Supporting Information

Rhodium(III)-Catalyzed Asymmetric [4+1] Spiroannulations of *O*-Pivaloyl Oximes with *α*-Diazo Compounds

Lincong Sun,[a] Bingxian Liu,[a] Yanlian Zhao,[b] Junbiao Chang,[a] Lingheng Kong,[c] Fen Wang,[c] Wei-Qiao Deng,[b] Xingwei Li*[a,b,c]

[a]Henan Key Laboratory of Organic Functional Molecule and Drug Innovation, Key Laboratory of Green Chemical Media and Reactions, Ministry of Education, School of Chemistry and Chemical Engineering, Henan Normal University, Xinxiang 453007, China
[b]Institute of Molecular Science and Engineering, Institute of Frontier and Interdisciplinary Sciences, Shandong University, Qingdao, China
[c]School of Chemistry and Chemical Engineering, Shaanxi Normal University, Xi'an 710062, China

* E-mail: lixw@snnu.edu.cn

Contents

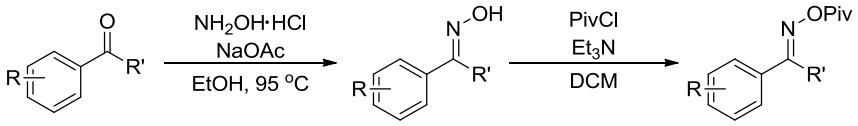
1. General Information

All chemicals were obtained from commercial sources and were used as received unless otherwise noted. All the reactions were carried out in an argon-filled glove box. The ^{1}H NMR spectra were recorded on a 400 MHz or 600 MHz NMR spectrometer. The ^{13}C NMR spectra were recorded at 100 MHz or 150 MHz. The ^{19}F NMR spectra were recorded at 376 MHz or 565 MHz. Chemical shifts were expressed in parts per million (δ) downfield from the internal standard tetramethylsilane (TMS), and were reported as s (singlet), d (doublet), t (triplet), dd (doublets of doublet), dt (doublets of triplet), and m (multiplet). The residual solvent signals were used as references and the chemical shifts were converted to the TMS scale ($CDCl_3$: δ H = 7.26 ppm, δ C = 77.16 ppm). The coupling constants *J* were given in Hz. High resolution mass spectra (HRMS) were obtained via ESI mode by using a MicroTOF mass spectrometer. The conversion of starting materials was monitored by thin layer chromatography (TLC) using silica gel plates (silica gel 60 F254 0.25 mm), and components were visualized by observation under UV light (254 and 365 nm). X-ray measurements were performed on a Bruker D& Advance X-ray powder diffractometer with graphite monochromatized Cu Kα radiation at 293 K. Column chromatography was performed on silica gel 200-300 mesh. The enantiomeric excess (ee) of the products were determined by high-performance liquid chromatography (HPLC) with a chiral stationary phase in comparison with the authentic racemate sample. All the chiral stationary phases including Chiralcel AD-H, IC-H, OD-H used in this study were purchased from Daicel Chirsal Technologies. Optical rotations were reported as follows: $[\alpha]_D^T$ = (c: g/100 mL, in $CDCl_3$).

Chiral rhodium catalysts[1] and diazo carbonyl compounds[2] were prepared according to published procedures. Other chemicals were purchased from commercial suppliers and were dried and purified when necessary.

2. General Procedure for the Preparation of Substrates

Synthesis of Oxime Esters

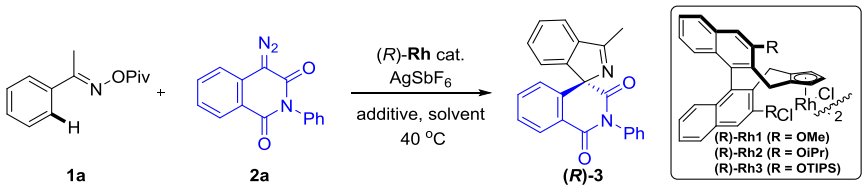


According to literature reports,[3] a mixture of ketone (20 mmol), $NH_2OH·HCl$ (30 mmol, 2.1 g), and NaOAc (50 mmol, 4.1 g) in ethanol (15 mL) and water (50 mL) was placed into a 100 mL round-bottomed flask with a reflux condenser. Then the reaction flask was heated to 95 ^oC and the reaction progress was monitored by TLC. After full conversion, the mixture was cooled to 0 ^oC. After cooling, the precipitate was filtered with suction, and the crude product was washed with cold water and dried under vacuum. Recrystallization of the crude product with ethanol gives the pure ketone oxime in nearly quantitative yields, which was dissolved in anhydrous dichloromethane (40 mL) and cooled to 0 ^oC. after the addition of Et_3N (3.03 g, 30 mmol), a solution of pivaloyl chloride (2.41 g, 20 mmol) in 10 mL of dichloromethane was added dropwise at 0 ^oC. the mixture was stirred at room temperature for 50 min and quenched with water. the aqueous layer was extracted with dichloromethane three times and the combined organic layers were washed with saturated $NaHCO_3$ and the brine. It was then dried over $MgSO_4$ and evaporated under reduced pressure. The purification was made by flash column chromatography to give the oxime ester.

3. Experimental Section

(1) Tables of the Optimization of Reaction Conditions

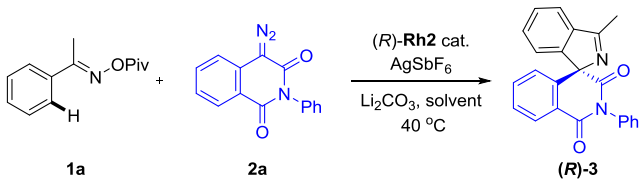
Table S1: Optimization of the reaction conditions of synthesis of (*R*)-3.[a]



Entry	Additive	Solvent	Yield [%][b]	ee [%]
1	Li_2CO_3	DCE	82	86
2[c]	Li_2CO_3	DCE	83	90
3[d]	Li_2CO_3	DCE	81	83

[a]Reaction Conditions: **1a** (0.06 mmol), **2a** (0.05 mmol), (*R*)-**Rh1** (5 mol%), $AgSbF_6$ (20 mol%), additive (1.0 equiv), solvent (1 mL), under Ar for 24 h, [b]isolated yield, [c](*R*)-**Rh2** was used, [d](*R*)-**Rh3** was used.

Table S2: Optimization of the reaction solvents of synthesis of (*R*)-3.[a]

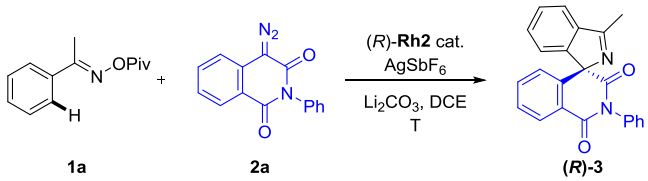


Entry	Solvent	Yield [%][b]	ee [%]
1	DCE	83	90
2	PhCl	72	89
3	THF	NR	-
4	MeOH	NR	-
5	1,4-Dioxane	NR	-
6	CH_3CN	NR	-
7	Acetone	NR	-
8	EtOAc	80	80
9	Ether	81	87
10	PhMe	80	84

11	DCM	78	79
12	TFE	65	75
13	$CHCl_3$	75	79
14	CCl_4	NR	-

[a]Reaction Conditions: **1a** (0.06 mmol), **2a** (0.05 mmol), (*R*)-**Rh2** (5 mol%), $AgSbF_6$ (20 mol%), additive (1.0 equiv), solvent (1 mL), under Ar for 24 h, [b]isolated yield.

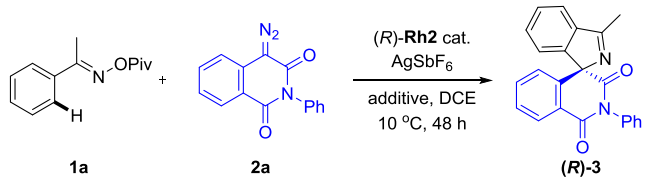
Table S3: Optimization of the reaction temperatures of synthesis of (*R*)-3.[a]



Entry	Temperature [°C]	Yield [%][b]	ee [%]
1	40	83	90
2	25	83	90
3[c]	10	84	91
4[c]	0	75	92
5[c]	-20	73	91

[a]Reaction Conditions: **1a** (0.06 mmol), **2a** (0.05 mmol), (*R*)-**Rh2** (5 mol%), $AgSbF_6$ (20 mol%), additive (1.0 equiv), solvent (1 mL), under Ar for 24 h, [b]isolated yield, [c] Under Ar for 48 h

Table S4: Optimization of the reaction additives of synthesis of (*R*)-3.[a]

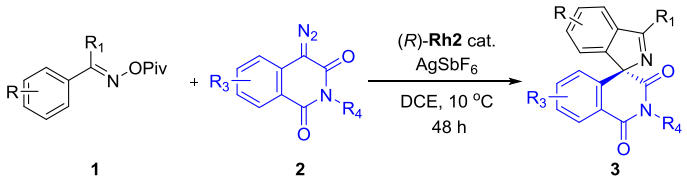


Entry	Additive	Yield [%][b]	ee [%]
1	Li_2CO_3	84	91
2	LiOAc	72	88
3	K_2CO_3	50	90
4	Na_2CO_3	55	90
5	Cs_2CO_3	NR	-
6	NaOAc	75	88
7	CsOAc	NR	-

8	HOAc	80	84
9	PivOH	81	89
10	$Zn(OTf)_2$	75	88
11	$Zn(OAc)_2$	78	85
12	-	83	91
13[c]	-	85	91

[a]Reaction Conditions: **1a** (0.06 mmol), **2a** (0.05 mmol), (*R*)-**Rh2** (5 mol%), $AgSbF_6$ (20 mol%), additive (1.0 equiv), solvent (1 mL), under Ar for 48 h, [b] isolated yield, [c](*R*)-**Rh2** (4 mol%), $AgSbF_6$ (16 mol%) were used.

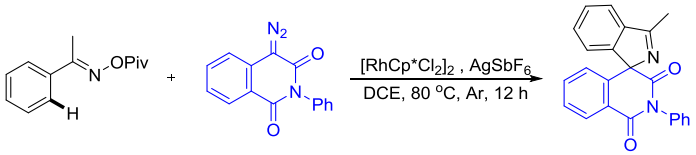
(2) General procedures for the synthesis of products 3 - 51



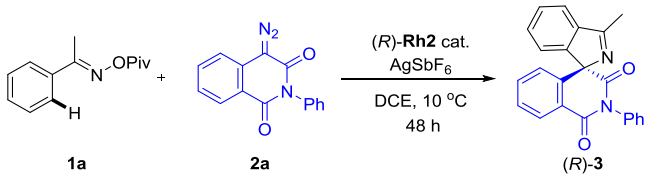
A mixture of **1** (0.12 mmol), **2** (0.1 mmol), (*R*)-**Rh2** (4 mol%), $AgSbF_6$ (16 mol%) were weighted in a pressure tube equipped with a stir bar. DCE (2 mL) was added and the mixture was stirred at 10 °C for 48 h under dry Ar atmosphere. Afterwards, it was evaporated under reduced pressure and the residue was adsorbed onto small amounts of silica. The purification was performed by flash column chromatography on silica gel (eluent: EtOAc/petroleum ether = 1:1).

(3) Diversification of the Products

(a) Scale-up Synthesis



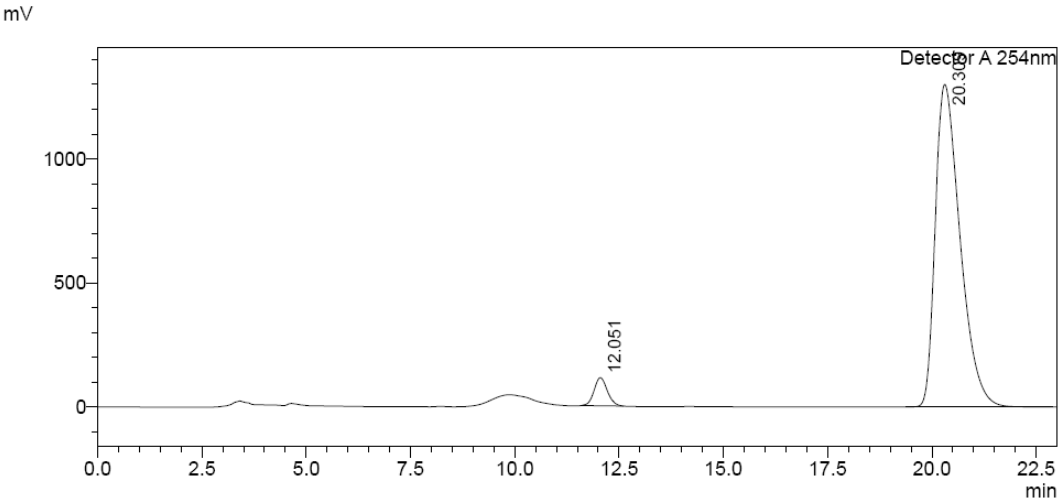
A mixture of **1a** (4.4 mmol, 0.96 g), **2a** (4.0 mmol, 1.05 g), $[RhCp^*Cl_2]_2$ (2.5 mol%, 61.8 mg), $AgSbF_6$ (10 mol%, 137.4 mg) were weighted in a pressure tube equipped with a stir bar. DCE (40 mL) was added and the mixture was stirred at 80 °C for 12 h under dry Ar atmosphere. Afterwards, it was evaporated under reduced pressure, and the residue was purified by silica gelchromatography using EtOAc/petroleum ether = 1:1 to afford rac-**3** (1.22 g, 87%).



A mixture of **1a** (1.2 mmol, 262.9 mg), **2a** (1.0 mmol, 263.1 mg), (*R*)-**Rh2** (4 mol%, 53 mg), $AgSbF_6$ (16 mol%, 55 mg) were weighted in a pressure tube equipped with a stir bar. DCE (20 mL) was added and the mixture was stirred at 10 °C for 48 h under dry Ar atmosphere. Afterwards, it was evaporated under reduced pressure, and the residue was purified by silica gelchromatography using

EtOAc/petroleum ether = 1:1 to afford **3** (301.2 mg, 85%, 91% ee).

<Chromatogram>

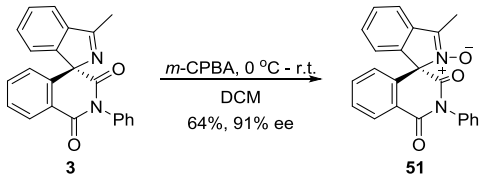


<Peak Table>

Detector A 254nm

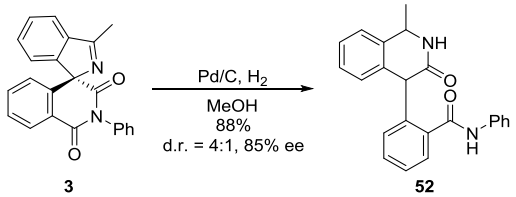
Peak#	Ret. Time	Area	Area%	Height	Conc.	Unit	Mark
1	12.051	2503177	4.447	113499	4.447		M
2	20.309	53790152	95.553	1298910	95.553		
Total		56293329	100.000	1412409			

(b) Synthetic Transformation



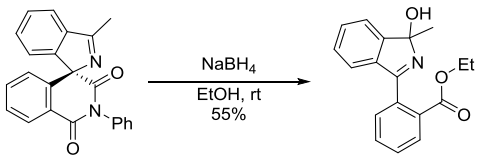
3 **51**

To a solution of **3** (91% ee, 35.2 mg, 0.10 mmol) in CH_2Cl_2 (2.0 mL) was added *m*-chloroperoxybenzoic acid (41 mg, 0.20 mmol) at 0 ℃. The reaction mixture was stirred at room temperature for 24 hours. Then the reaction mixture was quenched with saturated Na_2CO_3 aqueous solution and extracted with CH_2Cl_2 (4×20 mL). The combined organic layers were washed with brine, dried over Na_2SO_4 and filtrated. The solvent was removed under reduced pressure and the residue was purified by preparative TLC (EtOAc/petroleum ether = 2:1) to afford product **51** as a yellow solid (23.4 mg, 61% yield).



3 **52**

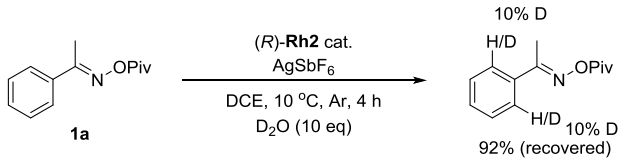
To a solution of **3** (91% ee, 35.2 mg, 0.10 mmol) in MeOH (2.0 mL) was added 10 mol % Pd/C (42.0 mg, 10 mol%). The mixture was stirred overnight under 1 atm of hydrogen at room temperature and filtered through a pad of silica, and the solvent was removed in vacuo. The residue was purified by silica gel chromatography (EtOAc/petroleum ether = 1:2) to give the **52** (31.2 mg (d.r = 4:1), 88% yield, 85% ee).



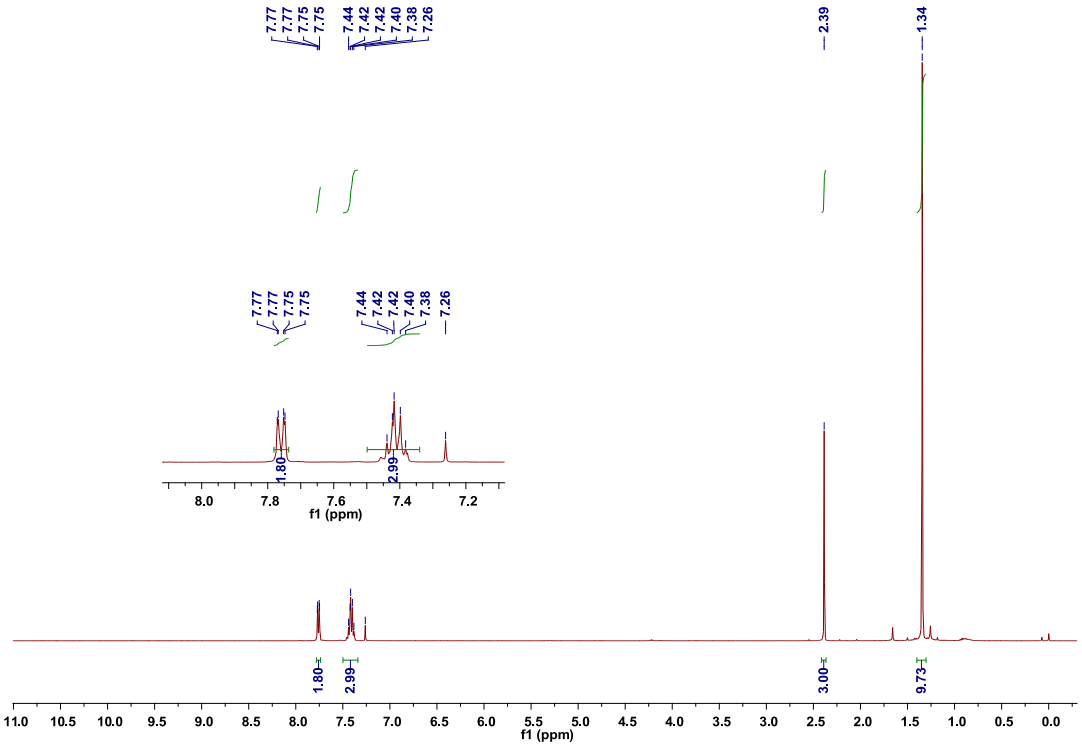
To a stirred suspension of **3** (35.2 mg, 0.10 mmol) in anhydrous ethanol (2.0 mL) was added $NaBH_4$ (3.0 mg, 0.08 mmol) at room temperature. After stirring for 12 h at the same temperature, the reaction was quenched with H_2O and extracted with dichloromethane. The extract was washed with brine and then dried over anhydrous Na_2SO_4. The solvent was evaporated in vacuo and the residue was purified by chromatography on silica gel (EtOAc/petroleum ether = 1:2) to afford **53** (16.3 mg, 55%).

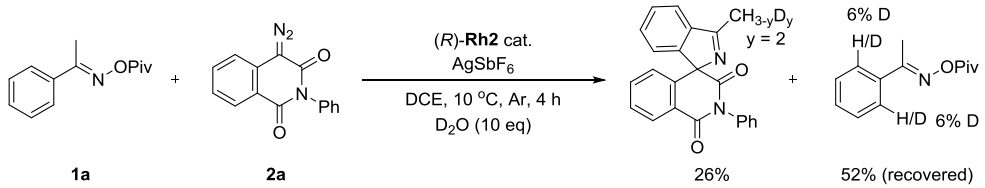
(4) Mechanistic Studies

(a) H/D Exchange experiment

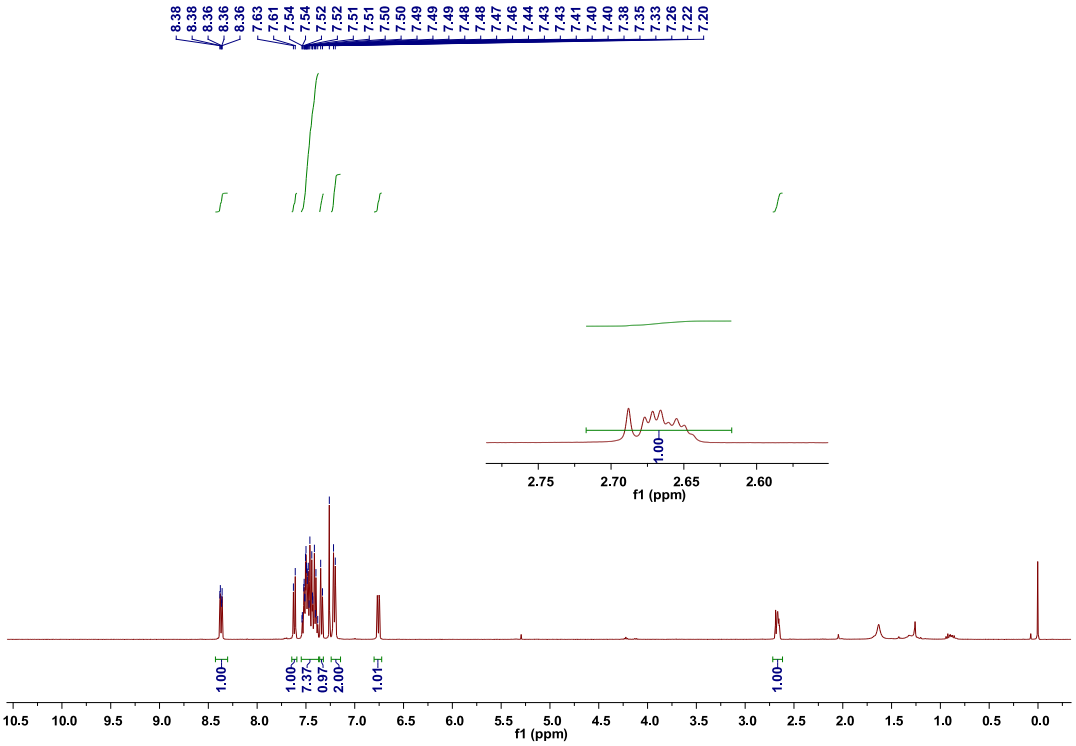


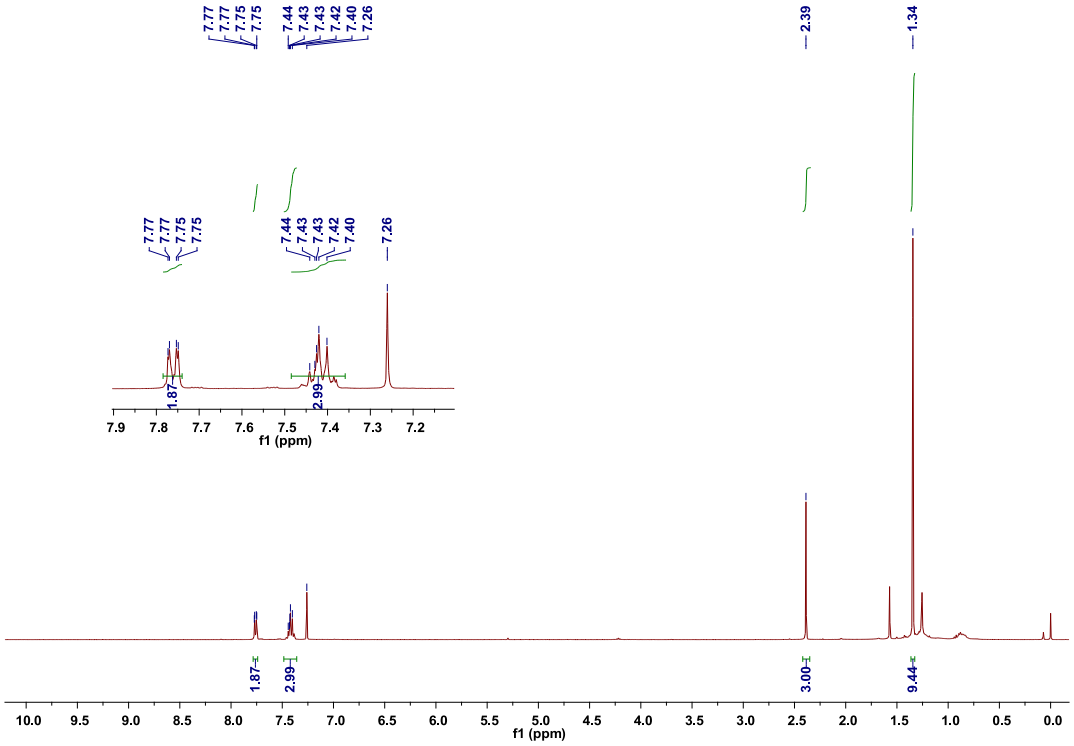
Procedures for H/D Exchange Studies in the absence of 2a: A mixture of arene **1a** (0.1 mmol), (*R*)-**Rh2** (4 mol%), $AgSbF_6$ (16 mol%) were weighted in a pressure tube equipped with a stir bar. DCE (2 mL) and D_2O (10 equiv) were added and the mixture was stirred at 10 °C for 4 h under Ar atmosphere. Afterwards, it was evaporated under reduced pressure and the residue was adsorbed onto small amounts of silica. The purification was performed by flash column chromatography on silica gel (EtOAc/petroleum ether = 1:1). ^1H NMR analysis indicated 10% deuteration at the *ortho* position of the phenyl.



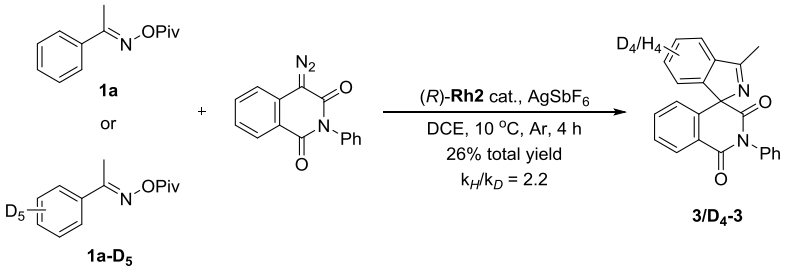


Procedures for H/D Exchange Studies in the Presence of 2a: A mixture of arene **1a** (0.12 mmol), **2a** (0.1 mmol), (*R*)-**Rh2** (4 mol%), $AgSbF_6$ (16 mol%) were weighted in a pressure tube equipped with a stir bar. DCE (2 mL) and D_2O (10 equiv) were added and the mixture was stirred at 10 ^oC for 4 h under Ar atmosphere. Afterwards, it was evaporated under reduced pressure and the residue was adsorbed onto small amounts of silica. The purification was performed by flash column chromatography on silica gel (EtOAc/petroleum ether = 1:1). The ratio was determined by ^1H NMR.

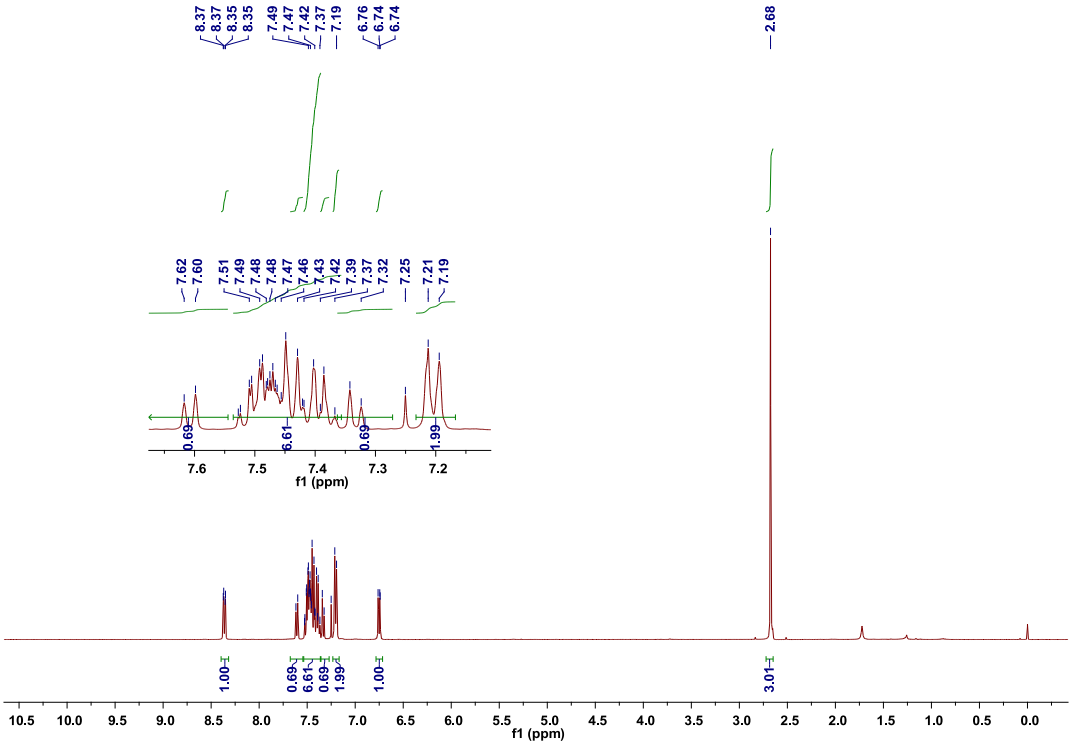




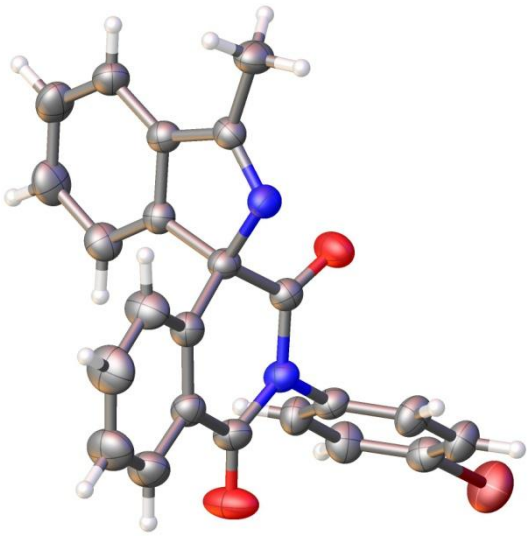
(d) KIE experiments



Two pressure tubes each was charged with **1a** (0.12 mmol, 1.2 equiv) or **1a**-d_5 (0.12 mmol, 1.2 equiv) and a stir bar. To each tube was added **2a** (0.1 mmol, 1.0 equiv), (*R*)-**Rh2** (4 mol%), $AgSbF_6$ (16 mol%) were weighted in a pressure tube equipped with a stir bar. DCE (2 mL) was added and the mixture was stirred at 10 ^oC for 4 h under Ar atmosphere. The reaction tubes were quenched by cooling in ice-water. The two mixtures were rapidly evaporated under reduced pressure separately. The purification was performed by flash column chromatography on silica gel (EtOAc/petroleum ether = 1:1), giving the mixed products **3**/D_4-**3** in 26% yield. k_H/k_D = 0.69/0.31 = 2.2 was determined by ^1H NMR spectroscopy.


8.37
8.37
8.35
8.35
7.49
7.47
7.42
7.37
7.19
6.76
6.74
6.74
2.68
7.62
7.60
7.51
7.49
7.48
7.48
7.47
7.46
7.43
7.42
7.39
7.37
7.32
7.25
7.21
7.19
0.69
6.61
0.69
1.99
7.6
7.5
7.4
7.3
7.2
f1 (ppm)
1.00
0.69
6.61
0.69
1.99
1.00
3.01
10.5
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)

4. X-Ray Crystal Structure of 44, 52 and 53.

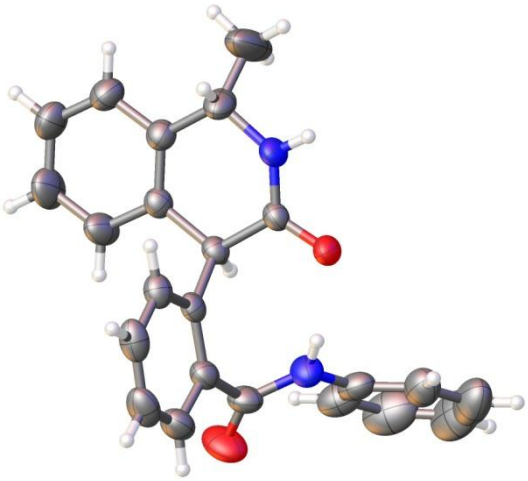


(CCDC 2069779)

Table 1 Crystal data and structure refinement for 44.

Identification code	SLC-5-33-20210310
Empirical formula	$C_{23}H_{15}BrN_2O_2$
Formula weight	431.28
Temperature/K	293(2)
Crystal system	orthorhombic
Space group	$P2_12_12_1$
a/Å	8.46680(10)
b/Å	12.02910(10)
c/Å	18.2481(2)
α/°	90
β/°	90
γ/°	90
Volume/Å^3	1858.53(3)
Z	4
ρ_{calc}g/cm^3	1.541
μ/mm^{-1}	3.192
F(000)	872.0
Crystal size/mm^3	0.1 × 0.1 × 0.1
Radiation	Cu Kα (λ = 1.54184)
2Θ range for data collection/	8.804 to 142.854
Index ranges	$-10 \le h \le 10$, $-14 \le k \le 14$, $-22 \le l \le 22$
Reflections collected	24553

Independent reflections	3613 [R_{int} = 0.0347, R_{sigma} = 0.0175]
Data/restraints/parameters	3613/0/254
Goodness-of-fit on F^2	1.076
Final R indexes [I>=2σ (I)]	R_1 = 0.0271, wR_2 = 0.0731
Final R indexes [all data]	R_1 = 0.0277, wR_2 = 0.0736
Largest diff. peak/hole / e $Å^{-3}$	0.22/-0.36
Flack parameter	-0.026(6)

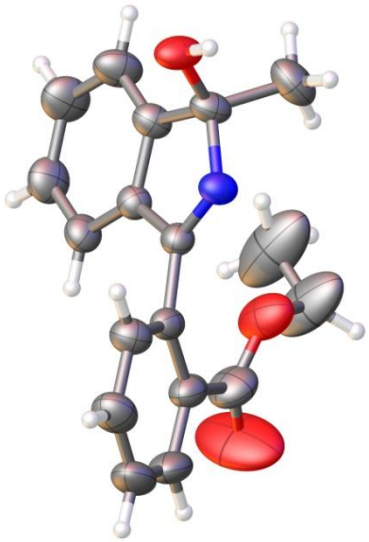


(CCDC 2073889)

Table 2 Crystal data and structure refinement for 52.

Identification code	SLC-20210326
Empirical formula	$C_{23}H_{20}N_2O_2$
Formula weight	356.41
Temperature/K	293(2)
Crystal system	triclinic
Space group	P-1
a/Å	8.5174(4)
b/Å	10.7513(5)
c/Å	10.7978(6)
α/°	90.516(4)
β/°	103.384(4)
γ/°	98.725(4)
Volume/$Å^3$	949.80(8)
Z	2
$\rho_{calc}g/cm^3$	1.246
μ/mm^{-1}	0.639
F(000)	376.0

Crystal size/mm^3	0.2 × 0.1 × 0.1
Radiation	CuKα (λ = 1.54184)
2Θ range for data collection/°	8.33 to 142.976
Index ranges	-10 ≤ h ≤ 10, -13 ≤ k ≤ 13, -13 ≤ l ≤ 12
Reflections collected	6678
Independent reflections	3614 [R_{int} = 0.0196, R_{sigma} = 0.0279]
Data/restraints/parameters	3614/0/245
Goodness-of-fit on F^2	1.042
Final R indexes [I>=2σ (I)]	R_1 = 0.0561, wR_2 = 0.1589
Final R indexes [all data]	R_1 = 0.0646, wR_2 = 0.1664
Largest diff. peak/hole / e Å^{-3}	0.72/-0.38



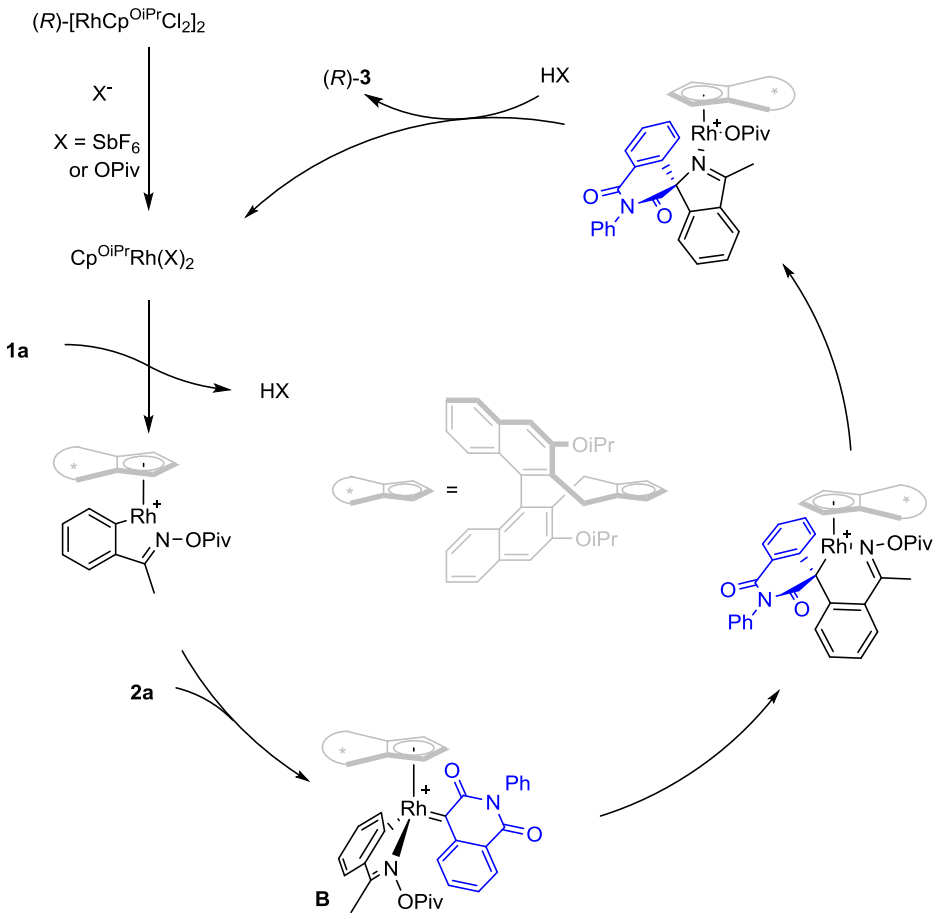
(CCDC 2073891)

Table 3 Crystal data and structure refinement for 53.

Identification code	SLC-20210329
Empirical formula	$C_{18}H_{15}NO_3$
Formula weight	293.31
Temperature/K	293(2)
Crystal system	triclinic
Space group	P-1
a/Å	7.4610(5)
b/Å	10.2760(5)
c/Å	11.7263(8)
α/°	70.212(5)
β/°	73.352(6)
γ/°	70.063(5)

Volume/$Å^3$	780.25(9)
Z	2
$\rho_{calc}g/cm^3$	1.248
μ/mm^{-1}	0.695
F(000)	308.0
Crystal size/mm^3	0.2 × 0.1 × 0.1
Radiation	CuKα (λ = 1.54184)
2Θ range for data collection/°	8.168 to 143.176
Index ranges	$-9 \leq h \leq 8$, $-10 \leq k \leq 12$, $-14 \leq l \leq 14$
Reflections collected	6371
Independent reflections	2972 [R_{int} = 0.0179, R_{sigma} = 0.0236]
Data/restraints/parameters	2972/0/202
Goodness-of-fit on F^2	1.045
Final R indexes [I>=2σ (I)]	R_1 = 0.0552, wR_2 = 0.1509
Final R indexes [all data]	R_1 = 0.0619, wR_2 = 0.1588
Largest diff. peak/hole / e $Å^{-3}$	0.33/-0.25

5. Possible Reaction Pathway.



6. Computational Methods

All calculations were performed by the Gaussian 16 program suite [4]. Density functional theory (DFT) was performed employing with the B3LYP [5-7] functional including the D3 version of Grimme's empirical dispersion correction with Becke−Johnson damping [8]. The SDD basis set with the associated effective core potential was carried out employing for Rh, and the standard 6-31G(d) basis set for H, C, N, and O atoms. Optimizations were conducted without any constraint. Frequency analysis was used to determine that each structure is a local minimum with no imaginary frequency. The energies were further estimated by single-point calculations using the B3LYP-D3(BJ)/def2-TZVPP [9] theoretical level. In order to be consistent with the experiment, all optimizations and energy calculations were conducted using the SMD solvation model [10] in dichloroethane (ε=10.125). The Gibbs free energy including the single-point corrections is used for the structural assessment.

Cartesian coordinates of all the structures

A Structure

C	-0.73823900	-0.24421300	-1.83785700
C	-0.63905700	0.87184000	-0.89945800
C	0.46325500	1.63736000	-1.26601500
C	1.15683400	0.98033700	-2.36047900
C	0.34755800	-0.16416400	-2.72437400
C	-1.89919100	-1.18798400	-2.00968200
C	-1.60348800	1.17532200	0.21021600
C	-7.55412300	1.24930700	-2.54957200
C	-7.26999100	-0.06877300	-2.12009100
C	-6.08099800	-0.34948200	-1.48056600
C	-5.12288000	0.67045800	-1.23847100
C	-5.40409500	2.00047400	-1.68588400
C	-6.63988200	2.25847300	-2.33846900
C	-3.87450300	0.42071000	-0.57891000
C	-2.96390100	1.44474200	-0.39487400
C	-3.24727400	2.76662100	-0.87319600
C	-4.45183100	3.03559000	-1.48707600
C	-3.53680300	-0.95547800	-0.09836500
C	-4.18019700	-1.46329300	1.07723100
C	-3.85587600	-2.78473600	1.51580600
C	-2.89659000	-3.54897700	0.80450700
C	-2.24659900	-3.01837500	-0.28876300
C	-2.58206600	-1.70730300	-0.76170300
C	-5.11285400	-0.70265100	1.83197700
C	-5.70866400	-1.22660900	2.95949200

C	-5.39709700	-2.53986700	3.38553200
C	-4.49081800	-3.29975100	2.67888700
O	-2.23449200	3.64381000	-0.64158100
C	-2.18190900	5.00046800	-1.14551700
O	-1.26541000	-3.62801100	-1.00682200
C	-0.86393900	-5.00960000	-0.82874900
H	0.77979300	2.55022200	-0.78060800
H	1.92235300	1.43207200	-2.97756000
H	0.52887500	-0.82939400	-3.55825400
H	-1.57285800	-2.02760500	-2.62547500
H	-2.64331400	-0.63382200	-2.59884600
H	-1.65228800	0.32888200	0.89518000
H	-1.24789200	2.04538700	0.76379600
H	-8.49401400	1.46258100	-3.05130500
H	-7.99160000	-0.86137800	-2.29635300
H	-5.86492600	-1.36125000	-1.15496300
H	-6.84841800	3.27198200	-2.67218300
H	-4.69861300	4.02624100	-1.84251400
H	-2.67741900	-4.54319900	1.16461800
H	-5.35009500	0.30617600	1.51271000
H	-6.41786000	-0.62938400	3.52549900
H	-5.87192900	-2.94555900	4.27465600
H	-4.24076300	-4.30678700	3.00384600
H	-1.18255700	5.30018500	-0.81634600
H	-0.07085200	-5.08690100	-1.57851600
Rh	1.80106100	-0.41738000	-0.86079600
C	3.03165400	-1.49599500	-2.01720700
C	3.29153200	-2.80099800	-1.52487700
C	2.81015500	-3.09926800	-0.17880600
N	2.05741900	-2.15626400	0.31061600
C	3.58525700	-1.10930600	-3.23642000
C	4.38086500	-2.00510600	-3.96078100
C	4.63247000	-3.29296900	-3.47822200
C	4.09328100	-3.69135900	-2.25829700
H	3.41668300	-0.11365600	-3.63206900
H	4.80779500	-1.68997800	-4.90908400
H	5.25281000	-3.97858400	-4.04673700
H	4.30399700	-4.68241600	-1.86942600
O	1.80892200	-2.27098200	1.68410900
C	0.56833100	-1.81741200	2.09851100
O	-0.28678200	-1.48301500	1.32270900
C	0.44415600	-1.89587600	3.61382800

C	-0.73285900	-1.00485000	4.03777700
H	-1.66399500	-1.32113600	3.56019000
H	-0.86154900	-1.06913200	5.12339800
H	-0.54881600	0.04156800	3.77332400
C	1.73925000	-1.44128100	4.30878000
H	2.58182300	-2.09423400	4.06367600
H	1.99804900	-0.41701400	4.02235300
H	1.59115800	-1.46867900	5.39376500
C	0.13761000	-3.37110500	3.96180400
H	-0.78005700	-3.70735700	3.46766900
H	0.95786700	-4.03344500	3.66593900
H	-0.00287200	-3.46226400	5.04433400
C	3.23356300	-4.31670500	0.57488100
H	2.70670000	-4.41377300	1.52186100
H	3.05445500	-5.20884800	-0.03268800
H	4.31123700	-4.26284000	0.77130700
C	-2.20313200	5.06193100	-2.67024600
H	-3.18802200	4.85435000	-3.09510200
H	-1.90467200	6.06703200	-2.98861800
H	-1.48647900	4.34488100	-3.08576300
C	-3.18552700	5.91728000	-0.45188600
H	-2.93826000	6.95907100	-0.68554700
H	-4.21741500	5.73941800	-0.76551700
H	-3.12402200	5.78696700	0.63375100
C	-1.97577600	-5.97972800	-1.21555800
H	-1.57325500	-6.99873300	-1.23718500
H	-2.80975600	-5.96112000	-0.50892300
H	-2.35933600	-5.74042700	-2.21296000
C	-0.23205600	-5.29202900	0.53611400
H	0.43452400	-6.15640800	0.44385300
H	0.36127000	-4.43605900	0.86254400
H	-0.96204400	-5.52401100	1.31466700
C	3.14010500	0.55183200	0.08120500
C	2.52519000	1.48404200	1.08694200
N	2.97742500	2.80454900	1.06818100
C	4.26043900	3.12842100	0.59428000
C	5.10929700	1.98049000	0.16594300
C	4.56730000	0.68030700	-0.04471000
C	6.46065600	2.22106800	-0.06117900
C	7.30487200	1.17137800	-0.43026700
C	6.79404700	-0.11995300	-0.59521100
C	5.43544000	-0.36216500	-0.43022700

O	4.65928800	4.27991300	0.60196000
O	1.66237100	1.09403600	1.85945200
C	2.16200300	3.82868900	1.67627400
C	1.97455200	3.84691600	3.05760400
C	1.14326600	4.81863800	3.61685600
C	0.51597900	5.76252600	2.80019700
C	0.72121600	5.74066600	1.41830700
C	1.54452900	4.76851600	0.84965700
H	6.84403700	3.22699400	0.06619600
H	8.36237500	1.36141900	-0.58387300
H	7.45501500	-0.93689200	-0.86578000
H	5.04411400	-1.35888400	-0.56616900
H	2.46875700	3.10986700	3.68052800
H	0.98642400	4.83595500	4.69107100
H	-0.13088100	6.51571100	3.24014500
H	0.23947300	6.47638200	0.78166200
H	1.70972100	4.73365900	-0.22237600

# of imaginary frequencies= 0

B Structure

C	-1.11193500	0.68863900	-1.60733700
C	-1.18688500	1.66868500	-0.52401700
C	-0.09328300	2.53052400	-0.65636800
C	0.72131300	2.09330000	-1.76443100
C	0.01018300	1.00000700	-2.39124900
C	-2.08884700	-0.41304100	-1.93275300
C	-2.23750000	1.74056200	0.54747900
C	-8.15222700	0.07180300	-1.75113100
C	-7.44931000	-1.10522500	-1.39960200
C	-6.17451100	-1.02433800	-0.88090400
C	-5.54431400	0.23372900	-0.68447100
C	-6.24861300	1.42233400	-1.05602400
C	-7.56261900	1.30582400	-1.58511500
C	-4.22176000	0.36479300	-0.14715700
C	-3.64187400	1.61096400	-0.00002300
C	-4.34655900	2.78950500	-0.40806000
C	-5.62827000	2.69019200	-0.90705500
C	-3.43144700	-0.86946600	0.15451100
C	-3.70028200	-1.63537500	1.33180300
C	-2.96965200	-2.84621600	1.55236200

C	-2.01511100	-3.26580200	0.59245200
C	-1.77745500	-2.51571500	-0.53711600
C	-2.45804400	-1.27752100	-0.74624400
C	-4.64722900	-1.22400400	2.30801600
C	-4.86595600	-1.97516400	3.44283400
C	-4.15165200	-3.17971800	3.65352600
C	-3.22487300	-3.60432300	2.72690300
O	-3.63809300	3.93724700	-0.22802600
C	-3.94163800	5.19364500	-0.88793200
O	-0.84607200	-2.90976000	-1.47217600
C	-1.18305200	-4.00040600	-2.38547100
H	0.12647800	3.36691500	-0.00765800
H	1.54087600	2.64746700	-2.20337300
H	0.29252100	0.49439600	-3.30331600
H	-1.64476700	-1.02721700	-2.71548400
H	-2.99539000	0.04312400	-2.34749400
H	-2.06166200	0.93477600	1.26055300
H	-2.12641300	2.68764600	1.07928600
H	-9.15733900	-0.00130700	-2.15716500
H	-7.91695100	-2.07549400	-1.54077200
H	-5.63928100	-1.92926900	-0.61517400
H	-8.09378000	2.21343400	-1.86083700
H	-6.18720200	3.56576600	-1.20545400
H	-1.46904800	-4.18758500	0.75636500
H	-5.19571600	-0.30137200	2.15102000
H	-5.59060500	-1.64306900	4.18067200
H	-4.33683500	-3.76653200	4.54870100
H	-2.67507500	-4.52957200	2.87829300
H	-3.04647700	5.77405200	-0.64387600
H	-0.38280400	-3.92081400	-3.12710700
Rh	1.22224000	0.35563400	-0.52331600
C	2.31437600	-0.66948800	-1.85980300
C	2.33188800	-2.06556300	-1.63668500
C	1.78748200	-2.52005500	-0.36404400
N	1.24904500	-1.56410400	0.33567900
C	2.95809400	-0.13936000	-2.97359500
C	3.59945200	-0.99572500	-3.87926900
C	3.59732400	-2.37803900	-3.67680700
C	2.96929100	-2.91431900	-2.55452400
H	2.96411900	0.93102300	-3.15328800
H	4.10160500	-0.57443100	-4.74597200
H	4.09279100	-3.03486500	-4.38476500

H	2.98943800	-3.98601000	-2.38635500
O	1.05966900	-1.93957700	1.67556300
C	0.15730700	-1.22042900	2.40913200
O	-0.57769700	-0.39482300	1.92489000
C	0.28581700	-1.56504800	3.88716900
C	-0.92237100	-0.97632400	4.62722400
H	-1.85958200	-1.40909000	4.26525300
H	-0.83191500	-1.19530100	5.69634100
H	-0.97450700	0.10911700	4.50084000
C	1.59166300	-0.90326200	4.38622600
H	2.46848600	-1.31703700	3.87802400
H	1.57342200	0.18044900	4.22315500
H	1.69860400	-1.08469300	5.46111800
C	0.35382700	-3.08907500	4.09403200
H	-0.54290100	-3.57917300	3.70173500
H	1.23171400	-3.52508500	3.60930000
H	0.41544600	-3.30151100	5.16673200
C	1.94891500	-3.90543600	0.16202600
H	1.10504900	-4.18102700	0.79528500
H	2.03978900	-4.62340900	-0.65302000
H	2.86132400	-3.95857500	0.76980900
C	-4.00591300	5.05406300	-2.40578200
H	-4.90452400	4.53401700	-2.74689700
H	-4.00382300	6.05353500	-2.85444200
H	-3.12788900	4.51174400	-2.77363000
C	-5.13651700	5.91363700	-0.26625700
H	-5.12663700	6.96079200	-0.58938400
H	-6.09861600	5.48556500	-0.55929800
H	-5.06383700	5.89362200	0.82621600
C	-2.52920500	-3.78641400	-3.06781700
H	-2.70173800	-4.59458400	-3.78696500
H	-3.34877200	-3.80257200	-2.34114400
H	-2.56114300	-2.83743200	-3.61092900
C	-1.09440900	-5.36543500	-1.71089600
H	-1.13705000	-6.14849200	-2.47665800
H	-0.15262100	-5.47238200	-1.16446900
H	-1.92621800	-5.52952400	-1.01883200
C	2.73642500	0.93864700	0.46919800
C	4.08312100	0.29631400	0.36949300
N	5.15892600	1.18194100	0.19747900
C	5.10946100	2.51561300	0.64261400
C	3.87223400	2.91205800	1.36878800

C	2.70628900	2.10729600	1.31157200
C	3.86235900	4.10415300	2.08655100
C	2.72296000	4.47187300	2.80830000
C	1.58498000	3.65790500	2.80181300
C	1.56528600	2.49057900	2.04446000
O	6.05697800	3.26801600	0.48894400
O	4.24594700	-0.91048800	0.41918800
C	6.40960100	0.63867400	-0.27413600
C	6.48244200	0.17361900	-1.58656100
C	7.67681500	-0.37796400	-2.05031000
C	8.78822100	-0.45144500	-1.20731100
C	8.70315600	0.02057100	0.10533700
C	7.50889600	0.56263000	0.58050900
H	4.74863400	4.72874900	2.08649900
H	2.72807800	5.39072100	3.38591300
H	0.71227300	3.93817000	3.38304400
H	0.69408200	1.84673400	2.03635700
H	5.60993500	0.23589900	-2.22821300
H	7.73710500	-0.74672600	-3.06994400
H	9.71879700	-0.87704400	-1.57115200
H	9.56493000	-0.03737400	0.76350800
H	7.42793600	0.92291300	1.60066100

# of imaginary frequencies= 0

7. References

[1].a) B. Ye, N. Cramer, *J. Am. Chem. Soc*. **2013**, *135*, 636; b) G. Smits, B. Audic, M. D. Wodrich, C. Corminboeuf, N. Cramer, *Chem. Sci*. **2017**, *8*, 7174; c)Y. Sun, N. Cramer, *Chem. Sci*. **2018**, *9*, 2981. d) Y. Sun, N. Cramer, *Angew.Chem. Int. Ed*. **2018**, *57*,15539.

[2].a) S. Zhu, X. Song, Y. Li, Y. Cai, Q. Zhou, *J. Am. Chem. Soc.* **2010**, *132*, 16374. b) D. Dar'in, G. Kantin, M. Krasavin, *Chem. Commun*. **2019**, *55*, 5239.

[3]. a) G. Zhang, X. Wen, Y. Wang, W. Mo, C. Ding, *J. Org. Chem.* **2011**, *76*, 4665. b) J. M. Neely, T. Rovis, *J. Am. Chem. Soc.* **2012**, *135*, 66.

[4] M. J. Frisch, G. W. Trucks, H. B. Schlegel, G. E. Scuseria, M. A. Robb, J. R. Cheeseman, G. Scalmani, V. Barone, G. A. Petersson, H. Nakatsuji, X. Li, M. Caricato, A. V. Marenich, J. Bloino, B. G. Janesko, R. Gomperts, B. Mennucci, H. P. Hratchian, J. V. Ortiz, A. F. Izmaylov, J. L. Sonnenberg, D. Williams–Young, F. Ding, F. Lipparini, F. Egidi, J. Goings, B. Peng, A. Petrone, T. Henderson, D. Ranasinghe, V. G. Zakrzewski, J. Gao, N. Rega, G. Zheng, W. Liang, M. Hada, M. Ehara, K. Toyota, R. Fukuda, J. Hasegawa, M. Ishida, T. Nakajima, Y. Honda, O. Kitao, H. Nakai, T. Vreven, K. Throssell, J. A. Montgomery, J. E. Peralta Jr., F. Ogliaro, M. J. Bearpark, J. J. Heyd, E. N. Brothers, K. N. Kudin, V. N. Staroverov, T. A. Keith, R. Kobayashi, J. Normand, K. Raghavachari, A. P. Rendell, J. C. Burant, S. S. Iyengar, J. Tomasi, M. Cossi, J. M. Millam, M. Klene, C. Adamo, R. Cammi, J. W. Ochterski, R. L. Martin, K. Morokuma, O. Farkas, J. B. Foresman, D. J. Fox, Gaussian, Inc., Wallingford CT **2019**.

[5] A. D. Becke, *J. Chem. Phys.* **1993**, *98*, 5648.

[6] C. Lee, W. Yang, R. G. Parr, *Phys. Rev. B: Condens. Matter Mater. Phys*. **1988**, *37*, 785.

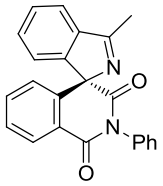
[7] P. J. Stephens, F. J. Devlin, C. F. Chabalowski, M. J. Frisch, *J. Phys. Chem*. **1994**, *98*, 11623.

[8] E. R. Johnson, A. D. Becke, *J. Chem. Phys*. **2005**, *123*, 024101.

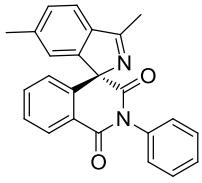
[9] F. Weigend, R. Ahlrichs, *Phys. Chem. Chem. Phys*. **2005**, *7*, 3297.

[10] A. V. Marenich, C. J. Cramer, D. G. Truhlar, *J. Phys. Chem. B*. **2009**, *113*, 6378.

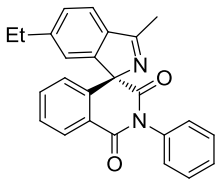
8. Characterization Data



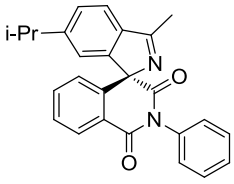
(*R*)-3-methyl-2'-phenyl-1'*H*-spiro[isoindole-1,4'-isoquinoline]-1',3'(2'*H*)-dione (**3**). Colorless solid (29.9 mg, 85%, m.p. 227 - 228 °C). ^{1}H NMR (600 MHz, $CDCl_3$) δ 8.37 (dd, *J* = 7.6, 1.5 Hz, 1H), 7.62 (d, *J* = 7.6 Hz, 1H), 7.54 – 7.37 (m, 7H), 7.34 (d, *J* = 7.5 Hz, 1H), 7.22 (d, *J* = 7.5 Hz, 2H), 6.80 – 6.72 (m, 1H), 2.69 (s, 3H). ^{13}C NMR (150 MHz, $CDCl_3$) δ 176.5, 168.4, 164.6, 153.2, 139.9, 136.3, 135.2, 134.5, 130.3, 129.8, 129.33, 129.29, 129.1, 128.8, 128.4, 125.49, 125.47, 122.4, 121.8, 82.6, 16.9. HRMS (ESI-TOF) m/z: $[M + H]^+$ Calcd for $C_{23}H_{17}N_2O_2^+$ 353.1285, Found: 353.1276. Enantiomeric excess was determined by HPLC with a Daicel Chiralpak AD-H, n-hexane/2-propanol = 70/30, v = 1.0 mL·min-1, λ = 254 nm, t (minor) = 11.6 min, t (major) = 19.2 min, 91% ee; $[\alpha]_D^{25.6}$ = +71.67 (c = 1.0, $CHCl_3$).



(*R*)-3,6-dimethyl-2'-phenyl-1'*H*-spiro[isoindole-1,4'-isoquinoline]-1',3'(2'*H*)-dione (**4**). Colorless solid (28.9 mg, 79%, m.p. 199 - 200 °C). ^{1}H NMR (600 MHz, $CDCl_3$) δ 8.37 (dd, *J* = 7.5, 1.6 Hz, 1H), 7.55 – 7.48 (m, 3H), 7.46 (t, *J* = 7.6 Hz, 2H), 7.41 – 7.39 (m, 1H), 7.30 (d, *J* = 7.7 Hz, 1H), 7.22 (d, *J* = 7.5 Hz, 2H), 7.13 (s, 1H), 6.79 (d, *J* = 7.1 Hz, 1H), 2.70 (s, 3H), 2.39 (s, 3H). ^{13}C NMR (150 MHz, $CDCl_3$) δ 177.2, 168.2, 164.5, 153.5, 141.9, 137.0, 136.0, 135.1, 134.6, 130.4, 129.9, 129.3, 129.2, 128.8, 128.5, 125.6, 125.5, 122.53, 122.48, 81.9, 21.9, 16.8. HRMS (ESI-TOF) m/z: $[M + H]^+$ Calcd for $C_{24}H_{19}N_2O_2^+$ 367.1441, Found: 367.1439. Enantiomeric excess was determined by HPLC with a Daicel Chiralpak AD-H, n-hexane/2-propanol = 70/30, v = 1.0 mL·min-1, λ = 254 nm, t (minor) = 8.9 min, t (major) = 13.8 min, 89% ee; $[\alpha]_D^{25.6}$ = +120.60 (c = 1.0, $CHCl_3$).

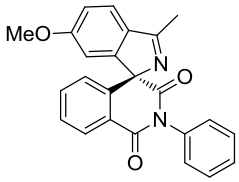


(*R*)-6-ethyl-3-methyl-2'-phenyl-1'*H*-spiro[isoindole-1,4'-isoquinoline]-1',3'(2'*H*)-dione (**5**). Colorless solid (32.8 mg, 86%, m.p. 178 - 179 °C). ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.42 – 8.34 (m, 1H), 7.59 – 7.49 (m, 3H), 7.48 – 7.44 (m, 2H), 7.42 – 7.38 (m, 1H), 7.33 (d, *J* = 7.8 Hz, 1H), 7.21 (d, *J* = 7.3 Hz, 2H), 7.15 (s, 1H), 6.81 – 6.79 (m, 1H), 2.71 – 2.65 (m, 5H), 1.21 (t, *J* = 7.6 Hz, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 177.0, 168.4, 164.6, 153.5, 148.0, 137.3, 136.2, 135.2, 134.6, 129.8, 129.3, 129.2, 129.1, 128.8, 128.4, 125.6, 125.5, 122.5, 121.3, 82.1, 29.2, 16.9, 15.6. HRMS (ESI-TOF) m/z: $[M + H]^+$ Calcd for $C_{25}H_{21}N_2O_2^+$ 381.1598, Found: 381.1590. Enantiomeric excess was determined by HPLC with a Daicel Chiralpak AD-H, n-hexane/2-propanol = 90/10, v = 1.0 mL·min-1, λ = 254 nm, t (minor) = 29.8 min, t (major) = 40.9 min, 89% ee; $[\alpha]_D^{25.6}$ = +201.13 (c = 1.0, $CHCl_3$).

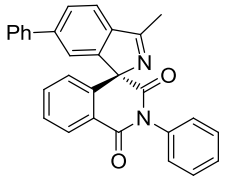


(*R*)-6-isopropyl-3-methyl-2'-phenyl-1'H-spiro[isoindole-1,4'-isoquinoline]-1',3'(2'H)-dione (**6**). Brown solid (38.7 mg, 98%, m.p. 164 - 165 °C). ^{1}H NMR (400 MHz, DMSO–d_6) δ 8.29– 8.27 (m, 1H), 7.80 (d, *J* = 7.8 Hz, 1H), 7.66 – 7.61 (m, 2H), 7.55 – 7.50 (m, 4H), 7.47 – 7.43 (m, 1H), 7.32 (d, *J* = 7.4 Hz, 2H), 6.79 – 6.77 (m, 1H), 3.04 – 2.98 (m, 1H), 2.68 (s, 3H), 1.21 – 1.18 (m, 6H). ^{13}C NMR (100 MHz, DMSO–d_6) δ 177.4, 168.2, 164.3, 153.6, 153.0, 137.5, 136.3, 135.9, 135.0, 129.6,

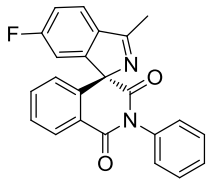
129.5, 129.3, 129.1, 128.9, 128.0, 126.1, 125.6, 123.6, 120.6, 81.5, 34.1, 24.4, 24.1, 16.8. HRMS (ESI-TOF) m/z: $[M + H]^+$ Calcd for $C_{26}H_{23}N_2O_4^+$ 395.1754, Found: 395.1752. Enantiomeric excess was determined by HPLC with a Daicel Chiralpak AD-H, n-hexane/2-propanol = 90/10, v = 1.0 mL·min-1, λ = 254 nm, t (minor) = 19.4 min, t (major) = 30.7 min, 87% ee; $[\alpha]_D^{25.6}$ = +172.80 (c = 1.0, $CHCl_3$).



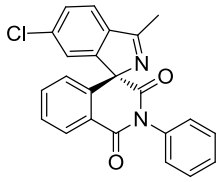
(*R*)-6-methoxy-3-methyl-2'-phenyl-1'*H*-spiro[isoindole-1,4'-isoquinoline]-1',3'(2'*H*)-dione (**7**). Purple solid (25.6 mg, 67%, m.p. 205 - 206 °C). ^{1}H NMR (600 MHz, $CDCl_3$) δ 8.38 – 8.34 (m, 1H), 7.55 – 7.48 (m, 3H), 7.46 (t, *J* = 7.6 Hz, 2H), 7.40 (t, *J* = 7.4 Hz, 1H), 7.23 (d, *J* = 7.5 Hz, 2H), 6.99 (dd, *J* = 8.4, 2.1 Hz, 1H), 6.83 (d, *J* = 2.0 Hz, 1H), 6.80 – 6.77 (m, 1H), 3.79 (s, 3H), 2.65 (s, 3H). ^{13}C NMR (150 MHz, $CDCl_3$) δ 176.2, 168.3, 164.5, 162.2, 155.4, 136.3, 135.1, 134.5, 132.7, 129.8, 129.3, 129.1, 128.8, 128.4, 125.7, 125.4, 123.6, 115.2, 107.9, 81.8, 55.9, 16.8. HRMS (ESI-TOF) m/z: $[M + H]^+$ Calcd for $C_{24}H_{19}N_2O_3^+$ 383.1390, Found: 383.1383. Enantiomeric excess was determined by HPLC with a Daicel Chiralpak AD-H, n-hexane/2-propanol = 70/30, v = 1.0 mL·min-1, λ = 254 nm, t (minor) = 12.1 min, t (major) = 23.0 min, 89% ee; $[\alpha]_D^{25.6}$ = +16.20 (c = 0.5, $CHCl_3$).



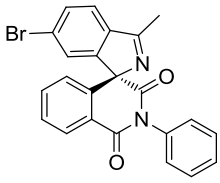
(*R*)-3-methyl-2',6-diphenyl-1'*H*-spiro[isoindole-1,4'-isoquinoline]-1',3'(2'*H*)-dione (**8**). Black solid (36.0 mg, 84%, m.p. 214 - 215 °C). ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.50 – 8.40 (m, 1H), 7.76 (q, *J* = 7.9 Hz, 2H), 7.63 – 7.38 (m, 12H), 7.29 (d, *J* = 7.5 Hz, 2H), 6.88 (d, *J* = 7.9 Hz, 1H), 2.80 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 176.8, 168.1, 164.5, 153.9, 144.2, 139.8, 138.5, 135.9, 135.1, 134.6, 129.9, 129.34, 129.26, 129.1, 128.8, 128.4, 127.5, 125.7, 125.5, 123.0, 120.4, 82.3, 16.9. HRMS (ESI-TOF) m/z: $[M + H]^+$ Calcd for $C_{29}H_{21}N_2O_2^+$ 429.1598, Found: 429.1597. Enantiomeric excess was determined by HPLC with a Daicel Chiralpak AD-H, n-hexane/2-propanol = 70/30, v = 1.0 mL·min-1, λ = 254 nm, t (minor) = 11.4 min, t (major) = 13.2 min, 89% ee; $[\alpha]_D^{25.6}$ = +236.27 (c = 1.0, $CHCl_3$).



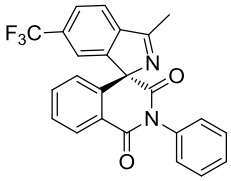
(*R*)-6-fluoro-3-methyl-2'-phenyl-1'*H*-spiro[isoindole-1,4'-isoquinoline]-1',3'(2'*H*)-dione (**9**). Purple solid (29.5 mg, 80%, m.p. 254 - 255 °C). ^{1}H NMR (600 MHz, $CDCl_3$) δ 8.38 (dd, *J* = 7.7, 1.2 Hz, 1H), 7.61 (dd, *J* = 8.3, 4.6 Hz, 1H), 7.55 (t, *J* = 7.3 Hz, 1H), 7.54 – 7.50 (m, 1H), 7.47 (t, *J* = 7.6 Hz, 2H), 7.41 (t, *J* = 7.4 Hz, 1H), 7.23 – 7.20 (m, 3H), 7.05 (dd, *J* = 7.5, 2.1 Hz, 1H), 6.76 (d, *J* = 7.5 Hz, 1H), 2.69 (s, 3H). ^{13}C NMR (150 MHz, $CDCl_3$) δ 176.0, 167.6, 164.5 (d, *J* = 252.6 Hz, 1C), 164.2, 155.5 (d, *J* = 8.7 Hz, 1C), 135.9, 135.2, 134.9, 134.7, 130.1, 129.6, 129.4, 129.0, 128.4, 125.6, 125.6, 124.2 (d, *J* = 9.8 Hz, 6H), 117.1 (d, *J* = 23.6 Hz, 1C), 110.2 (d, *J* = 24.5 Hz, 1C), 82.03, 16.85. ^{19}F NMR (376 MHz, $CDCl_3$) δ -108.16. HRMS (ESI-TOF) m/z: $[M + H]^+$ Calcd for $C_{23}H_{16}FN_2O_2^+$ 371.1190, Found: 371.1186. Enantiomeric excess was determined by HPLC with a Daicel Chiralpak AD-H, n-hexane/2-propanol = 70/30, v = 1.0 mL·min-1, λ = 254 nm, t (minor) = 9.2 min, t (major) = 16.2 min, 88% ee; $[\alpha]_D^{25.6}$ = +114.00 (c = 1.0, $CHCl_3$).



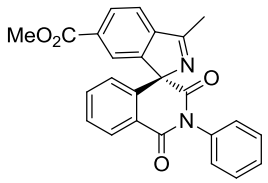
(*R*)-6-chloro-3-methyl-2'-phenyl-1'*H*-spiro[isoindole-1,4'-isoquinoline]-1',3'(2'*H*)-dione (**10**). Purple solid (28.8 mg, 75%, m.p. 209 - 210 °C). ^{1}H NMR (600 MHz, $CDCl_3$) δ 8.38 (dd, *J* = 7.7, 1.2 Hz, 1H), 7.58 – 7.54 (m, 2H), 7.54 – 7.51 (m, 1H), 7.50 – 7.45 (m, 3H), 7.44 – 7.39 (m, 1H), 7.32 (d, *J* = 1.5 Hz, 1H), 7.23 (d, *J* = 7.4 Hz, 2H), 6.75 (d, *J* = 7.5 Hz, 1H), 2.68 (s, 3H). ^{13}C NMR (150 MHz, $CDCl_3$) δ 175.9, 167.6, 164.2, 154.7, 138.3, 137.5, 135.1, 134.9, 134.7, 130.1, 130.0, 129.6, 129.4, 129.0, 128.4, 125.6, 125.5, 123.5, 122.7, 82.2, 16.9. HRMS (ESI-TOF) m/z: $[M + H]^+$ Calcd for $C_{23}H_{16}ClN_2O_2^+$ 387.0895, Found: 387.0888. Enantiomeric excess was determined by HPLC with a Daicel Chiralpak AD-H, n-hexane/2-propanol = 70/30, v = 1.0 mL·min-1, λ = 254 nm, t (minor) = 8.8 min, t (major) = 16.0 min, 90% ee; $[\alpha]_D^{25.6}$ = +305.20 (c = 1.0, $CHCl_3$).



(*R*)-6-bromo-3-methyl-2'-phenyl-1'*H*-spiro[isoindole-1,4'-isoquinoline]-1',3'(2'*H*)-dione (**11**). Purple solid (33.7 mg, 78%, m.p. 108 - 109 °C). ^{1}H NMR (600 MHz, $CDCl_3$) δ 8.38 (dd, *J* = 7.7, 1.3 Hz, 1H), 7.64 (dd, *J* = 8.1, 1.4 Hz, 1H), 7.58 – 7.45 (m, 6H), 7.43 – 7.41 (m, 1H), 7.23 (d, *J* = 7.5 Hz, 2H), 6.74 (d, *J* = 7.5 Hz, 1H), 2.67 (s, 3H). ^{13}C NMR (150 MHz, $CDCl_3$) δ 175.9, 167.6, 164.2, 154.9, 138.9, 135.1, 134.9, 134.7, 132.8, 130.1, 129.5, 129.4, 128.9, 128.4, 125.7, 125.64, 125.56, 125.5, 123.7, 82.3, 16.8. HRMS (ESI-TOF) m/z: $[M + H]^+$ Calcd for $C_{23}H_{16}BrN_2O_2^+$ 431.0390, Found: 431.0381. Enantiomeric excess was determined by HPLC with a Daicel Chiralpak AD-H, n-hexane/2-propanol = 70/30, v = 1.0 mL·min-1, λ = 254 nm, t (minor) = 9.2 min, t (major) = 16.6 min, 90% ee; $[\alpha]_D^{25.6}$ = +52.30 (c = 1.0, $CHCl_3$).

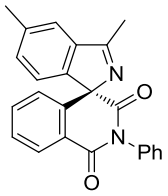


(*R*)-3-methyl-2'-phenyl-6-(trifluoromethyl)-1'*H*-spiro[isoindole-1,4'-isoquinoline]-1',3'(2'*H*)-dione (**12**). Yellow solid (33.3 mg, 79%, m.p. 150 - 151 °C). ^{1}H NMR (600 MHz, $CDCl_3$) δ 8.41 (dd, *J* = 7.8, 1.1 Hz, 1H), 7.80 (d, *J* = 7.9 Hz, 1H), 7.74 (d, *J* = 7.9 Hz, 1H), 7.59 – 7.56 (m, 2H), 7.52 (td, *J* = 7.6, 1.3 Hz, 1H), 7.48 (t, *J* = 7.6 Hz, 2H), 7.42 (t, *J* = 7.4 Hz, 1H), 7.22 (d, *J* = 7.5 Hz, 2H), 6.69 (d, *J* = 7.7 Hz, 1H), 2.72 (s, 3H). ^{13}C NMR (150 MHz, $CDCl_3$) δ 175.4, 167.6, 164.2, 153.6, 143.1, 134.9, 134.8, 134.7, 132.5 (q, *J* = 32.4 Hz, 1C), 130.2, 129.7, 129.5, 129.0, 128.4, 127.1 (q, *J* = 3.4 Hz, 1C), 125.7, 125.6, 123.7 (d, *J* = 271.2 Hz, 1C), 122.9, 119.04 (q, *J* = 3.5 Hz, 1C), 82.9, 17.0. ^{19}F NMR (565 MHz, $CDCl_3$) δ -62.03. HRMS (ESI-TOF) m/z: $[M + H]^+$ Calcd for $C_{24}H_{16}F_3N_2O_2^+$ 421.1158, Found: 421.1145. Enantiomeric excess was determined by HPLC with a Daicel Chiralpak AD-H, n-hexane/2-propanol = 70/30, v = 1.0 mL·min-1, λ = 254 nm, t (minor) = 7.2 min, t (major) = 10.8 min, 90% ee; $[\alpha]_D^{25.6}$ = +98.60 (c = 1.0, $CHCl_3$).

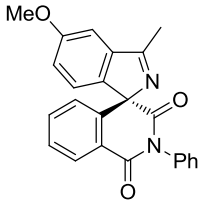


(*R*)-methyl 3-methyl-1',3'-dioxo-2'-phenyl-2',3'-dihydro-1'*H*-spiro[isoindole-1,4'-isoquinoline]-6-carboxylate (**13**). Purple solid (29.5 mg, 72%, m.p. 228 - 229 °C). ^{1}H NMR (600 MHz, $CDCl_3$) δ 8.40 (d, *J* = 7.7 Hz, 1H), 8.22 (d, *J* = 7.8 Hz, 1H), 7.96 (s, 1H), 7.70 (d, *J* = 7.9 Hz, 1H), 7.55 (t, *J* = 7.5 Hz, 1H), 7.52 – 7.44 (m, 3H), 7.41 (t, *J* = 7.4 Hz, 1H), 7.23 (d, *J* = 7.6 Hz, 2H), 6.71 (d, *J* = 7.7 Hz, 1H), 3.91 (s, 3H), 2.74 (s, 3H). ^{13}C NMR (150 MHz, $CDCl_3$) δ 176.1, 167.6, 166.1, 164.3, 153.4, 143.4, 135.05, 134. 97,

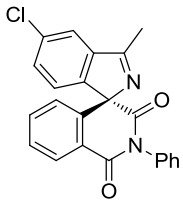
134.6, 132.2, 131.4, 130.1, 129.5, 129.4, 128.9, 128.5, 125.64, 125.61, 122.8, 122.5, 82.6, 52.7, 17.0. HRMS (ESI-TOF) m/z: $[M + H]^+$ Calcd for $C_{25}H_{19}N_2O_4^+$ 411.1339, Found: 411.1335. Enantiomeric excess was determined by HPLC with a Daicel Chiralpak AD-H, n-hexane/2-propanol = 70/30, v = 1.0 mL·min-1, λ = 254 nm, t (minor) = 15.0 min, t (major) = 25.5 min, 87% ee; $[\alpha]_D^{25.6}$ = +124.67 (c = 1.0, $CHCl_3$).



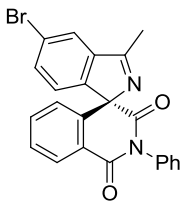
(*R*)-3,5-dimethyl-2'-phenyl-1'*H*-spiro[isoindole-1,4'-isoquinoline]-1',3'(2'*H*)-dione. (**14**). Colorless solid (32.8 mg, 90%, m.p. 174 - 175 °C). ^{1}H NMR (600 MHz, $CDCl_3$) δ 8.39 (dd, *J* = 7.6, 1.6 Hz, 1H), 7.53 (dq, *J* = 7.4, 5.9 Hz, 2H), 7.48 (t, *J* = 7.6 Hz, 3H), 7.42 (t, *J* = 7.4 Hz, 1H), 7.30 – 7.21 (m, 4H), 6.85 – 6.80 (m, 1H), 2.74 (s, 3H), 2.48 (s, 3H). ^{13}C NMR (150 MHz, $CDCl_3$) δ 177.3, 168.2, 164.5, 150.3, 139.8, 139.6, 136.0, 135.1, 134.5, 131.7, 129.8, 129.3, 129.1, 128.8, 128.4, 125.4, 123.3, 121.4, 81.9, 21.5, 16.8. HRMS (ESI-TOF) m/z: $[M + H]^+$ Calcd for $C_{24}H_{19}N_2O_2^+$ 367.1441, Found: 367.1441. Enantiomeric excess was determined by HPLC with a Daicel Chiralpak IC-H, n-hexane/2-propanol = 70/30, v = 1.0 mL·min-1, λ = 254 nm, t (minor) = 13.8 min, t (major) = 18.4 min, 91% ee; $[\alpha]_D^{25.6}$ = +205.80 (c = 1.0, $CHCl_3$).



(*R*)-5-methoxy-3-methyl-2'-phenyl-1'*H*-spiro[isoindole-1,4'-isoquinoline]-1',3'(2'*H*)-dione (**15**). Colorless solid (30.0 mg, 79%, m.p. 179 - 180 °C). ^{1}H NMR (600 MHz, DMSO-d_6) δ 8.23 – 8.21 (m, 1H), 7.61 – 7.58 (m, 2H), 7.50 – 7.46 (m, 3H), 7.43 (d, *J* = 7.3 Hz, 1H), 7.41 (d, *J* = 2.3 Hz, 1H), 7.28 (d, *J* = 7.5 Hz, 2H), 7.05 (dd, *J* = 8.4, 2.3 Hz, 1H), 6.75 (dd, *J* = 6.2, 2.6 Hz, 1H), 3.86 (s, 3H), 2.65 (s, 3H). ^{13}C NMR (150 MHz, DMSO-d_6) δ 177.1, 168.4, 164.3, 161.0, 145.3, 141.3, 136.6, 136.0, 134.9, 129.50, 129.45, 129.3, 129.2, 128.9, 125.9, 125.5, 123.4, 117.8, 108.1, 81.3, 56.3, 16.8. HRMS (ESI-TOF) m/z: $[M + H]^+$ Calcd for $C_{24}H_{19}N_2O_3^+$ 383.1390, Found: 383.1386. Enantiomeric excess was determined by HPLC with a Daicel Chiralpak AD-H, n-hexane/2-propanol = 70/30, v = 1.0 mL·min-1, λ = 254 nm, t (minor) = 17.2 min, t (major) = 24.2 min, 94% ee; $[\alpha]_D^{25.6}$ = +190.73 (c = 1.0, $CHCl_3$).

