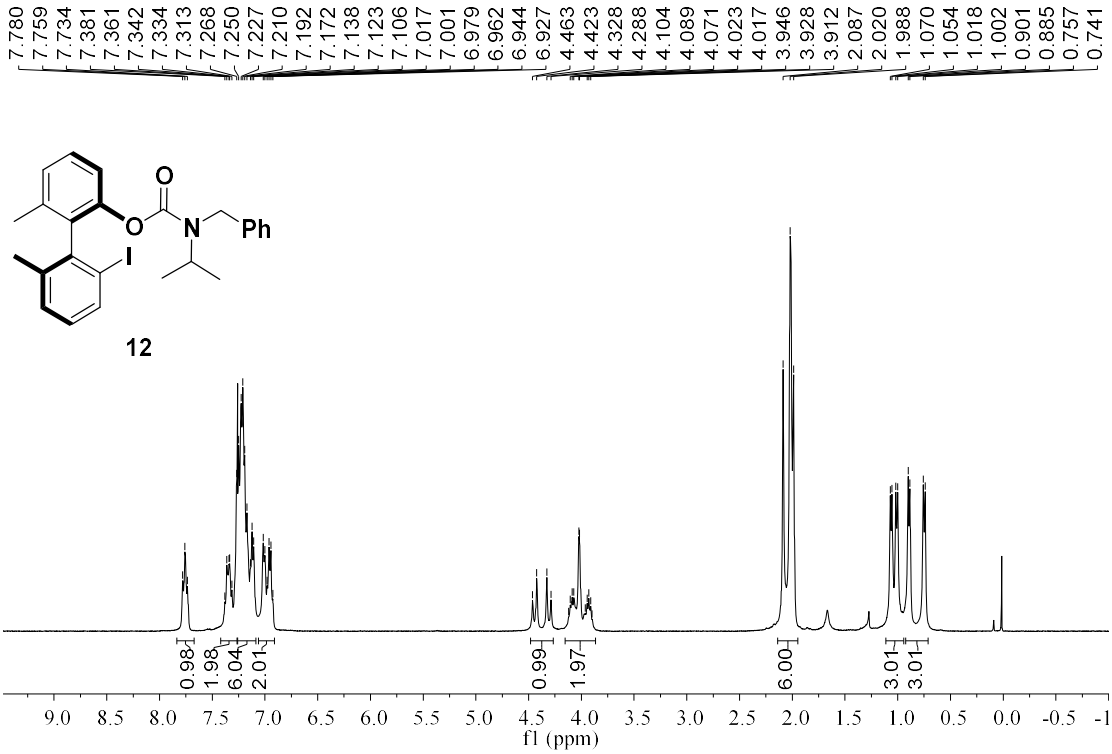


Figure S19. ^{1}H NMR Spectrum of **12**

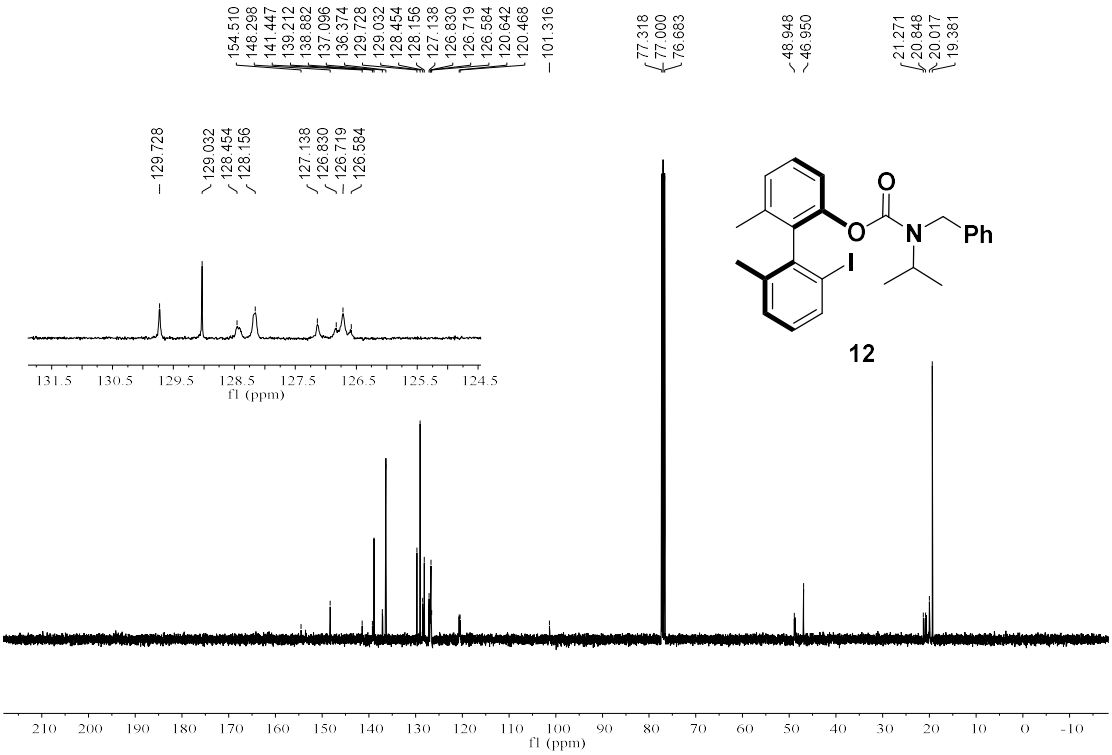


Figure S20. ^{13}C NMR Spectrum of **12**

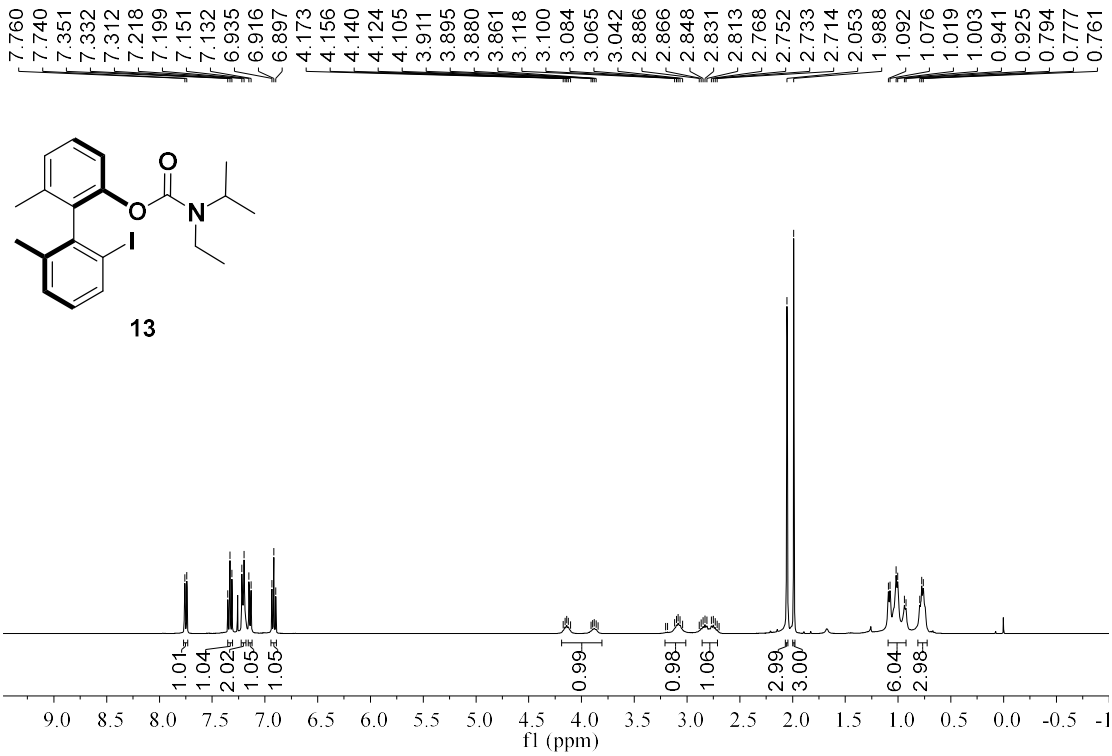


Figure S21. ^{1}H NMR Spectrum of **13**

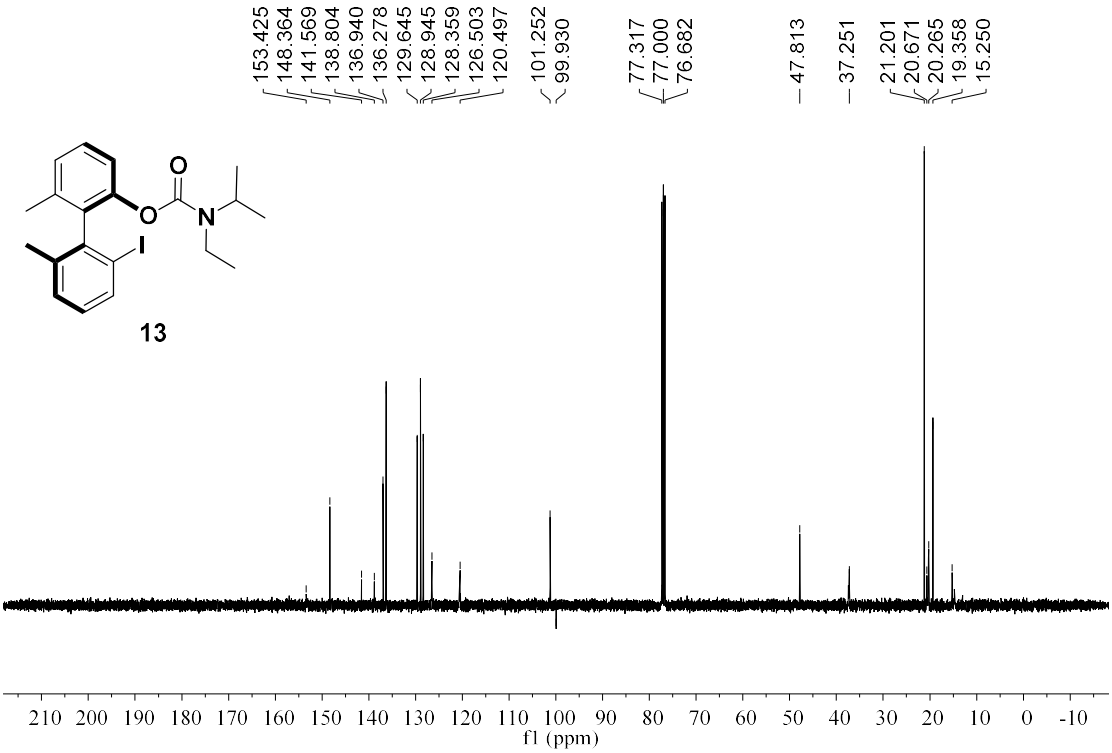


Figure S22. ^{13}C NMR Spectrum of **13**

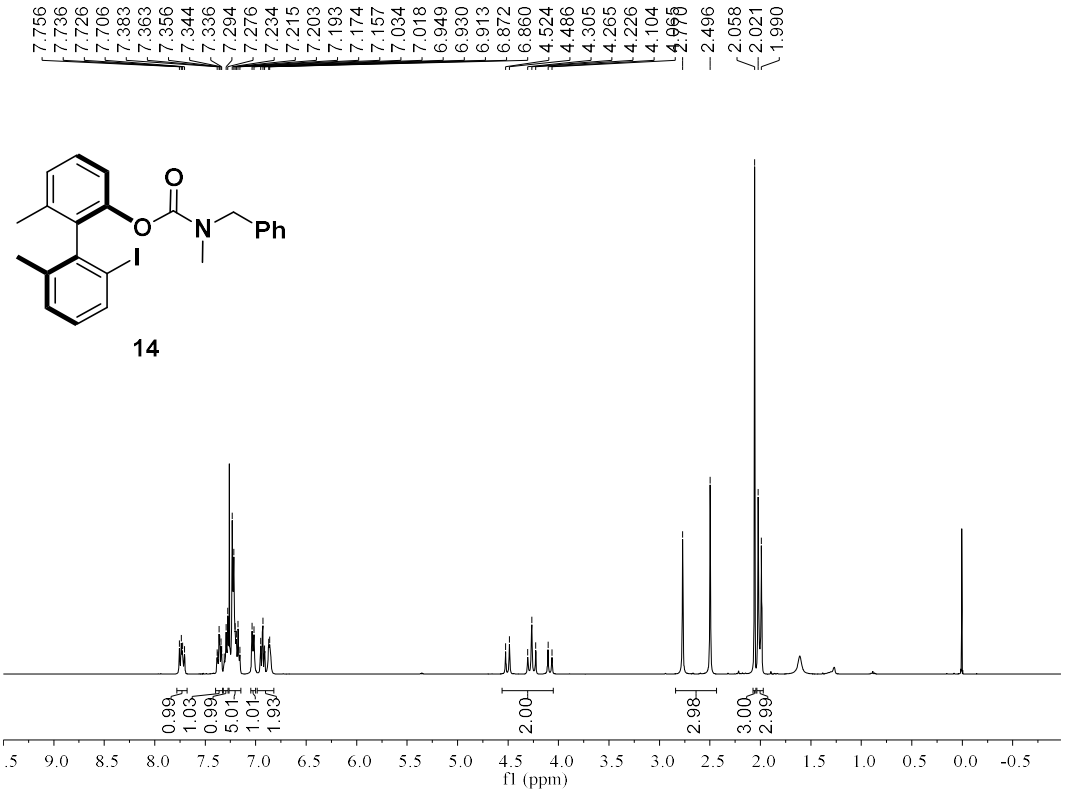


Figure S23. ^{1}H NMR Spectrum of **14**

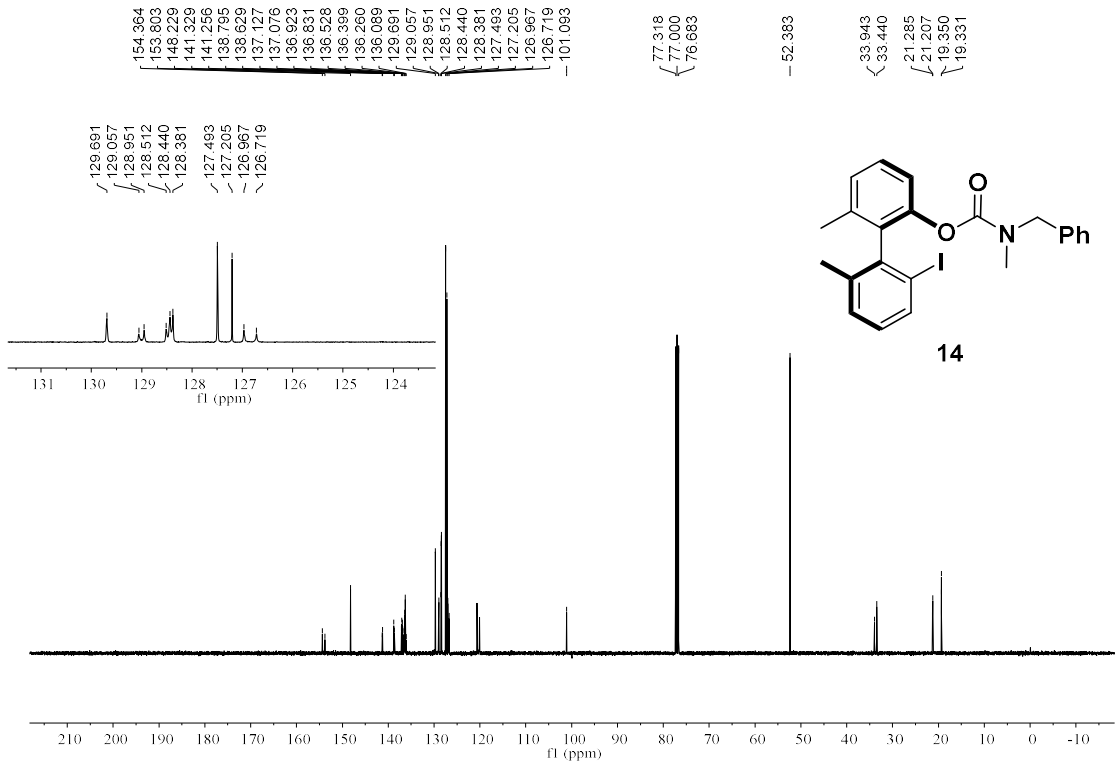


Figure S24. ^{13}C NMR Spectrum of **14**

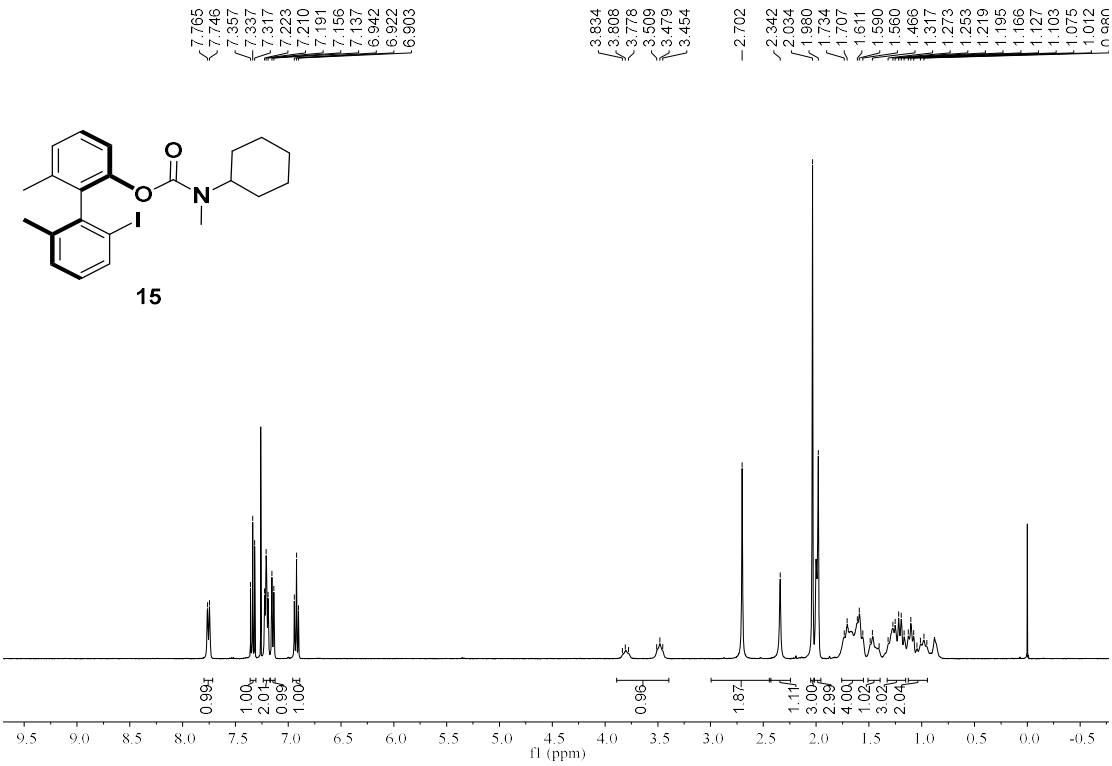


Figure S25. ^{1}H NMR Spectrum of **15**

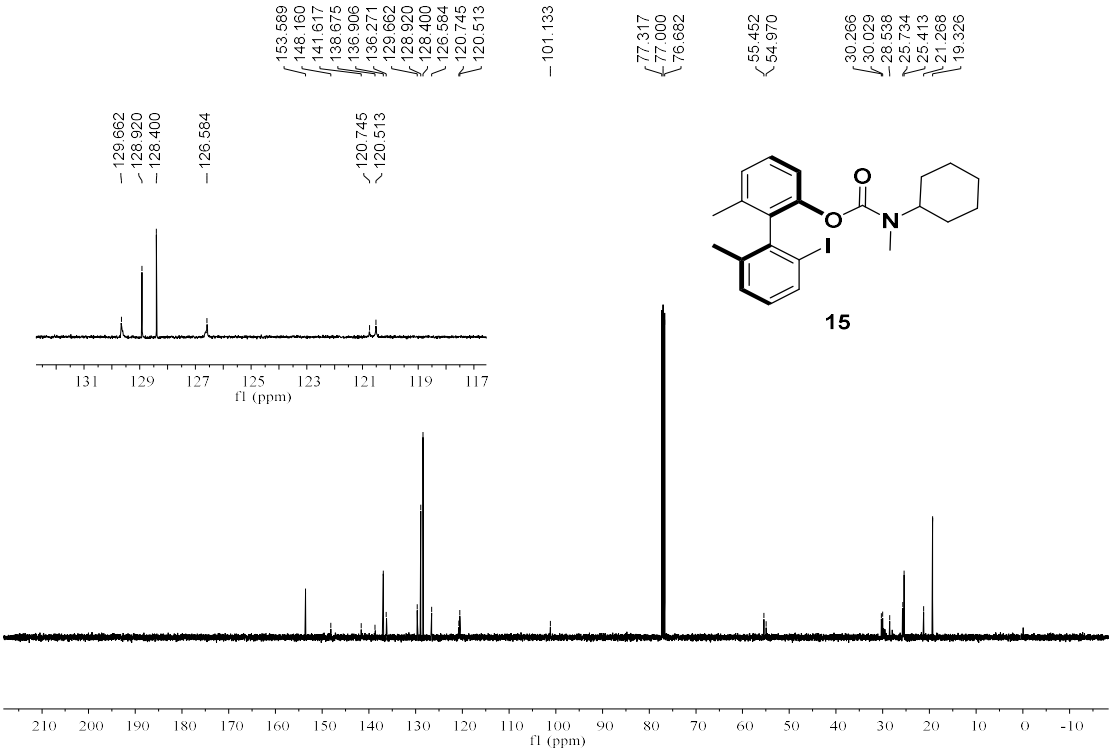


Figure S26. ^{13}C NMR Spectrum of **15**

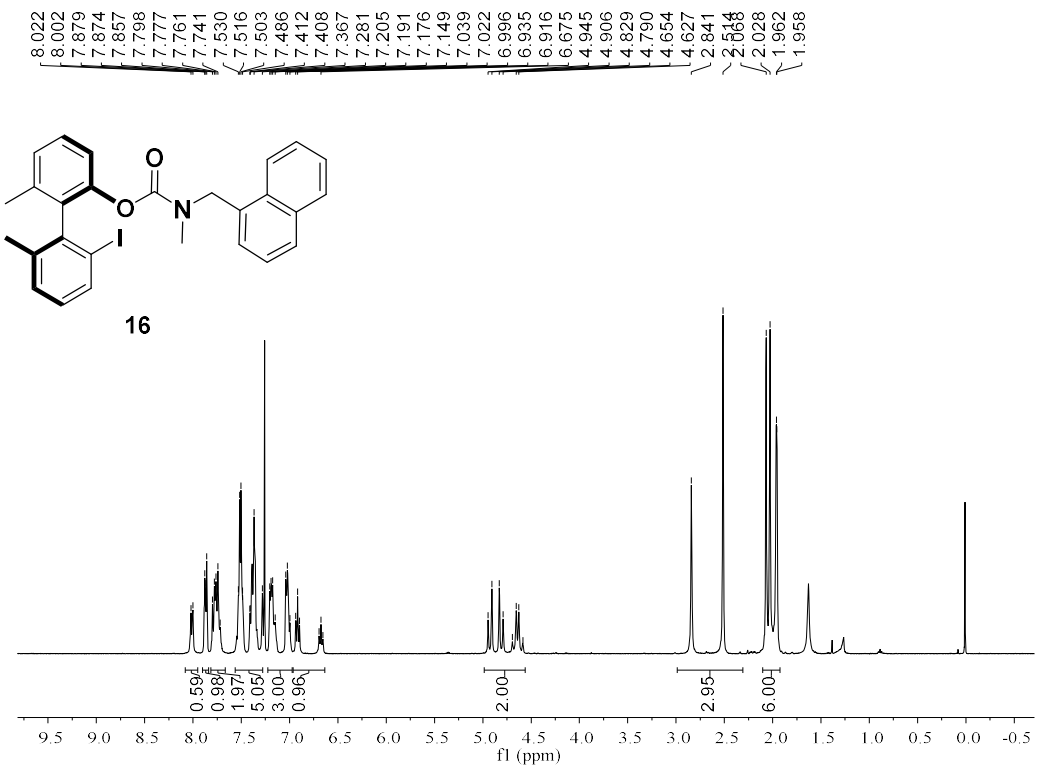


Figure S27. ^{1}H NMR Spectrum of **16**

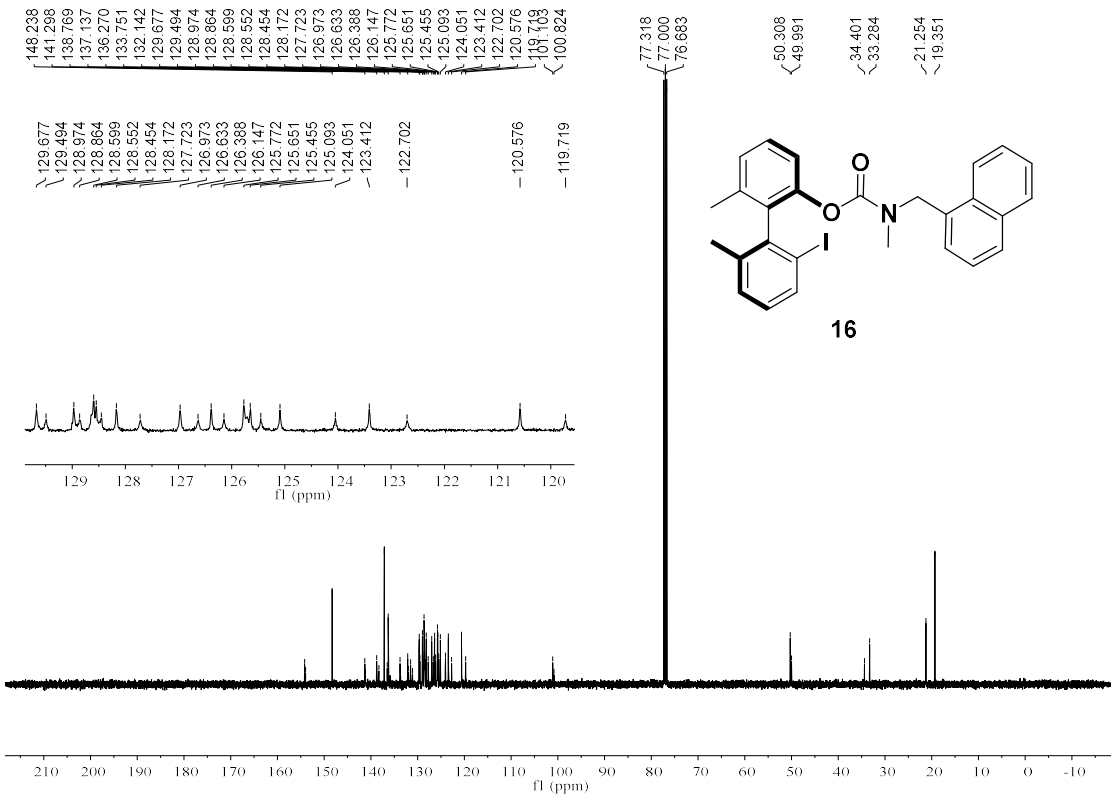


Figure S28. ^{13}C NMR Spectrum of **16**

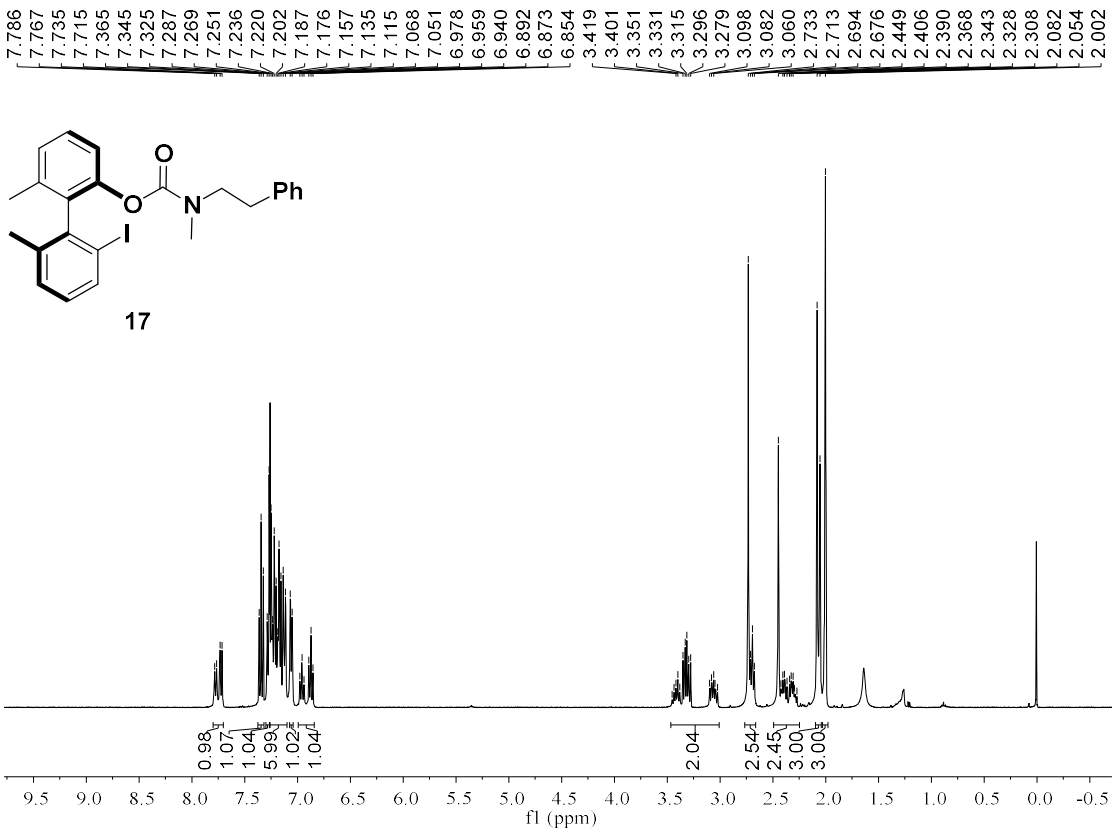


Figure S29. ^{13}C NMR Spectrum of **17**

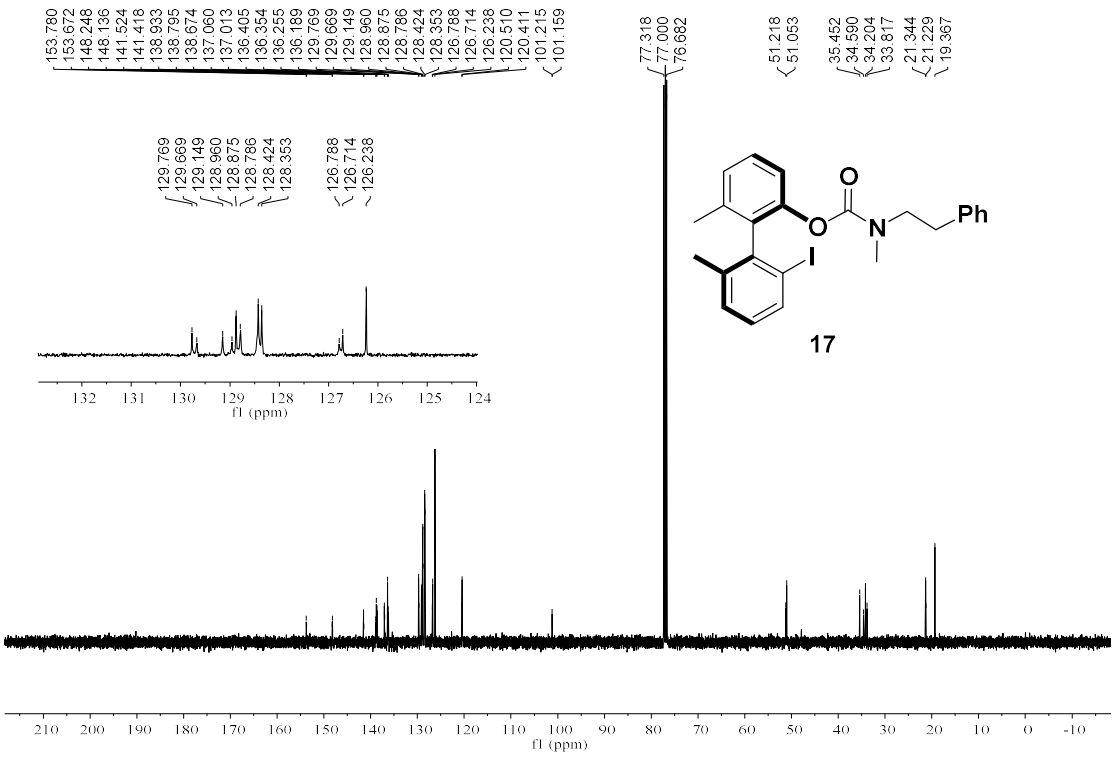


Figure S30. ^{13}C NMR Spectrum of **17**

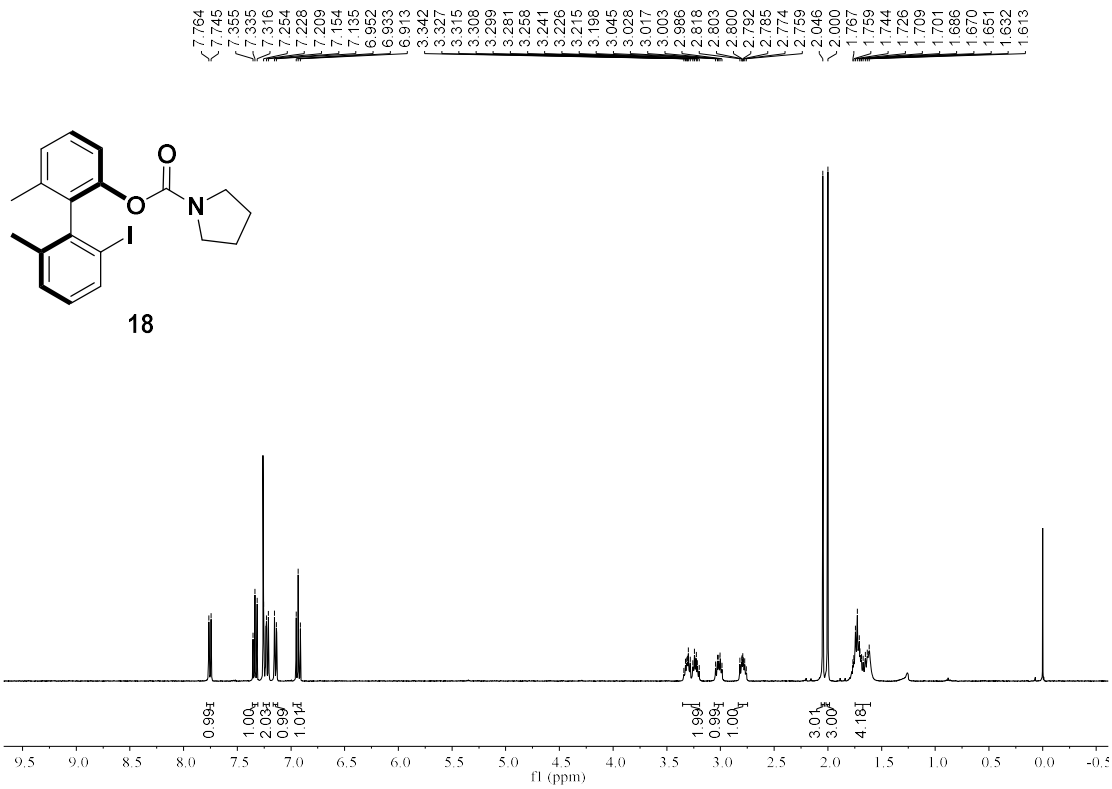


Figure S31. ^{1}H NMR Spectrum of **18**

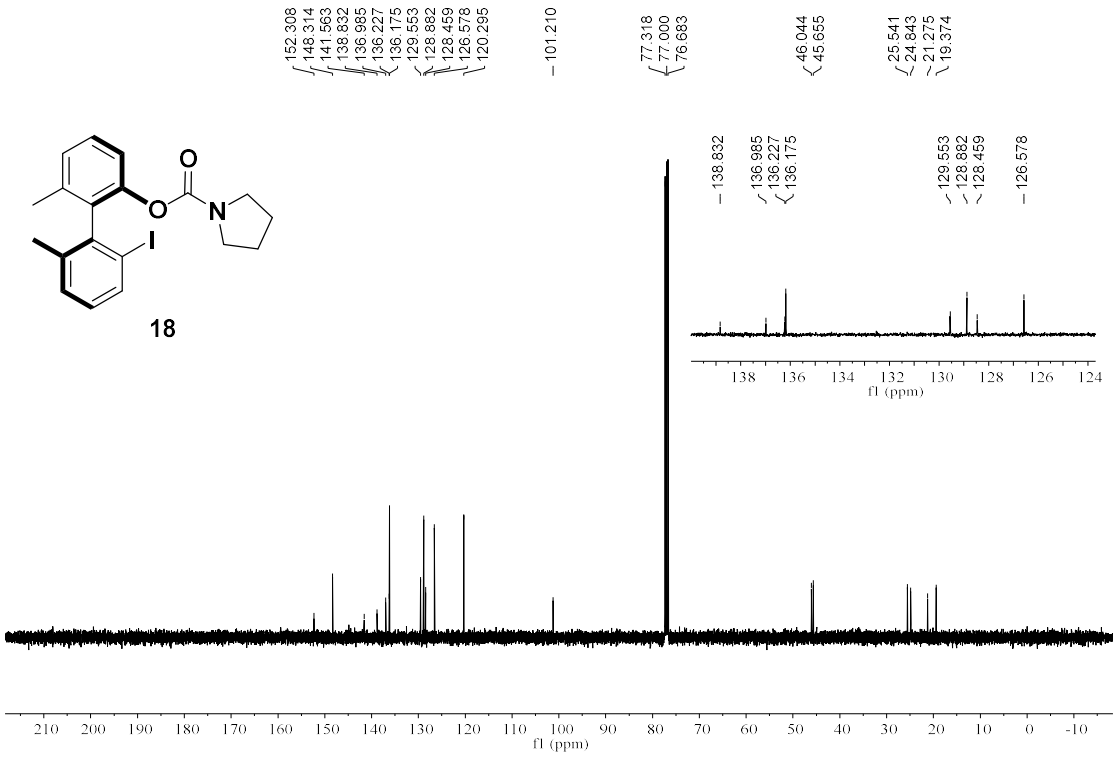


Figure S32. ^{13}C NMR Spectrum of **18**

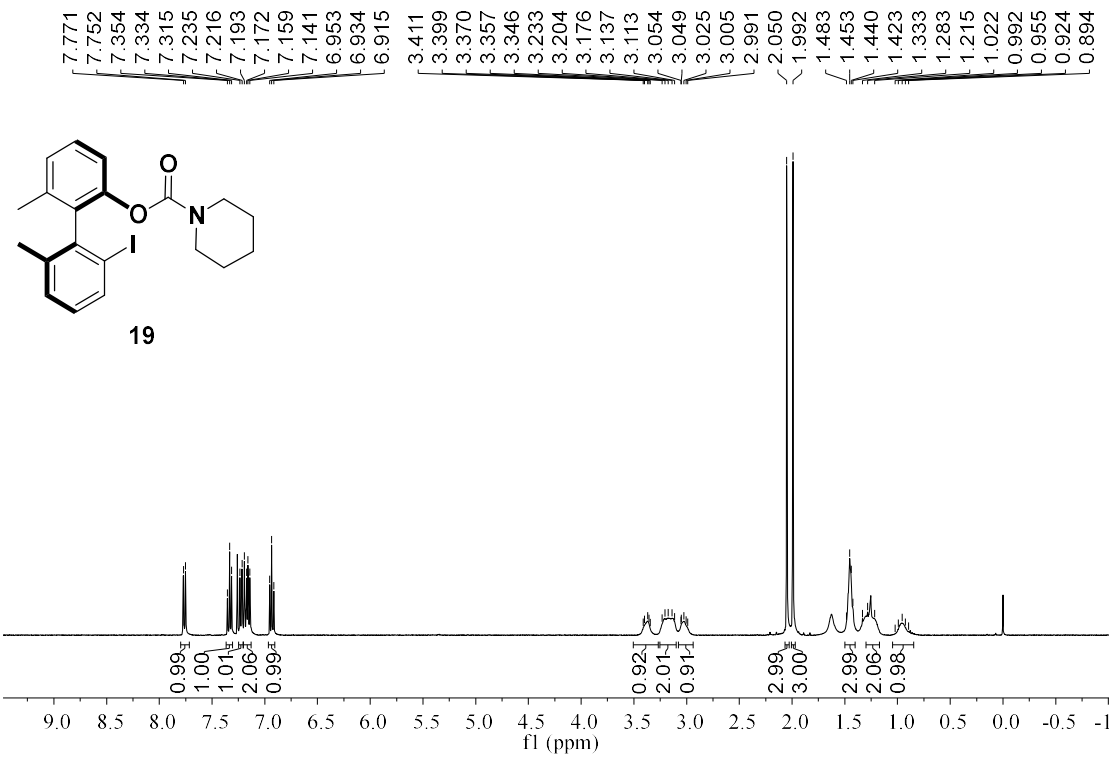


Figure S33. ^{1}H NMR Spectrum of **19**

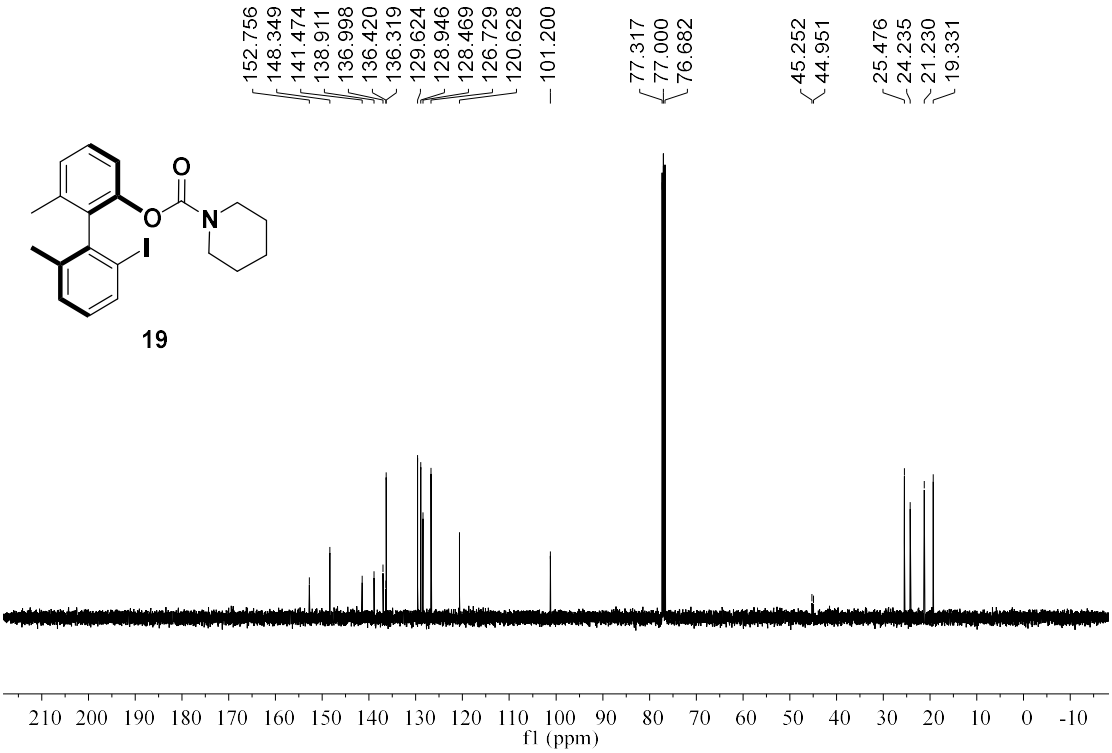


Figure S34. ^{13}C NMR Spectrum of **19**

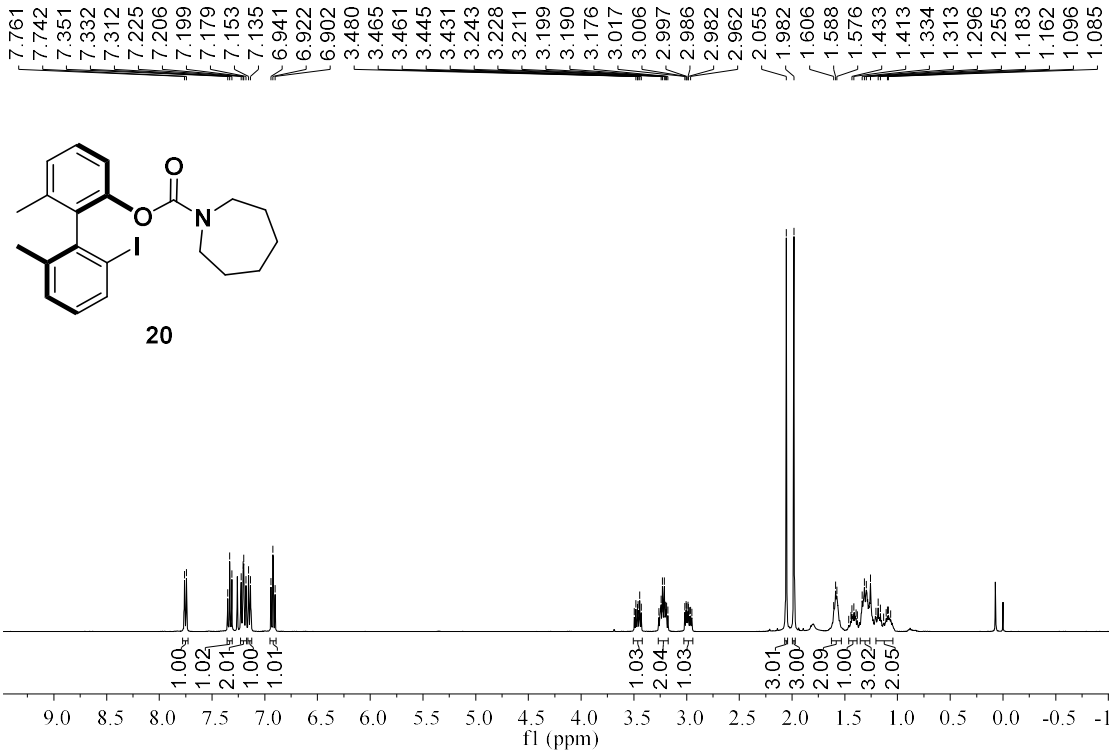


Figure S35. ^{1}H NMR Spectrum of **20**

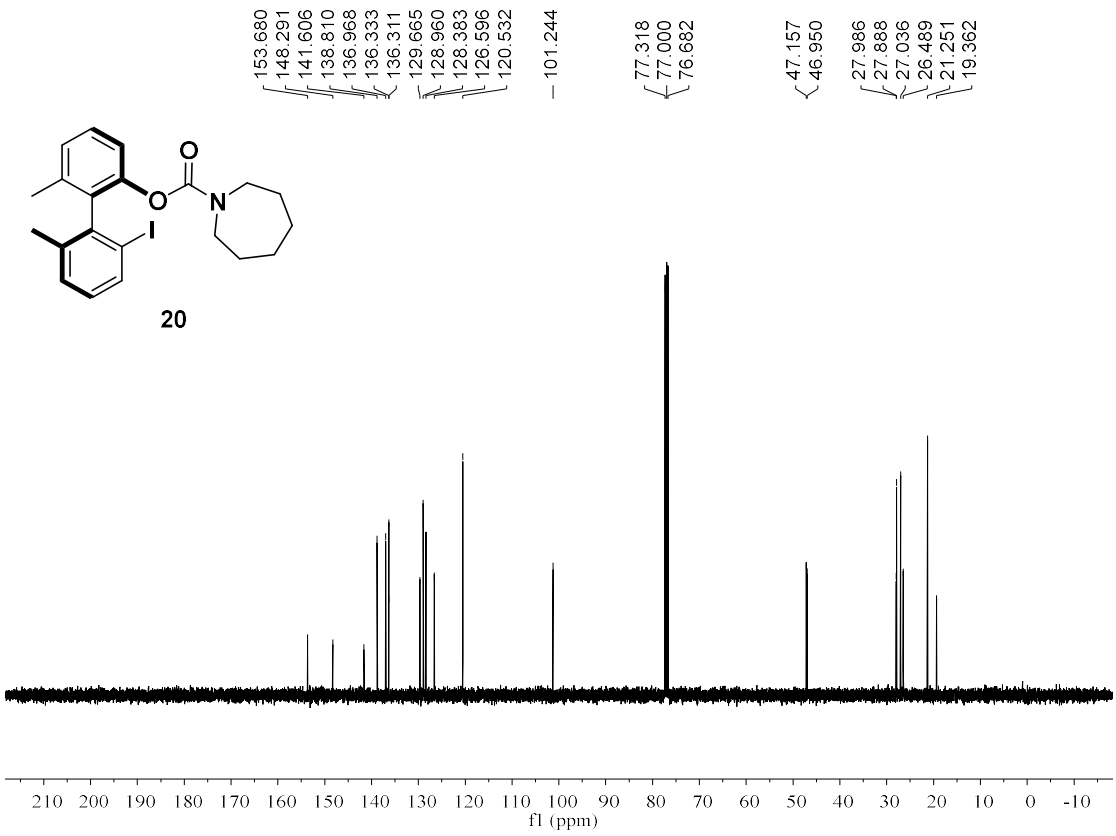


Figure S36. ^{13}C NMR Spectrum of **20**

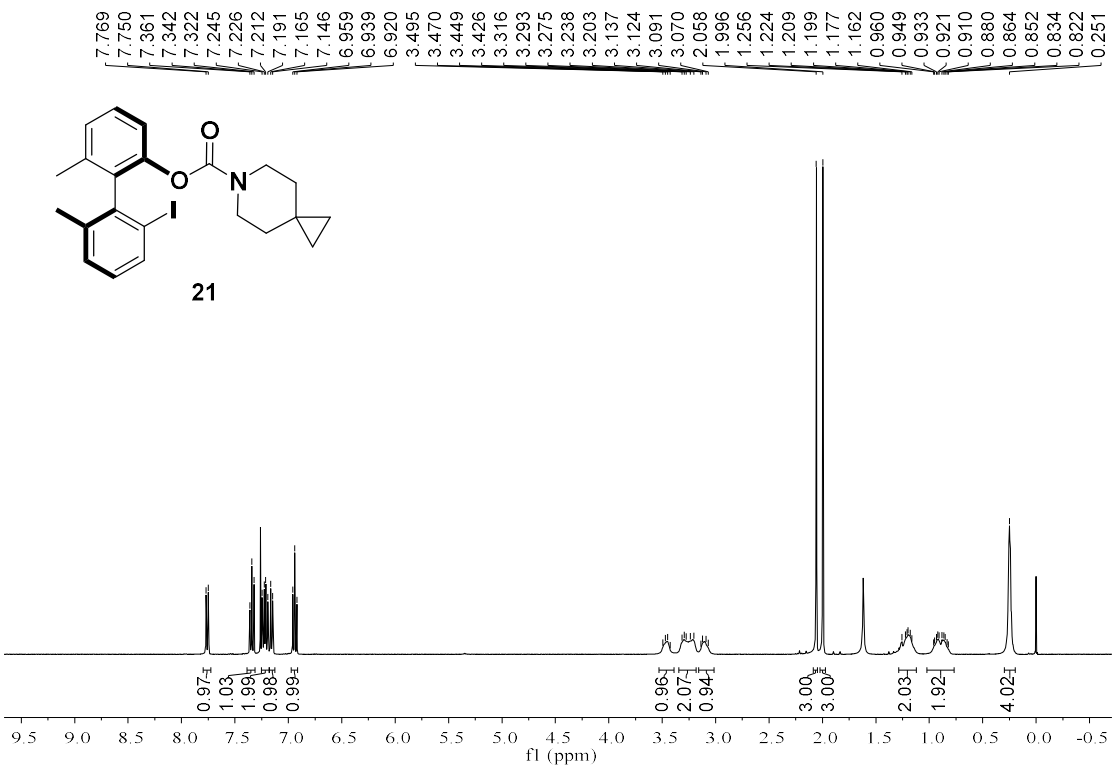


Figure S37. ^{1}H NMR Spectrum of **21**

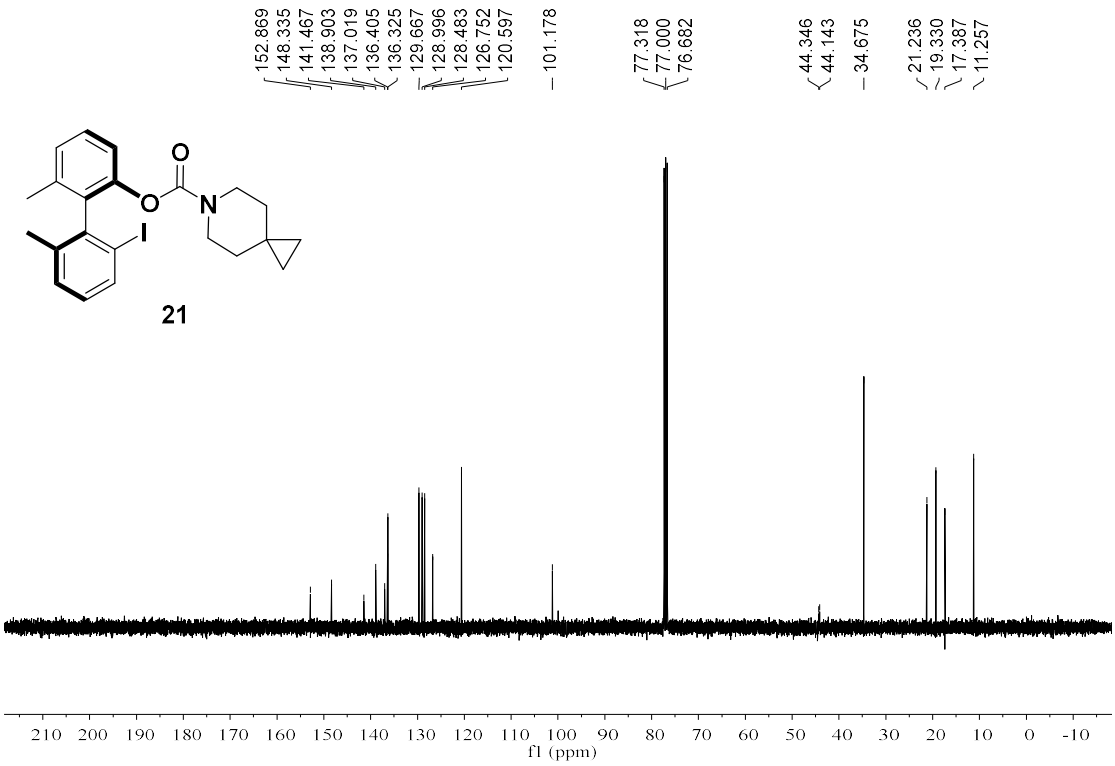


Figure S38. ^{13}C NMR Spectrum of **21**

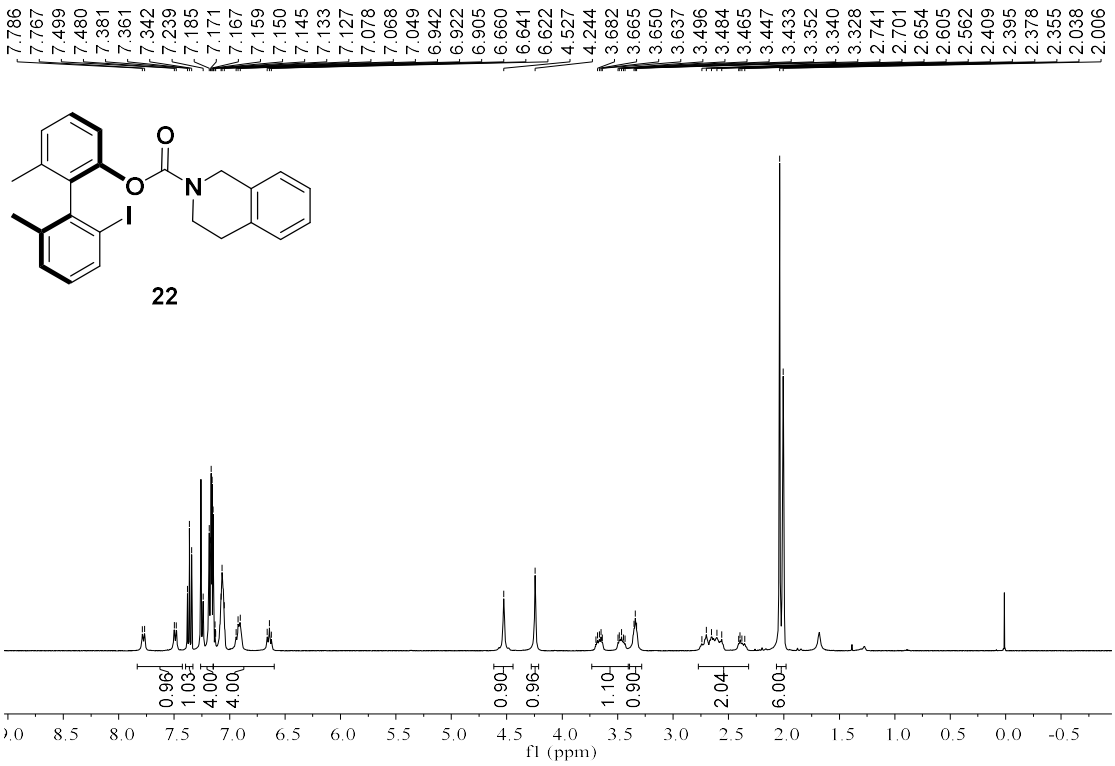


Figure S39. ^{1}H NMR Spectrum of **22**

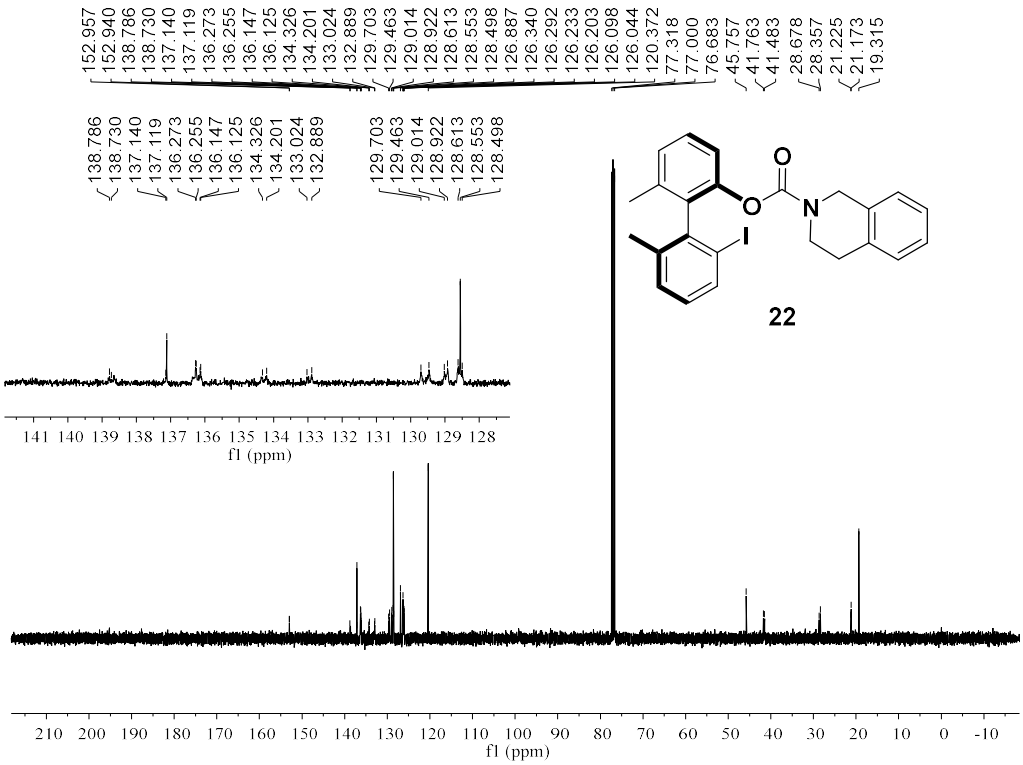


Figure S40. ^{13}C NMR Spectrum of **22**

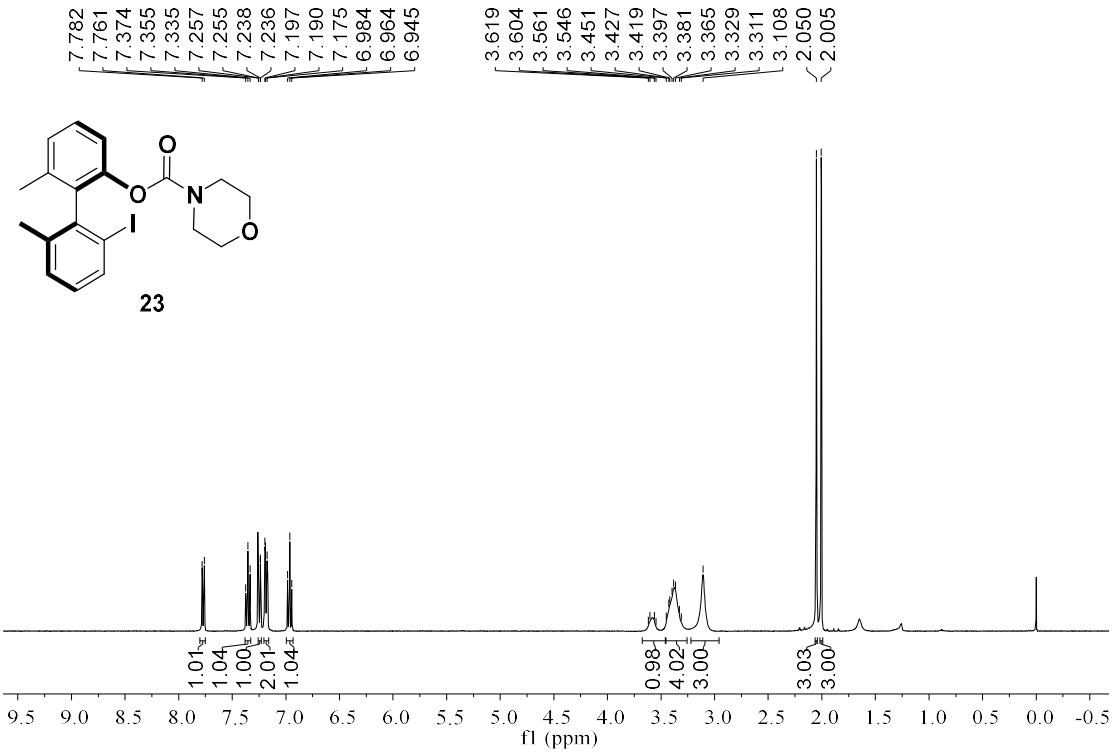


Figure S41. ^{1}H NMR Spectrum of **23**

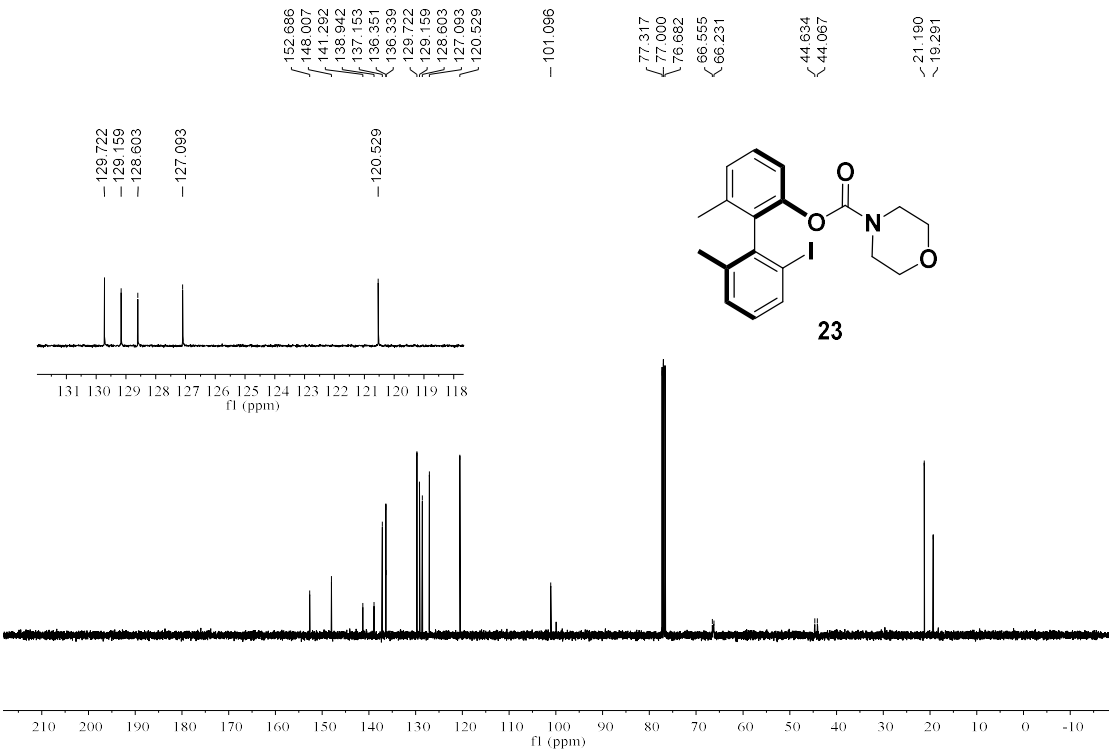


Figure S42. ^{13}C NMR Spectrum of **23**

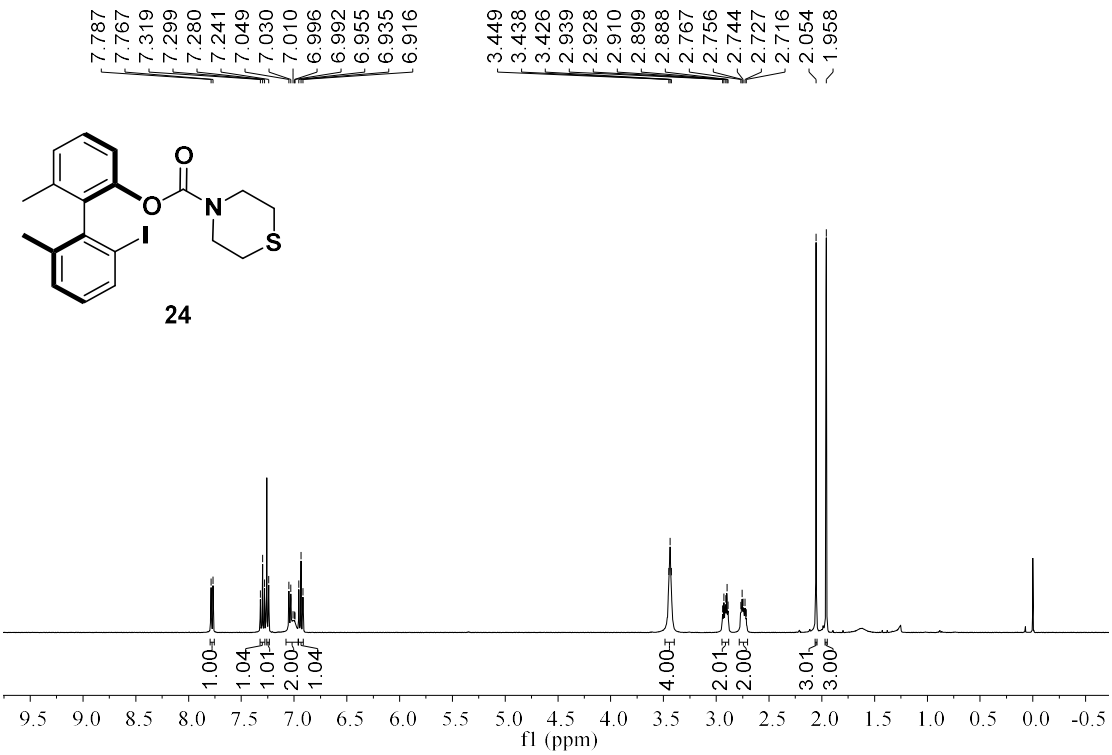


Figure S43. ^{1}H NMR Spectrum of **24**

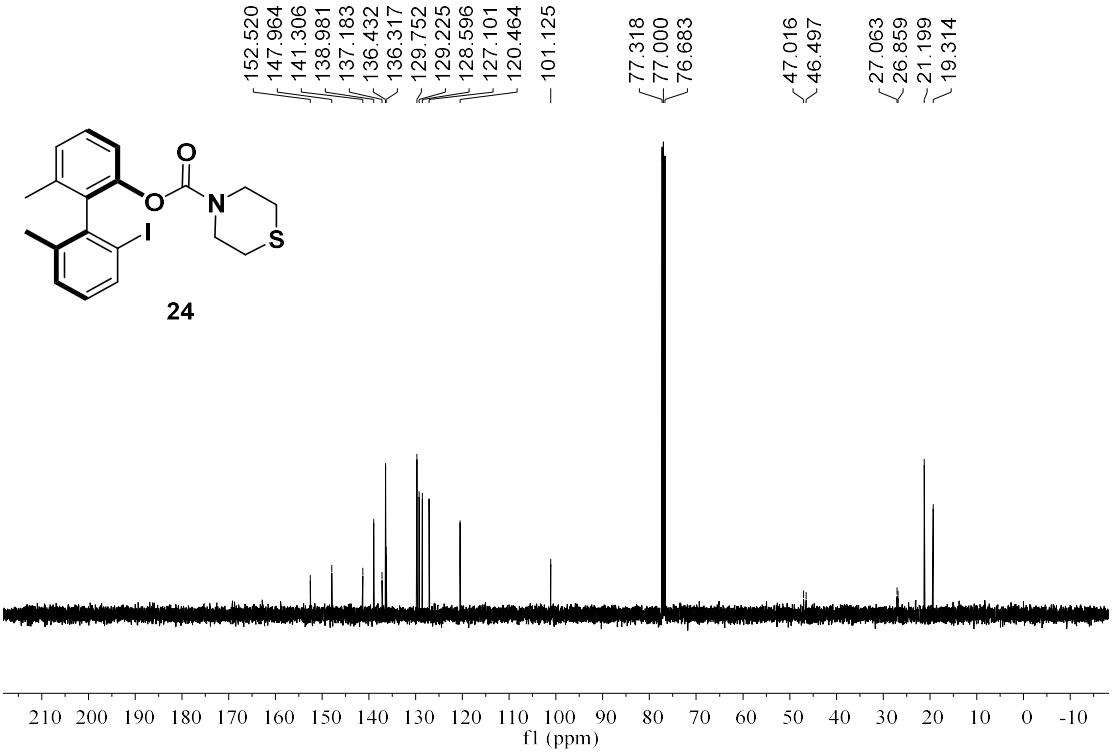


Figure S44. ^{13}C NMR Spectrum of **24**

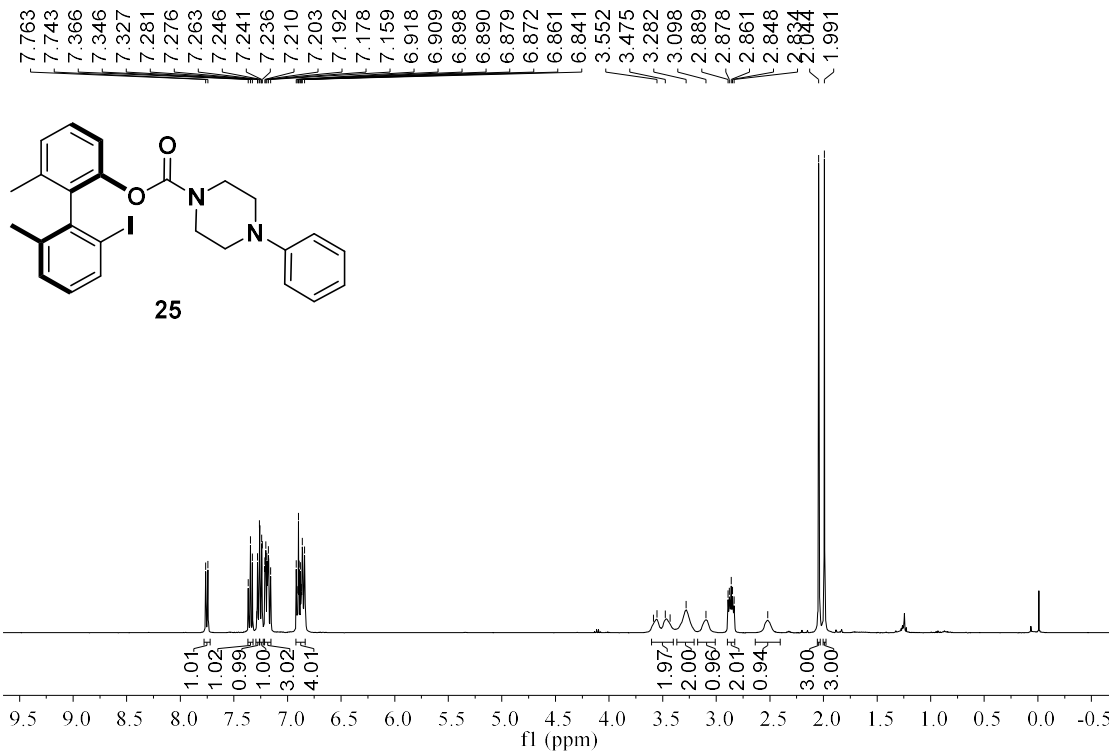


Figure S45. ^{1}H NMR Spectrum of **25**

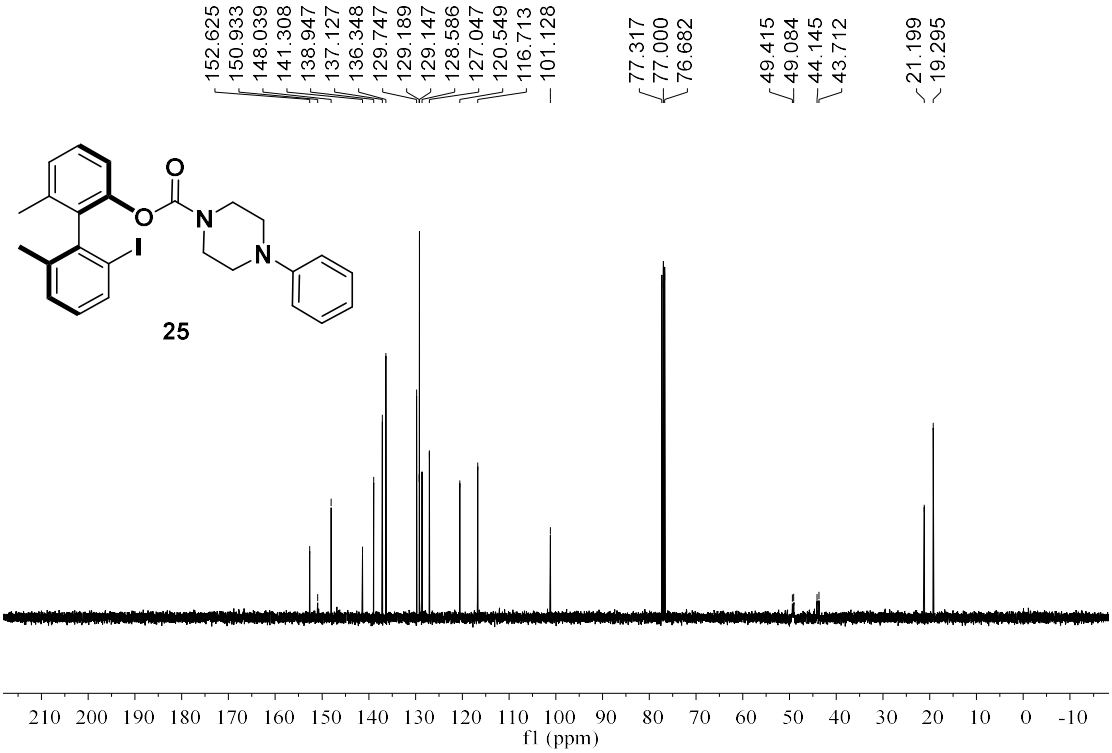


Figure S46. ^{13}C NMR Spectrum of **25**

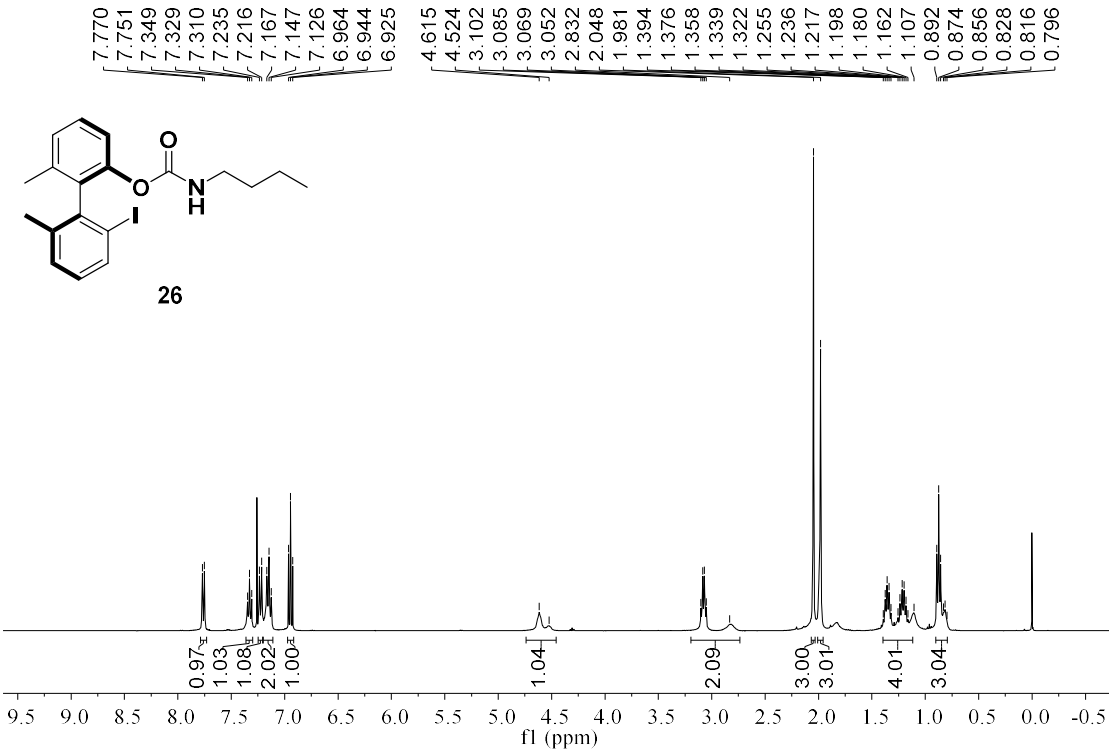


Figure S47. ^{1}H NMR Spectrum of **26**

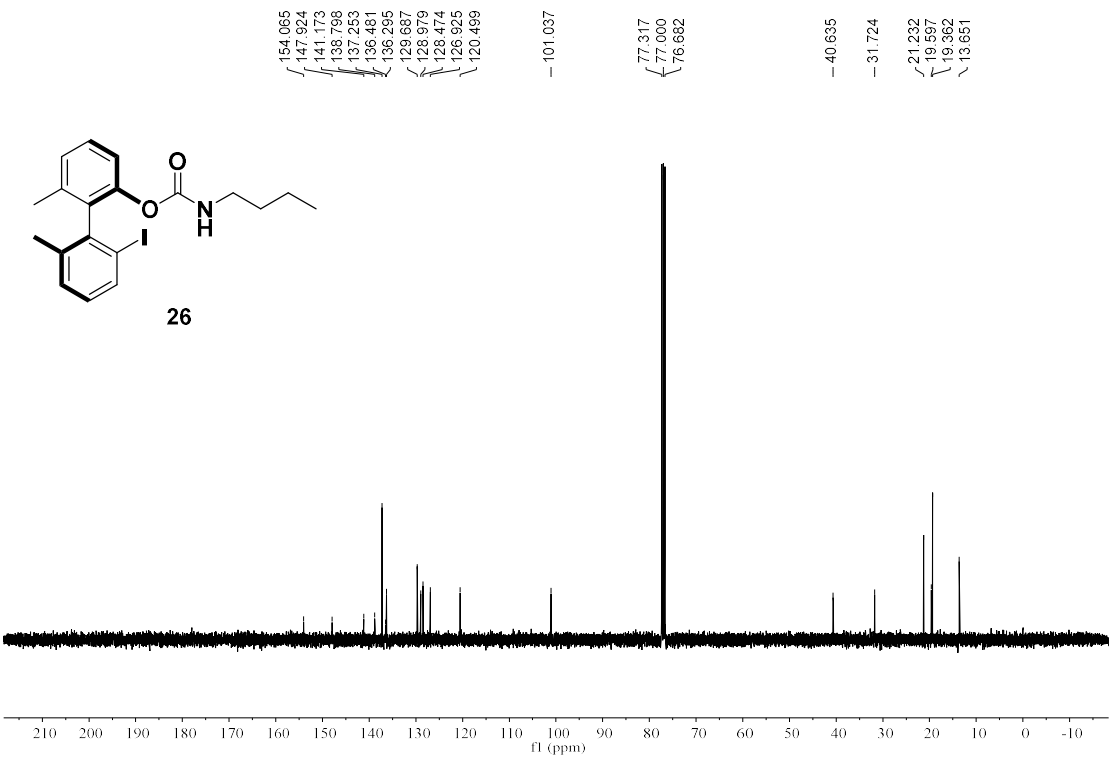


Figure S48. ^{13}C NMR Spectrum of **26**

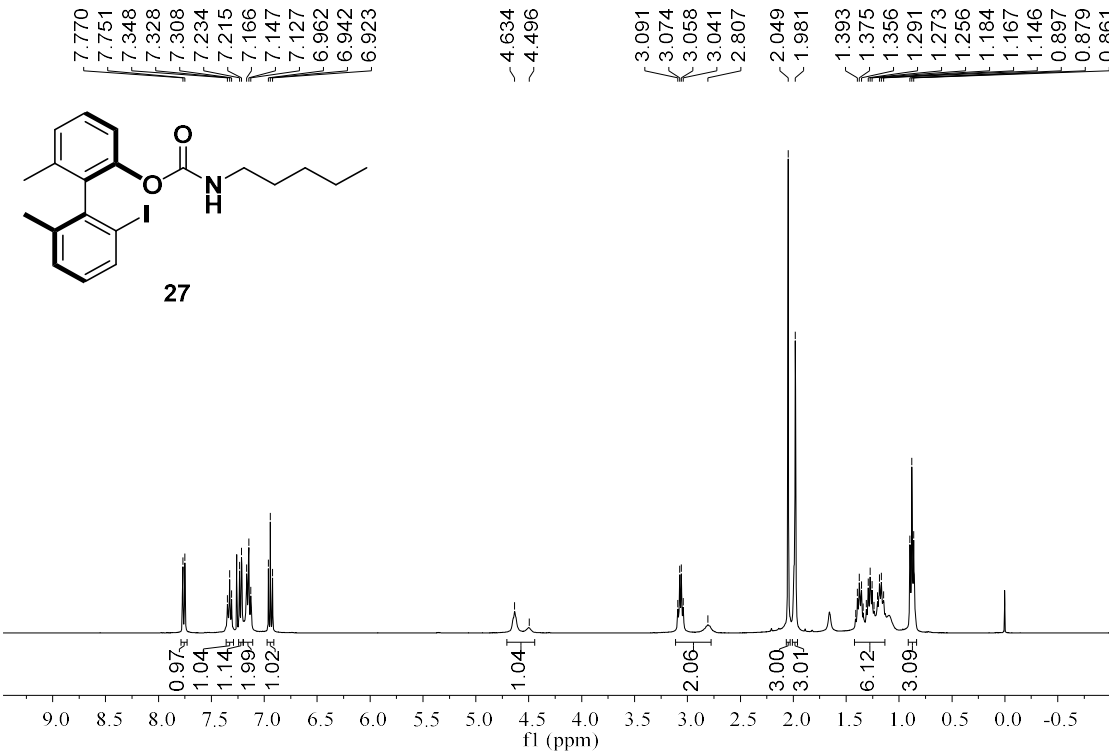


Figure S49. ^{1}H NMR Spectrum of **27**

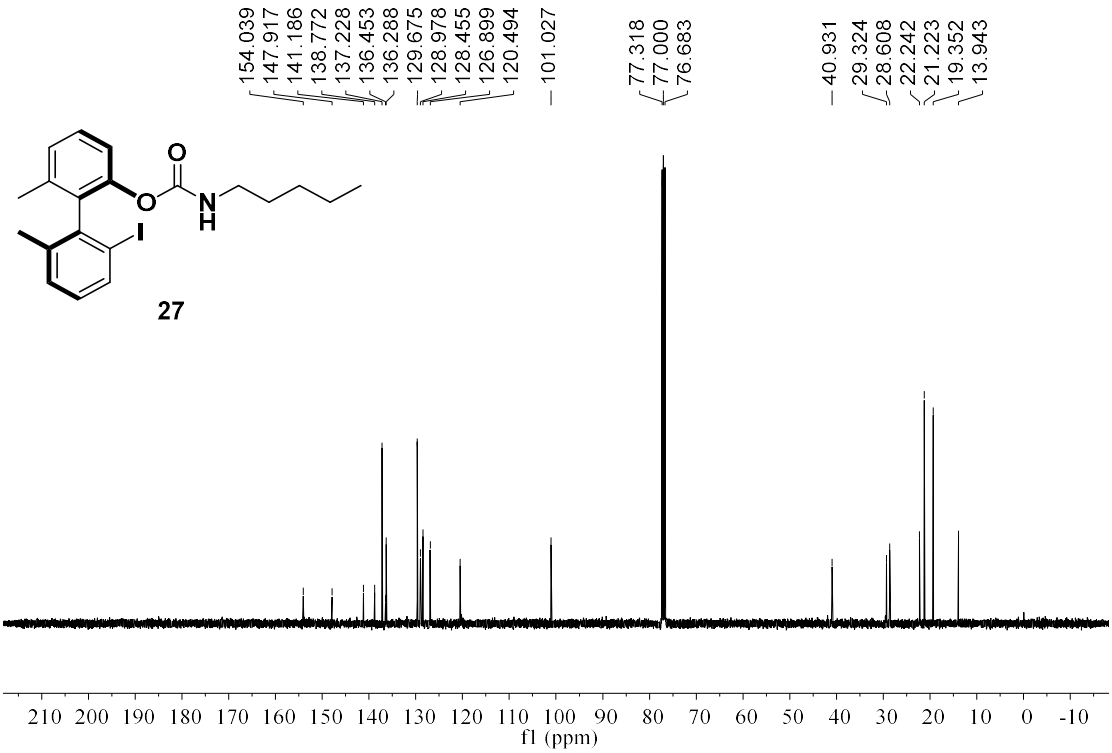


Figure S50. ^{13}C NMR Spectrum of **27**

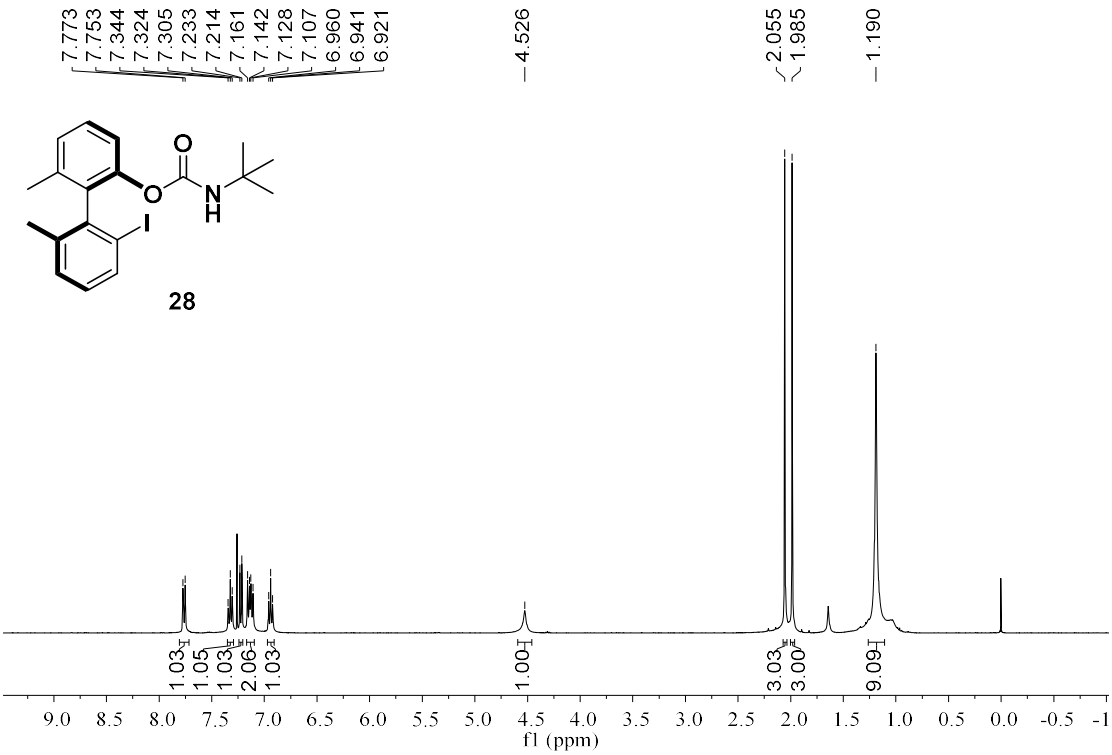


Figure S51. ^{1}H NMR Spectrum of **28**

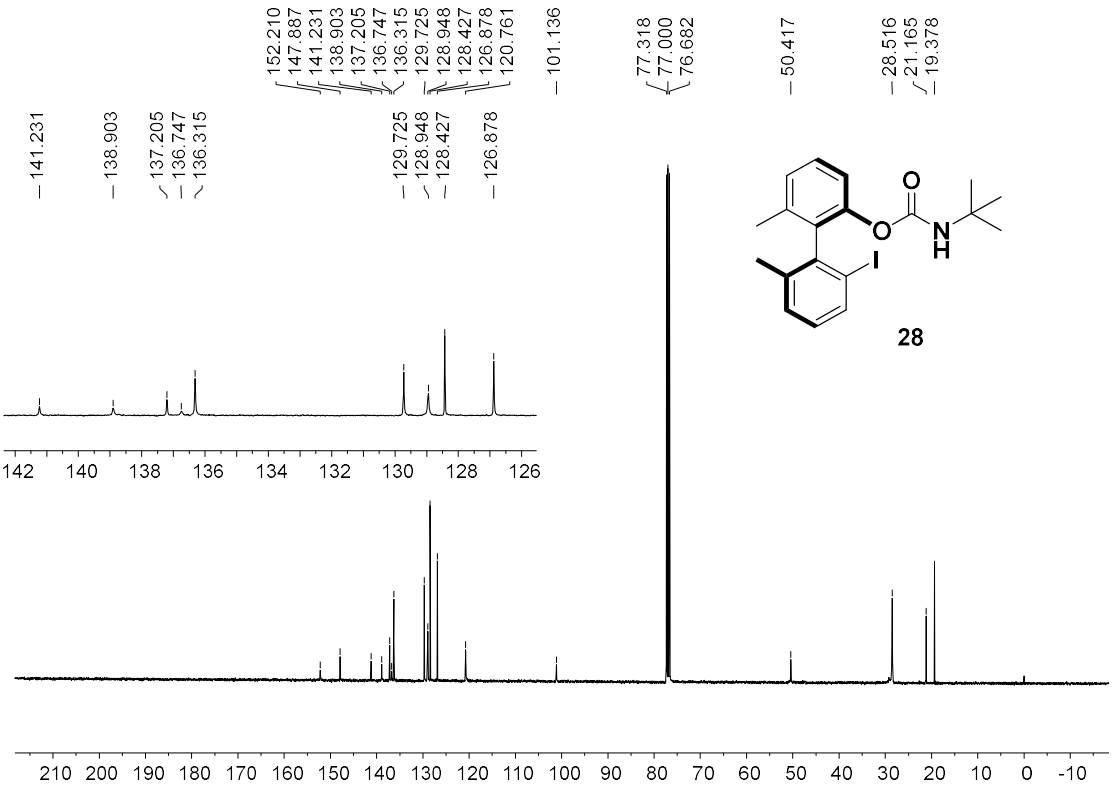


Figure S52. ^{13}C NMR Spectrum of **28**

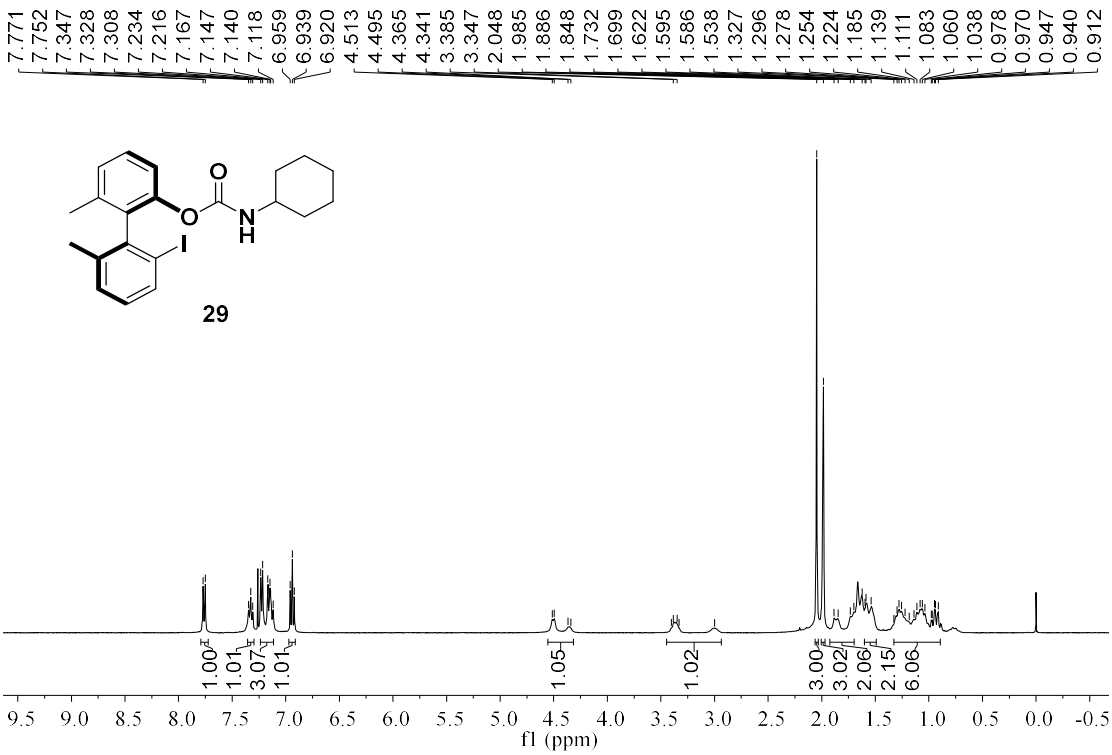


Figure S53. ^{1}H NMR Spectrum of **29**

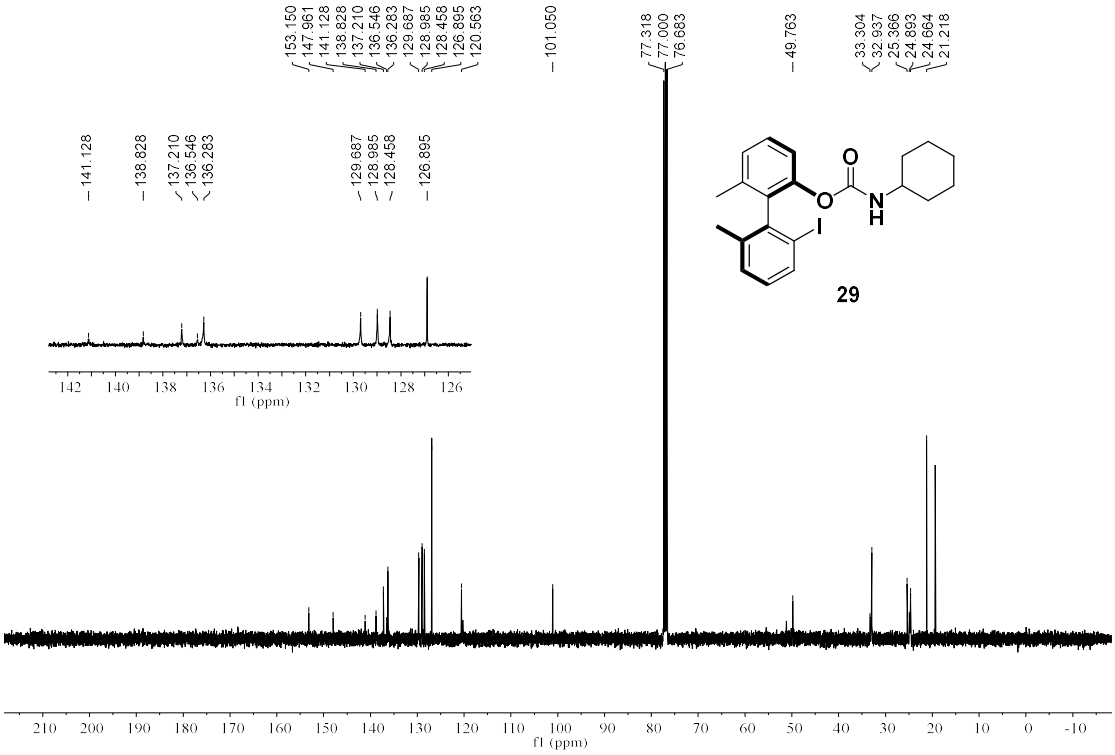


Figure S54. ^{13}C NMR Spectrum of **29**

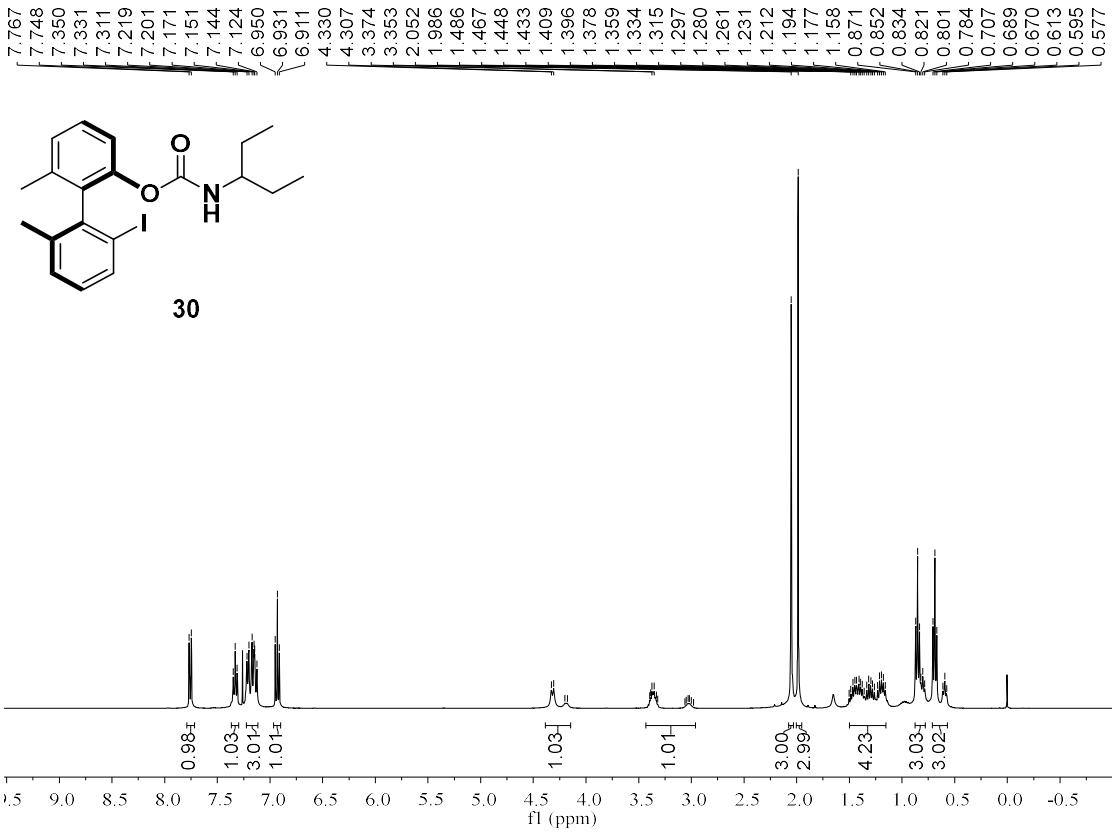


Figure S55. ^{1}H NMR Spectrum of **30**

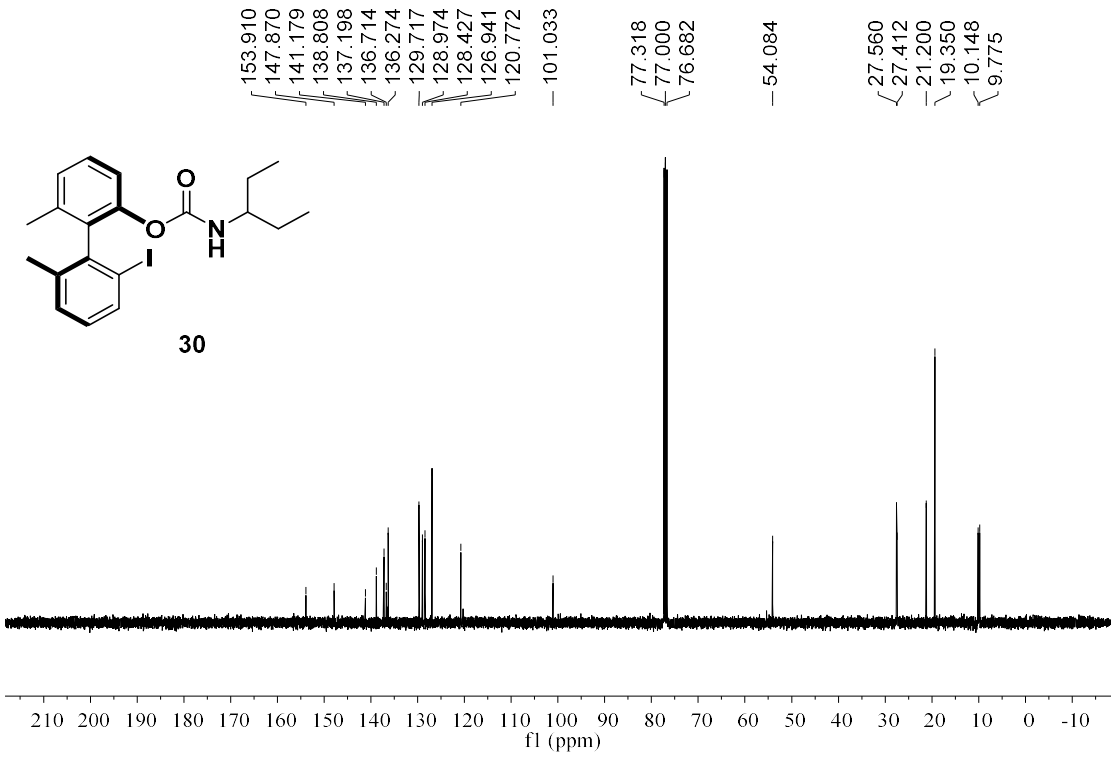


Figure S56. ^{13}C NMR Spectrum of **30**

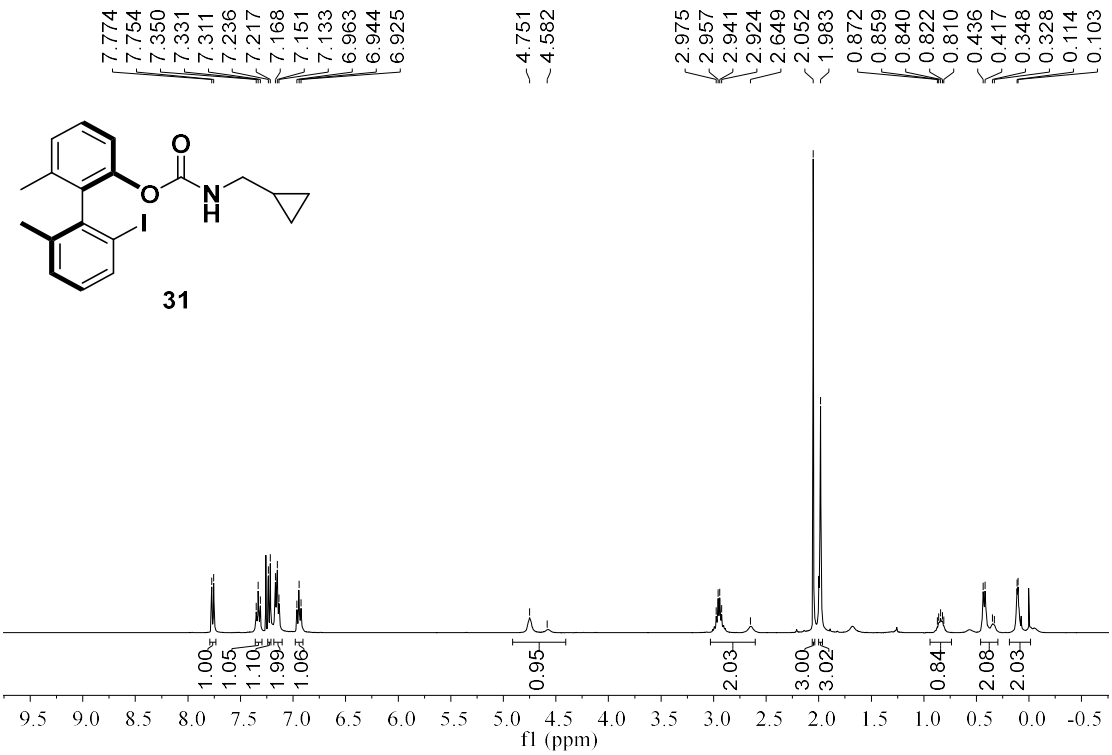


Figure S57. ^{1}H NMR Spectrum of **31**

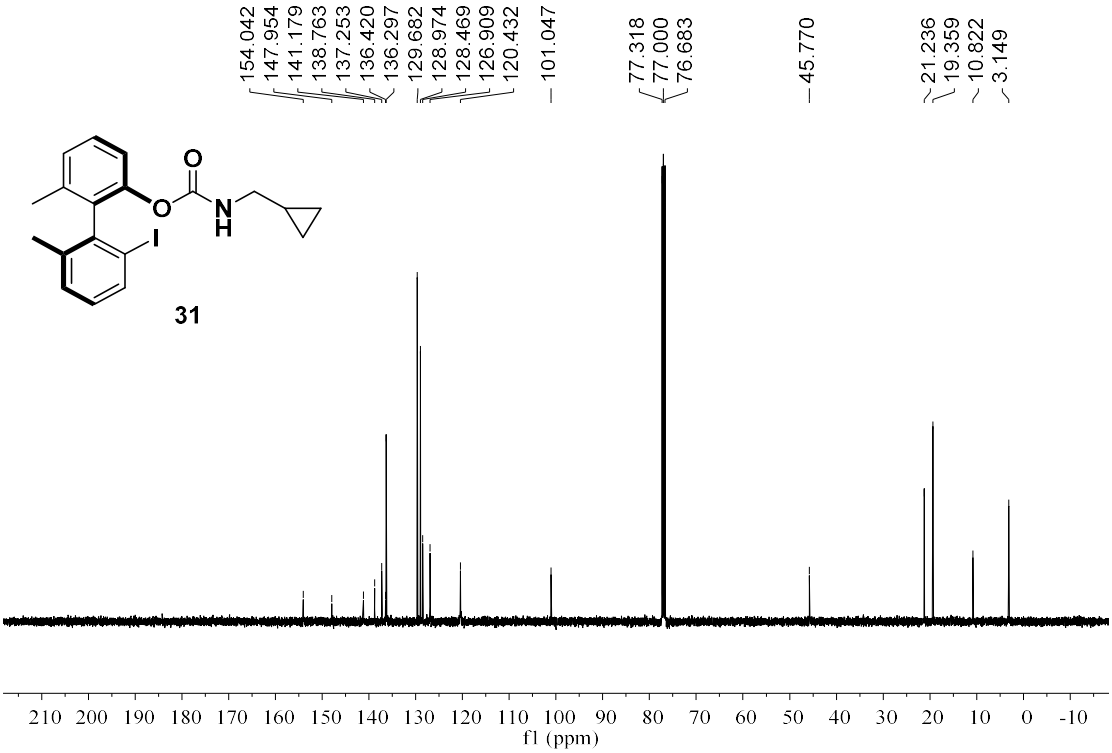


Figure S58. ^{13}C NMR Spectrum of **31**

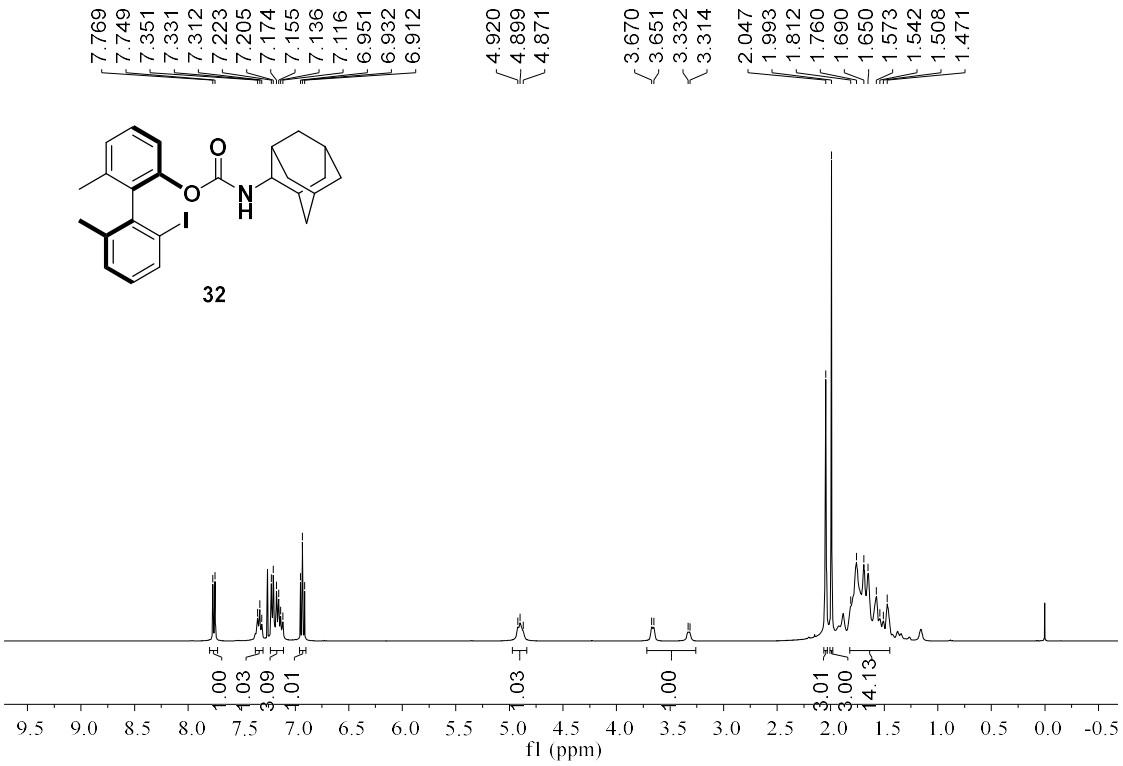


Figure S59. ^{1}H NMR Spectrum of **32**

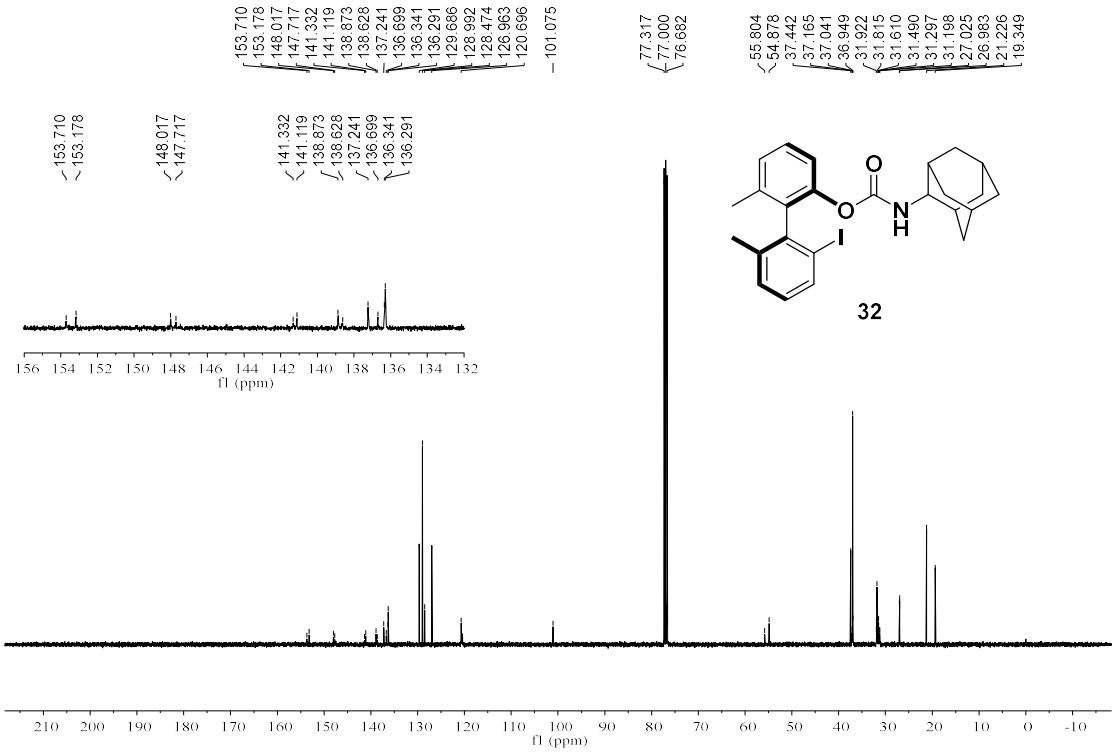


Figure S60. ^{13}C NMR Spectrum of **32**

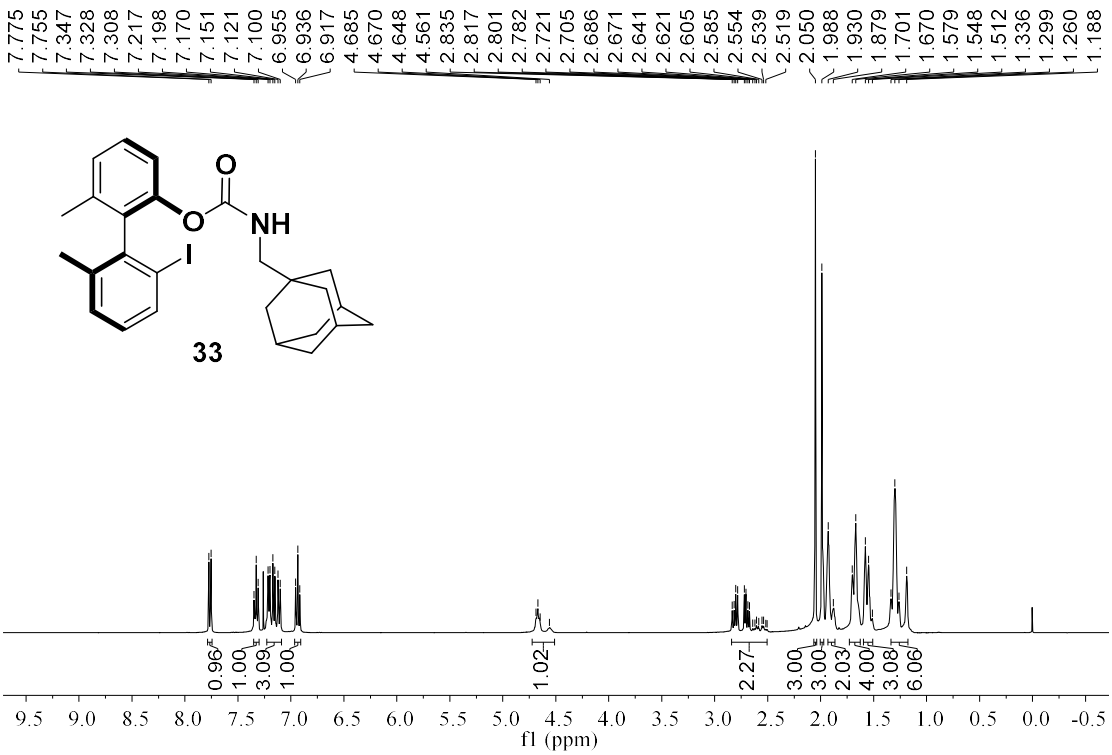


Figure S61. ^{1}H NMR Spectrum of **33**

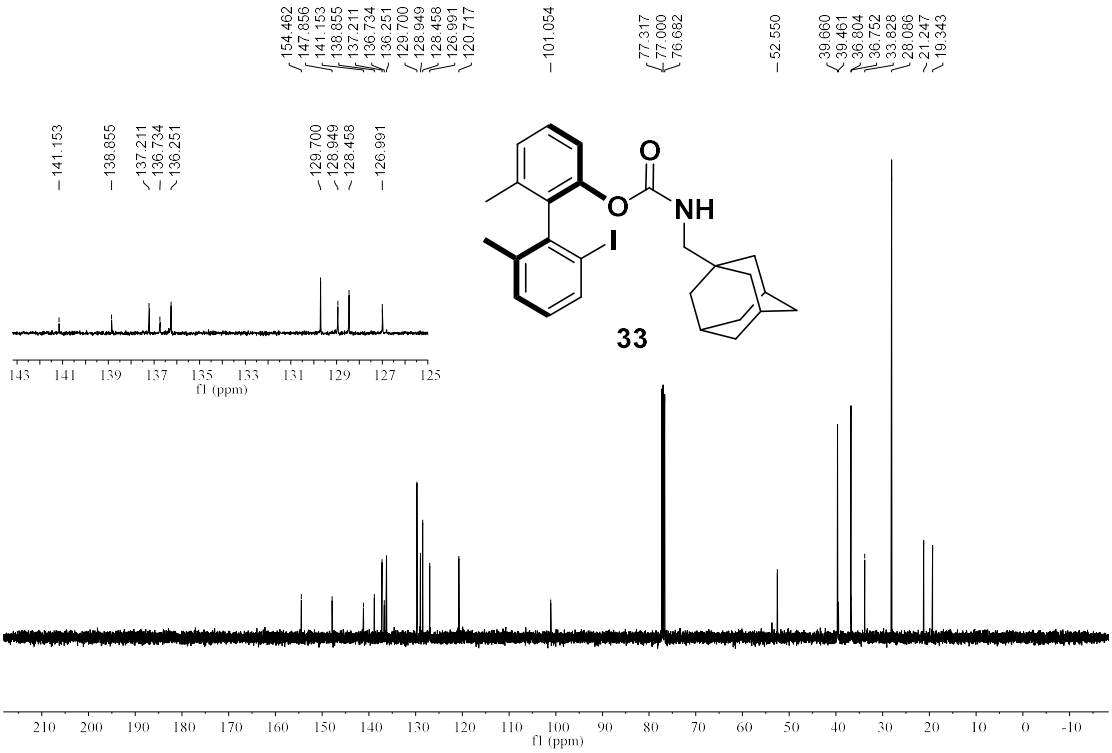


Figure S62. ^{13}C NMR Spectrum of **33**

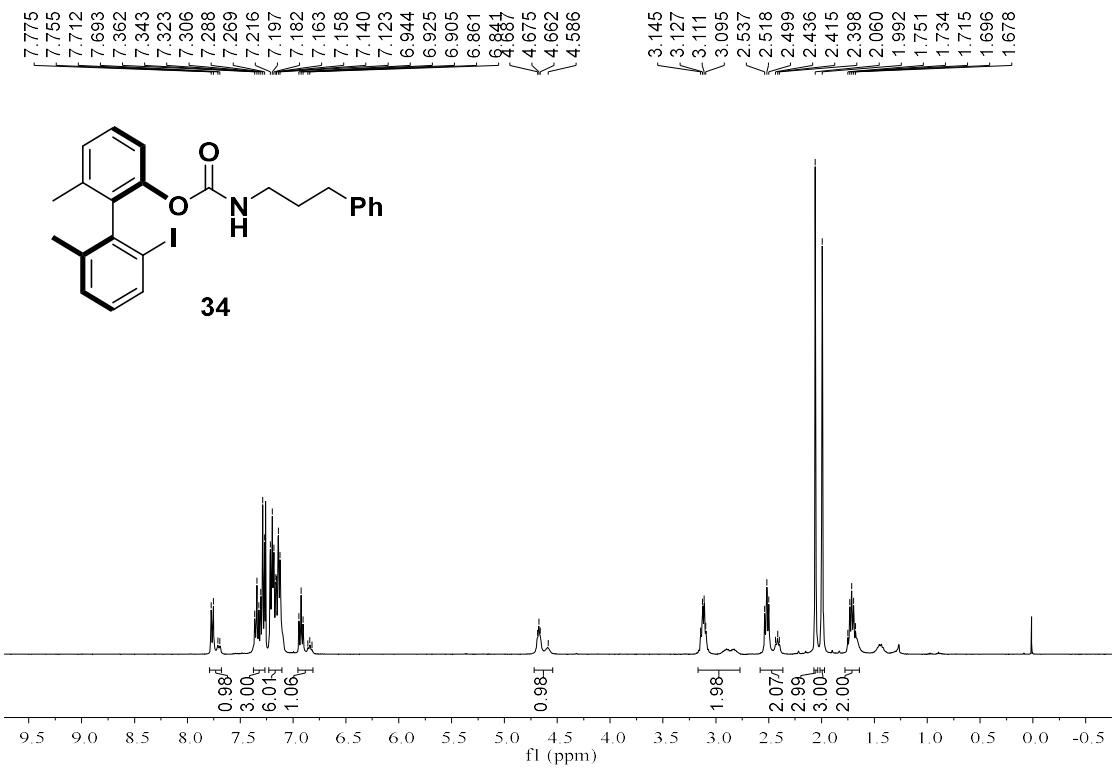


Figure S63. ^{1}H NMR Spectrum of **34**

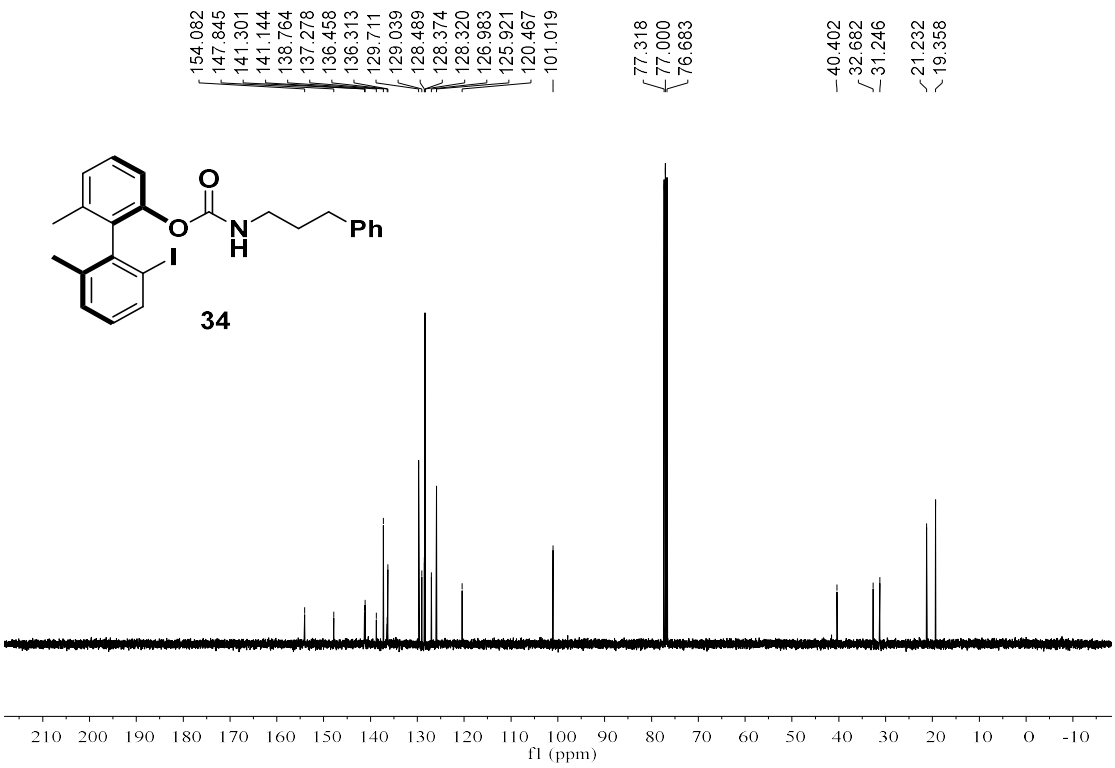


Figure S64. ^{13}C NMR Spectrum of **34**

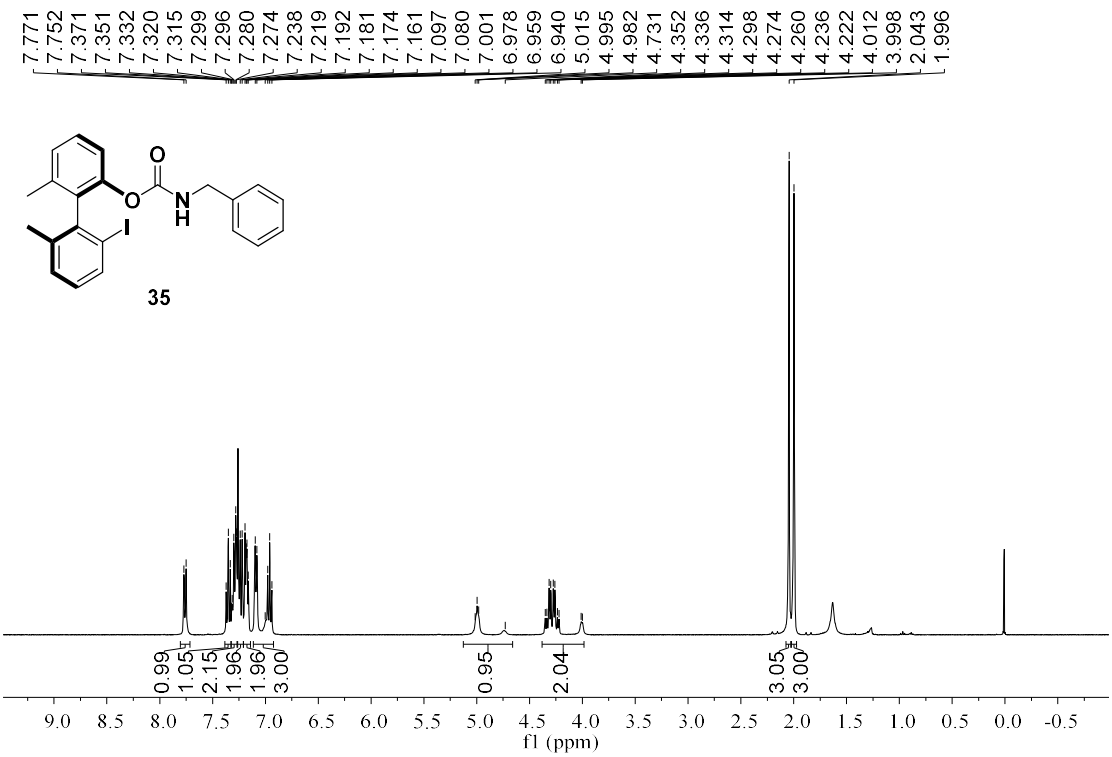


Figure S65. ^{1}H NMR Spectrum of **35**

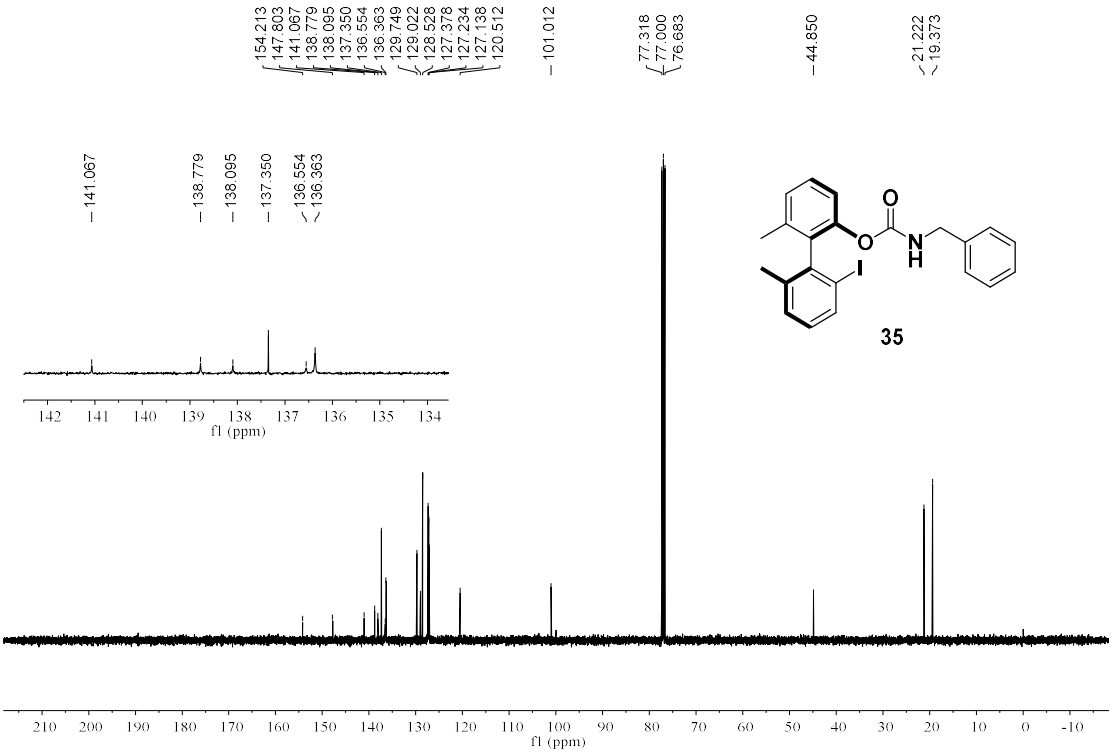


Figure S66. ^{13}C NMR Spectrum of **35**

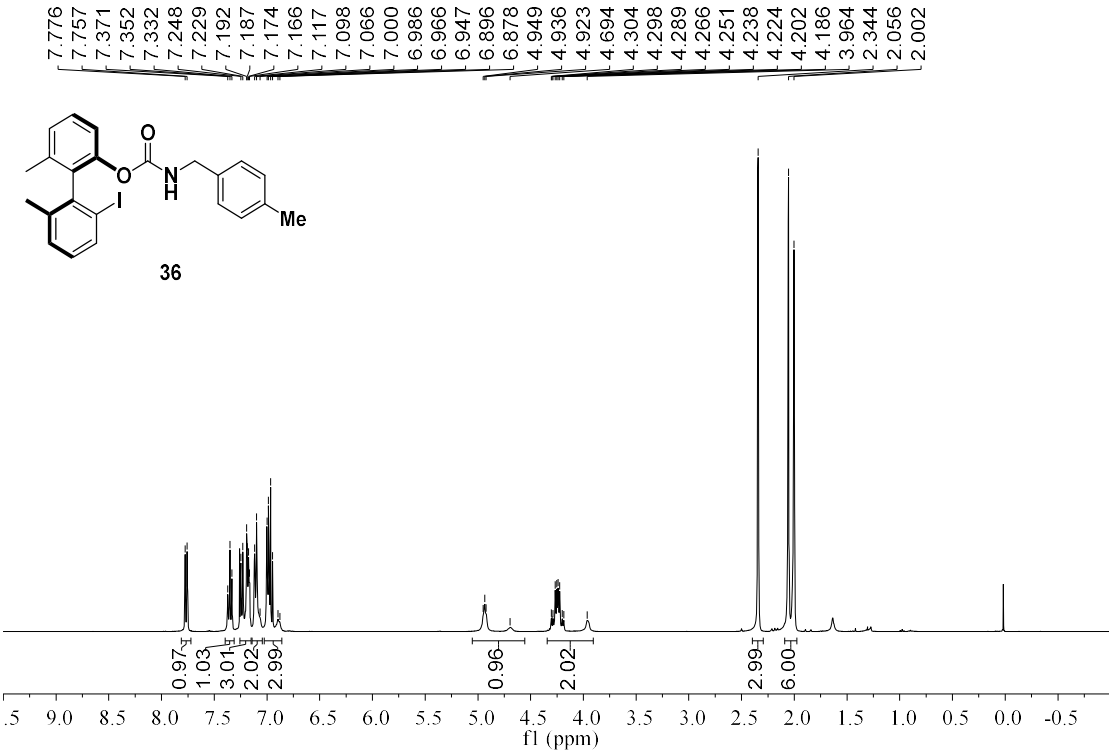


Figure S67. ^{1}H NMR Spectrum of **36**

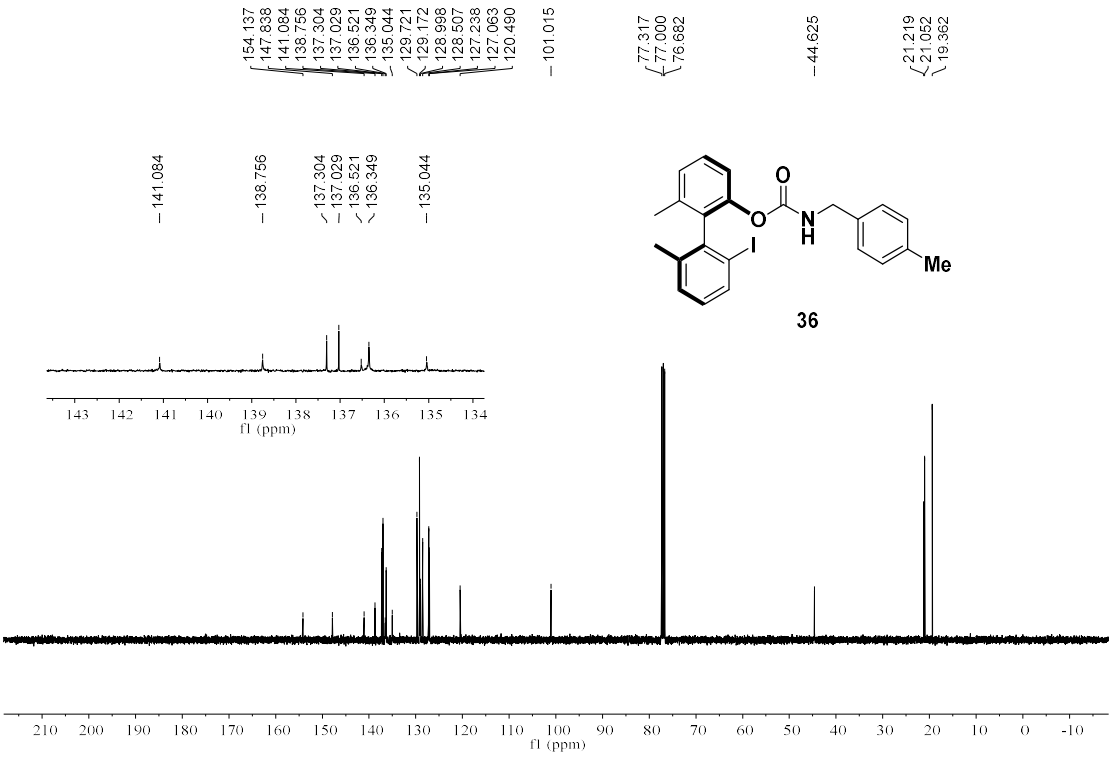


Figure S68. ^{13}C NMR Spectrum of **36**

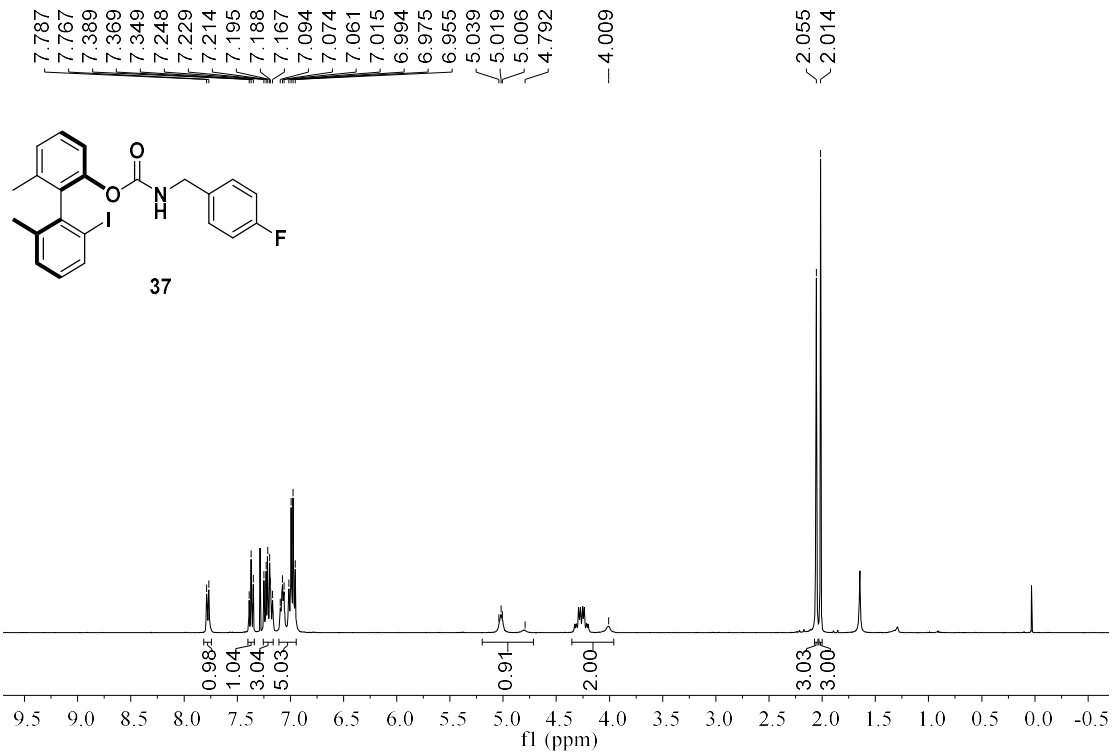


Figure S69. ^{1}H NMR Spectrum of **37**

