Electronic Supplementary Material (ESI) for Organic & Biomolecular Chemistry.

Supporting Information

Total Synthesis of Isatindigotindoline C

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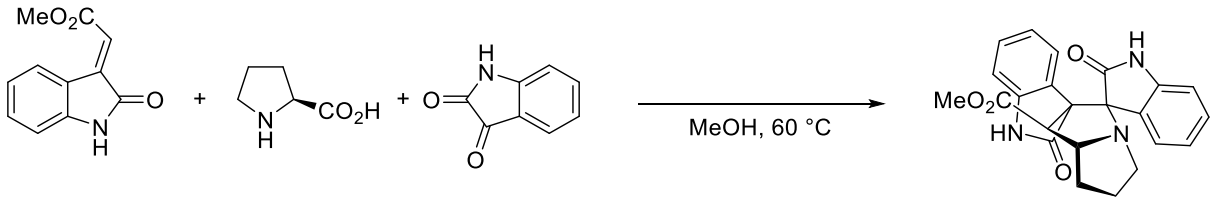
Contents

1 General procedures

All reactions were carried out under a nitrogen atmosphere in oven-dried glassware unless otherwise noted. Solvents and reagents were used as obtained from the supplier unless otherwise noted. Analytical TLC was performed using Merck silica gel F254 (230–400 mesh) plates and analyzed by UV light or by staining upon heating with ninhydrin solution (0.3 g of ninhydrin, 3 mL AcOH, 100 mL EtOH). For flash chromatography purifications silica gel 60 (230–400 mesh) and p.a. grade solvents were used. The NMR spectra were recorded in DMSO-d_6 on a Bruker Avance 600 spectrometer. The chemical shifts are reported in ppm relative to residual DMSO (δ 2.50) for ^{1}H NMR and DMSO-d_6 (δ 39.52) for ^{13}C NMR. The diastereomeric ratios were determined by ^{1}H NMR analysis of crude reaction mixtures. Melting points (mp) were determined in open capillaries using a Mettler Toledo MT50 melting point system and are uncorrected. High-resolution mass spectrometric data were measured using a Waters QTOF XEVO-G2 spectrometer.

2 Synthetic procedures

2.1 *epi*-Isatinindigotindoline C (*epi*-1)



A solution of methyleneindene **2** (5 mmol, 1.02 g, 1.0 equiv.), proline (**5**) (5 mmol, 576 mg, 1.0 equiv.) and isatin (**4**) (5 mmol, 736 mg, 1.0 equiv.) in MeOH (10 ml) was heated at 60 °C. During the first 5 min all solids dissolved and the deep-red solution evolved gas (CO_2). After 5 min white solid started precipitating out. Starting materials were consumed (TLC 50% EtOAc/Hex) after 3 h, and the reaction mixture was cooled in ice. The reaction mixture was vacuum filtered, and the solid product washed with cold methanol (2 × 2 ml) to yield *epi*-isatindingotindoline C as a white solid (1.75 g, 87 % yield).

Note: X-ray quality crystals were obtained by slow evaporation from MeOH/Acetone (1/1 v/v).

Note: *epi*-**1** is insoluble in most organic solvents (DCM, EtOAc, PhMe, MeOH, EtOH, Acetone).

MP: Decomp. >250 °C

R$_f$ (50% EtOAc/Hex): 0.27 (Ninhydrin, blue).

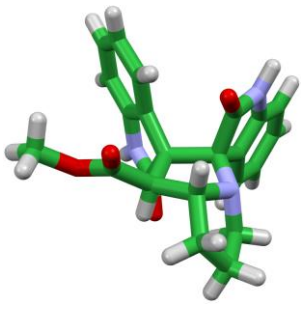
^{1}H NMR (600 MHz, DMSO-d_6) δ 10.30 (s, 1H), 10.08 (s, 1H), 7.51 (d, *J* = 7.6 Hz, 1H), 7.27 (d, *J* = 7.6 Hz, 1H), 7.17 (td, *J* = 7.7, 1.2 Hz, 1H), 7.07 (td, *J* = 7.7, 1.2 Hz, 1H), 6.92 (td, *J* = 7.7, 1.1 Hz, 1H), 6.83 (td, *J* = 7.7, 1.1 Hz, 1H), 6.60 (d, *J* = 8.3 Hz, 1H), 6.58 (d, *J* = 7.8 Hz, 1H), 4.93 (ddd, *J* = 9.5, 7.1, 4.4 Hz, 1H), 3.61 (d, *J* = 9.5 Hz, 1H), 3.42 (td, *J* = 8.9, 8.4, 6.6 Hz, 1H), 3.15 (s, 3H), 2.57 (ddd, *J* = 9.1, 7.1, 2.2 Hz, 1H), 2.18 – 2.09 (m, 1H), 2.06 – 1.98 (m, 1H), 1.86 – 1.73 (m, 2H).

{^{1}H}^{13}C NMR (151 MHz, DMSO-d_6) δ 178.3 (C=O), 175.7 (C=O), 170.2 (C=O), 142.6 (C), 142.0 (C), 129.5 (CH), 128.4 (CH), 128.2 (CH), 127.1 (CH), 126.3 (C), 124.7 (C), 120.9 (CH), 120.8 (CH), 109.3 (CH), 108.7 (CH), 77.2 (C), 66.3 (CH), 65.4 (CH), 57.4 (CH), 51.2 (CH), 47.2 (CH_2), 29.5 (CH_2), 25.8 (CH_2).

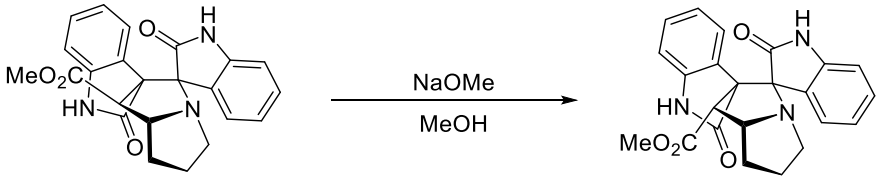
HRMS (ESI): m/z calcd. for $C_{23}H_{22}N_3O_4^+$ [*M*+H] 404.1605 measured 404.1606 Δ = 0.1 mDa.

FTIR (ATR, cm^{-1}): 3272, 2190, 3145, 3085, 3034, 2954, 1722, 1706, 1616, 1593, 1472, 1208, 1111, 749, 739, 680.

scXRD:



2.2 Isatinindigotindoline C (1)



A solution of *epi*-isatindigotindoline C (100 mg, 1.0 equiv.) in freshly prepared 1 M NaOMe in MeOH (2.5 ml, 10 equiv.) was stirred at rt for 12. The solution was cooled in an ice bath, diluted with ice water (5 mL) and extracted with dichloromethane (5 × 5 mL). The combined organic layers were dried with $MgSO_4$ and concentrated *in vacuo*. An analytical sample of the thus obtained crude product (97 mg, 97% mass recovery, dr 64:36 based on ^{1}H NMR) was purified using flash column chromatography (5% 7 M NH_3 in MeOH/DCM) to provide isatindigotindoline C as a white crystalline solid.

Note: The crude mixture is very sparingly soluble in most organic solvents. The material must be loaded to flash column with a minimum amount of DMSO and eluted very slowly to achieve separation. Attempts at loading the crude material in DCM/MeOH or Acetone/MeOH, or dry-loading led to tailing.

Note: X-ray quality crystals were obtained by slow evaporation from MeOH/Acetone (1/1 v/v).

R_f (50% EtOAc/Hex): 0.41 (Ninhydrin, brown).

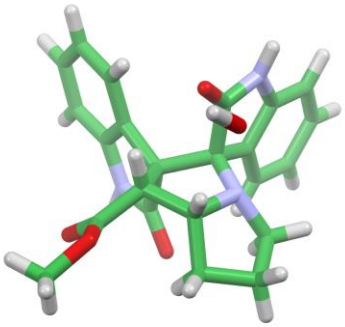
^{1}H NMR (600 MHz, DMSO-d_6) δ: 10.37 (s, 1H), 10.31 (s, 1H), 7.54 (d, *J* = 7.5 Hz, 1H), 7.19 (d, *J* = 7.5 Hz, 1H), 7.15 (td, *J* = 7.7, 1.1 Hz, 1H), 7.01 (td, *J* = 7.7, 1.1 Hz, 1H), 6.91 (td, *J* = 7.7, 1.0 Hz, 1H), 6.79 (td, *J* = 7.6, 0.9 Hz, 1H), 6.60 (d, *J* = 7.4 Hz, 1H), 6.53 (d, *J* = 7.5 Hz, 1H), 4.72 (d, *J* = 10.0 Hz, 1H), 4.41 (td, *J* = 10.2, 6.6 Hz, 1H), 3.96 (app. pent, *J* = 6.0 Hz, 1H), 3.54 (s, 3H), 2.40 (t, *J* = 7.0 Hz, 1H), 2.34 (tt, *J* = 10.8, 6.6 Hz, 1H), 1.92 (dt, *J* = 11.8, 6.0 Hz, 1H), 1.87 (dt, *J* = 12.0, 6.5 Hz, 1H), 1.66 (app. nonet, *J* = 6.8 Hz, 1H).

