Catalytic Asymmetric Sulfenylation of Unprotected 3-Substituted Oxindoles

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Supporting information

Contents:

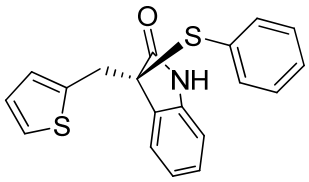
1. General remarks

Reactions were carried out using commercial available reagents in over-dried apparatus. CH_2Cl_2 was dried over powdered CaH_2 and distilled under nitrogen just before use. CH_3CCl_3, CH_2ClCH_2Cl, $CHCl_3$, $CHCl_2CHCl_2$ and PhCl were directly distilled before use. Enantiomeric excesses (*ee*) were determined by HPLC analysis using the corresponding commercial chiral column as stated in the experimental procedures at 23 ºC with UV detector at 254 nm. Optical rotations were reported as follows: $[\alpha]^{25}_{D}$ (c g/100 mL, in solvent). ^{1}H NMR spectra were recorded on commercial instruments (400 MHz). Chemical shifts were reported in ppm from tetramethylsilane with the solvent resonance as the internal standard ($CDCl_3$, δ = 7.26; DMSO, δ = 2.50). Spectra were reported as follows: chemical shift (δ ppm), multiplicity (s = singlet, d = doublet, t = triplet, q = quartet, m = multiplet), coupling constants (Hz), integration and assignment. ^{13}C NMR spectra were collected on commercial instruments (100 MHz) with complete proton decoupling. Chemical shifts are reported in ppm from the tetramethylsilane with

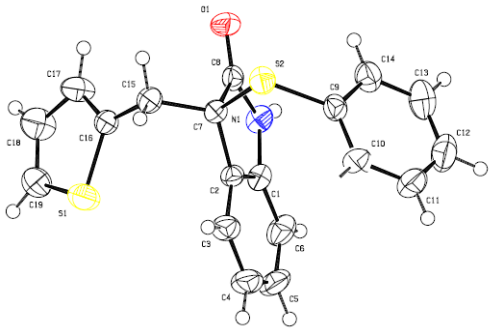
the solvent resonance as internal standard ($CDCl_3$, δ = 77.0; DMSO, δ = 39.5). HRMS was recorded on a commercial apparatus (ESI Source).

2. Determination of the absolute configuration and X-ray structure of 3p

The absolute configuration of the optically active sulfenylated product **3p** was determined by X-ray chromatography analysis. All other absolute configurations were assigned by comparison with the Cotton effect in the CD spectra of **3p**.



R-**3p**



Single crystal of $C_{19}H_{15}NOS_2$ **3p** was obtained by recrystallization in ethyl acetate. The absolute configuration of oxindole **3p** is *R*.

Crystal data. $C_{19}H_{15}NOS_2$, M = 337.44, monoclinic, a = 8.5240(3, b = 8.2187(2), c = 12.2542(4), U = 815.60(5) Å^3, T = 293(2) K, space group *P*1211, Z = 2.

3. General procedure for chiral *N,N'*-dioxide preparation

The *N,N'*-dioxide ligands **L1-L4** were synthesized by the same procedure in the literature[1].

4. Preparation of racemic 3a-3z and 6a-6o

A reaction tube was charged with oxindole **1** or **5** (0.1 mmol), sulfenylating agent **2** (0.105 mmol, 26.8 mg, 1.05 equiv) and NaOH (0.2 mmol, 8.0 mg). Then, CH_2Cl_2 (0.5 mL) were added. After stirring at 35 ºC for 0.5 h, the crude racemic products **3** or **6** were obtained directly by silica gel chromatography (eluent: petroleum ether/AcOEt 3:1 to 4:1). Removal of phthalimide in the crude product with 1 N NaOH aquous solution, following by extraction with CH_2Cl_2 and flash chromatography (petroleum ether/EtOAc 2:1) afforded the pure race products.

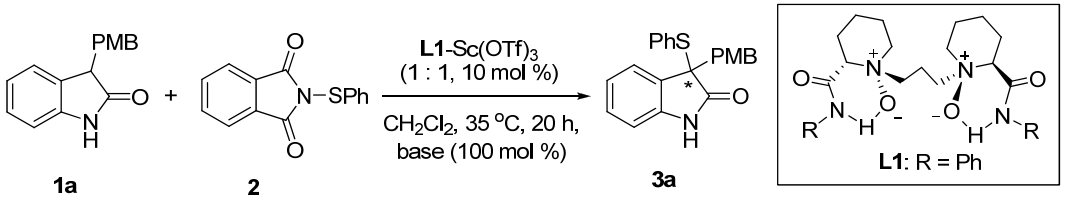
5. Procedures for catalytic asymmetric sulfenylation reaction

General procedure for catalytic asymmetric reaction: A dry reaction tube was charged with **L4**-Sc(OTf)$_3$ (1:1, 3–5 mol % catalyst loading), 4 Å MS (25.0 mg, activated at 500 ºC for 5 h before use), and **1** or **5** (0.1 mmol) under N_2 atmosphere. Then, CH_2Cl_2 (2.0 mL) were added and the mixture was stirred at 35 ºC for 0.5 h. Finally, N-(phenylthio)phthalimide **2** (0.105 mmol, 26.8 mg), and K_2CO_3 or Na_2CO_3 (10–200 mol %) were added under stirring. The reaction mixture was stirred at 35 ºC for 12–72 h. The residue was purified by flash chromatography (petroleum ether/AcOEt 3:1 to 4:1) on silica gel to afford the crude product. Removal of phthalimide in the crude product with 1 *N* NaOH aquous solution (5 mL), following by extraction with CH_2Cl_2 and flash chromatography (petroleum ether/AcOEt 2:1) afforded the products **3** or **6**. The enantiomeric excess (*ee*) was determined by high-performance liquid chromatography (HPLC) with Chiralcel OD-H, Chiralcel AD-H, Chiralcel IA, Chiralcel IB or Chiralcel IC.

Typical procedure for the scale-up reaction: A flask (150 mL) was charged with **L4** (0.15 mmol, 97.0 mg), $Sc(OTf)_3$ (0.15 mmol, 74.0 mg), 4 Å MS (1.25 g, activated at 500 ºC for 5 h before use), and **1a** (5.0 mmol, 1.267 g) under N_2 atmosphere. Then, CH_2Cl_2 (100 mL) were added and the mixture was stirred at 35 ºC for 0.5 h. Finally, N-(phenylthio)-phthalimide **2** (5.1 mmol, 1.34 g) and K_2CO_3 (10.0 mmol, 1.38 g) was added under stirring. The reaction mixture was stirred at 35 ºC for 20 h. The residue was purified by flash chromatography (petroleum ether/AcOEt = 3/1) on silica gel to afford the crude product. Removal of phthalimide in the crude product with 1 N NaOH aqous solution, following by extraction with CH_2Cl_2 and flash chromatography (petroleum ether/AcOEt = 2/1) afforded the product **3a** as a white solid (1.70 g, 94% yield, 97% *ee*). After a single recrystalization (petroleum ether/CH_2Cl_2) of the product, 82% yield with 99% *ee* was obtained.

6. Extra Optimization of reaction conditions

A) preliminary survey of base

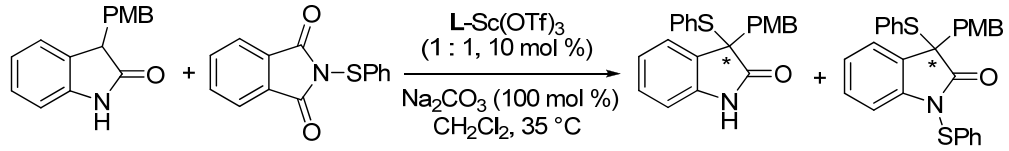


1a **2** **3a**

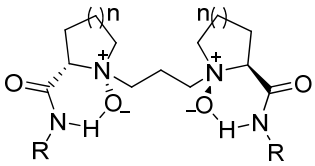
Entry[a]	Base	Time (h)	Yield[b] (%)	Ee[c] (%)
1	No	20	0	-
2	$NaHCO_3$	20	0	-
3	Li_2CO_3	20	0	-
4	Na_2CO_3	20	45	< 5
5	K_2CO_3	22	75	< 5
6	Cs_2CO_3	6	88[d]	< 5
7	NaOH	0.1	90[d]	< 5
8	DMAP	20	90[d]	< 5
9	$EtN(^iPr)_2$	20	85[d]	< 5

[a] Unless otherwise noted, all reactions were performed with **L1**-$Sc(OTf)_3$ (1:1, 10 mol %), base (0.1 mmol), **1a** (0.1 mmol, PMB = *p*-methoxybenzyl), N-(phenylthio)phthalimide **2** (0.12 mmol) in CH_2Cl_2 (0.5 mL) under N_2 at 35 ºC for the indicated time. [b] Isolated yield. [c] Determined by HPLC analysis (Chiralcel OD-H). [d] **1a** was completely consumed.

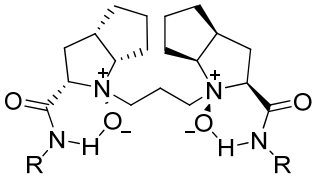
B) survey of chiral ligand



1a **2** **3a** **4a**



L1: R = Ph, n = 2
L2: R = 2,6-$Me_2C_6H_3$, n = 2
L3: R = 2,6-$Et_2C_6H_3$, n = 2
L4: R = 2,6-$^i Pr_2C_6H_3$, n = 2
L5: R = 2,4,6-$^i Pr_3C_6H_2$, n = 2
L6: R = 2,6-$^i Pr_2C_6H_3$, n = 1
L8: R = Bn, n = 2
L9: R = 1-admantyl, n = 2
L10: R = 3,5-$Me_2C_6H_3$, n = 2

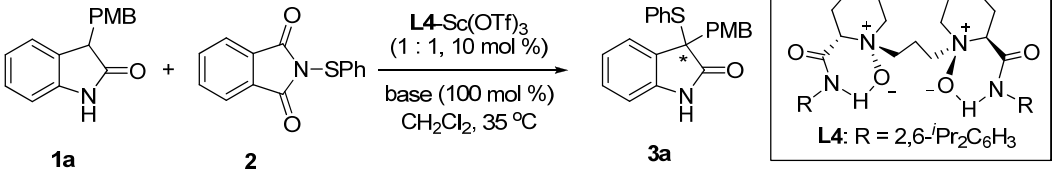


L7: R = 2,6-$^i Pr_2C_6H_3$
L11: R = 2,4,6-$^i Pr_3C_6H_2$

Entry[a]	Ligand (mol %)	Yield[b] (%)	Ee[c] (%)
1	**L1**	45	0
2	**L2**	71	46
3	**L3**	86[d]	76
4	**L4**	87[d]	94
5	**L5**	86[d]	93
6	**L6**	58	91
7	**L7**	76	94
8	**L8**	25	9
9	**L9**	21	0
10	**L10**	35	24
11	**L11**	30	70

[a] Unless otherwise noted, all reactions were performed with **L** (10 mol %), $Sc(OTf)_3$ (10 mol %, 4.9 mg), Na_2CO_3 (0.1 mmol), **1a** (0.1 mmol, PMB = *p*-methoxybenzyl), N-(phenylthio)phthalimide **2** (0.12 mmol) in CH_2Cl_2 (0.5 mL) under N_2 at 35 ºC for 20 h. [b] Isolated yield. [c] Determined by HPLC analysis (Chiralcel OD-H). [d] **1a** was completely consumed and about 10–15% yield of **4a** was observed.

C) the effect of base in the presence of chiral Lewis acid catalyst

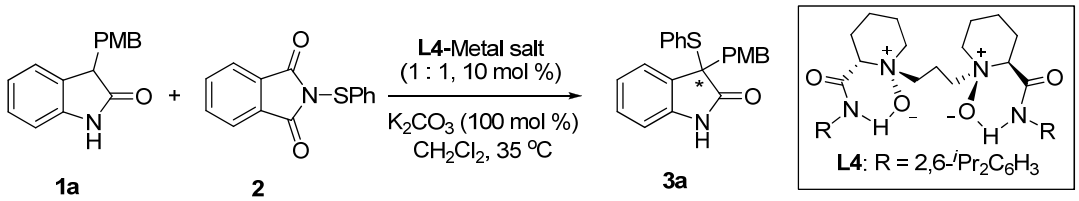


1a **2** **3a**

Entry[a]	Base	Time (h)	Yield[b] (%)	Ee[c] (%)
1	No	48	0	-
2	$NaHCO_3$	20	75	94
3	Li_2CO_3	20	65	94
4	Na_2CO_3	20	87[d]	94
5	K_2CO_3	2	88[d]	94
6	Cs_2CO_3	1	89[d]	90
7	NaOH	0.1	85[d]	71
8	DABCO	1	89[d]	68
9	DMAP	20	85[d]	–16
10	DBU	3	92[d]	19
11	TMG	3	90[d]	2
12	Pyridine	20	50	76
13	Lutidine	20	85[d]	94
14	$EtN(^iPr)_2$	20	86[d]	89

[a] Unless otherwise noted, all reactions were performed with **L4**-$Sc(OTf)_3$ (1:1, 10 mol %), base (0.1 mmol), **1a** (0.1 mmol, PMB = *p*-methoxybenzyl), N-(phenylthio)phthalimide **2** (0.12 mmol) in CH_2Cl_2 (0.5 mL) under N_2 at 35 ºC for the indicated time. [b] Isolated yield. [c] Determined by HPLC analysis (Chiralcel OD-H). [d] **1a** was completely consumed.

D) survey of other Lewis acid



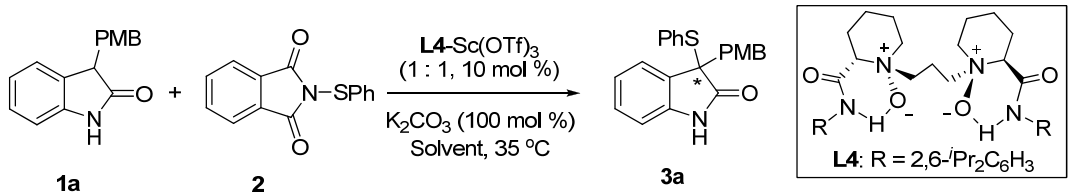
1a **2** **3a**

Entry[a]	Metal salt	Time (h)	Yield[b] (%)	Ee[c] (%)
1	$Sc(OTf)_3$	2	88[d]	94
2	$Y(OTf)_3$	20	52	27
3	$La(OTf)_3$	20	63	–16
4	$Yb(OTf)_3$	20	64	41
5	$Gd(OTf)_3$	20	54	7

[a] Unless otherwise noted, all reactions were performed with **L4**–Metal salt (1:1, 10 mol %), K_2CO_3 (0.1 mmol), **1a** (0.1 mmol, PMB = *p*-methoxybenzyl), N-(phenylthio)phthalimide **2** (0.12 mmol) in CH_2Cl_2 (0.5 mL) under N_2 at 35 ºC for the indicated time. [b] Isolated yield. [c] Determined by HPLC analysis (Chiralcel OD-H). [d] **1a** was

completely consumed.

E) survey of solvent effects

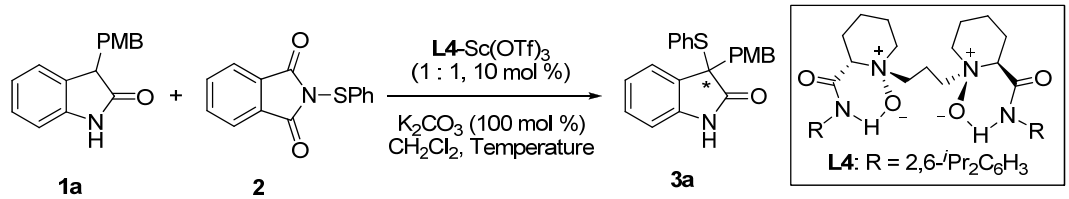


1a **2** **3a**

Entry[a]	Solvent	Time (h)	Yield[b] (%)	Ee[c] (%)
1	Cl_3CCH_3	12	87	73
2	CH_2Cl_2	2	88	94
3	CH_2ClCH_2Cl	12	86	90
4	$CHCl_3$	12	69	52
5	PhCl	12	87	74
6	$CHCl_2CHCl_2$	12	39	56
7	Cl_3CCH_3	12	87	73

[a] Unless otherwise noted, all reactions were performed with **L4**–Sc(OTf)$_3$ (1:1, 10 mol %), K_2CO_3 (0.1 mmol), **1a** (0.1 mmol, PMB = *p*-methoxybenzyl), N-(phenylthio)phthalimide **2** (0.12 mmol) in the corresponding solvent (0.5 mL) under N_2 at 35 ºC for the indicated time. [b] Isolated yield. [c] Determined by HPLC analysis (Chiralcel OD-H). [d] **1a** was completely consumed.

F) survey of temperature effects

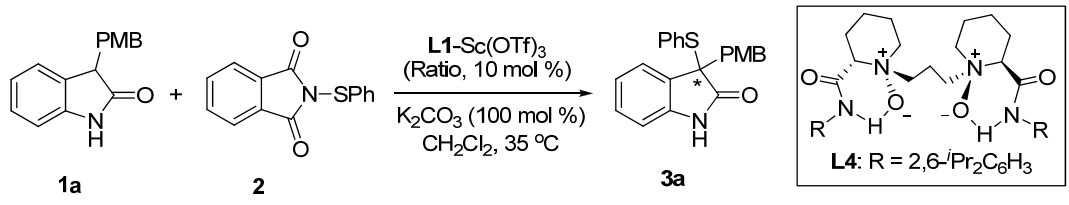


1a **2** **3a**

Entry[a]	Temperature (ºC)	Time (h)	Yield[b] (%)	Ee[c] (%)
1	35	2	88[d]	94
2	25	12	85[d]	89
3	0	24	86[d]	81

[a] Unless otherwise noted, all reactions were performed with **L4**–Sc(OTf)$_3$ (1:1, 10 mol %), K_2CO_3 (0.1 mmol), **1a** (0.1 mmol, PMB = *p*-methoxybenzyl), N-(phenylthio)phthalimide **2** (0.12 mmol) in CH_2Cl_2 (0.5 mL) under N_2 at the corresponding temperature for the indicated time. [b] Isolated yield. [c] Determined by HPLC analysis (Chiralcel OD-H). [d] **1a** was completely consumed.

G) optimization of the ratio between ligand and metal

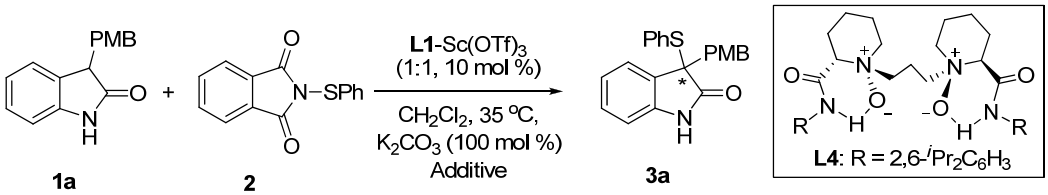


1a 2 3a

Entry[a]	Ratio (ligand : metal)	Time	Yield[b] (%)	Ee[c] (%)
1	1.5 : 1	2	86[d]	94
2	1.2 : 1	2	85[d]	94
3	1 : 1	2	88[d]	94
4	0.8 : 1	2	84[d]	94

[a] Unless otherwise noted, all reactions were performed with **L4**–Sc(OTf)$_3$ (corresponding ratio, 10 mol %), K_2CO_3 (0.1 mmol), **1a** (0.1 mmol, PMB = *p*-methoxybenzyl), N-(phenylthio)phthalimide **2** (0.12 mmol) in CH_2Cl_2 (0.5 mL) under N_2 at the 35 ºC for the indicated time. [b] Isolated yield. [c] Determined by HPLC analysis (Chiralcel OD-H). [d] **1a** was completely consumed.

H) screening of additive

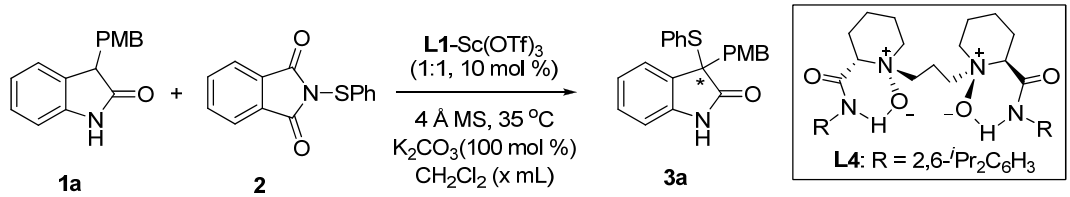


1a 2 3a

Entry[a]	Additive	Time	Yield[b] (%)	Ee[c] (%)
1	-	2	88[d]	94
2	3 Å MS	2	88[d]	95
3	4 Å MS	2	89[d]	96
4	5 Å MS	4	88[d]	95

[a] Unless otherwise noted, all reactions were performed with **L4**–Sc(OTf)$_3$ (1:1, 10 mol %), additive (25.0 mg), K_2CO_3 (0.1 mmol), **1a** (0.1 mmol, PMB = *p*-methoxybenzyl), N-(phenylthio)phthalimide **2** (0.12 mmol) in CH_2Cl_2 (0.5 mL) under N_2 at the 35 ºC for the indicated time. [b] Isolated yield. [c] Determined by HPLC analysis (Chiralcel OD-H). [d] **1a** was completely consumed.

I) survey of concentration effects



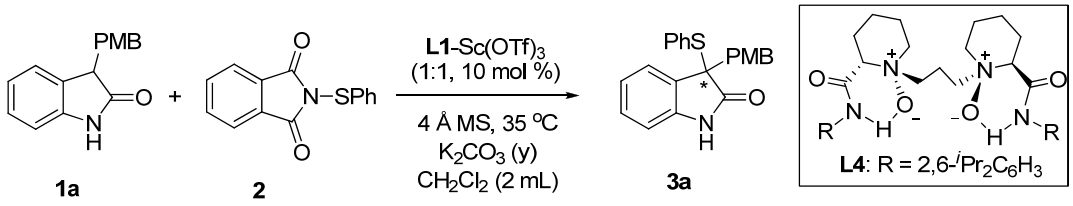
1a 2 3a

Entry[a]	x (mL)	Time	Yield[b] (%)	Ee[c] (%)
1	0.25	1.5	88[d]	95
2	0.5	3	89[d]	96
3	1.0	6	87[d]	97
4	2	14	88[d]	98
5	2.5	16	88[d]	98

[a] Unless otherwise noted, all reactions were performed with **L4**–Sc(OTf)$_3$ (1:1, 10 mol %), 4 Å MS (25.0 mg), K_2CO_3 (0.1 mmol), **1a** (0.1 mmol, PMB = *p*-methoxybenzyl), N-(phenylthio)phthalimide **2** (0.12 mmol) in CH_2Cl_2

(x mL) under N_2 at the 35 ºC for the indicated time. [b] Isolated yield. [c] Determined by HPLC analysis (Chiralcel OD-H). [d] **1a** was completely consumed.

J) survey of the amount of base

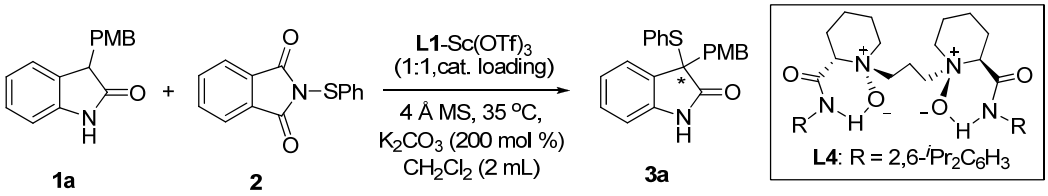


1a **2** **3a**

Entry[a]	y	Time	Yield[b] (%)	Ee[c] (%)
1	200 mol %	6	88[d]	98
2	150 mol %	10	87[d]	98
3	100 mol %	16	88[d]	98
4	50 mol %	24	85[d]	98
5	10 mol %	36	86[d]	98

[a] Unless otherwise noted, all reactions were performed with **L4**–$Sc(OTf)_3$ (1:1, 10 mol %), 4 Å MS (25.0 mg), K_2CO_3 (y), **1a** (0.1 mmol, PMB = *p*-methoxybenzyl), N-(phenylthio)phthalimide **2** (0.12 mmol) in CH_2Cl_2 (2.0 mL) under N_2 at the 35 ºC for the indicated time. [b] Isolated yield. [c] Determined by HPLC analysis (Chiralcel OD-H). [d] **1a** was completely consumed.

K) survey of catalyst loading

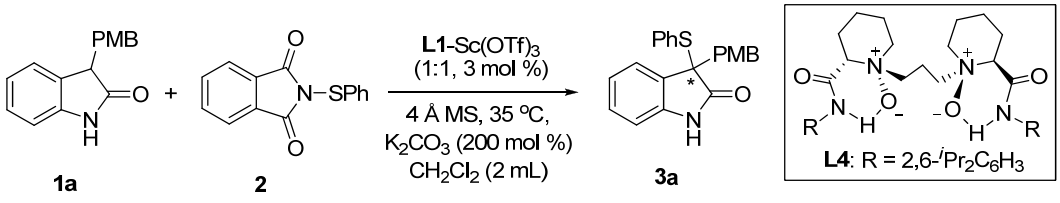


1a **2** **3a**

Entry[a]	Cat. loading	Time (h)	Yield[b] (%)	Ee[c] (%)
1	10 mol %	6	88[d]	98
2	5 mol %	6	86[d]	98
3	3 mol %	10	88[d]	97
4	2 mol %	14	87[d]	95
5	1 mol %	14	85[d]	92

[a] Unless otherwise noted, all reactions were performed with **L4**–$Sc(OTf)_3$ (1:1, cat. loading), 4 Å MS (25.0 mg), K_2CO_3 (0.2 mmol), **1a** (0.1 mmol, PMB = *p*-methoxybenzyl), N-(phenylthio)phthalimide **2** (0.12 mmol) in CH_2Cl_2 (2.0 mL) under N_2 at the 35 ºC for the indicated time. [b] Isolated yield. [c] Determined by HPLC analysis (Chiralcel OD-H). [d] **1a** was completely consumed.

L) optimization of the amount of the sulfenylating agent 2



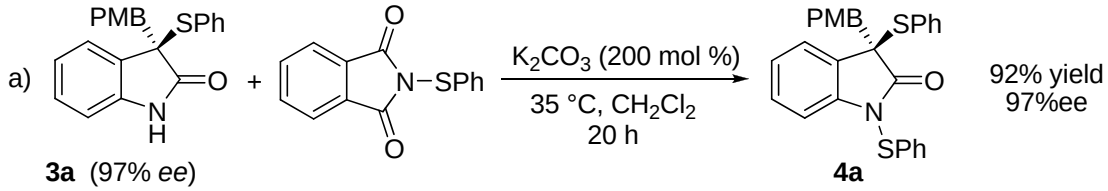
1a **2** (z equiv) **3a**

Entry[a]	z (equiv.)	Time (h)	Yield[b] (%)	Ee[c] (%)
1	2.0	12	16[d]	97
2	1.2	12	86[d]	97
3	1.05	12	98[d]	97
4	1	12	95	97

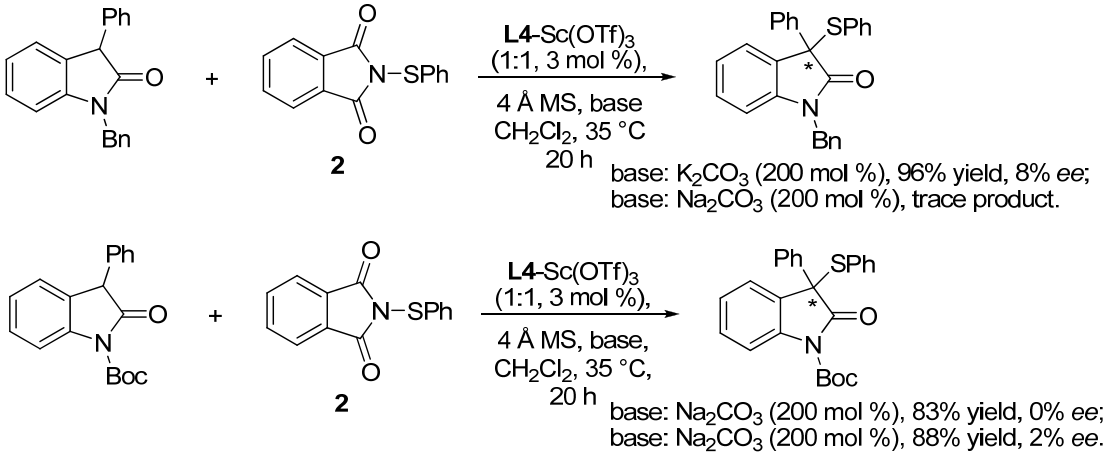
[a] Unless otherwise noted, all reactions were performed with **L4**–$Sc(OTf)_3$ (1:1, 3 mol %), 4 Å MS (25.0 mg), K_2CO_3 (0.2 mmol), **1a** (0.1 mmol, PMB = *p*-methoxybenzyl), N-(phenylthio)phthalimide **2** (z equiv.) in CH_2Cl_2 (2.0 mL) under N_2 at the 35 ºC for the indicated time. [b] Isolated yield. [c] Determined by HPLC analysis (Chiralcel OD-H). [d] **1a** was completely consumed.

7. Some preliminary mechanistic studies

A) Control experiments to elucidate the reaction process

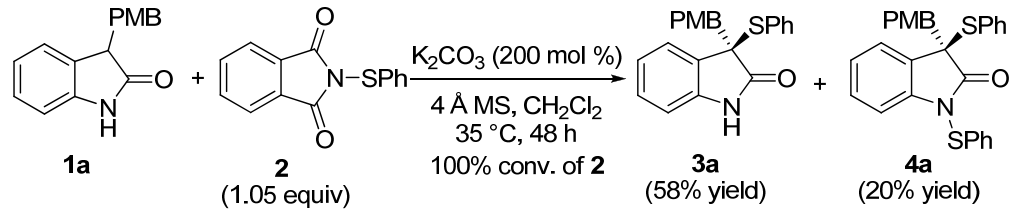


B) Sulfenylation of the *N*-Bn and *N*-Boc protected oxindole

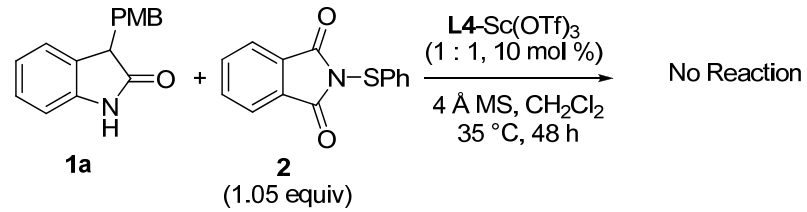


C) Control experiments using 1a and 2 as model substrates

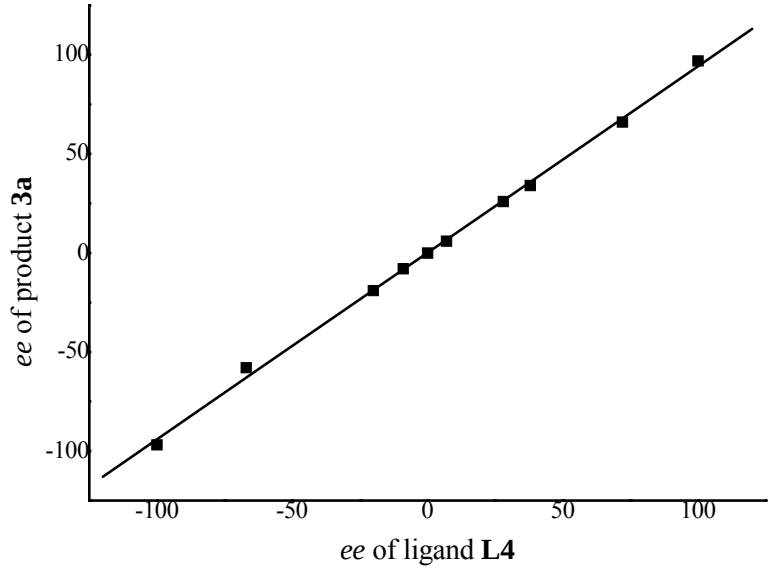
Without L4-Sc(OTf)$_3$



Without BrΦnsted base

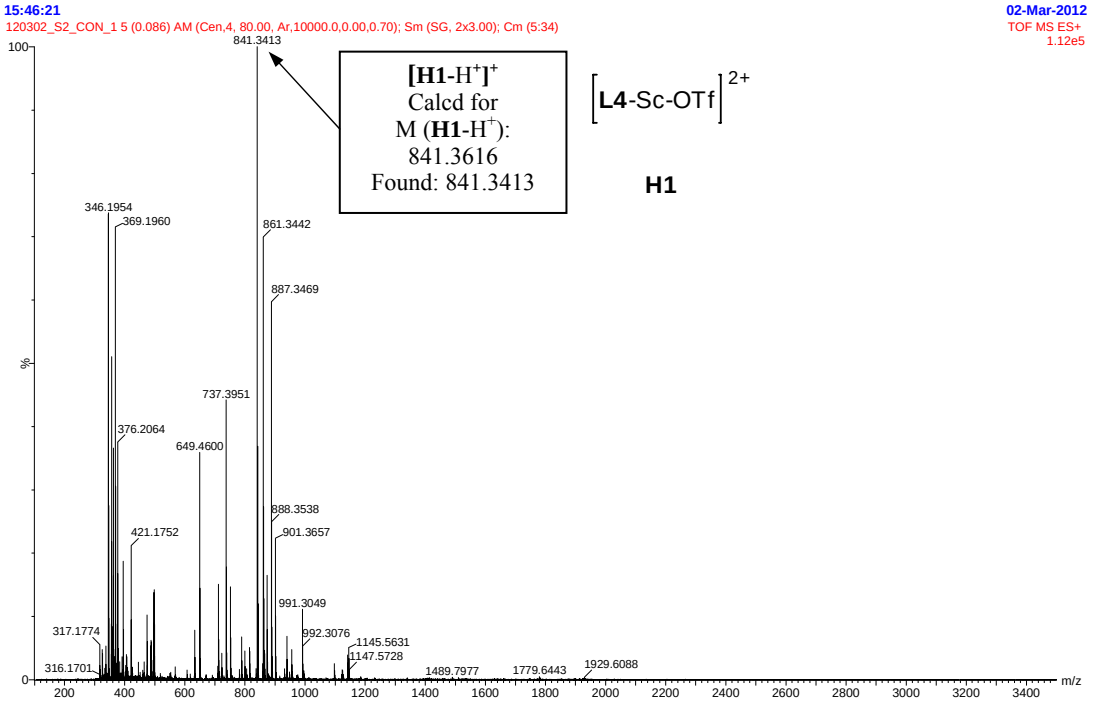


D) Nonlinear effect

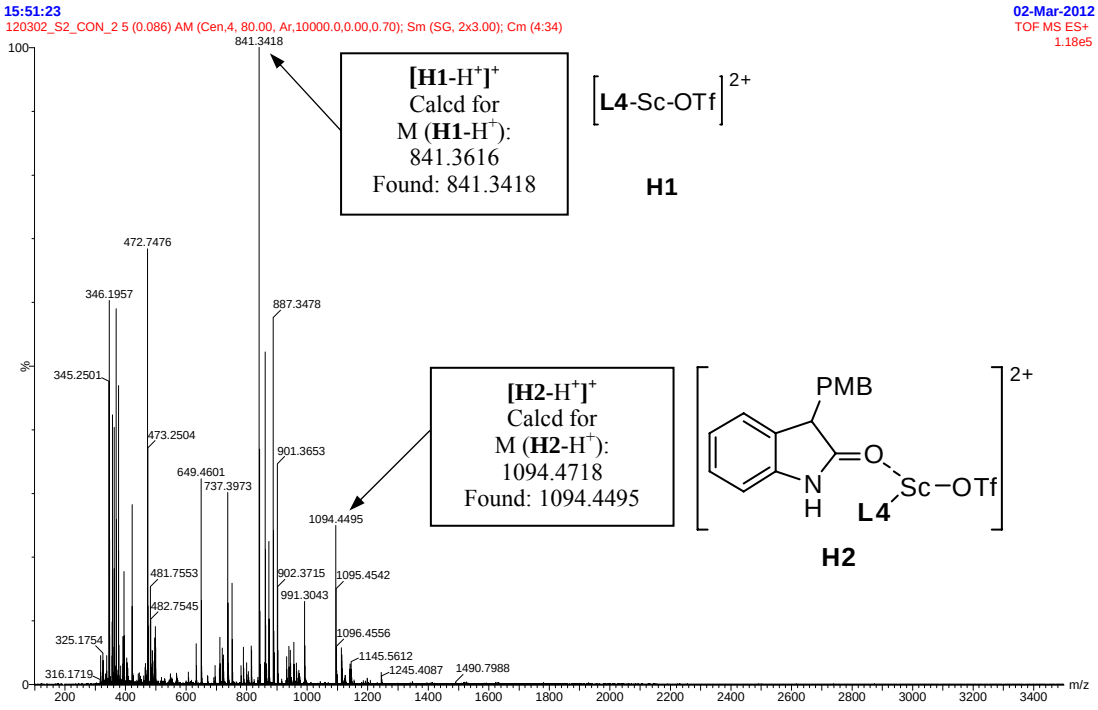


E) HRMS analysis

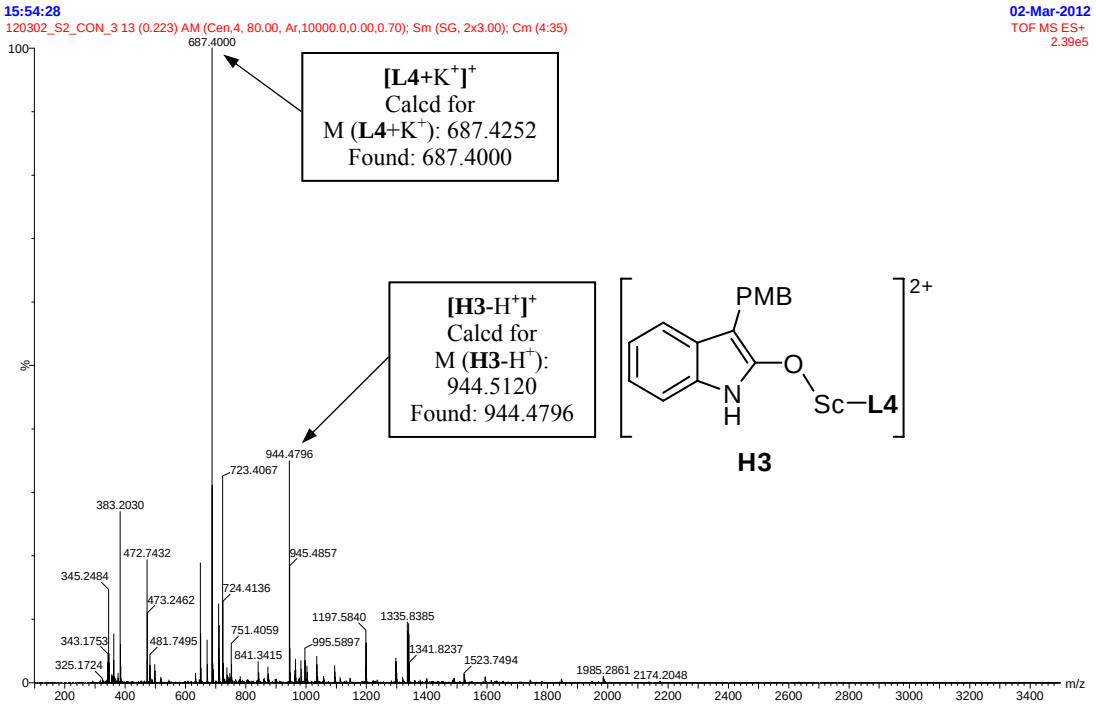
a) The mixture of **L4** and Sc(OTf)$_3$ (1:1)



b) The mixture of **L4**, $Sc(OTf)_3$ and **1a** (1:1:1)



c) The mixture of **L4**, $Sc(OTf)_3$,**1a** (1:1:1) and 200 mol % of K_2CO_3



8. Characterization of the new unprotected oxindoles 5b-5o and 1z

3-*o*-tolylindolin-2-one (5b)

^{1}H NMR (400 MHz, DMSO) δ = 10.60 (s, 1H), 7.40 – 6.40 (m, 8H), 4.95 (s, 1H), 2.27 (s, 3H).

^{13}C NMR (101 MHz, DMSO) δ = 177.29, 142.65, 136.91, 136.20, 130.60, 129.97, 127.92, 127.18, 126.05, 124.23, 121.63, 109.34, 19.07.

3-*m*-tolylindolin-2-one (5c)

^{1}H NMR (400 MHz, $CDCl_3$) δ = 8.89 (s, 1H), 7.24 (t, *J*=7.6, 2H), 7.11 (d, *J*=7.2, 2H), 7.05 – 6.97 (m, 3H), 6.94 (d, *J*=7.6, 1H), 4.60 (s, 1H), 2.32 (s, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ = 178.89, 141.63, 138.71, 136.38, 129.85, 129.17, 128.86, 128.53, 128.35, 125.58, 125.27, 122.73, 109.98, 52.72, 21.45.

3-*p*-tolylindolin-2-one (5d)

^{1}H NMR (400 MHz, $CDCl_3$) δ = 8.88 (s, 1H), 7.23 (t, J = 7.6, 1H), 7.19 – 7.06 (m, 5H), 7.02 (t, *J*=7.6, 1H), 6.93 (d, *J*=7.6, 1H), 4.60 (s, 1H), 2.33 (s, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ = 178.96, 141.67, 137.44, 133.43, 129.84, 129.70, 128.36, 125.25, 122.71, 109.98, 52.37, 21.16.

3-(4-fluorophenyl)indolin-2-one (5e)

^{1}H NMR (400 MHz, $CDCl_3$) δ = 8.81 (s, 1H), 7.29 – 7.23 (m, 1H), 7.23 – 7.16 (m, 2H), 7.12 (d, *J*=7.3, 1H), 7.08 – 7.00 (m, 3H), 6.95 (d, *J*=7.8, 1H), 4.62 (s, 1H).

^{13}C NMR (101 MHz, $CDCl_3$) δ = 178.51, 162.35 (d, *J*=246.2), 141.55, 132.14, 130.15, 130.07, 129.30, 128.61, 125.28, 122.88, 116.02, 115.80, 110.11, 51.84.

3-(4-chlorophenyl)indolin-2-one (5f)

^{1}H NMR (400 MHz, $CDCl_3$) δ = 9.10 (s, 1H), 7.32 (d, *J*=8.2, 2H), 7.24 (d, *J*=8.2, 1H), 7.16 (d, *J*=8.2, 2H), 7.10 (d, *J*=7.4, 1H), 7.04 (t, *J*=7.4, 1H), 6.94 (d, *J*=8.0, 1H), 4.61 (s, 1H).

^{13}C NMR (101 MHz, $CDCl_3$) δ = 178.45, 141.67, 134.89, 133.70, 129.87, 129.16, 129.02, 128.69, 125.24, 122.91, 110.24, 52.04.

3-(4-methoxyphenyl)indolin-2-one (5g)

^{1}H NMR (400 MHz, $CDCl_3$) δ = 9.35 (s, 1H), 7.22 (t, *J*=7.6, 1H), 7.17 – 6.07 (m, 3H), 7.01 (t, *J*=7.6, 1H), 6.92 (d, *J*=7.6, 1H), 6.88 (d, *J*=8.4, 2H), 4.58 (s, 1H), 3.78 (s, 3H).
^{13}C NMR (101 MHz, $CDCl_3$) δ = 179.50, 159.12, 141.78, 129.94, 129.58, 128.51, 128.34, 125.17, 122.68, 114.43, 110.16, 55.31, 52.04.

3-(naphthalen-1-yl)indolin-2-one (5h)

^{1}H NMR (400 MHz, DMSO) δ = 10.77 (d, 1H), 8.71 – 6.50 (m, 11H), 5.42 (d, 1H).
^{13}C NMR (101 MHz, DMSO) δ = 177.32, 142.67, 133.76, 130.54, 128.53, 128.04, 127.54, 126.24, 125.89, 125.60, 124.46, 121.69, 109.60, 47.55.

3-(naphthalen-2-yl)indolin-2-one (5i)

^{1}H NMR (400 MHz, $CDCl_3$) δ = 9.17 (s, 1H), 7.85 – 7.78 (m, 3H), 7.74 (s, 1H), 7.51 – 7.41 (m, 2H), 7.30 – 7.18 (m,, 2H), 7.12 (d, *J*=7.6, 1H), 7.01 (t, *J*=7.6, 1H), 6.94 (d, *J*=8.0, 1H), 4.79 (s, 1H).
^{13}C NMR (101 MHz, $CDCl_3$) δ = 178.96, 141.75, 133.89, 133.53, 132.85, 129.69, 128.92, 128.52, 127.86, 127.78, 127.72, 126.32, 126.07, 125.34, 122.82, 110.17, 52.97.

5-methyl-3-phenylindolin-2-one (5j)

^{1}H NMR (400 MHz, $CDCl_3$) δ = 8.99 (s, 1H), 7.41 – 7.27 (m, 3H), 7.22 (d, *J*=7.2, 2H), 7.03 (d, *J*=7.6, 1H), 6.93 (s, 1H), 6.82 (d, *J*=8,0, 1H), 4.60 (s, 1H), 2.27 (s, 3H).
^{13}C NMR (101 MHz, $CDCl_3$) δ = 178.94, 139.19, 136.73, 132.26, 129.81, 128.98, 128.71, 128.55, 127.65, 125.93, 109.75, 52.85, 21.10.

5-methoxy-3-phenylindolin-2-one (5k)

^{1}H NMR (400 MHz, $CDCl_3$) δ = 8.49 (s, 1H), 7.40 – 7.27 (m, 3H), 7.23 (d, *J*=7.2, 2H), 6.85 (d, *J*=8.4, 1H), 6.78 (d, *J*=8.4, 1H), 6.73 (s, 1H), 4.61 (s, 1H), 3.74 (s, 3H).
^{13}C NMR (101 MHz, $CDCl_3$) δ = 178.34, 155.98, 136.45, 134.95, 130.90, 129.01, 128.51, 127.71, 113.25, 112.14, 110.28, 55.78, 53.12.

5-fluoro-3-phenylindolin-2-one (5l)

^{1}H NMR (400 MHz, $CDCl_3$) δ = 9.15 (s, 1H), 7.41 – 7.28 (m, 3H), 7.21 (d, *J*=7.2, 2H), 6.94 (t, *J*=8.0, 1H), 6.89 – 6.82 (m, 2H), 4.63 (s, 1H).
^{13}C NMR (101 MHz, $CDCl_3$) δ = 178.79, 159.21 (d, *J*=240.8), 137.57, 135.82, 131.19 (d, *J*=8.3), 129.13, 128.43, 127.96, 114.90 (d, *J*=23.6), 113.12 (d, *J*=24.8), 110.64 (d, *J*=8.0), 53.14.

5-chloro-3-phenylindolin-2-one (5m)

^{1}H NMR (400 MHz, $CDCl_3$) δ = 9.21 (s, 1H), 7.41 – 7.28 (m, 3H), 7.24 – 7.15 (m, 3H), 7.10 (s, 1H), 6.85 (d, *J*=8.0, 1H), 4.62 (s, 1H).
^{13}C NMR (101 MHz, $CDCl_3$) δ = 178.59, 140.19, 135.68, 131.32, 129.16, 128.48, 128.45, 128.12, 128.01, 125.62, 111.08, 52.83.

6-bromo-3-phenylindolin-2-one (5n)

^{1}H NMR (400 MHz, DMSO) δ = 10.71 (s, 1H), 7.41 – 7.22 (m, 1H), 7.21 – 7.10 (m, 1H), 7.07 (s, 1H), 6.98 (d, *J*=7.4, 1H), 4.75 (s, 1H).

^{13}C NMR (101 MHz, DMSO) δ = 176.98, 144.45, 137.02, 129.38, 128.72, 128.32, 127.23, 126.55, 124.21, 120.61, 112.26, 51.37.

7-fluoro-3-phenylindolin-2-one (5o)

^{1}H NMR (400 MHz, $CDCl_3$) δ = 8.45 (s, 1H), 7.40 – 7.27 (m, 3H), 7.22 (d, *J*=7.2, 2H), 7.09 – 6.96 (m, 2H), 6.93 (d, *J*=7.2, 1H), 4.68 (s, 1H).

^{13}C NMR (101 MHz, $CDCl_3$) δ = 177.27, 146.99 (d, *J*=244.3), 135.82, 132.12, 132.09, 129.05, 128.87 (d, *J*=12.1), 128.43, 127.89, 123.37 (d, *J*=5.9), 121.01 (d, *J*=3.4), 115.48 (d, *J*=17.1), 52.67.

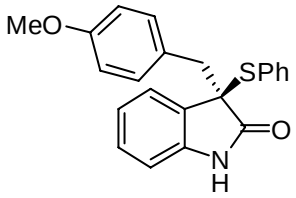
methyl 2-(2-oxoindolin-3-yl)acetate (1z)

^{1}H NMR (400 MHz, DMSO) δ = 10.45 (s, 1H), 7.25 – 7.11 (m, 2H), 6.92 (t, *J*=7.6, 1H), 6.82 (d, *J*=7.6, 1H), 3.68 (t, *J*=5.7, 1H), 3.57 (s, 3H), 2.91 (ddd, *J*=23.8, 16.9, 5.7, 2H).

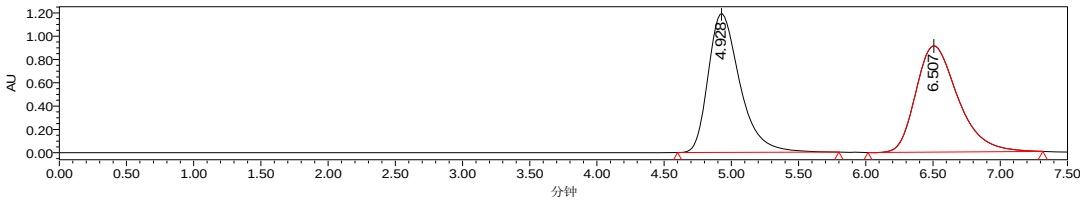
^{13}C NMR (101 MHz, DMSO) δ = 177.87, 171.18, 142.82, 128.93, 127.78, 123.57, 121.17, 109.17, 51.52, 41.62, 33.48.

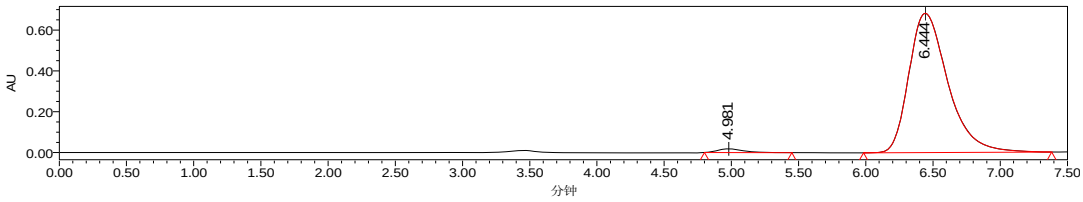
9. Characterization of the new products

(*R*)-3-(4-methoxybenzyl)-3-(phenylthio)indolin-2-one (3a):



Prepared according to the general procedure (12 h). The tittle compound **3a** was obtained as a white solid in 98% yield. HPLC (Chiralcel OD-H, hexane/ *i*-PrOH = 80/20, flow rate 1.0 mL/min, λ = 254 nm) t_r (major) = 6.44 min, t_r (minor) = 4.98 min, *ee* = 97%. $[\alpha]^{25}_D$ = −61.6 (*c* = 0.68, in CH_2Cl_2).





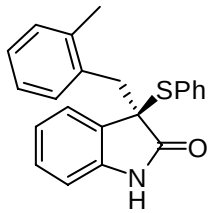
	Retention Time	Area	% Area
1	4.981	240776	1.72
2	6.444	13731490	98.28

^{1}H NMR (400 MHz, $CDCl_3$) δ = 8.37 (s, 1H), 7.45 – 7.29 (m, 1H), 7.29 – 7.15 (m, 3H), 7.14 – 6.95 (m, 4H), 6.88 (d, *J*=8.7, 2H), 6.60 – 6.48 (m, 3H), 3.62 (s, 3H), 3.39 (d, *J*=13.4, 1H), 3.32 (d, *J*=13.4, 1H).

^{13}C NMR (101 MHz, $CDCl_3$) δ = 178.25, 158.34, 140.47, 136.51, 131.23, 129.46, 129.42, 128.66, 128.44, 126.87, 125.21, 122.29, 113.28, 109.82, 60.51, 55.00, 40.36.

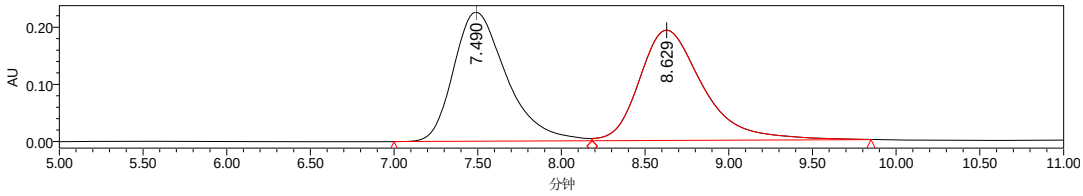
HRMS (ESI-TOF) calcd for $C_{22}H_{19}NO_2S$ ([M]+Na^+) = 384.1034, Found 384.1035.

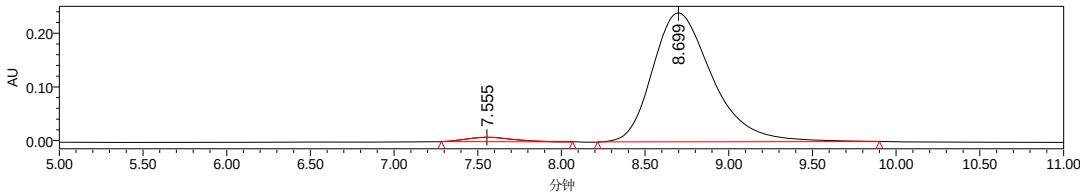
(*R*)-3-(2-methylbenzyl)-3-(phenylthio)indolin-2-one (3b):



Prepared according to the general procedure (24 h). The tittle compound **3b** was obtained as a white solid in 91% yield.

HPLC (Chiralcel OD-H, hexane/ *i*-PrOH = 95/5, flow rate 1.0 mL/min, λ = 254 nm) t_r (major) = 8.70 min, t_r (minor) = 7.56 min, *ee* = 95%. $[\alpha]^{25}_D$ = −45.4 (*c* = 0.63, in CH_2Cl_2).





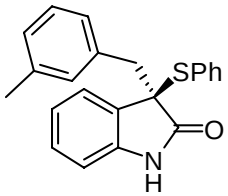
	Retention Time	Area	% Area
1	7.555	162015	2.65
2	8.699	5954989	97.35

^{1}H NMR (400 MHz, DMSO) δ = 10.23 (s, 1H), 7.36 – 7.26 (m, 2H), 7.26 – 7.15 (m, 4H), 7.07 (t, *J*=7.6, 1H), 7.03 – 6.92 (m, 3H), 6.92 – 6.84 (m, 1H), 6.80 (d, *J*=7.6, 1H), 6.49 (d, *J*=7.7, 1H), 3.42 (d, *J*=14.0, 1H), 3.33 (d, *J*=14.0, 1H), 2.16 (s, 3H).

^{13}C NMR (101 MHz, DMSO) δ = 176.49, 141.58, 136.69, 135.91, 133.87, 130.10, 129.60, 129.44, 128.91, 128.79, 128.51, 126.70, 125.19, 125.09, 121.29, 109.22, 59.67, 36.44, 19.69.

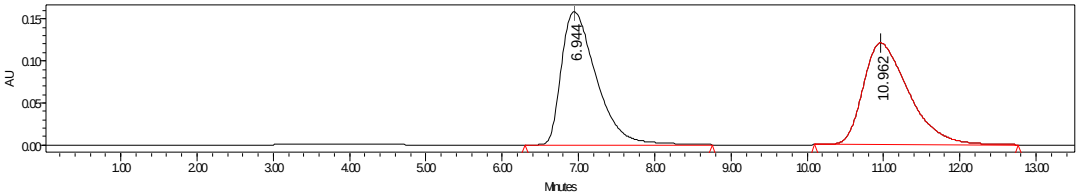
HRMS (ESI-TOF) calcd for $C_{22}H_{19}NOS$ ([M]+H^+) = 346.1266, Found 346.1266.

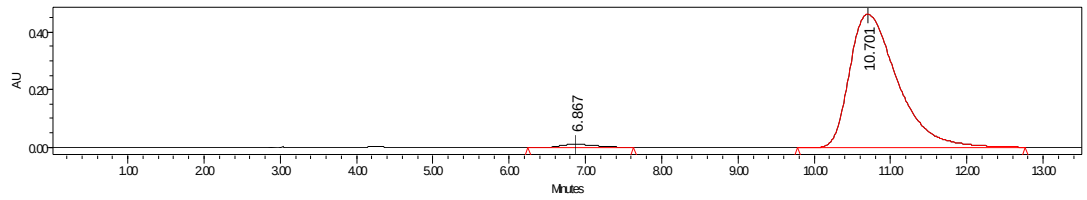
(*R*)-3-(3-methylbenzyl)-3-(phenylthio)indolin-2-one (3c):



Prepared according to the general procedure (20 h). The tittle compound **3c** was obtained as a white solid in 96% yield.

HPLC (Chiralcel OD-H, hexane/ *i*-PrOH = 95/5, flow rate 1.0 mL/min, λ = 254 nm) t_r (major) = 10.70 min, t_r (minor) = 6.87 min, *ee* = 97%. $[\alpha]^{25}_D$ = −50.5 (*c* = 0.63, in CH_2Cl_2).





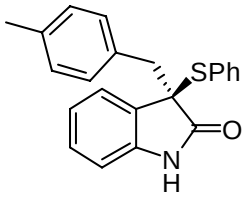
	Retention Time	Area	% Area
1	6.867	330294	1.62
2	10.701	20067439	98.38

^{1}H NMR (400 MHz, DMSO) δ = 10.16 (s, 1H), 7.41 (d, *J*=7.2, 1H), 7.37 – 7.29 (m, 1H), 7.28 – 7.16 (m, 4H), 7.04 (t, *J*=7.5, 1H), 7.01 – 6.90 (m, 2H), 6.87 (d, *J*=7.5, 1H), 6.75 (s, 1H), 6.70 (d, *J*=7.5, 1H), 6.44 (d, *J*=7.5, 1H), 3.35 (d, *J*=13.0, 1H), 3.26 (d, *J*=13.0, 1H), 2.09 (s, 3H).

^{13}C NMR (101 MHz, DMSO) δ = 176.14, 141.51, 136.59, 135.99, 135.11, 127.57, 127.27, 126.96, 125.03, 121.28, 109.15, 59.50, 40.15, 20.87.

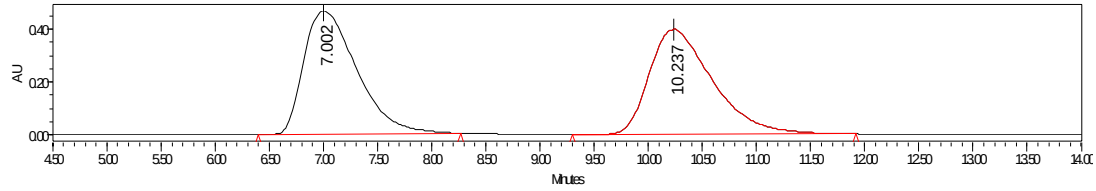
HRMS (ESI-TOF) calcd for $C_{22}H_{19}NOS$ ([M]+H^+) = 346.1266, Found 346.1264.

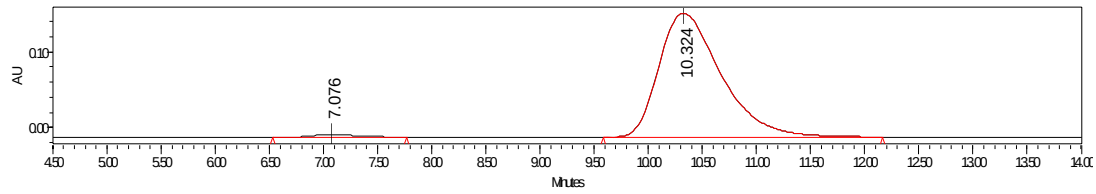
(*R*)-3-(4-methylbenzyl)-3-(phenylthio)indolin-2-one (3d):



Prepared according to the general procedure (20 h). The tittle compound **3d** was obtained as a white solid in 97% yield.

HPLC (Chiralcel OD-H, hexane/ *i*-PrOH = 95/5, flow rate 1.0 mL/min, λ = 254 nm) t_r (major) = 10.32 min, t_r (minor) = 7.08 min, *ee* = 97%. $[\alpha]^{25}_{D}$ = −54.1 (*c* = 0.67, in CH_2Cl_2).





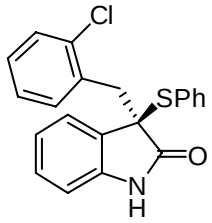
	Retention Time	Area	% Area
1	7.076	100229	1.51
2	10.324	6534656	98.49

^{1}H NMR (400 MHz, $CDCl_3$) δ = 8.24 (s, 1H), 7.35 (dd, *J*=6.4, 2.2, 1H), 7.28 – 7.19 (m, 3H), 7.15 – 6.99 (m, 4H), 6.89 – 6.81 (m, 4H), 6.53 – 6.46 (m, 1H), 3.41 (d, *J*=13.3, 1H), 3.35 (d, *J*=13.3, 1H), 2.17 (s, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ = 178.09, 140.40, 136.56, 136.38, 131.77, 130.10, 129.50, 129.44, 129.40, 128.66, 128.64, 128.45, 125.28, 122.27, 109.76, 60.42, 40.74, 21.05.

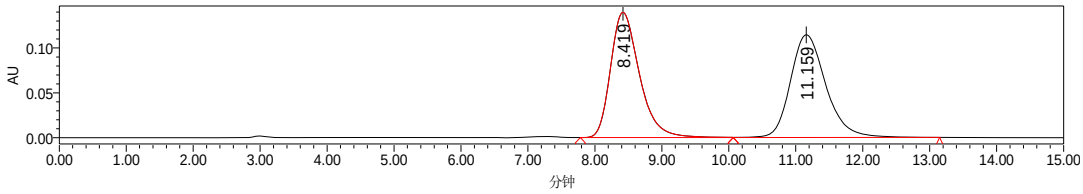
HRMS (ESI-TOF) calcd for $C_{22}H_{19}NOS$ ([M]+H^+) = 346.1266, Found 346.1259.

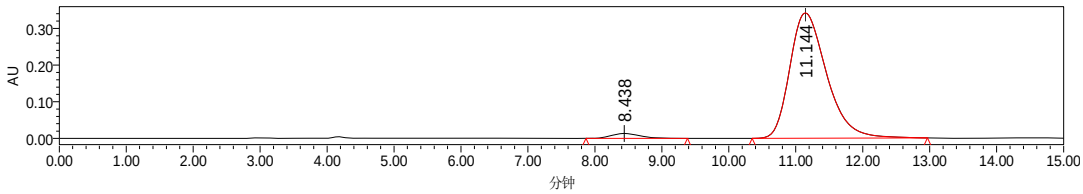
(*R*)-3-(2-chlorobenzyl)-3-(phenylthio)indolin-2-one (3e):



Prepared according to the general procedure (20 h). The tittle compound **3e** was obtained as a white solid in 95% yield.

HPLC (Chiralcel OD-H, hexane/ *i*-PrOH = 95/5, flow rate 1.0 mL/min, λ = 254 nm) t_r (major) = 11.14 min, t_r (minor) = 8.44 min, *ee* = 94%. $[\alpha]^{25}_D$ = 29.5 (*c* = 0.70, in CH_2Cl_2).





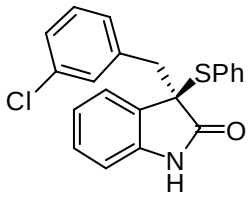
	Retention Time	Area	% Area
1	8.438	398149	2.96
2	11.144	13030276	97.04

^{1}H NMR (400 MHz, $CDCl_3$) δ = 8.58 (s, 1H), 7.33 (d, *J*=7.4, 1H), 7.30 – 7.22 (m, 3H), 7.22 – 7.09 (m, 4H), 7.08 – 6.91 (m, 4H), 6.54 (d, *J*=7.6, 1H), 3.79 (d, *J*=14.1, 1H), 3.58 (d, *J*=14.1, 1H).

^{13}C NMR (101 MHz, $CDCl_3$) δ = 178.47, 140.10, 136.69, 134.59, 133.52, 131.17, 129.69, 129.49, 129.21, 128.81, 128.64, 128.47, 128.34, 126.57, 125.97, 122.27, 109.56, 60.08, 36.78.

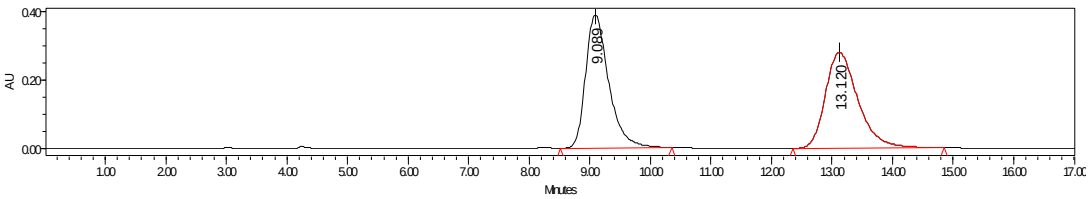
HRMS (ESI-TOF) calcd for $C_{21}H_{16}Cl^{34.9689}NOS$ ($[M]+H^+$) = 366.0719, Found 366.0717.

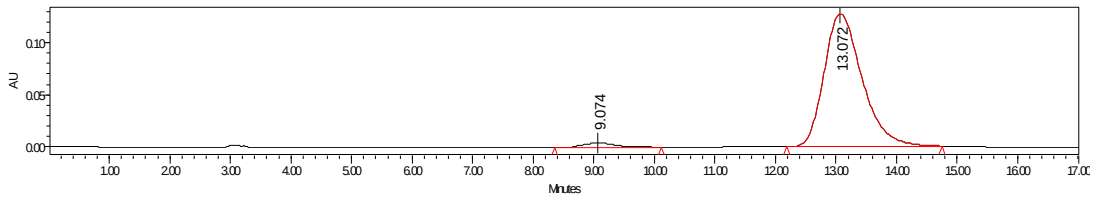
(R)-3-(3-chlorobenzyl)-3-(phenylthio)indolin-2-one (3f):



Prepared according to the general procedure (20 h). The tittle compound **3f** was obtained as a white solid in 96% yield.

HPLC (Chiralcel OD-H, hexane/ *i*-PrOH = 95/5, flow rate 1.0 mL/min, λ = 254 nm) t_r (major) = 13.07 min, t_r (minor) = 9.07 min, *ee* = 95%. $[\alpha]^{25}_D$ = −46.6 (*c* = 0.67, in CH_2Cl_2).





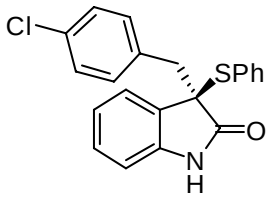
	Retention Time	Area	% Area
1	9.074	154628	2.71
2	13.072	5543775	97.29

^{1}H NMR (400 MHz, DMSO) δ = 10.35 – 10.11 (m, 1H), 7.46 (d, *J*=7.3, 1H), 7.38 – 7.29 (m, 1H), 7.29 – 7.17 (m, 4H), 7.17 – 6.94 (m, 5H), 6.89 (d, *J*=7.2, 1H), 6.45 (d, *J*=7.2, 1H), 3.46 (d, *J*=13.0, 1H), 3.30 (d, *J*=13.0, 1H).

^{13}C NMR (101 MHz, DMSO) δ = 176.00, 141.41, 137.71, 136.02, 132.22, 129.67, 129.55, 129.16, 128.85, 128.59, 128.22, 126.69, 125.06, 121.46, 109.26, 59.37, 39.52.

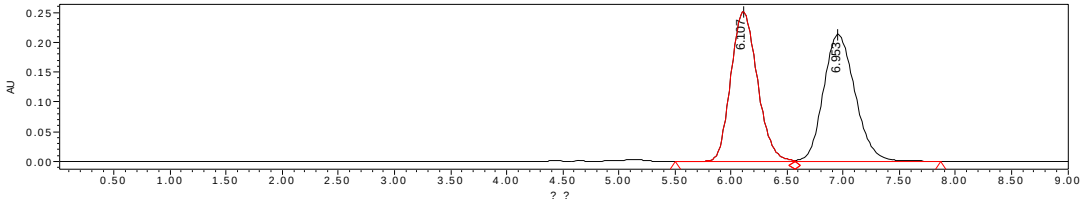
HRMS (ESI-TOF) calcd for $C_{21}H_{16}Cl^{34.9689}NOS$ ([M]+H^+) = 366.0719, Found 366.0713.

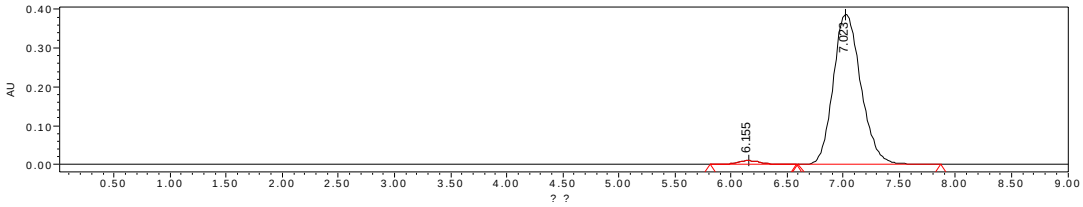
(*R*)-3-(4-chlorobenzyl)-3-(phenylthio)indolin-2-one (3g):



Prepared according to the general procedure (12 h). The tittle compound **3g** was obtained as a white solid in 97% yield.

HPLC (Chiralcel OD-H, hexane/ *i*-PrOH = 90/10, flow rate 1.0 mL/min, λ = 254 nm) t_r (major) = 7.02 min, t_r (minor) = 6.16 min, *ee* = 96%. $[\alpha]^{25}_D$ = −55.6 (*c* = 0.63, in CH_2Cl_2).





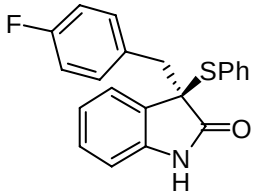
	Retention Time	Area	% Area
1	6.155	139308	2.06
2	7.023	6626623	97.94

^{1}H NMR (400 MHz, DMSO) δ = 10.18 (s, 1H), 7.44 (d, *J*=7.3, 1H), 7.36 – 7.28 (m, 1H), 7.27 – 7.18 (m, 4H), 7.14 (d, *J*=8.4, 2H), 7.05 (t, *J*=7.6, 1H), 6.98 (t, *J*=7.6, 1H), 6.94 (d, *J*=8.4, 2H), 6.45 (d, *J*=7.6, 1H), 3.43 (d, *J*=13.0, 1H), 3.29 (d, *J*=13.0, 1H).

^{13}C NMR (101 MHz, DMSO) δ = 175.92, 141.35, 135.92, 134.16, 131.62, 131.35, 129.44, 129.14, 128.72, 128.49, 128.22, 127.65, 124.96, 121.39, 109.15, 59.35, 39.30.

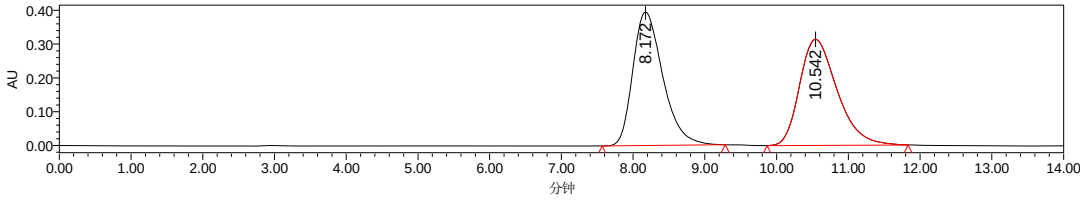
HRMS (ESI-TOF) calcd for $C_{21}H_{16}Cl^{34.9689}NOS$ ([M]+Na^+) = 388.0539, Found 388.0535.

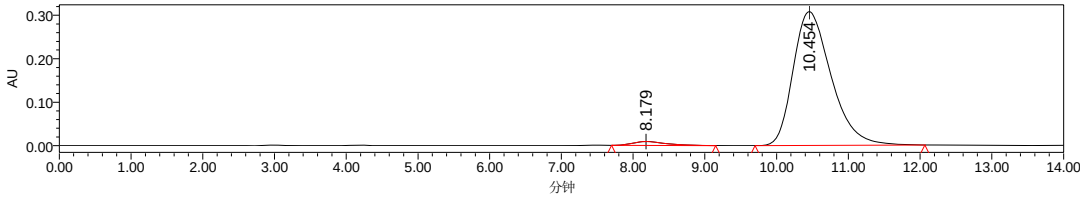
(*R*)-3-(4-fluorobenzyl)-3-(phenylthio)indolin-2-one (3h)



Prepared according to the general procedure (20 h). The tittle compound **3h** was obtained as a white solid in 95% yield.

HPLC (Chiralcel OD-H, hexane/ *i*-PrOH = 90/10, flow rate 1.0 mL/min, λ = 254 nm) t_r (major) = 10.45 min, t_r (minor) = 8.18 min, *ee* = 95%. $[\alpha]^{25}_D = -41.9$ (*c* = 0.61, in CH_2Cl_2).





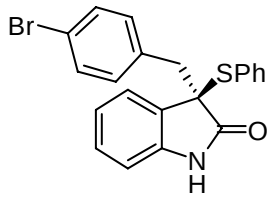
	Retention Time	Area	% Area
1	8.179	286564	2.46
2	10.454	11341088	97.54

^{1}H NMR (400 MHz, $CDCl_3$) δ = 8.31 (s, 1H), 7.40 – 7.33 (m, 1H), 7.30 – 7.20 (m, 3H), 7.17 – 7.02 (m, 4H), 6.95 – 6.85 (m,, 2H), 6.68 (t, *J*=8.6, 2H), 6.52 (d, *J*=7.1, 1H), 3.42 (d, *J*=13.4, 1H), 3.34 (d, *J*=13.4, 1H).

^{13}C NMR (101 MHz, $CDCl_3$) δ = 178.01, 161.75 (d, *J*=245.4), 140.35, 136.58, 131.69 (d, *J*=8.0), 130.53 (d, *J*=3.2), 129.61, 129.21, 129.03, 128.86, 128.51, 125.15, 122.45, 114.78 (d, *J*=21.2). 109.82, 60.32, 40.30.

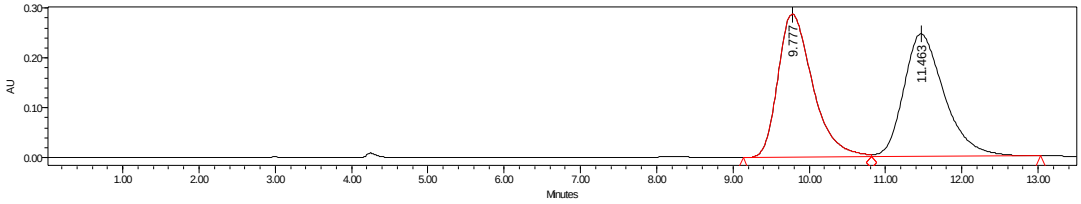
HRMS (ESI-TOF) calcd for $C_{21}H_{16}FNOS$ ([M]+Na^+) = 372.0834, Found 372.0823.

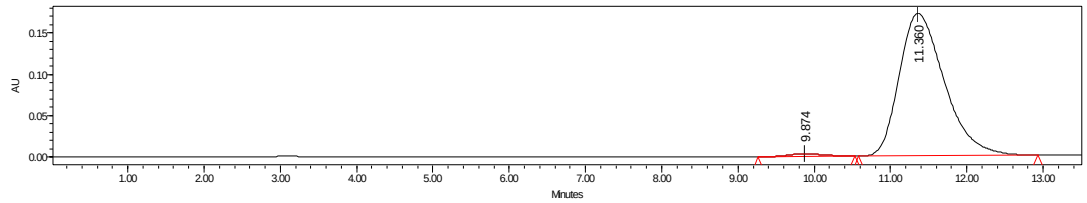
(*R*)-3-(4-bromobenzyl)-3-(phenylthio)indolin-2-one (3i):



Prepared according to the general procedure (20 h). The tittle compound **3i** was obtained as a white solid in 92% yield.

HPLC (Chiralcel OD-H, hexane/ *i*-PrOH = 95/5, flow rate 1.0 mL/min, λ = 254 nm) t_r (major) = 11.36 min, t_r (minor) = 9.87 min, *ee* = 97%. $[\alpha]^{25}_D = -39.9$ (*c* = 0.74, in CH_2Cl_2).





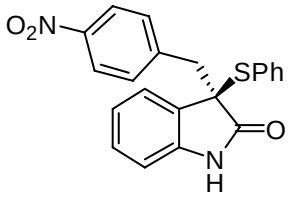
	Retention Time	Area	% Area
1	9.874	118745	1.64
2	11.360	7102909	98.36

^{1}H NMR (400 MHz, DMSO) δ = 10.19 (s, 1H), 7.44 (d, *J*=7.3, 1H), 7.38 – 7.30 (m, 1H), 7.30 – 7.18 (m, 6H), 7.05 (t, *J*=7.6, 1H), 6.98 (t, *J*=7.6, 1H), 6.88 (d, *J*=8.3, 2H), 6.45 (d, *J*=7.6, 1H), 3.41 (d, *J*=13.0, 1H), 3.27 (d, *J*=13.0, 1H).

^{13}C NMR (101 MHz, DMSO) δ = 175.98, 141.43, 136.01, 134.64, 132.07, 130.65, 129.53, 129.21, 128.81, 128.57, 128.29, 125.04, 121.47, 120.04, 109.24, 59.35. (One peak overlaps with peaks of DMSO).

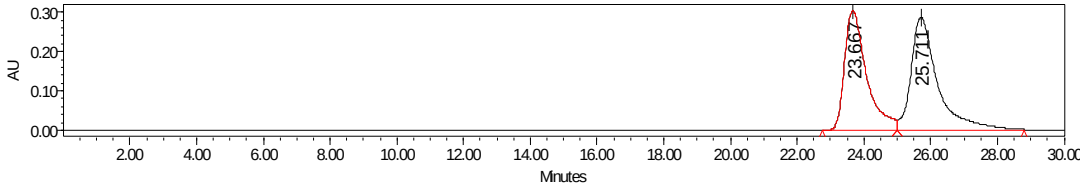
HRMS (ESI-TOF) calcd for $C_{21}H_{16}Br^{78.9183}NOS$ ([M]+Na^+) = 432.0034, Found 432.0027.

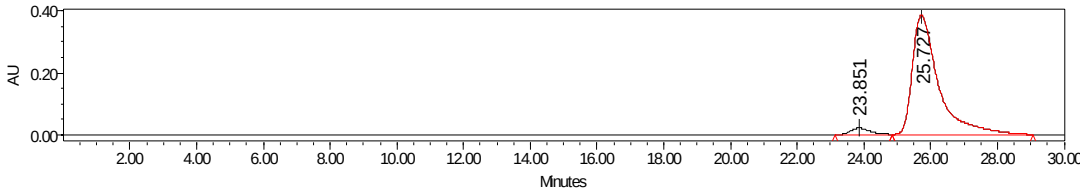
(*R*)-3-(4-nitrobenzyl)-3-(phenylthio)indolin-2-one (3j):



Prepared according to the general procedure (20 h). The tittle compound **3j** was obtained as a white solid in 95% yield.

HPLC (Chiralcel IA, hexane/ *i*-PrOH = 90/10, flow rate 1.0 mL/min, λ = 254 nm) t_r (major) = 25.73 min, t_r (minor) = 23.85 min, *ee* = 92%. $[\alpha]^{25}_D$ = −54.9 (*c* = 0.70, in CH_2Cl_2).





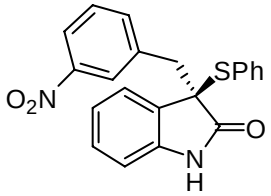
	Retention Time	Area	% Area
1	23.851	860521	3.96
2	25.727	20861671	96.04

^{1}H NMR (400 MHz, DMSO) δ = 10.25 (s, 1H), 7.96 (d, *J*=8.6, 2H), 7.48 (d, *J*=7.4, 1H), 7.39 – 7.30 (m, 1H), 7.26 – 7.18 (m, 6H), 7.05 (t, *J*=7.4, 1H), 6.99 (t, *J*=7.4, 1H), 6.45 (d, *J*=7.4, 1H), 3.62 (d, *J*=12.9, 1H), 3.43 (d, *J*=12.9, 1H).

^{13}C NMR (101 MHz, DMSO) δ = 175.72, 146.25, 143.30, 141.27, 136.06, 131.16, 129.60, 128.93, 128.56, 127.85, 125.05, 122.76, 121.54, 109.28, 59.16, 39.54.

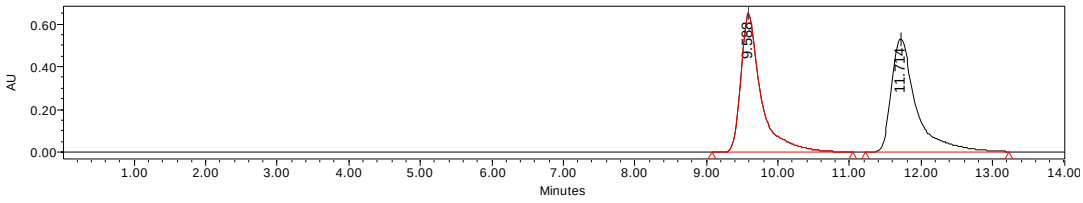
HRMS (ESI-TOF) calcd for $C_{21}H_{16}N_2O_3S$ ([M]+H^+) = 377.0960, Found 377.0953.

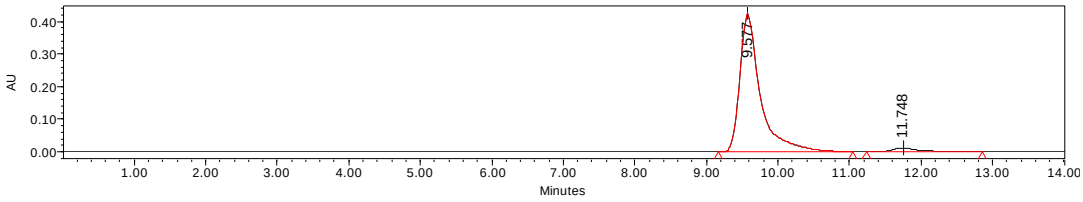
(*R*)-3-(3-nitrobenzyl)-3-(phenylthio)indolin-2-one (3k):



Prepared according to the general procedure (20 h). The tittle compound **3k** was obtained as a white solid in 94% yield.

HPLC (Chiralcel IA, hexane/ *i*-PrOH = 80/20, flow rate 1.0 mL/min, λ = 254 nm) t_r (major) = 9.58 min, t_r (minor) = 11.75 min, *ee* = 94%. $[\alpha]^{25}_D = -22.0$ (*c* = 0.66, in CH_2Cl_2).





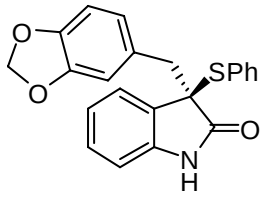
	Retention Time	Area	% Area
1	9.577	8471399	96.92
2	11.748	269448	3.08

^{1}H NMR (400 MHz, DMSO) δ = 10.26 (s, 1H), 8.02 – 7.86 (m, 1H), 7.79 (s, 1H), 7.52 (d, *J*=7.1, 1H), 7.44 – 7.30 (m, 3H), 7.29 – 7.18 (m, 4H), 7.09 – 6.94 (m,, 2H), 6.43 (d, *J*=7.5, 1H), 3.64 (d, *J*=13.0, 1H), 3.43 (d, *J*=13.0, 1H).

^{13}C NMR (101 MHz, DMSO) δ = 175.91, 147.03, 141.31, 137.46, 136.82, 136.04, 129.62, 129.27, 129.03, 129.00, 128.63, 127.90, 125.13, 124.43, 121.81, 121.58, 109.32, 59.29, 39.38.

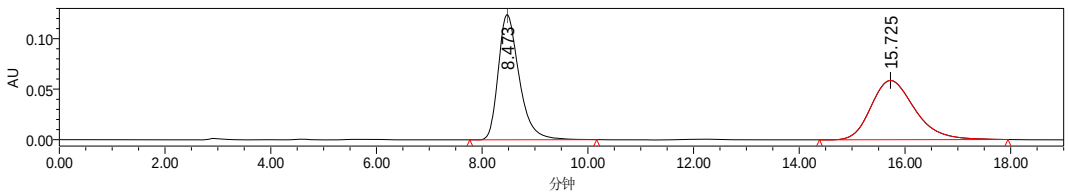
HRMS (ESI-TOF) calcd for $C_{21}H_{16}N_2O_3S$ ([M]+Na^+) = 399.0779, Found 399.0775.

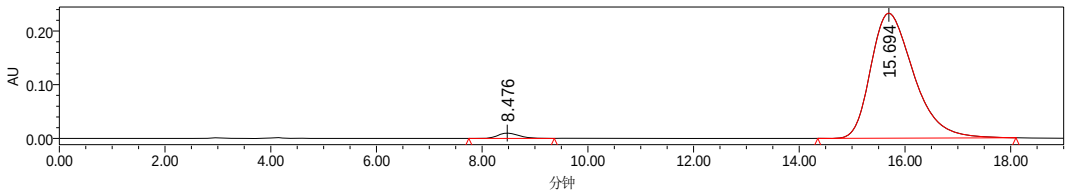
(*R*)-3-(benzo[d][1,3]dioxol-5-ylmethyl)-3-(phenylthio)indolin-2-one (3l):



Prepared according to the general procedure (20 h). The tittle compound **3l** was obtained as a white solid in 94% yield.

HPLC (Chiralcel OD-H, hexane/ *i*-PrOH = 90/10, flow rate 1.0 mL/min, λ = 254 nm) t_r (major) = 15.69 min, t_r (minor) = 8.48 min, *ee* = 96%. $[\alpha]^{25}_D = -58.9$ (*c* = 0.83, in CH_2Cl_2).





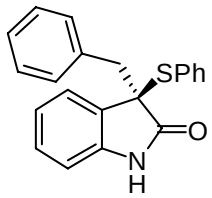
	Retention Time	Area	% Area
1	8.476	272783	2.04
2	15.694	13068656	97.96

^{1}H NMR (400 MHz, $CDCl_3$) δ = 8.33 (s, 1H), 7.41 – 7.31 (m, 1H), 7.28 – 7.18 (m, 3H), 7.17 – 6.99 (m, 4H), 6.57 – 6.51 (m, 1H), 6.50 – 6.37 (m, 3H), 5.78 (d, *J*=1.4, 1H), 5.74 (d, *J*=1.4, 1H), 3.38 (d, *J*=13.4, 1H), 3.30 (d, *J*=13.4, 1H).

^{13}C NMR (101 MHz, $CDCl_3$) δ = 178.07, 147.01, 146.34, 140.42, 136.57, 129.55, 129.33, 129.25, 128.75, 128.49, 128.47, 125.16, 123.51, 122.39, 110.48, 109.87, 107.79, 100.75, 60.37, 40.79.

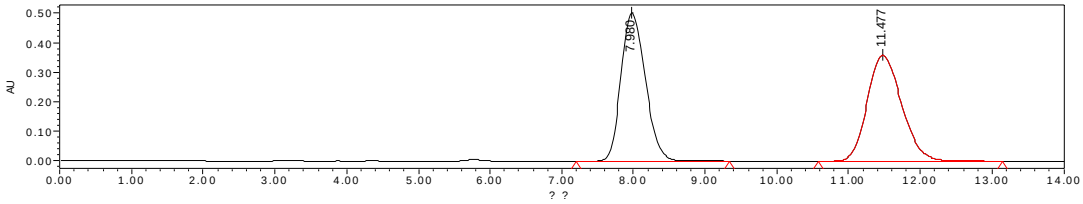
HRMS (ESI-TOF) calcd for $C_{22}H_{17}NO_3S$ ([M]+Na^+) = 398.0827, Found 398.0828.

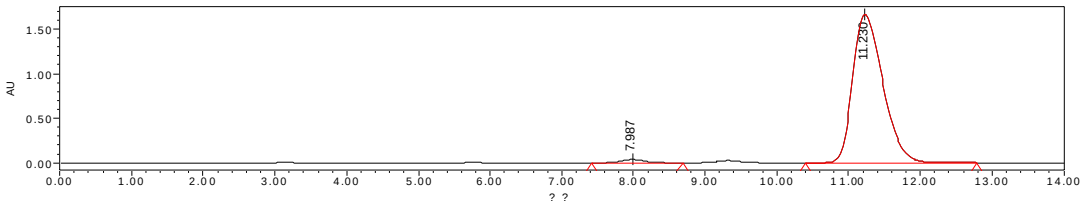
(*R*)-3-benzyl-3-(phenylthio)indolin-2-one (3m):



Prepared according to the general procedure (12 h). The tittle compound **3m** was obtained as a white solid in 96% yield.

HPLC (Chiralcel OD-H, hexane/ *i*-PrOH = 95/5, flow rate 1.0 mL/min, λ = 254 nm) t_r (major) = 11.23 min, t_r (minor) = 7.99 min, *ee* = 97%. $[\alpha]^{25}_D$ = −56.2 (*c* = 0.61, in CH_2Cl_2).





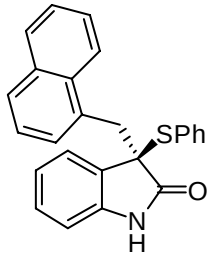
	Retention Time	Area	% Area
1	7.987	739117	1.50
2	11.230	48421915	98.50

^{1}H NMR (400 MHz, DMSO) δ = 10.14 (s, 1H), 7.42 (d, *J*=7.2, 1H), 7.36 – 7.29 (m, 1H), 7.29 – 7.15 (m, 4H), 7.08 – 6.88 (m, 7H), 6.42 (d, *J*=7.6, 1H), 3.41 (d, *J*=13.0, 1H), 3.31 (d, *J*=13.0, 1H).

^{13}C NMR (101 MHz, DMSO) δ = 176.02, 141.40, 135.90, 135.13, 129.81, 129.38, 129.28, 128.56, 128.50, 128.46, 127.64, 126.53, 124.94, 121.26, 109.05, 59.51, 40.11.

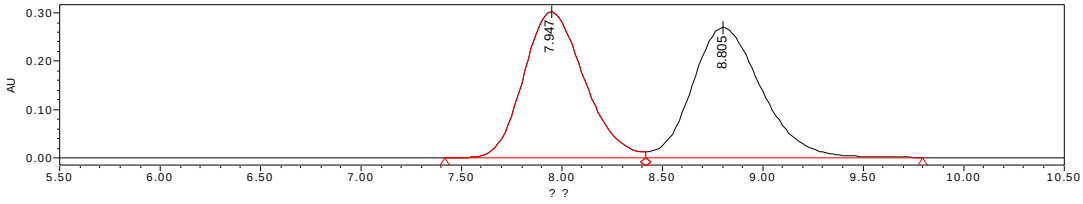
HRMS (ESI-TOF) calcd for $C_{21}H_{17}NOS$ ([M]+Na^+) = 354.0929, Found 354.0922.

