Electronic Supplementary Material (ESI) for ChemComm.

Electronic Supporting Information

One-pot synthesis of dibenzo[b,h][1,6]naphtylidines from 2-acetylaminobenzaldehyde: Binding Unit for DNA

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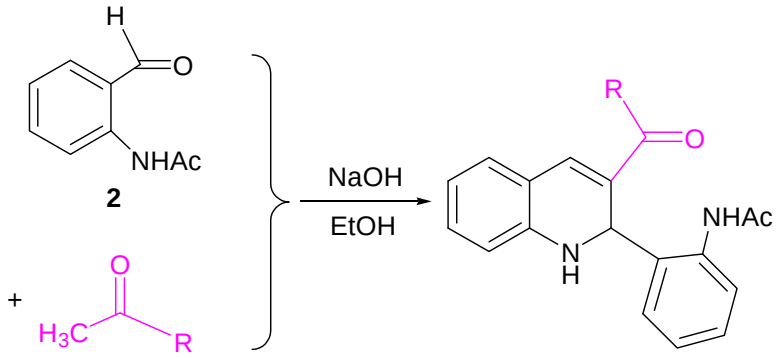
General: All chemicals were obtained from commercial suppliers and were used without further purification. Analytical TLC was carried out on precoated plates (Merck silica gel 60, F254) and flash column chromatography was performed with silica gel (Merck, 70-230 mesh). NMR spectra (^{1}H at 400 MHz; ^{13}C at 100 MHz) were recorded in $CDCl_3$, and chemical shifts are expressed in ppm relative to internal TMS for ^{1}H- and ^{13}C-NMR. Melting points are uncorrected.

Table S-1. Reaction of 2-acetylaminobenzaladehyde **2** with ketones **3**.

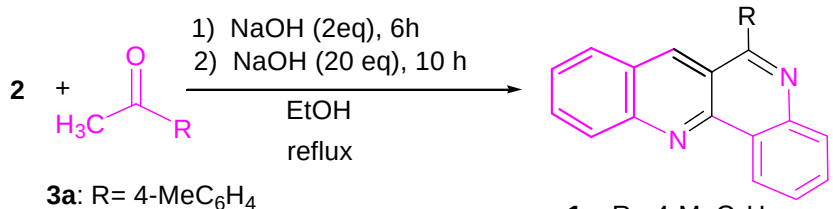


3a: R= 4-MeC_6H_4
3b: R= Ph
3c: R= 4-$MeOC_6H_4$
3d: R= 4-ClC_6H_4
3e: R= 4-BrC_6H_4
3f: R= 4-$NO_2C_6H_4$
3g: R= 1-naphthyl
3h: R= CH_3CH_2
3i: R= 2-pyridyl
3j: R= 2-thienyl

4a: R= 4-MeC_6H_4
4b: R= Ph
4c: R= 4-$MeOC_6H_4$
4d: R= 4-ClC_6H_4
4e: R= 4-BrC_6H_4
4f: R= 4-$NO_2C_6H_4$
4g: R= 1-naphthyl
4h: R= CH_3CH_2
4i: R=2-pyridyl
4j: R= 2-thienyl

Entry	**3**	**2** (eq.)	NaOH (eq)	Time (h)	Temp(^{o}C)	**4**	Yield (%)
1	**3a**	2	1	12	rt	**4a**	52
2	**3a**	2	2	8	reflux	**4a**	80
3	**3b**	2	2	7	reflux	**4b**	90
4	**3c**	2	2	7	reflux	**4c**	55
5	**3d**	2	2	6	reflux	**4d**	99
6	**3e**	2	2	7	reflux	**4e**	96
7	**3f**	2	2	8	reflux	**4f**	71
8	**3g**	2	2.5	7	reflux	**4g**	69
9	**3h**	2	2.5	7	reflux	**4h**	55
10	**3i**	3	2.5	7	reflux	**4i**	55
11	**3j**	2	2.5	7	reflux	**4j**	57

Table S-2. One-pot synthesis of dibenzonaphthyridines 1

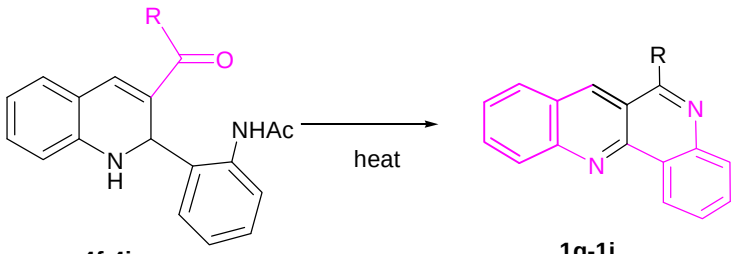


3a: R= 4-MeC_6H_4
3b: R= Ph
3c: R= 4-$MeOC_6H_4$
3d: R= 4-ClC_6H_4
3e: R= 4-BrC_6H_4
3f: R= 4-$NO_2C_6H_4$
3g: R= 1-naphthyl
3h: R= CH_3CH_2
3i: R=2-pyridyl
3j: R= 2-thienyl

1a: R= 4-MeC_6H_4
1b: R= Ph
1c: R= 4-$MeOC_6H_4$
1d: R= 4-ClC_6H_4
1e: R= 4-BrC_6H_4
1f: R= 4-$NO_2C_6H_4$
1g: R= 1-naphthyl
1h: R= CH_3CH_2
1i: R=2-pyridyl
1j: R= 2-thienyl

Entry	**3**	**2** (eq.)	NaOH (eq)	Time (h)	**1**	Yield (%)
1	**3a**	2	1	12	**1a**	70
2	**3b**	2	2	5	**1b**	50
3	**3c**	2	2	5	**1c**	42
4	**3d**	2	2	6	**1d**	55
5	**3e**	2	2	6	**1e**	52
6	**3f**	2	2	8	**1f**	23
7	**3g**	2	2.5	6	**1g**	35
8	**3h**	2	2.5	6	**1h**	30
9	**3i**	3	2.5	6	**1i**	25
10	**3j**	2	2.5	6	**1j**	22

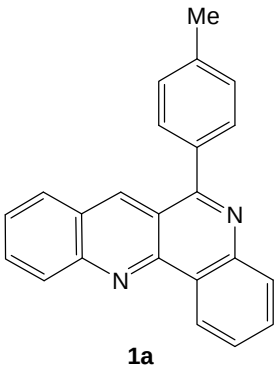
Table S-3. Thermal transformtion of **4f-4g** to **1g-1i**.



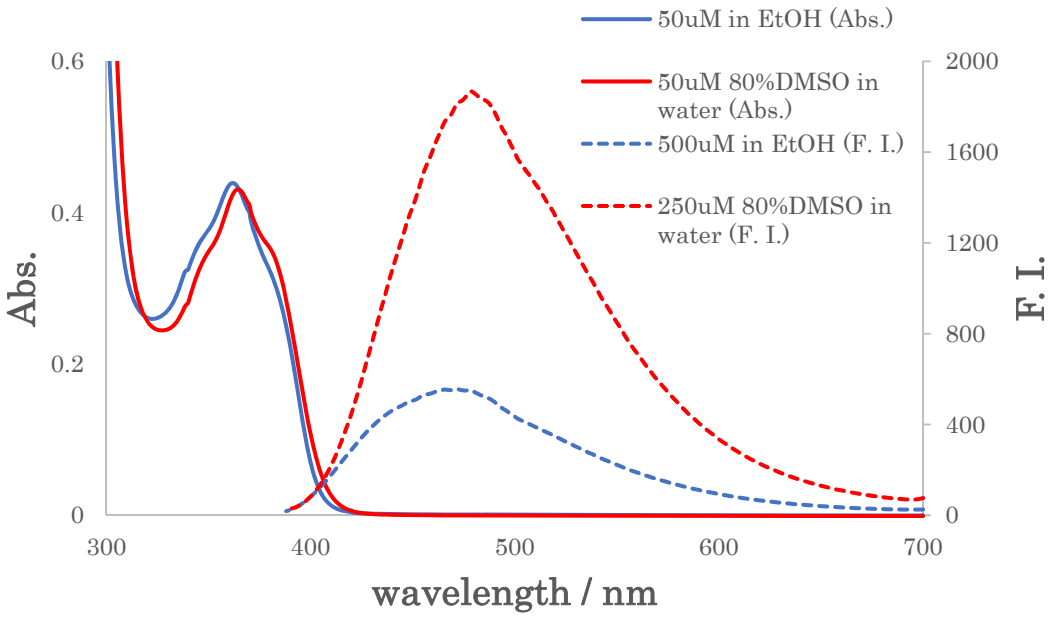
4f-4j **1g-1j**

Entry	**4**	Temp. (°C)	**1**	Yield (%)
1	**4f**	240	**1f**	82
2	**4g**	210	**1g**	76
3	**4h**	210	**1h**	75
4	**4i**	230	**1i**	96
5	**4j**	220	**1j**	89

Figure S-1. UV and fluorescence spectra of Compound **1a** in EtOH and 80% DMSO.

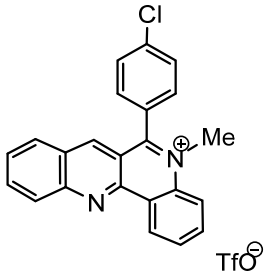


1a

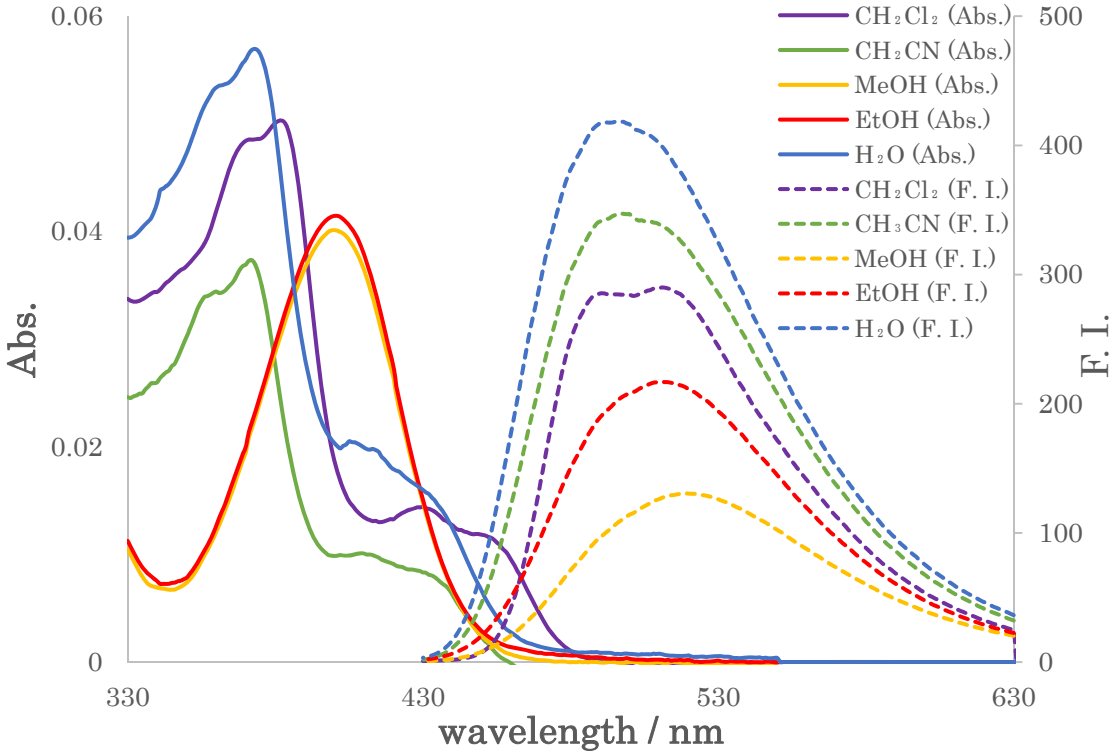


Solvent	Absorption [nm]	Emission [nm]
EtOH	362	472
80%DMSO in H_2O	364	479

Figure S-2. Solvent Effect of Compound **5c**.