{^{1}H}^{13}C NMR (151 MHz, DMSO-d_6) δ: 178.7, 177.1, 170.7, 143.2, 129.9, 128.3, 127.6, 126.5, 123.9, 122.9, 121.3, 121.2, 109.6, 108.9, 75.0, 64.9, 60.6, 53.6, 51.6, 49.3, 28.7, 26.2.

HRMS (ESI): m/z calcd. for $C_{23}H_{22}N_3O_4^+$ [*M*+H] 404.1606 measured 404.1606 Δ = 0.0 mDa.

FTIR (ATR, cm^{-1}): 3388, 2164, 1724, 1706, 1618, 1541, 1472, 1321, 1197, 118, 1037, 755, 688.

scXRD:



3 NMR data for Isatindingotindoline C

3.1 ^{13}C Data

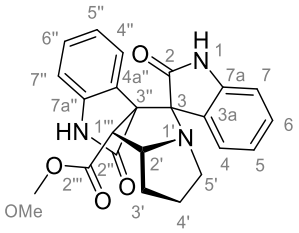


Table S1. ^{13}C NMR data

Shift for isolated (ppm)	**Shift for synthetic** (ppm)	**DEPT-135**	**Carbon**	**Δ (ppm)**
178.7	178.7	–	2''	0
177.1	177.1	–	2	0
170.7	170.7	–	2'''	0
143.2	143.2	–	7''a	0
129.9	129.9	CH	6	0
128.3	128.3	CH	6''	0
127.6	127.6	CH	4	0
122.8	122.9	–	3a	0.1
123.9	123.9	CH	4''	0
121.2	121.3	CH	5	0
121.1	121.2	CH	5''	0.1
109.5	109.6	CH	7	0.1
108.9	108.9	CH	7''	0
75.0	75.0	–	3	0
64.8	64.9	CH	2'	0.1
60.6	60.6	–	3''	0
53.6	53.6	CH	1'''	0
51.5	51.6	CH_3	OCH_3	0.1
49.3	49.3	CH_2	5'	0
28.7	28.7	CH_2	3'	0
26.1	26.2	CH_2	4'	0.1

3.2 ^{1}H Data

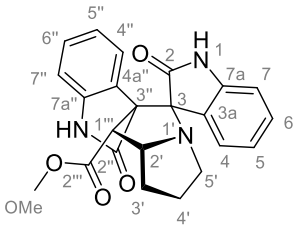


Table S2. ^{1}H NMR data

Shift for isolated (ppm)	**Shift for synthetic** (ppm)	**Integral**	**Multiplicity**	**Hydrogen**	**Δ (ppm)**
10.38	10.37	1	s	1''	0.01
10.33	10.31	1	s	1	0.02
7.54	7.54	1	d (*J* = 7.5 Hz)	4	0.00
7.19	7.19	1	d (*J* = 7.5 Hz)	4''	0.00
7.15	7.15	1	td (*J* = 7.7, 1.1 Hz)	6	0.00
7.01	7.01	1	td (*J* = 7.7, 1.1 Hz)	6''	0.00
6.91	6.91	1	td (*J* = 7.7, 1.1 Hz)	5	0.00
6.80	6.79	1	td (*J* = 7.6, 0.9 Hz)	5''	0.01
6.60	6.60	1	d (*J* = 7.4 Hz)	7	0.00
6.53	6.53	1	d (*J* = 7.5 Hz)	7''	0.00
4.73	4.72	1	d (*J* = 10.0 Hz)	1'''	0.01
4.41	4.41	1	td (*J* = 10.2, 6.6 Hz)	2'	0.00
3.96	3.96	1	app. pent (*J* = 6.0 Hz)	5'	0.00
3.54	3.54	3	s	OMe	0.00
2.40	2.40	1	t (*J* = 7.0 Hz)	5'	0.00
2.33	2.34	1	tt (*J* = 10.8, 6.6 Hz)	3'	–0.01
1.92	1.92	1	dt (*J* = 11.8, 6.0 Hz)	4'	0.00
1.87	1.87	1	dt (*J* = 12.0, 6.5 Hz)	3'	0.00
1.66	1.66	1	app. nonet (*J* = 6.8 Hz)	4'	0.00

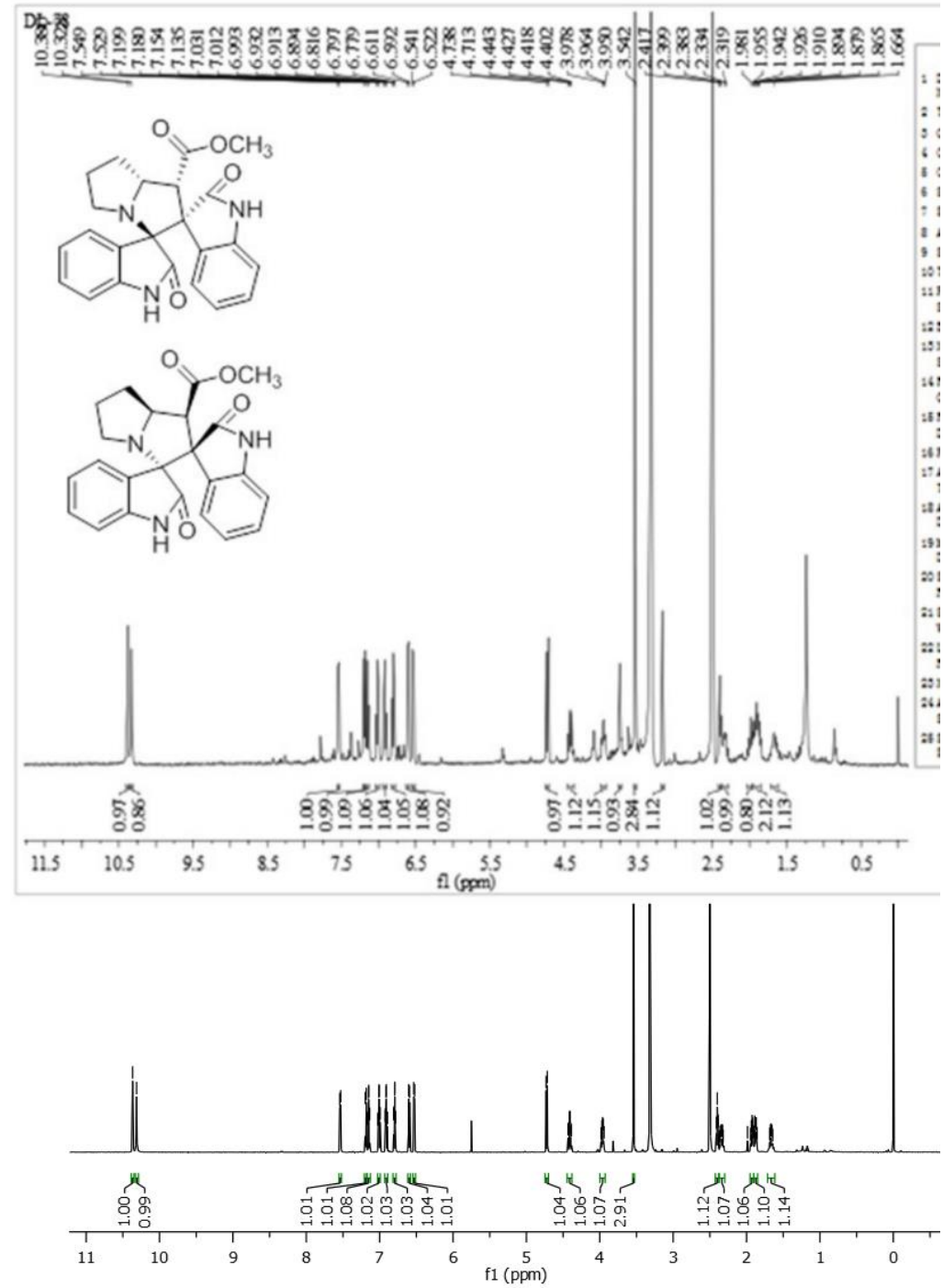


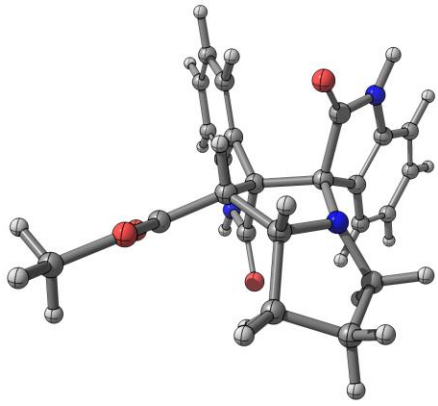
Figure S1. ^{1}H NMR spectral overlay of natural and synthetic Isatindigotindoline C.

