Supporting Information

Phosphite Mediated Asymmetric N to C Migration for the Synthesis of Chiral Heterocycles from Primary Amine

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Experimental Procedures

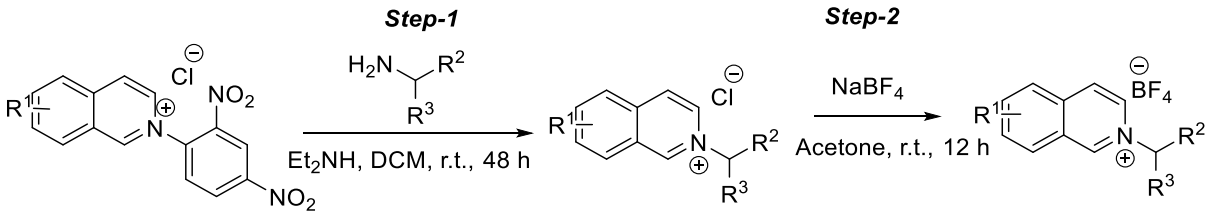
General information

The rearrangement reactions were carried out with anhydrous solvents in flame-dried glass wares under anhydrous argon and oxygen free conditions. All other reactions were carried out under anhydrous and argon atmosphere. THF was used from MBRAUN (MB-SPS-COMPACT) solvent purification system. All other solvents were purchased anhydrous and stored under argon over 4 Å molecular sieves. Analytical thin-layer chromatography was performed on glass plates pre-coated with silica gel (Silica Gel 60 F254; Merck). Plates were visualized using UV light (λ=254 nm) and then stained with either aqueous basic potassium permanganate ($KMnO_4$) or p-anisaldehyde and developed upon heating in Hitachi heat gun. Flash chromatography was performed using silica gel (Merck and Spectrochem, 230-400 mesh), eluting with solvents as indicated. Flash column was performed using Sebo aquarium air pump (SB-548A). ^{1}H, ^{13}C and ^{31}P spectrum were acquired in deuterated solvents at room temperature on Bruker: Ultrashield 400 MHz, Ultrashield 500 MHz and JEOL 400 spectrometer. Chemical shifts (δ) are reported for ^{1}HNMR in ppm from TMS as internal standard and ^{13}C from the residual solvent peak. ^{1}HNMR spectra are reported as follows: chemical shift (δ ppm), multiplicity, coupling constant (Hz), and integration. Data for ^{13}C NMR spectra are reported in terms of chemical shift (δ ppm). Melting points were recorded in Buchi Melting Point B-540 instrument and reported in °C. FT-IR were analyzed in Bruker ALPHA instrument and reported as cm^{-1}. High resolution (HRMS) mass spectral analyses were recorded by High- resolution mass spectrometry using ESI TOF mass analyzer. Chiral HPLC separations were achieved using an Agilent 1260 Infinity series normal phase HPLC unit and HP Chemstation software with Chiralpak® Diacel columns (250 × 4.6 mm). All eluent systems were isocratic. Specific rotations were recorded on JASCO P-2000 Digital Polarimeter. For pyridinium salt synthesis Microwave irradiation experiments were conducted using an Anton Paar microwave 300 single mode microwave reactor. For conducting all microwave irradiation experiments reusable 20 mL pyrex vials were utilized.

Materials

Commercially available reagents were purchased and used as obtained. Substituted analogs of isoquinoline such as 6,7-dimethoxyisoquinoline[1] and [1,3]dioxolo[4,5-g]isoquinoline[2] were synthesized following literature procedure. For salt formation all chiral and racemic amines were synthesized following literature procedures.[3,4,5] Racemic and chiral pyridinium salts were synthesized following the literature procedure.[6,7] For asymmetric version, chiral phosphite catalysts were used from the library of catalyst used in our previous report.[8] The literature reported spectral data were compared favorably with our ^{1}H NMR spectra of these compounds.

A. General procedure for the synthesis of N-alkyl Isoquinolinium salts



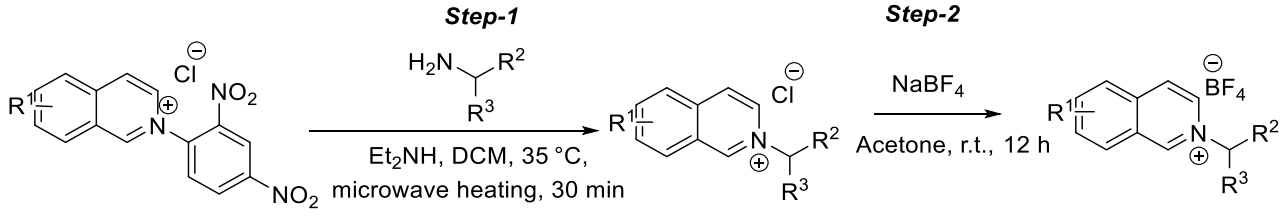
Step-1:

In a flame dried 50 mL round bottom flask with a magnetic bar, dinitro-phenyl isoquinolinium salt (6 mmol, 1 equiv.) was taken in dry DCM (20 mL) under argon atmosphere and stirred to dissolve the salt. To the solution appropriate racemic or chiral amine (7.2 mmol, 1.2 equiv.) and diethylamine (0.74 mL, 7.2 mmol, and 1.2 equiv.) were added and allowed to stir for 48 h at 30-35 °C. Upon complete consumption (monitored by TLC) of salt, the reaction mixture was concentrated under reduced pressure. EtOAc (100 mL) and H_2O (50 mL) were added to the crude mass and organic layer was separated. The aqueous layer was washed with EtOAc (3 × 50 mL) to eliminate 2,4-dinitroaniline. Then the aqueous layer was saturated with solid NaCl and extracted with DCM (3 × 60 mL). Evaporation of DCM under reduced pressure afforded the crude isoquinolinium chloride salt which was used in the next step without further purification.

Step-2:

Acetone (20 mL) was added to a flame dried 50 mL round bottom flask containing isoquinolinium chloride salt (6 mmol) under argon and stirred at room temperature for 10-15 min until the salt was dissolved. Sodium tetrafluoroborate (3.3 g, 30 mmol, 5 equiv.) was added to it and stirred at 30-35 °C. The anion exchange was monitored by TLC (the tetrafluoroborate salt is lower in polarity compare to the corresponding chloride salt). The complete exchange was judged by TLC, and the sodium chloride was filtered off. The solvent was removed under reduced pressure and the residual solid was purified by small silica pad filtration to obtain pure tetrafluoroborate salt.

B. General procedure for microwave promoted synthesis of N-alkyl Isoquinolinium salts



Step-1:

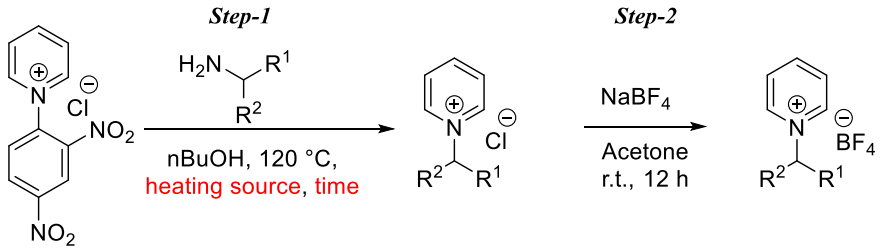
In a flame dried G-20 microwave vial with magnetic bar dinitro-phenyl isoquinolinium salt (3 mmol, 1 equiv.) in dry dichloromethane (9 mL) was taken. To this solution, appropriate chiral amine (3.6 mmol, 1.2 equiv.) was added and the resultant mixture was allowed to react under microwave conditions at 35 °C for 30 min. Upon complete consummation (monitored by TLC), the reaction mixturewas directly

poured into silica-gel column (3.5 cm in diameter, 40g of silica-gel 230 – 400 mess) and run 100 mL DCM solvent and next we used 5% MeOH/DCM to remove dinitro-phenylamine followed by 10% MeOH/DCM to obtain pure chloride salt.

Step-2:

Acetone (10 mL) was added to a flame dried 50 mL round bottom flask containing pyridinium chloride salt (3 mmol) under argon and stirred at room temperature for 10-15 min until the salt was dissolved. After that sodium tetrafluoroborate (15 mmol, 5 equiv.) was added to the solution and stirred at 30-35 °C. The anion exchange was monitored by TLC (the tetrafluoroborate salt is lower in polarity compare to the corresponding chloride salt). The complete exchange was judged by TLC, and the sodium chloride was filtered off. The solvent was removed under reduced pressure and the residual solid was purified by small silica pad filtration to obtain pure tetrafluoroborate salt.

C. General procedure for microwave promoted synthesis of pyridinium salt.



Step-1a: **Procedures for synthesis of chiral salt**

In a flame dried G-20 microwave vial with magnetic bar, dinitro-phenyl pyridinium salt (3 mmol, 1 equiv.) in dry n-BuOH (9 mL) was taken. To this solution, appropriate chiral amine (3.6 mmol, 1.2 equiv.) was added and the resultant mixture was allowed to react under microwave conditions at 120 °C for 5 min. Upon complete consummation (monitored by TLC), the reaction mixture was directly poured into silica-gel column (3.5 cm in diameter, 40g of silica-gel 230 – 400 mess) and run 250 mL DCM solvent to remove alcohol and next we used 5% MeOH/DCM to remove dinitro-phenylamine) followed by 10% MeOH/DCM to obtain pure chloride salt.

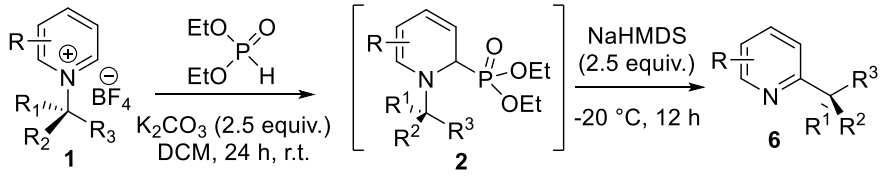
Step-1b: procedures for synthesis of racemic salt

In a flame dried 50 mL round bottom flask with attached condensor and a magnetic bar, dinitro-phenyl pyridinium salt (3 mmol, 1 equiv.) was taken in n-BuOH (9 mL) under argon atmosphere and stirred to dissolve the salt. To the solution, appropriate racemic amine (3.6 mmol, 1.2 equiv.) was added and the reaction mixture was continuously stirred with heating in an oil bath at 120 ºC for 12 h. Upon complete consumption (monitored by TLC) of salt, the reaction mixture was concentrated under reduced pressure. Crude reaction mixture was purified by using a small silica-gel column (3.5 cm in diameter, 40g of silica-gel 230 – 400 mess) and run 100 mL DCM solvent and next we used 5% MeOH/DCM to remove dinitro-phenylamine followed by 10% MeOH/DCM to obtain pure chloride salt.

Step-2:

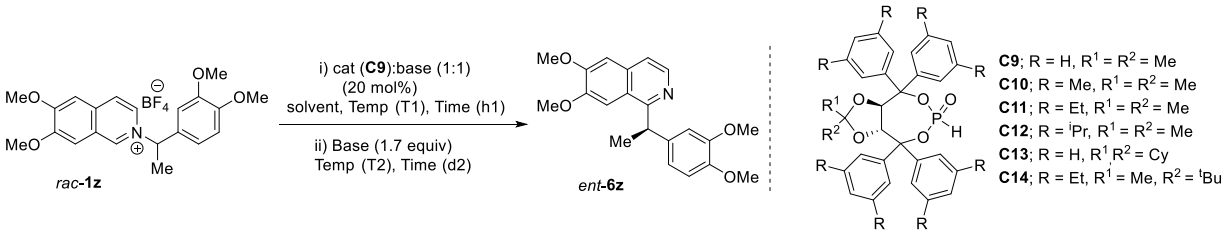
Acetone (10 mL) was added to a flame dried 50 ml round bottom flask containing pyridinium chloride salt (3 mmol) under argon and stirred at room temperature for 10-15 min until the salt dissolved. After that sodium tetrafluoroborate (15 mmol, 5 equiv.) was added to the solution and stirred at 30-35°C. The anion exchange was monitored by TLC (the tetrafluoroborate salt is lower in polarity compare to the corresponding chloride salt). The complete exchange was judged by TLC, and the sodium chloride was filtered off. The solvent was removed under reduced pressure and the residual solid was purified by small silica pad filtration to obtain pure tetrafluoroborate salt.

D. General reaction procedure for phosphite mediated stereoretentive N to C migration



In a flame dried 25 mL pear shape flask with a magnetic bar, pyridinium salt **1** (0.3 mmol, 1 equiv.) was taken in dry DCM (4 mL) under argon atmosphere. To the solution, diethyl hydrogen phosphite (0.3 mmol, 1 equiv.) was added followed by K_2CO_3 (0.75 mmol, 2.5 equiv.). The reaction vessel was sealed with insulating tape and covered with aluminium foil. The reaction mixture was degassed with argon for 15 minutes and then allowed to stir at 25 °C for 24 h. Then the reaction solution was cooled to -20 °C and NaHMDS (2.5 equiv., 2M in THF) was added dropwise over 5 minutes followed by stirring at that temperature for 12 h. The reaction mixture was quenched by saturated NH_4Cl solution (5 mL) and the organic layer was extracted by DCM (3 times). The combined organic layer was dried over anhydrous Na_2SO_4. Solvent removal under reduced pressure gave the crude product which was further purified by flash column chromatography on silica gel using ethyl acetate-pet ether as eluents to obtain the desired product.

Optimization Table for catalytic Chiral Phosphite Mediated Enantioselective N to C Migration:



Entry	Catalyst	T1 (°C), h1 (h)	T2 (°C), d2 (days)	Solvent	Base	Yield (%)	ee(%)
1	**C9**	-20, 12	-20, 6	THF	NaHMDS	25	73
2	**C9**	-20, 12	-20, 6	PhMe	NaHMDS	23	4
3	**C9**	-20, 12	-20, 6	DCM	NaHMDS	26	24

4	**C9**	-40, 12	-40, 6	THF	NaHMDS	41	80
5	**C9**	0, 12	0, 6	THF	NaHMDS	14	61
6	**C9**	-40, 12	-40, 6	THF	LiHMDS	31	77
7	**C9**	-40, 12	-40, 6	THF	KHMDS	46	82
8	**C10**	-40, 12	-40, 6	THF	KHMDS	25	73
9	**C11**	-40, 12	-40, 6	THF	KHMDS	<5%	ND
10	**C12**	-40, 12	-40, 6	THF	KHMDS	<5%	ND
11	**C13**	-40, 12	-40, 6	THF	KHMDS	45	69
12	**C14**	-40, 12	-40, 6	THF	KHMDS	<5%	ND
13	**C9**	-50, 12	-50, 6	THF	KHMDS	52	88
14	**C9**	-60, 12	-60, 6	THF	KHMDS	63	89
15	**C9**	-70, 12	-70, 6	THF	KHMDS	<5%	ND

All reactions are carried out at 1 mmol scale. NaHMDS was used as 2M solution in THF. LiHMDS and KHMDS were used as 1M solution in THF

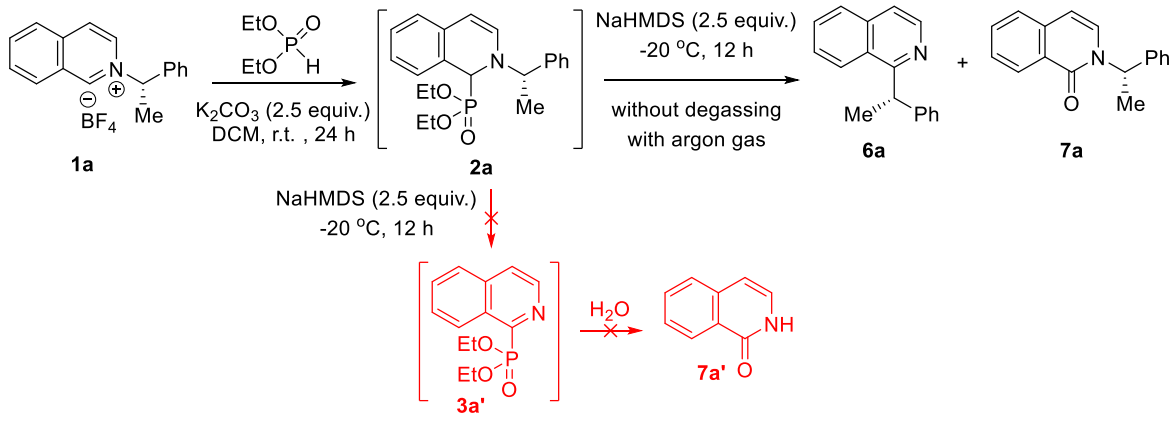
E. General Reaction Procedure for Catalytic (20 mol%) Chiral Phosphite Mediated Enantioselective N to C Migration

1. To a flame dried 25 mL pear shaped flask with a magneticbar, racemic isoquinolinium salt **1z** (1 mmol, 1 equiv.) and chiral phosphite catalyst (0.2 mmol, 0.2 equiv.) was taken in dry THF (12 mL) at room temperature under argon atmosphere. The reaction flask was sealed with septa and insulating tape and covered with aluminum foil. The reaction mixture was purged with argon for 15 min at 0 °C to make it oxygen free. After cooling the solution to -60 °C, MHMDS (0.2 mmol, 1-2 M in THF) was added dropwise over 5 min and reaction vessel was sealed with insulating tape with continued stirring at -60 °C.
2. After 12 h, 20 mol% MHMDS (0.2 mmol, 1-2 M in THF) was added to reaction mixture over 5 min followed by argon purging for 3-4 min and the reaction vessel was sealed with insulating tape.
3. After 13 h 15 mol% MHMDS (0.15 mmol, 1-2 M in THF) was added to reaction mixture over 5 min followed by argon purging for 3-4 min and the reaction vessel was closed with insulating tape. This step was repeated for 7 more times with the time interval 15, 16, 17, 18, 19, 20 and 21 h respectively.
4. The reaction mixture was quenched with saturated ammonium chloride (15 mL) after stirring the reaction mixture for another 12 h after last addition of MHMDS. The organic layer was extracted by ethyl acetate (3 times) and combined organic layer dried over anhydrous Na_2SO_4. The solvent removal under reduced pressure gave the crude product which was further purified by flash column chromatography on silica gel using ethyl acetate-pet ether as eluent to obtain the desired product. The phosphite catalysts can also be recovered during the column

chromatography (if the base strength is lower or quenched by moisture during the reaction leading to an incomplete reaction, the catalyst-substrate adduct would remain after the work-up).

Mechanistic studies:

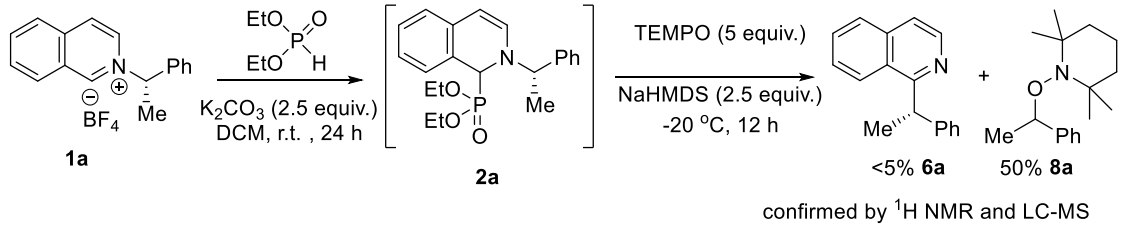
a) Reaction under aerobic condition



In a flame dried 25 mL pear shape flask with a magnetic bar, isoquinolinium salt **1a** (0.3 mmol, 1 equiv.) was taken in dry DCM (4 mL) under argon atmosphere. To the solution, diethyl hydrogen phosphite (0.3 mmol, 1 equiv.) was added followed by K_2CO_3 (0.75 mmol, 2.5 equiv.). The reaction vessel was sealed with insulating tape and covered with aluminum foil. The reaction mixture was allowed to stir at 25 °C for 24 h. Then the reaction solution was cooled to -20 °C and NaHMDS (2.5 equiv., 2M in THF) was added dropwise over 5 min followed by stirring at that temperature for 12 h. The reaction mixture was quenched by saturated NH_4Cl solution (5 mL) and the organic layer was extracted by DCM (3 times). The combined organic layer was dried over anhydrous Na_2SO_4. Solvent removal under reduced pressure gave the crude product which was further purified by flash column chromatography on silica gel using ethyl acetate-pet ether as eluents to obtain product **6a** in 45% yield along with oxidized product **7a** in 23% yield. No **3a'** or **7a'** were detected.

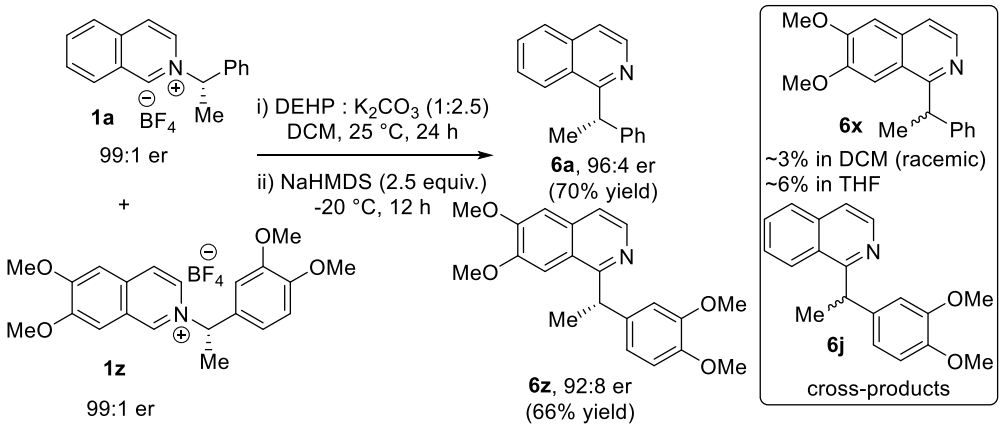
*The reaction was performed under optimized reaction condition except purging argon before NaHMDS addition.

b) Experimental procedure for radical trapping experiment:



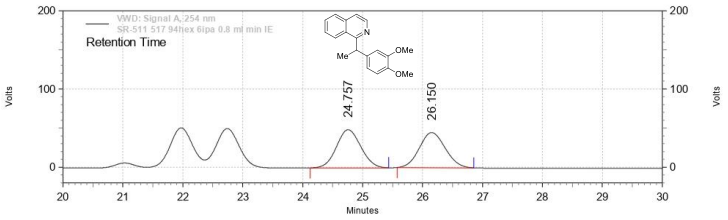
DCM (4 mL) was added to a flame dried 25 mL pear shaped flask containing isoquinolinium salt**1a**(0.3 mmol, 1 equiv.) under argon, followed by diethyl hydrogen phosphite (0.3 mmol, 1 equiv.) and K_2CO_3 (0.75 mmol, 2.5 equiv.) at room temperature. Then the reaction vessel was closed with septa and covered with alumina foil. The reaction mixture was degassed with argon purging for 15 min after cooling to 0 ºC to remove the oxygen and then stirred at 25 °C for 24 h. Degassed TEMPO solution in 0.5 ml DCM (1.5 mmol, 5 equiv.) was added to reaction mixture at 25 °C. The reaction mixture was then cooled at -20 °C and NaHMDS base (2.5 equiv., 2M in THF) was added over 5 minutes at -20 °C. After 12 h, saturated ammonium chloride solution (5 ml) was added to quench the reaction and the organic layer was extracted with DCM (3 times). The combined organic layer was dried over anhydrous sodium sulphate, and the solvent was removed under reduced pressure to obtain the crude which was analysed by LC-MS and ^{1}H NMR. The crude was filtered through a silica column to get the radical trapped product in pure form.

c) Experimental procedure for crossover experiment:



Reaction solvent (DCM or THF, 7 mL) was added to a flame dried 25 mL pear shaped flask containing pyridinium salts **1a** and **1z** (0.5 equiv. and 0.25 mmol each) under argon, followed by diethyl hydrogen phosphite (0.5 mmol, 1 equiv.) and K_2CO_3 (2.5 equiv, 1.25 mmol) at room temperature. The reaction vessel was closed with septa and covered with alumina foil. The reaction mixture was degassed with argon purging for 15 min at 0 °C to remove the oxygen and

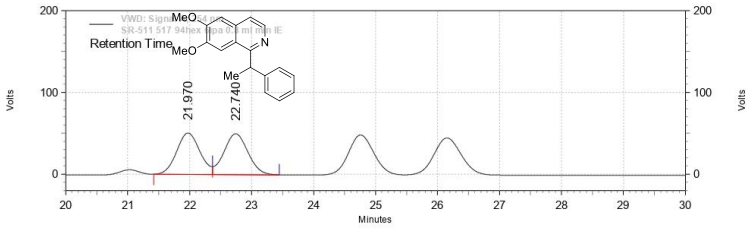
stirred at 25 °C for 24 h. NaHMDS base (2M in THF) was added to the reaction mixture over 5 min at -20 °C. The reaction was stirred for 12 h, and saturated ammonium chloride solution (5 mL was added to quench the reaction. The organic layer was extracted with DCM (3 times) and the combined organic layer was dried over anhydrous sodium sulphate. Solvent was removed under reduced pressure to obtain the crude. LC-MS and HPLC analysis were performed after filtration column of crude reaction mixture which shows intermolecular product (**6x** and **6j**) formation ~3% in DCM and ~6% in THF respectively. The normal products were formed with unchanged stereoretention, while cross-products are near racemic (see analysis below).



VWD: Signal A, 254 nm Results

Retention Time	Area	Area %
24.757	23197265	50.58
26.150	22665413	49.42
Totals	45862678	100.00

Column : CHIRALPAK IE
Eluent System: 94 :6 (HEXANE:IPA)
Flow Rate: 0.8 ml/min
Injection Vol.: 10ul
Wavelength: 254 nm
Sample Conc.: 0.3 mg/ml

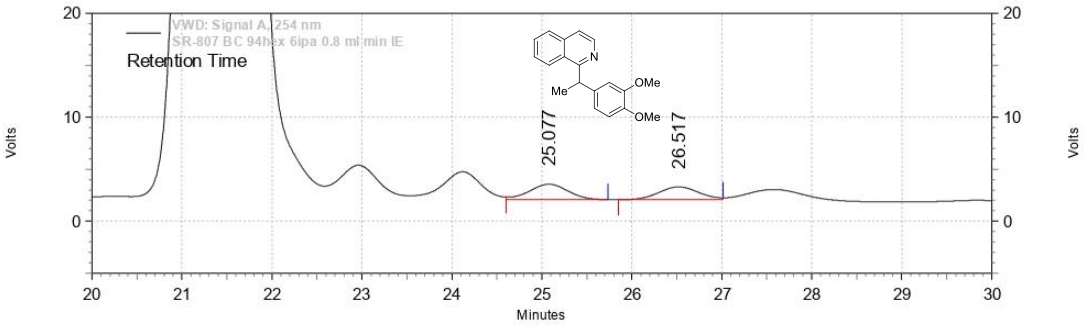


VWD: Signal A, 254 nm Results

Retention Time	Area	Area %
21.970	22136800	49.48
22.740	22605337	50.52
Totals	44742137	100.00

Column : CHIRALPAK IE
Eluent System: 94 :6 (HEXANE:IPA)
Flow Rate: 0.8 ml/min
Injection Vol.: 10ul
Wavelength: 254 nm
Sample Conc.: 1 mg/ml

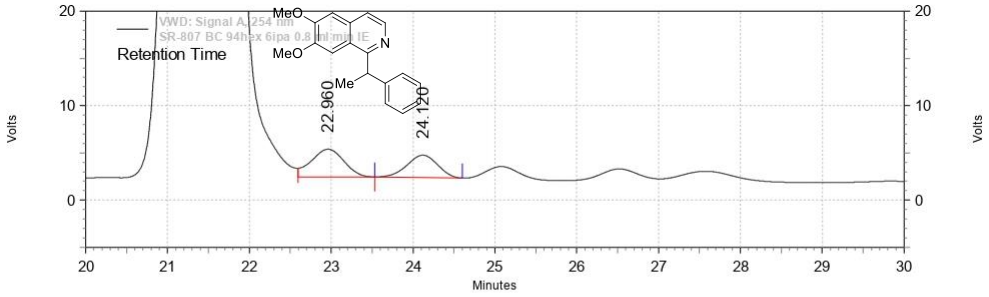
HPLC Traces for compound **6j** and **6x** in equimolar solution



VWD: Signal A, 254 nm Results

Retention Time	Area	Area %
25.077	762216	53.61
26.517	659595	46.39
Totals	1421811	100.00

Column : CHIRALPAK IE
Eluent System: 94 :6 (HEXANE:IPA)
Flow Rate: 0.8 ml/min
Injection Vol.: 10ul
Wavelength: 254 nm
Sample Conc.: 1 mg/ml



VWD: Signal A, 254 nm Results

Retention Time	Area	Area %
22.960	1374288	56.92
24.120	1040049	43.08
Totals	2414337	100.00

Column : CHIRALPAK IE
Eluent System: 94 :6 (HEXANE:IPA)
Flow Rate: 0.8 ml/min
Injection Vol.: 10ul
Wavelength: 254 nm
Sample Conc.: 1 mg/ml

HPLC Traces for compound **6j** and **6x** in reaction mixture in DCM

Computational Method:

All DFT calculations were performed by using the PBE functional[9] and def-TZVP[10] basis set by employing the Turbomole 6.4 suite of programs.[11] The resolution of identity (ri)[12] and multipole accelerated resolution of identity (marij)[13] approximations with dispersion correction (disp3)[14] were employed for all the calculations. Single point calculation at B3LYP/def2-TZVPP[15] level of theory was also carried out. Solvent corrections were incorporated in all calculations using the COSMO model,[16] with DCM (dielectric constant, $\varepsilon = 8.93$) as the solvent. For further analysis re-optimization in different levels of theory (B3LYP/M06-2x//6-31+G**/6-311+G**)[17] by taking the PBE/def-TZVP optimized geometry were carried out using Gaussian 09 program,[18] incorporating polarizable continuum model (PCM)[19] for solvation effect of DCM. The values reported are ΔG values, with zero-point energy corrections, internal energy and entropic contributions included through frequency calculations on the optimized minima, with the temperature 298.15 K. Harmonic frequency calculations were performed for all stationary points to confirm them as a local minima.

Table SI: Computed homolytic vs heterolytic C–N bond dissociation energy(ΔE) in kcal/mol

Substrate	DFT Methods	Homo	Hetero	Homo-Hetero
1a	*(u)*PBE/def-TZVP	+13.7	+18.2	-4.5
	*(u)*B3LYP/def2-TZVPP	+9.5	+15.3	-5.8
	*(u)*B3LYP/6-31+G**	-2.4	+4.1	-6.5
	*(u)*M06-2X/6-31+G**	+17.1	+20.5	-3.4
	*(u)*M06-2X/6-311+G**	+18.2	+21.9	-3.7
1u	*(u)*PBE/def-TZVP	+7.4	+15.9	-8.5
	*(u)*B3LYP/def2-TZVPP	+3.3	+13.2	-9.9

Optimized Cartesian Coordinates:

3a (Substrate **1a**)				**3u** (Substrate **1u**)			
C	-5.481754	-1.729714	3.294429	C	-5.0175564	-1.1444256	3.5305569
C	-4.352494	-1.321459	2.553569	C	-3.9301771	-0.8561910	2.6906143
C	-4.469841	-0.410206	1.479142	C	-4.1070457	-0.1525413	1.4768116
C	-5.747463	0.212070	1.258873	C	-5.4168175	0.3550839	1.1743483
C	-6.849223	-0.177931	2.034172	C	-6.4864132	0.0849996	2.0449385
C	-6.732251	-1.162909	3.035074	C	-6.2995369	-0.6699063	3.2141273
H	-5.365776	-2.468643	4.091637	H	-4.8569101	-1.7166103	4.4478251
H	-3.368912	-1.735307	2.789156	H	-2.9272533	-1.2010975	2.9532790

C	-3.423310	-0.110274	0.523984
C	-5.817444	1.233399	0.228396
H	-7.822815	0.280097	1.834827
H	-7.610034	-1.468879	3.608075
C	-4.674911	1.746362	-0.320409
H	-6.777377	1.694727	-0.010121
H	-4.698995	2.658704	-0.921046
N	-3.438351	1.179826	-0.137946
C	-2.241496	2.060795	0.060691
P	-2.377916	-1.321751	-0.118607
O	-2.034907	-0.943267	-1.704092
O	-0.835331	-1.122754	0.463016
C	-3.147056	-0.944944	-2.637626
H	-3.452367	-1.987418	-2.830767
H	-3.998117	-0.408633	-2.186670
C	0.219451	-2.008832	-0.003718
H	0.378333	-1.844599	-1.082116
H	-0.095169	-3.054971	0.143856
O	-2.814971	-2.792236	0.076688
C	-2.176202	3.188670	-0.966413
H	-1.203912	3.693772	-0.884036
H	-2.956190	3.949449	-0.826400
H	-2.269688	2.779809	-1.983394
H	-1.380625	1.401030	-0.121198
C	-2.177282	2.510717	1.508667
C	-1.417134	1.761333	2.422518
C	-1.423948	2.077217	3.784993
C	-2.189023	3.150193	4.253620
C	-2.951051	3.902492	3.350426
C	-2.947968	3.580876	1.990385
H	-0.837191	0.911395	2.053818
H	-0.830259	1.482808	4.483792
H	-2.193527	3.400543	5.316801
H	-3.550828	4.742609	3.708711
H	-3.560076	4.168365	1.301803
C	1.475057	-1.697921	0.785762
H	2.295874	-2.352008	0.455506
H	1.311085	-1.861079	1.860565
H	1.783011	-0.653289	0.634298
C	-2.691032	-0.267352	-3.914101
H	-3.515098	-0.247446	-4.642684
H	-1.843459	-0.802920	-4.365441
H	-2.383446	0.769162	-3.712133
Na	-4.948754	-3.155206	0.707821

C	-3.0860824	0.0125251	0.4578847
C	-5.5596984	1.0982575	-0.0609821
H	-7.4839856	0.4557824	1.7904277
H	-7.1453942	-0.8829927	3.8710106
C	-4.4590276	1.5478231	-0.7305127
H	-6.5545626	1.3720816	-0.4187455
H	-4.5712055	2.2385558	-1.5696575
N	-3.1610881	1.1876285	-0.3894713
C	-2.1573892	2.3189818	-0.1202745
P	-2.2992939	-1.4109709	-0.1450521
O	-2.0236933	-1.2460122	-1.7768554
O	-0.7117165	-1.4581041	0.3353182
C	-3.1870426	-1.1802163	-2.6424065
H	-3.3976650	-2.1959748	-3.0162174
H	-4.0606323	-0.8359079	-2.0625546
C	0.1212654	-2.5716802	-0.0801710
H	0.2408976	-2.5462646	-1.1758172
H	-0.3746679	-3.5185624	0.1904394
O	-2.9565336	-2.7671106	0.2158615
C	-2.4375311	3.4973488	-1.0811286
H	-3.4467957	3.8996552	-0.9166851
H	-2.4291509	3.0957660	-2.1084889
C	-2.3358046	2.7100345	1.3497610
C	-1.5566002	2.1111179	2.3556946
C	-1.8139121	2.3484880	3.7093095
C	-2.8570747	3.1960940	4.0922656
C	-3.6393465	3.8037422	3.1042813
C	-3.3823170	3.5588962	1.7529982
H	-0.7507596	1.4307895	2.0824972
H	-1.1975420	1.8615636	4.4688951
H	-3.0600940	3.3814076	5.1494752
H	-4.4585311	4.4696204	3.3862868
H	-4.0232949	4.0280210	1.0052338
C	1.4612890	-2.4366211	0.6160023
H	2.1236652	-3.2641431	0.3208080
H	1.3369461	-2.4632032	1.7079892
H	1.9487420	-1.4890904	0.3439651
C	-2.8940939	-0.2241290	-3.7810795
H	-3.7551681	-0.1777451	-4.4648420
H	-2.0151719	-0.5514665	-4.3557807
H	-2.7034823	0.7841237	-3.3876413
Na	-5.0286519	-2.7741592	1.0822586
C	-0.7584547	1.7735088	-0.4197582
H	0.0149845	2.4926762	-0.1169295
H	-0.6648121	1.5834208	-1.4989695
H	-0.5724586	0.8272377	0.0992507
C	-1.4374103	4.6516099	-0.9695670
H	-1.7530148	5.4894563	-1.6085773
H	-0.4267187	4.3561608	-1.2836523
H	-1.3758734	5.0220563	0.0647898

Parent_Homo_Fragment	Parent_Hetero_Fragment

P	0.1128401	0.2079369	-2.1883799	C	-5.2595519	0.7232818	-1.7797847
C	-0.1321065	0.7943685	-0.5261562	C	-4.0413691	0.1201083	-2.0214994
N	0.9272376	1.5518945	-0.0359950	C	-2.8741826	0.9102529	-2.2122854
C	0.8179021	2.0146596	1.2216527	C	-2.9896564	2.3426793	-2.1416446
C	-0.2697653	1.7907909	2.0586023	C	-4.2594192	2.9302842	-1.8937523
C	-1.3871071	1.0273909	1.5838632	C	-5.3722894	2.1345228	-1.7169298
C	-1.3271438	0.5111594	0.2372057	H	-6.1481800	0.1062552	-1.6350139
C	-2.4342568	-0.2339457	-0.2385286	H	-3.9715720	-0.9652446	-2.0667189
C	-3.5529417	-0.4712989	0.5690203	C	-1.5662603	0.3863199	-2.4765018
C	-3.6050091	0.0265280	1.8764001	C	-1.8176538	3.1180355	-2.3236370
C	-2.5280353	0.7706984	2.3735987	H	-4.3364049	4.0187192	-1.8461531
O	-1.1231062	0.8109715	-3.0860370	H	-6.3461544	2.5895571	-1.5268428
C	-1.2912756	0.3676692	-4.4705478	C	-0.6143934	2.4880982	-2.5597206
H	-0.3413242	0.5082414	-5.0102049	H	-1.8725034	4.2075941	-2.2753510
H	-1.5385539	-0.7046625	-4.4691508	H	0.3053063	3.0608317	-2.6995058
C	0.5886764	-2.3450857	-1.5999899	N	-0.4836791	1.1351465	-2.6384469
O	-0.2689301	-1.3978296	-2.3006803	P	-1.2182315	-1.4244759	-2.6132413
H	-0.0908632	-3.1106619	-1.1993217	O	-1.9045457	-2.1373047	-1.2978239
H	1.0709432	-1.8430005	-0.7442149	O	-2.2764499	-1.8694401	-3.7712794
O	1.5000873	0.5234547	-2.7612254	C	-1.1822171	-2.0736931	-0.0263528
Na	2.7976514	1.8611652	-1.4672796	H	-0.1919303	-2.5350019	-0.1573884
H	1.6667672	2.6062059	1.5829148	H	-1.0427311	-1.0161771	0.2534903
H	-0.2794531	2.2002933	3.0704982	C	-2.3249638	-3.2792580	-4.1798339
H	-2.5573773	1.1678414	3.3918886	H	-2.5480322	-3.8942446	-3.2945726
H	-4.4786139	-0.1604212	2.5045292	H	-1.3372367	-3.5650153	-4.5713456
H	-4.3885879	-1.0506726	0.1693658	O	0.2343040	-1.7814922	-2.8249563
H	-2.4182503	-0.6311577	-1.2532993	C	-3.4022947	-3.4126560	-5.2324980
C	-2.4026177	1.1907354	-5.0860972	H	-3.4651894	-4.4612342	-5.5582726
H	-2.5621003	0.8744965	-6.1276319	H	-3.1743760	-2.7911095	-6.1098085
H	-2.1487476	2.2602058	-5.0838398	H	-4.3815366	-3.1153156	-4.8316611
H	-3.3432527	1.0507256	-4.5346482	C	-2.0073387	-2.8051914	1.0092968
C	1.6163136	-2.9528033	-2.5366314	H	-1.4831180	-2.7862652	1.9759992
H	2.2143850	-3.7017939	-1.9955653	H	-2.1580378	-3.8546031	0.7187420
H	2.2912731	-2.1787917	-2.9274063	H	-2.9893109	-2.3282567	1.1381946
H	1.1229363	-3.4510320	-3.3834291				

1a_Homo_Fragment				**1u**_Homo_Fragment			
C	3.9836296	0.7933567	-3.2347172	C	3.9994763	0.8726608	-3.2219784
C	4.2619998	0.6374552	-4.6916230	C	4.2046433	0.7875821	-4.7079922
H	5.0956855	1.2852717	-5.0232880	H	3.4345352	1.3556817	-5.2510203
H	3.3945082	0.9180090	-5.3142117	H	4.0913469	-0.2645201	-5.0203230
H	4.5340044	-0.3971604	-4.9371984	C	3.4032237	2.0120137	-2.6024408
H	4.2181835	-0.0442601	-2.5723271	C	3.1434216	2.0479239	-1.1951731
C	3.4555065	1.9621876	-2.6353124	C	2.5616848	3.1561652	-0.5896978
C	3.2341202	2.0130748	-1.2231381	C	2.2141750	4.2872831	-1.3448935
C	2.7195670	3.1491017	-0.6129930	C	2.4602920	4.2832631	-2.7274993
C	2.4003388	4.2857589	-1.3768816	C	3.0360645	3.1791374	-3.3448775
C	2.6072014	4.2622433	-2.7658070	H	3.3939064	1.1825602	-0.5799450
C	3.1232255	3.1308187	-3.3883309	H	2.3735185	3.1423669	0.4865103
H	3.4793791	1.1332416	-0.6224638	H	1.7599880	5.1561811	-0.8653289
H	2.5620840	3.1587758	0.4679379	H	2.1993345	5.1576778	-3.3283623
H	1.9958158	5.1778396	-0.8953320	H	3.2197455	3.2153356	-4.4194811

H	2.3609556	5.1416257	-3.3655863	C	4.4790516	-0.2909547	-2.4056733
H	3.2785810	3.1358073	-4.4687494	H	5.0312737	0.0187036	-1.5042681
				H	5.1381117	-0.9398495	-2.9991239
				H	3.6371470	-0.9193665	-2.0576114
				C	5.6007572	1.2816020	-5.1462271
				H	5.7320858	1.1667999	-6.2328045
				H	6.3960090	0.7098508	-4.6449542
				H	5.7377182	2.3431876	-4.8924266

1a_Hetero_Fragment				**1u**_Hetero_Fragment			
C	3.8570075	0.6891073	-3.2346887	C	3.8951015	0.7474042	-3.2042698
C	4.2647360	0.6360786	-4.6885580	C	4.2157554	0.7094589	-4.6853253
H	5.1261783	1.2957483	-4.9372924	H	3.4338506	1.2171949	-5.2798804
H	3.4549506	0.9391316	-5.3782680	H	4.2102742	-0.3404359	-5.0312638
H	4.5541303	-0.3855539	-4.9792314	C	3.4484124	1.9471639	-2.5966602
H	4.3413283	-0.0372546	-2.5688860	C	3.3688574	2.1188871	-1.1553852
C	3.4353159	1.8999281	-2.6250209	C	2.7758161	3.2313311	-0.5660122
C	3.2598878	2.0221159	-1.1946262	C	2.2428406	4.2854865	-1.3317726
C	2.7470193	3.1684015	-0.6002911	C	2.3688271	4.1914140	-2.7322737
C	2.3809592	4.2944853	-1.3663181	C	2.9566641	3.0915901	-3.3470796
C	2.5740472	4.2254016	-2.7568296	H	3.7868390	1.3460910	-0.5068155
C	3.0875305	3.0853328	-3.3726804	H	2.7427499	3.2892449	0.5270735
H	3.5482886	1.1737636	-0.5626469	H	1.7906338	5.1590609	-0.8595621
H	2.6398703	3.1972559	0.4887847	H	2.0132518	5.0142666	-3.3613026
H	1.9829512	5.1941569	-0.8939290	H	3.0495819	3.0930387	-4.4357922
H	2.3267576	5.0923074	-3.3783328	Na	1.3522979	0.5636093	-2.8994155
H	3.2309785	3.0879486	-4.4559905	C	5.5793692	1.3339038	-5.0542455
Na	1.4405520	0.2066710	-2.7240458	H	5.7825322	1.2797986	-6.1372103
				H	6.3978401	0.8149108	-4.5311960
				H	5.6122038	2.3927953	-4.7539485
				C	4.5757860	-0.3102822	-2.3613975
				H	4.0032239	-0.5846327	-1.4567779
				H	5.5846865	-0.0157917	-1.9948508
				H	4.7129955	-1.2381005	-2.9406644

5a				**6a**			
C	-6.0838422	-1.4744277	1.5751674	C	-5.7217635	-1.9166102	0.9780977
C	-4.7081562	-1.2603341	1.4209740	C	-4.7305924	-1.1564450	1.5699041
C	-4.2079042	-0.1202055	0.7873919	C	-4.3515338	0.0986353	1.0208878
C	-5.1109713	0.8459543	0.2600650	C	-5.0234073	0.5600907	-0.1606527
C	-6.4990185	0.6183941	0.4332779	C	-6.0378056	-0.2429201	-0.7477259
C	-6.9795704	-0.5171341	1.0809810	C	-6.3810261	-1.4574738	-0.1880517
H	-6.4476463	-2.3733615	2.0773135	H	-6.0010044	-2.8785786	1.4120008
H	-4.0118945	-2.0097865	1.8052851	H	-4.2429091	-1.5243931	2.4723977
C	-2.6961576	0.1333515	0.6912547	C	-3.3298299	0.9403668	1.5874628
C	-4.5891631	1.9910683	-0.4251255	C	-4.6401991	1.8170875	-0.6972597
H	-7.2011296	1.3596354	0.0395758	H	-6.5412130	0.1184806	-1.6475712
H	-8.0572162	-0.6606464	1.1979073	H	-7.1625572	-2.0687483	-0.6437204
C	-3.2197794	2.1027456	-0.5782885	C	-3.6484520	2.5338827	-0.0695519
H	-5.2619035	2.7366788	-0.8519296	H	-5.1272318	2.2043025	-1.5946866
H	-2.8267672	2.9596118	-1.1449682	H	-3.3288829	3.5049329	-0.4574714

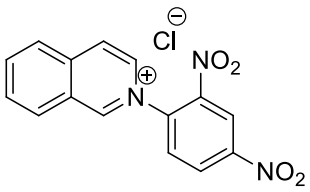
N	-2.2680099	1.2777828	-0.1067038	N	-2.9993653	2.1086426	1.0530060
C	-2.0818179	0.1805863	2.1543826	C	-2.5958206	0.5159566	2.8547633
P	-1.8819713	-1.3265264	-0.2422022	C	-1.2907900	1.2954279	3.0775901
O	-1.9148422	-2.7120573	0.6634800	H	-0.7763531	0.9070239	3.9681841
O	-2.9901089	-1.6186344	-1.4081547	H	-1.4932612	2.3641491	3.2260477
C	-0.6985560	-3.4151342	1.0604164	H	-0.6230271	1.1944194	2.2105342
H	-0.7473630	-4.4083429	0.5887249	H	-2.3320413	-0.5490349	2.7432321
H	0.1766676	-2.8847993	0.6576495	C	-3.4996186	0.6287227	4.0801759
C	-2.7118571	-2.6612275	-2.3872359	C	-3.5270020	-0.3944857	5.0392977
H	-2.6559010	-3.6316566	-1.8672442	C	-4.3184497	-0.2813319	6.1868815
H	-1.7378264	-2.4626928	-2.8629700	C	-5.0980136	0.8619938	6.3907270
O	-0.4730617	-1.0614435	-0.7950872	C	-5.0767084	1.8895333	5.4408088
H	-2.2853040	-0.8049034	2.6034930	C	-4.2837516	1.7728620	4.2957458
C	-0.6407562	-3.5302505	2.5712055	H	-2.9209529	-1.2918238	4.8839675
H	0.2331467	-4.1334845	2.8602881	H	-4.3273604	-1.0894427	6.9219524
H	-1.5428069	-4.0215976	2.9624444	H	-5.7199657	0.9519461	7.2837994
H	-0.5470187	-2.5422313	3.0433589	H	-5.6827891	2.7856563	5.5911725
C	-3.8346056	-2.6483858	-3.4025332	H	-4.2739514	2.5792694	3.5582117
H	-3.6645765	-3.4352368	-4.1521549				
H	-3.8821751	-1.6792272	-3.9187503				
H	-4.8016303	-2.8338221	-2.9144476				
C	-0.5664882	0.4168940	2.1931342				
H	-0.2139193	0.4216635	3.2346108				
H	-0.3091110	1.3895716	1.7496341				
H	-0.0140118	-0.3638978	1.6503184				
C	-2.8258598	1.2086341	2.9885248				
C	-3.7289431	0.7948303	3.9802866				
C	-4.4387734	1.7240565	4.7457291				
C	-4.2573580	3.0940984	4.5292055				
C	-3.3596391	3.5209883	3.5445691				
C	-2.6485286	2.5874690	2.7856044				
H	-3.8874215	-0.2738550	4.1439893				
H	-5.1375315	1.3775025	5.5108275				
H	-4.8116534	3.8238638	5.1236837				
H	-3.2131980	4.5888740	3.3655012				
H	-1.9646941	2.9282476	2.0073754				
Na	-0.1173101	1.1997464	-1.0202474				

4a'				DEPNa (Cat_Na)			
C	-5.4139980	0.9368612	-2.0699701	P	-1.5186251	-0.3180589	-0.2026322
C	-4.1793665	0.3166784	-2.1274423	O	-0.9724535	0.6498813	-1.5070997
C	-3.0073219	1.0956790	-2.2785291	O	-1.2817033	0.9247502	0.9851400
C	-3.0968017	2.5321964	-2.3725611	O	-0.4182813	-1.3916880	-0.0373934
C	-4.3821158	3.1303719	-2.3114238	C	-1.7944093	1.7709432	-1.8816966
C	-5.5122437	2.3466324	-2.1629309	H	-1.6128992	2.6089485	-1.1864708
H	-6.3204570	0.3407212	-1.9518132	H	-2.8673425	1.5042422	-1.7976163
H	-4.0888499	-0.7687109	-2.0569716	C	-1.6382453	0.5573840	2.3297194
C	-1.6876517	0.5828920	-2.3478327	H	-2.0913233	1.4461349	2.7983782
C	-1.8905593	3.2779310	-2.5197728	H	-2.4156793	-0.2351002	2.3187379
H	-4.4657408	4.2174377	-2.3822280	C	-1.4632049	2.1725674	-3.3081771
H	-6.4954046	2.8191116	-2.1157404	H	-2.0654103	3.0435280	-3.6087995
C	-0.6777126	2.6317826	-2.5689087	H	-1.6713212	1.3482238	-4.0060589

H	-1.9323165	4.3664934	-2.5922381	H	-0.4006770	2.4424451	-3.3977922
H	0.2687363	3.1625581	-2.6785032	C	-0.4316754	0.0864616	3.1312381
N	-0.6152771	1.2549108	-2.4784914	H	-0.7271299	-0.1521415	4.1652763
				H	0.3384628	0.8714766	3.1658956
				H	0.0071110	-0.8092976	2.6702089
				Na	-4.0870522	-1.3697046	-0.4399579

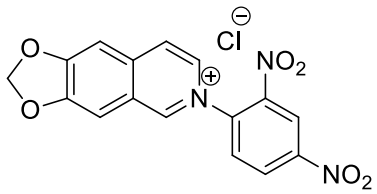
Compound Characterization data

2-(2,4-dinitrophenyl)isoquinolin-2-ium chloride (S1)



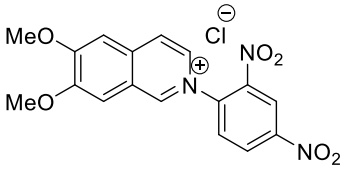
The titled compound was prepared following the literature procedure, obtained as a brown solid (1.7 g, 88% yield). R_f (MeOH/DCM; 10:90) = 0.8. The spectral values were matched favorably with previously reported literature values.[20]

6-(2,4-dinitrophenyl)-[1,3]dioxolo[4,5-g]isoquinolin-6-ium chloride (S2)



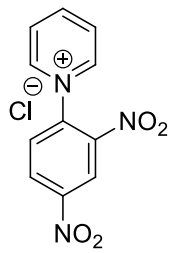
The titled compound was prepared following the literature procedure,[20] obtained as a yellowish solid (2.0 g, 90% yield). R_f (MeOH/DCM; 10:90) = 0.10. MP = 223.4 - 224.5 °C. **^{1}H NMR (400 MHz, DMSO-d_6)** δ 10.13 (s, 1H), 9.13 (d, *J* = 2.50 Hz, 1H), 9.00 (dd, *J* = 8.75, 2.50 Hz, 1H), 8.91 (dd, *J* = 6.88, 1.50 Hz, 1H), 8.60 - 8.49 (m, 2H), 7.94 (d, *J* = 3.00 Hz, 2H), 6.53 (s, 2H).**^{13}C NMR (100 MHz, DMSO-d_6)** δ 157.9, 151.8, 148.8, 146.7, 143.4, 139.1, 139.1, 134.5, 132.1, 130.1, 125.0, 123.3, 121.6, 105.0, 104.6, 103.5. **FTIR (cm^{-1}):** 3111, 3046, 2924, 1607, 1543, 1462, 1350, 1277, 1179, 1031, 967, 918, 740. **HRMS** (ESI) *m/z* Calculated for $C_{16}H_{10}N_3O_6$ $[M]^+$: 340.0564, found: 340.0572.

2-(2,4-dinitrophenyl)-6,7-dimethoxyisoquinolin-2-ium chloride (S3)



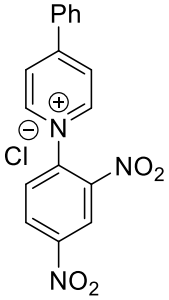
The titled compound was prepared following the literature procedure,[20] obtained as a yellowish solid (2.1 g, 89% yield). R_f (MeOH/DCM; 10:90) = 0.10. MP = 133.5 – 135.5 °C. **^{1}H NMR (400 MHz, DMSO-d_6)** δ 10.11 (s, 1H), 9.14 (d, *J* = 2.38 Hz, 1H), 9.00 (dd, *J* = 8.63, 2.38 Hz, 1H), 8.88 (d, *J* = 6.75 Hz, 1H), 8.61 - 8.48 (m, 2H), 8.01 (s, 1H), 7.97 (s, 1H), 4.16 (s, 3H), 4.04 (s, 3H).**^{13}C NMR (100 MHz, DMSO-d_6)** δ 59.3, 152.9, 148.9, 146.4, 143.5, 139.3, 136.6, 134.0, 132.1, 130.2, 123.4, 122.8, 121.7, 108.1, 106.4, 57.3, 56.6. **FTIR (cm^{-1}):** 2077, 1613, 1528, 1489, 1428, 1350, 1270, 1195, 997. **HRMS** (ESI) *m/z* Calculated for $C_{17}H_{14}N_3O_6$ $[M]^+$: 356.0877, found: 356.0893.

1-(2,4-dinitrophenyl)pyridin-1-ium chloride (S4)



The titled compound was prepared following the literature procedure, obtained as a yellowish solid (1.6 g, 93% yield). R_f (MeOH/DCM; 10:90) = 0.11. The spectral values were matched favorably with previously reported literature values.[21]

1-(2,4-dinitrophenyl)-4-phenylpyridin-1-ium chloride (S5)

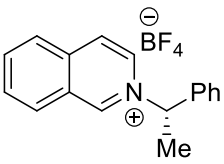


The titled compound was prepared following the literature procedure, obtained as a yellowish solid (1.46 g, 82% yield). R_f (MeOH/DCM; 10:90) = 0.12. The spectral values were matched favorably with previously reported literature values.[22]

Compound characterization data for pyridinium salts:

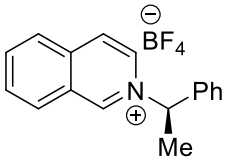
The e.r. for each pyridinium salts were confirmed by the HPLC analysis of their oxidation product (pyridone).[23,24]

(S)-2-(1-phenylethyl)isoquinolin-2-ium tetrafluoroborate (1a)



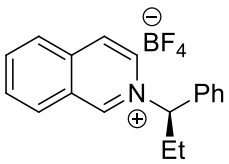
The titled compound was prepared by following the above procedure **A**, obtained as brown solid (1.3 g, 67% yield, 99.0:1.0 e.r. (98% ee). $\mathbf{R}_f$ (MeOH/DCM = 10:90) = 0.6. The spectral values were matched favorably with previously reported literature values.[25]

(R)-2-(1-phenylethyl)isoquinolin-2-ium tetrafluoroborate (*ent*-1a)



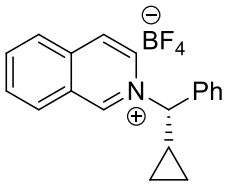
The titled compound was prepared by following the above procedure **A**, obtained as brown solid (1.3 g, 68% yield, 2.5:97.5 e.r. (95% ee). $\mathbf{R}_f$ (MeOH/DCM = 10:90) = 0.6. The spectral values were matched favorably with previously reported literature values.[25]

(R)-2-(1-phenylpropyl)isoquinolin-2-ium tetrafluoroborate (1b)



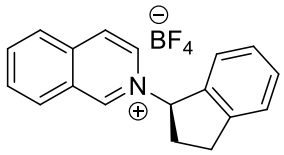
The titled compound was prepared by following the above procedure **A**, obtained as a yellow solid (1.5 g, 75% yield, 1.5:98.5 e.r. (97% ee). $[\alpha]_D^{25}$+1.2 (c = 1.0, CH_2Cl_2). R_f (MeOH/DCM; 10:90) = 0.4. MP = 116.5 - 117.0 °C.**^{1}H NMR (500 MHz, DMSO-*d*$_6$)** δ 10.36 (s, 1H), 8.92 (d, *J* = 6.87 Hz, 1H), 8.63 (d, *J* = 6.87 Hz, 1H), 8.58 (d, *J* = 8.39 Hz, 1H), 8.37 (d, *J* = 8.01 Hz, 1H), 8.30 (t, *J* = 7.44 Hz, 1H), 8.13 (t, *J* = 7.63 Hz, 1H), 7.70 (d, *J* = 7.25 Hz, 2H), 7.55 - 7.42 (m, 3H), 6.08 (t, *J* = 7.63 Hz, 1H), 2.68 - 2.62 (m, 2H), 0.94 (t, *J* = 7.06 Hz, 3H).**^{13}C NMR (125 MHz, DMSO-*d*$_6$)** δ 148.8, 137.3, 136.8, 133.3, 131.4, 130.8, 129.5, 129.3, 127.8, 127.5, 127.3, 126.7, 75.4, 26.0, 10.4.**FTIR (cm^{-1}):** 3067, 2977, 2937, 2885, 1643, 1507, 1462, 1399, 1274, 1066, 884, 827, 738. **HRMS** (ESI) *m/z* Calculated for $C_{18}H_{18}N$ $[M]^+$: 248.1433, found: 248.1443.