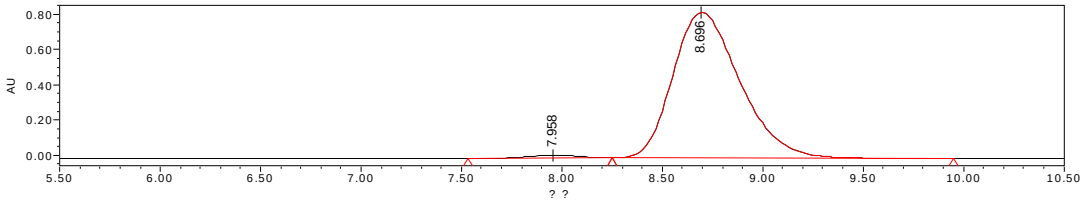
(*R*)-3-(naphthalen-1-ylmethyl)-3-(phenylthio)indolin-2-one (3n):



Prepared according to the general procedure (12 h). The tittle compound **3n** was obtained as a white solid in 98% yield.

HPLC (Chiralcel OD-H, hexane/ *i*-PrOH = 90/10, flow rate 1.0 mL/min, λ = 254 nm) t_r (major) = 8.70 min, t_r (minor) = 7.96 min, *ee* = 97%. $[\alpha]^{25}_D$ = −21.5 (*c* = 0.69, in CH_2Cl_2).





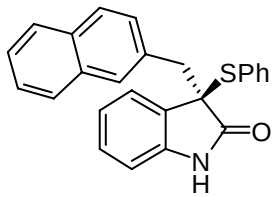
	Retention Time	Area	% Area
1	7.958	300562	1.54
2	8.696	19179609	98.46

^{1}H NMR (400 MHz, DMSO) δ = 10.14 (d, *J*=47.6, 1H), 8.19 (d, *J*=8.2, 1H), 7.79 (d, *J*=7.6, 1H), 7.68 (d, *J*=8.1, 1H), 7.51 – 7.40 (m, 2H), 7.40 – 7.30 (m, 2H), 7.30 – 7.20 (m, 5H), 7.13 (d, *J*=7.1, 1H), 6.96 (t, *J*=7.6, 1H), 6.83 (t, *J*=7.6, 1H), 6.40 (d, *J*=7.6, 1H), 3.94 (d, *J*=14.1, 1H), 3.83 (d, *J*=14.1, 1H).

^{13}C NMR (101 MHz, DMSO) δ = 176.43, 141.48, 136.04, 133.15, 131.74, 131.71, 129.52, 129.48, 128.70, 128.62, 128.54, 128.18, 127.95, 127.41, 125.52, 125.41, 124.82, 124.49, 121.13, 109.10, 59.82, 35.70.

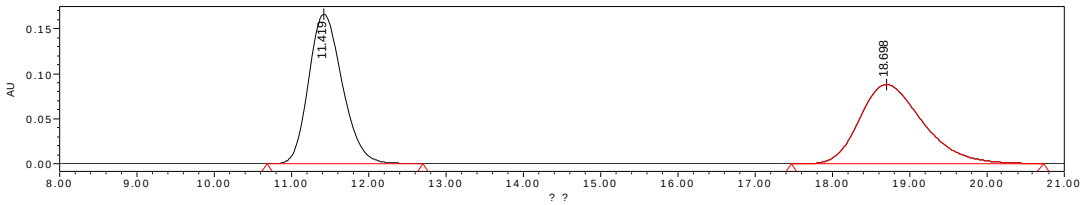
HRMS (ESI-TOF) calcd for $C_{25}H_{19}NOS$ ($[M+Na^+]$) = 404.1085, Found 404.1079.

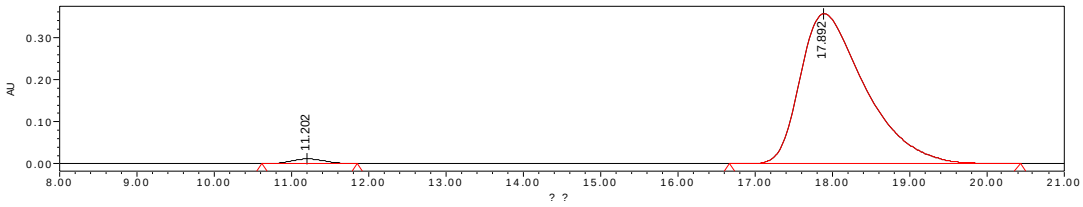
(*R*)-3-(naphthalen-2-ylmethyl)-3-(phenylthio)indolin-2-one (3o):



Prepared according to the general procedure (12 h). The tittle compound **3o** was obtained as a white solid in 95% yield.

HPLC (Chiralcel OD-H, hexane/ *i*-PrOH = 90/10, flow rate 1.0 mL/min, λ = 254 nm) t_r (major) = 17.89 min, t_r (minor) = 11.20 min, *ee* = 97%. $[\alpha]^{25}_D$ = −65.2 (*c* = 0.66, in CH_2Cl_2).





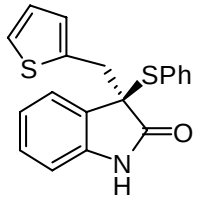
	Retention Time	Area	% Area
1	11.202	358923	1.70
2	17.892	20814402	98.30

^{1}H NMR (400 MHz, DMSO) δ = 10.16 (s, 1H), 7.79 – 7.71 (m, 1H), 7.71 – 7.63 (m, 1H), 7.60 (d, *J*=8.5, 1H), 7.55 – 7.45 (m, 2H), 7.44 – 7.37 (m, 2H), 7.34 (t, *J*=7.0, 1H), 7.31 – 7.20 (m, 4H), 7.11 – 6.93 (m, 3H), 6.43 – 6.33 (m, 1H), 3.60 (d, *J*=13.0, 1H), 3.49 (d, *J*=13.0, 1H).

^{13}C NMR (101 MHz, DMSO) δ = 176.17, 141.46, 136.06, 132.95, 132.48, 131.68, 129.51, 129.38, 128.71, 128.63, 128.58, 128.55, 128.15, 127.38, 127.30, 127.00, 125.94, 125.67, 125.14, 121.38, 109.16, 59.58, 40.38.

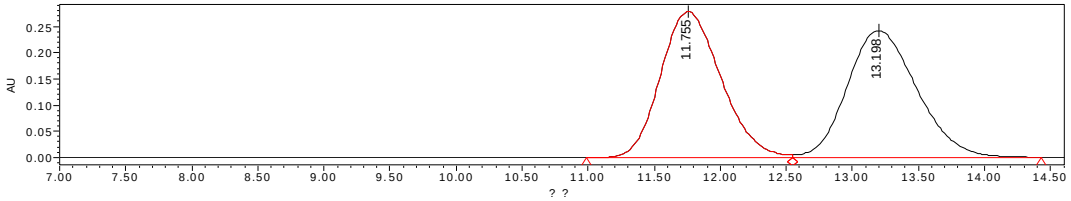
HRMS (ESI-TOF) calcd for $C_{25}H_{19}NOS$ ([M]+Na^+) = 404.1085, Found 404.1077.

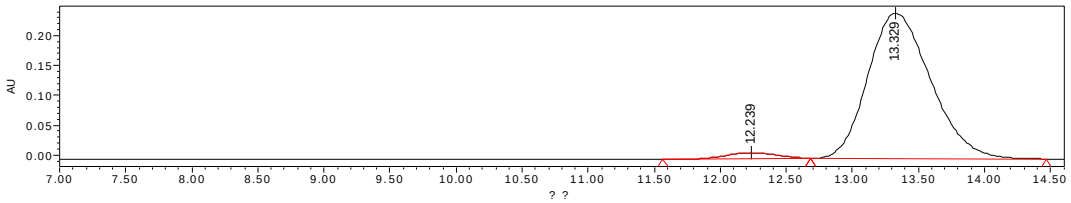
(*R*)-3-(phenylthio)-3-(thiophen-2-ylmethyl)indolin-2-one (3p):



Prepared according to the general procedure (20 h). The tittle compound **3p** was obtained as a white solid in 85% yield.

HPLC (Chiralcel OD-H, hexane/ *i*-PrOH = 95/5, flow rate 1.0 mL/min, λ = 254 nm) t_r (major) = 13.33 min, t_r (minor) = 12.24 min, *ee* = 94%. $[\alpha]^{25}_D$ = −26.1 (*c* = 0.54, in CH_2Cl_2).





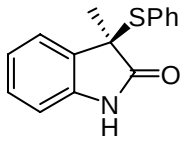
	Retention Time	Area	% Area
1	12.239	259564	3.13
2	13.329	8037386	96.87

^{1}H NMR (400 MHz, DMSO) δ = 10.25 (s, 1H), 7.40 – 7.32 (m, 2H), 7.30 – 7.21 (m, 4H), 7.17 (d, *J*=5.1, 1H), 7.10 (t, *J*=7.6, 1H), 6.99 (t, *J*=7.5, 1H), 6.78 – 6.71 (m, 1H), 6.61 (d, *J*=3.2, 1H), 6.52 (d, *J*=7.6, 1H), 3.65 (d, *J*=14.2, 1H), 3.50 (d, *J*=14.2, 1H).

^{13}C NMR (101 MHz, DMSO) δ = 175.97, 141.91, 136.66, 136.19, 129.62, 129.09, 129.02, 128.61, 128.47, 127.29, 126.28, 125.26, 124.78, 121.51, 109.32, 58.69, 34.64.

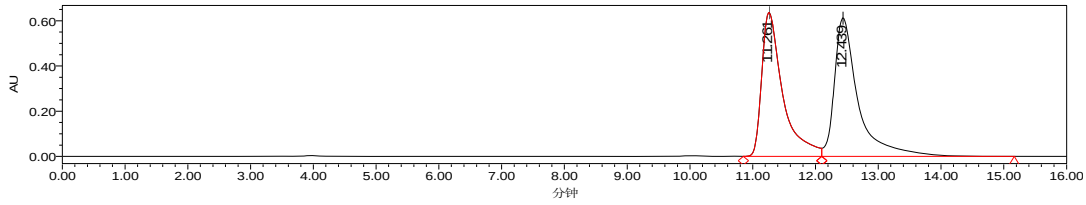
HRMS (ESI-TOF) calcd for $C_{19}H_{15}NOS_2$ ([M]+Na^+) = 360.0493, Found 360.0483.

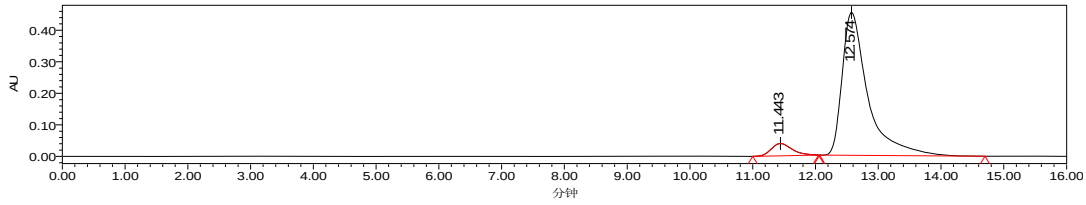
(*R*)-3-methyl-3-(phenylthio)indolin-2-one (3q):



Prepared according to the general procedure (48 h). The tittle compound **3q** was obtained as a white solid in 83% yield.

HPLC (Chiralcel IA, hexane/ *i*-PrOH = 95/5, flow rate 1.0 mL/min, λ = 254 nm) t_r (major) = 12.57 min, t_r (minor) = 11.44 min, *ee* = 87%. $[\alpha]^{25}_D$ = −7.7 (*c* = 0.72, in CH_2Cl_2).





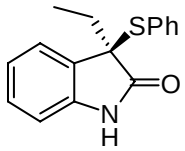
	Retention Time	Area	% Area
1	11.443	897127	6.51
2	12.574	12878628	93.49

^{1}H NMR (400 MHz, $CDCl_3$) δ = 8.85 (s, 1H), 7.35 (d, *J*=7.3, 1H), 7.22 (d, *J*=7.3, 3H), 7.15 (t, *J*=7.6, 1H), 7.12 – 7.02 (m, 3H), 6.71 (d, *J*=7.6, 1H), 1.71 (s, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ = 179.75, 139.94, 136.30, 131.96, 129.83, 129.48, 128.74, 128.40, 124.21, 122.70, 109.96, 55.19, 21.50.

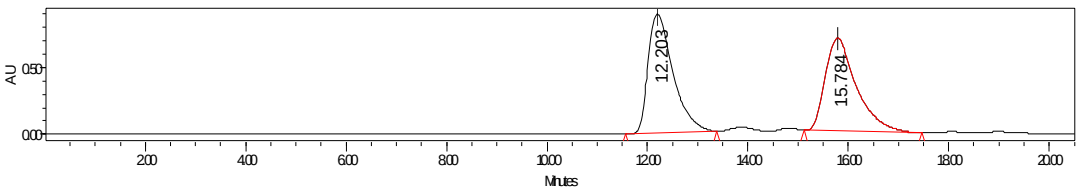
HRMS (ESI-TOF) calcd for $C_{15}H_{13}NOS$ ([M]+Na^+) = 278.0616, Found 278.0613.

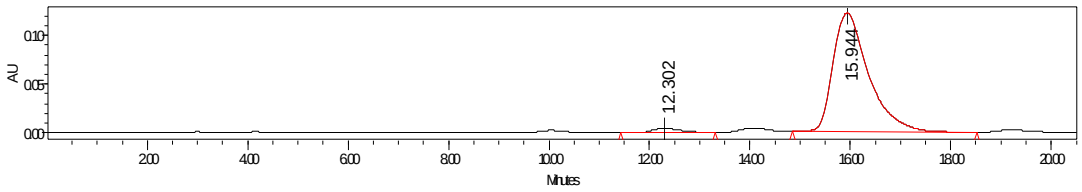
(R)-3-ethyl-3-(phenylthio)indolin-2-one (3r):



Prepared according to the general procedure (48 h). The tittle compound **3r** was obtained as a white solid in 82% yield.

HPLC (Chiralcel AD-H, hexane/ *i*-PrOH = 95/5, flow rate 1.0 mL/min, λ = 254 nm) t_r (major) = 15.94 min, t_r (minor) = 12.30 min, *ee* = 95%. $[\alpha]^{25}_D$ = 1.1 (*c* = 0.28, in CH_2Cl_2).





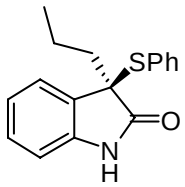
	Retention Time	Area	% Area
1	12.302	170236	2.74
2	15.944	6053346	97.26

^{1}H NMR (400 MHz, $CDCl_3$) δ = 8.95 (s, 1H), 7.32 (d, *J*=7.3, 1H), 7.26 – 7.18 (m, 3H), 7.15 (t, *J*=7.6, 1H), 7.10 – 7.02 (m, 3H), 6.71 (d, *J*=7.6, 1H), 2.28 – 2.07 (m, 2H), 0.76 (t, *J*=7.3, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ = 179.12, 140.80, 136.43, 129.84, 129.50, 129.38, 128.66, 128.34, 124.51, 122.62, 109.91, 60.25, 28.62, 9.34.

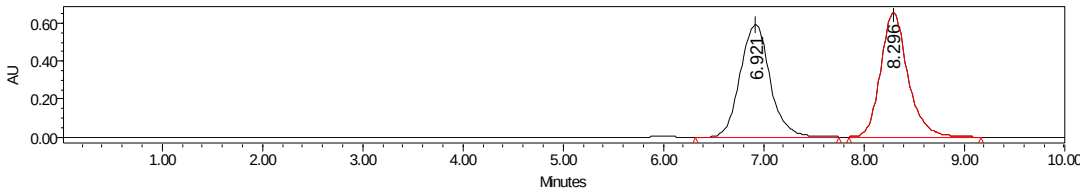
HRMS (ESI-TOF) calcd for $C_{16}H_{15}NOS$ ([M]+Na^+) = 292.0772, Found 292.0764.

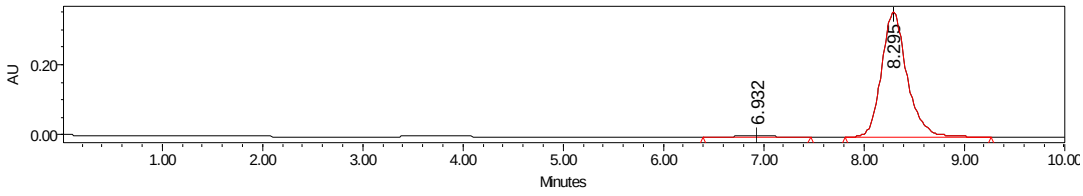
(*R*)-3-(phenylthio)-3-propylindolin-2-one (3s):



Prepared according to the general procedure (48 h). The tittle compound **3s** was obtained as a white solid in 85% yield.

HPLC (Chiralcel IC, hexane/ *i*-PrOH = 90/10, flow rate 1.0 mL/min, λ = 254 nm) t_r (major) = 8.30 min, t_r (minor) = 6.93 min, *ee* = 97%. $[\alpha]^{25}_D$ = 1.4 (*c* = 0.50, in CH_2Cl_2).





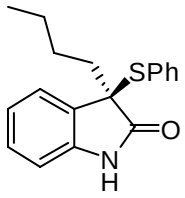
	Retention Time	Area	% Area
1	6.932	85343	1.34
2	8.295	6263867	98.66

^{1}H NMR (400 MHz, $CDCl_3$) δ = 8.88 (s, 1H), 7.33 (d, *J*=7.2, 1H), 7.21 (d, *J*=7.2, 3H), 7.14 (t, *J*=7.6, 1H), 7.07 (t, *J*=7.2, 3H), 6.70 (d, *J*=7.6, 1H), 2.22 – 1.99 (m, 2H), 1.27 – 0.98 (m, 2H), 0.84 (t, *J*=7.2, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ = 179.20, 140.61, 136.43, 130.27, 129.45, 129.38, 128.60, 128.33, 124.49, 122.59, 109.87, 59.60, 37.44, 18.38, 14.07.

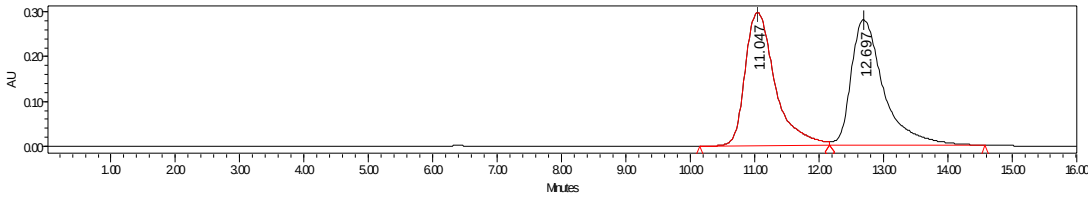
HRMS (ESI-TOF) calcd for $C_{17}H_{17}NOS$ ([M]+Na^+) = 306.0929, Found 306.0922.

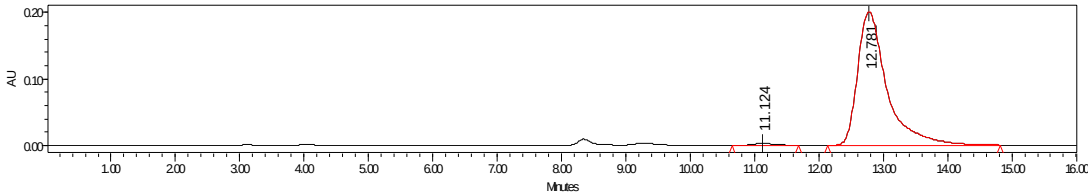
(*R*)-3-butyl-3-(phenylthio)indolin-2-one (3t):



Prepared according to the general procedure (48 h). The tittle compound **3t** was obtained as a white solid in 89% yield.

HPLC (Chiralcel IA, hexane/ *i*-PrOH = 95/5, flow rate 1.0 mL/min, λ = 254 nm) t_r (major) = 12.78 min, t_r (minor) = 11.12 min, *ee* = 98%. $[\alpha]^{25}_D$ = −3.7 (*c* = 0.53, in CH_2Cl_2).





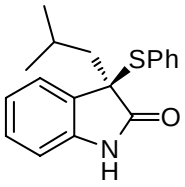
	Retention Time	Area	% Area
1	11.124	57596	0.90
2	12.781	6317443	99.10

^{1}H NMR (400 MHz, $CDCl_3$) δ = 8.64 (s, 1H), 7.33 (d, *J*=7.4, 1H), 7.20 (d, *J*=7.2, 3H), 7.14 (t, *J*=7.6, 1H), 7.07 (t, *J*=7.4, 3H), 6.68 (d, *J*=7.6, 1H), 2.25 – 2.00 (m, 2H), 1.35 – 1.19 (m, 2H), 1.18 – 0.94 (m, 2H), 0.80 (t, *J*=7.2, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ = 179.02, 140.55, 136.43, 130.29, 129.47, 129.38, 128.58, 128.32, 124.50, 122.61, 109.79, 59.58, 35.10, 26.97, 22.71, 13.77.

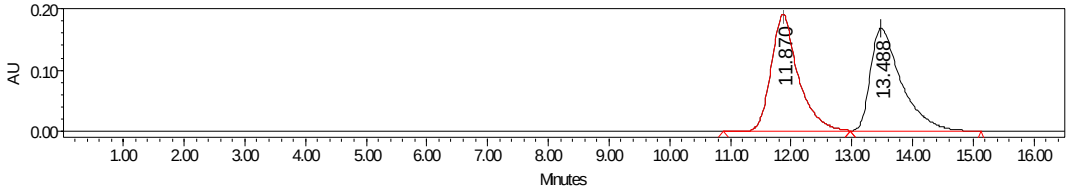
HRMS (ESI-TOF) calcd for $C_{18}H_{19}NOS$ ([M]+Na^+) = 320.1085, Found 320.1085.

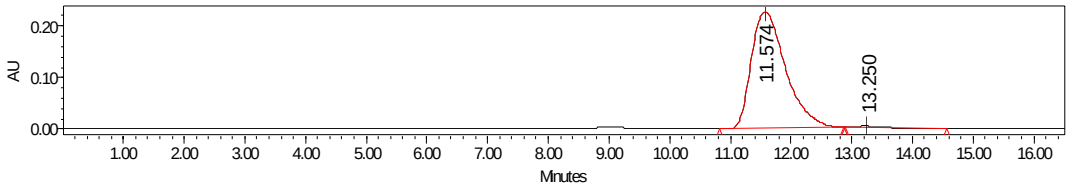
(*R*)-3-isobutyl-3-(phenylthio)indolin-2-one (3u):



Prepared according to the general procedure (48 h). The tittle compound **3u** was obtained as a white solid in 91% yield.

HPLC (Chiralcel AD-H, hexane/ *i*-PrOH = 95/5, flow rate 1.0 mL/min, λ = 254 nm) t_r (major) = 11.57 min, t_r (minor) = 13.25 min, *ee* = 98%. $[\alpha]^{25}_D$ = −27.7 (*c* = 0.74, in CH_2Cl_2).





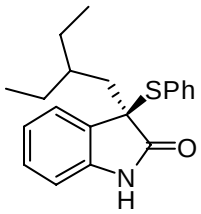
	Retention Time	Area	% Area
1	11.574	8881129	98.95
2	13.250	93940	1.05

^{1}H NMR (400 MHz, $CDCl_3$) δ = 8.60 (s, 1H), 7.31 (d, *J*=7.3, 1H), 7.22 (t, *J*=7.3, 1H), 7.17 (d, *J*=7.3, 2H), 7.13 (d, *J*=7.7, 1H), 7.11 – 7.02 (m, 3H), 6.67 (d, *J*=7.6, 1H), 2.24 – 2.08 (m, 2H), 1.60 – 1.44 (m, 1H), 0.72 (d, *J*=6.6, 6H).

^{13}C NMR (101 MHz, $CDCl_3$) δ = 179.15, 140.43, 136.62, 130.15, 129.53, 129.31, 128.55, 128.29, 124.87, 122.47, 109.85, 59.21, 43.09, 26.23, 23.93, 22.69.

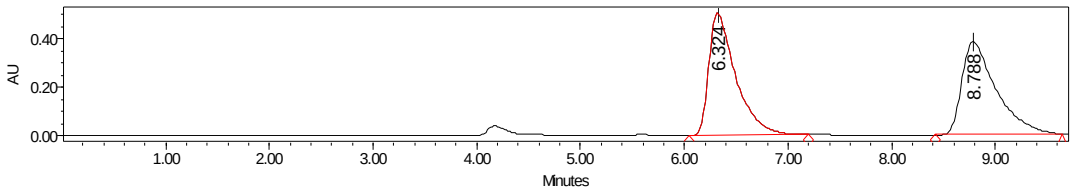
HRMS (ESI-TOF) calcd for $C_{18}H_{19}NOS$ ([M]+Na^+) = 320.1085, Found 320.1087.

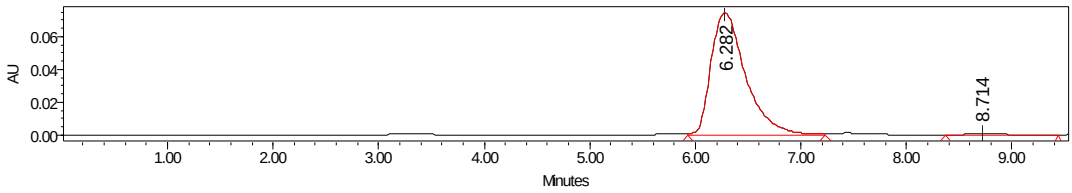
(*R*)-3-(2-ethylbutyl)-3-(phenylthio)indolin-2-one (3v):



Prepared according to the general procedure (48 h). The tittle compound **3v** was obtained as a white solid in 90% yield.

HPLC (Chiralcel AD-H, hexane/ *i*-PrOH = 90/10, flow rate 1.0 mL/min, λ = 254 nm) t_r (major) = 6.28 min, t_r (minor) = 8.71 min, *ee* = 98%. $[\alpha]^{25}_D$ = −23.0 (*c* = 0.64, in CH_2Cl_2).





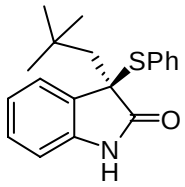
	Retention Time	Area	% Area
1	6.282	1701784	99.18
2	8.714	14031	0.82

^{1}H NMR (400 MHz, $CDCl_3$) δ = 8.75 (s, 1H), 7.31 (d, *J*=7.3, 1H), 7.21 (t, *J*=7.3, 1H), 7.16 (d, *J*=7.8, 2H), 7.12 (d, *J*=7.6, 1H), 7.07 (d, *J*=6.8, 3H), 6.64 (d, *J*=7.6, 1H), 2.24 – 2.08 (m, 2H), 1.24 – 1.02 (m, 5H), 0.78 – 0.58 (m, 6H).

^{13}C NMR (101 MHz, $CDCl_3$) δ = 179.31, 140.51, 136.47, 130.20, 129.45, 129.42, 128.51, 128.27, 124.94, 122.39, 109.83, 59.67, 37.83, 37.58, 25.76, 25.13, 10.38, 9.87.

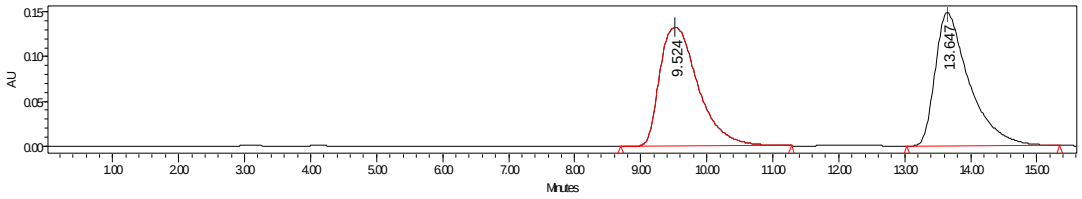
HRMS (ESI-TOF) calcd for $C_{20}H_{23}NOS$ ([M]+Na^+) = 348.1398, Found 348.1396.

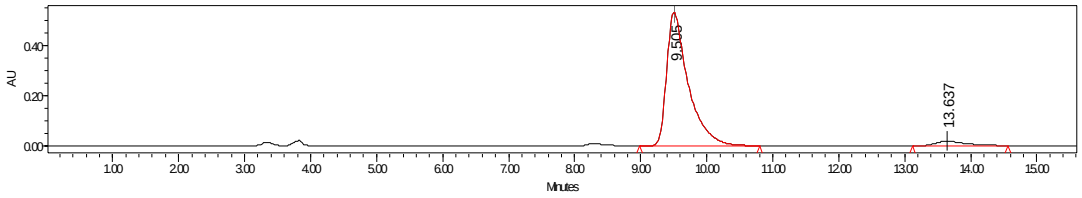
(*R*)-3-neopentyl-3-(phenylthio)indolin-2-one (3w):



Prepared according to the general procedure (48 h). The tittle compound **3w** was obtained as a white solid in 90% yield.

HPLC (Chiralcel AD-H, hexane/ *i*-PrOH = 95/5, flow rate 1.0 mL/min, λ = 254 nm) t_r (major) = 9.51 min, t_r (minor) = 13.64 min, *ee* = 91%. $[\alpha]^{25}_D = -18.1$ (*c* = 0.56, in CH_2Cl_2).





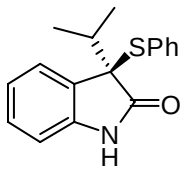
	Retention Time	Area	% Area
1	9.505	12043888	95.63
2	13.637	550802	4.37

^{1}H NMR (400 MHz, $CDCl_3$) δ = 8.47 (s, 1H), 7.36 (d, *J*=7.4, 1H), 7.23 (t, *J*=7.0, 1H), 7.16 – 6.96 (m, 6H), 6.63 (d, *J*=7.7, 1H), 2.42 (d, *J*=14.2, 1H), 2.23 (d, *J*=14.2, 1H), 0.74 (s, 9H).

^{13}C NMR (101 MHz, $CDCl_3$) δ = 178.99, 140.09, 136.77, 130.04, 129.62, 129.04, 128.48, 128.23, 126.18, 122.06, 109.81, 59.16, 46.88, 32.74, 30.98..

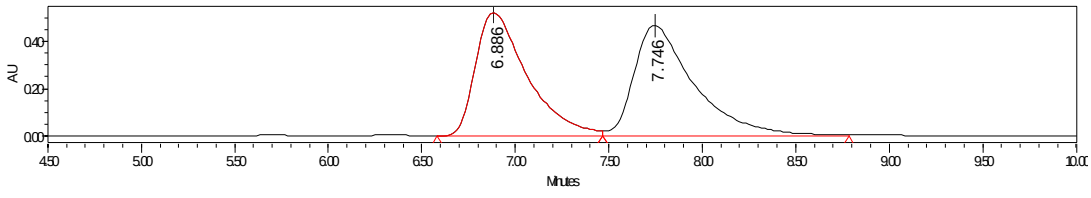
HRMS (ESI-TOF) calcd for $C_{19}H_{21}NOS$ ([M]+Na^+) = 334.1242, Found 334.1240.

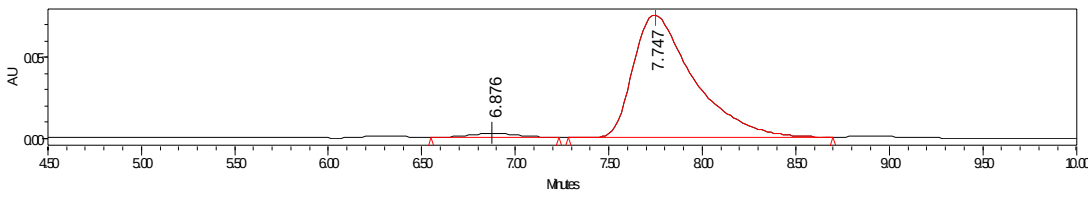
(R)-3-isopropyl-3-(phenylthio)indolin-2-one (3x):



Prepared according to the general procedure (48 h). The tittle compound **3x** was obtained as a white solid in 92% yield.

HPLC (Chiralcel AD-H, hexane/ *i*-PrOH = 90/10, flow rate 1.0 mL/min, λ = 254 nm) t_r (major) = 7.75 min, t_r (minor) = 6.88 min, *ee* = 95%. $[\alpha]^{25}_D = 40.3$ (*c* = 0.26, in CH_2Cl_2).





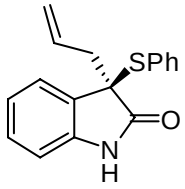
	Retention Time	Area	% Area
1	6.876	47116	2.71
2	7.747	1692013	97.29

^{1}H NMR (400 MHz, $CDCl_3$) δ = 8.86 (s, 1H), 7.43 (d, *J*=7.4, 1H), 7.25 – 7.09 (m, 4H), 7.09 – 6.96 (m, 3H), 6.67 (d, *J*=7.6, 1H), 2.48 (dt, *J*=13.5, 6.7, 1H), 1.28 (d, *J*=6.7, 3H), 0.87 (d, *J*=6.7, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ = 179.20, 140.84, 136.32, 129.65, 129.19, 128.53, 128.27, 125.57, 122.33, 109.76, 64.29, 34.02, 18.12, 17.78.

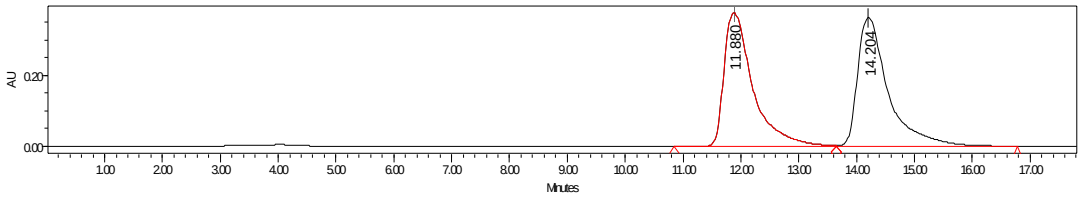
HRMS (ESI-TOF) calcd for $C_{17}H_{17}NOS$ ([M]+Na^+) = 306.0929, Found 306.0927.

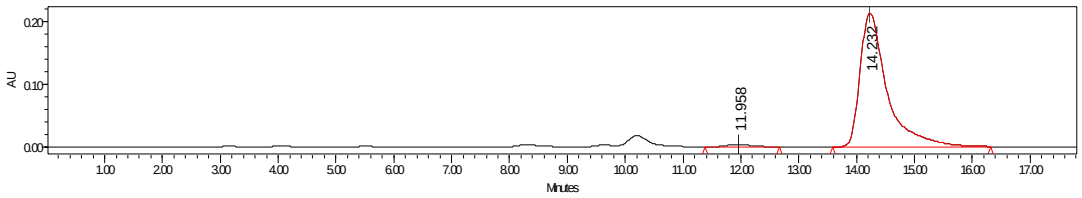
(*R*)-3-allyl-3-(phenylthio)indolin-2-one (3y):



Prepared according to the general procedure (48 h). The tittle compound **3y** was obtained as a white solid in 85% yield.

HPLC (Chiralcel IA, hexane/ *i*-PrOH = 95/5, flow rate 1.0 mL/min, λ = 254 nm) t_r (major) = 14.23 min, t_r (minor) = 11.96 min, *ee* = 95%. $[\alpha]^{25}_D$ = −26.9 (*c* = 0.45, in CH_2Cl_2).





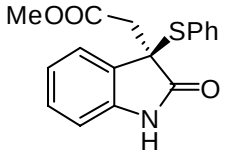
	Retention Time	Area	% Area
1	11.958	102136	1.45
2	14.232	6918870	98.55

^{1}H NMR (400 MHz, $CDCl_3$) δ = 8.76 (s, 1H), 7.35 (d, *J*=7.3, 1H), 7.28 – 7.18 (m, 3H), 7.14 (t, *J*=7.6, 1H), 7.11 – 7.00 (m, 3H), 6.69 (d, *J*=7.6, 1H), 5.60 – 5.42 (m, 1H), 5.07 (d, *J*=17.0, 1H), 4.96 (d, *J*=10.1, 1H), 2.86 (d, *J*=7.1, 2H).

^{13}C NMR (101 MHz, $CDCl_3$) δ = 178.50, 140.46, 136.49, 131.18, 129.74, 129.48, 129.27, 128.76, 128.42, 124.80, 122.57, 119.81, 109.87, 58.86, 39.62.

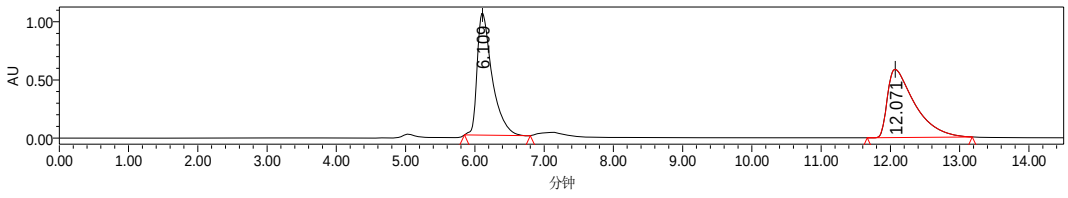
HRMS (ESI-TOF) calcd for $C_{17}H_{15}NOS$ ([M]+Na^+) = 304.0772, Found 304.0777.

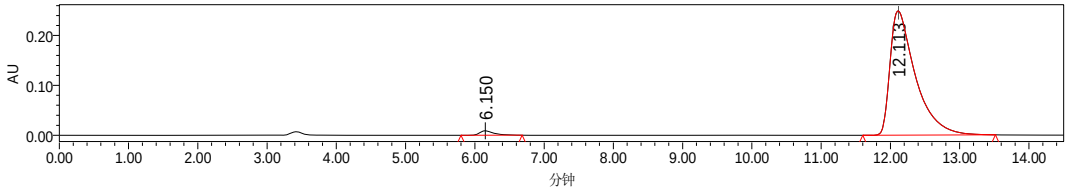
(*R*)-methyl 2-(2-oxo-3-(phenylthio)indolin-3-yl)acetate (3z):



Prepared according to the general procedure (20 h). The tittle compound **3z** was obtained as a white solid in 98% yield.

HPLC (Chiralcel IB, hexane/ *i*-PrOH = 80/20, flow rate 1.0 mL/min, λ = 254 nm) t_r (major) = 12.11 min, t_r (minor) = 6.15 min, *ee* = 96%. $[\alpha]^{25}_D$ = −69.0 (*c* = 0.54, in CH_2Cl_2).





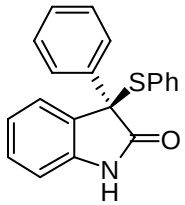
	Retention Time	Area	% Area
1	6.150	122296	1.90
2	12.113	6321193	98.10

^{1}H NMR (400 MHz, $CDCl_3$) δ = 8.54 (s, 1H), 7.38 – 7.28 (m, 3H), 7.25 – 7.12 (m, 4H), 7.02 (t, *J*=7.5, 1H), 6.71 (d, *J*=7.7, 1H), 3.46 (s, 3H), 3.33 (d, *J*=16.7, 1H), 3.22 (d, *J*=16.7, 1H).

^{13}C NMR (101 MHz, $CDCl_3$) δ = 177.81, 169.29, 140.94, 137.24, 130.08, 129.14, 129.02, 128.58, 128.28, 123.74, 122.46, 110.01, 54.82, 51.98, 39.25.

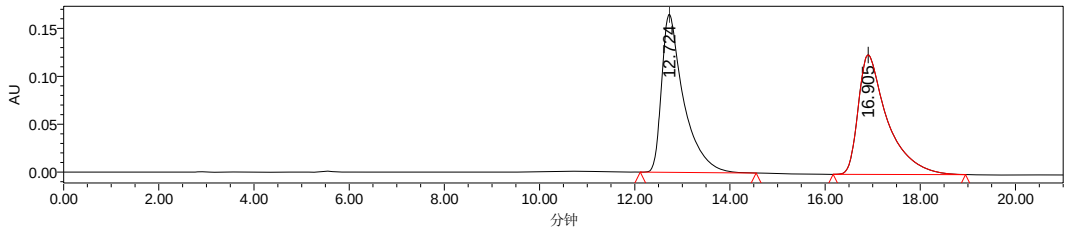
HRMS (ESI-TOF) calcd for $C_{17}H_{15}NO_3S$ ([M]+H^+) = 314.0851, Found 314.0851.

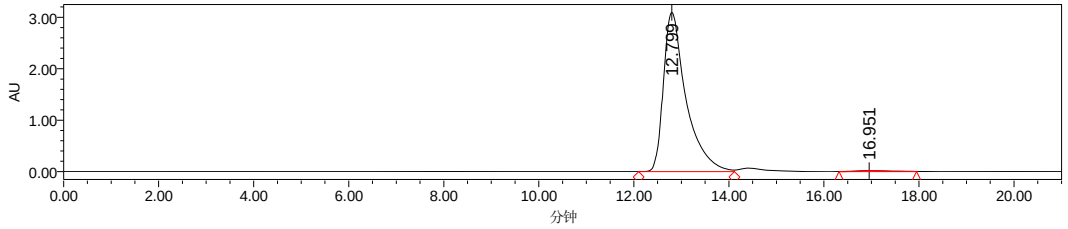
3-phenyl-3-(phenylthio)indolin-2-one (6a):



Prepared according to the general procedure (48 h). The tittle compound **6a** was obtained as a white solid in 95% yield.

HPLC (Chiralcel AD-H, hexane/ *i*-PrOH = 90/10, flow rate 1.0 mL/min, λ = 254 nm) t_r (major) = 12.80 min, t_r (minor) = 16.95 min, *ee* = 99%. $[\alpha]^{25}_D$ = −116.8 (*c* = 0.45, in CH_2Cl_2).





	Retention Time	Area	% Area
1	12.799	102021224	99.29

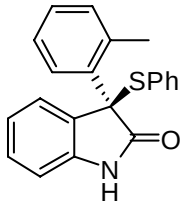
2	16.951	724468	0.71

^{1}H NMR (400 MHz, $CDCl_3$) δ = 8.53 (s, 1H), 7.70 (d, *J*=7.6, 2H), 7.45 – 7.30 (m, 4H), 7.24 – 7.13 (m,, 4H), 7.09 (t, *J*=7.6, 1H), 7.03 (t, *J*=7.6, 2H), 6.67 (d, *J*=7.6, 1H).

^{13}C NMR (101 MHz, $CDCl_3$) δ = 177.52, 140.20, 136.32, 136.06, 130.48, 129.88, 129.58, 128.89, 128.71, 128.41, 128.35, 128.09, 126.50, 122.71, 110.09, 63.00.

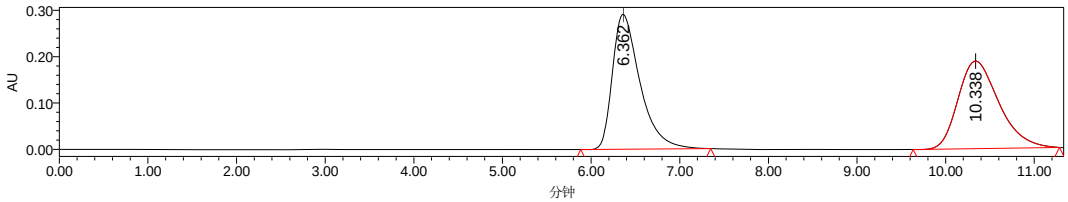
HRMS (ESI-TOF) calcd for $C_{20}H_{15}NOS$ ([M]+Na^+) = 340.0772, Found 340.0771.

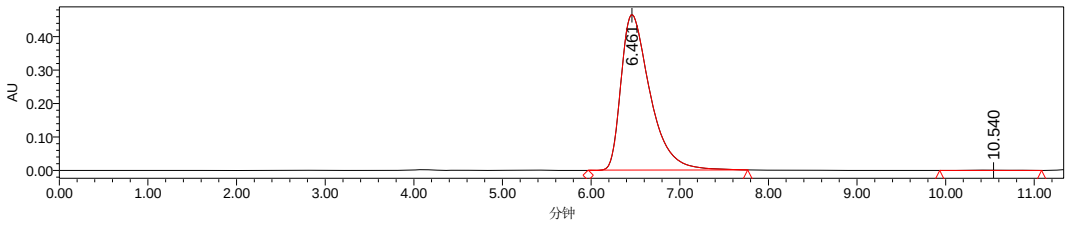
3-(phenylthio)-3-o-tolylindolin-2-one (6b):



Prepared according to the general procedure (72 h). The tittle compound **6b** was obtained as a white solid in 92% yield.

HPLC (Chiralcel OD-H, hexane/ *i*-PrOH = 90/10, flow rate 1.0 mL/min, λ = 254 nm) t_r (major) = 6.46 min, t_r (minor) = 10.54 min, *ee* = 99.5%. $[\alpha]^{25}_D$ = 32.7 (*c* = 0.66, in CH_2Cl_2).





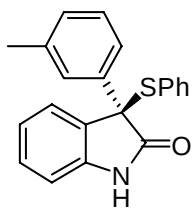
	Retention Time	Area	% Area
1	6.461	10646968	99.77
2	10.540	24798	0.23

^{1}H NMR (400 MHz, $CDCl_3$) δ = 8.57 (s, 1H), 8.27 (d, *J*=7.8, 1H), 7.38 (t, *J*=7.6, 1H), 7.31 – 7.22 (m, 2H), 7.19 (d, *J*=7.6, 2H), 7.05 – 7.15 (m, 4H), 7.03 – 6.93 (m, 2H), 6.56 (d, *J*=7.8, 1H), 1.83 (s, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ = 177.48, 140.05, 136.64, 136.60, 134.12, 131.94, 131.13, 129.58, 129.14, 129.05, 128.71, 128.43, 128.31, 126.15, 124.83, 123.02, 109.71, 63.81, 19.92.

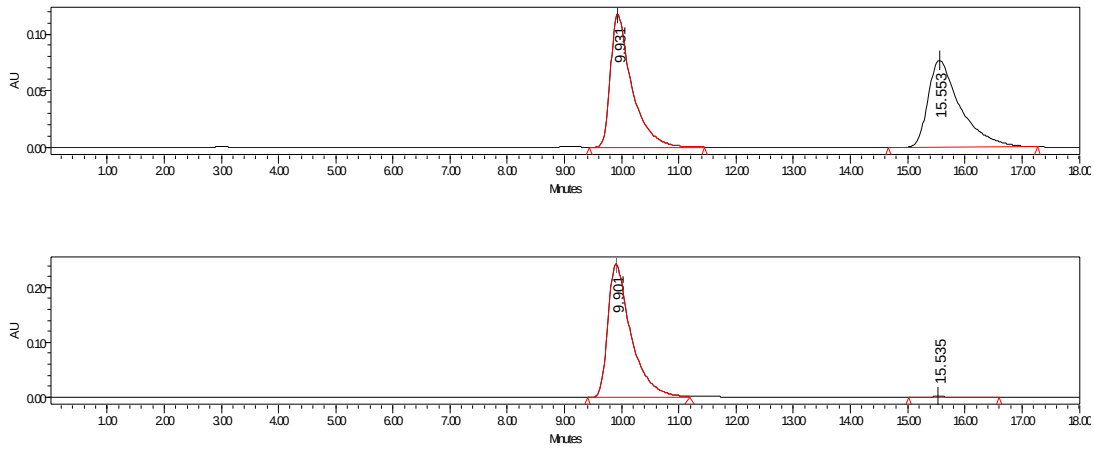
HRMS (ESI-TOF) calcd for $C_{21}H_{17}NOS$ ([M]+H^+) =332.1109, Found 332.1104.

3-(phenylthio)-3-m-tolylindolin-2-one (6c):



Prepared according to the general procedure (48 h). The tittle compound **6c** was obtained as a white solid in 93% yield.

HPLC (Chiralcel AD-H, hexane/ *i*-PrOH = 90/10, flow rate 1.0 mL/min, λ = 254 nm) t_r (major) = 9.90 min, t_r (minor) = 15.54 min, *ee* = 99%. $[\alpha]^{25}_D$ = −103.1 (*c* = 0.38, in CH_2Cl_2).



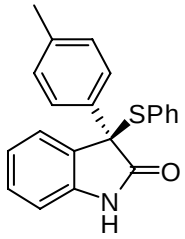
	Retention Time	Area	% Area
1	9.901	6816678	99.50
2	15.535	34120	0.50

^{1}H NMR (400 MHz, $CDCl_3$) δ = 8.60 (s, 1H), 7.52 (s, 1H), 7.46 (d, *J*=7.8, 1H), 7.40 (d, *J*=7.3, 1H), 7.26 (t, *J*=7.8, 1H), 7.22 – 7.12 (m, 5H), 7.09 (t, *J*=7.6, 1H), 7.02 (t, *J*=7.5, 2H), 6.67 (d, *J*=7.6, 1H), 2.36 (s, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ = 177.72, 140.22, 138.47, 136.31, 135.96, 130.71, 129.91, 129.54, 129.17, 128.81, 128.59, 128.38, 126.46, 125.07, 122.71, 110.07, 63.07, 21.63.

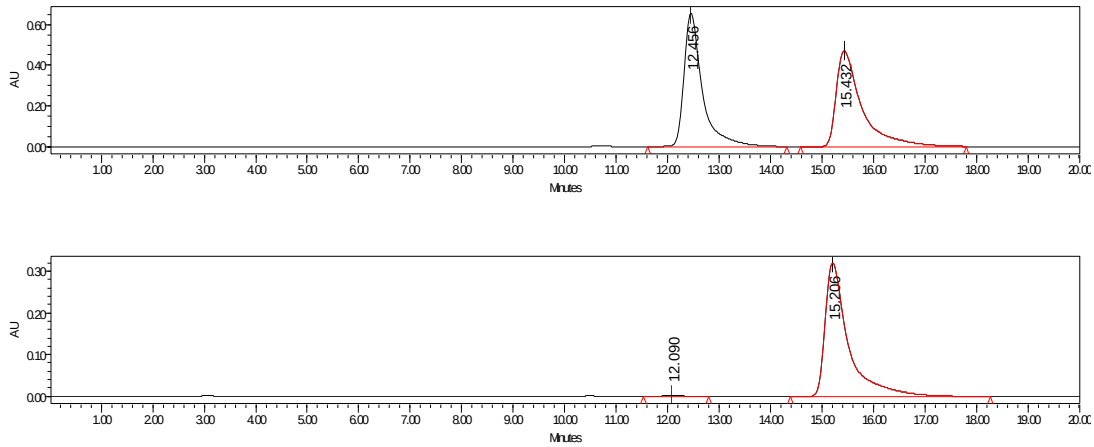
HRMS (ESI-TOF) calcd for $C_{21}H_{17}NOS$ ([M]+Na^+) =354.0929, Found 354.0928.

3-(phenylthio)-3-p-tolylindolin-2-one (6d)



Prepared according to the general procedure (48 h). The tittle compound **6d** was obtained as a white solid in 94% yield.

HPLC (Chiralcel IA, hexane/ *i*-PrOH = 90/10, flow rate 1.0 mL/min, λ = 254 nm) t_r (major) = 15.21 min, t_r (minor) = 12.09 min, *ee* = 99%. $[\alpha]^{25}_D$ = −114.3 (*c* = 0.54, in CH_2Cl_2).



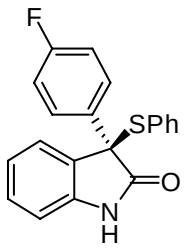
	Retention Time	Area	% Area
1	12.090	70241	0.70
2	15.206	9979659	99.30

^{1}H NMR (400 MHz, $CDCl_3$) δ = 8.64 (s, 1H), 7.58 (d, *J*=7.6, 2H), 7.38 (d, *J*=7.3, 1H), 7.23 – 7.12 (m, 6H), 7.08 (t, *J*=7.4, 1H), 7.02 (t, *J*=7.4, 2H), 6.66 (d, *J*=7.6, 1H), 2.34 (s, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ = 177.78, 140.25, 138.22, 136.28, 133.02, 130.63, 130.01, 129.51, 129.42, 128.79, 128.38, 127.95, 126.44, 122.65, 110.10, 62.86, 21.14.

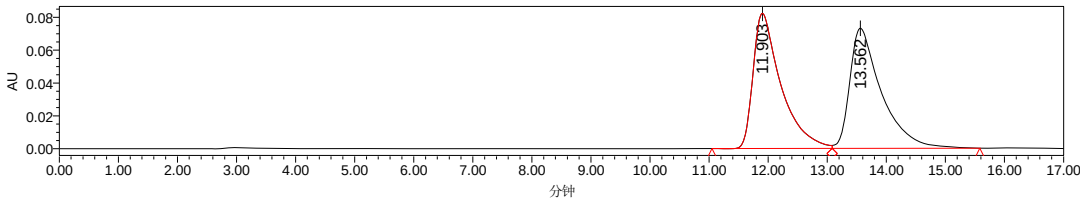
HRMS (ESI-TOF) calcd for $C_{21}H_{17}NOS$ ([M]+Na^+) =354.0929, Found 354.0931.

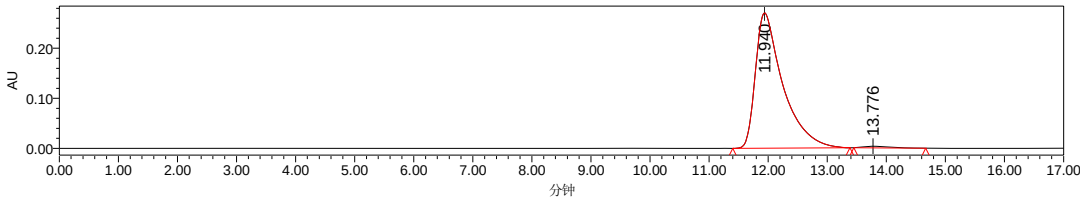
3-(4-fluorophenyl)-3-(phenylthio)indolin-2-one (6e):



Prepared according to the general procedure (48 h). The tittle compound **6e** was obtained as a white solid in 97% yield.

HPLC (Chiralcel AD-H, hexane/ *i*-PrOH = 90/10, flow rate 1.0 mL/min, λ = 254 nm) t_r (major) = 11.94 min, t_r (minor) = 13.78 min, *ee* = 98%. $[\alpha]^{25}_D$ = −126.4 (*c* = 0.60, in CH_2Cl_2).





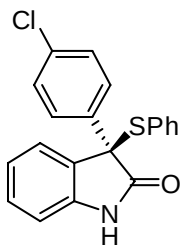
	Retention Time	Area	% Area
1	11.940	8690165	98.85
2	13.776	101528	1.15

^{1}H NMR (400 MHz, $CDCl_3$) δ = 8.39 (s, 1H), 7.70 (dd, *J*=8.2, 5.5, 2H), 7.37 (d, *J*=7.6, 1H), 7.19 (t, *J*=9.6, 4H), 7.14 – 6.99 (m, 5H), 6.68 (d, *J*=7.6, 1H).

^{13}C NMR (101 MHz, $CDCl_3$) δ = 177.23, 162.66 (d, *J*=248.3), 140.12, 136.33, 131.78, 130.13, 130.10, 130.05, 129.73, 129.70, 129.07, 128.46, 126.48, 122.81, 115.66, 115.45, 110.17, 62.22.

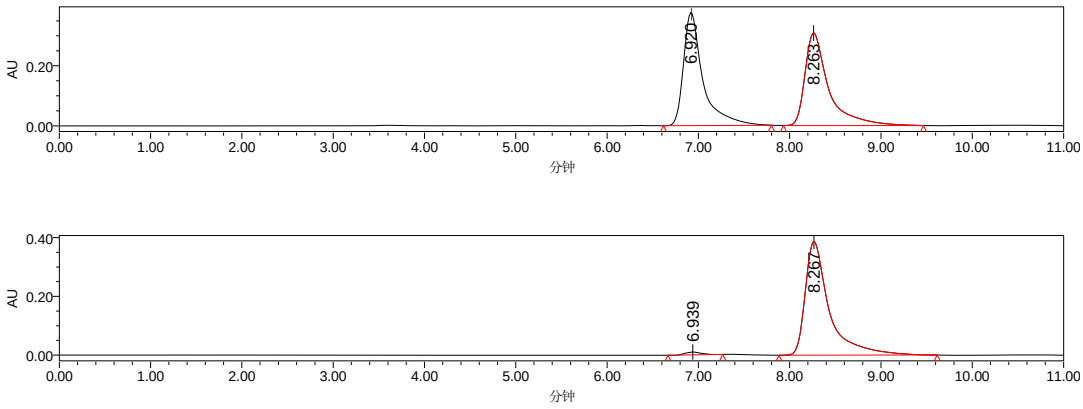
HRMS (ESI-TOF) calcd for $C_{20}H_{14}FNOS$ ([M]+Na^+) = 358.0678, Found 358.0674.

3-(4-chlorophenyl)-3-(phenylthio)indolin-2-one (6f):



Prepared according to the general procedure (48 h). The tittle compound **6f** was obtained as a white solid in 91% yield.

HPLC (Chiralcel IA, hexane/ *i*-PrOH = 80/20, flow rate 1.0 mL/min, λ = 254 nm) t_r (major) = 8.27 min, t_r (minor) = 6.94 min, *ee* = 97%. $[\alpha]^{25}_D$ = −125.7 (*c* = 0.53, in CH_2Cl_2).



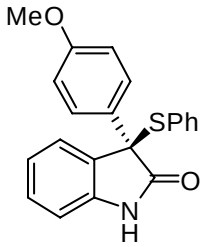
	Retention Time	Area	% Area
1	6.939	117221	1.63
2	8.267	7062361	98.37

^{1}H NMR (400 MHz, $CDCl_3$) δ = 8.31 (s, 1H), 7.66 (d, *J*=8.2, 2H), 7.34 (d, *J*=7.7, 3H), 7.24 – 7.14 (m, 4H), 7.11 (t, *J*=7.5, 1H), 7.05 (t, *J*=7.5, 2H), 6.68 (d, *J*=7.7, 1H).

^{13}C NMR (101 MHz, $CDCl_3$) δ = 176.92, 140.10, 136.35, 134.54, 134.47, 129.85, 129.75, 129.64, 129.61, 129.13, 128.81, 128.49, 126.47, 122.85, 110.18, 62.29.

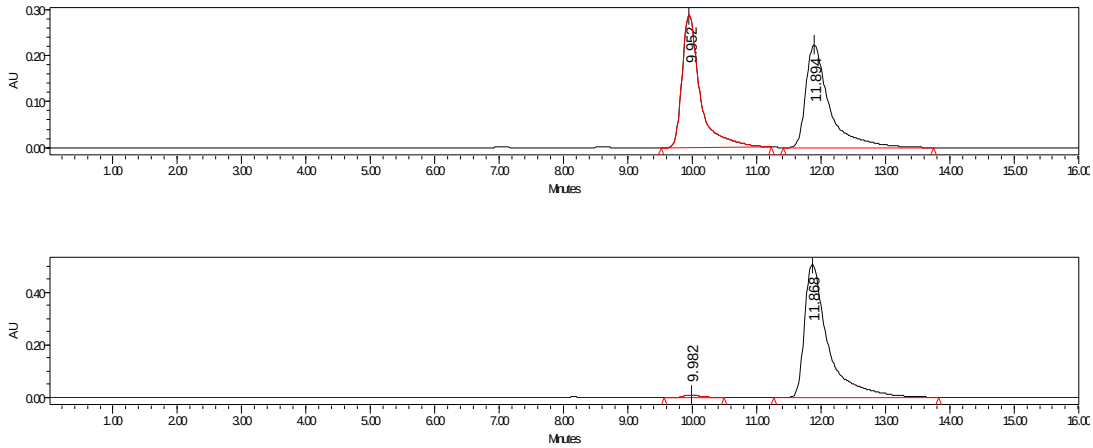
HRMS (ESI-TOF) calcd for $C_{20}H_{14}Cl^{34.9689}NOS$ ([M]+Na^+) = 374.0382, Found 374.0375.

3-(4-methoxyphenyl)-3-(phenylthio)indolin-2-one (6g):



Prepared according to the general procedure (48 h). The tittle compound **6g** was obtained as a white solid in 90% yield.

HPLC (Chiralcel IA, hexane/ *i*-PrOH = 80/20, flow rate 1.0 mL/min, λ = 254 nm) t_r (major) = 11.87 min, t_r (minor) = 9.98 min, *ee* = 98%. $[\alpha]^{25}_D$ = −131.4 (*c* = 0.62, in CH_2Cl_2).



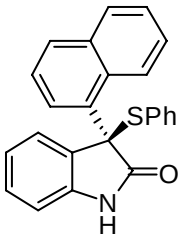
	Retention Time	Area	% Area
1	9.982	161579	1.24
2	11.868	12886407	98.76

^{1}H NMR (400 MHz, $CDCl_3$) δ = 8.50 (s, 1H), 7.63 (d, *J*=7.9, 2H), 7.38 (d, *J*=7.4, 1H), 7.17 (t, *J*=9.7, 4H), 7.21 – 7.13 (m, 1H), 7.03 (t, *J*=7.4, 2H), 6.90 (d, *J*=7.9, 2H), 6.67 (d, *J*=7.6, 1H), 3.80 (s, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ = 177.69, 159.55, 140.19, 136.26, 130.54, 130.07, 129.52, 129.41, 128.81, 128.39, 127.86, 126.48, 122.64, 114.03, 110.08, 62.46, 55.35.

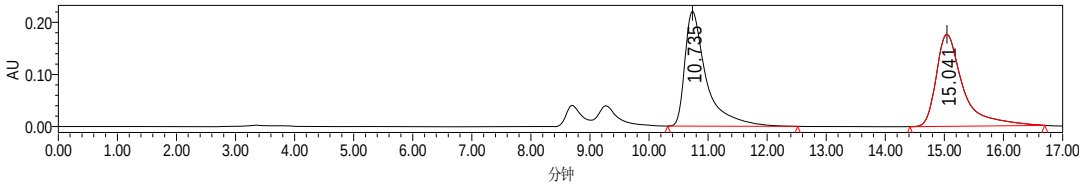
HRMS (ESI-TOF) calcd for $C_{21}H_{17}NO_2S$ ([M]+Na^+) = 370.0878, Found 370.0872.

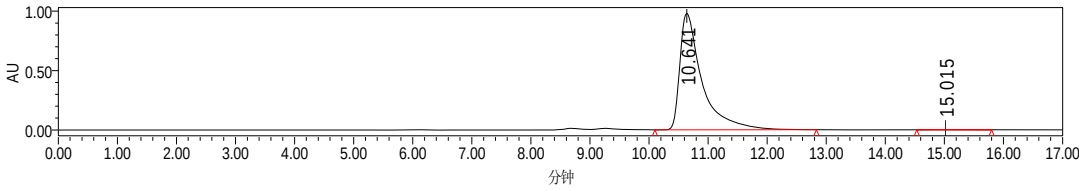
3-(naphthalen-1-yl)-3-(phenylthio)indolin-2-one (6h):



Prepared according to the general procedure (48 h). The tittle compound **6h** was obtained as a white solid in 91% yield.

HPLC (Chiralcel IA, hexane/ *i*-PrOH = 80/20, flow rate 1.0 mL/min, λ = 254 nm) t_r (major) = 10.64 min, t_r (minor) = 15.02 min, *ee* = 99%. $[\alpha]^{25}_D$ = −8.7 (*c* = 0.61, in CH_2Cl_2).





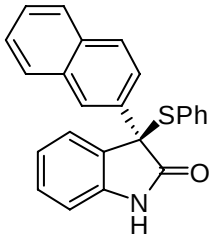
	Retention Time	Area	% Area
1	10.641	25439598	99.64
2	15.015	92970	0.36

^{1}H NMR (400 MHz, $CDCl_3$) δ = 9.05 (s, 1H), 8.48 (d, *J*=7.2, 1H), 7.90 (d, *J*=8.2, 1H), 7.85 (d, *J*=8.2, 1H), 7.62 (t, *J*=7.8, 1H), 7.45 – 7.32 (m,, 2H), 7.30 – 7.15 (m, 4H), 7.12 – 7.01 (m, 3H), 6.96 (d, *J*=7.4, 1H), 6.89 (t, *J*=7.4, 1H), 6.57 (d, *J*=7.8, 1H).

^{13}C NMR (101 MHz, $CDCl_3$) δ = 178.28, 139.47, 136.74, 134.49, 132.35, 131.28, 130.91, 129.98, 129.69, 129.23, 129.08, 128.76, 128.35, 128.26, 126.51, 125.61, 125.08, 124.86, 123.94, 123.04, 110.36, 64.18.

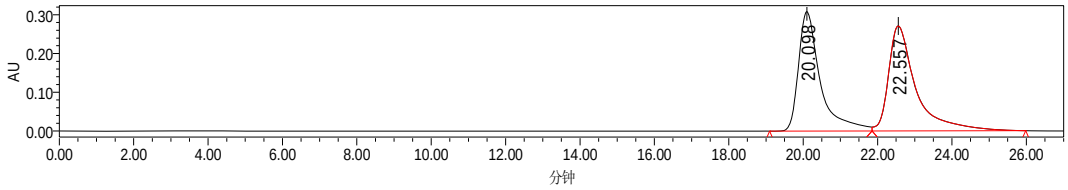
HRMS (ESI-TOF) calcd for $C_{24}H_{17}NOS$ ([M]+Na^+) = 390.0929, Found 390.0913.

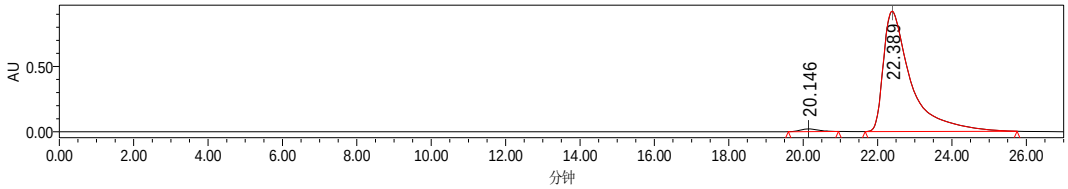
3-(naphthalen-2-yl)-3-(phenylthio)indolin-2-one (6i):



Prepared according to the general procedure (48 h). The tittle compound **6i** was obtained as a white solid in 92% yield.

HPLC (Chiralcel IA, hexane/ *i*-PrOH = 90/10, flow rate 1.0 mL/min, λ = 254 nm) t_r (major) = 22.39 min, t_r (minor) = 20.15 min, *ee* = 97%. $[\alpha]^{25}_D$ = −126.2 (*c* = 0.54, in CH_2Cl_2).





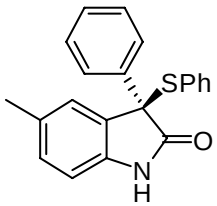
	Retention Time	Area	% Area
1	20.146	684853	1.42
2	22.389	47397370	98.58

^{1}H NMR (400 MHz, $CDCl_3$) δ = 8.70 (s, 1H), 8.07 (s, 1H), 7.95 – 7.73 (m, 4H), 7.52 – 7.43 (m, 2H), 7.41 (d, *J*=7.6, 1H), 7.29 – 7.07 (m, 5H), 7.02 (t, *J*=7.6, 2H), 6.71 (d, *J*=7.6, 1H).

^{13}C NMR (101 MHz, $CDCl_3$) δ = 177.56, 140.27, 136.36, 133.41, 133.10, 132.99, 130.52, 129.85, 129.62, 128.98, 128.53, 128.46, 128.43, 127.56, 127.41, 126.60, 126.51, 126.32, 125.70, 122.78, 110.23, 63.20.

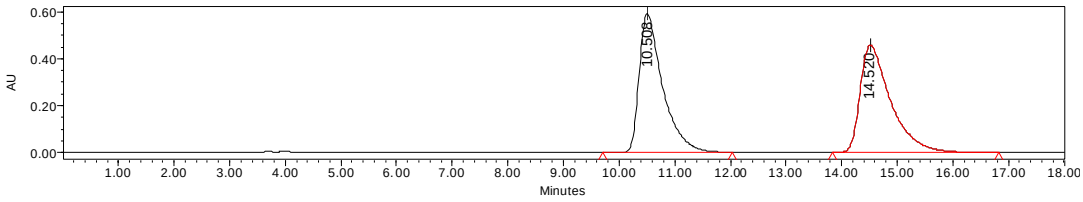
HRMS (ESI-TOF) calcd for $C_{24}H_{17}NOS$ ([M]+Na^+) = 390.0929, Found 390.0917.

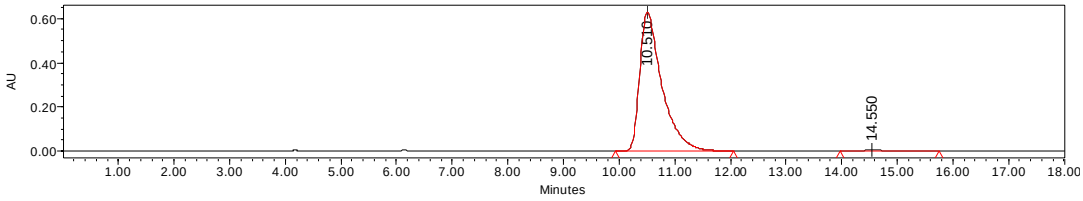
5-methyl-3-phenyl-3-(phenylthio)indolin-2-one (6j):



Prepared according to the general procedure (48 h). The tittle compound **6j** was obtained as a white solid in 90% yield.

HPLC (Chiralcel AD-H, hexane/ *i*-PrOH = 90/10, flow rate 1.0 mL/min, λ = 254 nm) t_r (major) = 10.51 min, t_r (minor) = 14.55 min, *ee* = 99%. $[\alpha]^{25}_D$ = −48.0(*c* = 0.56, in CH_2Cl_2).





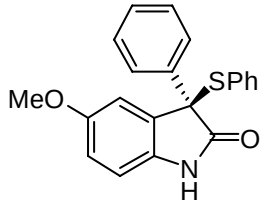
	Retention Time	Area	% Area
1	10.510	17357570	99.26
2	14.550	129440	0.74

^{1}H NMR (400 MHz, DMSO) δ = 10.45 (s, 1H), 7.66 (d, *J*=7.3, 2H), 7.52 – 7.29 (m, 4H), 7.29 – 7.09 (m, 5H), 7.04 (d, *J*=7.8, 1H), 6.63 (d, *J*=7.9, 1H), 2.32 (s, 3H).

^{13}C NMR (101 MHz, DMSO) δ = 175.44, 138.75, 136.70, 135.36, 130.73, 130.05, 129.69, 129.43, 129.28, 128.57, 128.52, 128.01, 127.68, 126.42, 109.48, 62.18, 20.72.

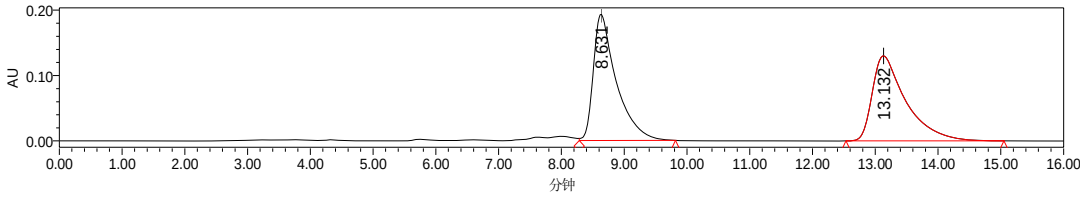
HRMS (ESI-TOF) calcd for $C_{21}H_{17}NOS$ ([M]+H^{+}) = 332.1109, Found 332.1113.

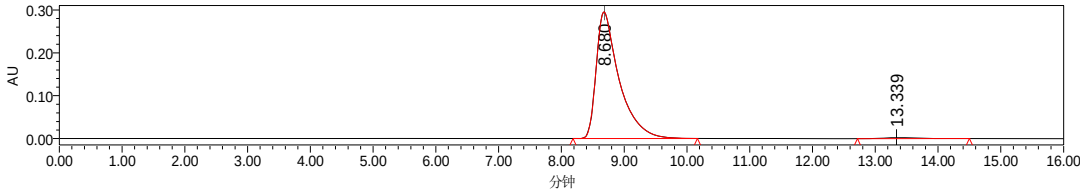
5-methoxy-3-phenyl-3-(phenylthio)indolin-2-one (6k):



Prepared according to the general procedure (48 h). The tittle compound **6k** was obtained as a white solid in 97% yield.

HPLC (Chiralcel AD-H, hexane/ *i*-PrOH = 80/20, flow rate 1.0 mL/min, λ = 254 nm) t_r (major) = 8.68 min, t_r (minor) = 13.34 min, *ee* = 98%. $[\alpha]^{25}_{D}$ = −37.9 (*c* = 0.75, in CH_2Cl_2).





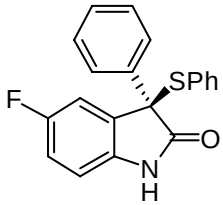
	Retention Time	Area	% Area
1	8.680	7468027	98.83
2	13.339	88687	1.17

^{1}H NMR (400 MHz, $CDCl_3$) δ = 8.31 (s, 1H), 7.70 (d, *J*=7.5, 2H), 7.49 – 7.30 (m, 3H), 7.25 – 7.16 (m, 3H), 7.06 (t, *J*=7.4, 2H), 6.95 (s, 1H), 6.72 (d, *J*=8.5, 1H), 6.59 (d, *J*=8.5, 1H), 3.79 (s, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ = 177.32, 155.86, 136.30, 136.11, 133.62, 131.70, 129.90, 129.60, 128.73, 128.47, 128.35, 128.08, 114.29, 112.62, 110.56, 63.48, 55.91.

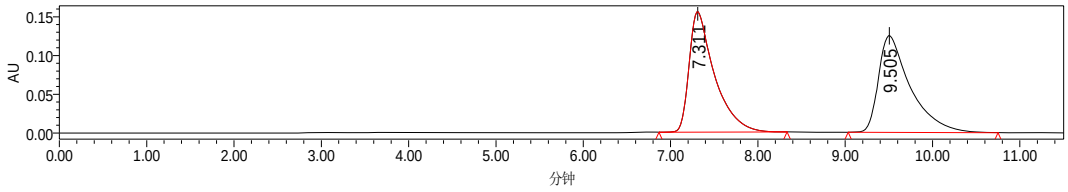
HRMS (ESI-TOF) calcd for $C_{21}H_{17}NO_2S$ ([M]+H^{+}) = 348.1058, Found 348.1053.

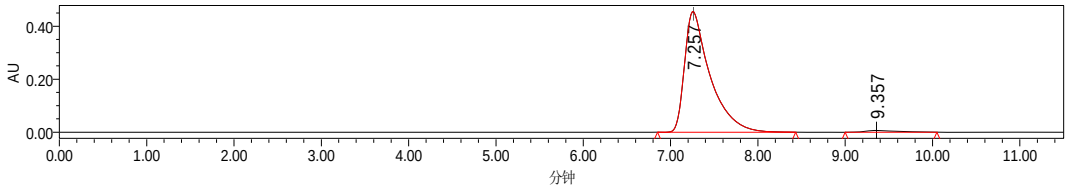
5-fluoro-3-phenyl-3-(phenylthio)indolin-2-one (6l):



Prepared according to the general procedure (48 h). The tittle compound **6l** was obtained as a white solid in 93% yield.

HPLC (Chiralcel AD-H, hexane/ *i*-PrOH = 85/15, flow rate 1.0 mL/min, λ = 254 nm) t_r (major) = 7.26 min, t_r (minor) = 9.36 min, *ee* = 97%. $[\alpha]^{25}_{D}$ = −130.0 (*c* = 0.56, in CH_2Cl_2).





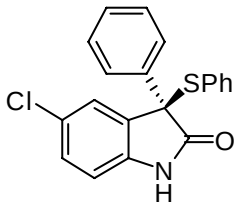
	Retention Time	Area	% Area
1	7.257	9248070	98.40
2	9.357	150414	1.60

^{1}H NMR (400 MHz, DMSO) δ = 10.53 (s, 1H), 7.62 (d, *J*=7.5, 2H), 7.49 – 7.28 (m, 4H), 7.25 – 7.14 (m, 5H), 7.02 (t, *J*=9.0, 1H), 6.65 (dd, *J*=8.1, 4.2, 1H).

^{13}C NMR (101 MHz, DMSO) δ = 175.52, 157.90 (d, *J*=237.4), 137.42, 135.98, 135.56, 131.26 (d, *J*=8.4), 129.78, 129.50, 128.72, 128.30, 127.57, 115.55 (d, *J*=23.3), 113.48 (d, *J*=25.2), 110.64 (d, *J*=8.1), 62.53.

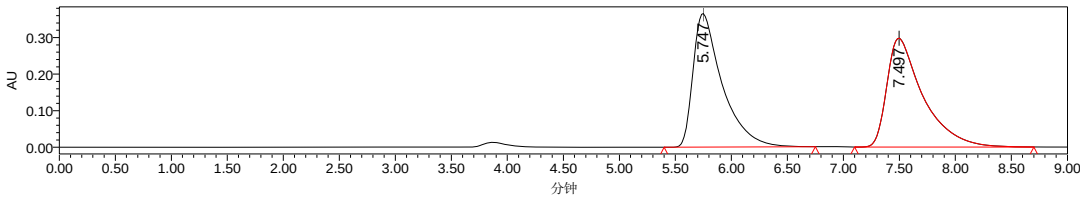
HRMS (ESI-TOF) calcd for $C_{20}H_{14}FNOS$ ([M]+Na^+) = 358.0678, Found 358.0677.

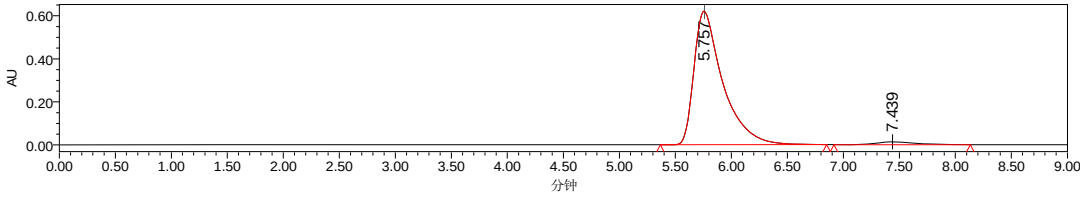
5-chloro-3-phenyl-3-(phenylthio)indolin-2-one (6m):



Prepared according to the general procedure (48 h). The tittle compound **6m** was obtained as a white solid in 92% yield.

HPLC (Chiralcel AD-H, hexane/ *i*-PrOH = 80/20, flow rate 1.0 mL/min, λ = 254 nm) t_r (major) = 5.76 min, t_r (minor) = 7.44 min, *ee* = 95%. $[\alpha]^{25}_D$ = −10.8 (*c* = 0.67, in CH_2Cl_2).





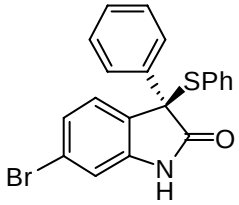
	Retention Time	Area	% Area
1	5.757	11068479	97.31
2	7.439	305641	2.69

^{1}H NMR (400 MHz, DMSO) δ = 10.67 (s, 1H), 7.61 (d, *J*=7.6, 2H), 7.50 – 7.30 (m, 4H), 7.22 (t, *J*=7.4, 3H), 7.17 (d, *J*=7.6, 2H), 6.69 (d, *J*=8.3, 1H).

^{13}C NMR (101 MHz, DMSO) δ = 175.21, 140.07, 135.88, 135.57, 131.67, 129.84, 129.43, 128.94, 128.78, 128.75, 128.34, 127.57, 125.87, 125.77, 111.27, 62.26.

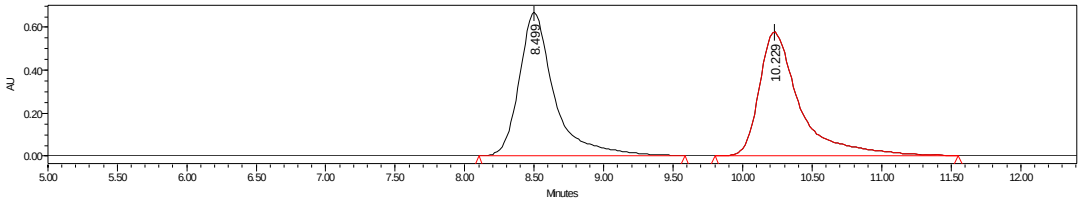
HRMS (ESI-TOF) calcd for $C_{20}H_{14}Cl^{34.9689}NOS$ ([M]+Na^+) = 374.0382, Found 374.0372.

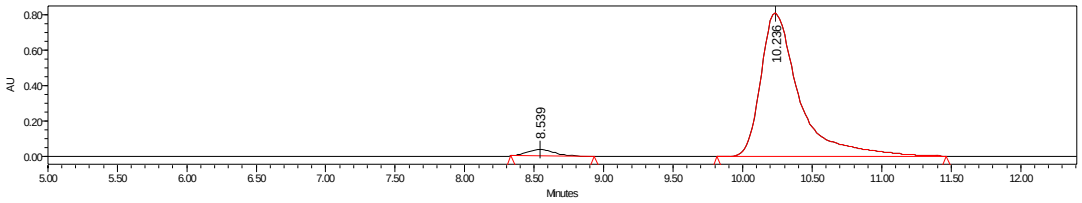
6-bromo-3-phenyl-3-(phenylthio)indolin-2-one (6n):



Prepared according to the general procedure (48 h). The tittle compound **6n** was obtained as a white solid in 93% yield.

HPLC (Chiralcel AD-H, hexane/ *i*-PrOH = 80/20, flow rate 1.0 mL/min, λ = 254 nm) t_r (major) = 10.24 min, t_r (minor) = 8.54 min, *ee* = 94%. $[\alpha]^{25}_D$ = −68.3 (*c* = 0.73, in CH_2Cl_2).





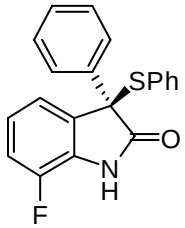
	Retention Time	Area	% Area
1	8.539	503030	3.13
2	10.236	15586443	96.87

^{1}H NMR (400 MHz, DMSO) δ = 10.65 (s, 1H), 7.60 (d, *J*=7.9, 2H), 7.48 – 7.10 (m, 10H), 6.82 (s, 1H).

^{13}C NMR (101 MHz, DMSO) δ = 175.37, 142.80, 135.88, 135.57, 129.82, 129.46, 128.94, 128.72, 128.31, 127.87, 127.56, 124.55, 121.48, 112.52, 61.91.

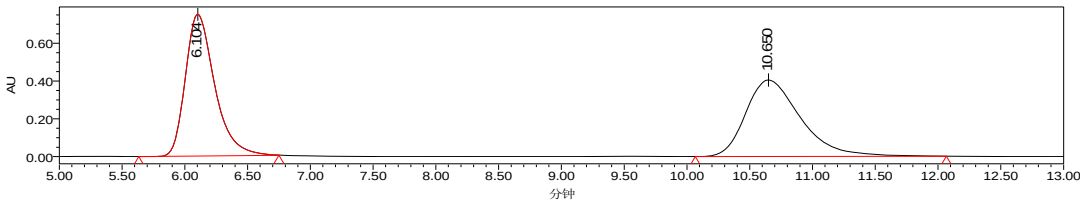
HRMS (ESI-TOF) calcd for $C_{20}H_{14}BrNOS$ ([M]+Na^+) = 417.9877, Found 417.9880.

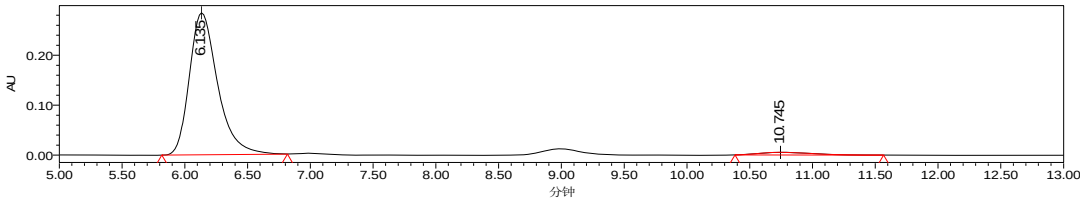
7-fluoro-3-phenyl-3-(phenylthio)indolin-2-one (6o):



Prepared according to the general procedure (72 h). The tittle compound **6n** was obtained as a white solid in 88% yield.

HPLC (Chiralcel OD-H, hexane/ *i*-PrOH = 90/10, flow rate 1.0 mL/min, λ = 254 nm) t_r (major) = 6.14 min, t_r (minor) = 10.75 min, *ee* = 93%. $[\alpha]^{25}_D$ = −94.6 (*c* = 0.63, in CH_2Cl_2).





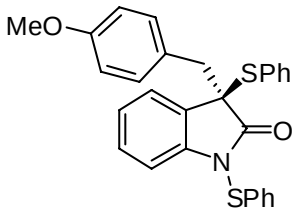
	Retention Time	Area	% Area
1	6.135	4435926	96.50
2	10.745	161049	3.50

^{1}H NMR (400 MHz, $CDCl_3$) δ = 7.93 (s, 1H), 7.70 (d, *J*=7.4, 2H), 7.44 – 7.28 (m, 3H), 7.28 – 7.16 (m, 4H), 7.13 – 7.01 (m, 3H), 6.95 (t, *J*=9.0, 1H).

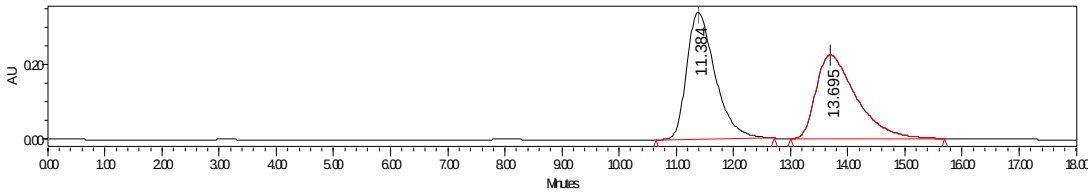
^{13}C NMR (101 MHz, $CDCl_3$) δ = 176.16, 146.84 (d, *J*=245.0), 136.34, 135.44, 133.13 (d, *J*=3.0), 129.87, 129.57, 128.78, 128.55, 128.04, 127.62 (d, *J*=12.7), 123.20 (d, *J*=5.9), 122.24 (d, *J*=3.4), 115.65 (d, *J*=17.0), 63.05.

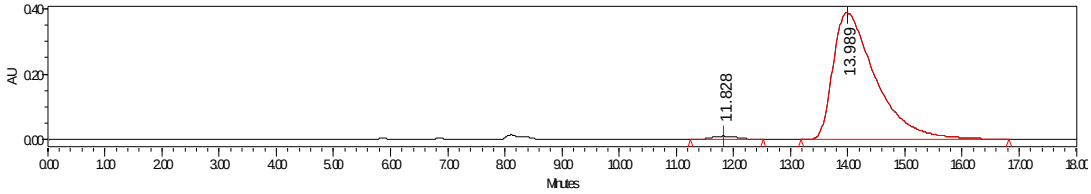
HRMS (ESI-TOF) calcd for $C_{20}H_{14}FNOS$ ([M]+Na^+) = 358.0678, Found 358.0669.

(*R*)-3-(4-methoxybenzyl)-1,3-bis(phenylthio)indolin-2-one (4a):



HPLC (Chiralcel ODH, hexane/ *i*-PrOH = 90/10, flow rate 1.0 mL/min, λ = 254 nm) t_r (major) = 13.99 min, t_r (minor) = 11.83 min, *ee* = 97%. $[\alpha]^{25}_D$ = −89.4 (*c* = 0.85, in CH_2Cl_2).





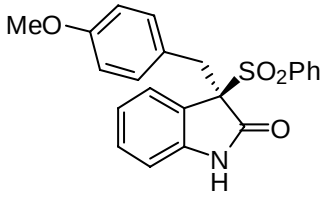
	Retention Time	Area	% Area
1	11.828	345841	1.69
2	13.989	20099868	98.31

^{1}H NMR (400 MHz, DMSO) δ = 7.76 (d, *J*=7.2, 1H), 7.35 (t, *J*=7.3, 1H), 7.28 – 6.98 (m, 9H), 6.80 (d, *J*=8.5, 2H), 6.69 – 6.57 (m, 3H), 6.52 (d, *J*=7.3, 2H), 3.64 (s, 3H), 3.59 (d, *J*=13.2, 1H), 3.38 (d, *J*=13.2, 1H).

^{13}C NMR (101 MHz, DMSO) δ = 176.54, 158.11, 142.48, 136.08, 134.83, 131.19, 129.99, 129.41, 129.02, 128.69, 128.44, 128.23, 126.83, 126.35, 125.39, 124.00, 123.91, 113.34, 109.76, 60.01, 54.84.

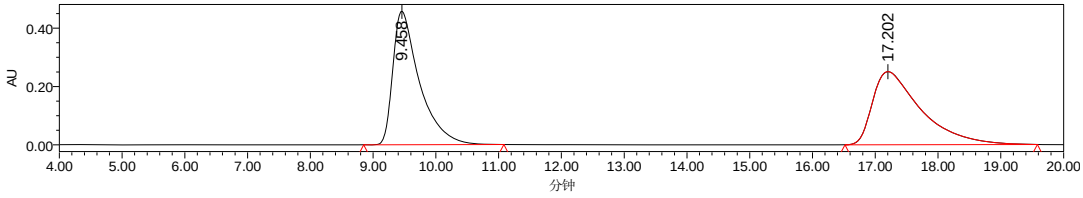
HRMS (ESI-TOF) calcd for $C_{28}H_{23}NO_2S_2$ ([M]+H^+) = 470.1248, Found 470.1247.

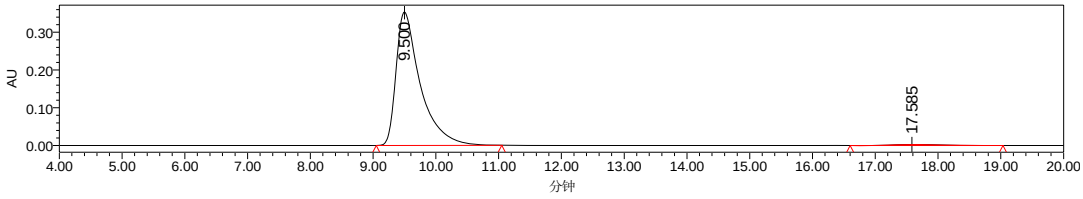
(*R*)-3-(4-methoxybenzyl)-3-(phenylsulfonyl)indolin-2-one (7a)



Prepared by oxidization of **3a** with m-CPBA (2.5 equiv) in CH_2Cl_2. The tittle compound **7a** was purified by silica gel chromatography (petroleum ether : EtOAc = 2 : 1) to afford a white solid in 82% yield.

HPLC (Chiralcel AD-H, hexane/ *i*-PrOH = 70/30, flow rate 1.0 mL/min, λ = 254 nm) t_r (major) = 9.50 min, t_r (minor) = 17.59 min, *ee* = 97%. $[\alpha]^{25}_D$ = −72.3 (*c* = 0.37, in CH_2Cl_2).





	Retention Time	Area	% Area
1	9.500	9432240	98.52
2	17.585	141251	1.48

^{1}H NMR (400 MHz, $CDCl_3$) δ = 7.92 (s, 1H), 7.77 (d, *J*=7.2, 1H), 7.65 – 6.48 (m, 3H), 7.35 (t, *J*=7.3, 2H), 7.24 – 7.10 (m, 2H), 6.83 (d, *J*=7.4, 2H), 6.49 (t, *J*=7.6, 3H), 3.83 (d, *J*=13.3, 1H), 3.68 (d, *J*=13.3, 1H), 3.57 (s, 3H).

