Electronic Supplementary Material (ESI) for Chemical Communications.

Atroposelective Construction of Axially Chiral Enamides via *N*-Allylic Alkylation

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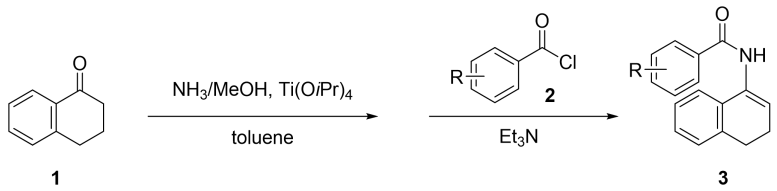
1. General Information

Unless otherwise noted, all commercial materials were purchased from Aladdin, Adamas and Energy Chemicals and used without further purification. TLC were performed on silica gel Huanghai HSGF254 plates and visualization of the developed chromatogram was performed by fluorescence quenching of UV fluorescence (λ = 254 nm). Flash chromatography was performed using Silica gel (200-300 mesh) purchased fromed Qingdao Haiyang Chemical Co. ^{1}H and ^{13}C NMR were recorded on a Bruker-DPX 400 spectrometer. Chemical shifts are reported in ppm from tetramethylsilane (TMS) with the solvent resonance as the internal standard. The following abbreviations were used to designate chemical shift multiplicities: s = singlet, d = doublet, t = triplet, q = quartet, dd = doublet of doublets, m = multiplet, br = broad. All first-order splitting patterns were assigned on the basis of the appearance of the multiplet. Splitting patterns that could not be easily interpreted are designated as multiplet (m) or broad (br). ^{19}F NMR were recorded on a Varian NMR 400 spectrometer. Mass spectra were obtained using electrospray ionization (ESI) mass spectrometer.

2. General Procedure for the Synthesis of Prochiral Enamides

General procedure I

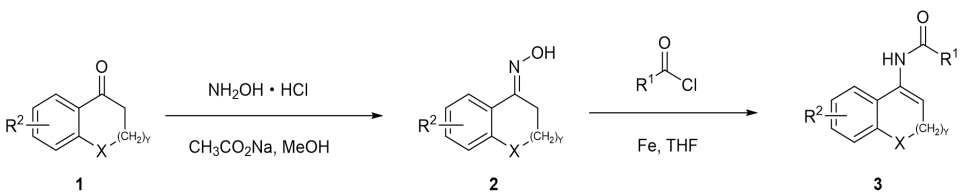


To a dry round bottom flask equipped with a football shaped magnetic stir bar was charged tetralone (10 mmol, 1.0 equiv) and toluene (6 mL). The flask was sealed with a rubber septum and a nitrogen inlet needle was inserted in the septum. The resultant solution was stirred and cooled in an ice/water bath. To the resultant cold stirring solution was added 7N NH_3 in MeOH (15.0 mmol, 1.5 equiv) followed by dropwise addition of Ti(O*i*-Pr)$_4$ (20.0 mmol, 2.0 equiv). After 10 min, the ice/water cooling bath was removed, and the solution was stirred at rt for 18-24 h. After that the reaction mixture was then cooled in an ice/water bath (~5 °C) and treated with Et_3N (40.0 mmol, 4.0 equiv) followed by acyl chloride (20.0 mmol, 2.0 equiv). The cooling bath was then removed and the solution was stirred at rt for 1-3 h. The reaction mixture was extracted with DCM and evaporated *in vacuo.* The desired product was obtained by flash column chromatography on silica gel with hexane/EtOAc as the eluent.[1]

General procedure II

In a round-bottomed flask, ketoximes (10 mmol, 1.0 equiv), acid anhydride (25 mmol, 2.5 equiv), KI (12 mmol, 1.2 equiv), and CuI (1 mmol, 10 mol%) were stirred in 1,2-dichloroethane at 120 °C under an argon atmosphere. After completion of the reaction (detected by TLC), the reaction mixture was cooled to room temperature, extracted with ethyl acetate, and washed with brine. The organic layer was dried over anhydrous Na_2SO_4 and evaporated *in vacuo*. The desired iodoenamide was obtained by flash column chromatography on silica gel with hexane/EtOAc as the eluent.[2]

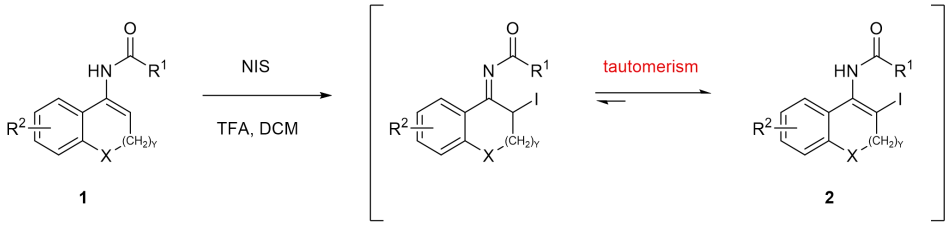
General procedure III



To a solution of ketone **1** (10 mmol, 1.0 equiv) in MeOH (25 ml) was added hydroxylamine hydrochloride (12 mmol, 1.2 equiv) and sodium acetate (12 mmol, 1.2 equiv) and this solution was

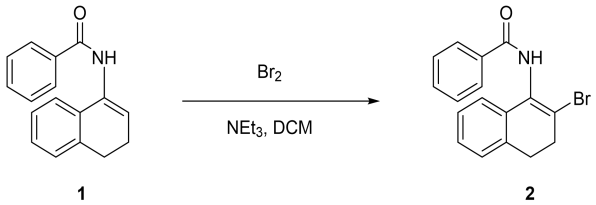
heated at 65 °C for 2 h. After this time, the solution was allowed to cool and water and EtOAc were added. The layers were separated and the aqueous layer extracted with further EtOAc. The combined organics were washed with brine, dried (Na_2SO_4) and evaporated *in vacuo*. This crude residue was directly dissolved in THF (50 ml) and iron powder (50.0 mmol, 5.0 equiv) and benzoyl chloride (80 mmol, 8.0 equiv) were added. The reaction was stirred at rt for overnight before addition of saturated $NaHCO_3$ solution. This was extracted twice with ethyl acetate and the organic layer was washed with brine, dried (Na_2SO_4) and evaporated *in vacuo*. The crude residue was purified by flash column chromatography to give the product **3**.[3,4]

General procedure IV



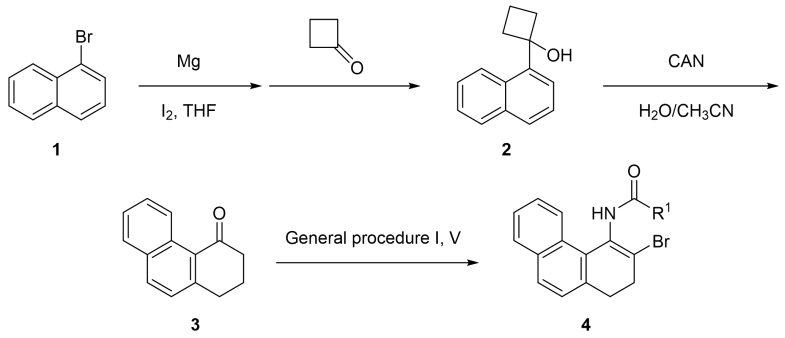
Compound **1** (1.0 equiv) was added to a solution of NIS (1.2 equiv) in 2% TFA in CH_2Cl_2 and stirred at room temperature for overnight. The mixture was cooled in an ice bath to stir for a further hour before triethylamine was added slowly. The mixture was concentrated and taken up in CH_2Cl_2, washed with 1 M $KHSO_4$, water and brine before concentrating and running down a column of silica to obtain the target product **2**.

General procedure V



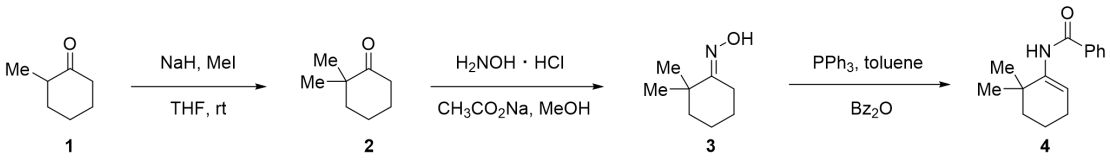
To a solution of N-(3,4-dihydronaphthalen-1-yl)benzamide (1.0 equiv) in CH_2Cl_2 was added dropwise bromine (1.1 equiv) at 0 °C. The reaction mixture was stirred for 5 min at 0 °C, subsequently triethylamine (2.2 equiv) was added and stirred for 5 min at 0 °C. The resulting mixture was extracted with EtOAc, and washed with saturated $NaHSO_3$ solution. The combined organic layer was dried (Na_2SO_4) and concentrated *in vacuo*. The crude residue was purified by flash column chromatography to give the target compound.[5]

General procedure VI



To a two-neck round bottom flask was added crushed magnesium (1.65 equiv), a small crystal of I_2 and THF. While stirring, the appropriate aryl bromide (1.5 equiv) was added via a syringe. After introduced aryl bromide, the mixture was heated to reflux in an oil bath under argon atmosphere for 1 hour and cooled down until room temperature. Cyclobutanone (1.0 equiv) dissolved in THF was added dropwise to the Grignard solution under argon at 0 ℃, and the reaction mixture was stirred for overnight at room temperature. When cyclobutanone were completely consumed, the mixture was quenched with NH_4Cl (aq.). The aqueous layer was extracted with ethyl acetate. The combined organic layers were dried over anhydrous Na_2SO_4, filtered and concentrated under reduced pressure. After removal of the solvent *in vacuo*, the crude material was purified by flash column chromatography on silica gel to give the desired product **2**. A solution of 1-(naphthalen-1-yl) cyclobutan-1-ol (1.0 equiv) in a water–acetonitrile mixture was stirred in an open reactorat at 0 °C for 60 s. Subsequently, CAN was added and the mixture was stirred at 0 °C for 60 s. Then, saturated sodium thiosulfate was added to quench the reaction. Followed, the reaction mixture was extracted with ethyl acetate. Afterwards, the combined organic phase was dried with sodium sulphate anhydrous, and the solvent was evaporated *in vacuo*. The residue was purified by flash column chromatography on silica gel to yield the pure product **3**. The desired compound **4** was acquired from 2,3-dihydrophenanthren-4(1H)-one through general procedure I and V.[6]

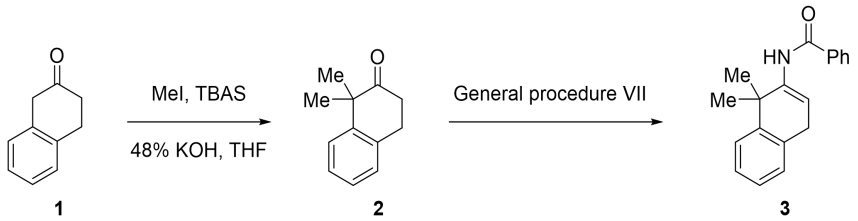
General procedure VII



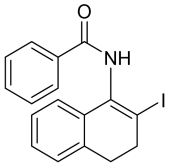
A flame-dried two-neck round-bottom flask equipped with stir bar and reflux condenser was charged with NaH (1.1 equiv) and THF under Ar. 2-methylcyclohexan-1-one (1.0 equiv) was added and the reaction mixture was refluxed for 1.5 h. HMDS (0.15 equiv) was added and the solution was refluxed for another 15 min. The reaction mixture was cooled to 0 °C and MeI (1.1 equiv) was added dropwise. After addition was complete, the reaction mixture was allowed to reach room temperature and then it was stirred for 3 h. The reaction mixture was evaporated at 20 ℃ to remove the solvent. Then to the residue added hydroxylamine hydrochloride, sodium acetate and methanol directly. The reaction mixture was refluxed for about three hours to afford the desired product **3** by flash column chromatography on silica gel. The solution of the above oxime (1.0 equiv) in toluene was purged with N_2 for 30 min. PPh_3 (1.2 equiv) in toluene was charged at room temperature. After stirring for 10 min, benzoic anhydride (1.2 equiv) was added and the reaction heated to reflux. After 16 h, the reaction mixture was cooled to room temperature and concentrated in vacuo. The residue was mixed with

methanol and excess K_2CO_3. After 1 h, methanol was removed in vacuo. The residue was dissolved in EtOAc and washed with brine, concentrated and purified with flash column to afford the target white solid **4**.[7, 8]

General procedure VIII



To the mixture of β-tetralone (1.0 equiv), TBAS (0.16 equiv) and methyl iodide (3.0 equiv) in THF was rapidly added 50% KOH solution in H_2O. The reaction mixture became warm and turned blue. The reaction mixture was stirred for 30 min during which time the color changed from blue to green and finally light brown. The reaction mixture was poured into water and extracted with EtOAc. The combined organic layer was washed with sat. NH_4Cl (aq.), dried over anhydrous $MgSO_4$, filtered and evaporated to give a crude oil. The oil was purified by column chromatography using hexane and ethyl acetate as eluent to give compound **2** as a white solid. The desired product **3** was acquired from 1,1-dimethyl-3,4-dihydronaphthalen-2(1*H*)-one through general procedure VII.[9]



1b

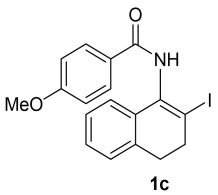
***N*-(2-iodo-3,4-dihydronaphthalen-1-yl)benzamide (1b)**

According to the general procedure III and IV, **1b** was obtained as a white solid.

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.05 – 7.89 (m, 2H), 7.60 (t, *J* = 7.3 Hz, 1H), 7.52 (dd, *J* = 8.3, 6.7 Hz, 2H), 7.37 (s, 1H), 7.24 – 7.09 (m, 4H), 3.07 – 2.87 (m, *J* = 4.4 Hz, 4H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 165.7, 136.9, 135.0, 133.8, 132.2, 130.8, 128.8, 128.1, 127.6, 127.4, 126.6, 123.3, 98.0, 37.9, 29.6.

HRMS (ESI) calcd for $[C_{17}H_{15}INO]^+$, m/z: 376.0193, found: 376.0198.



1c

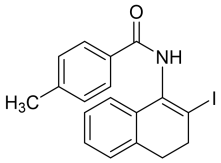
***N*-(2-iodo-3,4-dihydronaphthalen-1-yl)-4-methoxybenzamide (1c)**

According to the general procedure III and IV, **1c** was obtained as a white solid.

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.96 (d, *J* = 8.4 Hz, 2H), 7.32 (s, 1H), 7.25 – 7.13 (m, 4H), 7.02 (d, *J* = 8.4 Hz, 2H), 3.91 (s, 3H), 3.00 (q, *J* = 4.6 Hz, 4H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 165.2, 162.8, 137.1, 135.0, 130.9, 129.4, 128.0, 127.5, 126.6, 126.0, 123.4, 114.0, 97.6, 55.5, 37.9, 29.6.

HRMS (ESI) calcd for $[C_{18}H_{17}INO_2]^+$, m/z: 406.0298, found: 406.0306.



1d

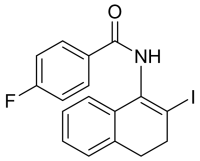
***N*-(2-iodo-3,4-dihydronaphthalen-1-yl)-4-methylbenzamide (1d)**

According to the general procedure III and IV, **1d** was obtained as a white solid.

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.89 (d, *J* = 7.9 Hz, 2H), 7.38 (s, 1H), 7.33 (d, *J* = 7.8 Hz, 2H), 7.25 – 7.12 (m, 4H), 3.09 – 2.92 (m, 4H), 2.47 (s, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 165.6, 142.7, 137.0, 135.0, 131.0, 130.8, 129.5, 128.0, 127.5, 127.5, 126.6, 123.4, 97.8, 37.9, 29.6, 21.6.

HRMS (ESI) calcd for $[C_{18}H_{17}INO]^+$, m/z: 390.0349, found: 390.0358.



1e

4-fluoro-*N*-(2-iodo-3,4-dihydronaphthalen-1-yl)benzamide (1e)

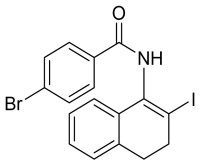
According to the general procedure III and IV, **1e** was obtained as a white solid.

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.96 (dd, *J* = 8.4, 5.2 Hz, 2H), 7.37 (s, 1H), 7.22 – 7.13 (m, 6H), 3.08 – 2.85 (m, 4H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 164.7, 163.9, 136.8, 135.0, 130.7, 129.9 (d, *J* = 9.2 Hz), 128.2, 127.6, 126.7, 123.2, 115.9 (d, *J* = 22.0 Hz), 98.3, 37.9, 29.5.

^{19}F NMR (376 MHz, $CDCl_3$) δ -106.96.

HRMS (ESI) calcd for $[C_{17}H_{14}FINO]^+$, m/z: 394.0099, found: 394.0107.



1f

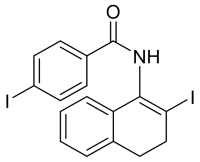
4-bromo-*N*-(2-iodo-3,4-dihydronaphthalen-1-yl)benzamide (1f)

According to the general procedure III and IV, **1f** was obtained as a white solid.

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.85 (d, *J* = 8.1 Hz, 2H), 7.67 (t, *J* = 6.7 Hz, 2H), 7.37 (s, 1H), 7.25 – 7.16 (m, 4H), 3.21 – 2.90 (m, 4H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 164.8, 136.7, 135.0, 132.6, 132.1, 131.9, 130.6, 129.0, 128.2, 127.6, 126.7, 123.2, 98.3, 37.9, 29.5.

HRMS (ESI) calcd for $[C_{17}H_{14}BrINO]^+$, m/z: 453.9298, found: 453.9299.



1g

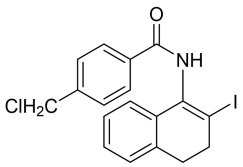
4-iodo-*N*-(2-iodo-3,4-dihydronaphthalen-1-yl)benzamide (1g)

According to the general procedure III and IV, **1g** was obtained as a white solid.

^{1}H NMR (400 MHz, DMSO-d_6) δ 9.93 (s, 1H), 7.94 (d, *J* = 8.1 Hz, 2H), 7.79 (d, *J* = 8.1 Hz, 2H), 7.26 – 7.13 (m, 3H), 7.09 (d, *J* = 7.5 Hz, 1H), 2.96 (d, *J* = 7.6 Hz, 2H), 2.90 (d, *J* = 7.7 Hz, 2H).

^{13}C NMR (101 MHz, DMSO-d_6) δ 164.8, 137.8, 137.4, 135.3, 133.9, 132.3, 130.0, 128.3, 127.9, 127.0, 123.3, 101.7, 99.9, 37.9, 29.3.

HRMS (ESI) calcd for $[C_{17}H_{13}I_2NNaO]^+$, m/z: 523.8979, found: 523.8986.



1h

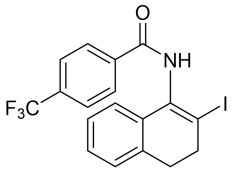
4-(chloromethyl)-*N*-(2-iodo-3,4-dihydronaphthalen-1-yl)benzamide (1h)

According to the general procedure I and IV, **1h** was obtained as a white solid.

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.03 (d, *J* = 6.1 Hz, 2H), 7.68 – 7.54 (m, 2H), 7.49 (s, 1H), 7.24 (s, 4H), 4.72 (s, 2H), 3.05 (s, 4H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 165.1, 141.5, 136.8, 135.0, 133.8, 130.7, 128.9, 128.1, 127.9, 127.6, 126.7, 123.3, 98.3, 45.4, 37.9, 29.5.

HRMS (ESI) calcd for $[C_{18}H_{16}ClINO]^+$, m/z: 423.9960, found: 423.9966.



1i

***N*-(2-iodo-3,4-dihydronaphthalen-1-yl)-4-(trifluoromethyl)benzamide (1i)**

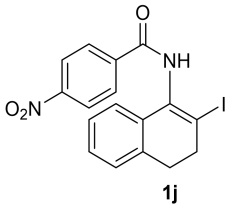
According to the general procedure III and IV, **1i** was obtained as a white solid.

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.09 (d, *J* = 7.9 Hz, 2H), 7.77 (d, *J* = 8.0 Hz, 2H), 7.49 (s, 1H), 7.26 – 6.89 (m, 4H), 3.20 – 2.81 (m, 4H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 164.5, 137.1, 136.6, 135.0, 130.6, 128.3, 127.9, 127.7, 126.7, 125.9 (q, *J* = 3.5 Hz), 123.1, 98.8, 37.9, 29.5.

^{19}F NMR (376 MHz, $CDCl_3$) δ -62.97.

HRMS (ESI) calcd for $[C_{18}H_{14}F_3INO]^+$, m/z: 444.0067, found: 444.0077.



1j

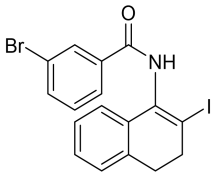
***N*-(2-iodo-3,4-dihydronaphthalen-1-yl)-4-nitrobenzamide (1j)**

According to the general procedure I and IV, **1j** was obtained as a white solid.

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.33 (d, *J* = 8.4 Hz, 2H), 8.11 (d, *J* = 8.3 Hz, 2H), 7.48 (s, 1H), 7.25 – 7.09 (m, 4H), 3.04 – 2.94 (m, 4H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 163.8, 150.0, 139.3, 136.4, 135.0, 130.4, 128.6, 128.4, 127.8, 126.7, 124.0, 123.0, 99.1, 37.9, 29.5.

HRMS (ESI) calcd for $[C_{17}H_{14}IN_2O_3]^+$, m/z: 421.0044, found: 421.0045.



1k

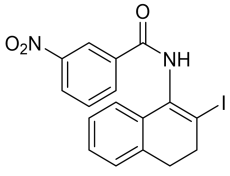
3-bromo-*N*-(2-iodo-3,4-dihydronaphthalen-1-yl)benzamide (1k)

According to the general procedure III and IV, **1k** was obtained as a white solid.

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.19 (s, 1H), 7.97 (d, *J* = 7.9 Hz, 1H), 7.80 (d, *J* = 8.0 Hz, 1H), 7.46 (dd, *J* = 17.7, 9.8 Hz, 2H), 7.31 – 7.22 (m, 4H), 3.12 – 3.02 (m, 4H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 164.3, 136.6, 135.8, 135.1, 135.0, 130.7, 130.6, 130.4, 128.2, 127.6, 126.7, 125.9, 123.2, 123.0, 98.6, 37.9, 29.5.

HRMS (ESI) calcd for $[C_{17}H_{14}BrINO]^+$, m/z: 453.9298, found: 453.9306.



1l

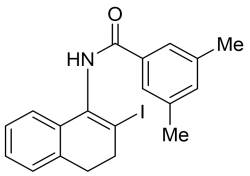
***N*-(2-iodo-3,4-dihydronaphthalen-1-yl)-3-nitrobenzamide (1l)**

According to the general procedure III and IV, **1l** was obtained as a white solid.

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.82 (s, 1H), 8.46 (d, *J* = 8.6 Hz, 1H), 8.33 (d, *J* = 7.7 Hz, 1H), 7.74 (t, *J* = 7.9 Hz, 1H), 7.51 (s, 1H), 7.27 – 7.08 (m, 4H), 3.06 – 2.96 (m, 4H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 163.4, 148.4, 136.4, 135.0, 133.5, 130.5, 130.2, 128.4, 127.7, 126.7, 126.7, 123.0, 122.3, 99.1, 37.9, 29.5.

HRMS (ESI) calcd for $[C_{17}H_{14}IN_2O_3]^+$, m/z: 421.0044, found: 421.0046.



1m

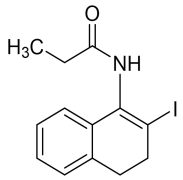
***N*-(2-iodo-3,4-dihydronaphthalen-1-yl)-3,5-dimethylbenzamide (1m)**

According to the general procedure I and IV, **1m** was obtained as a white solid.

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.55 (s, 2H), 7.30 (s, 1H), 7.22 – 7.08 (m, 5H), 3.11 – 2.78 (m, *J* = 4.4 Hz, 4H), 2.39 (s, 6H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 166.0, 138.6, 137.0, 135.0, 133.8, 133.8, 130.8, 128.0, 127.5, 126.6, 125.2, 123.4, 98.0, 37.9, 29.6, 21.3.

HRMS (ESI) calcd for $[C_{19}H_{18}INNaO]^+$, m/z: 426.0325, found: 426.0325.



1n

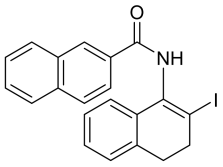
***N*-(2-iodo-3,4-dihydronaphthalen-1-yl) propionamide (1n)**

According to the general procedure II, **1n** was obtained as a white solid.

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.25 – 7.04 (m, 4H), 6.68 (s, 1H), 3.04 – 2.86 (m, 4H), 2.45 (q, *J* = 7.2 Hz, 2H), 1.30 (t, *J* = 7.4 Hz, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 172.3, 136.8, 135.0, 130.9, 128.0, 127.5, 126.6, 123.2, 98.2, 37.9, 30.0, 29.5, 9.9.

HRMS (ESI) calcd for $[C_{13}H_{14}INNaO]^+$, m/z: 350.0012, found: 350.0017.



1o

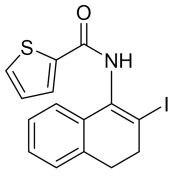
***N*-(2-iodo-3,4-dihydronaphthalen-1-yl)-2-naphthamide (1o)**

According to the general procedure I and IV, **1o** was obtained as a white solid.

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.49 (s, 1H), 8.04 – 7.84 (m, 4H), 7.57 (p, *J* = 6.8 Hz, 3H), 7.27 – 7.05 (m, 4H), 3.18 – 2.72 (m, *J* = 4.2 Hz, 4H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 165.8, 137.0, 135.1, 135.0, 132.6, 131.0, 130.9, 129.1, 128.8, 128.1, 128.0, 127.8, 127.6, 126.9, 126.7, 123.8, 123.4, 98.2, 37.9, 29.6.

HRMS (ESI) calcd for $[C_{21}H_{16}INNaO]^+$, m/z: 448.0169, found: 448.0186.



1p

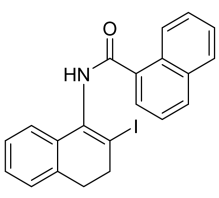
***N*-(2-iodo-3,4-dihydronaphthalen-1-yl)thiophene-2-carboxamide (1p)**

According to the general procedure III and IV, **1p** was obtained as a white solid.

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.75 (d, *J* = 3.7 Hz, 1H), 7.59 (d, *J* = 5.0 Hz, 1H), 7.32 – 7.14 (m, 4H), 3.26 – 2.68 (m, 4H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 160.1, 138.0, 136.6, 135.0, 131.0, 130.8, 129.4, 128.1, 127.9, 127.5, 126.7, 123.4, 98.2, 37.9, 29.5.

HRMS (ESI) calcd for $[C_{15}H_{12}INNaOS]^+$, m/z: 403.9576, found: 403.9583.



1q

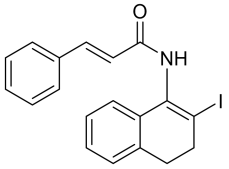
***N*-(2-iodo-3,4-dihydronaphthalen-1-yl)-2-naphthamide (1q)**

According to the general procedure I and IV, **1q** was obtained as a white solid.

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.58 (d, *J* = 8.1 Hz, 1H), 8.00 (dd, *J* = 7.2, 4.0 Hz, 2H), 7.92 (d, *J* = 7.7 Hz, 1H), 7.67 – 7.51 (m, 3H), 7.43 – 7.34 (m, 1H), 7.32 – 7.15 (m, 4H), 3.02 (dt, *J* = 11.0, 5.5 Hz, 4H).

^{13}C NMR (101 MHz, $CDCl_3$) δ167.6, 136.7, 135.1, 133.9, 133.4, 131.5, 131.0, 130.5, 128.4, 128.2, 127.7, 127.4, 126.8, 126.6, 125.8, 125.5, 124.7, 123.1, 99.2, 38.1, 29.6.

HRMS (ESI) calcd for $[C_{21}H_{16}INNaO]^+$, m/z: 448.0169, found: 448.0184.



1r

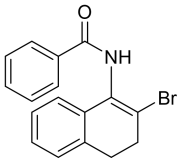
***N*-(2-iodo-3,4-dihydronaphthalen-1-yl)cinnamamide (1r)**

According to the general procedure III and IV, **1r** was obtained as a yellow solid.

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.81 (d, *J* = 15.6 Hz, 1H), 7.61 (s, 2H), 7.46 (d, *J* = 4.6 Hz, 3H), 7.38 (s, 1H), 7.28 (s, 3H), 7.18 (s, 1H), 6.73 (d, *J* = 15.6 Hz, 1H), 3.07 – 2.94 (m, 4H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 164.4, 163.9, 142.9, 136.9, 134.9, 134.6, 130.9, 130.0, 128.9, 128.1, 127.5, 126.6, 123.5, 119.8, 98.3, 37.9, 29.5.

HRMS (ESI) calcd for $[C_{19}H_{16}INNaO]^+$, m/z: 424.0169, found: 424.0179.



1s

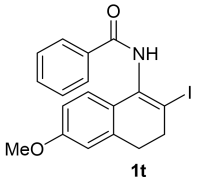
***N*-(2-bromo-3,4-dihydronaphthalen-1-yl)benzamide (1s)**

According to the general procedure III and V, **1s** was obtained as a white solid.

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.04 – 7.89 (m, 2H), 7.65 – 7.39 (m, 4H), 7.26 – 7.06 (m, 4H), 3.04 – 2.99 (m, 2H), 2.93 – 2.89 (m, 2H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 166.5, 136.9, 134.9, 131.8, 131.7, 128.8, 128.0, 127.7, 127.1, 126.6, 120.6, 119.8, 105.1, 27.7, 22.3.

HRMS (ESI) calcd for $[C_{17}H_{15}BrNO]^+$, m/z: 328.0332, found: 328.0342.



1t

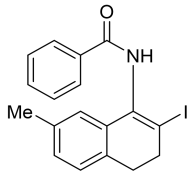
***N*-(2-iodo-6-methoxy-3,4-dihydronaphthalen-1-yl)benzamide (1t)**

According to procedure III and IV, **1t** was obtained as a white solid.

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.95 (d, *J* = 7.5 Hz, 2H), 7.57 (t, *J* = 7.2 Hz, 1H), 7.49 (t, *J* = 7.5 Hz, 2H), 7.33 (s, 1H), 7.10 (d, *J* = 8.5 Hz, 1H), 6.75 – 6.56 (m, 2H), 3.77 (s, 3H), 2.97 – 2.89 (m, 4H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 165.6, 159.4, 136.9, 136.6, 133.9, 132.1, 128.8, 127.4, 124.9, 124.0, 113.8, 111.2, 94.1, 55.3, 37.7, 30.0.

HRMS (ESI) calcd for $[C_{18}H_{17}INO_2]^+$, m/z: 406.0298, found: 406.0312.



1u

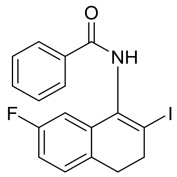
***N*-(2-iodo-7-methyl-3,4-dihydronaphthalen-1-yl)benzamide (1u)**

According to the general procedure I and IV, **1u** was obtained as a white solid.

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.23 (d, *J* = 7.4 Hz, 2H), 7.89 – 7.71 (m, 3H), 7.62 (s, 1H), 7.33 – 7.16 (m, 3H), 3.19 (dq, *J* = 13.8, 6.8 Hz, 4H), 2.51 (s, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 165.7, 136.9, 136.1, 133.9, 132.2, 132.0, 130.7, 128.8, 128.8, 127.5, 123.9, 98.5, 38.2, 29.2, 21.3.

HRMS (ESI) calcd for $[C_{18}H_{16}INNaO]^+$, m/z: 412.0169, found: 412.0171.



1v

***N*-(7-fluoro-2-iodo-3,4-dihydronaphthalen-1-yl)benzamide (1v)**

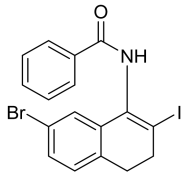
According to the general procedure III and IV, **1v** was obtained as a white solid.

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.96 (d, *J* = 7.6 Hz, 2H), 7.59 (t, *J* = 7.4 Hz, 1H), 7.51 (t, *J* = 7.7 Hz, 2H), 7.41 (s, 1H), 7.08 (t, *J* = 6.9 Hz, 1H), 6.89 (d, *J* = 10.5 Hz, 2H), 3.13 – 2.74 (m, 4H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 165.8, 161.8 (d, *J* = 243.2 Hz), 136.4, 133.5, 132.3, 130.5 (d, *J* = 2.7 Hz), 128.9, 128.8 (d, *J* = 8.1 Hz), 127.6, 127.4, 114.5 (d, *J* = 21.5 Hz), 110.7 (d, *J* = 23.9 Hz), 99.9, 38.1, 28.8.

^{19}F NMR (376 MHz, $CDCl_3$) δ -115.95.

HRMS (ESI) calcd for $[C_{17}H_{13}FINNaO]^+$, m/z: 415.9918, found: 415.9926.



1w

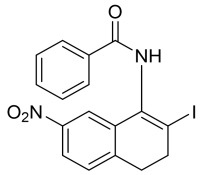
***N*-(7-bromo-2-iodo-3,4-dihydronaphthalen-1-yl)benzamide (1w)**

According to the general procedure III and IV, **1w** was obtained as a white solid.

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.00 (d, *J* = 7.6 Hz, 2H), 7.63 (t, *J* = 7.4 Hz, 1H), 7.55 (t, *J* = 7.6 Hz, 2H), 7.40 (s, 1H), 7.33 (d, *J* = 6.9 Hz, 2H), 7.03 (d, *J* = 7.9 Hz, 1H), 3.01 (t, *J* = 7.9 Hz, 2H), 2.92 (t, *J* = 7.9 Hz, 2H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 165.7, 136.0, 133.8, 133.5, 132.7, 132.3, 130.8, 129.1, 128.9, 127.5, 126.2, 120.4, 100.0, 37.8, 29.0.

HRMS (ESI) calcd for $[C_{17}H_{14}BrINO]^+$, m/z: 453.9298, found: 453.9308.



1x

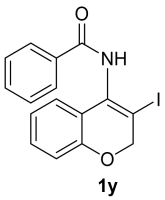
***N*-(2-iodo-7-nitro-3,4-dihydronaphthalen-1-yl)benzamide (1x)**

According to the general procedure III and IV, **1x** was obtained as a white solid.

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.08 – 7.93 (m, 4H), 7.62 (t, *J* = 7.5 Hz, 1H), 7.54 (d, *J* = 7.4 Hz, 3H), 7.28 (s, 1H), 3.04 (s, 4H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 165.9, 147.2, 142.2, 135.8, 133.2, 132.5, 132.0, 129.0, 128.4, 127.5, 122.8, 118.4, 100.4, 37.2, 29.5.

HRMS (ESI) calcd for $[C_{17}H_{13}IN_2NaO_3]^+$, m/z: 442.9863, found: 442.9863.



1y

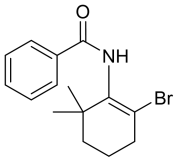
***N*-(3-iodo-2*H*-chromen-4-yl)benzamide (1y)**

According to procedure III and IV, **1y** was obtained as a white solid.

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.95 (d, *J* = 7.6 Hz, 2H), 7.60 (t, *J* = 7.3 Hz, 1H), 7.52 (t, *J* = 7.6 Hz, 2H), 7.28 (s, 1H), 7.20 (td, *J* = 7.8, 1.6 Hz, 1H), 7.13 (dd, *J* = 7.7, 1.6 Hz, 1H), 6.97 – 6.79 (m, 2H), 5.04 (s, 2H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 165.5, 153.9, 133.5, 132.4, 130.3, 129.5, 128.9, 128.3, 127.5, 123.6, 121.7, 116.3, 88.3, 74.1.

HRMS (ESI) calcd for $[C_{16}H_{13}INO_2]^+$, m/z: 377.9985, found: 377.9995.



1z

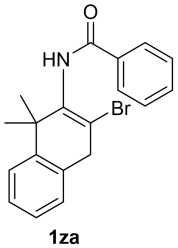
***N*-(2-bromo-6,6-dimethylcyclohex-1-en-1-yl)benzamide (1z)**

According to the general procedure VII and V, **1z** was obtained as a white solid.

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.64 (d, *J* = 8.1 Hz, 2H), 7.35 – 7.28 (m, 1H), 7.24 (t, *J* = 7.6 Hz, 2H), 6.73 (s, 1H), 2.44 (t, *J* = 6.2 Hz, 2H), 1.59 (dt, *J* = 12.0, 5.9 Hz, 2H), 1.51 – 1.39 (m, 2H), 0.93 (s, 6H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 165.8, 137.4, 134.7, 131.6, 128.6, 127.2, 123.5, 38.6, 38.0, 36.5, 27.2, 20.7.

HRMS (ESI) calcd for $[C_{15}H_{18}BrNNaO]^+$, m/z: 330.0464, found: 330.0470.



1za

***N*-(3-bromo-1,1-dimethyl-1,4-dihydronaphthalen-2-yl)benzamide (1za)**

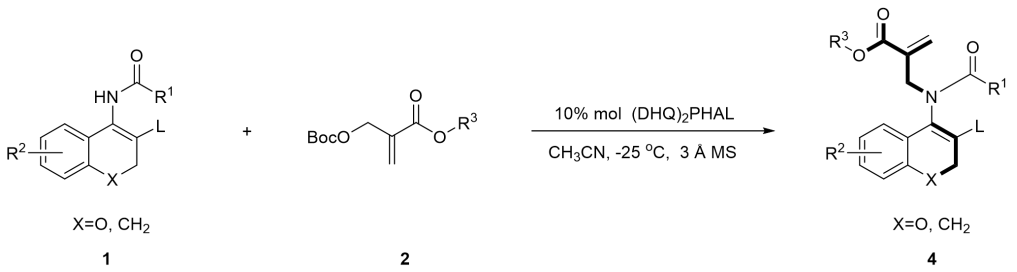
According to the general procedure VIII and V, **1za** was obtained as a yellow solid.

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.93 – 7.85 (m, 2H), 7.56 – 7.50 (m, 1H), 7.46 (dd, *J* = 8.2, 6.6 Hz, 2H), 7.36 (dd, *J* = 7.9, 1.4 Hz, 1H), 7.26 – 7.21 (m, 1H), 7.17 (td, *J* = 7.4, 1.4 Hz, 1H), 7.12 – 7.01 (m, 2H), 4.02 (d, *J* = 2.0 Hz, 2H), 1.49 (s, 6H).

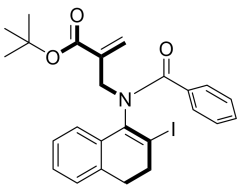
^{13}C NMR (101 MHz, $CDCl_3$) δ 166.2, 141.9, 135.7, 134.5, 131.9, 131.3, 128.7, 127.3, 127.3, 126.9, 126.4, 126.3, 120.6, 42.7, 40.1, 29.0.

HRMS (ESI) calcd for $[C_{19}H_{19}BrNO]^+$, m/z: 356.0645, found: 356.0637.

3. Experimental Procedure for the Organocatalytic Reactions



To a reaction tube equipped with a magnetic stir bar was added enamide **1** (0.10 mmol), catalyst **3g** (0.01 mmol) and 3 Å MS (40 mg). Then 1.0 mL of CH_3CN was added. When the temperature of the mixture was decreased to -25 ℃, achiral MBH carbonate **2** (0.30 mmol) was added and the reaction mixture was stirred at -25 ℃. Upon the reaction completed, the resulting crude residue was purified directly *via* column chromatography on silica gel to afford the product.



4ba

***tert*-butyl 2-((*N*-(2-iodo-3,4-dihydronaphthalen-1-yl)benzamido)methyl)acrylate (4ba)**

According to the general procedure, **4ba** was obtained in 83% yield and 96.0:4.0 er as a white solid.

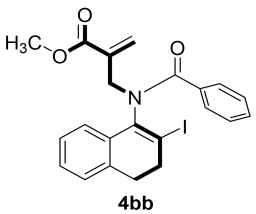
Specific rotation $[\alpha]^{25}_D$ = +36.1 (*c* = 0.5, CH_2Cl_2)

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.43 (d, *J* = 7.3 Hz, 2H), 7.24 – 7.11 (m, 4H), 7.07 (t, *J* = 7.7 Hz, 2H), 7.00 (d, *J* = 8.0 Hz, 1H), 6.30 (d, *J* = 1.7 Hz, 1H), 6.07 (d, *J* = 1.7 Hz, 1H), 4.59 (d, *J* = 14.4 Hz, 1H), 4.47 (d, *J* = 14.4 Hz, 1H), 2.81 – 2.69 (m, 2H), 2.67 – 2.57 (m, 1H), 2.53 – 2.42 (m, 1H), 1.31 (s, 9H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 170.6, 165.5, 143.2, 136.7, 136.1, 135.9, 132.5, 130.4, 130.2, 128.3, 127.8, 127.7, 127.3, 127.0, 123.8, 102.5, 80.7, 47.2, 39.0, 29.0, 28.0.

HRMS (ESI) calcd for $[C_{25}H_{26}INNaO_3]^+$, m/z: 538.0850, found: 538.0861.

HPLC analysis: Daicel Chiralpak OD-H, hexane/isopropyl alcohol = 95/5, flow rate = 1.0 mL/min, UV = 210 nm, t_R = 8.2 min (major), t_R = 11.7 min (minor).



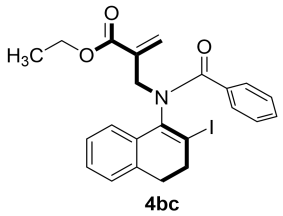
4bb

methyl 2-((*N*-(2-iodo-3,4-dihydronaphthalen-1-yl)benzamido)methyl)acrylate (4bb)

According to the general procedure, **4bb** was obtained in 99% yield and 93.5:6.5 er as a white solid.

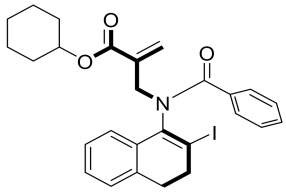
Specific rotation $[\alpha]^{25}_D$ = +67.7 (*c* = 0.5, CH_2Cl_2)

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.45 (d, *J* = 7.6 Hz, 2H), 7.24 – 7.13 (m, 4H), 7.08 (t, *J* = 7.5 Hz, 2H), 7.04 (d, *J* = 5.8 Hz, 1H), 6.38 (s, 1H), 6.09 (s, 1H), 4.65 (d, *J* = 14.5 Hz, 1H), 4.41 (d, *J* = 14.5 Hz, 1H), 3.53 (s, 3H), 2.78 (ddd, *J* = 31.2, 17.0, 7.2 Hz, 2H), 2.67 – 2.44 (m, 2H).
^{13}C NMR (101 MHz, $CDCl_3$) δ 170.6, 166.9, 143.1, 136.1, 136.0, 135.0, 132.3, 131.3, 130.3, 128.4, 127.9, 127.8, 127.3, 127.0, 123.7, 102.8, 51.9, 47.7, 39.0, 29.0.
HRMS (ESI) calcd for $[C_{22}H_{20}INNaO_3]^+$, m/z: 496.0380, found: 496.0401.
HPLC analysis: Daicel Chiralpak OD-H, hexane/isopropyl alcohol = 95/5, flow rate = 1.0 mL/min, UV = 210 nm, t_R = 18.0 min (major), t_R = 24.3 min (minor).



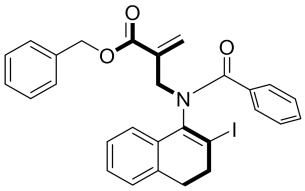
4bc

ethyl 2-((*N*-(2-iodo-3,4-dihydronaphthalen-1-yl)benzamido)methyl)acrylate (4bc)
According to the general procedure, **4bc** was obtained in 99% yield and 95.0:5.0 er as a white solid.
Specific rotation $[\alpha]^{25}_D$ = +149.6 (*c* = 0.5, CH_2Cl_2)
^{1}H NMR (400 MHz, $CDCl_3$) δ 7.52 (d, *J* = 7.3 Hz, 2H), 7.32 – 7.20 (m, 4H), 7.16 (t, *J* = 7.7 Hz, 2H), 7.12 – 7.08 (m, 1H), 6.45 (d, *J* = 1.4 Hz, 1H), 6.16 (d, *J* = 1.4 Hz, 1H), 4.73 (d, *J* = 14.7 Hz, 1H), 4.52 (d, *J* = 14.4 Hz, 1H), 4.06 (dd, *J* = 7.1, 4.4 Hz, 2H), 2.92 – 2.76 (m, 2H), 2.75 – 2.66 (m, 1H), 2.56 (dt, *J* = 15.8, 6.8 Hz, 1H), 1.19 (t, *J* = 7.1 Hz, 3H).
^{13}C NMR (101 MHz, $CDCl_3$) δ 170.6, 166.4, 143.1, 136.1, 136.0, 135.4, 132.4, 131.0, 130.3, 128.4, 127.8, 127.8, 127.3, 126.9, 123.7, 102.7, 60.9, 47.5, 39.0, 29.0, 14.1.
HRMS (ESI) calcd for $[C_{23}H_{22}INNaO_3]^+$, m/z: 510.0537, found: 510.0555.
HPLC analysis: Daicel Chiralpak OD-H, hexane/isopropyl alcohol = 95/5, flow rate = 1.0 mL/min, UV = 210 nm, t_R = 13.5 min (major), t_R = 18.3 min (minor).



4bd

cyclohexyl 2-((*N*-(2-iodo-3,4-dihydronaphthalen-1-yl)benzamido)methyl)acrylate (4bd)
According to the general procedure, **4bd** was obtained in 99% yield and 95.0:5.0 er as a white solid.
Specific rotation $[\alpha]^{25}_D$ = +55.9 (*c* = 0.5, CH_2Cl_2)
^{1}H NMR (400 MHz, $CDCl_3$) δ 7.55 – 7.48 (m, 2H), 7.35 – 7.27 (m, 2H), 7.25 – 7.19 (m, 2H), 7.15 (t, *J* = 7.7 Hz, 2H), 7.12 – 7.06 (m, 1H), 6.45 (d, *J* = 1.6 Hz, 1H), 6.15 (d, *J* = 1.4 Hz, 1H), 4.73 (d, *J* = 14.6 Hz, 2H), 4.52 (d, *J* = 14.4 Hz, 1H), 2.90 – 2.76 (m, 2H), 2.68 (ddd, *J* = 16.4, 12.5, 5.9 Hz, 1H), 2.62 – 2.50 (m, 1H), 1.80 – 1.73 (m, 2H), 1.69 (dd, *J* = 8.4, 5.7 Hz, 2H), 1.44 – 1.16 (m, 6H).
^{13}C NMR (101 MHz, $CDCl_3$) δ 170.6, 165.8, 143.1, 136.1, 135.8, 132.4, 130.8, 130.3, 128.4, 127.8, 127.8, 127.3, 126.9, 123.7, 102.7, 100.0, 73.0, 47.3, 39.0, 31.4, 29.1, 25.4, 23.6.
HRMS (ESI) calcd for $[C_{27}H_{28}INNaO_3]^+$, m/z: 564.1006, found: 564.1021.
HPLC analysis: Daicel Chiralpak OD-H, hexane/isopropyl alcohol = 95/5, flow rate = 1.0 mL/min, UV = 210 nm, t_R = 10.3 min (major), t_R = 14.5 min (minor).



4be

benzyl 2-((*N*-(2-iodo-3,4-dihydronaphthalen-1-yl)benzamido)methyl)acrylate (4be)

According to the general procedure, **4be** was obtained in 98% yield and 93.5:6.5 er as a colorless oil.

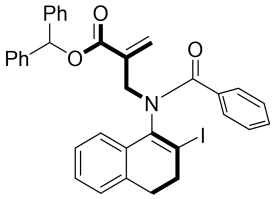
Specific rotation $[\alpha]^{25}_{D}$ = +71.6 (*c* = 0.5, CH_2Cl_2)

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.50 (d, *J* = 7.4 Hz, 2H), 7.34 – 7.24 (m, 7H), 7.23 – 7.18 (m, 2H), 7.15 (t, *J* = 7.7 Hz, 2H), 7.10 – 7.03 (m, 1H), 6.51 (d, *J* = 1.4 Hz, 1H), 6.22 (d, *J* = 1.4 Hz, 1H), 5.03 (s, 2H), 4.76 (d, *J* = 14.4 Hz, 1H), 4.53 (d, *J* = 14.3 Hz, 1H), 2.80 – 2.60 (m, 3H), 2.55 – 2.44 (m, 1H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 170.6, 166.3, 143.0, 136.1, 135.9, 135.8, 135.1, 132.3, 131.9, 130.3, 128.5, 128.4, 128.1, 127.9, 127.3, 127.0, 123.7, 102.9, 66.6, 47.5, 38.8, 28.9.

HRMS (ESI) calcd for $[C_{28}H_{24}INNaO_3]^+$, m/z: 572.0693, found: 572.0711.

HPLC analysis: Daicel Chiralpak OD-H, hexane/isopropyl alcohol = 75/25, flow rate = 1.0 mL/min, UV = 210 nm, t_R = 7.3 min (major), t_R = 9.5 min (minor).



4bf

benzhydryl 2-((*N*-(2-iodo-3,4-dihydronaphthalen-1-yl)benzamido)methyl)acrylate (4bf)

According to the general procedure, **4bf** was obtained in 91% yield and 96.0:4.0 er as a white solid.

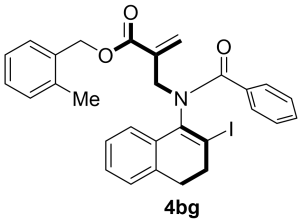
Specific rotation $[\alpha]^{25}_{D}$ = +80.8 (*c* = 0.5, CH_2Cl_2)

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.50 (d, *J* = 7.3 Hz, 2H), 7.36 – 7.22 (m, 12H), 7.19 – 7.08 (m, 4H), 7.04 (d, *J* = 7.3 Hz, 1H), 6.82 (s, 1H), 6.61 (d, *J* = 1.4 Hz, 1H), 6.25 (d, *J* = 1.4 Hz, 1H), 4.87 (d, *J* = 14.3 Hz, 1H), 4.53 (d, *J* = 14.3 Hz, 1H), 2.64 (dd, *J* = 11.5, 6.5 Hz, 3H), 2.48 – 2.34 (m, 1H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 170.7, 165.4, 142.6, 140.2, 140.2, 136.2, 136.0, 135.3, 132.4, 132.1, 130.3, 128.5, 128.5, 128.4, 127.9, 127.9, 127.8, 127.3, 127.3, 127.2, 127.0, 123.6, 103.0, 100.0, 77.6, 46.7, 38.9, 28.8.

HRMS (ESI) calcd for $[C_{34}H_{28}INNaO_3]^+$, m/z: 648.1006, found: 648.1026.

HPLC analysis: Daicel Chiralpak OD-H, hexane/isopropyl alcohol = 75/25, flow rate = 1.0 mL/min, UV = 210 nm, t_R = 7.3 min (major), t_R = 8.5 min (minor).



4bg

2-methylbenzyl 2-((*N*-(2-iodo-3,4-dihydronaphthalen-1-yl)benzamido)methyl)acrylate (4bg)

According to the general procedure, **4bg** was obtained in 96% yield and 95.5:4.5 er as a white solid.

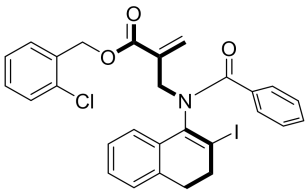
Specific rotation $[\alpha]^{25}_{D}$ = +99.2 (*c* = 0.5, CH_2Cl_2)

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.49 (d, *J* = 7.2 Hz, 2H), 7.31 – 7.23 (m, 3H), 7.21 (dd, *J* = 8.9, 4.5 Hz, 3H), 7.18 – 7.12 (m, 4H), 7.10 – 7.02 (m, 1H), 6.51 (s, 1H), 6.23 (s, 1H), 5.05 (s, 2H), 4.75 (d, *J* = 14.4 Hz, 1H), 4.53 (d, *J* = 14.4 Hz, 1H), 2.73 (ddd, *J* = 14.2, 11.2, 6.8 Hz, 1H), 2.62 (dd, *J* = 11.9, 4.7 Hz, 2H), 2.56 – 2.45 (m, 1H), 2.29 (s, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 170.6, 166.2, 143.0, 137.0, 136.1, 136.0, 135.1, 133.8, 132.3, 131.9, 130.3, 129.2, 128.4, 128.4, 127.8, 127.8, 127.3, 126.9, 125.9, 123.7, 102.8, 65.1, 47.5, 38.8, 28.9, 19.0.

HRMS (ESI) calcd for $[C_{29}H_{26}INNaO_3]^+$, m/z: 586.0850, found: 586.0848.

HPLC analysis: Daicel Chiralpak OD-H, hexane/isopropyl alcohol = 75/25, flow rate = 1.0 mL/min, UV = 210 nm, t_R = 7.7 min (major), t_R = 10.4 min (minor).



4bh

2-chlorobenzyl 2-((*N*-(2-iodo-3,4-dihydronaphthalen-1-yl)benzamido)methyl)acrylate (4bh)

According to the general procedure, **4bh** was obtained in 93% yield and 93.0:7.0 er as a white solid.

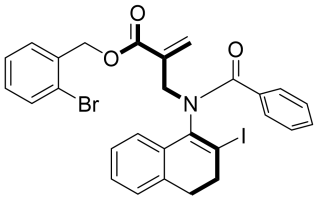
Specific rotation $[\alpha]^{25}_D$ = +93.2 (*c* = 0.5, CH_2Cl_2)

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.51 (d, *J* = 8.5 Hz, 2H), 7.37 – 7.33 (m, 2H), 7.30 – 7.24 (m, 3H), 7.24 – 7.19 (m, 3H), 7.16 (t, *J* = 7.7 Hz, 2H), 7.11 – 7.04 (m, 1H), 6.55 (d, *J* = 1.4 Hz, 1H), 6.27 (d, *J* = 1.3 Hz, 1H), 5.15 (s, 2H), 4.79 (d, *J* = 14.4 Hz, 1H), 4.53 (d, *J* = 14.4 Hz, 1H), 2.82 – 2.62 (m, 3H), 2.52 (dt, *J* = 14.3, 6.0 Hz, 1H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 170.6, 166.1, 143.0, 136.2, 135.9, 135.0, 133.6, 133.5, 132.2, 132.1, 130.3, 129.7, 129.5, 129.4, 128.4, 127.9, 127.3, 127.0, 126.8, 123.7, 102.8, 63.9, 47.4, 38.9, 28.9.

HRMS (ESI) calcd for $[C_{28}H_{23}ClINNaO_3]^+$, m/z: 606.0303, found: 606.0316.

HPLC analysis: Daicel Chiralpak OD-H, hexane/isopropyl alcohol = 75/25, flow rate = 1.0 mL/min, UV = 210 nm, t_R = 7.5 min (major), t_R = 10.1 min (minor).



4bi

2-bromobenzyl 2-((*N*-(2-iodo-3,4-dihydronaphthalen-1-yl)benzamido)methyl)acrylate (4bi)

According to the general procedure, **4bi** was obtained in 96% yield and 95.0:5.0 er as a white solid.

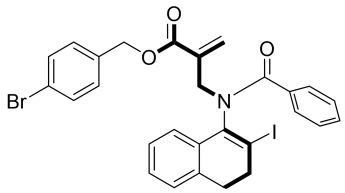
Specific rotation $[\alpha]^{25}_D$ = +97.9 (*c* = 0.5, CH_2Cl_2)

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.51 (d, *J* = 8.5 Hz, 2H), 7.37 – 7.33 (m, 2H), 7.30 – 7.24 (m, 3H), 7.24 – 7.19 (m, 3H), 7.16 (t, *J* = 7.7 Hz, 2H), 7.11 – 7.04 (m, 1H), 6.55 (d, *J* = 1.4 Hz, 1H), 6.27 (d, *J* = 1.3 Hz, 1H), 5.15 (s, 2H), 4.79 (d, *J* = 14.4 Hz, 1H), 4.53 (d, *J* = 14.4 Hz, 1H), 2.82 – 2.62 (m, 3H), 2.52 (dt, *J* = 14.3, 6.0 Hz, 1H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 170.6, 166.0, 143.0, 136.2, 135.9, 135.2, 135.0, 132.8, 132.2, 130.3, 129.8, 129.6, 128.4, 127.9, 127.4, 127.3, 127.0, 123.7, 123.3, 102.8, 66.1, 47.4, 38.9, 28.9.

HRMS (ESI) calcd for $[C_{28}H_{23}BrINNaO_3]^+$, m/z: 649.9798, found: 649.9801.

HPLC analysis: Daicel Chiralpak OD-H, hexane/isopropyl alcohol = 75/25, flow rate = 1.0 mL/min, UV = 210 nm, t_R = 8.1 min (major), t_R = 10.8 min (minor).



4bj

4-bromobenzyl 2-((*N*-(2-iodo-3,4-dihydronaphthalen-1-yl)benzamido)methyl)acrylate (4bj)

According to the general procedure, **4bj** was obtained in 99% yield and 96.0:4.0 er as a white solid.

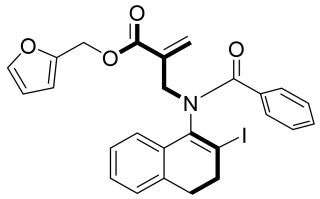
Specific rotation $[\alpha]^{25}_D$ = +83.5 (*c* = 0.5, CH_2Cl_2)

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.53 – 7.48 (m, 2H), 7.44 (d, *J* = 8.4 Hz, 2H), 7.29 – 7.25 (m, 2H), 7.24 – 7.19 (m, 2H), 7.19 – 7.11 (m, 4H), 7.10 – 7.06 (m, 1H), 6.50 (d, *J* = 1.4 Hz, 1H), 6.23 (d, *J* = 1.4 Hz, 1H), 4.99 (s, 2H), 4.77 (d, *J* = 14.4 Hz, 1H), 4.50 (d, *J* = 14.4 Hz, 1H), 2.80 – 2.61 (m, 3H), 2.58 – 2.46 (m, 1H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 170.6, 166.1, 142.9, 136.1, 135.9, 135.0, 134.8, 132.2, 132.1, 131.6, 130.4, 129.9, 128.4, 127.9, 127.3, 127.2, 127.0, 123.7, 122.2, 102.8, 65.8, 47.4, 38.9, 28.9.

HRMS (ESI) calcd for $[C_{28}H_{23}BrINNaO_3]^+$, m/z: 649.9798, found: 649.9800.

HPLC analysis: Daicel Chiralpak OD-H, hexane/isopropyl alcohol = 75/25, flow rate = 1.0 mL/min, UV = 210 nm, t_R = 9.0 min (major), t_R = 11.1 min (minor).



4bk

furan-2-ylmethyl 2-((*N*-(2-iodo-3,4-dihydronaphthalen-1-yl)benzamido)methyl)acrylate (4bk)

According to the general procedure, **4bk** was obtained in 96% yield and 95.0:5.0 er as a white solid.

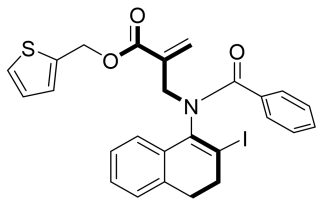
Specific rotation $[\alpha]^{25}_D$ = +99.6 (*c* = 0.5, CH_2Cl_2)

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.55 – 7.47 (m, 2H), 7.42 – 7.34 (m, 1H), 7.32 – 7.26 (m, 2H), 7.24 – 7.20 (m, 2H), 7.18 – 7.08 (m, 3H), 6.48 (d, *J* = 1.4 Hz, 1H), 6.42 – 6.30 (m, 2H), 6.20 (d, *J* = 1.3 Hz, 1H), 4.99 (s, 2H), 4.73 (d, *J* = 14.4 Hz, 1H), 4.48 (d, *J* = 14.4 Hz, 1H), 2.90 – 2.63 (m, 3H), 2.62 – 2.48 (m, 1H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 170.6, 166.0, 149.3, 143.1, 143.0, 136.2, 136.0, 134.9, 132.3, 131.9, 130.3, 128.4, 127.9, 127.8, 127.3, 127.0, 123.7, 110.7, 110.5, 102.9, 58.4, 47.6, 38.9, 29.0.

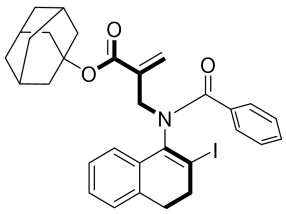
HRMS (ESI) calcd for $[C_{26}H_{22}INNaO_4]^+$, m/z: 562.0486, found: 562.0499.

HPLC analysis: Daicel Chiralpak OD-H, hexane/isopropyl alcohol = 75/25, flow rate = 1.0 mL/min, UV = 210 nm, t_R = 7.2 min (major), t_R = 9.3 min (minor).



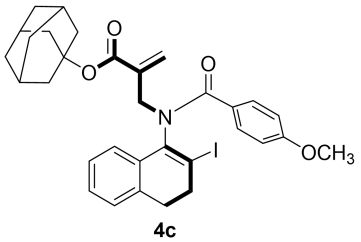
4bl

thiophen-2-ylmethyl 2-((*N*-(2-iodo-3,4-dihydronaphthalen-1-yl)benzamido)methyl)acrylate (4bl)
According to the general procedure, **4bl** was obtained in 84% yield and 93.5:6.5 er as a white solid.
Specific rotation $[\alpha]^{25}_{D}$ = +83.9 (*c* = 0.5, CH_2Cl_2)
^{1}H NMR (400 MHz, $CDCl_3$) δ 7.50 (d, *J* = 7.2 Hz, 2H), 7.30 – 7.24 (m, 3H), 7.24 – 7.18 (m, 2H), 7.15 (t, *J* = 7.7 Hz, 2H), 7.11 – 7.06 (m, 1H), 7.02 (d, *J* = 3.3 Hz, 1H), 6.94 (dd, *J* = 5.0, 3.5 Hz, 1H), 6.49 (d, *J* = 1.4 Hz, 1H), 6.21 (d, *J* = 1.3 Hz, 1H), 5.18 (s, 2H), 4.74 (d, *J* = 14.9 Hz, 1H), 4.50 (d, *J* = 14.4 Hz, 1H), 2.86 – 2.60 (m, 3H), 2.59 – 2.44 (m, 1H).
^{13}C NMR (101 MHz, $CDCl_3$) δ 170.6, 166.1, 143.0, 137.7, 136.1, 135.9, 134.9, 132.3, 132.1, 130.3, 128.4, 128.2, 127.9, 127.3, 127.0, 126.8, 126.8, 123.7, 103.0, 61.0, 47.5, 38.9, 29.0.
HRMS (ESI) calcd for $[C_{26}H_{22}INNaO_3S]^+$, m/z: 578.0257, found: 578.0263.
HPLC analysis: Daicel Chiralpak OD-H, hexane/isopropyl alcohol = 75/25, flow rate = 1.0 mL/min, UV = 210 nm, t_R = 7.9 min (major), t_R = 10.8 min (minor).



4bm

adamantan-1-yl 2-((*N*-(2-iodo-3,4-dihydronaphthalen-1-yl)benzamido)methyl)acrylate (4bm)
According to the general procedure, **4bm** was obtained in 97% yield and 97.5:2.5 er as a white solid.
Specific rotation $[\alpha]^{25}_{D}$ = +42.5 (*c* = 0.5, CH_2Cl_2)
^{1}H NMR (400 MHz, $CDCl_3$) δ 7.50 (d, *J* = 7.3 Hz, 2H), 7.33 – 7.29 (m, 1H), 7.29 – 7.20 (m, 3H), 7.15 (t, *J* = 7.7 Hz, 2H), 7.09 (d, *J* = 6.4 Hz, 1H), 6.37 (d, *J* = 1.7 Hz, 1H), 6.10 (d, *J* = 1.7 Hz, 1H), 4.67 (d, *J* = 14.4 Hz, 1H), 4.53 (d, *J* = 14.4 Hz, 1H), 2.91 – 2.78 (m, 2H), 2.76 – 2.64 (m, 1H), 2.61 – 2.49 (m, 1H), 2.12 (s, 3H), 2.04 (d, *J* = 2.9 Hz, 6H), 1.63 (s, 6H).
^{13}C NMR (101 MHz, $CDCl_3$) δ 170.6, 165.2, 143.1, 136.8, 136.2, 135.9, 132.5, 130.3, 130.2, 128.3, 127.8, 127.7, 127.3, 127.0, 123.8, 102.7, 80.8, 47.1, 41.2, 39.0, 36.2, 30.8, 29.1.
HRMS (ESI) calcd for $[C_{31}H_{32}INNaO_3]^+$, m/z: 616.1319, found: 616.1340.
HPLC analysis: Daicel Chiralpak OD-H, hexane/isopropyl alcohol = 95/5, flow rate = 1.0 mL/min, UV = 210 nm, t_R = 9.3 min (major), t_R = 13.1 min (minor).



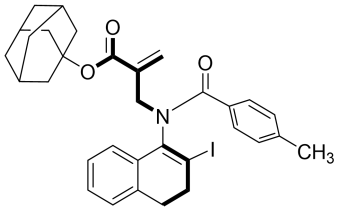
4c

adamantan-1-yl 2-((*N*-(2-iodo-3,4-dihydronaphthalen-1-yl)-4-methoxybenzamido)methyl)acrylate (4c)
According to the general procedure, **4c** was obtained in 81% yield and 95.0:5.0 er as a white solid.
Specific rotation $[\alpha]^{25}_{D}$ = +30.8 (*c* = 0.5, CH_2Cl_2)
^{1}H NMR (400 MHz, $CDCl_3$) δ 7.51 (d, *J* = 8.9 Hz, 2H), 7.35 – 7.28 (m, 1H), 7.23 (dd, *J* = 5.8, 2.1 Hz, 2H), 7.15 – 7.09 (m, 1H), 6.68 (d, *J* = 8.9 Hz, 2H), 6.36 (d, *J* = 1.8 Hz, 1H), 6.09 (d, *J* = 1.6 Hz, 1H), 4.65 (d, *J* = 14.5 Hz, 1H), 4.47 (d, *J* = 14.5 Hz, 1H), 3.75 (s, 3H), 2.97 – 2.80 (m, 2H), 2.79 – 2.68 (m, 1H), 2.65 – 2.58 (m, 1H), 2.13 (s, 3H), 2.05 (d, *J* = 2.9 Hz, 6H), 1.63 (s, 6H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 170.1, 165.3, 161.1, 143.3, 136.8, 136.1, 132.4, 130.1, 129.9, 128.4, 128.3, 127.8, 127.1, 123.8, 112.6, 102.5, 80.7, 55.2, 47.2, 41.1, 39.1, 36.2, 30.8, 29.1.

HRMS (ESI) calcd for $[C_{32}H_{34}INNaO_4]^+$, m/z: 646.1425, found: 646.1443.

HPLC analysis: Daicel Chiralpak OD-H, hexane/isopropyl alcohol = 90/10, flow rate = 1.0 mL/min, UV = 210 nm, t_R = 10.4 min (major), t_R = 23.8 min (minor).



4d

adamantan-1-yl 2-((*N*-(2-iodo-3,4-dihydronaphthalen-1-yl)-4-methylbenzamido)methyl)acrylate (4d)

According to the general procedure, **4d** was obtained in 72% yield and 95.5:4.5 er as a white solid.

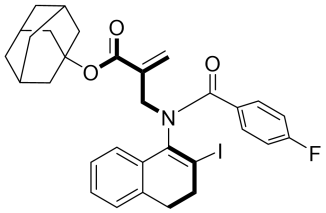
Specific rotation $[\alpha]^{25}_D$ = +32.7 (*c* = 0.5, CH_2Cl_2)

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.42 (d, *J* = 8.1 Hz, 2H), 7.34 – 7.29 (m, 1H), 7.25 – 7.17 (m, 2H), 7.13 – 7.08 (m, 1H), 6.95 (d, *J* = 7.9 Hz, 2H), 6.36 (d, *J* = 1.7 Hz, 1H), 6.09 (d, *J* = 1.7 Hz, 1H), 4.65 (d, *J* = 14.5 Hz, 1H), 4.50 (d, *J* = 14.5 Hz, 1H), 2.93 – 2.78 (m, 2H), 2.77 – 2.66 (m, 1H), 2.64 – 2.52 (m, 1H), 2.26 (s, 3H), 2.12 (s, 3H), 2.04 (d, *J* = 5.0 Hz, 6H), 1.63 (s, 6H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 170.6, 165.3, 143.2, 140.3, 136.8, 136.0, 133.3, 132.5, 130.2, 128.3, 128.0, 127.9, 127.7, 127.0, 123.9, 102.6, 80.7, 47.2, 41.1, 39.0, 36.2, 30.8, 29.1, 21.4.

HRMS (ESI) calcd for $[C_{32}H_{34}INNaO_3]^+$, m/z: 630.1476, found: 630.1484.

HPLC analysis: Daicel Chiralpak OD-H, hexane/isopropyl alcohol = 90/10, flow rate = 1.0 mL/min, UV = 210 nm, t_R = 7.5 min (major), t_R = 10.5 min (minor).



4e

adamantan-1-yl 2-((4-fluoro-*N*-(2-iodo-3,4-dihydronaphthalen-1-yl)benzamido)methyl)acrylate (4e)

According to the general procedure, **4e** was obtained in 99% yield and 95.5:4.5 er as a white solid.

Specific rotation $[\alpha]^{25}_D$ = +53.3 (*c* = 0.5, CH_2Cl_2)

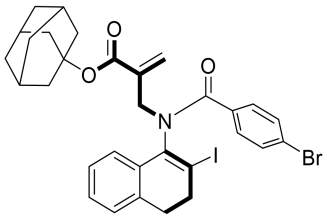
^{1}H NMR (400 MHz, $CDCl_3$) δ 7.52 (dd, *J* = 8.7, 5.5 Hz, 2H), 7.29 (d, *J* = 9.2 Hz, 1H), 7.23 (dd, *J* = 5.6, 3.2 Hz, 2H), 7.14 – 7.08 (m, 1H), 6.84 (t, *J* = 8.7 Hz, 2H), 6.36 (d, *J* = 1.7 Hz, 1H), 6.08 (d, *J* = 1.6 Hz, 1H), 4.67 (d, *J* = 14.4 Hz, 1H), 4.49 (d, *J* = 14.3 Hz, 1H), 2.94 – 2.80 (m, 2H), 2.77 – 2.65 (m, 1H), 2.64 – 2.53 (m, 1H), 2.12 (s, 3H), 2.03 (d, *J* = 6.0 Hz,, 6H), 1.63 (s, 6H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 169.5, 165.2, 163.7 (d, *J* = 250.0 Hz), 143.0, 136.7, 136.0, 132.3, 130.4, 130.1 (d, *J* = 8.7 Hz), 128.5, 127.9, 127.1, 123.7, 114.4 (d, *J* = 21.7 Hz), 102.8, 100.0, 80.8, 47.2, 41.2, 39.0, 36.2, 30.8, 29.1.

^{19}F NMR (376 MHz, $CDCl_3$) δ -109.66.

HRMS (ESI) calcd for $[C_{31}H_{31}FINNaO_3]^+$, m/z: 634.1225, found: 634.1224.

HPLC analysis: Daicel Chiralpak AD-H, hexane/isopropyl alcohol = 75/25, flow rate = 1.0 mL/min, UV = 210 nm, t_R = 9.5 min (minor), t_R = 14.7 min (major).



4f

adamantan-1-yl 2-((4-bromo-*N*-(2-iodo-3,4-dihydronaphthalen-1-yl)benzamido)methyl)acrylate (4f)

According to the general procedure, **4f** was obtained in 97% yield and 96.5:3.5 er as a white solid.