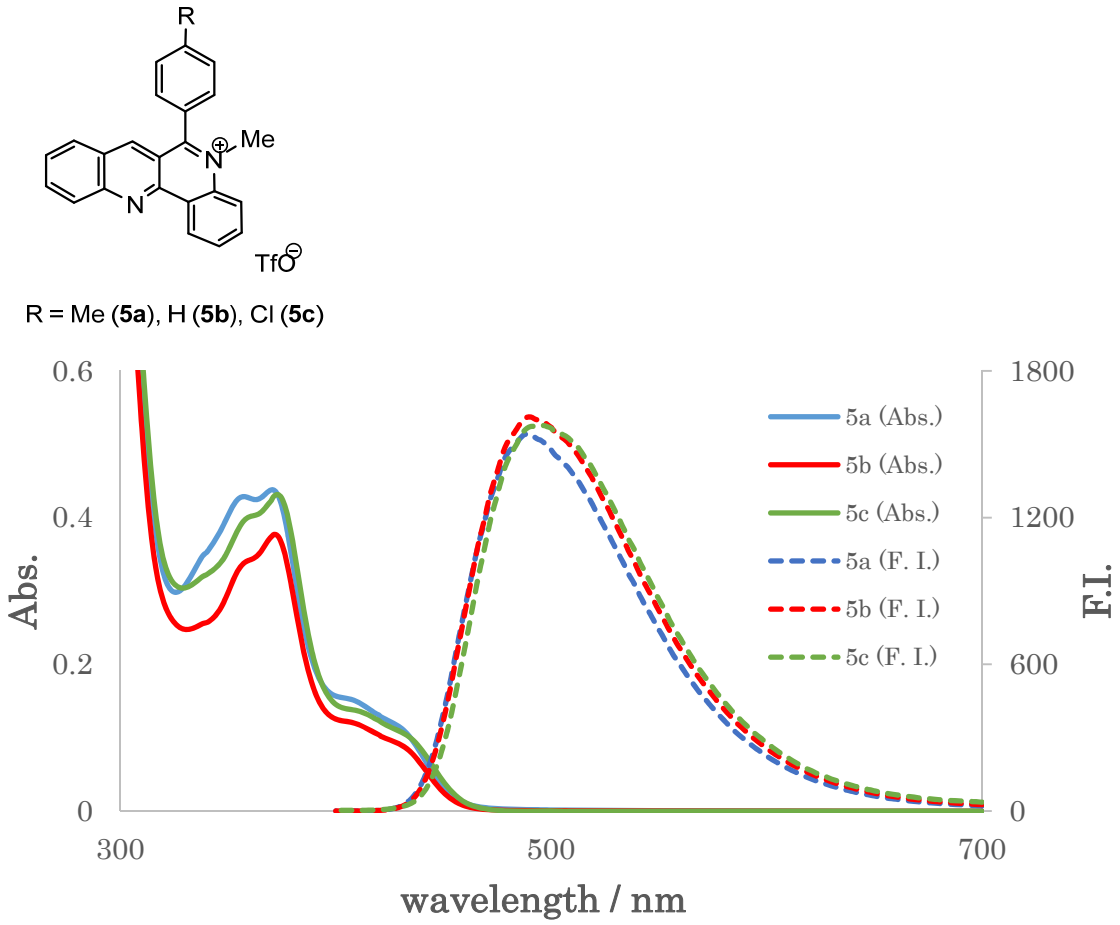
5c



solvent	Absorption [nm]	Emission [nm]	Stokes shift [nm] / [cm^{-1}]
CH_2Cl_2	382	491	108 / 5800
CH_3CN	372	497	124 / 6700
MeOH	400	518	118 / 5700
EtOH	398	513	115 / 5600
H_2O※	373	496	123 / 6600

*containing 0.01% DMSO. Concentration: 5 μM

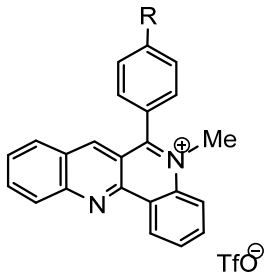
Figure S-3. Substituent Effect of Compound **5a-c** in 0.1% DMSO/water solution.



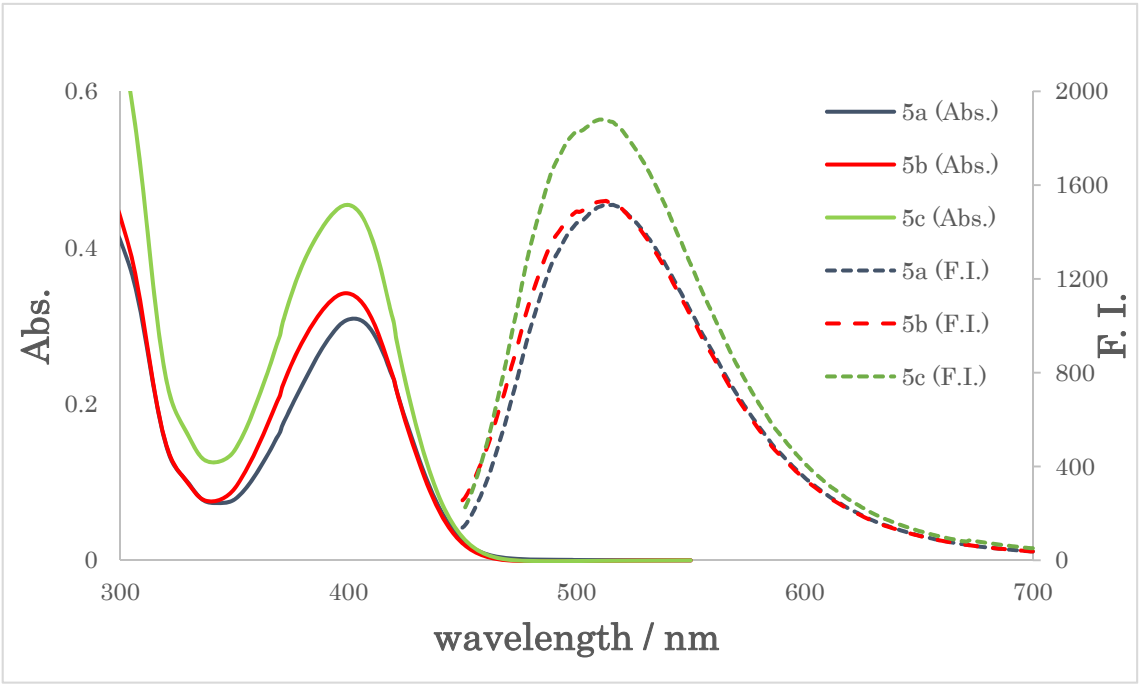
R	Absorption [nm]	Emission [nm]
5a	371	489
5b	372	490
5c	373	495

Concentration 50uM

Figure S-4. Quantum yields of Compound **5a-c** in EtOH.



R = Me (**5a**), H (**5b**), Cl (**5c**)



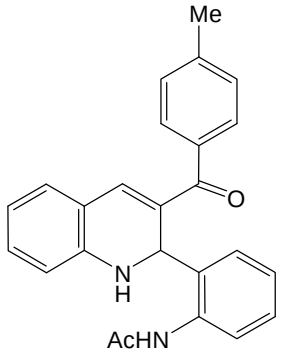
R	Absorption [nm]	Emission [nm]	ε	Quantum yield
5a	405	513	7600	0.15
5b	404	513	7300	0.17
5c	405	513	7200	0.18

Concentration: 50 μM

Experimental

Reaction of N-acetyl 2-acetylaminobenzoaldehyde 2a with 4-methylacetophenone 3a

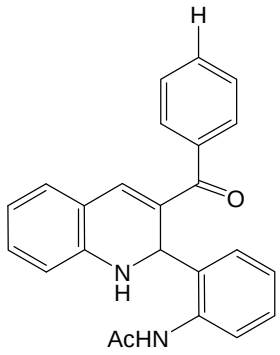
To a solution of aldehyde **2a** (0.180 g, 1.1 mmol) and 4-methylacetophenone **3a** (0.67 mg, 0.50 mmol) in ethanol (5 mL) was added 5 M aq. NaOH (0.42 mL) at rt. After refluxing for 8 h, the solution was concentrated to half volume and the reaction mixture was standing for additional 2h. When the solution temperature was reached to rt, orange crystals were precipitated, which were collected by filtration to afford almost pure dihydroquinoline **4a** (0.16 g, 0.41 mmol). Recrystallization from ethanol gave analytically pure sample.



4a

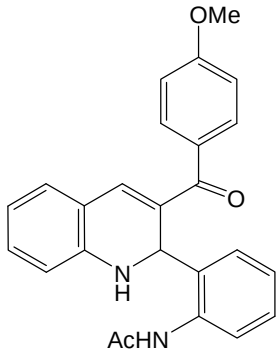
4a: orange crystals, mp 234-236 °C, ^{1}H NMR（$CDCl_3$）δ=2.29 (s, 3H, Me), 2.40 (s, 3H, Me), 4.80 (br, 1H, NH), 6.09 (s, 1H, CH), 6.43 (d, 1H, *J* = 8.0 Hz, Ar), 6.60 (dd, 1H, *J* = 6.4 and 7.2 Hz, Ar), 6.98 (dd, 1H, *J* = 7.6 and 1.4 Hz, Ar), 7.05-7.15 (m, 2h, Ar), 7.20-7.27 (m, 4H, Ar), 7.46 (dd, 2H, *J* = 8.0 and 1.6 Hz, Tol), 7.54 (dd, 1H, *J* = 8.0 and 1.4 Hz, Ar), 7.69 (dd, 1H, *J* = 8.0 and 1.4 Hz, Ar), 9.05 (br, 1H, NH). ^{13}C NMR ($CDCl_3$) δ = 21.8 (Me), 24.4 (Me), 50.0 (CH), 113.3, 116.9, 117.7, 125.7, 126.8, 128.7, 129.3, 129.3, 130.5, 131.3, 132.0, 133.7, 135.6, 138.9, 141.1, 142.7, 145.3 (Ar), 169.9 (C=O), 196.8 (C=O). Anal. Calcd for $C_{25}H_{22}N_2O_3$: C, 78.51; H, 5.80; N, 7.32. Found: C, 78.22; H,

5.82, N, 7.57.