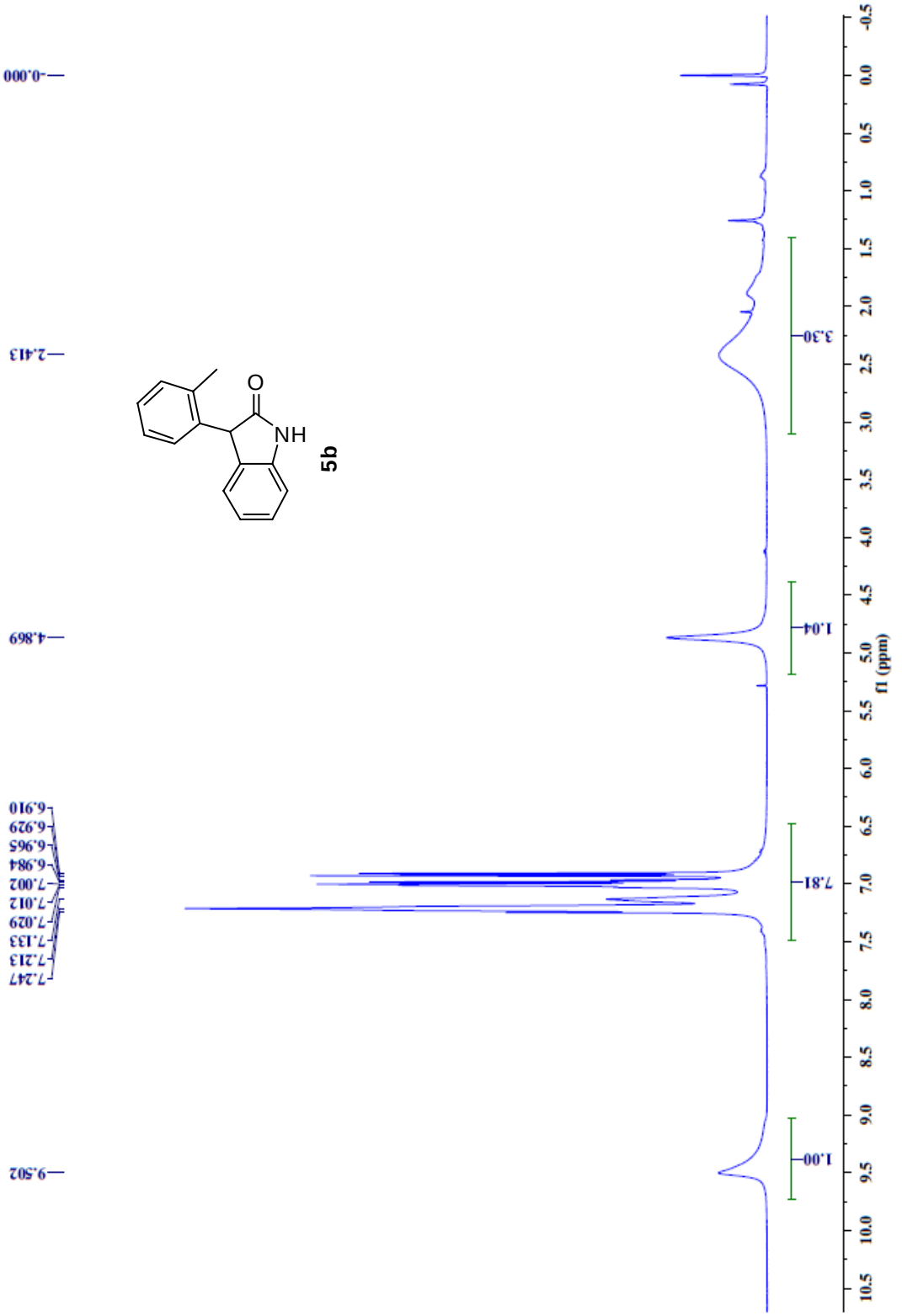
^{13}C NMR (101 MHz, $CDCl_3$) δ = 171.54, 158.52, 141.39, 134.96, 134.27, 131.17, 130.46, 130.30, 128.45, 127.26, 124.73, 122.89, 122.23, 113.49, 109.98, 54.95, 34.15.

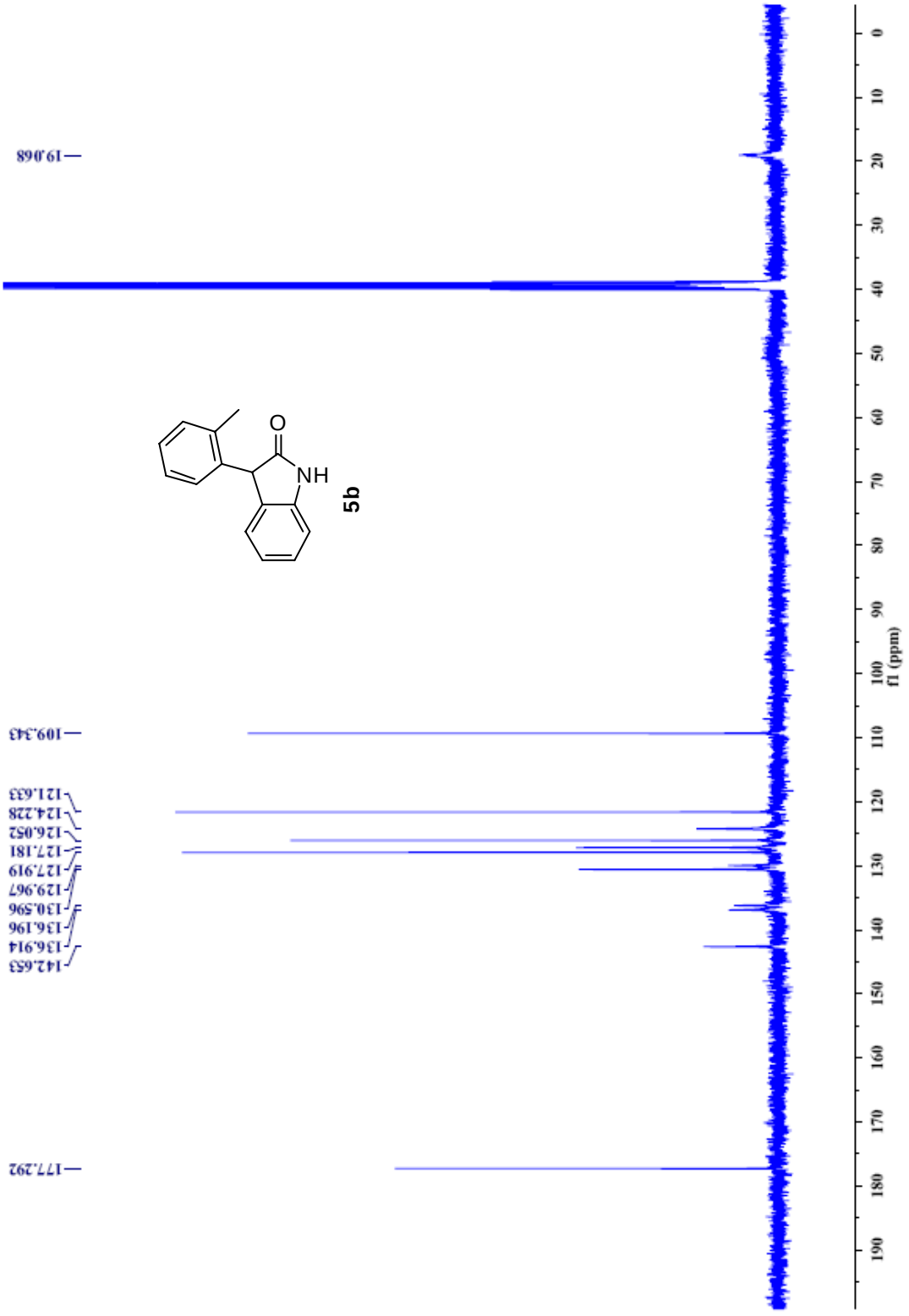
HRMS (ESI-TOF) calcd for $C_{22}H_{19}NO_4S$ ([M]+Na^+) = 416.0932, Found 416.0927.

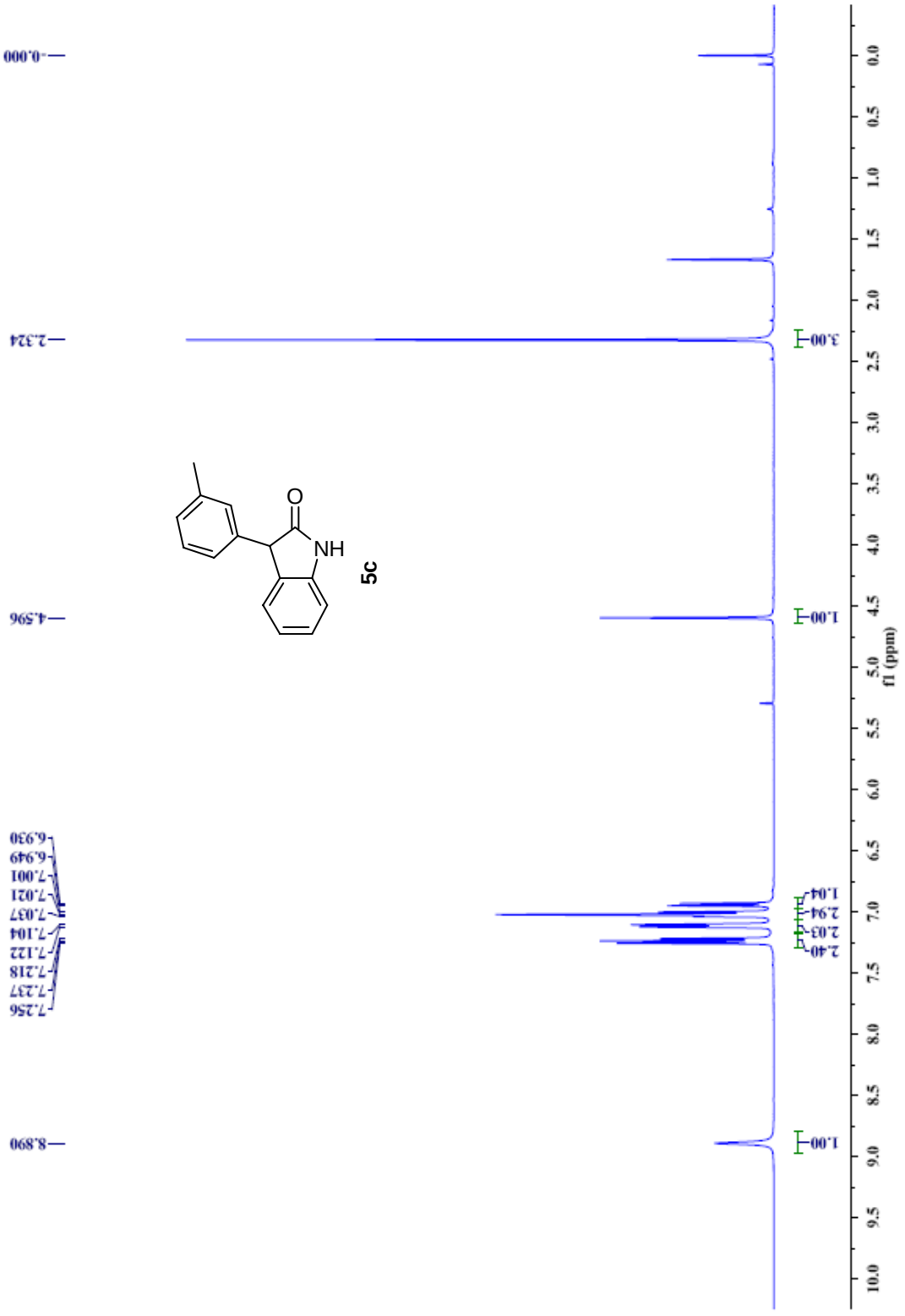
10. References

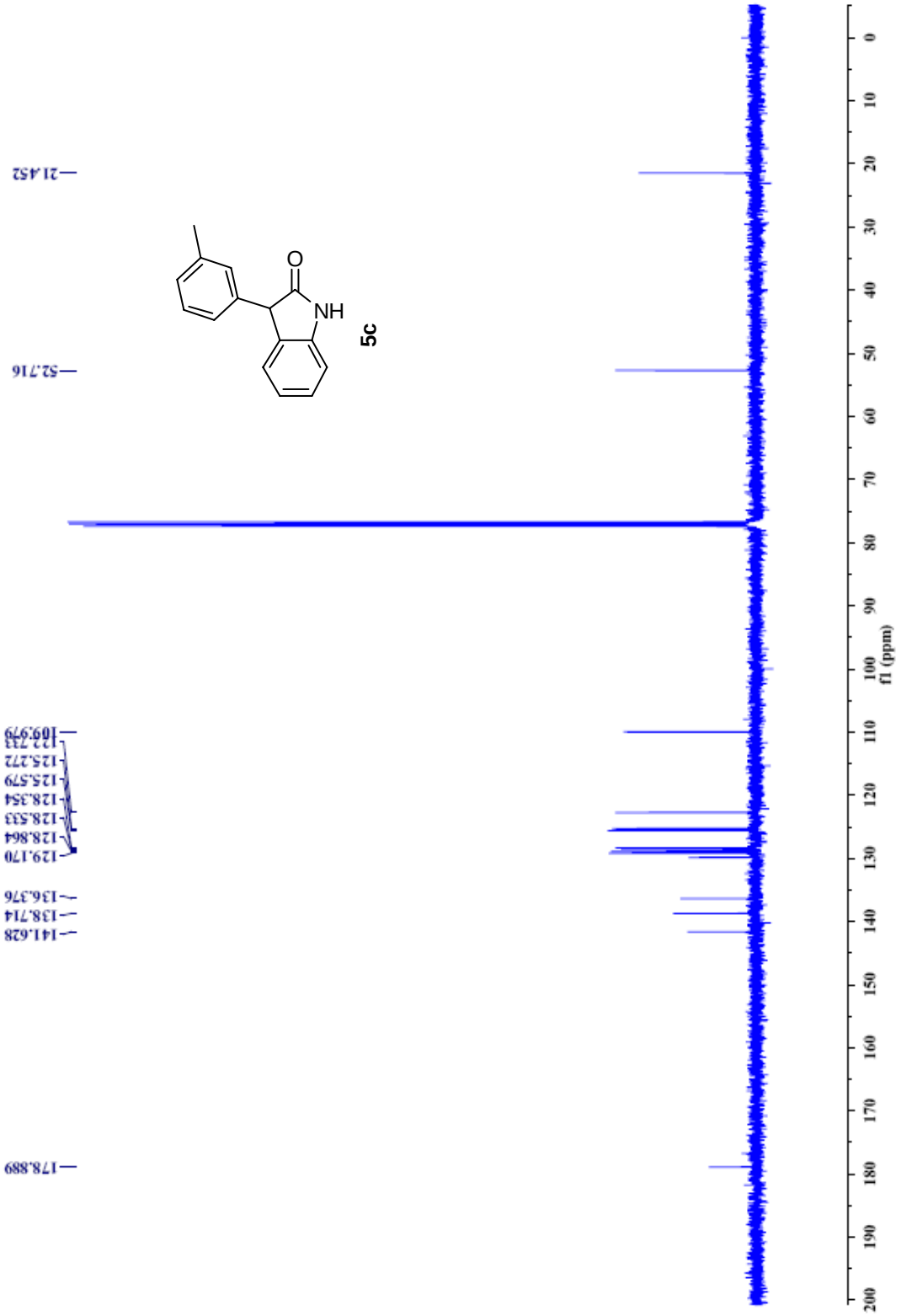
[1]. Y. H. Wen, X. Huang, J. L. Huang, Y. Xiong , B. Qin, X. M. Feng, *Synlett.* **2005**, 2445-2448.

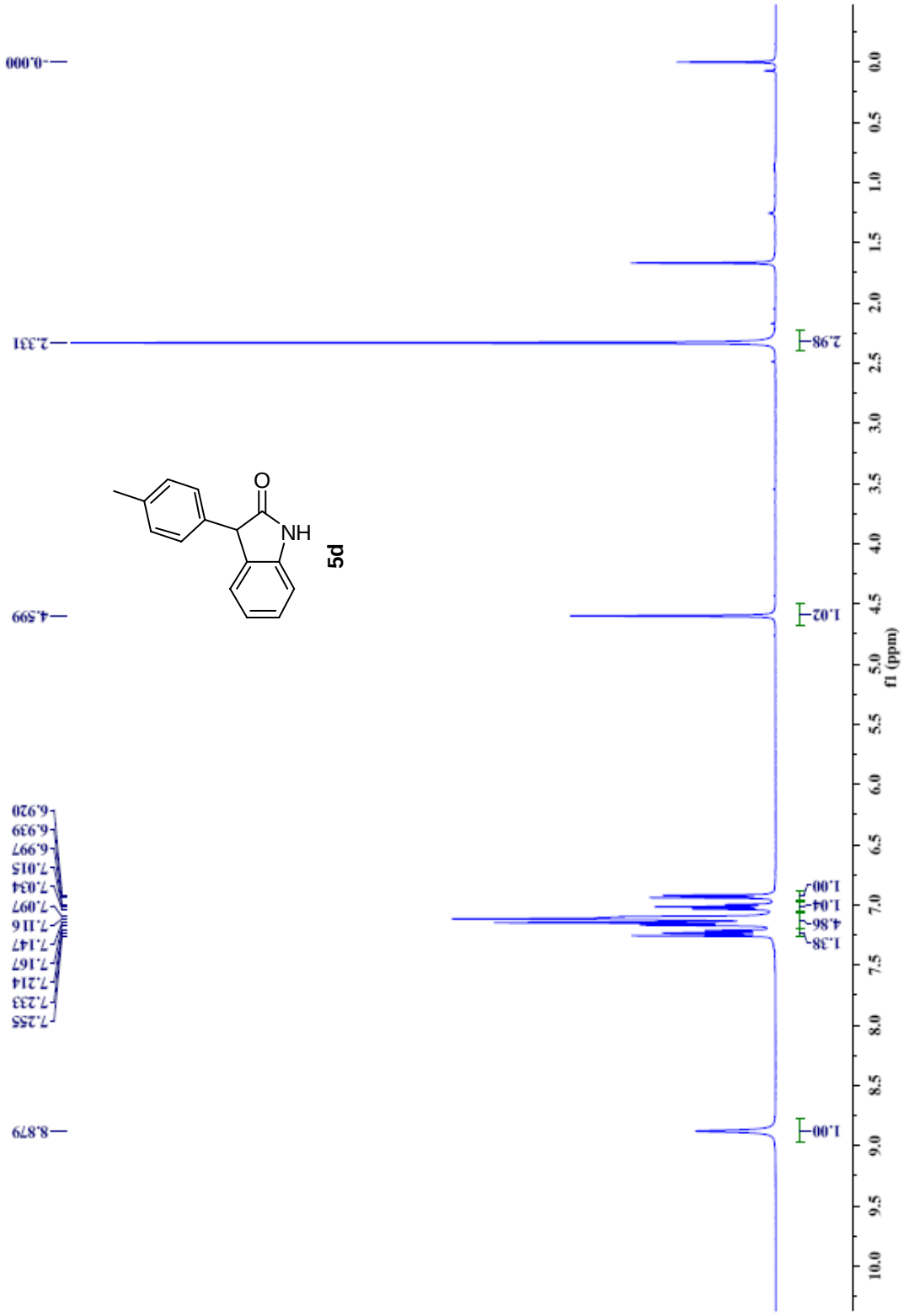
11. Copy of ^{1}H NMR and ^{13}C NMR spectra

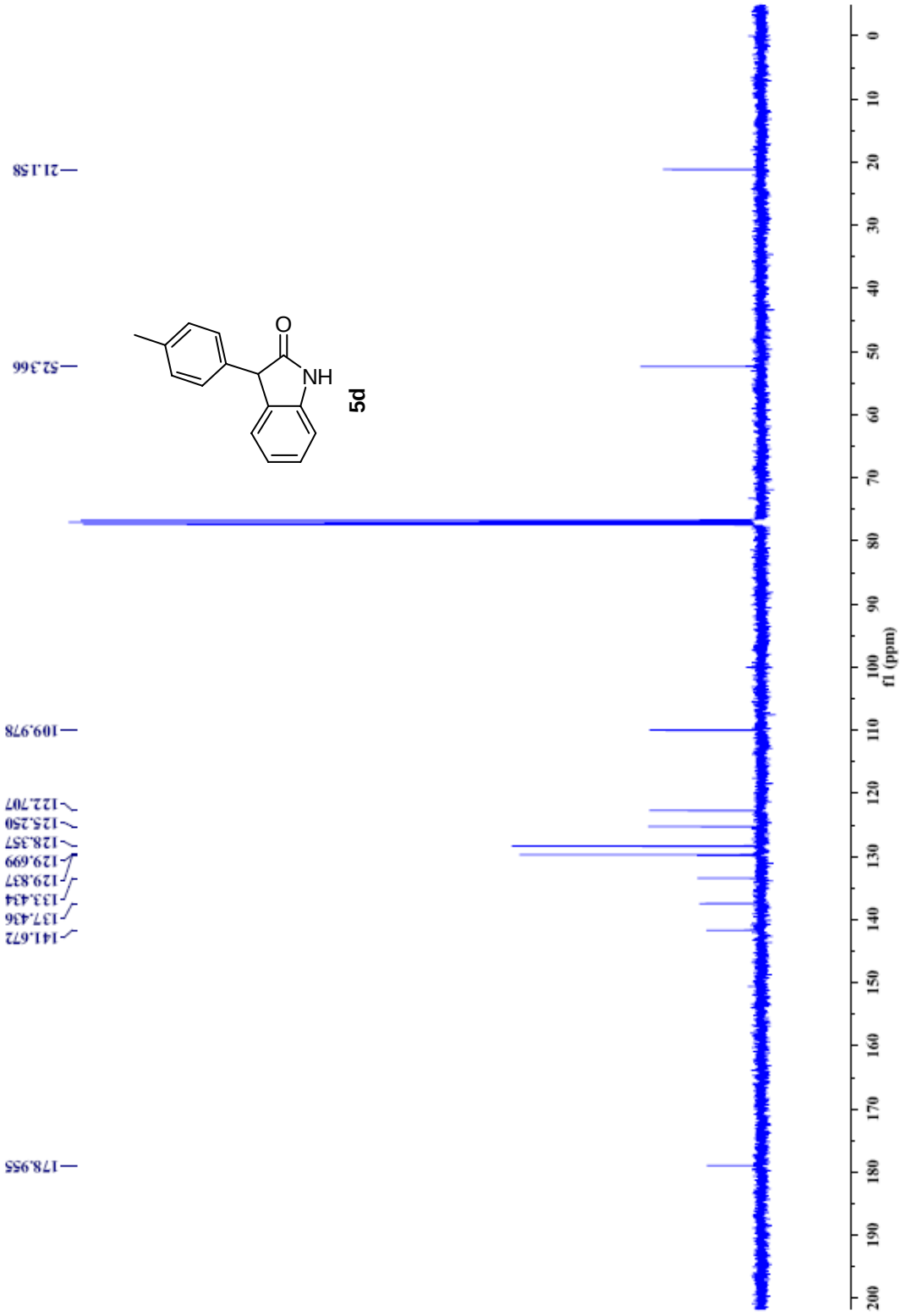



19.068
109.343
121.633
124.228
126.052
127.181
127.919
129.967
130.596
136.196
136.914
142.653
177.292
O
NH
5b
f1 (ppm)


O
NH
5c
f1 (ppm)


21.452
52.716
109.979
122.733
125.272
125.579
128.354
128.533
128.864
129.170
136.376
138.714
141.628
178.889
O
NH
5c
f1 (ppm)


O
NH
5d
f1 (ppm)


21.158
52.366
109.978
122.707
125.250
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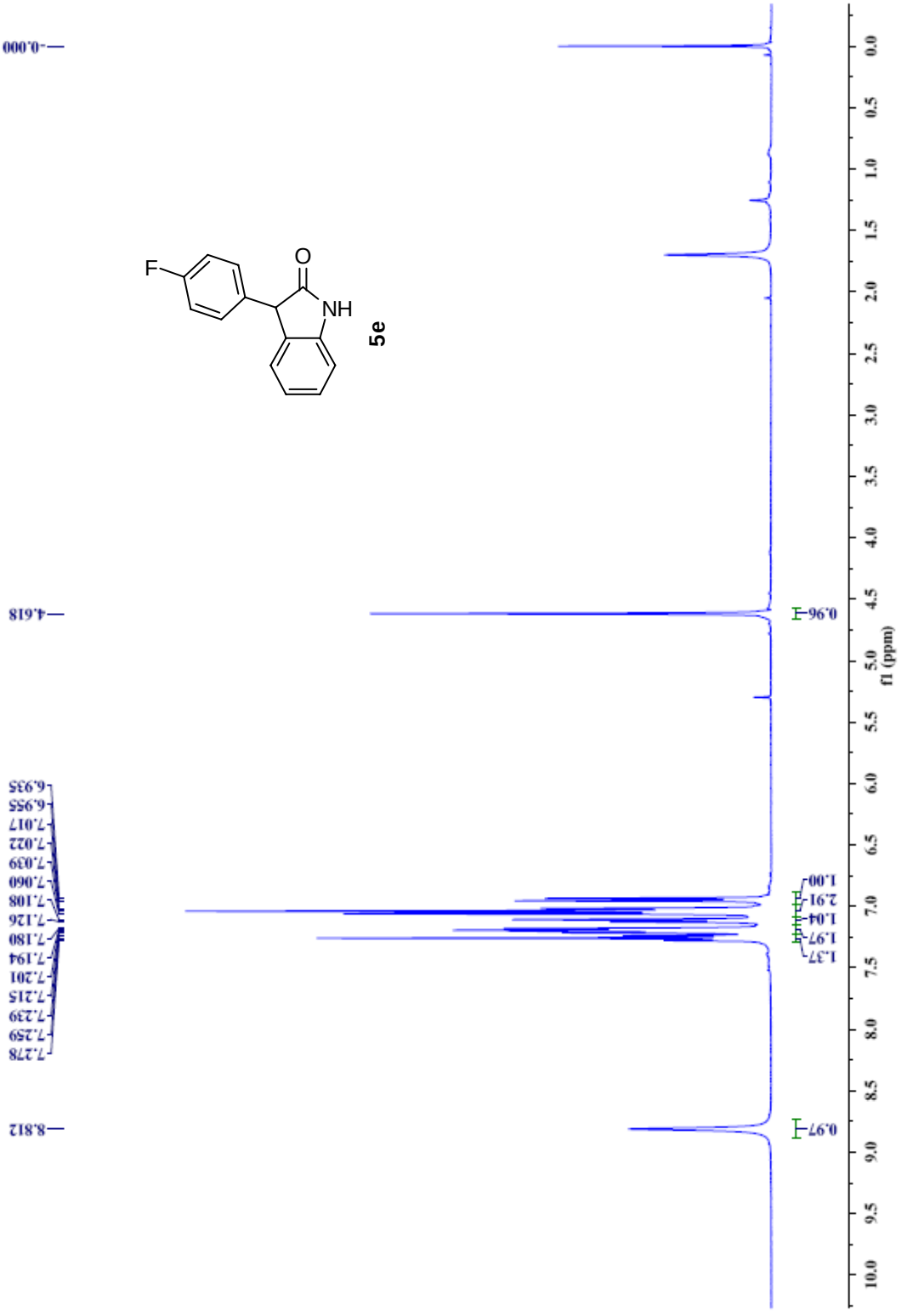
129.699
129.837
133.434
137.436
141.672
178.955
O
NH
5d
f1 (ppm)


F
O
NH
5e
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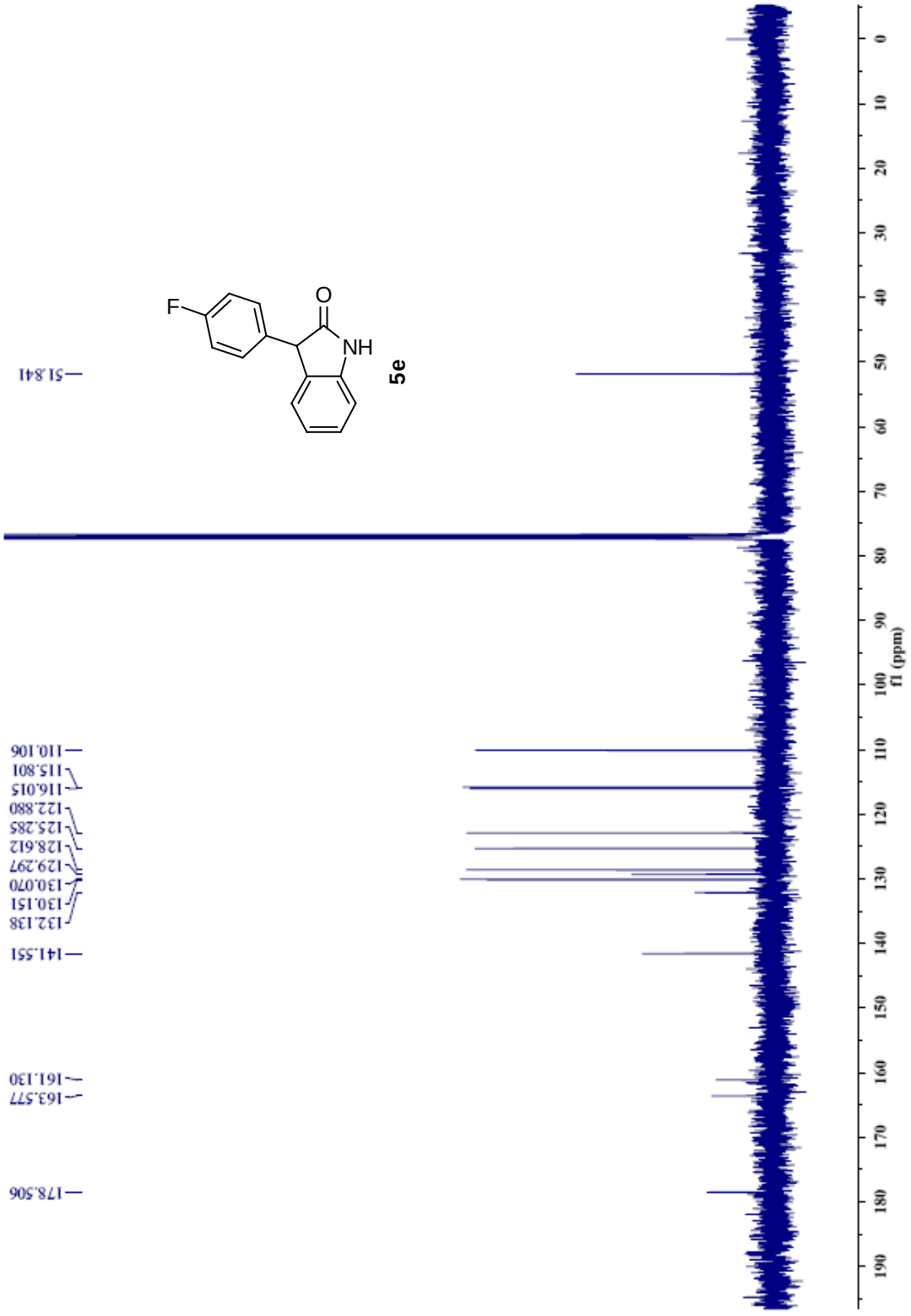
4.618
8.812
6.935
6.955
7.017
7.022
7.039
7.060
7.108
7.126
7.180
7.194
7.201
7.215
7.239
7.259
7.278
0.96
1.00
2.91
1.04
1.97
1.37
0.97
f1 (ppm)


F
O
NH
5e
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115.801
116.015
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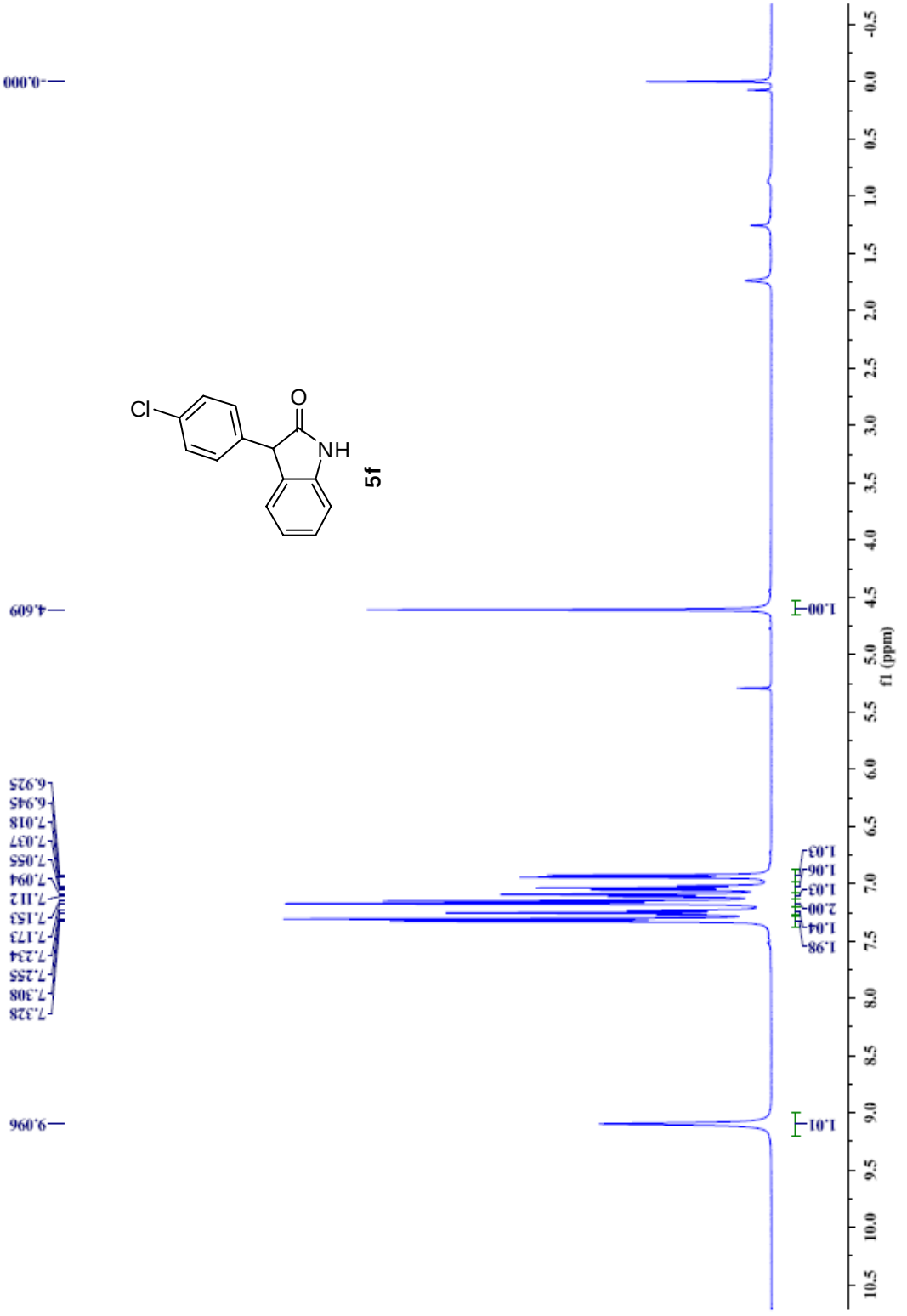
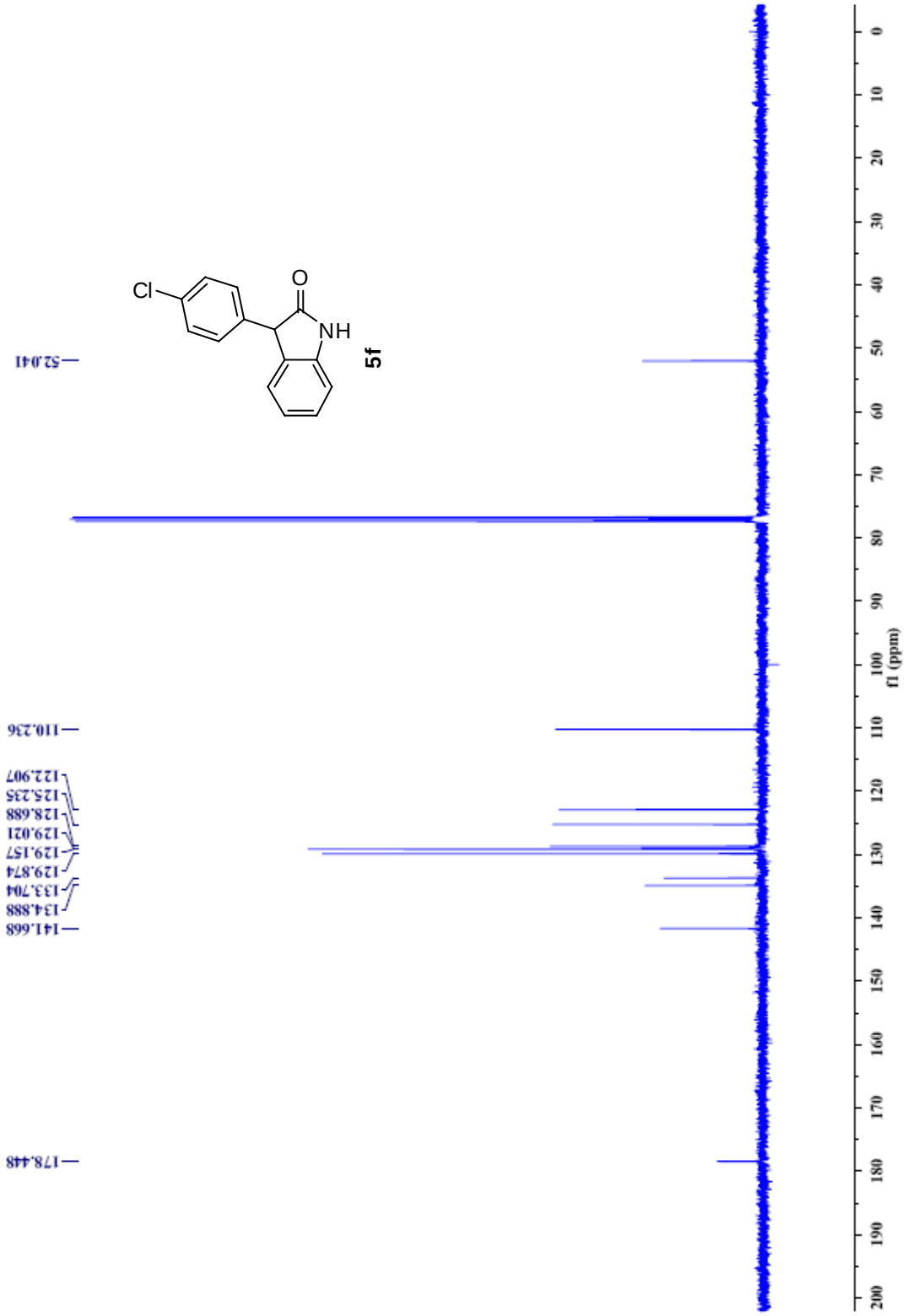
129.297
130.070
130.151
132.138
141.551
161.130
163.577
178.506
f1 (ppm)


Cl
O
NH
5f
f1 (ppm)


Cl
O
NH
5f
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122.907
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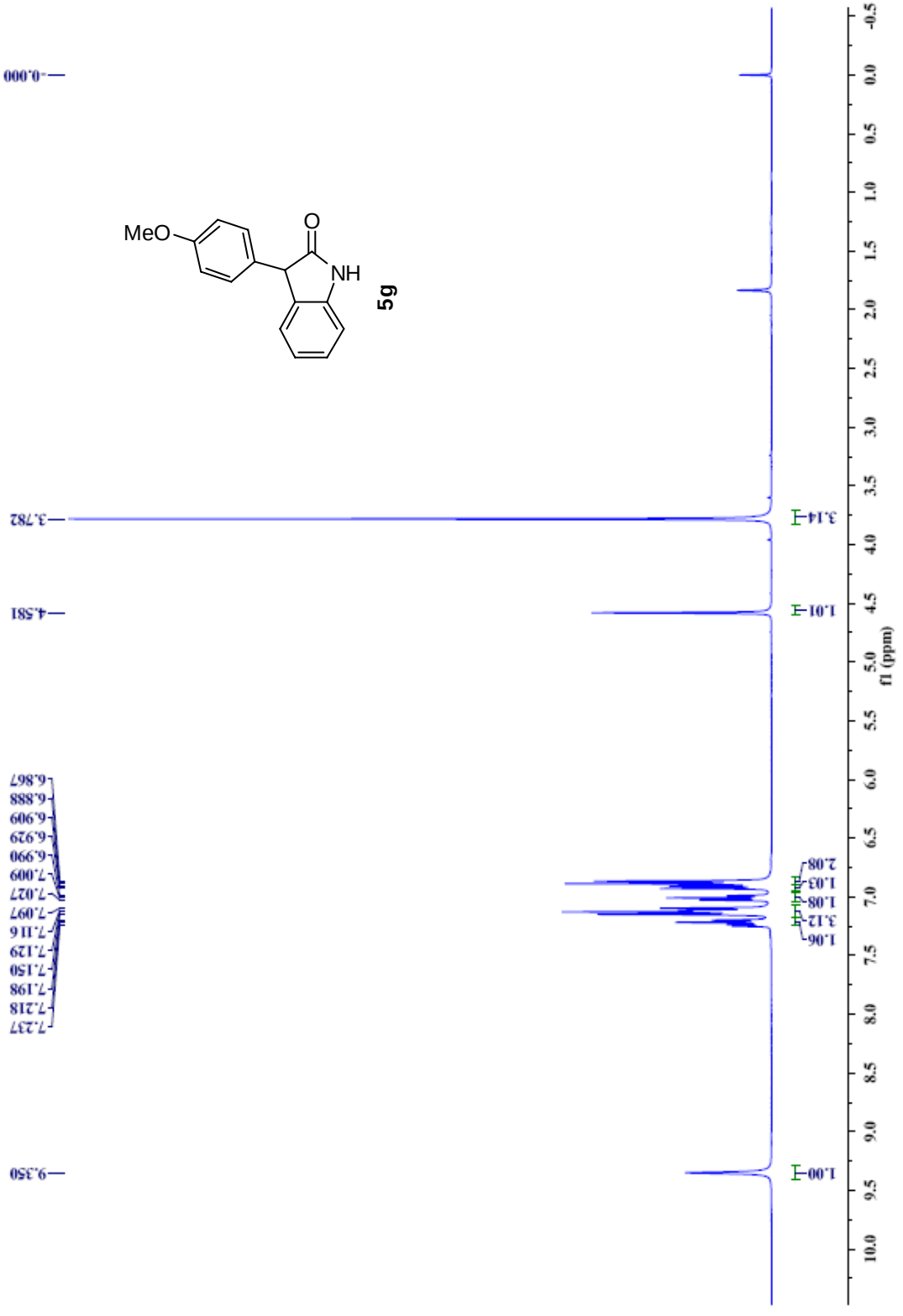
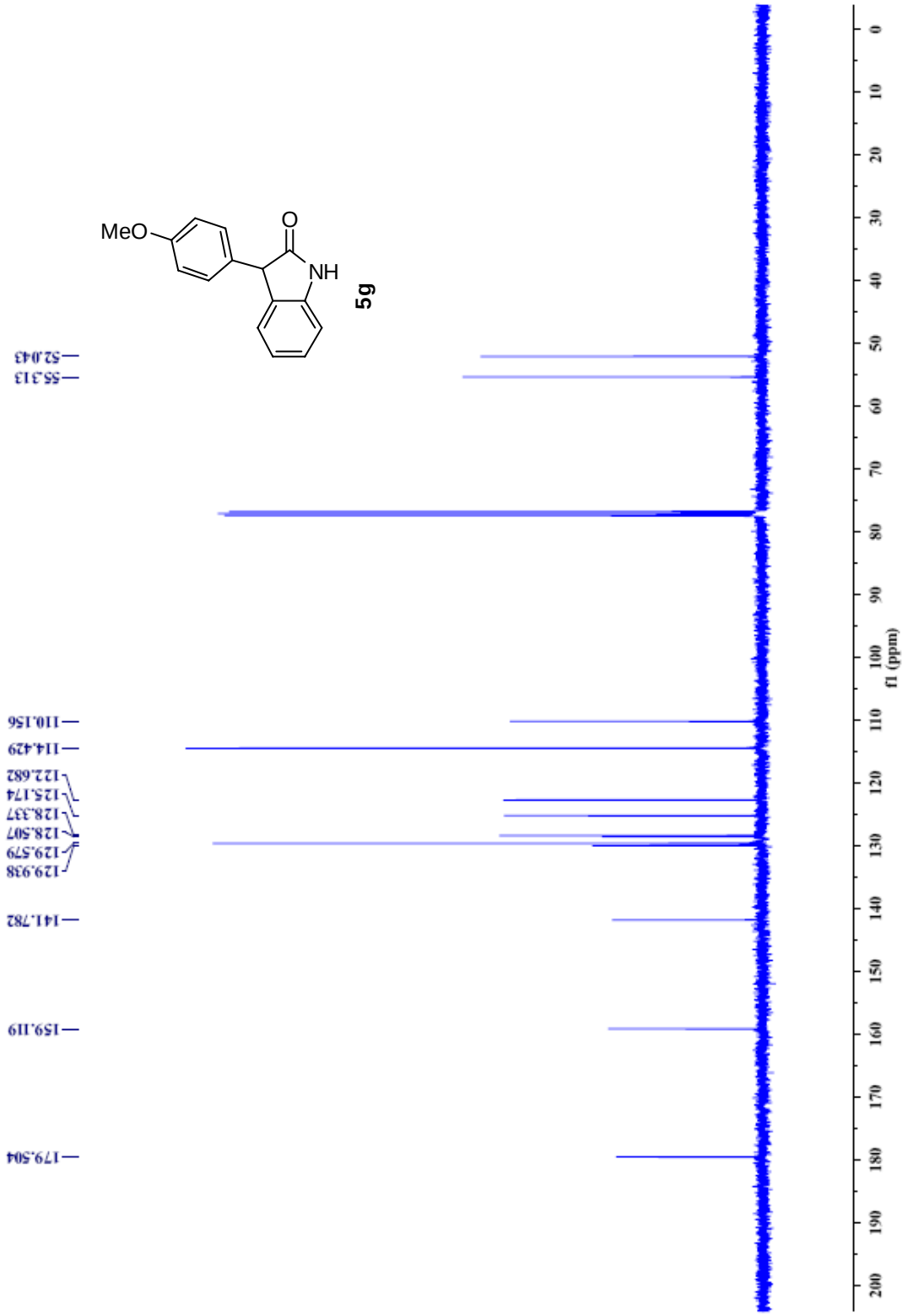
178.448
f1 (ppm)


MeO
O
NH
5g
f1 (ppm)


MeO
O
NH
5g
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55.313
110.156
114.429
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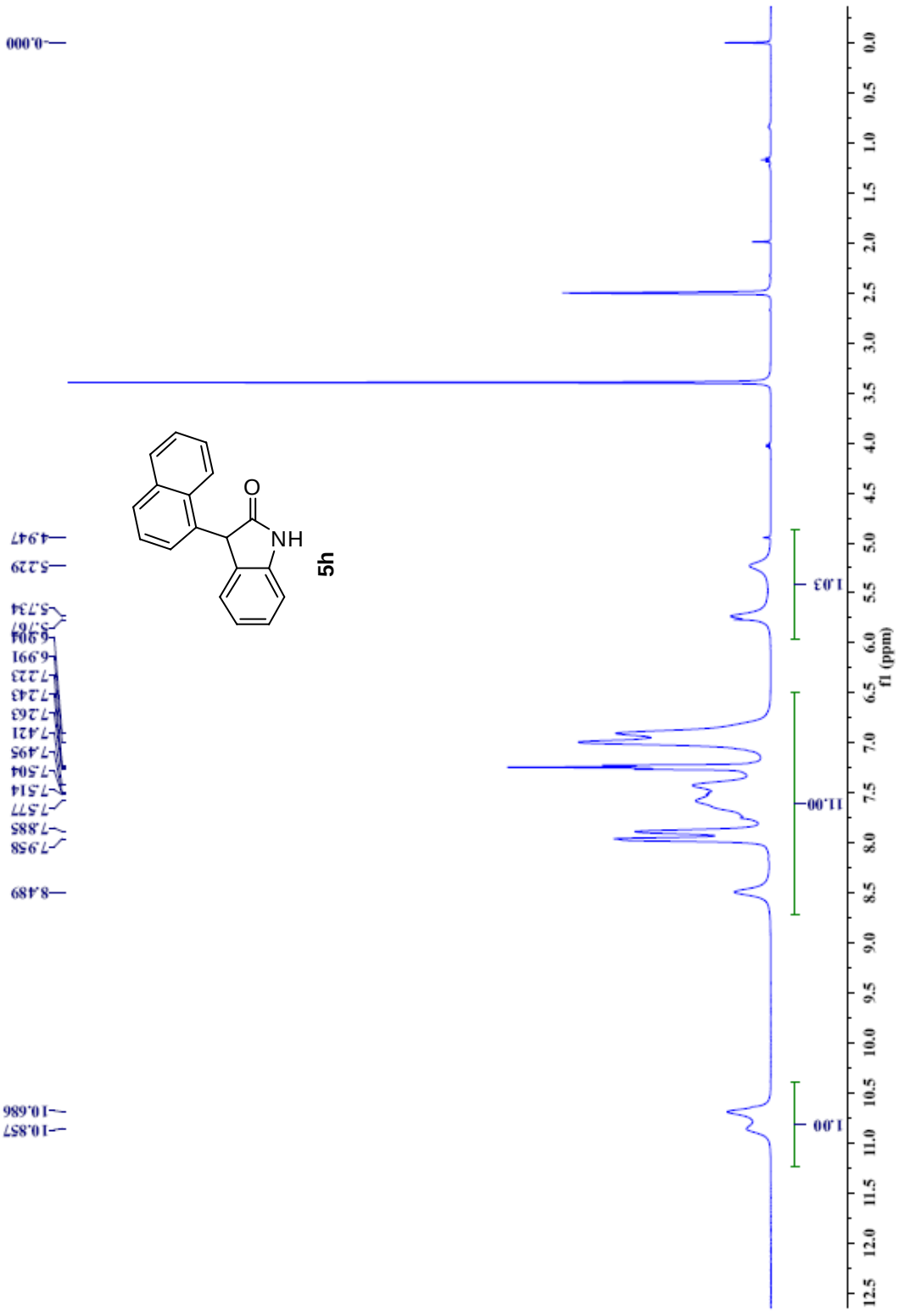
125.174
128.337
128.507
129.579
129.938
141.782
159.119
179.504
f1 (ppm)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5.734
5.767
6.904
6.991
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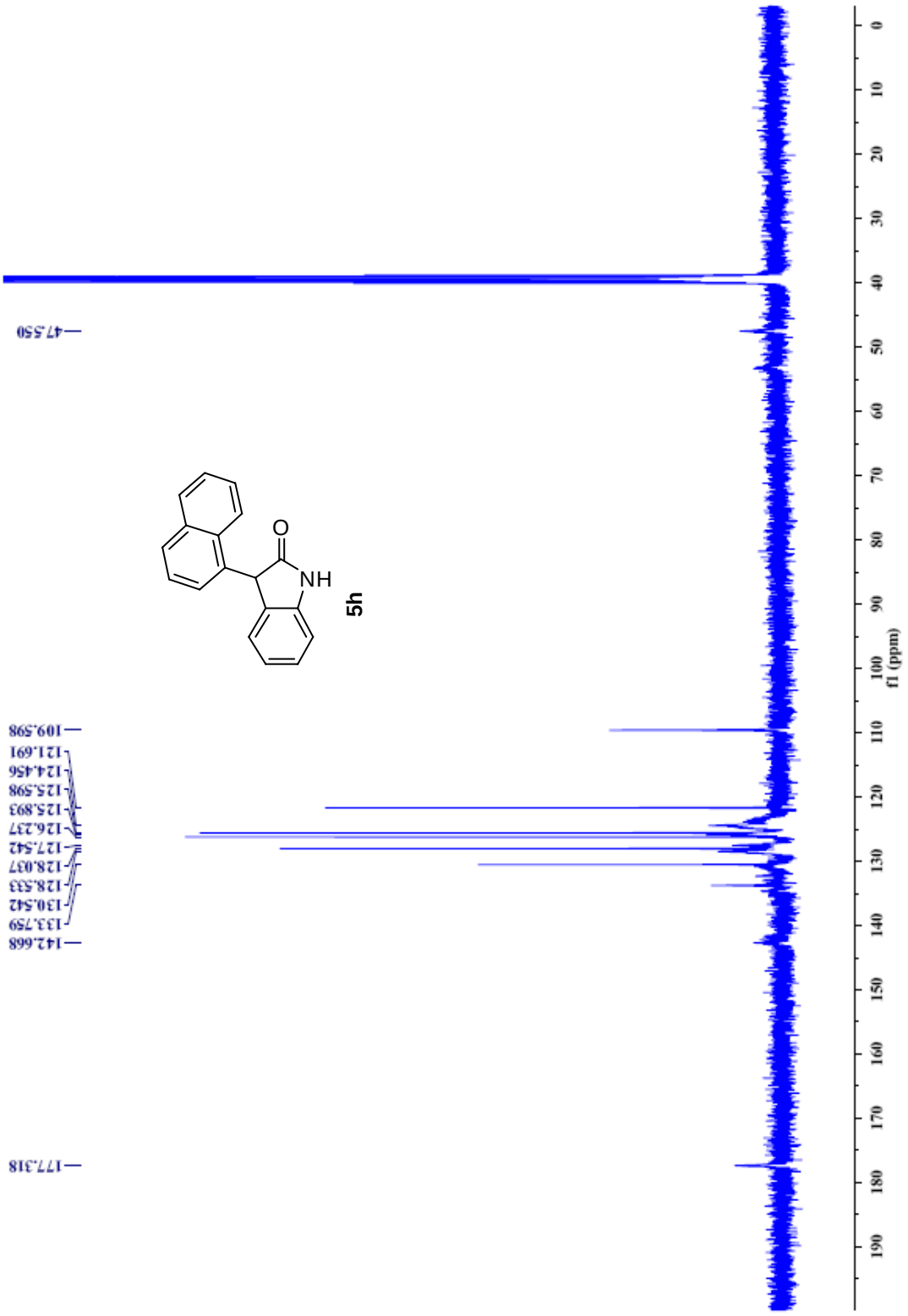
7.243
7.263
7.421
7.495
7.504
7.514
7.577
7.885
7.958
8.489
10.857
10.686
1.03
11.00
1.00
5h
NH
O
f1 (ppm)


47.550
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121.691
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127.542
128.037
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130.542
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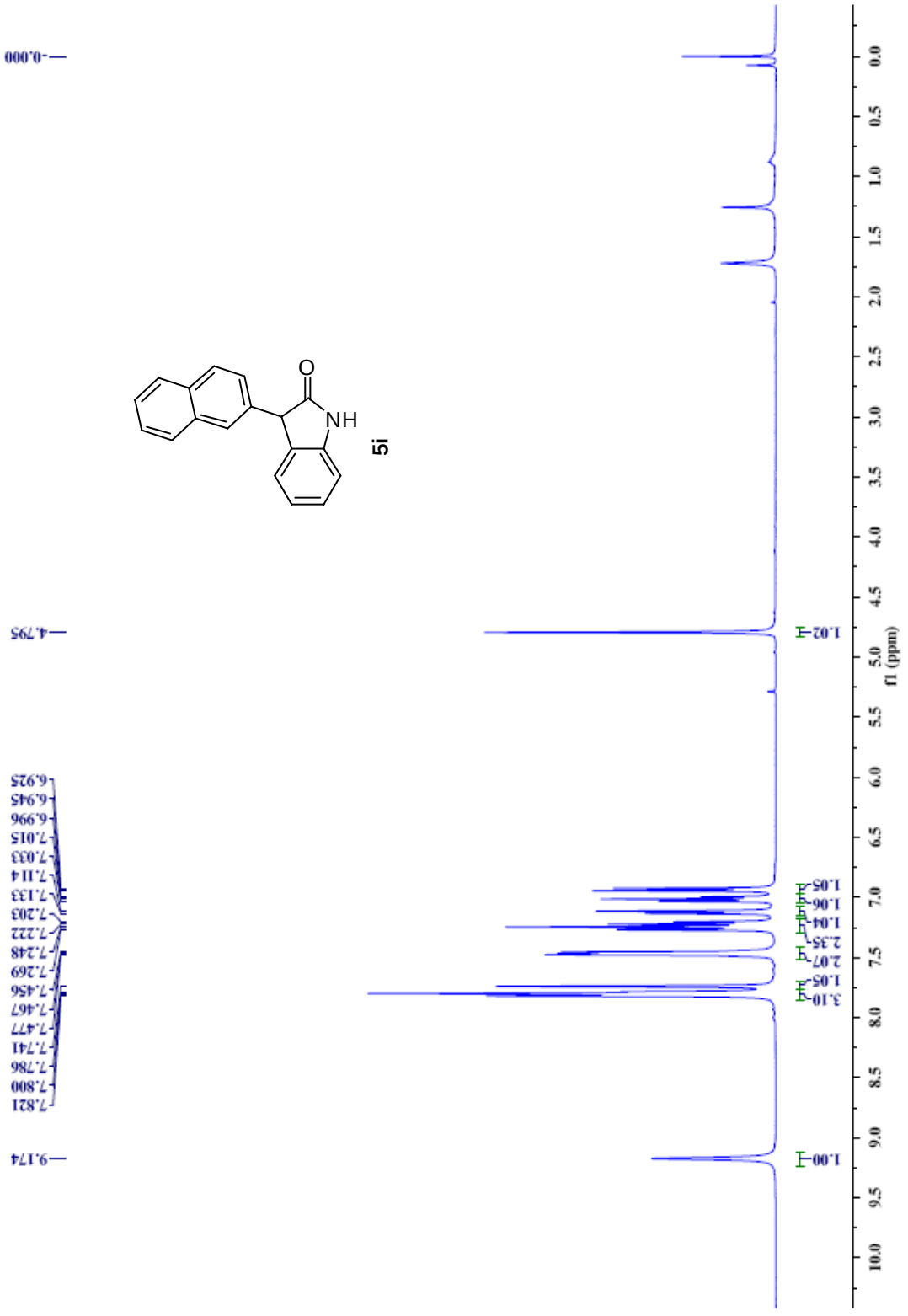
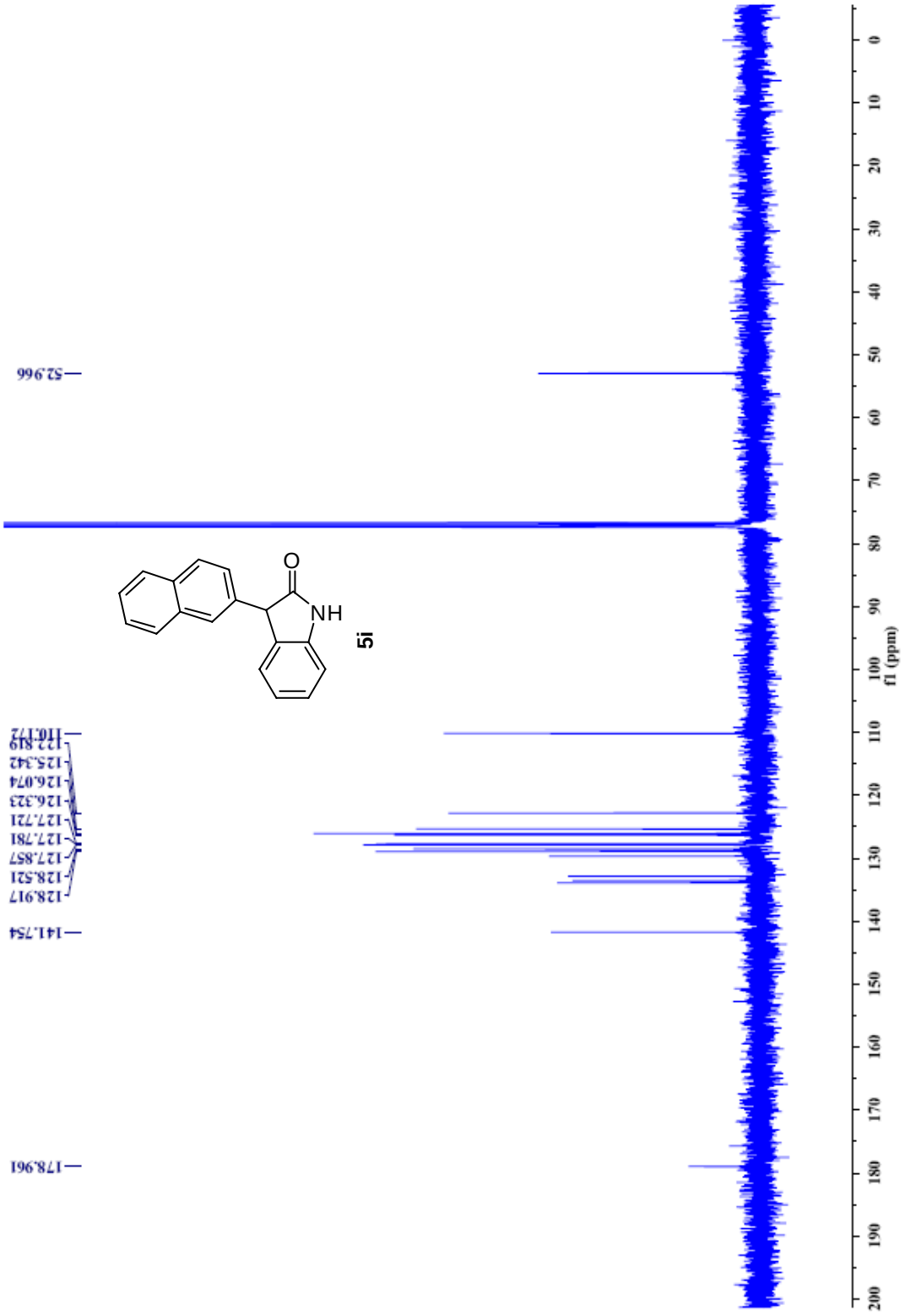
142.668
177.318
O
NH
5h
f1 (ppm)


O
NH
5i
f1 (ppm)


52.966
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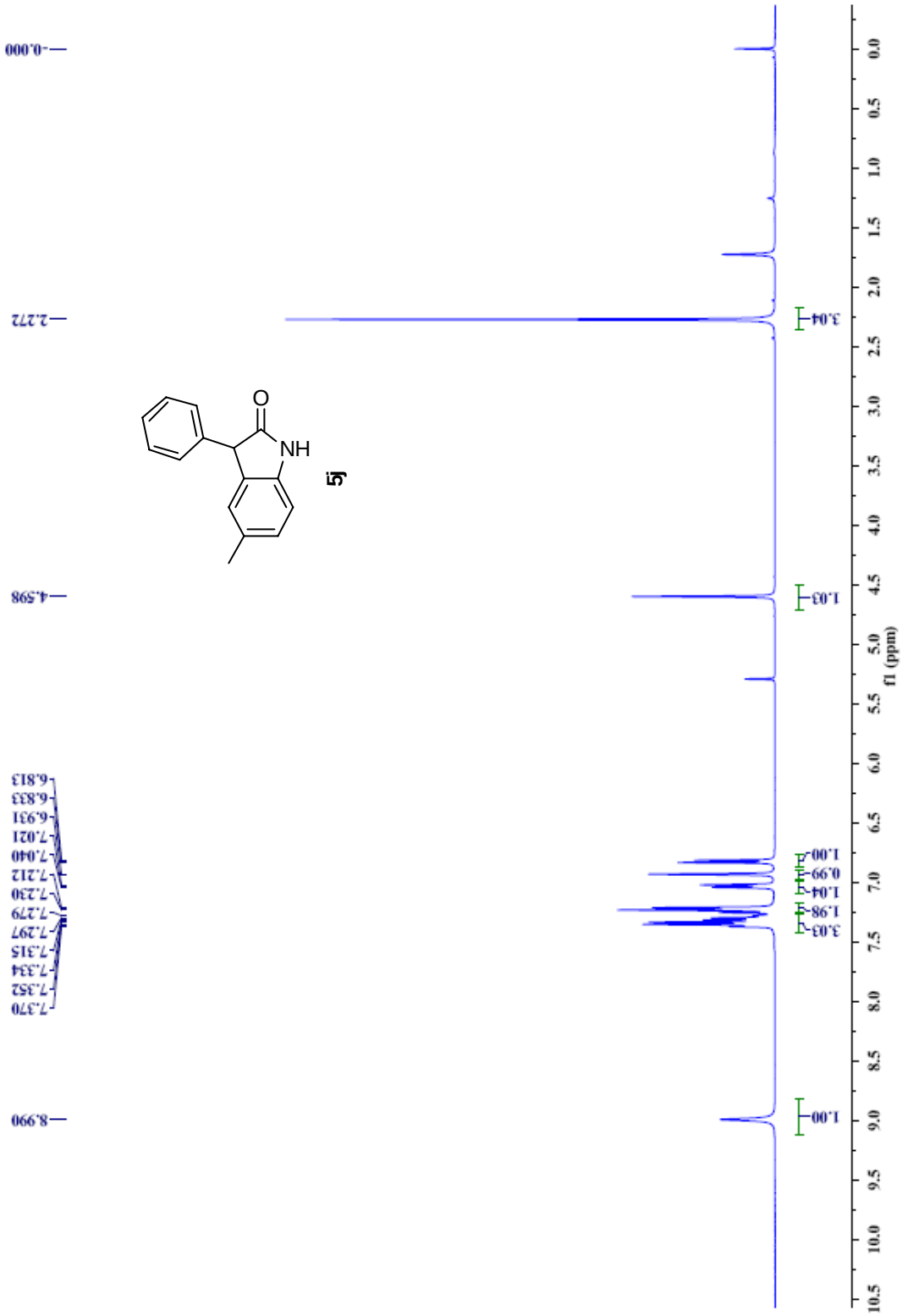
122.819
125.342
126.074
126.323
127.721
127.781
127.857
128.521
128.917
141.754
178.961
O
NH
5i
f1 (ppm)


O
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5j
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7.352
7.334
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7.297
7.279
7.230
7.212
7.040
7.021
6.931
6.833
6.813
4.598
2.272
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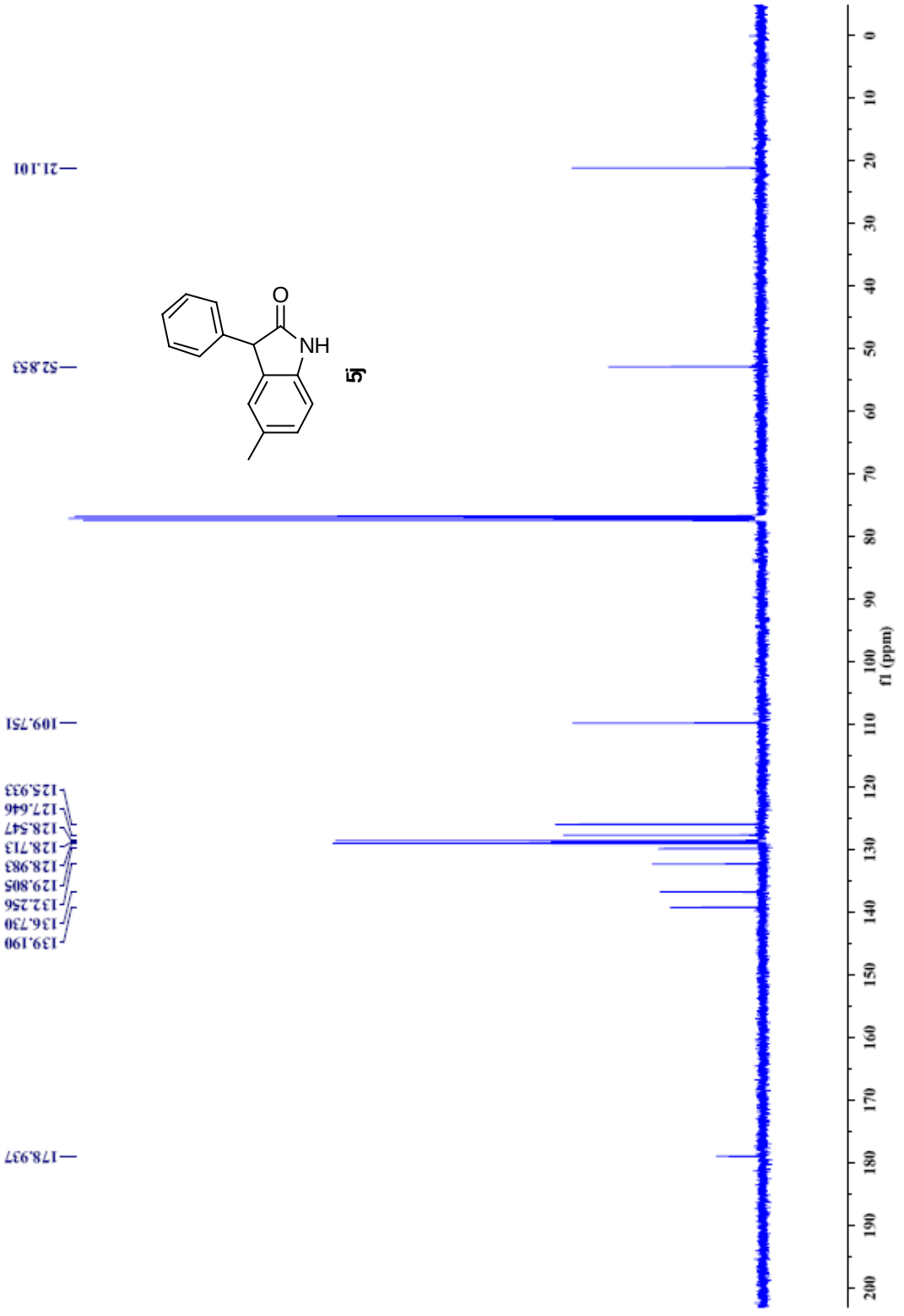
1.00
3.03
1.98
1.04
0.99
1.00
1.03
3.04
f1 (ppm)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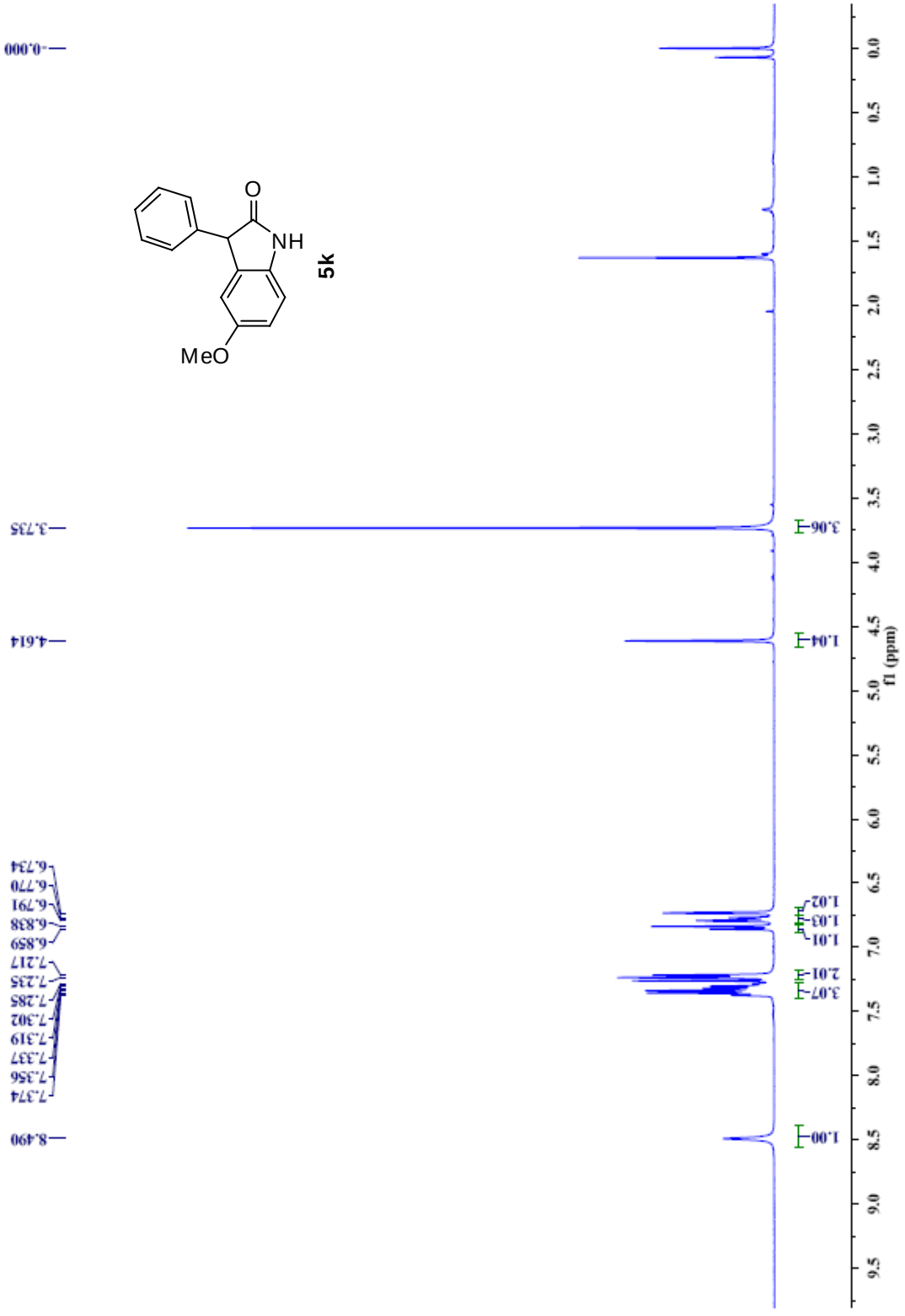
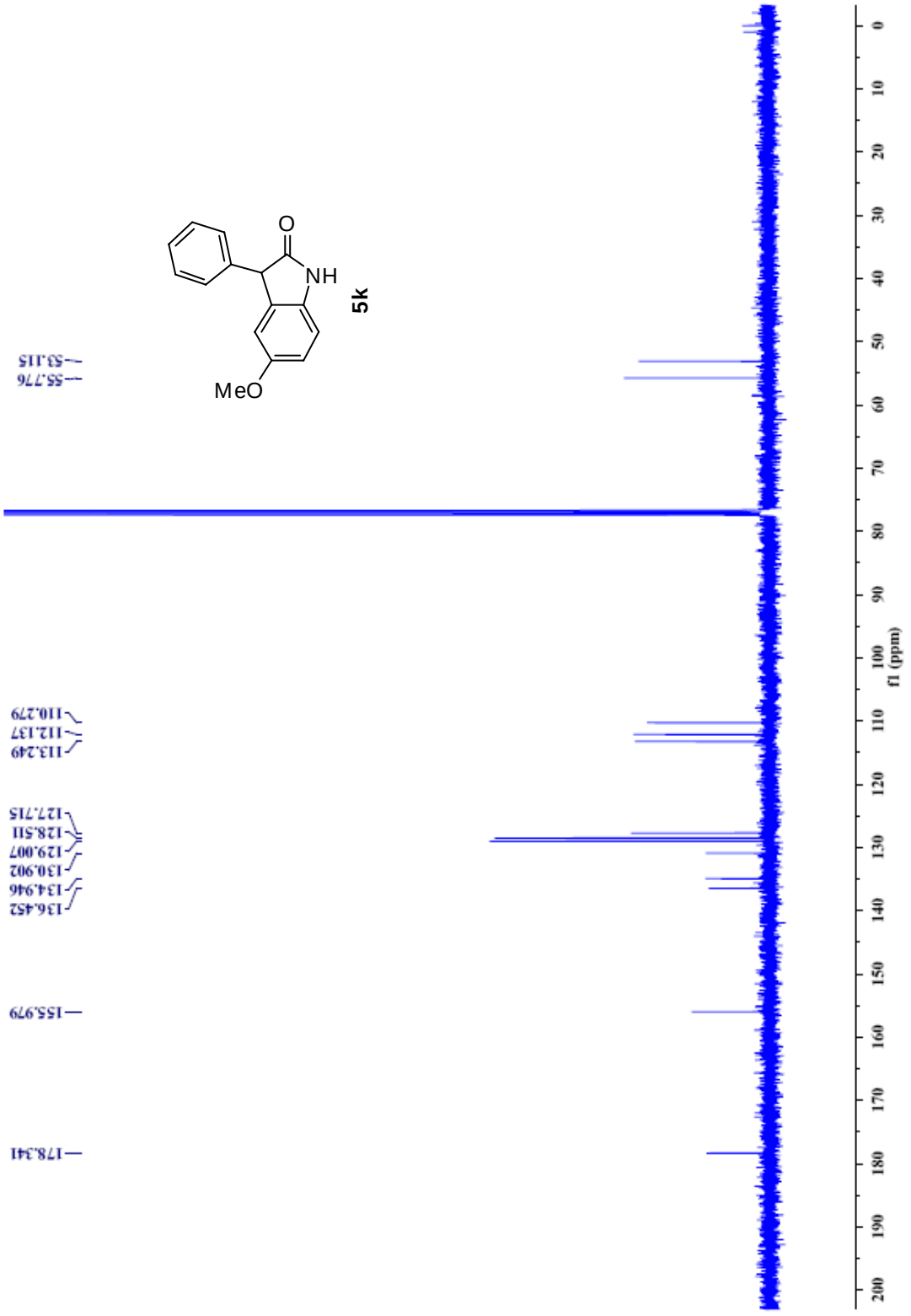
O
NH
5j
f1 (ppm)


O
NH
MeO
5k
f1 (ppm)


O
NH
MeO
5k
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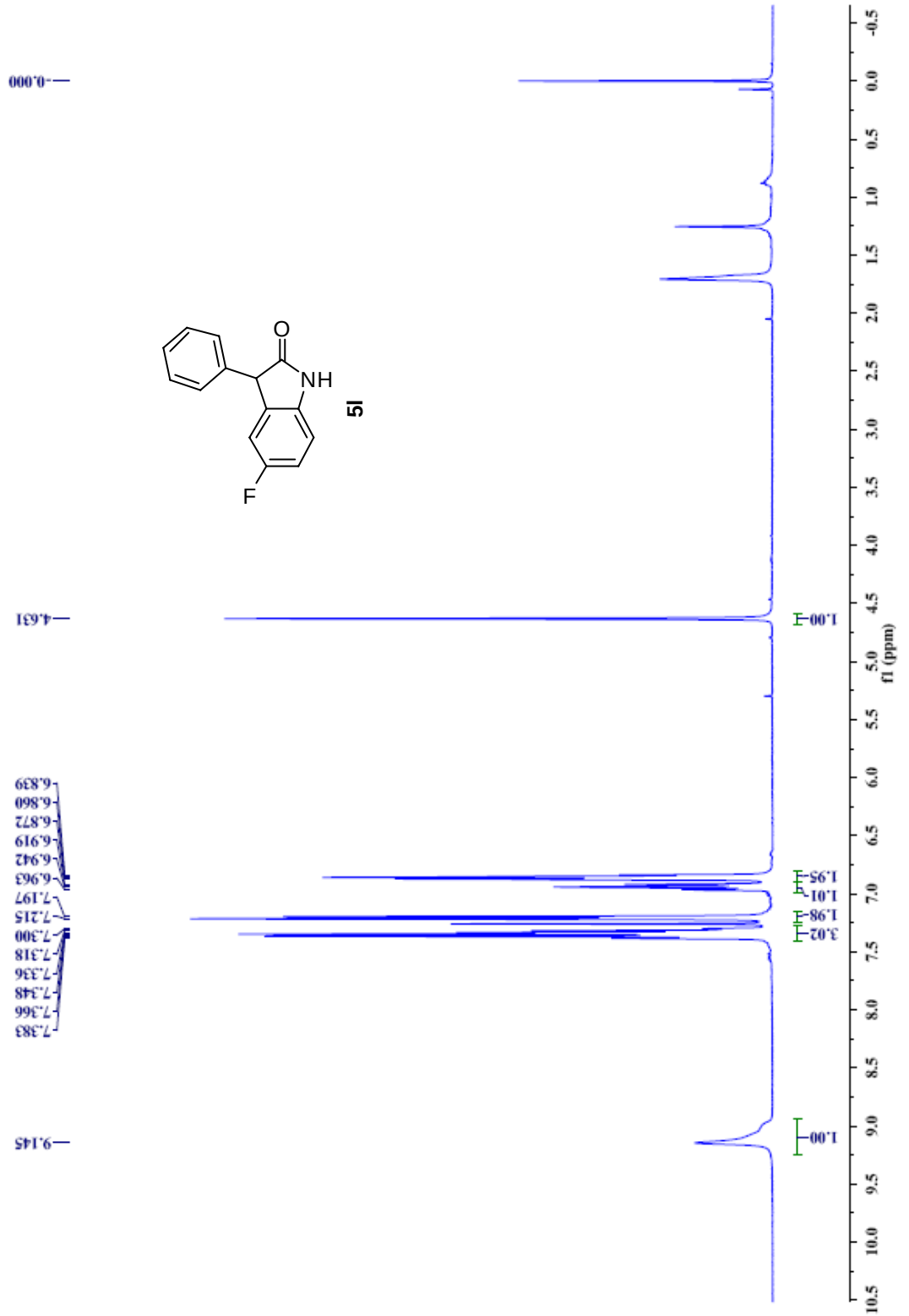
55.776
110.279
112.137
113.249
127.715
128.511
129.007
130.902
134.946
136.452
155.979
178.341
f1 (ppm)


O
NH
F
5l
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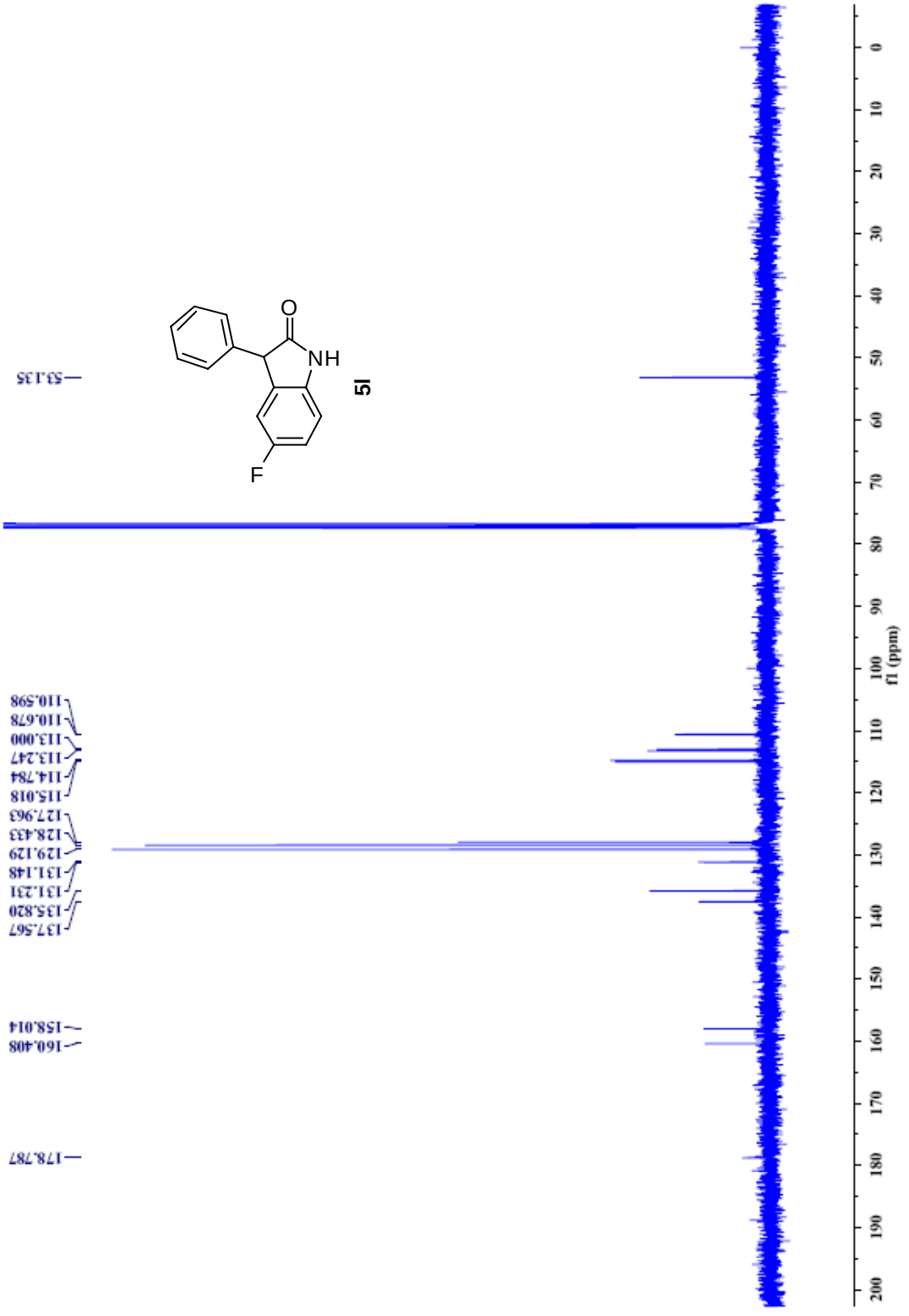
4.631
6.839
6.860
6.872
6.919
6.942
6.963
7.197
7.215
7.300
7.318
7.336
7.348
7.366
7.383
9.145
1.00
1.95
1.01
1.98
3.02
1.00
f1 (ppm)


O
NH
F
5l
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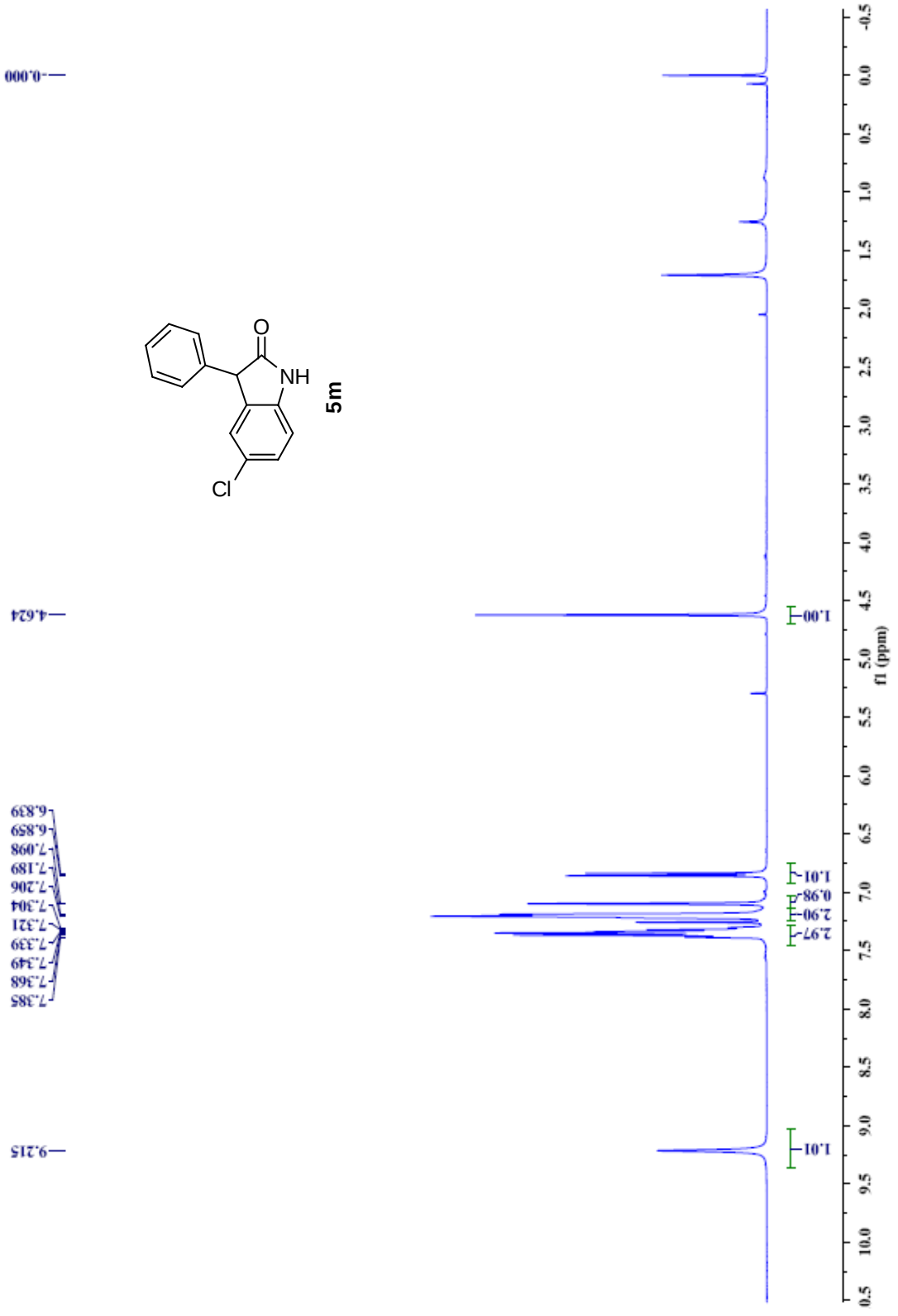
110.598
110.678
113.000
113.247
114.784
115.018
127.963
128.433
129.129
131.148
131.231
135.820
137.567
158.014
160.408
178.787
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170
180
190
200
f1 (ppm)


O
NH
Cl
5m
9.215
7.385
7.368
7.349
7.339
7.321
7.304
7.206
7.189
7.098
6.859
6.839
4.624
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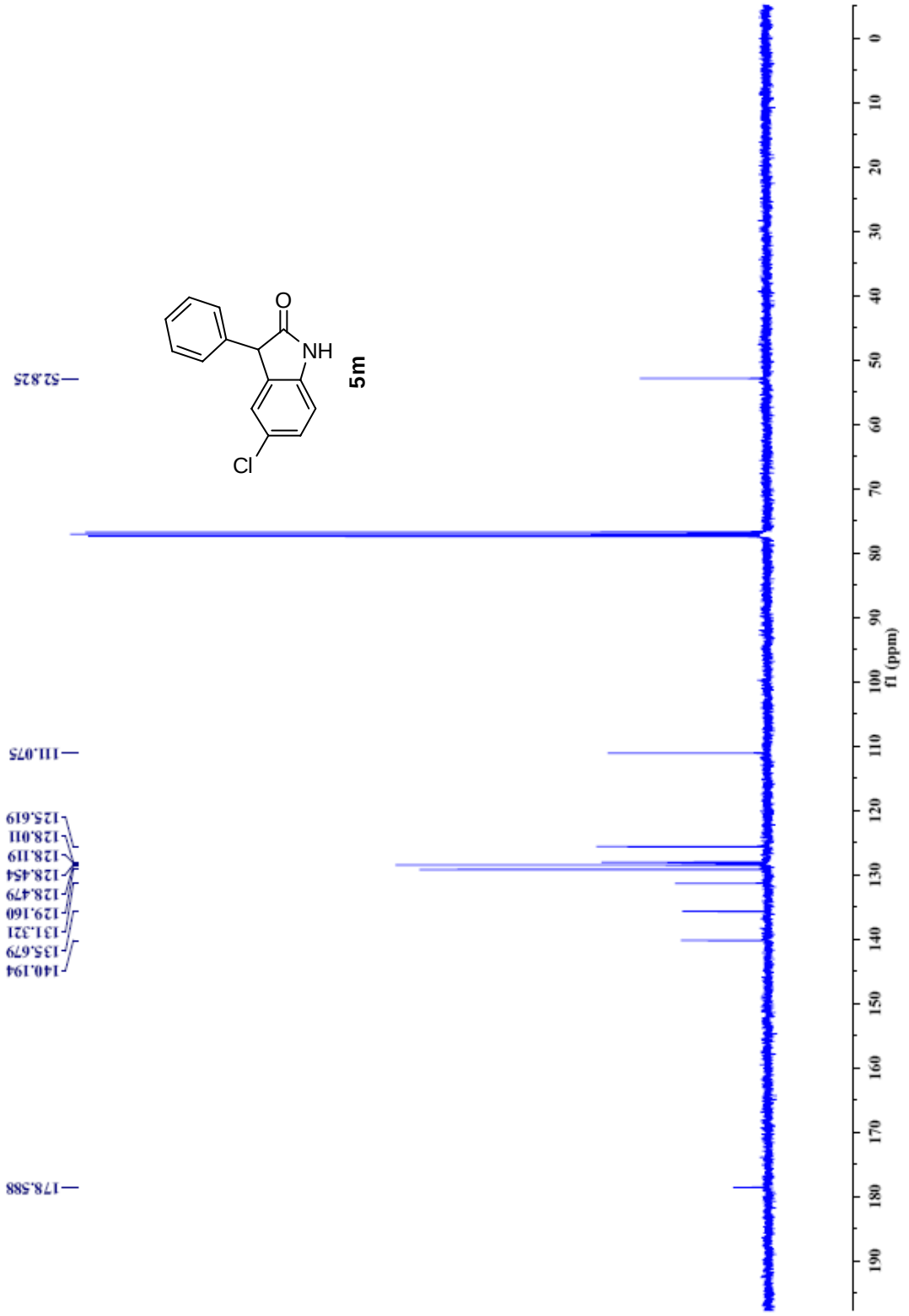
1.01
2.97
2.90
0.98
1.01
1.00
f1 (ppm)