(S)-2-(cyclopropyl(phenyl)methyl)isoquinolin-2-ium tetrafluoroborate (1c)



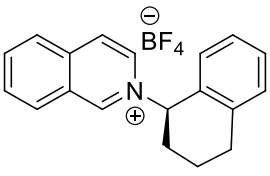
The titled compound was prepared by following the above procedure **A**, obtained as a yellow solid (1.5 g, 75% yield, 5.2:94.8 e.r. (90% ee).$[\alpha]_D^{25}$-1.5 (c = 1.0, CH_2Cl_2). R_f (MeOH/DCM; 10:90) = 0.4. MP = 118.2 – 120.5 °C.**^{1}H NMR (400 MHz, DMSO-d_6)** δ 10.37 (s, 1H), 8.86 (dd, *J* = 6.94, 1.44 Hz, 1 H), 8.63 (dd, *J* = 7.25, 4.50 Hz, 2H), 8.40 (d, *J* = 8.13 Hz, 1H), 8.32 (ddd, *J* = 8.22, 7.04, 1.13 Hz, 1H), 8.14 (ddd, *J* = 8.25, 7.07, 1.06 Hz, 1H), 7.64 - 7.59 (m, 2H), 7.52 - 7.43 (m, 3H), 5.51 (d, *J* = 10.26 Hz, 1H), 2.24 - 2.14 (m, 1H), 1.08 - 1.00 (m, 1H), 0.85 - 0.75 (m, 2H), 0.75 - 0.69 (m, 1H).**^{13}C NMR (100 MHz, DMSO-d_6)** δ 148.8, 137.6, 137.3, 137.3, 133.7, 131.4, 130.9, 129.2, 129.2, 127.5, 127.4, 127.3, 126.4, 78.5, 15.0, 6.5, 4.8.**FTIR (cm^{-1}):** 3072,2923, 1643, 1505, 1462, 1396, 1281, 1064, 881, 828, 735. **HRMS** (ESI) *m/z* Calculated for $C_{19}H_{18}N$ $[M]^+$: 260.1434, found: 260.1441.

(R)-2-(2,3-dihydro-1H-inden-1-yl)isoquinolin-2-ium tetrafluoroborate (1d)



The titled compound was prepared by following the above procedure **B**, obtained as a brown solid (1.4 g, 70% yield, 99.1:0.9 e.r. (98% ee). $[\alpha]_D^{25}$-1.6 (c = 0.7, CH_2Cl_2). R_f (MeOH/DCM; 10:90) = 0.40. MP = 180.6 – 181.5 °C. **^{1}H NMR (400 MHz, DMSO-d_6)** δ 10.08 (s, 1H), 8.64 - 8.48 (m, 3H), 8.38 (d, *J* = 8.25 Hz, 1H), 8.29 (ddd, *J* = 8.22, 7.04, 1.13 Hz, 1H), 8.10 (ddd, *J* = 8.29, 7.04, 1.06 Hz, 1H), 7.52 (d, *J* = 7.63Hz,1H), 7.47 (td, *J* = 7.19, 1.50 Hz, 1H), 7.39 - 7.27 (m, 2H), 6.59 (dd, *J* = 8.38, 5.38 Hz, 1H), 3.44 - 3.34 (m, 1H), 3.19 - 3.09 (m, 1H), 3.07 – 2.98 (m, 1H). 2.53 – 2.62 (m, 1H).**^{13}CNMR (100 MHz, DMSO-d_6)** δ 149.3, 145.0, 138.9, 137.4, 137.1, 133.1, 131.2, 130.8, 130.0, 127.5, 127.6, 127.3, 126.5, 125.5, 125.3, 75.6, 33.7, 30.2.**FTIR (cm^{-1}):** 3075, 2995, 2938, 2867, 1642, 1516, 1467, 1401, 1286, 1179, 1049, 829, 765.**HRMS** (ESI) *m/z* Calculated for $C_{18}H_{16}N[M]^+$: 246.1277, found: 246.1288.

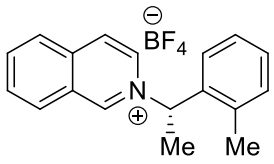
(R)-2-(1,2,3,4-tetrahydronaphthalen-1-yl)isoquinolin-2-ium tetrafluoroborate (1e)



The titled compound was prepared by following the above procedure **A**, obtained as a yellow solid (1.4 g, 67% yield, 99.3:0.7 e.r. (99% ee).$[\alpha]_D^{25}$+1.6 (c = 1.0, CH_2Cl_2). R_f (MeOH/DCM; 10:90) = 0.45. MP = 127.0 – 129.2 °C.**^{1}H NMR (500 MHz, DMSO-d_6)** δ10.10 (s, 1H), 8.67 (dd, *J* = 6.87, 1.14 Hz, 1H), 8.59 (d, *J* = 6.87 Hz, 1H), 8.54 (d, *J* = 8.01 Hz, 1H), 8.38 (d, *J* = 8.01 Hz, 1H), 8.31 - 8.28 (m, 1H), 8.13 - 8.06 (m, 1H), 7.41 - 7.33 (m, 2H), 7.19 - 7.16 (m, 1H), 6.94 (d, *J* = 7.63 Hz, 1H), 6.35 (t, *J* = 7.06 Hz, 1H), 3.02 - 3.12 (m, 1H), 2.91 (dt, *J* = 17.07, 5.39 Hz, 1H), 2.53 - 2.61 (m, 1H), 2.39 - 2.30 (m, 1H), 2.04 - 1.94 (m, 1H), 1.93 - 1.82 (m, 1H).**^{13}C NMR (125 MHz, DMSO-d_6)** δ 150.3, 139.0, 137.4, 137.2, 134.1, 131.7, 131.3, 130.8, 129.7, 129.0, 128.6, 127.4, 127.3, 126.9, 126.3, 69.5, 31.5, 28.4, 19.7.**FTIR (cm^{-1}):** 3067, 2938, 2868,1644,

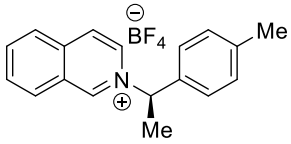
1505, 1456, 1401, 1284, 1062, 878, 827, 752. **HRMS** (ESI) *m/z* Calculated for $C_{19}H_{18}N$ $[M]^+$: 260.1434, found: 260.1434.

(S)-2-(1-(o-tolyl)ethyl)isoquinolin-2-ium tetrafluoroborate (1f)



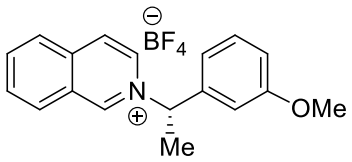
The titled compound was prepared by following the above procedure **A**, obtained as a brown solid (1.4 g, 71% yield, 98.4:1.6 e.r. (97% ee).$[\alpha]_D^{25}$-1.8 (c = 1.0, CH_2Cl_2). R_f (MeOH/DCM; 10:90) = 0.41. MP = 118.9 – 119.7 °C. **^{1}H NMR (400 MHz, DMSO-d_6)** δ 10.20 (s, 1H), 8.81 - 8.67 (m, 1H), 8.65 - 8.55 (m, 2H), 8.40 - 8.33 (m, 1H), 8.33 - 8.24 (m, 1H), 8.11 (t, *J* = 7.63 Hz, 1H), 7.58 - 7.48 (m, 1H), 7.40 - 7.33 (m, 2H), 7.33 - 7.26 (m, 1H), 6.49 (q, *J* = 6.80 Hz, 1H), 2.32 (s, 3H), 2.11 (d, *J* = 6.88 Hz, 3H).**^{13}C NMR (100 MHz, DMSO-d_6)** δ 148.7, 137.2, 137.2, 135.8, 133.9, 131.3, 131.2, 130.9, 129.4, 127.4, 127.2, 126.9, 126.7, 126.3, 66.7, 20.6, 18.9.**FTIR (cm^{-1}):** 3068, 2923, 2857, 1641, 1460, 1395, 1283, 1054, 827, 764. **HRMS** (ESI) *m/z* Calculated for $C_{18}H_{18}N$ $[M]^+$: 248.1434, found: 248.1445.

(R)-2-(1-(p-tolyl)ethyl)isoquinolin-2-ium tetrafluoroborate (1g)



The titled compound was prepared by following the above procedure **A**, obtained as a yellow solid (1.4 g, 70% yield, 1.3:98.7 e.r. (97% ee). $[\alpha]_D^{25}$-2.1 (c = 1.0, CH_2Cl_2). R_f (MeOH/DCM; 10:90) = 0.4. MP = 123.8 – 124.5 °C. **^{1}H NMR (400 MHz, DMSO-d_6)** δ 10.31 (s, 1H), 8.83 (dd, *J* = 7.33, 1.37 Hz, 1H), 8.60 - 8.56 (m, 2H), 8.41 - 8.33 (m, 1H), 8.33 - 8.24 (m, 1H), 8.16 - 8.08 (m, 1H), 7.51 (d, *J* = 7.78 Hz, 2H), 7.29 (d, *J* = 7.78 Hz, 2H), 6.30 (q, *J* = 6.87 Hz, 1H), 2.32 (s, 3H), 2.15 (d, *J* = 6.87 Hz, 3H).**^{13}C NMR (100 MHz, DMSO-d_6)** δ 148.7, 138.9, 137.2, 135.2, 133.4, 131.3, 130.8, 129.7, 127.4, 127.3, 127.3, 126.3, 69.3, 20.7, 19.8.**FTIR (cm^{-1}):** 3068, 2990, 2926,1644, 1515, 1461, 1399, 1282, 1064, 879, 828, 734, 694. **HRMS** (ESI) *m/z* Calculated for $C_{18}H_{18}N$ $[M]^+$: 248.1434, found: 248.1445.

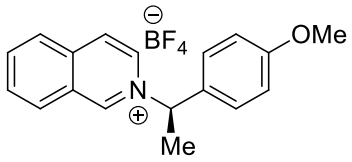
(S)-2-(1-(3-methoxyphenyl)ethyl)isoquinolin-2-ium tetrafluoroborate (1h)



The titled compound was prepared by following the above procedure **A**, obtained as a sticky solid (1.6 g, 76% yield, 99.7:0.3 e.r. (99% ee). $[\alpha]_D^{25}$-0.5 (c = 1.0, CH_2Cl_2). R_f (MeOH/DCM; 10:90) = 0.37. **^{1}H NMR (400 MHz, DMSO-d_6)** δ 10.35 (s, 1H), 8.91 (dd, *J* = 6.87, 1.37 Hz, 1H), 8.64 - 8.61 (m, 2H), 8.39 (d, *J* = 8.24 Hz, 1H), 8.35 - 8.27 (m, 1H), 8.14 (t, *J* = 7.56 Hz, 1H), 7.43 (t, *J* = 8.0 Hz, 1H), 7.32 - 7.27 (m, 1H), 7.23 (d, *J* = 7.79 Hz, 1H), 7.03 (dd, *J* = 8.01, 2.06 Hz, 1H), 6.34 (q, *J* = 6.87 Hz, 1H), 3.83 (s, 3H), 2.22 (d, *J* = 7.33 Hz, 3H).**^{13}C NMR (100 MHz, DMSO-d_6)** δ 159.7, 148.8, 139.6, 137.2, 137.2, 133.4, 131.3, 130.9, 130.5, 127.4, 127.3, 126.4, 119.4, 114.6, 113.4, 69.5, 55.3, 19.7.**FTIR (cm^{-1}):** 3027, 2937, 2846, 1643, 1518,

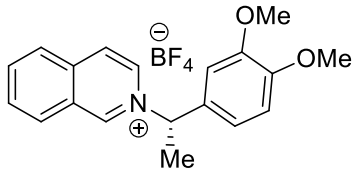
1461, 1408, 1259, 1154,1064, 870, 822,760. **HRMS** (ESI) *m/z* Calculated for $C_{18}H_{18}NO$ $[M]^+$: 264.1383, found: 264.1390.

(R)-2-(1-(4-methoxyphenyl)ethyl)isoquinolin-2-ium tetrafluoroborate (1i)



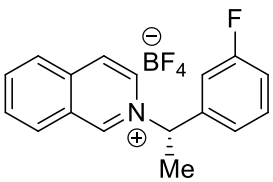
The titled compound was prepared by following the above procedure **A**, obtained as a sticky solid (1.6 g, 74% yield, 0.5:99.5 e.r. (99% ee). $[\alpha]_D^{25}$+0.4 (c = 1.1, CH_2Cl_2). R_f(MeOH/DCM; 10:90) = 0.37. **^{1}H NMR (400 MHz, DMSO-*d*$_6$)** δ10.28 (s, 1H), 8.83 (dd, *J* = 6.94, 1.44 Hz, 1H), 8.58 (t, *J* = 8.0 Hz, 2H), 8.39 - 8.33 (m, 1H), 8.31 - 8.26 (m, 1H), 8.12 (ddd, *J* = 8.19, 7.07, 1.00 Hz, 1H), 7.60 (d, *J* = 8.75 Hz, 2H), 7.04 (d, *J* = 8.76 Hz, 2H), 6.30 (q, *J* = 6.96 Hz, 1H), 3.79 (s, 3H), 2.15 (d, *J* = 7.13 Hz, 3H).**^{13}C NMR (100 MHz, DMSO-*d*$_6$)** δ 159.9, 148.6, 137.2, 137.1, 133.2, 131.3, 130.7, 129.9, 129.0, 127.4, 127.3, 126.3, 114.5, 69.2, 55.3, 19.9. **FTIR (cm^{-1}):** 3076, 2972, 2844, 1643, 1514, 1463, 1397, 1256, 1178, 1064, 879, 834, 761. **HRMS** (ESI) *m/z* Calculated for $C_{18}H_{18}NO[M]^+$: 264.1383, found: 264.1387.

(S)-2-(1-(3,4-dimethoxyphenyl)ethyl)isoquinolin-2-ium tetrafluoroborate (1j)



The titled compound was prepared by following the above procedure **A**, obtained as a sticky solid (1.6 g, 72% yield, 98.2:1.8 e.r.(96% ee). $[\alpha]_D^{25}$-1.1 (c = 1.0, CH_2Cl_2). R_f(MeOH/DCM; 10:90) = 0.35. **^{1}H NMR (400 MHz, DMSO-*d*$_6$)** δ 10.26 (s, 1H), 8.82 (dd, *J* = 6.94, 1.31 Hz, 1H), 8.63 - 8.48 (m, 2H), 8.39 - 8.31 (m, 1H), 8.31 - 8.23 (m, 1H), 8.14 - 8.06 (m, 1H), 7.25 (d, *J* = 2.00 Hz, 1H), 7.20 (dd, *J* = 8.38, 2.00 Hz, 1H), 7.03 (d, *J* = 8.50 Hz, 1H), 6.24 (q, *J* = 6.96 Hz, 1H), 3.78 (s, 3H), 3.76 (s, 3H), 2.12 (d, *J* = 7.00 Hz, 3H).**^{13}C NMR (100 MHz, DMSO-*d*$_6$)** δ 149.6, 149.0, 148.5, 137.1, 137.0, 133.2, 131.2, 130.8, 130.0, 127.3, 127.2, 126.2, 120.1, 111.9, 111.4, 69.6, 55.7, 55.5, 19.9.**FTIR (cm^{-1}):** 3074, 2933, 2847, 1643, 1601, 1518, 1461, 1408, 1260, 1155, 1064, 870, 824, 762.**HRMS** (ESI) *m/z* Calculated for $C_{19}H_{20}NO_2$ $[M]^+$:294.1488, found: 294.1495.

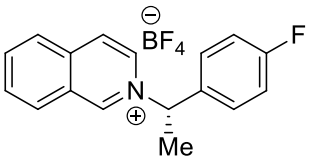
(S)-2-(1-(3-fluorophenyl)ethyl)isoquinolin-2-ium tetrafluoroborate (1k):



The titled compound was prepared by following the above procedure **B**, obtained as sticky liquid (762 mg, 75 % yield, 99.1:0.9 e.r.(98% ee).$[\alpha]_D^{25}$-0.8 (c = 1.0, CH_2Cl_2). R_f(MeOH/DCM; 10:90) = 0.37. **^{1}H NMR (500 MHz, DMSO-*d*$_6$)** δ 10.30 (s, 1H), 8.84 (dd, *J* = 6.87, 1.14 Hz, 1H), 8.62 - 8.56 (m, 2H), 8.40 - 8.34 (m, 1H), 8.33 - 8.27 (m, 1H), 8.16 - 8.08 (m, 1H), 7.59 - 7.48 (m, 2H), 7.44 (d, *J* = 8.01 Hz, 1H), 7.29 (td, *J* = 8.49, 2.10 Hz, 1H), 6.36 (q, *J* = 6.87 Hz, 1H), 2.17 (d, *J* = 6.87 Hz, 3H).**^{13}C NMR (125 MHz, DMSO-*d*$_6$)** δ 163.3 (C-F, 1JC-F = 245.09 Hz), 161.4 (C-F, 1JC-F = 245.09 Hz), 149.1, 140.7 (C-F, 4JC-F = 7.63 Hz), 140.6 (C-F, 4JC-F = 7.63 Hz), 137.3, 133.4, 131.3, 131.2, 130.9, 127.4, 127.3, 126.4, 123.7, 116.3 (C-F, 3JC-F = 20.98 Hz), 116.1 (C-

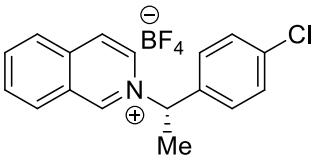
F, 3JC-F = 20.98 Hz), 114.7 (C-F, 2JC-F = 22.89 Hz), 114.5 (C-F, 2JC-F = 22.89 Hz), 68.8, 19.7. **FTIR (cm^{-1}):**3074, 2953, 2923, 2862, 1695, 1644, 1600, 1457, 1397, 1278, 1065, 879, 829, 732. **HRMS** (ESI) *m/z* Calculated for $C_{17}H_{15}NF[M]^+$:252.1183 found: 252.1188.

(S)-2-(1-(4-fluorophenyl)ethyl)isoquinolin-2-ium tetrafluoroborate (1l):



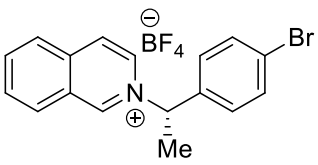
The titled compound was prepared by following the above procedure **A**, obtained as a brown solid (1.4 g, 73 % yield, 95.4:4.6 e.r. (91% ee). $[\alpha]_D^{25}$-0.6 (c = 1.0, CH_2Cl_2). ***R**$_f$*(MeOH/DCM; 10:90) = 0.38. MP = 89.9 – 91.0 °C. **^{1}H NMR (400 MHz, DMSO-*d*$_6$)** δ 10.26 (s, 1H), 8.81 (dd, *J* = 6.88, 1.38 Hz, 1H), 8.56 (t, *J* = 7.75 Hz, 2H), 8.37 - 8.28 (m, 1H), 8.24 (td, *J* = 7.60, 1.06 Hz, 1H), 8.08 (ddd, *J* = 8.16, 7.10, 1.00 Hz, 1H), 7.76 - 7.64 (m, 2H), 7.28 (t, *J* = 8.88 Hz, 2H), 6.34 (q, *J* = 7.00 Hz, 1H), 2.15 (d, *J* = 7.00 Hz, 3H).**^{13}C NMR (100 MHz, DMSO-*d*$_6$)** δ 163.8 (C-F,1JC-F = 246.32 Hz), 161.2 (C-F,1JC-F = 246.32 Hz), 148.8, 137.2, 137.2, 134.3 (C-F, 4JC-F = 3.63 Hz), 134.2 (C-F, 4JC-F = 3.63 Hz), 133.2, 131.3, 130.8, 130.0 (C-F, 3JC-F = 8.72 Hz), 129.9 (C-F, 3JC-F = 8.72 Hz), 127.4, 27.3, 126.4, 116.1 (C-F, 2JC-F = 21.1 Hz), 115.9 (C-F, 2JC-F = 21.1 Hz), 69.9, 19.9. **FTIR (cm^{-1}):** 3081, 2982, 2935, 2868, 1643, 1608, 1512, 1463, 1400, 1283, 1233, 1065, 838, 754.**HRMS** (ESI) *m/z* Calculated for $C_{17}H_{15}NF[M]^+$: 252.1183, found: 252.1183.

(S)-2-(1-(4-chlorophenyl)ethyl)isoquinolin-2-ium tetrafluoroborate (1m)



The titled compound was prepared by following the above procedure **A**, obtained as a sticky liquid (1.5 g, 70% yield, 94.6:5.4 e.r. (89% ee). $[\alpha]_D^{25}$-0.9 (c = 1.0, CH_2Cl_2). ***R**$_f$*(MeOH/DCM; 10:90) = 0.37. **^{1}H NMR (400 MHz, DMSO-*d*$_6$)** δ10.29 (s, 1H), 8.82 (dd, *J* = 6.88, 1.38 Hz, 1H), 8.57 (d, *J* = 8.38 Hz, 1H), 8.59 (d, *J* = 7.00 Hz, 1H), 8.36 (d, *J* = 8.13 Hz, 1H), 8.29 (ddd, *J* = 8.16, 6.97, 1.13 Hz, 1H), 8.12 (ddd, *J* = 8.19, 7.00, 1.06 Hz, 1H), 7.71 - 7.60 (m, 2H), 7.59 - 7.48 (m, 2H), 6.35 (q, *J* = 7.00 Hz, 1H), 2.15 (d, *J* = 7.00 Hz, 3H).**^{13}C NMR (100 MHz, DMSO-*d*$_6$)** δ149.0, 137.3, 137.0, 134.1, 133.4, 131.3, 130.9, 129.5, 129.1, 127.4, 127.3, 126.4, 68.7, 19.8. **FTIR (cm^{-1}):** 3070, 2925, 2857, 1644, 1604, 1498, 1462, 1403, 1276, 1064, 881, 832, 737.**HRMS** (ESI) *m/z* Calculated for $C_{17}H_{15}NCl[M]^+$: 268.0887, found: 268.0897.

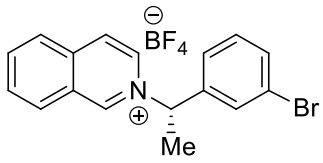
(S)-2-(1-(4-bromophenyl)ethyl)isoquinolin-2-ium tetrafluoroborate (1n)



The titled compound was prepared by following the above procedure **A**, obtained as a sticky liquid (1.6 g, 68% yield, 95.1:4.9 e.r.(90% ee).$[\alpha]_D^{25}$-1.1 (c = 1.0, CH_2Cl_2).***R**$_f$*(MeOH/DCM; 10:90) = 0.33. **^{1}H NMR (400 MHz, DMSO-*d*$_6$)** δ10.28 (s, 1H), 8.81 (dd, *J* = 6.87, 1.37 Hz, 1H), 8.66 - 8.49 (m, 2H), 8.41 - 8.33 (m, 1H), 8.33 - 8.25 (m, 1H), 8.11 (ddd, *J* = 8.24, 6.87, 1.37 Hz, 1H), 7.74 - 7.64 (m, 2H), 7.59 - 7.49 (m, 2H), 6.32 (q, *J* = 6.87 Hz, 1H), 2.13 (d, *J* =

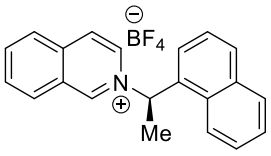
6.87 Hz, 3H).**^{13}C NMR (100 MHz, DMSO-d_6)** δ 149.0, 137.4, 137.3, 137.3, 133.4, 132.1, 131.4, 130.9, 129.8, 127.5, 127.3, 126.5, 122.8, 68.8, 19.8. **FTIR (cm^{-1}):** 3073,2925, 2857, 1644, 1481, 1401, 1277, 1079, 880, 830, 738. **HRMS** (ESI) *m/z* Calculated for $C_{17}H_{15}NBr[M]^+$:312.0382, found: 312.0390.

(S)-2-(1-(3-bromophenyl)ethyl)isoquinolin-2-ium tetrafluoroborate (1o)



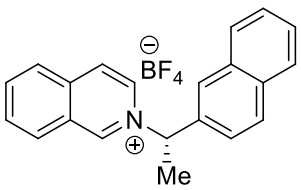
The titled compound was prepared by following the above procedure **A**, obtained as a sticky liquid (1.7 g, 70% yield, 92.7:7.3 e.r. (85% ee). $[\alpha]_D^{25}$-1.2 (c = 1.0, CH_2Cl_2). R_f(MeOH/DCM; 10:90) = 0.33. **^{1}H NMR (400 MHz, DMSO-d_6)** δ 10.31 (s, 1H), 8.84 (d, *J* = 6.87 Hz, 1H), 8.57 (d, *J* = 8.24 Hz, 1H), 8.60 (d, *J* = 6.87 Hz, 1H), 8.36 (d, *J* = 7.78 Hz, 1H), 8.30 (t, *J* = 7.33 Hz, 1H), 8.12 (t, *J* = 7.33 Hz, 1H), 7.90 (s, 1H), 7.68 - 7.56 (m, 2H), 7.51 - 7.38 (m, 1H), 6.33 (q, *J* = 6.72 Hz, 1H), 2.15 (d, *J* = 6.87 Hz, 3H). **^{13}C NMR (100 MHz, DMSO-d_6)** δ 148.7, 140.6, 137.4, 132.9, 131.4, 130.8, 128.5, 128.4, 127.7, 127.4, 126.5, 65.1, 21.2. **FTIR (cm^{-1}):** 3065, 2962, 2928, 2865, 1647, 1467, 1391, 1275, 1198, 1067, 883, 825, 734.**HRMS** (ESI) *m/z* Calculated for $C_{17}H_{15}BrN[M+H]^+$: 312.0382, found: 312.0383.

(R)-2-(1-(naphthalen-1-yl)ethyl)isoquinolin-2-ium tetrafluoroborate (1p)



The titled compound was prepared by following the above procedure **A**, obtained as a sticky solid (1.6 g, 72% yield, 2.5:97.5 e.r.(95% ee). $[\alpha]_D^{25}$-1.7 (c = 0.5, CH_2Cl_2). R_f(MeOH/DCM; 10:90) = 0.55. **^{1}H NMR (500 MHz, DMSO-d_6)** δ 10.33 (s, 1H), 8.86 (d, *J* = 6.48 Hz, 1H), 8.58 (d, *J* = 7.25 Hz, 2H), 8.35 (d, *J* = 8.01 Hz, 1H), 8.28 (t, *J* = 7.44 Hz, 1H), 8.17 (d, *J* = 8.01 Hz, 1H), 8.13 - 8.02 (m, 3H), 7.89 (d, *J* = 6.87 Hz, 1H), 7.71 (t, *J* = 7.44 Hz, 1H), 7.65 - 7.54 (m, 2H), 7.18 (q, *J* = 6.49 Hz, 1H), 2.28 (d, *J* = 6.49 Hz, 3H).**^{13}C NMR (125 MHz, DMSO-d_6)** δ 148.9, 137.3, 137.2, 133.7, 133.6, 132.5, 131.3, 130.9, 130.5, 130.2, 129.2, 127.6, 127.4, 127.3, 126.5, 126.4, 126.1, 125.7, 122.4, 66.0, 21.1.**FTIR (cm^{-1}):** 3066, 2964,1641, 1513, 1461, 1394, 1277, 1063, 876, 792. **HRMS** (ESI) *m/z* Calculated for $C_{21}H_{18}N$ $[M]^+$:284.1434, found: 284.1444.

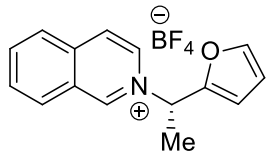
(S)-2-(1-(naphthalen-2-yl)ethyl)isoquinolin-2-ium tetrafluoroborate (1q)



The titled compound was prepared by following the above procedure **A**, obtained as a sticky solid (1.6 g, 73% yield, 98.9:1.1 e.r. (98% ee). $[\alpha]_D^{25}$-2.1 (c = 0.5, CH_2Cl_2). R_f (MeOH/DCM; 10:90) = 0.53. **^{1}H NMR (400 MHz, DMSO-d_6)** δ 10.36 (s, 1H), 8.95 - 8.79 (m, 1H), 8.58 (d, *J* = 6.87 Hz, 2H), 8.36 (d, *J* = 8.39 Hz, 1H), 8.29 (t, *J* = 7.63 Hz, 1H), 8.20 (s, 1H), 8.15 - 8.07 (m, 1H), 7.92 - 8.03 (m, 3H), 7.55 - 7.66 (m, 3H), 6.51 (q, *J* = 6.87 Hz, 1H), 2.25 (d, *J* = 6.87 Hz, 3H).**^{13}C NMR (100 MHz, DMSO-d_6)** δ 148.9, 137.3, 137.2, 133.6, 133.6, 132.5, 131.3, 130.9, 130.4, 130.2, 129.2, 127.5, 127.4, 127.3, 126.5, 126.4, 126.1, 125.6, 122.4, 65.9, 21.1.**FTIR (cm^{-}**

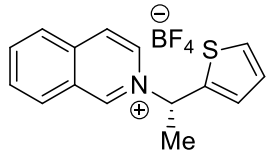
[1]): 3065, 2986, 2926, 2857, 1643, 1513, 1462, 1395, 1278, 1063, 877,820, 776,738. **HRMS** (ESI) *m/z* Calculated for $C_{21}H_{18}N$ $[M]^+$: 284.1433, found: 284.1447.

(S)-2-(1-(furan-2-yl)ethyl)isoquinolin-2-ium tetrafluoroborate (1r)



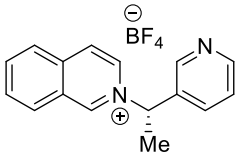
The titled compound was prepared by following the above procedure **B**, obtained as a sticky liquid (681 mg, 73% yield, 99.2:0.8 e.r. (98% ee). $[\alpha]_D^{25}$-1.9 (c = 1.0, CH_2Cl_2). R_f(MeOH/DCM; 10:90) = 0.53. **^{1}H NMR (400 MHz, DMSO-d_6)** δ 10.21 (s, 1H), 8.80 (dd, *J* = 6.88, 1.50 Hz, 1H), 8.63 (d, *J* = 6.88 Hz, 1H), 8.57 (d, *J* = 8.26 Hz, 1H), 8.37 (d, *J* = 8.25 Hz, 1H), 8.30 (ddd, *J* = 8.25, 6.94, 1.19 Hz, 1H), 8.11 (ddd, *J* = 8.22, 6.97, 1.19 Hz, 1H), 7.76 (dd, *J* = 1.88, 0.75 Hz, 1H), 6.93 (dt, *J* = 3.38, 0.81 Hz, 1H), 6.61 (dd, *J* = 3.38, 1.88 Hz, 1H), 6.39 (q, *J* = 7.00 Hz, 1H), 2.10 (d, *J* = 7.00 Hz, 3H).**^{13}C NMR (100 MHz, DMSO-d_6)** δ 150.0, 148.9, 144.9, 137.4, 137.4, 132.8, 131.4, 130.8, 127.4, 127.4, 126.6, 111.2, 111.0, 63.6, 18.6.**FTIR (cm^{-1}):** 3124, 3094, 2992, 2928, 1692, 1644, 1509, 1463, 1398, 1288, 1065, 830, 762.**HRMS** (ESI) *m/z* Calculated for $C_{15}H_{14}NO$ $[M]^+$: 224.1070, found 224.1072.

(S)-2-(1-(thiophen-2-yl)ethyl)isoquinolin-2-ium tetrafluoroborate (1s)



The titled compound was prepared by following the above procedure **B**, obtained as a yellow solid (725 mg, 74% yield, 99.2:0.8e.r.(98% ee).$[\alpha]_D^{25}$-2.2 (c = 0.9, CH_2Cl_2). R_f(MeOH/DCM; 10:90) = 0.53. MP = 116.5 – 118.9 °C. **^{1}H NMR (400 MHz, DMSO-d_6)** δ 10.29 (s, 1H), 8.90 (d, *J* = 6.87 Hz, 1H), 8.62 (d, *J* = 6.87 Hz, 1H), 8.56 (d, *J* = 8.24 Hz, 1H), 8.37 (d, *J* = 8.24 Hz, 1H), 8.30 (t, *J* = 7.56 Hz, 1H), 8.11 (t, *J* = 7.56 Hz, 1H), 7.71 (d, *J* = 5.04 Hz, 1H), 7.51 (d, *J* = 3.21 Hz, 1H), 7.16 (t, *J* = 4.12 Hz, 1H), 6.59 (q, *J* = 6.87 Hz, 1H), 2.20 (d, *J* = 6.87 Hz, 3H).**^{13}C NMR (100 MHz, DMSO-d_6)** δ 148.7, 140.5, 137.4, 132.8, 131.5, 130.8, 128.5, 128.4, 127.7, 127.4, 126.6, 65.3, 21.3.**FTIR (cm^{-1}):** 3095, 2992,2931, 2861, 1642, 1516, 1463, 1398, 1284, 1062, 838, 726. **HRMS** (ESI) *m/z* Calculated for $C_{15}H_{14}NS$ $[M]^+$:240.0841, found: 240.0843.

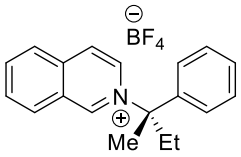
(S)-2-(1-(pyridin-3-yl)ethyl)isoquinolin-2-ium tetrafluoroborate (1t)



The titled compound was prepared by following the above procedure **A**, obtained as a sticky solid (1.4 g, 75% yield, 5.9:94.1 e.r. (88% ee). $[\alpha]_D^{25}$-1.4 (c = 1.1, CH_2Cl_2). R_f (MeOH/DCM; 10:90) = 0.36. **^{1}H NMR (400 MHz, DMSO-d_6)** δ 10.18 (s, 1H), 8.78 (d, *J* = 2.38 Hz, 1H), 8.74 (dd, *J* = 7.00, 1.50 Hz, 1H), 8.59 (dd, *J* = 4.88, 1.50 Hz, 1H), 8.55 - 8.47 (m, 2H), 8.33 - 8.27 (m, 1H), 8.24 (ddd, *J* = 8.22, 6.91, 1.13 Hz, 1H), 8.07 (ddd, *J* = 8.25, 6.88, 1.25 Hz, 1H), 7.99 (dt, *J* = 8.13, 1.88 Hz, 1H), 7.49 (ddd, *J* = 8.04, 4.85, 0.75 Hz, 1H), 6.34 (q, *J* = 7.00 Hz, 1H), 2.15 (d, *J* = 7.00 Hz, 3H).**^{13}C NMR (100 MHz, DMSO-d_6)** δ150.7, 149.3, 149.0, 137.9, 137.8, 136.0, 134.3, 133.6, 131.9, 131.4, 127.9, 127.8, 127.1, 124.9, 68.0, 20.0. **FTIR (cm^{-1}):** 3235, 2995, 2505, 1642, 1464, 1405,

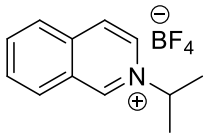
1292, 1068, 831,764. **HRMS** (ESI) *m/z* Calculated for $C_{16}H_{15}N_2$ $[M]^+$: 235.1229, found: 235.1239.

(S)-2-(2-phenylbutan-2-yl)isoquinolin-2-ium tetrafluoroborate (1u)



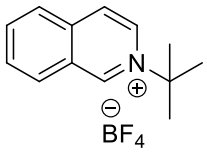
The titled compound was prepared by following the above procedure **B**, obtained as a sticky liquid (0.78 g, 75% yield, 0.9:99.1 e.r.(98% ee).$[\alpha]_D^{25}$-2.3 (c = 1.2, CH_2Cl_2). R_f(MeOH/DCM; 10:90) = 0.36. **^{1}H NMR (500 MHz, DMSO-d_6)** δ 10.28 (s, 1H), 8.70 (d, *J* = 8.39 Hz, 1H), 8.47 (s, 2H), 8.39 - 8.33 (m, 1H), 8.33 - 8.28 (m, 1H), 8.14 (t, *J* = 7.63 Hz, 1H), 7.49 - 7.42 (m, 3H), 7.41 - 7.30 (m, 4H), 2.78 - 2.64 (m, 2H), 2.18 (s, 3H), 0.74 (t, *J* = 7.25 Hz, 3H).**^{13}C NMR (125 MHz, DMSO-d_6)** δ 148.7, 142.4, 137.4, 136.8, 133.6, 131.6, 131.1, 129.0, 129.0, 128.7, 128.1, 127.1, 126.5, 125.7, 76.9, 32.1, 25.6, 8.2. **FTIR (cm^{-1}):** 3051, 2965, 2928, 2834, 1610, 1510, 1461,1300, 1246, 1177, 1032, 826. **HRMS** (ESI) *m/z* Calculated for $C_{19}H_{20}N[M]^+$: 262.1590, found 262.1590.

2-isopropylisoquinolin-2-ium tetrafluoroborate (1v)



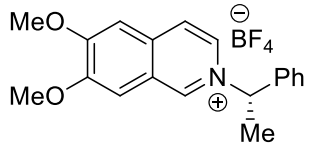
The titled compound was prepared by following the above procedure **A**, obtained as a brown solid (1.1 g, 72% yield). R_f(MeOH/DCM; 10:90) = 0.34.MP = 100.7 – 101.9 °C. **^{1}H NMR (500 MHz, DMSO-d_6)** δ 10.13 (s, 1H), 8.92 (dd, *J* = 6.87, 1.53 Hz, 1H), 8.62 (d, *J* = 6.87 Hz, 1H), 8.51 (d, *J* = 7.63 Hz, 1H), 8.36 (d, *J* = 8.39 Hz, 1H), 8.30 - 8.24 (m, 1H), 8.12 - 8.06 (m, 1H), 5.17 - 5.09 (m, 1H), 1.72 (d, *J* = 6.87 Hz, 6H).**^{13}C NMR (125 MHz, DMSO-d_6)** δ 148.5, 137.2, 136.9, 133.0, 131.1, 130.5, 127.4, 127.2, 126.1, 64.0, 22.2.**FTIR (cm^{-1}):** 3391, 3096, 2985, 2858, 2349, 1644, 1515, 1397, 1058, 880, 830,762. **HRMS** (ESI) *m/z* Calculated for $C_{12}H_{14}N$ $[M]^+$: 172.1121, found: 172.1125.

2-(tert-butyl)isoquinolin-2-ium tetrafluoroborate (1w)



The titled compound was prepared by following the above procedure **A**, obtained as a brown solid (1.2 g, 73% yield). R_f(MeOH/DCM; 10:90) = 0.33.MP = 199.4 – 200.7 °C.**^{1}H NMR (400 MHz, DMSO-d_6)** δ 10.14 (s, 1H), 9.11 (dd, *J* = 7.25, 1.91 Hz, 1H), 8.65 (d, *J* = 8.39 Hz, 1H), 8.59 (d, *J* = 7.63 Hz, 1H), 8.35 (d, *J* = 7.63 Hz, 1H), 8.27 (t, *J* = 7.63 Hz, 1H), 8.09 (t, *J* = 7.63 Hz, 1H), 1.86 (s, 9H).**^{13}C NMR (100 MHz, DMSO-d_6)** δ 147.6, 136.9, 131.2, 130.9, 127.2, 126.8, 125.5, 69.1, 29.0. **FTIR (cm^{-1}):** 3064, 2925, 2856, 1666, 1458, 1394, 1266, 1051, 826, 741. 136.6, 132.2. **HRMS** (ESI) *m/z* Calculated for $C_{13}H_{16}N$ $[M]^+$: 186.1277, found: 186.1286.

(S)-6,7-dimethoxy-2-(1-phenylethyl)isoquinolin-2-ium tetrafluoroborate (1x)



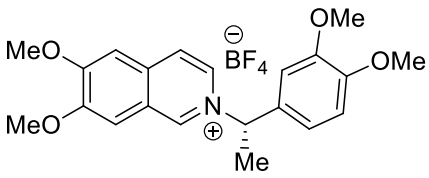
The titled compound was prepared by following the above procedure **A**, obtained as a brown solid (1.7 g, 73% yield, 97.1:2.9 e.r.(94%

ee).$[\alpha]_D^{25}$+0.15 (c = 0.4, CH_2Cl_2). R_f(MeOH/DCM; 10:90) = 0.35. MP = 167.8 – 168.8 °C. **^{1}H NMR (400 MHz, DMSO-d_6)** δ 9.83 (s, 1H), 8.70 (dd, *J* = 6.82, 1.44 Hz, 1H), 8.31 (d, *J* = 6.75 Hz, 1H), 7.84 (s, 1H), 7.76 (s, 1H), 7.62 - 7.54 (m, 2H), 7.54 - 7.37 (m, 3H), 6.25 (q, *J* = 6.96 Hz, 1H), 4.07 (s, 3H), 4.02 (s, 3H), 2.13 (d, *J* = 7.00 Hz, 3H).**^{13}C NMR (100 MHz, DMSO-d_6)** δ 157.8, 152.5, 143.5, 138.6, 135.5, 132.4, 129.2, 127.1, 124.0, 123.7, 107.5, 105.7, 68.6, 56.8, 56.3, 19.9.**FTIR (cm^{-1}):** 3072, 2940, 2848,1620, 1498, 1429, 1272, 1214, 1062, 868, 927, 867,738. **HRMS** (ESI) *m/z* Calculated for $C_{19}H_{20}NO_2$ $[M]^+$: 294.1489, found: 294.1503.

(S)-6-(1-phenylethyl)-[1,3]dioxolo[4,5-g]isoquinolin-6-ium tetrafluoroborate (1y)

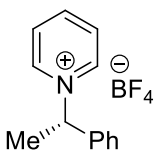
The titled compound was prepared by following the above procedure **A**, obtained as a yellow solid (1.6 g, 71% yield, 97.6:2.4 e.r.(95% ee).$[\alpha]_D^{25}$-2.0 (c = 0.7, CH_2Cl_2). R_f(MeOH/DCM; 10:90) = 0.40. MP = 161.6 – 163.2 °C. **^{1}H NMR (400 MHz, DMSO-d_6)** δ 9.80 (s, 1H), 8.68 (dd, *J* = 6.88, 1.50 Hz, 1H), 8.29 (d, *J* = 6.88 Hz, 1H), 7.78 (s, 1H), 7.71 (s, 1H), 7.59 - 7.51 (m, 2H), 7.51 - 7.39 (m, 3H), 6.45 (s, 2H), 6.22 (q, *J* = 7.00 Hz, 1H), 2.11 (d, *J* = 7.00 Hz, 3H).**^{13}C NMR (100 MHz, DMSO-d_6)** δ 156.4, 151.3, 144.0, 138.5, 137.8, 132.7, 129.2, 127.1, 125.6, 124.3, 104.5, 104.1, 103.0, 68.6, 19.8. **FTIR (cm^{-1}):** 3067, 2982,2927, 1617, 1467, 1271, 1189, 1063, 929, 868, 708. **HRMS** (ESI) *m/z* Calculated for $C_{18}H_{16}NO_2$ $[M]^+$: 278.1176, found: 278.1180.

(S)-2-(1-(3,4-dimethoxyphenyl)ethyl)-6,7-dimethoxyisoquinolin-2-ium tetrafluoroborate (1z)



The titled compound was prepared by following the above procedure **A**, obtained as a brown solid (1.9 g, 75% yield, 99.2:0.8 e.r.(98% ee).$[\alpha]_D^{25}$-1.0 (c = 0.5, CH_2Cl_2). R_f(MeOH/DCM; 10:90) = 0.35. MP = 178.8 – 180.2 °C. **^{1}H NMR (400 MHz, DMSO-d_6)** δ 9.77 (s, 1H), 8.70 (dd, *J* = 6.87, 1.37 Hz, 1H), 8.29 (d, *J* = 6.87 Hz, 1H), 7.82 (s, 1H), 7.75 (s, 1H), 7.23 (d, *J* = 2.29 Hz, 1H), 7.16 (dd, *J* = 8.47, 2.06 Hz, 1H), 7.04 (d, *J* = 8.70 Hz, 1H), 6.14 (q, *J* = 6.87 Hz, 1H), 4.07 (s, 3H), 4.02 (s, 3H), 3.80 (s, 3H), 3.77 (s, 3H), 2.09 (d, *J* = 6.87 Hz, 3H).**^{13}C NMR (100 MHz, DMSO-d_6)** δ 157.7, 152.5, 149.5, 149.0, 143.4, 135.5, 132.2, 130.4, 124.0, 123.6, 119.9, 111.9, 111.2, 107.5, 105.7, 68.7, 56.8, 56.3, 55.7, 55.6, 20.1.**FTIR (cm^{-1}):** 3080, 2928, 2848, 1612, 1509, 1457,1430, 1268, 1154, 1063, 924, 867, 738. **HRMS** (ESI) *m/z* Calculated for $C_{21}H_{24}NO_4$ $[M]^+$: 354.1700, found: 354.1702.

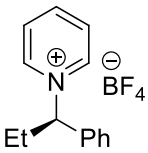
(S)-1-(1-phenylethyl)pyridin-1-ium tetrafluoroborate (1aa)



The titled compound was prepared by following the above procedure **C**, obtained as a sticky liquid (0.66 g, 81% yield, 99.0:1.0 e.r.(98% ee). R_f(MeOH/DCM; 10:90) =

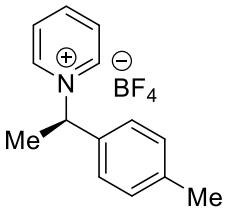
0.35. The spectral values were matchedfavorably with previously reported literaturevalues.[24]

(R)-1-(1-phenylpropyl)pyridin-1-ium tetrafluoroborate (1ab):



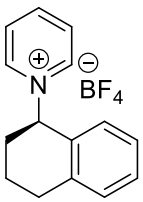
The titled compound was prepared by following the above procedure **C**, obtained as a sticky liquid (693.5 mg, 81 % yield, 0.9:99.1 e.r. (99% ee). $[\alpha]_D^{25}$-1.5 (c = 0.6, CH_2Cl_2). R_f(MeOH/DCM; 10:90) = 0.35. **^{1}H NMR (400 MHz, DMSO-d_6)** δ 9.28 (d, *J* = 5.50 Hz, 2H), 8.64 (tt, *J* = 7.75, 1.25 Hz, 1H), 8.28 - 8.11 (m, 2H), 7.70 - 7.57 (m, 2H), 7.54 - 7.38 (m, 3H), 5.98 (t, *J* = 7.82 Hz, 1H), 2.60 - 2.51 (m, 2H), 0.86 (t, *J* = 7.25 Hz, 3H).**^{13}C NMR (100 MHz, DMSO-d_6)** δ 146.4, 143.4, 136.6, 129.7, 129.4, 128.8, 127.8, 75.5, 26.1, 10.3.**FTIR (cm^{-1}):** 3137, 3086, 2974, 2885, 1631, 1488, 1390, 1286, 1060, 846, 773, 694. **HRMS** (ESI) *m/z* Calculated for $C_{14}H_{16}N[M]^+$:198.1277, found: 198.1283.

(R)-1-(1-(p-tolyl)ethyl)pyridin-1-ium tetrafluoroborate (1ac)



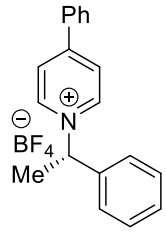
The titled compound was prepared by following the above procedure **C**, obtained as a sticky liquid (675.5 mg, 79 % yield, 0.7:99.3 e.r. (99% ee). $[\alpha]_D^{25}$ +2.1 (c = 0.5, CH_2Cl_2). R_f(MeOH/DCM; 10:90) = 0.34. **^{1}H NMR (400 MHz, DMSO-d_6)**δ ppm 9.21 (dd, *J*= 6.82, 1.19 Hz, 2H), 8.61 (tt, *J*= 7.75, 1.31 Hz, 1H), 8.17 (t, *J*= 7.19 Hz, 2H), 7.54 – 7.38 (m, 2H), 7.34 – 7.21 (m, 2H), 6.19 (q, *J*= 7.00 Hz, 1H), 2.31 (s, 3H), 2.04 (d, *J*= 7.13 Hz, 3H).**^{13}C NMR (100 MHz, DMSO-d_6)**δ 146.1, 143.4, 139.1, 134.9, 129.7, 128.5, 127.3, 69.5, 20.6, 19.8.**FTIR (cm^{-1}):** 3138, 3088, 2988, 2931, 1629, 1488, 1387, 1278, 1063, 829, 777, 685. **HRMS** (ESI) *m/z* Calculated for $C_{14}H_{16}N[M]^+$:198.1277, found: 198.1277.

(R)-1-(1,2,3,4-tetrahydronaphthalen-1-yl)pyridin-1-ium tetrafluoroborate (1ad)



The titled compound was prepared by following the above procedure **C**, obtained as a brown solid (668.3 mg, 75 % yield, 0.8:99.2 e.r. (98% ee). $[\alpha]_D^{25}$ +1.1 (c = 0.4, CH_2Cl_2). R_f(MeOH/DCM; 10:90) = 0.32. MP = 161.2 – 163.2 °C. **^{1}H NMR (400 MHz, DMSO-d_6)**δ ppm 9.00 (dd, *J*= 6.69, 1.19 Hz, 2H), 8.65 (tt, *J*=7.75, 1.25 Hz, 1H), 8.10 - 8.26 (m, 2H), 7.29 - 7.42 (m, 2H), 7.15 - 7.26 (m, 1H), 6.90 (d, *J*= 7.75 Hz, 1H), 6.25 (t, *J*= 6.69 Hz, 1H), 3.08 – 2.95 (m, 1 H), 2.86 (dt, *J*= 16.98, 5.83 Hz, 1H), 2.48 - 2.42 (m, 1H), 2.30 - 2.15 (m, 1H), 1.93 - 1.77 (m, 2H).**^{13}C NMR (100 MHz, DMSO-d_6)**δ 146.2, 144.4, 139.0, 131.2, 129.7, 129.1, 128.5, 128.4, 126.9, 69.3, 31.5, 28.2, 19.1.**FTIR (cm^{-1}):** 3135, 3086, 2932, 2865, 1630, 1490, 1449, 1338, 1273, 1059, 872, 752, 685. **HRMS** (ESI) *m/z* Calculated for $C_{15}H_{16}N[M]^+$:210.1277, found: 210.1277.

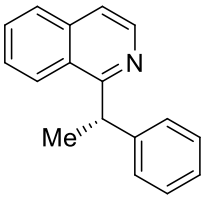
(S)-4-phenyl-1-(1-phenylethyl)pyridin-1-iumtetrafluoroborate (1ae)



The titled compound was prepared by following the above procedure **C**, obtained as a yellow solid (843.2 mg, 81 % yield, 99.7:0.3 e.r. (99% ee). $[\alpha]_D^{25}$+2.1 (c = 0.4, CH_2Cl_2). R_f(MeOH/DCM; 10:90) = 0.45. MP = 89.4 – 90.4 °C. **^{1}H NMR (400 MHz, DMSO-d_6)**δ ppm 9.25 (d, *J*= 7.00 Hz, 2H), 8.52 (d, *J*= 7.00 Hz, 2H), 8.11 - 8.06 (m, 2H), 7.69 - 7.59 (m, 5H), 7.52 - 7.44 (m, 3H), 6.24 (q, *J*= 7.00 Hz, 1H), 2.10 (d, *J*= 7.00 Hz, 3H).**^{13}C NMR (100 MHz, DMSO-d_6)**δ 155.4, 143.4, 138.1, 134.1, 133.5, 132.2, 129.7, 129.4, 129.2, 128.3, 127.3, 125.0, 68.8, 19.6.**FTIR (cm^{-1}):** 3129, 3068, 2997, 2954, 1635, 1445, 1373, 1285, 1065, 856, 767, 700. **HRMS** (ESI) *m/z* Calculated for $C_{19}H_{18}N[M]^+$:260.1434, found: 260.1434.

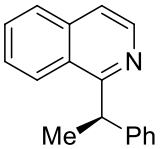
Compound characterization data for products:

(S)-1-(1-phenylethyl)isoquinoline (6a)



The titled compound was prepared by following the optimized migration procedure **D**, obtained as a white solid (50.4 mg, 72% yield (162 mg, 72% yield for 1 mmol) 96.0:4.0 e.r., starting with 99.0:1.0 e.r. of **1a** = 92% ee&97% es). $[\alpha]_D^{25}$-22.3 (c = 0.9, $CHCl_3$). R_f(Ethyl acetate/Pet. ether = 20:80) = 0.65. The spectral values were matched favorably with previously reported literature values.[26]

(R)-1-(1-Phenylethyl)isoquinoline (*ent*- 6a)



The titled compound was prepared by following the optimized migration procedure **D**, obtained as a white solid (49.6 mg, 71% yield, 6.7:93.3 e.r., starting with 2.5:97.5 e.r. of *ent*-**1a** = 87% ee&96% es). $[\alpha]_D^{25}$+20.2 (c = 0.9, $CHCl_3$).R_f(Ethyl acetate/Pet. ether = 20:80) = 0.65. The spectral values were matched favorably with previously reported literature values.[26]

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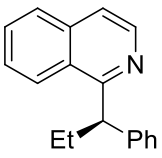
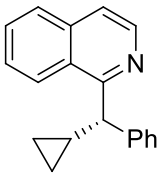
(R)-1-(1-Phenylpropyl)isoquinoline (6b)



The titled compound was prepared by following the optimized migration procedure **D**,obtained as a sticky liquid (55.6 mg, 75% yield, 2.6:97.4 e.r., starting with 1.5:98.5 e.r. of **1b** = 95% ee& 99% es). $[\alpha]_D^{25}$-4.05 (c = 1.3, $CHCl_3$).R_f(Ethyl acetate/Pet. ether = 20:80) = 0.75. **^{1}H NMR (400 MHz, $CDCl_3$)** δ 8.57 (d, *J* = 5.95 Hz, 1H), 8.25 (d, *J* = 8.70 Hz, 1H), 7.76 (d, *J* = 7.78 Hz, 1H), 7.61 - 7.55 (m, 1H), 7.53 - 7.47 (m, 2H), 7.41 - 7.36 (m, 2H), 7.26 - 7.20 (m, 2H), 7.16 - 7.10 (m, 1H), 4.76 (t, *J* = 7.33 Hz, 1H), 2.59 - 2.45 (m, 1H), 2.30 - 2.17 (m, 1H), 0.94 (t, *J* = 7.33 Hz, 3H).**^{13}C NMR (100 MHz, $CDCl_3$)** δ 162.3, 144.1, 141.7, 136.4, 129.4, 128.3, 128.1, 127.4, 127.3, 127.0, 126.2, 125.0, 119.3, 50.5,

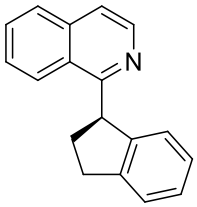
29.0, 12.8.**FTIR (cm^{-1}):**3055, 2962, 2928, 2871, 1615, 1591, 1496, 1452, 1370, 1071, 825, 746. **HRMS** (ESI) *m/z* Calculated for $C_{18}H_{18}N$ $[M+H]^+$: 248.1439, found: 248.1445.

(S)-1-(cyclopropyl(phenyl)methyl)isoquinoline (6c)



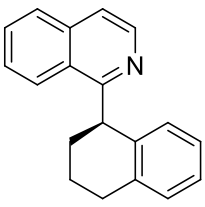
The titled compound was prepared by following the optimized migration procedure **D**, obtained as a white solid (60.7 mg, 78% yield, 5.9:94.1 e.r., starting with 5.2:94.8 e.r. of **1c** =88%ee& 99% es). $[\alpha]_D^{25}$+3.6 (c = 1.3, $CHCl_3$).R_f(Ethyl acetate/Pet. ether = 20:80) = 0.20. MP = 123.2 – 125.7 °C. **^{1}H NMR (400 MHz, $CDCl_3$)** δ 8.51 (d, *J* = 5.95 Hz, 1H), 8.00 (d, *J* = 8.70 Hz, 1H), 7.70 (d, *J* = 7.79 Hz, 1H), 7.50 (t, *J* = 7.56 Hz, 1H), 7.46 (d, *J* = 5.95 Hz, 1H), 7.38 (t, *J* = 7.79 Hz, 1H), 7.32 (d, *J* = 7.33 Hz, 2H), 7.21 - 7.15 (m, 2H), 7.11 - 7.05 (m, 1H), 3.96 (d, *J* = 10.07 Hz, 1H), 1.92 - 1.83 (m, 1H), 0.71 - 0.51 (m, 2H), 0.38 (dq, *J* = 9.27, 4.85 Hz, 1H), 0.17 (dq, *J* = 9.50, 4.92 Hz, 1H).**^{13}C NMR (100 MHz, $CDCl_3$)** δ 163.1, 143.9, 141.9, 136.5, 129.5, 128.4, 127.8, 127.4, 127.0, 126.9, 126.3, 125.2, 119.5, 54.8, 16.7, 5.6, 5.3.**FTIR (cm^{-1}):** 3062, 3010,2922, 1639, 1499, 1457,1565, 1457, 1392, 1061, 824, 750. **HRMS** (ESI) *m/z* Calculated for $C_{19}H_{18}N$ $[M+H]^+$: 260.1439, found: 260.1447.

(R)-1-(2,3-dihydro-1H-inden-1-yl)isoquinoline (6d)



The titled compound was prepared by following the optimized migration procedure **D**, obtained as a liquid (51.5 mg, 70% yield, 96.0:4.0 e.r., starting with 99.1:0.9e.r. of **1d**= 92% ee& 97% es). $[\alpha]_D^{25}$+32.1 (c = 1.0, $CHCl_3$).R_f(Ethyl acetate/Pet. ether = 20:80) = 0.65. **^{1}H NMR (400 MHz, $CDCl_3$)** δ 8.47 (d, *J* = 5.63 Hz, 1H), 8.25 (d, *J* = 8.63 Hz, 1H), 7.86 (d, *J* = 8.13 Hz, 1H), 7.69 (ddd, *J* = 8.10, 6.91, 1.13 Hz, 1H), 7.59 (ddd, *J* = 8.41, 6.97, 1.25 Hz, 1H), 7.54 (d, *J* = 5.75 Hz, 1H), 7.33 (d, *J* = 7.38 Hz, 1H), 7.18 (t, *J* = 7.44 Hz, 1H), 7.06 (t, *J* = 7.44 Hz, 1H), 6.88 (d, *J* = 7.50 Hz, 1H), 5.39 (t, *J* = 8.50 Hz, 1H), 3.25 (ddd, *J* = 15.67, 8.10, 4.13 Hz, 1H), 3.17 - 3.07 (m, 1H), 2.74 - 2.64 (m, 2H).**^{13}C NMR (100 MHz, $CDCl_3$)** δ163.2, 145.7, 144.2, 142.3, 136.7, 129.7, 127.5, 127.3, 127.0, 126.7, 126.2, 125.3, 124.7, 124.7, 119.4, 49.5, 33.1, 32.2.**FTIR (cm^{-1}):** 3055, 2952, 1734,1566, 1464, 1372, 1242, 1086, 1044, 968,749. **HRMS** (ESI) *m/z* Calculated for $C_{18}H_{16}N$ $[M+H]^+$: 246.1282, found: 246.1288.

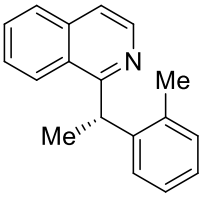
(R)-1-(1,2,3,4-tetrahydronaphthalen-1-yl)isoquinoline (6e)



The titled compound was prepared by following the optimized migration procedure **D**, obtained as a liquid (55.5 mg, 72% yield, 97.5:2.5 e.r., starting with 99.3:0.7e.r. of **1e** =95% ee& 98% es). $[\alpha]_D^{25}$+36.4 (c = 0.6, $CHCl_3$).R_f(Ethyl acetate/Pet. ether = 20:80) = 0.55. **^{1}H NMR (500 MHz, $CDCl_3$)** δ 8.48 (d, *J* = 5.72 Hz, 1H), 8.09 (d, *J* = 8.39 Hz, 1H), 7.84 (d, *J* = 8.01

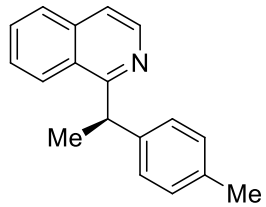
Hz, 1H), 7.65 (t, *J* = 7.44 Hz, 1H), 7.58 - 7.47 (m, 2H), 7.19 (d, *J* = 7.63 Hz, 1H), 7.10 (t, *J* = 7.44 Hz, 1H), 6.94 (t, *J* = 7.44 Hz, 1H), 6.64 (d, *J* = 8.01 Hz, 1H), 5.10 (t, *J* = 8.01 Hz, 1H), 3.09 (ddd, *J* = 16.31, 10.59, 5.53 Hz, 1H), 2.94 (dt, *J* = 16.69, 4.43 Hz, 1H), 2.34 - 2.22 (m, 2H), 2.16 - 2.07 (m, 1H), 1.97 - 1.86 (m, 1H).**^{13}C NMR (100 MHz, $CDCl_3$)**δ 165.3, 142.2, 138.9, 137.1, 136.8, 129.6, 129.3, 127.6, 126.9, 126.8, 125.9, 125.8, 125.5, 119.4, 45.3, 31.0, 29.9, 22.4.**FTIR (cm^{-1}):** 3055, 3013, 2928, 2860, 1724, 1651, 1564, 1496, 1376, 1270, 1075, 966, 745. **HRMS** (ESI) *m/z* Calculated for $C_{19}H_{18}N$ $[M+H]^+$: 260.1439,: 260.1443.