4b

4b: orange crystals: mp 242-244 °C. ^{1}H NMR（$CDCl_3$） δ = 2.29 (s, 3H, Me), 4.85 (bd, 1H, CH), 6.10 (s, 1H, =CH), 6.44 (d, *J* = 8.1 Hz, 1H, Ar), 6.60 (t, *J* = 7.9 Hz, 1H, Ar), 6.99 (d, *J* = 7.6 Hz, 1H, Ar), 7.11 (t, *J* = 7.1 Hz, 1H, Ar), 7.14 (t, *J* = 6.5 Hz, 1H, Ar), 7.22-7.26 (m, 2H, Ar), 7.41-7.45 (m, 2H, Ar), 7.51-7.56 (m, 4H, Ar), 7.69 (s, *J* = 7.8 Hz, 1H, Ar), 9.05 (s, 1H, NH). ^{13}C NMR ($CDCl_3$) δ = 24.4 (Me), 50.0 (CH), 113.3, 116.8, 117.7, 125.7, 126.9, 128.0, 128.6, 128.7, 129.0, 130.7, 131.9, 133.9, 138.4, 138.9, 141.6, 145.4 (Ar), 169.9 (C=O), 197.0 (C=O). Anal. Calcd for $C_{24}H_{20}N_2O_2$: C, 78.24; H, 5.47; N, 7.60. Found: C, 78.02; H, 5.76; N, 7.89.

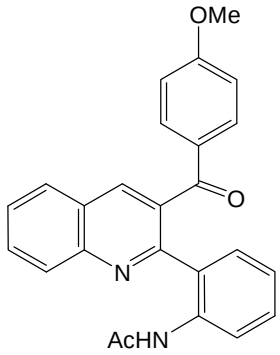


4c

Compound **4c**: red crystals, mp 217-219 °C. ^{1}H NMR ($CDCl_3$) δ = 2.26 (s, 3H, Me), 3.85 (s, 3H, OMe), 4.80 (br, 1H, NH), 6.10 (s, 1H, CH), 6.42 (d, 1H, *J* = 8.0 Hz, Ar), 6.58 (dt, 1H, *J* = 1.4 Hz, 7.6 Hz, Ar), 6.91 (d, 2H, *J* = 8.8 Hz, $MeOC_6H_4$), 6.99 (dd, 1H, *J* = 7.6

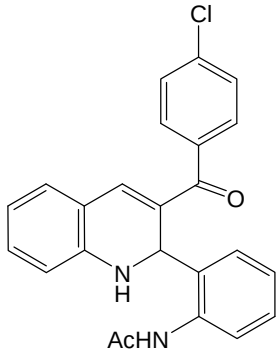
and 1.6 Hz, Ar), (7.05-7.14 (m, 2H, Ar), 7.20 (s, 1H, Ar), 7.21 (dt, 1H, *J* = 1.4 and 7.6 Hz, Ar), 7.53 br d, *J* =8.2 Hz, Ar), 7.58 (d, 2H, *J* = 8.8 Hz, MeO C_6H_4), 7.69 (dd, 1H, *J* = 1.4 and 8.0 Hz, Ar), 9.02 (NH). ^{13}C NMR ($CDCl_3$) δ = 24.4 (Me), 50.2 (CH), 55.7 (OMe), 112.2, 113.9, 116.9, 117.6, 125.6, 126.8, 128.1, 128.6, 130.8, 131.4, 131.4, 132.1, 133.5, 138.9, 140.1, 145.2, 163.0 (Ar), 169.9 (C=O), 195.8 (C=O). Anal. Calcd for $C_{25}H_{22}N_2O_3$: C, 75.36; H, 5.57; N, 7.03. Found: C, 75.09; H, 5.51; N, 7.05.

When compond **4c** (20 mg, 0.050 mmol) in CH_2Cl_2 (10 mL) in Erlenmeyer flask was stirred for 24 hr at rt, **4c** was oxidized to the corresponding quinoline **4c'** (16 mg, 0.040 mmol).



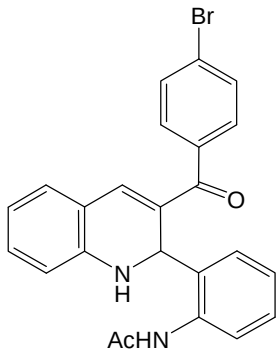
4c'

Compound **4c'**: yellow crystals, mp 94-97 ºC. ^{1}H NMR ($CDCl_3$) δ = 2.18 (s, 3H, Me), 3.80 (s, 3H, OMe), 6.75 (d, 2H, *J* = 8.0 Hz, Ar), 6.88 (dd, 1H, *J* = 7.6 Hz and 8.0 Hz, Ar), 7.21-7.26 (m, 2H, Ar), 7.59 (d, 2H, *J* = 8.0 Hz, Ar). 7.67 (dd, 1H, *J* = 7.8 Hz and 8.0 Hz, Ar), 7.87 (dd, 1H, *J* = 7.8 Hz and 8.4 Hz, Ar), 7.95 (d, 1H, *J* = 8.0, Ar), 8.17 (d, 1H, *J* = 8.4 Hz. Ar), 8.31 (d, 1H, *J* = 7.6 Hz, Ar), 8.45 (s, 1H, Ar). 10.77 (br, 1H, NH). ^{13}C NMR ($CDCl_3$) δ = 25.3 (Me), 55.7 (OMe), 114.0, 122.3, 123.6, 126.0, 127.1, 128.1, 128.6. 128.8, 129.8, 130.3, 131.2, 131.9, 132.3, 134.6, 136.6, 138.9, 147.1, 156.4, 164.1 (Ar), 168.3, 194.9 (C=O). MS (ESI): Calcd for $C_{25}H_{20}N_2O_3$: m/z 419. [(M^++Na)]. Found: 419.



4d

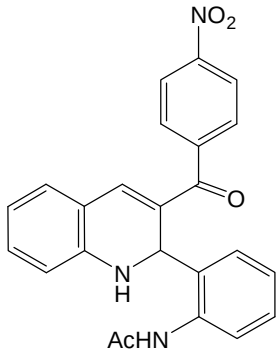
Compound **4d**: orange crystals, mp 242-244 °C. ^{1}H NMR（$CDCl_3$） δ = 2.27 (s, 3H, Me), 4.90 (br, 1H, NH), 6.06 (s, 1H, CH), 6.43 (d, 1H, *J* = 8.0 Hz, Ar), 6.60 (t, 1H, *J* = 7.6 Hz, Ar), 6.99 (d, 1H, *J* = 7.6 Hz, Ar), 7.06-7.17 (m, 2H, Ar), 7.21 (s, 1H, Ar), 7.21-7.26 (m, 1H, Ar), 7.41 (d, 2H, *J* = 8.4 Hz, ClC_6H_4), 7.48-7.54 (m, 3H, Ar and ClC_6H_4), 7.67, dd, 1H, *J* = 7.6 and 1.4 Hz, Ar), 8.94 (br, 1H, NH). ^{13}C NMR ($CDCl_3$) δ = 24.3 (Me), 49.9 (CH), 113.4, 116.7, 117.8, 125.8, 127.0. 128.0, 128.9, 130.4, 130.9, 131.9, 134.1, 136.7, 138.3, 138.9, 141.6, 145.5 (Ar), 170.0 (C=O), 195.6 (C=O). Anal. Calcd for $C_{24}H_{19}ClN_2O_2$: C, 71.55; H, 4.75; N, 6.95. Found: C, 71.58; H, 5.07; N, 7.13.



4e

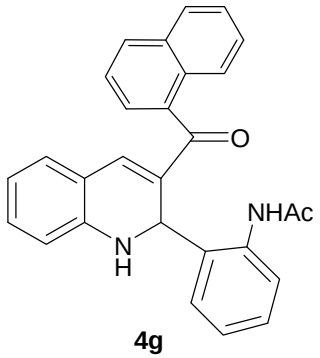
Compound **4e**: orange crystals, mp 257-258 °C. ^{1}H NMR ($CDCl_3$) δ = 2.29 (s, 3H, Me),

4.85 (br, 1H, NH), 6.07 (s, 1H, Ar), 6.44 (d, 1H, *J* = 8.8 Hz, Ar), 6.61 (d, 1H, *J* = 7.6 Hz, Ar), 6.99 (d, 1H, *J* = 7.6 Hz, Ar), 7.08-7.18 (m, 2H, Ar), 7.21 (s, 1H, Ar), 7.21-7.26 (m, 1H, Ar), 7.43 (d, 2H, *J* = 8.8 Hz, BrC_6H_4), 7.53 (d, 1H, *J* = 8.4 Hz, Ar), 7.59 (d, 2H, *J* = 8.8 Hz, BrC_6H_4), 7.67 (dd, 1H, *J* = 1.4 and 7.6 Hz, Ar), 8.91 (br, 1H, NH). ^{13}C NMR ($CDCl_3$) δ = 24.4 (Me), 49.9 (CH), 113.4, 116.7, 117.8, 125.8, 126.7, 126.7, 127.0, 128.0, 128.9, 130.6, 130.9, 131.9, 134.1, 137.2, 138.9, 141.7, 145.4 (Ar), 169.9 (C=O), 195.7 (C=O). Anal. Calcd for $C_{24}H_{19}BrN_2O_2$: C, 64.44; H, 4.28; N, 6.26. Found: C, 64.13; H, 4.68; N, 6.34.



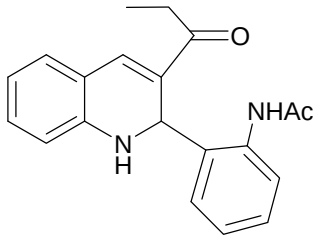
4f

Compound **4f**: red crystals, mp 229-230 ^{o}C. ^{1}H NMR ($CDCl_3$) δ = 2.30 (s, 3H, Me), 4.98 (br, 1H, NH), 6.07 (s, 1H, CH), 6.46 (d, 1H, *J* = 8.0 Hz, Ar), 6.61 (t, 1H, *J* = 7.6 Hz, Ar), 6.98 (d, 1H, *J* = 8.4 Hz, Ar), 7.12-7.18 (m, 2H, Ar), 7.18 (s, 1H, Ar), 7.28 (t, 1H, *J* = 7.6 Hz, Ar), 7.51 (d, 1H, *J* = 8.0 Hz, Ar), 7.65-7.71 (m, 3H, $NO_2C_6H_4$ and Ar), 8.29 (d, 2H, *J* = 8.8 Hz, $NO_2C_6H_4$), 8.74 (br, 1H, NH). ^{13}C NMR ($CDCl_3$) δ = 24.3 (Me), 49.8 (CH), 113.7, 116.4, 118.0, 123.9, 126.0, 127.3, 128.0, 129.0, 129.8, 131.0, 131.8, 134.7, 138.9, 142.9, 144.1, 145.7, 149.6 (Ar), 170.0 (C=O), 194.6 (C=O). Anal. Calcd for $C_{24}H_{19}N_3O_4$: C, 69.72; H, 4.63; N, 10.16. Found: C, 69.34; H, 4.81; N, 9.80.