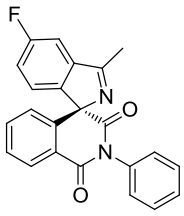


(*R*)-5-chloro-3-methyl-2'-phenyl-1'*H*-spiro[isoindole-1,4'-isoquinoline]-1',3'(2'*H*)-dione (**16**). Colorless solid (28.7 mg, 74%, m.p. 216 - 217 °C). ^{1}H NMR (600 MHz, $CDCl_3$) δ 8.37 (dd, *J* = 7.7, 1.3 Hz, 1H), 7.61 (d, *J* = 1.6 Hz, 1H), 7.54 (t, *J* = 7.4 Hz, 1H), 7.52 – 7.49 (m, 1H), 7.46 (t, *J* = 7.6 Hz, 2H), 7.43 – 7.39 (m, 2H), 7.27 (d, *J* = 8.1 Hz, 1H), 7.21 (d, *J* = 7.5 Hz, 2H), 6.75 (d, *J* = 7.5 Hz, 1H), 2.68 (s, 3H). ^{13}C NMR (150 MHz, $CDCl_3$) δ 175.7, 167.7, 164.3, 151.3, 141.5, 135.8, 135.3, 135.0, 134.6, 130.6, 130.0, 129.44, 129.36, 128.9, 128.4, 125.52, 125.48, 122.9, 82.4, 16.9. HRMS (ESI-TOF) m/z: $[M + H]^+$ Calcd for $C_{23}H_{16}ClN_2O_2^+$ 387.0895, Found: 387.0890. Enantiomeric excess was determined by HPLC with a Daicel Chiralpak AD-H, n-hexane/2-propanol = 70/30, v = 1.0 mL·min-1, λ = 254 nm, t (minor) = 12.5 min, t (major) = 24.1 min, 90% ee; $[\alpha]_D^{25.6}$ = +175.67 (c = 1.0, $CHCl_3$).

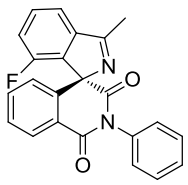


(*R*)-5-bromo-3-methyl-2'-phenyl-1'*H*-spiro[isoindole-1,4'-isoquinoline]-1',3'(2'*H*)-dione (**17**). Yellow solid (30.0 mg, 93%, m.p. 190 - 191 °C). ^{1}H NMR (600 MHz,

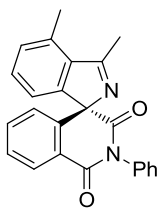
$CDCl_3$) δ 8.37 (dd, *J* = 7.7, 1.4 Hz, 1H), 7.77 (d, *J* = 1.5 Hz, 1H), 7.58 – 7.53 (m, 2H), 7.51 (td, *J* = 7.5, 1.5 Hz, 1H), 7.47 – 7.45 (m, 2H), 7.43 – 7.38 (m, 1H), 7.22 – 7.20 (m, 3H), 6.75 (d, *J* = 7.3 Hz, 1H), 2.68 (s, 3H). ^{13}C NMR (150 MHz, $CDCl_3$) δ 175.7, 167.6, 164.3, 151.8, 141.7, 135.2, 135.0, 134.6, 133.4, 130.0, 129.5, 129.4, 128.9, 128.4, 125.9, 125.53, 125.48, 123.6, 123.2, 82.4, 16.8. HRMS (ESI-TOF) m/z: $[M + H]^+$ Calcd for $C_{23}H_{16}BrN_2O_2^+$ 431.0390, Found: 431.0386. Enantiomeric excess was determined by HPLC with a Daicel Chiralpak AD-H, n-hexane/2-propanol = 70/30, v = 1.0 mL·min-1, λ = 254 nm, t (minor) = 19.4 min, t (major) = 36.8 min, 90% ee; $[\alpha]_D^{25.6}$ = +152.27 (c = 1.0, $CHCl_3$).



(*R*)-5-fluoro-3-methyl-2'-phenyl-1'*H*-spiro[isoindole-1,4'-isoquinoline]-1',3'(2'*H*)-dione (**18**).Colorless solid (10.8 mg, 30%, m.p. 179 - 180 °C). ^{1}H NMR (600 MHz, DMSO-d_6) δ 8.23 (dd, *J* = 7.6, 1.5 Hz, 1H), 7.70 (dd, *J* = 8.3, 2.3 Hz, 1H), 7.66 (dd, *J* = 8.3, 4.5 Hz, 1H), 7.63 – 7.57 (m, 2H), 7.48 (t, *J* = 7.5 Hz, 2H), 7.43 (t, *J* = 7.4 Hz, 1H), 7.34 – 7.27 (m, 3H), 6.70 – 6.65 (m, 1H), 2.59 (s, 3H). ^{13}C NMR (150 MHz, DMSO-d_6) δ 175.2, 168.3, 164.3, 163.4 (d, *J* = 245.3 Hz, 1C), 149.4, 142.8 (d, *J* = 8.8 Hz, 1C), 136.4, 136.0, 134.9, 129.6, 129.4, 129.3, 129.2, 129.0, 126.0, 125.7, 124.5 (d, *J* = 9.2 Hz, 1C), 117.7 (d, *J* = 23.9 Hz, 1C), 110.1 (d, *J* = 23.8 Hz, 1C), 82.1, 16.8. ^{19}F NMR (565 MHz, DMSO-d_6) δ -113.16. HRMS (ESI-TOF) m/z: $[M + H]^+$ Calcd for $C_{23}H_{16}FN_2O_2^+$ 371.1190, Found: 371.1184. Enantiomeric excess was determined by HPLC with a Daicel Chiralpak AD-H, n-hexane/2-propanol = 70/30, v = 1.0 mL·min-1, λ = 254 nm, t (minor) = 11.7 min, t (major) = 24.7 min, 88% ee; $[\alpha]_D^{25.6}$ = +90.20 (c = 0.5, $CHCl_3$).

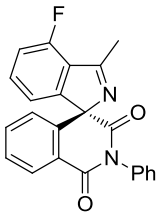


(*R*)-7-fluoro-3-methyl-2'-phenyl-1'*H*-spiro[isoindole-1,4'-isoquinoline]-1',3'(2'*H*)-dione (**18'**). Colorless solid (9.7 mg, 26%, m.p. 200 - 201 °C). ^{1}H NMR (400 MHz, DMSO-d_6) δ 8.24 – 8.22 (m, 1H), 7.70 – 7.61 (m, 4H), 7.50 (t, *J* = 7.4 Hz, 2H), 7.47 – 7.41 (m, 1H), 7.37 – 7.31 (m, 1H), 7.26 (d, *J* = 7.4 Hz, 2H), 6.80 – 6.78 (m, 1H), 2.62 (s, 3H). ^{13}C NMR (150 MHz, DMSO-d_6) δ 174.8, 167.2, 163.6, 156.4 (d, *J* = 246.0 Hz, 1C), 143.5 (d, *J* = 3.0 Hz, 1C), 137.7 (d, *J* = 16.8 Hz, 1C), 135.3, 134.7, 134.2, 132.8 (d, *J* = 6.4 Hz, 1C), 129.5, 129.2, 128.9, 128.6, 128.5, 125.3, 125.2, 119.2 (d, *J* = 2.3 Hz, 1C), 117.3 (d, *J* = 20.0 Hz, 1C), 80.7 (d, *J* = 2.6 Hz, 1C), 16.4. ^{19}F NMR (565 MHz, DMSO-d_6) δ -120.16. HRMS (ESI-TOF) m/z: $[M + H]^+$ Calcd for $C_{23}H_{16}FN_2O_2^+$ 371.1190, Found: 371.1185. Enantiomeric excess was determined by HPLC with a Daicel Chiralpak AD-H, n-hexane/2-propanol = 70/30, v = 1.0 mL·min-1, λ = 254 nm, t (minor) = 15.7 min, t (major) = 16.8 min, 80% ee; $[\alpha]_D^{25.6}$ = +94.20 (c = 1.0, $CHCl_3$).

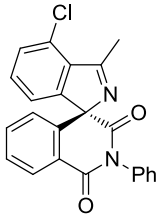


(*R*)-3,4-dimethyl-2'-phenyl-1'*H*-spiro[isoindole-1,4'-isoquinoline]-1',3'(2'*H*)-dione (**19**). Purple solid (29.5 mg, 80%, m.p. 119 - 120 °C). ^{1}H NMR (400 MHz, DMSO-d_6) δ 8.24 – 8.21 (m, 1H), 7.61 – 7.59 (m, 2H), 7.50 – 7.46 (m, 2H), 7.44 – 7.40 (m, 1H), 7.38 – 7.26 (m, 5H), 6.75 – 6.73 (m, 1H), 2.75 (s, 3H), 2.68 (s, 3H). ^{13}C NMR (100 MHz, DMSO-d_6) δ 176.7, 168.1, 163.8, 153.8, 137.3, 136.4, 135.5, 134.5, 134.4, 131.5, 130.6, 129.0, 128.8, 128.7, 128.4, 125.5, 125.0, 119.8, 80.8, 20.6, 19.1. HRMS (ESI-TOF) m/z: $[M + H]^+$ Calcd for $C_{24}H_{19}N_2O_2^+$ 367.1441, Found: 367.1440. Enantiomeric excess

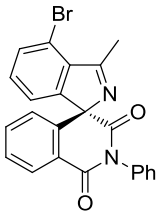
was determined by HPLC with a Daicel Chiralpak AD-H, n-hexane/2-propanol = 70/30, v = 1.0 mL·min-1, λ = 254 nm, t (minor) = 12.7 min, t (major) = 20.7 min, 89% ee; $[\alpha]_D^{25.6}$ = +134.05 (c = 1.0, $CHCl_3$).



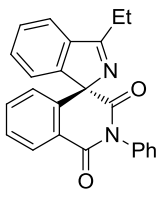
(*R*)-4-fluoro-3-methyl-2'-phenyl-1'*H*-spiro[isoindole-1,4'-isoquinoline]-1',3'(2'*H*)-dione (**20**). Purple solid (28.9 mg, 78%, m.p. 158 - 159 °C). ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.39 – 8.36 (m, 1H), 7.56 – 7.51 (m, 2H), 7.48 – 7.38 (m, 4H), 7.20 (d, *J* = 7.3 Hz, 2H), 7.16 – 7.11 (m, 2H), 6.82 – 6.80 (m, 1H), 2.82 (s, 3H). ^{13}C NMR (150 MHz, $CDCl_3$) δ 174.2 (d, *J* = 4.4 Hz, 1C), 167.7, 164.3, 157.4 (d, *J* = 255.0 Hz, 1C), 156.2 (d, *J* = 2.7 Hz, 1C), 135.4, 135.0, 134.6, 133.2 (d, *J* = 7.0 Hz, 1C), 130.0, 129.5, 129.4, 128.9, 128.4, 126.8 (d, *J* = 16.1 Hz, 1C), 125.5, 125.4, 118.0 (d, *J* = 3.8 Hz, 1C), 116.7 (d, *J* = 19.5 Hz, 1C), 83.0, 19.6 (d, *J* = 1.9 Hz, 1C). ^{19}F NMR (376 MHz, $CDCl_3$) δ -115.98. HRMS (ESI-TOF) m/z: $[M + H]^+$ Calcd for $C_{23}H_{16}FN_2O_2^+$ 371.1190, Found: 371.1191. Enantiomeric excess was determined by HPLC with a Daicel Chiralpak AD-H, n-hexane/2-propanol =70/30, v = 1.0 mL·min-1, λ = 254 nm, t (minor) = 11.5 min, t (major) = 31.5 min, 90% ee; $[\alpha]_D^{25.6}$ = +118.60 (c = 0.5, $CHCl_3$).



(*R*)-4-chloro-3-methyl-2'-phenyl-1'*H*-spiro[isoindole-1,4'-isoquinoline]-1',3'(2'*H*)-dione (**21**). Colorless solid (24.0 mg, 62%, m.p. 144 - 145 °C). ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.40 – 8.36 (m, 1H), 7.56 – 7.53 (m, 2H), 7.48 – 7.35 (m, 6H), 7.23 – 7.35 (m, 3H), 6.81 (dd, *J* = 6.4, 2.3 Hz, 1H), 2.94 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 176.6, 167.3, 164.2, 155.4, 135.8, 134.9, 134.7, 132.3, 131.1, 130.2, 130.1, 129.6, 129.4, 129.0, 128.4, 125.6, 125.5, 120.5, 81.8, 20.9. HRMS (ESI-TOF) m/z: $[M + H]^+$ Calcd for $C_{23}H_{16}ClN_2O_2^+$ 387.0895, Found: 387.0888. Enantiomeric excess was determined by HPLC with a Daicel Chiralpak AD-H, n-hexane/2-propanol = 70/30, v = 1.0 mL·min-1, λ = 254 nm, t (minor) = 10.9 min, t (major) = 28.2 min, 83% ee; $[\alpha]_D^{25.6}$ = +159.40 (c = 1.0, $CHCl_3$).

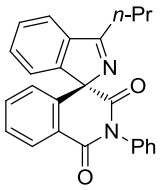


(*R*)-4-bromo-3-methyl-2'-phenyl-1'*H*-spiro[isoindole-1,4'-isoquinoline]-1',3'(2'*H*)-dione (**22**). Colorless solid (30.0 mg, 70%, m.p. 129 - 130 °C). ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.31 – 8.29 (m, 1H), 7.58 – 7.54 (m, 1H), 7.47 – 7.42 (m, 2H), 7.41 – 7.30 (m, 4H), 7.20 – 7.18 (m, 2H), 7.12 (d, *J* = 7.2 Hz, 2H), 6.75 – 6.72 (m, 1H), 2.86 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 176.9, 167.4, 164.2, 155.6, 137.7, 135.0, 134.9, 134.7, 134.5, 132.1, 130.1, 129.6, 129.4, 129.0, 128.4, 125.6, 125.5, 121.1, 117.9, 81.6, 21.1. HRMS (ESI-TOF) m/z: $[M + H]^+$ Calcd for $C_{23}H_{16}BrN_2O_2^+$ 431.0390, Found: 431.0375. Enantiomeric excess was determined by HPLC with a Daicel Chiralpak AD-H, n-hexane/2-propanol = 70/30, v = 1.0 mL·min-1, λ = 254 nm, t (minor) = 11.9 min, t (major) = 29.8 min, 80% ee; $[\alpha]_D^{25.6}$ = +87.53 (c = 1.0, $CHCl_3$).

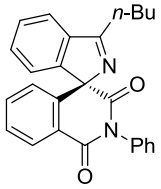


(*R*)-3-ethyl-2'-phenyl-1'*H*-spiro[isoindole-1,4'-isoquinoline]-1',3'(2'*H*)-dione (2**3**). Colorless solid (34.5 mg, 94%, m.p. 188 - 189 °C). ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.38 – 8.36 (m, 1H), 7.65 (d, *J* = 7.5 Hz, 1H), 7.54 – 7.39 (m, 7H), 7.34 (d, *J* = 7.5 Hz, 1H), 7.21 (d, *J* = 7.4 Hz, 2H), 6.79 – 6.77 (m, 1H), 3.09 (q, *J* = 7.5 Hz, 2H), 1.52 (t, *J* = 7.5 Hz, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 181.5, 168.2, 164.6, 153.5, 138.8, 136.1,

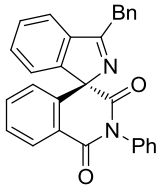
135.1, 134.5, 130.5, 129.8, 129.3, 129.1, 128.8, 128.4, 125.41, 125.36, 122.6, 121.7, 82.1, 24.2, 11.1. HRMS (ESI-TOF) m/z: $[M + H]^+$ Calcd for $C_{24}H_{19}N_2O_2^+$ 367.1441, Found: 367.1443. Enantiomeric excess was determined by HPLC with a Daicel Chiralpak AD-H, n-hexane/2-propanol = 70/30, v = 1.0 mL·min-1, λ = 254 nm, t (minor) = 9.9 min, t (major) = 12.4 min, 90% ee; $[\alpha]_D^{25.6}$ = +218.93 (c = 1.0, $CHCl_3$).



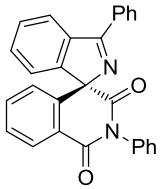
(*R*)-2'-phenyl-3-propyl-1'*H*-spiro[isoindole-1,4'-isoquinoline]-1',3'(2'*H*)-dione (**24**). Purple solid (30.0 mg, 79%, m.p. 146 - 147 °C). ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.38 – 8.36 (m, 1H), 7.66 (d, *J* = 7.5 Hz, 1H), 7.52 – 7.39 (m, 7H), 7.34 (d, *J* = 7.5 Hz, 1H), 7.20 (d, *J* = 7.4 Hz, 2H), 6.79 (dd, *J* = 6.4, 2.4 Hz, 1H), 3.08 – 3.03 (m, 2H), 2.05 – 1.98 (m, 2H), 1.14 (t, *J* = 7.4 Hz, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 180.6, 168.1, 164.6, 153.4, 139.0, 136.0, 135.1, 134.5, 130.6, 129.8, 129.4, 129.1, 128.8, 128.4, 125.42, 125.37, 122.7, 121.7, 82.2, 32.6, 20.4, 14.1. HRMS (ESI-TOF) m/z: $[M + H]^+$ Calcd for $C_{25}H_{21}N_2O_2^+$ 381.1598, Found: 381.1595. Enantiomeric excess was determined by HPLC with a Daicel Chiralpak AD-H, n-hexane/2-propanol = 70/30, v = 1.0 mL·min-1, λ = 254 nm, t (minor) = 10.2 min, t (major) = 10.9 min, 91% ee; $[\alpha]_D^{25.6}$ = +218.33 (c = 1.0, $CHCl_3$).



(*R*)-3-butyl-2'-phenyl-1'*H*-spiro[isoindole-1,4'-isoquinoline]-1',3'(2'*H*)-dione (**25**). Colorless solid (31.0 mg, 79%, m.p. 164 - 165 °C). ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.38 – 8.36 (m, 1H), 7.65 (d, *J* = 7.5 Hz, 1H), 7.54 – 7.37 (m, 7H), 7.34 (d, *J* = 7.5 Hz, 1H), 7.20 (d, *J* = 7.4 Hz, 2H), 6.79 – 6.77 (m, 1H), 3.07 (t, *J* = 6.8 Hz, 2H), 1.98 – 1.92 (m, 2H), 1.59 – 1.54 (m, 2H), 1.00 (t, *J* = 7.4 Hz, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 180.6, 168.2, 164.6, 153.5, 139.0, 136.2, 135.1, 134.5, 130.4, 129.8, 129.3, 129.1, 128.8, 128.4, 125.40, 125.37, 122.6, 121.7, 82.3, 30.6, 29.0, 22.7, 14.0. HRMS (ESI-TOF) m/z: $[M + H]^+$ Calcd for $C_{26}H_{23}N_2O_2^+$ 395.1754, Found: 395.1756. Enantiomeric excess was determined by HPLC with a Daicel Chiralpak IC-H, n-hexane/2-propanol = 80/20, v = 1.0 mL·min-1, λ = 254 nm, t (major) = 15.2 min, t (minor) = 18.4 min, 91% ee; $[\alpha]_D^{25.6}$ = +228.07 (c = 1.0, $CHCl_3$).

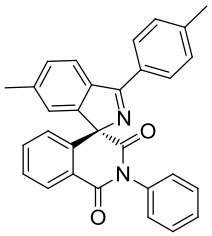


(*R*)-3-benzyl-2'-phenyl-1'*H*-spiro[isoindole-1,4'-isoquinoline]-1',3'(2'*H*)-dione (**26**). Brown solid (35.3 mg, 83%, m.p. 166 - 167 °C). ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.39 (dd, *J* = 7.5, 1.6 Hz, 1H), 7.58 – 7.30 (m, 14H), 7.30 – 7.21 (m, 3H), 6.80 – 6.77 (m, 1H), 4.45 (q, *J* = 15.0 Hz, 2H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 178.6, 167.9, 164.6, 153.7, 138.4, 135.9, 135.6, 135.1, 134.6, 130.5, 129.9, 129.4, 129.31, 129.30, 129.2, 129.1, 128.9, 128.4, 127.3, 125.4, 123.5, 121.6, 82.3, 37.9. HRMS (ESI-TOF) m/z: $[M + H]^+$ Calcd for $C_{29}H_{21}N_2O_2^+$ 429.1598, Found: 429.1598. Enantiomeric excess was determined by HPLC with a Daicel Chiralpak AD-H, n-hexane/2-propanol = 70/30, v = 1.0 mL·min-1, λ = 254 nm, t (minor) = 20.3 min, t (major) = 25.8 min, 90% ee; $[\alpha]_D^{25.6}$ = +230.80 (c = 1.0, $CHCl_3$).

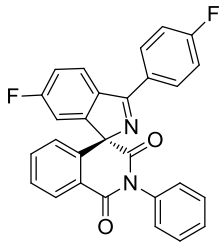


(*R*)-2',3-diphenyl-1'*H*-spiro[isoindole-1,4'-isoquinoline]-1',3'(2'*H*)-dione (**27**). White solid (25.3 mg, 61%, m.p. 253 - 254 °C). ^{1}H NMR (600 MHz, DMSO-d_6) δ 8.28 (dd, *J* = 7.7, 1.3 Hz, 1H), 8.11 – 8.10 (m, 2H), 8.01 (d, *J* = 7.7 Hz, 1H), 7.72 (d, *J* = 7.5 Hz, 1H), 7.64 – 7.58 (m, 6H), 7.54 (t, *J* = 7.4 Hz, 1H), 7.49 (t, *J* = 7.6 Hz, 2H), 7.44 (d, *J*

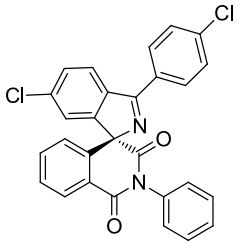
= 7.4 Hz, 1H), 7.34 (d, *J* = 7.5 Hz, 2H), 6.78 – 6.73 (m, 1H). ^{13}C NMR (150 MHz, DMSO-d_6) δ 174.5, 167.8, 163.9, 154.4, 137.7, 136.1, 135.5, 134.6, 132.9, 131.9, 130.3, 129.3, 129.1, 129.00, 128.96, 128.92, 128.7, 128.44, 128.40, 125.5, 125.1, 123.9, 122.7, 81.8. HRMS (ESI-TOF) m/z: $[M + H]^+$ Calcd for $C_{28}H_{19}N_2O_2^+$ 415.1441, Found: 415.1430. Enantiomeric excess was determined by HPLC with a Daicel Chiralpak IC-H, n-hexane/2-propanol = 70/30, v = 1.0 mL·min-1, λ = 254 nm, t (major) = 14.7 min, t (minor) = 19.4 min, 97% ee; $[\alpha]_D^{25.6}$ = +139.13 (c = 1.0, $CHCl_3$).



(*R*)-6-methyl-2'-phenyl-3-(*p*-tolyl)-1'*H*-spiro[isoindole-1,4'-isoquinoline]-1',3'(2'*H*)-dione (**28**). Yellow solid (22.0 mg, 50%, m.p. 230 – 231 °C). ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.46 – 8.44 (m, 1H), 8.05 (d, *J* = 8.0 Hz, 2H), 7.83 (d, *J* = 7.9 Hz, 1H), 7.57 – 7.50 (m, 4H), 7.47 – 7.42 (m, 3H), 7.36 (d, *J* = 7.9 Hz, 1H), 7.30 (d, *J* = 7.4 Hz, 2H), 7.25 (s, 1H), 6.92 – 6.90 (m, 1H), 2.52 (s, 3H), 2.45 (s, 3H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 175.8, 168.4, 164.7, 155.0, 141.6, 140.9, 136.8, 136.0, 135.2, 134.5, 130.7, 130.2, 129.7, 129.6, 129.3, 129.0, 128.8, 128.6, 128.5, 125.7, 125.4, 124.0, 122.7, 81.9, 21.74, 21.69. HRMS (ESI-TOF) m/z: $[M + H]^+$ Calcd for $C_{30}H_{23}N_2O_2^+$ 443.1754, Found: 443.1755. Enantiomeric excess was determined by HPLC with a Daicel Chiralpak AD-H, n-hexane/2-propanol = 80/20, v = 1.0 mL·min-1, λ = 254 nm, t (major) = 30.7 min, t (minor) =57.8 min, 95% ee; $[\alpha]_D^{25.6}$ = +196.47 (c = 1.0, $CHCl_3$).

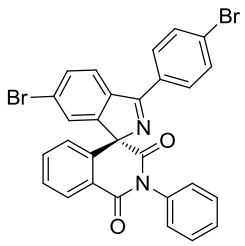


(*R*)-6-fluoro-3-(4-fluorophenyl)-2'-phenyl-1'*H*-spiro[isoindole-1,4'-isoquinoline]-1',3'(2'*H*)-dione (**29**). Yellow solid (15.9 mg, 36%, m.p. 152 - 153 °C). ^{1}H NMR (600 MHz, DMSO-d_6) δ 8.28 (dd, *J* = 7.7, 1.4 Hz, 1H), 8.16 – 8.14 (m, 2H), 8.05 (dd, *J* = 8.5, 4.7 Hz, 1H), 7.79 (dd, *J* = 8.2, 2.3 Hz, 1H), 7.64 (td, *J* = 7.5, 1.2 Hz, 1H), 7.61 (td, *J* = 7.5, 1.5 Hz, 1H), 7.50 (t, *J* = 7.6 Hz, 2H), 7.47 – 7.42 (m, 4H), 7.38 – 7.35 (m, 2H), 6.73 (dd, *J* = 7.7, 0.9 Hz, 1H). ^{13}C NMR (150 MHz, DMSO-d_6) δ 172.4, 167.9, 164.4 (d, *J* = 247.5 Hz, 1C), 164.1, 163.9 (d, *J* = 249.0 Hz, 1C), 157.8 (d, *J* = 9.5 Hz, 1C), 136.0 (d, *J* = 9.9 Hz, 1C), 135.1 (d, *J* = 4.1 Hz, 1C), 131.5 (d, *J* = 8.9 Hz, 2C), 129.7, 129.6 (d, *J* = 2.9 Hz, 1C), 129.42, 129.40, 129.3, 129.0, 126.3, 126.0 (d, *J* = 9.8 Hz, 1C), 125.8, 117.1 (d, *J* = 24.0 Hz, 1C), 116.6 (d, *J* = 16.5 Hz, 2C), 111.7 (d, *J* = 24.0 Hz, 1C), 81.90 (d, *J* = 1.7 Hz, 1C). ^{19}F NMR (565 MHz, DMSO-d_6) δ -108.69, -109.85. HRMS (ESI-TOF) m/z: $[M + H]^+$ Calcd for $C_{28}H_{17}F_2N_2O_2^+$ 451.1253, Found: 451.1254. Enantiomeric excess was determined by HPLC with a Daicel Chiralpak AD-H, n-hexane/2-propanol = 70/30, v = 1.0 mL·min-1, λ = 254 nm, t (major) = 25.1 min, t (minor) = 41.6 min, 94% ee; $[\alpha]_D^{25.6}$ = +78.60 (c = 1.0, $CHCl_3$).

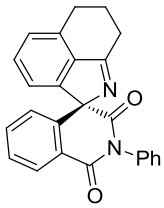


(*R*)-6-chloro-3-(4-chlorophenyl)-2'-phenyl-1'*H*-spiro[isoindole-1,4'-isoquinoline]-1',3'(2'*H*)-dione (**30**). Yellow solid (17.8 mg, 37%, m.p. 209 - 210 °C). ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.46 (dd, *J* = 7.6, 1.2 Hz, 1H), 8.03 (d, *J* = 8.5 Hz, 2H), 7.81 (d, *J* = 8.2 Hz, 1H), 7.64 – 7.50 (m, 7H), 7.48 – 7.45 (m, 2H), 7.29 (d, *J* = 7.5 Hz, 2H), 6.86 – 6.84 (m, 1H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 174.0, 167.5, 164.3, 156.2, 137.8, 137.2, 136.8, 135.3, 134.9, 134.7, 131.4, 130.1, 129.92, 129.88, 129.6, 129.4, 129.4, 129.0, 128.4, 126.0, 125.5, 124.7, 123.1, 82.4. HRMS (ESI-TOF) m/z: $[M + H]^+$ Calcd for $C_{28}H_{17}Cl_2N_2O_2^+$ 483.0662, Found: 483.0660. Enantiomeric excess was

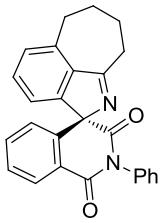
determined by HPLC with a Daicel Chiralpak AD-H, n-hexane/2-propanol = 70/30, v = 1.0 mL·min-1, λ = 254 nm, t (major) = 26.8 min, t (minor) = 45.4 min, 95% ee; $[\alpha]_D^{25.6}$ = +116.73 (c = 1.0, $CHCl_3$).



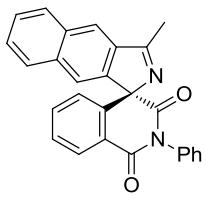
(*R*)-6-bromo-3-(4-bromophenyl)-2'-phenyl-1'*H*-spiro[isoindole-1,4'-isoquinoline]-1',3'(2'*H*)-dione (**31**). Yellow solid (20.5 mg, 36%, m.p. 259 - 260 °C). ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.42 (dd, *J* = 7.6, 0.9 Hz, 1H), 7.91 (d, *J* = 8.4 Hz, 2H), 7.72 – 7.65 (m, 4H), 7.60 – 7.54 (m, 3H), 7.51 – 7.47 (m, 2H), 7.45 – 7.41 (m, 1H), 7.26 – 7.23 (m, 2H), 6.80 (d, *J* = 7.4 Hz, 1H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 174.2, 167.4, 164.3, 156.4, 137.1, 135.2, 134.9, 134.7, , 132.8, 132.4, 131.8, 130.12, 130.09, 129.6, 129.5, 129.0, 128.4, 126.2, 126.0, 125.7, 125.6, 125.5, 124.9, 82.4. HRMS (ESI-TOF) m/z: $[M + H]^+$ Calcd for $C_{28}H_{17}Br_2N_2O_2^+$ 570.9651, Found: 570.9641. Enantiomeric excess was determined by HPLC with a Daicel Chiralpak IC-H, n-hexane/2-propanol = 80/20, v = 1.0 mL·min-1, λ = 254 nm, t (major) = 18.6 min, t (minor) = 25.0 min, 96% ee; $[\alpha]_D^{25.6}$ = +123.60 (c = 1.0, $CHCl_3$).



(*R*)-2'-phenyl-7,8-dihydro-1'H,6H-spiro[benzo[cd]indole-2,4'-isoquinoline]-1',3'(2'H)-dione (**32**). Brown solid (22.8 mg, 60%, m.p. 208 - 209 °C). ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.42 – 8.40 (m, 1H), 7.59 – 7.47 (m, 4H), 7.45 – 7.39 (m, 2H), 7.31 (d, *J* = 7.7 Hz, 1H), 7.25 (dd, *J* = 10.7, 7.5 Hz, 3H), 6.89 (d, *J* = 6.9 Hz, 1H), 3.16 (t, *J* = 6.2 Hz, 2H), 2.98 (t, *J* = 5.9 Hz, 2H), 2.32 – 2.25 (m, 2H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 179.0, 168.1, 164.5, 151.2, 138.4, 136.5, 135.7, 135.1, 134.5, 131.7, 129.9, 129.3, 129.2, 128.8, 128.5, 127.8, 125.48, 125.42, 119.6, 83.8, 28.1, 26.4, 24.1. HRMS (ESI-TOF) m/z: $[M + H]^+$ Calcd for $C_{25}H_{19}N_2O_2^+$ 379.1441, Found: 379.1440. Enantiomeric excess was determined by HPLC with a Daicel Chiralpak AD-H, n-hexane/2-propanol = 70/30, v = 1.0 mL·min-1, λ = 254 nm, t (minor) = 15.6 min, t (major) = 36.9 min, 92% ee; $[\alpha]_D^{25.6}$ = +142.00 (c = 1.0, $CHCl_3$).

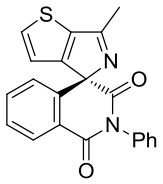


(*R*)-2'-phenyl-6,7,8,9-tetrahydro-1'*H*-spiro[cyclohepta[*cd*]isoindole-2,4'-isoquinoline]-1',3'(2'*H*)-dione (**33**). Black solid (20.8 mg, 53%, m.p. 136 - 137 °C). ^{1}H NMR (600 MHz, DMSO-d_6) δ 8.24 – 8.22 (m, 1H), 7.62 – 7.60 (m, 2H), 7.48 (t, *J* = 7.6 Hz, 2H), 7.44 – 7.41 (m, 1H), 7.39 – 7.35 (m, 2H), 7.33 (d, *J* = 6.8 Hz, 1H), 7.27 (d, *J* = 7.4 Hz, 2H), 6.79 (dd, *J* = 6.0, 3.0 Hz, 1H), 3.20 – 3.08 (m, 4H), 2.08 – 1.90 (m, 4H). ^{13}C NMR (150 MHz, DMSO-d_6) δ 181.7, 168.4, 164.3, 154.4, 140.1, 137.7, 136.7, 135.9, 135.0, 131.1, 130.5, 129.5, 129.4, 129.3, 129.1, 128.9, 126.0, 125.5, 120.1, 81.8, 33.9, 33.0, 27.3, 23.9. HRMS (ESI-TOF) m/z: $[M + H]^+$ Calcd for $C_{26}H_{21}N_2O_2^+$ 393.1598, Found: 393.1600. Enantiomeric excess was determined by HPLC with a Daicel Chiralpak AD-H, n-hexane/2-propanol = 70/30, v = 1.0 mL·min-1, λ = 254 nm, t (minor) = 14.5 min, t (major) = 25.6 min, 88% ee; $[\alpha]_D^{25.6}$ = +137.27 (c = 1.0, $CHCl_3$).

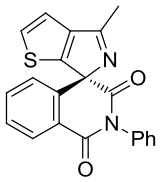


(*R*)-3-methyl-2'-phenyl-1'*H*-spiro[benzo[*f*]isoindole-1,4'-isoquinoline]-1',3'(2'*H*)-dione (**34**). Colorless solid (38.9 mg, 97%, m.p. 168 - 169 °C). ^{1}H NMR (400 MHz, DMSO-d_6) δ 8.45 (s, 1H), 8.30 – 8.27 (m, 1H), 8.17 – 8.14 (m, 2H), 8.04 – 8.02 (m, 1H), 7.65 – 7.58 (m, 4H), 7.48 (t, *J* = 7.4 Hz, 2H), 7.43 (d, *J* = 7.2 Hz, 1H),

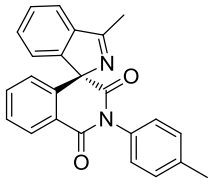
7.35 (d, *J* = 7.3 Hz, 2H), 6.86 – 6.80 (m, 1H), 2.79 (s, 3H). ^{13}C NMR (100 MHz, DMSO-d_6) δ 176.6, 168.3, 163.8, 147.5, 137.0, 136.7, 135.4, 134.5, 133.7, 133.0, 129.3, 129.1, 129.0, 128.9, 128.7, 128.6, 128.5, 128.2, 127.1, 125.8, 124.9, 123.1, 121.0, 80.6, 16.3. HRMS (ESI-TOF) m/z: $[M + H]^+$ Calcd for $C_{27}H_{19}N_2O_2^+$ 403.1441, Found: 403.1442. Enantiomeric excess was determined by HPLC with a Daicel Chiralpak AD-H, n-hexane/2-propanol = 85/15, v = 1.0 mL·min-1, λ = 254 nm, t (minor) = 40.9 min, t (major) = 50.9 min, 89% ee; $[\alpha]_D^{25.6}$ = +137.27 (c = 1.0, $CHCl_3$).



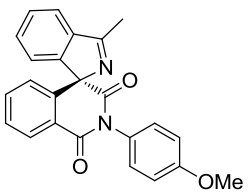
(*R*)-6'-methyl-2-phenyl-1*H*-spiro[isoquinoline-4,4'-thieno[2,3-*c*]pyrrole]-1,3(2*H*)-dion e (**35**). Purple solid (30.0 mg, 84%, m.p. 164 - 165 °C). ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.35 – 8.33 (m, 1H), 7.59 (d, *J* = 4.8 Hz, 1H), 7.55 – 7.45 (m, 4H), 7.43 – 7.39 (m, 1H), 7.25 – 7.21 (m, 2H), 6.96 (d, *J* = 4.8 Hz, 1H), 6.84 – 6.82 (m, 1H), 2.57 (s, 3H).^{13}C NMR (100 MHz, $CDCl_3$) δ 169.8, 167.7, 164.4, 163.4, 145.2, 135.3, 135.2, 134.5, 129.9, 129.33, 129.29, 128.8, 128.5, 125.8, 125.4, 120.4, 79.5, 18.3. HRMS (ESI-TOF) m/z: $[M + H]^+$ Calcd for $C_{21}H_{15}N_2O_2S^+$ 359.0849, Found: 359.0843. Enantiomeric excess was determined by HPLC with a Daicel Chiralpak AD-H, n-hexane/2-propanol = 70/30, v = 1.0 mL·min-1, λ = 254 nm, t (minor) = 10.6 min, t (major) = 22.1 min, 75% ee; $[\alpha]_D^{25.6}$ = +41.73 (c = 1.0, $CHCl_3$).



(*R*)-4'-methyl-2-phenyl-1*H*-spiro[isoquinoline-4,6'-thieno[2,3-*c*]pyrrole]-1,3(2*H*)-dion e (**36**). Purple solid (27.0 mg, 75%, m.p. 191 - 192 °C). ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.40 – 8.37 (m, 1H), 7.59 – 7.57 (m, 3H), 7.52 (t, *J* = 7.4 Hz, 2H), 7.48 – 7.44 (m, 1H), 7.34 – 7.30 (m, 2H), 7.11 (d, *J* = 4.9 Hz, 1H), 6.92 – 6.89 (m, 1H), 2.61 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 171.7, 167.5, 164.1, 159.5, 151.0, 135.4, 135.1, 134.6, 134.2, 129.9, 129.6, 129.3, 128.8, 128.5, 125.8, 125.5, 118.1, 79.9, 18.0. HRMS (ESI-TOF) m/z: $[M + H]^+$ Calcd for $C_{21}H_{15}N_2O_2S^+$ 359.0849, Found: 359.0846. Enantiomeric excess was determined by HPLC with a Daicel Chiralpak AD-H, n-hexane/2-propanol = 80/20, v = 1.0 mL·min-1, λ = 254 nm, t (minor) = 15.5 min, t (major) = 31.6 min, 82% ee; $[\alpha]_D^{25.6}$ = +10.53 (c = 1.0, $CHCl_3$).

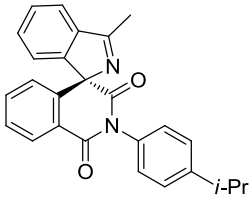


(*R*)-3-methyl-2'-(*p*-tolyl)-1'*H*-spiro[isoindole-1,4'-isoquinoline]-1',3'(2'*H*)-dione (**37**). Colorless solid (25.9 mg, 71%, m.p. 262 - 263 °C). ^{1}H NMR (600 MHz, $CDCl_3$) δ 8.36 (dd, *J* = 7.6, 1.3 Hz, 1H), 7.61 (d, *J* = 7.6 Hz, 1H), 7.52 – 7.47 (m, 3H), 7.40 (t, *J* = 7.3 Hz, 1H), 7.33 (d, *J* = 7.5 Hz, 1H), 7.26 – 7.24 (m, 2H), 7.09 (d, *J* = 8.0 Hz, 2H), 6.75 (d, *J* = 7.3 Hz, 1H), 2.68 (s, 3H), 2.37 (s, 3H). ^{13}C NMR (150 MHz, $CDCl_3$) δ 176.4, 168.5, 164.7, 153.3, 139.9, 138.7, 136.3, 134.4, 132.5, 130.2, 130.0, 129.8, 129.3, 129.0, 128.1, 125.5, 125.4, 122.4, 121.7, 82.6, 21.3, 16.9. HRMS (ESI-TOF) m/z: $[M + H]^+$ Calcd for $C_{24}H_{19}N_2O_2^+$ 367.1441, Found: 367.1443. Enantiomeric excess was determined by HPLC with a Daicel Chiralpak AD-H, n-hexane/2-propanol =70/30, v = 1.0 mL·min-1, λ = 254 nm, t (minor) = 18.5 min, t (major) = 23.3 min, 92% ee; $[\alpha]_D^{25.6}$ = +117.67 (c = 1.0, $CHCl_3$).

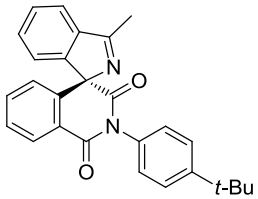


(R)-2'-(4-methoxyphenyl)-3-methyl-1'H-spiro[isoindole-1,4'-isoquinoline]-1', 3'(2'H)-dione (**38**). Colorless solid (25.0 mg, 65%, m.p. 240 - 241 °C). ^{1}H NMR (600 MHz, $CDCl_3$) δ 8.36 (dd, *J* = 7.7, 1.4 Hz, 1H), 7.61 (d, *J* = 7.6 Hz, 1H), 7.50 – 7.46 (m, 3H), 7.40 (td, *J* = 7.5, 0.6 Hz, 1H), 7.32 (d, *J* = 7.6 Hz,

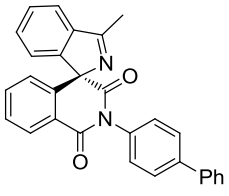
1H), 7.12 (d, *J* = 8.6 Hz, 2H), 6.96 (d, *J* = 9.0 Hz, 2H), 6.75 – 6.73 (m, 1H), 3.81 (s, 3H), 2.68 (s, 3H). ^{13}C NMR (150 MHz, $CDCl_3$) δ 176.4, 168.7, 164.9, 159.6, 153.4, 140.0, 136.4, 134.4, 130.2, 129.8, 129.4, 129.3, 129.0, 127.7, 125.6, 125.5, 122.4, 121.8, 114.6, 82.7, 55.6, 17.0. HRMS (ESI-TOF) m/z: $[M + H]^+$ Calcd for $C_{24}H_{19}N_2O_3^+$ 383.1390, Found: 383.1389. Enantiomeric excess was determined by HPLC with a Daicel Chiralpak AD-H, n-hexane/2-propanol = 70/30, v = 1.0 mL·min-1, λ = 254 nm, t (minor) = 25.6 min, t (major) = 38.2 min, 96% ee; $[\alpha]_D^{25.6}$ = +136.90 (c = 1.0, $CHCl_3$).



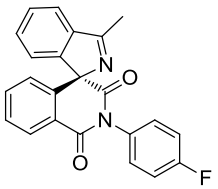
(*R*)-2'-isopropyl-3-methyl-1'*H*-spiro[isoindole-1,4'-isoquinoline]-1',3'(2'*H*)-dione (**39**). Colorless solid (25.0 mg, 63%, m.p. 223 - 224 °C). ^{1}H NMR (600 MHz, $CDCl_3$) δ 8.37 (d, *J* = 7.4 Hz, 1H), 7.61 (d, *J* = 7.4 Hz, 1H), 7.54 – 7.45 (m, 3H), 7.40 (t, *J* = 7.3 Hz, 1H), 7.36 – 7.30 (m, 3H), 7.12 (d, *J* = 7.8 Hz, 2H), 6.76 (d, *J* = 7.4 Hz, 1H), 2.96 – 2.91 (m, 1H), 2.68 (s, 3H), 1.25 (d, *J* = 6.7 Hz, 6H). ^{13}C NMR (150 MHz, $CDCl_3$) δ 176.4, 168.6, 164.7, 153.4, 149.4, 140.0, 136.4, 134.4, 132.6, 130.1, 129.8, 129.3, 129.0, 128.1, 127.4, 125.6, 125.5, 122.3, 121.8, 82.7, 34.0, 24.02, 23.97, 16.9. HRMS (ESI-TOF) m/z: $[M + H]^+$ Calcd for $C_{26}H_{23}N_2O_2^+$ 395.1754, Found: 395.1740. Enantiomeric excess was determined by HPLC with a Daicel Chiralpak OD-H, n-hexane/2-propanol = 80/20, v = 1.0 mL·min-1, λ = 254 nm, t (minor) = 14.9 min, t (major) = 20.1 min, 95% ee; $[\alpha]_D^{25.6}$ = +212.27 (c = 1.0, $CHCl_3$).



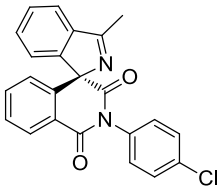
(*R*)-2'-(4-(tert-butyl)phenyl)-3-methyl-1'*H*-spiro[isoindole-1,4'-isoquinoline]-1',3'(2'*H*)-dione (**40**). Colorless solid (26.0 mg, 64%, m.p. 231 - 232 °C). ^{1}H NMR (600 MHz, $CDCl_3$) δ 8.37 (d, *J* = 7.6 Hz, 1H), 7.61 (d, *J* = 7.6 Hz, 1H), 7.54 – 7.44 (m, 5H), 7.40 (t, *J* = 7.4 Hz, 1H), 7.34 (d, *J* = 7.5 Hz, 1H), 7.13 (d, *J* = 8.3 Hz, 2H), 6.77 (d, *J* = 7.5 Hz, 1H), 2.68 (s, 3H), 1.32 (s, 10H). ^{13}C NMR (150 MHz, $CDCl_3$) δ 176.4, 168.6, 164.7, 153.3, 151.6, 140.0, 136.4, 134.4, 132.4, 130.1, 129.8, 129.3, 129.0, 127.8, 126.3, 125.6, 125.5, 122.3, 121.8, 82.7, 34.8, 31.4, 16.9. HRMS (ESI-TOF) m/z: $[M + H]^+$ Calcd for $C_{27}H_{25}N_2O_2^+$ 409.1911, Found: 409.1910. Enantiomeric excess was determined by HPLC with a Daicel Chiralpak OD-H, n-hexane/2-propanol = 80/20, v = 1.0 mL·min-1, λ = 254 nm, t (minor) = 13.9 min, t (major) = 21.7 min, 94% ee; $[\alpha]_D^{25.6}$ = +204.00 (c = 1.0, $CHCl_3$).



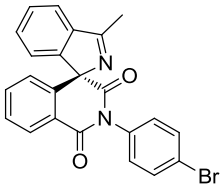
(*R*)-2'-([1,1'-biphenyl]-4-yl)-3-methyl-1'*H*-spiro[isoindole-1,4'-isoquinoline]-1',3'(2'*H*)-dione (**41**). Colorless solid (37.9 mg, 89%, m.p. 218 - 219 °C). ^{1}H NMR (600 MHz, $CDCl_3$) δ 8.40 (dd, *J* = 7.6, 1.2 Hz, 1H), 7.67 (d, *J* = 8.5 Hz, 2H), 7.63 (d, *J* = 7.6 Hz, 1H), 7.59 (d, *J* = 7.3 Hz, 2H), 7.54 – 7.49 (m, 3H), 7.47 – 7.40 (m, 3H), 7.39 – 7.34 (m, 2H), 7.30 (d, *J* = 8.2 Hz, 2H), 6.78 (d, *J* = 7.4 Hz, 1H), 2.70 (s, 3H). ^{13}C NMR (150 MHz, $CDCl_3$) δ 176.5, 168.6, 164.7, 153.2, 141.8, 140.5, 140.0, 136.4, 134.5, 134.3, 130.2, 129.8, 129.3, 129.1, 128.9, 128.8, 128.1, 127.7, 127.4, 125.5, 122.4, 121.8, 82.7, 16.9. HRMS (ESI-TOF) m/z: $[M + H]^+$ Calcd for $C_{29}H_{21}N_2O_2^+$ 429.1598, Found: 429.1593. Enantiomeric excess was determined by HPLC with a Daicel Chiralpak AD-H, n-hexane/2-propanol = 7030, v = 1.0 mL·min-1, λ = 254 nm, t (minor) = 24.1 min, t (major) = 39.6 min, 89% ee; $[\alpha]_D^{25.6}$ = +224.60 (c = 1.0, $CHCl_3$).



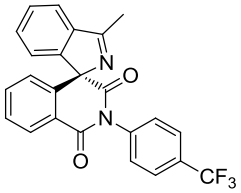
(*R*)-2'-(4-fluorophenyl)-3-methyl-1'*H*-spiro[isoindole-1,4'-isoquinoline]-1',3'(2'*H*)-dione (**42**). Colorless solid (33.2 mg, 90%, m.p. 208 - 209 °C). ^{1}H NMR (600 MHz, $CDCl_3$) δ 8.36 (dd, *J* = 7.7, 1.5 Hz, 1H), 7.62 (d, *J* = 7.6 Hz, 1H), 7.53 – 7.47(m, 3H), 7.41 (td, *J* = 7.5, 0.8 Hz, 1H), 7.32 (d, *J* = 7.6 Hz, 1H), 7.20 – 7.18 (m, 2H), 7.13 (t, *J* = 8.7 Hz, 2H), 6.75 (dd, *J* = 7.7, 1.0 Hz, 1H), 2.68 (s, 3H). ^{13}C NMR (150 MHz, $CDCl_3$) δ 176.5, 168.6, 164.6, 162.5 (d, *J* = 246.0 Hz, 1C), 153.1, 140.0, 136.4, 134.6, 130.91 (d, *J* = 3.2 Hz, 1C), 130.30, 130.26, 129.8, 129.4, 129.1, 125.5, 125.4, 122.4, 121.8, 116.3 (d, *J* = 22.5 Hz, 2C), 82.7, 16.9. ^{19}F NMR (565 MHz, $CDCl_3$) δ -112.9. HRMS (ESI-TOF) m/z: $[M + H]^+$ Calcd for $C_{23}H_{16}FN_2O_2^+$ 371.1190, Found: 371.1193. Enantiomeric excess was determined by HPLC with a Daicel Chiralpak AD-H, n-hexane/2-propanol = 70/30, v = 1.0 mL·min-1, λ = 254 nm, t (minor) = 15.1 min, t (major) = 24.5 min, 90% ee; $[\alpha]_D^{25.6}$ = +192.93 (c = 1.0, $CHCl_3$).



(*R*)-2'-(4-chlorophenyl)-3-methyl-1'*H*-spiro[isoindole-1,4'-isoquinoline]-1',3'(2'*H*)-dione (**43**). Colorless solid (16.0 mg, 41%, m.p. 234 - 235 °C). ^{1}H NMR (600 MHz, $CDCl_3$) δ 8.36 (dd, *J* = 7.7, 1.5 Hz, 1H), 7.63 (d, *J* = 7.6 Hz, 1H), 7.53 – 7.47 (m, 3H), 7.43 – 7.40 (m, 3H), 7.32 (d, *J* = 7.6 Hz, 1H), 7.17 – 7.13 (m, 2H), 6.75 (dd, *J* = 7.6, 1.1 Hz, 1H), 2.68 (s, 3H). ^{13}C NMR (150 MHz, $CDCl_3$) δ 176.5, 168.4, 164.5, 153.1, 140.0, 136.4, 134.7, 134.6, 133.6, 130.3, 129.9, 129.8, 129.5, 129.4, 129.1, 125.5, 125.3, 122.5, 121.8, 82.7, 16.9. HRMS (ESI-TOF) m/z: $[M + H]^+$ Calcd for $C_{23}H_{16}ClN_2O_2^+$ 387.0895, Found: 387.0893. Enantiomeric excess was determined by HPLC with a Daicel Chiralpak AD-H, n-hexane/2-propanol = 70/30, v = 1.0 mL·min-1, λ = 254 nm, t (minor) = 18.1 min, t (major) = 27.2 min, 86% ee; $[\alpha]_D^{25.6}$ = +128.87 (c = 1.0, $CHCl_3$).

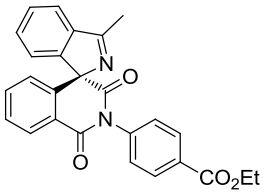


(*R*)-2'-(4-bromophenyl)-3-methyl-1'*H*-spiro[isoindole-1,4'-isoquinoline]-1',3'(2'*H*)-dione (**44**). Colorless solid (31.3 mg, 73%, m.p. 227 - 228 °C). ^{1}H NMR (600 MHz, $CDCl_3$) δ 8.35 (d, *J* = 7.5 Hz, 1H), 7.63 (d, *J* = 7.6 Hz, 1H), 7.57 (d, *J* = 8.5 Hz, 2H), 7.53 – 7.47 (m, 3H), 7.41 (t, *J* = 7.5 Hz, 1H), 7.32 (d, *J* = 7.5 Hz, 1H), 7.09 (d, *J* = 8.5 Hz, 2H), 6.75 (d, *J* = 7.5 Hz, 1H), 2.68 (s, 3H). ^{13}C NMR (150 MHz, $CDCl_3$) δ 176.5, 168.4, 164.4, 153.0, 140.0, 136.4, 134.6, 134.2, 132.5, 130.28, 130.25, 129.8, 129.4, 129.1, 125.6, 125.3, 122.8, 122.5, 121.8, 82.7, 17.0. HRMS (ESI-TOF) m/z: $[M + H]^+$ Calcd for $C_{23}H_{16}BrN_2O_2^+$ 431.0390, Found: 431.0391. Enantiomeric excess was determined by HPLC with a Daicel Chiralpak AD-H, n-hexane/2-propanol = 70/30, v = 1.0 mL·min-1, λ = 254 nm, t (minor) = 20.6 min, t (major) = 31.3 min, 95% ee; $[\alpha]_D^{25.6}$ = +199.40 (c = 1.0, $CHCl_3$).

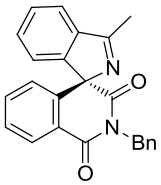


(*R*)-3-methyl-2'-(4-(trifluoromethyl)phenyl)-1'*H*-spiro[isoindole-1,4'-isoquinoline]-1',3'(2'*H*)-dione (**45**). Colorless solid (35.6 mg, 85%, m.p. 184 - 185 °C). ^{1}H NMR (600 MHz, $CDCl_3$) δ 8.37 (dd, *J* = 7.6, 1.5 Hz, 1H), 7.72 (d, *J* = 8.4 Hz, 2H), 7.64 (d, *J* = 7.6 Hz, 1H), 7.55 – 7.48 (m, 3H), 7.43 (td, *J* = 7.5, 0.7 Hz, 1H), 7.35 (dd, *J* = 10.9, 7.9 Hz, 3H), 6.78 – 6.73 (m, 1H), 2.69 (s, 3H). ^{13}C NMR (150 MHz, $CDCl_3$) δ 176.6, 168.4, 164.4, 153.0, 140.1, 138.4, 136.4, 134.8, 131.0 (q, *J* = 32.8 Hz, 1C), 130.4, 129.8, 129.5, 129.3, 129.2, 126.4 (q, *J* = 3.4 Hz, 2C), 125.6, 125.2, 123.88 (q, *J* = 272.8 Hz, 1C), 122.5, 121.8, 82.7, 17.0. ^{19}F NMR (565 MHz, $CDCl_3$) δ -62.7. HRMS (ESI-TOF) m/z:

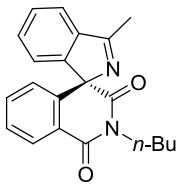
$[M + H]^+$ Calcd for $C_{24}H_{16}F_3N_2O_2^+$ 421.1158, Found: 421.1160. Enantiomeric excess was determined by HPLC with a Daicel Chiralpak AD-H, n-hexane/2-propanol = 70/30, v = 1.0 mL·min-1, λ = 254 nm, t (minor) = 13.7 min, t (major) = 18.3 min, 91% ee; $[\alpha]_D^{25.6}$ = +165.27 (c = 1.0, $CHCl_3$).



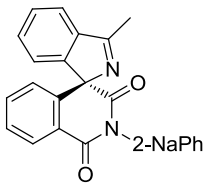
(*R*)-ethyl 4-(3-methyl-1',3'-dioxo-1'*H*-spiro[isoindole-1,4'-isoquinolin]-2'(3'*H*)-yl)benzoate (**46**). Colorless solid (22.0 mg, 52%, m.p. 185 - 186 °C). ^{1}H NMR (600 MHz, $CDCl_3$) δ 8.38 – 8.35 (m, 1H), 8.14 (d, *J* = 8.7 Hz, 2H), 7.63 (d, *J* = 7.6 Hz, 1H), 7.55 – 7.48 (m, 3H), 7.43 (td, *J* = 7.5, 1.0 Hz, 1H), 7.34 (d, *J* = 7.6 Hz, 1H), 7.29 (d, *J* = 8.5 Hz, 2H), 6.75 (dd, *J* = 7.7, 1.1 Hz, 1H), 4.38 (q, *J* = 7.1 Hz, 2H), 2.69 (s, 3H), 1.39 (t, *J* = 7.1 Hz, 3H). ^{13}C NMR (150 MHz, $CDCl_3$) δ 176.7, 168.3, 165.9, 164.4, 153.1, 140.0, 139.3, 136.4, 134.7, 130.9, 130.6, 130.4, 129.9, 129.5, 129.2, 128.7, 125.6, 125.3, 122.5, 121.8, 82.7, 61.3, 17.0, 14.4. HRMS (ESI-TOF) m/z: $[M + H]^+$ Calcd for $C_{26}H_{21}N_2O_4^+$ 425.1496, Found: 425.1494. Enantiomeric excess was determined by HPLC with a Daicel Chiralpak AD-H, n-hexane/2-propanol = 70/30, v = 1.0 mL·min-1, λ = 254 nm, t (minor) = 37.2 min, t (major) = 65.8 min, 93% ee; $[\alpha]_D^{25.6}$ = +131.13 (c = 1.0, $CHCl_3$).



(*R*)-2'-benzyl-3-methyl-1'H-spiro[isoindole-1,4'-isoquinoline]-1',3'(2'H)-dione (**47**). Colorless solid (30.0 mg, 82%, m.p. 139 - 140 °C). ^{1}H NMR (600 MHz, $CDCl_3$) δ 8.32 (dd, *J* = 7.9, 1.3 Hz, 1H), 7.60 (d, *J* = 7.6 Hz, 1H), 7.47 – 7.43 (m, 2H), 7.43 – 7.37 (m, 3H), 7.30 – 7.19 (m, 4H), 7.02 (d, *J* = 7.6 Hz, 1H), 6.63 (dd, *J* = 7.8, 0.7 Hz, 1H), 5.22 (d, *J* = 13.9 Hz, 1H), 5.17 (d, *J* = 13.9 Hz, 1H), 2.68 (s, 3H). ^{13}C NMR (150 MHz, $CDCl_3$) δ 176.3, 168.7, 164.4, 153.4, 139.9, 136.9, 136.2, 134.2, 130.1, 129.6, 129.2, 129.05, 128.95, 128.5, 127.6, 125.42, 125.34, 122.2, 121.9, 82.2, 44.5, 17.0. HRMS (ESI-TOF) m/z: $[M + H]^+$ Calcd for $C_{24}H_{19}N_2O_2^+$ 367.1441, Found: 367.1439. Enantiomeric excess was determined by HPLC with a Daicel Chiralpak AD-H, n-hexane/2-propanol = 70/30, v = 1.0 mL·min-1, λ = 254 nm, t (major) = 9.6 min, t (minor) = 15.1 min, 90% ee; $[\alpha]_D^{25.6}$ = +45.13 (c = 1.0, $CHCl_3$).

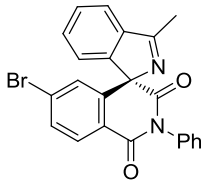


(*R*)-2'-butyl-3-methyl-1'*H*-spiro[isoindole-1,4'-isoquinoline]-1',3'(2'*H*)-dione (**48**). Colorless solid (24.0 mg, 72%, m.p. 106 - 107 °C). ^{1}H NMR (600 MHz, $CDCl_3$) δ 8.32 (dd, *J* = 7.9, 1.2 Hz, 1H), 7.61 (d, *J* = 7.6 Hz, 1H), 7.47 – 7.43 (m, 2H), 7.40 (td, *J* = 7.6, 1.3 Hz, 1H), 7.34 (td, *J* = 7.5, 0.6 Hz, 1H), 7.12 (d, *J* = 7.6 Hz, 1H), 6.63 (d, *J* = 7.6 Hz, 1H), 4.05 – 3.95 (m, 2H), 2.68 (s, 3H), 1.60 – 1.54 (m, 2H), 1.40 – 1.32 (m, 2H), 0.90 (t, *J* = 7.4 Hz, 3H). ^{13}C NMR (150 MHz, $CDCl_3$) δ 176.2, 168.5, 164.4, 153.6, 140.0, 136.2, 134.0, 130.1, 129.4, 129.2, 128.9, 125.4, 122.2, 121.7, 82.1, 41.1, 30.1, 20.3, 16.9, 13.8. HRMS (ESI-TOF) m/z: $[M + H]^+$ Calcd for $C_{21}H_{21}N_2O_2^+$ 333.1598, Found: 333.1593. Enantiomeric excess was determined by HPLC with a Daicel Chiralpak AD-H, n-hexane/2-propanol = 95/5, v = 1.0 mL·min-1, λ = 254 nm, t (minor) = 26.1 min, t (major) = 27.9 min, 79% ee; $[\alpha]_D^{25.6}$ = +84.27 (c = 1.0, $CHCl_3$).

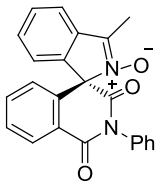


(*R*)-3-methyl-2'-(naphthalen-2-yl)-1'*H*-spiro[isoindole-1,4'-isoquinoline]-1',3'(2'*H*)-dione (**49**). Colorless solid (34.1 mg, 85%, m.p. 239 - 240 °C). ^{1}H NMR (600

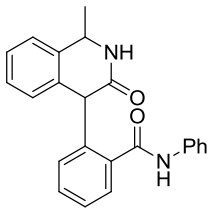
MHz, $CDCl_3$) δ 8.40 (d, *J* = 7.6 Hz, 1H), 7.93 (d, *J* = 8.6 Hz, 1H), 7.87 (d, *J* = 7.8 Hz, 1H), 7.83 (d, *J* = 7.8 Hz, 1H), 7.74 (s, 1H), 7.62 (d, *J* = 7.5 Hz, 1H), 7.56 – 7.46 (m, 5H), 7.46 – 7.38 (m, 2H), 7.30 (d, *J* = 8.5 Hz, 1H), 6.78 (d, *J* = 7.6 Hz, 1H), 2.70 (s, 3H). ^{13}C NMR (150 MHz, $CDCl_3$) δ 176.4, 168.7, 164.8, 153.3, 140.0, 136.5, 134.5, 133.5, 133.2, 132.6, 130.2, 129.8, 129.3, 129.2, 129.1, 128.3, 127.9, 127.6, 126.8, 126.5, 125.9, 125.6, 125.5, 122.4, 121.8, 82.8, 17.0. HRMS (ESI-TOF) m/z: $[M + H]^+$ Calcd for $C_{27}H_{19}N_2O_2^+$ 403.1441, Found: 403.1440. Enantiomeric excess was determined by HPLC with a Daicel Chiralpak AD-H, n-hexane/2-propanol = 60/40, v = 1.0 mL·min-1, λ = 254 nm, t (minor) = 17.3 min, t (major) = 26.7 min, 91% ee; $[\alpha]_D^{25.6}$ = +226.80 (c = 1.0, $CHCl_3$).



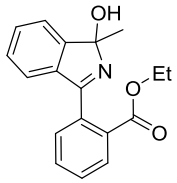
(*R*)-6'-bromo-3-methyl-2'-phenyl-1'*H*-spiro[isoindole-1,4'-isoquinoline]-1',3'(2'*H*)-dione (**50**). Yellow solid (40.0 mg, 64%, m.p. 190 - 191 °C). ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.22 (d, *J* = 8.4 Hz, 1H), 7.69 – 7.61 (m, 2H), 7.56 – 7.37 (m, 5H), 7.34 (d, *J* = 7.5 Hz, 1H), 7.23 – 7.14 (m, 2H), 6.90 (d, *J* = 1.9 Hz, 1H), 2.70 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 177.2, 167.9, 164.0, 152.7, 139.9, 138.2, 134.9, 132.6, 131.3, 130.4, 129.7, 129.7, 129.4, 129.0, 128.6, 128.4, 124.4, 122.7, 121.7, 82.3, 17.1. HRMS (ESI-TOF) m/z: $[M + H]^+$ Calcd for $C_{23}H_{16}BrN_2O_2^+$ 431.0390, Found: 431.0388. Enantiomeric excess was determined by HPLC with a Daicel Chiralpak AD-H, n-hexane/2-propanol = 70/30, v = 1.0 mL·min-1, λ = 254 nm, t (minor) = 13.9 min, t (major) = 23.1 min, 91% ee; $[\alpha]_D^{25.6}$ = +79.47 (c = 1.0, $CHCl_3$).



(*R*)-3-methyl-1',3'-dioxo-2'-phenyl-2',3'-dihydro-1'*H*-spiro[isoindole-1,4'-isoquinoline] 2-oxide (**51**). Yellow solid (23.4 mg, 64%, m.p. 231 - 232 °C). ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.42 – 8.36 (m, 1H), 7.65 – 7.58 (m, 2H), 7.51 – 7.33 (m, 7H), 7.28 – 7.21 (m, 2H), 7.15 (d, *J* = 7.5 Hz, 1H), 7.02 – 6.95 (m, 1H), 2.52 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 165.2, 163.7, 145.7, 138.9, 136.3, 135.0, 134.4, 133.0, 130.28, 130.26, 129.9, 129.3, 129.05, 129.02, 128.3, 126.8, 125.7, 121.4, 120.4, 84.5, 9.8. HRMS (ESI-TOF) m/z: $[M + H]^+$ Calcd for $C_{17}H_{13}N_2O_2^+$ 277.0972, Found: 277.0975. Enantiomeric excess was determined by HPLC with a Daicel Chiralpak OD-H, n-hexane/2-propanol = 80/20, v = 1.0 mL·min-1, λ = 254 nm, t (major) = 25.9 min, t (minor) = 38.3 min, 91% ee; $[\alpha]_D^{25.6}$ = +70.00 (c = 1.0, $CHCl_3$).



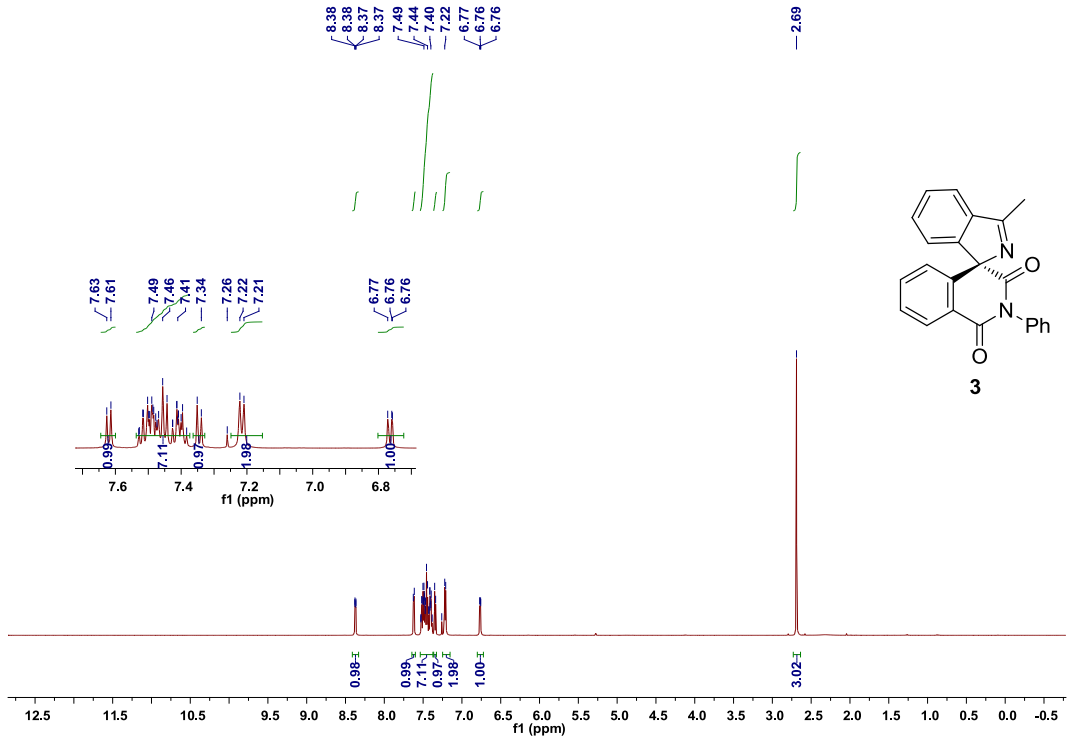
2-(1-methyl-3-oxo-1,2,3,4-tetrahydroisoquinolin-4-yl)-*N*-phenylbenzamide (**52**). Colorless solid (31.2 mg, 88%, d.r. = 4:1, m.p. 246 - 247 °C). ^{1}H NMR (600 MHz, $CDCl_3$) δ 11.36 (s, 1H), 11.12 (s, 4.3H), 7.82 – 7.67 (m, 15.7H), 7.32 – 7.11 (m, 39.7H), 7.11 – 7.01 (m, 10.6H), 6.82 – 6.75 (m, 6.2H), 6.68 (d, *J* = 7.5 Hz, 4.2H), 5.36 – 5.34 (m, 5H), 4.91 (q, *J* = 6.5 Hz, 4H), 4.81 – 4.75 (m, 1H), 1.61 (d, *J* = 6.7 Hz, 3H), 1.50 (d, *J* = 6.6 Hz, 12.7H). ^{13}C NMR (150 MHz, $CDCl_3$) δ 172.6, 172.2, 167.3 139.01, 138.99, 138.7, 138.0, 137.7, 134.2, 133.8, 133.5, 133.0, 130.70, 130.67, 130.2, 130.1, 129.9, 129.8, 129.8, 129.24, 129.22, 129.08, 129.05, 128.25, 128.20, 127.81, 127.78, 127.63, 127.57, 125.5, 125.0, 124.2, 120.0, 51.6, 51.3, 46.3, 46.0, 26.9, 25.3. HRMS (ESI-TOF) m/z: $[M + H]^+$ Calcd for $C_{23}H_{21}N_2O_2^+$ 357.1598, Found: 357.1586. Enantiomeric excess was determined by HPLC with a Daicel Chiralpak OD-H, n-hexane/2-propanol = 80/20, v = 1.0 mL·min-1, λ = 254 nm, t (major) = 12.4 min, t (minor) = 18.6 min, 85% ee; $[\alpha]_D^{25.6}$ = +12.20 (c = 1.0, $CHCl_3$).



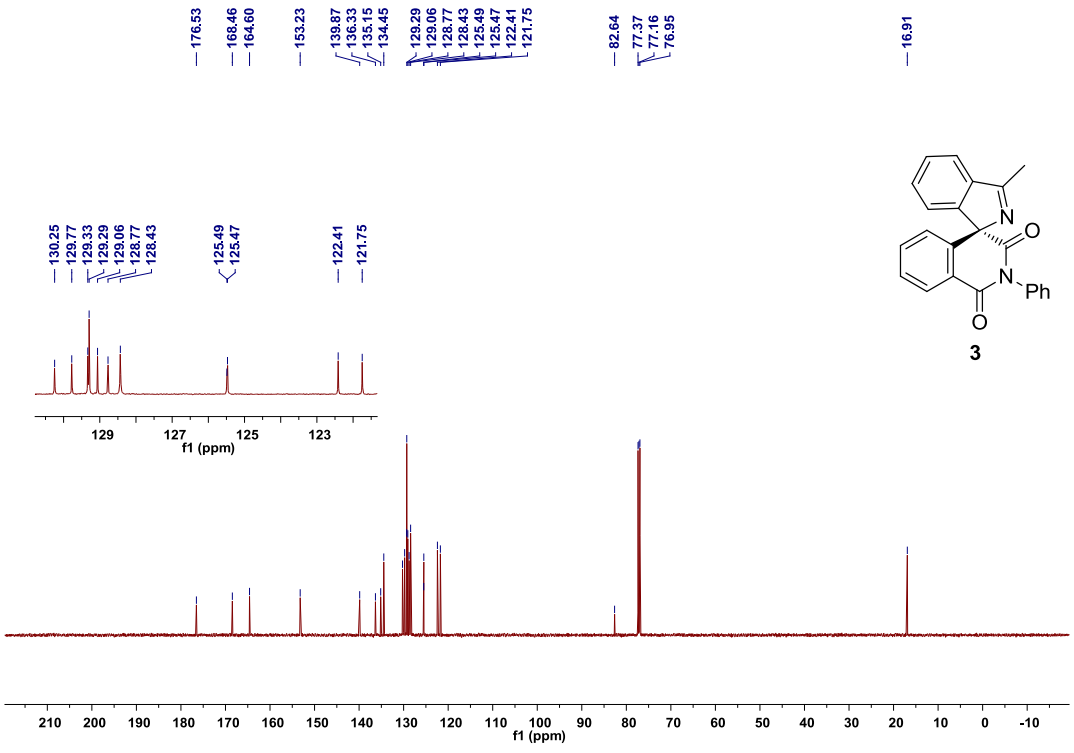
ethyl 2-(1-hydroxy-1-methyl-1*H*-isoindol-3-yl)benzoate (**53**). Colorless solid (16.3 mg, 55%, m.p. 135 - 136 °C).^{1}H NMR (400 MHz, DMSO-d_6) δ 7.96 (dd, *J* = 7.7, 0.7 Hz, 1H), 7.77 (td, *J* = 7.5, 1.2 Hz, 1H), 7.68 (td, *J* = 7.6, 1.1 Hz, 1H), 7.61 (dd, *J* = 6.9, 5.9 Hz, 2H), 7.42 (t, *J* = 7.1 Hz, 1H), 7.35 (dt, *J* = 7.4, 3.7 Hz, 1H), 7.04 (d, *J* = 7.4 Hz, 1H), 6.18 (s, 1H), 4.07 – 3.92 (m, 2H), 1.58 (s, 3H), 0.89 (t, *J* = 7.1 Hz, 4H). ^{13}C NMR (101 MHz, DMSO-d_6) δ 168.8, 167.1, 154.9, 137.7, 134.9, 132.9, 131.1, 130.2, 130.0, 129.4, 128.9, 122.6, 121.4, 100.0, 61.4, 25.9, 13.9. HRMS (ESI-TOF) m/z: [M + H]+ Calcd for $C_{18}H_{18}NO_3^+$ 296.1281, Found: 296.1275.