4 Computational details

For all stationary points a systematic rotor conformer search was carried out with UFF force-field as implemented in Avogadro 1.2.0. Obtained minimum energy conformers were optimized with B97D3/DEF2SVP level of theory using def2/j Weigend J auxiliary basis set as implemented in ORCA 4.0.0. Final geometry optimizations and free energies were obtained using with B97D3/DEF2TZVP level of theory using Weigend J auxiliary basis set, and a final grid size of 5 with the tightscf parameter.

5 Coordinates

5.1 Isatindigotindoline C



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Coordinates from ORCA-job nat_final

C	-2.48764444095788	1.03156863048140	-1.58787508920952
C	-3.76804176573853	1.12148354768916	-2.11788813409887
C	-1.61448811973856	-0.02366717647897	-1.90669401485866
C	-2.02718549159150	-0.99943912840365	-2.80364831119877
O	0.24740995913404	2.18717164905163	0.21197414853197
C	-0.53665550278612	1.54860643640660	-0.46734406917643
C	-0.32354185659614	0.16604399242114	-1.14624016524127
C	-0.03872611658049	-0.92629974097091	-0.01639846908968
C	0.98188290338302	0.06808346424324	-1.95365822027479
C	2.09690687572008	-0.35142429686492	-0.94174970904335
N	1.37992666388411	-0.83795357927322	0.25621760249698
C	3.06323605829104	0.71700747686530	-0.41218512098974
C	3.30703777139858	0.25615489722386	1.03179240781880
C	1.92346770172678	-0.22759158695803	1.47859973471150
C	-3.31653686771693	-0.92527879904928	-3.35136753145918
C	-4.17530964985978	0.11914066400345	-3.00693537256016
N	-1.84243400138935	1.90911320519815	-0.71612598919633

C	-0.99960867696644	-0.91134136832287	1.15789503858012
C	-1.71172621413040	-2.12452519052004	1.17620953029781
N	-1.27488451383403	-2.94583300248962	0.13364580935149
C	-0.29351150294669	-2.35753120826287	-0.62804831726933
C	-1.29499841159464	0.05382430290607	2.11331933570470
C	-2.28126888442042	-0.20573345377809	3.07534003479461
C	-2.97174779920777	-1.41740294088789	3.07600004555465
C	-2.69568562391146	-2.39867941179301	2.11770880874760
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C	1.27918689816373	1.28045963182690	-2.80271891781874
O	0.57167188876918	2.25583755704392	-2.92806237895537
O	2.45425853531462	1.11439879749716	-3.46165945250141
C	2.84786897958218	2.21255388274519	-4.31267070756936
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H	4.02547561499873	-0.57219971550427	1.05310988367946
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H	-3.64533078553721	-1.68626676699120	-4.05338086028396
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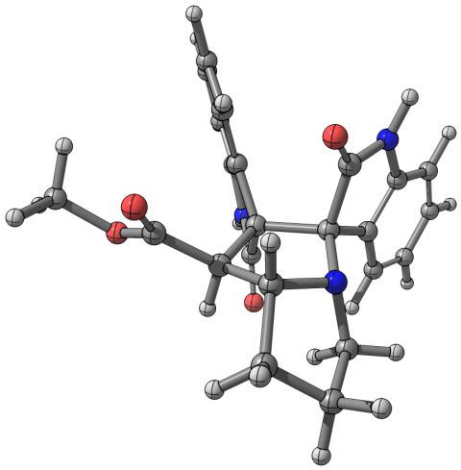
H	-3.23436175712318	-3.34227309594299	2.10903921744502
H	3.79986230652259	1.91093301199072	-4.75113154477604
H	2.09798223981713	2.38022915305873	-5.09094640190539
H	2.96467708300301	3.12653078555958	-3.72334463189543

5.2 *epi*-Isatindigotindoline C



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Coordinates from ORCA-job epi_final

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C	-1.39938409293753	-0.07104817183532	-2.12627796007731
C	-1.44966391921773	-1.00674372081122	-3.15218567312242
O	-0.33603945195694	2.42166199188609	0.19527172484187
C	-0.90227073357746	1.60313025804261	-0.50807347131804
C	-0.28875083325030	0.35521867091763	-1.19147722257917
C	0.08493143079066	-0.77129576369257	-0.04466460346766
C	1.11537553957682	0.70001309311573	-1.76092485659778
C	2.11134816764411	-0.31487996676388	-1.14089840859476
N	1.50968785881534	-0.68661143986798	0.15293283597821
C	3.49742116948132	0.26166718534503	-0.79308622315863
C	3.55630692213896	0.23519811800172	0.75217202889848
C	2.08686659597493	0.20393491876179	1.17308343071457
C	-2.65150586565409	-1.19252138571053	-3.85047575708090
C	-3.78744424094246	-0.45030728658067	-3.52555354762404
N	-2.23573338421627	1.63046321892081	-0.84934424924229
C	-0.81439989259951	-0.74455573591444	1.17590049431149
C	-1.62328898925218	-1.89592365880881	1.16627875618418
N	-1.27734324506358	-2.70457702218432	0.08232785412088
C	-0.21830633139219	-2.19748350236000	-0.63905478024476
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C	-1.93825314601942	-0.04854725208443	3.19229626860920

C	-2.73910396383051	-1.18991241909688	3.15494901537301
C	-2.59044099348887	-2.13555735273453	2.13443167018860
O	0.36205671609114	-2.77670020984147	-1.53347483562985
C	1.15013580306589	0.76690646498628	-3.27152817923108
O	1.71088887584851	-0.01199023691565	-4.00835950507807
O	0.44354156749899	1.84299806077463	-3.70580283823796
C	0.28858887174076	1.94773566679111	-5.13712772423489
H	-4.62314728792524	1.11151543686485	-2.26914471167955
H	-0.57316132948942	-1.58935308775607	-3.40737843889491
H	1.35321280696675	1.70097083257010	-1.38432545479092
H	2.16909277598013	-1.18854825363496	-1.78995097702965
H	3.58929314866231	1.28509157293555	-1.17232081242046
H	4.30214366017025	-0.32338350705464	-1.24438675815070
H	4.05611972470586	-0.67724651958375	1.09376404844994
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6 X-ray Crystallography

Diffraction data were collected on a Bruker APEX II with graphite-monochromated Mo Kαradiation (λ = 0.71073 Å). The cell parameters were obtained from the least-squares refinement of the spots (from 60 collected frames) using the Apex 2 program. Data collection, data processing, and structure solution were performed using the Apex 2 program. Initial atomic positions were located using intrinsic phasing and the structures were refined by least-squares methods using SHELXL-2017. Calculated hydrogen positions were input and refined in a riding manner along with the attached carbons. The *epi*-**1** crystal was solvated with disordered acetone and the SQUEEZE program was used to treat the reflections from the solvent as diffuse scattering.