4g

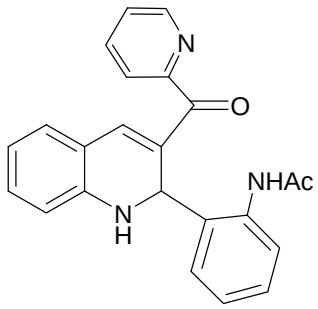
Compound **4g**: red crystals, mp 203-204 ^{o}C. ^{1}H NMR ($CDCl_3$) δ = 2.33 (s, 3H, Me), 4.91 (bd, 1H, NH), 6.21 (s, 1H, CH), 6.46 (d, 1H, *J* = 8.2 Hz, Ar), 6.55 (t, 1H, *J* = 7.8 Hz, Ar), 6.85 (d, 1H, *J* = 8.4 Hz, Ar), 7.12-7.18 (m, 3H, Ar), 7.30 (t, 1H, *J* = 8.4 Hz, Ar), 7.37-7.43 (m, 2H, Ar), 7.46-7.51 (m, 2H, Ar), 7.59 (d, 1H, *J* = 8.0 Hz, Ar), 7.65 (d, 1H, *J* = 6.4 Hz, Ar), 7.72 (d, 1H, *J* = 8.8 Hz, Ar), 7.88 (d, 1H, *J* = 8.4 Hz, Ar), 7.95 (d, 1H, *J* = 8.4 Hz, Ar), 9.14 (bd, 1H, NH) ^{13}C NMR ($CDCl_3$) δ = 24.3 (Me), 49.5 (CH), 113.5, 116.6, 117.6, 124.7, 125.3, 125.8, 126.3, 126.7, 127.0, 127.4, 128.0, 128.6, 128.9, 130.7, 130.9, 131.9, 132.7, 133.8, 134.2, 136.4, 139.1, 142.7, 145.8 (Ar), 170.1 (C=O), 198.6 (C=O). Anal. Calcd for $C_{28}H_{22}N_2O_2$: C, 80.36; H, 5.30; N, 6.69. Found. C, 80.52; H, 5.24; N, 6.83.



4h

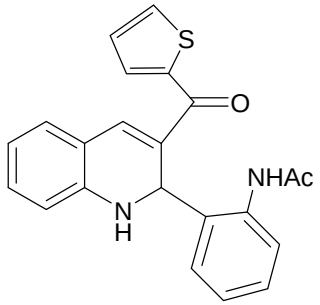
Compound **4h**: yellow crystals, mp 203-204^{o}C. ^{1}H NMR ($CDCl_3$) δ = 1.09 (t, 3H, *J* = 7.2 Hz, Me) 2.29 (s, 3H, Me), 2.66-2.72 (m, 1H, Me), 2.82-2.88 (m, 1H, Me), 4.76 (bd, 1H, NH), 5.83 (s, 1H, CH), 6.42 (d. 1H, *J* = 8.2 Hz, Ar), 6.65 (t, 1H, *J* = 7.6 Hz, Ar), 7.03 (t, 1H, *J* =7.6 Hz, Ar), 7.10 (t, 1H, *J* = 8.4 Hz, Ar), 7.13 (t, 1H, *J* = 7.6 Hz, Ar), 7.22 (t, 1H,

J = 7.6 Hz, Ar), 7.50 (s, 1H, Ar), 7.55 (t, 2H, *J* = 7.6 Hz, Ar), 9.15 (br, 1H, NH) ^{13}C NMR ($CDCl_3$) δ = 8.8 (Me), 24.2 (Me), 30.2 (CH_2), 48.9 (CH), 113.3, 116.8, 117.6, 125.5, 126.6, 127.6, 128.5, 130.3, 131.3, 131.5, 133.4, 136.7, 138.8, 145.4 (Ar), 169.7 (C=O), 201.2 (C=O). Anal. Calcd for $C_{20}H_{20}N_2O_2$: C, 74.98; H, 6.29; N, 8.74. Found. C, 74.74; H, 6.21; N, 8.52.



4i

Compound **4i**: red crystals, mp 228-229 ^{o}C. ^{1}H NMR ($CDCl_3$) δ = 2.30 (s, 3H, Me), 4.87 (bd, 1H, NH), 6.08 (s, 1H, CH_2), 6.43 (d, 1H, *J* = 8.4 Hz, Ar), 6.61 (t, 1H, *J* = 7.6 Hz, Ar), 7.07-7.10 (m, 2H, Ar), 7.14 (t, 1H, *J* = 7.6 Hz, Ar), 7.21 (t, 1H, *J* = 7.6 Hz, Ar), 7.43 (t, 1H, *J* = 6.2 Hz, Ar), 7.54 (d, 1H, *J* = 7.6 Hz, Ar), 7.68 (d, 1H, *J* = 7.6 Hz, Ar), 7.72 (d, 1H, *J* = 7.6 Hz, Ar), 7.81 (t, 1H, *J* = 7.6 Hz, Ar), 8.06 (s, 1H, Ar), 8.68 (d, 1H, *J* = 4.8 Hz, Ar), 9.10 (bd, 1H, NH). ^{13}C NMR ($CDCl_3$) δ = 24.1 (Me), 49.7 (CH_2), 113.2, 117.1, 117.5, 124.1, 125.5, 125.7, 126.7, 128.0, 128.5, 129.7, 131.1, 131.8, 133.9, 137.0, 138.6, 143.8, 145.4, 148.6, 155.8, 169.6 (C=O), 192.2 (C=O). Anal. Calcd for $C_{23}H_{19}N_3O_2$: C, 74.78; H, 5.18; N, 11.37. Found. C, 74..41; H, 5.34; N, 11.52.

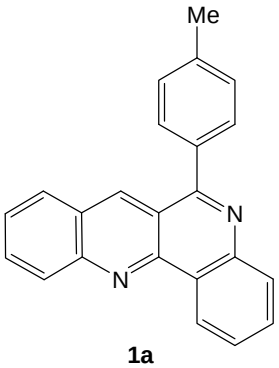


4j

Compound **4i**: red crystals, mp 217-219 ˚C. ^{1}H NMR ($CDCl_3$) δ = 2.28 (s, 3H, Me), 4.80 (bd, 1H, NH), 6.09 (s, 1H, CH), 6.44 (d, 1H, *J* = 8.0, Ar), 6.63 (t, 1H, *J* = 7.6, Ar), 7.06-7.16 (m, 4H, Ar), 7.23 (t, 1H, *J* = 8.0, Ar), 7.49 (d, 1H, *J* = 8.0, Ar), 7.57 (s, 1H,Ar), 7.60-7.62 (m, 2H, Ar), 7.69 (d, 1H, *J* = 7.6, Ar), 8.74 (bd, 1H, NH) ^{13}C NMR ($CDCl_3$) δ = 24.5 (Me), 50.5 (CH), 113.4, 116.9, 117.7, 125.8, 127.0,127.9, 128.3, 128.7, 130.5, 131.5, 132.2, 133.0, 133.1, 133.6, 134.0, 139.2, 142.8, 145.4 (Ar), 170.1 (C=O), 187.2 (C=O). Anal. Calcd for $C_{22}H_{18}N_2O_2S$: C, 70.57; H, 4.85; N, 7.48. Found. C, 70.83; H, 4.96; N, 7.40.

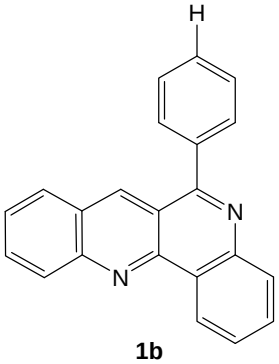
One-pot synthesis of naphthyridine 1a

To a solution of aldehyde **2** (1.34 g, 8.2 mmol) and acetophenone **3a** (0.54 g, 4.0 mmol) in ethanol (80 mL) was added 5 M NaOH (1.2 mL) at rt. After refluxing for 6 h, 20 M NaOH (8.0 mL) was added. After refluxing for 10 h, the reaction mixture was poured into water (20 mL) and extracted with EtOAc for three times. The combined extract was dried over magnesium sulfate, filtered, and evaporated to give orange solid, which was chromatographed over silica gel by elution with hexane-ethyl acetate to give pale yellow crystals of **1a** (0.89 g, 2.78 mmol). Recrystallization from ethanol gave pure **1a**.



1a

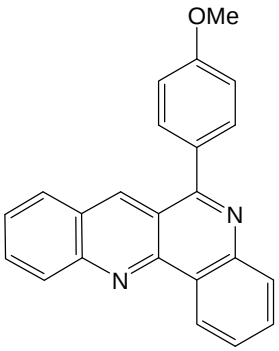
Compound **1a**: pale yellow crystals, mp 193-195 °C. ^{1}H NMR ($CDCl_3$) δ = 2.51 (s, 3H, Me), 7.42 (d, 2H, *J*= 8.0 Hz, Tol), 7.55 (t, 1H, *J*= 7.6 Hz, Ar), 7.71 (d, 2H, *J*= 8.0 Hz, Tol), 7.74 (t, 1H, *J* = 7.2 Hz, Ar), 7.80-7.91 (m, 2H, Ar), 7.92 (d, 1H, *J*= 8.0 Hz, Ar), 8.20 (d, 1H, *J*= 8.0 Hz, Ar), 8.34 (d, 1H, *J*= 8.4 Hz, Ar), 8.90 (s, 1H, Ar), 9.33 (d, 1H, *J*= 8.0 Hz, Ar). ^{13}C NMR ($CDCl_3$) δ = 21.7 (Me), 119.1, 124.5, 125.0, 126.6, 126.9, 127.6, 129.3, 129. 6, 129.7, 129.9, 130.0, 131.0, 132.1, 136.3, 137.9, 145.7, 148.9, 149.9, 162.1 (Ar). Anal. Calcd for $C_{23}H_{16}N_2$: C, 86.22; H, 5.03; N, 8.74. Found: C, 85.90; H, 5.59; N, 8.97.



1b

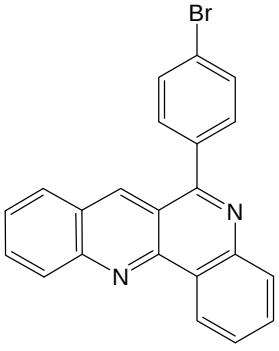
Compound **1b**: pale yellow crystals, mp 208-209 °C. ^{1}H NMR ($CDCl_3$) δ = 2.51 (s, 3H, Me), 7.57-7.67 (m, 4H, Ar), 7.78 (dt, 1H, *J*= 1.2 and 7.2 Hz, Ar), 7.82 (dd, 2H, *J*= 1.2 and 8.0 Hz, Ph), 7.87 (dt, 1H, *J*= 1.2 and 7.2 Hz, Ar), 7.92 (dt, 1H, *J*= 1.2 and 7.2 Hz, Ar), 8.00 (d, 1H, *J*= 8.4 Hz, Ar), 8.23 (d, 1H, *J*= 8.0 Hz, Ar), 8.39 (d, 1H, *J*= 8.4 Hz, Ar), 8.92 (s, 1H, Ar), 9.38 (dd, 1H, *J*= 1.2 and 8.0 Hz, Ar). ^{13}C NMR ($CDCl_3$) δ = 118.9, 124.5,

125.0, 126.6, 126.9, 127.7, 128.9, 129.2, 129.5, 129.7, 129.9, 130.1, 131.0, 132.2, 137.8, 139.2, 145.6, 148.8, 149.9, 162.0 (Ar). HRMS: Calcd for $C_{22}H_{14}N_2$: 306.1157 (M^+). Found M^+: 306.1164. Anal. Calcd for $C_{22}H_{14}N_2$: C, 86.25; H, 4.61; N, 9.14. Found: C, 86.23; H, 4.93; N, 9.09.