O
NH
Cl
5m
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129.160
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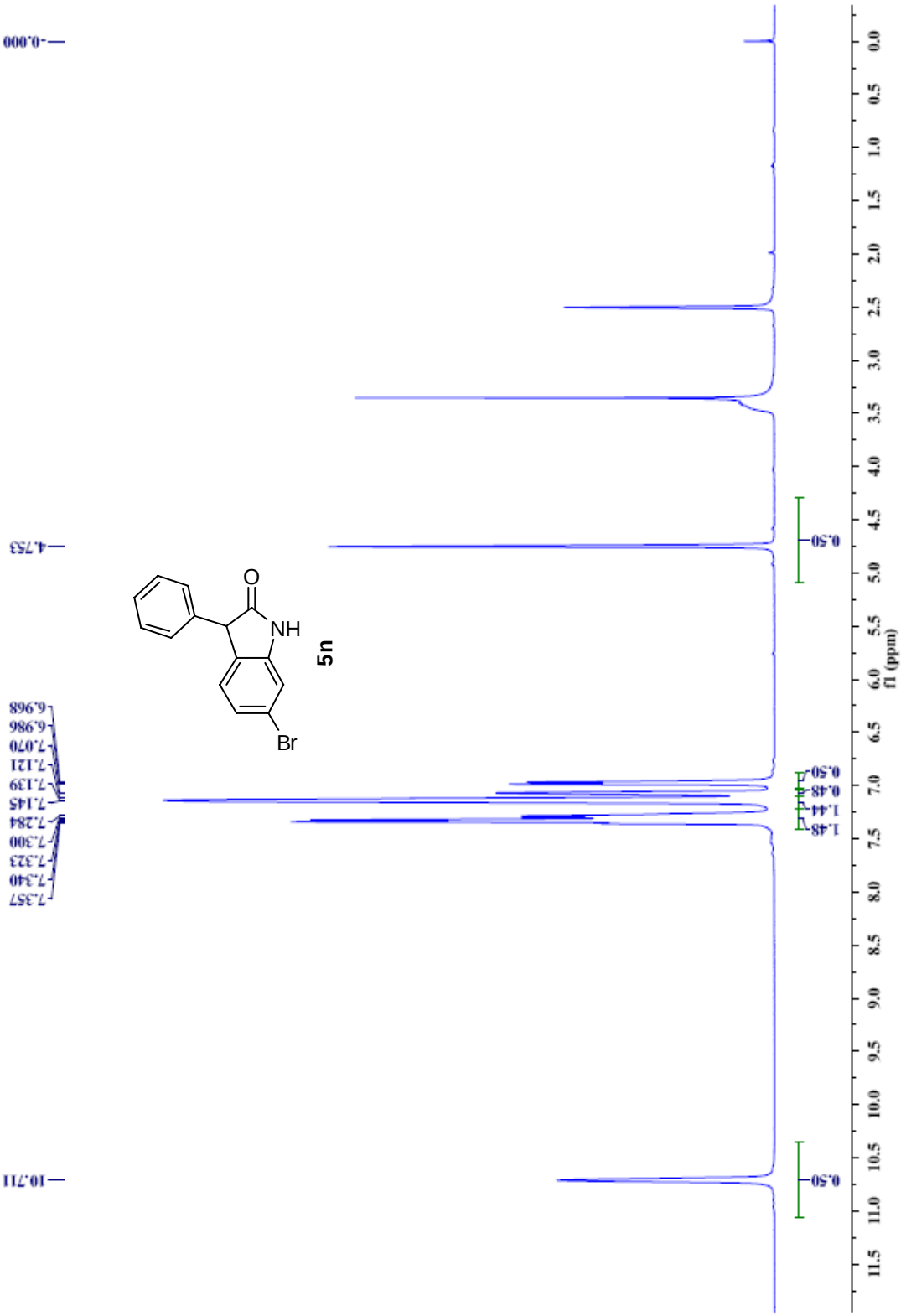
f1 (ppm)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7.145
7.139
7.121
7.070
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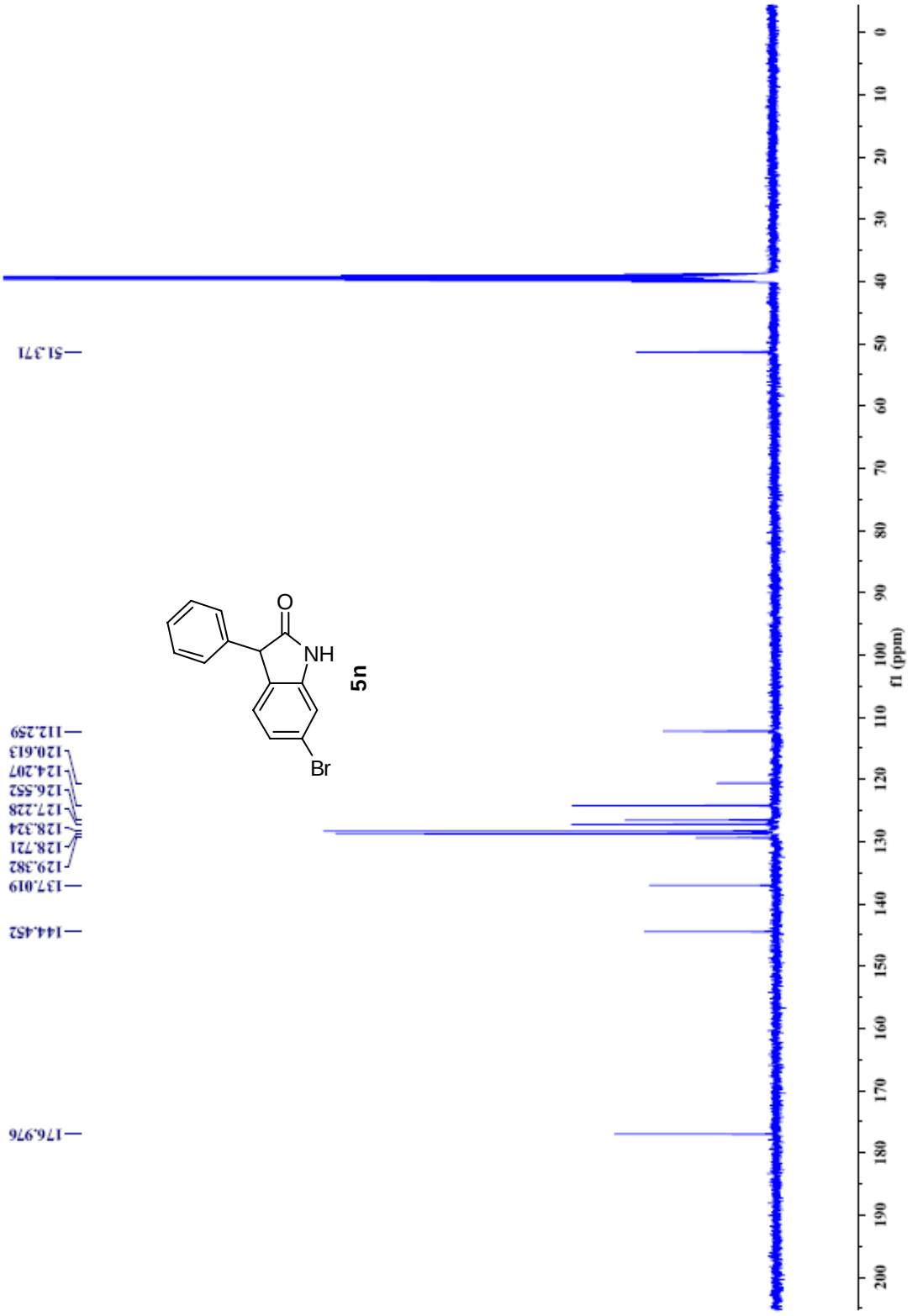
0.50
0.48
1.44
1.48
0.50
0.50
NH
O
Br
5n
f1 (ppm)


O
NH
Br
5n
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112.259
120.613
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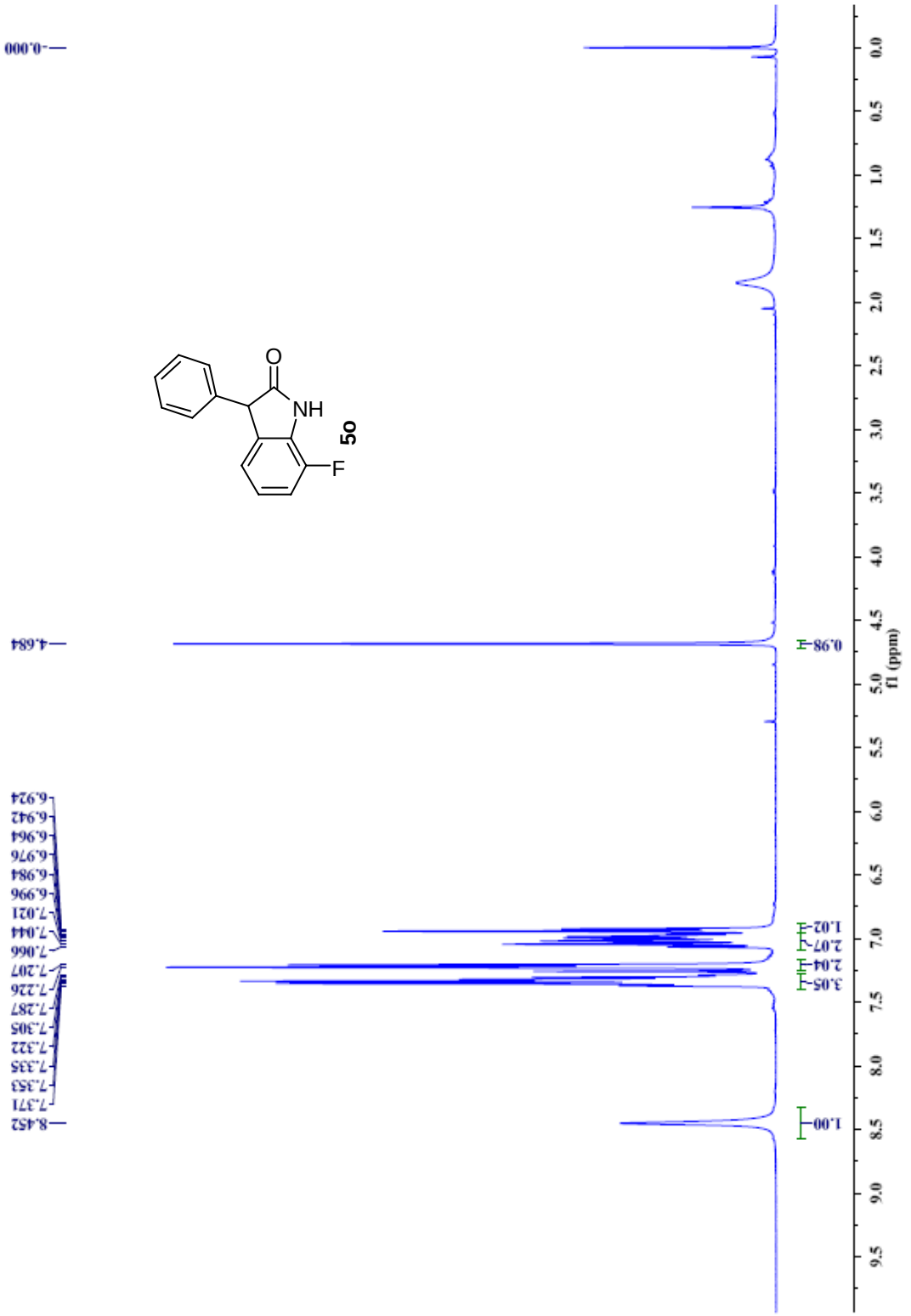
144.452
176.976
f1 (ppm)


O
NH
F
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7.335
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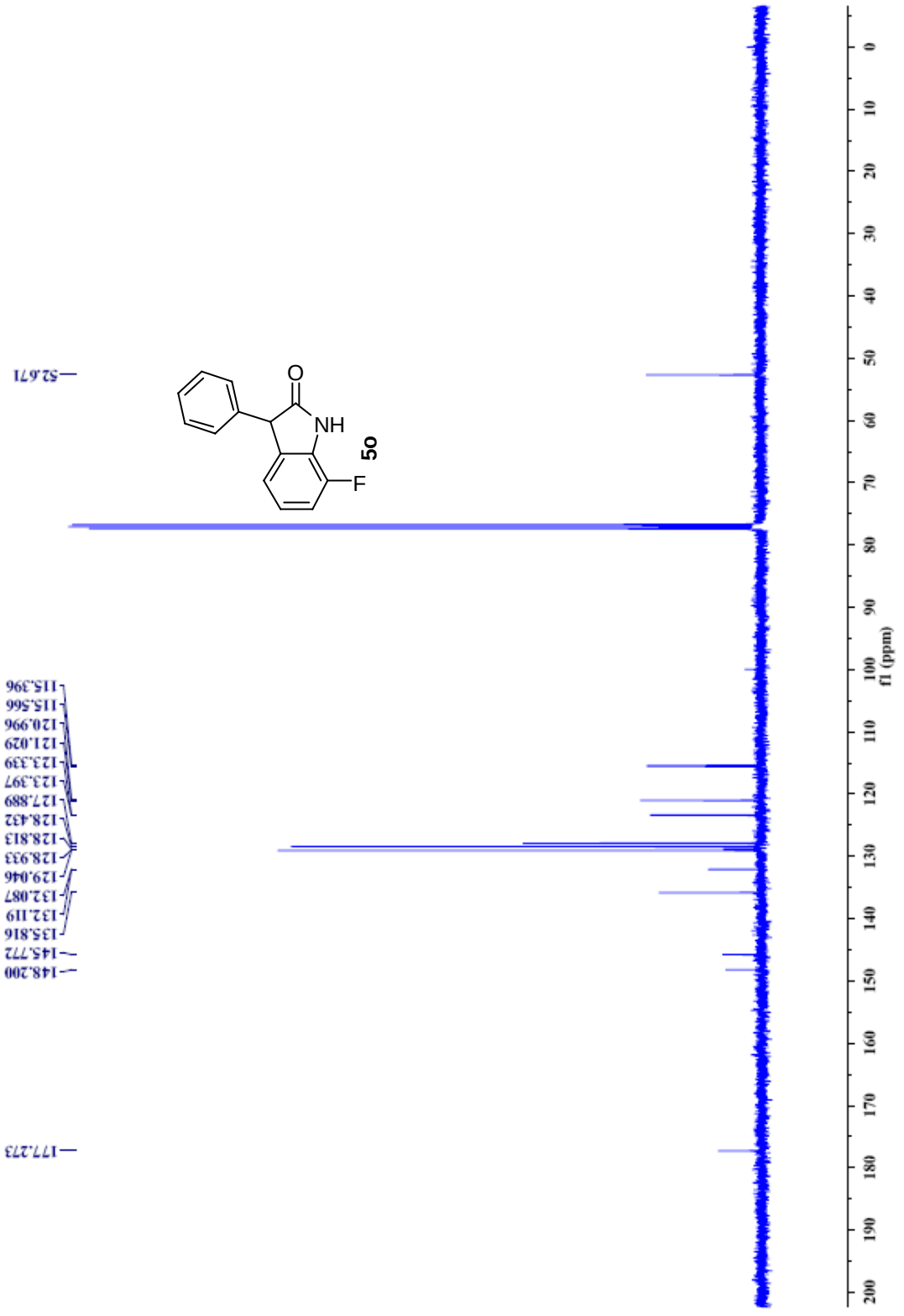
7.226
7.207
7.066
7.044
7.021
6.996
6.984
6.976
6.964
6.942
6.924
4.684
-0.000
1.00
3.05
2.04
2.07
1.02
0.98
f1 (ppm)


52.671
177.273
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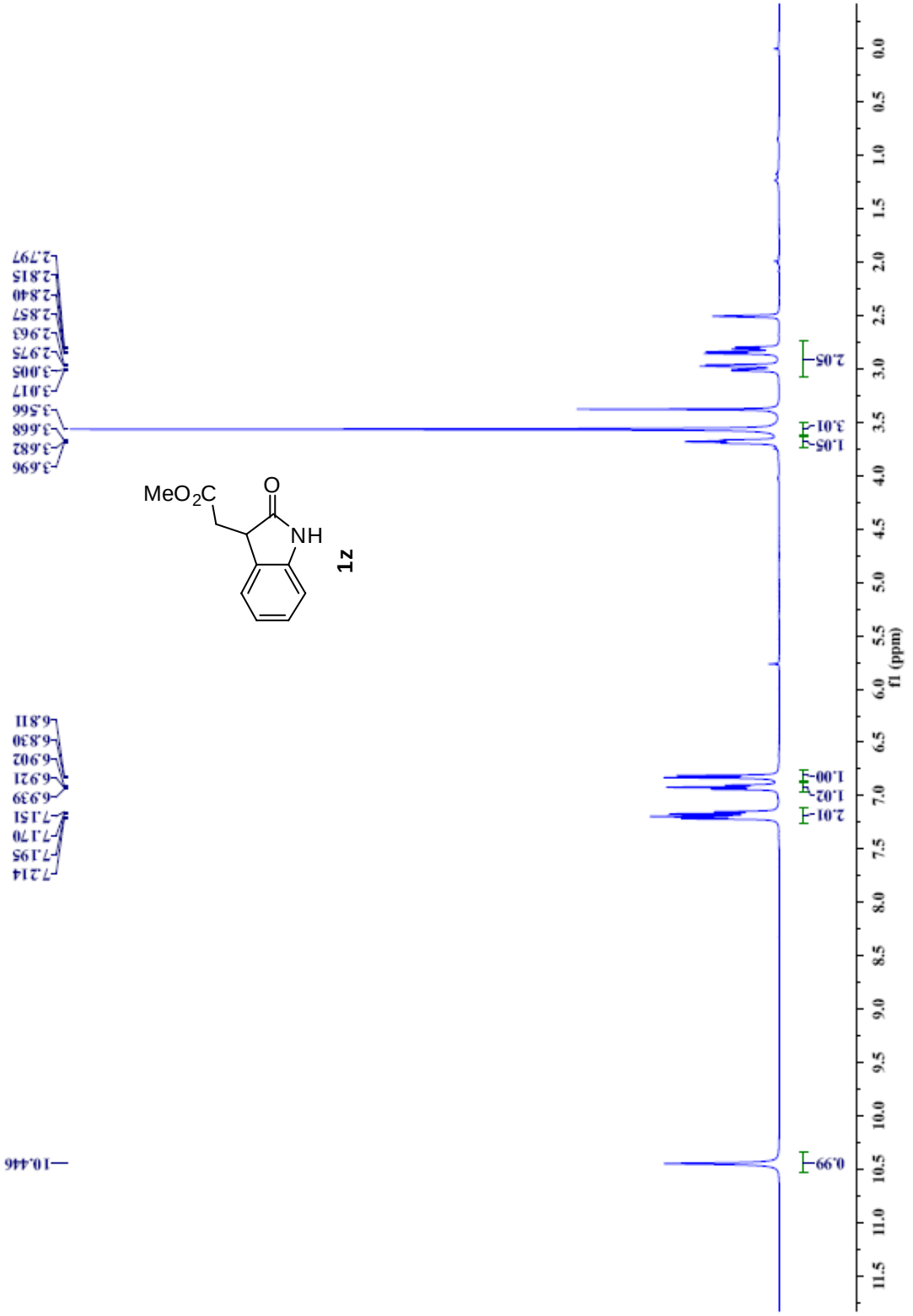
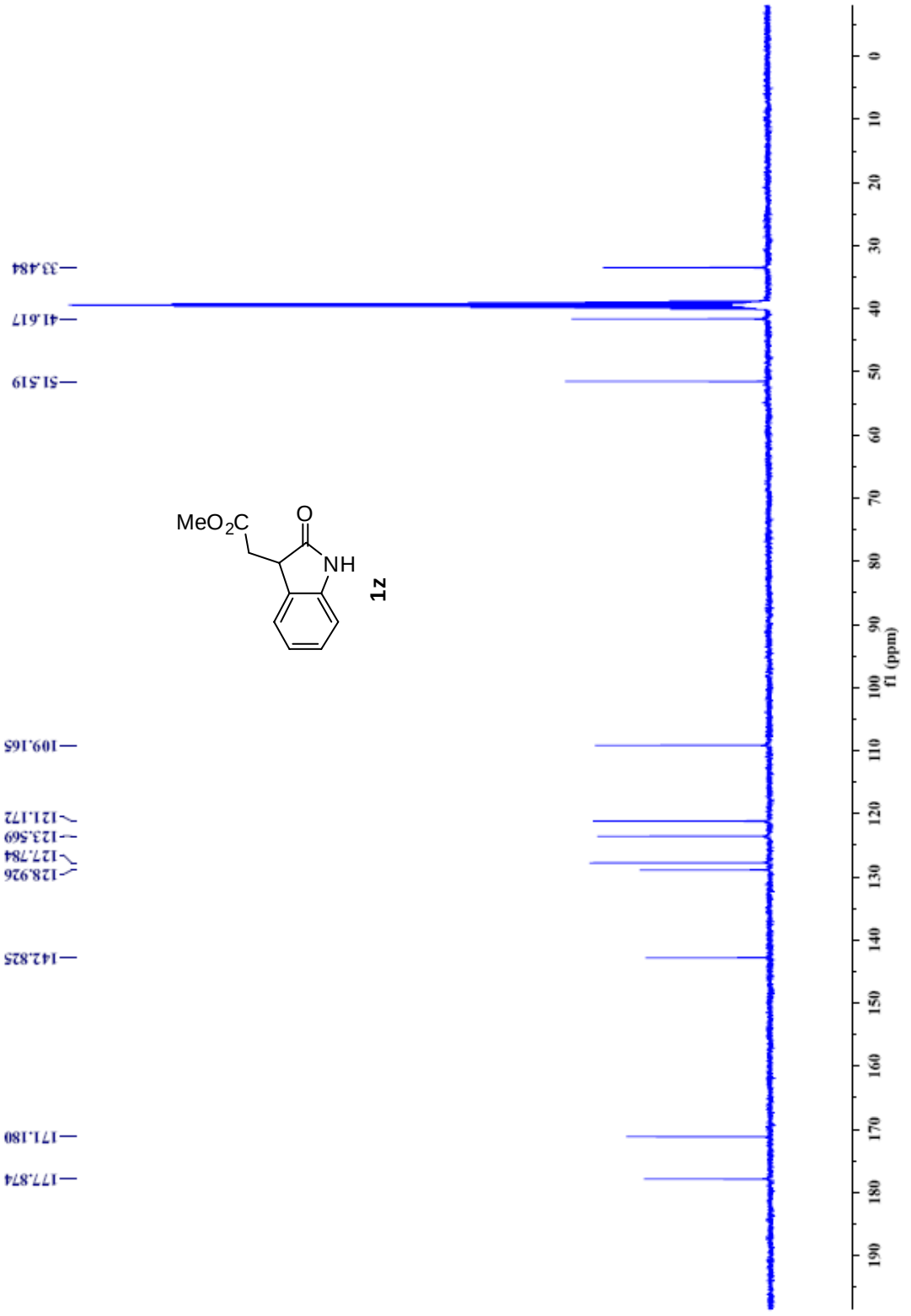
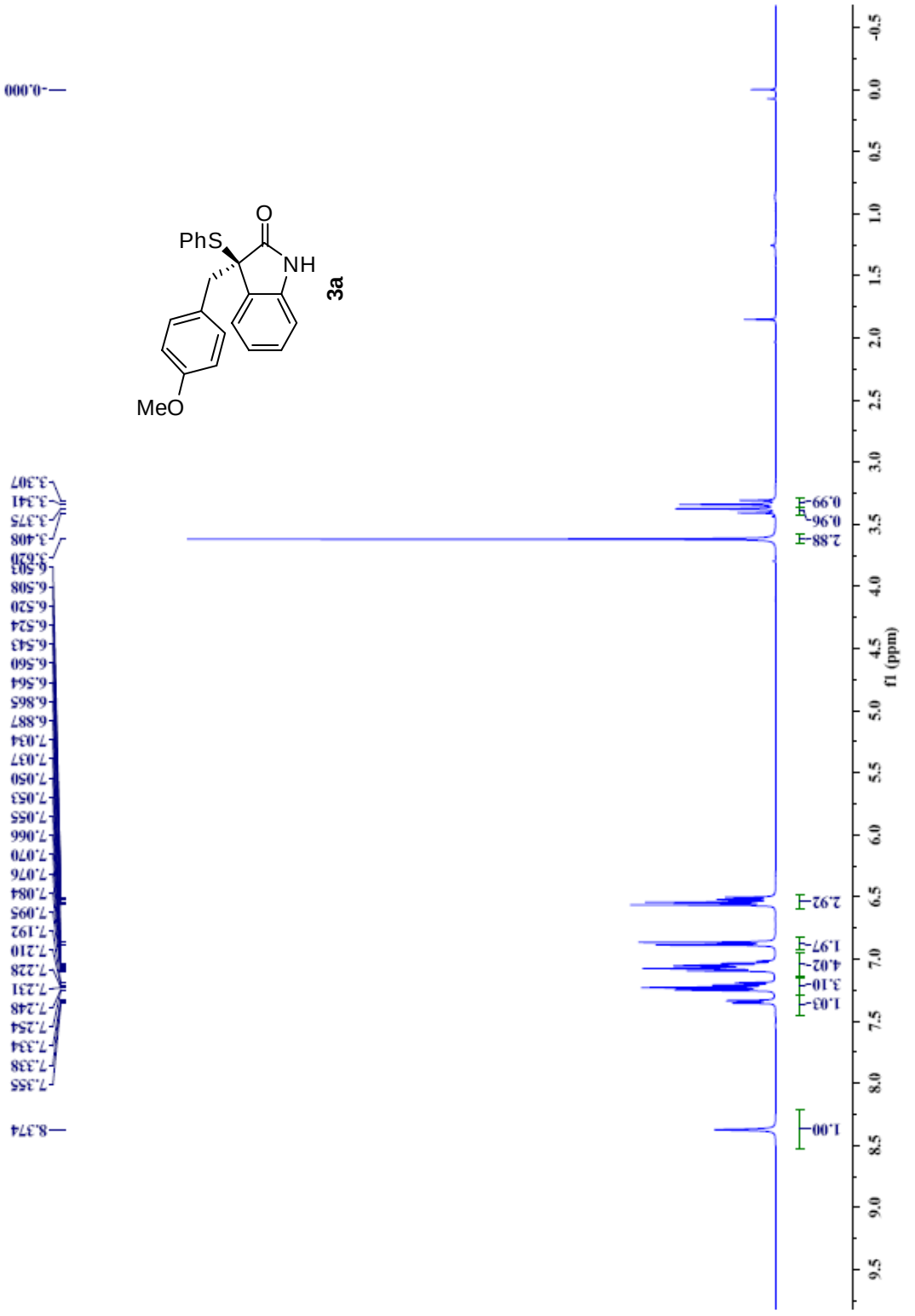
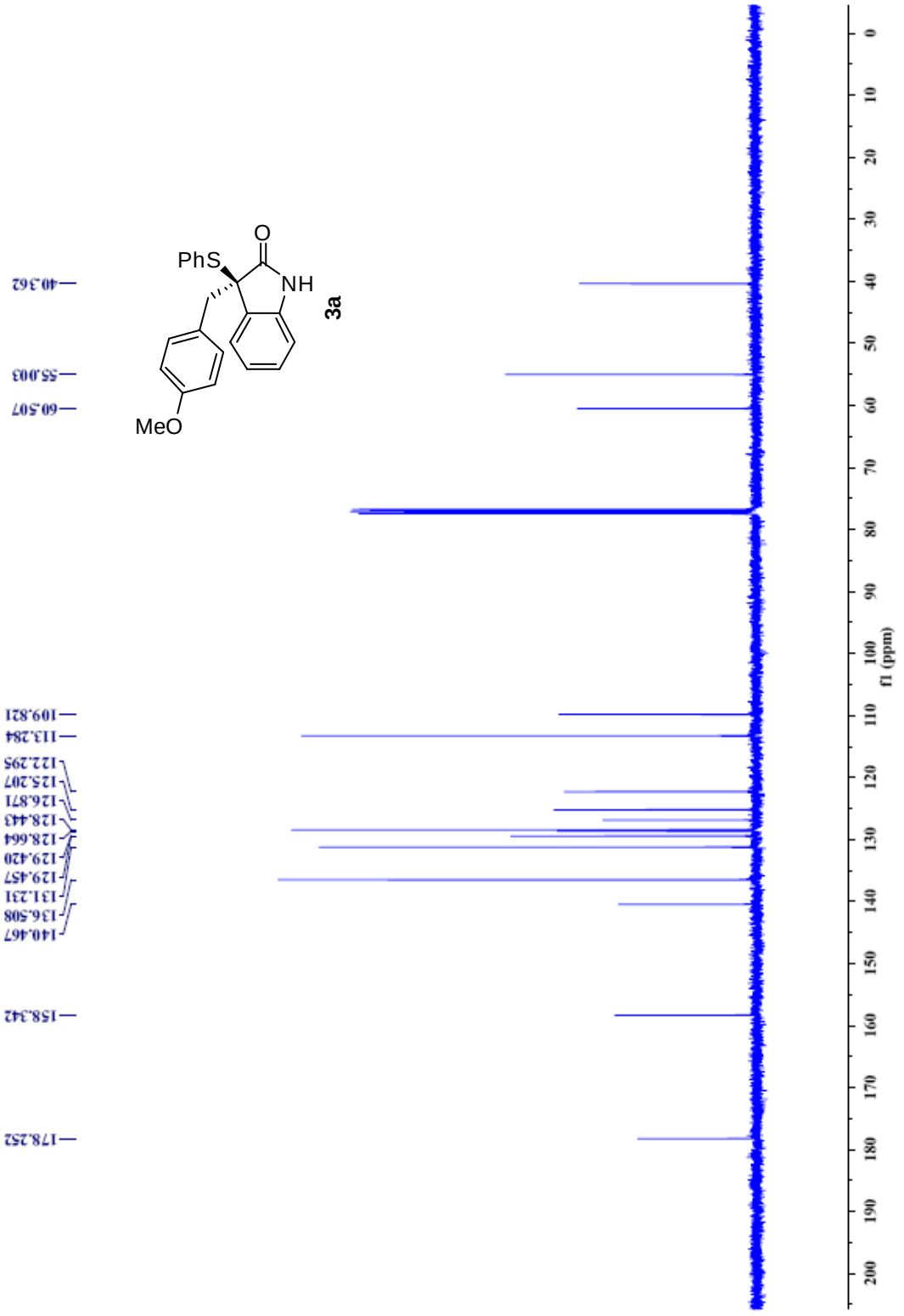
145.772
135.816
132.119
132.087
129.046
128.933
128.813
128.432
127.889
123.397
123.339
121.029
120.996
115.566
115.396
O
NH
F
50
f1 (ppm)


MeO2C
O
NH
1z
f1 (ppm)


33.484
41.617
51.519
109.165
121.172
123.569
127.784
128.926
142.825
171.180
177.874
MeO2C
O
NH
1z
f1 (ppm)


PhS
O
NH
MeO
3a
f1 (ppm)


PhS
O
NH
MeO
3a
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60.507
109.821
113.284
122.295
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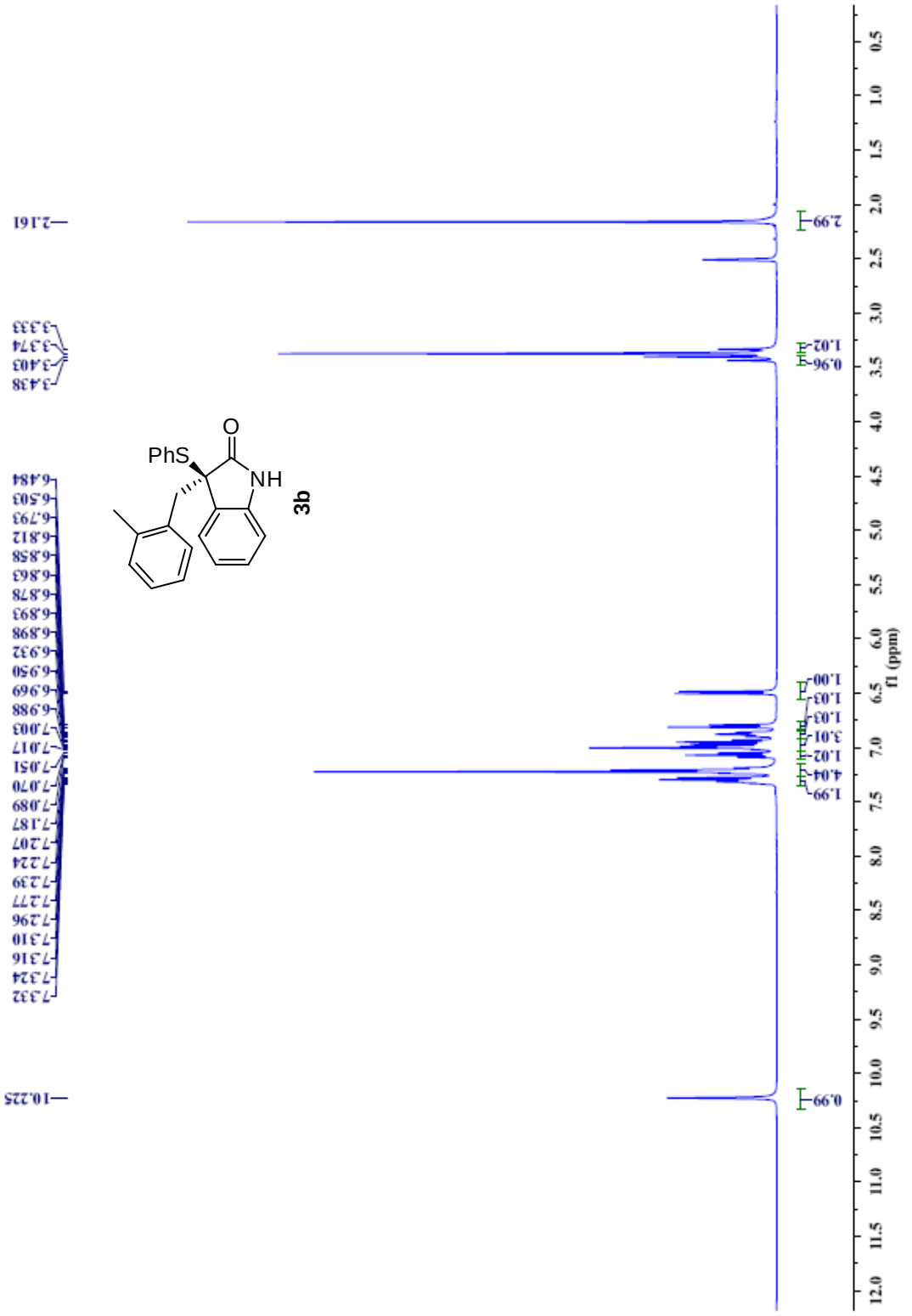
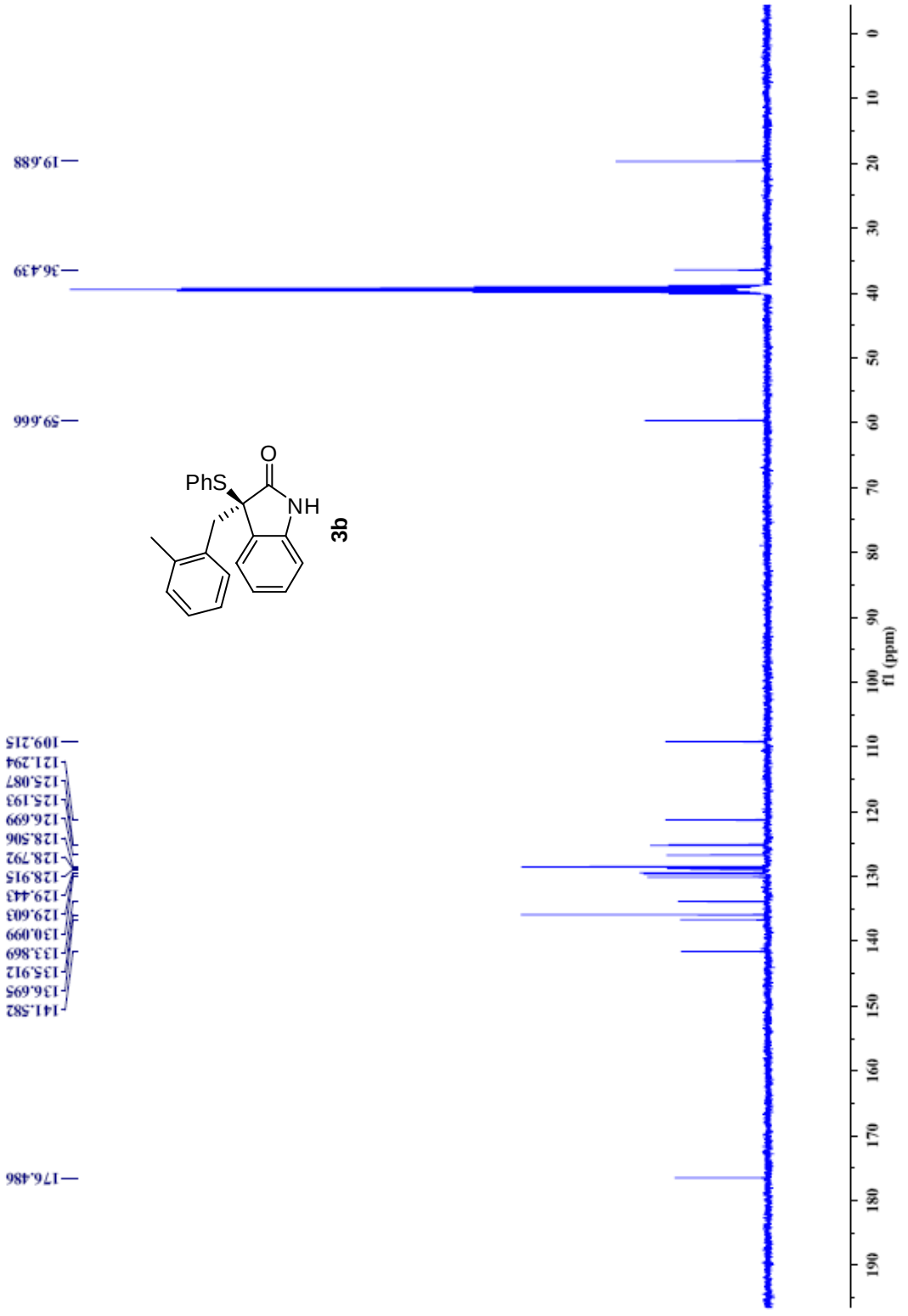
f1 (ppm)


PhS
O
NH
3b
f1 (ppm)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59.666
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121.294
125.087
125.193
126.699
128.506
128.792
128.915
129.443
129.603
130.099
133.869
135.912
136.695
141.582
176.486
PhS
O
NH
3b
0
10
20
30
40
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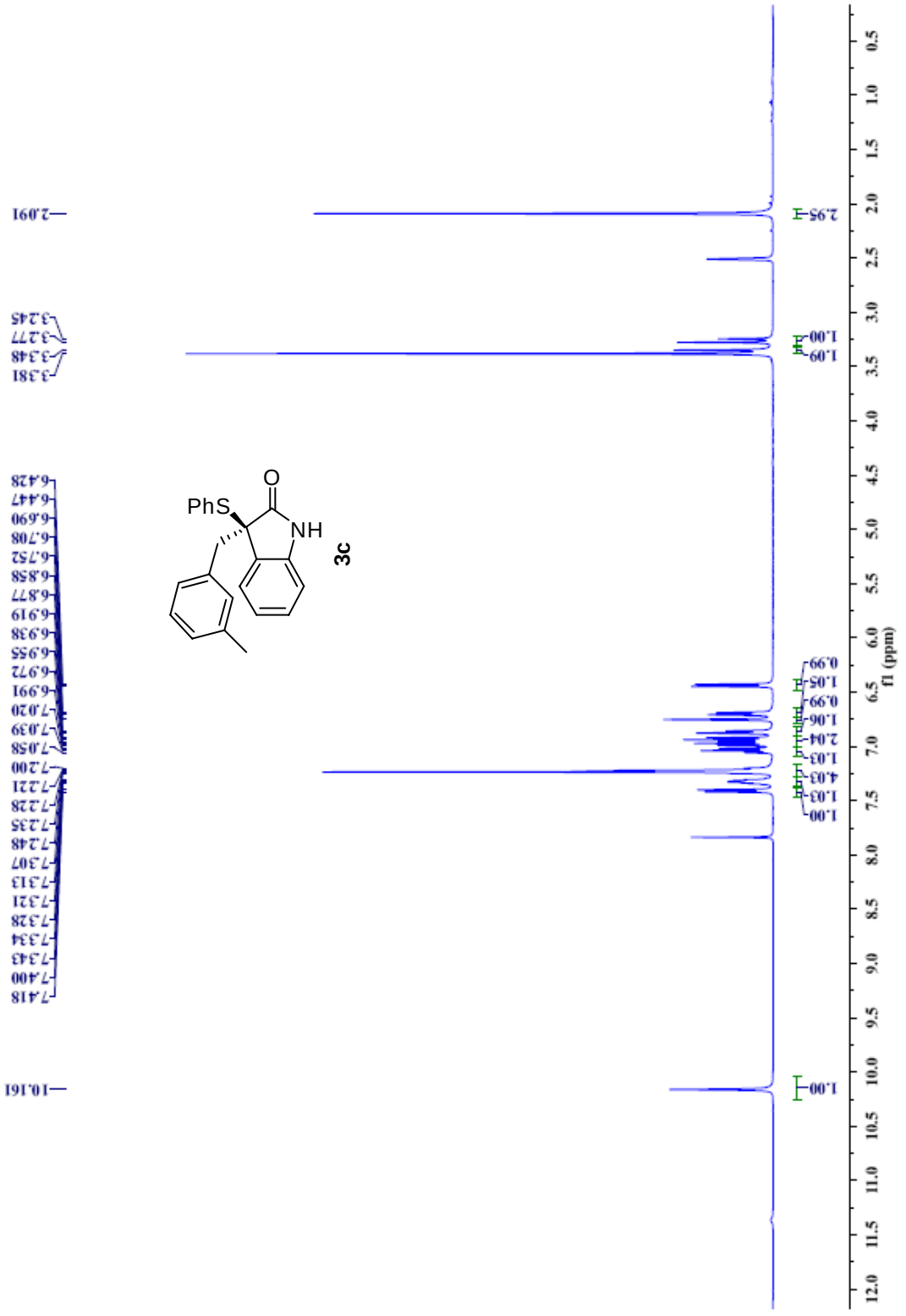
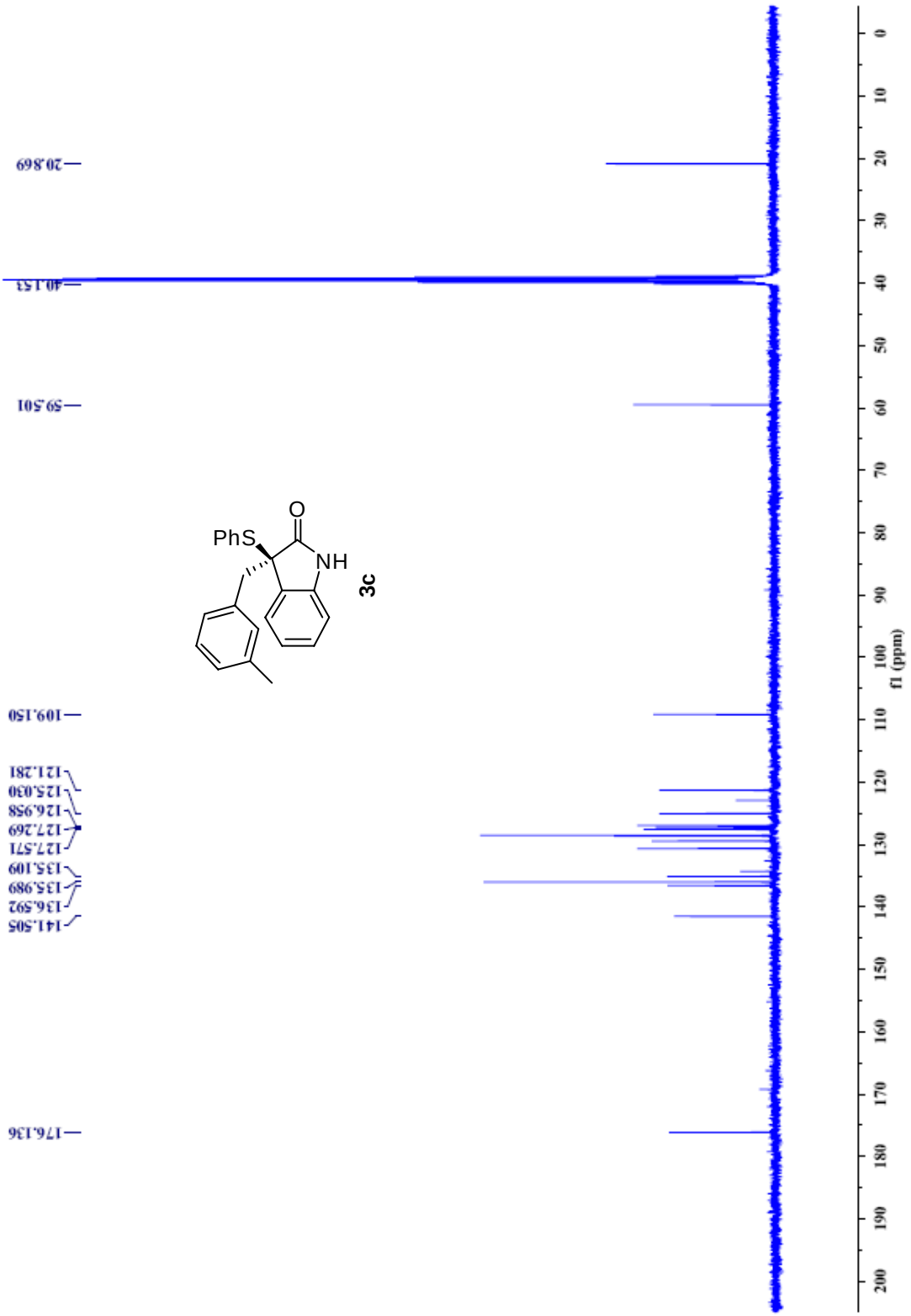
70
80
90
100
110
120
130
140
150
160
170
180
190
f1 (ppm)


PhS
O
NH
3c
f1 (ppm)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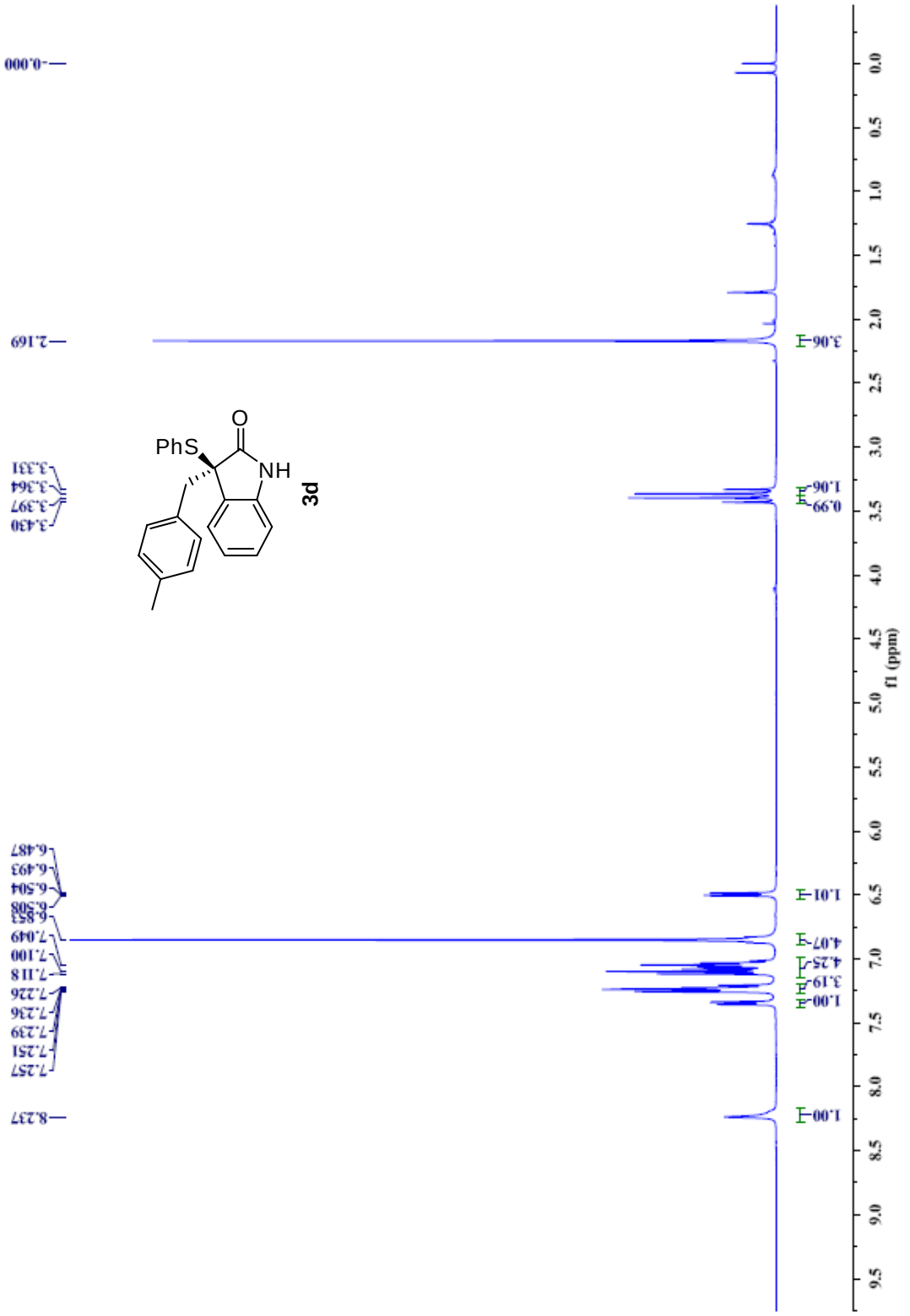
136.592
141.505
176.136
PhS
O
NH
3c
f1 (ppm)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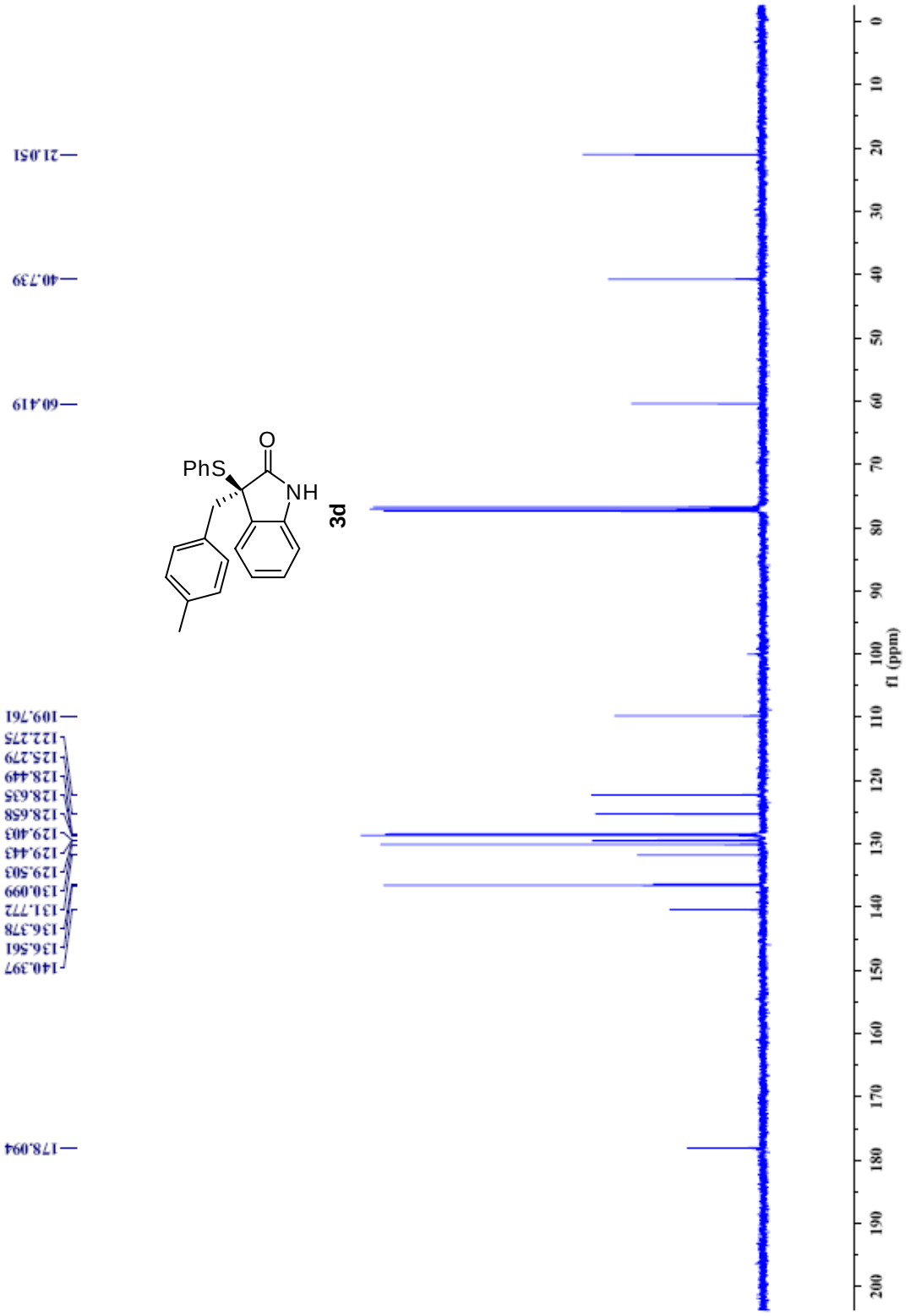
O
NH
3d
f1 (ppm)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60.419
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122.275
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128.449
128.635
128.658
129.403
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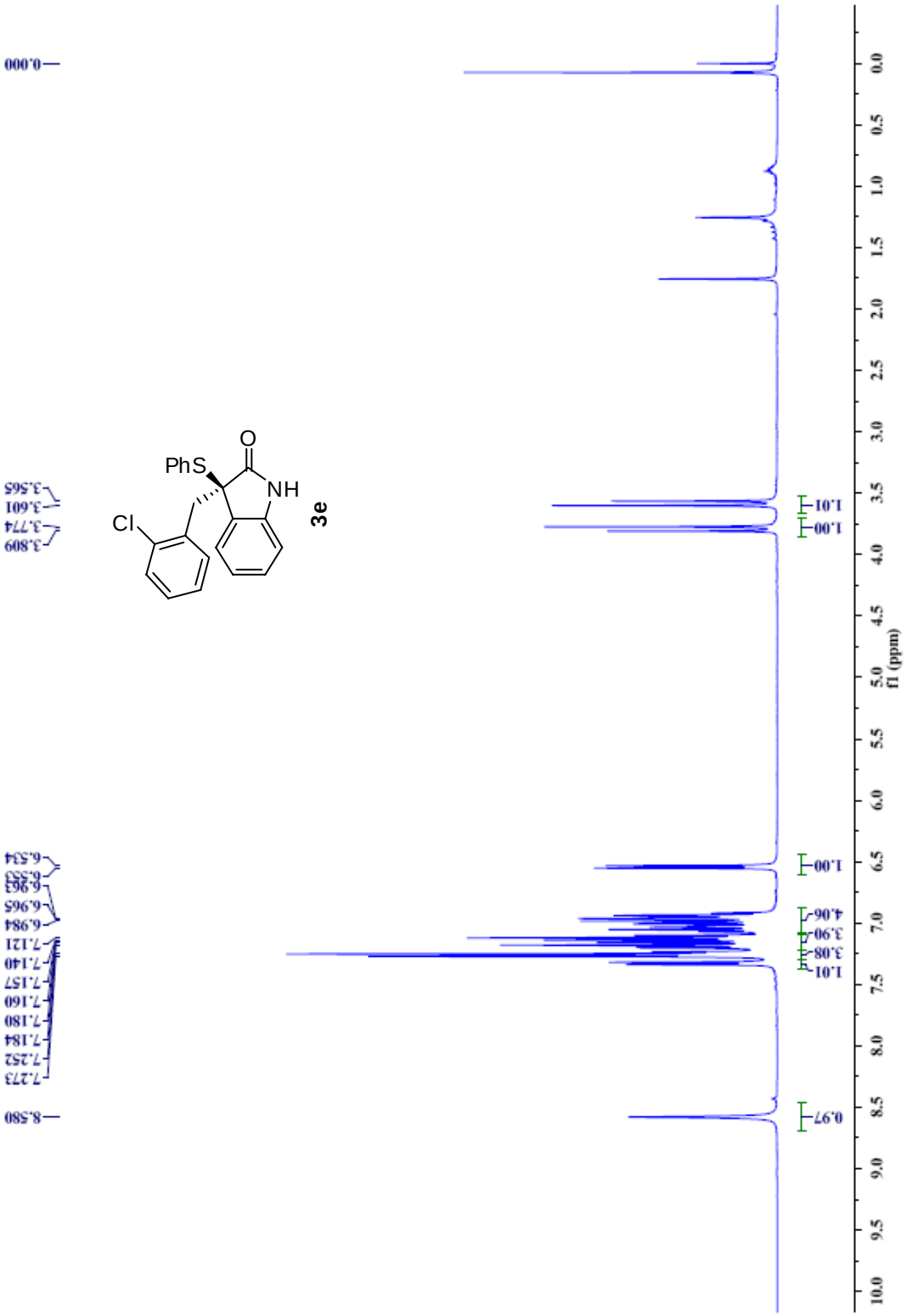
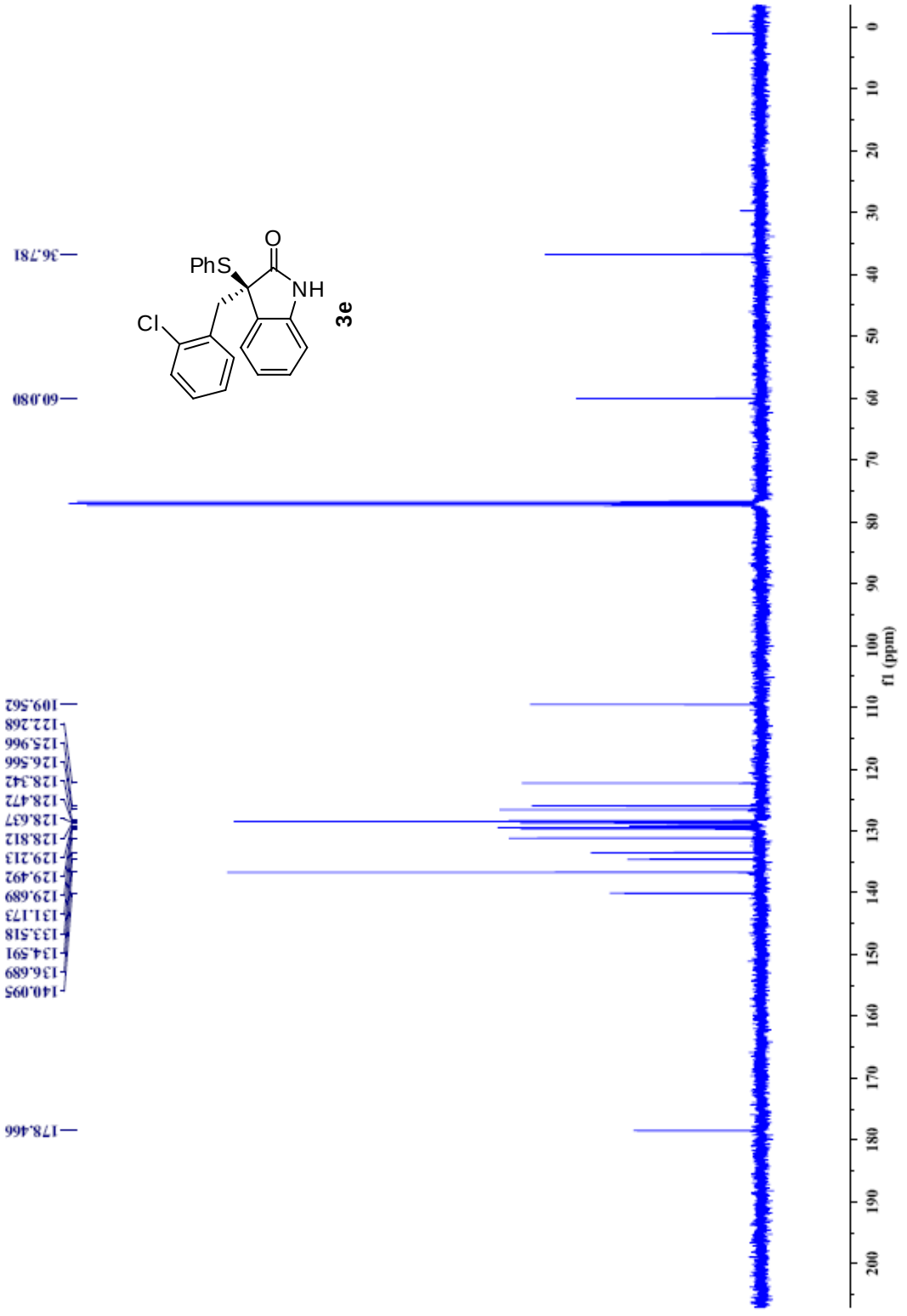
130.099
131.772
136.378
136.561
140.397
178.094
PhS
O
NH
3d
f1 (ppm)


PhS
O
NH
Cl
3e
f1 (ppm)


O
PhS
NH
Cl
3e
36.781
60.080
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125.966
126.566
128.342
128.472
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129.213
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131.173
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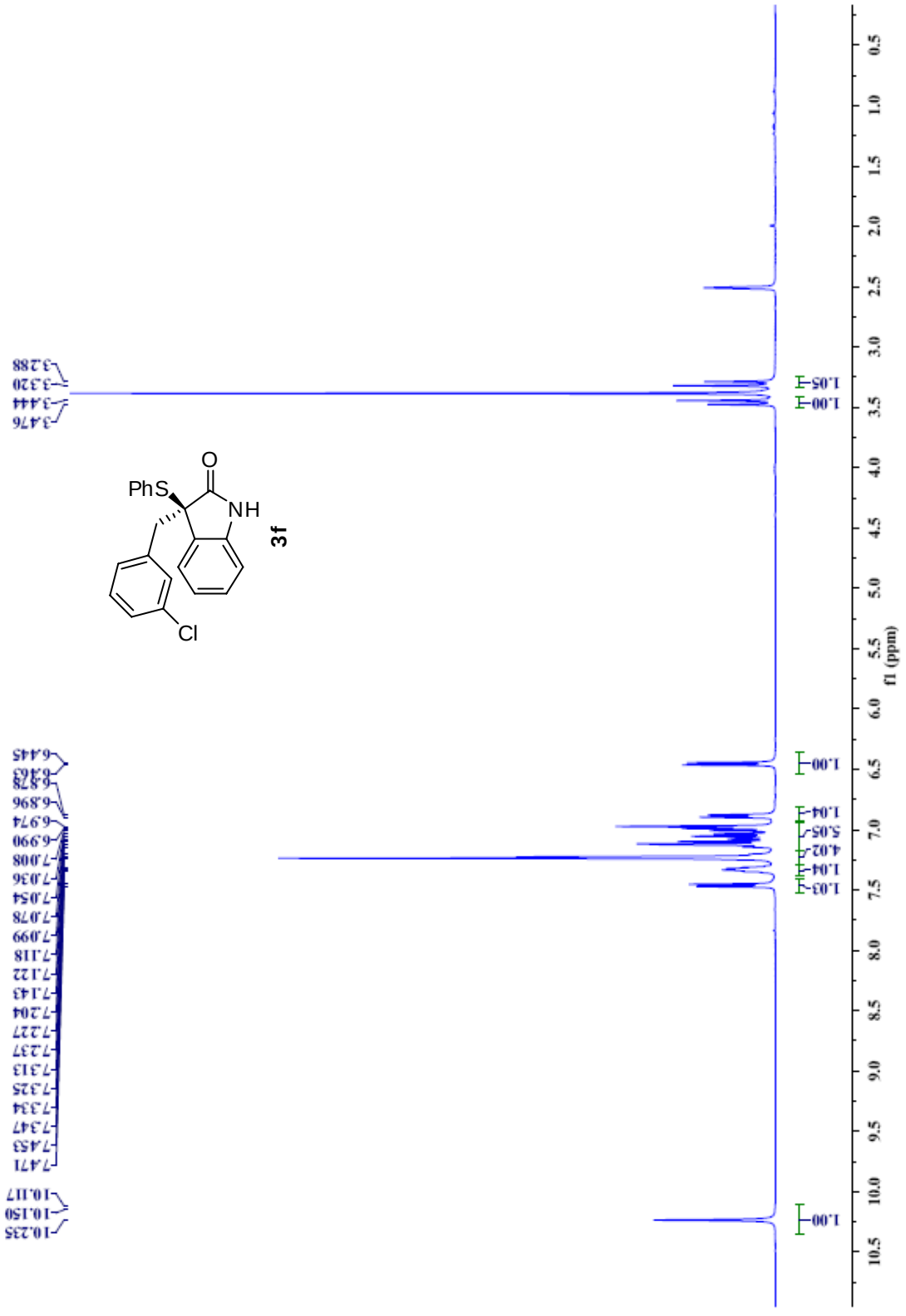
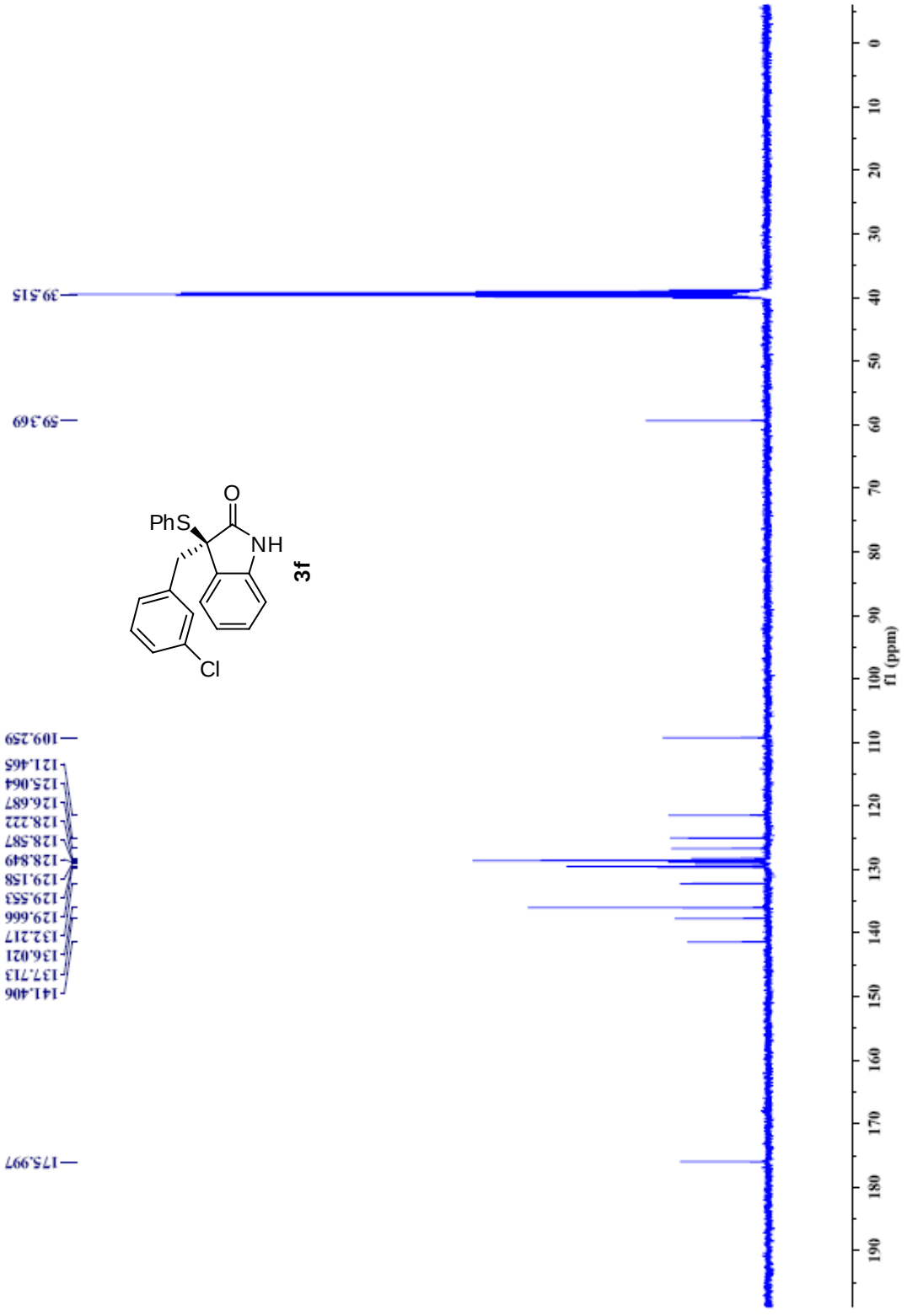
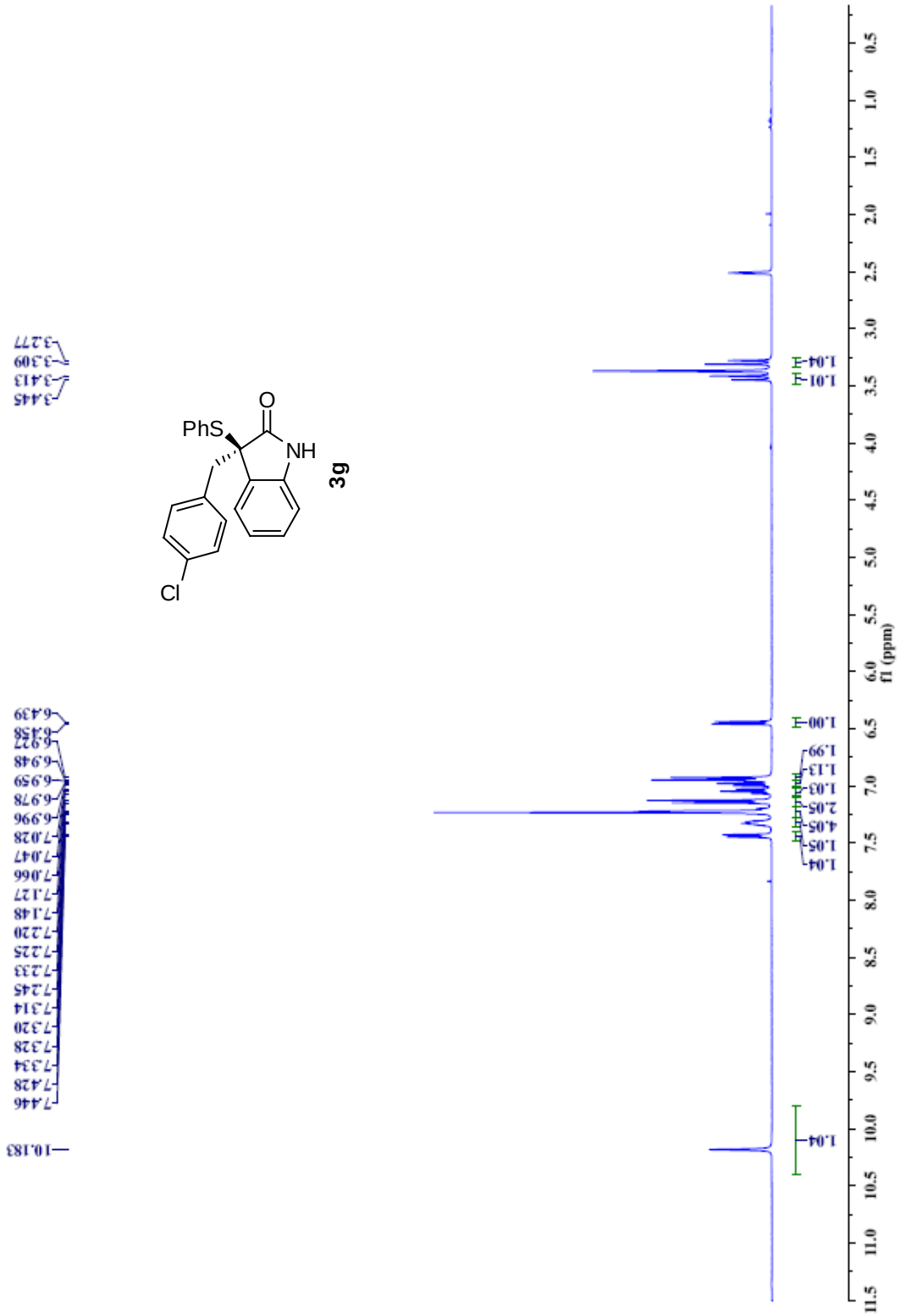
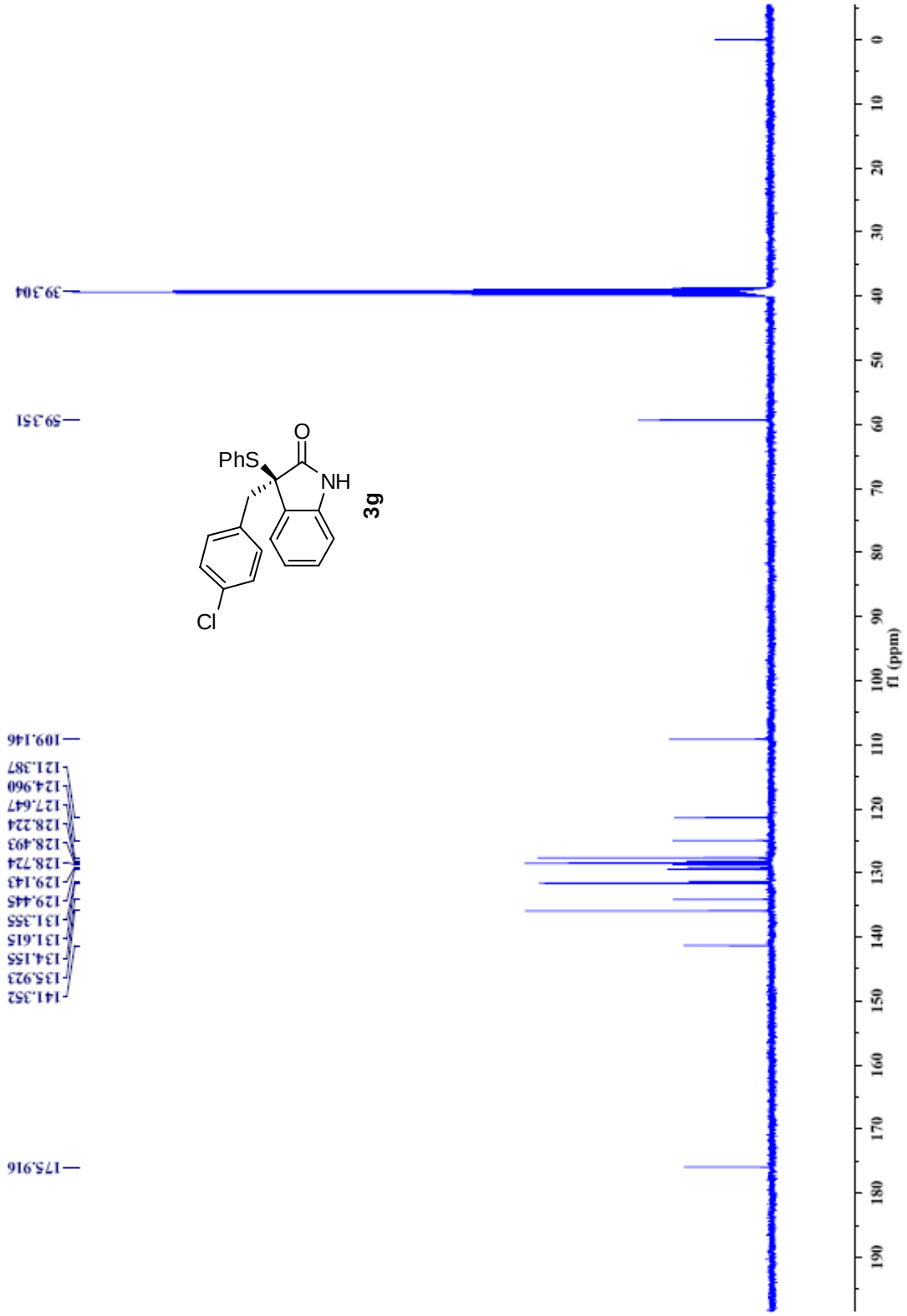
136.689
140.095
178.466
f1 (ppm)


PhS
O
NH
Cl
3f
f1 (ppm)


39.515
59.369
109.259
121.465
125.064
126.687
128.222
128.587
128.849
129.158
129.553
129.666
132.217
136.021
137.713
141.406
175.997
O
PhS
NH
Cl
3f
f1 (ppm)


3.277
3.309
3.413
3.445
6.439
6.458
6.927
6.948
6.959
6.978
6.996
7.028
7.047
7.066
7.127
7.148
7.220
7.225
7.233
7.245
7.314
7.320
7.328
7.334
7.428
7.446
10.183
PhS
O
NH
Cl
3g
1.04
1.04
1.00
1.04
1.05
4.05
2.05
1.03
1.13
1.99
f1 (ppm)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127.647
128.224
128.493
128.724
129.143
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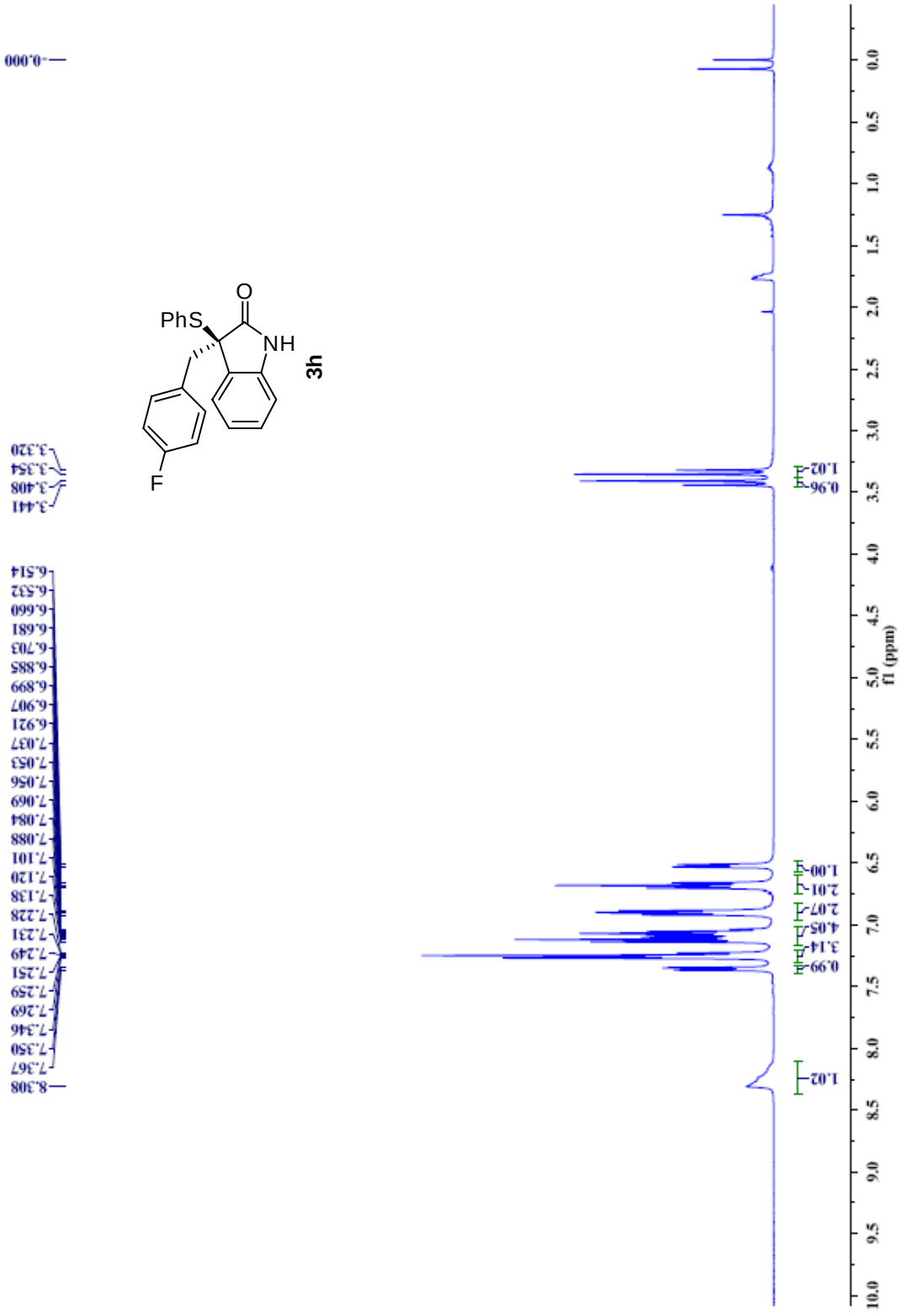
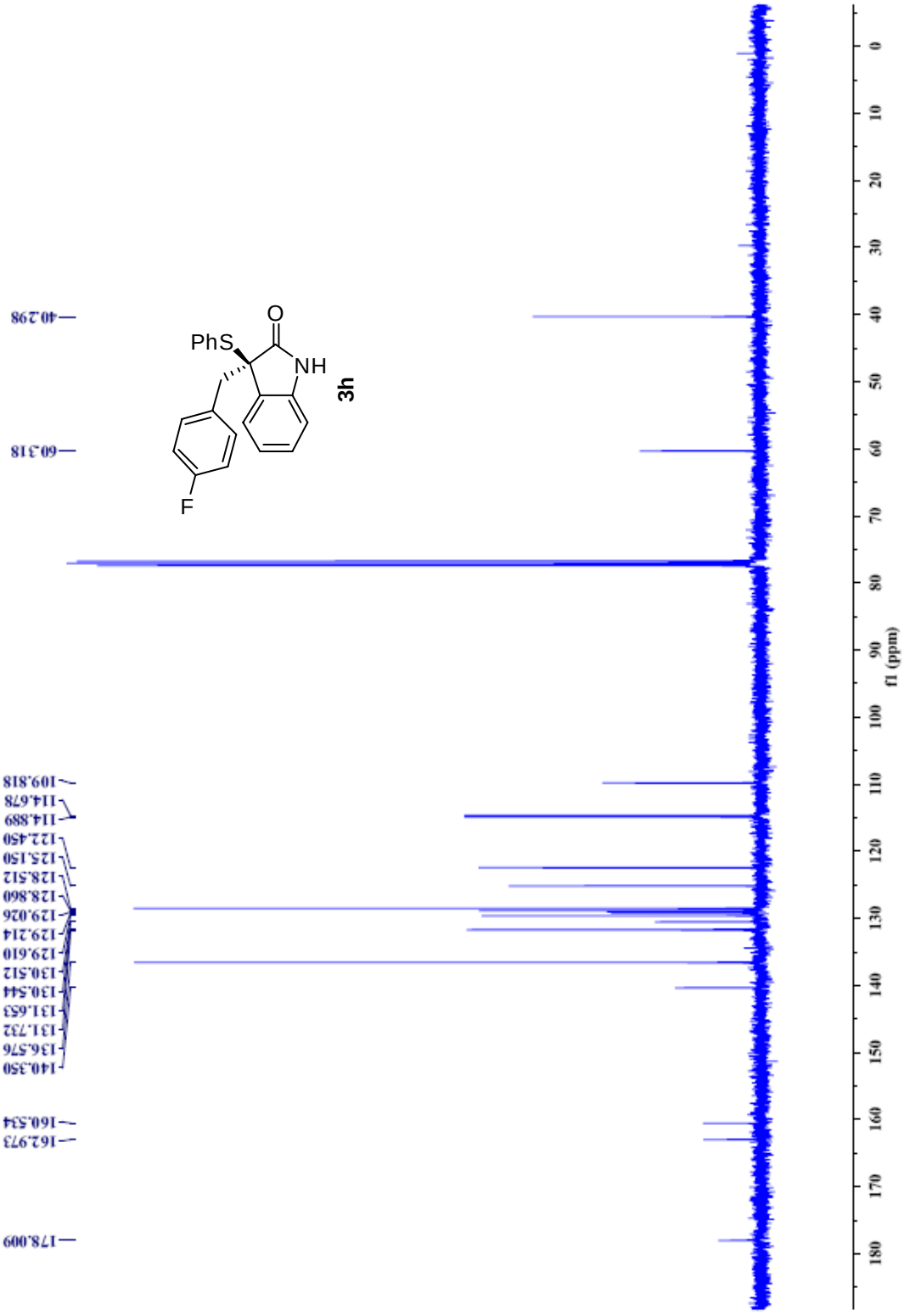
131.615
134.155
135.923
141.352
175.916
PhS
O
NH
Cl
3g
f1 (ppm)


PhS
O
NH
F
3h
f1 (ppm)


PhS
O
NH
F
3h
40.298
60.318
109.818
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114.889
122.450
125.150
128.512
128.860
129.026
129.214
129.610
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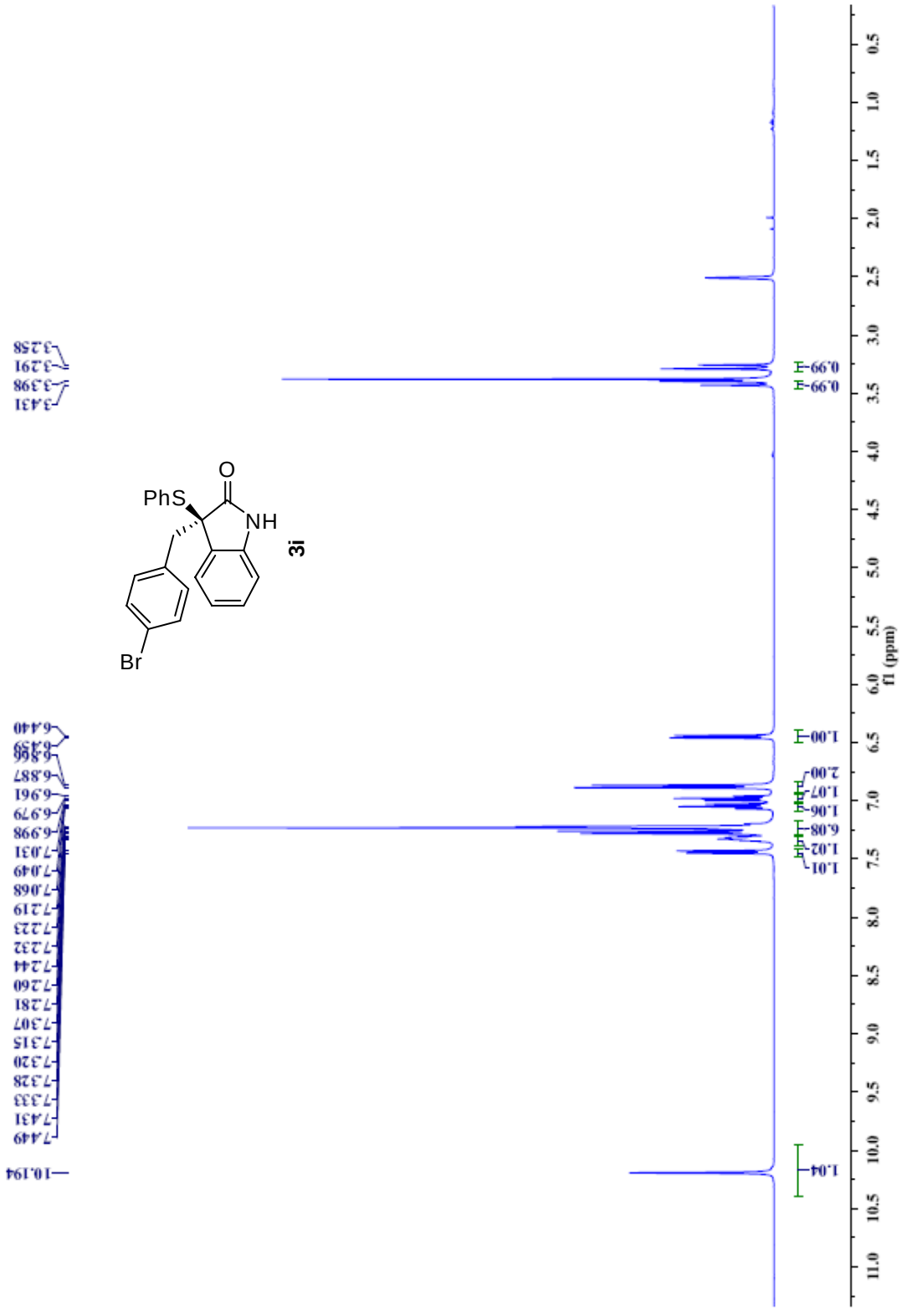
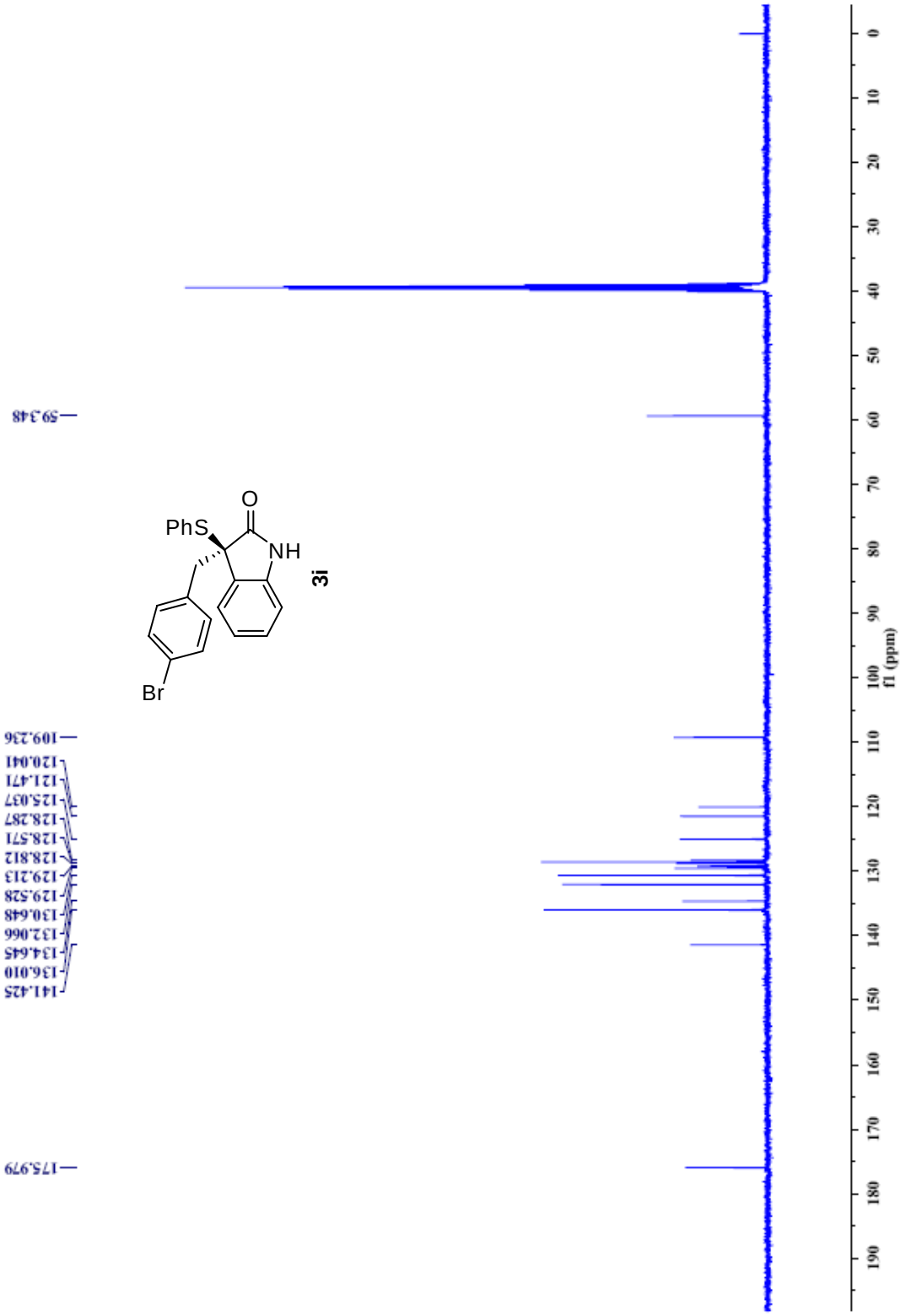
130.544
131.653
131.732
136.576
140.350
160.534
162.973
178.009
f1 (ppm)