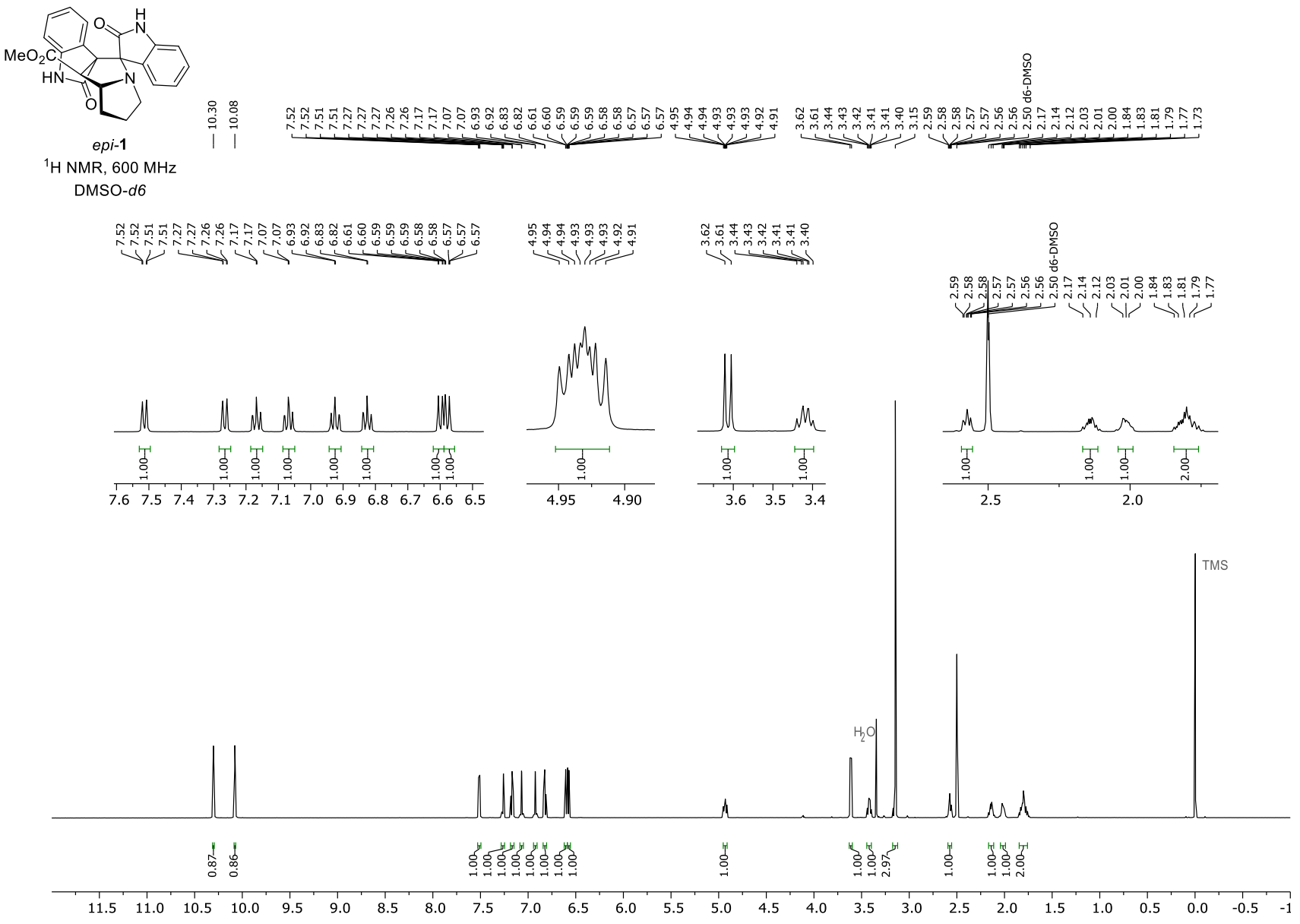
Table S3. Crystal data and structure refinement for $C_{23}H_{21}N_3O_4$ (*epi*-**1**).

Identification code	js1259_0m_a (*epi*-Isatinindigotindoline C)	
Empirical formula	C23 H21 N3 O4	
Formula weight	403.43	
Temperature	296(2) K	
Wavelength	0.71073 Å	
Crystal system	Monoclinic	
Space group	C2/c	
Unit cell dimensions	a = 28.260(5) Å	a= 90°.
	b = 7.7137(14) Å	b= 102.209(3)°.
	c = 20.218(4) Å	g = 90°.
Volume	4307.5(13) $Å^3$	
Z	8	
Density (calculated)	1.244 Mg/m^3	
Absorption coefficient	0.087 mm^{-1}	
F(000)	1696	
Crystal size	0.250 x 0.200 x 0.100 mm^3	
Theta range for data collection	2.267 to 33.111°.	
Index ranges	-43<=h<=42, -11<=k<=11, -30<=l<=30	
Reflections collected	28555	
Independent reflections	7823 [R(int) = 0.0335]	
Completeness to theta = 25.000°	99.9 %	
Absorption correction	Semi-empirical from equivalents	
Max. and min. transmission	0.745 and 0.697	
Refinement method	Full-matrix least-squares on F^2	
Data / restraints / parameters	7823 / 0 / 280	
Goodness-of-fit on F^2	1.039	
Final R indices [I>2sigma(I)]	R1 = 0.0506, wR2 = 0.1346	
R indices (all data)	R1 = 0.0986, wR2 = 0.1559	
Extinction coefficient	n/a	
Largest diff. peak and hole	0.237 and -0.195 e.$Å^{-3}$	

Table S4. Crystal data and structure refinement for $C_{23}H_{21}N_3O_4$, H_2O (**1**).

Identification code	js1266_0m_a (Isatinindigotindoline C)	
Empirical formula	C23 H21 N3 O4, H2 O	
Formula weight	421.44	
Temperature	100(2) K	
Wavelength	0.71073 Å	
Crystal system	Monoclinic	
Space group	$P2_1/n$	
Unit cell dimensions	a = 9.0958(6) Å	a= 90°.
	b = 15.2107(11) Å	b= 92.6250(10)°.
	c = 14.0883(10) Å	g = 90°.
Volume	1947.1(2) $Å^3$	
Z	4	
Density (calculated)	1.438 Mg/m^3	
Absorption coefficient	0.103 mm^{-1}	
F(000)	888	
Crystal size	0.150 x 0.100 x 0.050 mm^3	
Theta range for data collection	1.971 to 30.659°.	
Index ranges	-12<=h<=12, -21<=k<=21, -20<=l<=20	
Reflections collected	23822	
Independent reflections	5989 [R(int) = 0.0346]	
Completeness to theta = 25.000°	100.0 %	
Absorption correction	Semi-empirical from equivalents	
Max. and min. transmission	0.746 and 0.7055	
Refinement method	Full-matrix least-squares on F^2	
Data / restraints / parameters	5989 / 0 / 297	
Goodness-of-fit on F^2	1.037	
Final R indices [I>2sigma(I)]	R1 = 0.0439, wR2 = 0.1154	
R indices (all data)	R1 = 0.0592, wR2 = 0.1256	
Extinction coefficient	n/a	
Largest diff. peak and hole	0.437 and -0.224 e.$Å^{-3}$	