1c

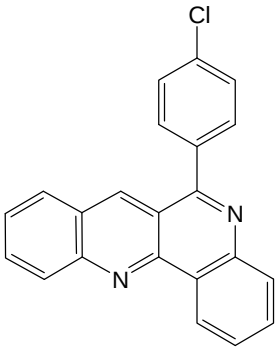
Compound **1c**: pale yellow crystals, mp 254-255 °C. ^{1}H NMR ($CDCl_3$) δ = 3.95 (s, 3H, OMe), 7.15 (d, 2H, *J* = 8.4 Hz, $MeOC_6H_4$), 7.60 (t, 1H, *J* = 7.6 Hz, Ar), 7.71-7.82 (m, 3H, Ar and $MeOC_6H_4$), 7.86 (t, 1H, *J* = 7.6 Hz, Ar), 7.92 (t, 1H, *J* = 7.6 Hz, Ar), 7.98 (d, 1H, *J* = 8.4 Hz, Ar), 8.20 (d, 1H, *J* = 8.0 Hz, Ar), 8.37 (d, 1H, *J* = 8.0 Hz, Ar), 8.95 (s, 1H, Ar), 9.35 (d, 1H, *J* = 8.0 Hz, Ar). ^{13}C NMR ($CDCl_3$) δ = 55.8 (OMe), 114.4, 119.1, 124.5, 124.9, 126.6, 126.9, 127.5, 129.7, 129.8, 131.0, 131.5, 131.7, 132.2, 138.0, 145.7, 149.0, 149.9, 160.8, 161.7 (Ar). Anal. Calcd for $C_{23}H_{16}N_2O$: C, 82.12; H, 4.79; N, 8.33. Found: C, 82.02; H, 4.59; N, 8.03.



1d

Compound **1d**: pale yellow crystals, mp 258-260 °C. ^{1}H NMR ($CDCl_3$) δ = 7.65 (t, 1H, *J*

= 7.2 Hz, Ar), 7.72 (d, 2H, *J* = 8.0 Hz, BrC_6H_4), 7.76-7.82 (m, 3H, Ar and BrC_6H_4), 7.89 (t, 1H, *J* = 8.0 Hz, Ar), 7.95 (t, 1H, *J* = 7.6 Hz, Ar), 8.01 (d, 1H, *J* = 8.4 Hz, Ar), 8.22 (d, 1H, *J* = 8.0 Hz, Ar), 8.41 (d, 1H, *J* =8.0 Hz, Ar), 8.88 (s, 1H, Ar), 9.38 (d, 1H, *J* = 8.0 Hz, Ar). ^{13}C NMR ($CDCl_3$) δ= 118.8, 124.0, 124.6, 125.1, 126.9, 126.9, 128.0, 129.3, 129.8, 129.9, 131.2, 131.7, 132.2, 132.4, 137.5, 138.0, 145.5, 148.8, 150.1, 160.9 (Ar). Anal. Calcd for $C_{22}H_{13}BrN_2$: C, 68.59; H, 3.40; N, 7.27. Found: C, 68.73; H, 3.96; N, 7.15.

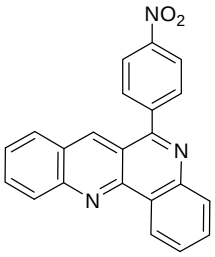


1e

Compound **1e**: pale yellow crystals, mp 251-252 ^{o}C. ^{1}H NMR ($CDCl_3$) δ = 7.59-7.65 (m, 3H, Ar and ClC_6H_4), 7.74-7.82 (m, 3H, Ar and ClC_6H_4), 7.86 t, 1H, *J* = 8.0 Hz, Ar), 7.92 (t, 1H, *J* = 8.0 Hz, Ar), 7.98 (d, 1H, *J* = 8.0 Hz, Ar), 8.20 (d, 1H, *J* = 8.0 Hz, Ar), 8.38 (d, 1H, *J* = 8.4 Hz, Ar), 8.85 (s, 1H, Ar), 9.36 (br d, 1H, *J* = 8.0 Hz, Ar). ^{13}C NMR ($CDCl_3$) δ = 118.8, 124.8, 125.1, 126.9, 126.9, 127.9, 129.2, 129.2, 129.8, 129.9, 131.2, 131.4, 132.4, 135.7, 137.5, 137.6, 145.5, 148.8, 150.1, 160.8 (Ar). Anal. Calcd for $C_{22}H_{14}ClN_2$: C, 77.53; H, 3.84; N, 8.22. Found: C, 77.60; H, 4.10; N, 8.30.

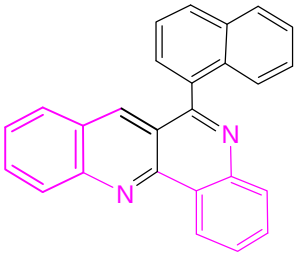
Thermolysis of **4f**

Compound **4f** (41 mg, 0.1 mmol) in a 15 mL of opened round bottomed flask was heated at 230^{o}C for 5 min. The flask was standing for additional 30 min, and the color was changed from orange-red to pale yellow. The resulting solid was recrystallized from ethanol to give dibenzonaphthyridine **1f** (28 mg, 0.082 mmol).



Compound **1f**: pale yellow crystals, mp 225-228 ºC. ^{1}H NMR ($CDCl_3$) δ = 7.68 (t, 1H, *J*=7.2 Hz, Ar), 7.85 (t, 1H, *J*= 8.0 Hz, Ar), 7.92 (t, 1H, *J*= 7.8 Hz, Ar), 7.95-8.05 (m, 4H, Ar), 8.24 (d, 1H, *J*= 6.8 Hz, Ar), 8.44 (d, 1H, *J*= 8.4 Hz, Ar), 8.51 (d, 2H, *J*= 8.8 Hz, Ar), 8.82 (s, 1H, Ar), 9.43 (d, 1H, *J*= 8.8 Hz, Ar). ^{13}C NMR ($CDCl_3$) δ = 118.4, 124.2, 124.7, 125.2, 126.9, 127.2, 128.6, 129.2, 129.9, 130.0, 130.0, 131.1, 131.4, 132.7, 137.7, 137.0, 145.2, 145.3, 148.6, 150.2, 159.6. Anal. Calcd for $C_{22}H_{13}N_3O_2$: C, 73.32; H, 3.92; N, 11.66. Found: C, 73.58; H, 4.08; N, 11.39.

Compounds **1g-1i** were similarly synthesized.

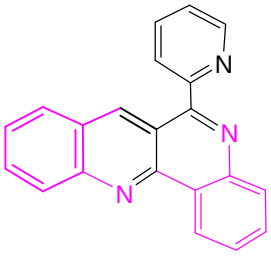


1g

Compound **1g**: pale yellow crystals, mp 236-237ºC. ^{1}H NMR ($CDCl_3$) δ = 7.37 (t, 1H, *J* = 8.4 Hz, Ar), 7.50-7.57 (m, 3H, Ar), 7.71-7.75 (m, 2H, Ar), 7.81 (d, 1H, J = 8.4 Hz, Ar), 7. (t, 1H, *J* = , Ar), 7.91 (t, 2H, *J* = 7.6 Hz, Ar), 8.01 (d, 1H, *J* = 8.0 Hz, Ar), 8.10 (d, 1H, *J* = 7.6 Hz, Ar), 8.27 (d, 1H, *J* = 7.6 Hz, Ar), 8.41 (d, 1H, *J* = 8.4 Hz, Ar), 8.48 (s, 1H, Ar), 9.46 (d, 1H, *J* = 8.0 Hz, Ar). ^{13}C NMR ($CDCl_3$) δ = 120.3, 124.5, 125.2, 125.5, 126.0, 126.4, 126.5, 126.8, 126.9, 127.7, 127.9, 128.5, 129.2, 129.5, 129.7, 129.9, 131.0,

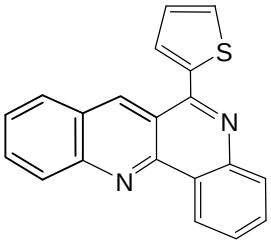
132.1, 132.4, 134.0, 136.3, 137.9, 145.6, 148.4, 150.2, 162.0 (Ar). Anal. Calcd for $C_{26}H_{16}N_2$: C, 87.62; H, 4.52; N, 7.86. Found. C, 87.50; H, 4.61; N, 8.12

Compound **1h**: pale yellow crystals, mp 165-166°C. ^{1}H NMR ($CDCl_3$) δ = 1.59 (t, 3H, *J* = 7.6 Hz, CH_3), 3.50 (q, 2H, *J* = 7.6 Hz, CH_2), 7.66 (t, 1H, *J* = 7.6 Hz, Ar), 7.71 (t, 1H, *J* =7.6 Hz, Ar), 7.82 (t, 1H, *J* = 7.6 Hz, Ar), 7.93 (t, 1H, *J* = 7.6 Hz, Ar), 8.11 (d, 2H, *J* = 8.0 Hz, Ar), 8.37 (d, 1H, *J* = 8.4 Hz, Ar), 9.05 (s, 1H, Ar), 9.30 (d, 1H, *J* = 8.0 Hz, Ar). ^{13}C NMR ($CDCl_3$) δ = 13.4 (Me), 29.0 (CH_2), 118.7, 124.4, 124.9, 126.5, 126.9, 127.0, 129.0, 129.1, 129.7, 130.7, 131.8, 134.7, 145.5, 148.6, 149.8, 163.9 (Ar). Anal. Calcd for $C_{18}H_{14}N_2$: C, 83.69; H, 5.46; N, 10.84. Found. C, 83.64; H, 5.54; N, 10.86



1i

Compound **1i**: pale yellow crystals, mp 221-223°C. ^{1}H NMR ($CDCl_3$) δ = .51 (t, 1H, *J* = 4.8 Hz, Ar), 7.62 (t, 1H, *J* = 7.6 Hz, Ar), 7.81 (t, 1H, *J* = 7.6 Hz, Ar), 7.86-7.93 (m, 2H, Ar), 8.01 (t, 1H, *J* = 7.6 Hz, Ar), 8.07 (d, 1H, *J* = 8.0 Hz, Ar), 8.25 (d, 1H, *J* = 8.0 Hz, Ar), 8.26 (d, 1H, *J* = 7.6 Hz, Ar), 8.38 (d, 1H, *J* = 8.4 Hz, Ar), 8.89 (d, 1H, *J* = 4.8 Hz, Ar), 9.40 (d, 1H, *J* = 8.0 Hz, Ar), 9.68 (s, 1H, Ar). ^{13}C NMR ($CDCl_3$) δ = 118.5, 124.0, 124.6, 125.5, 125.6, 126.4, 127.1, 128.1, 129.6, 129.7, 130.0, 130.8, 132.1, 137.5, 138.8, 145.3, 148.8, 148.9, 149.9, 158.0, 158.5 (Ar). HRMS; Calcd for $C_{21}H_{13}N_3$: m/z 307.1109. Found; m/z 307.1123 (M^+).