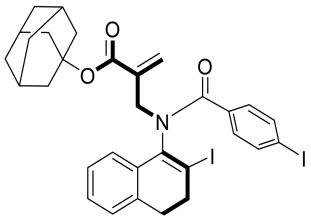
Specific rotation $[\alpha]^{25}_{D}$ = +62.0 (*c* = 0.5, CH_2Cl_2)

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.39 (d, *J* = 8.6 Hz, 2H), 7.30 (d, *J* = 2.0 Hz, 1H), 7.28 (t, *J* = 2.0 Hz, 1H), 7.27 (d, *J* = 5.3 Hz, 1H), 7.26 – 7.20 (m, 2H), 7.15 – 7.08 (m, 1H), 6.36 (d, *J* = 1.7 Hz, 1H), 6.07 (d, *J* = 1.6 Hz, 1H), 4.66 (d, *J* = 14.3 Hz, 1H), 4.49 (d, *J* = 14.3 Hz, 1H), 2.98 – 2.79 (m, 2H), 2.71 (ddd, *J* = 16.5, 12.6, 6.0 Hz, 1H), 2.58 (dt, *J* = 15.9, 7.0 Hz, 1H), 2.12 (s, 3H), 2.04 (d, *J* = 3.0 Hz, 6H), 1.63 (s, 6H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 169.5, 165.1, 142.8, 136.6, 136.0, 135.1, 132.2, 130.5, 129.4, 128.5, 127.9, 127.1, 124.7, 123.7, 103.1, 80.9, 47.1, 41.2, 39.0, 36.2, 30.8, 29.0.

HRMS (ESI) calcd for $[C_{31}H_{32}BrINO_3]^+$, m/z: 672.0605, found: 672.0605.

HPLC analysis: Daicel Chiralpak IC, hexane/isopropyl alcohol = 75/25, flow rate = 1.0 mL/min, UV = 210 nm, t_R = 19.0 min (major), t_R = 22.1 min (minor).



4g

adamantan-1-yl 2-((4-iodo-*N*-(2-iodo-3,4-dihydronaphthalen-1-yl)benzamido)methyl)acrylate (4g)

According to the general procedure, **4g** was obtained in 95% yield and 98.5:1.5 er as a white solid.

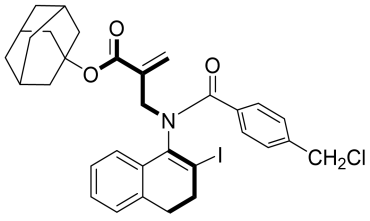
Specific rotation $[\alpha]^{25}_{D}$ = +49.9 (*c* = 0.5, CH_2Cl_2)

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.51 (d, *J* = 8.5 Hz, 2H), 7.31 – 7.25 (m, 2H), 7.23 (dd, *J* = 6.4, 2.5 Hz, 3H), 7.14 – 7.08 (m, 1H), 6.36 (d, *J* = 1.7 Hz, 1H), 6.07 (d, *J* = 1.7 Hz, 1H), 4.65 (d, *J* = 14.3 Hz, 1H), 4.48 (d, *J* = 14.3 Hz, 1H), 2.96 – 2.79 (m, 2H), 2.71 (ddd, *J* = 16.5, 12.7, 6.0 Hz, 1H), 2.58 (dt, *J* = 16.0, 6.9 Hz, 1H), 2.12 (s, 3H), 2.03 (d, *J* = 2.9 Hz, 6H), 1.63 (s, 6H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 169.7, 165.1, 142.7, 136.6, 136.5, 136.0, 135.7, 132.2, 130.5, 129.4, 128.5, 127.9, 127.1, 123.7, 103.1, 97.0, 80.8, 47.1, 41.1, 39.0, 36.2, 30.8, 29.0.

HRMS (ESI) calcd for $[C_{31}H_{32}I_2NO_3]^+$, m/z: 720.0466, found: 720.0477.

HPLC analysis: Daicel Chiralpak IC, hexane/isopropyl alcohol = 75/25, flow rate = 1.0 mL/min, UV = 210 nm, t_R = 20.6 min (major), t_R = 26.0 min (minor).



4h

adamantan-1-yl 2-((4-(chloromethyl)-*N*-(2-iodo-3,4-dihydronaphthalen-1-yl)benzamido)methyl)acrylate (4h)

According to the general procedure, **4h** was obtained in 64% yield and 97.5:2.5 er as a white solid.

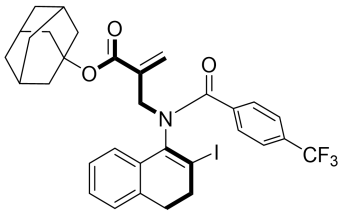
Specific rotation $[\alpha]^{25}_D$ = +50.9 (*c* = 0.5, CH_2Cl_2)

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.50 (d, *J* = 8.2 Hz, 2H), 7.33 – 7.28 (m, 1H), 7.23 (dd, *J* = 6.0, 2.6 Hz, 2H), 7.18 (d, *J* = 8.2 Hz, 2H), 7.13 – 7.07 (m, 1H), 6.37 (d, *J* = 1.7 Hz, 1H), 6.09 (d, *J* = 1.6 Hz, 1H), 4.66 (d, *J* = 14.4 Hz, 1H), 4.55 – 4.45 (m, 3H), 2.91 – 2.79 (m, 2H), 2.69 (ddd, *J* = 16.7, 12.4, 5.9 Hz, 1H), 2.56 (dt, *J* = 14.1, 6.9 Hz, 1H), 2.13 (s, 3H), 2.04 (s, 6H), 1.63 (s, 6H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 170.0, 165.2, 142.9, 139.3, 136.7, 136.2, 136.0, 132.4, 130.4, 128.4, 128.2, 127.8, 127.4, 127.1, 123.8, 102.9, 80.8, 47.1, 45.6, 41.2, 39.0, 36.2, 30.8, 29.1.

HRMS (ESI) calcd for $[C_{32}H_{33}ClINNaO_3]^+$, m/z: 664.1086, found: 664.1095.

HPLC analysis: Daicel Chiralpak OD-H, hexane/isopropyl alcohol = 75/25, flow rate = 1.0 mL/min, UV = 210 nm, t_R = 6.5 min (major), t_R = 8.1 min (minor).



4i

adamantan-1-yl 2-((*N*-(2-iodo-3,4-dihydronaphthalen-1-yl)-4-(trifluoromethyl)benzamido)methyl)acrylate (4i)

According to the general procedure, **4i** was obtained in 63% yield and 96.5:3.5 er as a white solid.

Specific rotation $[\alpha]^{25}_D$ = +47.6 (*c* = 0.5, CH_2Cl_2)

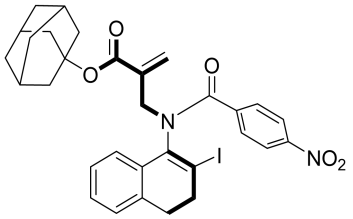
^{1}H NMR (400 MHz, $CDCl_3$) δ 7.62 (d, *J* = 8.1 Hz, 2H), 7.43 (d, *J* = 8.2 Hz, 2H), 7.33 – 7.28 (m, 1H), 7.27 – 7.20 (m, 2H), 7.14 – 7.07 (m, 1H), 6.38 (d, *J* = 1.7 Hz, 1H), 6.09 (d, *J* = 1.6 Hz, 1H), 4.70 (d, *J* = 14.2 Hz, 1H), 4.53 (d, *J* = 14.2 Hz, 1H), 2.92-2.80 (m, 2H), 2.75 – 2.62 (m, 1H), 2.60 – 2.49 (m, 1H), 2.13 (s, 3H), 2.04 (d, *J* = 2.9 Hz, 6H), 1.63 (s, 6H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 169.2, 165.1, 142.5, 139.6, 136.5, 136.0, 132.2, 131.8 (d, *J* = 32.6 Hz), 130.7, 128.6, 128.0, 128.0, 127.1, 124.3 (q, *J* = 3.4 Hz), 123.6, 103.3, 80.9, 47.1, 41.2, 38.9, 36.2, 30.8, 29.0.

^{19}F NMR (376 MHz, $CDCl_3$) δ -62.88.

HRMS (ESI) calcd for $[C_{32}H_{31}F_3INNaO_3]^+$, m/z: 684.1193, found: 684.1200.

HPLC analysis: Daicel Chiralpak IC, hexane/isopropyl alcohol = 50/10, flow rate = 1.0 mL/min, UV = 210 nm, t_R = 14.8 min (major), t_R = 19.7 min (minor).



4j

adamantan-1-yl 2-((*N*-(2-iodo-3,4-dihydronaphthalen-1-yl)-4-nitrobenzamido)methyl)acrylate (4j)

According to the general procedure, **4j** was obtained in 86% yield and 97.5:2.5 er as a white solid.

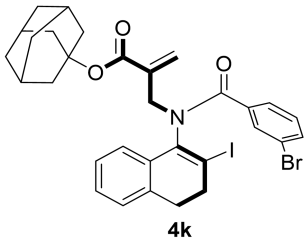
Specific rotation $[\alpha]^{25}_D$ = +47.7 (*c* = 0.5, CH_2Cl_2)

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.02 (d, *J* = 8.8 Hz, 2H), 7.66 (d, *J* = 8.8 Hz, 2H), 7.28 (dt, *J* = 7.0, 4.0 Hz, 2H), 7.26 – 7.21 (m, 1H), 7.16 – 7.07 (m, 1H), 6.38 (d, *J* = 1.7 Hz, 1H), 6.08 (d, *J* = 1.6 Hz, 1H), 4.72 (d, *J* = 14.1 Hz, 1H), 4.54 (d, *J* = 14.1 Hz, 1H), 2.96 – 2.79 (m, 2H), 2.76 – 2.62 (m, 1H), 2.62 – 2.49 (m, 1H), 2.13 (s, 3H), 2.04 (d, *J* = 3.0 Hz, 6H), 1.63 (s, 6H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 168.4, 165.0, 148.5, 142.3, 142.2, 136.4, 135.9, 132.0, 131.0, 128.8, 128.7, 128.1, 127.2, 123.5, 122.5, 103.6, 81.0, 47.1, 41.2, 38.9, 36.2, 30.8, 28.9.

HRMS (ESI) calcd for $[C_{31}H_{31}IN_2NaO_5]^+$, m/z: 661.1170, found: 661.1183.

HPLC analysis: Daicel Chiralpak IC, hexane/isopropyl alcohol = 75/25, flow rate = 1.0 mL/min, UV = 210 nm, t_R = 26.1 min (minor), t_R = 29.7 min (major).



4k

adamantan-1-yl 2-((3-bromo-*N*-(2-iodo-3,4-dihydronaphthalen-1-yl)benzamido)methyl)acrylate (4k)

According to the general procedure, **4k** was obtained in 91% yield and 95.5:4.5 er as a white solid.

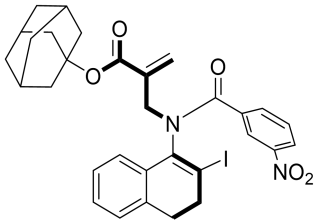
Specific rotation $[\alpha]^{25}_D$ = +32.3 (*c* = 0.5, CH_2Cl_2)

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.70 (t, *J* = 1.6 Hz, 1H), 7.38 (dd, *J* = 15.9, 7.9 Hz, 2H), 7.26 – 7.19 (m, 3H), 7.13 – 7.07 (m, 1H), 7.00 (t, *J* = 7.9 Hz, 1H), 6.37 (d, *J* = 1.7 Hz, 1H), 6.08 (d, *J* = 1.6 Hz, 1H), 4.71 – 4.51 (m, 2H), 2.91 – 2.80 (m, 2H), 2.79 – 2.66 (m, 1H), 2.65 – 2.52 (m, 1H), 2.12 (s, 3H), 2.03 (d, *J* = 2.9 Hz, 6H), 1.63 (t, *J* = 3.0 Hz, 6H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 168.9, 165.1, 142.8, 137.9, 136.6, 135.9, 133.1, 132.3, 131.3, 130.6, 128.8, 128.5, 127.8, 127.1, 125.9, 123.6, 121.3, 103.0, 80.9, 47.2, 41.1, 39.0, 36.2, 30.8, 29.0.

HRMS (ESI) calcd for $[C_{31}H_{31}BrINNaO_3]^+$, m/z: 694.0424, found: 694.0427.

HPLC analysis: Daicel Chiralpak AD-H, hexane/isopropyl alcohol = 75/25, flow rate = 1.0 mL/min, UV = 210 nm, t_R = 10.4 min (minor), t_R = 12.2 min (major).



4l

adamantan-1-yl 2-((*N*-(2-iodo-3,4-dihydronaphthalen-1-yl)-3-nitrobenzamido)methyl)acrylate (4l)

According to the general procedure, **4l** was obtained in 95% yield and 95.0:5.0 er as a white solid.

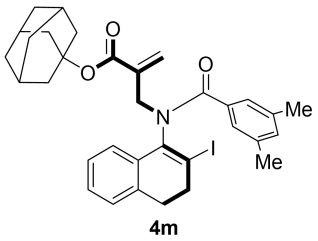
Specific rotation $[\alpha]^{25}_D$ = +61.1 (*c* = 0.5, CH_2Cl_2)

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.43 (t, *J* = 1.9 Hz, 1H), 8.18 – 8.10 (m, 1H), 7.81 (d, *J* = 7.9 Hz, 1H), 7.35 (t, *J* = 8.0 Hz, 1H), 7.28 (s, 1H), 7.27 – 7.21 (m, 2H), 7.16 – 7.06 (m, 1H), 6.39 (d, *J* = 1.7 Hz, 1H), 6.10 (d, *J* = 1.6 Hz, 1H), 4.71 (d, *J* = 14.1 Hz, 1H), 4.57 (d, *J* = 14.1 Hz, 1H), 2.95 – 2.79 (m, 2H), 2.77 – 2.49 (m, 2H), 2.13 (s, 3H), 2.03 (d, *J* = 3.1 Hz, 6H), 1.63 (t, *J* = 3.0 Hz, 6H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 167.9, 165.0, 147.2, 142.4, 137.7, 136.4, 135.9, 133.4, 131.9, 131.0, 128.8, 128.4, 128.0, 127.2, 124.9, 123.5, 123.3, 103.6, 81.0, 47.2, 41.2, 39.0, 36.2, 30.8, 29.0.

HRMS (ESI) calcd for $[C_{31}H_{32}IN_2O_5]^+$, m/z: 639.1350, found: 639.1352.

HPLC analysis: Daicel Chiralpak IC, hexane/isopropyl alcohol = 75/25, flow rate = 1.0 mL/min, UV = 210 nm, t_R = 23.8 min (minor), t_R = 27.5 min (major).



4m

adamantan-1-yl 2-((*N*-(2-iodo-3,4-dihydronaphthalen-1-yl)-3,5-dimethylbenzamido)methyl)acrylate (4m)

According to the general procedure, **4m** was obtained in 65% yield and 96.5:3.5 er as a white solid.

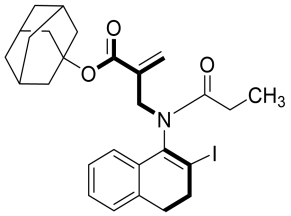
Specific rotation $[\alpha]^{25}_D$ = +72.4 (*c* = 0.5, CH_2Cl_2)

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.36 – 7.24 (m, 2H), 7.23 – 7.15 (m, 2H), 7.06 (d, *J* = 6.8 Hz, 2H), 6.89 (s, 1H), 6.38 (d, *J* = 1.7 Hz, 1H), 6.10 (d, *J* = 1.7 Hz, 1H), 4.60 (q, *J* = 14.6 Hz, 2H), 2.89 – 2.65 (m, 3H), 2.58 – 2.47 (m, 1H), 2.12 (s, 9H), 2.03 (d, *J* = 3.0 Hz, 6H), 1.62 (d, *J* = 3.1 Hz, 6H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 171.0, 165.2, 143.6, 136.9, 136.6, 135.9, 135.7, 132.9, 131.7, 130.1, 128.2, 127.5, 126.8, 125.5, 123.9, 102.3, 80.8, 47.3, 41.1, 39.1, 36.2, 30.8, 29.1, 21.1.

HRMS (ESI) calcd for $[C_{33}H_{36}INNaO_3]^+$, m/z: 644.1632, found: 644.1626.

HPLC analysis: Daicel Chiralpak OD-H, hexane/isopropyl alcohol = 75/25, flow rate = 1.0 mL/min, UV = 210 nm, t_R = 4.3 min (major), t_R = 5.7 min (minor).



4n

adamantan-1-yl 2-((*N*-(2-iodo-3,4-dihydronaphthalen-1-yl)propionamido)methyl)acrylate (4n)

According to the general procedure, **4n** was obtained in 41% yield and 84.0:16.0 er as a white solid.

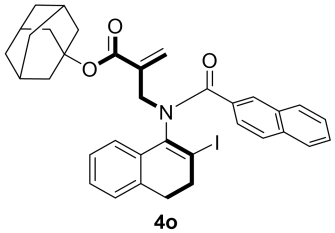
Specific rotation $[\alpha]^{25}_D$ = +50.7 (*c* = 0.5, CH_2Cl_2)

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.26 – 7.07 (m, 3H), 6.97 (d, *J* = 7.8 Hz, 1H), 6.23 (d, *J* = 1.8 Hz, 1H), 5.92 (d, *J* = 1.8 Hz, 1H), 4.52 (d, *J* = 13.9 Hz, 1H), 4.36 (d, *J* = 13.9 Hz, 1H), 3.02 (q, *J* = 2.9, 2.5 Hz, 2H), 2.10 (s, 3H), 1.96 (d, *J* = 2.9 Hz, 6H), 1.61 (t, *J* = 3.0 Hz, 6H), 1.11 (t, *J* = 7.4 Hz, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 173.8, 165.1, 142.5, 137.3, 135.6, 131.9, 130.5, 128.4, 127.7, 127.1, 123.1, 103.8, 80.6, 46.2, 41.1, 38.8, 36.2, 30.8, 29.4, 27.1, 9.4.

HRMS (ESI) calcd for $[C_{27}H_{32}INNaO_3]^+$, m/z: 568.1319, found: 568.1313.

HPLC analysis: Daicel Chiralpak IC, hexane/isopropyl alcohol = 75/25, flow rate = 1.0 mL/min, UV = 210 nm, t_R = 14.2 min (minor), t_R = 18.9 min (major).



4o

adamantan-1-yl 2-((*N*-(2-iodo-3,4-dihydronaphthalen-1-yl)-2-naphthamido)methyl)acrylate (4o)

According to the general procedure, **4o** was obtained in 73% yield and 98.0:2.0 er as a white solid.

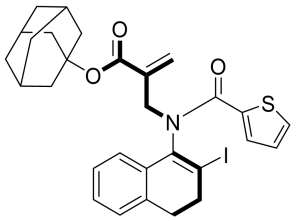
Specific rotation $[\alpha]^{25}_D$ = +68.4 (*c* = 0.5, CH_2Cl_2)

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.04 (s, 1H), 7.71 (d, *J* = 8.0 Hz, 1H), 7.60 (d, *J* = 6.2 Hz, 3H), 7.45 – 7.34 (m, 3H), 7.27 (d, *J* = 6.6 Hz, 1H), 7.20 (t, *J* = 6.8 Hz, 1H), 7.05 (d, *J* = 7.3 Hz, 1H), 6.40 (d, *J* = 1.7 Hz, 1H), 6.15 (d, *J* = 1.6 Hz, 1H), 4.71 (d, *J* = 14.4 Hz, 1H), 4.61 (d, *J* = 14.4 Hz, 1H), 2.89 – 2.72 (m, 2H), 2.69 – 2.56 (m, 1H), 2.53 – 2.42 (m, 1H), 2.12 (s, 3H), 2.05 (d, *J* = 3.0 Hz, 6H), 1.62 (d, *J* = 3.0 Hz, 6H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 170.6, 165.3, 143.3, 136.8, 135.9, 134.0, 133.4, 132.6, 132.0, 130.4, 128.8, 128.4, 128.1, 127.8, 127.5, 127.1, 127.1, 126.9, 126.1, 125.1, 123.9, 103.0, 80.8, 47.3, 41.2, 39.0, 36.2, 30.8, 29.1.

HRMS (ESI) calcd for $[C_{35}H_{34}INNaO_3]^+$, m/z: 666.1476, found: 666.1482.

HPLC analysis: Daicel Chiralpak IC, hexane/isopropyl alcohol = 60/40, flow rate = 1.0 mL/min, UV = 210 nm, t_R = 17.5 min (major), t_R = 20.5 min (minor).



4p

adamantan-1-yl 2-((*N*-(2-iodo-3,4-dihydronaphthalen-1-yl)thiophene-2-carboxamido)methyl)acrylate (4p)

According to the general procedure, **4p** was obtained in 93% yield and 86.5:13.5 er as a white solid.

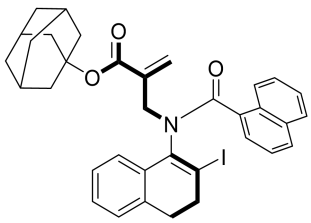
Specific rotation $[\alpha]^{25}_D$ = -28.8 (*c* = 0.5, CH_2Cl_2)

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.51 (d, *J* = 4.4 Hz, 1H), 7.33 (d, *J* = 4.9 Hz, 1H), 7.24 – 7.19 (m, 1H), 7.18 – 7.09 (m, 3H), 6.88 (dd, *J* = 5.0, 3.8 Hz, 1H), 6.30 (d, *J* = 1.8 Hz, 1H), 6.06 (d, *J* = 1.7 Hz, 1H), 4.64 – 4.52 (m, 2H), 3.15 – 2.87 (m, 3H), 2.82 – 2.69 (m, 1H), 2.12 (s, 3H), 2.01 (d, *J* = 3.0 Hz, 6H), 1.62 (t, *J* = 3.1 Hz, 6H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 165.1, 162.6, 142.5, 137.0, 136.7, 135.8, 132.2, 131.9, 130.9, 130.8, 128.5, 127.8, 127.1, 126.6, 123.9, 105.5, 100.0, 80.7, 47.5, 41.1, 39.2, 36.2, 30.8, 29.2.

HRMS (ESI) calcd for $[C_{29}H_{30}INNaO_3S]^+$, m/z: 622.0883, found: 622.0880.

HPLC analysis: Daicel Chiralpak AS, hexane/isopropyl alcohol = 75/25, flow rate = 1.0 mL/min, UV = 210 nm, t_R = 5.5 min (major), t_R = 7.7 min (minor).



4q

adamantan-1-yl 2-((*N*-(2-iodo-3,4-dihydronaphthalen-1-yl)-1-naphthamido)methyl)acrylate (4q)

According to the general procedure, **4q** was obtained in 67% yield and 99.0:1.0 er as a white solid.

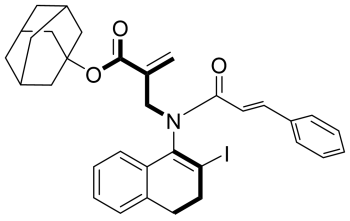
Specific rotation $[\alpha]^{25}_D$ = +20.0 (*c* = 0.5, CH_2Cl_2)

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.30 (d, *J* = 8.4 Hz, 1H), 7.91 (dd, *J* = 13.4, 8.3 Hz, 1H), 7.66 (d, *J* = 8.1 Hz, 2H), 7.46 – 7.35 (m, 3H), 7.12 (d, *J* = 7.7 Hz, 1H), 6.97 (dd, *J* = 5.3, 3.4 Hz, 2H), 6.90 – 6.80 (m, 1H), 6.47 (d, *J* = 1.8 Hz, 1H), 6.25 (d, *J* = 1.7 Hz, 1H), 4.91 (d, *J* = 14.2 Hz, 1H), 4.79 (d, *J* = 14.2 Hz, 1H), 2.81 (td, *J* = 10.9, 5.5 Hz, 1H), 2.76 – 2.66 (m, 1H), 2.56 (dt, *J* = 14.1, 6.9 Hz, 1H), 2.43 – 2.35 (m, 1H), 2.10 (s, 3H), 2.00 (d, *J* = 2.9 Hz, 6H), 1.61 (d, *J* = 3.0 Hz, 6H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 169.9, 165.2, 143.5, 137.4, 135.3, 133.5, 132.8, 132.6, 131.0, 130.8, 130.0, 128.0, 127.9, 127.2, 127.1, 126.6, 126.2, 125.8, 124.0, 123.9, 123.4, 102.2, 80.9, 47.2, 41.1, 39.2, 36.1, 30.8, 29.1.

HRMS (ESI) calcd for $[C_{35}H_{34}INNaO_3]^+$, m/z: 666.1476, found: 666.1479.

HPLC analysis: Daicel Chiralpak OD-H, hexane/isopropyl alcohol = 75/25, flow rate = 1.0 mL/min, UV = 210 nm, t_R = 5.7 min (major), t_R = 6.8 min (minor).



4r

adamantan-1-yl 2-((*N*-(2-iodo-3,4-dihydronaphthalen-1-yl)cinnamamido)methyl)acrylate (4r)

According to the general procedure, **4r** was obtained in 75% yield and 78.0:22.0 er as a white solid.

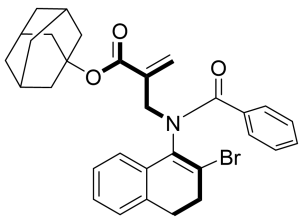
Specific rotation $[\alpha]^{25}_D$ = -19.6 (*c* = 0.5, CH_2Cl_2)

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.82 (d, *J* = 15.4 Hz, 1H), 7.36 (dd, *J* = 6.5, 3.1 Hz, 2H), 7.32 – 7.27 (m, 3H), 7.25 – 7.11 (m, 3H), 7.04 (d, *J* = 7.7 Hz, 1H), 6.44 (d, *J* = 15.4 Hz, 1H), 6.25 (d, *J* = 1.8 Hz, 1H), 5.97 (d, *J* = 1.7 Hz, 1H), 4.53 (s, 2H), 3.24 – 2.96 (m, 3H), 2.86 – 2.68 (m, 1H), 2.12 (s, 3H), 2.01 (d, *J* = 2.9 Hz, 6H), 1.62 (t, *J* = 3.0 Hz, 6H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 166.3, 165.1, 143.3, 142.0, 137.1, 135.7, 135.3, 132.2, 130.4, 129.6, 128.7, 128.5, 128.0, 127.6, 127.2, 123.3, 118.5, 104.2, 80.8, 46.2, 41.1, 39.0, 36.2, 30.8, 29.5.

HRMS (ESI) calcd for $[C_{33}H_{34}INNaO_3]^+$, m/z: 642.1476, found: 642.1486.

HPLC analysis: Daicel Chiralpak IC, hexane/isopropyl alcohol = 75/25, flow rate = 1.0 mL/min, UV = 210 nm, t_R = 13.6 min (minor), t_R = 18.6 min (major).



4s

adamantan-1-yl 2-((*N*-(2-bromo-3,4-dihydronaphthalen-1-yl)benzamido)methyl)acrylate (4s)

According to the general procedure, **4s** was obtained in 74% yield and 91.0:9.0 er as a white solid.

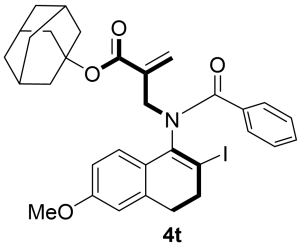
Specific rotation $[\alpha]^{25}_D$ = +45.3 (*c* = 0.5, CH_2Cl_2)

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.50 – 7.45 (m, 2H), 7.30 (dd, *J* = 12.6, 7.5 Hz, 2H), 7.26 – 7.20 (m, 2H), 7.15 (t, *J* = 7.7 Hz, 2H), 7.09 (d, *J* = 7.2 Hz, 1H), 6.34 (d, *J* = 1.6 Hz, 1H), 6.05 (d, *J* = 1.6 Hz, 1H), 4.74 (d, *J* = 14.5 Hz, 1H), 4.44 (d, *J* = 14.5 Hz, 1H), 2.99 – 2.81 (m, 1H), 2.75 – 2.51 (m, 3H), 2.13 (s, 3H), 2.05 (d, *J* = 2.6 Hz, 6H), 1.62 (s, 6H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 170.9, 165.2, 137.7, 136.8, 136.2, 135.3, 132.5, 130.1, 129.8, 128.2, 127.8, 127.3, 127.3, 127.1, 124.8, 123.6, 80.8, 46.9, 41.1, 36.2, 34.4, 30.8, 28.6.

HRMS (ESI) calcd for $[C_{31}H_{32}BrNNaO_3]^+$, m/z: 568.1458 found: 568.1459.

HPLC analysis: Daicel Chiralpak OD-H, hexane/isopropyl alcohol = 15/1, flow rate = 1.0 mL/min, UV = 210 nm, t_R = 8.2 min (major), t_R = 11.9 min (minor).



4t

adamantan-1-yl 2-((*N*-(2-iodo-6-methoxy-3,4-dihydronaphthalen-1-yl)benzamido)methyl)acrylate (4t)

According to the general procedure, **4t** was obtained in 94% yield and 98.0:2.0 er as a white solid.

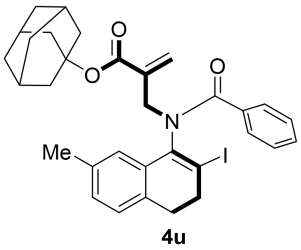
Specific rotation $[\alpha]^{25}_D$ = +58.8 (*c* = 0.5, CH_2Cl_2)

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.52 (d, *J* = 8.0 Hz, 2H), 7.30 (d, *J* = 7.9 Hz, 1H), 7.24 (d, *J* = 8.6 Hz, 1H), 7.16 (t, *J* = 7.4 Hz, 2H), 6.74 (d, *J* = 8.6 Hz, 1H), 6.65 (s, 1H), 6.36 (d, *J* = 1.5 Hz, 1H), 6.09 (s, 1H), 4.65 (d, *J* = 14.4 Hz, 1H), 4.52 (d, *J* = 14.4 Hz, 1H), 3.80 (s, 3H), 2.88 – 2.74 (m, 2H), 2.65 (ddd, *J* = 16.9, 12.3, 5.8 Hz, 1H), 2.52 (dt, *J* = 15.0, 6.7 Hz, 1H), 2.13 (s, 3H), 2.05 (d, *J* = 2.8 Hz, 6H), 1.64 (t, *J* = 2.9 Hz, 6H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 170.5, 165.2, 159.5, 142.8, 137.9, 136.8, 136.2, 130.2, 130.2, 127.8, 127.2, 125.7, 125.4, 114.0, 111.5, 99.0, 80.8, 55.3, 47.1, 41.2, 38.8, 36.2, 30.8, 29.5.

HRMS (ESI) calcd for $[C_{32}H_{34}INNaO_4]^+$, m/z: 646.1425 found: 646.1440.

HPLC analysis: Daicel Chiralpak AD-H, hexane/isopropyl alcohol = 75/25, flow rate = 1.0 mL/min, UV = 210 nm, t_R = 15.0 min (minor), t_R = 18.3 min (major).



4u

adamantan-1-yl 2-((*N*-(7-methyl-2-iodo-3,4-dihydronaphthalen-1-yl)benzamido)methyl)acrylate (4u)

According to the general procedure, **4u** was obtained in 57% yield and 89.5:10.5 er as a white solid.

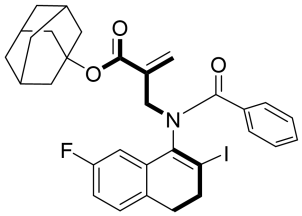
Specific rotation $[\alpha]^{25}_D$ = +61.6 (*c* = 0.5, CH_2Cl_2)

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.51 (d, *J* = 7.1 Hz, 2H), 7.29 (d, *J* = 7.4 Hz, 1H), 7.16 (t, *J* = 7.7 Hz, 2H), 7.11 (s, 1H), 7.00 (q, *J* = 7.6 Hz, 2H), 6.38 (d, *J* = 1.7 Hz, 1H), 6.12 (d, *J* = 1.7 Hz, 1H), 4.73 (d, *J* = 14.4 Hz, 1H), 4.46 (d, *J* = 14.4 Hz, 1H), 2.88 – 2.74 (m, 2H), 2.73 – 2.60 (m, 1H), 2.57 – 2.46 (m, 1H), 2.33 (s, 3H), 2.12 (s, 3H), 2.03 (d, *J* = 2.9 Hz, 6H), 1.62 (t, *J* = 3.0 Hz, 6H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 170.5, 165.2, 143.1, 136.9, 136.5, 136.2, 133.0, 132.2, 130.3, 130.2, 128.9, 127.8, 127.6, 127.2, 124.5, 102.7, 80.7, 47.1, 41.1, 39.2, 36.2, 30.8, 28.7, 21.4.

HRMS (ESI) calcd for $[C_{32}H_{34}INNaO_3]^+$, m/z: 630.1476, found: 630.1472.

HPLC analysis: Daicel Chiralpak IC, hexane/isopropyl alcohol = 75/25, flow rate = 1.0 mL/min, UV = 210 nm, t_R = 13.5 min (major), t_R = 14,8 min (minor).



4v

adamantan-1-yl 2-((*N*-(7-fluoro-2-iodo-3,4-dihydronaphthalen-1-yl)benzamido)methyl)acrylate (4v)

According to the general procedure, **4v** was obtained in 91% yield and 95.5:4.5 er as a white solid.

Specific rotation $[\alpha]^{25}_{D}$ = +73.7 (*c* = 0.5, CH_2Cl_2)

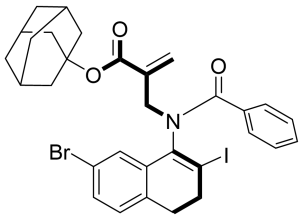
^{1}H NMR (400 MHz, $CDCl_3$) δ 7.52 – 7.45 (m, 2H), 7.29 (d, *J* = 7.4 Hz, 1H), 7.17 (t, *J* = 7.6 Hz, 2H), 7.06 – 6.98 (m, 2H), 6.88 (td, *J* = 8.3, 2.6 Hz, 1H), 6.39 (d, *J* = 1.7 Hz, 1H), 6.14 (d, *J* = 1.6 Hz, 1H), 4.61 (s, 2H), 2.89 – 2.81 (m, 1H), 2.80 – 2.66 (m, 2H), 2.59 – 2.46 (m, 1H), 2.13 (s, 3H), 2.04 (d, *J* = 2.9 Hz, 6H), 1.62 (d, *J* = 3.0 Hz, 6H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 170.5, 165.2, 161.8 (d, *J* = 243.9 Hz), 142.6, 136.8, 136.0, 134.3 (d, *J* = 7.4 Hz), 131.3 (d, *J* = 3.1 Hz), 130.7, 130.3, 129.0 (d, *J* = 7.9 Hz), 127.6, 127.3, 114.8 (d, *J* = 21.4 Hz), 111.1 (d, *J* = 24.0 Hz), 104.3, 80.9, 47.0, 41.1, 39.2, 36.2, 30.8, 28.2.

^{19}F NMR (376 MHz, $CDCl_3$) δ -114.73.

HRMS (ESI) calcd for $[C_{31}H_{31}FINNaO_3]^+$, m/z: 634.1225 found: 634.1214.

HPLC analysis: Daicel Chiralpak IC, hexane/isopropyl alcohol = 75/25, flow rate = 1.0 mL/min, UV = 210 nm, t_R = 13.8 min (major), t_R = 21.8 min (minor).



4w

adamantan-1-yl 2-((*N*-(7-bromo-2-iodo-3,4-dihydronaphthalen-1-yl)benzamido)methyl)acrylate (4w)

According to the general procedure, **4w** was obtained in 87% yield and 95.0:5.0 er as a white solid.

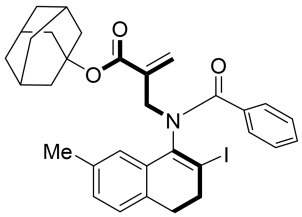
Specific rotation $[\alpha]^{25}_{D}$ = +52.3 (*c* = 0.5, CH_2Cl_2)

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.50 – 7.45 (m, 2H), 7.41 (d, *J* = 1.8 Hz, 1H), 7.33 – 7.27 (m, 2H), 7.18 (t, *J* = 7.6 Hz, 2H), 6.95 (d, *J* = 8.0 Hz, 1H), 6.41 (d, *J* = 1.7 Hz, 1H), 6.19 (d, *J* = 1.6 Hz, 1H), 4.66 (d, *J* = 14.3 Hz, 1H), 4.54 (d, *J* = 14.2 Hz, 1H), 2.89 – 2.66 (m, 3H), 2.57 – 2.45 (m, 1H), 2.12 (s, 3H), 2.03 (d, *J* = 2.9 Hz, 6H), 1.63 (d, *J* = 3.1 Hz, 6H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 170.4, 165.2, 142.2, 136.8, 135.9, 134.7, 134.3, 131.0, 130.8, 130.3, 129.3, 127.6, 127.4, 126.7, 120.6, 104.2, 80.9, 47.0, 41.1, 38.8, 36.2, 30.8, 28.5.

HRMS (ESI) calcd for $[C_{31}H_{31}BrINNaO_3]^+$, m/z: 694.0424 found: 694.0412.

HPLC analysis: Daicel Chiralpak IC, hexane/isopropyl alcohol = 75/25, flow rate = 1.0 mL/min, UV = 210 nm, t_R = 12.2 min (major), t_R = 16.6 min (minor).



4x

adamantan-1-yl 2-((*N*-(2-iodo-7-nitro-3,4-dihydronaphthalen-1-yl)benzamido)methyl)acrylate (4x)

According to the general procedure, **4x** was obtained in 98% yield and 94.0:6.0 er as a white solid.

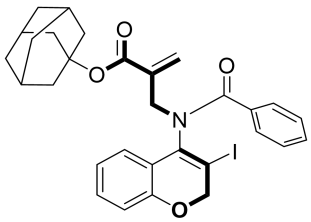
Specific rotation $[\alpha]^{25}_{D}$ = +32.1 (*c* = 0.5, CH_2Cl_2)

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.13 (d, *J* = 2.1 Hz, 1H), 8.04 (dd, *J* = 8.2, 2.1 Hz, 1H), 7.46 (d, *J* = 7.3 Hz, 2H), 7.29 (d, *J* = 7.5 Hz, 1H), 7.23 (d, *J* = 8.3 Hz, 1H), 7.16 (t, *J* = 7.7 Hz, 2H), 6.45 (d, *J* = 1.6 Hz, 1H), 6.30 (d, *J* = 1.6 Hz, 1H), 4.68 (d, *J* = 14.2 Hz, 1H), 4.58 (d, *J* = 14.3 Hz, 1H), 2.99 – 2.89 (m, 2H), 2.79 (dt, *J* = 12.2, 6.2 Hz, 1H), 2.67 (td, *J* = 13.7, 8.4 Hz, 1H), 2.10 (s, 3H), 1.95 (d, *J* = 2.8 Hz, 6H), 1.60 (t, *J* = 3.2 Hz, 6H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 170.4, 165.3, 147.2, 143.0, 142.2, 136.7, 135.8, 133.8, 131.2, 130.4, 128.6, 127.5, 122.9, 118.6, 105.4, 80.9, 46.9, 41.1, 38.4, 36.1, 30.8, 29.0.

HRMS (ESI) calcd for $[C_{31}H_{32}IN_2O_5]^+$, m/z: 639.1350 found: 639.1348.

HPLC analysis: Daicel Chiralpak AS, hexane/isopropyl alcohol = 75/25, flow rate = 1.0 mL/min, UV = 210 nm, t_R = 6.6 min (major), t_R = 9.2 min (minor).



4y

adamantan-1-yl 2-((*N*-(3-iodo-2*H*-chromen-4-yl)benzamido)methyl)acrylate (4y)

According to the general procedure, **4y** was obtained in 95% yield and 95.5:4.5 er as a white solid.

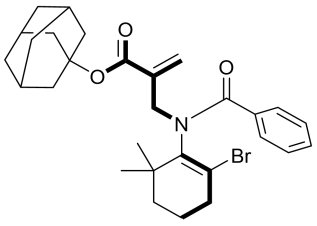
Specific rotation $[\alpha]^{25}_{D}$ = +16.0 (*c* = 0.5, CH_2Cl_2)

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.56 – 7.50 (m, 2H), 7.31 (t, *J* = 7.4 Hz, 1H), 7.26 – 7.15 (m, 4H), 6.99 (t, *J* = 7.6 Hz, 1H), 6.81 (d, *J* = 7.5 Hz, 1H), 6.39 (d, *J* = 1.7 Hz, 1H), 6.12 (d, *J* = 1.6 Hz, 1H), 4.84 (d, *J* = 14.5 Hz, 1H), 4.67 (dd, *J* = 30.6, 14.4 Hz, 2H), 4.49 (d, *J* = 14.3 Hz, 1H), 2.12 (s, 3H), 2.06 – 1.98 (m, 6H), 1.63 (t, *J* = 3.0 Hz, 6H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 170.4, 165.0, 154.5, 141.4, 136.6, 135.7, 130.9, 130.6, 130.5, 127.8, 127.5, 123.9, 122.0, 121.5, 116.5, 92.0, 81.0, 74.8, 46.8, 41.0, 36.2, 30.8.

HRMS (ESI) calcd for $[C_{30}H_{30}INNaO_4]^+$, m/z: 618.1112, found: 618.1104.

HPLC analysis: Daicel Chiralpak IC, hexane/isopropyl alcohol = 75/25, flow rate = 1.0 mL/min, UV = 210 nm, t_R = 22.5 min (major), t_R = 26.2 min (minor).



4z

adamantan-1-yl 2-((*N*-(2-bromo-6,6-dimethylcyclohex-1-en-1-yl)benzamido)methyl)acrylate (4z)

According to the general procedure, **4z** was obtained in 37% yield and 77.0:23.0 er as a colorless oil at -10 ℃.

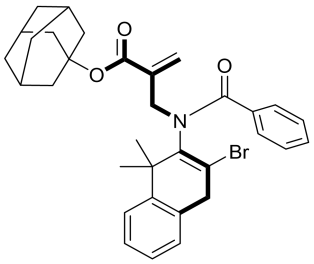
Specific rotation $[\alpha]^{25}_{D}$ = -9.6 (*c* = 0.5, CH_2Cl_2)

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.62 (d, *J* = 8.0 Hz, 2H), 7.40 – 7.31 (m, 3H), 6.37 (s, 1H), 5.79 (s, 1H), 4.81 (d, *J* = 17.3 Hz, 1H), 4.03 (d, *J* = 17.3 Hz, 1H), 2.64 (t, *J* = 6.3 Hz, 2H), 2.17 (s, 9H), 1.78 (d, *J* = 11.2 Hz, 2H), 1.68 (s, 5H), 1.41 (dt, *J* = 8.5, 4.7 Hz, 1H), 1.30 (d, *J* = 15.3 Hz, 2H), 1.05 (s, 3H), 0.47 (s, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 170.6, 165.2, 147.1, 137.0, 136.5, 130.0, 128.1, 127.7, 126.7, 125.1, 81.1, 52.7, 41.3, 39.5, 39.1, 37.0, 36.2, 30.9, 28.4, 27.5, 20.2.

HRMS (ESI) calcd for $[C_{29}H_{36}BrNNaO_3]^+$, m/z: 548.1771 found: 548.1763.

HPLC analysis: Daicel Chiralpak IC, hexane/isopropyl alcohol = 75/25, flow rate = 1.0 mL/min, UV = 210 nm, t_R = 16.5 min (minor), t_R = 20.5 min (major).



4za

adamantan-1-yl 2-((*N*-(3-bromo-1,1-dimethyl-1,4-dihydronaphthalen-2-yl)benzamido)methyl)acrylate (4za)

According to the general procedure, **4za** was obtained in 77% yield and 90.5:9.5 er as a colorless oil at -10 ℃.

Specific rotation $[\alpha]^{25}_{D}$ = -38.5 (*c* = 0.5, CH_2Cl_2)

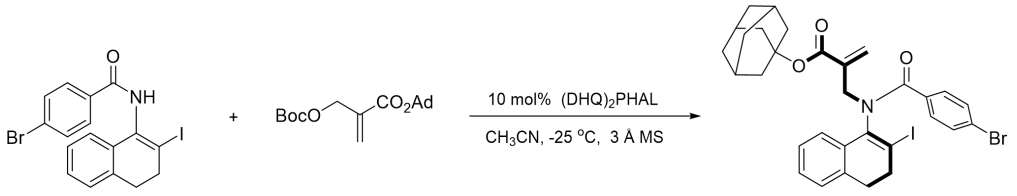
^{1}H NMR (400 MHz, $CDCl_3$) δ 7.58 – 7.53 (m, 2H), 7.24 – 7.10 (m, 6H), 7.06 (d, *J* = 7.2 Hz, 1H), 6.40 (d, *J* = 1.3 Hz, 1H), 5.96 (d, *J* = 1.5 Hz, 1H), 4.67 (d, *J* = 16.3 Hz, 1H), 4.39 (d, *J* = 16.3 Hz, 1H), 3.97 (d, *J* = 20.9 Hz, 1H), 3.80 (d, *J* = 21.0 Hz, 1H), 2.16 (s, 3H), 2.13 (d, *J* = 2.8 Hz, 6H), 1.66 (d, *J* = 3.2 Hz, 6H), 1.39 (s, 3H), 1.06 (s, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 170.8, 165.3, 145.6, 144.1, 136.5, 136.2, 132.4, 130.2, 128.3, 128.1, 127.6, 127.3, 127.1, 126.1, 124.6, 123.9, 81.1, 51.0, 43.8, 41.3, 41.1, 36.2, 30.9, 29.7, 26.1.

HRMS (ESI) calcd for $[C_{33}H_{37}BrNO_3]^+$, m/z: 574.1951 found: 574.1946.

HPLC analysis: Daicel Chiralpak AD-H, hexane/isopropyl alcohol = 90/10, flow rate = 1.0 mL/min, UV = 210 nm, t_R = 8.2 min (major), t_R = 9.8 min (minor).

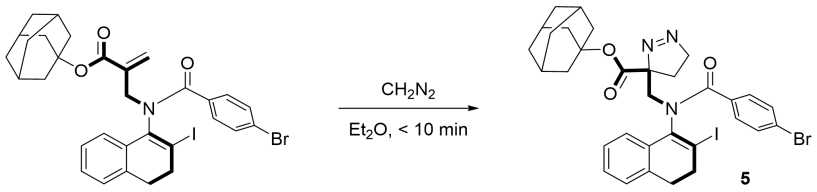
4. Large Scale Experiment



1f, 1 mmol　　**2m**, 3 mmol　　**4f**, 0.63 g, 94% yield, 96.0:4.0 e.r.

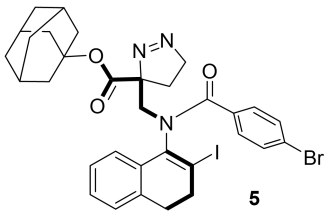
To a 100 mL round-bottom flask equipped with a magnetic stir bar was added achiral MBH carbonate **2m** (3 mmol), enamide **1f** (1 mmol) and 3 Å MS (400 mg). Then the solvent CH_3CN (10 mL) was added. When the temperature of the mixture was decreased to -25 ℃, biscinchona alkaloid **3g** was added and the reaction mixture was stirred at -25 ℃. Upon the reaction completed, the mixture was extracted with DCM and concentrated under reduced pressure. The resulting crude residue was purified *via* flash column chromatography on silica gel to afford the product **4f** (0.63 g, 94% yield, 96.0:4.0 e.r.).

5. Experimental Procedure for the Transformation of Axially Chiral Enamides



4f, 96.0:4.0 e.r.　　**5**
92% yield, 1.4:1 d.r.,
95.5:4.5 e.r./95.0:5.0 e.r.

To a vial containing the compound **4f** (0.10 mmol) was added the freshly prepared CH_2N_2 ether solution (1.0 mL). Then the reaction mixture was stirred at 25 ℃ for less than 10 min on a magnetic stirrer. Upon the reaction completed, the resulting crude residue was purified directly *via* column chromatography on silica gel to afford the desired product **5** as a white solid.



5

adamantan-1-yl 3-((4-bromo-*N*-(2-iodo-3,4-dihydronaphthalen-1-yl)benzamido)methyl)-4,5-dihydro-3H-pyrazole-3-carboxylate (5)

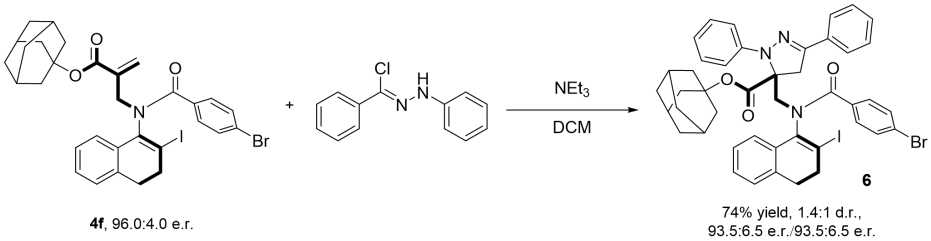
Specific rotation $[\alpha]^{25}_D$ = +59.6 (*c* = 0.5, CH_2Cl_2)

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.41 – 7.26 (m, 7H), 7.20 (dd, *J* = 8.7, 5.1 Hz, 1H), 5.38 – 4.58 (m, 2H), 4.58 – 3.75 (m, 2H), 3.36 – 2.66 (m, 3H), 2.66 – 2.07 (m, 7H), 1.96 (s, 5H), 1.63 (d, *J* = 26.0 Hz, 6H).

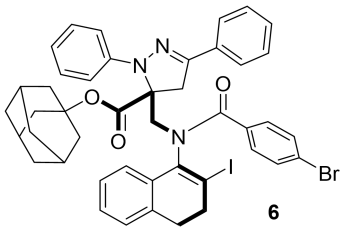
^{13}C NMR (101 MHz, $CDCl_3$) δ 170.6, 166.8, 142.7, 137.3, 134.6, 131.6, 130.5, 129.6, 128.8, 127.2, 125.3, 123.8, 104.7, 100.5, 83.0, 79.6, 50.2, 40.9, 39.5, 36.0, 30.8, 28.9, 26.0, 25.4.

HRMS (ESI) calcd for $[C_{32}H_{33}BrIN_3NaO_3]^+$, m/z: 736.0642 found: 736.0658.

HPLC analysis: Daicel Chiralpak IC, hexane/isopropyl alcohol = 50/50, flow rate = 1.0 mL/min, UV = 210 nm, t_R = 12.3 min (minor), t_R = 20.3 min (minor), t_R = 41.1 min (major), t_R = 51.4 min (major).



The compound **4f** (0.10 mmol) and nitrilimine (0.15 mmol, 1.5 equiv) were dissolved in dichloromethane (1.0 mL), and then Et_3N (0.15 mmol, 1.5 equiv) was added. After stirring at room temperature for 3 h, the mixture was purified by flash column chromatography on silica gel to furnish the desired product **6** as a white solid.[10]



adamantan-1-yl 5-((4-bromo-*N*-(2-iodo-3,4-dihydronaphthalen-1-yl)benzamido)methyl)-1,3-diphenyl-4,5-dihydro-1H-pyrazole-5-carboxylate (6)

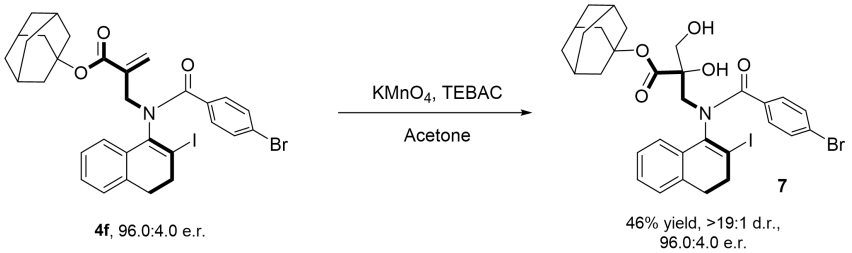
Specific rotation $[\alpha]^{25}_D$ = -8.4 (*c* = 0.5, CH_2Cl_2)

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.71 (dd, *J* = 37.3, 8.4 Hz, 2H), 7.43 – 7.33 (m, 5H), 7.29 – 7.17 (m, 4H), 7.05 (dd, *J* = 7.4, 2.7 Hz, 1H), 6.97 – 6.62 (m, 6H), 5.17 (dd, *J* = 52.7, 15.3 Hz, 1H), 4.61 – 4.21 (m, 1H), 4.20 – 4.03 (m, 1H), 3.67 (dd, *J* = 47.1, 17.8 Hz, 1H), 2.63 – 1.98 (m, 7H), 1.93 - 1.76 (m, 6H), 1.53 (d, *J* = 19.5 Hz, 6H).

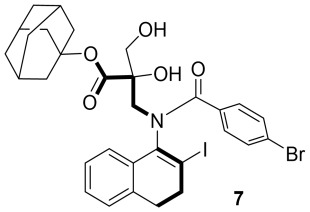
^{13}C NMR (101 MHz, $CDCl_3$) δ 171.1, 170.4, 147.7, 144.5, 142.7, 138.0, 134.5, 133.0, 131.8, 130.6, 130.4, 128.6, 128.5, 128.3, 128.0, 127.2, 126.0, 125.7, 124.8, 124.2, 119.8, 114.6, 104.5, 82.7, 72.7, 49.2, 44.6, 40.9, 39.4, 36.0, 30.8, 28.4.

HRMS (ESI) calcd for $[C_{44}H_{41}BrIN_3NaO_3]^+$, m/z: 888.1268 found: 888.1274.

HPLC analysis: Daicel Chiralpak IC, hexane/isopropyl alcohol = 75/25, flow rate = 1.0 mL/min, UV = 210 nm, t_R = 4.9 min (major), t_R = 6.1 min (minor), t_R = 8.8 min (major), t_R = 9.7 min (minor).



TEBAC (0.12 mmol, 1.2 equiv) and $KMnO_4$ (0.12 mmol, 1.2 equiv) were mixed in acetone (1.0 mL), and the mixture was stirred at rt for 3 h then cooled to 0 ℃. The compound **4f** (0.10 mmol) was added to the solution while the internal temperature was kept at 5 ℃ or below. After stirring for a further 30 min, the mixture was purified by flash column chromatography on silica gel to acquire the desired product **7** as a white solid.[11]



7

adamantan-1-yl 3-(4-bromo-*N*-(2-iodo-3,4-dihydronaphthalen-1-yl)benzamido)-2-hydroxy-2-(hydroxymethyl)propanoate (7)

Specific rotation $[\alpha]^{25}_{D}$ = +23.7 (*c* = 0.5, CH_2Cl_2)

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.40 – 7.28 (m, 5H), 7.28 – 7.22 (m, 2H), 7.13 (d, *J* = 6.3 Hz, 1H), 4.42 (s, 1H), 4.23 (d, *J* = 14.2 Hz, 1H), 3.83 (d, *J* = 14.3 Hz, 1H), 3.75 – 3.67 (m, 2H), 2.99 – 2.84 (m, 2H), 2.75 – 2.67 (m, 1H), 2.66 – 2.54 (m, 1H), 2.23 – 1.98 (m, 9H), 1.64 (s, 6H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 171.7, 143.2, 136.4, 134.2, 131.5, 130.6, 129.7, 128.8, 128.0, 127.1, 125.2, 124.0, 102.5, 83.1, 77.8, 66.7, 52.5, 41.0, 39.4, 36.1, 30.9, 28.9.

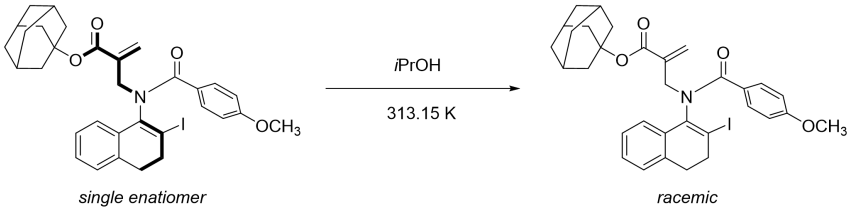
HRMS (ESI) calcd for $[C_{31}H_{34}BrINO_5]^+$, m/z: 706.0660 found: 706.0677.

HPLC analysis: Daicel Chiralpak IF, hexane/isopropyl alcohol = 50/50, flow rate = 1.0 mL/min, UV = 210 nm, t_R = 12.4 min (major), t_R = 15.0 min (minor).

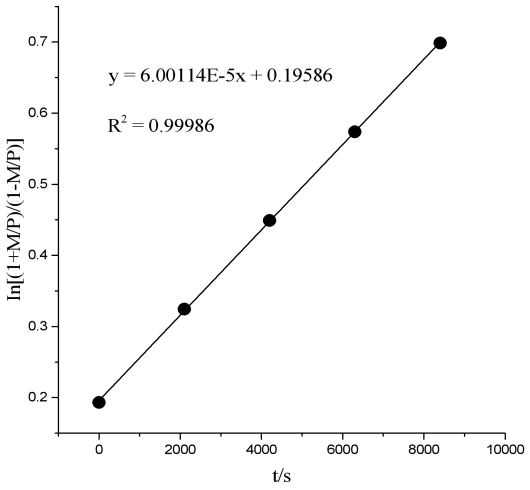
6. The Racemization Experiments

Barriers to racemization of **4c**

Fractions collected and racemized by incubation at 40 °C in isopropyl alcohol.



t/(s)	er	M/P	(1+(M/P))/(1-(M/P))	In
0	91.212:8.788	0.09635	1.21324	0.19329
2100	84.818:15.182	0.17900	1.43604	0.32444
4200	79.686:20.314	0.25493	1.68430	0.44919
6300	75.683:24.317	0.32130	1.94681	0.57393
8400	71.879:28.121	0.39123	2.28530	0.69867



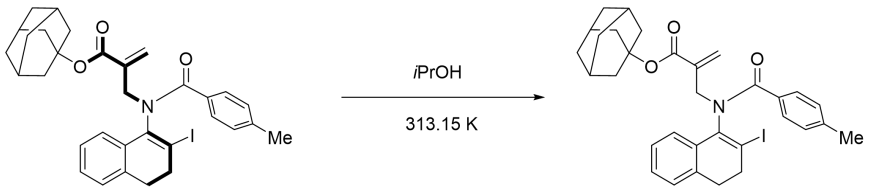
$k_{ent} = \frac{1}{2} k_{rac}$

$k_{ent} = \frac{1}{2} slope = 3.00057 \times 10^{-5}$

$\Delta G_T^{\ddagger} = \ln\left(\frac{k_B T}{h \times k_{ent}}\right) RT = 103.97$ kJ mol^{-1}

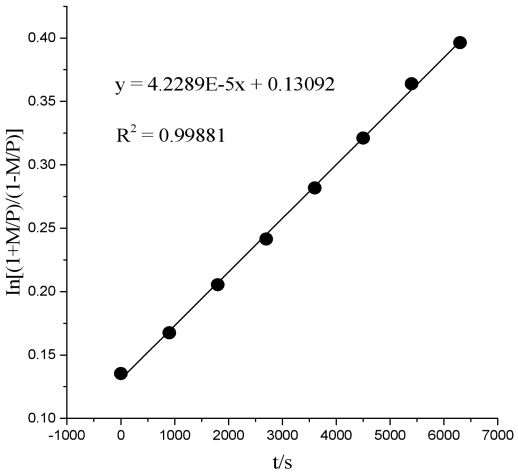
Barriers to racemization of **4d**

Fractions collected and racemized by incubation at 40 °C in isopropyl alcohol.



single enatiomer *racemic*

t/(s)	er	M/P	[1+(M/P)]/[1-(M/P)]	In
0	93.670:6.330	0.06758	1.14495	0.13536
900	92.289:7.711	0.08355	1.18234	0.16750
1800	90.714:9.286	0.10237	1.22808	0.20545
2700	89.273:10.727	0.12016	1.27314	0.24149
3600	87.722:12.278	0.13996	1.32549	0.28178
4500	86.267:13.733	0.15919	1.37866	0.32111
5400	84.746:15.254	0.18000	1.43901	0.36396
6300	83.636:16.364	0.19566	1.48650	0.39643



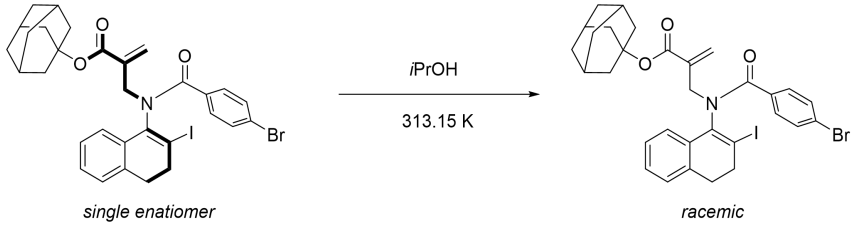
$k_{ent} = \frac{1}{2} k_{rac}$

$k_{ent} = \frac{1}{2} slope = 2.11445 \times 10^{-5}$

$\Delta G_T^{\ddagger} = \text{In}\left(\frac{k_B T}{h \times k_{ent}}\right) RT = 104.85 \text{ kJ mol}^{-1}$

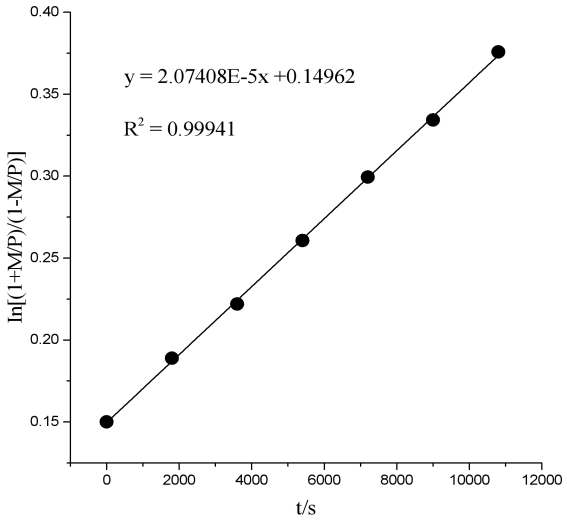
Barriers to racemization of **4f**

Fractions collected and racemized by incubation at 40 °C in isopropyl alcohol.



single enatiomer *racemic*

t/(s)	er	M/P	[1+(M/P)]/[1-(M/P)]	In
0	93.031:6.969	0.07491	1.16195	0.15010
1800	91.731:8.269	0.09014	1.19815	0.18078
3600	90.046:9.954	0.11054	1.24856	0.22199
5400	88.524:11.476	0.12964	1.29789	0.26074
7200	87.062:12.938	0.14861	1.34909	0.29943
9000	85.792:14.208	0.16561	1.39696	0.33430
10800	84.336:15.664	0.18573	1.45620	0.37583



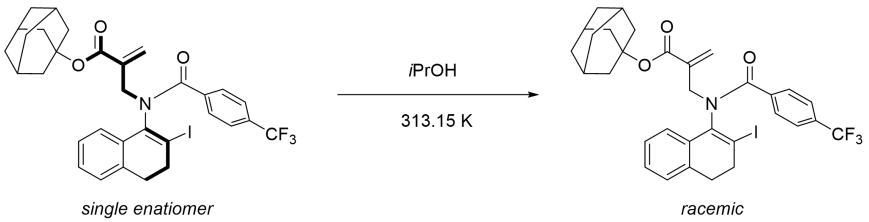
$k_{ent} = \frac{1}{2} k_{rac}$

$k_{ent} = \frac{1}{2} slope = 1.03704 \times 10^{-5}$

$\Delta G_T^{\ddagger} = \ln\left(\frac{k_B T}{h \times k_{ent}}\right) RT = 106.71$ kJ mol^{-1}

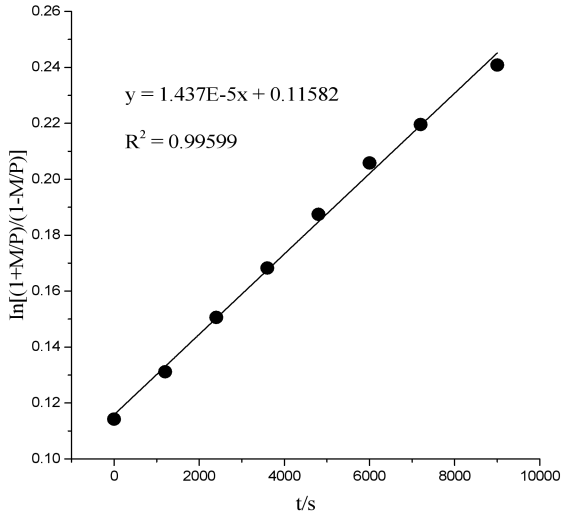
Barriers to racemization of **4i**

Fractions collected and racemized by incubation at 40 °C in isopropyl alcohol.



single enatiomer *racemic*

t/(s)	er	M/P	[1+(M/P)]/[1-(M/P)]	In
0	94.603:5.397	0.05705	1.12100	0.11422
1200	93.853:6.147	0.06550	1.14017	0.13118
2400	93.009:6.991	0.07516	1.16255	0.15061
3600	92.257:7.743	0.08393	1.18324	0.16825
4800	91.453:8.547	0.09346	1.20619	0.18746
6000	90.698:9.302	0.10256	1.22856	0.20584
7200	90.144:9.856	0.10934	1.24552	0.21955
9000	89.298:10.702	0.11985	1.27233	0.24085



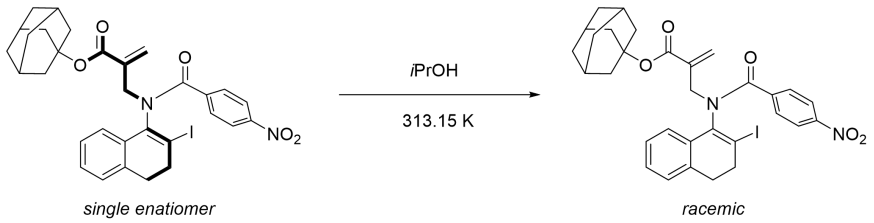
$k_{ent} = \frac{1}{2} k_{rac}$

$k_{ent} = \frac{1}{2} slope = 7.185 \times 10^{-6}$

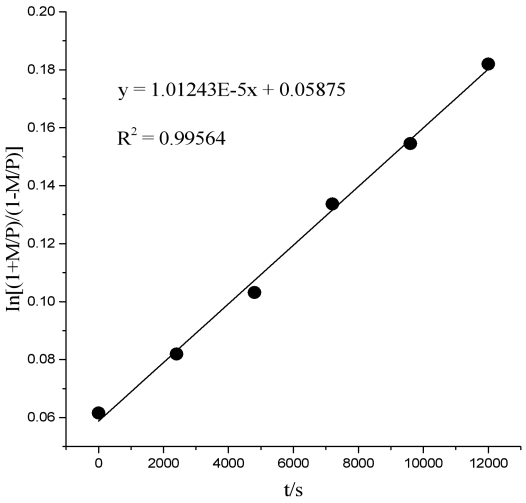
$\Delta G_T^{\ddagger} = \text{In}\left(\frac{k_B T}{h \times k_{ent}}\right) RT = 107.66 \text{ kJ mol}^{-1}$

Barriers to racemization of **4j**

Fractions collected and racemized by incubation at 40 °C in isopropyl alcohol.



t/(s)	er	M/P	[1+(M/P)]/[1-(M/P)]	In
0	97.013:2.987	0.03079	1.06354	0.06160
2400	96.067:3.933	0.04094	1.08538	0.08193
4800	95.099:4.901	0.05154	1.10867	0.10316
7200	93.742:6.258	0.06676	1.14307	0.13371
9600	92.840:7.160	0.07712	1.16713	0.15455
12000	91.680:8.320	0.09075	1.19962	0.18200



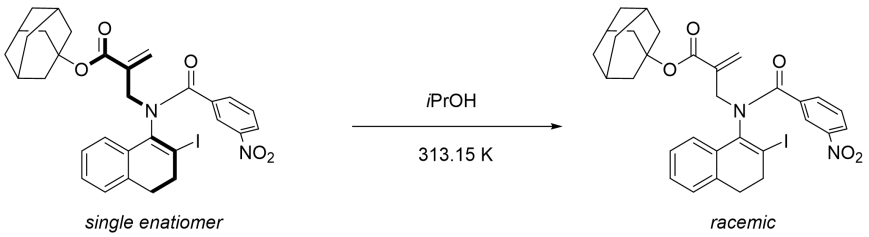
$k_{ent} = \frac{1}{2} k_{rac}$

$k_{ent} = \frac{1}{2} slope = 5.06215 \times 10^{-6}$

$\Delta G^{\ddagger}_{T} = \ln\left(\frac{k_B T}{h \times k_{ent}}\right) RT = 108.57$ kJ mol^{-1} = 25.94 kcal/mol

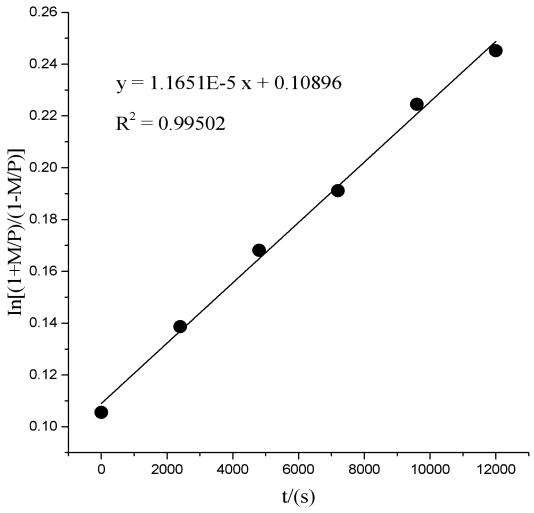
Barriers to racemization of **4l**

Fractions collected and racemized by incubation at 40 °C in isopropyl alcohol.



single enatiomer *racemic*

t/(s)	er	M/P	[1+(M/P)]/[1-(M/P)]	In
0	94.991:5.009	0.05273	1.11133	0.10556
2400	93.526:6.474	0.06922	1.14874	0.13866
4800	92.262:7.738	0.08387	1.18310	0.16813
7200	91.301:8.699	0.09528	1.21062	0.19114
9600	89.945:10.055	0.11179	1.25172	0.22452
12000	89.128:10.872	0.12198	1.27786	0.24518



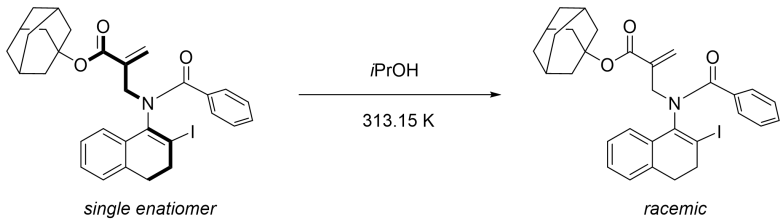
$k_{ent} = \frac{1}{2} k_{rac}$

$k_{ent} = \frac{1}{2} slope = 5.8255 \times 10^{-6}$

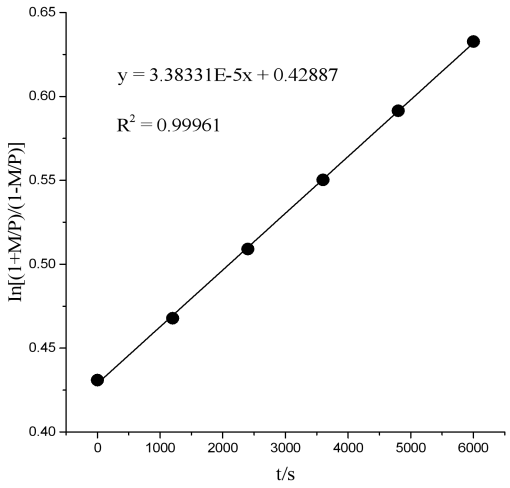
$\Delta G_T^{\ddagger} = \text{In}\left(\frac{k_B T}{h \times k_{ent}}\right) RT = 108.21 \text{ kJ mol}^{-1} = 25.85 \text{ kcal/mol}$

Barriers to racemization of **4bm**

Fractions collected and racemized by incubation at 40 °C in isopropyl alcohol.



t/(s)	er	M/P	[1+(M/P)]/[1-(M/P)]	In
0	82.495:17.505	0.21220	1.53870	0.43094
1200	81.319:18.681	0.22973	1.59651	0.46782
2400	80.054:19.946	0.24916	1.66370	0.50904
3600	73.839:21.161	0.26840	1.73370	0.55026
4800	77.675:22.325	0.28741	1.80666	0.59148
6000	76.558:23.442	0.30620	1.88268	0.63270