7 Spectral data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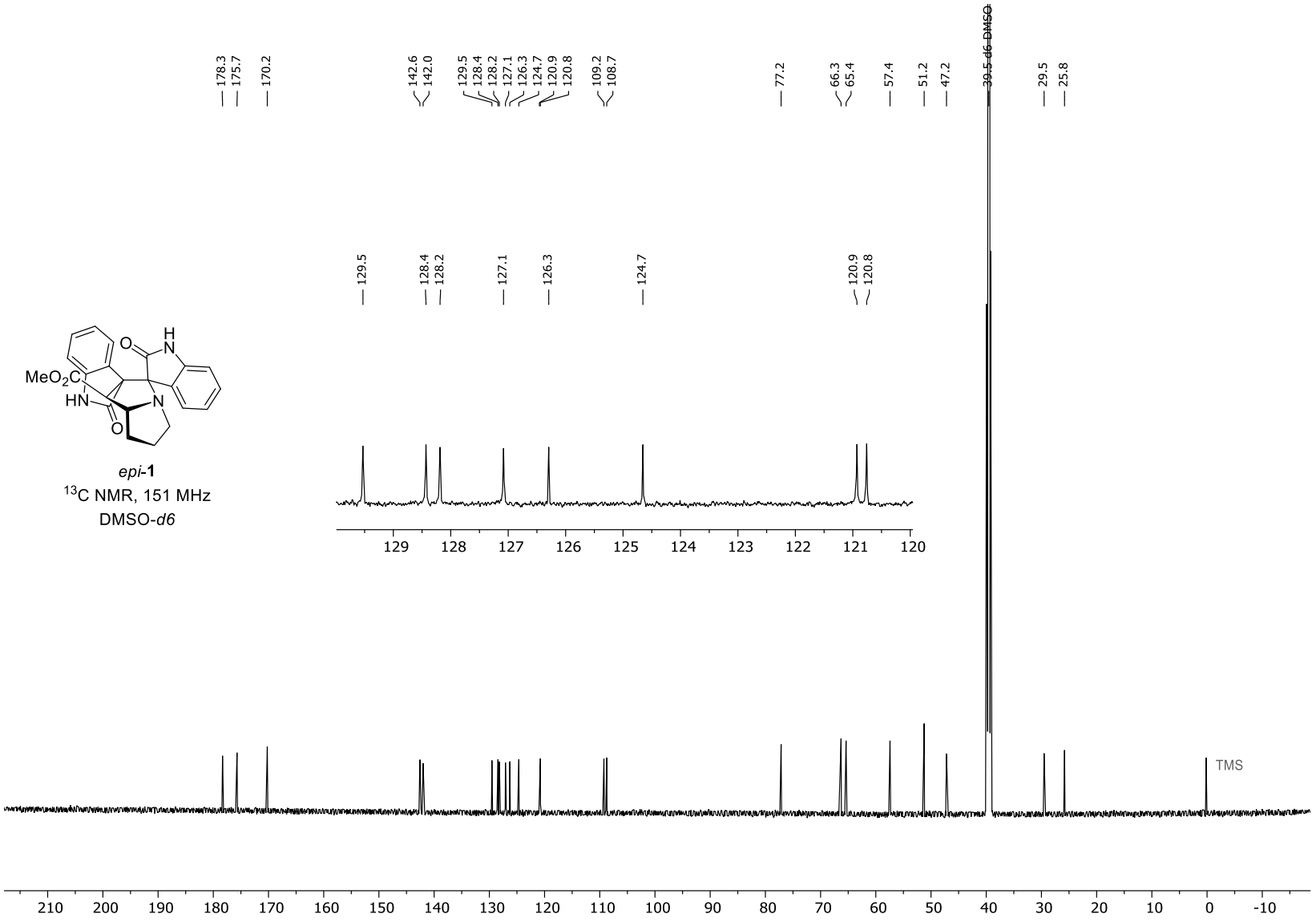
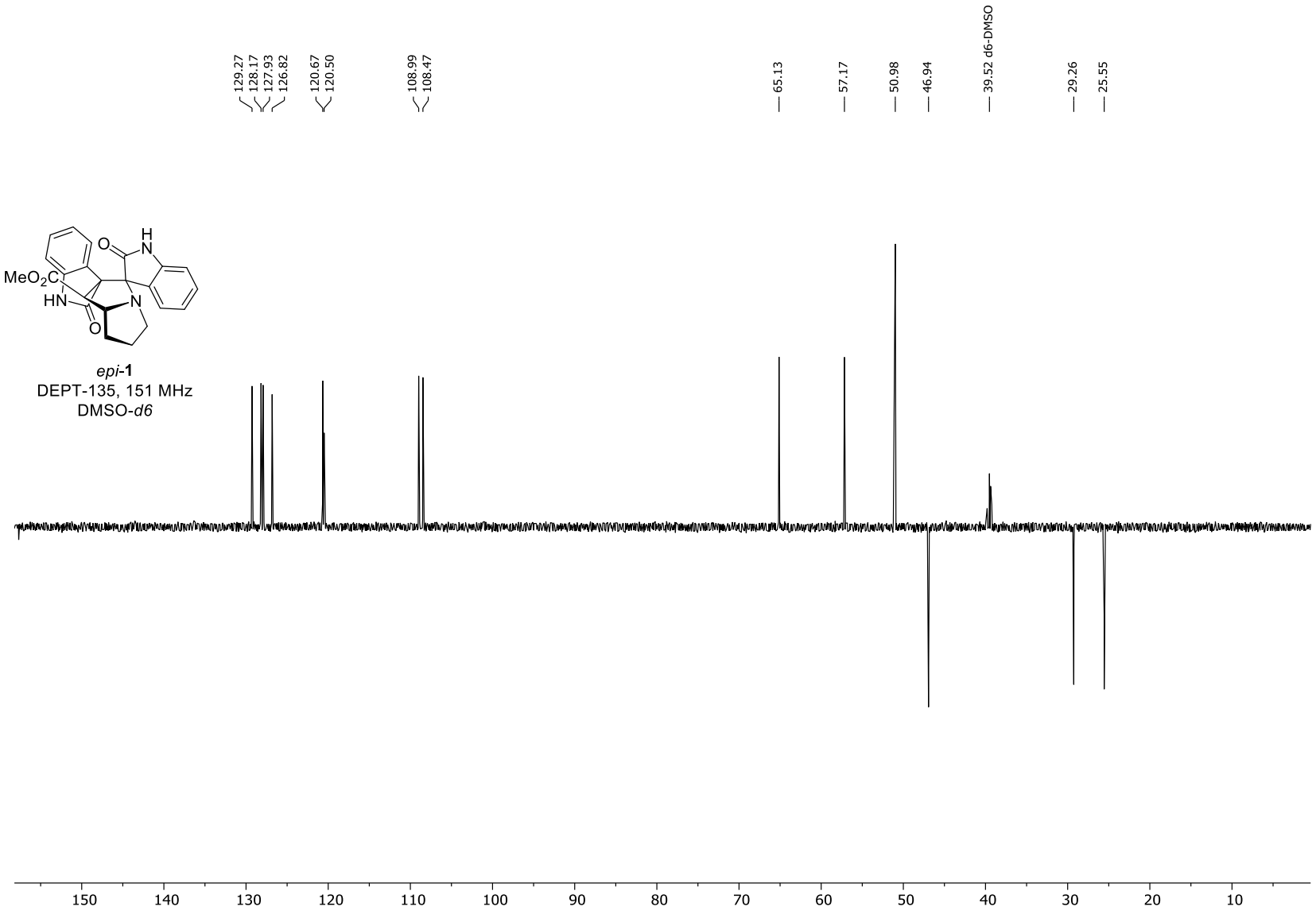
O
H
N
O
N
epi-1
1H NMR, 600 MHz
DMSO-d6
d6-DMSO
H2O
TMS