9. NMR spectrum and HPLC Chromatograms

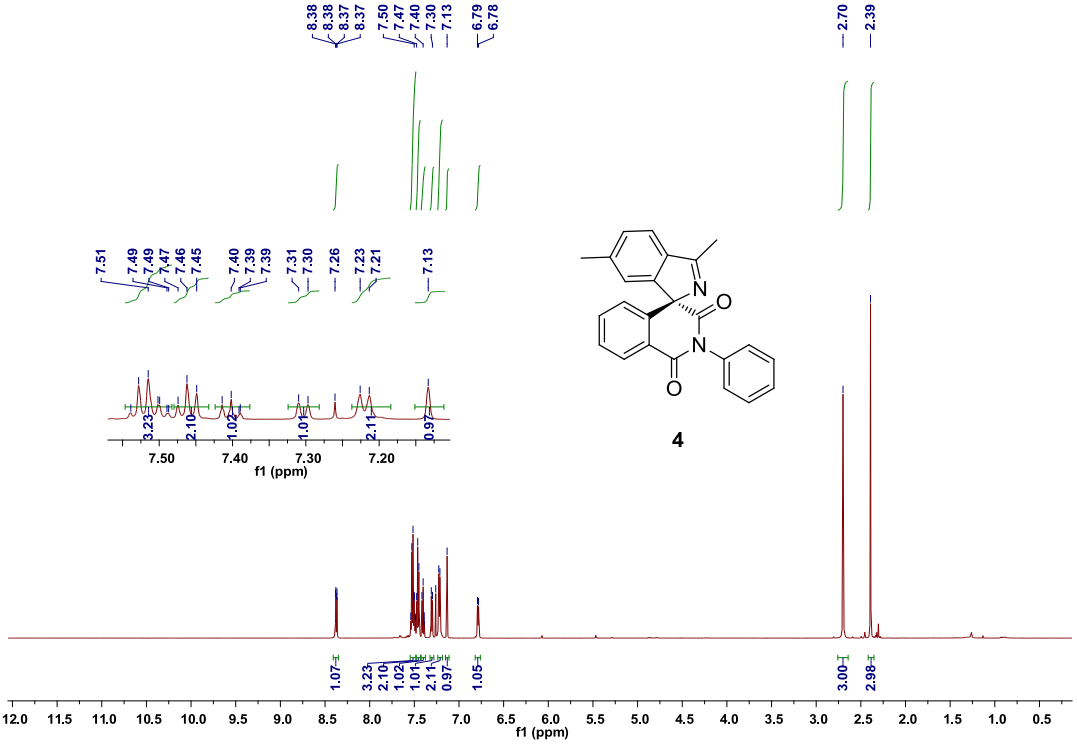
^{1}H NMR (600 MHz, $CDCl_3$)



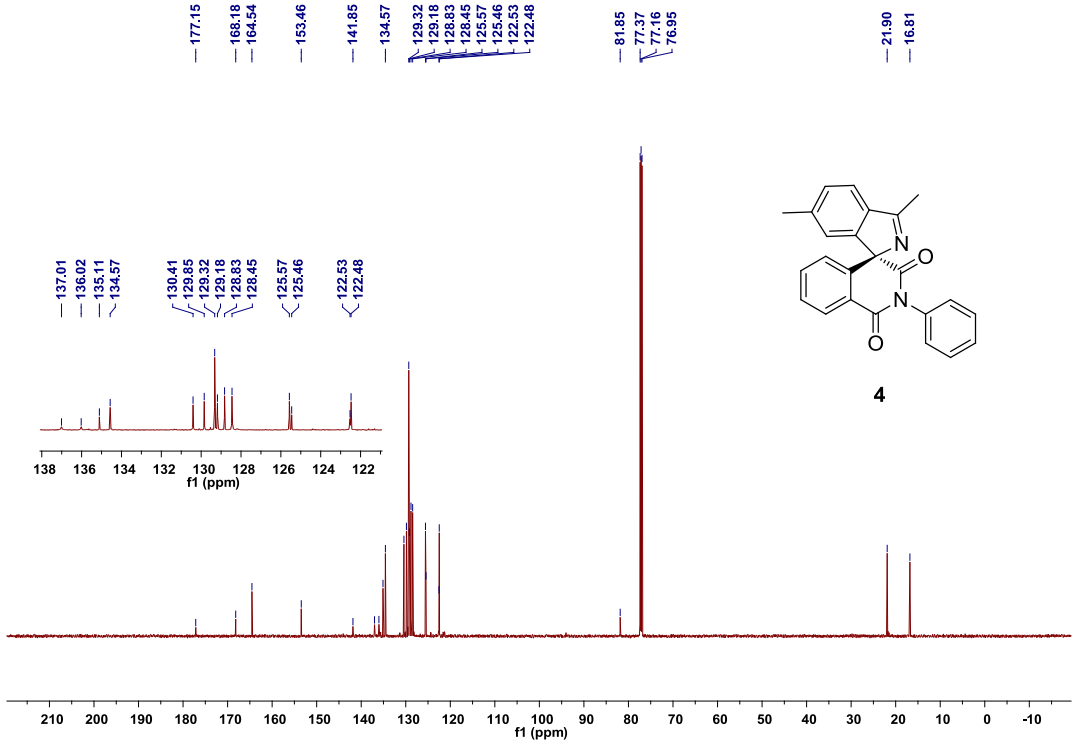
^{13}C NMR (150 MHz, $CDCl_3$)



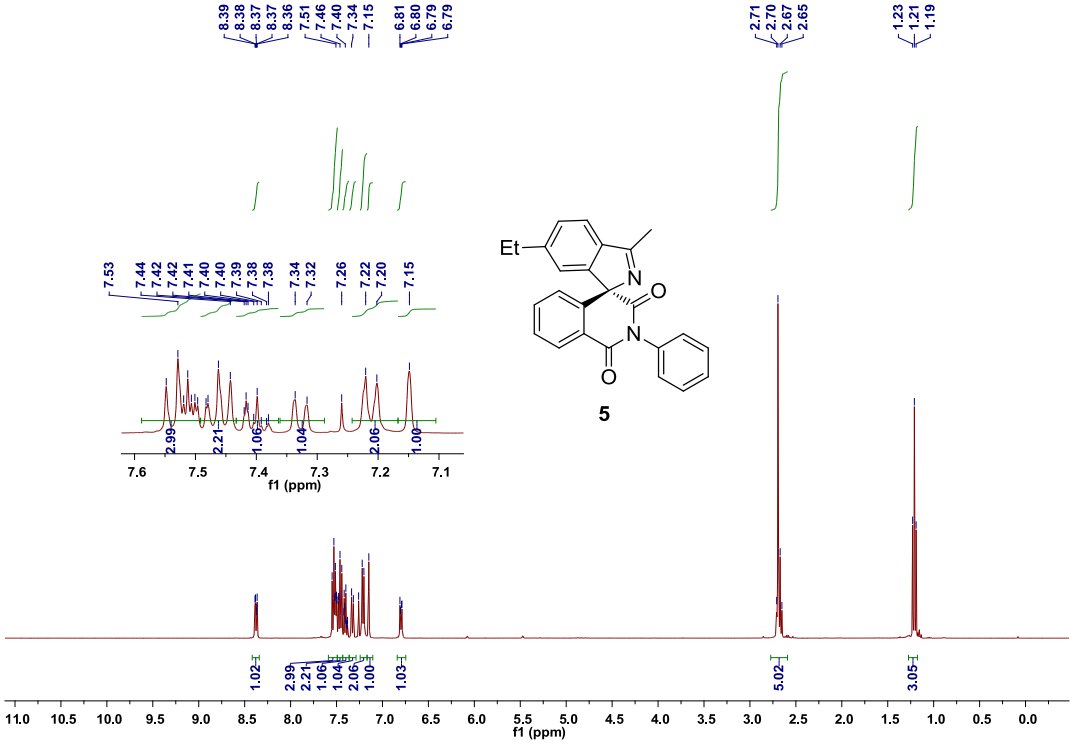
^{1}H NMR (600 MHz, $CDCl_3$)



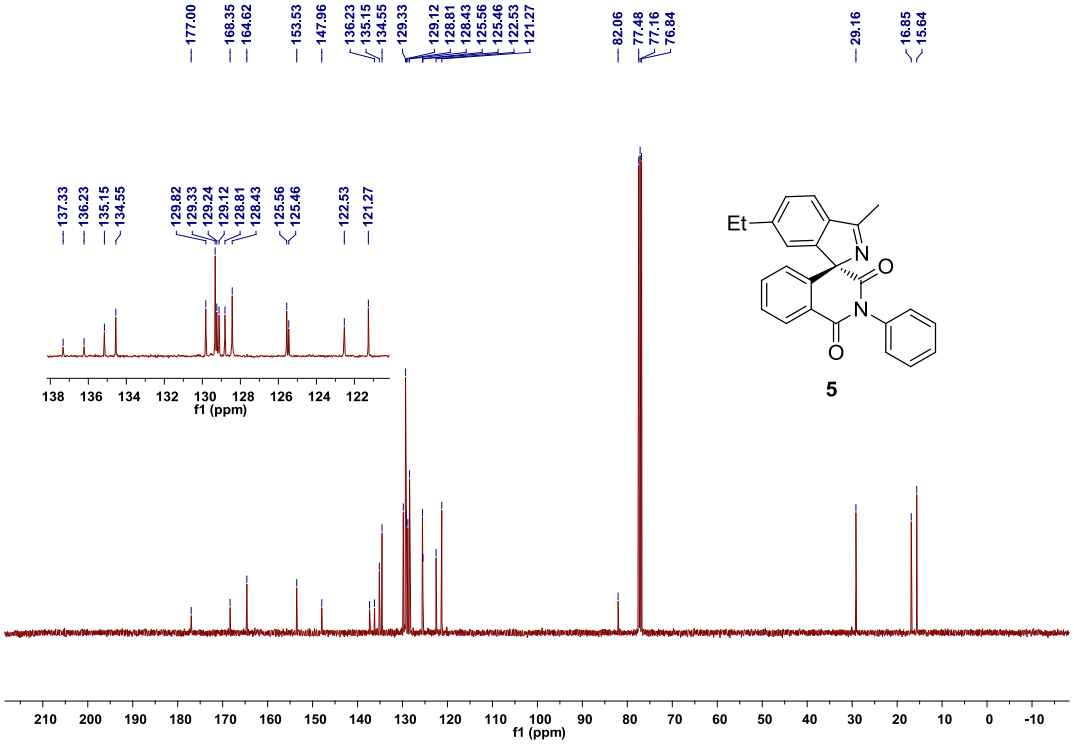
^{13}C NMR (150 MHz, $CDCl_3$)



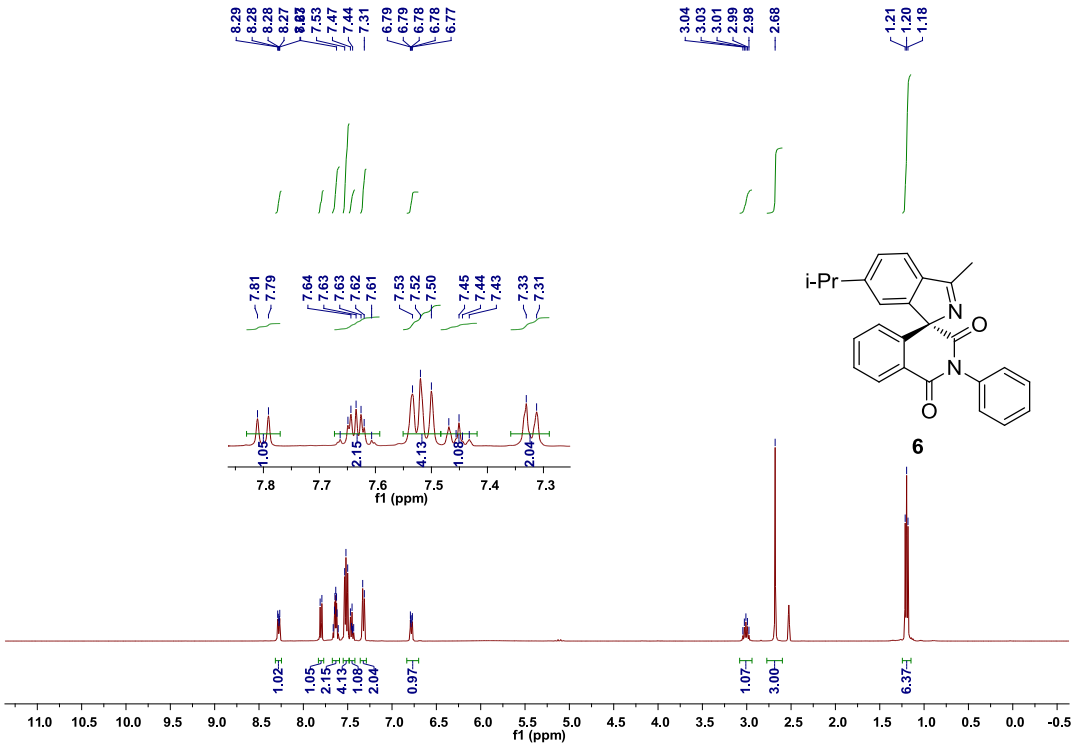
^{1}H NMR (400 MHz, $CDCl_3$)



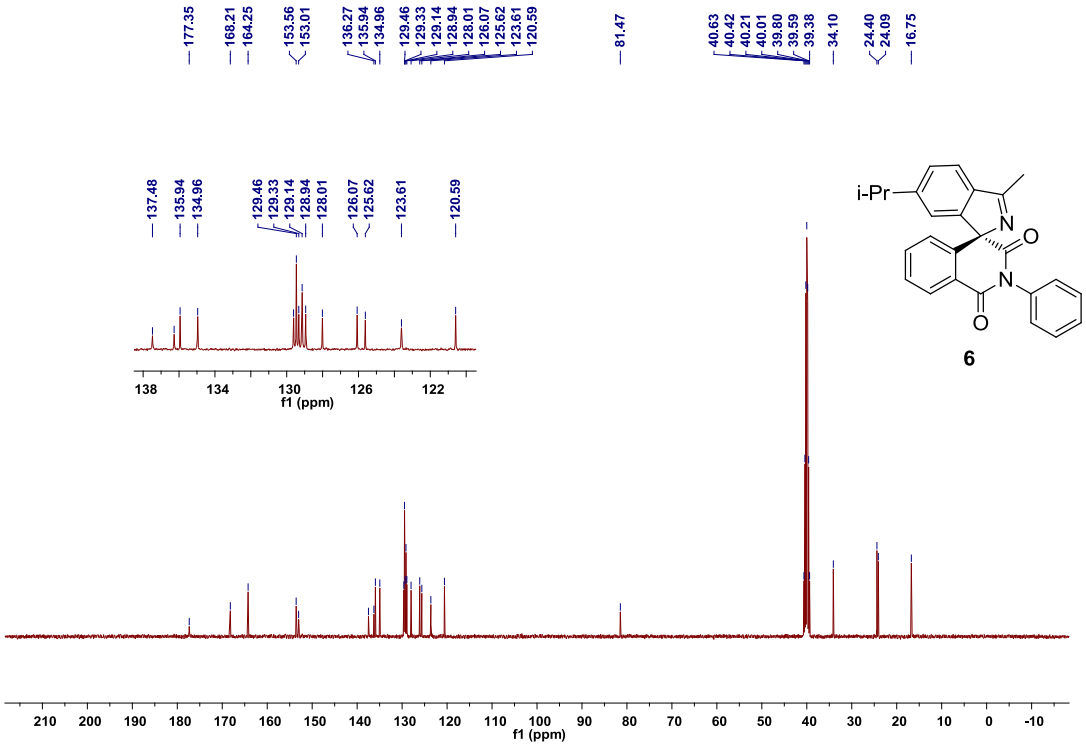
^{13}C NMR (100 MHz, $CDCl_3$)



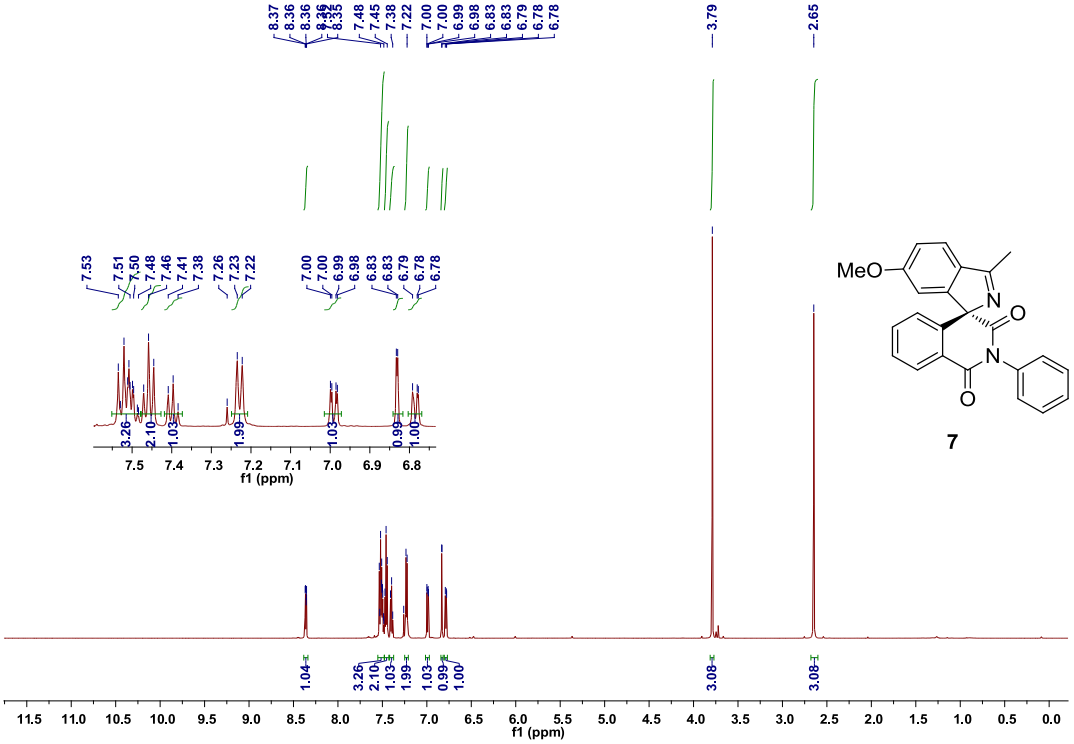
^{1}H NMR (400 MHz, DMSO–d_6)



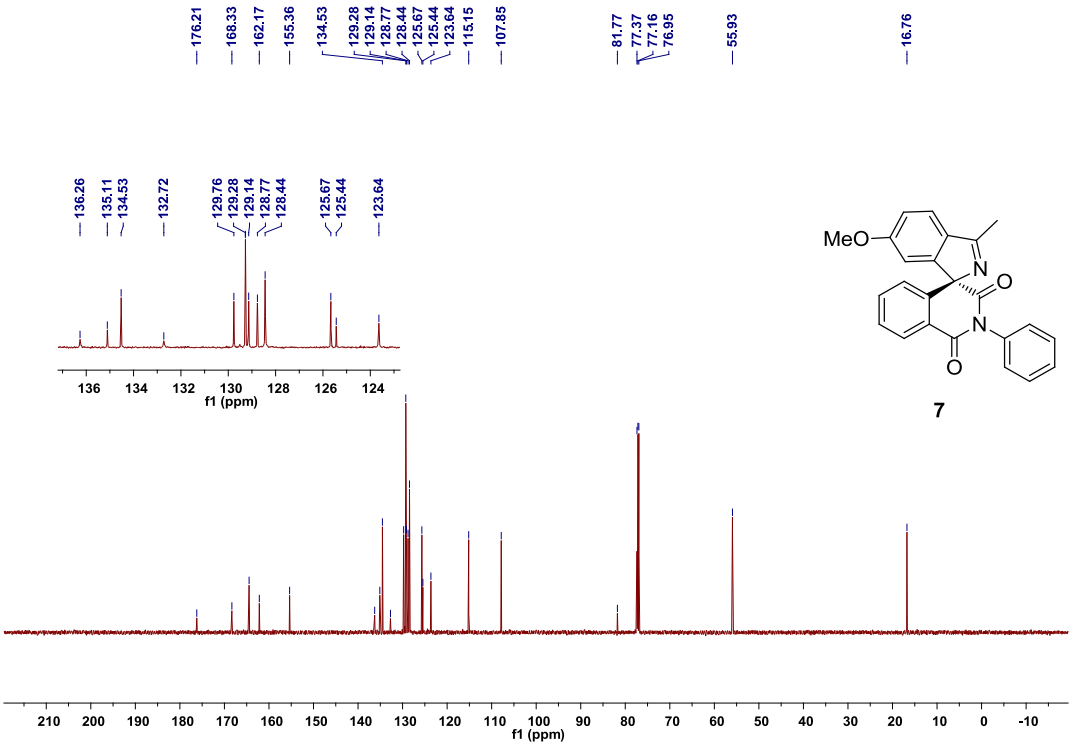
^{13}C NMR (100 MHz, DMSO–d_6)



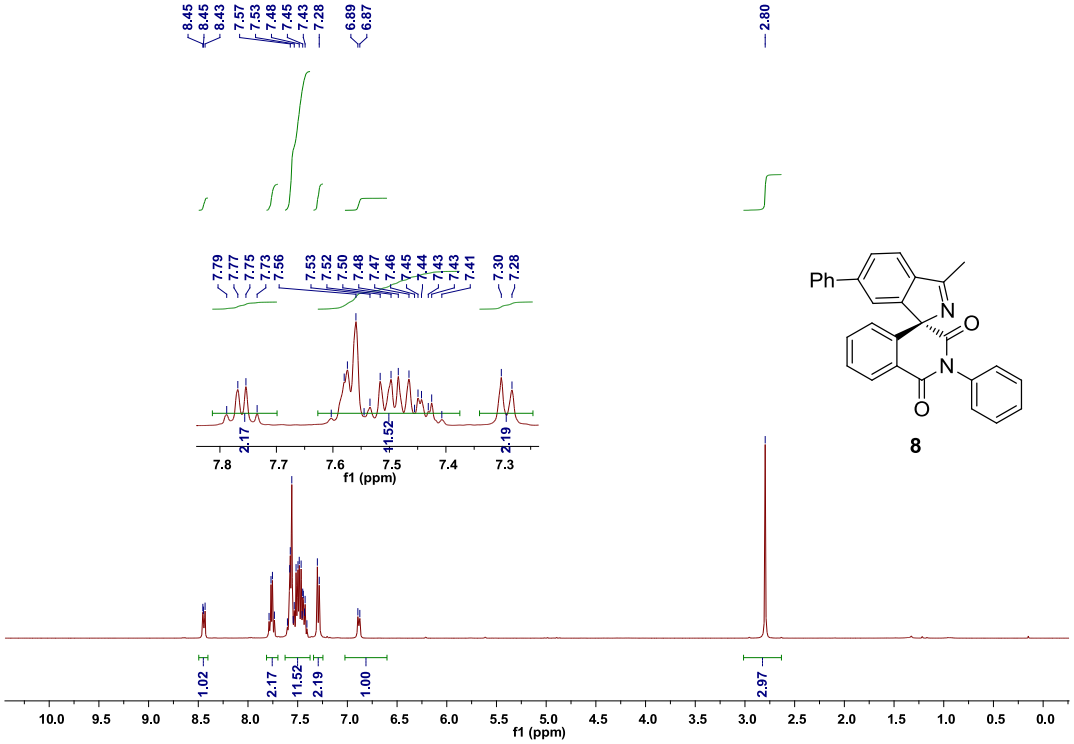
^{1}H NMR (600 MHz, $CDCl_3$)



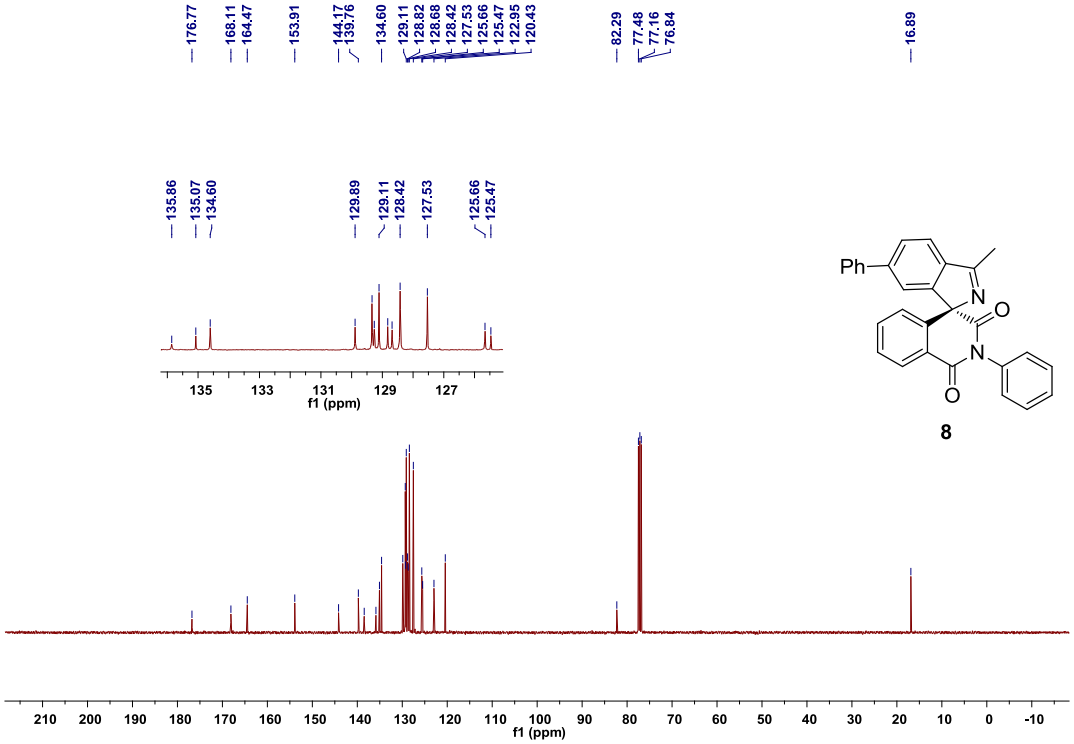
^{13}C NMR (150 MHz, $CDCl_3$)



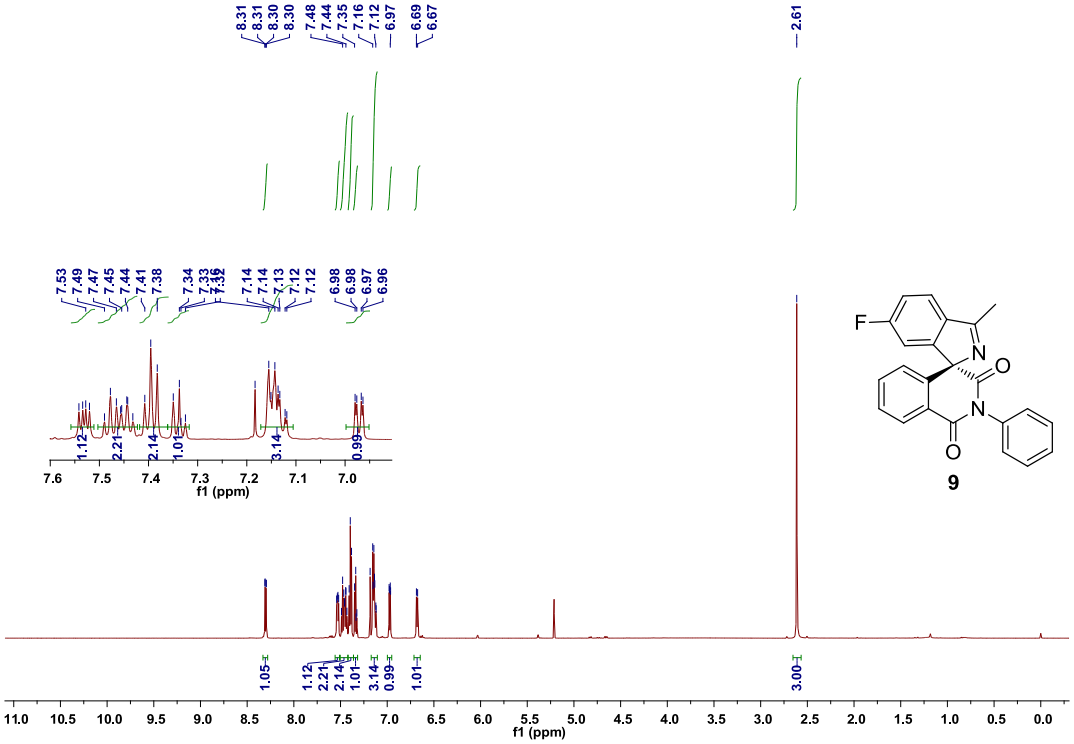
^{1}H NMR (400 MHz, $CDCl_3$)



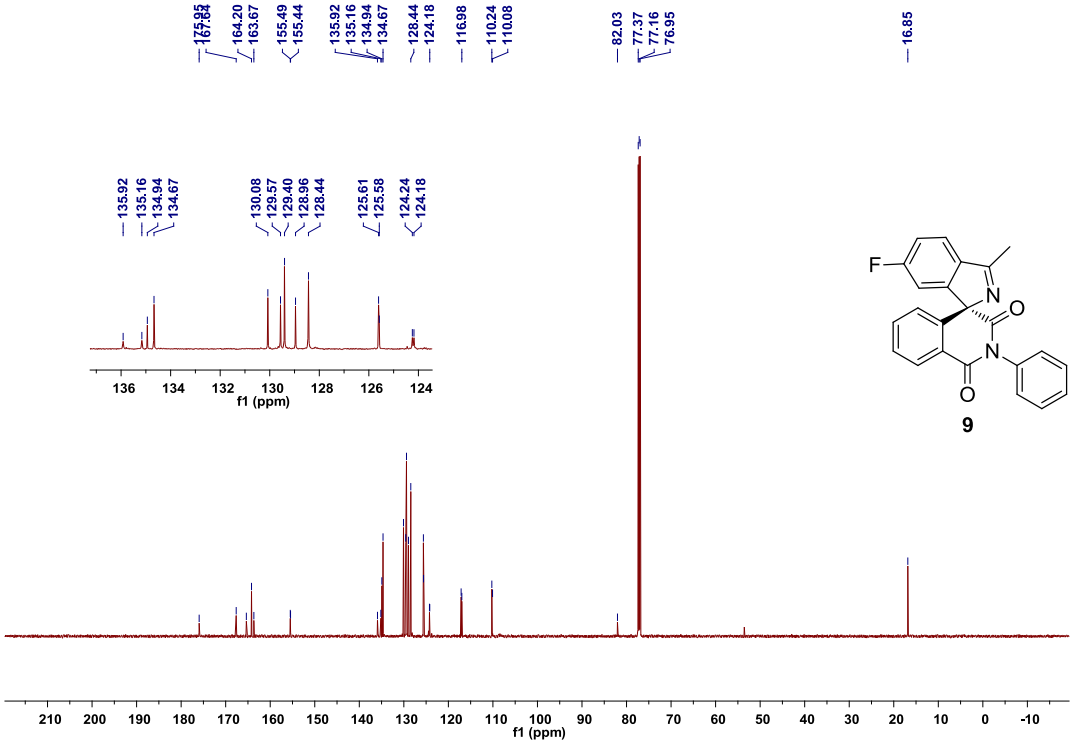
^{13}C NMR (100 MHz, $CDCl_3$)



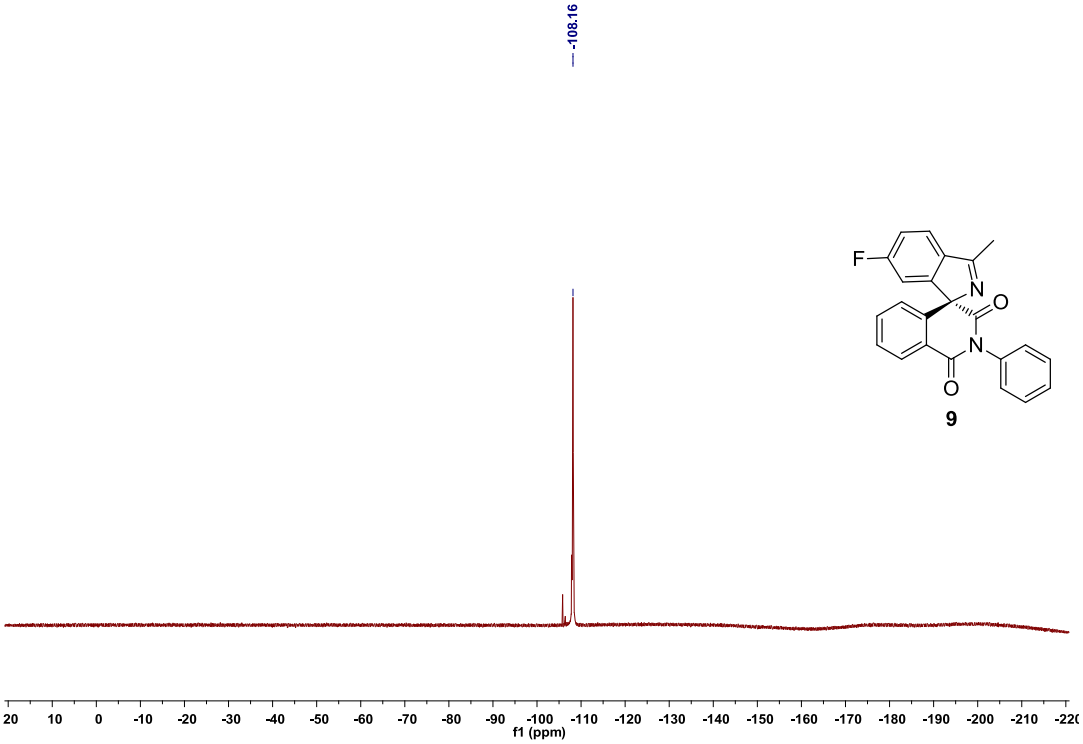
^{1}H NMR (600 MHz, $CDCl_3$)



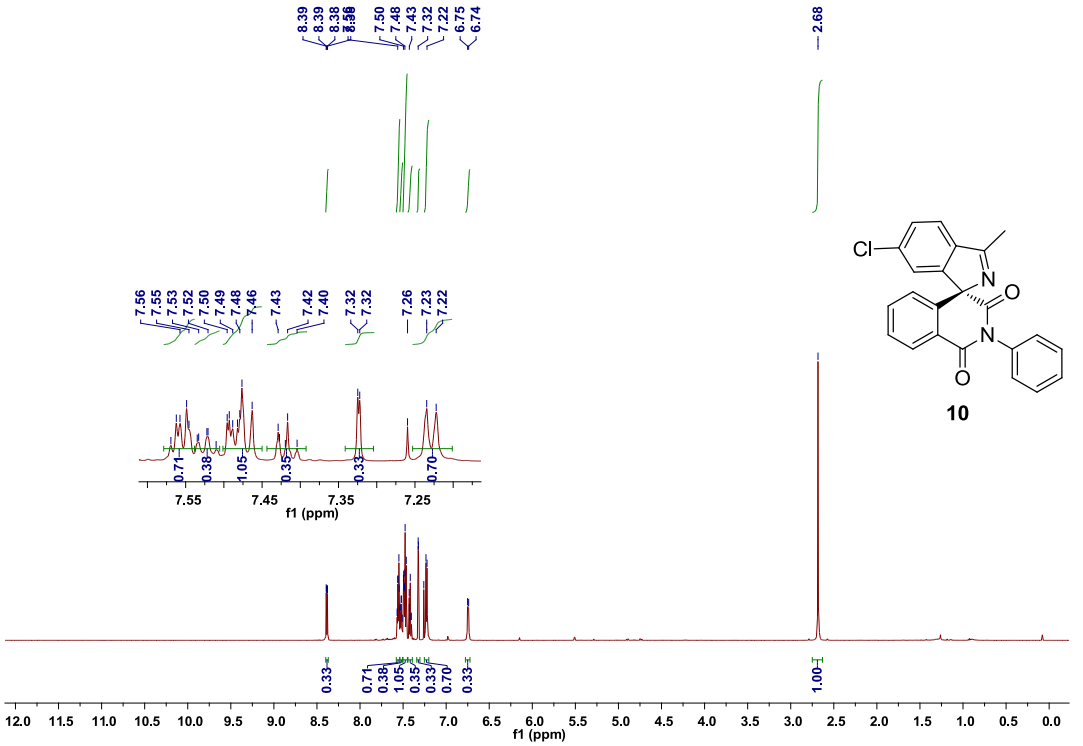
^{13}C NMR (150 MHz, $CDCl_3$)



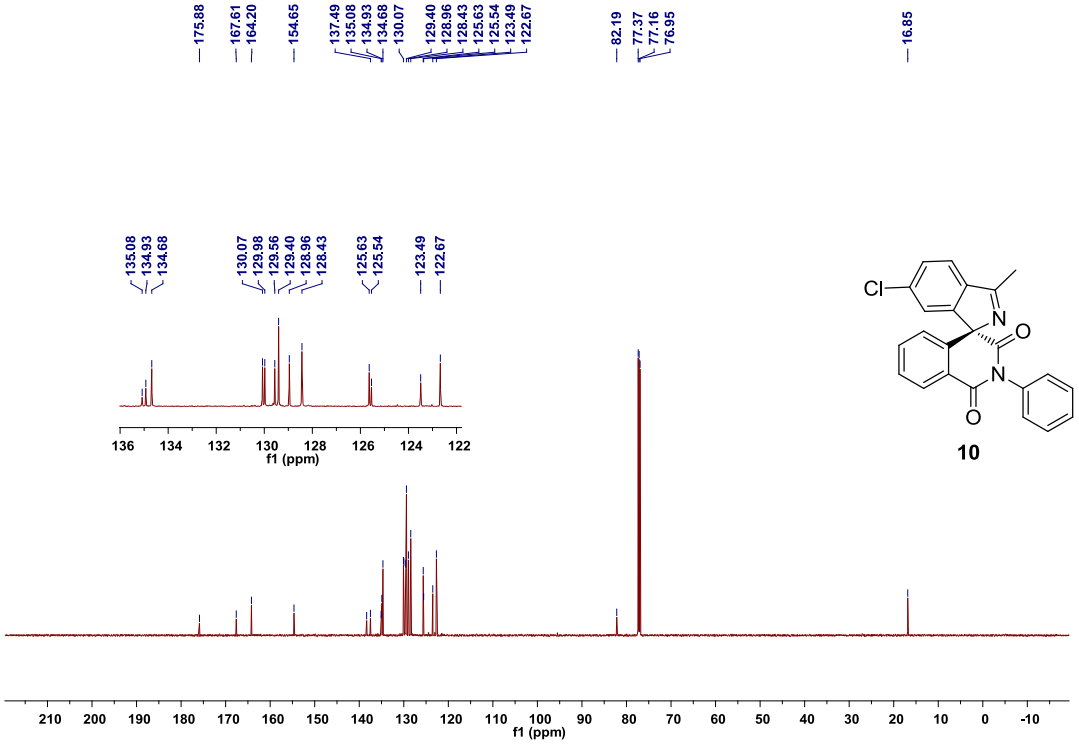
^{19}F NMR (376 MHz, $CDCl_3$)



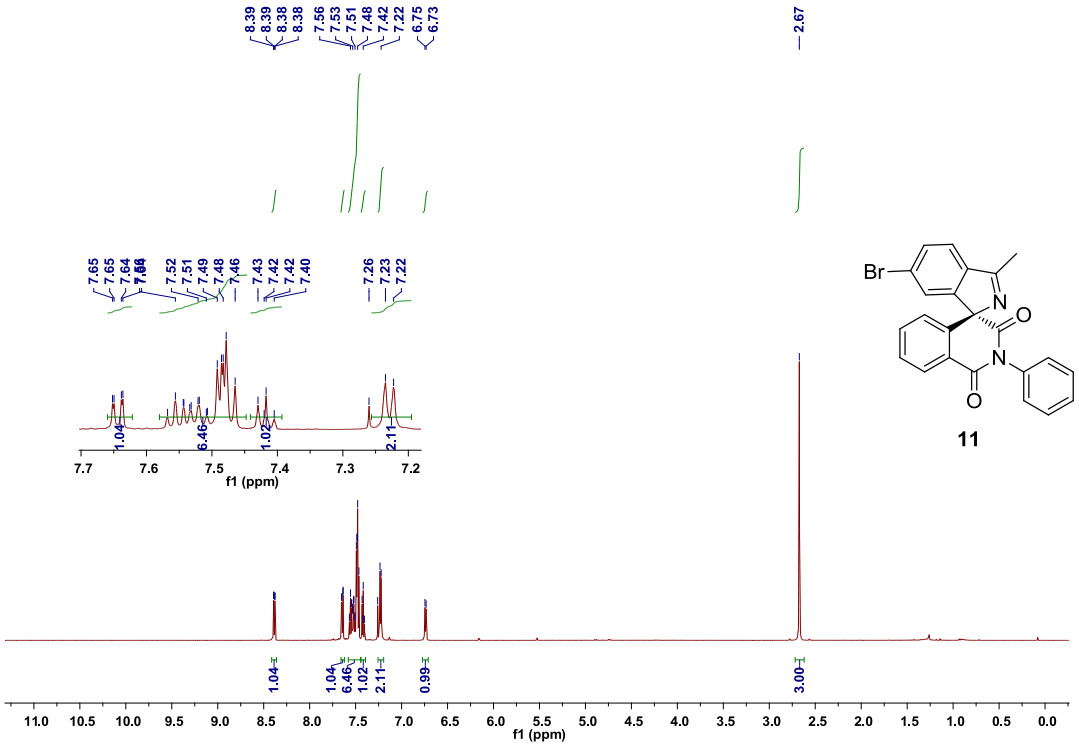
^{1}H NMR (600 MHz, $CDCl_3$)



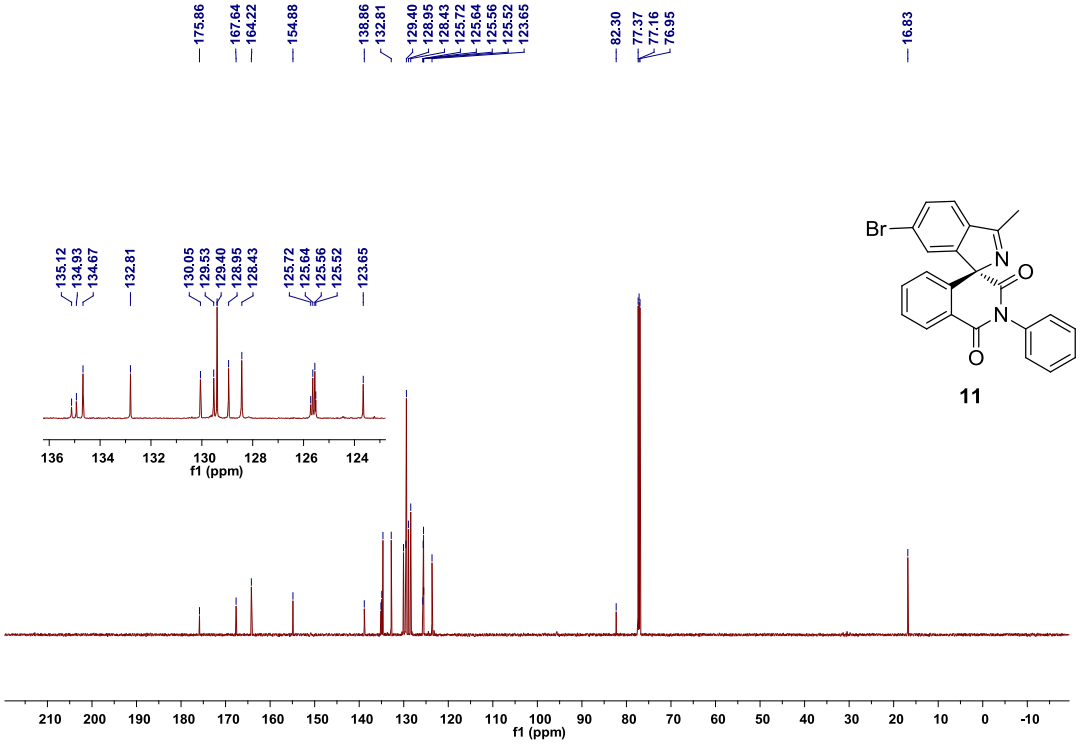
^{13}C NMR (150 MHz, $CDCl_3$)



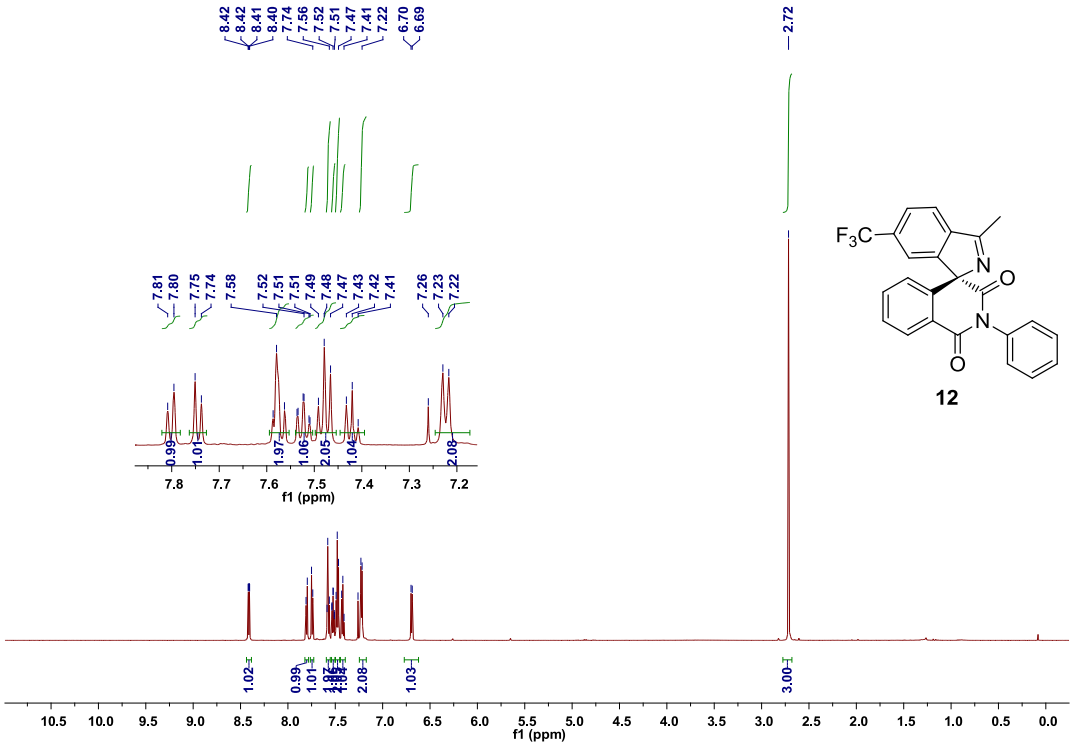
^{1}H NMR (600 MHz, $CDCl_3$)



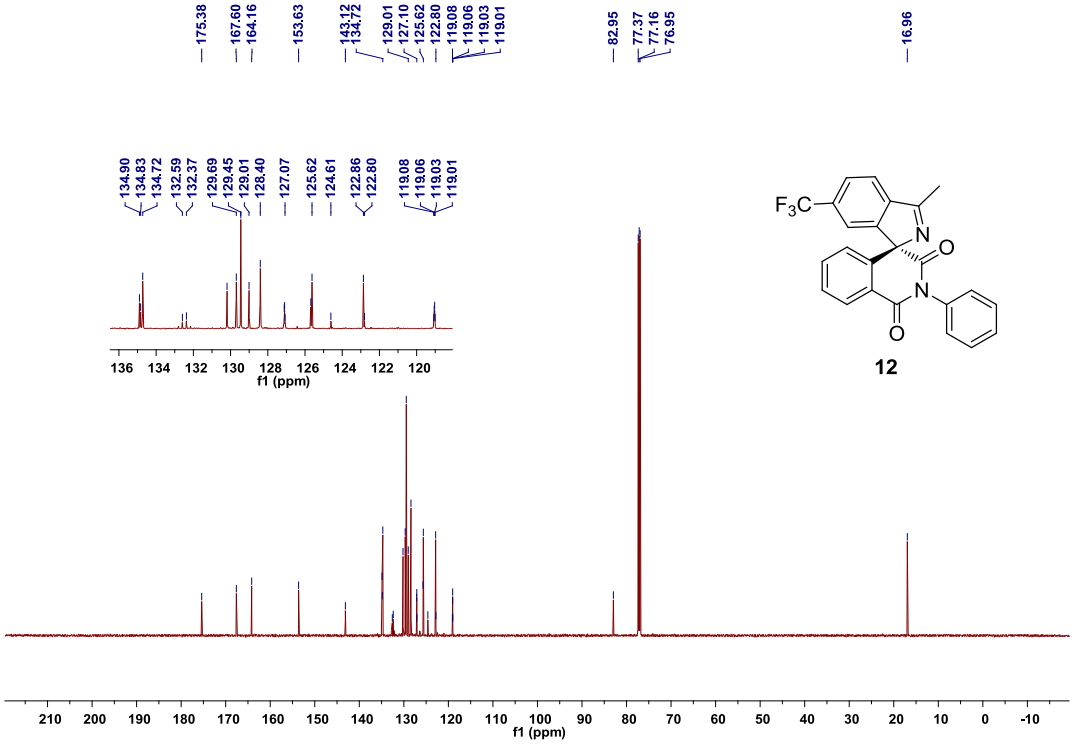
^{13}C NMR (150 MHz, $CDCl_3$)



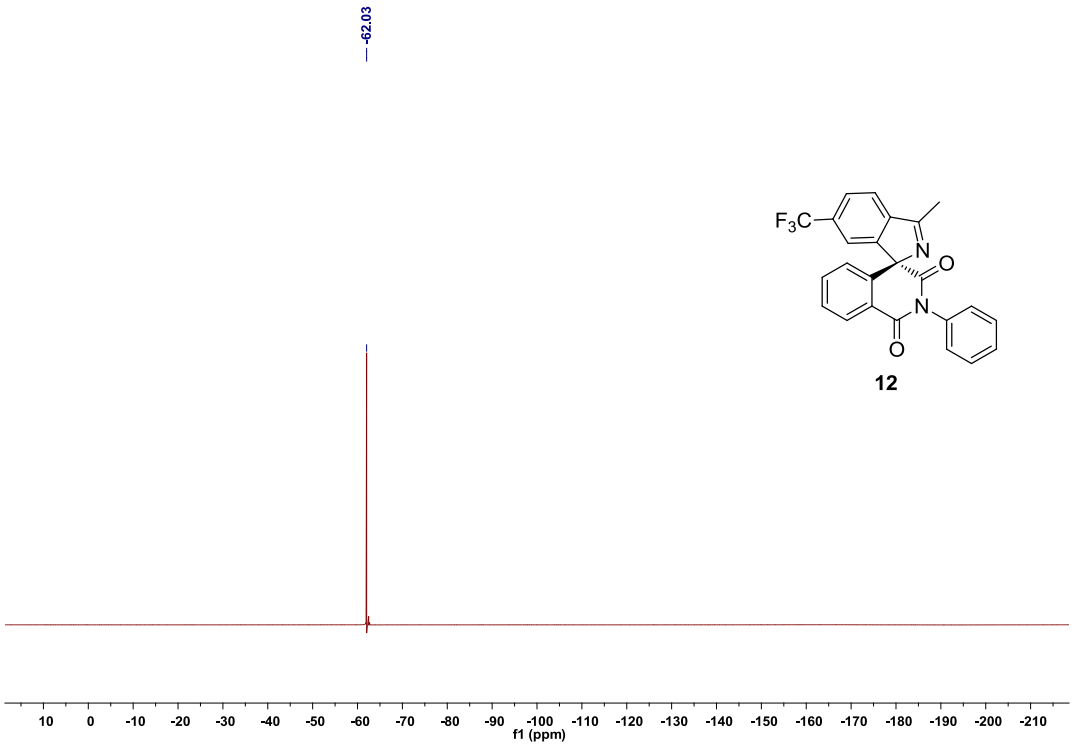
^{1}H NMR (600 MHz, $CDCl_3$)



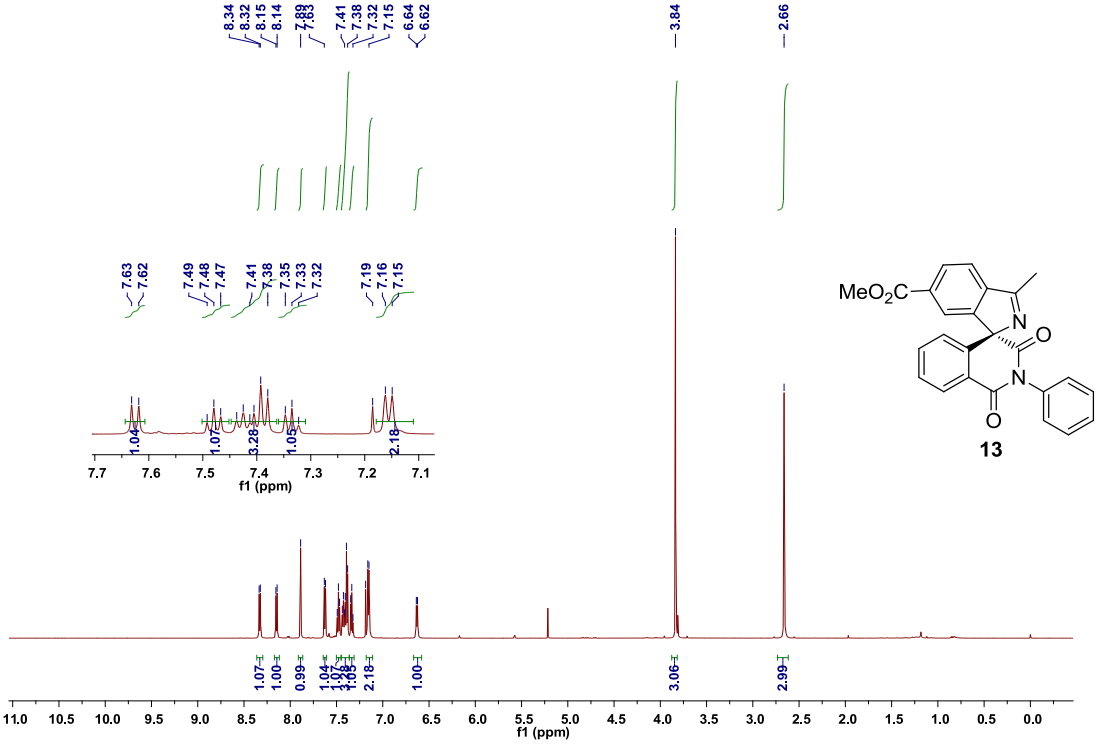
^{13}C NMR (150 MHz, $CDCl_3$)



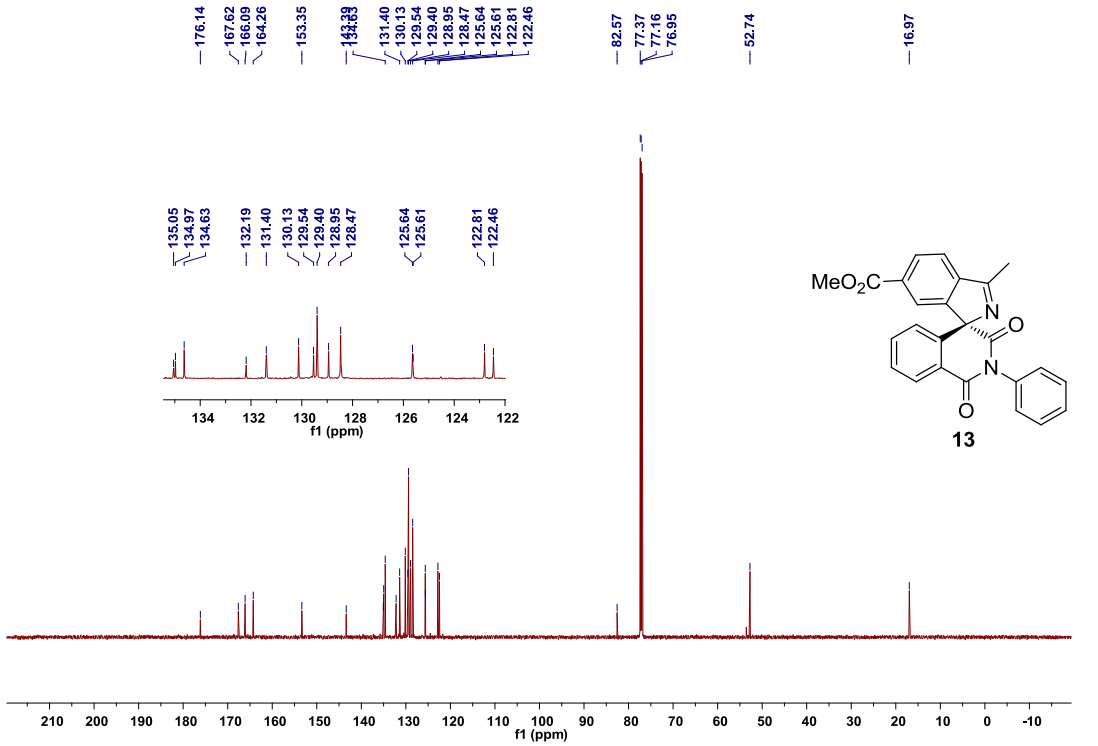
^{19}F NMR (565 MHz, $CDCl_3$)



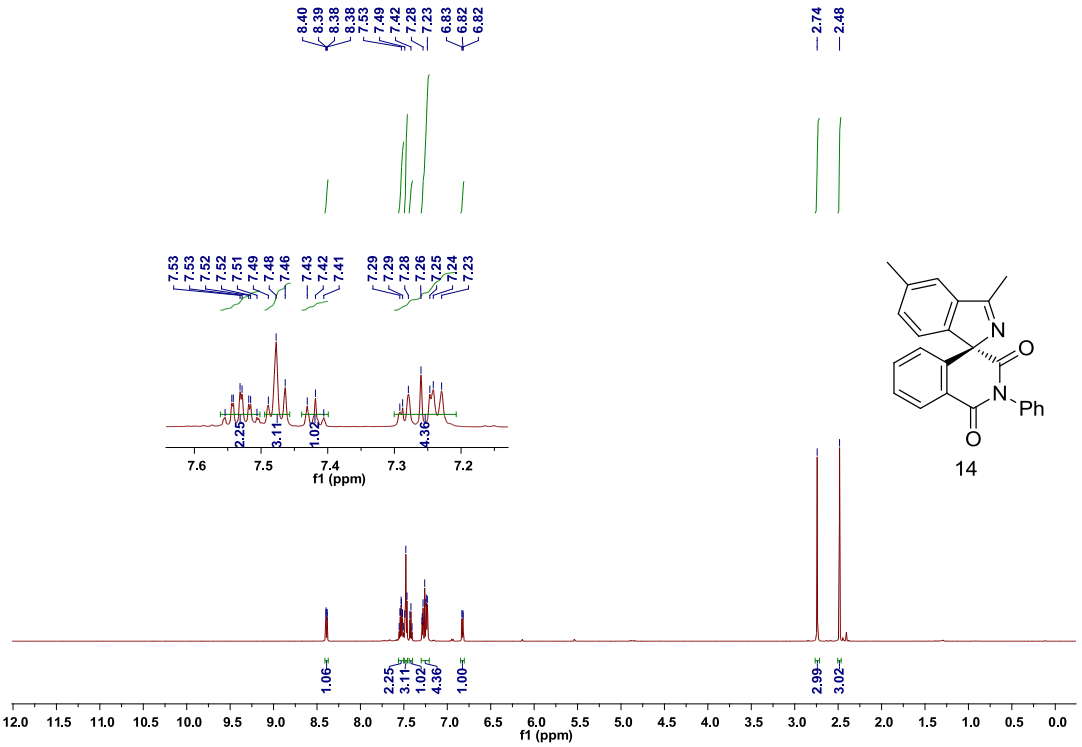
^{1}H NMR (600 MHz, $CDCl_3$)



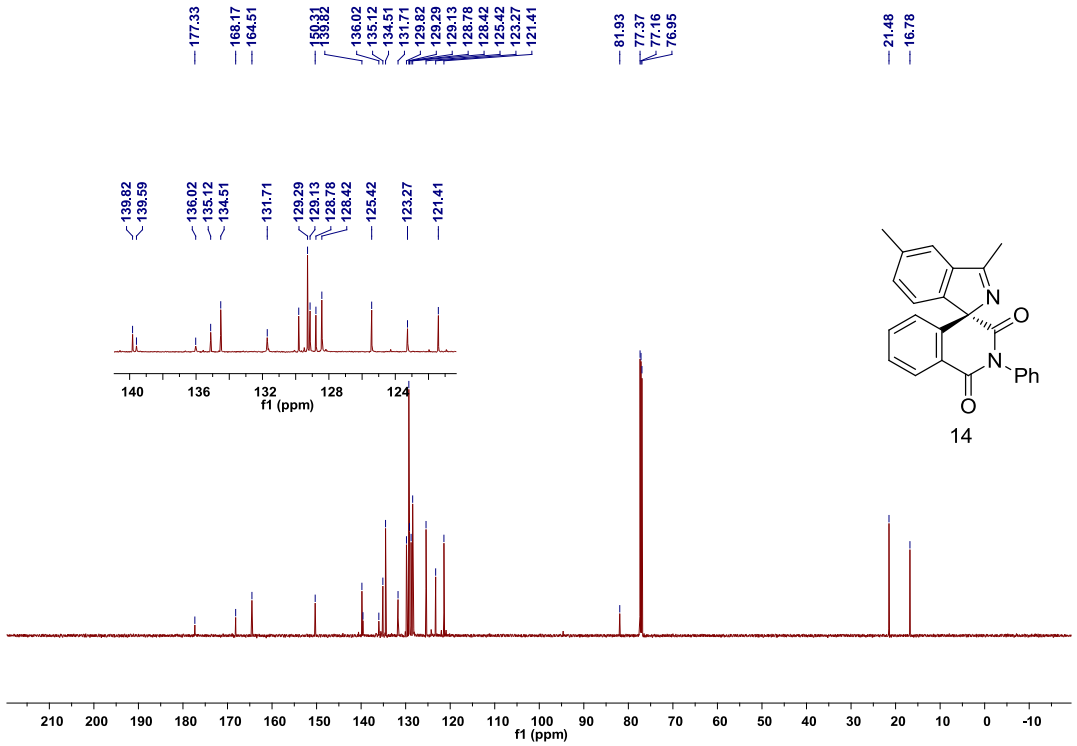
^{13}C NMR (150 MHz, $CDCl_3$)



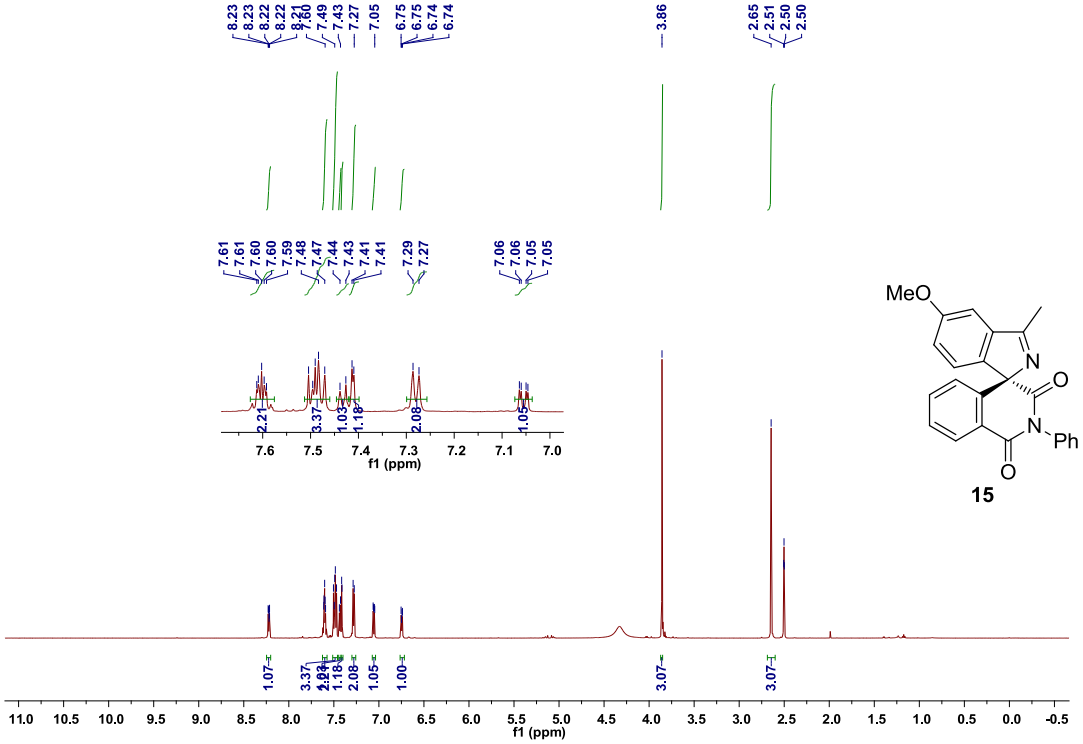
^{1}H NMR (600 MHz, $CDCl_3$)



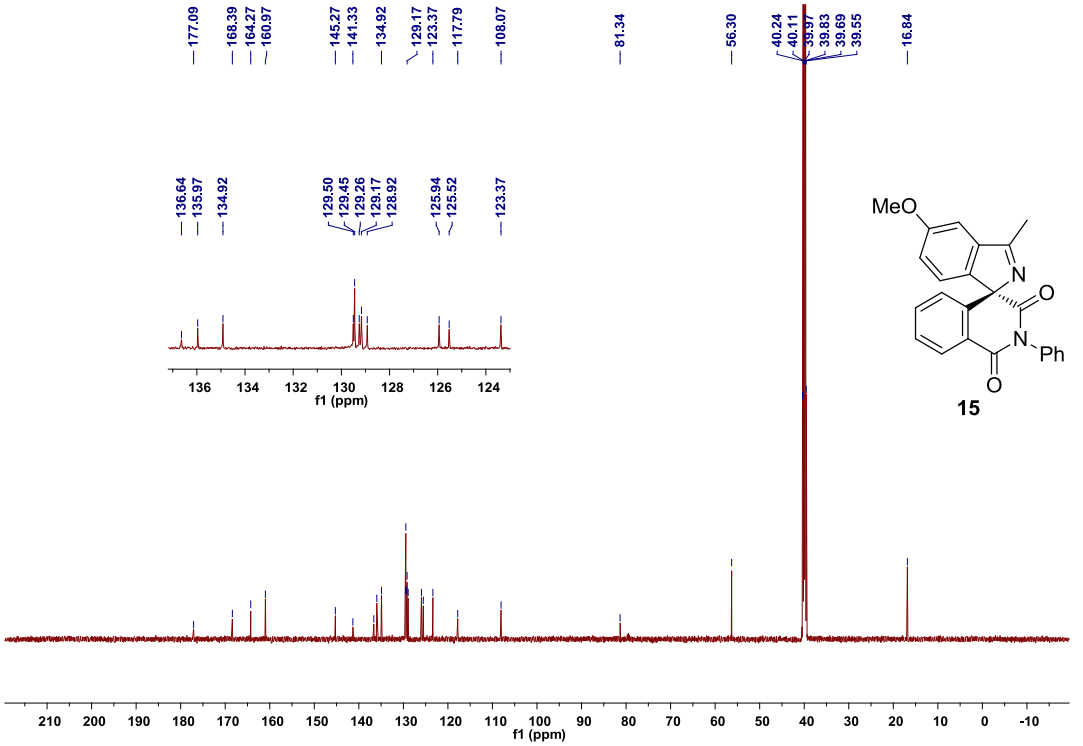
^{13}C NMR (150 MHz, $CDCl_3$)



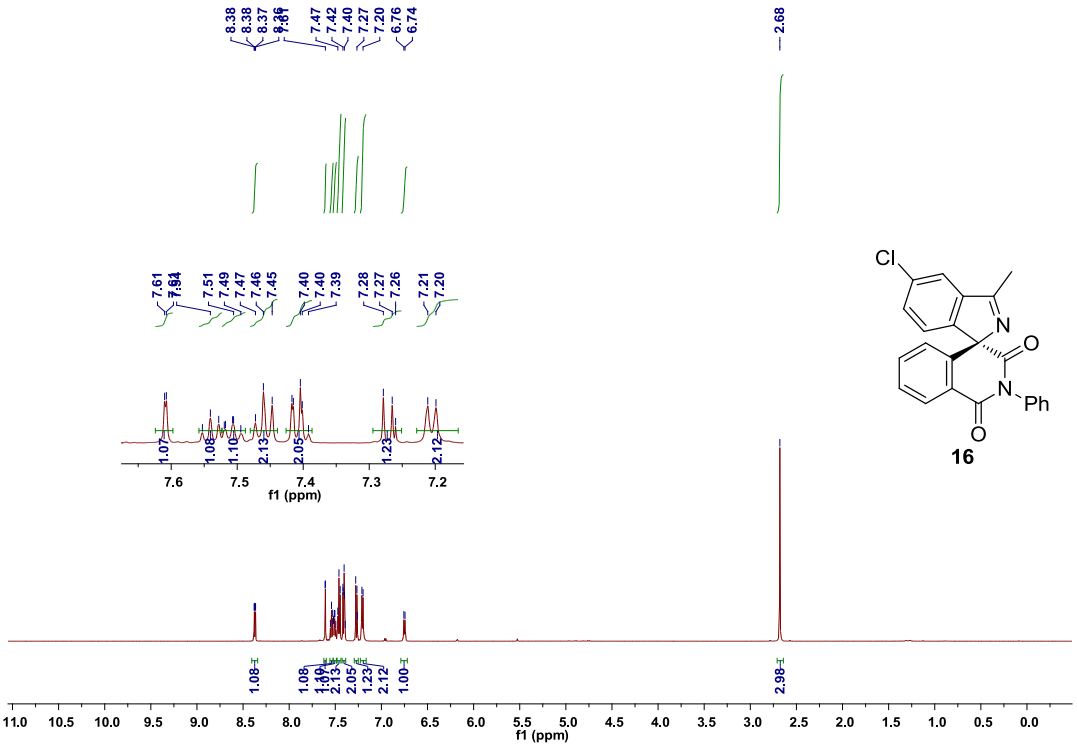
^{1}H NMR (600 MHz, DMSO-d_6)



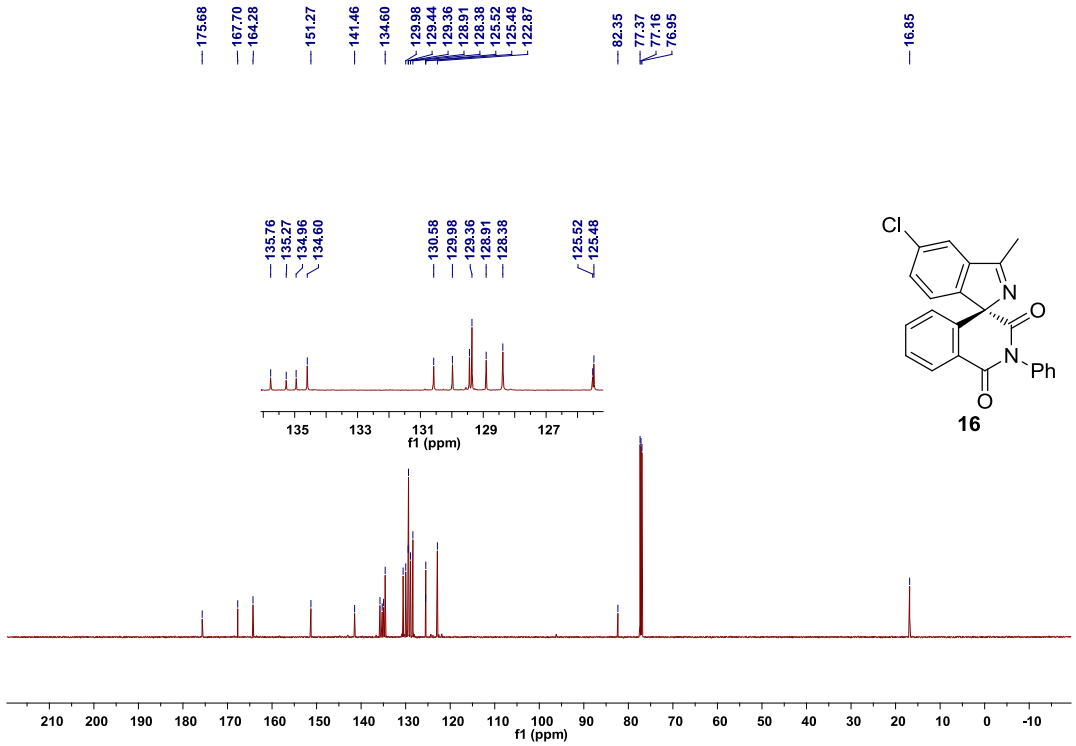
^{13}C NMR (150 MHz, DMSO-d_6)



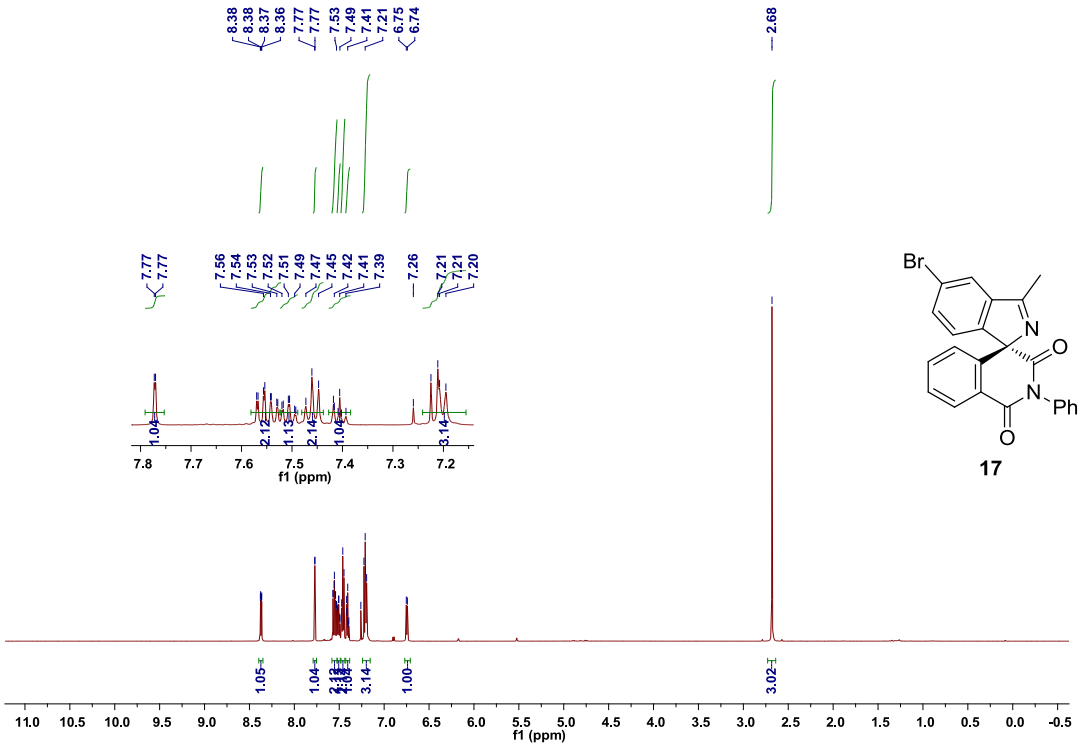
^{1}H NMR (600 MHz, $CDCl_3$)



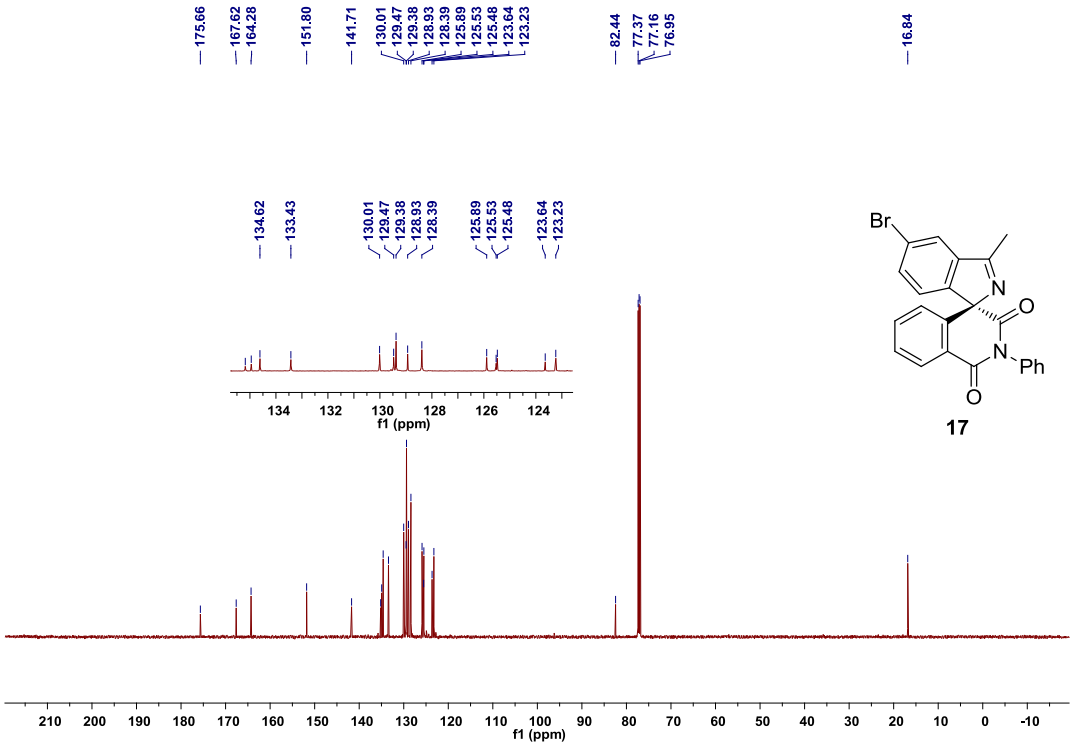
^{13}C NMR (150 MHz, $CDCl_3$)



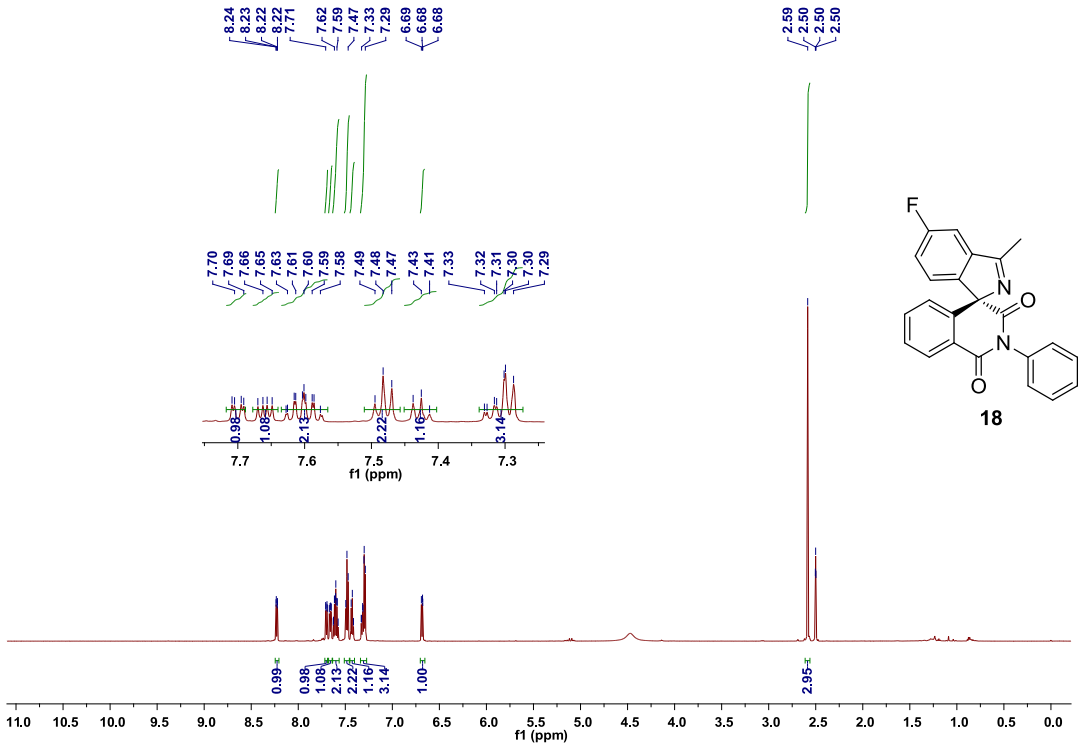
^{1}H NMR (600 MHz, $CDCl_3$)



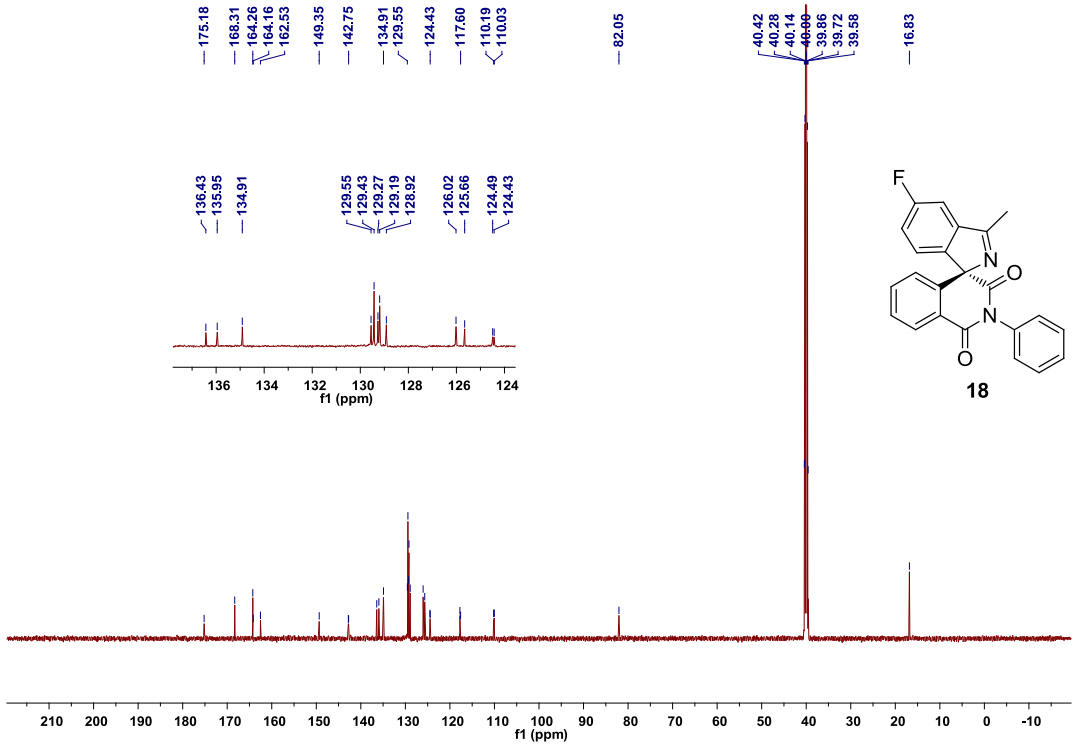
^{13}C NMR (150 MHz, $CDCl_3$)



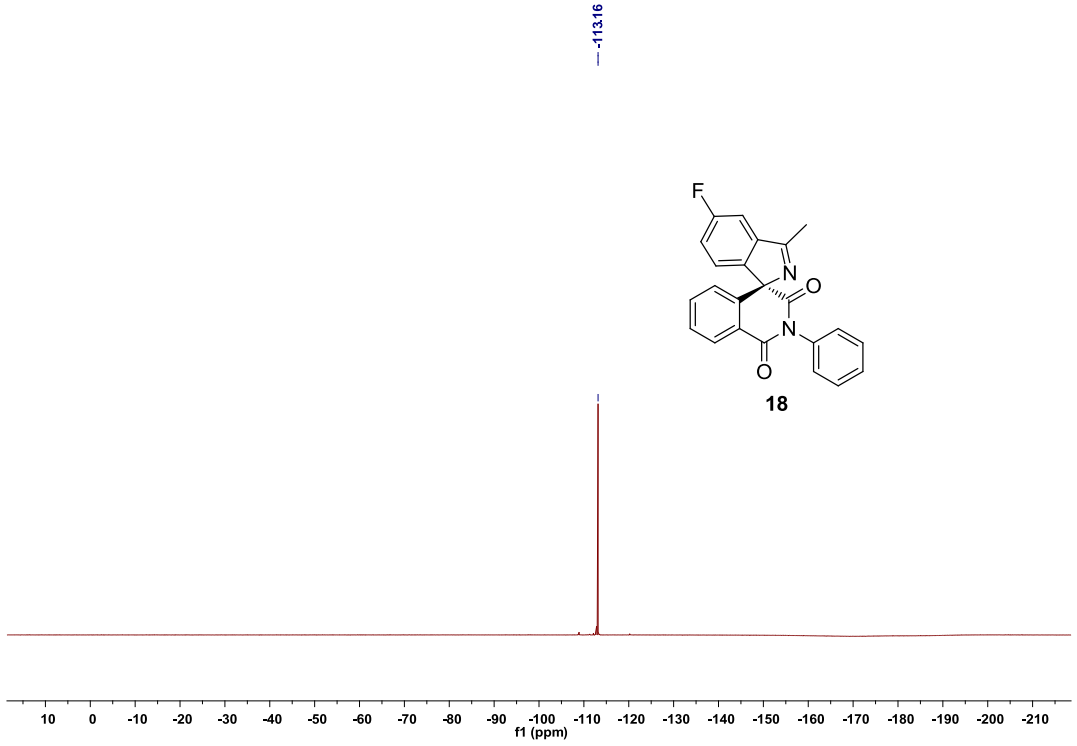
^{1}H NMR (600 MHz, DMSO-d_6)