(S)-1-(1-(o-tolyl)ethyl)isoquinoline (6f)



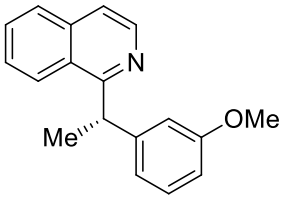
The titled compound was prepared by following the optimized migration procedure **D**, obtained as a liquid (50.4 mg, 68% yield, 94.2:5.8 e.r., starting with 98.4:1.6e.r. of **1f** = 88% ee& 96% es). $[\alpha]_D^{25}$+30.8 (c = 1.3, $CHCl_3$).***R*$_f$**(Ethyl acetate/Pet. ether = 20:80) = 0.75. **^{1}H NMR (400 MHz, $CDCl_3$)** δ 8.56 (d, *J* = 5.75 Hz, 1H), 7.97 - 7.86 (m, 1H), 7.78 (d, *J* = 8.13 Hz, 1H), 7.58 (ddd, *J* = 8.13, 6.94, 1.19 Hz, 1H), 7.54 (d, *J* = 5.75 Hz, 1H), 7.45 (ddd, *J* = 8.47, 6.97, 1.31 Hz, 1H), 7.18 (d, *J* = 7.38 Hz, 1H), 7.07 (td, *J* = 7.32, 1.50 Hz, 1H), 7.00 (td, *J* = 7.47, 1.44 Hz, 1H), 6.96 - 6.91 (m, 1H), 5.18 (q, *J* = 6.96 Hz, 1H), 2.51 (s, 3H), 1.77 (d, *J* = 6.88 Hz, 3H).**^{13}C NMR (100 MHz, $CDCl_3$)** δ163.4, 144.4, 141.6, 136.4, 134.4, 130.4, 129.5, 127.4, 127.1, 127.1, 126.9, 126.4, 126.1, 125.0, 119.5, 39.7, 20.3, 19.6.**FTIR (cm^{-1}):** 3055, 2965, 2925, 2866, 1592, 1569, 1493, 1453, 1375, 1262, 1027, 819,751. **HRMS** (ESI) *m/z* Calculated for $C_{18}H_{18}N$ $[M+H]^+$: 248.1439, found: 248.1441.

(R)-1-(1-(p-tolyl)ethyl)isoquinoline (6g)



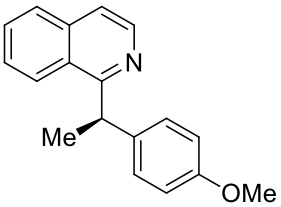
The titled compound was prepared by following the optimized migration procedure **D**, obtained as a liquid (51.1 mg, 69% yield, 6.0:94.0 e.r., starting with 1.3:98.7e.r. of **1g** =88% ee& 95% es). $[\alpha]_D^{25}$-22.4 (c = 0.8, $CHCl_3$).***R*$_f$**(Ethyl acetate/Pet. ether = 20:80) = 0.70. **^{1}H NMR (400 MHz, $CDCl_3$)** δ 8.56 (d, *J* = 5.75 Hz, 1H), 8.17 (d, *J* = 8.50 Hz, 1H), 7.77 (d, *J* = 8.13 Hz, 1H), 7.57 (ddd, *J* = 8.16, 6.91, 1.19 Hz, 1H), 7.52 (d, *J* = 5.63 Hz, 1H), 7.22 - 7.17 (m, 1H), 7.05 (d, *J* = 7.88 Hz, 2H), 5.04 (q, *J* = 7.00 Hz, 1H), 2.25 (s, 3H), 1.82 (d, *J* = 7.00 Hz, 3H).**^{13}C NMR (100 MHz, $CDCl_3$)** δ 163.1, 142.9, 141.7, 136.4, 135.6, 129.4, 129.2, 127.4, 127.4, 126.9, 126.8, 125.3, 119.5, 42.8, 21.9, 20.9.**FTIR (cm^{-1}):** 3057, 2960**,** 2925,2860, 1592, 1496, 1454, 1371, 1029, 869,825, 748. **HRMS** (ESI) *m/z*Calculated for $C_{18}H_{18}N$ $[M+H]^+$: 248.1439, found: 248.1441

(S)-1-(1-(3-Methoxyphenyl)ethyl)isoquinoline (6h)



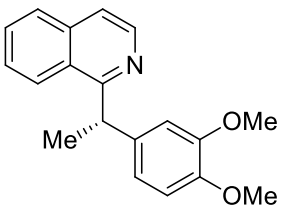
The titled compound was prepared by following the optimized migration procedure **D**, obtained as a liquid (56.9 mg, 72% yield, 90.0:10.0 e.r., starting with 99.7:0.3e.r. of **1h** = 80% ee& 90% es). $[\alpha]_D^{25}$-25.7 (c = 1.3, CH_2Cl_2).R_f(Ethyl acetate/Pet. ether = 20:80) = 0.69. **^{1}H NMR (400 MHz, $CDCl_3$)** δ 8.56 (d, *J* = 5.34 Hz, 1H), 8.17 (d, *J* = 8.39 Hz, 1H), 7.78 (d, *J* = 8.39 Hz, 1H), 7.63 - 7.55 (m, 1H), 7.53 (d, *J* = 5.34 Hz, 1H), 7.51 - 7.44 (m, 1H), 7.16 (t, *J* = 8.01 Hz, 1H), 6.90 (d, *J* = 7.63 Hz, 1H), 6.87 - 6.82 (m, 1H), 6.68 (dd, *J* = 8.01, 2.67 Hz, 1H), 5.04 (q, *J* = 6.87 Hz, 1H), 3.72 (s, 3H), 1.83 (d, *J* = 6.87 Hz, 3H).**^{13}C NMR (100 MHz, $CDCl_3$)** δ 162.7, 159.7, 147.5, 141.7, 136.4, 129.5, 129.4, 127.4, 127.0, 126.9, 125.2, 120.0, 119.6, 113.6, 111.1, 55.1, 43.3, 21.7.**FTIR (cm^{-1}):**3053, 2969, 2931, 2838, 1724, 1594, 1488, 1449, 1267, 1154, 1043, 825, 740.**HRMS** (ESI) *m/z* Calculated for $C_{18}H_{18}NO$ $[M+H]^+$: 264.1388, found: 264.1396.

(R)-1-(1-(4-methoxyphenyl)ethyl)isoquinoline (6i)



The titled compound was prepared by following the optimized migration procedure **D**, obtained as a liquid (56.1 mg, 71% yield, 73 % ee, 13.7:86.3 e.r., starting with 0.5:99.5e.r. of **1i** = 73%ee&87% es). $[\alpha]_D^{25}$+33.9 (c = 1.1, $CHCl_3$).R_f(Ethyl acetate/Pet. ether = 20:80) = 0.70. **^{1}H NMR (500 MHz, $CDCl_3$)** δ 8.55 (d, *J* = 5.72 Hz, 1H), 8.17 (d, *J* = 8.39 Hz, 1H), 7.78 (d, *J* = 8.39 Hz, 1H), 7.62 - 7.56 (m, 1H), 7.52 (d, *J* = 5.72 Hz, 1H), 7.51 - 7.46 (m, 1H), 7.22 (m, *J* = 8.39 Hz, 2H), 6.78 (d, *J*= 8.77 Hz, 2H), 5.03 (q, *J* = 7.12 Hz, 1H), 3.73 (s, 3H), 1.81 (d, *J* = 6.87 Hz, 3H).**^{13}C NMR (125 MHz, $CDCl_3$)** δ 163.3, 157.9, 141.7, 138.1, 136.5, 129.5, 128.5, 127.4, 127.0, 126.8, 125.3, 119.5, 113.9, 55.2, 42.3, 21.9.**FTIR (cm^{-1}):** 3095, 2962,2849, 1645, 1516, 1467,1397, 1285, 1065, 880, 830, 758. **HRMS** (ESI) *m/z* Calculated for $C_{18}H_{18}NO$ $[M+H]^+$: 264.1388, found: 264.1396.

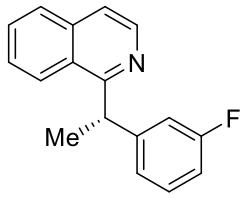
(S)-1-(1-(3,4-dimethoxyphenyl)ethyl)isoquinolineisoquinoline (6j)



The titled compound was prepared by following the optimized migration procedure **D**, obtained as a sticky liquid (60.5 mg, 69% yield, 93.0:7.0 e.r., starting with 98.2:1.8e.r. of **1j** = 86% ee& 95% es). $[\alpha]_D^{25}$+7.5 (c = 1.3, $CHCl_3$).R_f(Ethyl acetate/Pet. ether = 20:90) = 0.21. **^{1}H NMR (400 MHz, $CDCl_3$)** δ 8.56 (d, *J* = 5.50 Hz, 1H), 8.19 (d, *J* = 8.24 Hz, 1H), 7.79 (d, *J* = 8.24 Hz, 1H), 7.64 - 7.58 (m, 1H), 7.54 (d, *J* = 5.95 Hz, 1H), 7.53 - 7.47 (m, 1H), 6.88 - 6.82 (m, 2H), 6.78 - 6.73 (m, 1H), 5.03 (q, *J* = 7.02 Hz, 1H), 3.81 (s, 3H), 3.79 (s, 3H), 1.82 (d, *J* = 6.87 Hz, 3H).**^{13}C NMR (100 MHz, $CDCl_3$)** δ 163.1, 148.9, 147.4, 141.6, 138.5, 136.5, 129.5, 127.4, 127.0, 126.8, 125.2, 119.6, 119.5, 111.1, 110.8, 55.8, 55.8, 42.8, 21.9.**FTIR (cm^{-1}):** 3375,

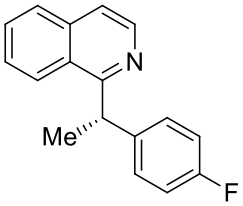
2971, 2929, 1590, 1511, 1459,1414, 1121, 1034, 858, 768. **HRMS** (ESI) *m/z* Calculated for $C_{19}H_{20}NO_2$ $[M+H]^+$: 294.1493, found: 294.1501..

(S)-1-(1-(3-fluorophenyl)ethyl)isoquinoline (6k)



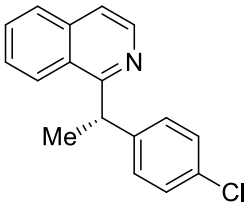
The titled compound was prepared by following the optimized migration procedure **D**, obtained as a sticky liquid (53.5 mg, 71% yield, 96.1:3.9 e.r., starting with 99.1:0.9e.r. of **1k** = 92% ee& 97% es). $[\boldsymbol{\alpha}]_{\mathbf{D}}^{\mathbf{25}}$-18.7 (c = 0.6, $CHCl_3$).$\boldsymbol{R_f}$(Ethyl acetate/Pet. ether = 20:80) = 0.80.**^{1}H NMR (400 MHz, $CDCl_3$)** δ 8.56 (d, *J* = 5.75 Hz, 1H), 8.13 (d, *J* = 8.38 Hz, 1H), 7.80 (d, *J* = 8.13 Hz, 1H), 7.61 (ddd, *J* = 8.19, 6.94, 1.13 Hz, 1H), 7.55 (d, *J* = 5.50 Hz, 1H), 7.51 (ddd, *J* = 8.44, 7.00, 1.31 Hz, 1H), 7.20 (td, *J* = 7.97, 6.07 Hz, 1H), 7.09 (d, *J* = 7.63 Hz, 1H), 7.00 (dt, *J* = 10.22, 2.08 Hz, 1H), 6.83 (tdd, *J* = 8.43, 8.43, 2.60, 0.94 Hz, 1H), 5.07 (q, *J* = 6.92 Hz, 1H), 1.83 (d, *J* = 7.00 Hz, 3H).**^{13}C NMR (100 MHz, $CDCl_3$)**δ 164.2 (C-F, 1JC-F = 245.67 Hz), 162.3, 161.7 (C-F, 1JC-F = 245.67 Hz), 148.4 (C-F, 5JC-F = 6.87 Hz),148.3 (C-F, 5JC-F = 6.87 Hz), 141.7, 136.5, 129.9 (C-F, 4JC-F = 7.63 Hz), 129.8 (C-F, 4JC-F = 7.63 Hz), 129.7, 127.5, 127.2, 126.8, 125.0, 123.3, 123.2, 119.8, 114.6 (C-F, 3JC-F = 21.36 Hz), 114.4 (C-F, 3JC-F = 21.36 Hz), 113.2 (C-F, 2JC-F= 21.36 Hz), 113.0 (C-F, 2JC-F = 21.36 Hz), 42.9, 42.8, 21.6.**FTIR (cm^{-1}):**3054, 2974, 2928, 2863, 1592, 1487, 1447, 1375, 1254, 1140, 1040, 824, 747.**HRMS** (ESI) *m/z* Calculated for $C_{17}H_{15}FN$ $[M+H]^+$: 252.1188, found: 252.1190.

(S)-1-(1-(4-fluorophenyl)ethyl)isoquinoline (6l)



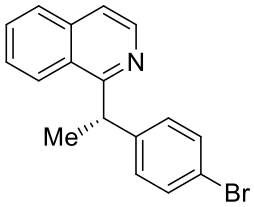
The titled compound was prepared by following the optimized migration procedure **D**, obtained as a sticky liquid (52.8 mg, 70% yield, 90.2:9.8 e.r., starting with 95.4:4.6e.r. of **1l** = 82% ee& 95% es). $[\boldsymbol{\alpha}]_{\mathbf{D}}^{\mathbf{25}}$-15.4 (c = 0.7, $CHCl_3$).$\boldsymbol{R_f}$(Ethyl acetate/Pet. ether = 20:80) = 0.81. **^{1}H NMR (400 MHz, $CDCl_3$)** δ 8.56 (d, *J* = 6.10 Hz, 1H), 8.14 (d, *J* = 8.39 Hz, 1H), 7.80 (d, *J* = 8.39 Hz, 1H), 7.64 - 7.58 (m, 1H), 7.54 (d, *J* = 5.34 Hz, 1H), 7.53 - 7.48 (m, 1H), 7.29 - 7.24 (m, 2H), 6.96 - 6.89 (m, 2H), 5.07 (q, *J* = 7.12 Hz, 1H), 1.81 (d, *J* = 6.87 Hz, 3H).**^{13}C NMR (100 MHz, $CDCl_3$)**δ 162.8, 162.5 (C-F, 1JC-F = 243.45 Hz), 160.1 (C-F, 1JC-F = 243.45 Hz), 141.8, 141.5 (C-F, 4JC-F = 2.88 Hz), 141.4 (C-F, 4JC-F = 2.88 Hz), 136.5, 134.3, 129.6, 129.0 (C-F, 3JC-F = 7.67 Hz), 128.9 (C-F, 3JC-F = 7.67 Hz), 127.5, 127.1, 126.7, 125.0, 119.6, 115.4 (C-F, 2JC-F = 21.1), 115.2 (C-F, 2JC-F = 21.1), 42.3, 21.9.**FTIR (cm^{-1}):**3054, 2871, 2926, 1712, 1596, 1505, 1454, 1377, 1226, 1155, 1012, 830, 738. **HRMS** (ESI) *m/z* Calculated for $C_{17}H_{15}FN$ $[M+H]^+$: 252.1188, found: 252.1196.

(S)-1-(1-(4-chlorophenyl)ethyl)isoquinoline (6m)



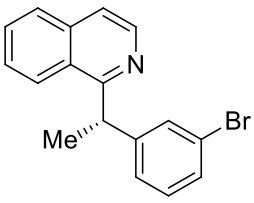
The titled compound was prepared by following the optimized migration procedure **D**, obtained as liquid (54.6 mg, 68% yield, 85.9:14.1 e.r., starting with 94.6:5.4e.r. of **1m** = 72% ee& 91% es). $[\alpha]_D^{25}$-15.7 (c = 0.6, $CHCl_3$).***R*$_f$**(Ethyl acetate/Pet. ether = 20:80) = 0.83. **^{1}H NMR (400 MHz, $CDCl_3$)** δ 8.55 (d, *J* = 5.63 Hz, 1H), 8.11 (d, *J* = 8.38 Hz, 1H), 7.79 (d, *J* = 8.25 Hz, 1H), 7.60 (ddd, *J* = 8.10, 6.91, 1.13 Hz, 1H), 7.57 - 7.45 (m, 2H), 7.28 - 7.15 (m, 4H), 5.05 (q, *J* = 6.92 Hz, 1H), 1.81 (d, *J* = 7.00 Hz, 3H).**^{13}C NMR (100 MHz, $CDCl_3$)** δ 162.5, 144.3, 141.8, 136.5, 131.9, 129.6, 128.9, 128.6, 127.5, 127.1, 126.7, 125.0, 119.7, 42.5, 21.7.**FTIR (cm^{-1}):** 3054, 2974, 2926, 2862,1736, 1569, 1491, 1373, 1246, 1094, 1046, 825. **HRMS** (ESI) *m/z*Calculated for $C_{17}H_{15}ClN$ $[M+H]^+$: 268.0892, found: 268.0898.

(S)-1-(1-(4-bromophenyl)ethyl)isoquinoline (6n)



The titled compound was prepared by following the optimized migration procedure **D**, obtained as liquid (60.9 mg, 65% yield, 88.4:11.6 e.r., starting with 95.1:4.9e.r. of **1n** = 77% ee& 93% CT). $[\alpha]_D^{25}$-13.8 (c = 0.5, $CHCl_3$).***R*$_f$**(Ethyl acetate/Pet. ether = 20:80) = 0.85. **^{1}H NMR (400 MHz, $CDCl_3$)** δ 8.55 (d, *J* = 5.75 Hz, 1H), 8.10 (d, *J* = 8.25 Hz, 1H), 7.78 (d, *J* = 8.13 Hz, 1H), 7.60 (ddd, *J* = 8.16, 6.91, 1.19 Hz, 1H), 7.53 (d, *J* = 5.75 Hz, 1H), 7.49 (ddd, *J* = 8.44, 7.00, 1.31 Hz, 1H), 7.38 - 7.32 (m, 2H), 7.21 - 7.15 (m, 2H), 5.03 (q, *J* = 6.96 Hz, 1H), 1.81 (d, *J* = 7.00 Hz, 3H).**^{13}C NMR (100 MHz, $CDCl_3$)** δ 162.3, 144.8, 141.7, 136.5, 131.6, 129.6, 129.3, 127.5, 127.1, 126.7, 124.9, 120.0, 119.7, 42.5, 21.7.**FTIR (cm^{-1}):** 3054**,** 2974, 2927, 1736, 1569, 1373, 1245, 1011, 865, 825, 741.**HRMS** (ESI) *m/z* Calculated for $C_{17}H_{15}BrN$ $[M+H]^+$: 312.0387, found: 312.0390.

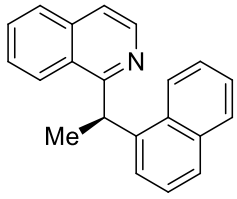
(S)-1-(1-(3-bromophenyl)ethyl)isoquinoline (6o)



The titled compound was prepared by following the optimized migration procedure **D**, obtained as liquid (61.8 mg, 66% yield, 80.7:19.4 e.r., starting with 92.7:7.3e.r. of **1o** = 61% ee& 87% es). $[\alpha]_D^{25}$-7.8 (c = 0.6, $CHCl_3$).***R*$_f$**(Ethyl acetate/Pet. ether = 20:80) = 0.84. **^{1}H NMR (400 MHz, $CDCl_3$)** δ 8.56 (d, *J* = 5.75 Hz, 1H), 8.12 (d, *J* = 8.25 Hz, 1H), 7.80 (d, *J* = 8.13 Hz, 1H), 7.61 (ddd, *J* = 8.19, 6.94, 1.13 Hz, 1H), 7.55 (d, *J* = 5.63 Hz, 1H), 7.54 - 7.49 (m, 1H), 7.47 (t, *J* = 1.88 Hz, 1H), 7.27 (ddd, *J* = 7.88, 1.94, 1.06 Hz, 1H), 7.22 (dt, *J* = 7.72, 1.14 Hz, 1H), 7.10 (t, *J* = 7.82 Hz, 1H), 5.03 (q, *J* = 6.92 Hz, 1H), 1.81 (d, *J* = 7.00 Hz, 3H).**^{13}C NMR (100 MHz, $CDCl_3$)** δ 162.1, 148.1, 141.8, 136.5, 130.6, 130.1, 129.6, 129.3, 127.5, 127.2, 126.7, 126.3, 124.9, 122.6, 119.8, 42.8, 21.8.**FTIR (cm^{-1}):** 3054, 2970, 2926, 2867, 1571, 1379, 1250,

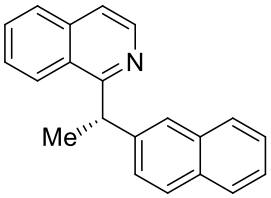
1076, 1007, 875, 823, 743.**HRMS** (ESI) *m/z* Calculated for $C_{17}H_{15}BrN$ $[M+H]^+$: 312.0388, found: 312.0386.

(R)-1-(1-(naphthalen-1-yl)ethyl)isoquinoline (6p)



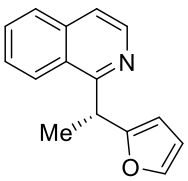
The titled compound was prepared by following the optimized migration procedure **D**,obtained as liquid (59.4 mg, 70% yield, 12.3:87.7 e.r., starting with 2.5:97.5e.r. of **1p** =75% ee, 90% es). $[\alpha]_D^{25}$-89.5 (c = 0.7, $CHCl_3$).R_f(Ethyl acetate/Pet. ether = 20:80) = 0.80. **^{1}H NMR (400 MHz, $CDCl_3$)** δ 8.59 (d, *J* = 5.75 Hz, 1H), 8.38 (d, *J* = 8.50 Hz, 1H), 7.96 - 7.85 (m, 2H), 7.79 (d, *J* = 8.25 Hz, 1H), 7.68 (d, *J* = 8.25 Hz, 1H), 7.62 - 7.50 (m, 4H), 7.33 (ddd, *J* = 8.50, 7.00, 1.25 Hz, 1H), 7.28 - 7.23 (m, 2H), 7.04 (dd, *J* = 7.25, 1.00 Hz, 1H), 5.83 (q, *J* = 7.00 Hz, 1H), 1.94 (d, *J* = 6.88 Hz, 3H).**^{13}C NMR (100 MHz, $CDCl_3$)** δ 163.4, 142.3, 141.6, 136.4, 134.1, 130.9, 129.5, 129.2, 127.4, 127.2, 127.0, 126.8, 126.3, 125.8, 125.5, 125.1, 124.9, 122.8, 119.7, 39.0, 20.7.**FTIR (cm^{-1}):** 3056, 2925,2857, 1591, 1501,1456, 1383, 1116, 1035, 865, 811, 766. **HRMS** (ESI) *m/z* Calculated for $C_{21}H_{18}N$ $[M+H]^+$: 284.1439, found: 284.1441.

(S)-1-(1-(naphthalen-2-yl)ethyl)isoquinoline (6q)



The titled compound was prepared by following the optimized migration procedure **D**, obtained as a sticky solid (61.1 mg, 72% yield, 90.8:9.2 e.r., starting with 98.9:1.1e.r. of **1q** = 82% ee& 92% es). $[\alpha]_D^{25}$+70 (c = 0.9, $CHCl_3$).R_f(Ethyl acetate/Pet. ether = 20:80) = 0.79. **^{1}H NMR (400 MHz, $CDCl_3$)** δ 8.60 (d, *J* = 5.75 Hz, 1H), 8.20 (d, *J* = 8.13 Hz, 1H), 7.77 (d, *J* = 8.25 Hz, 1H), 7.75 - 7.68 (m, 4H), 7.58 - 7.53 (m, 2H), 7.46 - 7.41 (m, 2H), 7.41 - 7.32 (m, 2H), 5.23 (q, *J* = 7.00 Hz, 1H), 1.92 (d, *J* = 6.88 Hz, 3H).**^{13}C NMR (100 MHz, $CDCl_3$)** δ 162.8, 143.4, 141.7, 136.5, 133.6, 132.1, 129.5, 128.2, 127.7, 127.5, 127.4, 127.0, 126.9, 126.3, 125.9, 125.7, 125.3, 125.3, 119.7, 43.4, 21.8.**FTIR (cm^{-1}):** 3054, 2927, 2862, 1739, 1499,1454, 1375, 1243, 1046, 812,787, 738. **HRMS** (ESI) *m/z* Calculated for $C_{21}H_{18}N$ $[M+H]^+$: 284.1439, found: 284.1434.

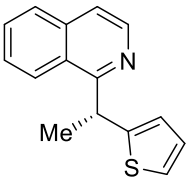
(S)-1-(1-(furan-2-yl)ethyl)isoquinoline (6r)



The titled compound was prepared by following the optimized migration procedure **D**, obtained as a sticky liquid (46.3 mg, 70% yield, 97.2:2.8 e.r., starting with 99.2:0.8e.r. of **1r** = 94% ee& 98% es). $[\alpha]_D^{25}$-5.8 (c = 0.9, $CHCl_3$).R_f(Ethyl acetate/Pet. ether = 20:80) = 0.76. **^{1}H NMR (400 MHz, $CDCl_3$)** δ 8.51 (d, *J* = 5.63 Hz, 1H), 8.24 (d, *J* = 8.38 Hz, 1H), 7.82 (d, *J* = 8.25 Hz, 1H), 7.67 - 7.63 (m, 1H), 7.59 - 7.55 (m, 1H), 7.55 - 7.52 (m, 1H), 7.28 (dd, *J* = 1.88, 0.63 Hz, 1H), 6.28 (dd, *J* = 3.25, 1.88 Hz, 1H), 6.08 (dt, *J* = 3.22, 0.89 Hz, 1H), 5.15 (q, *J* = 7.05 Hz, 1H), 1.83 (d, *J* = 7.00 Hz,

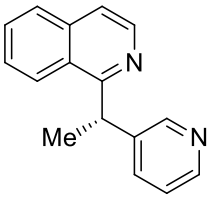
3H).**^{13}C NMR (100 MHz, $CDCl_3$)** δ 161.4, 158.0, 142.0, 141.2, 136.6, 129.7, 127.5, 127.1, 126.7, 124.9, 119.8, 110.2, 105.3, 37.2, 18.5.**FTIR (cm^{-1}):**3047, 2929 1702, 1642, 1462, 1395, 1222, 1063, 819, 756. **HRMS** (ESI) *m/z* Calculated for $C_{15}H_{14}NO$ $[M+H]^+$: 224.1075, found: 224.1078.

(S)-1-(1-(thiophen-2-yl)ethyl)isoquinoline (6s)



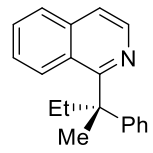
The titled compound was prepared by following the optimized migration procedure **D**, obtained as liquid (48.5 mg, 68% yield, 95.7:4.3 e.r., starting with 99.2:0.8e.r. of **1s** = 92% ee& 97% es). $[\alpha]_D^{25}$-6.1 (c = 0.9, $CHCl_3$).R_f(Ethyl acetate/Pet. ether = 20:80) = 0.79. **^{1}H NMR (400 MHz, $CDCl_3$)** δ 8.54 (d, *J* = 5.63 Hz, 1H), 8.25 (d, *J* = 8.38 Hz, 1H), 7.81 (d, *J* = 8.13 Hz, 1H), 7.67 - 7.61 (m, 1H), 7.60 - 7.51 (m, 2H), 7.11 (dd, *J* = 5.13, 1.25 Hz, 1H), 6.87 (dd, *J* = 5.13, 3.50 Hz, 1H), 6.82 (dt, *J* = 3.41, 1.05 Hz, 1H), 5.37 (q, *J* = 6.88 Hz, 1H), 1.92 (d, *J* = 7.00 Hz, 3H).**^{13}C NMR (100 MHz, $CDCl_3$)** δ 162.5, 149.1, 141.9, 136.6, 129.7, 127.5, 127.2, 126.5, 126.4, 124.8, 124.0, 123.7, 119.8, 38.4, 22.5. **FTIR (cm^{-1}):** 3056, 2974, 2871, 1623, 1570, 1500, 1448, 1379, 1240, 827, 745, 697. **HRMS** (ESI) *m/z* Calculated for $C_{15}H_{14}NS$ $[M+H]^+$: 240.0846, found: 240.0848.

(S)-1-(1-(pyridin-3-yl)ethyl)isoquinoline (6t)



The titled compound was prepared by following the optimized migration procedure **D**, obtained as liquid (49.1 mg, 70% yield, 19.2:80.8 e.r., starting with 5.9:94.1e.r. of **1t**= 62% ee& 86% es). $[\alpha]_D^{25}$-2.8 (c = 0.8, $CHCl_3$).R_f(Ethyl acetate/Pet. ether = 50:50) = 0.70.**^{1}H NMR (400 MHz, $CDCl_3$)** δ 8.49 (d, *J* =5.72 Hz, 1H), 8.00 (d, *J* = 8.77 Hz, 1H), 7.72 (d, *J* = 8.01 Hz, 1H), 7.55 - 7.51 (m, 1H), 7.49 (d, *J* = 5.72 Hz, 1H), 7.43 (ddd, *J* = 8.30, 6.96, 1.14 Hz, 1H), 7.32 (d, *J* = 8.01 Hz, 1H), 7.04 – 6.95 (m, 3H), 5.46 (q, *J* = 6.99 Hz, 1H), 1.71 (d, *J* = 6.87 Hz, 3H).**^{13}C NMR (100 MHz, $CDCl_3$)** δ 162.5, 143.4, 141.6, 136.4, 132.7, 129.6, 129.4, 128.9, 127.5, 127.3, 127.3, 127.1, 126.9, 125.1, 119.8, 39.4, 20.2.**FTIR (cm^{-1}):** 3031, 2982,2941,2848, 1621, 1498, 1430, 1273, 1217, 1064, 926,868, 757. **HRMS** (ESI) *m/z* Calculated for $C_{16}H_{15}N_2$ $[M+H]^+$: 235.1235, found: 235.1239.

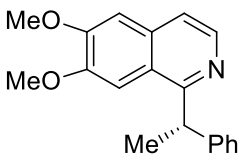
(S)-1-(2-phenylbutan-2-yl)isoquinoline (6u)



The titled compound was prepared by following the optimized migration procedure **D**, obtained as a sticky liquid (59.6 mg, 76% yield, 5.5: 94.5e.r., starting with 0.9: 99.1e.r. of **1u** = 89% ee& 95% es). $[\alpha]_D^{25}$-7.8 (c = 1.2, $CHCl_3$).R_f(Ethyl acetate/Pet. ether = 10:90) = 0.80. **^{1}H NMR (400 MHz, $CDCl_3$)** δ 8.55 (d, *J* = 5.34 Hz, 1H), 7.76 (d, *J* = 7.63 Hz, 1H), 7.60 (d, *J* = 9.16 Hz, 1H), 7.55 (d, *J* = 6.10 Hz, 1H), 7.47 (t, *J* = 7.63 Hz, 1H), 7.24 (d, *J* = 7.63 Hz, 2H), 7.21 - 7.16 (m, 4H), 2.56 (dd, *J* = 13.35, 7.25 Hz, 1H), 2.38 (dd, *J* = 13.35, 7.25 Hz, 1H), 1.81 (s, 3H), 0.61 (t, *J* = 7.63 Hz, 3H).**^{13}C NMR (100 MHz, $CDCl_3$)**

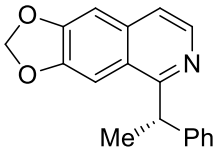
δ 165.8, 150.0, 140.5, 137.3, 128.7, 128.4, 127.6, 127.6, 126.4, 126.4, 125.7, 125.7, 120.1, 50.7, 34.3, 28.0, 8.9.**FTIR (cm^{-1}):** 3050, 2970, 2930, 2874, 1590, 1557, 1496, 1451, 1370, 1014, 824, 754. **HRMS** (ESI) *m/z* Calculated for $C_{19}H_{20}N[M+H]^+$: 262.1595, found: 262.1598.

(S)-6,7-dimethoxy-1-(1-phenylethyl)isoquinoline (6x)



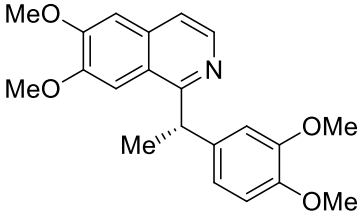
The titled compound was prepared by following the optimized migration procedure **D**, obtained as a sticky solid (63.3 mg, 72% yield, 91.1:8.9 e.r., starting with 97.1:2.9e.r. of **1x** = 82% ee& 94% es). $[\alpha]_D^{25}$-3.8 (c = 0.9, $CHCl_3$).R_f(Ethyl acetate/Pet. ether = 20:80) = 0.40. **^{1}H NMR (400 MHz, $CDCl_3$)** δ 8.37 (d, *J* = 5.49 Hz, 1H), 7.33 (d, *J* = 5.49 Hz, 1H), 7.26 - 7.12 (m, 5H), 7.11 - 7.01 (m, 1H), 6.93 (s, 1H), 4.81 (q, *J* = 7.12 Hz, 1H), 3.89 (s, 3H), 3.75 (s, 3H), 1.76 (d, *J* = 6.71 Hz, 3H).**^{13}C NMR (100 MHz, $CDCl_3$)** δ 160.4, 152.1, 149.5, 146.2, 140.7, 133.2, 128.5, 127.4, 126.1, 122.5, 118.5, 105.3, 104.1, 55.9, 55.7, 44.0, 21.6.**FTIR (cm^{-1}):** 3019, 2967, 1615, 1573, 1506,1470,1423, 1270, 1160, 1090,1029, 856, 757. **HRMS** (ESI) *m/z* Calculated for $C_{19}H_{20}NO_2$ $[M+H]^+$: 294.1494, found 294.1497.

(S)-5-(1-phenylethyl)-[1,3]dioxolo[4,5-g]isoquinoline (6y)



The titled compound was prepared by following the optimized migration procedure **D**, obtained as a sticky solid (62.3 mg, 75% yield, 92.2:7.8 e.r., starting with 97.6:2.4e.r. of **1y** = 84% ee& 95% es). $[\alpha]_D^{25}$+20.8 (c = 1.0, $CHCl_3$).R_f(Ethyl acetate/Pet. ether = 20:80) = 0.40. **^{1}H NMR (500 MHz, $CDCl_3$)** δ 8.35 (d, *J* = 5.72 Hz, 1H), 7.32 - 7.28 (m, 2H), 7.21 - 7.14 (m, 4H), 7.10 - 7.03 (m, 1H), 6.94 (s, 1H), 5.96 (d, *J* = 1.14 Hz, 1H), 5.91 (d, *J* = 1.14 Hz, 1H), 4.76 (q, *J* = 6.87 Hz, 1H), 1.73 (d, *J* = 6.87 Hz, 3H).**^{13}C NMR (125 MHz, $CDCl_3$)** δ 160.8, 150.0, 148.1, 145.9, 141.0, 134.8, 128.5, 127.4, 126.1, 123.9, 119.2, 103.2, 101.5, 101.4, 43.6, 21.9.**FTIR (cm^{-1}):** 2969, 2920, 1586, 1463, 1268, 1220, 1038, 936, 861,758, 703. **HRMS** (ESI) *m/z* Calculated for $C_{18}H_{15}NO_2$ $[M+Na]^+$: 300.1000, found 300.1010.

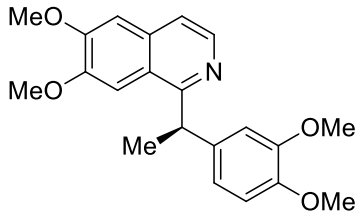
(S)-1-(1-(3,4-dimethoxyphenyl)ethyl)-6,7-dimethoxyisoquinoline (6z)



The titled compound was prepared by following the optimized migration procedure **D**, obtained as a white solid (74.2 mg, 70% yield, 91.5:8.5 e.r., starting with 99.2:0.8e.r. of **1z** = 83% ee& 92% es). $[\alpha]_D^{25}$-43.8 (c = 1.0, $CHCl_3$).R_f(Ethyl acetate/Pet. ether = 50:50) = 0.60. MP = 148.2 – 149.5 °C. **^{1}H NMR (400 MHz, $CDCl_3$)** δ 8.44 (d, *J* = 5.63 Hz, 1H), 7.40 (d, *J* = 5.75 Hz, 1H), 7.36 (s, 1H), 7.01 (s, 1H), 6.88 - 6.83 (m, 1H), 6.81 (d, *J* = 1.75 Hz, 1H), 6.76 (d, *J* = 8.25 Hz, 1H), 4.85 (q, *J* = 7.00 Hz, 1H), 3.97 (s, 3H), 3.87 (s, 3H), 3.80 (s, 3H), 3.76 (s, 3H), 1.83 (d, *J* = 6.88 Hz, 3H).**^{13}C NMR (100 MHz, $CDCl_3$)** δ

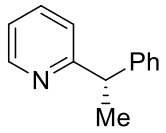
160.5, 152.0, 149.4, 149.0, 147.3, 140.6, 138.8, 133.2, 122.4, 119.3, 118.4, 111.1, 110.7, 105.2, 103.9, 55.8, 55.7, 55.7, 55.6, 43.4, 21.6.**FTIR (cm^{-1}):** 2937, 2836,1619, 1572, 1510, 1467, 1424, 1267, 1240, 1151, 1091, 1028, 859, 812.**HRMS** (ESI) *m/z* Calculated for $C_{21}H_{24}NO_4$ $[M+H]^+$: 354.1705, found: 354.1713.

(R)-1-(1-(3,4-dimethoxyphenyl)ethyl)-6,7-dimethoxyisoquinoline (*ent* – 6z):



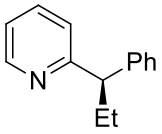
The titled compound was prepared by following the catalytic asymmetric migration procedure **E** with racemic **1z**, obtained as a white solid (222.4 mg, 63% yield, 89% ee). $[\alpha]_D^{25}$+45.9 (c = 1.0, $CHCl_3$).

(S)-2-(1-phenylethyl)pyridine (6aa)



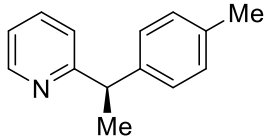
The titled compound was prepared by following the optimized migration procedure **D**, obtained as a liquid (21.9 mg, 40% yield, 95.3:4.7 e.r., starting with 99.0:1.0e.r. of **1aa** = 91% ee & 96% es). $[\alpha]_D^{25}$+2.8 (c = 0.5, $CHCl_3$).R_f(Ethyl acetate/Pet. ether = 20:80) = 0.7. The spectral values were matched favorably with previously reported literaturevalues.[20]

(R)-2-(1-phenylpropyl)pyridine (6ab)



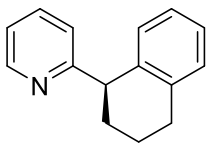
The titled compound was prepared by following the optimized migration procedure **D**, obtained as liquid (26.9 mg, 45% yield, 3.6:96.4e.r., starting with 0.5: 99.5e.r. of **1ab** = 93% ee & 97% es). $[\alpha]_D^{25}$-5.7 (c = 0.5, $CHCl_3$). R_f(Ethyl acetate/Pet. ether = 20:80) = 0.6. The spectral values were matched favorably with previously reported literature values.[27]

(R)-2-(1-(p-tolyl)ethyl)pyridine (6ac)



The titled compound was prepared by following the optimized migration procedure **D**, obtained as liquid (25.4 mg, 43% yield, 6.3:93.7 e.r., starting with 0.7: 99.3e.r. of **1ac** = 87% ee& 94% es). $[\alpha]_D^{25}$-3.2 (c = 0.4, $CHCl_3$). R_f(Ethyl acetate/Pet. ether = 20:80) = 0.6. The spectral values were matched favorably with previously reported literature values.[28]

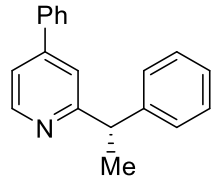
(R)-2-(1,2,3,4-tetrahydronaphthalen-1-yl)pyridine (6ad)



The titled compound was prepared by following the optimized migration procedure **D**, obtained as liquid (27.0 mg, 43% yield, 3.3:96.7e.r., starting with 0.8: 99.2 e.r. of **1ad** = 93% ee & 98% es). $[\alpha]_D^{25}$-5.7 (c = 0.5, $CHCl_3$).

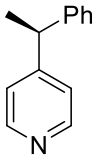
R_f(Ethyl acetate/Pet. ether = 20:80) = 0.6. The spectral values were matched favorably with previously reported literature values.[27]

(S)-4-phenyl-2-(1-phenylethyl)pyridine (6ae)



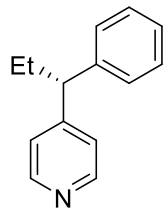
The titled compound was prepared by following the optimized migration procedure **D** (the first step for 96h instead of 24h), obtained as a liquid (41.2 mg, 53% yield, 89.9:10.1 e.r., starting with 99.7:0.3 e.r. of **1ae** = 80% ee & 91% es). $[\alpha]_D^{25}$+1.3 (c = 0.4, $CHCl_3$).R_f(Ethyl acetate/Pet. ether = 20:80) = 0.25.**^{1}H NMR (400 MHz, $CDCl_3$)** δ 8.61 (dd, *J*= 5.13, 0.63 Hz, 1H), 7.60 - 7.53 (m, 2H), 7.48 - 7.38 (m, 3H), 7.36 - 7.28 (m, 6H), 7.23 - 7.17 (m, 1H), 4.36 (q, *J*= 7.13 Hz, 1H), 1.76 (d, *J*= 7.25 Hz, 3H). **^{13}C NMR (100 MHz, $CDCl_3$)** δ 165.5, 149.6, 148.9, 145.1, 138.6, 129.0, 128.9, 128.5, 127.7, 127.0, 126.3, 120.1, 119.4,47.5, 20.8. **FTIR (cm^{-1}):** 3065, 3023, 2922, 2855, 1598, 1460, 1259, 1063, 1033, 848, 759, 703, 661. **HRMS** (ESI) *m/z* Calculated for $C_{19}H_{18}N[M+H]^+$: 260.1434, found: 260.1434.

(S)-4-(1-phenylethyl)pyridine (7aa) :



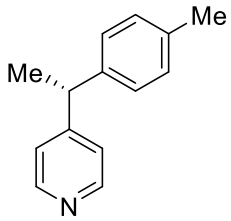
The titled compound was prepared by following the optimized migration procedure **D**, obtained as a liquid (10.9 mg, 20% yield, 90.7:9.3 e.r., starting with 99.0:1.0 e.r. of **1aa** = 81% ee & 92% es). $[\alpha]_D^{25}$+1.85 (c = 0.5, $CHCl_3$). R_f (Ethyl acetate/Pet. ether = 20:80) = 0.20. The spectral values were matched favorably with previously reported literature values.[29]

(R)-2-(1-phenylpropyl)pyridine (7ab)



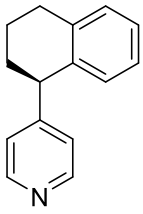
The titled compound was prepared by following the optimized migration procedure **D**, obtained as a liquid (4.7 mg, 8% yield, 8.0:92.0 e.r., starting with 0.5:99.5e.r. of **1ab** = 84% ee & 92% es). $[\alpha]_D^{25}$-2.12 (c = 0.3, $CHCl_3$). R_f (Ethyl acetate/Pet. ether = 20:80) = 0.22. The spectral values were matched favorably with previously reported literature values.[29]

(R)-4-(1-(p-tolyl)ethyl)pyridine (7ac)



The titled compound was prepared by following the optimized migration procedure **D**, obtained as a liquid (5.9 mg, 10% yield, 14.0:86.0 e.r., starting with 0.7:99.3 e.r. of **1aa** = 72% ee & 87% es). $[\alpha]_D^{25}$-1.82 (c = 0.3, $CHCl_3$). R_f (Ethyl acetate/Pet. ether = 20:80) = 0.22. The spectral values were matched favorably with previously reported literature values.[29]

(R)-4-(1,2,3,4-tetrahydronaphthalen-1-yl)pyridine (7ad)



The titled compound was prepared by following the optimized migration procedure **D**, obtained as a liquid (4.4 mg, 7% yield, 8.8:91.2 e.r., starting with 0.8:99.2 e.r. of **1ad** = 82% ee & 92% es). $[\alpha]_D^{25}$-2.53 (c = 0.2, $CHCl_3$). R_f (Ethyl acetate/Pet. ether = 20:80) = 0.18. The spectral values were matched favorably with previously reported literature values.[30]