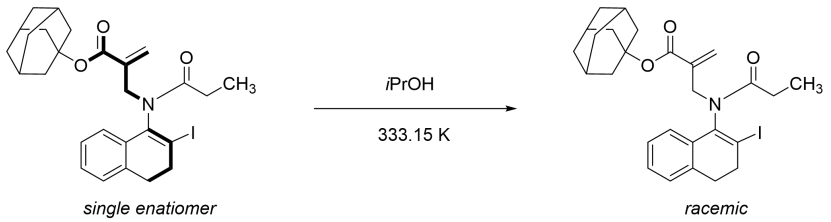
$k_{ent} = \frac{1}{2} k_{rac}$

$k_{ent} = \frac{1}{2} slope = 1.691655 \times 10^{-5}$

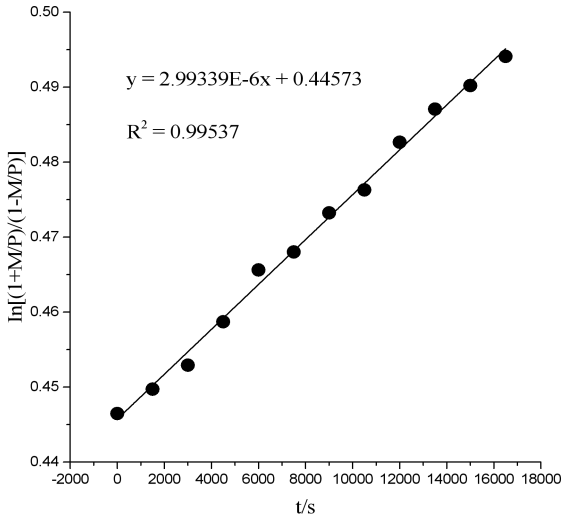
$\Delta G_T^{\ddagger} = \text{In}\left(\frac{k_B T}{h \times k_{ent}}\right) RT = 105.39$ kJ mol

Barriers to racemization of **4n**

Fractions collected and racemized by incubation at 60 °C in isopropyl alcohol.



t/(s)	er	M/P	[1+(M/P)]/[1-(M/P)]	In
0	81.994:18.006	0.21960	1.56279	0.44647
1500	81.890:18.110	0.22115	1.56789	0.44973
3000	81.788:18.212	0.22267	1.57292	0.45293
4500	81.605:18.395	0.22542	1.58203	0.45871
6000	81.387:18.613	0.22870	1.59302	0.46563
7500	81.322:18.688	0.22980	1.59674	0.46802
9000	81.149:18.851	0.23230	1.60519	0.47324
10500	81.054:18.946	0.23375	1.61010	0.47630
12000	80.857:19.143	0.23675	1.62038	0.48266
13500	80.721:19.279	0.23883	1.62755	0.48708
15000	80.625:19.375	0.24031	1.63265	0.49021
16500	80.506:19.494	0.24214	1.63902	0.49410



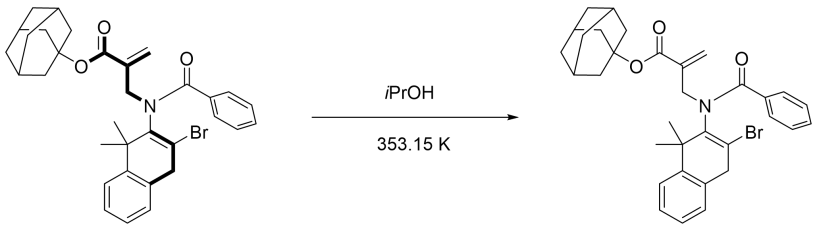
$k_{ent} = \frac{1}{2} k_{rac}$

$k_{ent} = \frac{1}{2} slope = 1.496695 \times 10^{-6}$

$\Delta G_T^{\ddagger} = \text{In}\,(\frac{k_B T}{h \times k_{ent}})\, RT = 119.06$ kJ mol^{-1} = 28.44 kcal/mol^{-1}

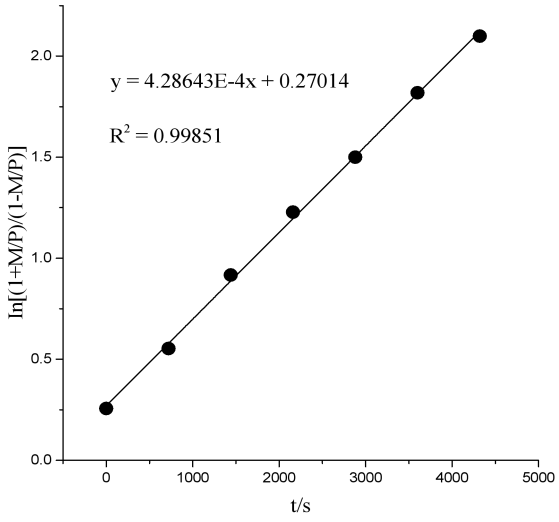
Barriers to racemization of **4za**

Fractions collected and racemized by incubation at 80 °C in isopropyl alcohol.



single enatiomer *racemic*

t/(s)	er	M/P	[1+(M/P)]/[1-(M/P)]	In
0	88.687:11.313	0.12756	1.29242	0.25652
720	78.761:21.239	0.26966	1.73847	0.55300
1440	69.985:30.015	0.42888	2.50188	0.91704
2160	64.644:35.356	0.54693	3.41437	1.22800
2880	61.157:38.843	0.63514	4.48149	1.49996
3600	58.113:41.887	0.72079	6.16295	1.81856
4320	56.129:43.871	0.78161	8.15794	2.09899

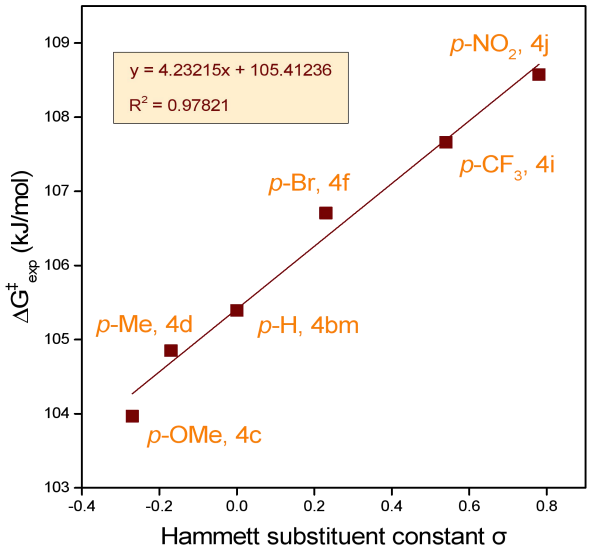


$k_{ent} = \frac{1}{2} k_{rac}$

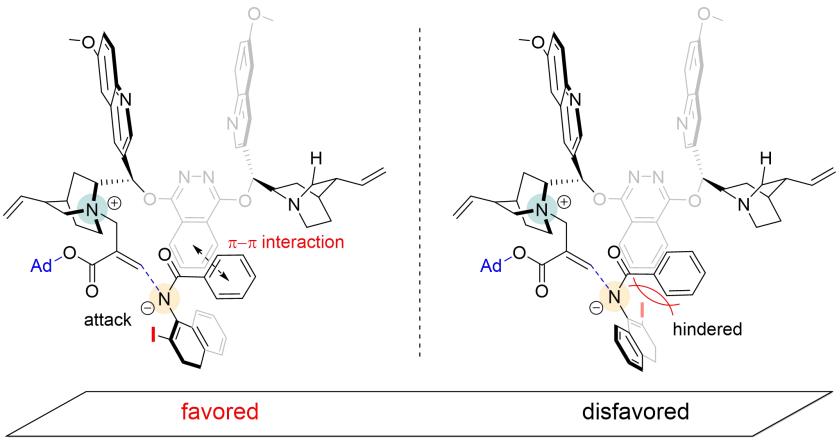
$k_{ent} = \frac{1}{2} slope = 2.14315 \times 10^{-4}$

$\Delta G_T^{\ddagger} = \text{In}\,(\frac{k_B T}{h \times k_{ent}})\, RT = 111.80$ kJ mol^{-1} = 26.71 kcal/mol^{-1}

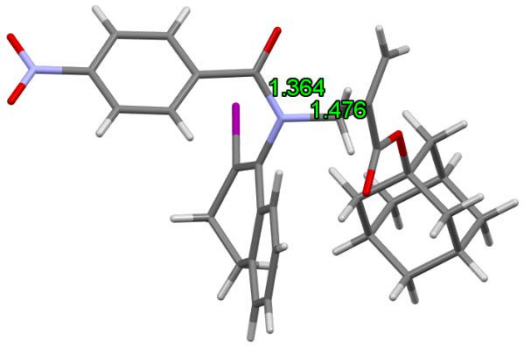
The linear relationship between rotational barriers and Hammett constant σ



Proposed transition state



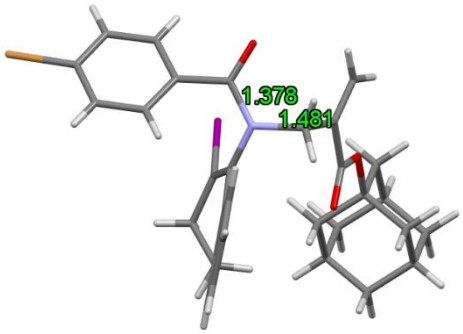
7. X-Ray Crystallographic Data



The X-ray single crystal structure of **4j**

Crystal data and structure refinement for r20211010b

Identification code	r20211010b
Empirical formula	$C_{31}H_{31}IN_2O_5$
Formula weight	638.48
Temperature/K	113.15
Crystal system	monoclinic
Space group	P21/c
a/Å	9.2462(3)
b/Å	13.0571(3)
c/Å	23.0265(7)
α/°	90
β/°	96.045(3)
γ/°	90
Volume/Å^3	2764.50(14)
Z	4
ρcalcg/cm^3	1.534
μ/mm^{-1}	1.202
F(000)	1296.0
Crystal size/mm^3	0.22 × 0.17 × 0.13
Radiation	MoKα (λ = 0.71073)
2Θ range for data collection/°	4.732 to 52.744
Index ranges	-10 ≤ h ≤ 11, -16 ≤ k ≤ 16, -28 ≤ l ≤ 28
Reflections collected	20680
Independent reflections	5642 [R_{int} = 0.0452, R_{sigma} = 0.0392]
Data/restraints/parameters	5642/0/353
Goodness-of-fit on F^2	1.061
Final R indexes [I>=2σ (I)]	R_1 = 0.0377, wR_2 = 0.0785
Final R indexes [all data]	R_1 = 0.0461, wR_2 = 0.0829
Largest diff. peak/hole / e Å^{-3}	1.96/-0.69

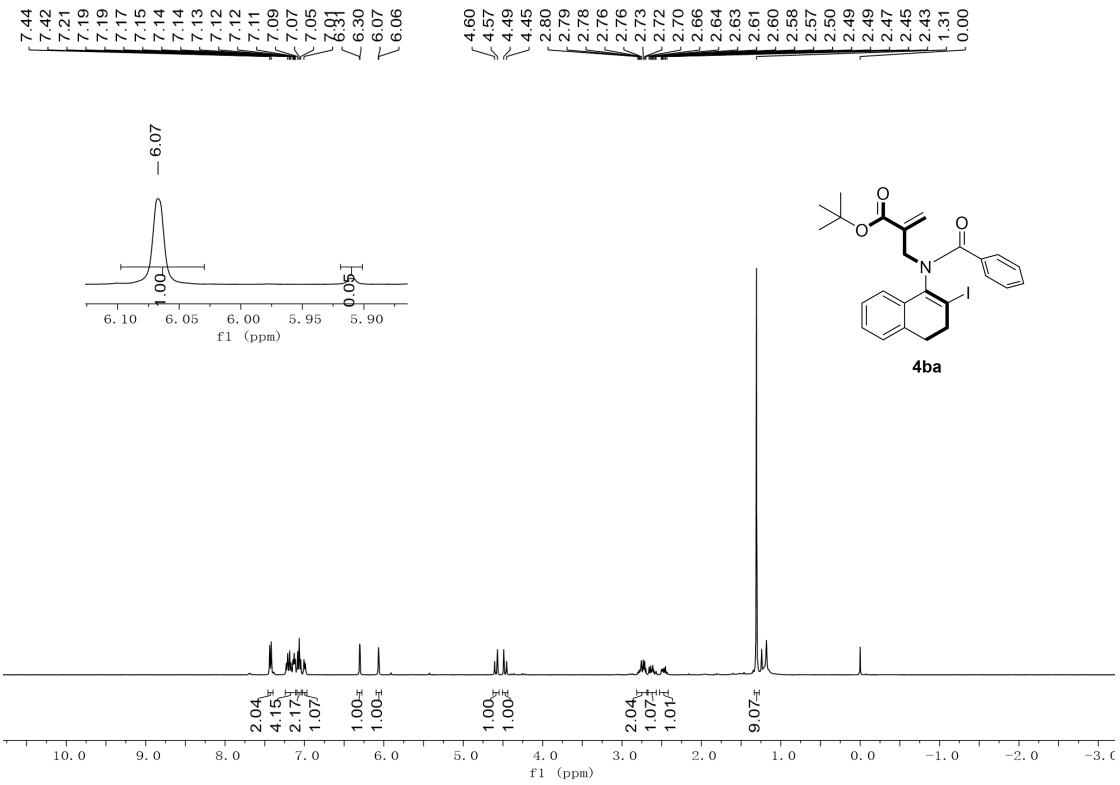


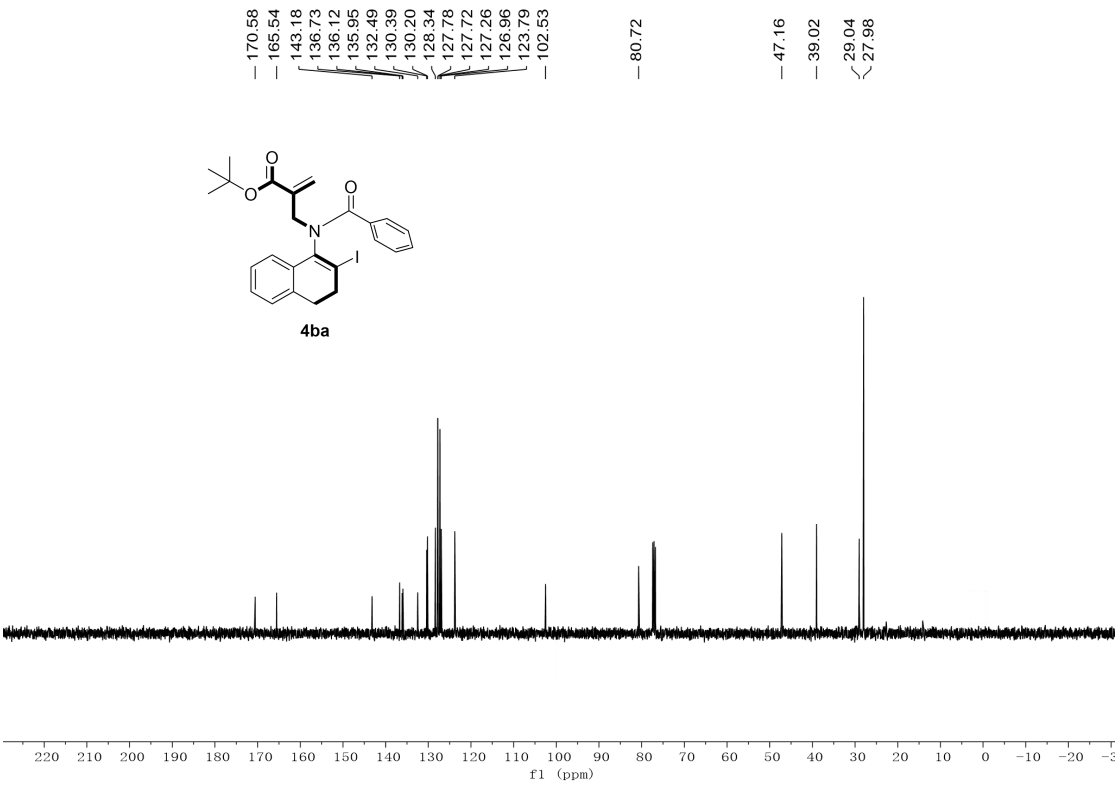
The X-ray single crystal structure of **4f**

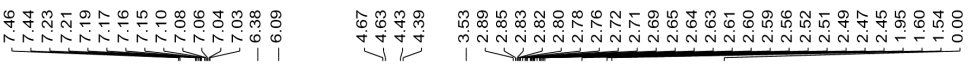
Crystal data and structure refinement for r20210720b.

Identification code	r20210720b
Empirical formula	$C_{31}H_{31}BrINO_3$
Formula weight	672.38
Temperature/K	113.15
Crystal system	triclinic
Space group	P-1
a/Å	14.3867(9)
b/Å	14.4019(8)
c/Å	16.0728(8)
α/°	82.079(4)
β/°	69.450(5)
γ/°	61.749(6)
Volume/Å^3	2745.2(3)
Z	4
ρcalcg/cm^3	1.627
μ/mm^{-1}	2.655
F(000)	1344.0
Crystal size/mm^3	0.22 × 0.2 × 0.16
Radiation	MoKα (λ = 0.71073)
2Θ range for data collection/°	3.212 to 65.876
Index ranges	-21 ≤ h ≤ 21, -21 ≤ k ≤ 21, -24 ≤ l ≤ 24
Reflections collected	41517
Independent reflections	18410 [R_{int} = 0.0847, R_{sigma} = 0.1339]
Data/restraints/parameters	18410/0/667
Goodness-of-fit on F^2	0.987
Final R indexes [I>=2σ (I)]	R_1 = 0.0568, wR_2 = 0.0907
Final R indexes [all data]	R_1 = 0.1171, wR_2 = 0.1145
Largest diff. peak/hole / e Å^{-3}	1.43/-1.16

8. NMR Spectra and HPLC Spectra of Products






7.46
7.44
7.23
7.21
7.19
7.17
7.16
7.15
7.10
7.08
7.06
7.04
7.03
6.38
6.09
4.67
4.63
4.43
4.39
3.53
2.89
2.85
2.83
2.82
2.80
2.78
2.76
2.72
2.71
2.69
2.65
2.64
2.63
2.61
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2.52
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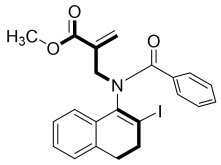
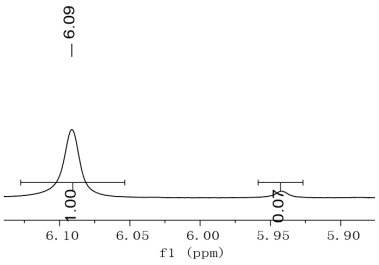
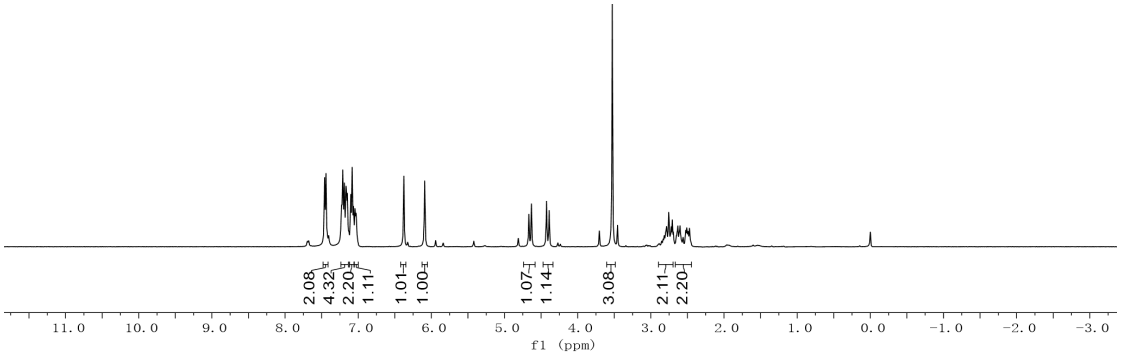
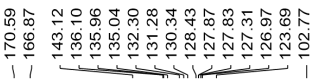
2.47
2.45
1.95
1.60
1.54
0.00


O
H3C
O
O
N
I

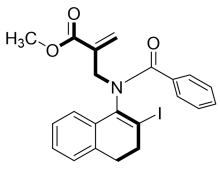
4bb


6.09
1.00
0.07
6.10
6.05
6.00
5.95
5.90
f1 (ppm)

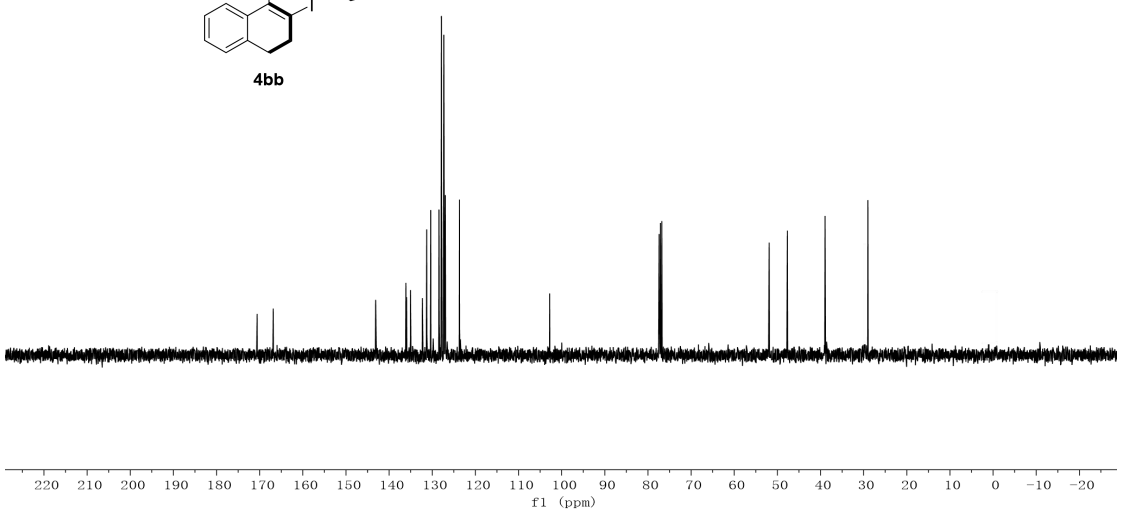

2.08
4.32
2.20
1.11
1.01
1.00
1.07
1.14
3.08
2.11
2.20
11.0
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
-1.0
-2.0
-3.0
f1 (ppm)

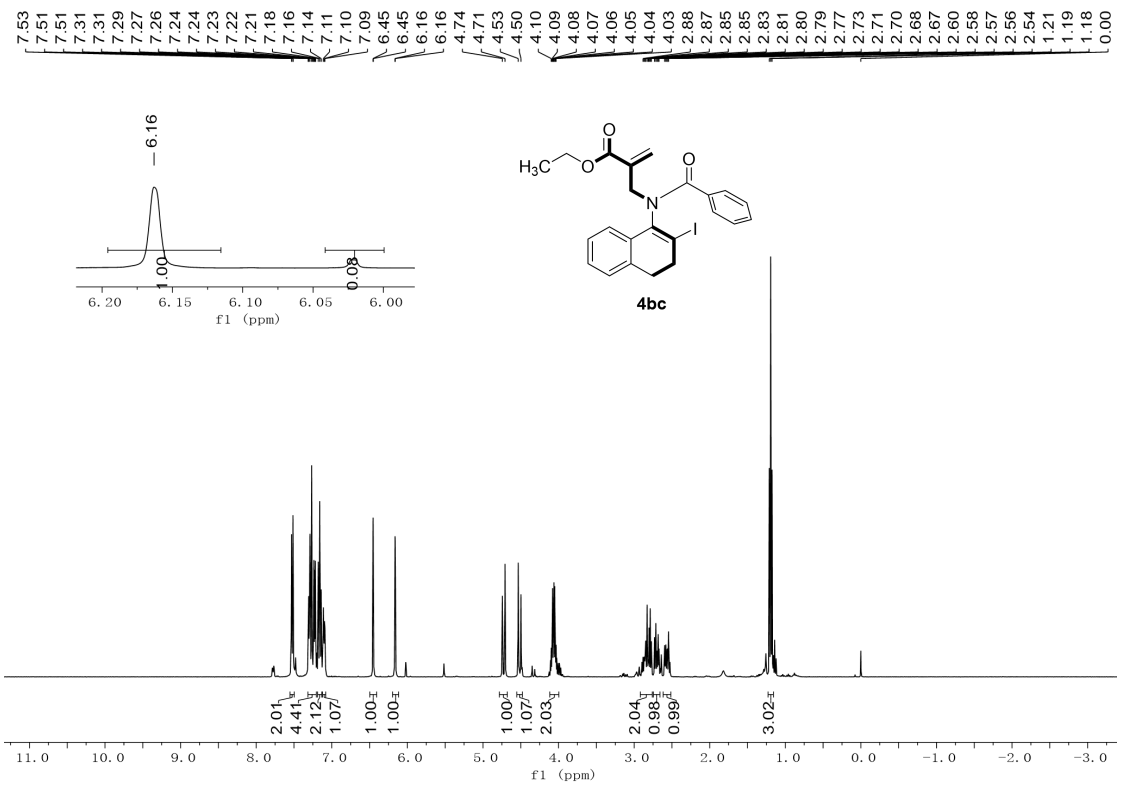

170.59
166.87
143.12
136.10
135.96
135.04
132.30
131.28
130.34
128.43
127.87
127.83
127.31
126.97
123.69
102.77

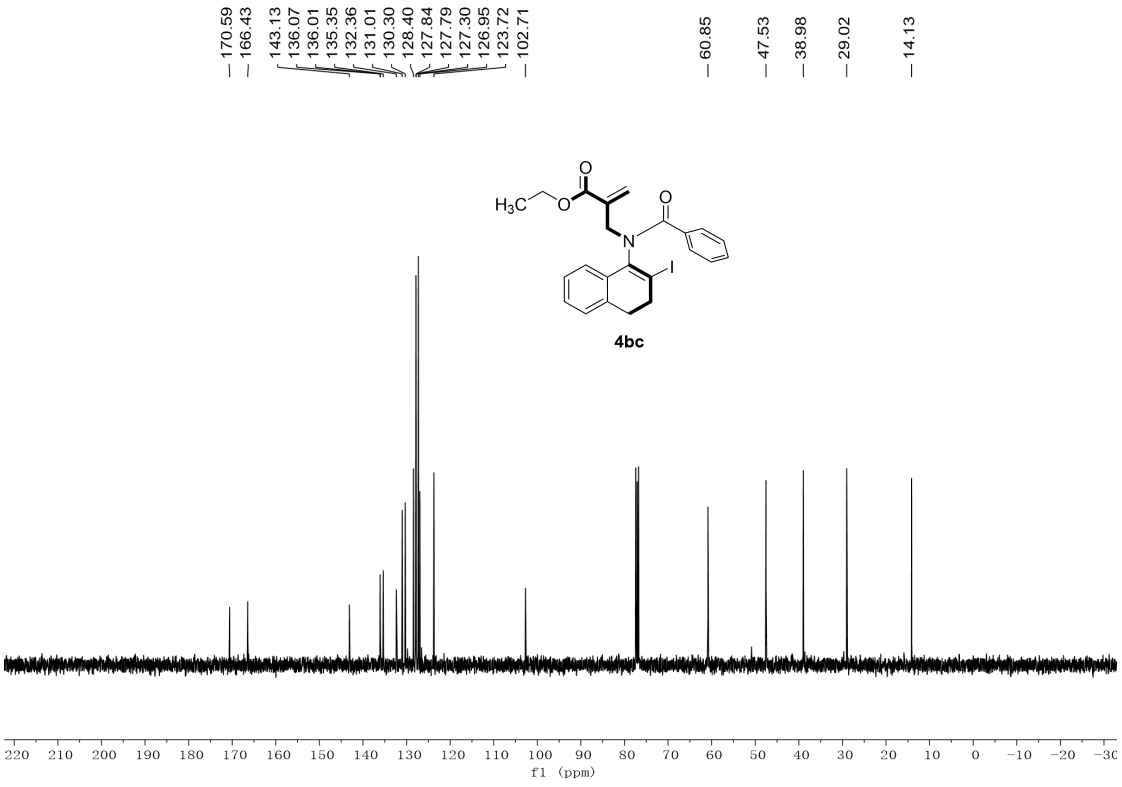

51.91
47.70
38.95
29.02

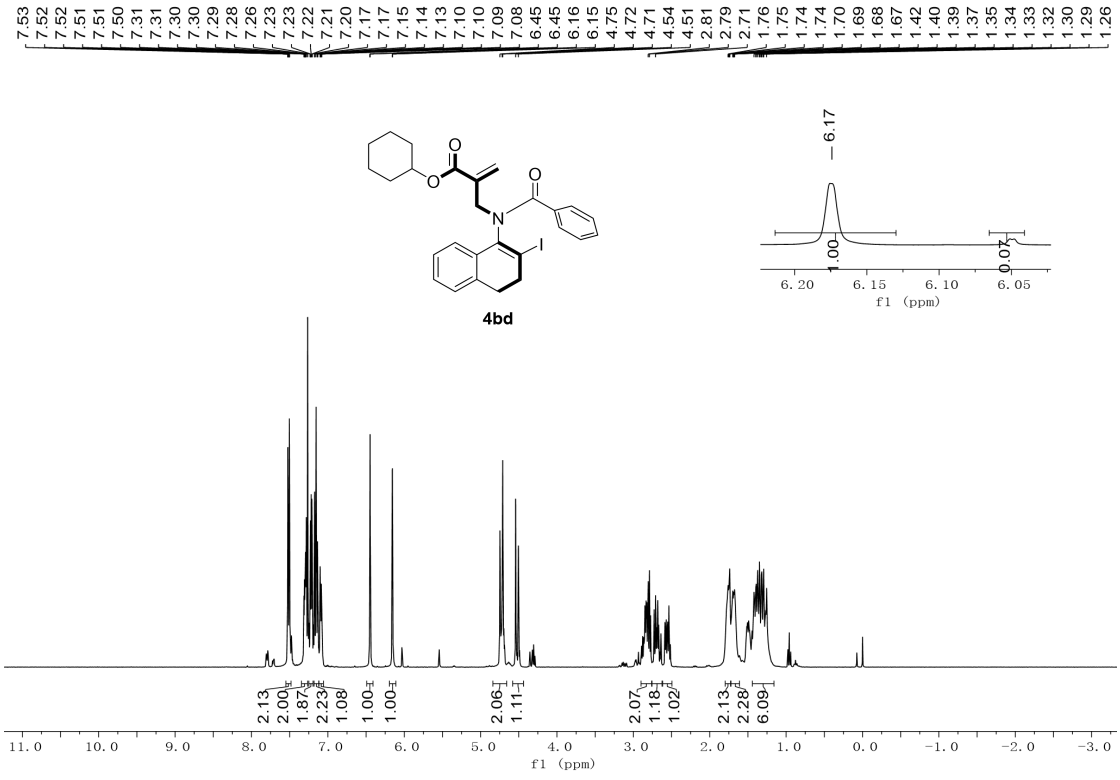

O
H3C
O
O
N
I

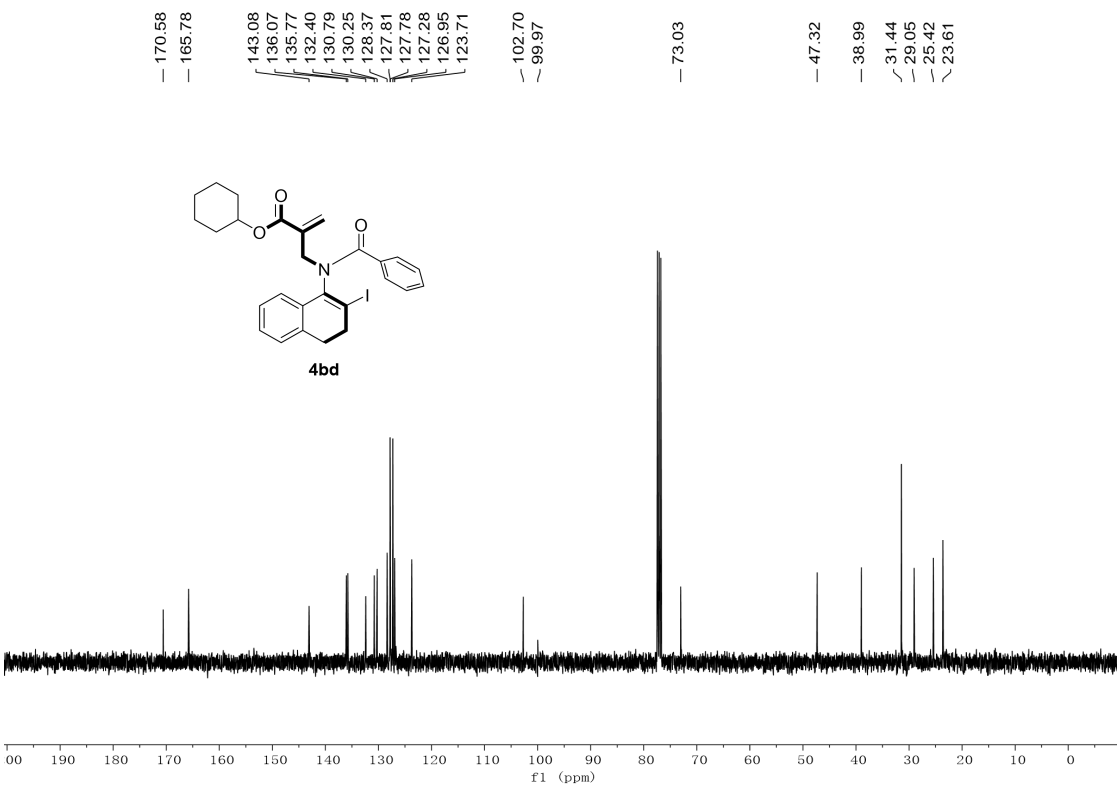
4bb

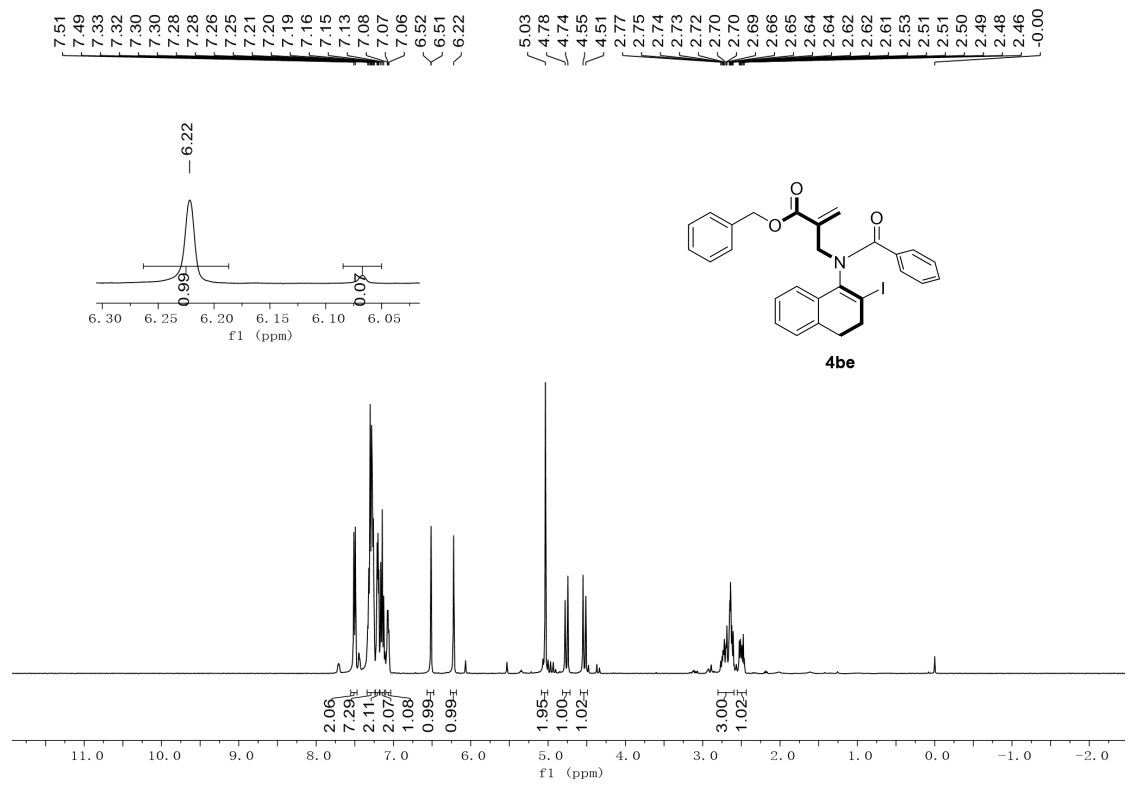

220
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
-10
-20
f1 (ppm)

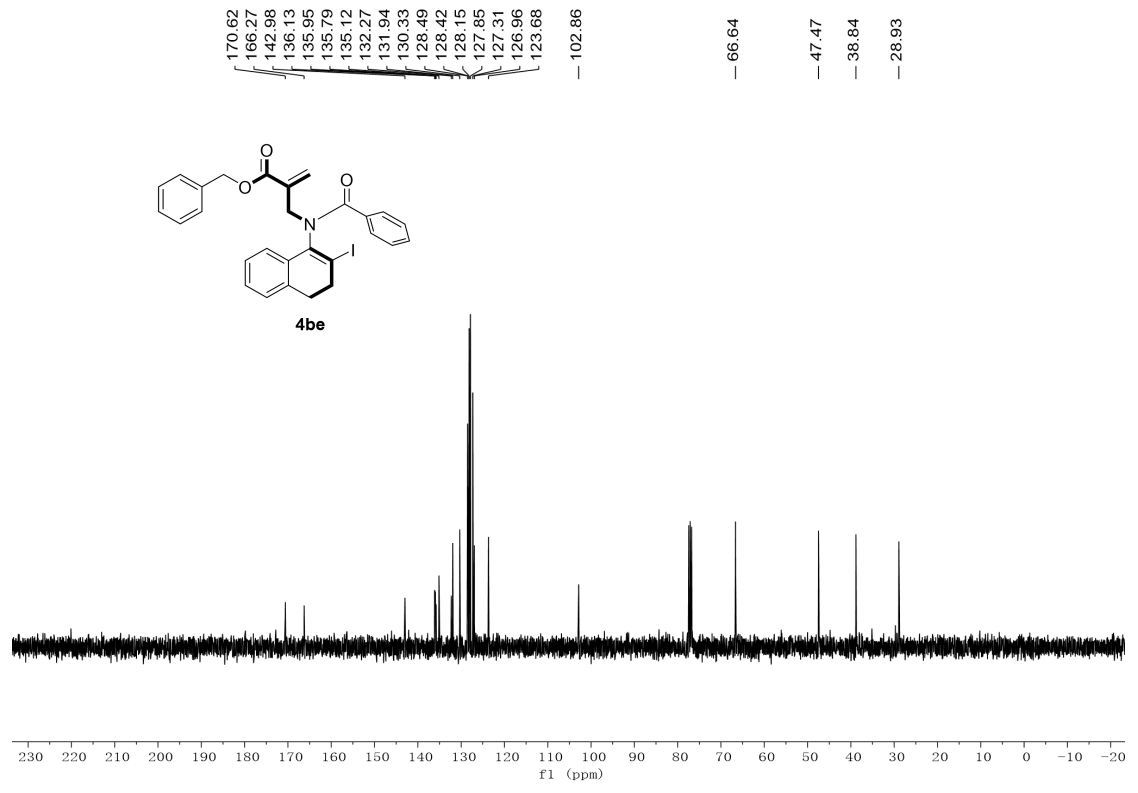

7.53 7.51 7.51 7.31 7.31 7.29 7.27 7.26 7.24 7.24 7.23 7.22 7.21 7.18 7.16 7.14 7.11 7.10 7.09 6.45 6.45 6.16 6.16 4.74 4.71 4.53 4.50 4.10 4.09 4.08 4.07 4.06 4.05 4.04 4.03 2.88 2.87 2.85 2.85 2.83 2.81 2.80 2.79 2.77 2.73 2.71 2.70 2.68 2.67 2.60 2.58 2.57 2.56 2.54 1.21 1.19 1.18 0.00
6.16
1.00
0.08
6.20 6.15 6.10 6.05 6.00
f1 (ppm)
4bc
2.01 4.41 2.12 1.07 1.00 1.00 1.00 1.07 2.03 2.04 0.98 0.99 3.02
11.0 10.0 9.0 8.0 7.0 6.0 5.0 4.0 3.0 2.0 1.0 0.0 -1.0 -2.0 -3.0
f1 (ppm)

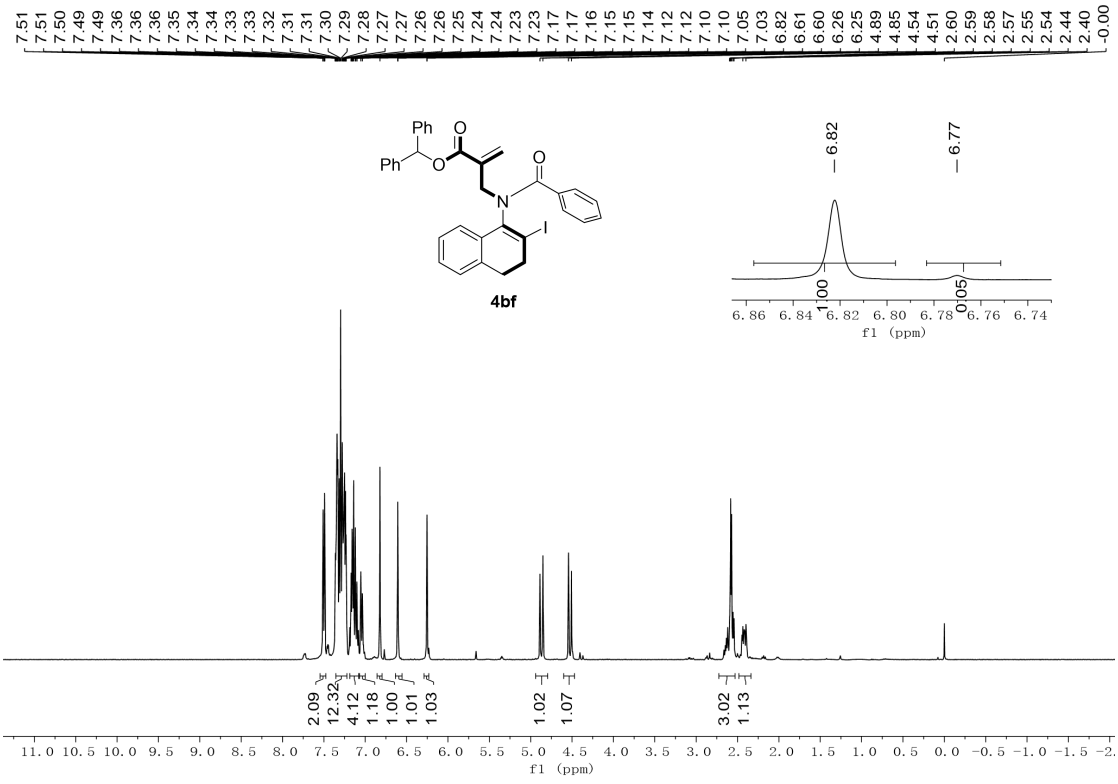

170.59 166.43 143.13 136.07 136.01 135.35 132.36 131.01 130.30 128.40 127.84 127.79 127.30 126.95 123.72 102.71 60.85 47.53 38.98 29.02 14.13
4bc
220 210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10 -20 -30
f1 (ppm)

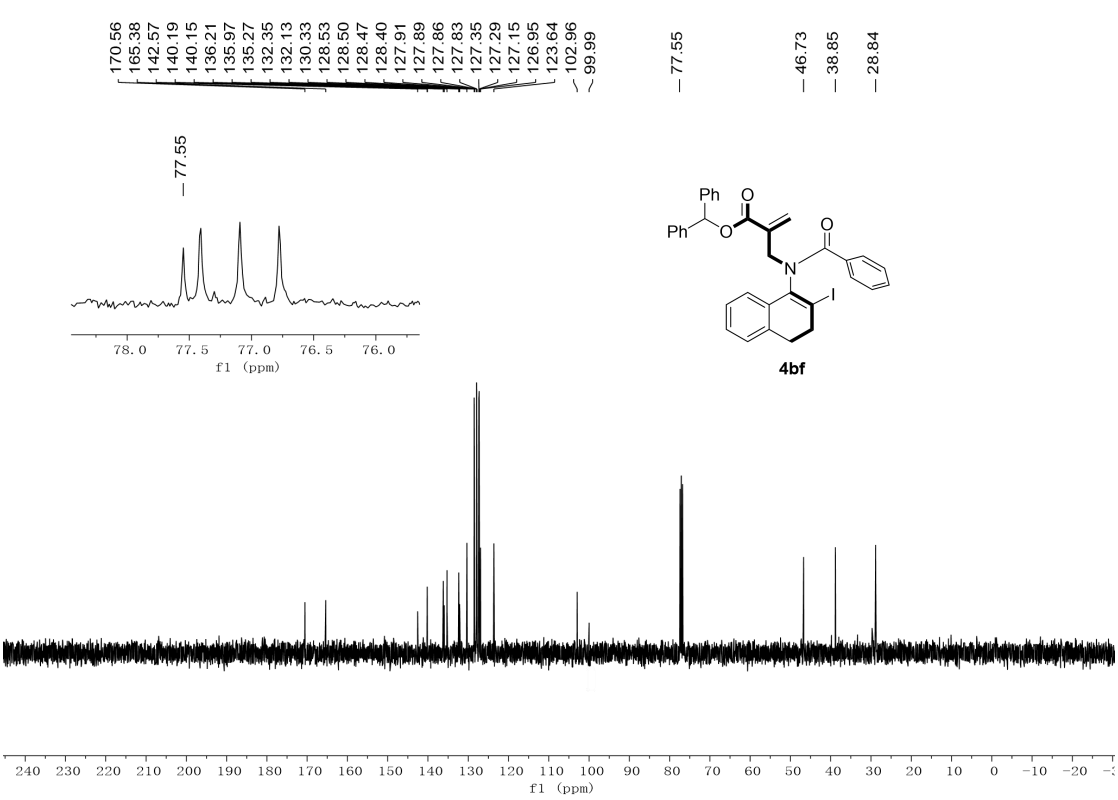

7.53 7.52 7.52 7.51 7.51 7.50 7.31 7.31 7.30 7.30 7.29 7.28 7.26 7.23 7.23 7.22 7.21 7.20 7.17 7.17 7.15 7.14 7.13 7.10 7.10 7.09 7.08 6.45 6.16 6.15 4.75 4.72 4.71 4.54 4.51 2.81 2.79 2.71 1.76 1.75 1.74 1.74 1.70 1.69 1.68 1.67 1.42 1.40 1.39 1.37 1.35 1.34 1.33 1.32 1.30 1.29 1.26
O
O
O
N
I
4bd
6.17
1.00
0.07
6.20 6.15 6.10 6.05
f1 (ppm)
2.13 2.00 1.87 2.23 1.08 1.00 1.00 2.06 1.11 2.07 1.18 1.02 2.13 2.28 6.09
11.0 10.0 9.0 8.0 7.0 6.0 5.0 4.0 3.0 2.0 1.0 0.0 -1.0 -2.0 -3.0
f1 (ppm)

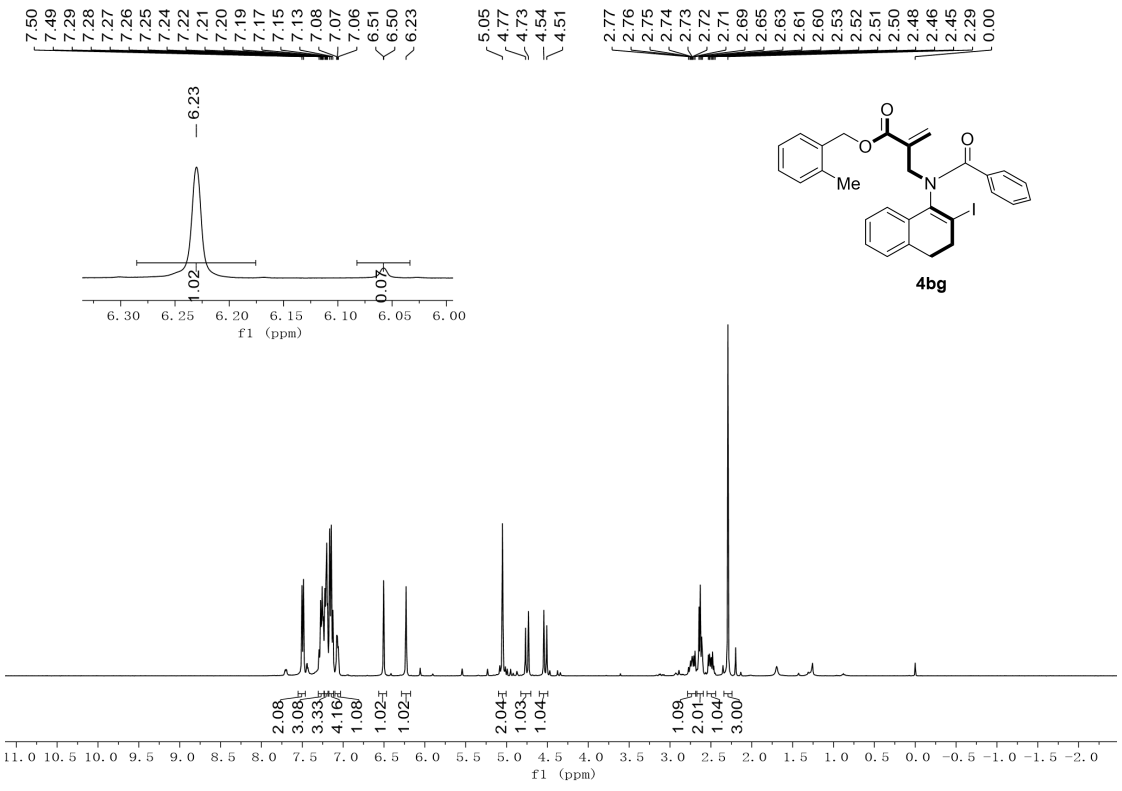

170.58
165.78
143.08
136.07
135.77
132.40
130.79
130.25
128.37
127.81
127.78
127.28
126.95
123.71
102.70
99.97
73.03
47.32
38.99
31.44
29.05
25.42
23.61
O
O
O
N
I
4bd
00 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

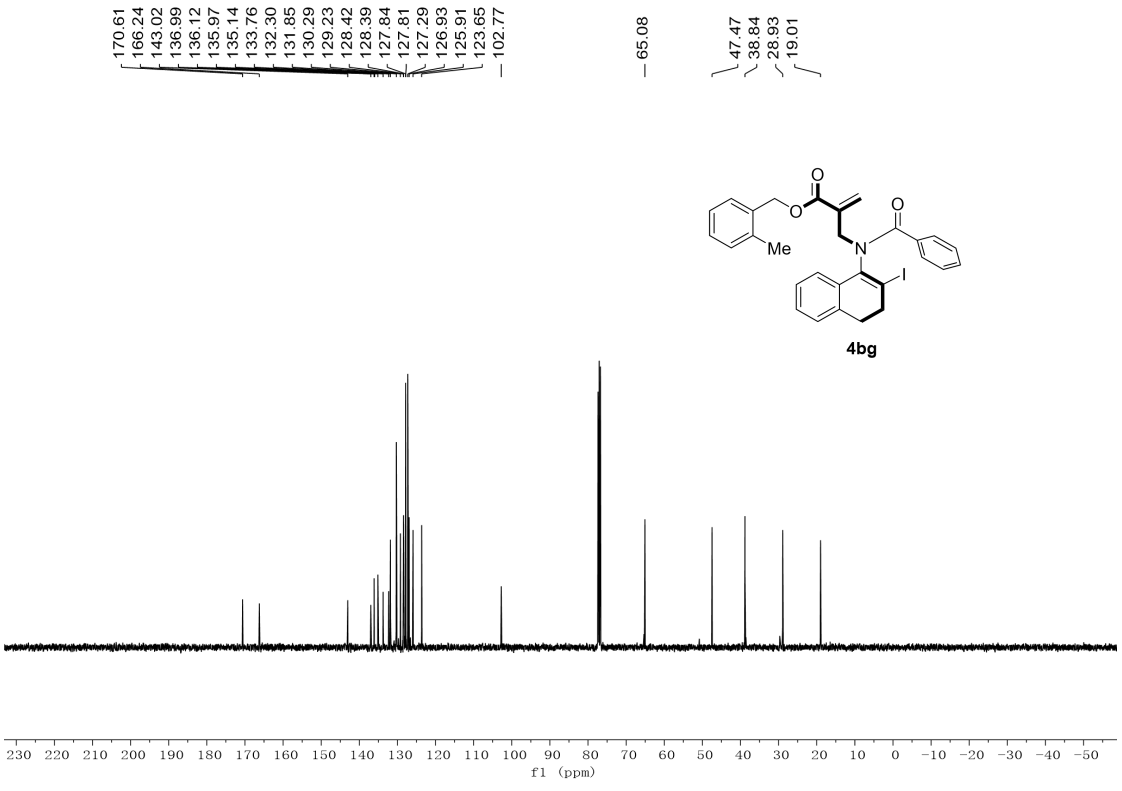

7.51 7.49 7.33 7.32 7.30 7.30 7.28 7.28 7.26 7.25 7.21 7.20 7.19 7.16 7.15 7.13 7.08 7.07 7.06 6.52 6.51 6.22
5.03 4.78 4.74 4.55 4.51 2.77 2.75 2.74 2.73 2.72 2.70 2.70 2.69 2.66 2.65 2.64 2.64 2.62 2.62 2.61 2.53 2.51 2.51 2.50 2.49 2.48 2.46 -0.00
6.22
0.99
0.07
6.30 6.25 6.20 6.15 6.10 6.05
f1 (ppm)
O
O
O
N
I
4be
2.06 7.29 2.11 2.07 1.08 0.99 0.99 1.95 1.00 1.02 3.00 1.02
11.0 10.0 9.0 8.0 7.0 6.0 5.0 4.0 3.0 2.0 1.0 0.0 -1.0 -2.0
f1 (ppm)

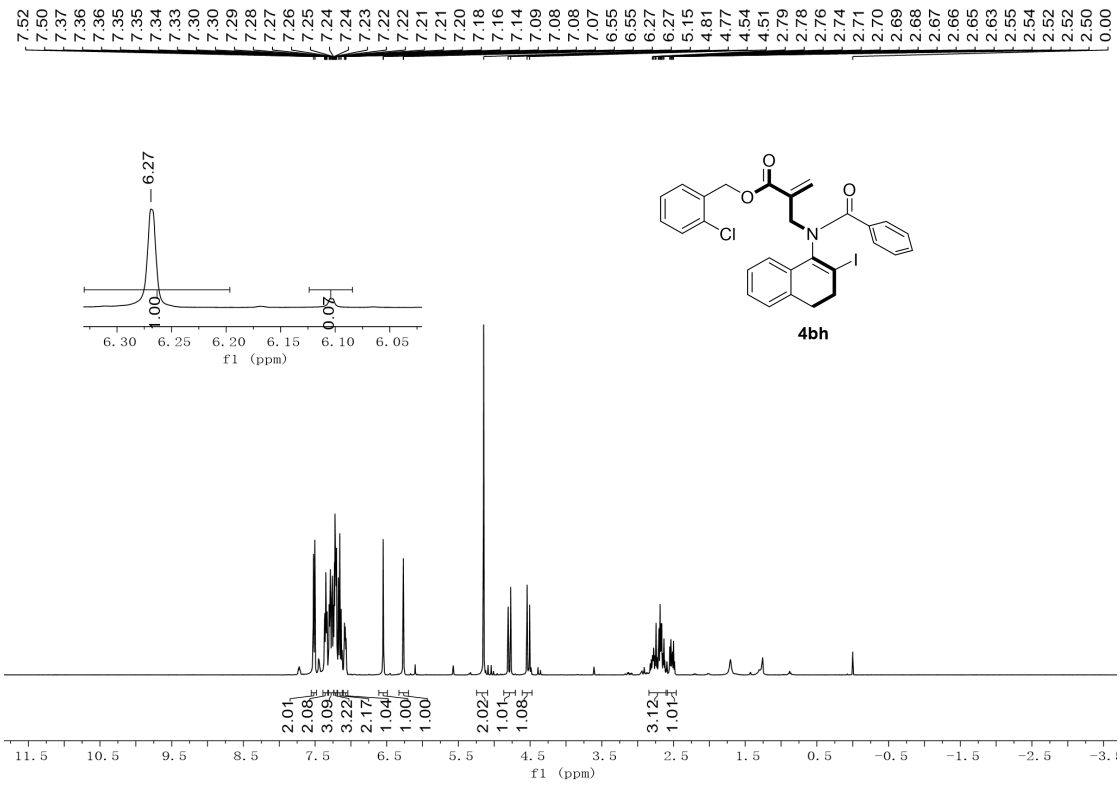

170.62 166.27 142.98 136.13 135.95 135.79 135.12 132.27 131.94 130.33 128.49 128.42 128.15 127.85 127.31 126.96 123.68 102.86 66.64 47.47 38.84 28.93
O
O
O
N
I
4be
230 220 210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10 -20
f1 (ppm)

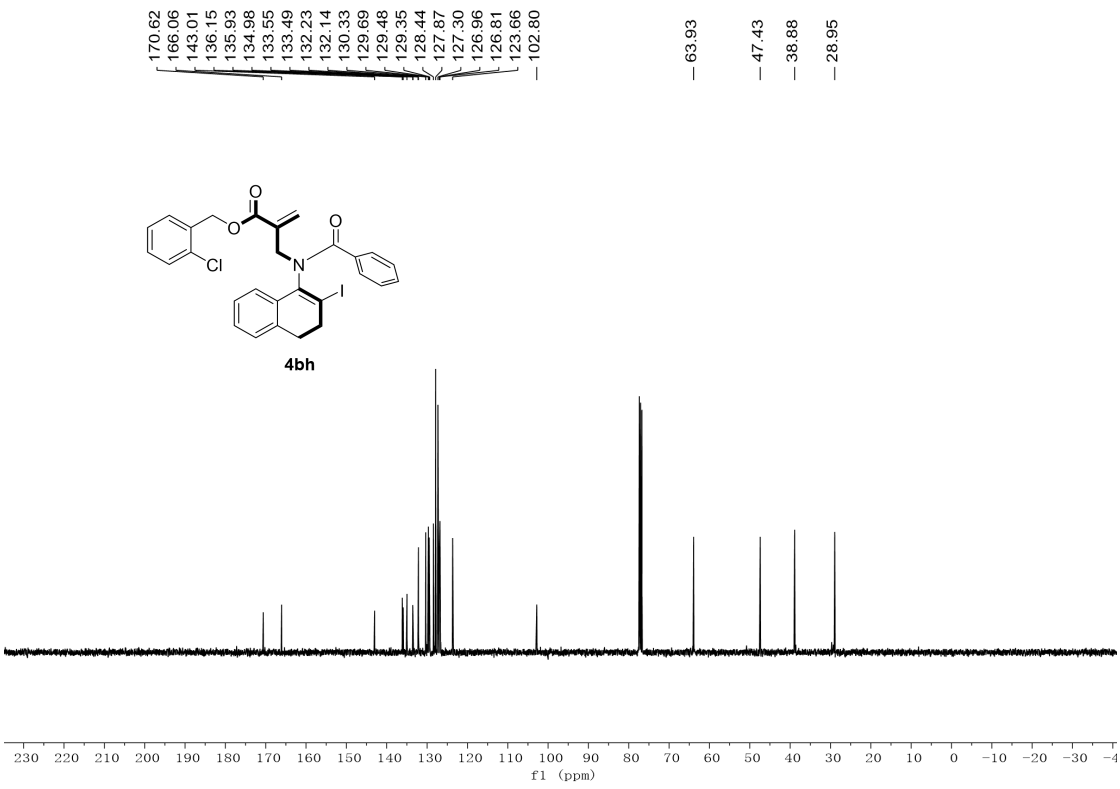

4bf
f1 (ppm)

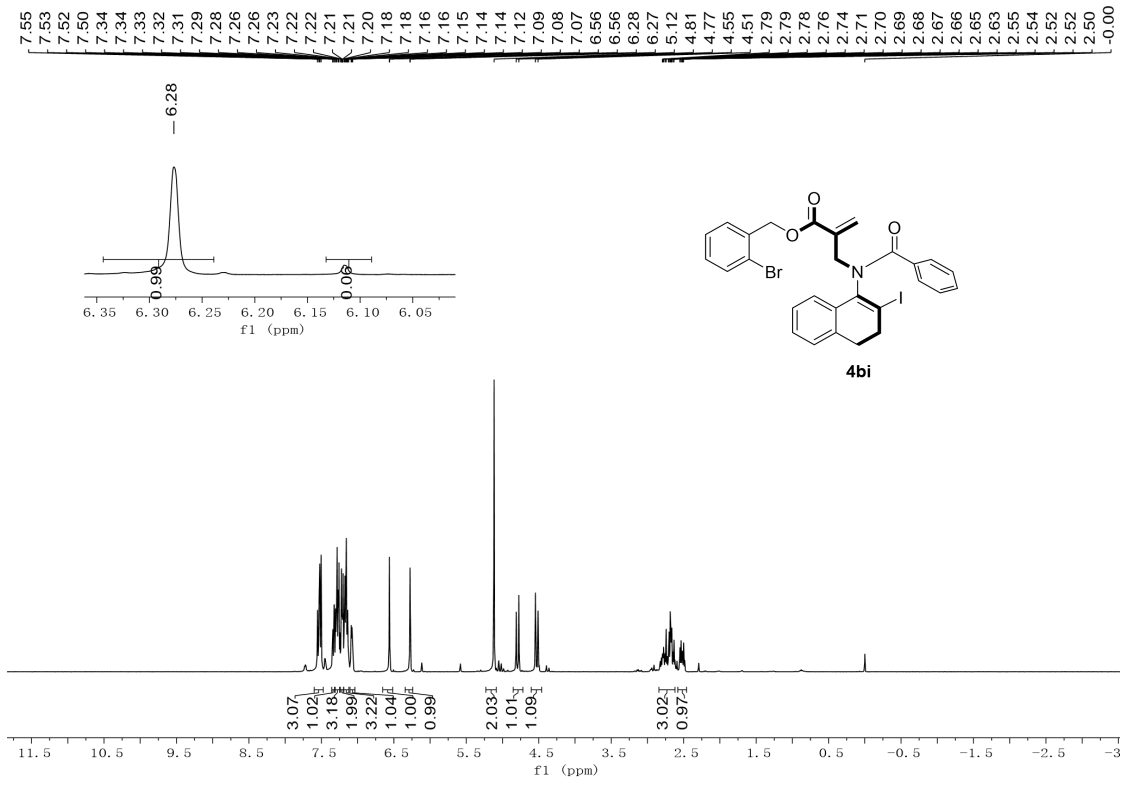

4bf
f1 (ppm)

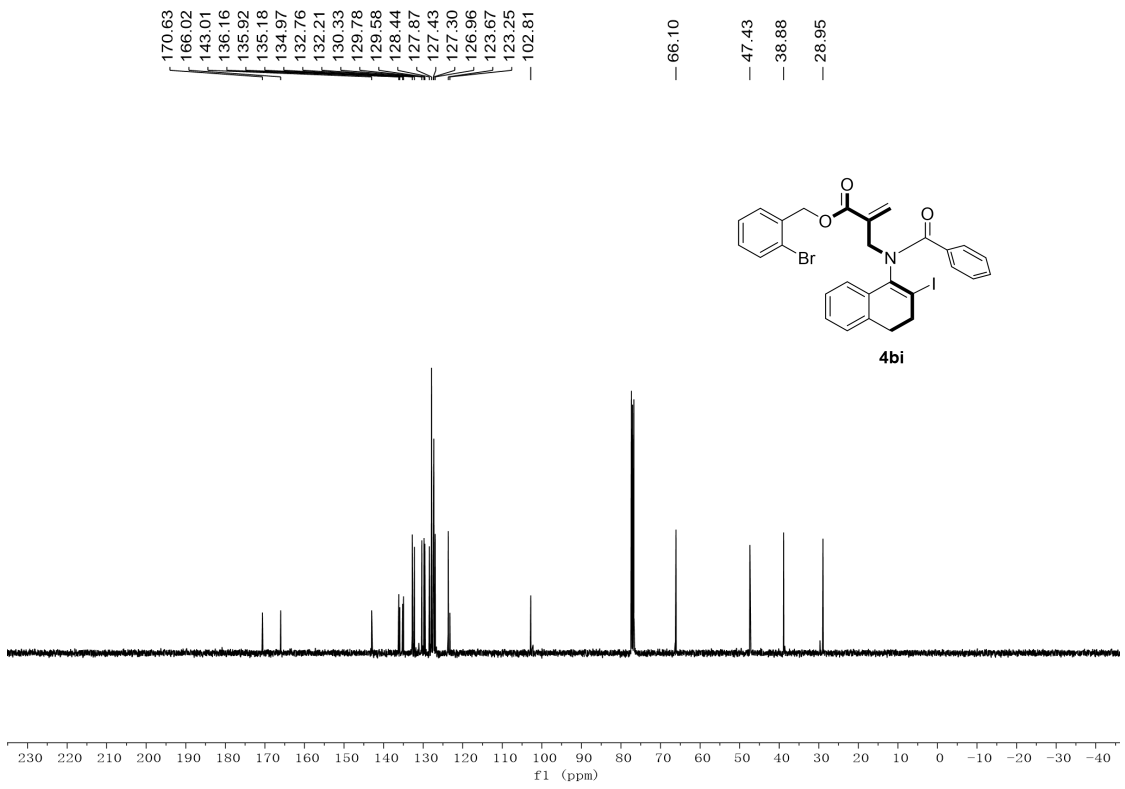

7.50 7.49 7.29 7.28 7.27 7.26 7.25 7.24 7.22 7.21 7.20 7.19 7.17 7.15 7.13 7.08 7.07 7.06 6.51 6.50 6.23
5.05 4.77 4.73 4.54 4.51
2.77 2.76 2.75 2.74 2.73 2.72 2.71 2.69 2.65 2.63 2.61 2.60 2.53 2.52 2.51 2.50 2.48 2.46 2.45 2.29 0.00
6.23
1.02
0.07
6.30 6.25 6.20 6.15 6.10 6.05 6.00
f1 (ppm)
Me
O
N
I
4bg
2.08 3.08 3.33 4.16 1.08 1.02 1.02 2.04 1.03 1.04 1.09 2.01 1.04 3.00
11.0 10.5 10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5 -1.0 -1.5 -2.0
f1 (ppm)

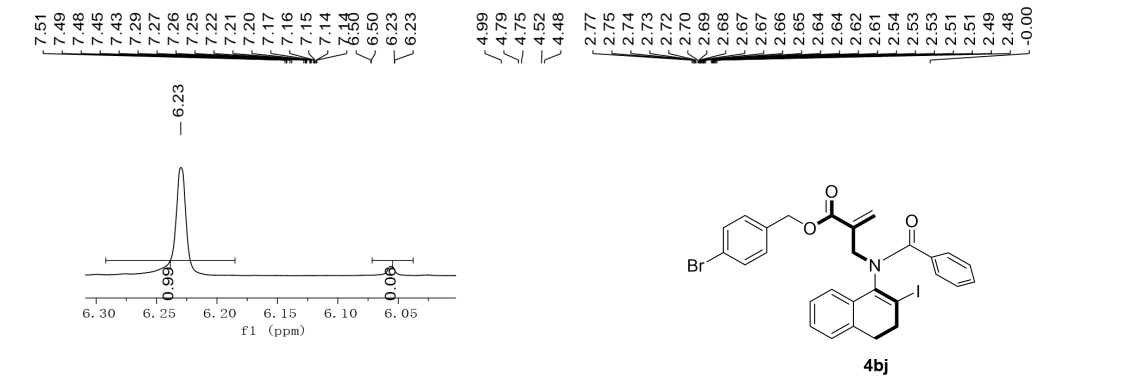

170.61 166.24 143.02 136.99 136.12 135.97 135.14 133.76 132.30 131.85 130.29 129.23 128.42 128.39 127.84 127.81 127.29 126.93 125.91 123.65 102.77
65.08
47.47 38.84 28.93 19.01
Me
O
N
I
4bg
230 220 210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10 -20 -30 -40 -50
f1 (ppm)


7.52 7.50 7.37 7.36 7.36 7.35 7.35 7.34 7.33 7.30 7.30 7.29 7.28 7.27 7.26 7.25 7.24 7.24 7.23 7.22 7.22 7.21 7.21 7.20 7.18 7.16 7.14 7.09 7.08 7.08 7.07 6.55 6.55 6.27 6.27 5.15 4.81 4.77 4.54 4.51 2.79 2.78 2.76 2.74 2.71 2.70 2.69 2.68 2.67 2.66 2.65 2.63 2.55 2.54 2.52 2.52 2.50 0.00
6.27
1.00
0.07
6.30 6.25 6.20 6.15 6.10 6.05
f1 (ppm)
O
O
O
Cl
N
I
4bh
2.01 2.08 3.09 3.22 2.17 1.04 1.00 1.00 2.02 1.01 1.08 3.12 1.01
11.5 10.5 9.5 8.5 7.5 6.5 5.5 4.5 3.5 2.5 1.5 0.5 −0.5 −1.5 −2.5
f1 (ppm)

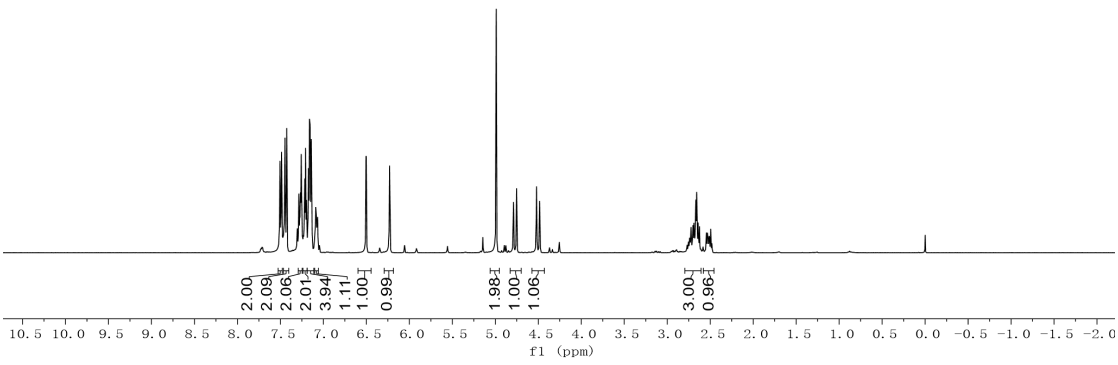

170.62 166.06 143.01 136.15 135.93 134.98 133.55 133.49 132.23 132.14 130.33 129.69 129.48 129.35 128.44 127.87 127.30 126.96 126.81 123.66 102.80
63.93
47.43
38.88
28.95
O
O
O
Cl
N
I
4bh
230 220 210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 −10 −20 −30
f1 (ppm)