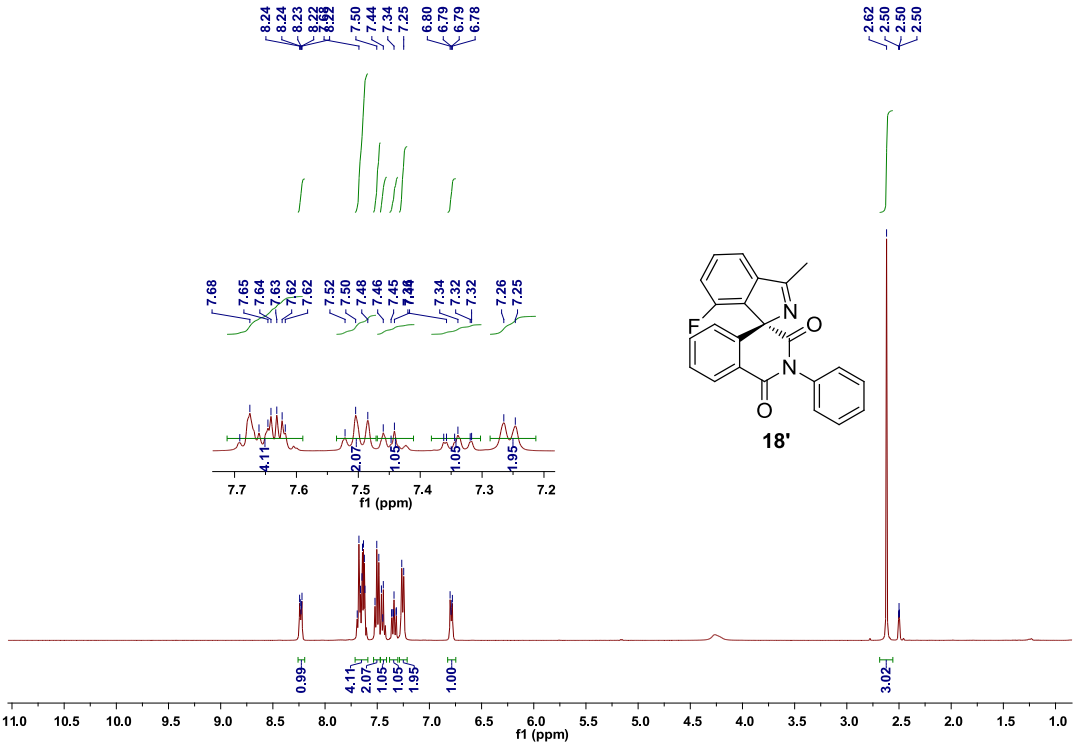
^{13}C NMR (150 MHz, DMSO-d_6)



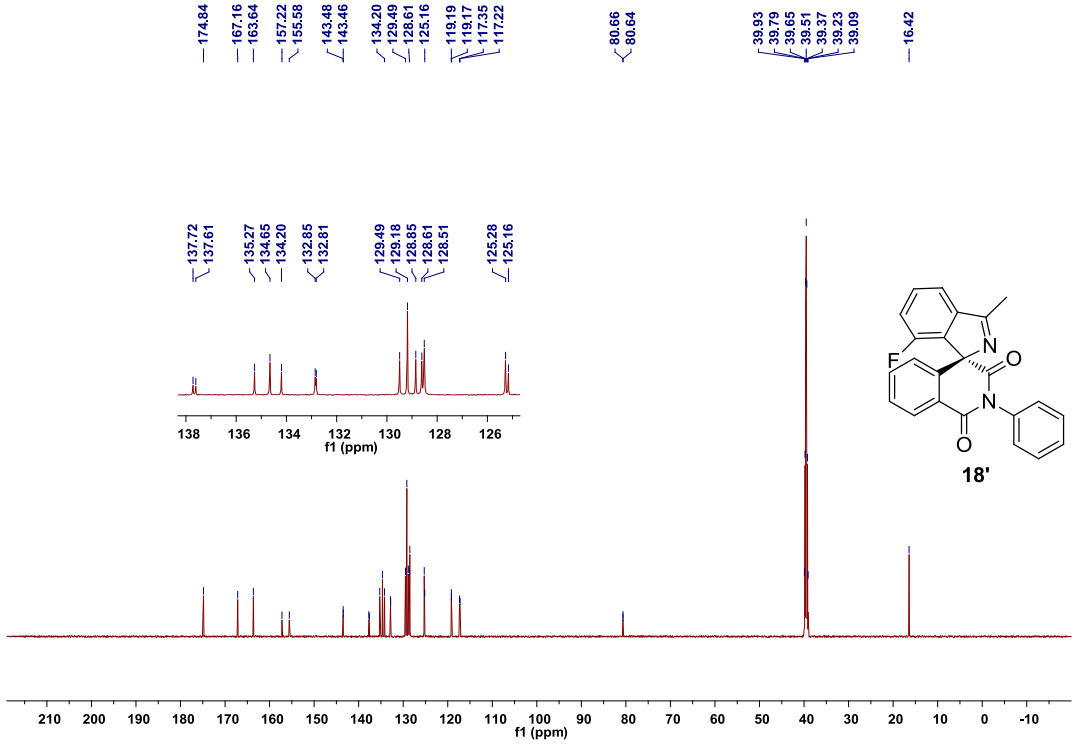
^{19}F NMR (565 MHz, DMSO-d_6)



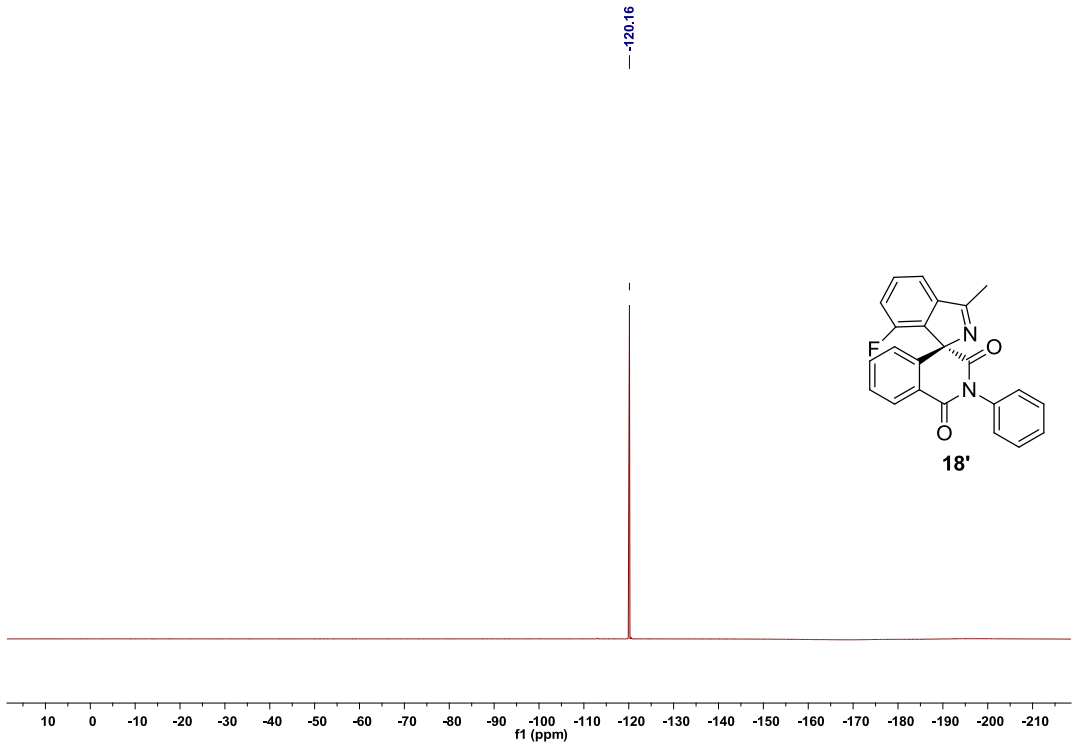
^{1}H NMR (400 MHz, DMSO-d_6)



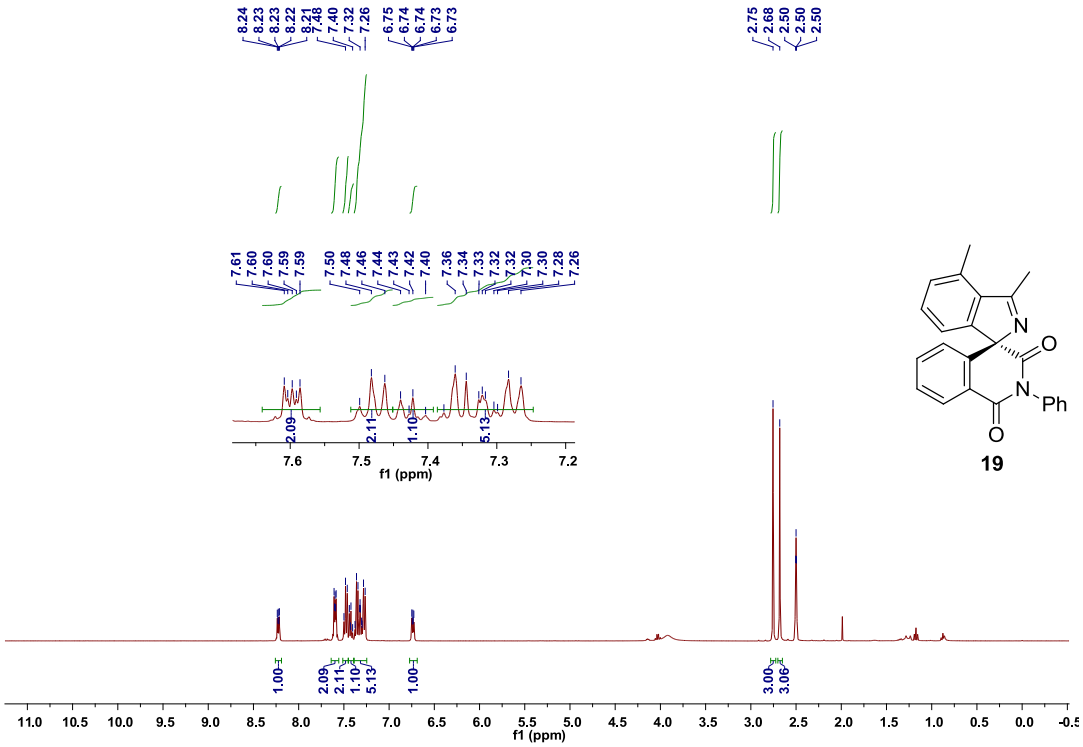
^{13}C NMR (150 MHz, DMSO-d_6)



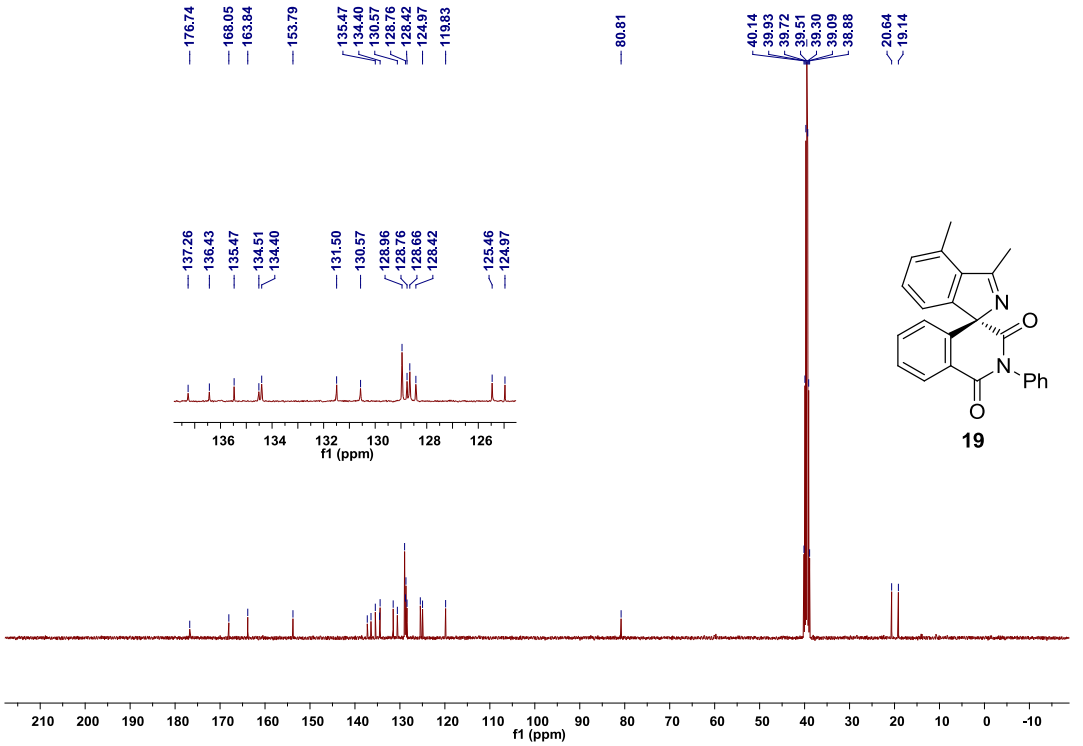
^{19}F NMR (565 MHz, DMSO-d_6)



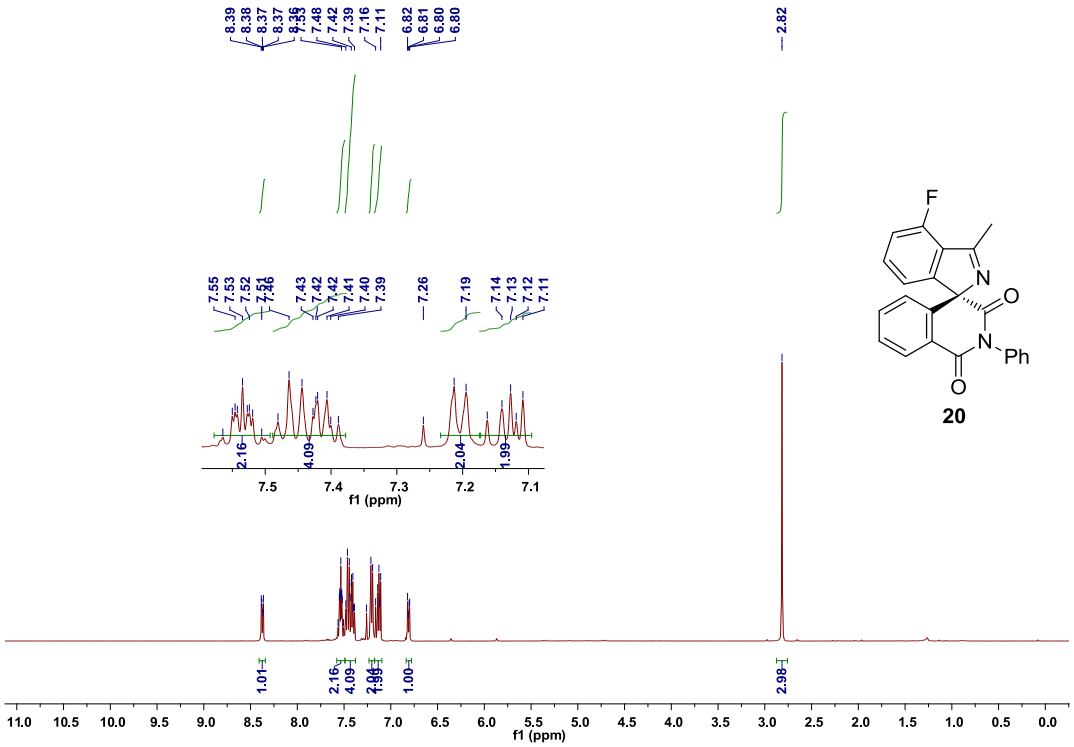
^{1}H NMR (400 MHz, DMSO-d_6)



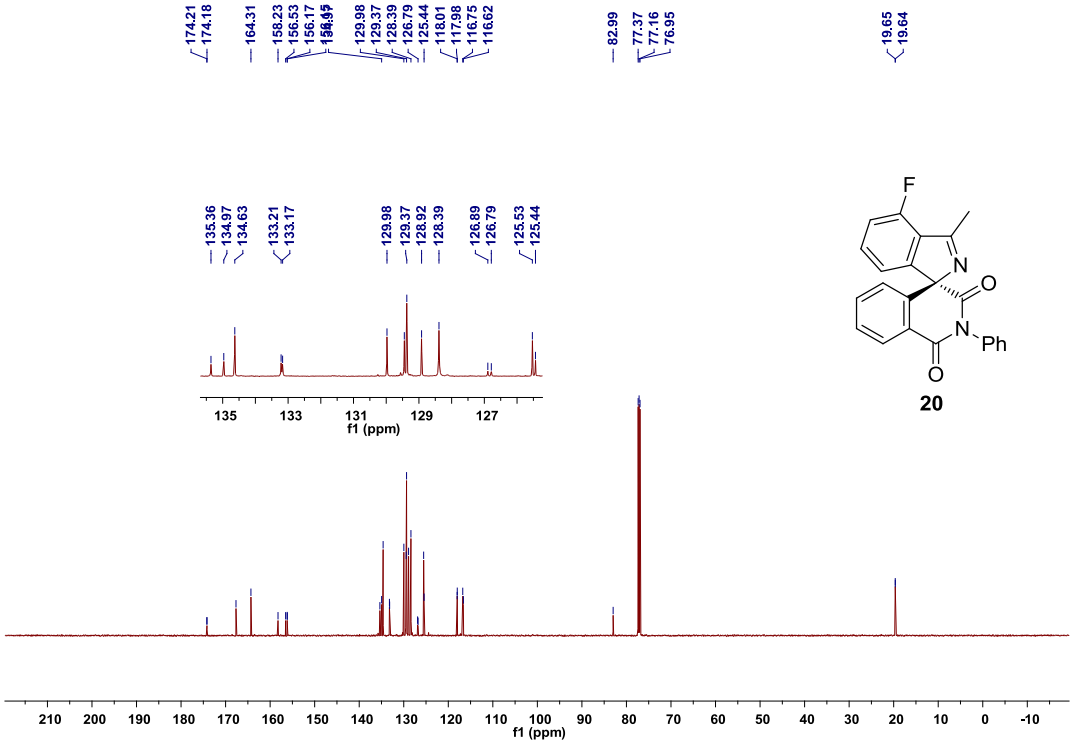
^{13}C NMR (100 MHz, DMSO-d_6)



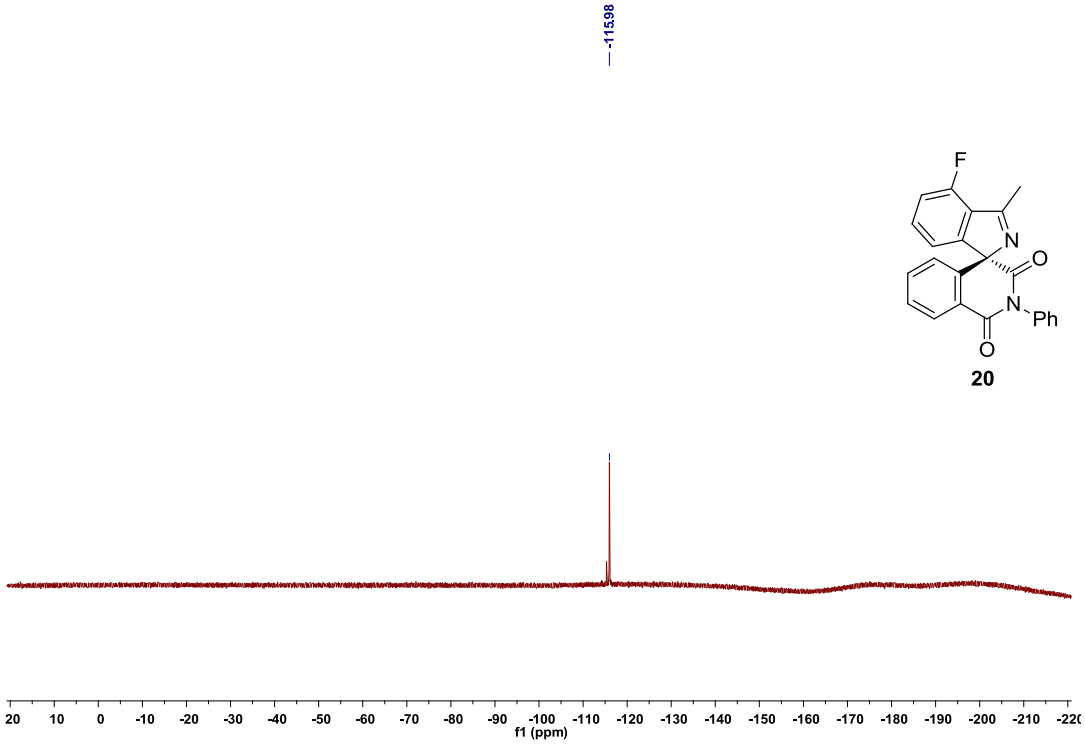
^{1}H NMR (400 MHz, $CDCl_3$)



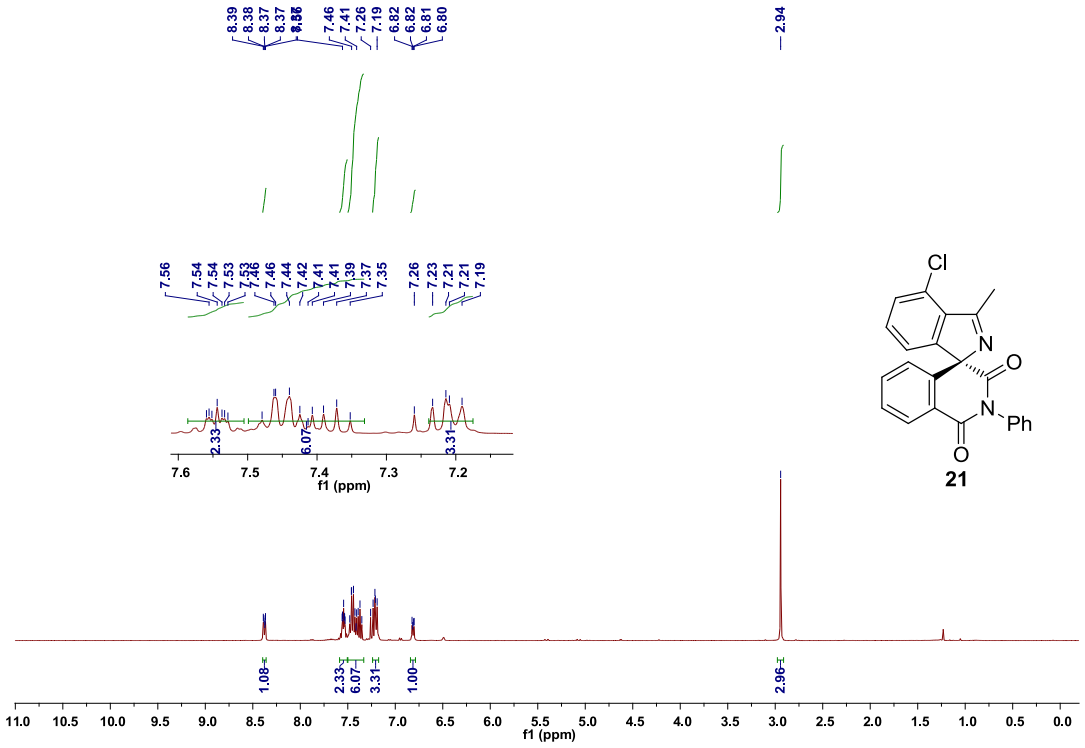
^{13}C NMR (150 MHz, $CDCl_3$)



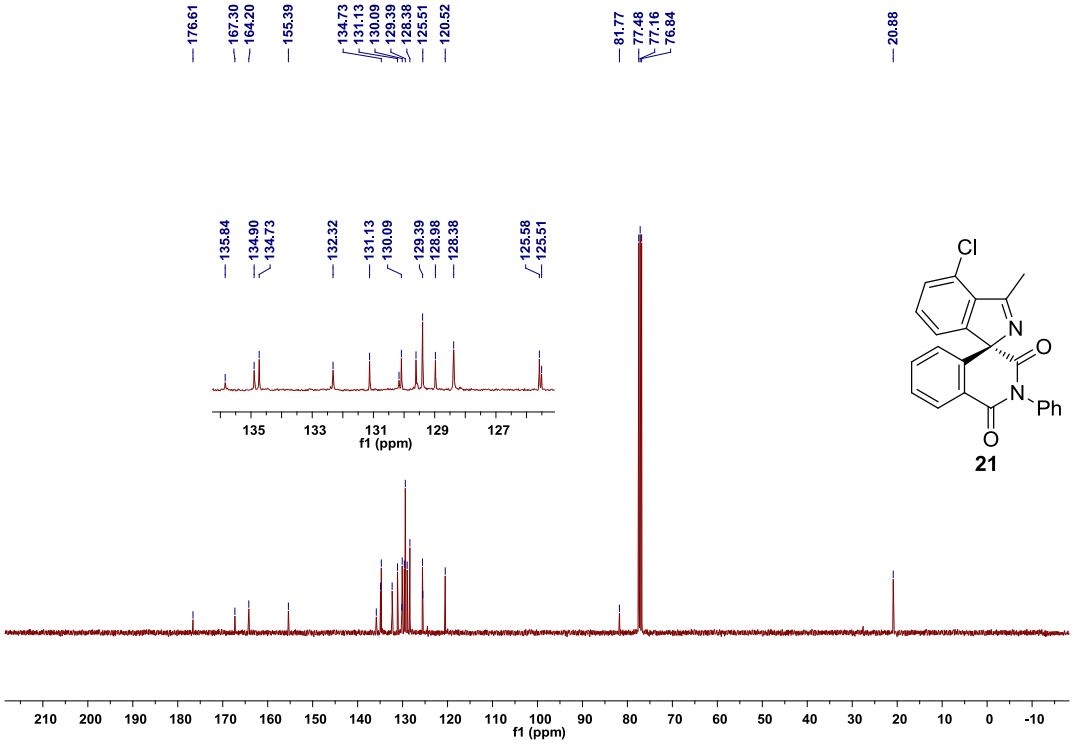
^{19}F NMR (376 MHz, $CDCl_3$) δ -115.98.



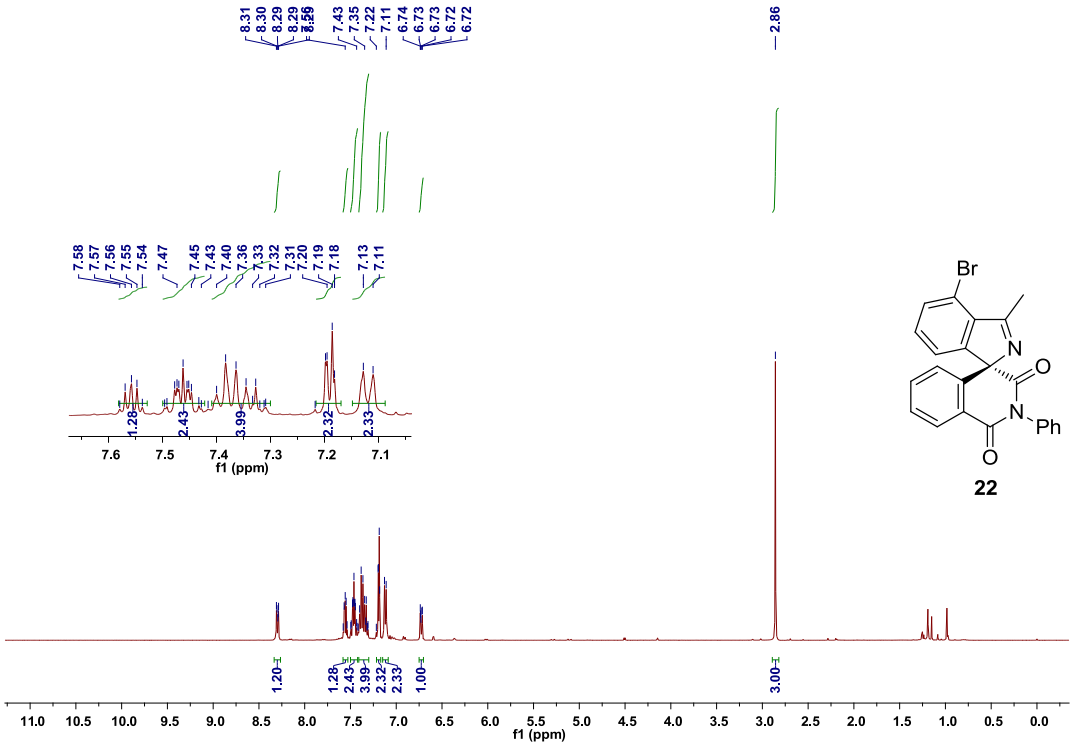
^{1}H NMR (400 MHz, $CDCl_3$)



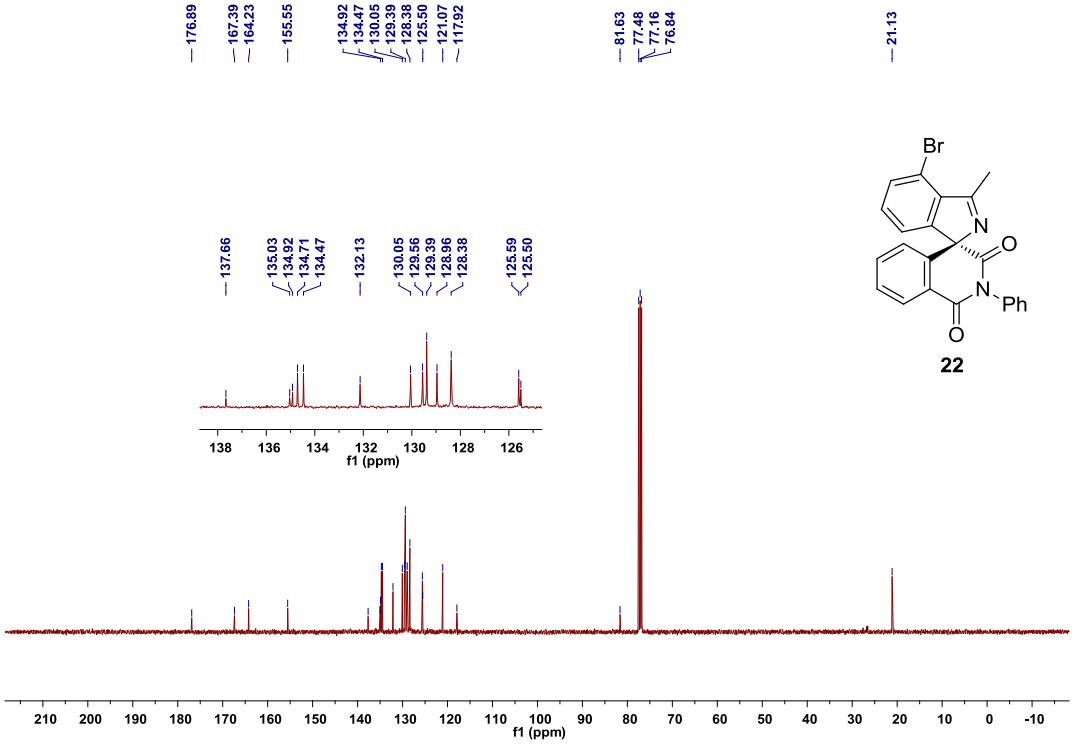
^{13}C NMR (100 MHz, $CDCl_3$)



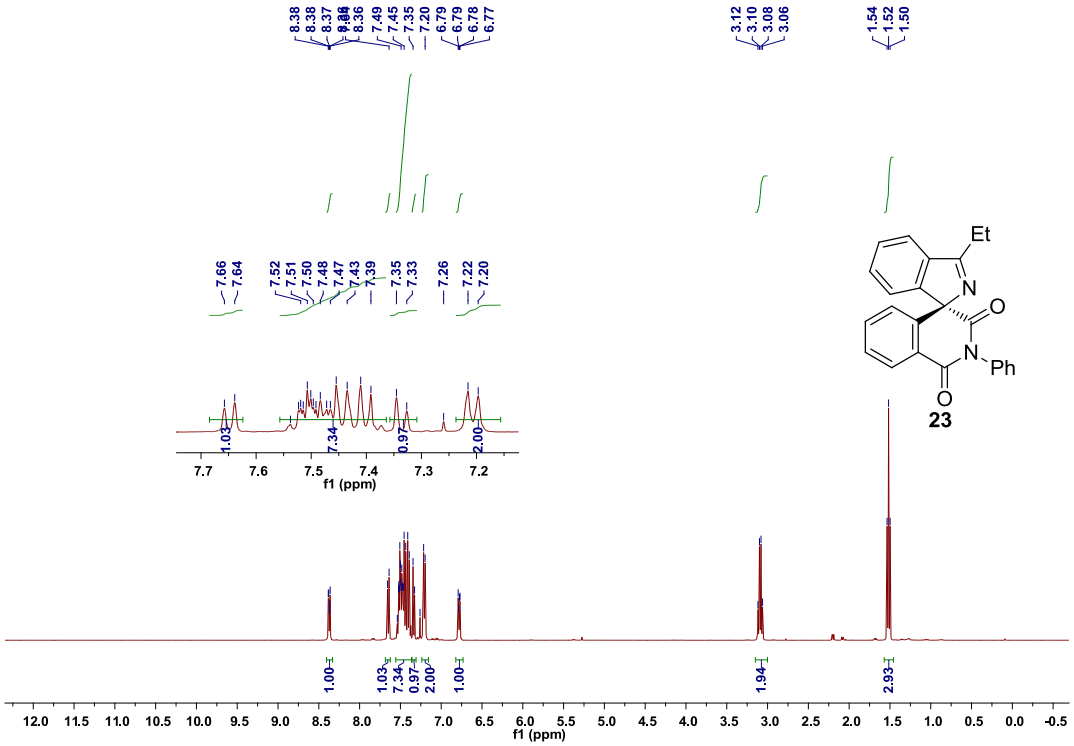
^{1}H NMR (400 MHz, $CDCl_3$)



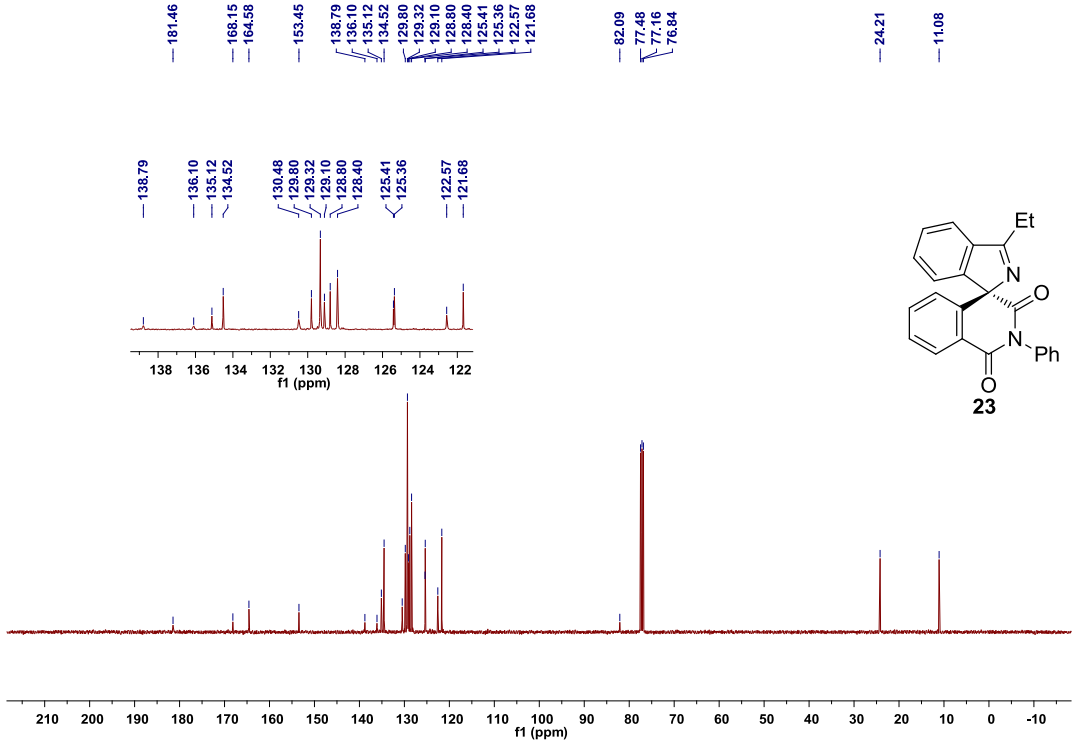
^{13}C NMR (100 MHz, $CDCl_3$)



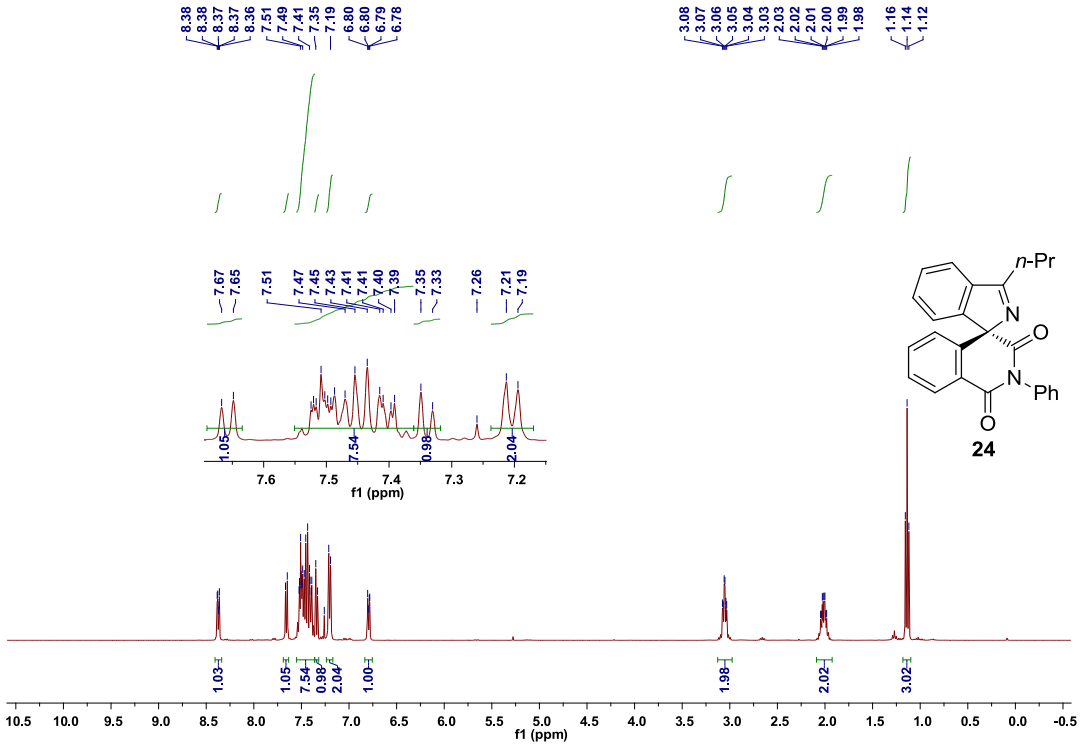
^{1}H NMR (400 MHz, $CDCl_3$)



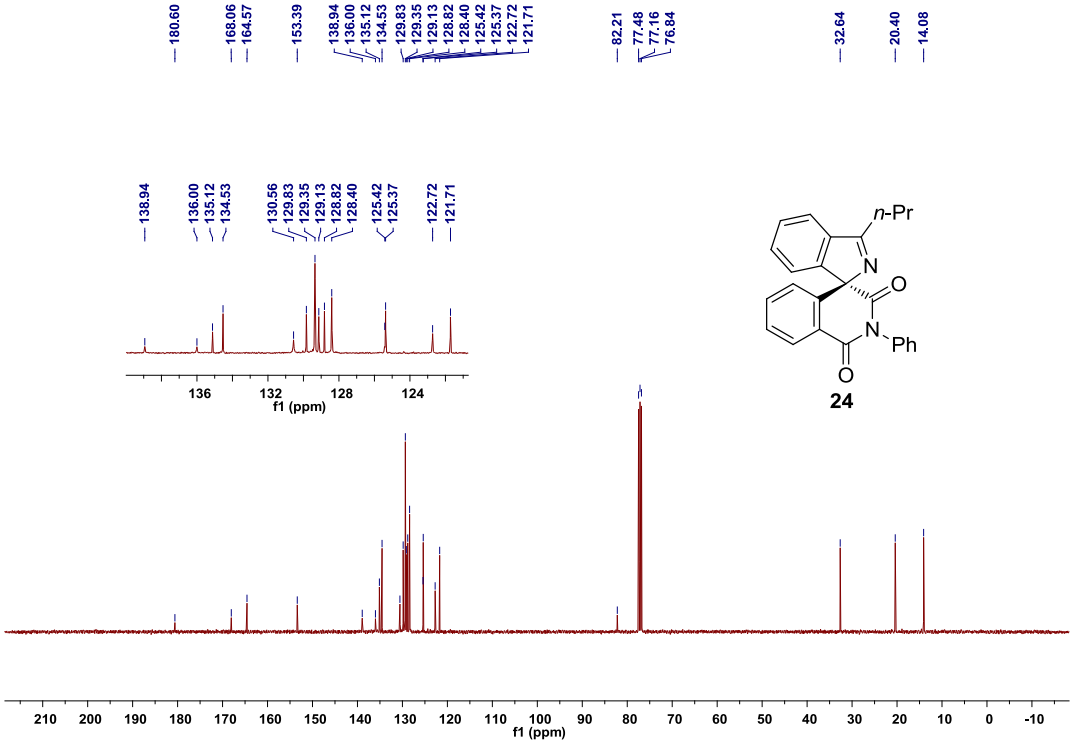
^{13}C NMR (100 MHz, $CDCl_3$)



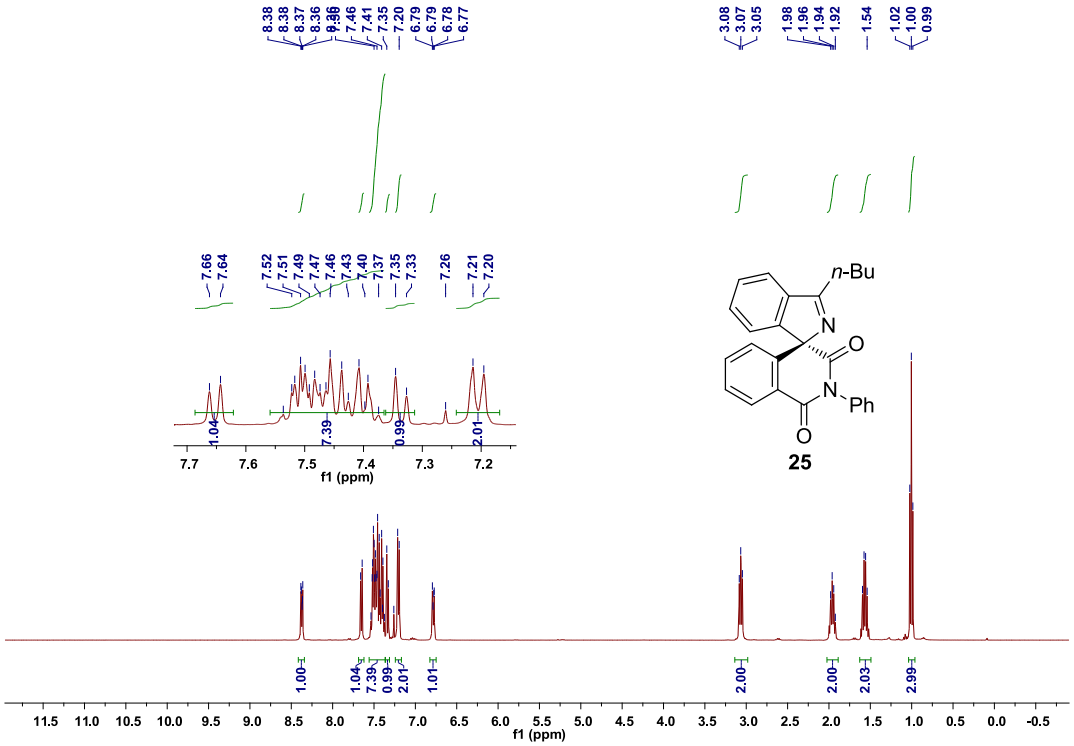
^{1}H NMR (400 MHz, $CDCl_3$)



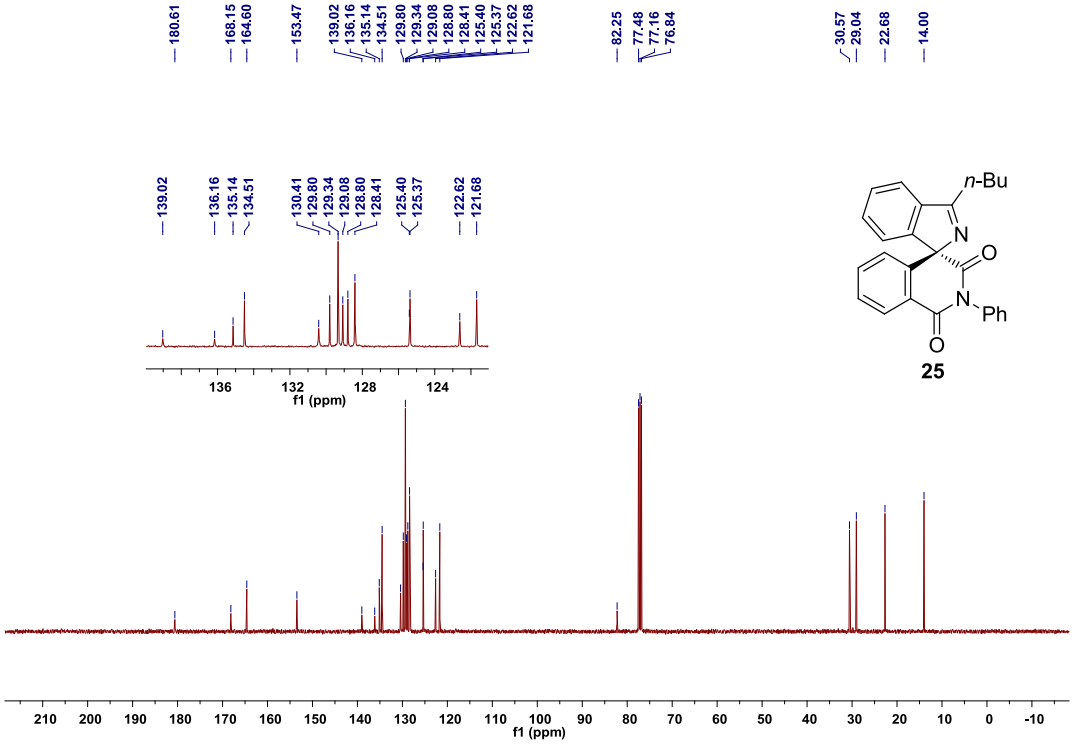
^{13}C NMR (100 MHz, $CDCl_3$)



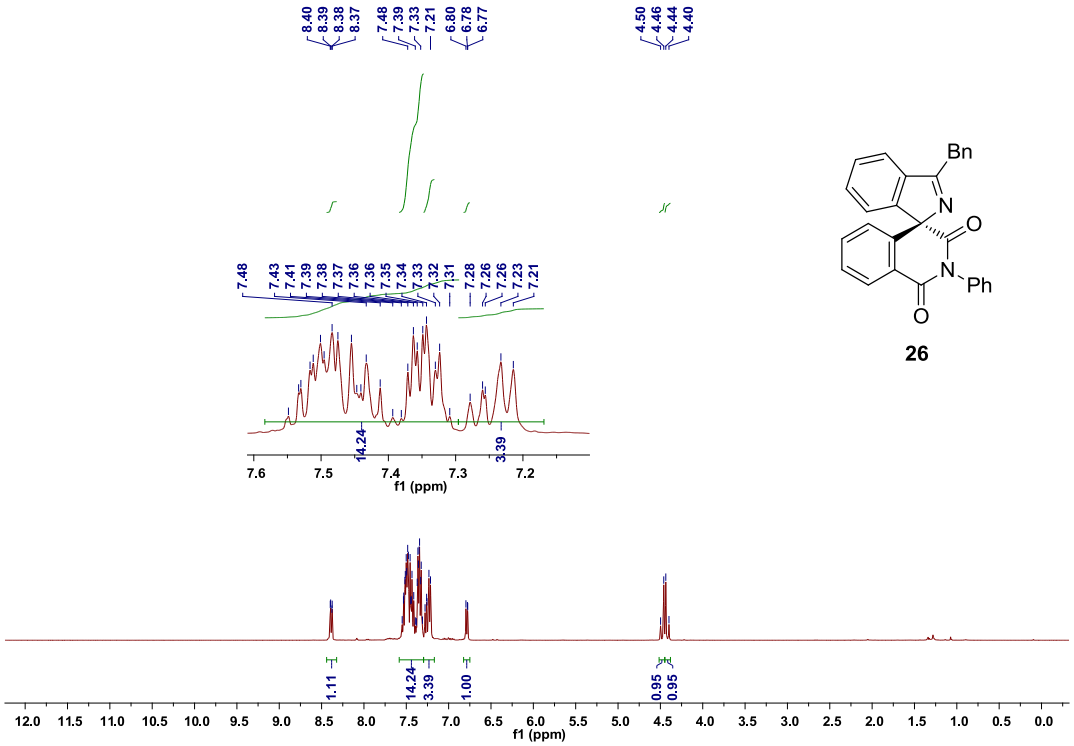
^{1}H NMR (400 MHz, $CDCl_3$)



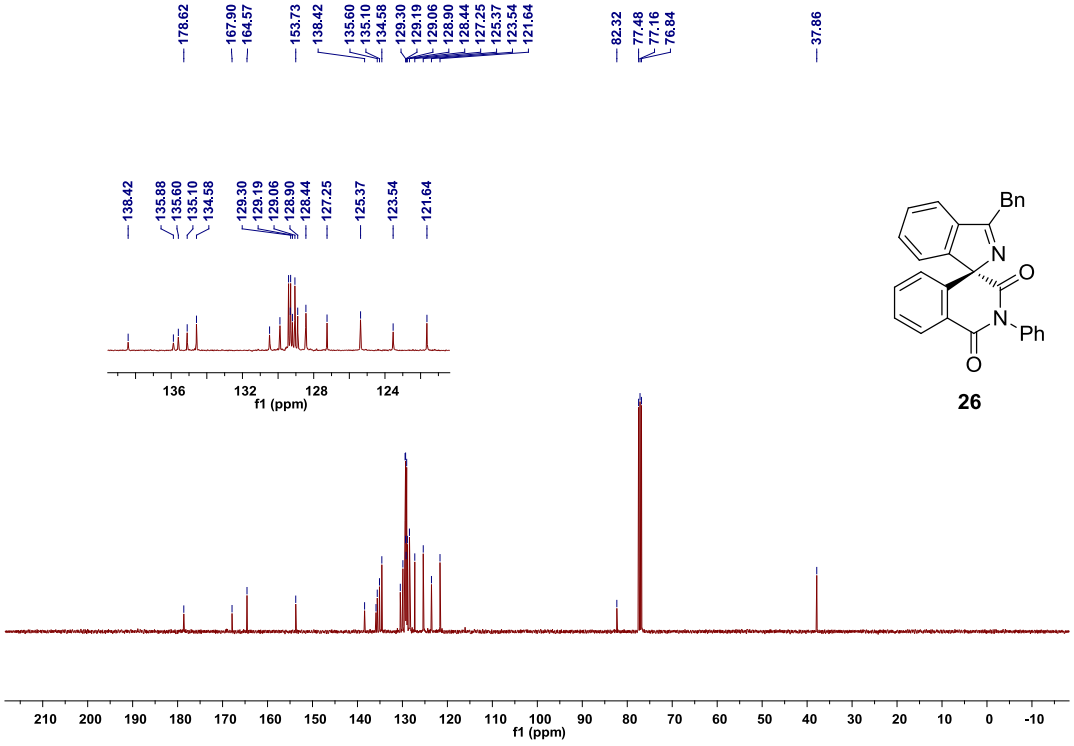
^{13}C NMR (100 MHz, $CDCl_3$)



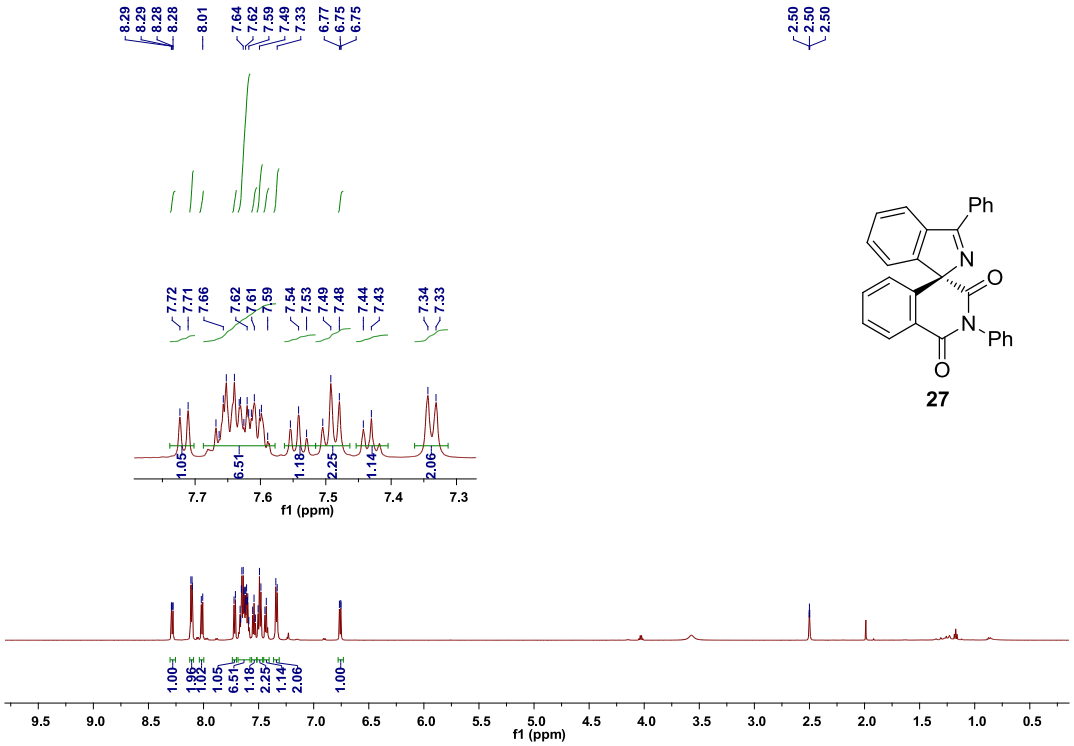
^{1}H NMR (400 MHz, $CDCl_3$)



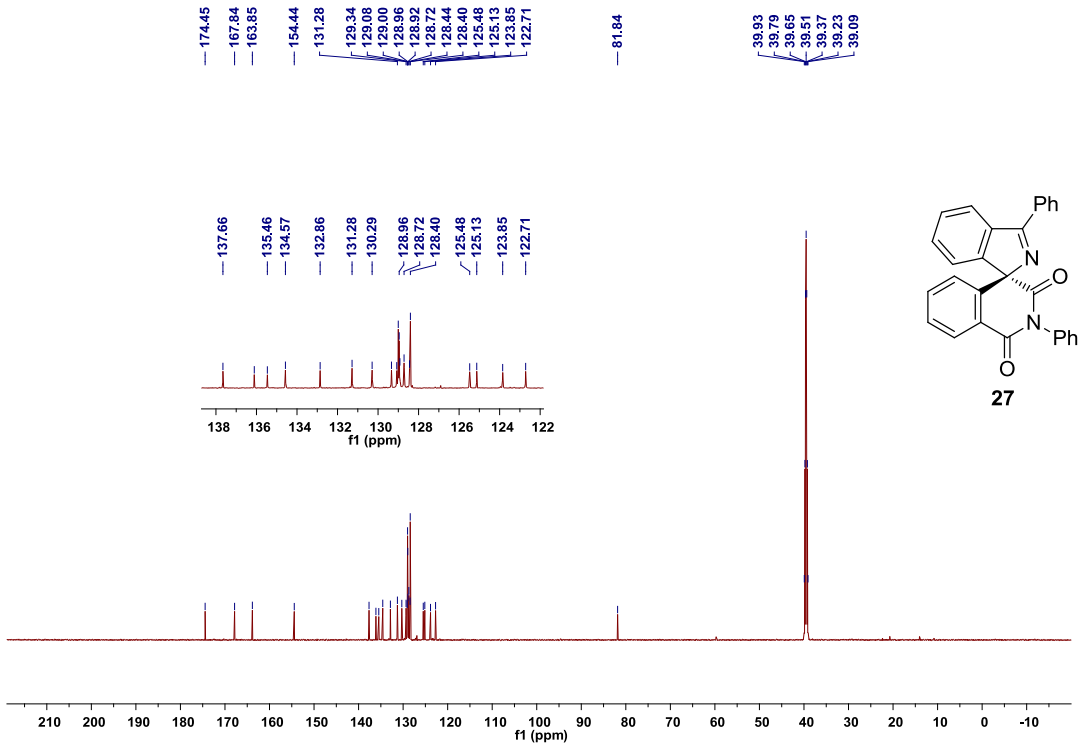
^{13}C NMR (100 MHz, $CDCl_3$)



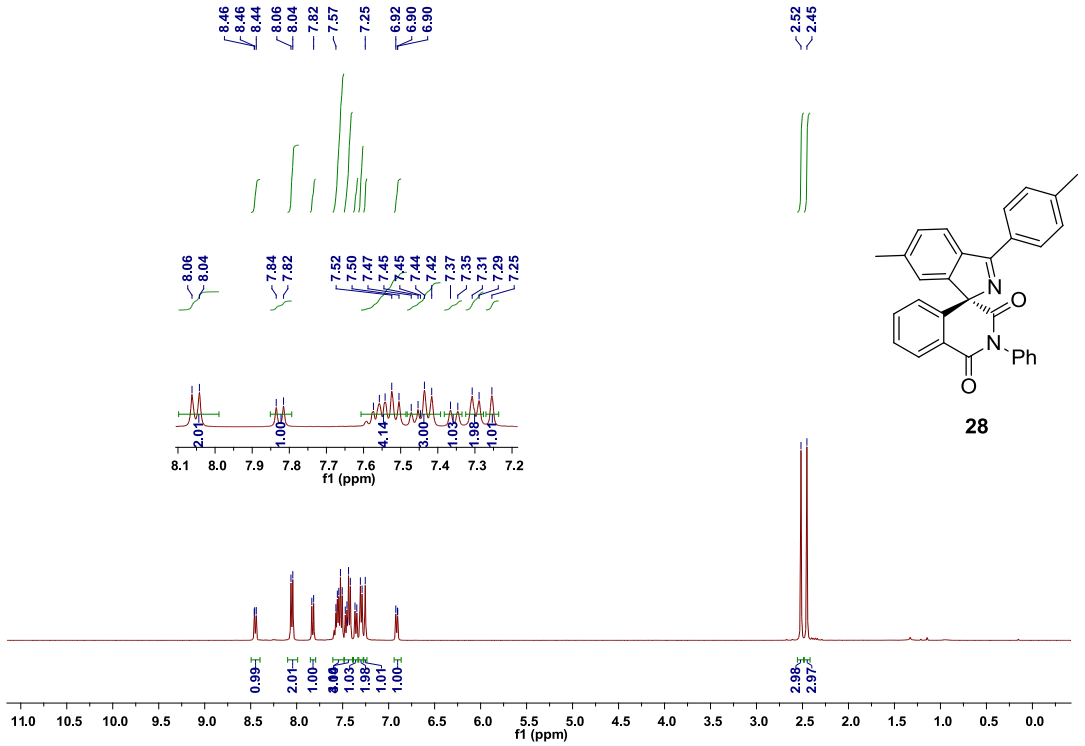
^{1}H NMR (600 MHz, DMSO-d_6)



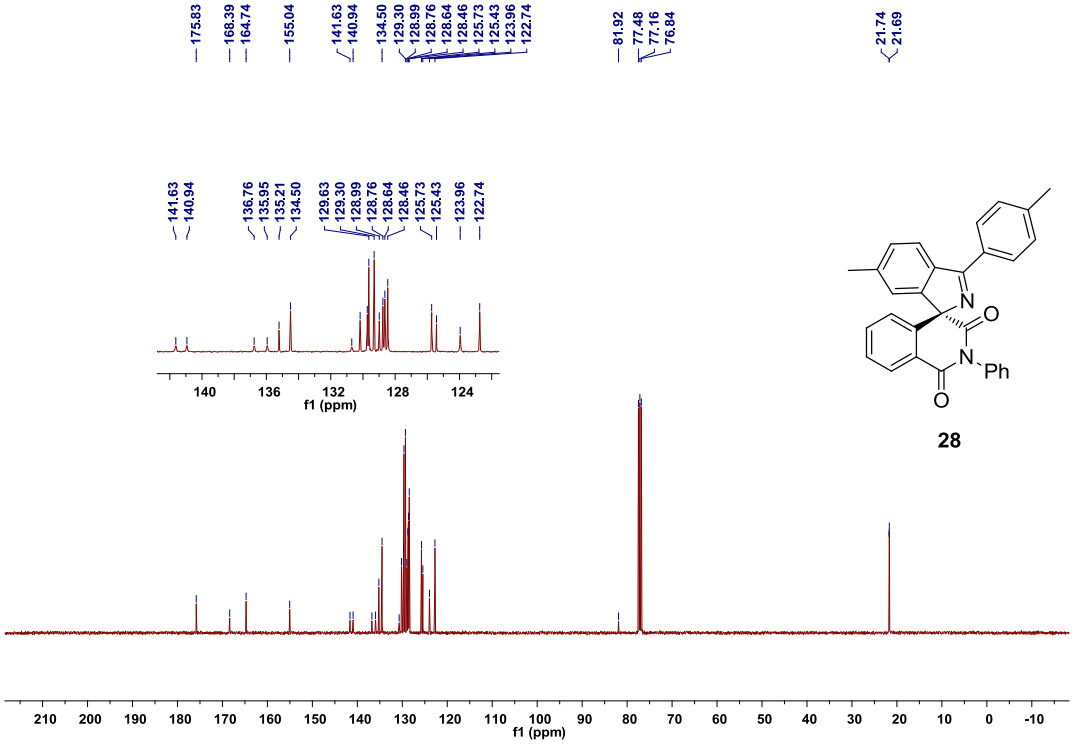
^{13}C NMR (150 MHz, DMSO-d_6)



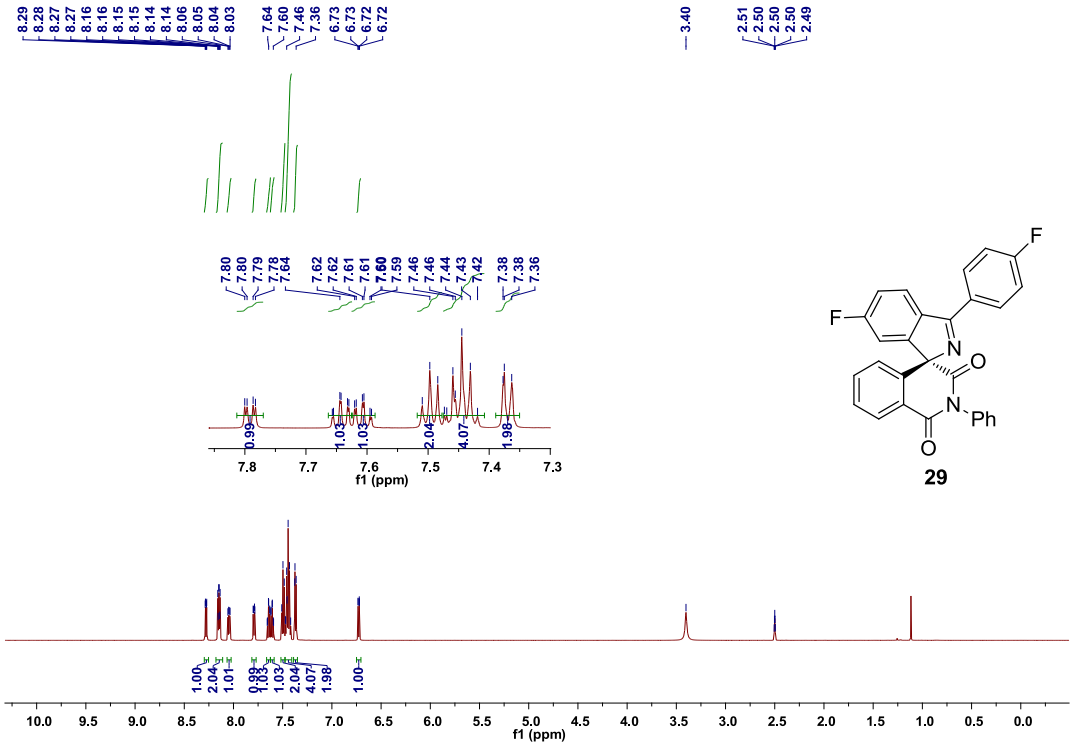
^{1}H NMR (400 MHz, $CDCl_3$)



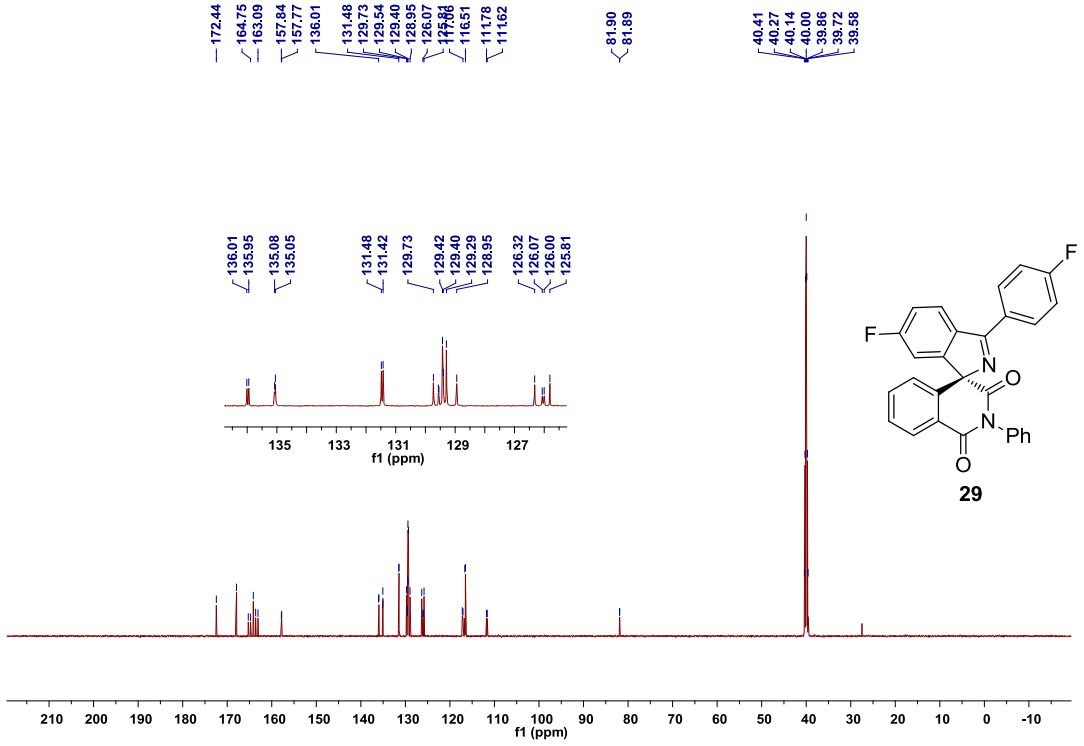
^{13}C NMR (101 MHz, $CDCl_3$)



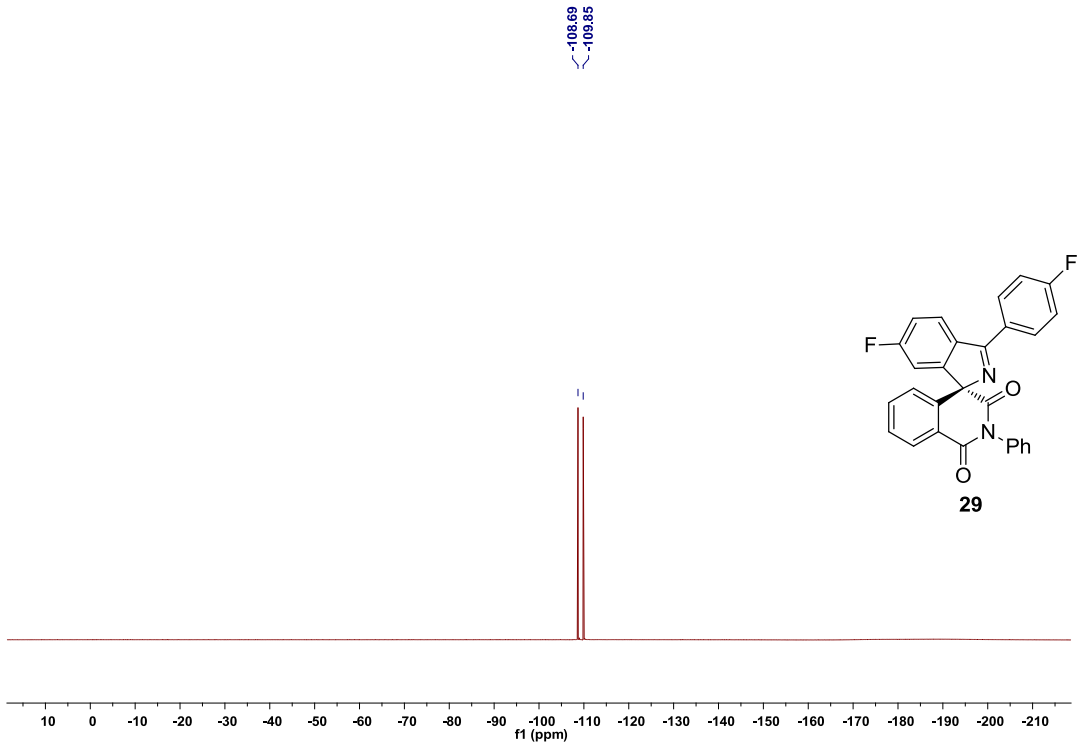
^{1}H NMR (600 MHz, DMSO-d_6)



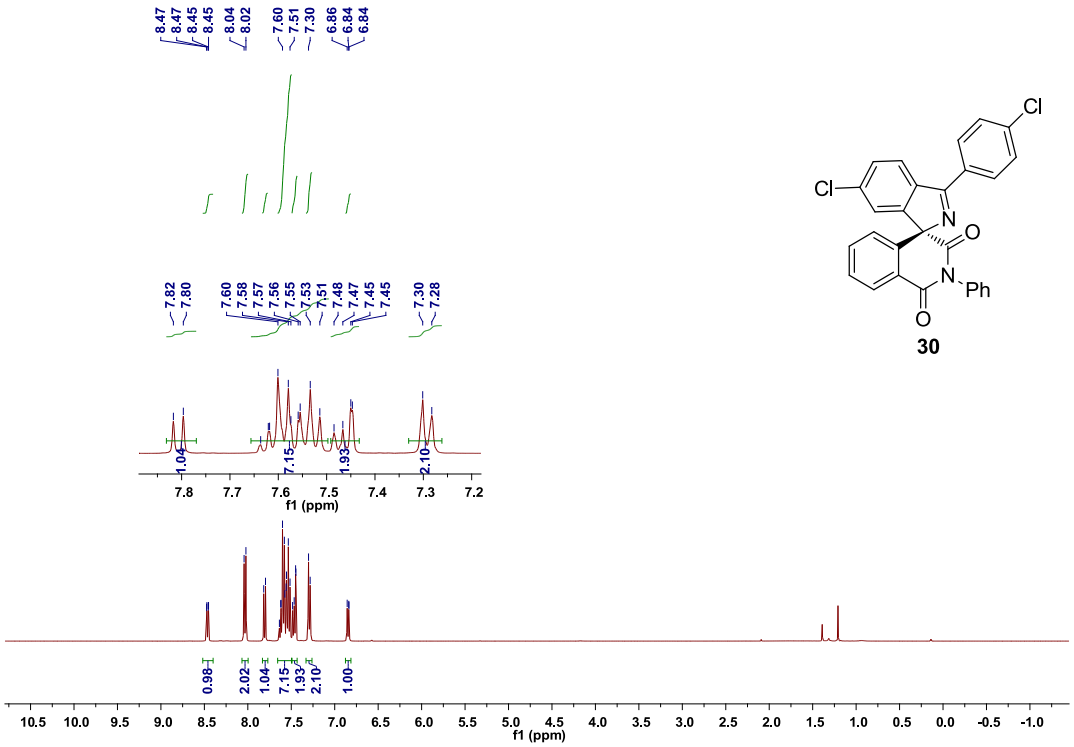
^{13}C NMR (150 MHz, DMSO-d_6)



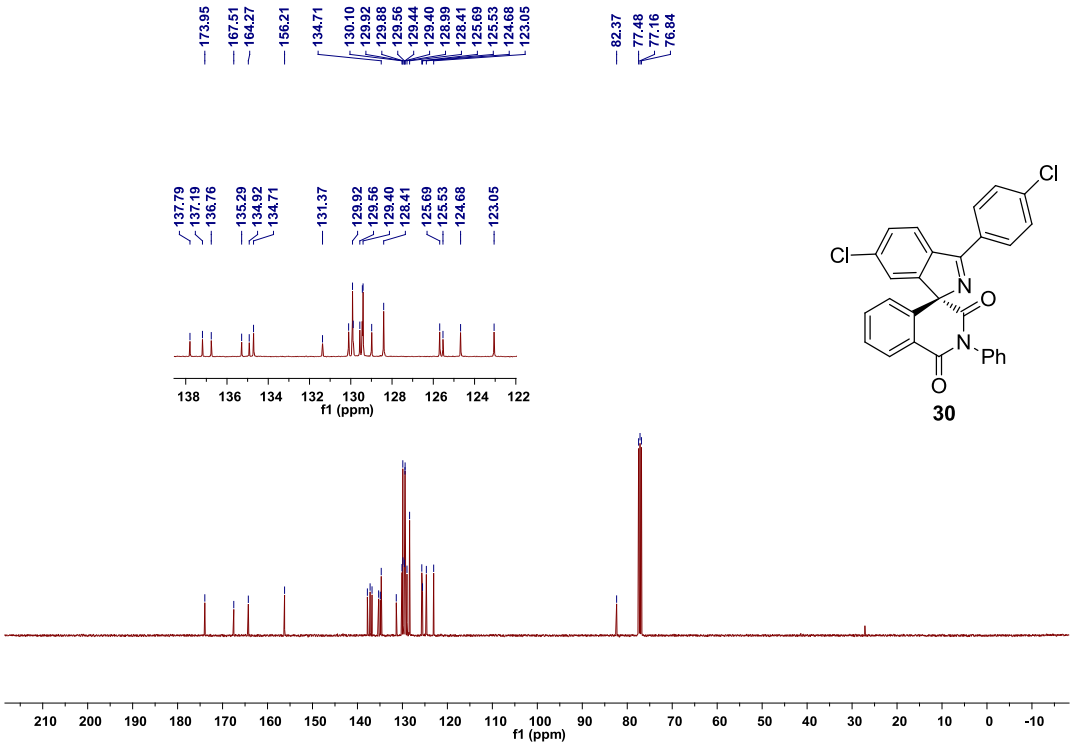
^{19}F NMR (565 MHz, DMSO-d_6)



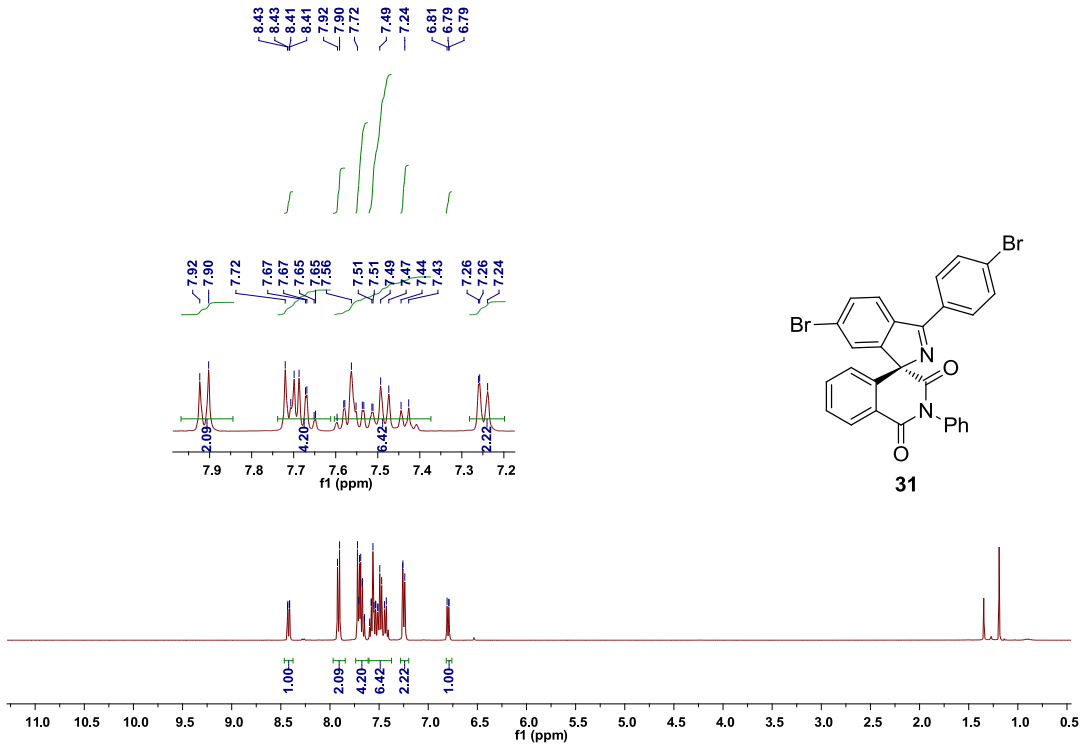
^{1}H NMR (400 MHz, $CDCl_3$)



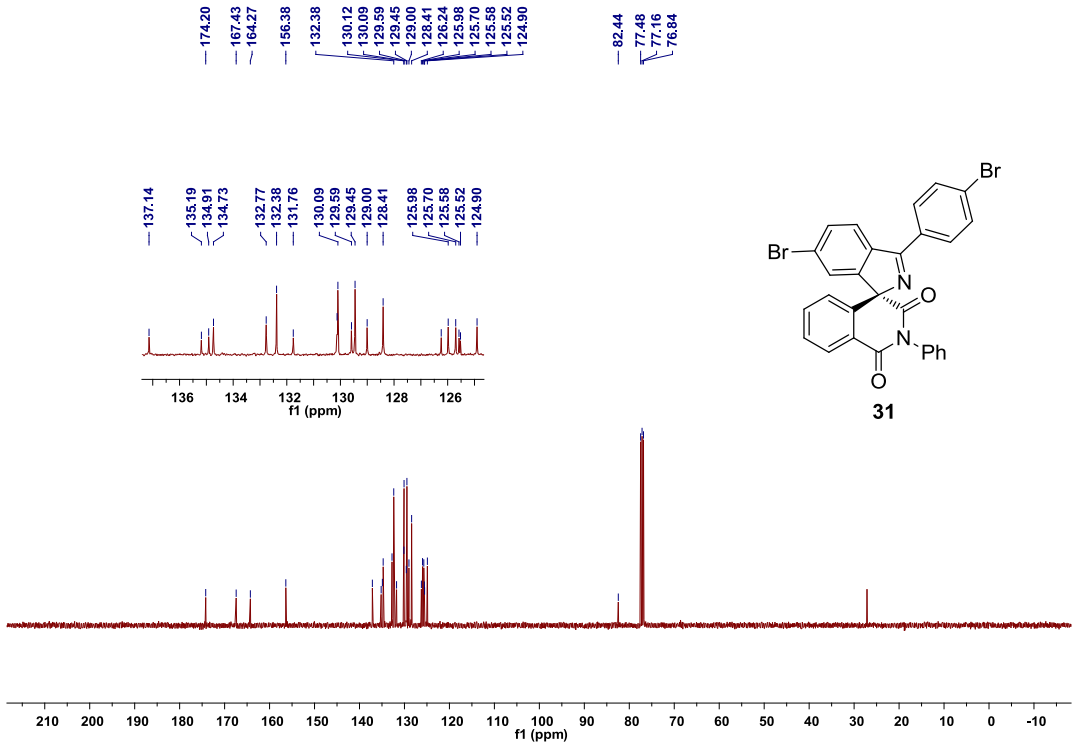
^{13}C NMR (100 MHz, $CDCl_3$)



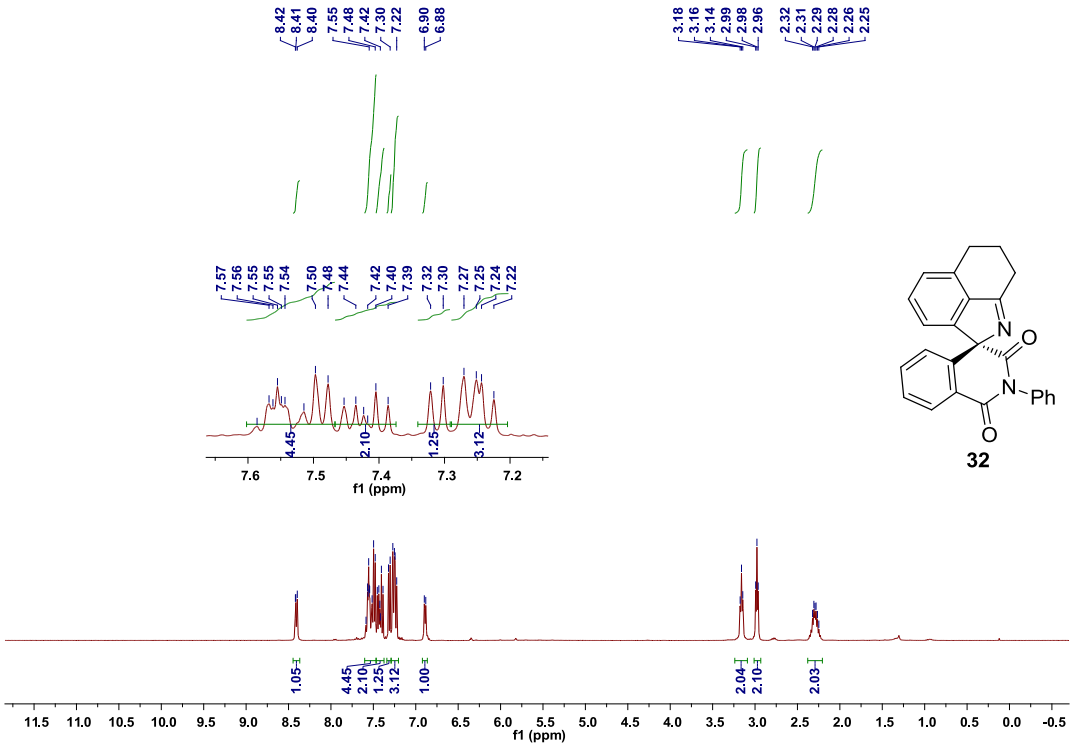
^{1}H NMR (400 MHz, $CDCl_3$)