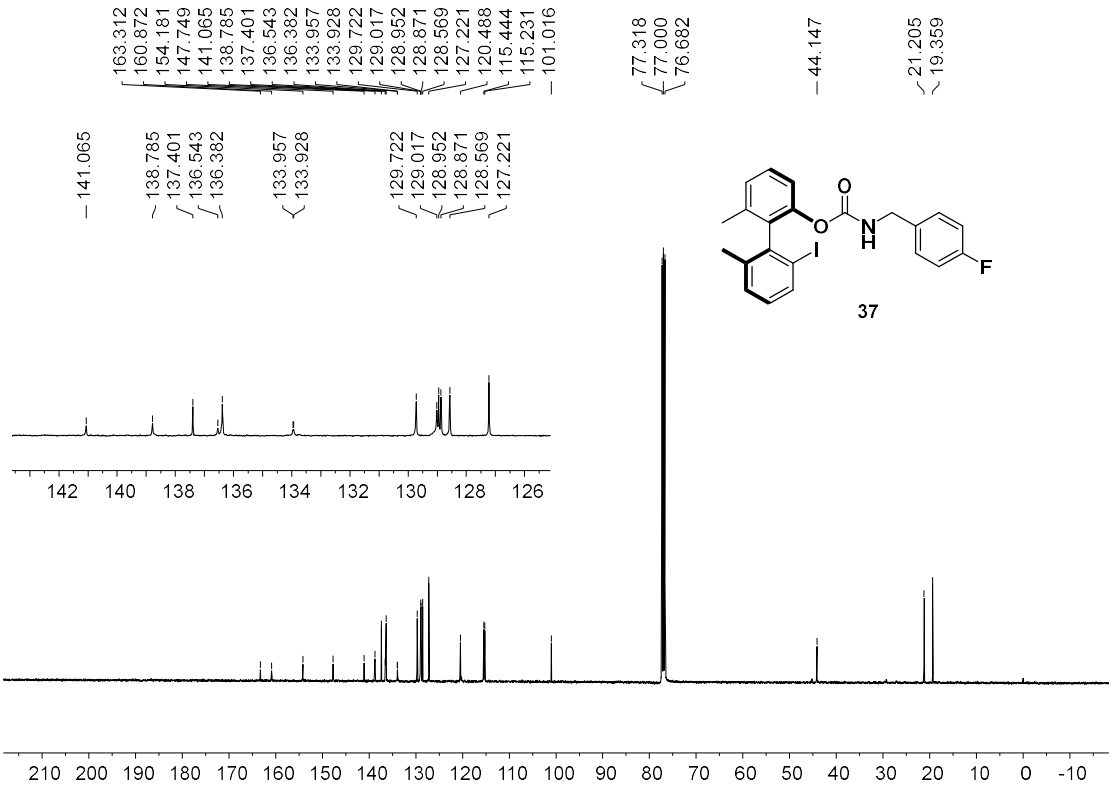


Figure S70. ^{13}C NMR Spectrum of **37**

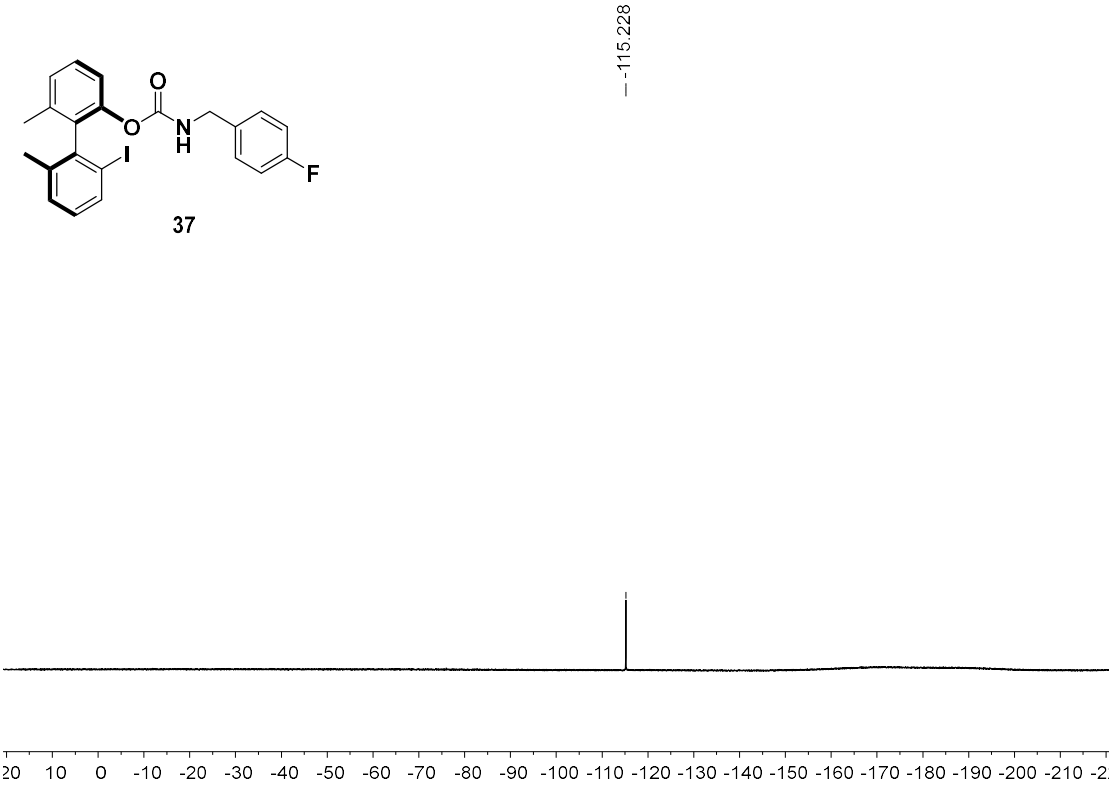


Figure S71. ^{19}F NMR Spectrum of **37**

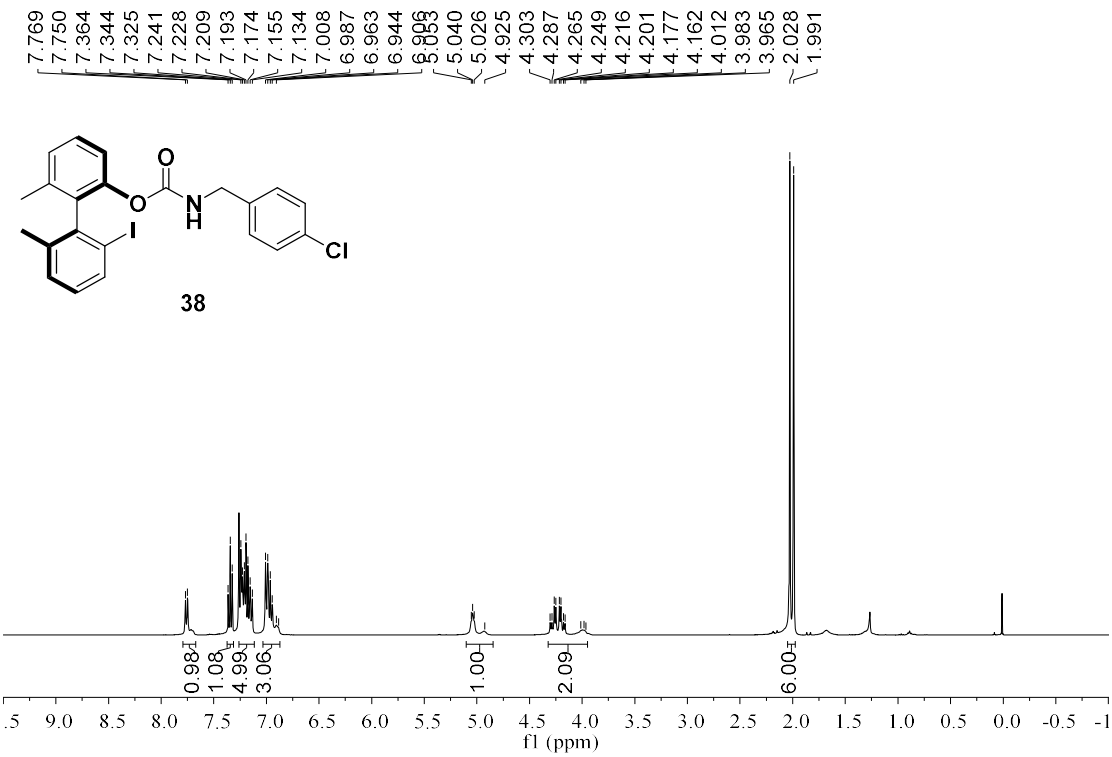


Figure S72. ^{1}H NMR Spectrum of **38**

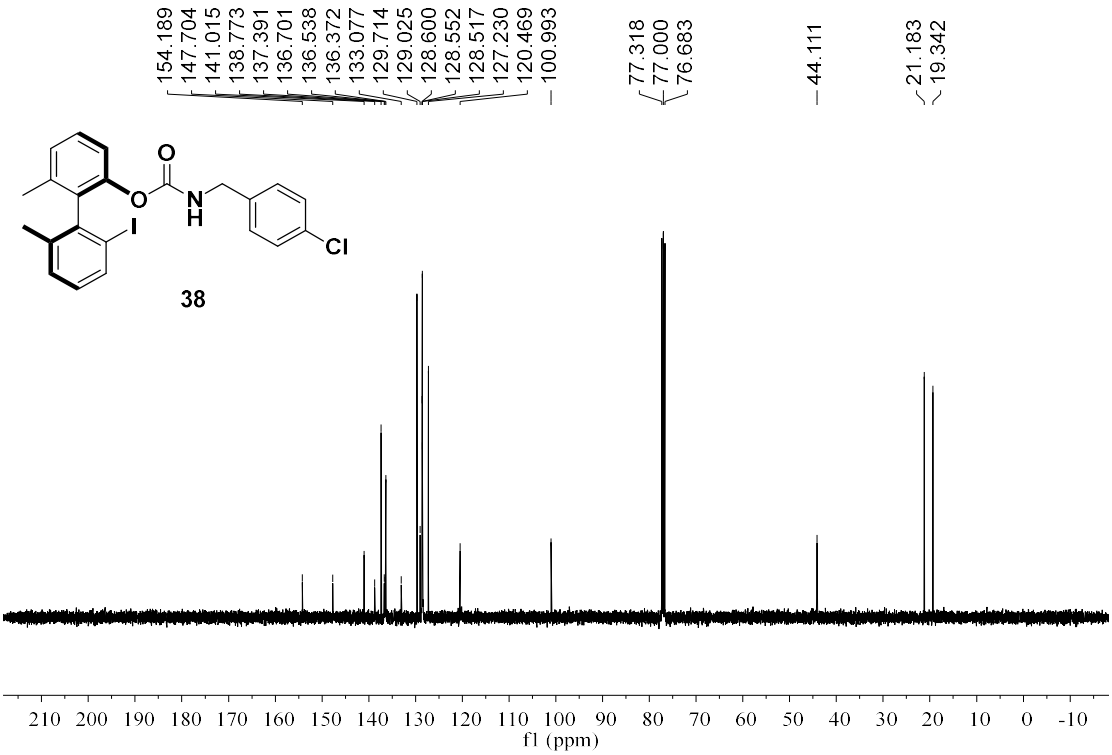


Figure S73. ^{13}C NMR Spectrum of **38**

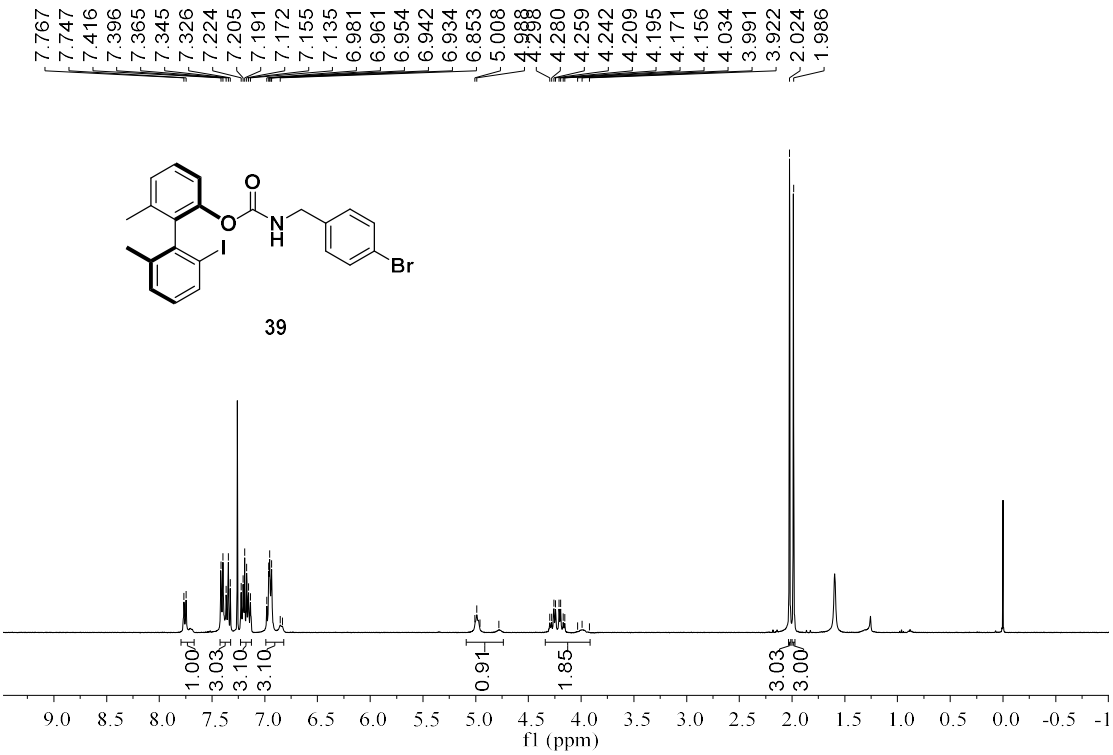


Figure S74. ^{1}H NMR Spectrum of **39**

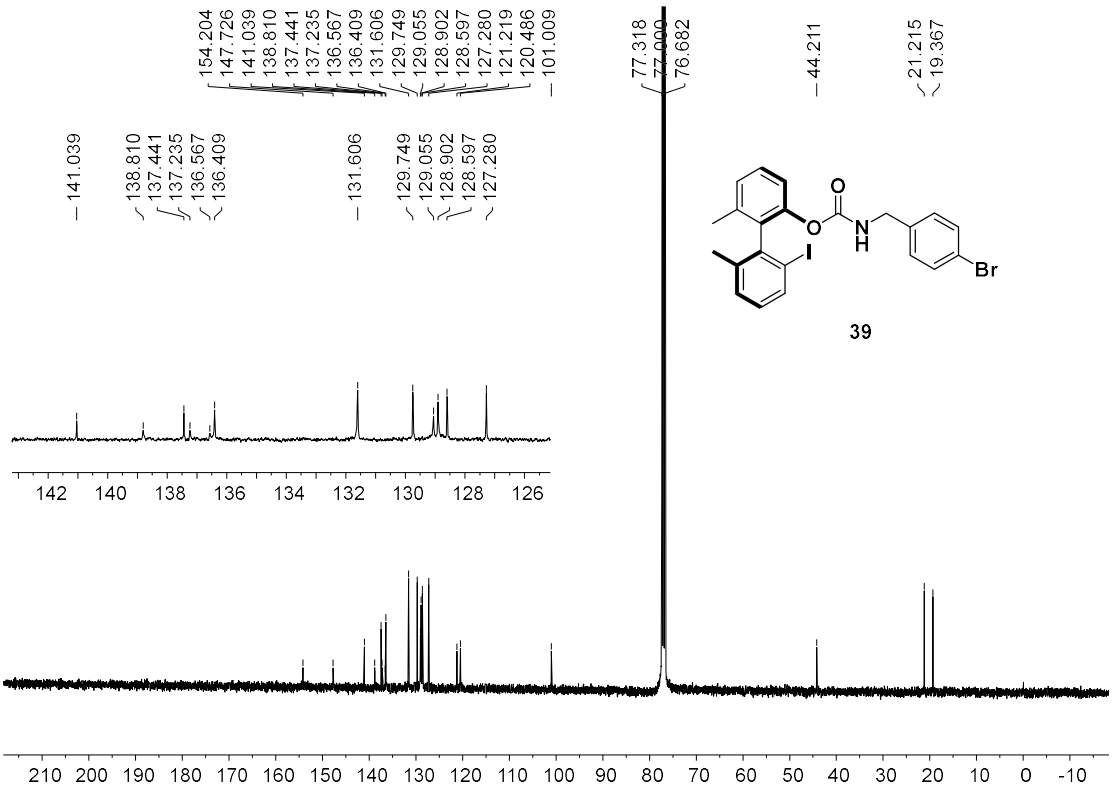


Figure S75. ^{13}C NMR Spectrum of **39**

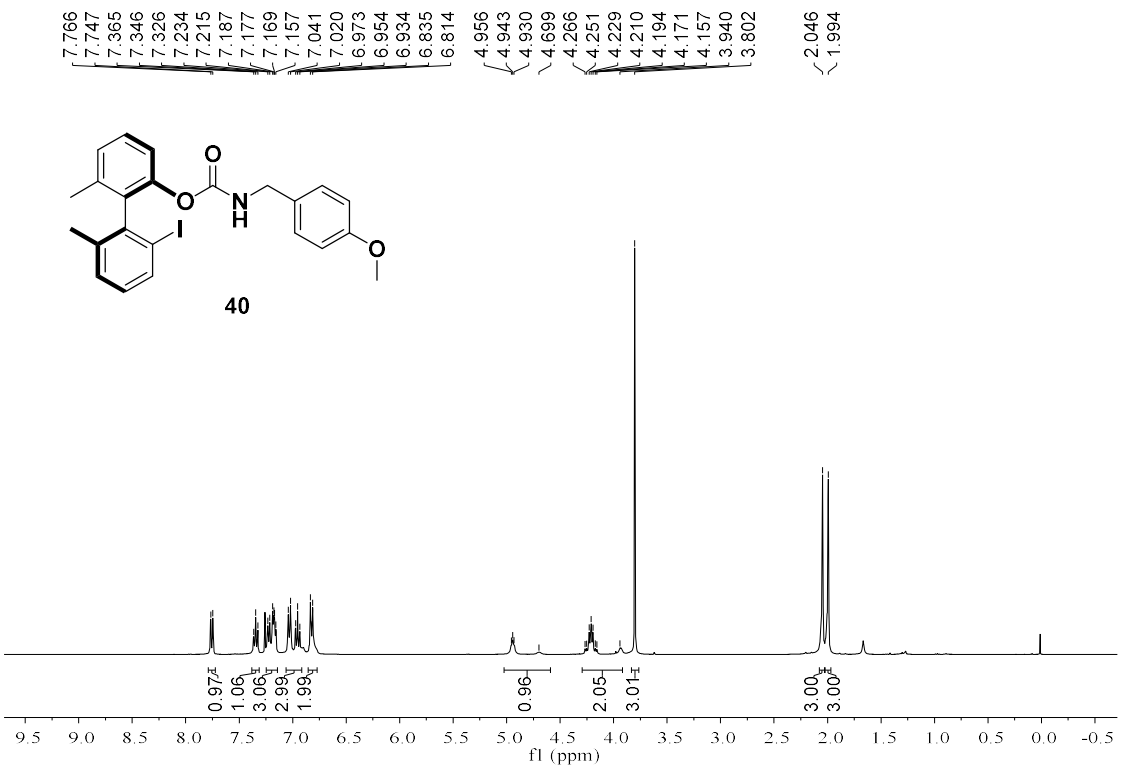


Figure S76. ^{1}H NMR Spectrum of **40**

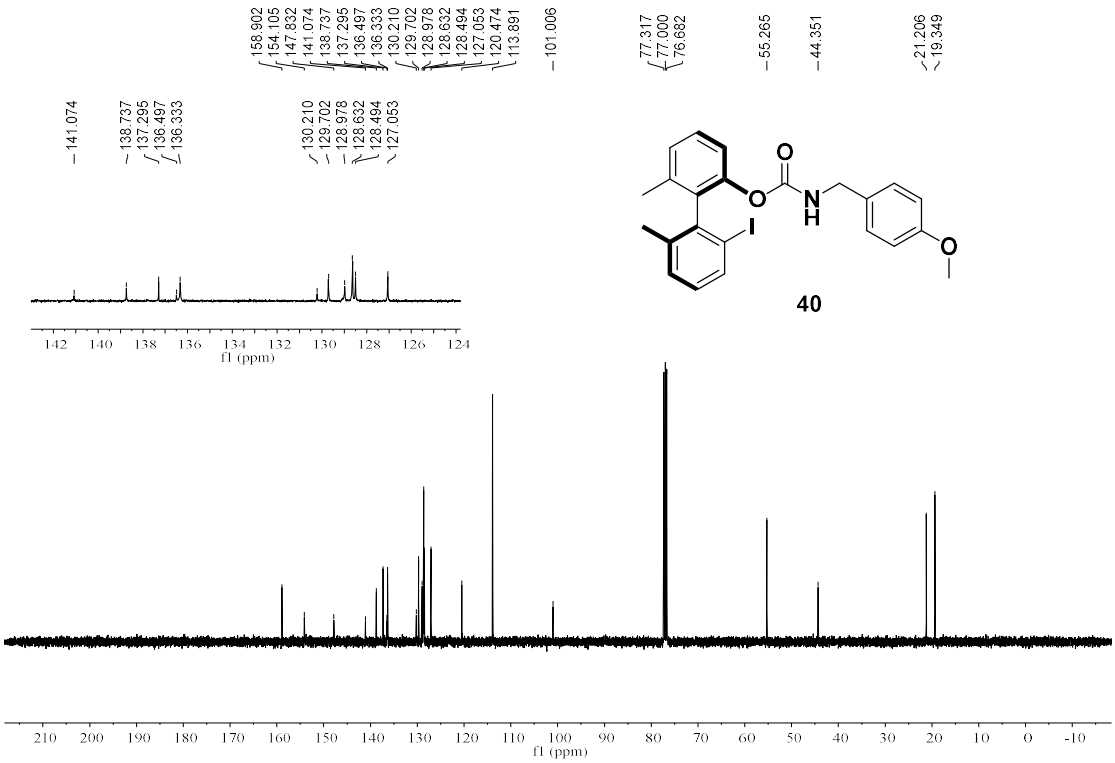


Figure S77. ^{13}C NMR Spectrum of **40**

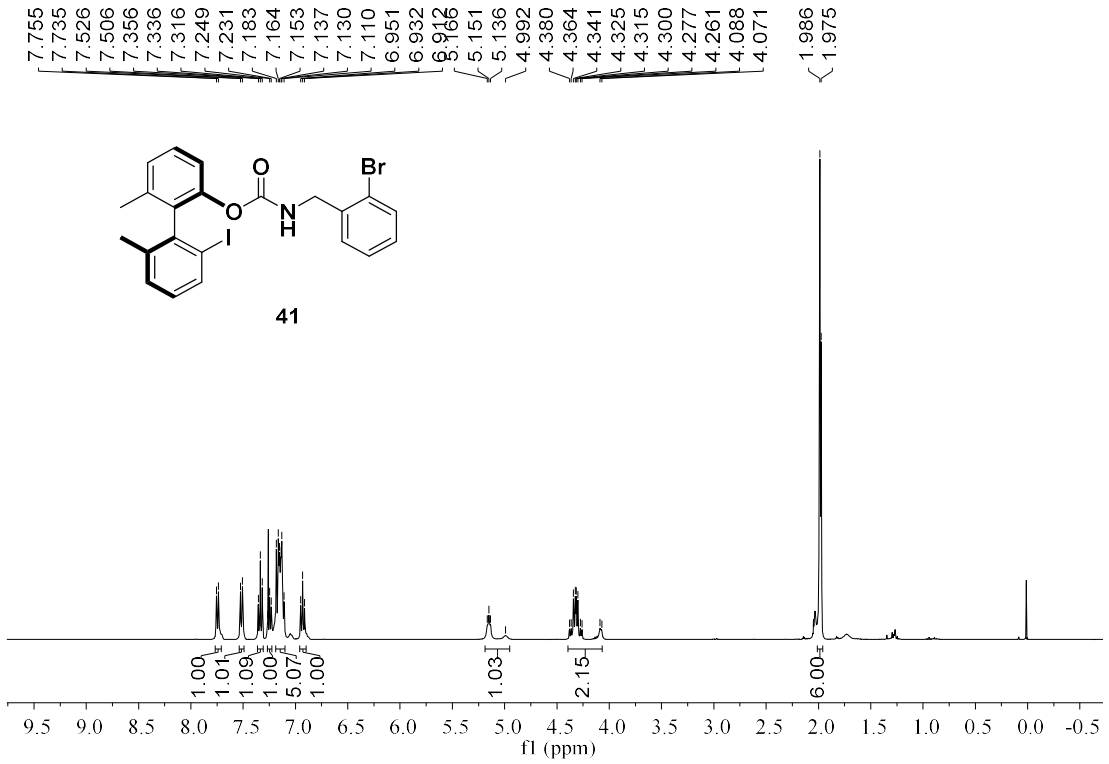


Figure S78. ^{1}H NMR Spectrum of **41**

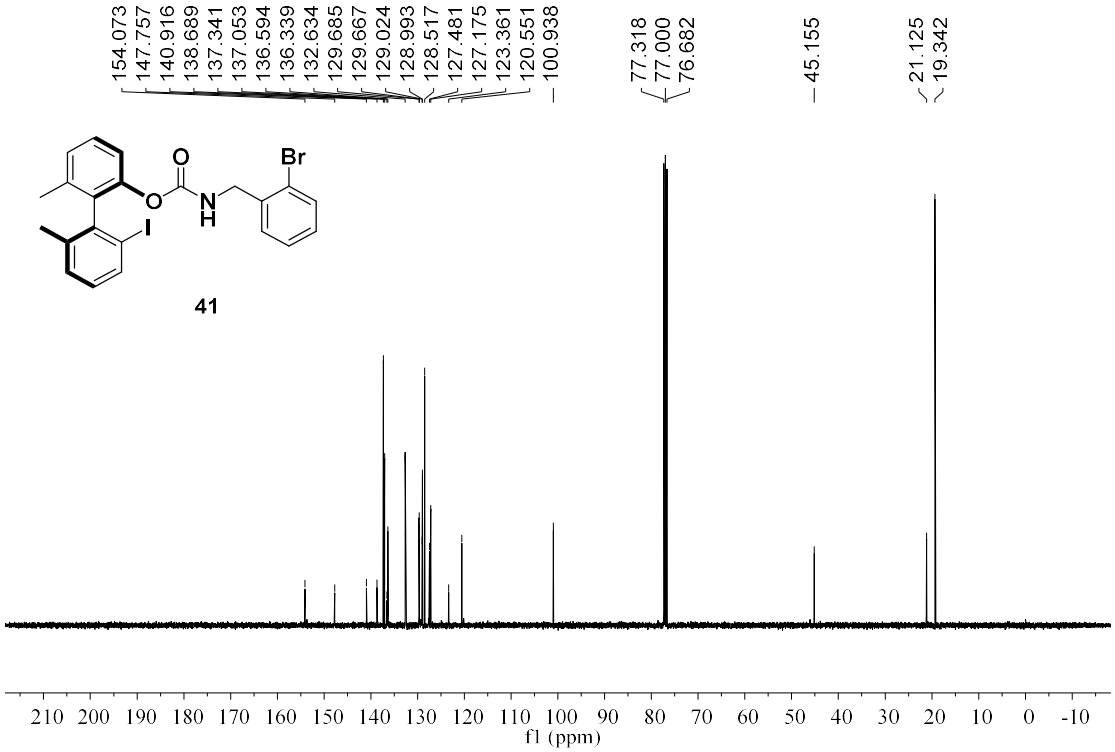


Figure S79. ^{13}C NMR Spectrum of **41**

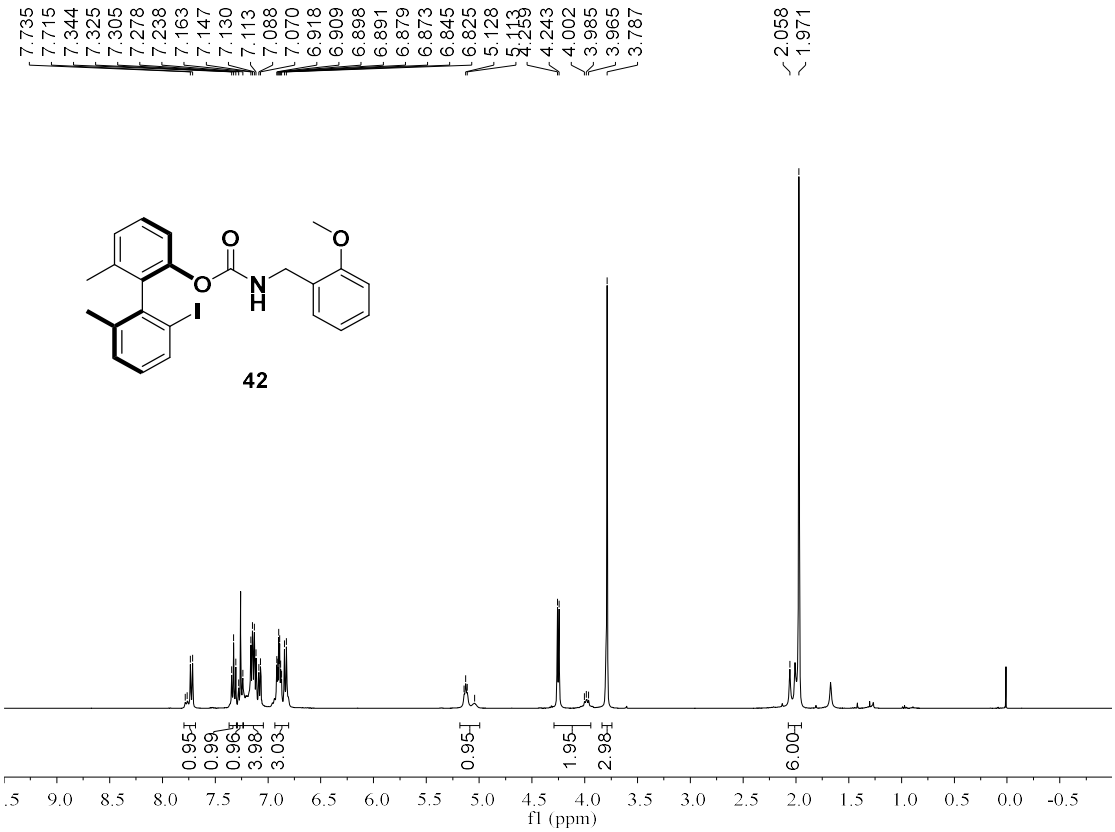


Figure S80. ^{1}H NMR Spectrum of **42**

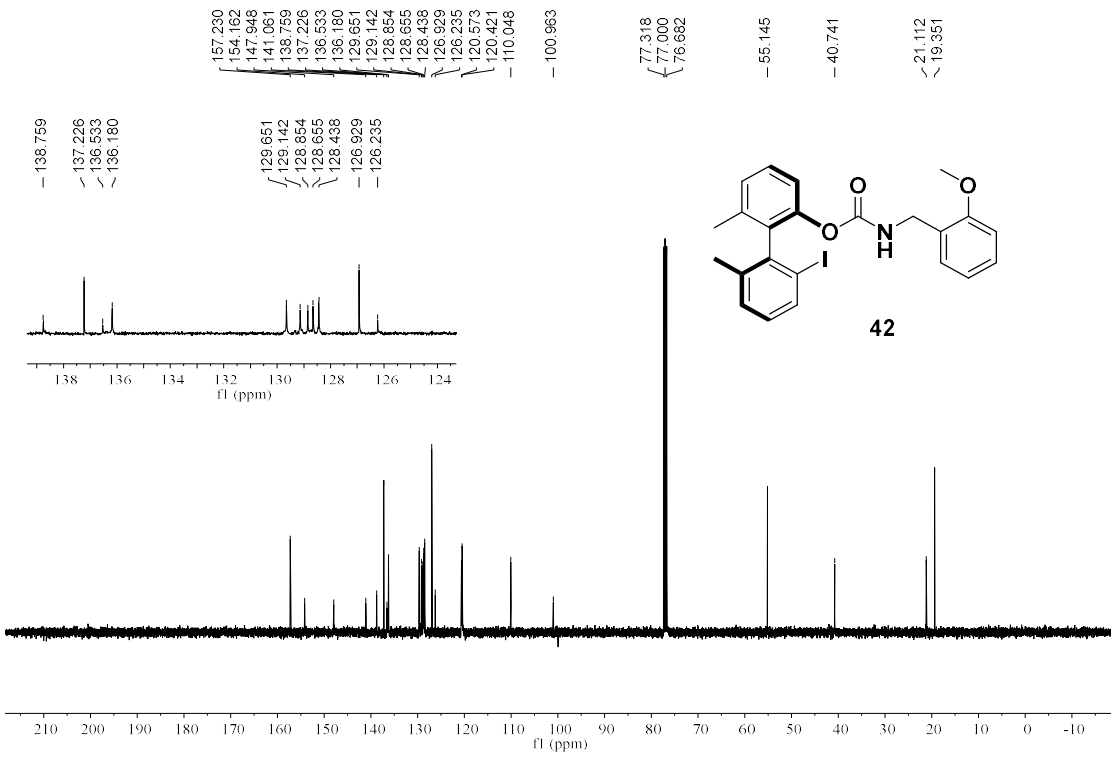


Figure S81. ^{13}C NMR Spectrum of **42**

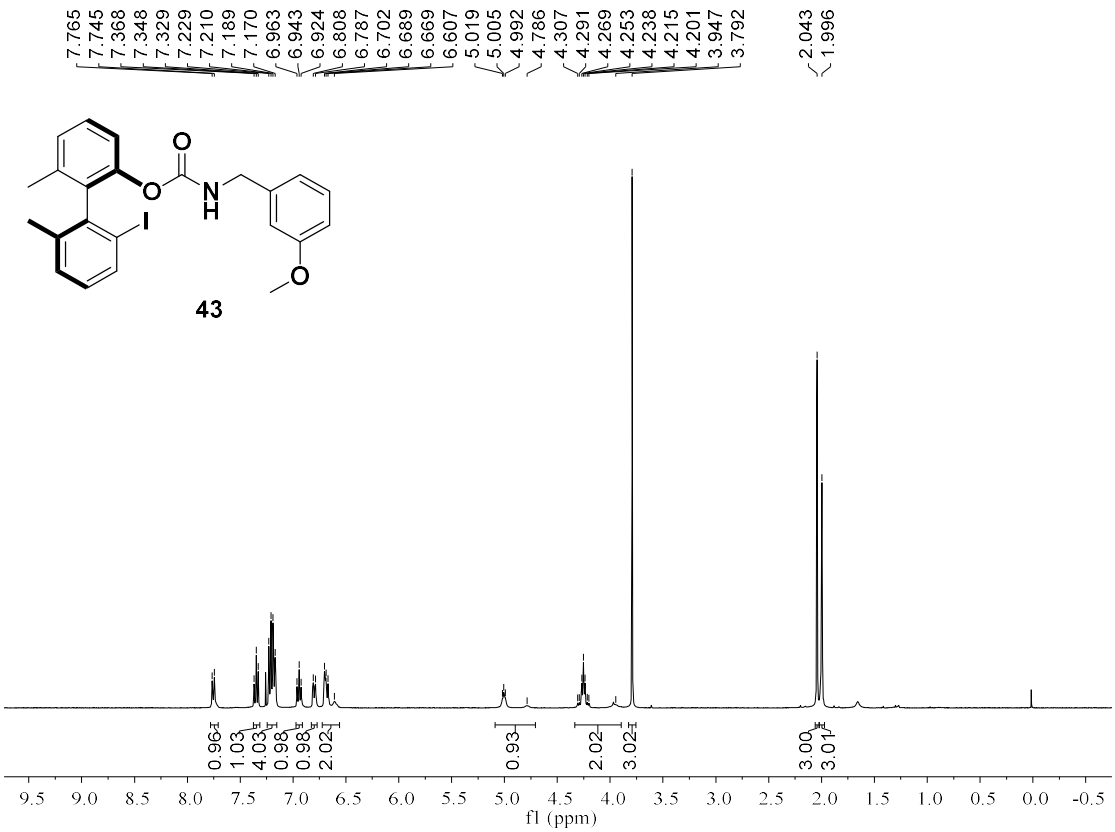


Figure S82. ^{1}H NMR Spectrum of **43**

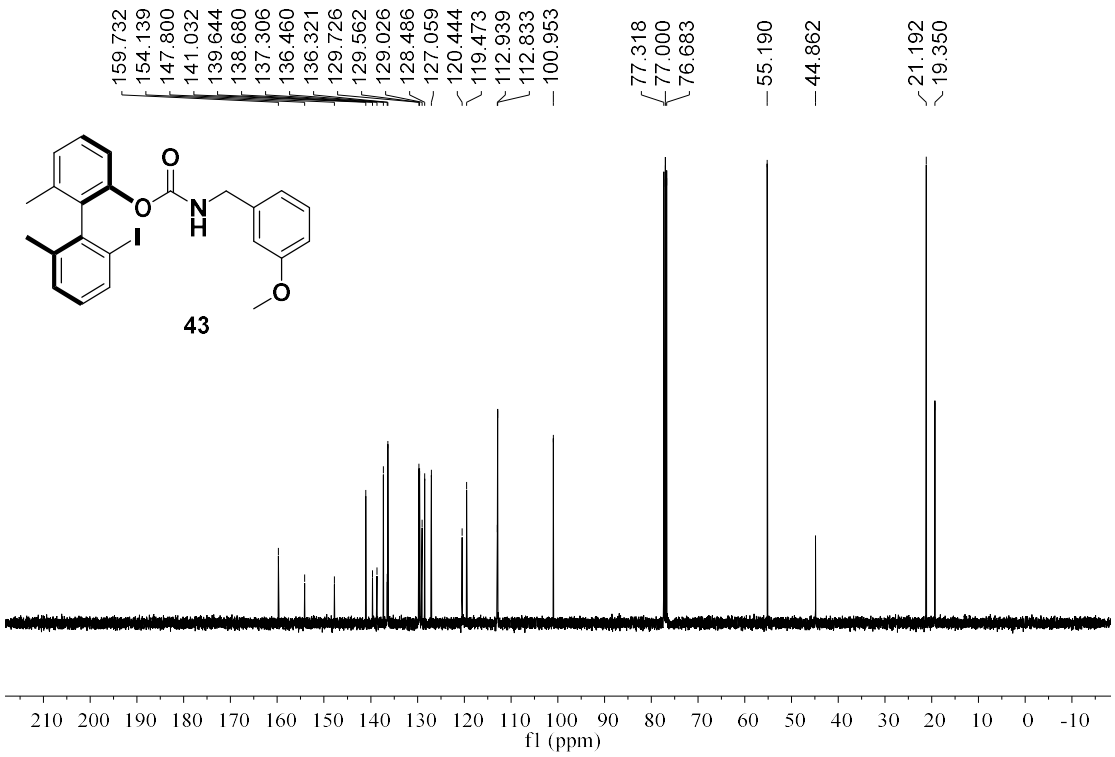


Figure S83. ^{13}C NMR Spectrum of **43**

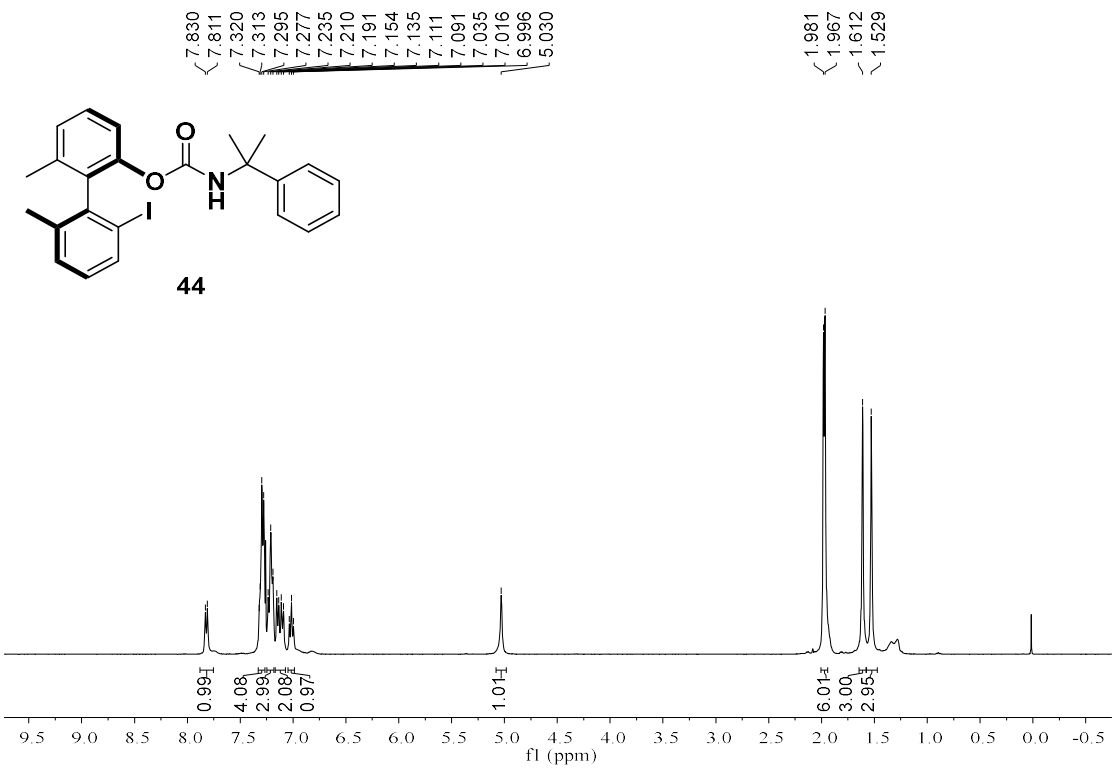


Figure S84. ^{1}H NMR Spectrum of **44**

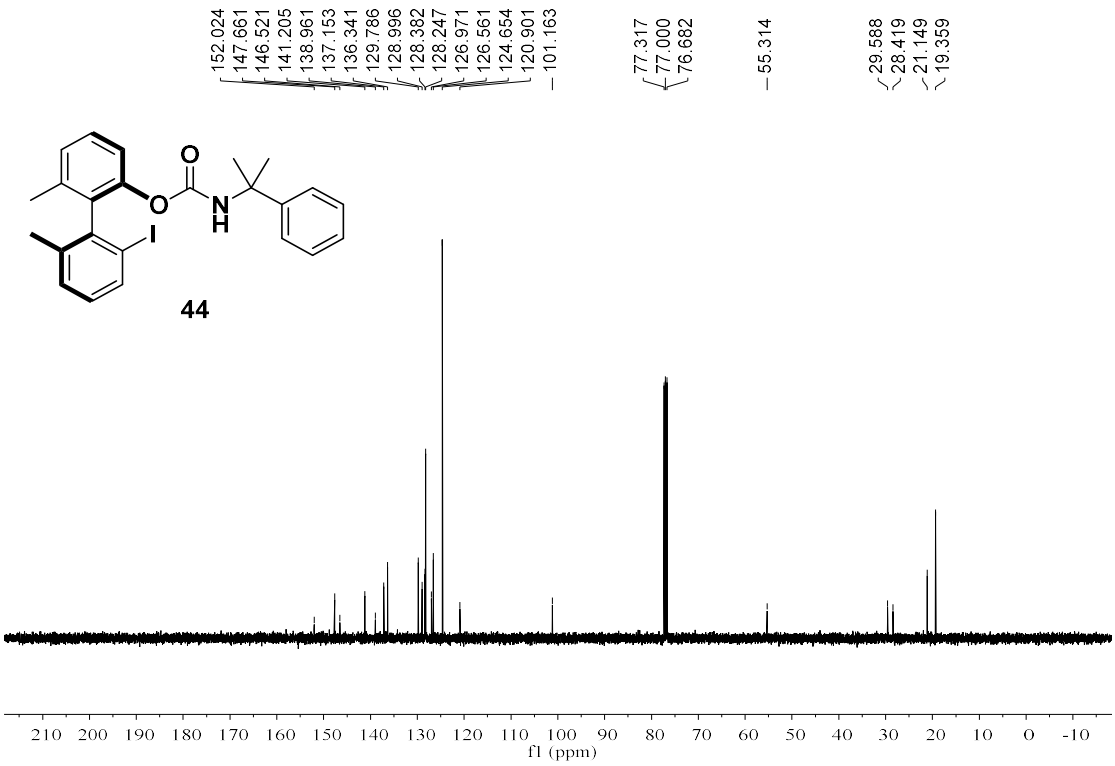


Figure S85. ^{13}C NMR Spectrum of **44**

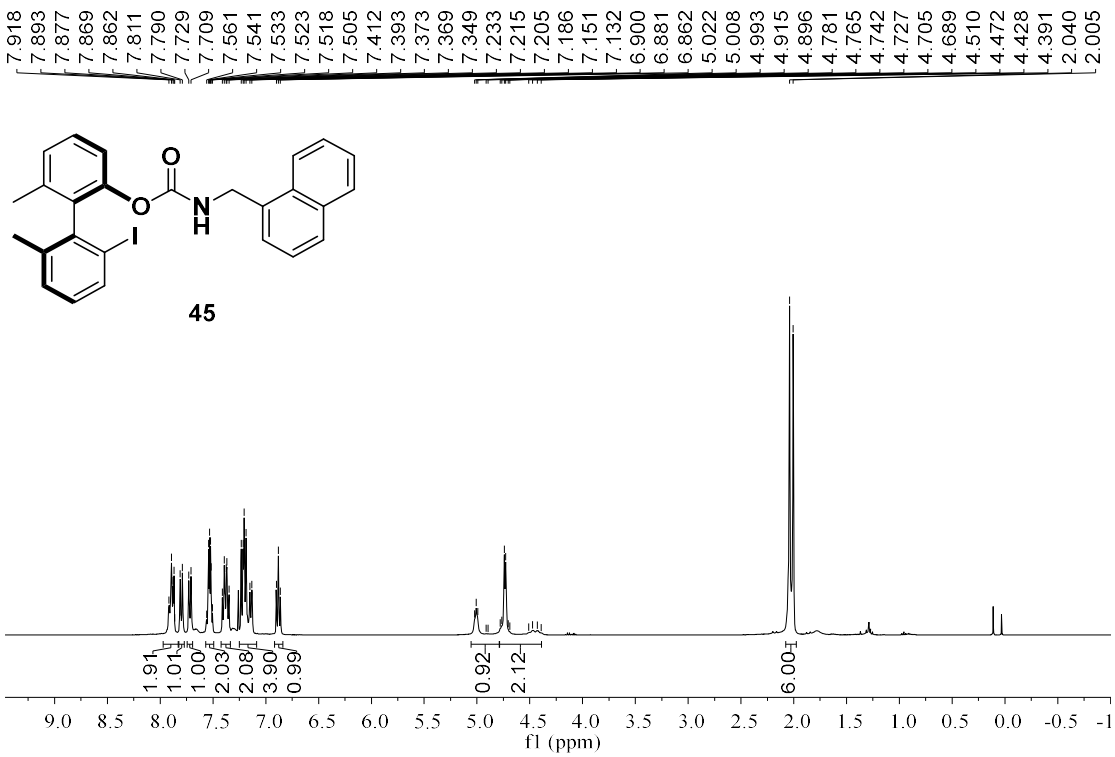


Figure S86. ^{1}H NMR Spectrum of **45**

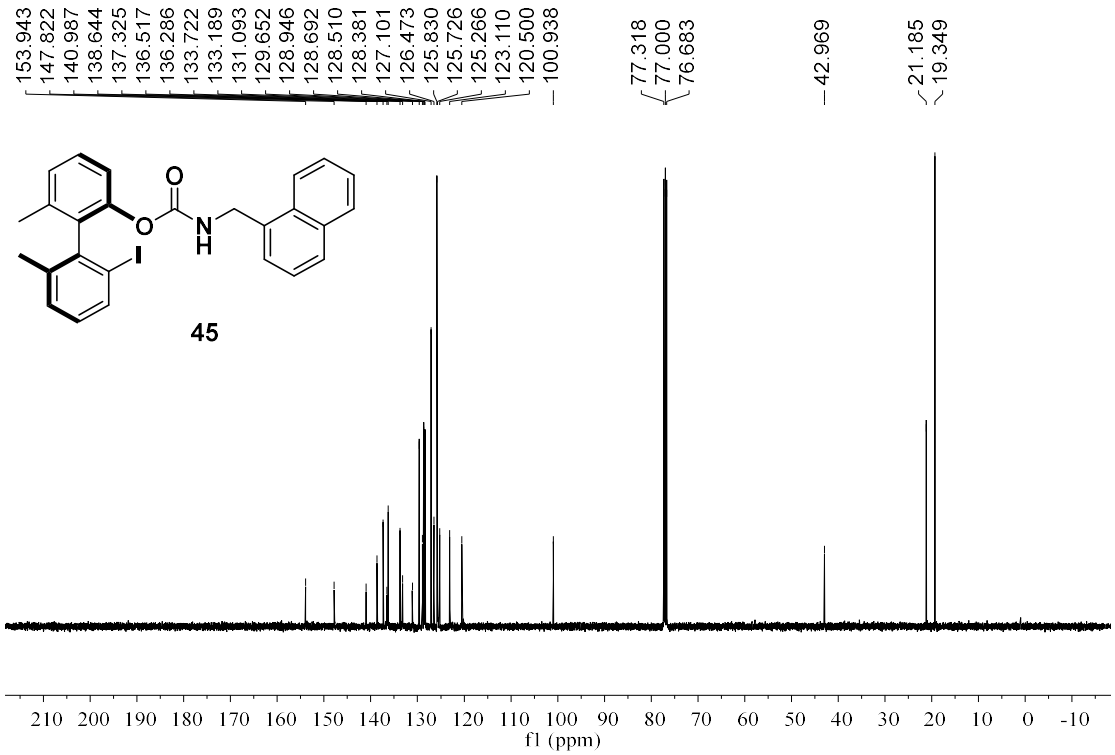


Figure S87. ^{13}C NMR Spectrum of **45**

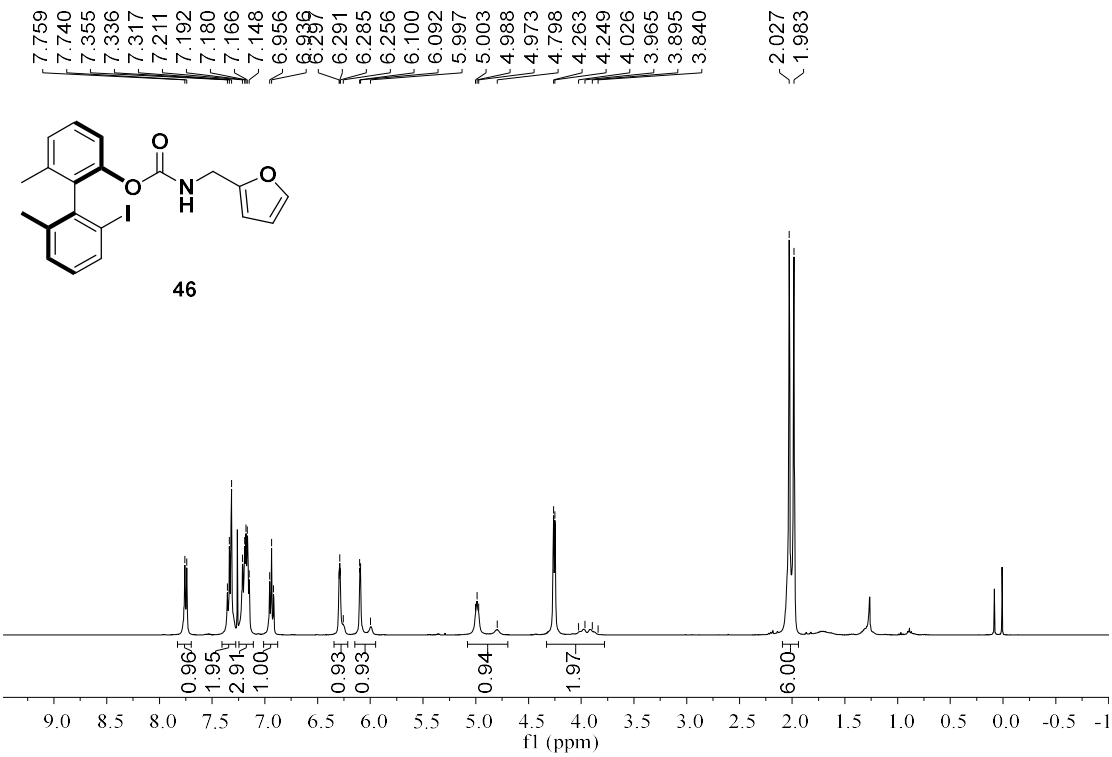


Figure S88. ^{1}H NMR Spectrum of **46**

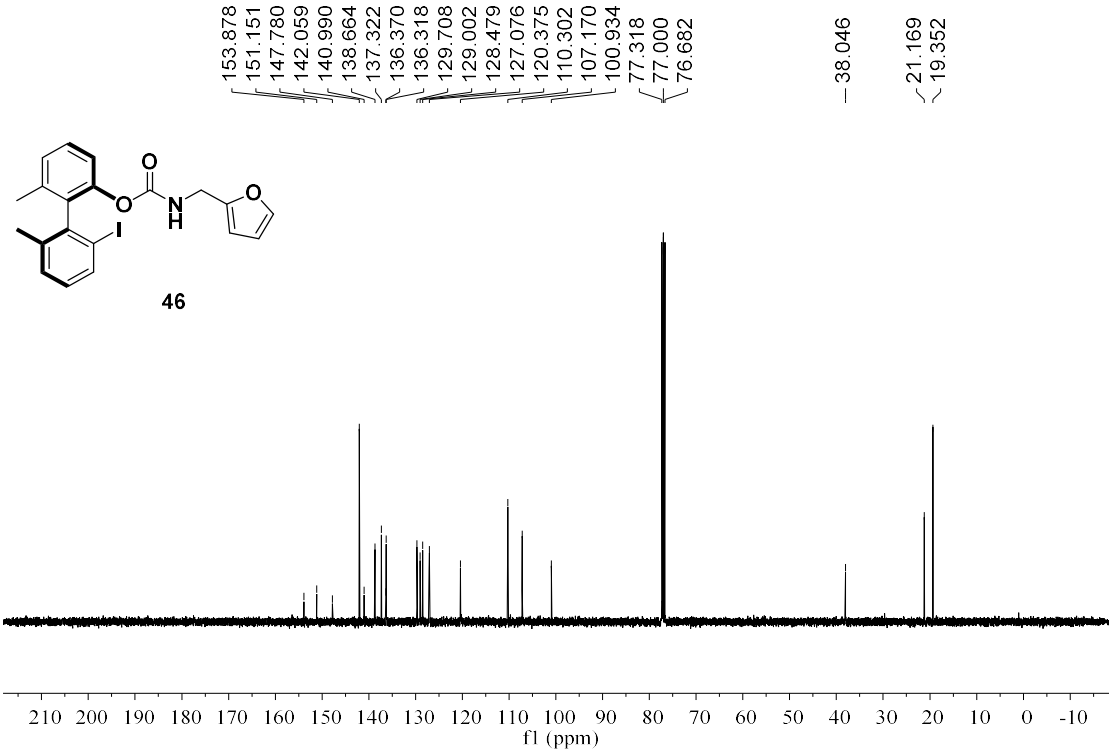


Figure S89. ^{13}C NMR Spectrum of **46**

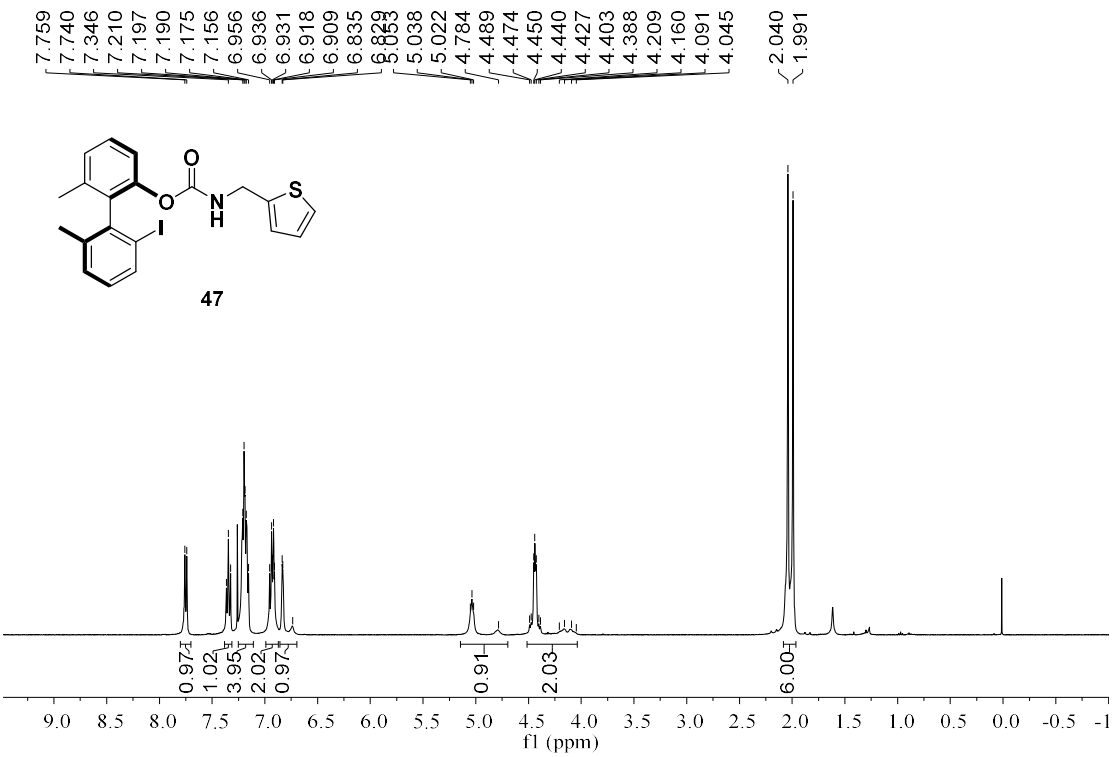


Figure S90. ^{1}H NMR Spectrum of **47**

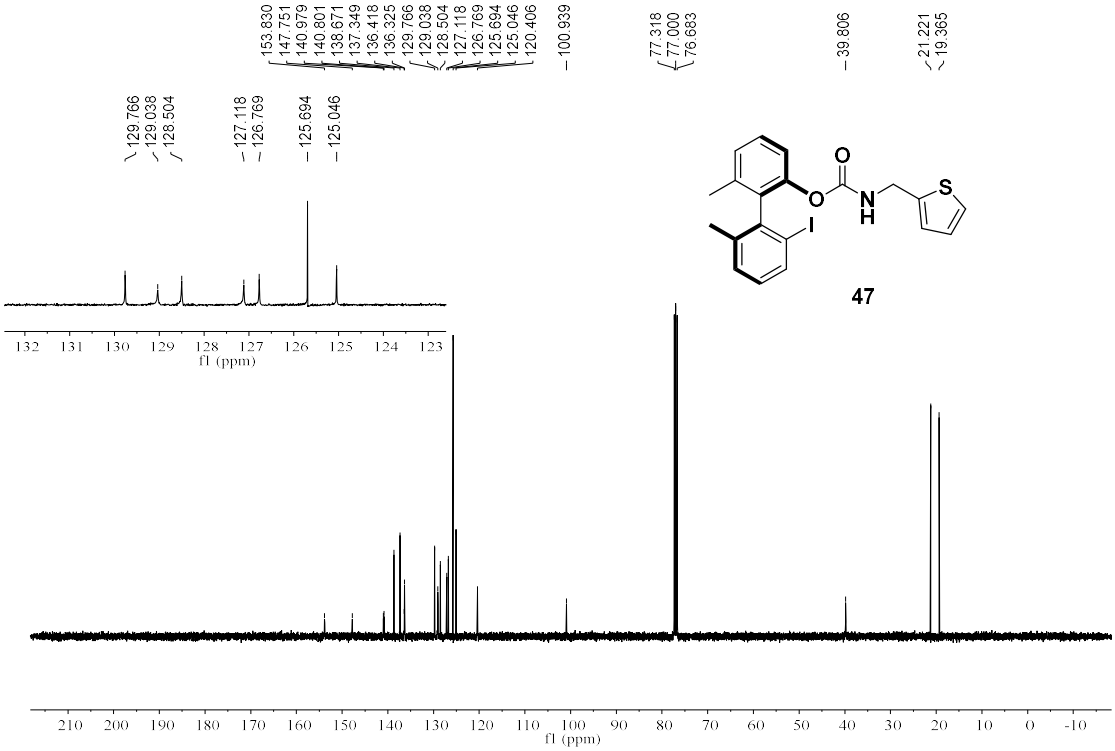


Figure S91. ^{13}C NMR Spectrum of **47**

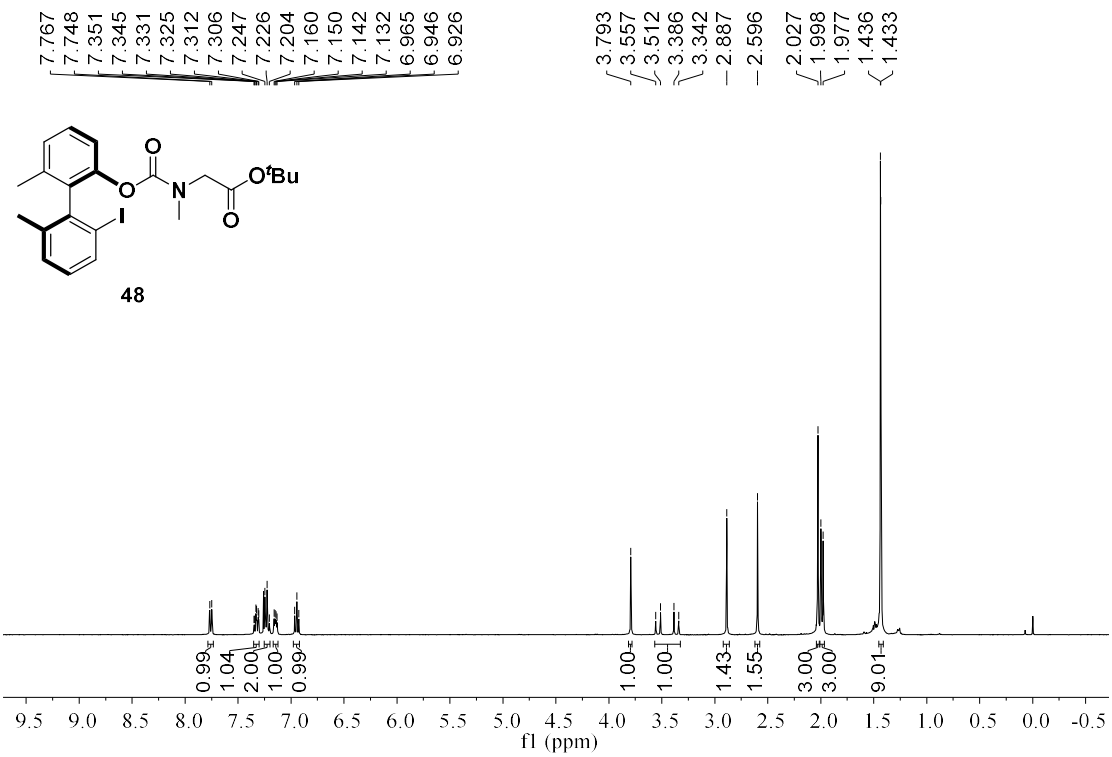


Figure S92. ^{1}H NMR Spectrum of **48**

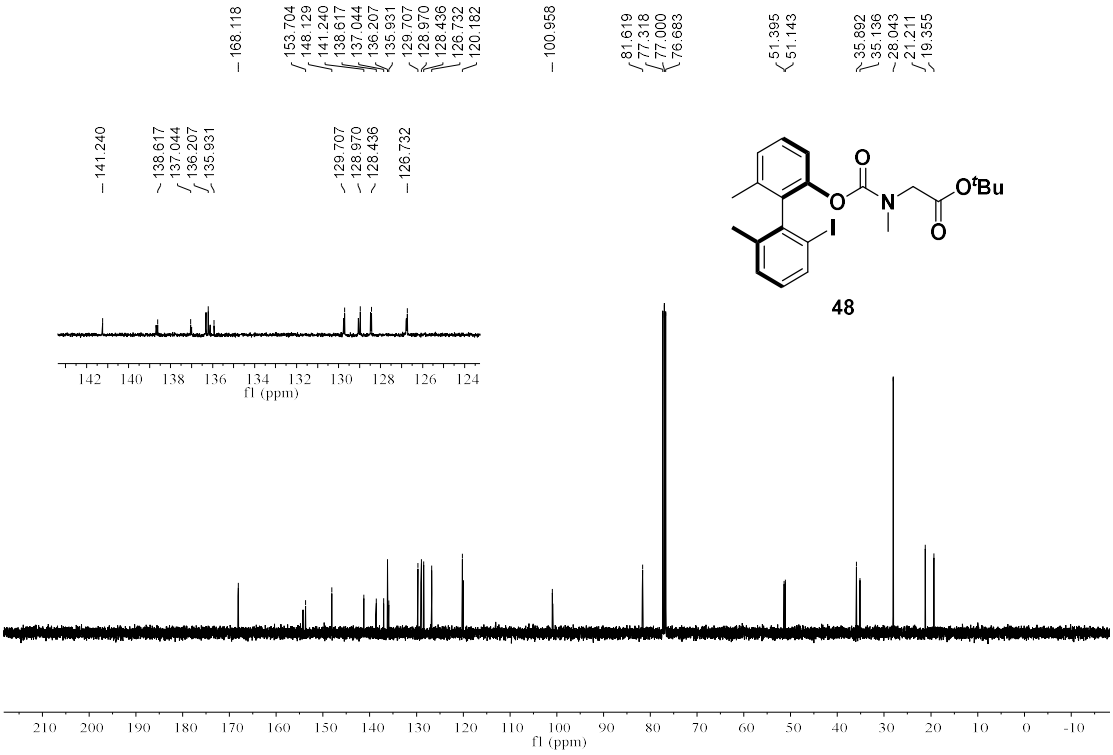


Figure S93. ^{13}C NMR Spectrum of **48**

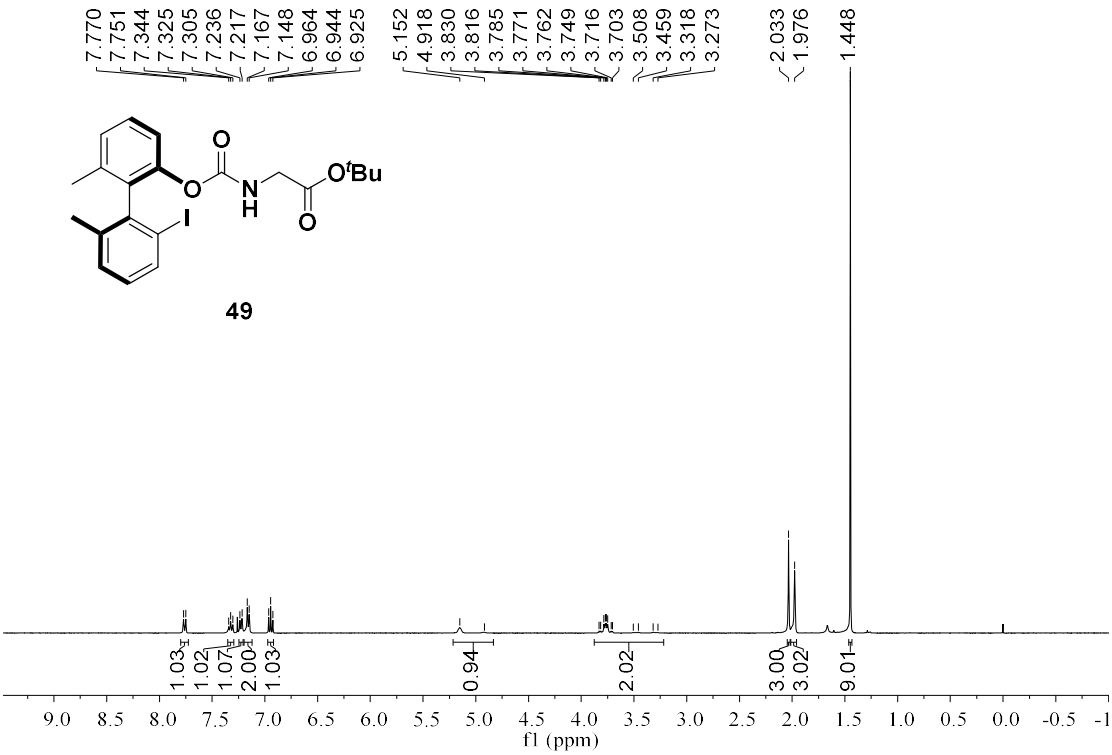


Figure S94. ^{1}H NMR Spectrum of **49**

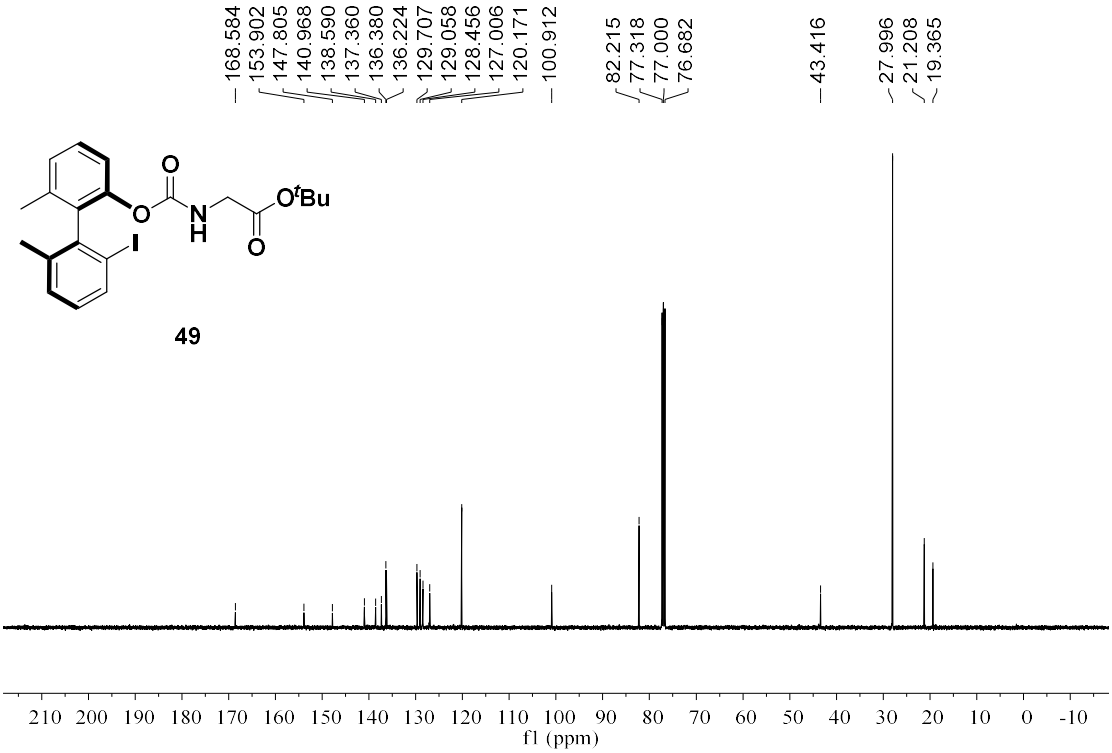


Figure S95. ^{13}C NMR Spectrum of **49**

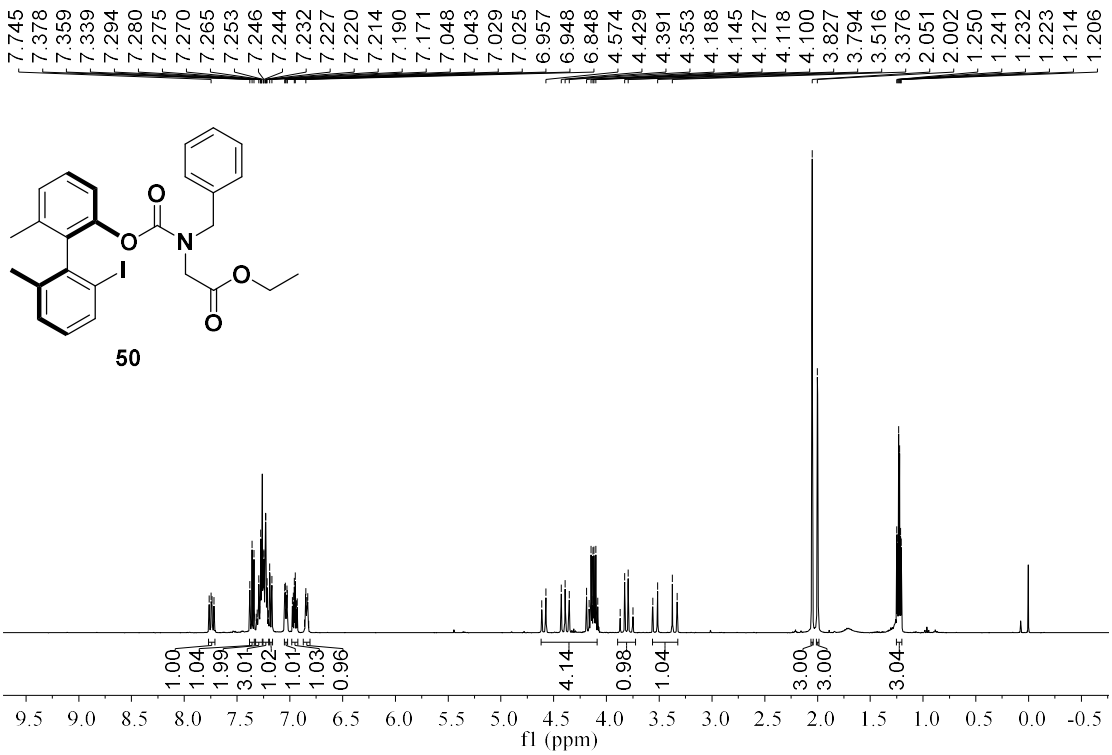


Figure S96. ^{1}H NMR Spectrum of **50**

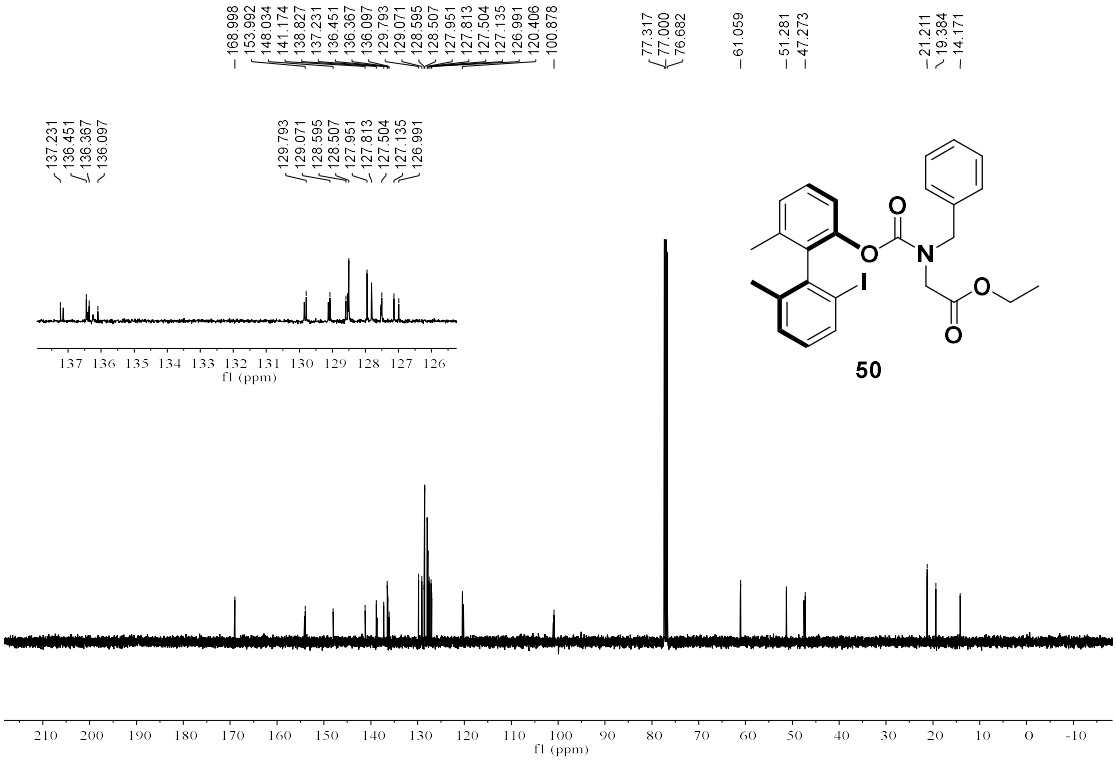


Figure S97. ^{13}C NMR Spectrum of **50**

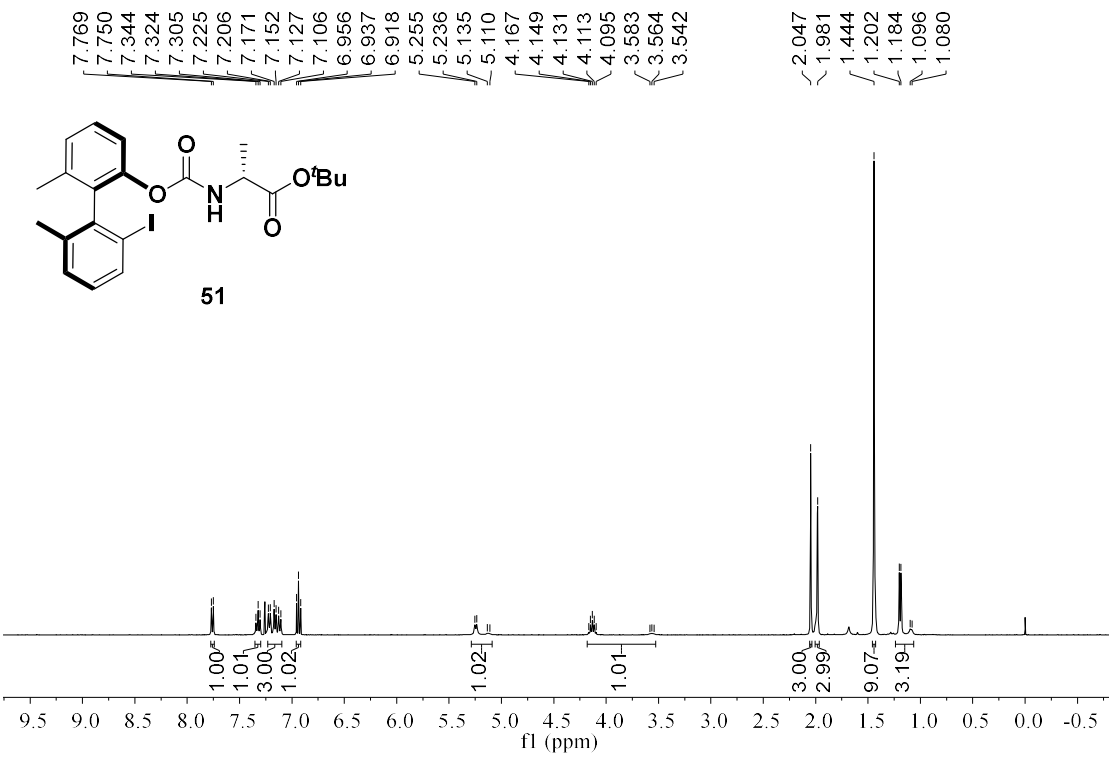


Figure S98. ^{1}H NMR Spectrum of **51**

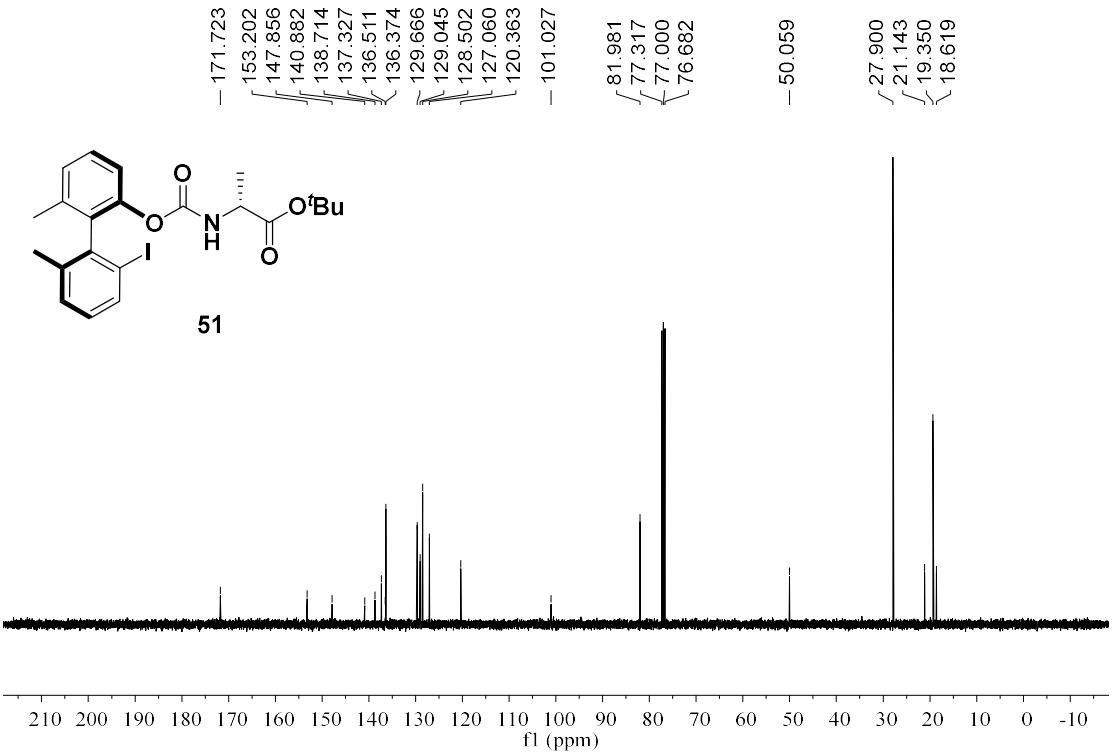


Figure S99. ^{13}C NMR Spectrum of **51**

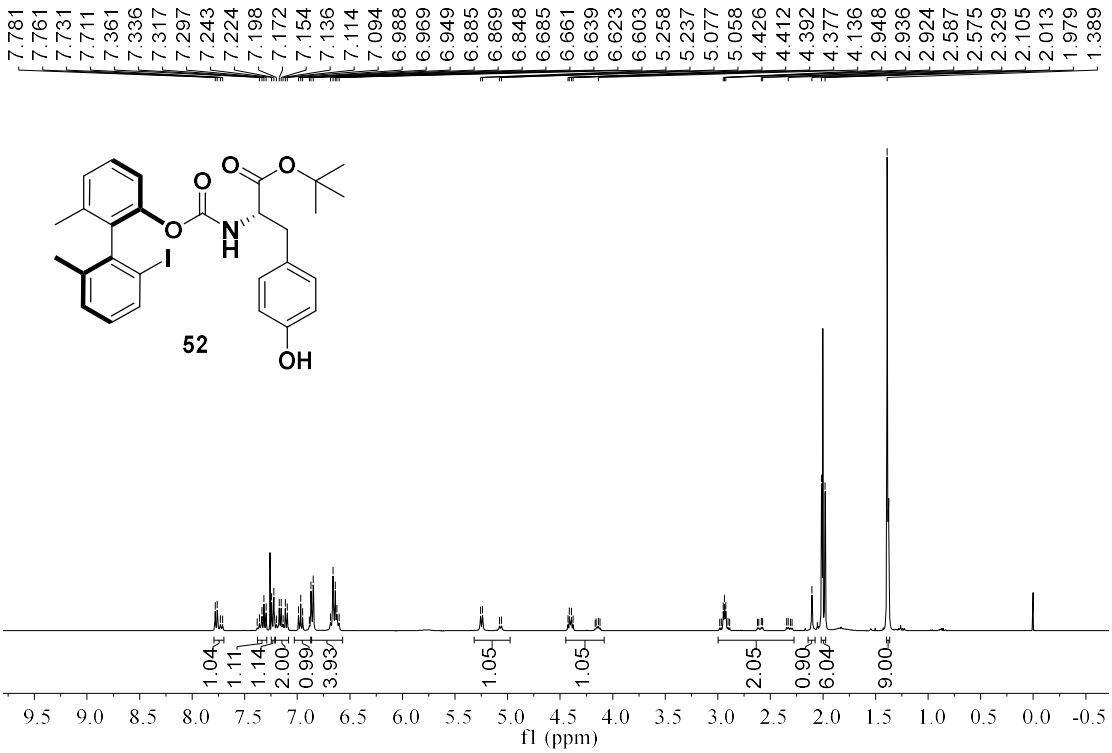


Figure S100. ^{1}H NMR Spectrum of **52**

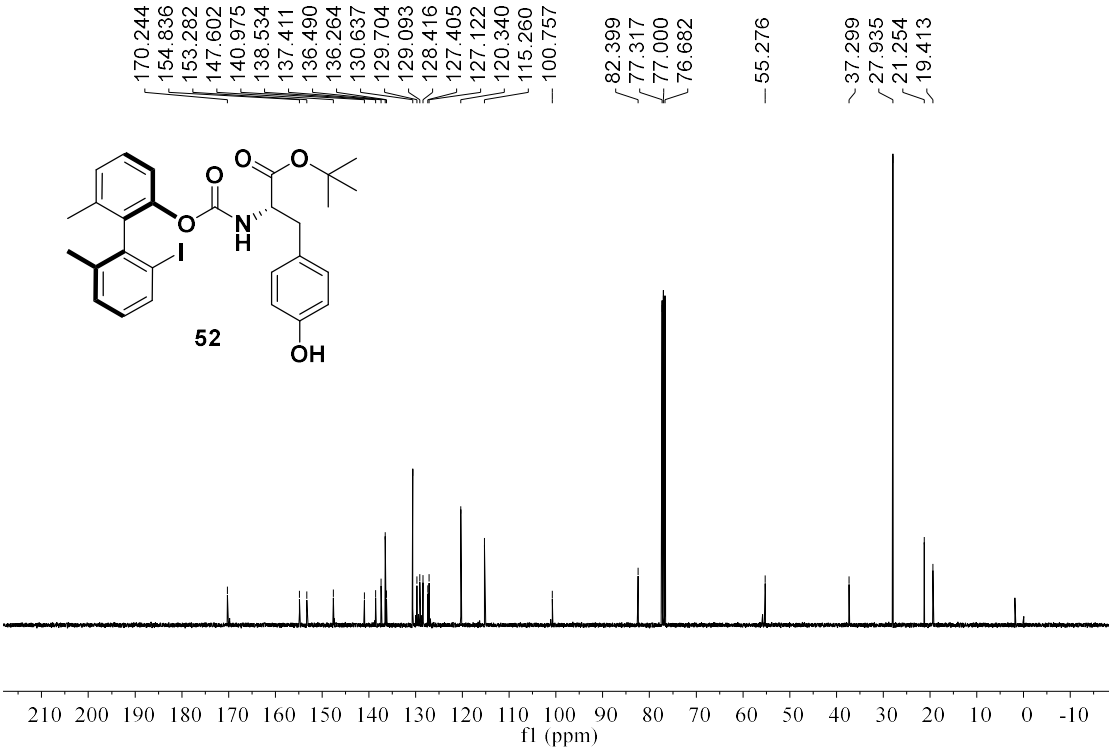


Figure S101. ^{13}C NMR Spectrum of **52**

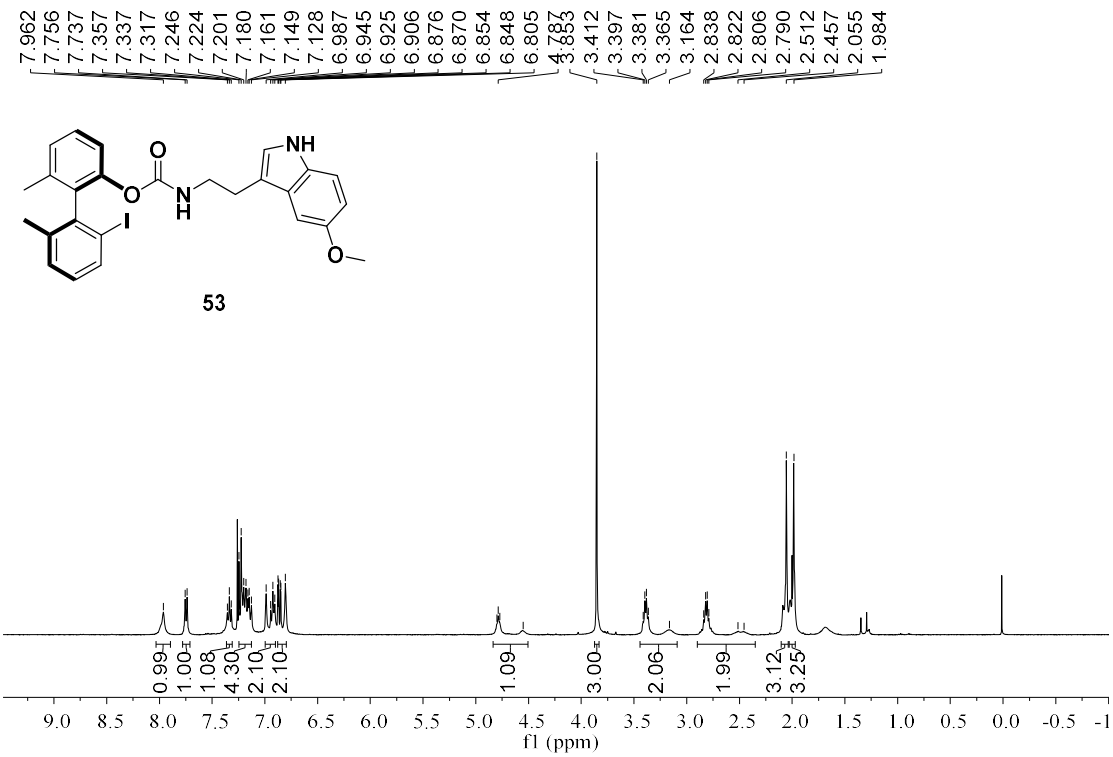


Figure S102. ^{1}H NMR Spectrum of **53**

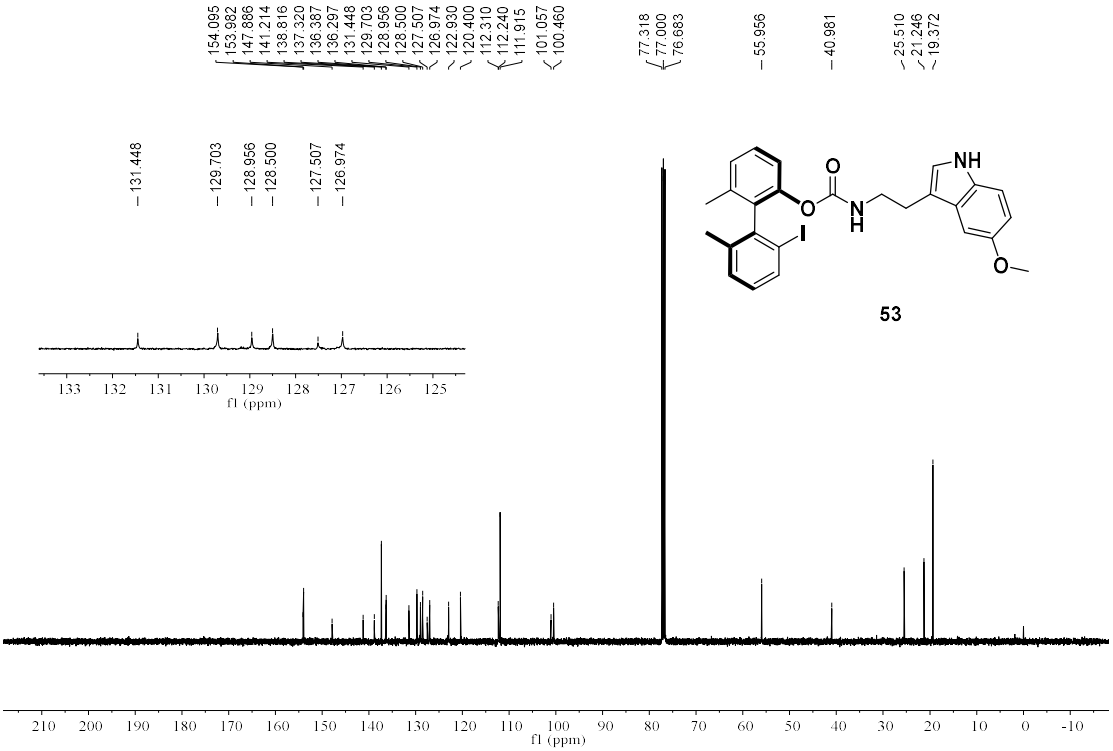


Figure S103. ^{13}C NMR Spectrum of **53**

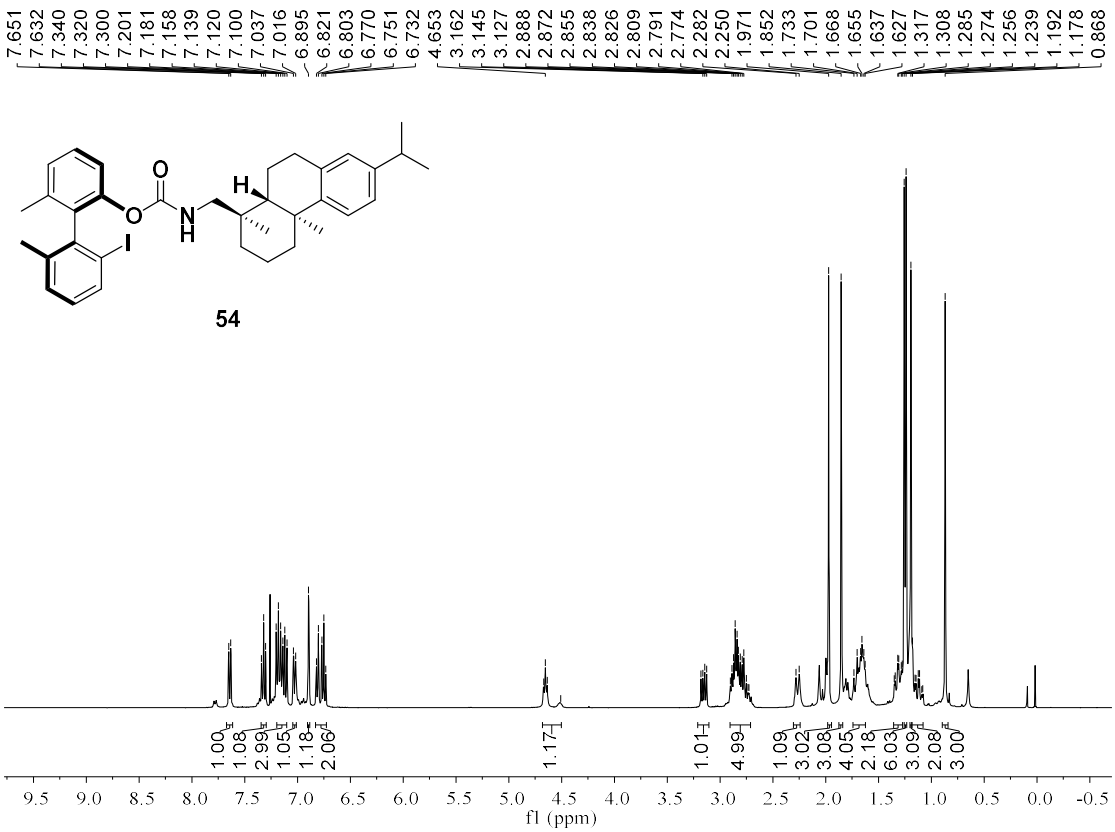


Figure S104. ^{1}H NMR Spectrum of **54**

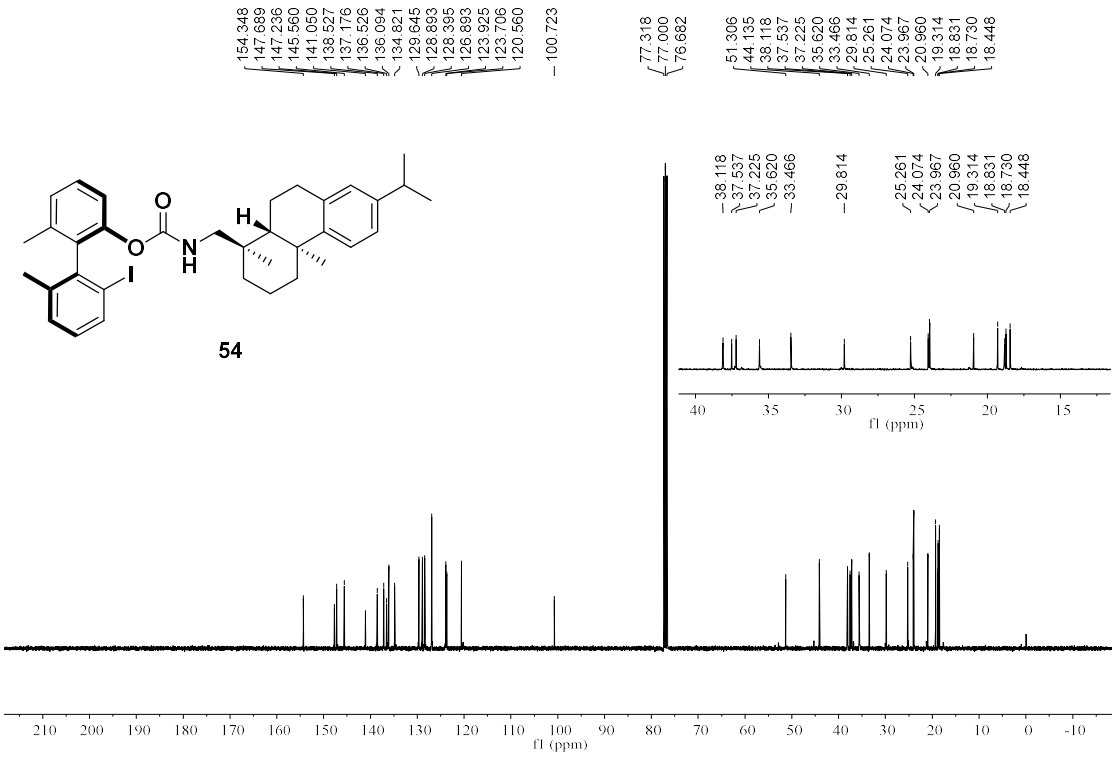


Figure S105. ^{13}C NMR Spectrum of **54**

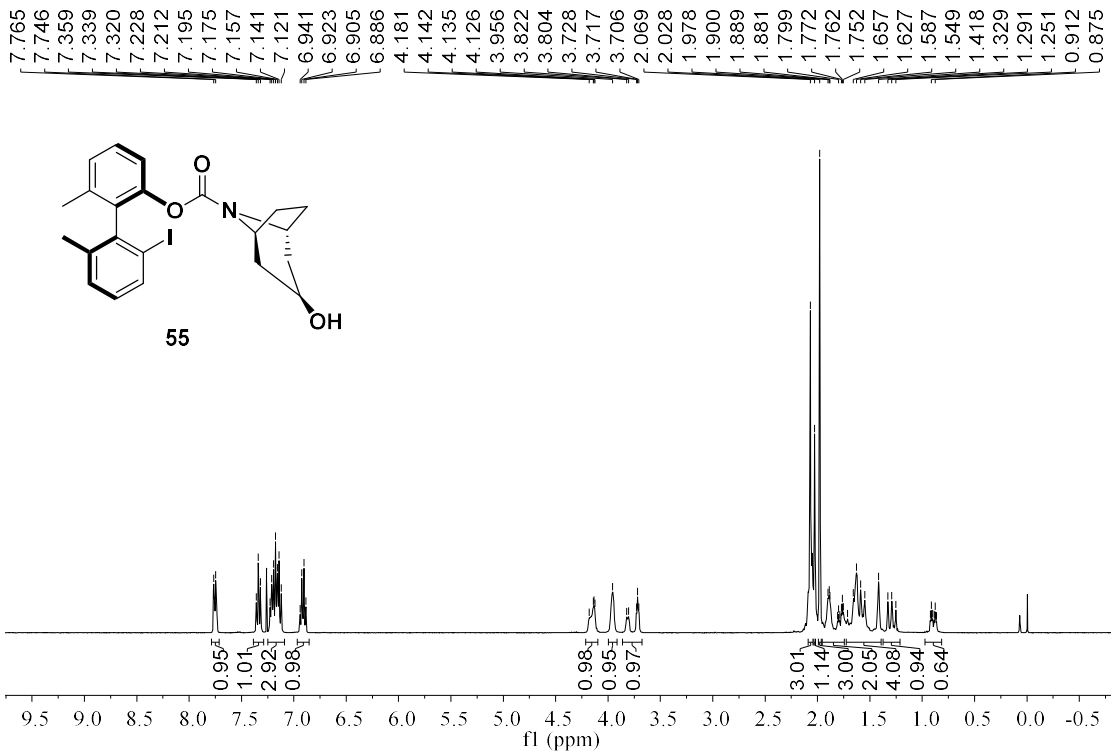


Figure S106. ^{1}H NMR Spectrum of **55**

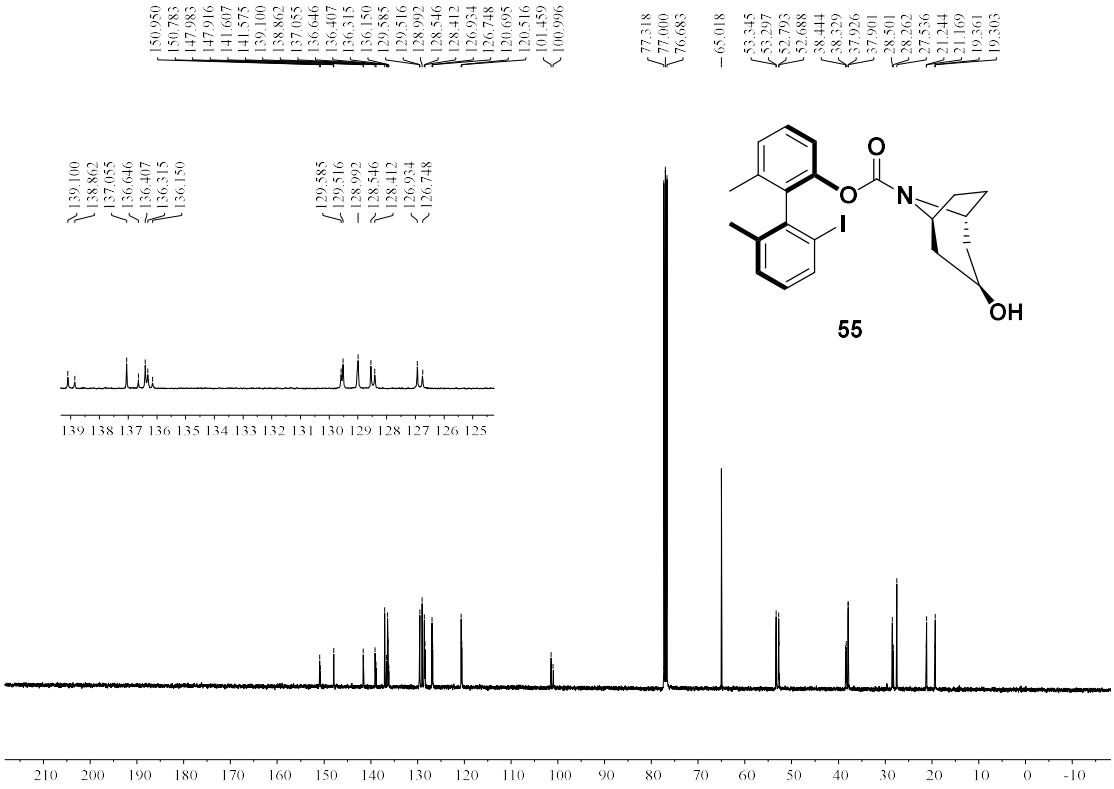


Figure S107. ^{13}C NMR Spectrum of **55**

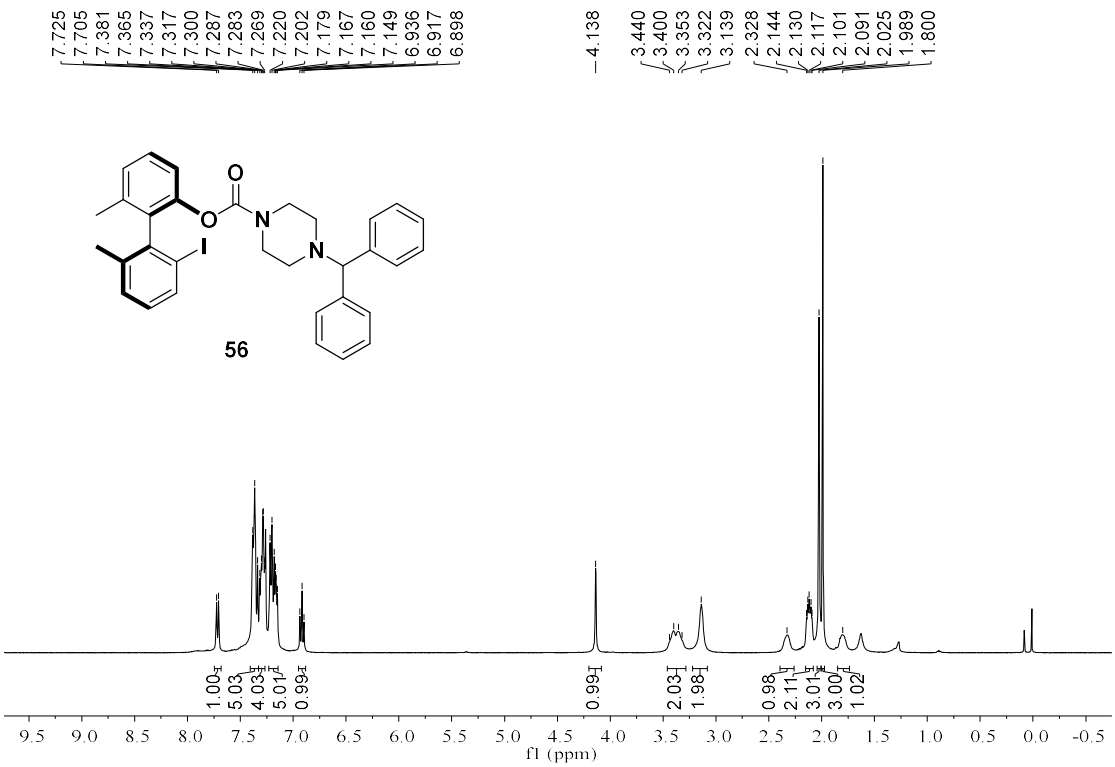


Figure S108. ^{1}H NMR Spectrum of **56**

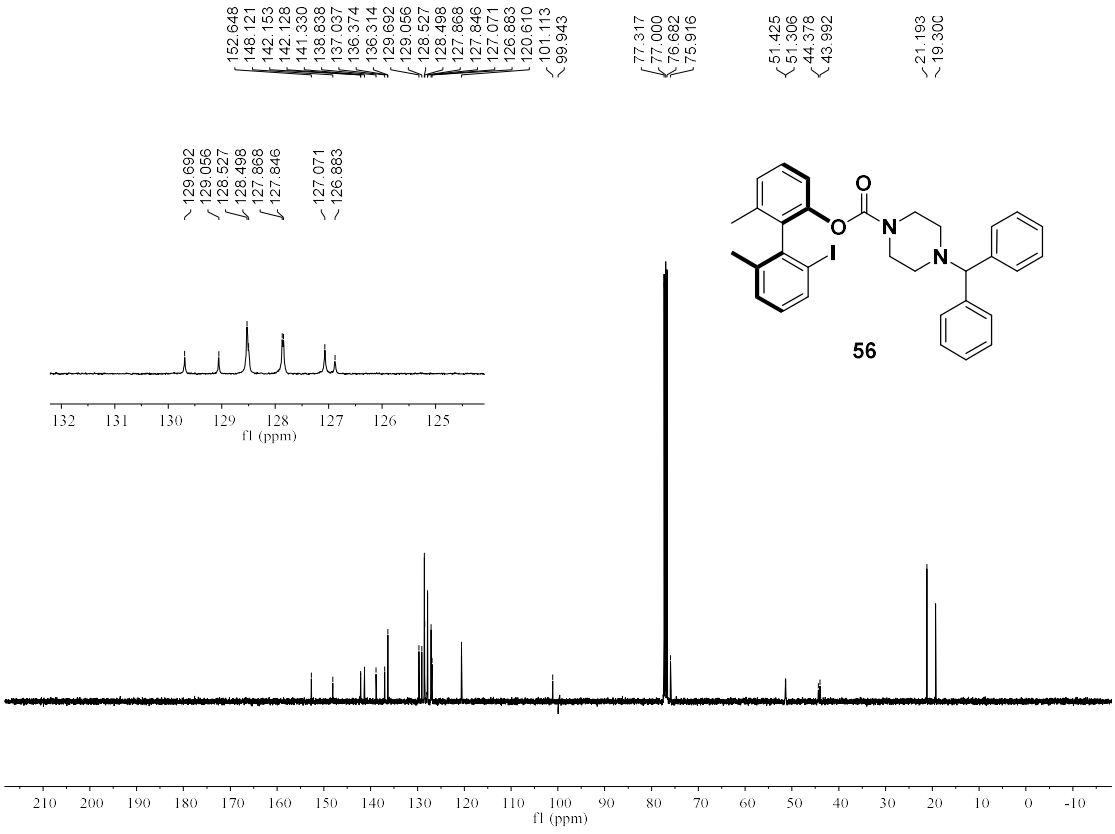


Figure S109. ^{13}C NMR Spectrum of **56**

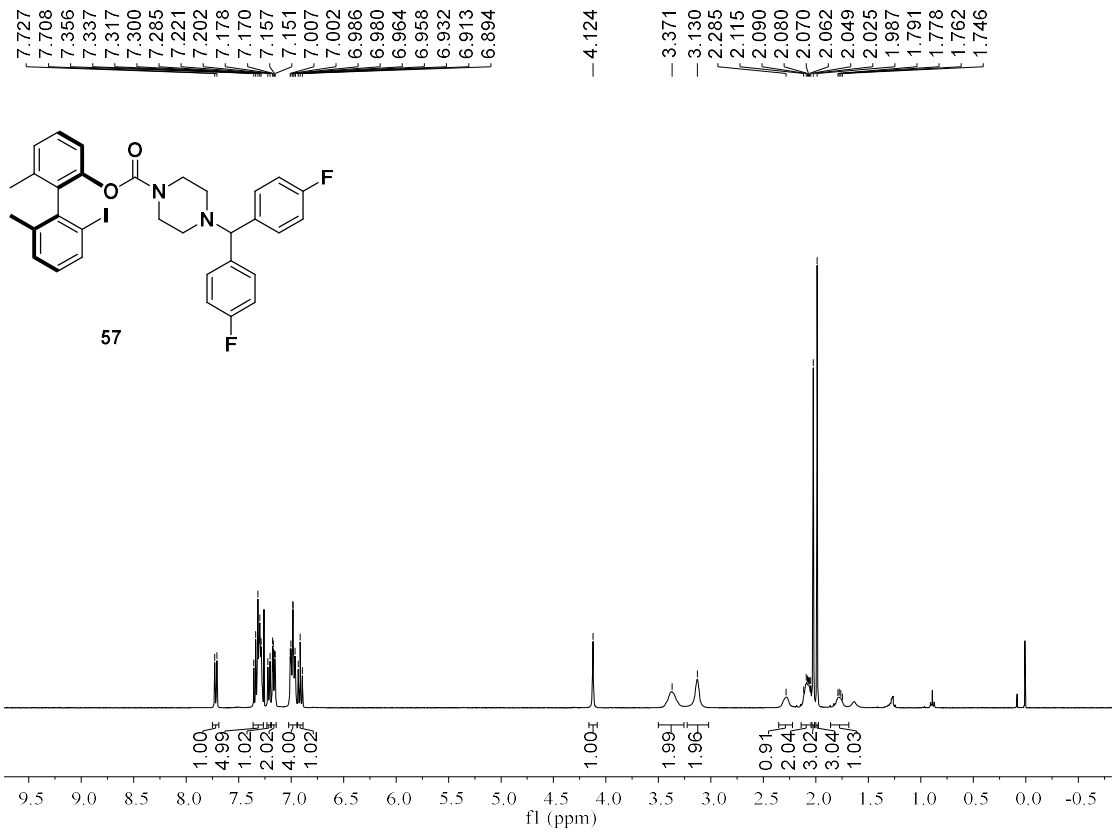


Figure S110. ^{1}H NMR Spectrum of **57**

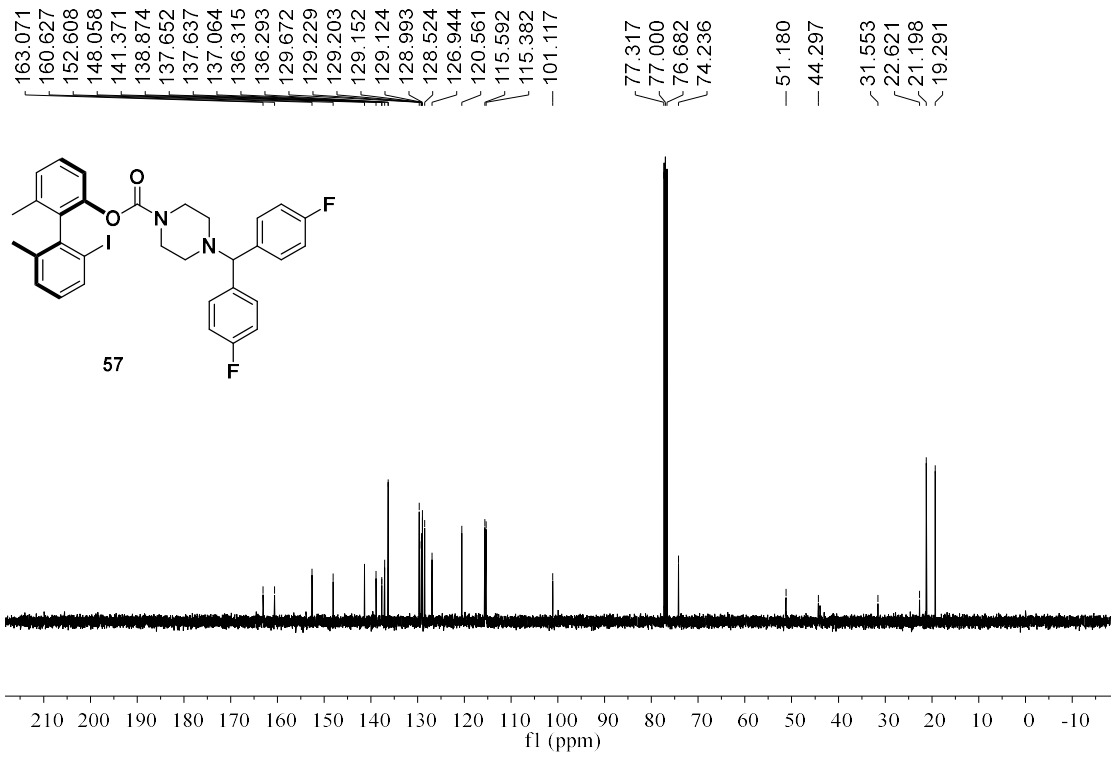


Figure S111. ^{13}C NMR Spectrum of **57**

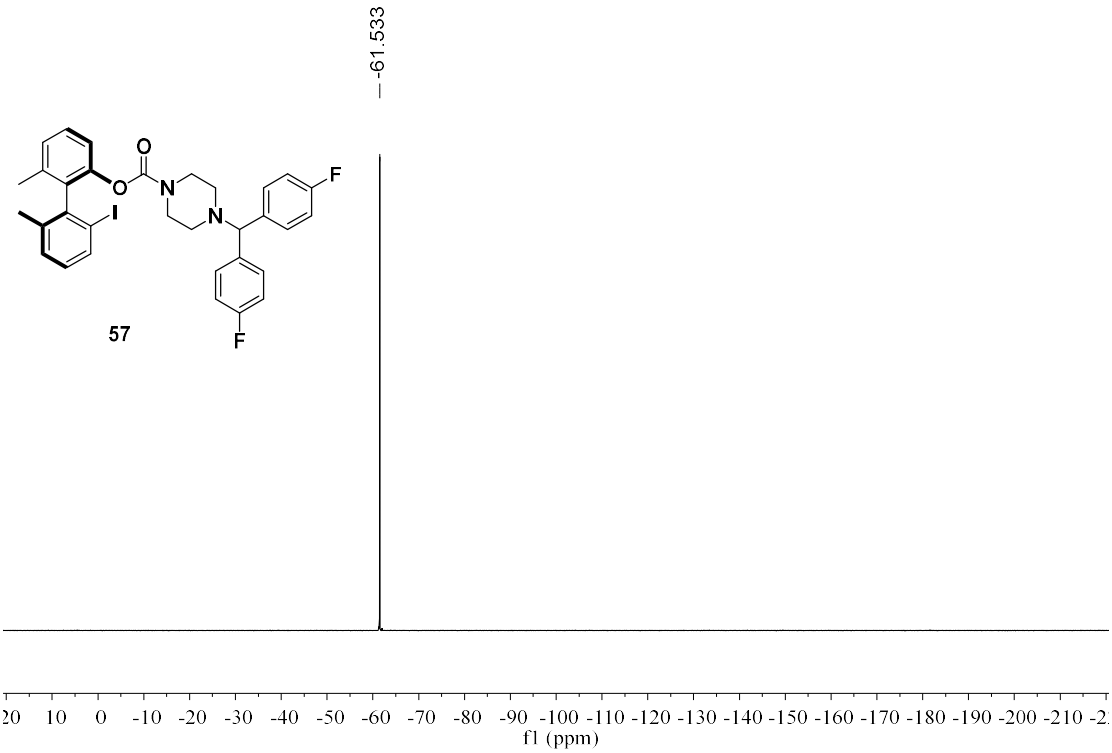


Figure S112. ^{19}F NMR Spectrum of **57**

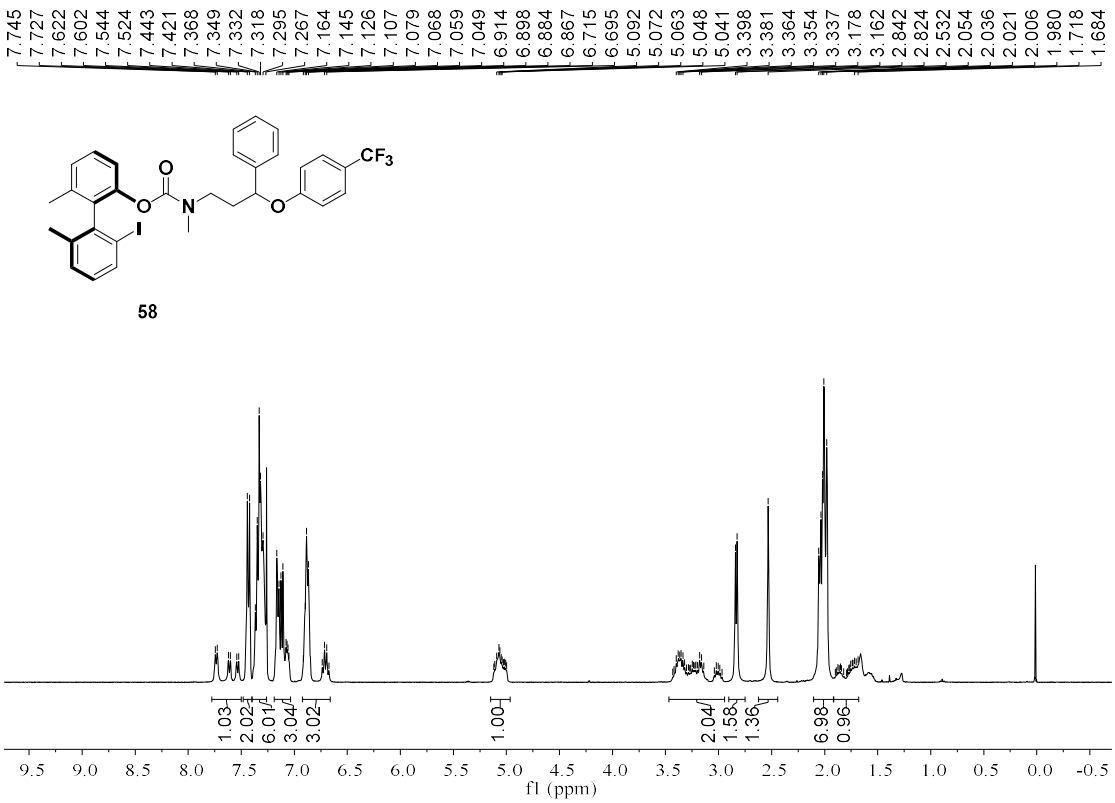


Figure S113. ^{1}H NMR Spectrum of **58**

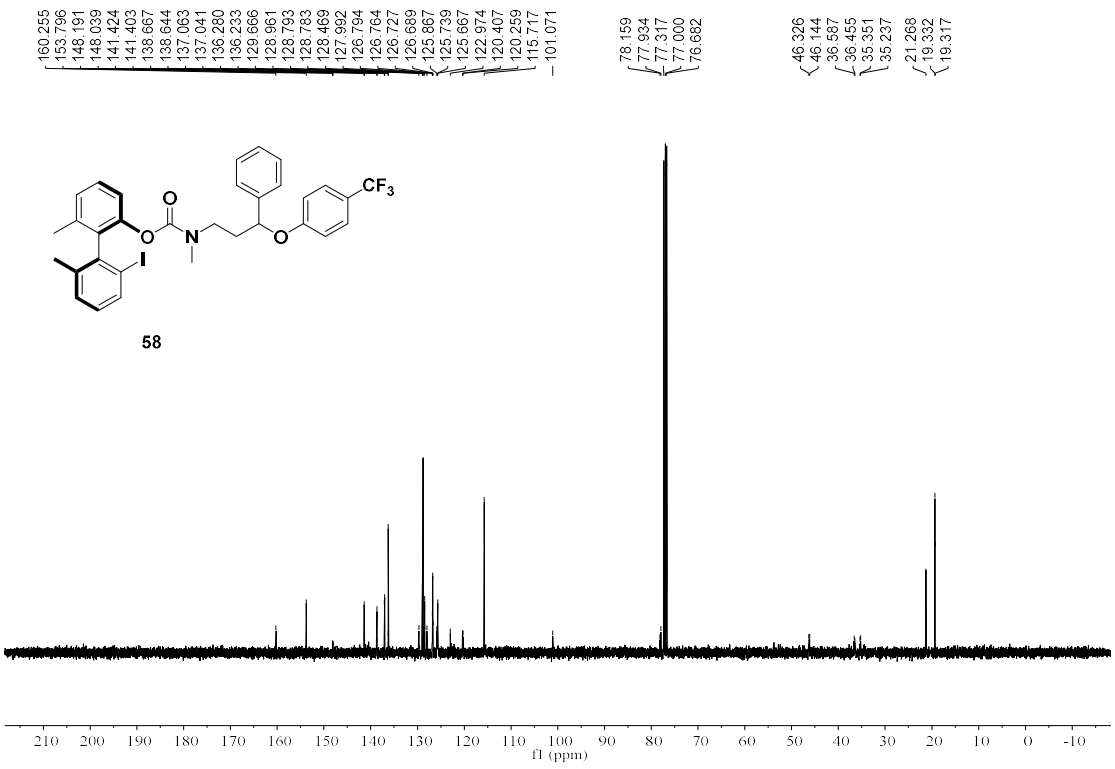


Figure S114. ^{13}C NMR Spectrum of **58**

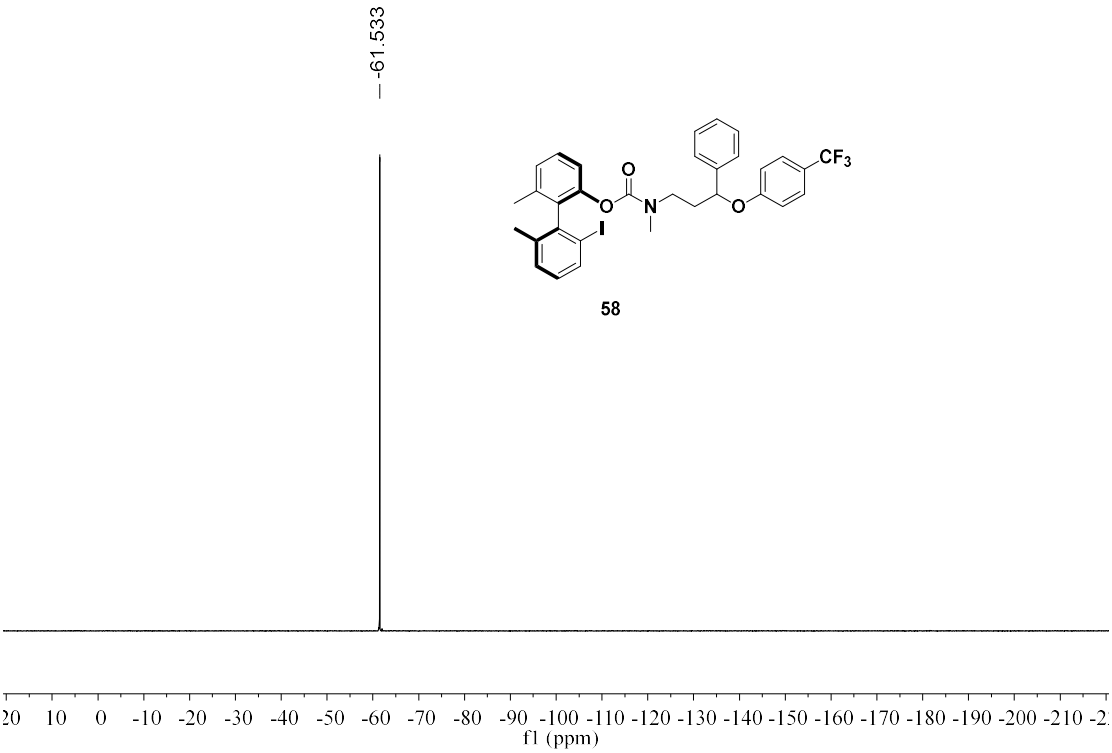


Figure S115. ^{19}F NMR Spectrum of **58**

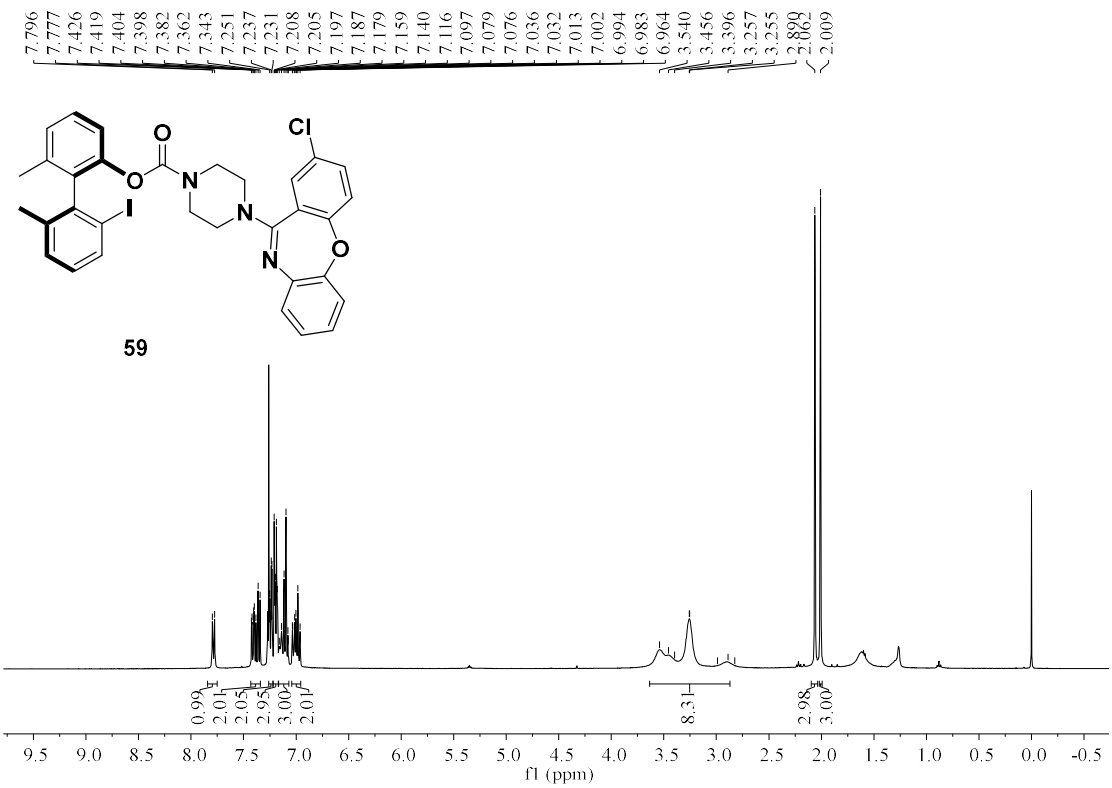


Figure S116. ^{1}H NMR Spectrum of **59**

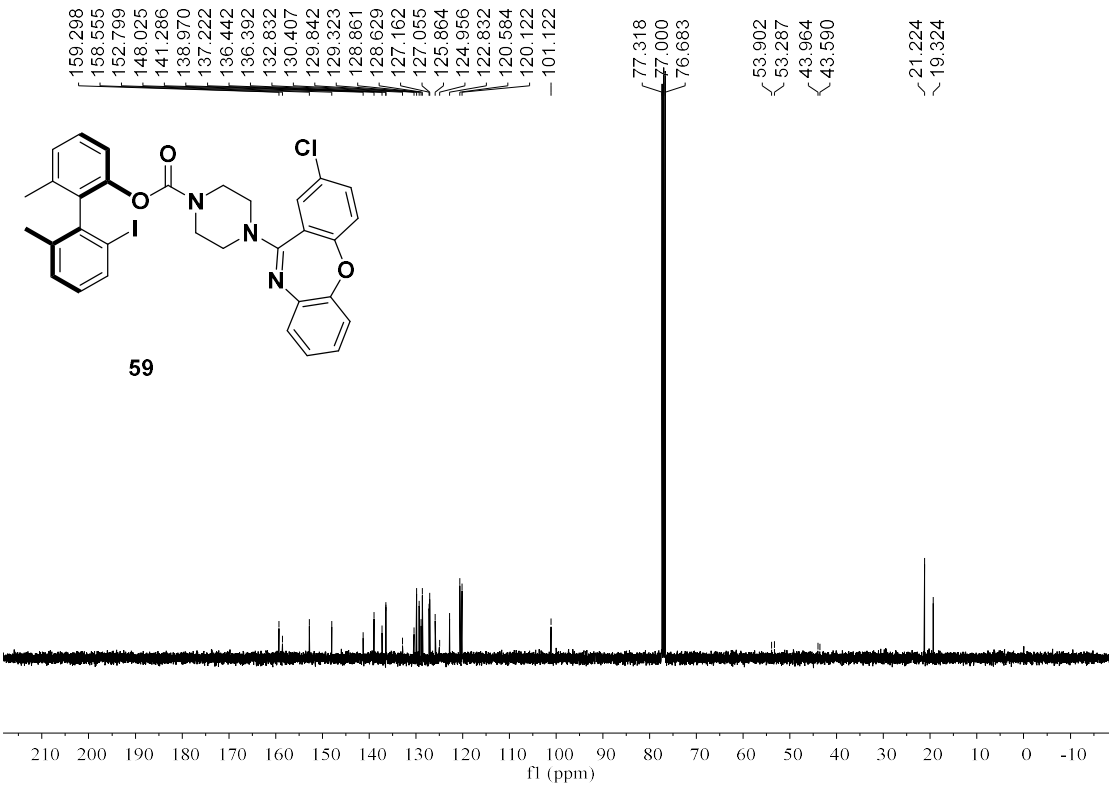


Figure S117. ^{13}C NMR Spectrum of **59**

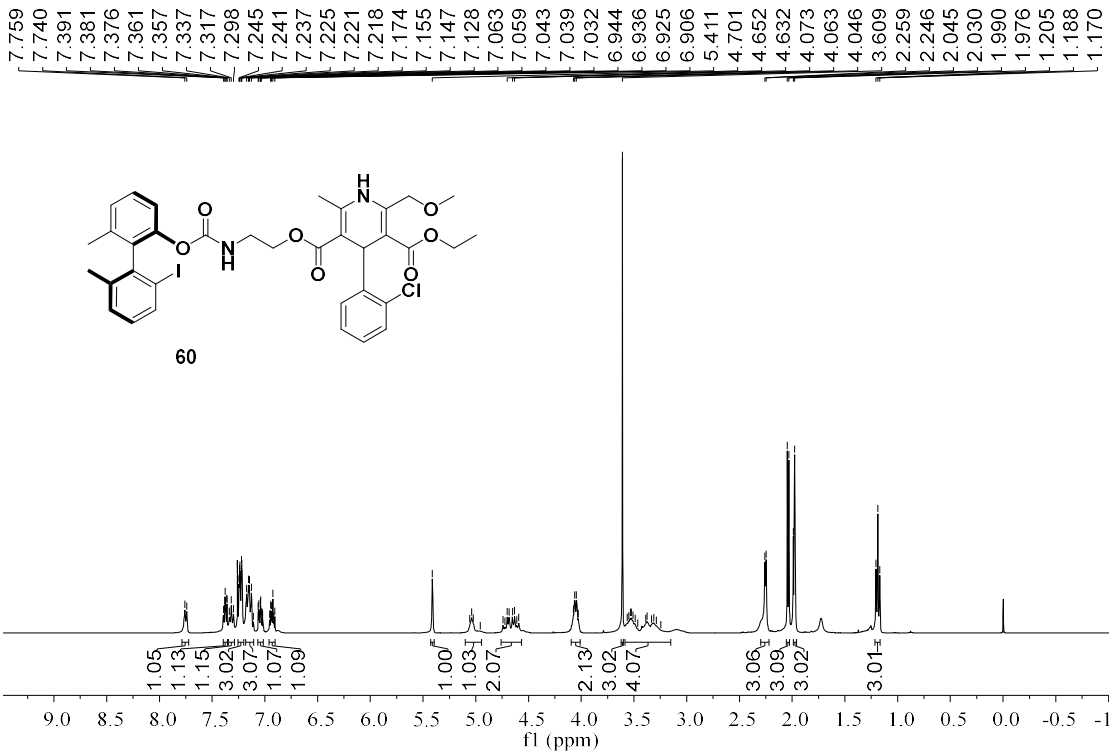


Figure S118. ^{1}H NMR Spectrum of **60**

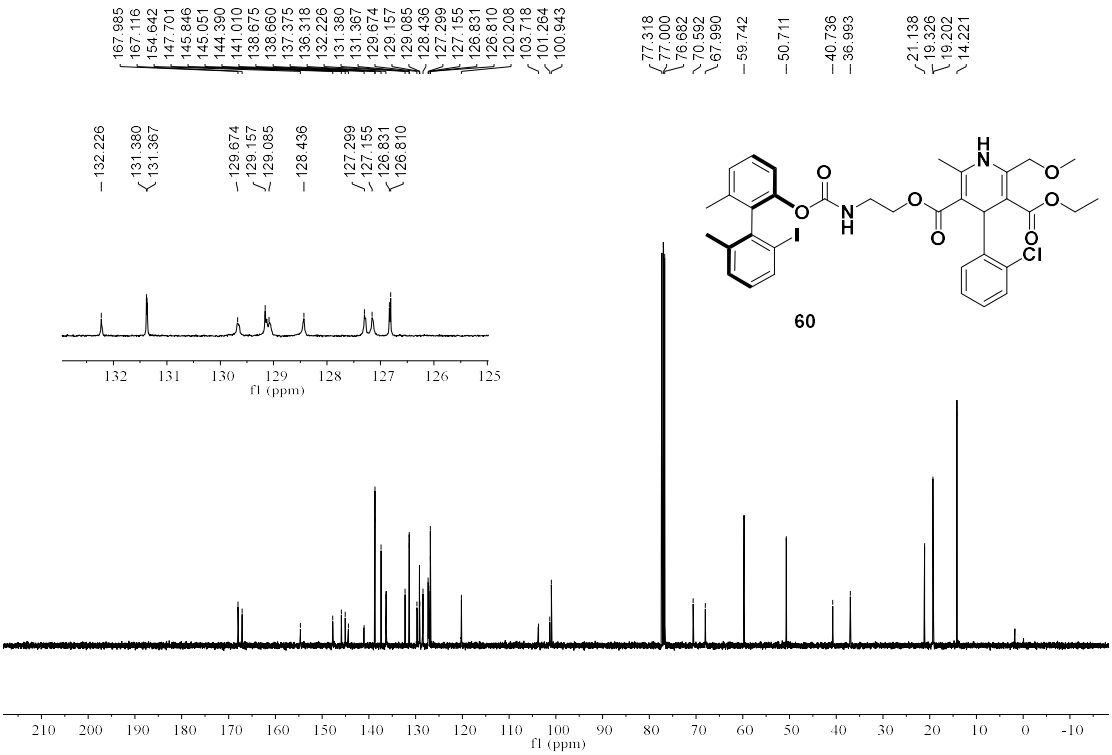


Figure S119. ^{13}C NMR Spectrum of **60**

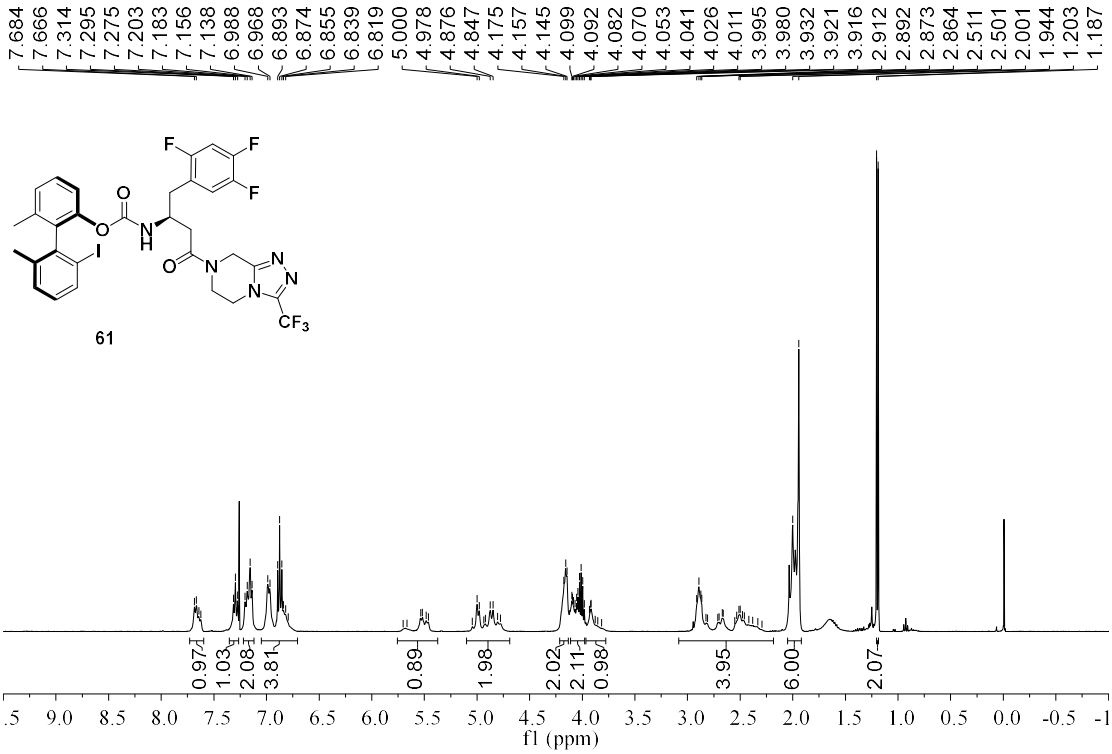