O
PhS
NH
Br
3i
f1 (ppm)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120.041
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125.037
128.287
128.571
128.812
129.213
129.528
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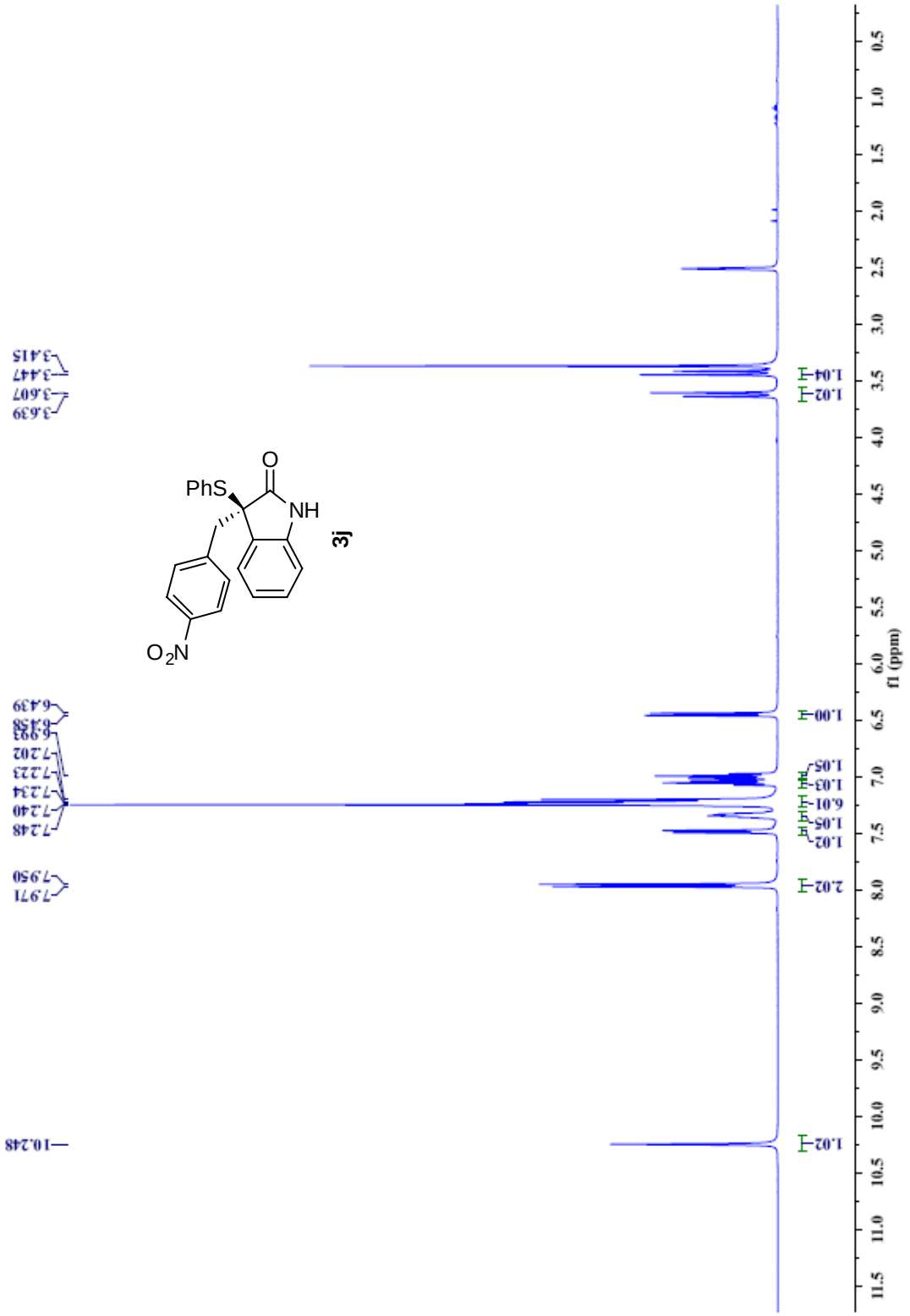
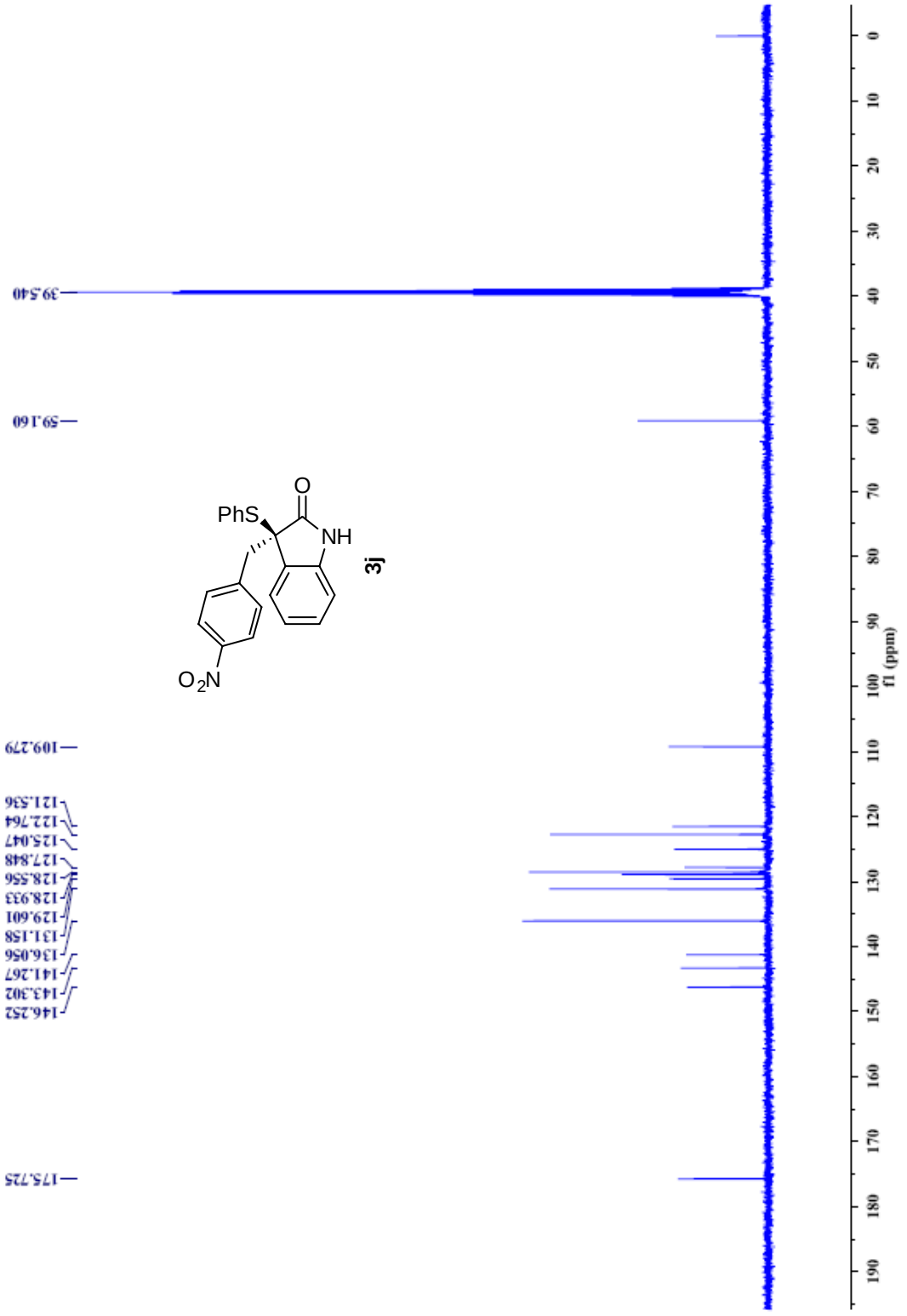
132.066
134.645
136.010
141.425
175.979
O
PhS
NH
Br
3i
f1 (ppm)


PhS
O
NH
O_2N
3j
f1 (ppm)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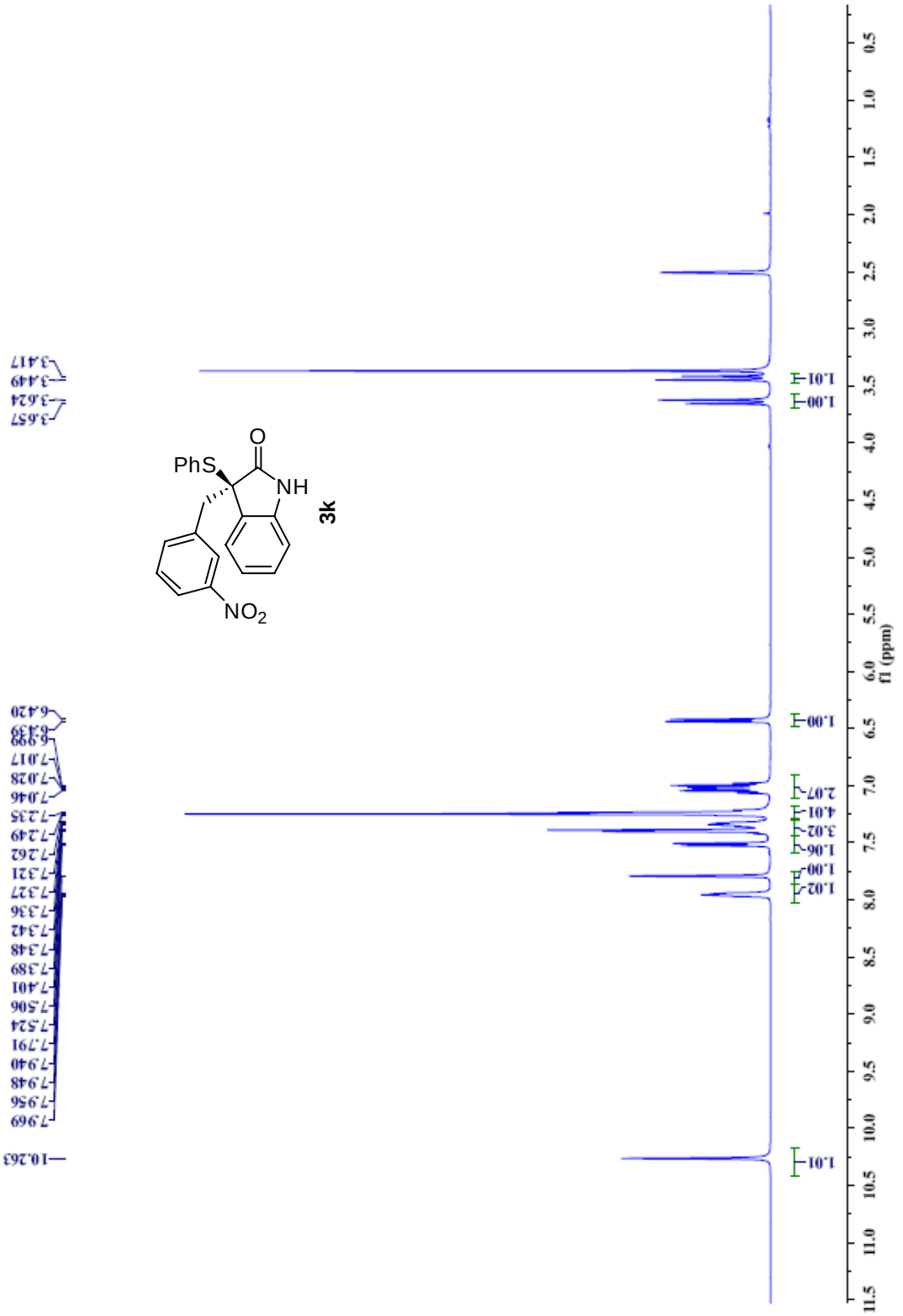
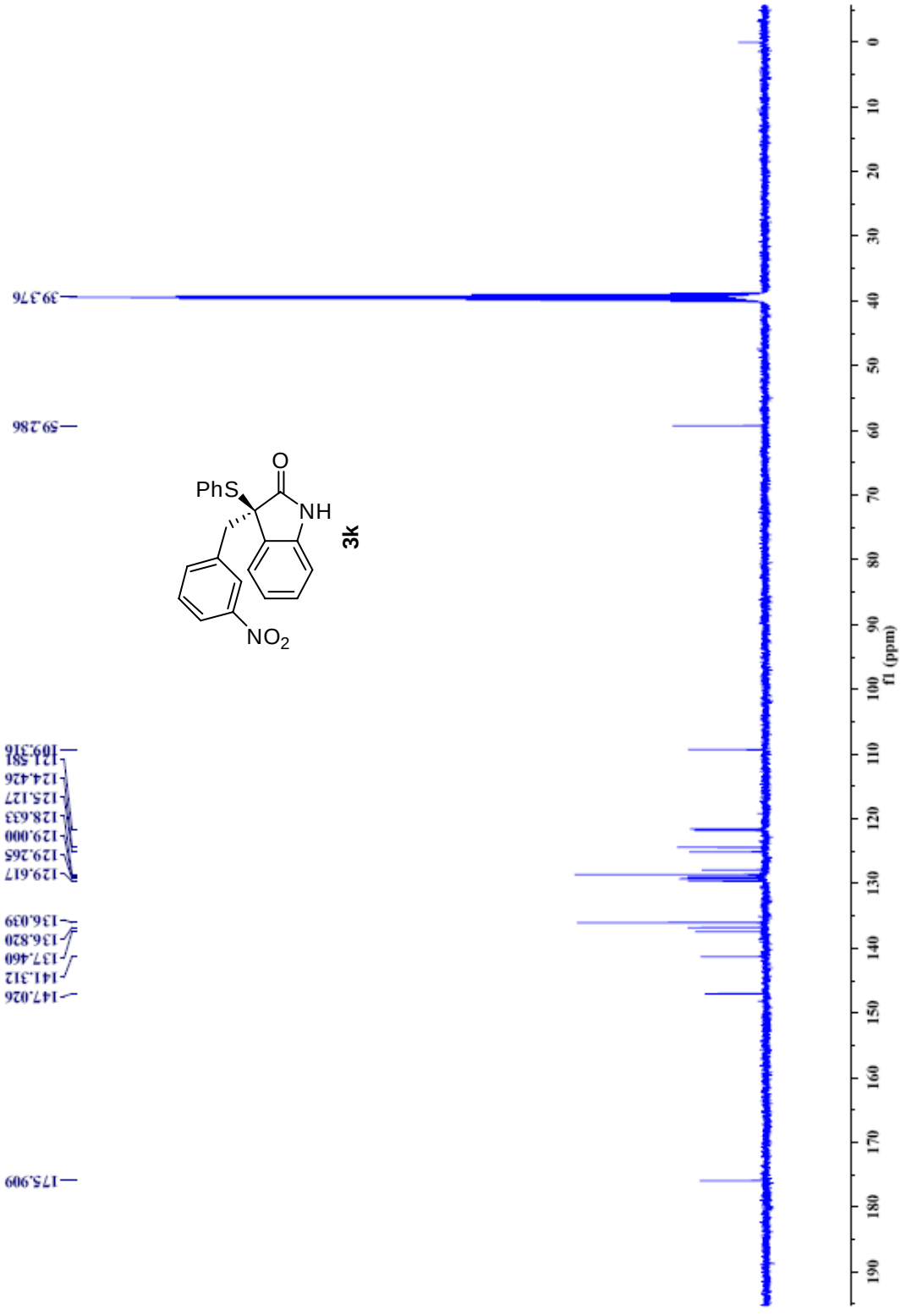
59.160
109.279
121.536
122.764
125.047
127.848
128.556
128.933
129.601
131.158
136.056
141.267
143.302
146.252
175.725
O
PhS
NH
O2N
3j
f1 (ppm)


O
PhS
NH
NO2
3k
f1 (ppm)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121.581
124.426
125.127
128.633
129.000
129.265
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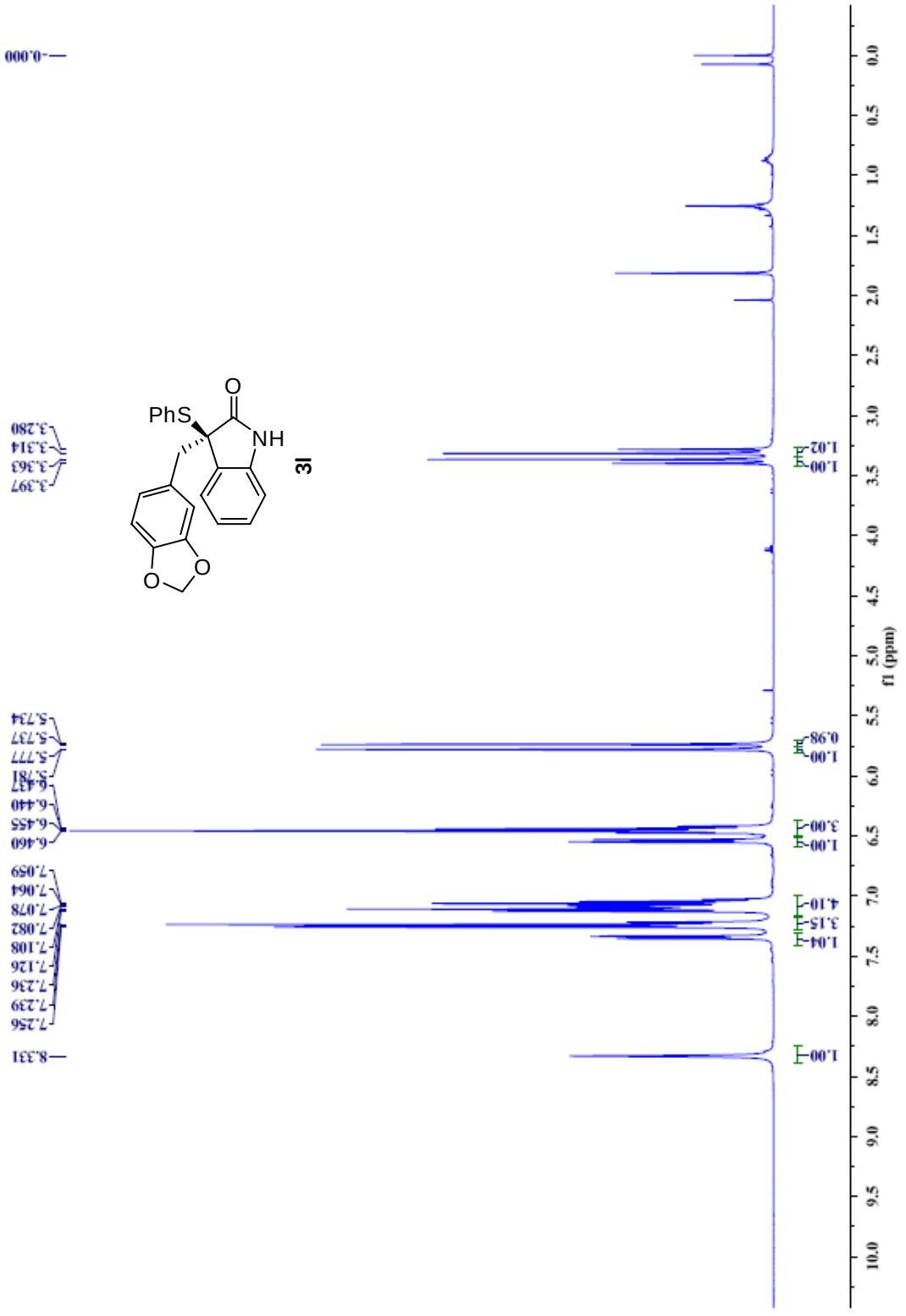
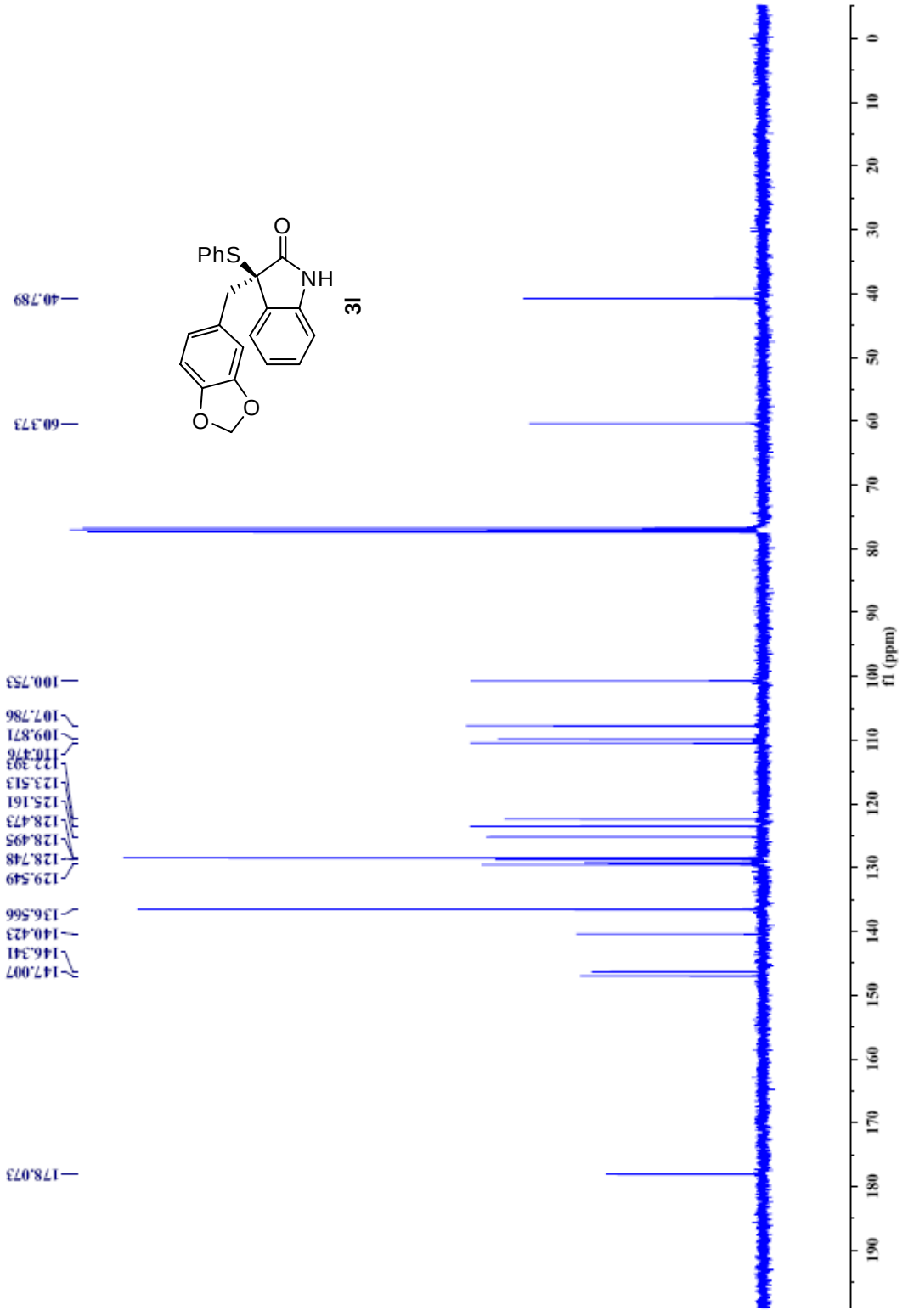
136.820
137.460
141.312
147.026
175.909
O
PhS
NH
NO2
3k
f1 (ppm)


PhS
O
NH
O
O
3l
f1 (ppm)


PhS
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NH
O
O
3l
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100.753
107.786
109.871
110.476
122.393
123.513
125.161
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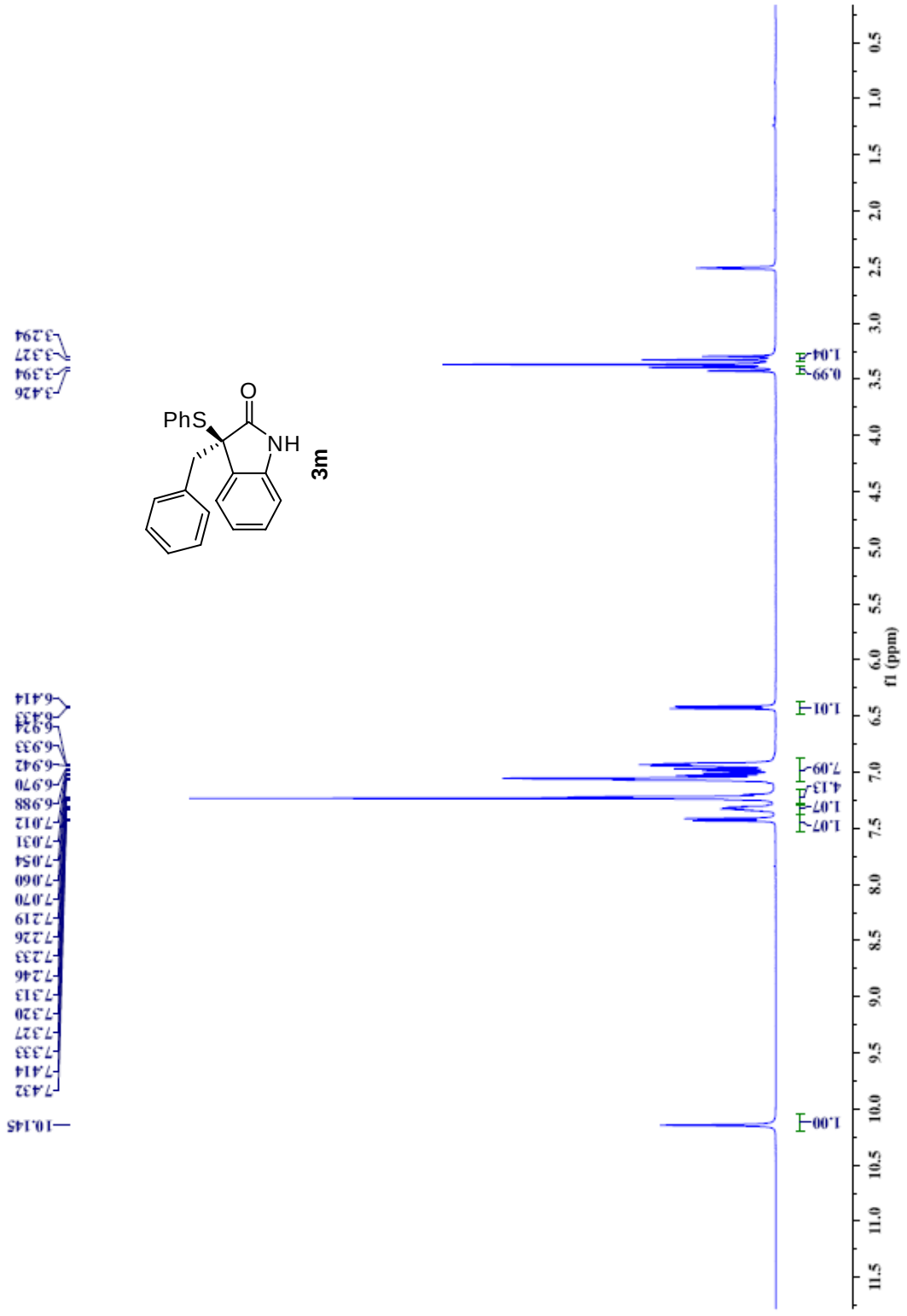
128.495
128.748
129.549
136.566
140.423
146.341
147.007
178.073
f1 (ppm)


PhS
O
NH
3m
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3.394
3.327
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6.414
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6.924
6.933
6.942
6.970
6.988
7.012
7.031
7.054
7.060
7.070
7.219
7.226
7.233
7.246
7.313
7.320
7.327
7.333
7.414
7.432
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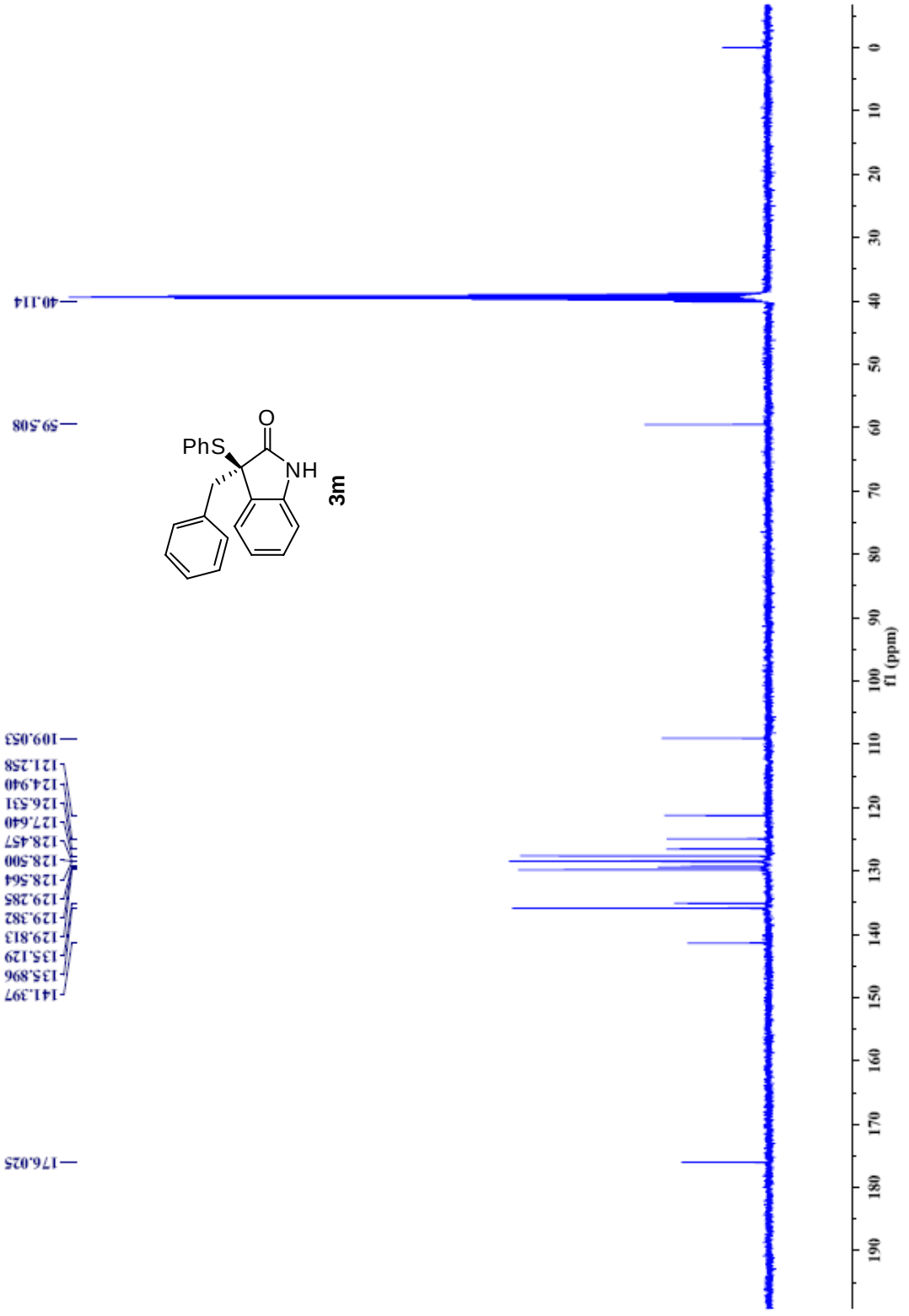
1.00
1.01
7.09
4.13
1.07
1.07
0.99
1.04
f1 (ppm)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126.531
127.640
128.457
128.500
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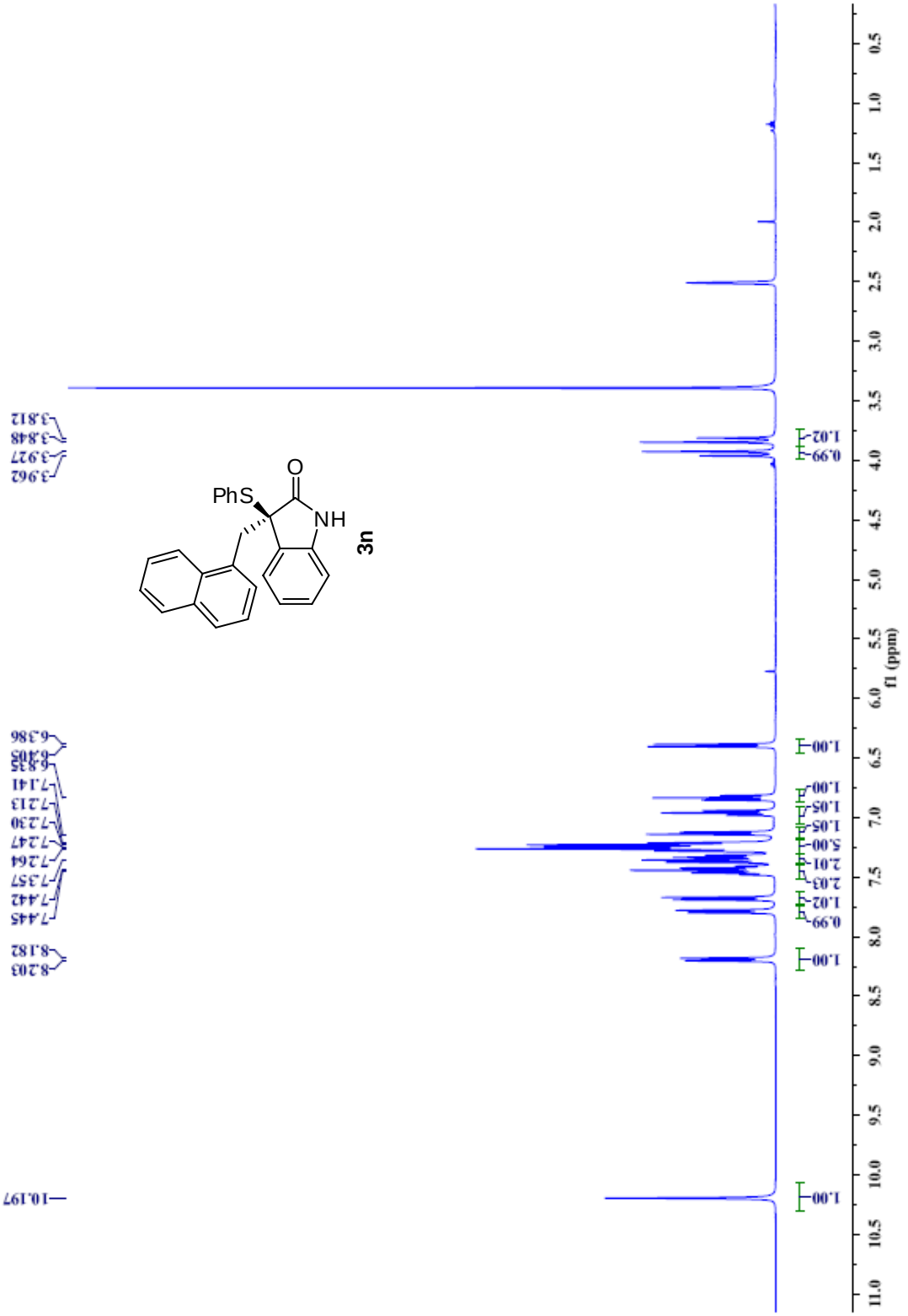
129.382
129.813
135.129
135.896
141.397
176.025
PhS
O
NH
3m
f1 (ppm)


PhS
O
NH
3n
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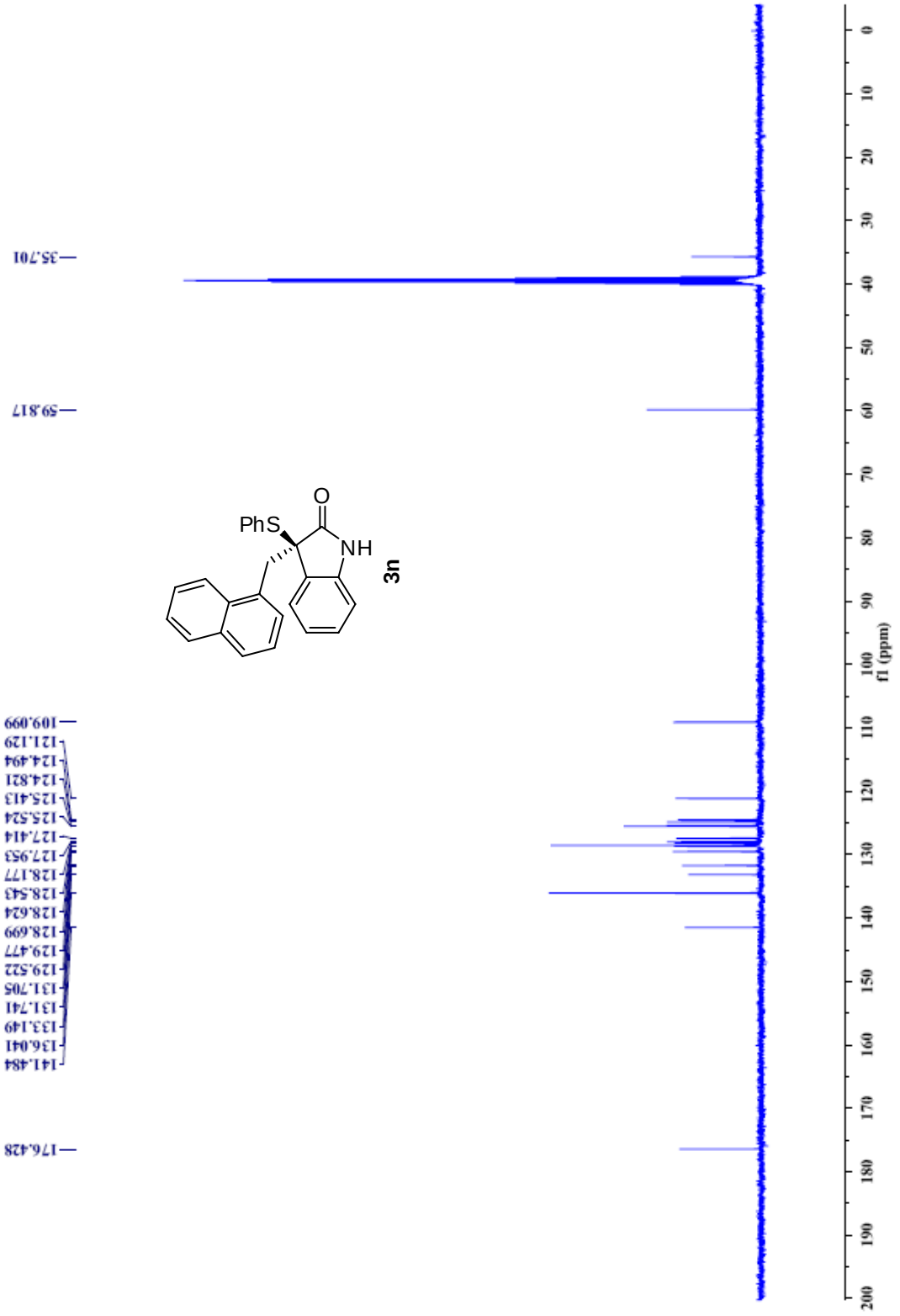
8.182
7.445
7.442
7.357
7.264
7.247
7.230
7.213
7.141
6.835
6.385
6.386
3.962
3.927
3.848
3.812
1.00
1.00
0.99
1.02
2.03
2.01
5.00
1.05
1.05
1.00
1.00
0.99
1.02
f1 (ppm)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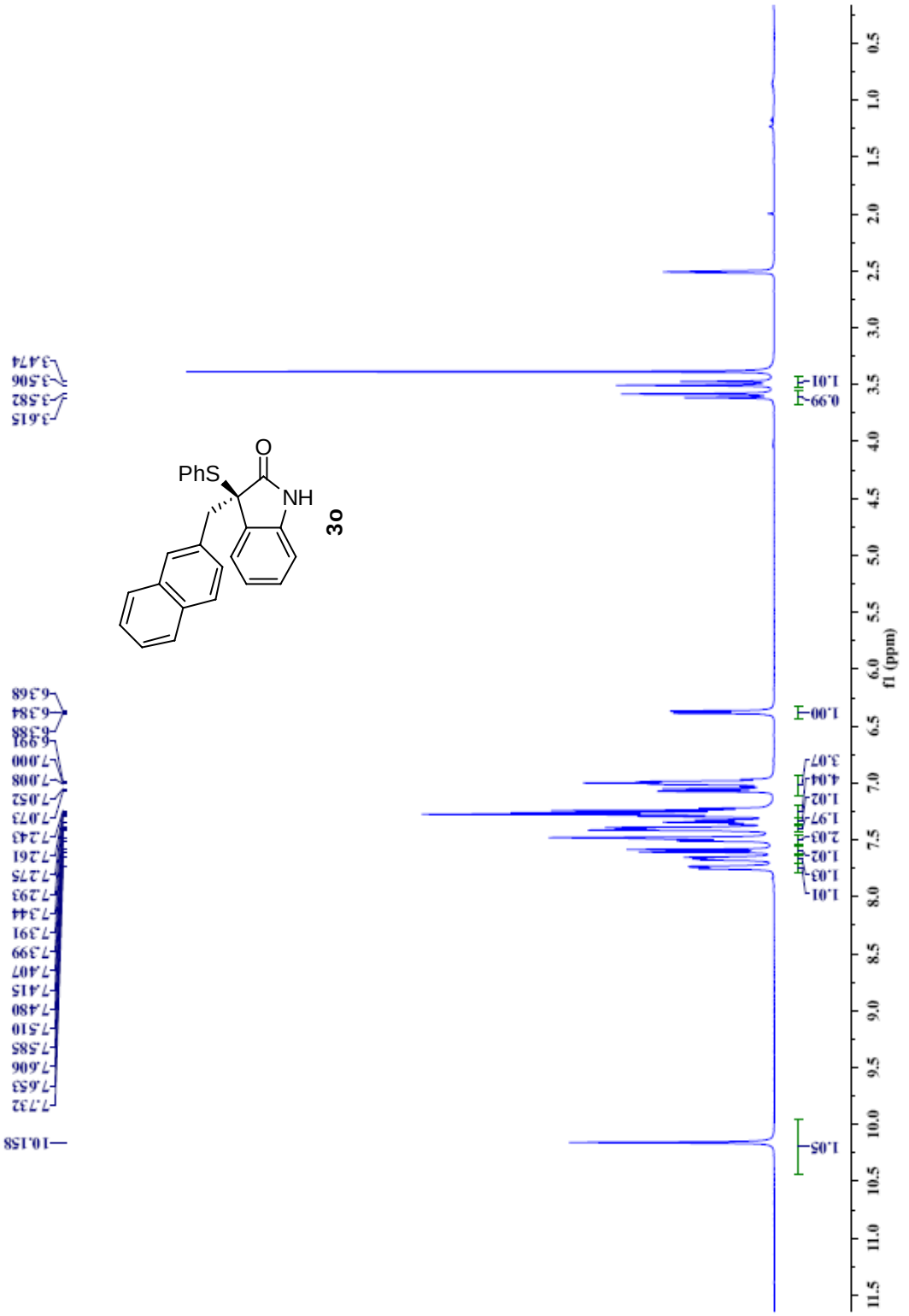
128.177
128.543
128.624
128.699
129.477
129.522
131.705
131.741
133.149
136.041
141.484
176.428
O
PhS
NH
3n
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170
180
190
200
f1 (ppm)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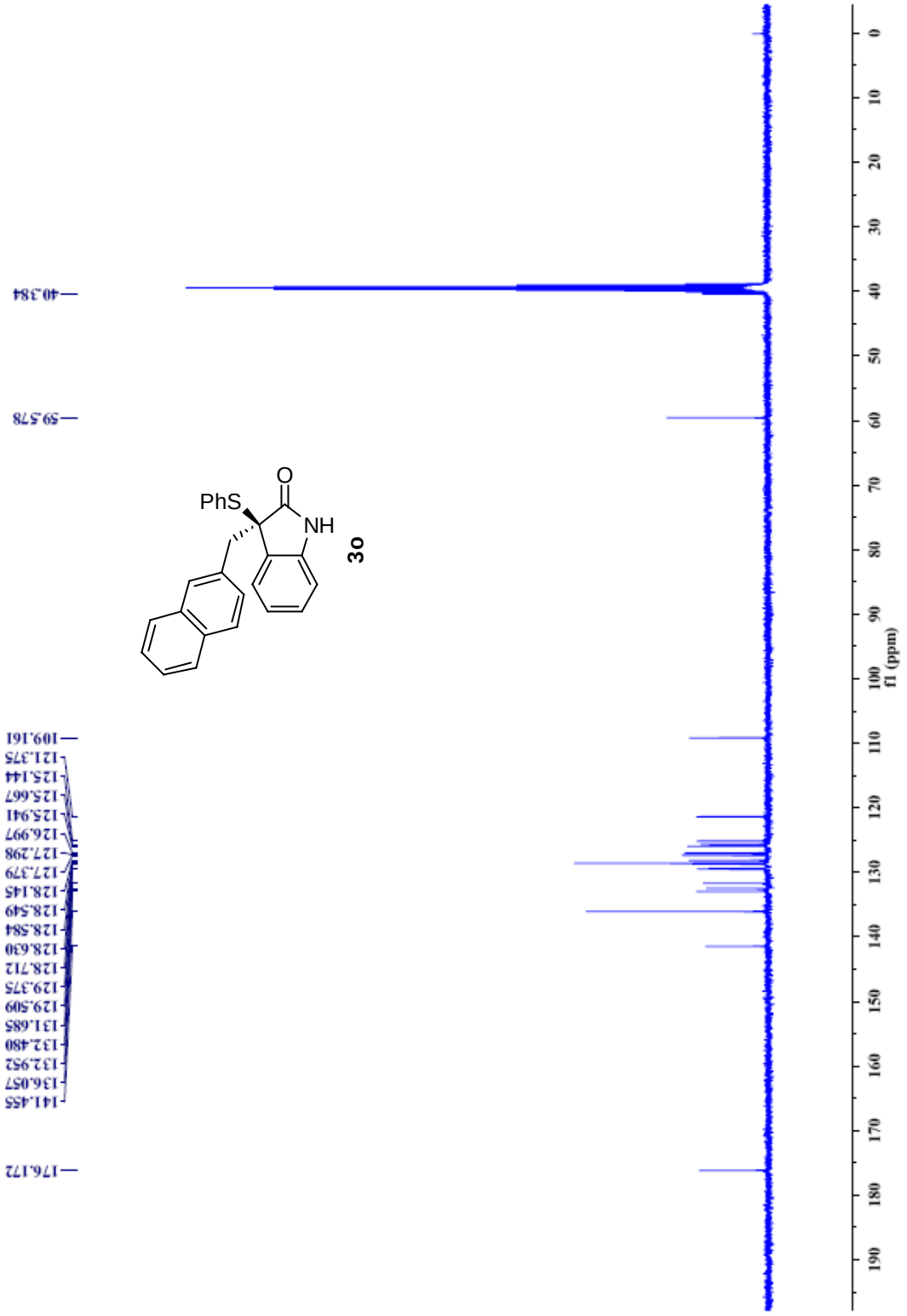
O
NH
3o
f1 (ppm)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O
NH
30
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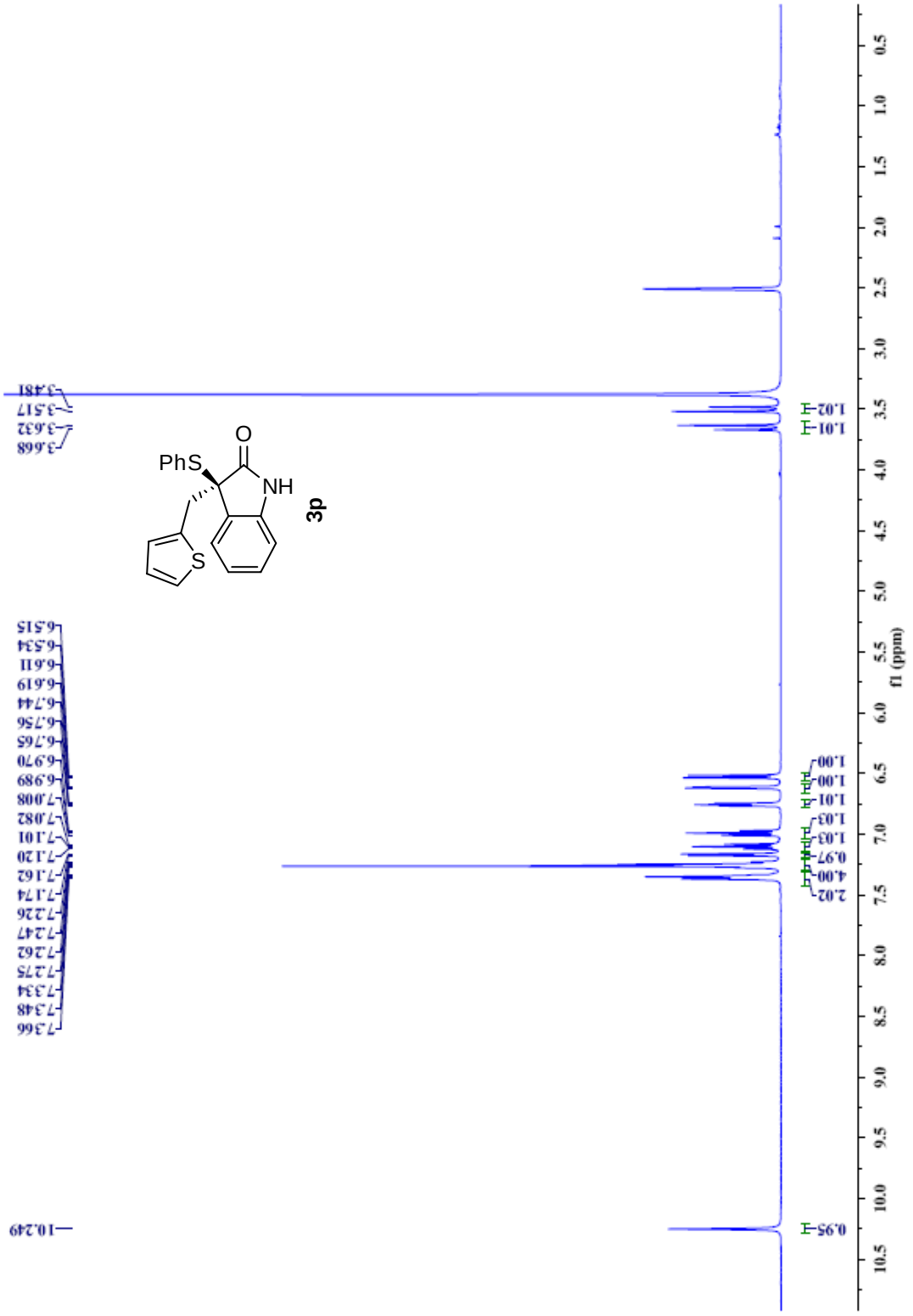
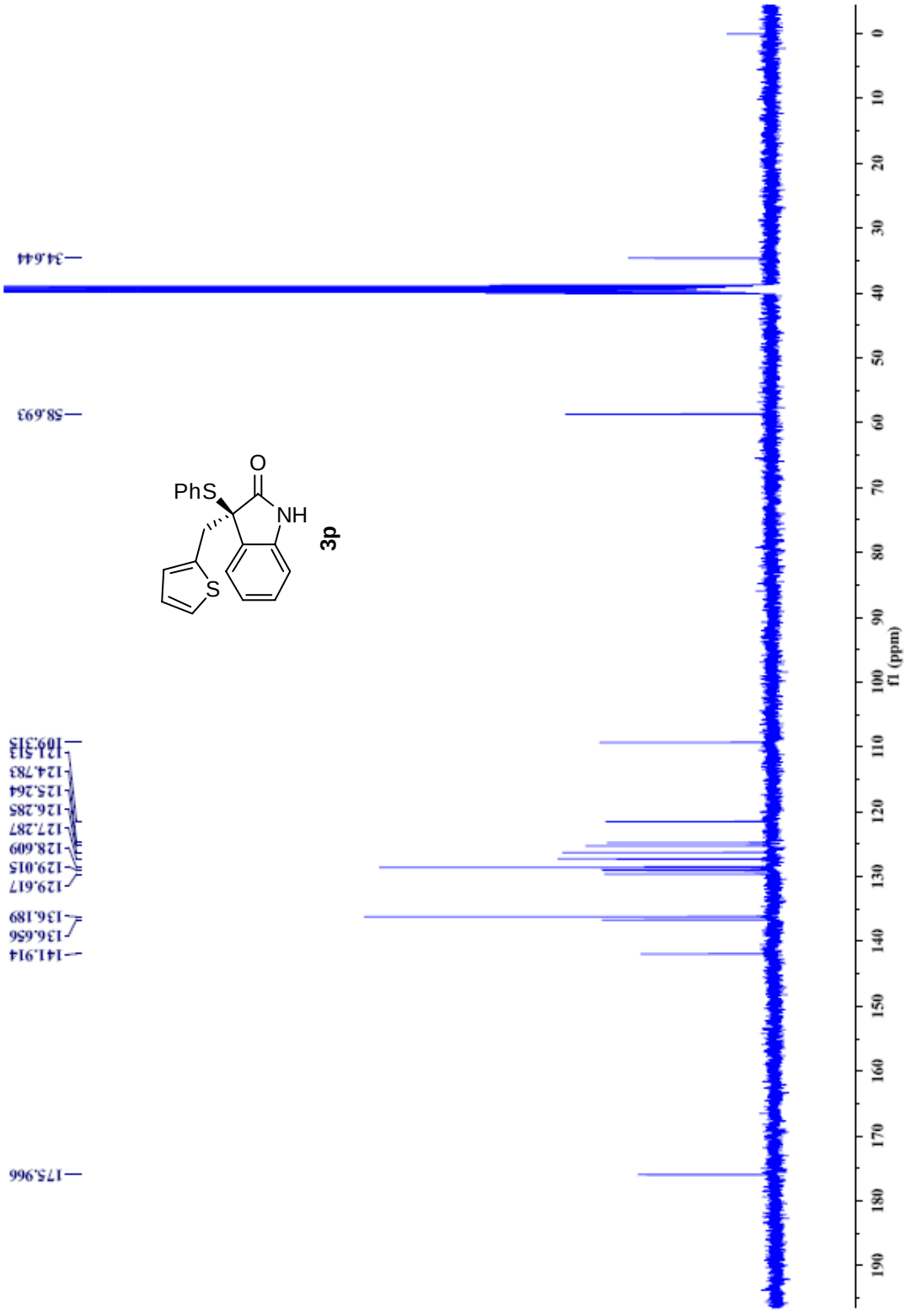
125.144
125.667
125.941
126.997
127.298
127.379
128.145
128.549
128.584
128.630
128.712
129.375
129.509
131.685
132.480
132.952
136.057
141.455
176.172
f1 (ppm)


PhS
O
NH
S
3p
f1 (ppm)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127.287
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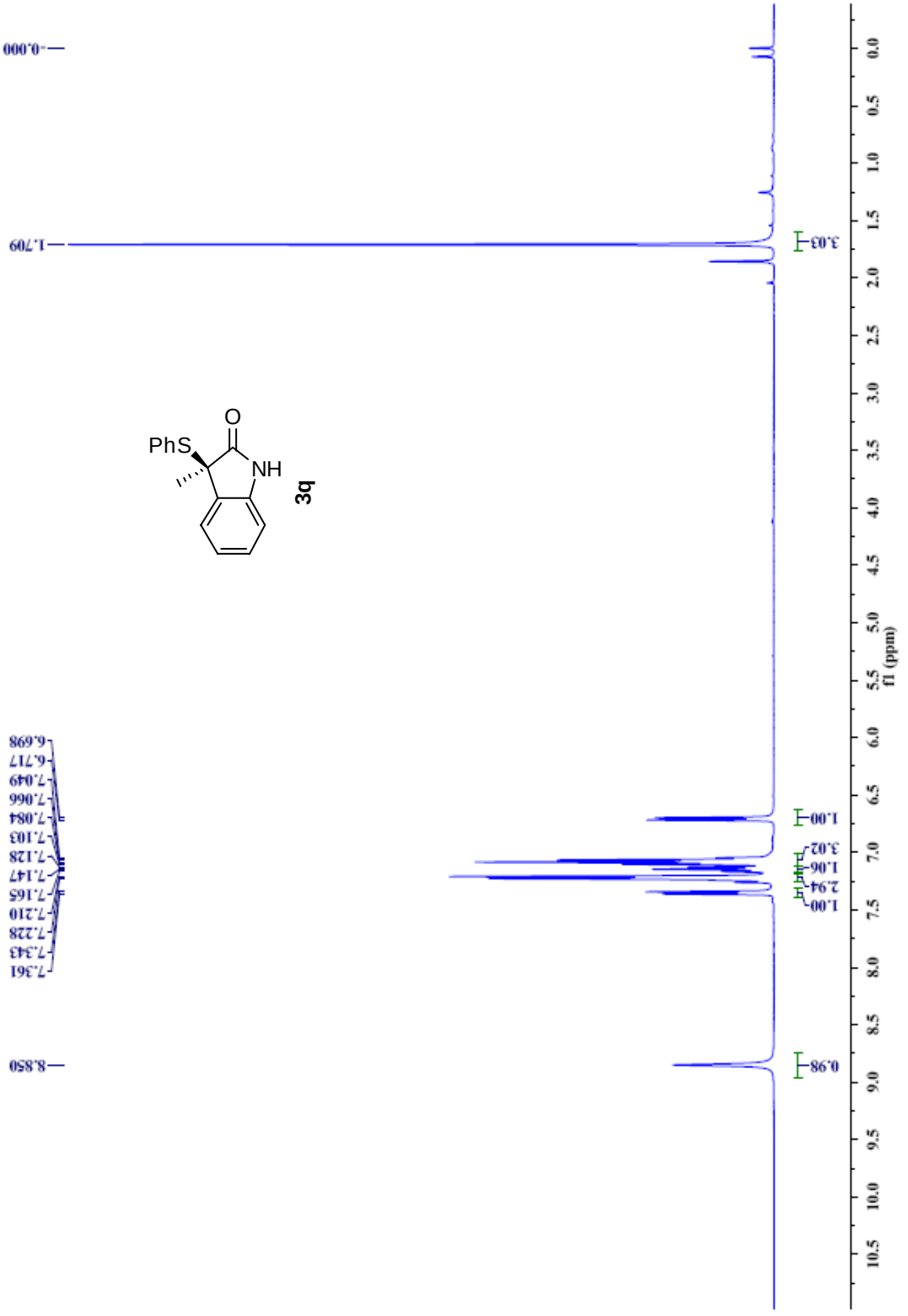
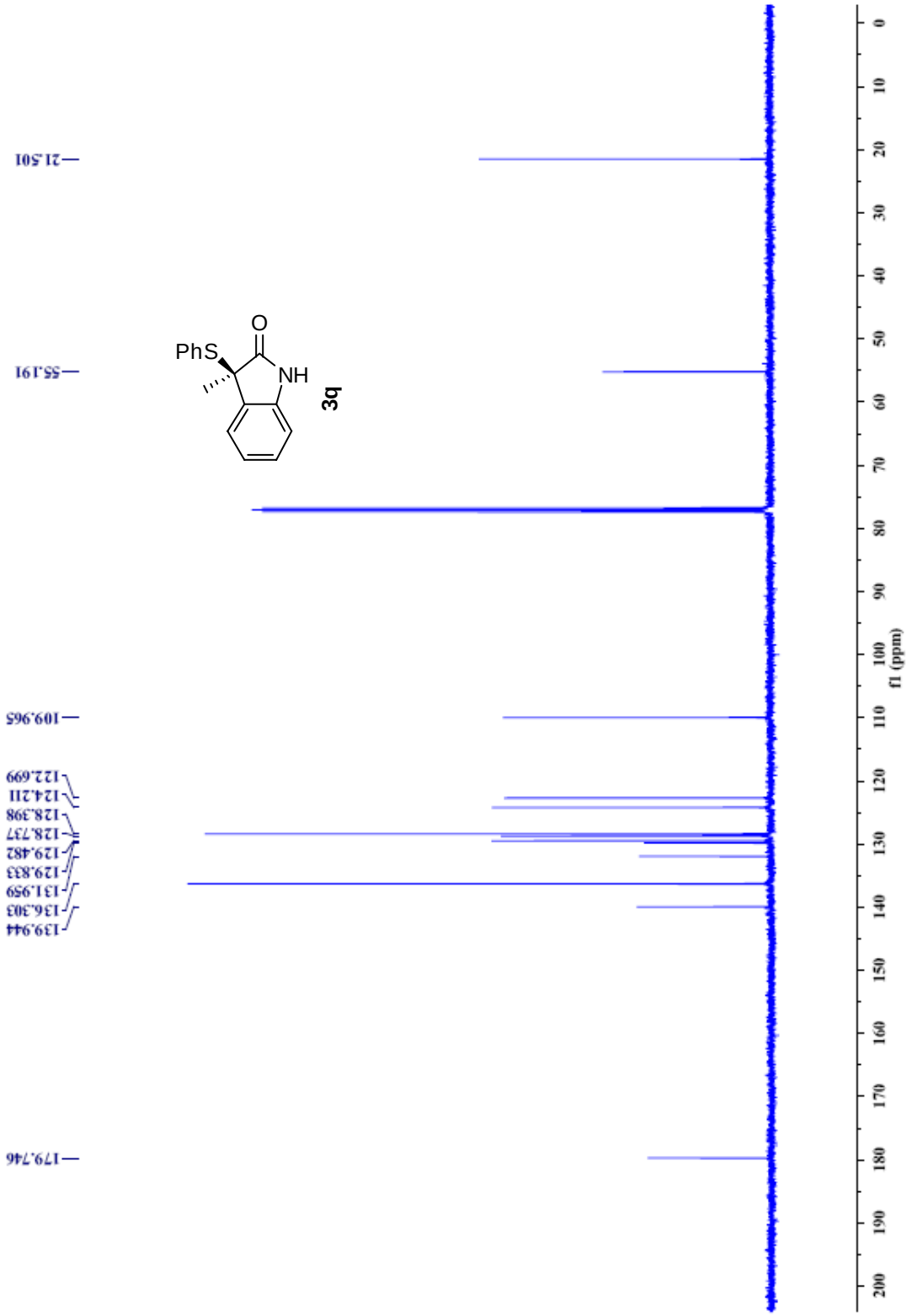
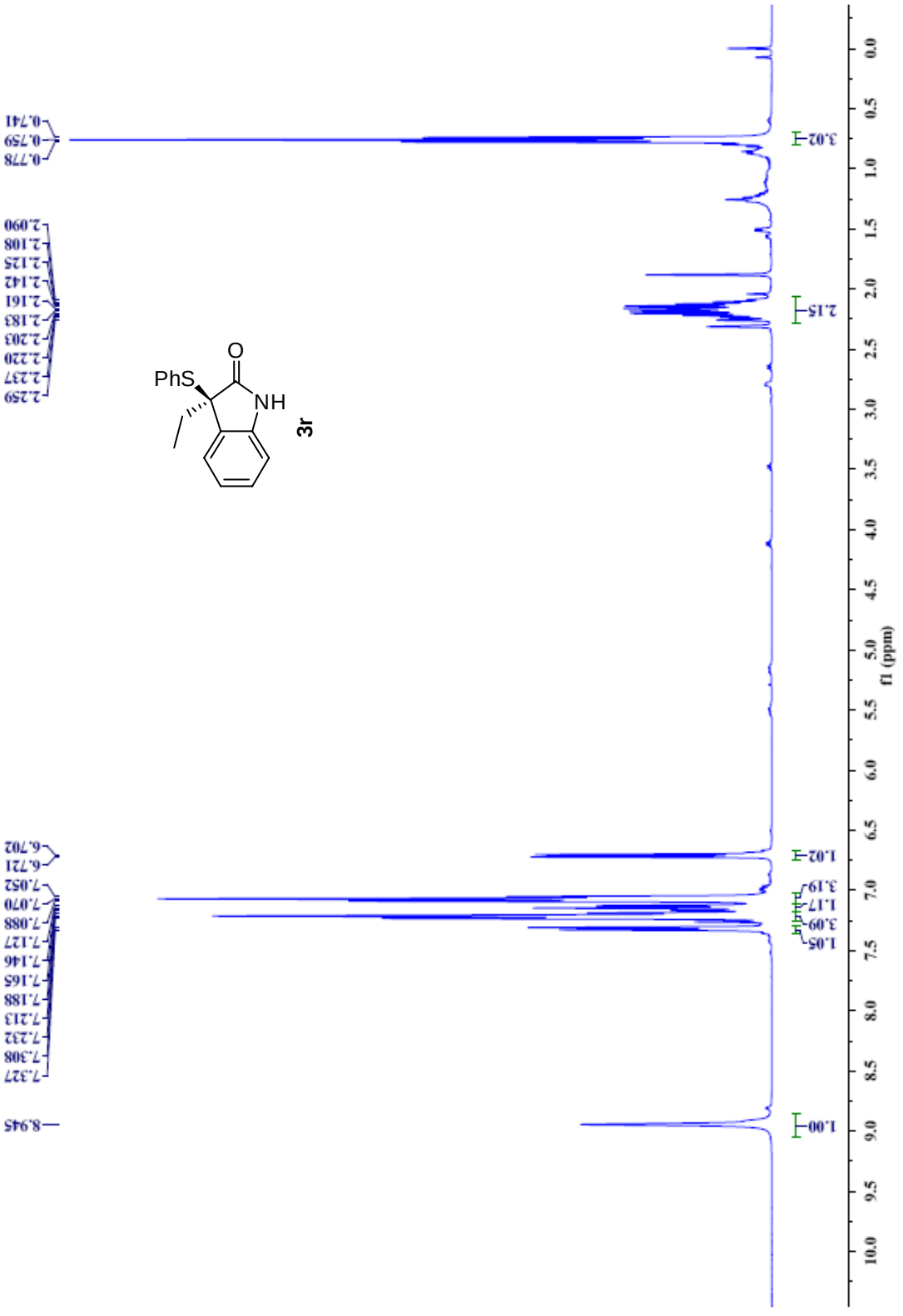
175.966
O
PhS
NH
S
3p
f1 (ppm)


PhS
O
NH
3q
f1 (ppm)


21.501
55.191
109.965
122.699
124.211
128.398
128.737
129.482
129.833
131.959
136.303
139.944
179.746
PhS
O
NH
3q
f1 (ppm)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0.759
0.778
2.090
2.108
2.125
2.142
2.161
2.183
2.203
2.220
2.237
2.259
6.702
6.721
7.052
7.070
7.088
7.127
7.146
7.165
7.188
7.213
7.232
7.308
7.327
8.945
PhS
O
NH
3r
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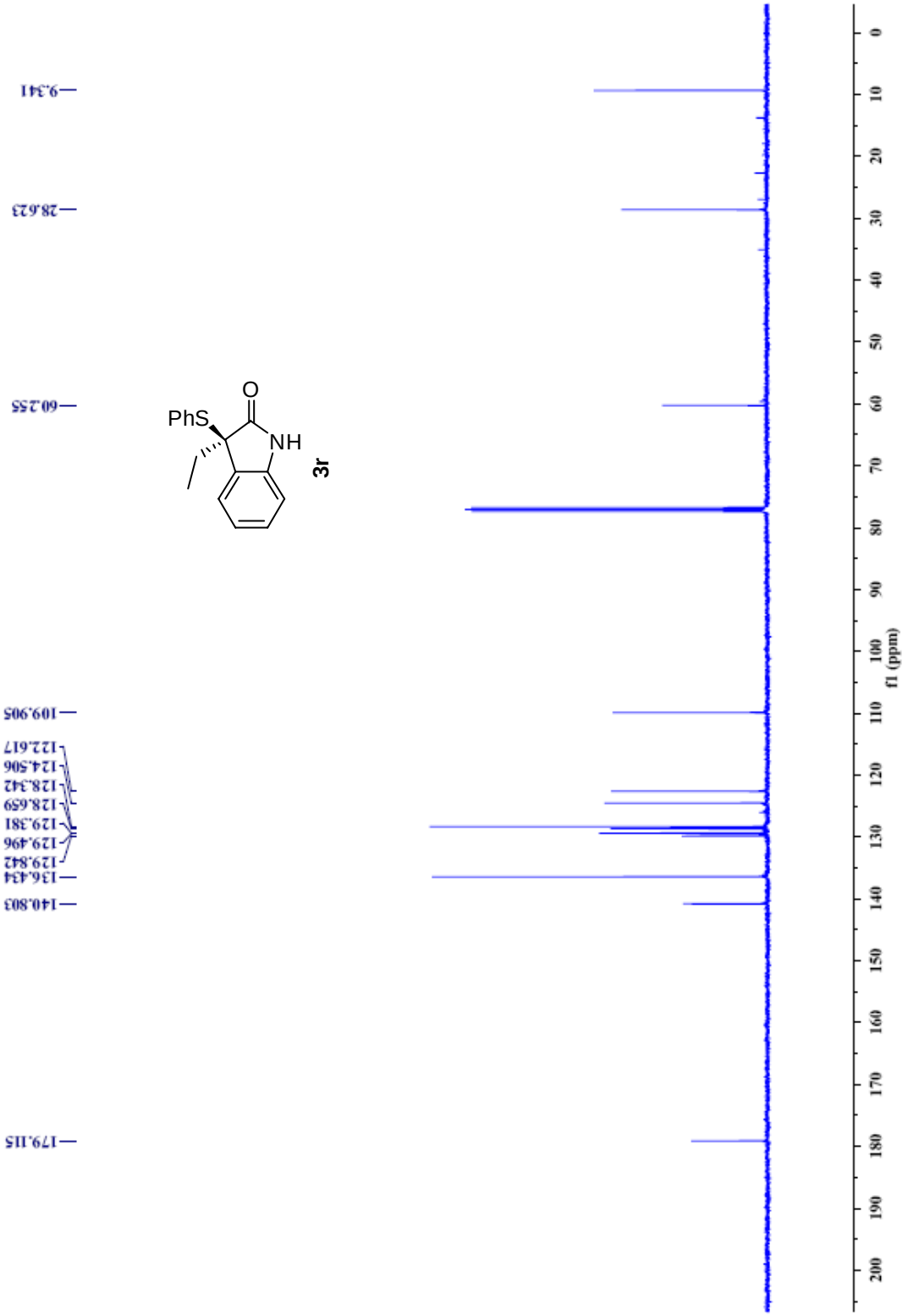
1.02
3.19
1.17
3.09
1.05
1.00
f1 (ppm)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124.506
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128.659
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129.496
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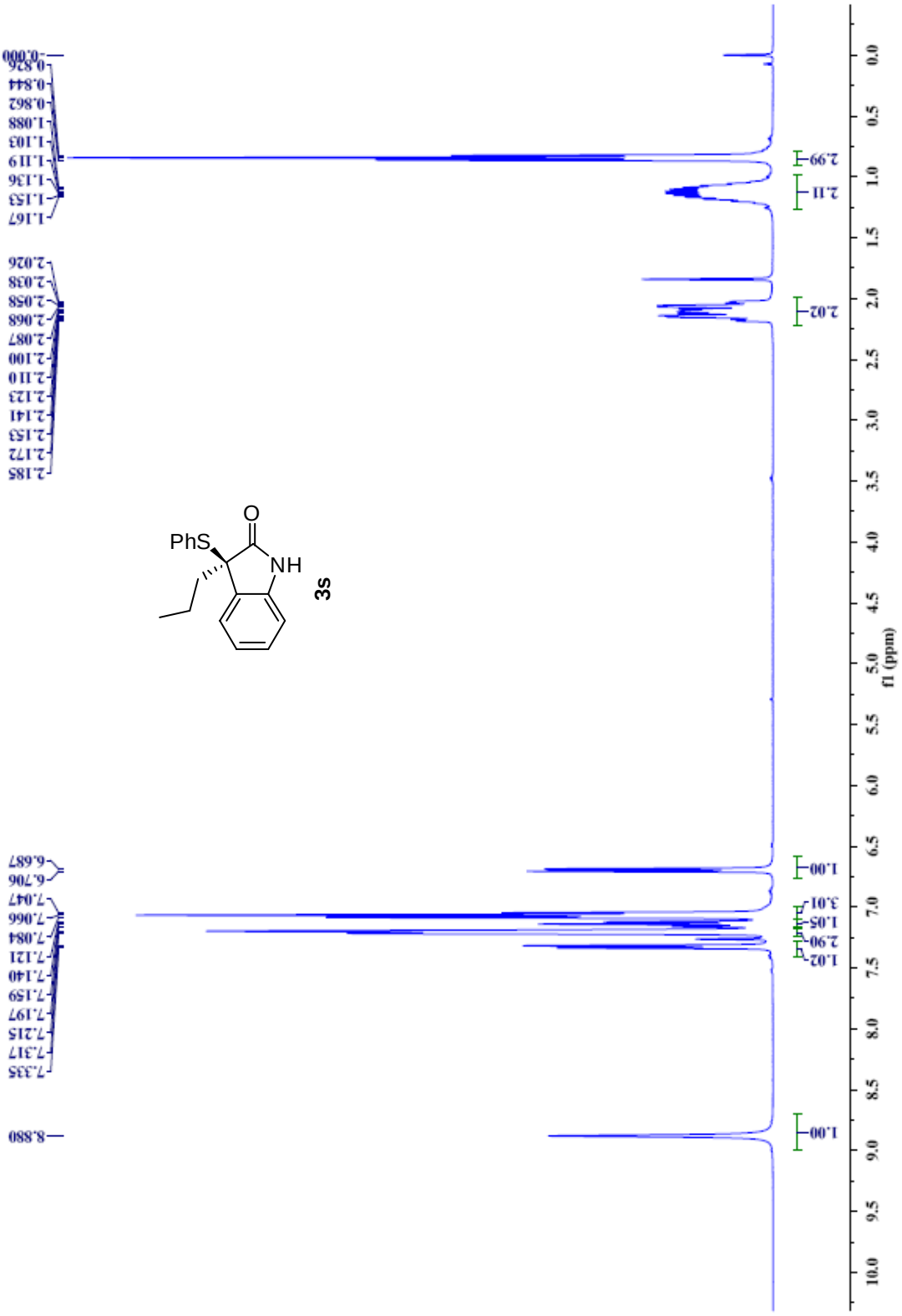
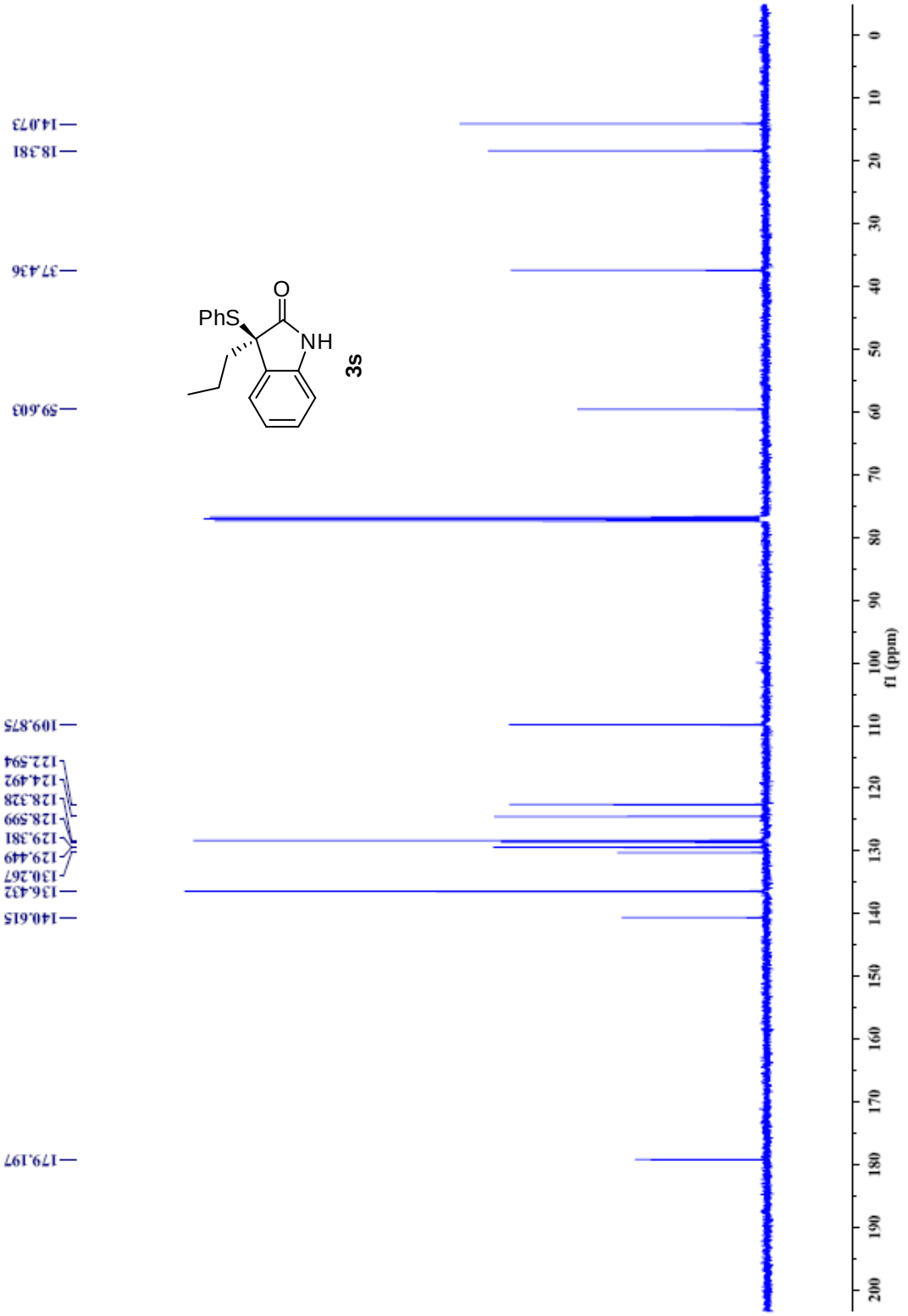
136.434
140.803
179.115
PhS
O
NH
3r
f1 (ppm)


PhS
O
NH
3s
f1 (ppm)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59.603
109.875
122.594
124.492
128.328
128.599
129.381
129.449
130.267
136.432
140.615
179.197
O
PhS
NH
3s
0
10
20
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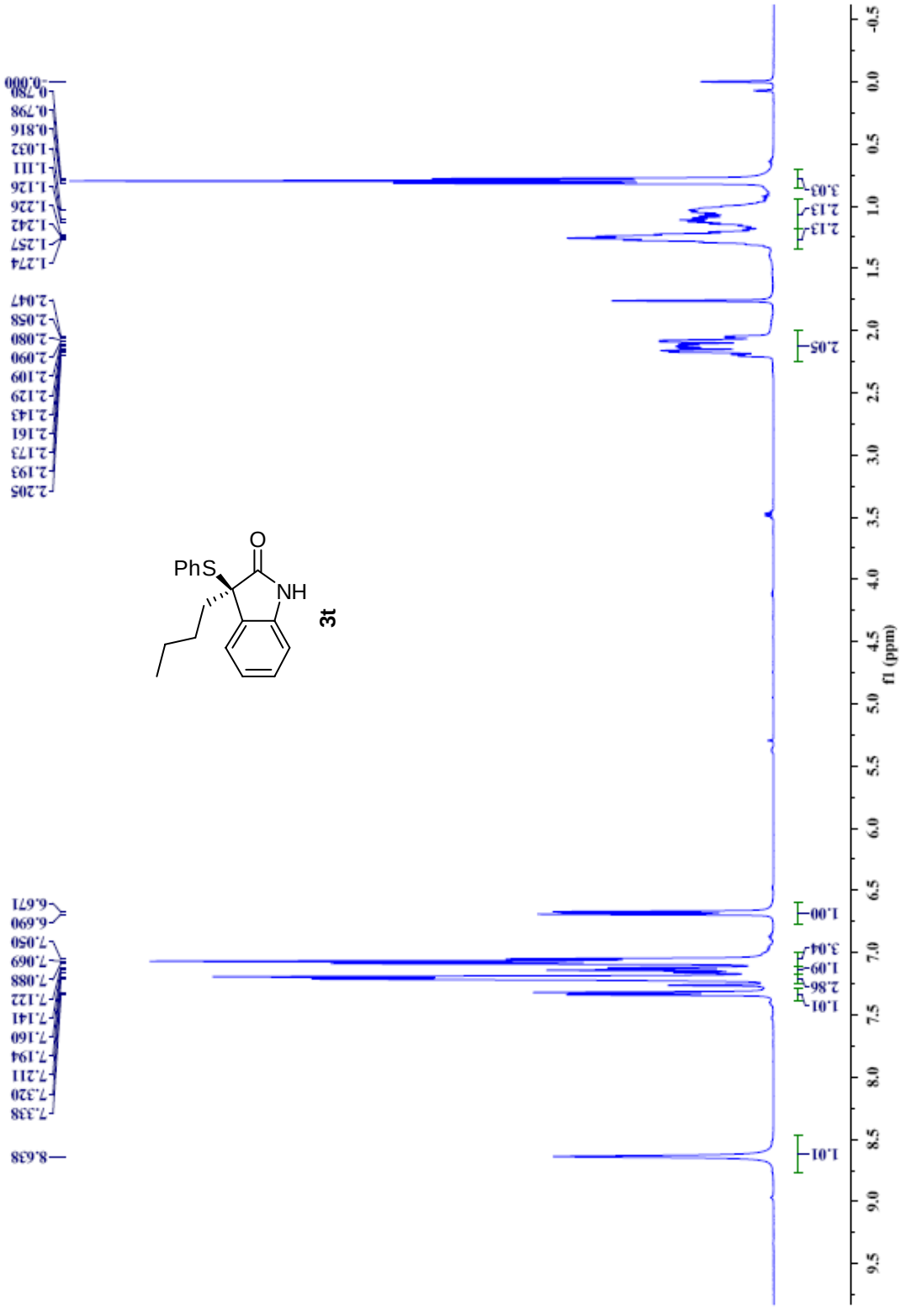
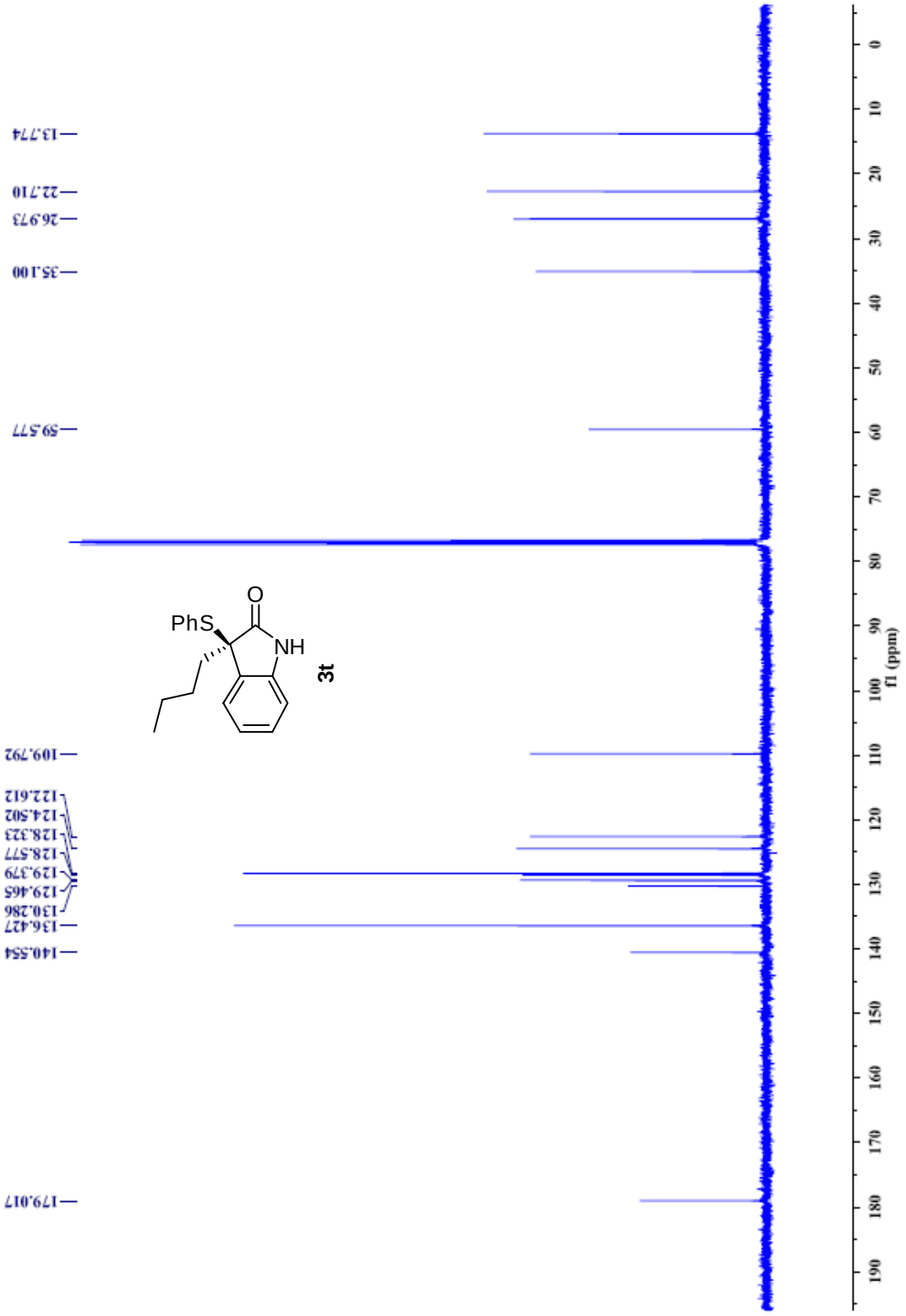
90
100
110
120
130
140
150
160
170
180
190
200
f1 (ppm)