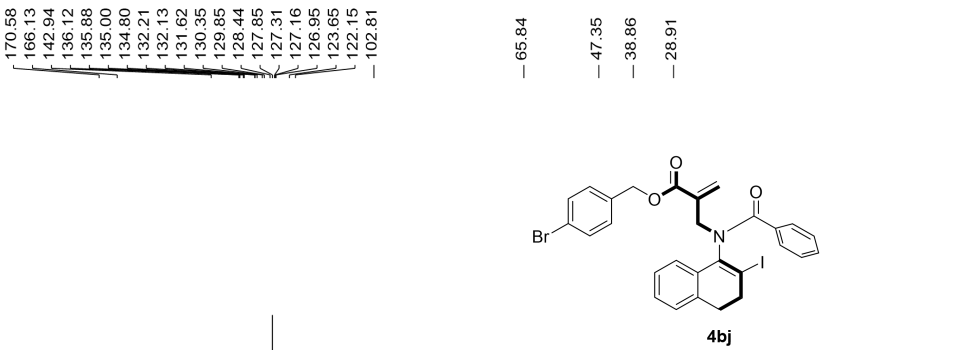

7.55 7.53 7.52 7.50 7.34 7.34 7.33 7.32 7.31 7.29 7.28 7.26 7.26 7.23 7.22 7.22 7.21 7.21 7.20 7.18 7.18 7.16 7.16 7.15 7.14 7.14 7.12 7.09 7.08 7.07 6.56 6.56 6.28 6.27 5.12 4.81 4.77 4.55 4.51 2.79 2.78 2.76 2.74 2.71 2.70 2.69 2.68 2.67 2.66 2.65 2.63 2.55 2.54 2.52 2.52 2.50 -0.00
6.28
0.99
0.09
6.35 6.30 6.25 6.20 6.15 6.10 6.05
f1 (ppm)
Br
I
4bi
3.07 1.02 3.18 1.99 3.22 1.04 1.00 0.99 2.03 1.01 1.09 3.02 0.97
11.5 10.5 9.5 8.5 7.5 6.5 5.5 4.5 3.5 2.5 1.5 0.5 -0.5 -1.5 -2.5 -3
f1 (ppm)


170.63 166.02 143.01 136.16 135.92 135.18 134.97 132.76 132.21 130.33 129.78 129.58 128.44 127.87 127.43 127.30 126.96 123.67 123.25 102.81 66.10 47.43 38.88 28.95
Br
I
4bi
230 220 210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10 -20 -30 -40
f1 (ppm)


7.51
7.49
7.48
7.45
7.43
7.29
7.27
7.26
7.25
7.22
7.21
7.20
7.17
7.16
7.15
7.14
6.50
6.50
6.23
6.23
4.99
4.79
4.75
4.52
4.48
2.77
2.75
2.74
2.73
2.72
2.70
2.69
2.68
2.67
2.67
2.66
2.65
2.64
2.64
2.62
2.61
2.54
2.53
2.53
2.51
2.51
2.49
2.48
-0.00
6.23
0.99
0.09
6.30
6.25
6.20
6.15
6.10
6.05
f1 (ppm)
O
O
O
N
Br
I

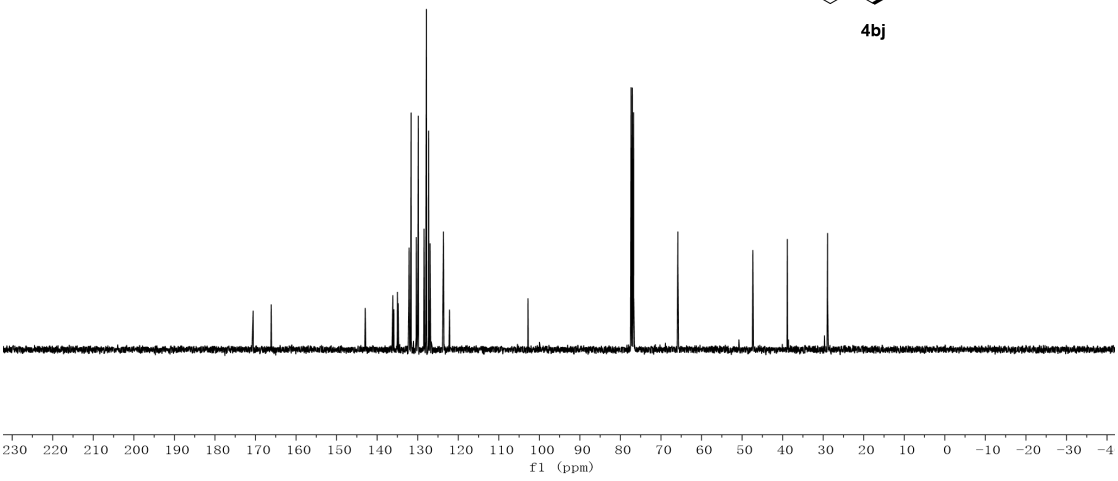
4bj

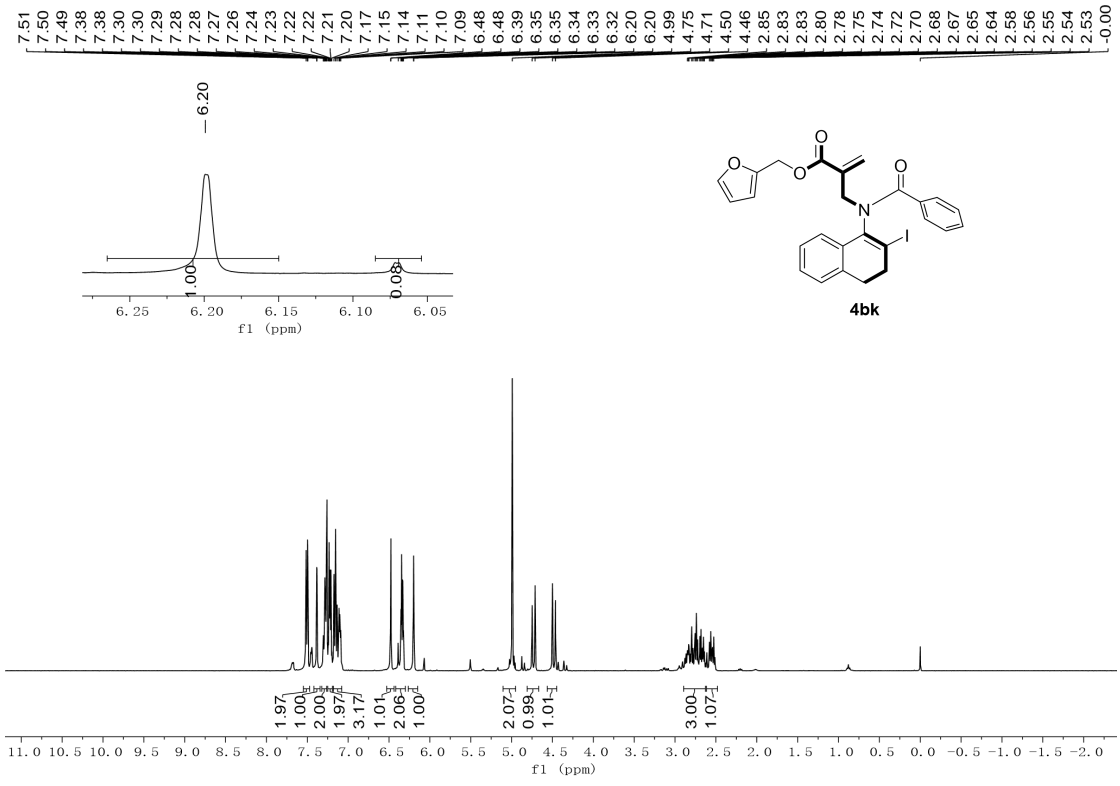

2.00
2.09
2.06
2.01
3.94
1.11
1.00
0.99
1.98
1.00
1.06
3.00
0.96
10.5 10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5 -1.0 -1.5 -2.0
f1 (ppm)

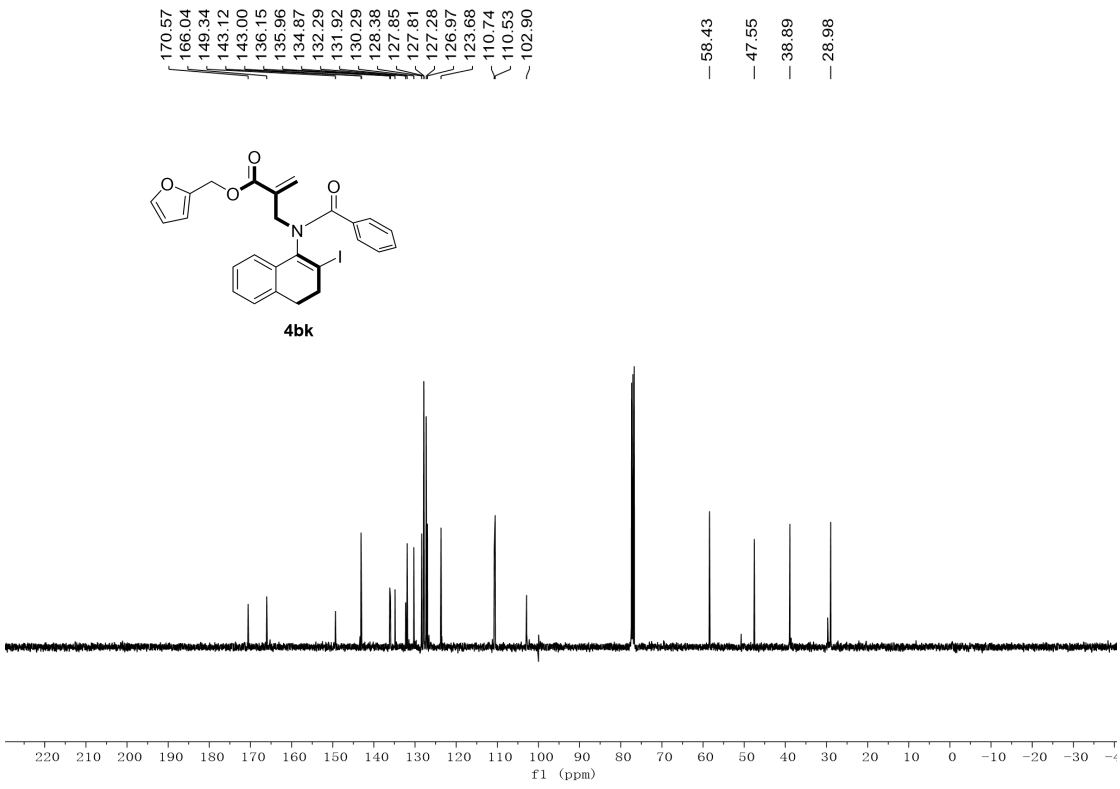

170.58
166.13
142.94
136.12
135.88
135.00
134.80
132.21
132.13
131.62
130.35
129.85
128.44
127.85
127.31
127.16
126.95
123.65
122.15
102.81
65.84
47.35
38.86
28.91

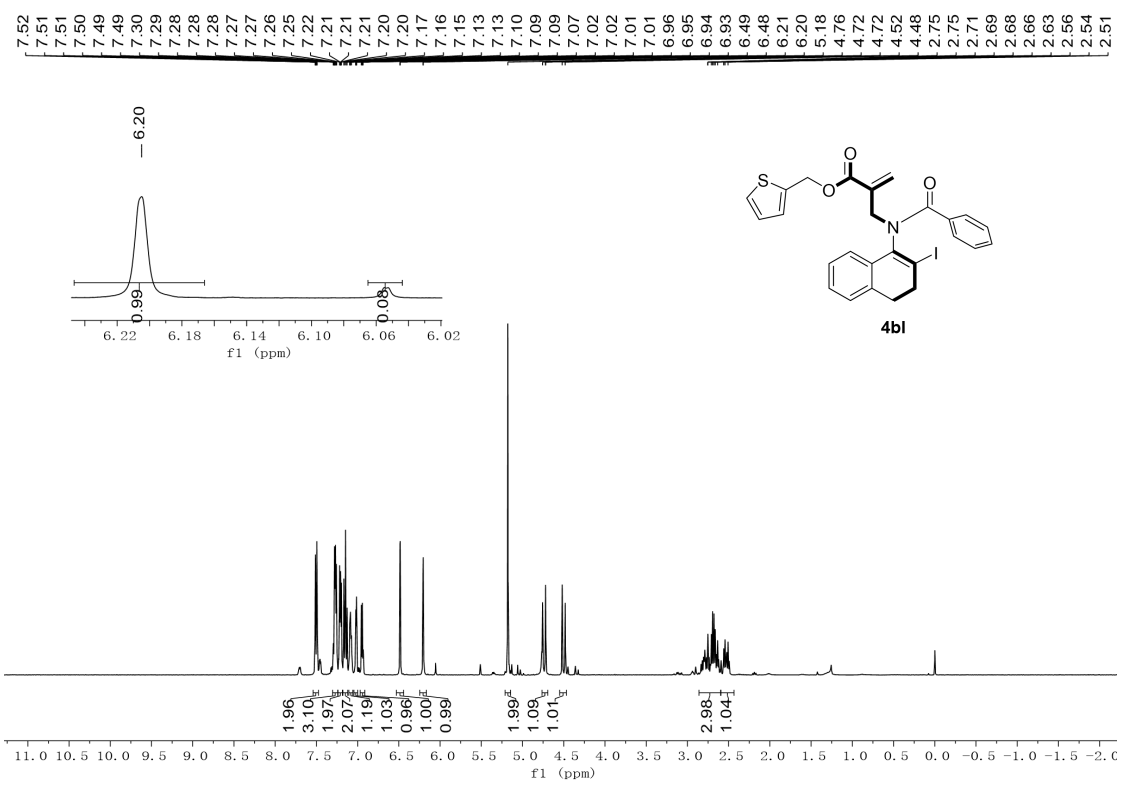
O
O
O
N
Br
I

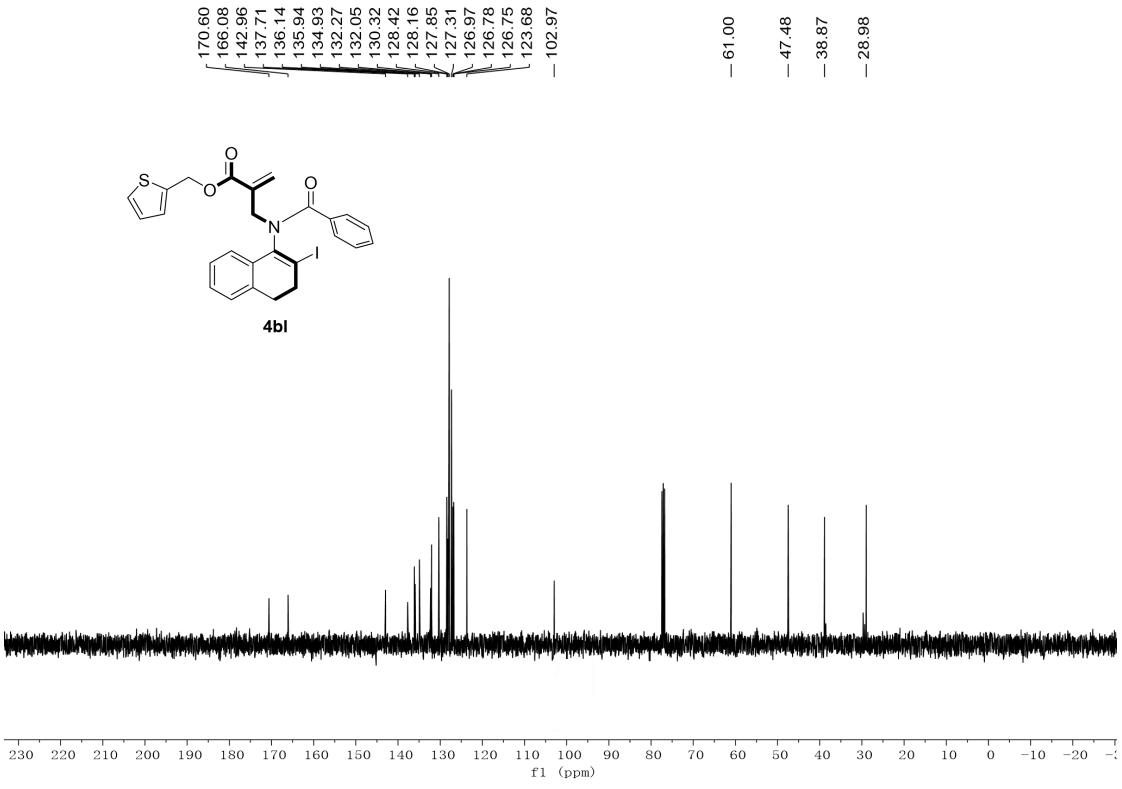
4bj

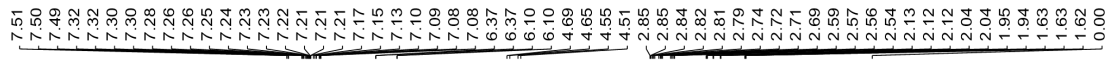

230 220 210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10 -20 -30 -4
f1 (ppm)


7.51 7.50 7.49 7.38 7.38 7.30 7.30 7.29 7.28 7.28 7.27 7.26 7.24 7.23 7.22 7.22 7.21 7.20 7.17 7.15 7.14 7.11 7.10 7.09 6.48 6.48 6.39 6.35 6.35 6.34 6.33 6.32 6.20 6.20 4.99 4.75 4.71 4.50 4.46 2.85 2.83 2.83 2.80 2.78 2.75 2.74 2.72 2.70 2.68 2.67 2.65 2.64 2.58 2.56 2.55 2.54 2.53 -0.00
6.20
1.00
0.08
6.25 6.20 6.15 6.10 6.05
f1 (ppm)
4bk
1.97 1.00 2.00 1.97 3.17 1.01 2.06 1.00 2.07 0.99 1.01 3.00 1.07
11.0 10.5 10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5 -1.0 -1.5 -2.0
f1 (ppm)


170.57 166.04 149.34 143.12 143.00 136.15 135.96 134.87 132.29 131.92 130.29 128.38 127.85 127.81 127.28 126.97 123.68 110.74 110.53 102.90
58.43 47.55 38.89 28.98
4bk
220 210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10 -20 -30
f1 (ppm)


7.52 7.51 7.51 7.50 7.49 7.49 7.30 7.29 7.28 7.28 7.28 7.27 7.27 7.26 7.25 7.22 7.21 7.21 7.21 7.20 7.20 7.17 7.16 7.15 7.13 7.13 7.10 7.09 7.09 7.07 7.02 7.02 7.01 7.01 6.96 6.95 6.94 6.93 6.49 6.48 6.21 6.20 5.18 4.76 4.72 4.72 4.52 4.48 2.75 2.75 2.71 2.69 2.68 2.66 2.63 2.56 2.54 2.51
6.20
0.99
0.08
6.22 6.18 6.14 6.10 6.06 6.02
f1 (ppm)
4bl
1.96 3.10 1.97 2.07 1.19 1.03 0.96 1.00 0.99 1.99 1.09 1.01 2.98 1.04
11.0 10.5 10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5 -1.0 -1.5 -2.0
f1 (ppm)


170.60 166.08 142.96 137.71 136.14 135.94 134.93 132.27 132.05 130.32 128.42 128.16 127.85 127.31 126.97 126.78 126.75 123.68 102.97
61.00 47.48 38.87 28.98
4bl
230 220 210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10 -20
f1 (ppm)


7.51
7.50
7.49
7.32
7.32
7.30
7.30
7.28
7.26
7.26
7.25
7.24
7.23
7.23
7.22
7.21
7.21
7.21
7.17
7.15
7.13
7.10
7.09
7.08
7.08
6.37
6.10
6.10
4.69
4.65
4.55
4.51
2.85
2.85
2.84
2.82
2.81
2.79
2.74
2.72
2.71
2.69
2.59
2.57
2.56
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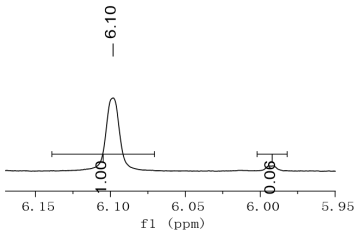
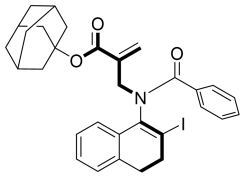
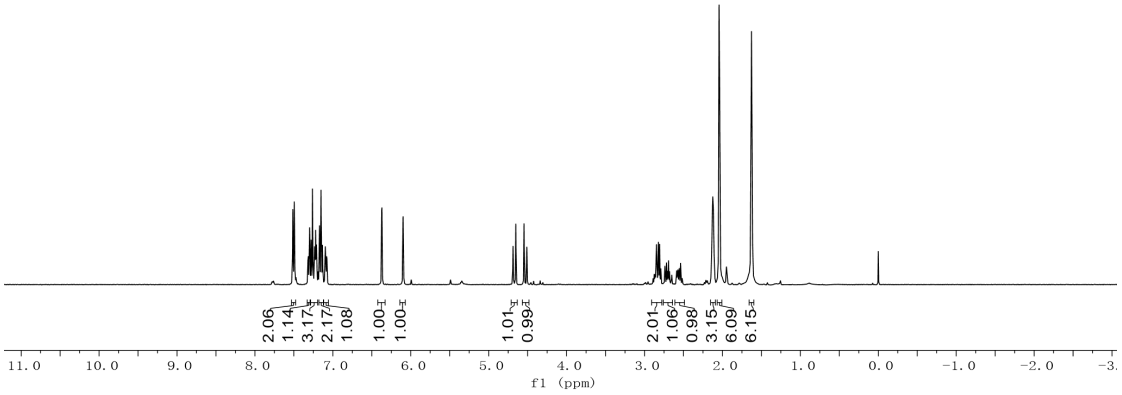
1.95
1.94
1.63
1.63
1.62
0.00

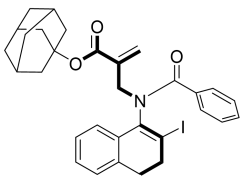

6.10
1.00
0.06
6.15
6.10
6.05
6.00
5.95
f1 (ppm)


O
O
O
N
I

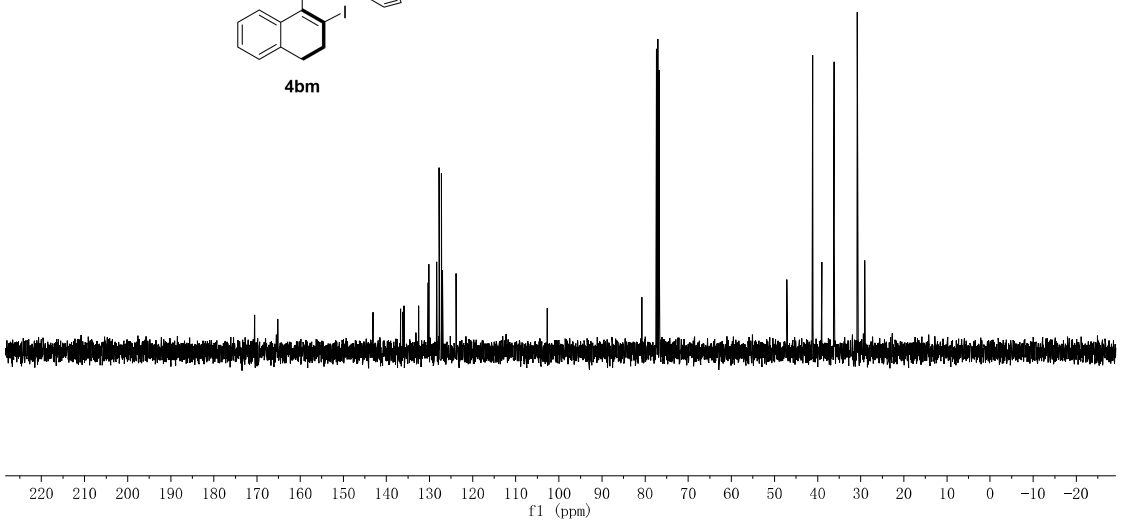
4bm

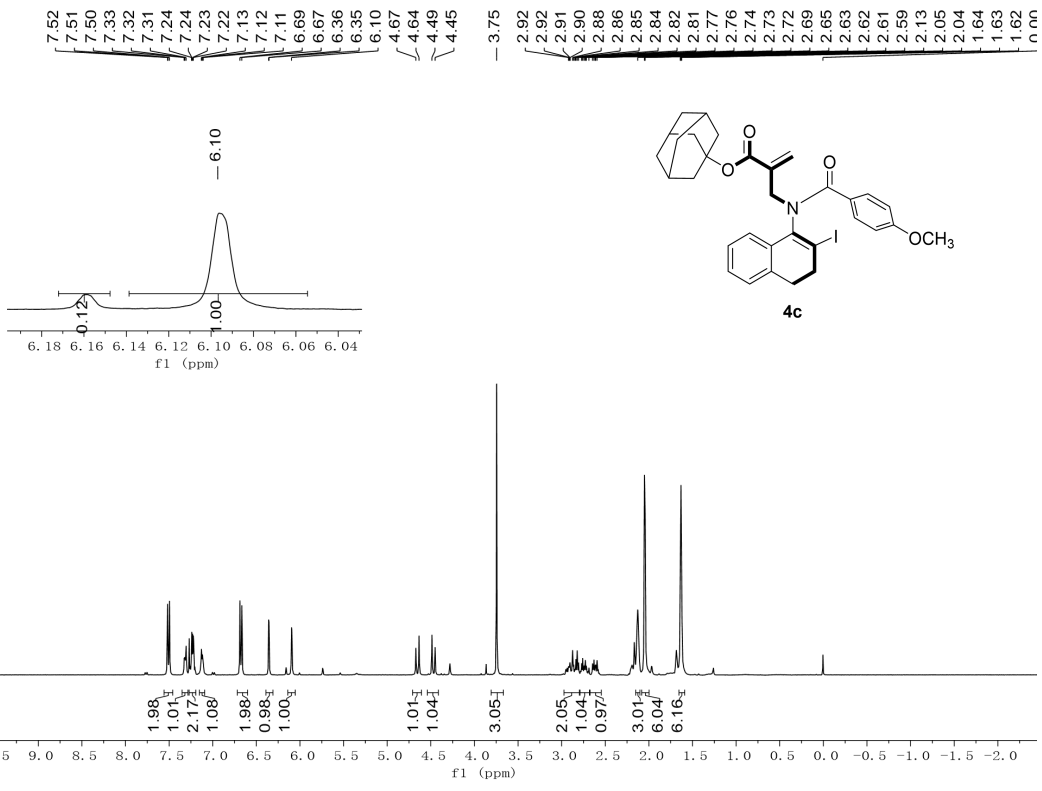

2.06
1.14
3.17
2.17
1.08
1.00
1.00
1.01
0.99
2.01
1.06
0.98
3.15
6.09
6.15
11.0
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
−1.0
−2.0
f1 (ppm)

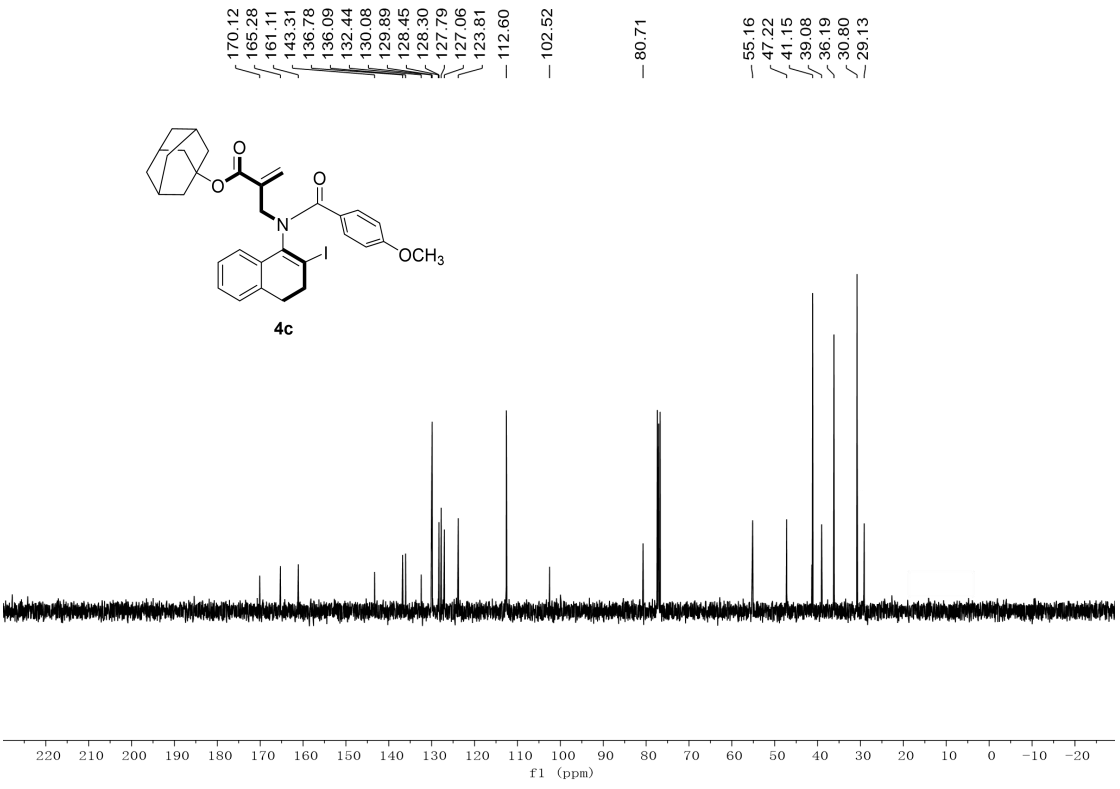

170.57
165.23
143.10
136.75
136.16
135.95
132.51
130.34
130.17
128.32
127.77
127.70
127.25
127.00
123.84
102.67
80.80
47.14
41.15
39.03
36.18
30.80
29.06

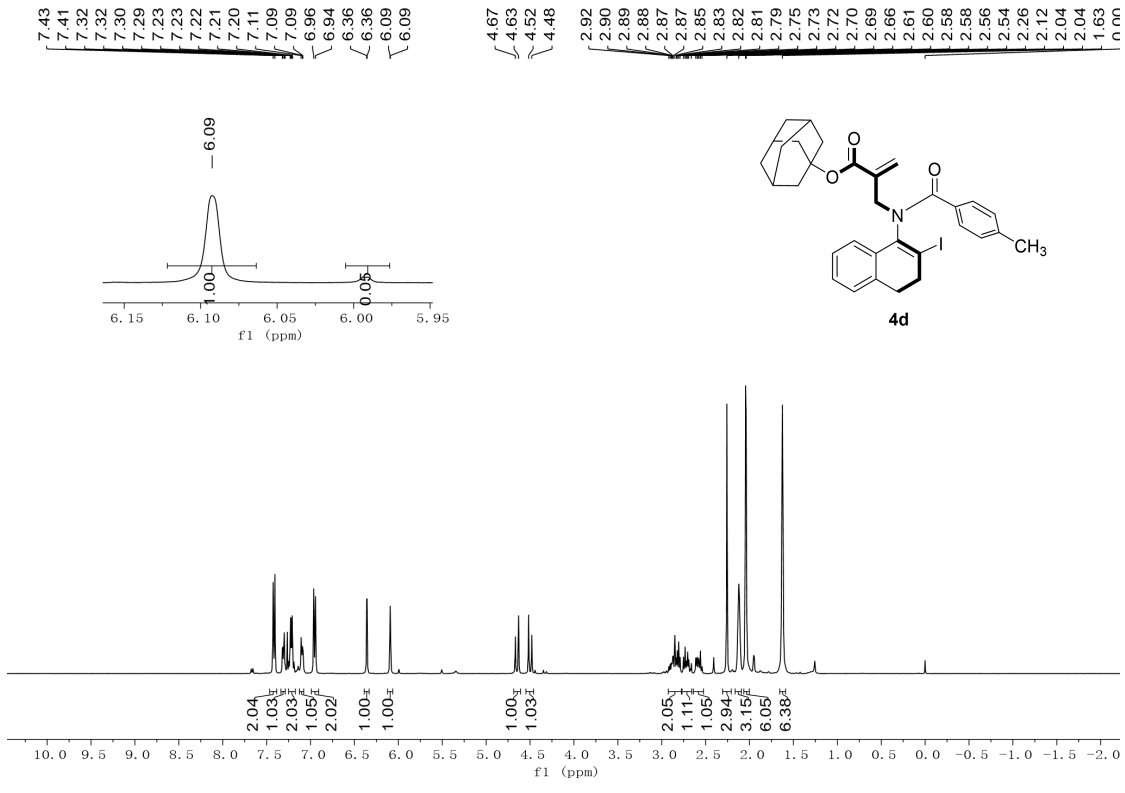

O
O
O
N
I

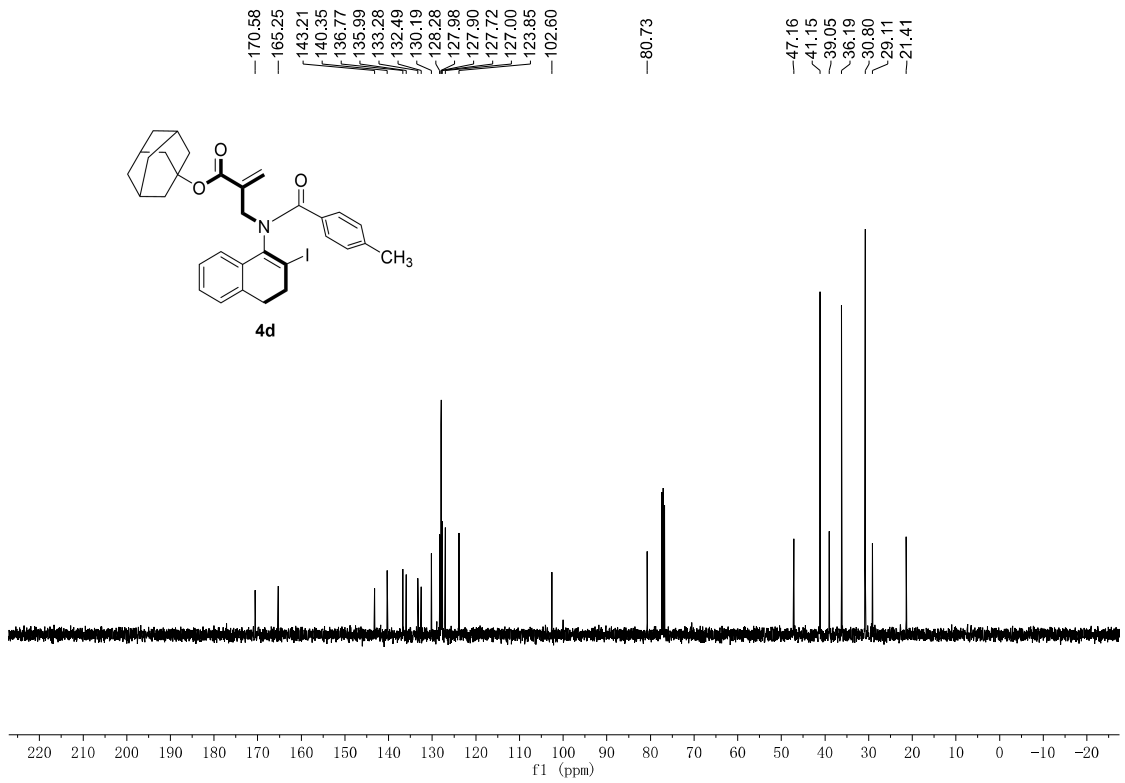
4bm

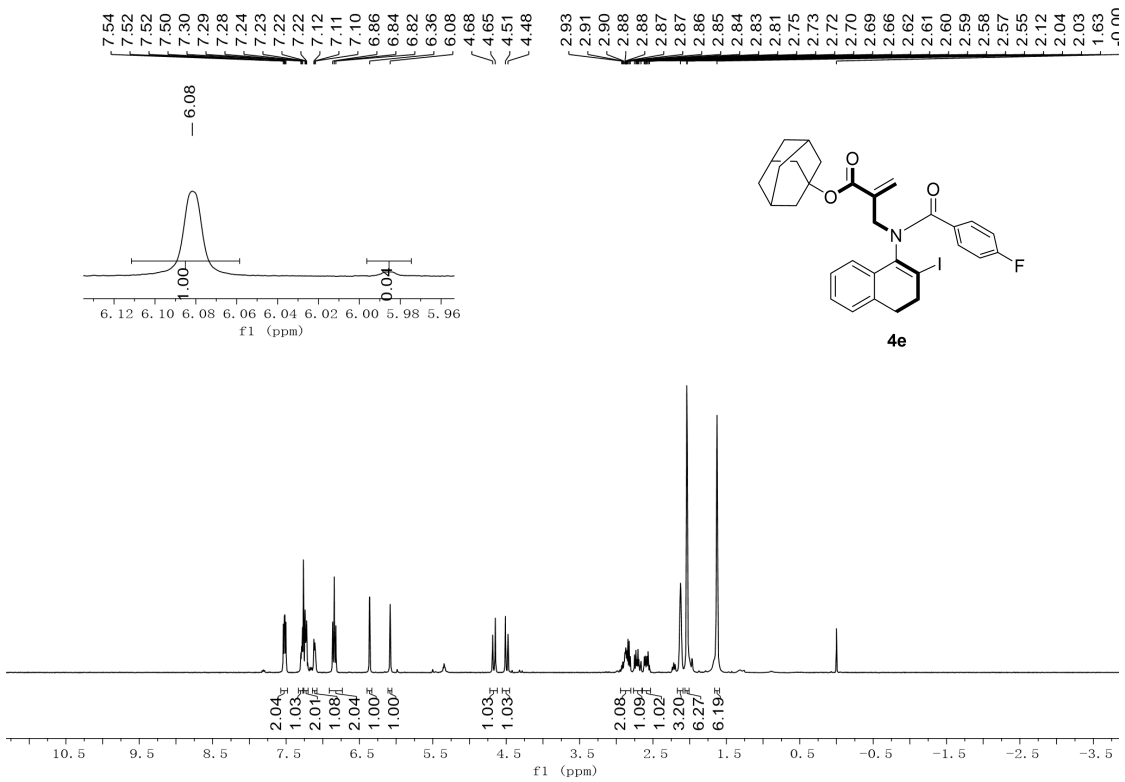

220
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
−10
−20
f1 (ppm)

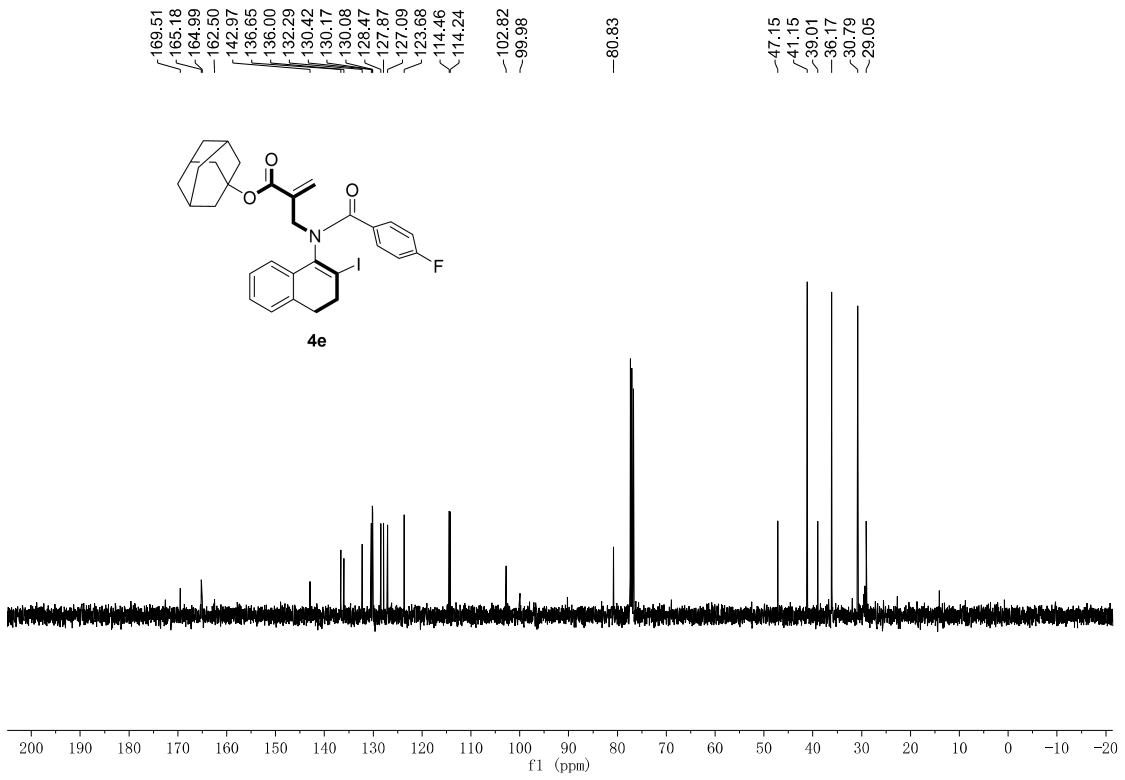

7.52 7.51 7.50 7.33 7.32 7.31 7.24 7.24 7.23 7.22 7.13 7.12 7.11 6.69 6.67 6.36 6.35 6.10 4.67 4.64 4.49 4.45 3.75 2.92 2.92 2.91 2.90 2.88 2.86 2.85 2.84 2.82 2.81 2.77 2.76 2.74 2.73 2.72 2.69 2.65 2.63 2.62 2.61 2.59 2.13 2.05 2.04 1.64 1.63 1.62
6.10
0.12
1.00
6.18 6.16 6.14 6.12 6.10 6.08 6.06 6.04
f1 (ppm)
O
O
N
O
I
OCH3
4c
1.98 1.01 2.17 1.08 1.98 0.98 1.00 1.01 1.04 3.05 2.05 1.04 0.97 3.01 6.04 6.16
10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5 -1.0 -1.5 -2.0
f1 (ppm)

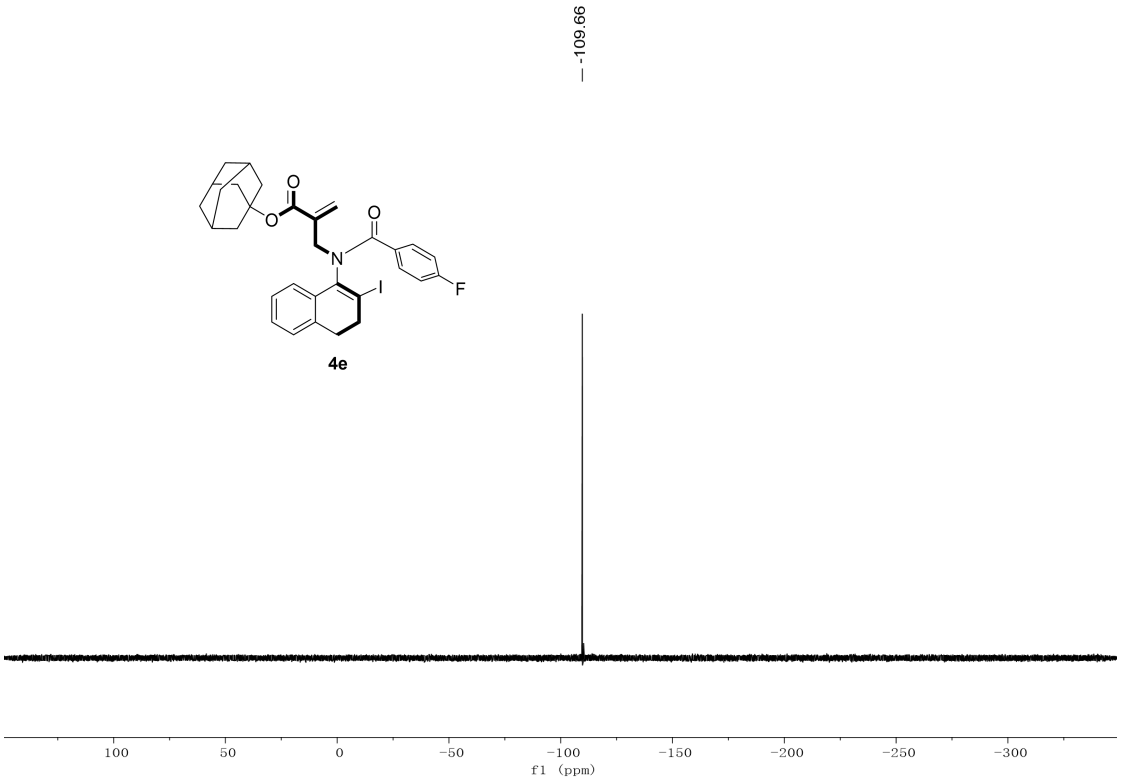

170.12 165.28 161.11 143.31 136.78 136.09 132.44 130.08 129.89 128.45 128.30 127.79 127.06 123.81 112.60 102.52 80.71 55.16 47.22 41.15 39.08 36.19 30.80 29.13
O
O
N
O
I
OCH3
4c
220 210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10 -20
f1 (ppm)

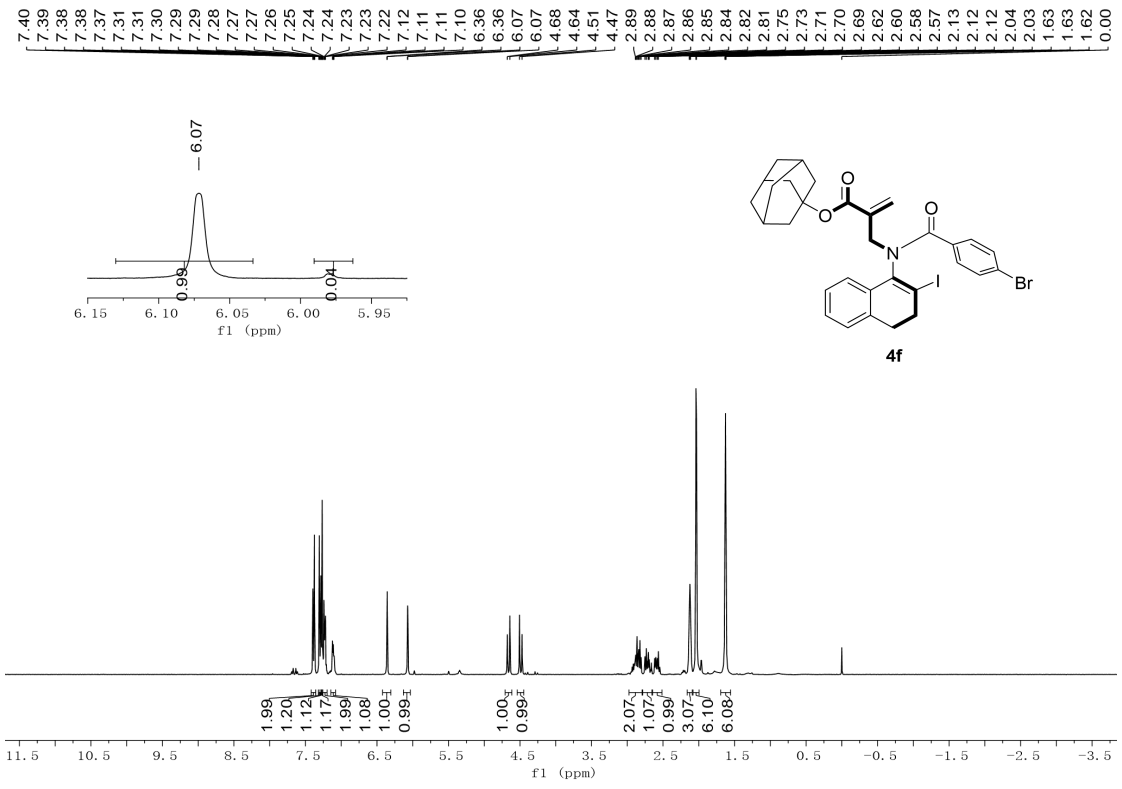

7.43 7.41 7.32 7.32 7.30 7.29 7.23 7.23 7.22 7.21 7.20 7.11 7.09 7.09 6.96 6.94 6.36 6.36 6.09 6.09
4.67 4.63 4.52 4.48
2.92 2.90 2.89 2.88 2.87 2.87 2.85 2.83 2.82 2.81 2.79 2.75 2.73 2.72 2.70 2.69 2.66 2.61 2.60 2.58 2.58 2.56 2.54 2.26 2.12 2.04 2.04 1.63
6.09
1.00
0.05
6.15 6.10 6.05 6.00 5.95
f1 (ppm)
O
O
O
N
I
CH3
4d
2.04 1.03 2.03 1.05 2.02 1.00 1.00 1.00 1.03 2.05 1.11 1.05 2.94 3.15 6.05 6.38
10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5 -1.0 -1.5 -2.0
f1 (ppm)


170.58 165.25 143.21 140.35 136.77 135.99 133.28 132.49 130.19 128.28 127.98 127.90 127.72 127.00 123.85 102.60
80.73
47.16 41.15 39.05 36.19 30.80 29.11 21.41
O
O
O
N
I
CH3
4d
220 210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10 -20
f1 (ppm)


7.54 7.52 7.52 7.50 7.30 7.29 7.28 7.24 7.23 7.22 7.22 7.12 7.11 7.10 6.86 6.84 6.82 6.36 6.08 4.68 4.65 4.51 4.48
2.93 2.91 2.90 2.88 2.88 2.87 2.87 2.86 2.85 2.84 2.83 2.81 2.75 2.73 2.72 2.70 2.69 2.66 2.62 2.61 2.60 2.59 2.58 2.57 2.55 2.12 2.04 2.03 1.63
6.08
1.00
0.04
6.12 6.10 6.08 6.06 6.04 6.02 6.00 5.98 5.96
f1 (ppm)
O
O
N
O
I
F
4e
2.04 1.03 2.01 1.08 2.04 1.00 1.00 1.03 1.03 2.08 1.09 1.02 3.20 6.27 6.19
10.5 9.5 8.5 7.5 6.5 5.5 4.5 3.5 2.5 1.5 0.5 −0.5 −1.5 −2.5 −3.5
f1 (ppm)


169.51 165.18 164.99 162.50 142.97 136.65 136.00 132.29 130.42 130.17 130.08 128.47 127.87 127.09 123.68 114.46 114.24
102.82 99.98
80.83
47.15 41.15 39.01 36.17 30.79 29.05
O
O
N
O
I
F
4e
200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 −10 −20
f1 (ppm)


-109.66
O
O
O
N
I
F
4e
100
50
0
−50
−100
−150
−200
−250
−300
f1 (ppm)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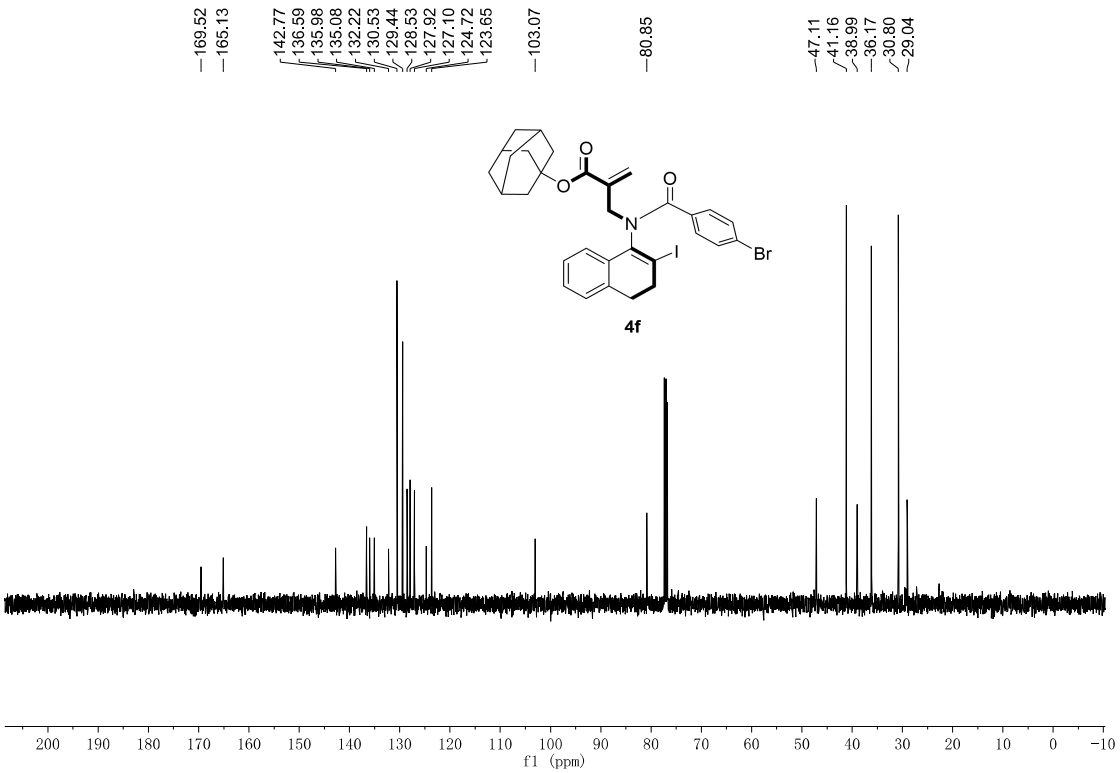
7.27
7.27
7.26
7.25
7.24
7.24
7.23
7.23
7.22
7.12
7.11
7.11
7.10
6.36
6.36
6.07
6.07
4.68
4.64
4.51
4.47
2.89
2.88
2.87
2.86
2.85
2.84
2.82
2.81
2.75
2.73
2.71
2.70
2.69
2.62
2.60
2.58
2.57
2.13
2.12
2.12
2.04
2.03
1.63
1.63
1.62
0.00
6.07
0.99
0.04
6.15
6.10
6.05
6.00
5.95
f1 (ppm)
O
O
O
N
I
Br
4f
1.99
1.20
1.12
1.17
1.99
1.08
1.00
0.99
1.00
0.99
2.07
1.07
0.99
3.07
6.10
6.08
11.5
10.5
9.5
8.5
7.5
6.5
5.5
4.5
3.5
2.5
1.5
0.5
−0.5
−1.5
−2.5
−3.5
f1 (ppm)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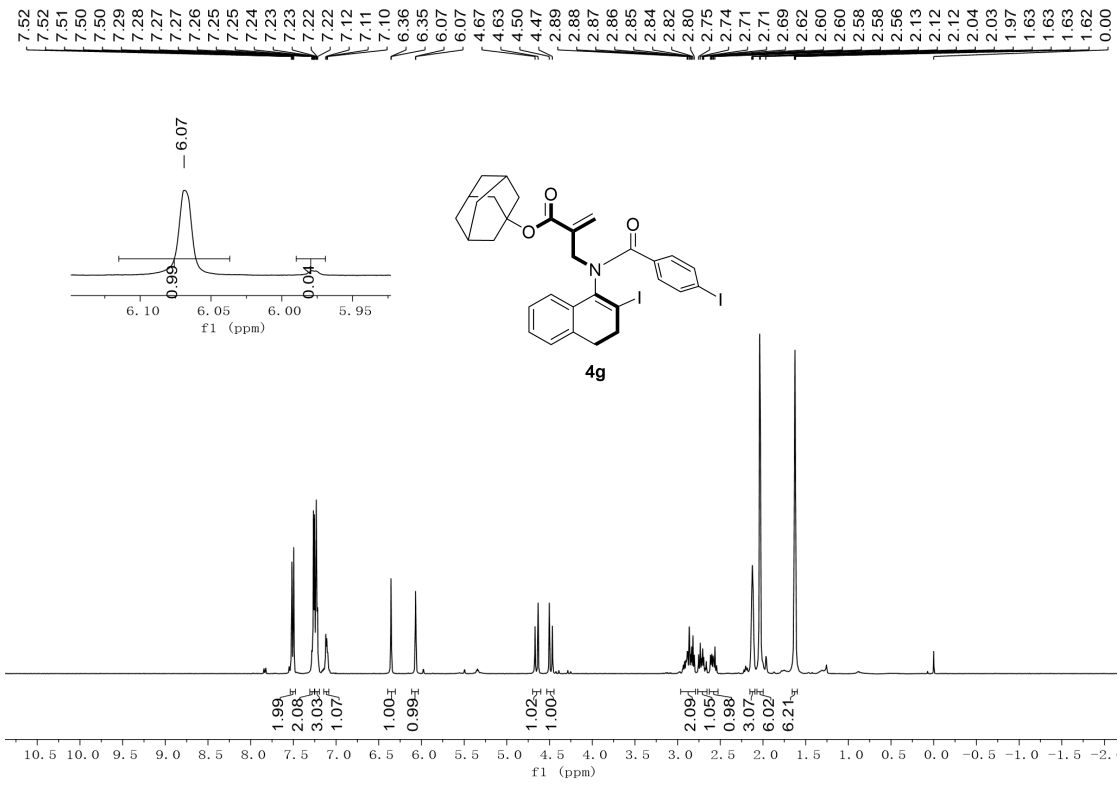
165.13
142.77
136.59
135.98
135.08
132.22
130.53
129.44
128.53
127.92
127.10
124.72
123.65
103.07
80.85
47.11
41.16
38.99
36.17
30.80
29.04
O
O
N
O
I
Br
4f
f1 (ppm)


7.52
7.52
7.51
7.50
7.50
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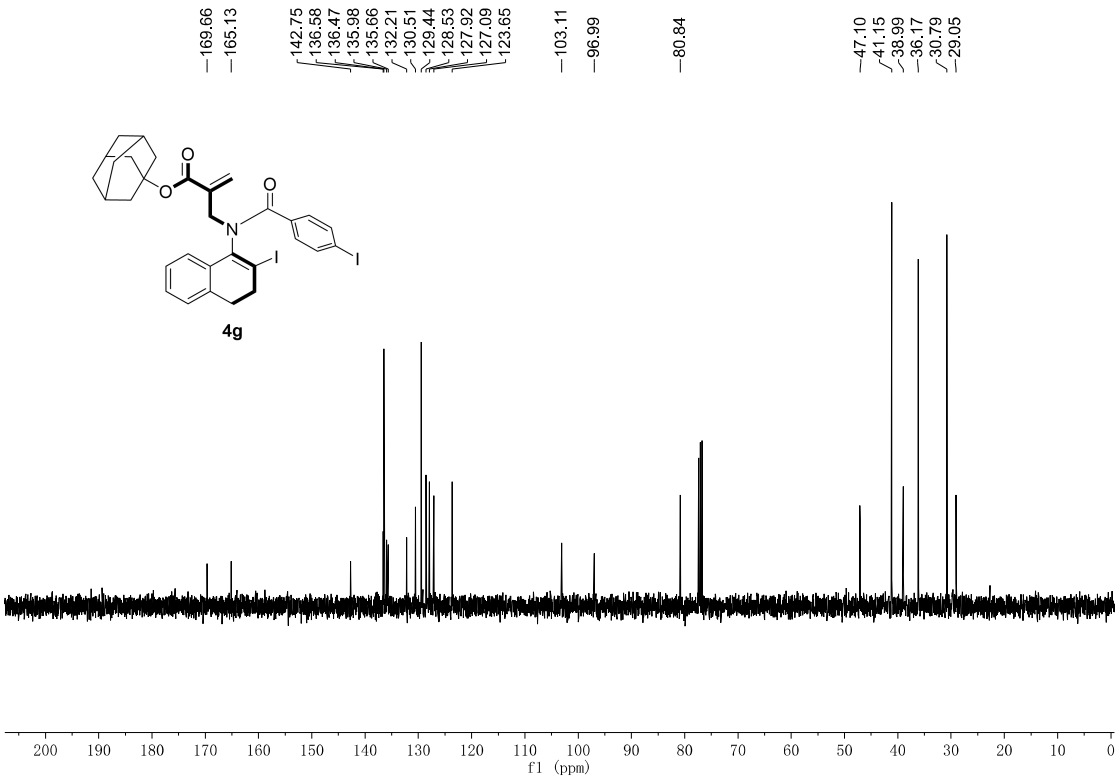
7.28
7.27
7.27
7.26
7.25
7.25
7.24
7.23
7.23
7.22
7.22
7.12
7.11
7.10
6.36
6.35
6.07
6.07
4.67
4.63
4.50
4.47
2.89
2.88
2.87
2.86
2.85
2.84
2.82
2.80
2.75
2.74
2.71
2.71
2.69
2.62
2.60
2.60
2.58
2.58
2.56
2.13
2.12
2.12
2.04
2.03
1.97
1.63
1.63
1.63
1.62
0.00
6.07
0.99
0.04
6.10
6.05
6.00
5.95
f1 (ppm)
O
O
N
O
I
I
4g
1.99
2.08
3.03
1.07
1.00
0.99
1.02
1.00
2.09
1.05
0.98
3.07
6.02
6.21
f1 (ppm)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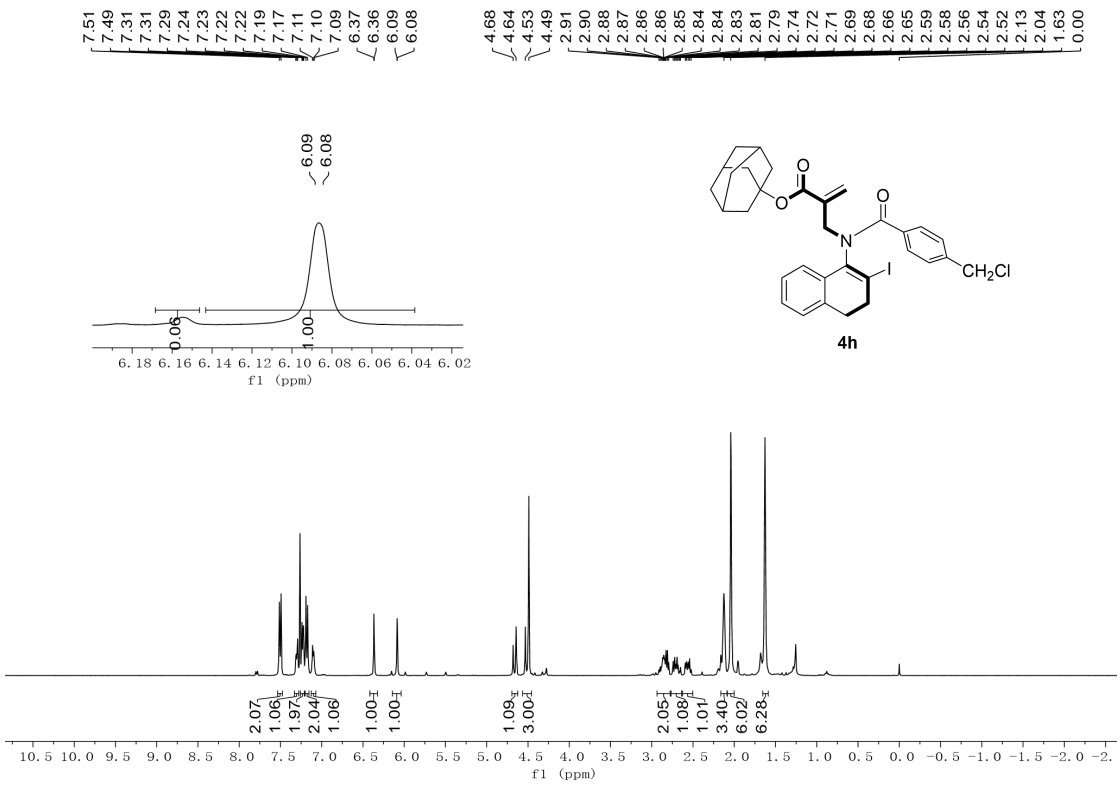
165.13
142.75
136.58
136.47
135.98
135.66
132.21
130.51
129.44
128.53
127.92
127.09
123.65
103.11
96.99
80.84
47.10
41.15
38.99
36.17
30.79
29.05
4g
f1 (ppm)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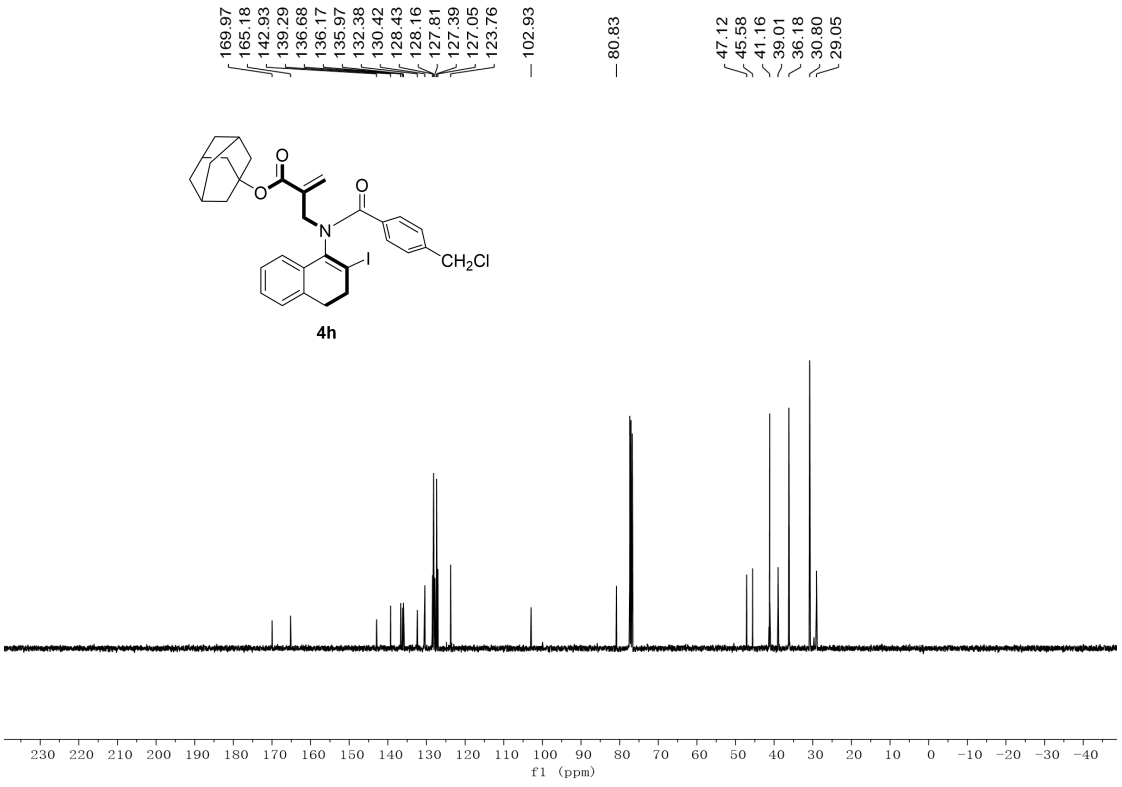
7.49
7.31
7.31
7.29
7.24
7.23
7.22
7.22
7.19
7.17
7.11
7.10
7.09
6.37
6.36
6.09
6.08
4.68
4.64
4.53
4.49
2.91
2.90
2.88
2.87
2.86
2.86
2.85
2.84
2.84
2.83
2.81
2.79
2.74
2.72
2.71
2.69
2.68
2.66
2.65
2.59
2.58
2.56
2.54
2.52
2.13
2.04
1.63
0.00
6.09
6.08
0.06
1.00
f1 (ppm)
4h
2.07
1.06
1.97
2.04
1.06
1.00
1.00
1.09
3.00
2.05
1.08
1.01
3.40
6.02
6.28
f1 (ppm)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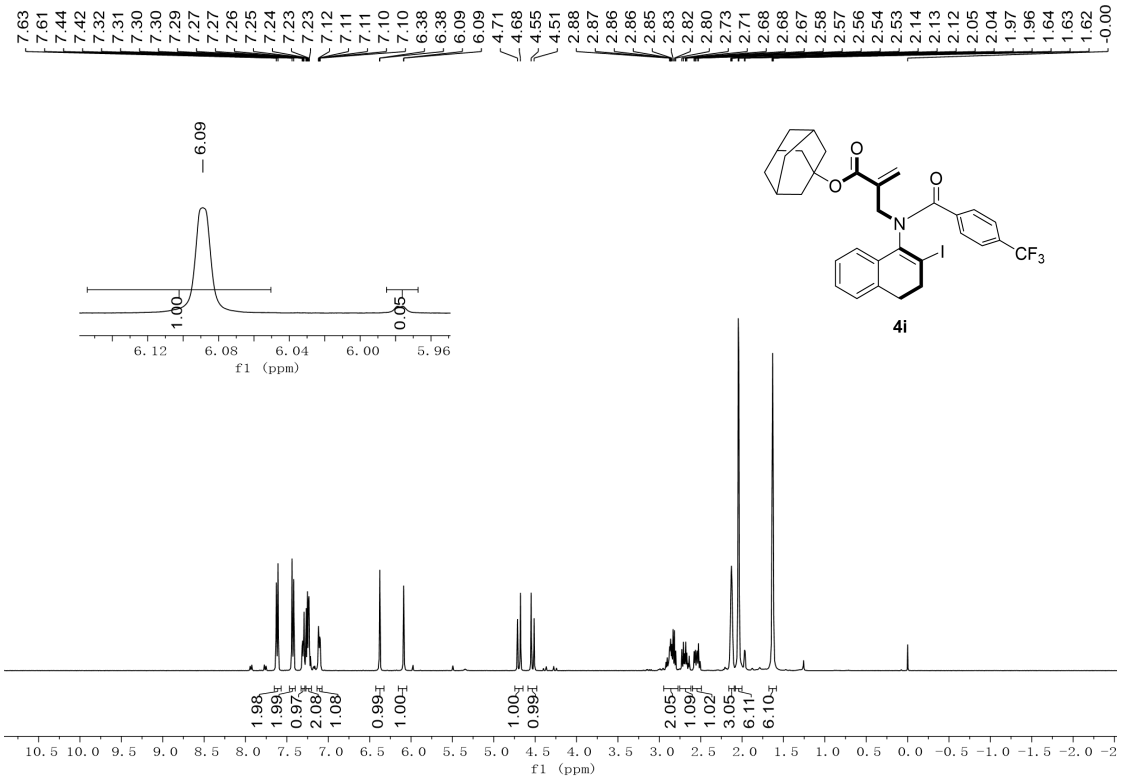
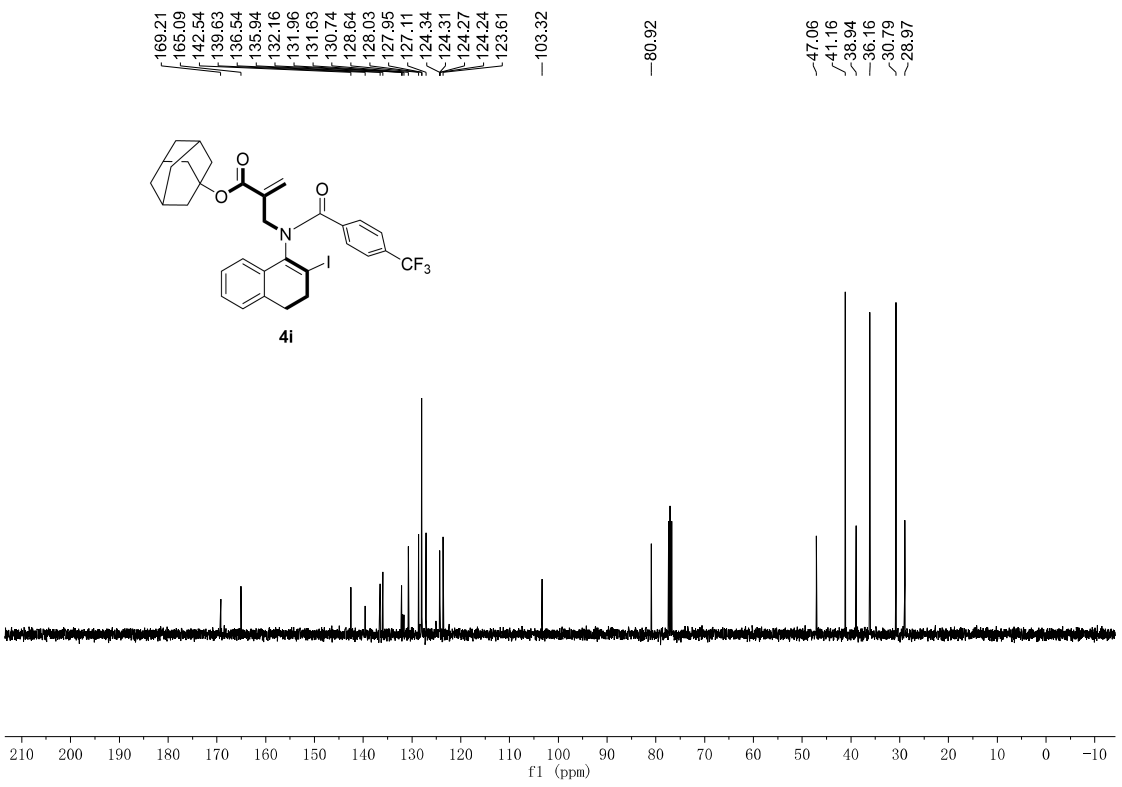
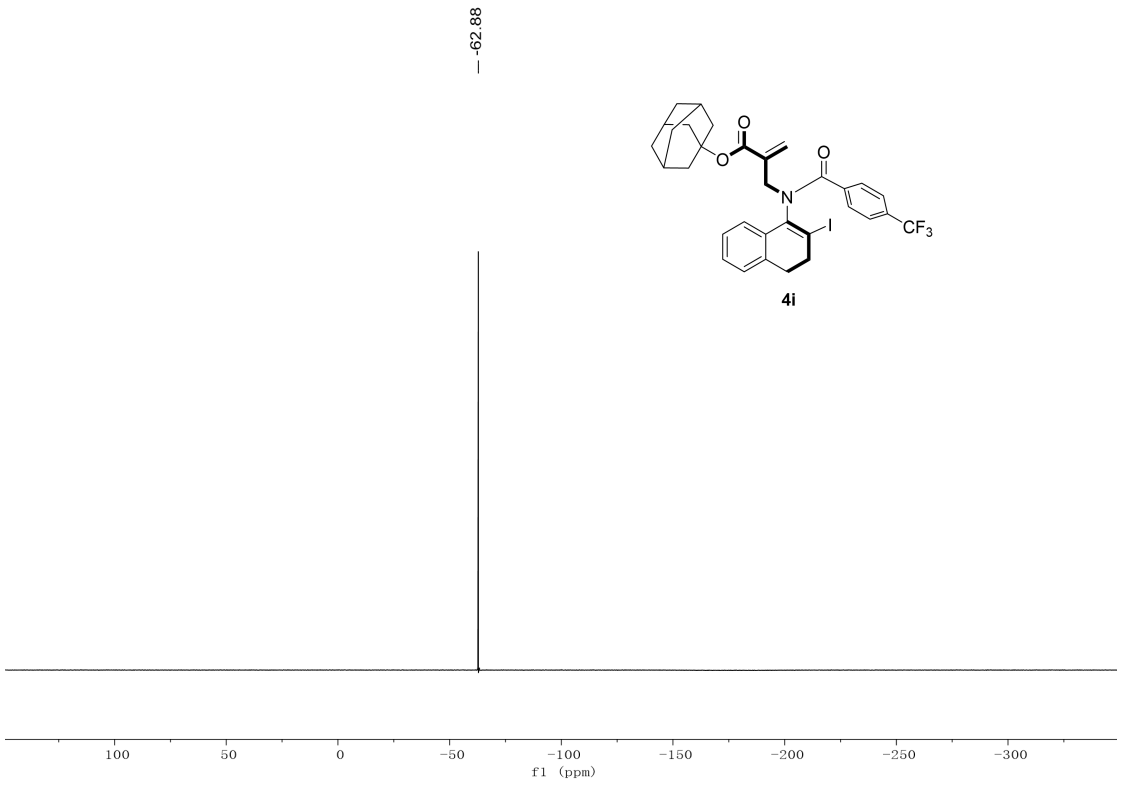
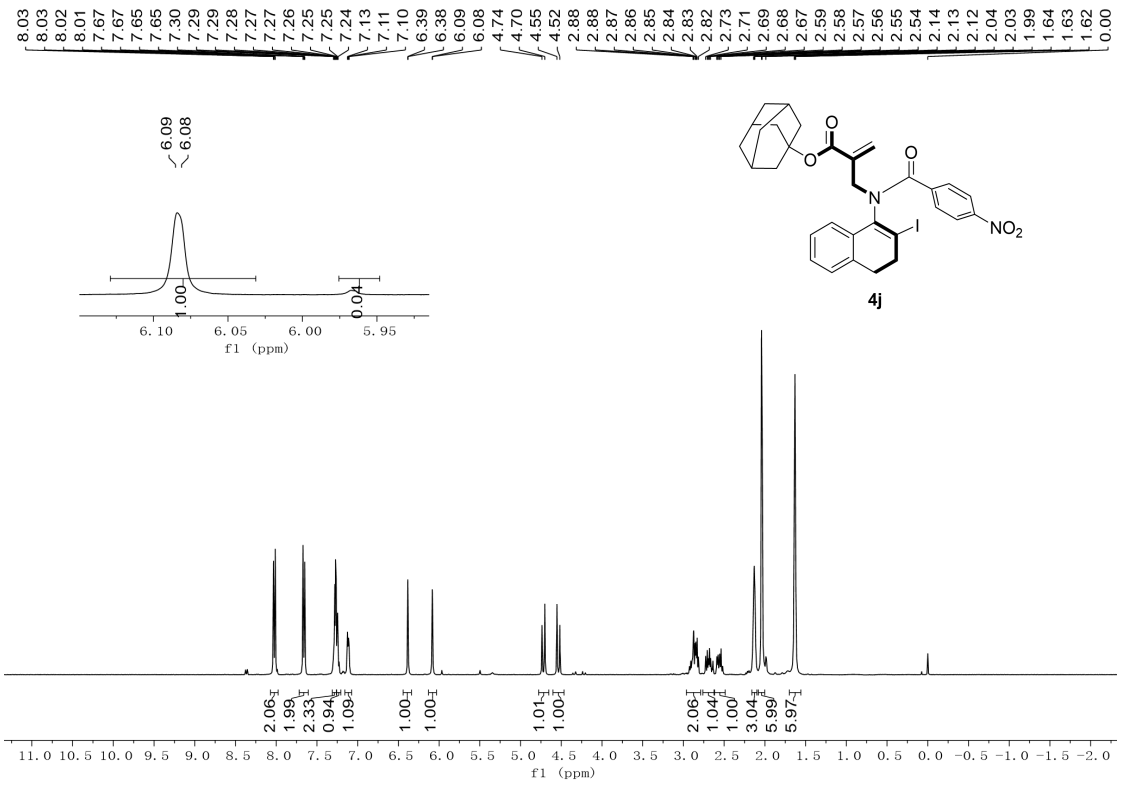
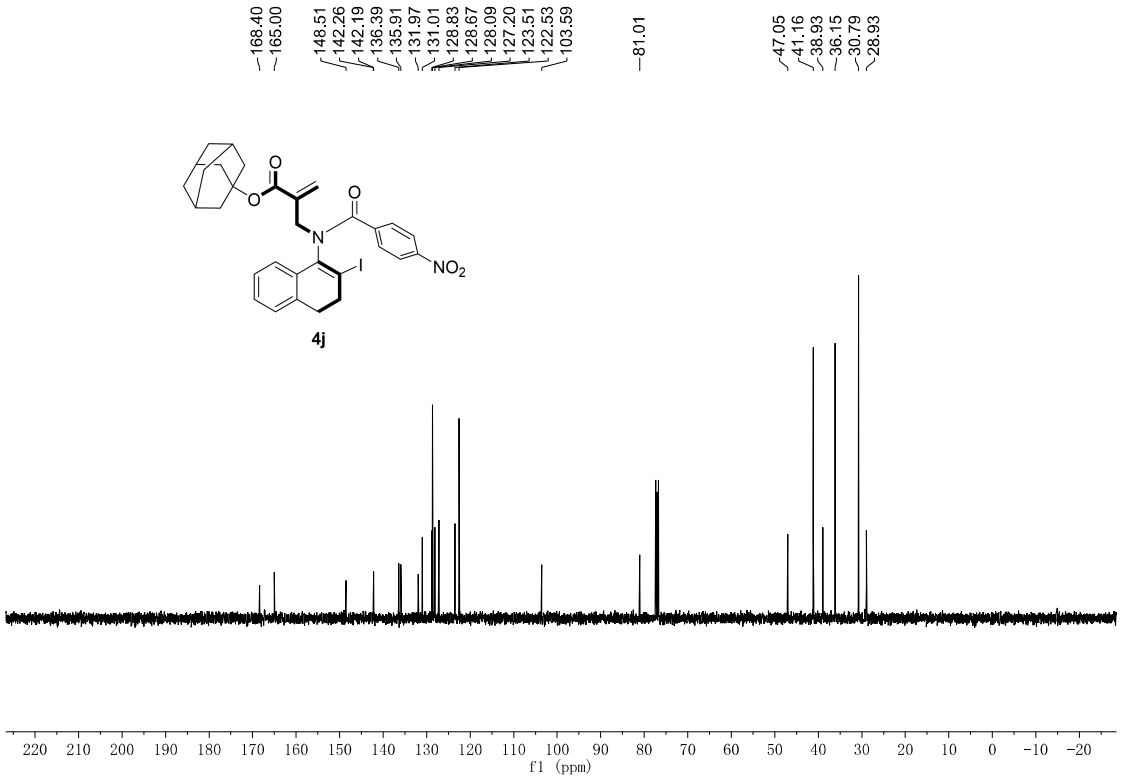
165.18
142.93
139.29
136.68
136.17
135.97
132.38
130.42
128.43
128.16
127.81
127.39
127.05
123.76
102.93
80.83
47.12
45.58
41.16
39.01
36.18
30.80
29.05
O
O
O
N
I
CH2Cl
4h
f1 (ppm)