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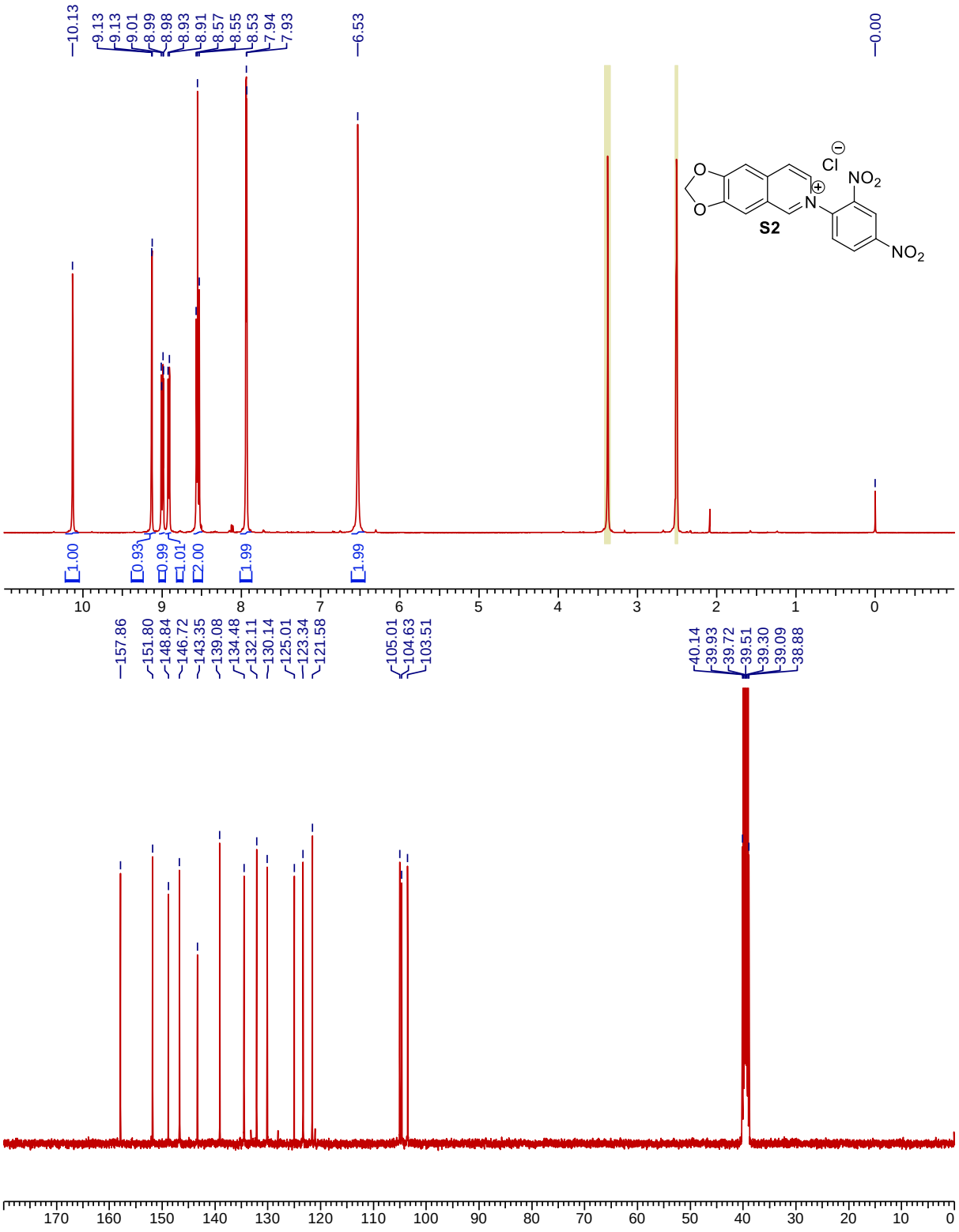
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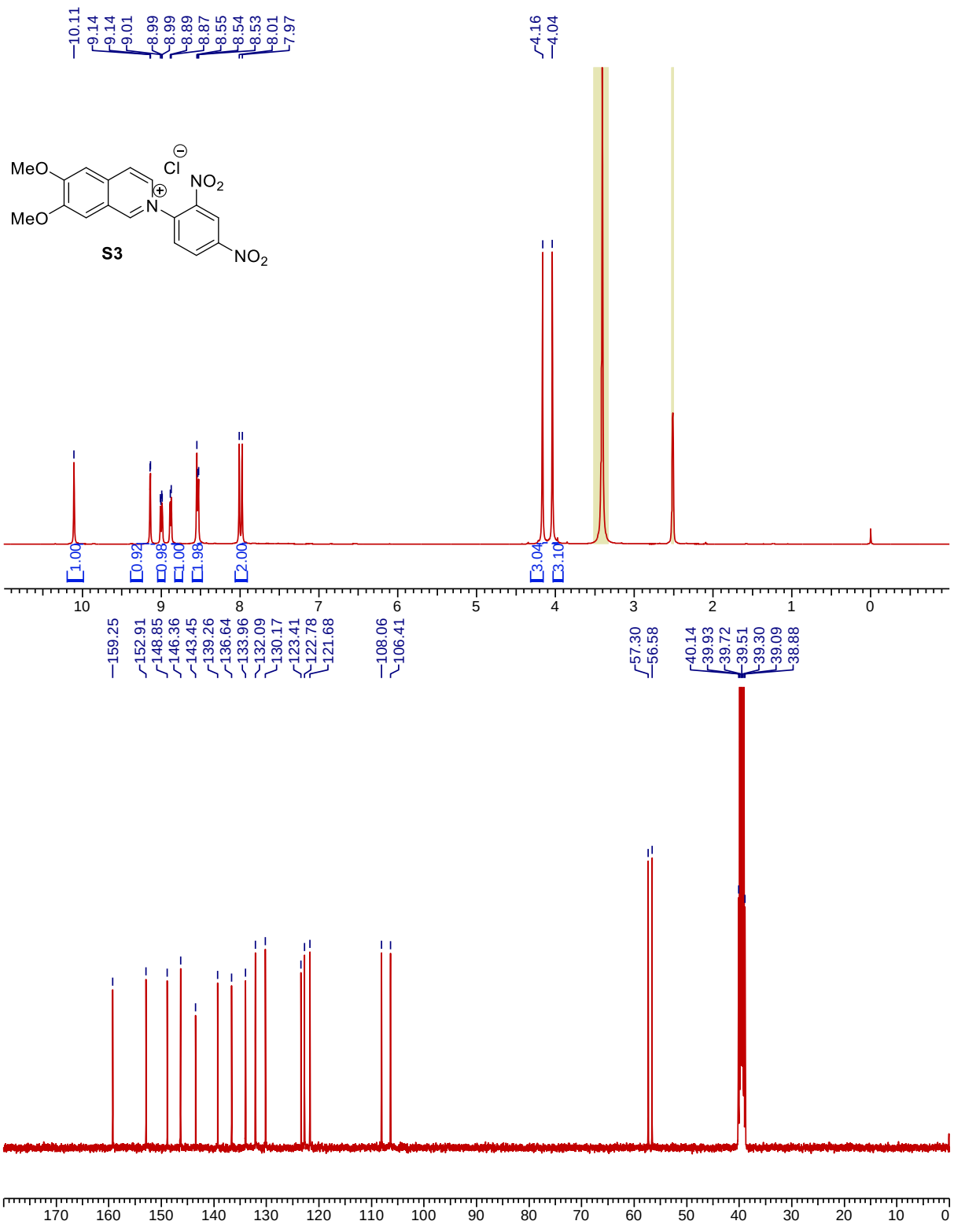
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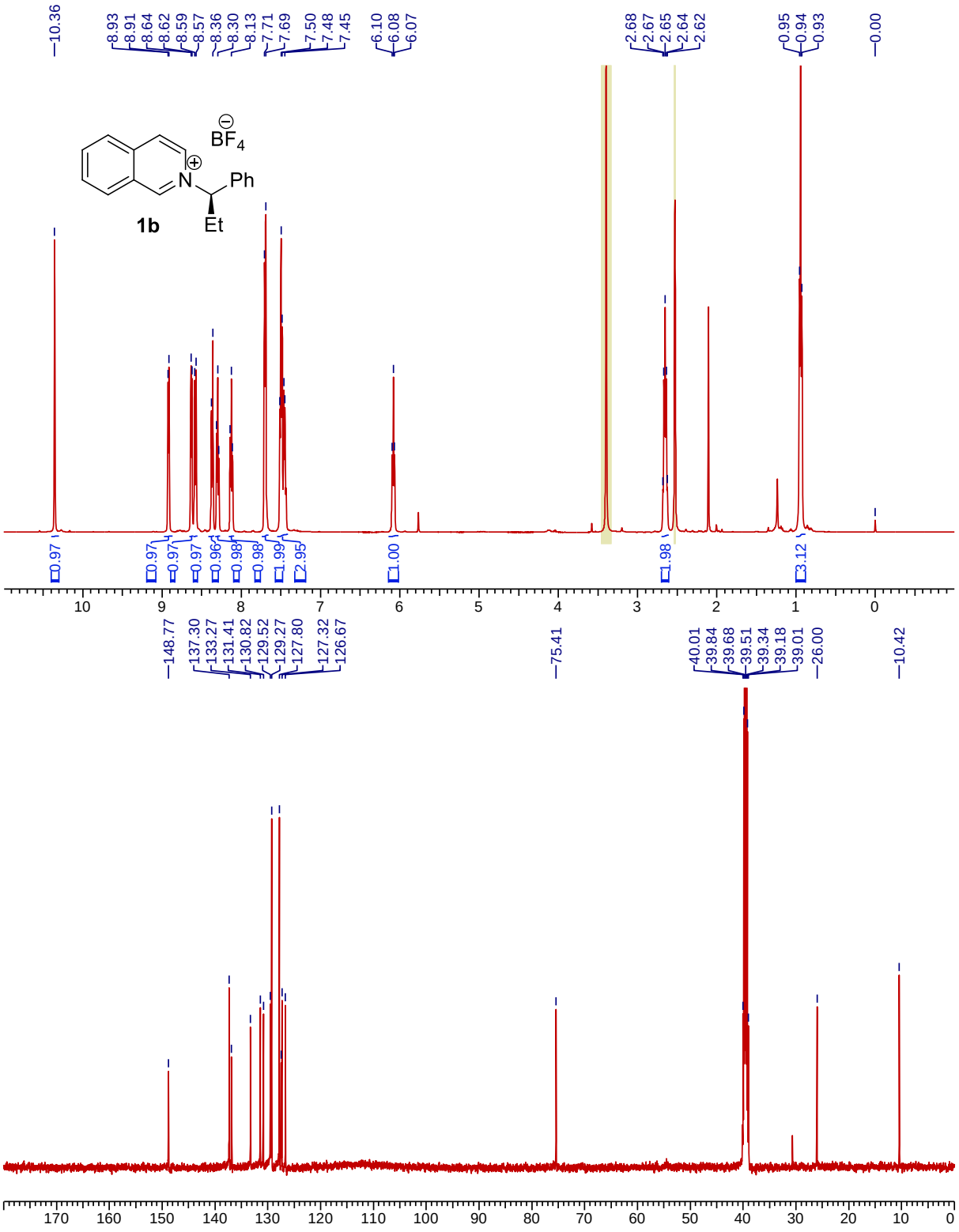
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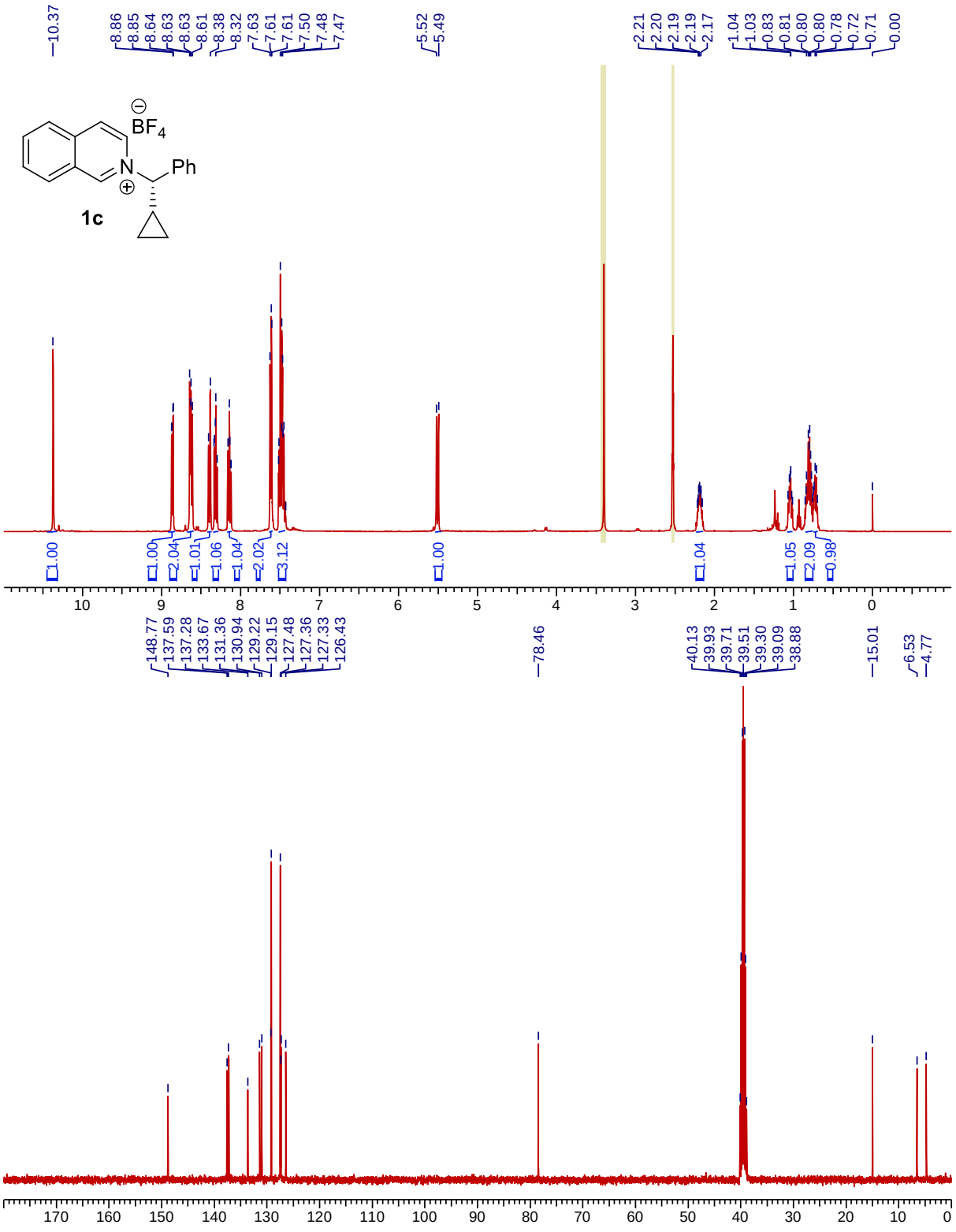
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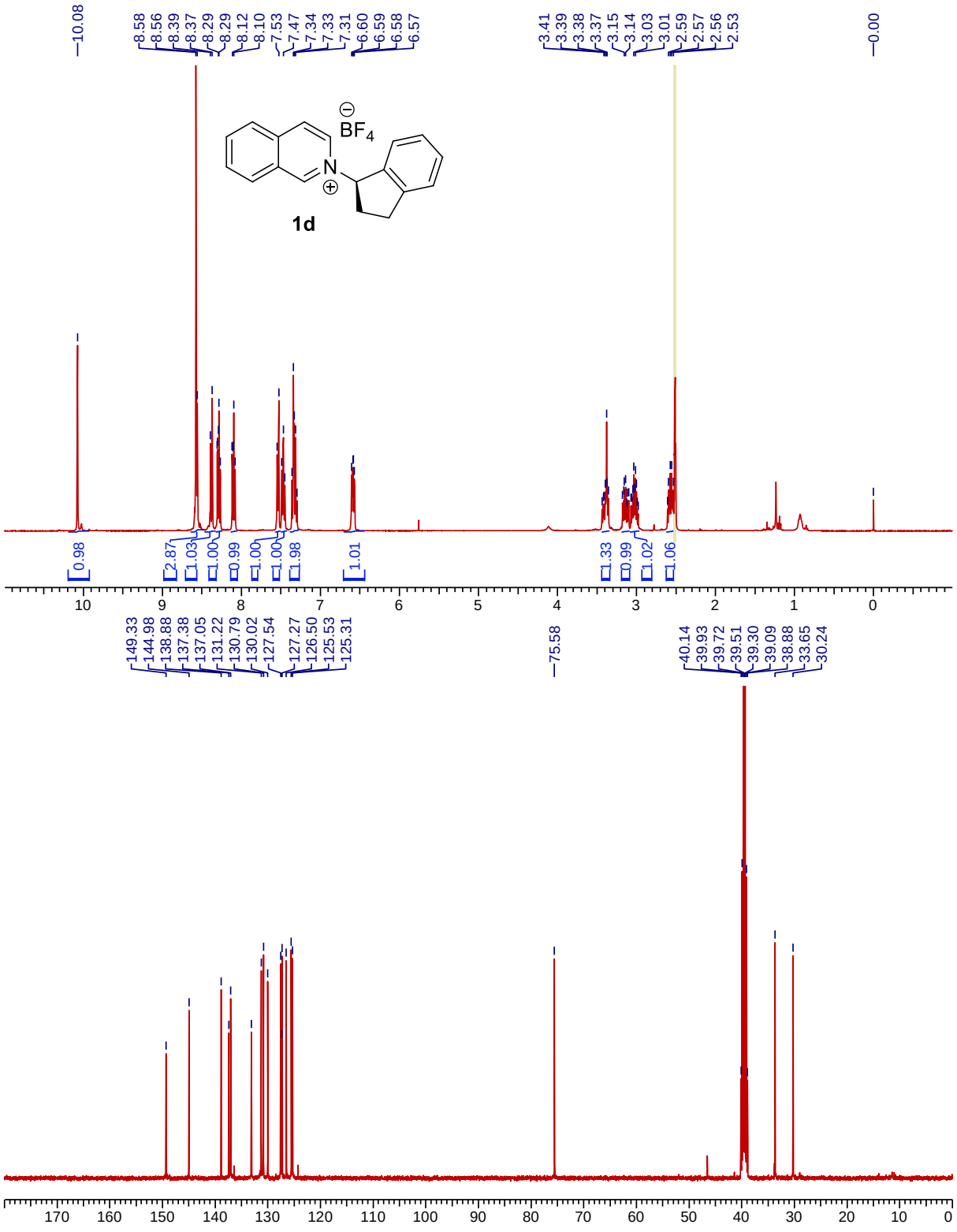
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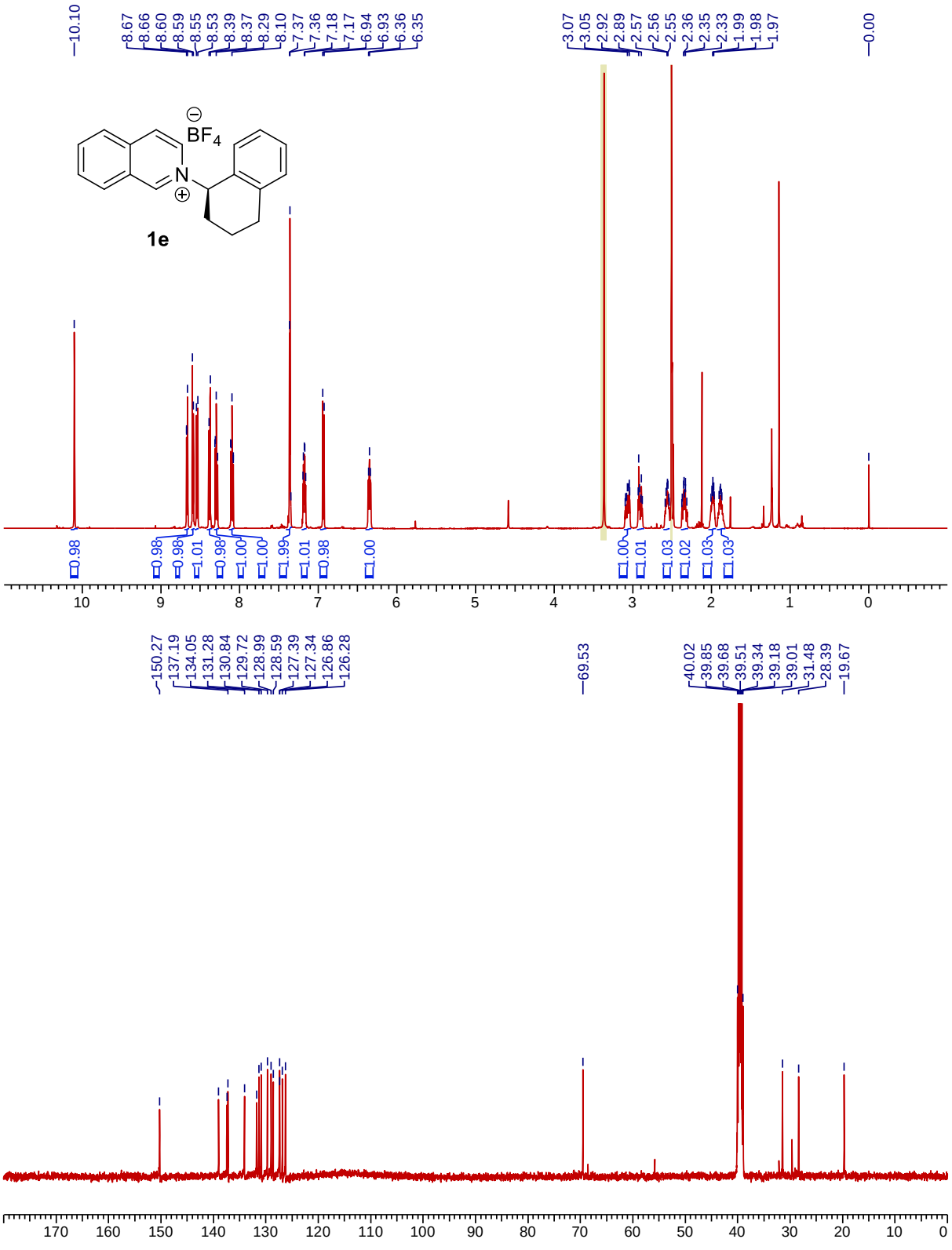
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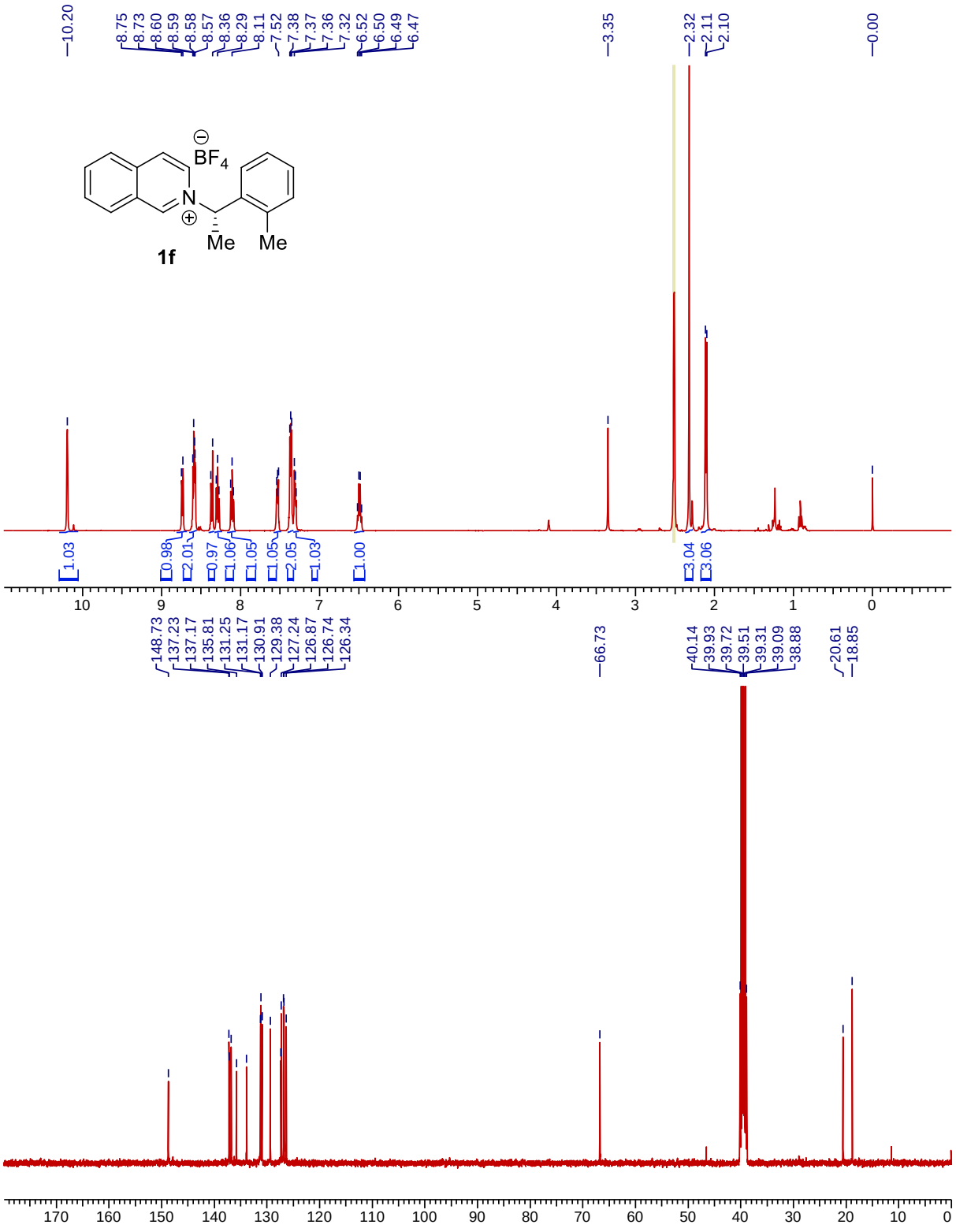
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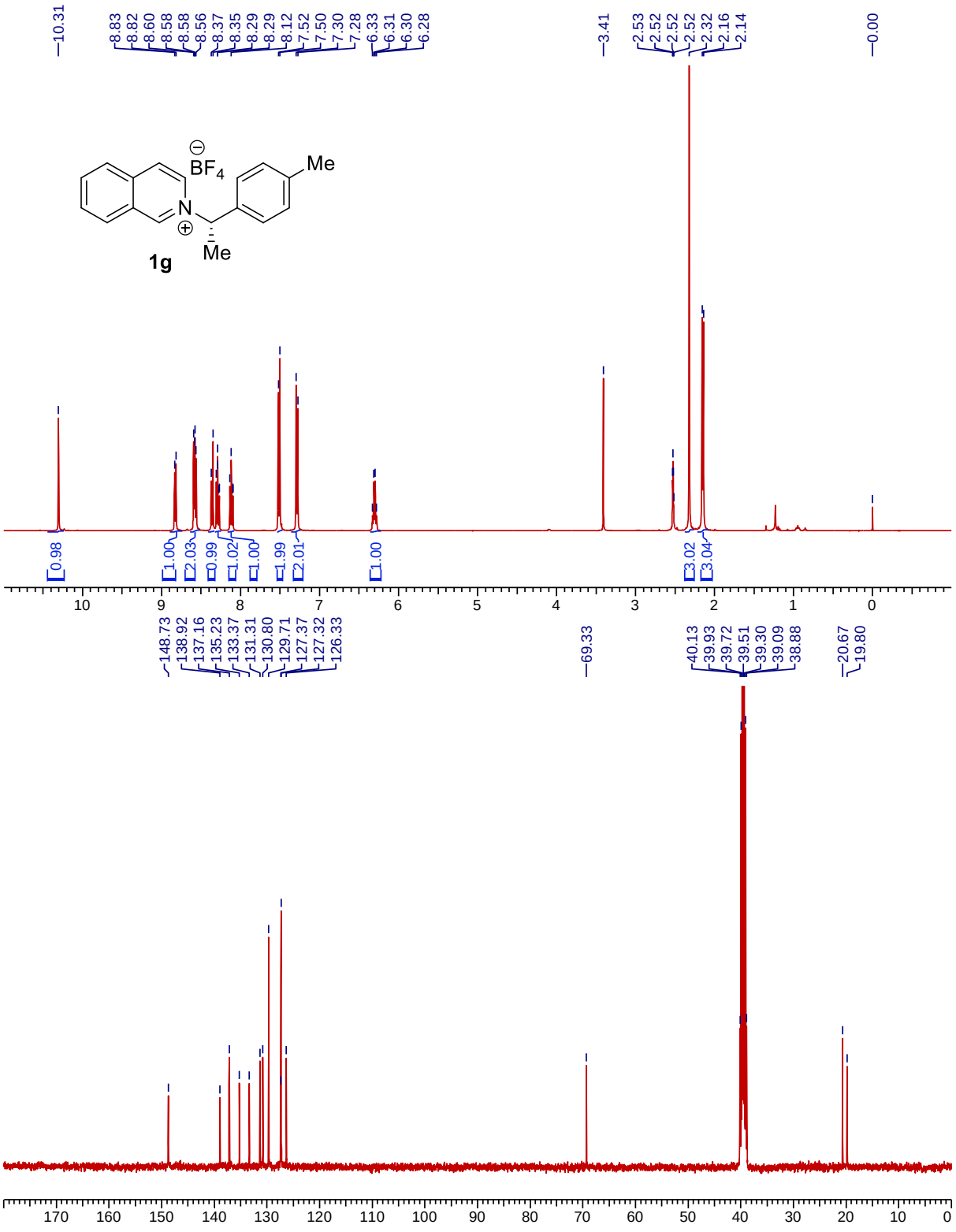
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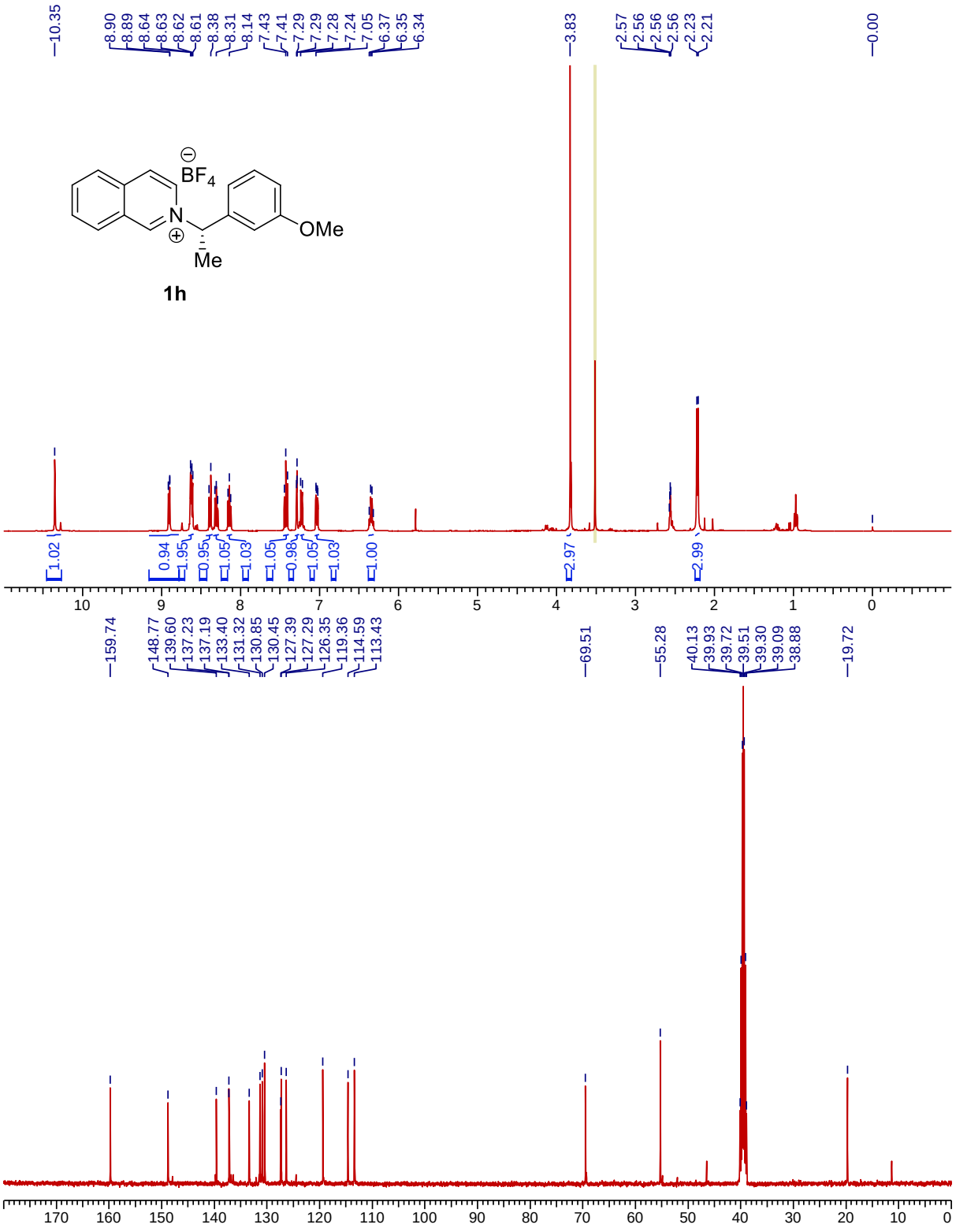
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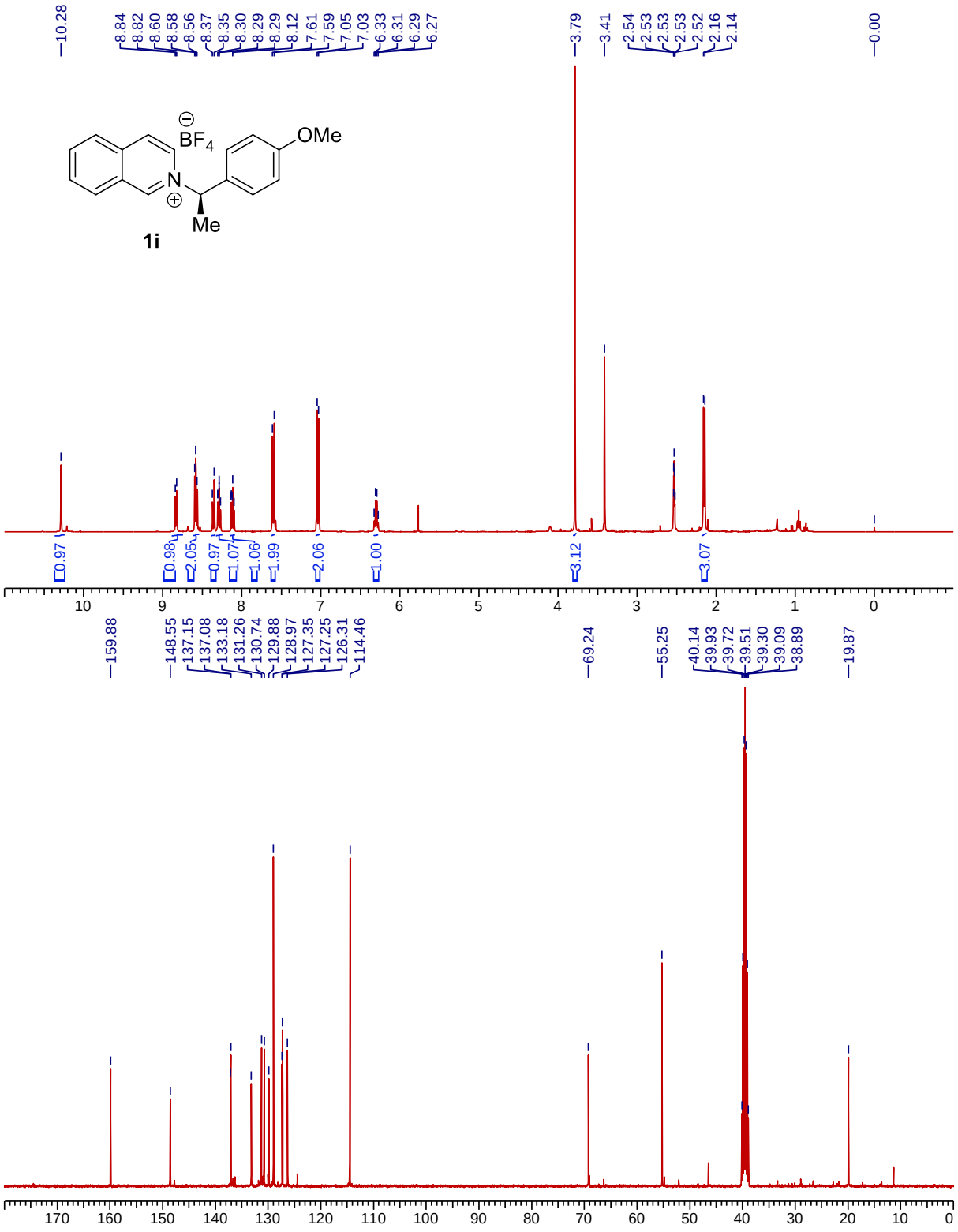
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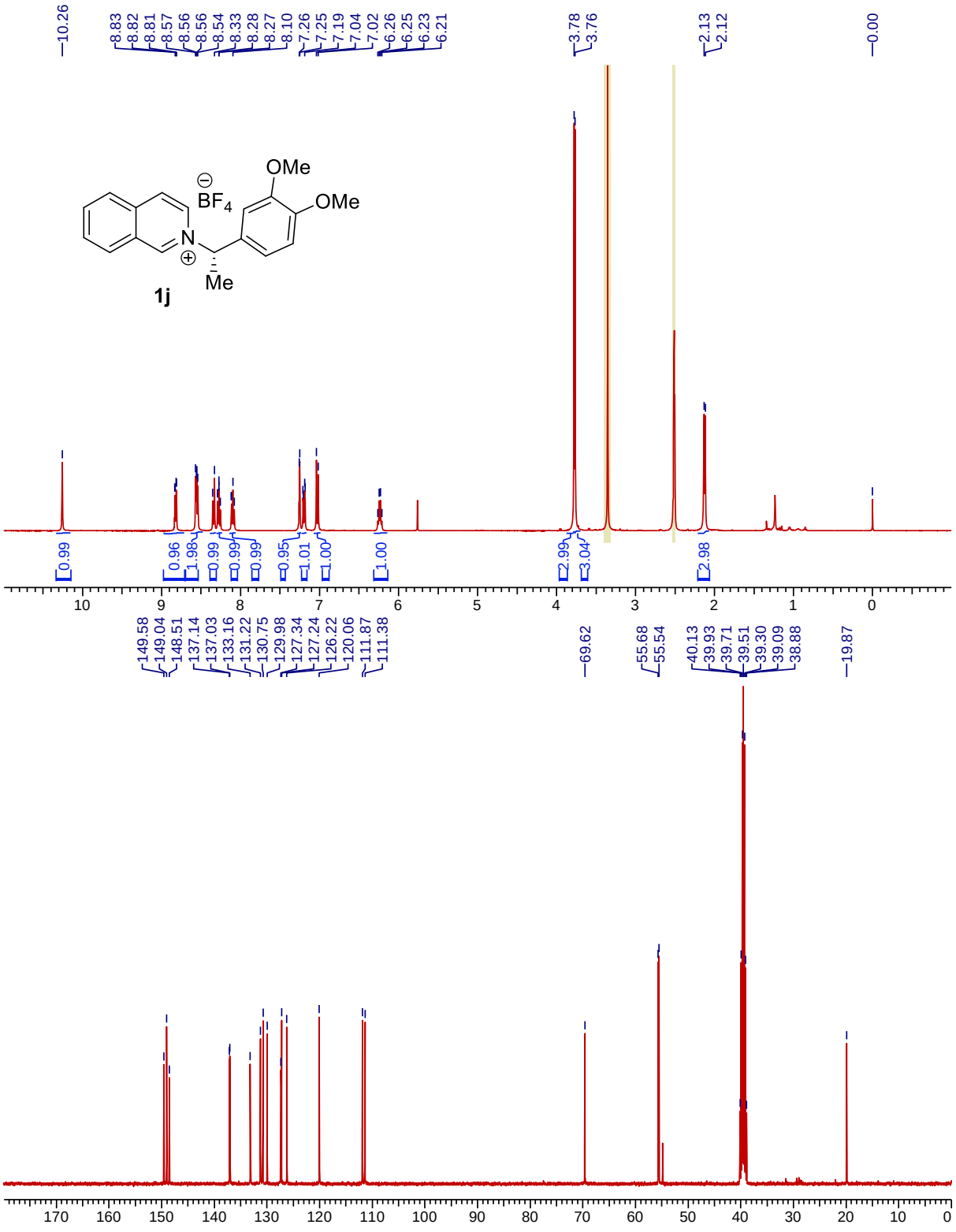
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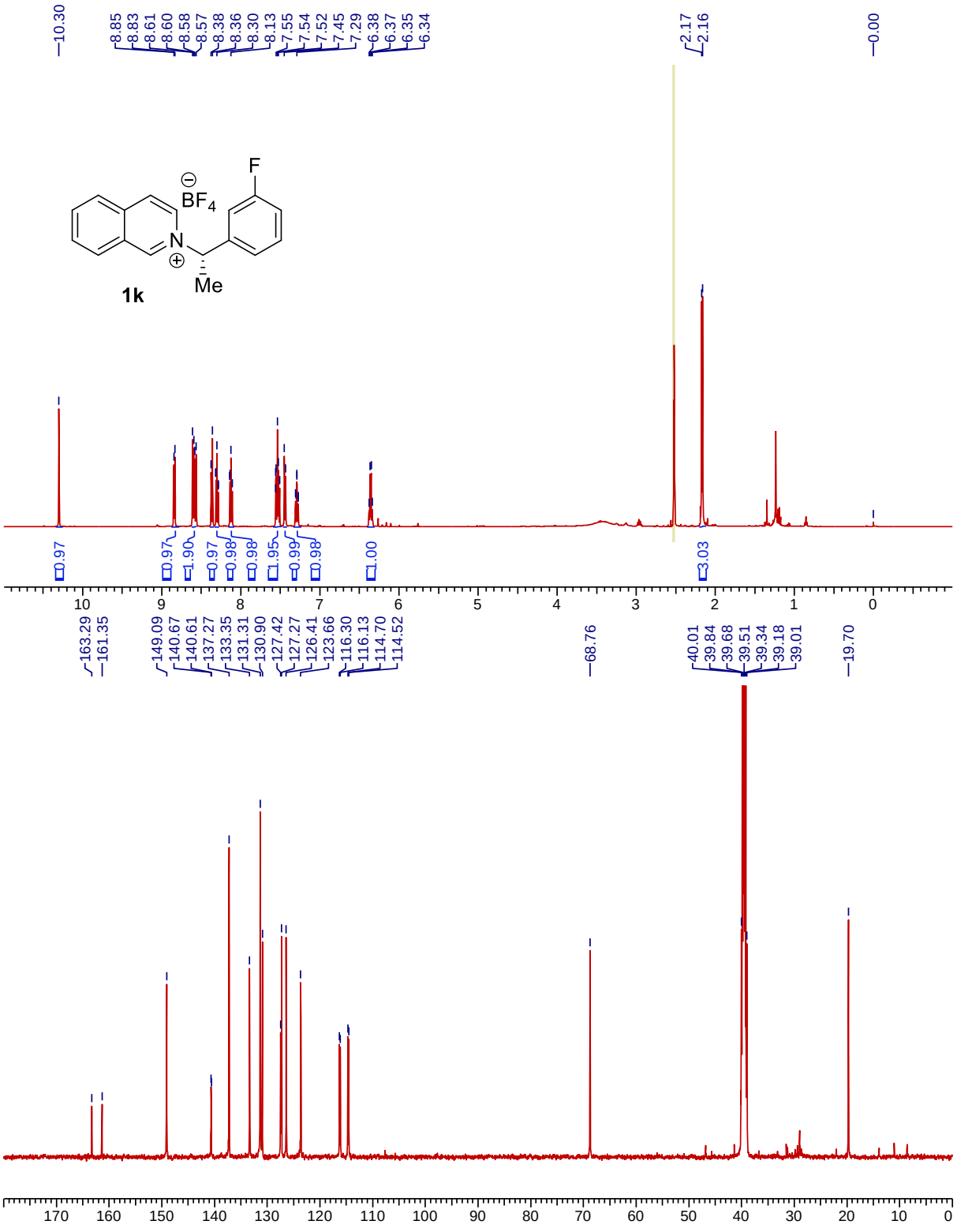
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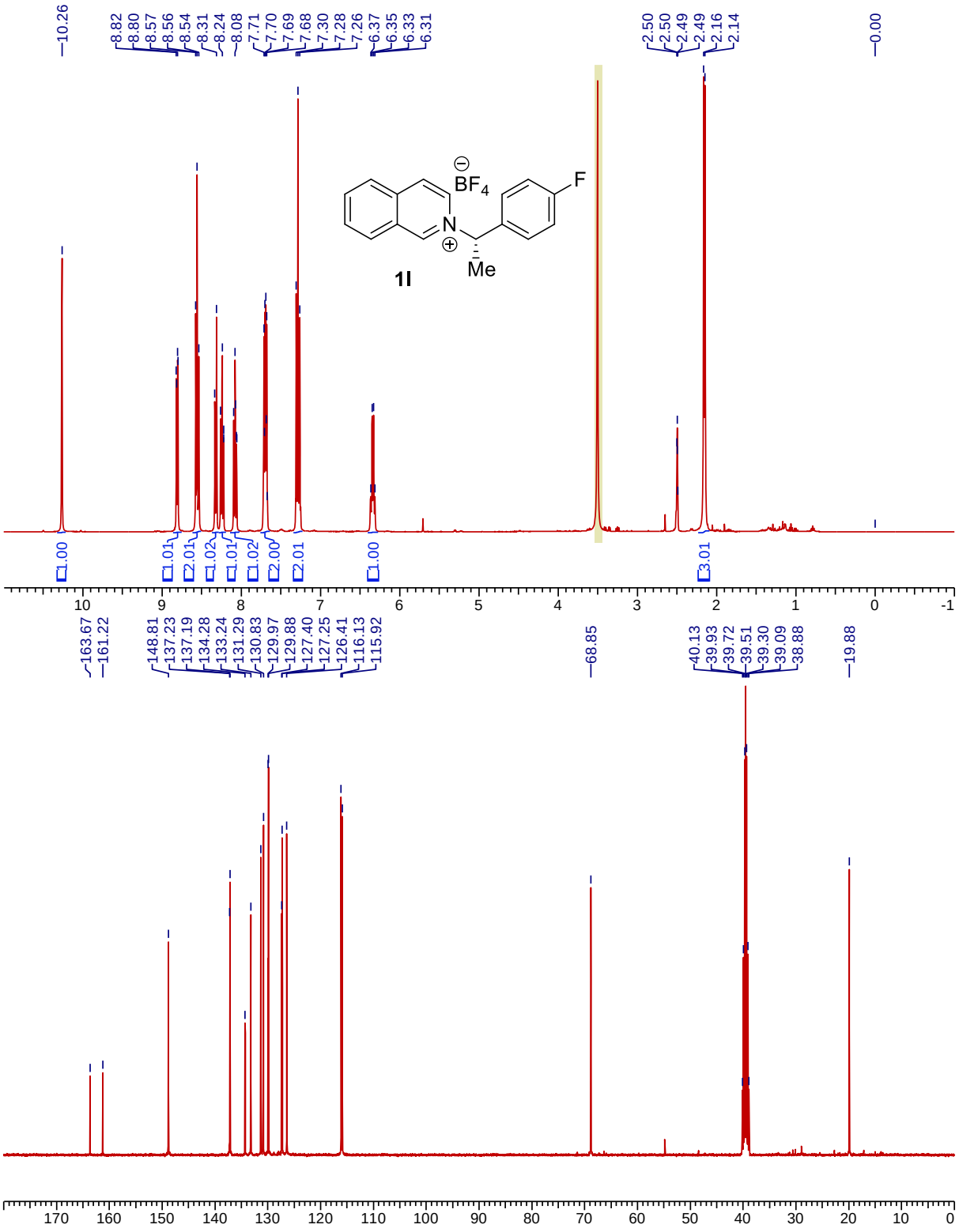
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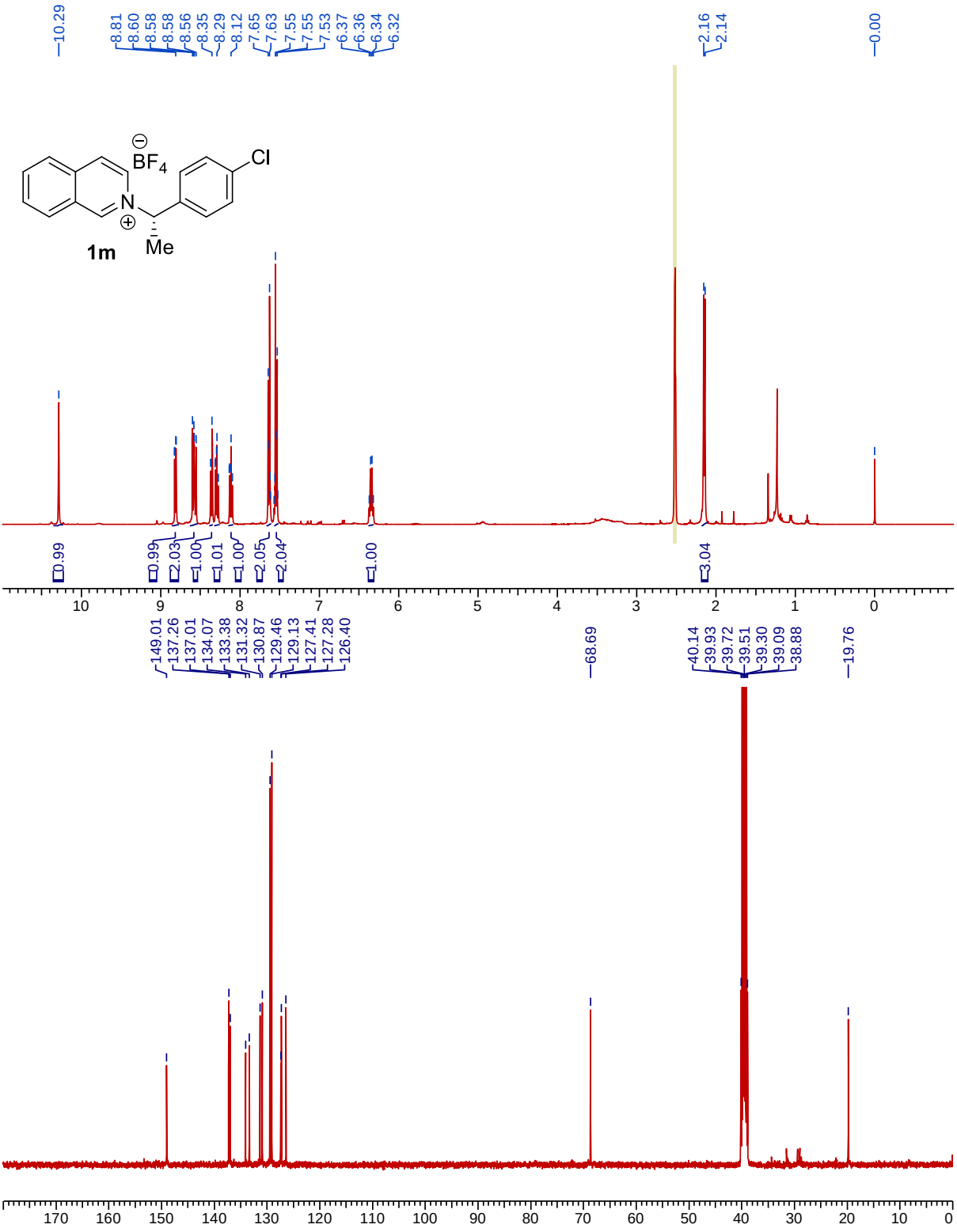
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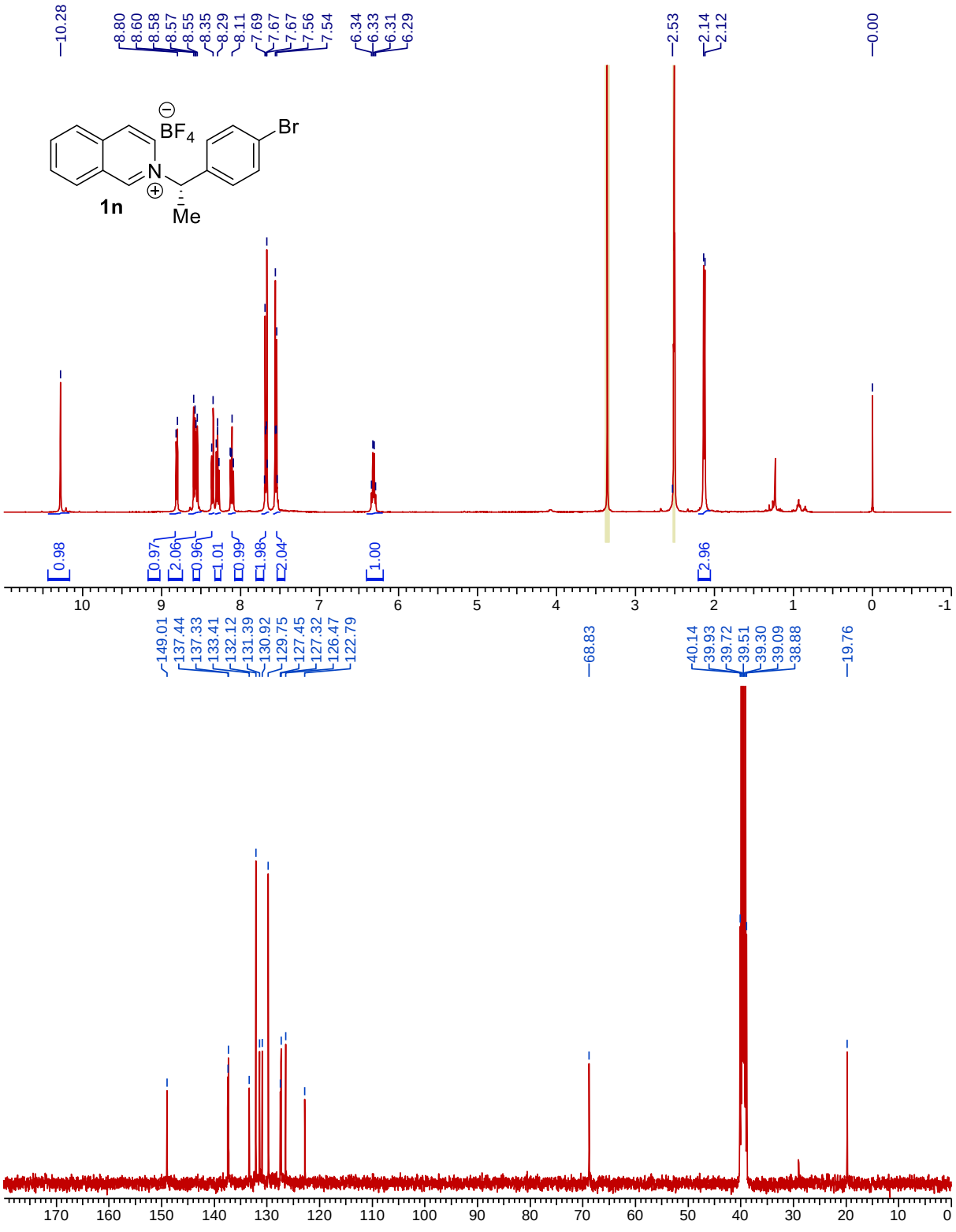
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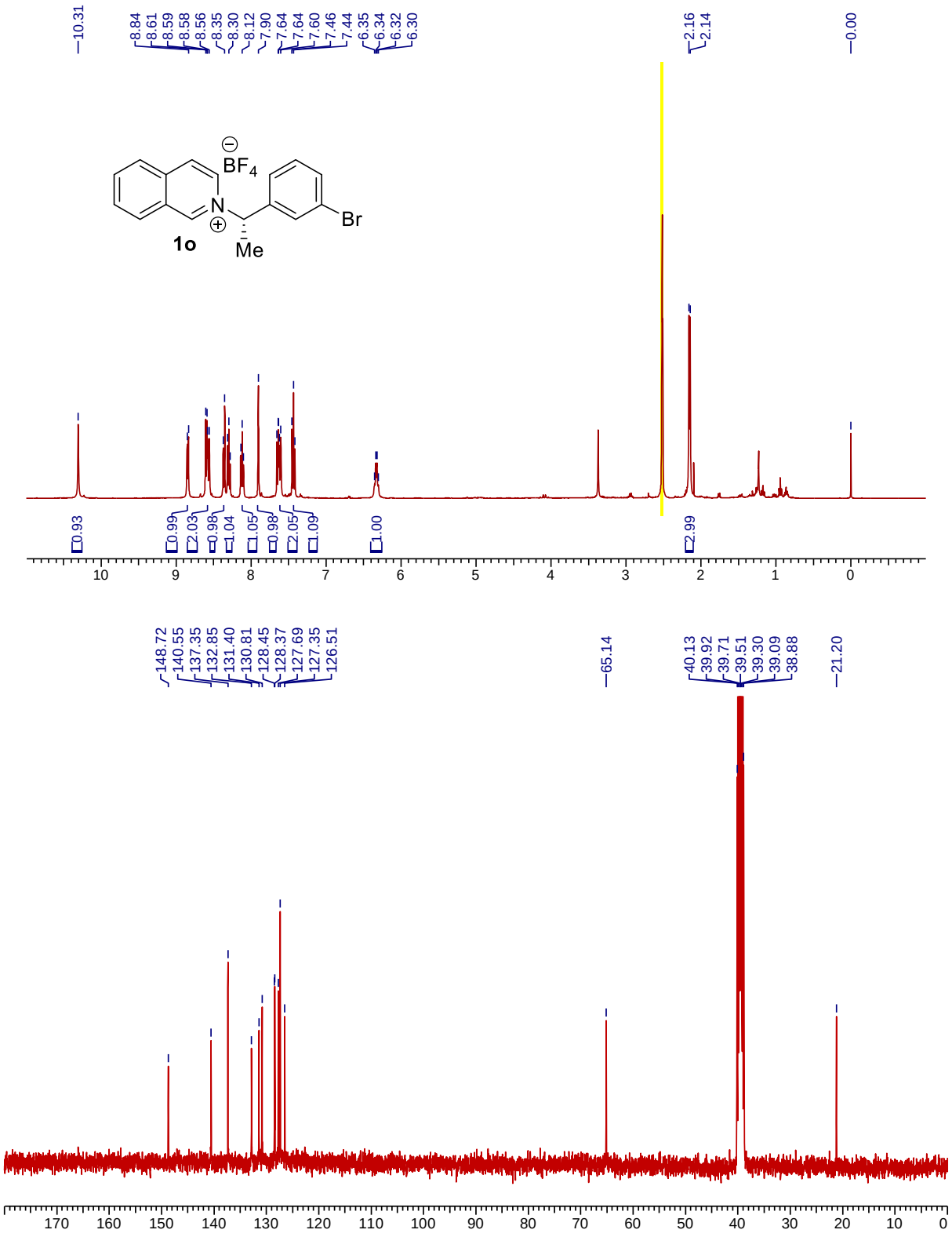
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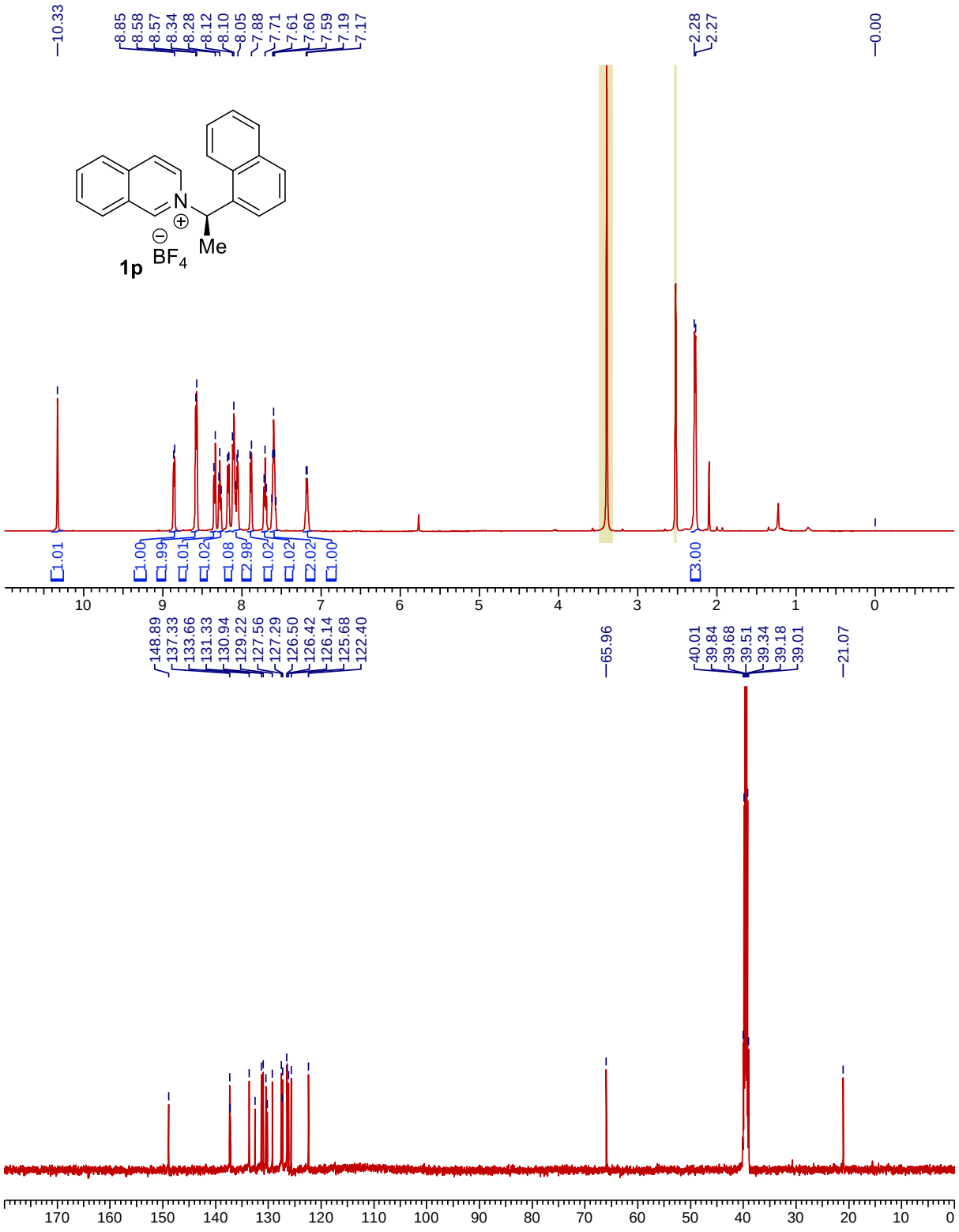
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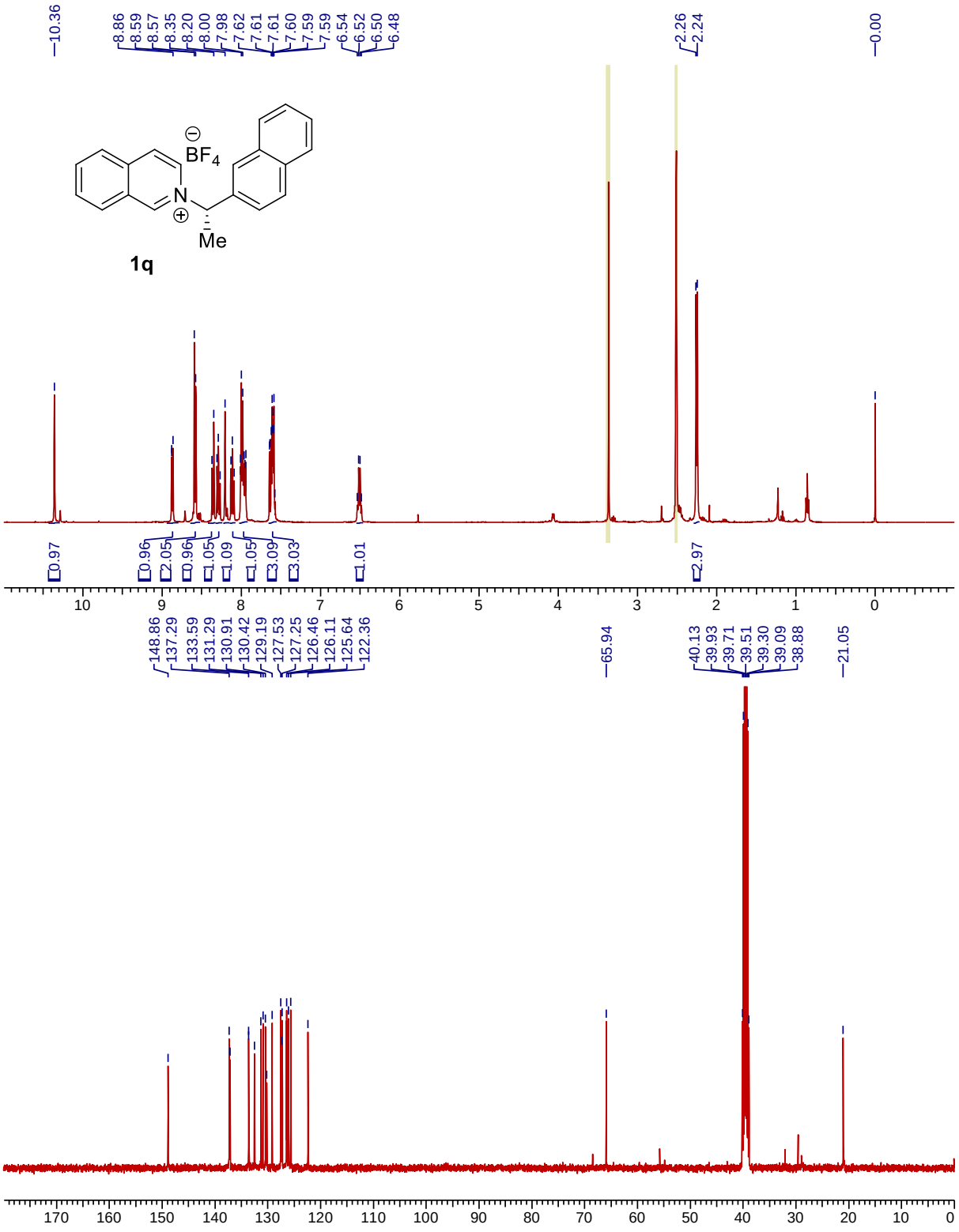
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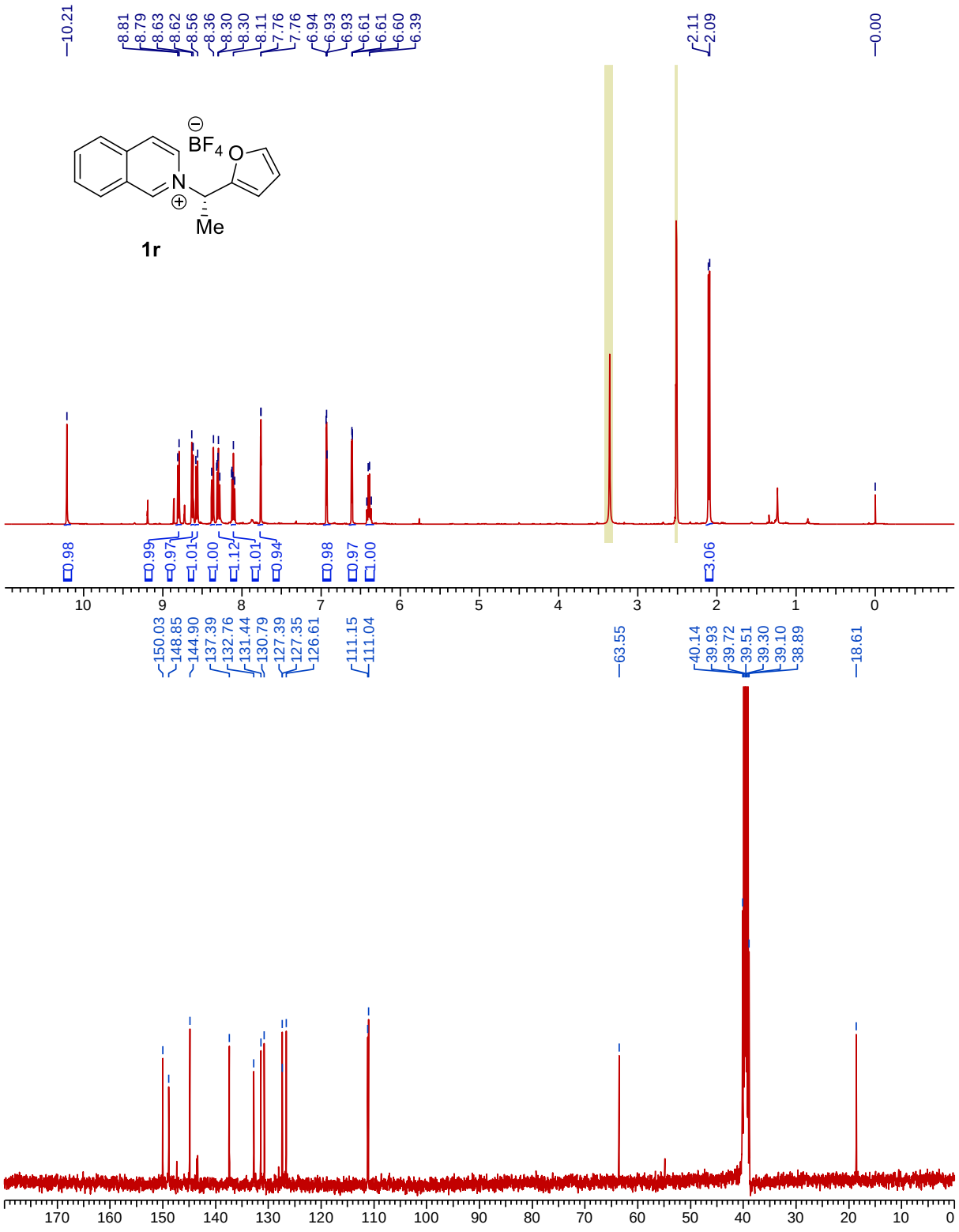