178.3
175.7
170.2
142.6
142.0
129.5
128.4
128.2
127.1
126.3
124.7
120.9
120.8
109.2
108.7
77.2
66.3
65.4
57.4
51.2
47.2
39.5 d6-DMSO
29.5
25.8
TMS
MeO2C
HN
O
H
N
N
O
epi-1
13C NMR, 151 MHz
DMSO-d6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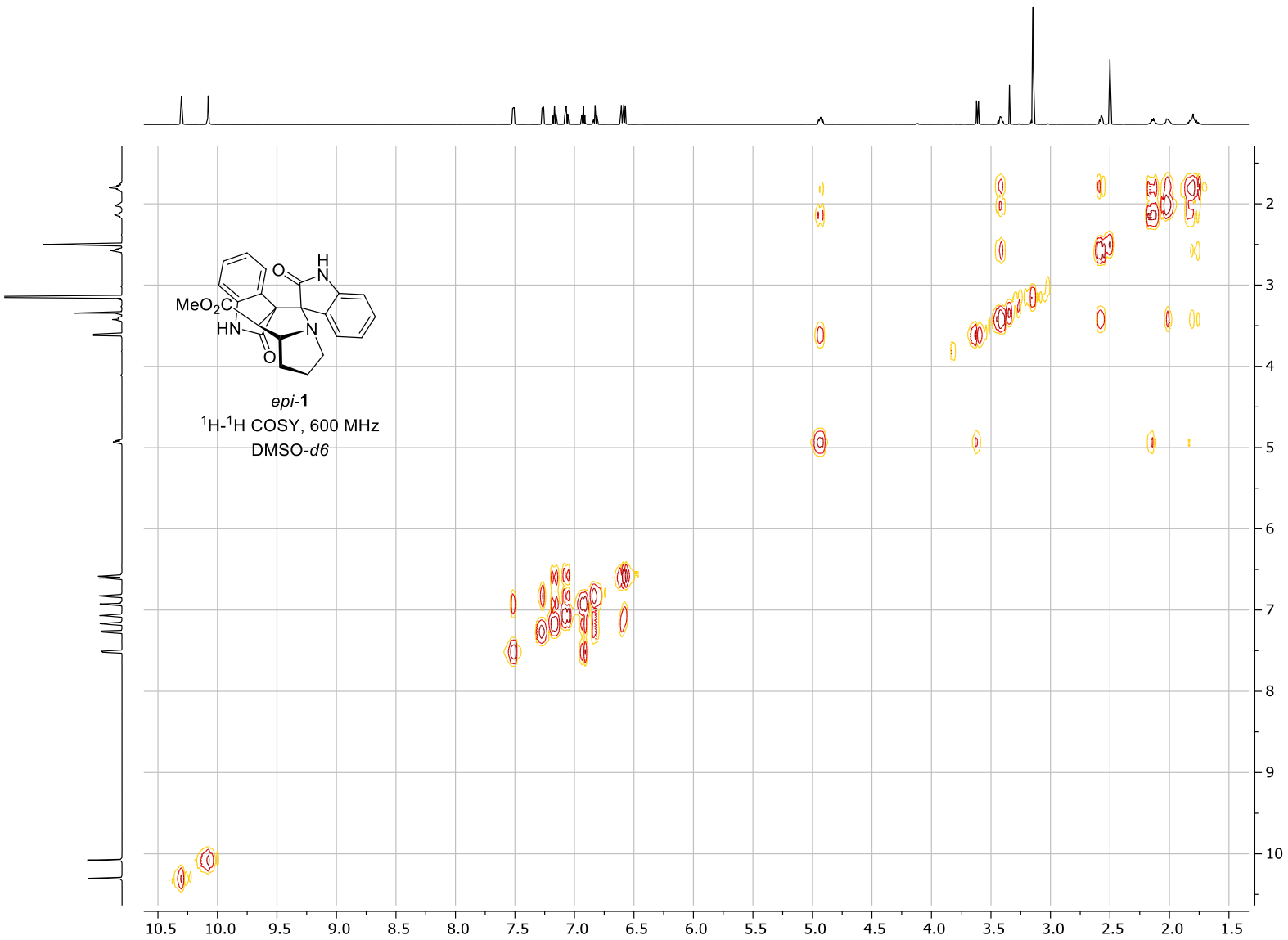
128.17
127.93
126.82
120.67
120.50
108.99
108.47
65.13
57.17
50.98
46.94
39.52 d6-DMSO
29.26
25.55
MeO2C
HN
O
H
N
N
O
epi-1
DEPT-135, 151 MHz
DMSO-d6
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10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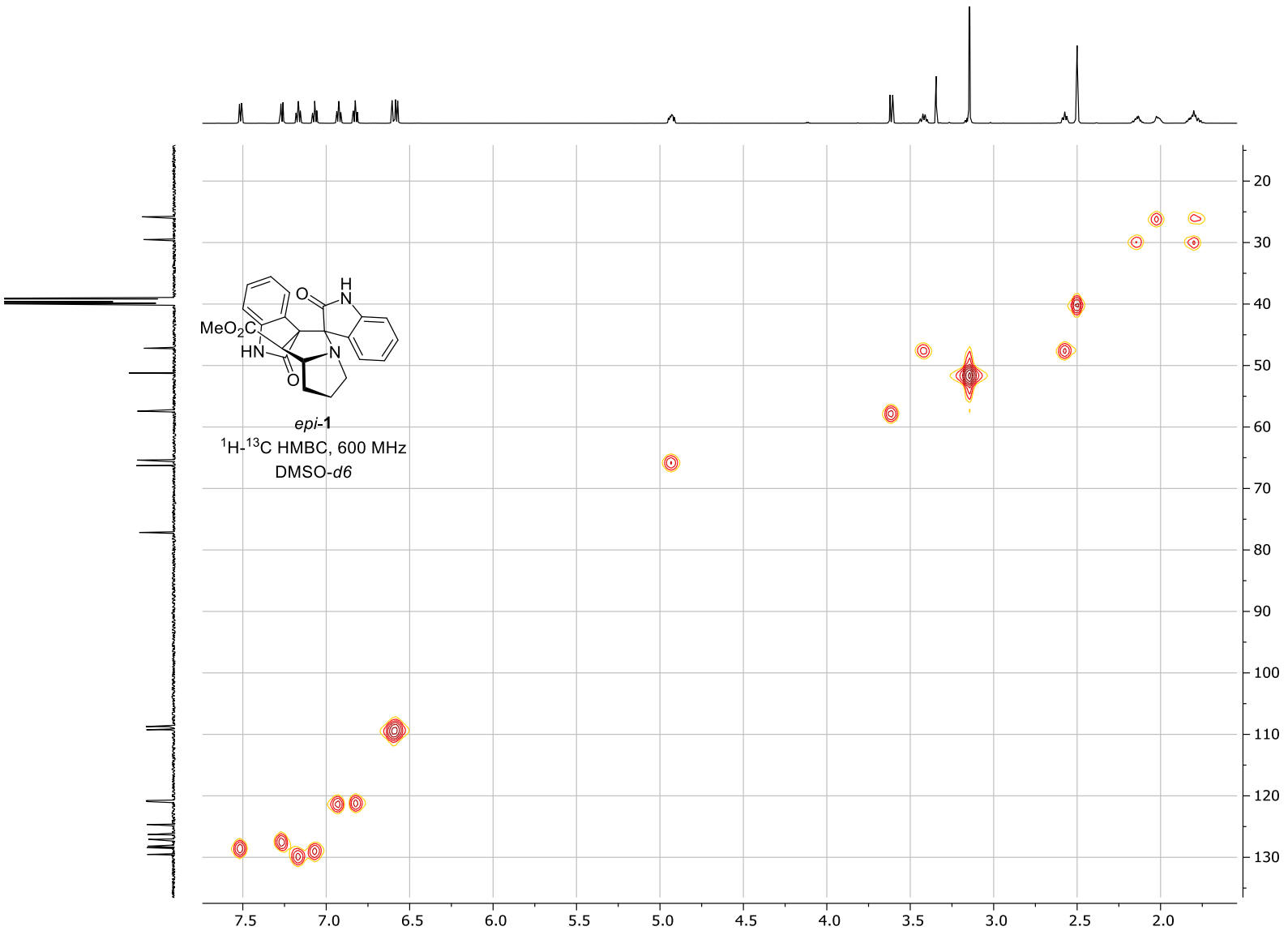
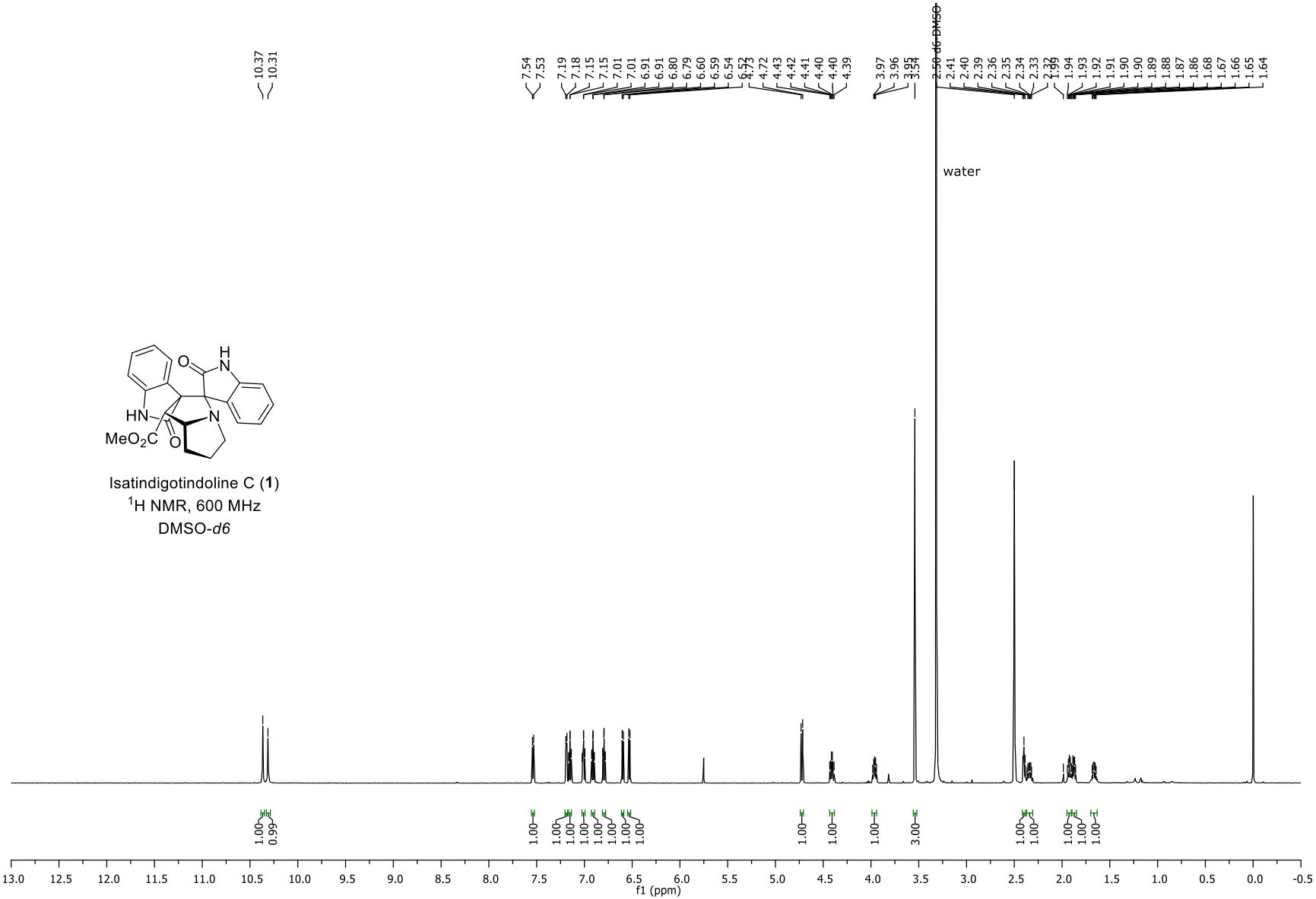
HN
O
H
N
N
O
epi-1
1H-1H COSY, 600 MHz
DMSO-d6
10.5
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
2
3
4
5
6
7
8
9
10