PhS
O
NH
3t
f1 (ppm)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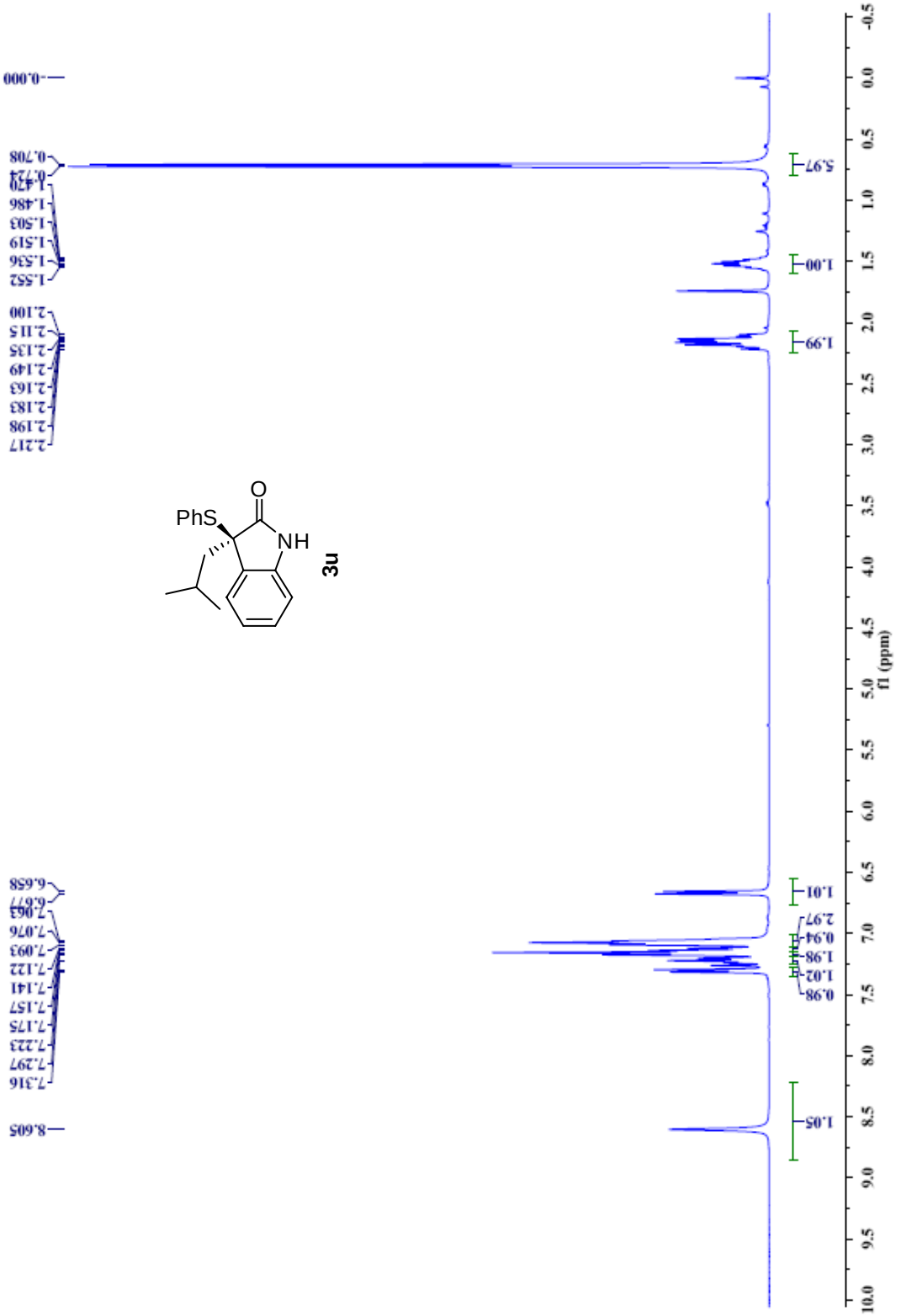
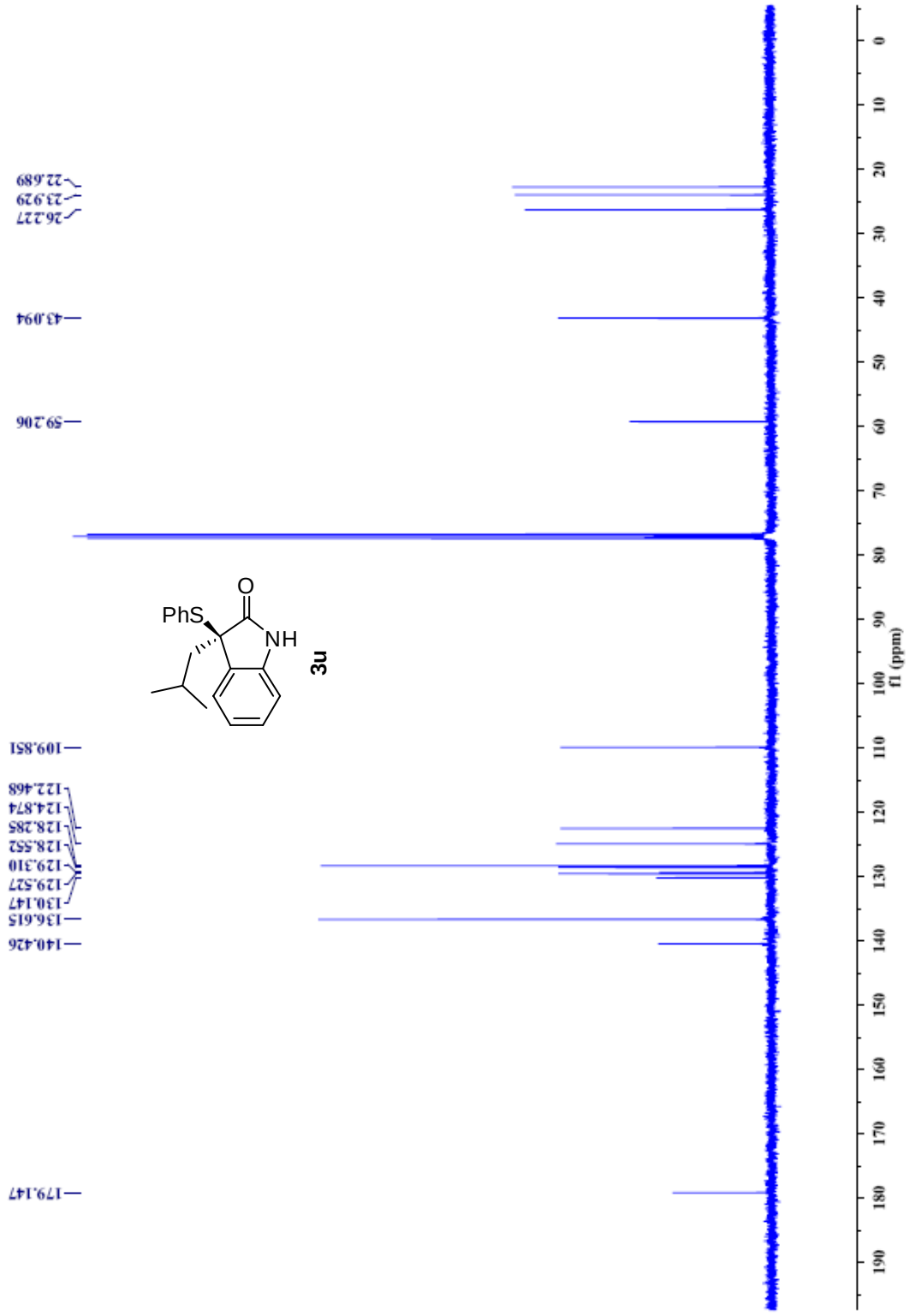
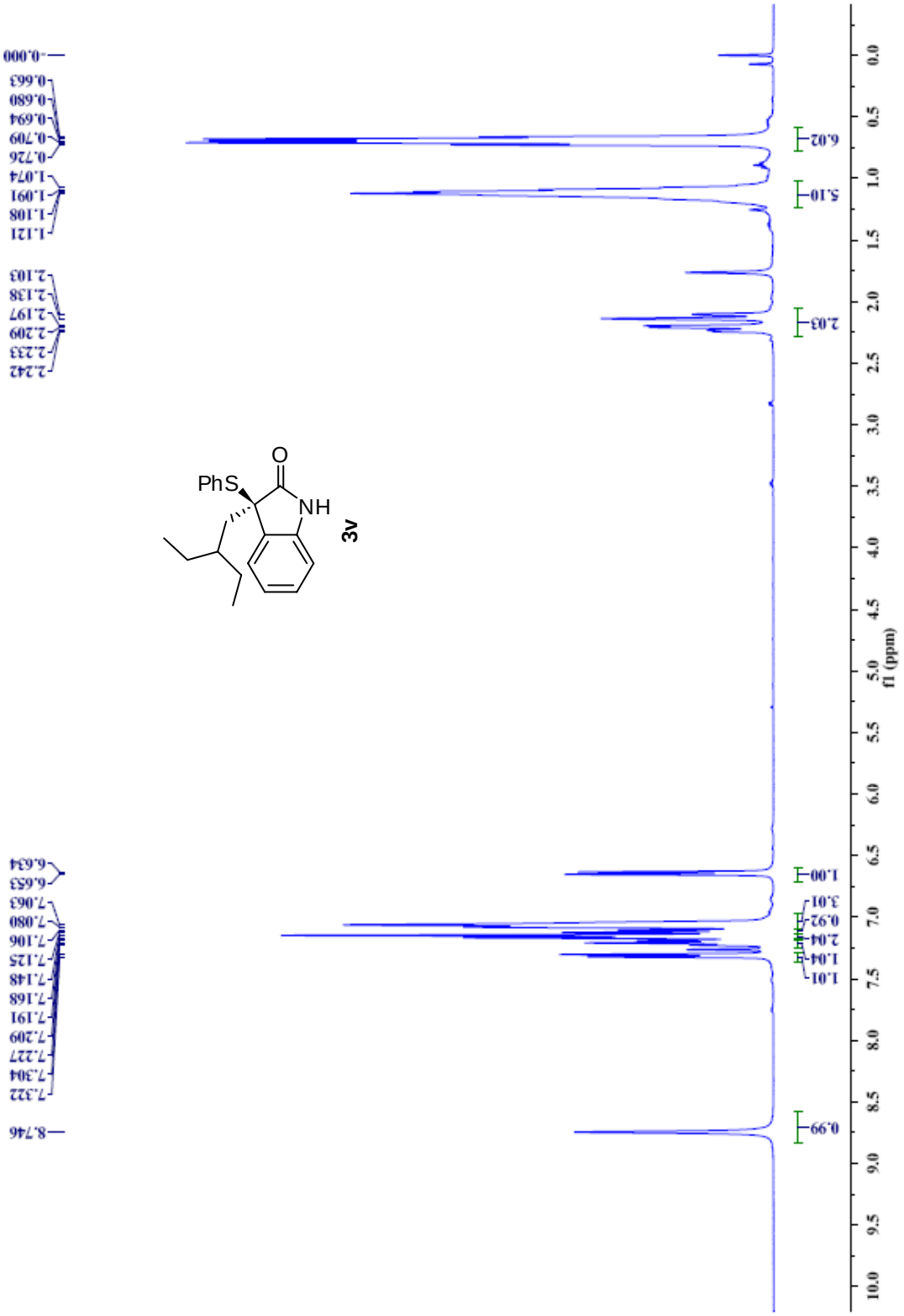
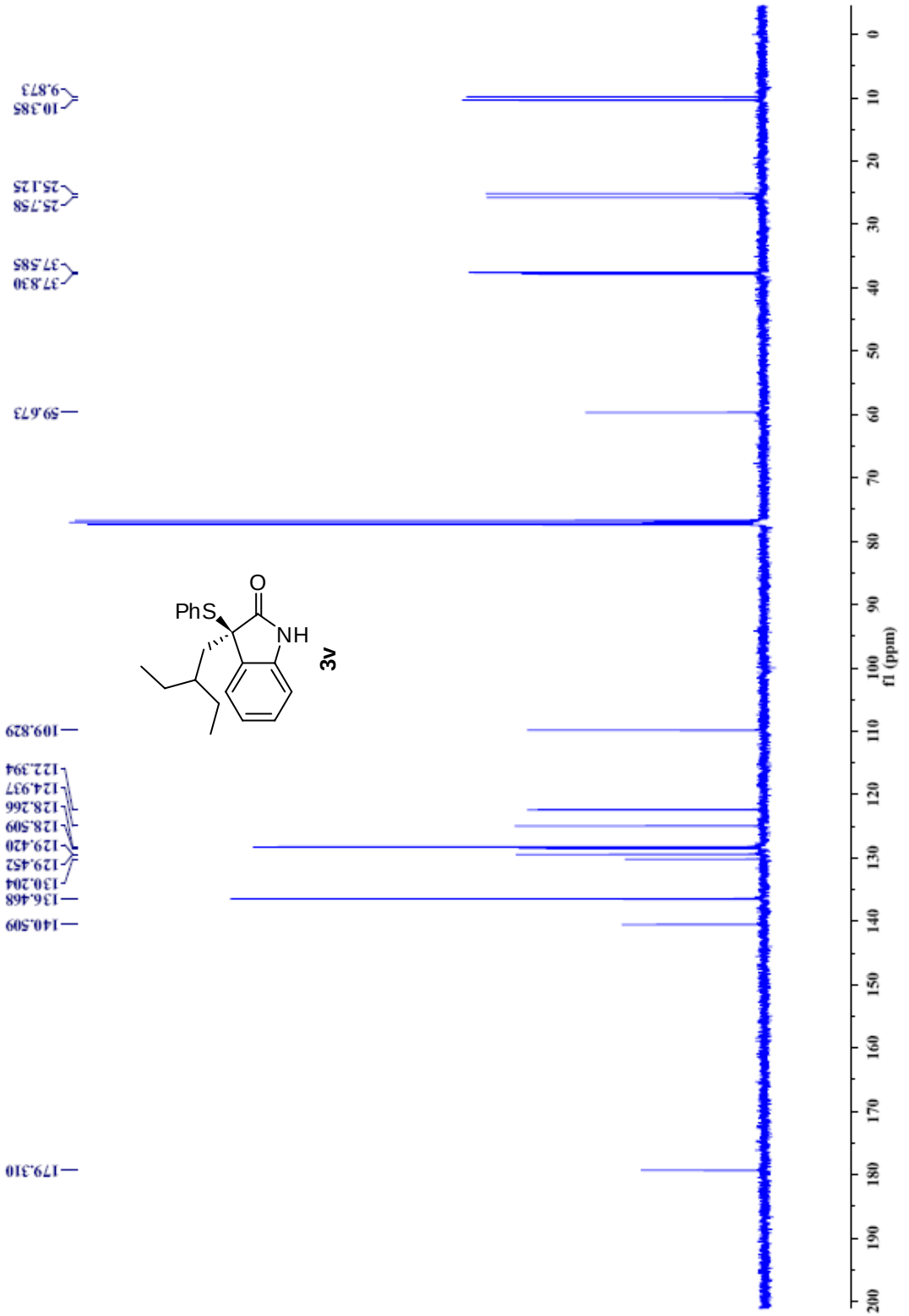
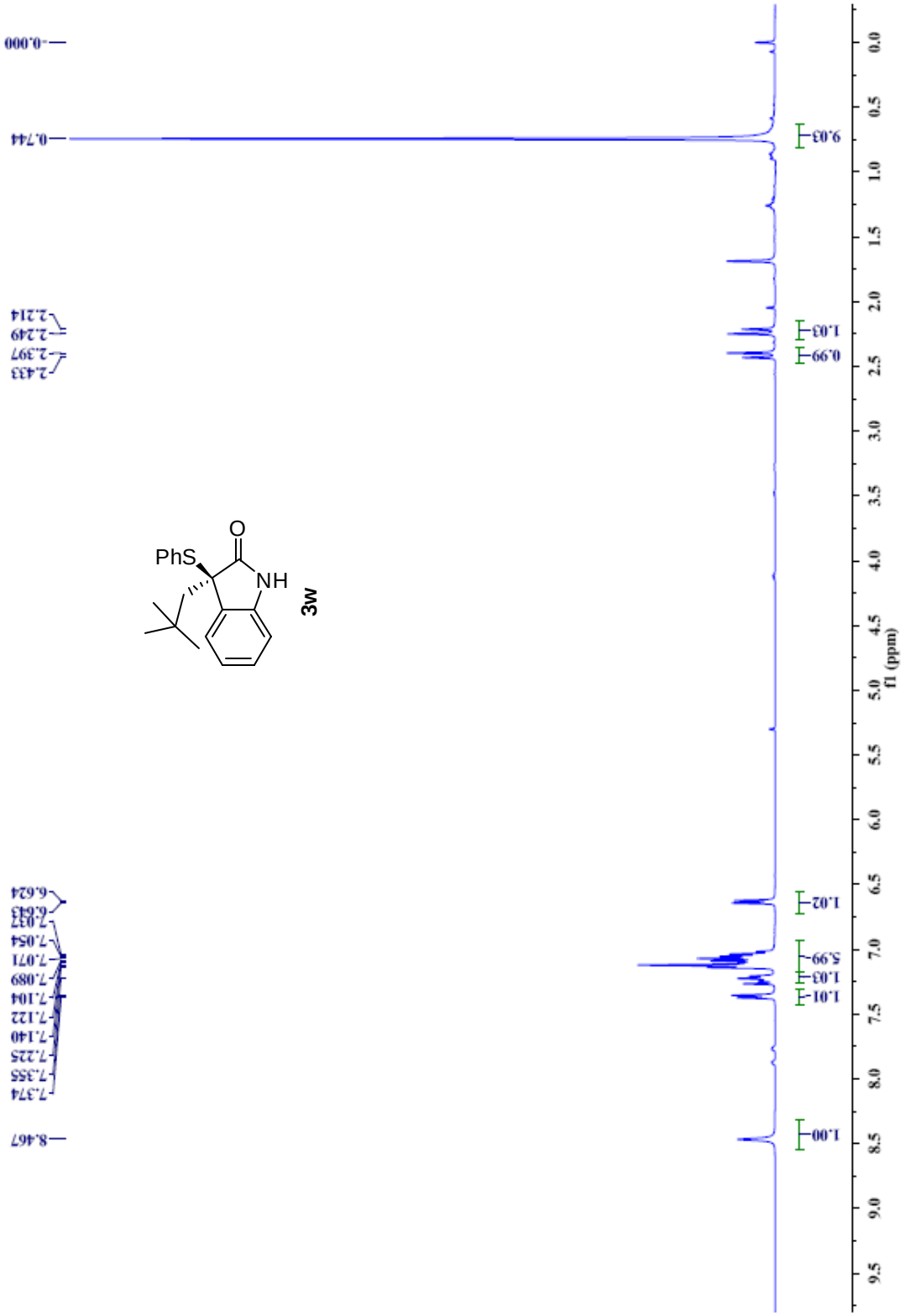
122.612
124.502
128.323
128.577
129.379
129.465
130.286
136.427
140.554
179.017
PhS
O
NH
3t
f1 (ppm)

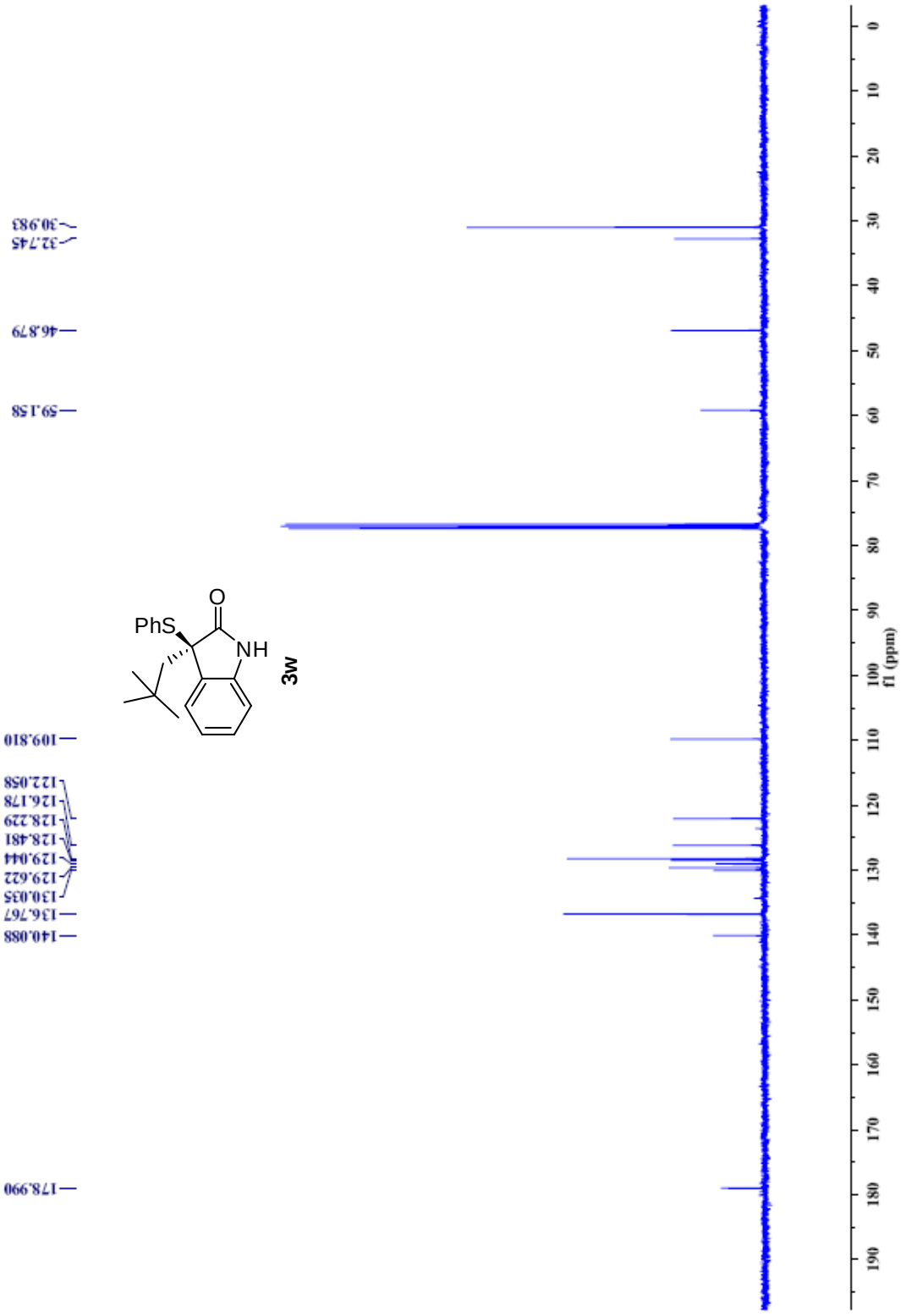

PhS
O
NH
3u
f1 (ppm)

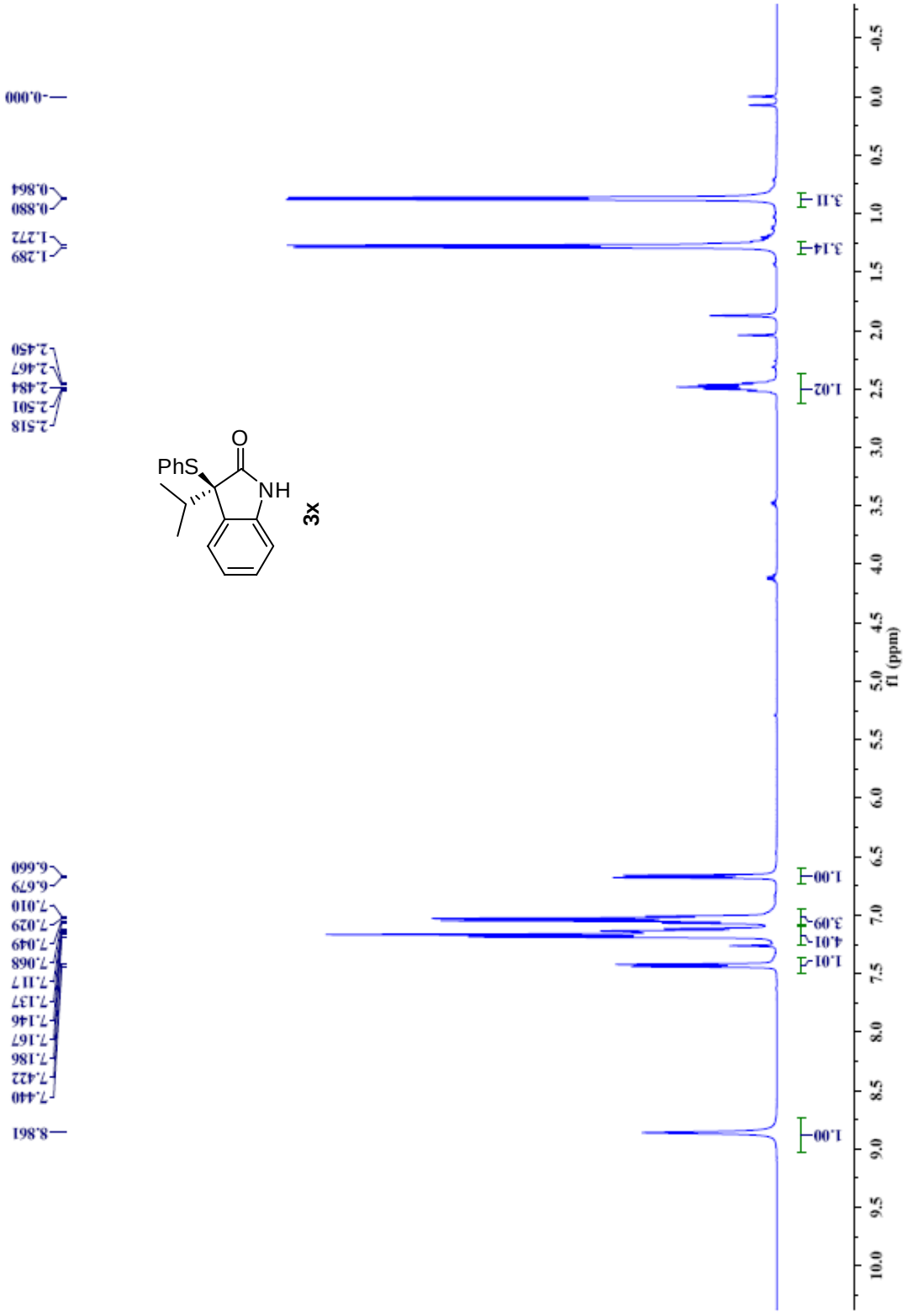

22.689
23.929
26.227
43.094
59.206
109.851
122.468
124.874
128.285
128.552
129.310
129.527
130.147
136.615
140.426
179.147
O
PhS
NH
3u
f1 (ppm)

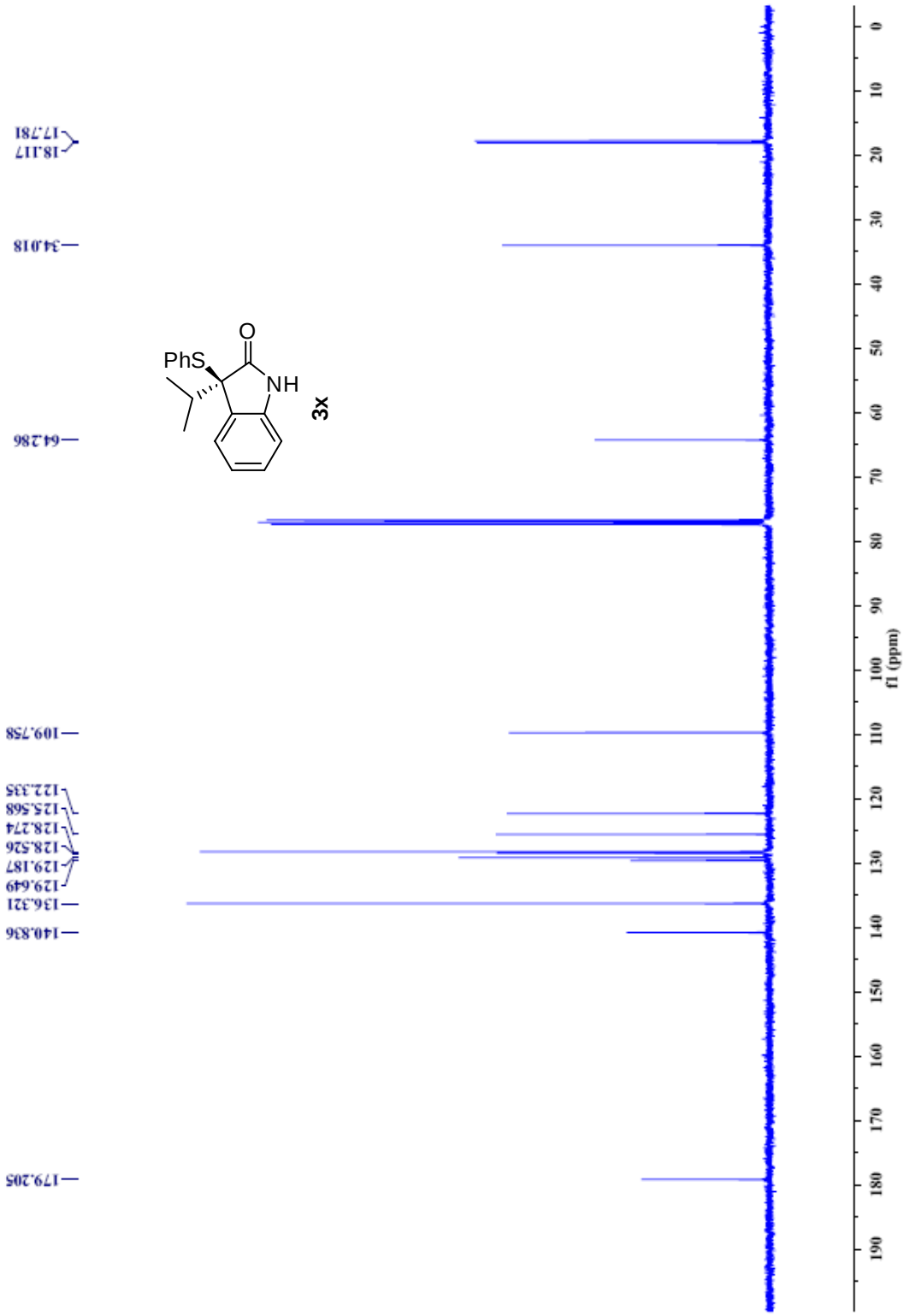

0.000
0.663
0.680
0.694
0.709
0.726
1.074
1.091
1.108
1.121
2.103
2.138
2.197
2.209
2.233
2.242
6.634
6.653
7.063
7.080
7.106
7.125
7.148
7.168
7.191
7.209
7.227
7.304
7.322
8.746
6.02
5.10
2.03
1.00
3.01
0.92
2.04
1.04
1.01
0.99
O
PhS
NH
3v
f1 (ppm)

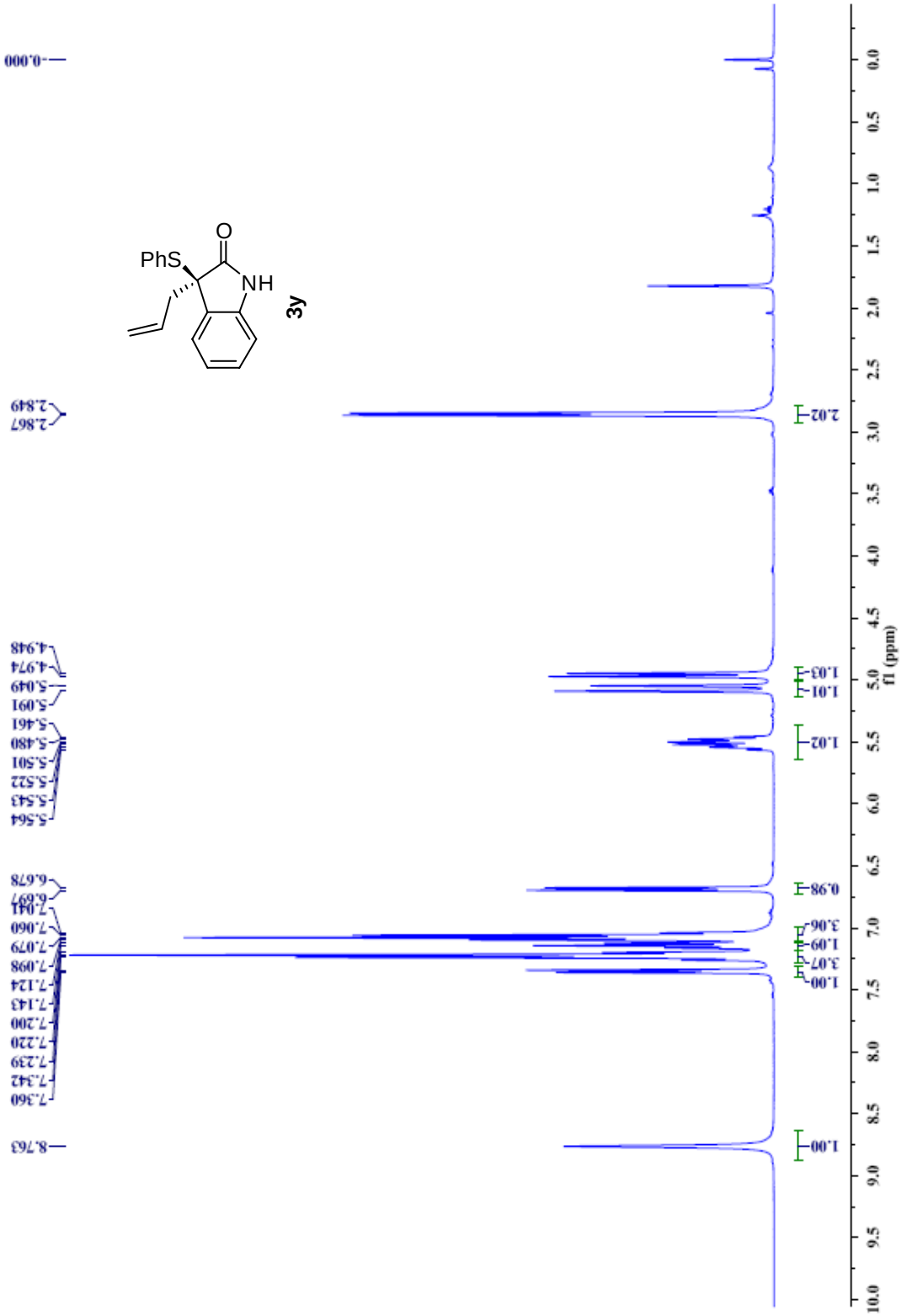

9.873
10.385
25.125
25.758
37.585
37.830
59.673
109.829
122.394
124.937
128.266
128.509
129.420
129.452
130.204
136.468
140.509
179.310
O
PhS
NH
3v
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170
180
190
200
f1 (ppm)

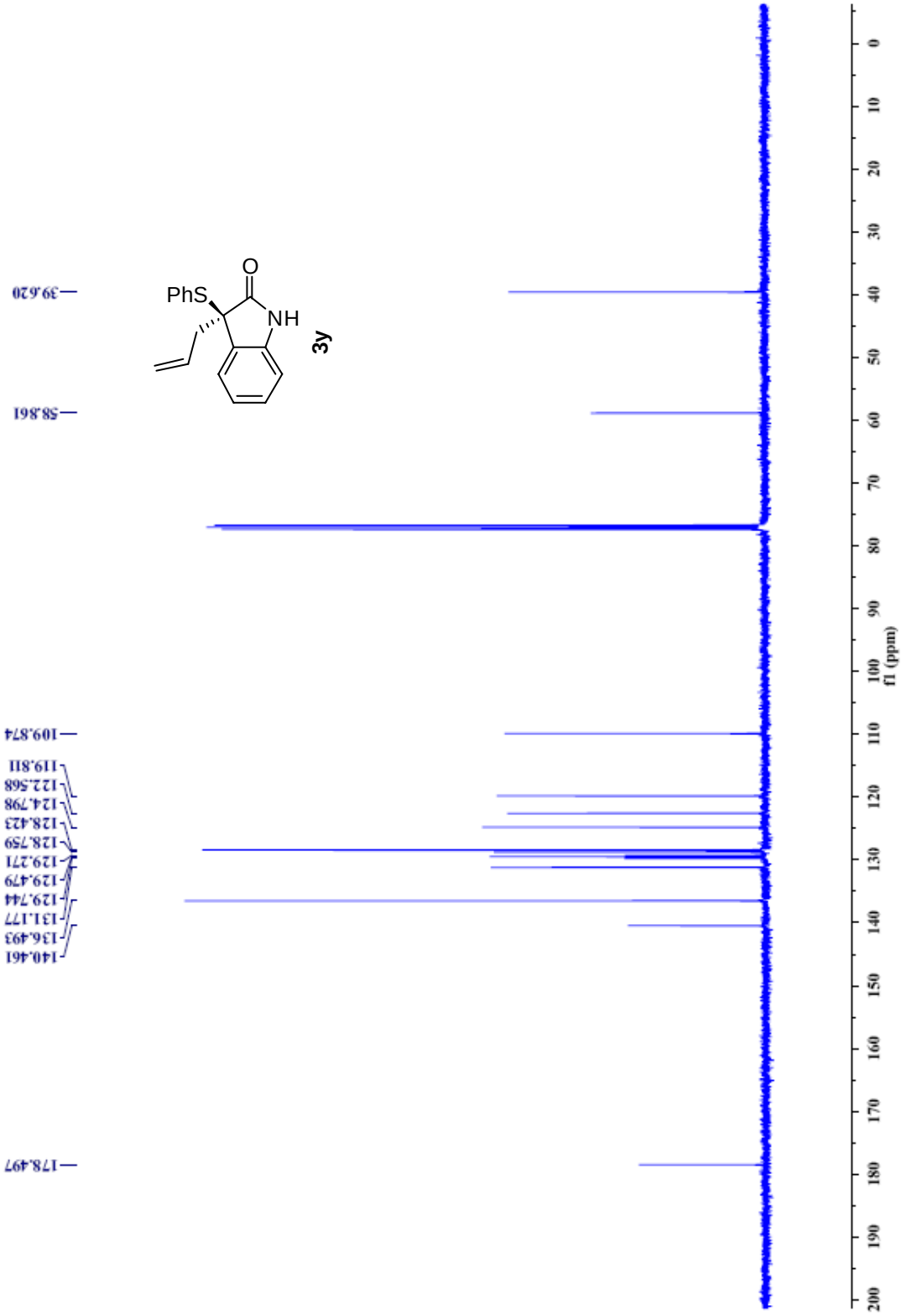

PhS
O
NH
3w
f1 (ppm)

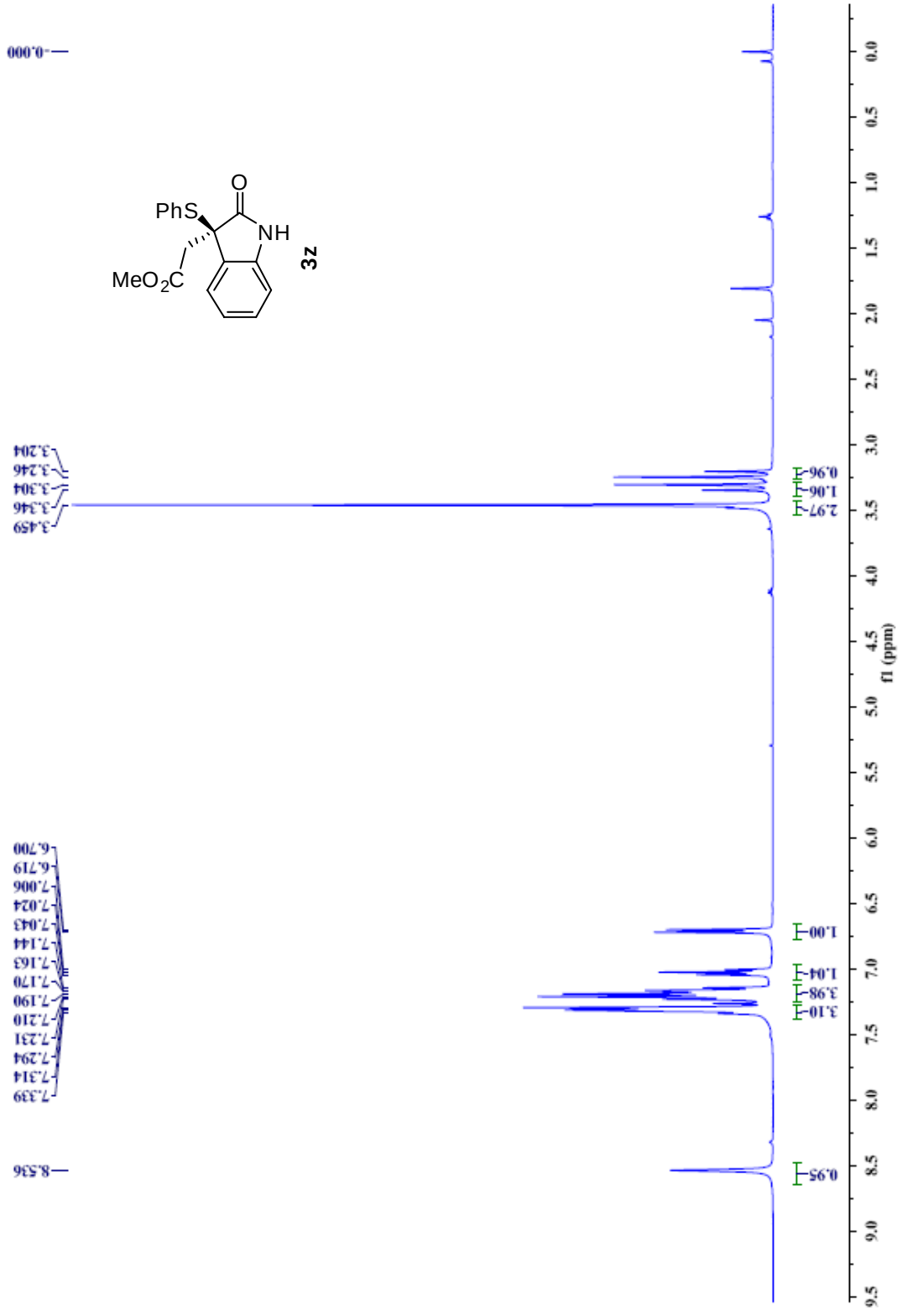

30.983
32.745
46.879
59.158
109.810
122.058
126.178
128.229
128.481
129.044
129.622
130.035
136.767
140.088
178.990
PhS
O
NH
3w
f1 (ppm)

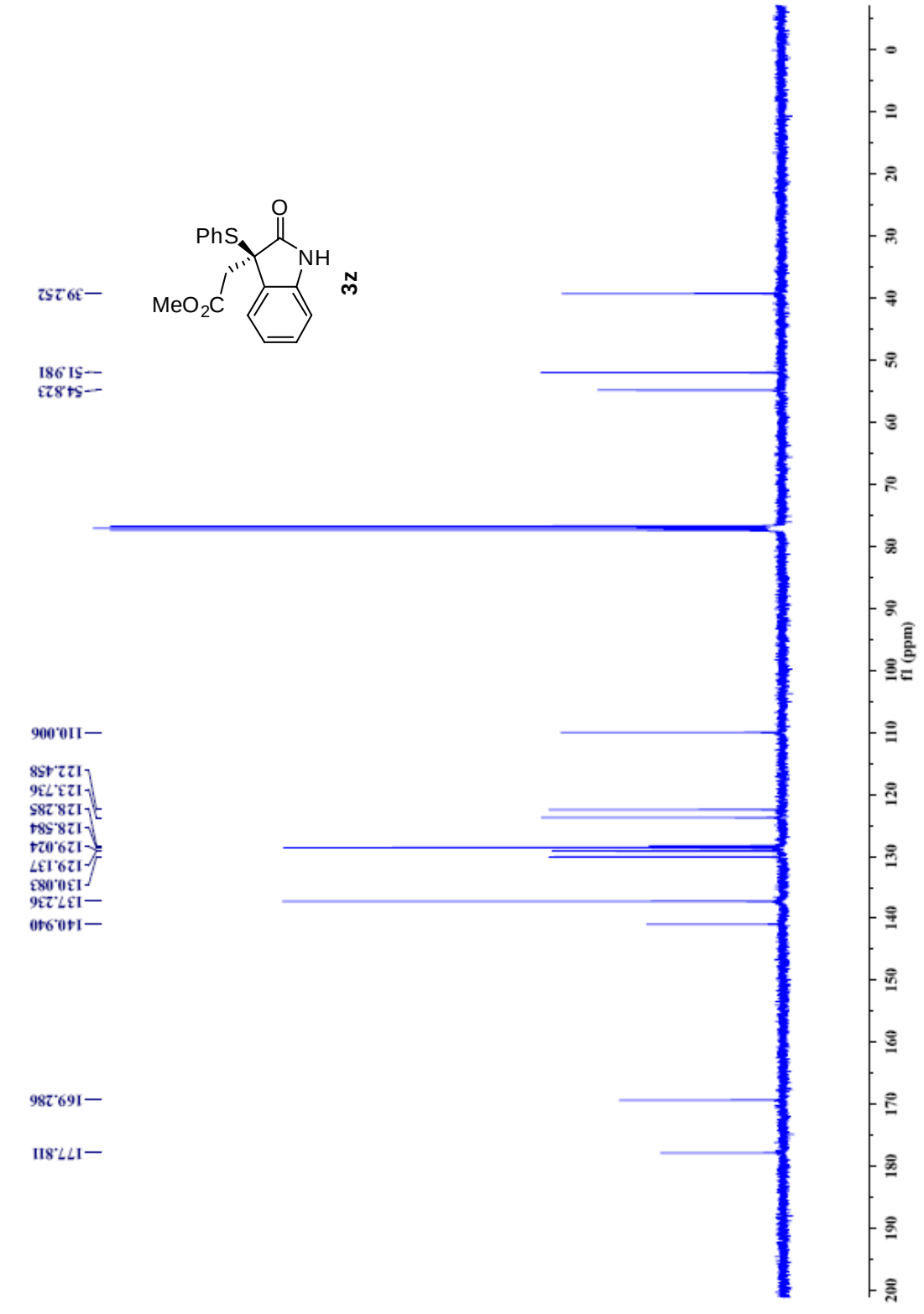

PhS
O
NH
3x
f1 (ppm)

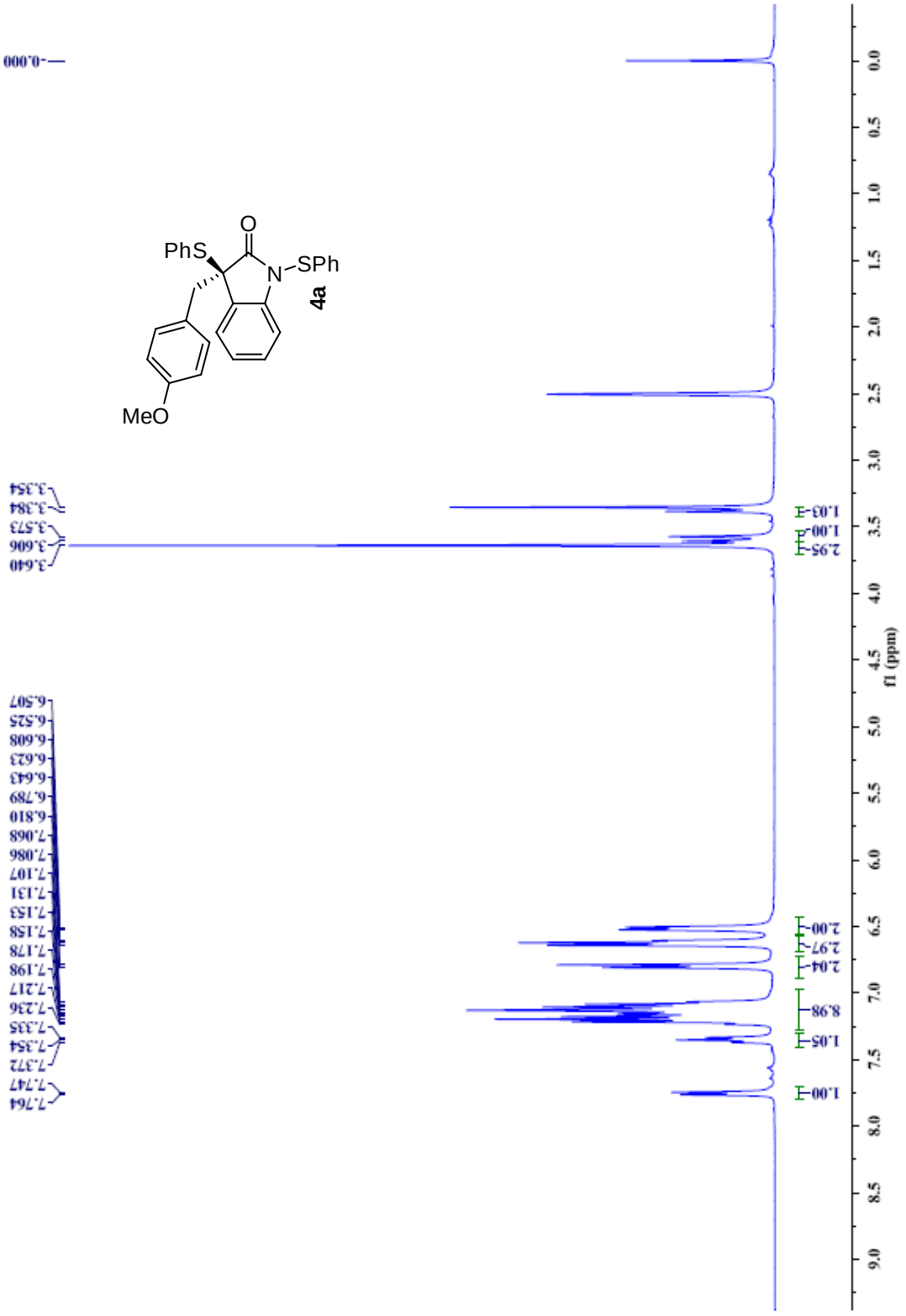

17.781
18.117
34.018
64.286
109.758
122.335
125.568
128.274
128.526
129.187
129.649
136.321
140.836
179.205
PhS
O
NH
3x
f1 (ppm)

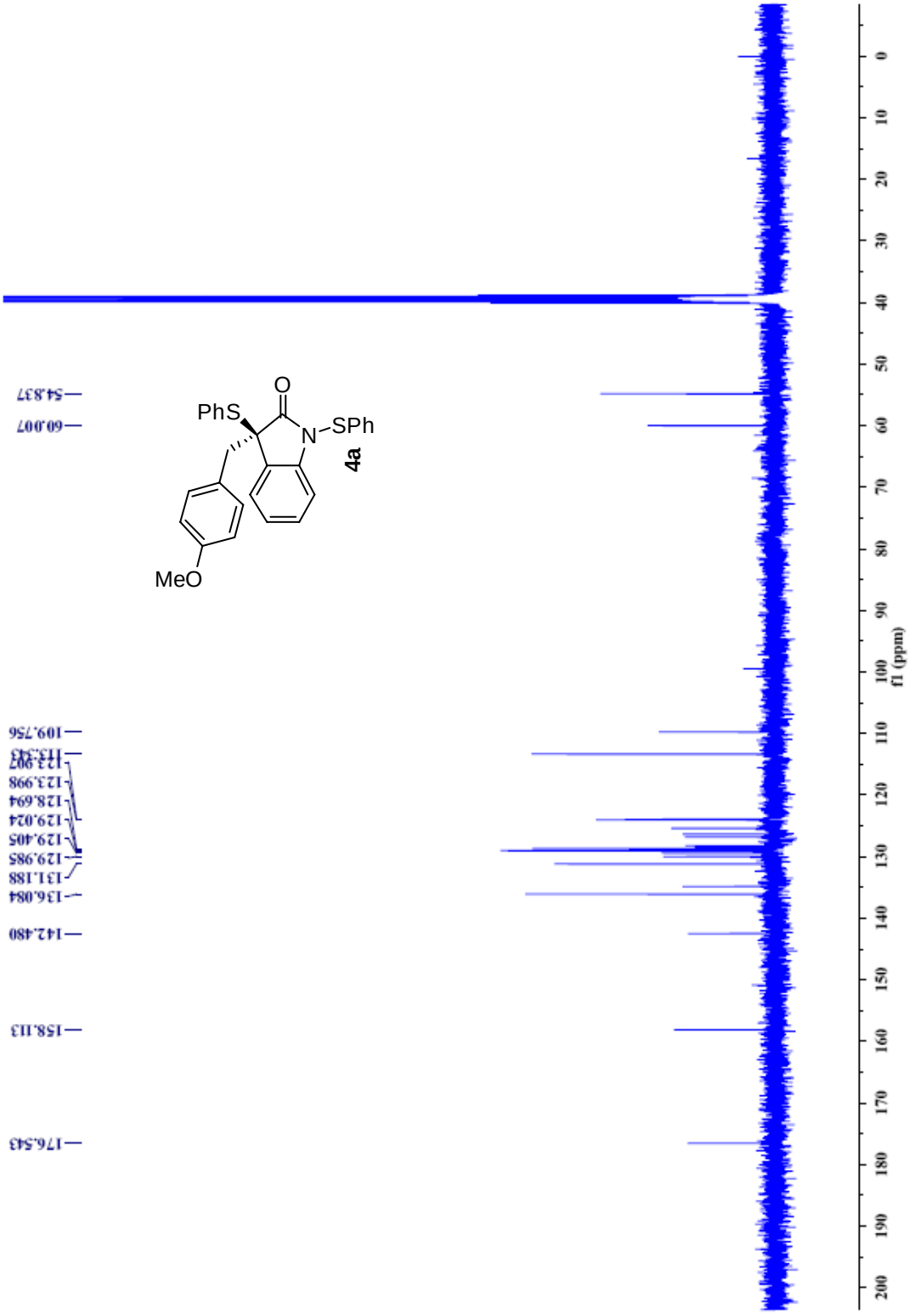

PhS
O
NH
3y
f1 (ppm)

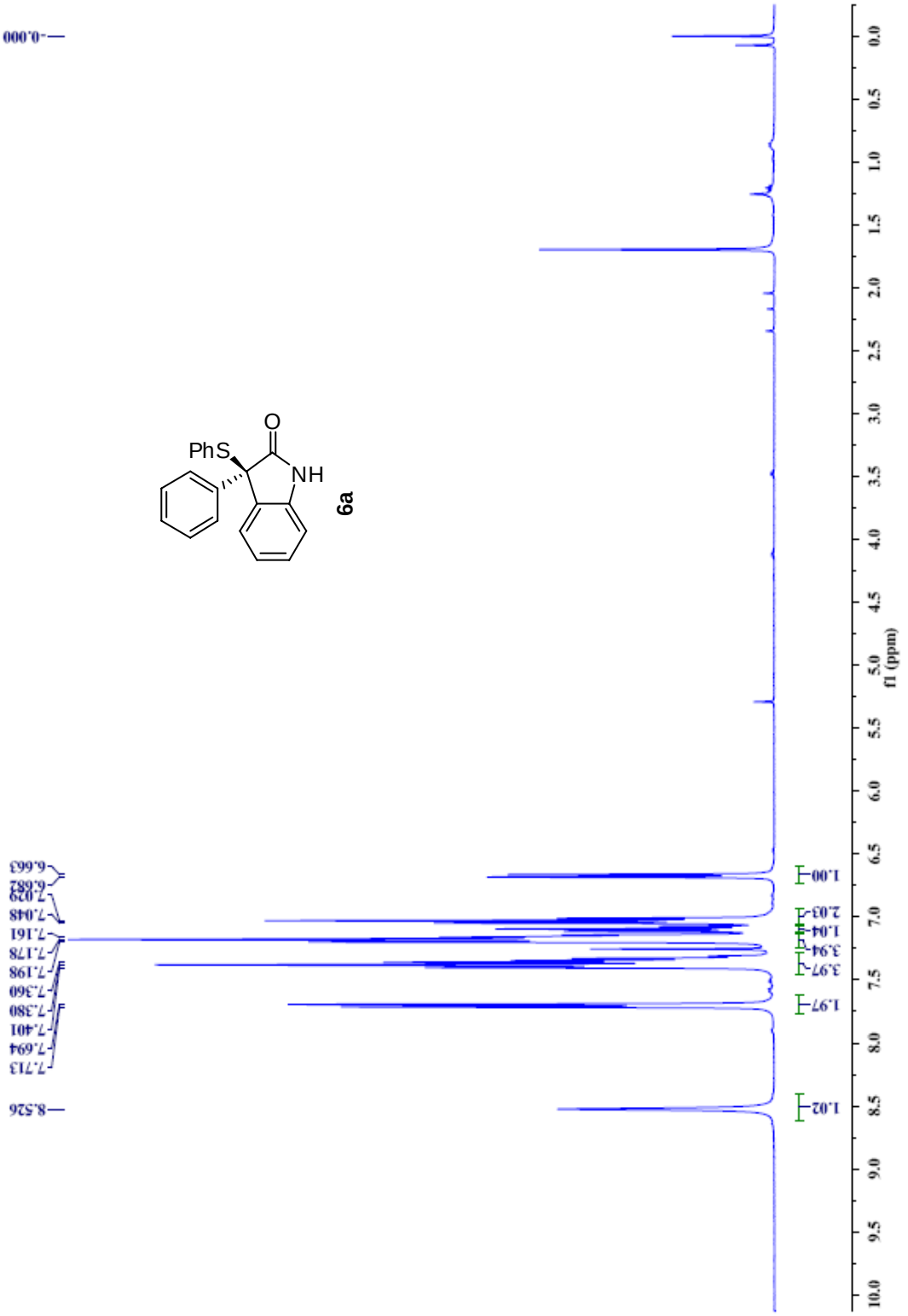

O
PhS
NH
3y
39.620
58.861
109.874
119.811
122.568
124.798
128.423
128.759
129.271
129.479
129.744
131.177
136.493
140.461
178.497
f1 (ppm)

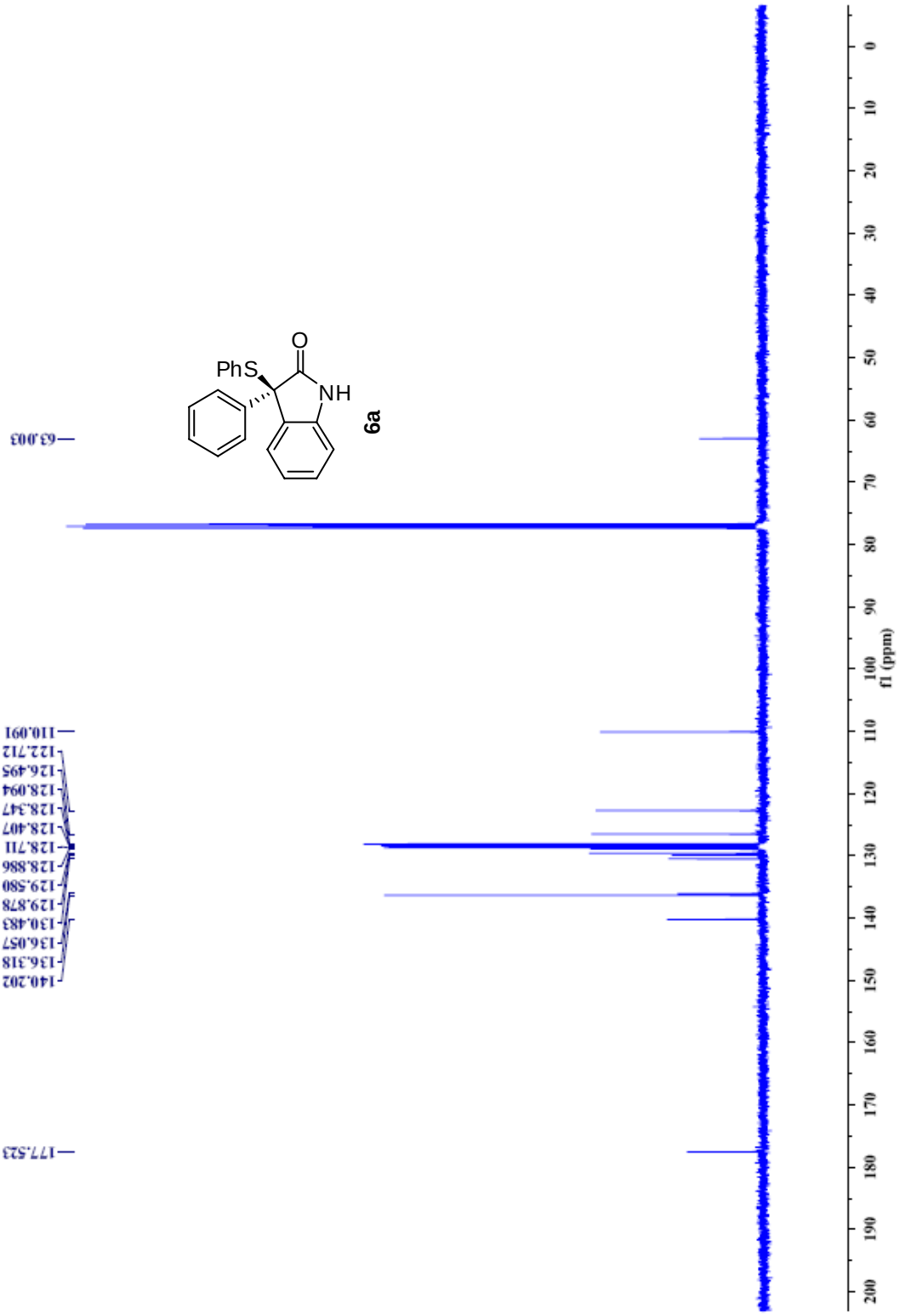

PhS
O
NH
MeO2C
3z
f1 (ppm)

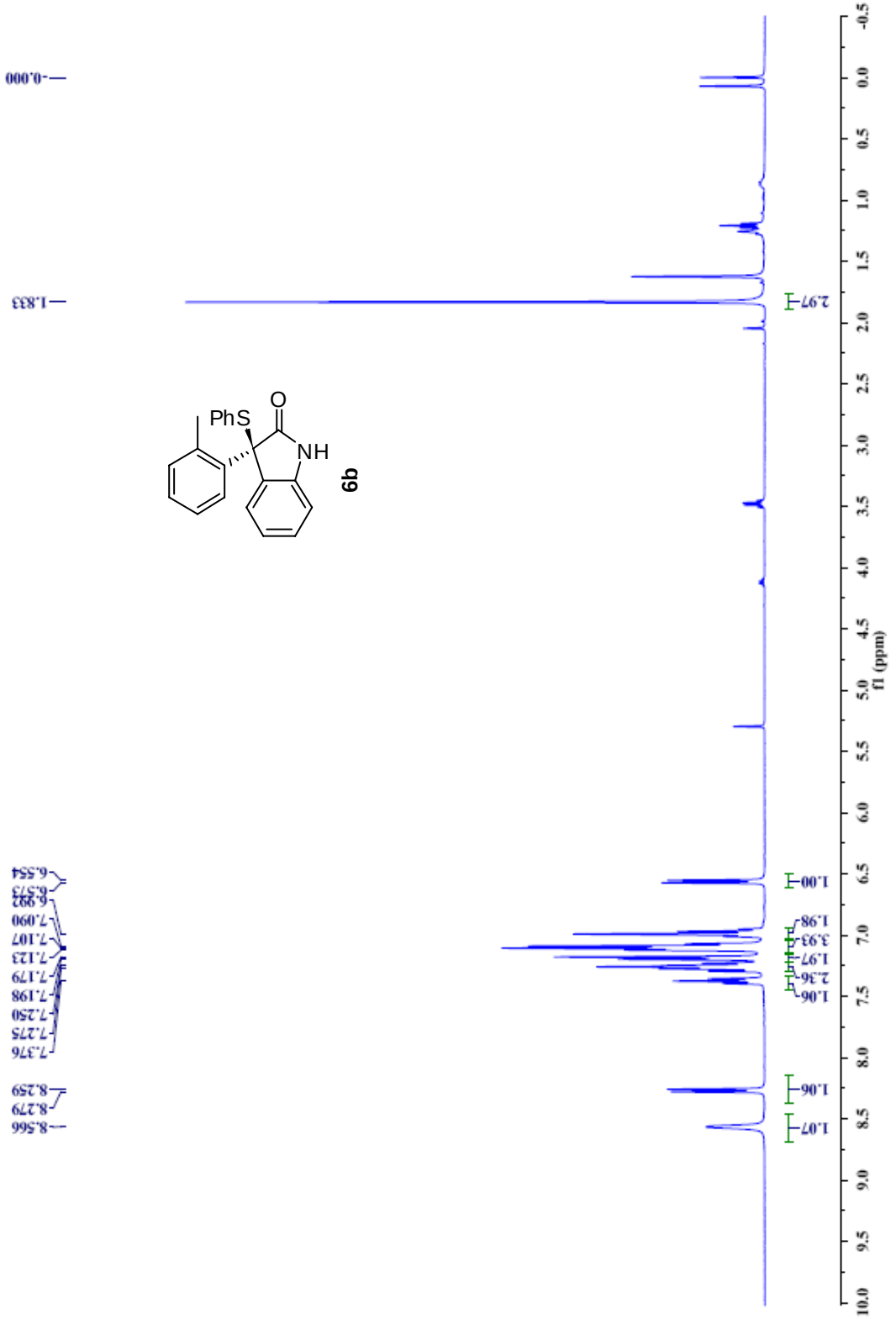

PhS
O
NH
MeO2C
3z
39.252
51.981
54.823
110.006
122.458
123.736
128.285
128.584
129.024
129.137
130.083
137.236
140.940
169.286
177.811
f1 (ppm)

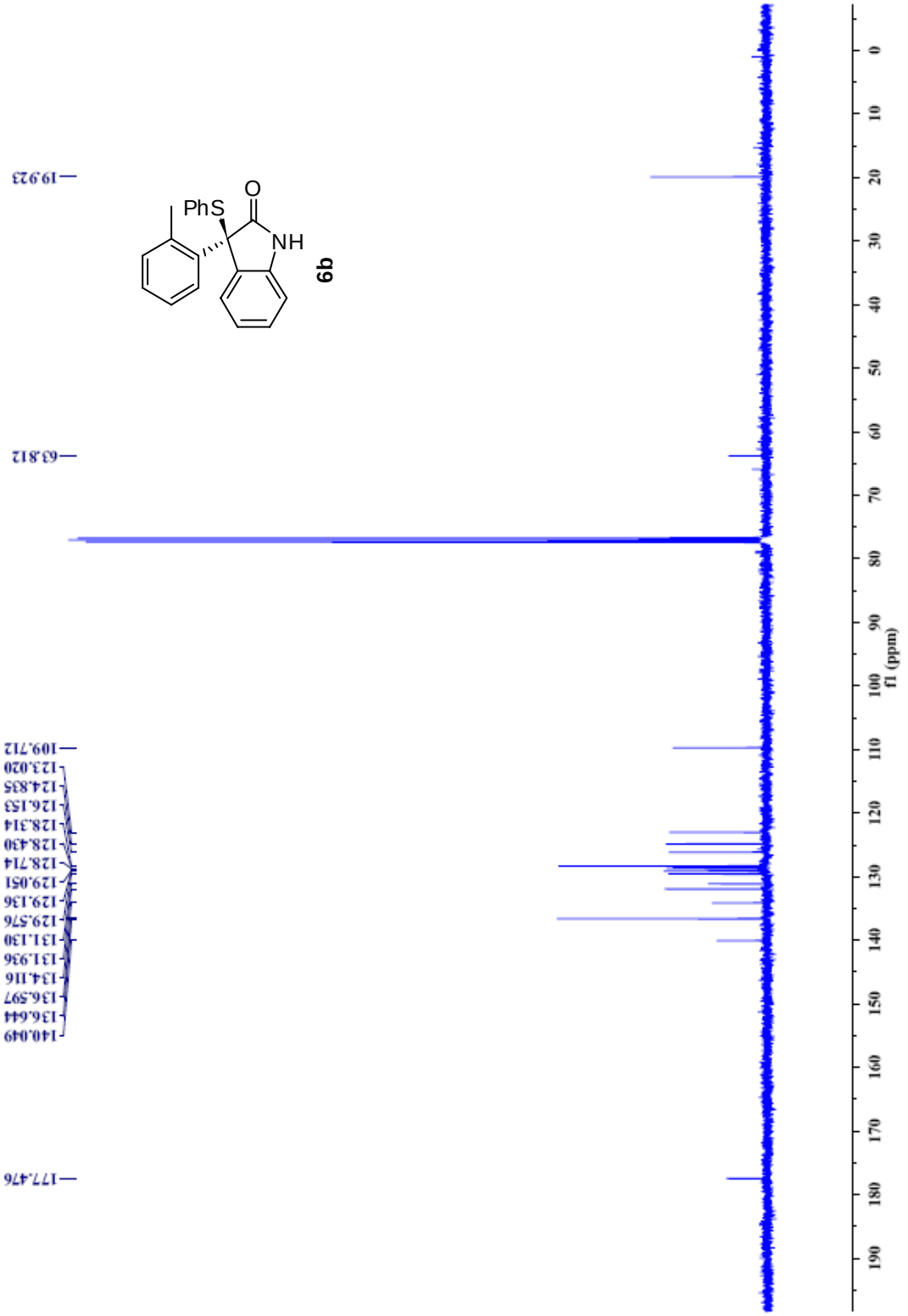

PhS
O
N
SPh
MeO
4a
f1 (ppm)

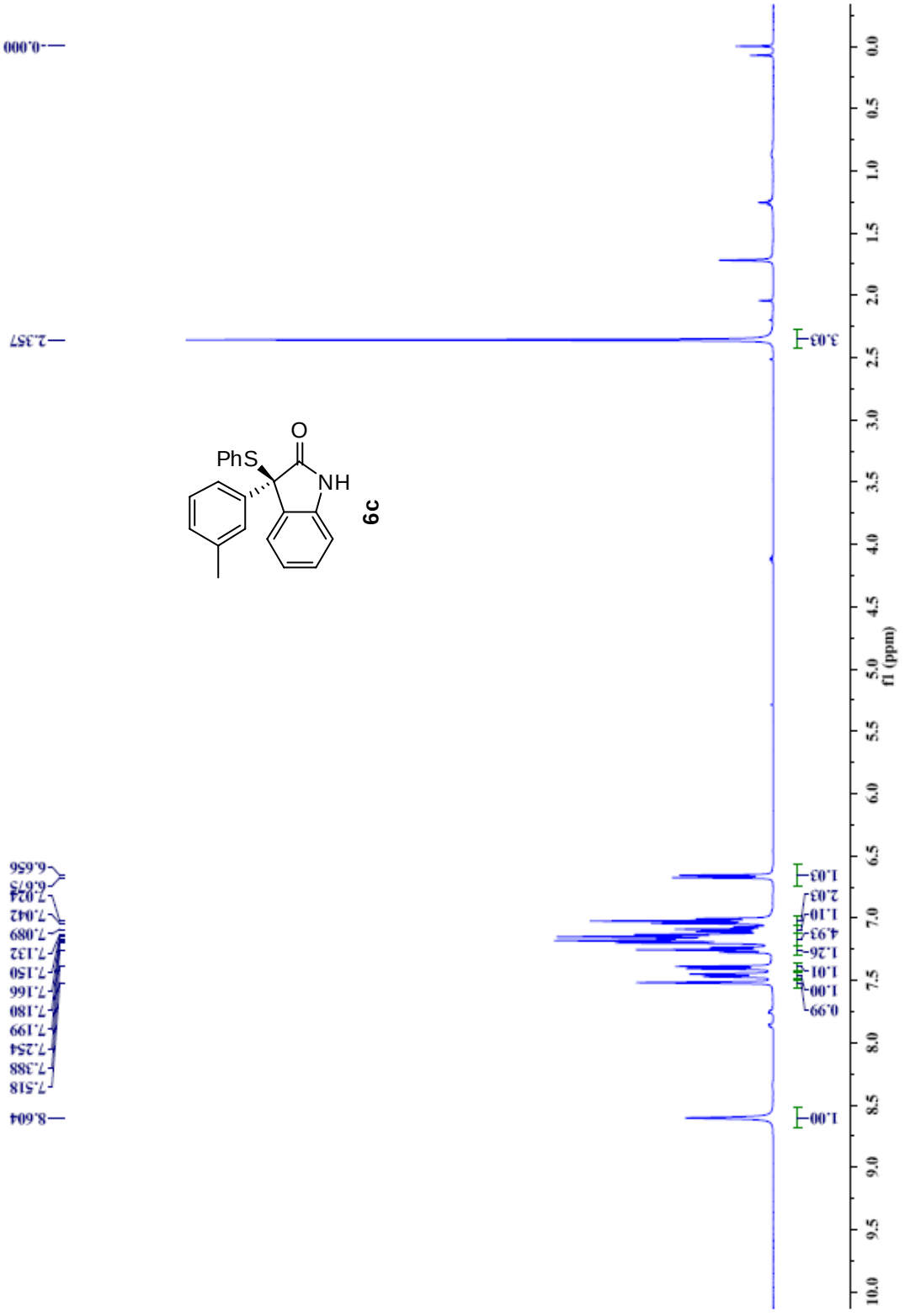

PhS
O
N
SPh
4a
MeO
54.837
60.007
109.756
113.243
123.907
123.998
128.694
129.024
129.405
129.985
131.188
136.084
142.480
158.113
176.543
f1 (ppm)

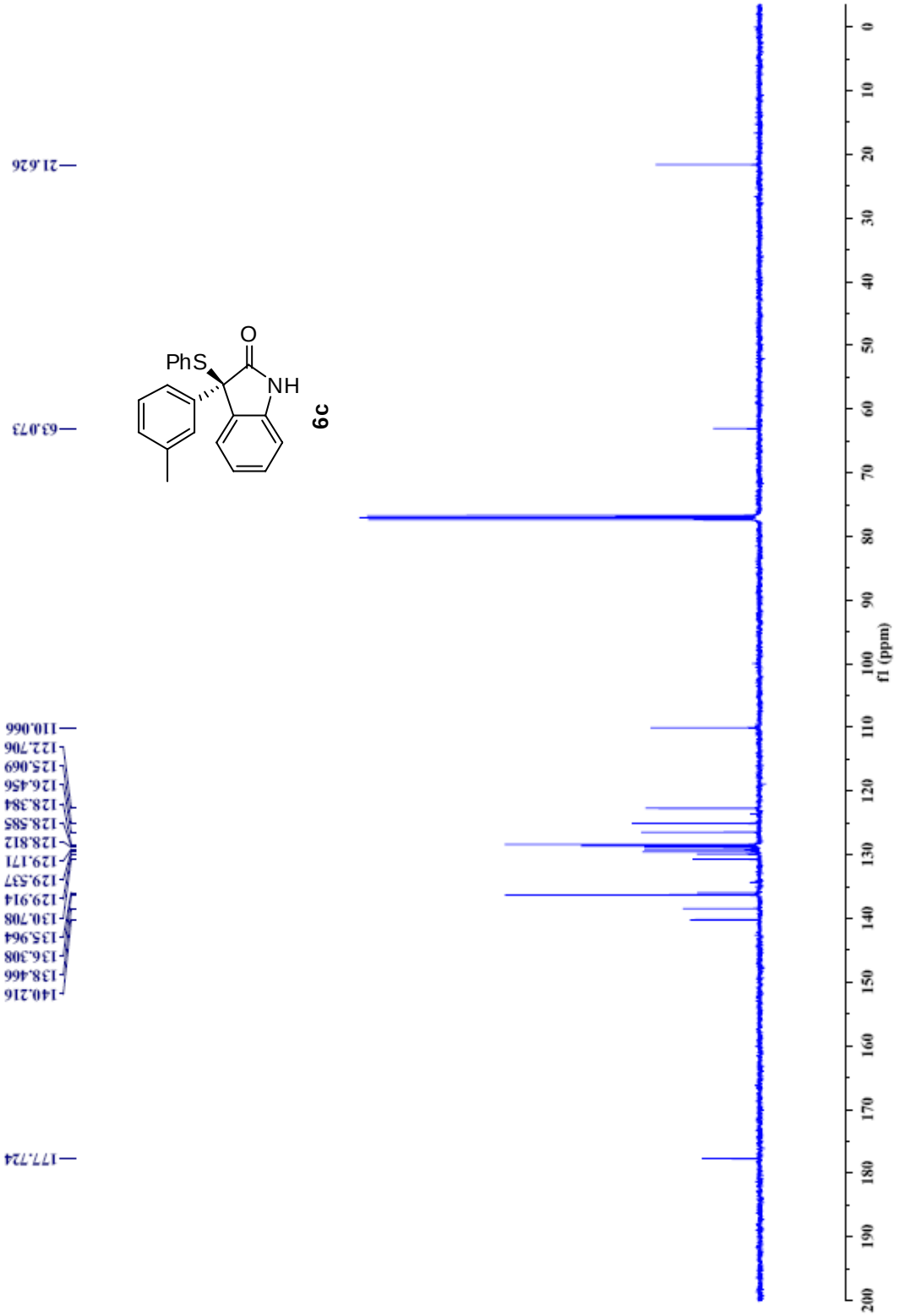

PhS
O
NH
6a
f1 (ppm)

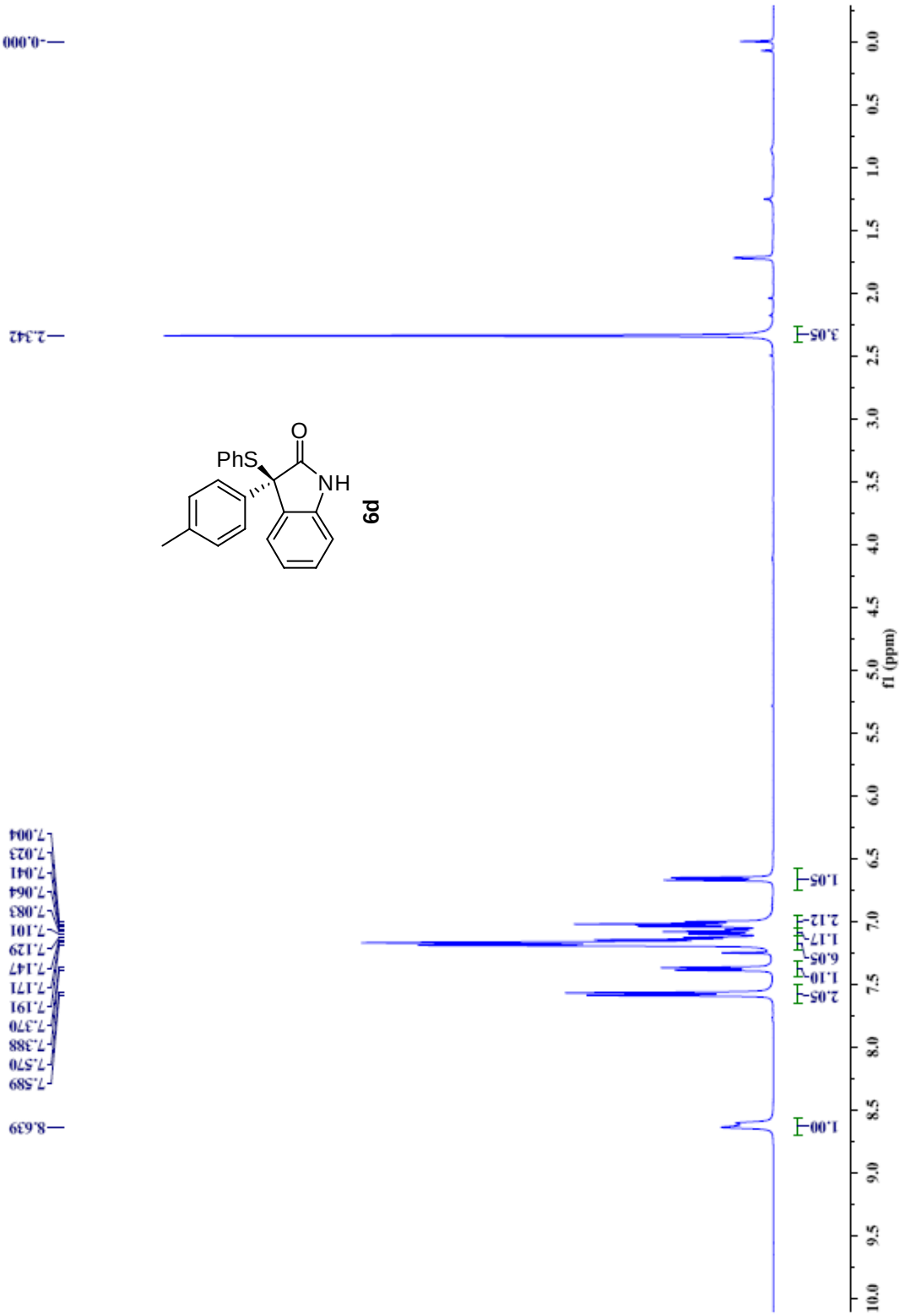

PhS
O
NH
6a
63.003
110.091
122.712
126.495
128.094
128.347
128.407
128.711
128.886
129.580
129.878
130.483
136.057
136.318
140.202
177.523
f1 (ppm)

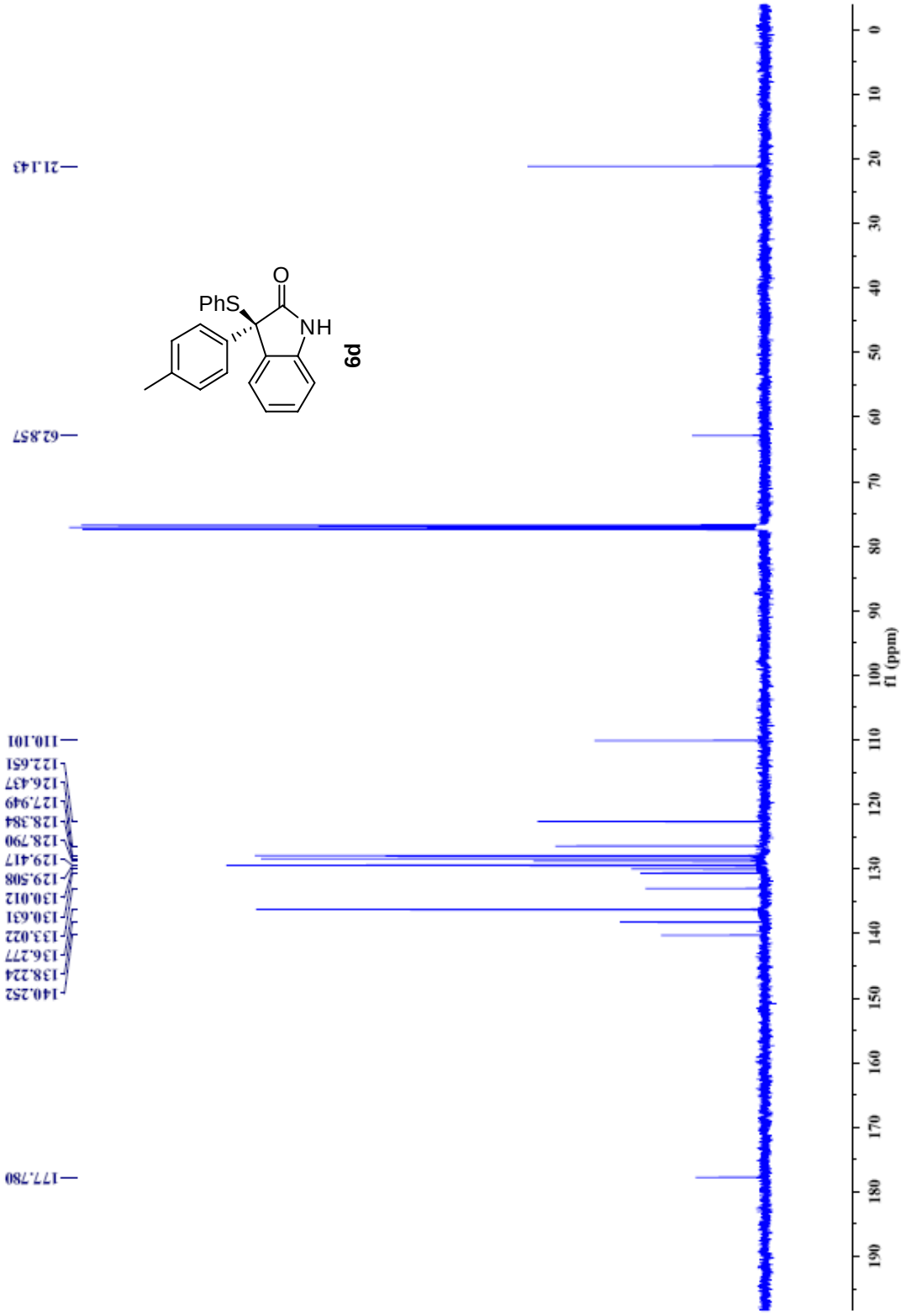

PhS
O
NH
6b
f1 (ppm)

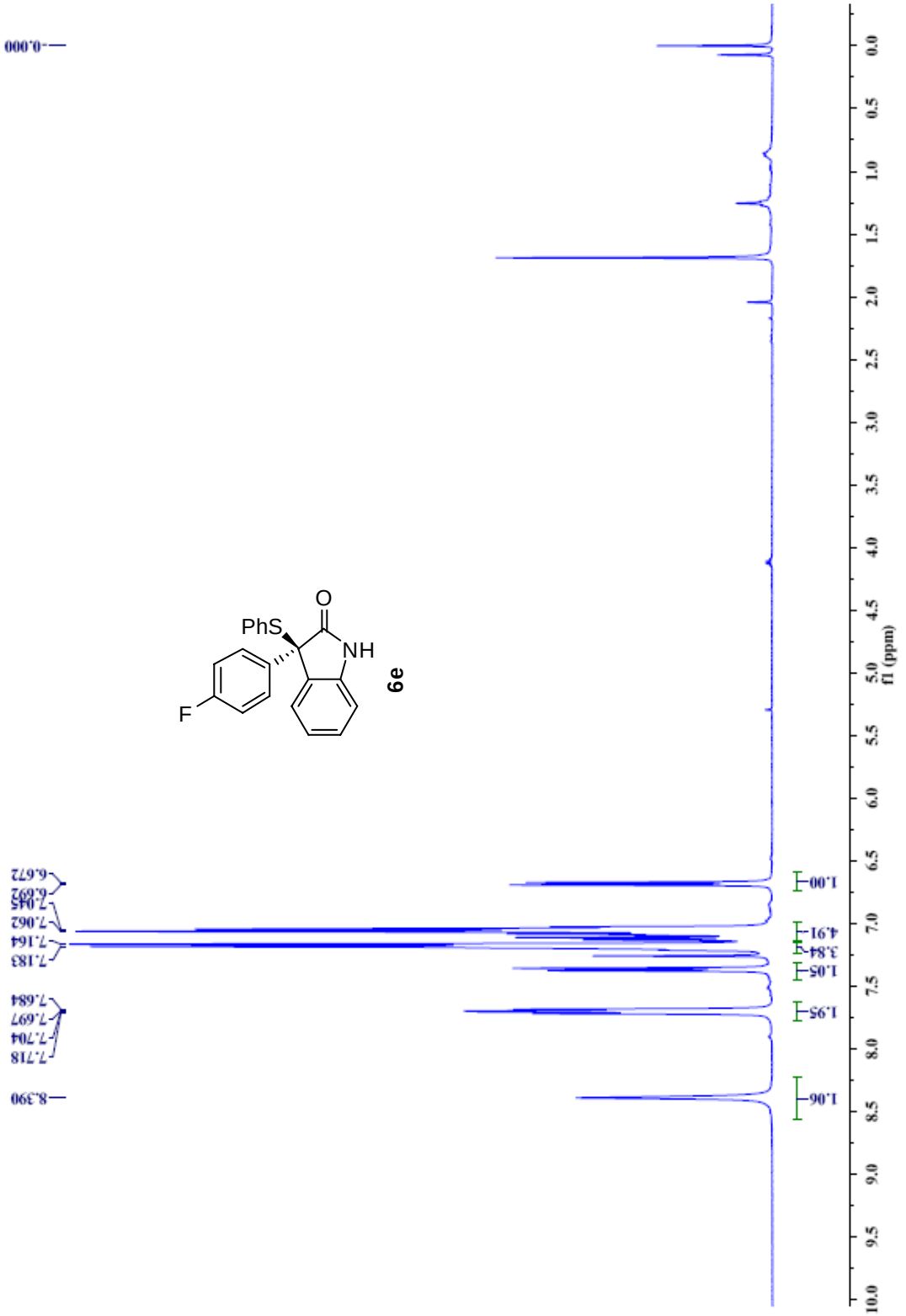

PhS
O
NH
6b
19.923
63.812
109.712
123.020
124.835
126.153
128.314
128.430
128.714
129.051
129.136
129.576
131.130
131.936
134.116
136.597
136.644
140.049
177.476
f1 (ppm)

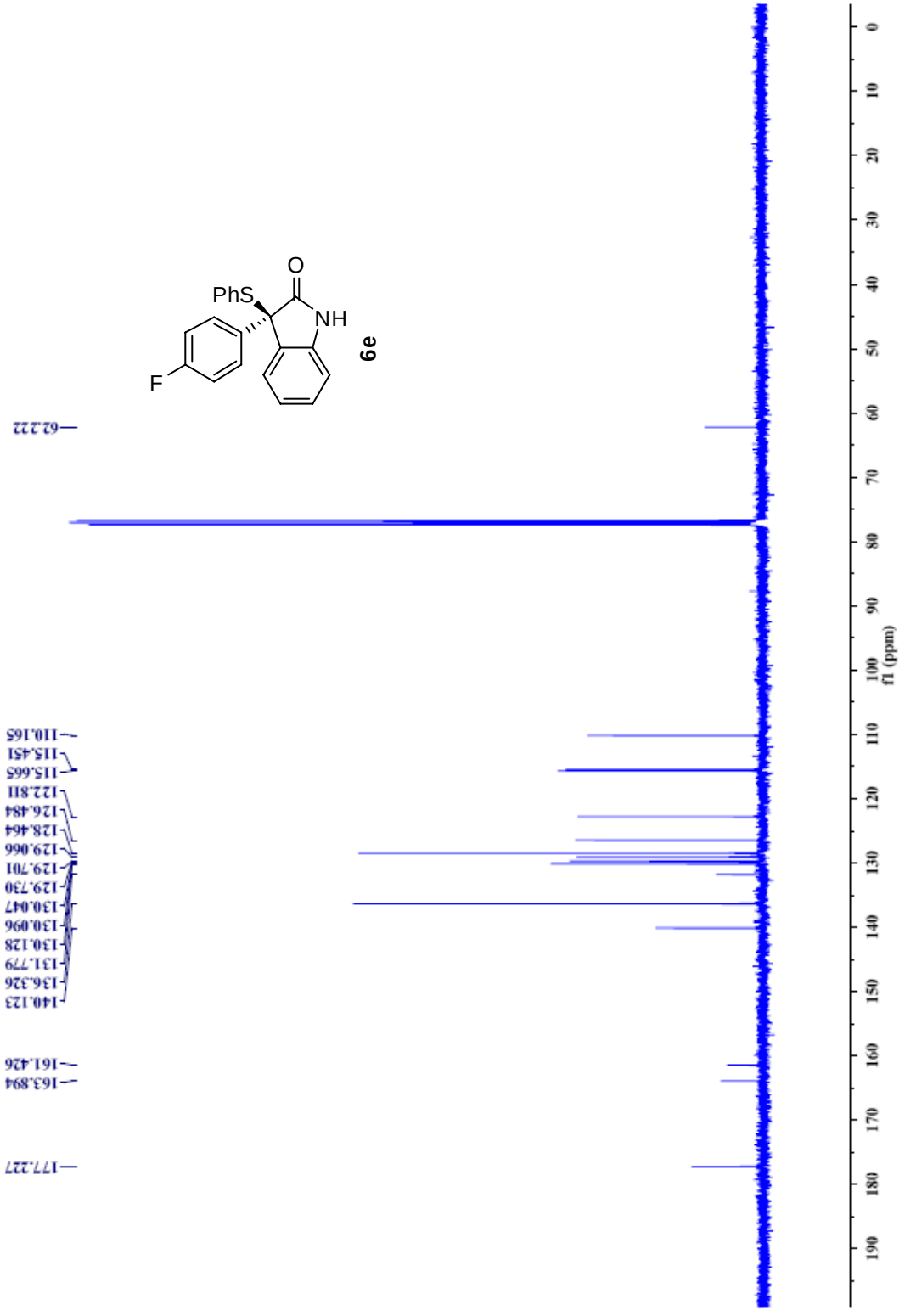

PhS
O
NH
6c
f1 (ppm)

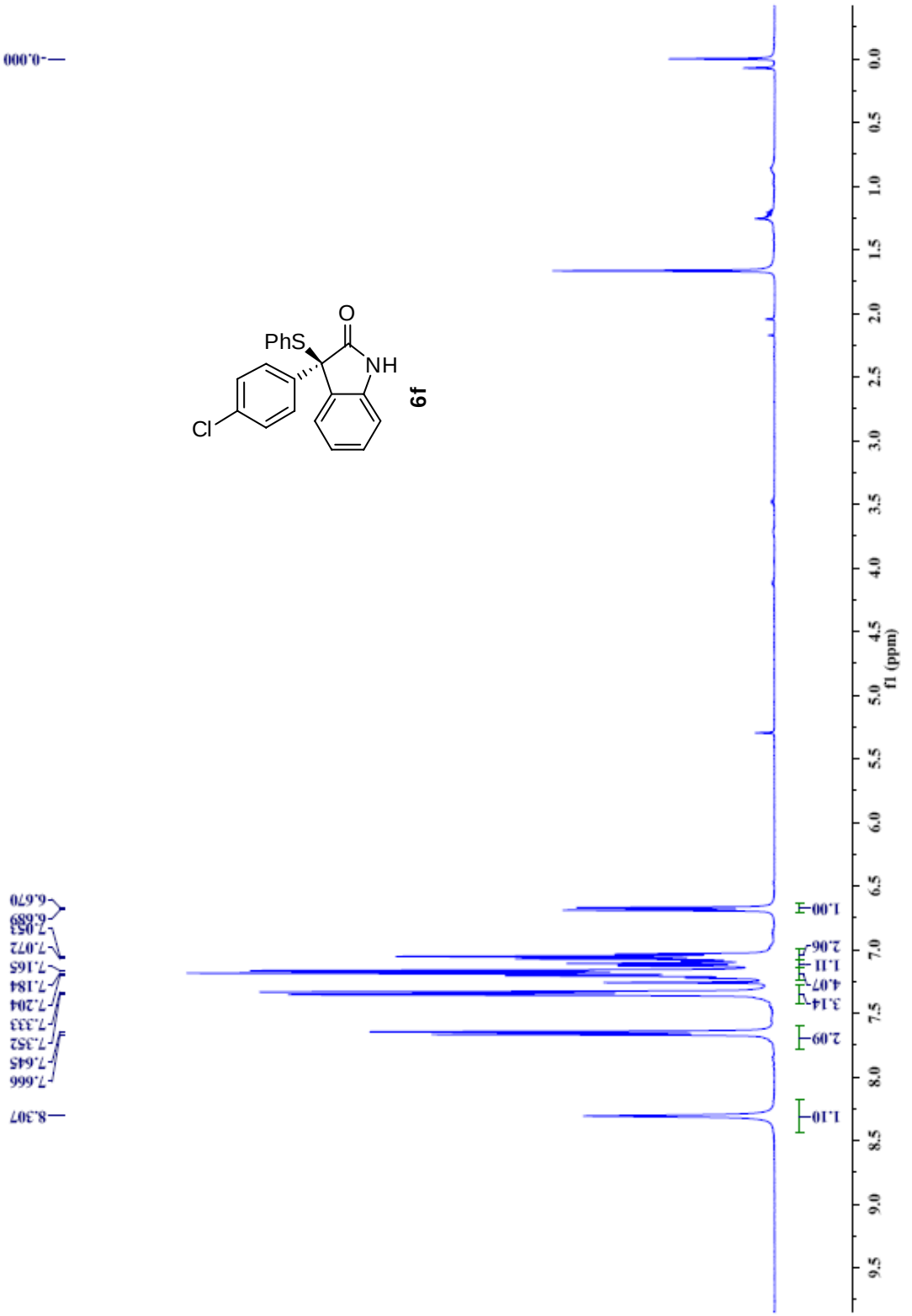

21.626
63.073
110.066
122.706
125.069
126.456
128.384
128.585
128.812
129.171
129.537
129.914
130.708
135.964
136.308
138.466
140.216
177.724
PhS
O
NH
6c
f1 (ppm)