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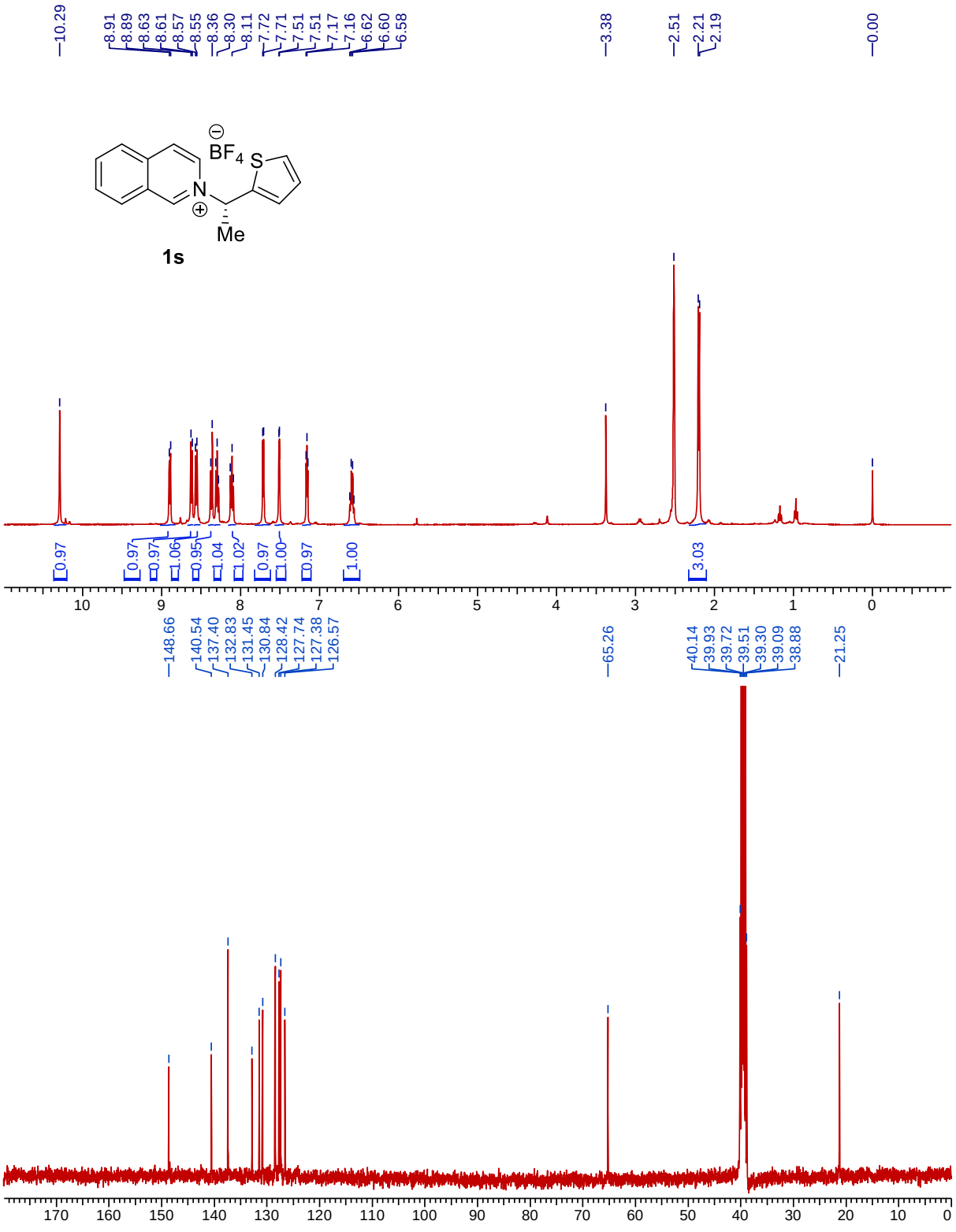
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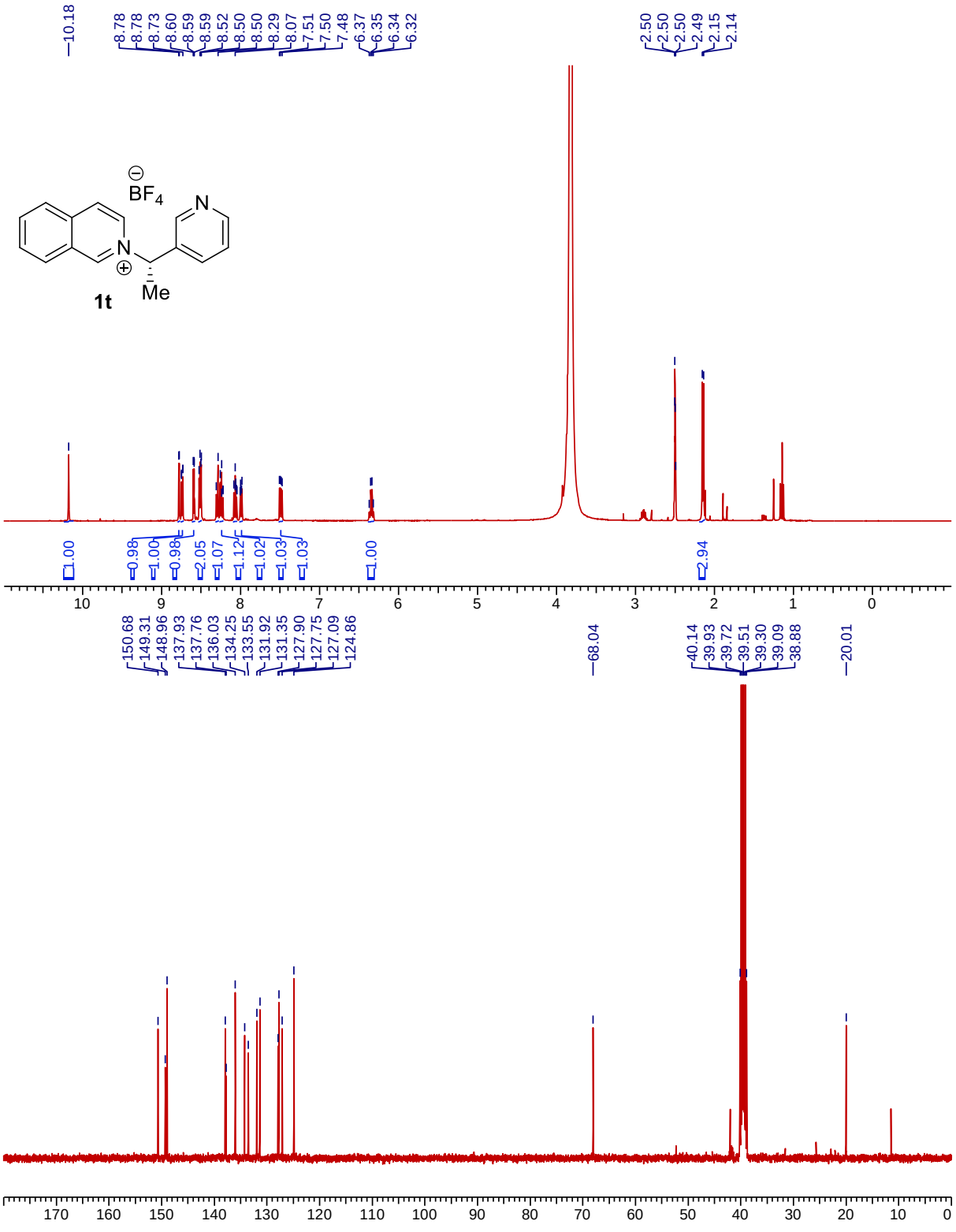
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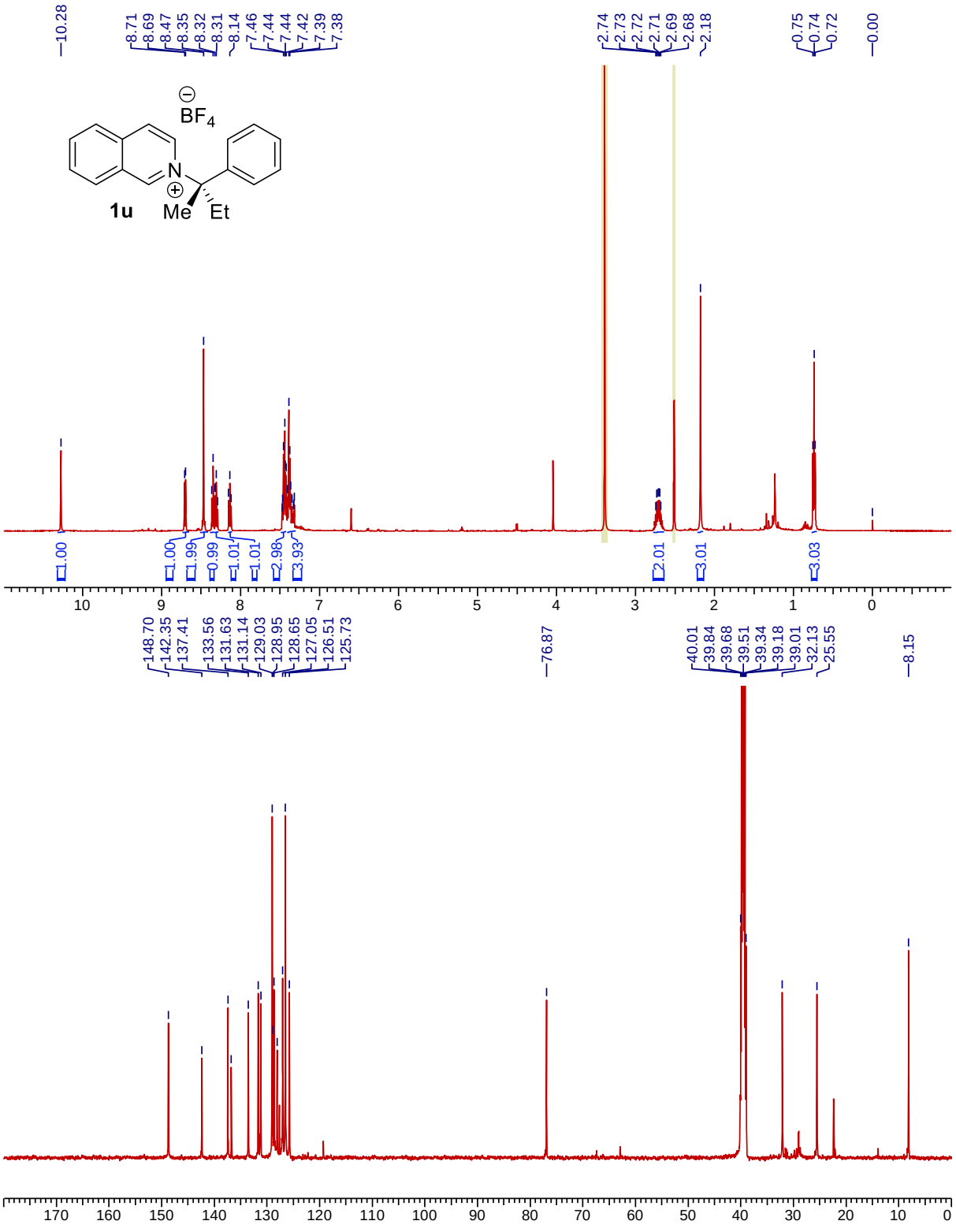
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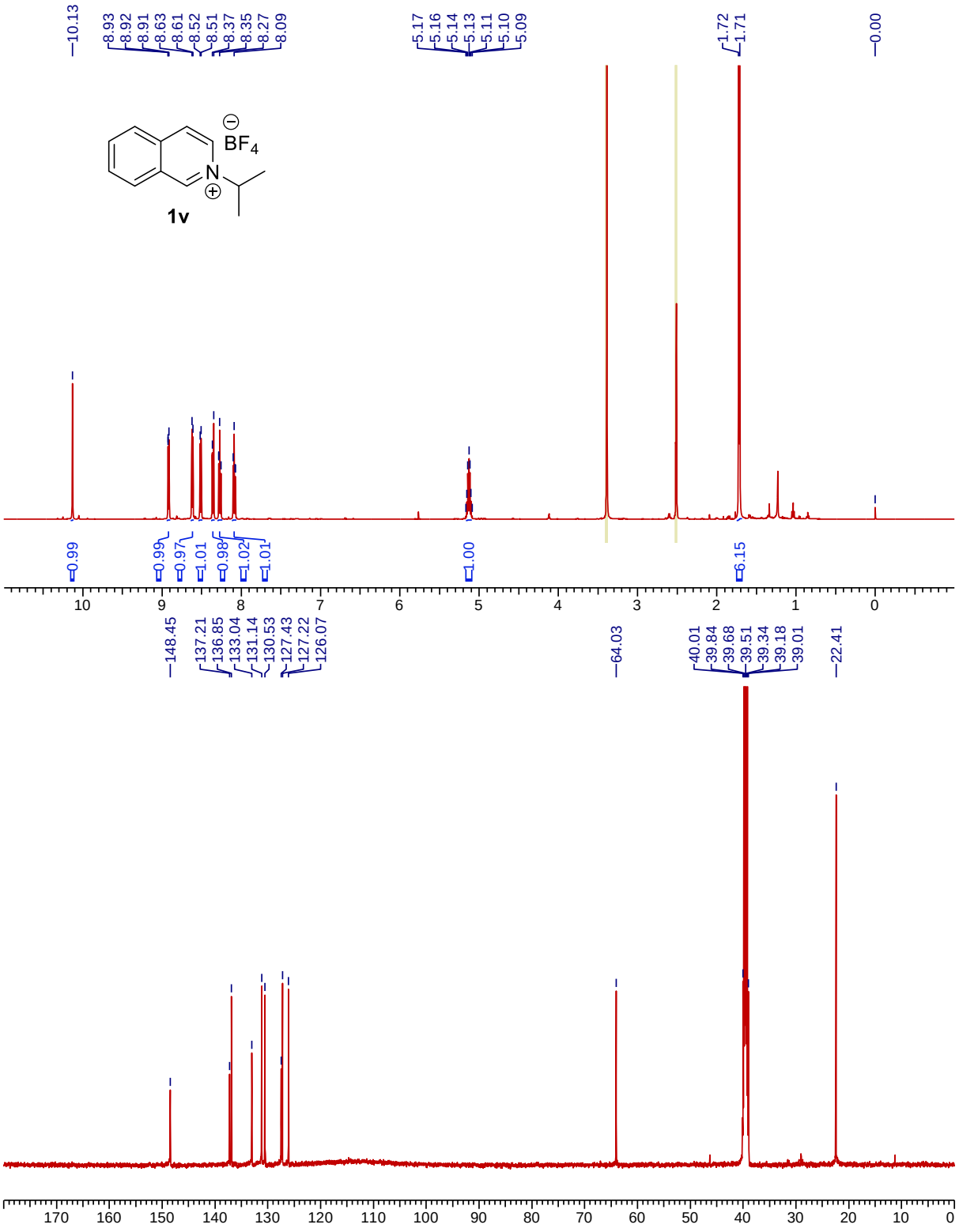
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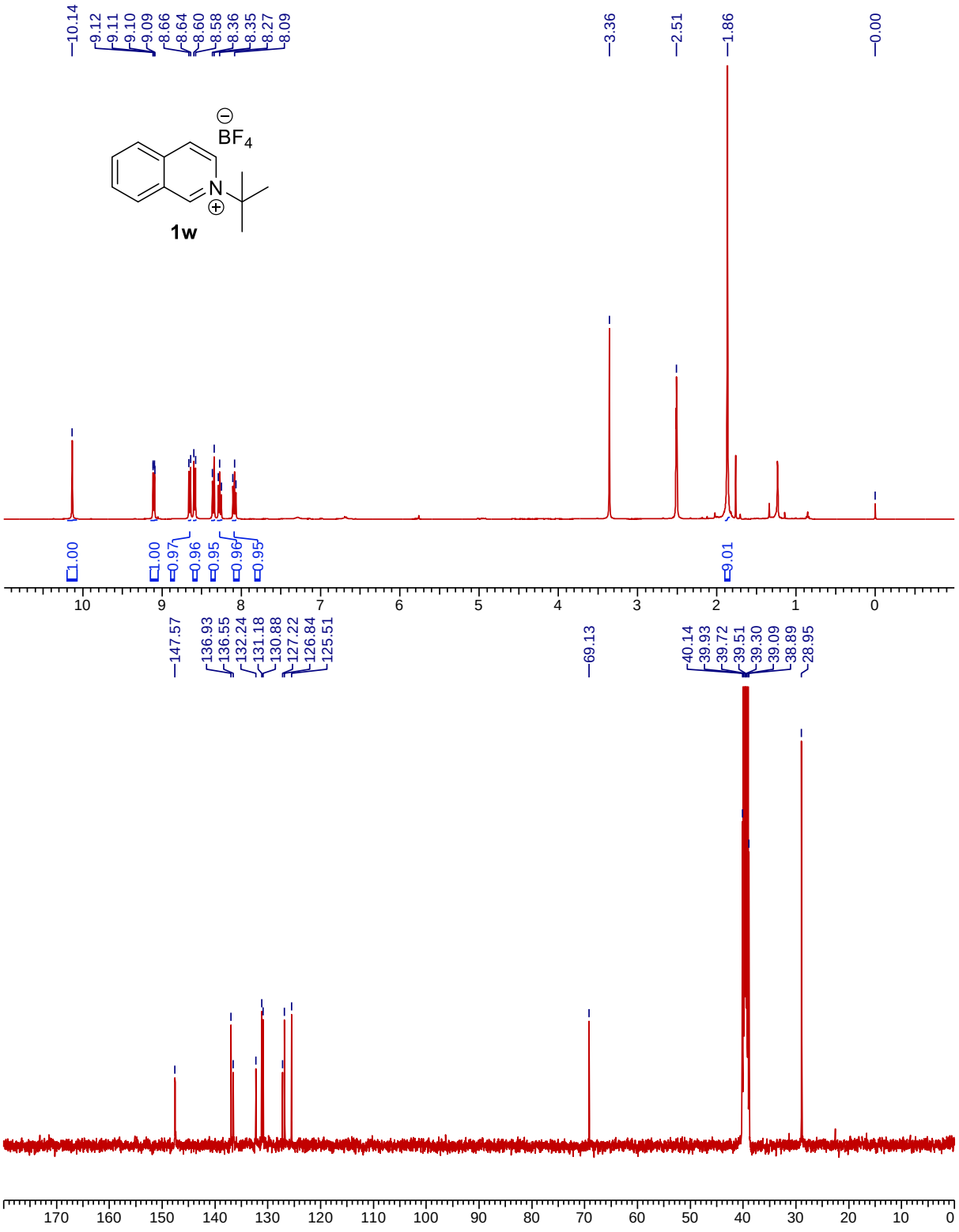
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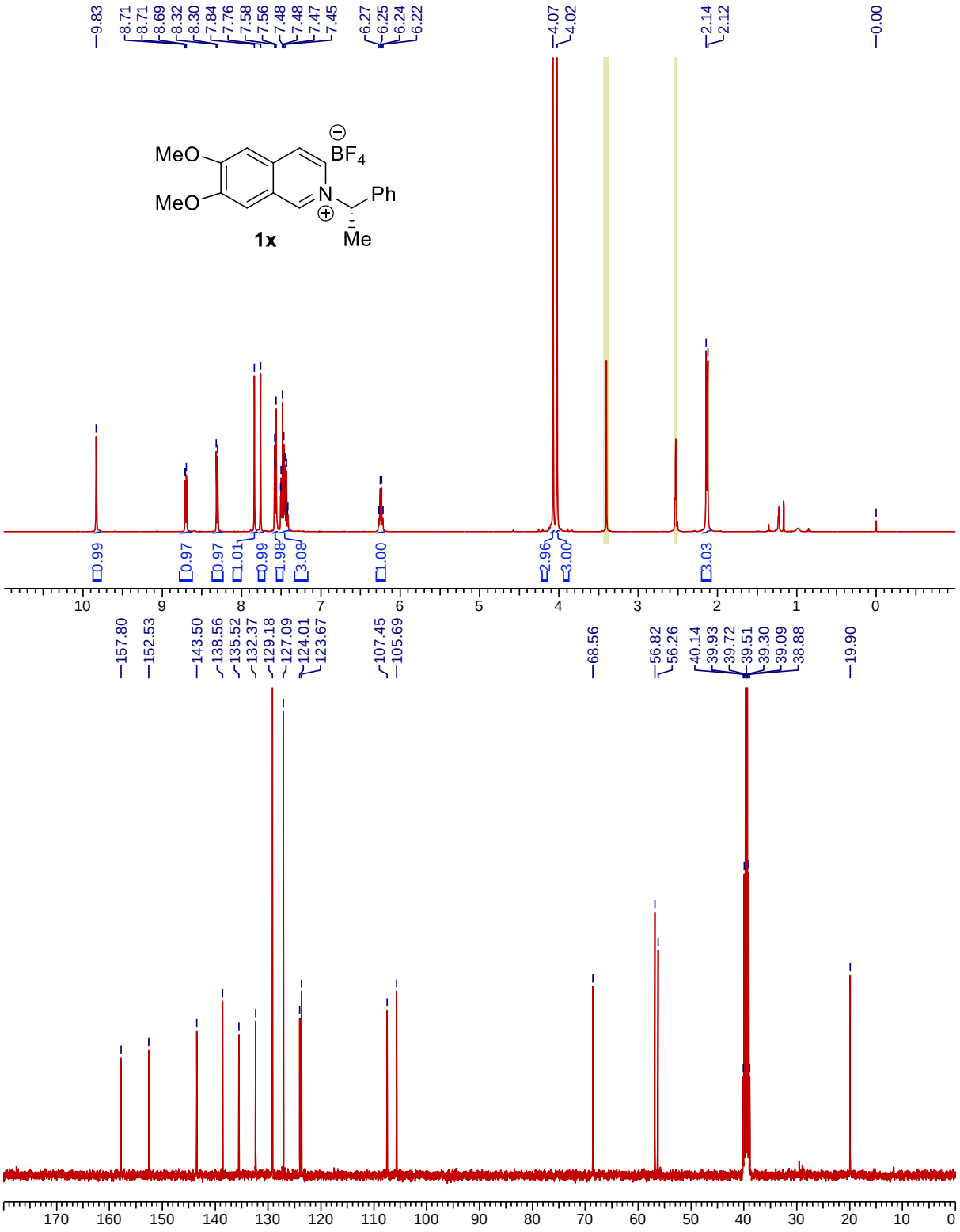
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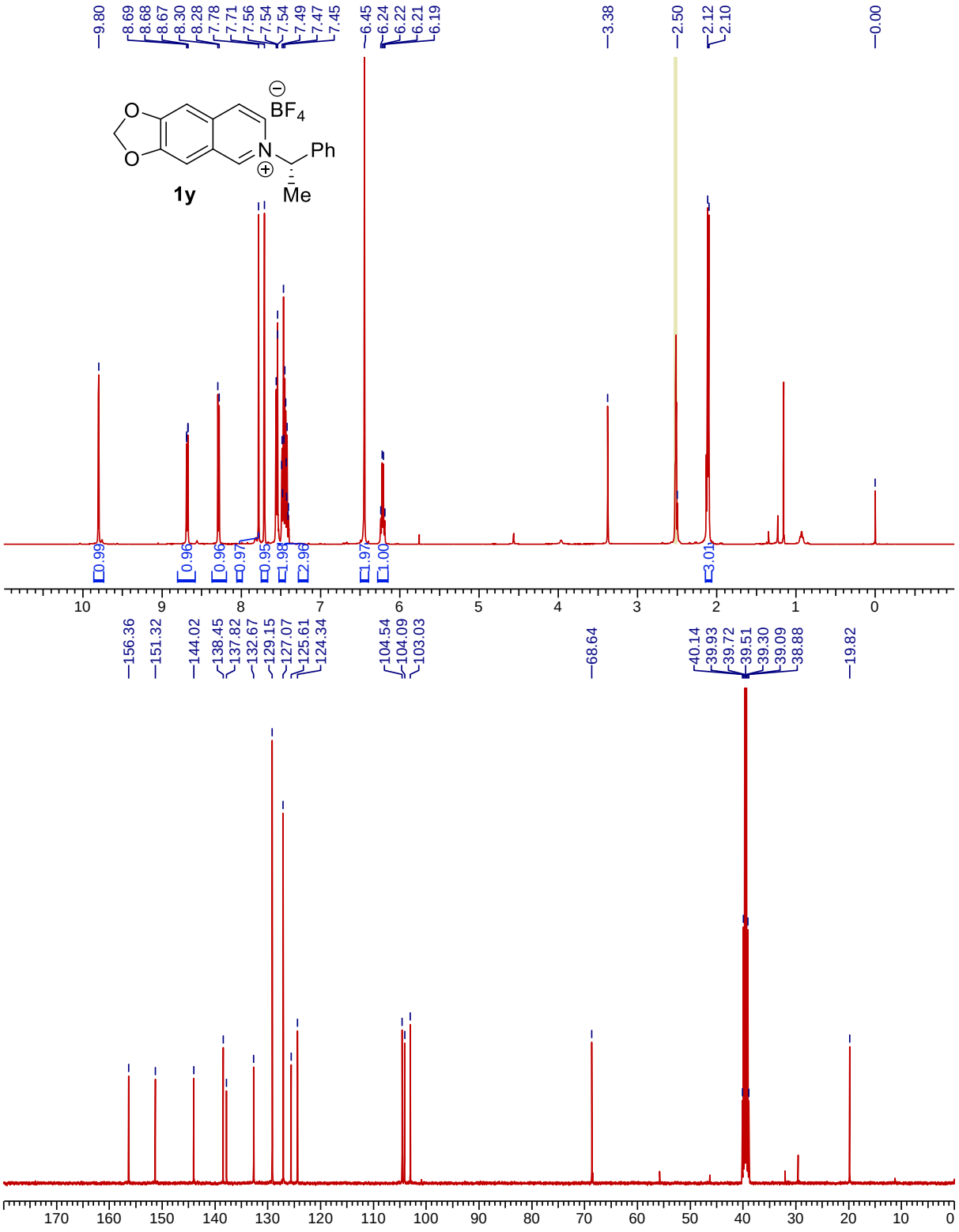
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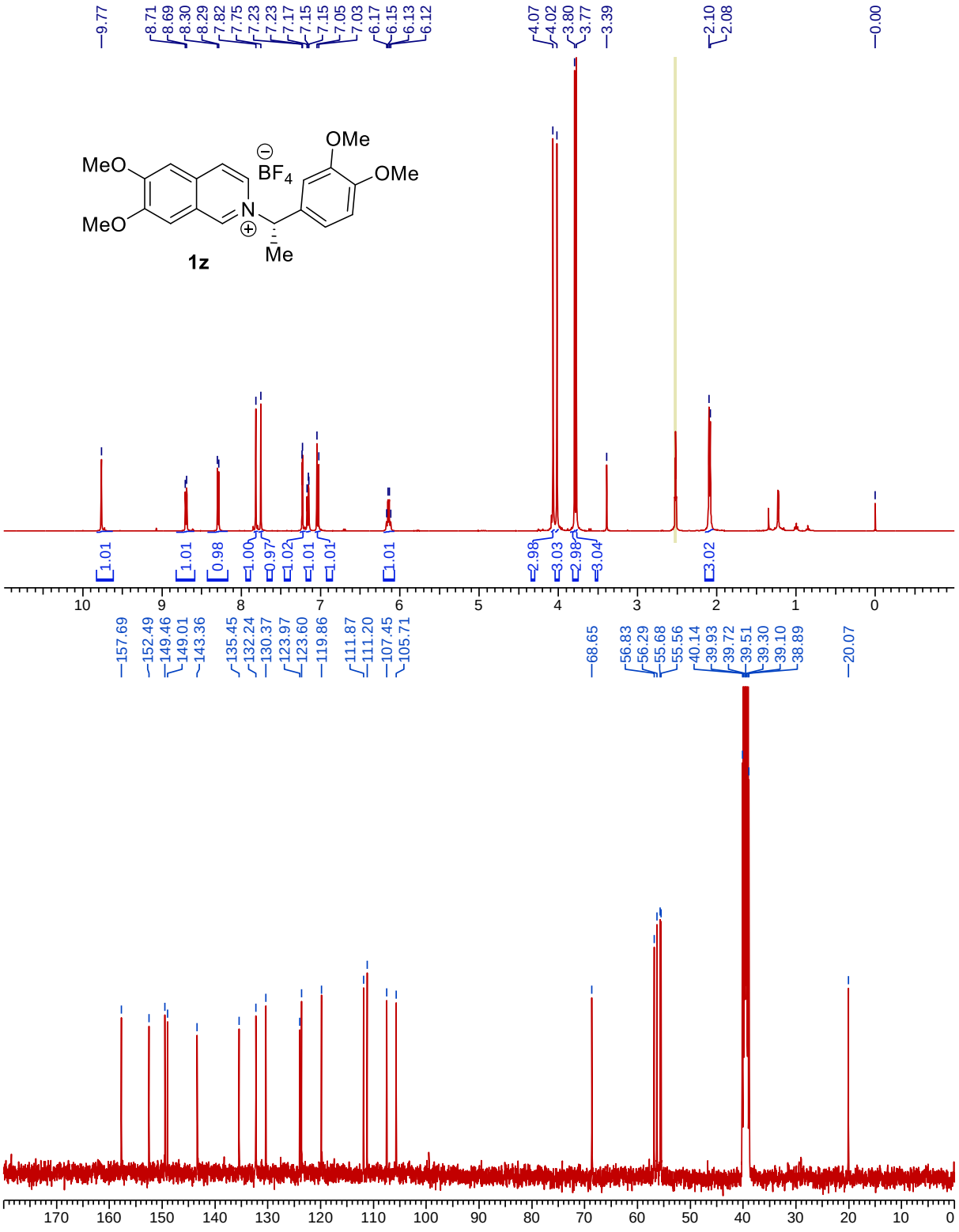
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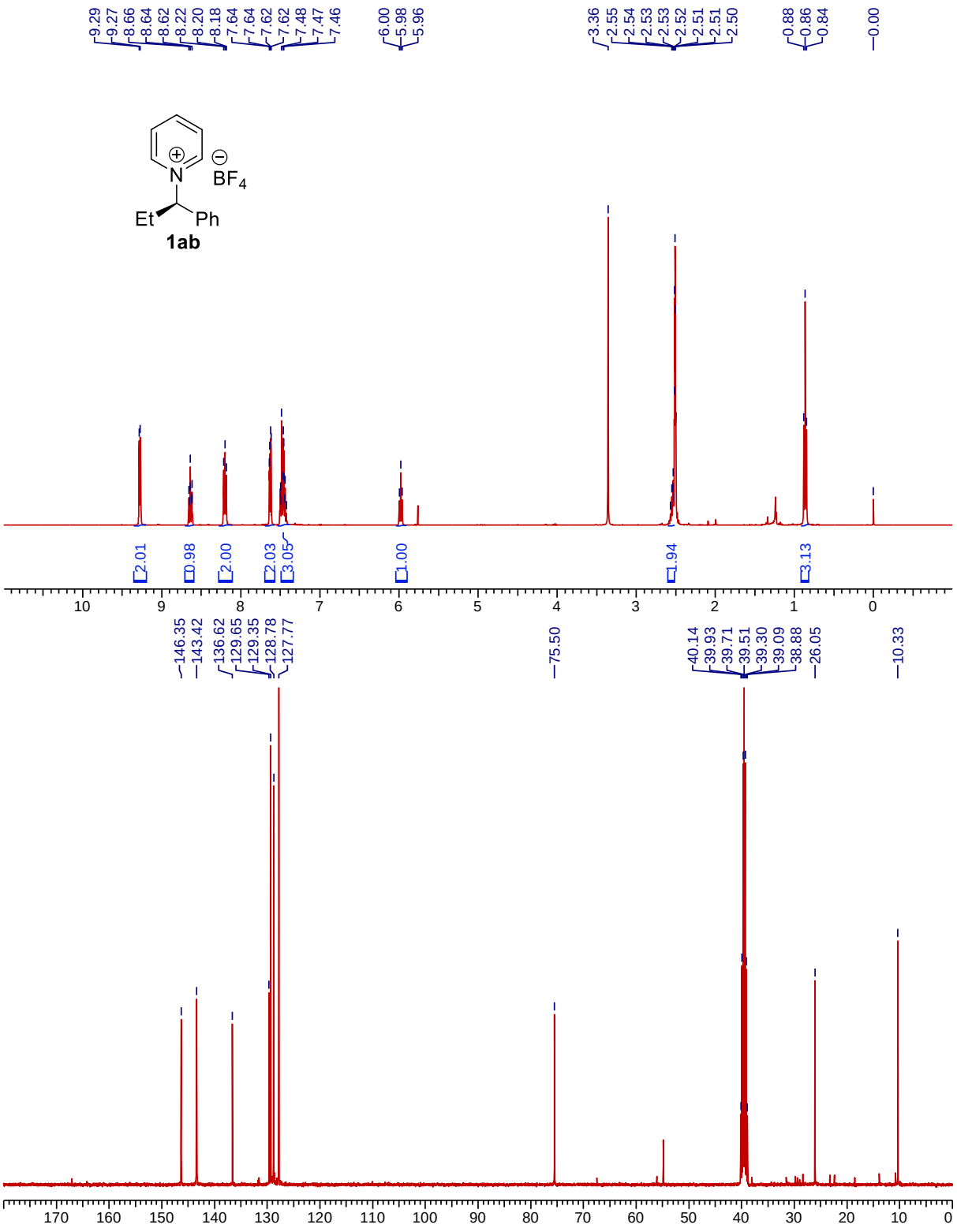
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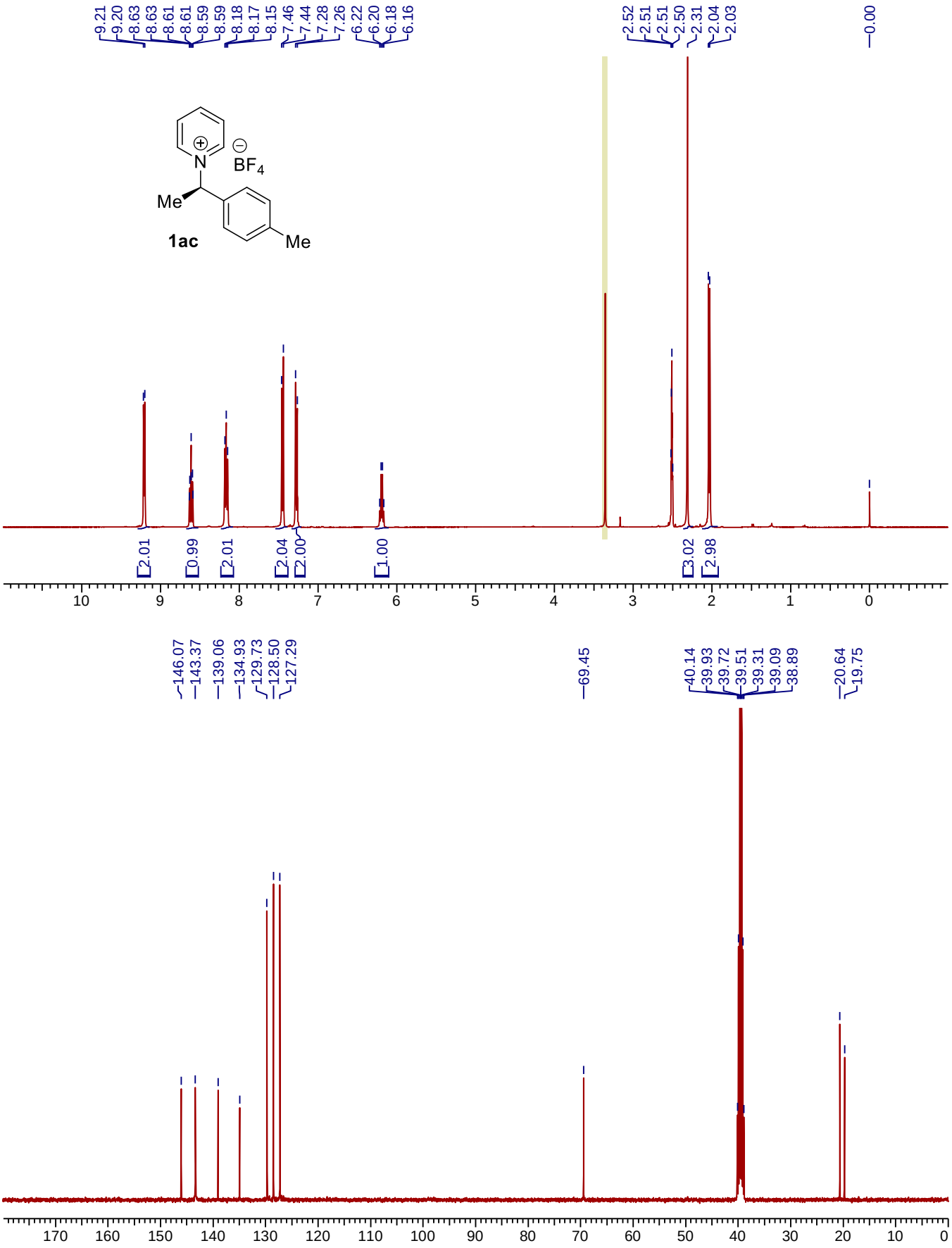
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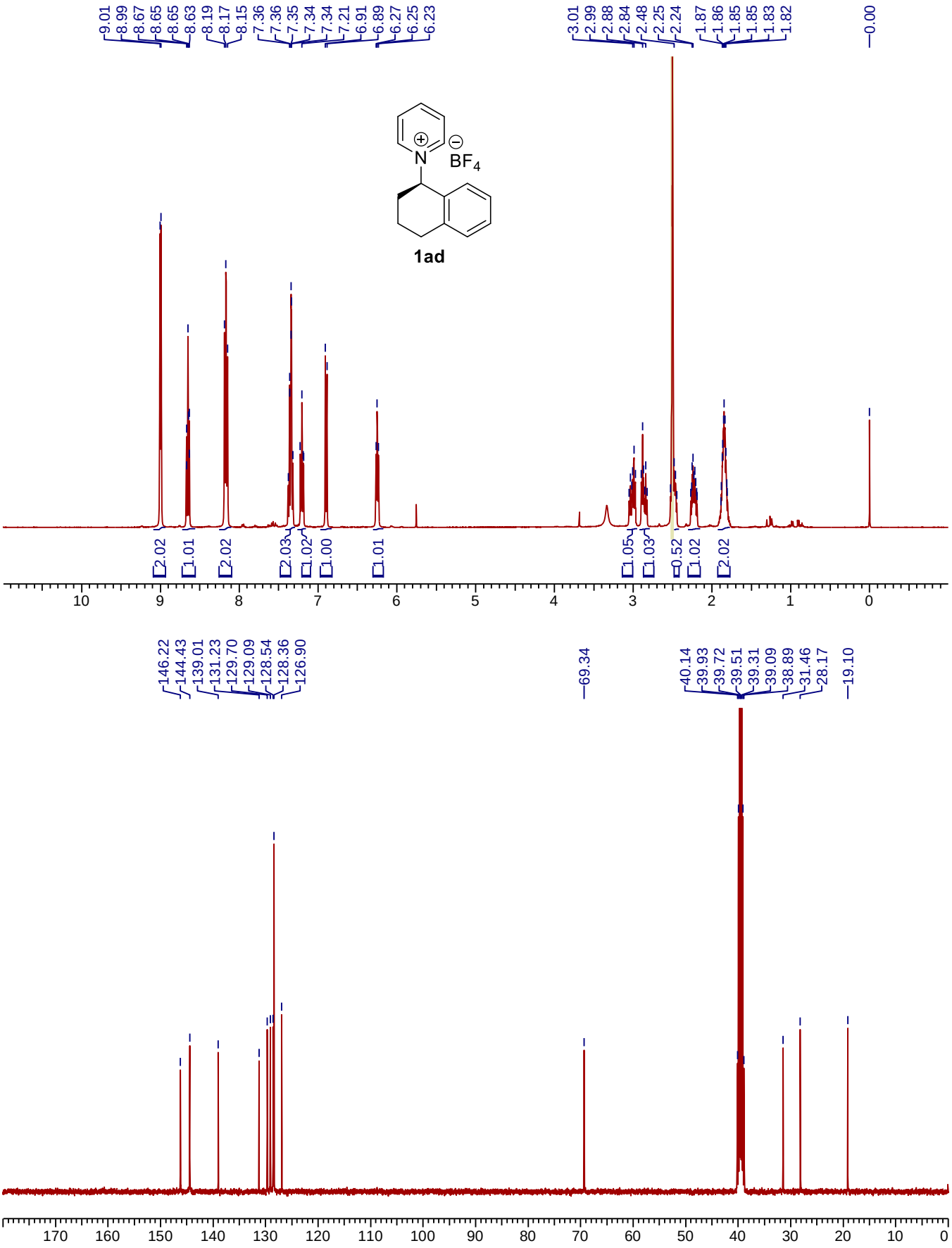
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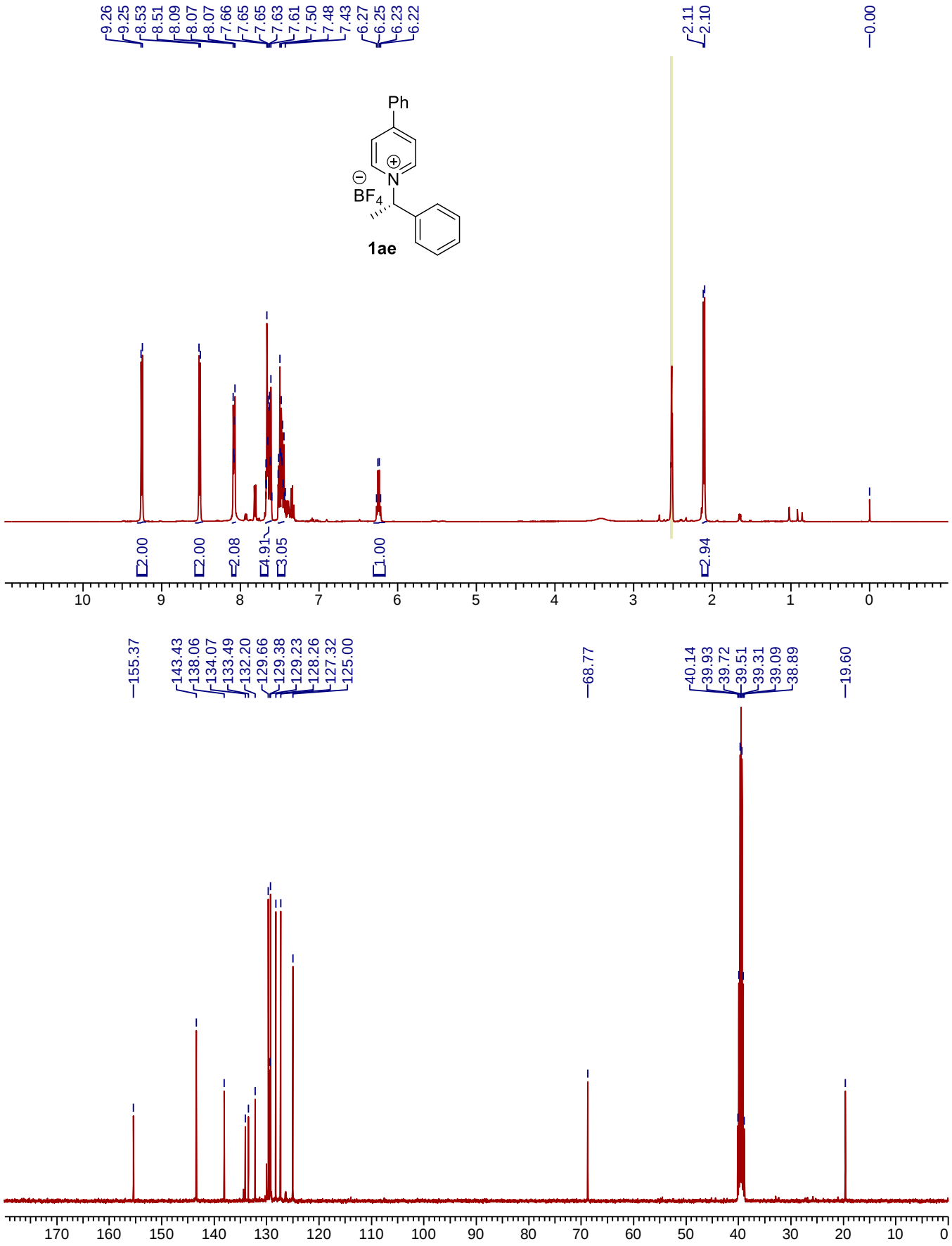
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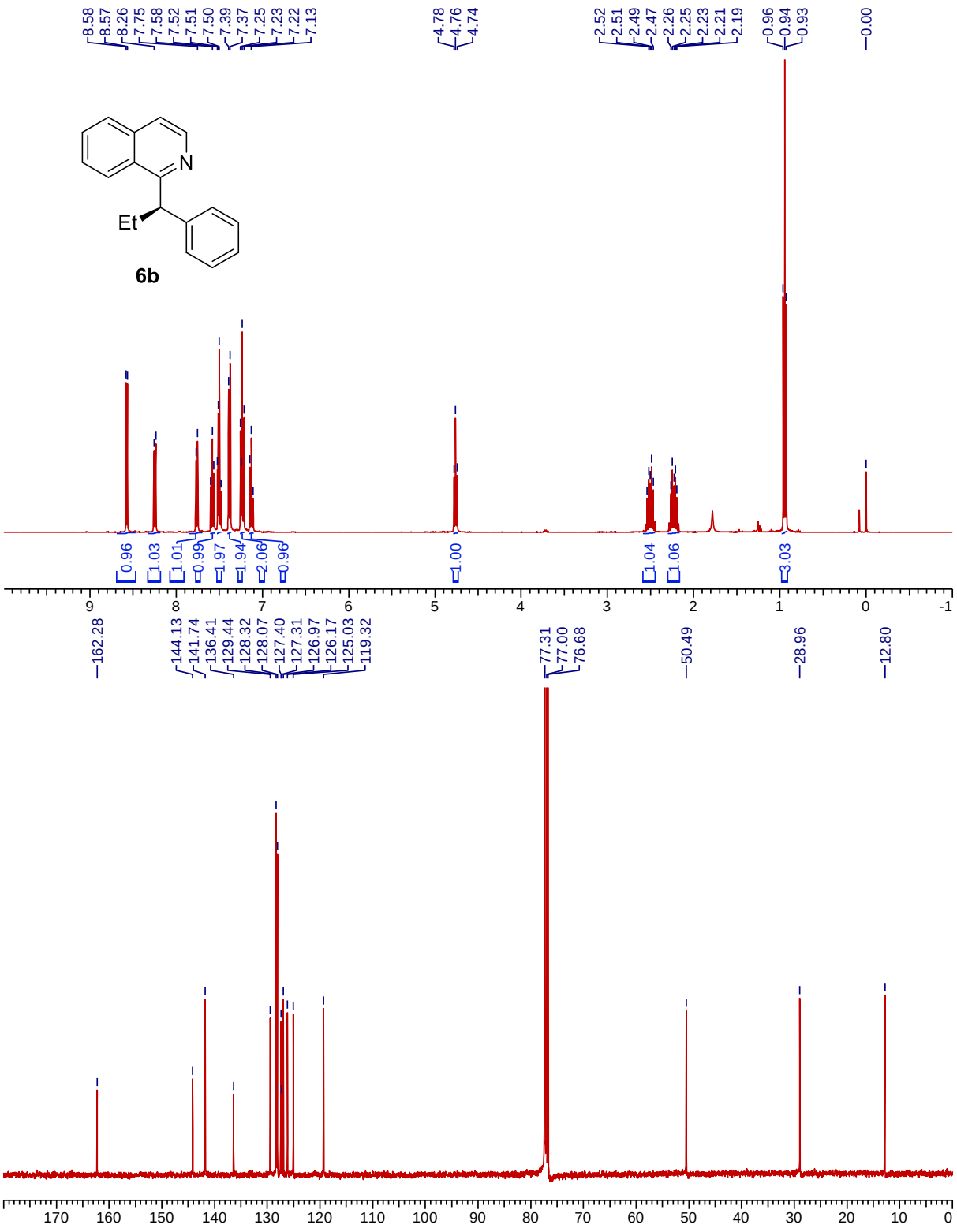
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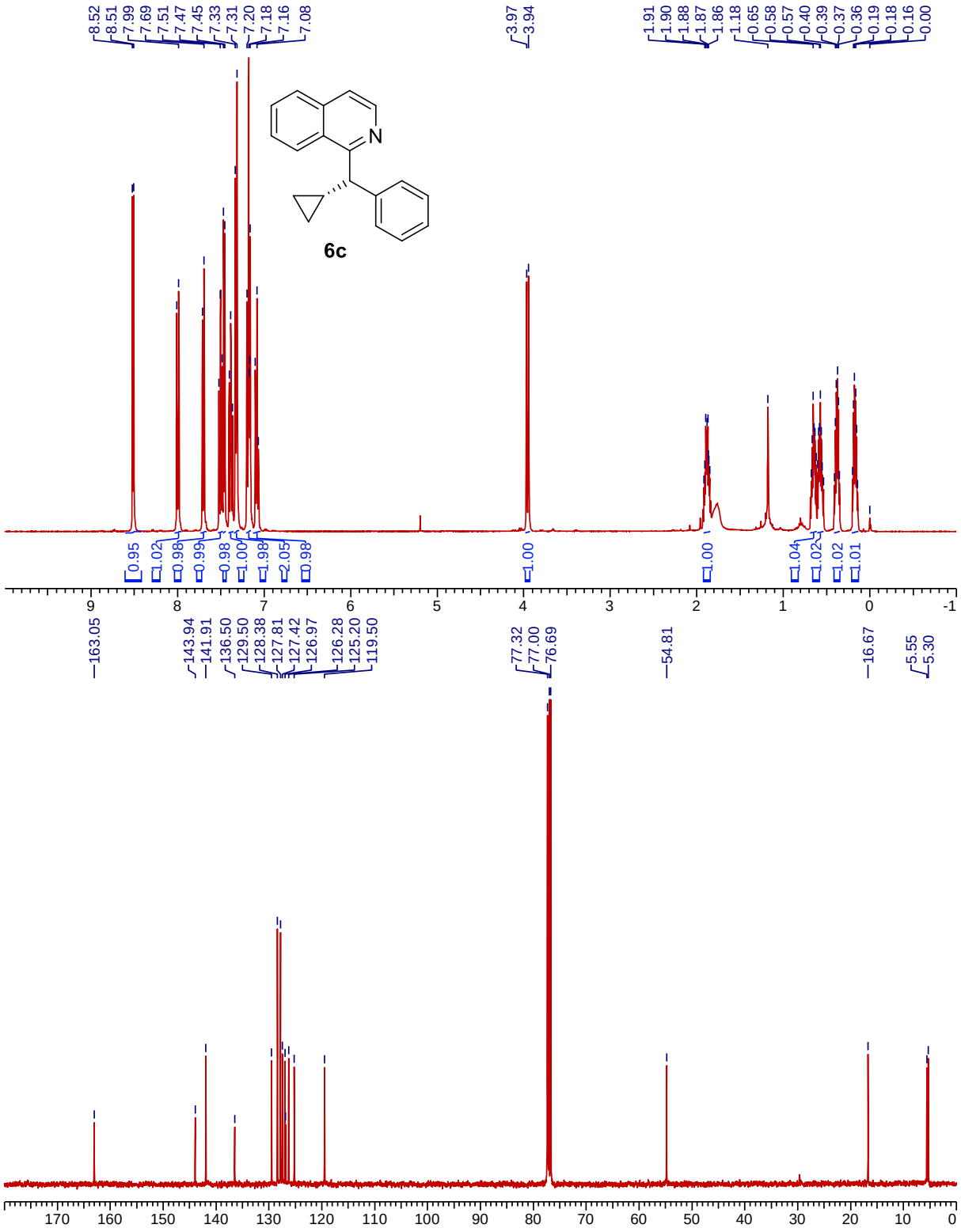
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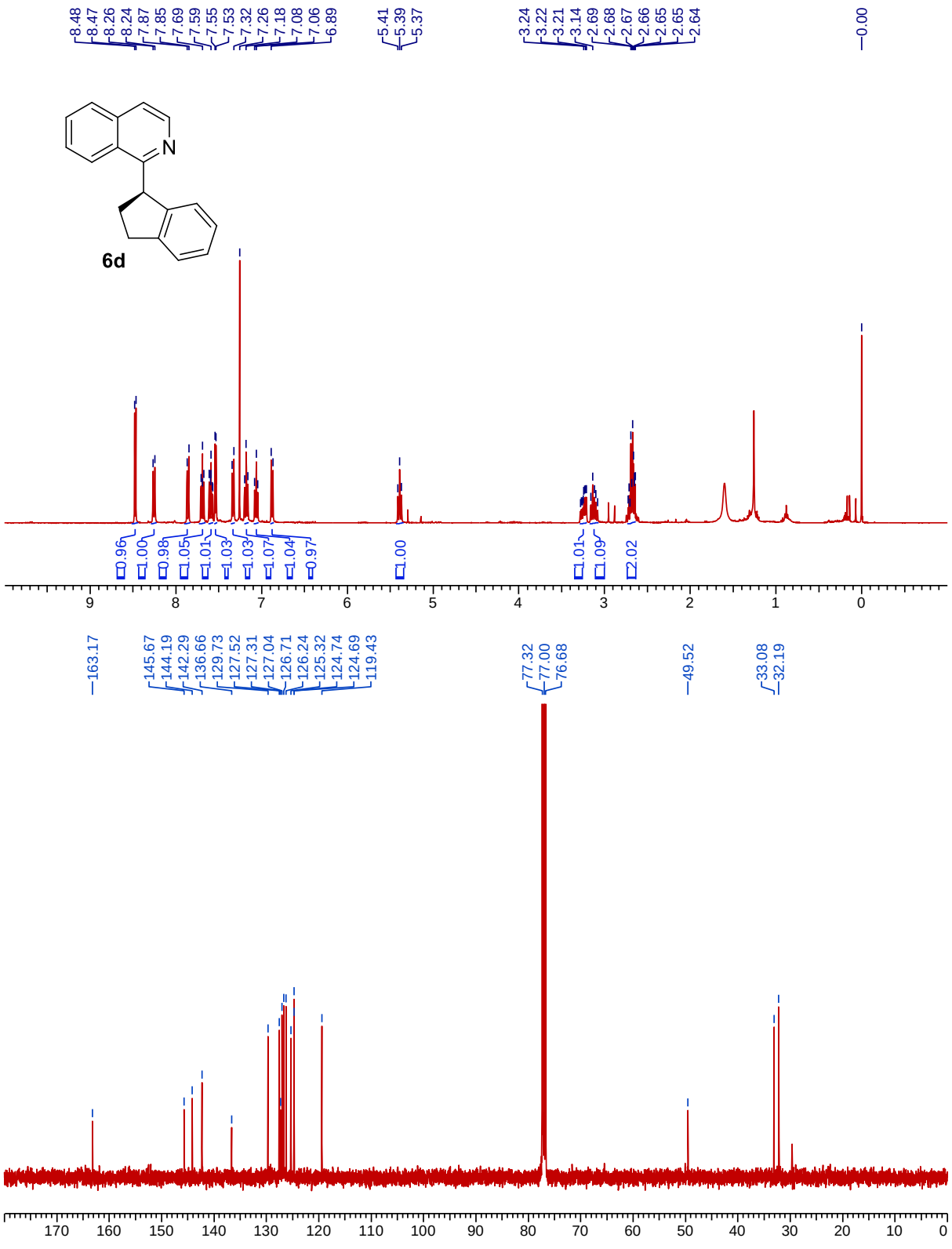
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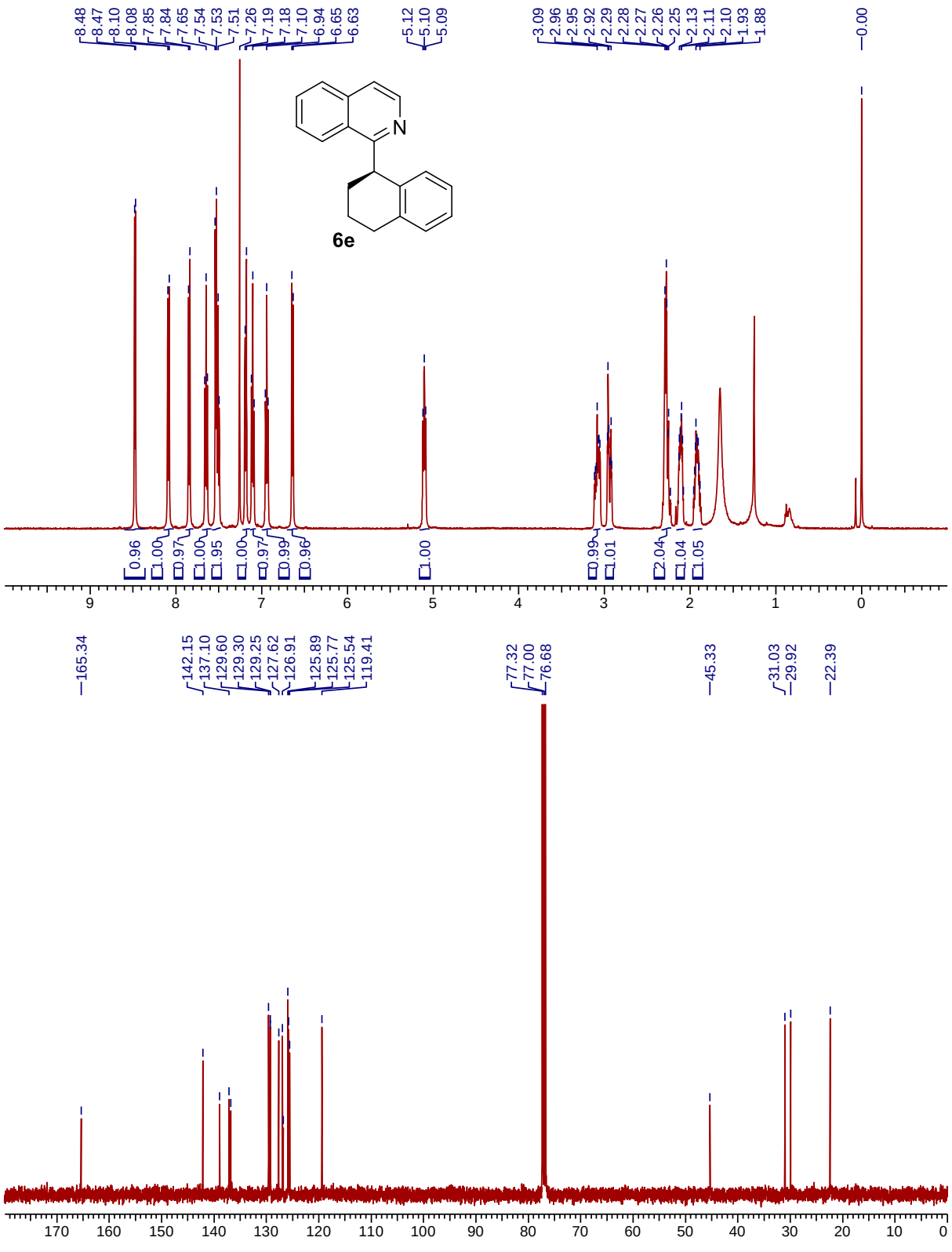
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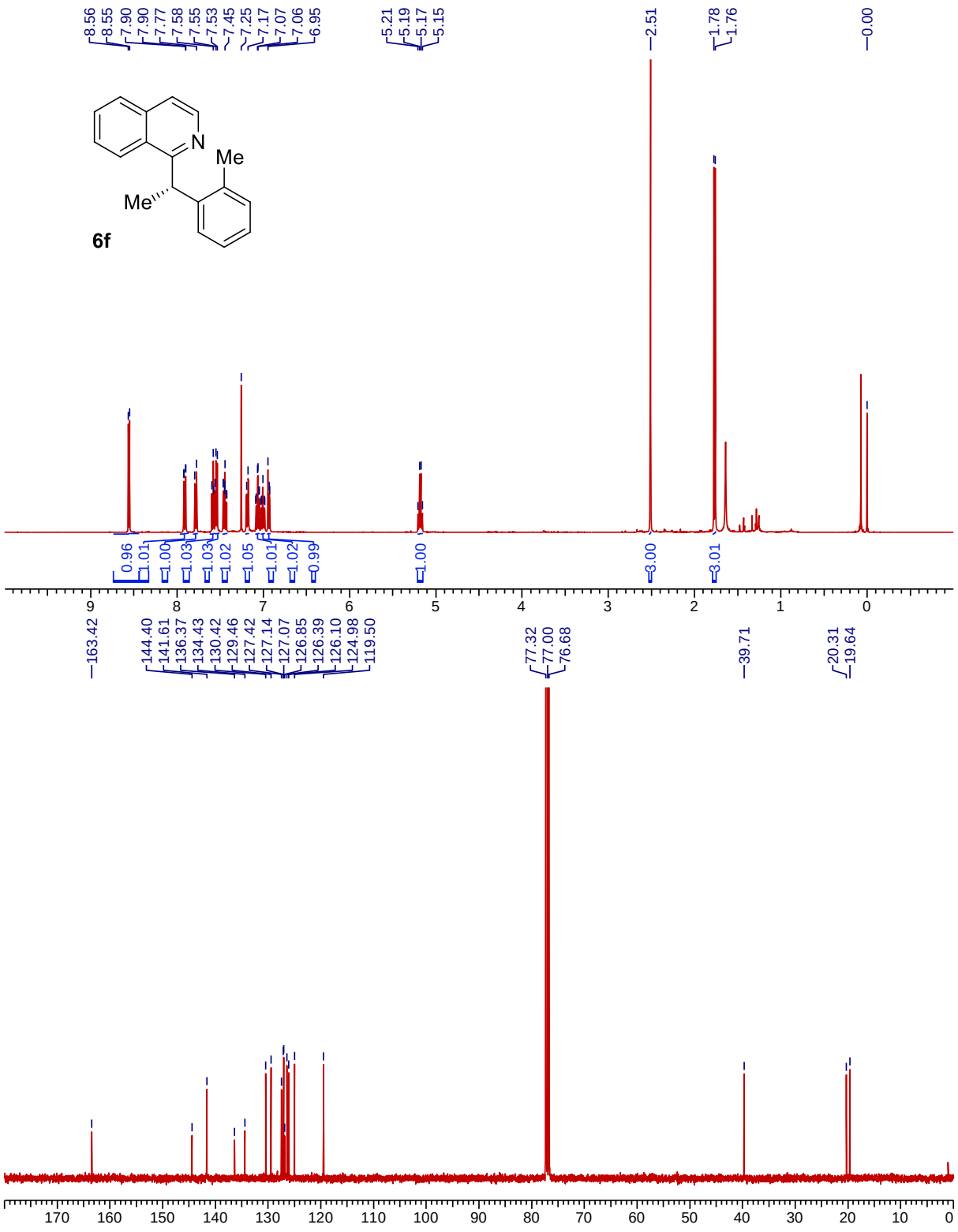
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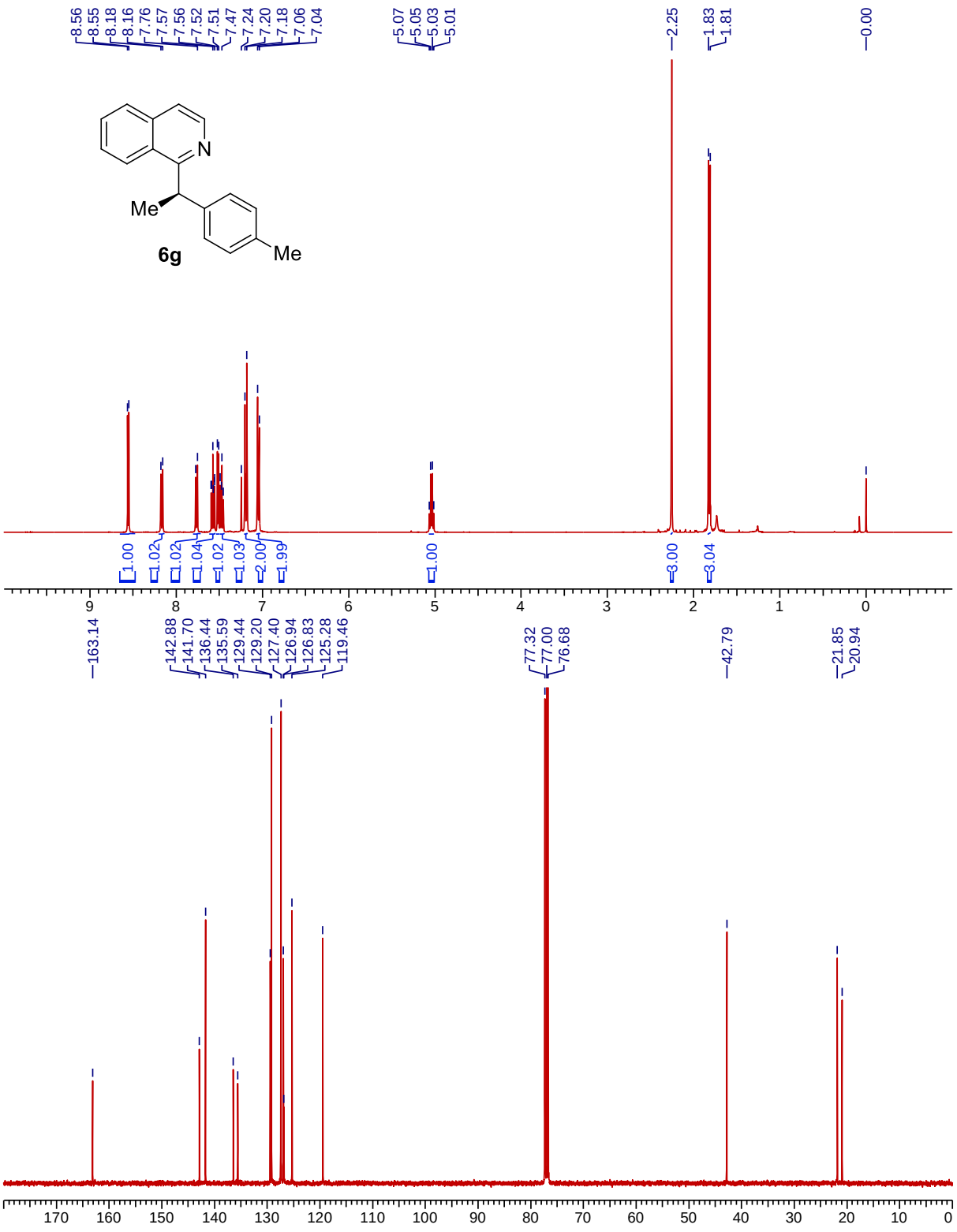
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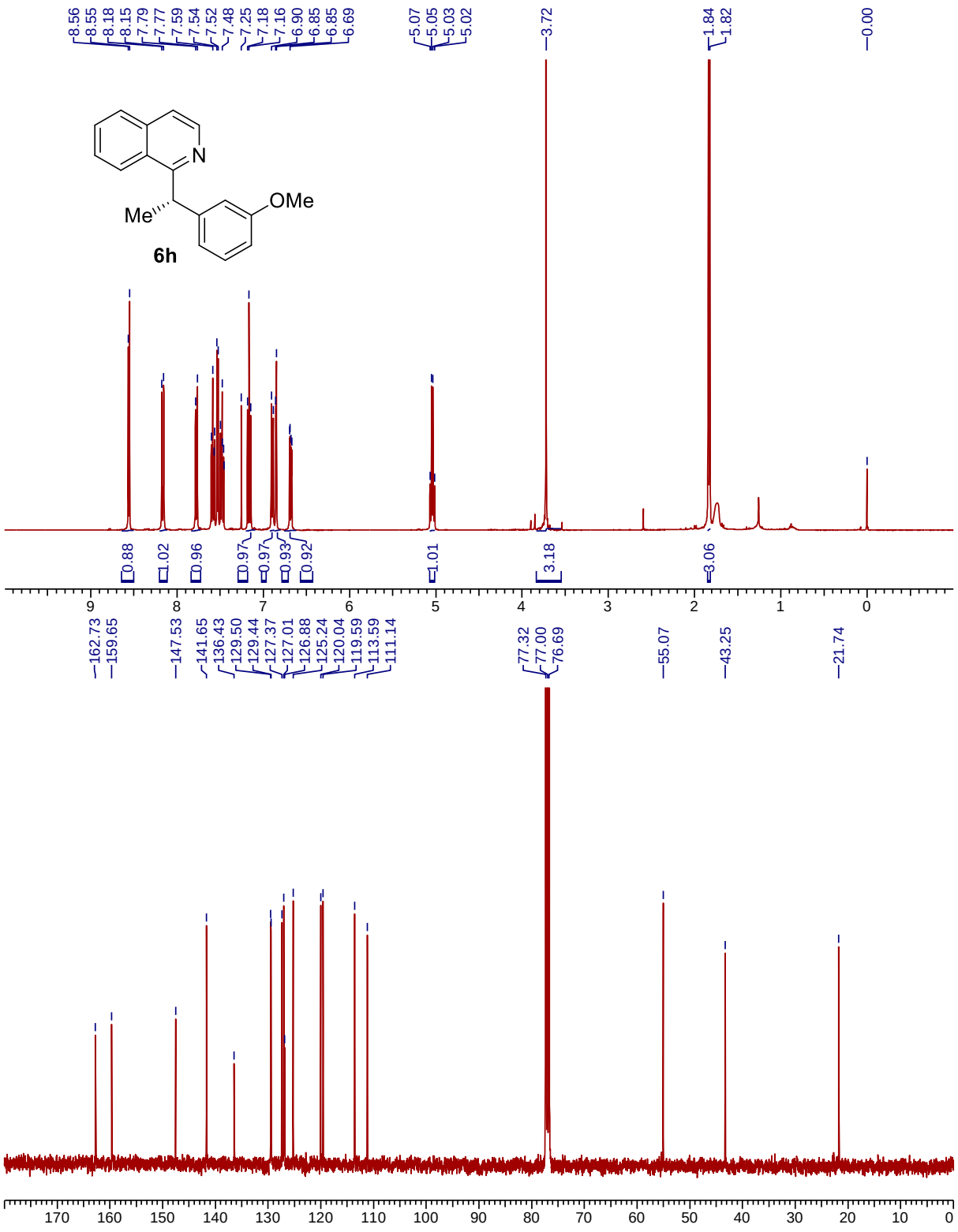