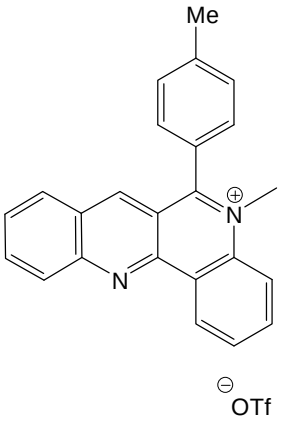


1j

Compound **1j**: pale yellow crystals, mp 165-166°C. ^{1}H NMR ($CDCl_3$) δ = 7.32 (t, 1H, *J* = 8.8 Hz, Ar), 7.64-7.68 (m, 2H, Ar), 7.74-7.78 (m, 2H, Ar), 7.85 (t, 1H, *J* = 7.6 Hz, Ar), 7.95 (t, 1H, *J* = 7.8 Hz, Ar), 8.09 (d, 1H, *J* = 8.4 Hz, Ar), 8.20 (d, 1H, *J* = 7.8 Hz, Ar), 8.40 (d, 1H, *J* = 8.4 Hz, Ar), 9.34 (d, 1H, *J* = 8.0 Hz, Ar), 9.37 (s, 1H, Ar). ^{13}C NMR ($CDCl_3$) δ = 118.5, 124.5, 124.8, 126.7, 127.0, 127.7, 127.8, 128.7, 129.2, 129.7, 129.7, 129.7, 131.0, 132.2, 137.1, 142.1, 145.5, 148.8, 149.9, 154.7 (Ar). Anal. Calcd for $C_{20}H_{12}N_2S$: C, 76.90; H, 3.87; N, 8.97. Found: C, 76.91; H, 3.87; N, 8.98.

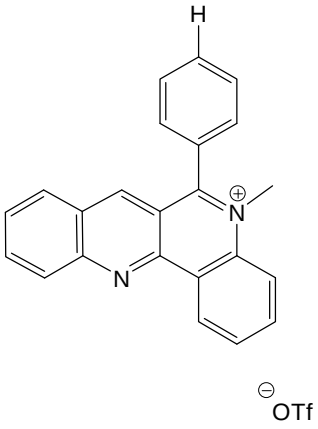
Methylation of Compound **1a**.

To a solution of **1a** (160 mg, 0.50 mmol) in dichloromethane (5 mL) was added methyl triflate (164 mg, 1.0 mmol). After standing for 3h, pale yellow crystals were precipitated. Further addition of ether gave fine crystals of **5a**, which was collected by filtration gave almost pure salts of **5a** (222 mg, 0.46 mmol).



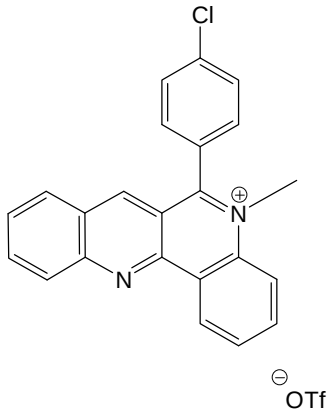
5a

Compound **5a**: yellow crystals, mp 255 °C (dec), ^{1}H-NMR (DMSO-d_6) δ = 2.56 (s, 3H, Me), 4.30 (s, 3H, Me), 7.66 (d, 2H, *J* = 8.0 Hz, Ar), 7.73 (d, 2H, *J* = 8.6, Ar), 7.84 (t, 1H, *J* = 7.8 Hz, Ar), 8.19-8.28 (m, 3H, Ar), 8.40-8.48 (m, 2H, Ar), 8.64 (d, 1H, *J* = 8.8 Hz, Ar), 8.93 (s, 1H, Ar), 9.55 (d, 1H, *J* = 10.0 Hz, Ar). ^{13}C NMR (DMSO-d_6) δ = 22.0 (Me), 44.1 (Me), 119.8, 121.5, 123.0, 125.7, 126.9, 127.7, 128.2, 129.1, 129.6, 129.9, 130.6, 131.4, 131.5, 137.2, 137.6, 142.6, 145.8, 146.7, 152.0, 168.1. Anal. Cacd for $C_{25}H_{19}F_3N_2O_3S$ TfOH C, 49.21; H, 3.42; N, 4.32. Found C, 49.06; H, 3.13; N, 4.69.



5b

Compound **5b**: yellow crystals, mp 210 °C (dec). ^{1}H-NMR (DMSO-d_6) δ= 4.31 (s, 3H, Me), 7.82-7.90 (m, 6H, Ar), 8.21-8.29 (m, 3H, Ar), 8.39 (d, 1H, *J* = 8.0 Hz, Ar), 8.45 (d, 1H, *J* = 10.8 Hz, Ar), 8.65 (d, 1H, *J* = 8.0 Hz, Ar), 8.88 (s, 1H, Ar), 9.56 (d, 1H, *J* =7.8 Hz, Ar). ^{13}C NMR (DMSO-d_6) δ= 44.1 (Me), 119.8, 120.1, 121.5, 123.0, 125.8, 127.0, 127.6, 129.2, 129.6, 129.8, 130.1, 131.0, 131.5, 131.5, 132.6, 134.0, 137.3, 137.6, 145.6, 146.7, 152.0, 167.7. Anal. Cacd for $C_{24}H_{17}F_3N_2O_3S$ TfOH: C, 48.39; H, 2.92; N, 4.51. Found C, 48.04; H, 3.30; N, 4.51.



5c

5c: yellow crystals, mp >300 °C, ^{1}H-NMR (DMSO-d_6) δ＝4.55 (s, 3H, Me), 7.76-7.86, (m, 5H, Ar), 8.04 (d, 1H, *J* =8.4 Hz, Ar), 8.11-8.20 (m, 3H, Ar), 8.45 (d, 1H, *J* = 8.6 Hz, Ar), 8.48 (d, 1H, *J*= 8.8 Hz, Ar), 8.61 (s, 1H, Ar), 9.69 (d, 1H, *J*= 7.8 Hz, Ar). ^{13}C NMR (DMSO-d_6) δ= 44.1 (Me), 120.1, 121.6, 125.8, 127.0, 127.8, 129.6, 129.8, 130.4, 131.6, 131.8, 134.0, 137.3, 137.5, 137.6, 145.7, 146.6, 152.0, 166.8 (Ar). Anal. Calcd for $C_{24}H_{16}ClF_3N_2O_3S$: C, 57.09; H, 3.19; N, 5.55; Found: C, 56.76; H, 3.21; N, 5.47.

Figure S-5. ORTEP Drawing of Compound **4e**.

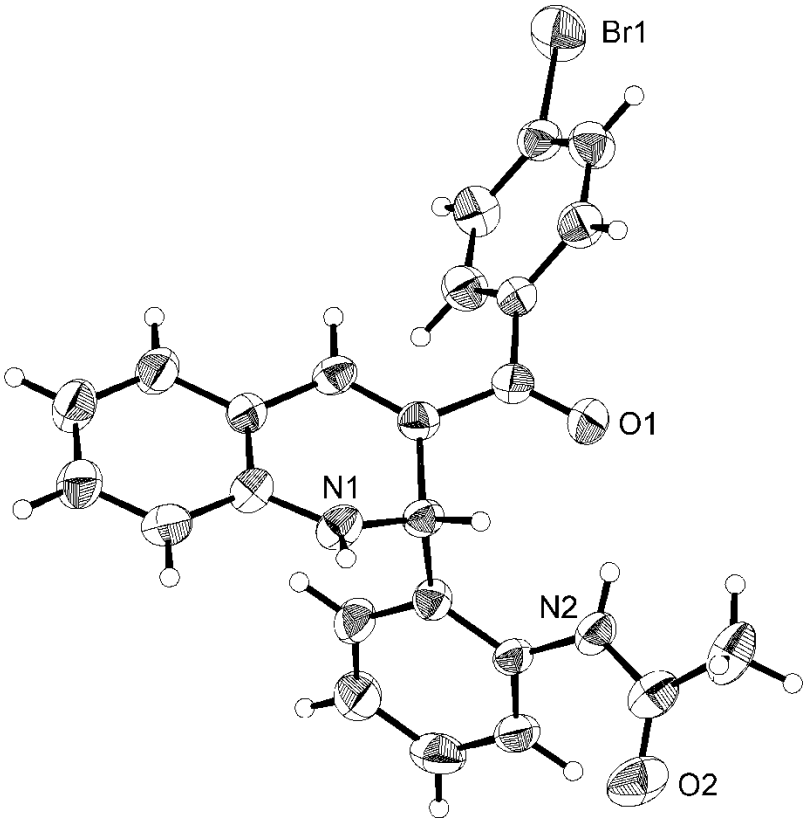


Table S-4. Crystal data and structure refinement for Compound **4e**.

Empirical formula	$C_{24}H_{19}BrN_2O_2$	
Formula weight	447.32	
Temperature	293(2) K	
Wavelength	0.71070 Å	
Crystal system	monoclinic	
Space group	$P2_1/n$	
Unit cell dimensions	a = 13.424(16) Å	α= 90°.
	b = 9.834(11) Å	β= 113.546(7)°.
	c = 16.368(19) Å	γ = 90°.
Volume	1981(4) $Å^3$	
Z	4	
Density (calculated)	1.500 Mg/m^3	
Absorption coefficient	2.099 mm^{-1}	
F(000)	912	
Crystal size	0.20 x 0.10 x 0.10 mm^3	
Theta range for data collection	3.27 to 25.50°.	
Index ranges	-16<=h<=16, -11<=k<=11, -19<=l<=19	

Reflections collected	16408
Independent reflections	3661 [R(int) = 0.0934]
Completeness to theta = 25.50°	99.5 %
Max. and min. transmission	0.8176 and 0.6790
Refinement method	Full-matrix least-squares on F^2
Data / restraints / parameters	3661 / 0 / 267
Goodness-of-fit on F^2	1.063
Final R indices [I>2sigma(I)]	R1 = 0.0902, wR2 = 0.2539
R indices (all data)	R1 = 0.1578, wR2 = 0.3358
Largest diff. peak and hole	0.374 and -0.542 e.Å^{-3}

Figure S-6. ORTEP Drawing of Compound **1a**.