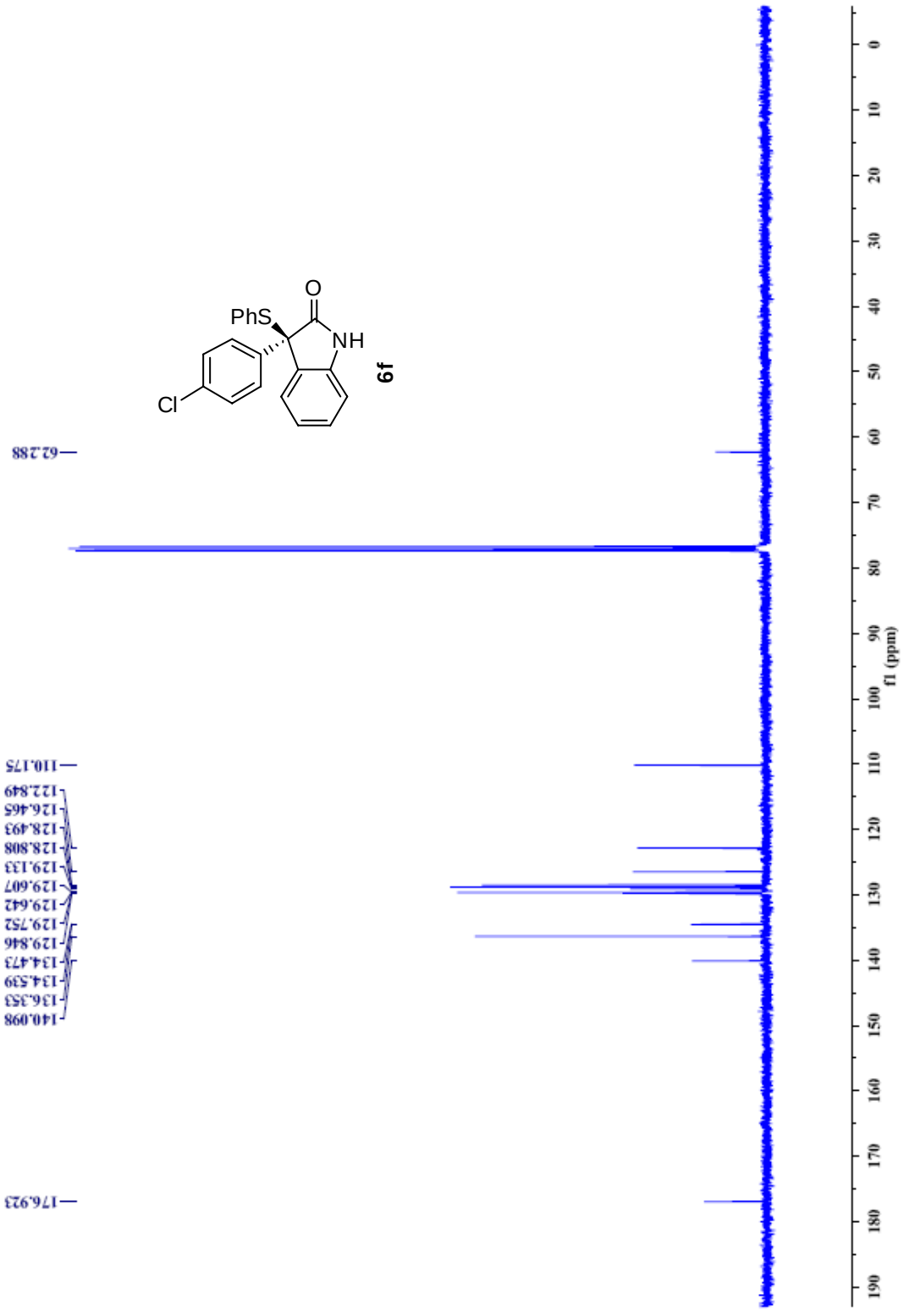

PhS
O
NH
6d
f1 (ppm)


21.143
62.857
110.101
122.651
126.437
127.949
128.384
128.790
129.417
129.508
130.012
130.631
133.022
136.277
138.224
140.252
177.780
PhS
O
NH
6d
f1 (ppm)


PhS
O
NH
F
6e
f1 (ppm)


O
PhS
NH
F
6e
62.222
110.165
115.451
115.665
122.811
126.484
128.464
129.066
129.701
129.730
130.047
130.096
130.128
131.779
136.326
140.123
161.426
163.894
177.227
f1 (ppm)


PhS
O
NH
Cl
6f
f1 (ppm)


O
PhS
NH
Cl
6f
62.288
110.175
122.849
126.465
128.493
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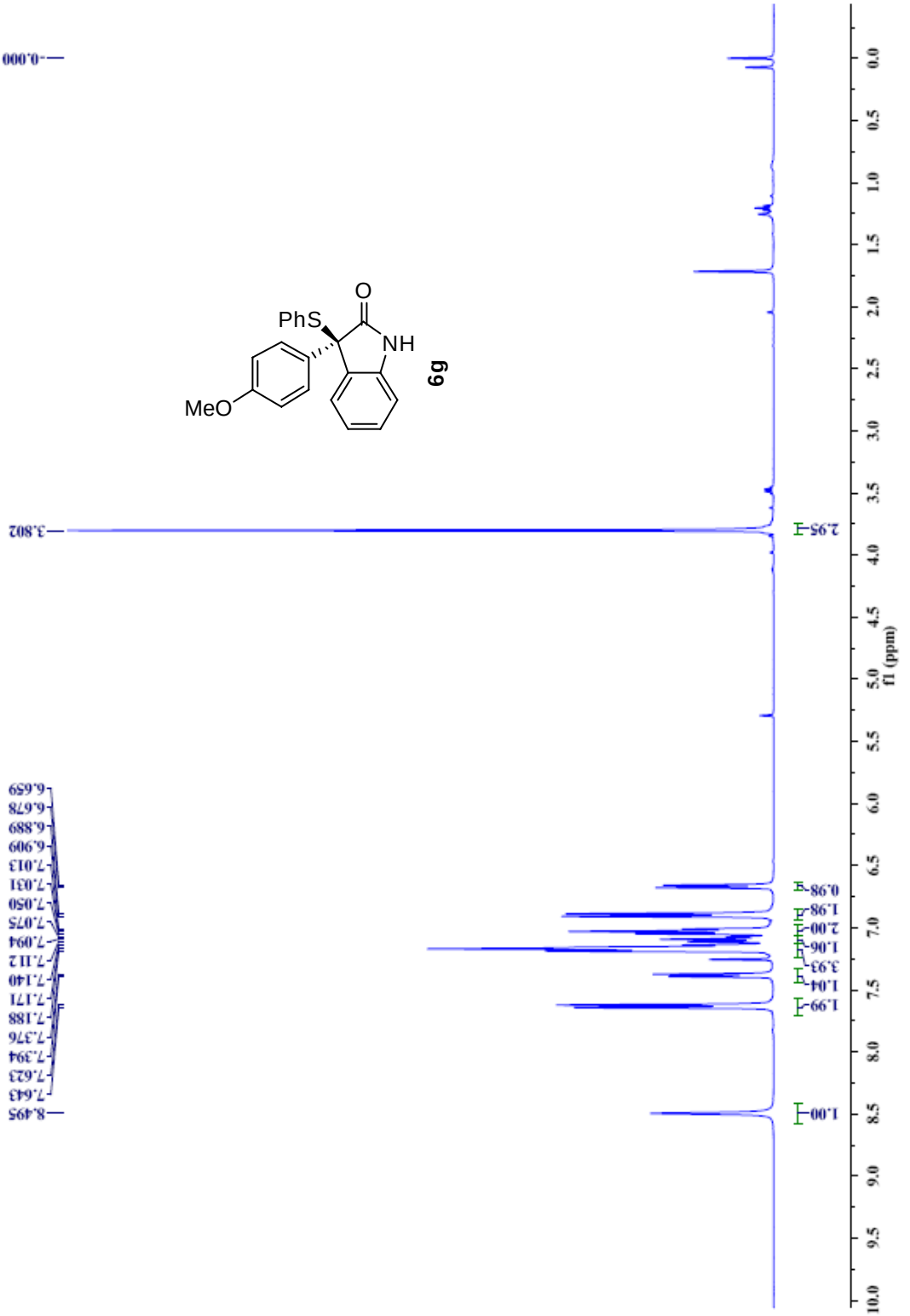
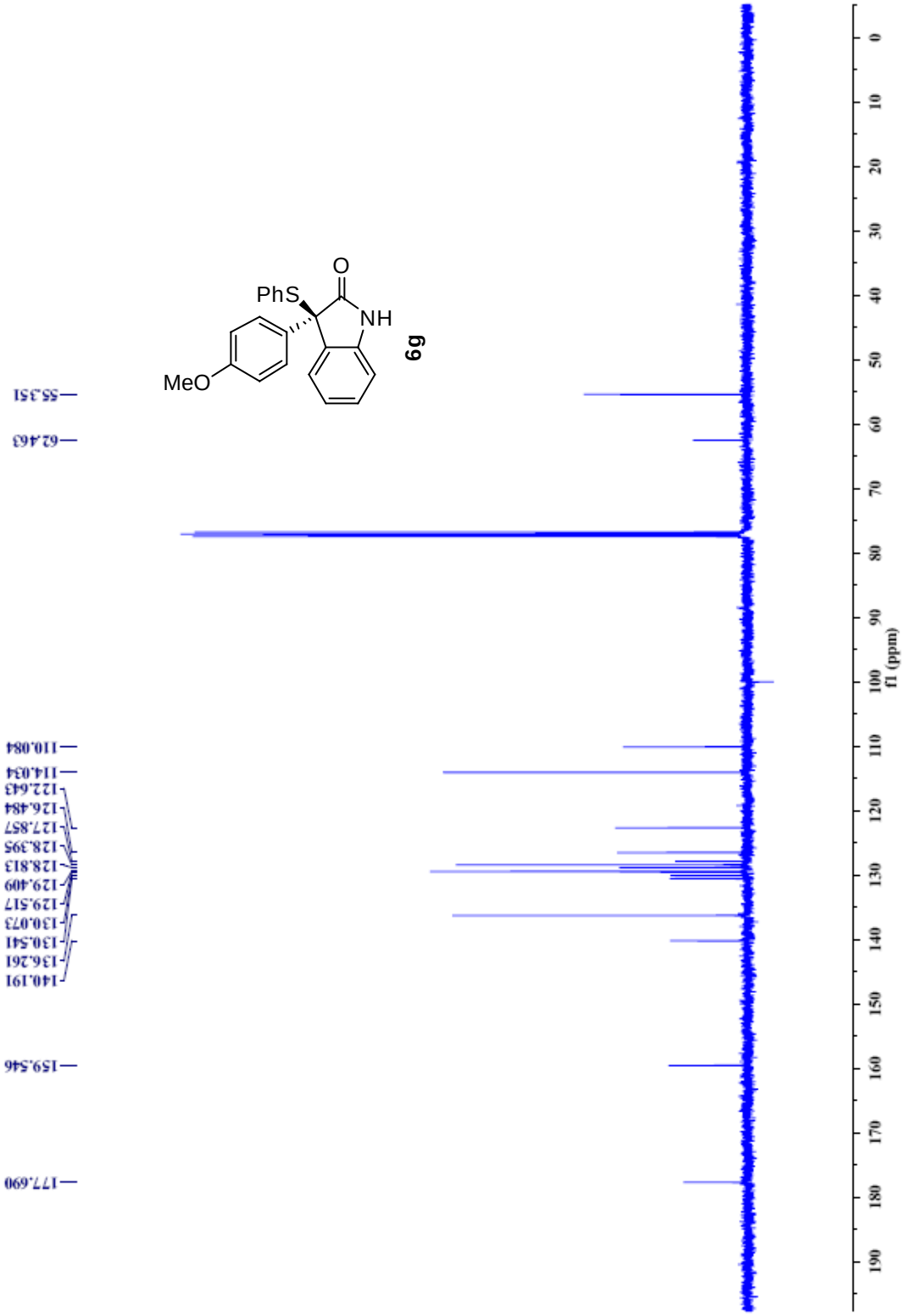
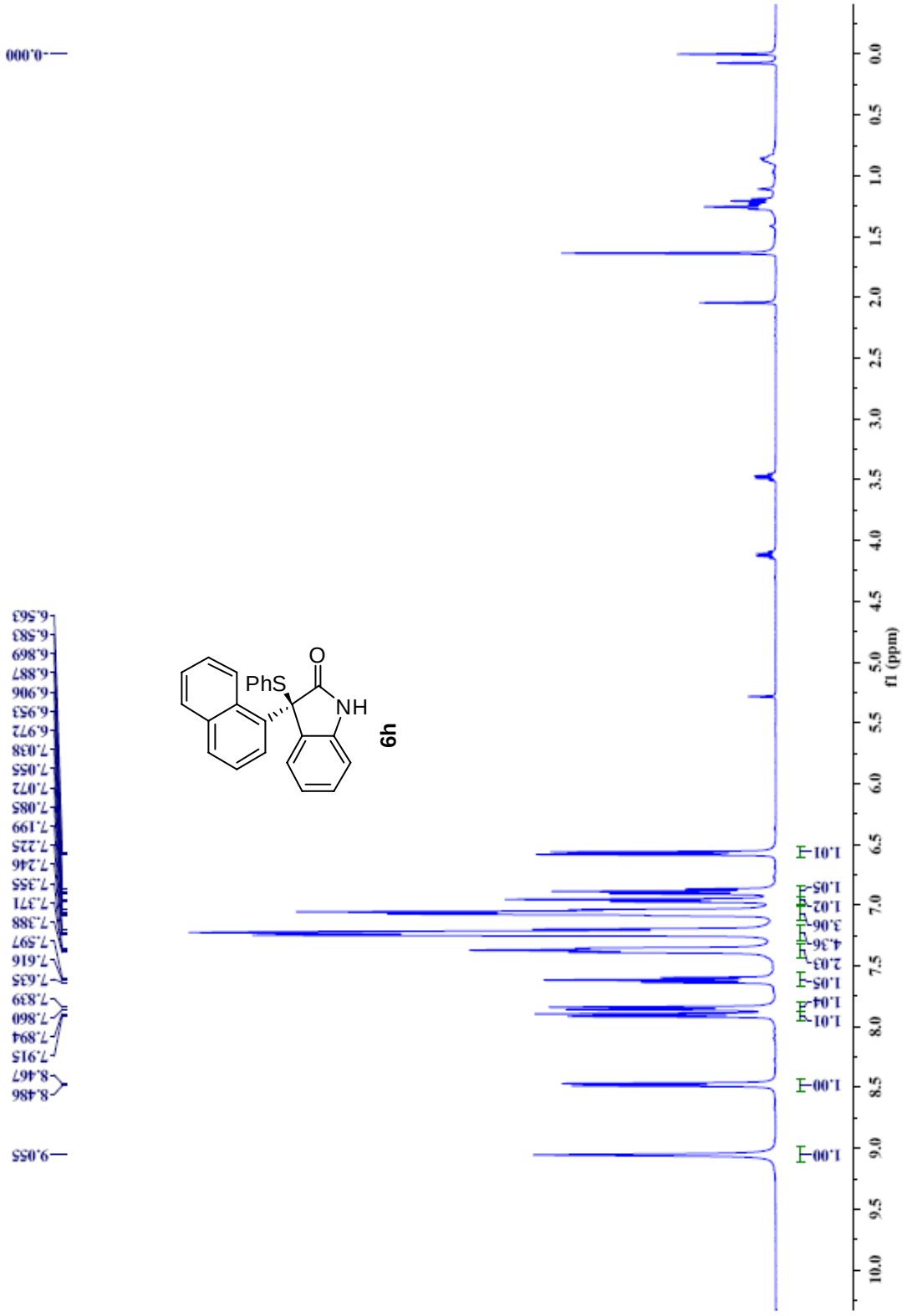
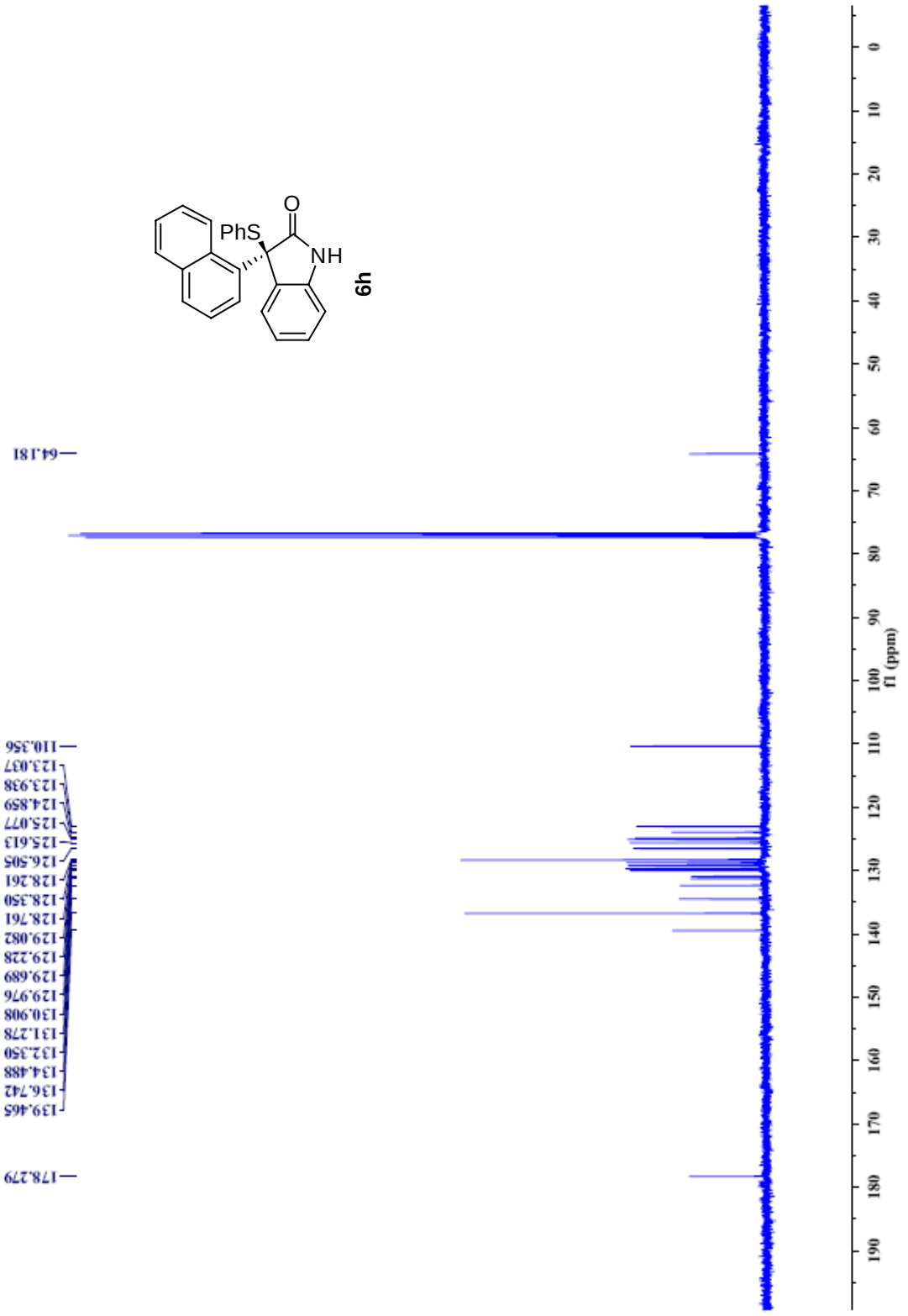
129.642
129.752
129.846
134.473
134.539
136.353
140.098
176.923
f1 (ppm)


PhS
O
NH
MeO
6g
f1 (ppm)


O
PhS
NH
MeO
6g
55.351
62.463
110.084
114.034
122.643
126.484
127.857
128.395
128.813
129.409
129.517
130.073
130.541
136.261
140.191
159.546
177.690
f1 (ppm)


PhS
O
NH
6h
f1 (ppm)


PhS
O
NH
6h
64.181
110.356
123.037
123.938
124.859
125.077
125.613
126.505
128.261
128.350
128.761
129.082
129.228
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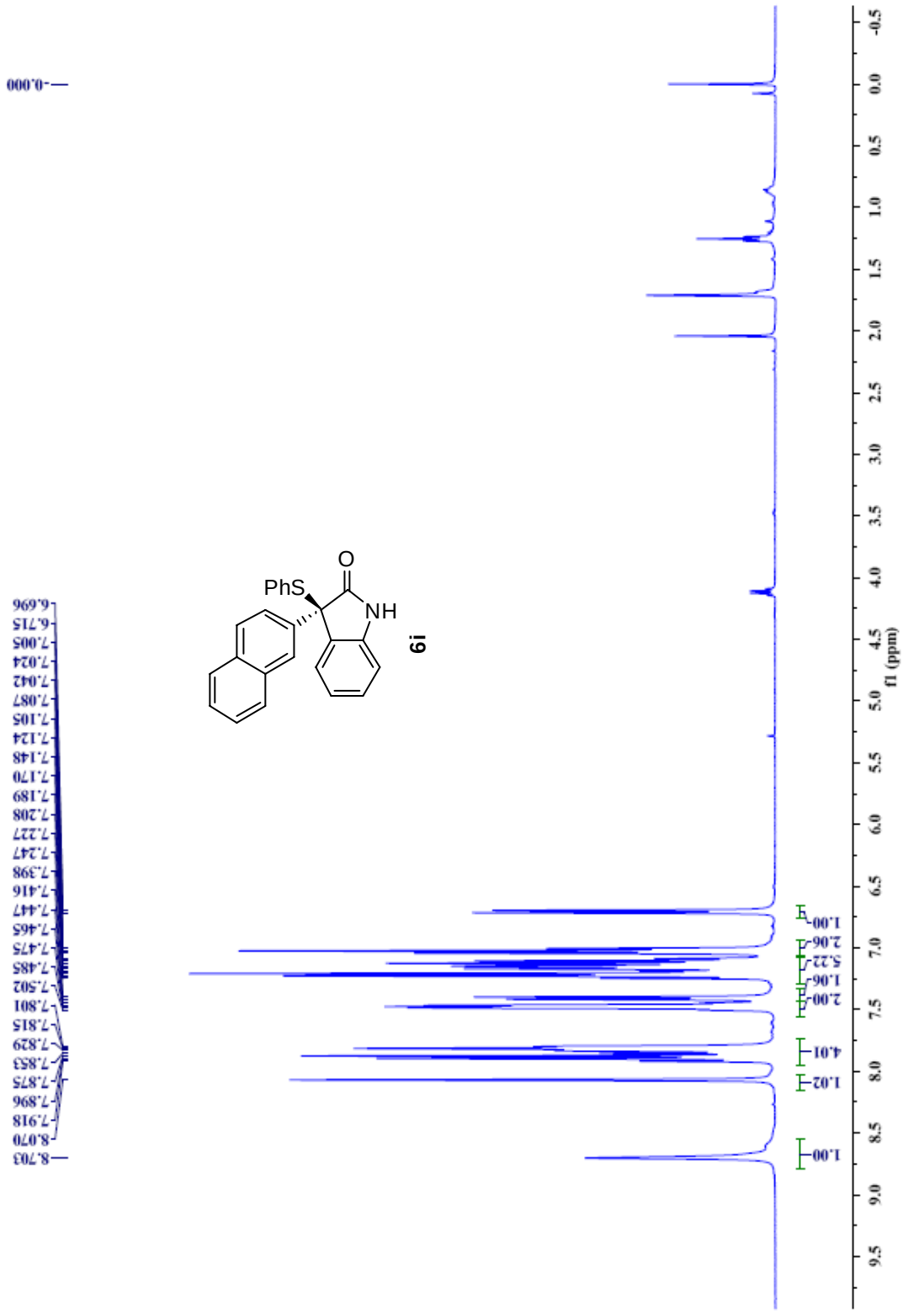
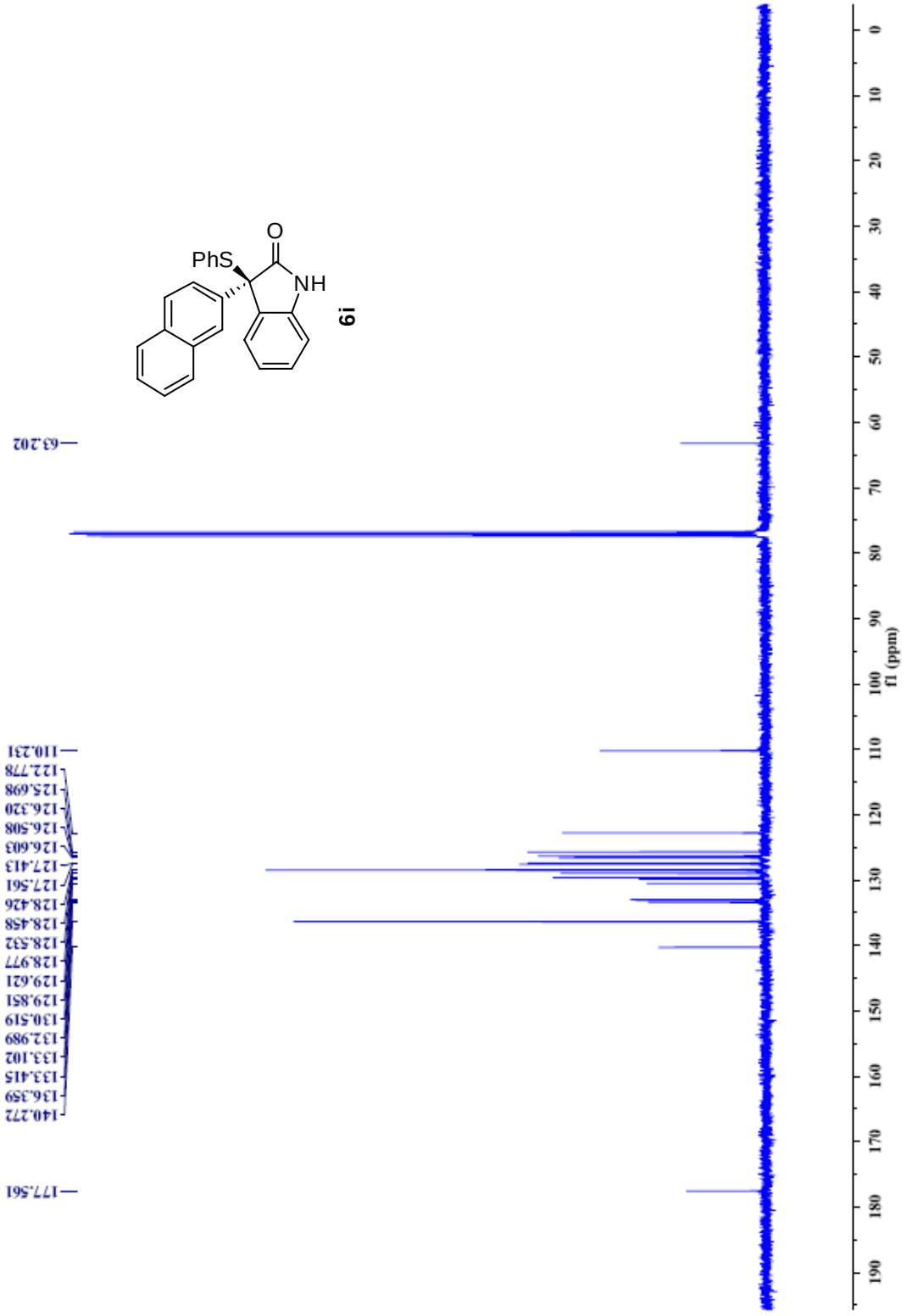
129.976
130.908
131.278
132.350
134.488
136.742
139.465
178.279
f1 (ppm)


PhS
O
NH
6i
f1 (ppm)


PhS
O
NH
6i
63.202
110.231
122.778
125.698
126.320
126.508
126.603
127.413
127.561
128.426
128.458
128.532
128.977
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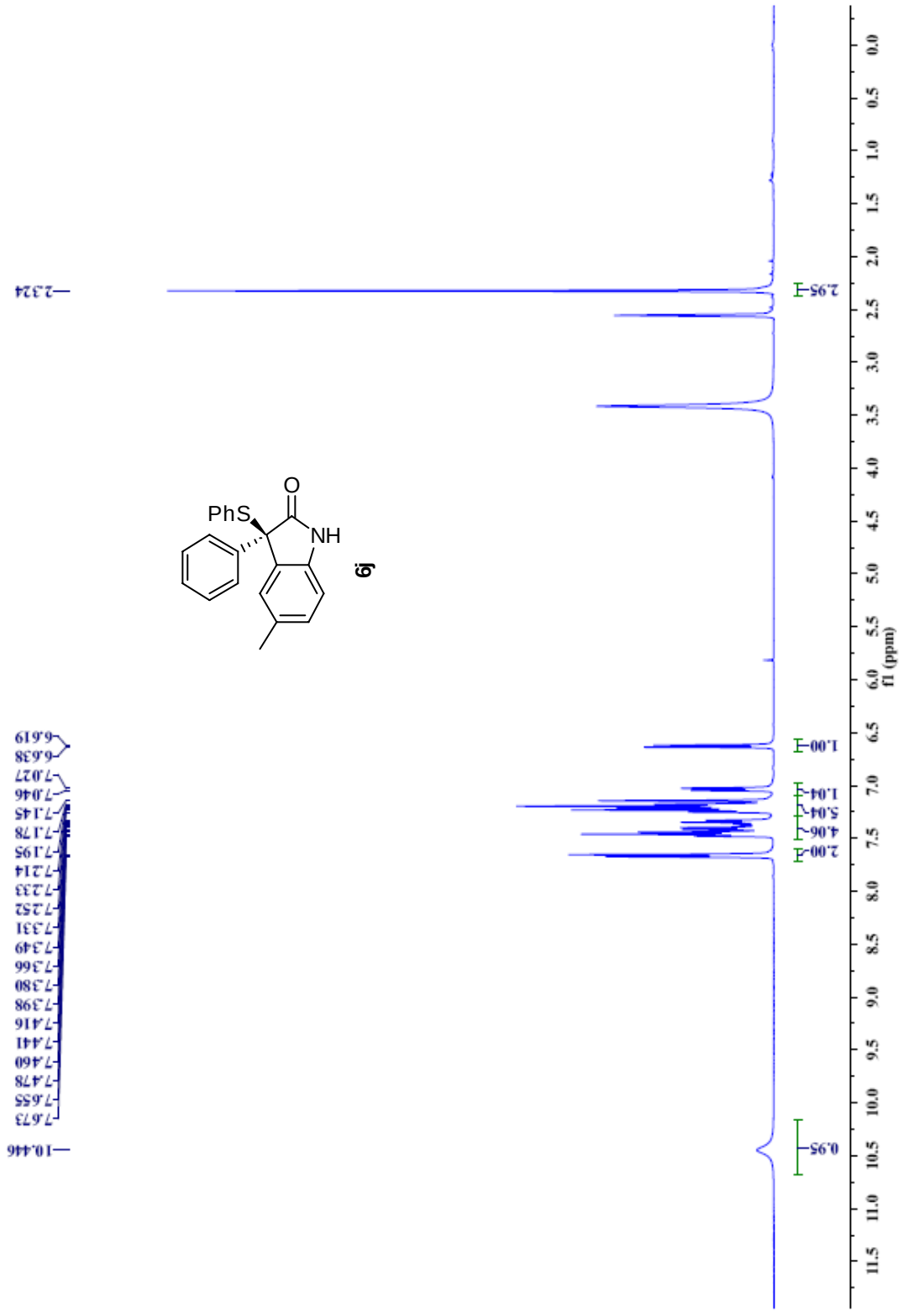
129.851
130.519
132.989
133.102
133.415
136.359
140.272
177.561
f1 (ppm)


PhS
O
NH
6j
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7.673
7.655
7.478
7.460
7.441
7.416
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7.380
7.366
7.349
7.331
7.252
7.233
7.214
7.195
7.178
7.145
7.046
7.027
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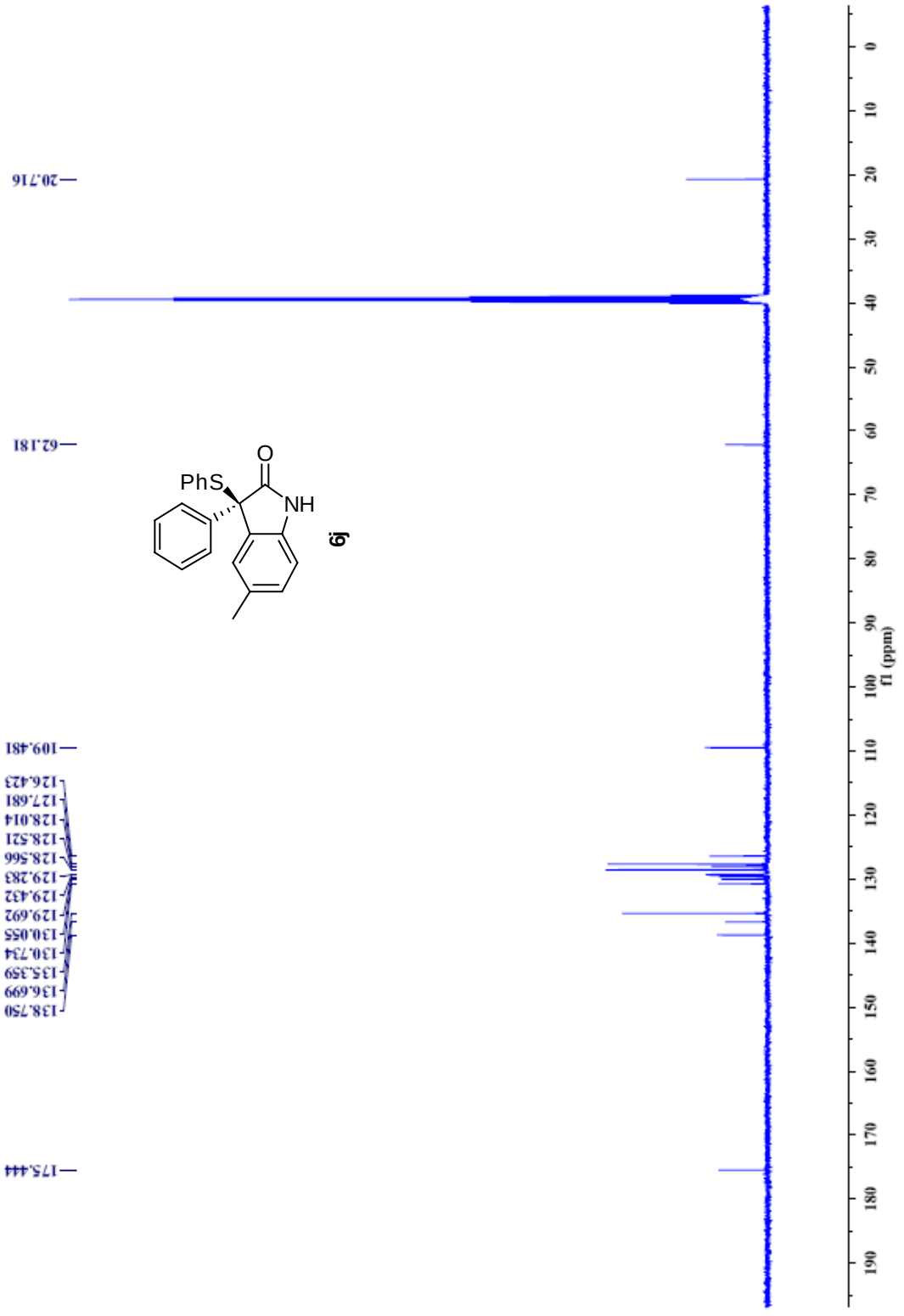
6.619
2.95
1.00
1.04
5.04
4.06
2.00
0.95
f1 (ppm)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126.423
127.681
128.014
128.521
128.566
129.283
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130.734
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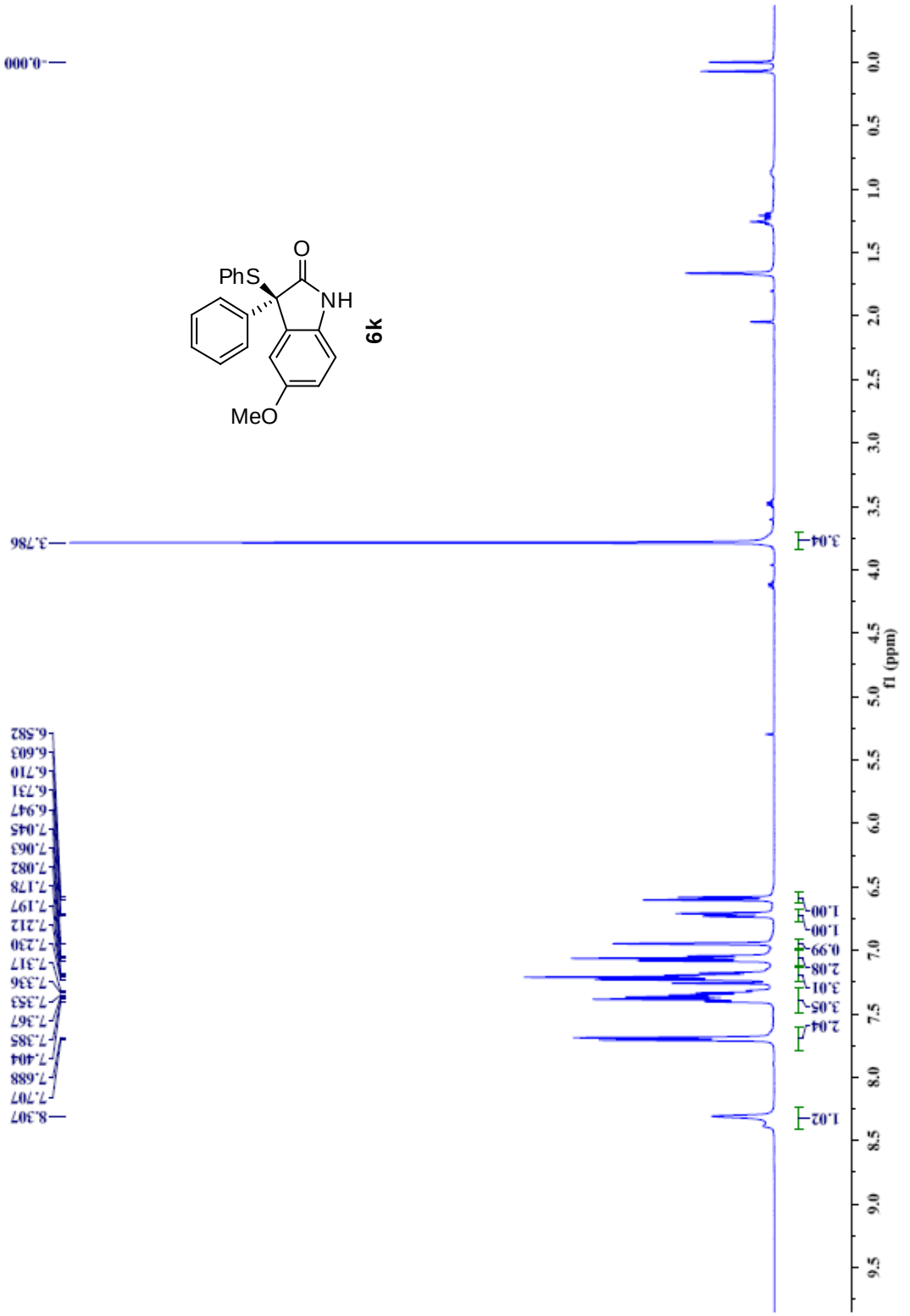
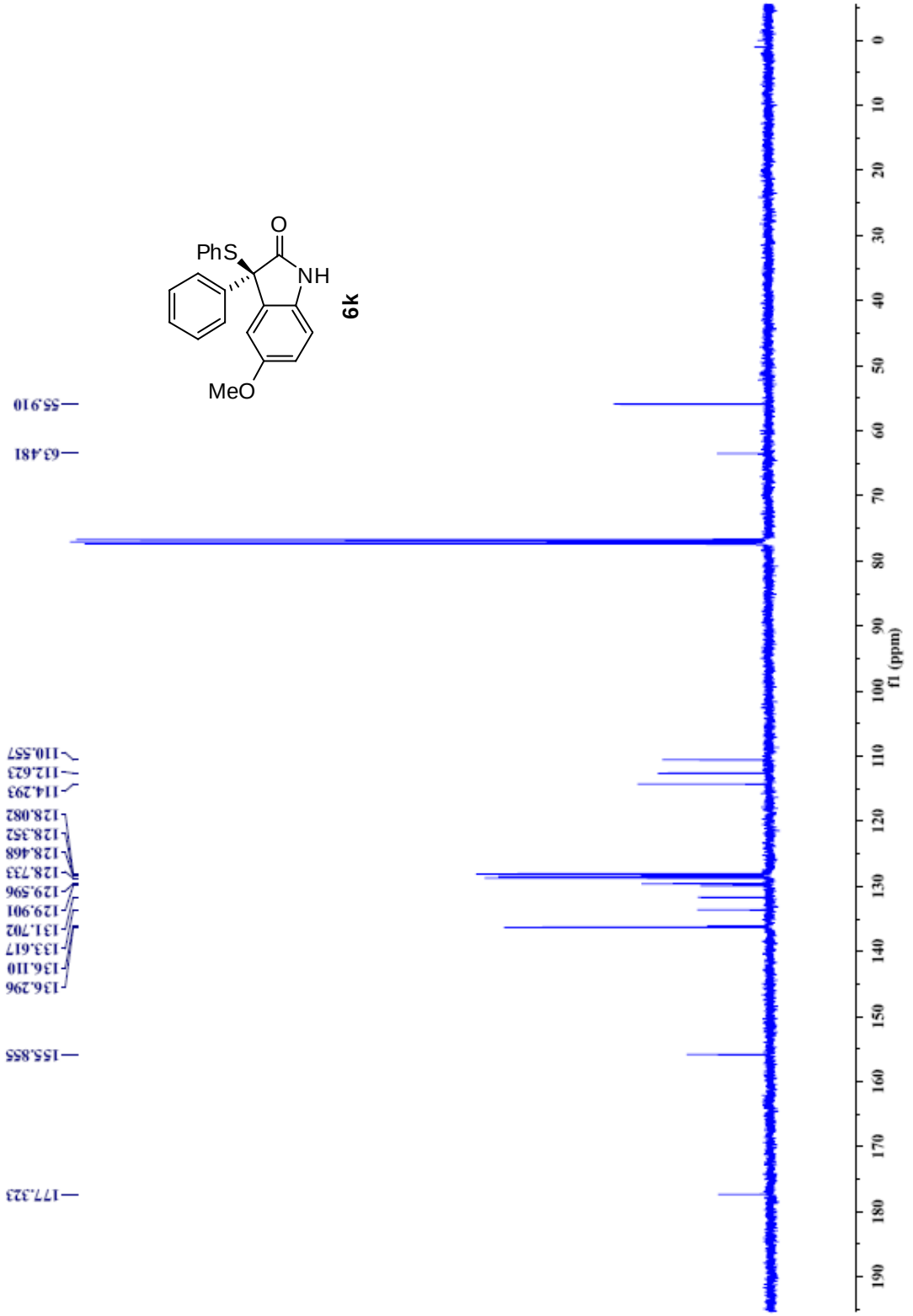
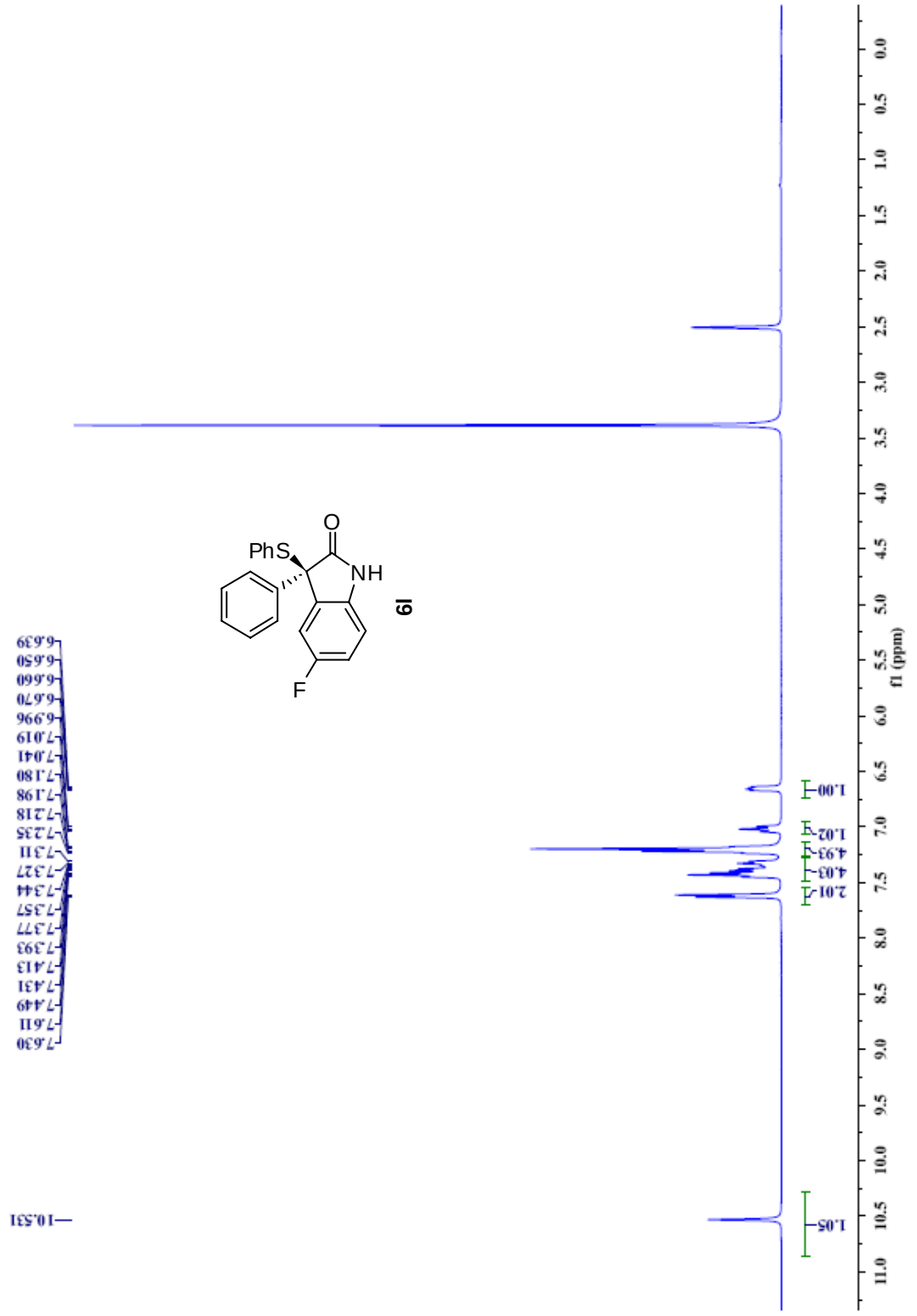
136.699
138.750
175.444
PhS
O
NH
6j
f1 (ppm)


PhS
O
NH
MeO
6k
f1 (ppm)


PhS
O
NH
MeO
6k
55.910
63.481
110.557
112.623
114.293
128.082
128.352
128.468
128.733
129.596
129.901
131.702
133.617
136.110
136.296
155.855
177.323
f1 (ppm)


PhS
O
NH
F
6l
10.531
7.630
7.611
7.449
7.431
7.413
7.393
7.377
7.357
7.344
7.327
7.311
7.235
7.218
7.198
7.180
7.041
7.019
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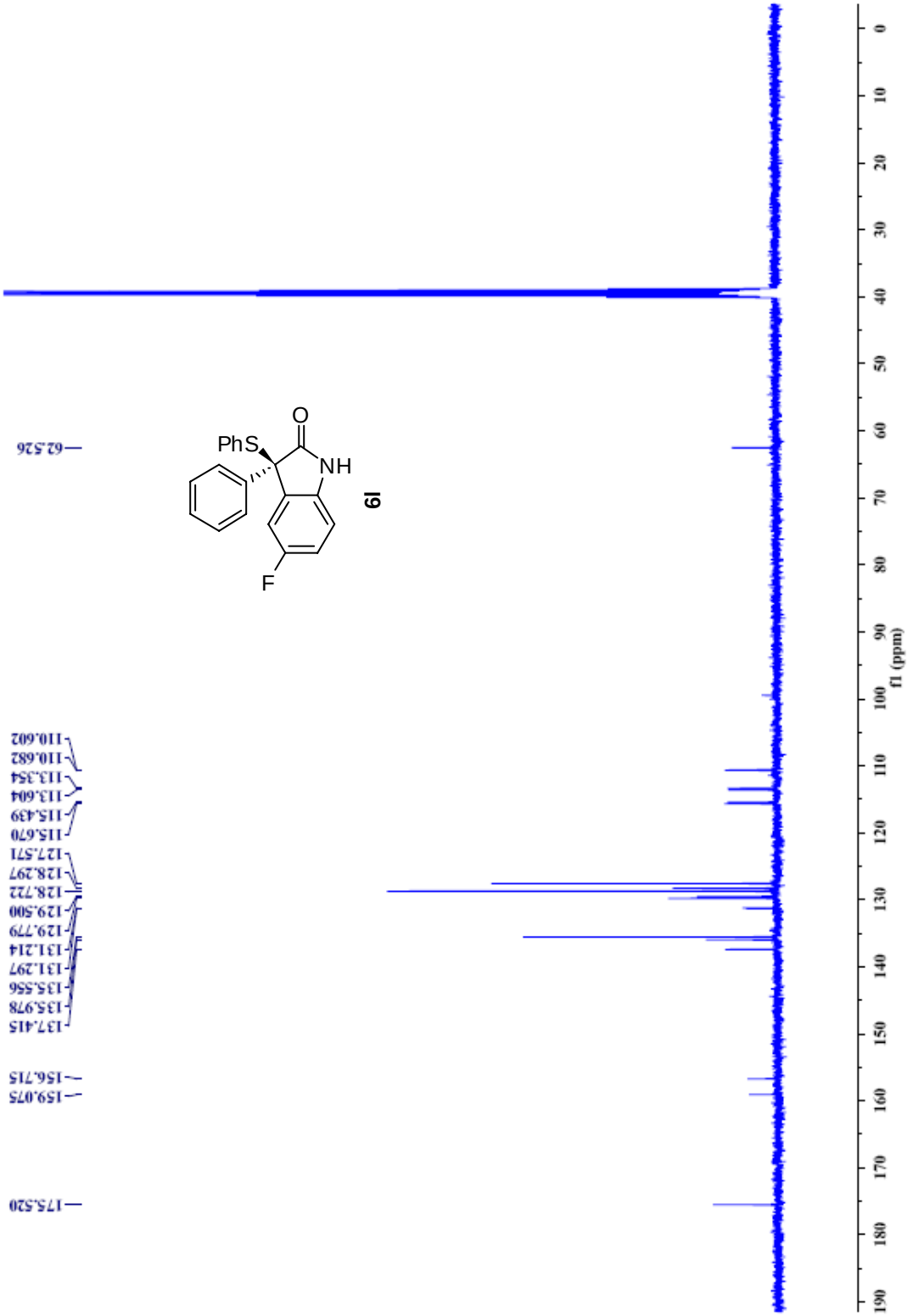
6.639
1.05
2.01
4.03
4.93
1.02
1.00
f1 (ppm)


62.526
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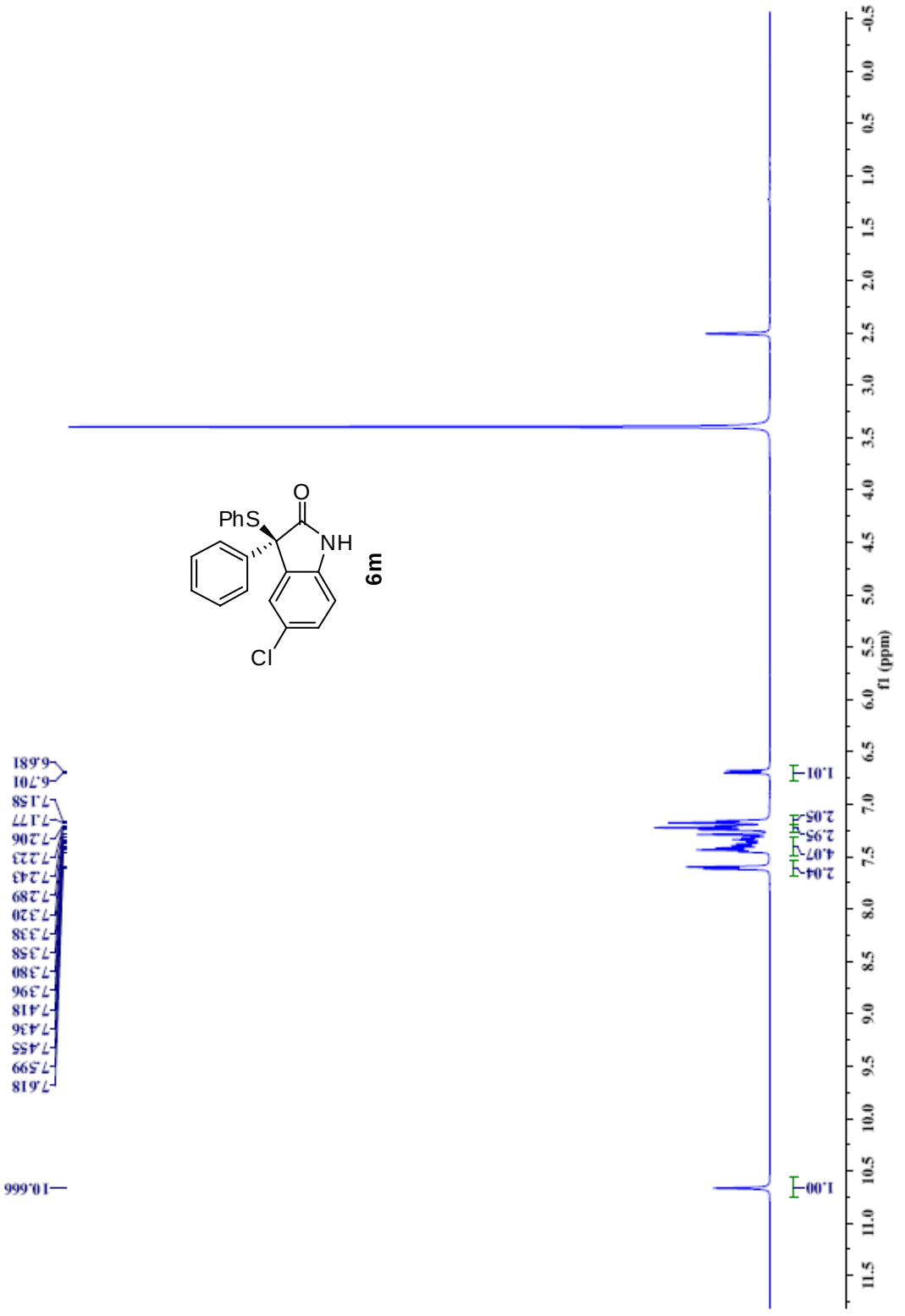
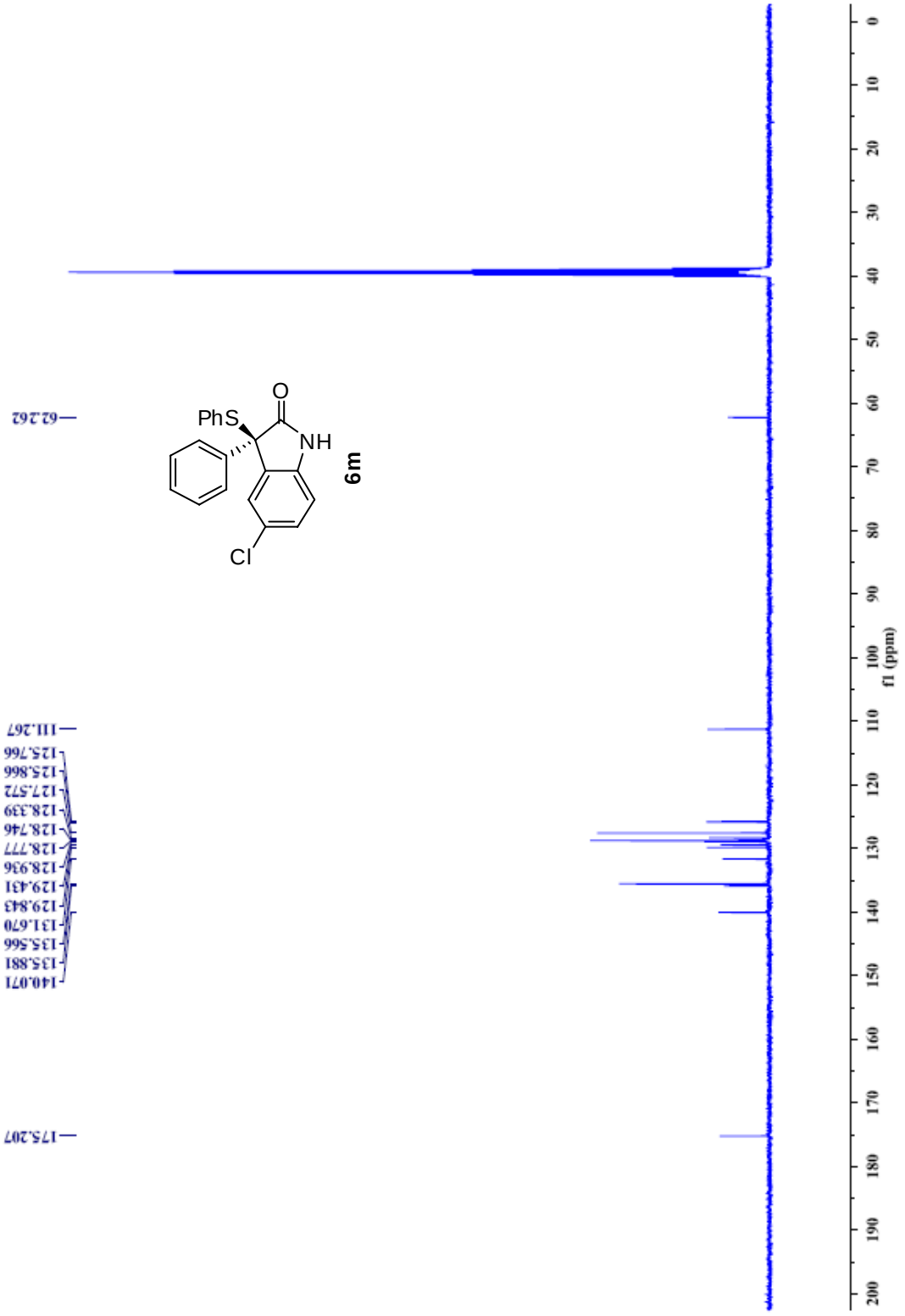
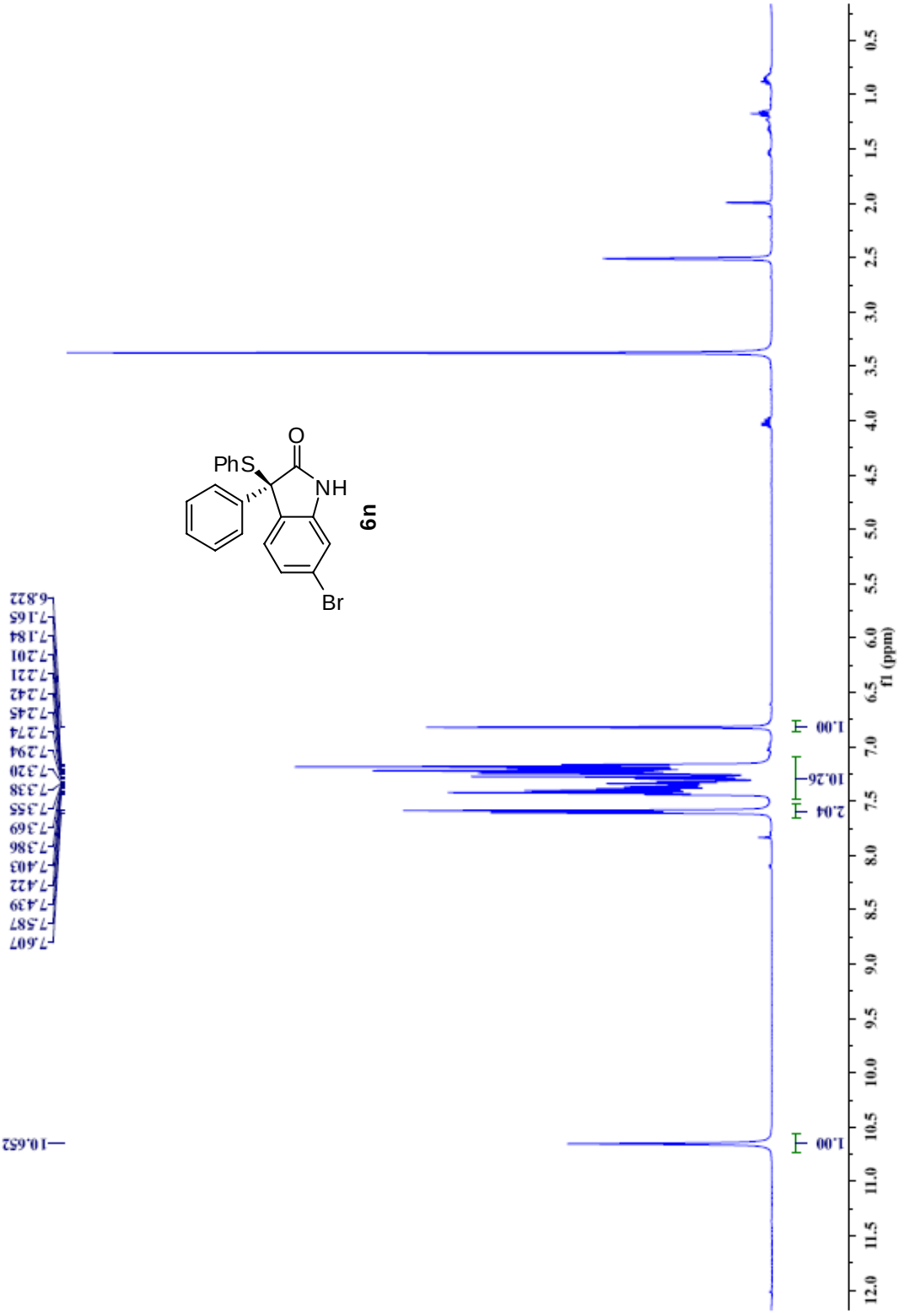
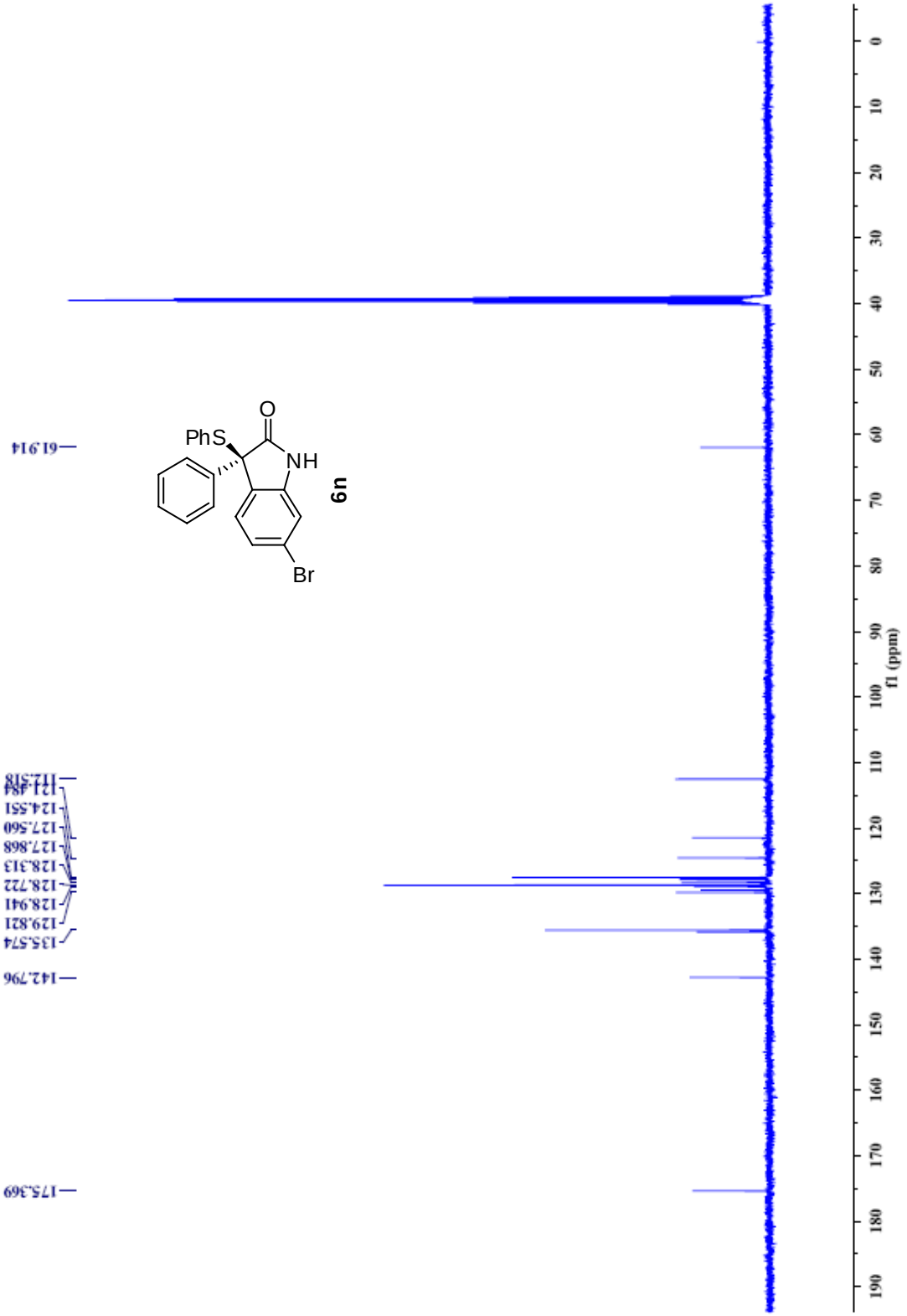
110.682
113.354
113.604
115.439
115.670
127.571
128.297
128.722
129.500
129.779
131.214
131.297
135.556
135.978
137.415
156.715
159.075
175.520
PhS
O
NH
F
6l
f1 (ppm)


PhS
O
NH
Cl
6m
f1 (ppm)


62.262
111.267
125.766
125.866
127.572
128.339
128.746
128.777
128.936
129.431
129.843
131.670
135.566
135.881
140.071
175.207
PhS
O
NH
Cl
6m
f1 (ppm)

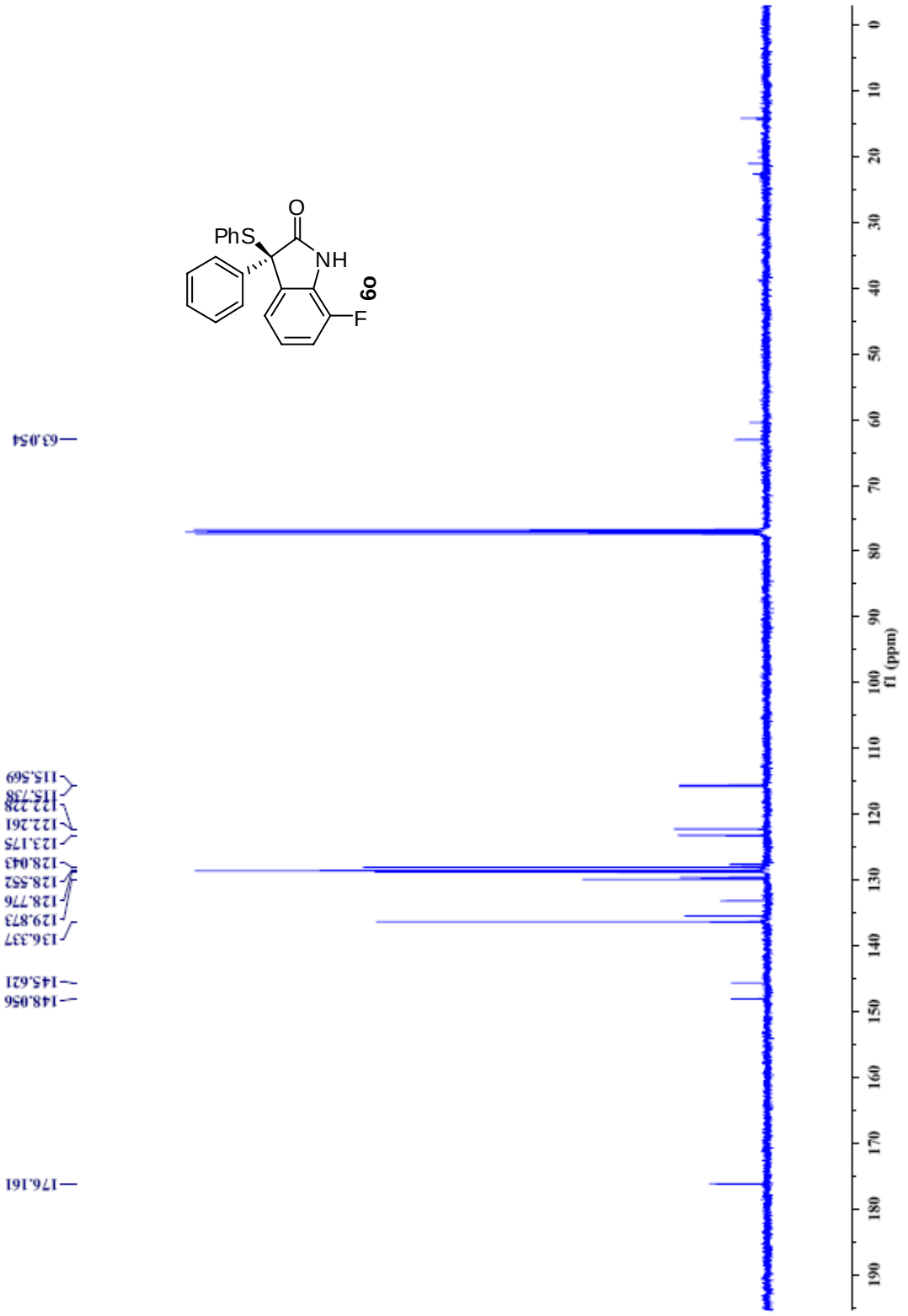

PhS
O
NH
Br
6n
f1 (ppm)
1.00
10.26
2.04
1.00
6.822
7.165
7.184
7.201
7.221
7.242
7.245
7.274
7.294
7.320
7.338
7.355
7.369
7.386
7.403
7.422
7.439
7.587
7.607
10.652


PhS
O
NH
Br
6n
61.914
112.518
121.484
124.551
127.560
127.868
128.313
128.722
128.941
129.821
135.574
142.796
175.369
f1 (ppm)

O
PhS
NH
F
6o

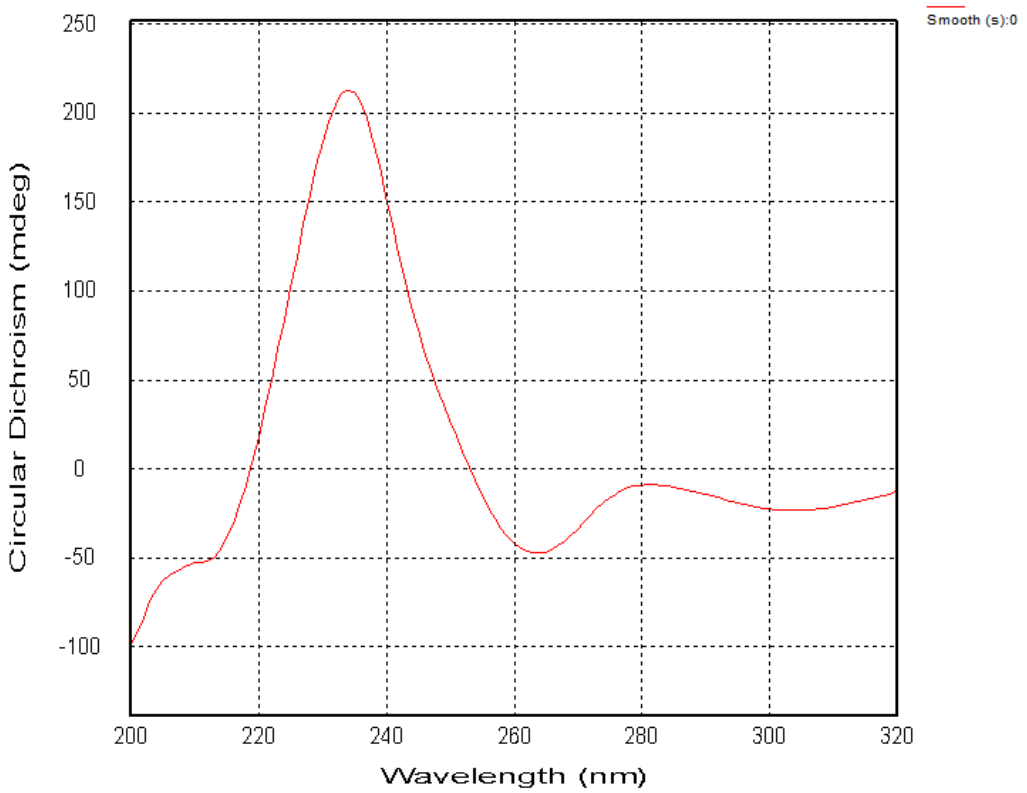
6.927
6.949
6.971
6.973
7.040
7.053
7.062
7.072
7.082
7.092
7.101
7.198
7.206
7.217
7.226
7.236
7.238
7.318
7.321
7.337
7.343
7.354
7.358
7.365
7.384
7.397
7.401
7.405
7.693
7.710
7.714
7.933

1.00
2.03
3.09
4.27
3.08
1.06
f1 (ppm)

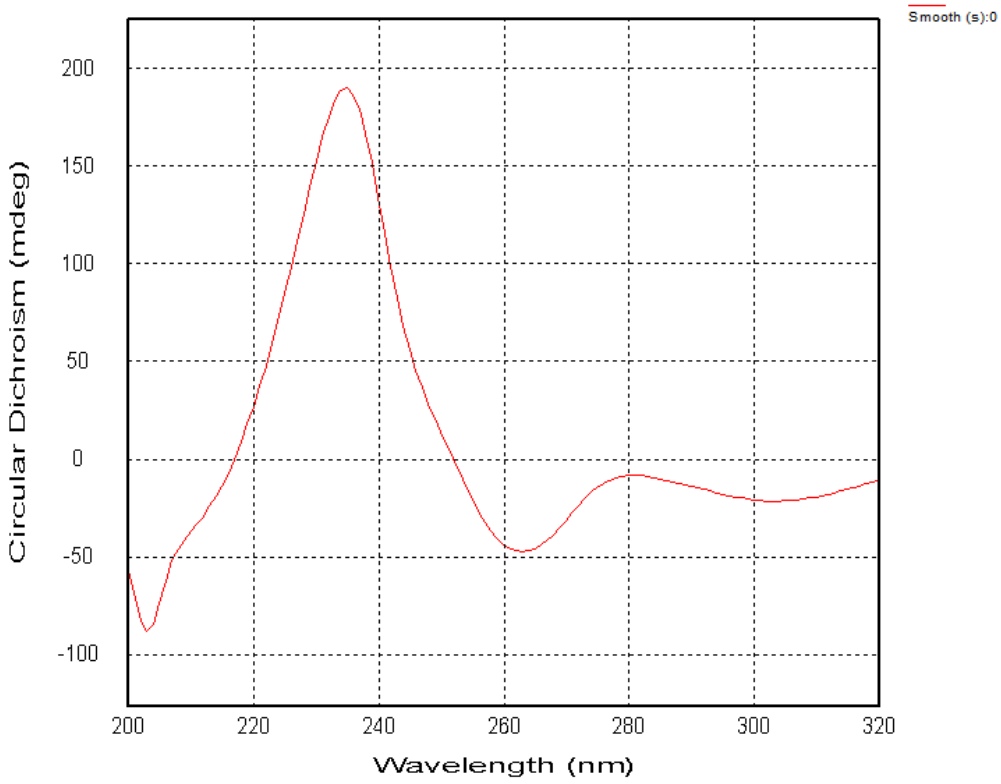

O
PhS
NH
F
09
63.054
115.569
115.738
122.328
122.261
123.175
128.043
128.552
128.776
129.873
136.337
145.621
148.056
176.161
f1 (ppm)

12. Copy of CD spectra in methanol

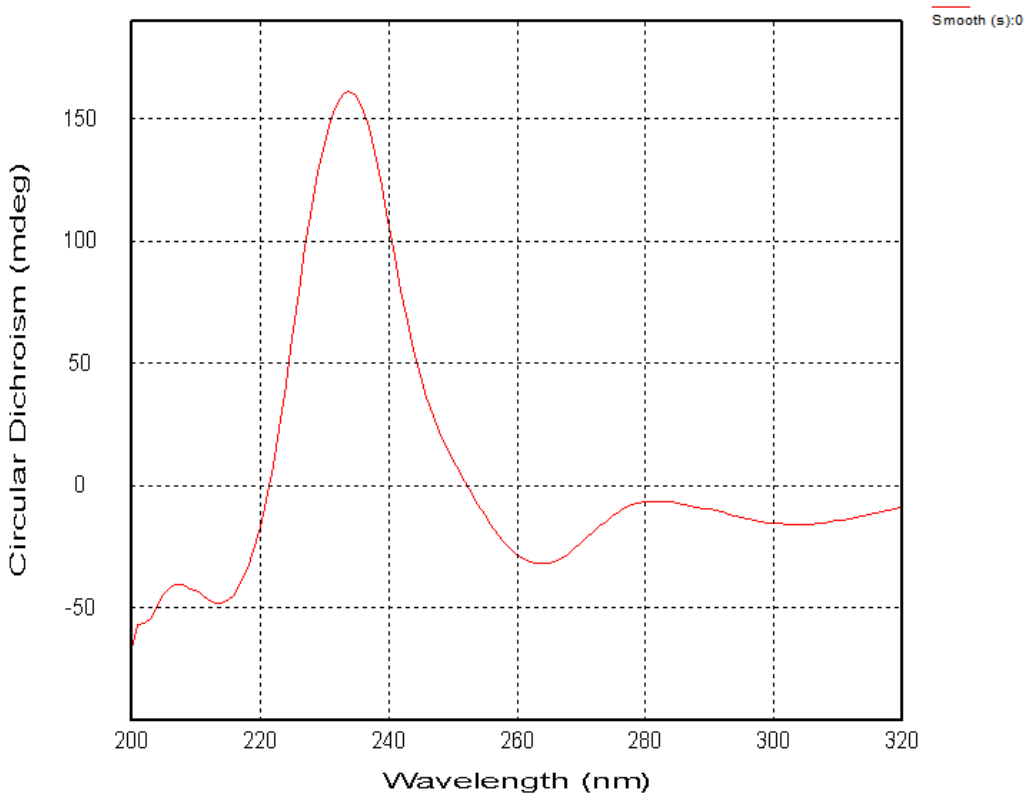
***R*-3p (Standard)**



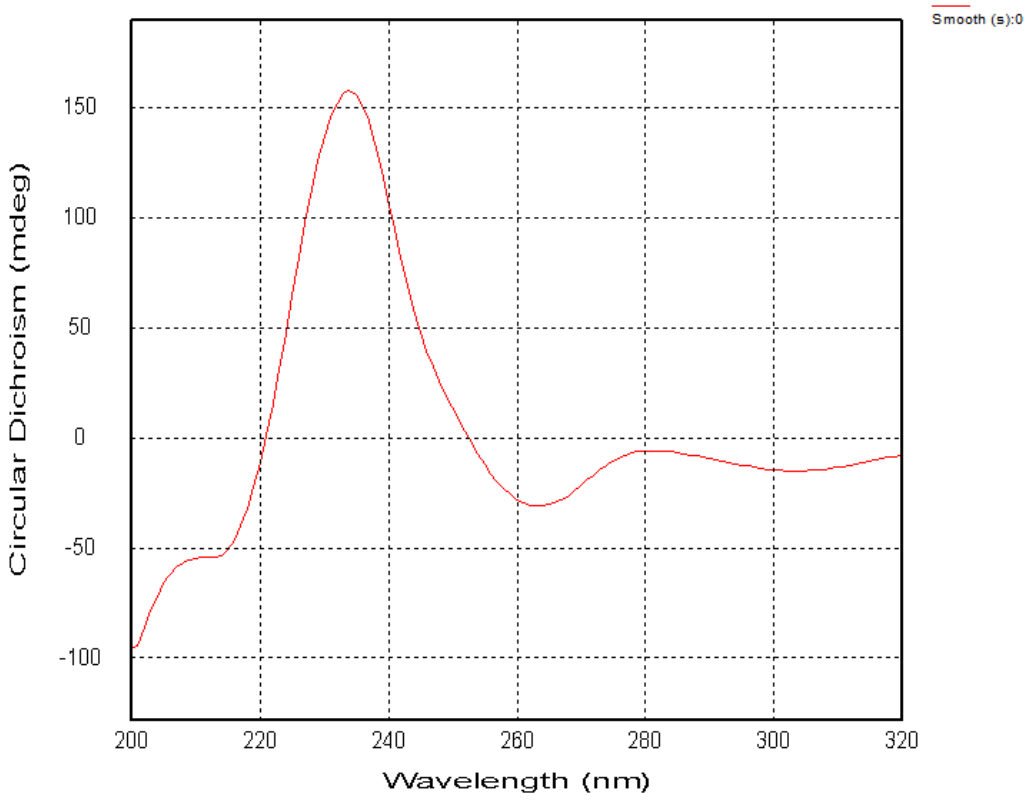
3a



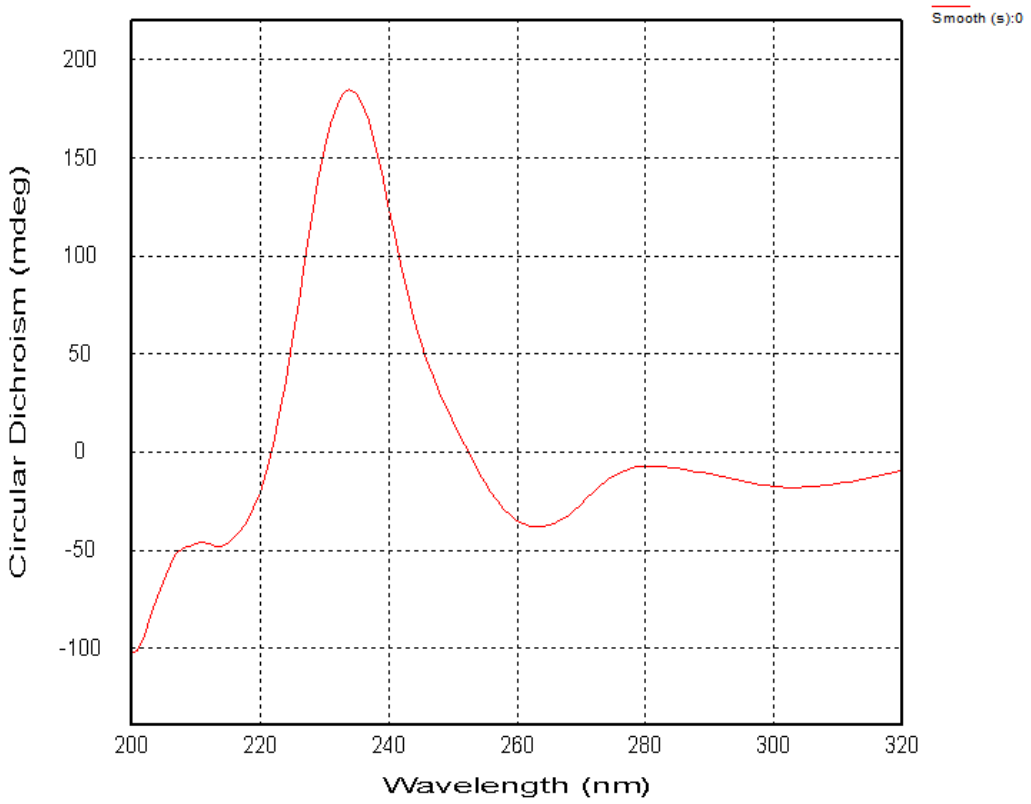
3b


Smooth (s):0
Circular Dichroism (mdeg)
150
100
50
0
-50
200
220
240
260
280
300
320
Wavelength (nm)

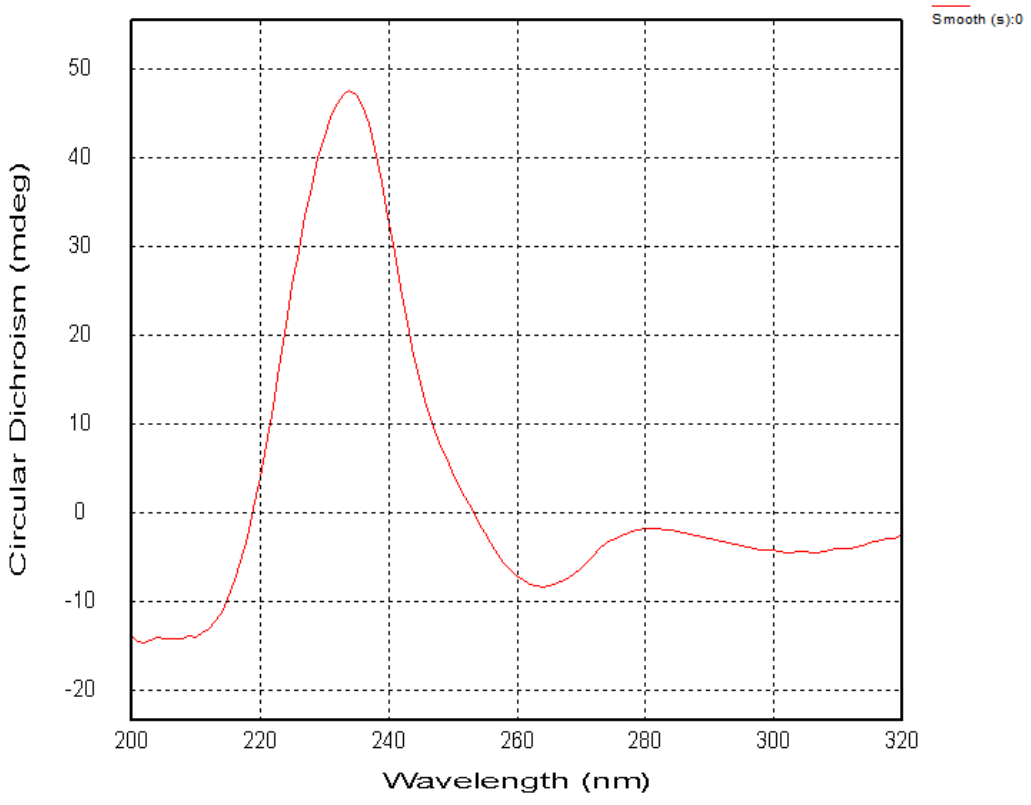
3c


Smooth (s):0
Circular Dichroism (mdeg)
150
100
50
0
-50
-100
200
220
240
260
280
300
320
Wavelength (nm)

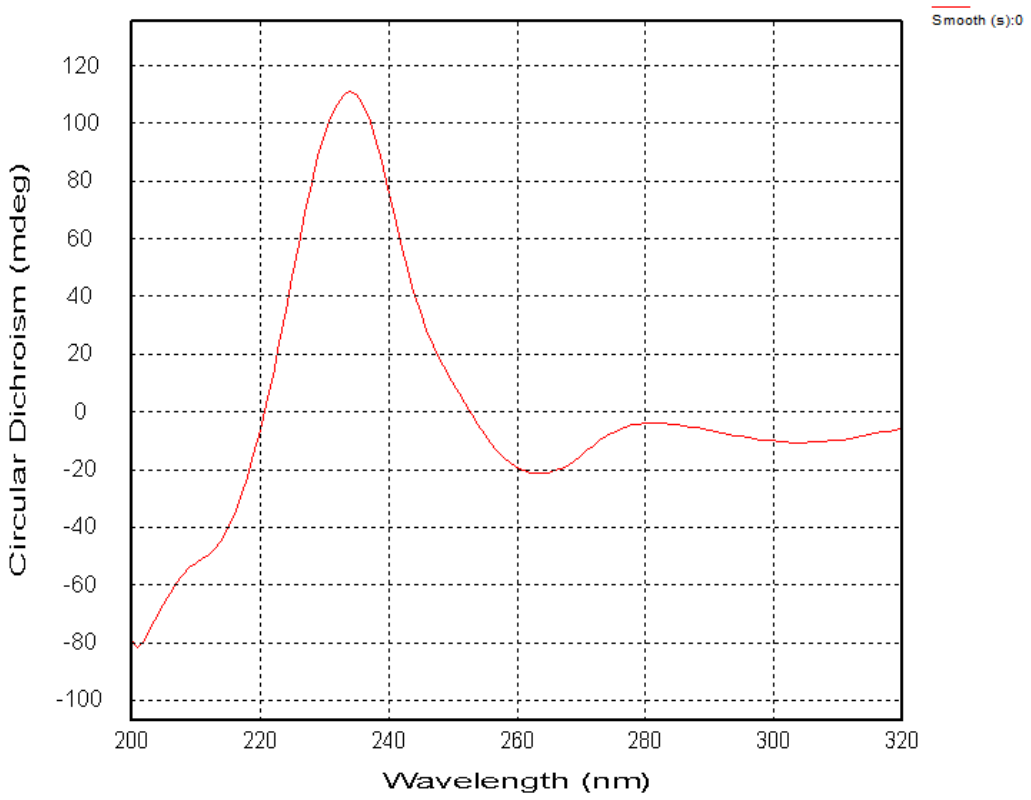
3d


Smooth (s):0
Circular Dichroism (mdeg)
200
150
100
50
0
-50
-100
200
220
240
260
280
300
320
Wavelength (nm)

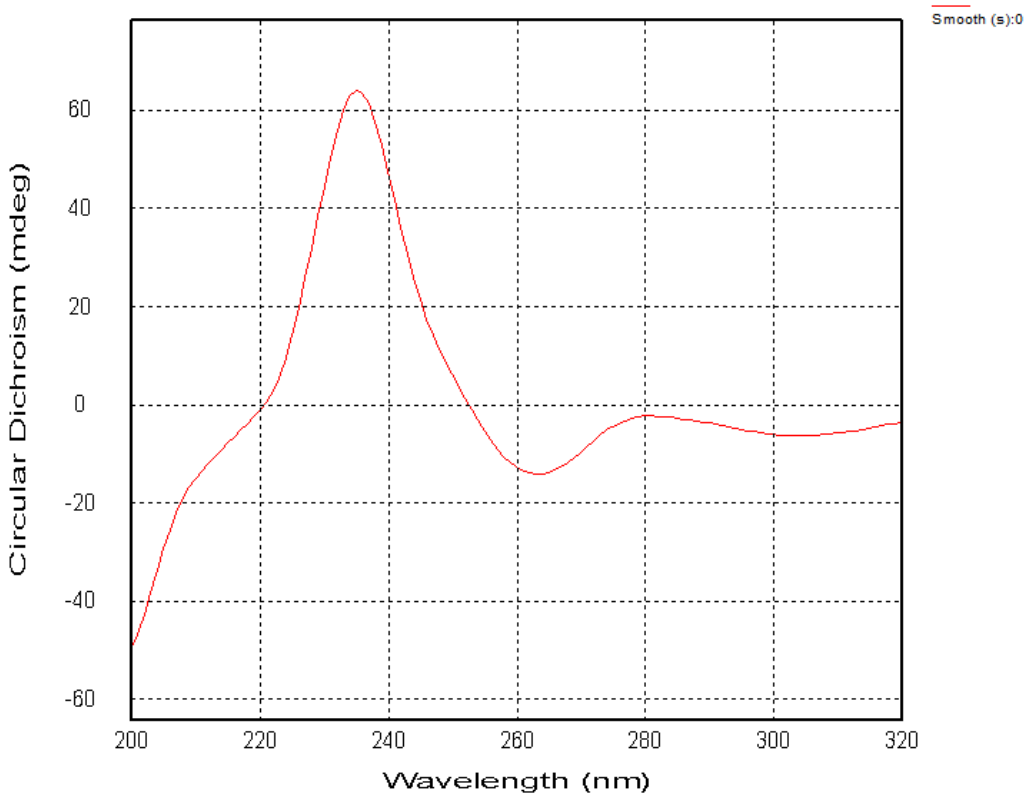
3e


Smooth (s):0
Circular Dichroism (mdeg)
50
40
30
20
10
0
-10
-20
200
220
240
260
280
300
320
Wavelength (nm)