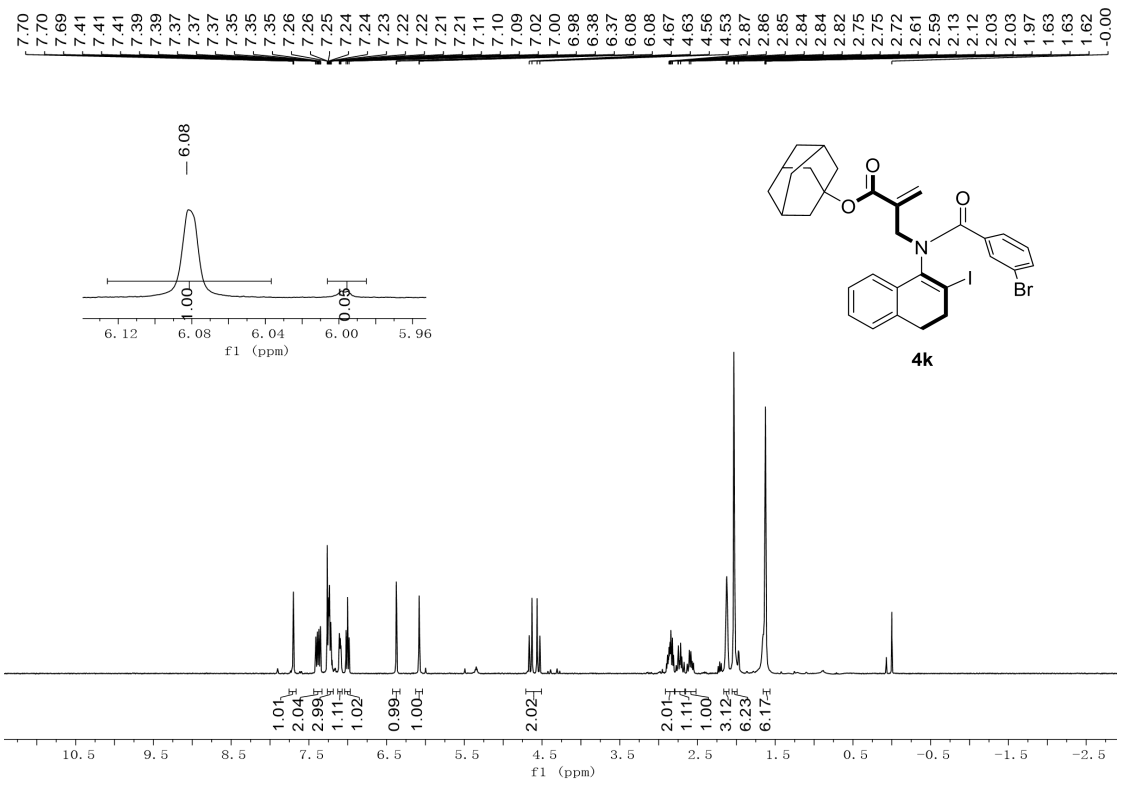

7.63
7.61
7.44
7.42
7.32
7.31
7.30
7.30
7.29
7.27
7.27
7.26
7.25
7.24
7.23
7.23
7.12
7.11
7.11
7.10
7.10
6.38
6.09
6.09
4.71
4.68
4.55
4.51
2.88
2.87
2.86
2.86
2.85
2.83
2.82
2.80
2.73
2.71
2.68
2.68
2.67
2.58
2.57
2.56
2.54
2.53
2.14
2.13
2.12
2.05
2.04
1.97
1.96
1.64
1.63
1.62
-0.00
6.09
1.00
0.95
6.12
6.08
6.04
6.00
5.96
f1 (ppm)
O
O
O
N
I
CF3
4i
1.98
1.99
0.97
2.08
1.08
0.99
1.00
1.00
0.99
2.05
1.09
1.02
3.05
6.11
6.10
f1 (ppm)

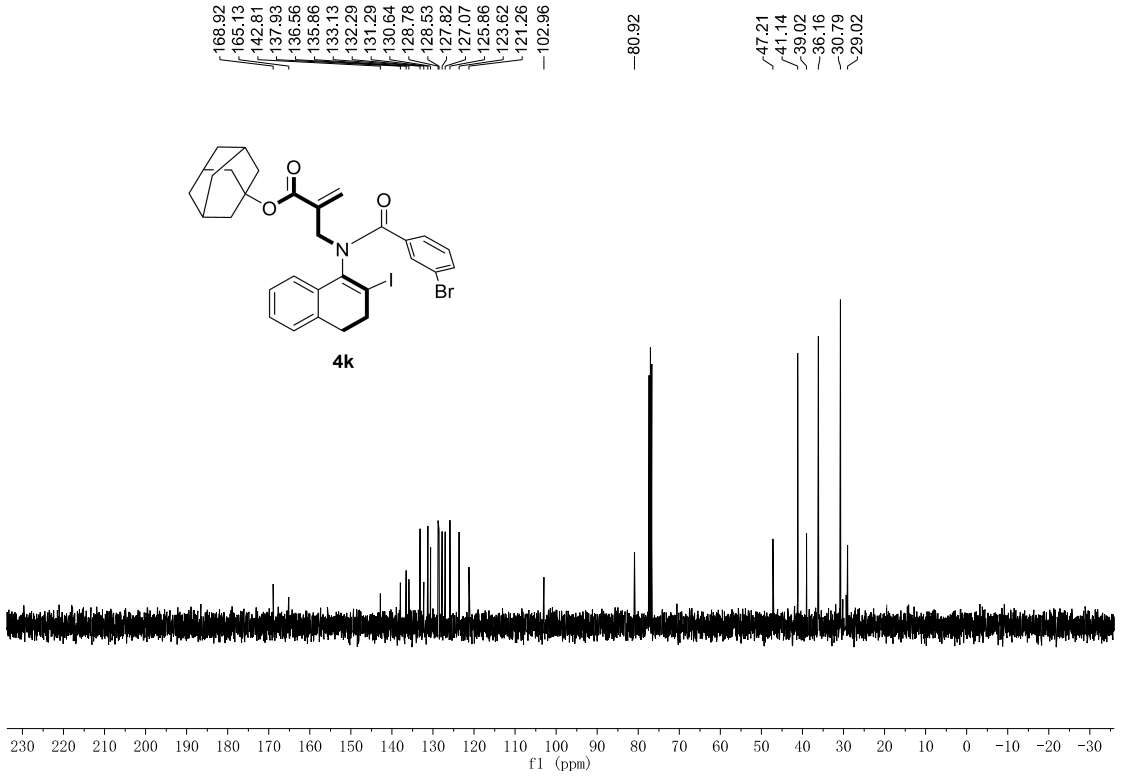

169.21
165.09
142.54
139.63
136.54
135.94
132.16
131.96
131.63
130.74
128.64
128.03
127.95
127.11
124.34
124.31
124.27
124.24
123.61
103.32
80.92
47.06
41.16
38.94
36.16
30.79
28.97
O
O
O
N
I
CF3
4i
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 −10
f1 (ppm)

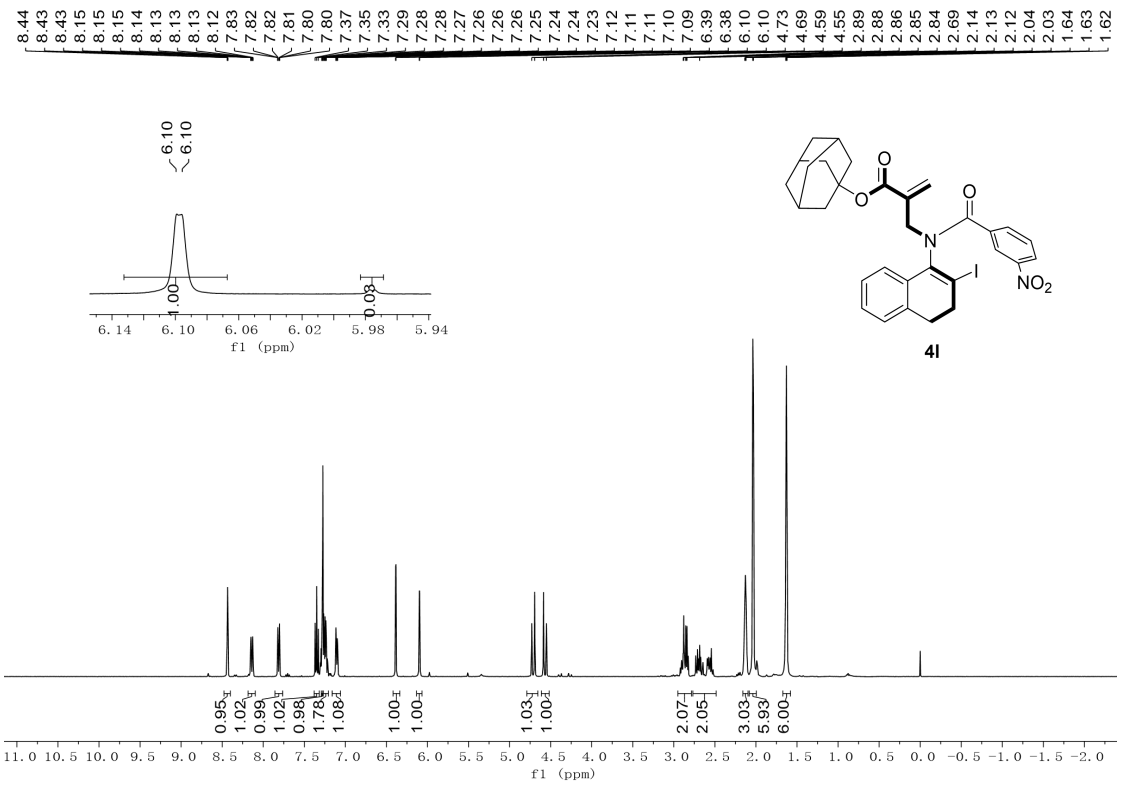

-62.88
O
O
O
N
I
CF3
4i
100 50 0 −50 −100 −150 −200 −250 −300
f1 (ppm)

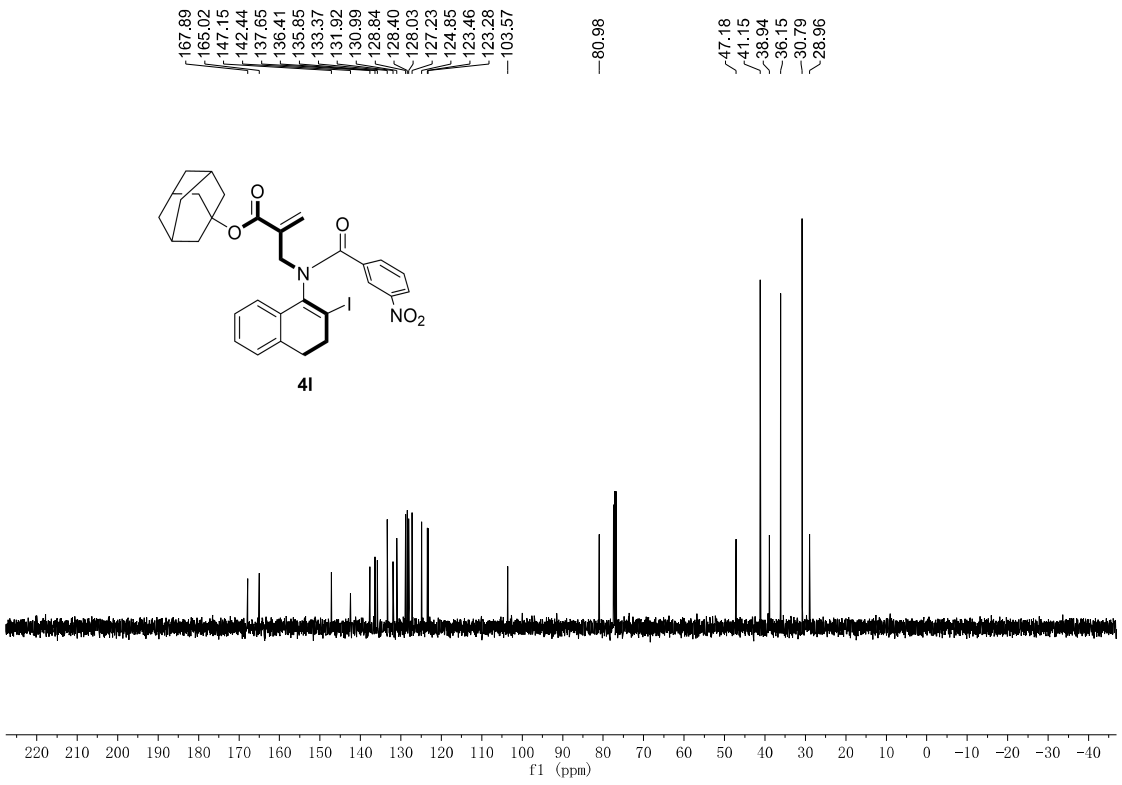

8.03 8.03 8.02 8.01 7.67 7.67 7.65 7.65 7.30 7.29 7.29 7.28 7.27 7.27 7.26 7.25 7.25 7.24 7.13 7.11 7.10 6.39 6.38 6.09 6.08 4.74 4.70 4.55 4.52 2.88 2.88 2.87 2.86 2.85 2.84 2.83 2.82 2.73 2.71 2.69 2.68 2.67 2.59 2.58 2.57 2.56 2.55 2.54 2.14 2.13 2.12 2.04 2.03 1.99 1.64 1.63 1.62 0.00
6.09
6.08
1.00
0.04
6.10 6.05 6.00 5.95
f1 (ppm)
O
O
N
O
I
NO2
4j
2.06 1.99 2.33 0.94 1.09 1.00 1.00 1.01 1.00 2.06 1.04 1.00 3.04 5.99 5.97
11.0 10.5 10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5 -1.0 -1.5 -2.0
f1 (ppm)

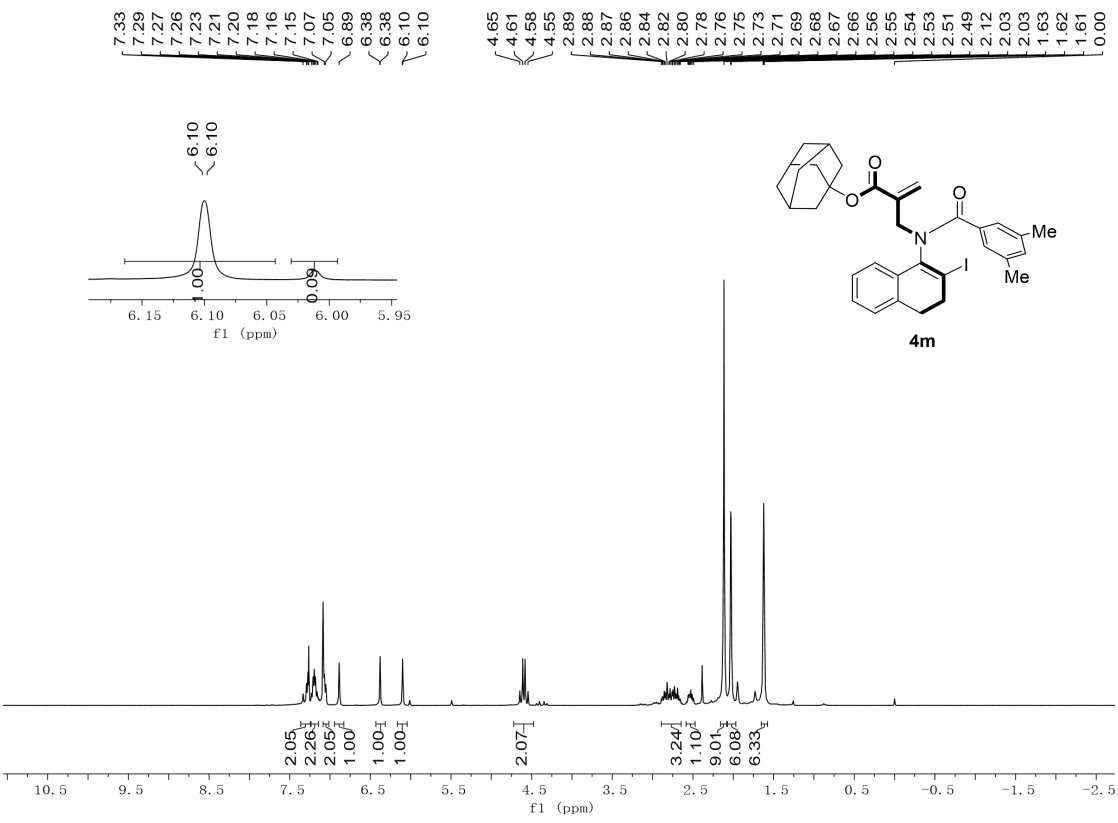

168.40
165.00
148.51
142.26
142.19
136.39
135.91
131.97
131.01
128.83
128.67
128.09
127.20
123.51
122.53
103.59
81.01
47.05
41.16
38.93
36.15
30.79
28.93
O
O
N
O
I
NO2
4j
220 210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10 -20
f1 (ppm)

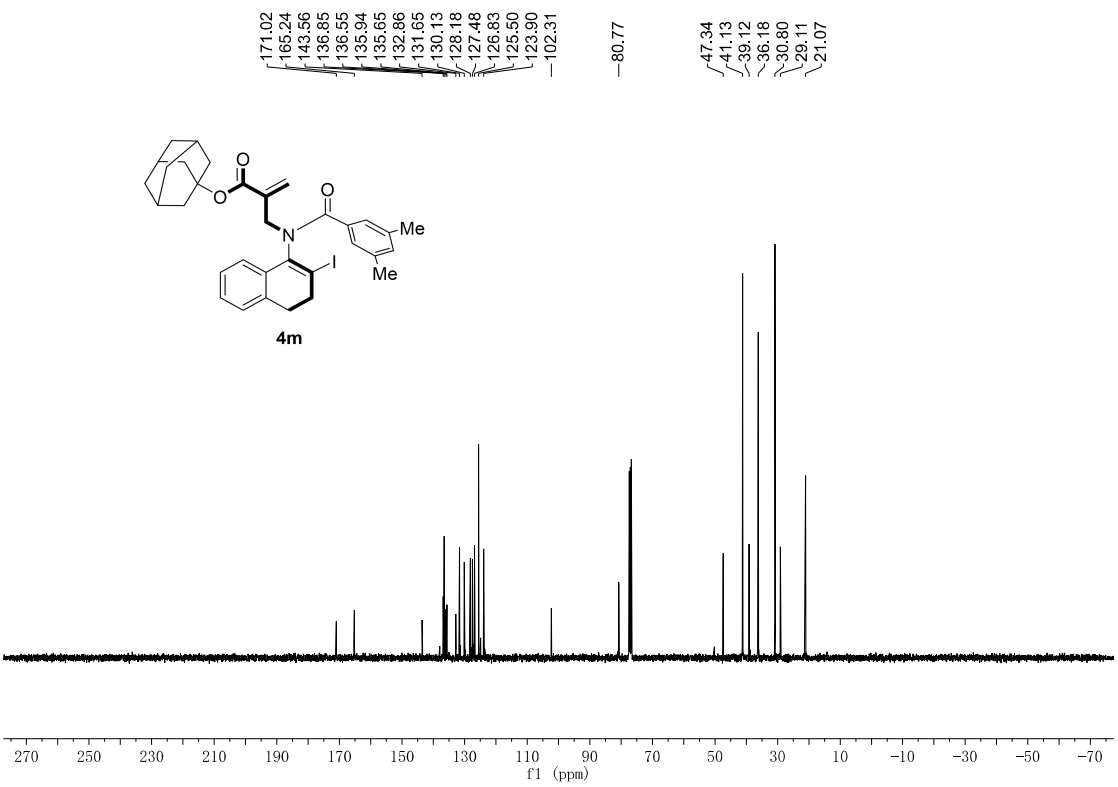

7.70 7.70 7.69 7.41 7.41 7.41 7.39 7.39 7.37 7.37 7.37 7.35 7.35 7.35 7.26 7.26 7.25 7.24 7.24 7.23 7.22 7.22 7.21 7.21 7.11 7.10 7.09 7.02 7.00 6.98 6.38 6.37 6.08 6.08 4.67 4.63 4.56 4.53 2.87 2.86 2.85 2.84 2.84 2.82 2.75 2.75 2.72 2.61 2.59 2.13 2.12 2.03 2.03 1.97 1.63 1.63 1.62 -0.00
6.08
1.00
0.05
6.12 6.08 6.04 6.00 5.96
f1 (ppm)
O
O
N
O
I
Br
4k
1.01 2.04 2.99 1.11 1.02 0.99 1.00 2.02 2.01 1.11 1.00 3.12 6.23 6.17
10.5 9.5 8.5 7.5 6.5 5.5 4.5 3.5 2.5 1.5 0.5 -0.5 -1.5 -2.5
f1 (ppm)

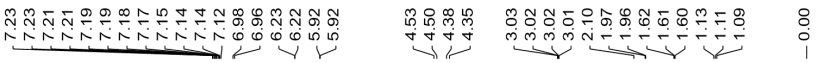

168.92 165.13 142.81 137.93 136.56 135.86 133.13 132.29 131.29 130.64 128.78 128.53 127.82 127.07 125.86 123.62 121.26 102.96
80.92
47.21 41.14 39.02 36.16 30.79 29.02
O
O
N
O
I
Br
4k
230 220 210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10 -20 -30
f1 (ppm)

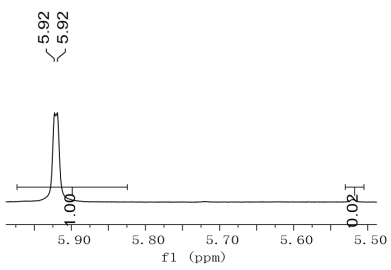

8.44 8.43 8.43 8.15 8.15 8.15 8.14 8.13 8.13 8.13 8.12 7.83 7.82 7.82 7.81 7.80 7.80 7.37 7.35 7.33 7.29 7.28 7.28 7.27 7.26 7.26 7.26 7.25 7.24 7.24 7.23 7.12 7.11 7.11 7.10 7.09 6.39 6.38 6.10 6.10 4.73 4.69 4.59 4.55 2.89 2.88 2.86 2.85 2.84 2.69 2.14 2.13 2.12 2.04 2.03 1.64 1.63 1.62
6.10
6.10
1.00
0.08
6.14 6.10 6.06 6.02 5.98 5.94
f1 (ppm)
O
O
O
N
I
NO2
4l
0.95 1.02 0.99 1.02 0.98 1.78 1.08 1.00 1.00 1.03 1.00 2.07 2.05 3.03 5.93 6.00
11.0 10.5 10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5 -1.0 -1.5 -2.0
f1 (ppm)

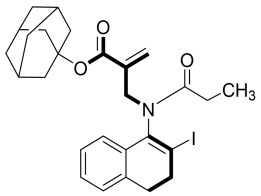

167.89 165.02 147.15 142.44 137.65 136.41 135.85 133.37 131.92 130.99 128.84 128.40 128.03 127.23 124.85 123.46 123.28 103.57
80.98
47.18 41.15 38.94 36.15 30.79 28.96
O
O
O
N
I
NO2
4l
220 210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10 -20 -30 -40
f1 (ppm)


7.33
7.29
7.27
7.26
7.23
7.21
7.20
7.18
7.16
7.15
7.07
7.05
6.89
6.38
6.10
6.10
4.65
4.61
4.58
4.55
2.89
2.88
2.87
2.86
2.84
2.82
2.80
2.78
2.76
2.75
2.73
2.71
2.69
2.68
2.67
2.66
2.56
2.55
2.54
2.53
2.51
2.49
2.12
2.03
2.03
1.63
1.62
1.61
0.00
6.10
6.10
1.00
0.09
6.15
6.10
6.05
6.00
5.95
f1 (ppm)
O
O
N
O
Me
Me
I
4m
2.05
2.26
2.05
1.00
1.00
1.00
2.07
3.24
1.10
9.01
6.08
6.33
10.5
9.5
8.5
7.5
6.5
5.5
4.5
3.5
2.5
1.5
0.5
-0.5
-1.5
-2.5
f1 (ppm)

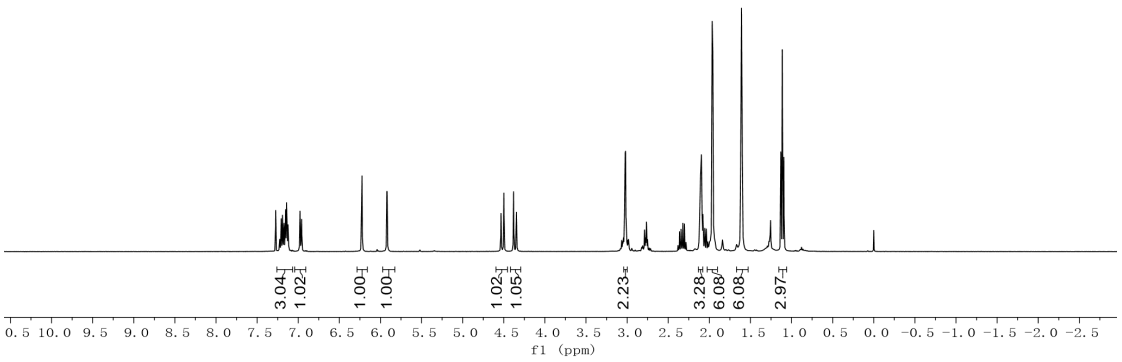

171.02
165.24
143.56
136.85
136.55
135.94
135.65
132.86
131.65
130.13
128.18
127.48
126.83
125.50
123.90
102.31
80.77
47.34
41.13
39.12
36.18
30.80
29.11
21.07
O
O
N
O
Me
Me
I
4m
270
250
230
210
190
170
150
130
110
90
70
50
30
10
-10
-30
-50
-70
f1 (ppm)


7.23
7.23
7.21
7.21
7.19
7.19
7.18
7.17
7.15
7.14
7.14
7.12
6.98
6.96
6.23
6.22
5.92
5.92
4.53
4.50
4.38
4.35
3.03
3.02
3.02
3.01
2.10
1.97
1.96
1.62
1.61
1.60
1.13
1.11
1.09
0.00

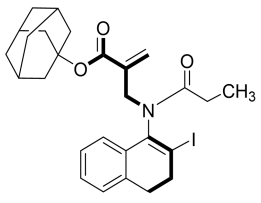

5.92
5.92
1.00
0.02
5.90
5.80
5.70
5.60
5.50
f1 (ppm)


O
O
O
CH3
N
I

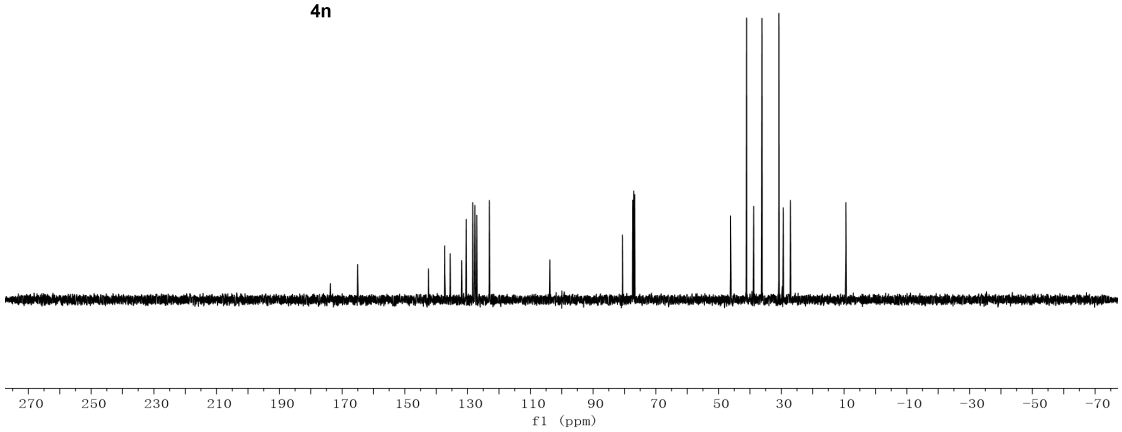
4n

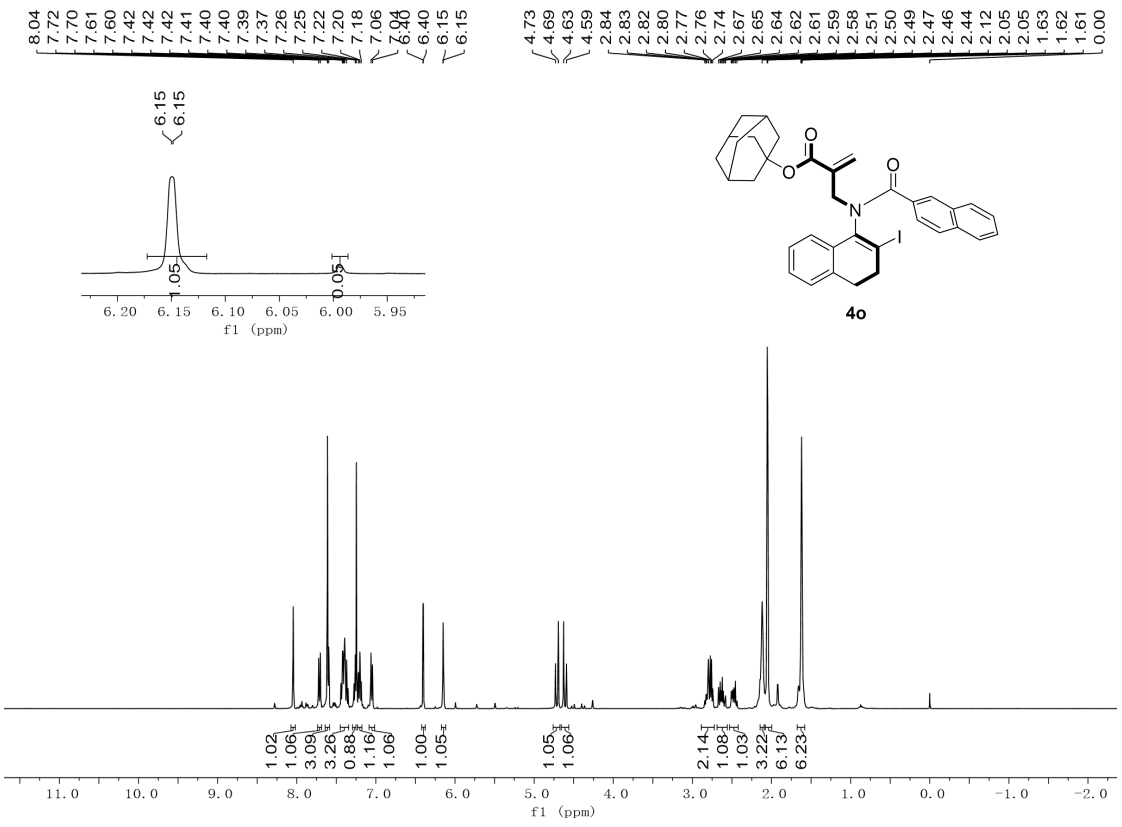

3.04
1.02
1.00
1.00
1.02
1.05
2.23
3.28
6.08
6.08
2.97
0.5 10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5 -1.0 -1.5 -2.0 -2.5
f1 (ppm)

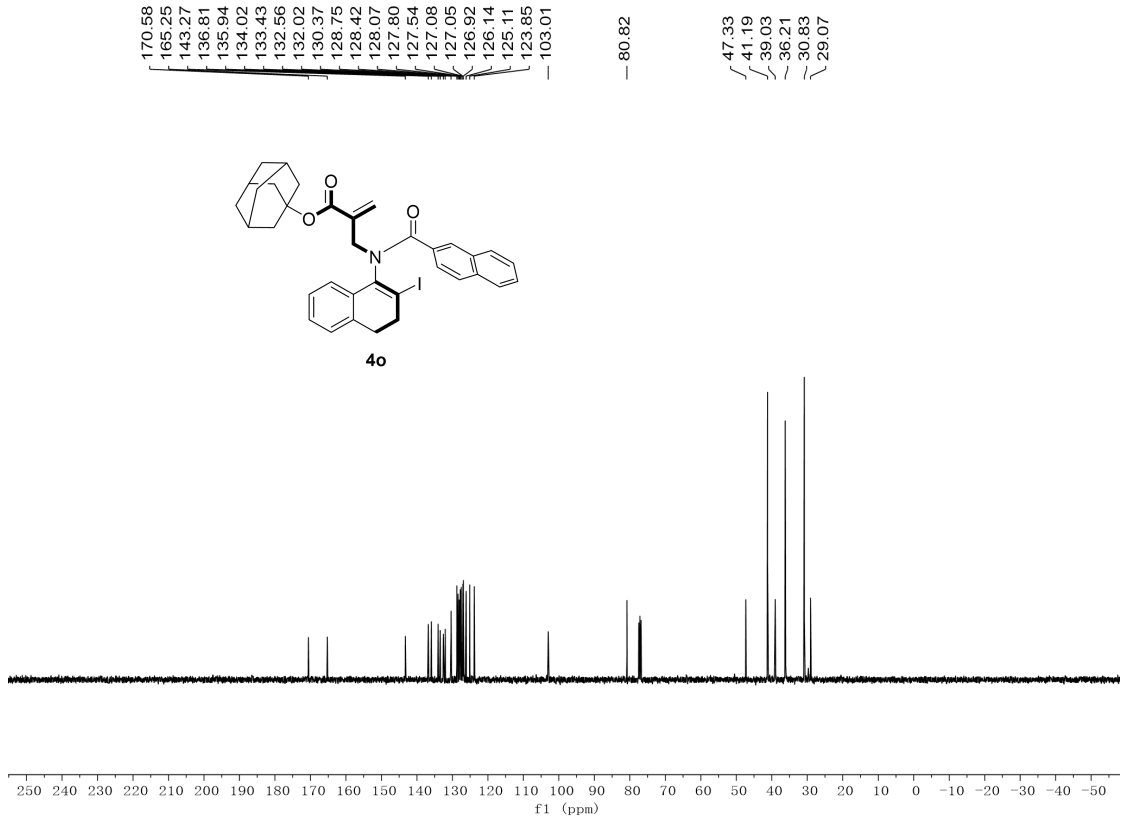

173.76
165.07
142.47
137.31
135.57
131.89
130.45
128.37
127.69
127.07
123.07
103.78
80.64
46.22
41.06
38.82
36.16
30.76
29.38
27.11
9.43

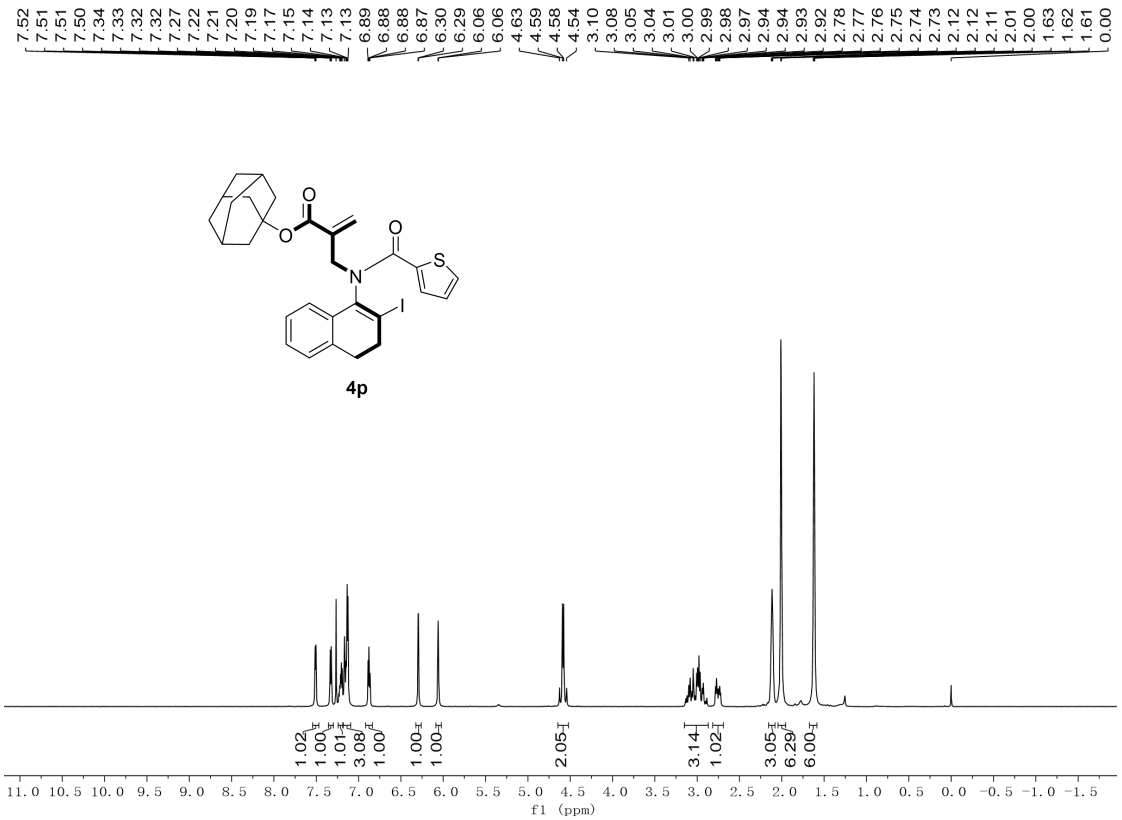

O
O
O
CH3
N
I

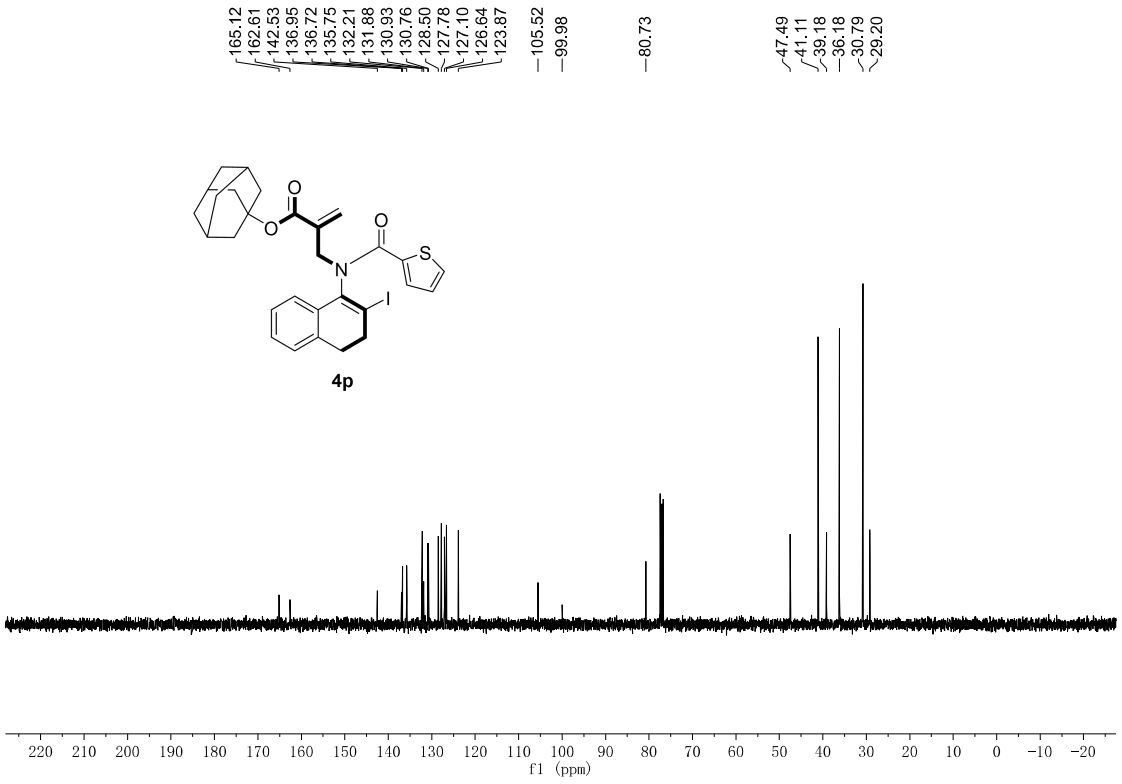
4n

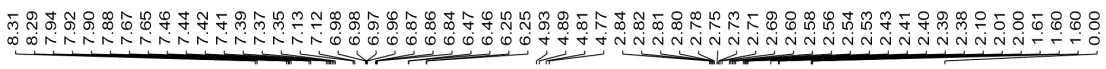

270 250 230 210 190 170 150 130 110 90 70 50 30 10 -10 -30 -50 -70
f1 (ppm)

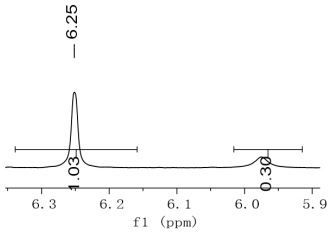

8.04 7.72 7.70 7.61 7.60 7.42 7.42 7.42 7.41 7.40 7.40 7.39 7.37 7.26 7.25 7.22 7.20 7.18 7.06 7.04 6.40 6.40 6.15 6.15
4.73 4.69 4.63 4.59 2.84 2.83 2.82 2.80 2.77 2.76 2.74 2.67 2.65 2.64 2.62 2.61 2.59 2.58 2.51 2.50 2.49 2.47 2.46 2.44 2.12 2.05 2.05 1.63 1.62 1.61 0.00
6.15 6.15
1.05 0.05
6.20 6.15 6.10 6.05 6.00 5.95
f1 (ppm)
O O O N I
4o
1.02 1.06 3.09 3.26 0.88 1.16 1.06 1.00 1.05 1.05 1.06 2.14 1.08 1.03 3.22 6.13 6.23
11.0 10.0 9.0 8.0 7.0 6.0 5.0 4.0 3.0 2.0 1.0 0.0 -1.0 -2.0
f1 (ppm)

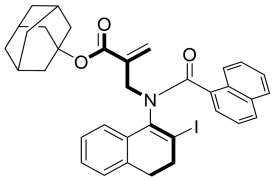

170.58 165.25 143.27 136.81 135.94 134.02 133.43 132.56 132.02 130.37 128.75 128.42 128.07 127.80 127.54 127.08 127.05 126.92 126.14 125.11 123.85 103.01
80.82
47.33 41.19 39.03 36.21 30.83 29.07
O O O N I
4o
250 240 230 220 210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10 -20 -30 -40 -50
f1 (ppm)


7.52 7.51 7.51 7.50 7.34 7.33 7.32 7.32 7.27 7.22 7.21 7.20 7.19 7.17 7.15 7.14 7.13 7.13 6.89 6.88 6.88 6.87 6.30 6.29 6.06 6.06 4.63 4.59 4.58 4.54 3.10 3.08 3.05 3.04 3.01 3.00 2.99 2.98 2.97 2.94 2.94 2.93 2.92 2.78 2.77 2.76 2.75 2.74 2.73 2.12 2.12 2.11 2.01 2.00 1.63 1.62 1.61 0.00
O
O
O
N
S
I
4p
1.02 1.00 1.01 3.08 1.00 1.00 1.00 2.05 3.14 1.02 3.05 6.29 6.00
11.0 10.5 10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5 -1.0 -1.5
f1 (ppm)

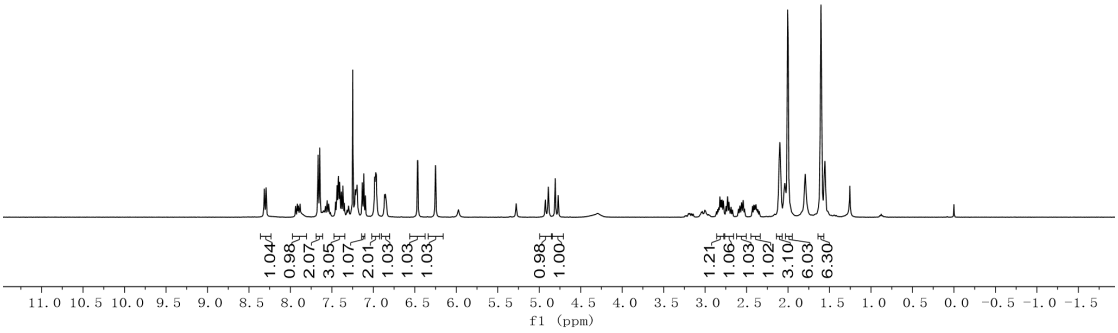

165.12 162.61 142.53 136.95 136.72 135.75 132.21 131.88 130.93 130.76 128.50 127.78 127.10 126.64 123.87 105.52 99.98 80.73 47.49 41.11 39.18 36.18 30.79 29.20
O
O
O
N
S
I
4p
220 210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10 -20
f1 (ppm)

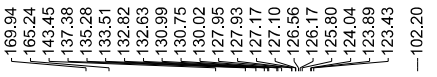

8.31
8.29
7.94
7.92
7.90
7.88
7.67
7.65
7.46
7.44
7.42
7.41
7.39
7.37
7.35
7.13
7.12
6.98
6.98
6.97
6.96
6.87
6.86
6.84
6.47
6.46
6.25
6.25
4.93
4.89
4.81
4.77
2.84
2.82
2.81
2.80
2.78
2.75
2.73
2.71
2.69
2.60
2.58
2.56
2.54
2.53
2.43
2.41
2.40
2.39
2.38
2.10
2.01
2.00
1.61
1.60
1.60
0.00

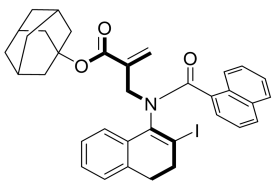

6.25
1.03
0.38
6.3
6.2
6.1
6.0
5.9
f1 (ppm)


O
O
O
N
I

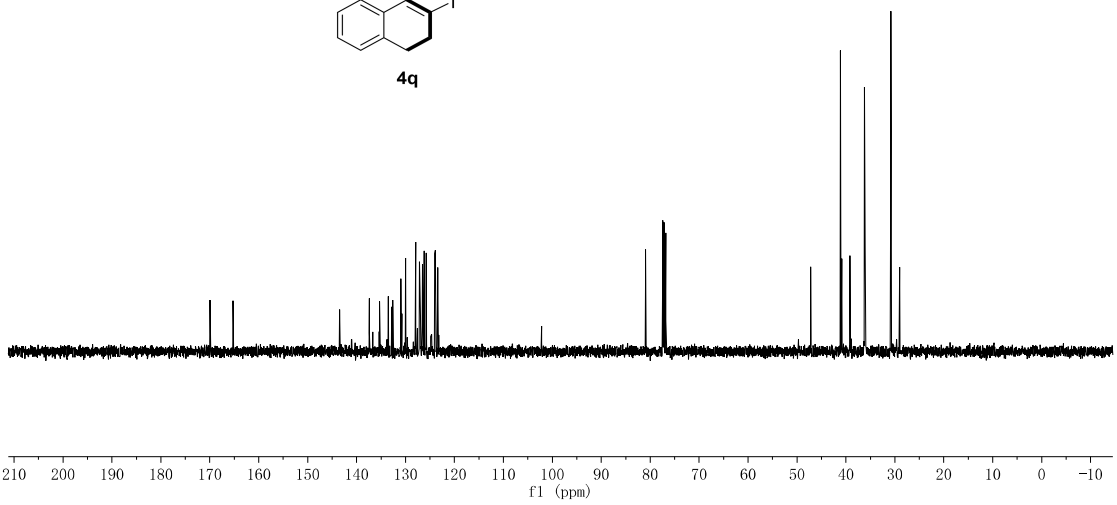
4q

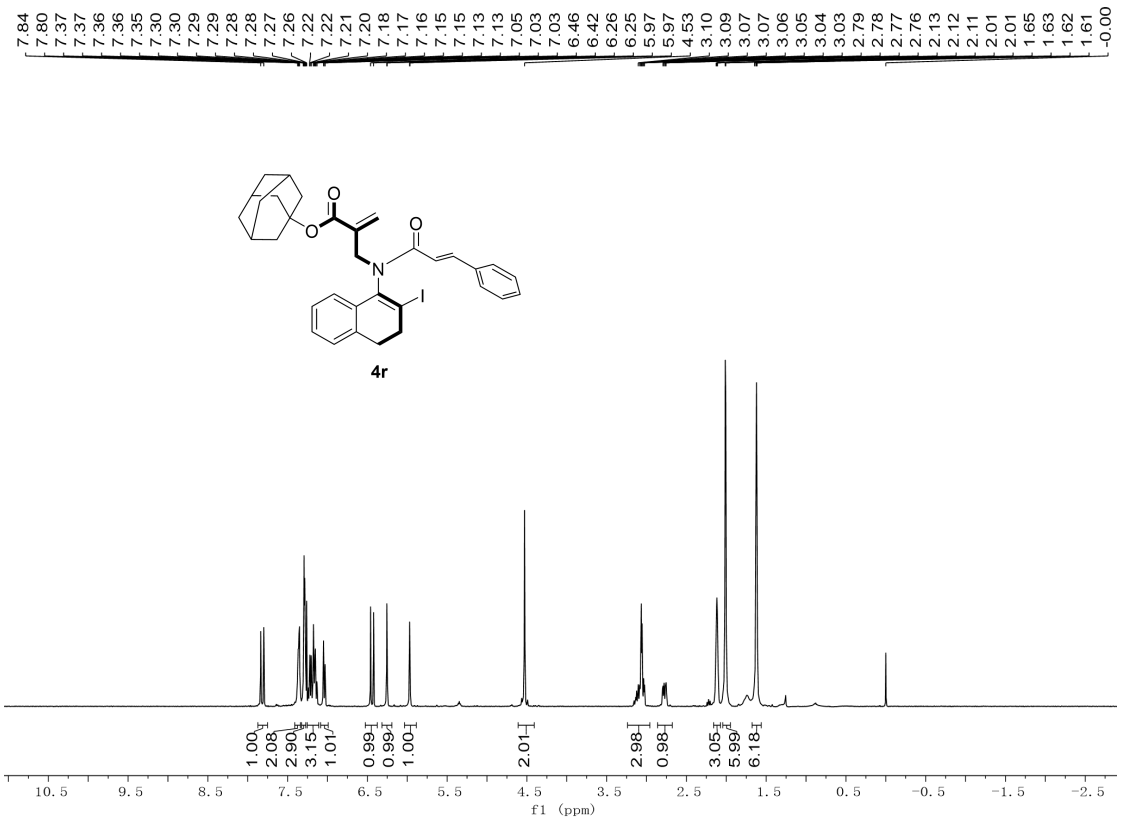

1.04
0.98
2.07
3.05
1.07
2.01
1.03
1.03
1.03
0.98
1.00
1.21
1.06
1.03
1.02
3.10
6.03
6.30
11.0 10.5 10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 −0.5 −1.0 −1.5
f1 (ppm)

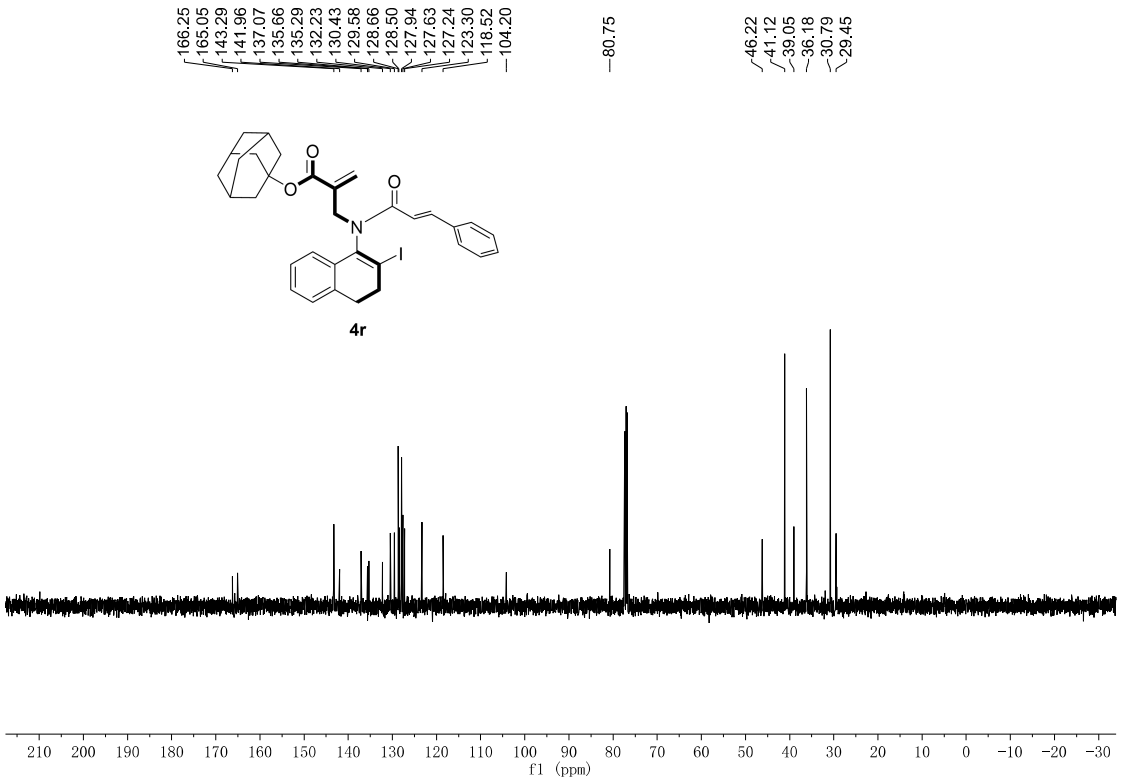

169.94
165.24
143.45
137.38
135.28
133.51
132.82
132.63
130.99
130.75
130.02
127.95
127.93
127.17
127.10
126.56
126.17
125.80
124.04
123.89
123.43
102.20
80.93
47.20
41.10
39.18
36.07
30.80
29.05

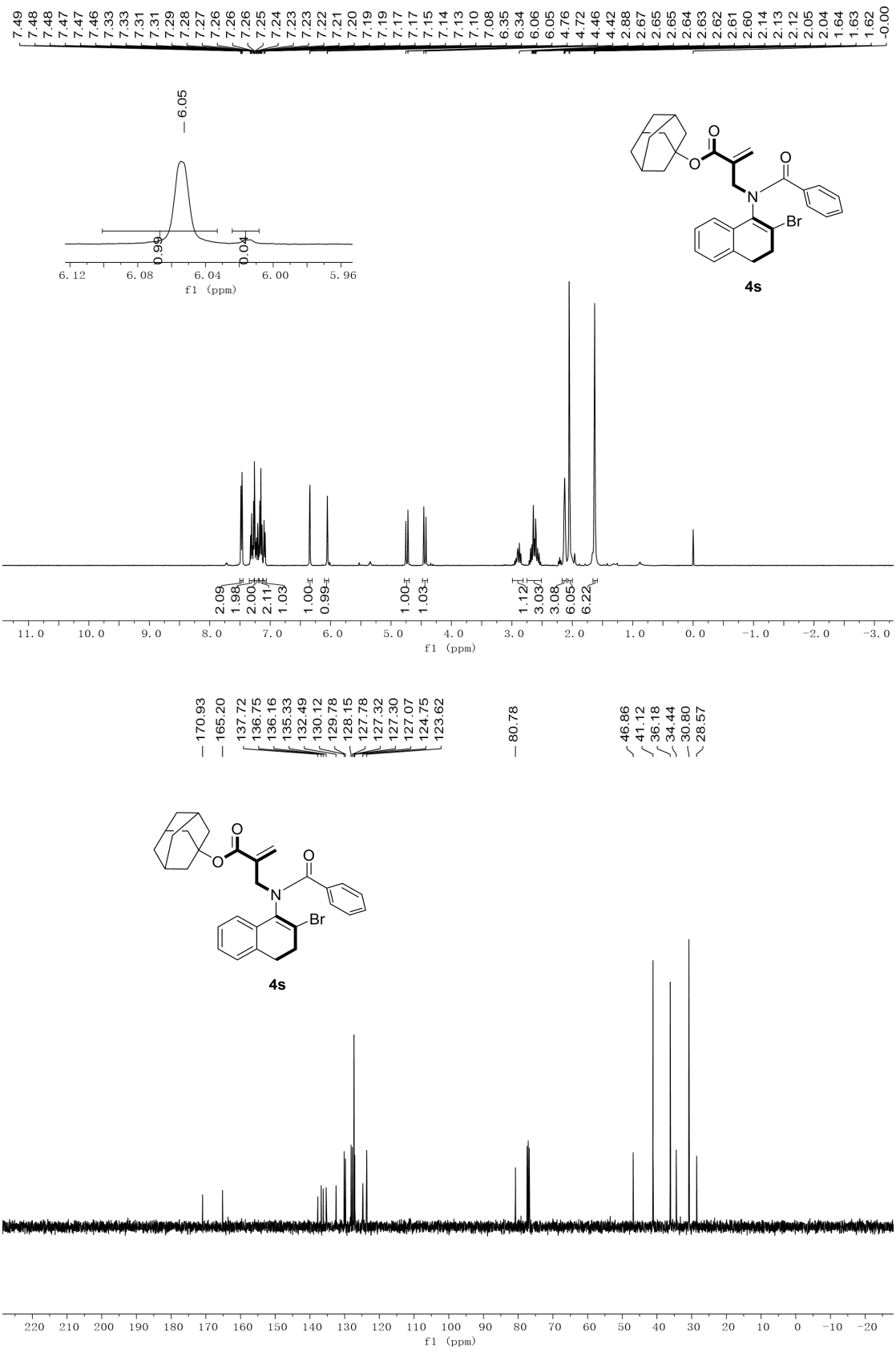

O
O
O
N
I

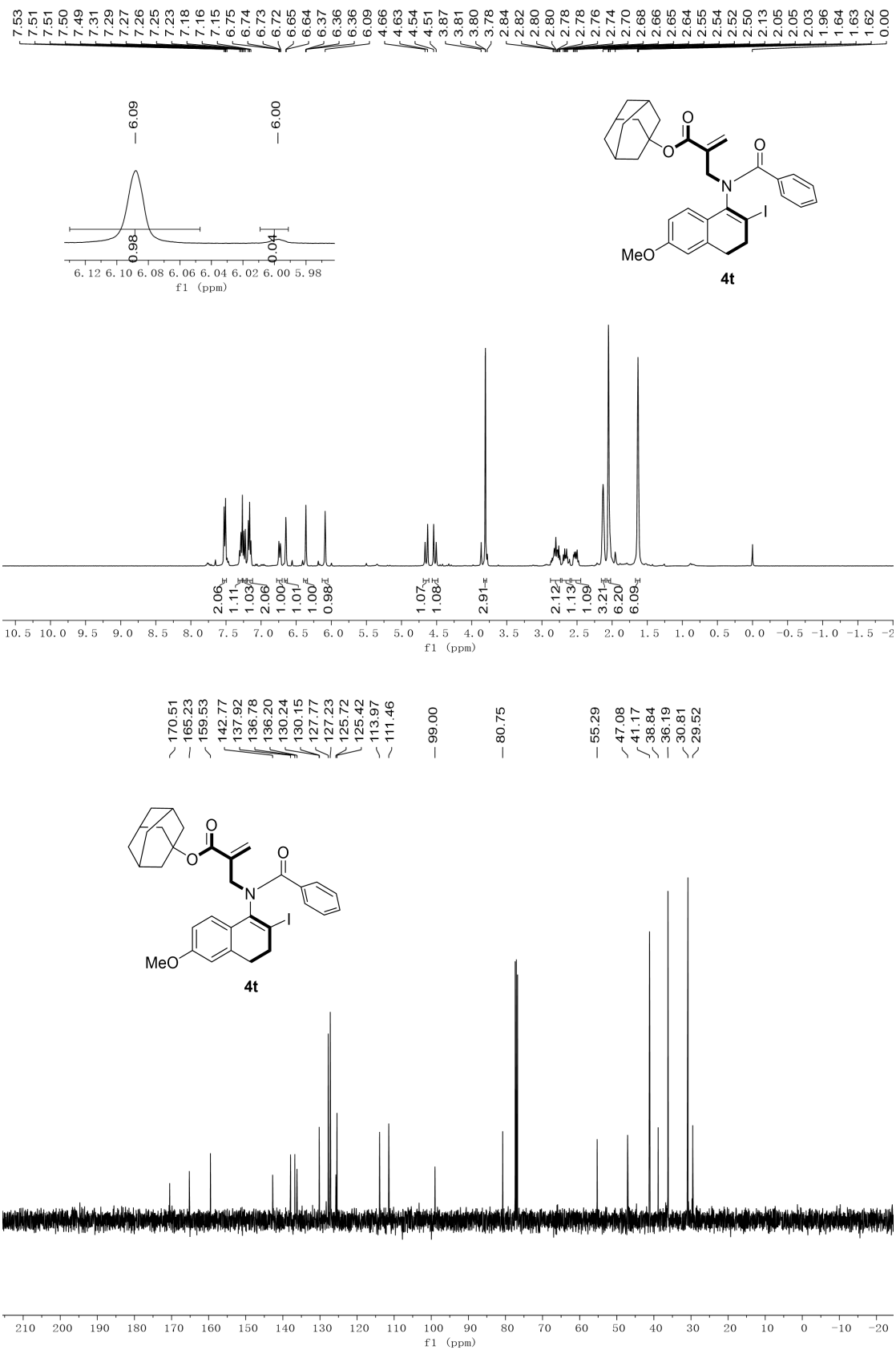
4q

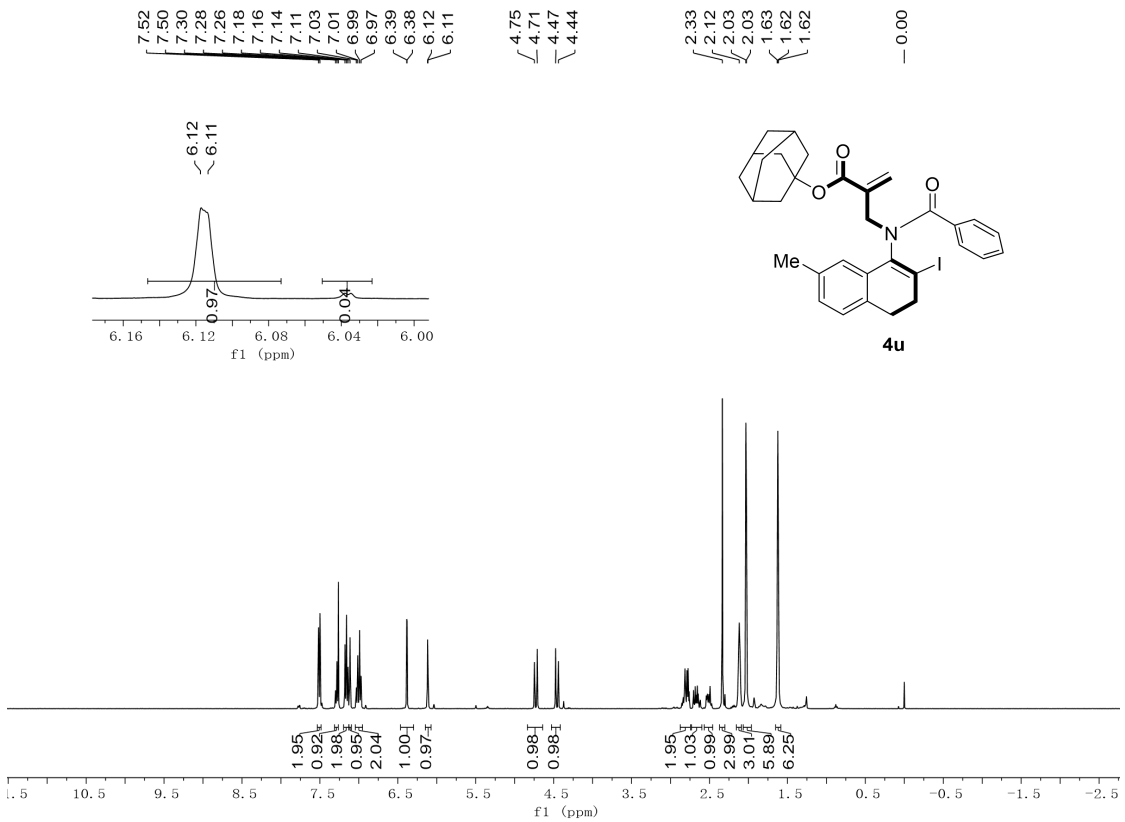

210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 −10
f1 (ppm)