Figure S120. ^{1}H NMR Spectrum of **61**

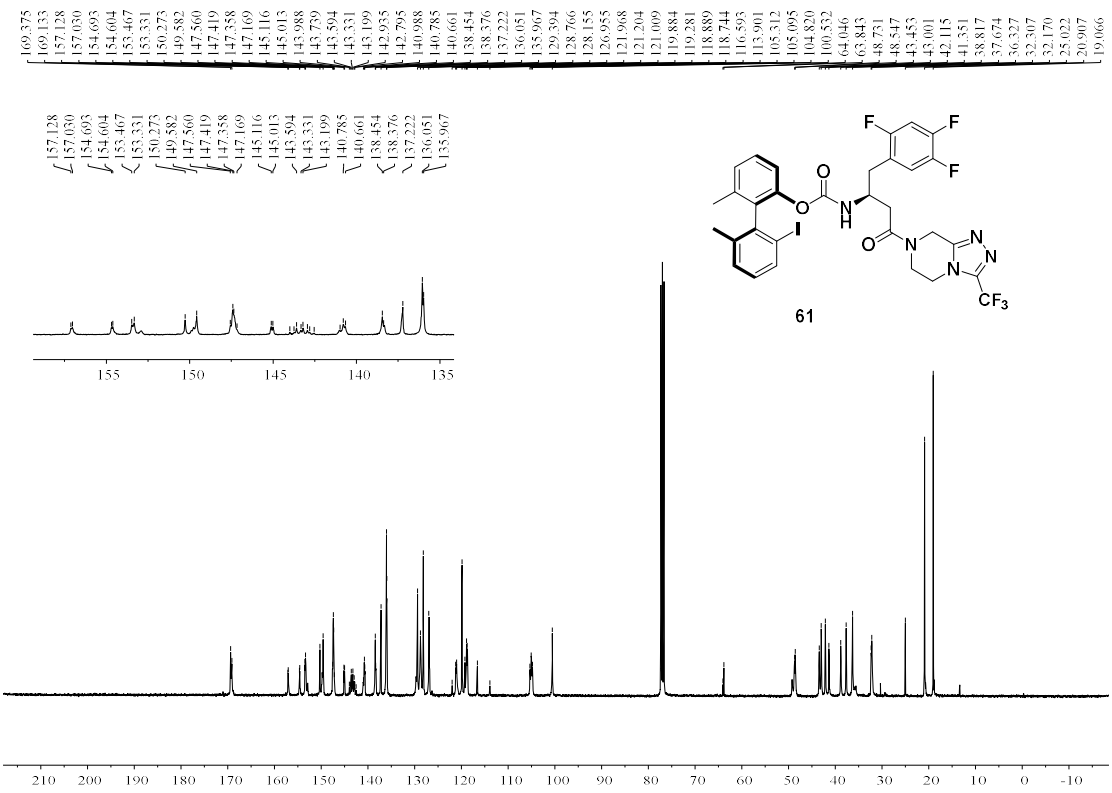


Figure S121. ^{13}C NMR Spectrum of **61**

Supplementary Figure 122. ^{19}F NMR Spectrum of **61**

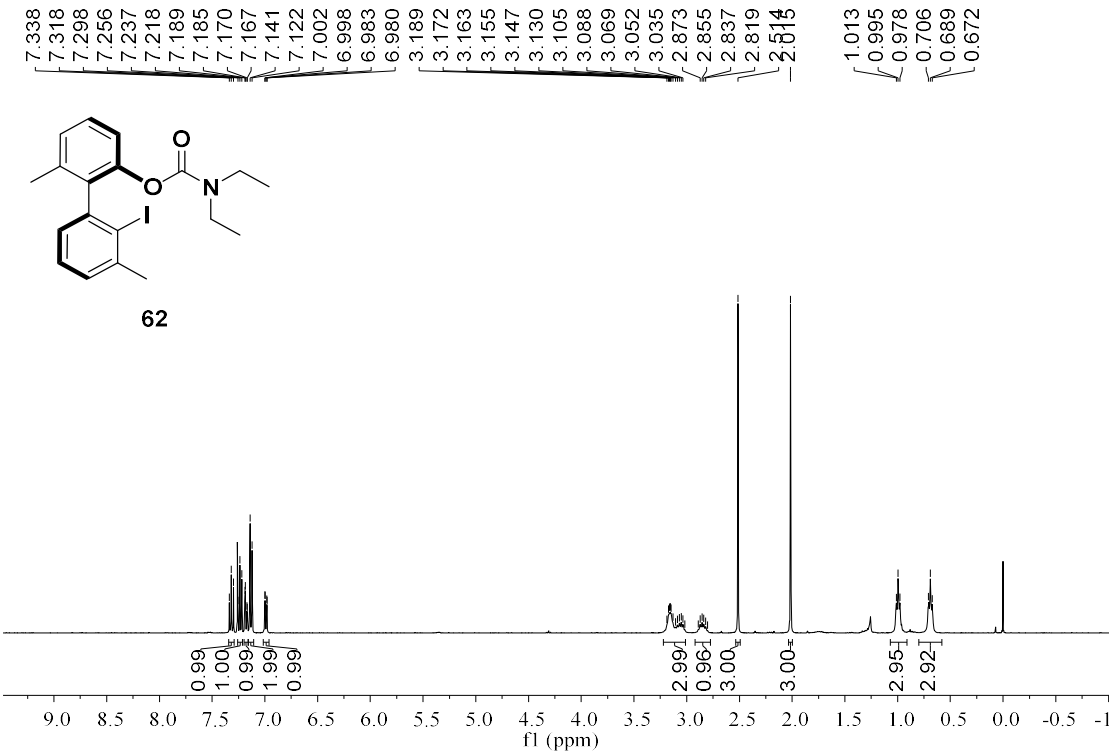


Figure S123. ^{1}H NMR Spectrum of **62**

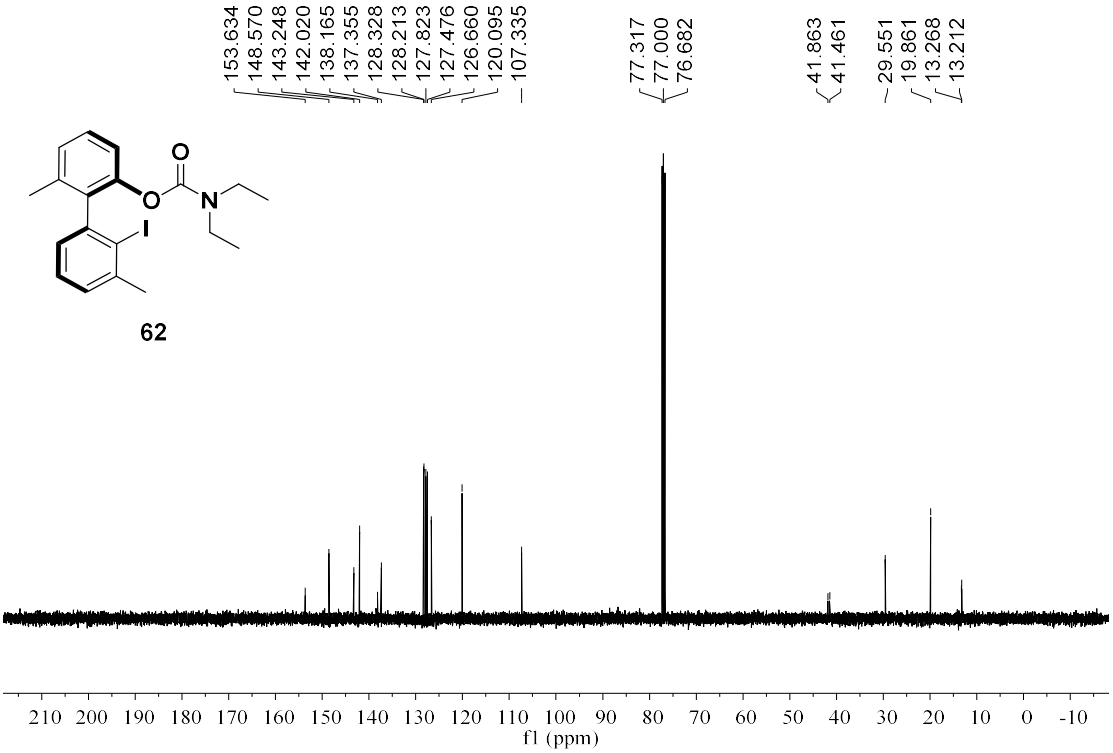


Figure S124. ^{13}C NMR Spectrum of **62**

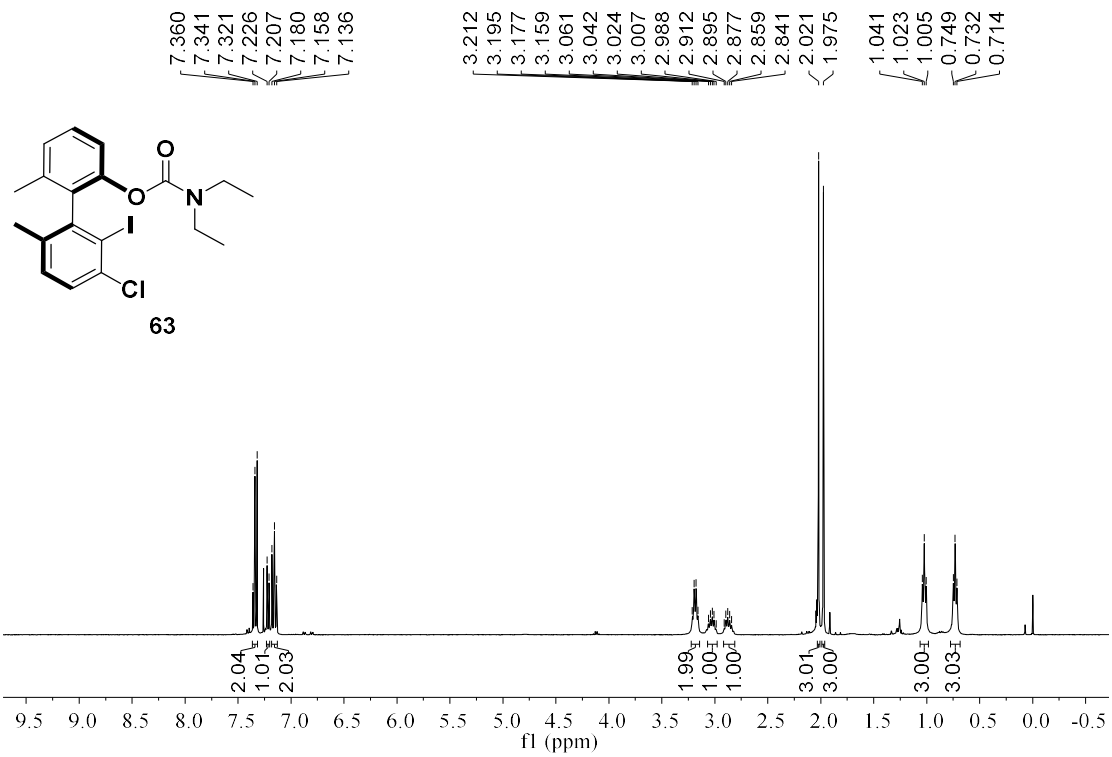


Figure S125. ^{1}H NMR Spectrum of **63**

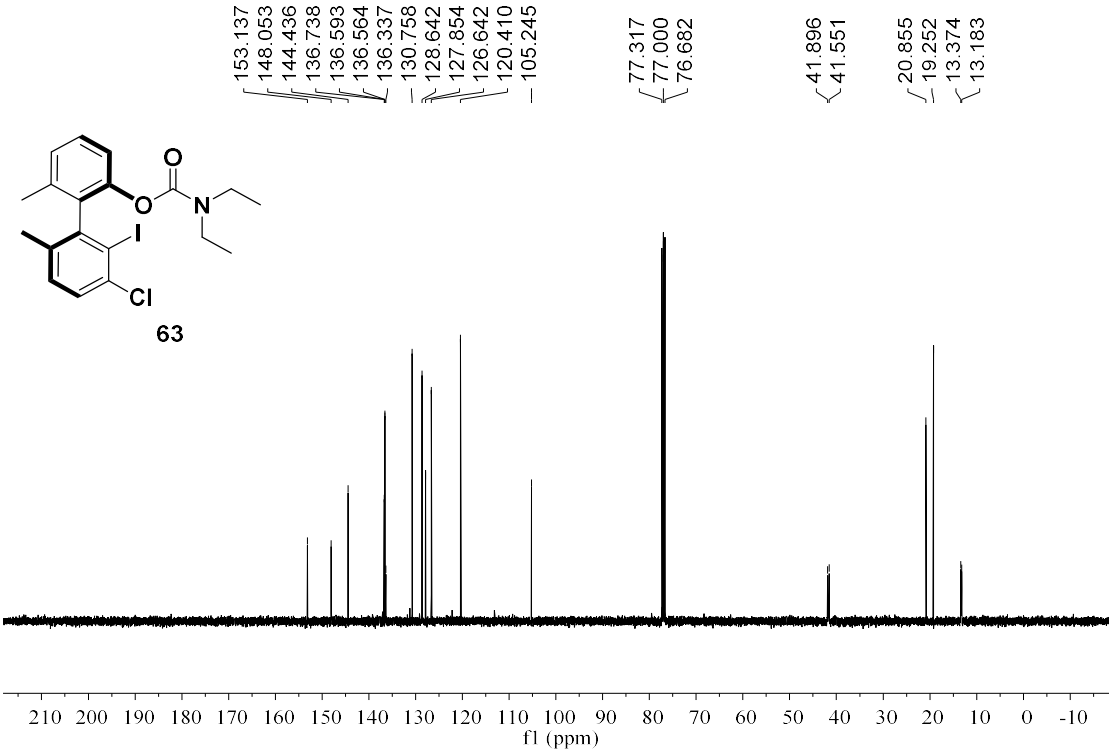


Figure S126. ^{13}C NMR Spectrum of **63**

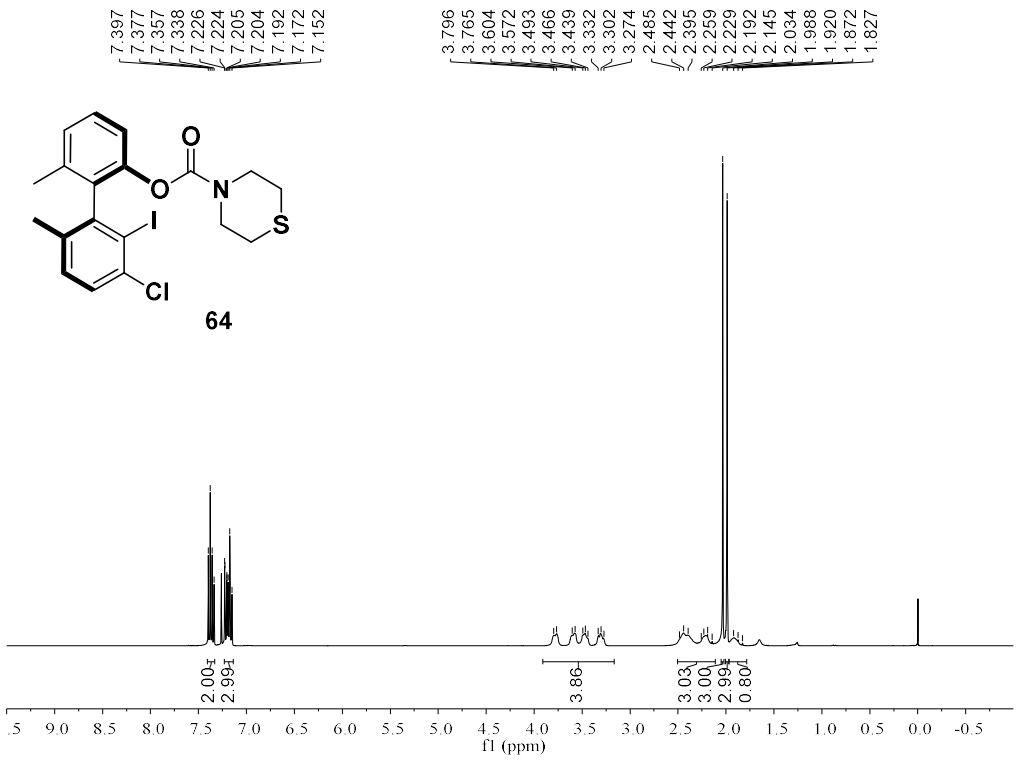


Figure S127. ^{1}H NMR Spectrum of **64**

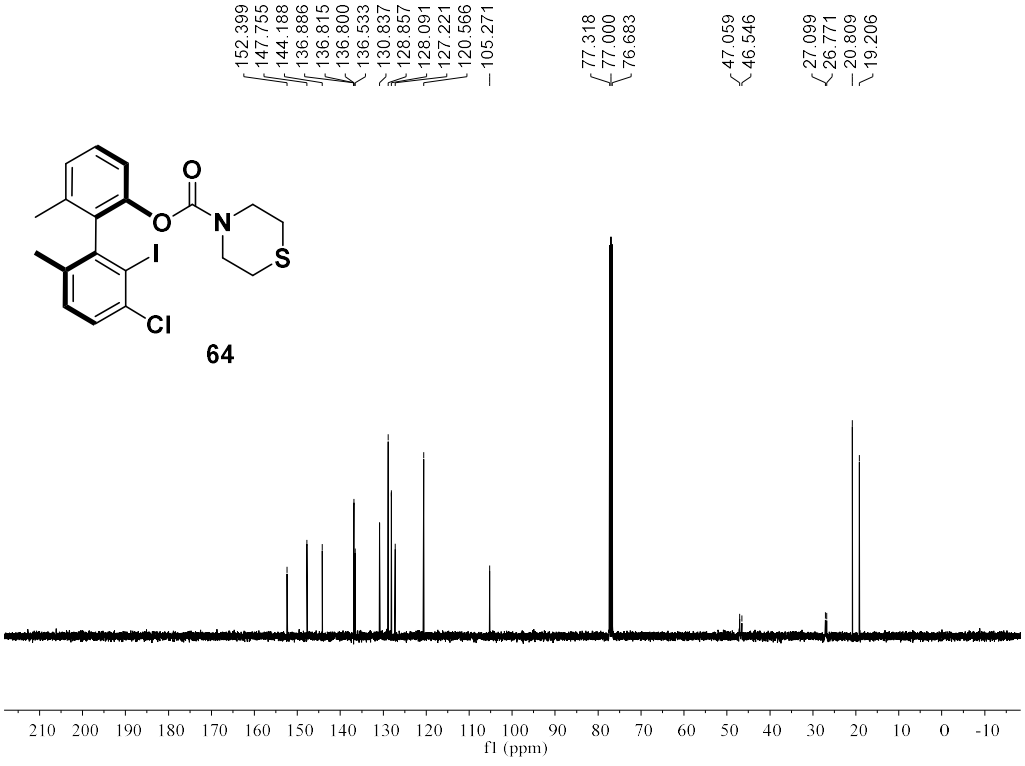


Figure S128. ^{13}C NMR Spectrum of **64**

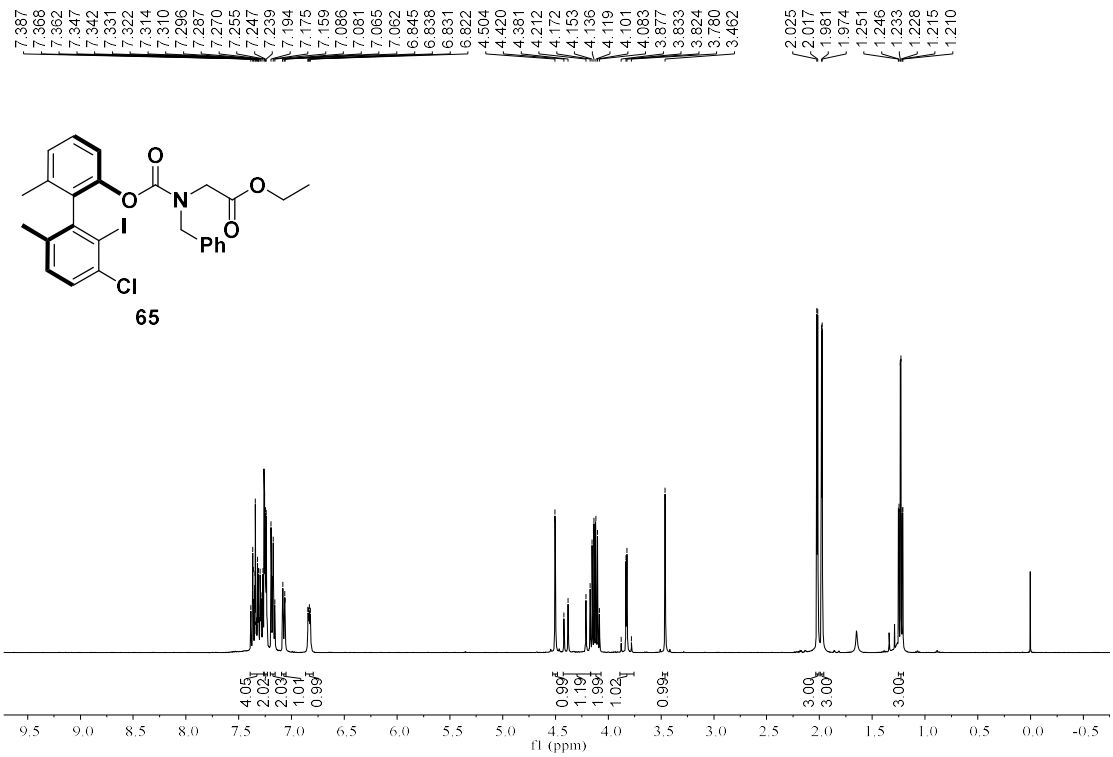


Figure S129. ^{1}H NMR Spectrum of **65**

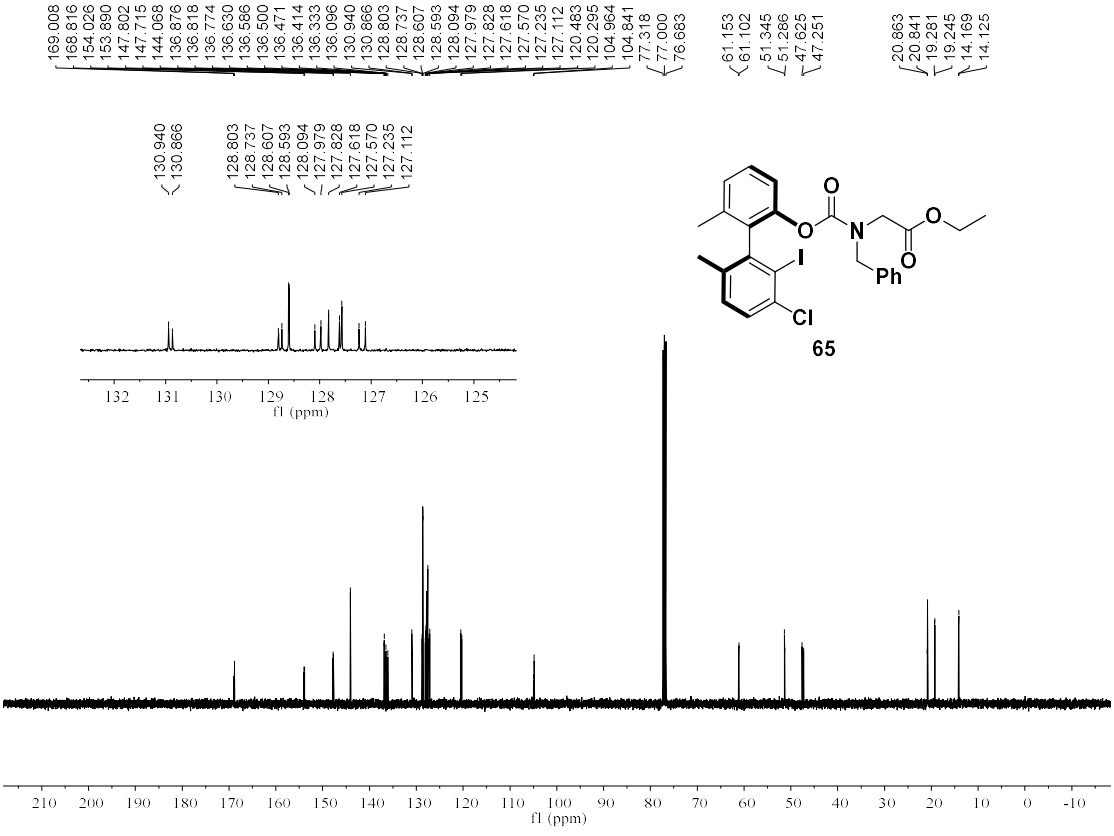


Figure S130. ^{13}C NMR Spectrum of **65**

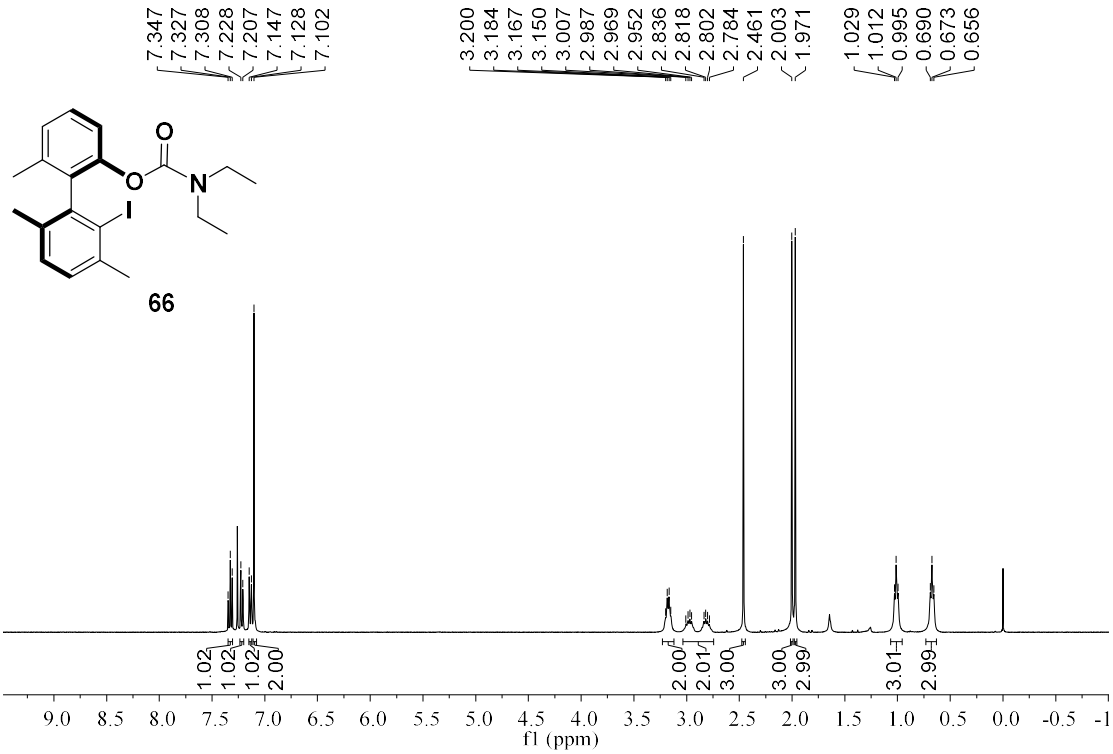


Figure S131. ^{1}H NMR Spectrum of **66**

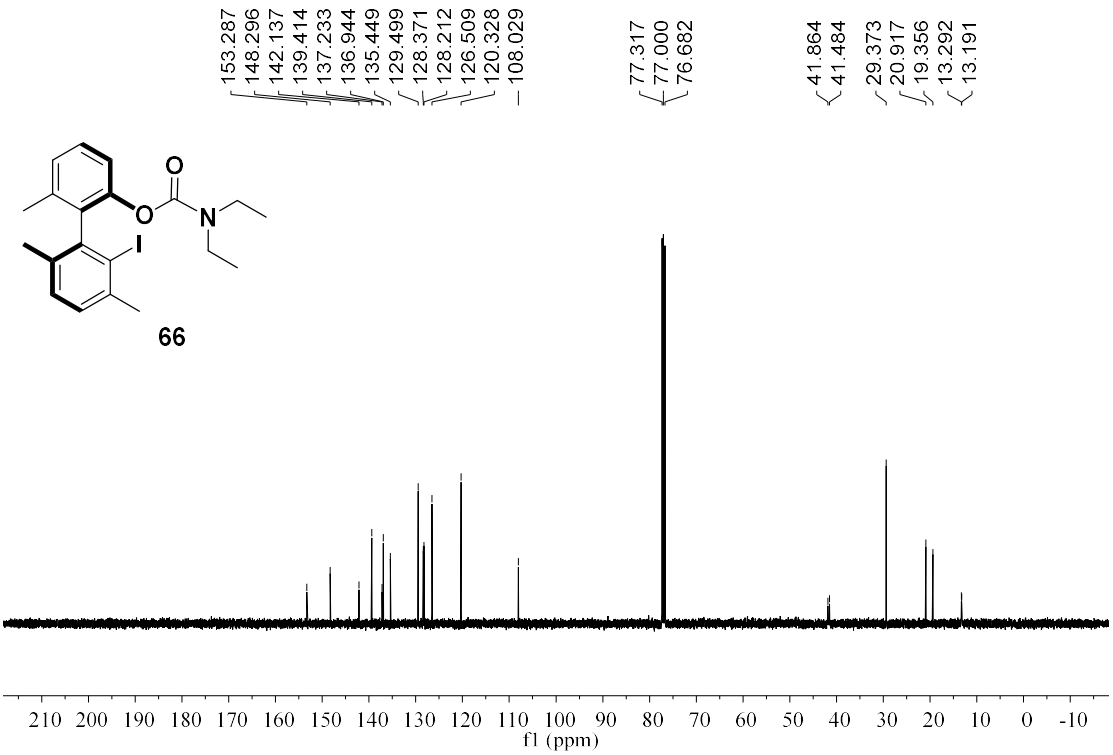


Figure S132. ^{13}C NMR Spectrum of **66**

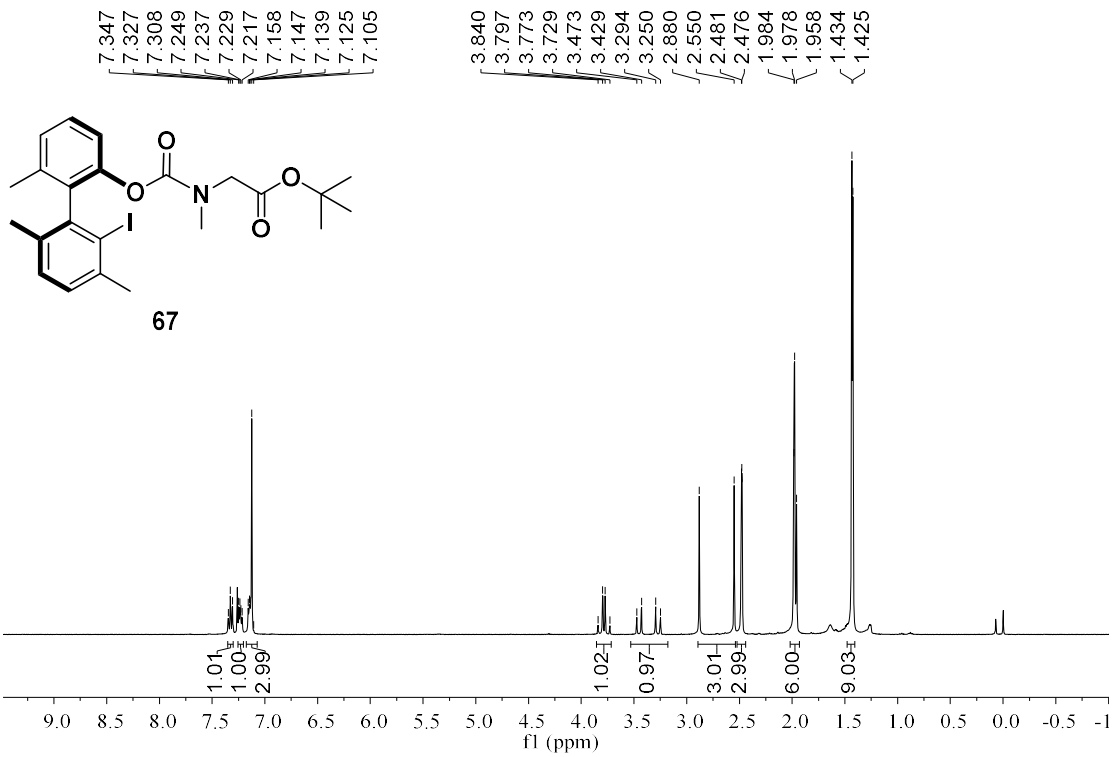


Figure S133. ^{1}H NMR Spectrum of **67**

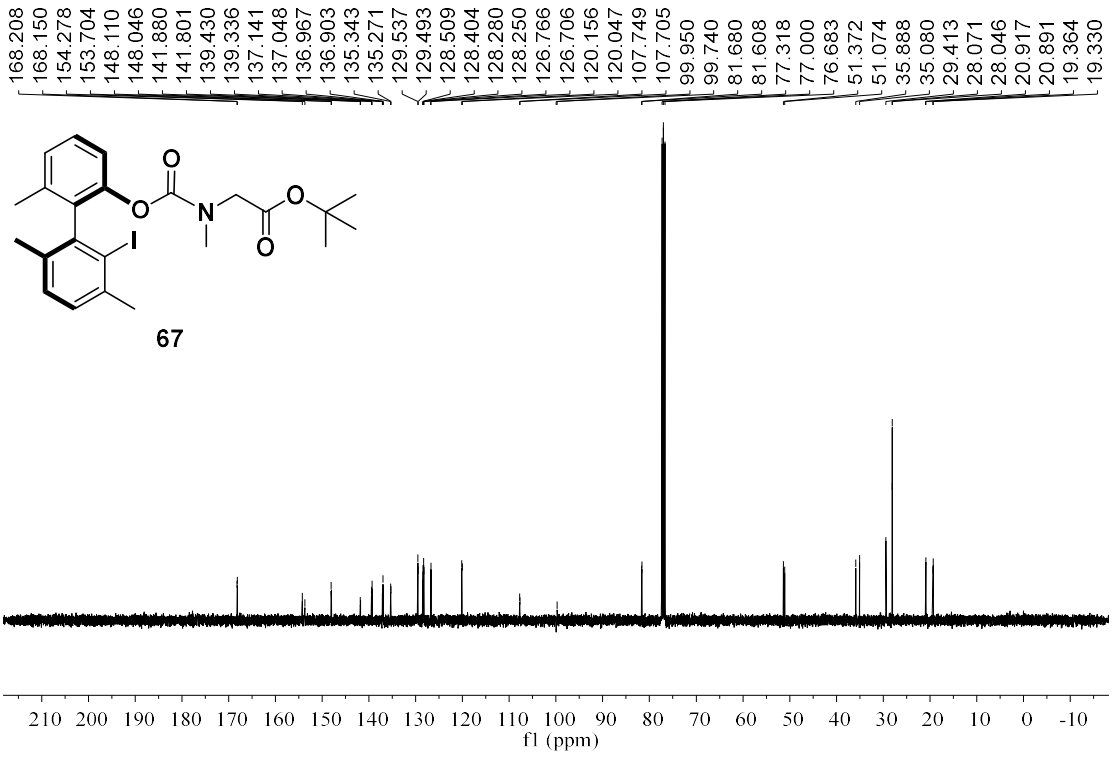


Figure S134. ^{13}C NMR Spectrum of **67**

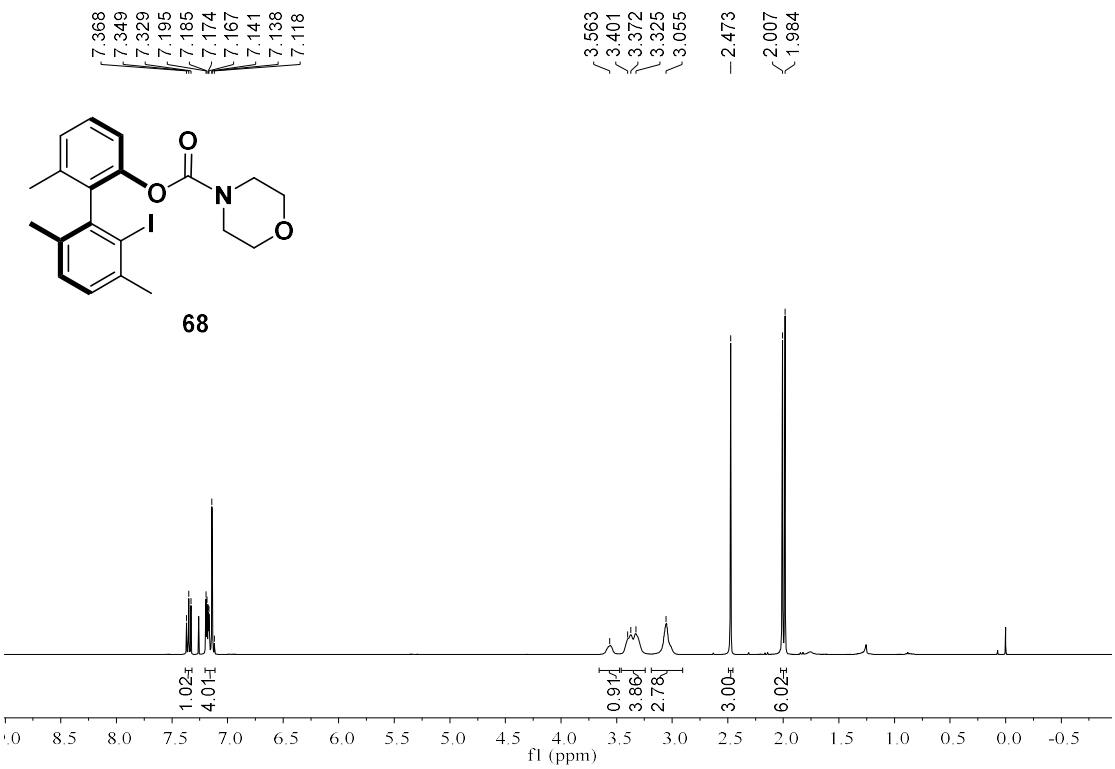


Figure S135. ^{1}H NMR Spectrum of **68**

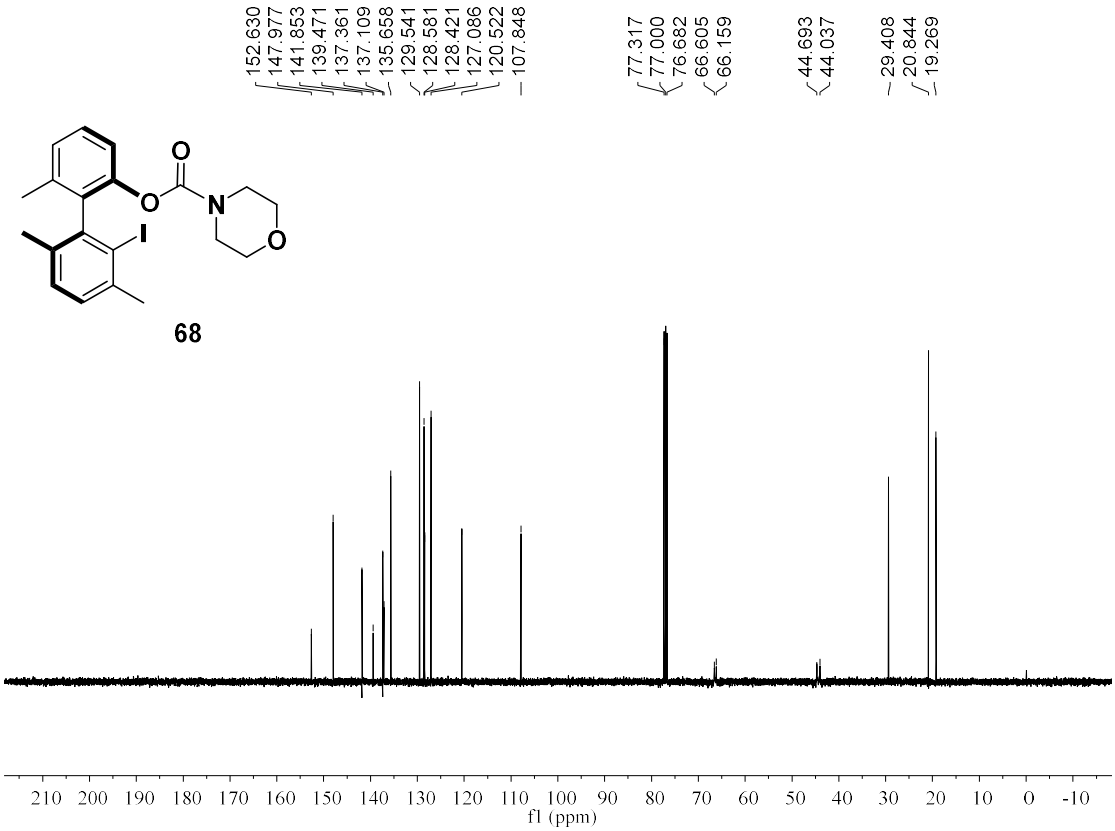


Figure S136. ^{13}C NMR Spectrum of **68**

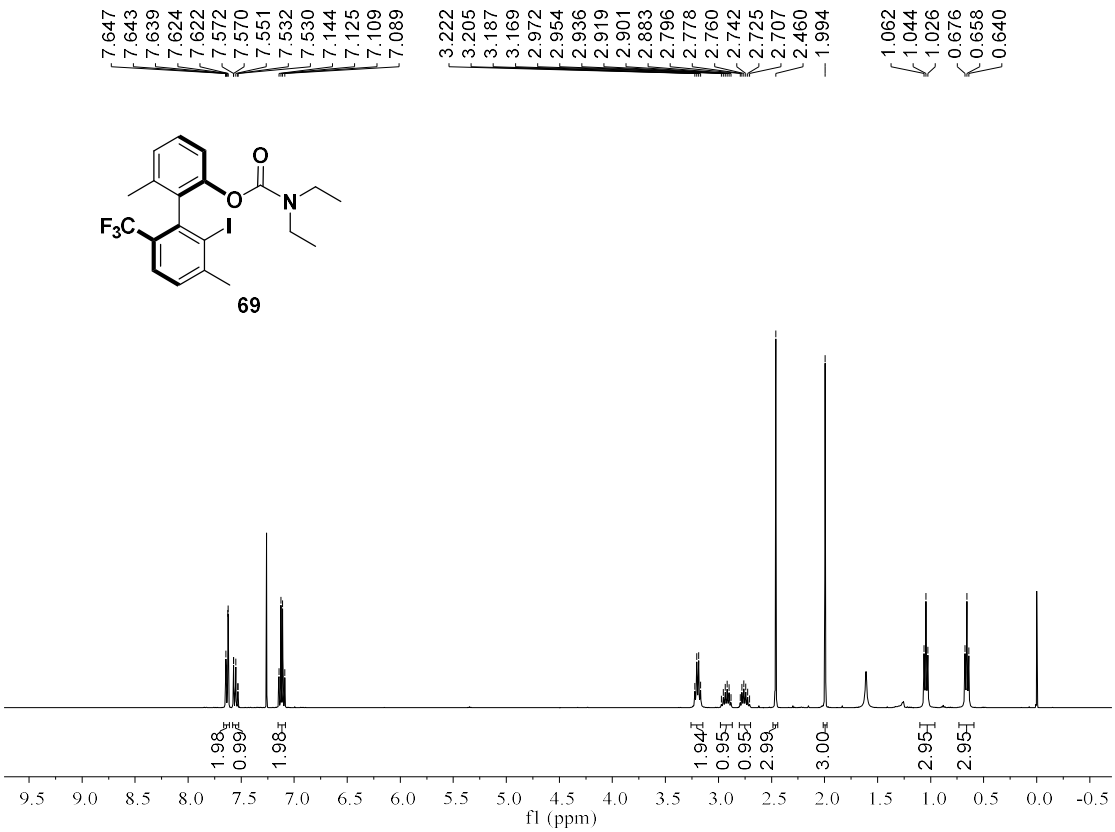


Figure S137. ^{1}H NMR Spectrum of **69**

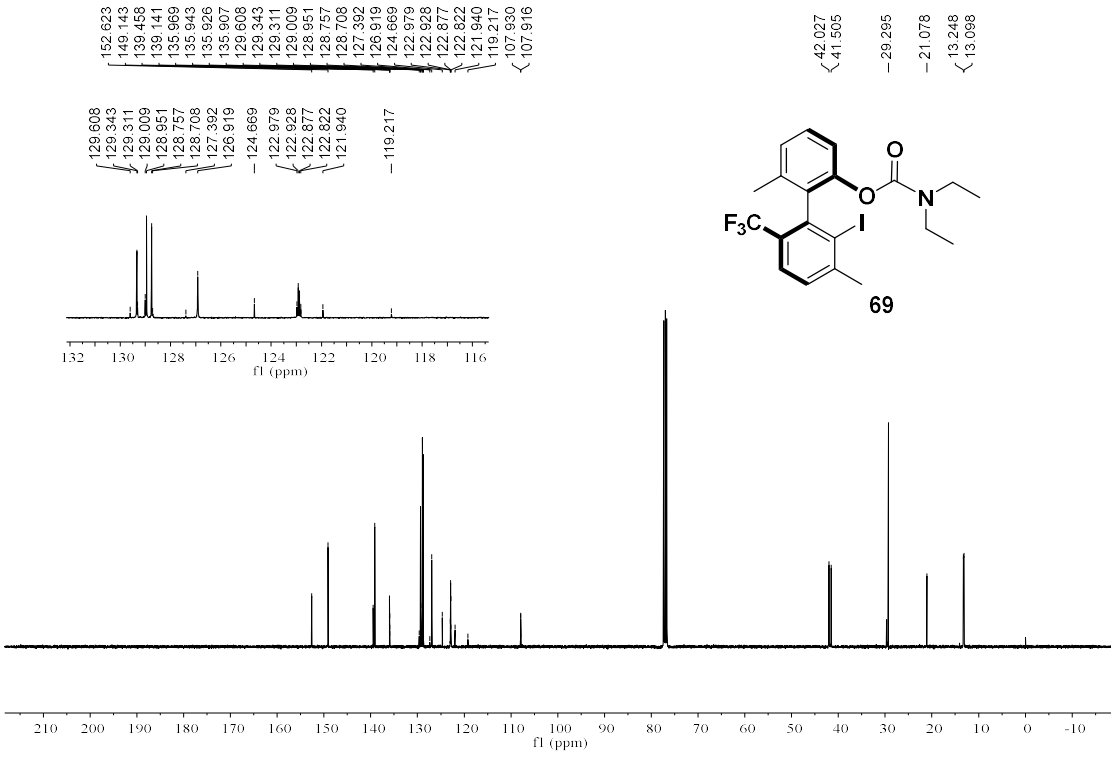


Figure S138. ^{13}C NMR Spectrum of **69**

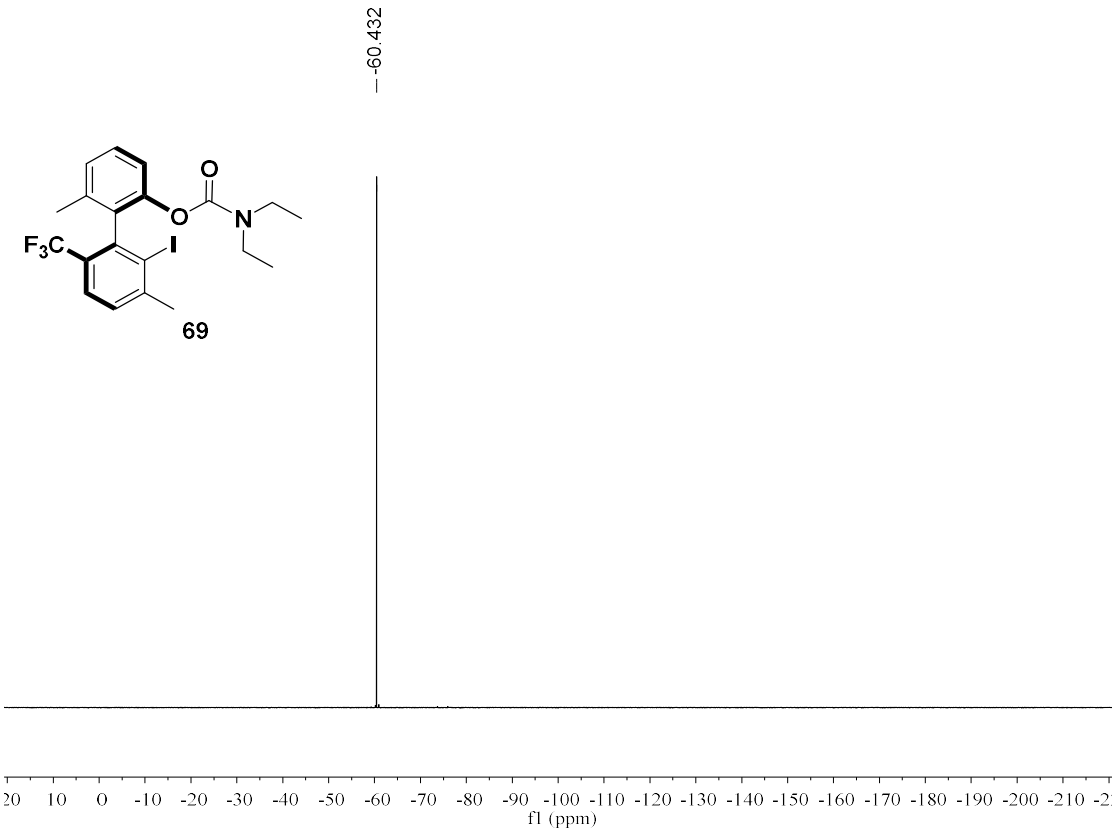


Figure S139. ^{19}F NMR Spectrum of **69**

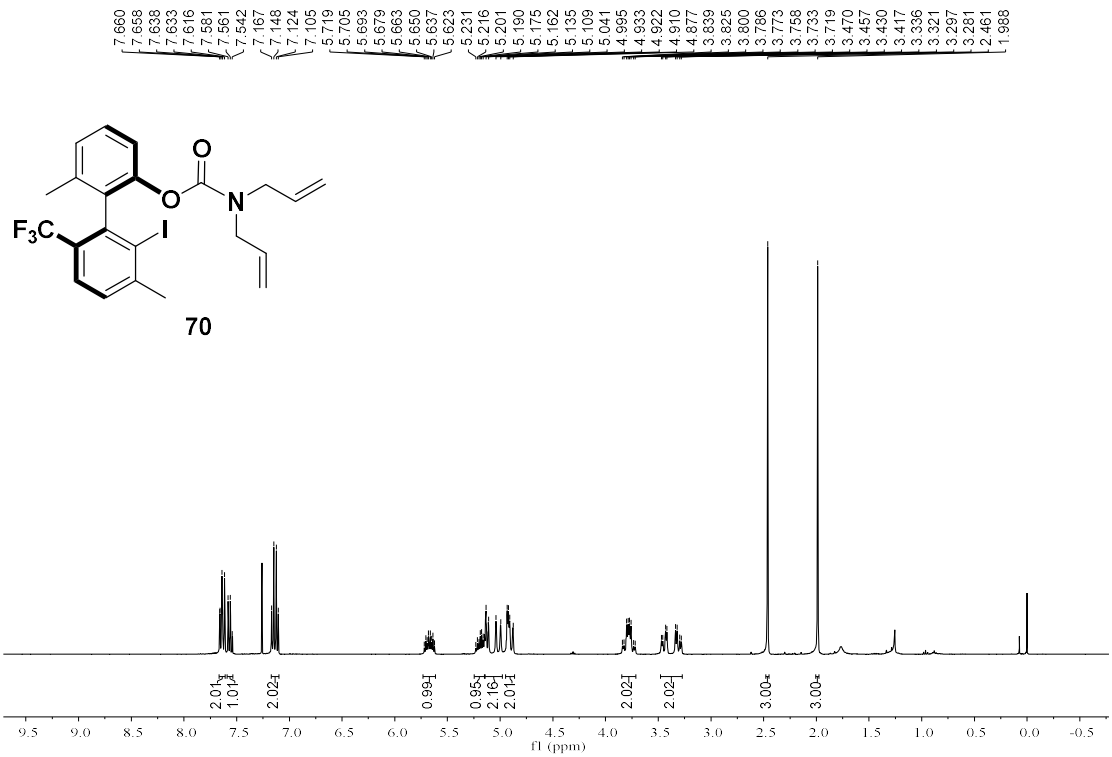


Figure S140. ^{1}H NMR Spectrum of **70**

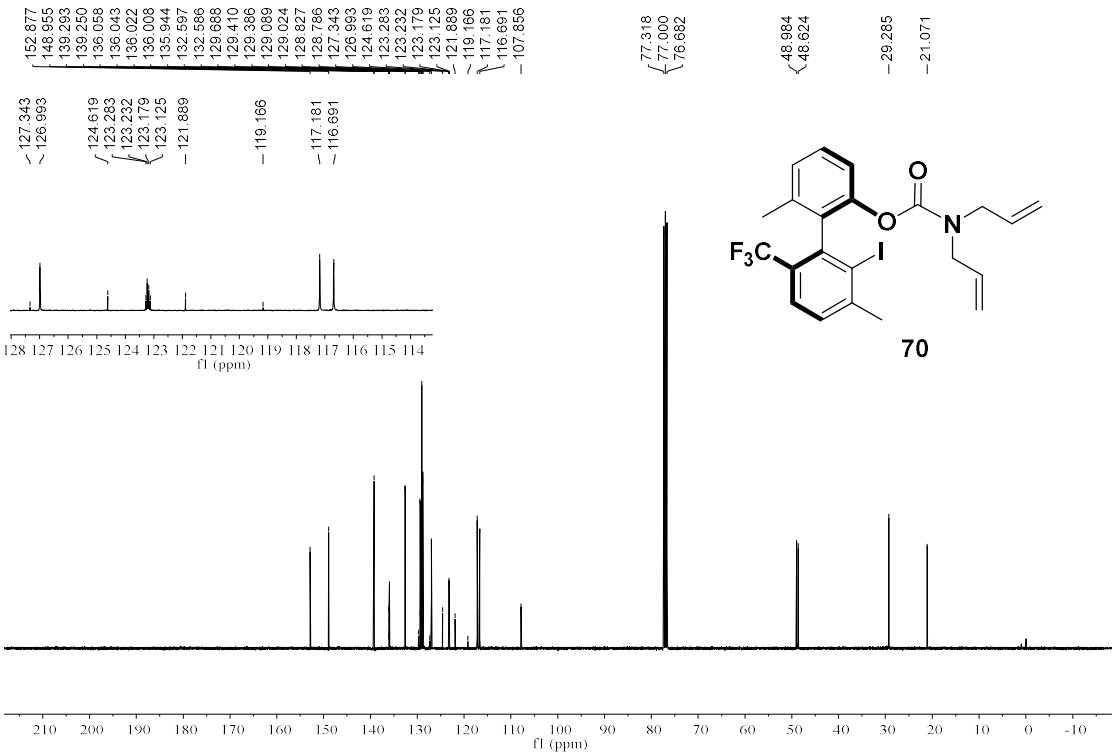


Figure S141. ^{13}C NMR Spectrum of **70**

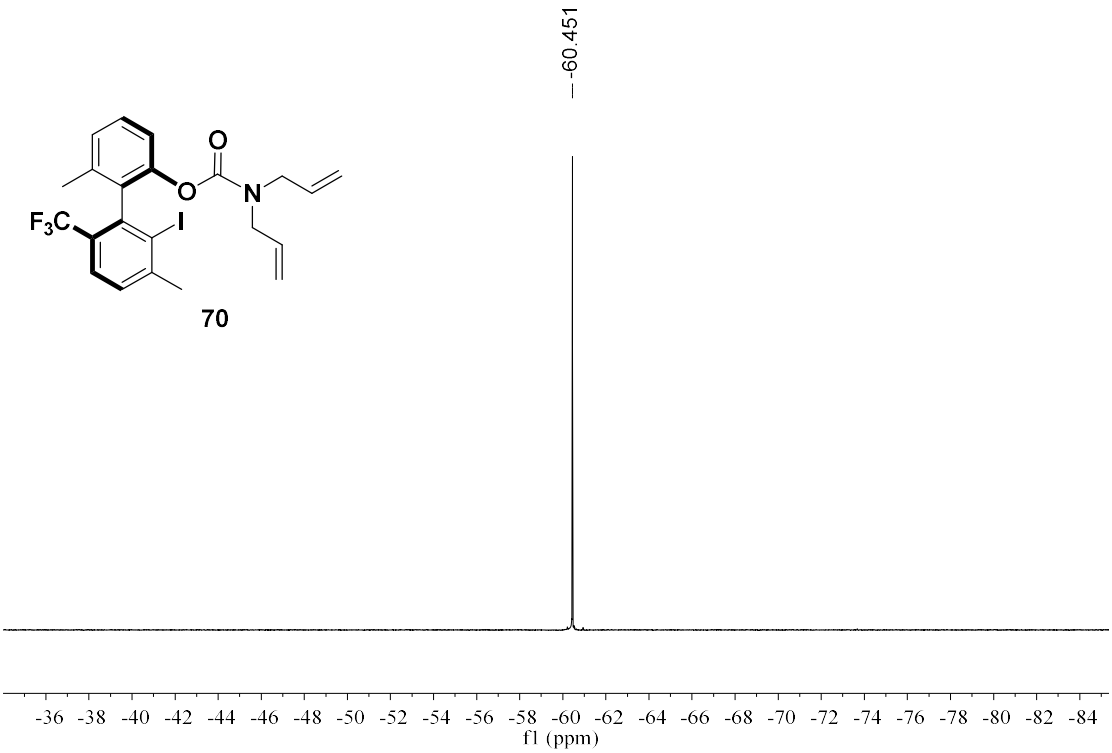


Figure S142. ^{19}F NMR Spectrum of **70**

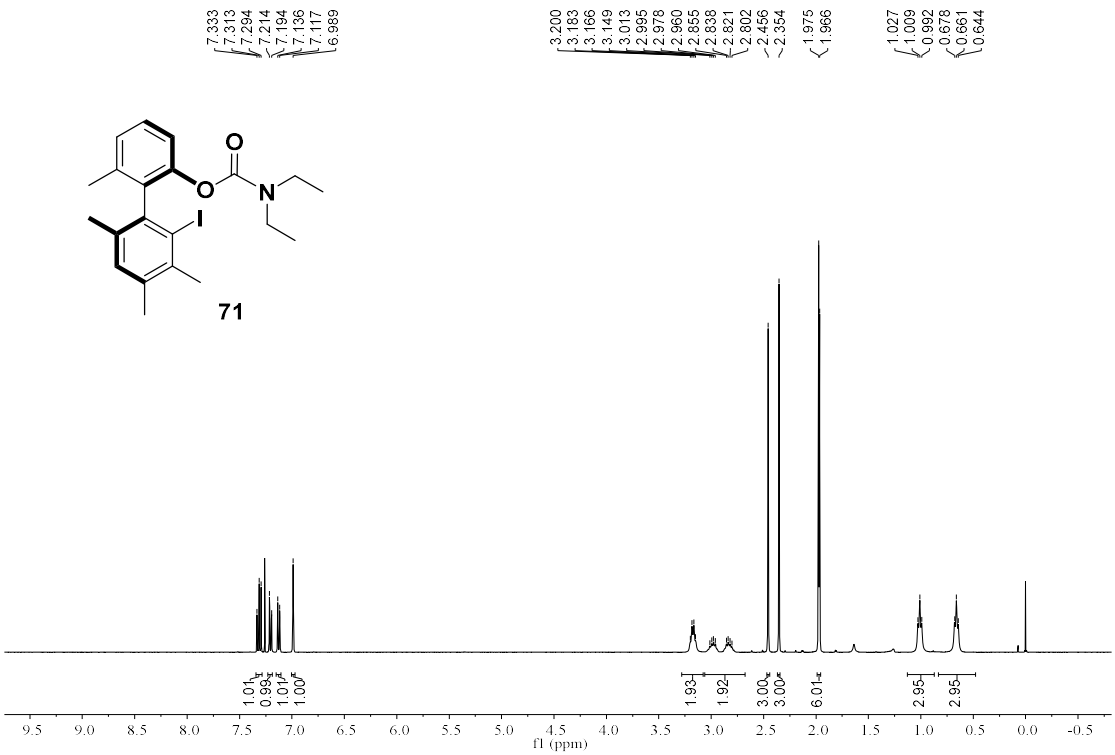


Figure S143. ^{1}H NMR Spectrum of **71**

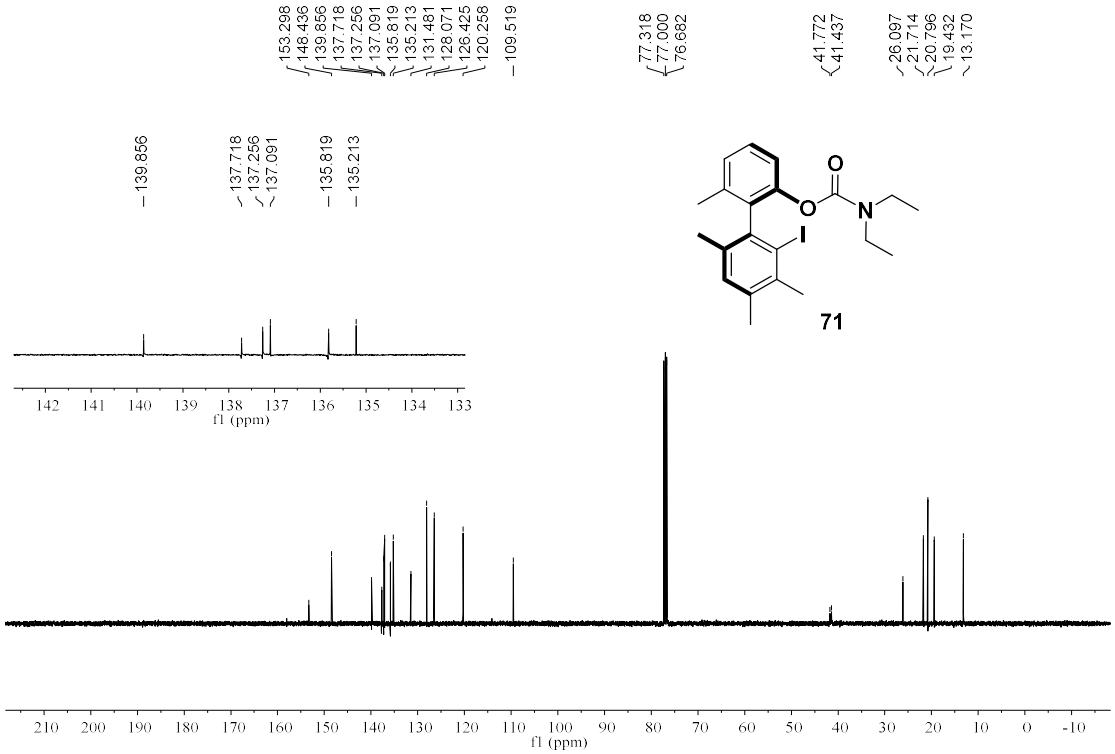


Figure S144. ^{13}C NMR Spectrum of **71**

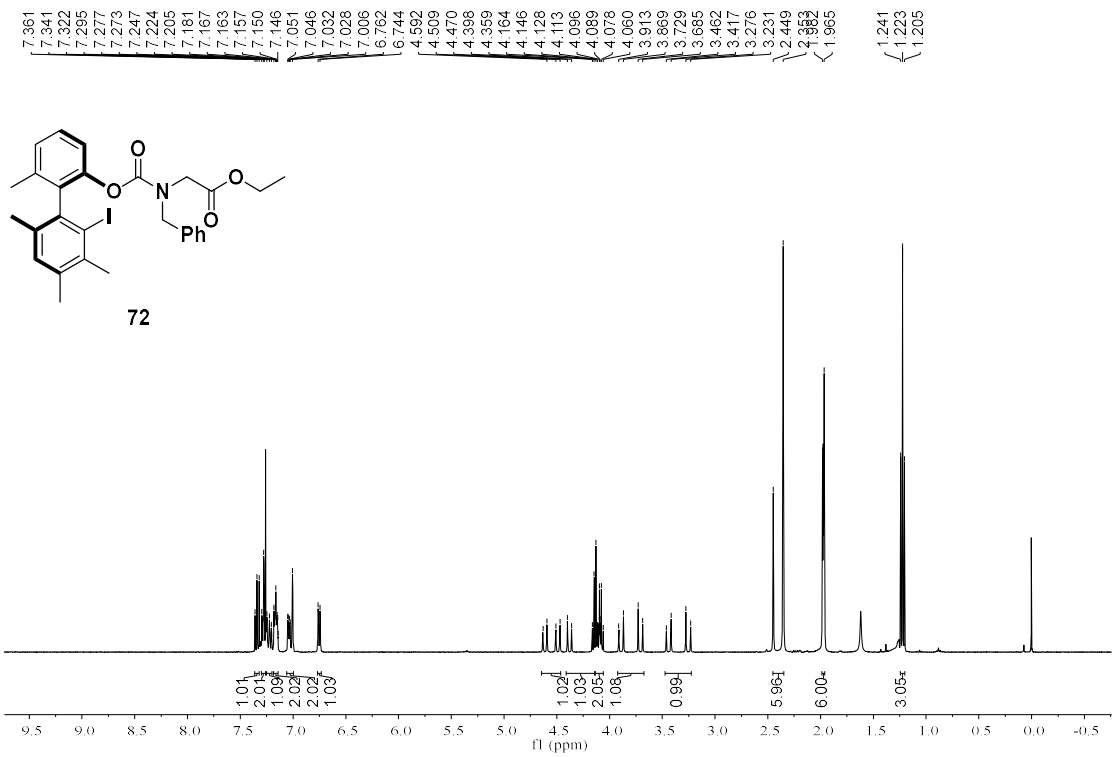


Figure S145. ^{1}H NMR Spectrum of **72**

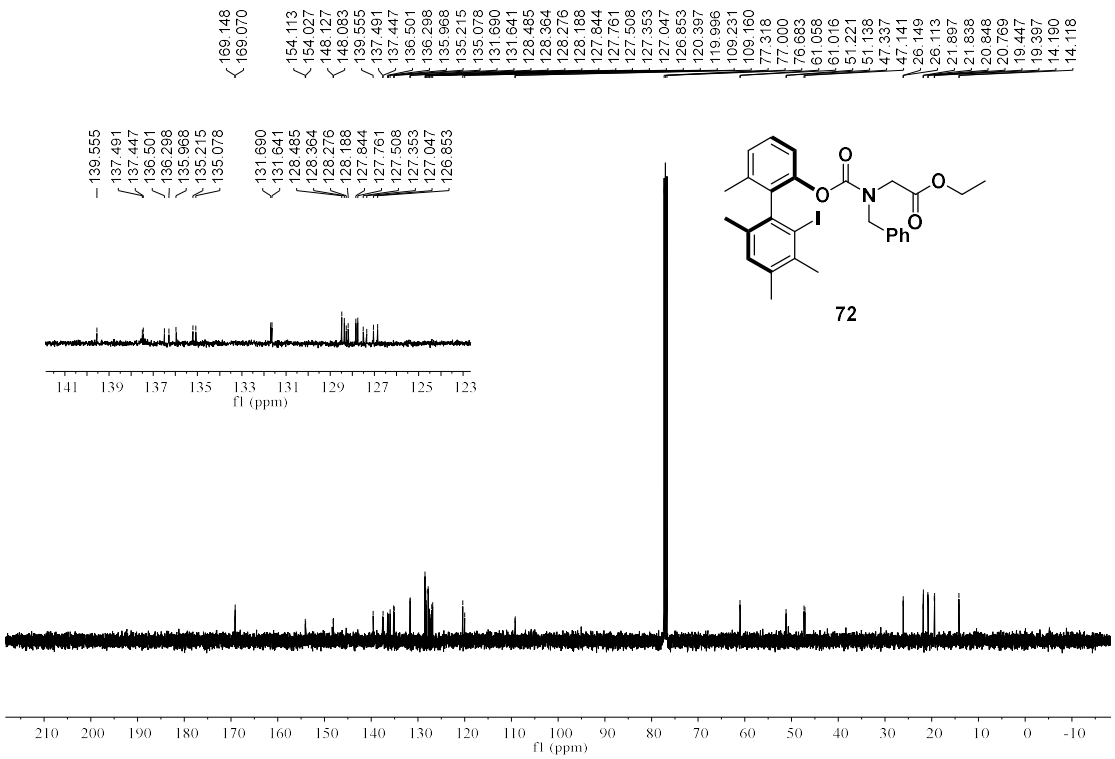


Figure 146. ^{13}C NMR Spectrum of **72**

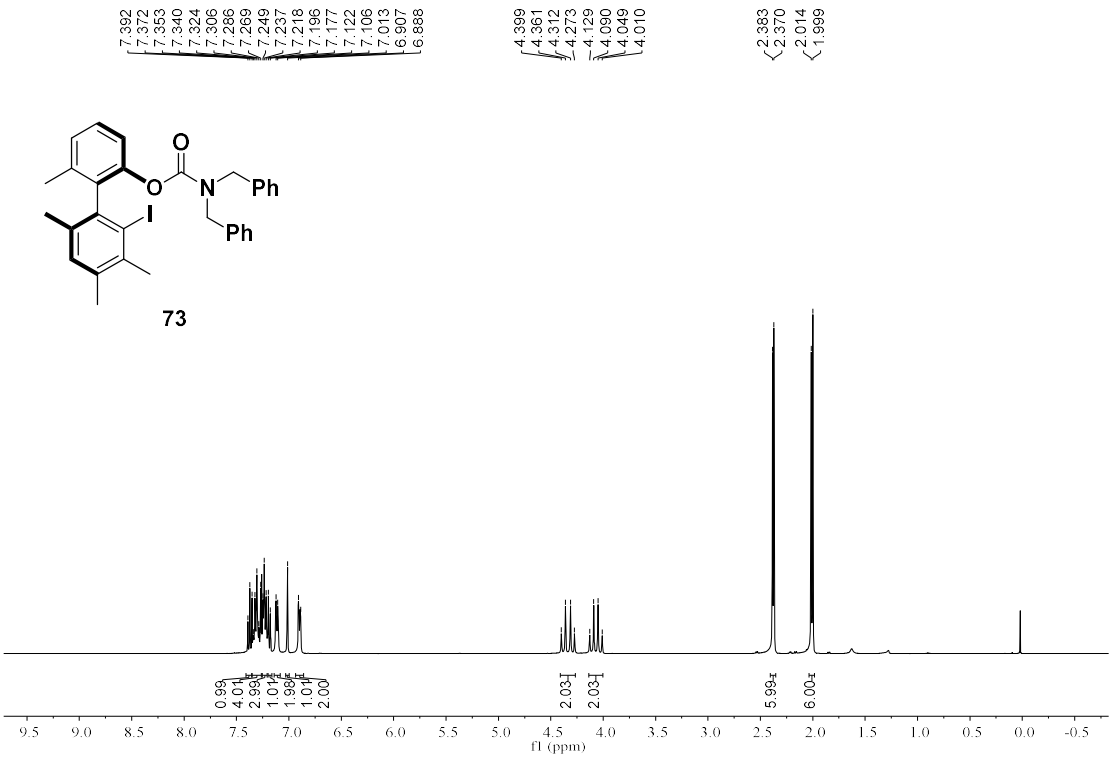


Figure S147. ^{1}H NMR Spectrum of **73**

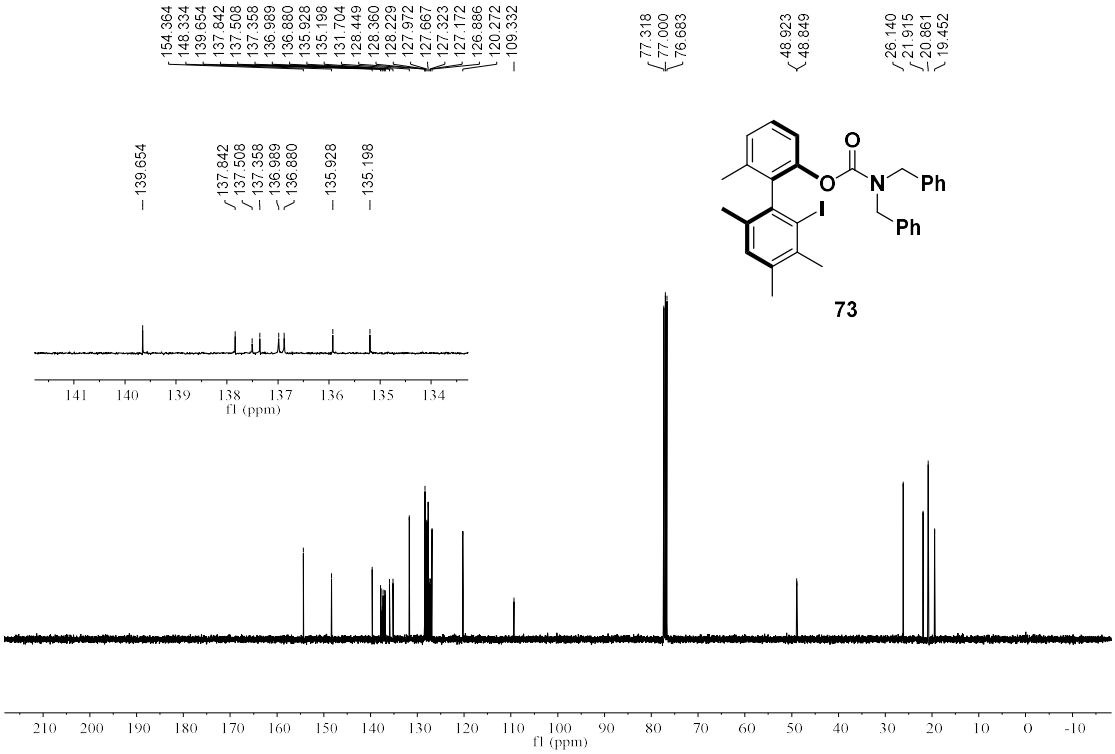


Figure S148. ^{13}C NMR Spectrum of **73**

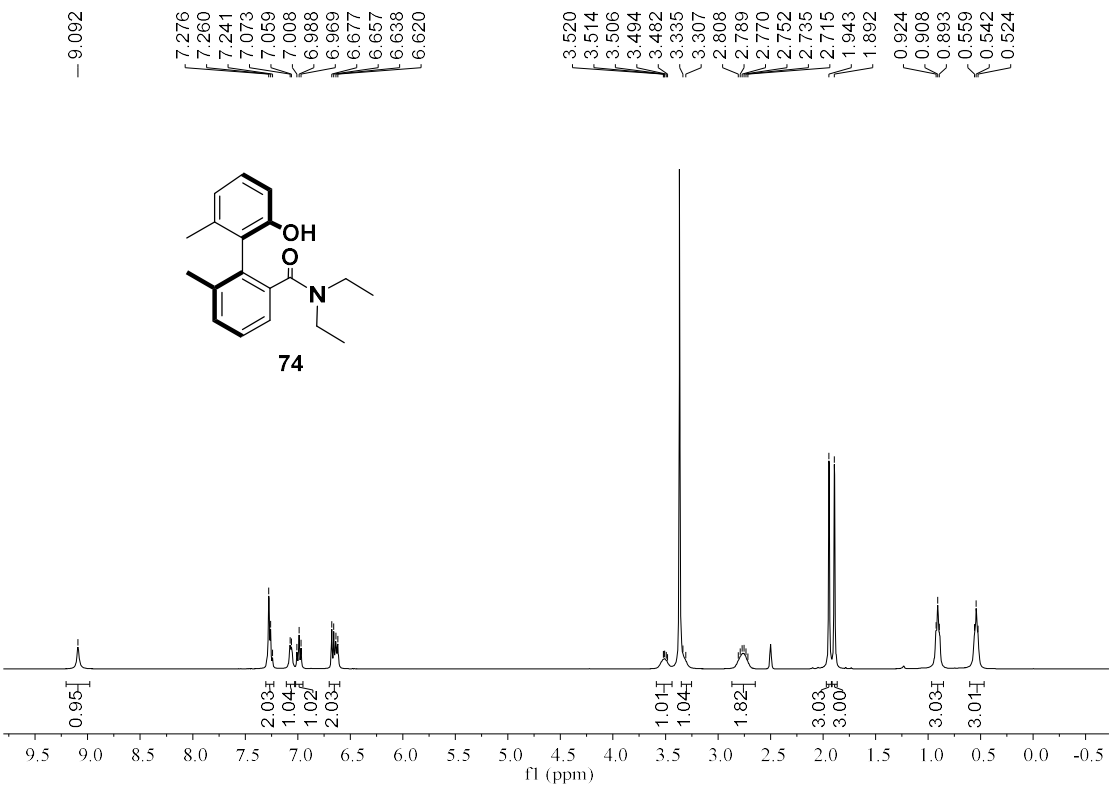


Figure S149. ^{1}H NMR Spectrum of **74**

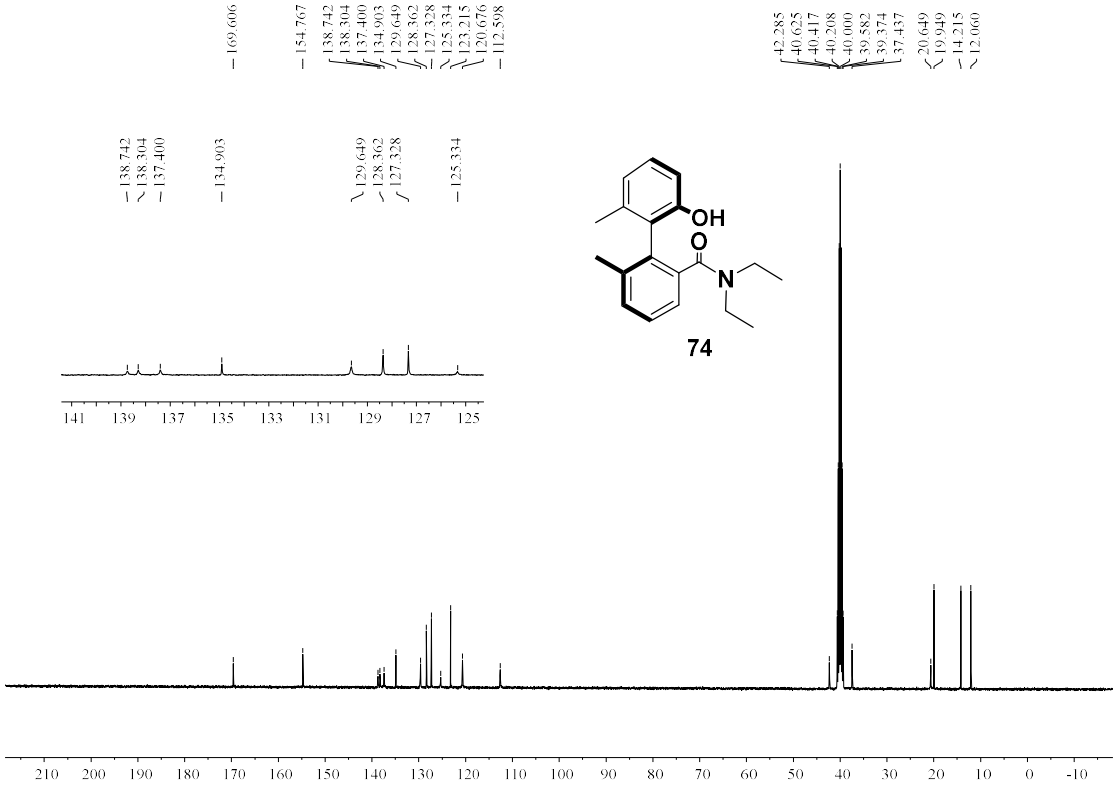


Figure S150. ^{13}C NMR Spectrum of **74**

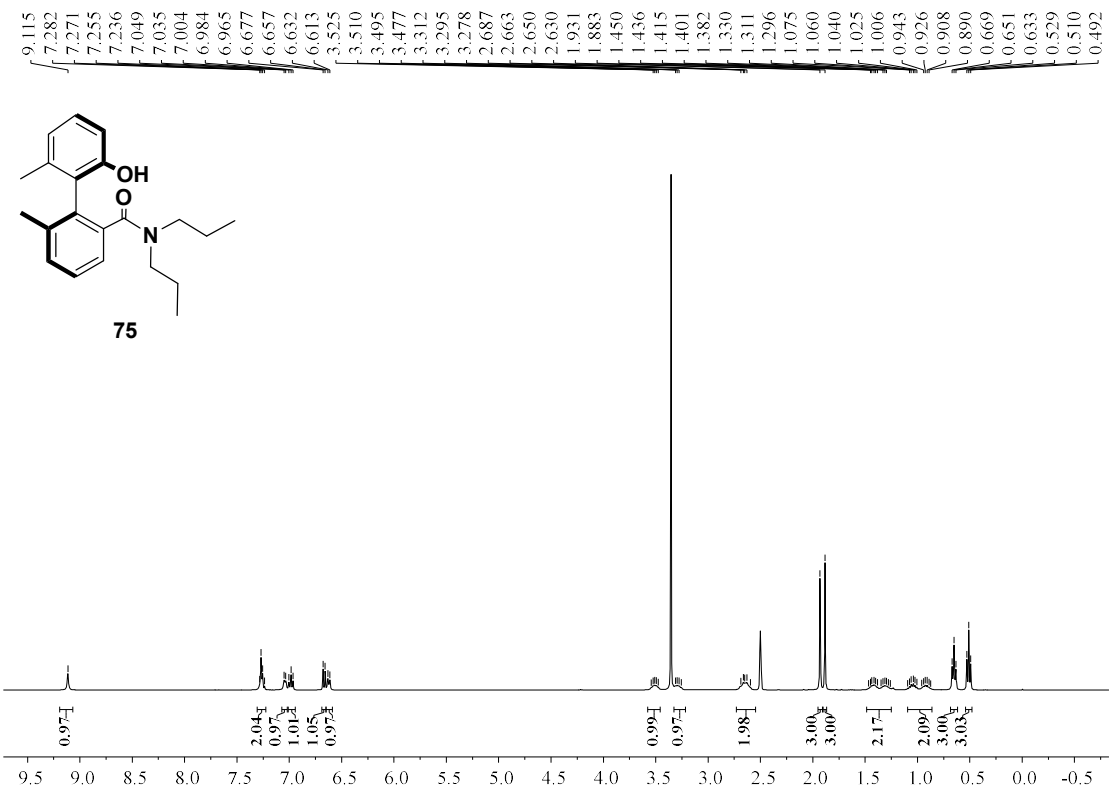


Figure S151. ^{1}H NMR Spectrum of **75**

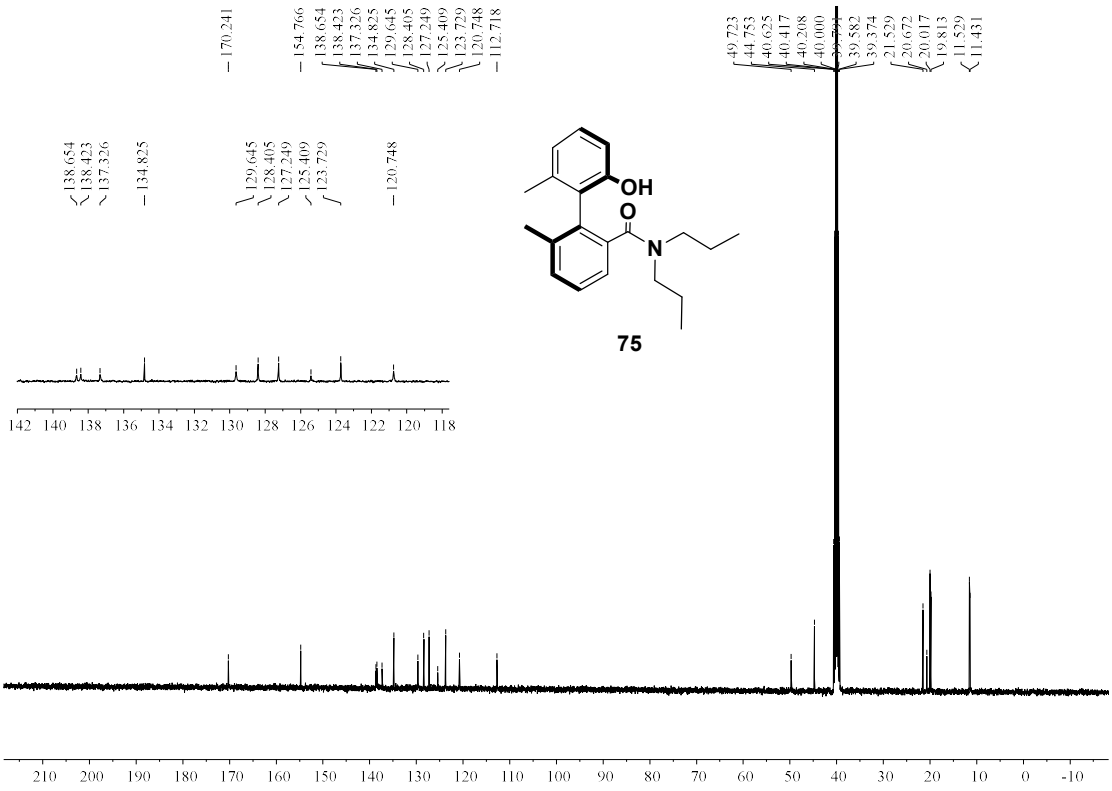


Figure S152. ^{13}C NMR Spectrum of **75**

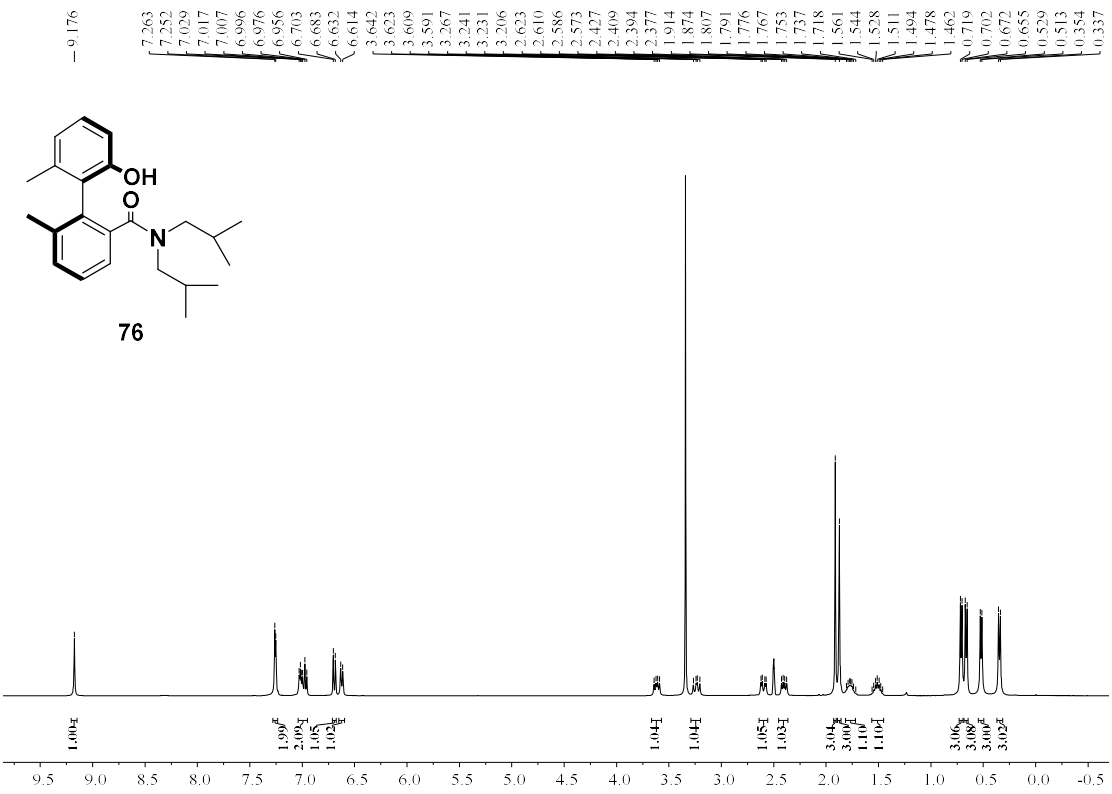


Figure S153. ^{1}H NMR Spectrum of **76**

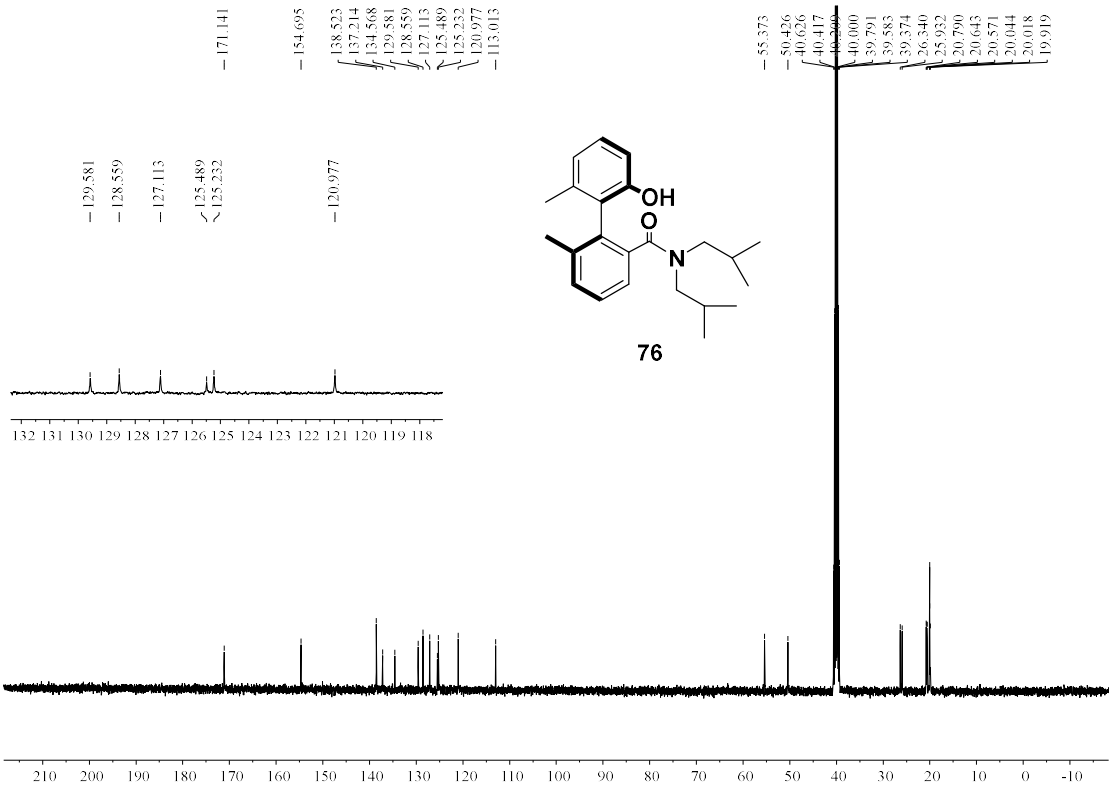


Figure S154. ^{13}C NMR Spectrum of **76**

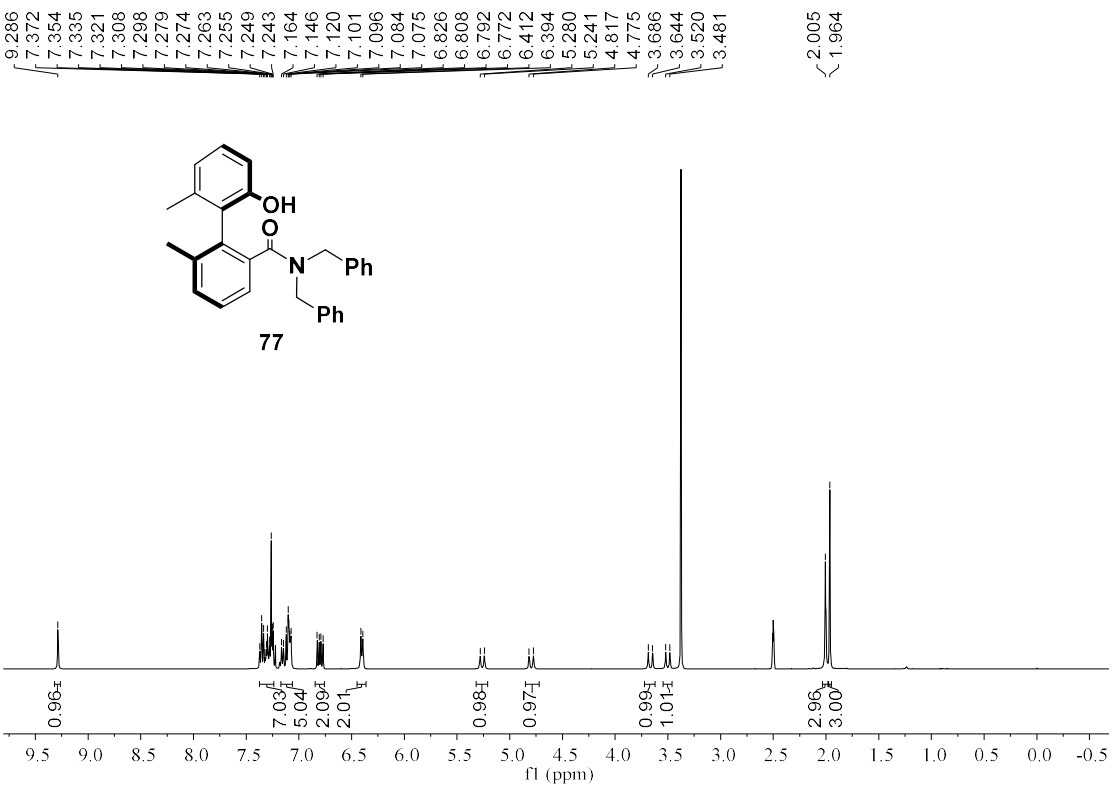


Figure S155. ^{1}H NMR Spectrum of **77**

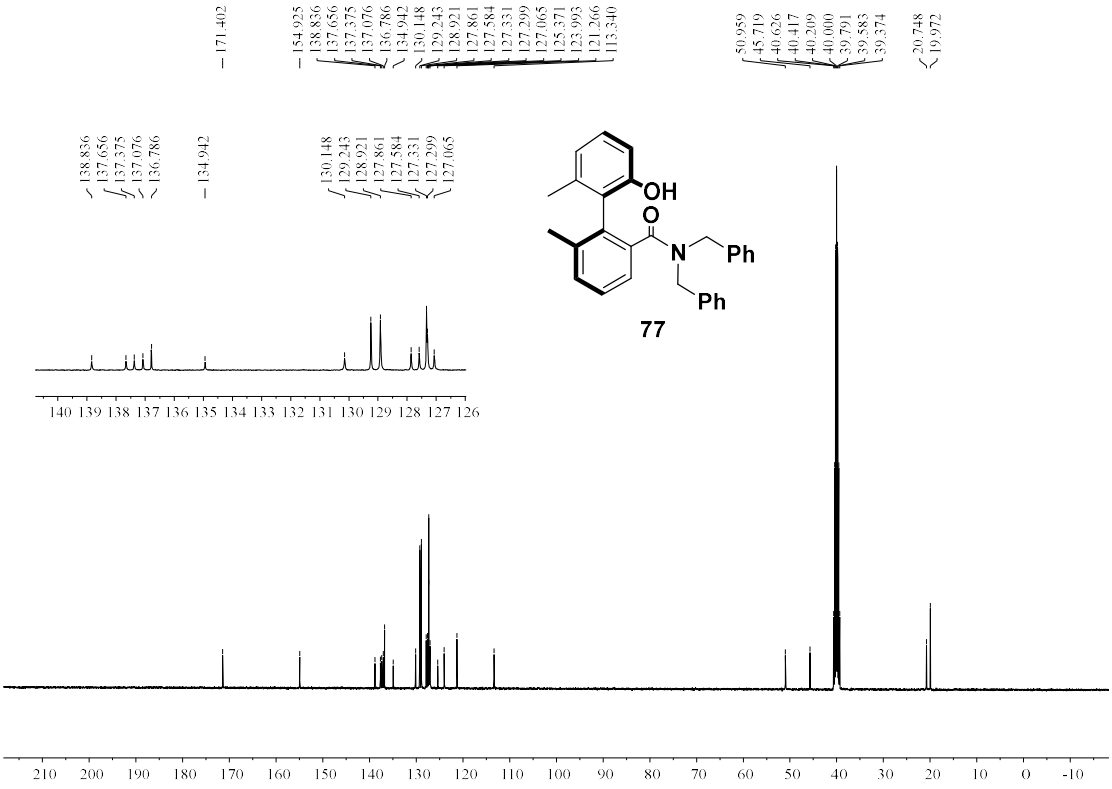


Figure S156. ^{13}C NMR Spectrum of **77**

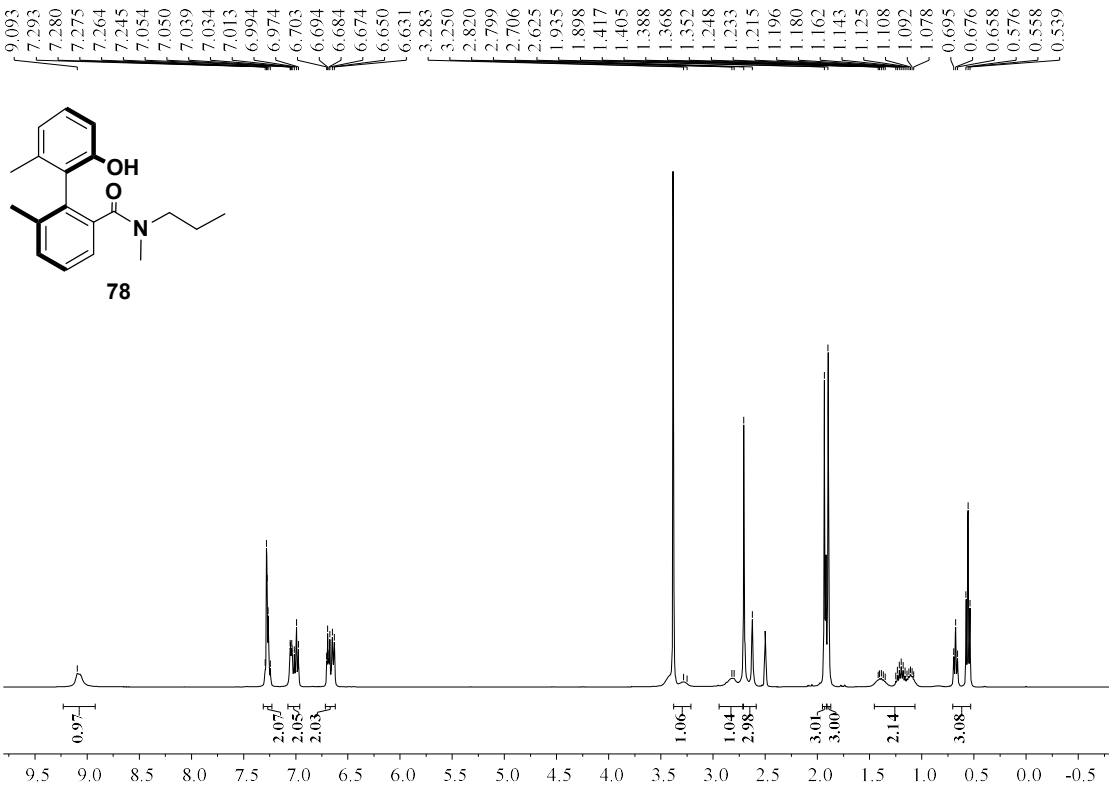


Figure S157. ^{1}H NMR Spectrum of **78**

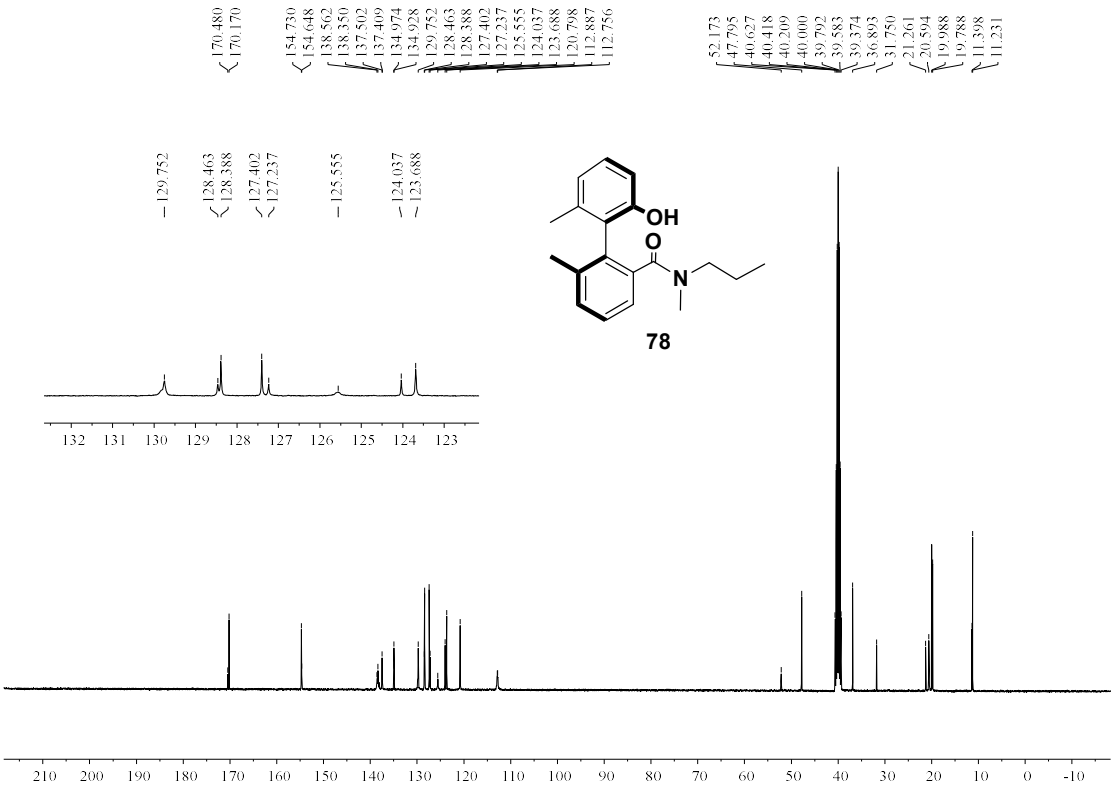


Figure S158. ^{13}C NMR Spectrum of **78**

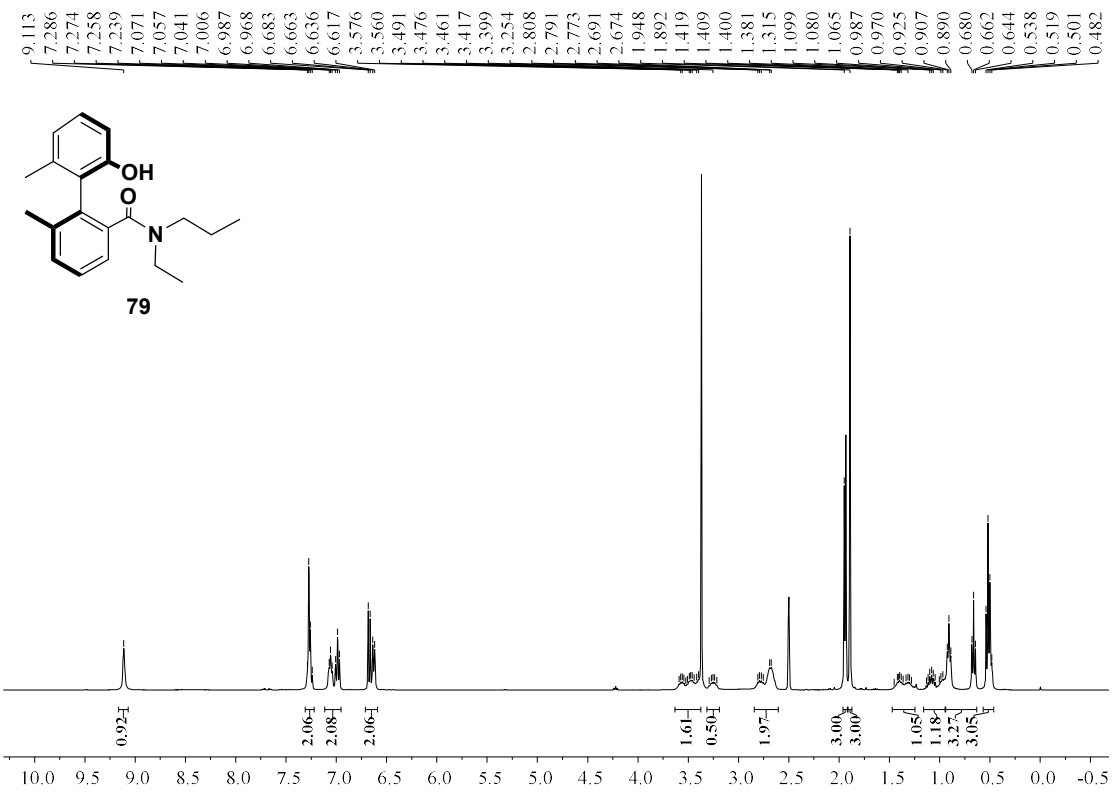


Figure S159. ^{1}H NMR Spectrum of **79**

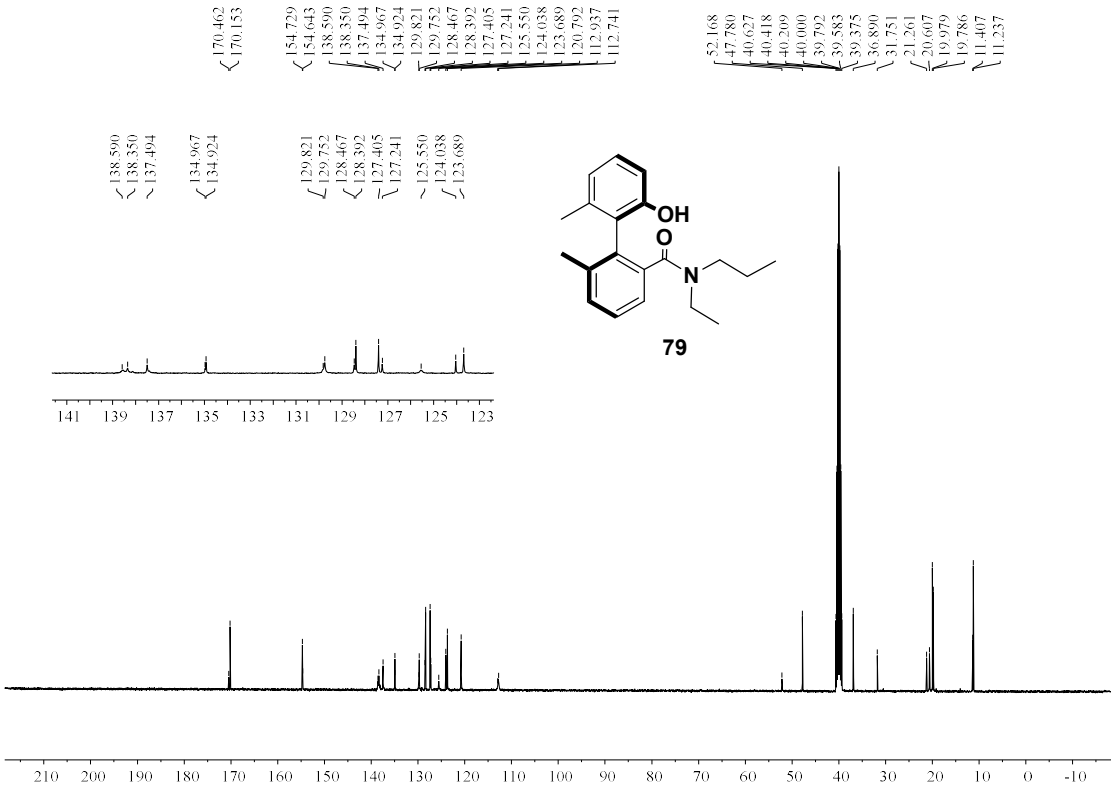


Figure S160. ^{13}C NMR Spectrum of **79**

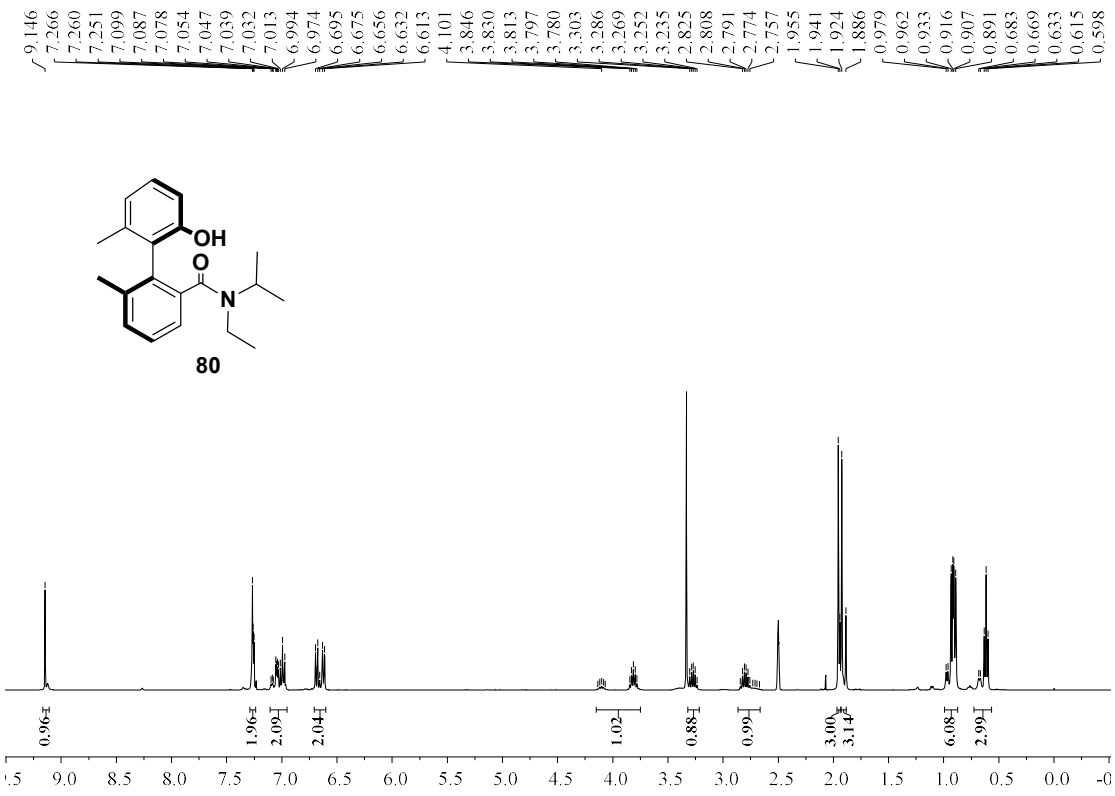


Figure S161. ^{1}H NMR Spectrum of **80**

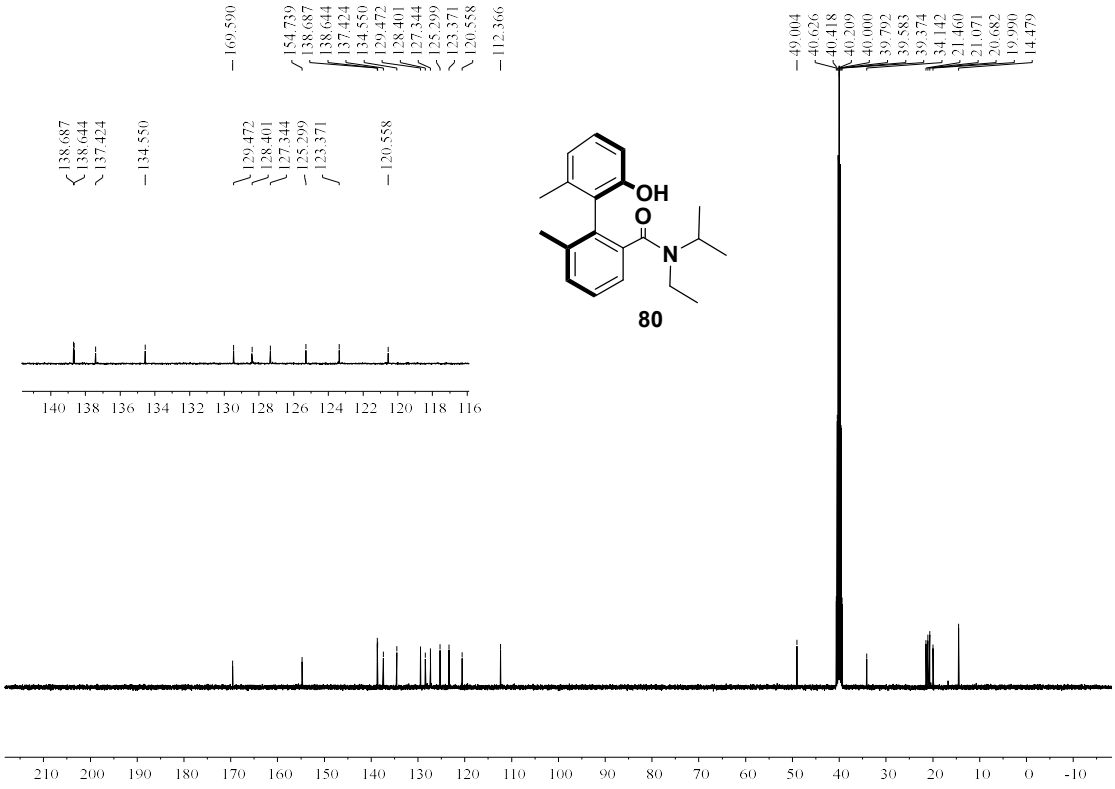


Figure S162. ^{13}C NMR Spectrum of **80**

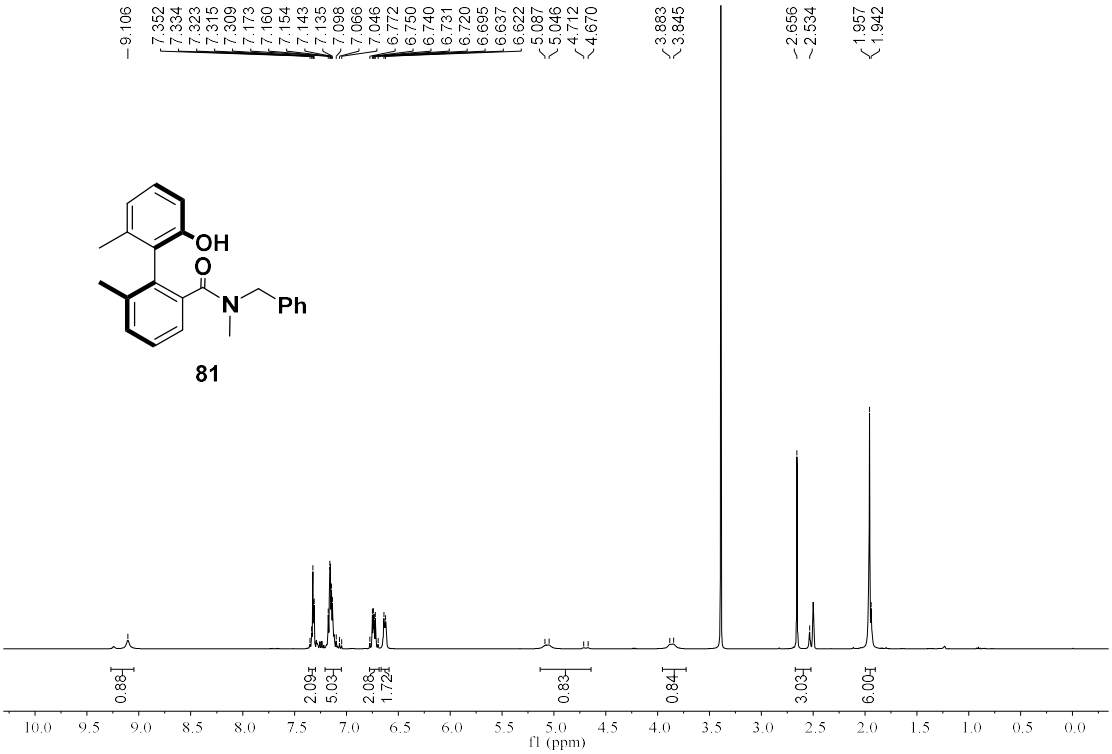


Figure S163. ^{1}H NMR Spectrum of **81**

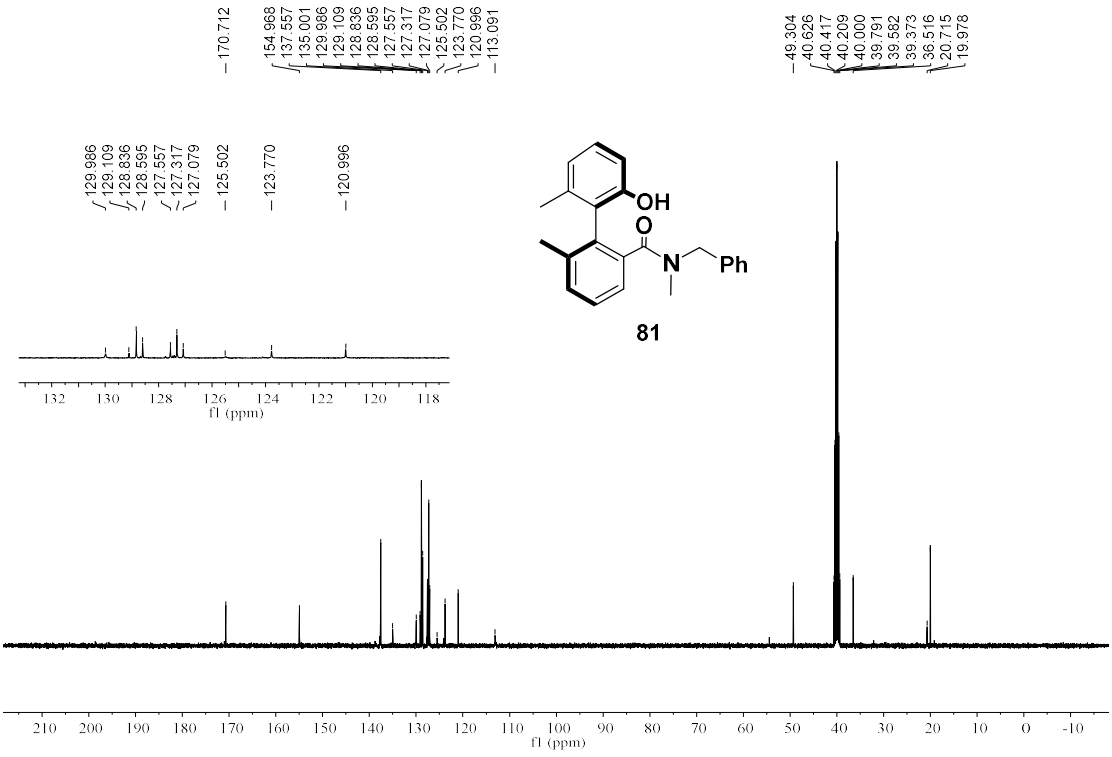


Figure S164. ^{13}C NMR Spectrum of **81**

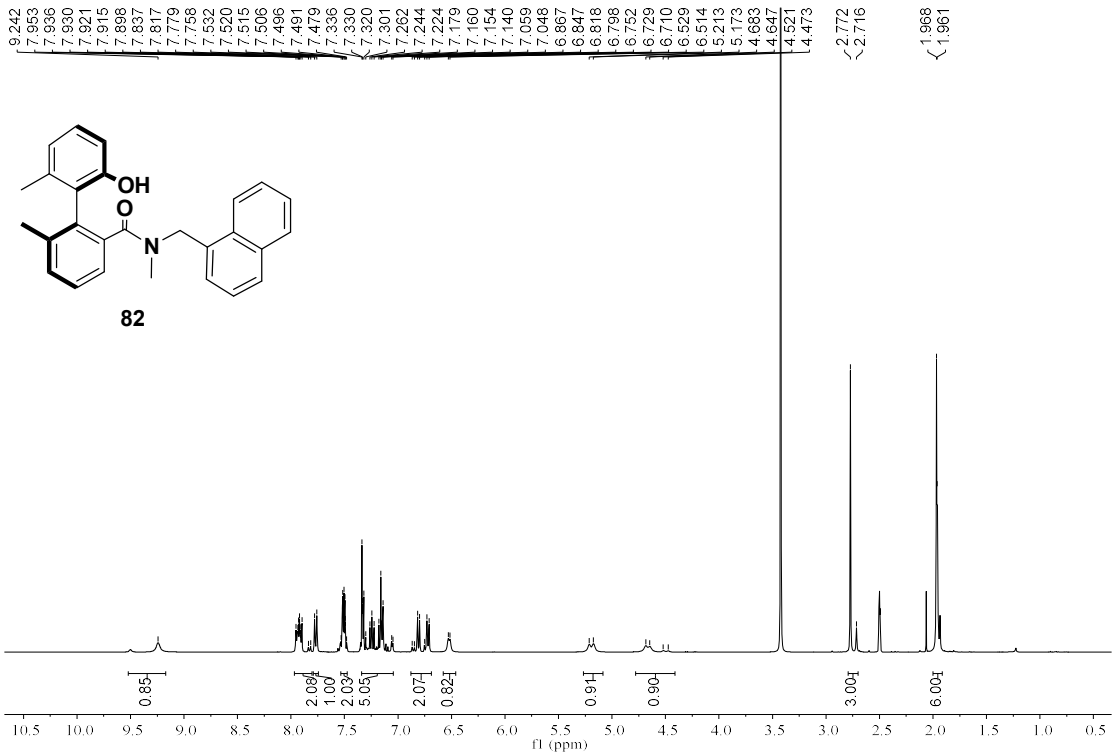


Figure S165. [1]H NMR Spectrum of **82**

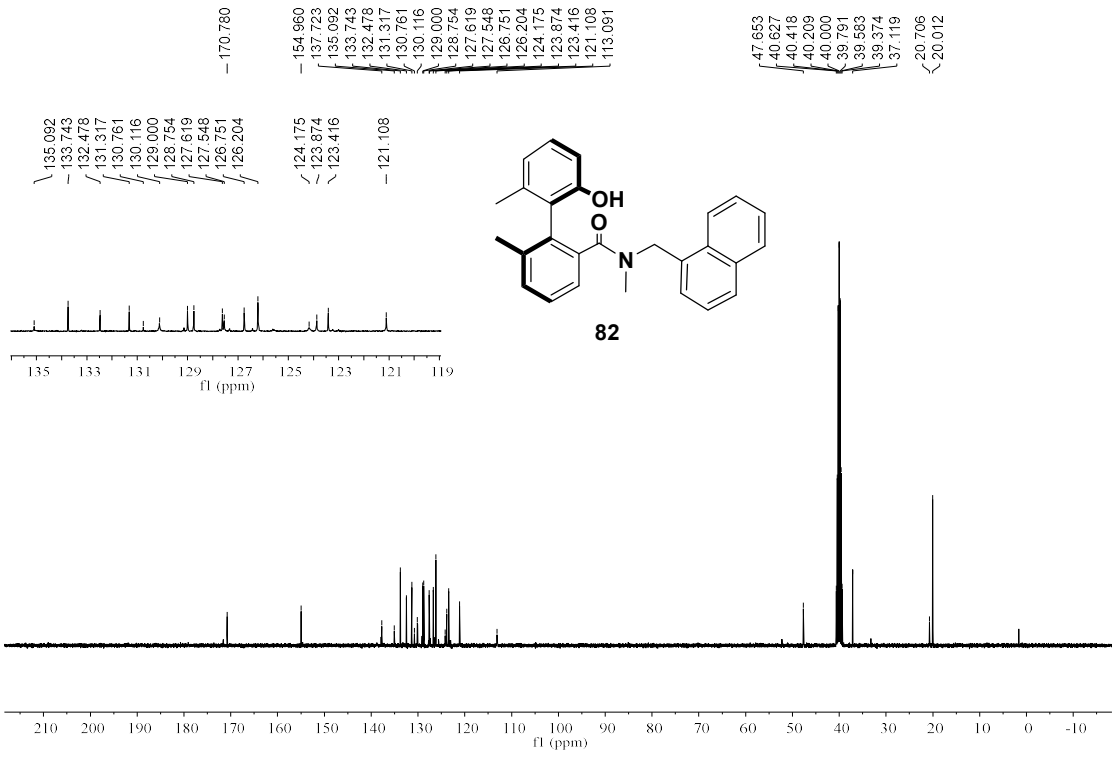


Figure S166. [13]C NMR Spectrum of **82**

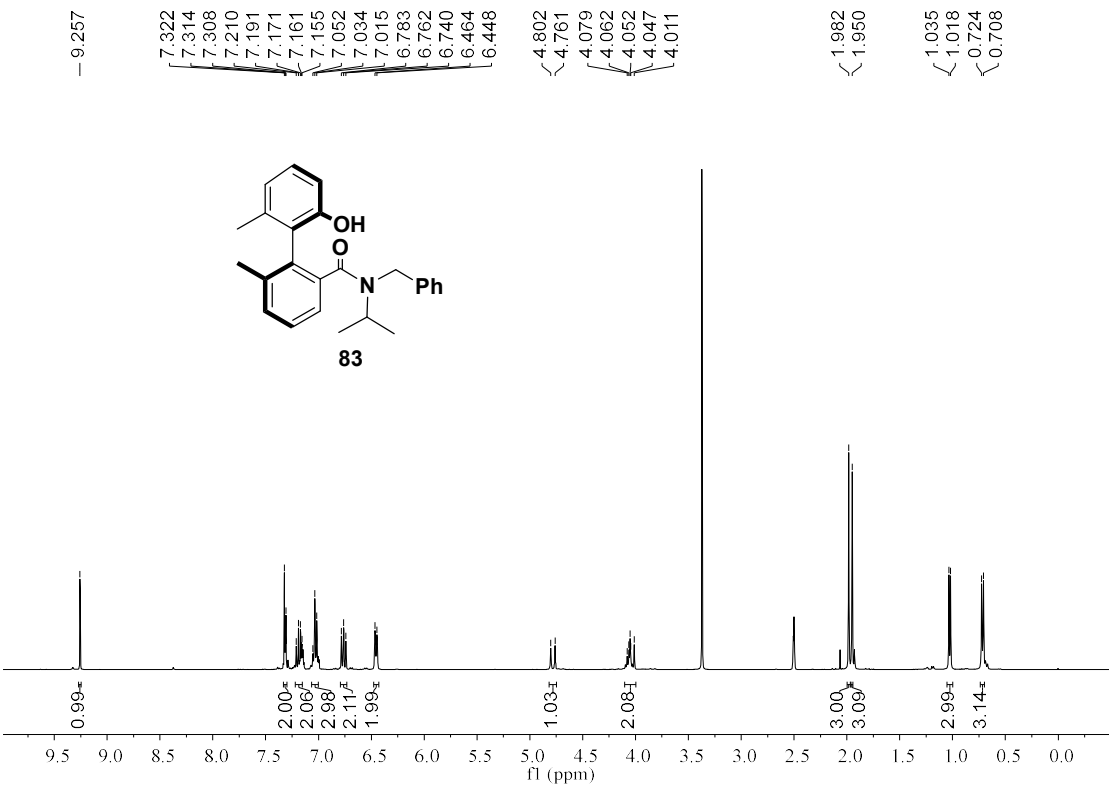


Figure S167. ^{1}H NMR Spectrum of **83**

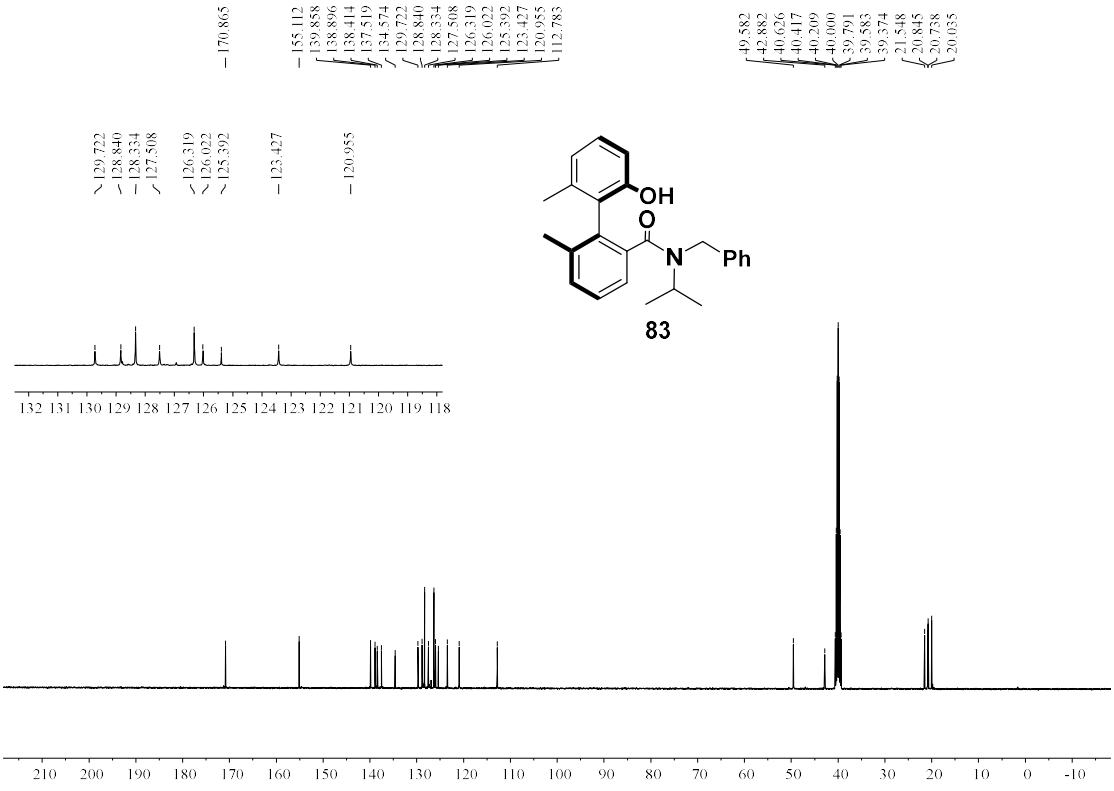


Figure S168. ^{13}C NMR Spectrum of **83**

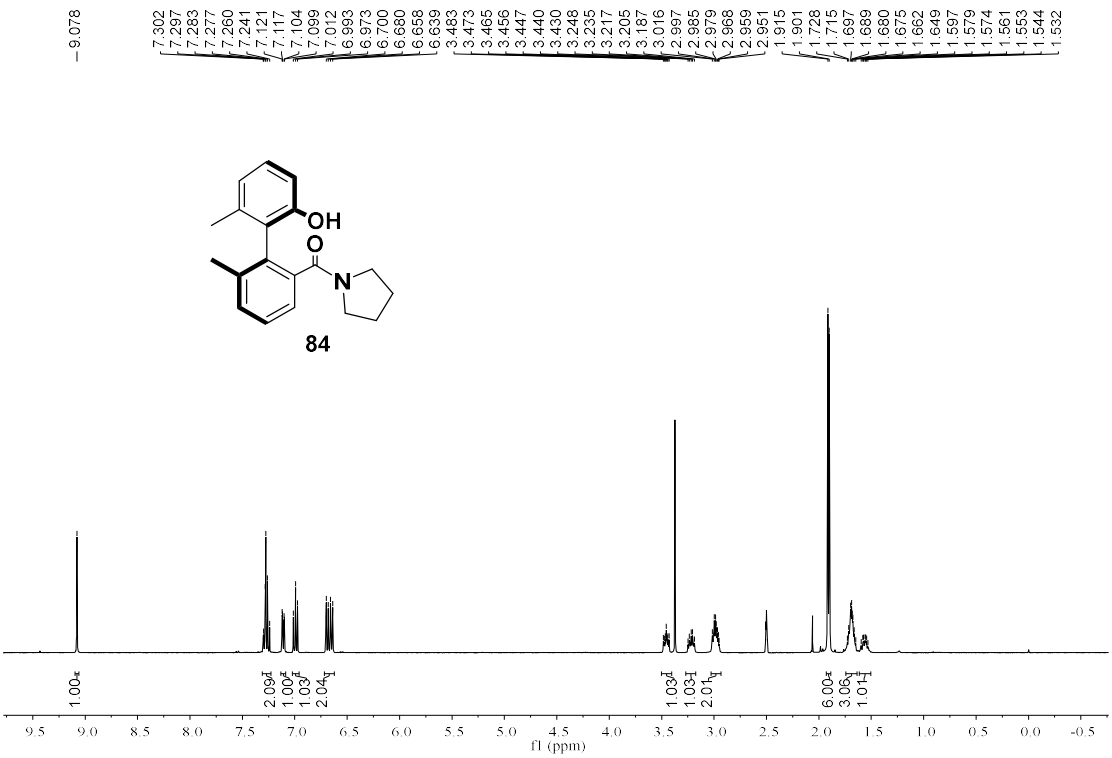


Figure S169. ^{1}H NMR Spectrum of **84**

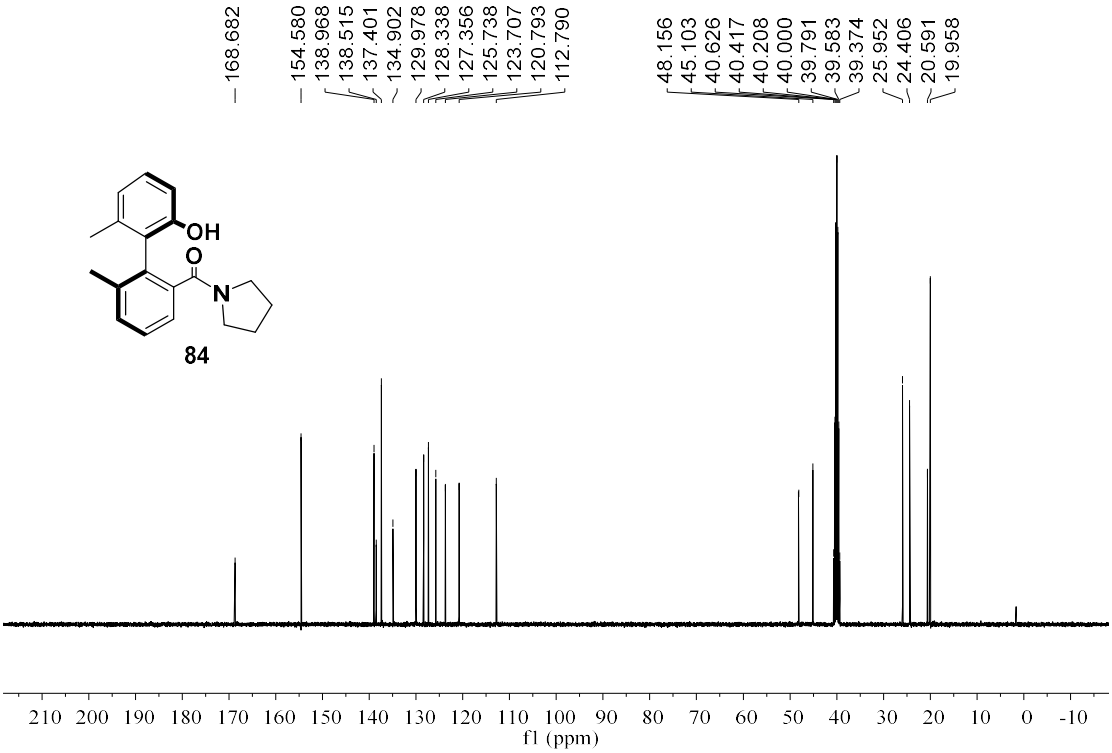


Figure S170. ^{13}C NMR Spectrum of **84**