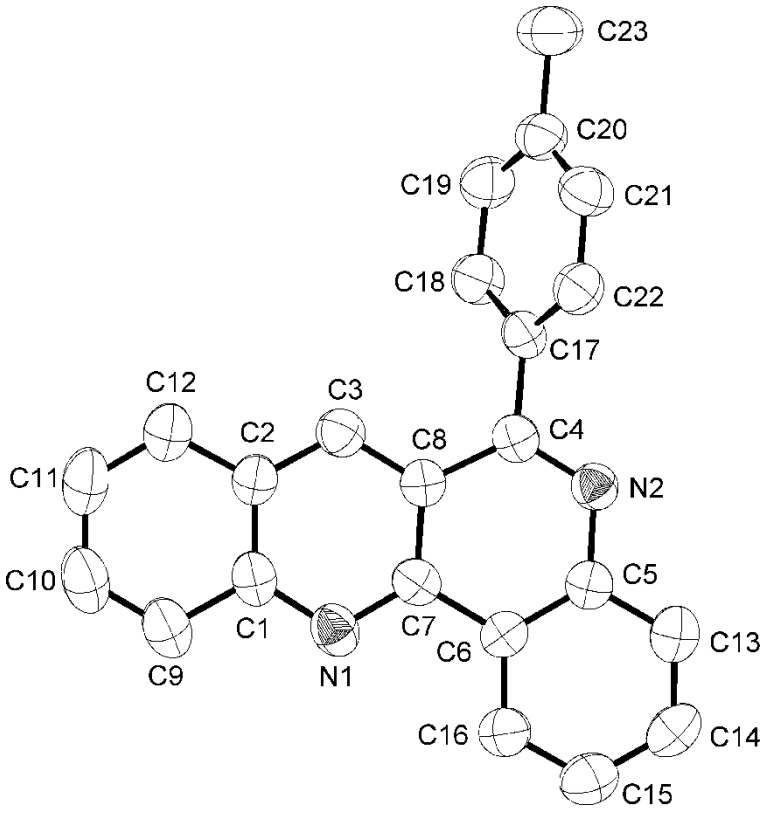


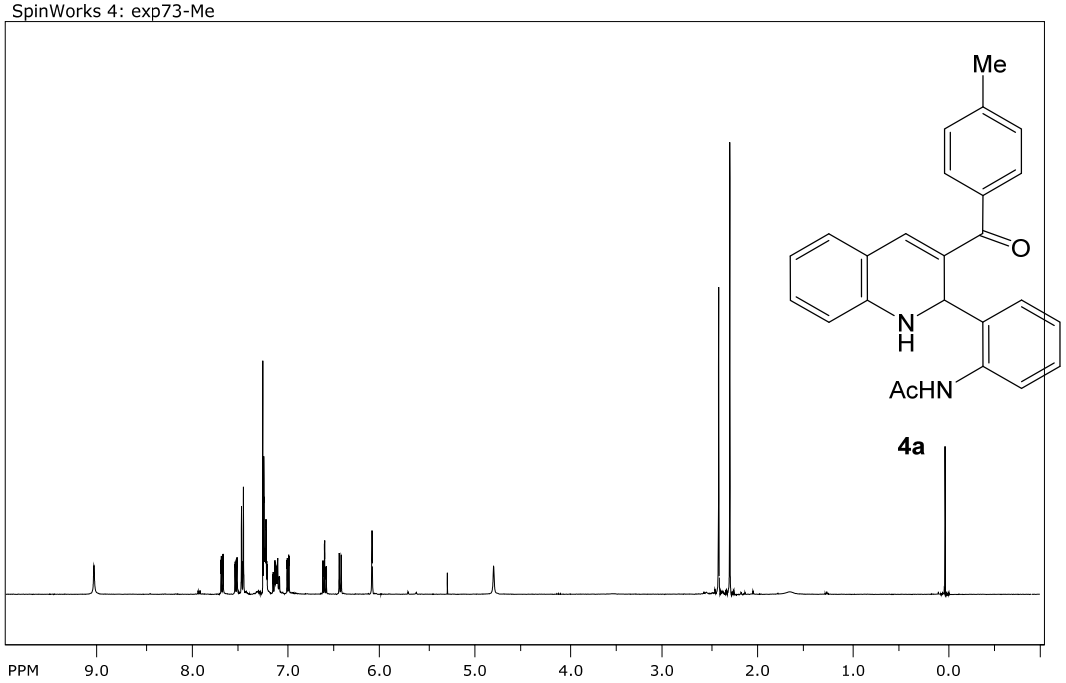
Table S-5. Crystal data and structure refinement for compound **1a**.

Empirical formula	$C_{23}H_{16}N_2$
Formula weight	320.38
Temperature	293(2) K
Wavelength	0.71075 Å
Crystal system	monoclinic
Space group	C2/c

Unit cell dimensions	a = 36.980(18) Å	α= 90°.
	b = 5.904(3) Å	β= 90.257(9)°.
	c = 15.103(7) Å	γ = 90°.
Volume	3297(3) $Å^3$	
Z	8	
Density (calculated)	1.291 Mg/m^3	
Absorption coefficient	0.076 mm^{-1}	
F(000)	1344	
Crystal size	0.25 x 0.05 x 0.05 mm^3	
Theta range for data collection	3.31 to 26.00°.	
Index ranges	-45<=h<=45, -7<=k<=5, -17<=l<=16	
Reflections collected	10985	
Independent reflections	3208 [R(int) = 0.0822]	
Completeness to theta = 26.00°	98.9 %	
Max. and min. transmission	0.9962 and 0.9812	
Refinement method	Full-matrix least-squares on F^2	
Data / restraints / parameters	3208 / 0 / 227	
Goodness-of-fit on F^2	1.025	
Final R indices [I>2sigma(I)]	R1 = 0.0707, wR2 = 0.1356	
R indices (all data)	R1 = 0.1603, wR2 = 0.1720	
Largest diff. peak and hole	0.134 and -0.156 $e.Å^{-3}$	

Spectral Data of dihyudroquinolines **4a**-**4j** and dibenzonaphthyridines **1a**-**1j**.

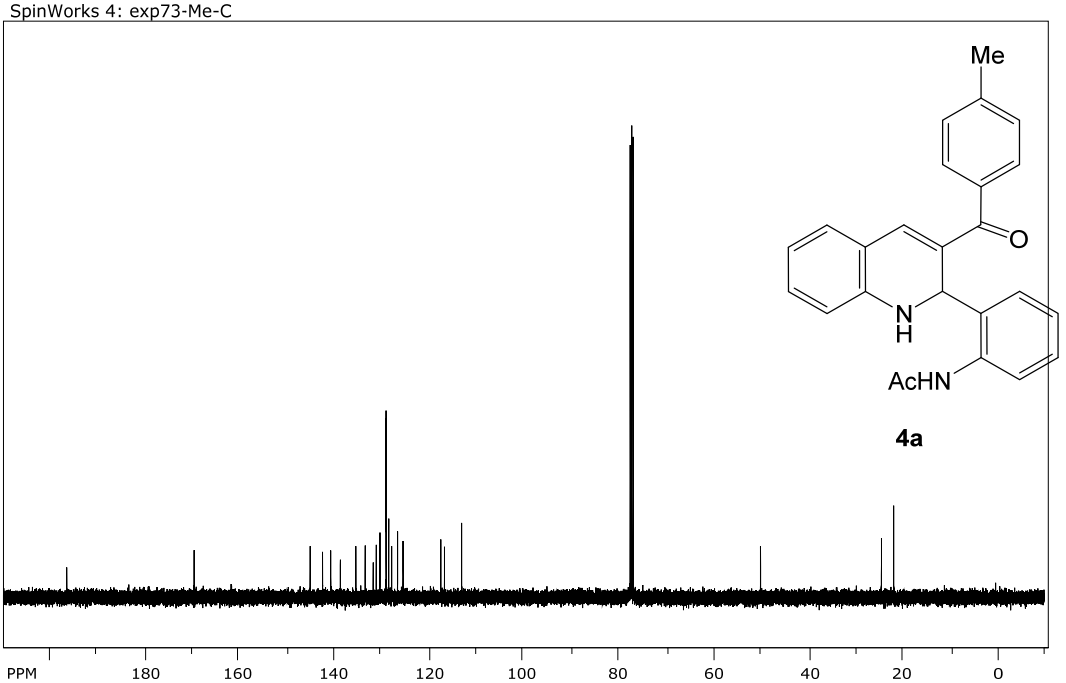
SpinWorks 4: exp73-Me



file: ...\exp73-Me_08Dec2011\PROTON.fid\fid block# 1 expt: "s2pul"
transmitter freq.: 400.452035 MHz
time domain size: 44844 points
width: 6402.05 Hz = 15.9871 ppm = 0.142763 Hz/pt
number of scans: 8

freq. of 0 ppm: 400.449632 MHz
processed size: 65536 complex points
LB: 0.000 GF: 0.0000
Hz/cm: 176.342 ppm/cm: 0.44036

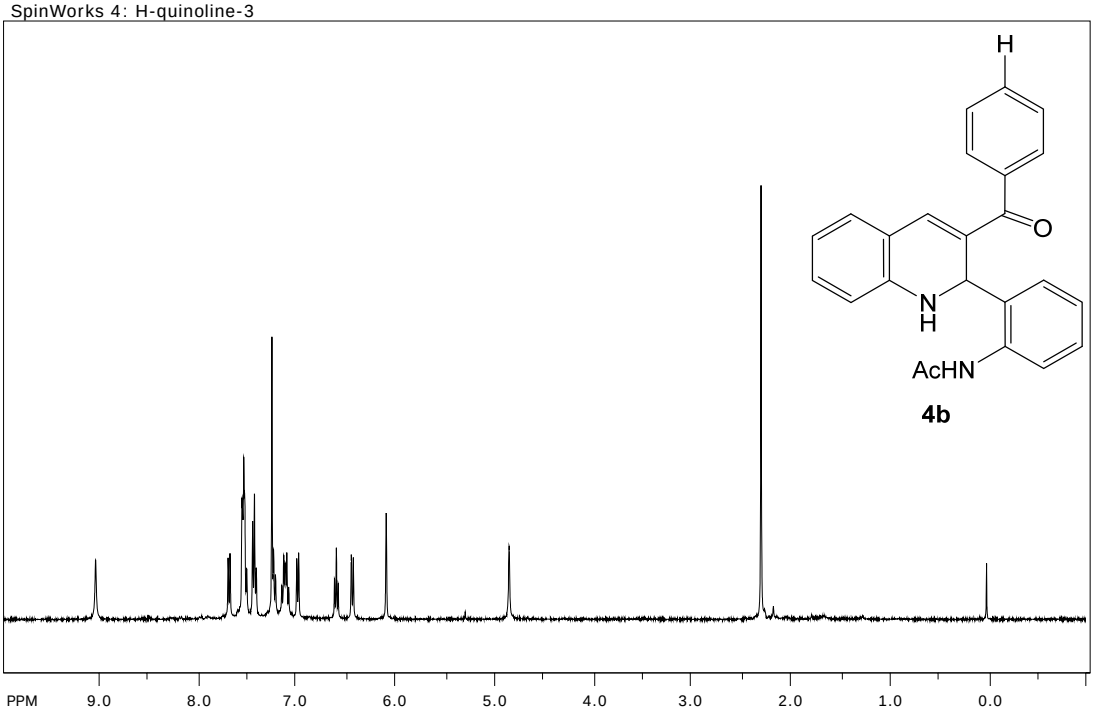
SpinWorks 4: exp73-Me-C



file: ...xp73-Me-C_08Dec2011\CARBON.fid\fid block# 1 expt: "s2pul"
transmitter freq.: 100.704192 MHz
time domain size: 65536 points
width: 25188.92 Hz = 250.1278 ppm = 0.384352 Hz/pt
number of scans: 1000

freq. of 0 ppm: 100.693124 MHz
processed size: 65536 complex points
LB: 0.000 GF: 0.0000
Hz/cm: 887.235 ppm/cm: 8.81030