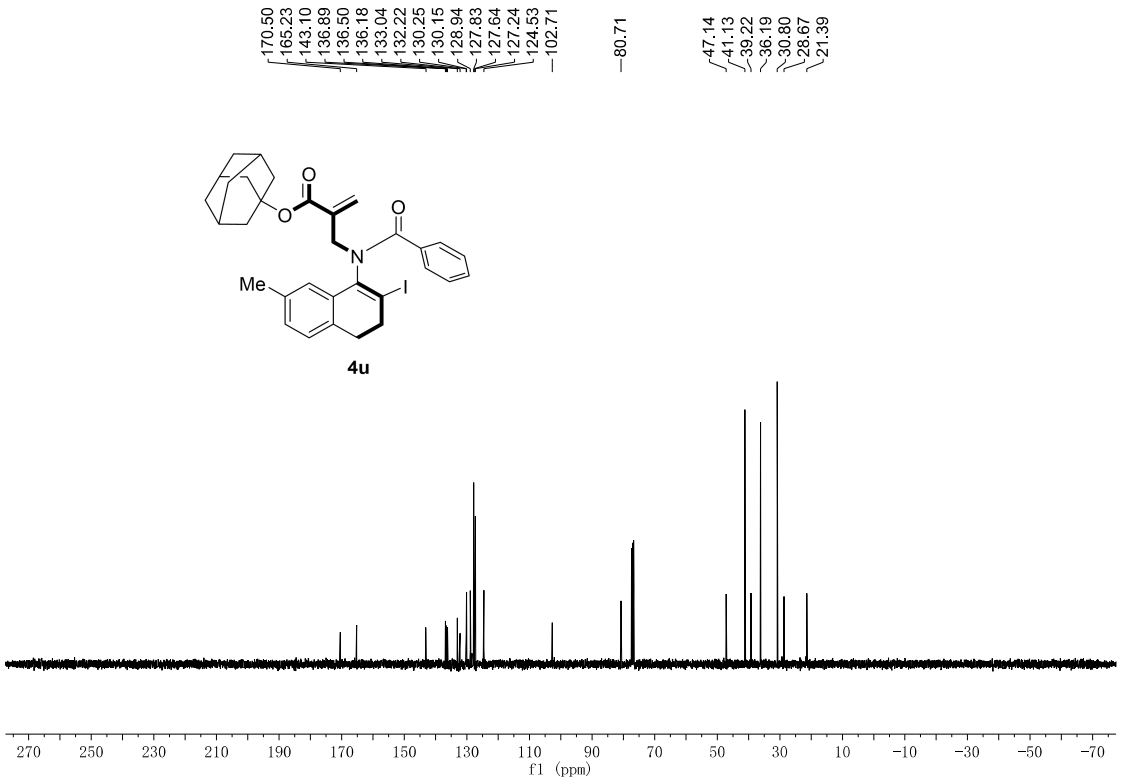

7.84
7.80
7.37
7.37
7.36
7.36
7.35
7.30
7.30
7.29
7.29
7.28
7.28
7.27
7.26
7.22
7.22
7.21
7.20
7.18
7.17
7.16
7.15
7.15
7.13
7.13
7.05
7.03
7.03
6.46
6.42
6.26
6.25
5.97
5.97
4.53
3.10
3.09
3.07
3.07
3.06
3.05
3.04
3.03
2.79
2.78
2.77
2.76
2.13
2.12
2.11
2.01
2.01
1.65
1.63
1.62
1.61
-0.00
O
O
O
N
I
4r
1.00
2.08
2.90
3.15
1.01
0.99
0.99
1.00
2.01
2.98
0.98
3.05
5.99
6.18
10.5
9.5
8.5
7.5
6.5
5.5
4.5
3.5
2.5
1.5
0.5
-0.5
-1.5
-2.5
f1 (ppm)


166.25
165.05
143.29
141.96
137.07
135.66
135.29
132.23
130.43
129.58
128.66
128.50
127.94
127.63
127.24
123.30
118.52
104.20
80.75
46.22
41.12
39.05
36.18
30.79
29.45
O
O
O
N
I
4r
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
-10
-20
-30
f1 (ppm)


7.49 7.48 7.48 7.47 7.47 7.46 7.33 7.33 7.31 7.31 7.29 7.28 7.27 7.26 7.26 7.26 7.25 7.24 7.23 7.23 7.22 7.21 7.20 7.19 7.19 7.17 7.17 7.15 7.14 7.13 7.10 7.08 6.35 6.34 6.06 6.05 4.76 4.72 4.46 4.42 2.88 2.67 2.65 2.65 2.64 2.63 2.62 2.61 2.60 2.14 2.13 2.12 2.05 2.04 1.64 1.63 1.62 -0.00
6.05
0.99
0.04
6.12 6.08 6.04 6.00 5.96
f1 (ppm)
O
O
O
N
Br
4s
2.09 1.98 2.00 2.11 1.03 1.00 0.99 1.00 1.03 1.12 3.03 3.08 6.05 6.22
11.0 10.0 9.0 8.0 7.0 6.0 5.0 4.0 3.0 2.0 1.0 0.0 -1.0 -2.0 -3.0
f1 (ppm)
170.93 165.20 137.72 136.75 136.16 135.33 132.49 130.12 129.78 128.15 127.78 127.32 127.30 127.07 124.75 123.62 80.78 46.86 41.12 36.18 34.44 30.80 28.57
O
O
O
N
Br
4s
220 210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10 -20
f1 (ppm)


7.53 7.51 7.51 7.50 7.49 7.31 7.29 7.27 7.26 7.25 7.23 7.18 7.16 7.15 6.75 6.74 6.73 6.72 6.65 6.64 6.37 6.36 6.36 6.09 4.66 4.63 4.54 4.51 3.87 3.81 3.80 3.78 2.84 2.82 2.80 2.80 2.78 2.78 2.76 2.74 2.70 2.68 2.66 2.65 2.64 2.55 2.54 2.52 2.50 2.13 2.05 2.05 2.03 1.96 1.64 1.63 1.62 0.00
6.09
6.00
0.98
0.04
6.12 6.10 6.08 6.06 6.04 6.02 6.00 5.98
f1 (ppm)
O
O
N
O
I
MeO
4t
2.06 1.11 1.03 2.06 1.00 1.01 1.00 0.98 1.07 1.08 2.91 2.12 1.13 1.09 3.21 6.20 6.09
10.5 10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5 -1.0 -1.5 -2
f1 (ppm)
170.51 165.23 159.53 142.77 137.92 136.78 136.20 130.24 130.15 127.77 127.23 125.72 125.42 113.97 111.46 99.00 80.75 55.29 47.08 41.17 38.84 36.19 30.81 29.52
O
O
N
O
I
MeO
4t
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10 -20
f1 (ppm)


7.52
7.50
7.30
7.28
7.26
7.18
7.16
7.14
7.11
7.03
7.01
6.99
6.97
6.39
6.38
6.12
6.11
4.75
4.71
4.47
4.44
2.33
2.12
2.03
2.03
1.63
1.62
1.62
0.00
6.12
6.11
0.97
0.04
6.16
6.12
6.08
6.04
6.00
f1 (ppm)
O
O
O
N
Me
I
4u
1.95
0.92
1.98
0.95
2.04
1.00
0.97
0.98
0.98
1.95
1.03
0.99
3.01
5.89
6.25
f1 (ppm)


170.50
165.23
143.10
136.89
136.50
136.18
133.04
132.22
130.25
130.15
128.94
127.83
127.64
127.24
124.53
102.71
80.71
47.14
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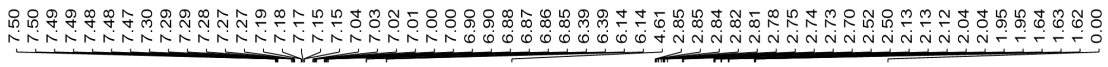
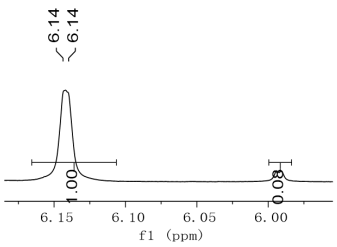
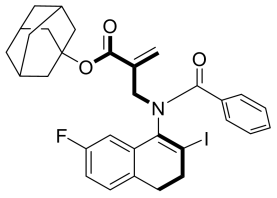
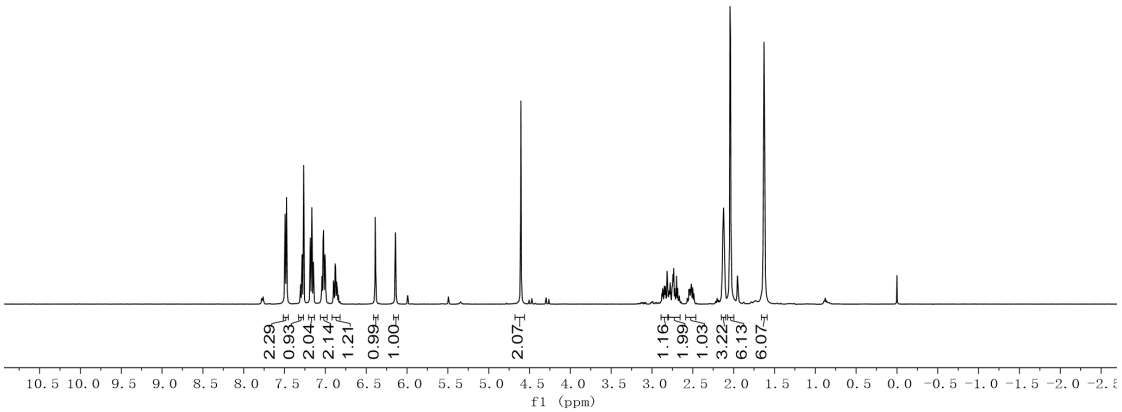
O
O
O
N
Me
I
4u
f1 (ppm)


7.50 7.50 7.49 7.49 7.48 7.48 7.47 7.30 7.29 7.29 7.28 7.27 7.27 7.19 7.18 7.17 7.15 7.15 7.04 7.03 7.02 7.01 7.00 7.00 6.90 6.90 6.88 6.87 6.86 6.85 6.39 6.14 6.14 4.61 2.85 2.85 2.84 2.82 2.81 2.78 2.75 2.74 2.73 2.70 2.52 2.50 2.13 2.13 2.12 2.04 2.04 1.95 1.64 1.63 1.62 0.00

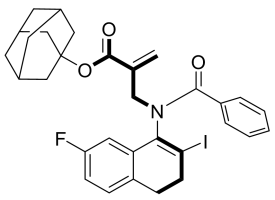

6.14
6.14
1.00
0.08
6.15 6.10 6.05 6.00
f1 (ppm)


O
O
O
N
F
I

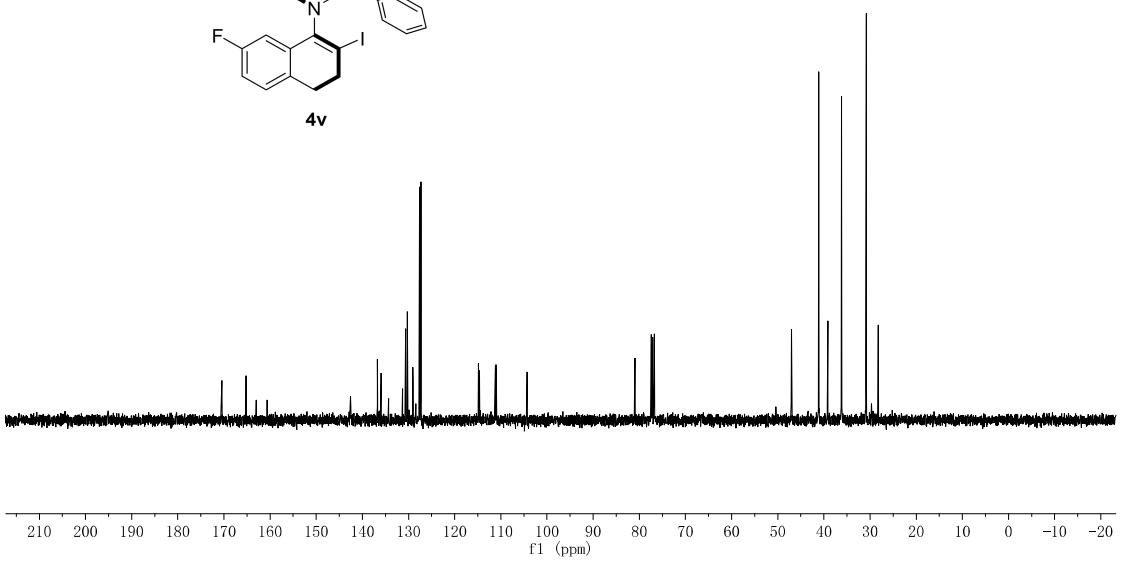
4v

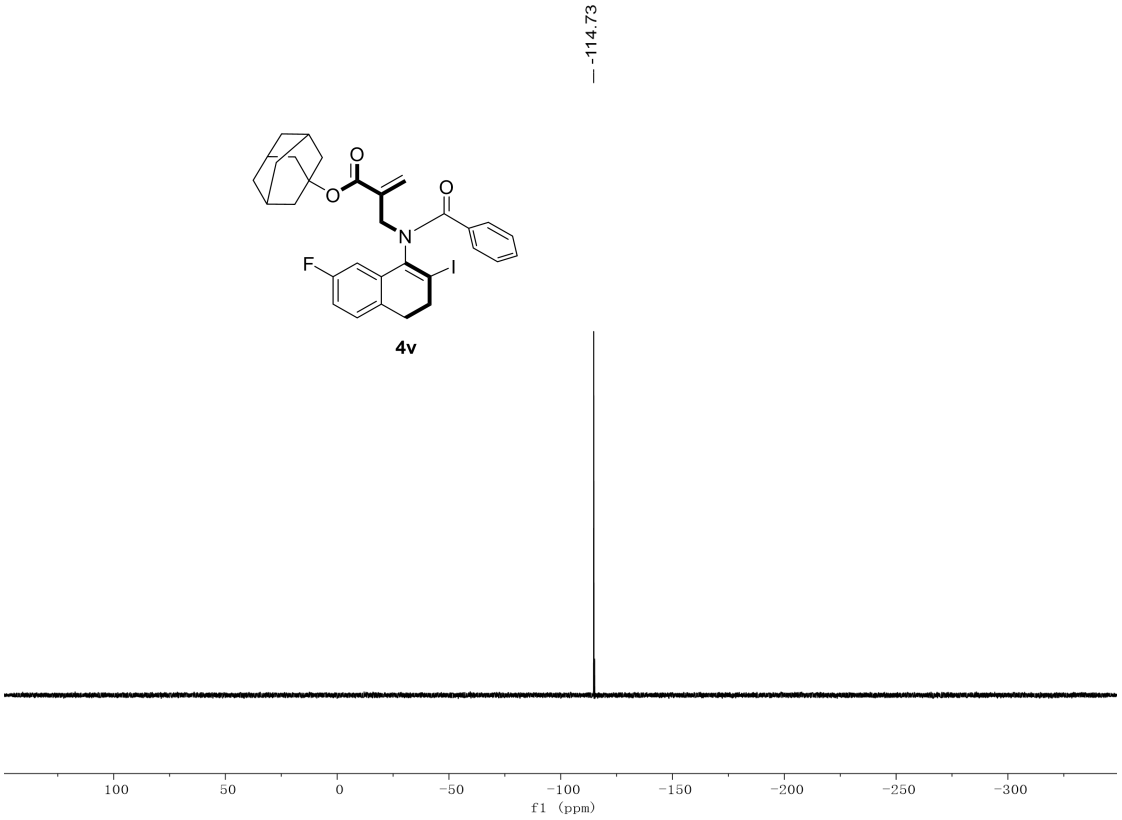

2.29
0.93
2.04
2.14
1.21
0.99
1.00
2.07
1.16
1.99
1.03
3.22
6.13
6.07
10.5 10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5 -1.0 -1.5 -2.0
f1 (ppm)

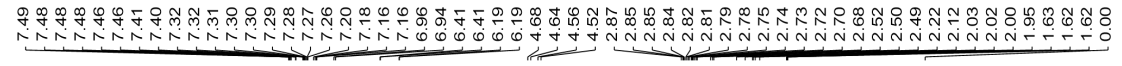

170.45
165.21
163.02
160.60
142.60
136.75
135.97
134.38
134.31
131.36
131.33
130.66
130.28
129.06
128.98
127.64
127.34
114.87
114.65
111.18
110.94
104.33
80.90
47.02
41.11
39.16
36.17
30.80
28.24

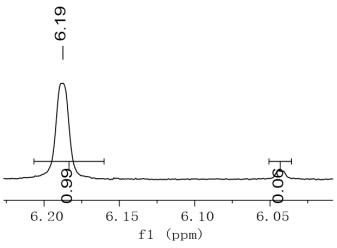

O
O
O
N
F
I

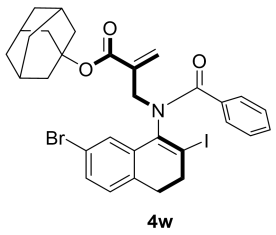
4v

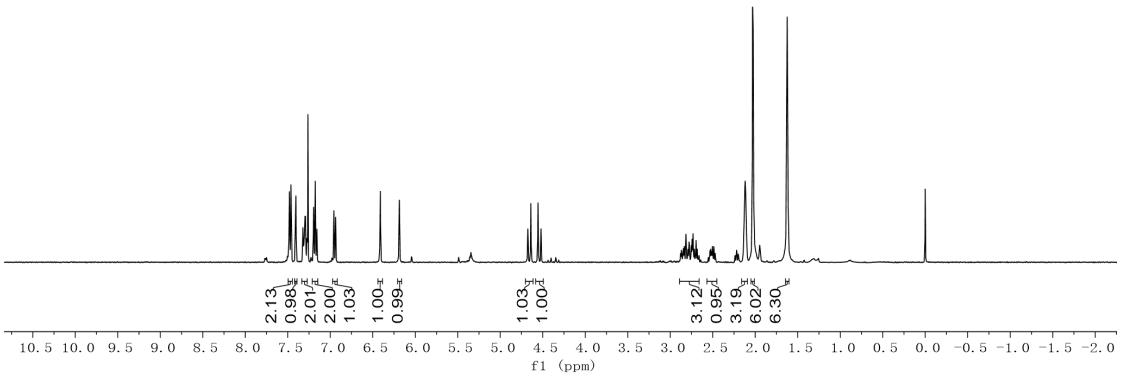

210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10 -20
f1 (ppm)

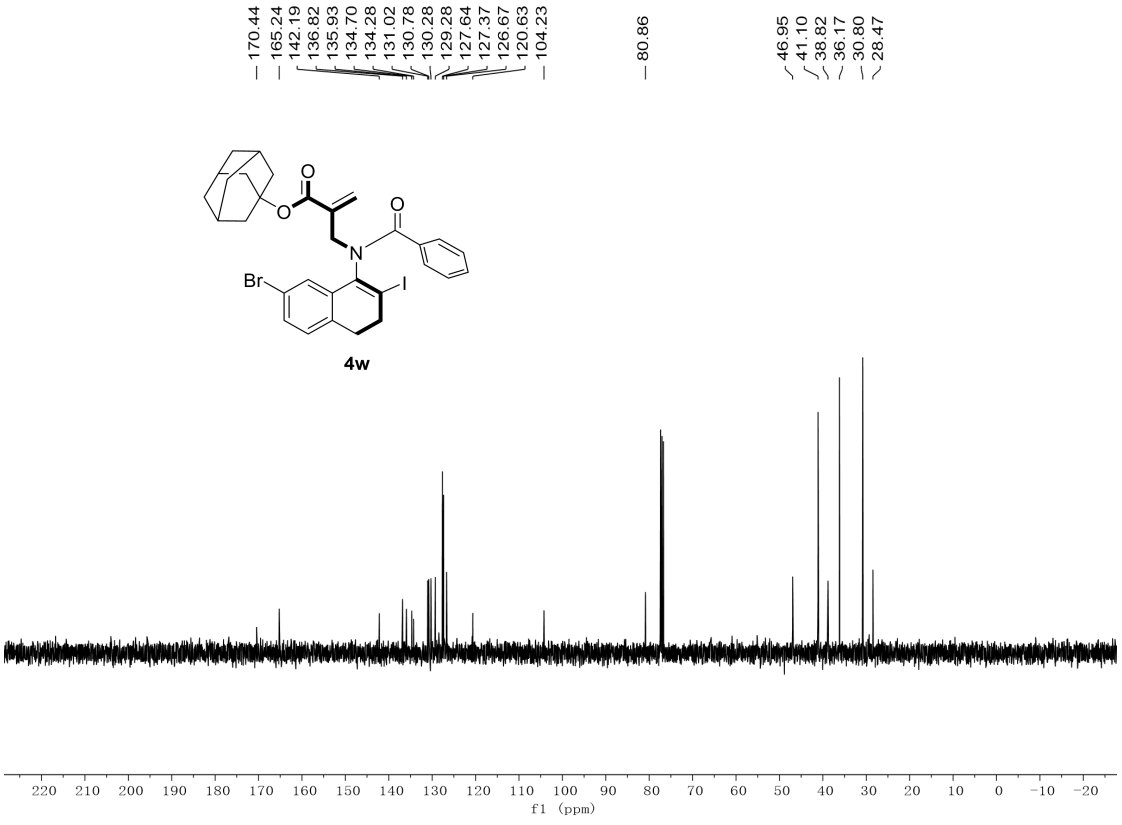

-114.73
F
I
4v
100
50
0
−50
−100
−150
−200
−250
−300
f1 (ppm)

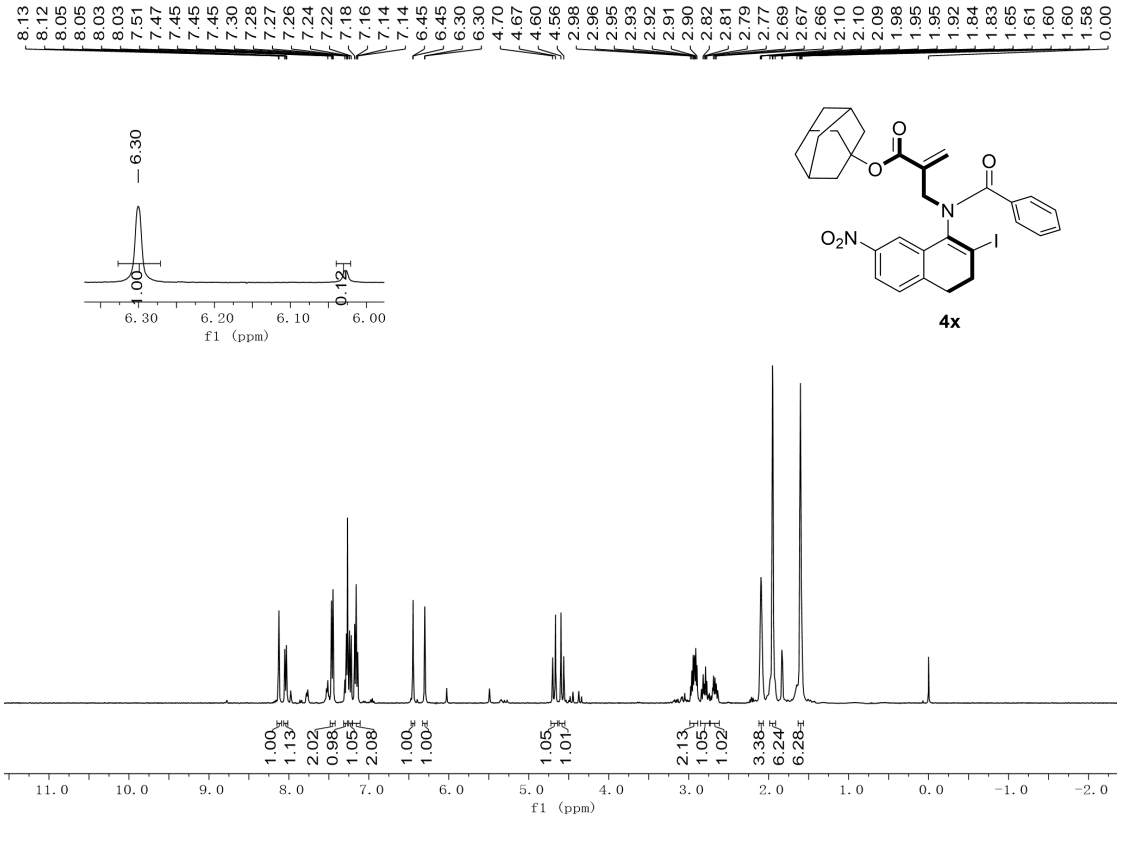

7.49
7.48
7.48
7.48
7.46
7.46
7.41
7.40
7.32
7.31
7.30
7.30
7.29
7.28
7.27
7.26
7.20
7.18
7.16
7.16
6.96
6.94
6.41
6.41
6.19
6.19
4.68
4.64
4.56
4.52
2.87
2.85
2.85
2.84
2.82
2.81
2.79
2.78
2.75
2.74
2.73
2.72
2.70
2.68
2.52
2.50
2.49
2.22
2.12
2.03
2.02
2.00
1.95
1.63
1.62
1.62
0.00

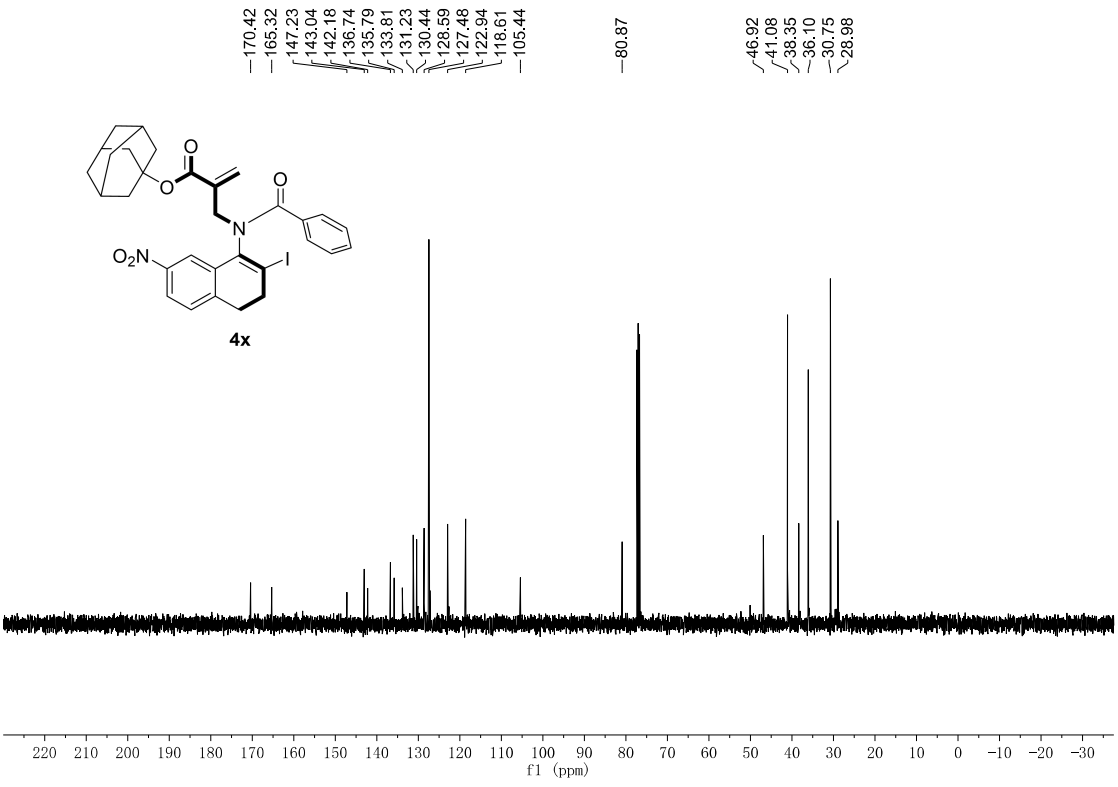

6.19
0.99
0.06
6.20
6.15
6.10
6.05
f1 (ppm)

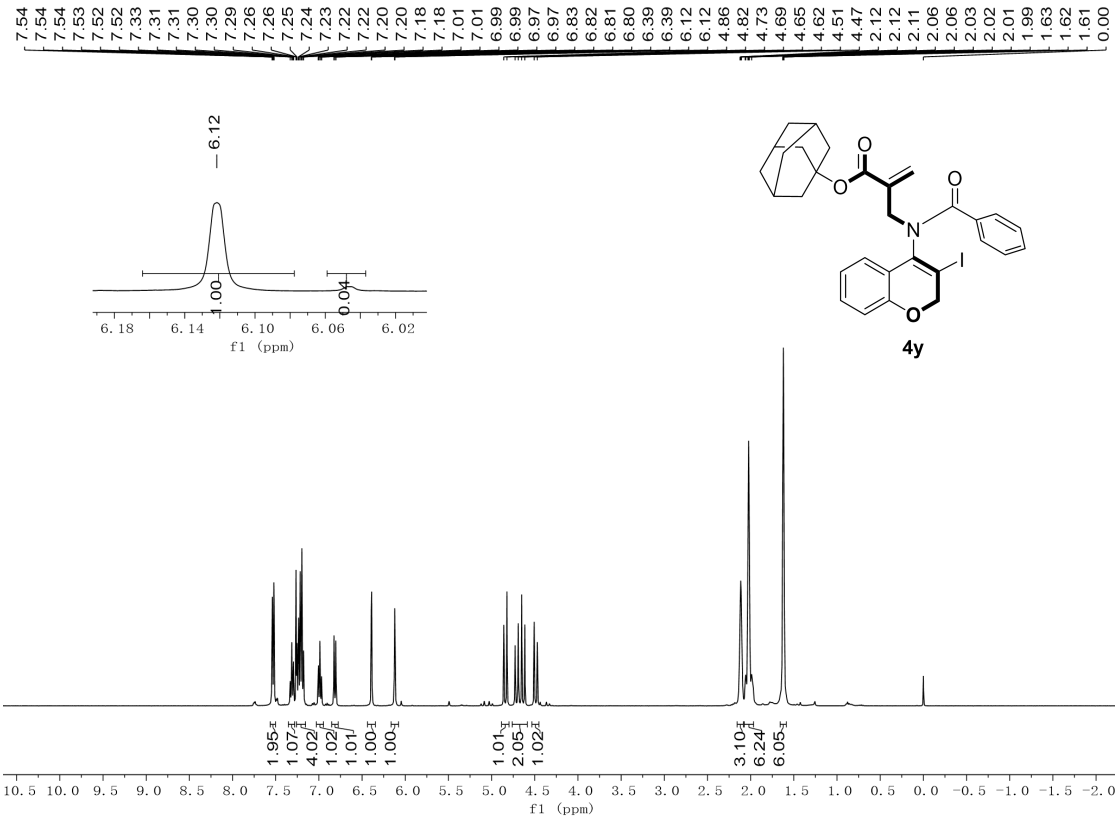

Br
I
4w

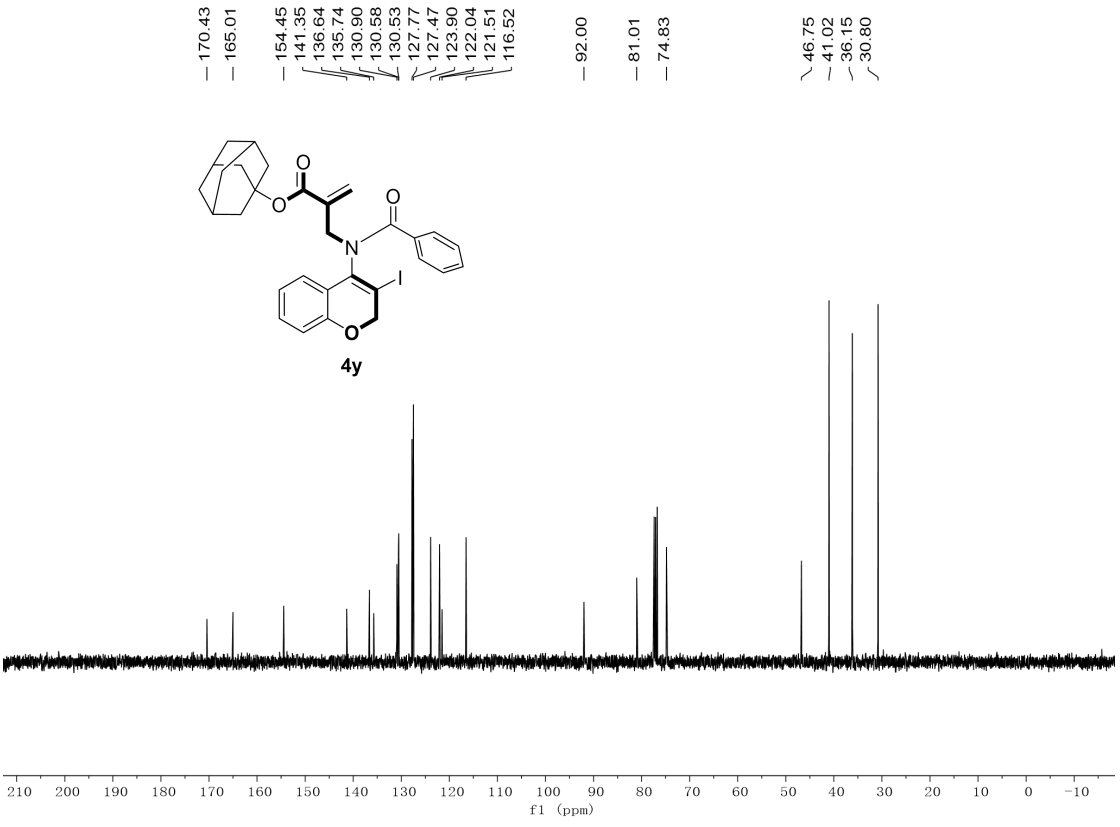

2.13
0.98
2.01
2.00
1.03
1.00
0.99
1.03
1.00
3.12
0.95
3.19
6.02
6.30
10.5 10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 −0.5 −1.0 −1.5 −2.0
f1 (ppm)

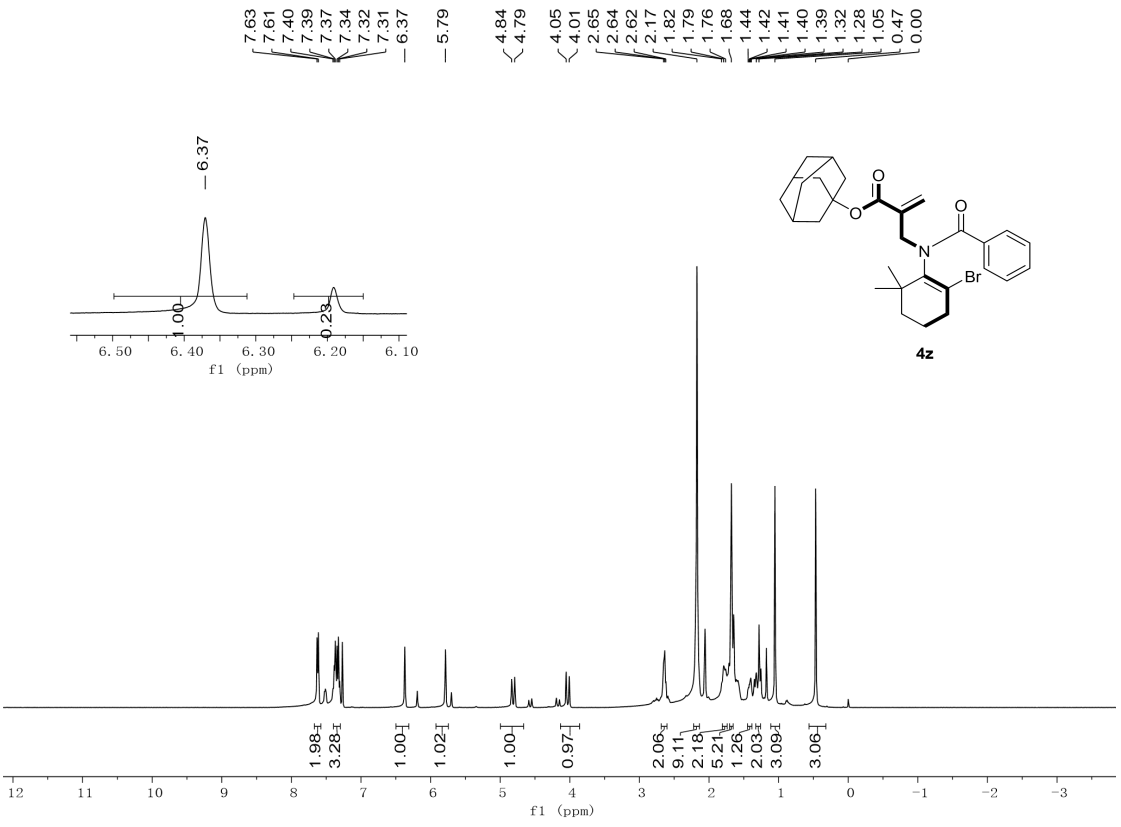

170.44
165.24
142.19
136.82
135.93
134.70
134.28
131.02
130.78
130.28
129.28
127.64
127.37
126.67
120.63
104.23
80.86
46.95
41.10
38.82
36.17
30.80
28.47
O
O
O
N
Br
I
4w
f1 (ppm)

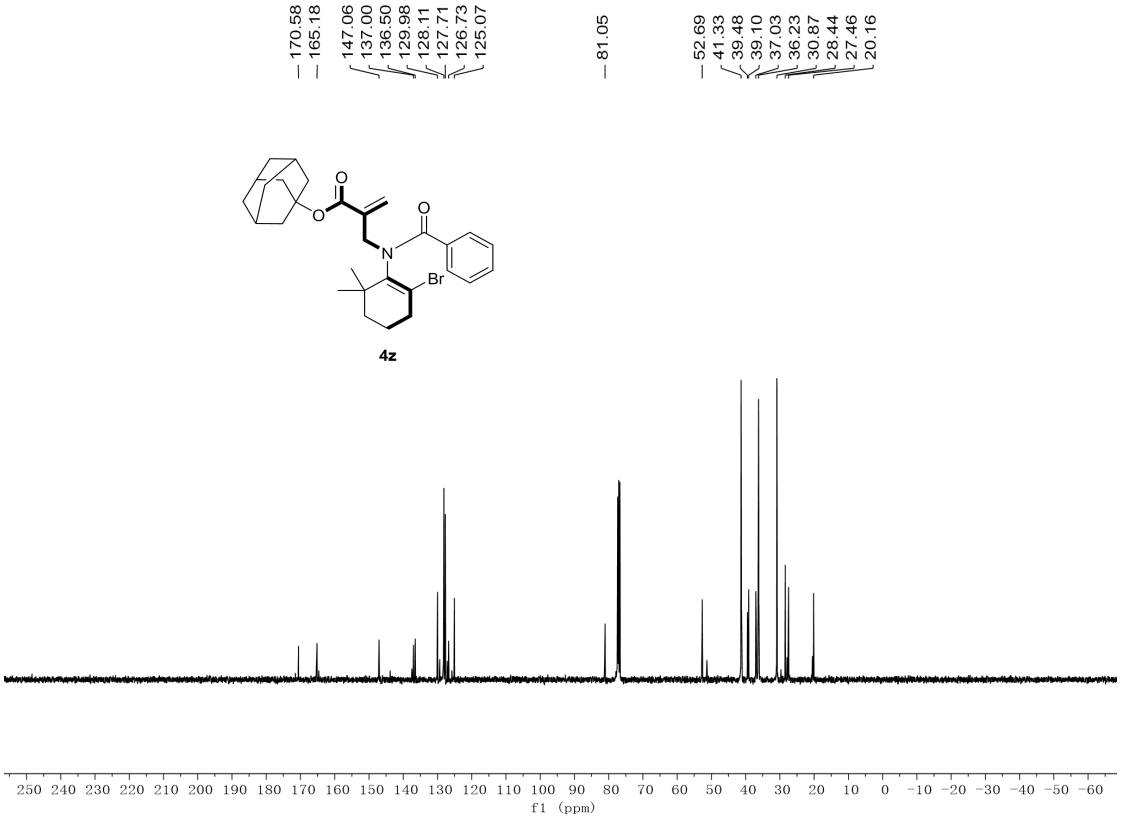

8.13
8.12
8.05
8.05
8.03
8.03
7.51
7.47
7.45
7.45
7.45
7.30
7.28
7.27
7.26
7.24
7.22
7.18
7.16
7.14
7.14
6.45
6.45
6.30
6.30
4.70
4.67
4.60
4.56
2.98
2.96
2.95
2.93
2.92
2.91
2.90
2.82
2.81
2.79
2.77
2.69
2.67
2.66
2.10
2.10
2.09
1.98
1.95
1.95
1.92
1.84
1.83
1.65
1.61
1.60
1.60
1.58
0.00
6.30
1.00
0.12
6.30
6.20
6.10
6.00
f1 (ppm)
O
O
O
N
O2N
I
4x
1.00
1.13
2.02
0.98
1.05
2.08
1.00
1.00
1.05
1.01
2.13
1.05
1.02
3.38
6.24
6.28
11.0
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
-1.0
-2.0
f1 (ppm)

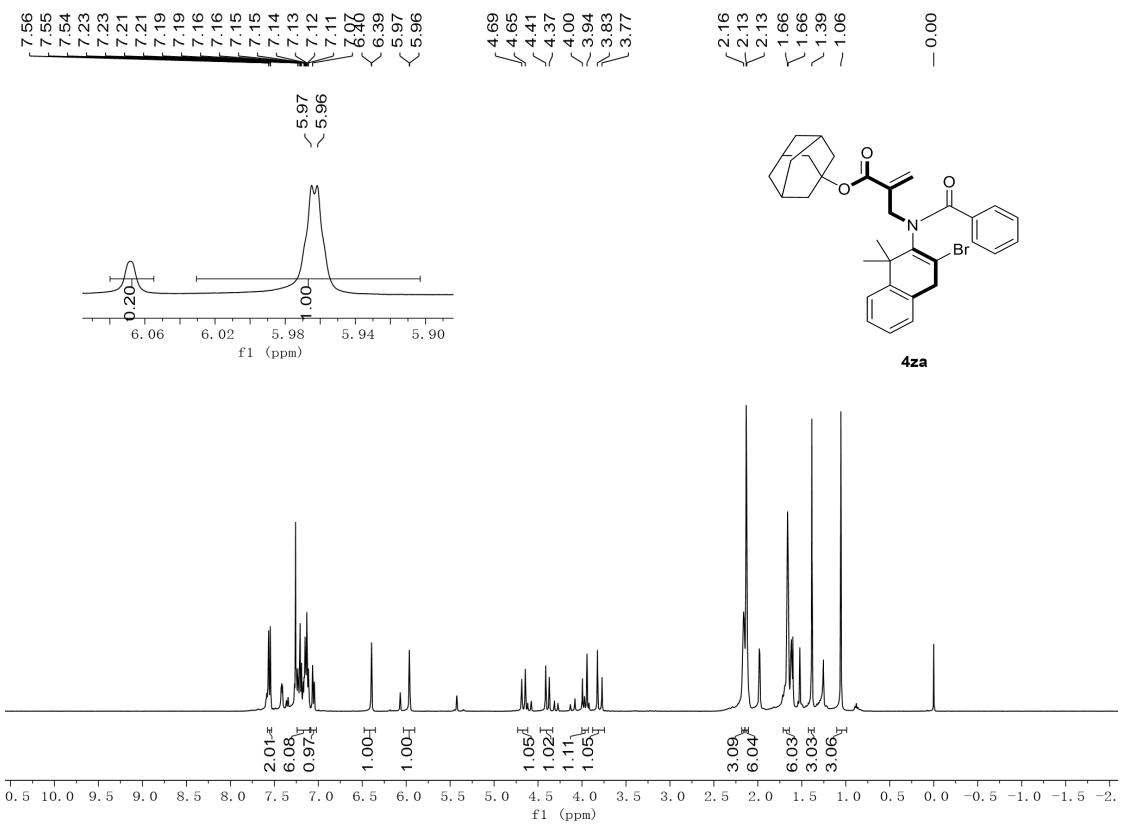

170.42
165.32
147.23
143.04
142.18
136.74
135.79
133.81
131.23
130.44
128.59
127.48
122.94
118.61
105.44
80.87
46.92
41.08
38.35
36.10
30.75
28.98
O
O
O
N
O2N
I
4x
f1 (ppm)

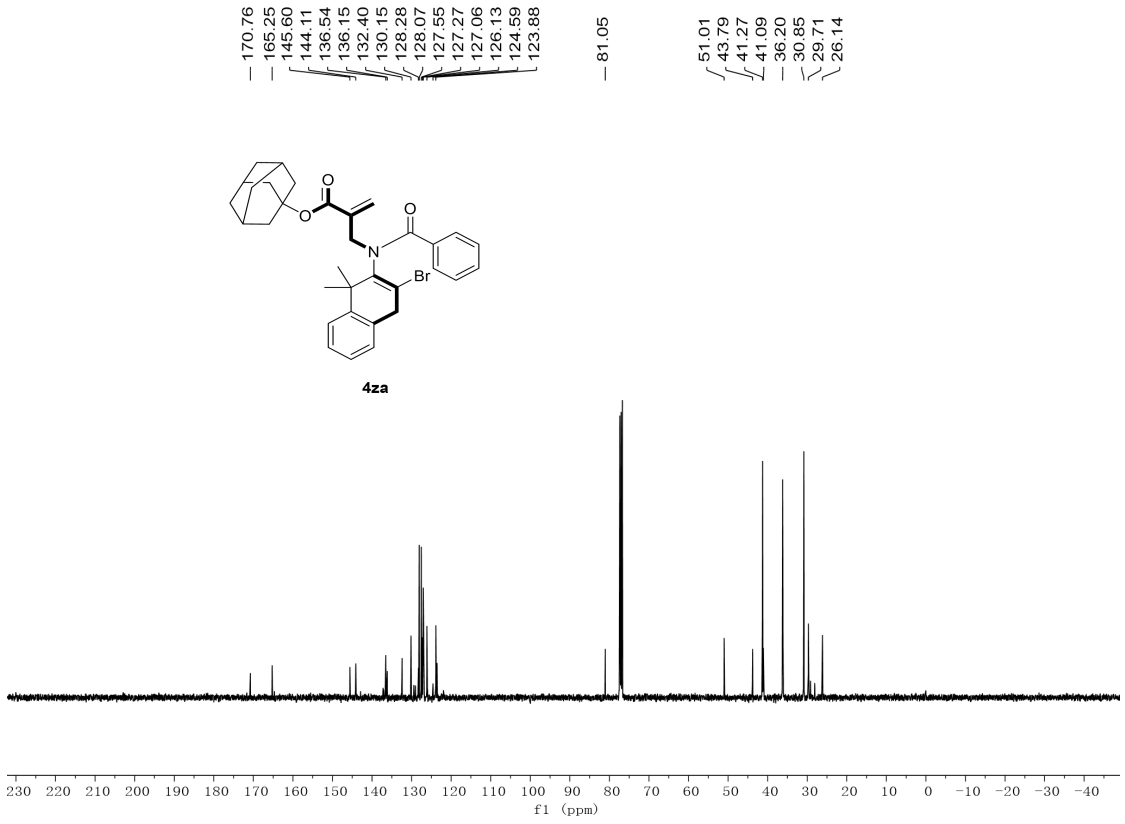

7.54
7.54
7.54
7.53
7.52
7.52
7.33
7.31
7.31
7.30
7.30
7.29
7.26
7.26
7.25
7.24
7.23
7.22
7.22
7.20
7.20
7.18
7.18
7.01
7.01
6.99
6.99
6.97
6.97
6.83
6.82
6.81
6.80
6.39
6.39
6.12
6.12
4.86
4.82
4.73
4.69
4.65
4.62
4.51
4.47
2.12
2.12
2.11
2.06
2.06
2.03
2.02
2.01
1.99
1.63
1.62
1.61
0.00
6.12
1.00
0.04
6.18
6.14
6.10
6.06
6.02
f1 (ppm)
O
O
O
N
I
O
4y
1.95
1.07
4.02
1.02
1.01
1.00
1.00
1.01
2.05
1.02
3.10
6.24
6.05
f1 (ppm)

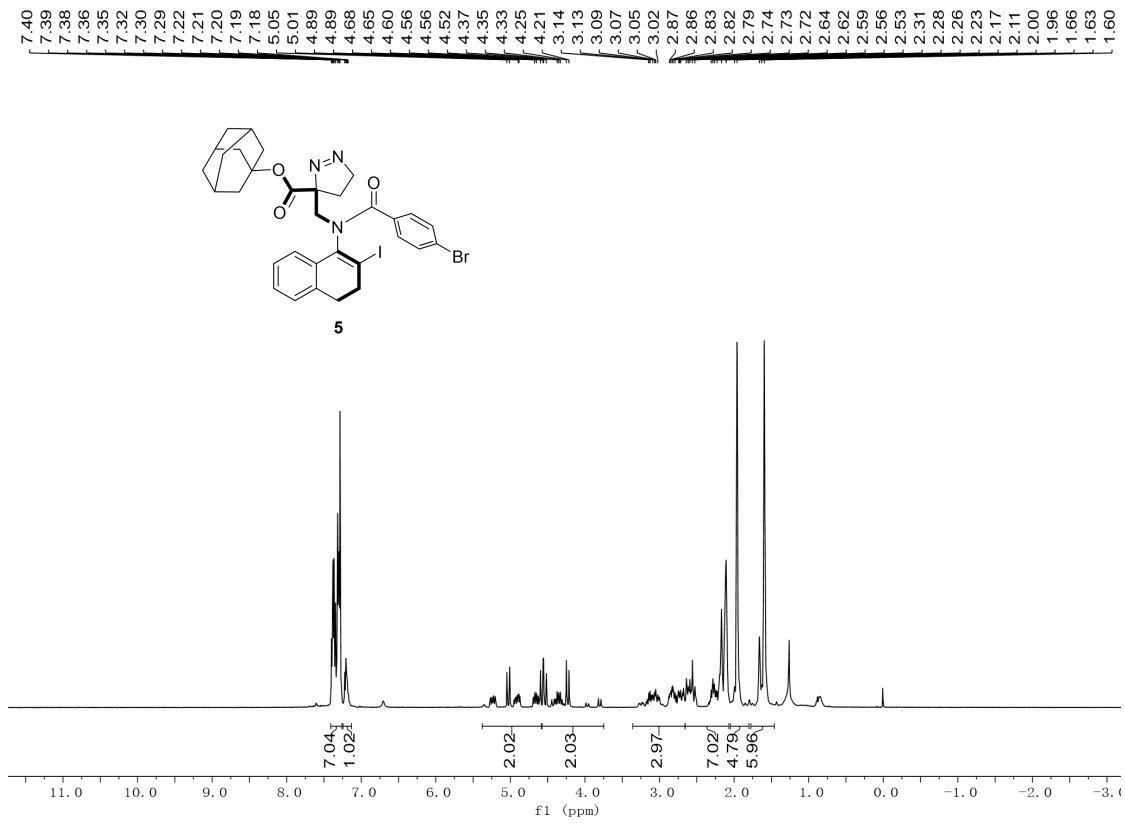

170.43
165.01
154.45
141.35
136.64
135.74
130.90
130.58
130.53
127.77
127.47
123.90
122.04
121.51
116.52
92.00
81.01
74.83
46.75
41.02
36.15
30.80
O
O
O
N
I
O
4y
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 −10
f1 (ppm)

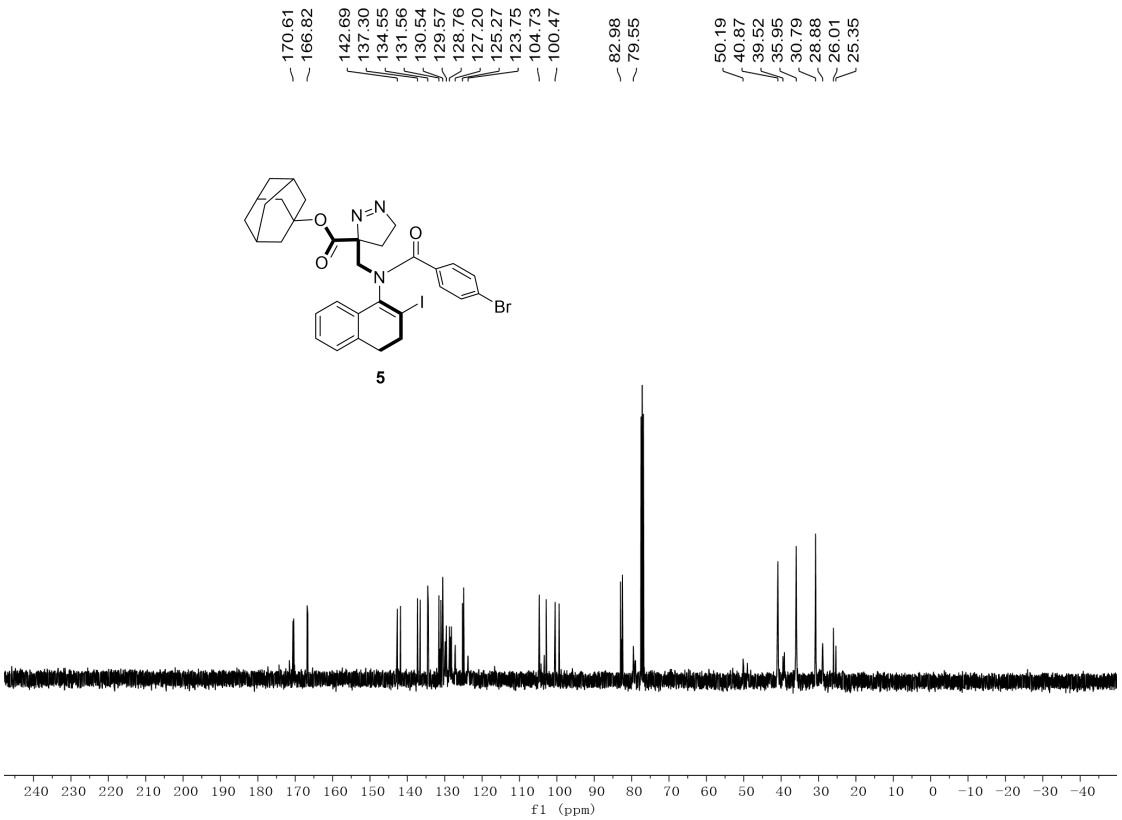

7.63
7.61
7.40
7.39
7.37
7.34
7.32
7.31
6.37
5.79
4.84
4.79
4.05
4.01
2.65
2.64
2.62
2.17
1.82
1.79
1.76
1.68
1.44
1.42
1.41
1.40
1.39
1.32
1.28
1.05
0.47
0.00
6.37
1.00
0.23
6.50 6.40 6.30 6.20 6.10
f1 (ppm)
O
O
O
N
Br
4z
1.98
3.28
1.00
1.02
1.00
0.97
2.06
9.11
2.18
5.21
1.26
2.03
3.09
3.06
12 11 10 9 8 7 6 5 4 3 2 1 0 −1 −2 −3
f1 (ppm)


170.58
165.18
147.06
137.00
136.50
129.98
128.11
127.71
126.73
125.07
81.05
52.69
41.33
39.48
39.10
37.03
36.23
30.87
28.44
27.46
20.16
O
O
O
N
Br
4z
250 240 230 220 210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10 -20 -30 -40 -50 -60
f1 (ppm)

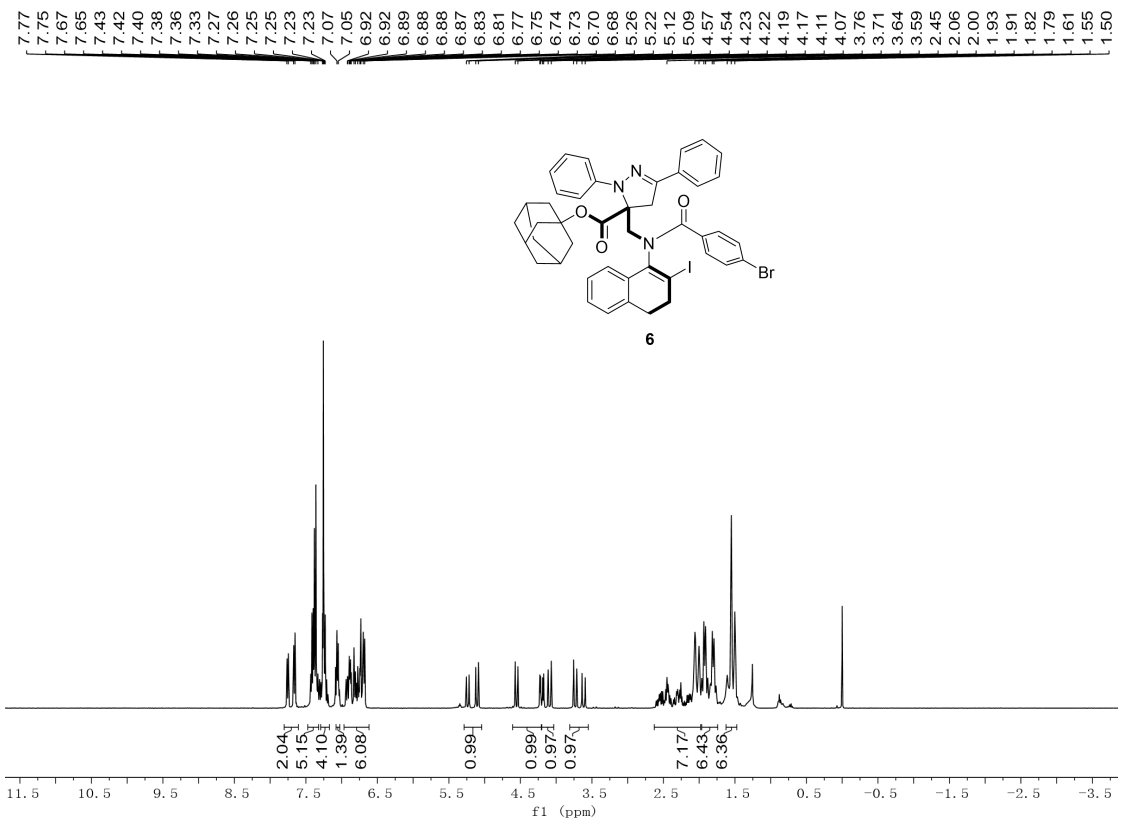

7.56
7.55
7.54
7.23
7.23
7.21
7.21
7.19
7.19
7.16
7.16
7.15
7.15
7.14
7.13
7.12
7.11
7.07
6.40
6.39
5.97
5.96
4.69
4.65
4.41
4.37
4.00
3.94
3.83
3.77
2.16
2.13
2.13
1.66
1.66
1.39
1.06
0.00
5.97
5.96
0.20
1.00
6.06
6.02
5.98
5.94
5.90
f1 (ppm)
O
O
O
N
Br
4za
2.01
6.08
0.97
1.00
1.00
1.05
1.02
1.11
1.05
3.09
6.04
6.03
3.03
3.06
0.5 10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5 -1.0 -1.5 -2.
f1 (ppm)


170.76
165.25
145.60
144.11
136.54
136.15
132.40
130.15
128.28
128.07
127.55
127.27
127.06
126.13
124.59
123.88
81.05
51.01
43.79
41.27
41.09
36.20
30.85
29.71
26.14
O
O
O
N
Br
4za
230 220 210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10 -20 -30 -40
f1 (ppm)

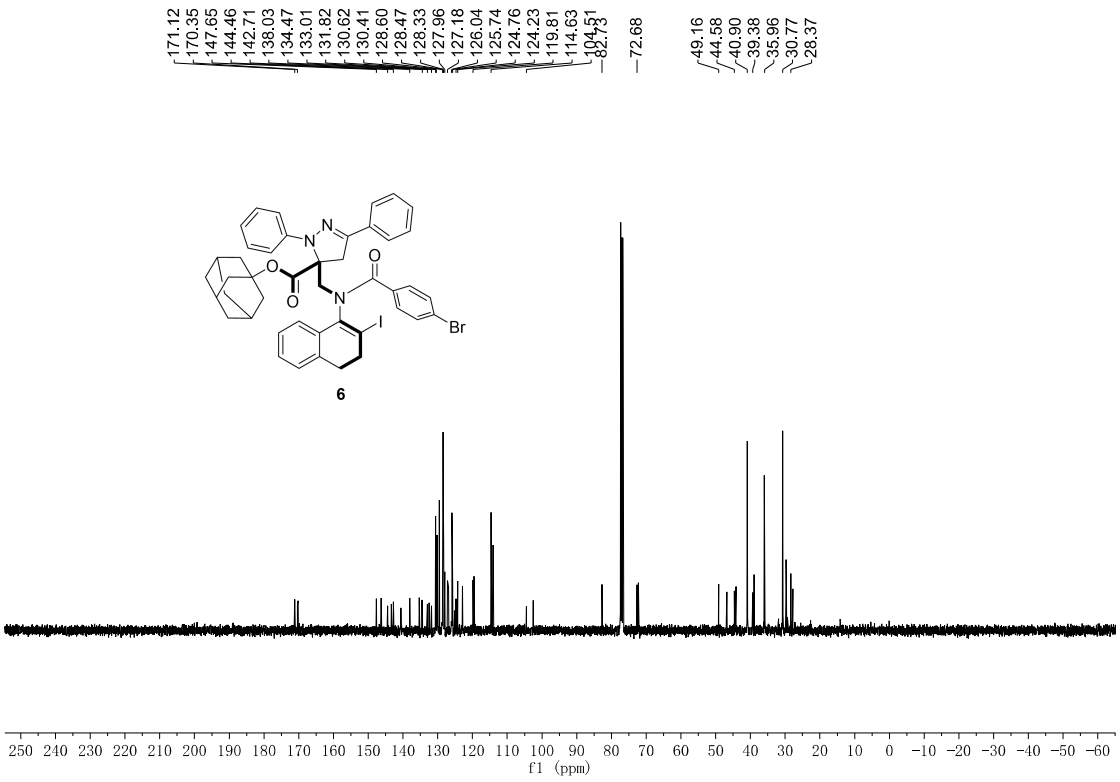

7.40
7.39
7.38
7.36
7.35
7.32
7.30
7.29
7.22
7.21
7.20
7.19
7.18
5.05
5.01
4.89
4.89
4.68
4.65
4.60
4.56
4.56
4.52
4.37
4.35
4.33
4.25
4.21
3.14
3.13
3.09
3.07
3.05
3.02
2.87
2.86
2.83
2.82
2.79
2.74
2.73
2.72
2.64
2.62
2.59
2.56
2.53
2.31
2.28
2.26
2.23
2.17
2.11
2.00
1.96
1.66
1.63
1.60
O
N=N
O
O
N
I
Br
5
7.04
1.02
2.02
2.03
2.97
7.02
4.79
5.96
11.0 10.0 9.0 8.0 7.0 6.0 5.0 4.0 3.0 2.0 1.0 0.0 -1.0 -2.0
f1 (ppm)

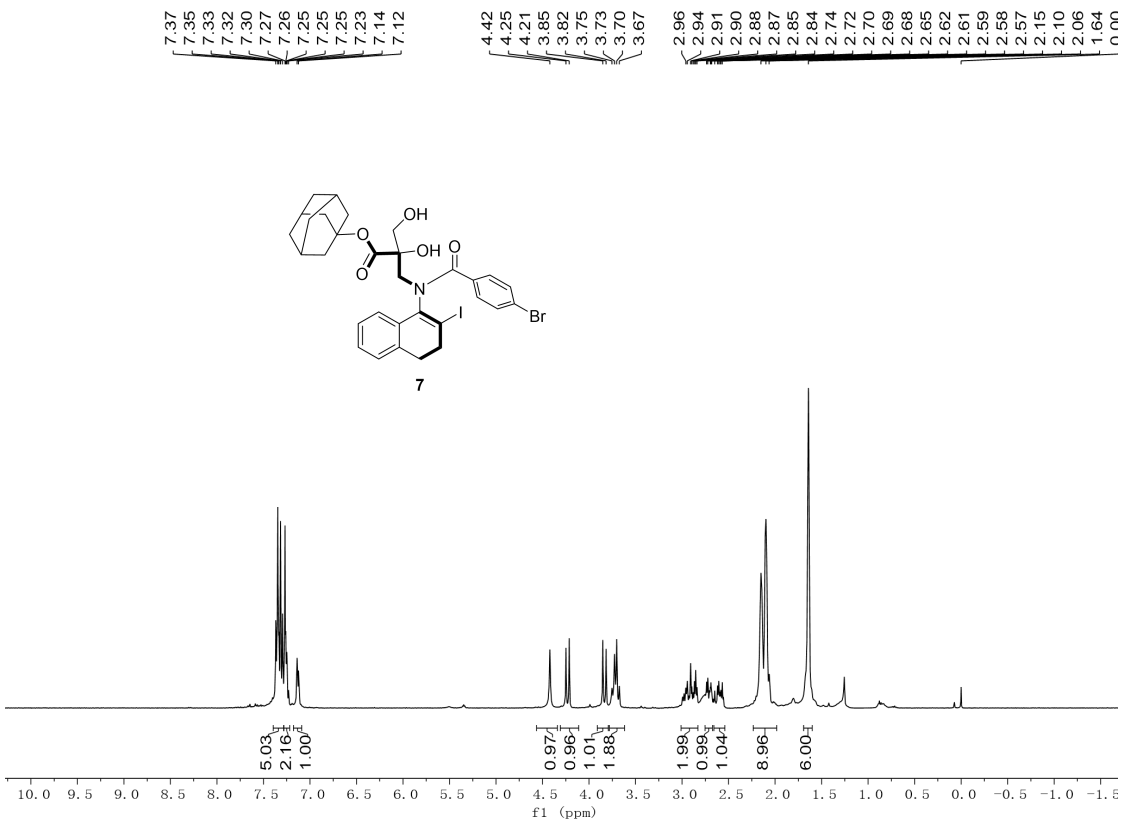

170.61
166.82
142.69
137.30
134.55
131.56
130.54
129.57
128.76
127.20
125.27
123.75
104.73
100.47
82.98
79.55
50.19
40.87
39.52
35.95
30.79
28.88
26.01
25.35
O
O
N
N
O
N
I
Br
240 230 220 210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 −10 −20 −30 −40
f1 (ppm)

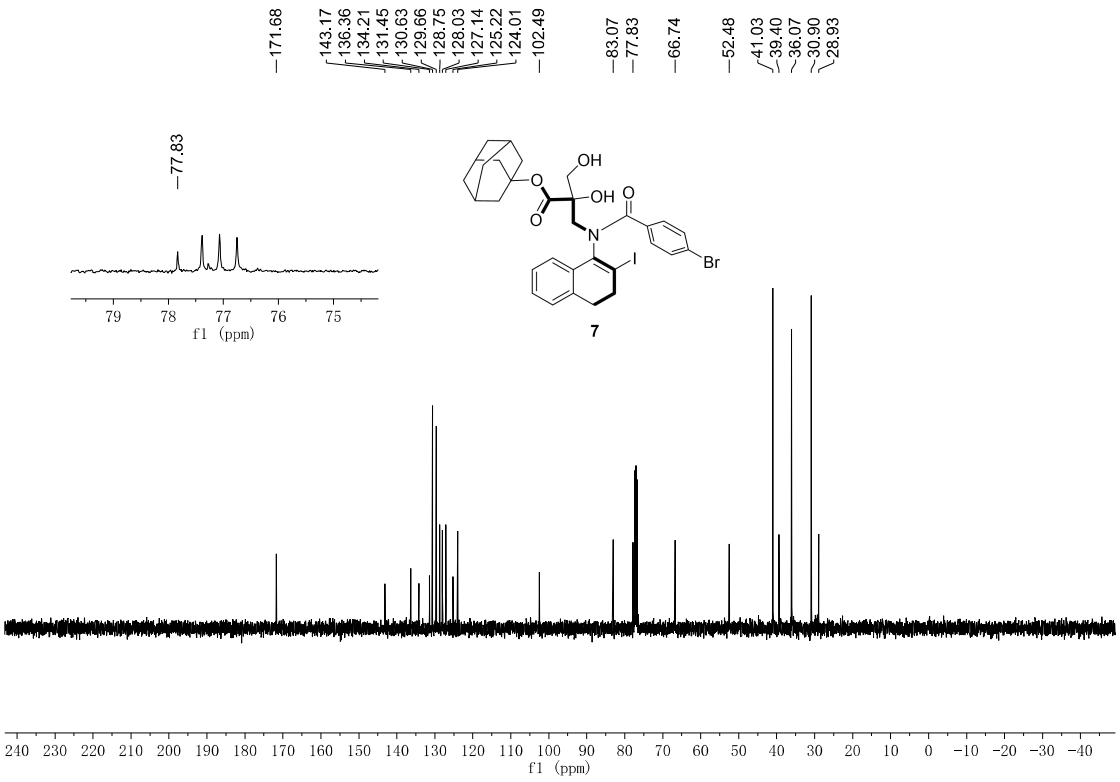
5

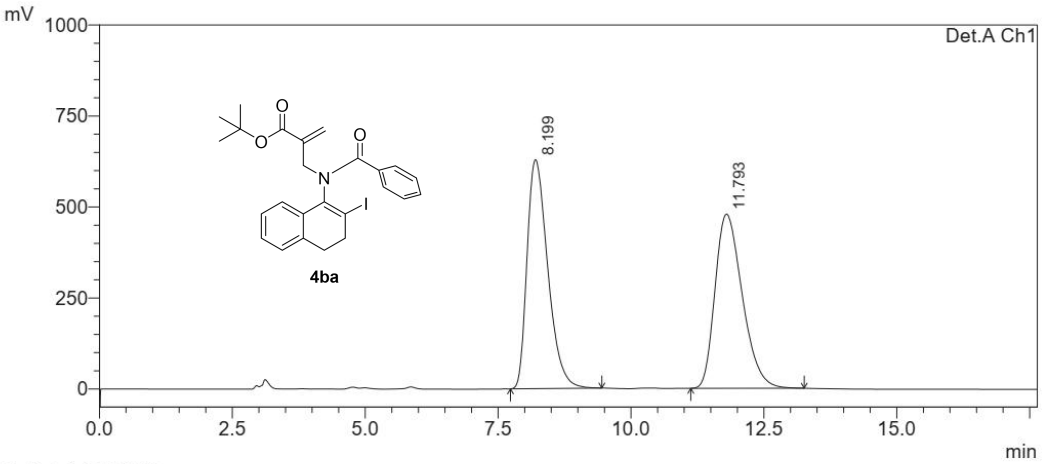

7.77
7.75
7.67
7.65
7.43
7.42
7.40
7.38
7.36
7.33
7.27
7.26
7.25
7.25
7.23
7.23
7.07
7.05
6.92
6.92
6.89
6.88
6.88
6.87
6.83
6.81
6.77
6.75
6.74
6.73
6.70
6.68
5.26
5.22
5.12
5.09
4.57
4.54
4.23
4.22
4.19
4.17
4.11
4.07
3.76
3.71
3.64
3.59
2.45
2.06
2.00
1.93
1.91
1.82
1.79
1.61
1.55
1.50
O
O
N
N
O
N
I
Br
2.04
5.15
4.10
1.39
6.08
0.99
0.99
0.97
0.97
7.17
6.43
6.36
11.5 10.5 9.5 8.5 7.5 6.5 5.5 4.5 3.5 2.5 1.5 0.5 −0.5 −1.5 −2.5 −3.5
f1 (ppm)