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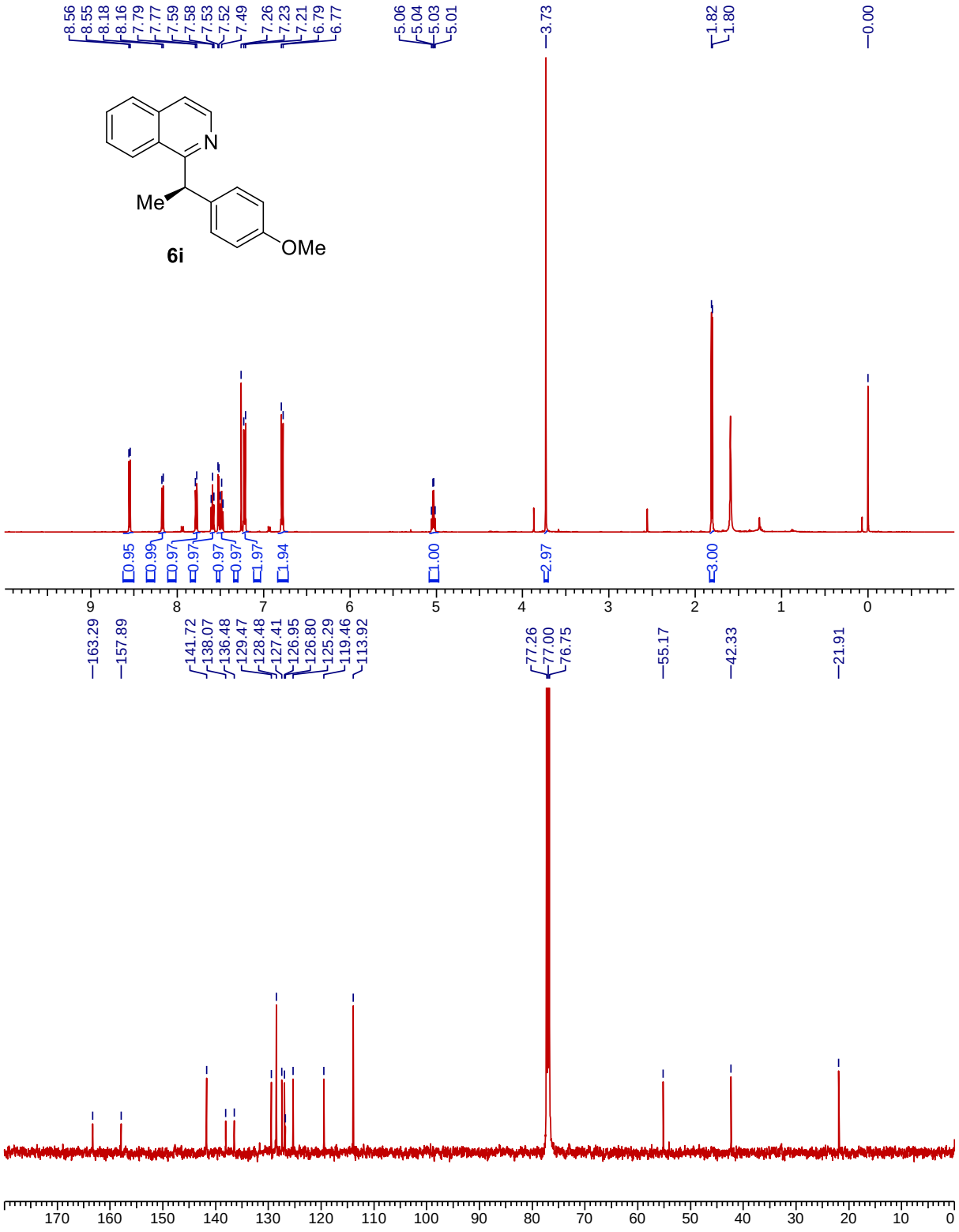
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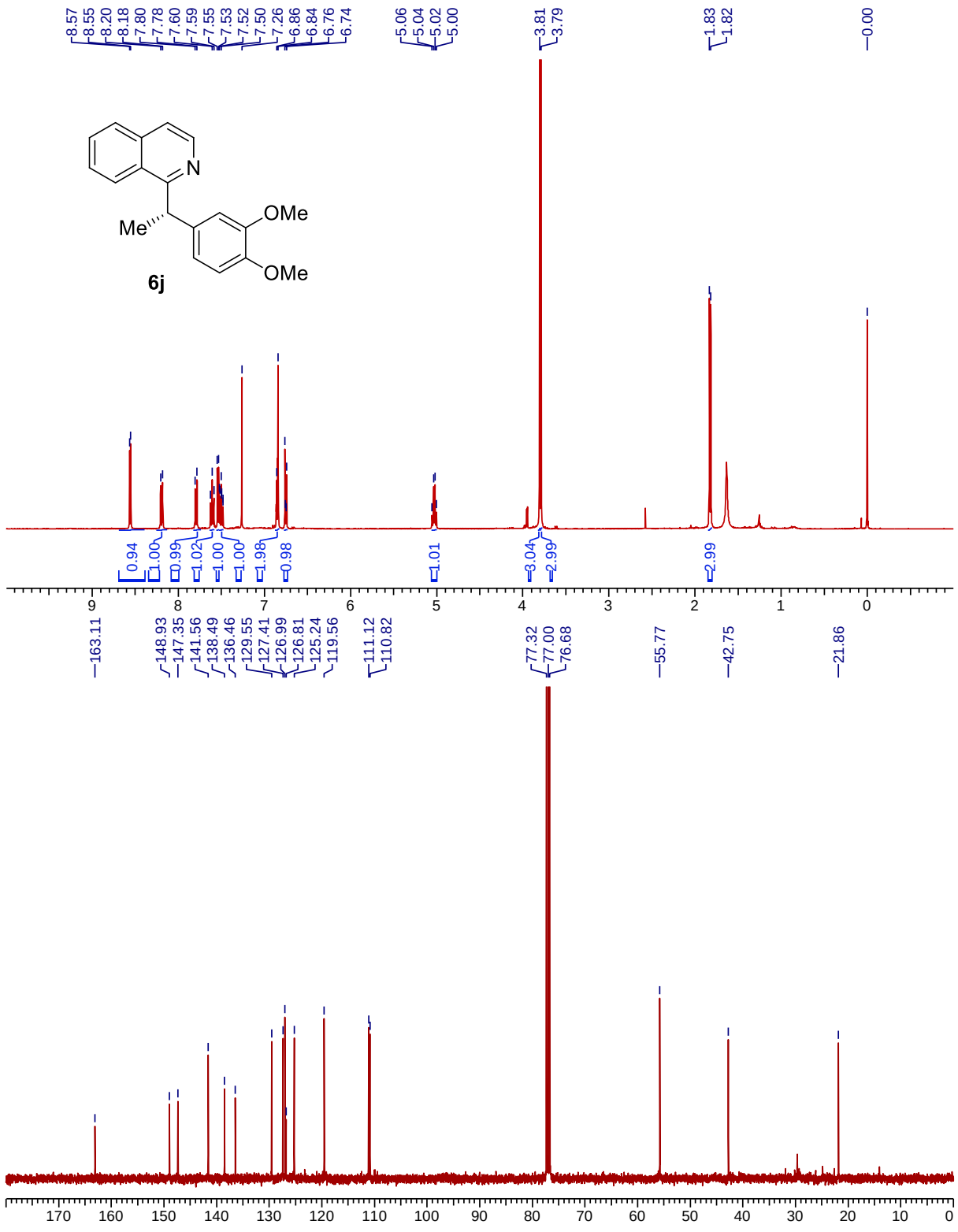
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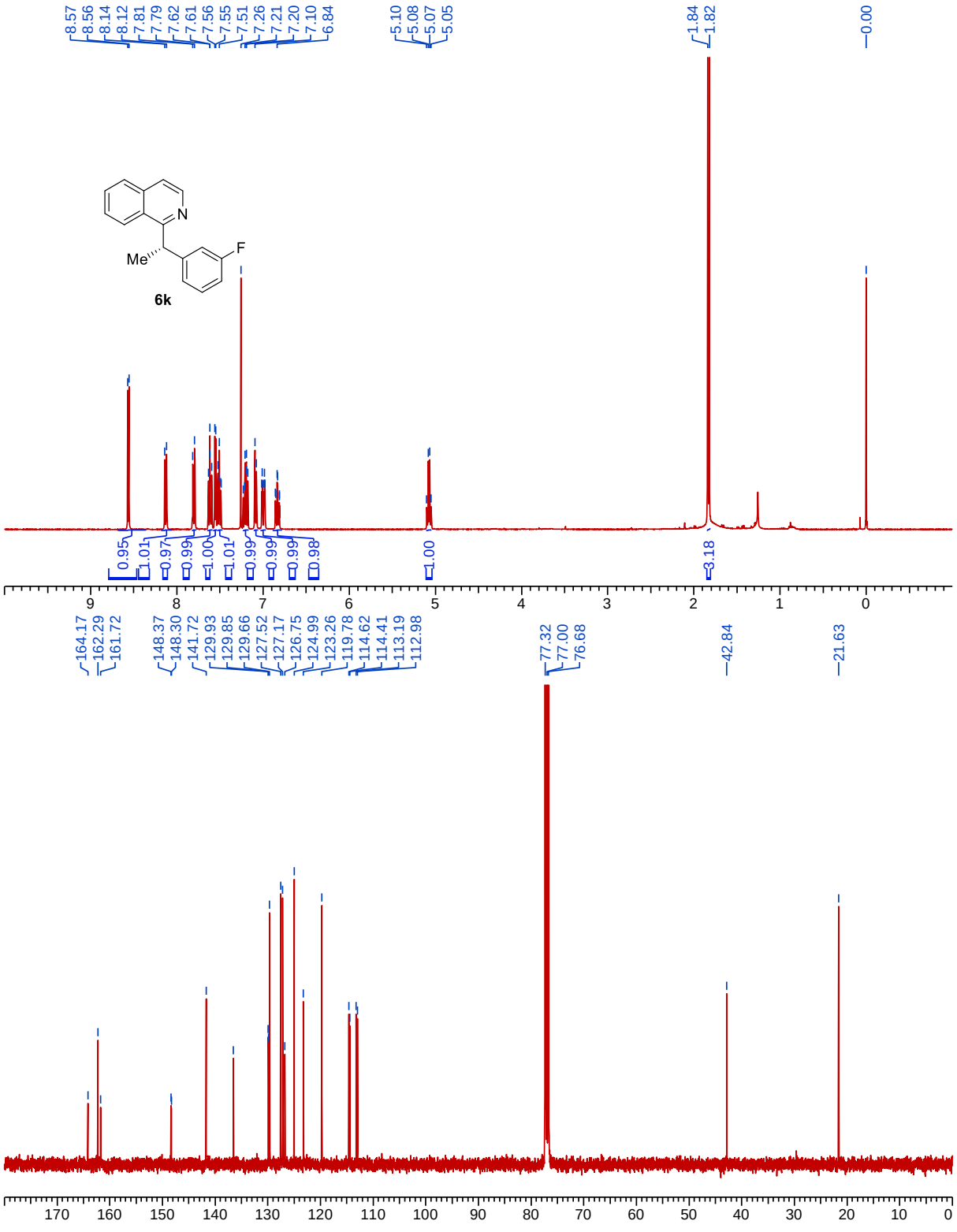
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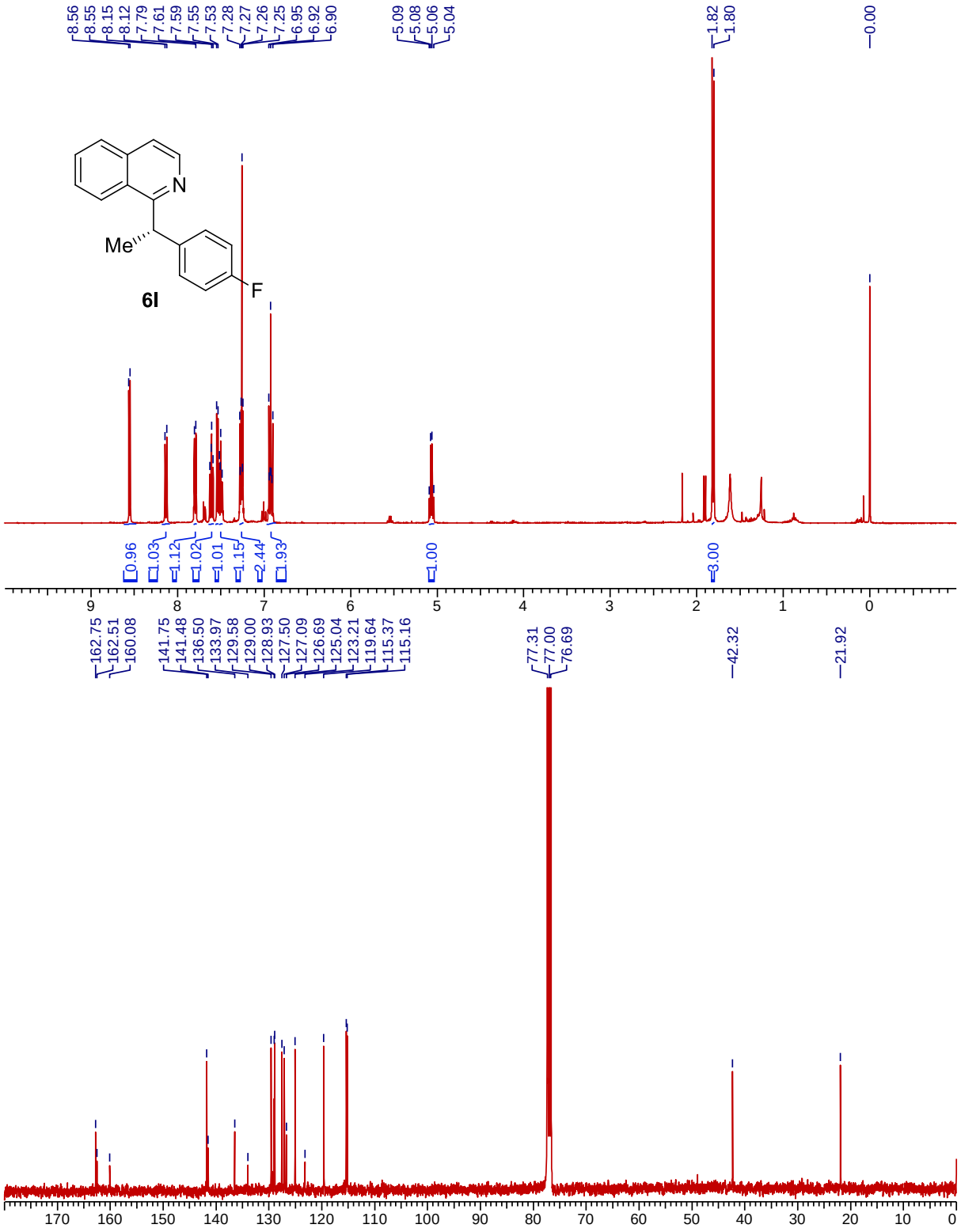
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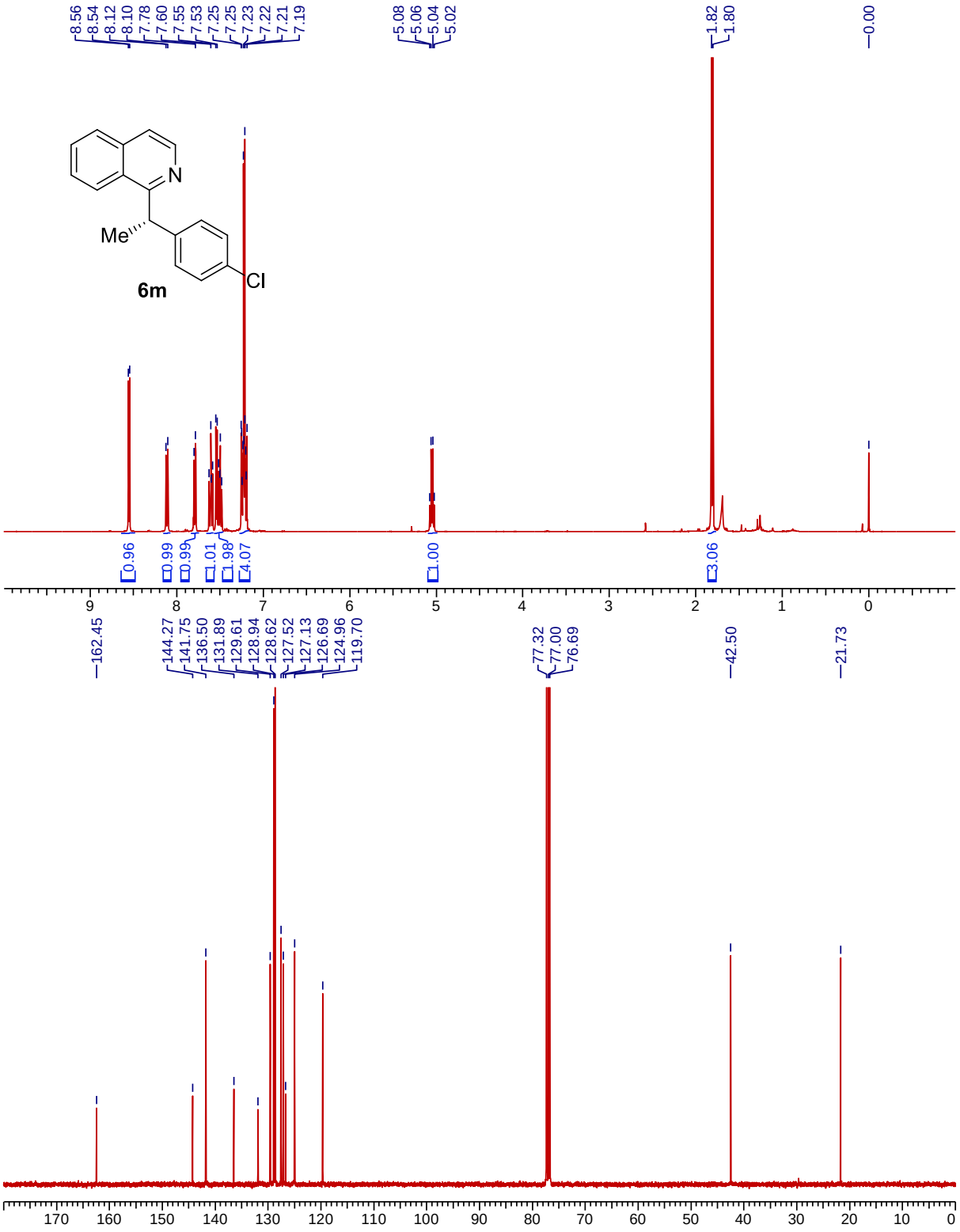
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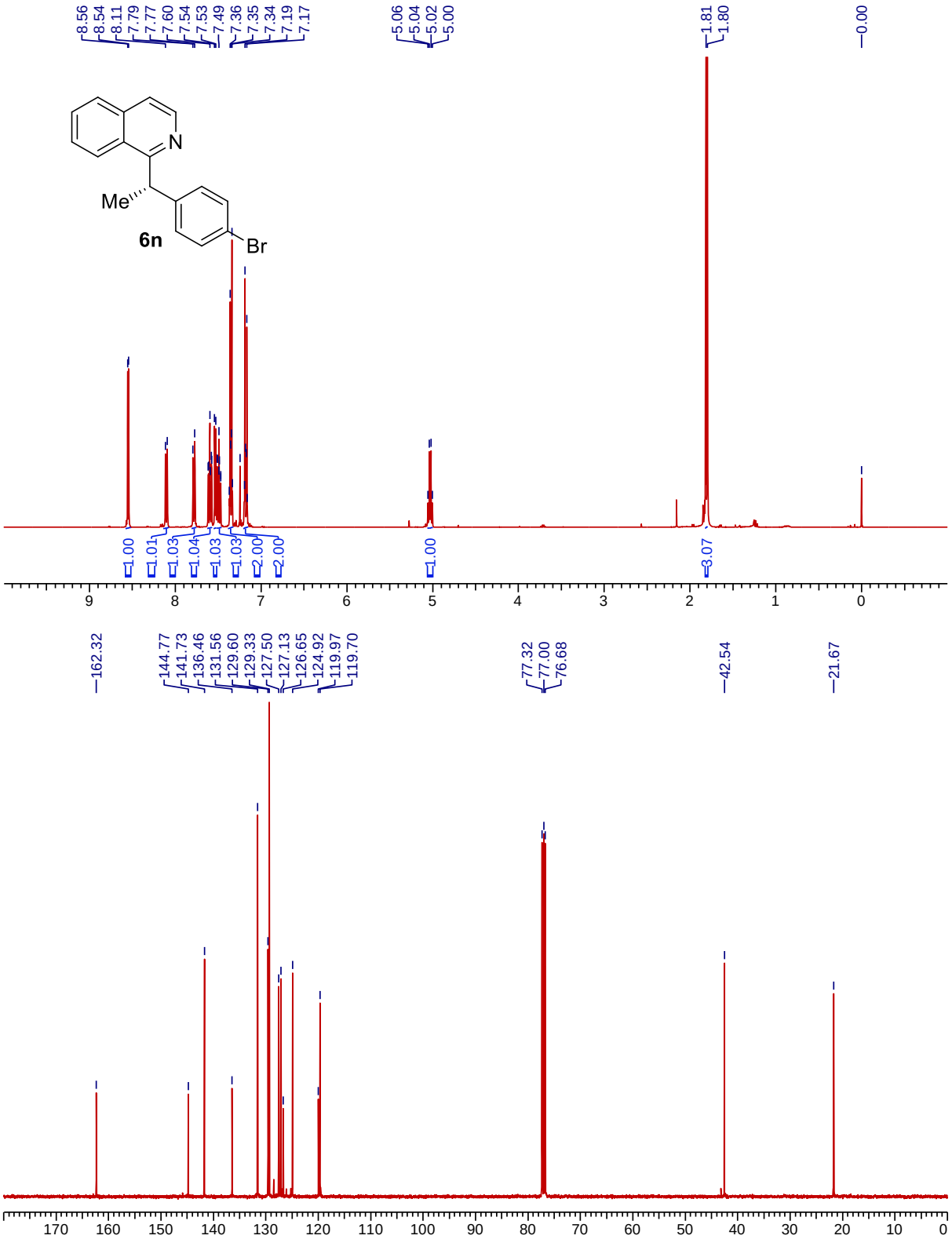
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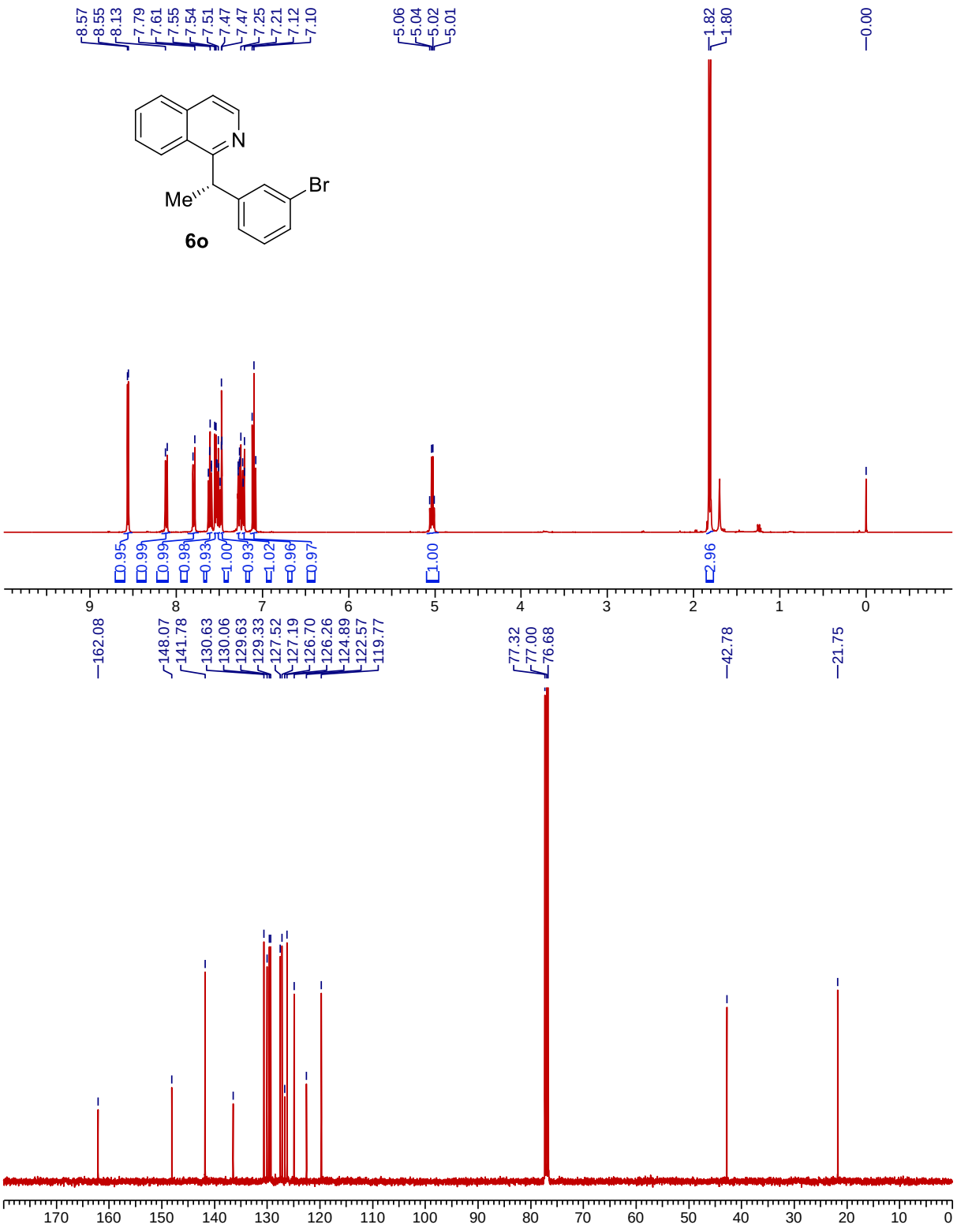
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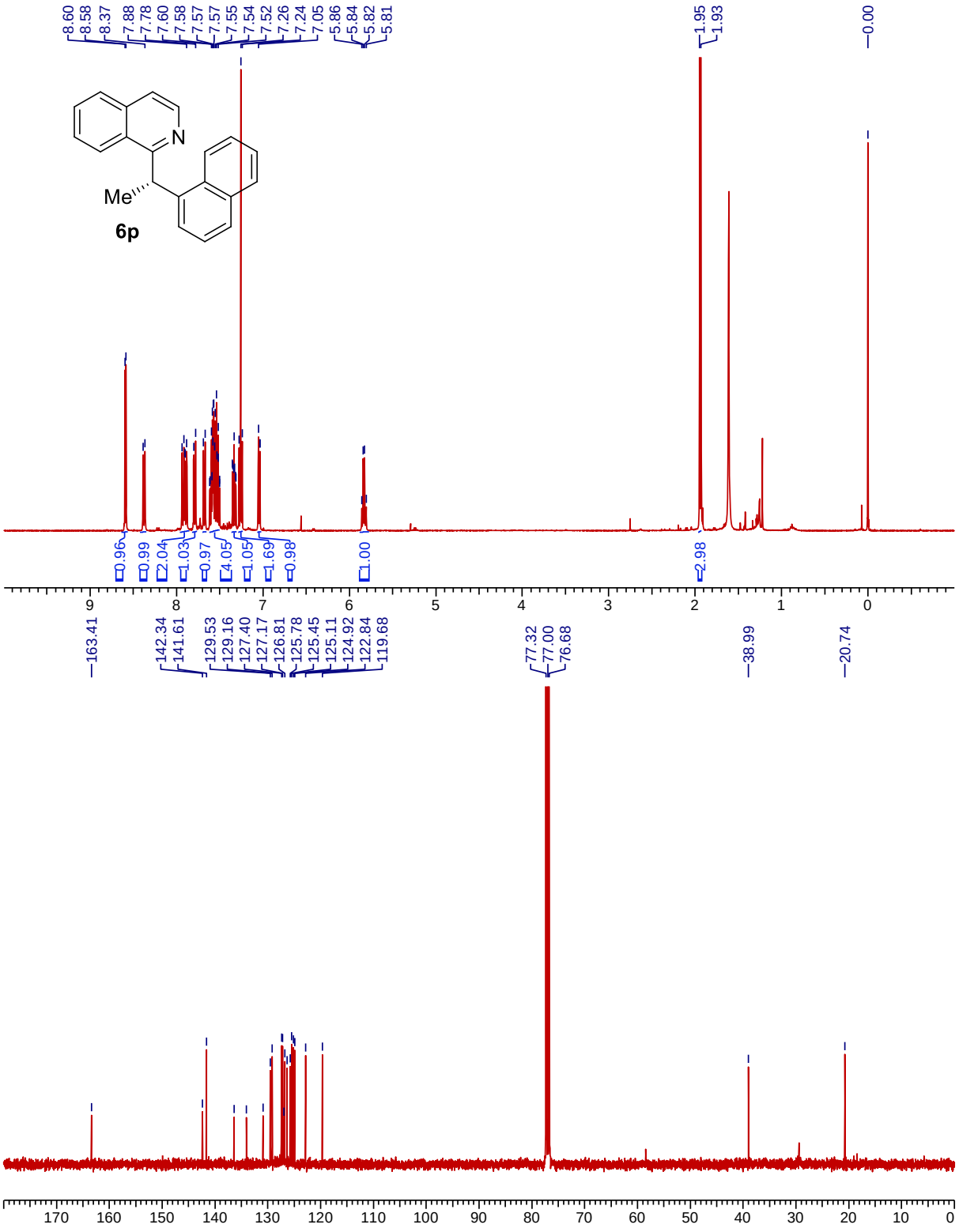
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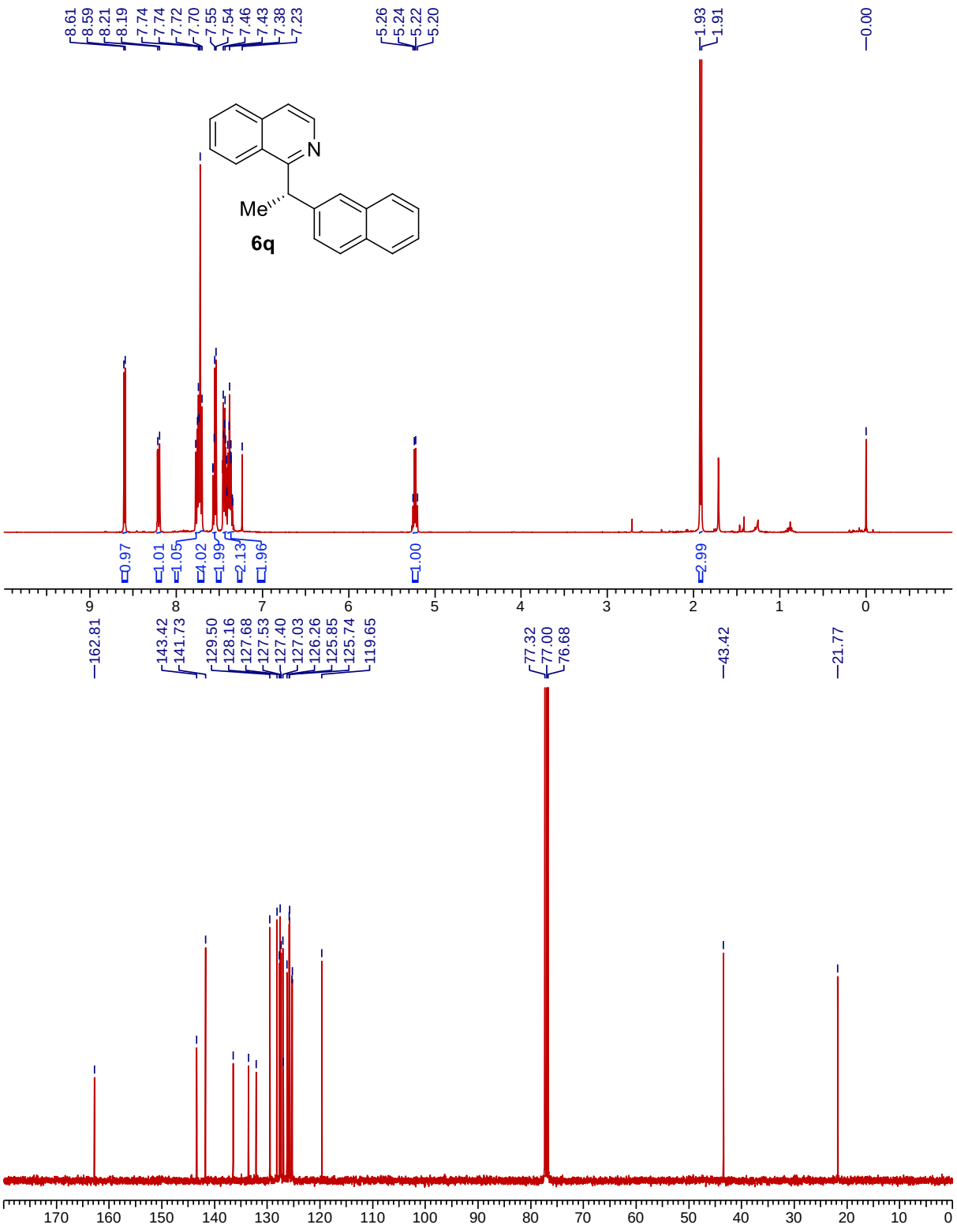
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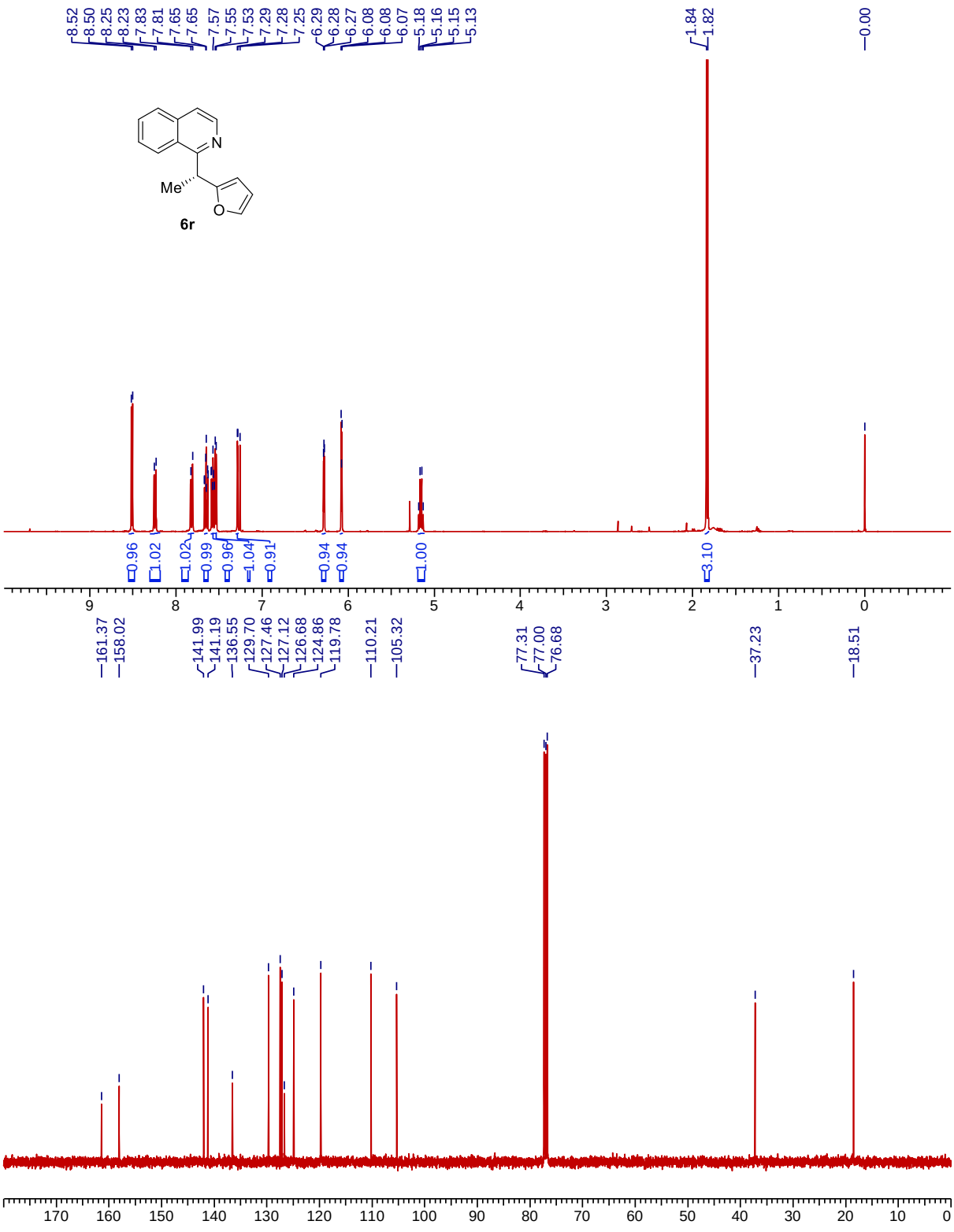
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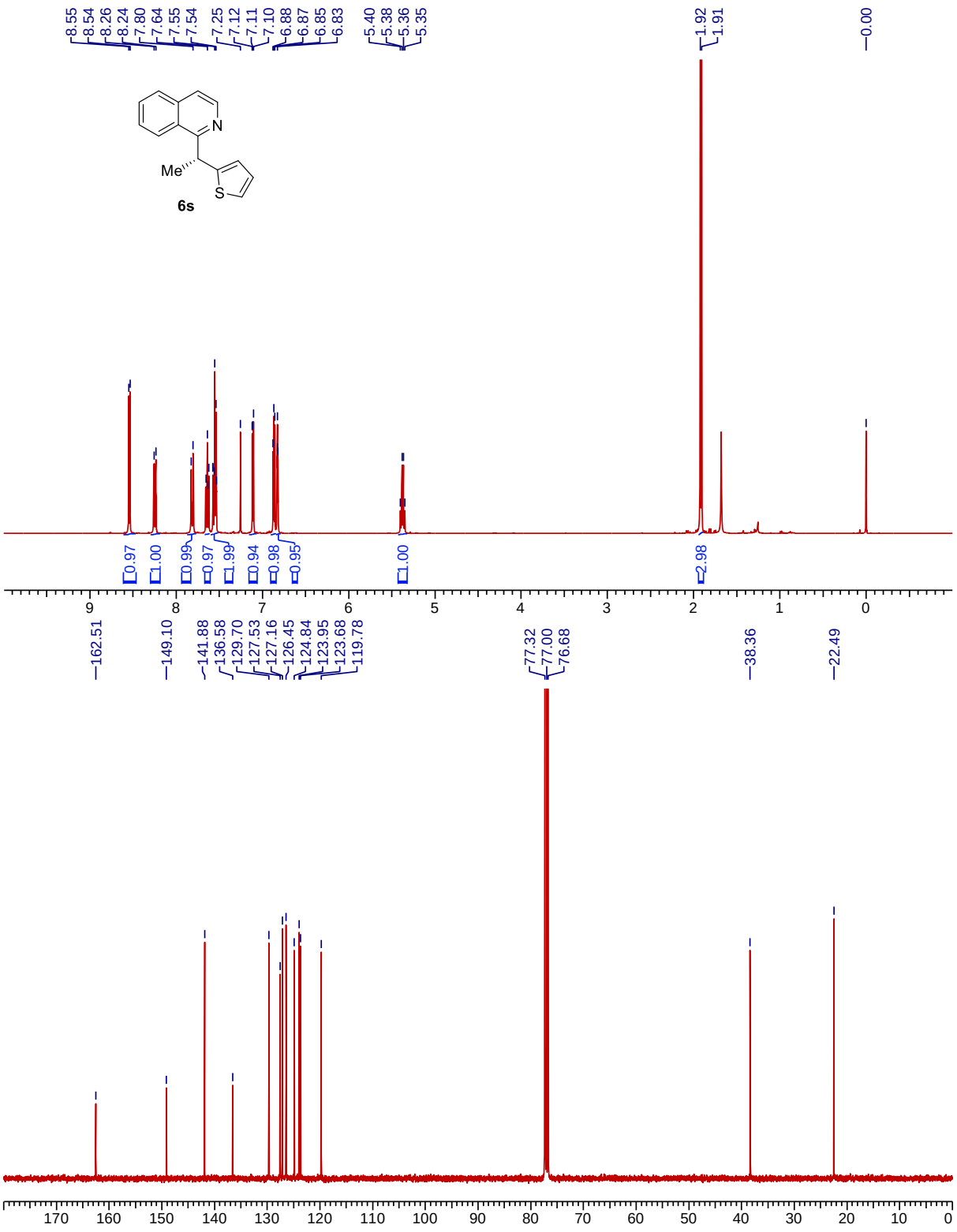
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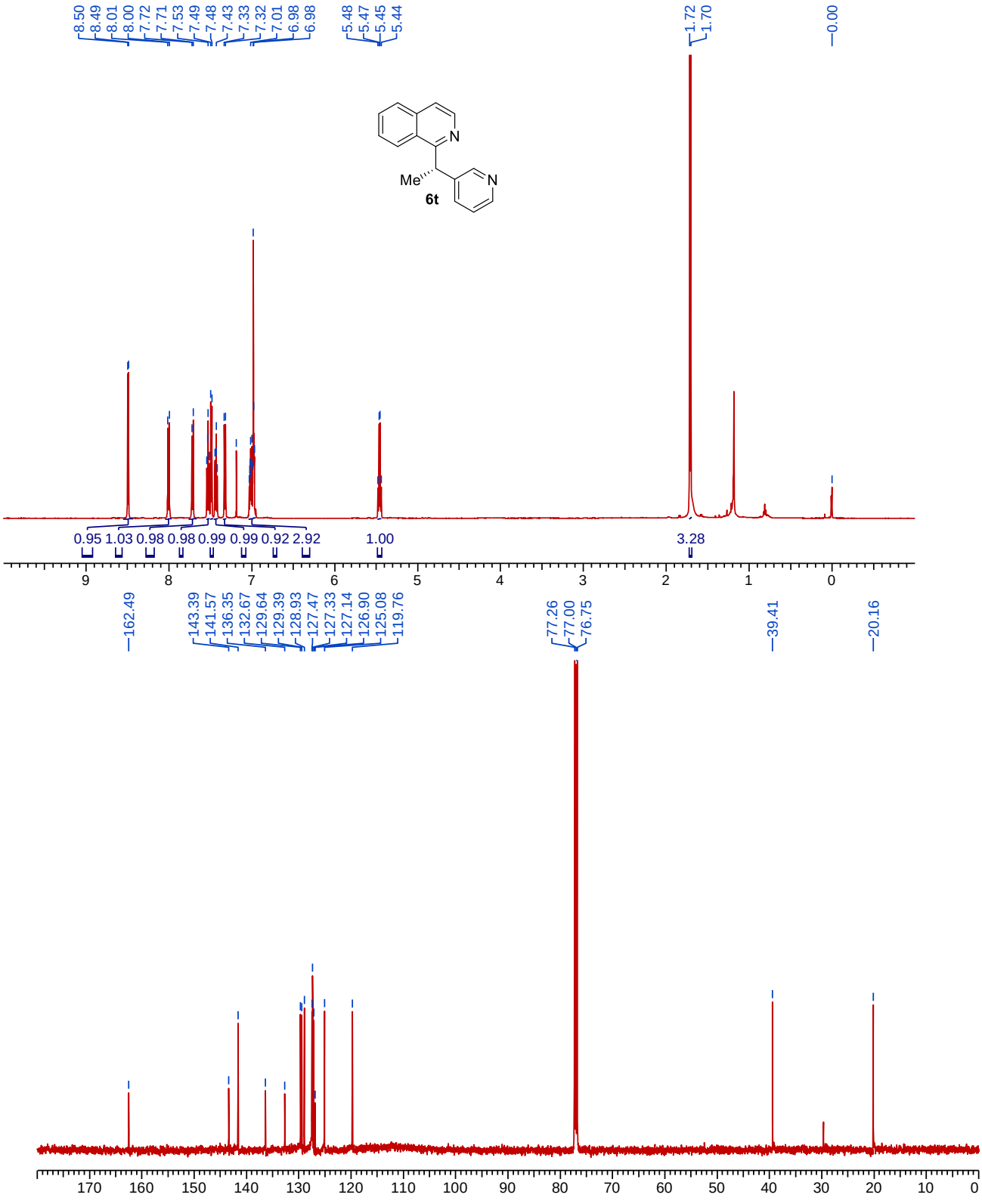
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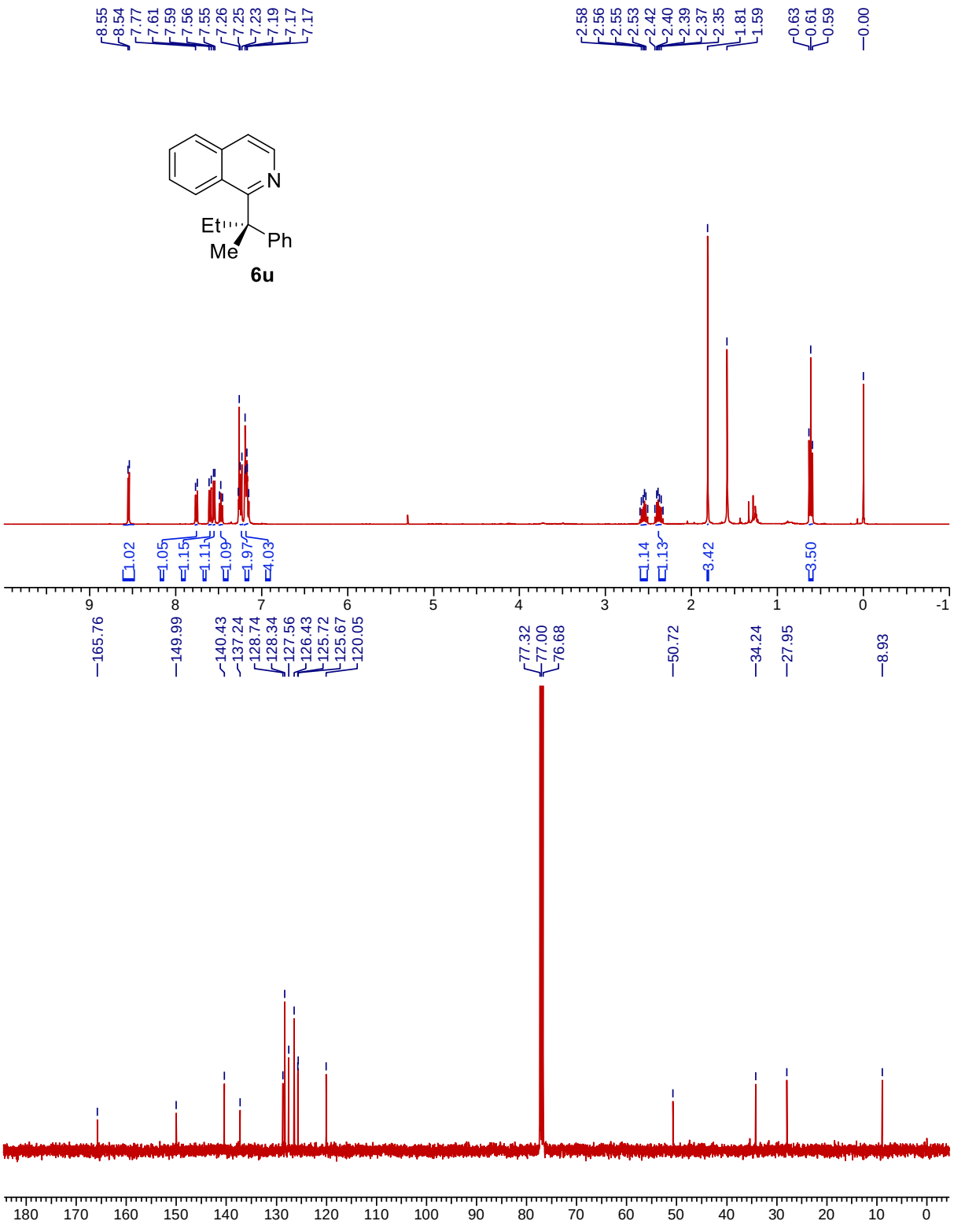
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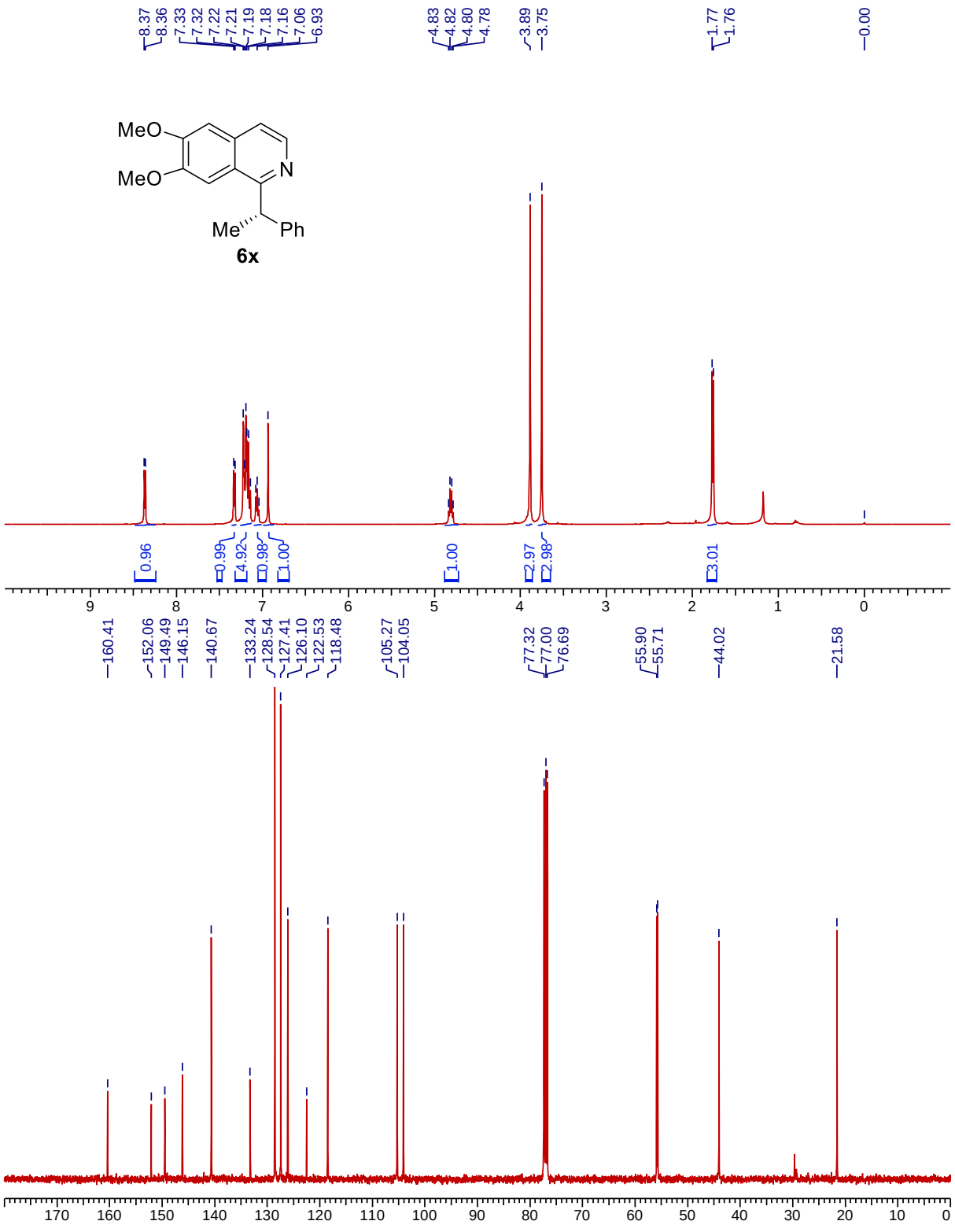
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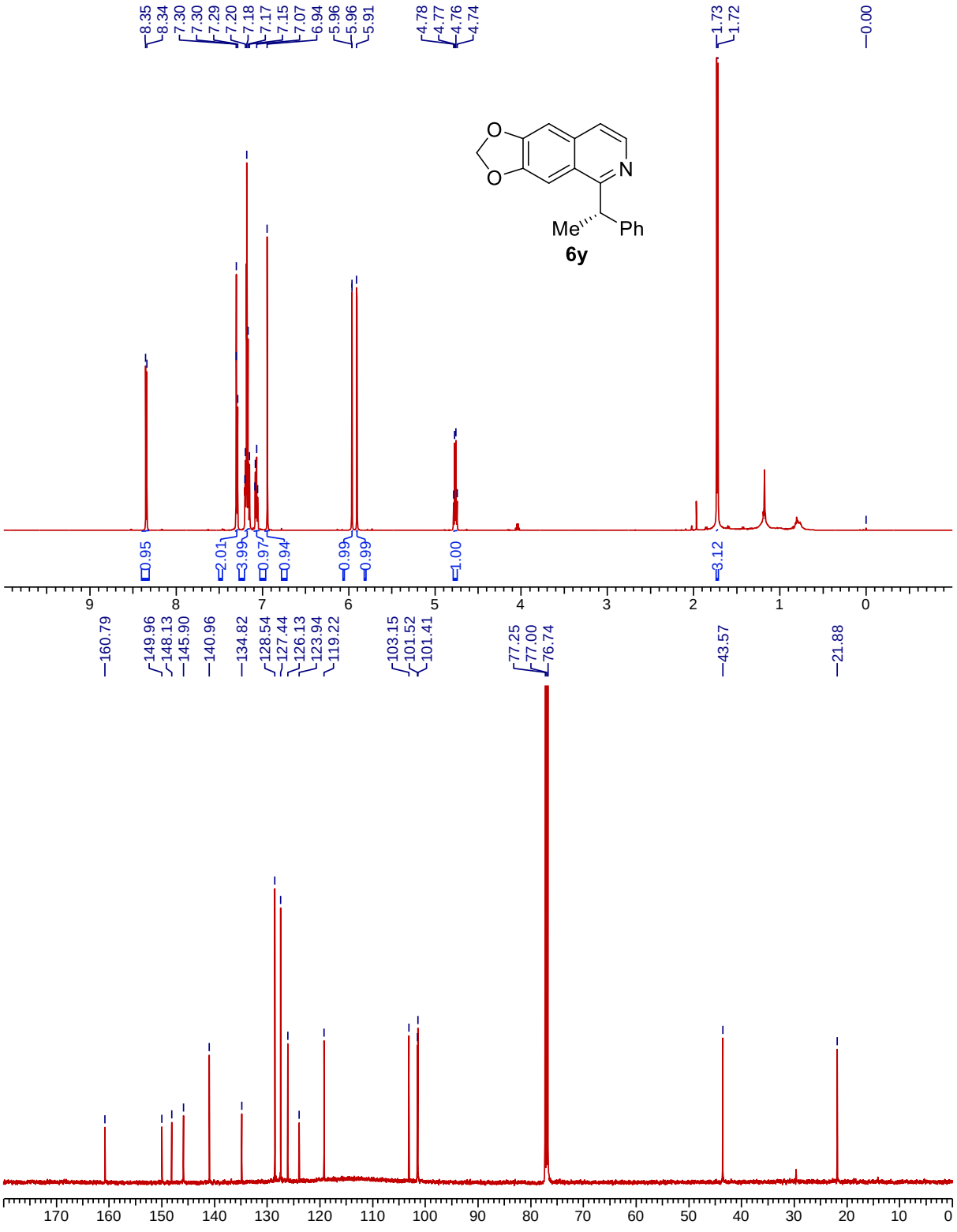
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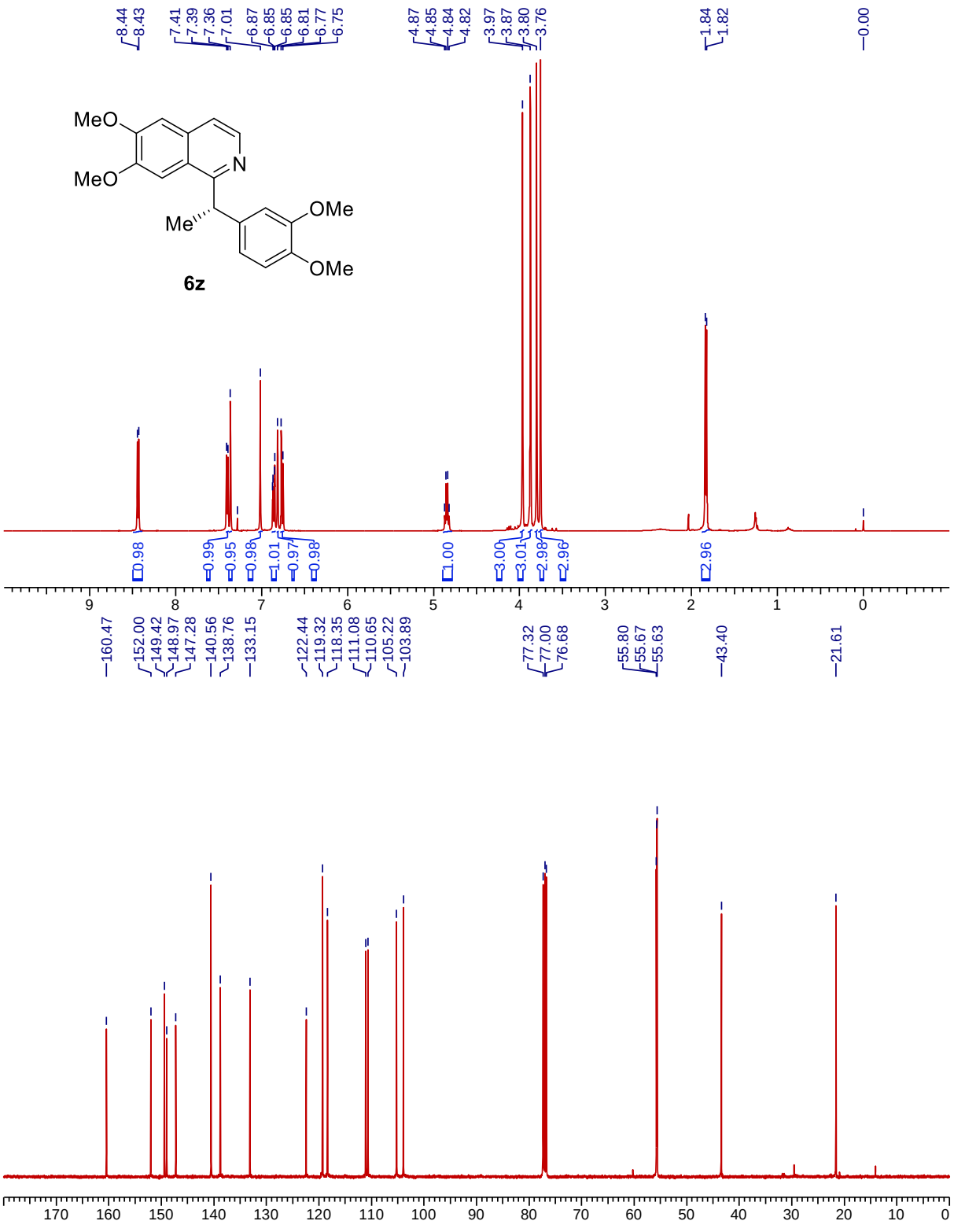
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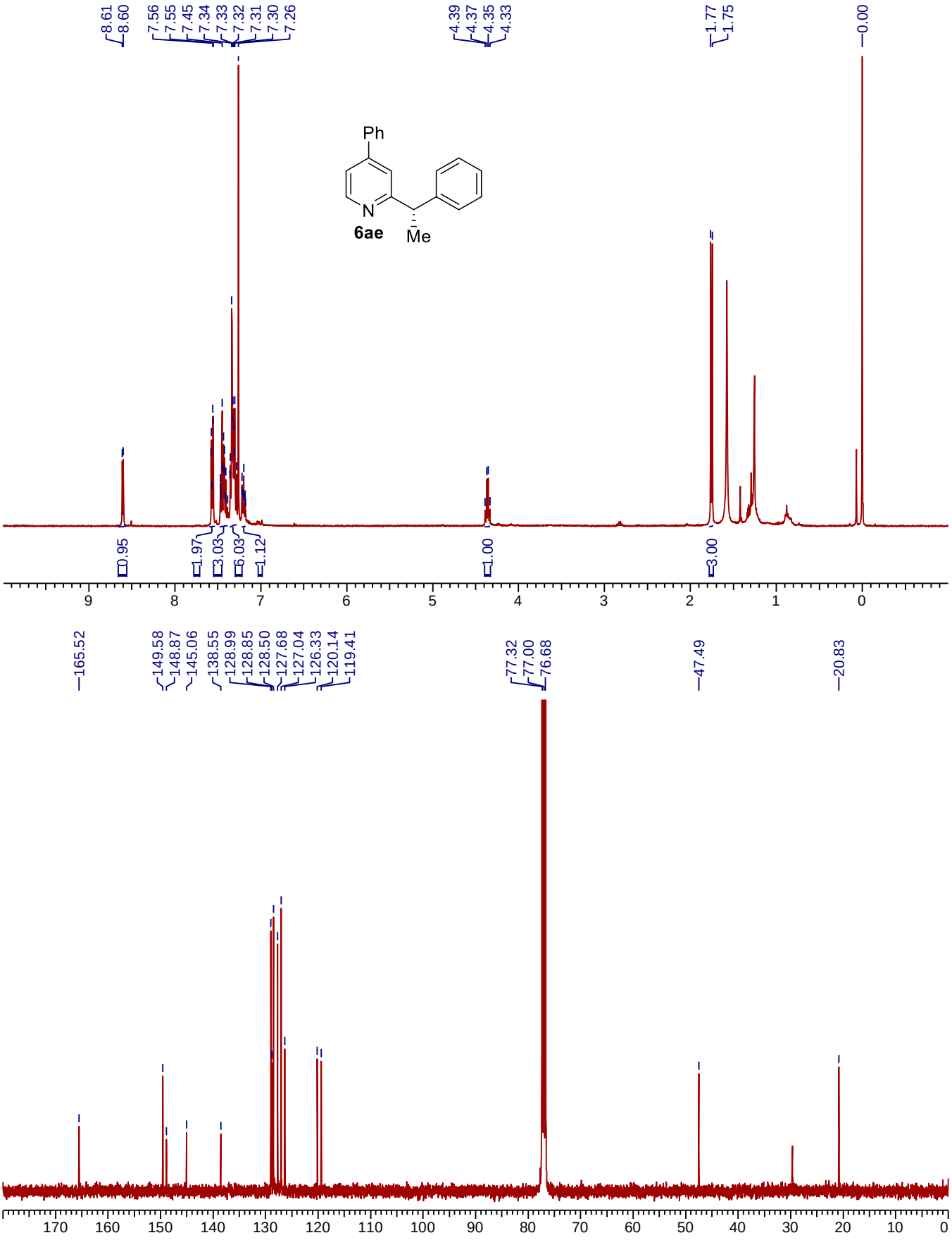
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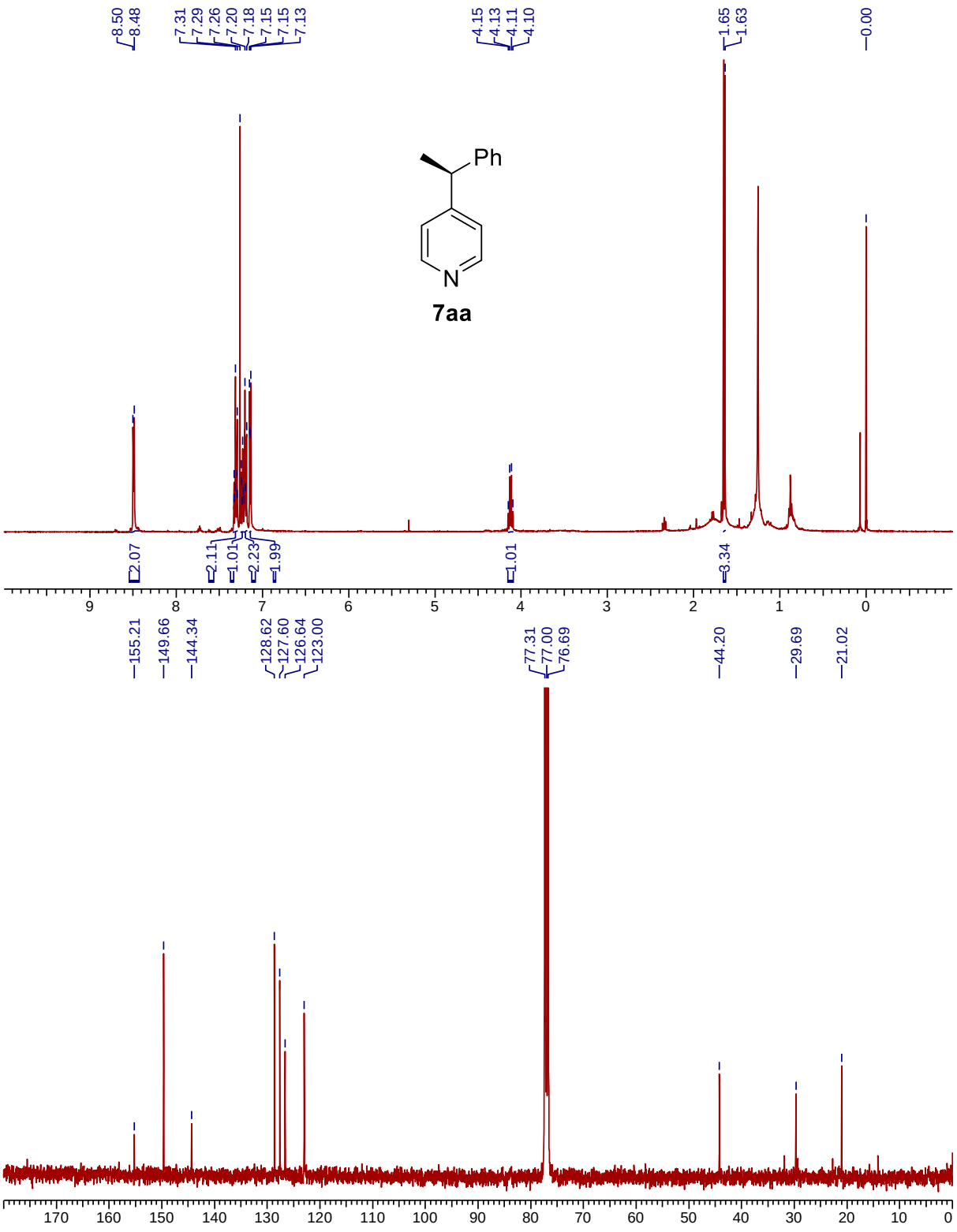
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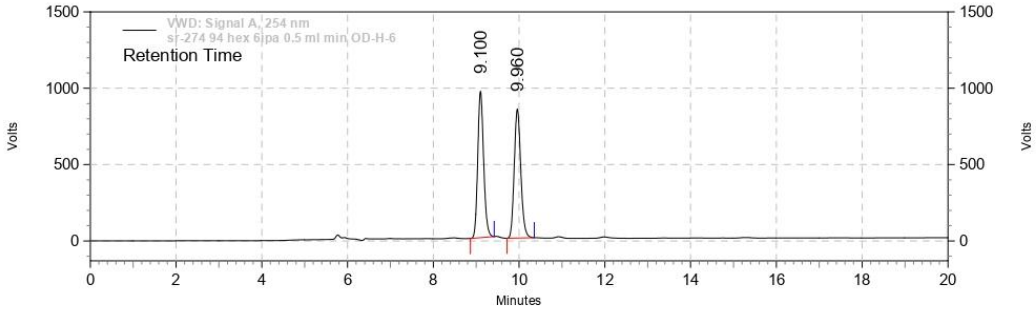
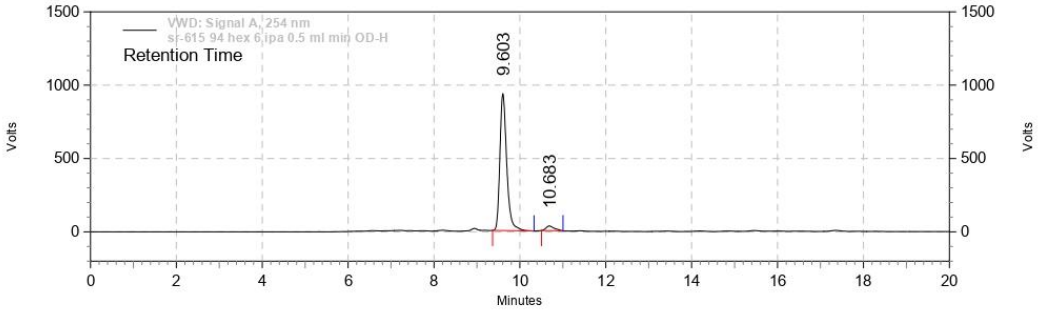