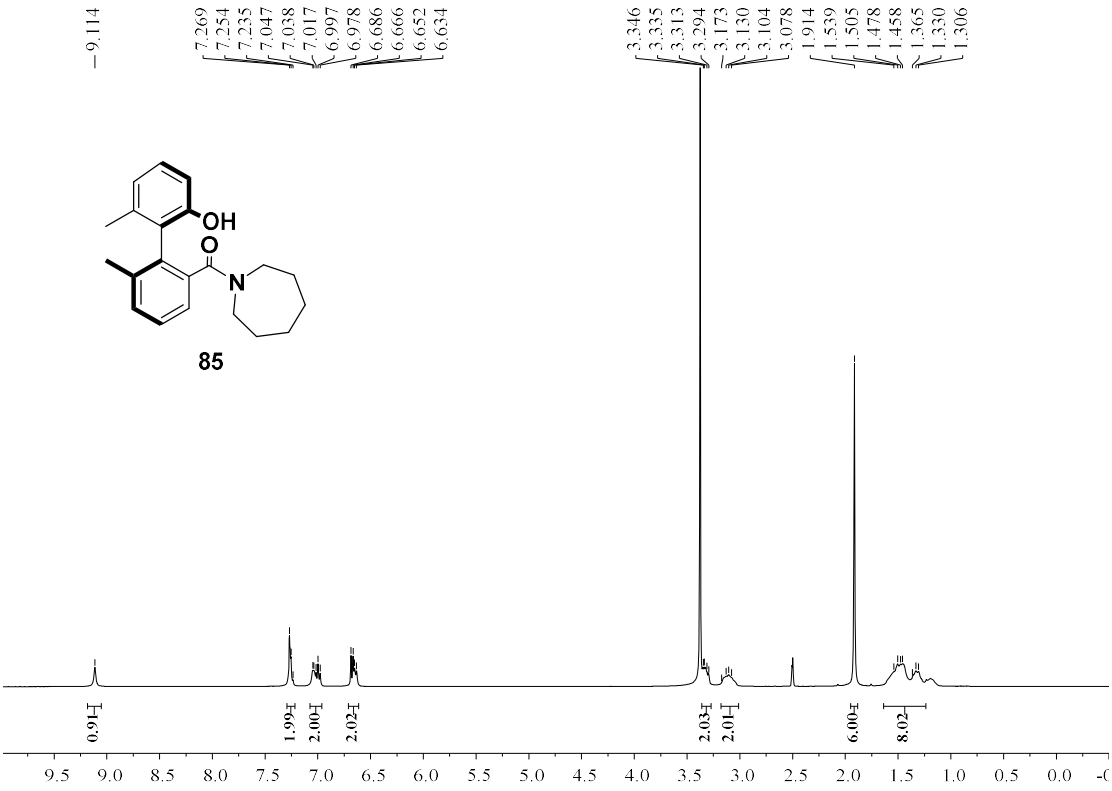


Figure S171. ^{1}H NMR Spectrum of **85**

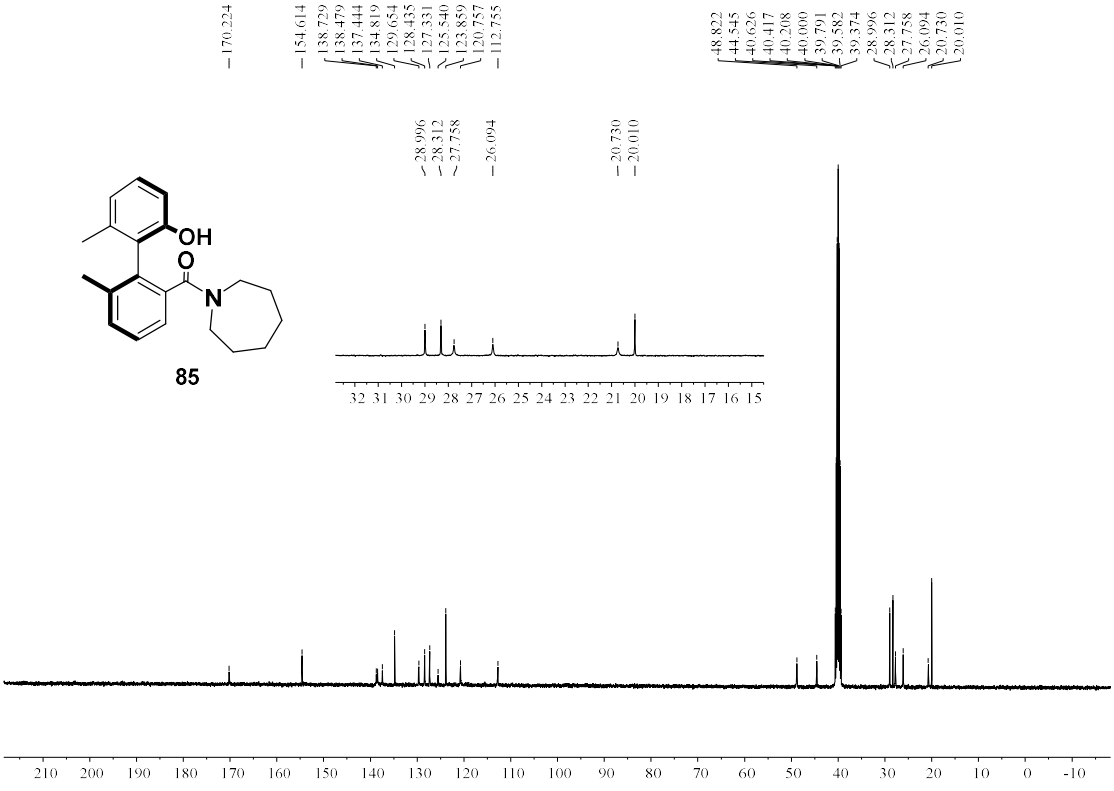


Figure S172. ^{13}C NMR Spectrum of **85**

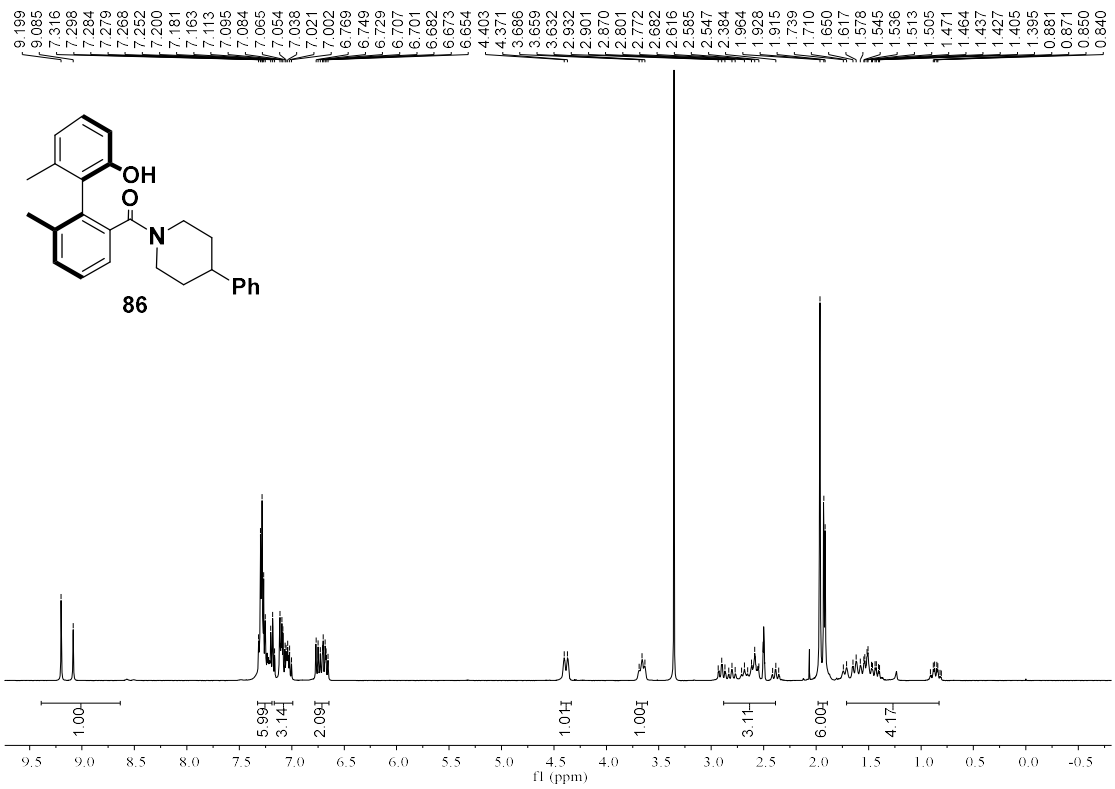


Figure S173. ^{1}H NMR Spectrum of **86**

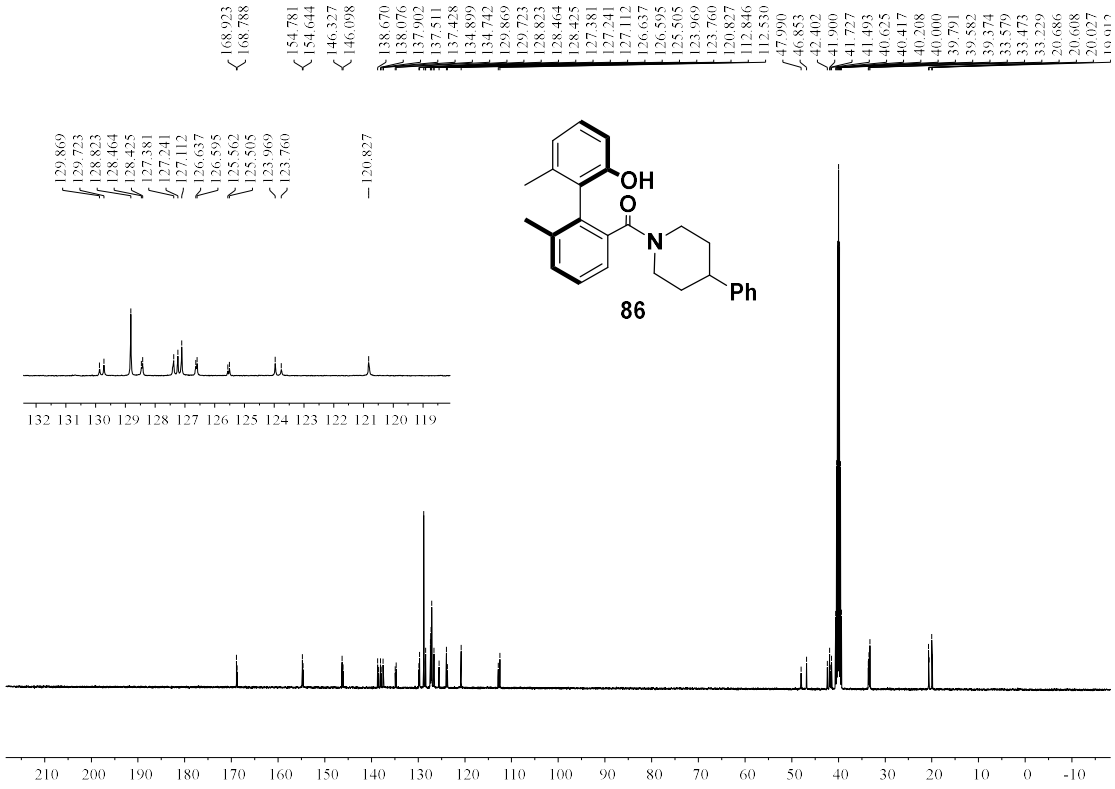


Figure S174. ^{13}C NMR Spectrum of **86**

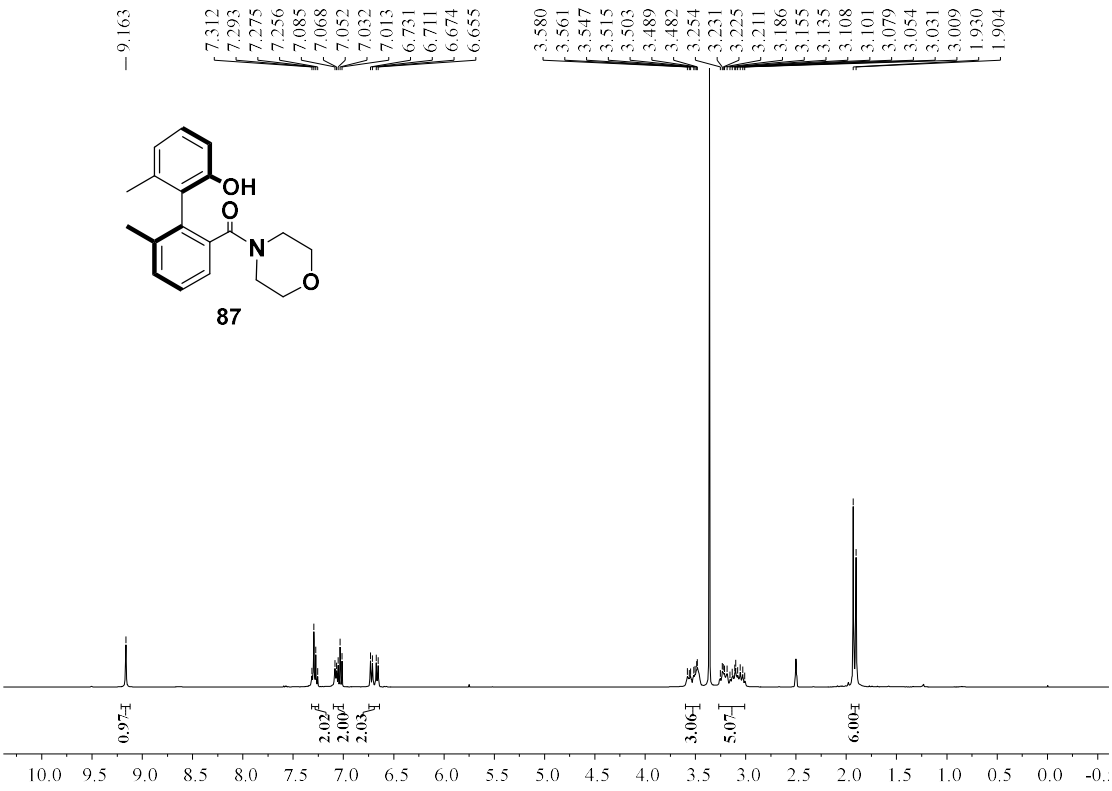


Figure S175. ^{1}H NMR Spectrum of **87**

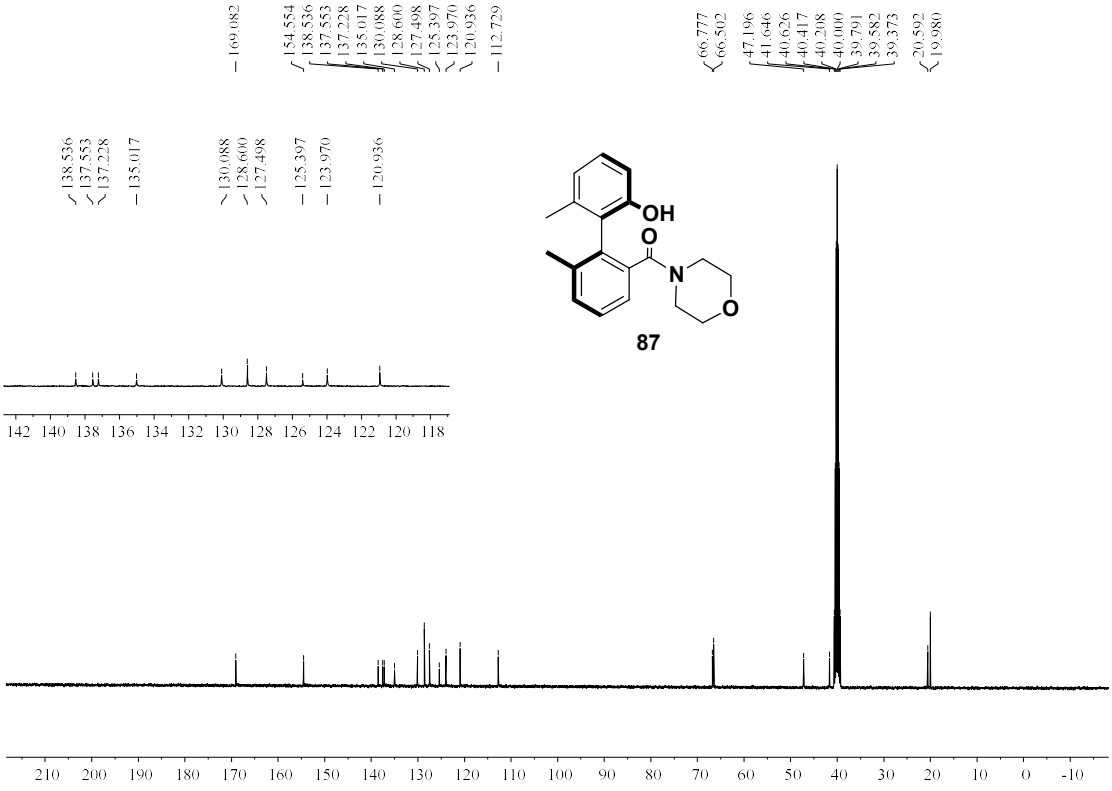


Figure S176. ^{13}C NMR Spectrum of **87**

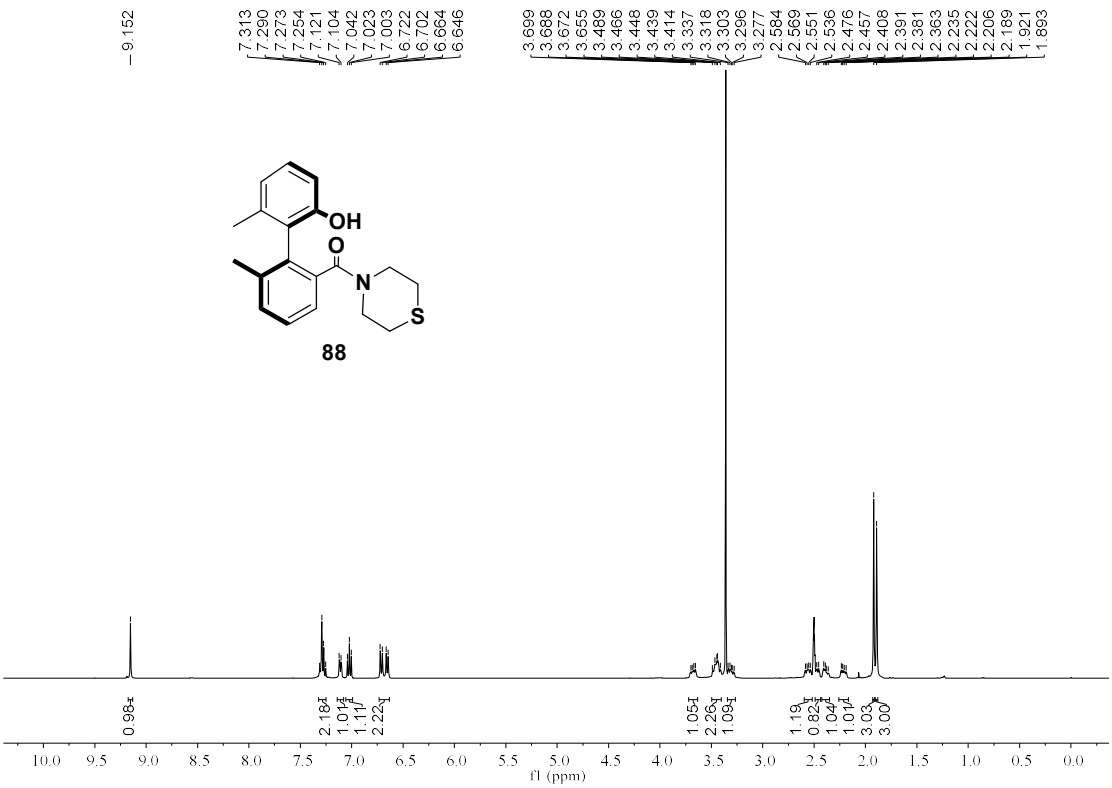


Figure S177. ^{1}H NMR Spectrum of **88**

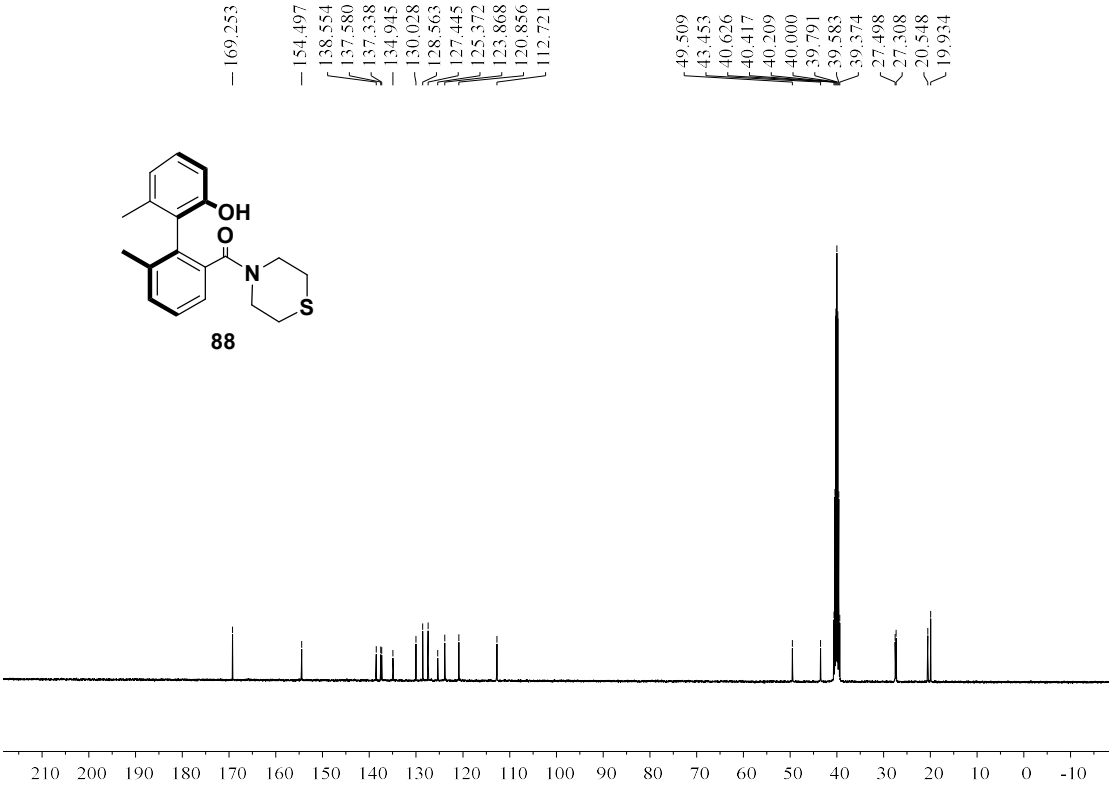


Figure S178. ^{13}C NMR Spectrum of **88**

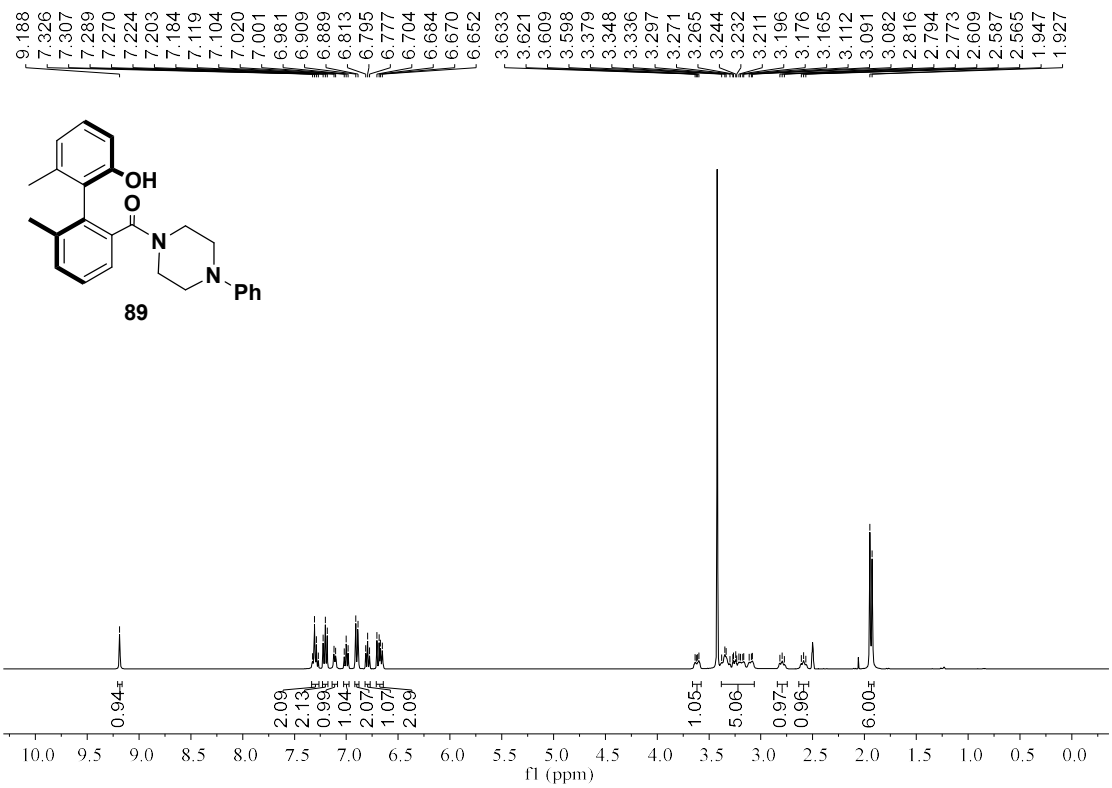


Figure S179. ^{1}H NMR Spectrum of **89**

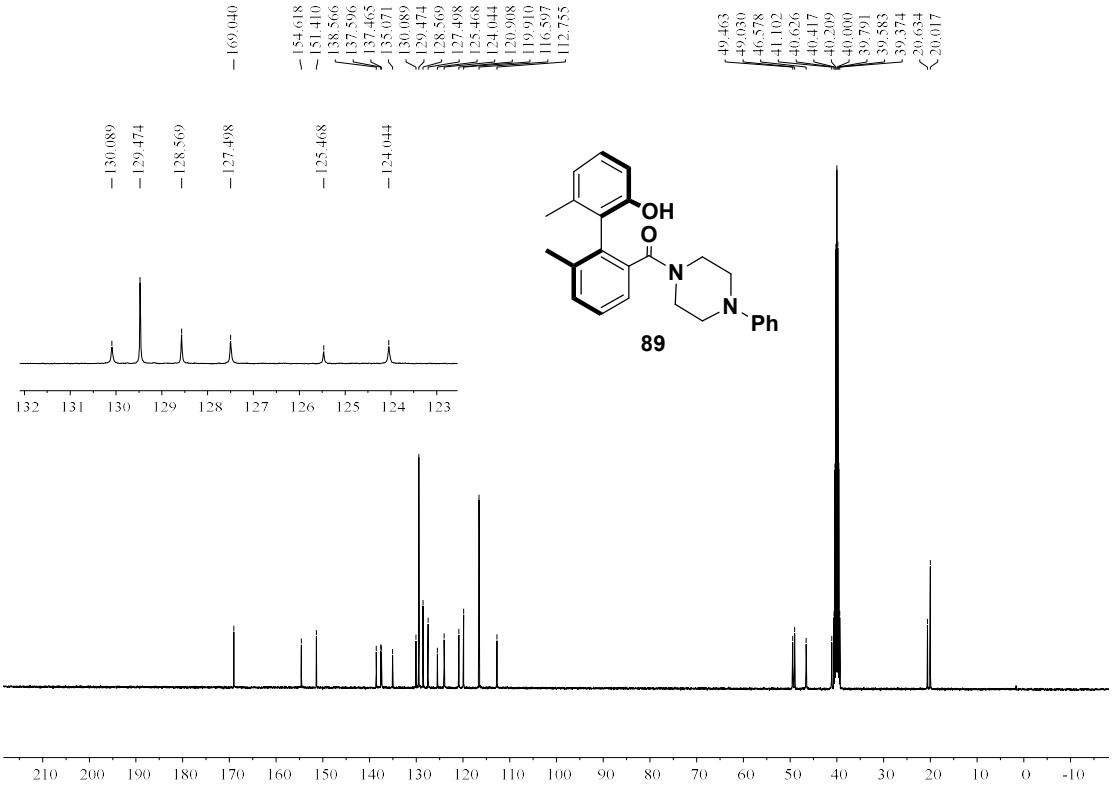


Figure S180. ^{13}C NMR Spectrum of **89**

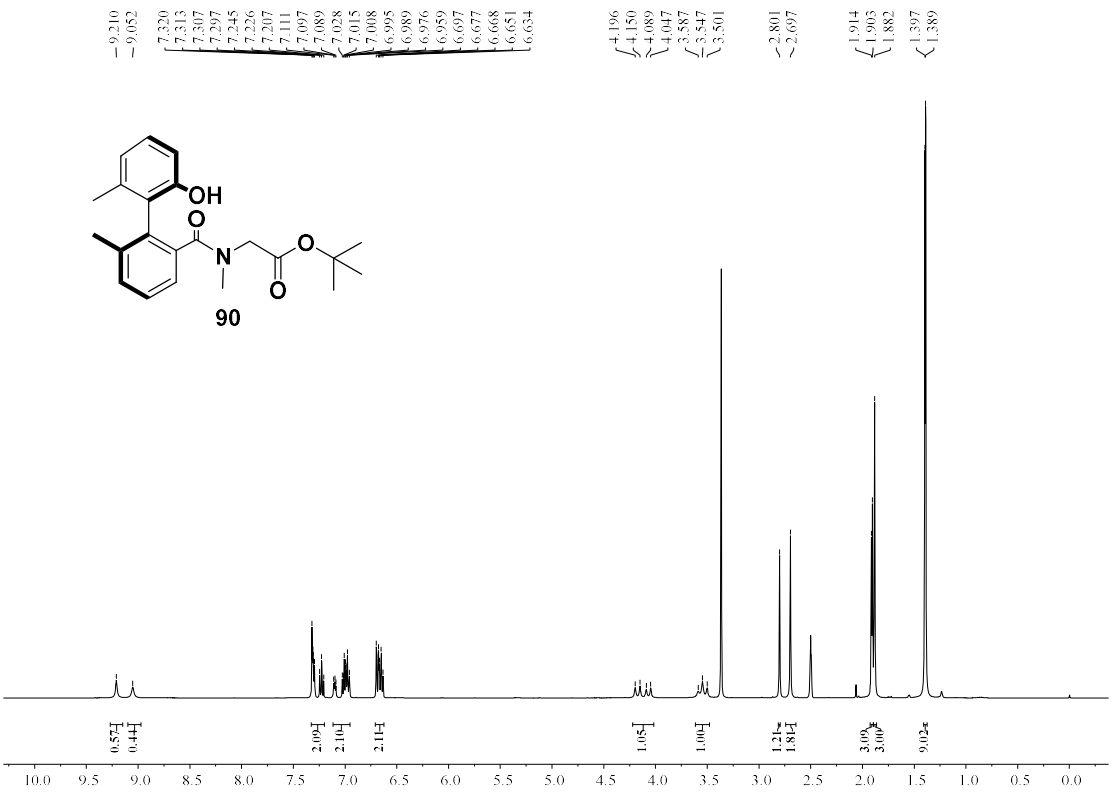


Figure S181. ^{1}H NMR Spectrum of **90**

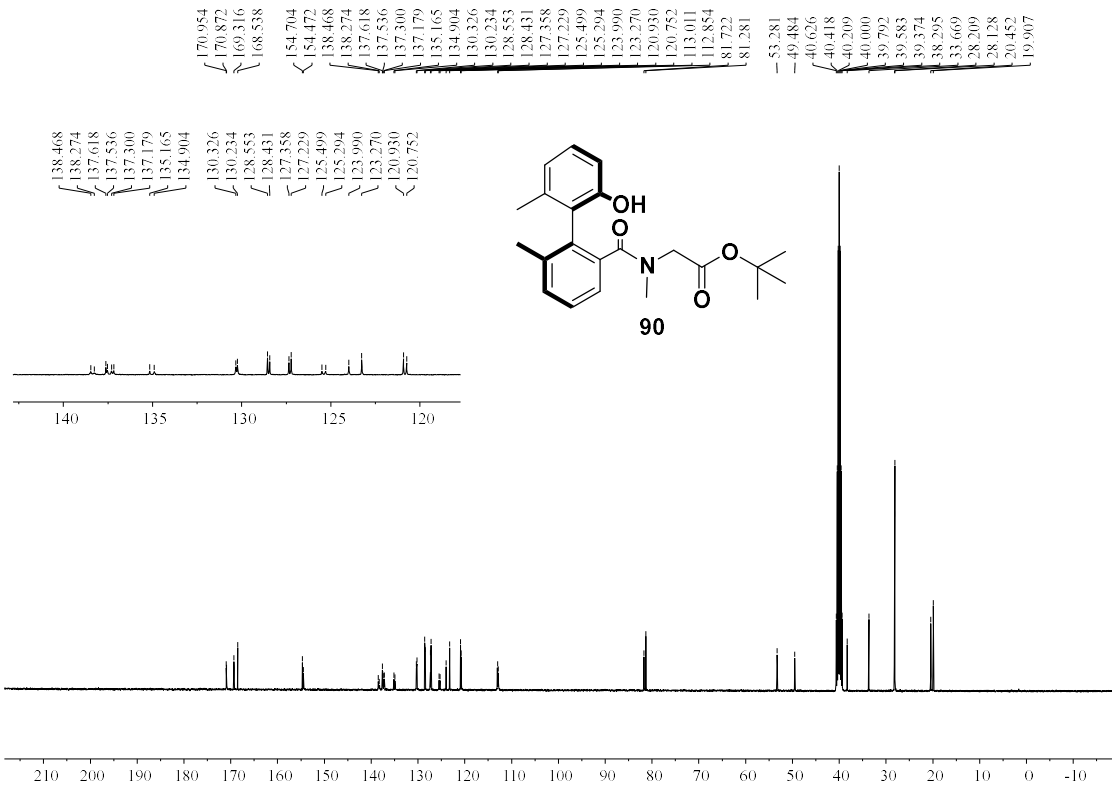


Figure S182. ^{13}C NMR Spectrum of **90**

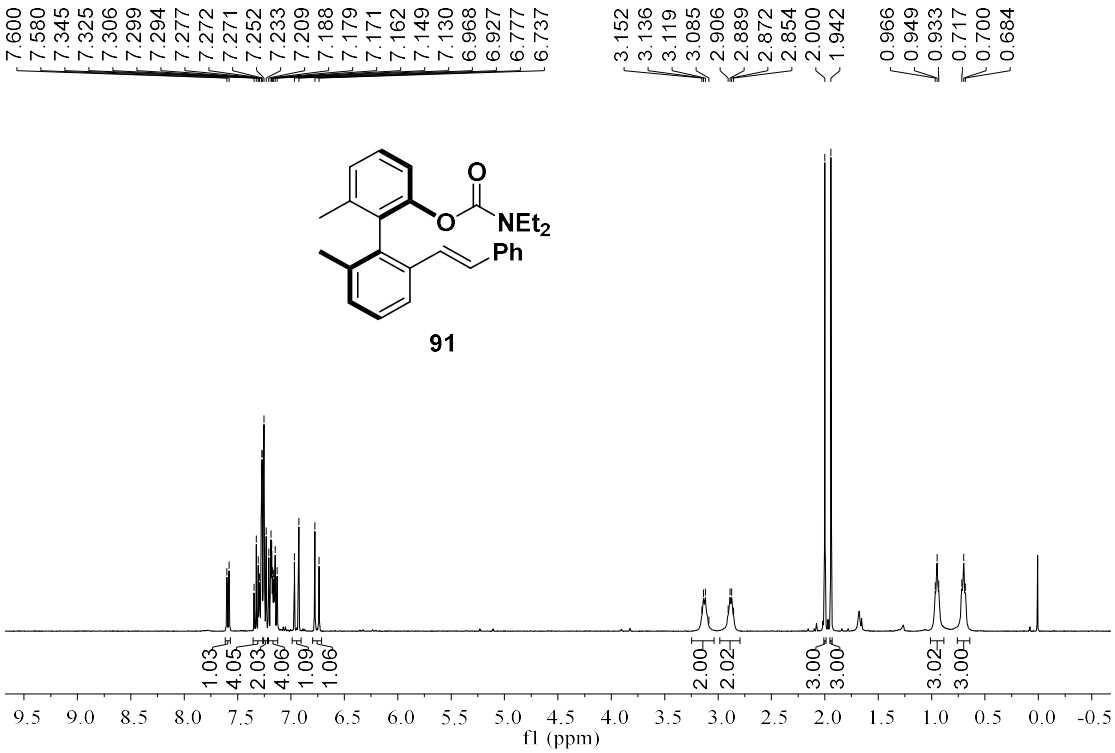


Figure S183. ^{1}H NMR Spectrum of **91**

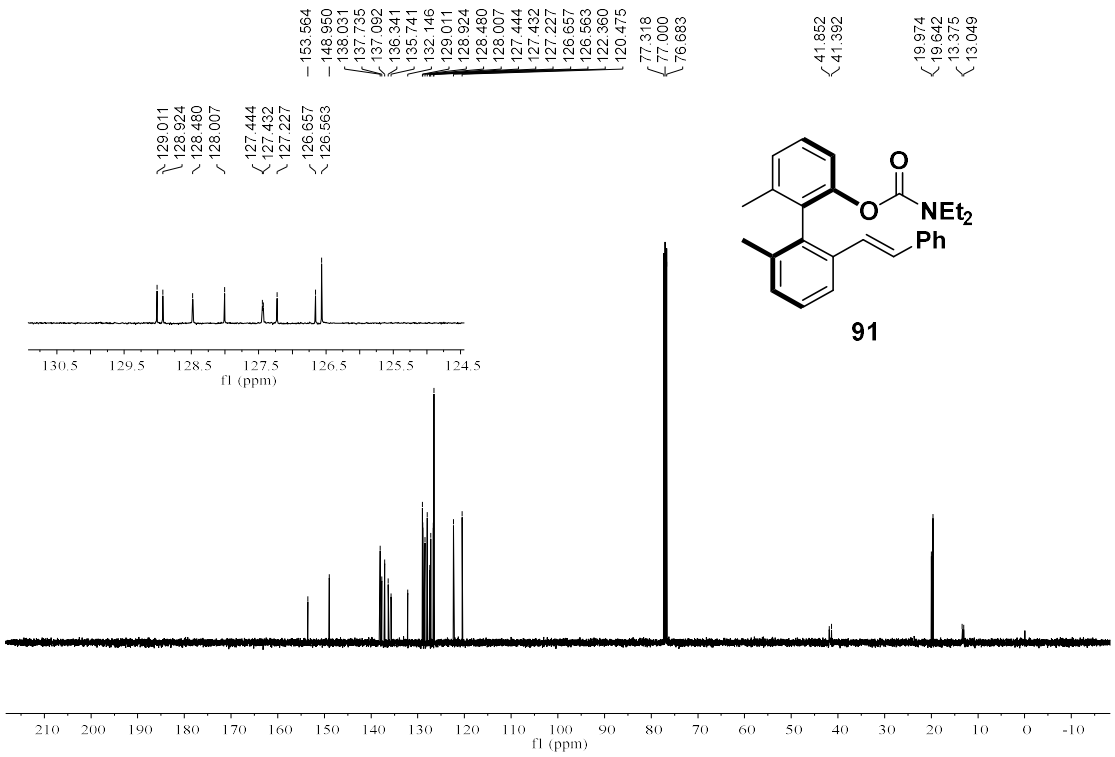


Figure S184. ^{13}C NMR Spectrum of **91**

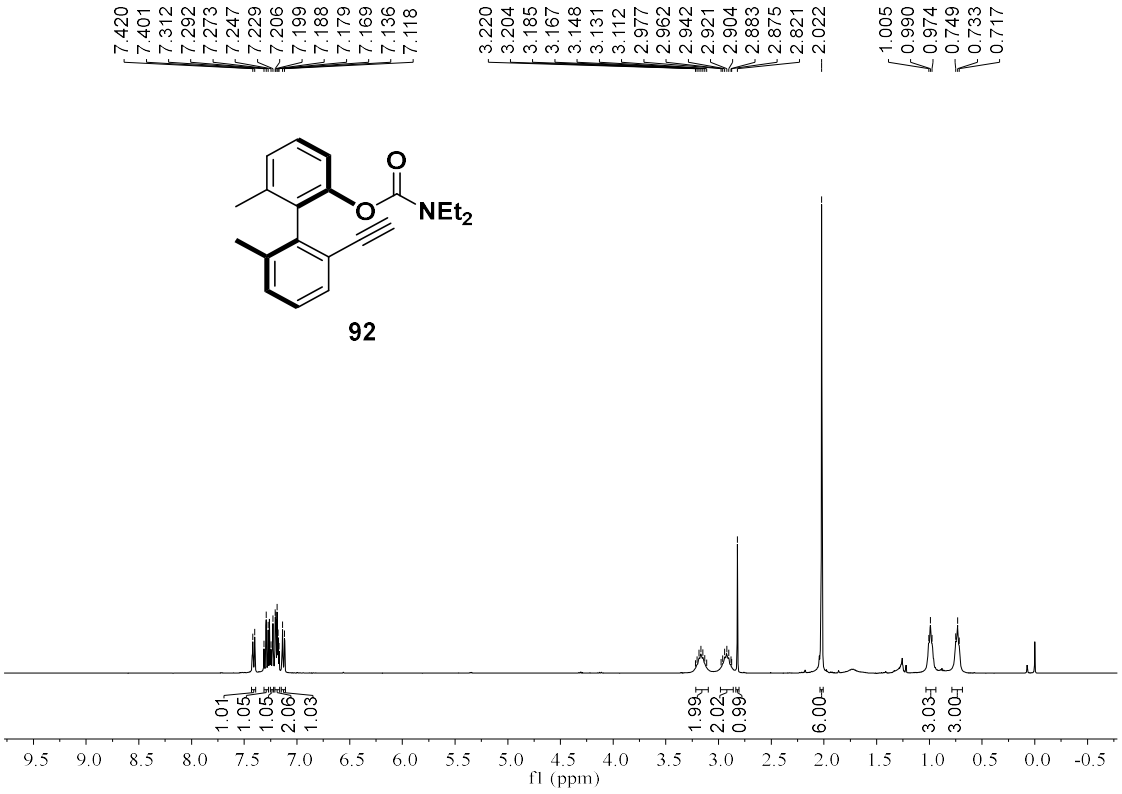


Figure S185. ^{1}H NMR Spectrum of **92**

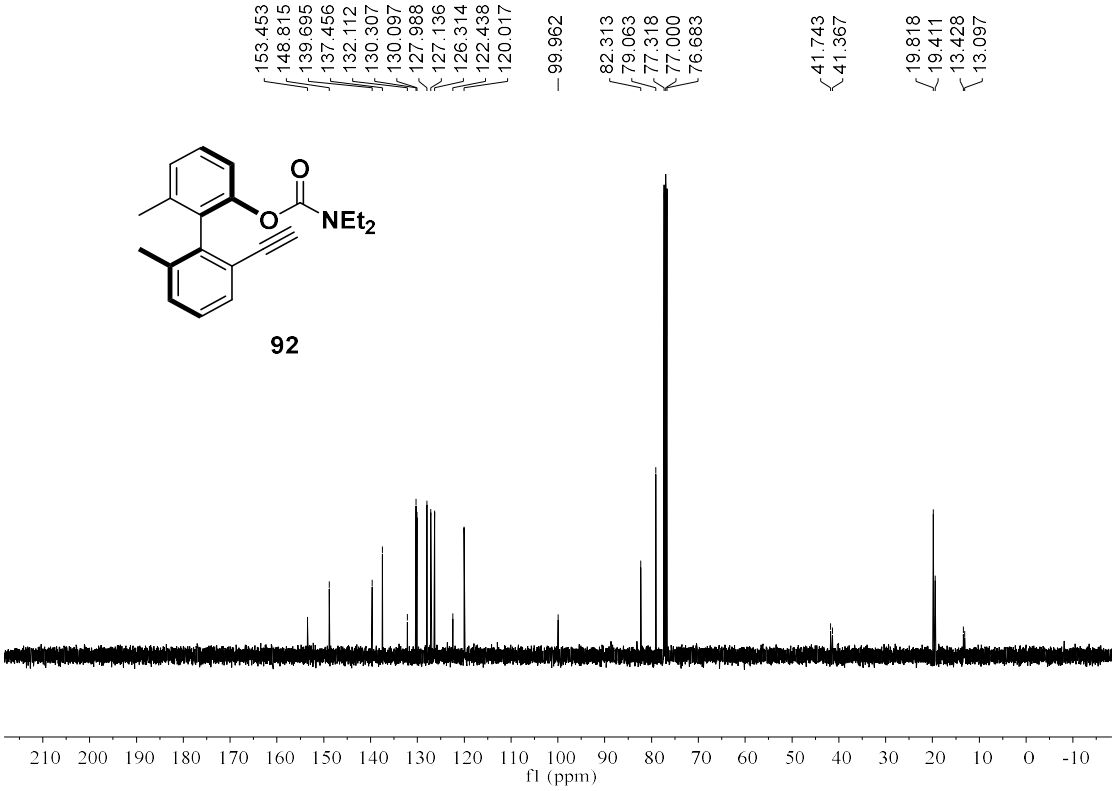


Figure S186. ^{13}C NMR Spectrum of **92**

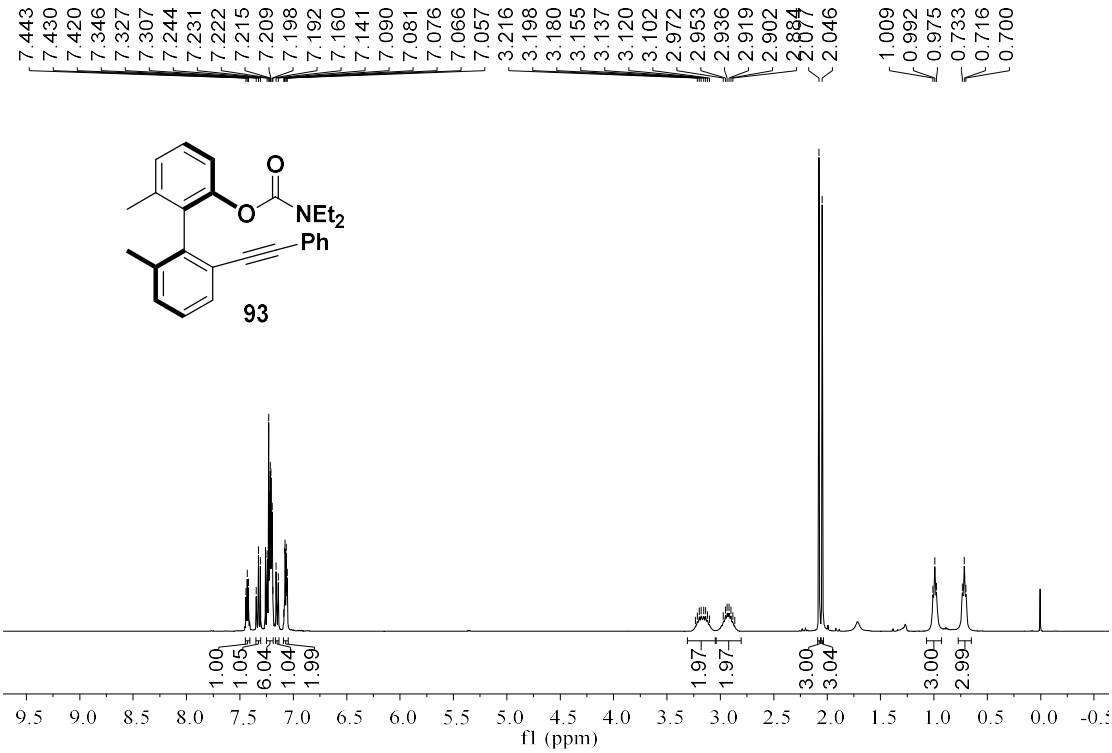


Figure S187. [1]H NMR Spectrum of **93**

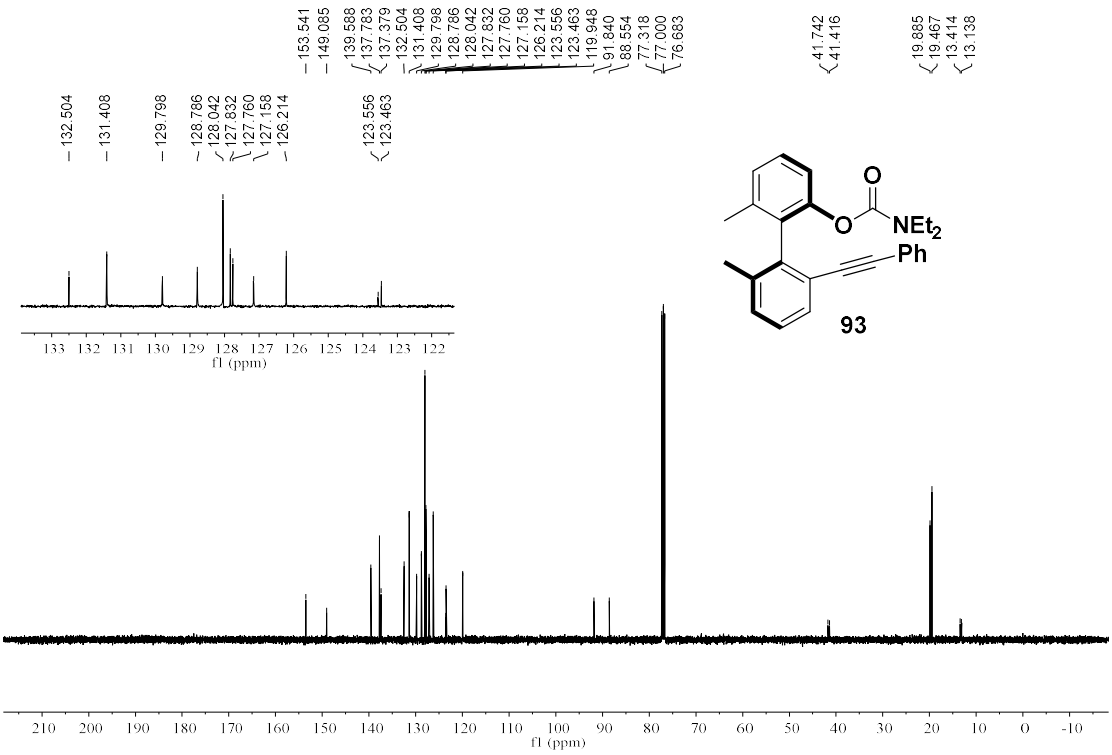


Figure S188. [13]C NMR Spectrum of **93**

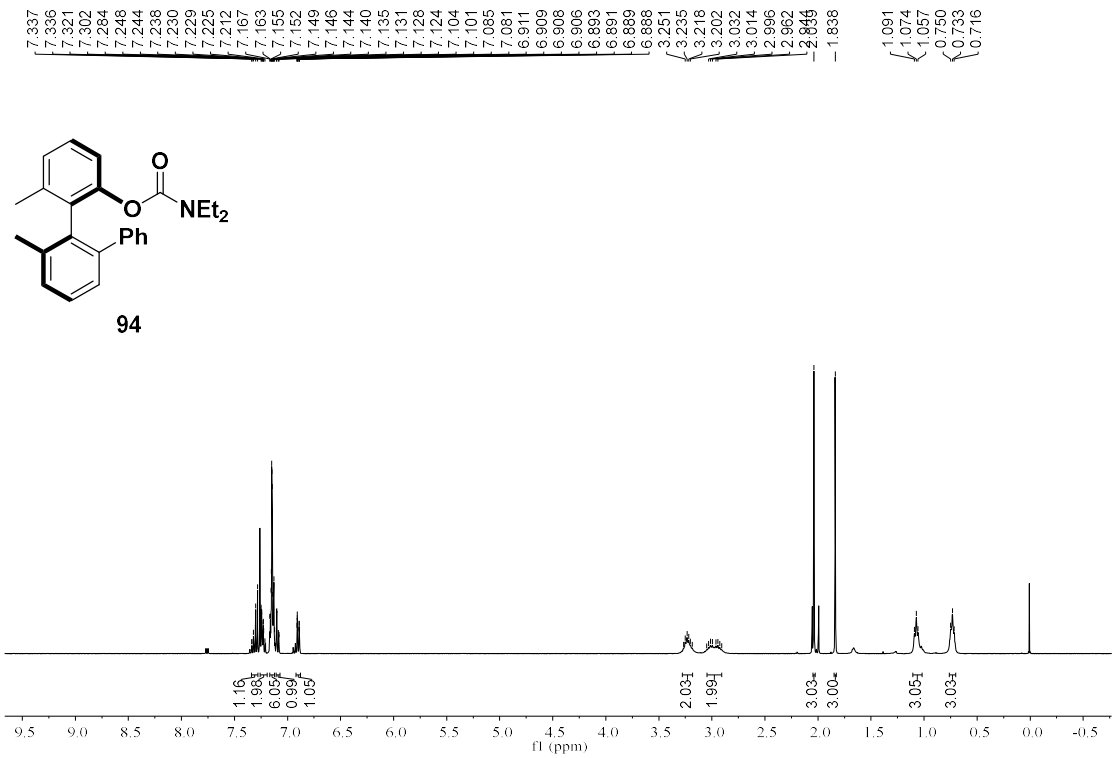


Figure S189. ^{1}H NMR Spectrum of **94**

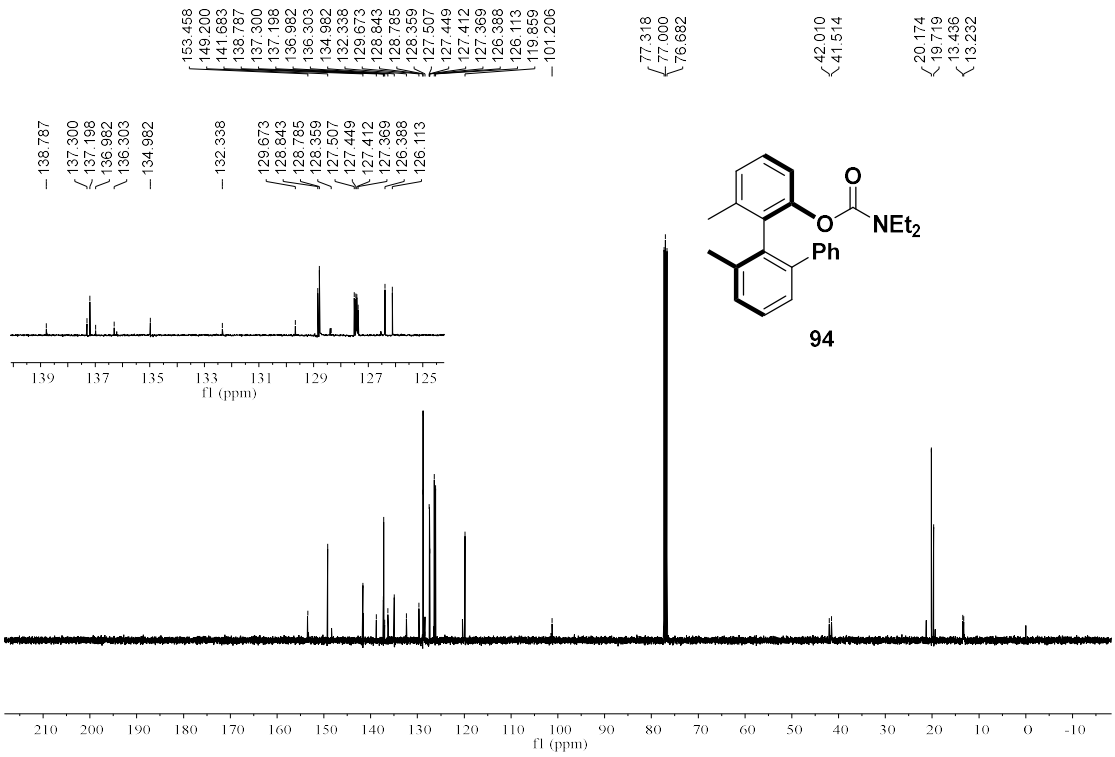


Figure S190. ^{13}C NMR Spectrum of **94**

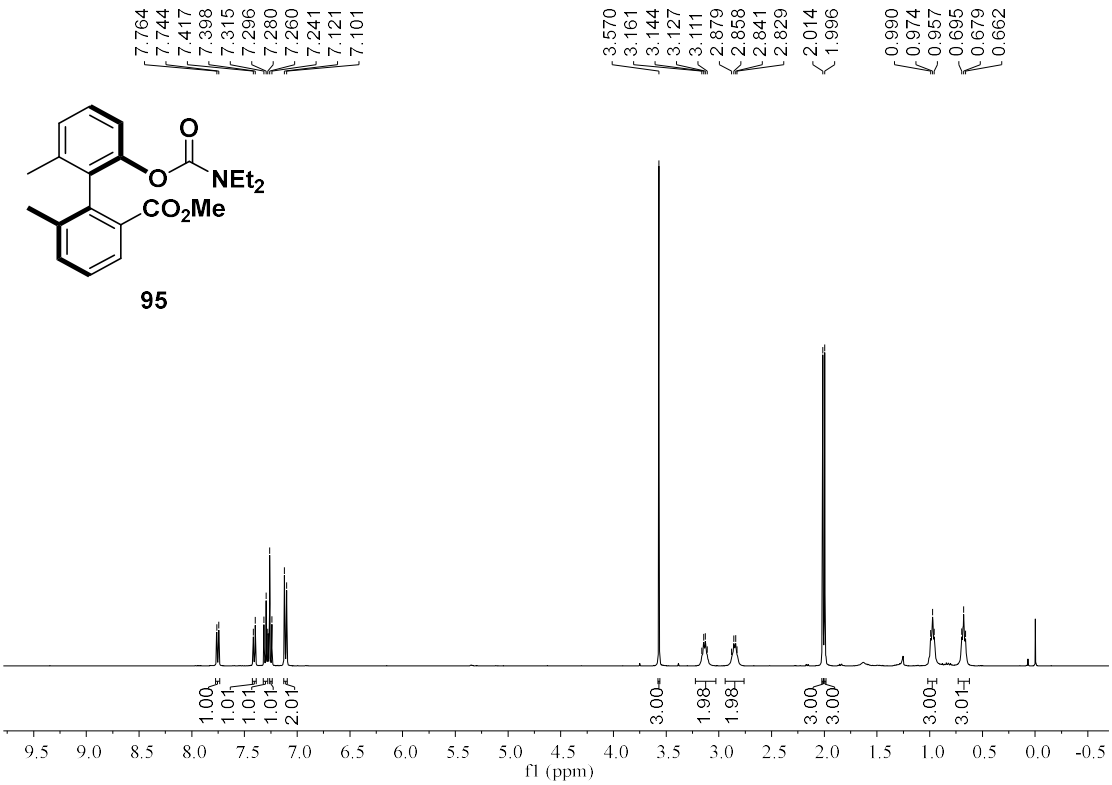


Figure S191. ^{1}H NMR Spectrum of **95**

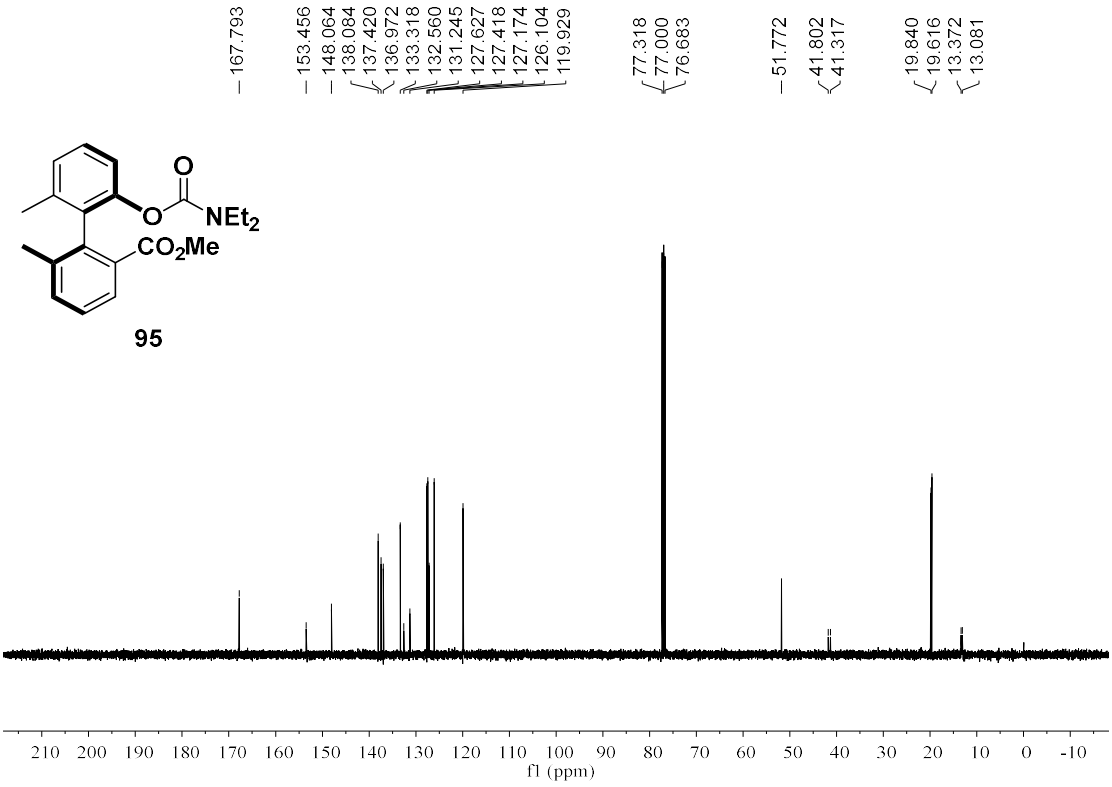


Figure S191. ^{13}C NMR Spectrum of **95**

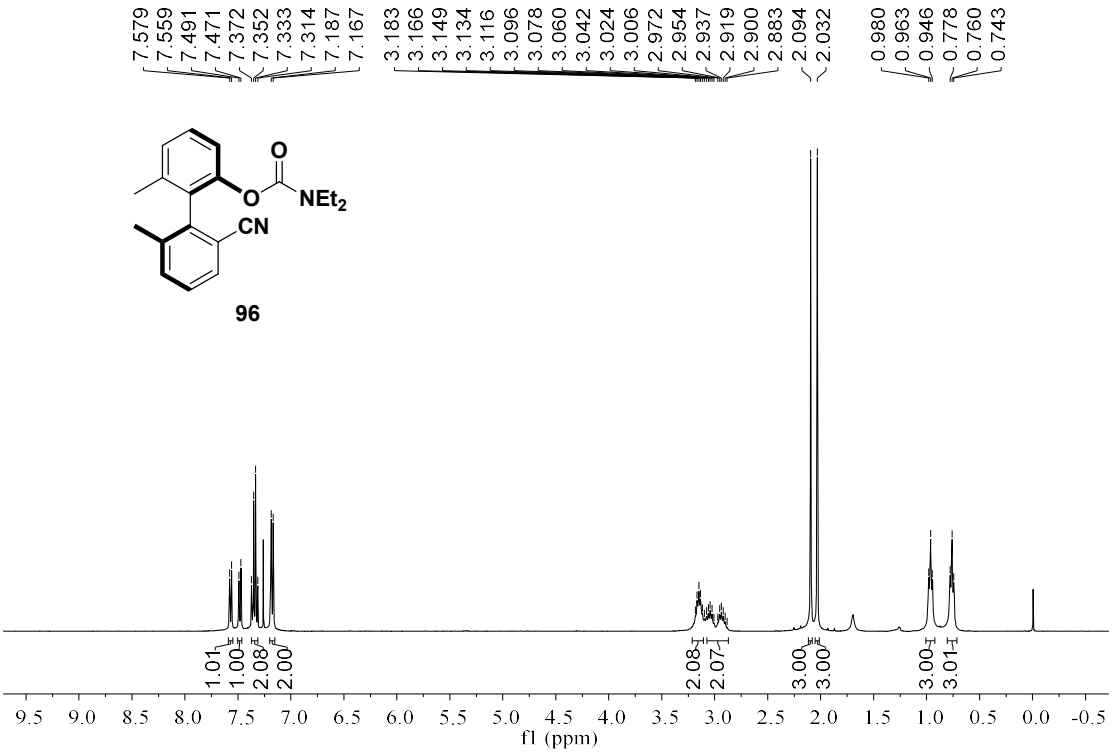


Figure S192. ^{1}H NMR Spectrum of **96**

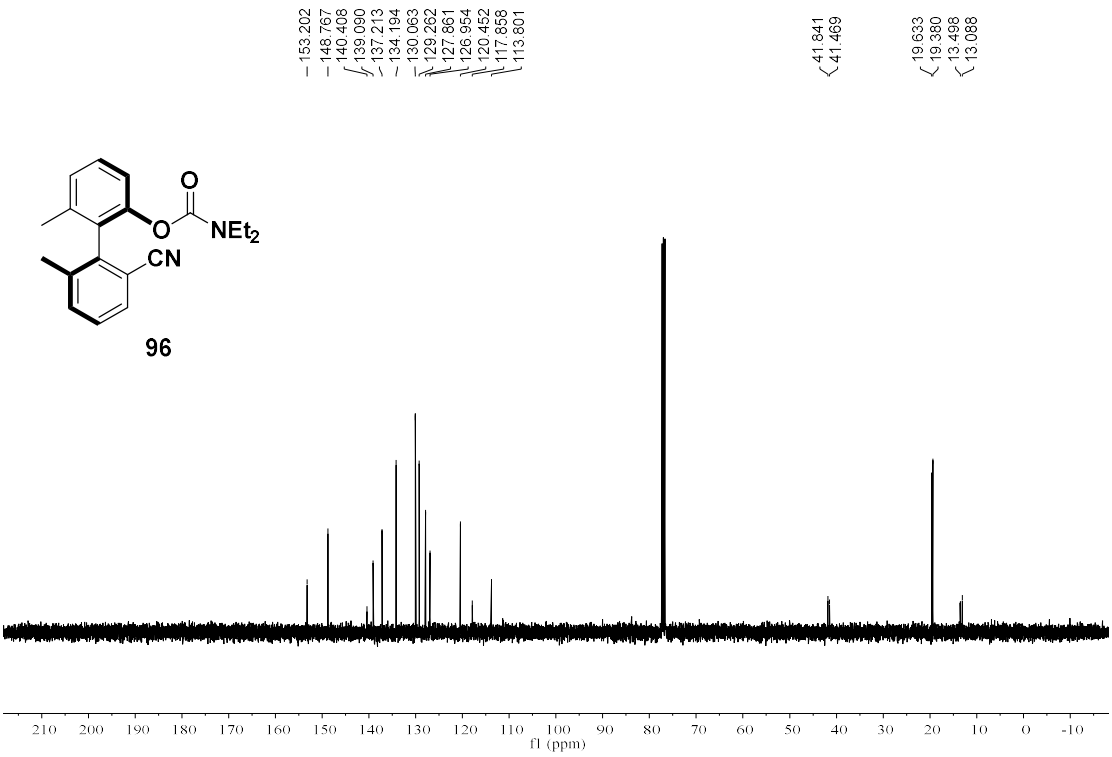


Figure S193. ^{13}C NMR Spectrum of **96**

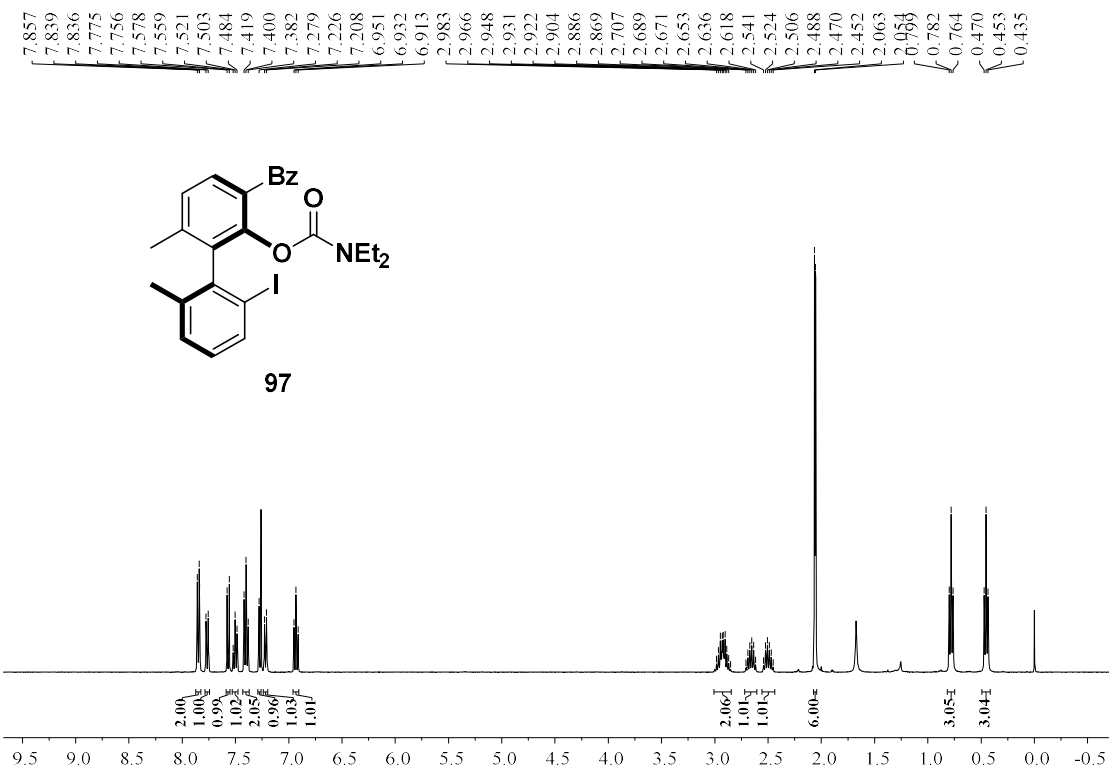


Figure S194. ^{1}H NMR Spectrum of **97**

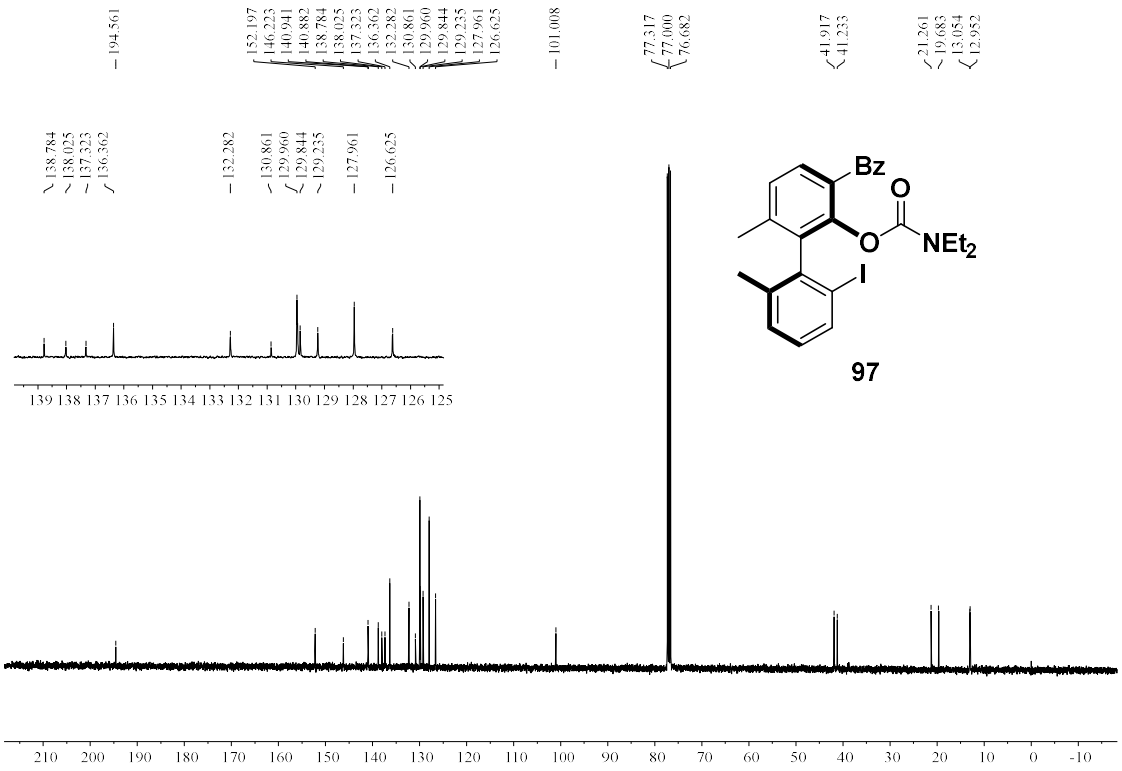


Figure S195. ^{13}C NMR Spectrum of **97**

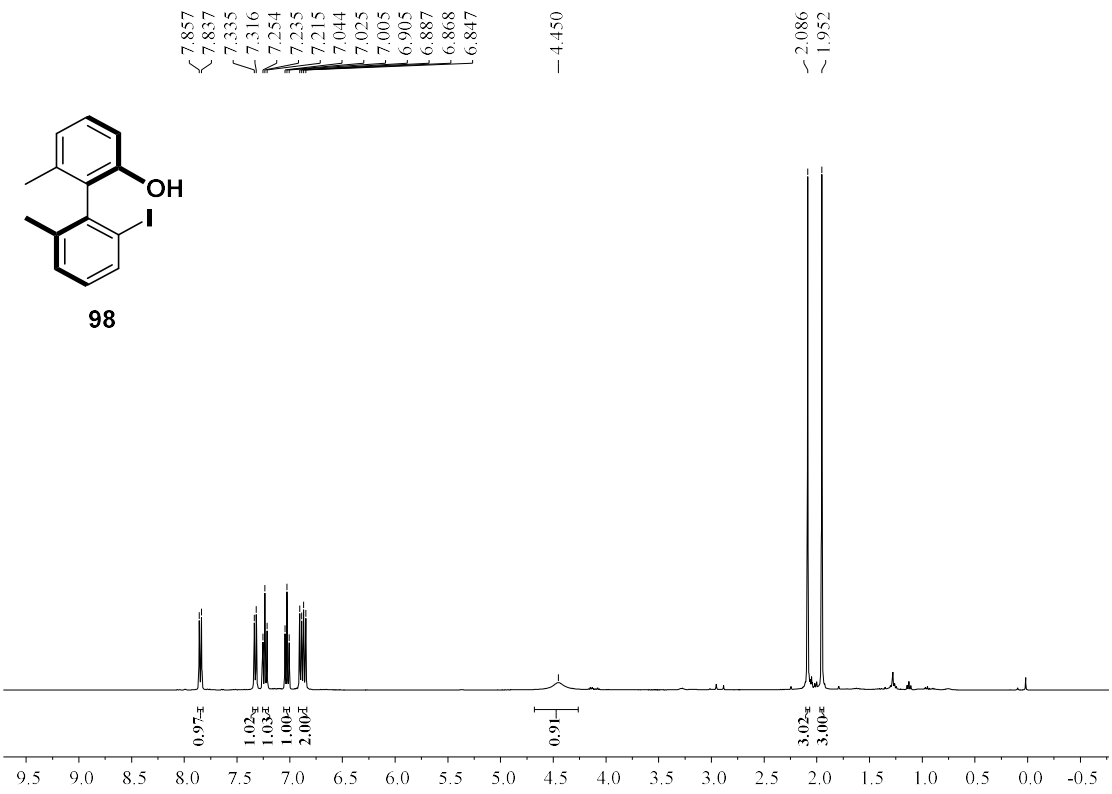


Figure S196. ^{1}H NMR Spectrum of **98**

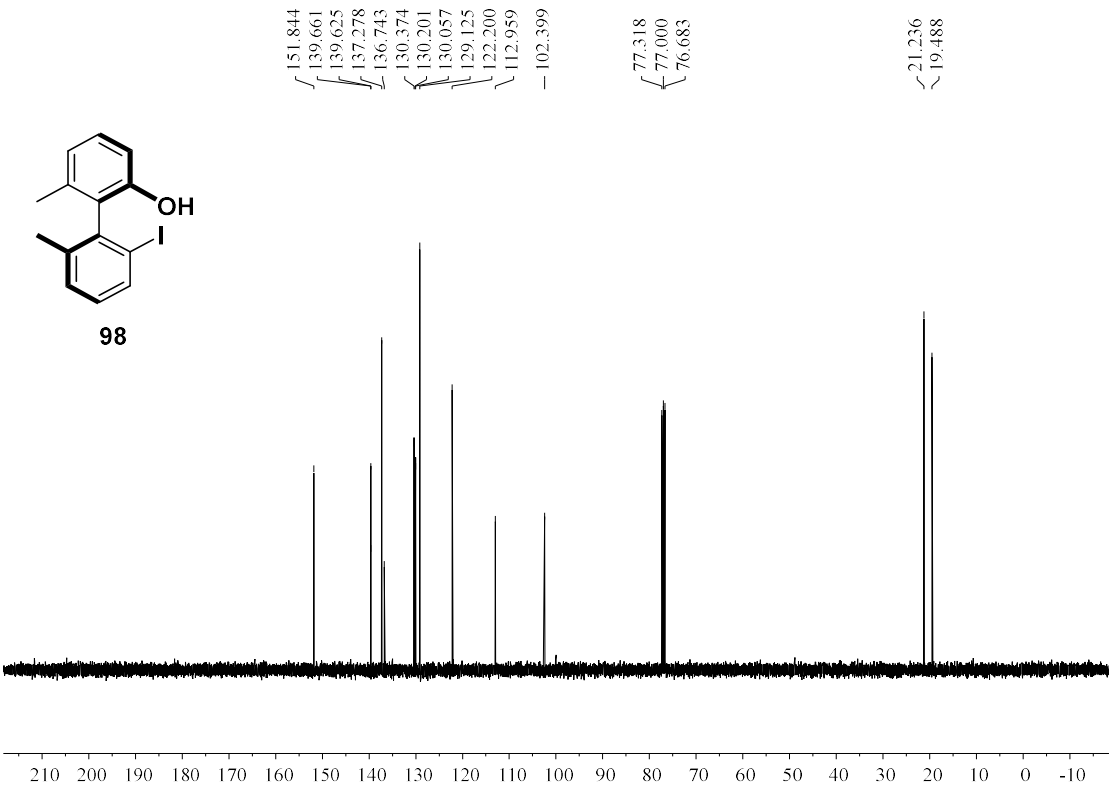


Figure S197. ^{13}C NMR Spectrum of **98**

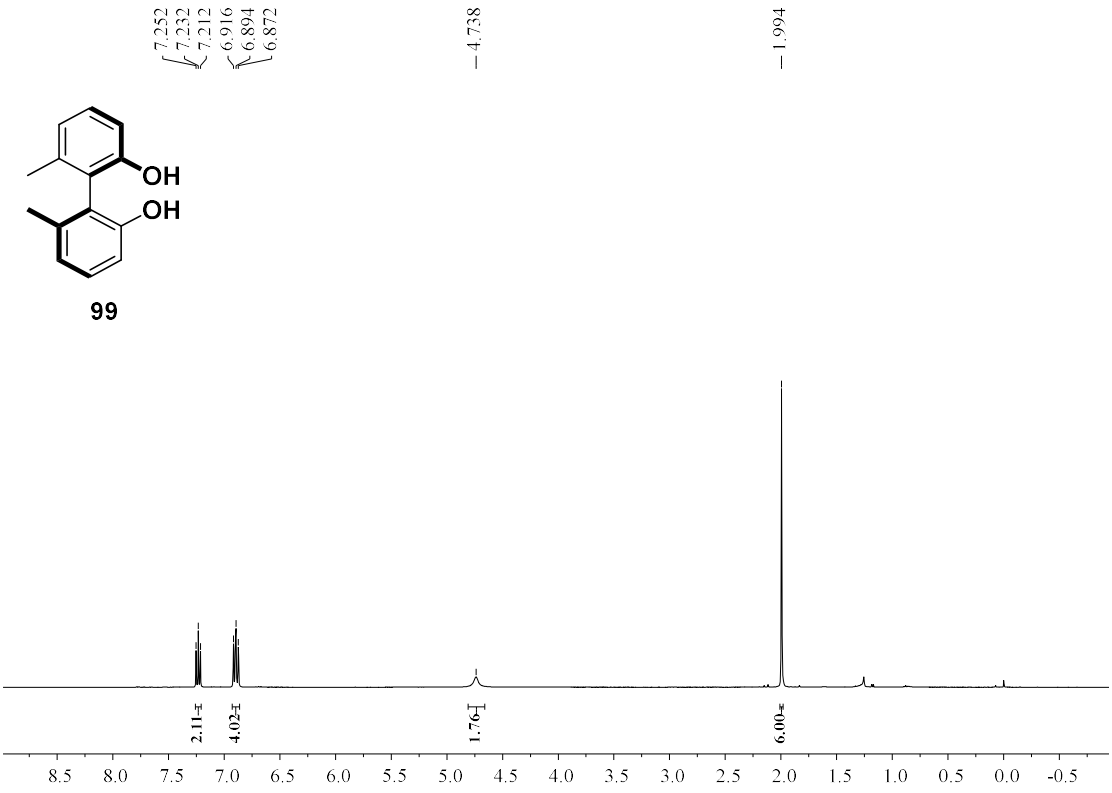


Figure S198. ^{1}H NMR Spectrum of **99**

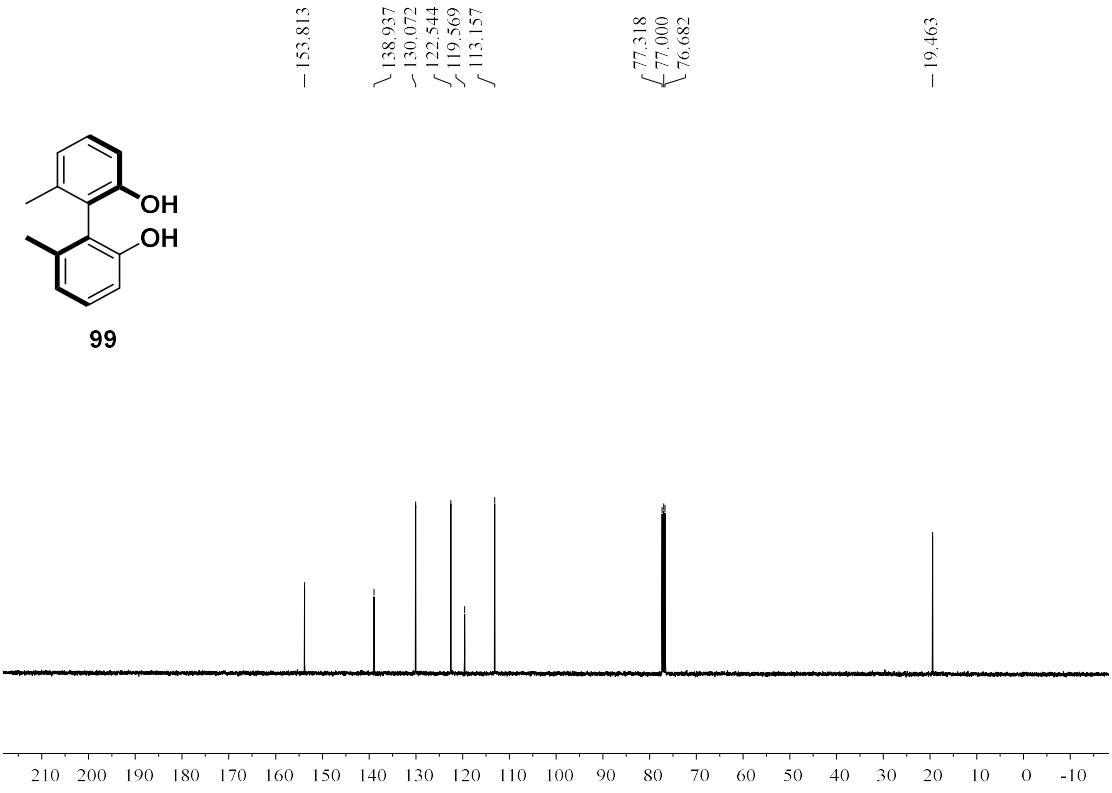


Figure S199. ^{13}C NMR Spectrum of **99**

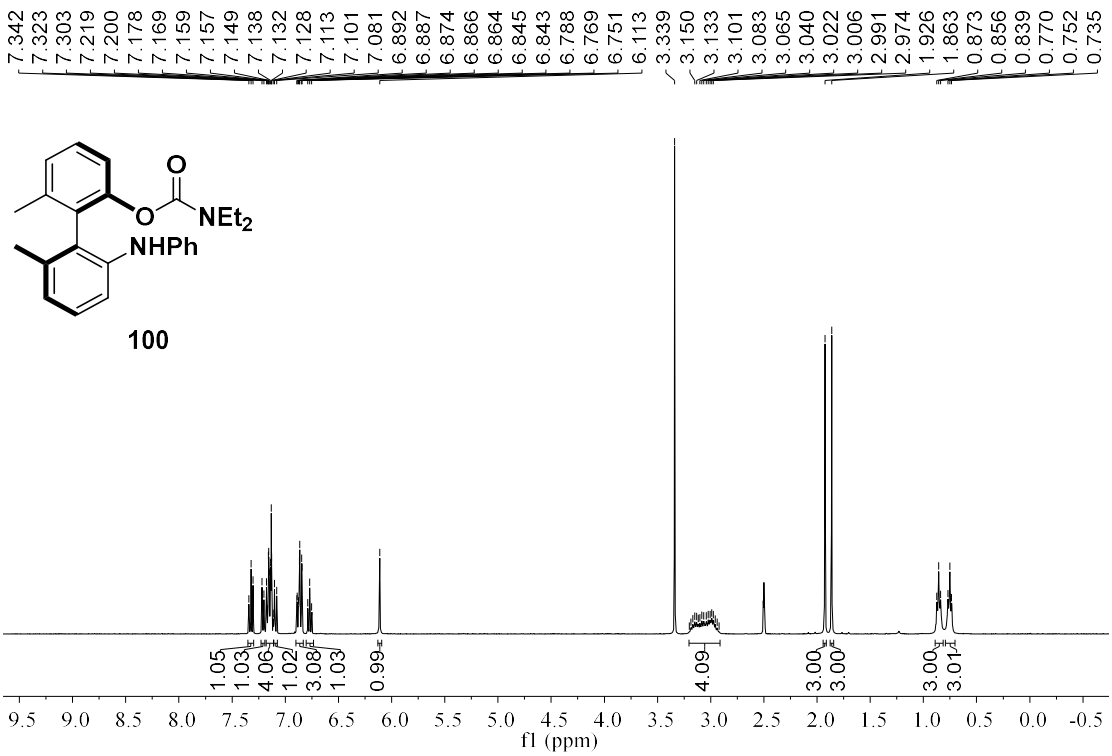


Figure S200. ^{1}H NMR Spectrum of **100**

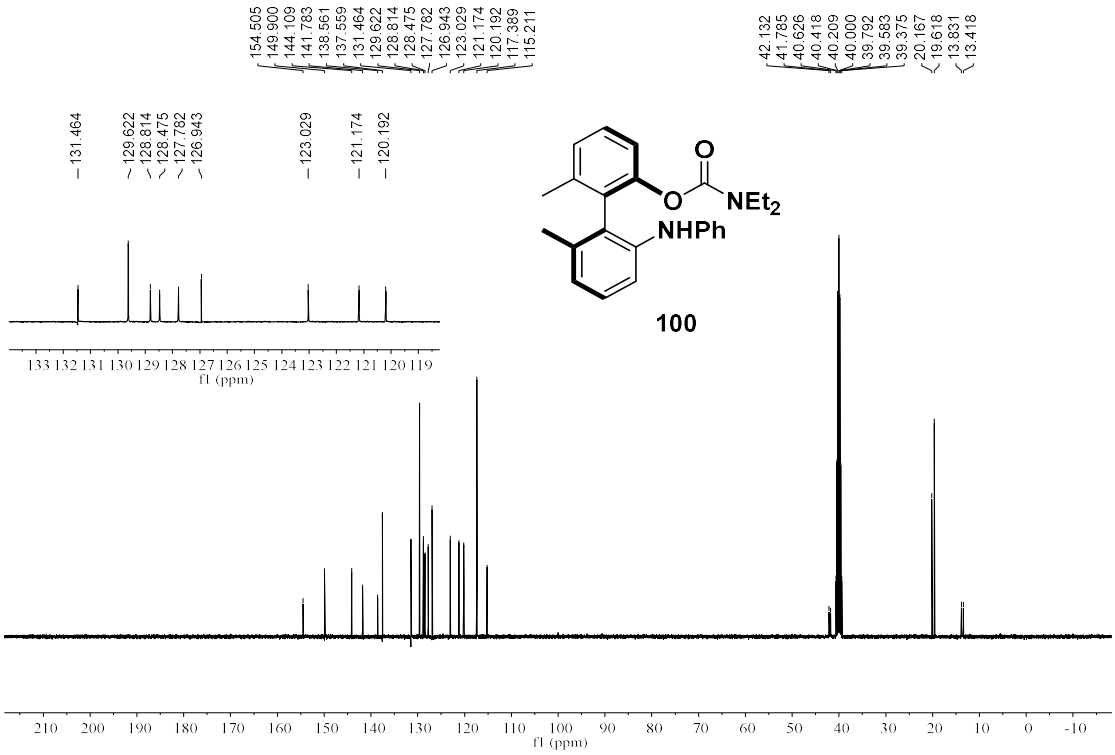


Figure S201. ^{13}C NMR Spectrum of **100**

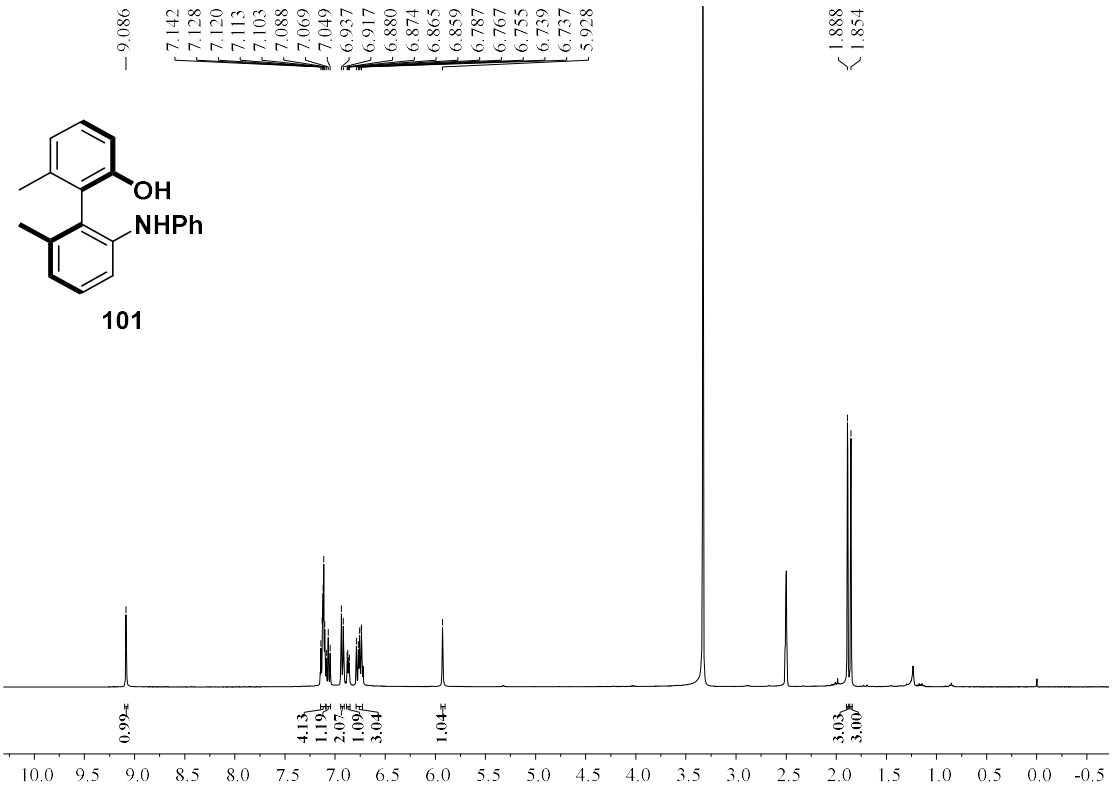


Figure S202. ^{1}H NMR Spectrum of **101**

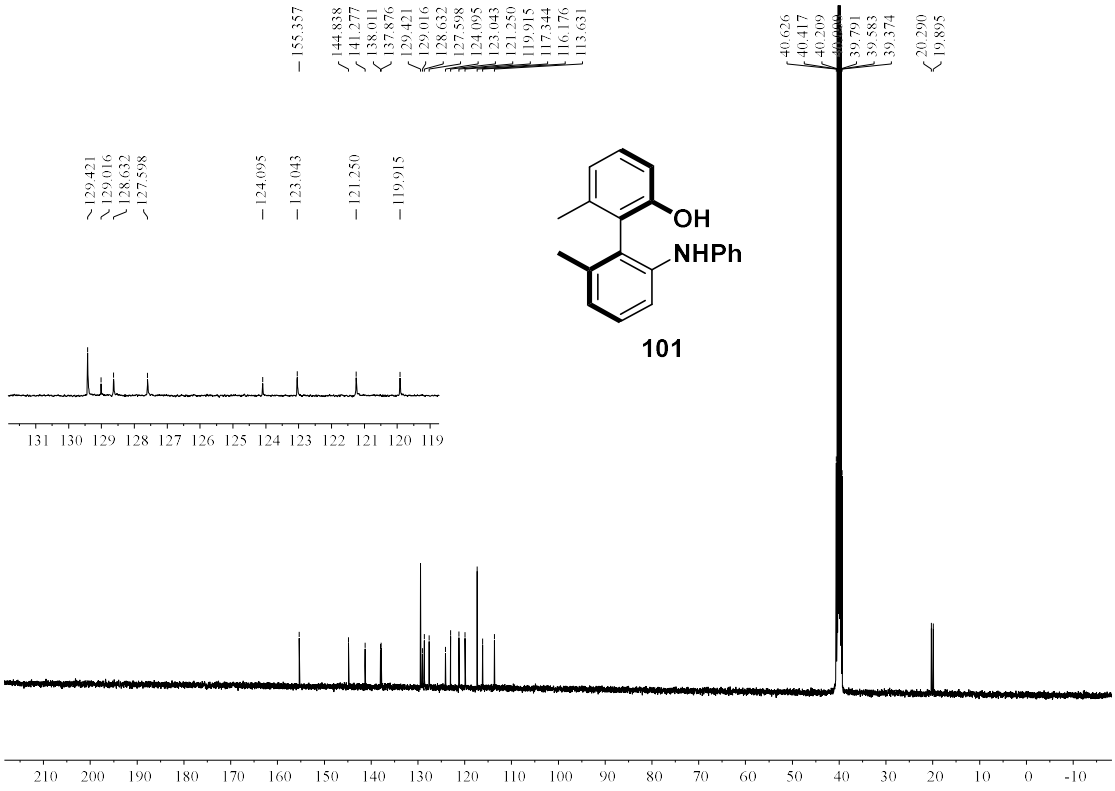


Figure S203. ^{13}C NMR Spectrum of **101**

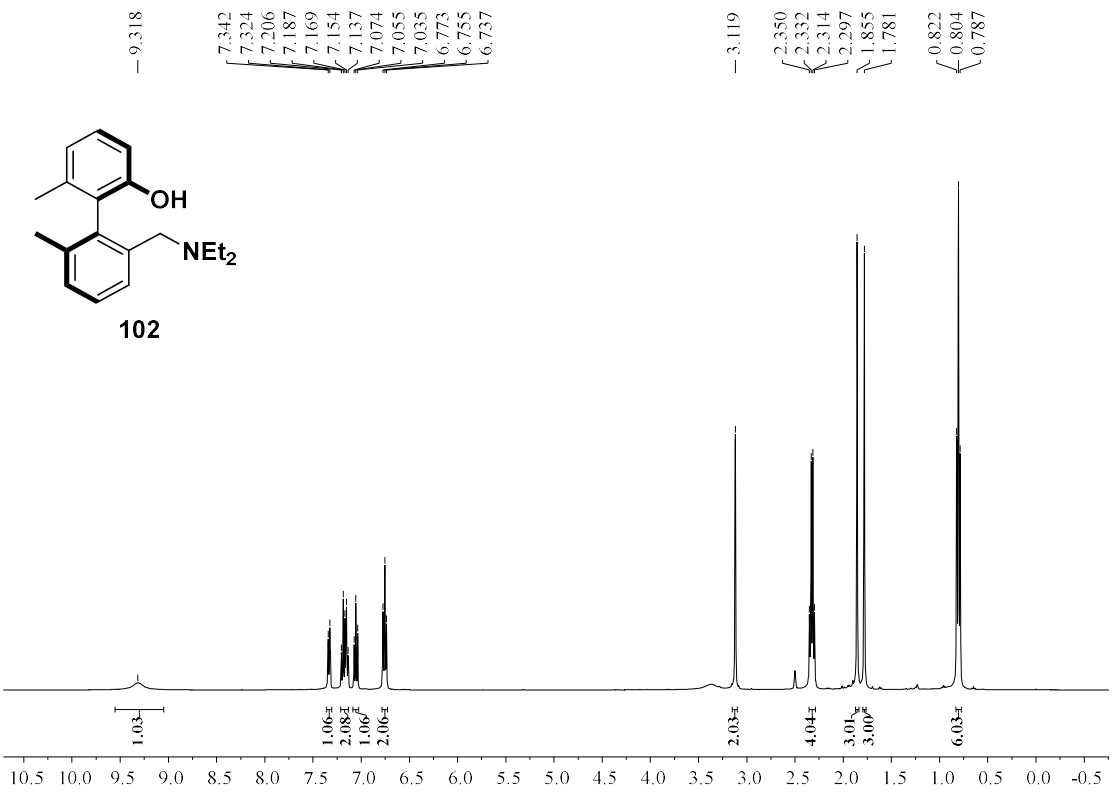


Figure S204. ^{1}H NMR Spectrum of **102**

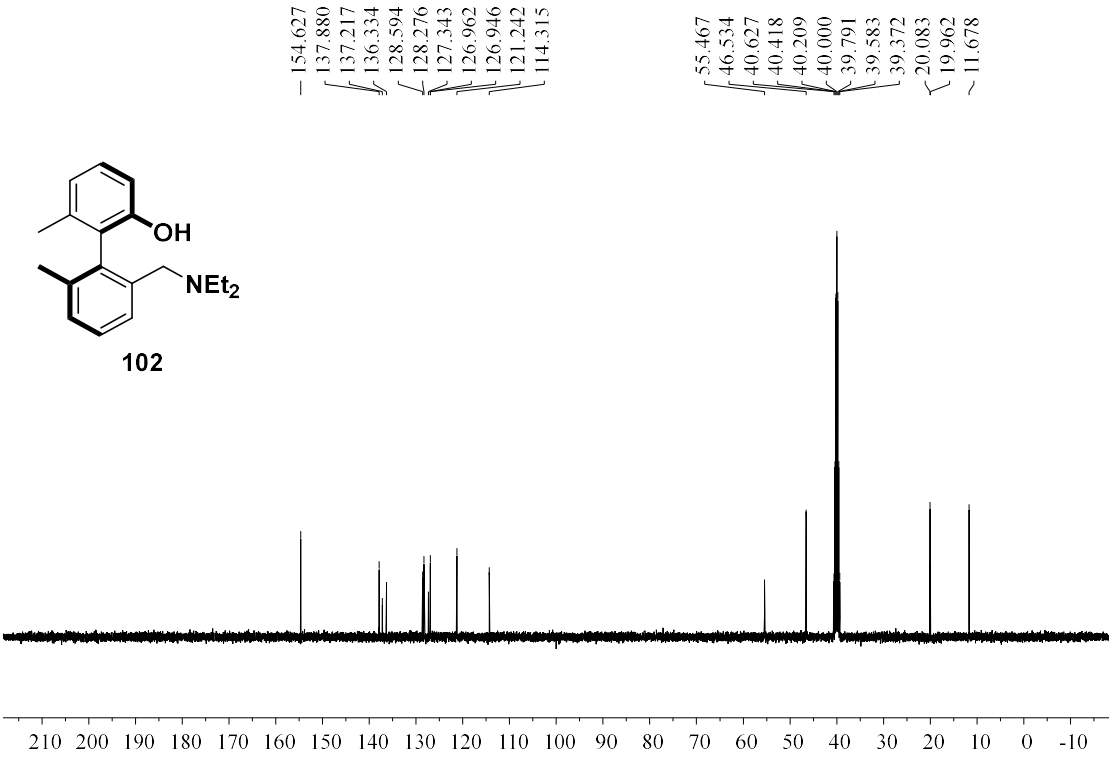


Figure S205. ^{13}C NMR Spectrum of **102**

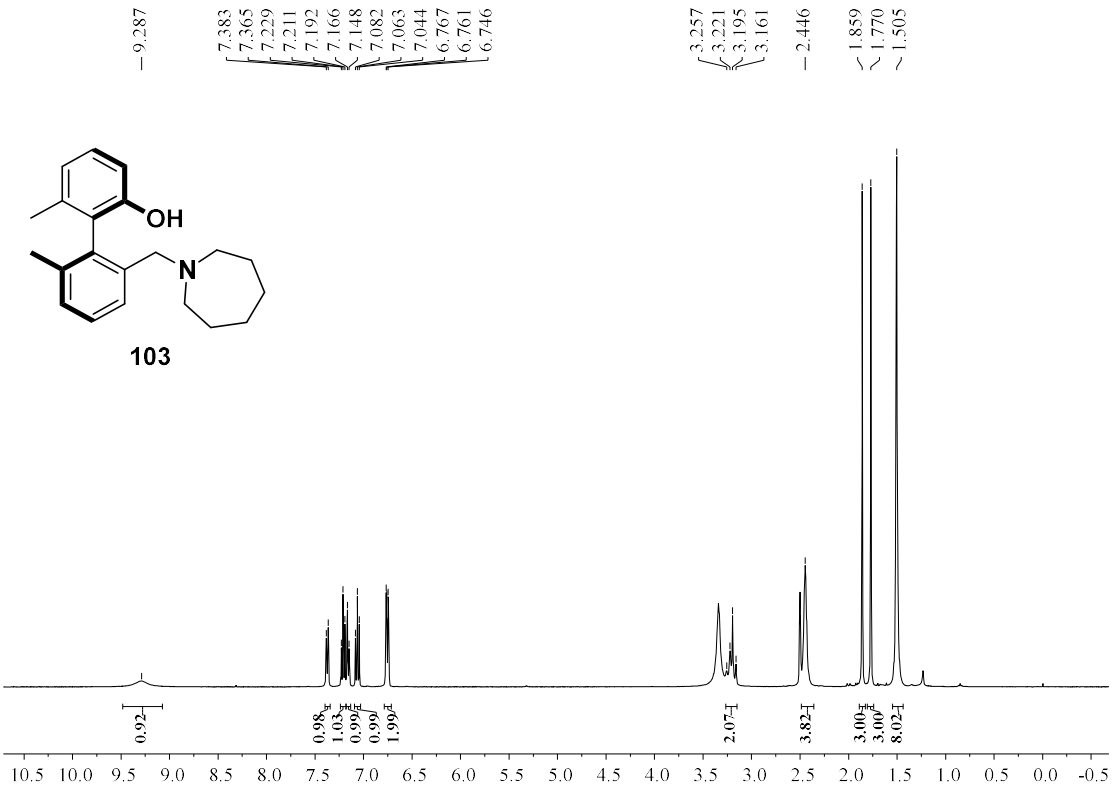


Figure S206. ^{1}H NMR Spectrum of **103**

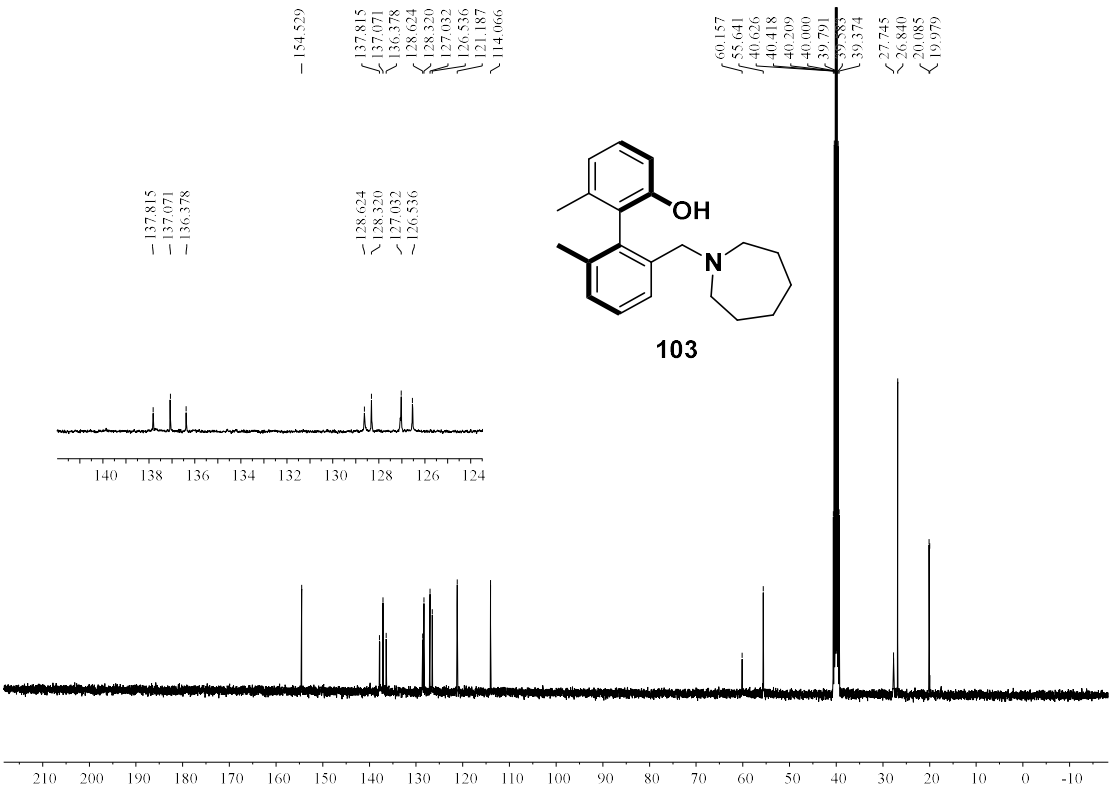


Figure S207. ^{13}C NMR Spectrum of **103**

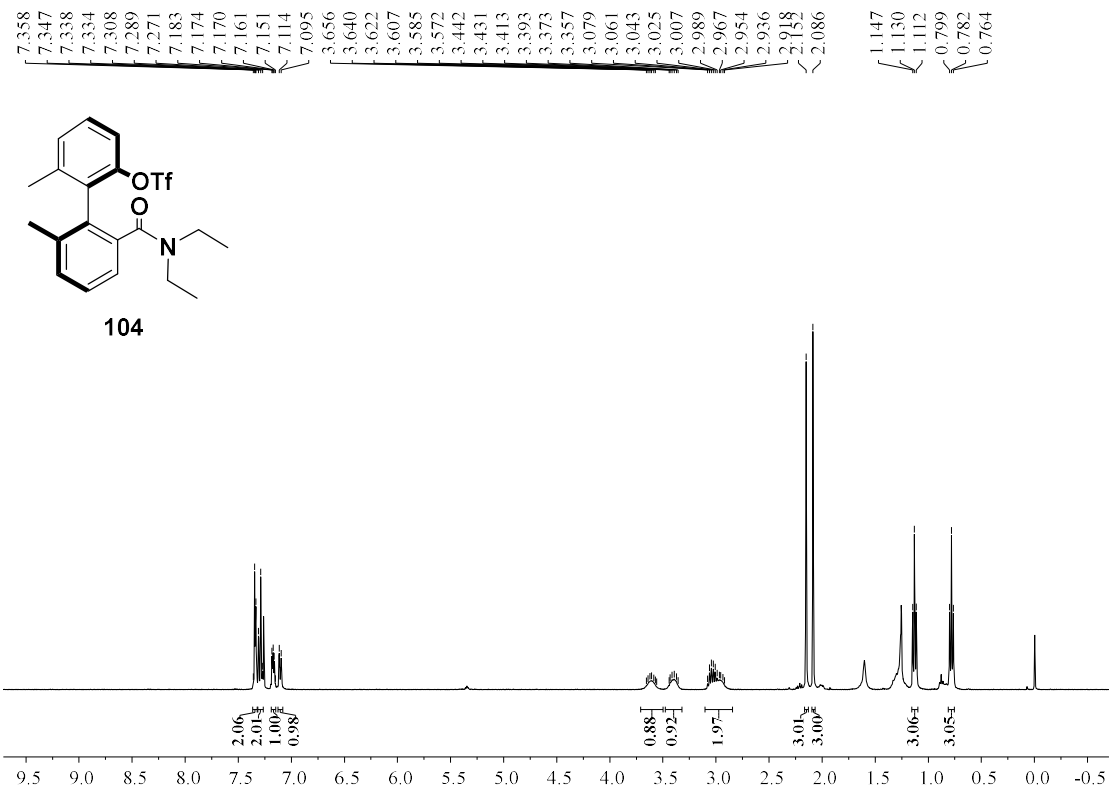


Figure S208. ^{1}H NMR Spectrum of **104**

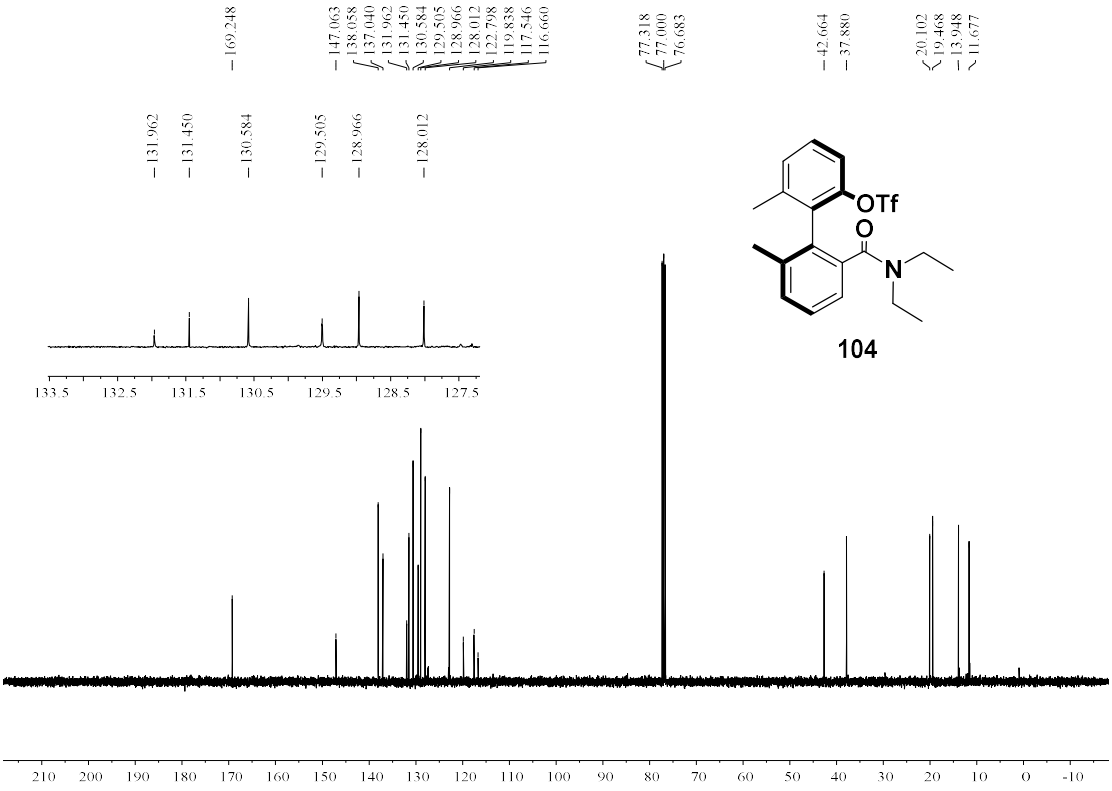


Figure S209. ^{13}C NMR Spectrum of **104**

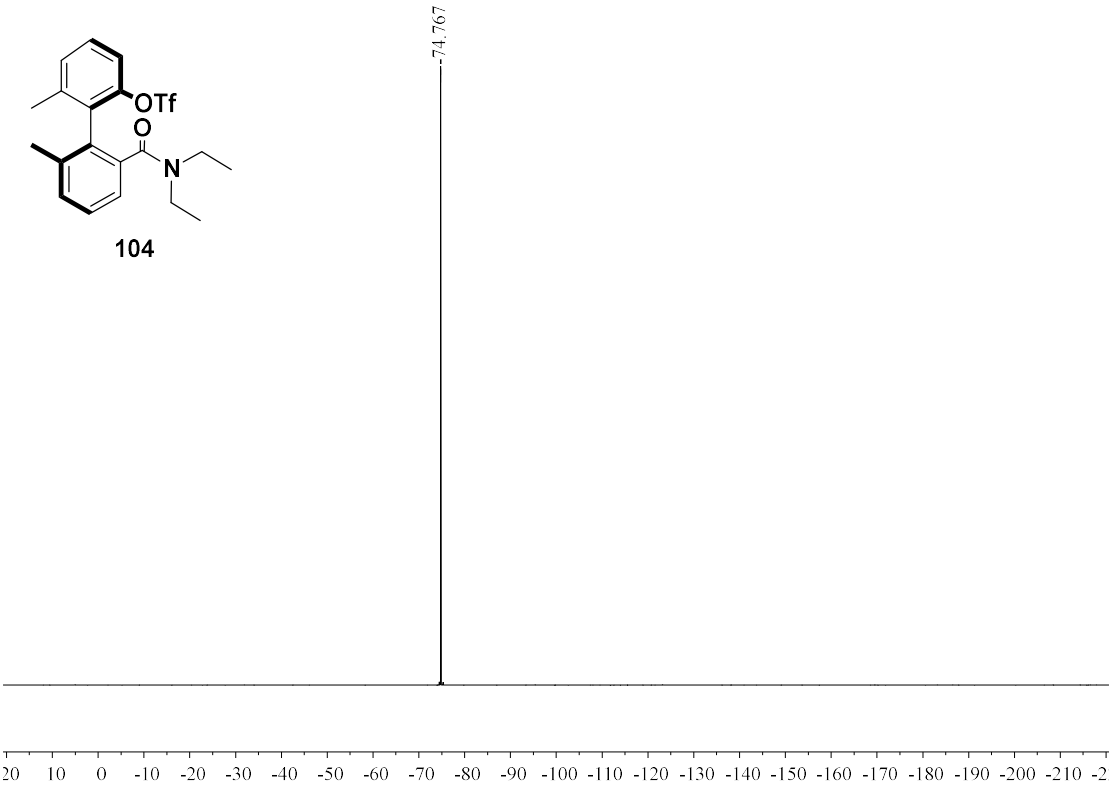
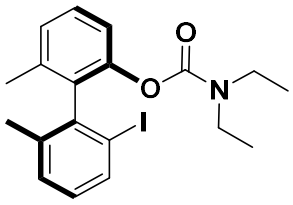


Figure S210. ^{19}F NMR Spectrum of **104**

K. Copies of HPLC traces



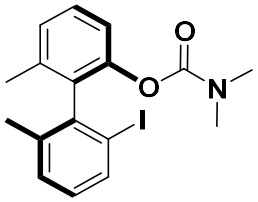
3a

Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	8.325	1593.8	138.2	0.1765	0.747	49.112
2	8.873	1651.5	126.1	0.2008	0.706	50.888

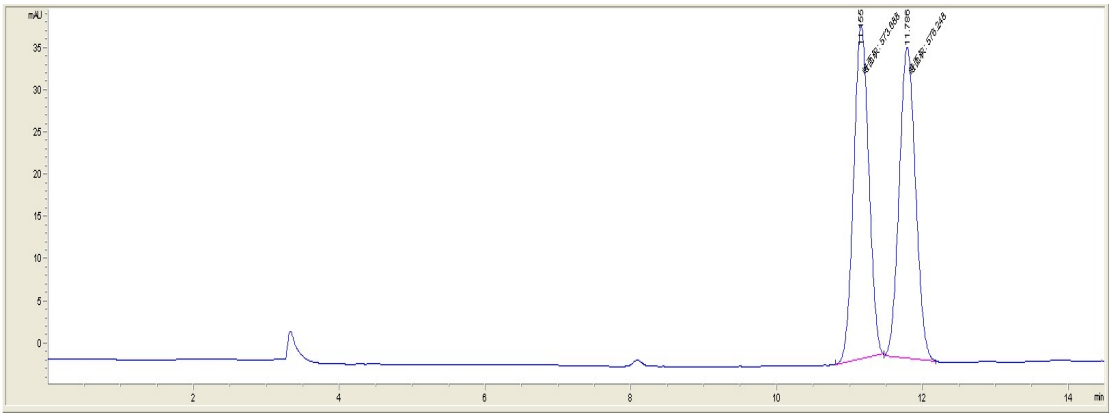
Figure S211. HPLC Spectra of racemic **3a**

Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	8.351	4564.8	383.2	0.1985	0.7	99.618
2	8.989	17.5	1.4	0.2154	0.265	0.382

Figure S212. HPLC Spectra of **3a**

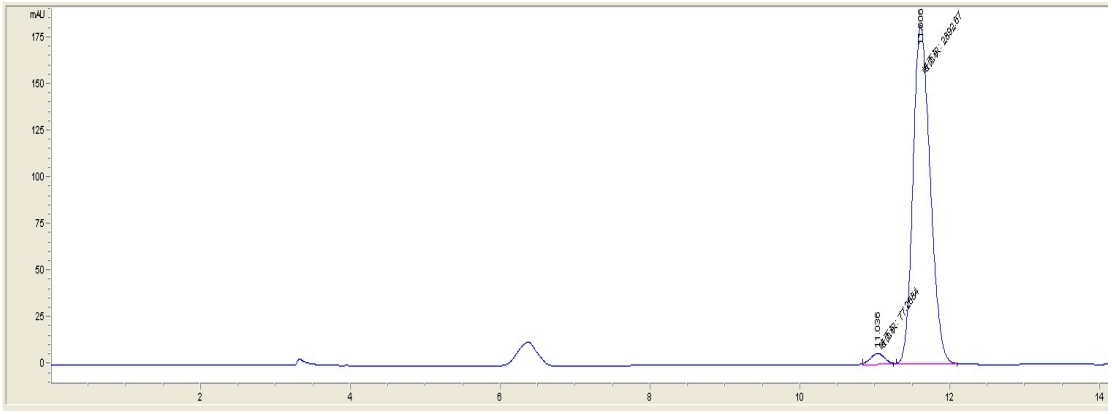


4



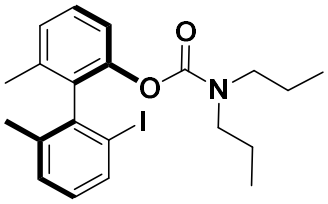
Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	11.155	573.7	39.5	0.2419	0.964	49.889
2	11.786	576.2	36.9	0.2604	0.909	50.111

Figure S213. HPLC Spectra of racemic **4**

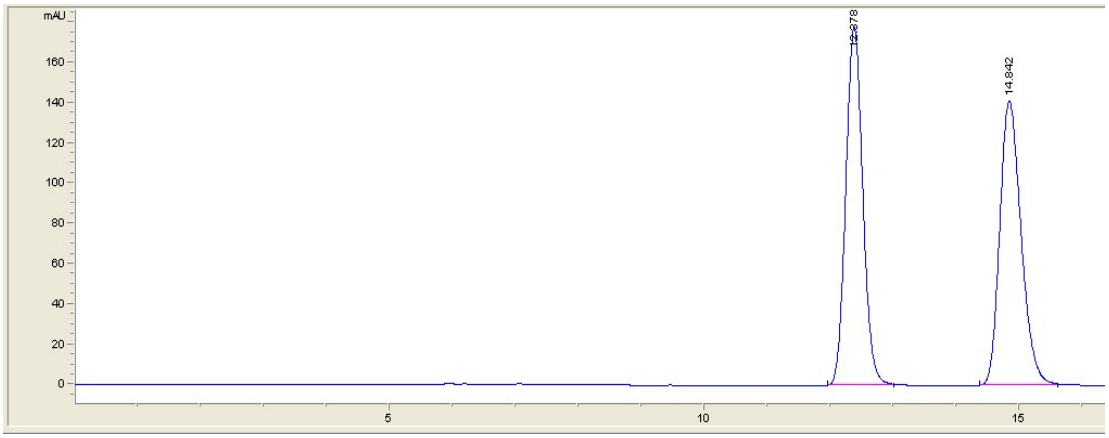


Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	11.036	77.3	5.8	0.2224	1.085	2.602
2	11.606	2892.7	181.5	0.2657	0.757	97.398

Figure S214. HPLC Spectra of **4**

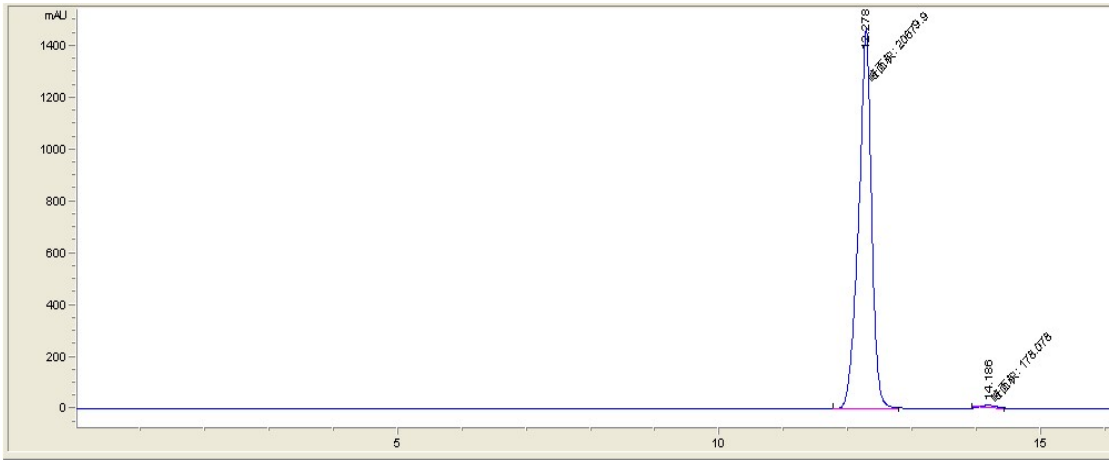


5



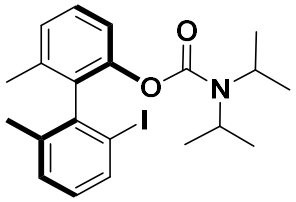
Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	12.378	3337.6	177.8	0.291	0.915	50.142
2	14.842	3318.7	141.1	0.3625	0.755	49.858

Figure S215. HPLC Spectra of racemic **5**

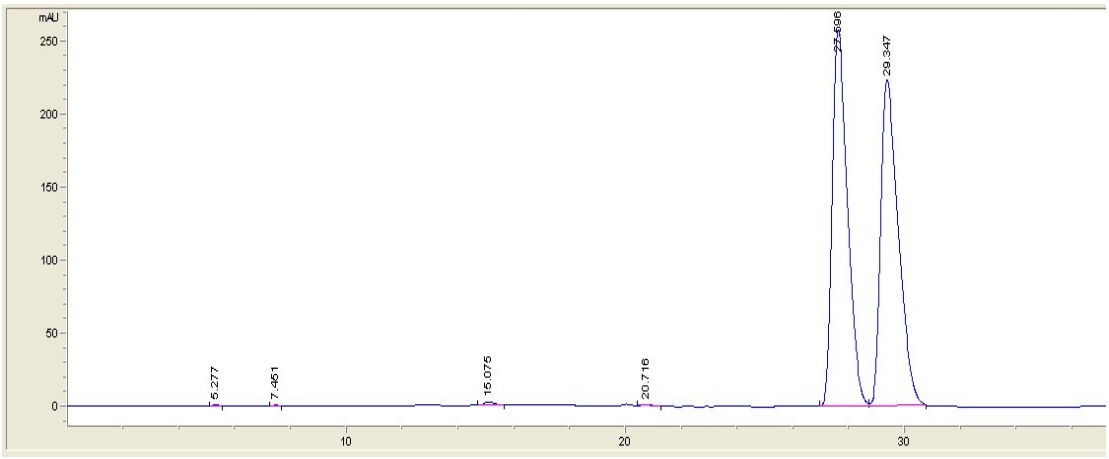


Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	12.278	20679.9	1471.2	0.2343	1.33	99.146
2	14.186	178.1	10.7	0.2778	0.624	0.854

Figure S216. HPLC Spectra of **5**

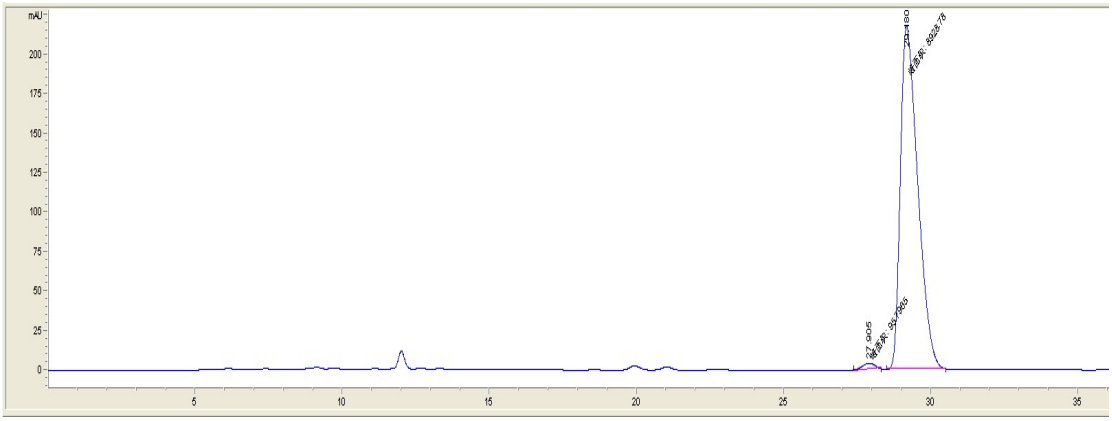


6



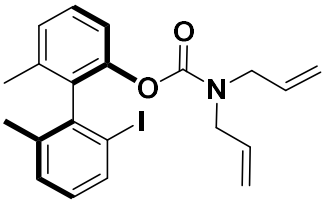
Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	27.596	9783.3	257.8	0.5828	0.579	50.009
2	29.347	9779.7	223.1	0.6634	0.504	49.991

Figure S217. HPLC Spectra of racemic **6**

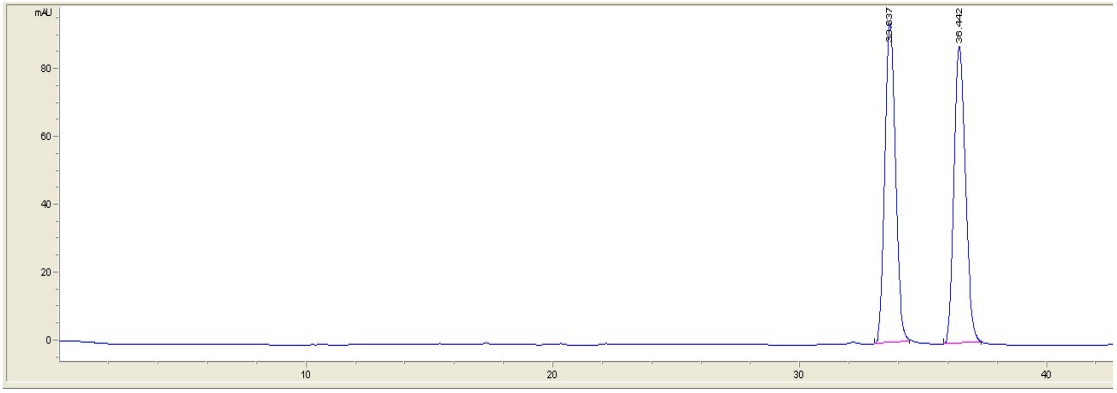


Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	27.905	95.8	3.4	0.4645	1.571	1.062
2	29.18	8928.8	217.1	0.6855	0.542	98.938

Figure S218. HPLC Spectra of **6**

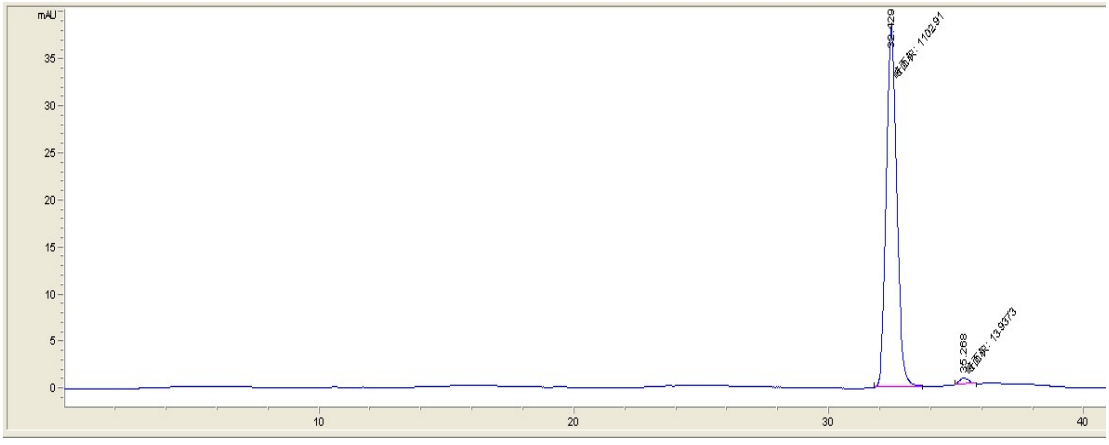


7



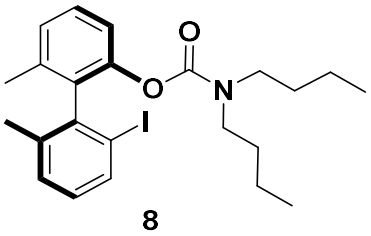
Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	33.637	2775.7	94.2	0.4597	0.875	49.946
2	36.442	2781.6	87.5	0.495	0.784	50.054

Figure S219. HPLC Spectra of racemic **7**

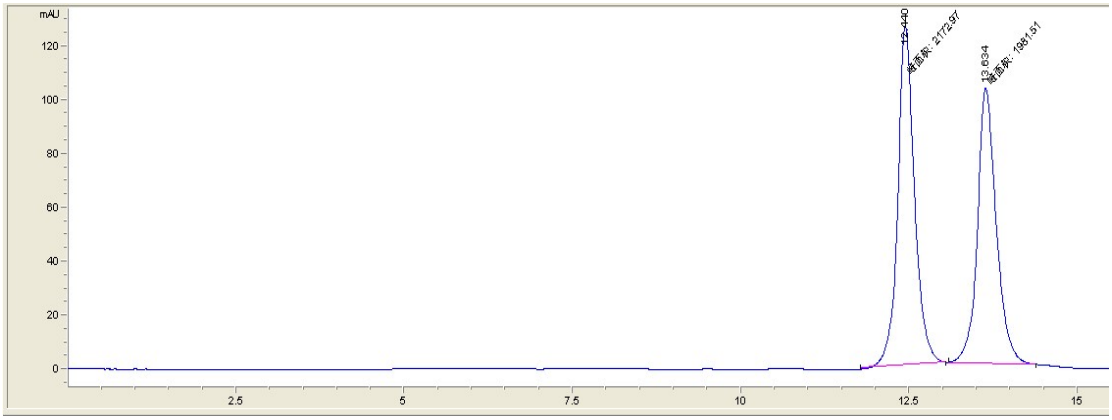


Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	32.429	1102.9	38.2	0.4808	0.87	98.752
2	35.268	13.9	6E-1	0.3902	0.947	1.248

Figure S220. HPLC Spectra of **7**



8

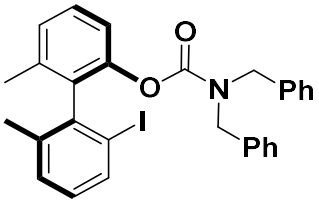


Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	12.44	2173	126.1	0.2871	0.8	52.304
2	13.634	1981.5	102.2	0.323	0.755	47.696

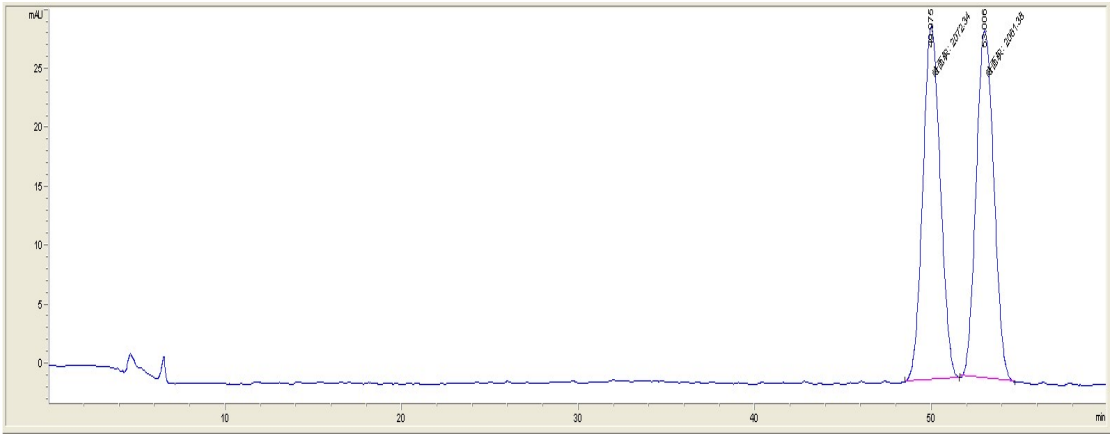
Figure S221. HPLC Spectra of racemic **8**

Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	12.214	6532.9	394	0.2763	0.647	97.064
2	13.438	197.6	13.3	0.2481	0.995	2.936

Figure S222. HPLC Spectra of **8**

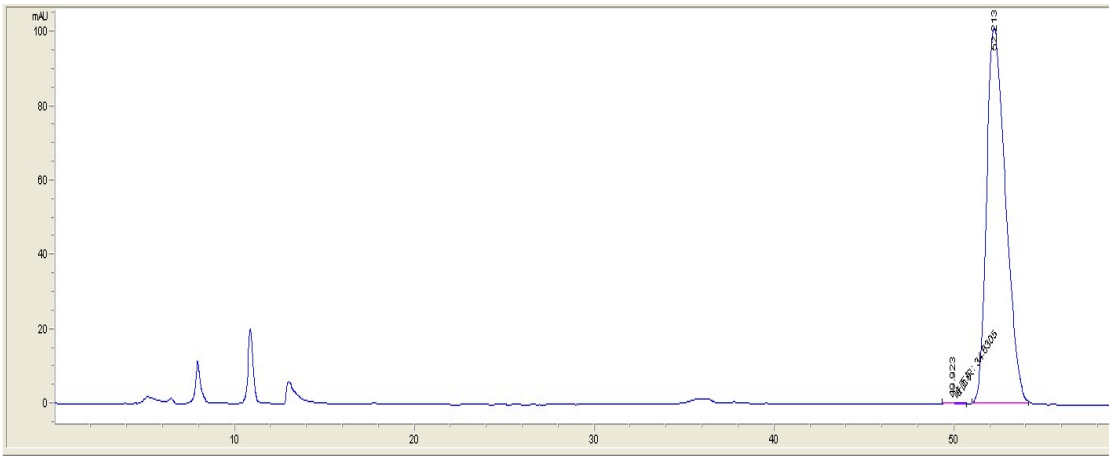


9



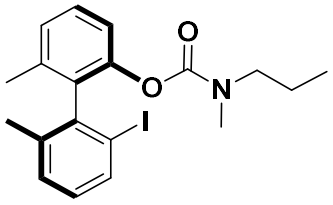
Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	49.975	2072.3	30	1.1506	0.911	50.133
2	53.006	2061.4	29.6	1.1625	0.903	49.867

Figure S223. HPLC Spectra of racemic **9**

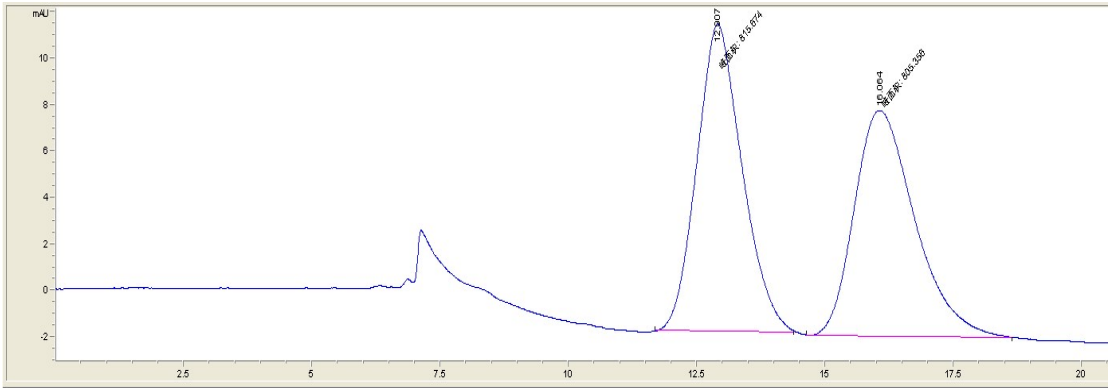


Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	49.923	34.6	5.5E-1	1.0442	0.557	0.465
2	52.213	7412.7	100.8	1.1022	0.615	99.535

Figure S224. HPLC Spectra of **9**

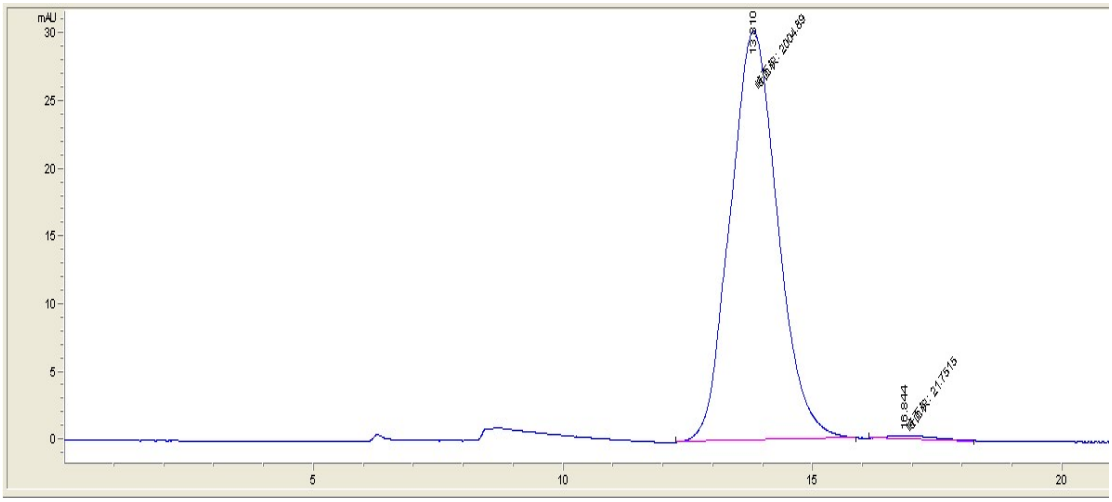


10



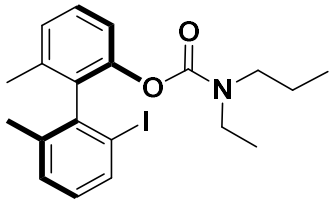
Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	12.907	815.7	13.3	1.0246	0.836	50.318
2	16.064	805.4	9.8	1.3754	0.694	49.682

Figure S225. HPLC Spectra of racemic **10**

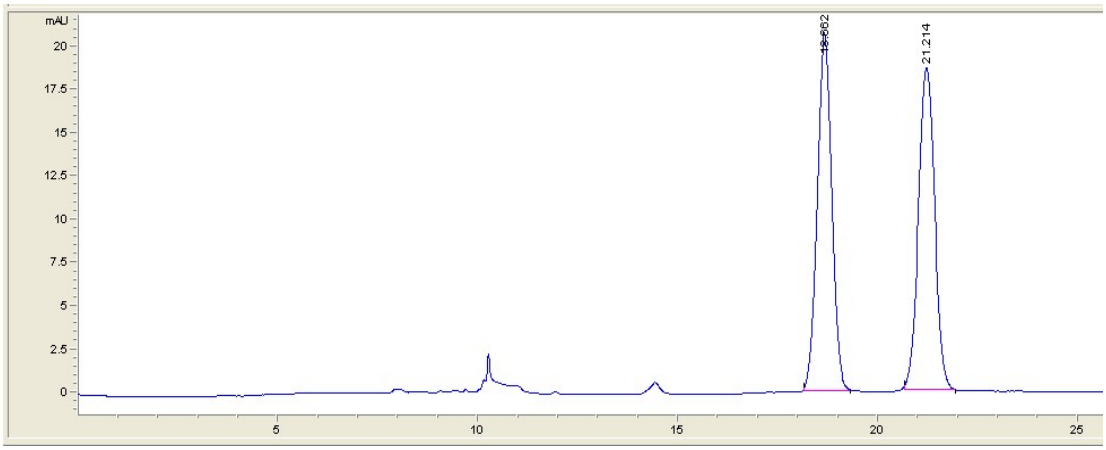


Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	13.81	2004.9	30.2	1.1054	0.925	98.927
2	16.844	21.8	3E-1	1.2074	0.508	1.073

Figure S226. HPLC Spectra of **10**

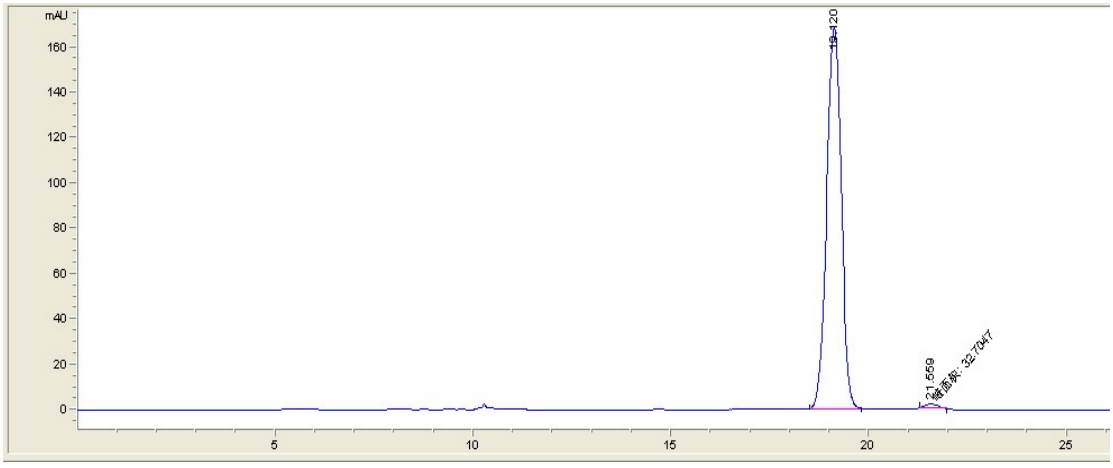


11



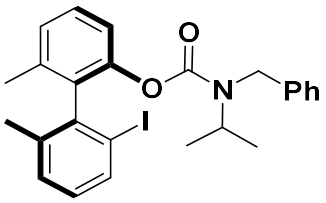
Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	18.662	524.6	20.7	0.3934	0.981	50.199
2	21.214	520.4	18.6	0.4348	0.968	49.801

Figure S227. HPLC Spectra of racemic **11**

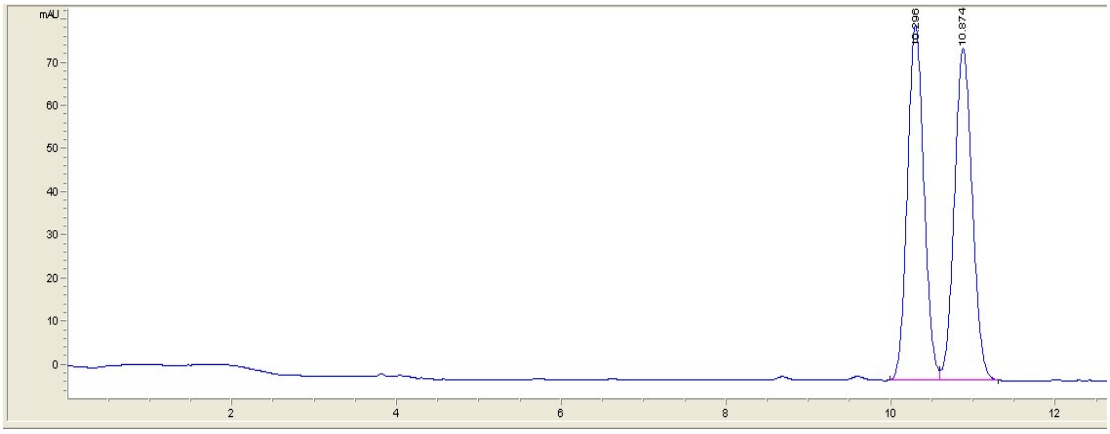


Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	19.12	4302.8	168.2	0.4004	1.062	99.246
2	21.559	32.7	1.6	0.3388	0.989	0.754

Figure S228. HPLC Spectra of **11**

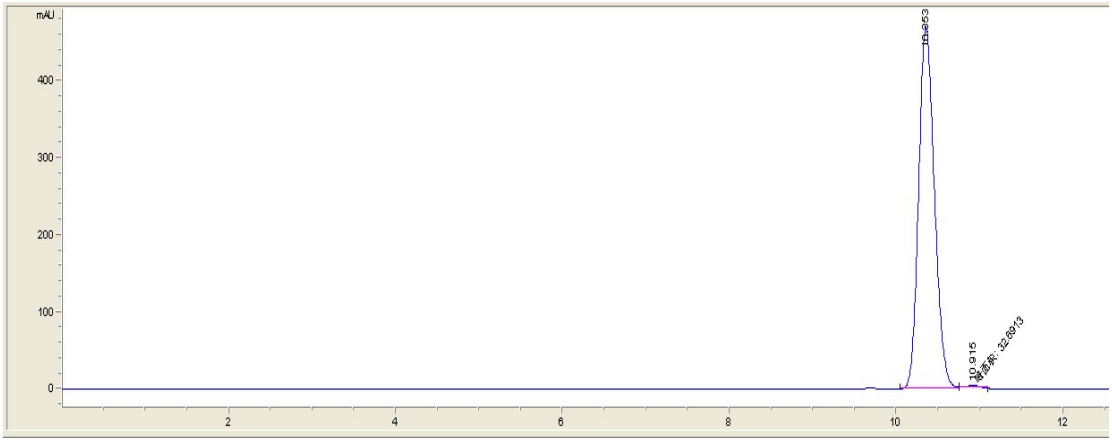


12



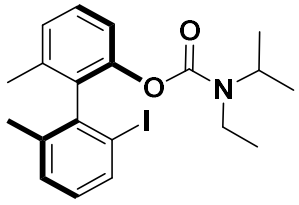
Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	10.296	1153.9	82.2	0.2178	0.901	49.836
2	10.874	1161.5	76.9	0.2342	0.895	50.164

Figure S229. HPLC Spectra of racemic **12**

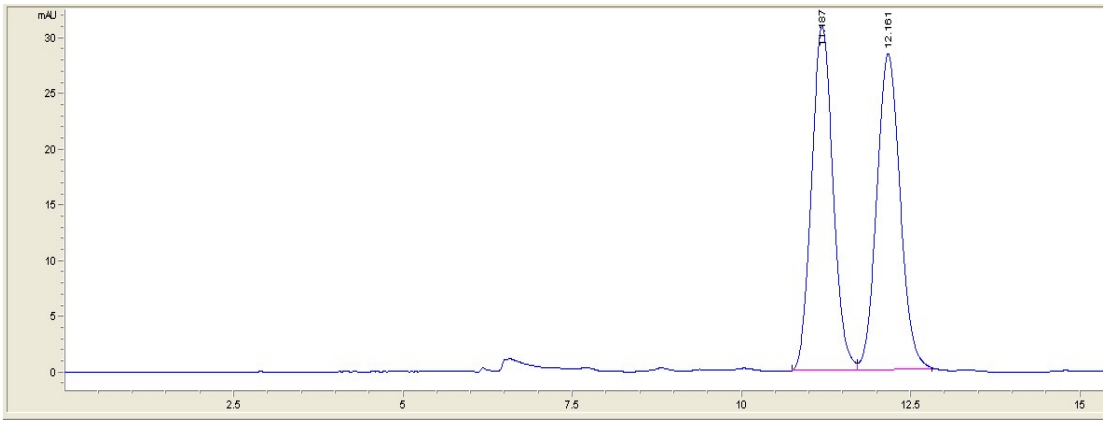


Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	10.353	6201.1	470.3	0.2058	0.79	99.476
2	10.915	32.7	3	0.1834	1.124	0.524

Figure S230. HPLC Spectra of **12**



13

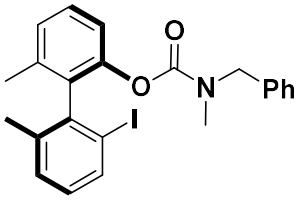


Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	11.187	681.7	30.9	0.3434	0.923	49.965
2	12.161	682.7	28.4	0.3724	0.897	50.035

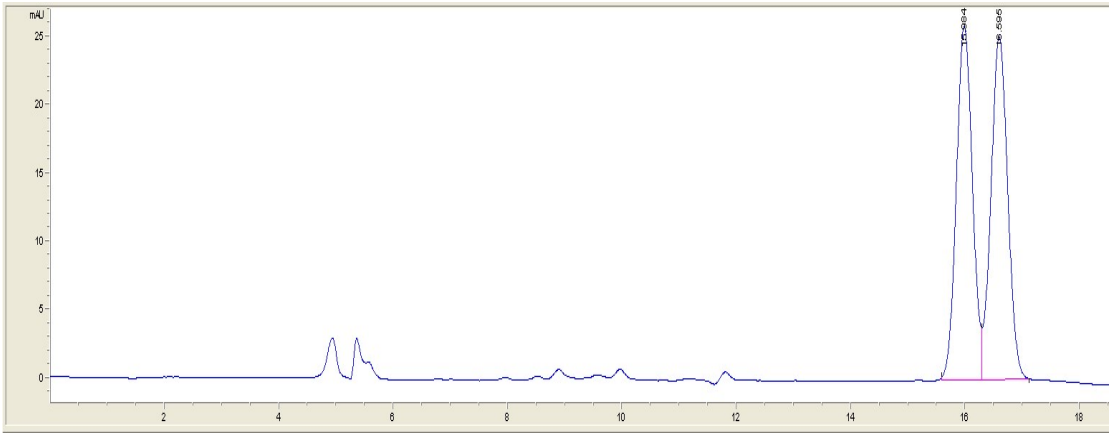
Figure S231. HPLC Spectra of racemic **13**

Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	11.247	14875.6	1049.9	0.2362	0.676	96.096
2	12.092	604.3	38.8	0.2596	0.621	3.904