6


171.12
170.35
147.65
144.46
142.71
138.03
134.47
133.01
131.82
130.62
130.41
128.60
128.47
128.33
127.96
127.18
126.04
125.74
124.76
124.23
119.81
114.63
104.51
82.73
72.68
49.16
44.58
40.90
39.38
35.96
30.77
28.37
O
N
N
O
O
N
I
Br
6
250 240 230 220 210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10 -20 -30 -40 -50 -60
f1 (ppm)


7.37
7.35
7.33
7.32
7.30
7.27
7.26
7.25
7.25
7.25
7.23
7.14
7.12
4.42
4.25
4.21
3.85
3.82
3.75
3.73
3.70
3.67
2.96
2.94
2.91
2.90
2.88
2.87
2.85
2.84
2.74
2.72
2.70
2.69
2.68
2.65
2.62
2.61
2.59
2.58
2.57
2.15
2.10
2.06
1.64
OH
OH
O
O
O
N
I
Br
7
5.03
2.16
1.00
0.97
0.96
1.01
1.88
1.99
0.99
1.04
8.96
6.00
10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5 -1.0
f1 (ppm)


171.68
143.17
136.36
134.21
131.45
130.63
129.66
128.75
128.03
127.14
125.22
124.01
102.49
83.07
77.83
66.74
52.48
41.03
39.40
36.07
30.90
28.93
77.83
79 78 77 76 75
f1 (ppm)
OH
OH
O
O
O
N
I
Br
7
240 230 220 210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10 -20 -30 -40
f1 (ppm)

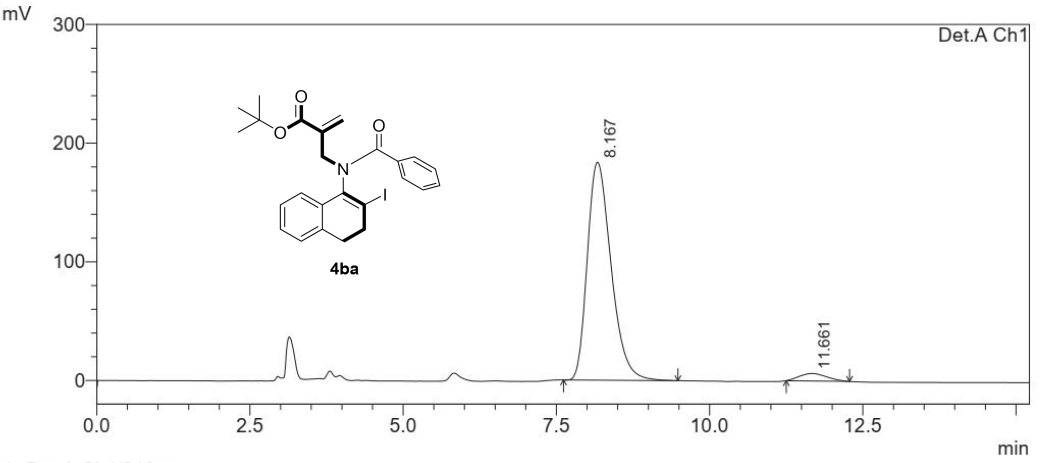


1 Det.A Ch1/210nm

PeakTable

Detector A Ch1 210nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	8.199	17056092	629272	49.959	56.805
2	11.793	17084397	478501	50.041	43.195
Total		34140488	1107773	100.000	100.000

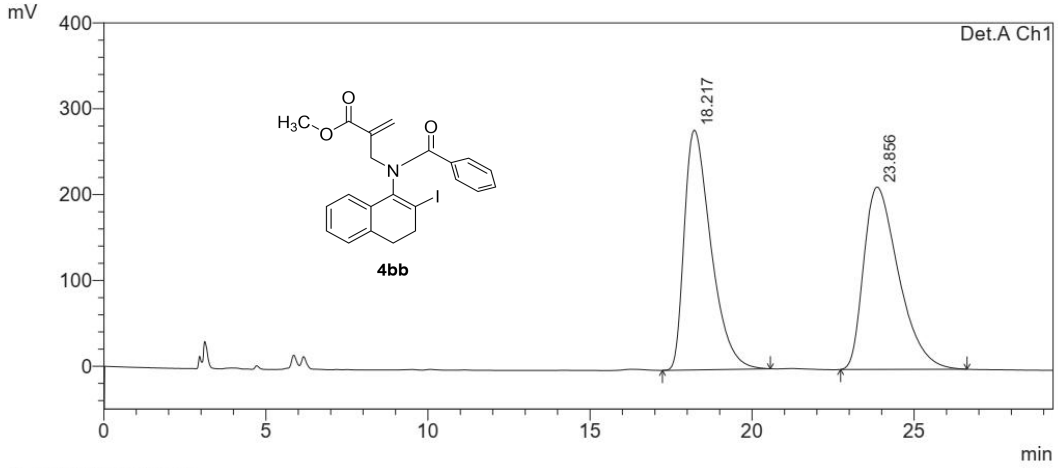


1 Det.A Ch1/210nm

PeakTable

Detector A Ch1 210nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	8.167	4956443	183443	96.142	96.642
2	11.661	198918	6374	3.858	3.358
Total		5155361	189817	100.000	100.000

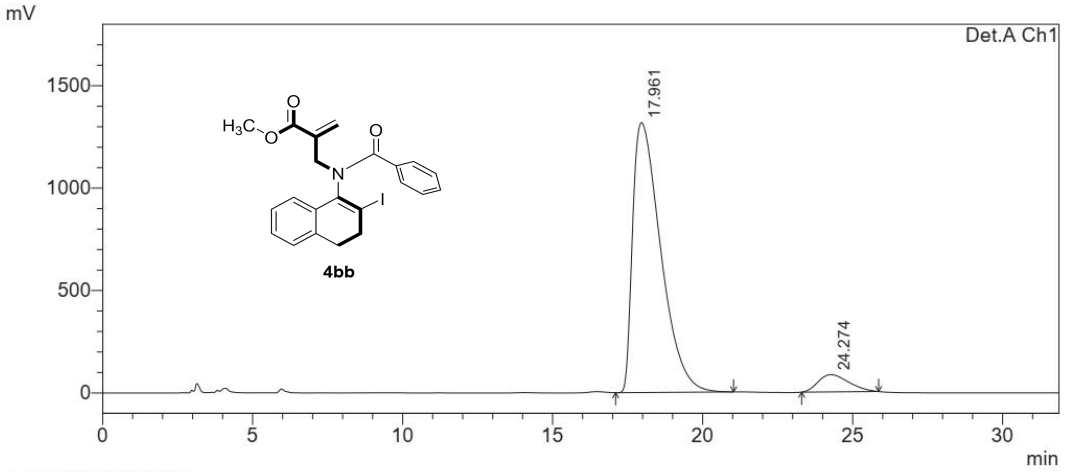


1 Det.A Ch1/210nm

PeakTable

Detector A Ch1 210nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	18.217	15986895	279294	50.032	56.829
2	23.856	15966574	212169	49.968	43.171
Total		31953469	491463	100.000	100.000

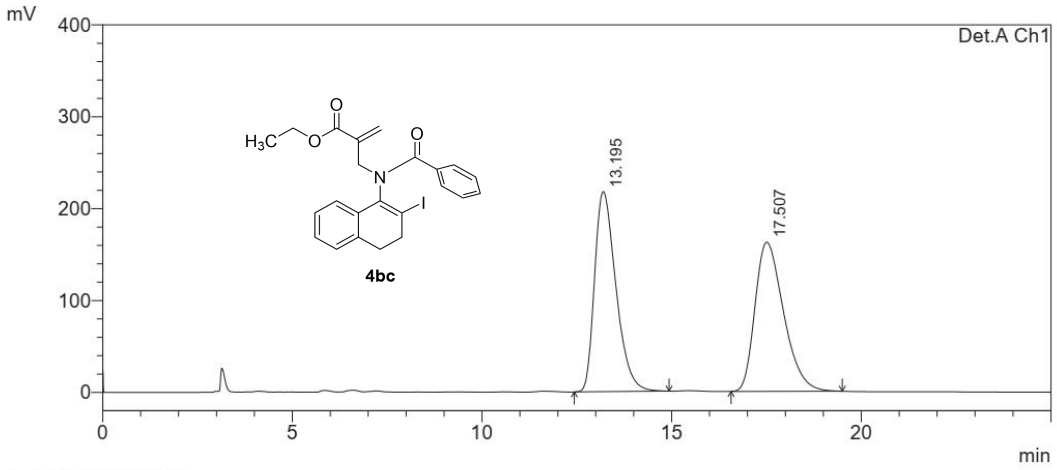


1 Det.A Ch1/210nm

PeakTable

Detector A Ch1 210nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	17.961	85801074	1317153	93.500	93.997
2	24.274	5965152	84116	6.500	6.003
Total		91766226	1401269	100.000	100.000

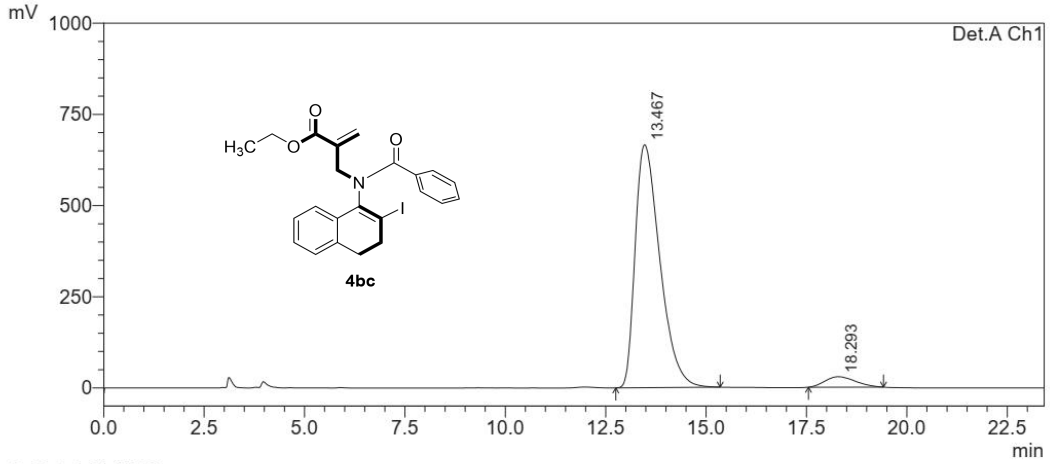


1 Det.A Ch1/210nm

PeakTable

Detector A Ch1 210nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	13.195	8511395	217435	49.995	57.267
2	17.507	8513038	162250	50.005	42.733
Total		17024433	379685	100.000	100.000

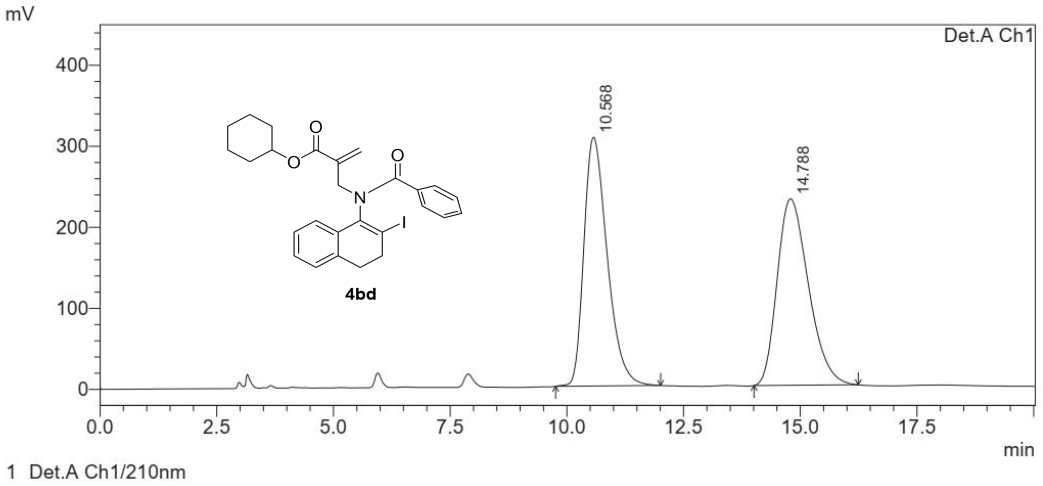


1 Det.A Ch1/210nm

PeakTable

Detector A Ch1 210nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	13.467	28535079	665701	94.983	95.875
2	18.293	1507106	28639	5.017	4.125
Total		30042185	694340	100.000	100.000

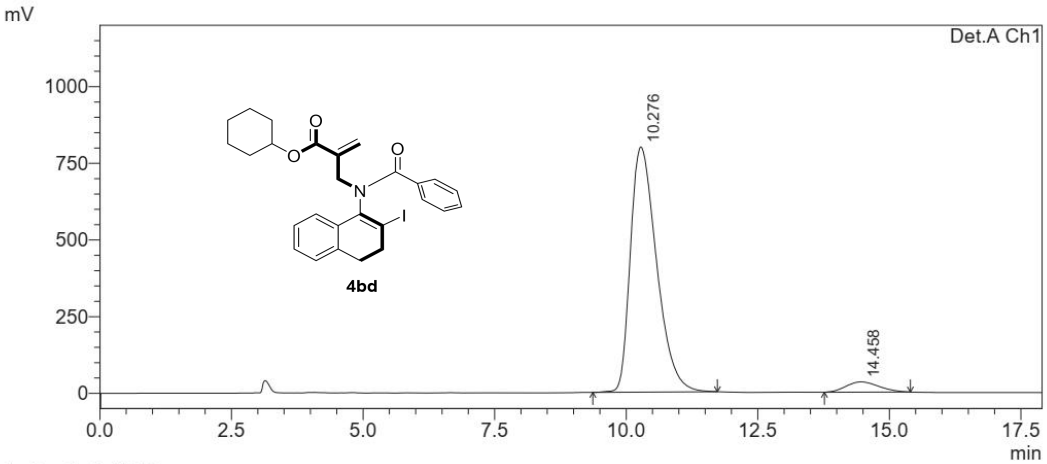


1 Det.A Ch1/210nm

PeakTable

Detector A Ch1 210nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	10.568	10672618	306536	49.857	57.111
2	14.788	10733885	230205	50.143	42.889
Total		21406503	536741	100.000	100.000

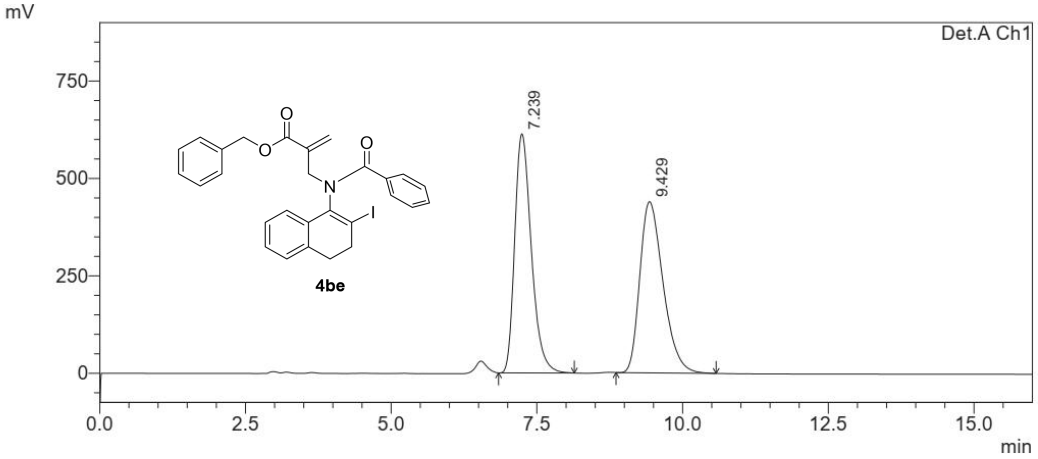


1 Det.A Ch1/210nm

PeakTable

Detector A Ch1 210nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	10.276	27735761	798295	95.017	95.972
2	14.458	1454663	33505	4.983	4.028
Total		29190424	831800	100.000	100.000

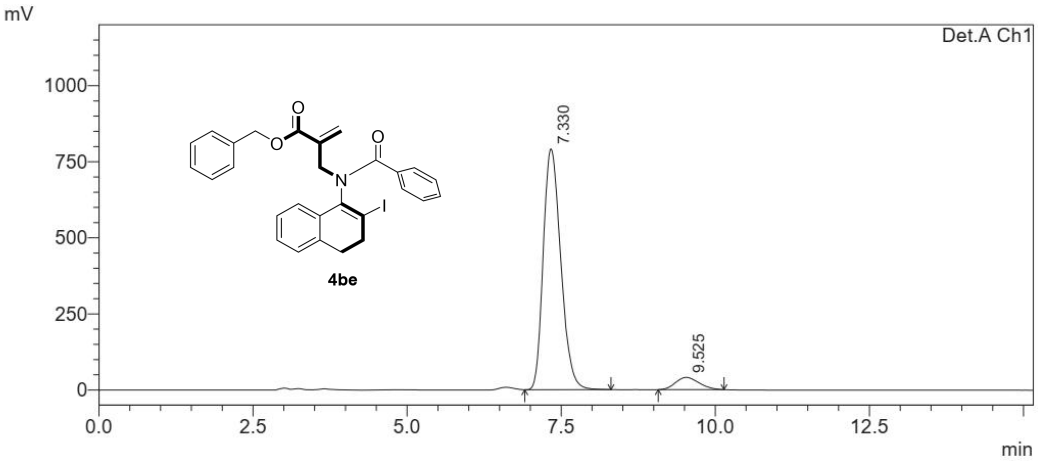


1 Det.A Ch1/210nm

PeakTable

Detector A Ch1 210nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	7.239	12157855	612969	49.961	58.262
2	9.429	12176814	439117	50.039	41.738
Total		24334668	1052086	100.000	100.000

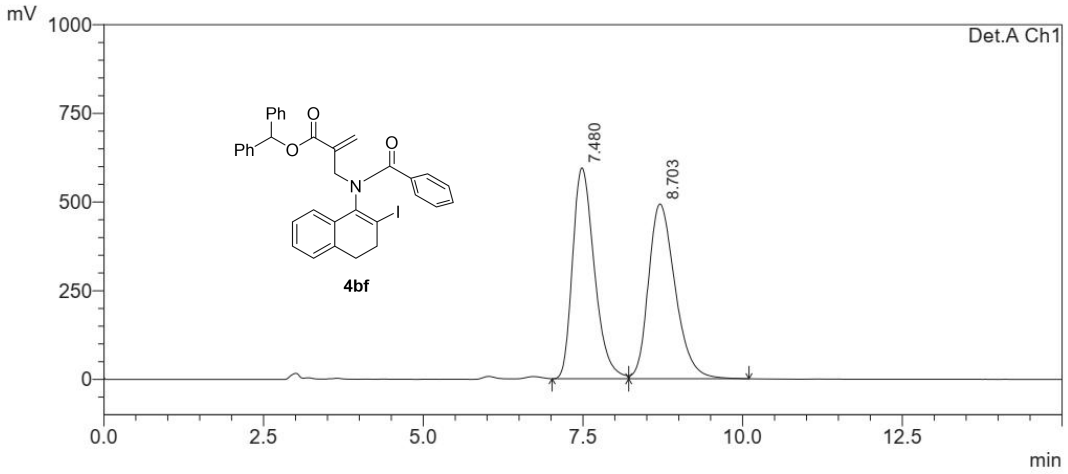


1 Det.A Ch1/210nm

PeakTable

Detector A Ch1 210nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	7.330	15659589	790757	93.630	95.157
2	9.525	1065320	40244	6.370	4.843
Total		16724909	831000	100.000	100.000

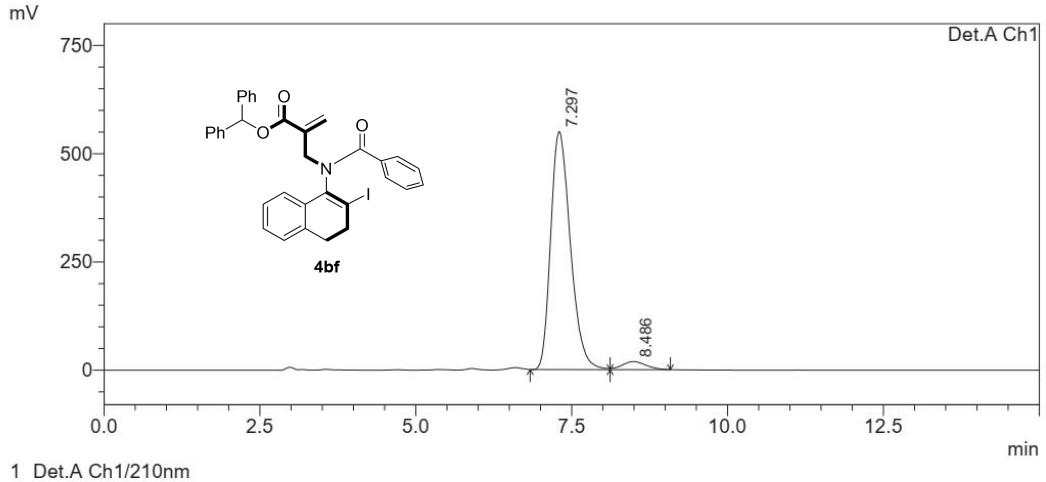


1 Det.A Ch1/210nm

PeakTable

Detector A Ch1 210nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	7.480	14115664	594168	49.652	54.687
2	8.703	14313406	492330	50.348	45.313
Total		28429070	1086498	100.000	100.000

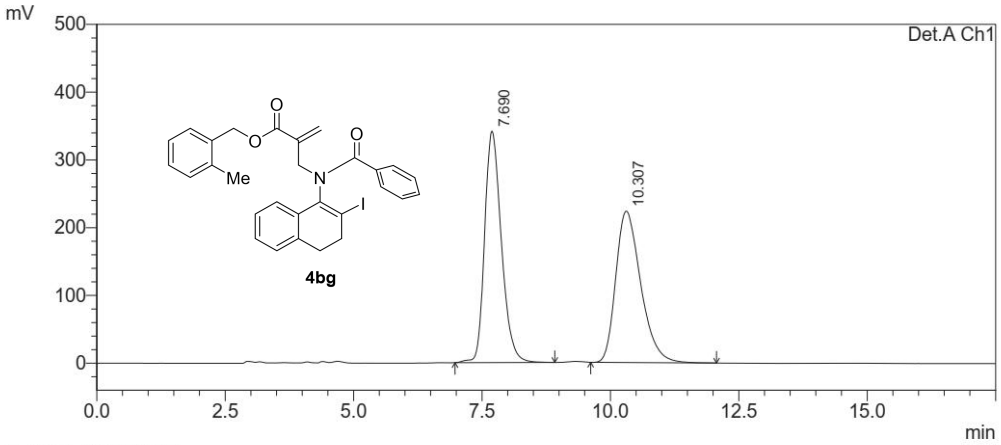


1 Det.A Ch1/210nm

PeakTable

Detector A Ch1 210nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	7.297	12108129	549116	96.084	96.734
2	8.486	493522	18542	3.916	3.266
Total		12601651	567659	100.000	100.000

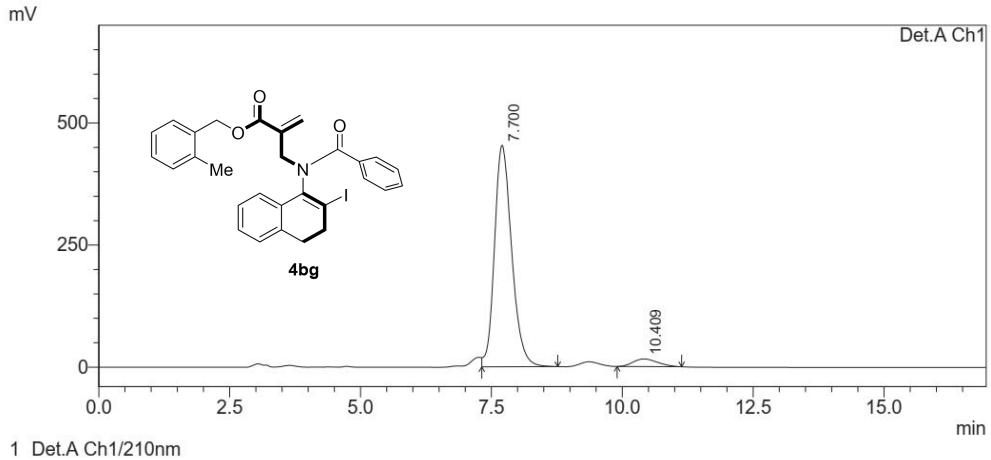


1 Det.A Ch1/210nm

PeakTable

Detector A Ch1 210nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	7.690	7767541	341350	50.686	60.491
2	10.307	7557418	222950	49.314	39.509
Total		15324960	564300	100.000	100.000

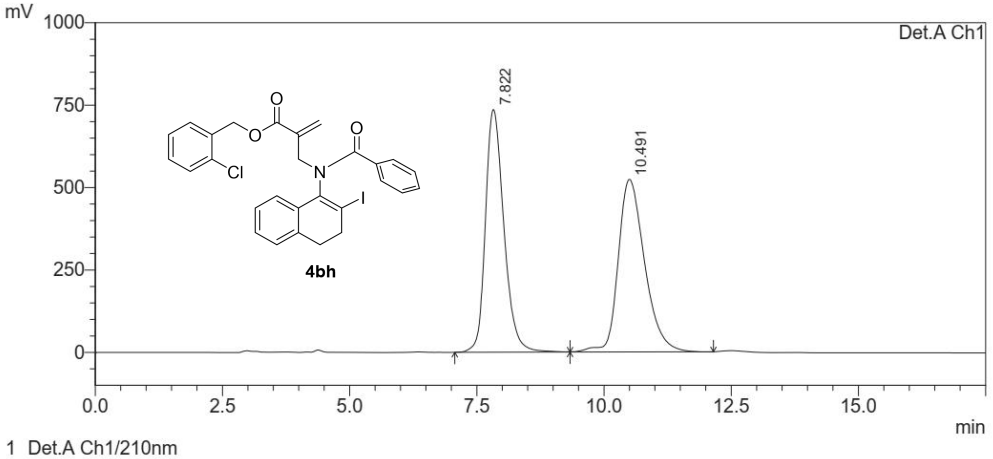


1 Det.A Ch1/210nm

PeakTable

Detector A Ch1 210nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	7.700	10382441	449816	95.289	96.629
2	10.409	513291	15694	4.711	3.371
Total		10895731	465510	100.000	100.000

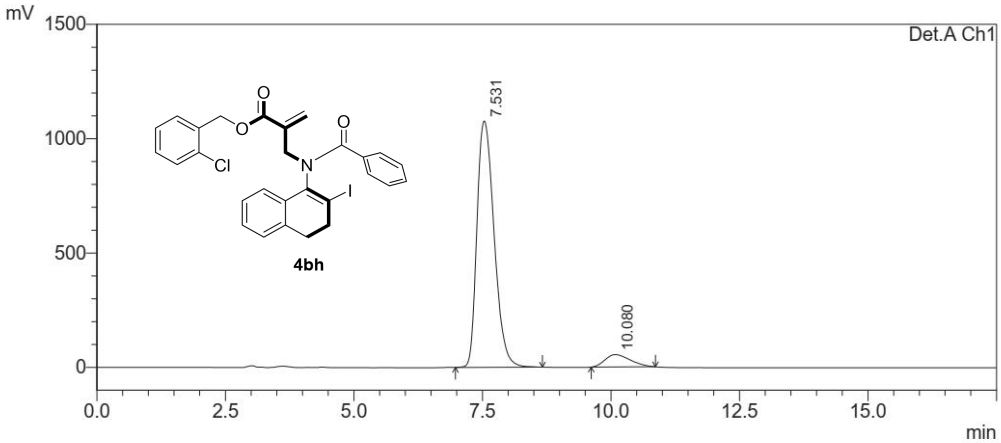


1 Det.A Ch1/210nm

PeakTable

Detector A Ch1 210nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	7.822	18607251	736096	49.593	58.452
2	10.491	18912343	523230	50.407	41.548
Total		37519594	1259326	100.000	100.000

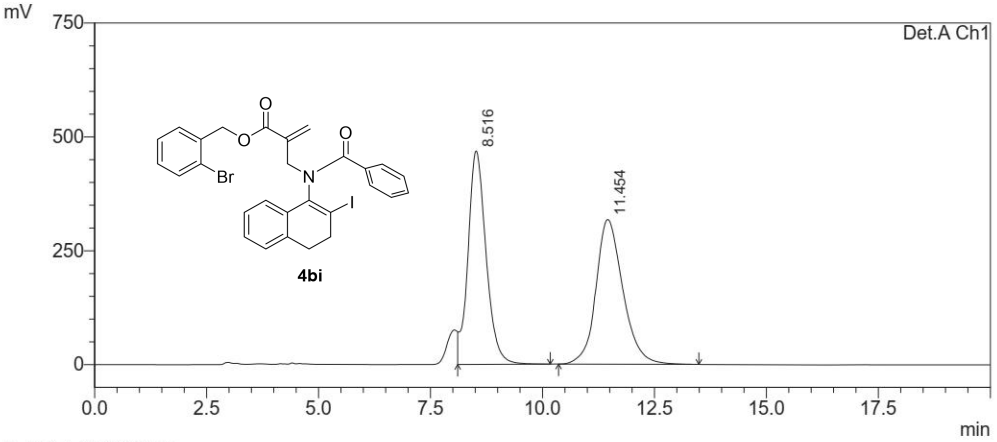


1 Det.A Ch1/210nm

PeakTable

Detector A Ch1 210nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	7.531	25022812	1076487	93.124	95.216
2	10.080	1847593	54087	6.876	4.784
Total		26870404	1130574	100.000	100.000

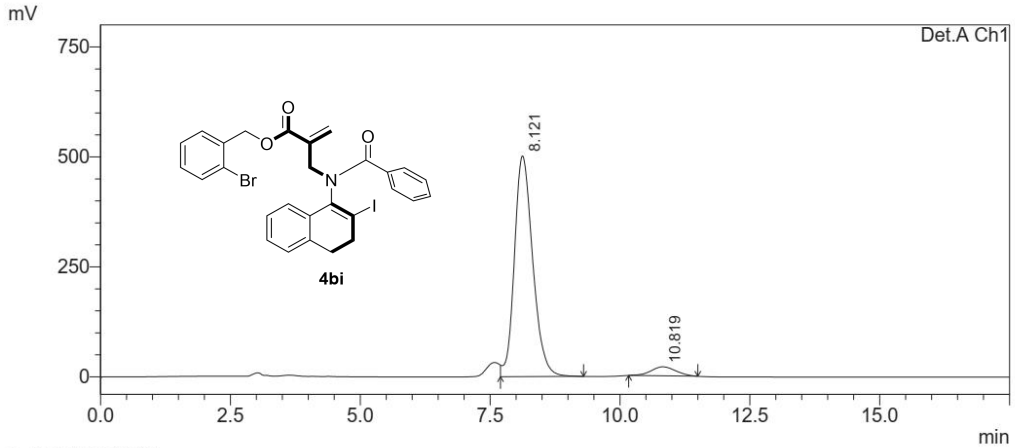


1 Det.A Ch1/210nm

PeakTable

Detector A Ch1 210nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	8.516	13128361	468635	49.672	59.648
2	11.454	13301899	317028	50.328	40.352
Total		26430261	785663	100.000	100.000

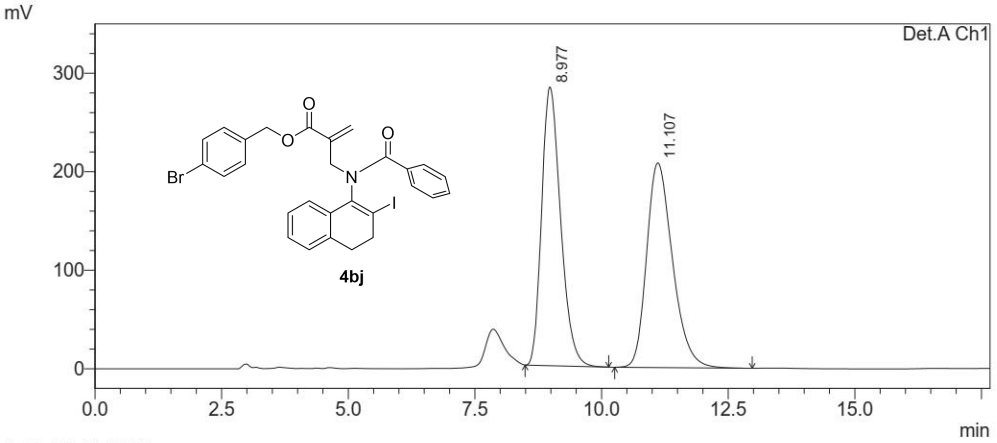


1 Det.A Ch1/210nm

PeakTable

Detector A Ch1 210nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	8.121	12325105	500871	94.790	96.082
2	10.819	677443	20426	5.210	3.918
Total		13002548	521296	100.000	100.000

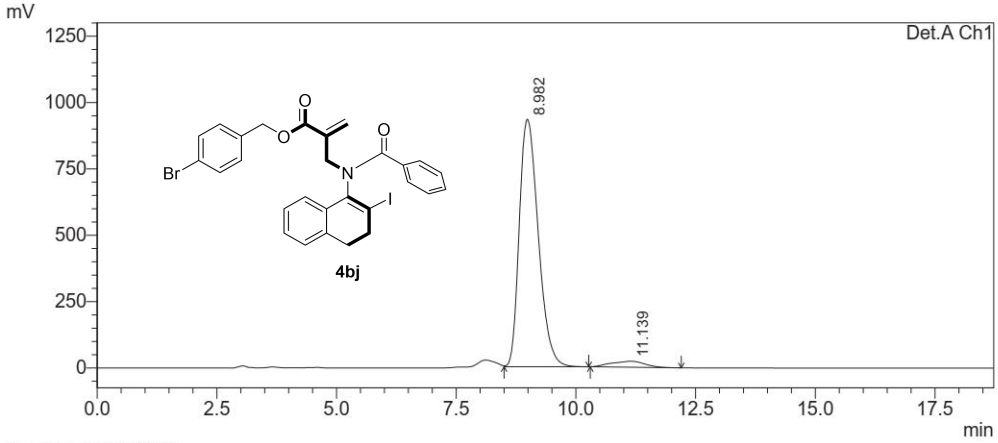


1 Det.A Ch1/210nm

PeakTable

Detector A Ch1 210nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	8.977	7371013	282711	49.938	57.715
2	11.107	7389306	207127	50.062	42.285
Total		14760320	489838	100.000	100.000

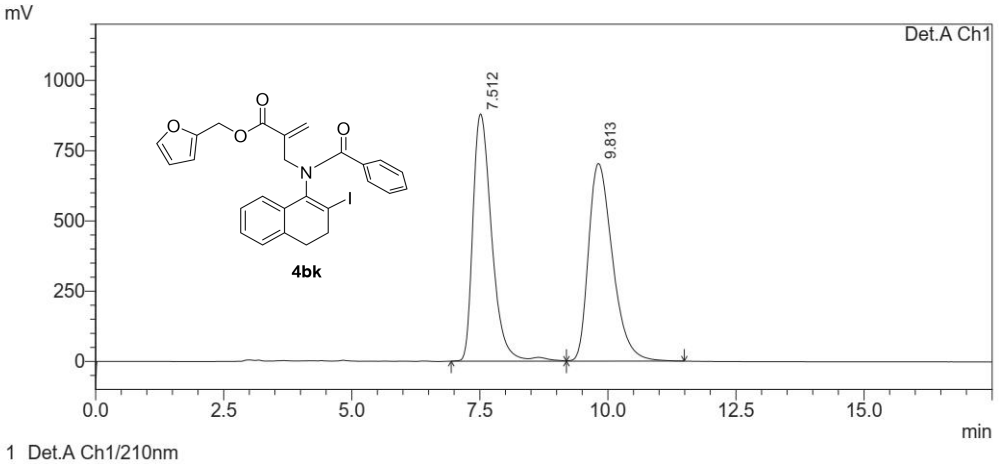


1 Det.A Ch1/210nm

PeakTable

Detector A Ch1 210nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	8.982	25699644	931808	95.947	97.636
2	11.139	1085674	22558	4.053	2.364
Total		26785318	954366	100.000	100.000

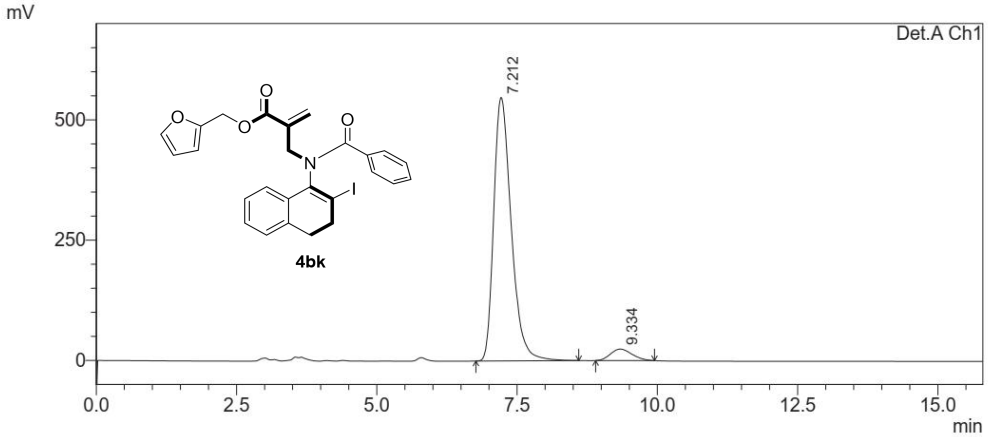


1 Det.A Ch1/210nm

PeakTable

Detector A Ch1 210nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	7.512	22480977	878244	49.483	55.552
2	9.813	22951087	702689	50.517	44.448
Total		45432064	1580933	100.000	100.000

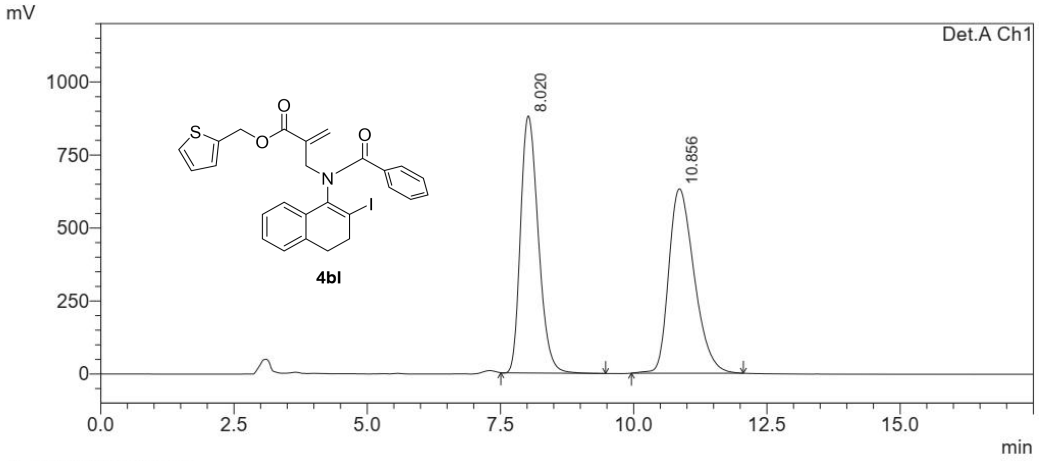


1 Det.A Ch1/210nm

PeakTable

Detector A Ch1 210nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	7.212	11851807	547024	94.919	95.829
2	9.334	634369	23808	5.081	4.171
Total		12486176	570832	100.000	100.000

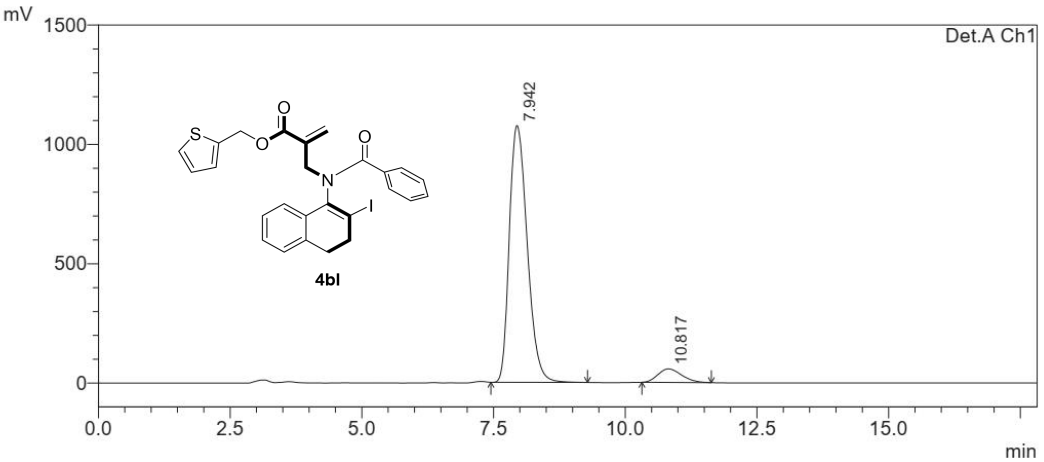


1 Det.A Ch1/210nm

PeakTable

Detector A Ch1 210nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	8.020	20442078	879980	49.316	58.292
2	10.856	21008827	629623	50.684	41.708
Total		41450905	1509602	100.000	100.000

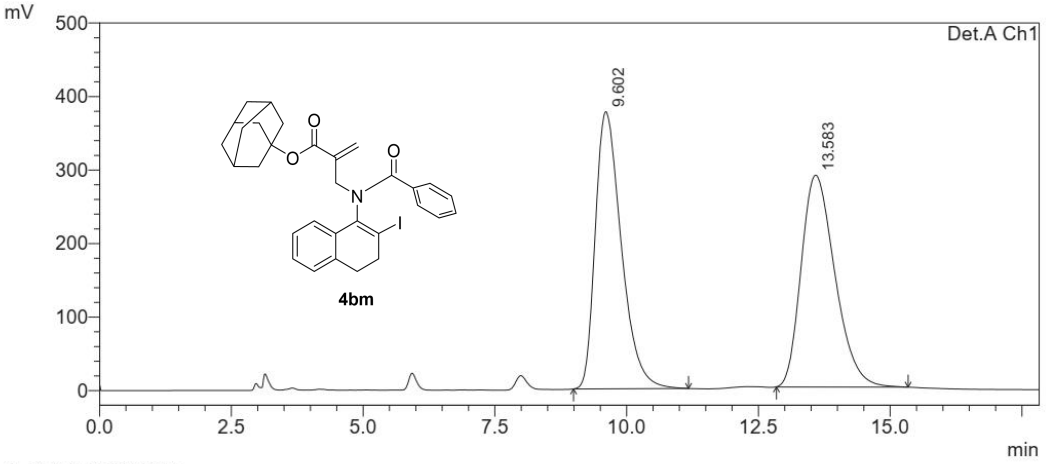


1 Det.A Ch1/210nm

PeakTable

Detector A Ch1 210nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	7.942	25450563	1075426	93.440	94.968
2	10.817	1786810	56979	6.560	5.032
Total		27237372	1132405	100.000	100.000

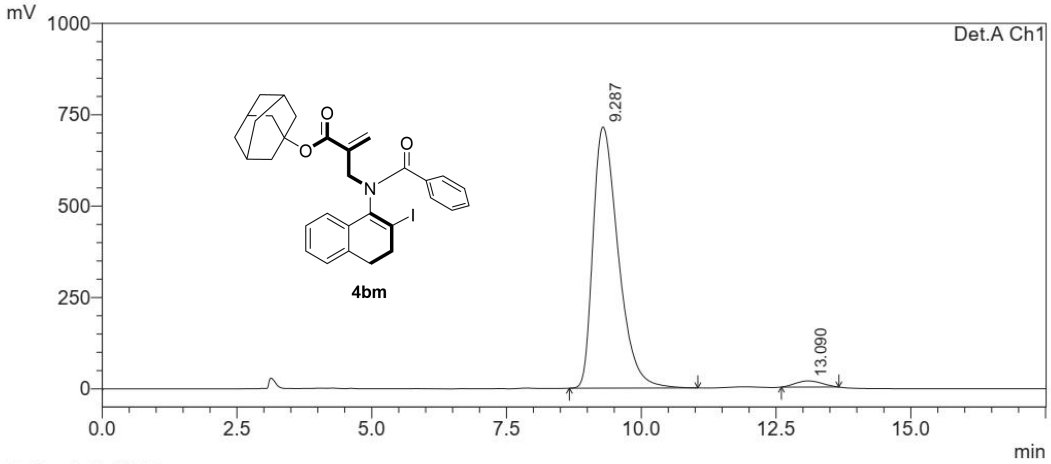


1 Det.A Ch1/210nm

PeakTable

Detector A Ch1 210nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	9.602	12960426	376236	50.199	56.660
2	13.583	12857760	287786	49.801	43.340
Total		25818186	664022	100.000	100.000

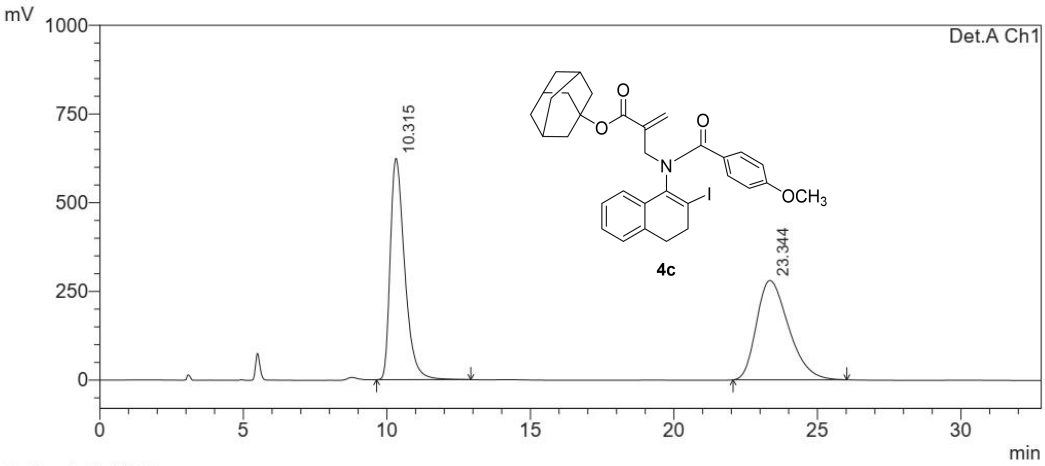


1 Det.A Ch1/210nm

PeakTable

Detector A Ch1 210nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	9.287	23273920	714327	97.593	97.702
2	13.090	574075	16799	2.407	2.298
Total		23847995	731126	100.000	100.000

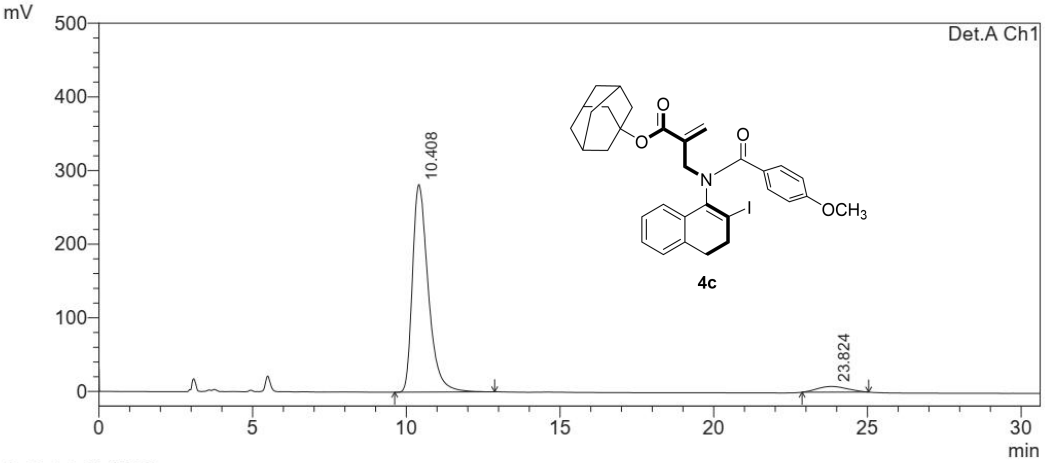


1 Det.A Ch1/210nm

PeakTable

Detector A Ch1 210nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	10.315	21765398	622969	49.960	69.019
2	23.344	21799909	279633	50.040	30.981
Total		43565308	902602	100.000	100.000

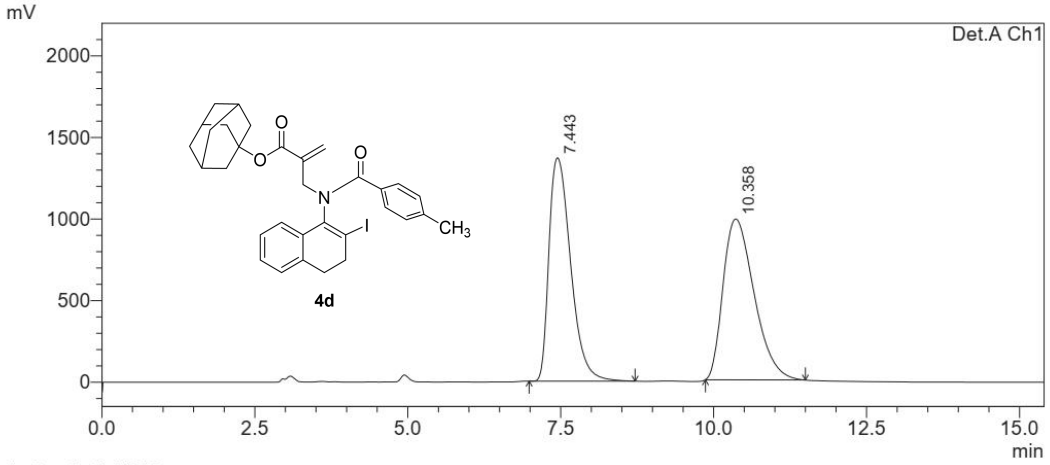


1 Det.A Ch1/210nm

PeakTable

Detector A Ch1 210nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	10.408	10044910	280944	95.039	97.329
2	23.824	524314	7710	4.961	2.671
Total		10569224	288654	100.000	100.000

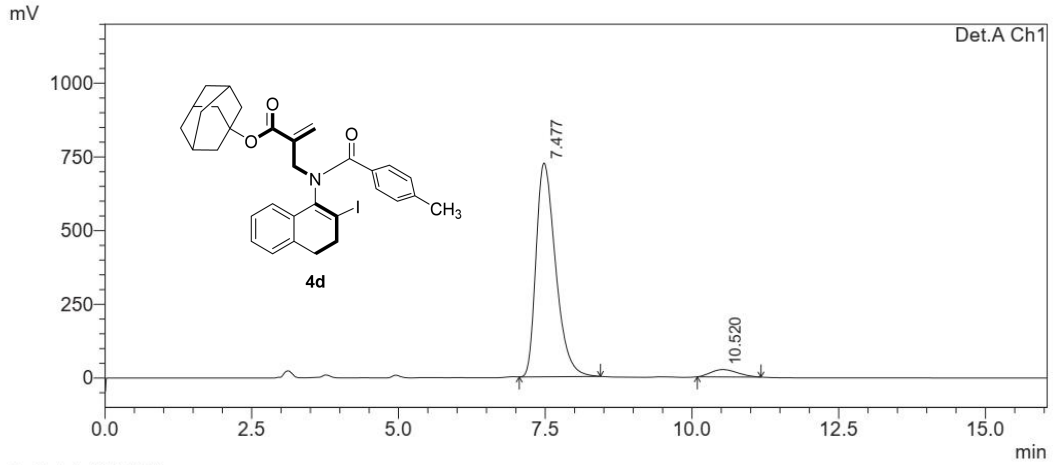


1 Det.A Ch1/210nm

PeakTable

Detector A Ch1 210nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	7.443	33731371	1368607	49.179	58.140
2	10.358	34858196	985397	50.821	41.860
Total		68589567	2354005	100.000	100.000

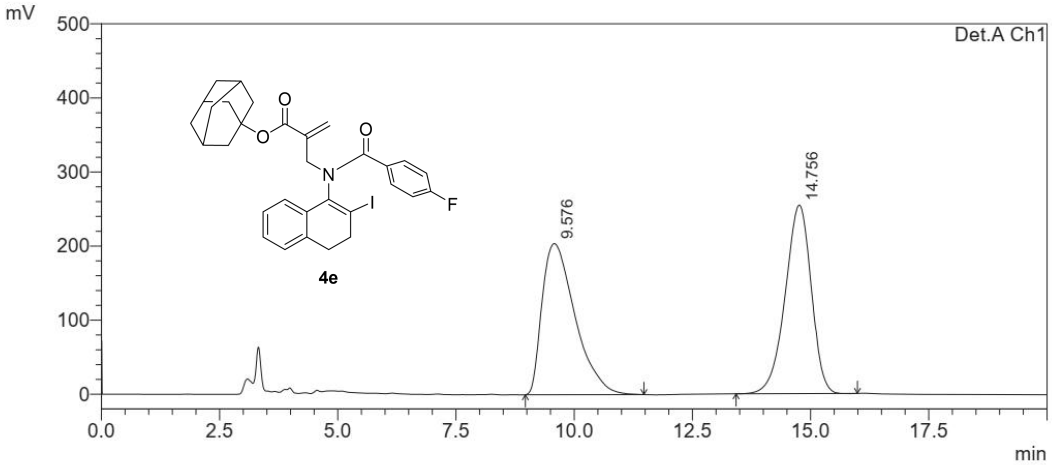


1 Det.A Ch1/210nm

PeakTable

Detector A Ch1 210nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	7.477	16769893	724370	95.511	96.676
2	10.520	788243	24909	4.489	3.324
Total		17558136	749279	100.000	100.000

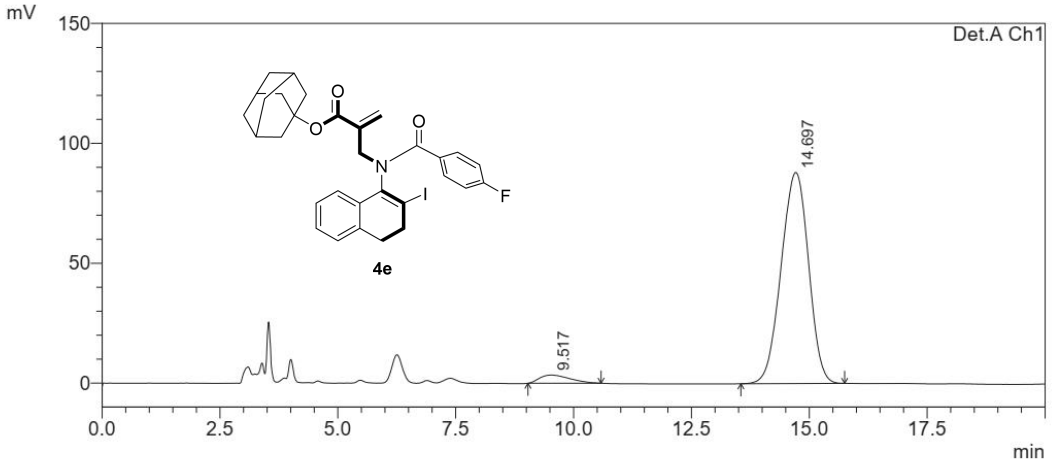


1 Det.A Ch1/210nm

PeakTable

Detector A Ch1 210nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	9.576	9900505	203907	50.367	44.558
2	14.756	9756068	253710	49.633	55.442
Total		19656573	457617	100.000	100.000

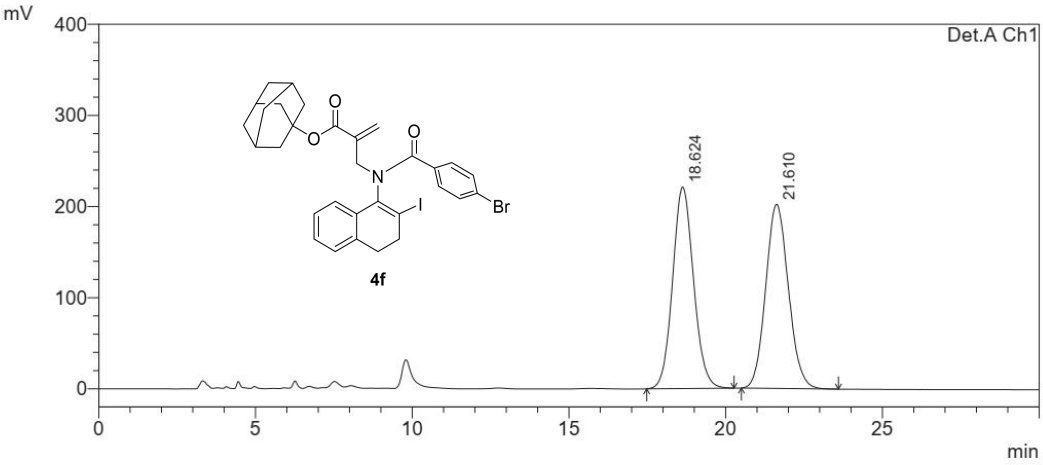


1 Det.A Ch1/210nm

PeakTable

Detector A Ch1 210nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	9.517	152454	3429	4.108	3.758
2	14.697	3558712	87800	95.892	96.242
Total		3711166	91229	100.000	100.000

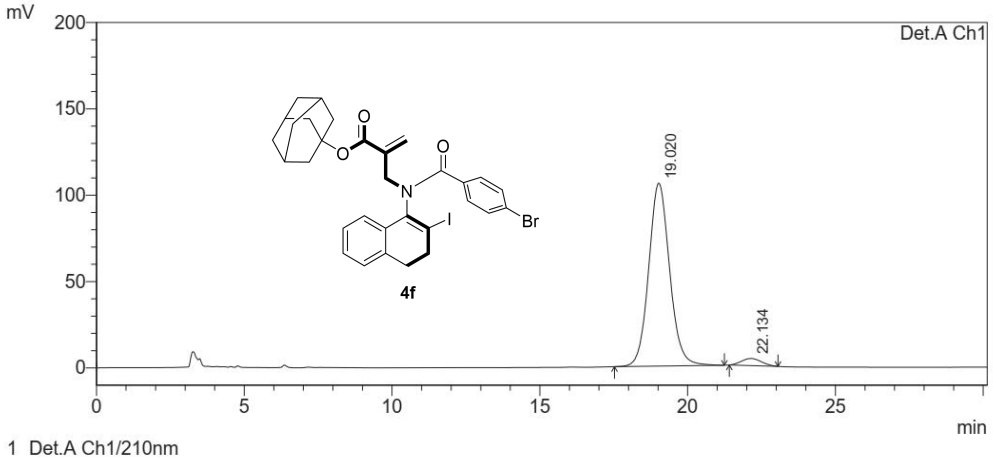


1 Det.A Ch1/210nm

PeakTable

Detector A Ch1 210nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	18.624	10247353	220912	50.158	52.280
2	21.610	10182682	201645	49.842	47.720
Total		20430035	422557	100.000	100.000

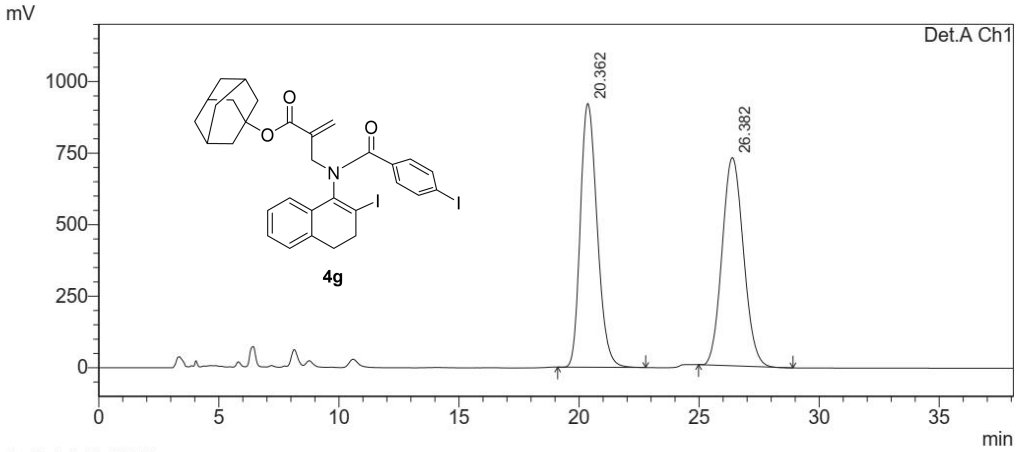


1 Det.A Ch1/210nm

PeakTable

Detector A Ch1 210nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	19.020	5207157	105919	96.423	96.249
2	22.134	193190	4127	3.577	3.751
Total		5400347	110046	100.000	100.000

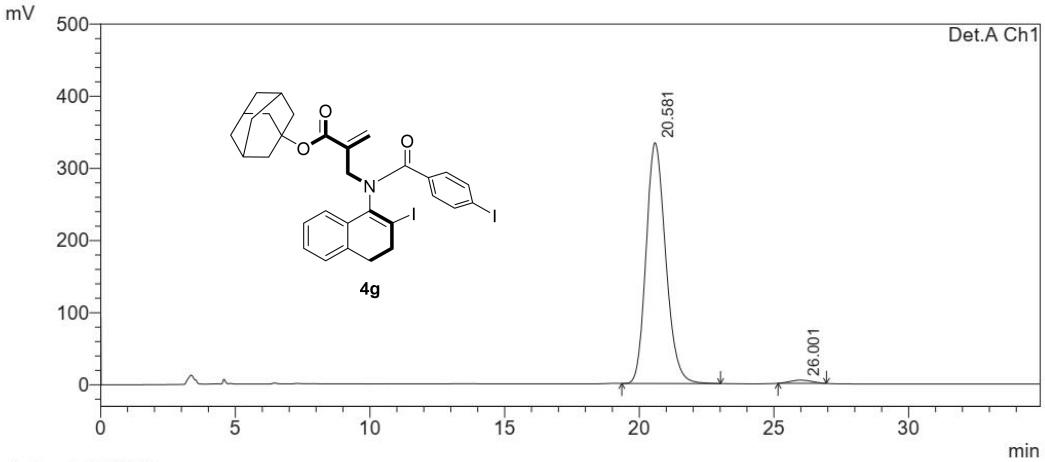


1 Det.A Ch1/210nm

PeakTable

Detector A Ch1 210nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	20.362	44892353	920995	49.972	56.229
2	26.382	44942128	716929	50.028	43.771
Total		89834481	1637923	100.000	100.000

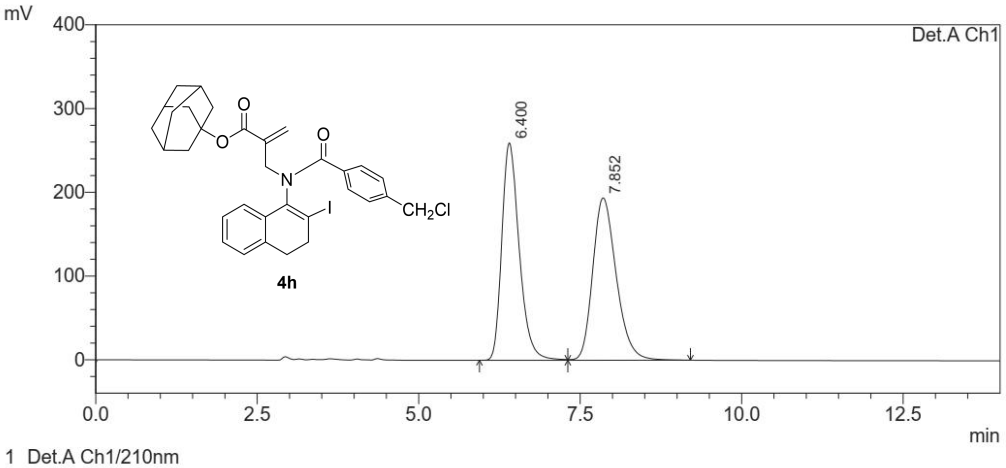


1 Det.A Ch1/210nm

PeakTable

Detector A Ch1 210nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	20.581	16863751	333273	98.540	98.679
2	26.001	249791	4461	1.460	1.321
Total		17113542	337734	100.000	100.000

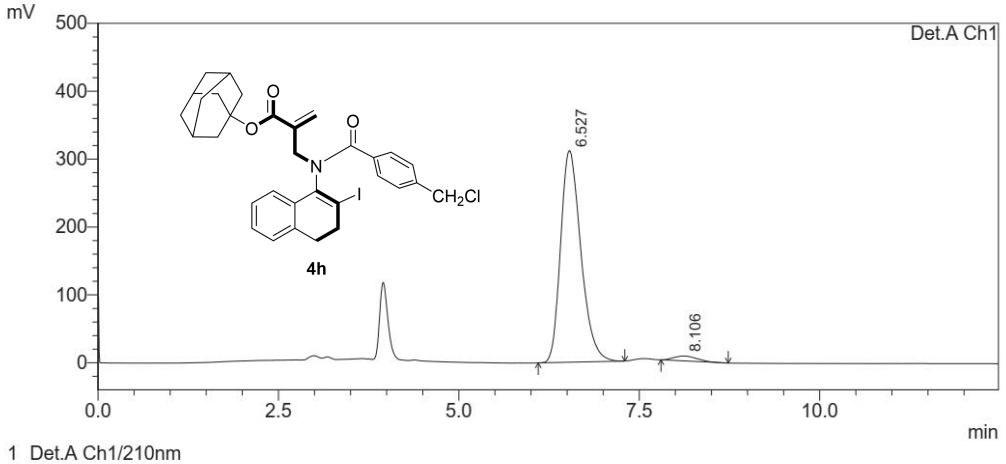


1 Det.A Ch1/210nm

PeakTable

Detector A Ch1 210nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	6.400	4870054	259453	49.839	57.243
2	7.852	4901457	193792	50.161	42.757
Total		9771511	453245	100.000	100.000

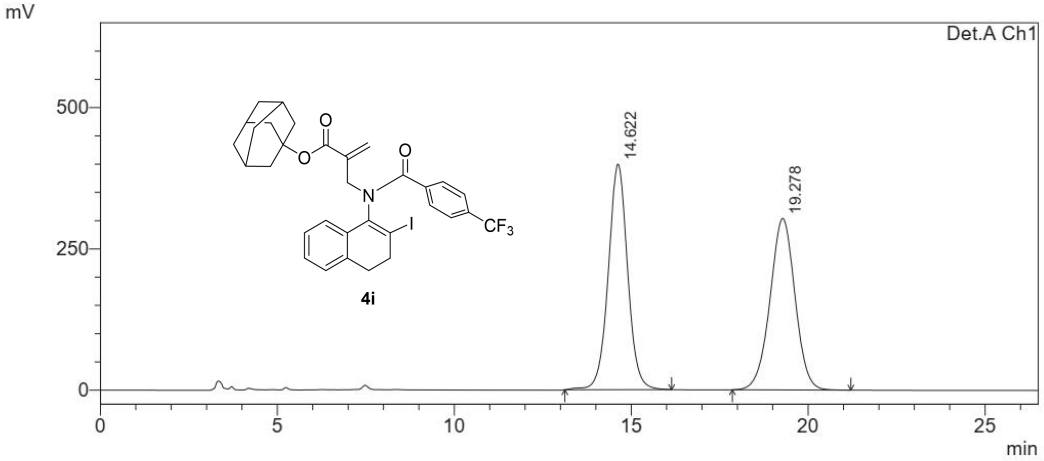


1 Det.A Ch1/210nm

PeakTable

Detector A Ch1 210nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	6.527	6092547	311610	97.410	97.743
2	8.106	162013	7195	2.590	2.257
Total		6254560	318805	100.000	100.000

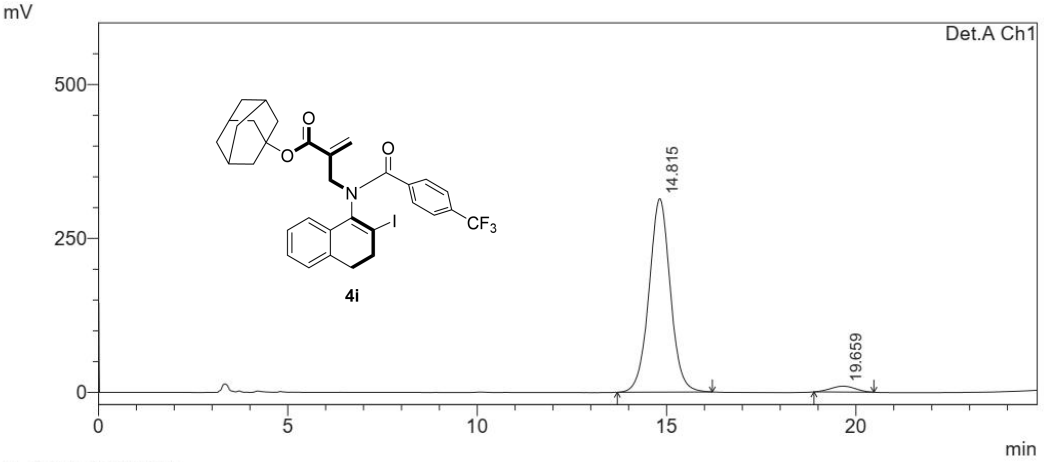


1 Det.A Ch1/210nm

PeakTable

Detector A Ch1 210nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	14.622	15193792	398997	50.487	56.829
2	19.278	14900928	303106	49.513	43.171
Total		30094720	702103	100.000	100.000

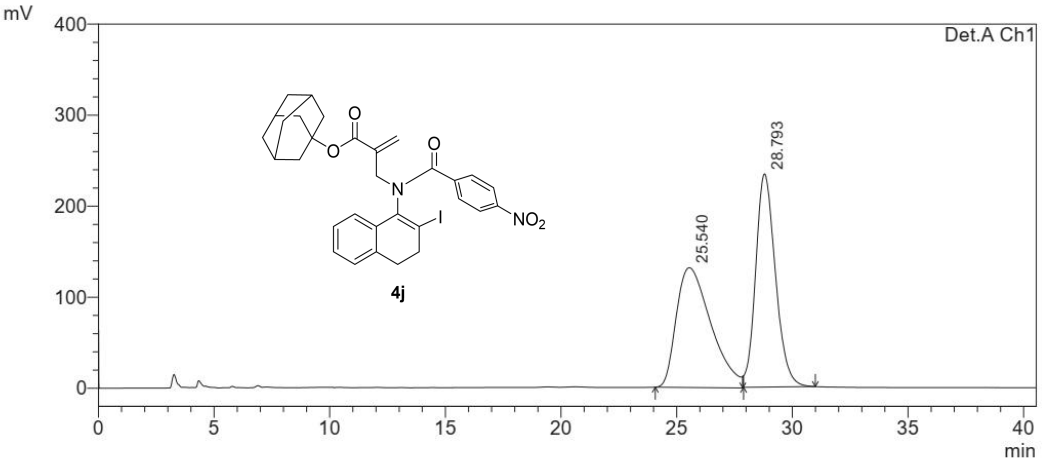


1 Det.A Ch1/210nm

PeakTable

Detector A Ch1 210nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	14.815	12256058	314193	96.565	97.040
2	19.659	435992	9583	3.435	2.960
Total		12692050	323775	100.000	100.000