VWD: Signal A, 254 nm Results

Retention Time	Area	Area %
9.100	153835413	50.48
9.960	150883444	49.52

Totals	304718857	100.00

Column : CHIRALPAK OD-H
Eluent System : 94 : 6 (HEXANE:IPA)
Flow rate: 0.5 ml/min
Injection vol..: 10ul
Wavelength: 254 nm
Sample Conc.: 1 mg/ ml



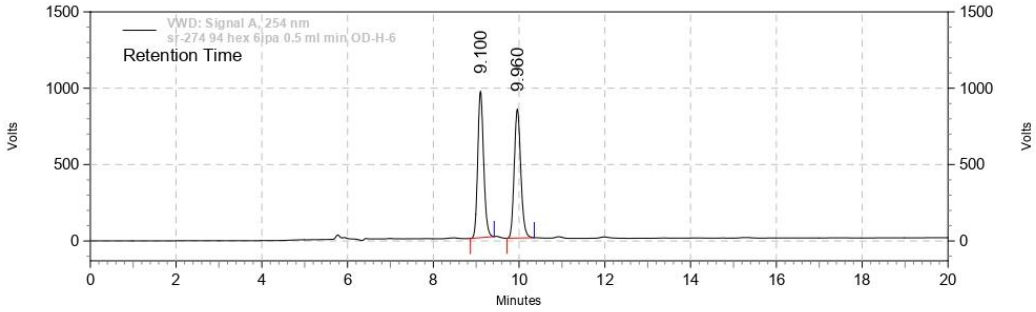
VWD: Signal A, 254 nm Results

Retention Time	Area	Area %
9.603	172659997	95.98
10.683	7227448	4.02

Totals	179887445	100.00

Column : CHIRALPAK OD-H
Eluent System : 94 : 6 (HEXANE:IPA)
Flow rate: 0.5 ml/min
Injection vol..: 10ul
Wavelength: 254 nm
Sample Conc.: 1 mg/ ml

HPLC Traces for compound **6a**

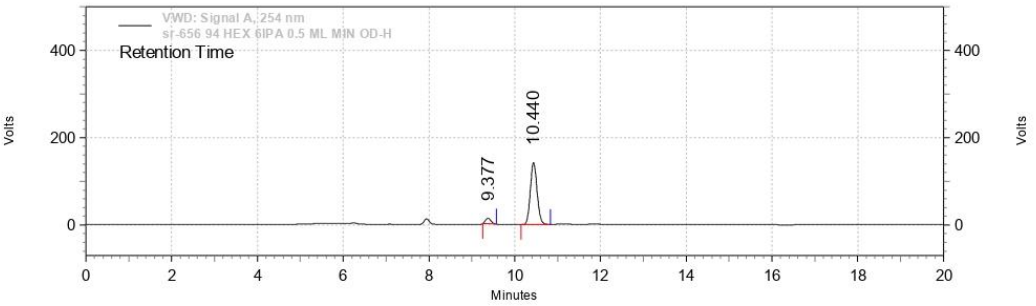


VWD: Signal A, 254 nm Results

Retention Time	Area	Area %
9.100	153835413	50.48
9.960	150883444	49.52

Totals	304718857	100.00

Column : CHIRALPAK OD-H
Eluent System : 94 : 6 (HEXANE:IPA)
Flow rate: 0.5 ml/min
Injection vol..: 10ul
Wavelength: 254 nm
Sample Conc.: 1 mg/ ml



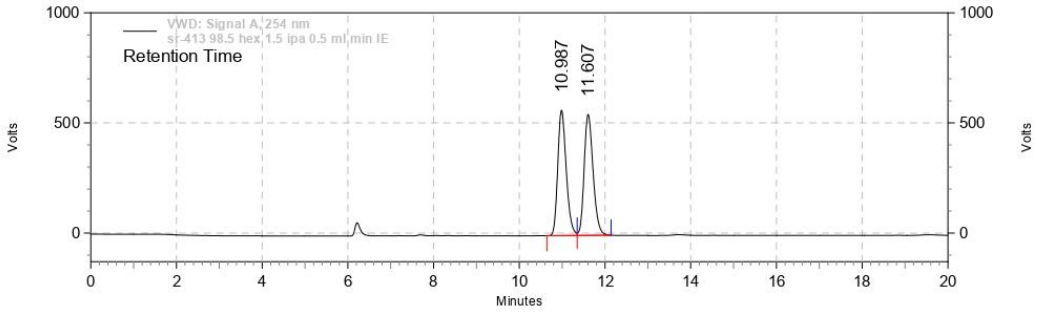
VWD: Signal A, 254 nm Results

Retention Time	Area	Area %
9.377	1899304	6.74
10.440	26279386	93.26

Totals	28178690	100.00

Column : CHIRALPAK OD-H
Eluent System: 94 :6 (HEXANE:IPA)
Flow Rate: 0.5 ml/min
Injection Vol.: 10ul
Wavelength: 254 nm
Sample Conc.: 1 mg/ml

HPLC Traces for compound *ent*-**6a**

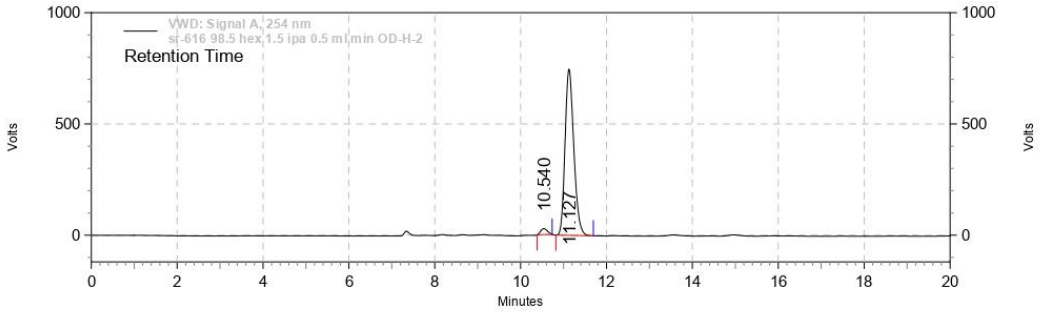


VWD: Signal A, 254 nm Results

Retention Time	Area	Area %
10.987	131273393	49.49
11.607	133996249	50.51

Totals		
	265269642	100.00

Column : CHIRALPAK IE
Eluent System : 98.5 : 1.5 (HEXANE:IPA)
Flow rate: 0.5 ml/min
Injection vol..: 10ul
Wavelength: 254 nm
Sample Conc.: 1 mg/ ml



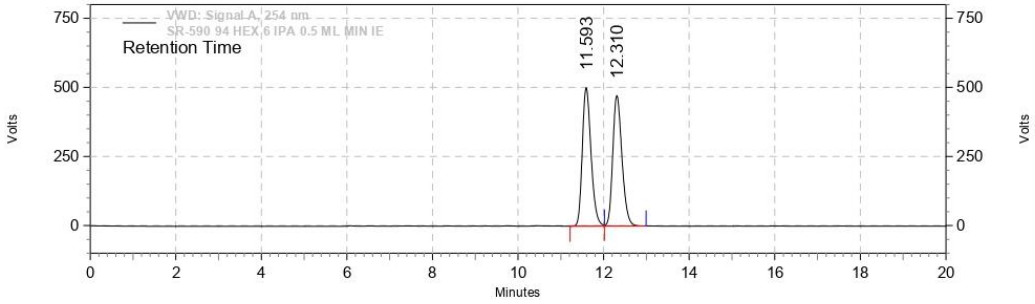
VWD: Signal A, 254 nm Results

Retention Time	Area	Area %
10.540	4805995	2.64
11.127	177431953	97.36

Totals		
	182237948	100.00

Column : CHIRALPAK IE
Eluent System : 98.5 : 1.5 (HEXANE:IPA)
Flow rate: 0.5 ml/min
Injection vol..: 10ul
Wavelength: 254 nm
Sample Conc.: 1 mg/ ml

HPLC Traces for compound **6b**

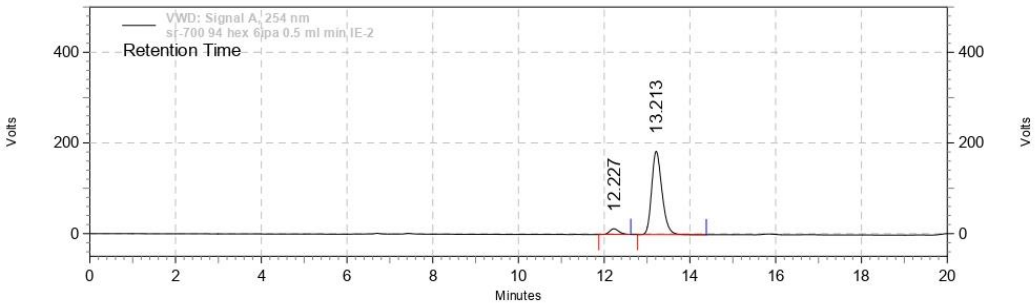


VWD: Signal A, 254 nm Results

Retention Time	Area	Area %
11.593	119225974	50.15
12.310	118497032	49.85

Totals		
	237723006	100.00

Column: CHIRALPAK IE
Eluent System: 94 : 06 (HEXANE : IPA)
Flow rate: 0.5 ml/min
Injection vol: 10ul
Wavelength: 254 nm
Sample Conc.: 1 mg/ml



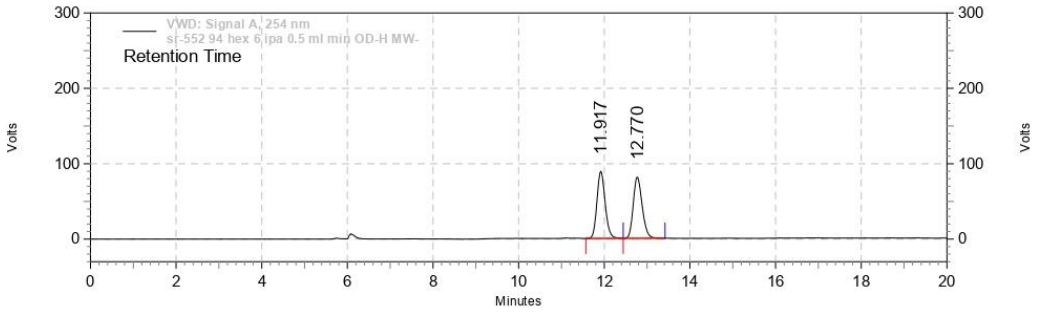
VWD: Signal A, 254 nm Results

Retention Time	Area	Area %
12.227	3219114	5.87
13.213	51601105	94.13

Totals		
	54820219	100.00

Column : CHIRALPAK IE
Eluent System : 94 : 6 (HEXANE:IPA)
Flow rate: 0.5 ml/min
Injection vol..: 10ul
Wavelength: 254 nm
Sample Conc.: 1 mg/ ml

HPLC Traces for compound **6c**

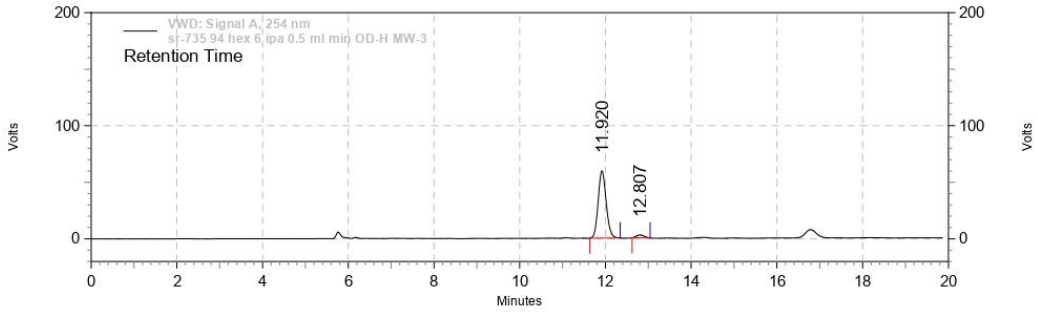


VWD: Signal A, 254 nm Results

Retention Time	Area	Area %
11.917	19875365	50.21
12.770	19710327	49.79

Totals	39585692	100.00

Column : CHIRALPAK OD-H
Eluent System : 94 : 6 (HEXANE:IPA)
Flow rate: 0.5 ml/min
Injection vol..: 10ul
Wavelength: 254 nm
Sample Conc.: 1 mg/ ml



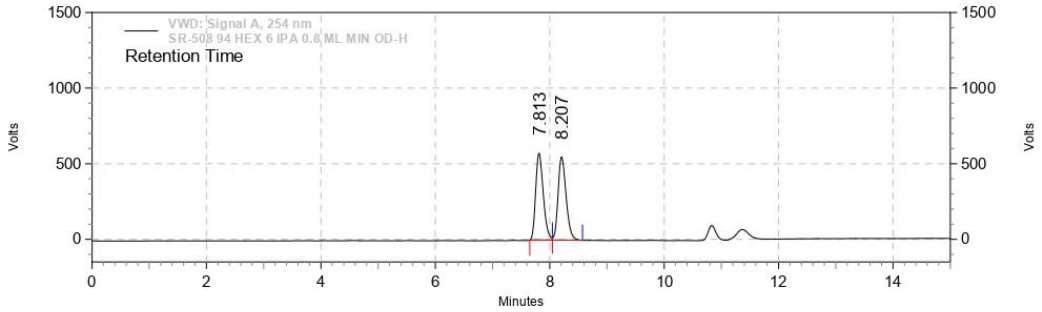
VWD: Signal A, 254 nm Results

Retention Time	Area	Area %
11.920	12902251	95.95
12.807	544040	4.05

Totals	13446291	100.00

Column : CHIRALPAK OD-H
Eluent System : 94 : 6 (HEXANE:IPA)
Flow rate: 0.5 ml/min
Injection vol..: 10ul
Wavelength: 254 nm
Sample Conc.: 1 mg/ ml

HPLC Traces for compound **6d**

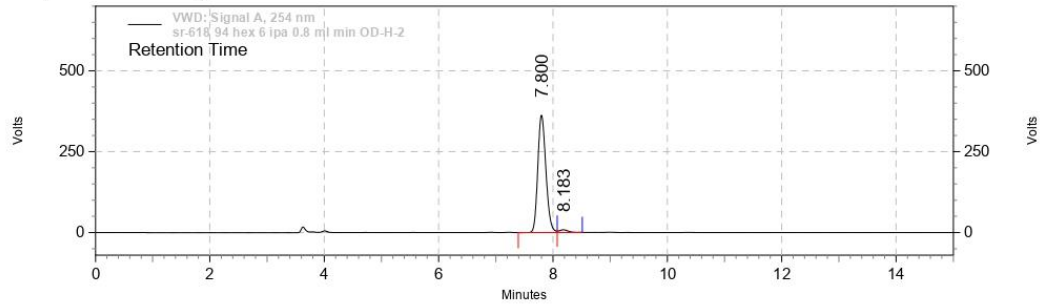


VWD: Signal A, 254 nm Results

Retention Time	Area	Area %
7.813	89103276	49.70
8.207	90188246	50.30

Totals		
	179291522	100.00

Column : CHIRALPAK OD-H
Eluent System : 94 : 6 (HEXANE:IPA)
Flow rate: 0.8 ml/min
Injection vol..: 10ul
Wavelength: 254 nm
Sample Conc.: 1 mg/ ml



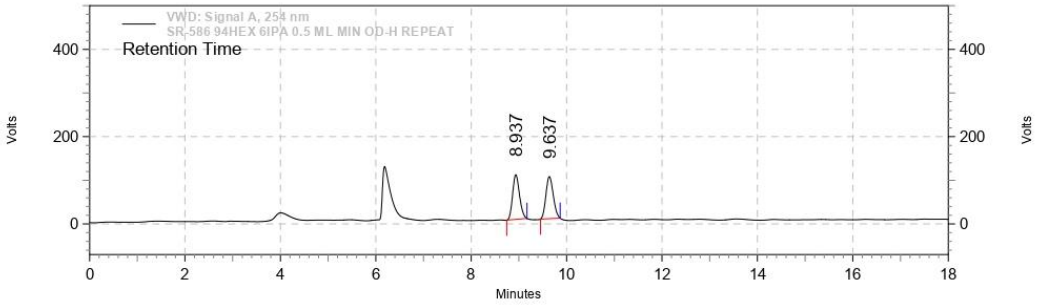
VWD: Signal A, 254 nm Results

Retention Time	Area	Area %
7.800	59832875	97.54
8.183	1507087	2.46

Totals		
	61339962	100.00

Column : CHIRALPAK OD-H
Eluent System : 94 : 6 (HEXANE:IPA)
Flow rate: 0.8 ml/min
Injection vol..: 10ul
Wavelength: 254 nm
Sample Conc.: 1 mg/ ml

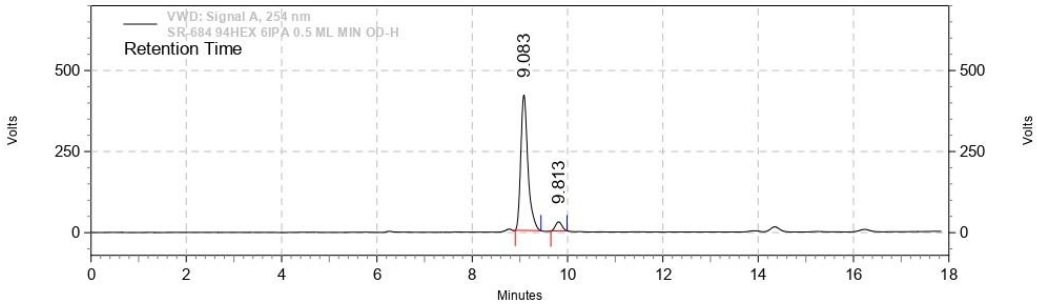
HPLC Traces for compound **6e**



VWD: Signal A, 254 nm Results

Retention Time	Area	Area %
8.937	17266276	50.00
9.637	17265108	50.00
Totals	34531384	100.00

Column : CHIRALPAK OD-H
Eluent System : 94 : 6 (HEXANE:IPA)
Flow rate: 0.5 ml/min
Injection vol..: 10ul
Wavelength: 254 nm
Sample Conc.: 1 mg/ ml

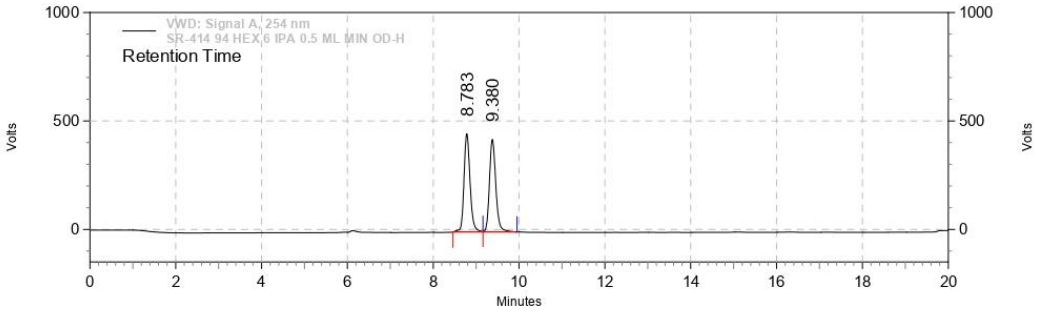


VWD: Signal A, 254 nm Results

Retention Time	Area	Area %
9.083	73104714	94.21
9.813	4489431	5.79
Totals	77594145	100.00

Column : CHIRALPAK OD-H
Eluent System : 94 : 6 (HEXANE:IPA)
Flow rate: 0.5 ml/min
Injection vol..: 10ul
Wavelength: 254 nm
Sample Conc.: 1 mg/ ml

HPLC Traces for compound **6f**

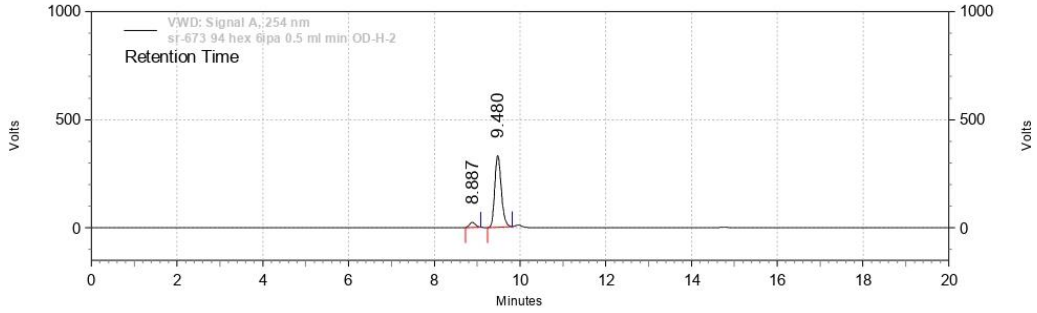


VWD: Signal A, 254 nm Results

Retention Time	Area	Area %
8.783	74712593	50.33
9.380	73730453	49.67

Totals		
	148443046	100.00

Column : CHIRALPAK OD-H
Eluent System : 94 : 6 (HEXANE:IPA)
Flow rate: 0.5 ml/min
Injection vol..: 10ul
Wavelength: 254 nm
Sample Conc.: 1 mg/ ml



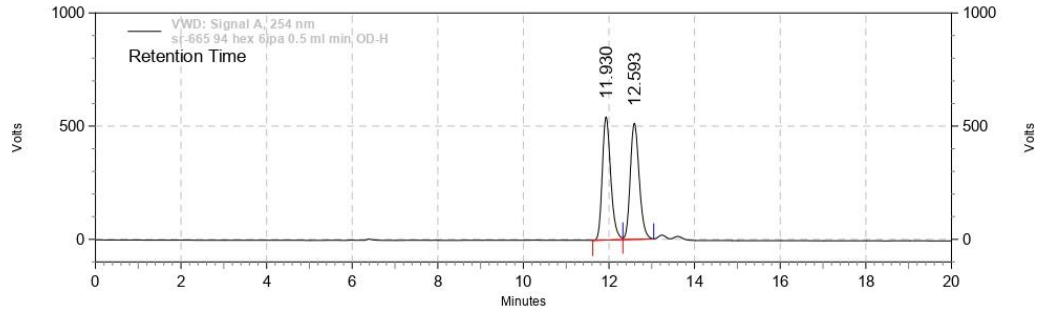
VWD: Signal A, 254 nm Results

Retention Time	Area	Area %
8.887	3768766	6.01
9.480	58893849	93.99

Totals		
	62662615	100.00

Column : CHIRALPAK OD-H
Eluent System: 94 :6 (HEXANE:IPA)
Flow Rate: 0.5 ml/min
Injection Vol.: 10ul
Wavelength: 254 nm
Sample Conc.: 1 mg/ml

HPLC Traces for compound **6g**

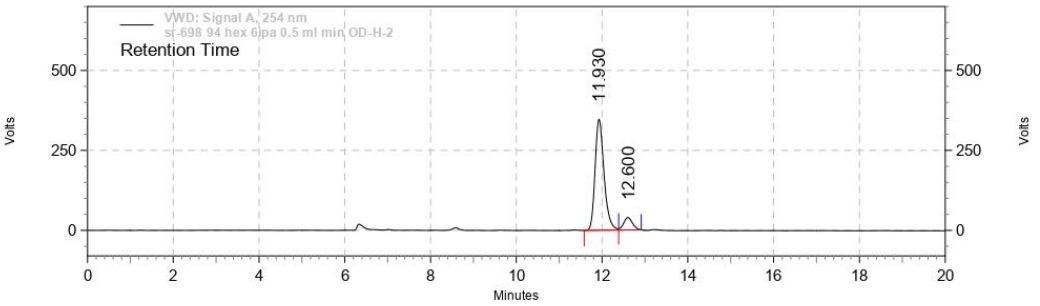


VWD: Signal A, 254 nm Results

Retention Time	Area	Area %
11.930	125070704	49.98
12.593	125178881	50.02

Totals	250249585	100.00

Column : CHIRALPAK OD-H
Eluent System : 94 : 06 (HEXANE:IPA)
Flow rate: 0.5 ml/min
Injection vol..: 10ul
Wavelength: 254 nm
Sample Conc.: 1 mg/ ml



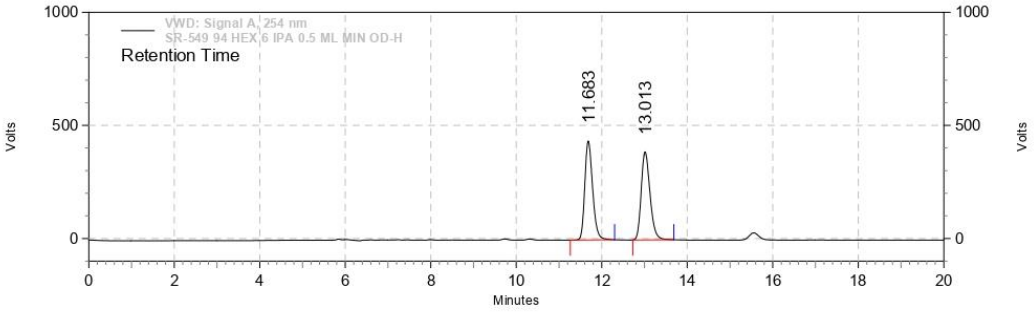
VWD: Signal A, 254 nm Results

Retention Time	Area	Area %
11.930	84510911	89.92
12.600	9477457	10.08

Totals	93988368	100.00

Column : CHIRALPAK OD-H
Eluent System : 94 : 6 (HEXANE:IPA)
Flow rate: 0.5 ml/min
Injection vol..: 10ul
Wavelength: 254 nm
Sample Conc.: 1 mg/ ml

HPLC Traces for compound **6h**

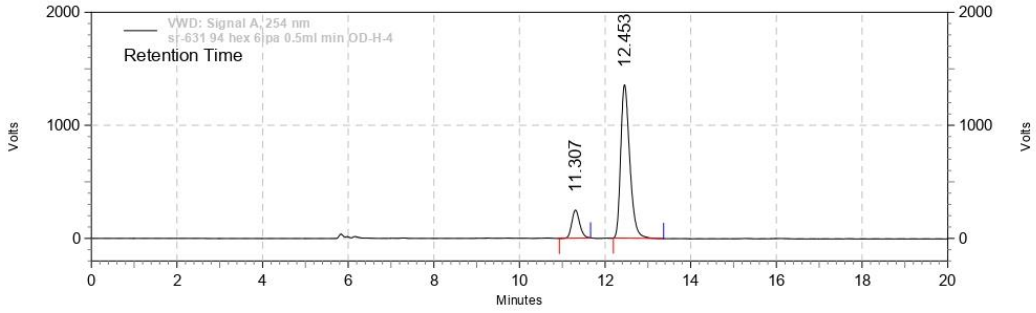


VWD: Signal A, 254 nm Results

Retention Time	Area	Area %
11.683	93545658	50.01
13.013	93502466	49.99

Totals		
	187048124	100.00

Column : CHIRALPAK OD-H
Eluent System : 94 : 6 (HEXANE:IPA)
Flow rate: 0.5 ml/min
Injection vol..: 10ul
Wavelength: 254 nm
Sample Conc.: 1 mg/ ml



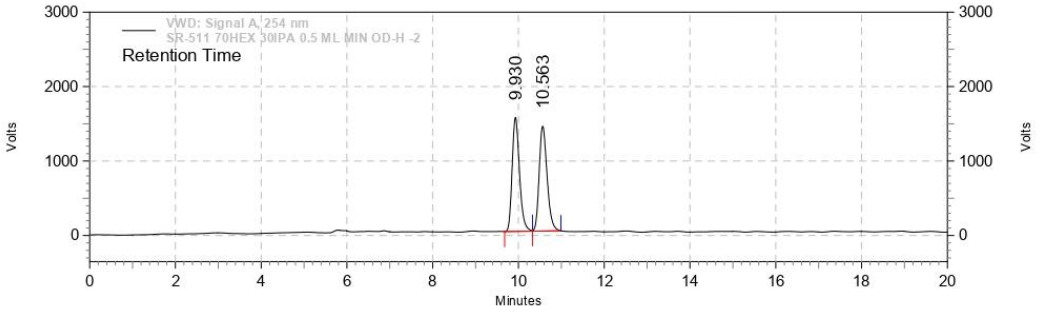
VWD: Signal A, 254 nm Results

Retention Time	Area	Area %
11.307	53065222	13.72
12.453	333736525	86.28

Totals		
	386801747	100.00

Column : CHIRALPAK OD-H
Eluent System : 94 : 6 (HEXANE:IPA)
Flow rate: 0.5 ml/min
Injection vol..: 10ul
Wavelength: 254 nm
Sample Conc.: 1 mg/ ml

HPLC Traces for compound **6i**

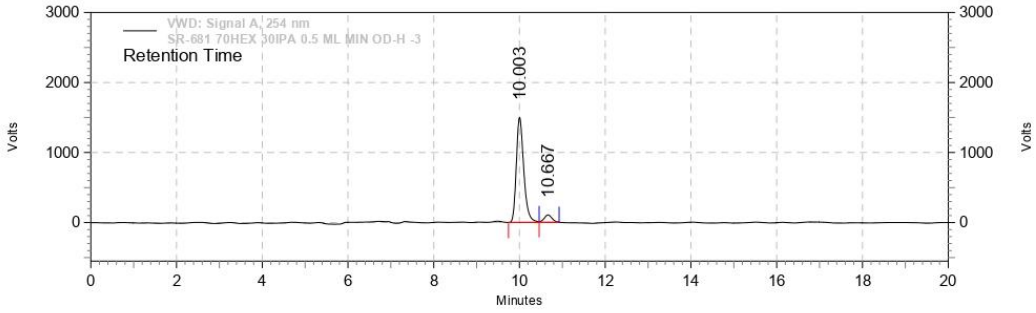


VWD: Signal A, 254 nm Results

Retention Time	Area	Area %
9.930	305836496	50.22
10.563	303178090	49.78

Totals		
	609014586	100.00

Column : CHIRALPAK OD-H
Eluent System : 70 : 30 (HEXANE:IPA)
Flow rate: 0.5 ml/min
Injection vol..: 10ul
Wavelength: 254 nm
Sample Conc.: 1 mg/ ml



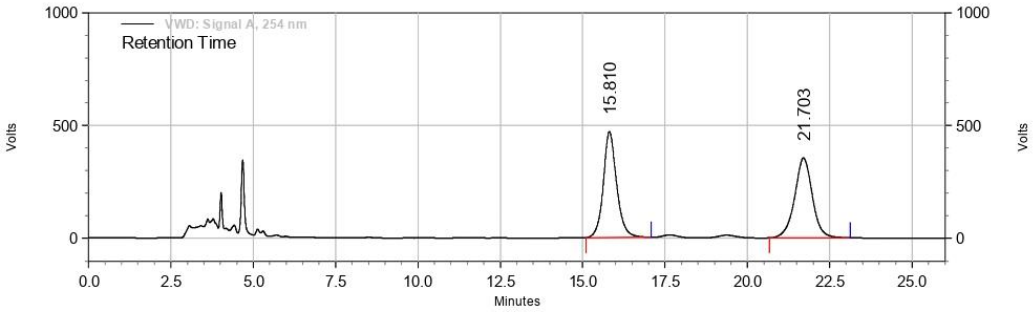
VWD: Signal A, 254 nm Results

Retention Time	Area	Area %
10.003	302624138	93.05
10.667	22616035	6.95

Totals		
	325240173	100.00

Column : CHIRALPAK OD-H
Eluent System : 70 : 30 (HEXANE:IPA)
Flow rate: 0.5 ml/min
Injection vol..: 10ul
Wavelength: 254 nm
Sample Conc.: 1 mg/ ml

HPLC Traces for compound **6j**

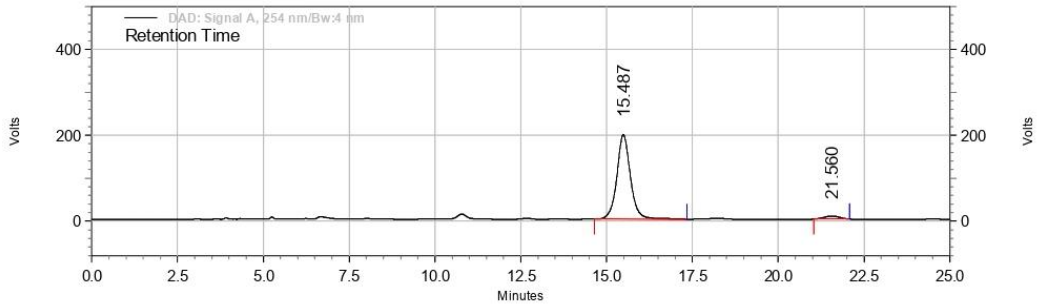


VWD: Signal A, 254 nm Results

Retention Time	Area	Area %
15.810	221622443	49.98
21.703	221832956	50.02

Totals		
	443455399	100.00

Column: CHIRALPAK OD-H
Eluent System: 97 : 03 (HEXANE:IPA)
Flow rate: 0.5 ml/min
Injection vol: 10ul
Wavelength: 254 nm
Sampl Conc: 1 mg/ml



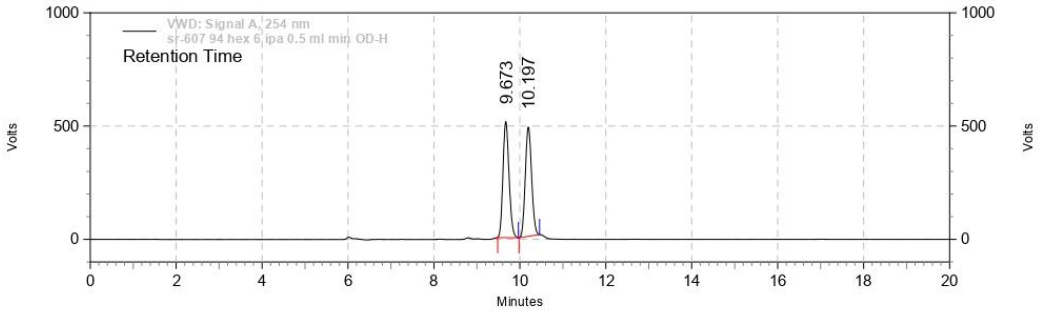
DAD: Signal A, 254 nm/Bw:4 nm Results

Retention Time	Area	Area %
15.487	11393244	96.12
21.560	460349	3.88

Totals		
	11853593	100.00

Column: CHIRALPAK OD-H
Eluent System: 97 : 3 (HEXANE:IPA)
Flow rate: 0.5 ml/min
Injection vol: 10ul
Wavelength: 254 nm
Sampl Conc: 1 mg/ml

HPLC traces for compound **6k**

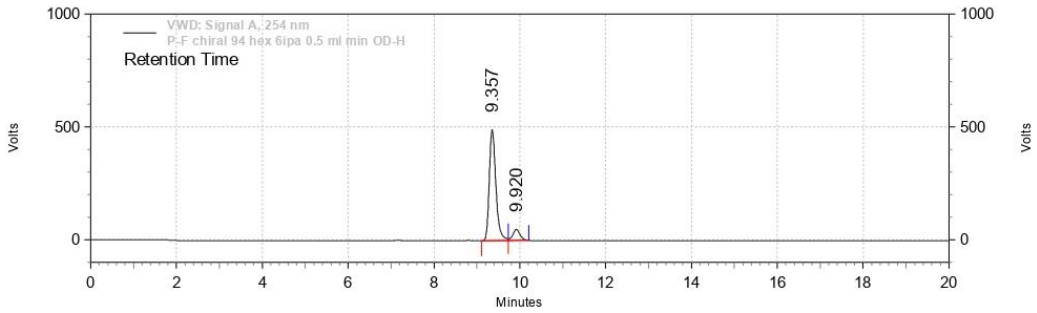


VWD: Signal A, 254 nm Results

Retention Time	Area	Area %
9.673	84494802	50.54
10.197	82701346	49.46

Totals		
	167196148	100.00

Column : CHIRALPAK OD-H
Eluent System : 94 : 6 (HEXANE:IPA)
Flow rate: 0.5 ml/min
Injection vol..: 10ul
Wavelength: 254 nm
Sample Conc.: 1 mg/ ml



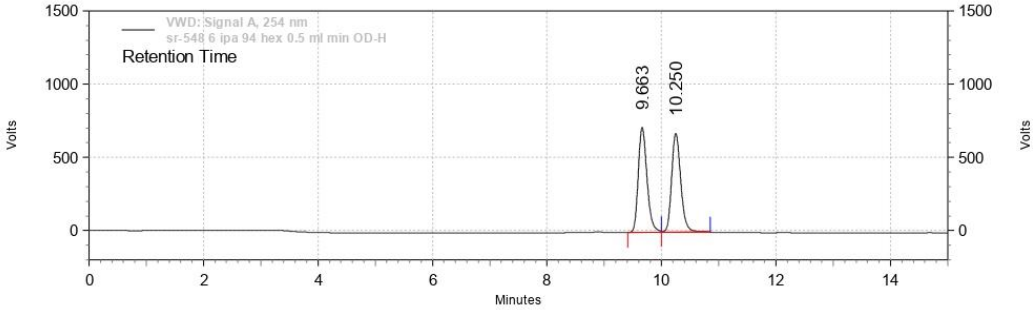
VWD: Signal A, 254 nm Results

Retention Time	Area	Area %
9.357	88537685	90.16
9.920	9660535	9.84

Totals		
	98198220	100.00

Column : CHIRALPAK OD-H
Eluent System: 94 :6 (HEXANE:IPA)
Flow Rate: 0.5 ml/min
Injection Vol.: 10ul
Wavelength: 254 nm
Sample Conc.: 1 mg/ml

HPLC Traces for compound **6l**

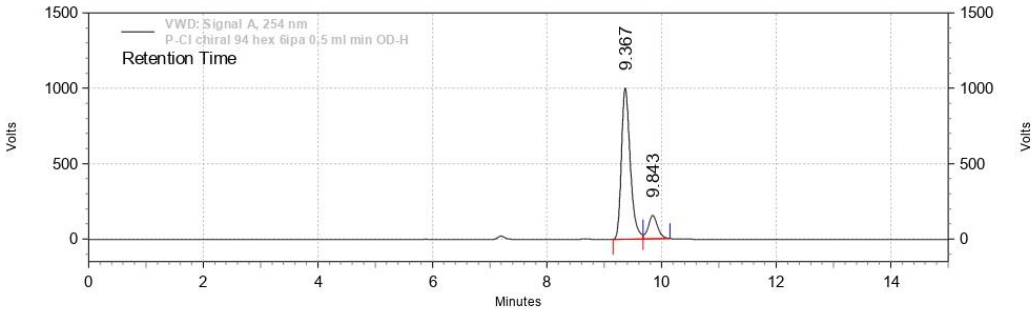


VWD: Signal A, 254 nm Results

Retention Time	Area	Area %
9.663	128078831	50.33
10.250	126395048	49.67

Totals	254473879	100.00

Column : CHIRALPAK OD-H
Eluent System: 94 :6 (HEXANE:IPA)
Flow Rate: 0.5 ml/min
Injection Vol.: 10ul
Wavelength: 254 nm
Sample Conc.: 1 mg/ml



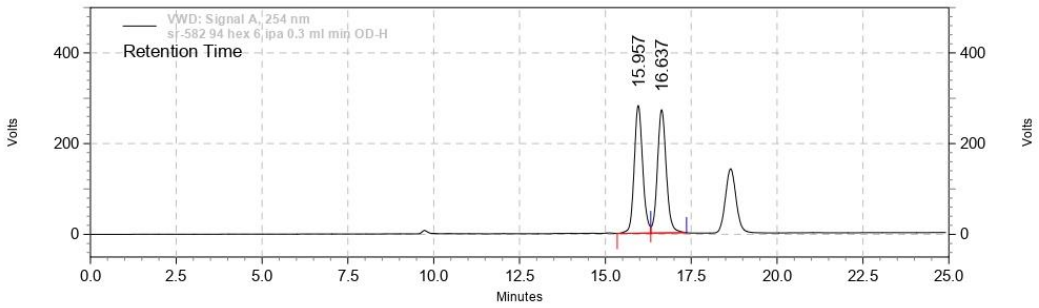
VWD: Signal A, 254 nm Results

Retention Time	Area	Area %
9.367	180611919	85.92
9.843	29587660	14.08

Totals	210199579	100.00

Column : CHIRALPAK OD-H
Eluent System: 94 :6 (HEXANE:IPA)
Flow Rate: 0.5 ml/min
Injection Vol.: 10ul
Wavelength: 254 nm
Sample Conc.: 1 mg/ml

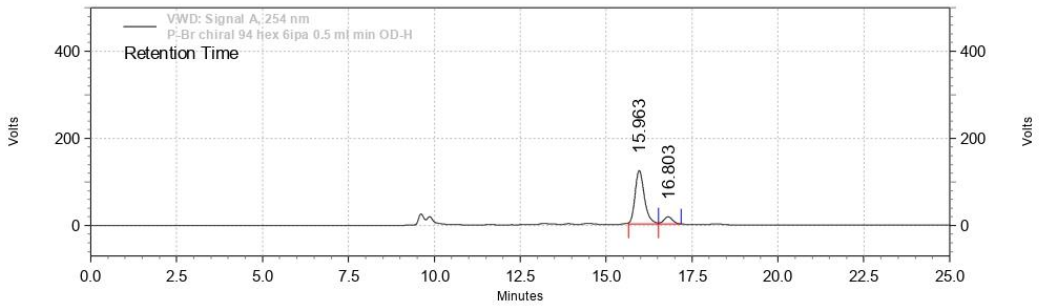
HPLC Traces for compound **6m**



VWD: Signal A, 254 nm Results

Retention Time	Area	Area %
15.957	81137600	49.84
16.637	81665720	50.16
Totals	162803320	100.00

Column : CHIRALPAK OD-H
Eluent System : 94 : 06 (HEXANE:IPA)
Flow rate: 0.3 ml/min
Injection vol..: 10ul
Wavelength: 254 nm
Sample Conc.: 1 mg/ ml