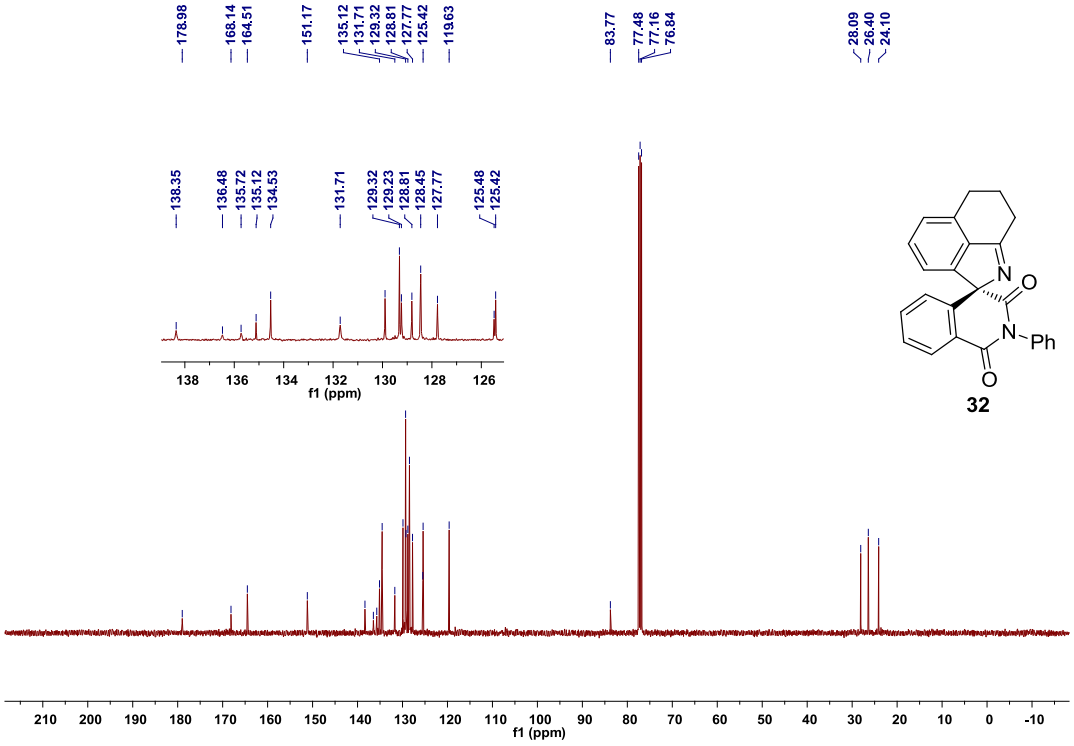
^{13}C NMR (100 MHz, $CDCl_3$)



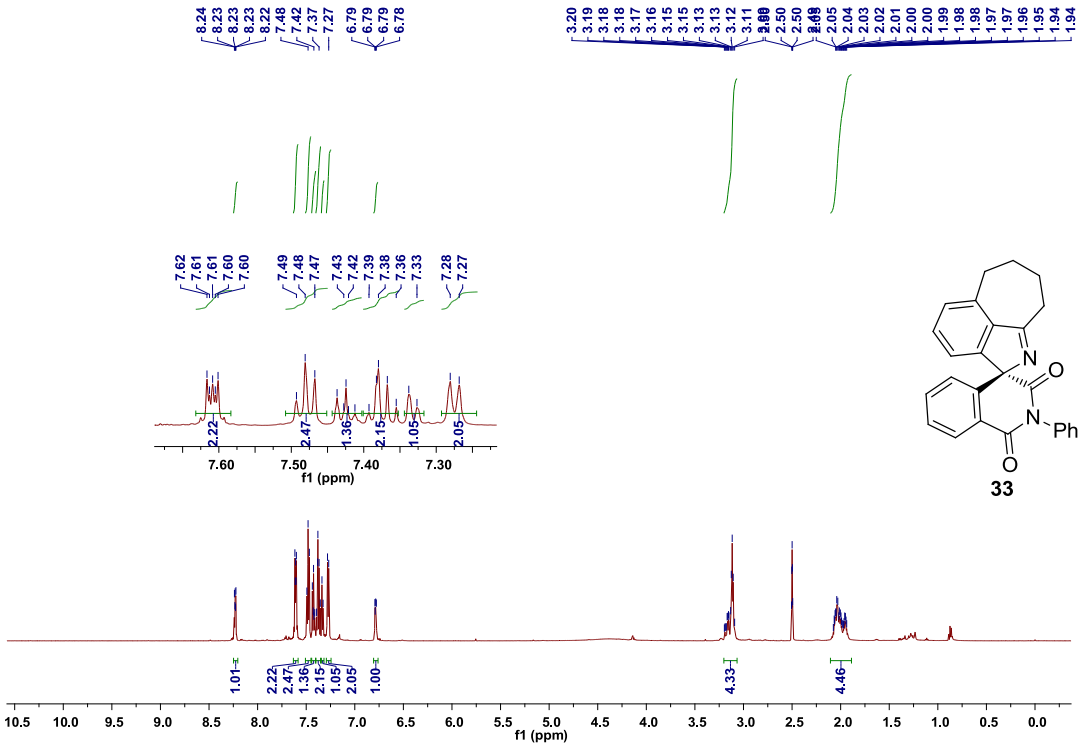
^{1}H NMR (400 MHz, $CDCl_3$)



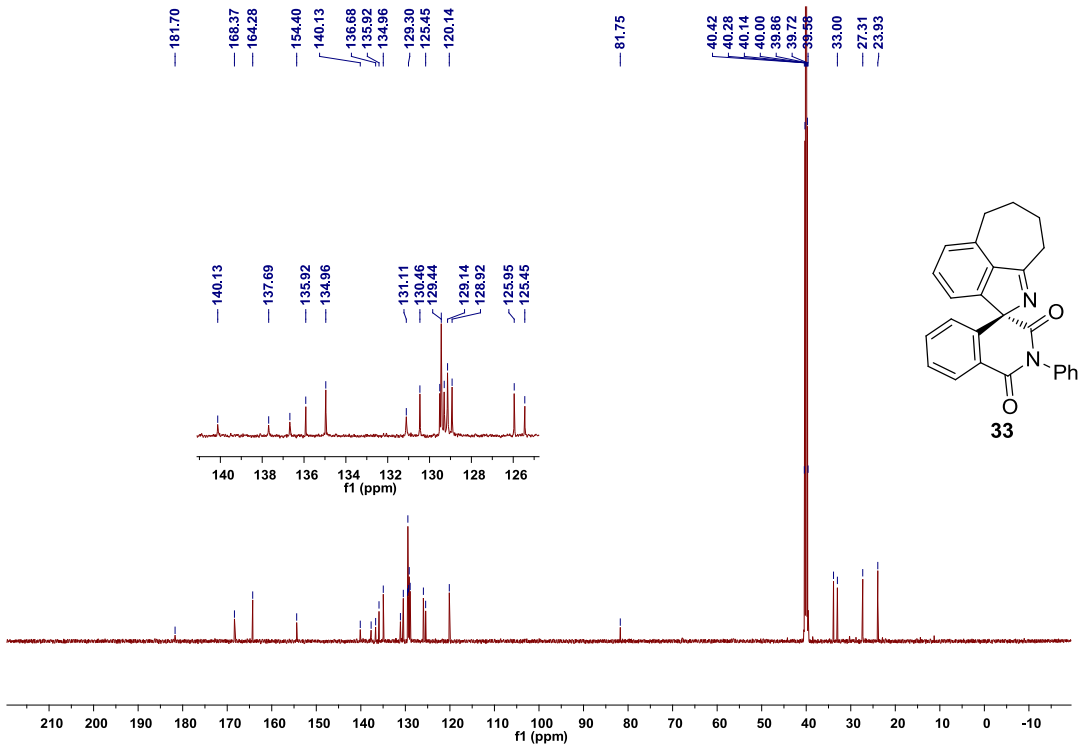
^{13}C NMR (100 MHz, $CDCl_3$)



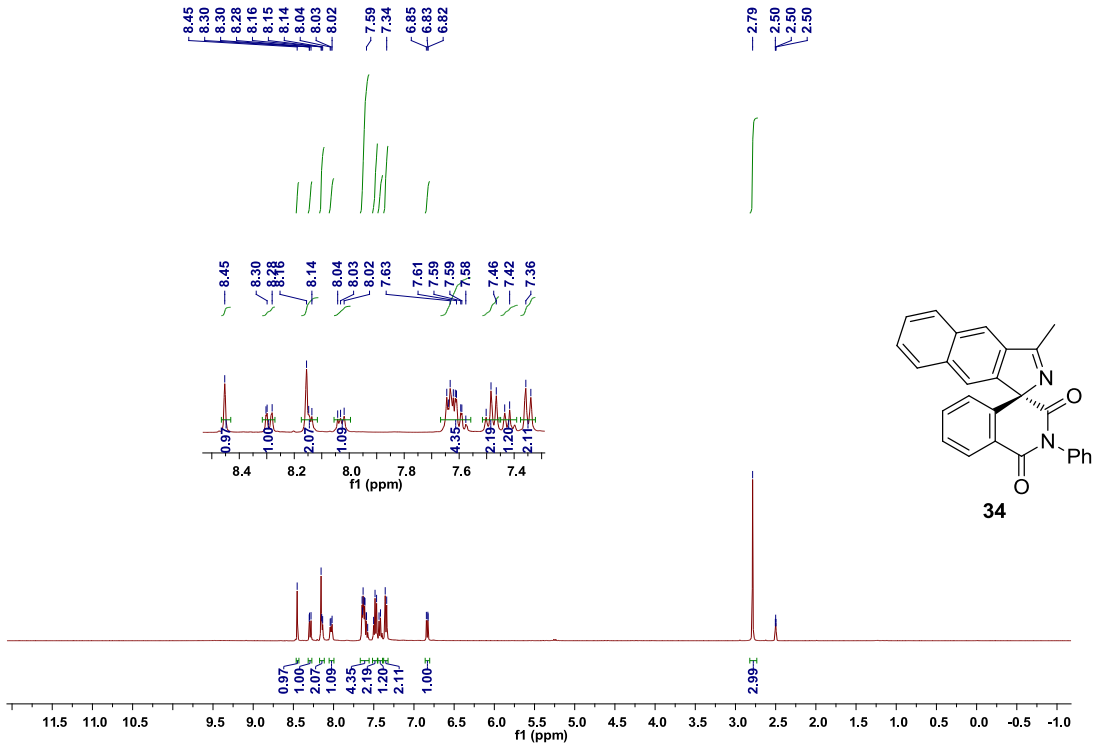
^{1}H NMR (600 MHz, DMSO-d_6)



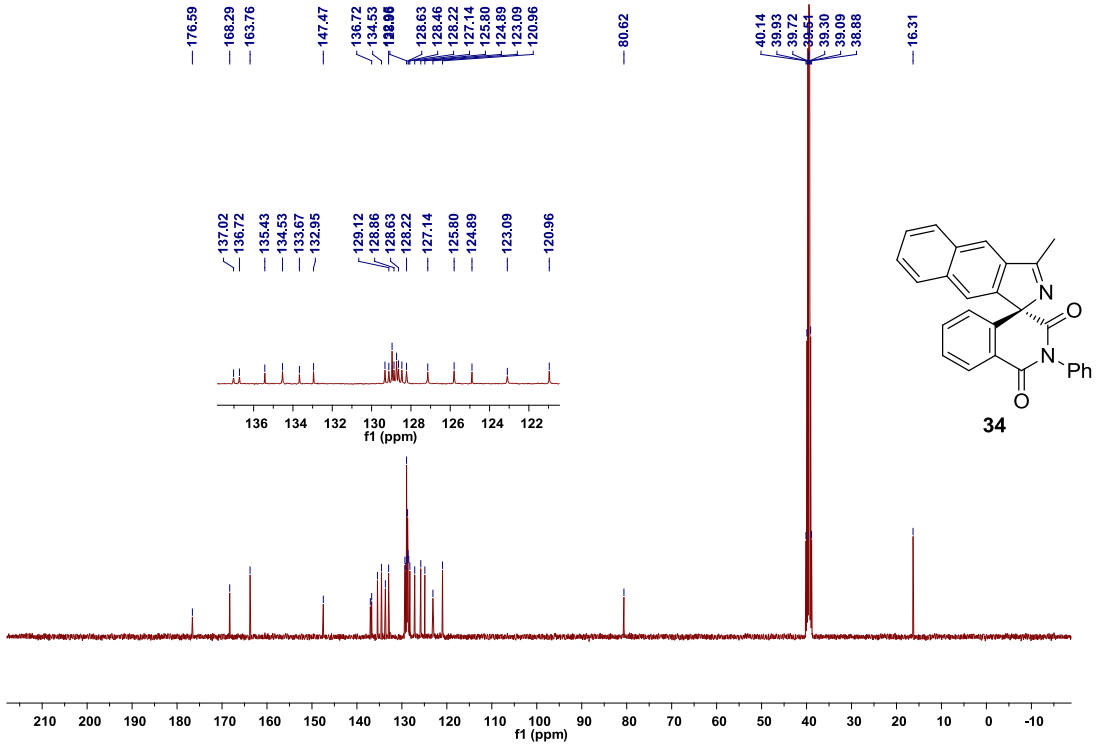
^{13}C NMR (150 MHz, DMSO-d_6)



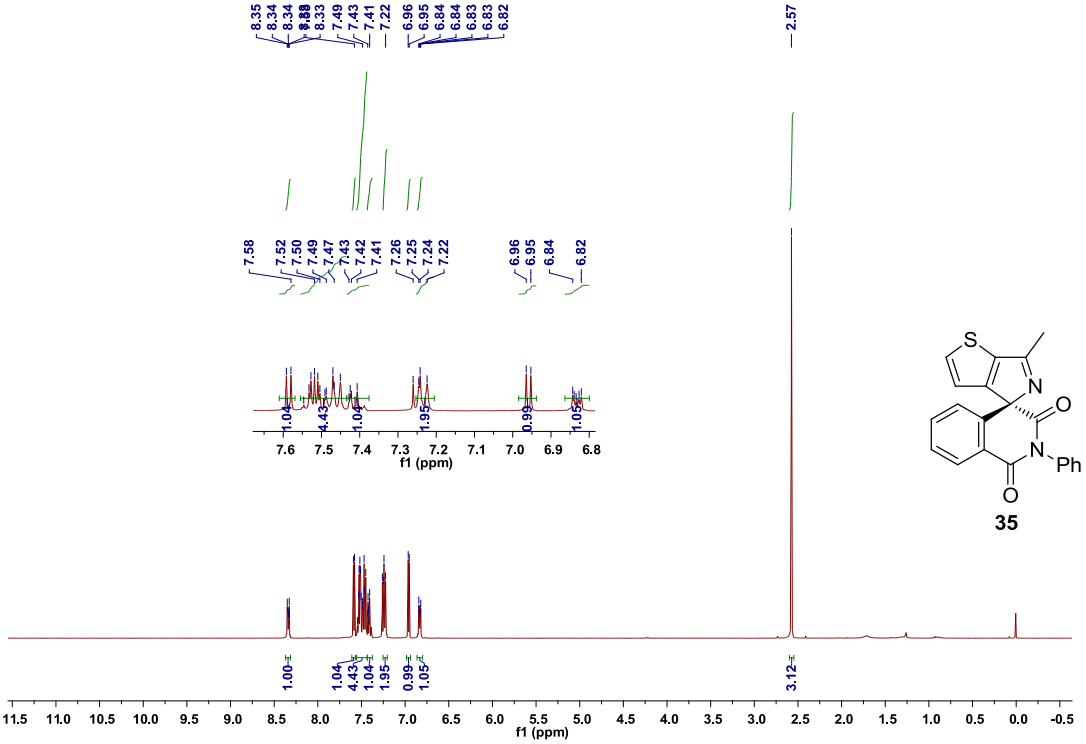
^{1}H NMR (400 MHz, DMSO-d_6)



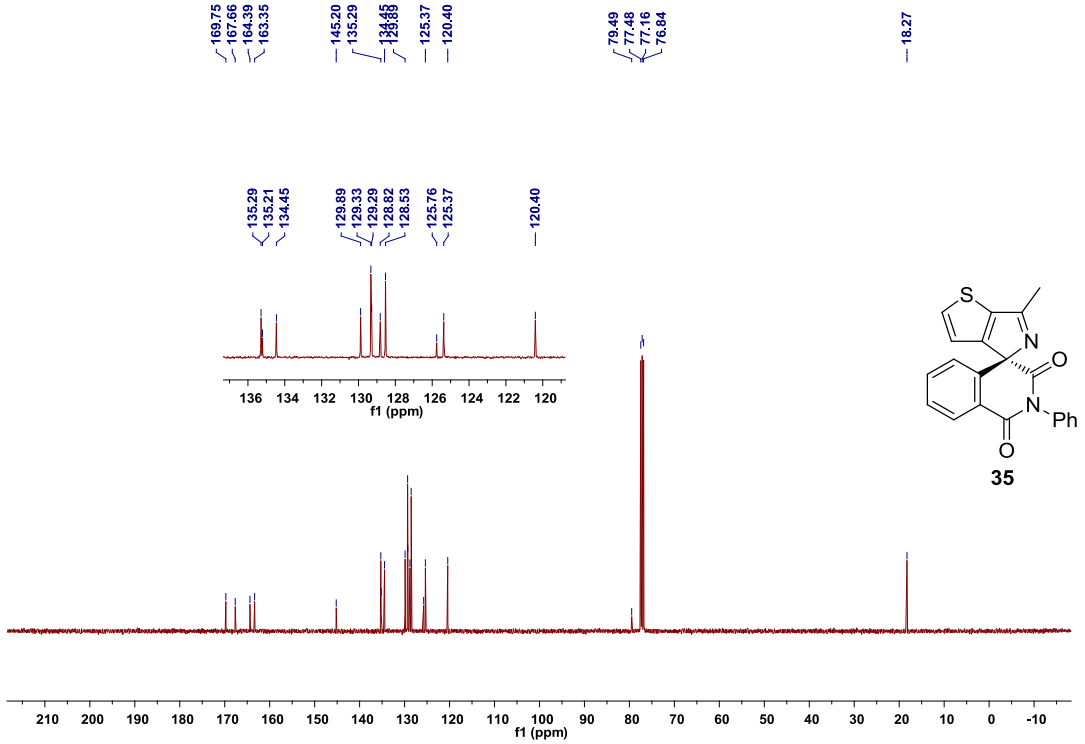
^{13}C NMR (100 MHz, DMSO-d_6)



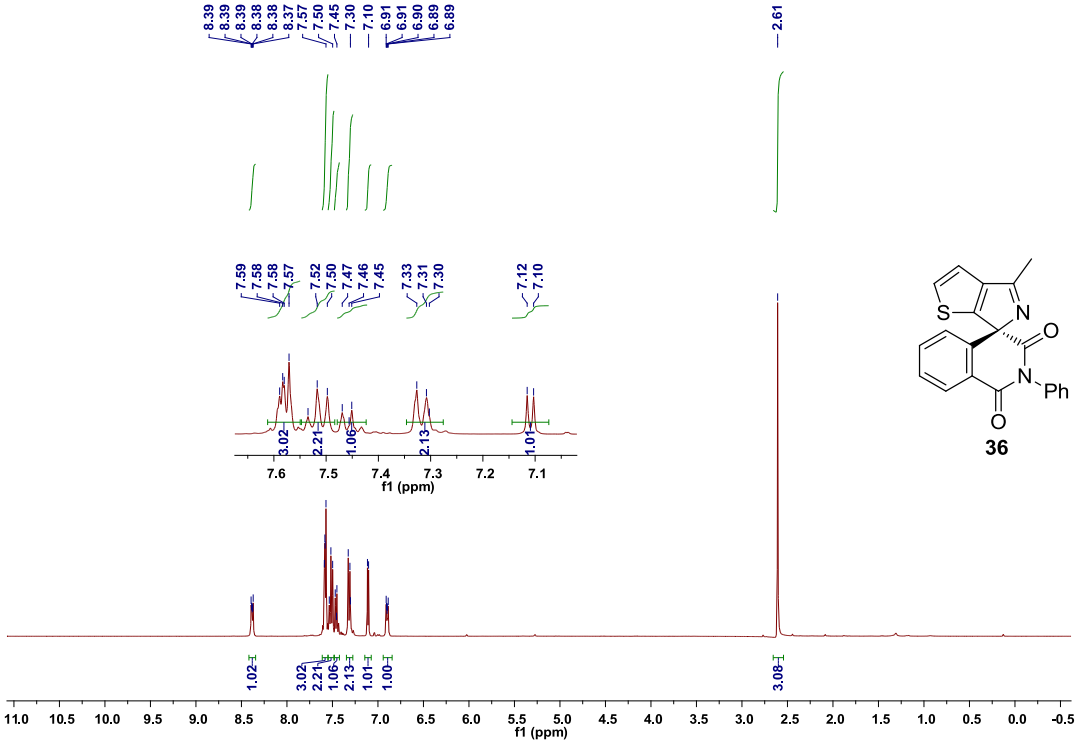
^{1}H NMR (400 MHz, $CDCl_3$)



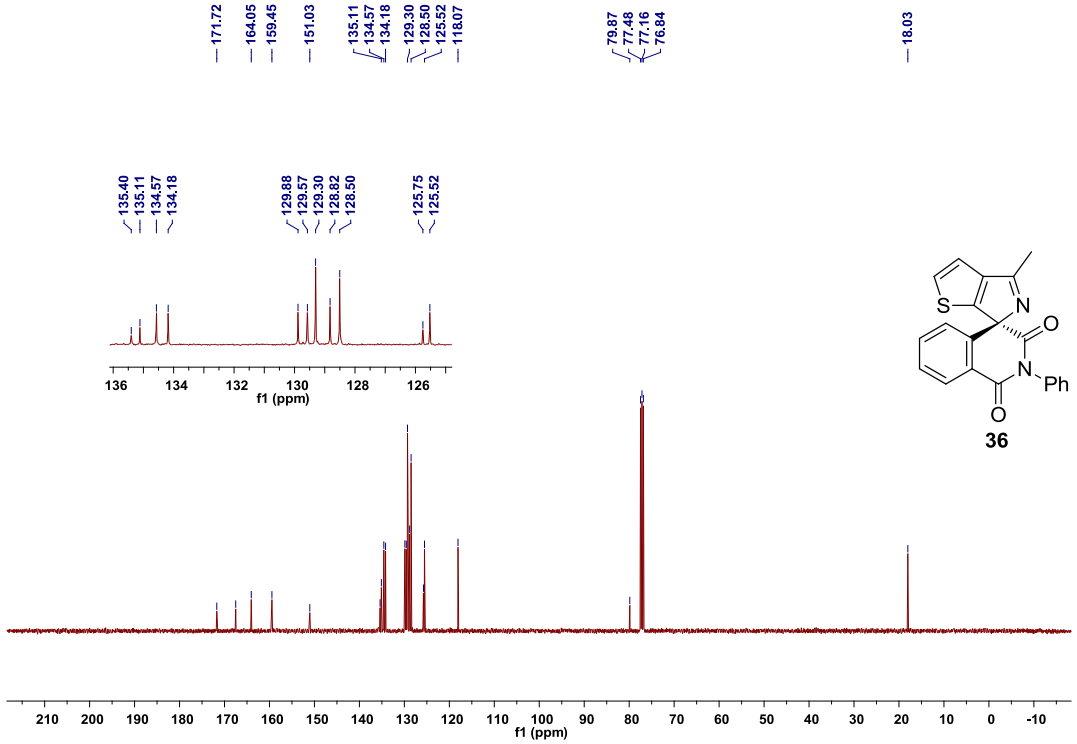
^{13}C NMR (100 MHz, $CDCl_3$)



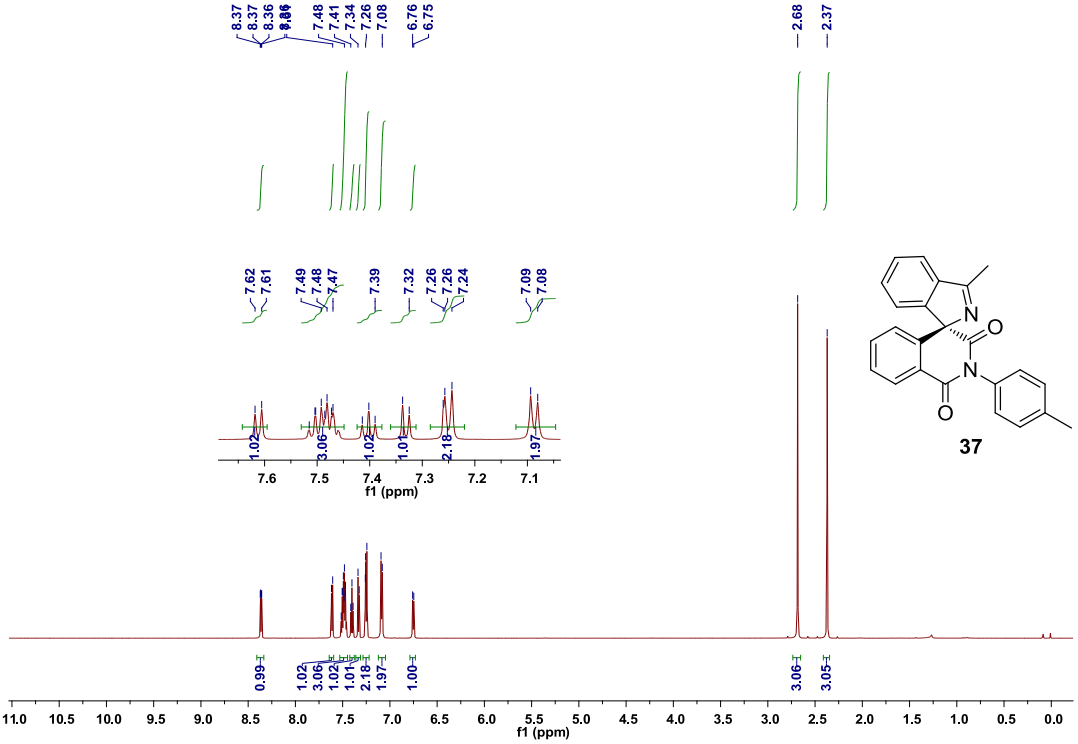
^{1}H NMR (400 MHz, $CDCl_3$)



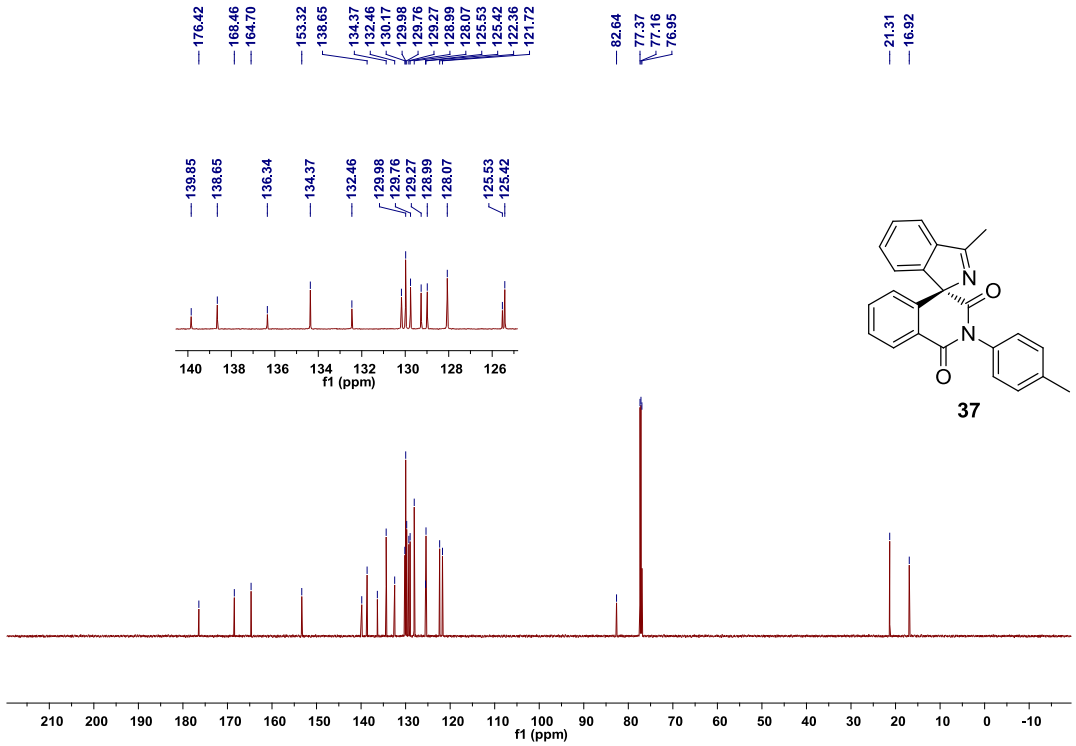
^{13}C NMR (100 MHz, $CDCl_3$)



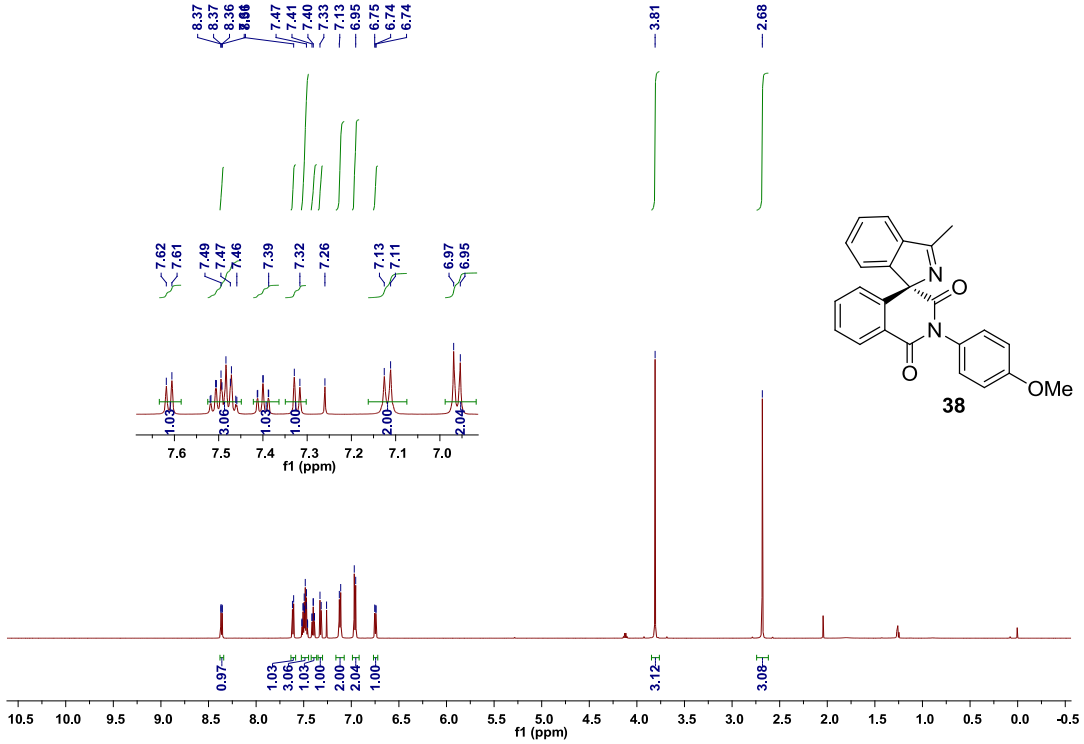
^{1}H NMR (600 MHz, $CDCl_3$)



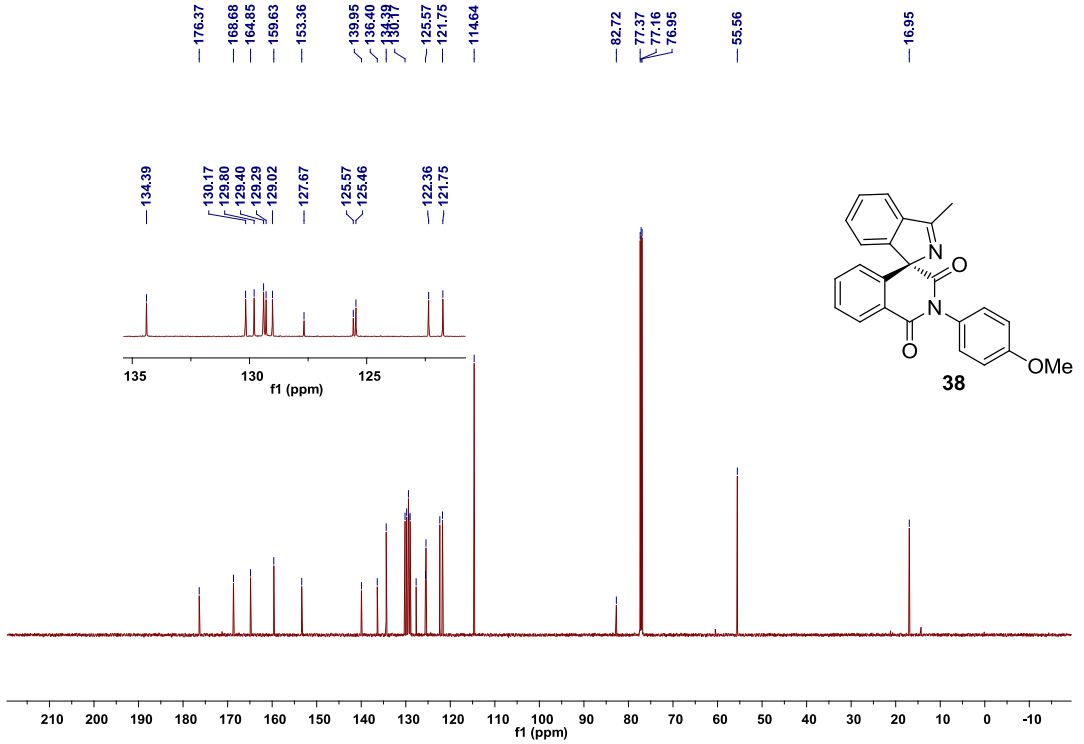
^{13}C NMR (150 MHz, $CDCl_3$)



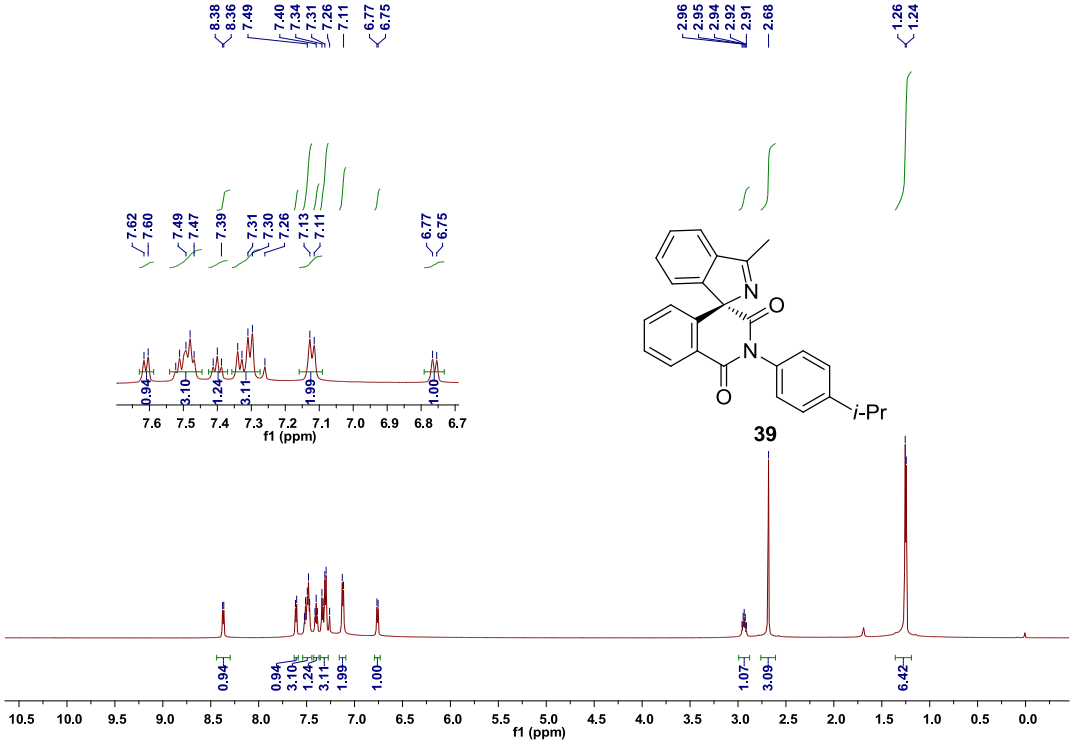
^{1}H NMR (600 MHz, $CDCl_3$)



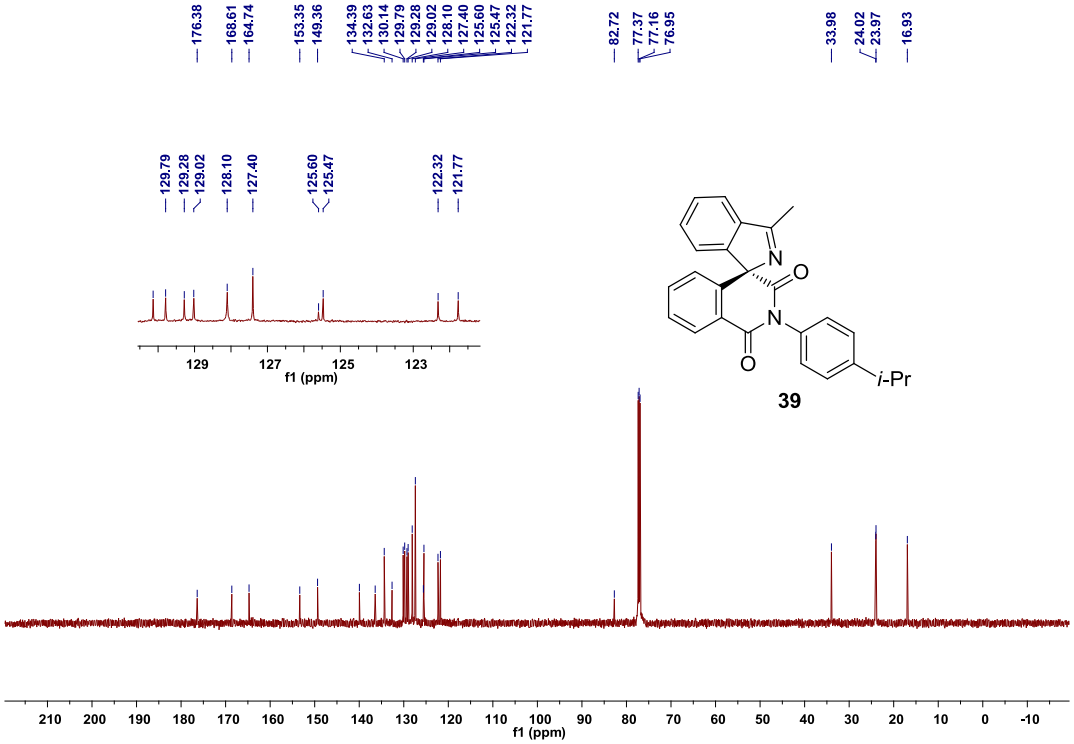
^{13}C NMR (150 MHz, $CDCl_3$)



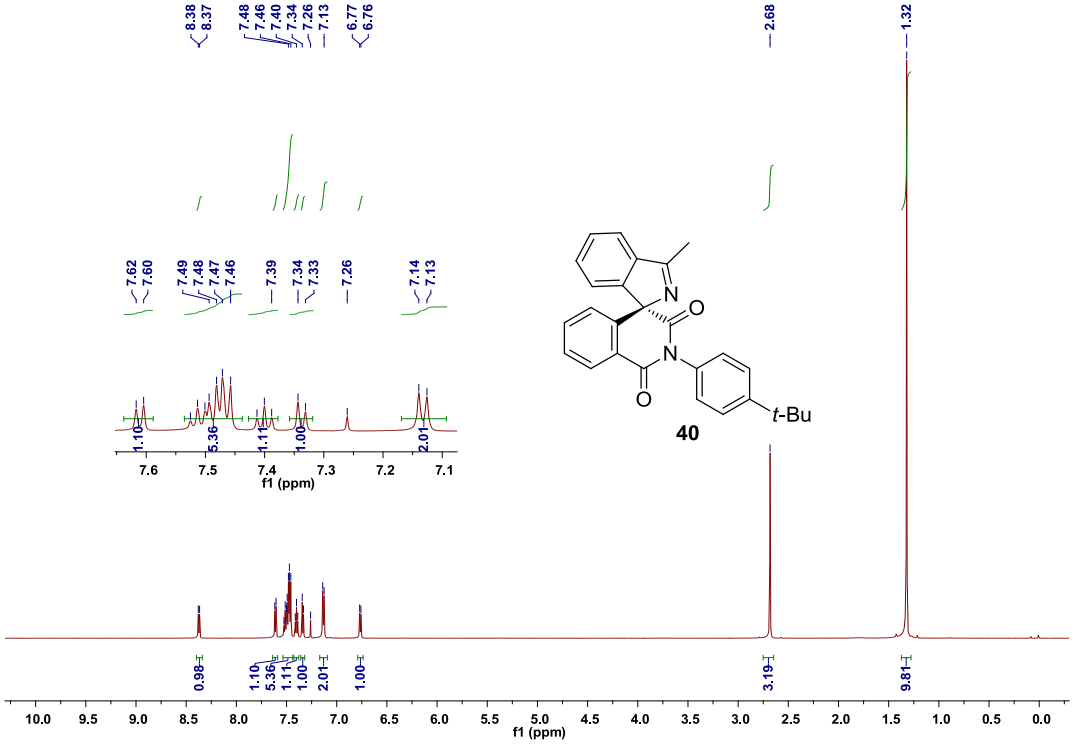
^{1}H NMR (600 MHz, $CDCl_3$)



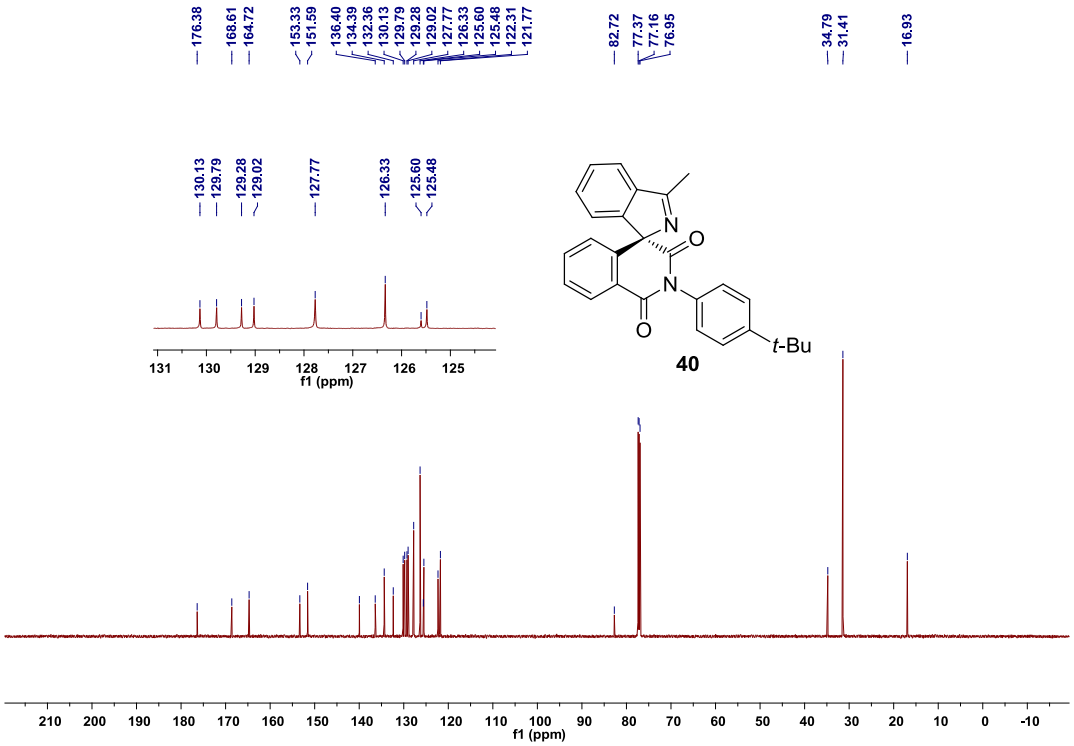
^{13}C NMR (150 MHz, $CDCl_3$)



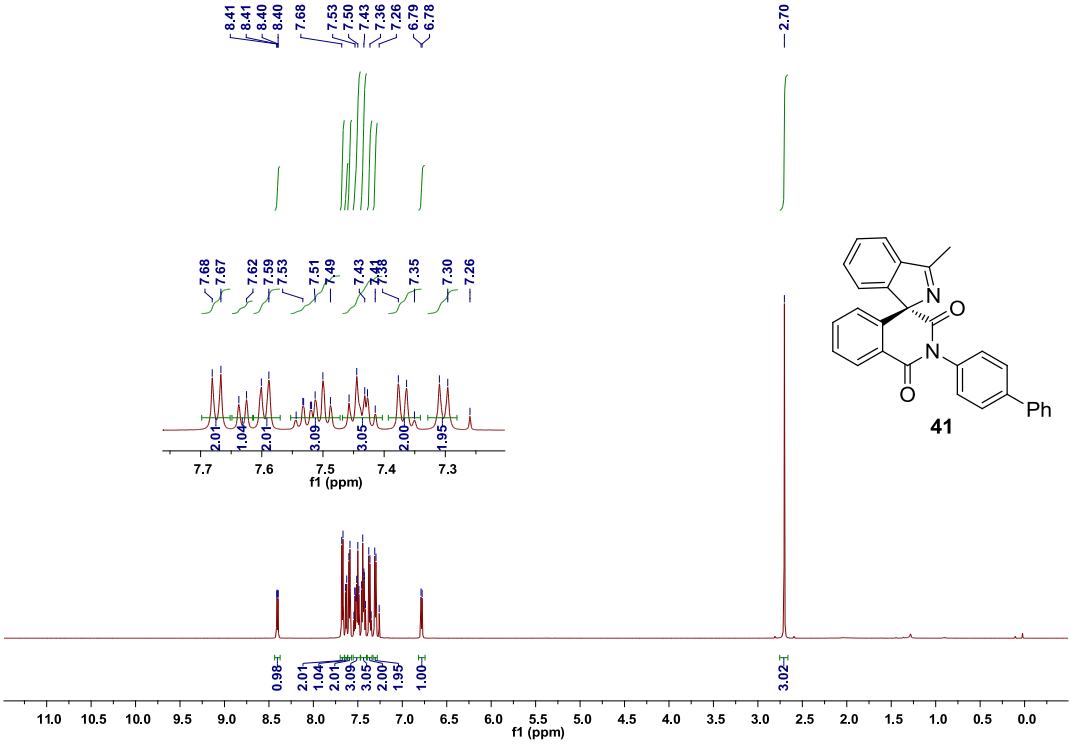
^{1}H NMR (600 MHz, $CDCl_3$)



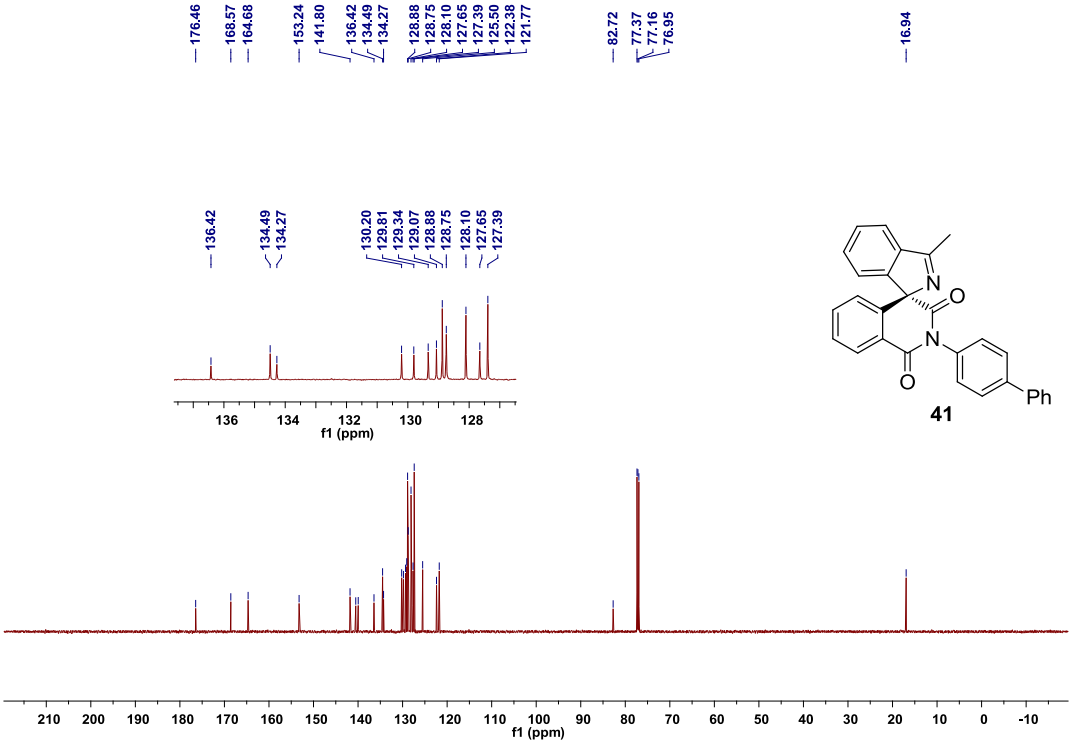
^{13}C NMR (150 MHz, $CDCl_3$)



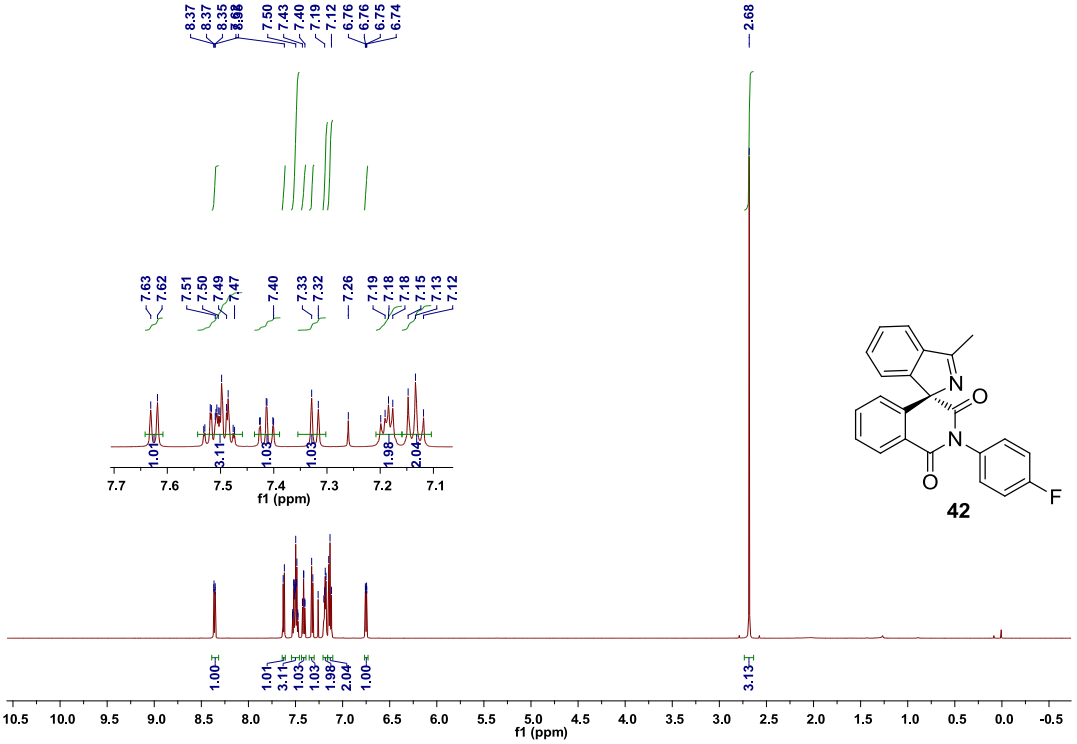
^{1}H NMR (600 MHz, $CDCl_3$)



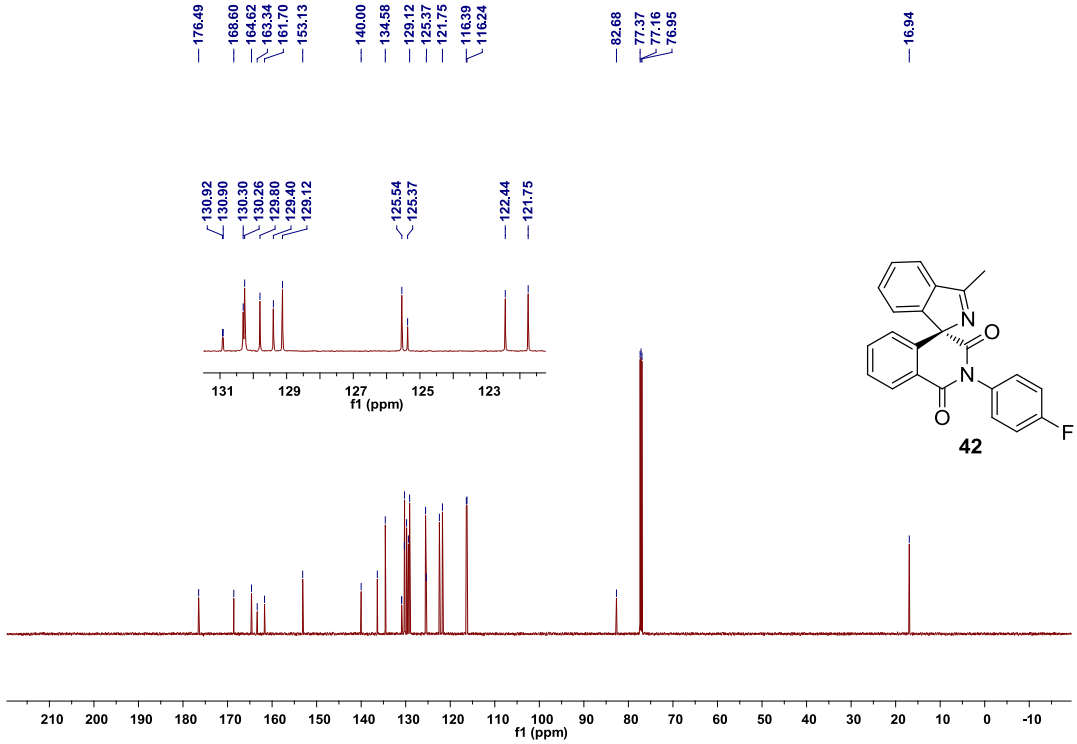
^{13}C NMR (150 MHz, $CDCl_3$)



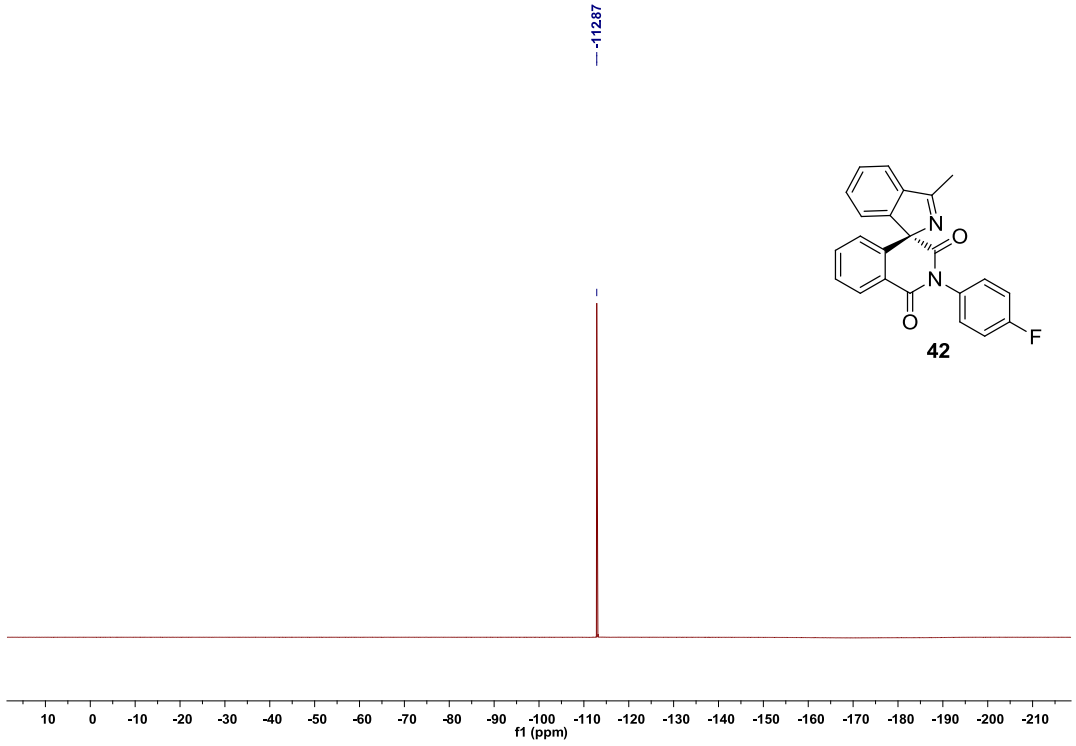
^{1}H NMR (600 MHz, $CDCl_3$)



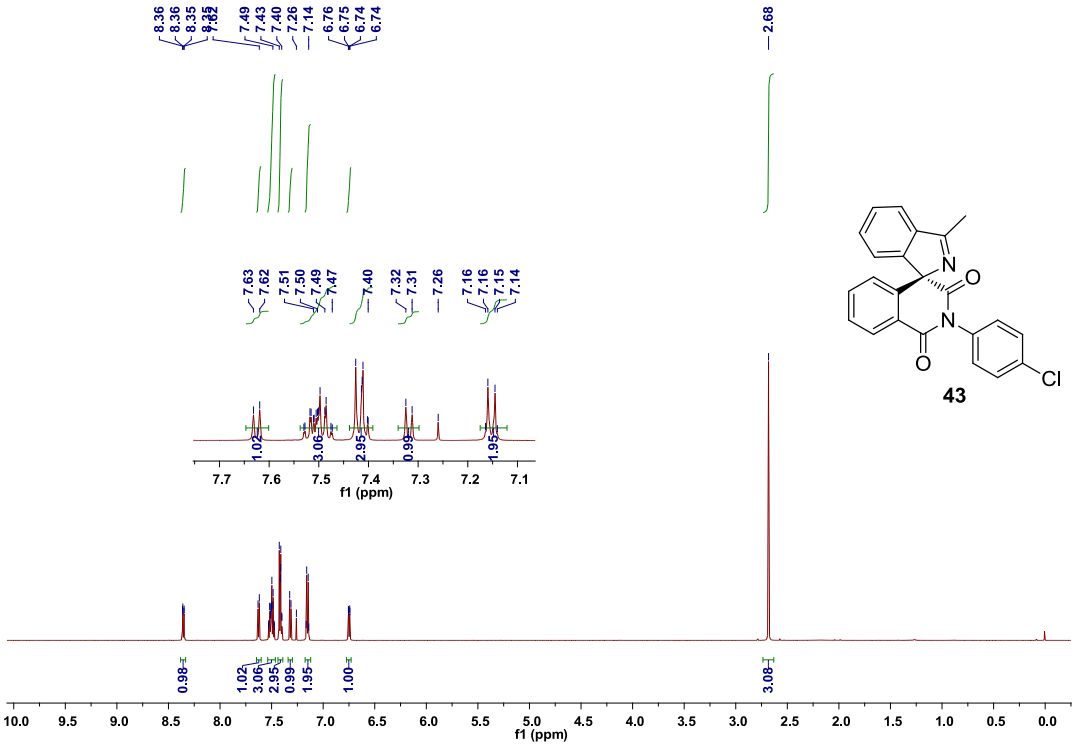
^{13}C NMR (150 MHz, $CDCl_3$)



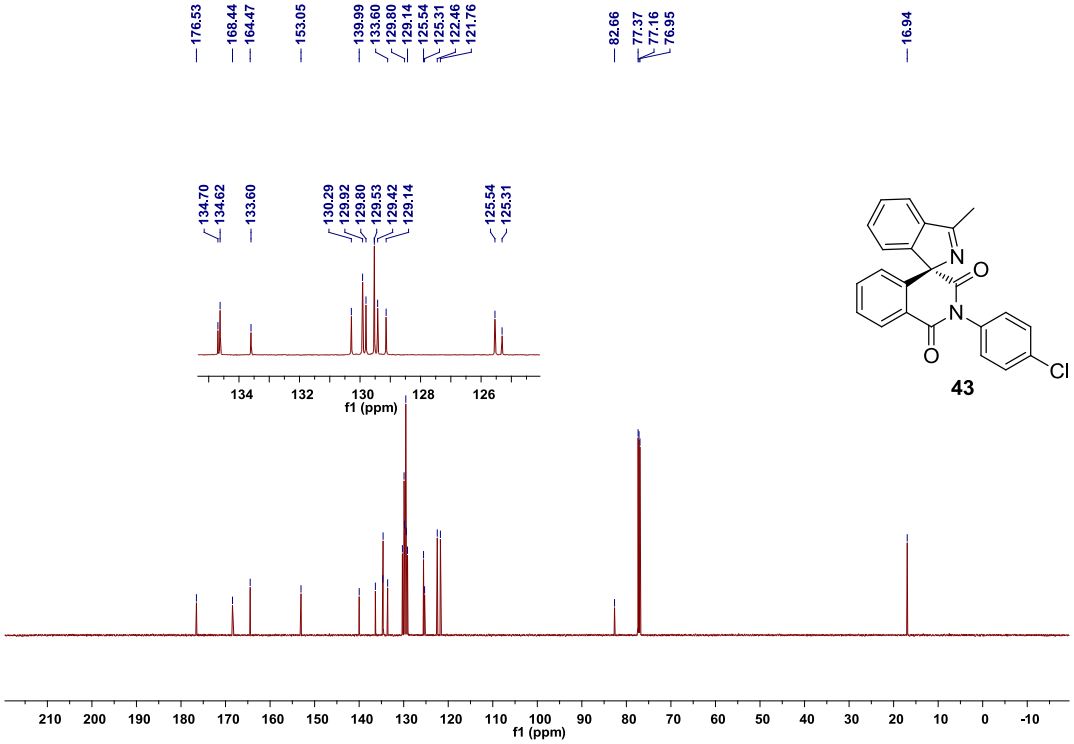
^{19}F NMR (565 MHz, $CDCl_3$)



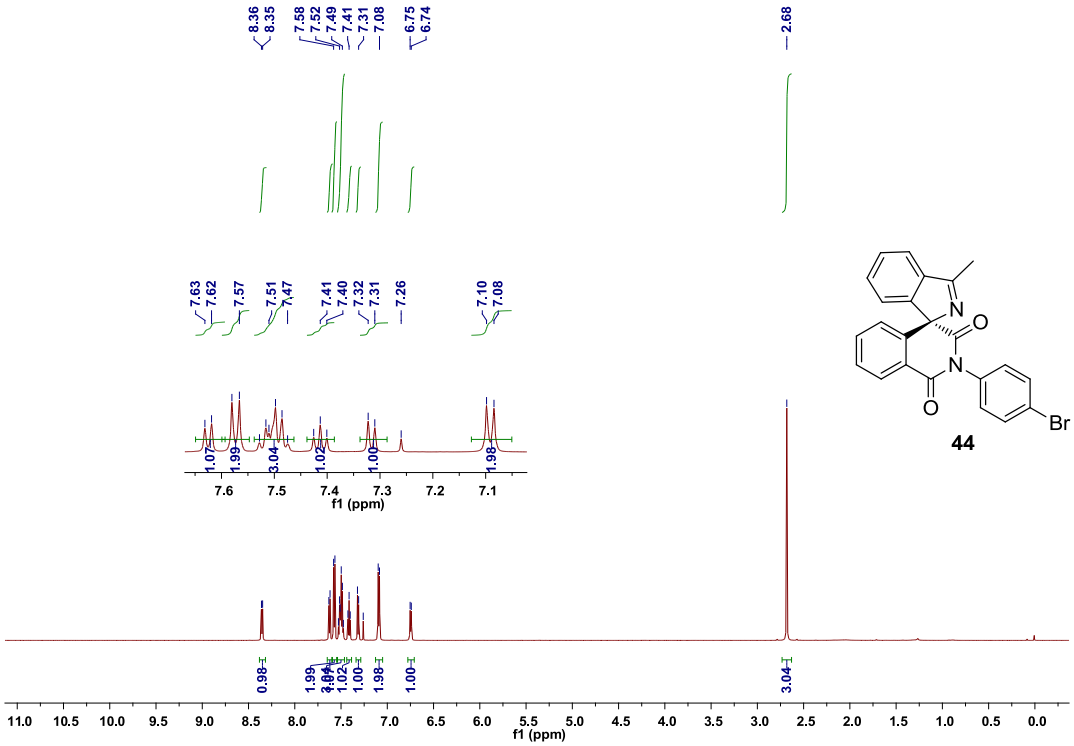
^{1}H NMR (600 MHz, $CDCl_3$)



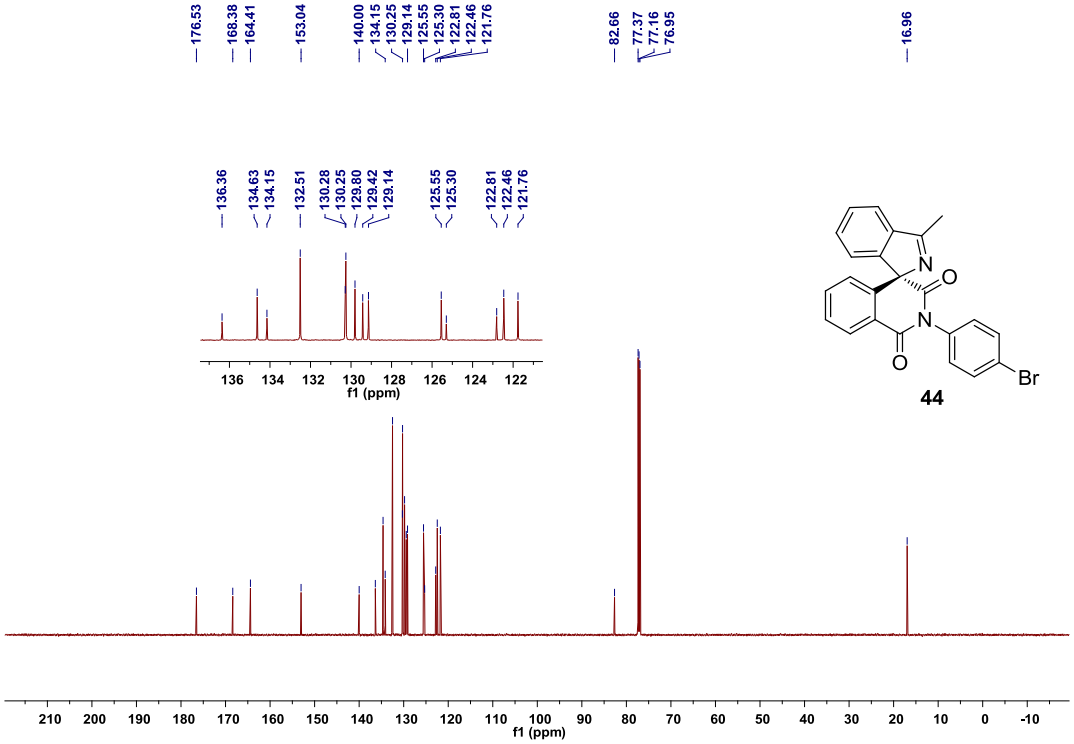
^{13}C NMR (150 MHz, $CDCl_3$)



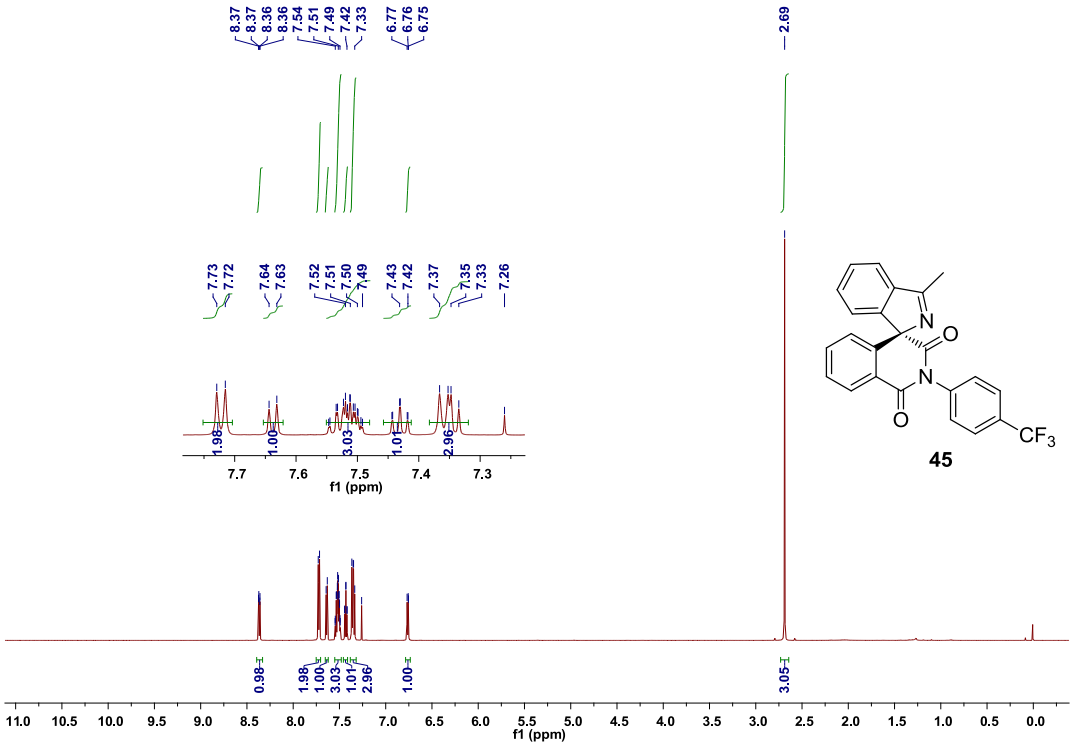
^{1}H NMR (600 MHz, $CDCl_3$)



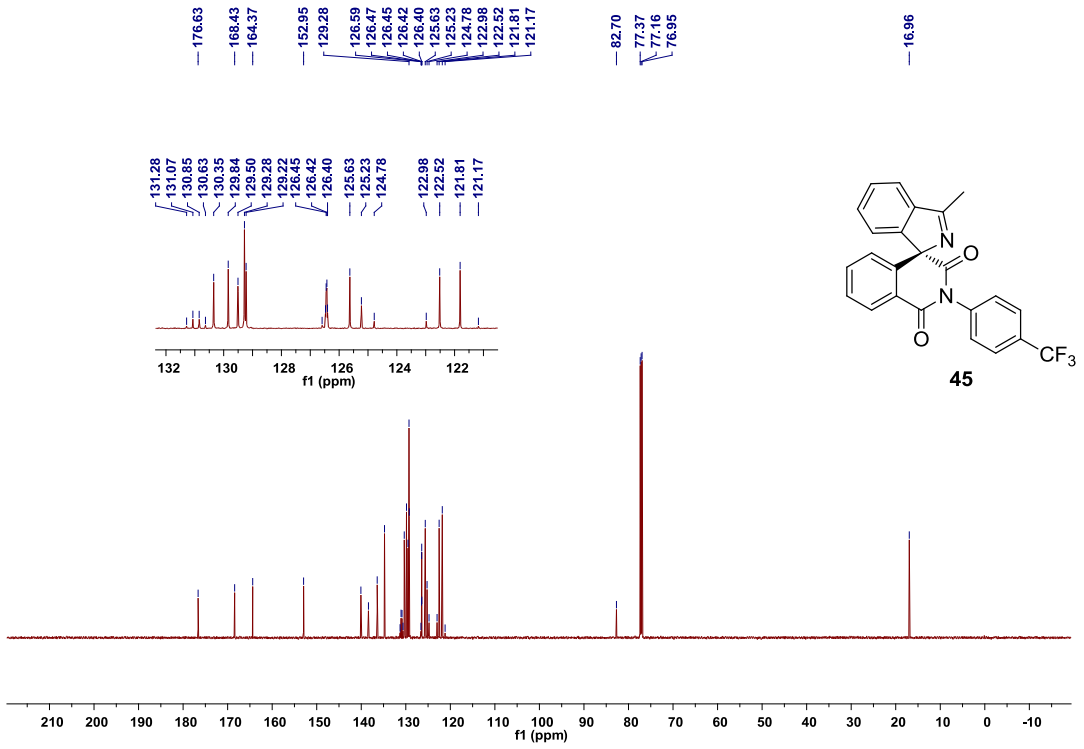
^{13}C NMR (150 MHz, $CDCl_3$)



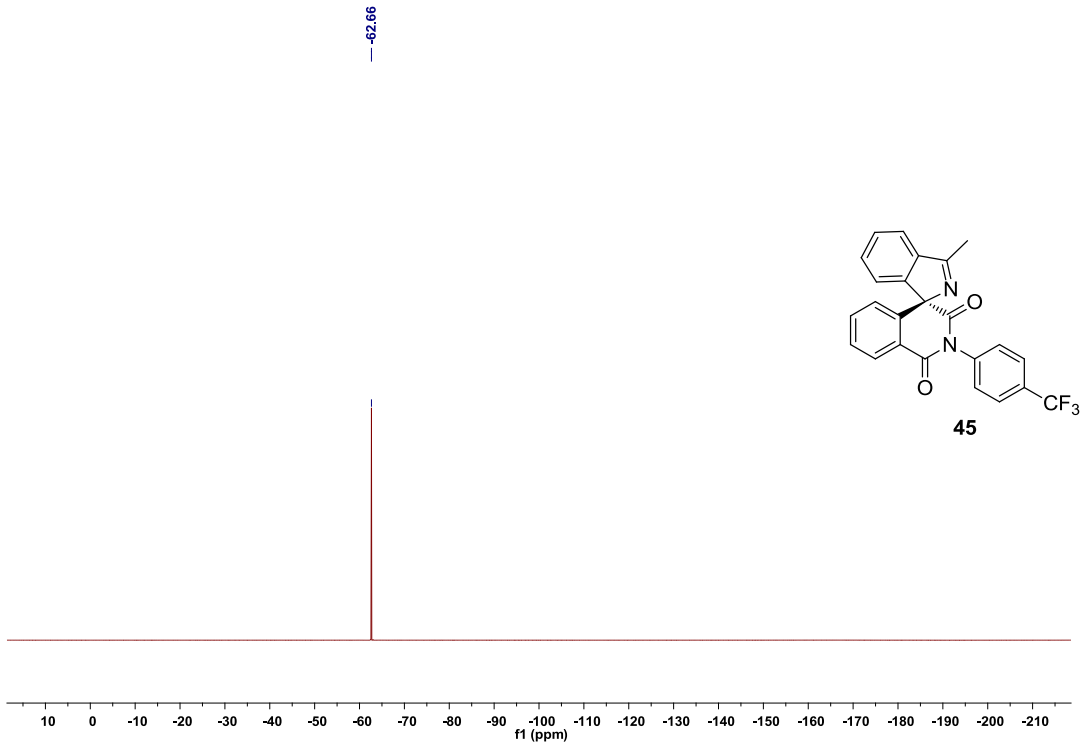
^{1}H NMR (600 MHz, $CDCl_3$)



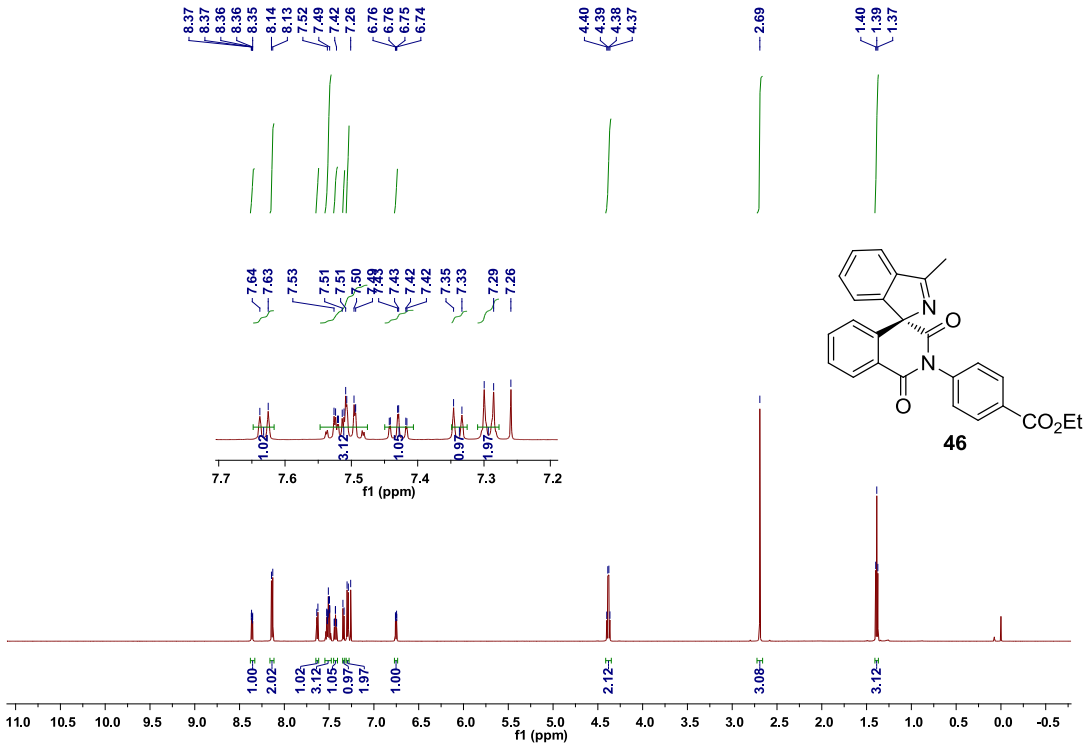
^{13}C NMR (150 MHz, $CDCl_3$)



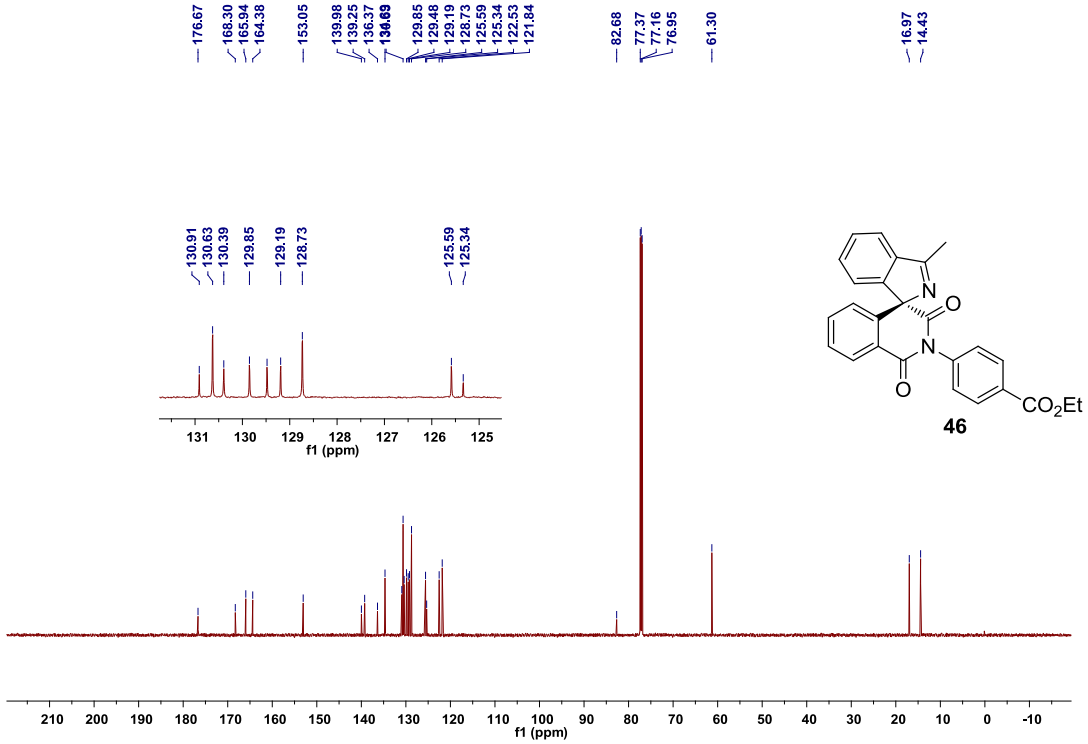
^{19}F NMR (565 MHz, $CDCl_3$)