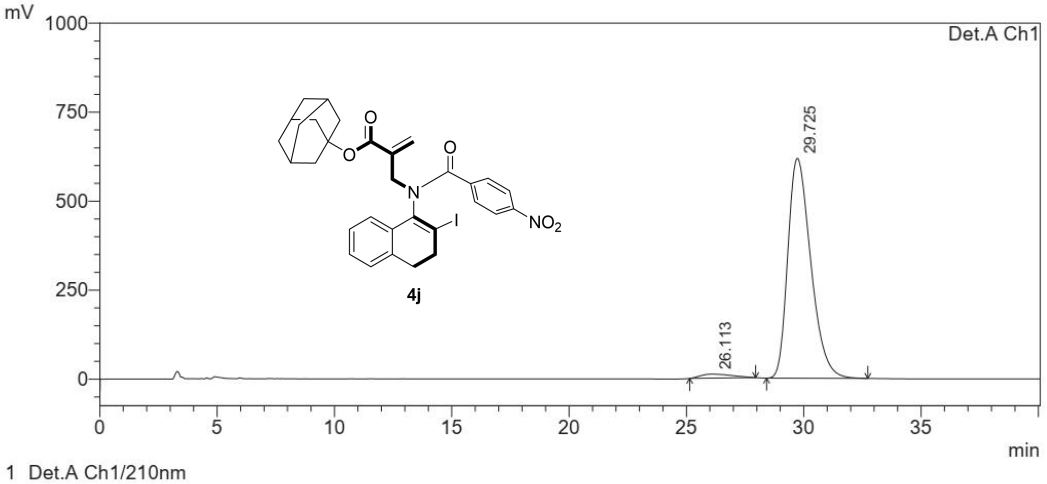


1 Det.A Ch1/210nm

PeakTable

Detector A Ch1 210nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	25.540	13660271	131591	49.567	35.993
2	28.793	13899150	234005	50.433	64.007
Total		27559420	365596	100.000	100.000

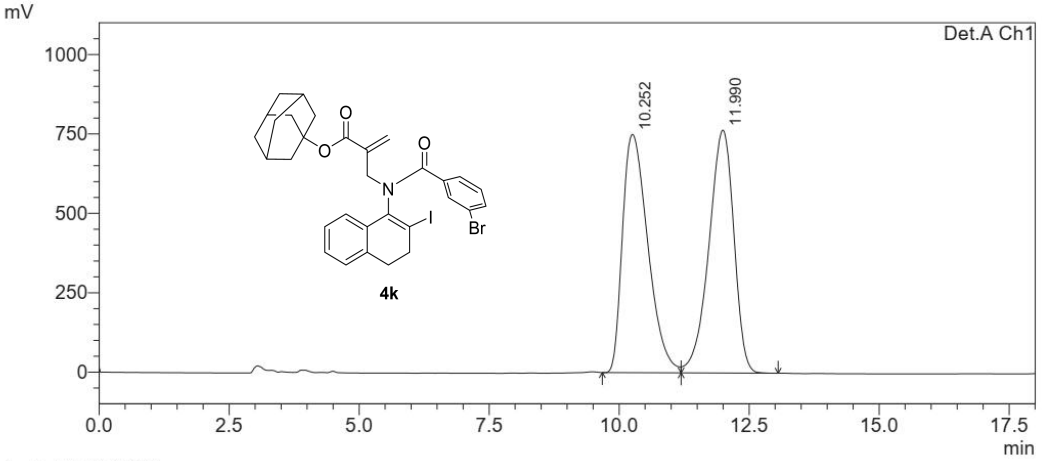


1 Det.A Ch1/210nm

PeakTable

Detector A Ch1 210nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	26.113	1059831	11357	2.458	1.806
2	29.725	42050092	617432	97.542	98.194
Total		43109923	628790	100.000	100.000

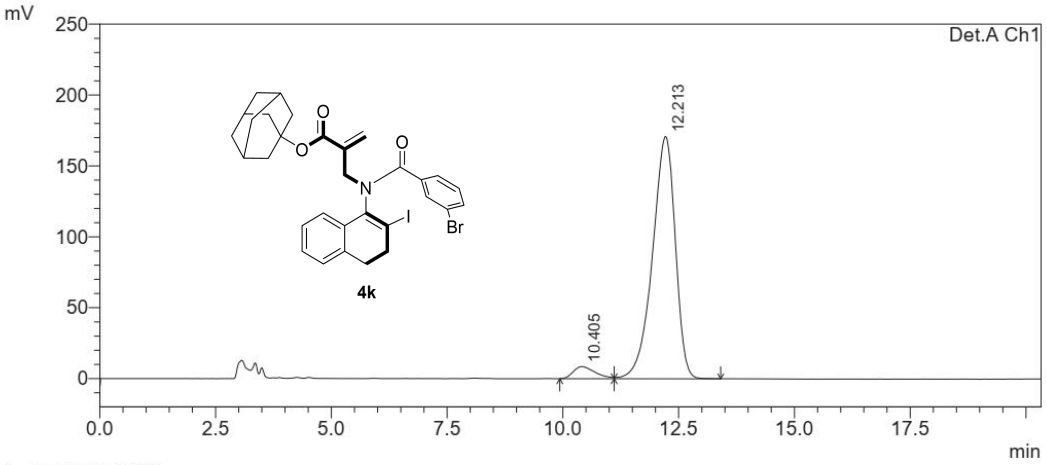


1 Det.A Ch1/210nm

PeakTable

Detector A Ch1 210nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	10.252	25509459	750550	49.968	49.601
2	11.990	25542448	762623	50.032	50.399
Total		51051907	1513173	100.000	100.000

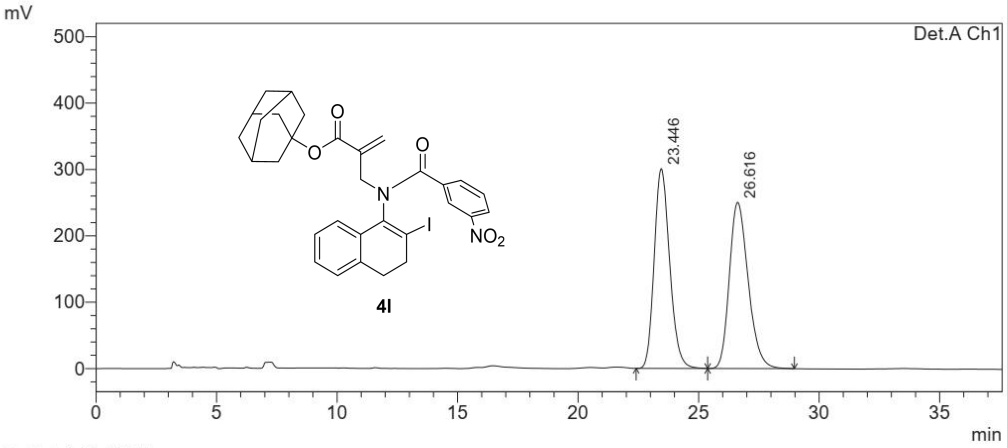


1 Det.A Ch1/210nm

PeakTable

Detector A Ch1 210nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	10.405	280906	8532	4.580	4.768
2	12.213	5852167	170421	95.420	95.232
Total		6133073	178952	100.000	100.000

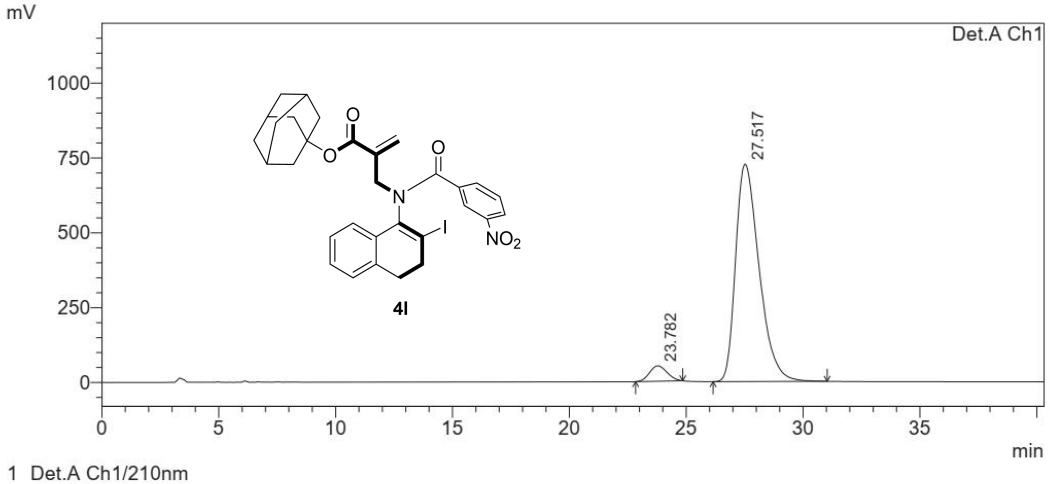


1 Det.A Ch1/210nm

PeakTable

Detector A Ch1 210nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	23.446	13453277	300508	49.725	54.584
2	26.616	13601835	250033	50.275	45.416
Total		27055112	550540	100.000	100.000

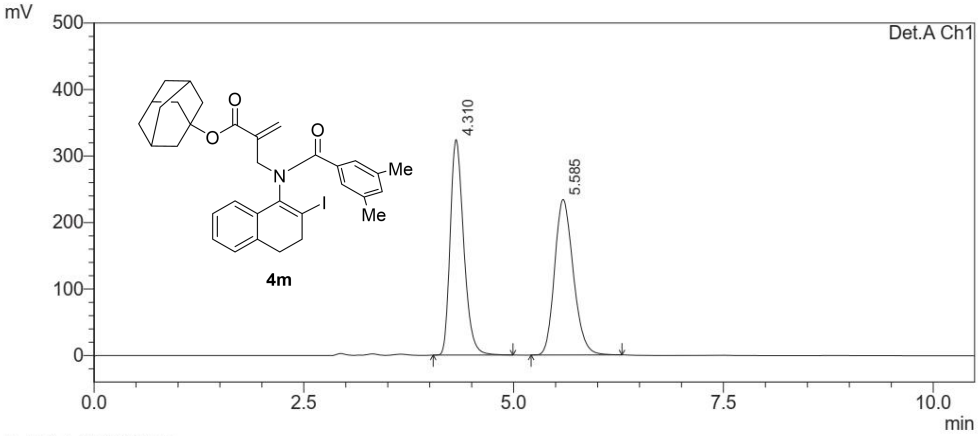


1 Det.A Ch1/210nm

PeakTable

Detector A Ch1 210nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	23.782	2675434	51441	5.009	6.617
2	27.517	50739812	725965	94.991	93.383
Total		53415246	777406	100.000	100.000

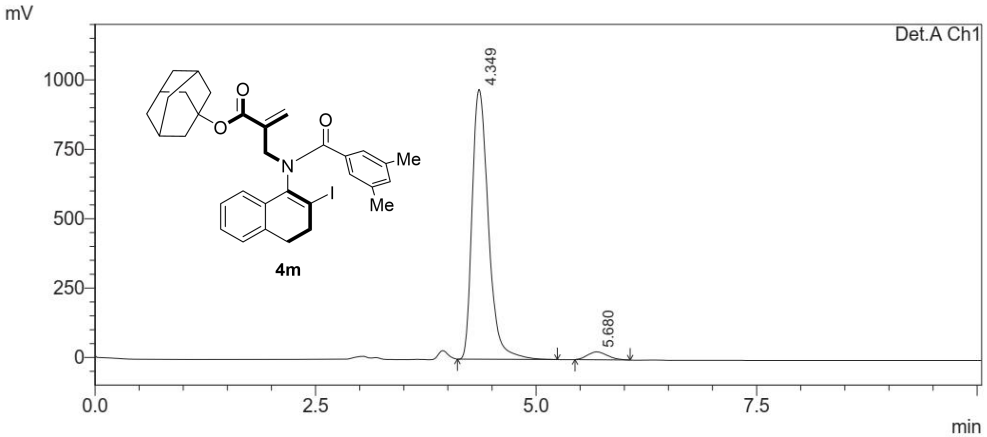


1 Det.A Ch1/210nm

PeakTable

Detector A Ch1 210nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	4.310	3627656	322336	49.966	57.969
2	5.585	3632543	233713	50.034	42.031
Total		7260199	556048	100.000	100.000

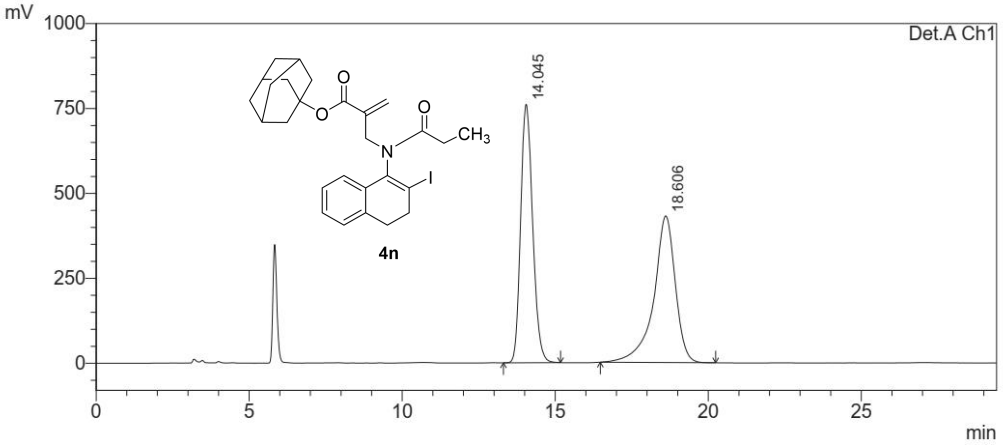


1 Det.A Ch1/210nm

PeakTable

Detector A Ch1 210nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	4.349	12438234	971879	96.565	97.167
2	5.680	442484	28333	3.435	2.833
Total		12880718	1000212	100.000	100.000

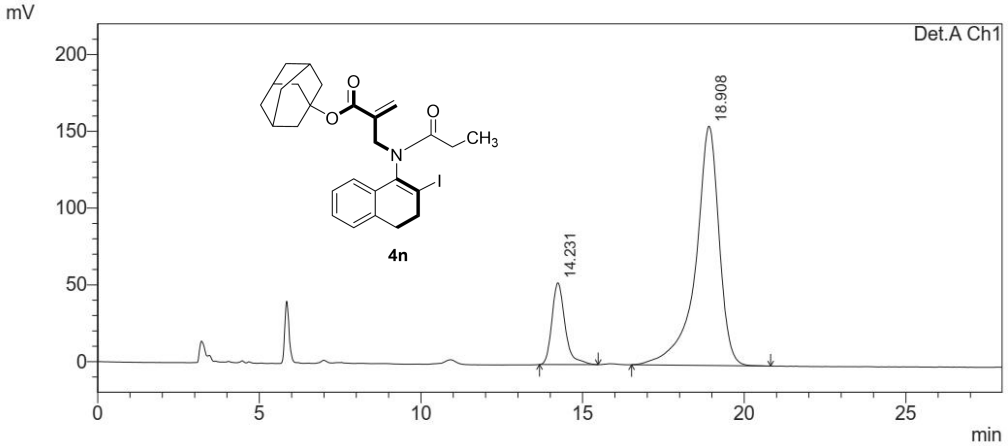


1 Det.A Ch1/210nm

PeakTable

Detector A Ch1 210nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	14.045	20750894	757616	49.577	63.761
2	18.606	21104737	430588	50.423	36.239
Total		41855631	1188204	100.000	100.000

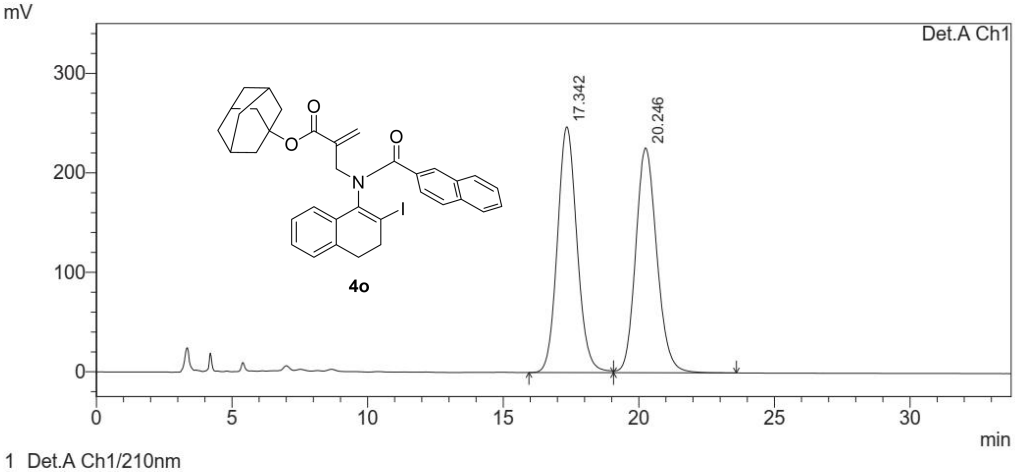


1 Det.A Ch1/210nm

PeakTable

Detector A Ch1 210nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	14.231	1505716	53172	16.062	25.486
2	18.908	7868707	155459	83.938	74.514
Total		9374423	208631	100.000	100.000

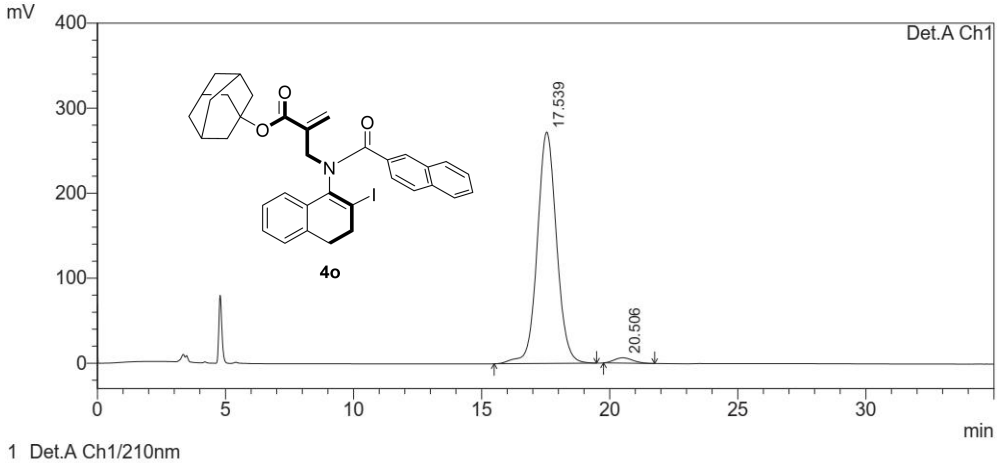


1 Det.A Ch1/210nm

PeakTable

Detector A Ch1 210nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	17.342	12410368	246896	50.313	52.213
2	20.246	12256040	225970	49.687	47.787
Total		24666408	472866	100.000	100.000

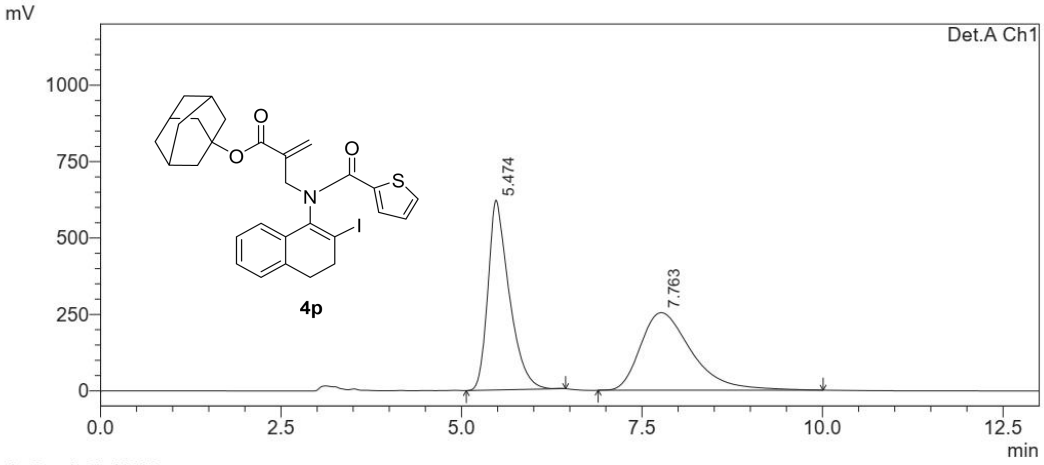


1 Det.A Ch1/210nm

PeakTable

Detector A Ch1 210nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	17.539	14203359	272119	97.812	97.746
2	20.506	317693	6274	2.188	2.254
Total		14521053	278393	100.000	100.000

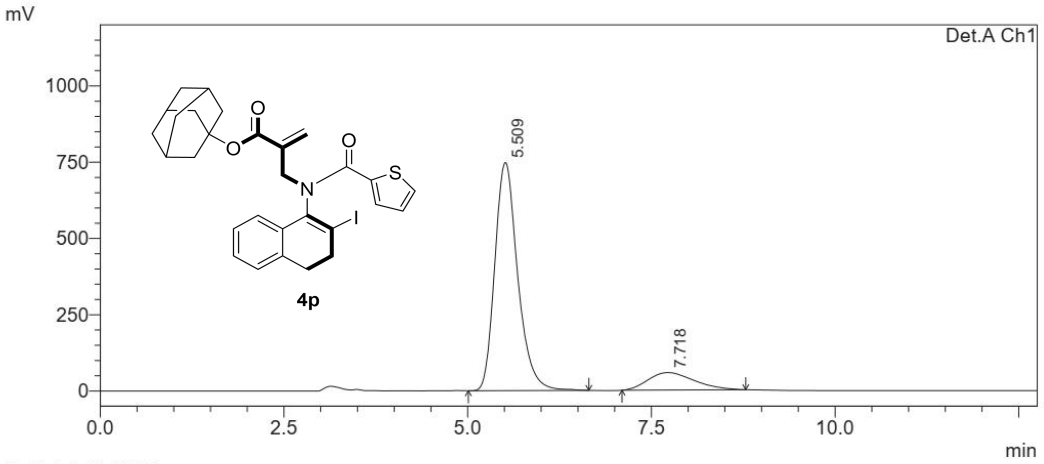


1 Det.A Ch1/210nm

PeakTable

Detector A Ch1 210nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	5.474	12699639	619157	50.431	70.926
2	7.763	12482432	253810	49.569	29.074
Total		25182071	872967	100.000	100.000

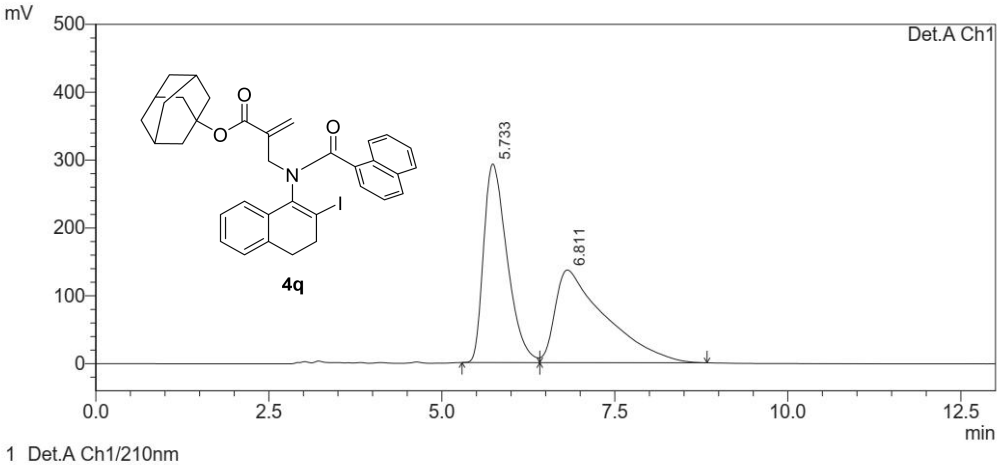


1 Det.A Ch1/210nm

PeakTable

Detector A Ch1 210nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	5.509	16195940	747545	86.664	92.892
2	7.718	2492173	57202	13.336	7.108
Total		18688113	804746	100.000	100.000

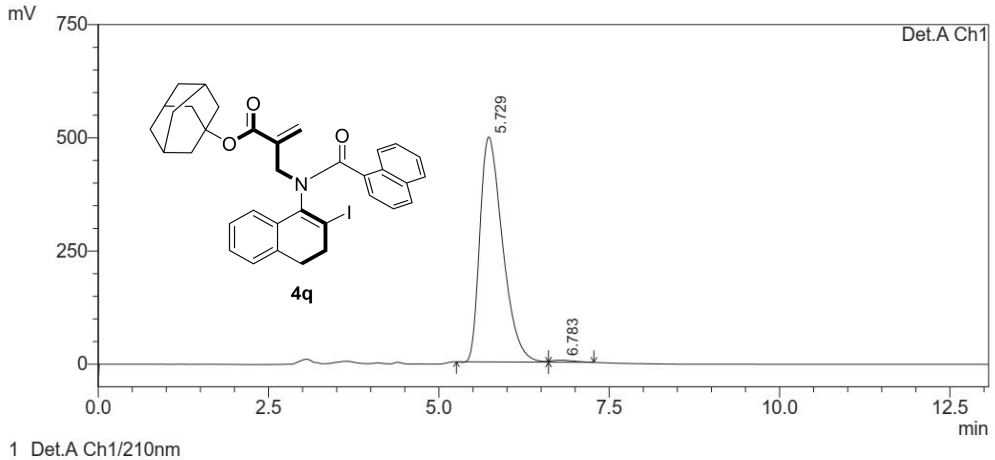


1 Det.A Ch1/210nm

PeakTable

Detector A Ch1 210nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	5.733	6947378	292159	50.155	68.167
2	6.811	6904433	136431	49.845	31.833
Total		13851811	428590	100.000	100.000

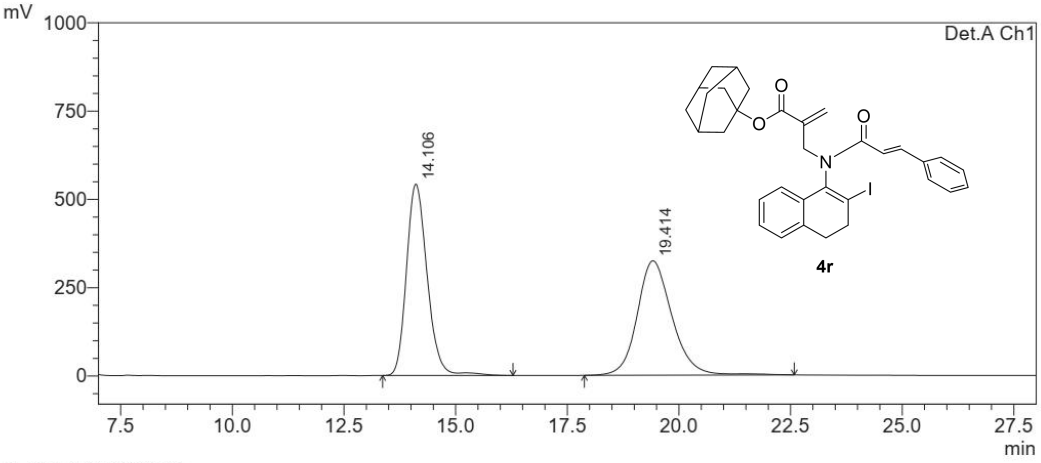


1 Det.A Ch1/210nm

PeakTable

Detector A Ch1 210nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	5.729	11509553	496487	99.122	99.098
2	6.783	101907	4522	0.878	0.902
Total		11611461	501009	100.000	100.000

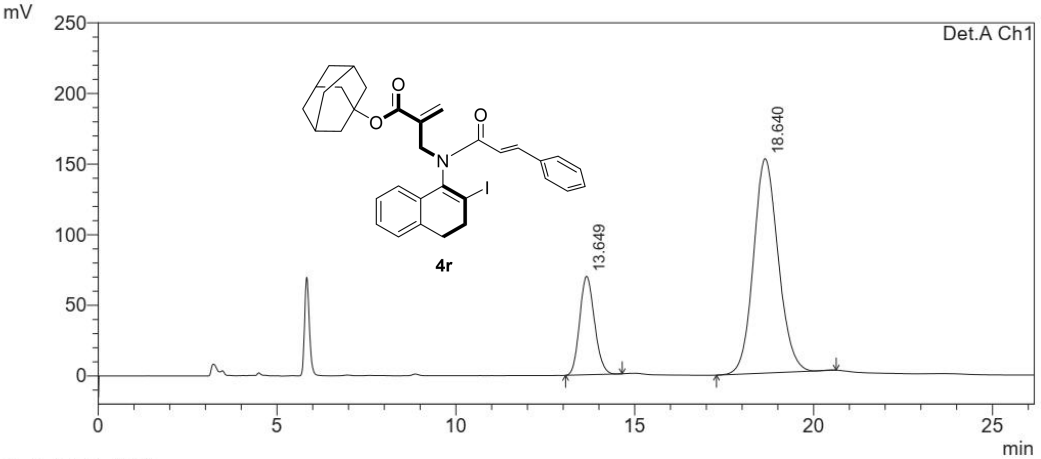


1 Det.A Ch1/210nm

PeakTable

Detector A Ch1 210nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	14.106	17498045	541057	49.866	62.583
2	19.414	17591905	323482	50.134	37.417
Total		35089950	864539	100.000	100.000

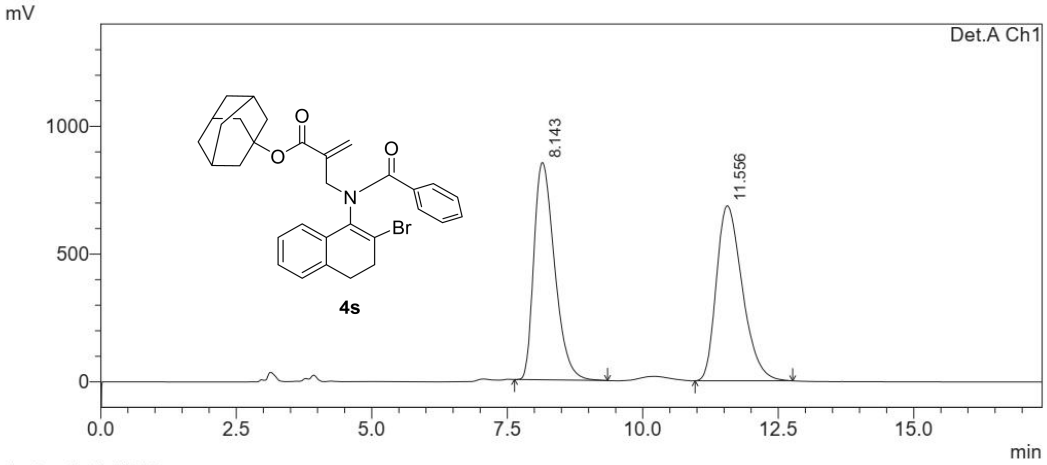


1 Det.A Ch1/210nm

PeakTable

Detector A Ch1 210nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	13.649	2008203	69687	21.577	31.480
2	18.640	7298952	151681	78.423	68.520
Total		9307154	221368	100.000	100.000

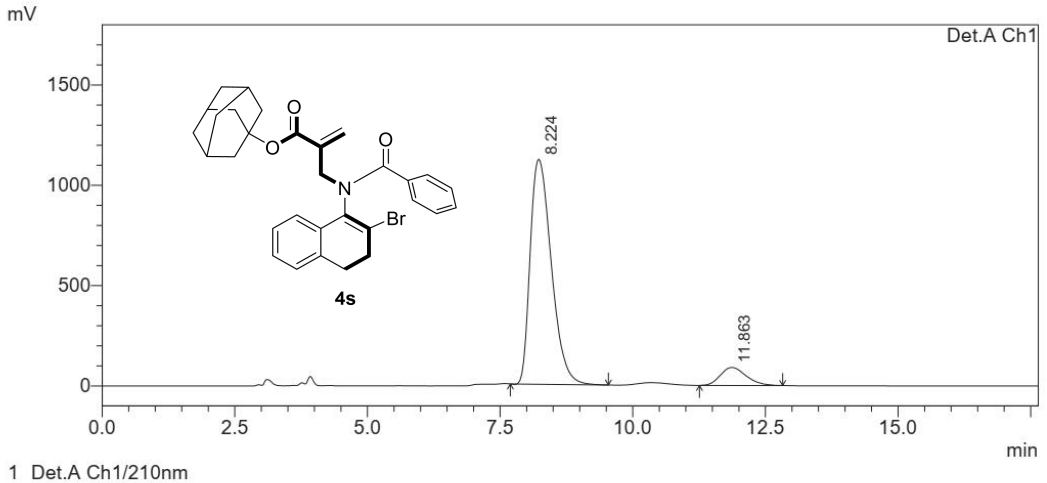


1 Det.A Ch1/210nm

PeakTable

Detector A Ch1 210nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	8.143	22547685	849911	49.674	55.405
2	11.556	22843218	684099	50.326	44.595
Total		45390903	1534010	100.000	100.000

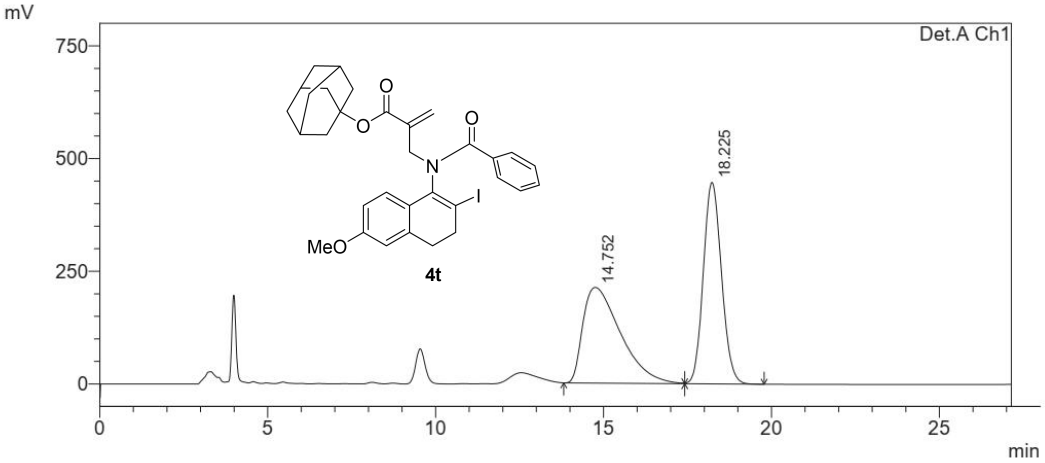


1 Det.A Ch1/210nm

PeakTable

Detector A Ch1 210nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	8.224	31049033	1120216	91.071	92.570
2	11.863	3044193	89910	8.929	7.430
Total		34093226	1210126	100.000	100.000

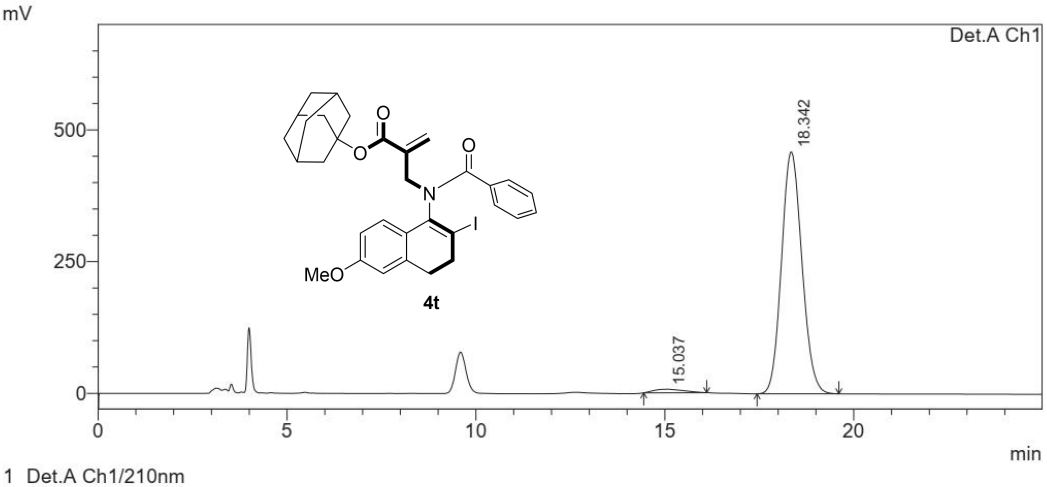


1 Det.A Ch1/210nm

PeakTable

Detector A Ch1 210nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	14.752	16549238	212125	49.614	32.212
2	18.225	16806826	446409	50.386	67.788
Total		33356064	658533	100.000	100.000

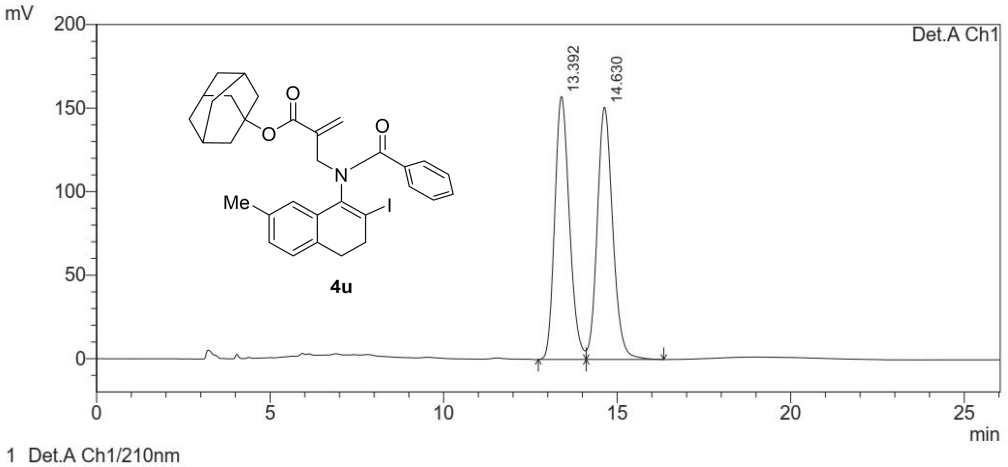


1 Det.A Ch1/210nm

PeakTable

Detector A Ch1 210nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	15.037	374291	6838	2.125	1.472
2	18.342	17241831	457616	97.875	98.528
Total		17616123	464454	100.000	100.000

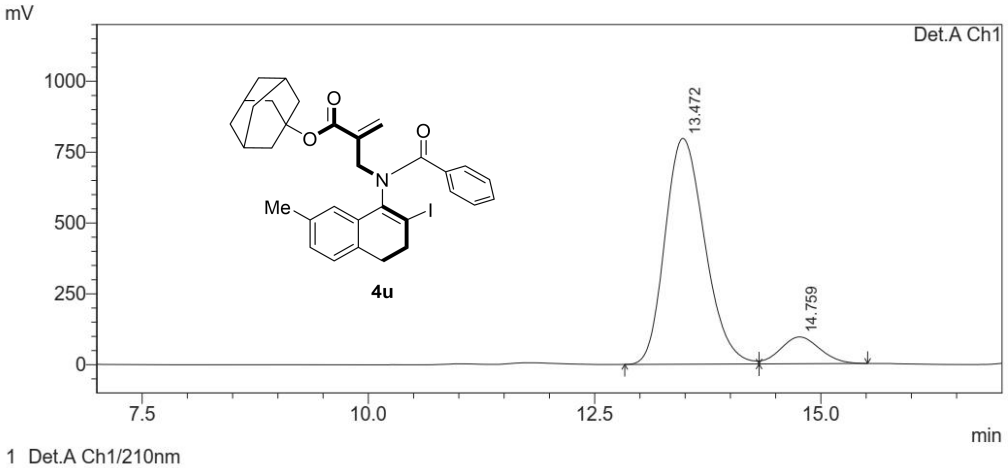


1 Det.A Ch1/210nm

PeakTable

Detector A Ch1 210nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	13.392	4619669	157222	49.582	51.028
2	14.630	4697542	150889	50.418	48.972
Total		9317210	308111	100.000	100.000

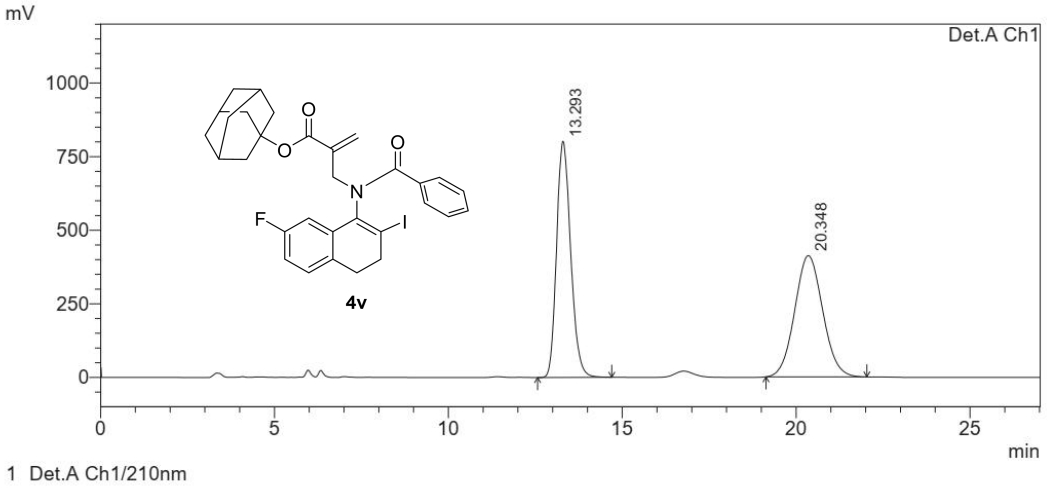


1 Det.A Ch1/210nm

PeakTable

Detector A Ch1 210nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	13.472	24339482	795675	89.493	89.390
2	14.759	2857631	94441	10.507	10.610
Total		27197113	890116	100.000	100.000

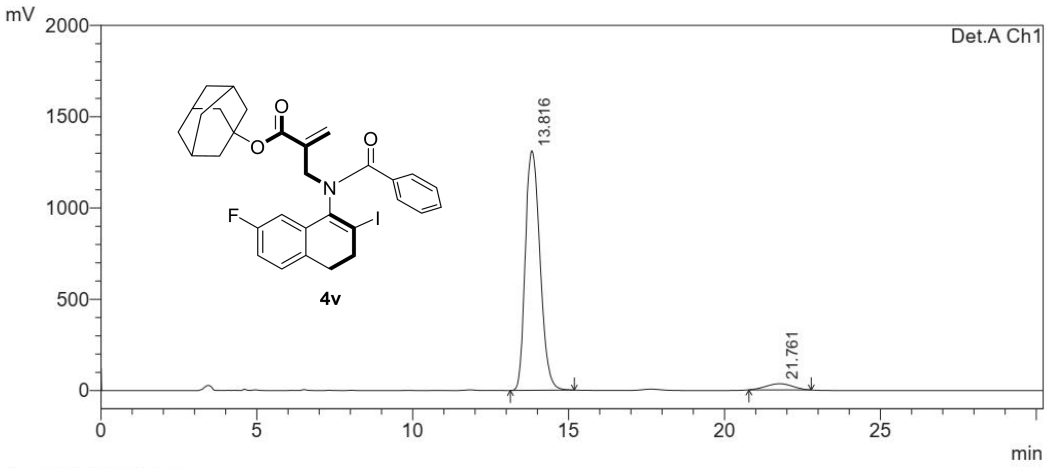


1 Det.A Ch1/210nm

PeakTable

Detector A Ch1 210nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	13.293	22681704	800333	49.584	66.068
2	20.348	23062631	411052	50.416	33.932
Total		45744335	1211385	100.000	100.000

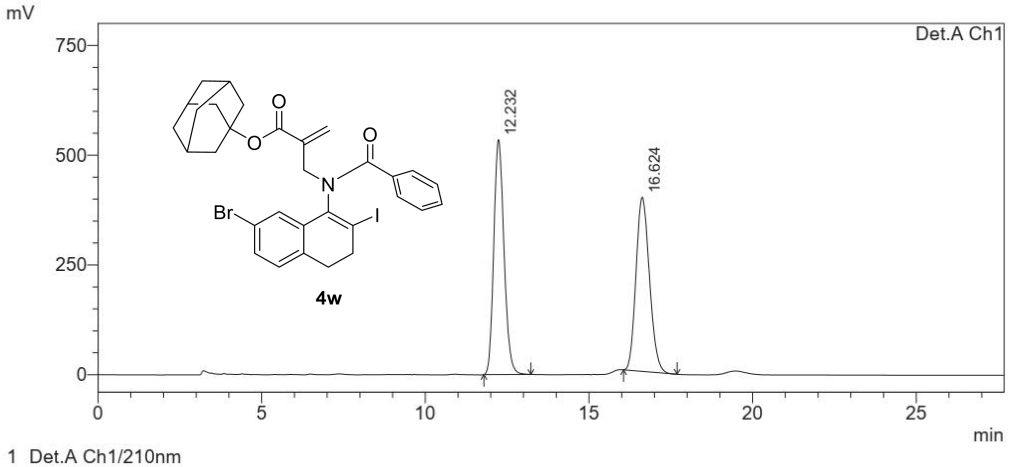


1 Det.A Ch1/210nm

PeakTable

Detector A Ch1 210nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	13.816	43108935	1308226	95.566	97.479
2	21.761	2000064	33827	4.434	2.521
Total		45108999	1342053	100.000	100.000

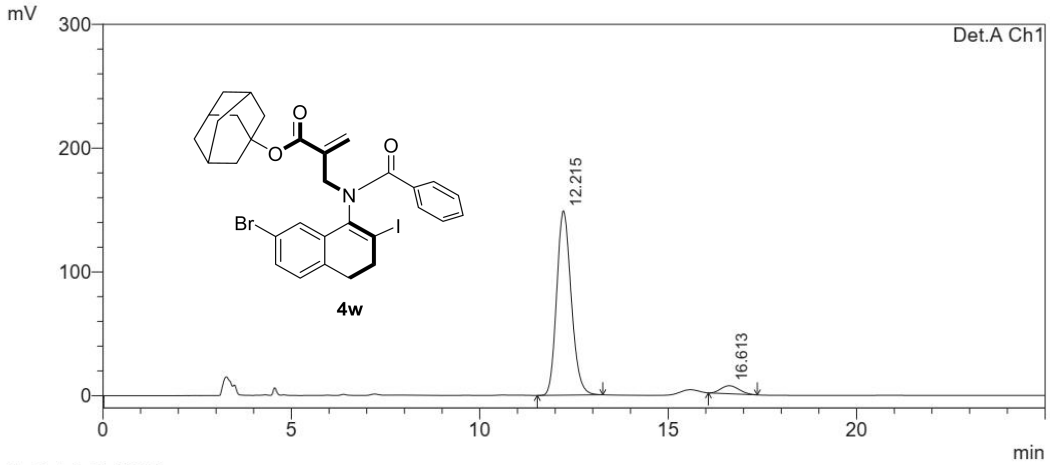


1 Det.A Ch1/210nm

PeakTable

Detector A Ch1 210nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	12.232	11656606	534977	50.662	57.909
2	16.624	11352122	388853	49.338	42.091
Total		23008728	923831	100.000	100.000

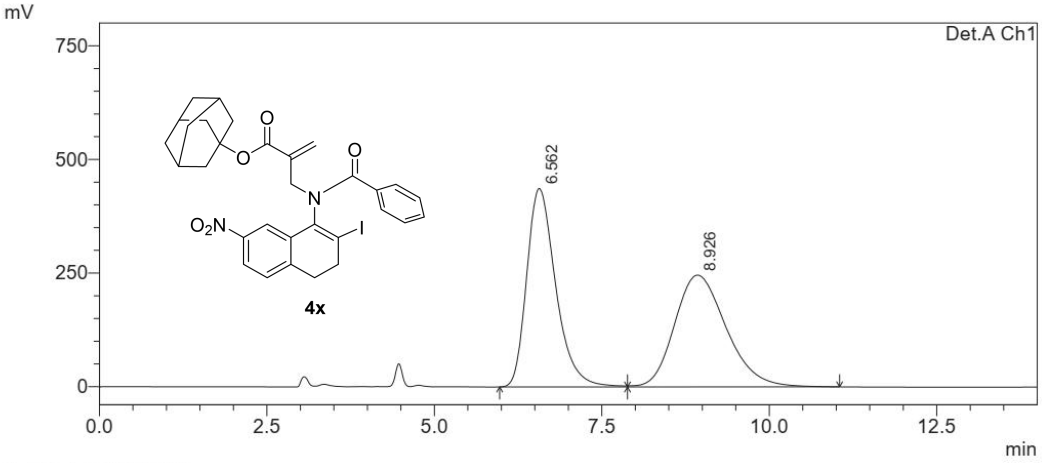


1 Det.A Ch1/210nm

PeakTable

Detector A Ch1 210nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	12.215	4001247	148842	94.831	95.832
2	16.613	218120	6474	5.169	4.168
Total		4219367	155316	100.000	100.000

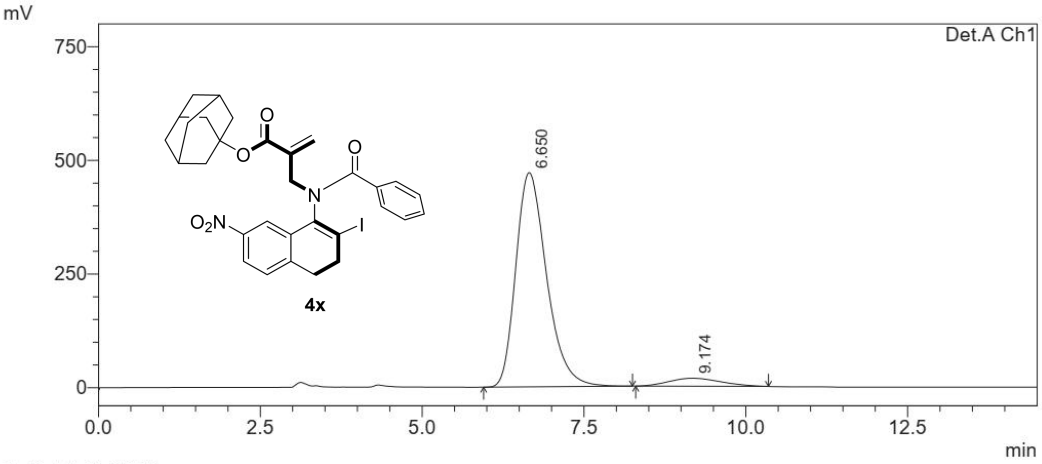


1 Det.A Ch1/210nm

PeakTable

Detector A Ch1 210nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	6.562	13167138	436464	49.939	63.965
2	8.926	13199310	245883	50.061	36.035
Total		26366449	682346	100.000	100.000

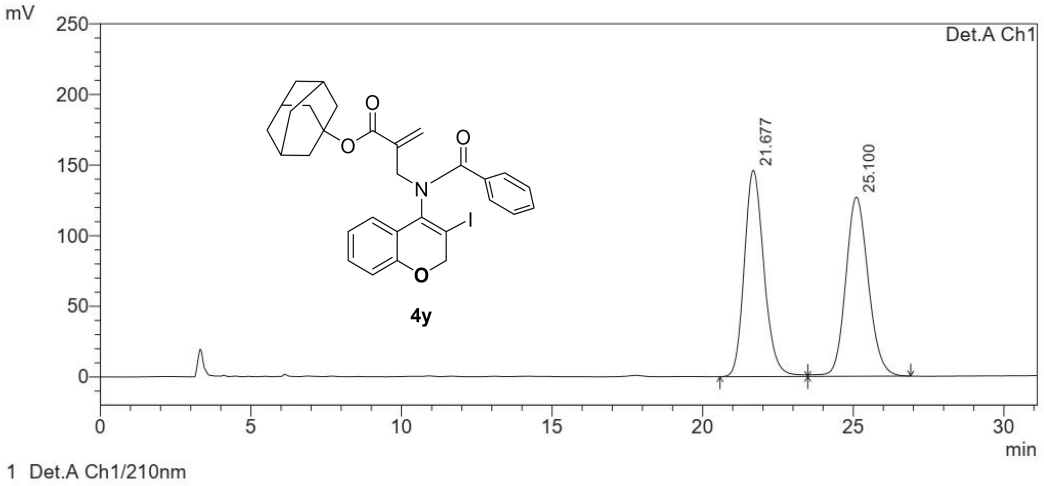


1 Det.A Ch1/210nm

PeakTable

Detector A Ch1 210nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	6.650	15594359	470834	94.097	96.400
2	9.174	978321	17582	5.903	3.600
Total		16572680	488415	100.000	100.000

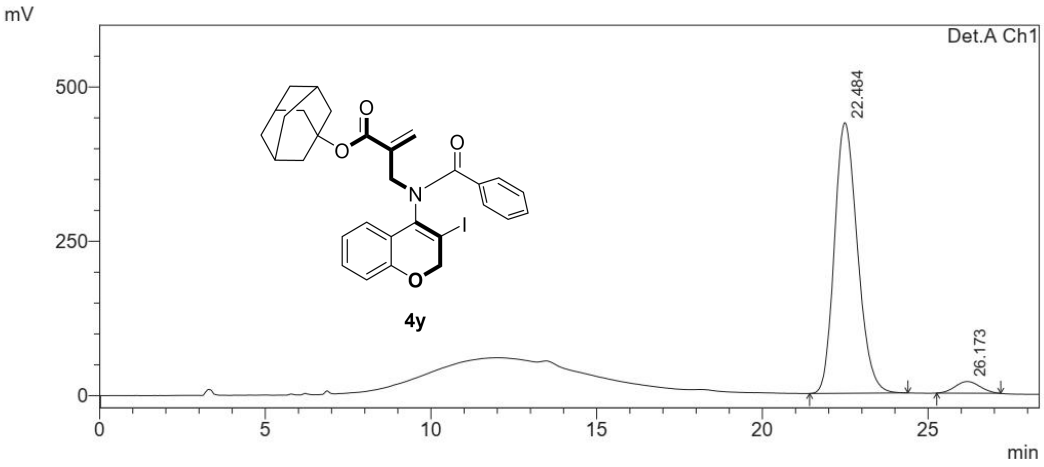


1 Det.A Ch1/210nm

PeakTable

Detector A Ch1 210nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	21.677	6622152	146025	50.025	53.527
2	25.100	6615462	126779	49.975	46.473
Total		13237614	272805	100.000	100.000

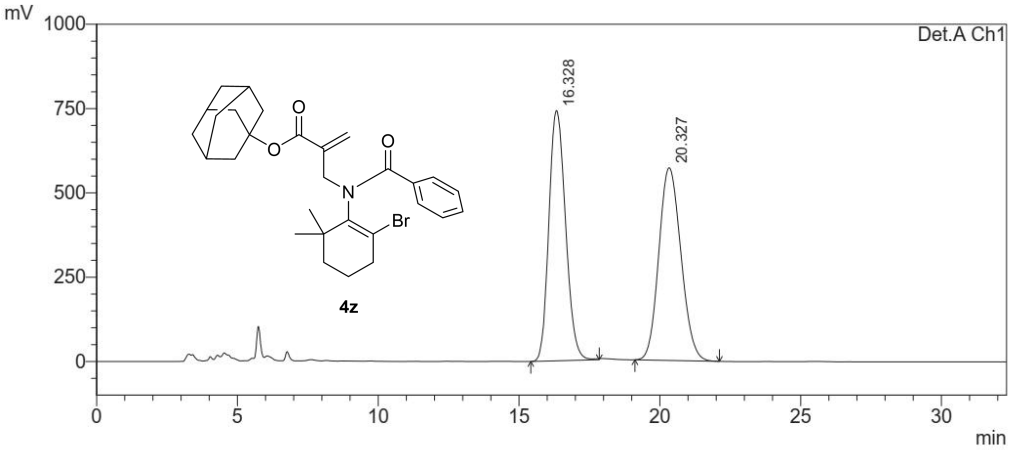


1 Det.A Ch1/210nm

PeakTable

Detector A Ch1 210nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	22.484	21190385	437896	95.561	95.865
2	26.173	984351	18888	4.439	4.135
Total		22174736	456784	100.000	100.000

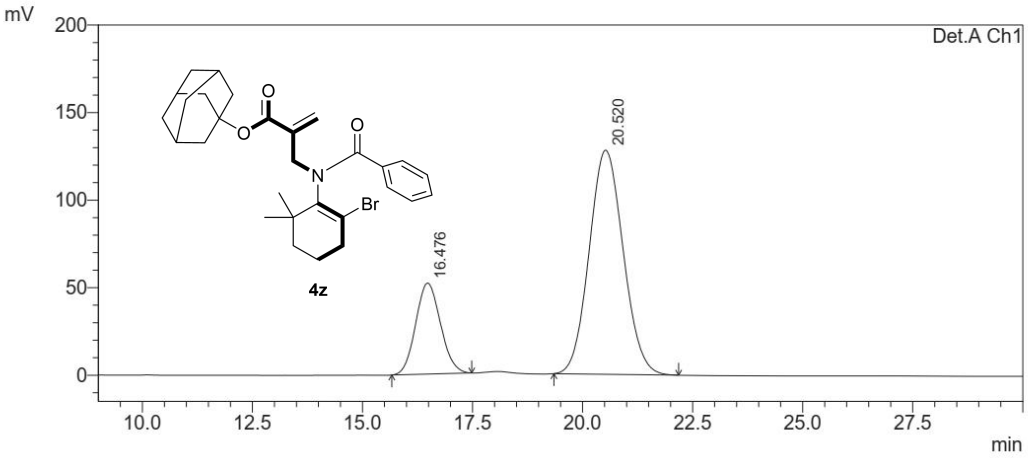


1 Det.A Ch1/210nm

PeakTable

Detector A Ch1 210nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	16.328	30540504	741847	49.476	56.572
2	20.327	31188013	569474	50.524	43.428
Total		61728517	1311322	100.000	100.000

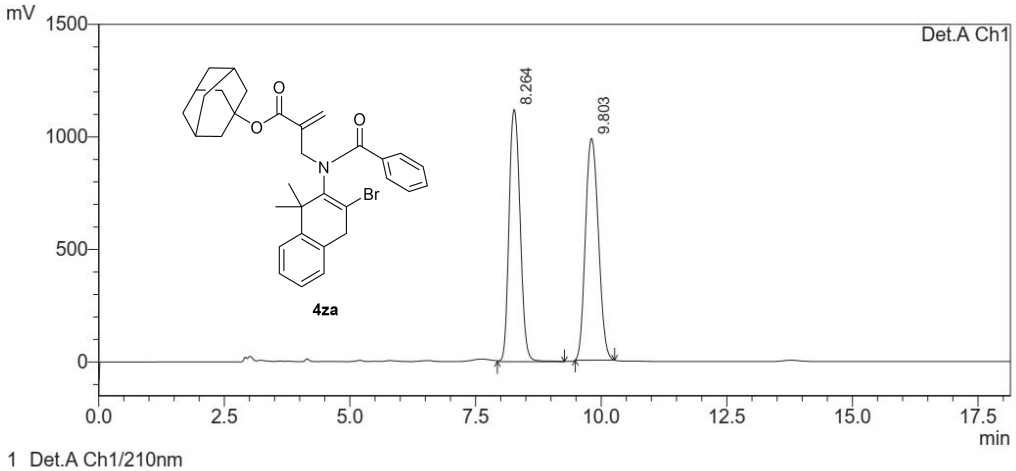


1 Det.A Ch1/210nm

PeakTable

Detector A Ch1 210nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	16.476	2038588	51895	22.847	28.952
2	20.520	6884295	127347	77.153	71.048
Total		8922883	179242	100.000	100.000

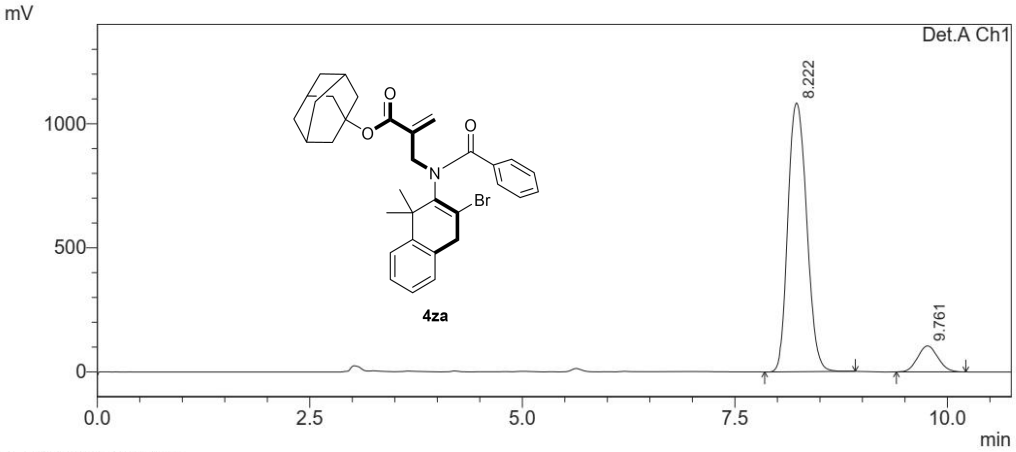


1 Det.A Ch1/210nm

PeakTable

Detector A Ch1 210nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	8.264	17212369	1118429	49.330	53.194
2	9.803	17679874	984132	50.670	46.806
Total		34892243	2102562	100.000	100.000

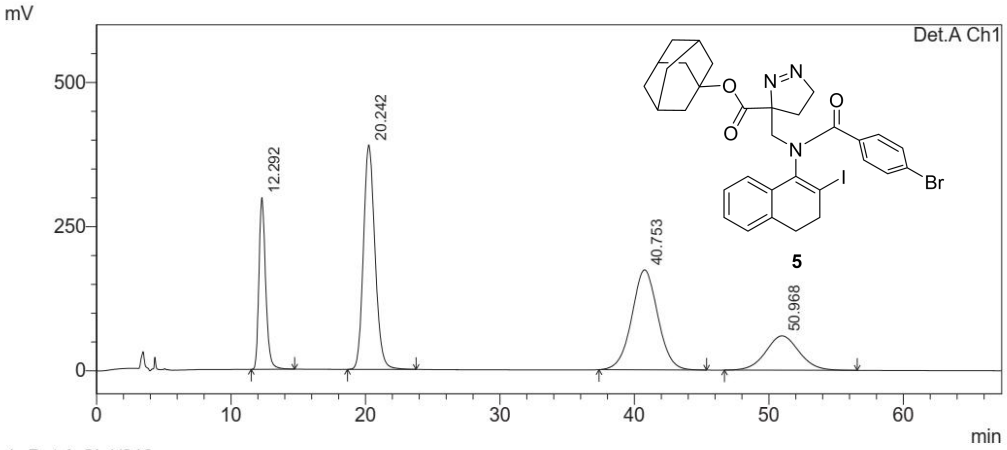


1 Det.A Ch1/210nm

PeakTable

Detector A Ch1 210nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	8.222	16663182	1081673	90.537	91.165
2	9.761	1741647	104828	9.463	8.835
Total		18404829	1186500	100.000	100.000

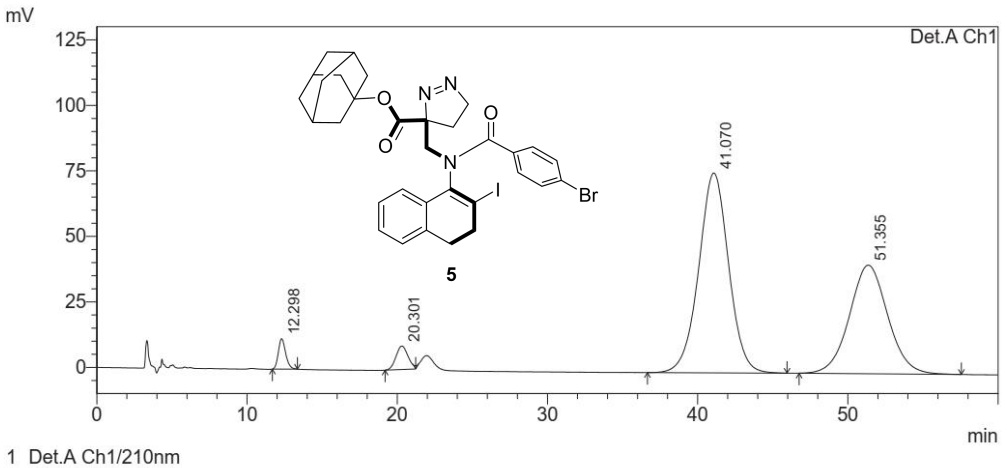


1 Det.A Ch1/210nm

PeakTable

Detector A Ch1 210nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	12.292	10341519	297187	15.383	32.398
2	20.242	23204199	387710	34.517	42.267
3	40.753	23359404	173062	34.748	18.867
4	50.968	10319779	59330	15.351	6.468
Total		67224901	917289	100.000	100.000

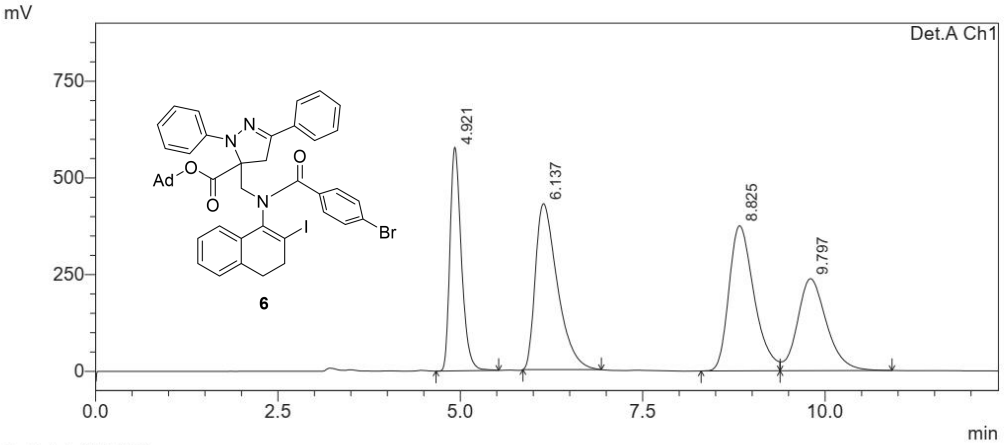


1 Det.A Ch1/210nm

PeakTable

Detector A Ch1 210nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	12.298	393332	11558	2.089	8.366
2	20.301	501448	8961	2.664	6.486
3	41.070	10565538	76235	56.121	55.180
4	51.355	7366036	41404	39.126	29.969
Total		18826355	138157	100.000	100.000

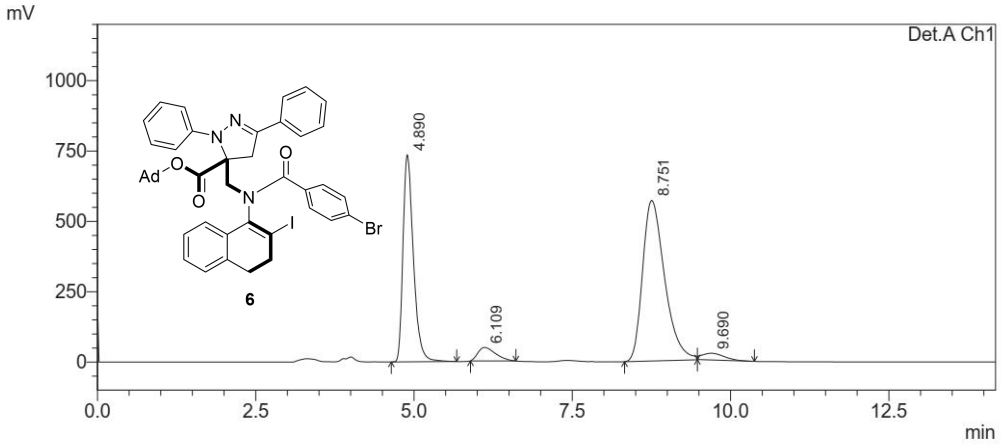


1 Det.A Ch1/210nm

PeakTable

Detector A Ch1 210nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	4.921	6267661	578373	20.310	35.713
2	6.137	9014554	428464	29.211	26.457
3	8.825	8995717	375095	29.149	23.161
4	9.797	6582697	237566	21.330	14.669
Total		30860628	1619498	100.000	100.000

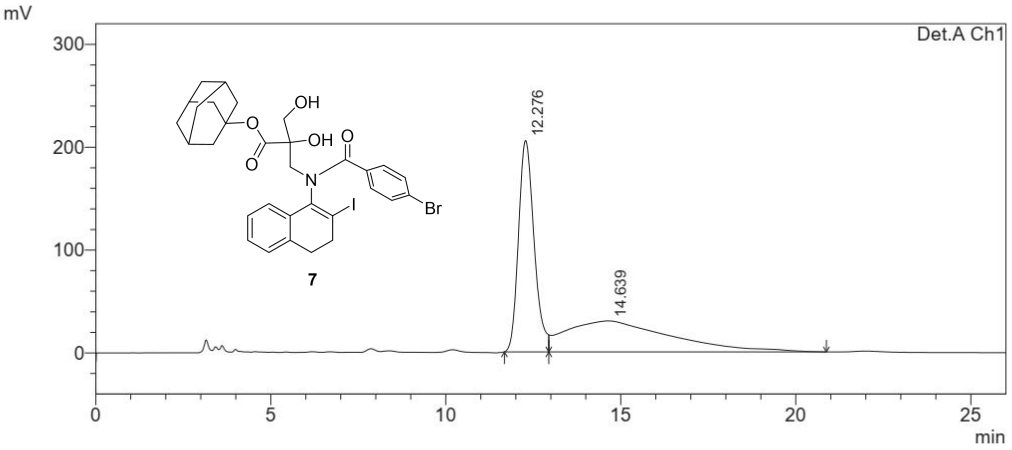


1 Det.A Ch1/210nm

PeakTable

Detector A Ch1 210nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	4.890	8393986	731729	35.333	53.246
2	6.109	934401	48183	3.933	3.506
3	8.751	13831132	570181	58.219	41.491
4	9.690	597460	24146	2.515	1.757
Total		23756979	1374239	100.000	100.000

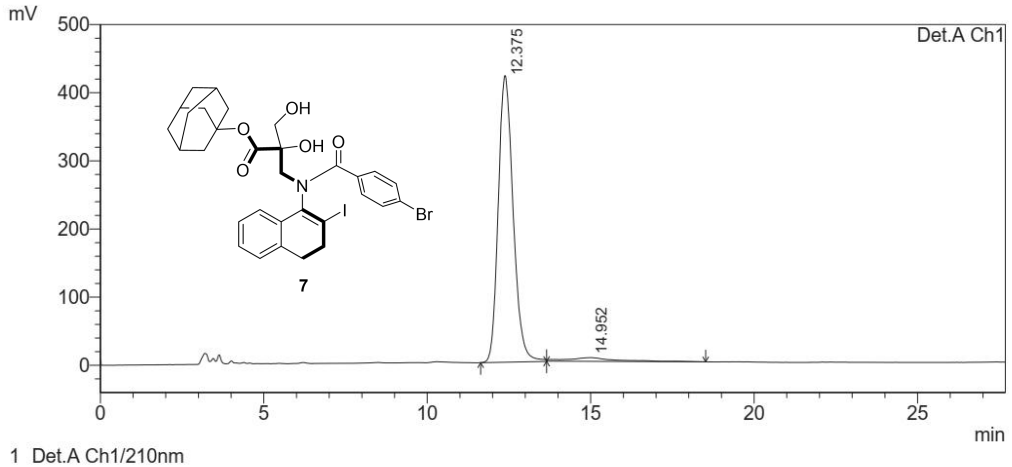


1 Det.A Ch1/210nm

PeakTable

Detector A Ch1 210nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	12.276	6360512	204757	50.347	87.152
2	14.639	6272838	30184	49.653	12.848
Total		12633351	234941	100.000	100.000



1 Det.A Ch1/210nm

PeakTable

Detector A Ch1 210nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	12.375	13318827	419865	95.882	98.692
2	14.952	572061	5563	4.118	1.308
Total		13890887	425428	100.000	100.000

9. References

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