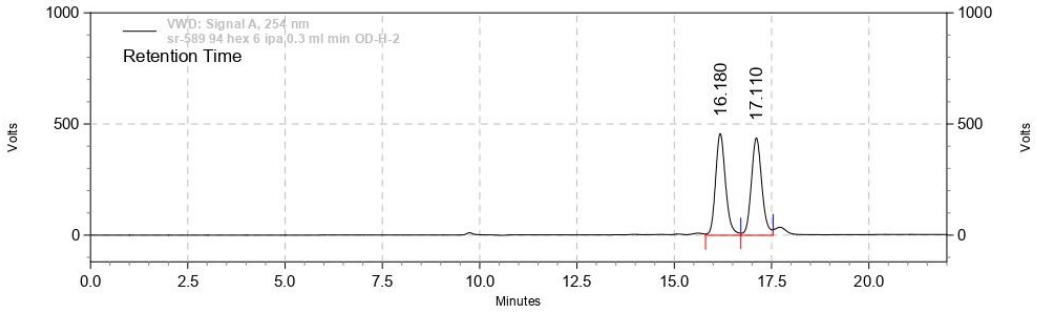


VWD: Signal A, 254 nm Results

Retention Time	Area	Area %
15.963	39182545	88.42
16.803	5133927	11.58
Totals	44316472	100.00

Column : CHIRALPAK OD-H
Eluent System: 94 :6 (HEXANE:IPA)
Flow Rate: 0.3 ml/min
Injection Vol.: 10ul
Wavelength: 254 nm
Sample Conc.: 1 mg/ml

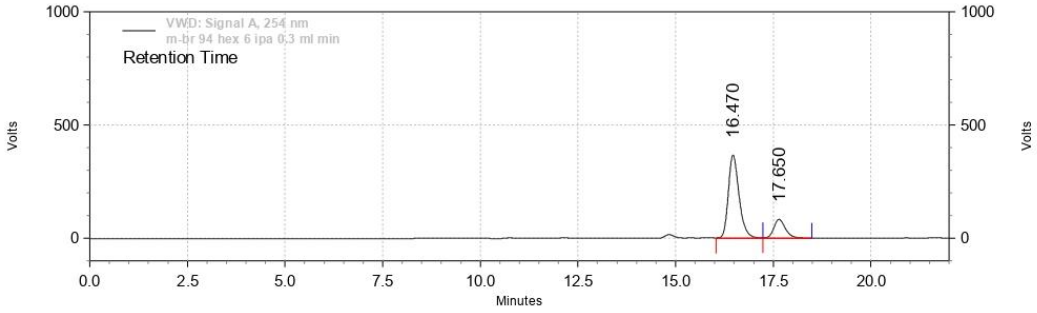
HPLC Traces for compound **6n**



VWD: Signal A, 254 nm Results

Retention Time	Area	Area %
16.180	137048357	49.75
17.110	138405103	50.25
Totals	275453460	100.00

Column : CHIRALPAK OD-H
Eluent System : 94 : 6 (HEXANE:IPA)
Flow rate: 0.3 ml/min
Injection vol..: 10ul
Wavelength: 254 nm
Sample Conc.: 1 mg/ ml

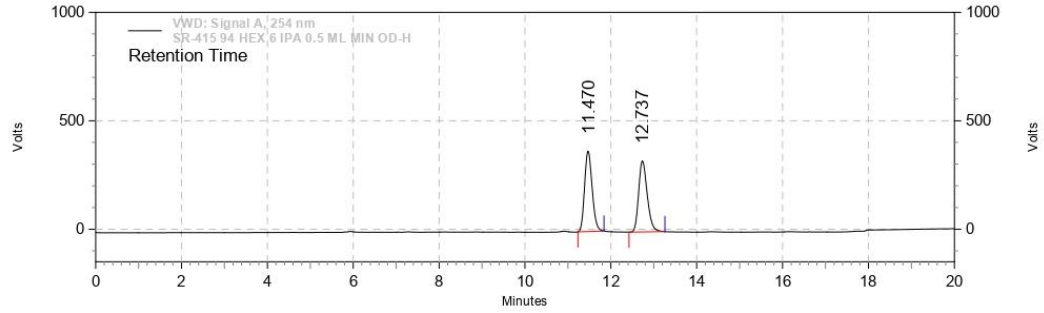


VWD: Signal A, 254 nm Results

Retention Time	Area	Area %
16.470	116969024	80.65
17.650	28064475	19.35
Totals	145033499	100.00

Column : CHIRALPAK OD-H
Eluent System: 94 :6 (HEXANE:IPA)
Flow Rate: 0.3 ml/min
Injection Vol.: 10ul
Wavelength: 254 nm
Sample Conc.: 1 mg/ml

HPLC Traces for compound **6o**

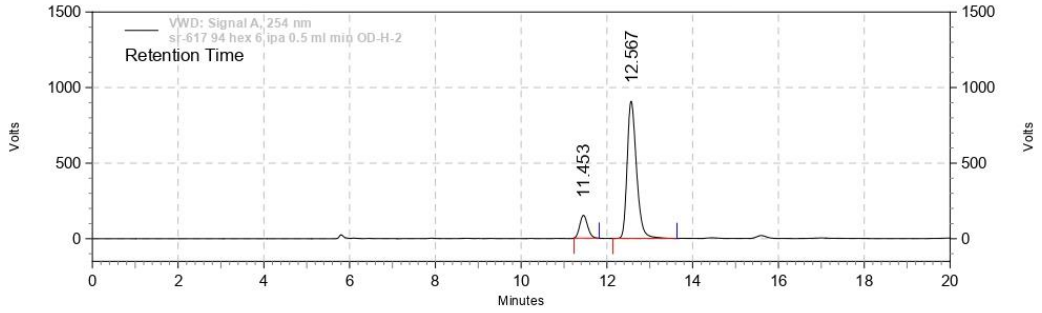


VWD: Signal A, 254 nm Results

Retention Time	Area	Area %
11.470	76439423	49.93
12.737	76652651	50.07

Totals	153092074	100.00

Column : CHIRALPAK OD-H
Eluent System : 94 : 6 (HEXANE:IPA)
Flow rate: 0.5 ml/min
Injection vol..: 10ul
Wavelength: 254 nm
Sample Conc.: 1 mg/ ml



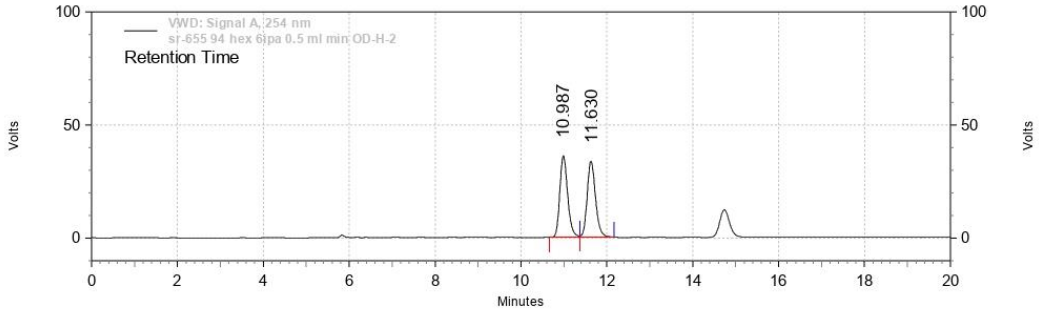
VWD: Signal A, 254 nm Results

Retention Time	Area	Area %
11.453	32462788	12.31
12.567	231162777	87.69

Totals	263625565	100.00

Column : CHIRALPAK OD-H
Eluent System : 94 : 6 (HEXANE:IPA)
Flow rate: 0.5 ml/min
Injection vol..: 10ul
Wavelength: 254 nm
Sample Conc.: 1 mg/ ml

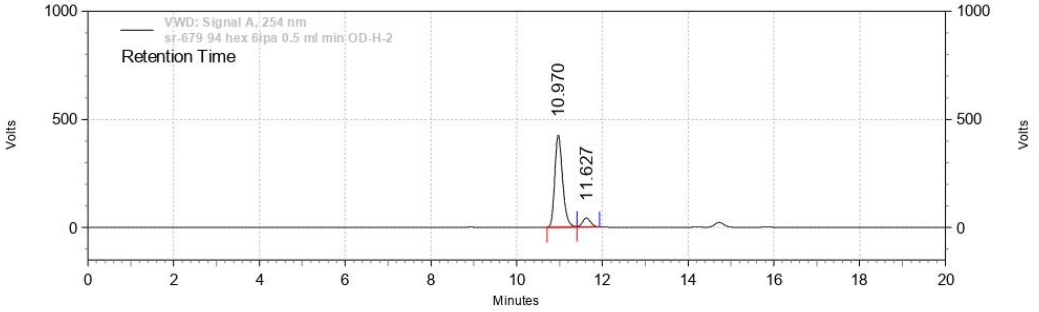
HPLC Traces for compound **6p**



VWD: Signal A, 254 nm Results

Retention Time	Area	Area %
10.987	7718859	50.24
11.630	7645391	49.76
Totals	15364250	100.00

Column : CHIRALPAK OD-H
Eluent System: 94 :6 (HEXANE:IPA)
Flow Rate: 0.5 ml/min
Injection Vol.: 10ul
Wavelength: 254 nm
Sample Conc.: 1 mg/ml

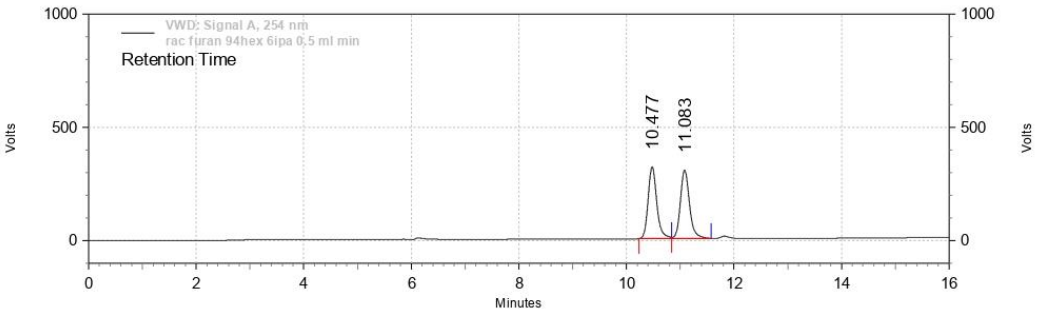


VWD: Signal A, 254 nm Results

Retention Time	Area	Area %
10.970	90409640	90.80
11.627	9164316	9.20
Totals	99573956	100.00

Column : CHIRALPAK OD-H
Eluent System: 94 :6 (HEXANE:IPA)
Flow Rate: 0.5 ml/min
Injection Vol.: 10ul
Wavelength: 254 nm
Sample Conc.: 1 mg/ml

HPLC Traces for compound **6q**

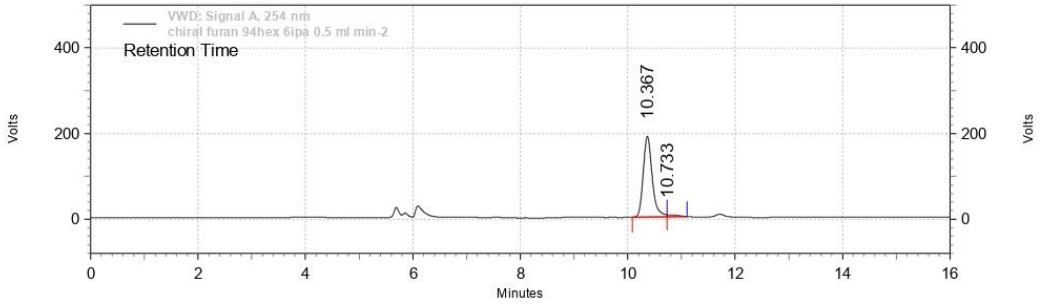


VWD: Signal A, 254 nm Results

Retention Time	Area	Area %
10.477	59823580	50.00
11.083	59826806	50.00

Totals		
	119650386	100.00

Column : CHIRALPAK OD-H
Eluent System: 94 :6 (HEXANE:IPA)
Flow Rate: 0.5 ml/min
Injection Vol.: 10ul
Wavelength: 254 nm
Sample Conc.: 1 mg/ml



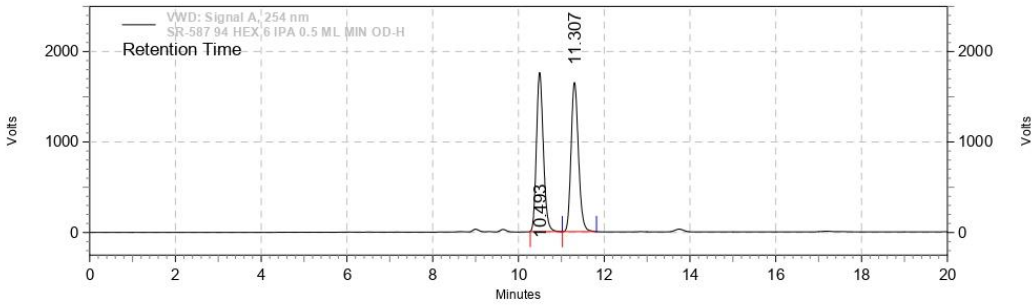
VWD: Signal A, 254 nm Results

Retention Time	Area	Area %
10.367	36864638	97.22
10.733	1053475	2.78

Totals		
	37918113	100.00

Column : CHIRALPAK OD-H
Eluent System: 94 :6 (HEXANE:IPA)
Flow Rate: 0.5 ml/min
Injection Vol.: 10ul
Wavelength: 254 nm
Sample Conc.: 1 mg/ml

HPLC traces for compound **6r**

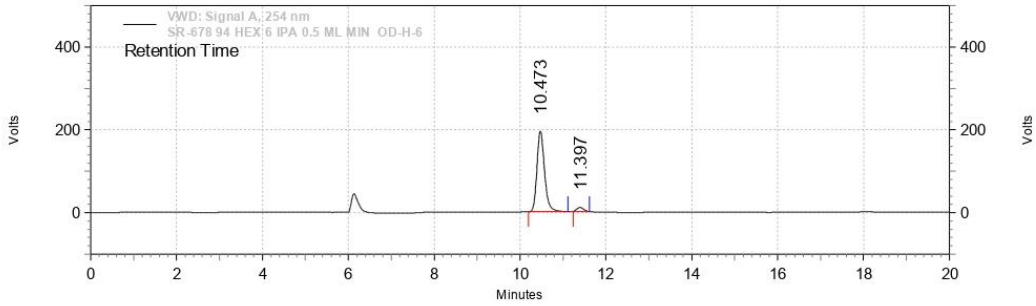


VWD: Signal A, 254 nm Results

Retention Time	Area	Area %
10.493	330077322	49.95
11.307	330723208	50.05

Totals	660800530	100.00

Column: CHIRALPAK OD-H
Eluent System: 94 : 06 (HEXANE : IPA)
Flow rate: 0.5 ml/min
Injection vol: 10ul
Wavelength: 254 nm
Sample Conc.: 1 mg/ml



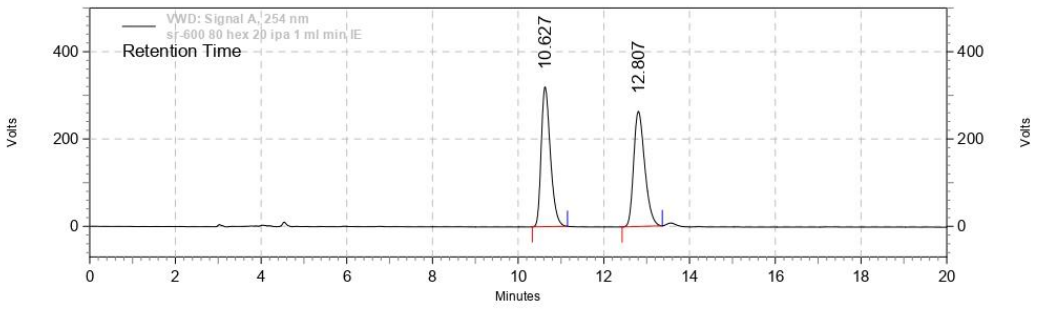
VWD: Signal A, 254 nm Results

Retention Time	Area	Area %
10.473	40133826	95.72
11.397	1795176	4.28

Totals	41929002	100.00

Column : CHIRALPAK OD-H
Eluent System: 94 :6 (HEXANE:IPA)
Flow Rate: 0.5 ml/min
Injection Vol.: 10ul
Wavelength: 254 nm
Sample Conc.: 1 mg/ml

HPLC Traces for compound **6s**

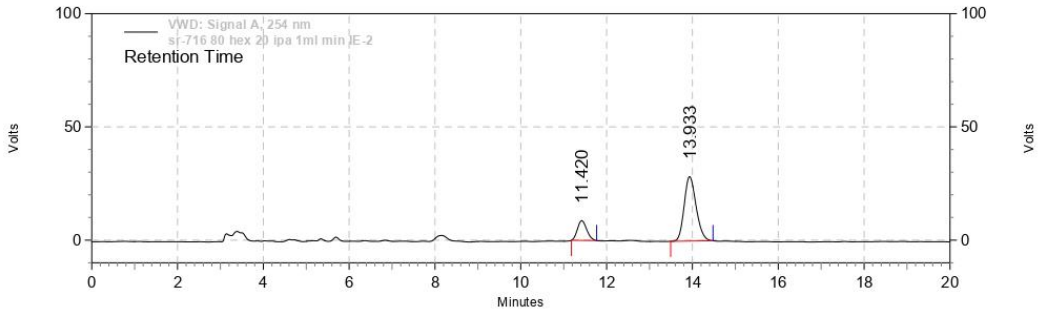


VWD: Signal A, 254 nm Results

Retention Time	Area	Area %
10.627	79907058	50.17
12.807	79374863	49.83

Totals	159281921	100.00

Column : CHIRALPAK IE
Eluent System : 80 : 20 (HEXANE:IPA)
Flow rate: 1.0 ml/min
Injection vol..: 10ul
Wavelength: 254 nm
Sample Conc.: 1 mg/ ml



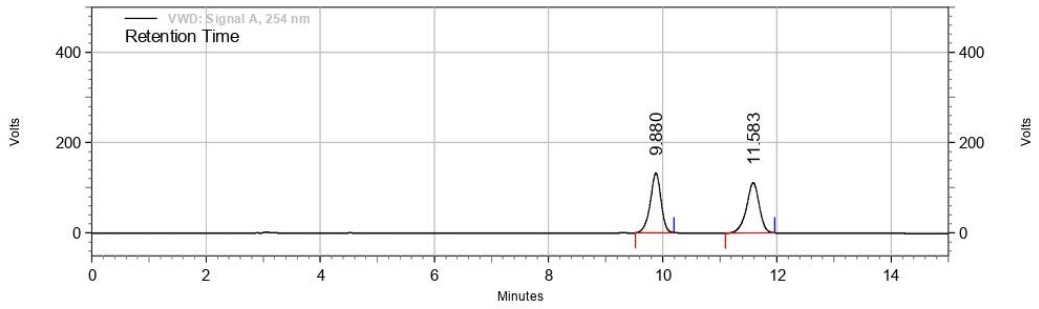
VWD: Signal A, 254 nm Results

Retention Time	Area	Area %
11.420	2199979	19.24
13.933	9232032	80.76

Totals	11432011	100.00

Column : CHIRALPAK IE
Eluent System : 80 : 20 (HEXANE:IPA)
Flow rate: 1 ml/min
Injection vol..: 10ul
Wavelength: 254 nm
Sample Conc.: 0.5 mg/ ml

HPLC Traces for compound **6t**

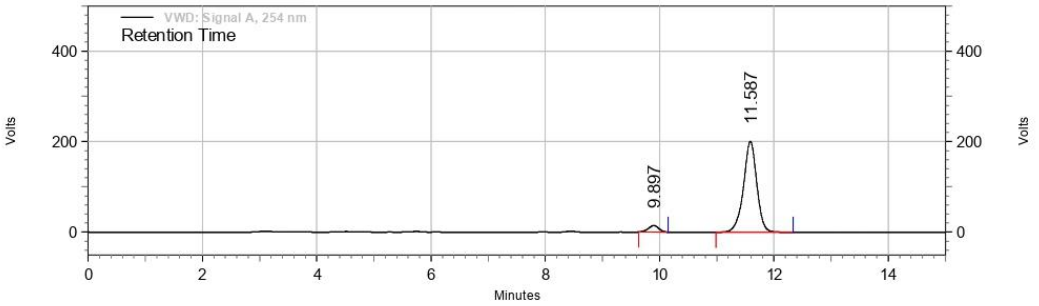


VWD: Signal A, 254 nm Results

Retention Time	Area	Area %
9.880	29059585	49.75
11.583	29354314	50.25

Totals		
	58413899	100.00

Column: CHIRALPAK OD-H
Eluent System: 94 : 6 (HEXANE:IPA)
Flow rate: 0.5 ml/min
Injection vol: 10ul
Wavelength: 254 nm
Sampl Conc: 1 mg/ml



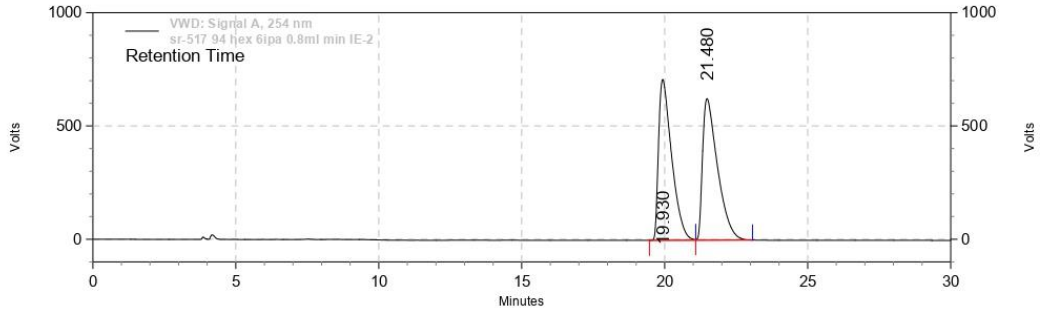
VWD: Signal A, 254 nm Results

Retention Time	Area	Area %
9.897	3158252	5.46
11.587	54671470	94.54

Totals		
	57829722	100.00

Column: CHIRALPAK OD-H
Eluent System: 94 : 6 (HEXANE:IPA)
Flow rate: 0.5 ml/min
Injection vol: 10ul
Wavelength: 254 nm
Sampl Conc: 1 mg/ml

HPLC traces for compound **6u**

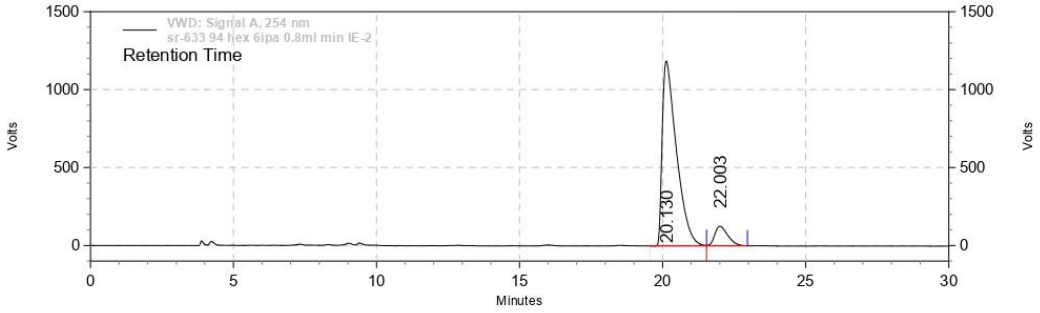


VWD: Signal A, 254 nm Results

Retention Time	Area	Area %
19.930	379611844	49.84
21.480	382030989	50.16

Totals	761642833	100.00

Column : CHIRALPAK IE
Eluent System : 94 : 6 (HEXANE:IPA)
Flow rate: 0.8 ml/min
Injection vol..: 10ul
Wavelength: 254 nm
Sample Conc.: 1 mg/ ml



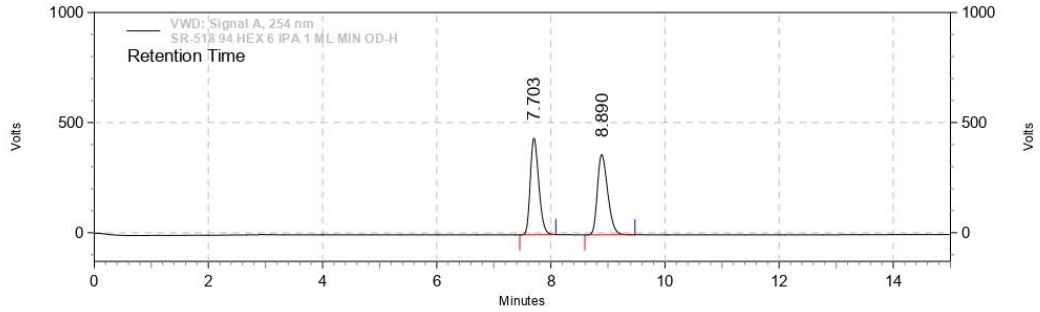
VWD: Signal A, 254 nm Results

Retention Time	Area	Area %
20.130	688033057	91.07
22.003	67482398	8.93

Totals	755515455	100.00

Column : CHIRALPAK IE
Eluent System : 94 : 6 (HEXANE:IPA)
Flow rate: 0.8ml/min
Injection vol..: 10ul
Wavelength: 254 nm
Sample Conc.: 1 mg/ ml

HPLC Traces for compound **6x**

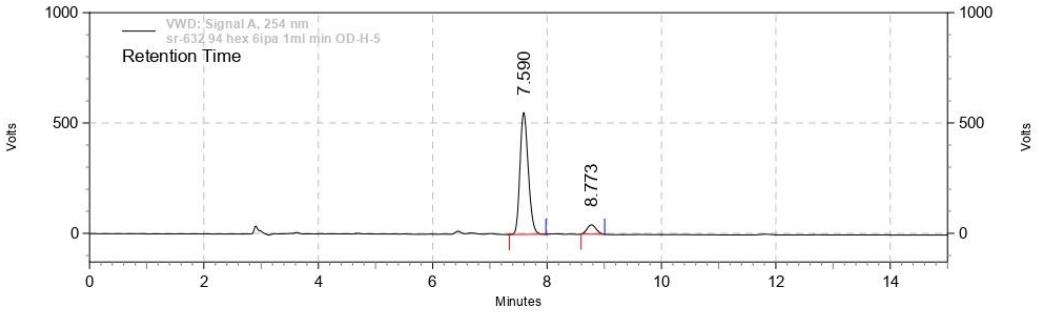


VWD: Signal A, 254 nm Results

Retention Time	Area	Area %
7.703	75936899	49.85
8.890	76399814	50.15

Totals		
	152336713	100.00

Column : CHIRALPAK OD-H
Eluent System : 94 : 6 (HEXANE:IPA)
Flow rate: 1 ml/min
Injection vol..: 10ul
Wavelength: 254 nm
Sample Conc.: 1 mg/ ml



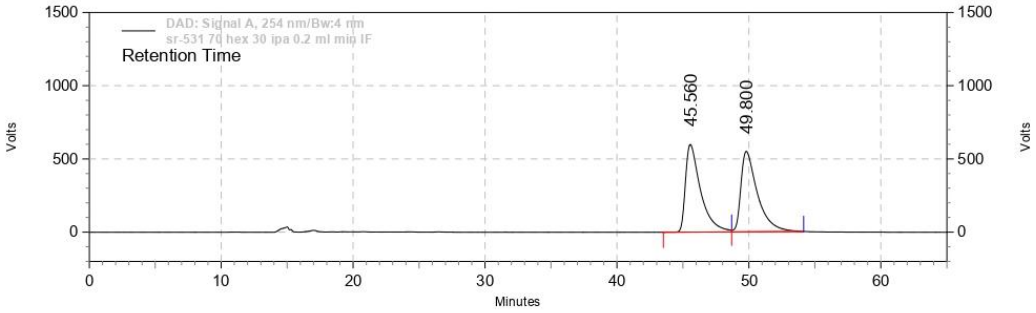
VWD: Signal A, 254 nm Results

Retention Time	Area	Area %
7.590	93013679	92.22
8.773	7847284	7.78

Totals		
	100860963	100.00

Column : CHIRALPAK OD-H
Eluent System : 94 : 6 (HEXANE:IPA)
Flow rate: 1 ml/min
Injection vol..: 10ul
Wavelength: 254 nm
Sample Conc.: 1 mg/ ml

HPLC Traces for compound **6y**

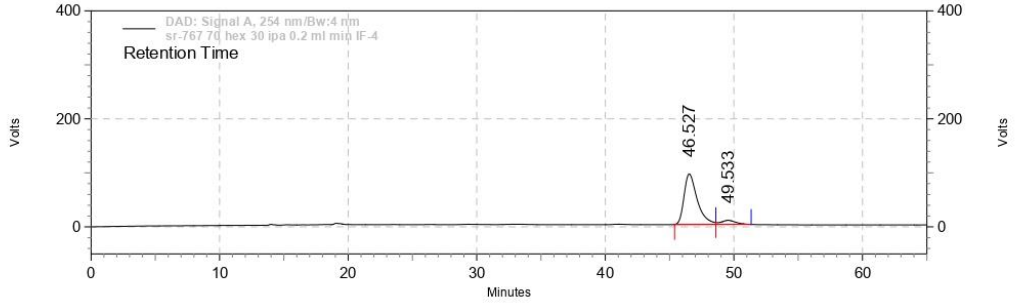


DAD: Signal A, 254 nm/Bw:4 nm
Results

Retention Time	Area	Area %
45.560	99903696	49.82
49.800	100637638	50.18

Totals	200541334	100.00

Column : CHIRALPAK IF
Eluent System : 70 : 30 (HEXANE:IPA)
Flow rate: 0.2 ml/min
Injection vol..: 10ul
Wavelength: 254 nm
Sample Conc.: 1 mg/ ml



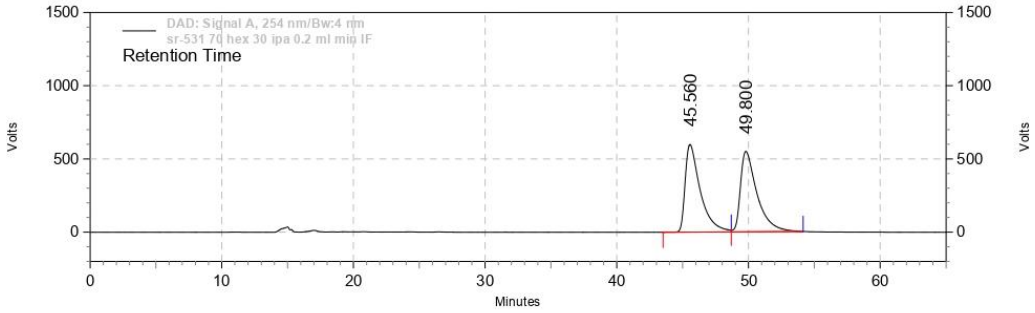
DAD: Signal A, 254 nm/Bw:4 nm
Results

Retention Time	Area	Area %
46.527	13985194	91.53
49.533	1293467	8.47

Totals	15278661	100.00

Column : CHIRALPAK IF
Eluent System : 70 : 30 (HEXANE:IPA)
Flow rate: 0.2 ml/min
Injection vol..: 10ul
Wavelength: 254 nm
Sample Conc.: 1 mg/ ml

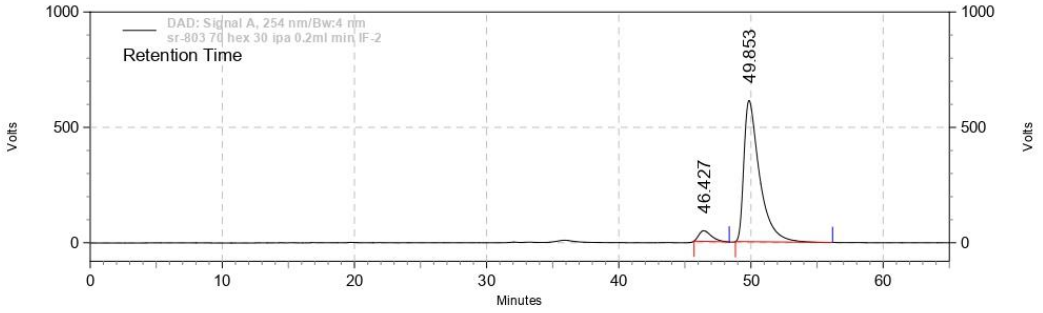
HPLC Traces for compound **6z**



DAD: Signal A, 254 nm/Bw:4 nm
Results

Retention Time	Area	Area %
45.560	99903696	49.82
49.800	100637638	50.18
Totals	200541334	100.00

Column : CHIRALPAK IF
Eluent System : 70 : 30 (HEXANE:IPA)
Flow rate: 0.2 ml/min
Injection vol..: 10ul
Wavelength: 254 nm
Sample Conc.: 1 mg/ ml

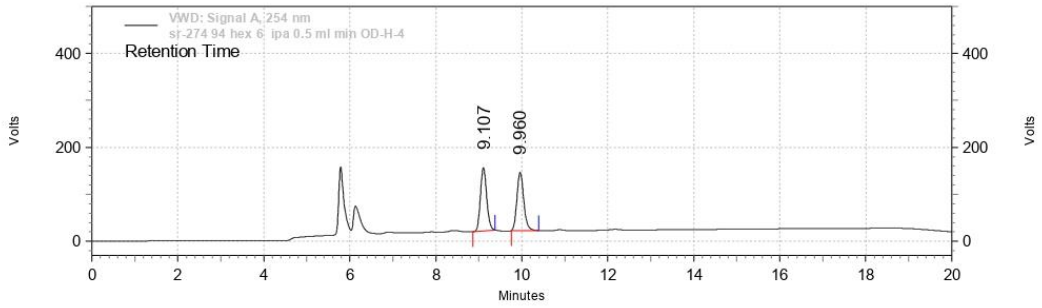


DAD: Signal A, 254 nm/Bw:4 nm
Results

Retention Time	Area	Area %
46.427	6336491	5.66
49.853	105707608	94.34
Totals	112044099	100.00

Column : CHIRALPAK IF
Eluent System : 70 : 30 (HEXANE:IPA)
Flow rate: 0.2 ml/min
Injection vol..: 10ul
Wavelength: 254 nm
Sample Conc.: 1 mg/ ml

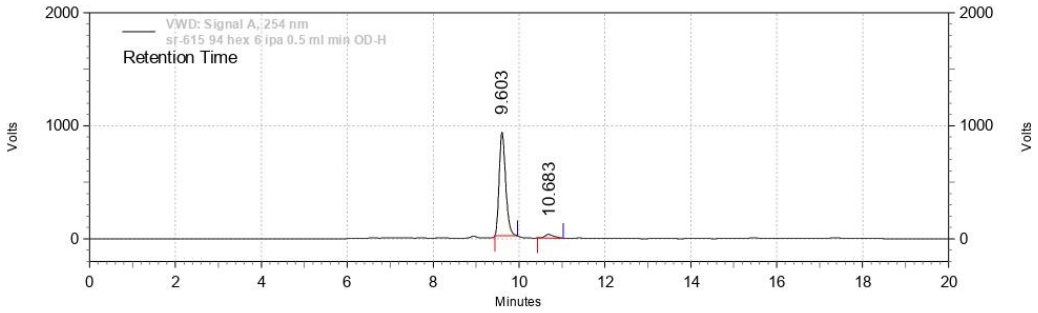
HPLC Traces for compound *ent*-**6z**



VWD: Signal A, 254 nm Results

Retention Time	Area	Area %
9.107	22928576	50.20
9.960	22745714	49.80
Totals	45674290	100.00

Column : CHIRALPAK OD-H
Eluent System: 97:3(HEXANE:IPA)
Flow Rate: 0.5ml/min
Injection Vol.: 10ul
Wavelength: 254 nm
Sample Conc.: 1 mg/ml

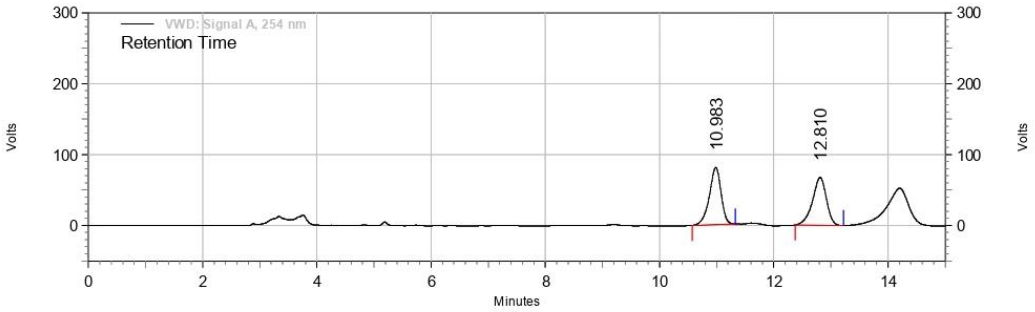


VWD: Signal A, 254 nm Results

Retention Time	Area	Area %
9.603	161676849	95.31
10.683	7947865	4.69
Totals	169624714	100.00

Column : CHIRALPAK OD-H
Eluent System: 97:3(HEXANE:IPA)
Flow Rate: 0.5ml/min
Injection Vol.: 10ul
Wavelength: 254 nm
Sample Conc.: 1 mg/ml

HPLC traces for compound **6aa**

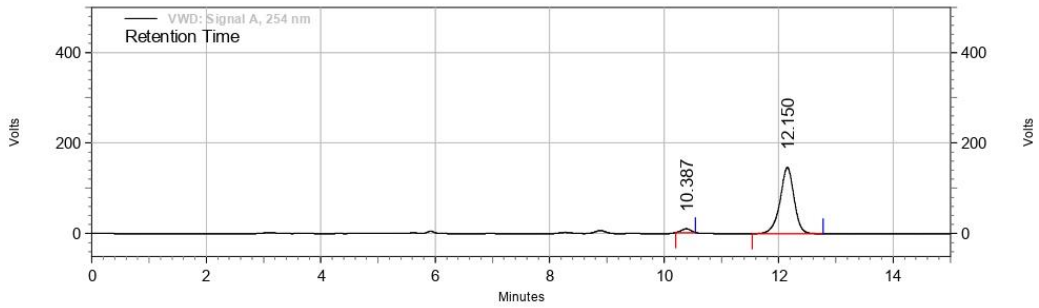


VWD: Signal A, 254 nm Results

Retention Time	Area	Area %
10.983	19202024	50.06
12.810	19159231	49.94

Totals	38361255	100.00

Column: CHIRALPAK OD-H
Eluent System: 94 : 6 (HEXANE:IPA)
Flow rate: 0.5 ml/min
Injection vol: 10ul
Wavelength: 254 nm
Sampl Conc: 1 mg/ml



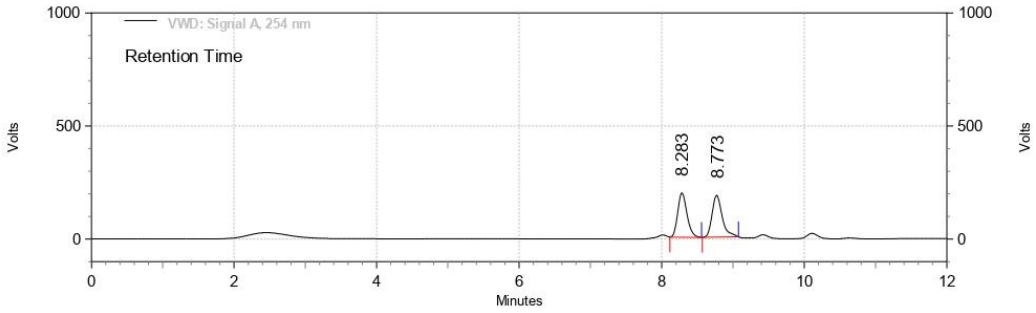
VWD: Signal A, 254 nm Results

Retention Time	Area	Area %
10.387	1542518	3.55
12.150	41870562	96.45

Totals	43413080	100.00

Column: CHIRALPAK OD-H
Eluent System: 94 : 6 (HEXANE:IPA)
Flow rate: 0.5 ml/min
Injection vol: 10ul
Wavelength: 254 nm
Sampl Conc: 1 mg/ml

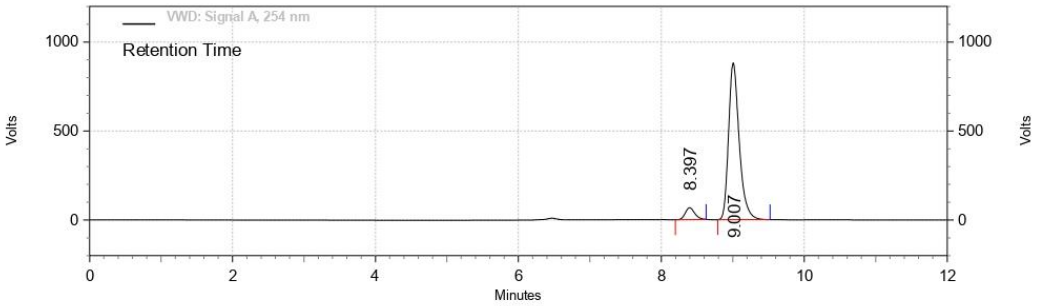
HPLC traces for compound **6ab**



VWD: Signal A, 254 nm Results

Retention Time	Area	Area %
8.283	29511386	49.00
8.773	30716120	51.00
Totals	60227506	100.00

Column : CHIRALCEL OD-H
Eluent System : 90 : 10(HEXANE:IPA)
Flow rate: 0.5 ml/min
Injection vol..: 10ul
Wavelength: 254 nm
Sample Conc.: 1 mg/ ml

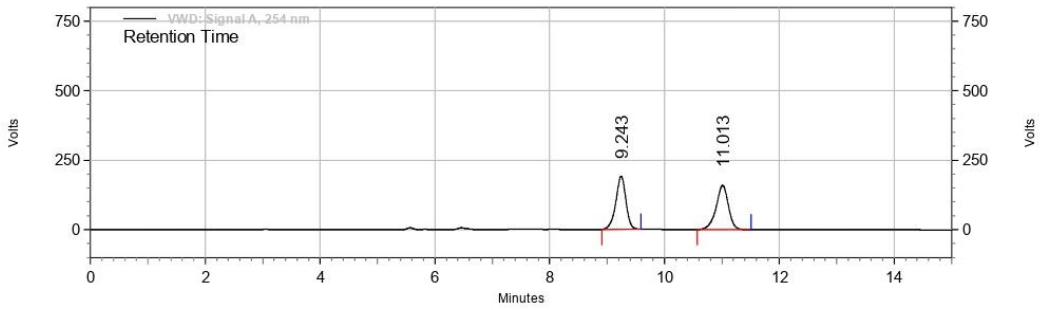


VWD: Signal A, 254 nm Results

Retention Time	Area	Area %
8.397	10224271	6.27
9.007	152843374	93.73
Totals	163067645	100.00

Column : CHIRALCEL OD-H
Eluent System : 90 : 10 (HEXANE:IPA)
Flow rate: 0.5 ml/min
Injection vol..: 10ul
Wavelength: 254 nm
Sample Conc.: 1 mg/ ml

HPLC traces of compound **6ac**

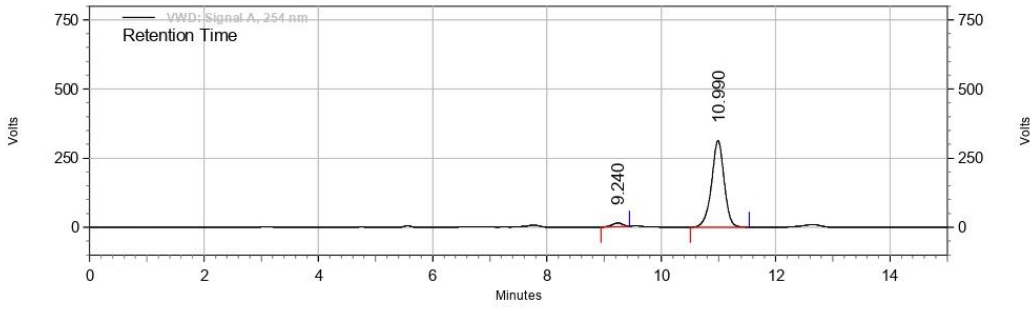


VWD: Signal A, 254 nm Results

Retention Time	Area	Area %
9.243	39231548	49.67
11.013	39754617	50.33

Totals	78986165	100.00

Column: CHIRALPAK OD-H
Eluent System: 94 : 6 (HEXANE:IPA)
Flow rate: 0.5 ml/min
Injection vol: 10ul
Wavelength: 254 nm
Sampl Conc: 1 mg/ml



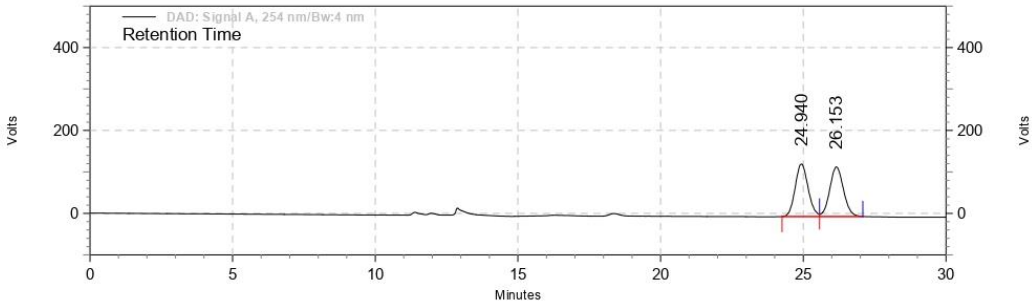
VWD: Signal A, 254 nm Results

Retention Time	Area	Area %
9.240	2710468	3.27
10.990	80217437	96.73

Totals	82927905	100.00

Column: CHIRALPAK OD-H
Eluent System: 94 : 6 (HEXANE:IPA)
Flow rate: 0.5 ml/min
Injection vol: 10ul
Wavelength: 254 nm
Sampl Conc: 1 mg/ml

HPLC traces for compound **6ad**

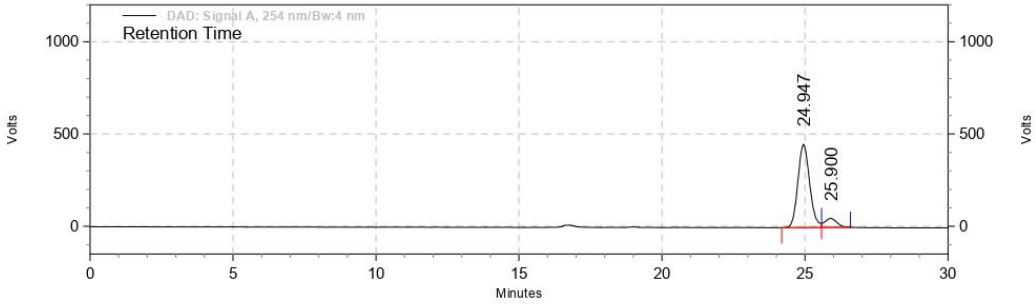


DAD: Signal A, 254 nm/Bw:4 nm
Results

Retention Time	Area	Area %
24.940	8389235	49.98
26.153	8396769	50.02

Totals		
	16786004	100.00

Column: CHIRALCEL OD-H
Eluent System: 98 : 2 (HEXANE:IPA)
Flow rate: 0.3 ml/min
Injection vol.: 10ul
Wavelength: 254 nm
Sample Conc.: 0.5mg/ml



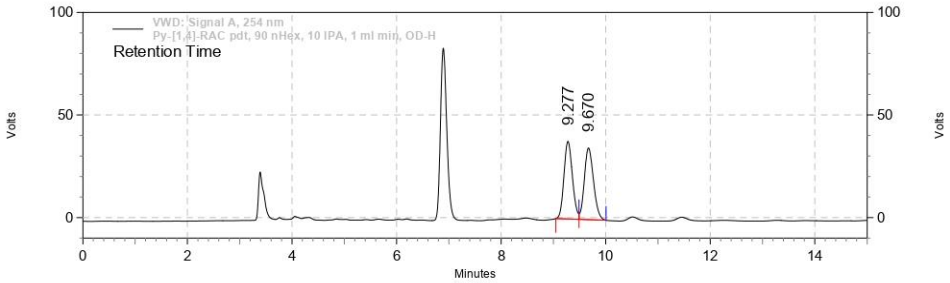
DAD: Signal A, 254 nm/Bw:4 nm
Results

Retention Time	Area	Area %
24.947	27013608	89.94
25.900	3022930	10.06

Totals		
	30036538	100.00

Column: CHIRALCEL OD-H
Eluent System: 98 : 2 (HEXANE:IPA)
Flow rate: 0.3 ml/min
Injection vol.: 10ul
Wavelength: 254 nm
Sample Conc.: 1mg/ml

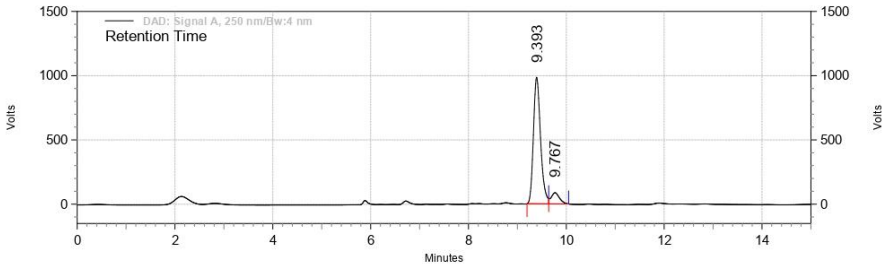
HPLC traces for compound 6**ae**



VWD: Signal A, 254 nm Results

Retention Time	Area	Area %
9.277	7133444	49.90
9.670	7163157	50.10
Totals	14296601	100.00

Column : CHIRALPAK OD-H
Eluent System : 90 : 10 (HEXANE:IPA)
Flow rate: 1.0 ml/min
Injection vol..: 10ul
Wavelength: 254 nm
Sample Conc.: 1 mg/ ml

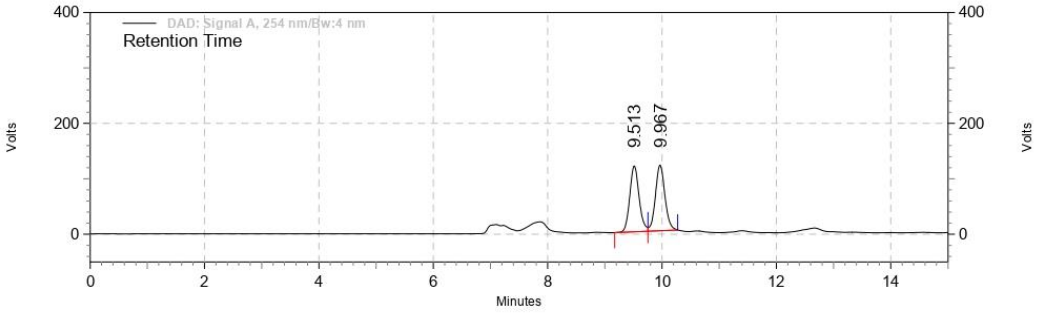


DAD: Signal A, 250 nm/Bw:4 nm Results

Retention Time	Area	Area %
9.393	20921127	90.67
9.767	2152922	9.33
Totals	23074049	100.00

Column: CHIRALPAK OD-H
Eluent System: 90 : 10 (HEXANE:IPA)
Flow rate: 1 ml/min
Injection vol.: 10ul
Wavelength: 254 nm
Sample Conc.: 1mg/ml

HPLC Traces for compound **7aa**

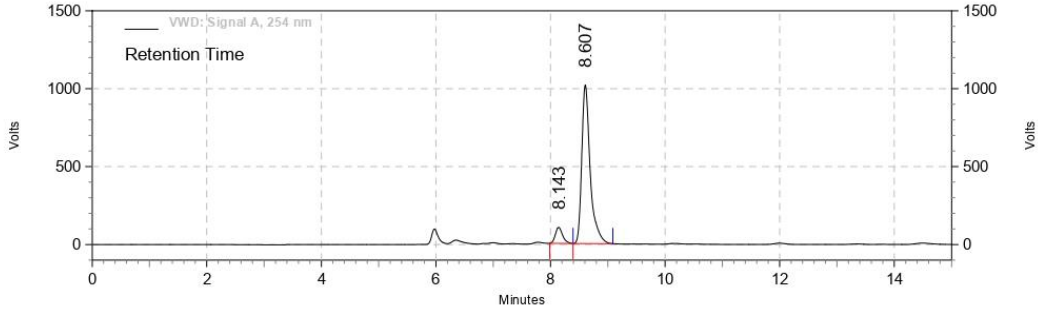


DAD: Signal A, 254 nm/Bw:4 nm
Results

Retention Time	Area	Area %
9.513	2825326	49.57
9.967	2874117	50.43

Totals		
	5699443	100.00

Column: CHIRALCEL OD-H
Eluent System: 90 : 10 (HEXANE:IPA)
Flow rate: 1 ml/min
Injection vol.: 10ul
Wavelength: 254 nm
Sample Conc.: 0.5mg/ml



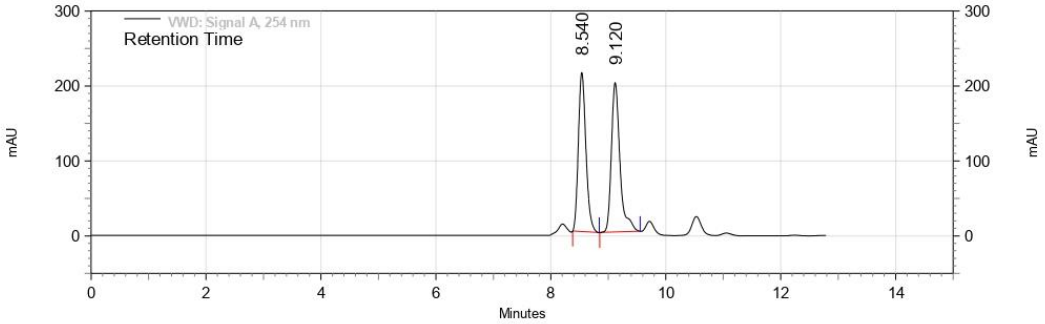
VWD: Signal A, 254 nm Results

Retention Time	Area	Area %
8.143	15072669	7.95
8.607	174539964	92.05

Totals		
	189612633	100.00

Column: CHIRALCEL OD-H
Eluent System: 90 : 10 (HEXANE:IPA)
Flow rate: 1 mL/min
Injection vol.: 10 uL
Wavelength: 254 nm
Sample Conc.: 1 mg/ mL

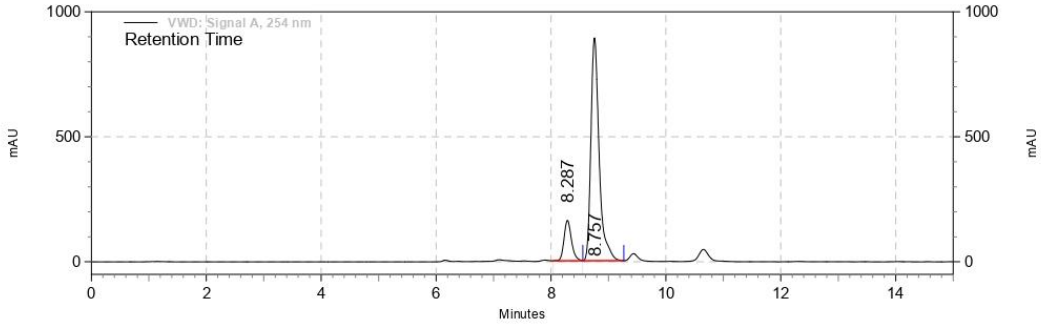
HPLC traces of compound 7**ab**



VWD: Signal A, 254 nm Results

Retention Time	Area	Area Percent
8.540	32668500	48.358
9.120	34886461	51.642
Totals	67554961	100.000

Column : CHIRALCEL OD-H
Eluent System : 90 : 10 (HEXANE:IPA)
Flow rate: 1 ml/min
Injection vol..: 10ul
Wavelength: 254 nm
Sample Conc.: 1 mg/ ml

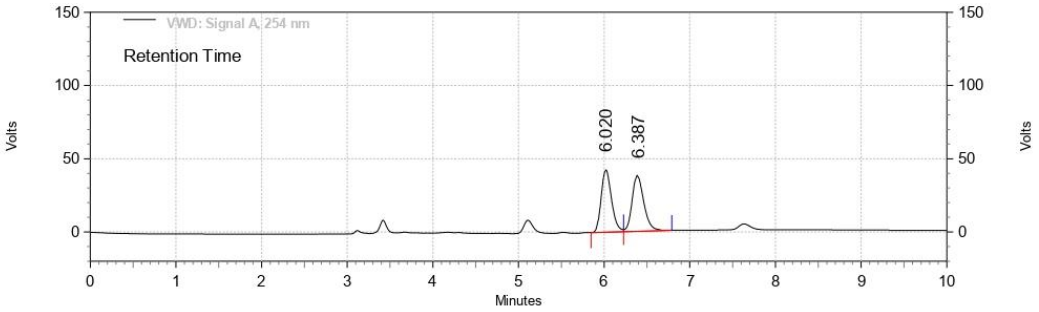


VWD: Signal A, 254 nm Results

Retention Time	Area	Area Percent
8.287	24388776	13.99
8.757	149870810	86.01
Totals	174259586	100.000

Coloumn : CHIRALCEL OD-H
Eluent : 90:10 (Hexane:IPA)
Wavelength : 254nm
Flow rate : 1 ml/min
Conc. : 1 mg/1ml
Injection Vol. : 10 ul

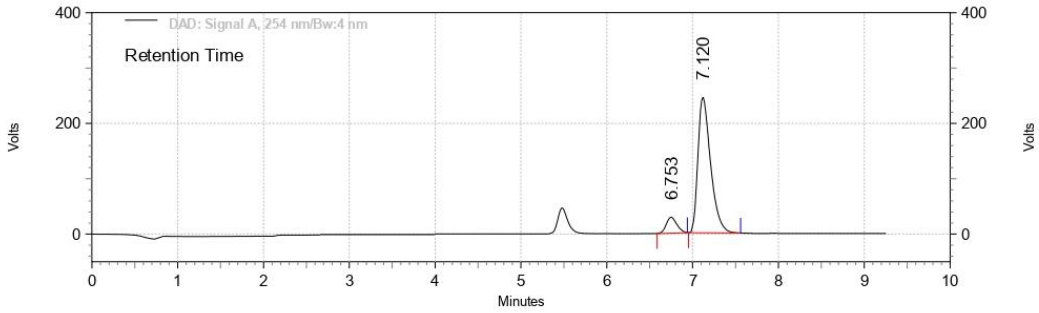
HPLC traces of compound **7ac**



VWD: Signal A, 254 nm Results

Retention Time	Area	Area %
6.020	5960212	49.38
6.387	6109879	50.62
Totals		
	12070091	100.00

Column : CHIRALCEL OD-H
Eluent System : 90 : 10 (HEXANE:IPA)
Flow rate: 1 ml/min
Injection vol..: 10ul
Wavelength: 254 nm
Sample Conc.: 1 mg/ ml



DAD: Signal A, 254 nm/Bw:4 nm Results

Retention Time	Area	Area %
6.753	508129	8.84
7.120	5240500	91.16
Totals		
	5748629	100.00

Column : CHIRALCEL OD-H
Eluent System : 90 : 10 (HEXANE:IPA)
Flow rate: 1 ml/min
Injection vol..: 10ul
Wavelength: 254 nm
Sample Conc.: 1 mg/ ml

HPLC traces of compound **7ad**