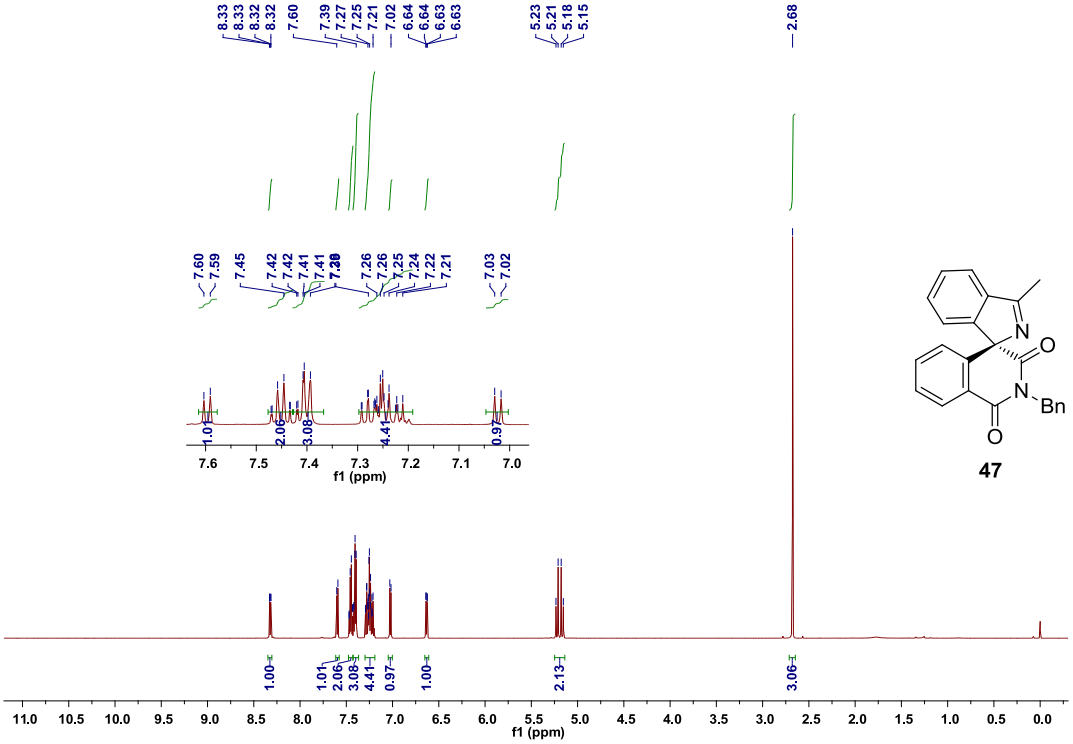
^{1}H NMR (600 MHz, $CDCl_3$)



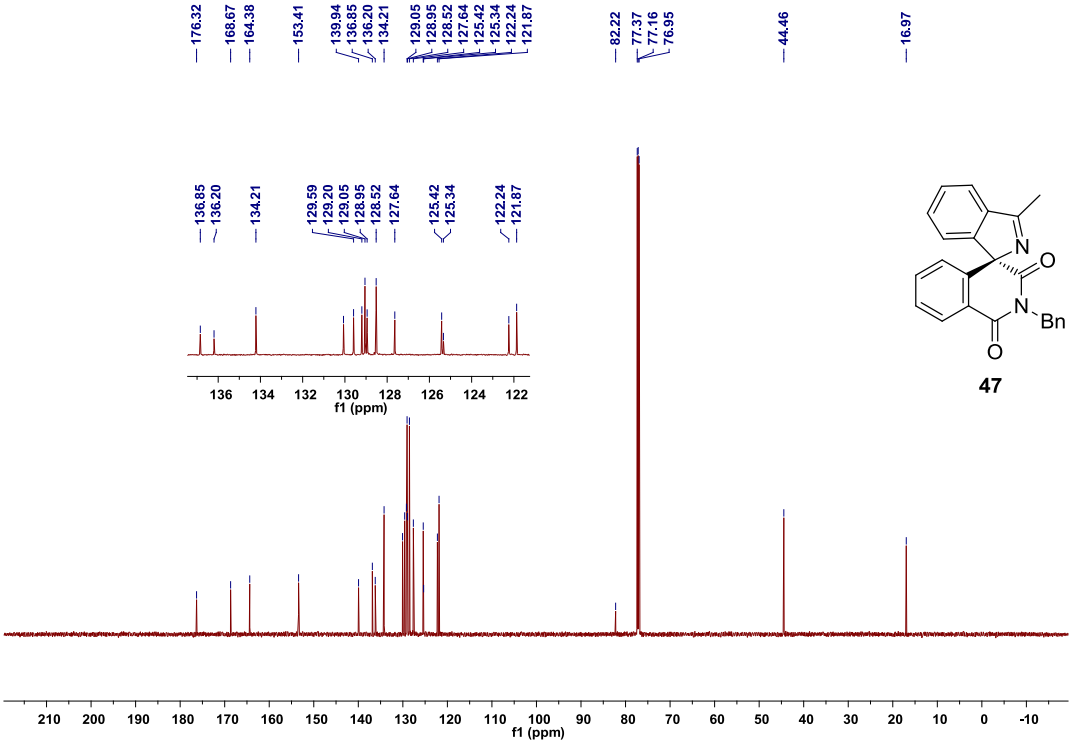
^{13}C NMR (150 MHz, $CDCl_3$)



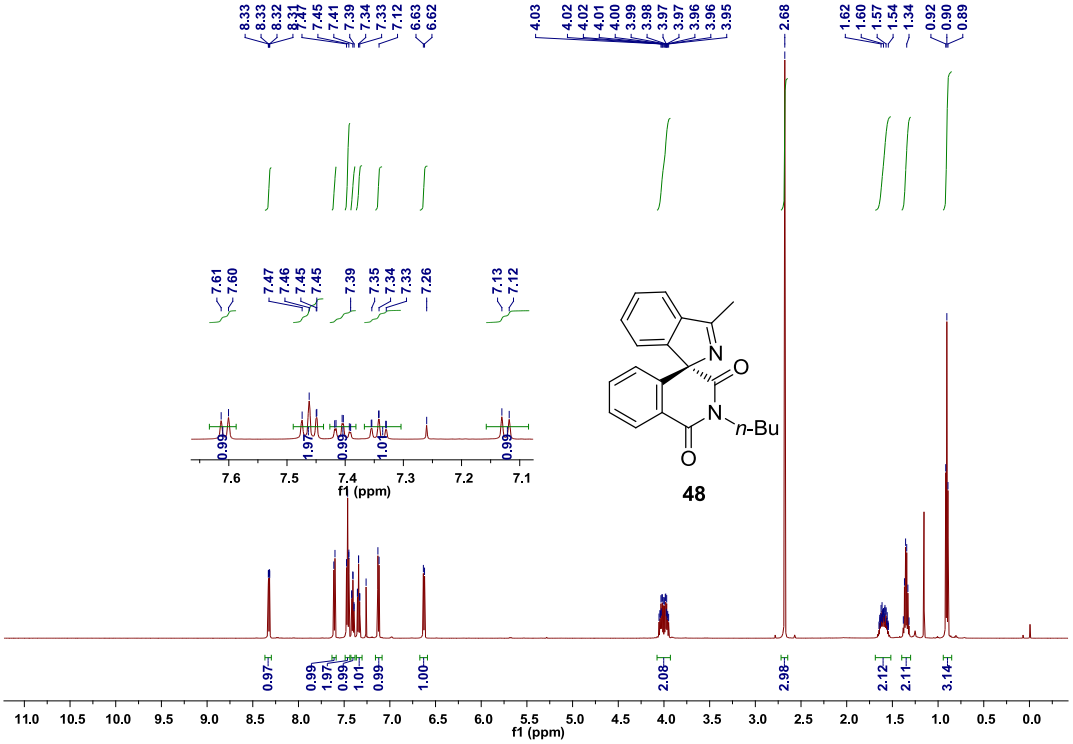
^{1}H NMR (600 MHz, $CDCl_3$)



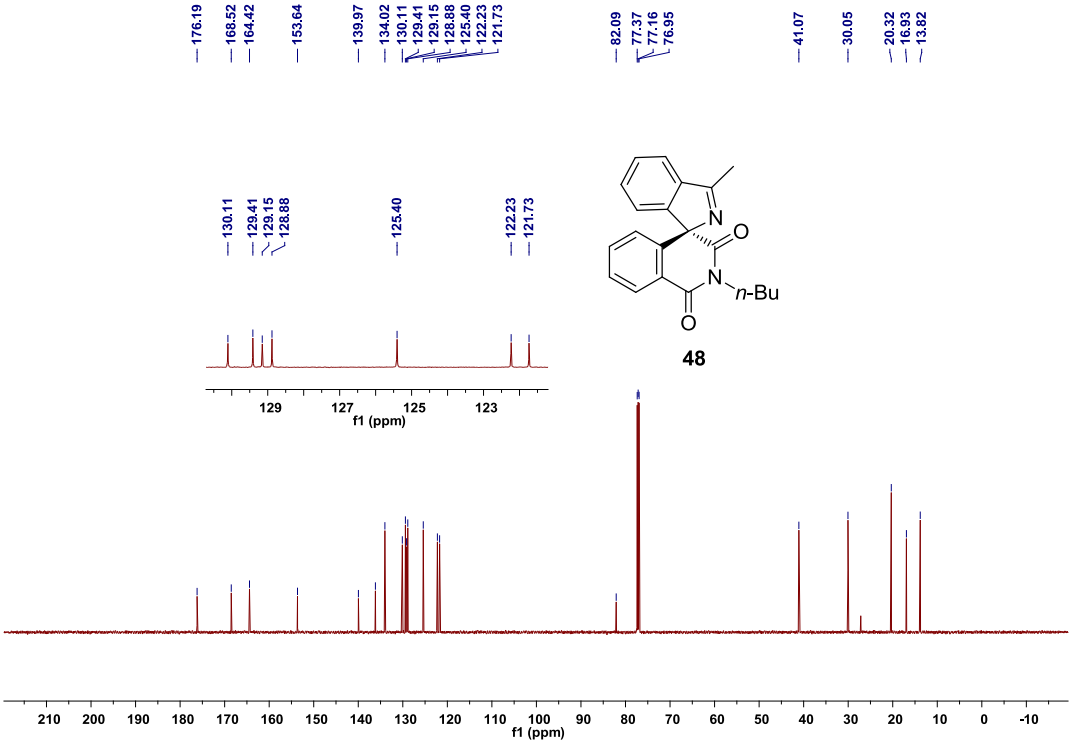
^{13}C NMR (150 MHz, $CDCl_3$)



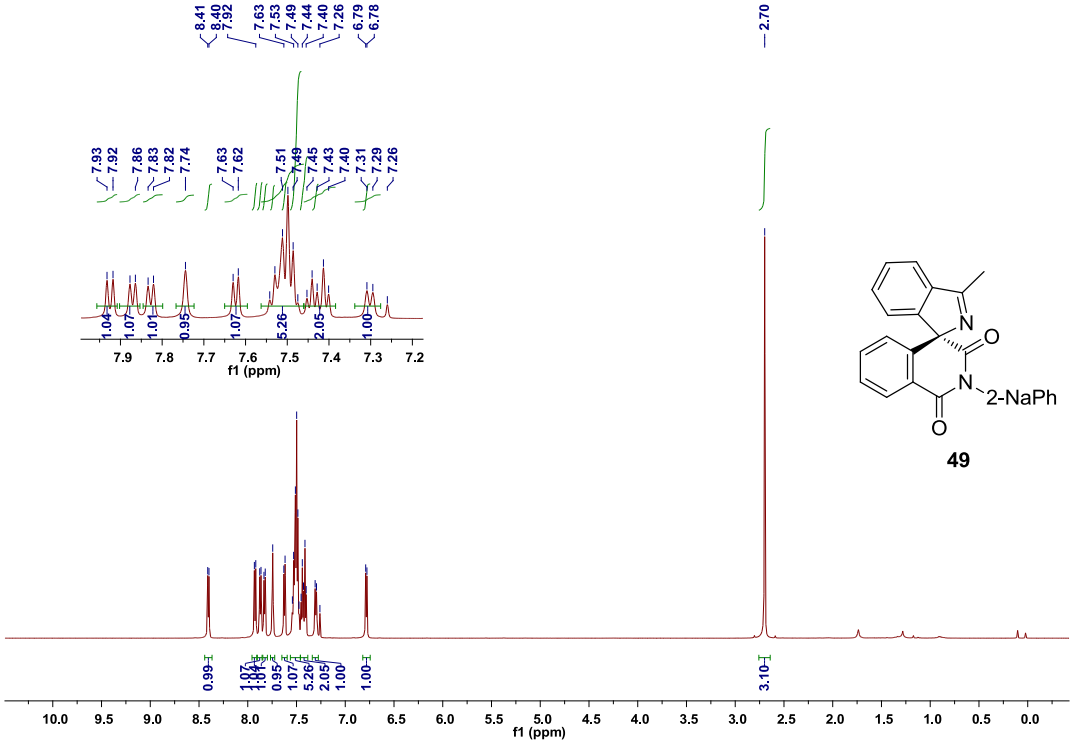
^{1}H NMR (600 MHz, $CDCl_3$)



^{13}C NMR (150 MHz, $CDCl_3$)

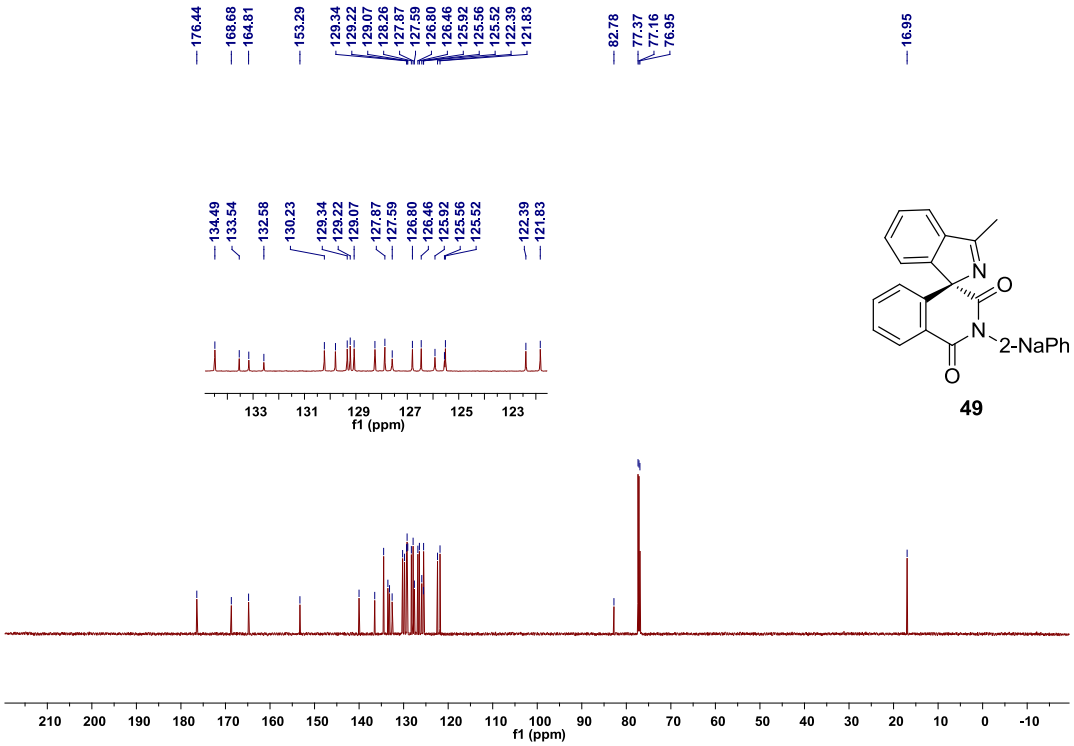


^{1}H NMR (600 MHz, $CDCl_3$)



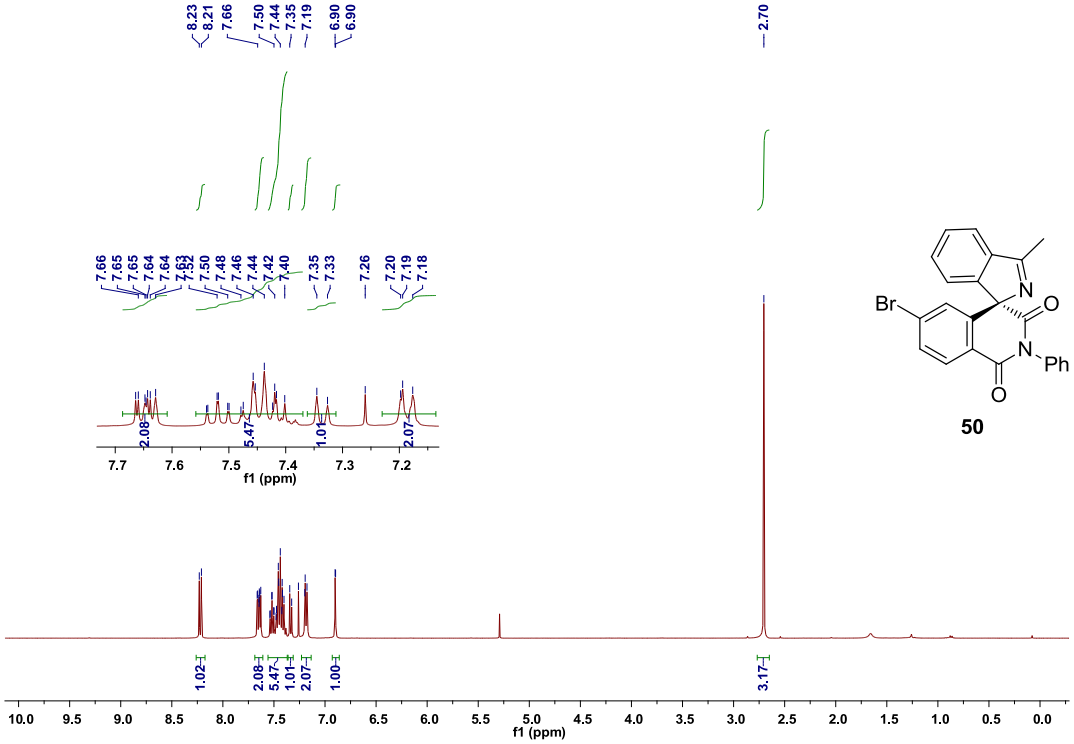
49

^{13}C NMR (150 MHz, $CDCl_3$)

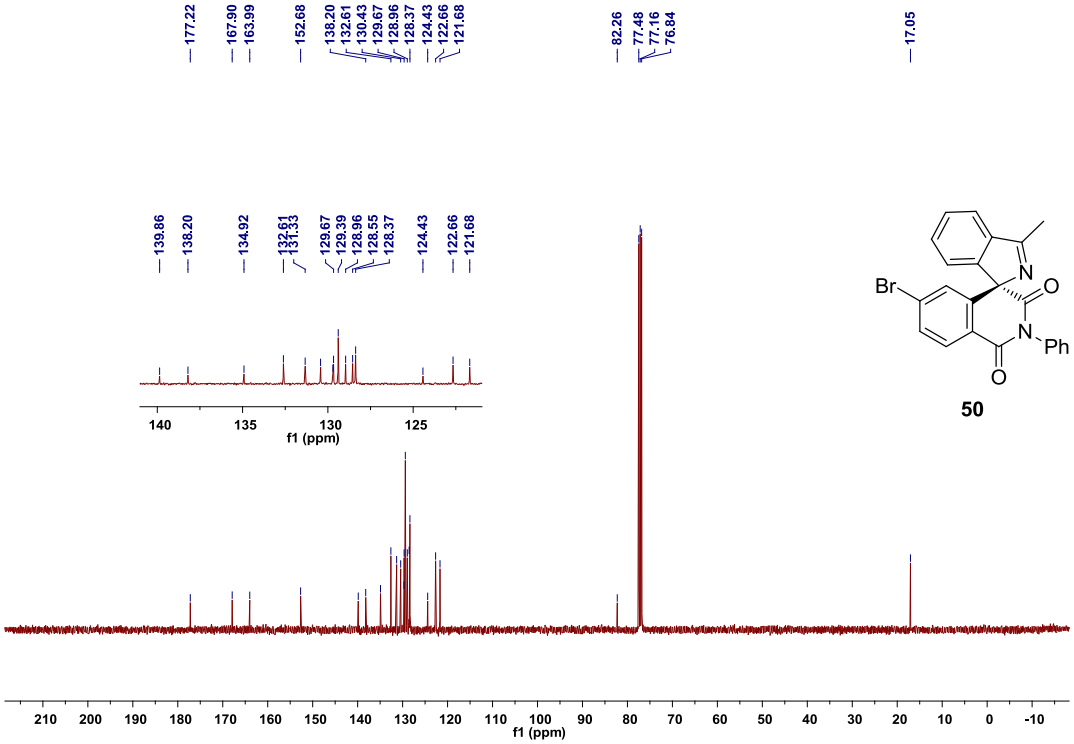


49

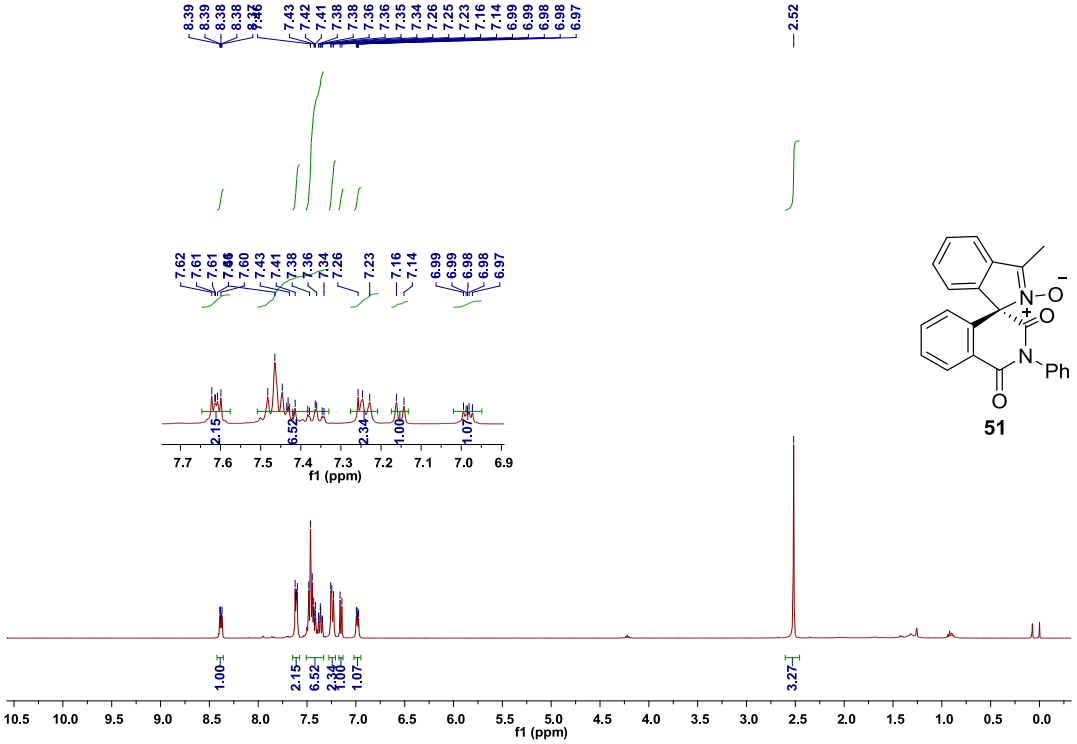
^{1}H NMR (400 MHz, $CDCl_3$)



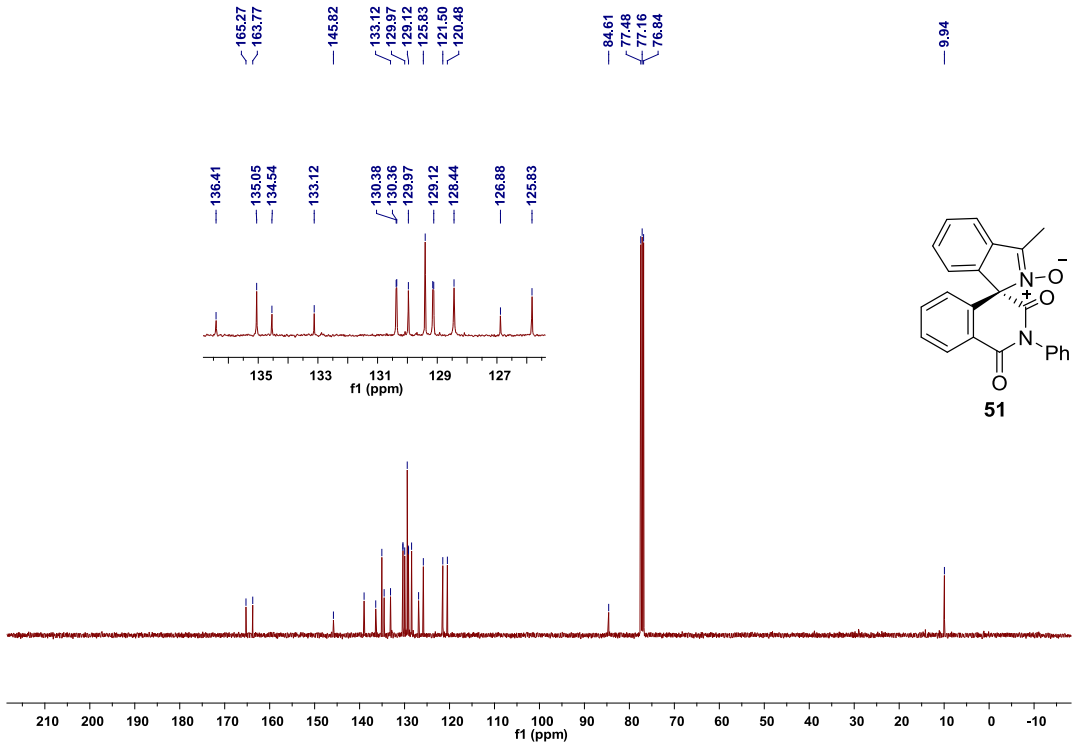
^{13}C NMR (100 MHz, $CDCl_3$)



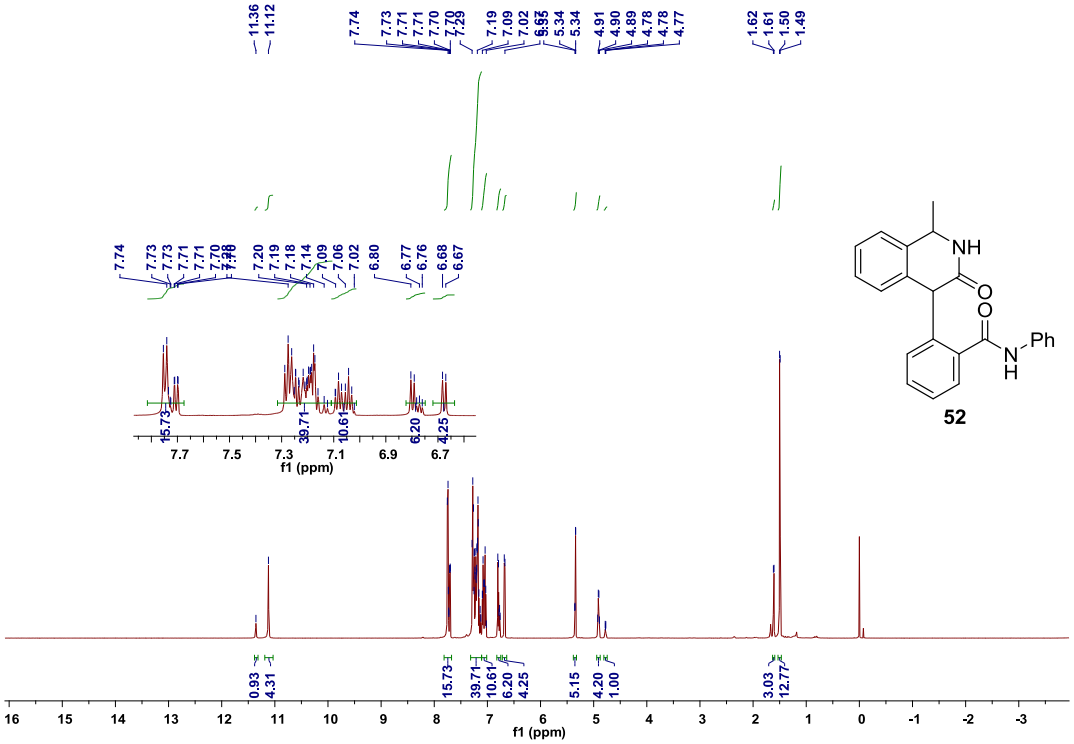
^{1}H NMR (400 MHz, $CDCl_3$)



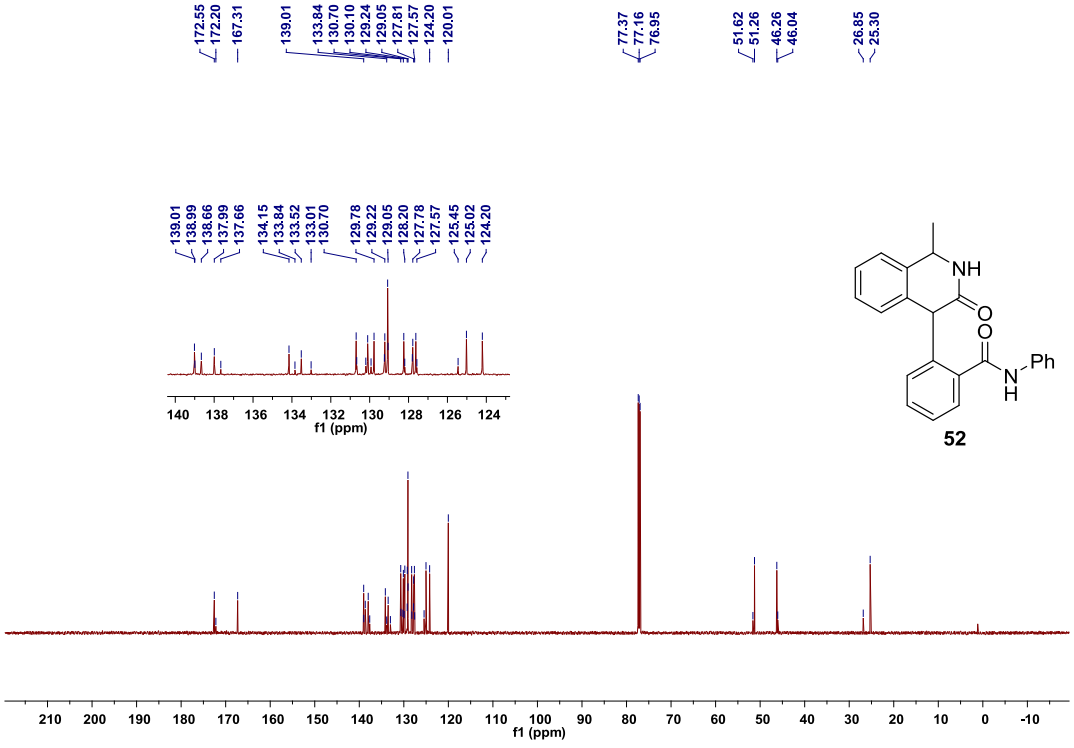
^{13}C NMR (100 MHz, $CDCl_3$)



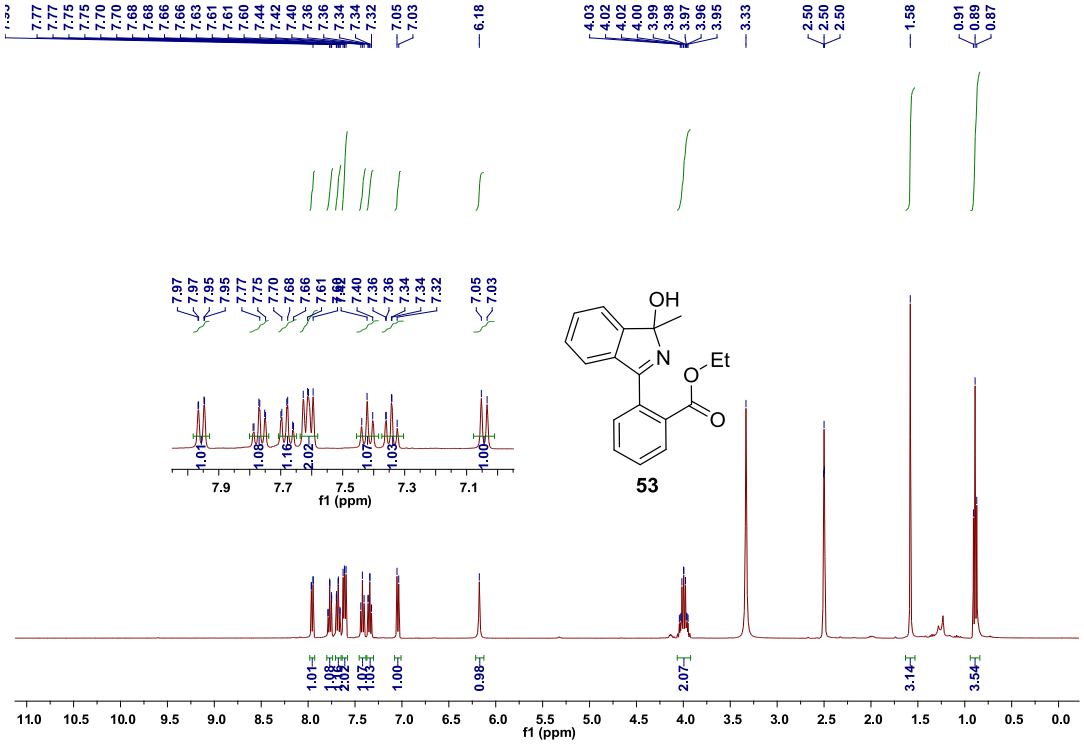
^{1}H NMR (600 MHz, $CDCl_3$)



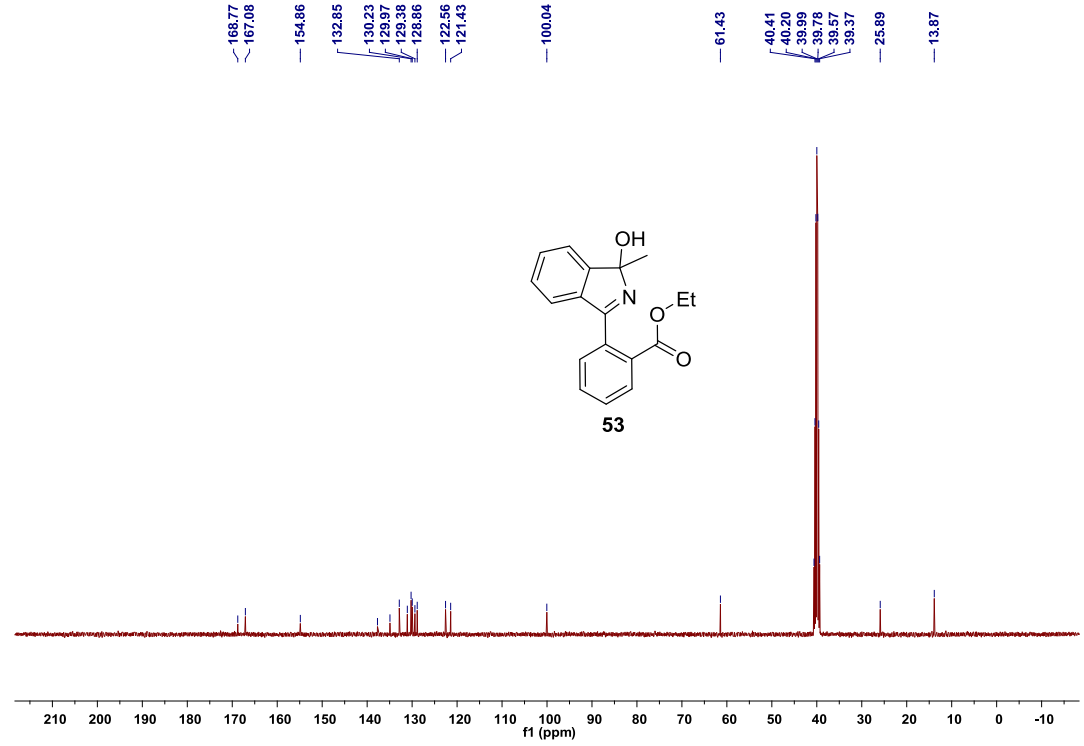
^{13}C NMR (150 MHz, $CDCl_3$)



^{1}H NMR (600 MHz, DMSO-d_6)



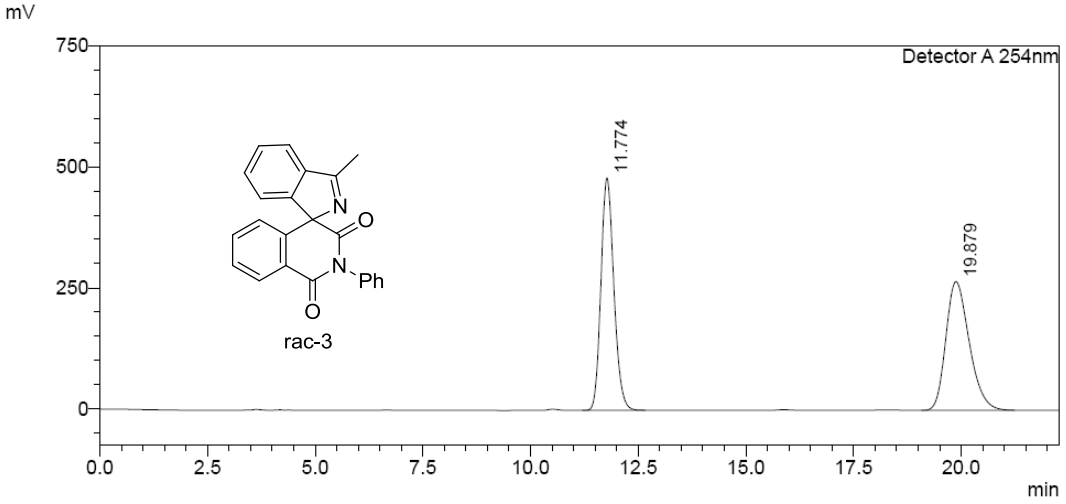
^{13}C NMR (100 MHz,DMSO-d_6)



HPLC Spectra

3, AD-H, Hex/*i*PrOH = 70/30, rate = 1.0 mL/min, 254 nm

<Chromatogram>

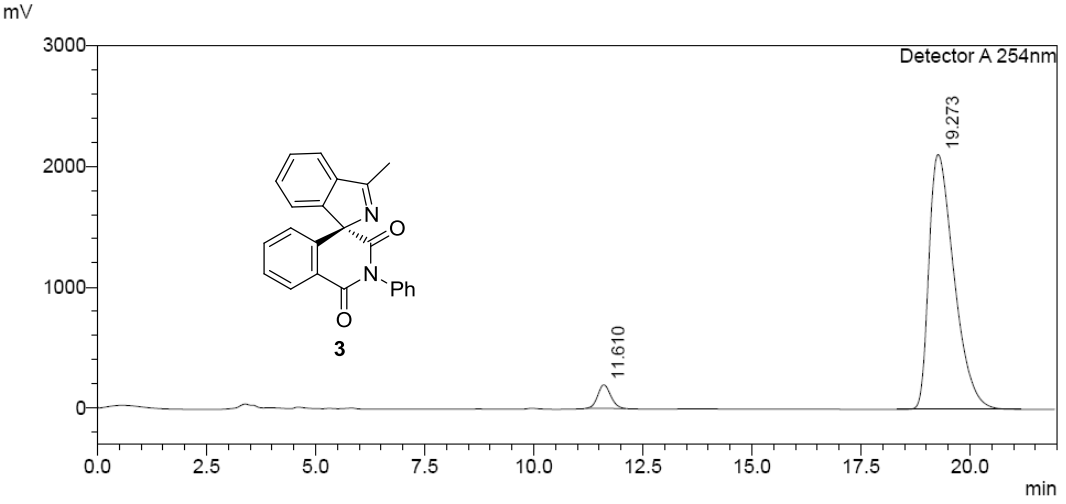


<Peak Table>

Detector A 254nm

Peak#	Ret. Time	Area	Area%	Height	Conc.	Unit	Mark
1	11.774	10013346	49.969	479369	49.969		M
2	19.879	10025853	50.031	265594	50.031		M
Total		20039199	100.000	744963			

<Chromatogram>



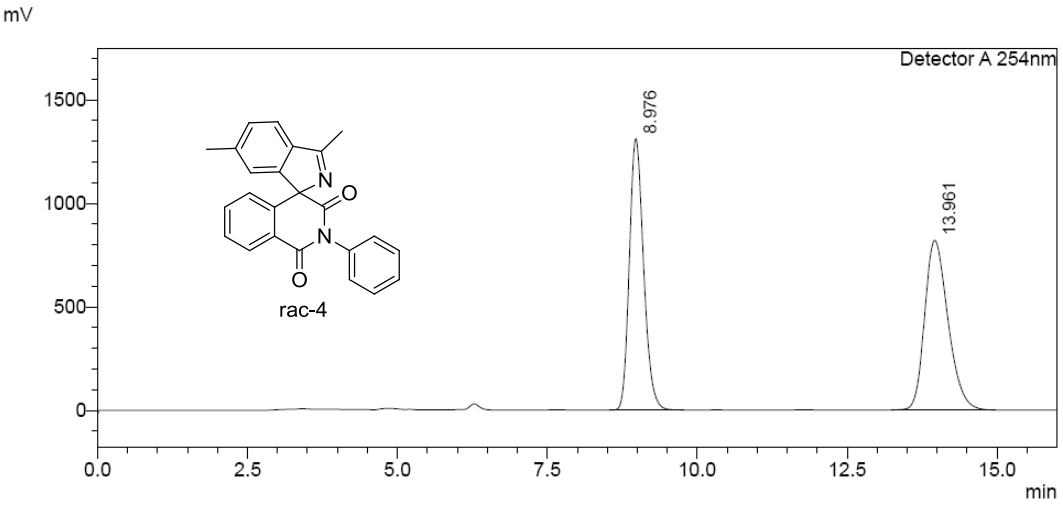
<Peak Table>

Detector A 254nm

Peak#	Ret. Time	Area	Area%	Height	Conc.	Unit	Mark
1	11.610	4014302	4.544	194731	4.544		M
2	19.273	84330687	95.456	2105838	95.456		M
Total		88344989	100.000	2300568			

4, AD-H, Hex/*i*PrOH = 70/30, rate = 1.0 mL/min, 254 nm

<Chromatogram>

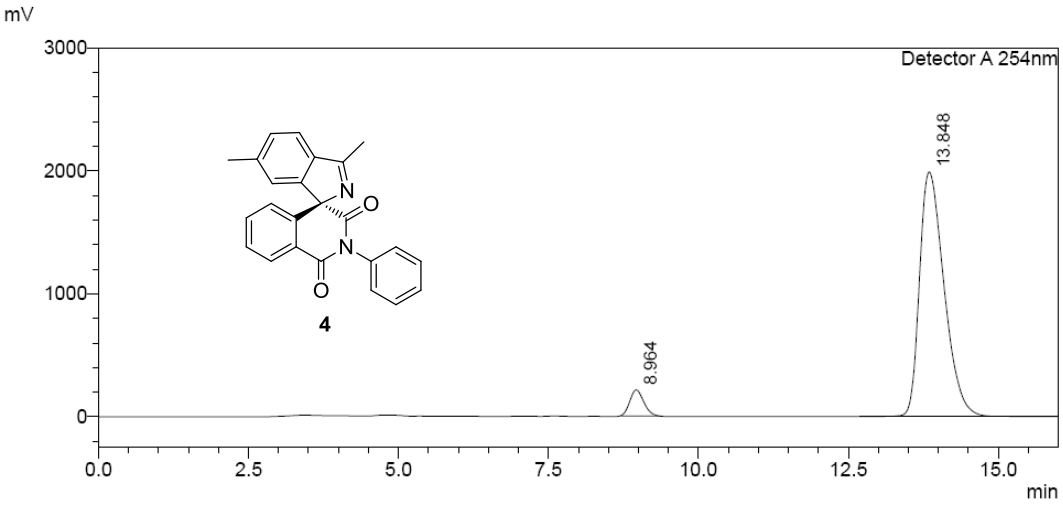


<Peak Table>

Detector A 254nm

Peak#	Ret. Time	Area	Area%	Height	Conc.	Unit	Mark
1	8.976	21714084	49.419	1311480	49.419		M
2	13.961	22224995	50.581	819801	50.581		M
Total		43939079	100.000	2131281			

<Chromatogram>



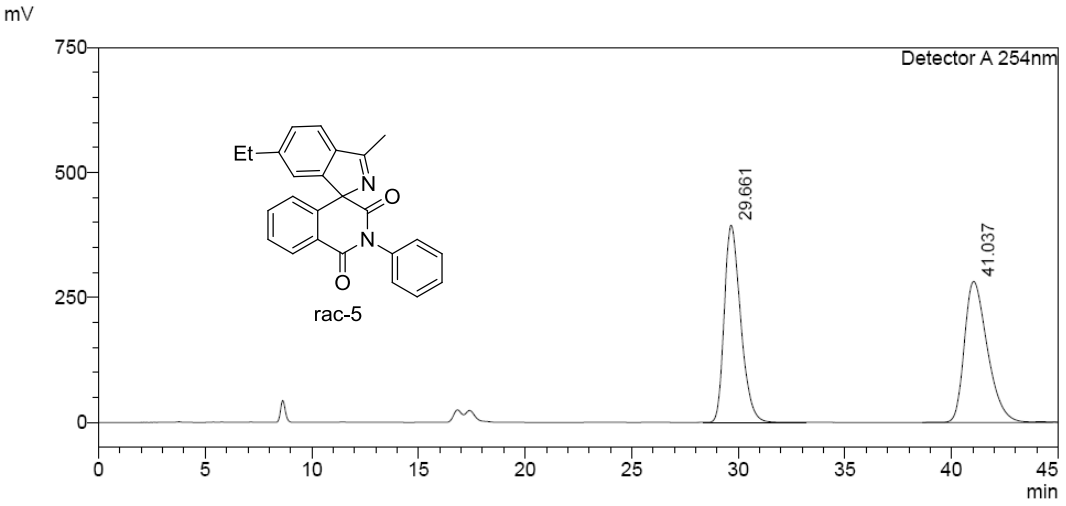
<Peak Table>

Detector A 254nm

Peak#	Ret. Time	Area	Area%	Height	Conc.	Unit	Mark
1	8.964	3394654	5.638	211094	5.638		M
2	13.848	56810994	94.362	1989633	94.362		M
Total		60205647	100.000	2200727			

5, AD-H, Hex/*i*PrOH = 90/10, rate = 1.0 mL/min, 254 nm

<Chromatogram>

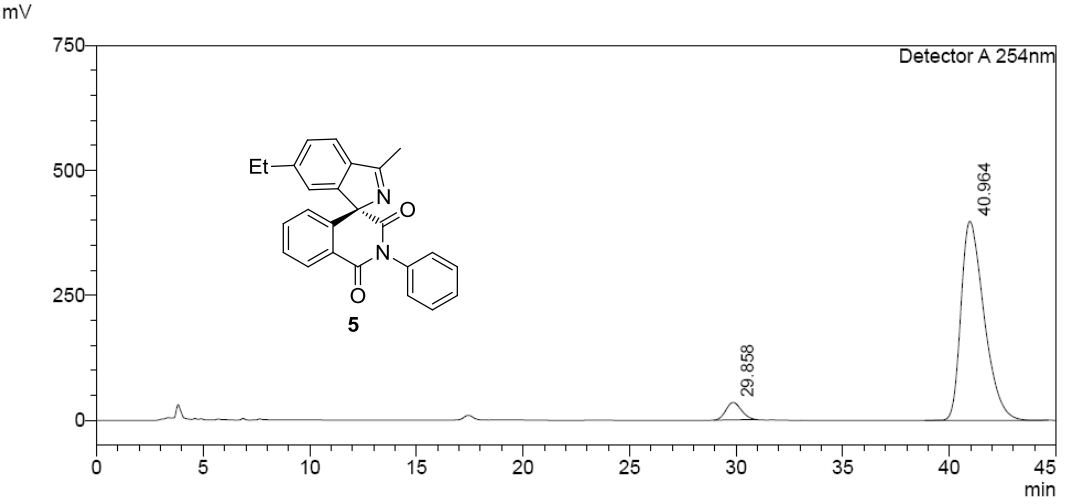


<Peak Table>

Detector A 254nm

Peak#	Ret. Time	Area	Area%	Height	Conc.	Unit	Mark
1	29.661	21097693	49.798	394127	49.798		S
2	41.037	21269078	50.202	282033	50.202		
Total		42366771	100.000	676161			

<Chromatogram>



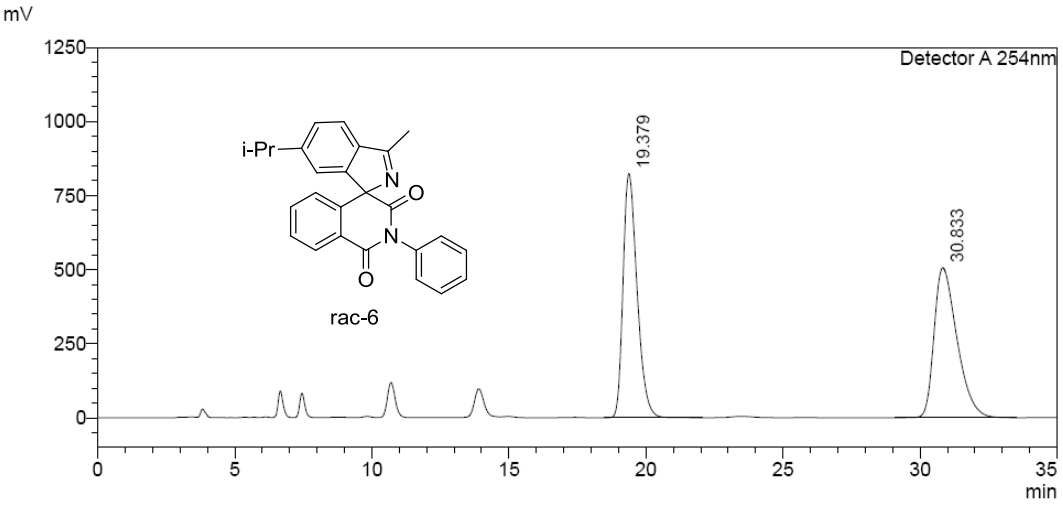
<Peak Table>

Detector A 254nm

Peak#	Ret. Time	Area	Area%	Height	Conc.	Unit	Mark
1	29.858	1756821	5.514	34800	5.514		M
2	40.964	30105453	94.486	398173	94.486		V
Total		31862274	100.000	432973			

6, AD-H, Hex/*i*PrOH = 90/10, rate = 1.0 mL/min, 254 nm

<Chromatogram>

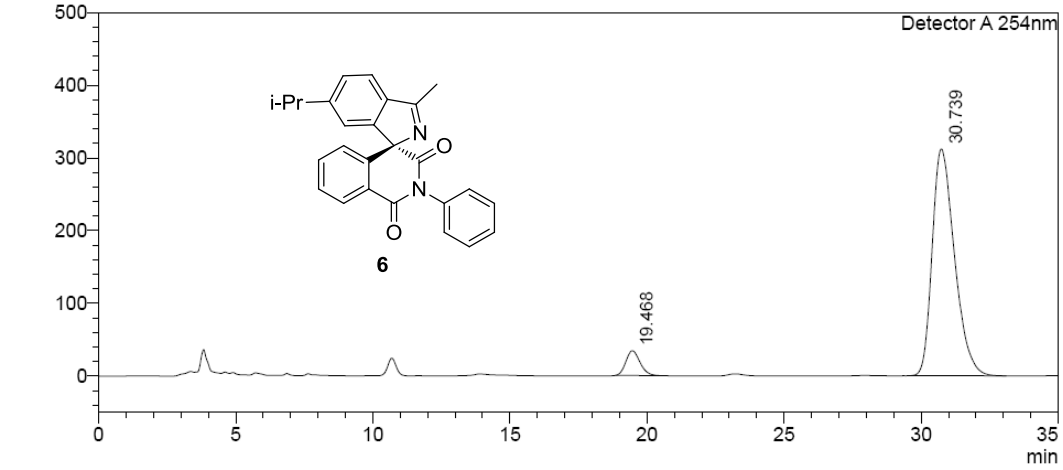


<Peak Table>

Detector A 254nm

Peak#	Ret. Time	Area	Area%	Height	Conc.	Unit	Mark
1	19.379	29298337	49.897	824454	49.897		S
2	30.833	29418974	50.103	506749	50.103		
Total		58717312	100.000	1331203			

<Chromatogram>



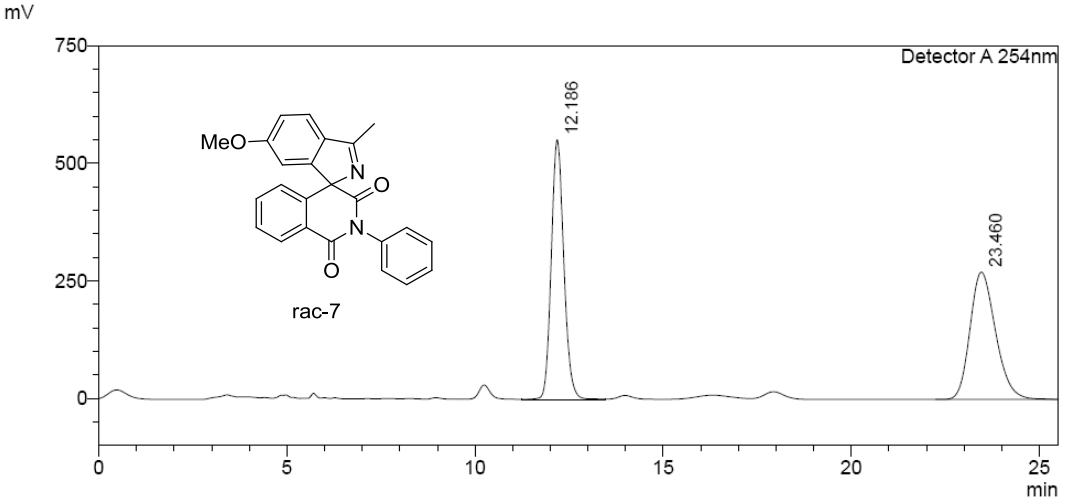
<Peak Table>

Detector A 254nm

Peak#	Ret. Time	Area	Area%	Height	Conc.	Unit	Mark
1	19.468	1218444	6.452	34114	6.452		M
2	30.739	17666351	93.548	311824	93.548		M
Total		18884796	100.000	345938			

7, AD-H, Hex/*i*PrOH = 70/30, rate = 1.0 mL/min, 254 nm

<Chromatogram>

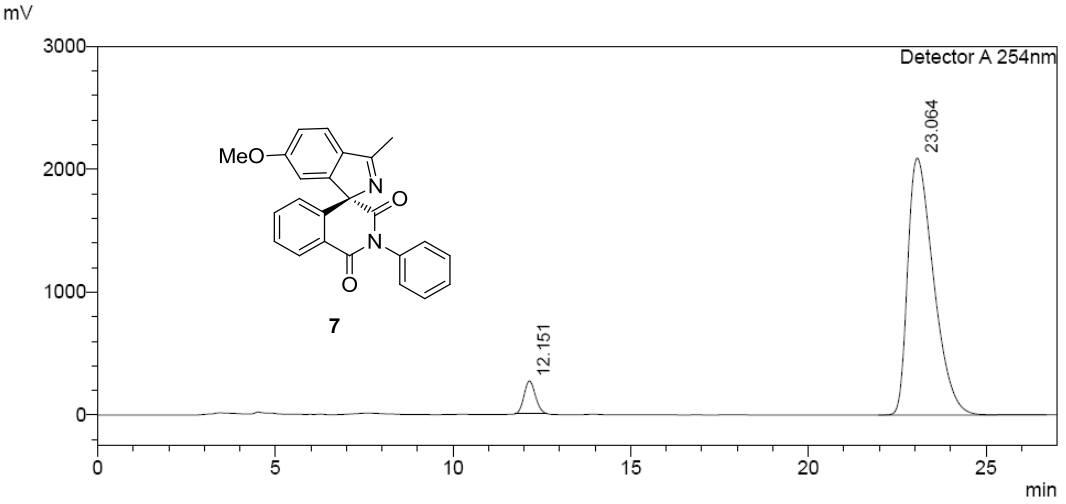


<Peak Table>

Detector A 254nm

Peak#	Ret. Time	Area	Area%	Height	Conc.	Unit	Mark
1	12.186	12823476	50.063	551921	50.063		
2	23.460	12791377	49.937	270439	49.937		
Total		25614853	100.000	822360			

<Chromatogram>



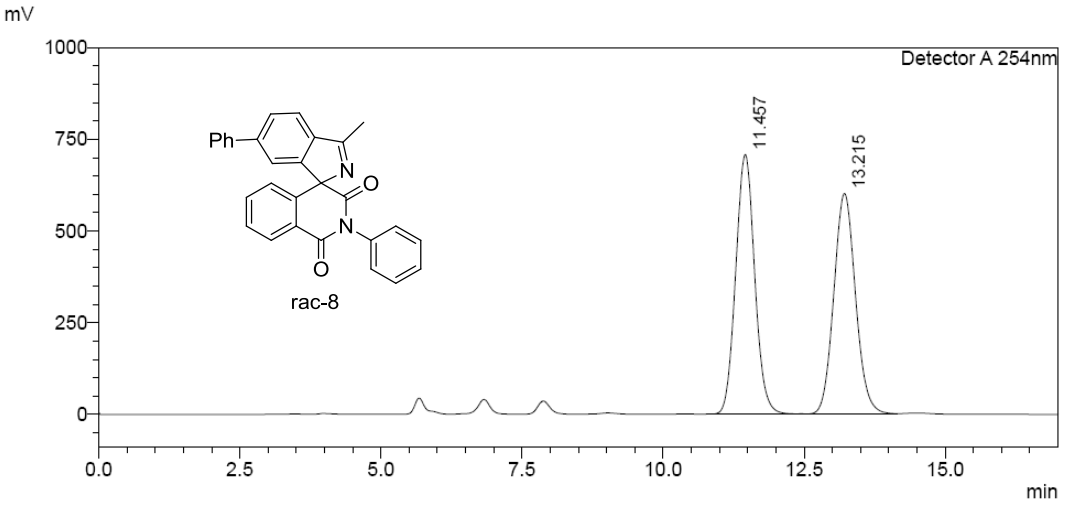
<Peak Table>

Detector A 254nm

Peak#	Ret. Time	Area	Area%	Height	Conc.	Unit	Mark
1	12.151	5943191	5.326	266751	5.326		M
2	23.064	105646462	94.674	2089147	94.674		S
Total		111589653	100.000	2355899			

8, AD-H, Hex/*i*PrOH = 70/30, rate = 1.0 mL/min, 254 nm

<Chromatogram>

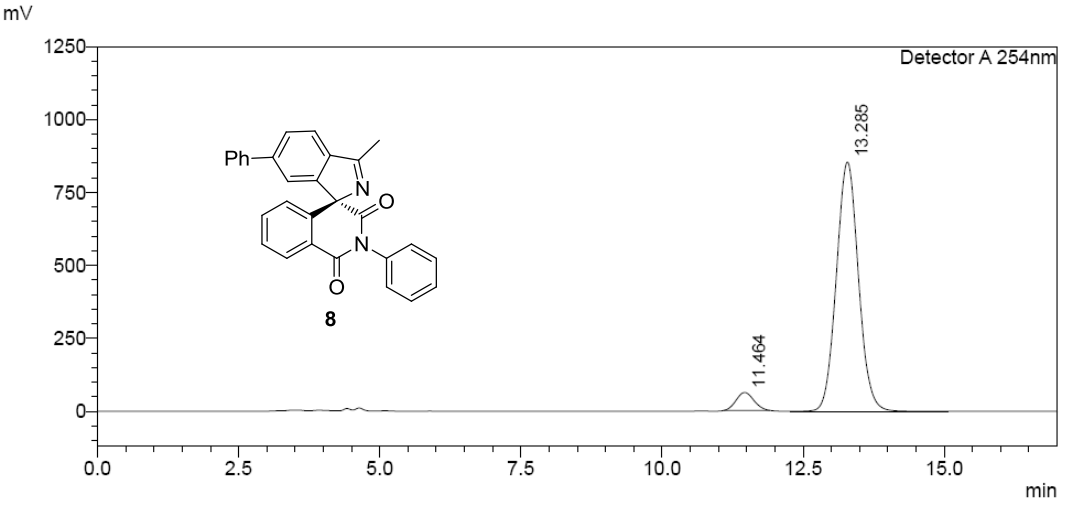


<Peak Table>

Detector A 254nm

Peak#	Ret. Time	Area	Area%	Height	Conc.	Unit	Mark
1	11.457	16630159	50.698	707941	50.698		
2	13.215	16172215	49.302	601864	49.302		V
Total		32802374	100.000	1309805			

<Chromatogram>



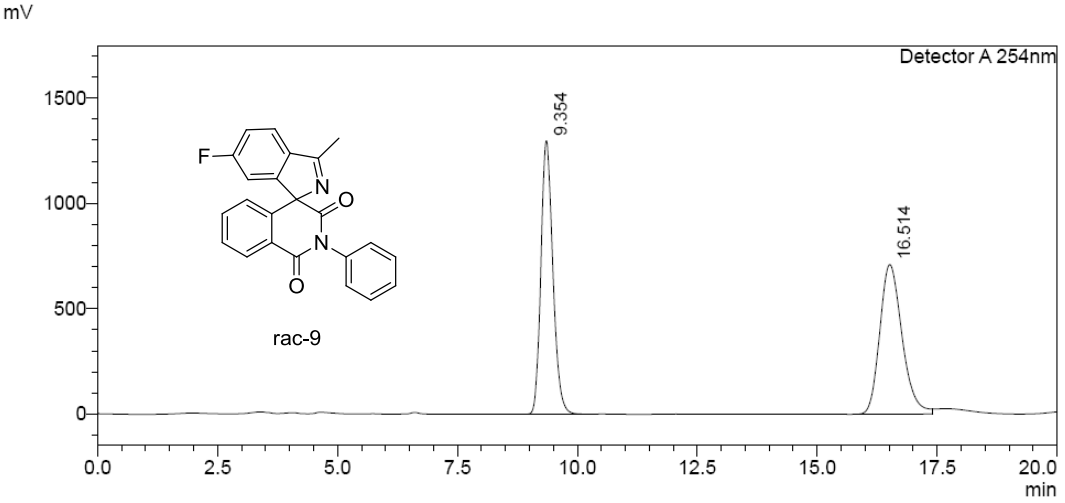
<Peak Table>

Detector A 254nm

Peak#	Ret. Time	Area	Area%	Height	Conc.	Unit	Mark
1	11.464	1341996	5.450	61578	5.450		M
2	13.285	23283302	94.550	854148	94.550		S
Total		24625298	100.000	915727			

9, AD-H, Hex/*i*PrOH = 70/30, rate = 1.0 mL/min, 254 nm

<Chromatogram>

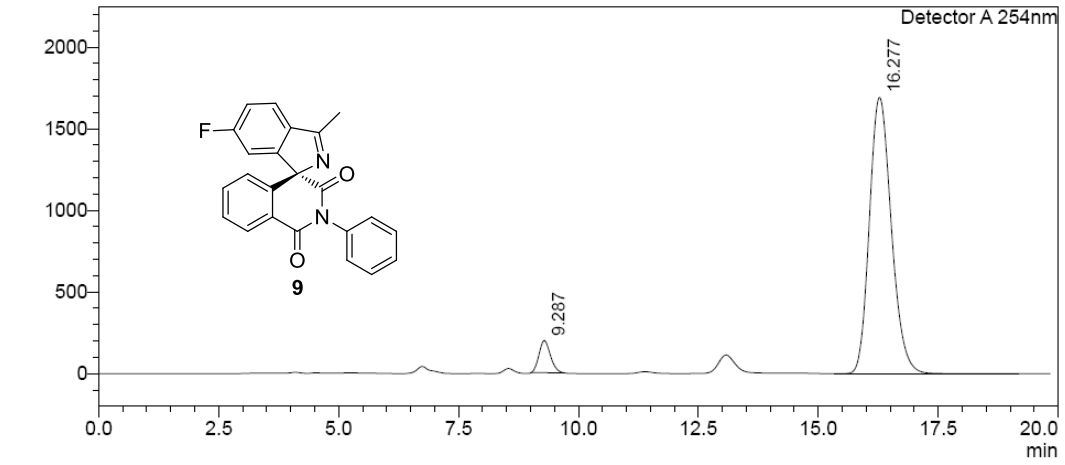


<Peak Table>

Detector A 254nm

Peak#	Ret. Time	Area	Area%	Height	Conc.	Unit	Mark
1	9.354	22584728	49.522	1299069	49.522		M
2	16.514	23020615	50.478	710711	50.478		M
Total		45605343	100.000	2009781			

<Chromatogram>



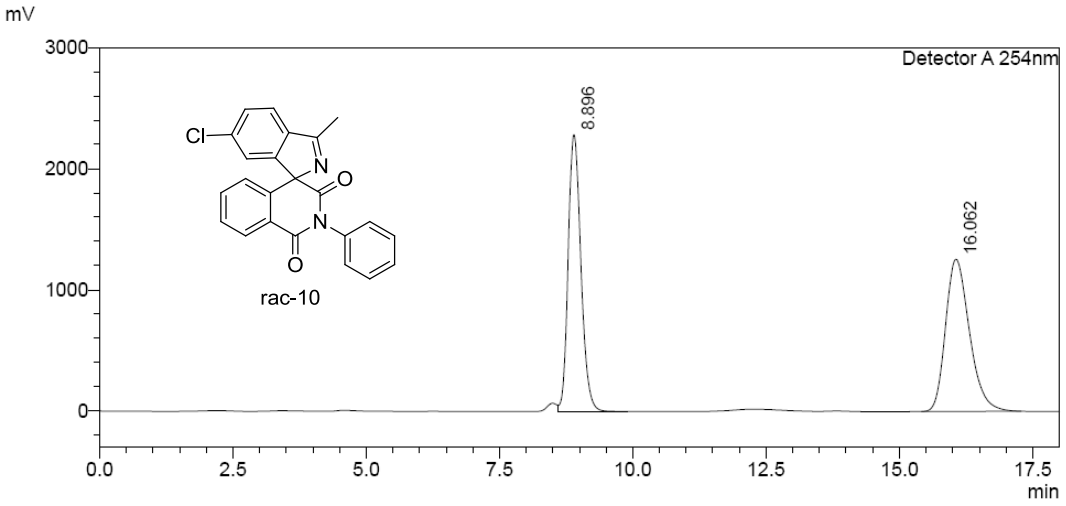
<Peak Table>

Detector A 254nm

Peak#	Ret. Time	Area	Area%	Height	Conc.	Unit	Mark
1	9.287	3269425	5.724	196207	5.724		M
2	16.277	53849966	94.276	1691456	94.276		M
Total		57119391	100.000	1887663			

10, AD-H, Hex/*i*PrOH = 70/30, rate = 1.0 mL/min, 254 nm

<Chromatogram>

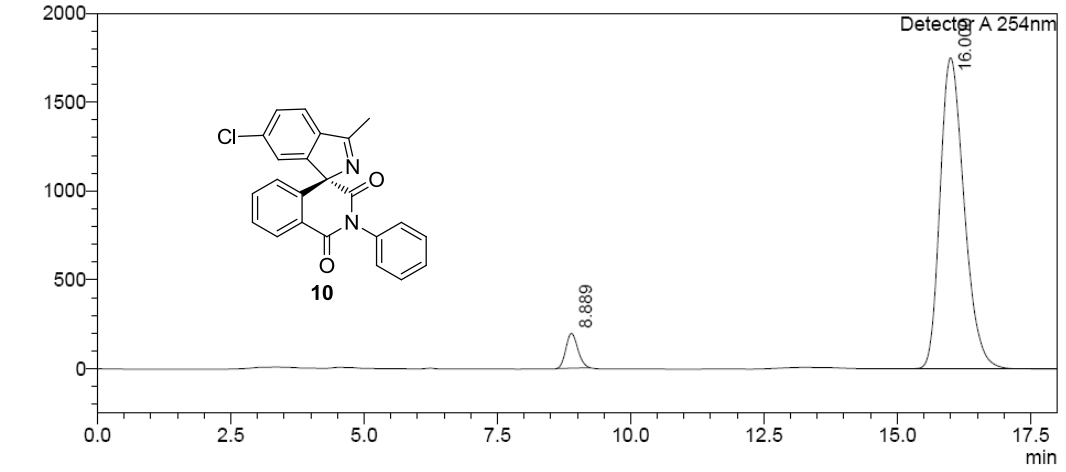


<Peak Table>

Detector A 254nm

Peak#	Ret. Time	Area	Area%	Height	Conc.	Unit	Mark
1	8.896	38042703	49.241	2282209	49.241		M
2	16.062	39214808	50.759	1255781	50.759		M
Total		77257511	100.000	3537990			

<Chromatogram>



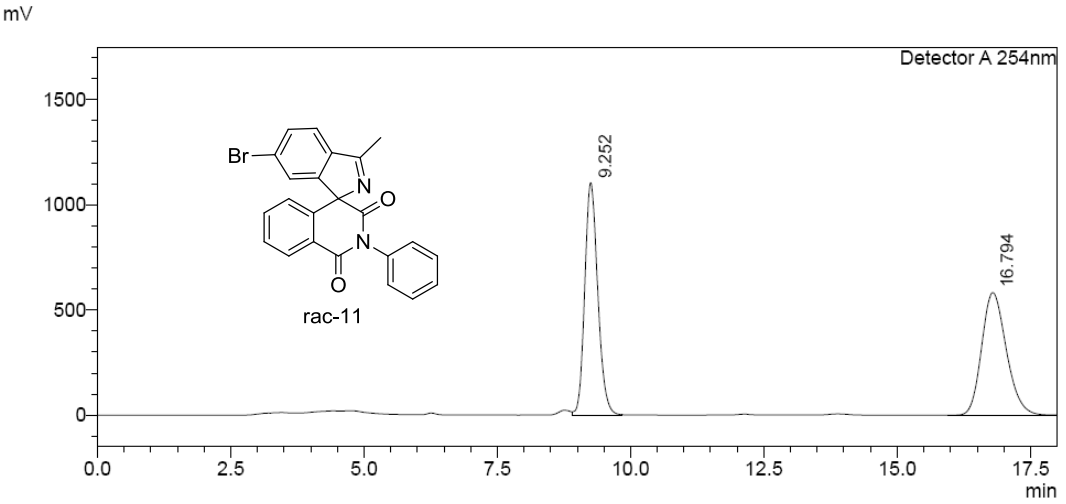
<Peak Table>

Detector A 254nm

Peak#	Ret. Time	Area	Area%	Height	Conc.	Unit	Mark
1	8.889	3035275	5.195	195179	5.195		M
2	16.000	55388493	94.805	1752225	94.805		
Total		58423768	100.000	1947404			

11, AD-H, Hex/*i*PrOH = 70/30, rate = 1.0 mL/min, 254 nm

<Chromatogram>

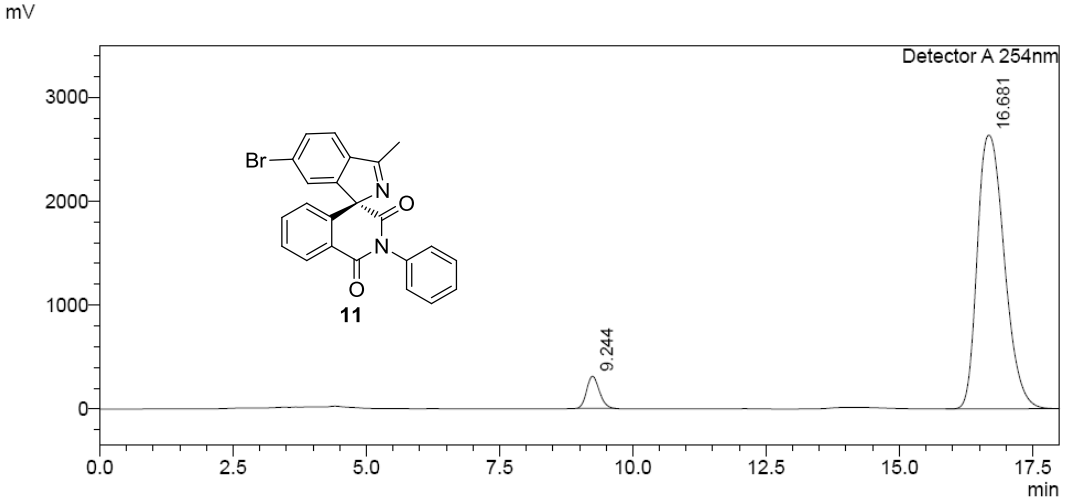


<Peak Table>

Detector A 254nm

Peak#	Ret. Time	Area	Area%	Height	Conc.	Unit	Mark
1	9.252	18847810	50.063	1105199	50.063		M
2	16.794	18800196	49.937	582953	49.937		
Total		37648006	100.000	1688152			

<Chromatogram>



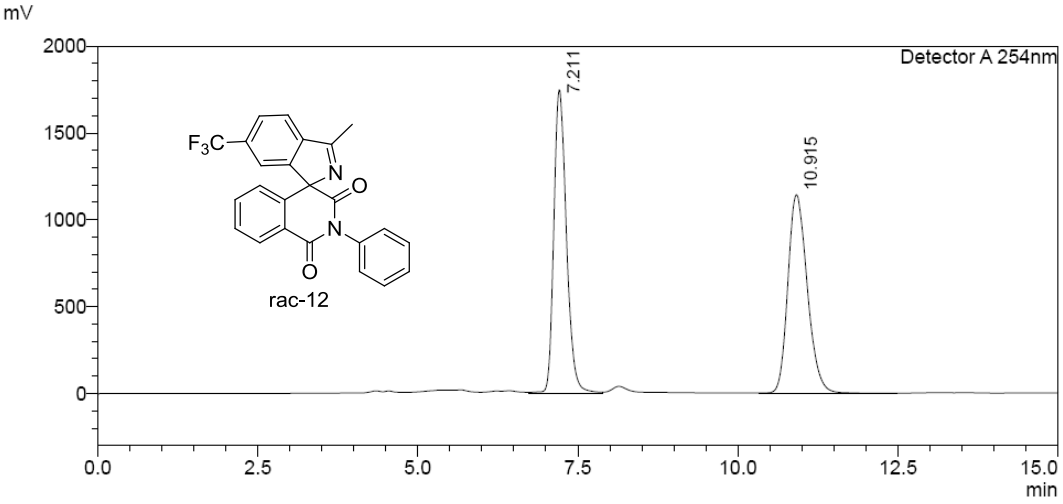
<Peak Table>

Detector A 254nm

Peak#	Ret. Time	Area	Area%	Height	Conc.	Unit	Mark
1	9.244	5074208	5.164	309187	5.164		M
2	16.681	93186985	94.836	2633728	94.836		
Total		98261192	100.000	2942914			

12, AD-H, Hex/*i*PrOH = 70/30, rate = 1.0 mL/min, 254 nm

<Chromatogram>

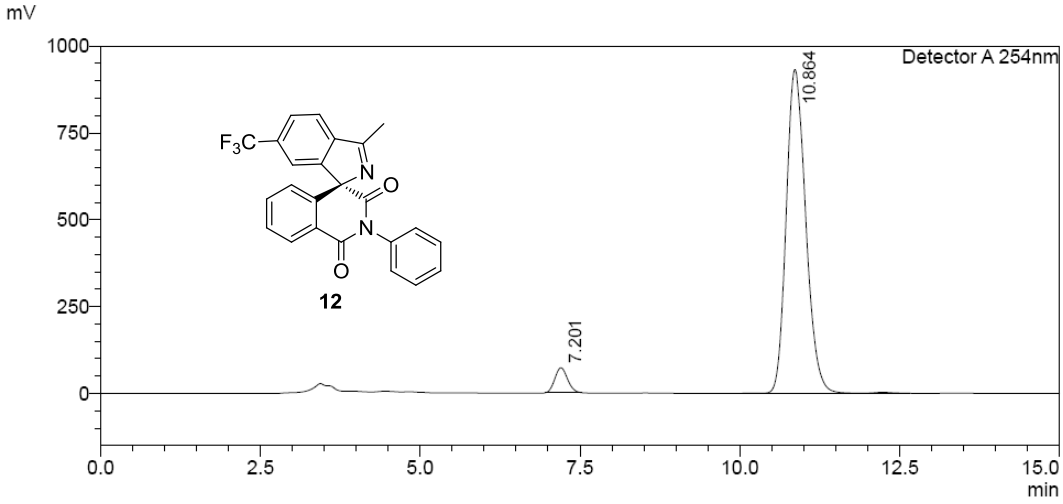


<Peak Table>

Detector A 254nm

Peak#	Ret. Time	Area	Area%	Height	Conc.	Unit	Mark
1	7.211	24105165	49.802	1748234	49.802		
2	10.915	24296789	50.198	1143427	50.198		
Total		48401953	100.000	2891661			

<Chromatogram>



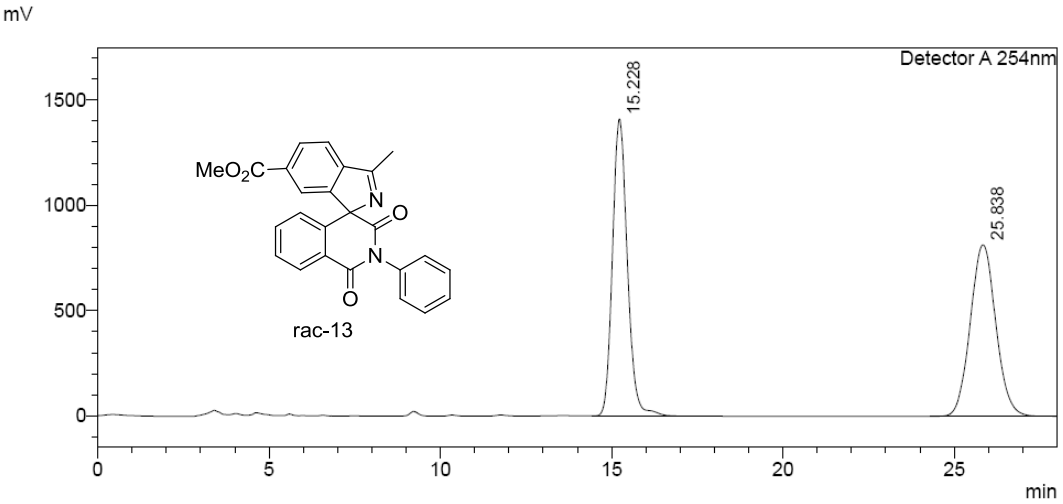
<Peak Table>

Detector A 254nm

Peak#	Ret. Time	Area	Area%	Height	Conc.	Unit	Mark
1	7.201	991968	4.728	72082	4.728		M
2	10.864	19987124	95.272	932195	95.272		M
Total		20979092	100.000	1004278			

13, AD-H, Hex/*i*PrOH = 70/30, rate = 1.0 mL/min, 254 nm

<Chromatogram>

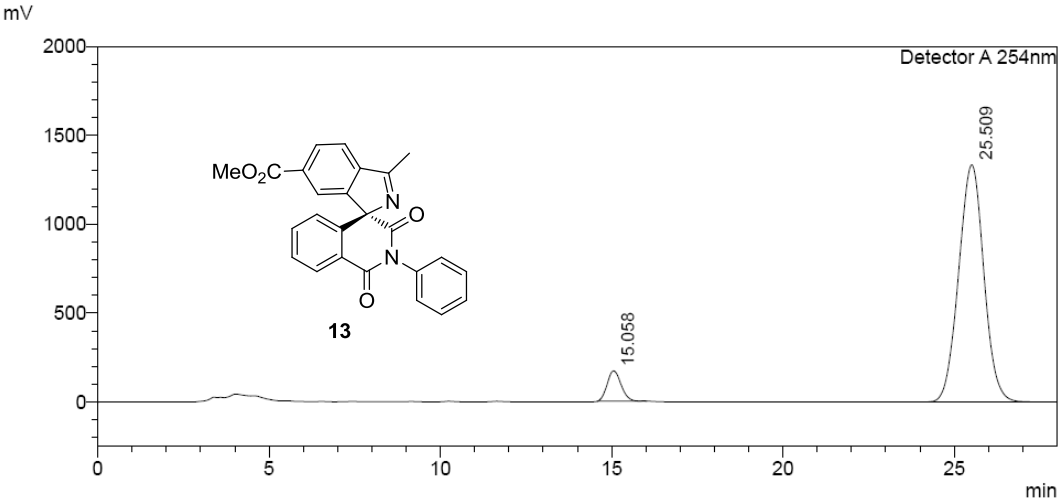


<Peak Table>

Detector A 254nm

Peak#	Ret. Time	Area	Area%	Height	Conc.	Unit	Mark
1	15.228	42801430	50.306	1412154	50.306		
2	25.838	42281176	49.694	815406	49.694		
Total		85082606	100.000	2227560			