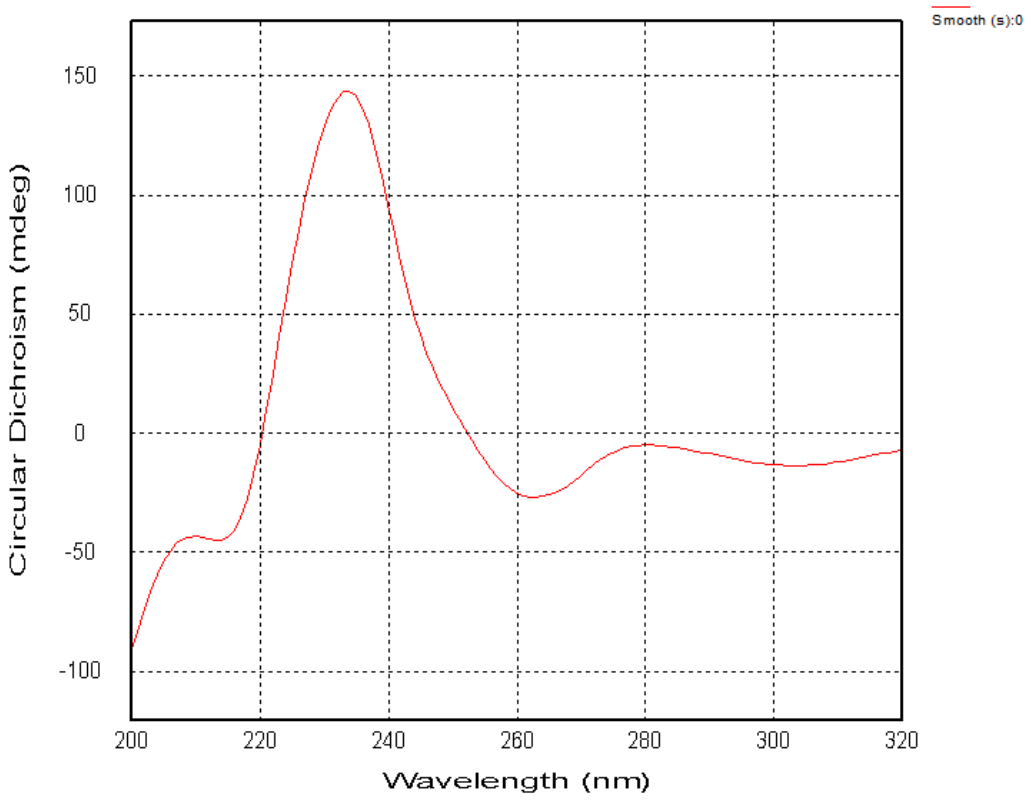
3f


Smooth (s):0
Circular Dichroism (mdeg)
120
100
80
60
40
20
0
-20
-40
-60
-80
-100
200
220
240
260
280
300
320
Wavelength (nm)

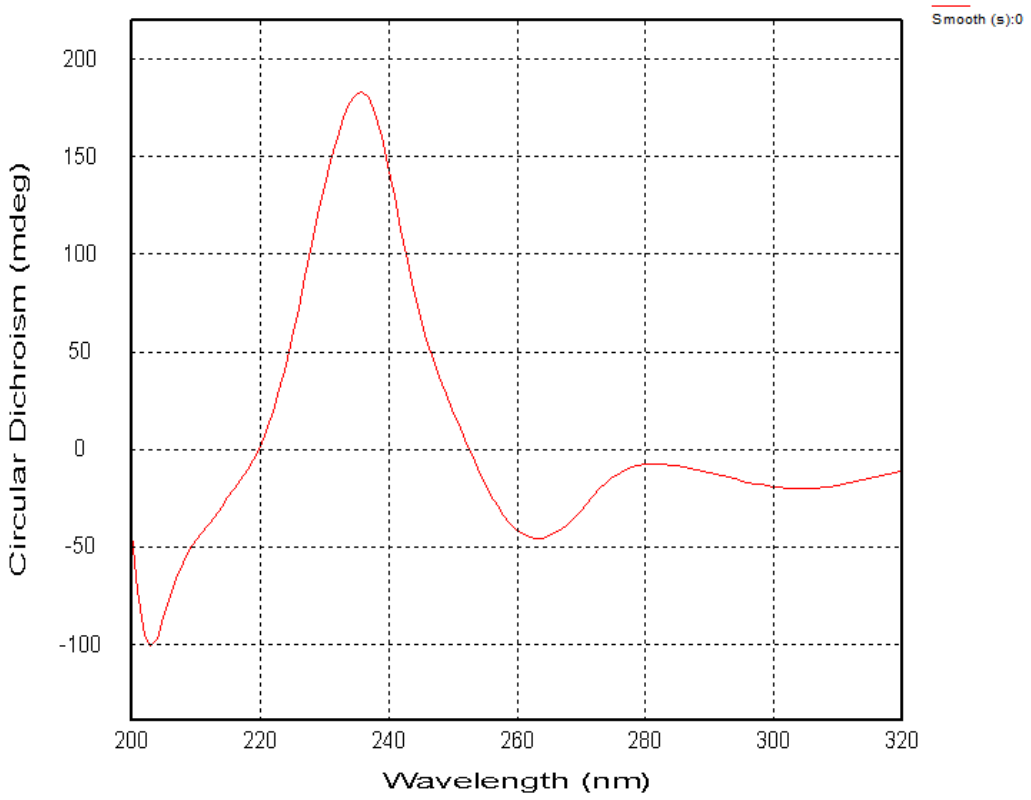
3g


Smooth (s):0
Circular Dichroism (mdeg)
60
40
20
0
-20
-40
-60
200
220
240
260
280
300
320
Wavelength (nm)

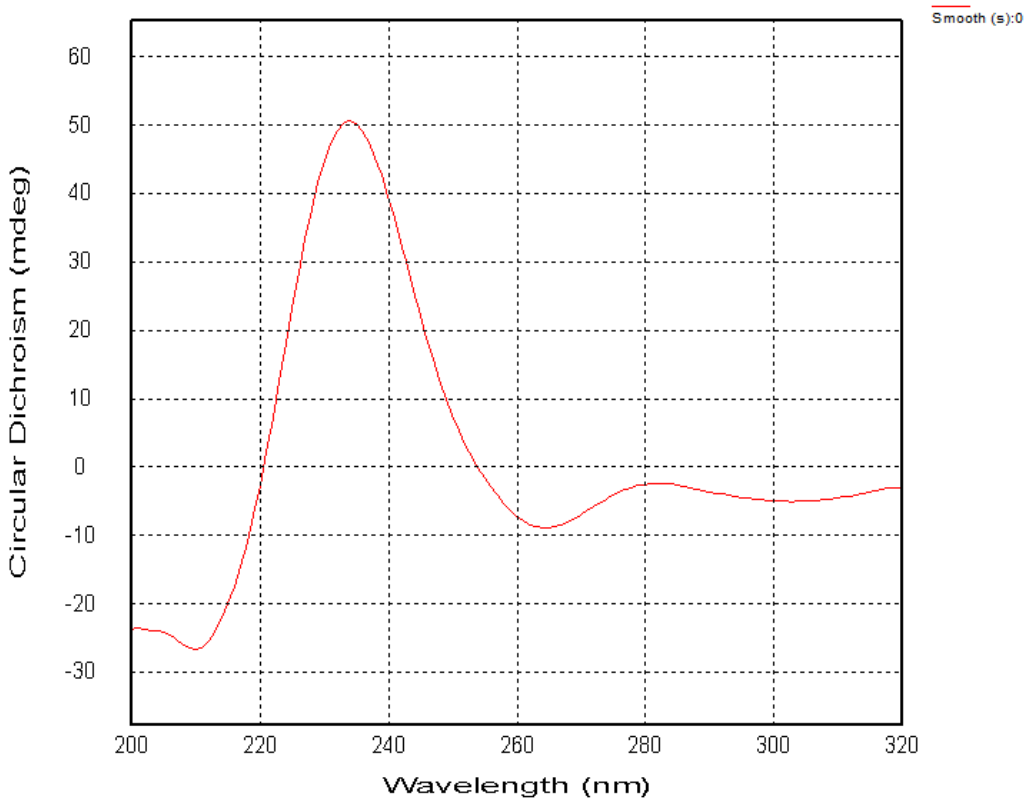
3h


Smooth (s):0
Circular Dichroism (mdeg)
150
100
50
0
-50
-100
200
220
240
260
280
300
320
Wavelength (nm)

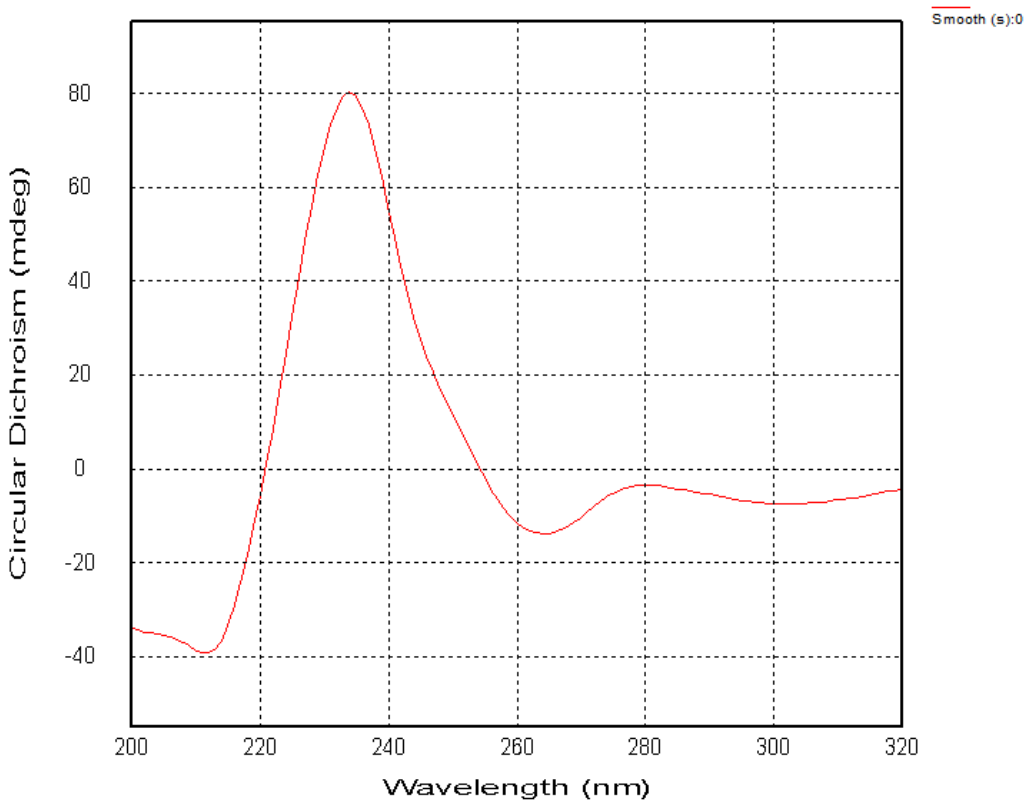
3i


Smooth (s):0
Circular Dichroism (mdeg)
200
150
100
50
0
-50
-100
200
220
240
260
280
300
320
Wavelength (nm)

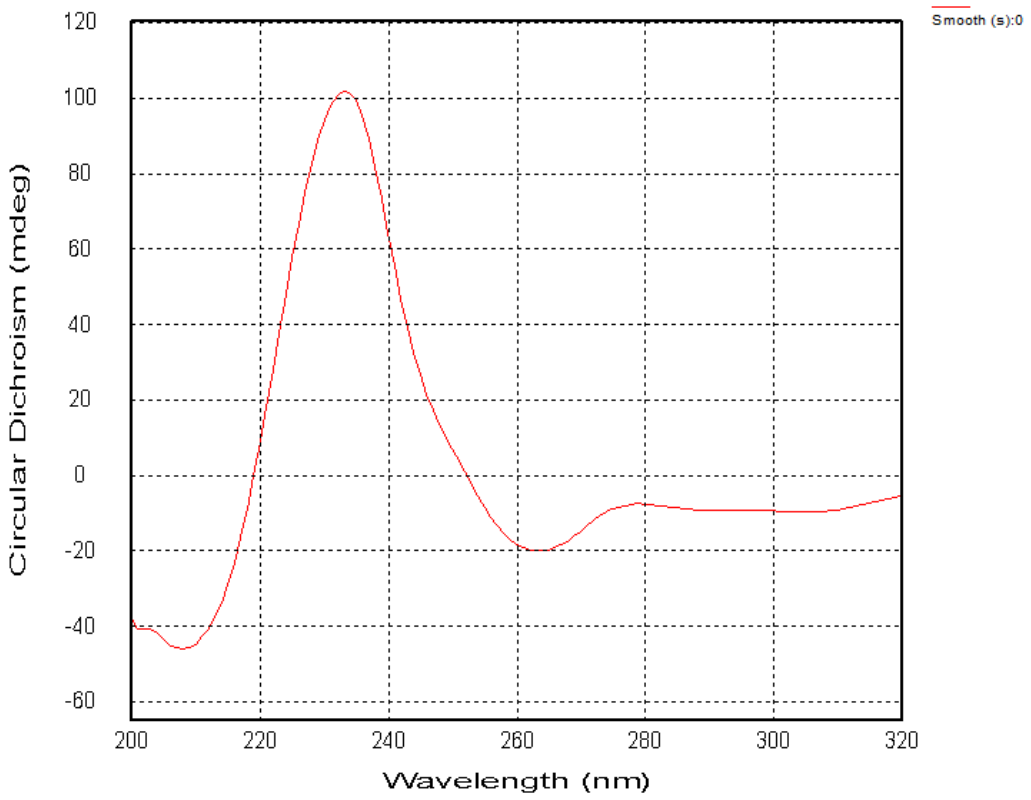
3j


Smooth (s):0
Circular Dichroism (mdeg)
60
50
40
30
20
10
0
-10
-20
-30
200
220
240
260
280
300
320
Wavelength (nm)

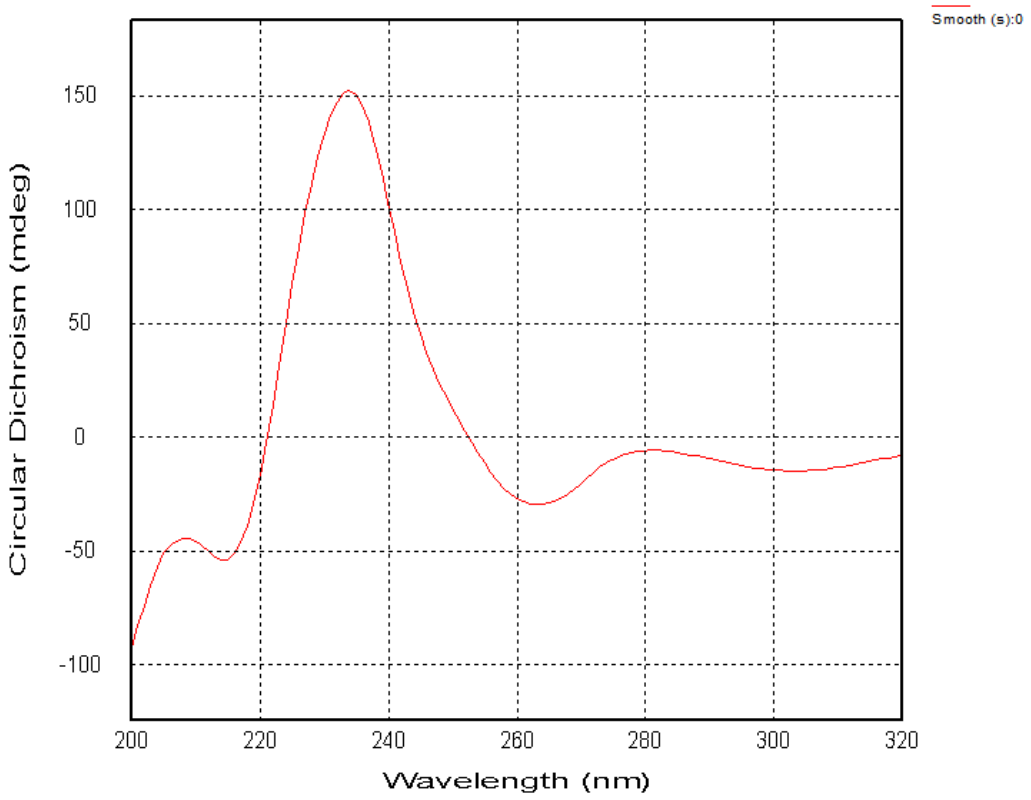
3k


Smooth (s):0
Circular Dichroism (mdeg)
80
60
40
20
0
-20
-40
200
220
240
260
280
300
320
Wavelength (nm)

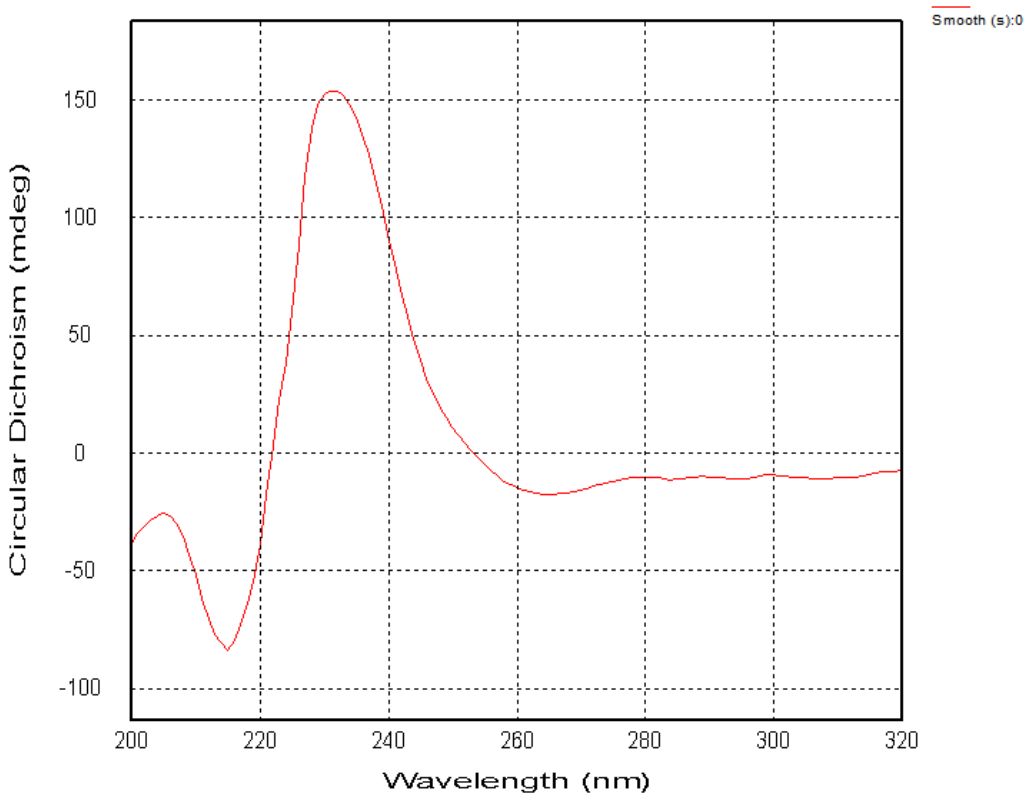
3l


Smooth (s):0
Circular Dichroism (mdeg)
120
100
80
60
40
20
0
-20
-40
-60
200
220
240
260
280
300
320
Wavelength (nm)

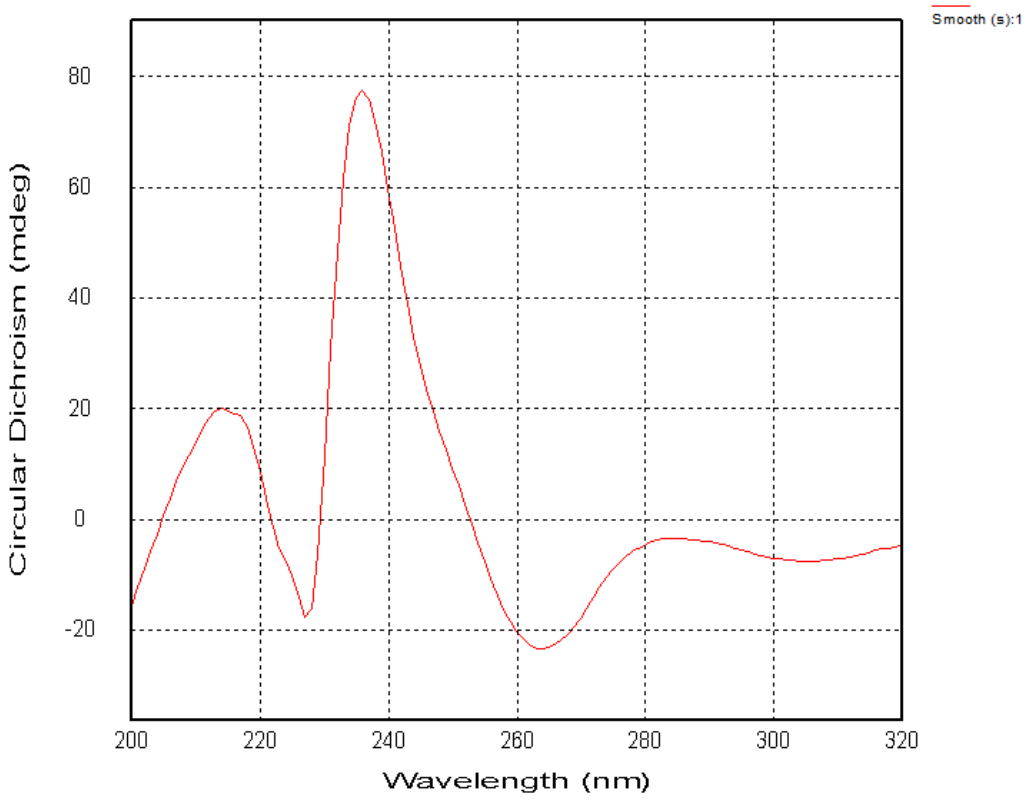
3m


Smooth (s):0
Circular Dichroism (mdeg)
150
100
50
0
-50
-100
200
220
240
260
280
300
320
Wavelength (nm)

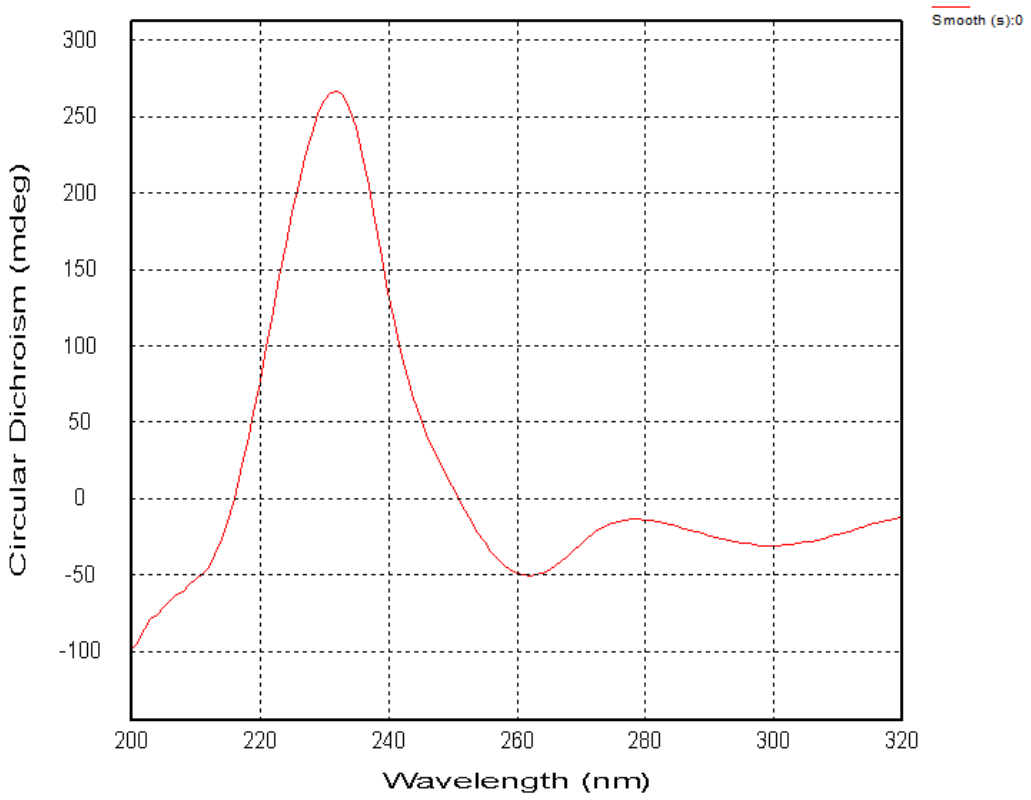
3n


Smooth (s):0
Circular Dichroism (mdeg)
150
100
50
0
-50
-100
200
220
240
260
280
300
320
Wavelength (nm)

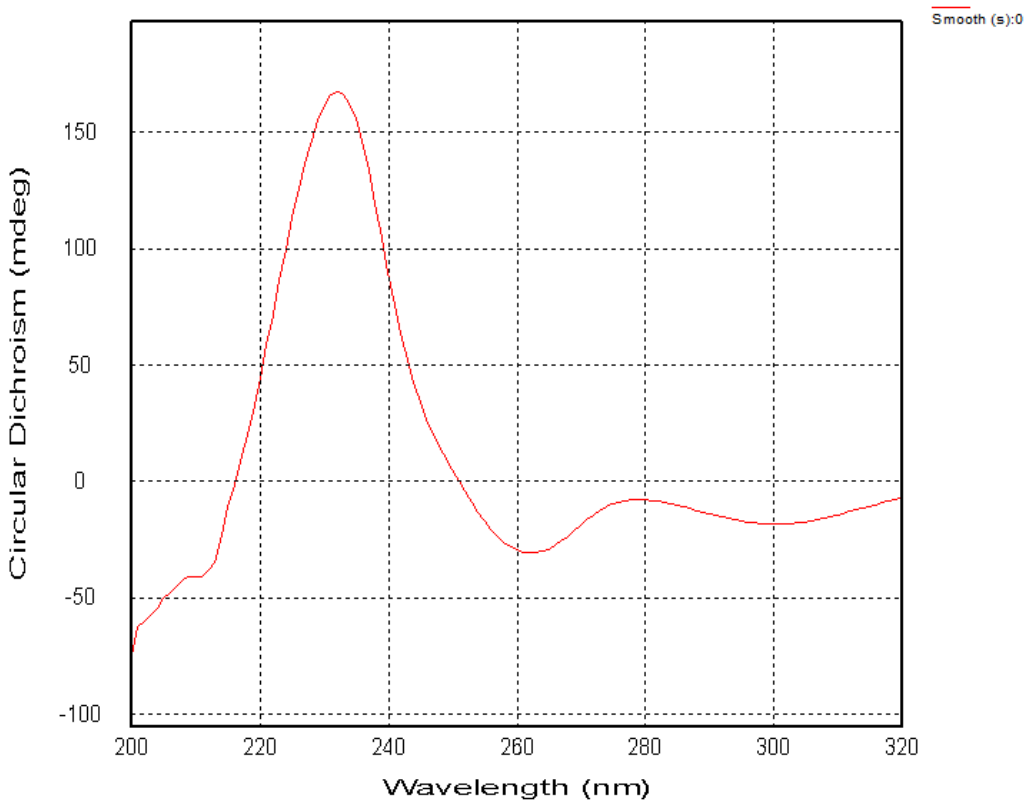
3o


Smooth (s):1
Circular Dichroism (mdeg)
80
60
40
20
0
-20
200
220
240
260
280
300
320
Wavelength (nm)

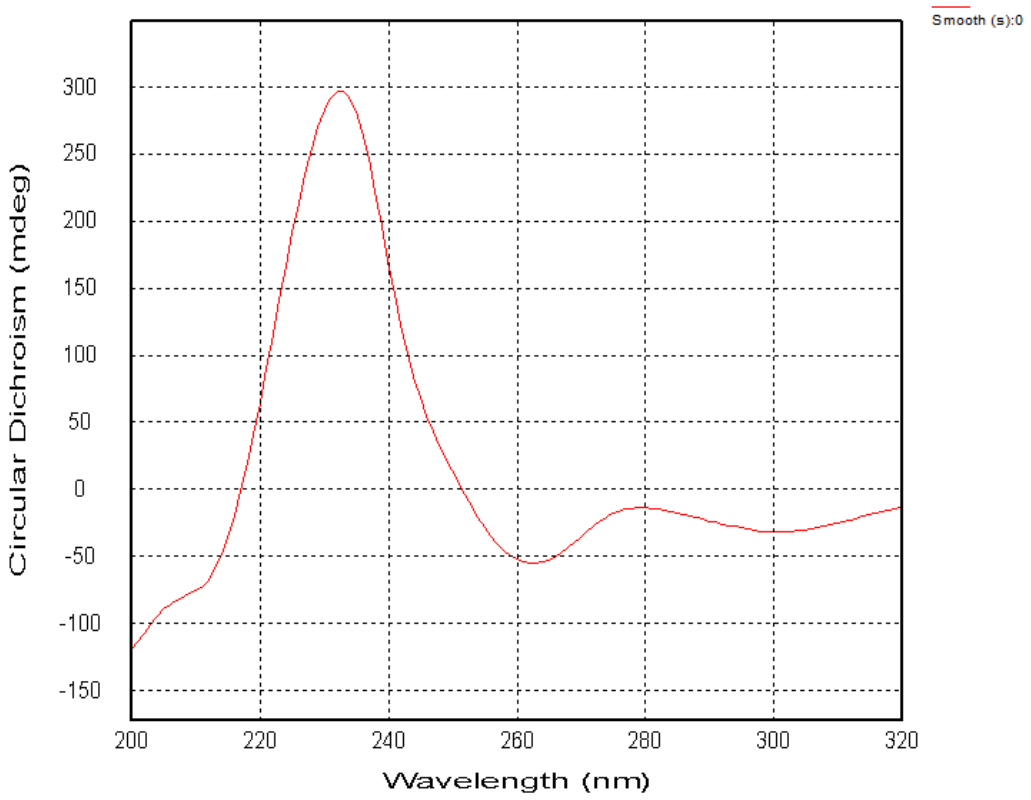
3q


Smooth (s):0
Circular Dichroism (mdeg)
300
250
200
150
100
50
0
-50
-100
200
220
240
260
280
300
320
Wavelength (nm)

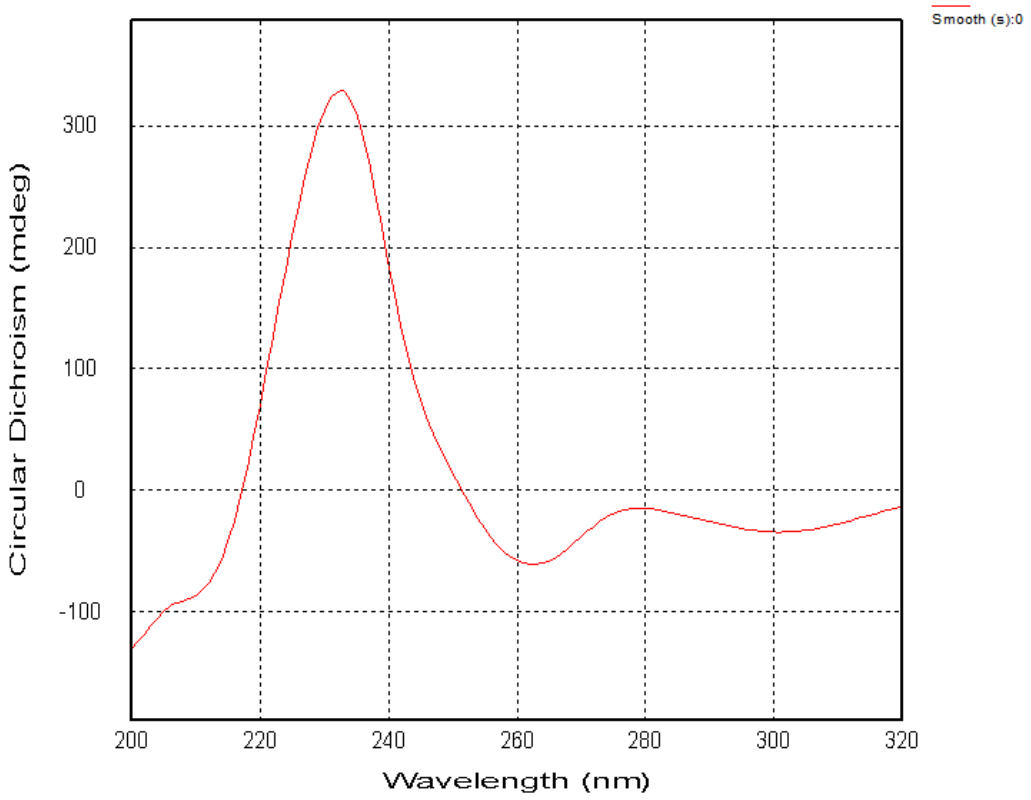
3r


Smooth (s):0
Circular Dichroism (mdeg)
150
100
50
0
-50
-100
200
220
240
260
280
300
320
Wavelength (nm)

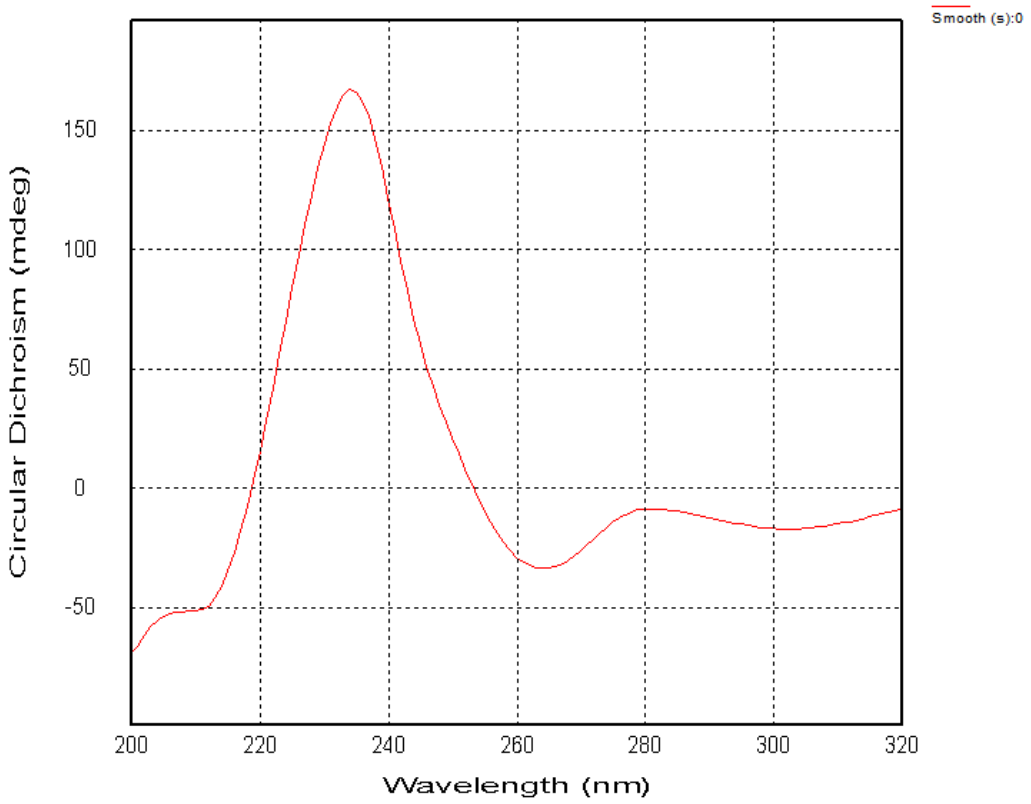
3s


Smooth (s):0
Circular Dichroism (mdeg)
300
250
200
150
100
50
0
-50
-100
-150
200
220
240
260
280
300
320
Wavelength (nm)

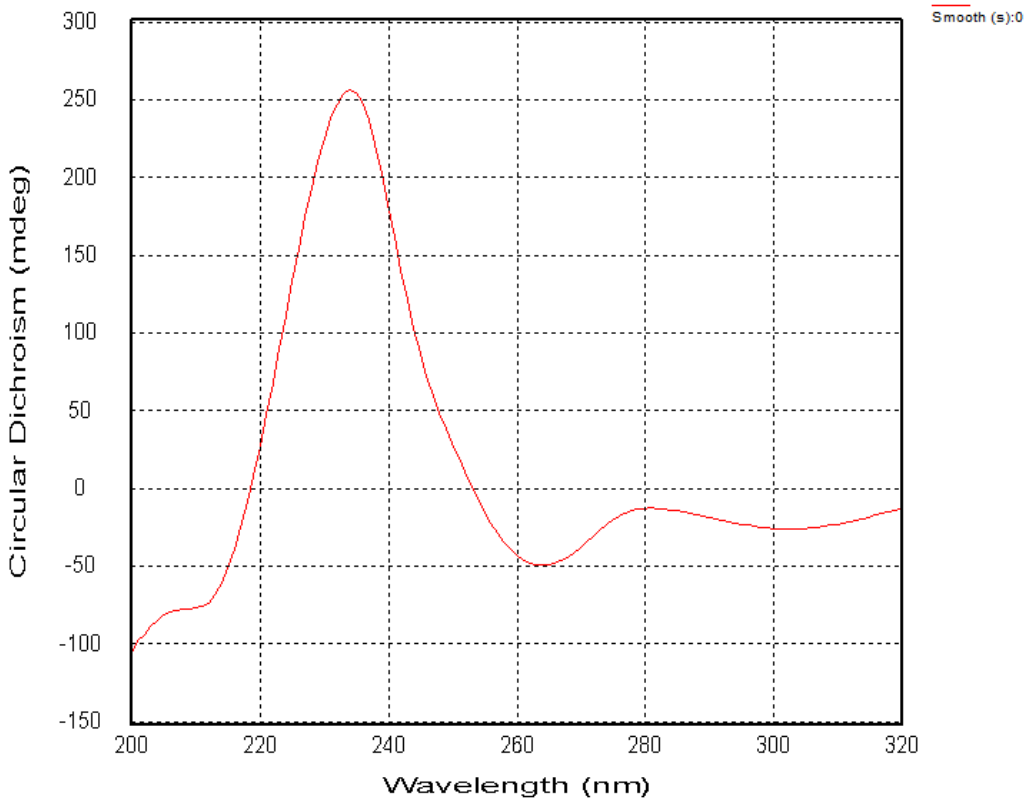
3t


Smooth (s):0
Circular Dichroism (mdeg)
300
200
100
0
-100
200
220
240
260
280
300
320
Wavelength (nm)

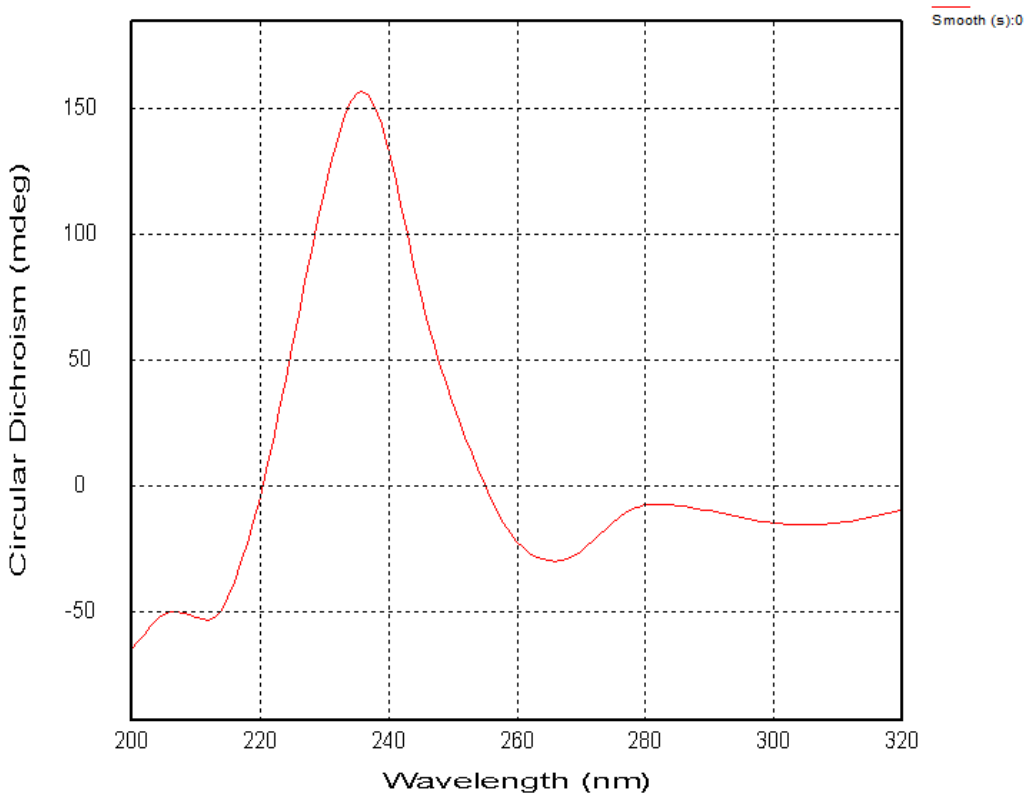
3u


Smooth (s):0
Circular Dichroism (mdeg)
150
100
50
0
-50
200
220
240
260
280
300
320
Wavelength (nm)

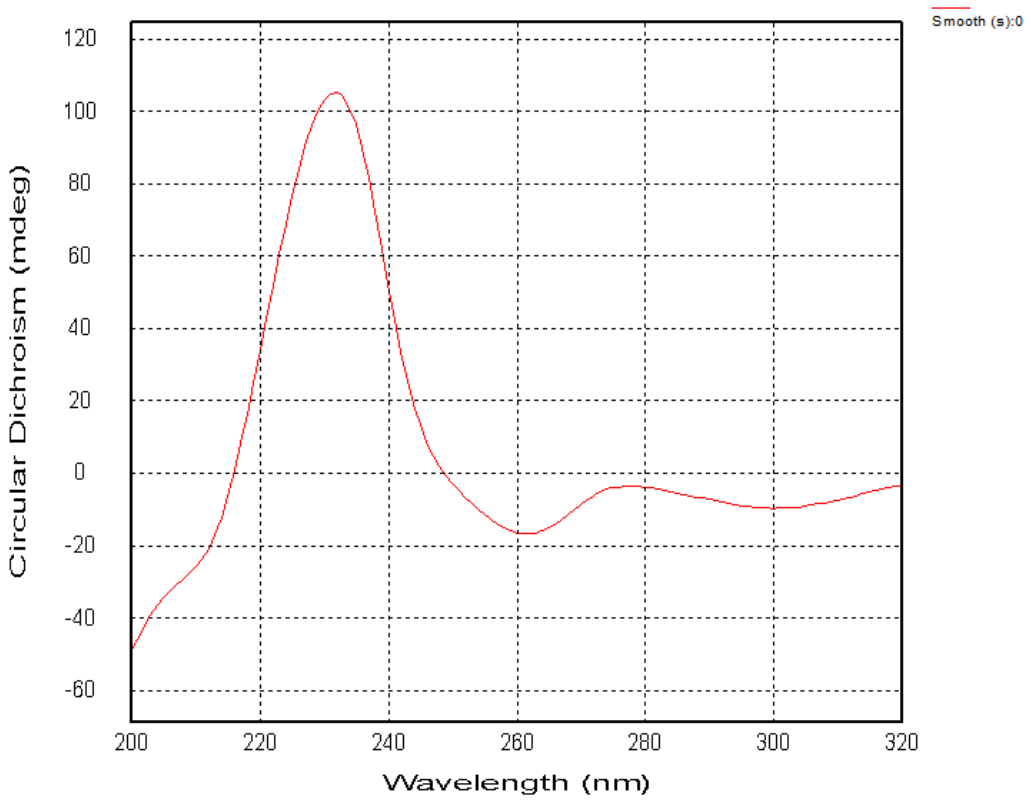
3v


Smooth (s):0
Circular Dichroism (mdeg)
300
250
200
150
100
50
0
-50
-100
-150
200
220
240
260
280
300
320
Wavelength (nm)

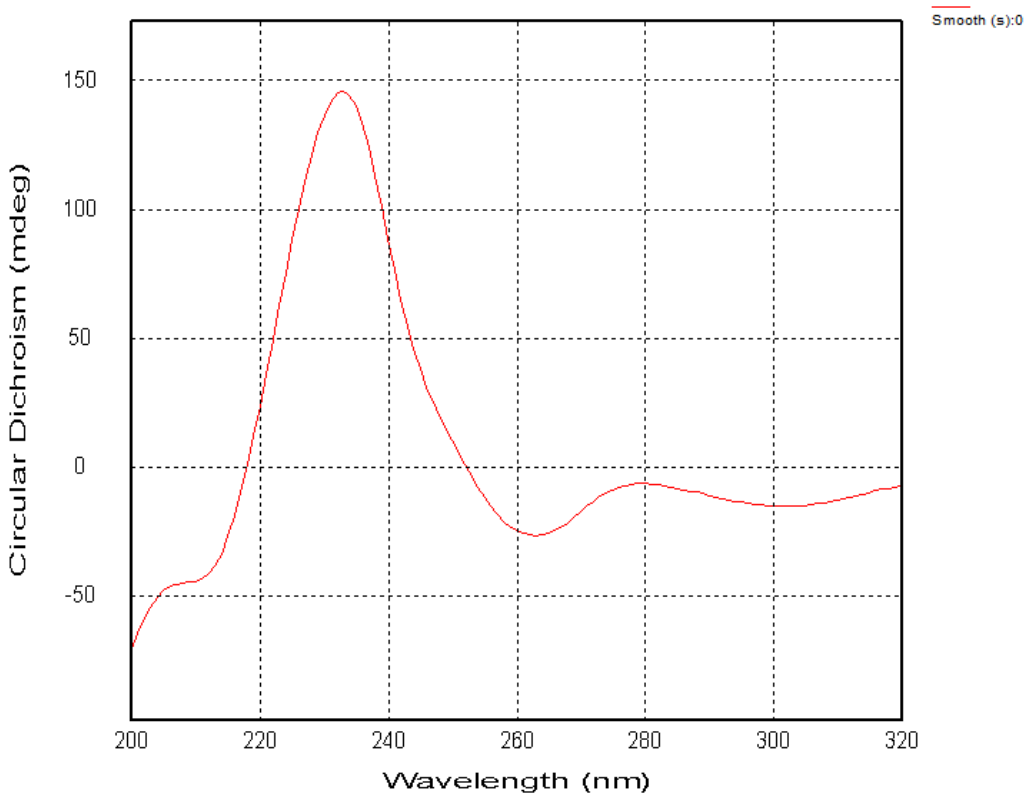
3w


Smooth (s):0
Circular Dichroism (mdeg)
150
100
50
0
-50
200
220
240
260
280
300
320
Wavelength (nm)

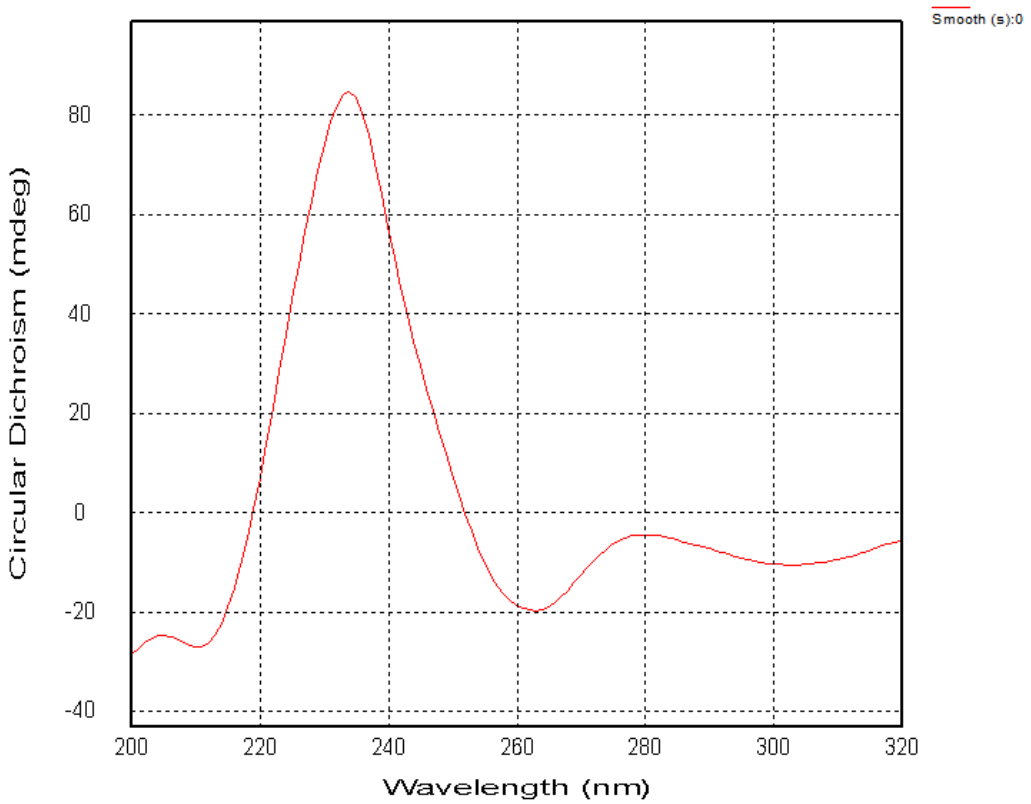
3x


Smooth (s):0
Circular Dichroism (mdeg)
120
100
80
60
40
20
0
-20
-40
-60
200
220
240
260
280
300
320
Wavelength (nm)

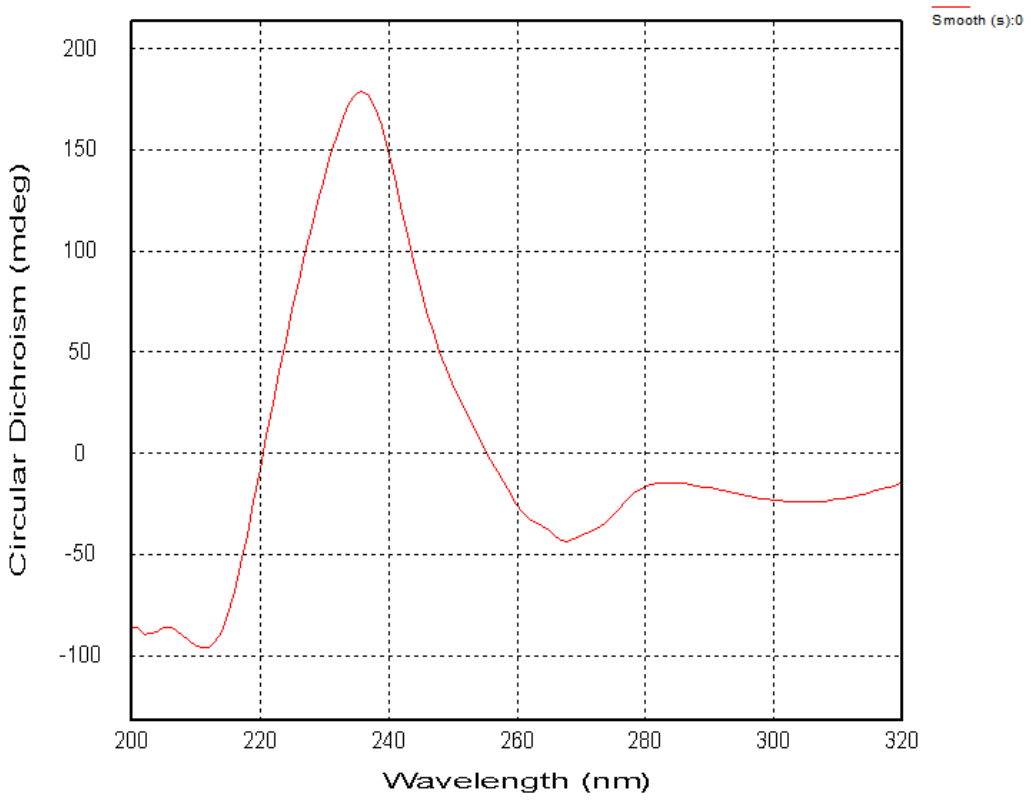
3y


Smooth (s):0
Circular Dichroism (mdeg)
150
100
50
0
-50
200
220
240
260
280
300
320
Wavelength (nm)

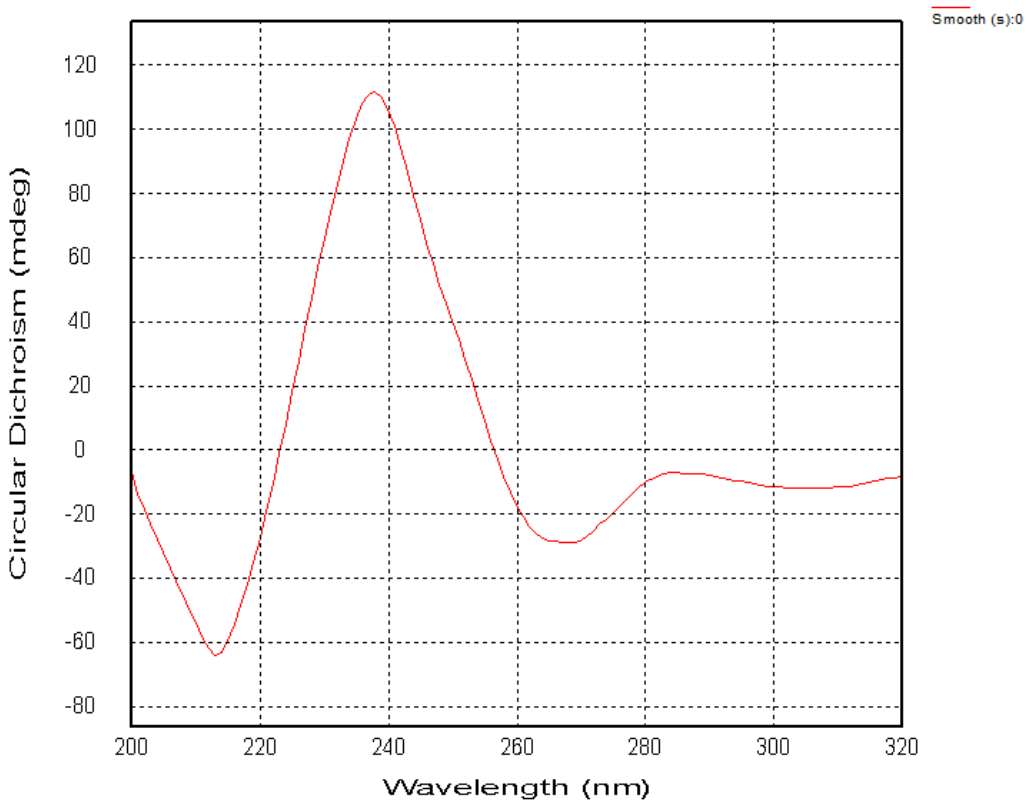
3z


Smooth (s):0
Circular Dichroism (mdeg)
80
60
40
20
0
-20
-40
200
220
240
260
280
300
320
Wavelength (nm)

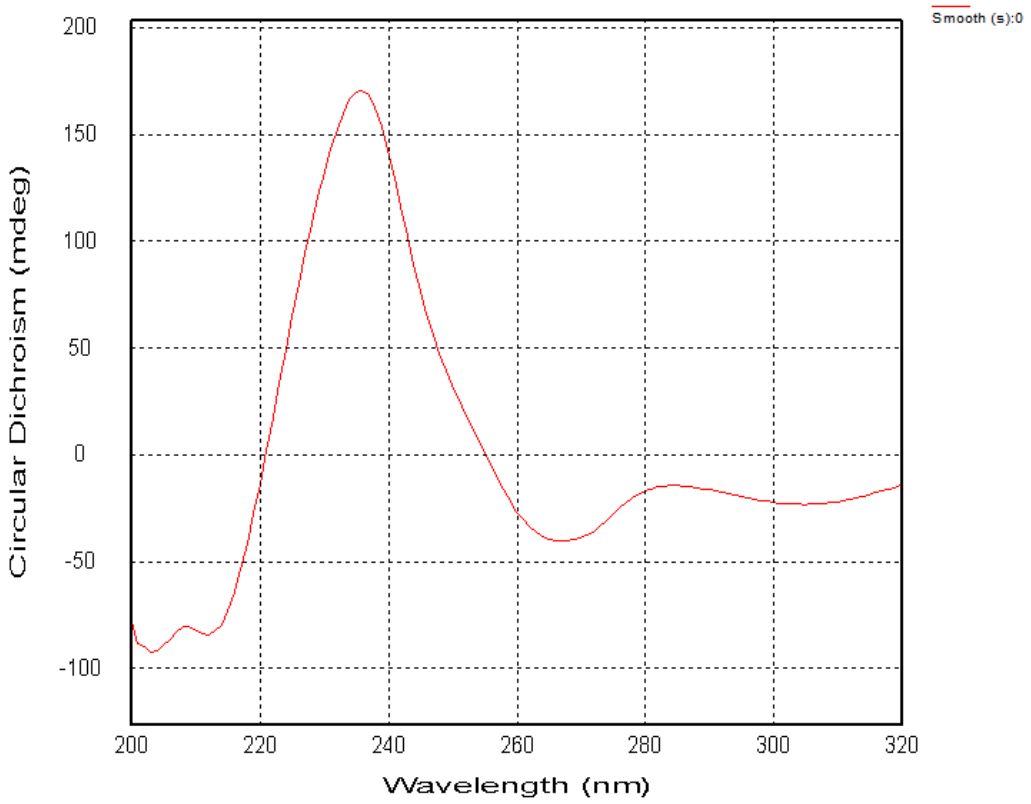
6a


Smooth (s):0
Circular Dichroism (mdeg)
200
150
100
50
0
-50
-100
200
220
240
260
280
300
320
Wavelength (nm)

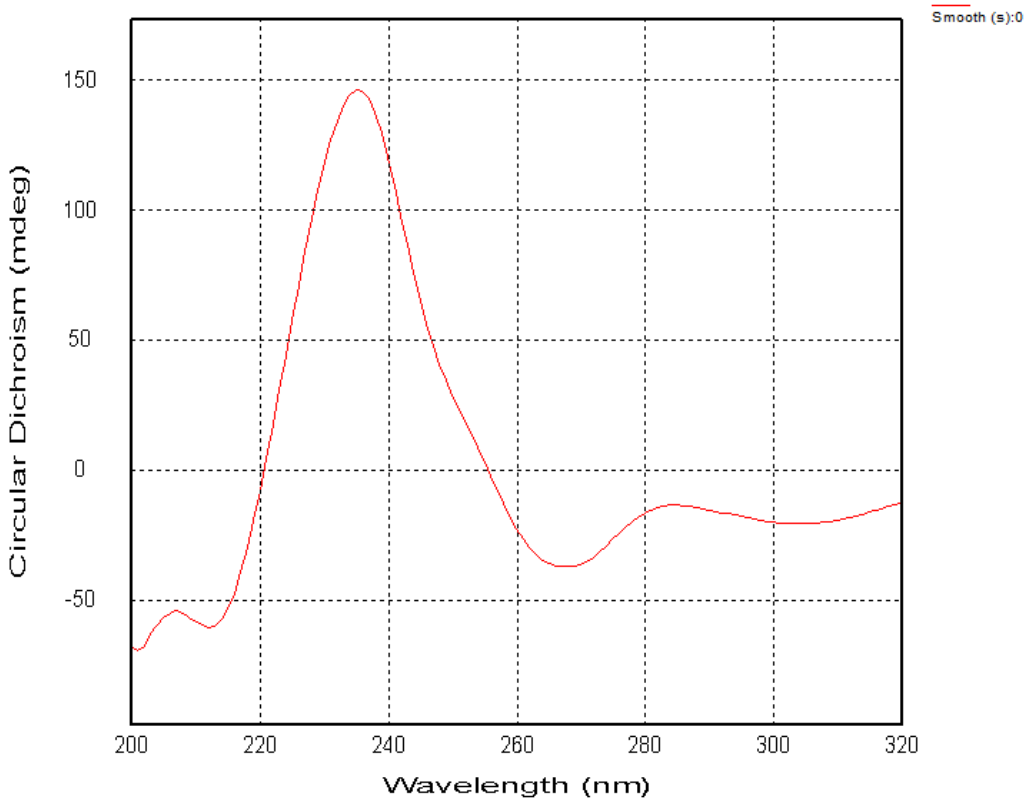
6b


Smooth (s):0
Circular Dichroism (mdeg)
120
100
80
60
40
20
0
-20
-40
-60
-80
200
220
240
260
280
300
320
Wavelength (nm)

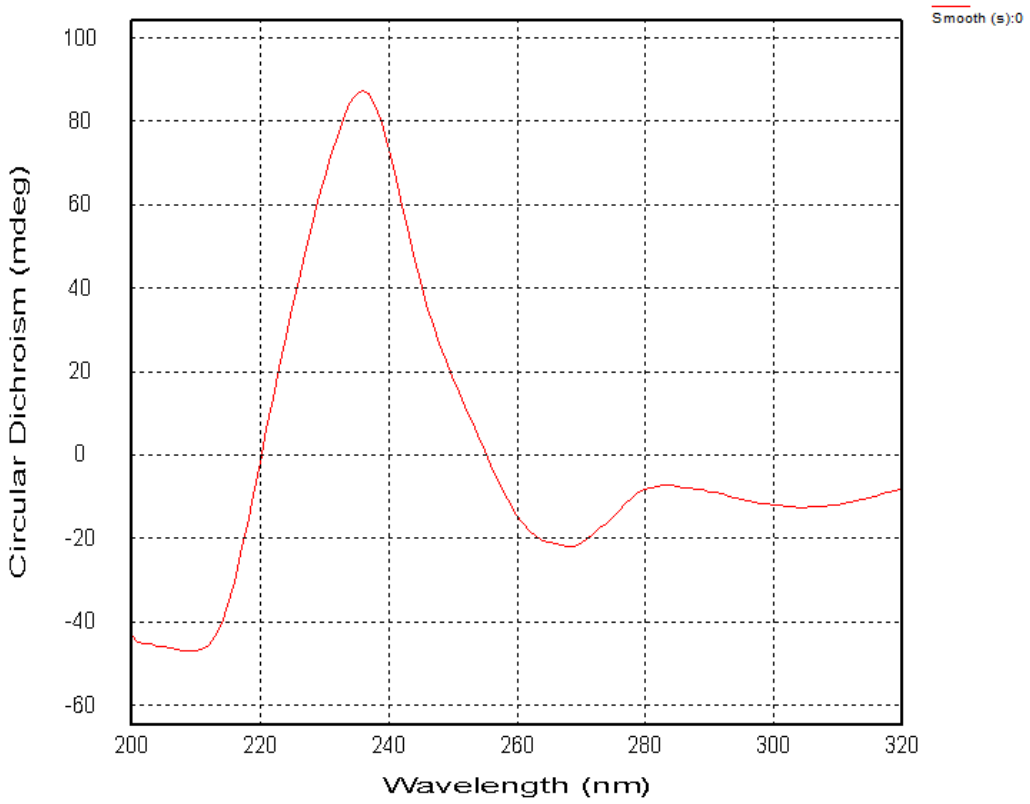
6c


Smooth (s):0
Circular Dichroism (mdeg)
200
150
100
50
0
-50
-100
200
220
240
260
280
300
320
Wavelength (nm)

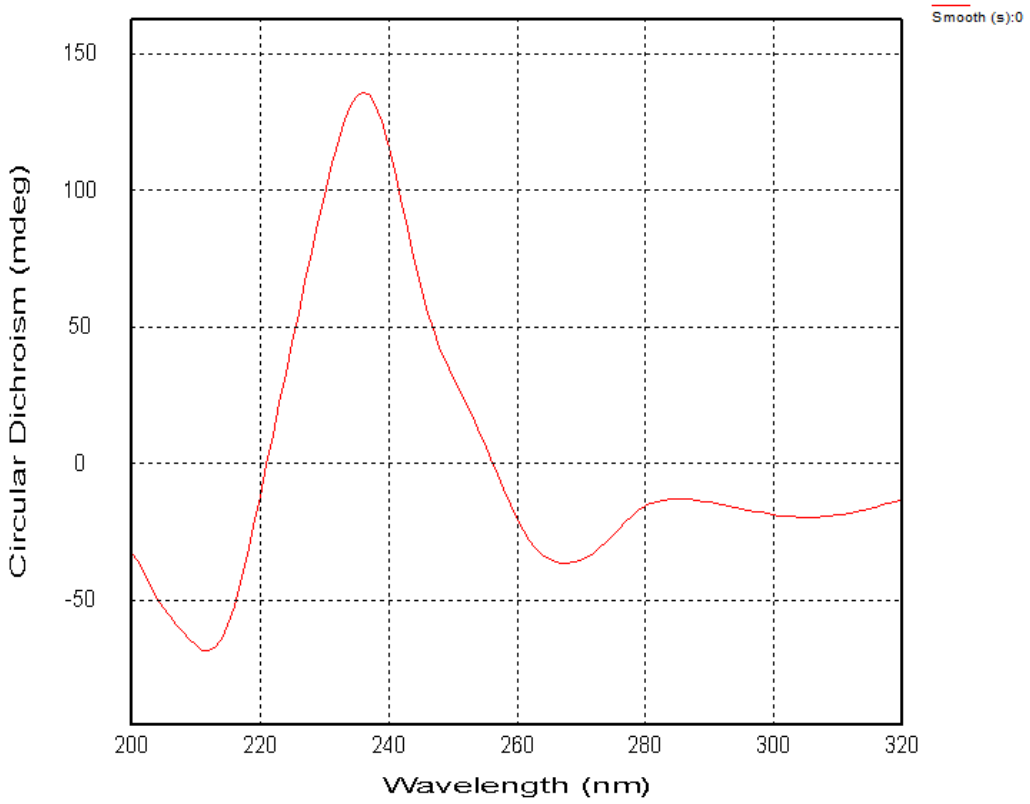
6d


Smooth (s):0
Circular Dichroism (mdeg)
150
100
50
0
-50
200
220
240
260
280
300
320
Wavelength (nm)

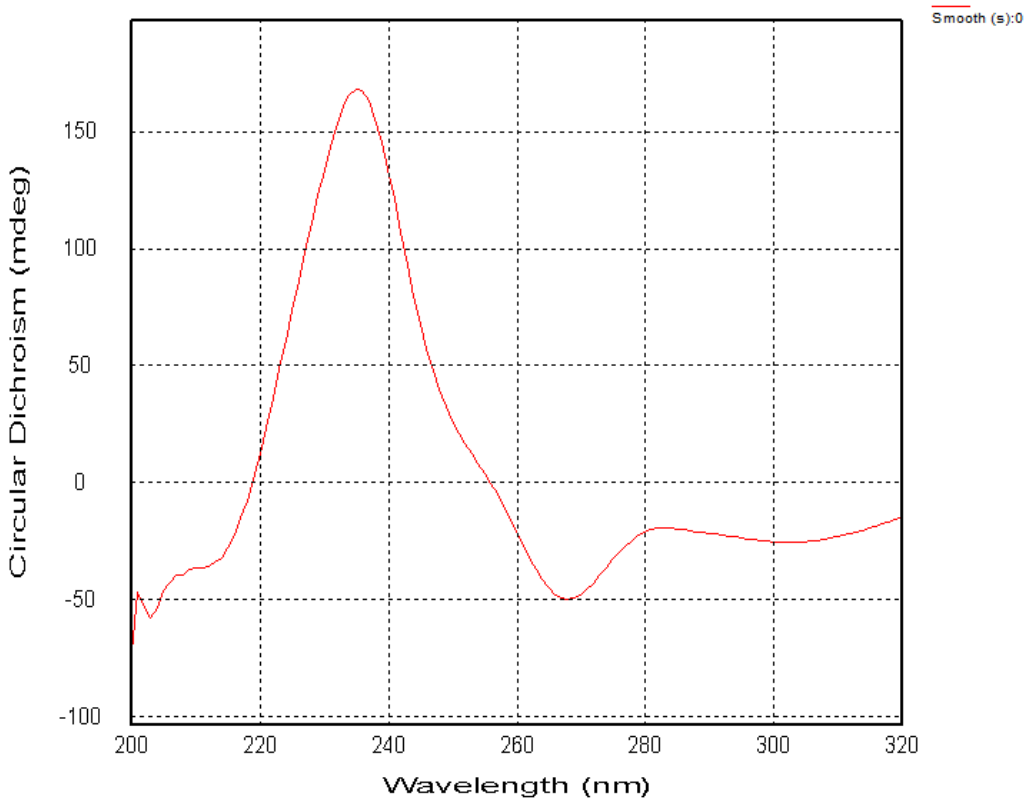
6e


Smooth (s):0
Circular Dichroism (mdeg)
100
80
60
40
20
0
-20
-40
-60
200
220
240
260
280
300
320
Wavelength (nm)

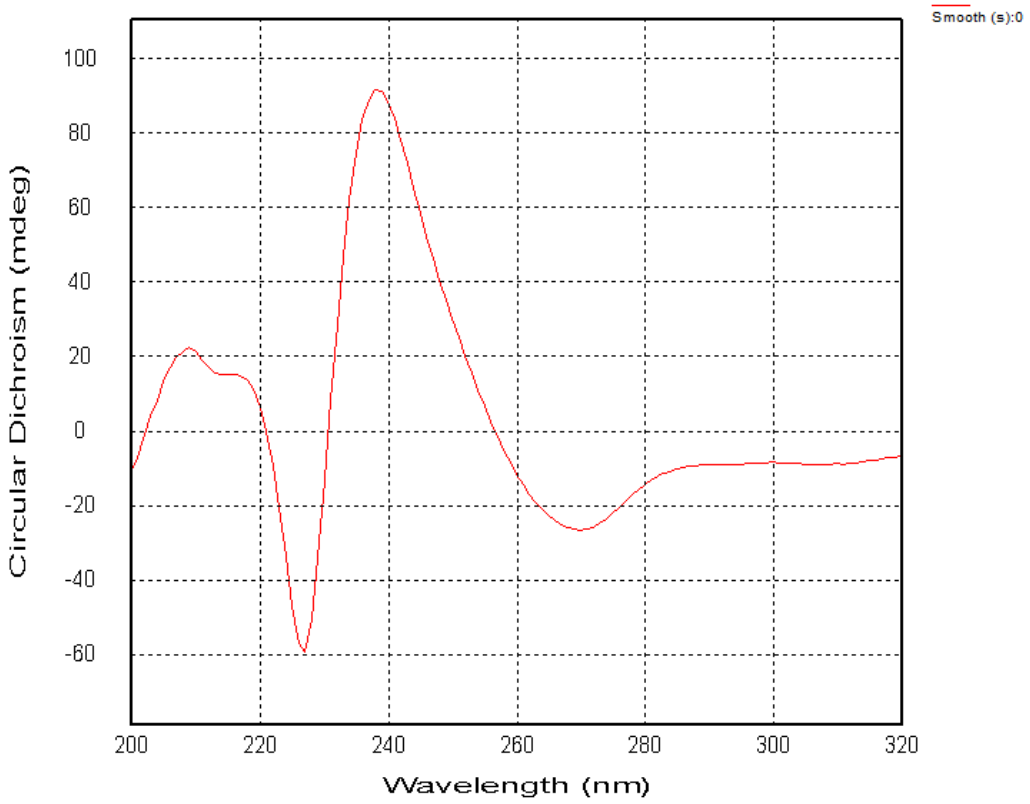
6f


Smooth (s):0
Circular Dichroism (mdeg)
150
100
50
0
-50
200
220
240
260
280
300
320
Wavelength (nm)

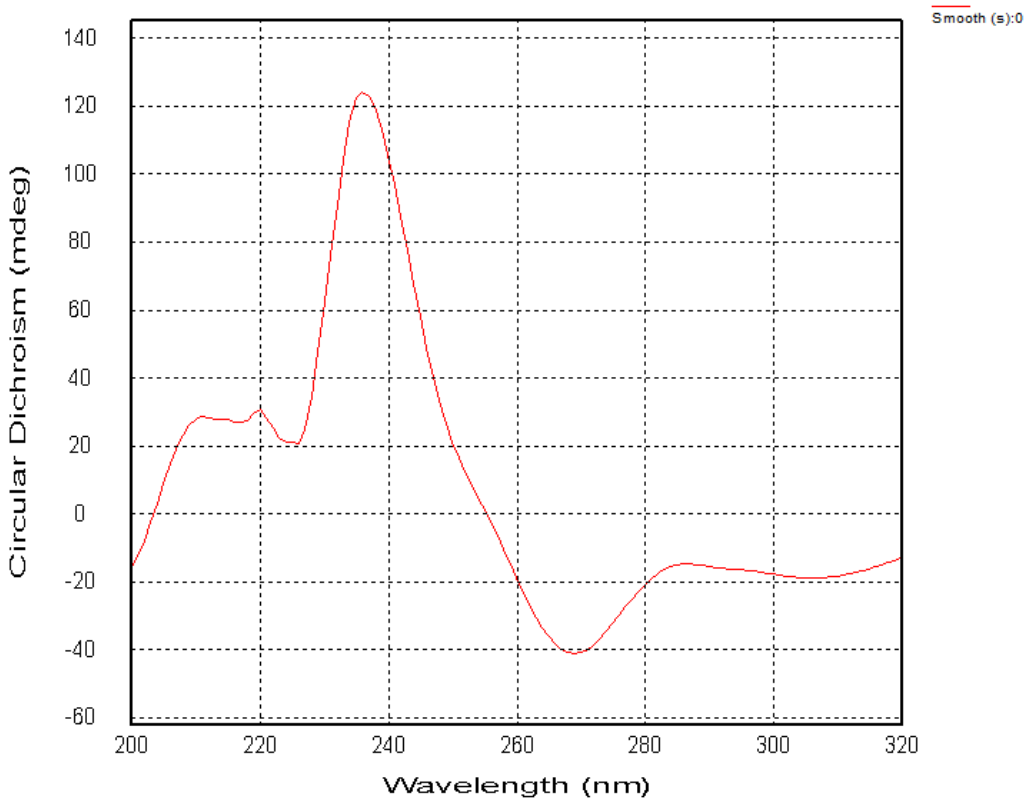
6g


Smooth (s):0
Circular Dichroism (mdeg)
150
100
50
0
-50
-100
200
220
240
260
280
300
320
Wavelength (nm)

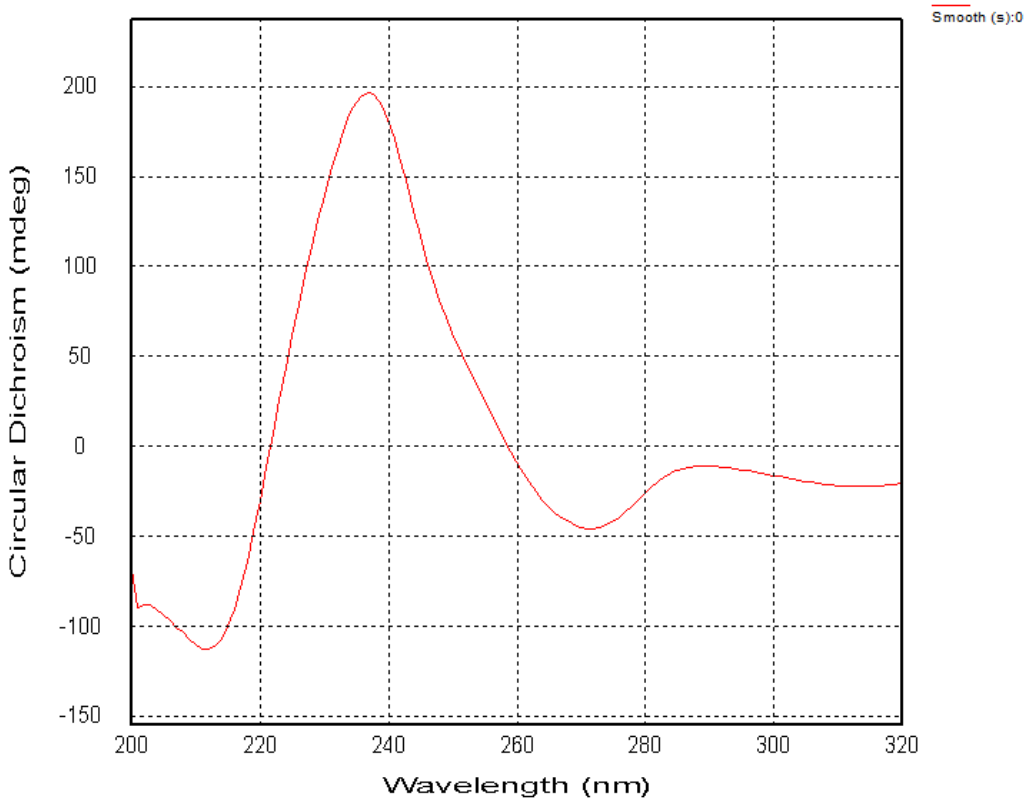
6h


Smooth (s):0
Circular Dichroism (mdeg)
100
80
60
40
20
0
-20
-40
-60
200
220
240
260
280
300
320
Wavelength (nm)

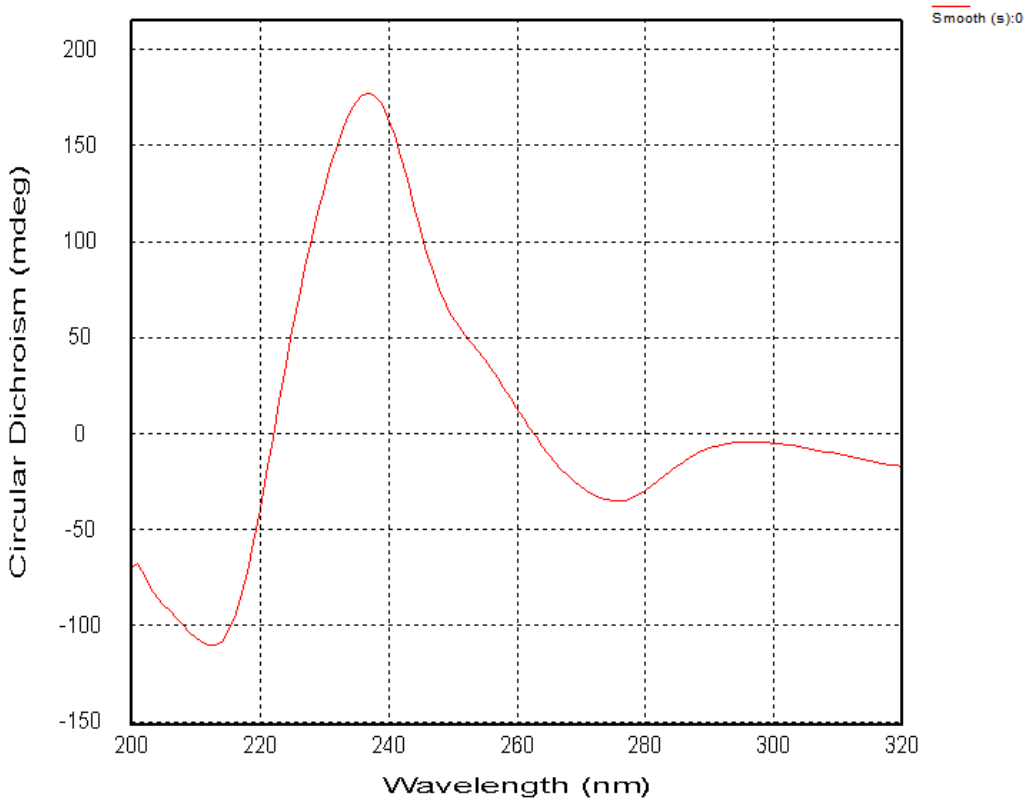
6i


Smooth (s):0
Circular Dichroism (mdeg)
140
120
100
80
60
40
20
0
-20
-40
-60
200
220
240
260
280
300
320
Wavelength (nm)

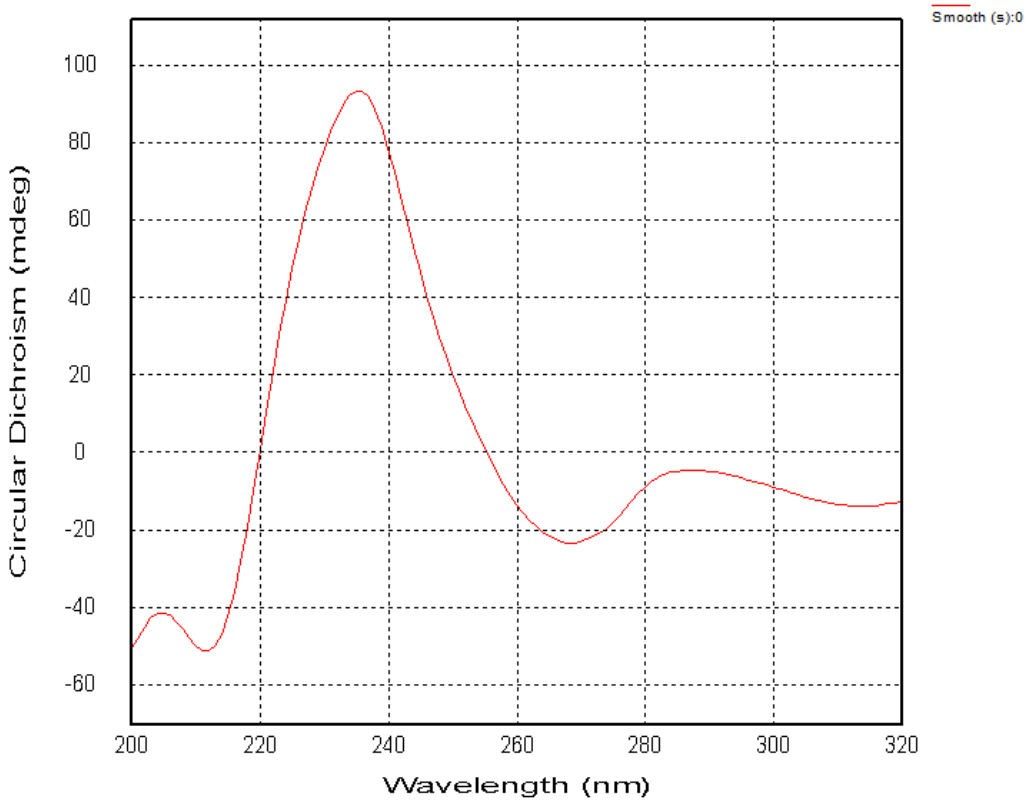
6j


Smooth (s):0
Circular Dichroism (mdeg)
200
150
100
50
0
-50
-100
-150
200
220
240
260
280
300
320
Wavelength (nm)

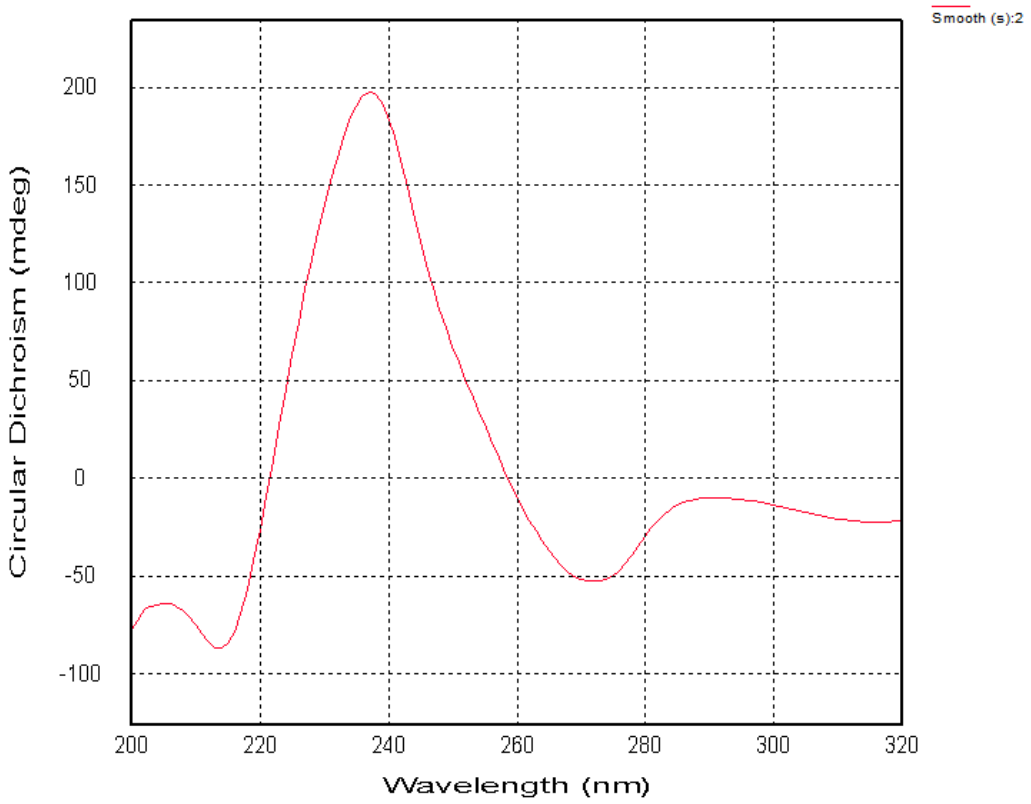
6k


Smooth (s):0
Circular Dichroism (mdeg)
200
150
100
50
0
-50
-100
-150
200
220
240
260
280
300
320
Wavelength (nm)

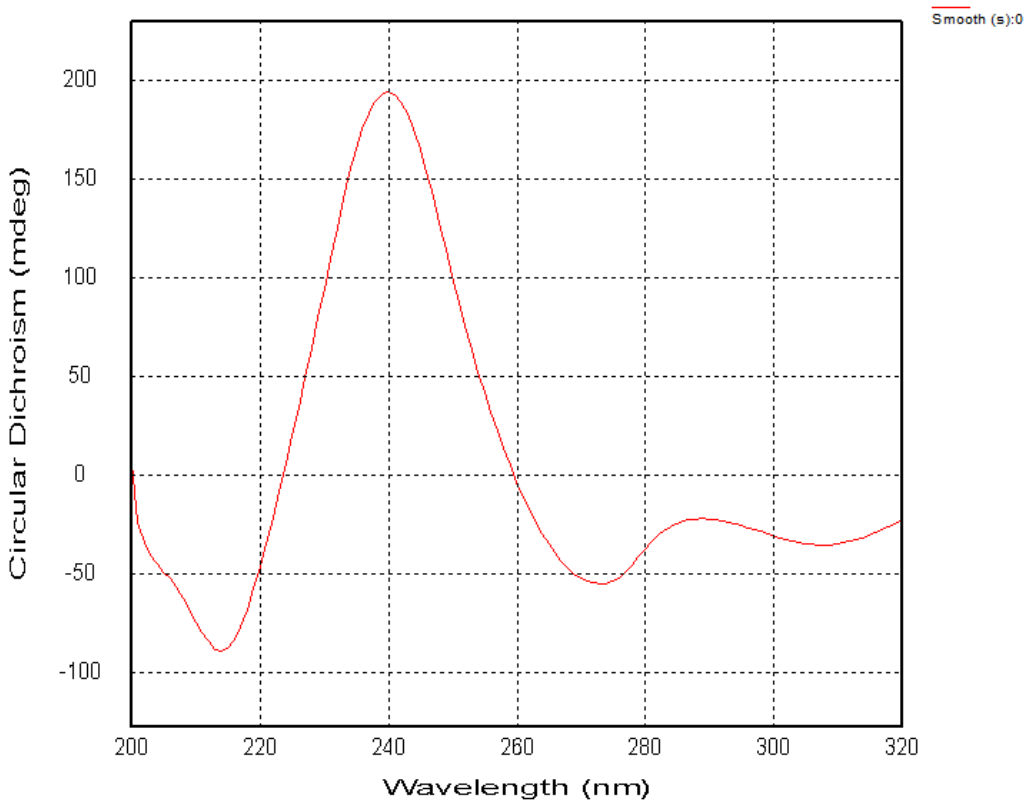
6l


Smooth (s):0
Circular Dichroism (mdeg)
100
80
60
40
20
0
-20
-40
-60
200
220
240
260
280
300
320
Wavelength (nm)

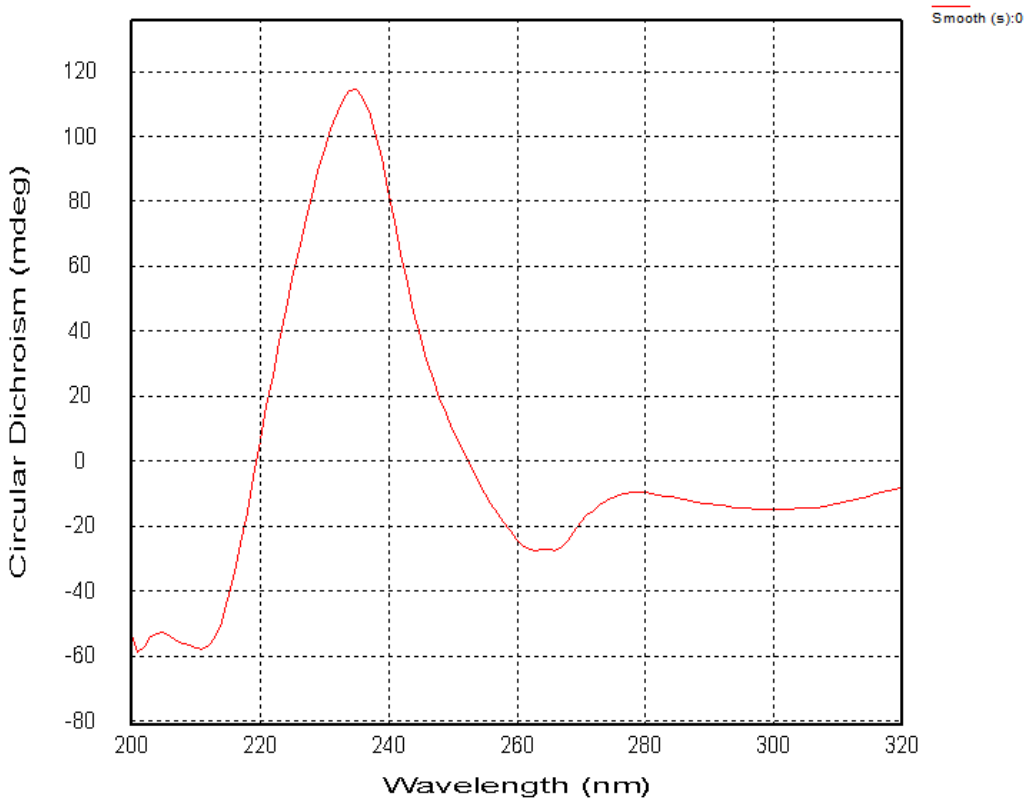
6m


Smooth (s):2
Circular Dichroism (mdeg)
200
150
100
50
0
-50
-100
200
220
240
260
280
300
320
Wavelength (nm)

6n


Smooth (s):0
Circular Dichroism (mdeg)
200
150
100
50
0
-50
-100
200
220
240
260
280
300
320
Wavelength (nm)

6o


Smooth (s):0
Circular Dichroism (mdeg)
120
100
80
60
40
20
0
-20
-40
-60
-80
200
220
240
260
280
300
320
Wavelength (nm)