Figure S232. HPLC Spectra of **13**

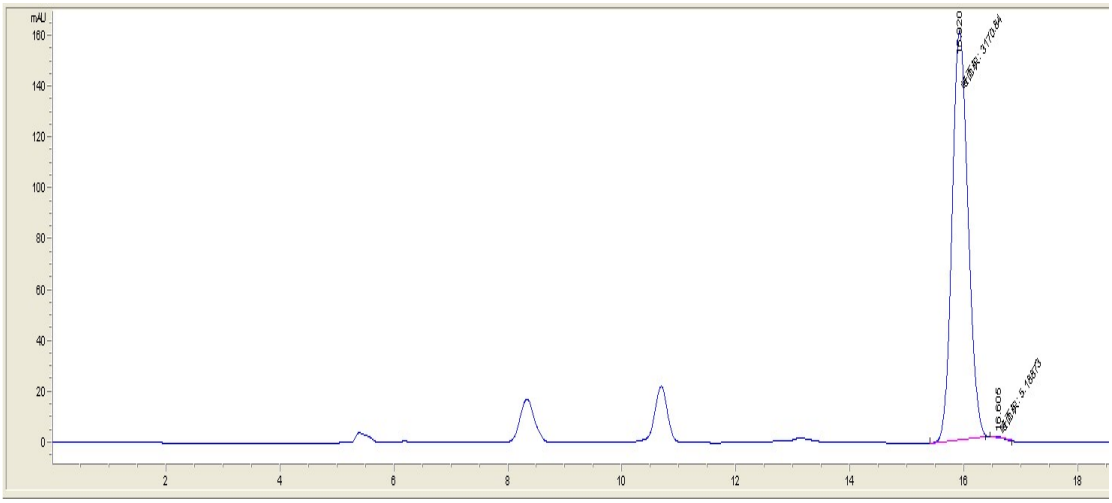


14



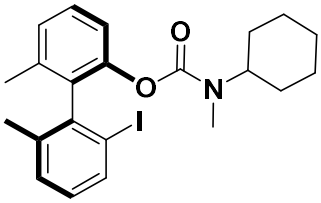
Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	15.984	507.1	25.9	0.3042	0.946	49.733
2	16.595	512.5	25.1	0.314	0.941	50.267

Figure S233. HPLC Spectra of racemic **14**

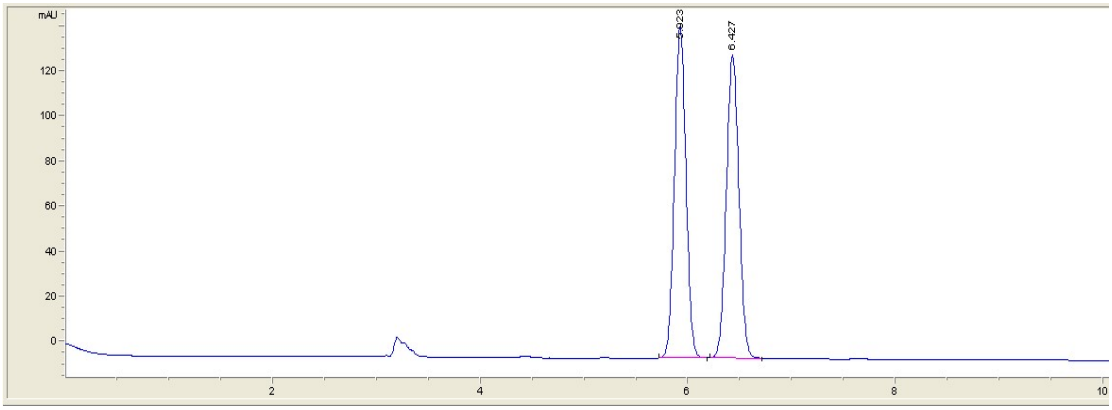


Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	15.92	3170.8	161.1	0.328	0.848	99.837
2	16.605	5.2	5.5E-1	0.1582	0.229	0.163

Figure S234. HPLC Spectra of **14**

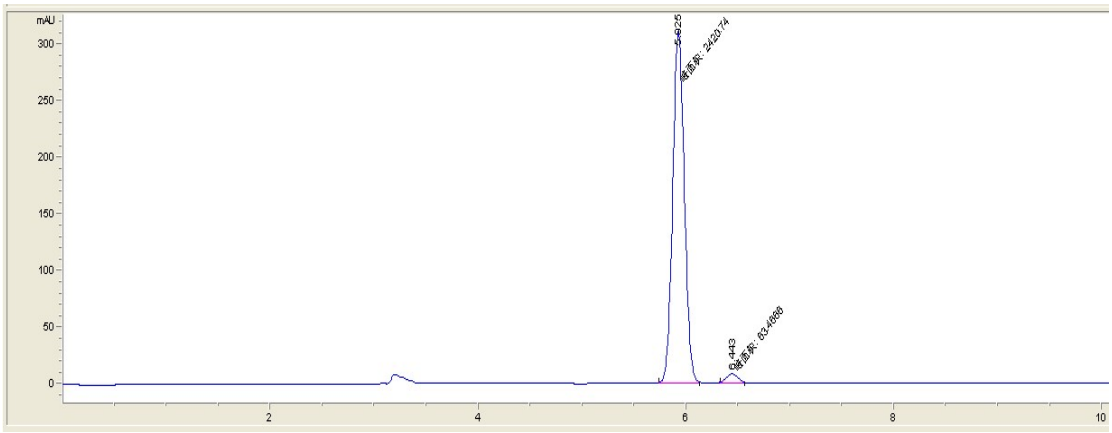


15



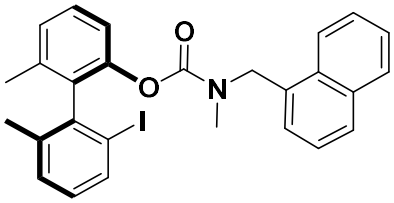
Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	5.923	1136.4	147.5	0.1199	0.937	50.000
2	6.427	1136.4	134.9	0.1303	0.931	50.000

Figure S235. HPLC Spectra of racemic **15**

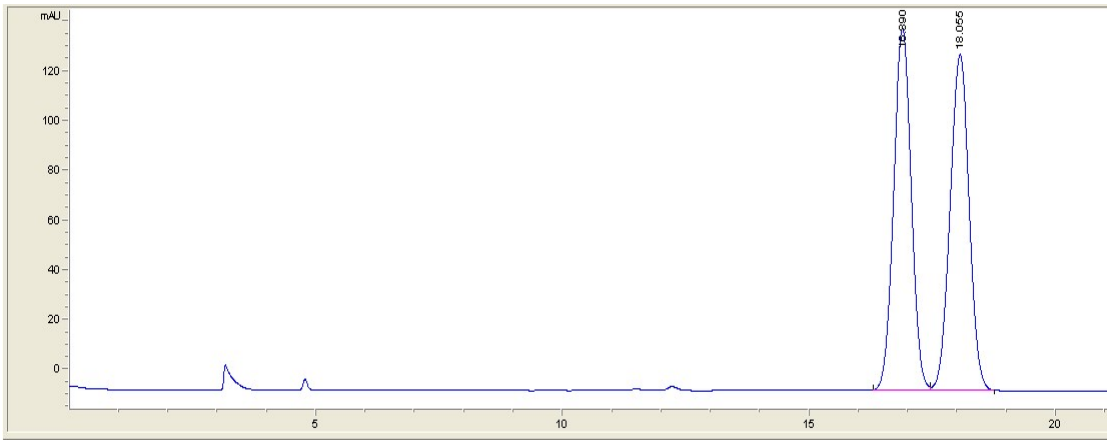


Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	5.925	2420.7	310.6	0.1299	0.916	97.445
2	6.443	63.5	8.1	0.1313	0.984	2.555

Figure S236. HPLC Spectra of **15**

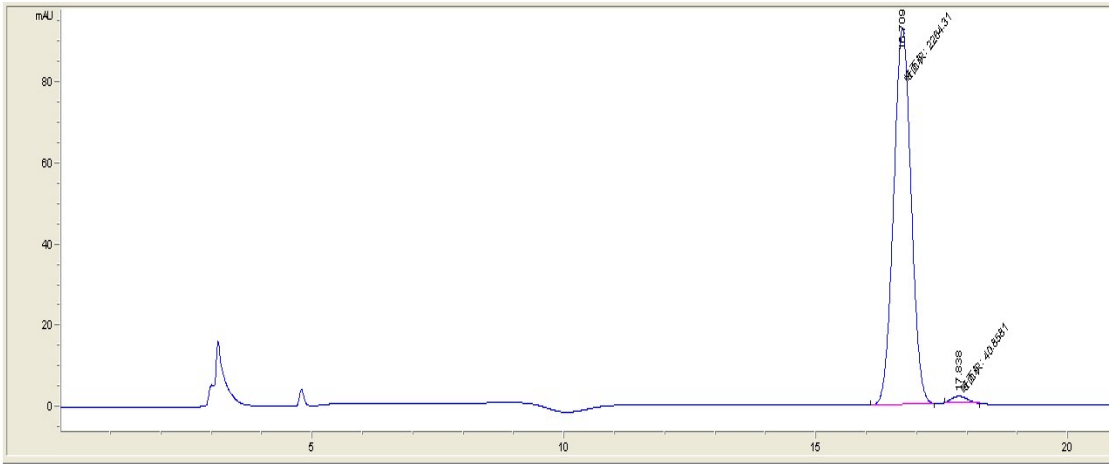


16



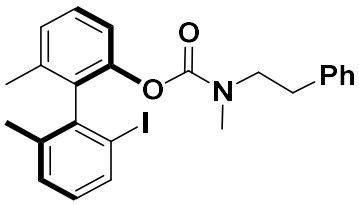
Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	16.89	3610.8	146	0.3866	0.993	49.902
2	18.055	3625	135.1	0.4189	1.035	50.098

Figure S237. HPLC Spectra of racemic **16**

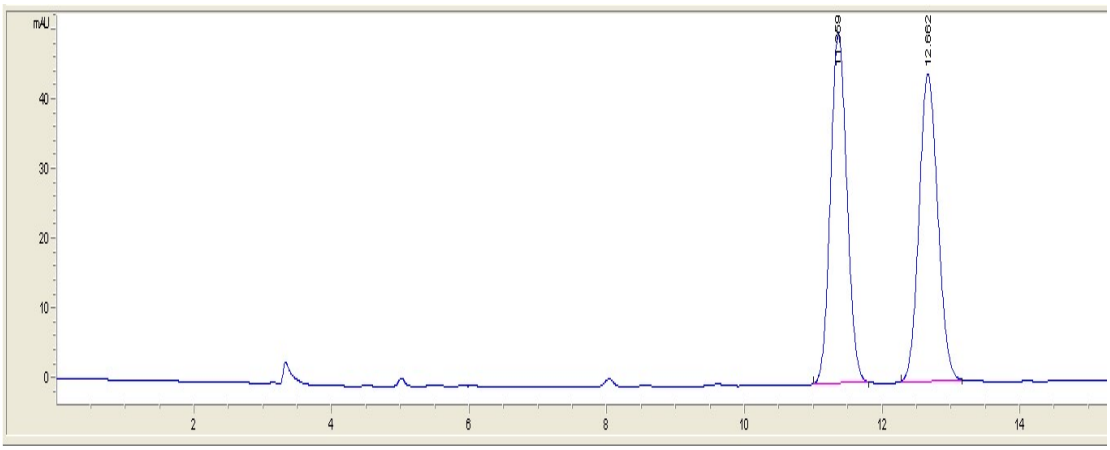


Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	16.709	2264.3	93	0.406	0.979	98.228
2	17.838	40.9	1.8	0.3801	0.951	1.772

Figure S238. HPLC Spectra of **16**

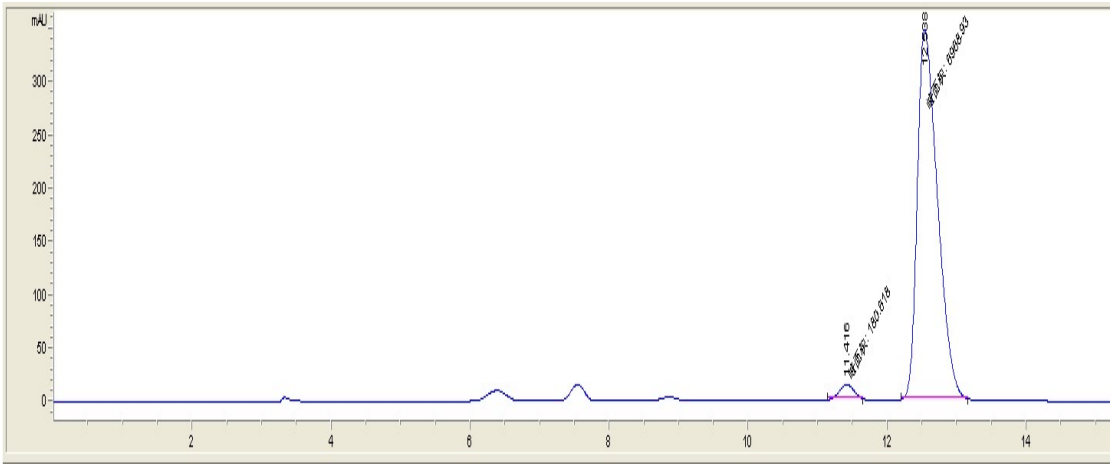


17



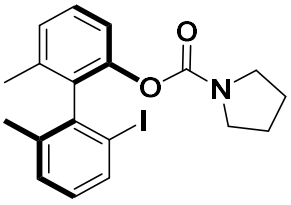
Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	11.359	839.3	50.5	0.26	0.883	50.030
2	12.662	838.3	44.2	0.2934	0.871	49.970

Figure 239. HPLC Spectra of racemic **17**

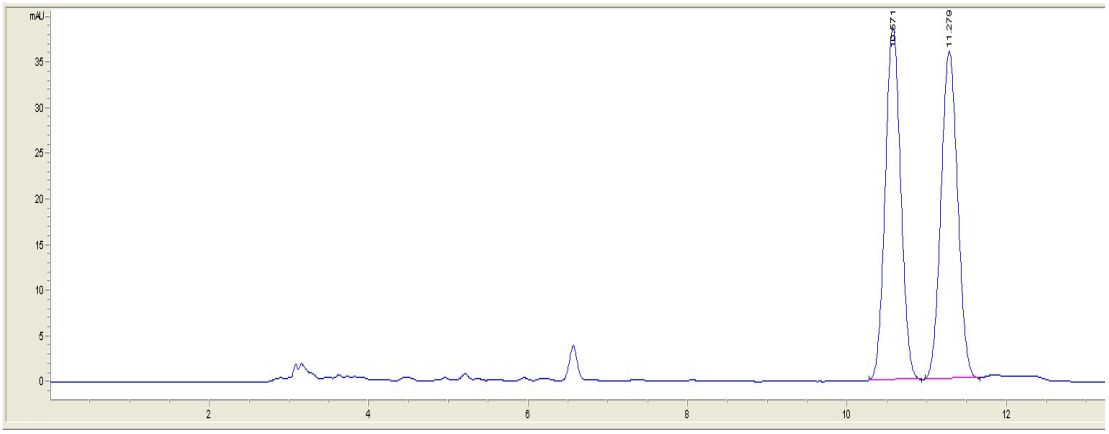


Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	11.416	180.6	13	0.2318	0.97	2.526
2	12.538	6968.9	345.8	0.3358	0.571	97.474

Figure S240. HPLC Spectra of **17**

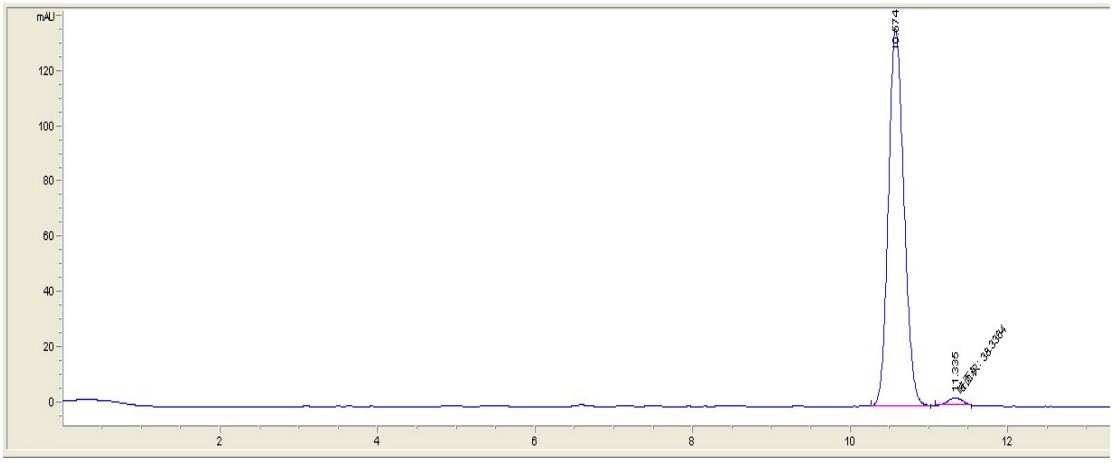


18



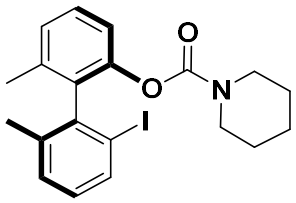
Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	10.571	524.4	38.7	0.2122	0.933	50.204
2	11.279	520.1	35.9	0.2271	0.933	49.796

Figure S241. HPLC Spectra of racemic **18**

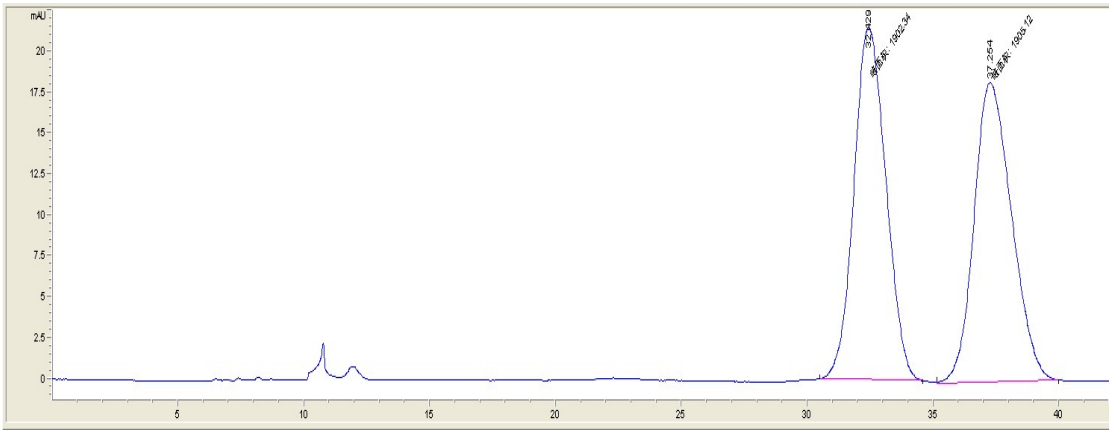


Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	10.574	1877.7	136.5	0.2125	0.822	97.999
2	11.335	38.3	2.8	0.2264	1.03	2.001

Figure S242. HPLC Spectra of **18**

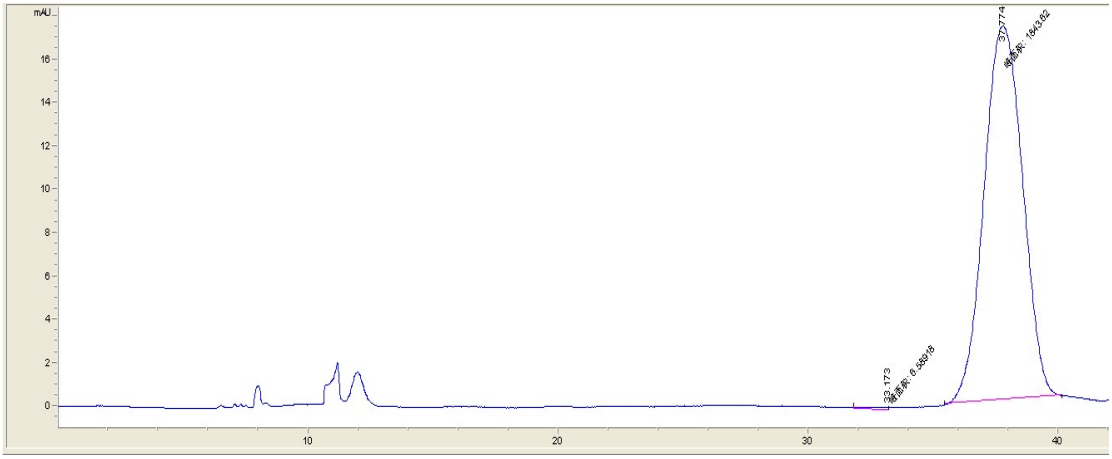


19



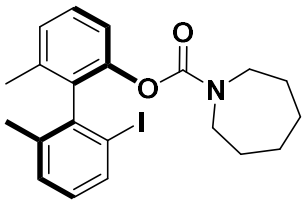
Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	32.429	1902.3	21.5	1.4725	0.831	49.964
2	37.254	1905.1	18.3	1.736	0.728	50.036

Figure S243. HPLC Spectra of racemic **19**

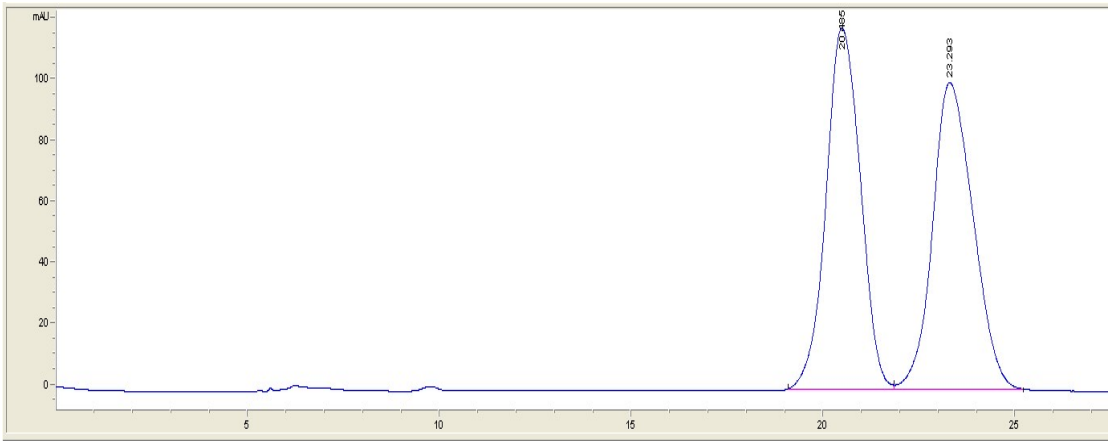


Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	33.173	6.6	1.1E-1	0.9879	11.588	0.356
2	37.774	1843.6	17.2	1.7846	0.922	99.644

Figure S244. HPLC Spectra of **19**

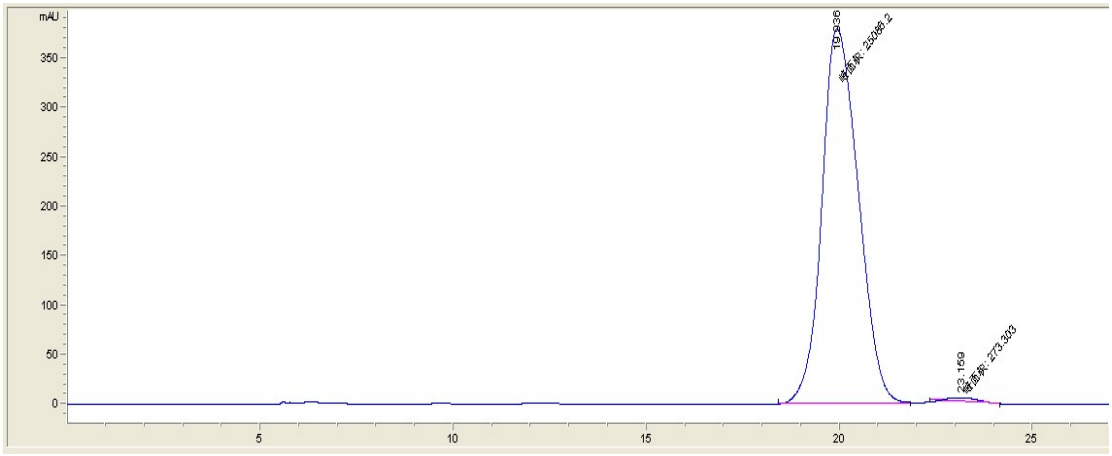


20



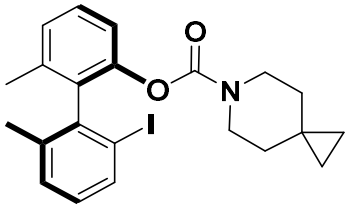
Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	20.485	7409.6	118.5	0.9936	0.867	50.013
2	23.293	7405.8	100.6	1.127	0.728	49.987

Figure S245. HPLC Spectra of racemic **20**

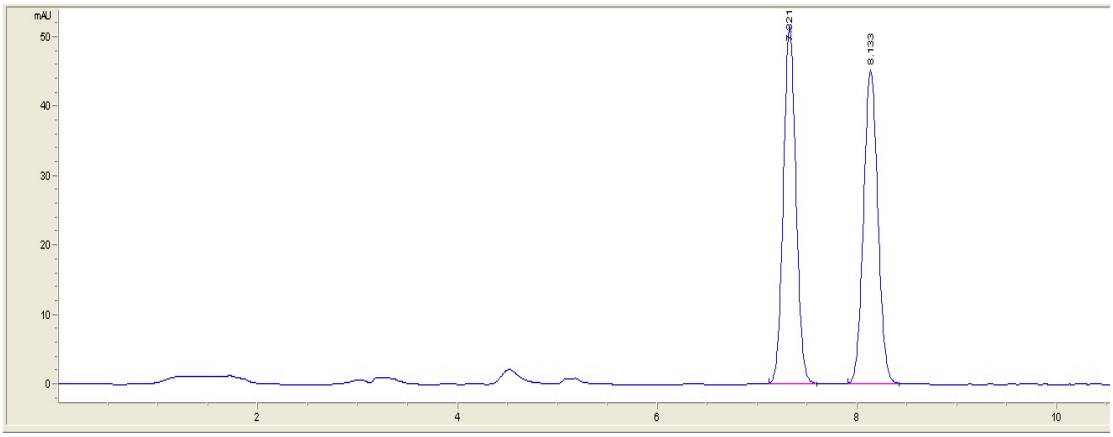


Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	19.936	25086.2	380.2	1.0998	0.706	98.922
2	23.159	273.3	4.8	0.9539	0.542	1.078

Figure S246. HPLC Spectra of **20**

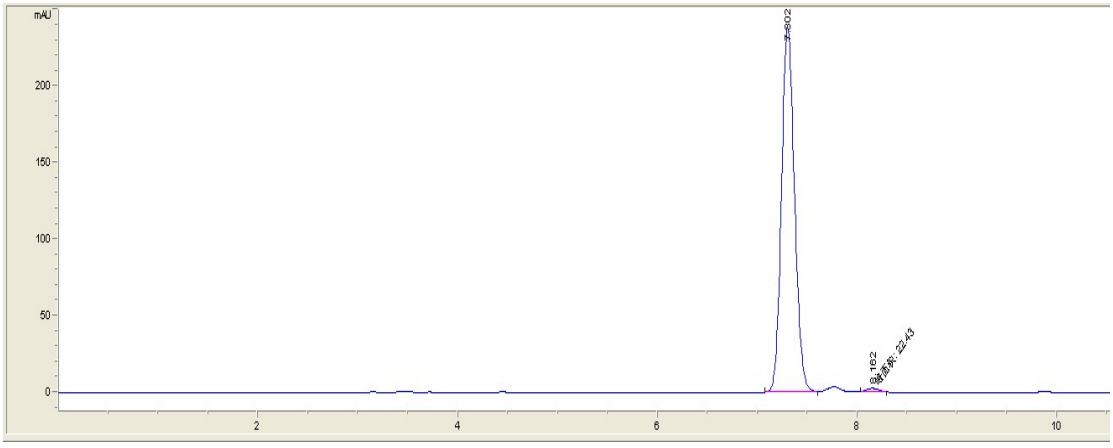


21



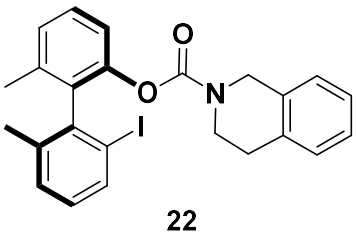
Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	7.321	451.8	51.4	0.1366	0.919	50.101
2	8.133	450	45.2	0.1541	0.919	49.899

Figure S247. HPLC Spectra of racemic **21**

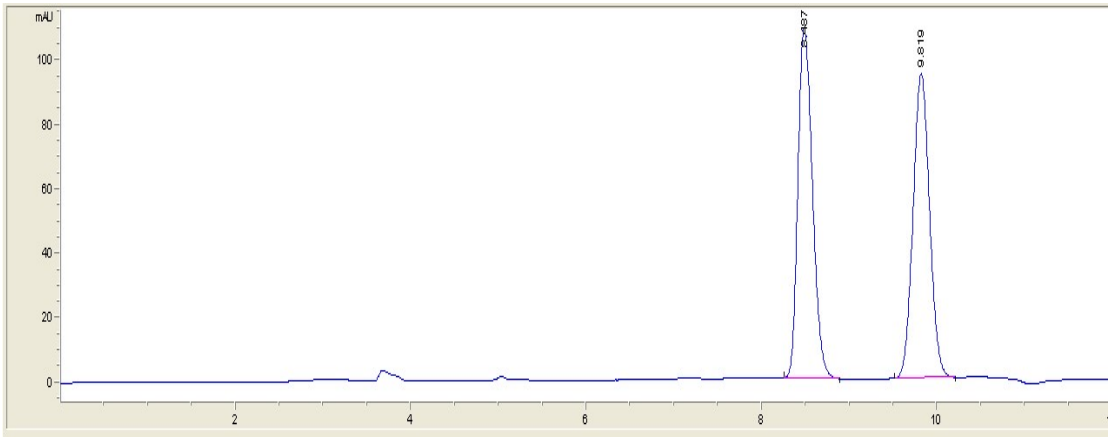


Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	7.302	2171.5	239	0.14	0.831	98.978
2	8.162	22.4	2.4	0.1551	0.733	1.022

Figure S248. HPLC Spectra of **21**

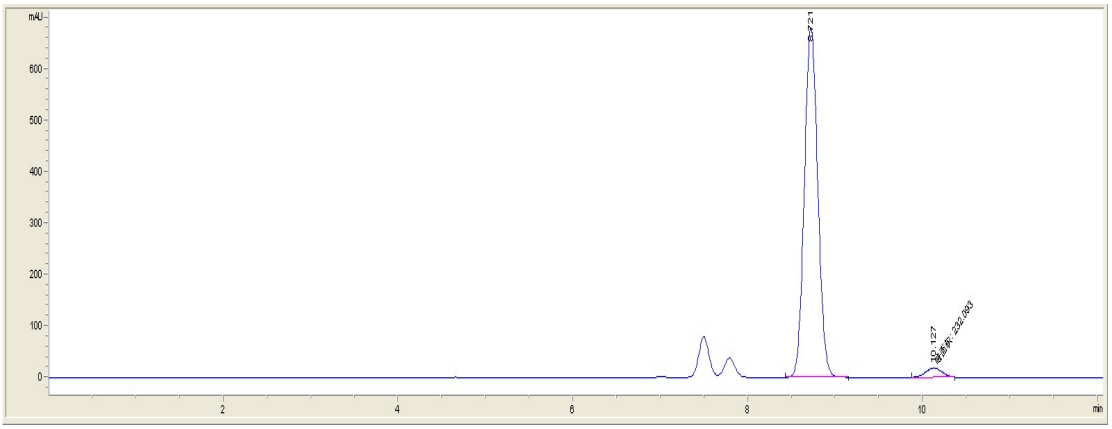


22



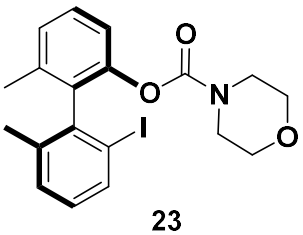
Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	8.487	1247.1	109.1	0.1774	0.737	50.172
2	9.819	1238.6	94.7	0.2026	0.924	49.828

Figure S249. HPLC Spectra of racemic **22**

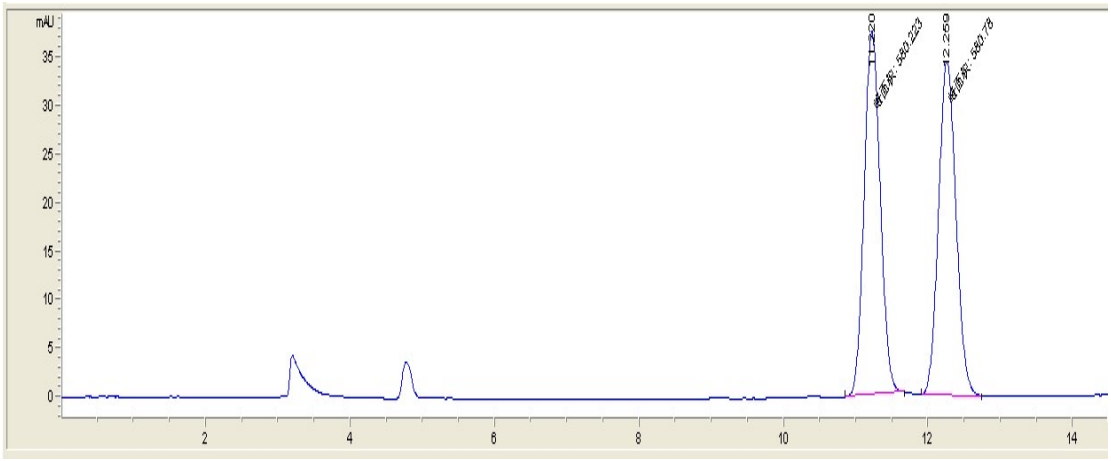


Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	8.721	7265.1	679.7	0.1667	0.91	96.904
2	10.127	232.1	18.2	0.2122	1.091	3.096

Figure S250 HPLC Spectra of **22**

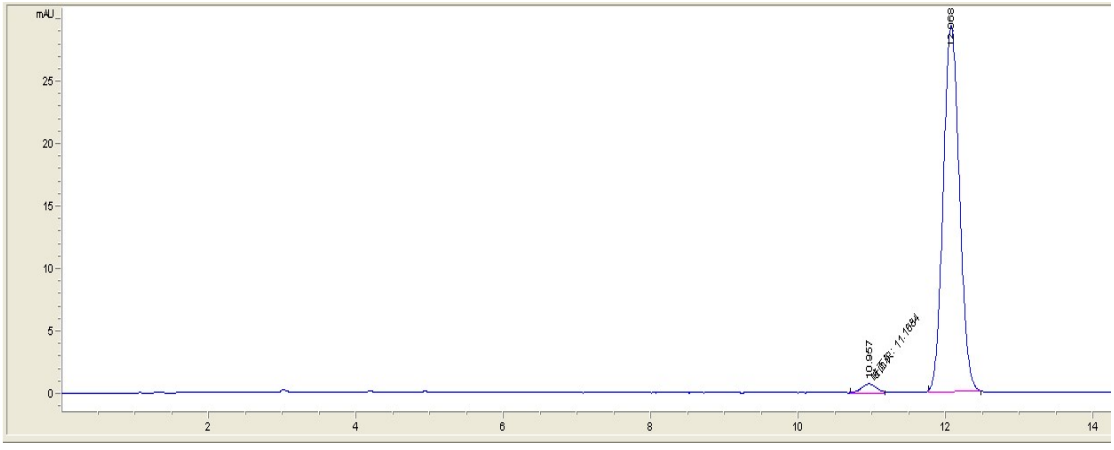


23



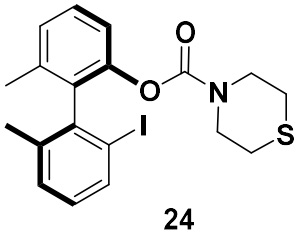
Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	11.22	580.2	37.4	0.2584	0.902	49.976
2	12.259	580.8	34.5	0.2809	0.889	50.024

Figure S251. HPLC Spectra of racemic **23**

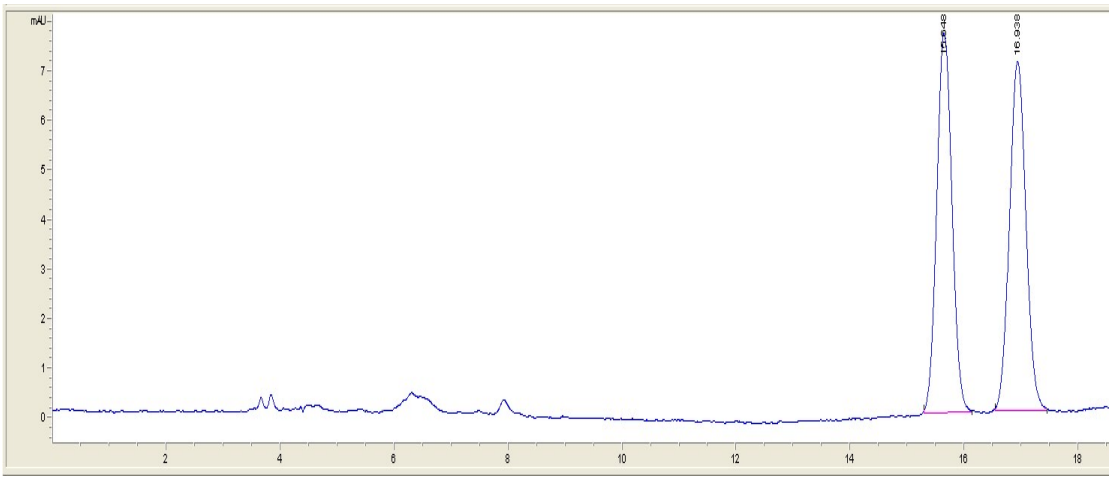


Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	10.957	11.2	7.5E-1	0.2483	1.057	2.431
2	12.068	448.3	29.3	0.2383	0.909	97.569

Figure S252. HPLC Spectra of **23**

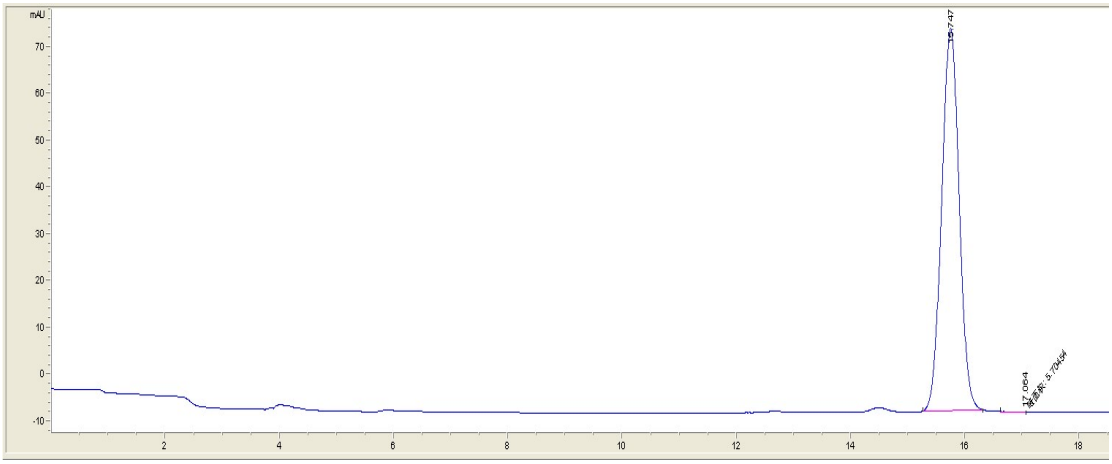


24



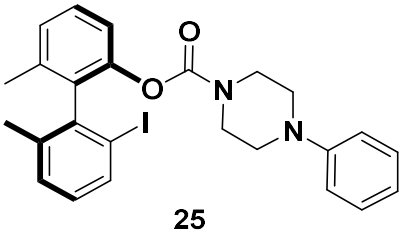
Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	15.648	141.8	7.7	0.2897	0.917	49.888
2	16.938	142.5	7.1	0.3077	0.936	50.112

Figure S253. HPLC Spectra of racemic **24**

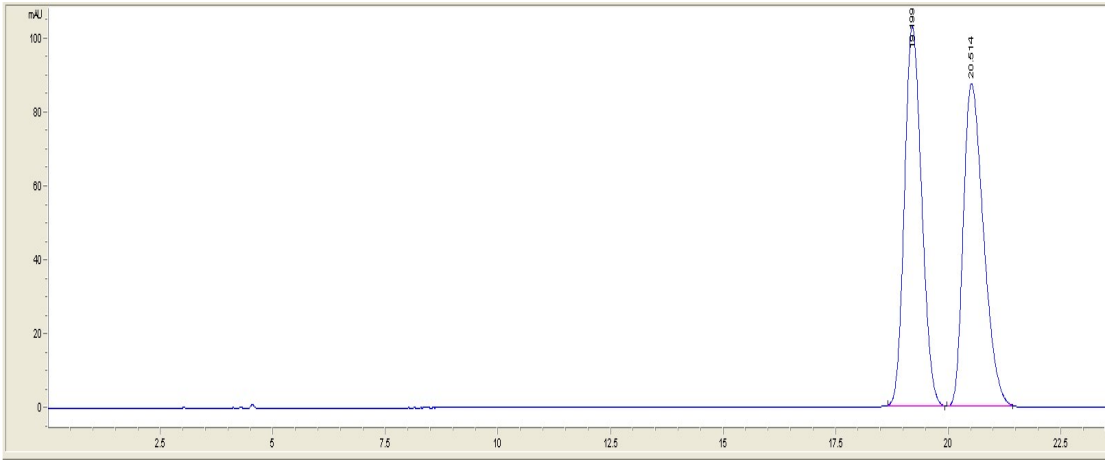


Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	15.747	1746.8	81.9	0.3307	1.009	99.674
2	17.064	5.7	2.9E-1	0.3238	1.352	0.326

Figure S254. HPLC Spectra of **24**

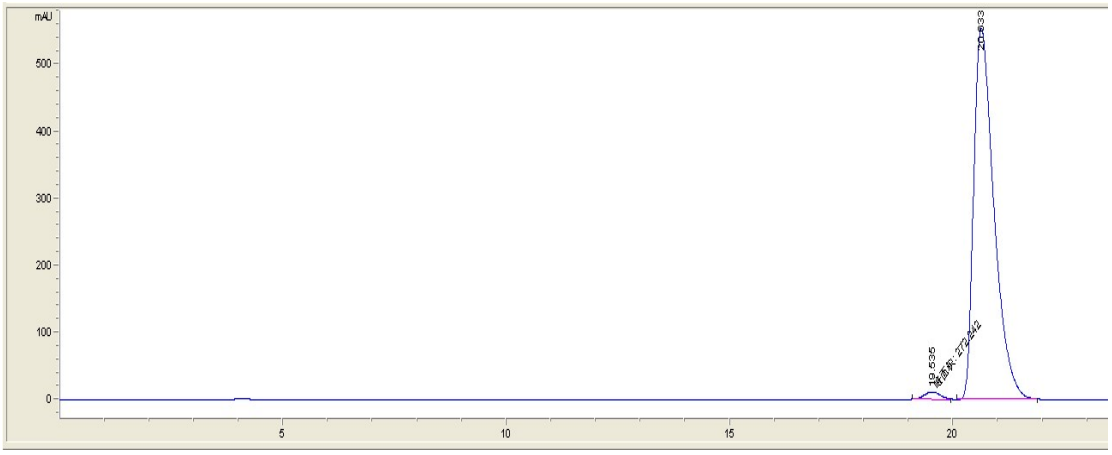


25



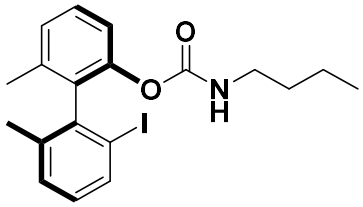
Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	19.199	2731	102.6	0.4145	0.814	50.020
2	20.514	2728.8	87.3	0.4845	0.64	49.980

Figure S255. HPLC Spectra of racemic **25**

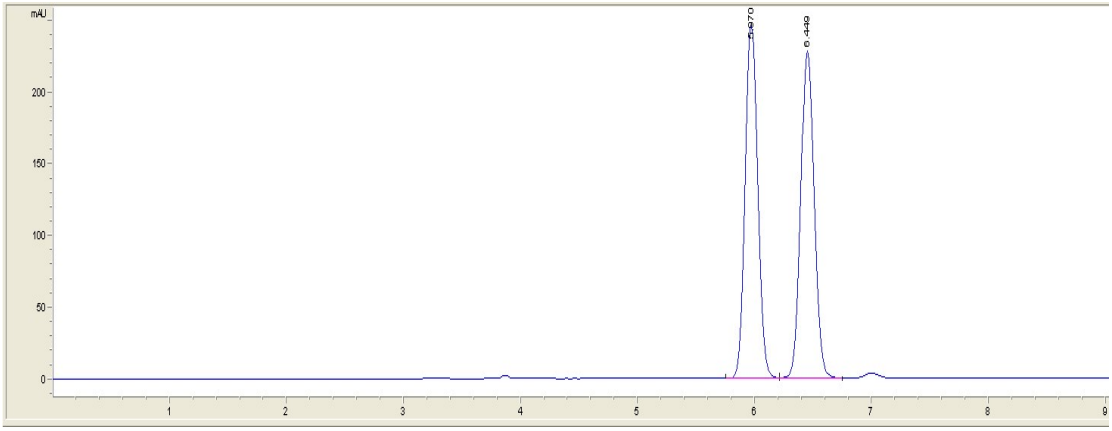


Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	19.535	272.2	11.1	0.4099	0.823	1.536
2	20.633	17453.9	553.5	0.4819	0.563	98.464

Figure S256. HPLC Spectra of **25**

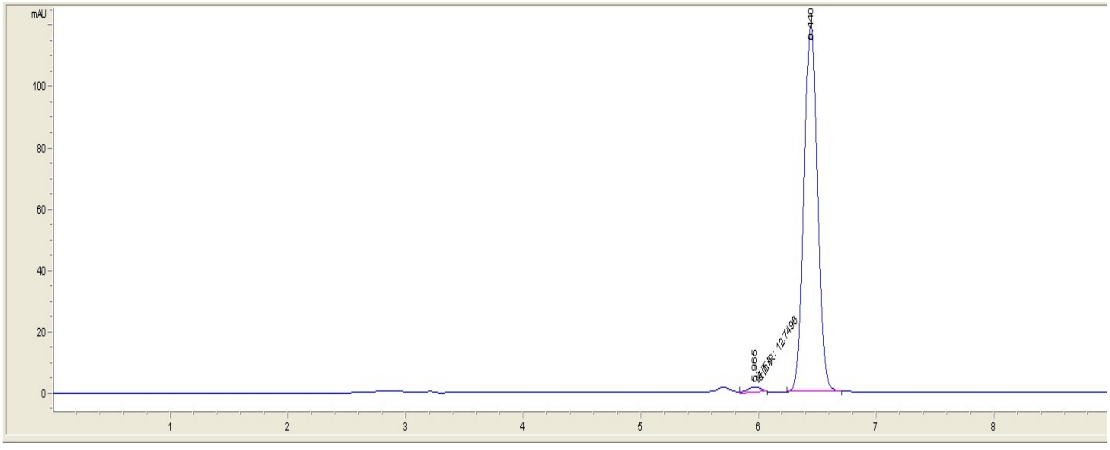


26



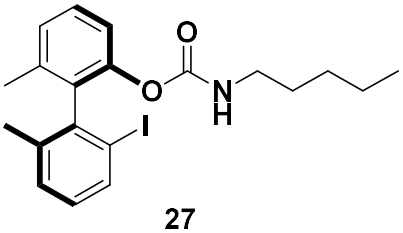
Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	5.97	1817.4	246.2	0.1141	0.891	49.898
2	6.449	1824.9	227.8	0.1235	0.893	50.102

Figure S257. HPLC Spectra of racemic **26**

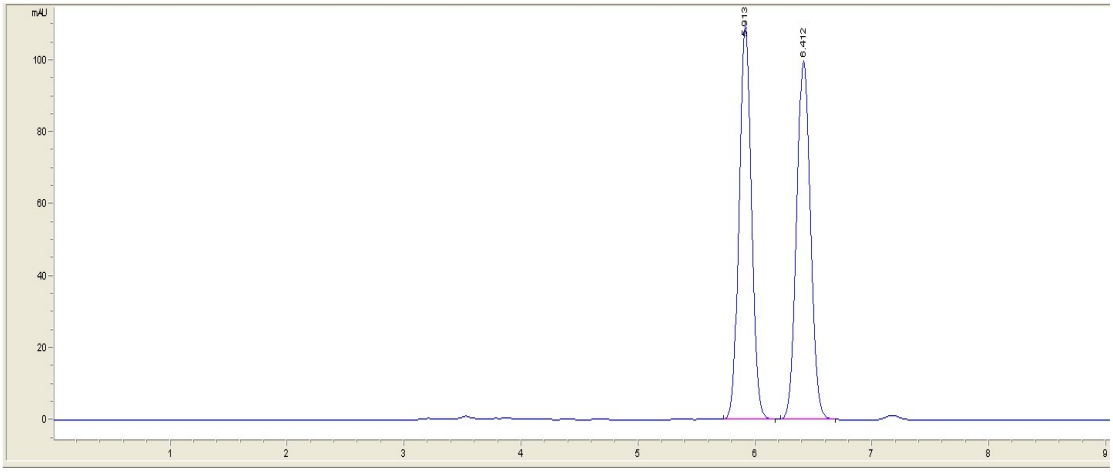


Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	5.965	12.7	1.7	0.1223	1.535	1.321
2	6.44	952.6	119.6	0.1249	0.917	98.679

Figure S258. HPLC Spectra of **26**

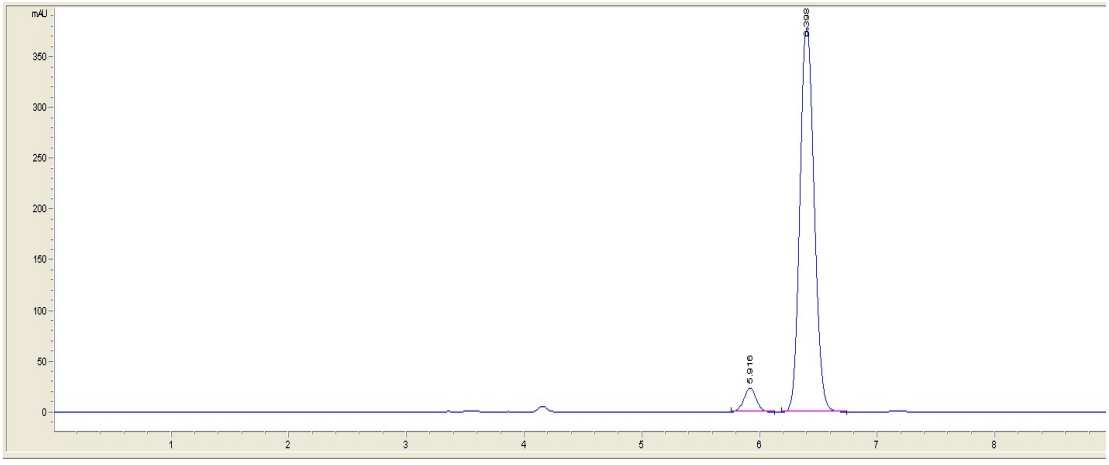


27



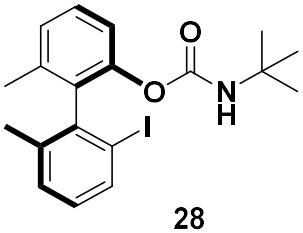
Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	5.913	802.3	109.2	0.1137	0.918	49.871
2	6.412	806.5	99.7	0.1244	0.916	50.129

Figure S259. HPLC Spectra of racemic **27**

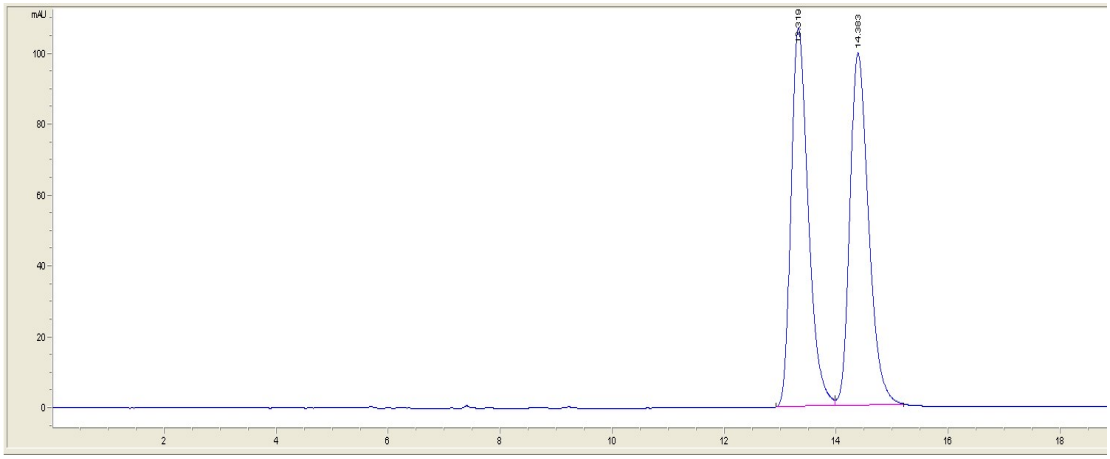


Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	5.916	173.5	23.7	0.1134	0.951	5.320
2	6.398	3087.4	379.2	0.125	0.837	94.680

Figure S260 HPLC Spectra of **27**

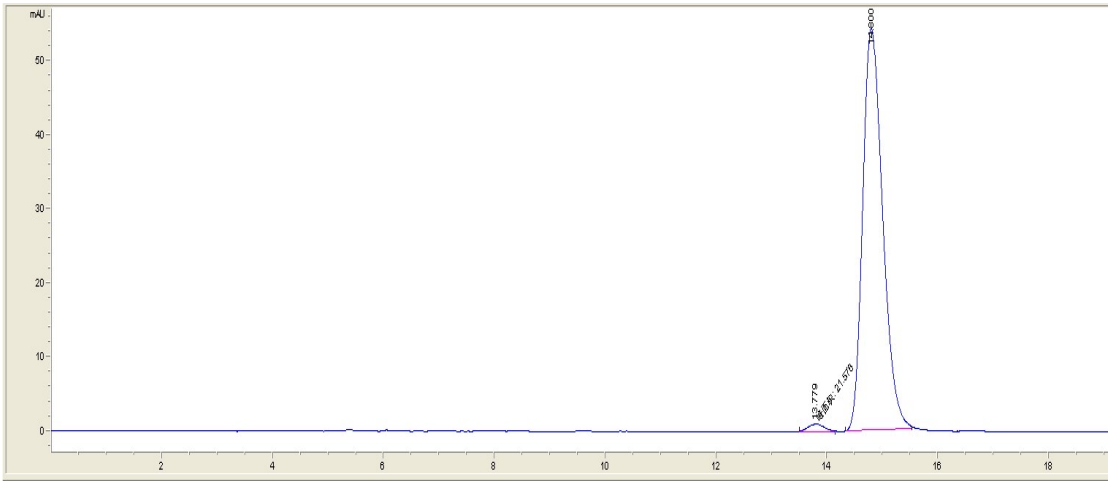


28



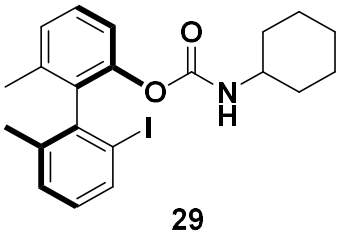
Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	13.319	2302.2	107	0.3311	0.682	49.824
2	14.383	2318.5	99.6	0.3576	0.701	50.176

Figure S261. HPLC Spectra of racemic **28**

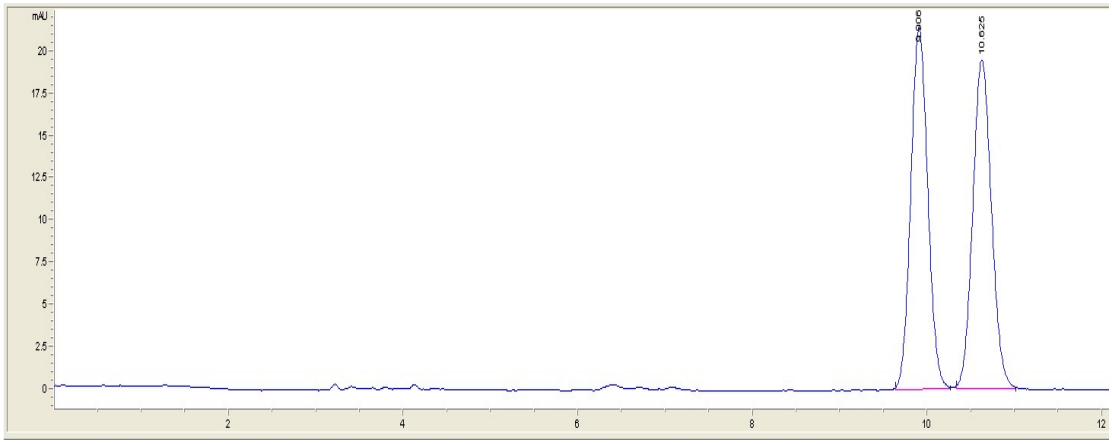


Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	13.779	21.6	1	0.352	0.712	1.565
2	14.8	1356.7	54.4	0.3852	0.724	98.435

Figure S262. HPLC Spectra of **28**

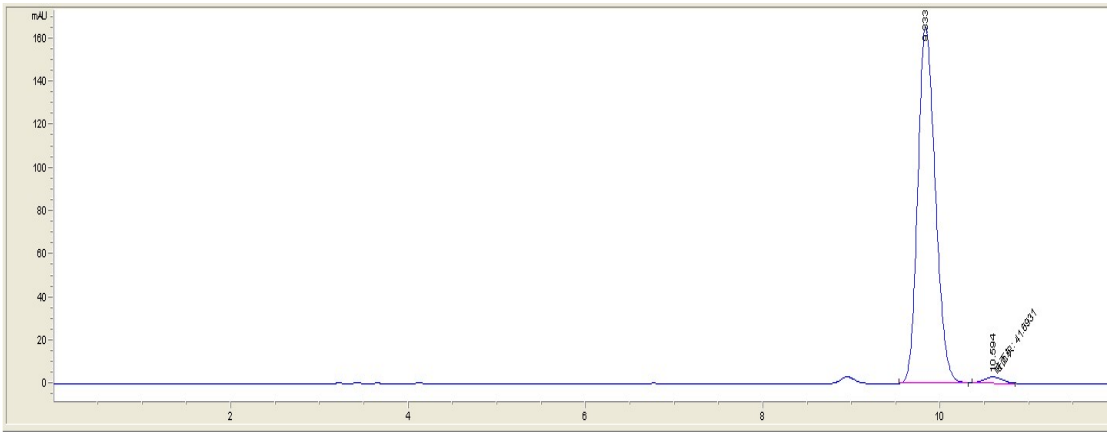


29



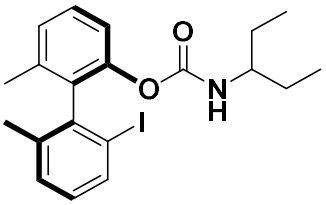
Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	9.906	291.4	21.5	0.2103	0.907	49.961
2	10.625	291.8	19.5	0.2303	0.893	50.039

Figure S263. HPLC Spectra of racemic **29**

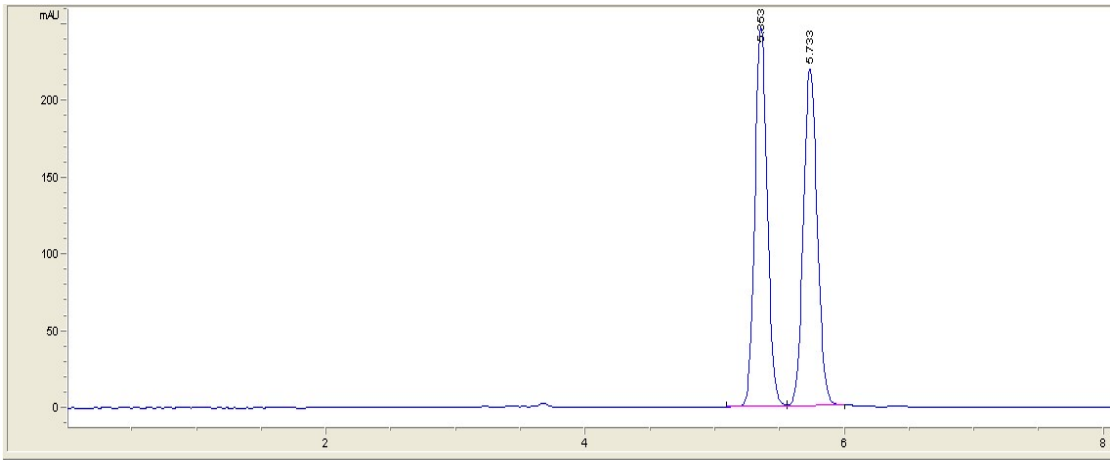


Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	9.833	2277	165.1	0.2129	0.767	98.202
2	10.594	41.7	2.9	0.2396	0.772	1.798

Figure S264. HPLC Spectra of **29**

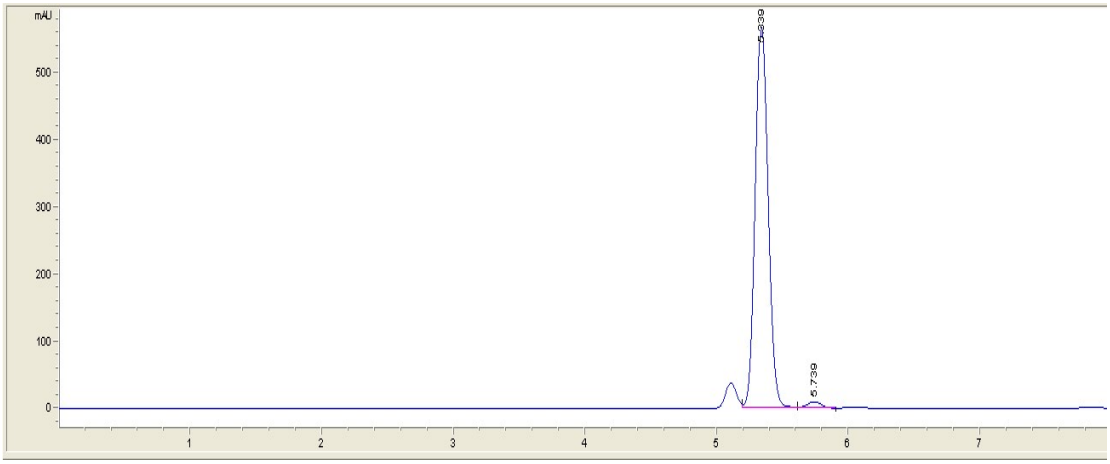


30



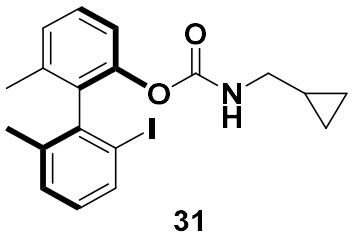
Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	5.353	1646.8	247.5	0.1036	0.905	50.000
2	5.733	1646.8	219.9	0.1154	0.888	50.000

Figure S265. HPLC Spectra of racemic **30**

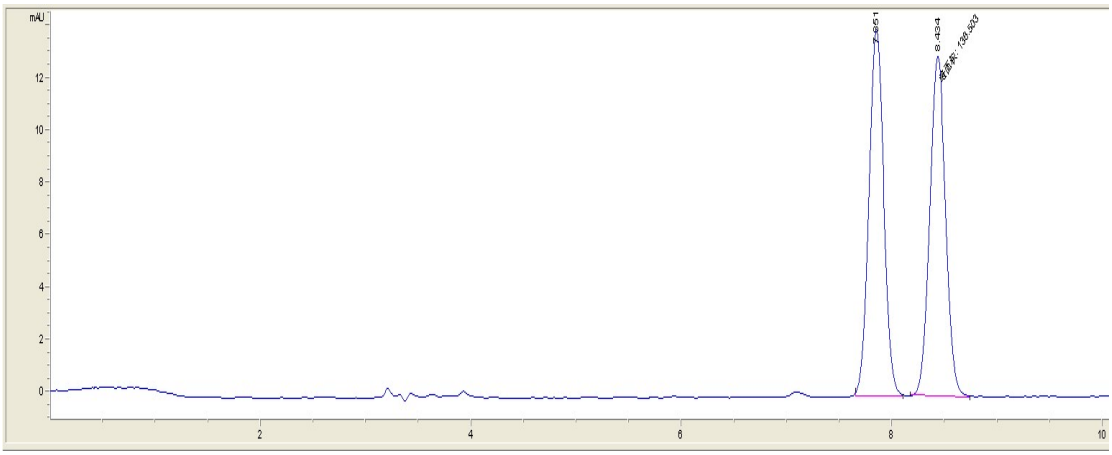


Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	5.339	3830	566.9	0.1048	0.859	97.992
2	5.739	78.5	9.8	0.1214	0.974	2.008

Figure S266. HPLC Spectra of **30**

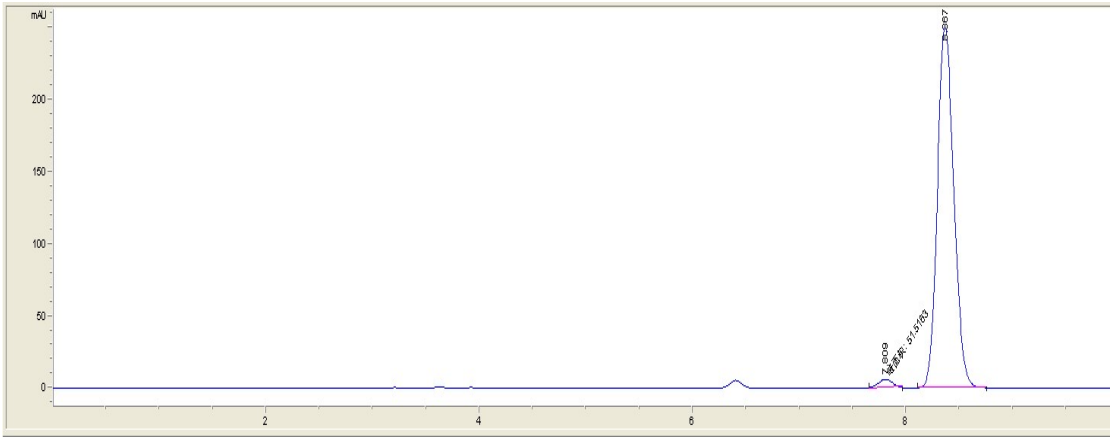


31



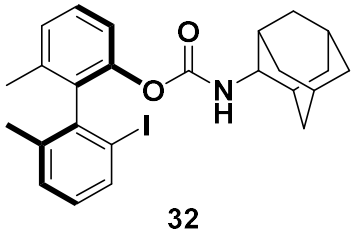
Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	7.851	138	14	0.1527	0.942	50.279
2	8.434	136.5	13	0.1747	0.959	49.721

Figure S267. HPLC Spectra of racemic **31**

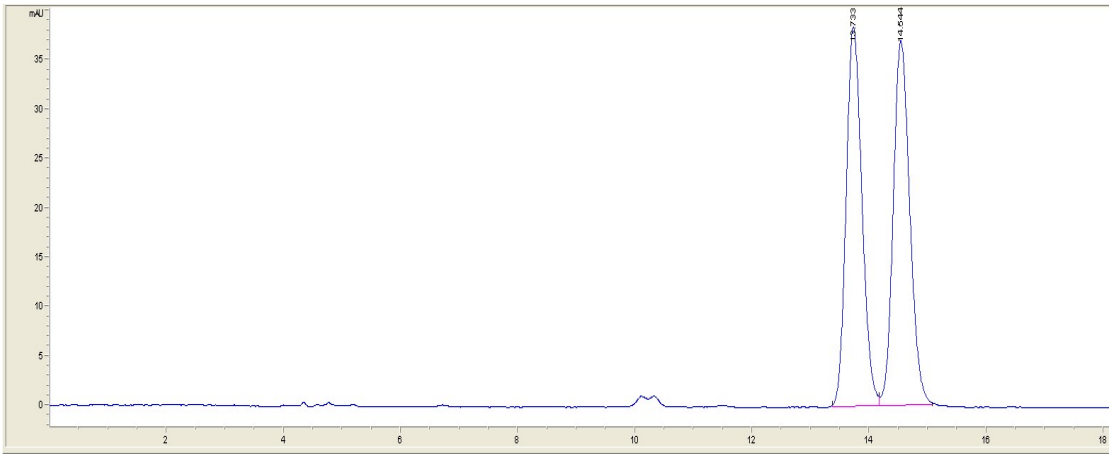


Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	7.809	51.5	5.7	0.1504	1.118	1.890
2	8.367	2674.6	250	0.1648	0.818	98.110

Figure S268. HPLC Spectra of **31**

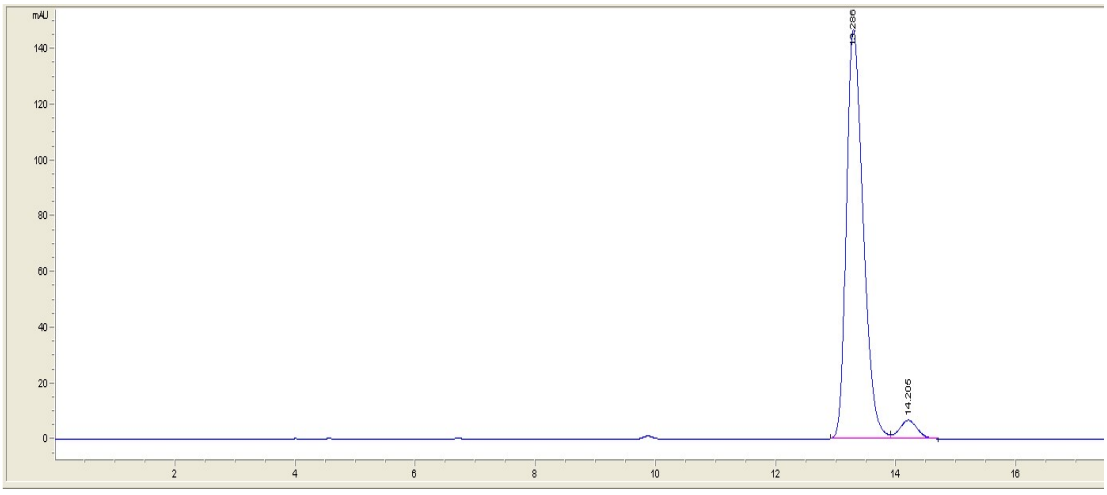


32



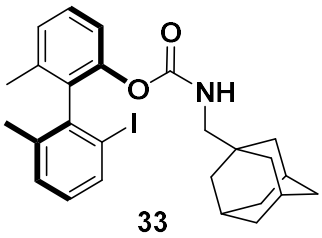
Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	13.733	723.9	38.5	0.2913	0.81	49.883
2	14.544	727.3	37	0.3054	0.81	50.117

Figure S269. HPLC Spectra of racemic **32**

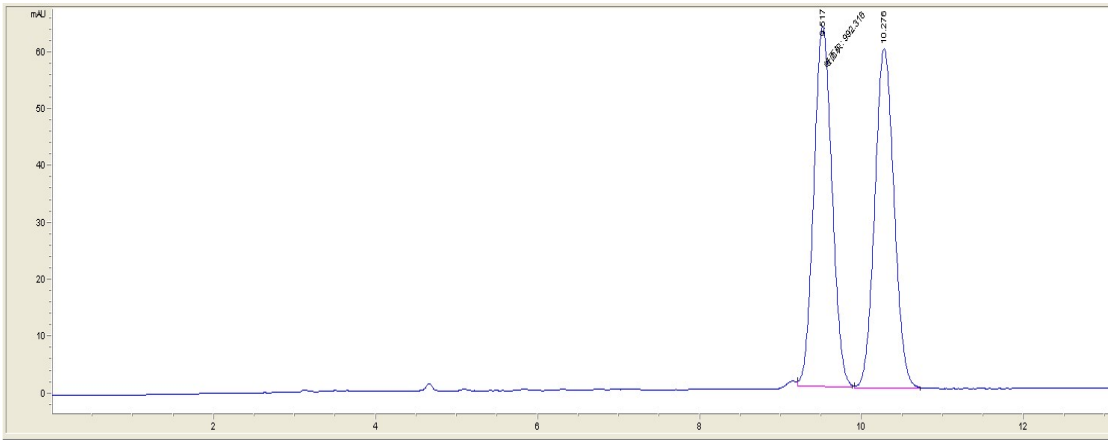


Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	13.286	2862.1	146.9	0.2993	0.655	95.386
2	14.205	138.4	6.7	0.3145	0.954	4.614

Figure S270 HPLC Spectra of **32**

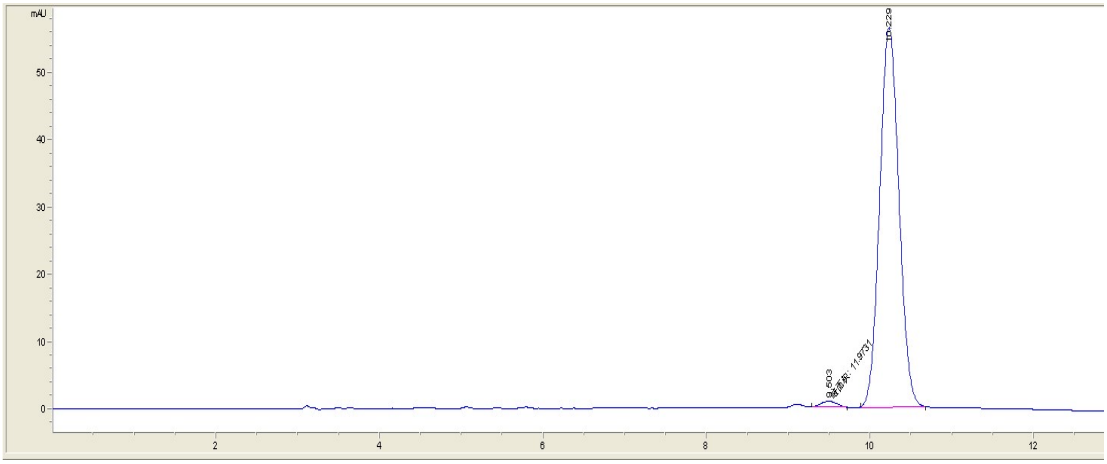


33



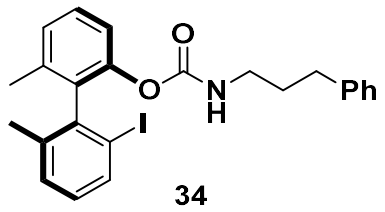
Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	9.517	992.3	63.3	0.2613	0.923	50.006
2	10.276	992.1	59.8	0.2575	0.918	49.994

Figure S271. HPLC Spectra of racemic **33**

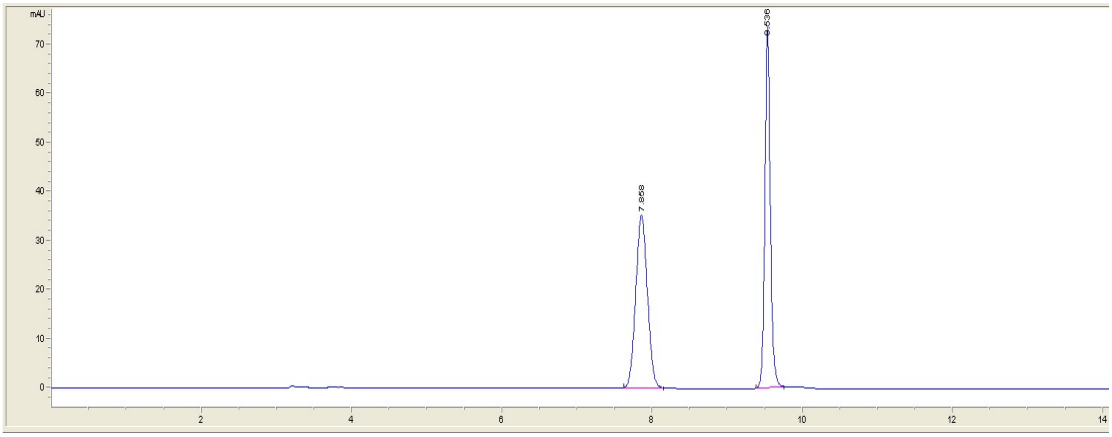


Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	9.503	12	8.8E-1	0.2275	0.909	1.275
2	10.229	926.7	56.6	0.2571	0.914	98.725

Figure S272. HPLC Spectra of **33**

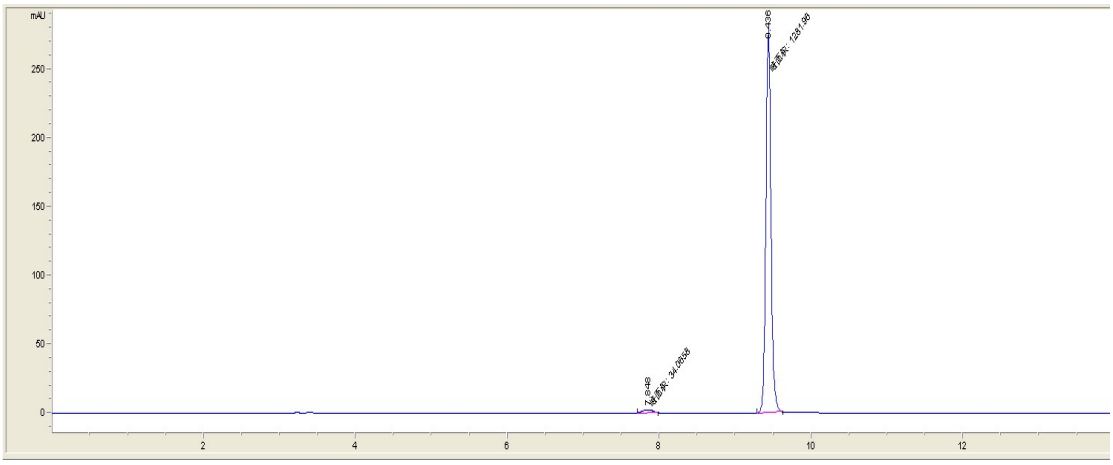


34



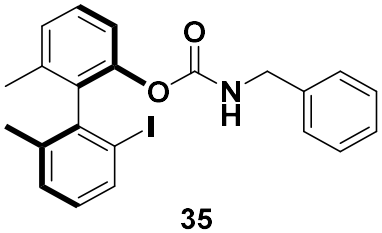
Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	7.858	382	35.3	0.1683	0.943	50.697
2	9.536	371.5	73.7	0.0768	0.917	49.303

Figure S273. HPLC Spectra of racemic **34**

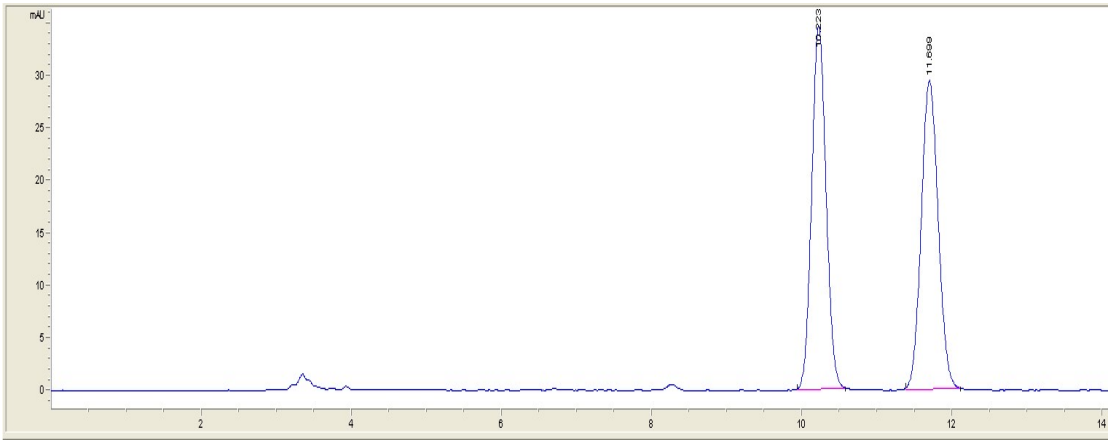


Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	7.848	34.1	3.1	0.1837	1.153	2.589
2	9.436	1282	280	0.0763	0.94	97.411

Figure S274. HPLC Spectra of **34**

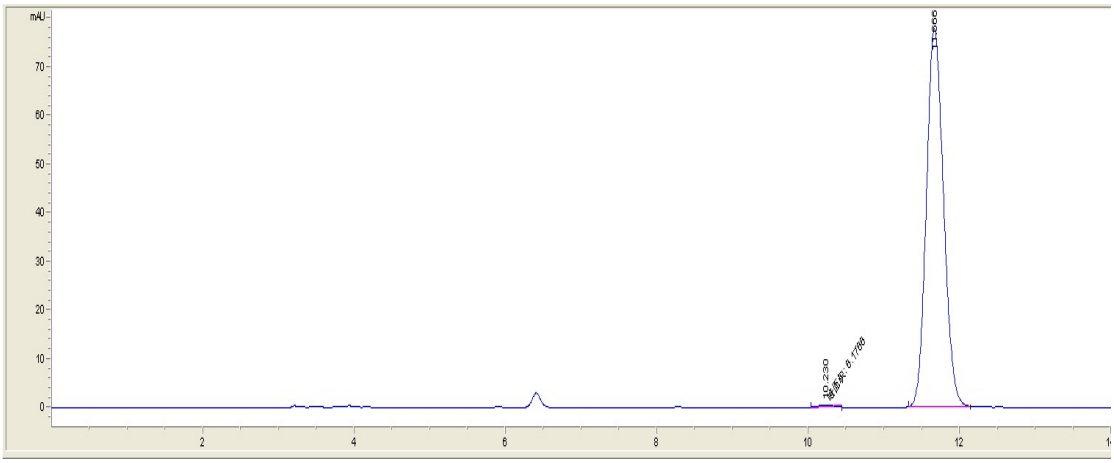


35



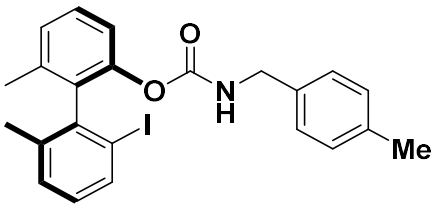
Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	10.223	463.9	34.7	0.2082	0.897	49.993
2	11.699	464	29.5	0.2435	0.899	50.007

Figure S275. HPLC Spectra of racemic **35**

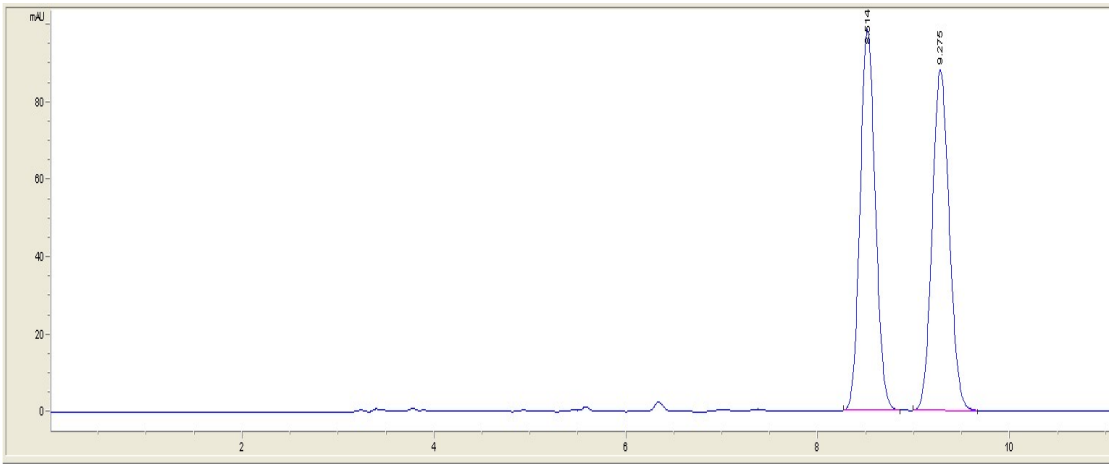


Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	10.23	6.2	4.9E-1	0.2092	1.406	0.500
2	11.666	1228	77.8	0.2461	0.84	99.500

Figure S276. HPLC Spectra of **35**

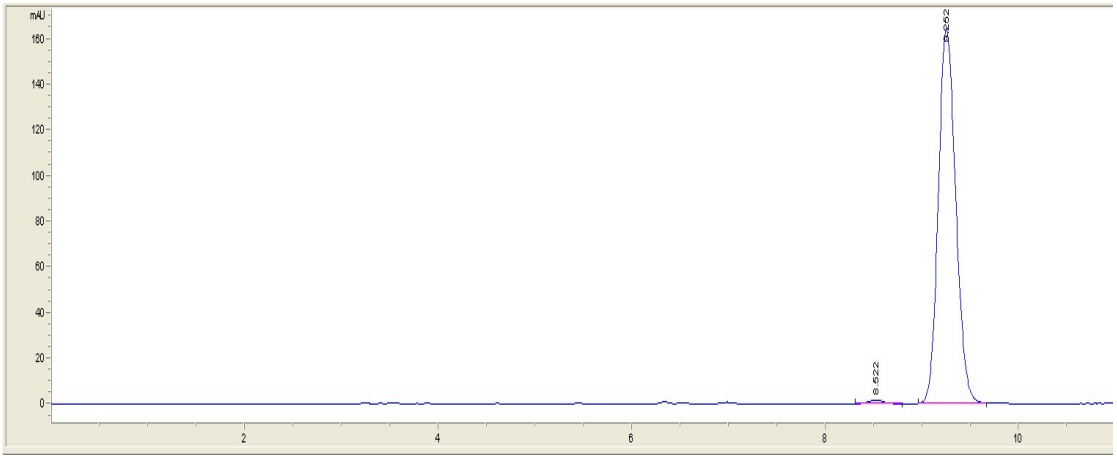


36



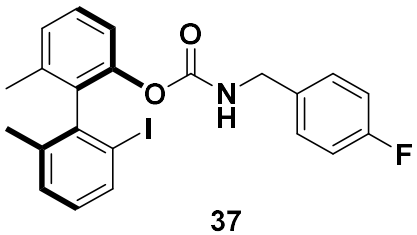
Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	8.514	1090.5	98.6	0.173	0.877	49.915
2	9.275	1094.2	88	0.193	0.88	50.085

Figure S277. HPLC Spectra of racemic **36**

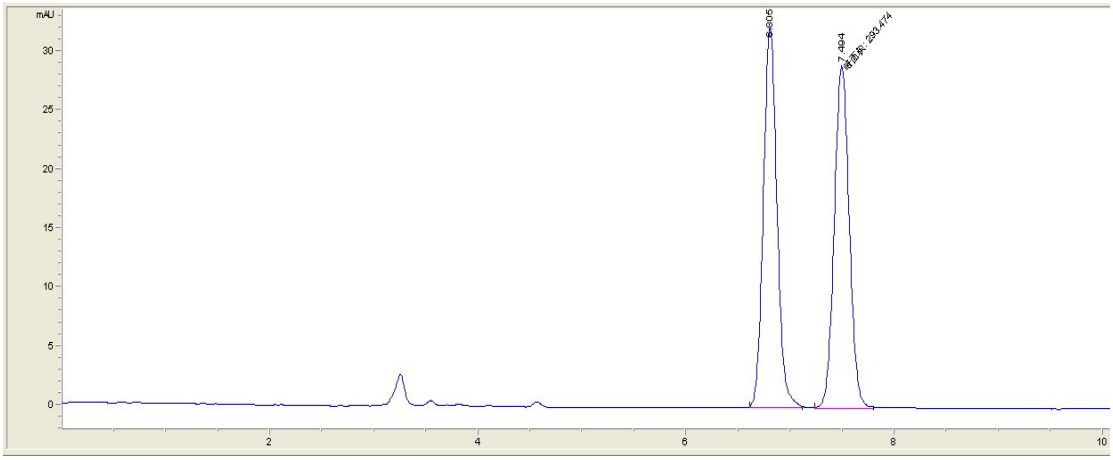


Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	8.522	17.1	1.6	0.1642	0.941	0.826
2	9.252	2056.7	164.8	0.1936	0.826	99.174

Figure S278. HPLC Spectra of **36**

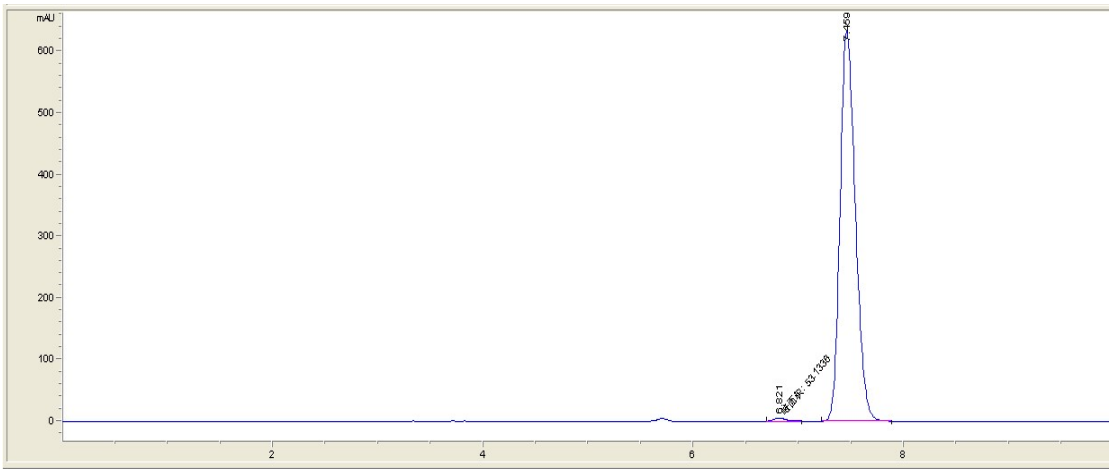


37



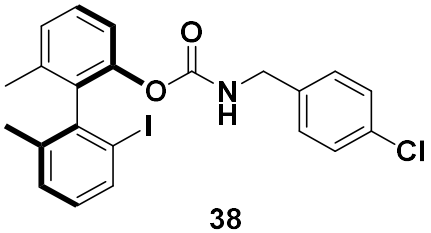
Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	6.805	293.2	32.2	0.1422	0.891	49.978
2	7.494	293.5	29.1	0.1678	0.947	50.022

Figure S279. HPLC Spectra of racemic **37**

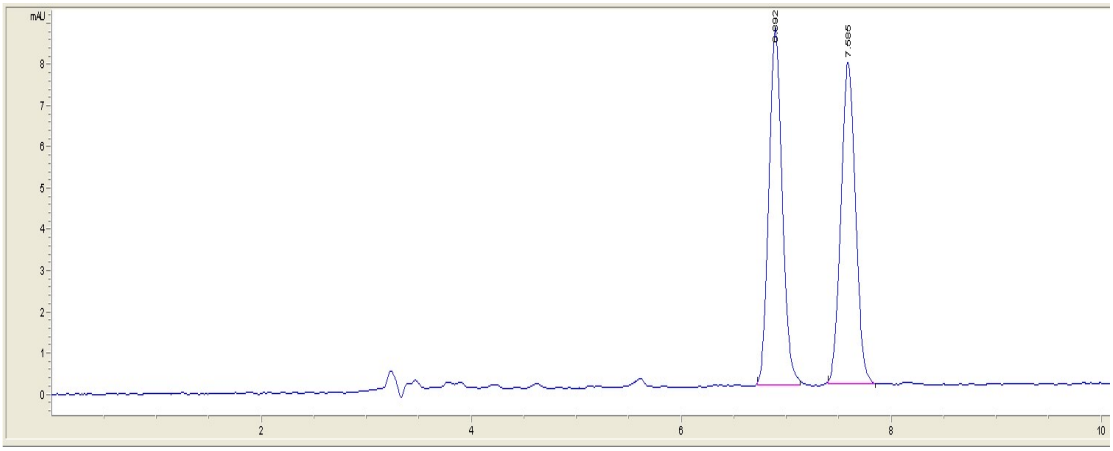


Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	6.821	53.1	5.5	0.1598	0.792	0.821
2	7.459	6420.5	633	0.1563	0.736	99.179

Figure S280 HPLC Spectra of **37**

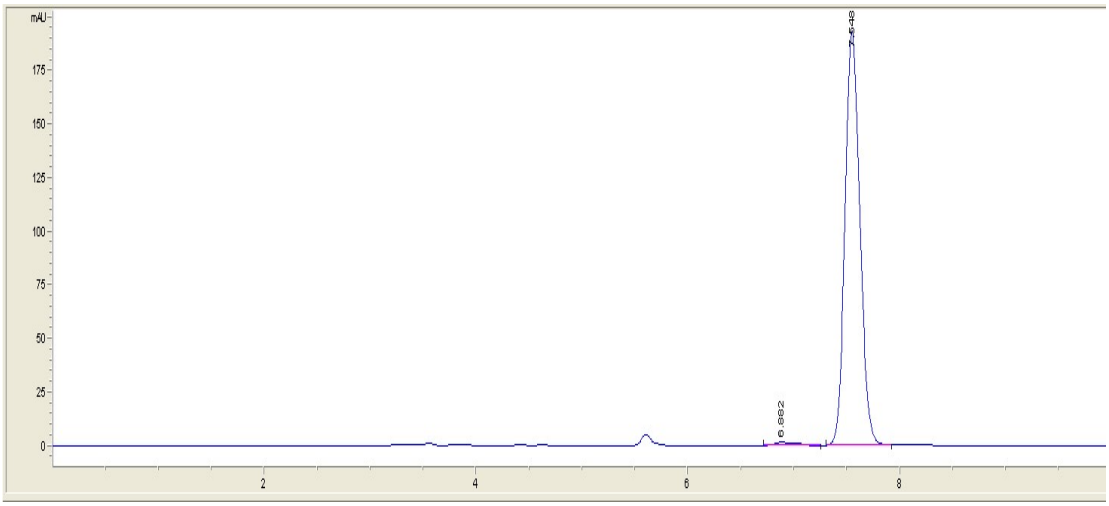


38



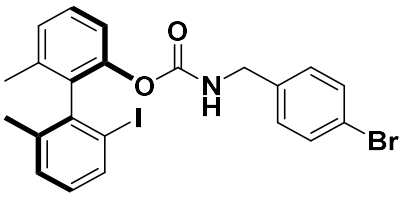
Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	6.892	77.3	8.7	0.138	0.883	50.544
2	7.585	75.6	7.8	0.1489	0.94	49.456

Figure S281. HPLC Spectra of racemic **38**

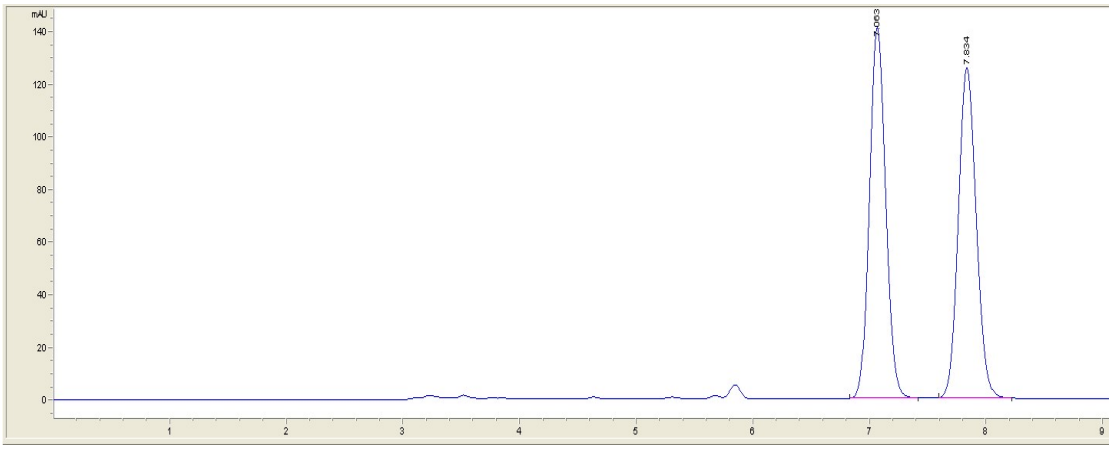


Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	6.882	22	1.6	0.1921	0.405	1.151
2	7.548	1887	193.3	0.1519	0.849	98.849

Figure S282. HPLC Spectra of **38**

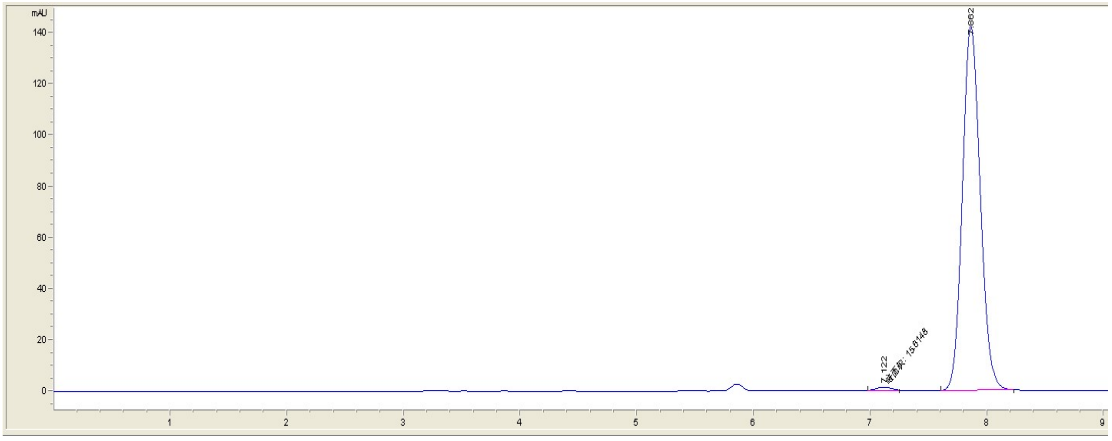


39



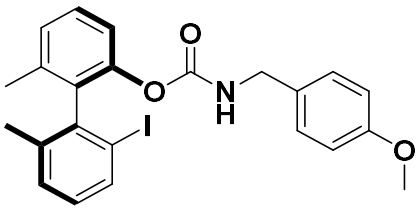
Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	7.063	1374.6	141.1	0.1516	0.869	50.260
2	7.834	1360.3	125.6	0.1683	0.868	49.740

Figure S283. HPLC Spectra of racemic **39**

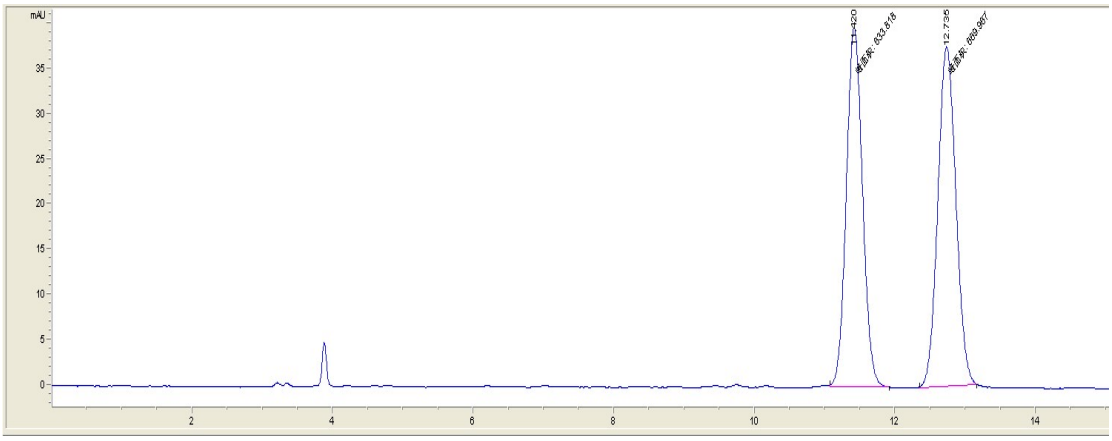


Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	7.122	15.6	1.5	0.172	0.726	1.008
2	7.862	1533	142.4	0.1676	0.859	98.992

Figure S284. HPLC Spectra of **39**

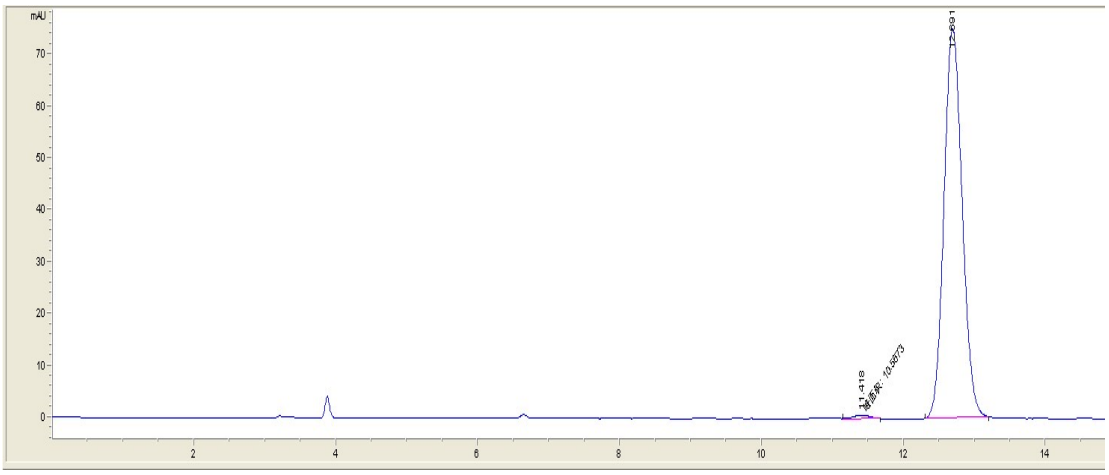


40



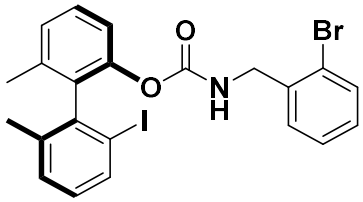
Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	11.42	633.8	39.7	0.2659	0.919	48.614
2	12.735	670	37.5	0.2978	0.924	51.386

Figure S285. HPLC Spectra of racemic **40**

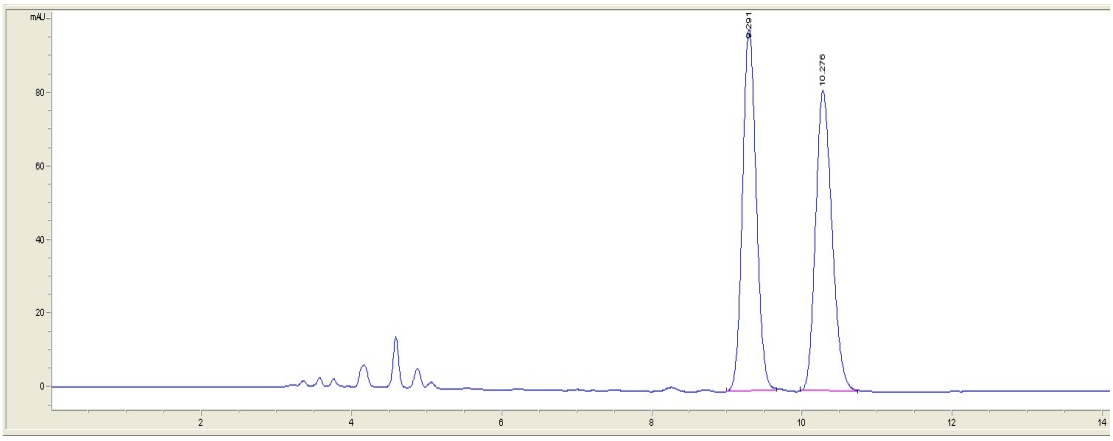


Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	11.418	10.6	6.9E-1	0.2541	1.425	0.782
2	12.691	1341	75.2	0.2781	0.865	99.218

Supplementary Figure 286. HPLC Spectra of **40**

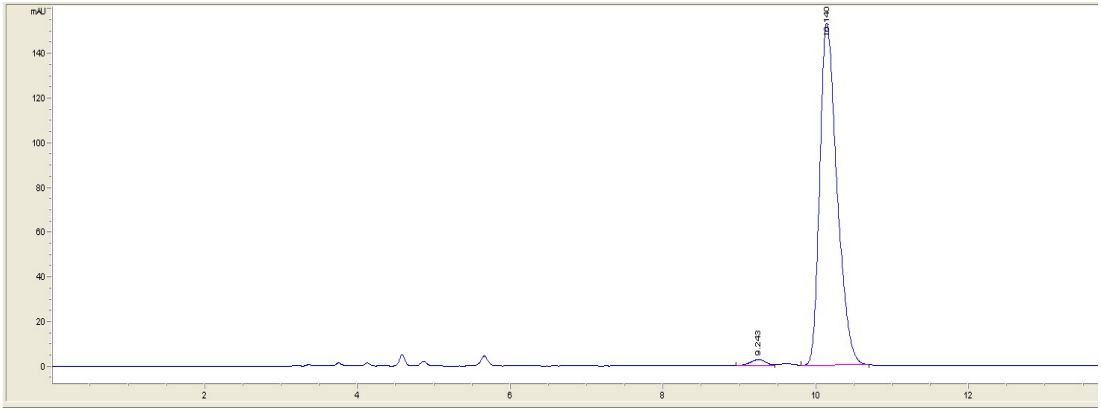


41



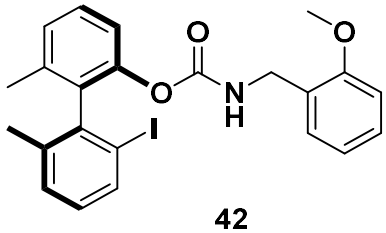
Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	9.291	1253.8	98.4	0.1987	0.861	50.249
2	10.276	1241.4	81.7	0.2333	0.775	49.751

Figure S287. HPLC Spectra of racemic **41**

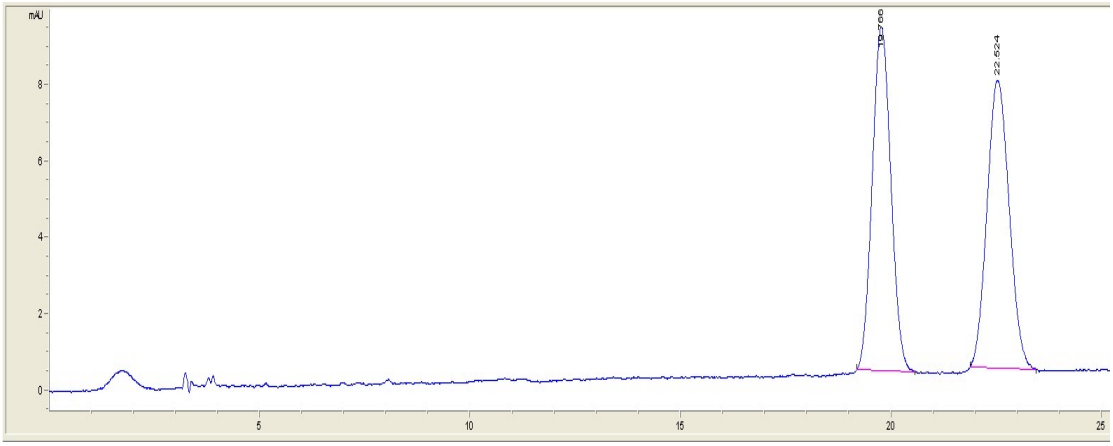


Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	9.243	38.7	2.7	0.2128	1.055	1.581
2	10.14	2408.3	153	0.2376	0.65	98.419

Figure S288. HPLC Spectra of **41**

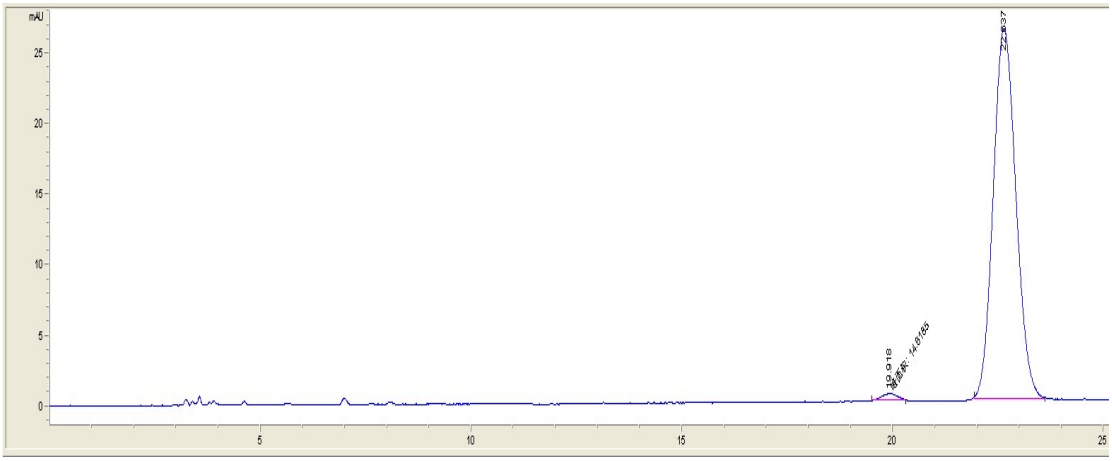


42



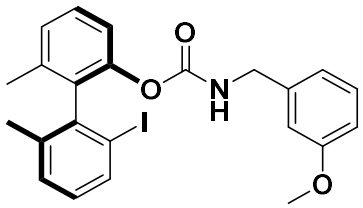
Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	19.766	279.1	9	0.4613	0.907	50.253
2	22.524	276.2	7.5	0.5137	0.844	49.747

Figure S289. HPLC Spectra of racemic **42**

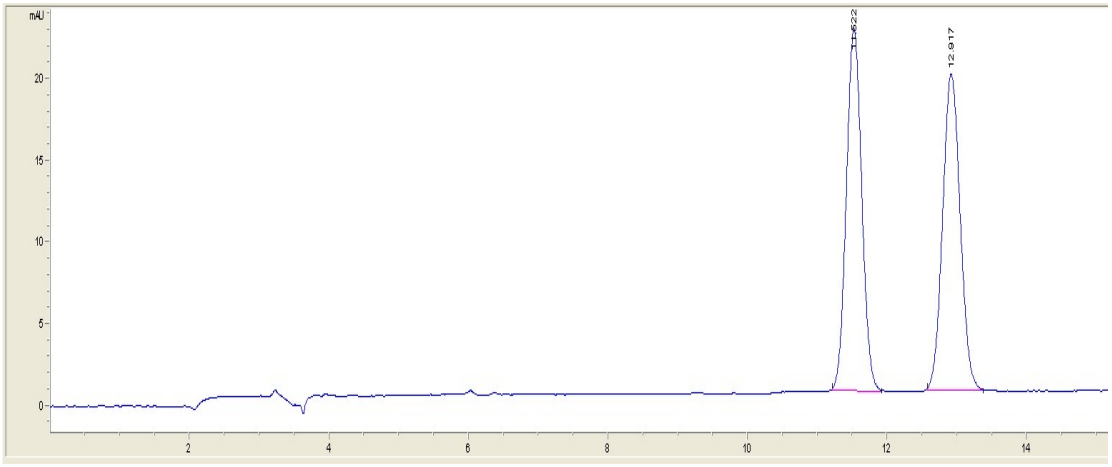


Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	19.918	14.6	5.2E-1	0.4719	0.902	1.470
2	22.637	979.6	26.2	0.582	0.861	98.530

Figure S290 HPLC Spectra of **42**

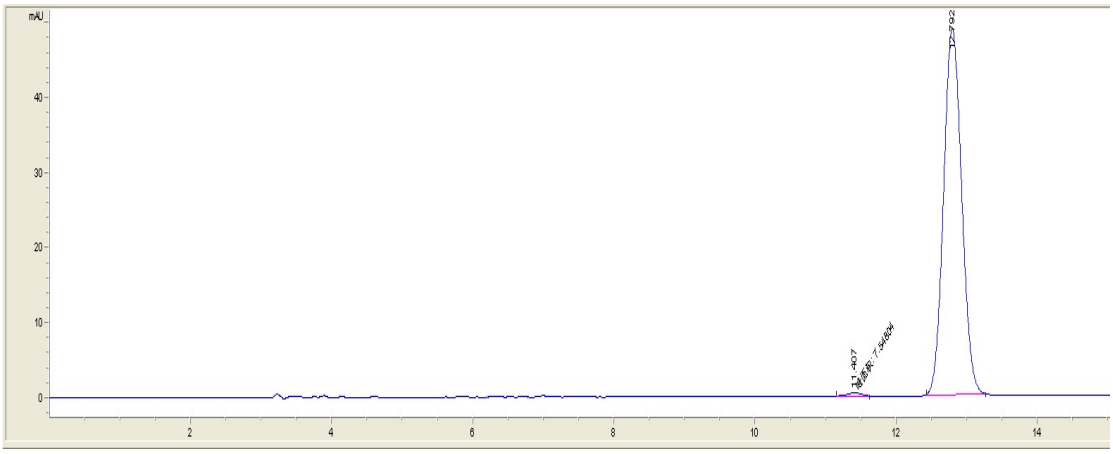


43



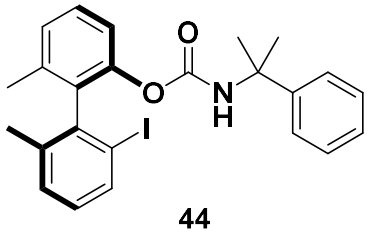
Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	11.522	340.8	22.2	0.2388	0.924	49.996
2	12.917	340.9	19.4	0.2708	0.916	50.004