<Chromatogram>



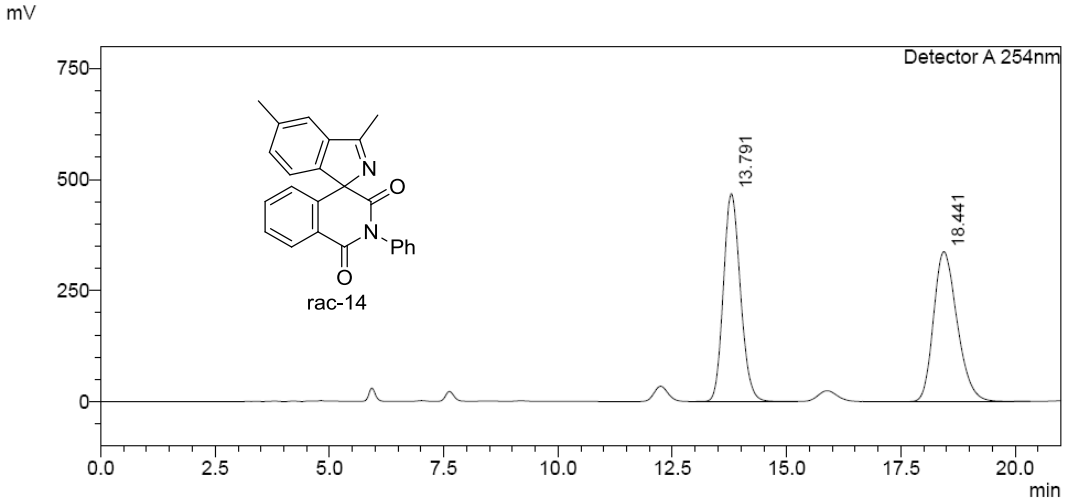
<Peak Table>

Detector A 254nm

Peak#	Ret. Time	Area	Area%	Height	Conc.	Unit	Mark
1	15.058	4811669	6.588	171048	6.588		M
2	25.509	68219705	93.412	1333620	93.412		M
Total		73031374	100.000	1504668			

14, AD-H, Hex/*i*PrOH = 70/30, rate = 1.0 mL/min, 254 nm

<Chromatogram>

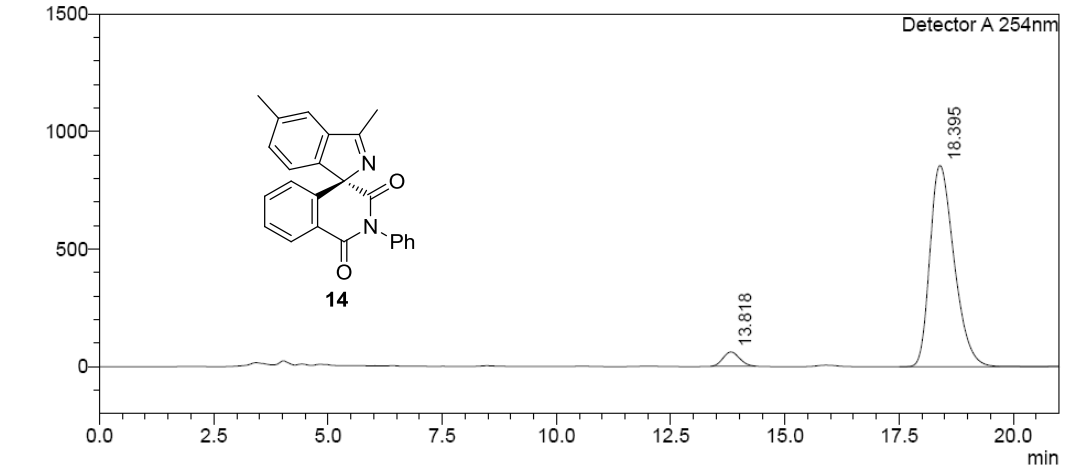


<Peak Table>

Detector A 254nm

Peak#	Ret. Time	Area	Area%	Height	Conc.	Unit	Mark
1	13.791	12156806	50.008	468209	50.008		
2	18.441	12152842	49.992	337362	49.992		
Total		24309648	100.000	805571			

<Chromatogram>



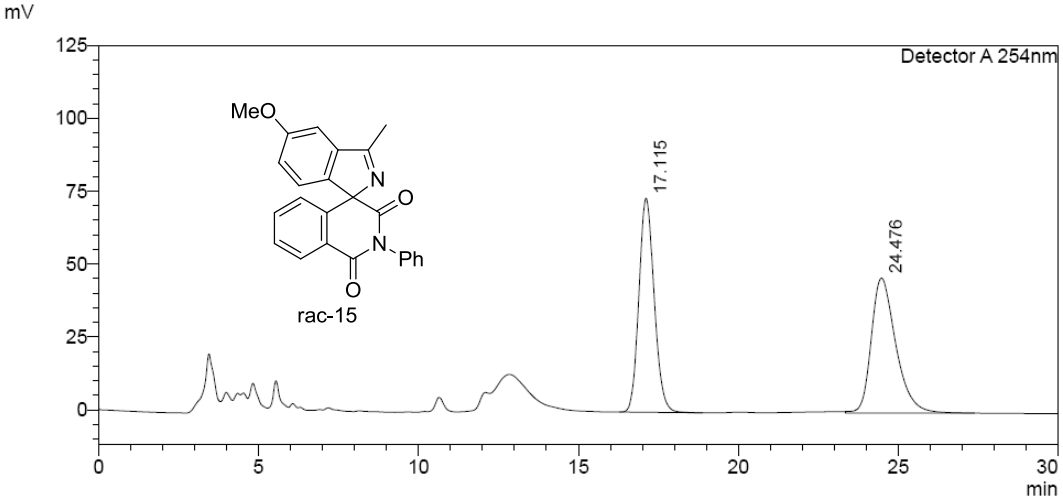
<Peak Table>

Detector A 254nm

Peak#	Ret. Time	Area	Area%	Height	Conc.	Unit	Mark
1	13.818	1522145	4.610	60767	4.610		M
2	18.395	31495922	95.390	855613	95.390		
Total		33018067	100.000	916381			

15, AD-H, Hex/*i*PrOH = 70/30, rate = 1.0 mL/min, 254 nm

<Chromatogram>

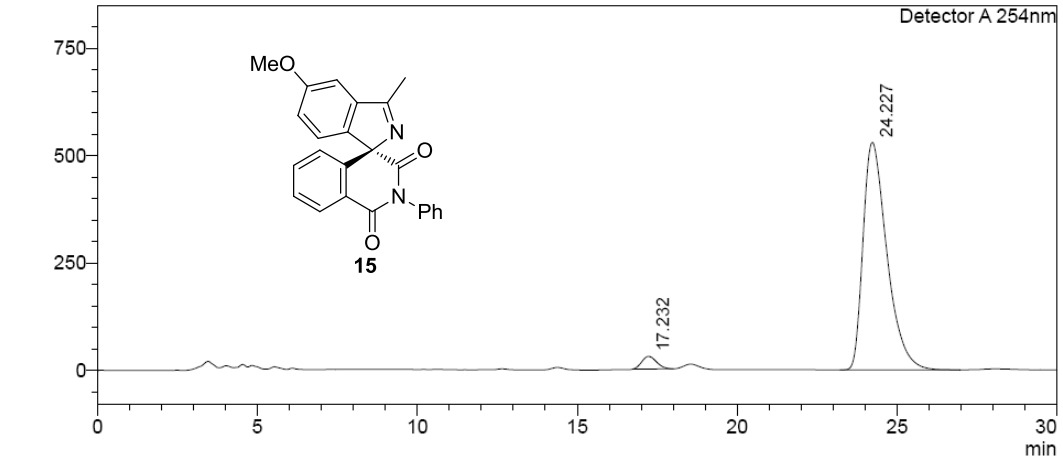


<Peak Table>

Detector A 254nm

Peak#	Ret. Time	Area	Area%	Height	Conc.	Unit	Mark
1	17.115	2443396	49.701	73361	49.701		
2	24.476	2472844	50.299	46248	50.299		
Total		4916239	100.000	119608			

<Chromatogram>



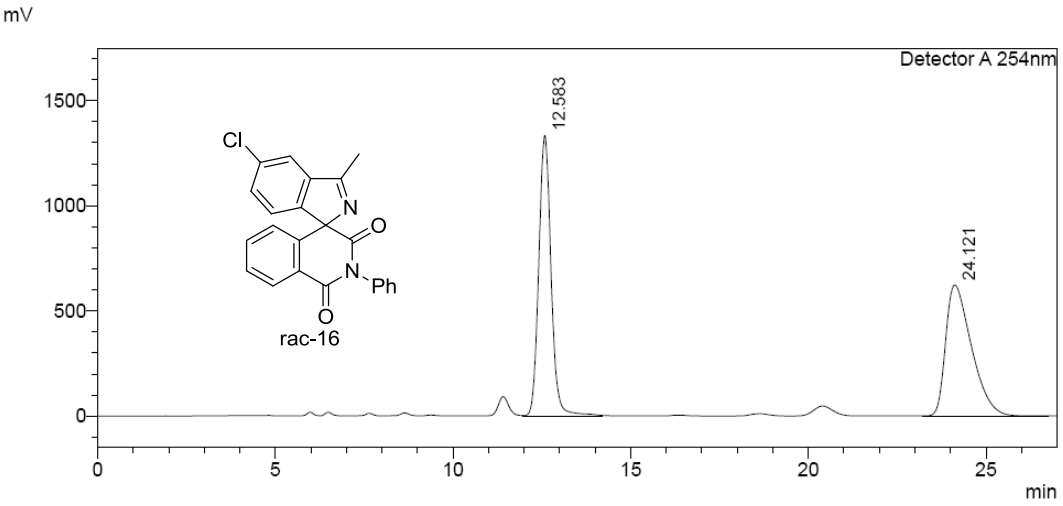
<Peak Table>

Detector A 254nm

Peak#	Ret. Time	Area	Area%	Height	Conc.	Unit	Mark
1	17.232	937998	3.290	29456	3.290		M
2	24.227	27575354	96.710	530212	96.710		
Total		28513352	100.000	559668			

16, AD-H, Hex/*i*PrOH = 70/30, rate = 1.0 mL/min, 254 nm

<Chromatogram>

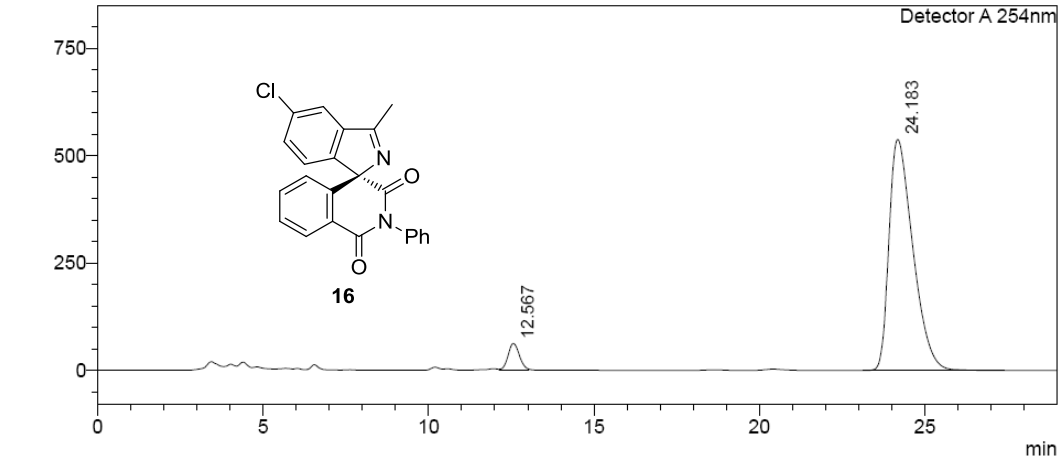


<Peak Table>

Detector A 254nm

Peak#	Ret. Time	Area	Area%	Height	Conc.	Unit	Mark
1	12.583	32212478	50.577	1333556	50.577		M
2	24.121	31476985	49.423	623205	49.423		
Total		63689463	100.000	1956762			

<Chromatogram>



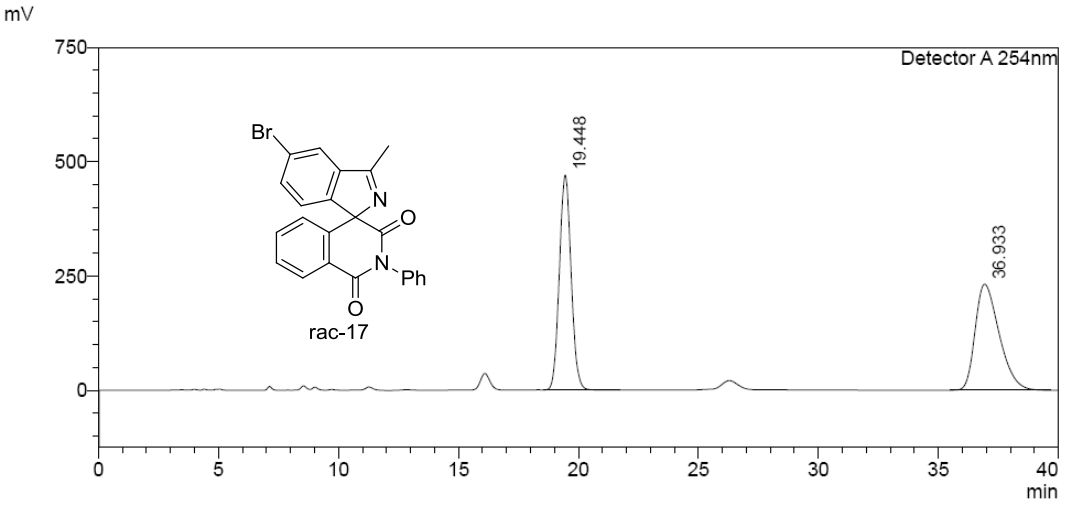
<Peak Table>

Detector A 254nm

Peak#	Ret. Time	Area	Area%	Height	Conc.	Unit	Mark
1	12.567	1482631	5.208	62333	5.208		M
2	24.183	26985916	94.792	538170	94.792		
Total		28468547	100.000	600503			

17, AD-H, Hex/*i*PrOH = 70/30, rate = 1.0 mL/min, 254 nm

<Chromatogram>

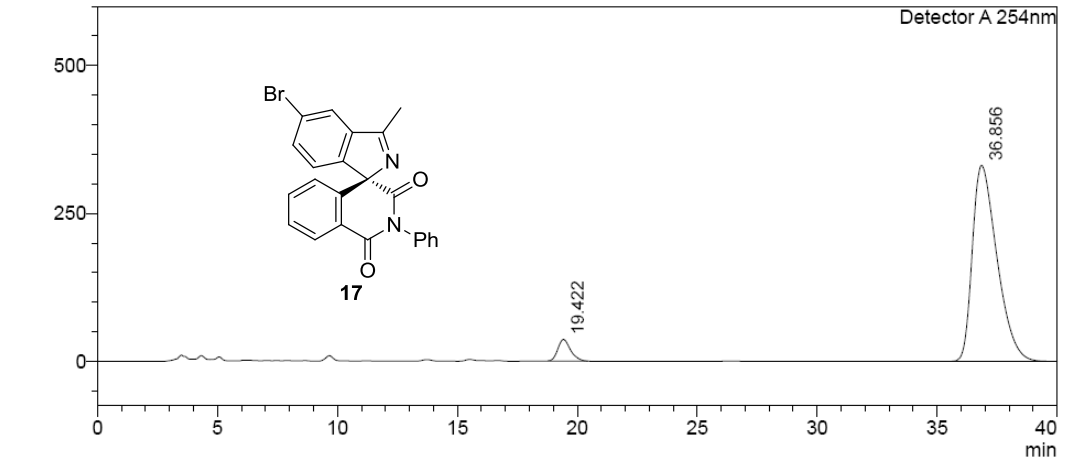


<Peak Table>

Detector A 254nm

Peak#	Ret. Time	Area	Area%	Height	Conc.	Unit	Mark
1	19.448	16105713	49.893	470524	49.893		S
2	36.933	16174554	50.107	231967	50.107		
Total		32280267	100.000	702492			

<Chromatogram>



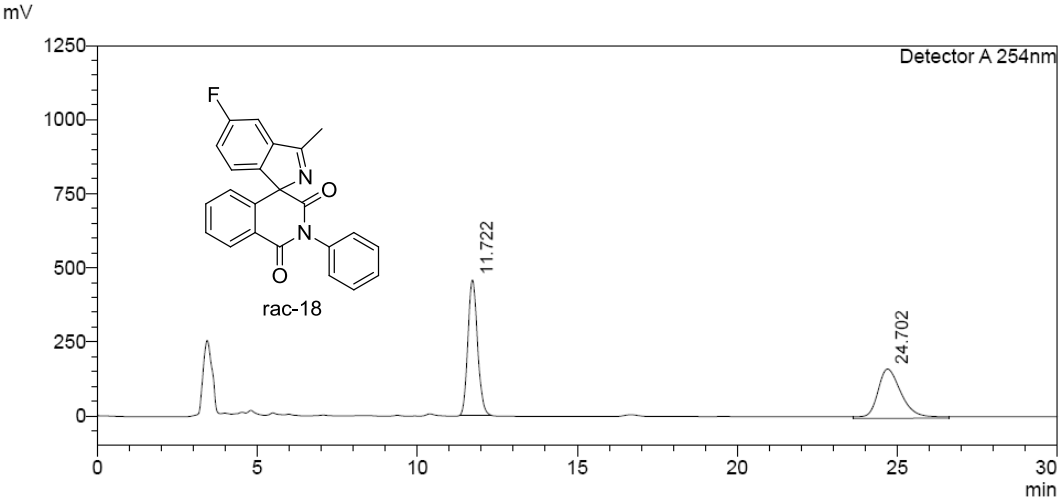
<Peak Table>

Detector A 254nm

Peak#	Ret. Time	Area	Area%	Height	Conc.	Unit	Mark
1	19.422	1339890	5.351	36540	5.351		M
2	36.856	23700147	94.649	331247	94.649		
Total		25040038	100.000	367787			

18, AD-H, Hex/*i*PrOH = 70/30, rate = 1.0 mL/min, 254 nm

<Chromatogram>

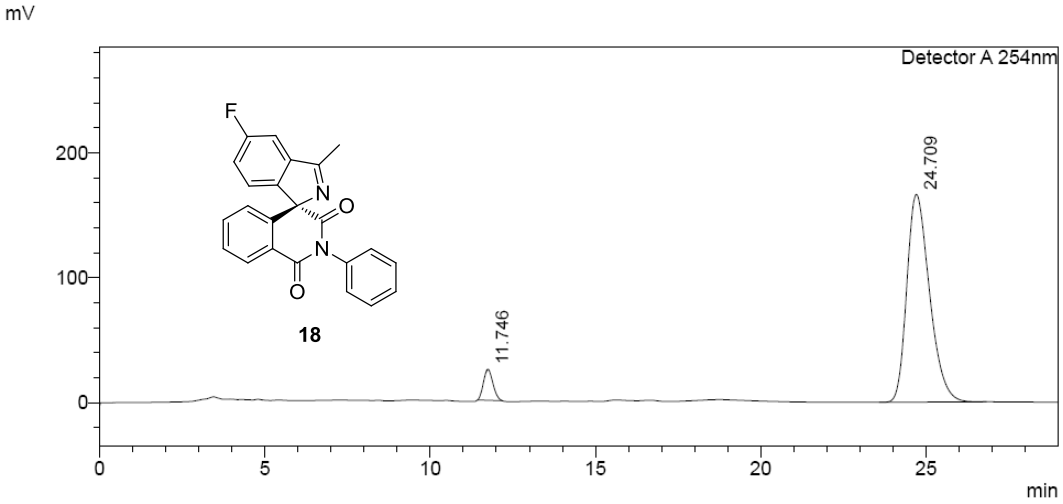


<Peak Table>

Detector A 254nm

Peak#	Ret. Time	Area	Area%	Height	Conc.	Unit	Mark
1	11.722	9522502	52.350	456551	52.350		M
2	24.702	8667509	47.650	166212	47.650		M
Total		18190011	100.000	622763			

<Chromatogram>



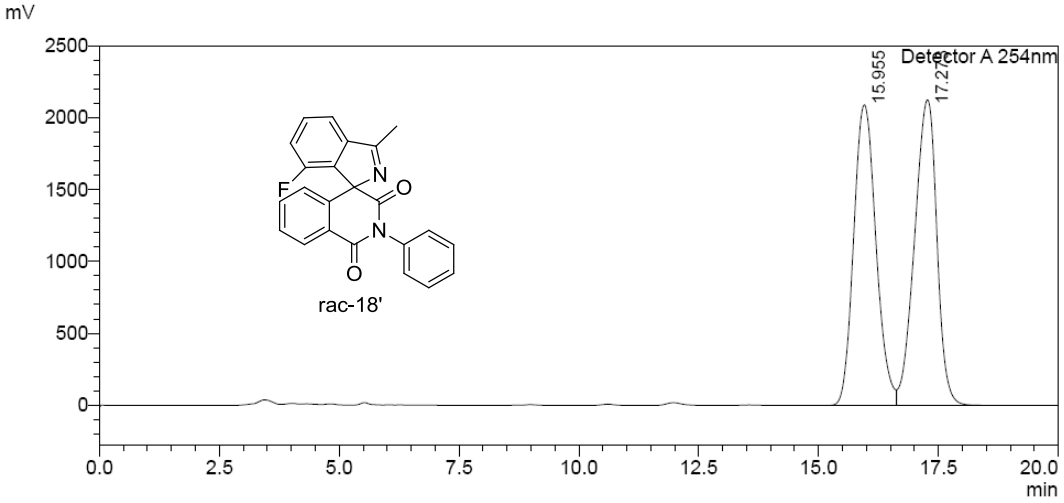
<Peak Table>

Detector A 254nm

Peak#	Ret. Time	Area	Area%	Height	Conc.	Unit	Mark
1	11.746	490964	5.814	24806	5.814		M
2	24.709	7954208	94.186	166288	94.186		
Total		8445171	100.000	191095			

18', AD-H, Hex/*i*PrOH = 80/20, rate = 1.0 mL/min, 254 nm

<Chromatogram>

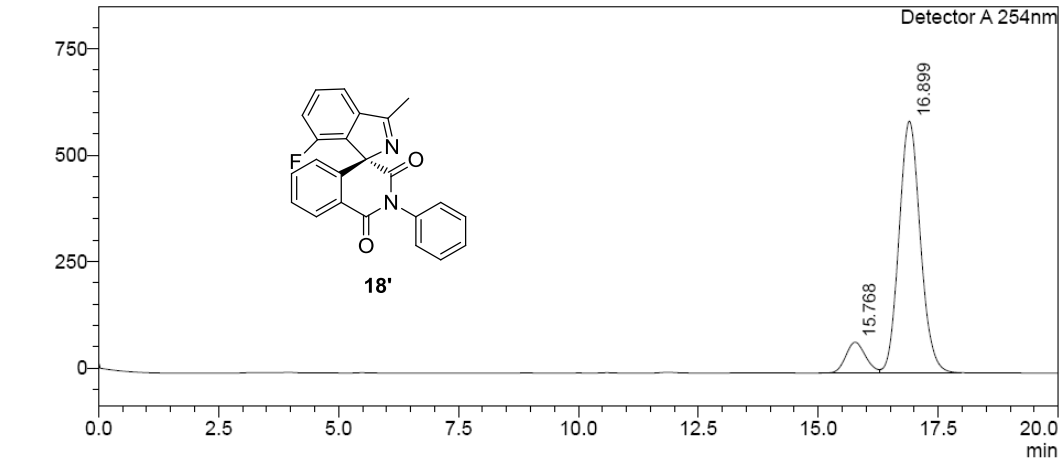


<Peak Table>

Detector A 254nm

Peak#	Ret. Time	Area	Area%	Height	Conc.	Unit	Mark
1	15.955	67769155	49.615	2090567	49.615		
2	17.273	68822006	50.385	2124928	50.385		V
Total		136591161	100.000	4215495			

<Chromatogram>



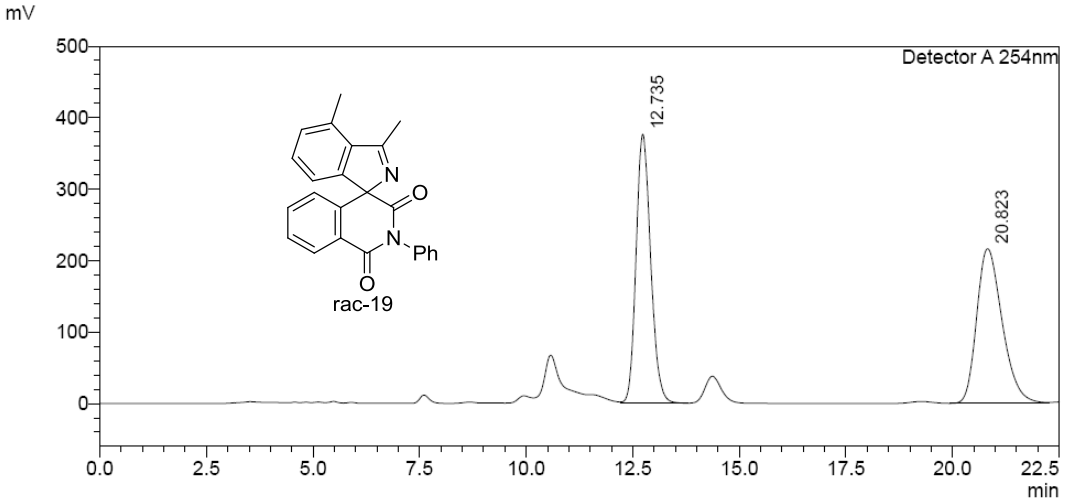
<Peak Table>

Detector A 254nm

Peak#	Ret. Time	Area	Area%	Height	Conc.	Unit	Mark
1	15.768	2079842	10.160	72463	10.160		
2	16.899	18390605	89.840	592015	89.840		V M
Total		20470447	100.000	664478			

19, AD-H, Hex/*i*PrOH = 70/30, rate = 1.0 mL/min, 254 nm

<Chromatogram>

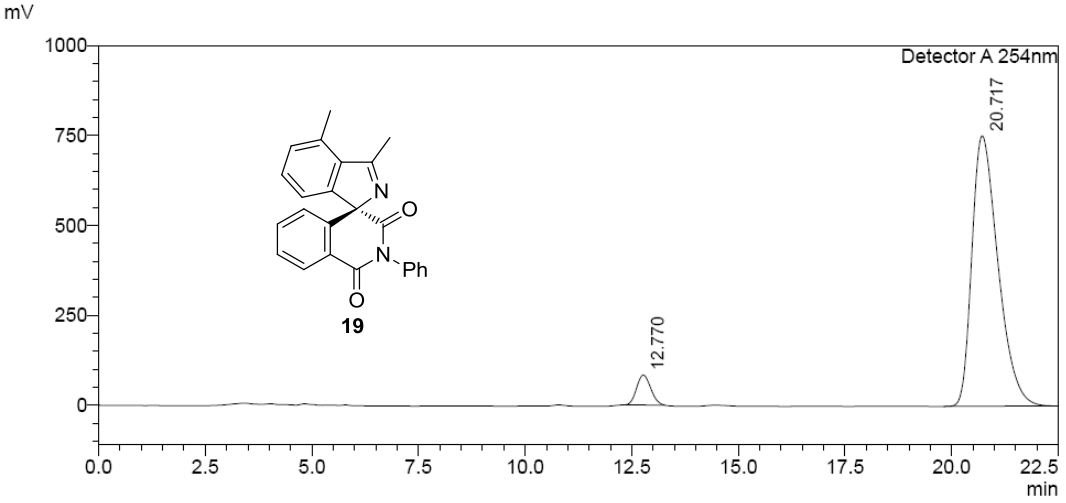


<Peak Table>

Detector A 254nm

Peak#	Ret. Time	Area	Area%	Height	Conc.	Unit	Mark
1	12.735	9033411	49.962	376862	49.962		
2	20.823	9047262	50.038	216646	50.038		
Total		18080673	100.000	593508			

<Chromatogram>



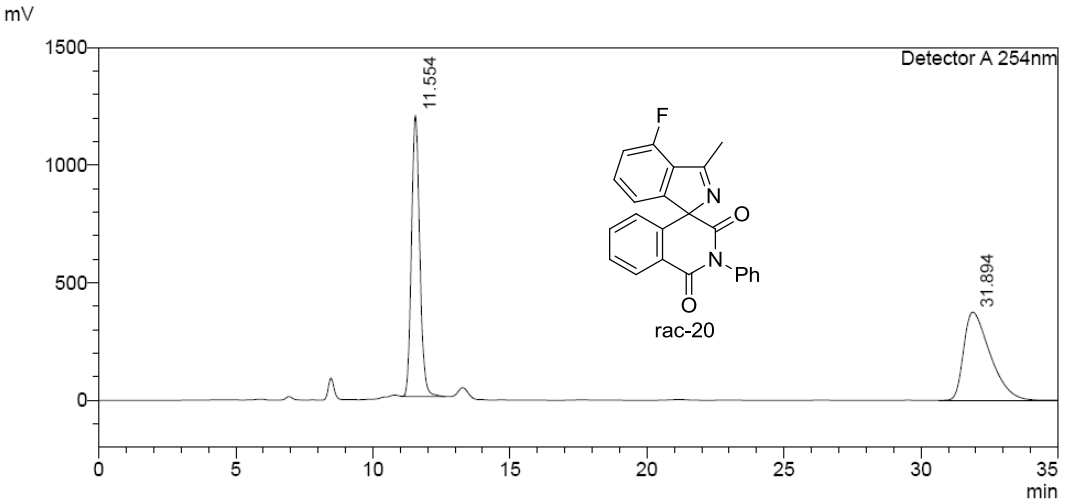
<Peak Table>

Detector A 254nm

Peak#	Ret. Time	Area	Area%	Height	Conc.	Unit	Mark
1	12.770	1915175	5.654	83403	5.654		M
2	20.717	31959847	94.346	751235	94.346		
Total		33875022	100.000	834637			

20, AD-H, Hex/*i*PrOH = 70/30, rate = 1.0 mL/min, 254 nm

<Chromatogram>

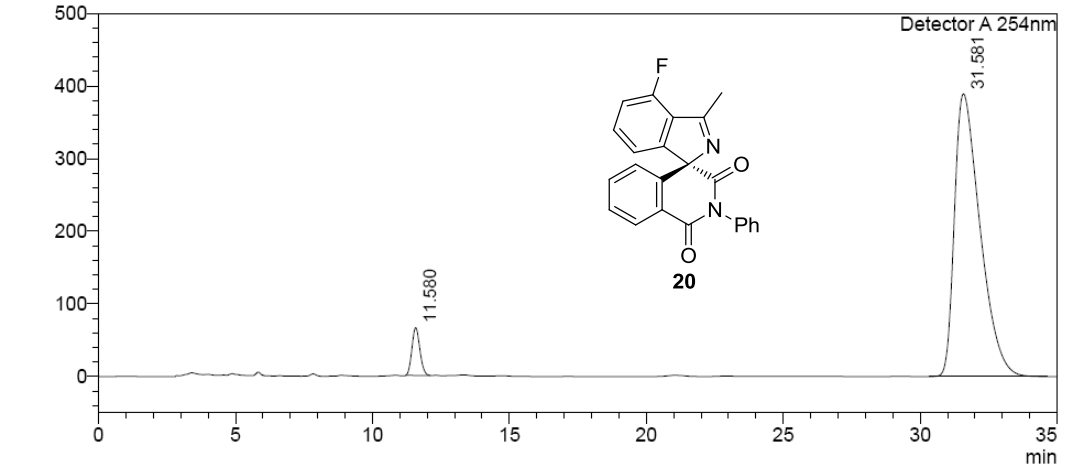


<Peak Table>

Detector A 254nm

Peak#	Ret. Time	Area	Area%	Height	Conc.	Unit	Mark
1	11.554	25086082	49.910	1194306	49.910		M
2	31.894	25176809	50.090	374692	50.090		S
Total		50262891	100.000	1568998			

<Chromatogram>



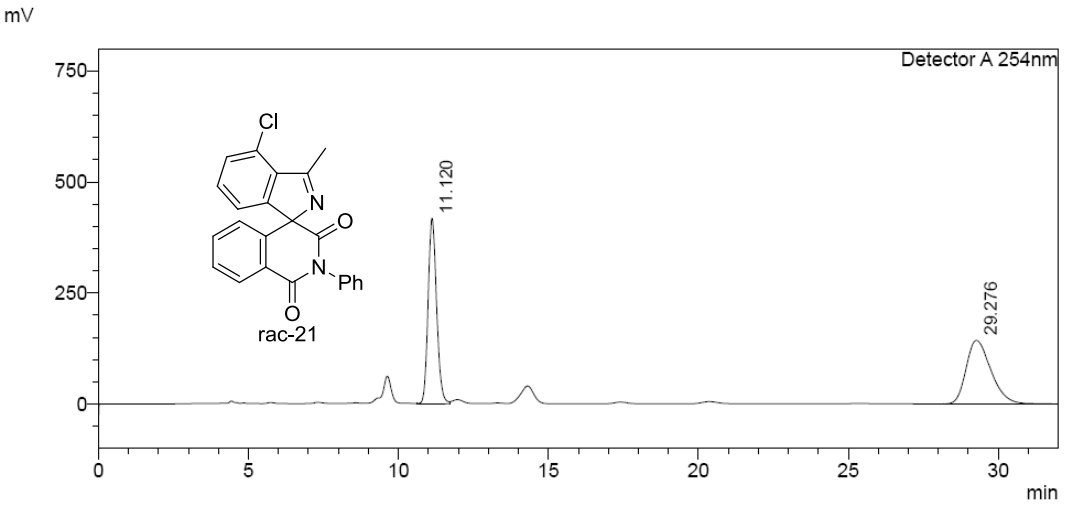
<Peak Table>

Detector A 254nm

Peak#	Ret. Time	Area	Area%	Height	Conc.	Unit	Mark
1	11.580	1330289	4.994	65826	4.994		M
2	31.581	25308705	95.006	389289	95.006		
Total		26638994	100.000	455115			

21, AD-H, Hex/*i*PrOH = 70/30, rate = 1.0 mL/min, 254 nm

<Chromatogram>

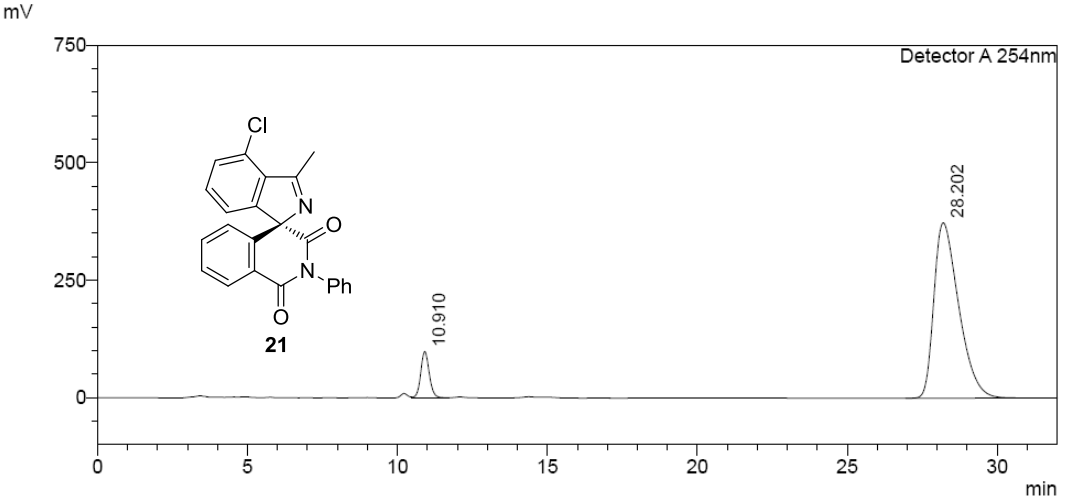


<Peak Table>

Detector A 254nm

Peak#	Ret. Time	Area	Area%	Height	Conc.	Unit	Mark
1	11.120	8275557	50.115	417820	50.115		
2	29.276	8237579	49.885	143173	49.885		
Total		16513136	100.000	560992			

<Chromatogram>



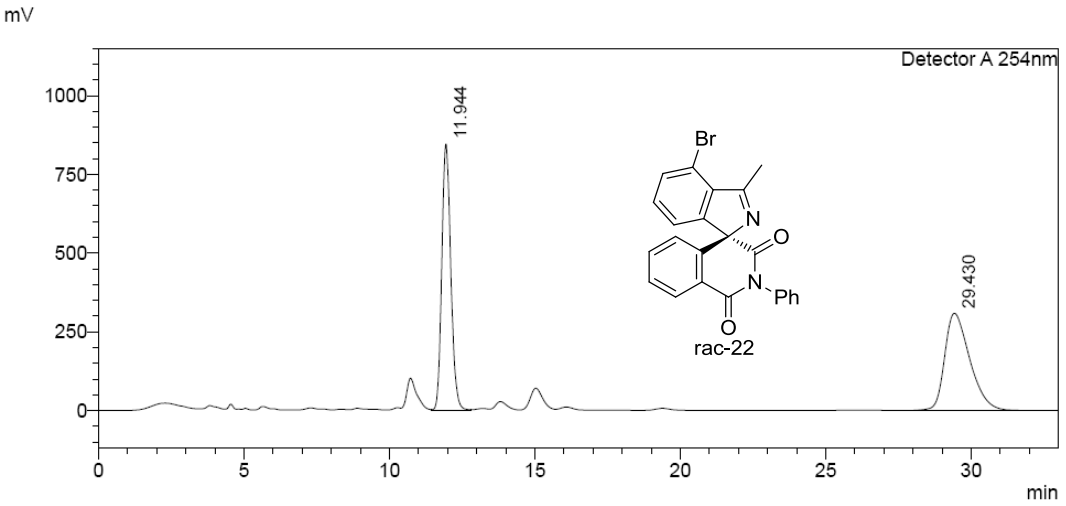
<Peak Table>

Detector A 254nm

Peak#	Ret. Time	Area	Area%	Height	Conc.	Unit	Mark
1	10.910	1991177	8.470	98878	8.470		
2	28.202	21516710	91.530	373062	91.530		
Total		23507886	100.000	471940			

22, AD-H, Hex/*i*PrOH = 70/30, rate = 1.0 mL/min, 254 nm

<Chromatogram>

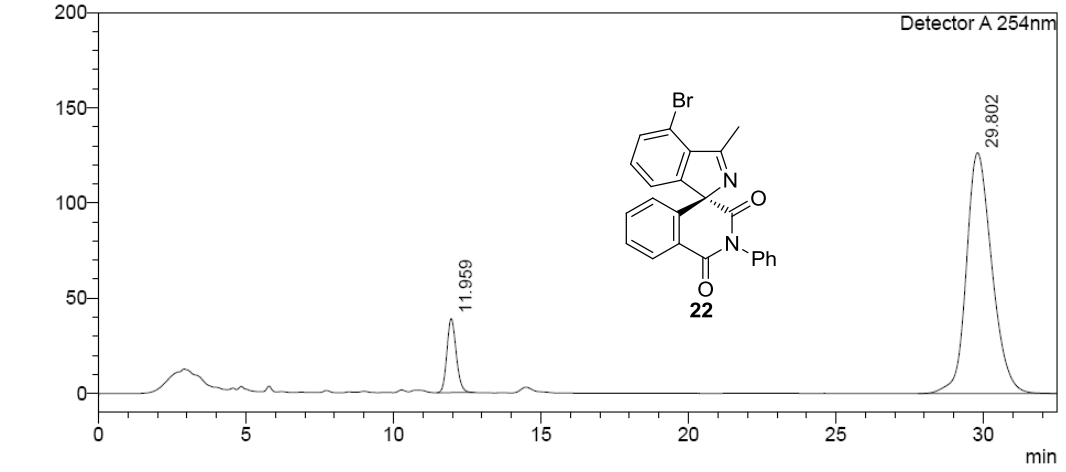


<Peak Table>

Detector A 254nm

Peak#	Ret. Time	Area	Area%	Height	Conc.	Unit	Mark
1	11.944	18275348	49.671	845974	49.671		
2	29.430	18517666	50.329	308522	50.329		
Total		36793014	100.000	1154496			

<Chromatogram>



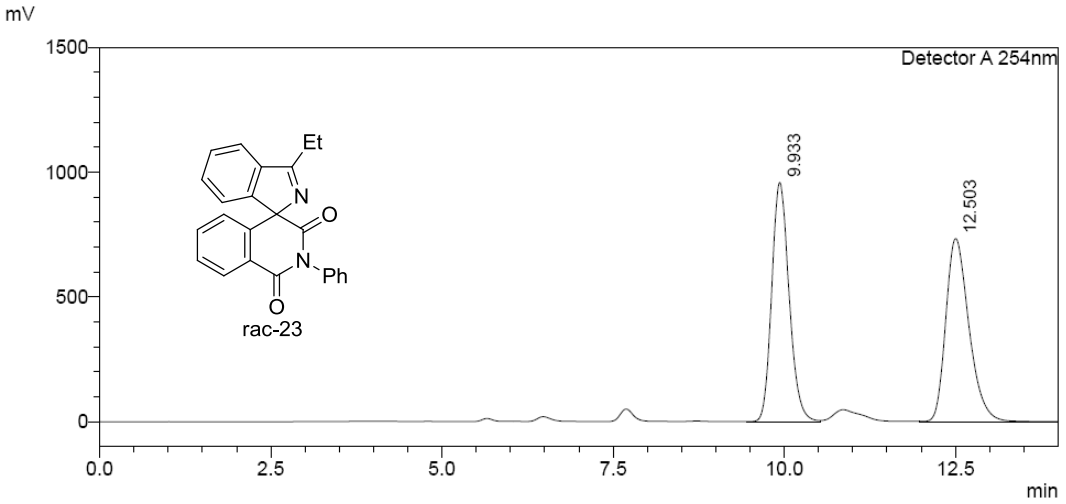
<Peak Table>

Detector A 254nm

Peak#	Ret. Time	Area	Area%	Height	Conc.	Unit	Mark
1	11.959	853799	10.081	38890	10.081		M
2	29.802	7615965	89.919	126421	89.919		S
Total		8469763	100.000	165311			

23, AD-H, Hex/*i*PrOH = 70/30, rate = 1.0 mL/min, 254 nm

<Chromatogram>

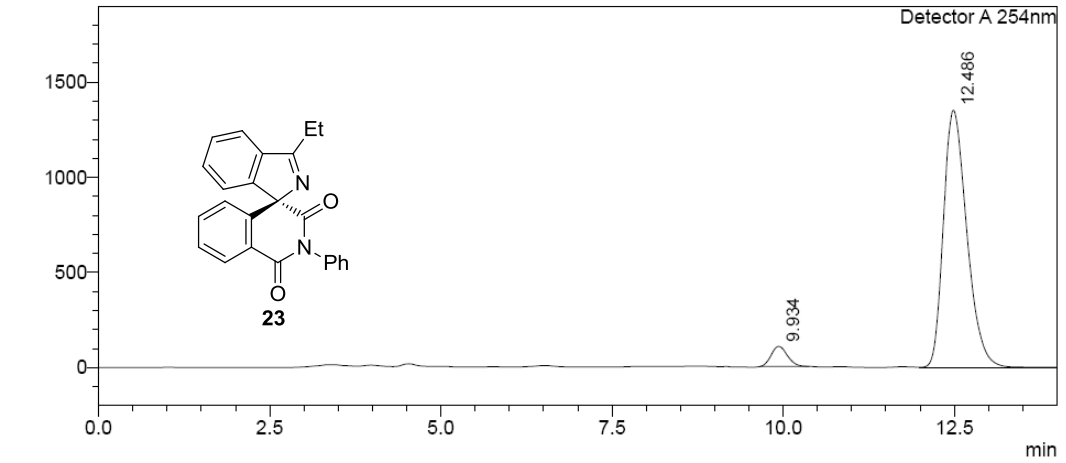


<Peak Table>

Detector A 254nm

Peak#	Ret. Time	Area	Area%	Height	Conc.	Unit	Mark
1	9.933	16975905	49.579	958213	49.579		
2	12.503	17264413	50.421	732975	50.421		
Total		34240318	100.000	1691188			

<Chromatogram>



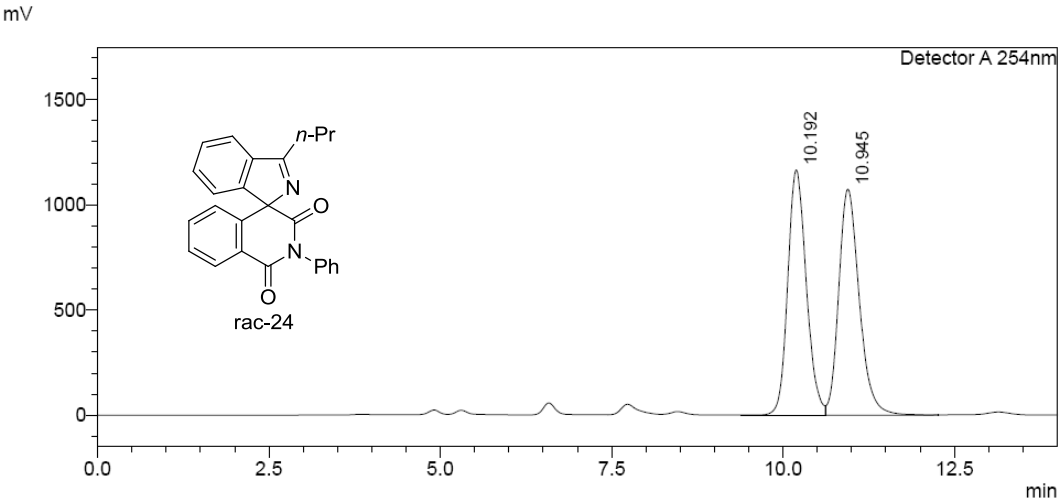
<Peak Table>

Detector A 254nm

Peak#	Ret. Time	Area	Area%	Height	Conc.	Unit	Mark
1	9.934	1723506	5.077	105384	5.077		M
2	12.486	32225214	94.923	1351954	94.923		
Total		33948720	100.000	1457338			

24, AD-H, Hex/*i*PrOH = 70/30, rate = 1.0 mL/min, 254 nm

<Chromatogram>

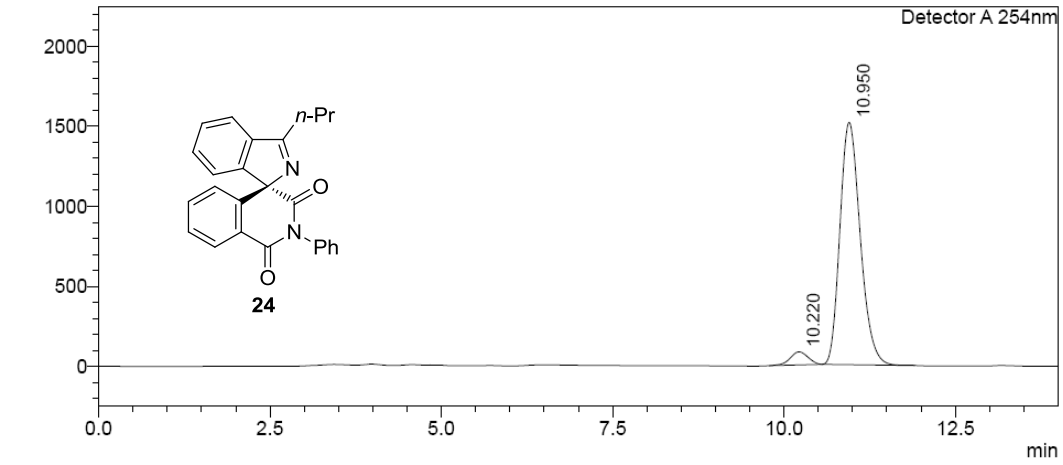


<Peak Table>

Detector A 254nm

Peak#	Ret. Time	Area	Area%	Height	Conc.	Unit	Mark
1	10.192	22014450	49.488	1166348	49.488		
2	10.945	22469578	50.512	1074630	50.512		V M
Total		44484028	100.000	2240978			

<Chromatogram>



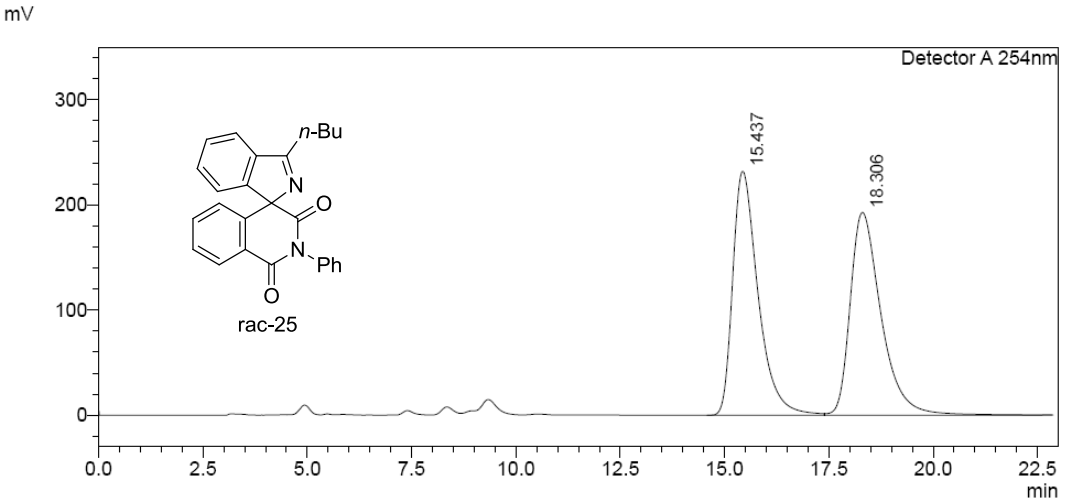
<Peak Table>

Detector A 254nm

Peak#	Ret. Time	Area	Area%	Height	Conc.	Unit	Mark
1	10.220	1483209	4.533	82083	4.533		M
2	10.950	31238785	95.467	1514190	95.467		M
Total		32721994	100.000	1596272			

25, IC-H, Hex/*i*PrOH = 80/20, rate = 1.0 mL/min, 254 nm

<Chromatogram>

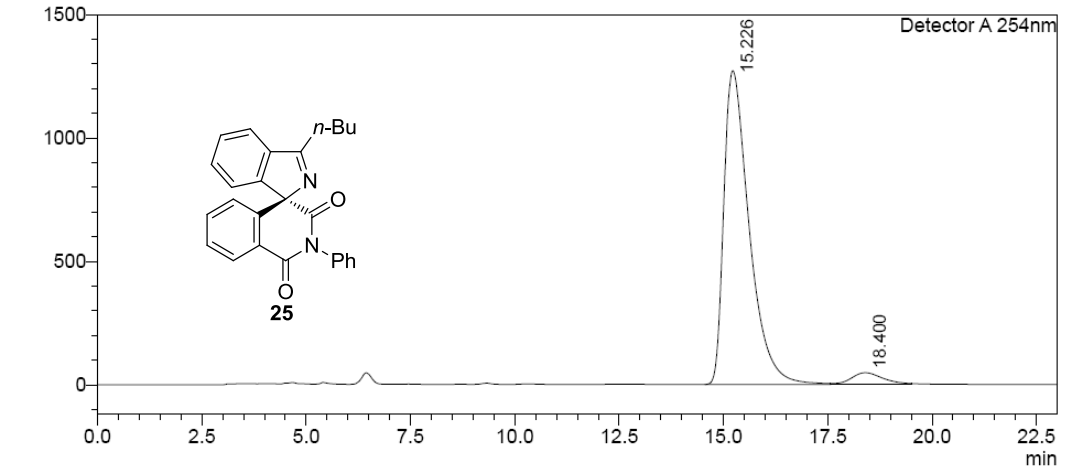


<Peak Table>

Detector A 254nm

Peak#	Ret. Time	Area	Area%	Height	Conc.	Unit	Mark
1	15.437	9839910	49.741	232176	49.741		
2	18.306	9942398	50.259	192893	50.259		V
Total		19782308	100.000	425069			

<Chromatogram>



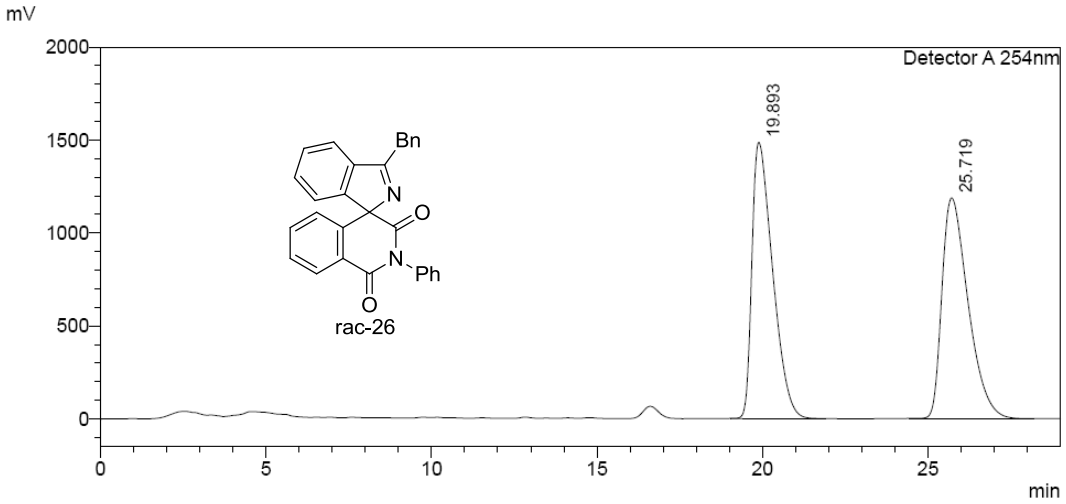
<Peak Table>

Detector A 254nm

Peak#	Ret. Time	Area	Area%	Height	Conc.	Unit	Mark
1	15.226	53885316	95.439	1271421	95.439		M
2	18.400	2574917	4.561	47858	4.561		V M
Total		56460233	100.000	1319279			

26, AD-H, Hex/*i*PrOH = 70/30, rate = 1.0 mL/min, 254 nm

<Chromatogram>

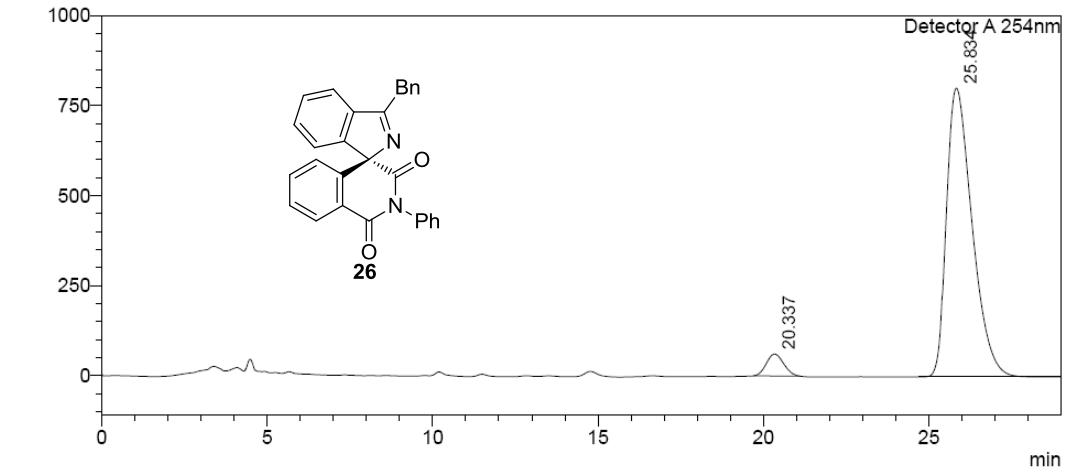


<Peak Table>

Detector A 254nm

Peak#	Ret. Time	Area	Area%	Height	Conc.	Unit	Mark
1	19.893	64757924	49.745	1487335	49.745		M
2	25.719	65422270	50.255	1188273	50.255		M
Total		130180194	100.000	2675608			

<Chromatogram>



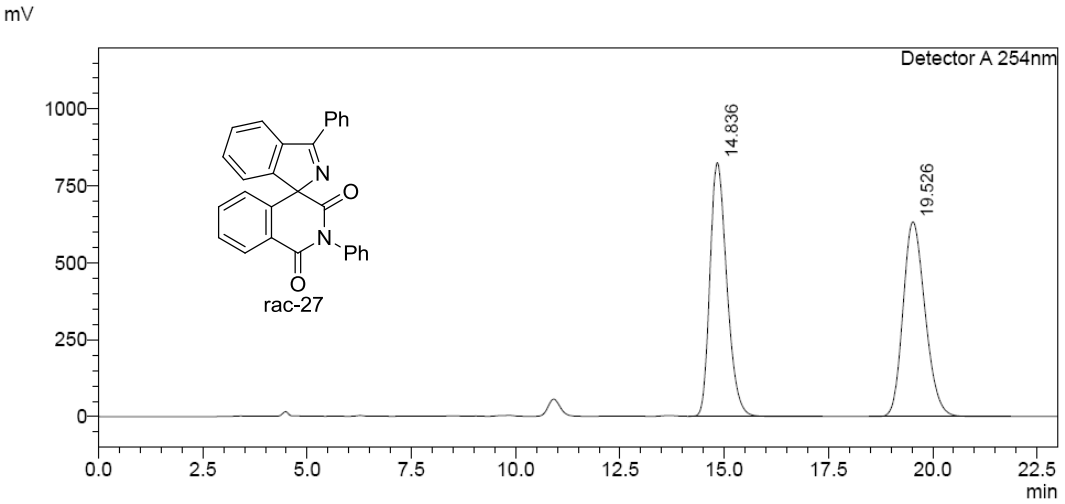
<Peak Table>

Detector A 254nm

Peak#	Ret. Time	Area	Area%	Height	Conc.	Unit	Mark
1	20.337	2215381	4.875	60750	4.875		M
2	25.834	43226159	95.125	801671	95.125		V
Total		45441540	100.000	862421			

27, AD-H, Hex/*i*PrOH = 70/30, rate = 1.0 mL/min, 254 nm

<Chromatogram>

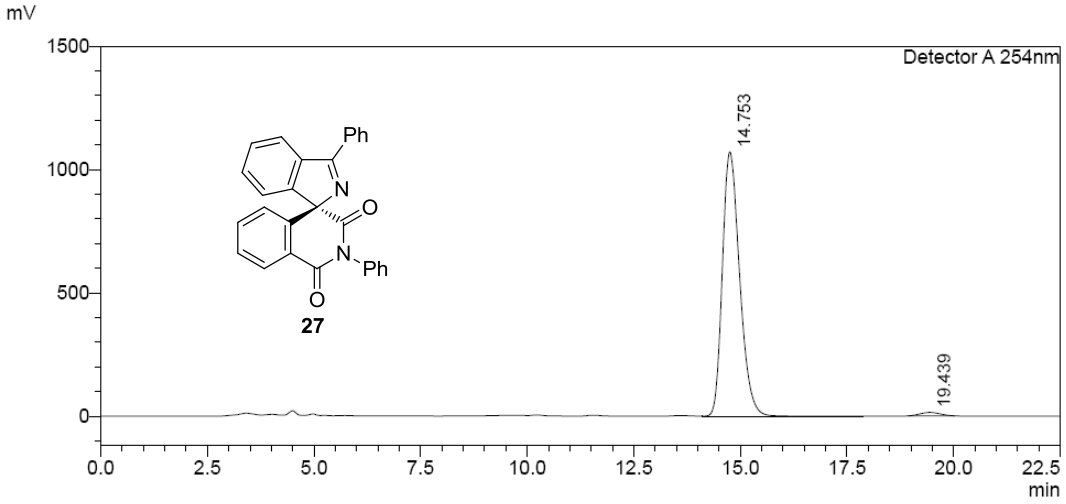


<Peak Table>

Detector A 254nm

Peak#	Ret. Time	Area	Area%	Height	Conc.	Unit	Mark
1	14.836	23335306	49.981	825540	49.981		S
2	19.526	23353079	50.019	632800	50.019		S
Total		46688385	100.000	1458340			

<Chromatogram>



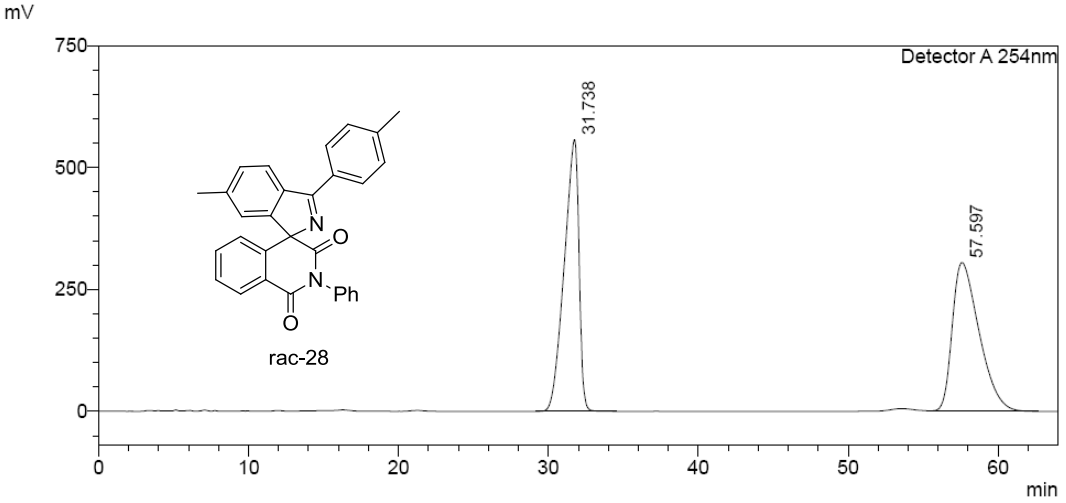
<Peak Table>

Detector A 254nm

Peak#	Ret. Time	Area	Area%	Height	Conc.	Unit	Mark
1	14.753	30171121	98.525	1071423	98.525		S
2	19.439	451610	1.475	13949	1.475		M
Total		30622731	100.000	1085372			

28, AD-H, Hex/*i*PrOH = 80/20, rate = 1.0 mL/min, 254 nm

<Chromatogram>

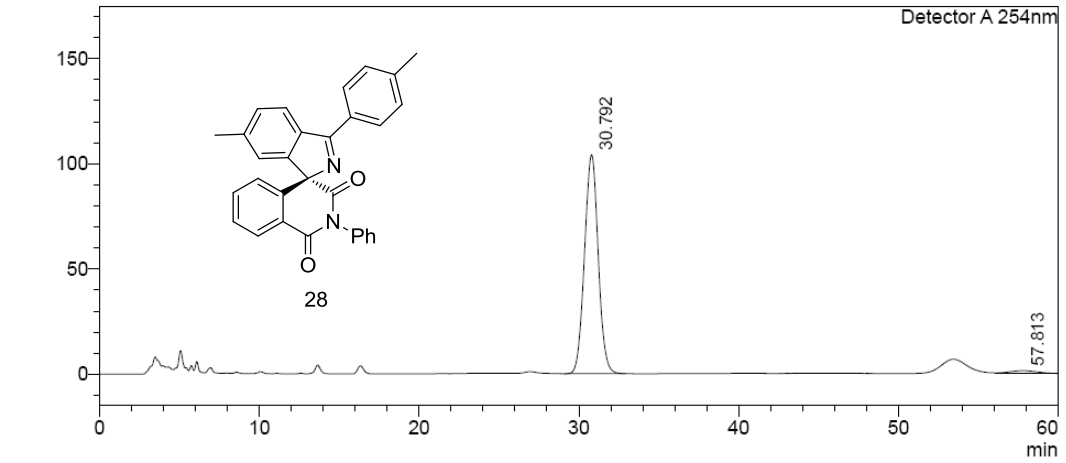


<Peak Table>

Detector A 254nm

Peak#	Ret. Time	Area	Area%	Height	Conc.	Unit	Mark
1	31.738	38077671	49.978	557190	49.978		SV
2	57.597	38110446	50.022	305232	50.022		
Total		76188116	100.000	862422			

<Chromatogram>



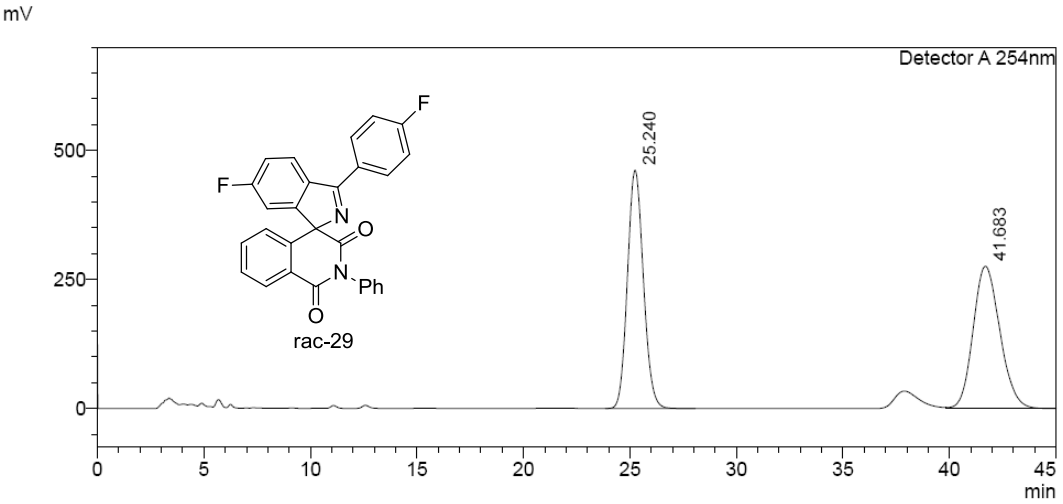
<Peak Table>

Detector A 254nm

Peak#	Ret. Time	Area	Area%	Height	Conc.	Unit	Mark
1	30.792	6203620	97.479	104094	97.479		
2	57.813	160430	2.521	1327	2.521		
Total		6364050	100.000	105421			

29, AD-H, Hex/*i*PrOH = 70/30, rate = 1.0 mL/min, 254 nm

<Chromatogram>

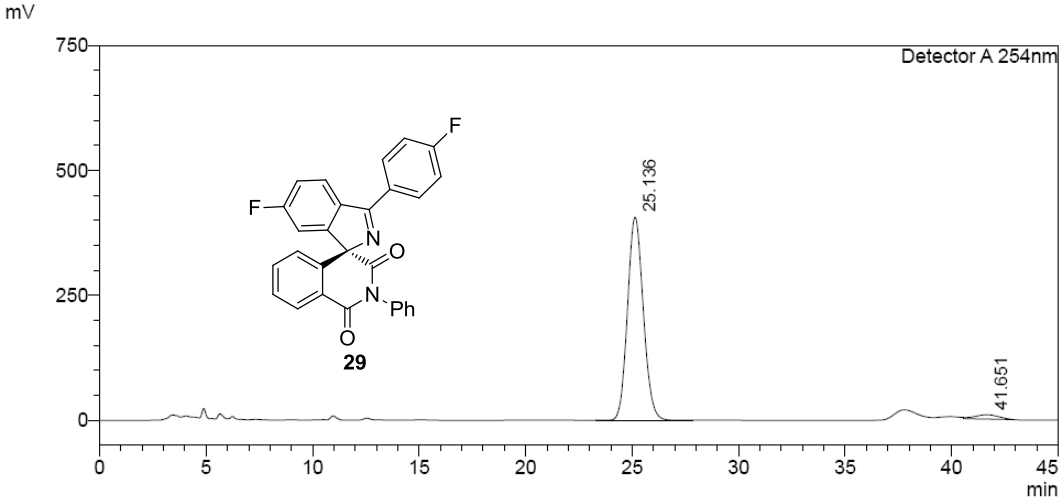


<Peak Table>

Detector A 254nm

Peak#	Ret. Time	Area	Area%	Height	Conc.	Unit	Mark
1	25.240	24047184	49.874	461530	49.874		V
2	41.683	24168606	50.126	275903	50.126		
Total		48215790	100.000	737434			

<Chromatogram>



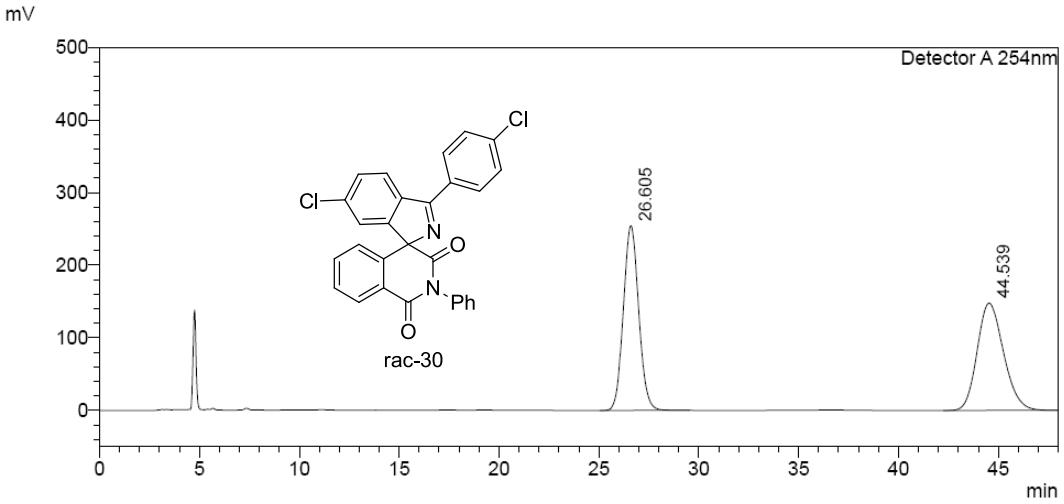
<Peak Table>

Detector A 254nm

Peak#	Ret. Time	Area	Area%	Height	Conc.	Unit	Mark
1	25.136	20971778	96.883	406244	96.883		S
2	41.651	674624	3.117	8666	3.117		M
Total		21646402	100.000	414910			

30, AD-H, Hex/*i*PrOH = 70/30, rate = 1.0 mL/min, 254 nm

<Chromatogram>

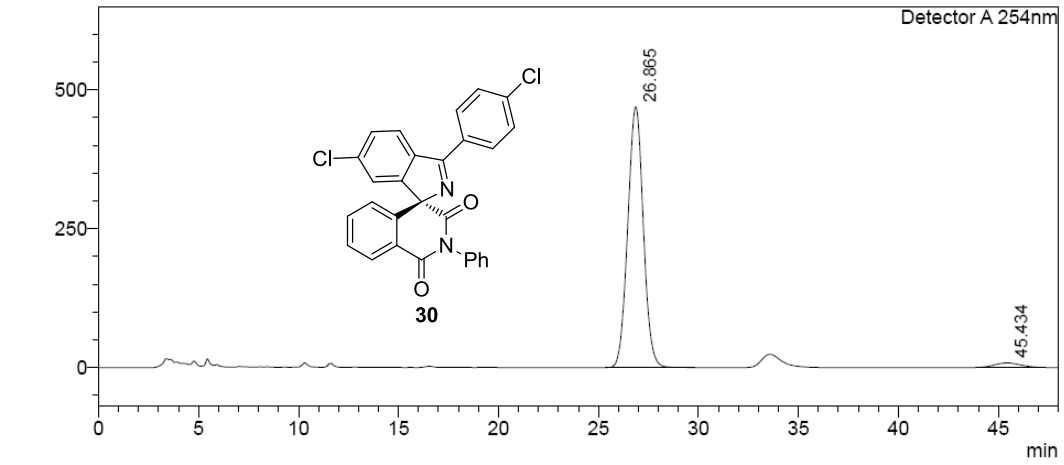


<Peak Table>

Detector A 254nm

Peak#	Ret. Time	Area	Area%	Height	Conc.	Unit	Mark
1	26.605	13591755	50.027	254363	50.027		S
2	44.539	13576889	49.973	147670	49.973		V
Total		27168643	100.000	402033			

<Chromatogram>



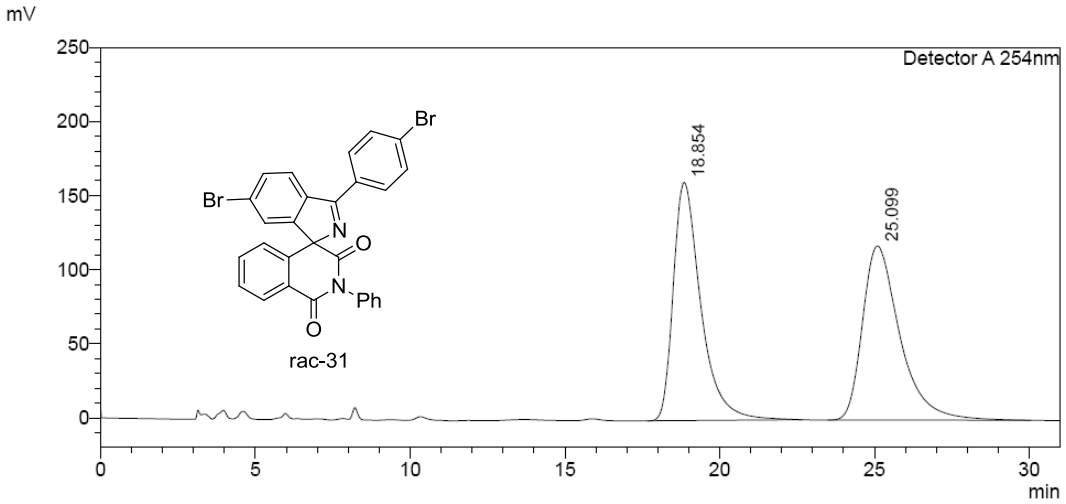
<Peak Table>

Detector A 254nm

Peak#	Ret. Time	Area	Area%	Height	Conc.	Unit	Mark
1	26.865	25375737	97.275	469452	97.275		SV
2	45.434	710954	2.725	8049	2.725		M
Total		26086691	100.000	477501			

31, IC-H, Hex/*i*PrOH = 80/20, rate = 1.0 mL/min, 254 nm

<Chromatogram>

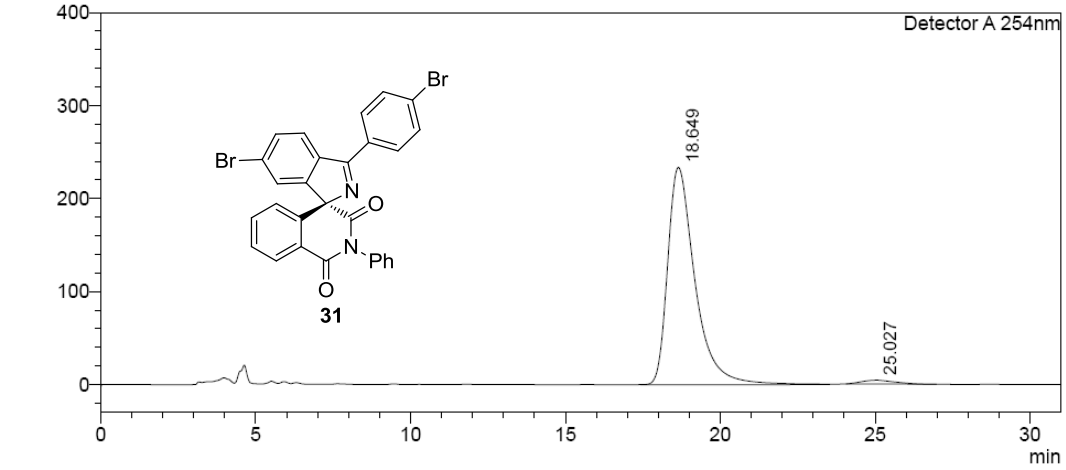


<Peak Table>

Detector A 254nm

Peak#	Ret. Time	Area	Area%	Height	Conc.	Unit	Mark
1	18.854	9974159	50.222	160712	50.222		M
2	25.099	9885979	49.778	117466	49.778		
Total		19860138	100.000	278178			

<Chromatogram>



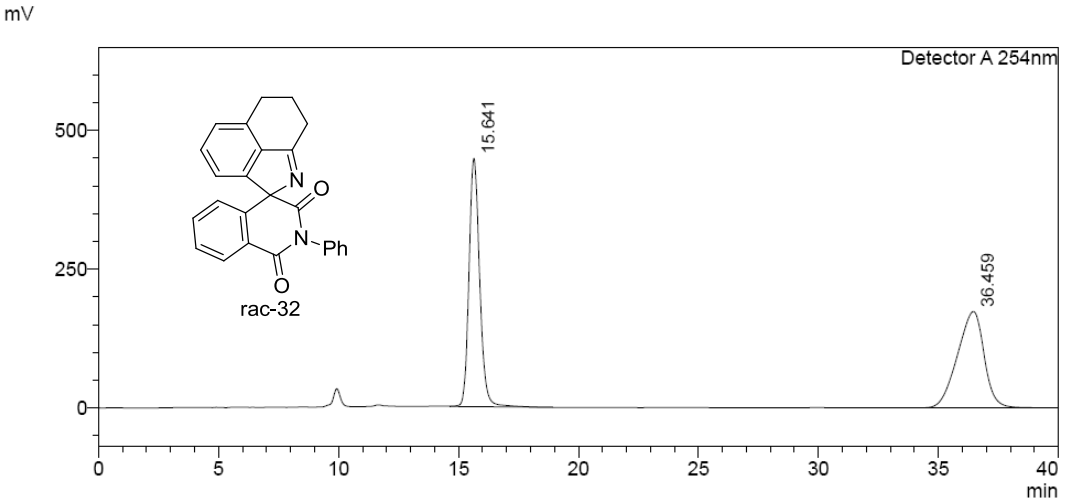
<Peak Table>

Detector A 254nm

Peak#	Ret. Time	Area	Area%	Height	Conc.	Unit	Mark
1	18.649	14371236	97.939	233647	97.939		V M
2	25.027	302397	2.061	4007	2.061		M
Total		14673632	100.000	237653			

32, AD-H, Hex/*i*PrOH = 70/30, rate = 1.0 mL/min, 254 nm

<Chromatogram>

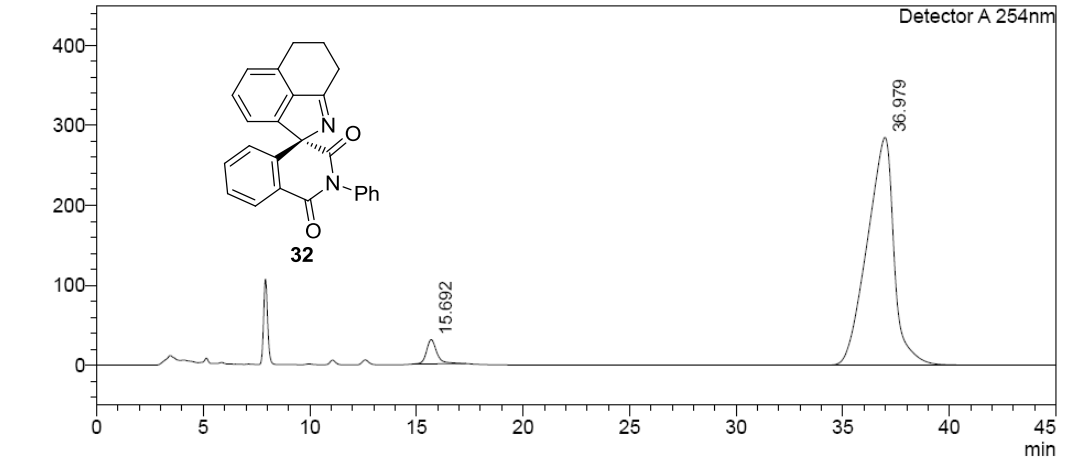


<Peak Table>

Detector A 254nm

Peak#	Ret. Time	Area	Area%	Height	Conc.	Unit	Mark
1	15.641	13876613	50.875	447538	50.875		
2	36.459	13399492	49.125	173376	49.125		S
Total		27276105	100.000	620914			