MeO2C
HN
O
H
N
N
O
epi-1
1H-13C HMBC, 600 MHz
DMSO-d6
20
30
40
50
60
70
80
90
100
110
120
130
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0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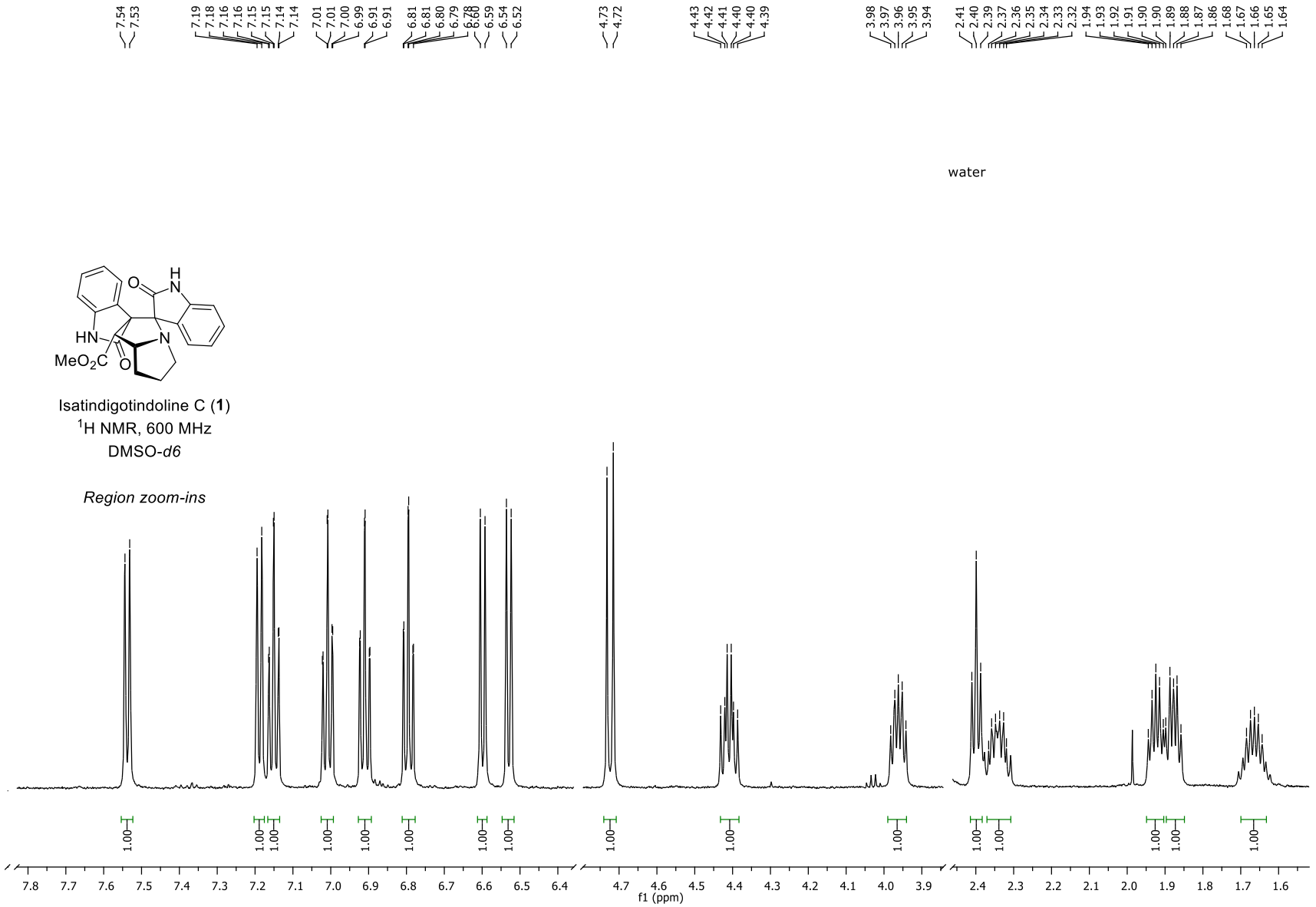
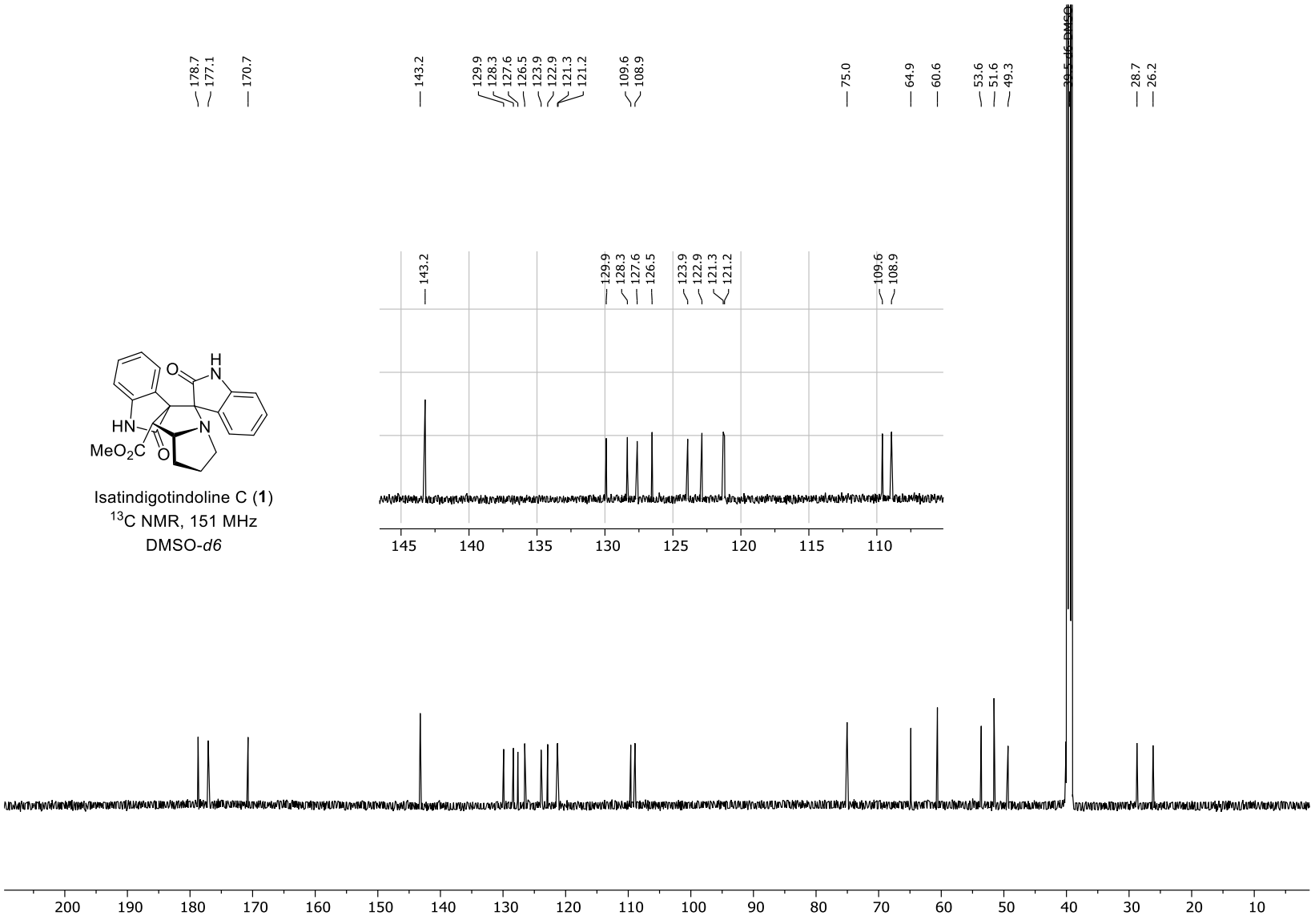
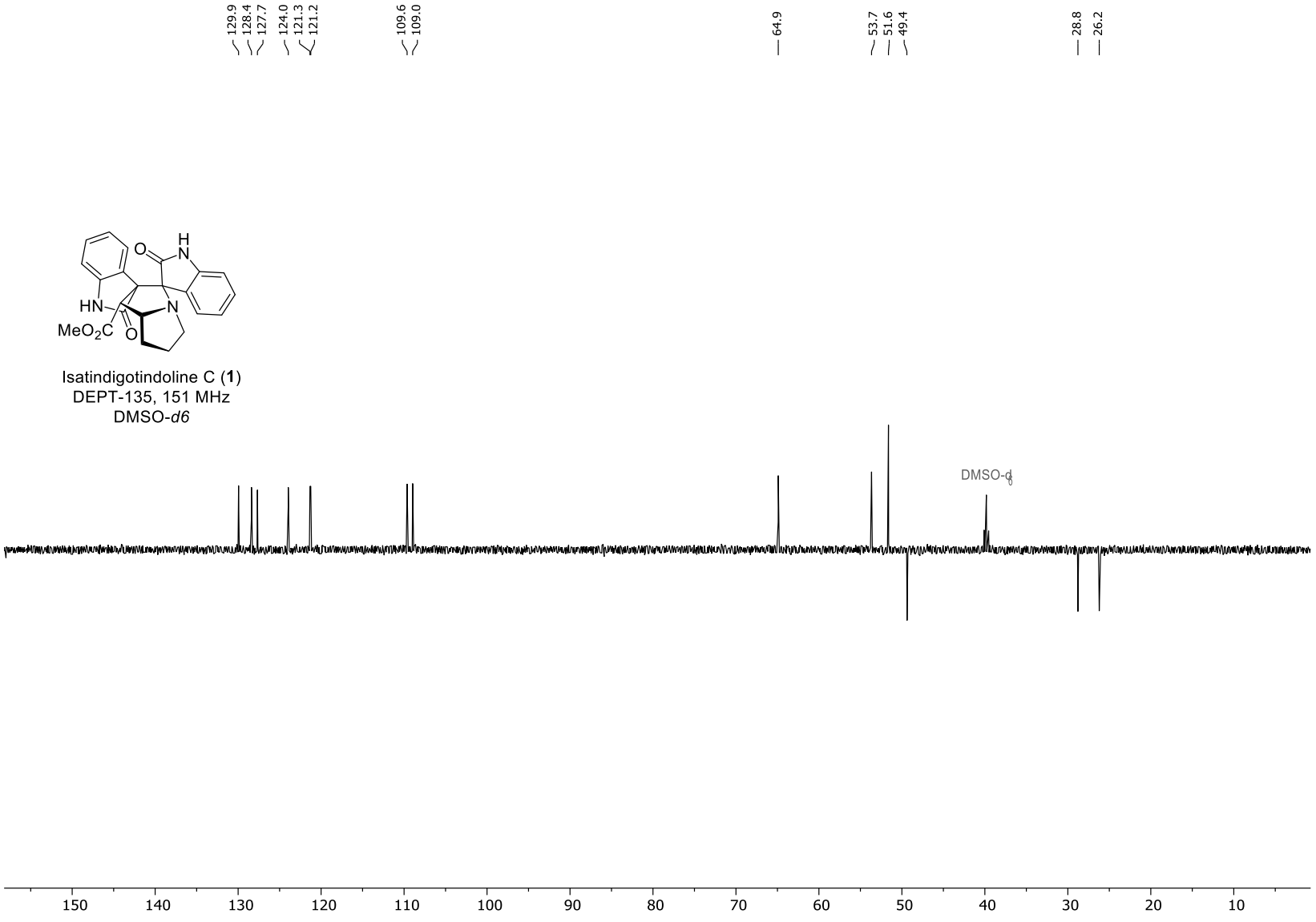
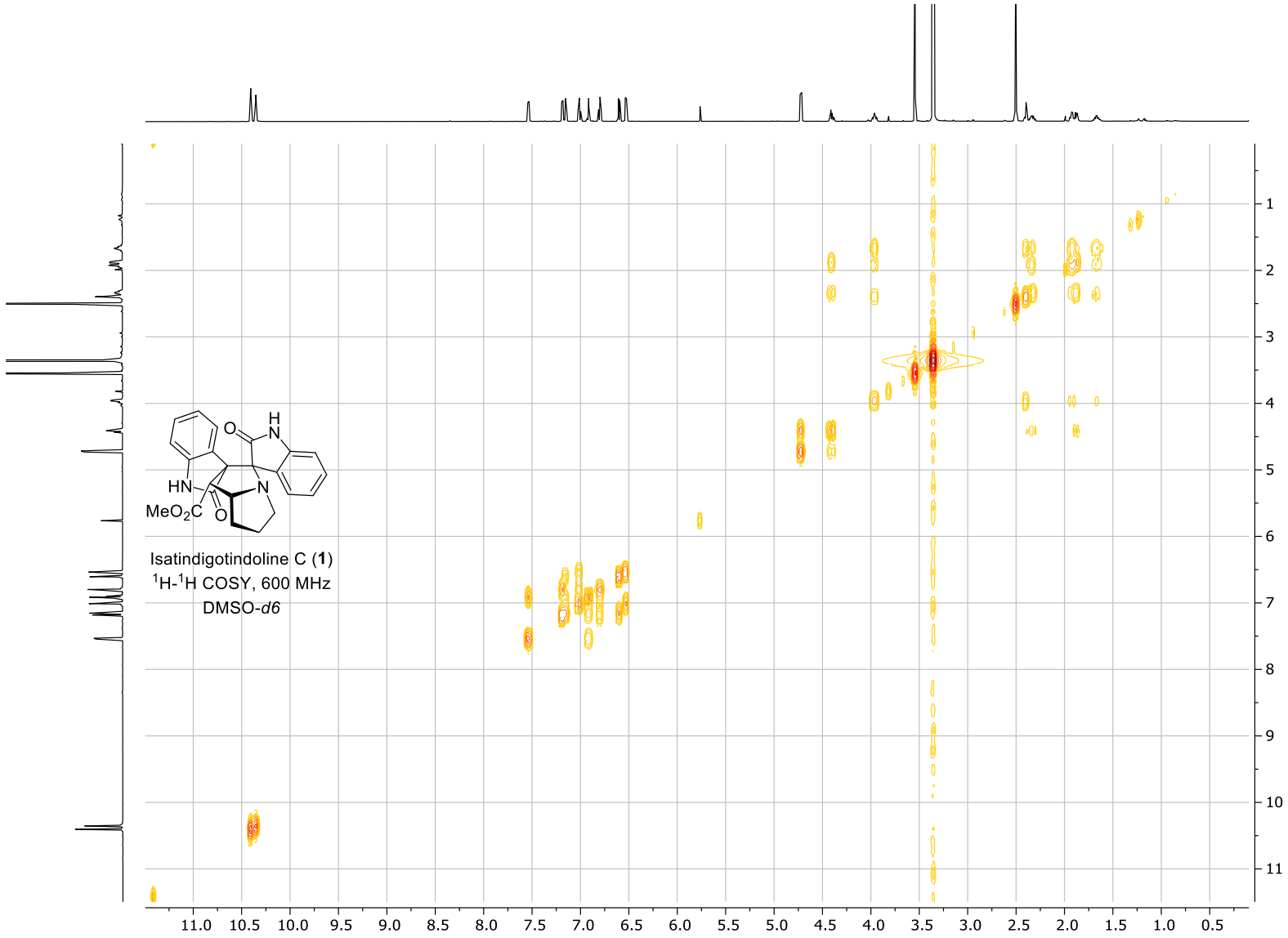
10.31
7.54
7.53
7.19
7.18
7.15
7.15
7.01
7.01
6.91
6.91
6.80
6.79
6.60
6.59
6.54
6.52
4.73
4.72
4.43
4.42
4.41
4.40
4.40
4.39
3.97
3.96
3.95
3.94
2.50 d6-DMSO
2.41
2.40
2.39
2.36
2.35
2.34
2.33
2.32
1.94
1.93
1.92
1.91
1.90
1.90
1.89
1.88
1.87
1.86
1.68
1.67
1.66
1.65
1.64
water
O
H
N
HN
N
MeO2C
O
Isatindigotindoline C (1)
1H NMR, 600 MHz
DMSO-d6
1.00
0.99
1.00
1.00
1.00
1.00
1.00
1.00
1.00
1.00
1.00
3.00
1.00
1.00
1.00
1.00
1.00
13.0
12.5
12.0
11.5
11.0
10.5
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
f1 (ppm)