Figure S291. HPLC Spectra of racemic **43**

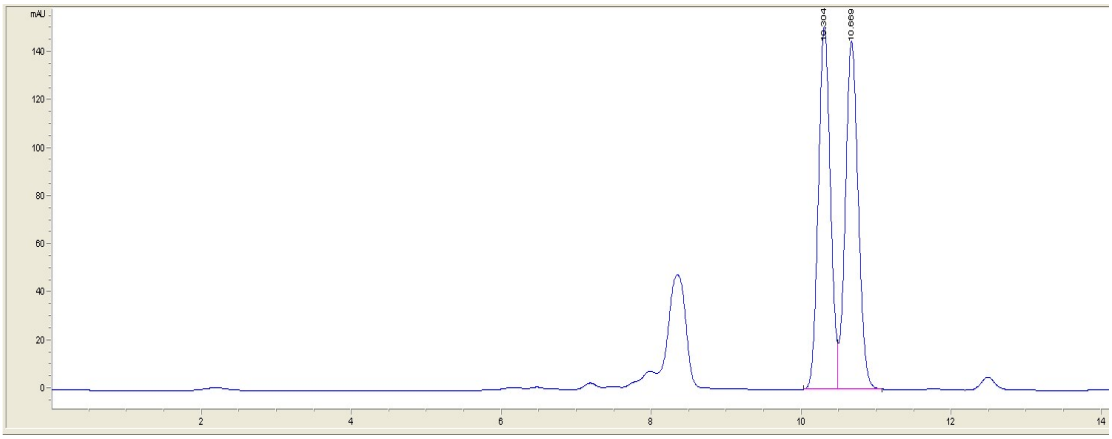


Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	11.407	7.5	4.9E-1	0.2552	1.088	0.863
2	12.792	866.7	49	0.2765	0.894	99.137

Figure S292. HPLC Spectra of **43**

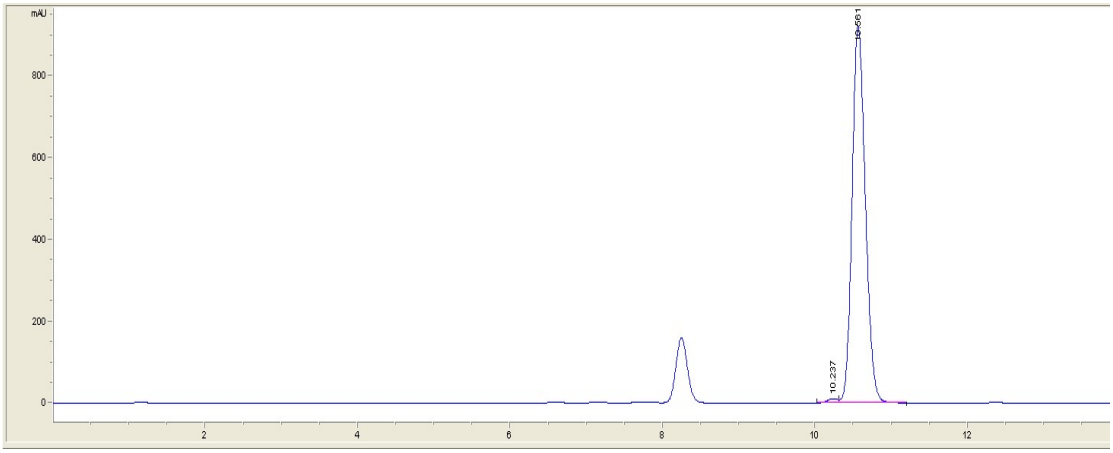


44



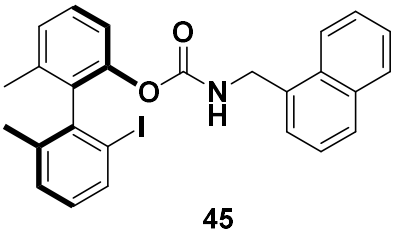
Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	10.304	1699.1	150.9	0.1733	0.912	49.572
2	10.669	1728.5	145	0.1851	0.896	50.428

Figure S293. HPLC Spectra of racemic **44**

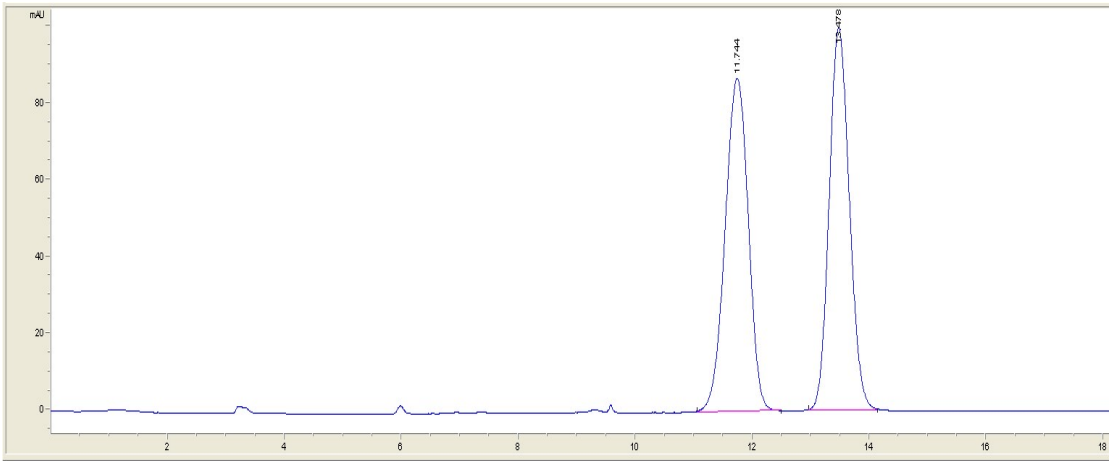


Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	10.237	102.4	11	0.1451	1.349	0.910
2	10.561	11151.2	921.4	0.1872	0.775	99.090

Figure S294. HPLC Spectra of **44**

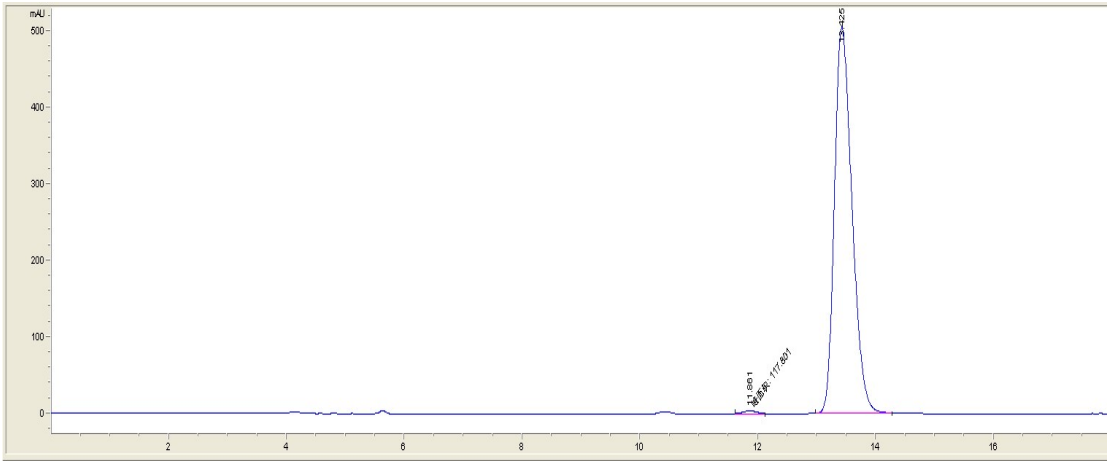


45



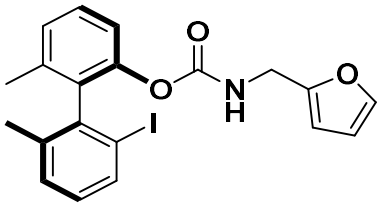
Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	11.744	2398.4	86.8	0.4365	1.069	50.077
2	13.478	2391	99.5	0.3742	0.858	49.923

Figure S295. HPLC Spectra of racemic **45**

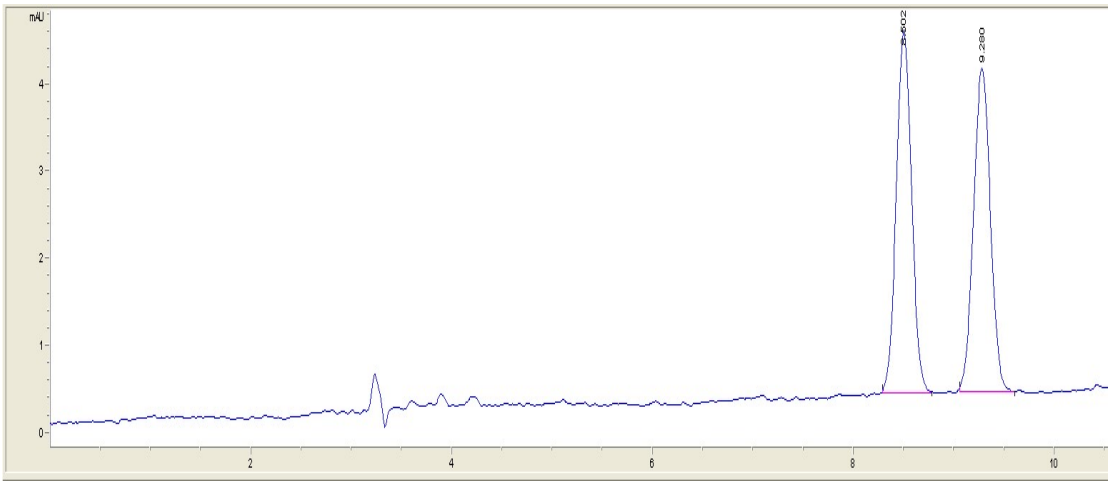


Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	11.861	117.8	5.7	0.3456	0.928	1.114
2	13.425	10459.7	504.9	0.3197	0.689	98.886

Figure S296. HPLC Spectra of **45**

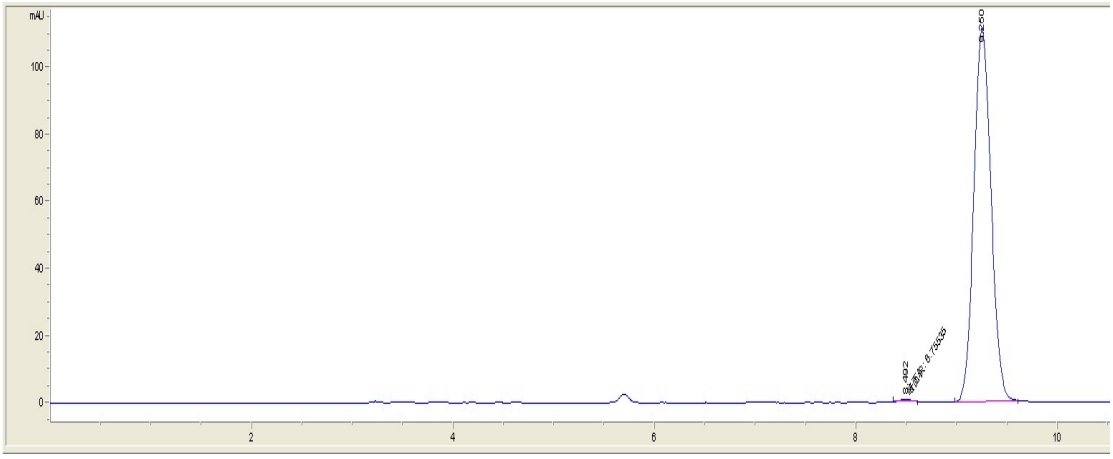


46



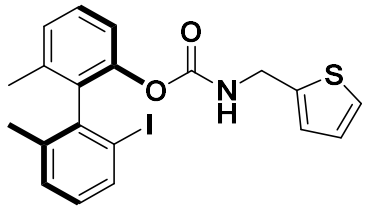
Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	8.502	44.2	4.2	0.1656	0.948	50.409
2	9.28	43.5	3.7	0.1845	0.966	49.591

Figure S297. HPLC Spectra of racemic **46**

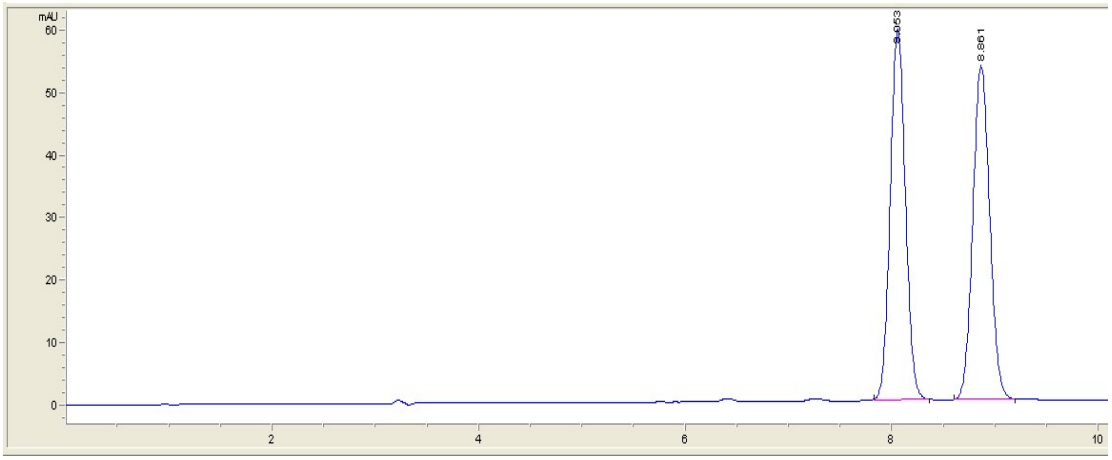


Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	8.492	6.8	7.8E-1	0.1448	0.879	0.507
2	9.25	1325.2	111.8	0.1843	0.868	99.493

Figure S298. HPLC Spectra of **46**

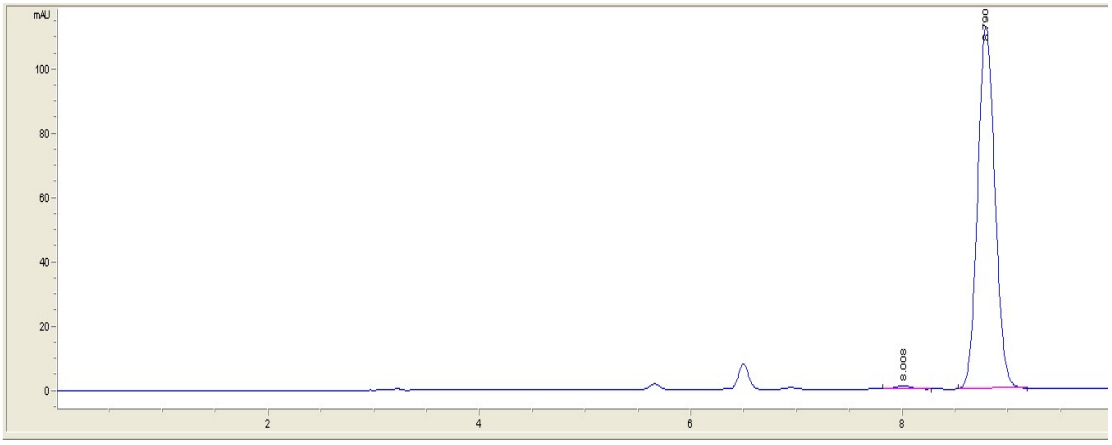


47



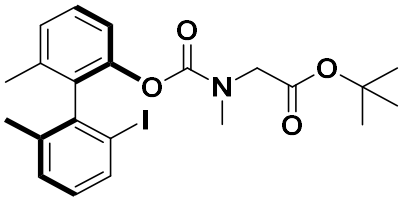
Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	8.053	605.3	59.4	0.159	0.918	50.008
2	8.861	605.1	53.4	0.1783	0.916	49.992

Figure S299. HPLC Spectra of racemic **47**

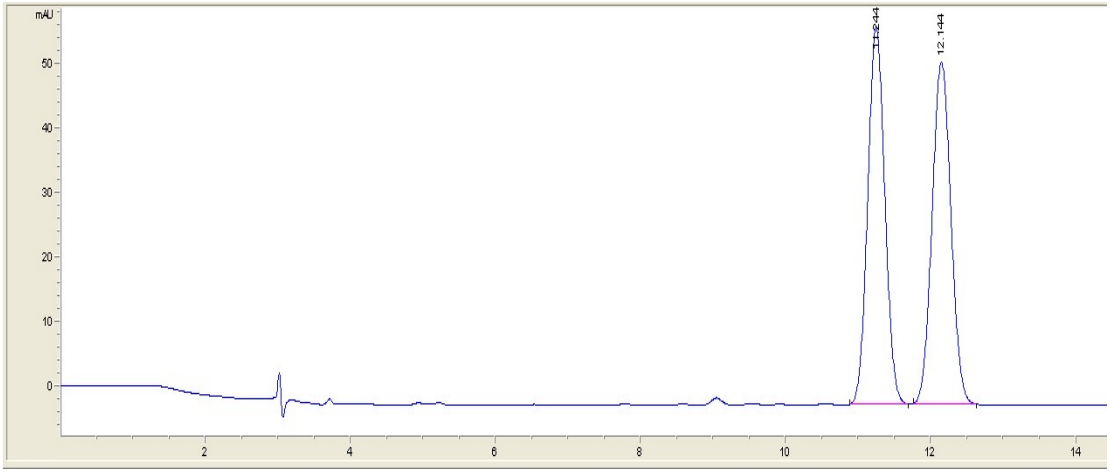


Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	8.008	10.3	1.1	0.1539	1.018	0.799
2	8.79	1274.7	112.6	0.1781	0.894	99.201

Figure S300 HPLC Spectra of **47**

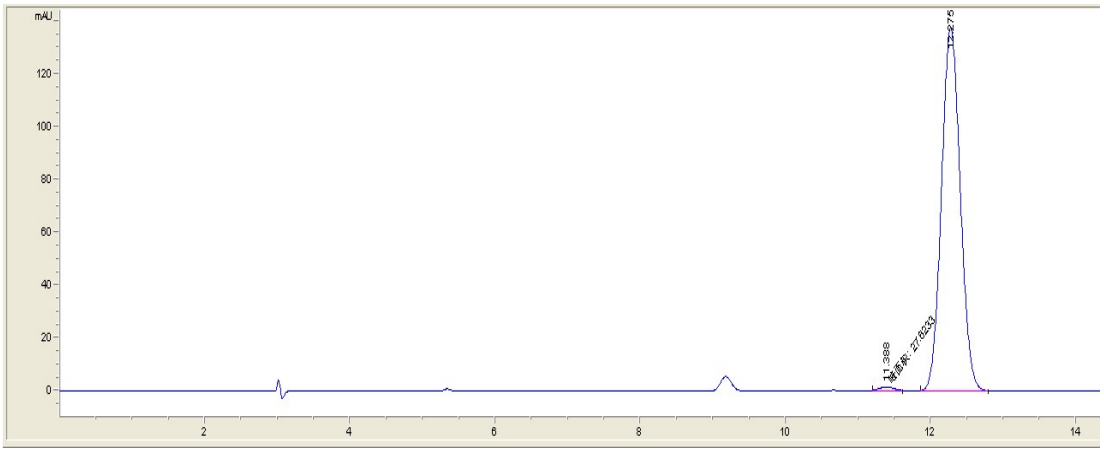


48



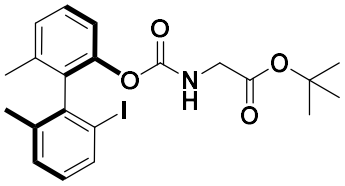
Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	11.244	963	58.5	0.2559	0.926	50.019
2	12.144	962.3	53.2	0.2831	0.936	49.981

Figure S301. HPLC Spectra of racemic **48**

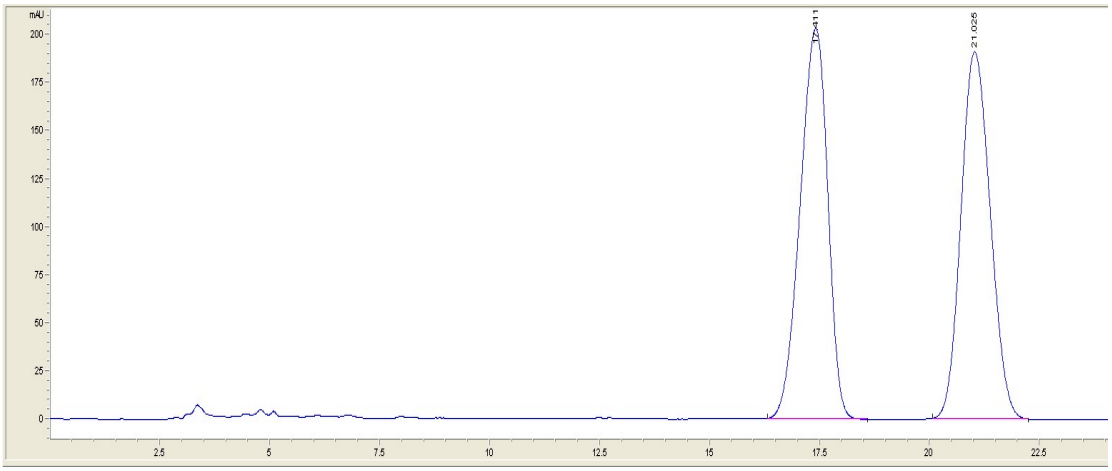


Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	11.388	27.6	1.8	0.258	1.065	1.103
2	12.275	2477.9	137.5	0.2823	0.918	98.897

Figure S302. HPLC Spectra of **48**

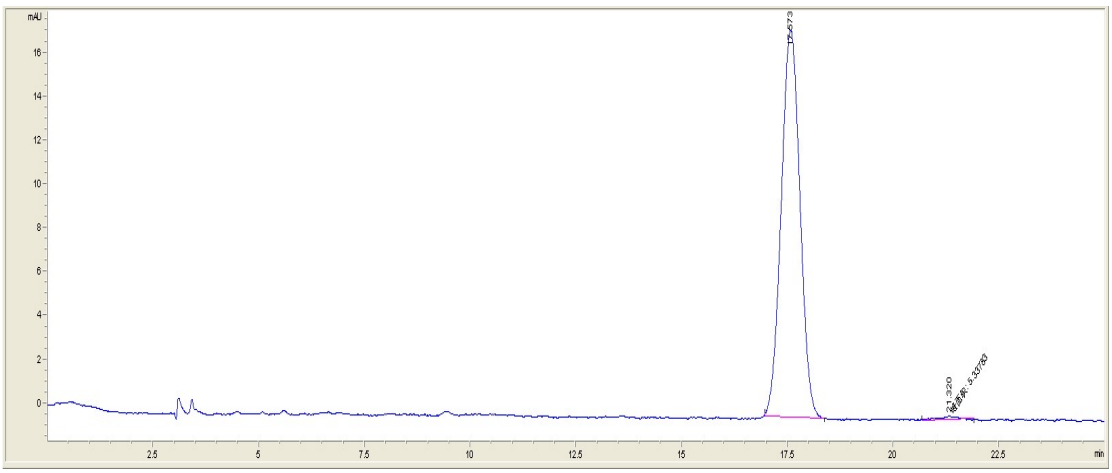


49



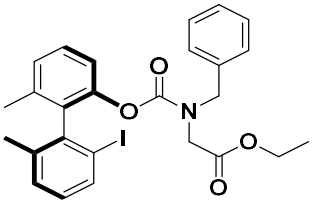
Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	17.411	8864	203.3	0.6868	1.267	50.055
2	21.025	8844.6	191.1	0.7239	0.847	49.945

Figure S303. HPLC Spectra of racemic **49**

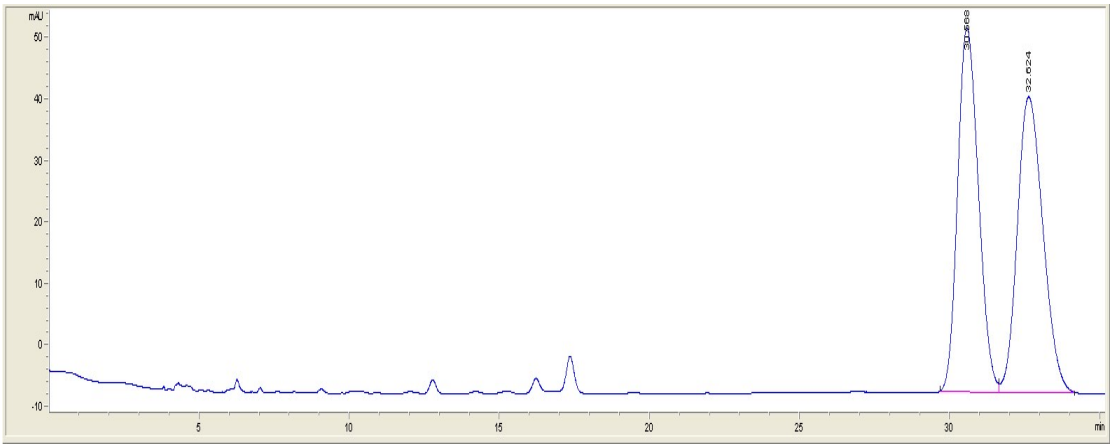


Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	17.573	546.7	17.7	0.4749	0.961	99.033
2	21.32	5.3	1.7E-1	0.5362	1.341	0.967

Figure S304. HPLC Spectra of **49**

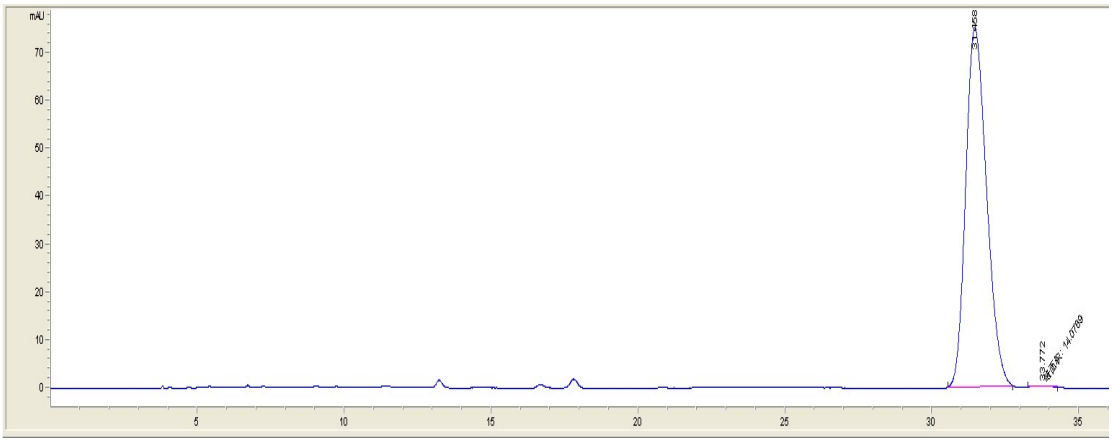


50



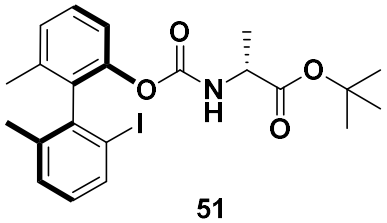
Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	30.568	2865	59.3	0.7554	0.782	49.951
2	32.624	2870.6	48.2	0.9129	0.761	50.049

Figure S305. HPLC Spectra of racemic **50**

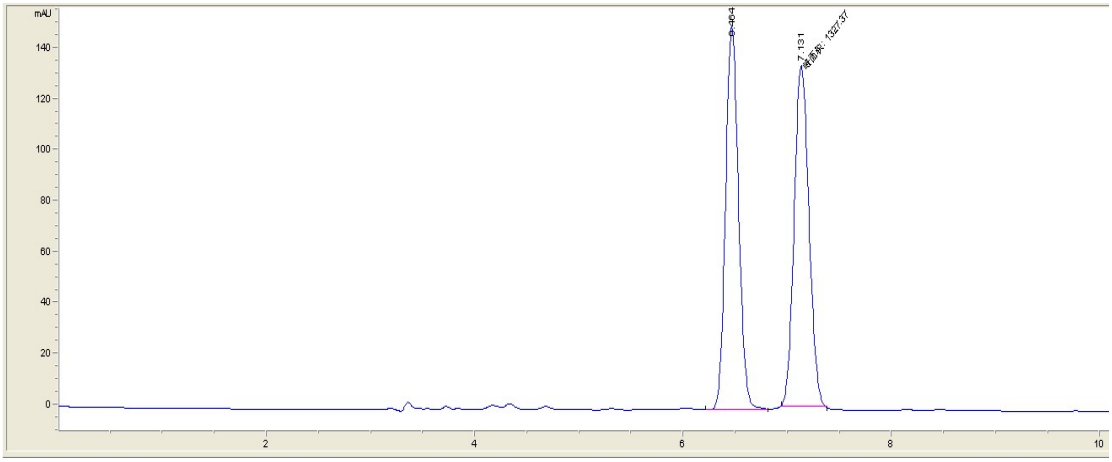


Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	31.458	3728.6	75.3	0.7618	0.744	99.624
2	33.772	14.1	3.6E-1	0.6445	1.218	0.376

Figure S306. HPLC Spectra of **50**

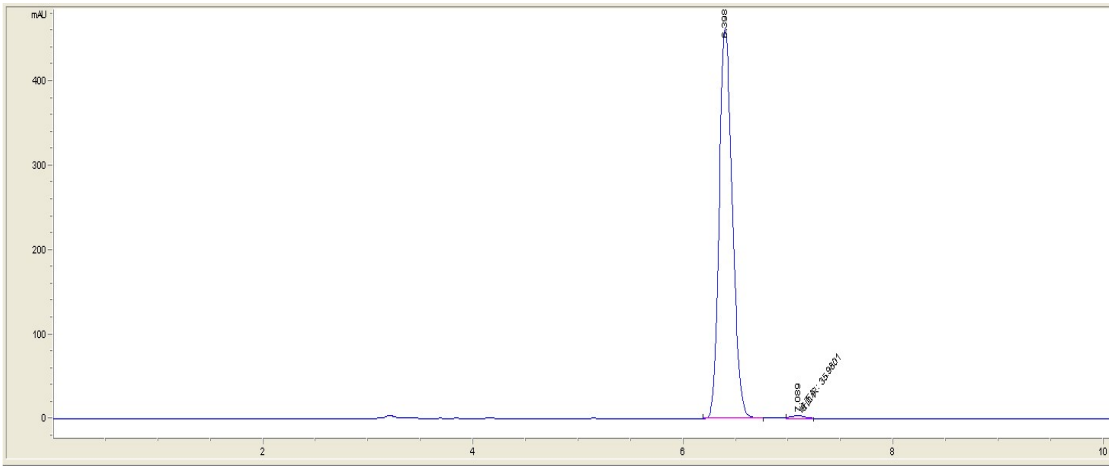


51



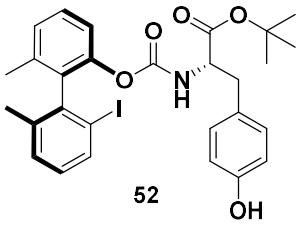
Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	6.464	1305	150.3	0.1353	0.859	49.575
2	7.131	1327.4	134.3	0.1647	0.888	50.425

Figure S307. HPLC Spectra of racemic **51**

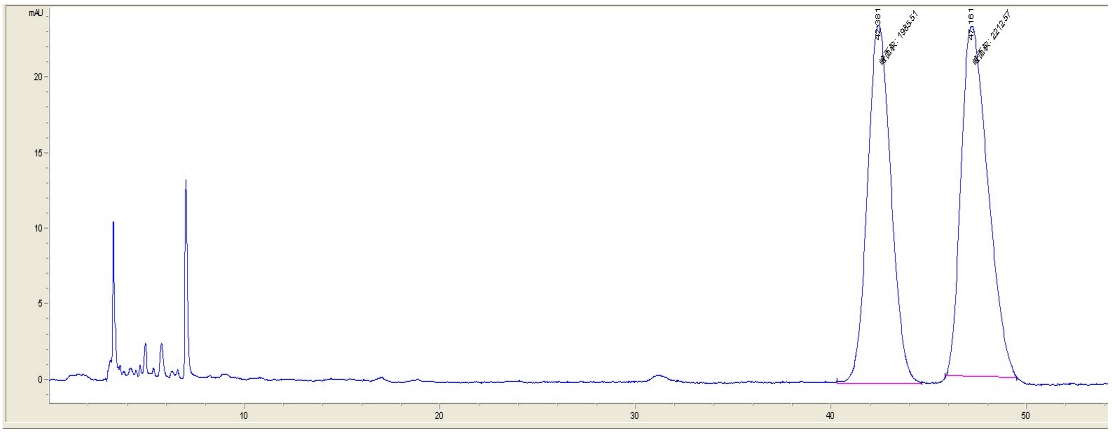


Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	6.398	4036.6	462.5	0.1358	0.772	99.117
2	7.089	36	3.8	0.1592	0.859	0.883

Figure S308. HPLC Spectra of **51**

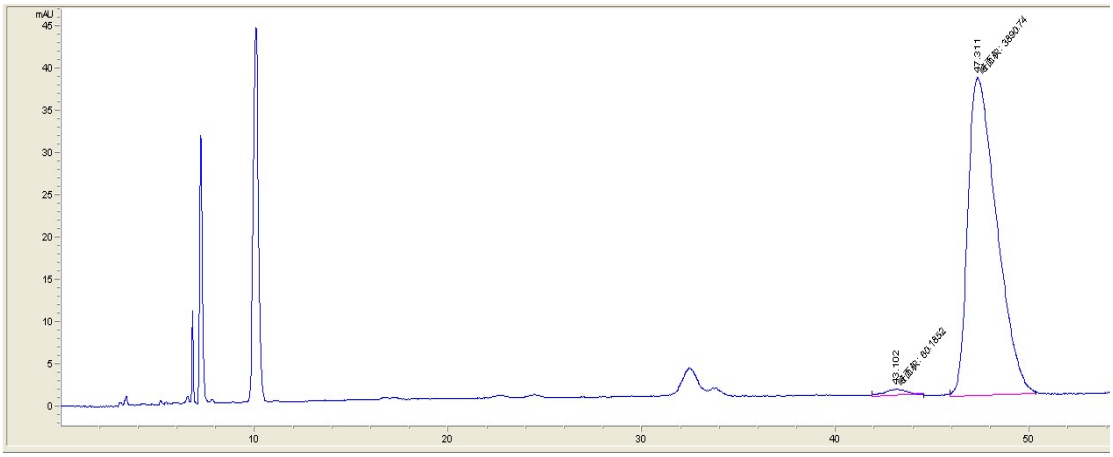


52



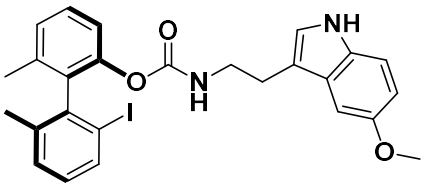
Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	42.381	1985.5	23.7	1.3965	0.814	47.296
2	47.161	2212.6	23.2	1.5909	0.628	52.704

Figure S309. HPLC Spectra of racemic **52**

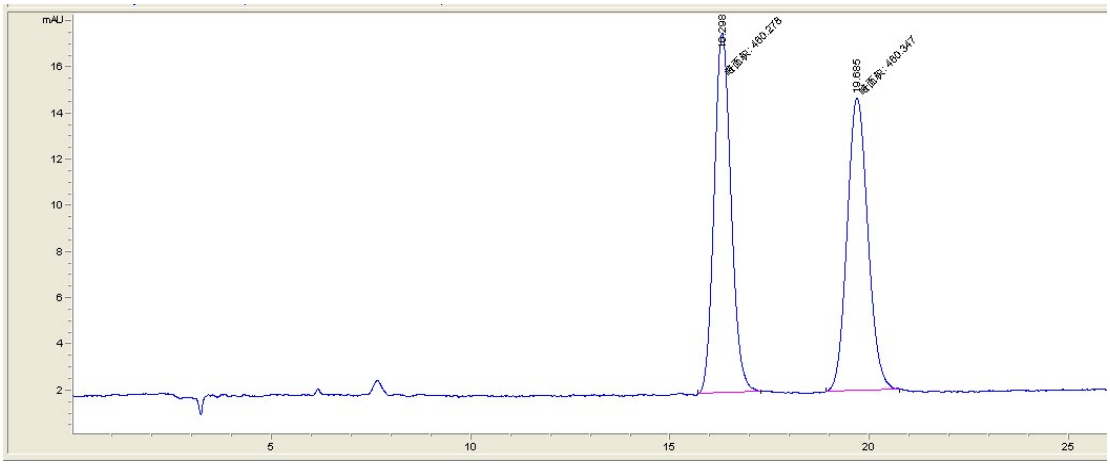


Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	43.102	60.2	7.7E-1	1.3036	1.253	1.523
2	47.311	3890.7	37.7	1.7218	0.492	98.477

Figure S310 HPLC Spectra of **52**

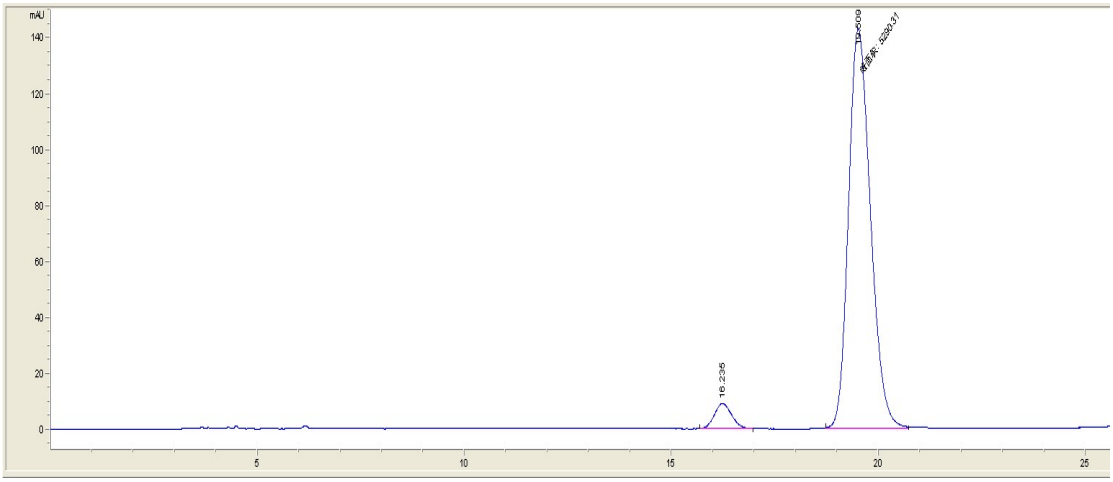


53



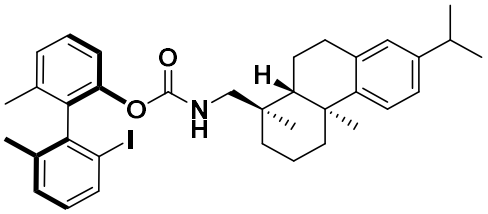
Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	16.298	460.3	15.6	0.4922	0.864	49.996
2	19.685	460.3	12.7	0.6048	0.895	50.004

Figure S311. HPLC Spectra of racemic **53**

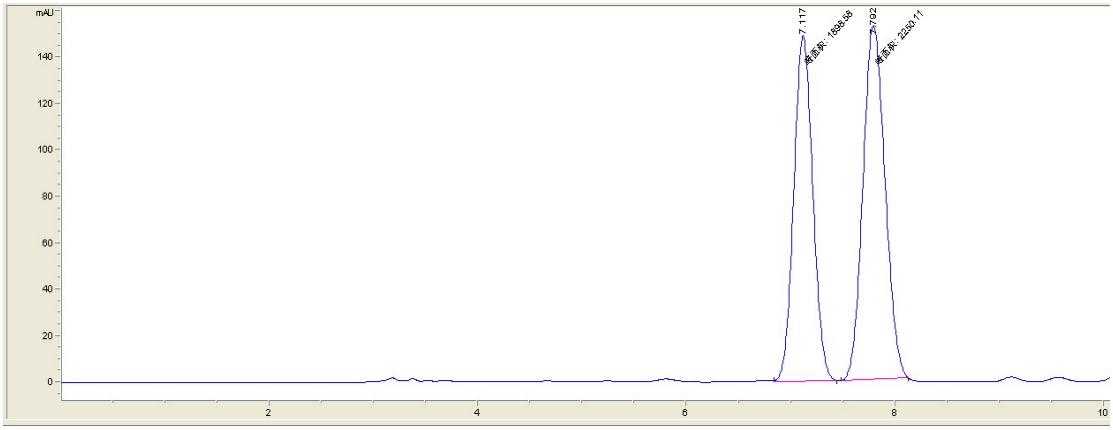


Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	16.235	260.5	9	0.4456	0.876	4.693
2	19.509	5290.3	143	0.6166	0.765	95.307

Figure S312. HPLC Spectra of **53**

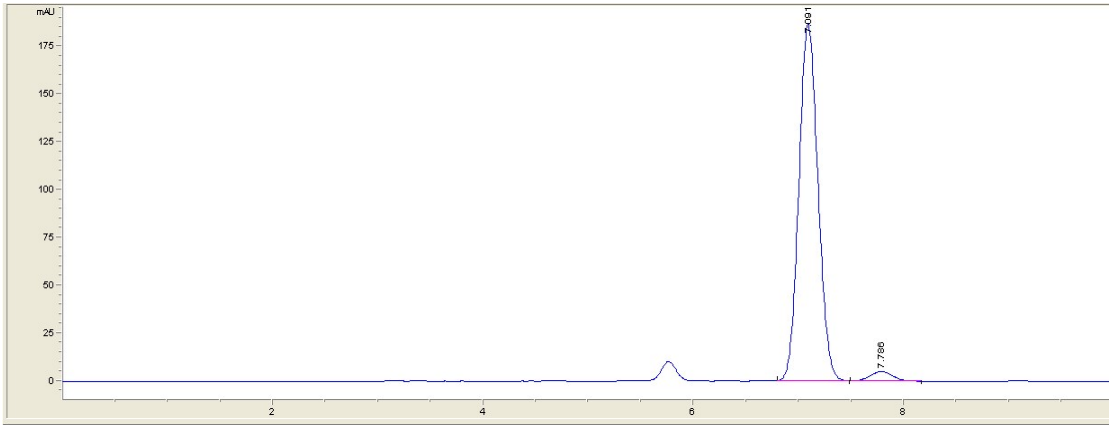


54



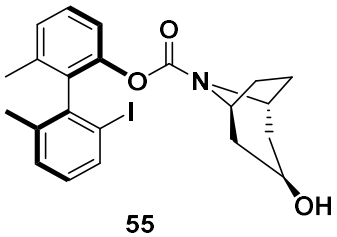
Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	7.117	1898.6	149.3	0.2119	0.916	45.763
2	7.792	2250.1	152.7	0.2455	0.885	54.237

Figure S313. HPLC Spectra of racemic **54**

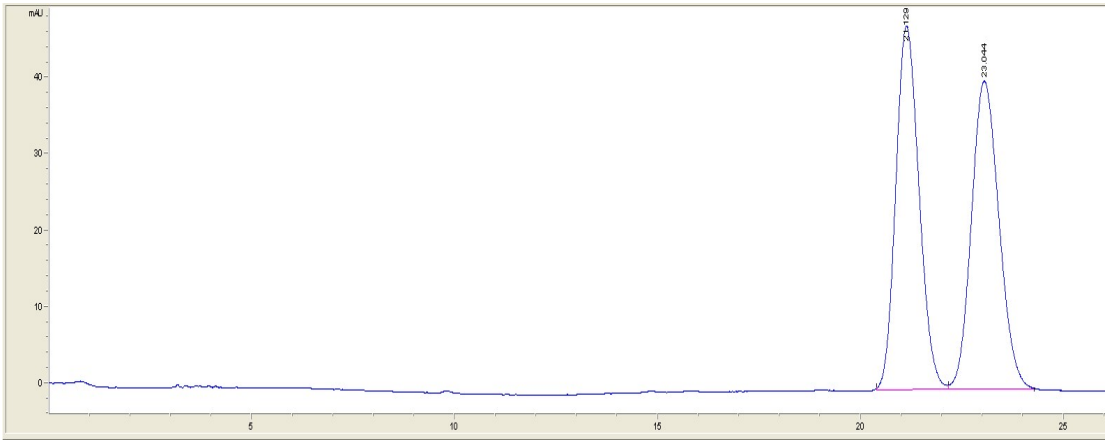


Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	7.091	2354.1	186.5	0.1952	0.887	96.996
2	7.786	72.9	4.9	0.2304	0.967	3.004

Figure S314. HPLC Spectra of **54**

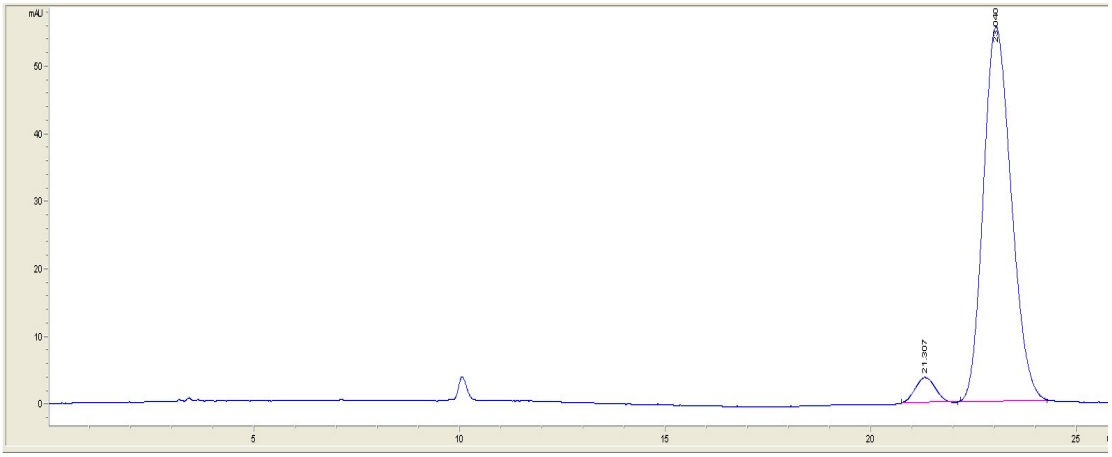


55



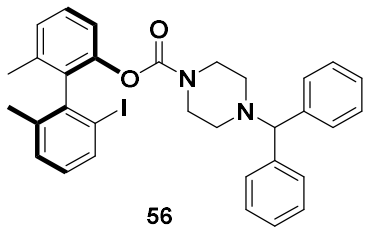
Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	21.129	1901.4	47.7	0.6155	0.811	49.890
2	23.044	1909.8	40.4	0.7277	0.835	50.110

Figure S315. HPLC Spectra of racemic **55**

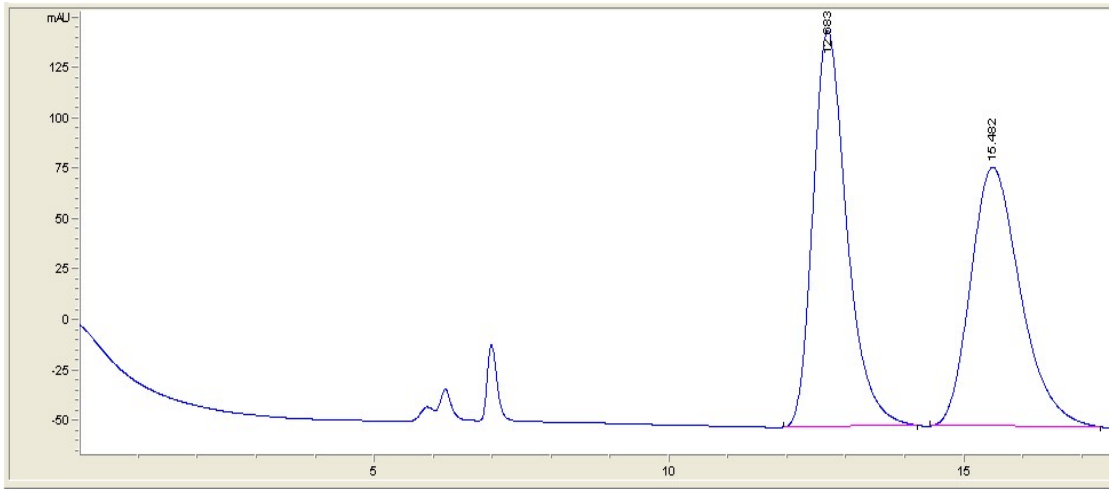


Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	21.307	126	3.7	0.4121	0.874	4.592
2	23.04	2618	55.4	0.7271	0.794	95.408

Figure S316. HPLC Spectra of **55**

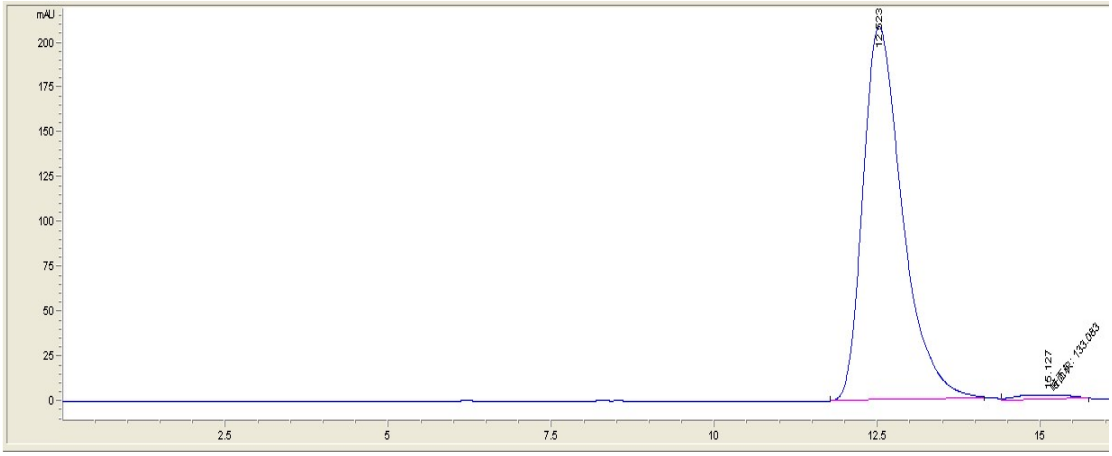


56



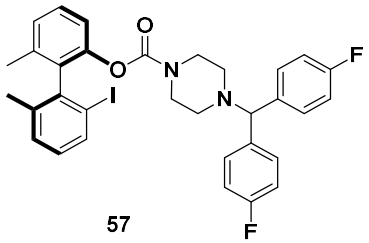
Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	12.683	7871.5	196.5	0.6115	0.718	50.925
2	15.482	7585.6	128.7	0.8857	0.75	49.075

Figure S317. HPLC Spectra of racemic **56**

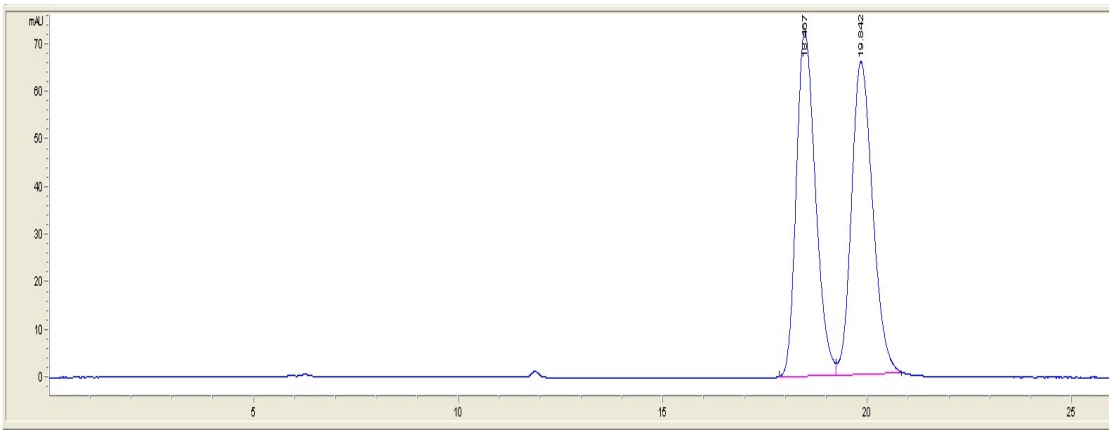


Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	12.523	8785.8	208.4	0.6458	0.645	98.508
2	15.127	133.1	2.3	0.9475	1.673	1.492

Figure S318. HPLC Spectra of **56**

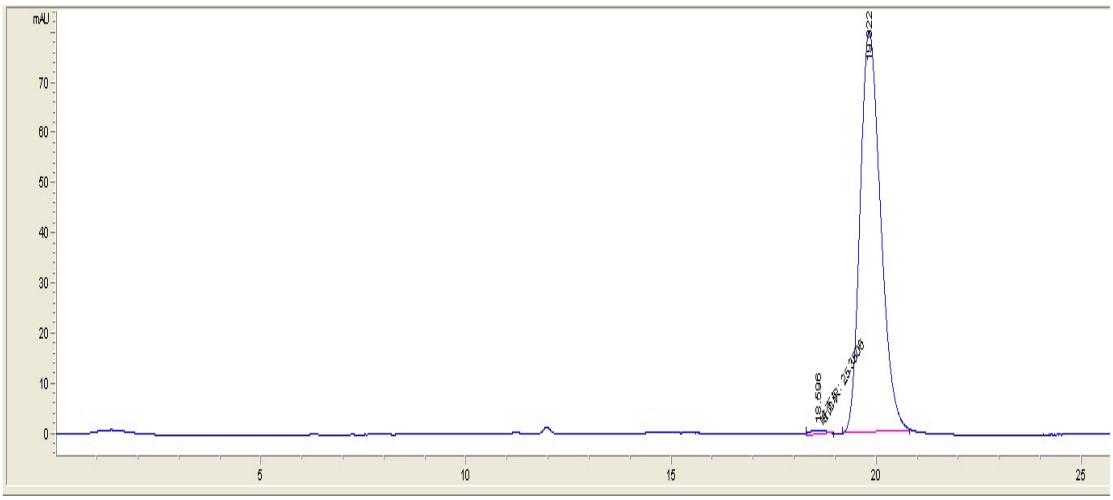


57



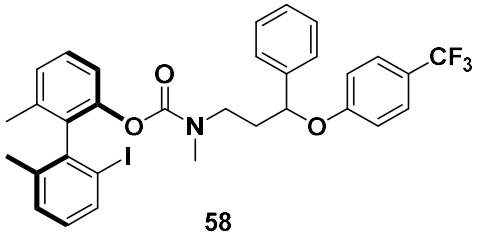
Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	18.467	2366.5	72.5	0.507	0.743	49.865
2	19.842	2379.3	65.8	0.5536	0.773	50.135

Figure S319. HPLC Spectra of racemic **57**

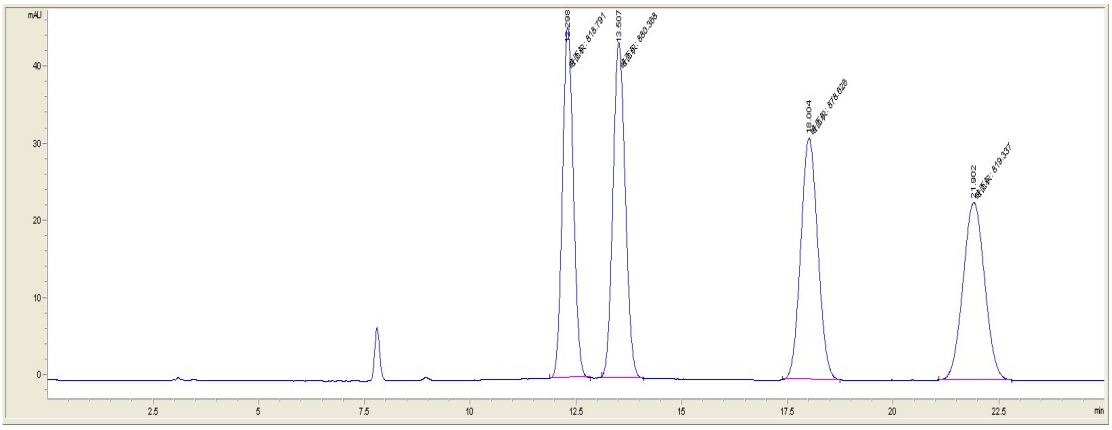


Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	18.596	25.4	9.5E-1	0.3274	1.169	0.900
2	19.822	2791.8	80.2	0.5401	0.743	99.100

Figure S320 HPLC Spectra of **57**

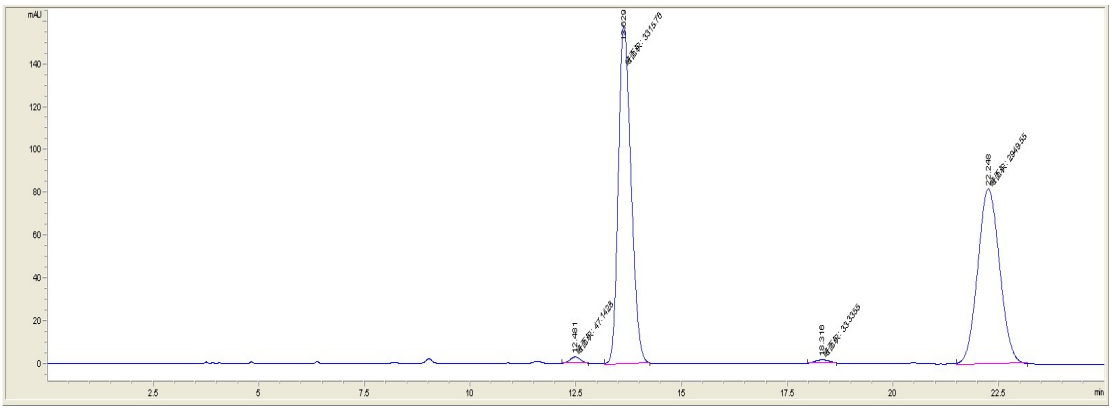


58



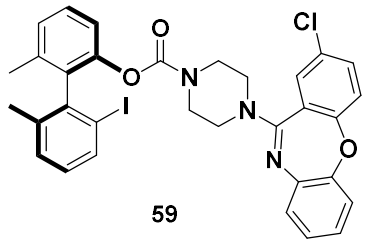
Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	12.298	818.8	45.5	0.3	0.903	24.102
2	13.507	880.4	43.5	0.3374	0.885	25.915
3	18.004	878.6	31.3	0.4677	0.912	25.864
4	21.902	819.3	23	0.5938	0.967	24.119

Figure S321. HPLC Spectra of racemic **58**

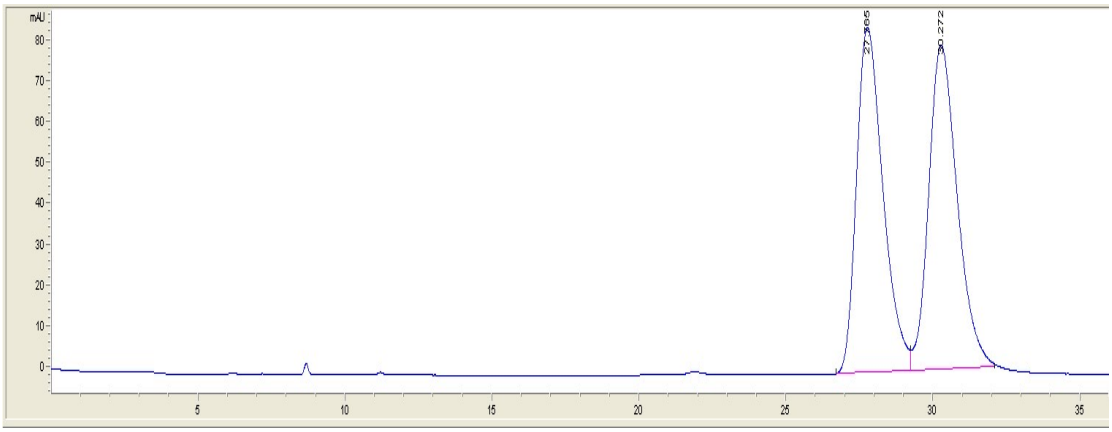


Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	12.481	47.1	2.8	0.2775	1.123	0.743
2	13.629	3315.8	157.9	0.3499	0.742	52.251
3	18.316	33.3	1.5	0.3749	1.136	0.525
4	22.248	2949.6	81.8	0.6007	0.914	46.480

Figure S322. HPLC Spectra of **58**

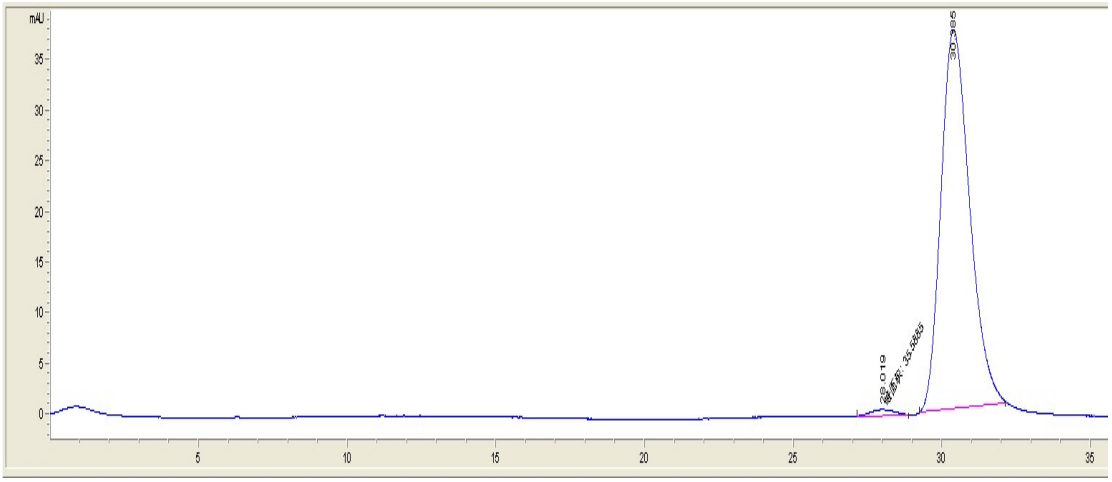


59



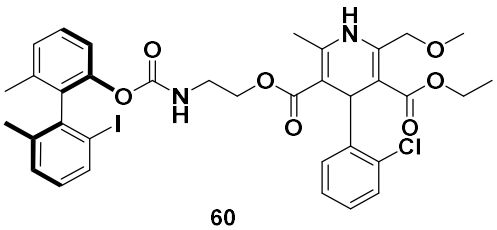
Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	27.765	5300.1	84.4	0.959	0.66	49.721
2	30.272	5359.5	79.1	1.0101	0.734	50.279

Figure S323. HPLC Spectra of racemic **59**

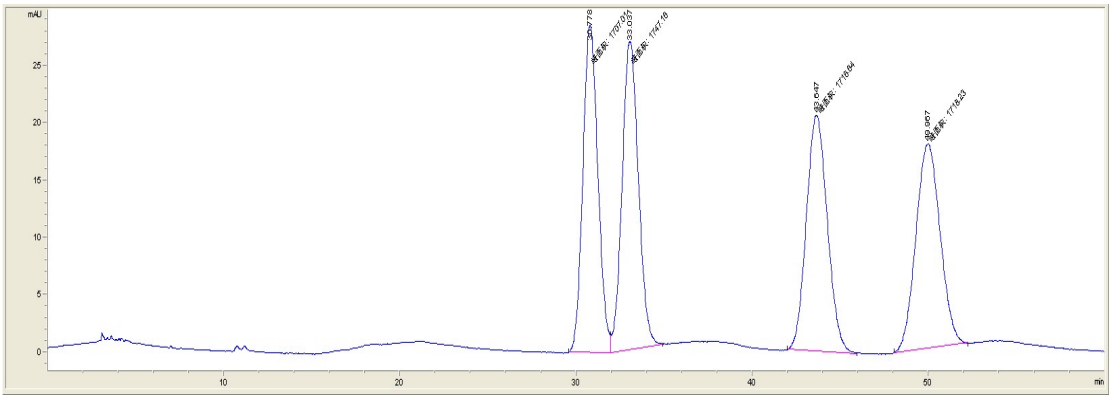


Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	28.019	35.6	6.3E-1	0.9455	1.116	1.389
2	30.385	2527.5	37.5	0.9869	0.741	98.611

Figure S324. HPLC Spectra of **59**

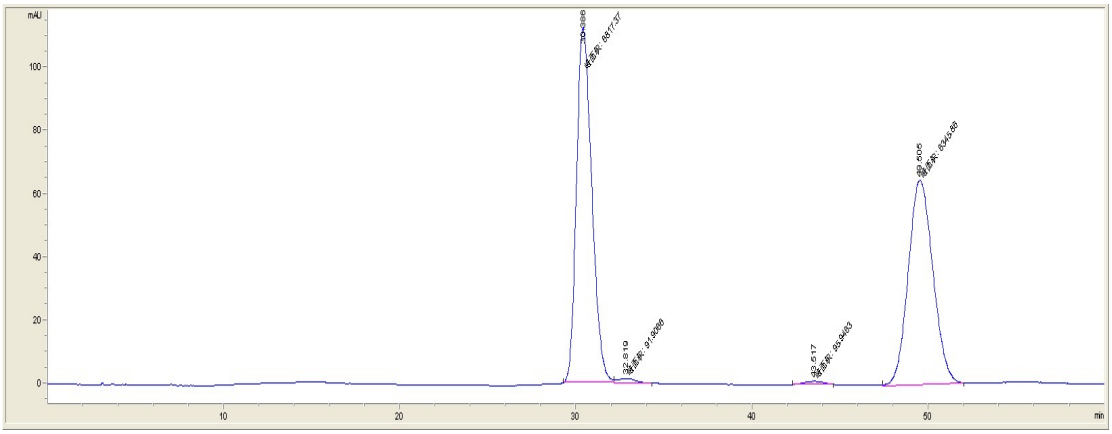


60



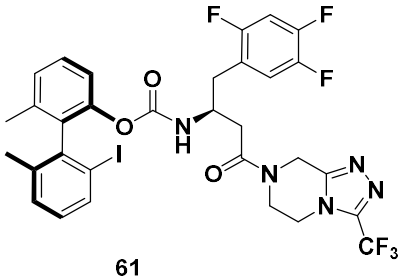
Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	30.778	1707	28.6	0.9956	0.866	24.779
2	33.037	1747.2	27	1.0795	0.86	25.361
3	43.647	1716.6	20.6	1.3896	0.916	24.918
4	49.967	1718.2	17.9	1.604	0.975	24.942

Figure S325. HPLC Spectra of racemic **60**

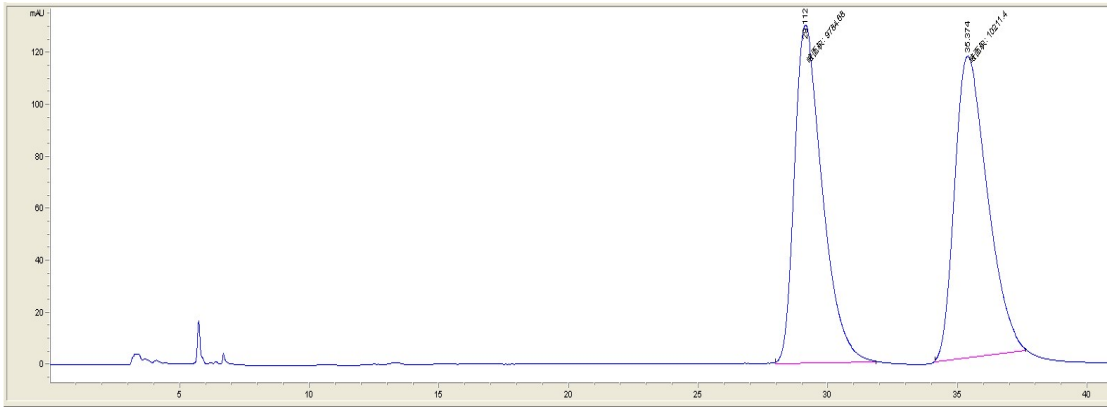


Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	30.386	6817.4	112.5	1.0098	0.721	51.062
2	32.819	91.9	1.4	1.0726	0.88	0.688
3	43.517	95.9	1.2	1.3501	1.102	0.719
4	49.505	6345.9	64.8	1.6315	0.869	47.531

Figure S326. HPLC Spectra of **60**

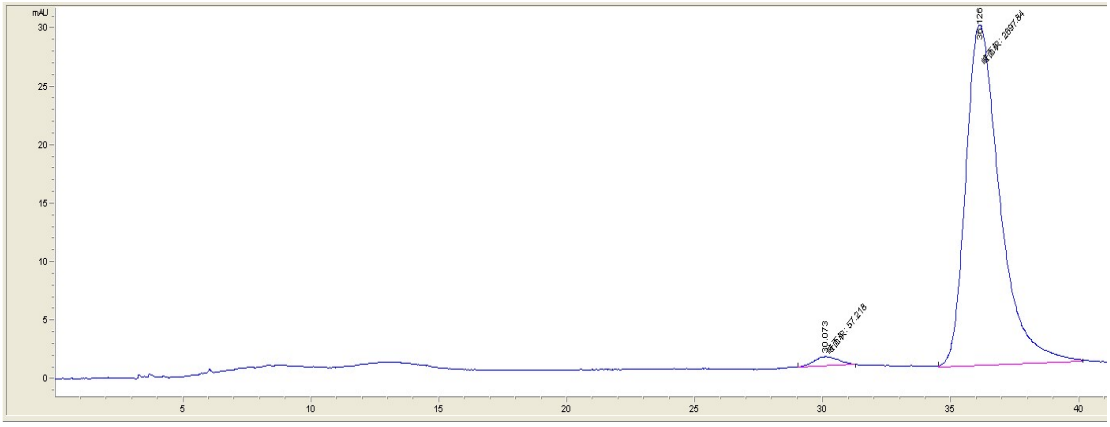


61



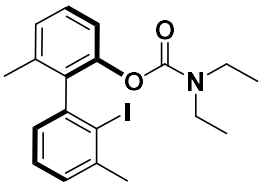
Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	29.112	9784.7	130.1	1.2536	0.6	48.933
2	35.374	10211.4	116	1.4669	0.625	51.067

Figure S327. HPLC Spectra of racemic **61**

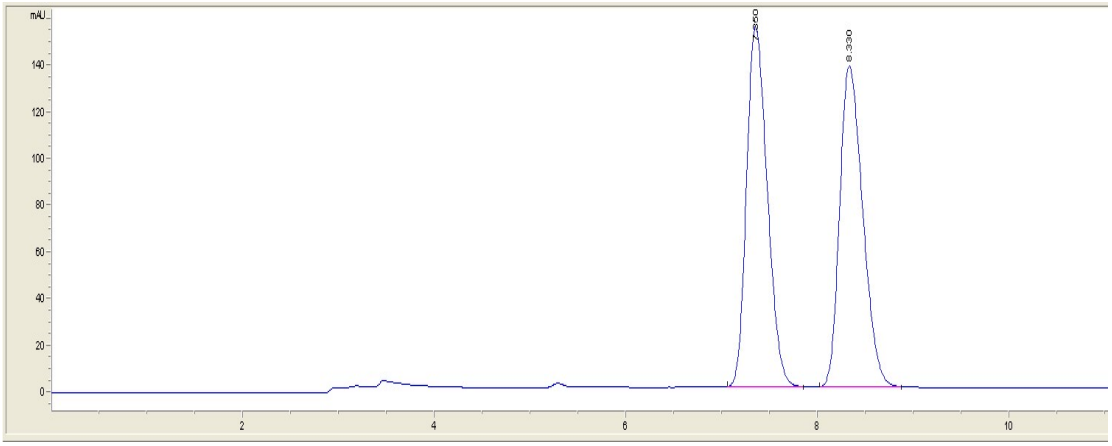


Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	30.073	57.2	8.3E-1	1.1557	0.788	2.077
2	36.126	2697.8	29.1	1.545	0.681	97.923

Figure S328. HPLC Spectra of **61**

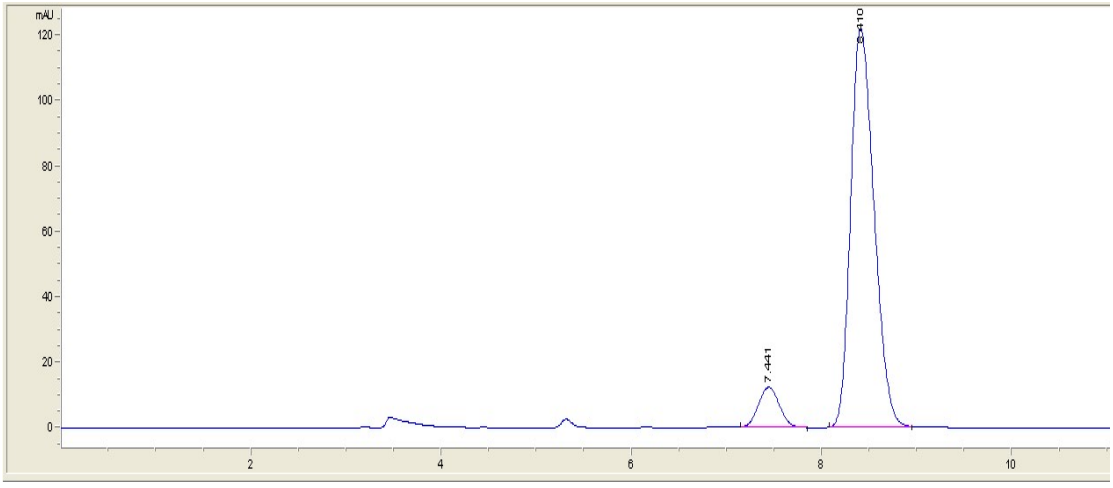


62



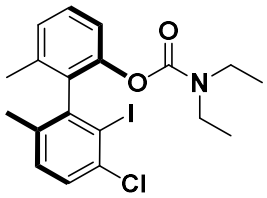
Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	7.35	2320.7	154.2	0.2356	0.727	50.195
2	8.33	2302.7	137.4	0.2615	0.688	49.805

Figure S329. HPLC Spectra of racemic **62**

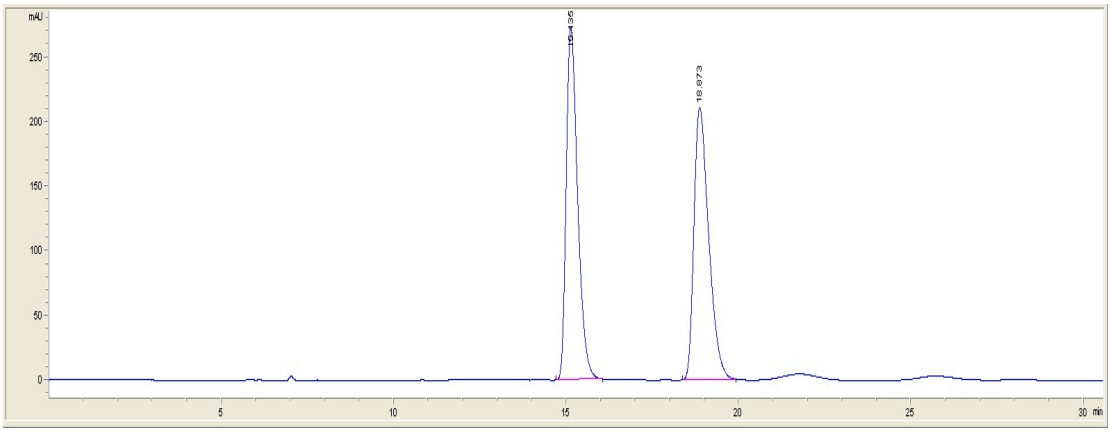


Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	7.441	185.9	12.2	0.2396	0.919	8.183
2	8.41	2085.9	122	0.2675	0.71	91.817

Figure S330 HPLC Spectra of **62**

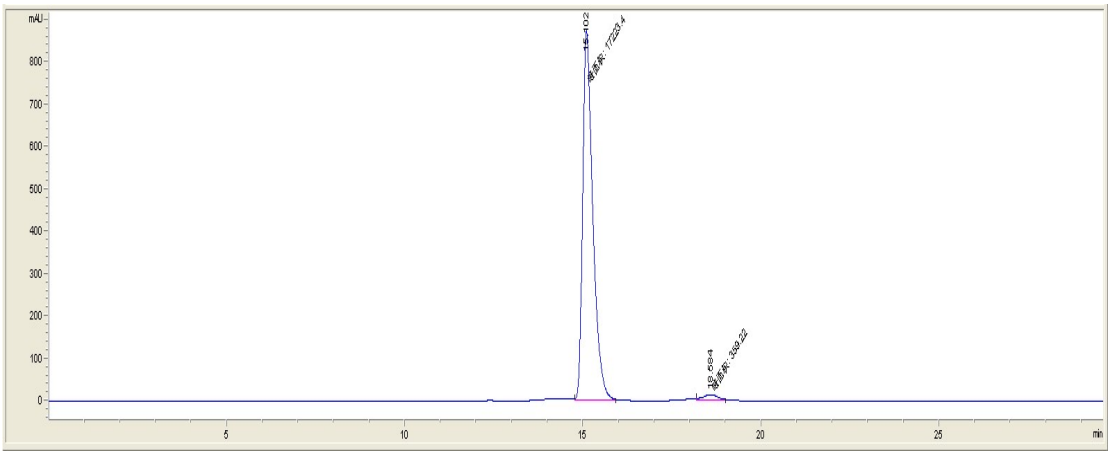


63



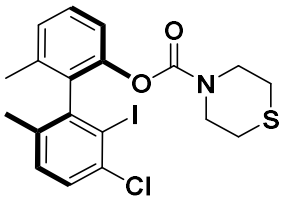
Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	15.135	6317.5	272.4	0.3546	0.622	50.029
2	18.873	6310.2	210.9	0.455	0.591	49.971

Figure S331. HPLC Spectra of racemic **63**

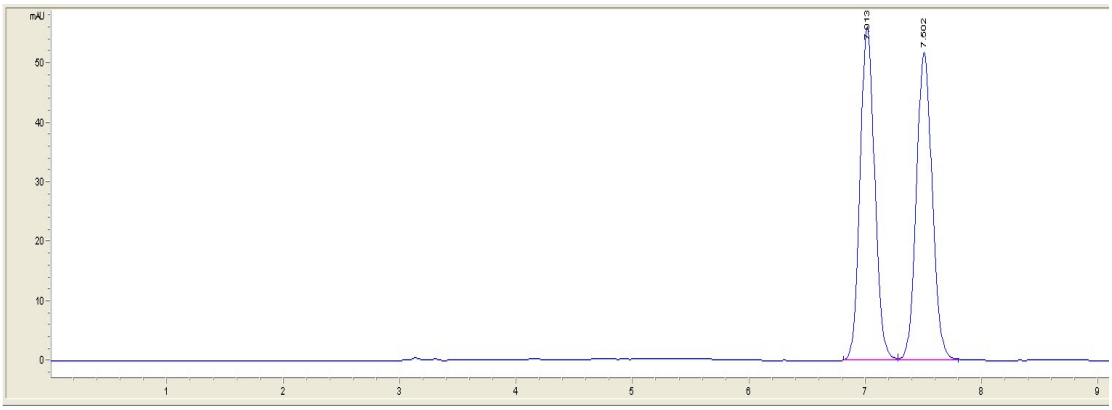


Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	15.102	17223.4	872.3	0.3291	0.595	97.957
2	18.584	359.2	12.6	0.4742	1.053	2.043

Figure S332. HPLC Spectra of **63**

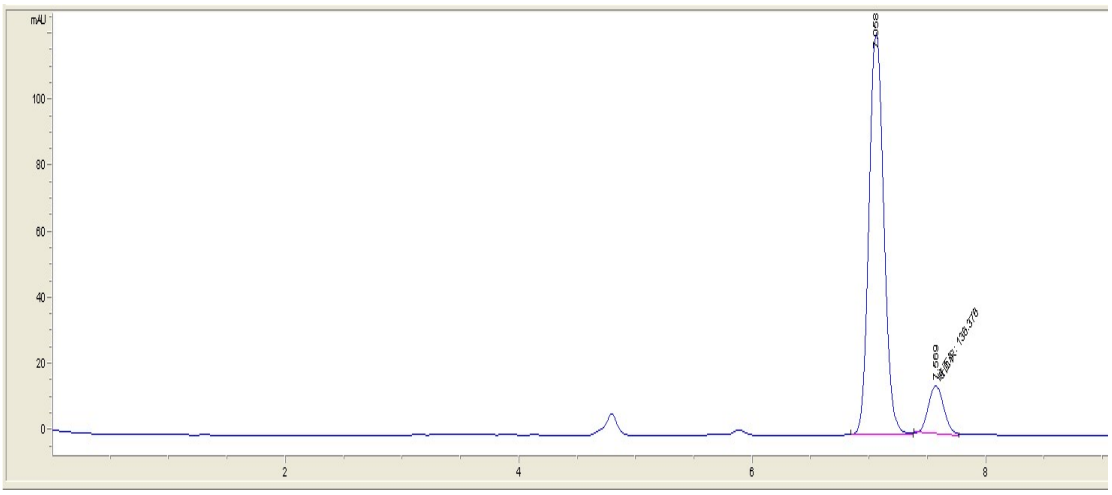


64



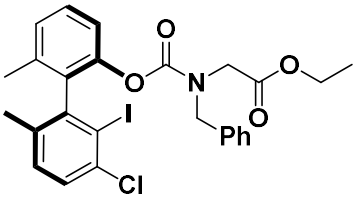
Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	7.013	489.6	56.1	0.1359	0.886	49.932
2	7.502	491	51.7	0.1488	0.898	50.068

Figure S333. HPLC Spectra of racemic **64**

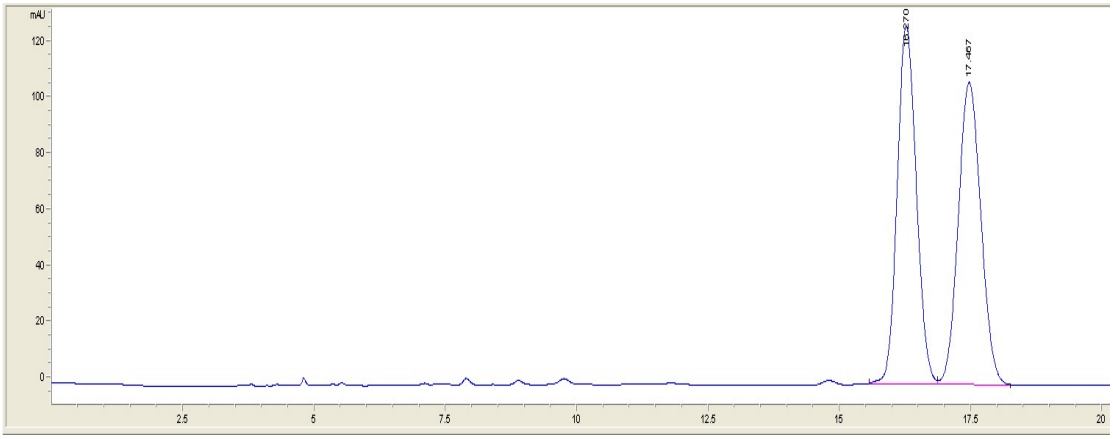


Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	7.058	1071.2	121.8	0.1366	0.864	88.706
2	7.569	136.4	14.7	0.1551	0.889	11.294

Figure S334. HPLC Spectra of **64**

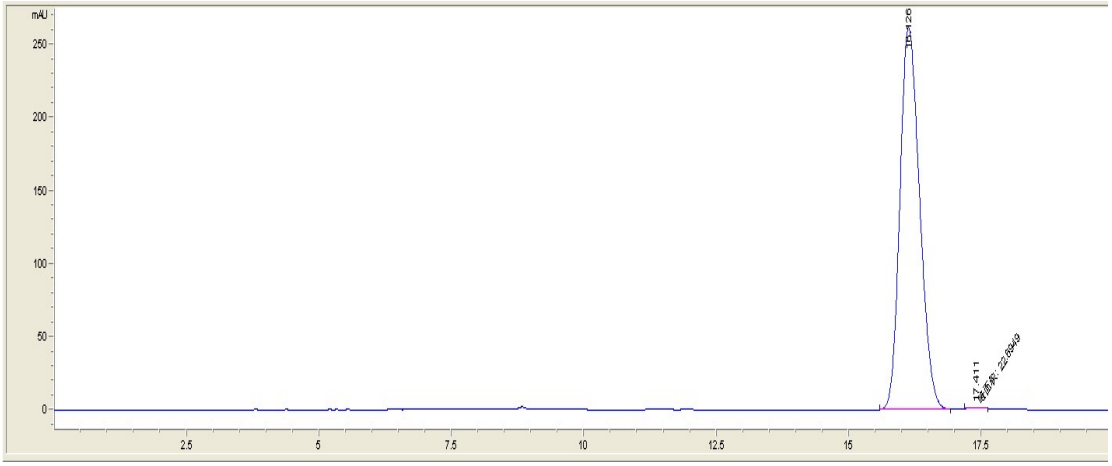


65



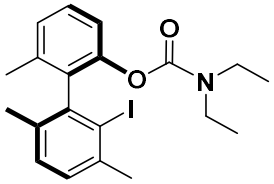
Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	16.27	3244.6	127.7	0.3945	0.865	50.076
2	17.467	3234.7	107.9	0.4676	0.89	49.924

Figure S335. HPLC Spectra of racemic **65**

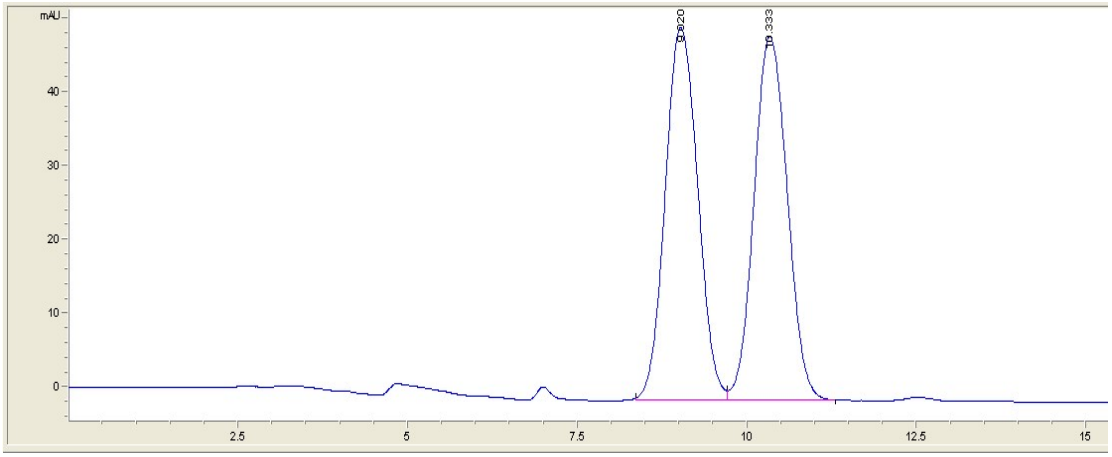


Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	16.126	6763.1	261.7	0.4015	0.751	99.666
2	17.411	22.7	1.2	0.3203	0.979	0.334

Figure S336. HPLC Spectra of **65**

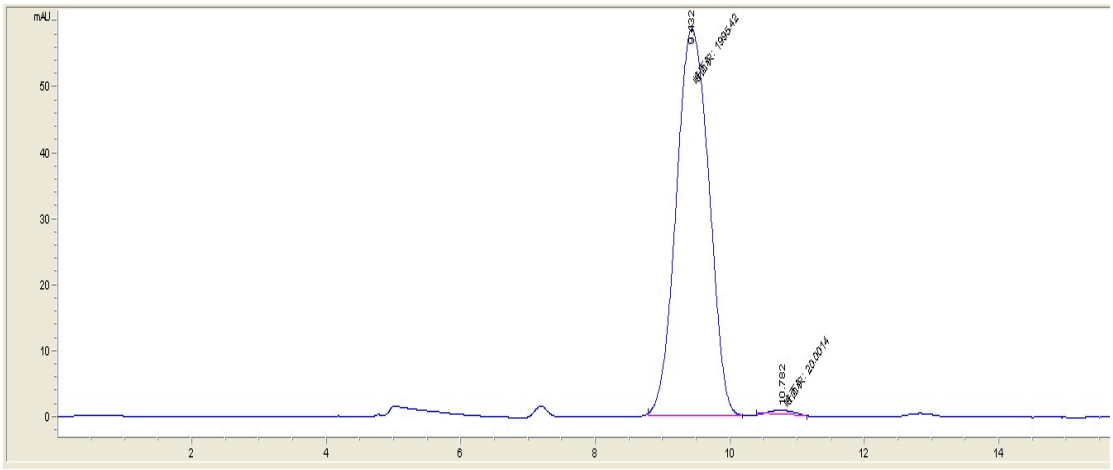


66



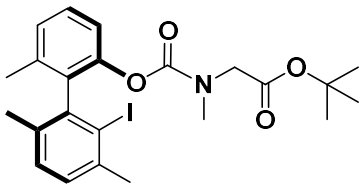
Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	9.02	1683.9	50.5	0.5289	0.88	50.017
2	10.333	1682.7	49.4	0.5437	0.867	49.983

Figure S337. HPLC Spectra of racemic **66**

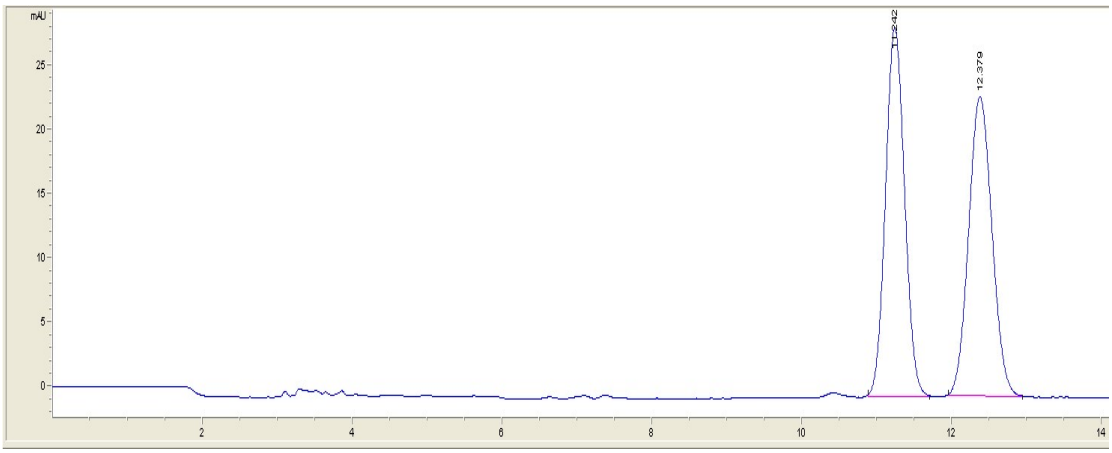


Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	9.432	1995.4	58.7	0.5665	0.896	99.008
2	10.782	20	7.5E-1	0.4448	0.581	0.992

Figure S338. HPLC Spectra of **66**

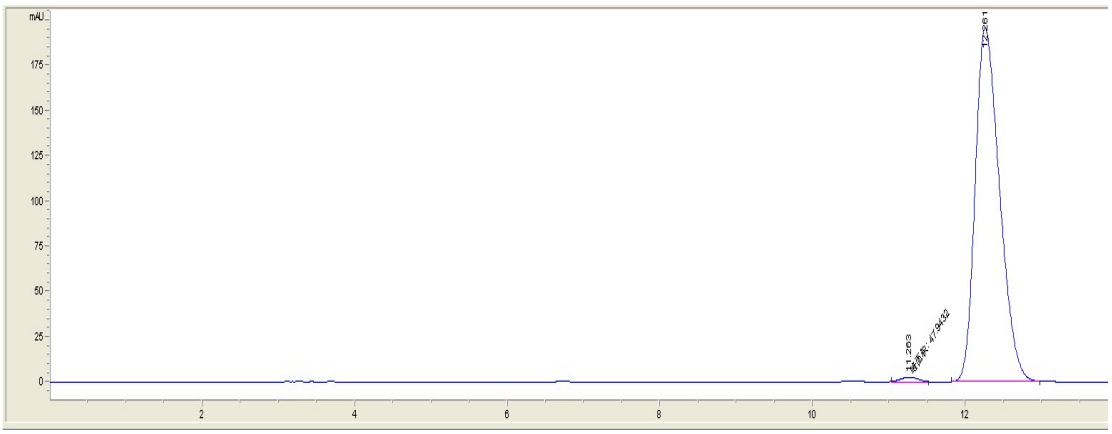


67



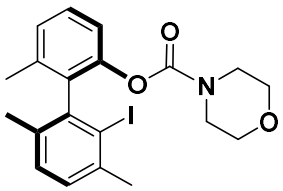
Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	11.242	508.9	28.7	0.2748	0.907	50.070
2	12.379	507.4	23.3	0.3396	0.903	49.930

Figure S339. HPLC Spectra of racemic **67**

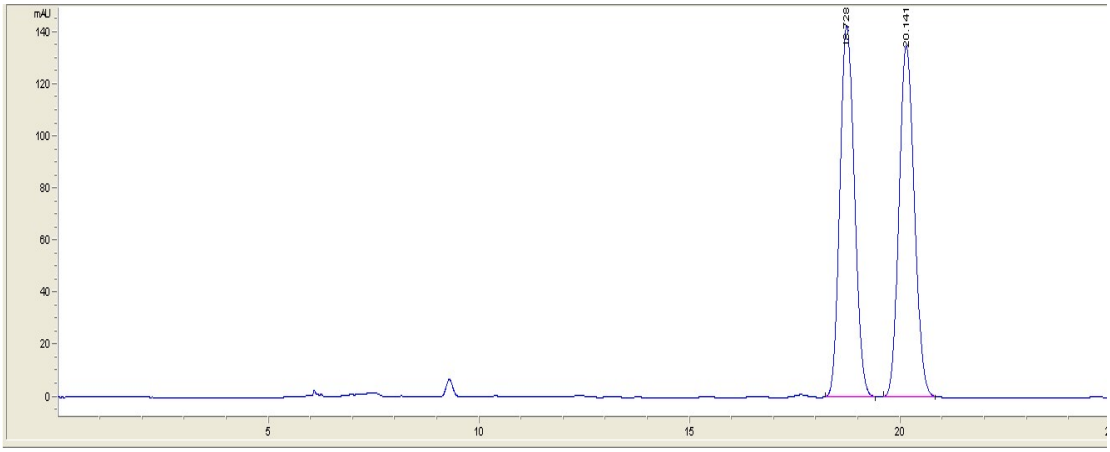


Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	11.263	47.9	2.8	0.2832	0.95	1.092
2	12.261	4341.4	195.5	0.3431	0.667	98.908

Figure S340. HPLC Spectra of **67**

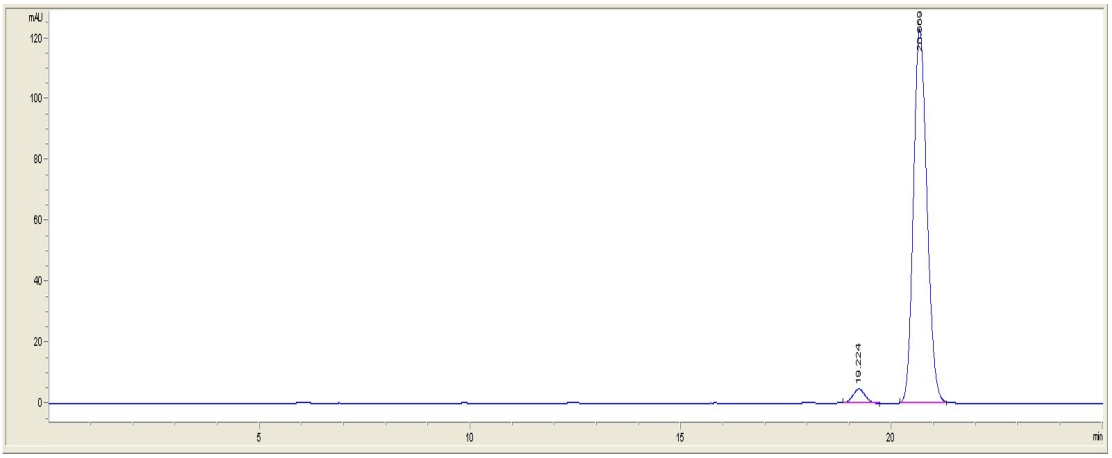


68



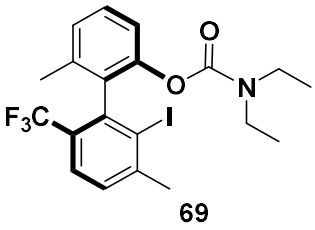
Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	18.728	3427.9	142.7	0.3762	0.865	49.986
2	20.141	3429.8	134.9	0.3986	0.856	50.014

Figure S341. HPLC Spectra of racemic **68**

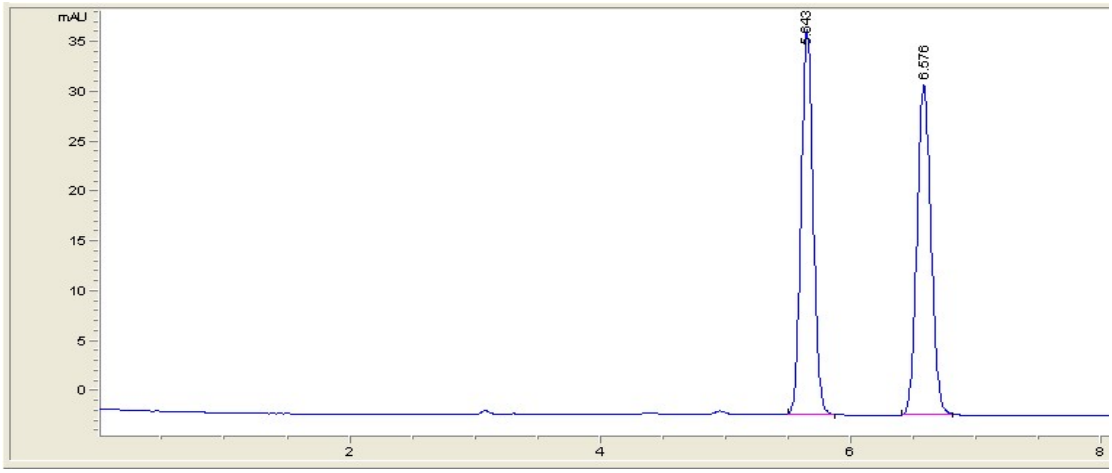


Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	19.224	92.3	4.6	0.3052	0.904	3.258
2	20.669	2741	122.8	0.3485	0.83	96.742

Figure S342. HPLC Spectra of **68**

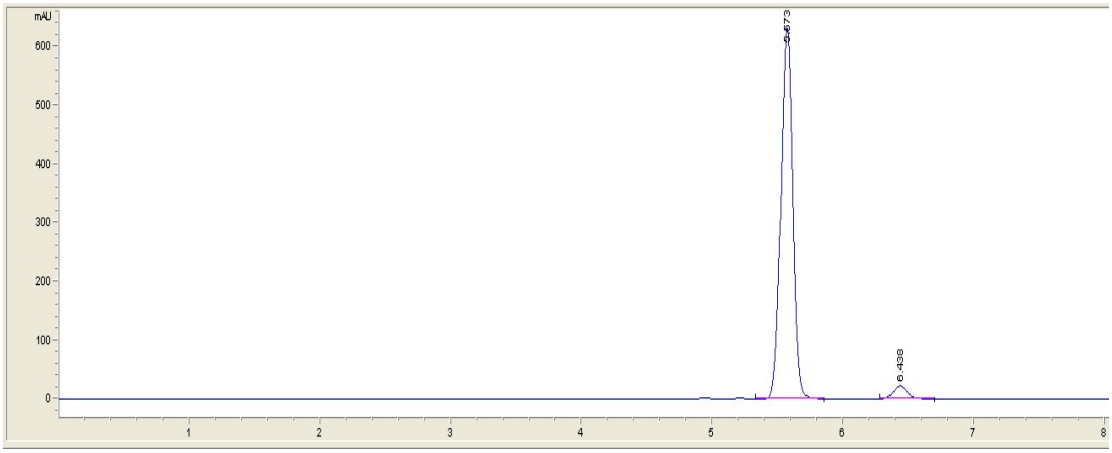


69



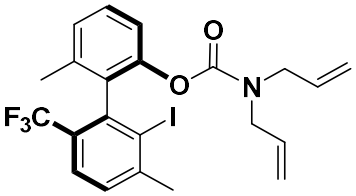
Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	5.643	256.6	38.6	0.1036	0.916	49.884
2	6.576	257.8	33.1	0.1208	0.914	50.116

Figure S343. HPLC Spectra of racemic **69**

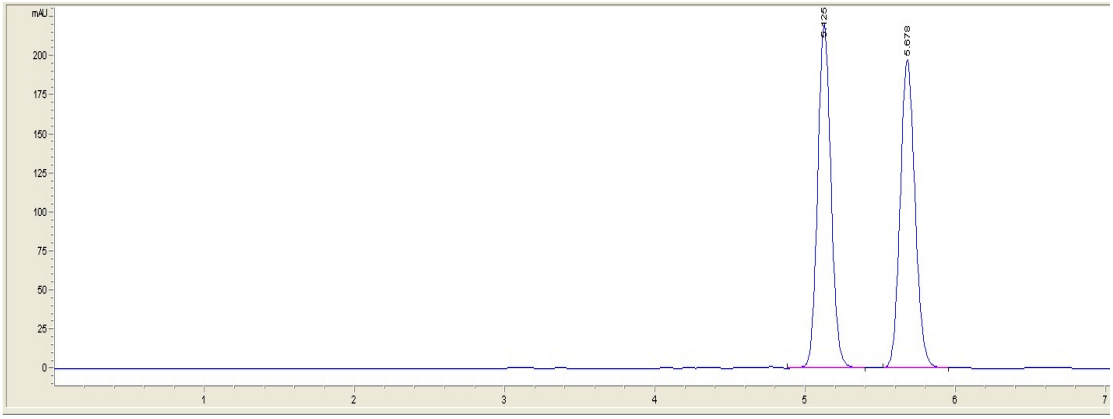


Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	5.573	4019.2	632.7	0.0981	1.047	95.995
2	6.438	167.7	21.9	0.1175	0.891	4.005

Figure S344. HPLC Spectra of **69**

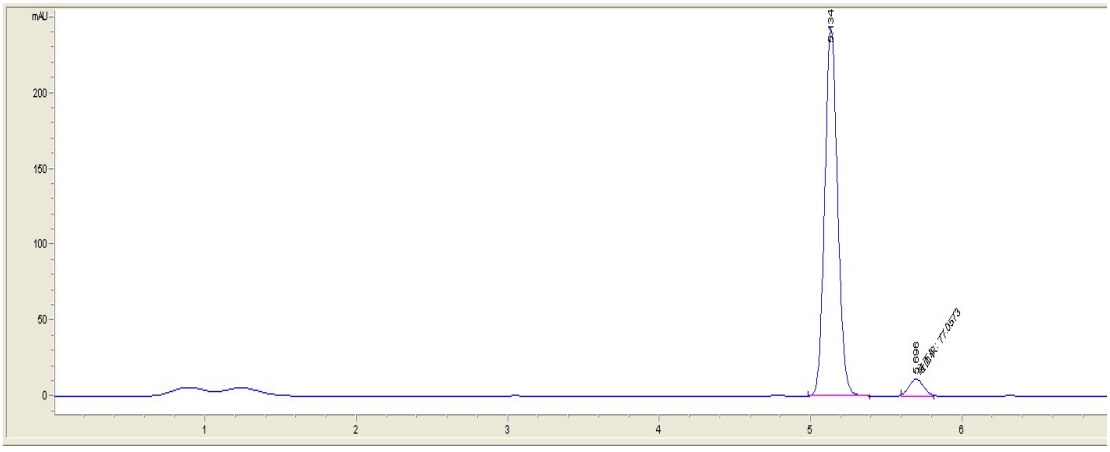


70



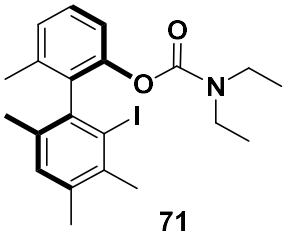
Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	5.125	1354.1	220.3	0.0957	0.912	50.035
2	5.678	1352.2	197.2	0.106	0.863	49.965

Figure S345. HPLC Spectra of racemic **70**

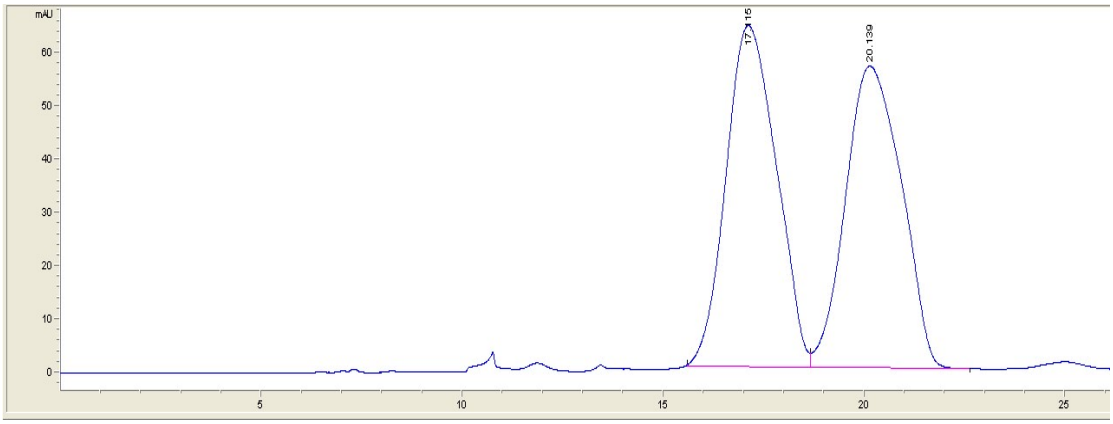


Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	5.134	1441	243.1	0.0912	0.906	94.924
2	5.696	77.1	11.6	0.1106	0.913	5.076

Figure S346. HPLC Spectra of **70**

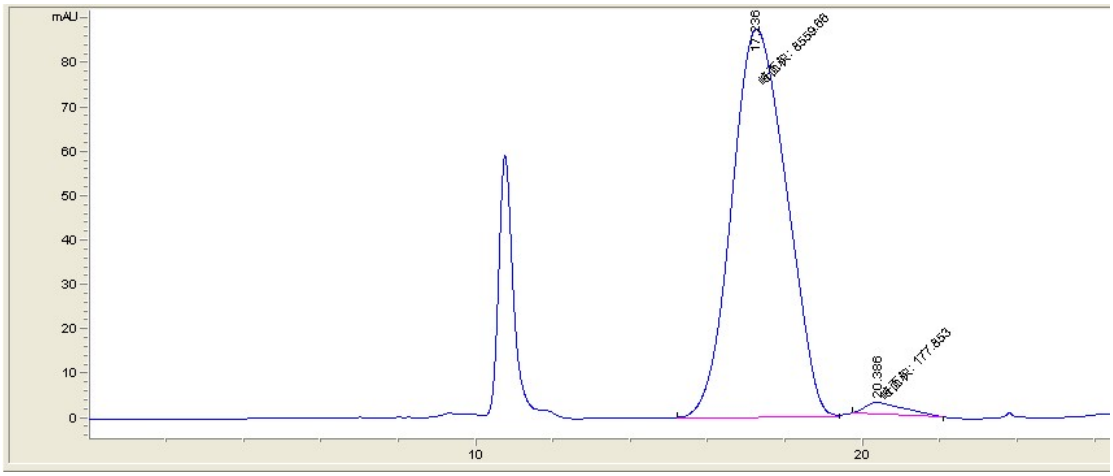


71



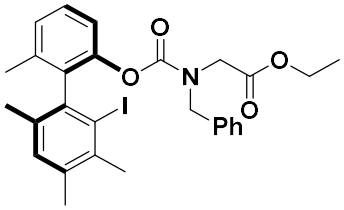
Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	17.115	5615.8	64.2	1.3147	0.788	50.542
2	20.139	5495.4	56.7	1.3907	0.767	49.458

Supplementary Figure 347. HPLC Spectra of racemic **71**

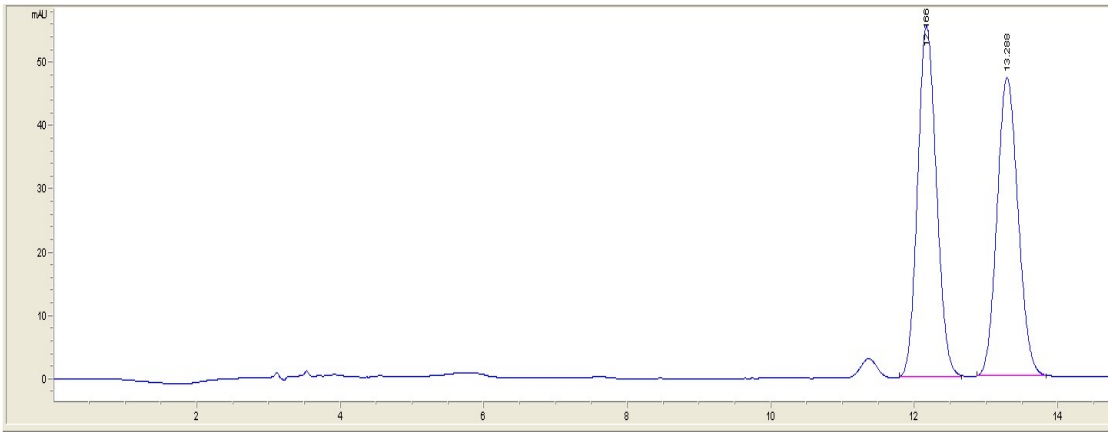


Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	17.236	8559.7	87.4	1.6325	0.813	97.964
2	20.386	177.9	2.6	1.1589	0.401	2.036

Figure S348. HPLC Spectra of **71**

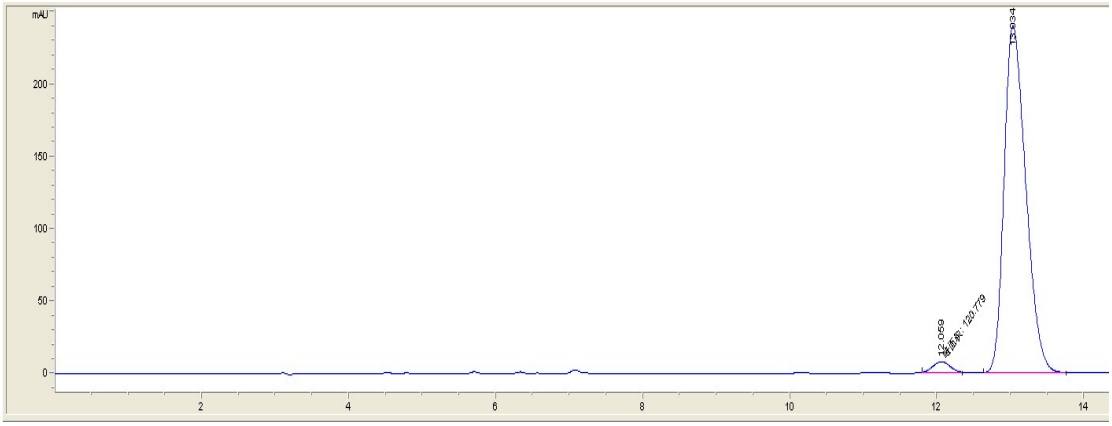


72



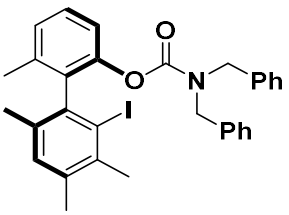
Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	12.166	1011.2	55.4	0.2848	0.861	51.267
2	13.288	961.3	47.2	0.3155	0.864	48.733

Figure S349. HPLC Spectra of racemic **72**

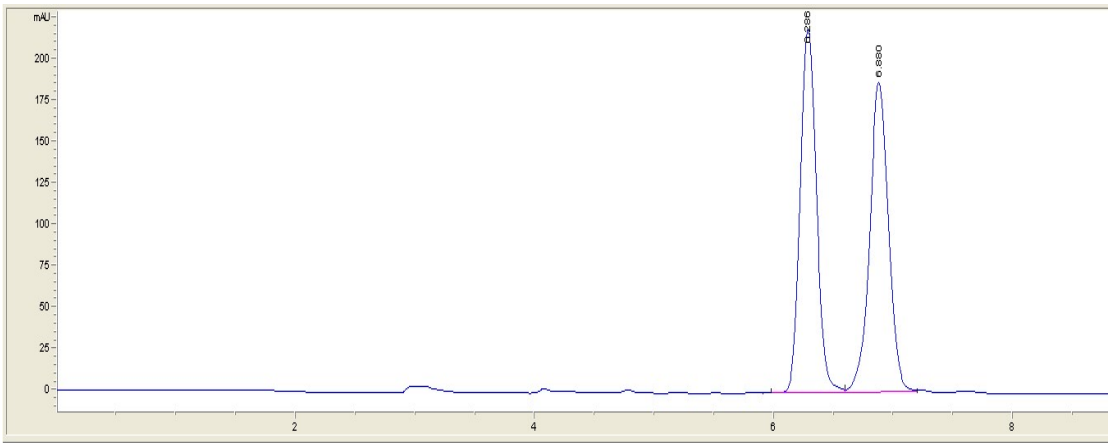


Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	12.059	120.8	7.5	0.2698	0.936	2.401
2	13.034	4910.5	239.9	0.3168	0.662	97.599