<Chromatogram>



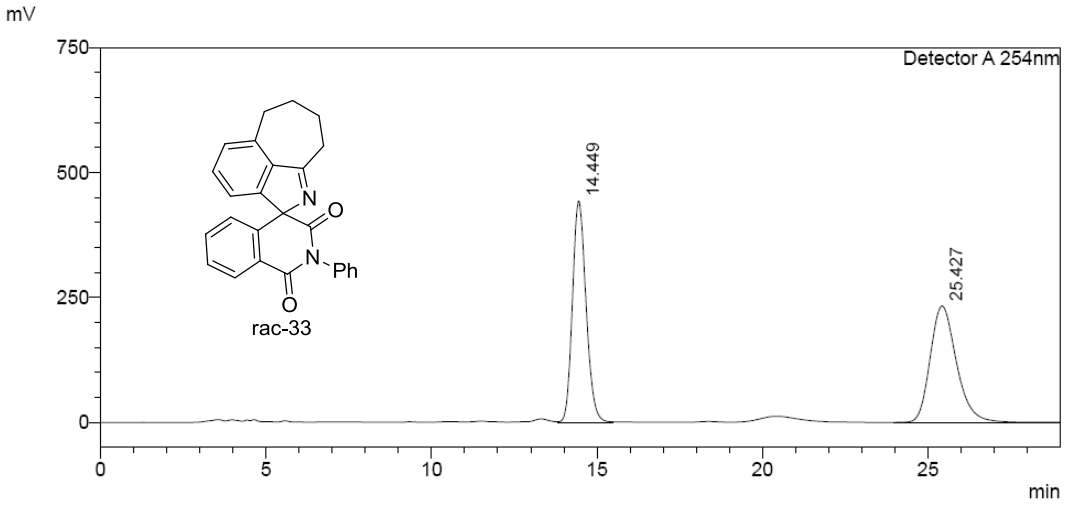
<Peak Table>

Detector A 254nm

Peak#	Ret. Time	Area	Area%	Height	Conc.	Unit	Mark
1	15.692	1041095	4.013	30431	4.013		M
2	36.979	24904210	95.987	284847	95.987		S
Total		25945304	100.000	315277			

33, AD-H, Hex/*i*PrOH = 70/30, rate = 1.0 mL/min, 254 nm

<Chromatogram>

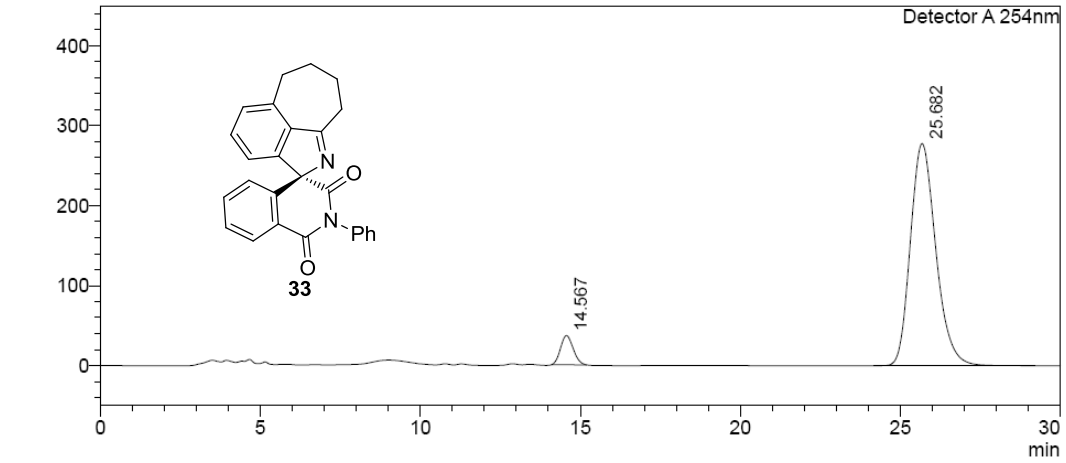


<Peak Table>

Detector A 254nm

Peak#	Ret. Time	Area	Area%	Height	Conc.	Unit	Mark
1	14.449	12666497	49.654	442534	49.654		M
2	25.427	12843005	50.346	232775	50.346		V
Total		25509502	100.000	675309			

<Chromatogram>



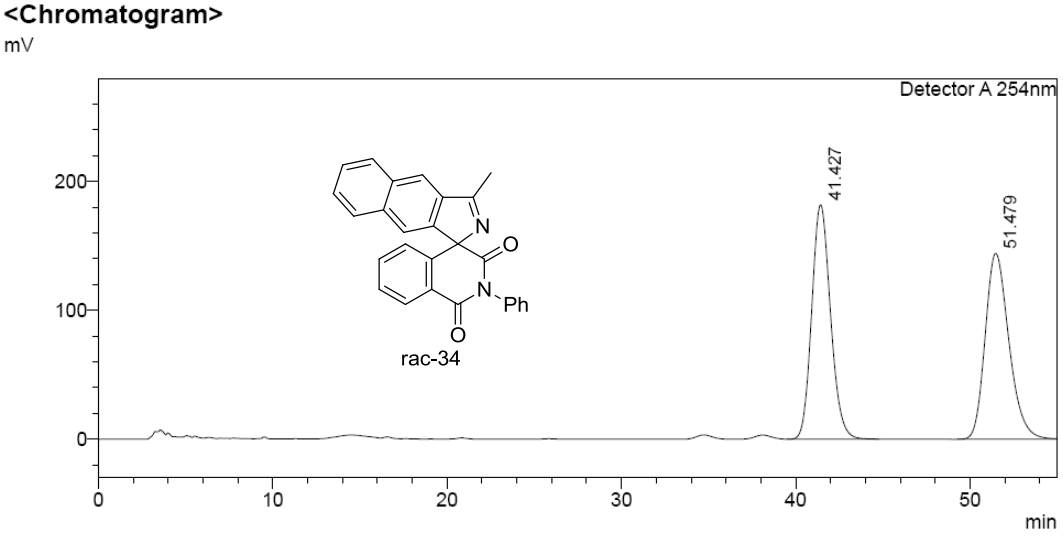
<Peak Table>

Detector A 254nm

Peak#	Ret. Time	Area	Area%	Height	Conc.	Unit	Mark
1	14.567	1007204	6.153	36535	6.153		M
2	25.682	15362184	93.847	277809	93.847		SV
Total		16369388	100.000	314344			

34, AD-H, Hex/*i*PrOH = 85/15, rate = 1.0 mL/min, 254 nm

<Chromatogram>

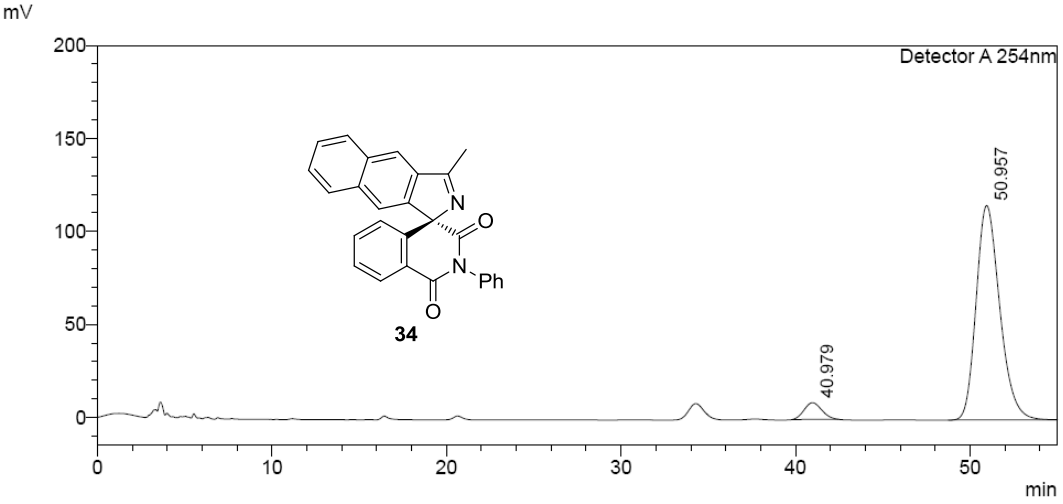


<Peak Table>

Detector A 254nm

Peak#	Ret. Time	Area	Area%	Height	Conc.	Unit	Mark
1	41.427	13627620	49.884	181797	49.884		
2	51.479	13690879	50.116	144214	50.116		S
Total		27318498	100.000	326010			

<Chromatogram>



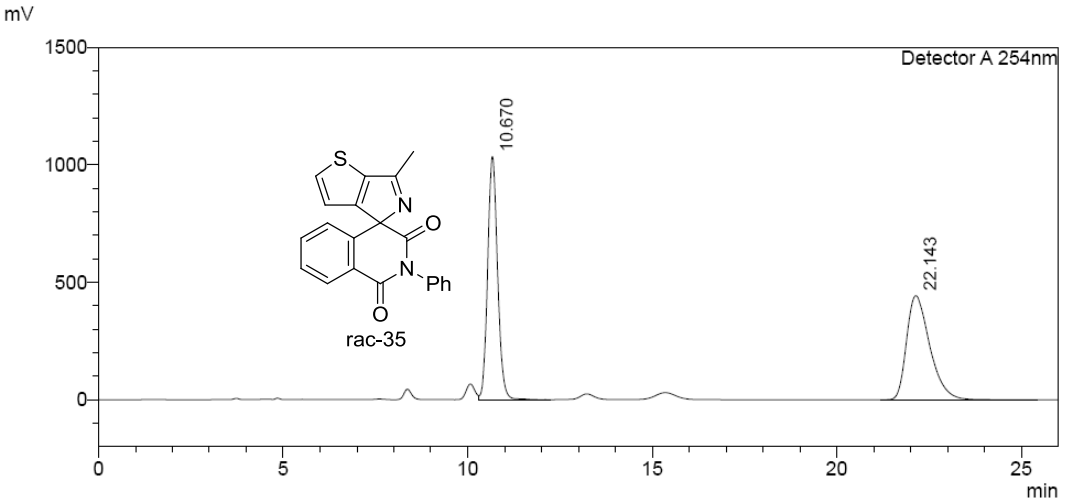
<Peak Table>

Detector A 254nm

Peak#	Ret. Time	Area	Area%	Height	Conc.	Unit	Mark
1	40.979	634769	5.516	9007	5.516		M
2	50.957	10873471	94.484	115315	94.484		S
Total		11508240	100.000	124321			

35, AD-H, Hex/*i*PrOH = 70/30, rate = 1.0 mL/min, 254 nm

<Chromatogram>

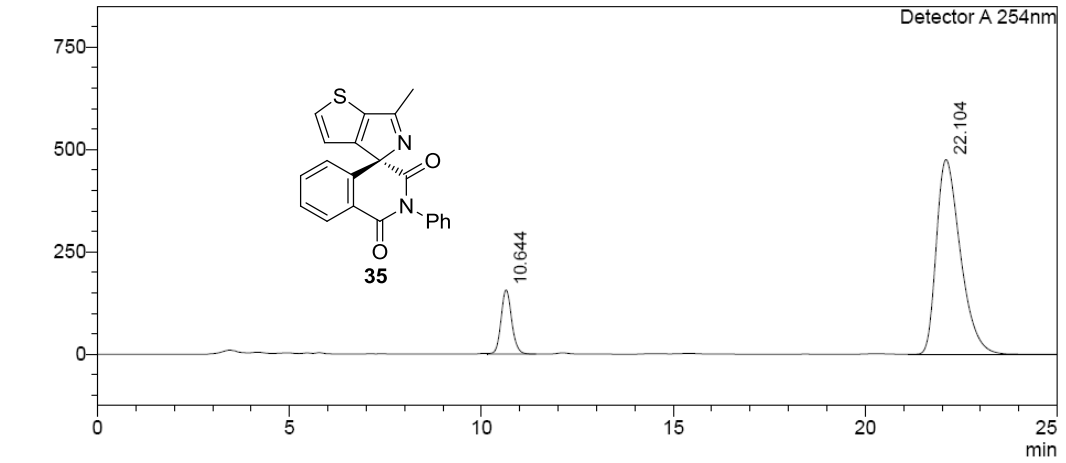


<Peak Table>

Detector A 254nm

Peak#	Ret. Time	Area	Area%	Height	Conc.	Unit	Mark
1	10.670	19402934	50.054	1035138	50.054		
2	22.143	19360852	49.946	442989	49.946		S
Total		38763786	100.000	1478127			

<Chromatogram>



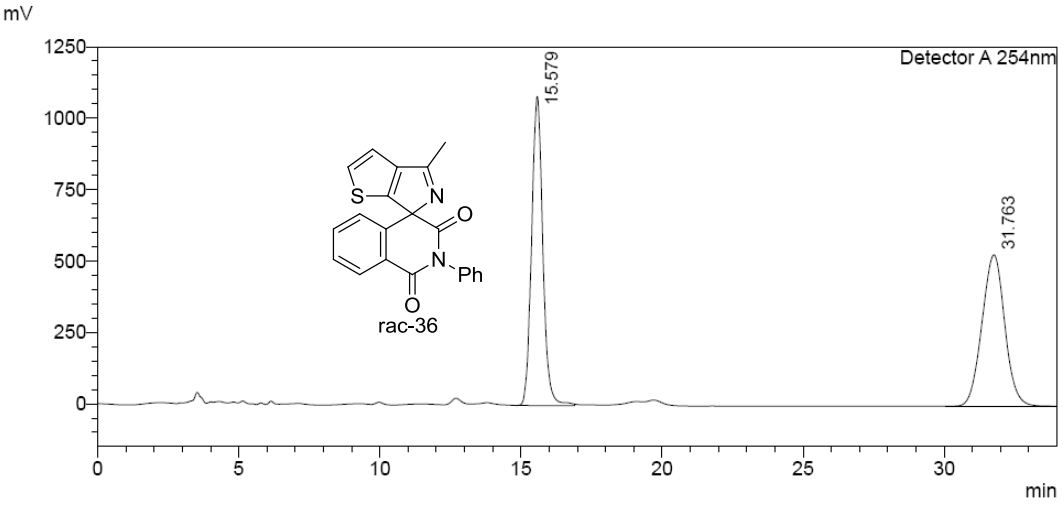
<Peak Table>

Detector A 254nm

Peak#	Ret. Time	Area	Area%	Height	Conc.	Unit	Mark
1	10.644	3028304	12.746	156574	12.746		
2	22.104	20730873	87.254	475268	87.254		S
Total		23759177	100.000	631842			

36, AD-H, Hex/*i*PrOH = 80/20, rate = 1.0 mL/min, 254 nm

<Chromatogram>

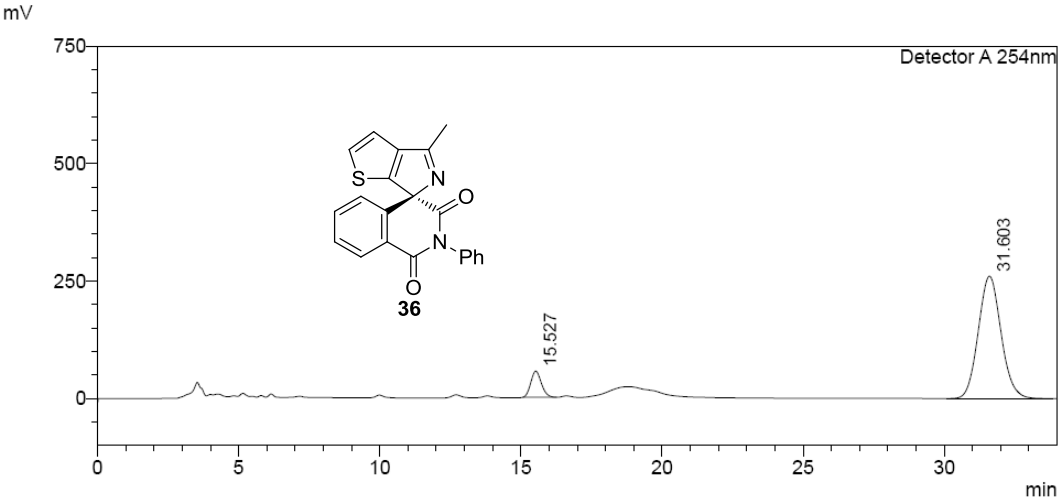


<Peak Table>

Detector A 254nm

Peak#	Ret. Time	Area	Area%	Height	Conc.	Unit	Mark
1	15.579	29975005	50.171	1082023	50.171		M
2	31.763	29770579	49.829	530084	49.829		
Total		59745584	100.000	1612108			

<Chromatogram>



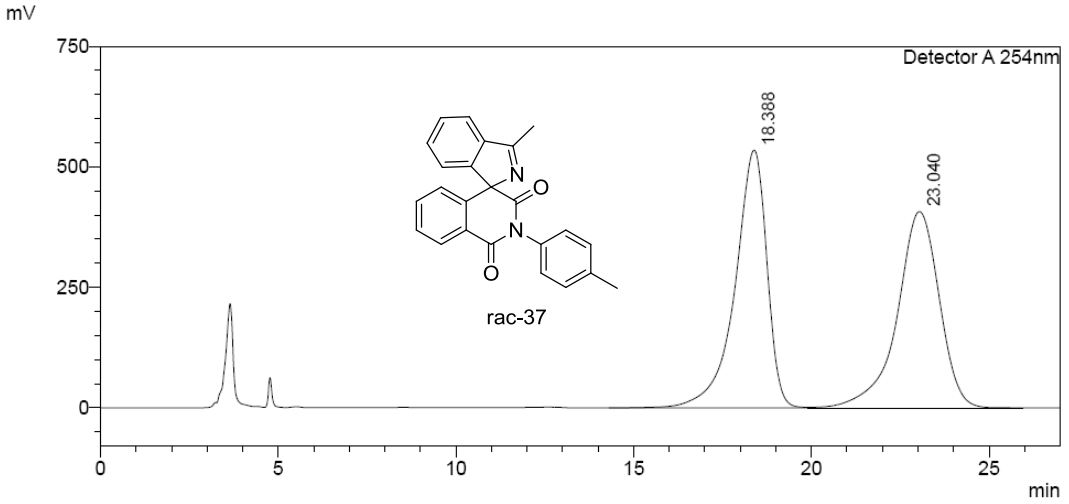
<Peak Table>

Detector A 254nm

Peak#	Ret. Time	Area	Area%	Height	Conc.	Unit	Mark
1	15.527	1452060	9.032	55528	9.032		M
2	31.603	14625008	90.968	260423	90.968		
Total		16077068	100.000	315951			

37, AD-H, Hex/*i*PrOH = 70/30, rate = 1.0 mL/min, 254 nm

<Chromatogram>

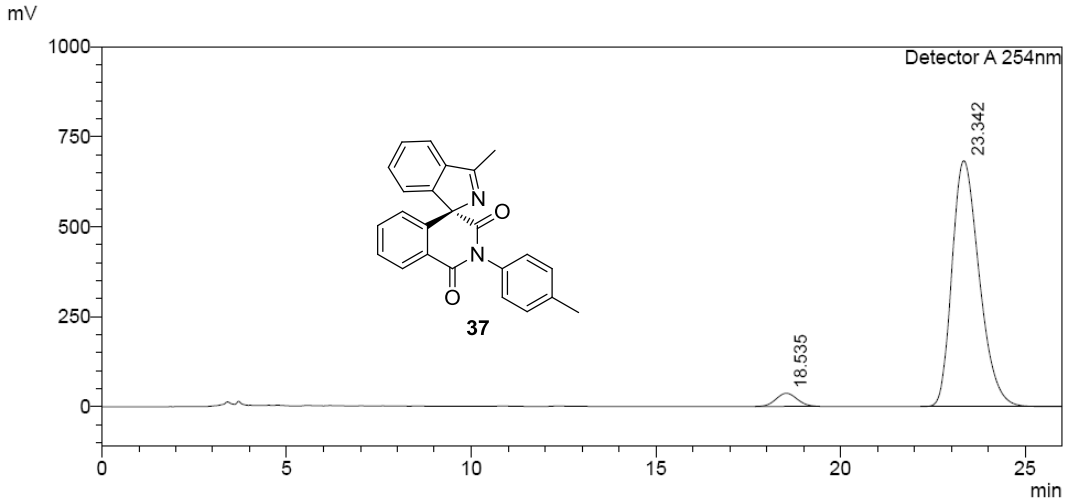


<Peak Table>

Detector A 254nm

Peak#	Ret. Time	Area	Area%	Height	Conc.	Unit	Mark
1	18.388	33478826	49.897	534780	49.897		
2	23.040	33617625	50.103	407274	50.103		V
Total		67096451	100.000	942054			

<Chromatogram>



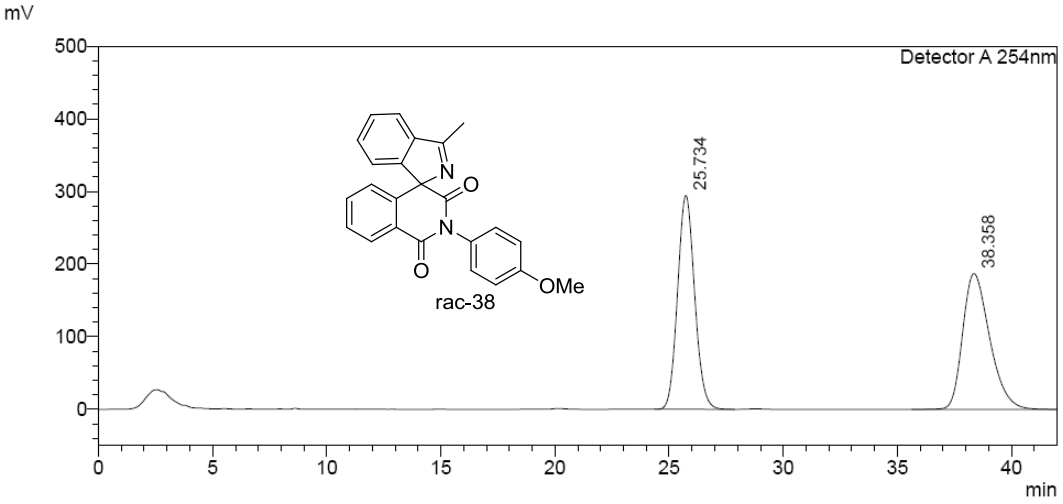
<Peak Table>

Detector A 254nm

Peak#	Ret. Time	Area	Area%	Height	Conc.	Unit	Mark
1	18.535	1446337	3.961	36463	3.961		M
2	23.342	35070774	96.039	683027	96.039		
Total		36517111	100.000	719490			

38, AD-H, Hex/*i*PrOH = 70/30, rate = 1.0 mL/min, 254 nm

<Chromatogram>

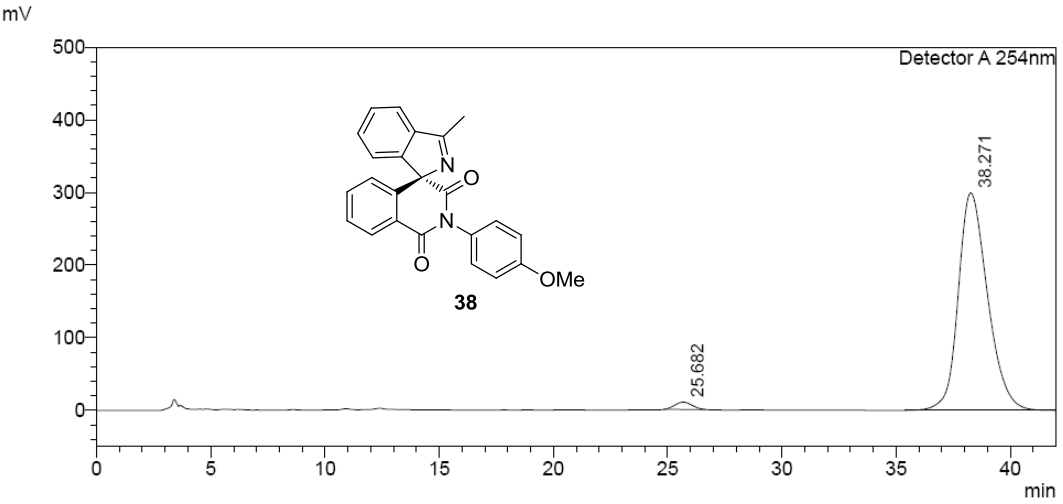


<Peak Table>

Detector A 254nm

Peak#	Ret. Time	Area	Area%	Height	Conc.	Unit	Mark
1	25.734	15312723	49.809	294467	49.809		
2	38.358	15430255	50.191	187028	50.191		V
Total		30742978	100.000	481495			

<Chromatogram>



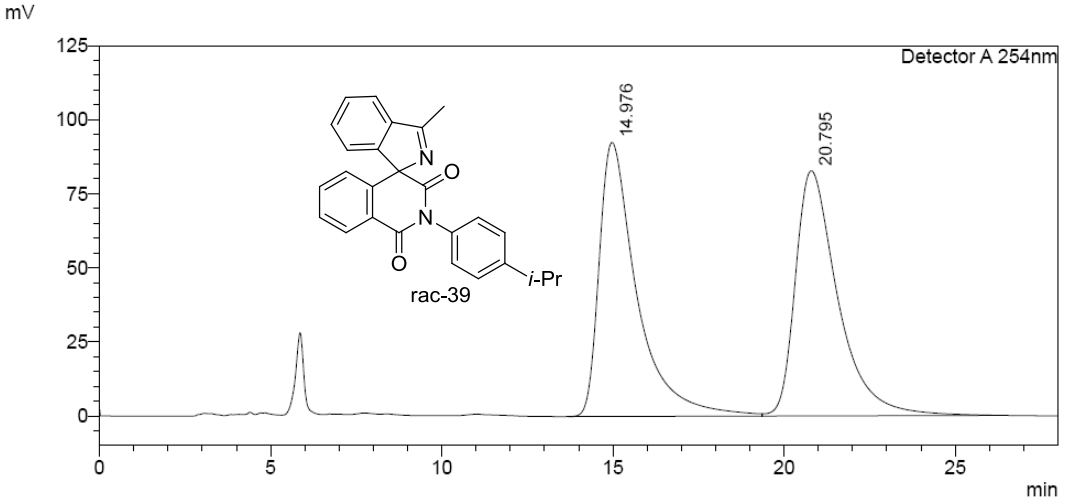
<Peak Table>

Detector A 254nm

Peak#	Ret. Time	Area	Area%	Height	Conc.	Unit	Mark
1	25.682	533543	1.956	10060	1.956		M
2	38.271	26744531	98.044	299377	98.044		V
Total		27278074	100.000	309437			

39, OD-H, Hex/*i*PrOH = 80/20, rate = 1.0 mL/min, 254 nm

<Chromatogram>

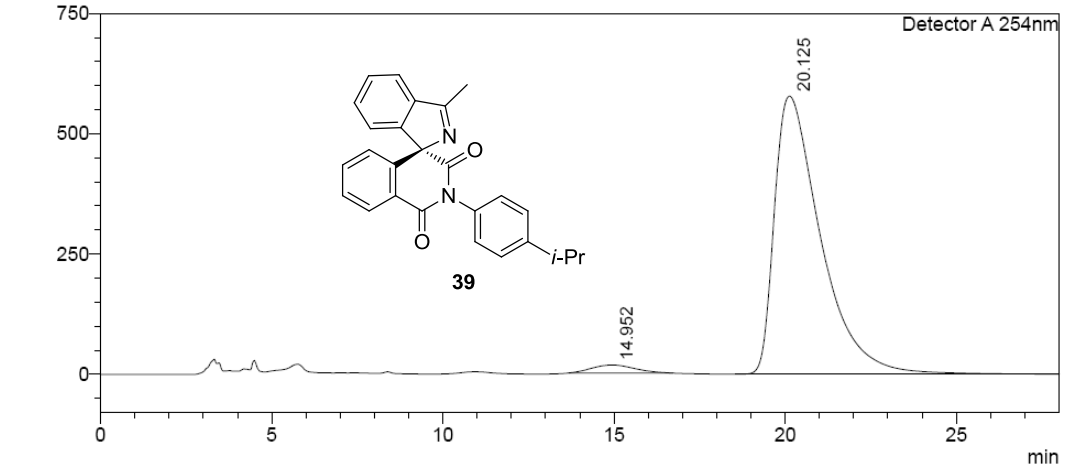


<Peak Table>

Detector A 254nm

Peak#	Ret. Time	Area	Area%	Height	Conc.	Unit	Mark
1	14.976	7101785	49.818	92509	49.818		V
2	20.795	7153648	50.182	82776	50.182		SV
Total		14255433	100.000	175285			

<Chromatogram>



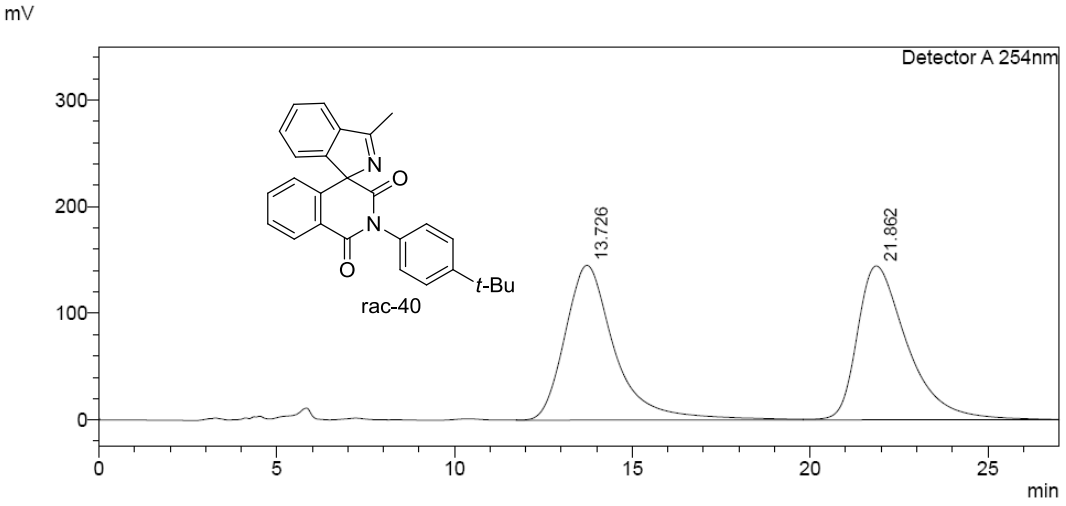
<Peak Table>

Detector A 254nm

Peak#	Ret. Time	Area	Area%	Height	Conc.	Unit	Mark
1	14.952	1459770	2.614	16587	2.614		M
2	20.125	54390286	97.386	578129	97.386		
Total		55850056	100.000	594716			

40, OD-H, Hex/*i*PrOH = 80/20, rate = 1.0 mL/min, 254 nm

<Chromatogram>

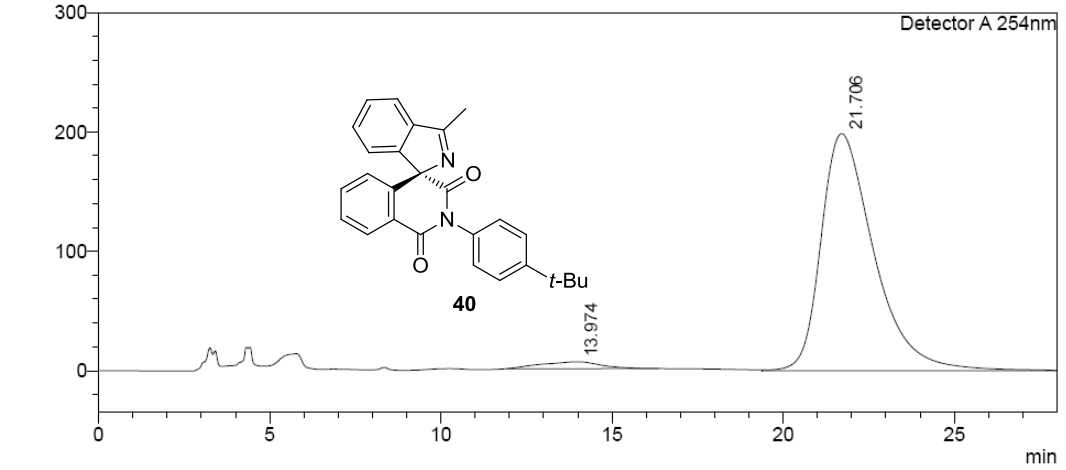


<Peak Table>

Detector A 254nm

Peak#	Ret. Time	Area	Area%	Height	Conc.	Unit	Mark
1	13.726	14179880	50.045	145137	50.045		
2	21.862	14154251	49.955	144348	49.955		V
Total		28334131	100.000	289485			

<Chromatogram>



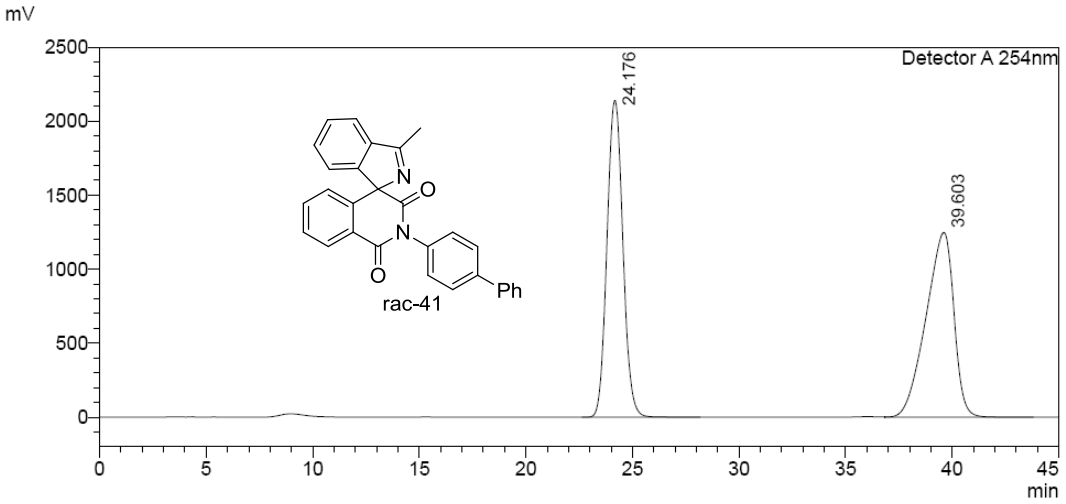
<Peak Table>

Detector A 254nm

Peak#	Ret. Time	Area	Area%	Height	Conc.	Unit	Mark
1	13.974	698567	3.155	5759	3.155		M
2	21.706	21439722	96.845	198637	96.845		S
Total		22138289	100.000	204397			

41, AD-H, Hex/*i*PrOH = 70/30, rate = 1.0 mL/min, 254 nm

<Chromatogram>

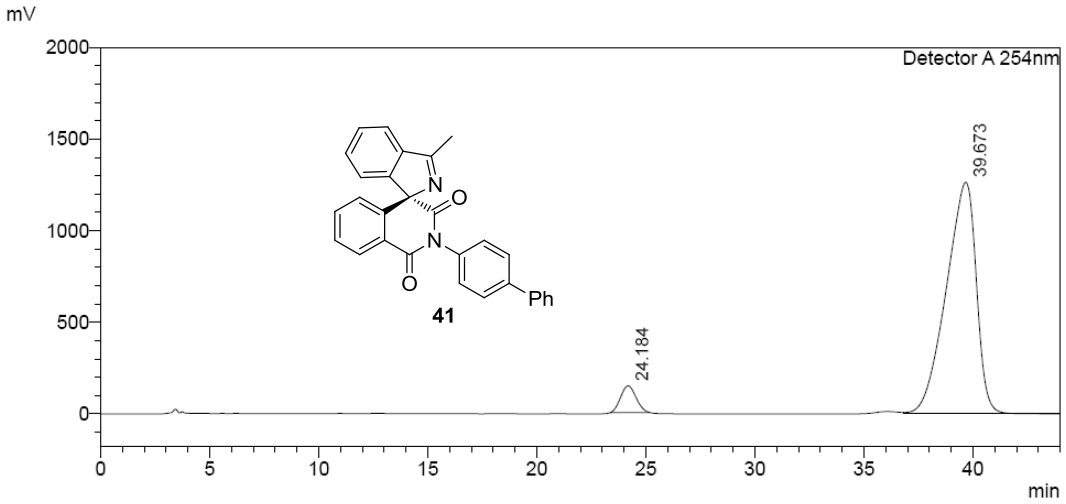


<Peak Table>

Detector A 254nm

Peak#	Ret. Time	Area	Area%	Height	Conc.	Unit	Mark
1	24.176	111134213	49.397	2140936	49.397		
2	39.603	113848394	50.603	1248113	50.603		S
Total		224982607	100.000	3389049			

<Chromatogram>



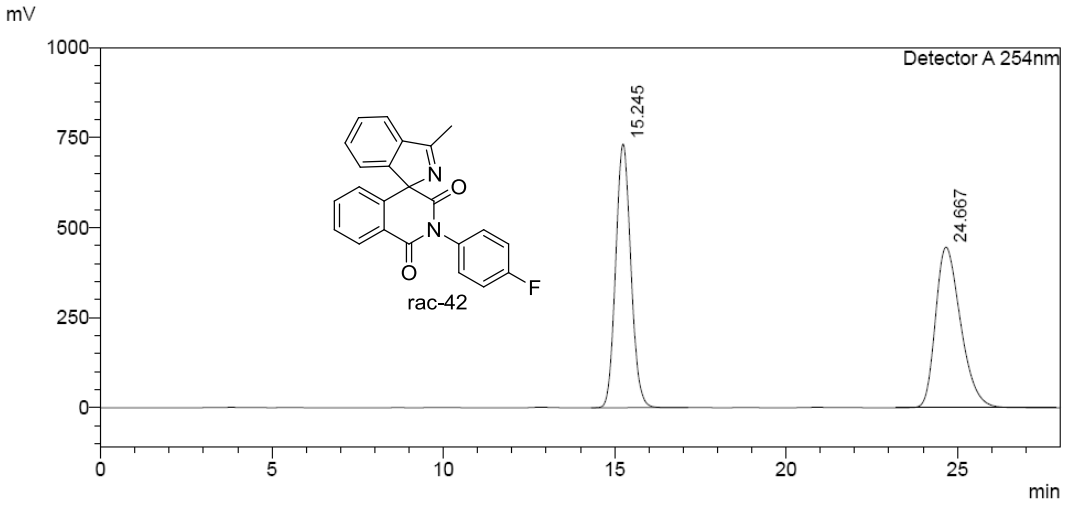
<Peak Table>

Detector A 254nm

Peak#	Ret. Time	Area	Area%	Height	Conc.	Unit	Mark
1	24.184	7187251	5.584	145942	5.584		M
2	39.673	121530943	94.416	1263802	94.416		S
Total		128718193	100.000	1409744			

42, AD-H, Hex/*i*PrOH = 70/30, rate = 1.0 mL/min, 254 nm

<Chromatogram>

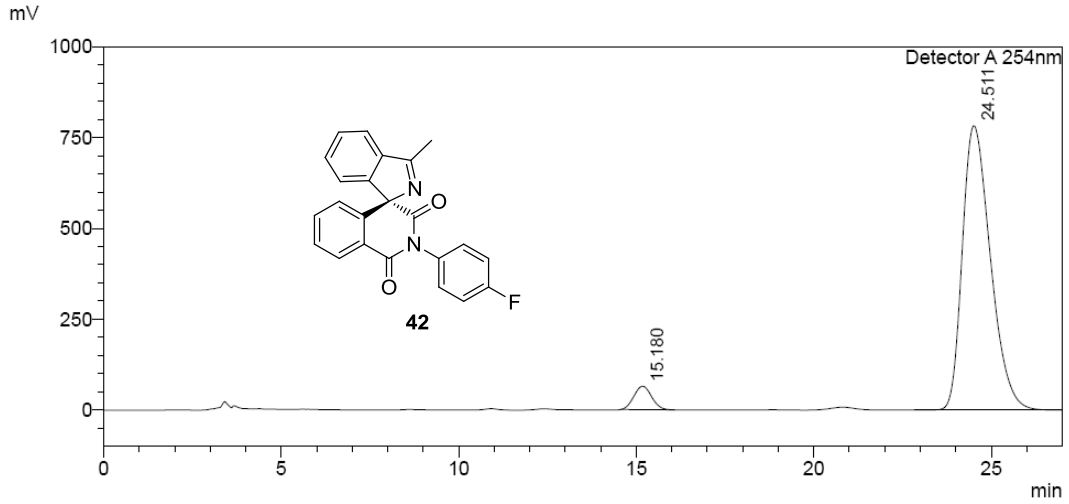


<Peak Table>

Detector A 254nm

Peak#	Ret. Time	Area	Area%	Height	Conc.	Unit	Mark
1	15.245	22559973	49.880	731864	49.880		S
2	24.667	22668589	50.120	445666	50.120		S
Total		45228561	100.000	1177530			

<Chromatogram>



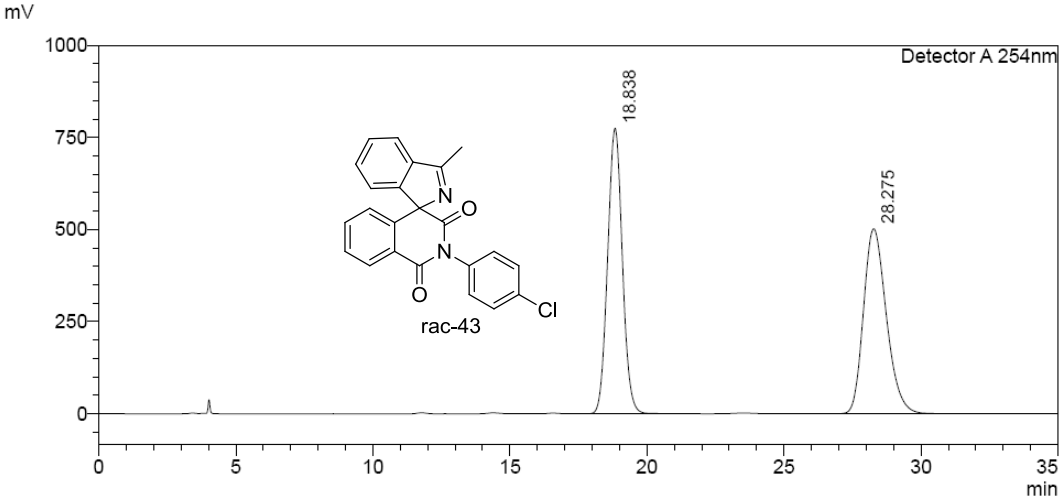
<Peak Table>

Detector A 254nm

Peak#	Ret. Time	Area	Area%	Height	Conc.	Unit	Mark
1	15.180	2240656	4.947	64568	4.947		M
2	24.511	43054669	95.053	782150	95.053		S
Total		45295325	100.000	846718			

43, AD-H, Hex/*i*PrOH = 70/30, rate = 1.0 mL/min, 254 nm

<Chromatogram>

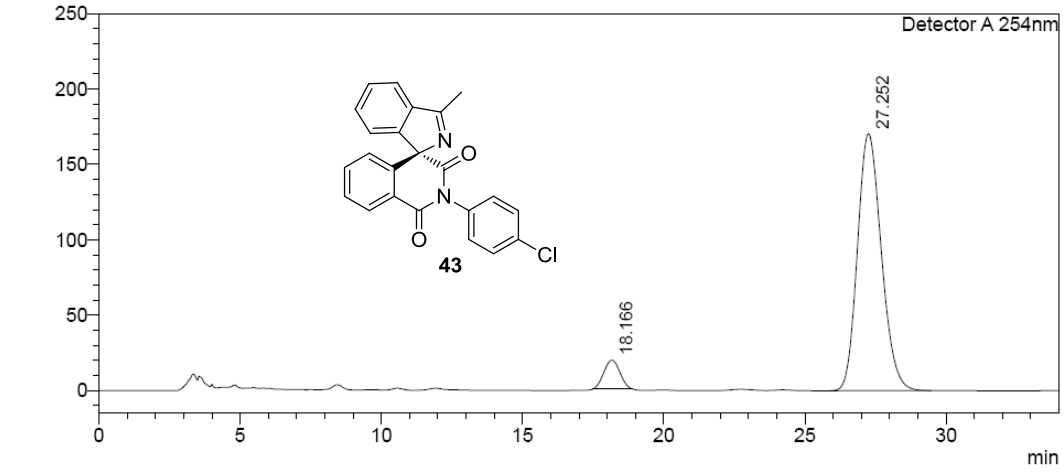


<Peak Table>

Detector A 254nm

Peak#	Ret. Time	Area	Area%	Height	Conc.	Unit	Mark
1	18.838	28984748	49.905	775101	49.905		V
2	28.275	29094708	50.095	502133	50.095		
Total		58079456	100.000	1277235			

<Chromatogram>



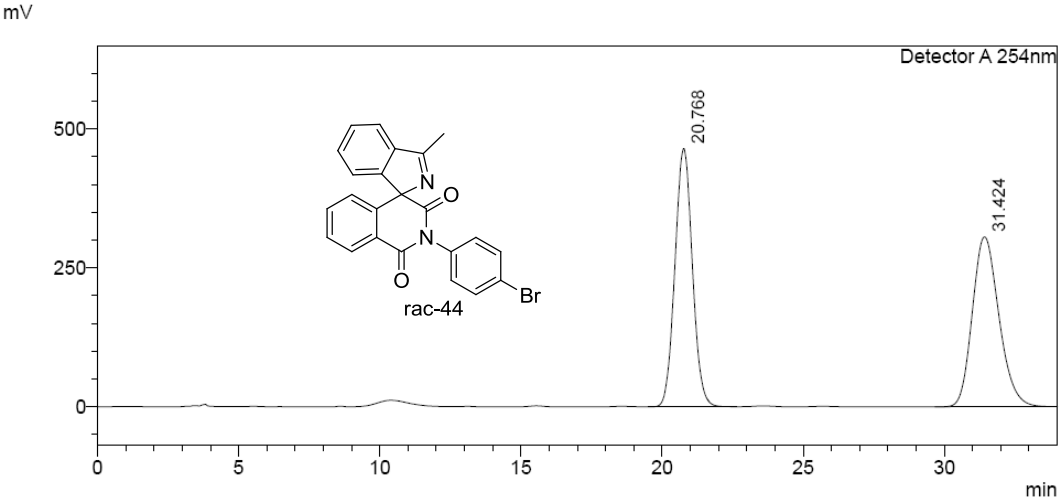
<Peak Table>

Detector A 254nm

Peak#	Ret. Time	Area	Area%	Height	Conc.	Unit	Mark
1	18.166	763402	7.082	19233	7.082		M
2	27.252	10016228	92.918	170322	92.918		
Total		10779629	100.000	189555			

44, AD-H, Hex/*i*PrOH = 70/30, rate = 1.0 mL/min, 254 nm

<Chromatogram>

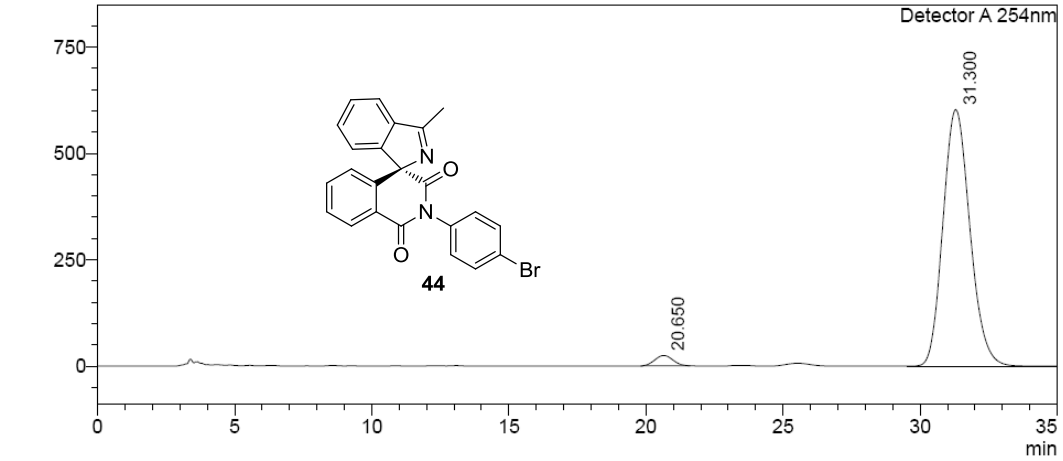


<Peak Table>

Detector A 254nm

Peak#	Ret. Time	Area	Area%	Height	Conc.	Unit	Mark
1	20.768	20010917	49.958	465193	49.958		
2	31.424	20044169	50.042	305888	50.042		
Total		40055086	100.000	771081			

<Chromatogram>



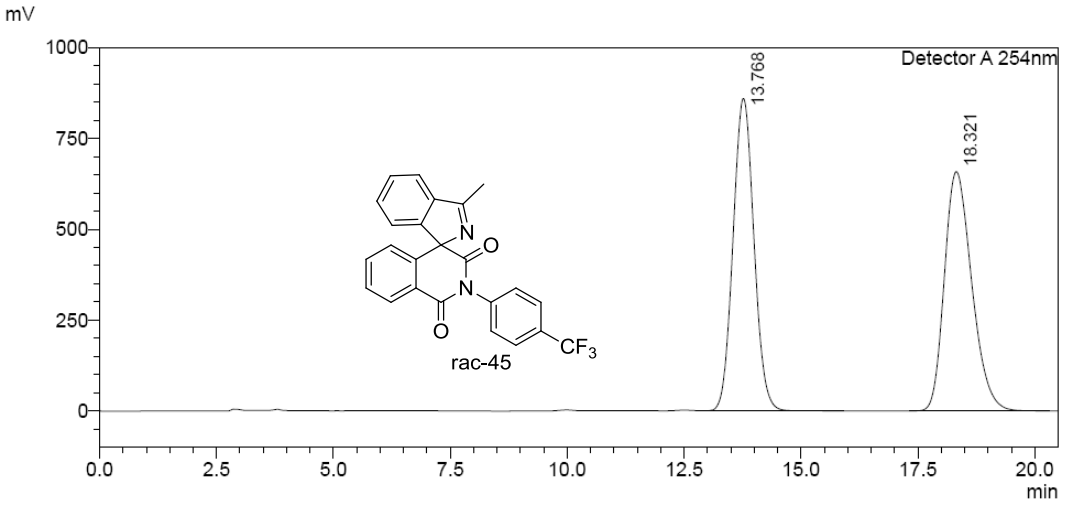
<Peak Table>

Detector A 254nm

Peak#	Ret. Time	Area	Area%	Height	Conc.	Unit	Mark
1	20.650	1117183	2.634	24524	2.634		M
2	31.300	41295591	97.366	603366	97.366		
Total		42412773	100.000	627890			

45, AD-H, Hex/*i*PrOH = 70/30, rate = 1.0 mL/min, 254 nm

<Chromatogram>

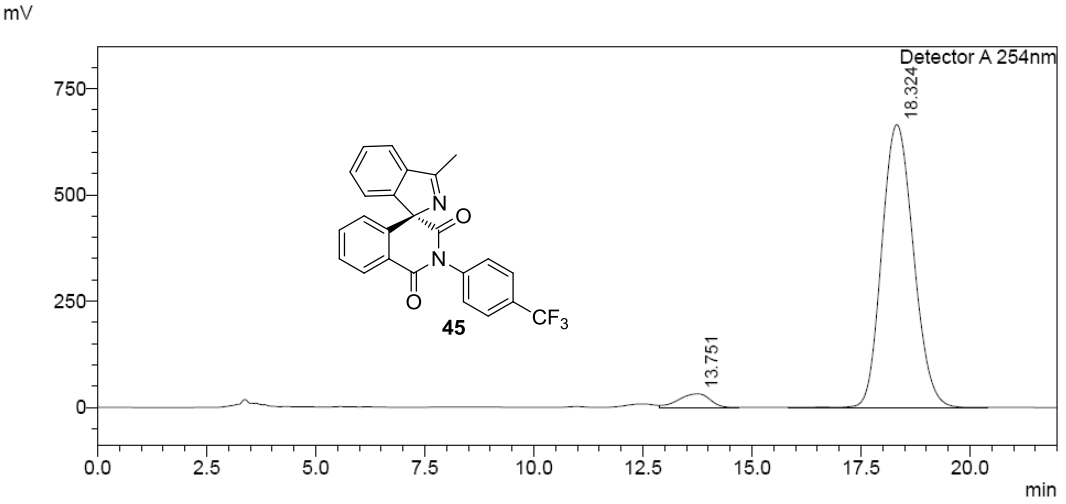


<Peak Table>

Detector A 254nm

Peak#	Ret. Time	Area	Area%	Height	Conc.	Unit	Mark
1	13.768	26735836	49.962	859241	49.962		
2	18.321	26776525	50.038	657818	50.038		
Total		53512361	100.000	1517060			

<Chromatogram>



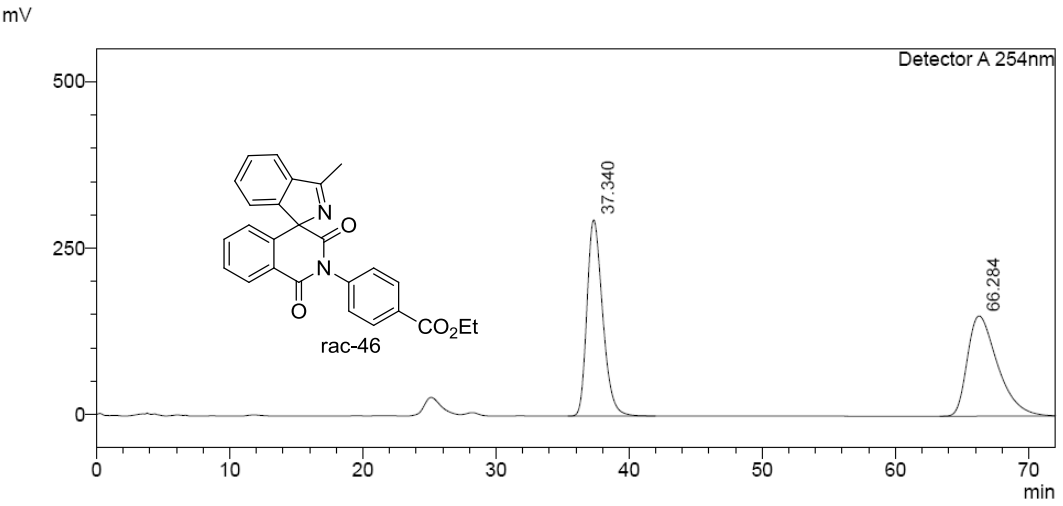
<Peak Table>

Detector A 254nm

Peak#	Ret. Time	Area	Area%	Height	Conc.	Unit	Mark
1	13.751	1627334	4.608	32459	4.608		
2	18.324	33688955	95.392	665969	95.392		
Total		35316290	100.000	698428			

46, AD-H, Hex/*i*PrOH = 70/30, rate = 1.0 mL/min, 254 nm

<Chromatogram>

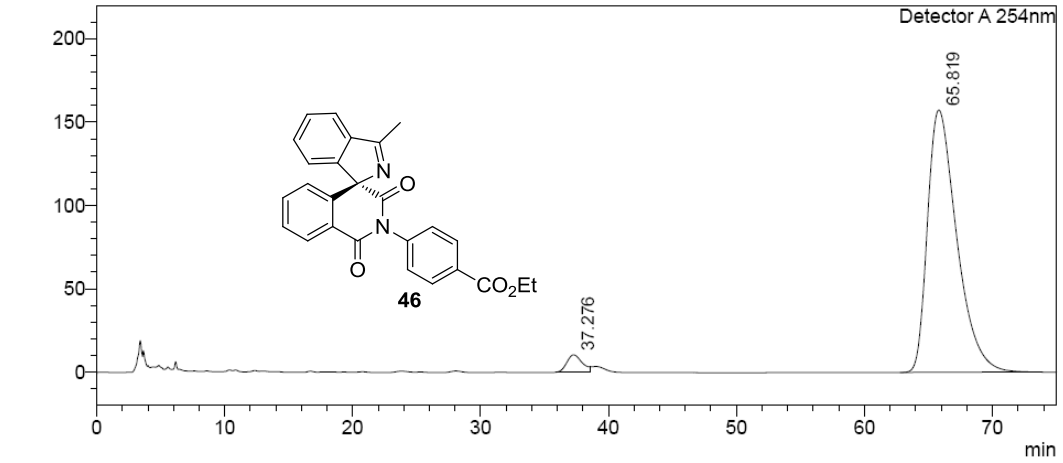


<Peak Table>

Detector A 254nm

Peak#	Ret. Time	Area	Area%	Height	Conc.	Unit	Mark
1	37.340	24125496	50.342	294631	50.342		S
2	66.284	23797713	49.658	150543	49.658		
Total		47923208	100.000	445174			

<Chromatogram>



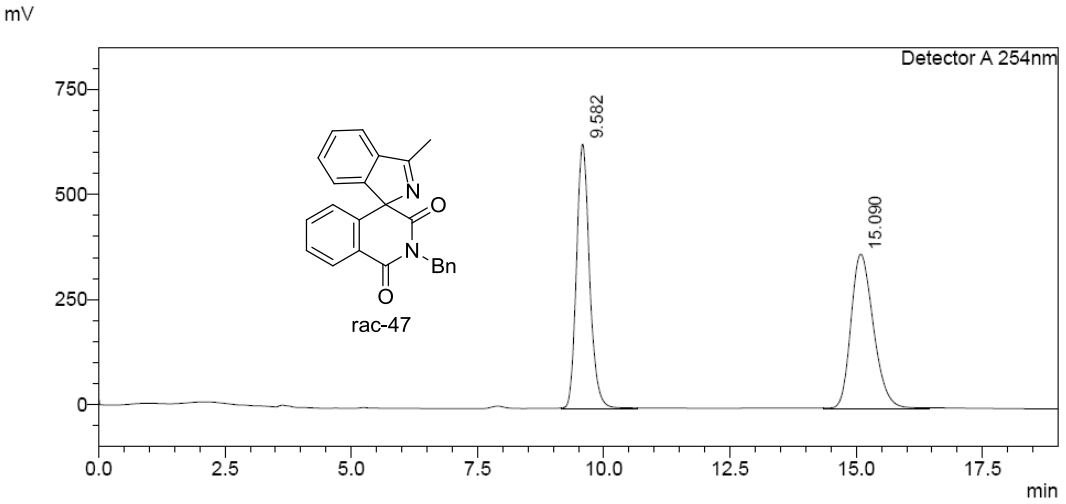
<Peak Table>

Detector A 254nm

Peak#	Ret. Time	Area	Area%	Height	Conc.	Unit	Mark
1	37.276	879397	3.392	10443	3.392		M
2	65.819	25049690	96.608	157399	96.608		
Total		25929088	100.000	167841			

47, AD-H, Hex/*i*PrOH = 70/30, rate = 1.0 mL/min, 254 nm

<Chromatogram>

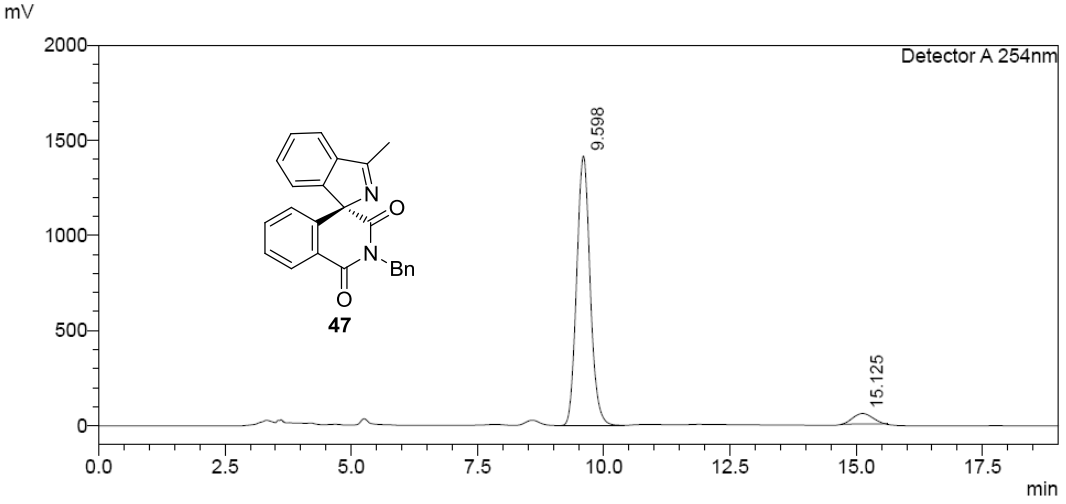


<Peak Table>

Detector A 254nm

Peak#	Ret. Time	Area	Area%	Height	Conc.	Unit	Mark
1	9.582	11424752	49.712	630027	49.712		M
2	15.090	11557287	50.288	368124	50.288		M
Total		22982039	100.000	998151			

<Chromatogram>



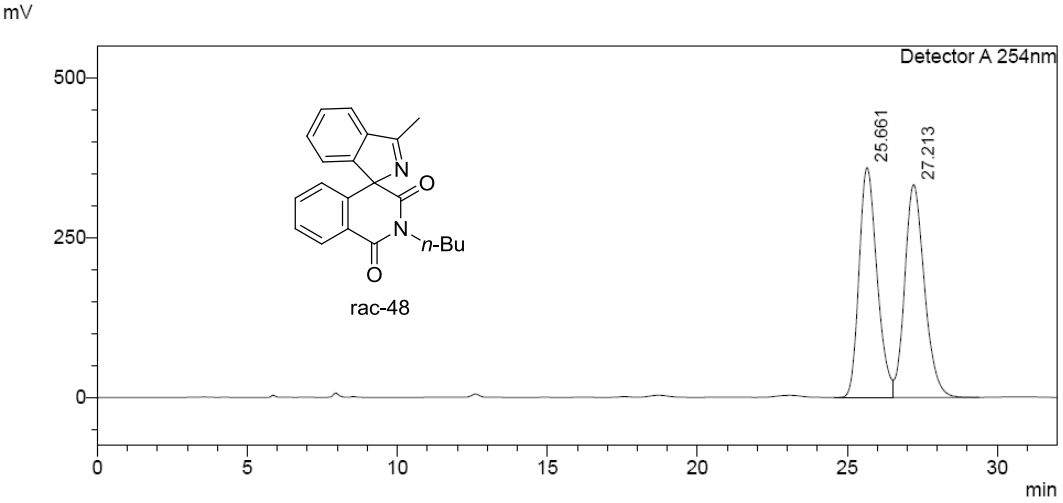
<Peak Table>

Detector A 254nm

Peak#	Ret. Time	Area	Area%	Height	Conc.	Unit	Mark
1	9.598	26501742	94.762	1418387	94.762		
2	15.125	1465025	5.238	54794	5.238		M
Total		27966767	100.000	1473181			

48, AD-H, Hex/*i*PrOH = 95/5, rate = 1.0 mL/min, 254 nm

<Chromatogram>

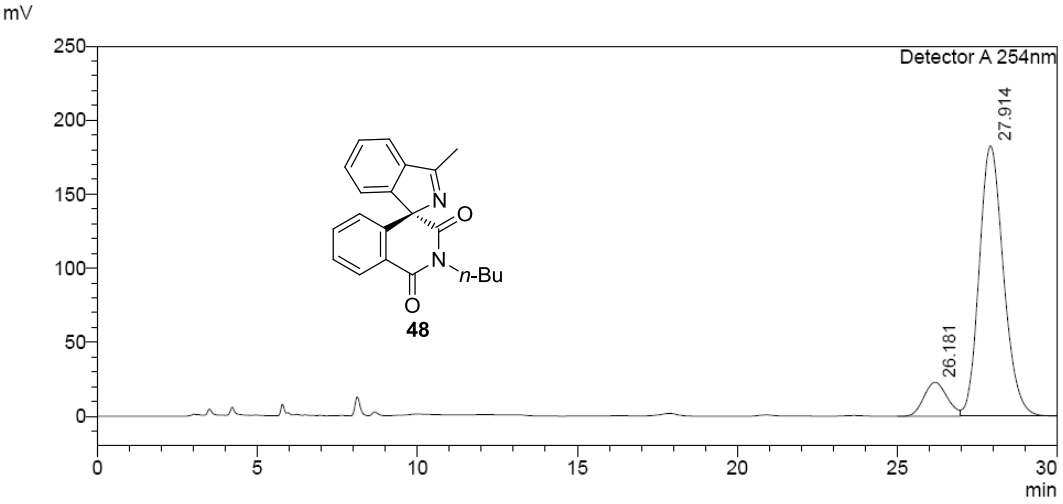


<Peak Table>

Detector A 254nm

Peak#	Ret. Time	Area	Area%	Height	Conc.	Unit	Mark
1	25.661	14976638	49.583	359265	49.583		
2	27.213	15228706	50.417	332585	50.417		V
Total		30205344	100.000	691850			

<Chromatogram>



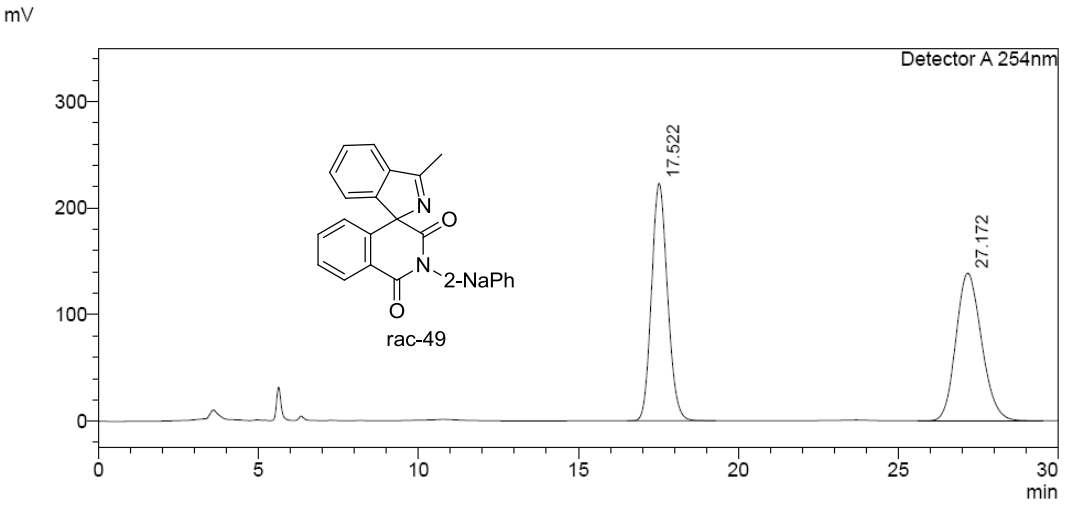
<Peak Table>

Detector A 254nm

Peak#	Ret. Time	Area	Area%	Height	Conc.	Unit	Mark
1	26.181	1160520	10.733	22960	10.733		
2	27.914	9652234	89.267	182645	89.267		SV
Total		10812754	100.000	205605			

49, AD-H, Hex/*i*PrOH = 60/40, rate = 1.0 mL/min, 254 nm

<Chromatogram>

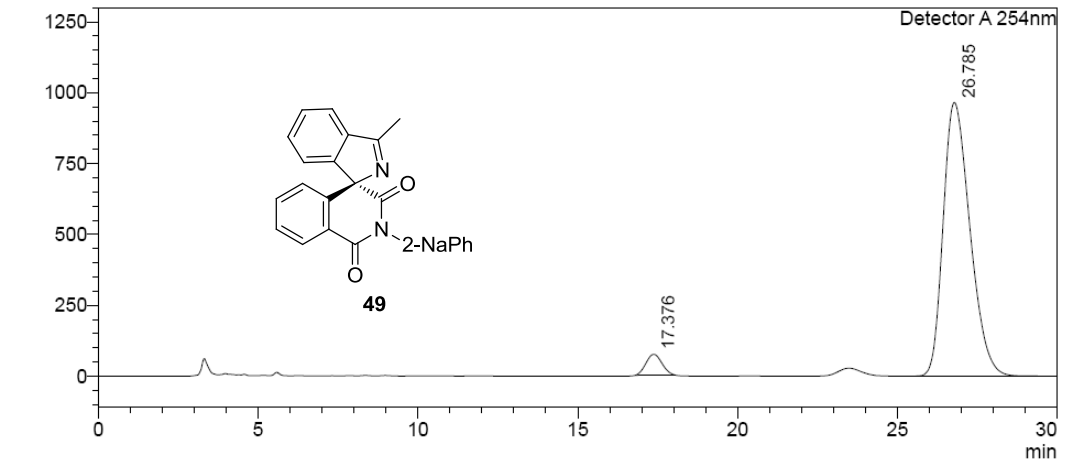


<Peak Table>

Detector A 254nm

Peak#	Ret. Time	Area	Area%	Height	Conc.	Unit	Mark
1	17.522	7749880	50.079	222760	50.079		
2	27.172	7725396	49.921	138568	49.921		
Total		15475276	100.000	361329			

<Chromatogram>



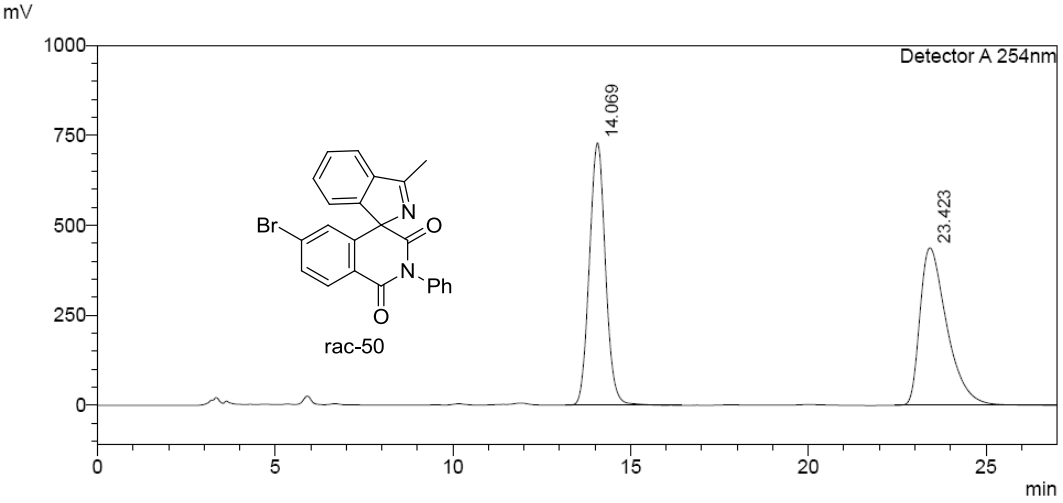
<Peak Table>

Detector A 254nm

Peak#	Ret. Time	Area	Area%	Height	Conc.	Unit	Mark
1	17.376	2546333	4.327	73513	4.327		M
2	26.785	56297915	95.673	965134	95.673		S
Total		58844248	100.000	1038647			

50, AD-H, Hex/*i*PrOH = 70/30, rate = 1.0 mL/min, 254 nm

<Chromatogram>

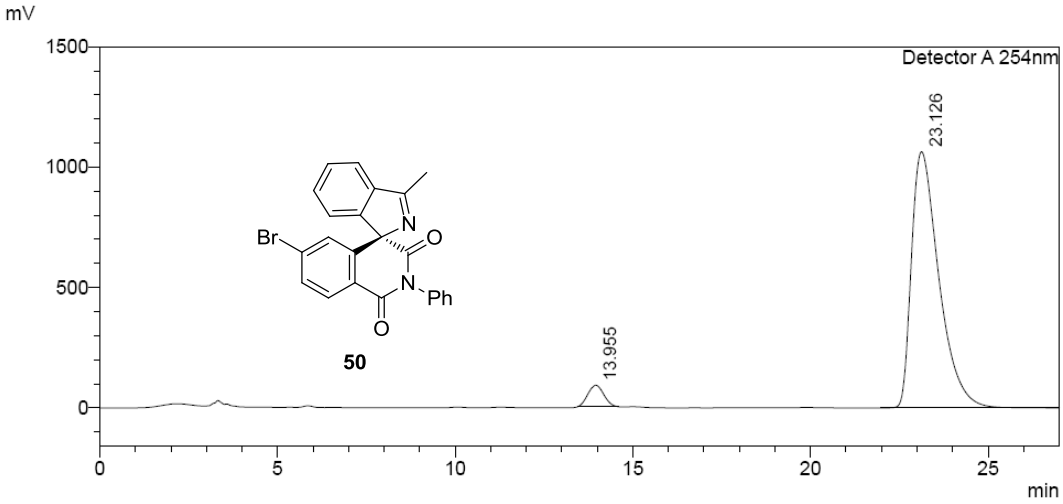


<Peak Table>

Detector A 254nm

Peak#	Ret. Time	Area	Area%	Height	Conc.	Unit	Mark
1	14.069	22941375	49.951	728923	49.951		
2	23.423	22986619	50.049	437432	50.049		S
Total		45927994	100.000	1166355			

<Chromatogram>



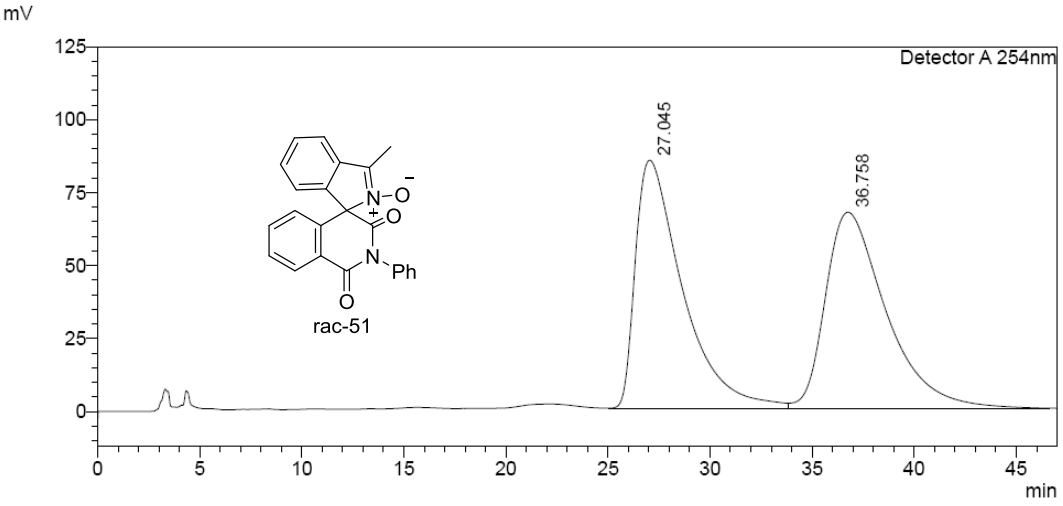
<Peak Table>

Detector A 254nm

Peak#	Ret. Time	Area	Area%	Height	Conc.	Unit	Mark
1	13.955	2778550	4.648	89033	4.648		M
2	23.126	57003046	95.352	1063254	95.352		
Total		59781597	100.000	1152287			

51, OD-H, Hex/*i*PrOH = 80/20, rate = 1.0 mL/min, 254 nm

<Chromatogram>

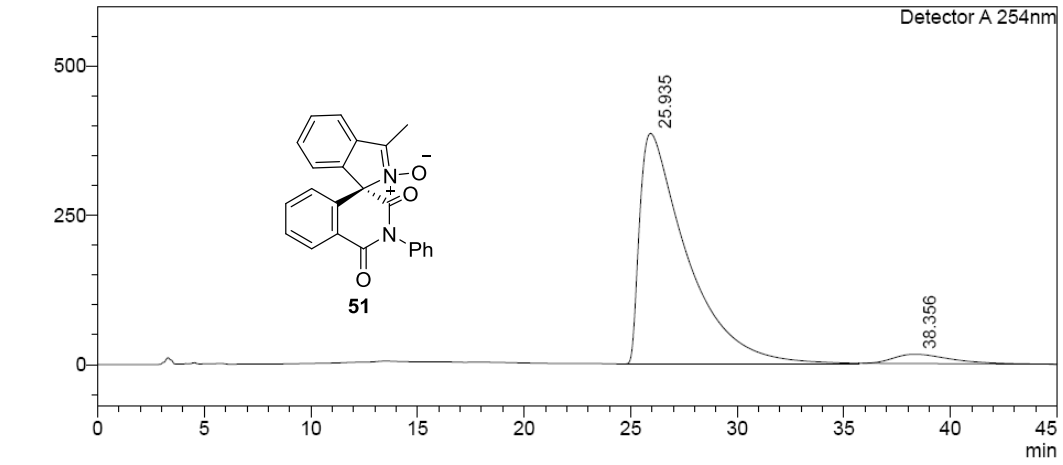


<Peak Table>

Detector A 254nm

Peak#	Ret. Time	Area	Area%	Height	Conc.	Unit	Mark
1	27.045	13639849	49.596	84930	49.596		
2	36.758	13861798	50.404	67140	50.404		SV
Total		27501648	100.000	152070			

<Chromatogram>



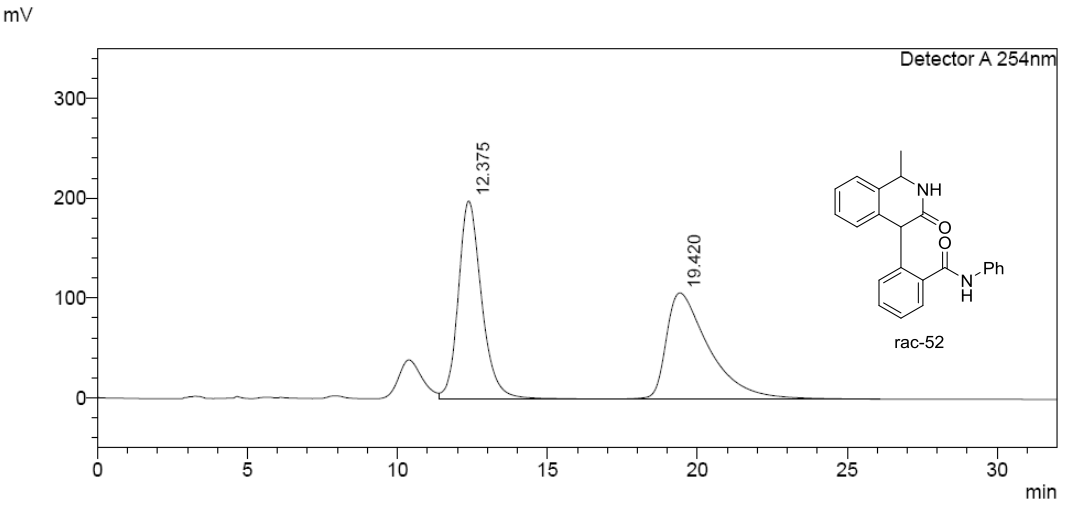
<Peak Table>

Detector A 254nm

Peak#	Ret. Time	Area	Area%	Height	Conc.	Unit	Mark
1	25.935	60036841	95.464	386203	95.464		M
2	38.356	2852547	4.536	15460	4.536		M
Total		62889388	100.000	401664			

52, OD-H, Hex/*i*PrOH = 80/20, rate = 1.0 mL/min, 254 nm

<Chromatogram>

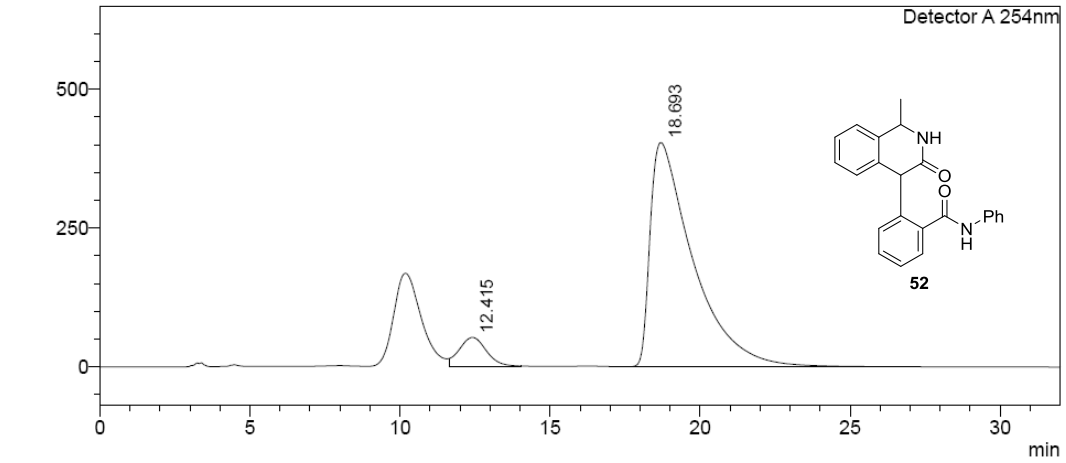


<Peak Table>

Detector A 254nm

Peak#	Ret. Time	Area	Area%	Height	Conc.	Unit	Mark
1	12.375	10681621	50.302	198021	50.302		
2	19.420	10553505	49.698	106268	49.698		S
Total		21235126	100.000	304289			

<Chromatogram>



<Peak Table>

Detector A 254nm

Peak#	Ret. Time	Area	Area%	Height	Conc.	Unit	Mark
1	12.415	3286028	7.589	52061	7.589		M
2	18.693	40011461	92.411	403668	92.411		M
Total		43297489	100.000	455730			