7.54
7.53
7.19
7.18
7.16
7.16
7.15
7.15
7.14
7.14
7.01
7.01
7.00
6.99
6.91
6.91
6.81
6.81
6.80
6.79
6.78
6.60
6.59
6.54
6.52
4.73
4.72
4.43
4.42
4.41
4.40
4.40
4.39
3.98
3.97
3.96
3.95
3.94
2.41
2.40
2.39
2.37
2.36
2.35
2.34
2.33
2.32
1.94
1.93
1.92
1.91
1.90
1.90
1.89
1.88
1.87
1.86
1.68
1.67
1.66
1.65
1.64
water
O
H
N
HN
N
MeO2C
O
Isatindigotindoline C (1)
1H NMR, 600 MHz
DMSO-d6
Region zoom-ins
1.00
f1 (ppm)


178.7
177.1
170.7
143.2
129.9
128.3
127.6
126.5
123.9
122.9
121.3
121.2
109.6
108.9
75.0
64.9
60.6
53.6
51.6
49.3
39.5 d6-DMSO
28.7
26.2
HN
MeO2C
O
H
N
Isatindigotindoline C (1)
13C NMR, 151 MHz
DMSO-d6


129.9
128.4
127.7
124.0
121.3
121.2
109.6
109.0
64.9
53.7
51.6
49.4
28.8
26.2
O
H
N
HN
N
MeO2C
O
Isatindigotindoline C (1)
DEPT-135, 151 MHz
DMSO-d6
DMSO-d6
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10


Isatindigotindoline C (1)
^{1}H-^{1}H COSY, 600 MHz
DMSO-*d6*
11.0 10.5 10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5
1 2 3 4 5 6 7 8 9 10 11