Figure S350. HPLC Spectra of **72**

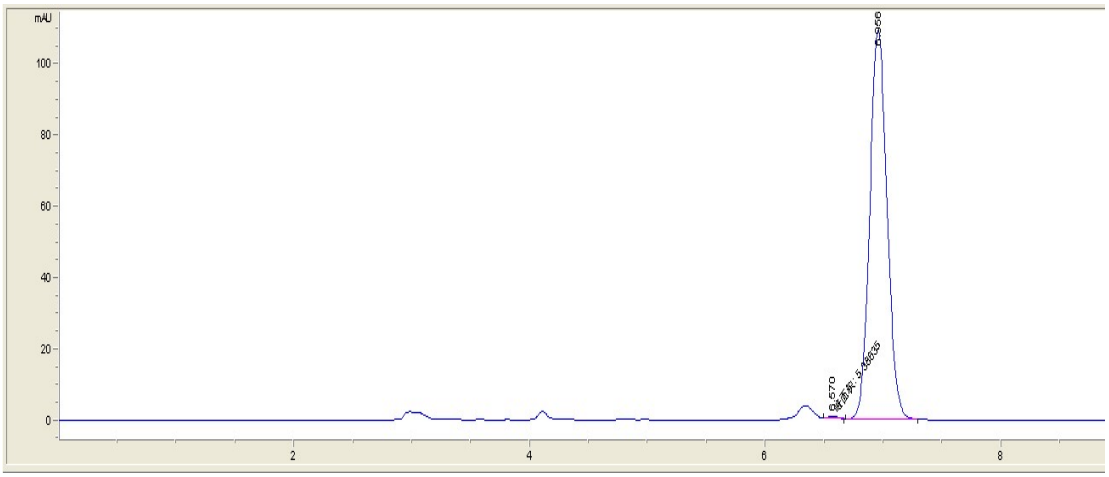


73



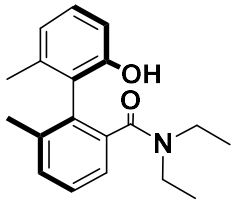
Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	6.286	2070.5	219.8	0.1479	0.859	50.115
2	6.88	2061	187.5	0.1682	0.952	49.885

Figure S351. HPLC Spectra of racemic **73**

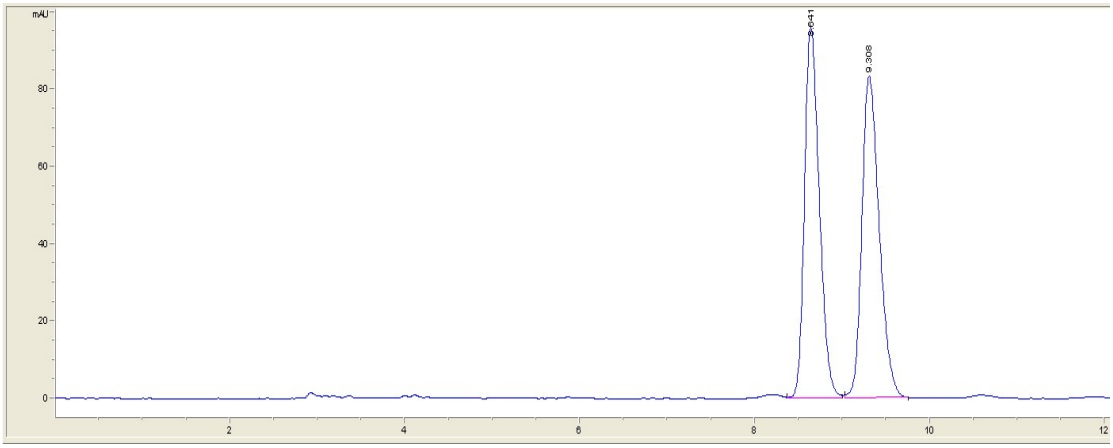


Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	6.57	5.4	8.8E-1	0.1015	0.977	0.479
2	6.956	1118.9	109.4	0.1593	0.892	99.521

Figure S352. HPLC Spectra of **73**

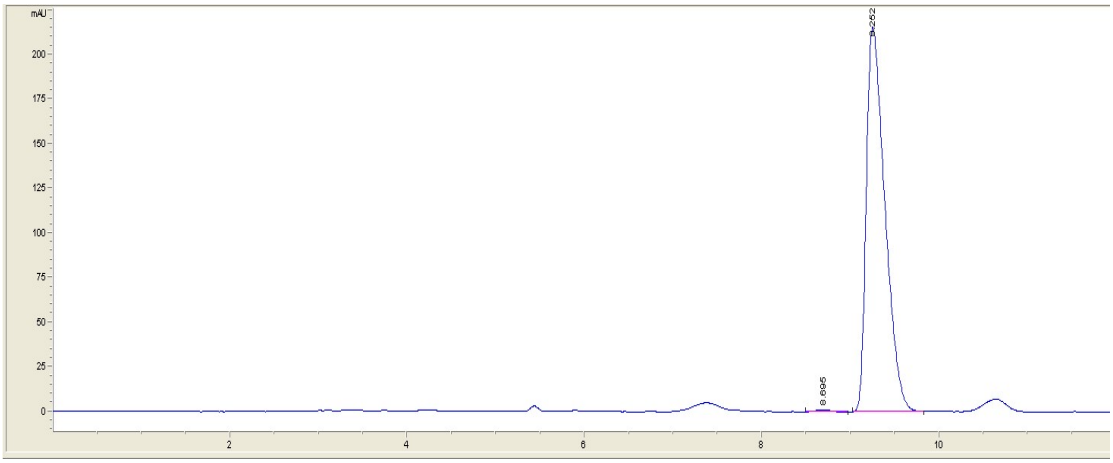


74



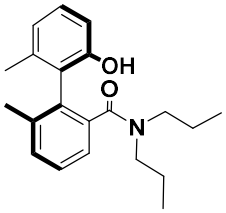
Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	8.641	1132.1	96	0.1836	0.704	49.670
2	9.308	1147.1	83.3	0.2127	0.688	50.330

Figure S353. HPLC Spectra of racemic **74**

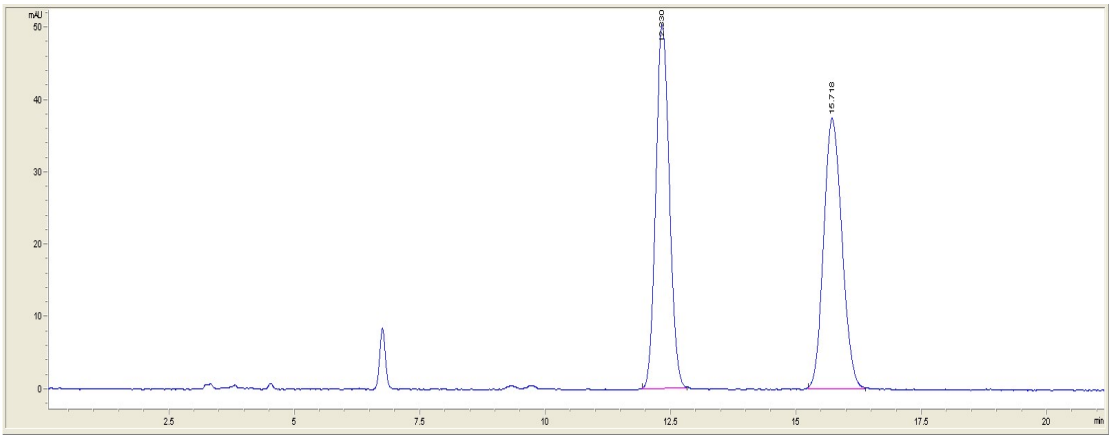


Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	8.695	13.7	1.3	0.1457	1.068	0.434
2	9.252	3148.9	215.8	0.2242	0.494	99.566

Figure S354. HPLC Spectra of **74**

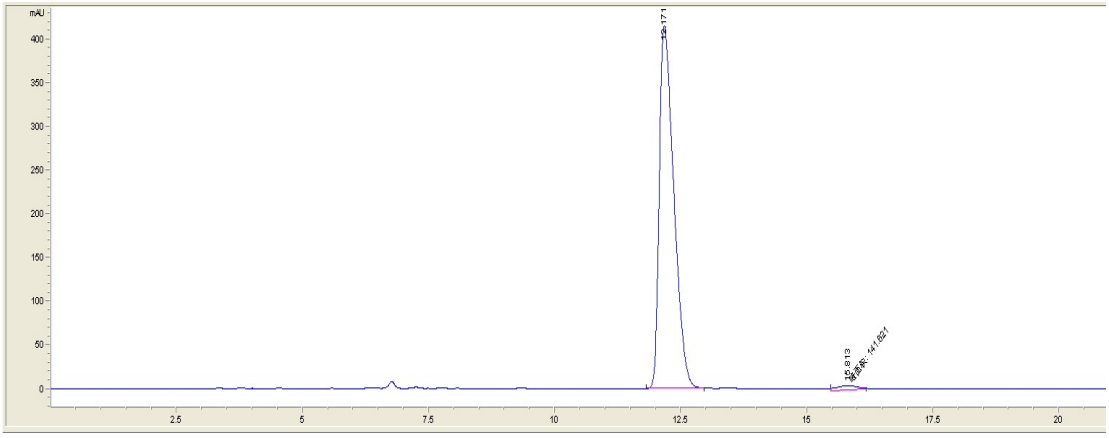


75



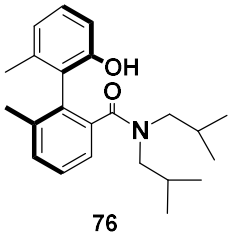
Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	12.33	951.7	50.4	0.2944	0.86	50.014
2	15.718	951.2	37.4	0.3926	0.828	49.986

Figure S355. HPLC Spectra of racemic **75**

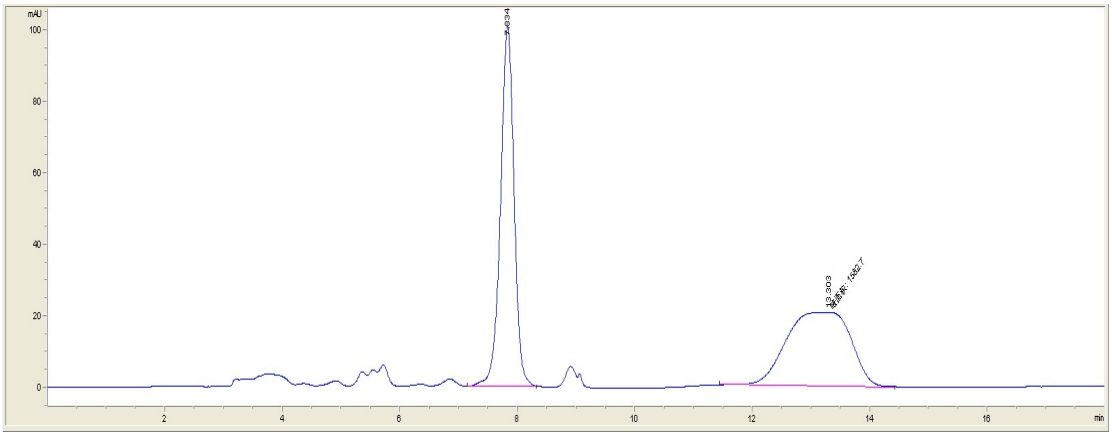


Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	12.171	8316.4	415.3	0.3056	0.491	98.302
2	15.813	143.7	4.9	0.4851	0.938	1.698

Figure S356. HPLC Spectra of **75**

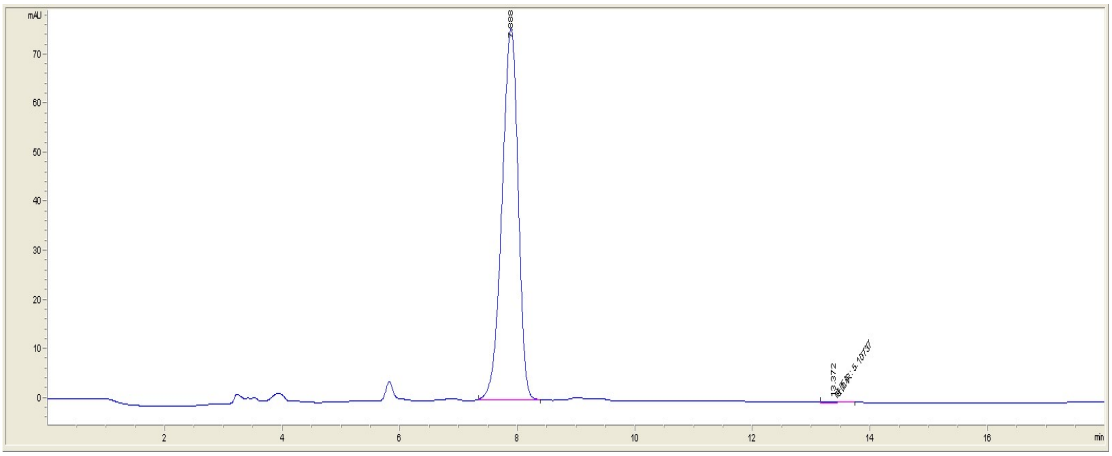


76



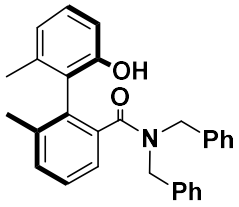
Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	7.834	1618.2	100.7	0.2455	1.079	50.555
2	13.303	1582.7	20.8	1.2712	1.747	49.445

Figure S357. HPLC Spectra of racemic **76**

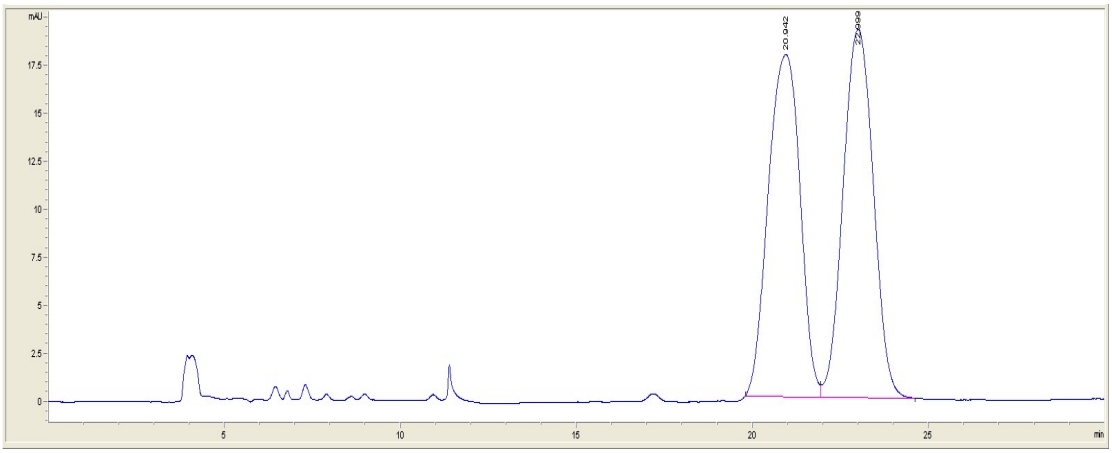


Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	7.888	1454.1	75.8	0.2999	1.24	99.650
2	13.372	5.1	2.2E-1	0.2856	1.17	0.350

Figure S358. HPLC Spectra of **76**

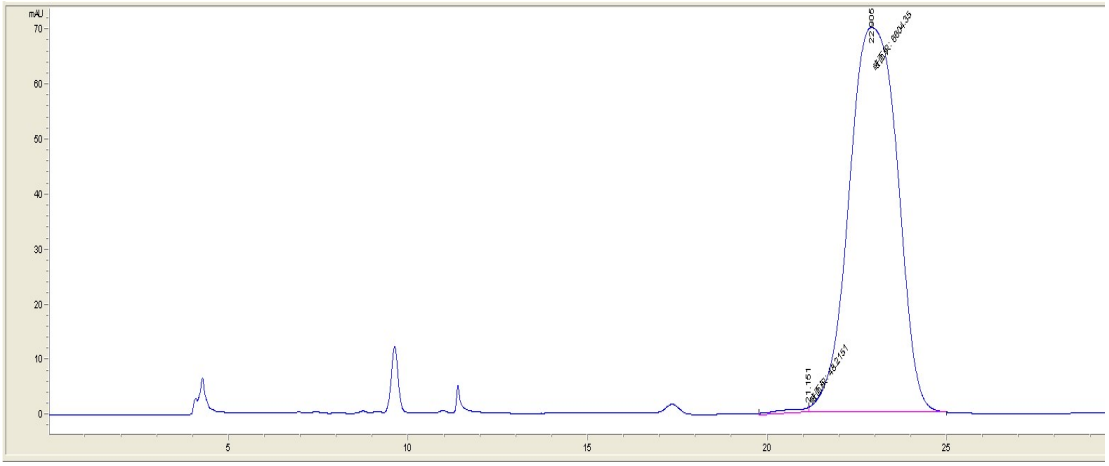


77



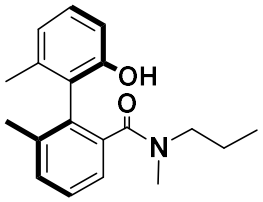
Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	20.942	1125	17.9	1.0031	1.17	49.512
2	22.999	1147.1	19.2	0.9411	0.955	50.488

Figure S359. HPLC Spectra of racemic **77**

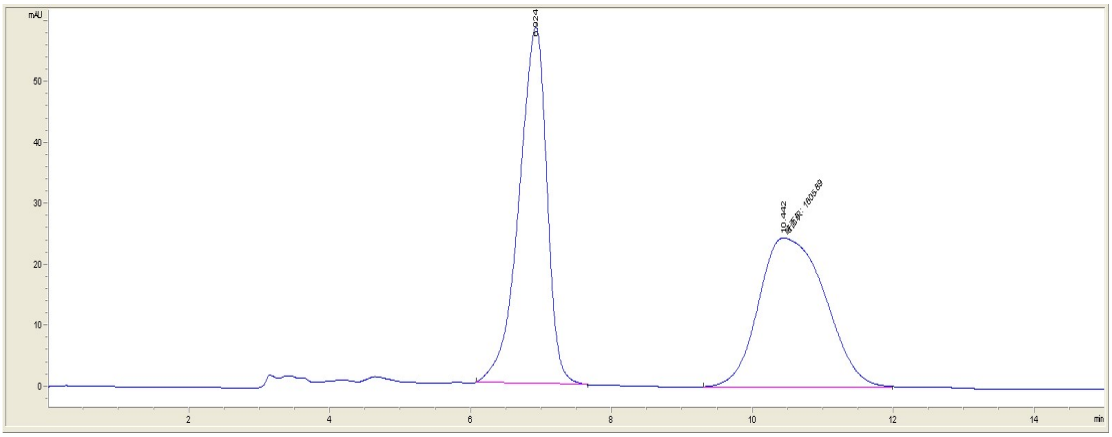


Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	21.151	48.2	1	0.8002	1.844	0.725
2	22.905	6604.4	70	1.5725	0.872	99.275

Figure S360. HPLC Spectra of **77**

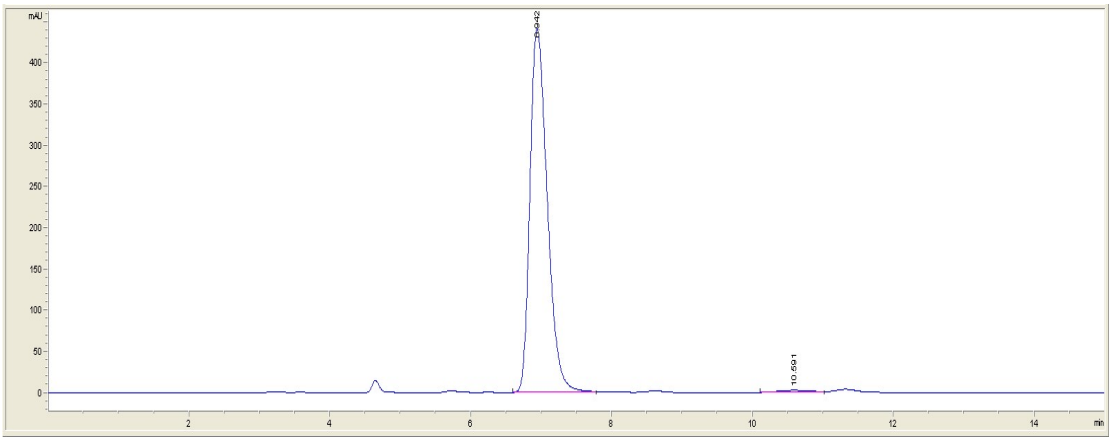


78



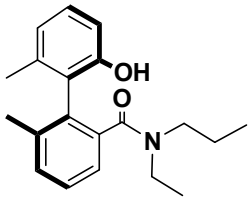
Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	6.924	1625	58.5	0.4299	1.497	50.296
2	10.442	1605.9	24.5	1.0918	0.609	49.704

Figure S361. HPLC Spectra of racemic **78**

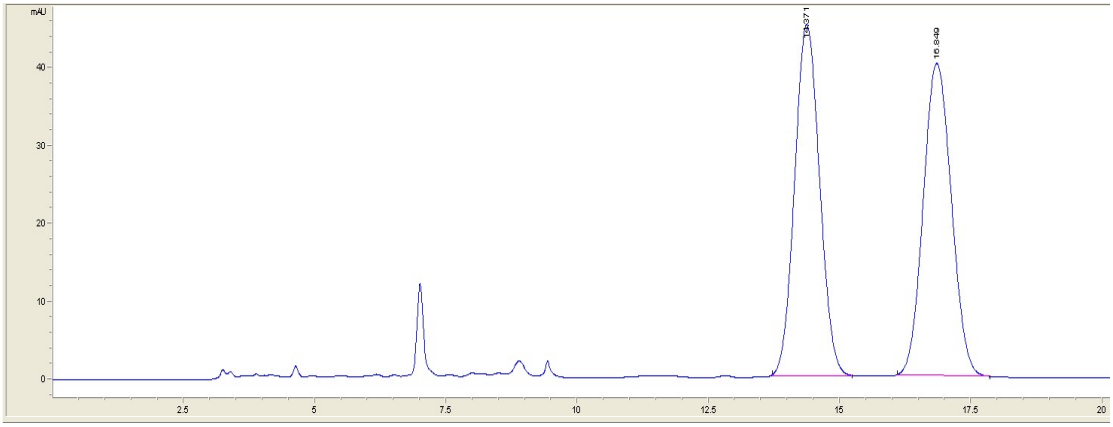


Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	6.942	7530.7	441.1	0.2652	0.663	98.828
2	10.591	89.3	2.7	0.4725	0.866	1.172

Figure S362. HPLC Spectra of **78**

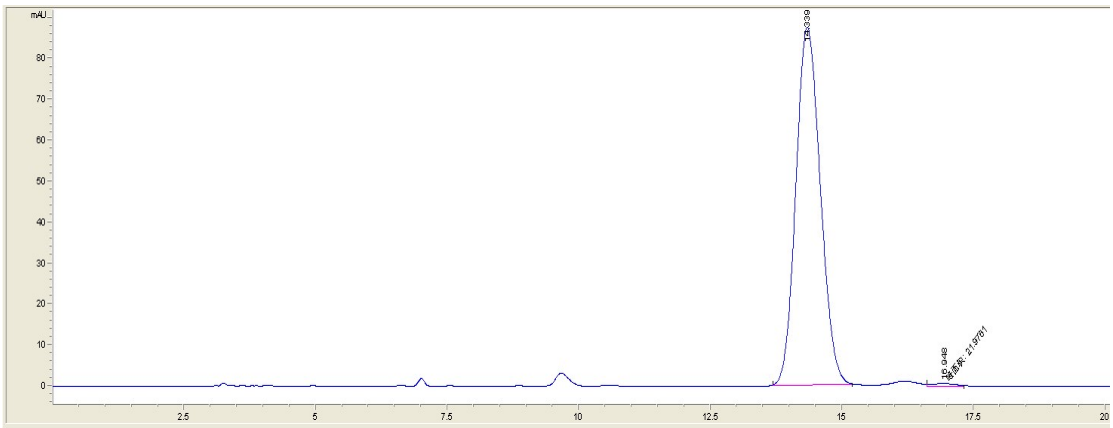


79



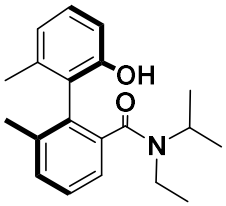
Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	14.371	1496.2	45.2	0.5164	0.91	49.929
2	16.849	1500.5	40.2	0.5879	0.897	50.071

Figure S363. HPLC Spectra of racemic **79**

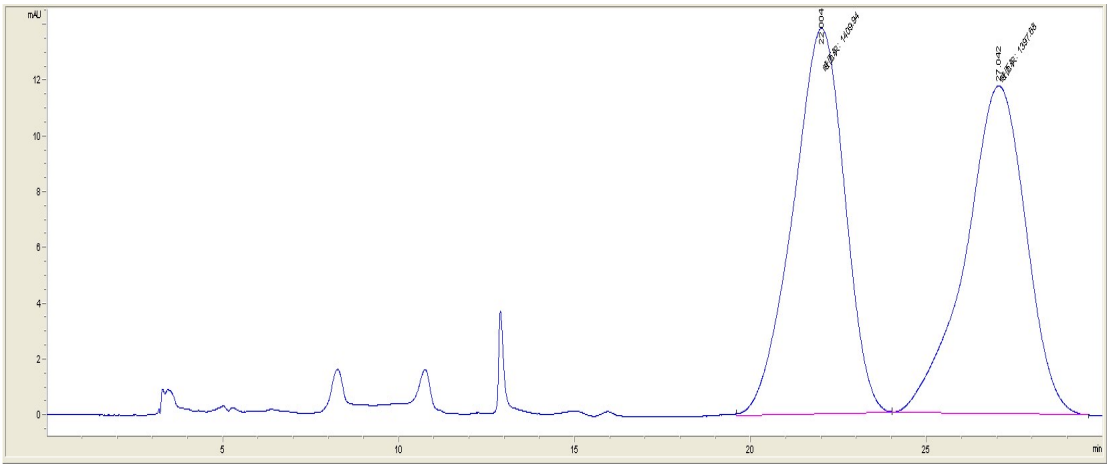


Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	14.339	2835.3	87.5	0.5059	0.836	99.231
2	16.948	22	6.7E-1	0.5485	1.15	0.769

Figure S364. HPLC Spectra of **79**

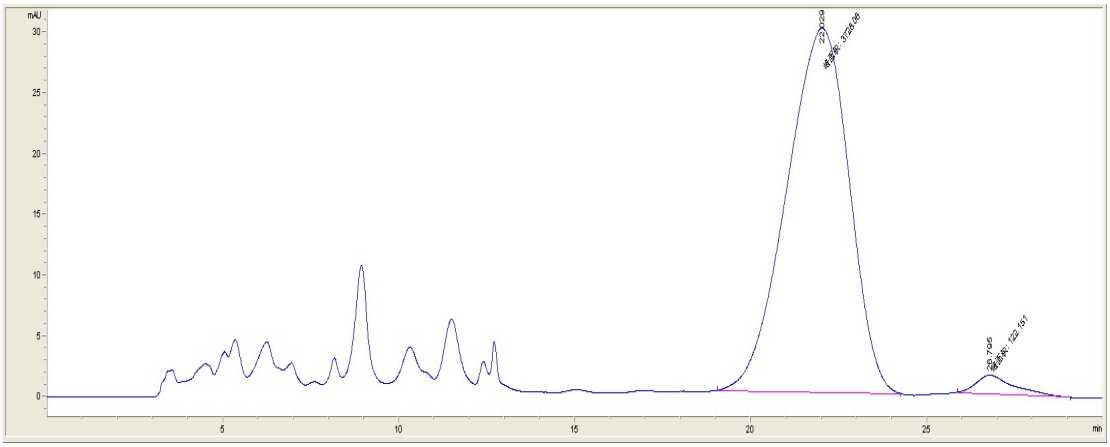


80



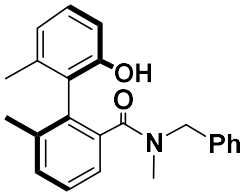
Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	22.004	1409.9	13.8	1.7009	1.191	50.218
2	27.042	1397.7	11.7	1.9839	1.188	49.782

Figure S365. HPLC Spectra of racemic **80**

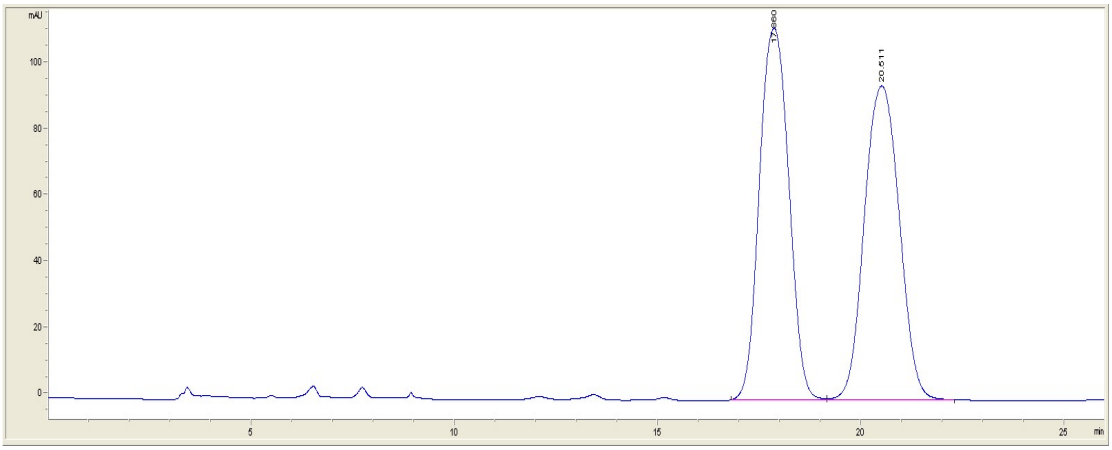


Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	22.029	3728.1	30.1	2.0669	1.277	96.827
2	26.795	122.2	1.6	1.2674	0.578	3.173

Figure S366. HPLC Spectra of **80**

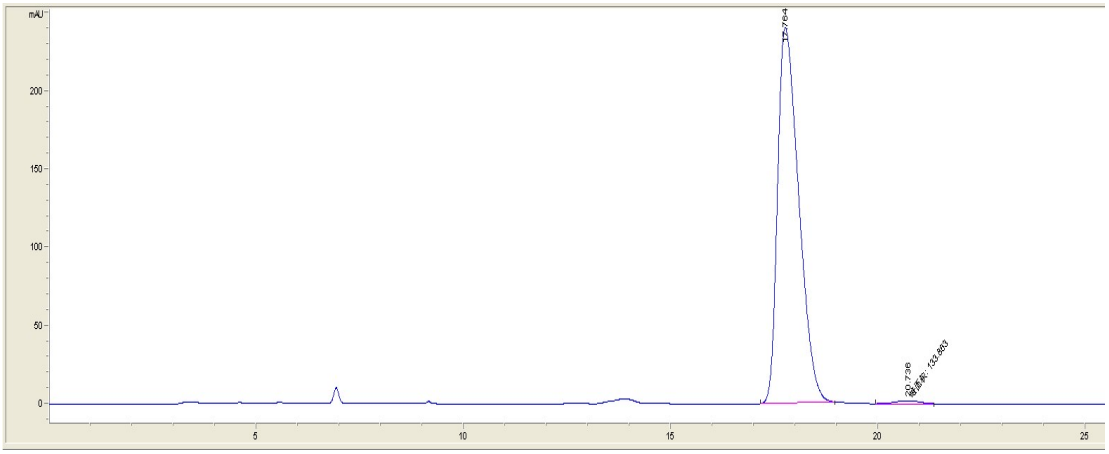


81



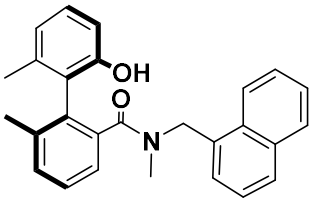
Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	17.86	5663.7	112.3	0.8165	0.945	49.920
2	20.511	5681.8	94.8	0.9691	0.952	50.080

Figure S367. HPLC Spectra of racemic **81**

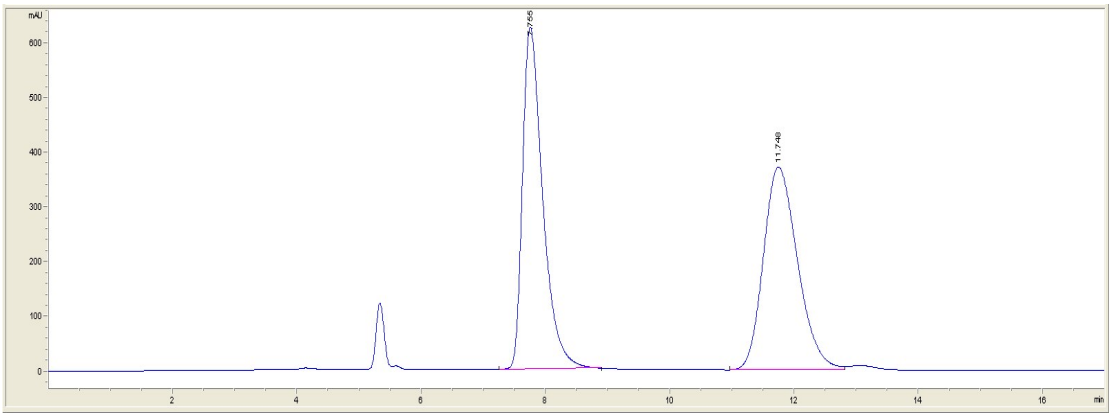


Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	17.764	8547.8	240.4	0.5528	0.543	98.458
2	20.736	133.9	2.7	0.8328	0.899	1.542

Figure S368. HPLC Spectra of **81**

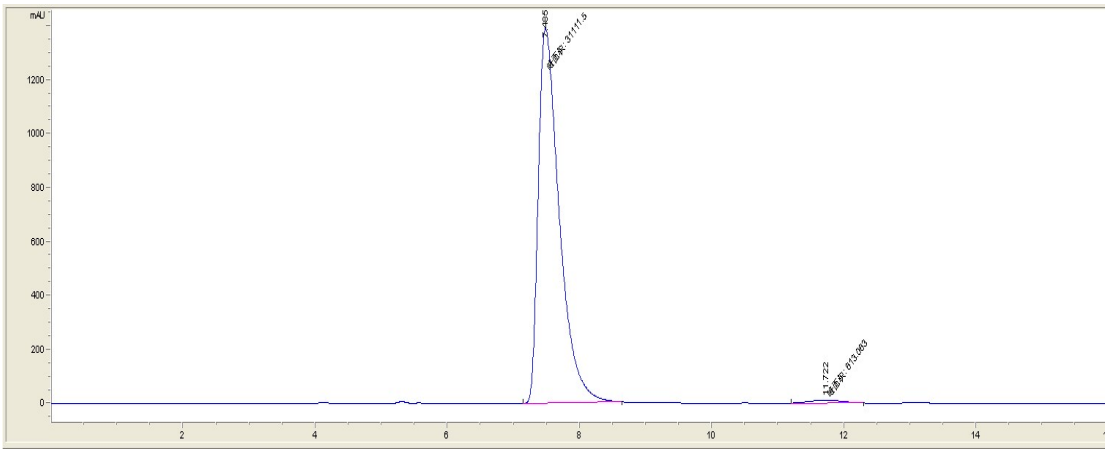


82



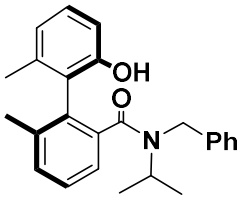
Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	7.755	14191.1	625	0.3449	0.576	49.971
2	11.748	14207.2	371.2	0.5926	0.748	50.029

Figure S369. HPLC Spectra of racemic **82**

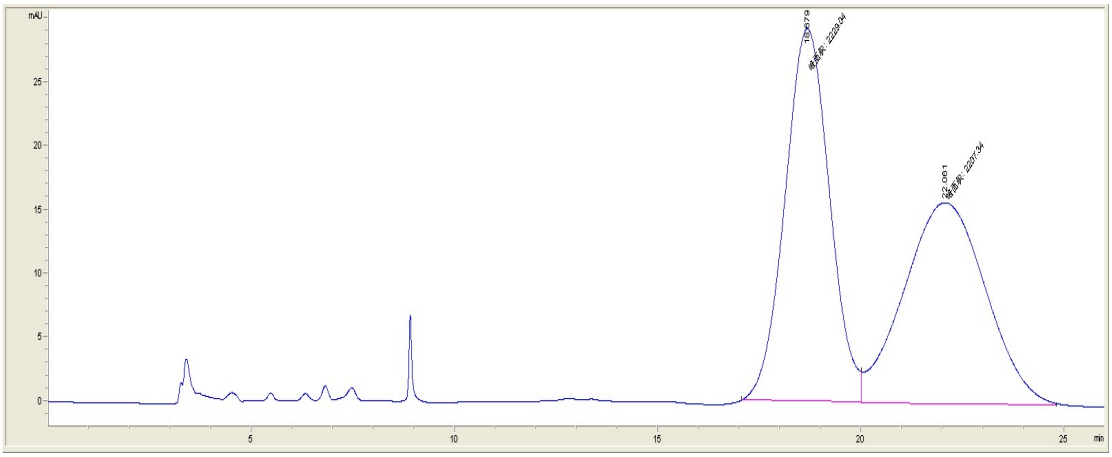


Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	7.485	31111.5	1393.3	0.3722	0.512	98.068
2	11.722	613.1	14.6	0.6981	1.086	1.932

Figure S370. HPLC Spectra of **82**

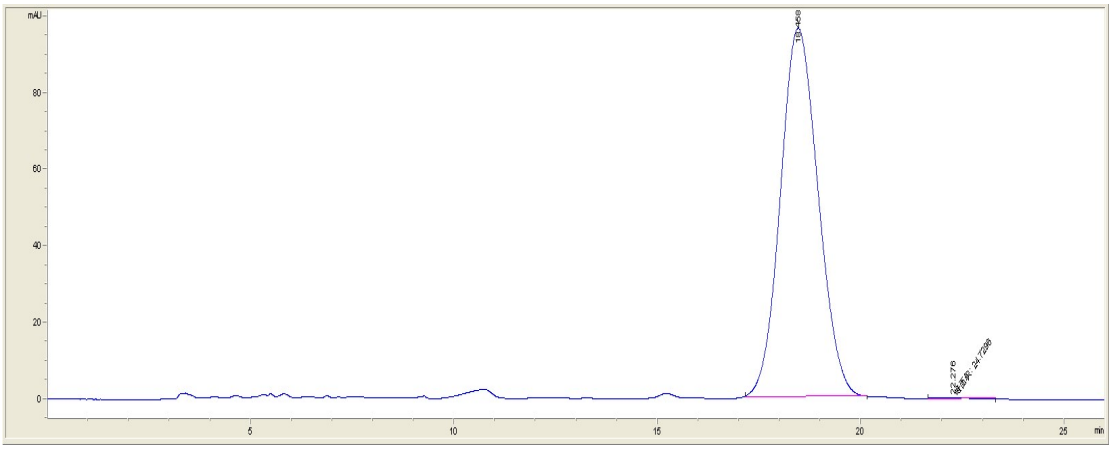


83



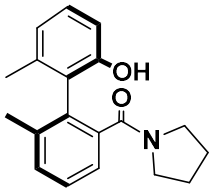
Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	18.679	2229	29.2	1.2722	0.978	50.245
2	22.061	2207.3	15.8	2.3356	0.974	49.755

Figure S371. HPLC Spectra of racemic **83**

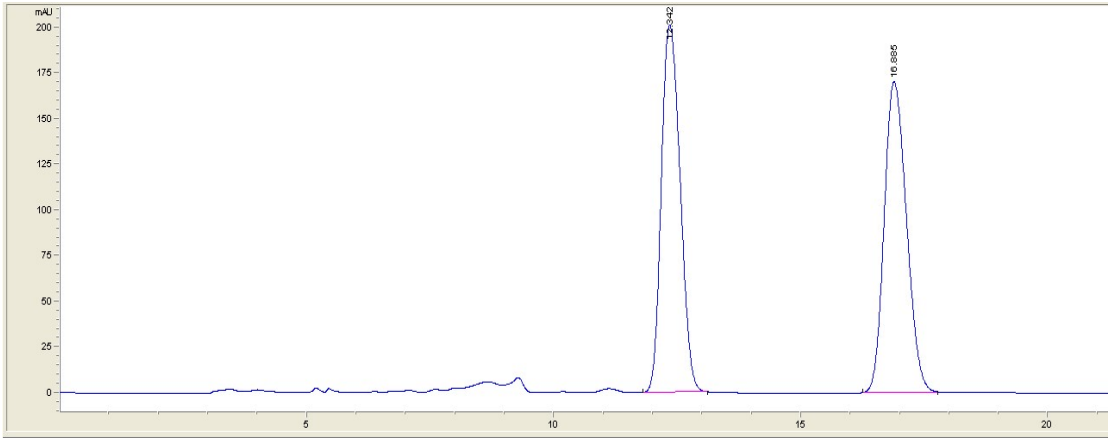


Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	18.458	6239.6	96.4	1.0012	0.858	99.605
2	22.276	24.7	3.4E-1	0.8441	0	0.395

Figure S372. HPLC Spectra of **83**

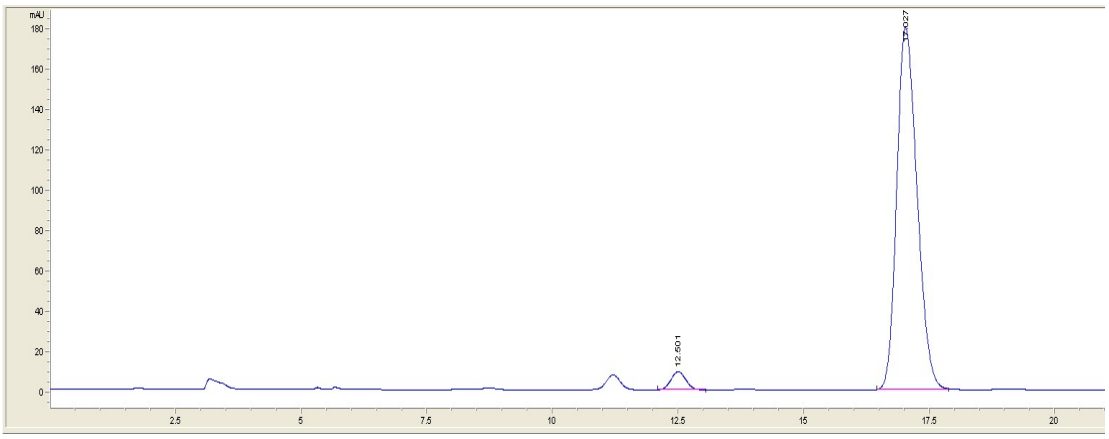


84



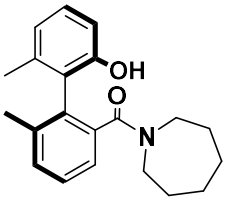
Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	12.342	5339	201.2	0.4256	0.761	49.991
2	16.885	5340.9	170.3	0.494	0.768	50.009

Figure S373. HPLC Spectra of racemic **84**

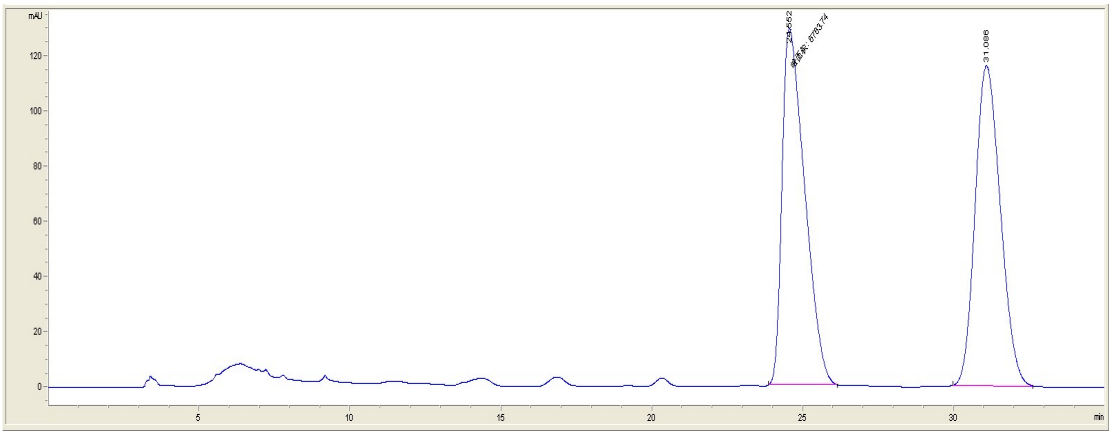


Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	12.501	186.3	9	0.3224	0.934	3.558
2	17.027	5051.3	179.6	0.4382	0.736	96.442

Figure S374. HPLC Spectra of **84**

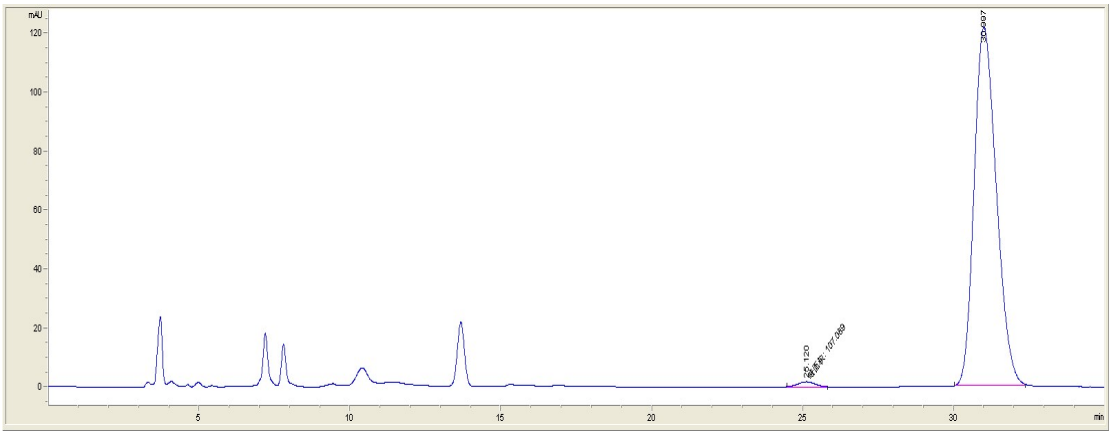


85



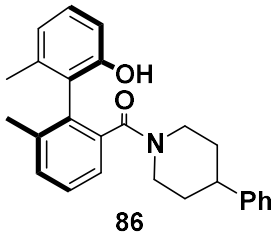
Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	24.552	6763.7	129.3	0.8719	0.463	50.022
2	31.086	6757.9	115.9	0.912	0.784	49.978

Figure S375. HPLC Spectra of racemic **85**

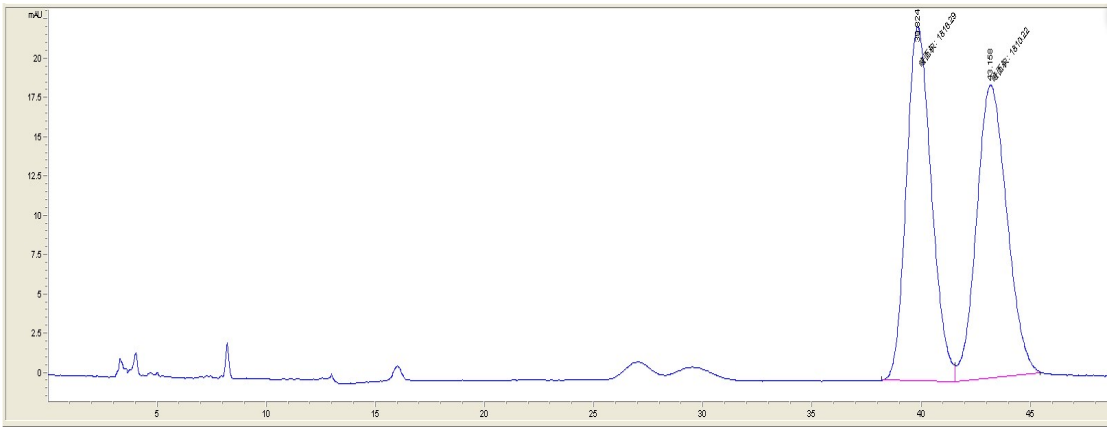


Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	25.12	107.1	2.2	0.8031	0.957	1.687
2	30.997	6242.4	121.7	0.8025	0.741	98.313

Figure S376. HPLC Spectra of **85**

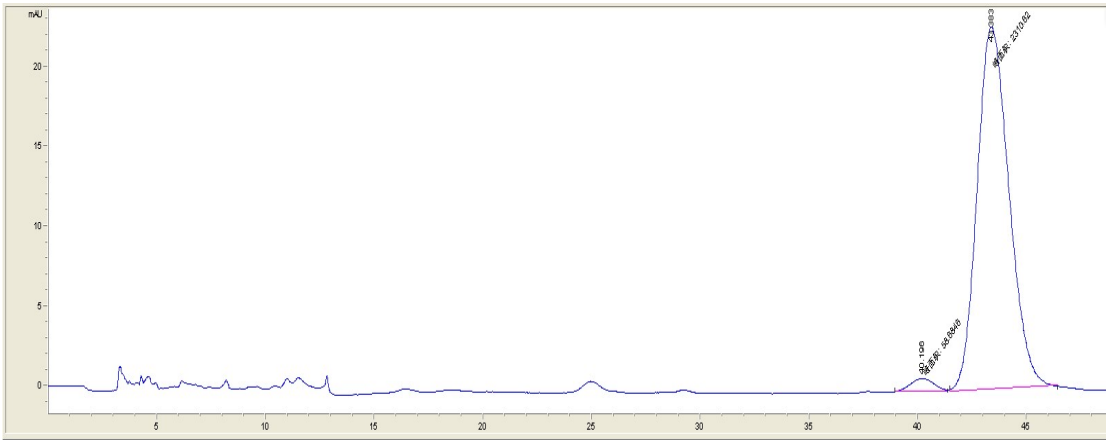


86



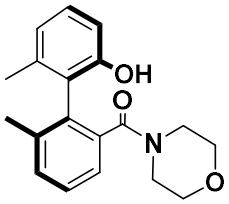
Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	39.824	1816.3	22.6	1.3422	0.796	50.084
2	43.158	1810.2	18.7	1.6148	0.831	49.916

Figure S377. HPLC Spectra of racemic **86**

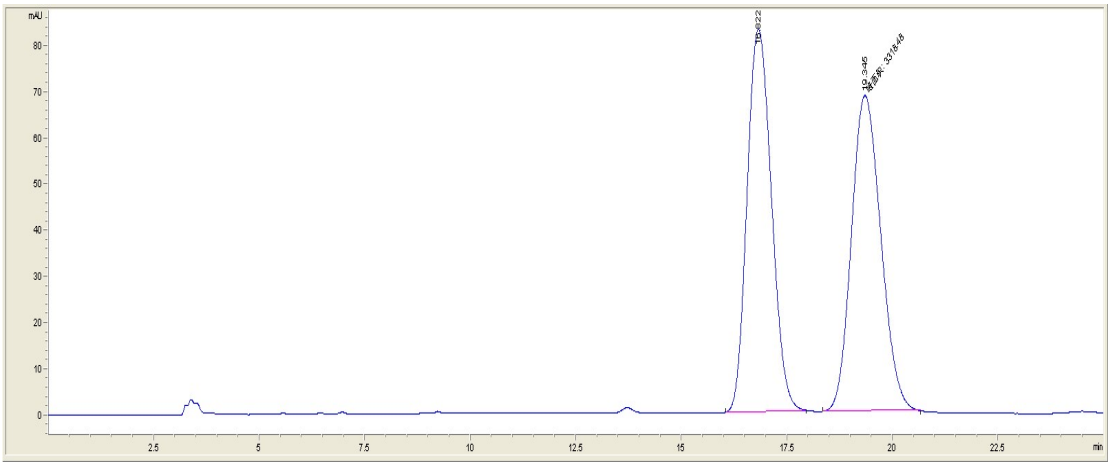


Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	40.196	58.7	8E-1	1.2254	0.961	2.477
2	43.383	2310.6	22.7	1.6985	0.79	97.523

Figure S378. HPLC Spectra of **86**

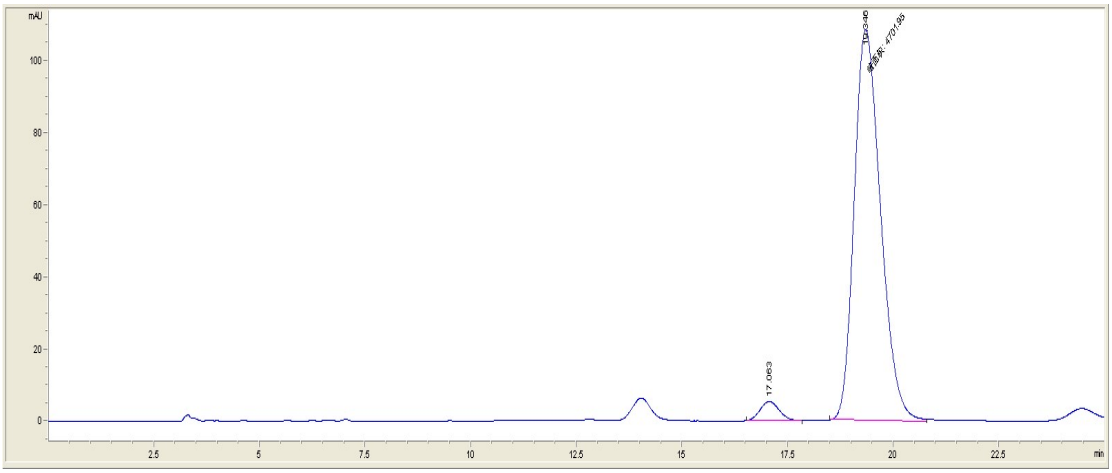


87



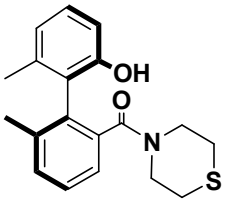
Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	16.822	3337.8	82.9	0.6398	0.825	50.145
2	19.345	3318.5	68.4	0.8087	0.823	49.855

Figure S379. HPLC Spectra of racemic **87**

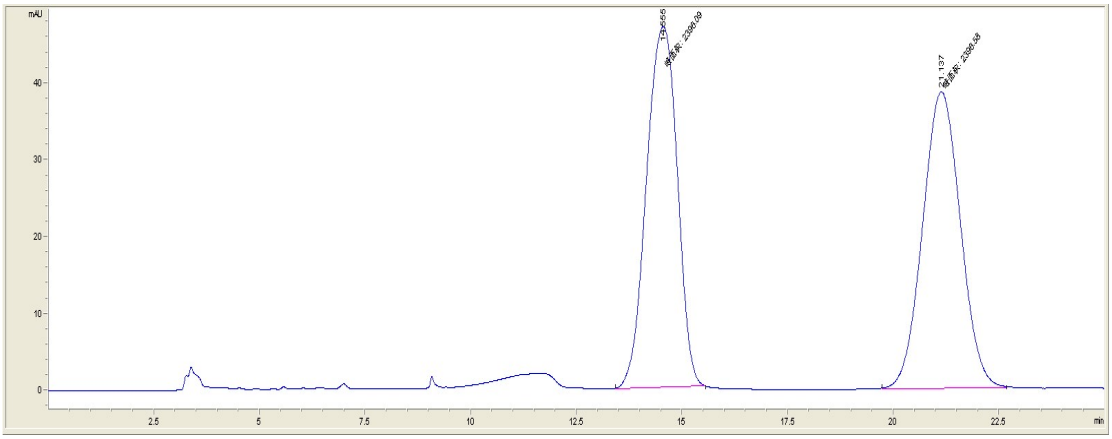


Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	17.063	165.7	5.3	0.4775	0.891	3.403
2	19.346	4701.9	108.3	0.7235	0.731	96.597

Figure S380 HPLC Spectra of **87**

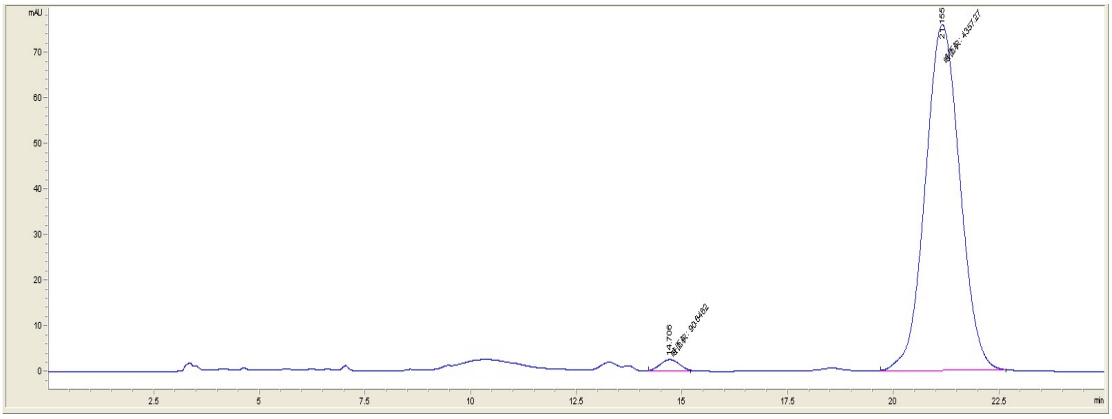


88



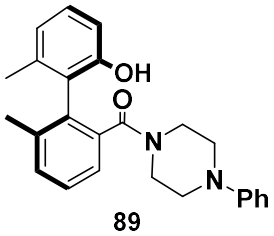
Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	14.555	2396.1	47	0.8494	1.157	49.995
2	21.137	2396.6	38.6	1.0358	0.956	50.005

Figure S381. HPLC Spectra of racemic **88**

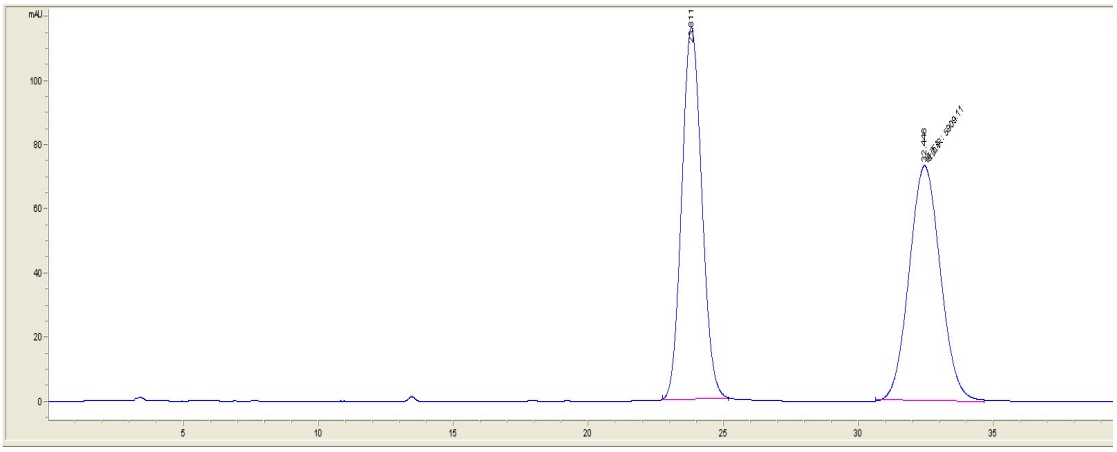


Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	14.706	90.6	2.7	0.5635	0.964	2.038
2	21.155	4357.3	76	0.9551	0.945	97.962

Figure S382. HPLC Spectra of **88**

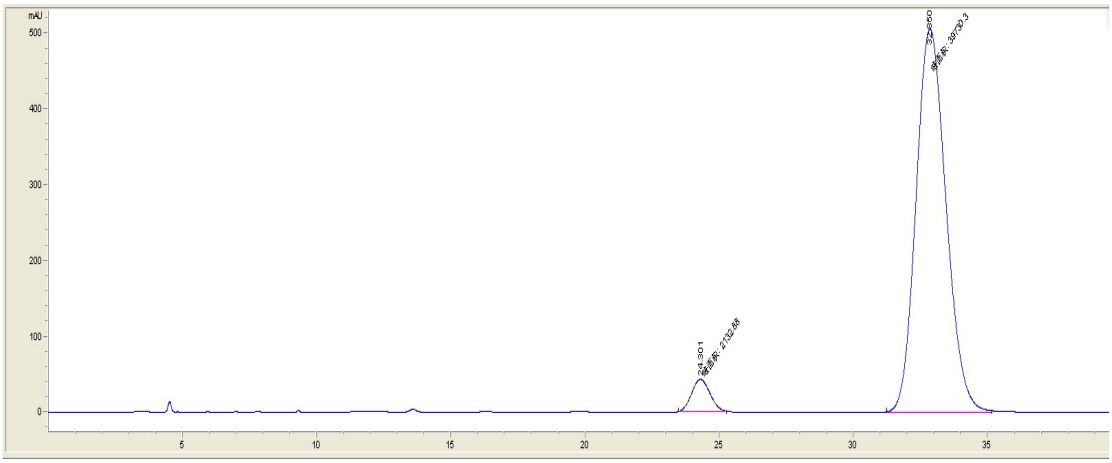


89



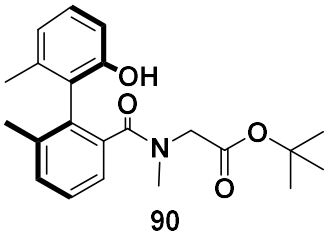
Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	23.811	5994.3	116.1	0.8086	0.891	50.358
2	32.446	5909.1	73.4	1.3426	0.933	49.642

Figure S383. HPLC Spectra of racemic **89**

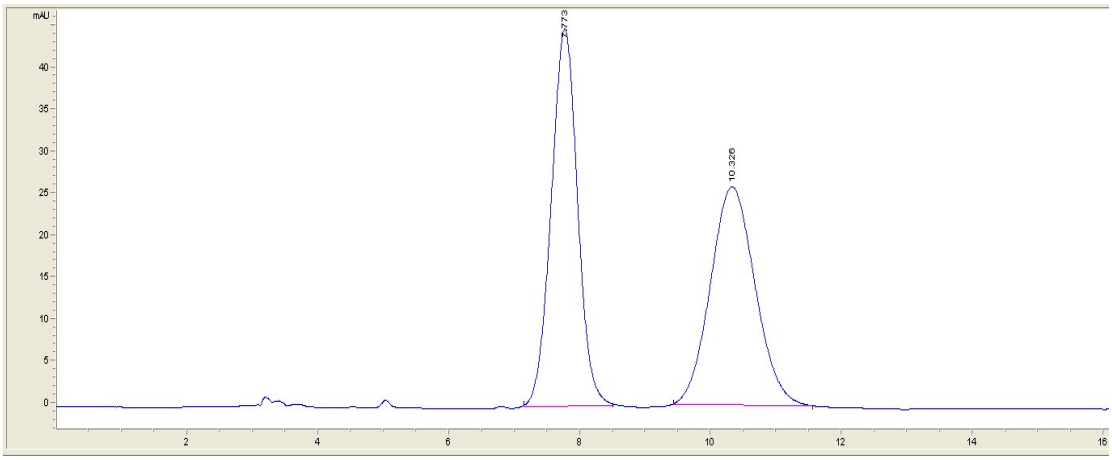


Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	24.301	2132.9	43.6	0.8155	0.908	5.095
2	32.85	39730.3	507.3	1.3054	0.833	94.905

Figure S384. HPLC Spectra of **89**

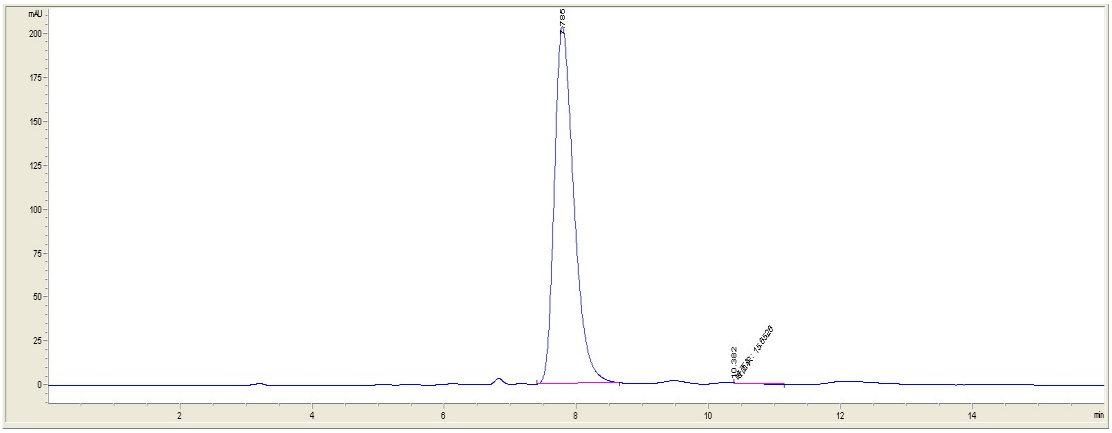


90



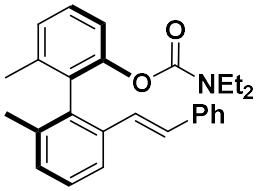
Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	7.773	1264.7	45	0.4316	1.034	50.343
2	10.326	1247.5	26.1	0.7311	0.896	49.657

Figure S385. HPLC Spectra of racemic **90**

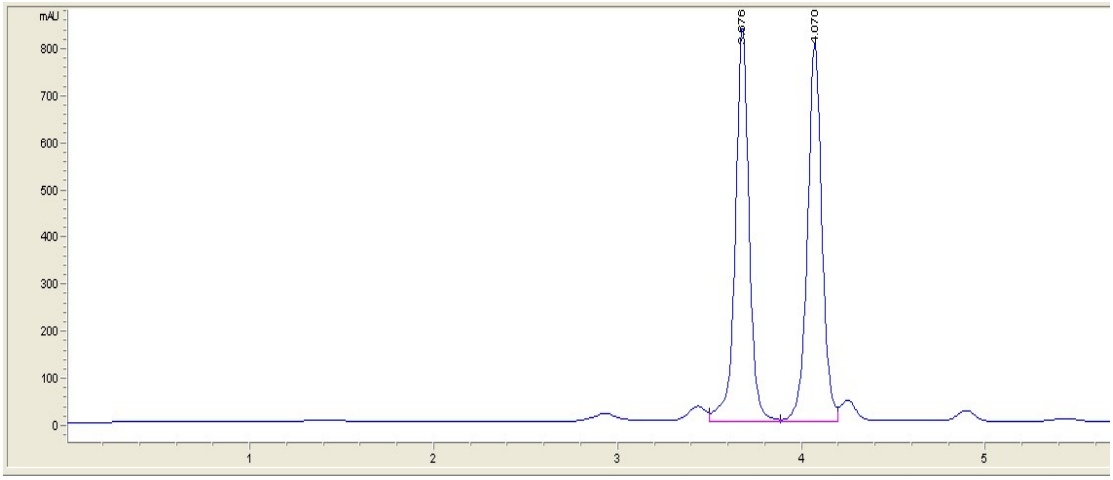


Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	7.785	4185.5	203.3	0.3142	0.647	99.627
2	10.382	15.7	8.7E-1	0.2137	0	0.373

Figure S386. HPLC Spectra of **90**

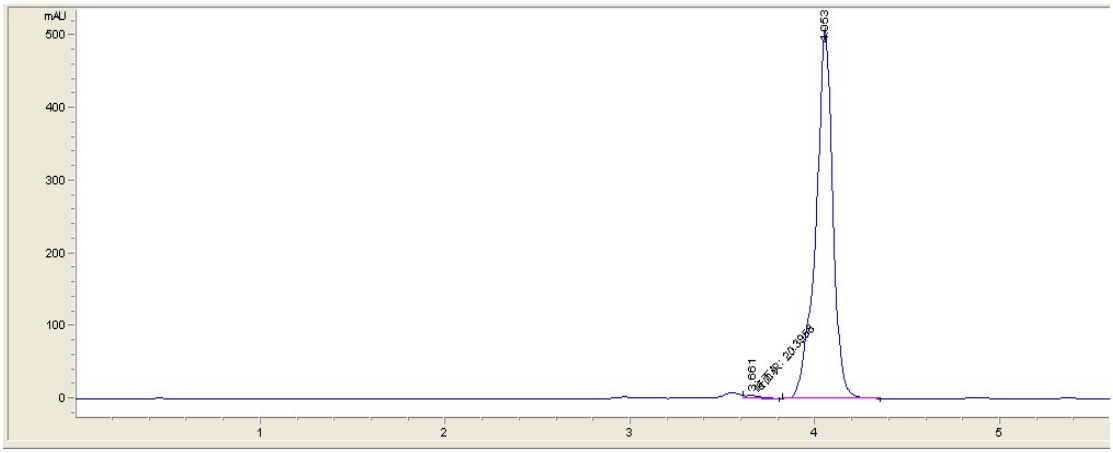


91



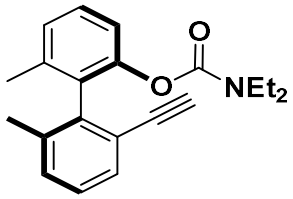
Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	3.676	4361.7	837.9	0.0767	1.004	49.763
2	4.07	4403.1	806.3	0.0837	0.978	50.237

Figure S387. HPLC Spectra of racemic **91**

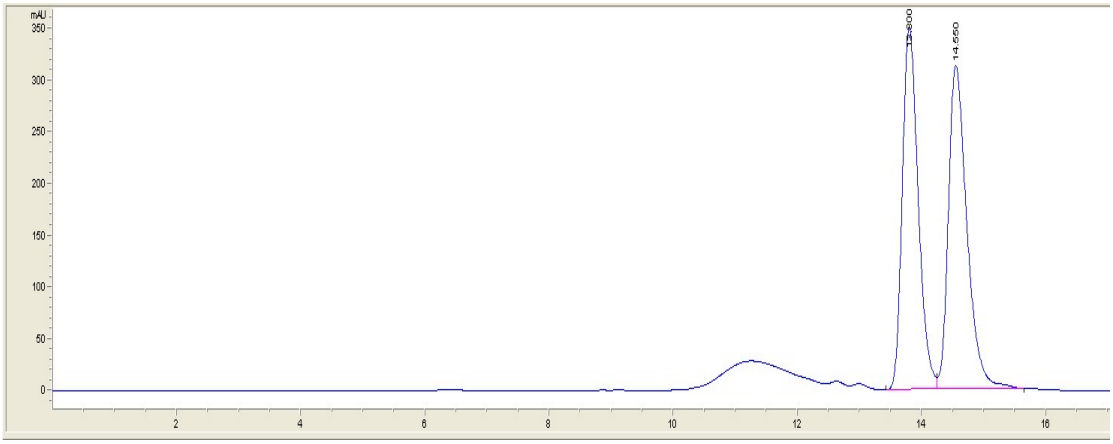


Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	3.661	20.4	3.3	0.1032	0.573	0.623
2	4.053	3251.2	510.7	0.0923	1.199	99.377

Figure S388. HPLC Spectra of **91**

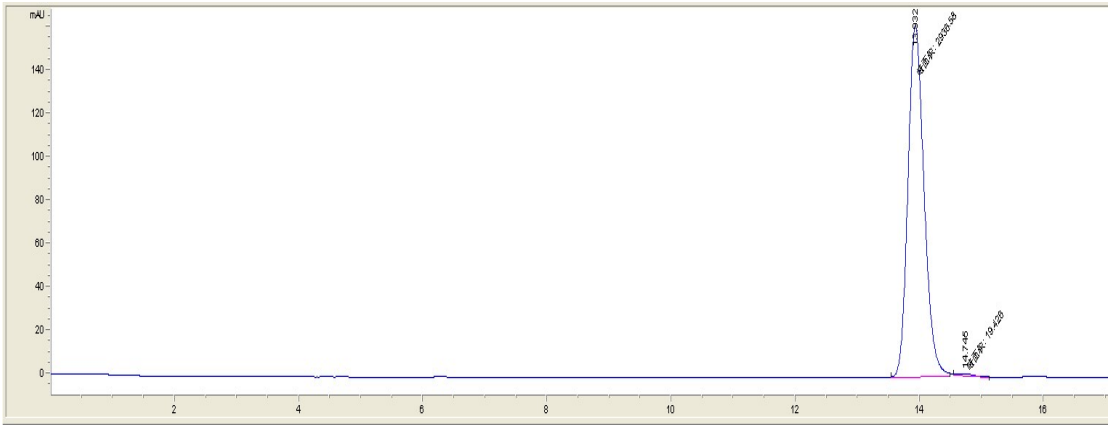


92



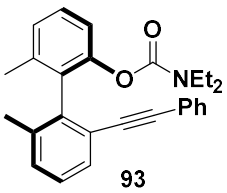
Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	13.8	6243.5	350.8	0.2736	0.725	48.929
2	14.55	6516.9	312.9	0.317	0.616	51.071

Figure S389. HPLC Spectra of racemic **92**



Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	13.932	2936.6	162	0.3021	0.806	99.343
2	14.745	19.4	9.7E-1	0.3349	0.401	0.657

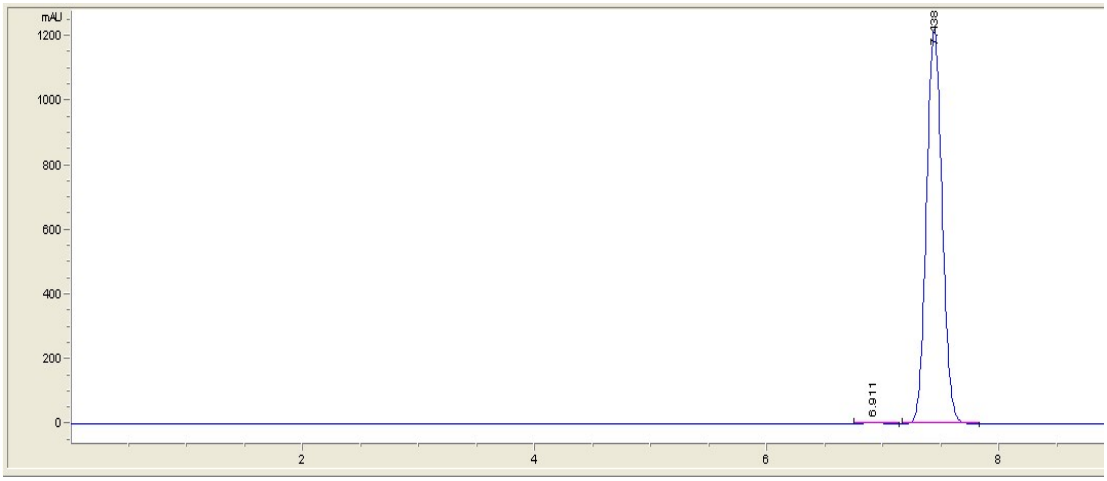
Figure S390. HPLC Spectra of **92**



93

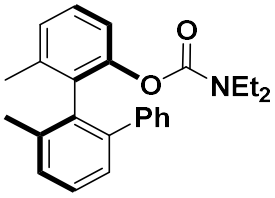
Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	6.939	7670.1	890	0.1345	0.933	36.476
2	7.452	13357.6	1405.7	0.1489	0.903	63.524

Figure S391. HPLC Spectra of racemic **93**

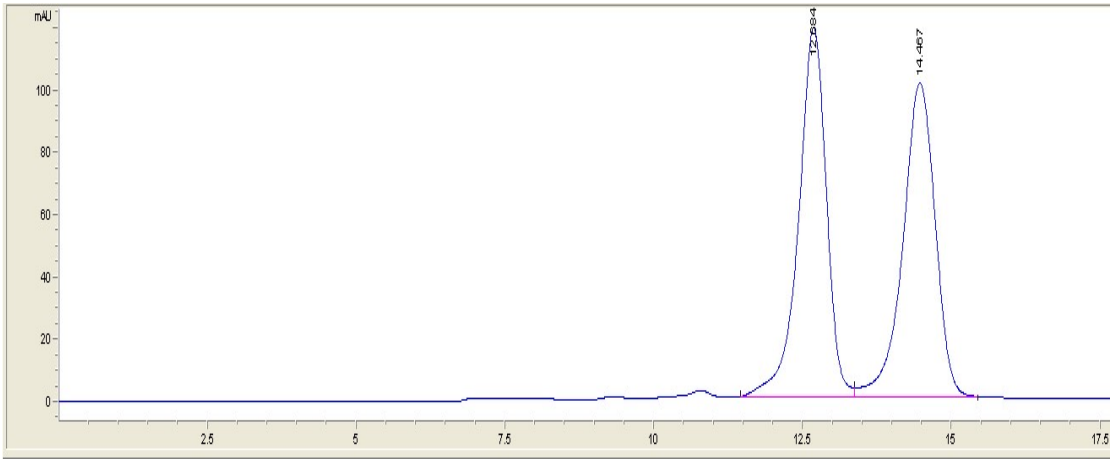


Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	6.911	47.6	5.6	0.133	0.95	0.416
2	7.438	11384.1	1218.6	0.145	0.903	99.584

Figure S392. HPLC Spectra of **93**

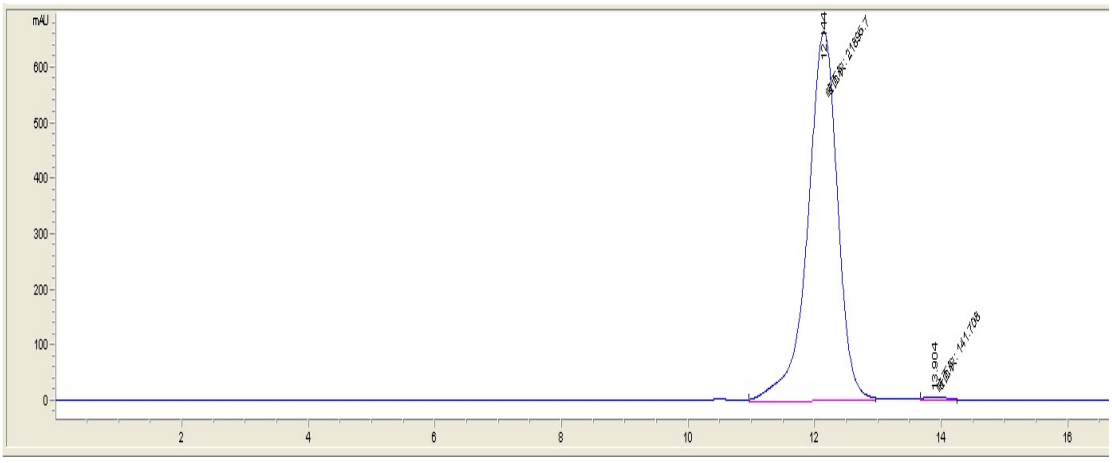


94



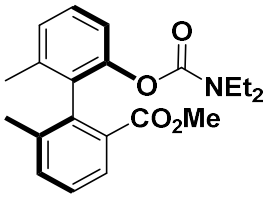
Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	12.684	3876.2	118.9	0.4904	1.206	50.395
2	14.467	3815.4	100.9	0.5832	1.114	49.605

Figure S393. HPLC Spectra of racemic **94**

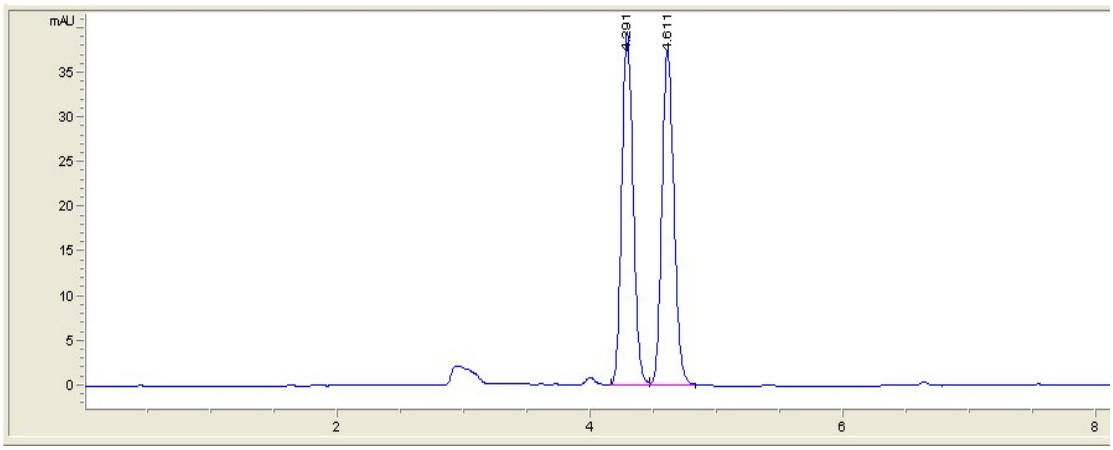


Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	12.144	21895.7	665.7	0.5482	1.182	99.357
2	13.904	141.7	5.4	0.4371	0.799	0.643

Figure S394. HPLC Spectra of **94**

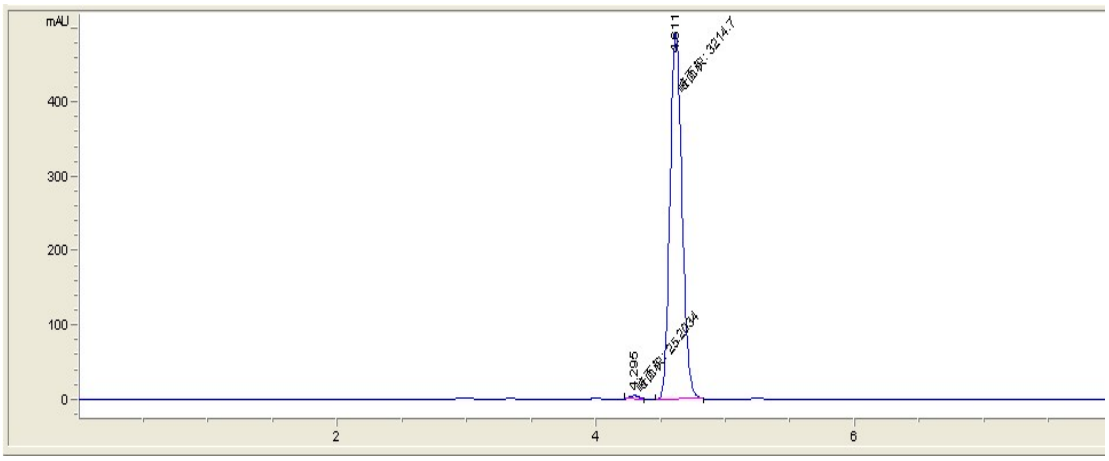


95



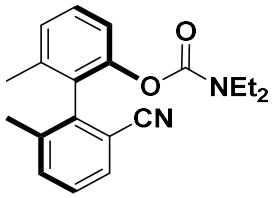
Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	4.291	245.8	39.7	0.0963	0.875	49.856
2	4.611	247.2	37.6	0.1027	0.862	50.144

Figure S395. HPLC Spectra of racemic **95**

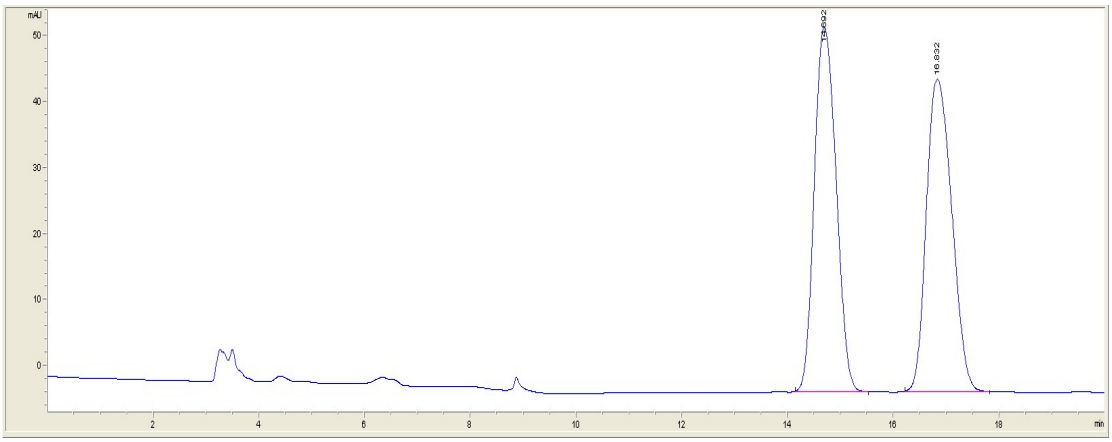


Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	4.295	25.2	4.7	0.0889	0.668	0.778
2	4.611	3214.7	495.9	0.108	0.867	99.222

Figure S396. HPLC Spectra of **95**

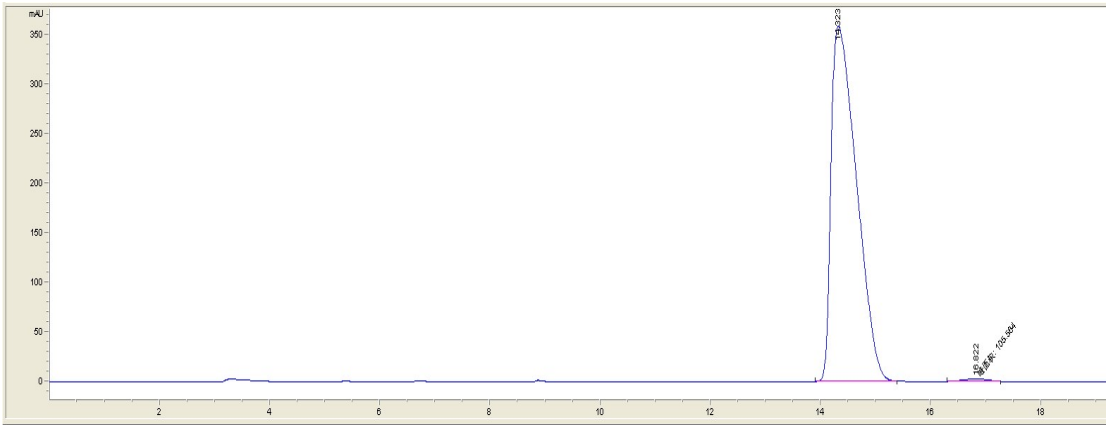


96



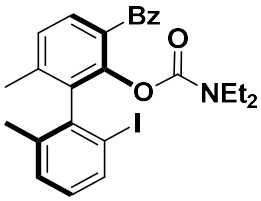
Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	14.692	1583.9	55.2	0.4607	0.805	49.968
2	16.832	1585.9	47.4	0.5384	0.733	50.032

Figure S397. HPLC Spectra of racemic **96**



Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	14.323	11477.1	358.7	0.5153	0.377	99.089
2	16.822	105.6	2.9	0.6127	1.078	0.911

Figure S398. HPLC Spectra of **96**



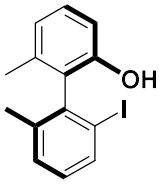
97

Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	46.682	4440.8	63.7	1.0776	0.892	50.115
2	50.822	4420.5	57.5	1.1806	0.882	49.885

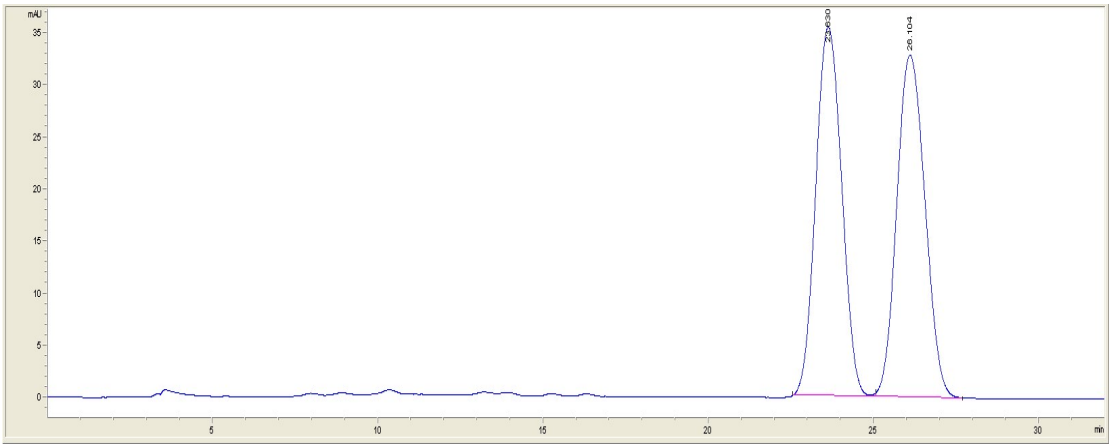
Figure S399. HPLC Spectra of racemic **97**

Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	46.525	211.5	2.8	1.2376	0.918	0.839
2	50.045	25006.8	303.3	1.2719	0.641	99.161

Figure S400. HPLC Spectra of **97**

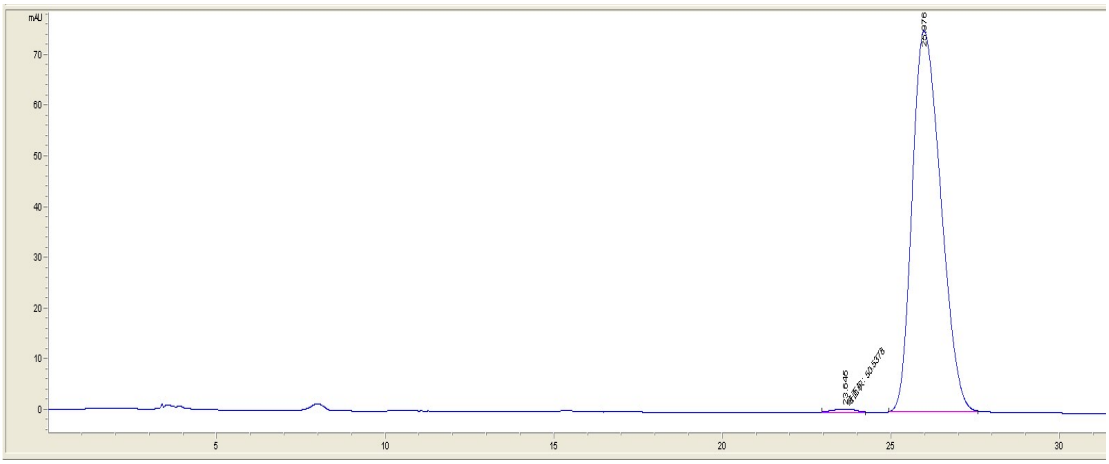


98



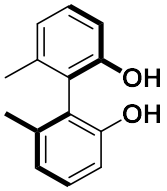
Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	23.63	1934.9	35.4	0.852	0.904	49.851
2	26.104	1946.5	32.8	0.93	0.852	50.149

Figure S401. HPLC Spectra of racemic **98**

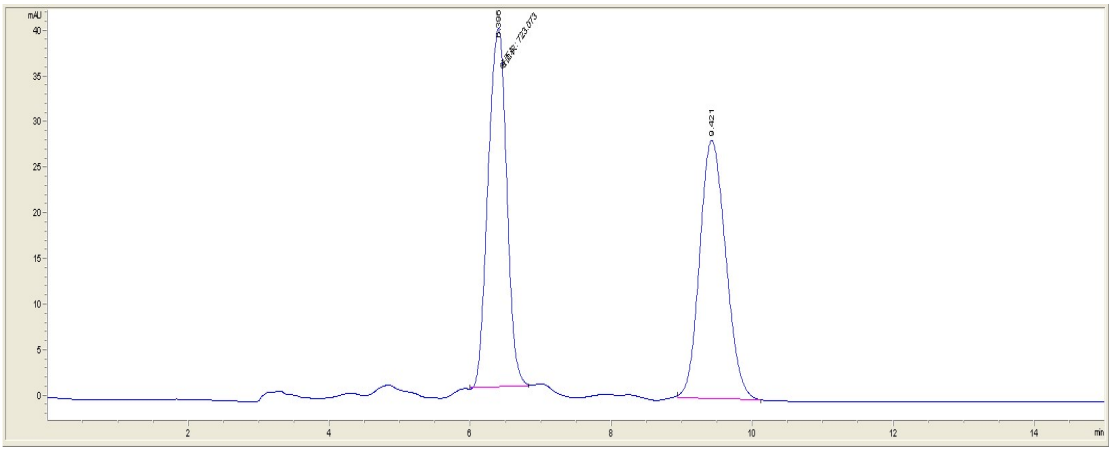


Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	23.645	50.5	9.3E-1	0.9066	1.199	1.124
2	25.976	4446.8	75.2	0.9321	0.682	98.876

Figure S402. HPLC Spectra of **98**

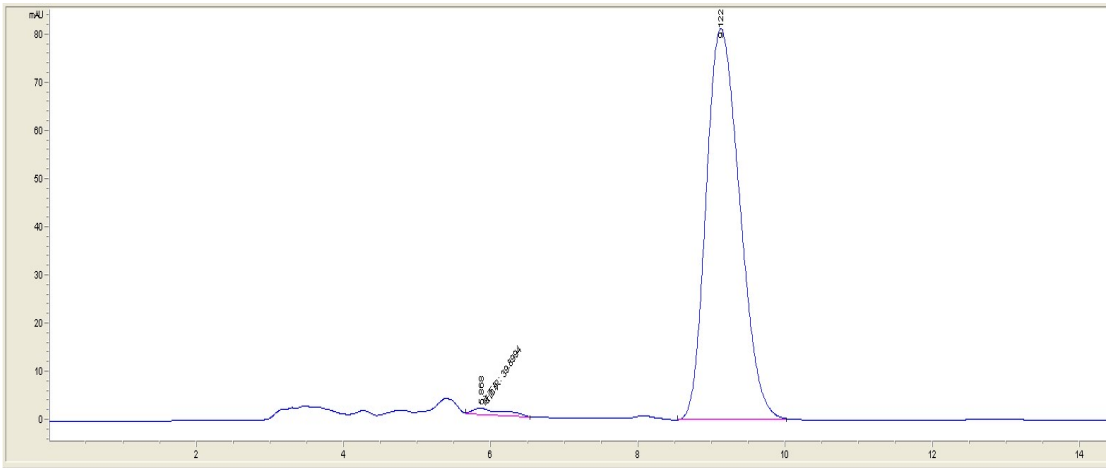


99



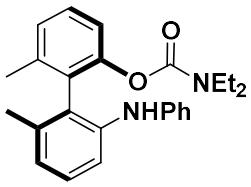
Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	6.396	723.1	39.3	0.3064	1.173	49.712
2	9.421	731.4	28.4	0.4048	0.816	50.288

Figure S403. HPLC Spectra of racemic **99**

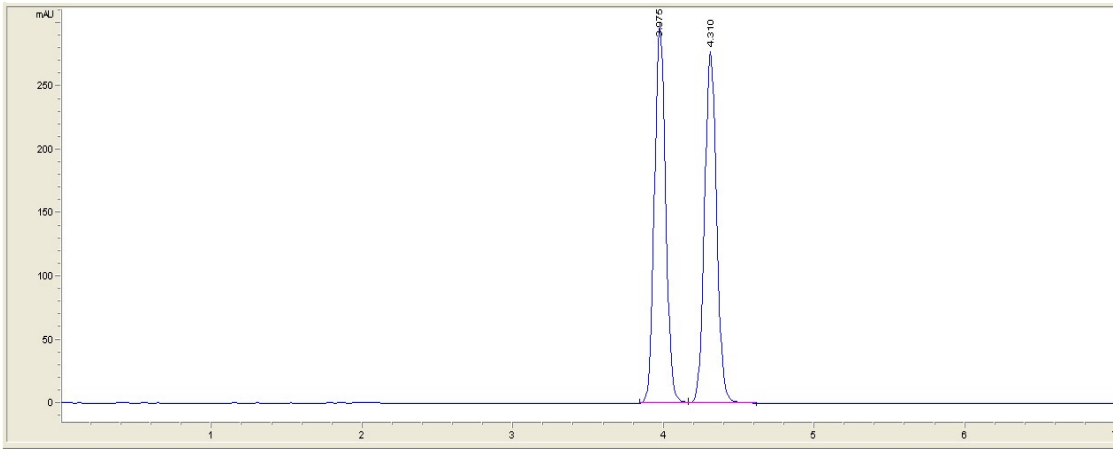


Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	5.868	39.9	1.3	0.5122	0.312	1.524
2	9.122	2577.5	81.2	0.5043	0.737	98.476

Figure S404. HPLC Spectra of **99**

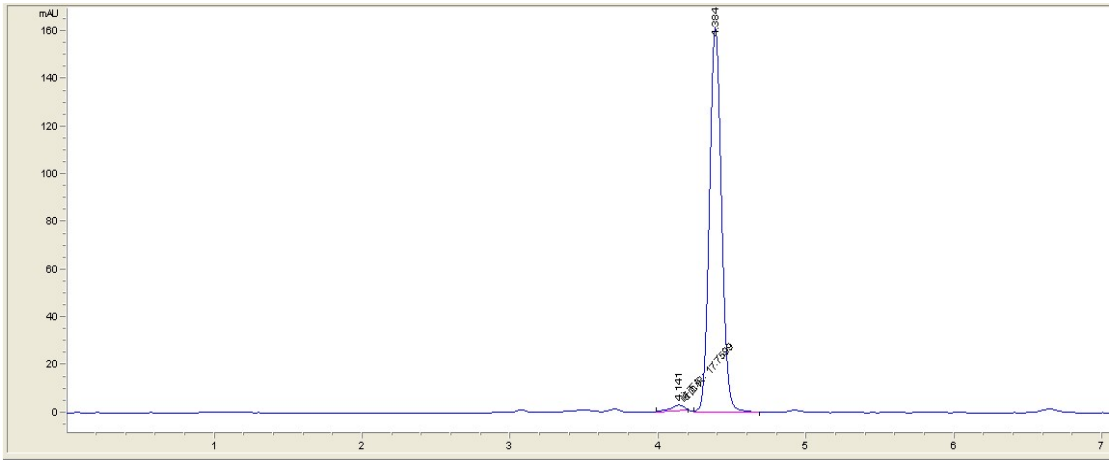


100



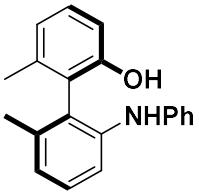
Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	3.975	1534.9	297.1	0.0803	0.912	49.881
2	4.31	1542.2	277.6	0.0868	0.91	50.119

Figure S405. HPLC Spectra of racemic **100**

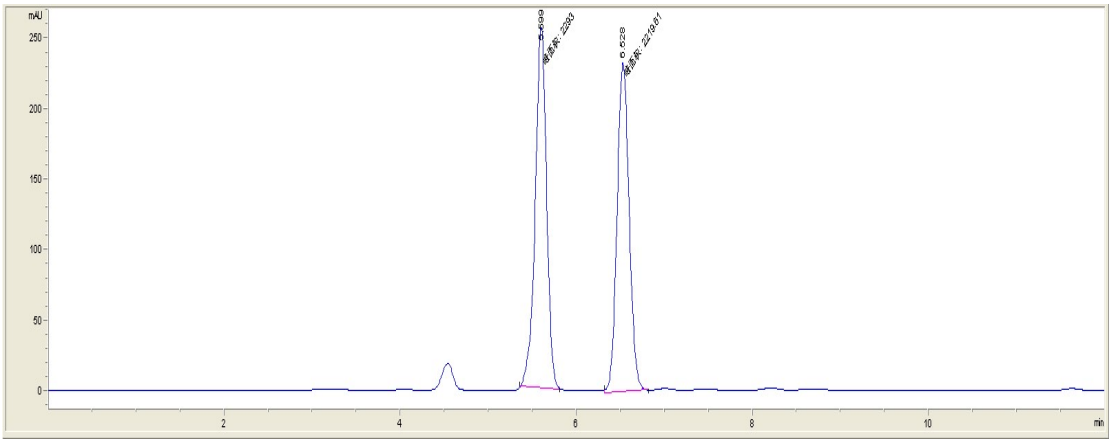


Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	4.141	17.8	2.5	0.1191	2.364	1.850
2	4.384	942	161.9	0.0899	0.901	98.150

Figure S406. HPLC Spectra of **100**

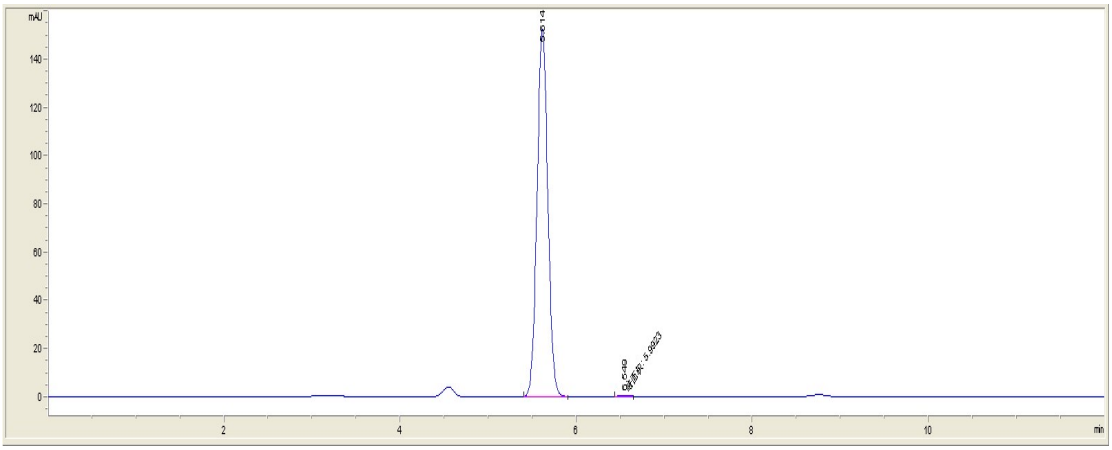


101



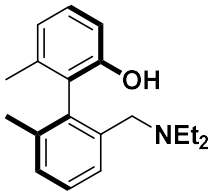
Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	5.599	2293	256.1	0.1492	1.065	50.813
2	6.528	2219.6	233.5	0.1584	0.907	49.187

Figure S407. HPLC Spectra of racemic **101**

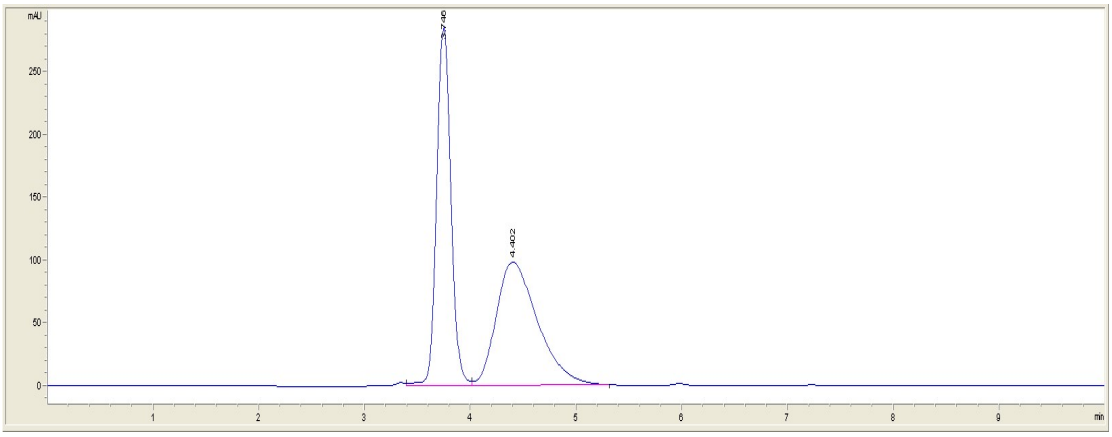


Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	5.614	1301.1	152.8	0.1313	0.945	99.542
2	6.549	6	7.4E-1	0.1355	0.972	0.458

Figure S408. HPLC Spectra of **101**

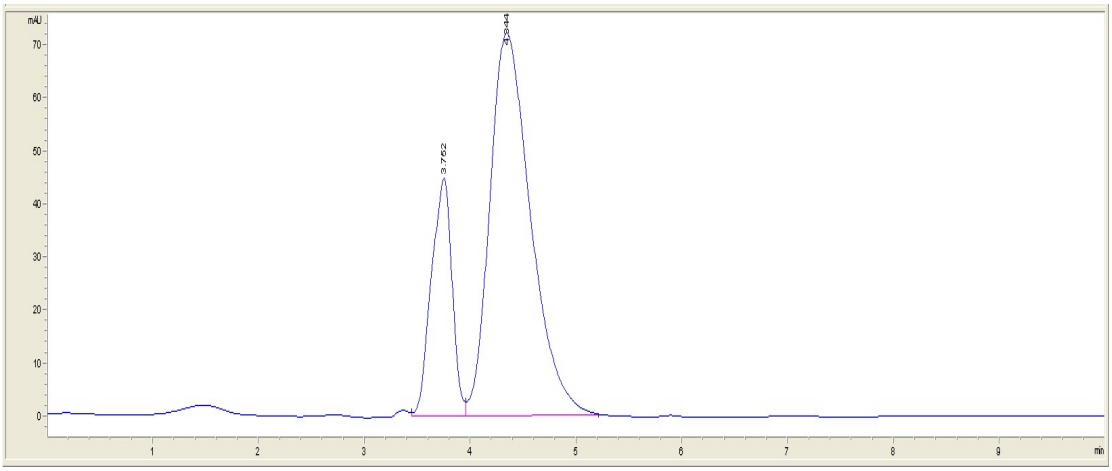


102



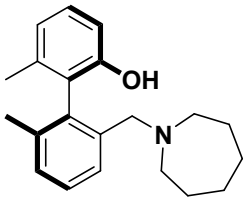
Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	3.746	2677.7	285.6	0.1454	0.918	49.858
2	4.402	2693	98.4	0.4194	0.635	50.142

Figure S409. HPLC Spectra of racemic **102**

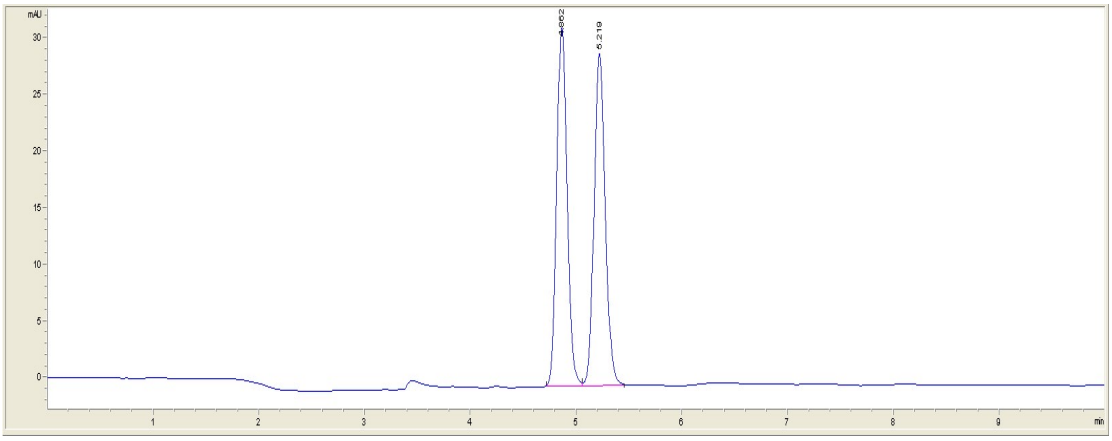


Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	3.752	617.6	45	0.2002	1.479	24.093
2	4.344	1945.7	72.3	0.4121	0.662	75.907

Figure S410. HPLC Spectra of **102**

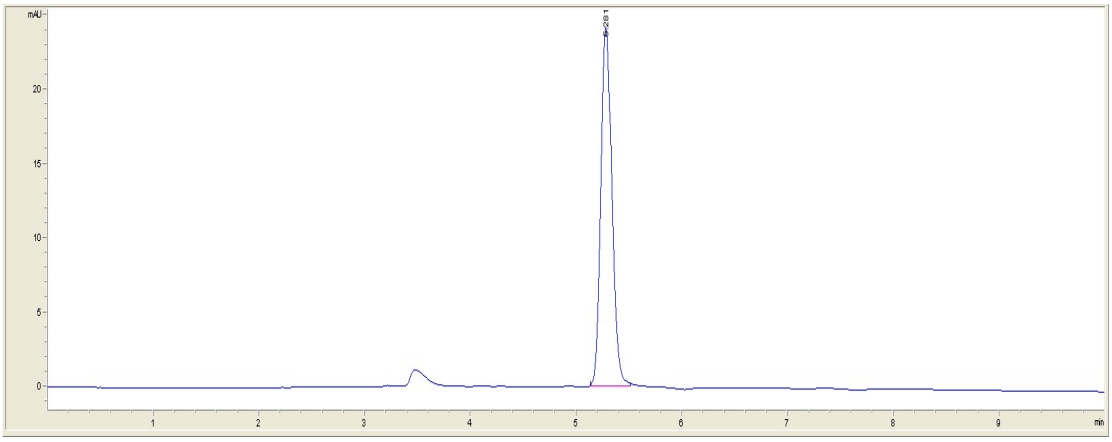


103



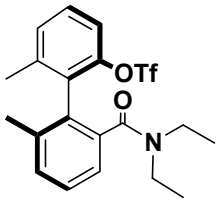
Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	4.862	217.7	31.8	0.106	0.852	50.080
2	5.219	217	29.4	0.1142	0.851	49.920

Figure S411. HPLC Spectra of racemic **103**

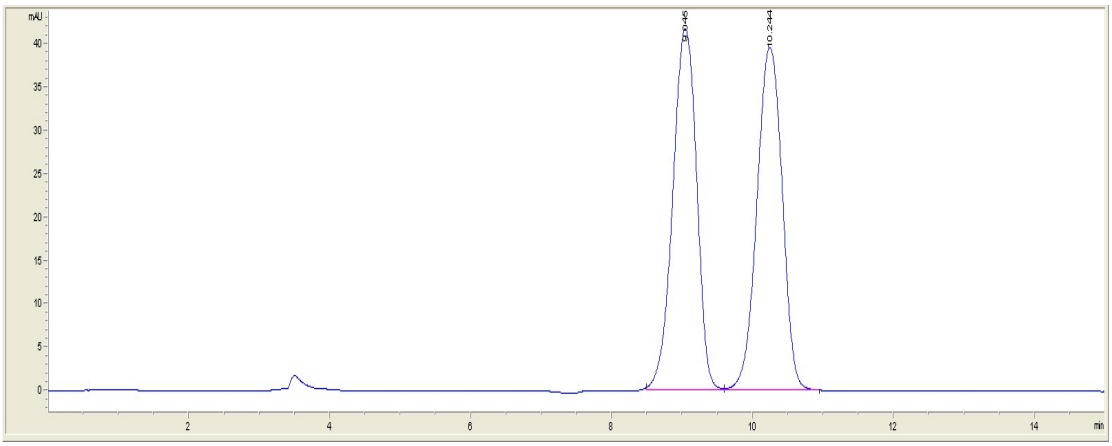


Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	5.281	176.9	24.2	0.1133	0.837	100.000

Figure S412. HPLC Spectra of **103**

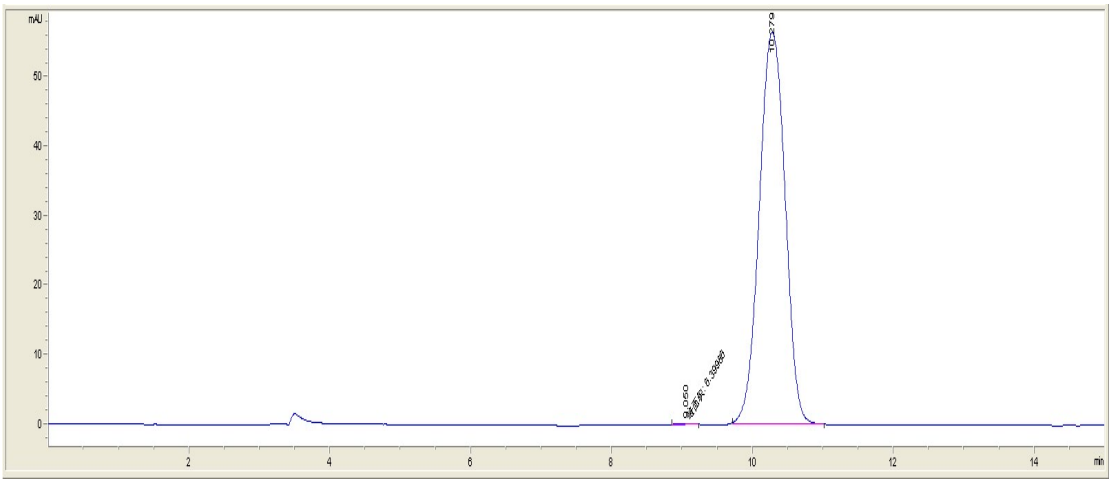


104



Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	9.045	985.1	41.7	0.3754	1.09	49.907
2	10.244	988.7	39.6	0.3975	1.017	50.093

Figure S413. HPLC Spectra of racemic **104**



Peak #	RetTime [min]	Area [mAU*s]	Height [mAU]	Width [min]	Symmetry	Area [%]
1	9.05	6.4	3.4E-1	0.3123	1.227	0.441
2	10.279	1444.3	56.6	0.4079	0.98	99.559

Figure S414. HPLC Spectra of **104**