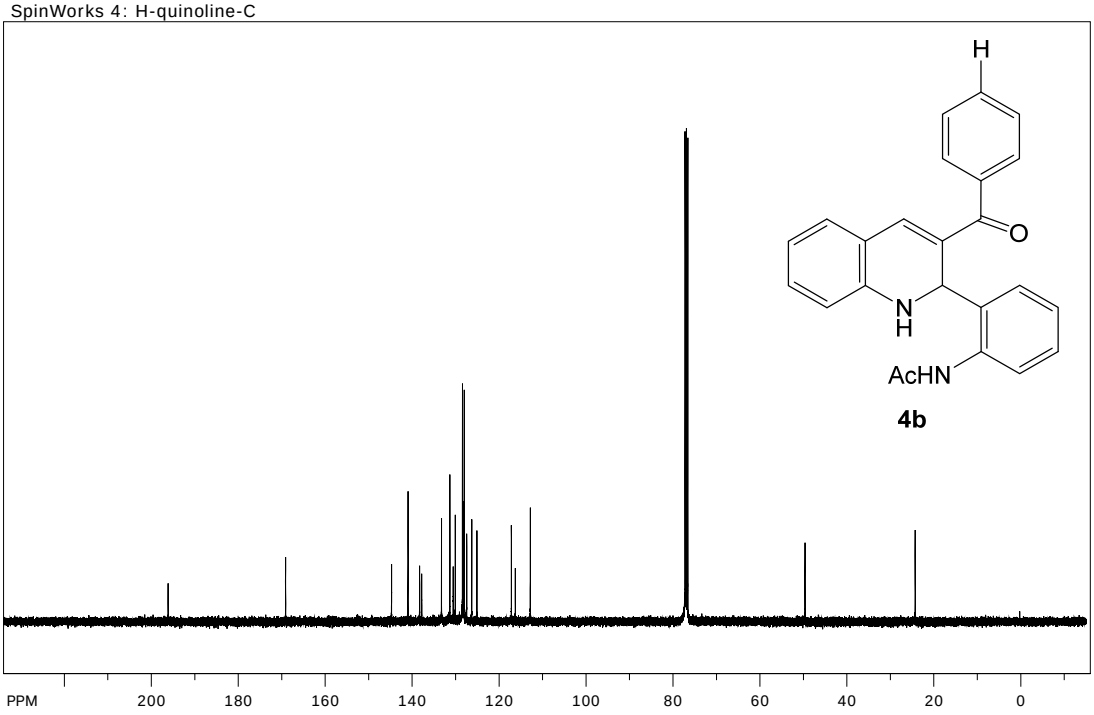
SpinWorks 4: H-quinoline-3



file: ...droquinolines\Ph-DQ\PROTON.fid\fid block# 1 expt: "s2pul"
transmitter freq.: 400.452035 MHz
time domain size: 44844 points
width: 6402.05 Hz = 15.9871 ppm = 0.142763 Hz/pt
number of scans: 8

freq. of 0 ppm: 400.449630 MHz
processed size: 65536 complex points
LB: 0.000 GF: 0.0000
Hz/cm: 176.056 ppm/cm: 0.43964

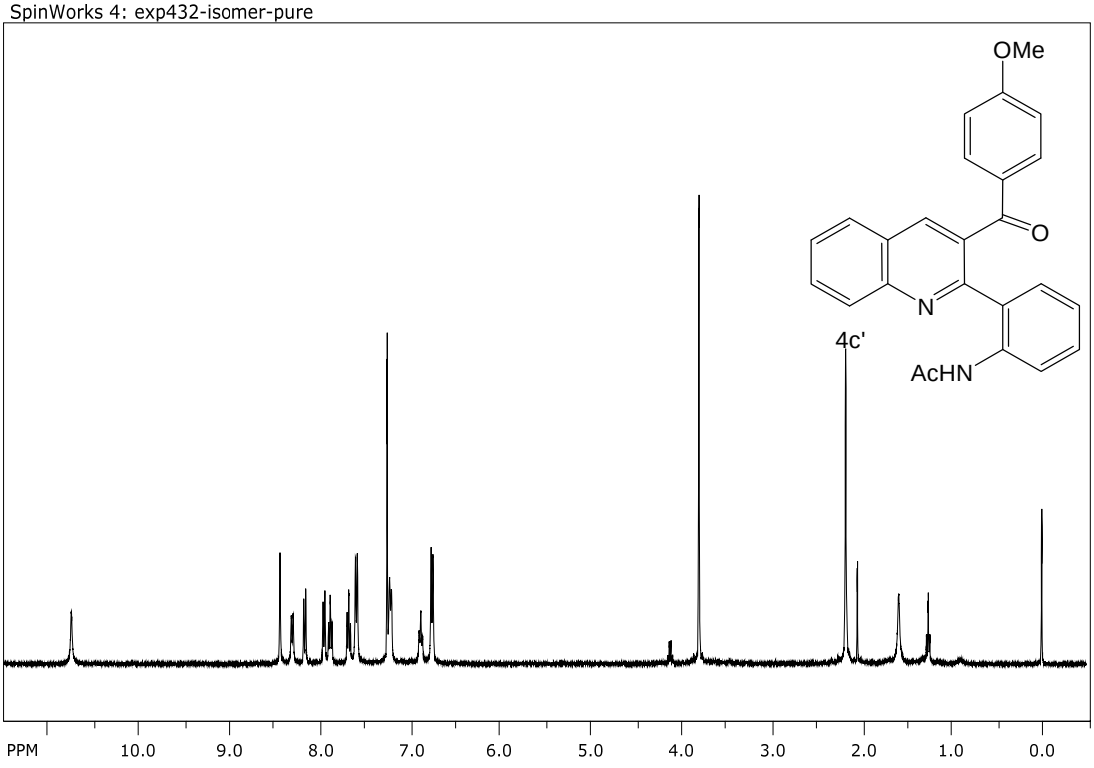
SpinWorks 4: H-quinoline-C



file: ...02Feb2012_03Feb2012\CARBON.fid\fid block# 1 expt: "s2pul"
transmitter freq.: 100.704192 MHz
time domain size: 65536 points
width: 25188.92 Hz = 250.1278 ppm = 0.384352 Hz/pt
number of scans: 15000

freq. of 0 ppm: 100.693124 MHz
processed size: 65536 complex points
LB: 0.000 GF: 0.0000
Hz/cm: 1007.557 ppm/cm: 10.00511

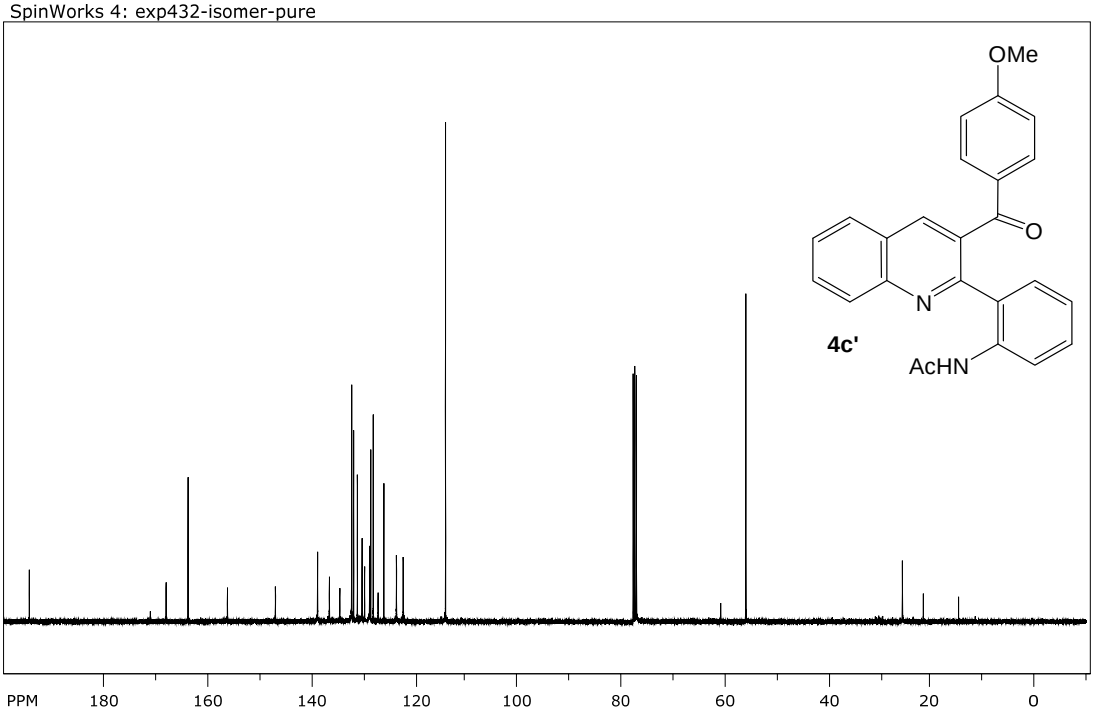
SpinWorks 4: exp432-isomer-pure



file: ...omer-pure_29Jul2010\PROTON.fid\fid block# 1 expt: "s2pul"
transmitter freq.: 400.452035 MHz
time domain size: 44844 points
width: 6402.05 Hz = 15.9871 ppm = 0.142763 Hz/pt
number of scans: 8

freq. of 0 ppm: 400.449630 MHz
processed size: 65536 complex points
LB: 0.000 GF: 0.0000
Hz/cm: 192.347 ppm/cm: 0.48033

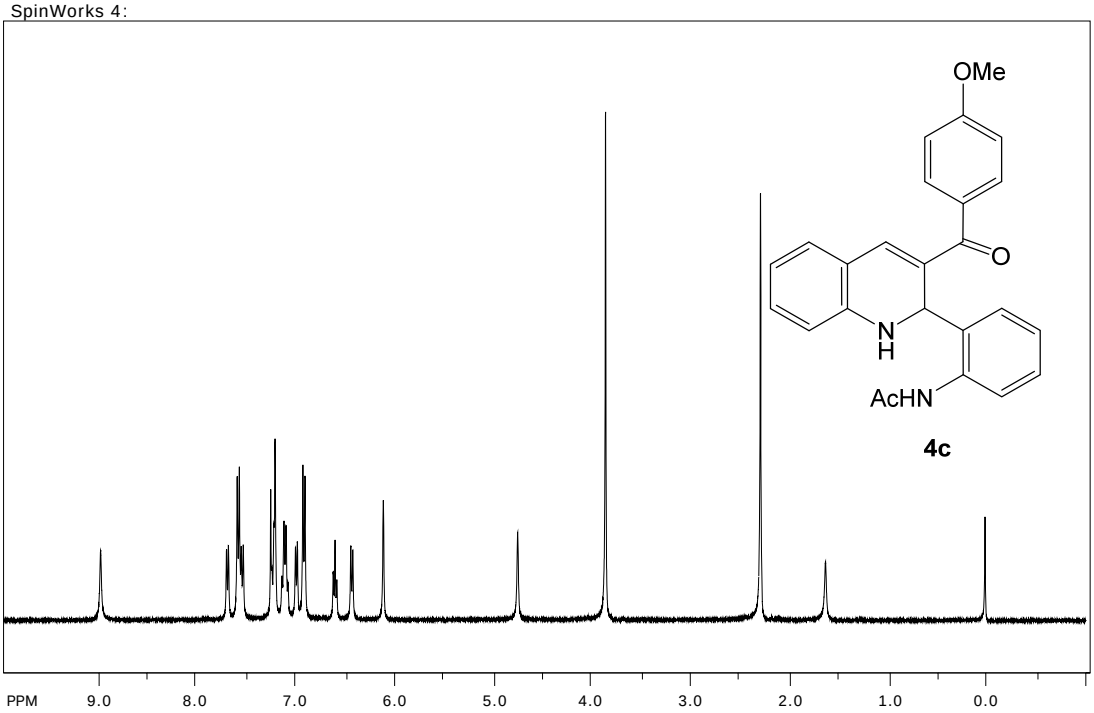
SpinWorks 4: exp432-isomer-pure



file: ...omer-pure_30Jul2010\CARBON.fid\fid block# 1 expt: "s2pul"
transmitter freq.: 100.704192 MHz
time domain size: 65536 points
width: 25188.92 Hz = 250.1278 ppm = 0.384352 Hz/pt
number of scans: 5000

freq. of 0 ppm: 100.693116 MHz
processed size: 65536 complex points
LB: 0.000 GF: 0.0000
Hz/cm: 846.752 ppm/cm: 8.40831

SpinWorks 4:



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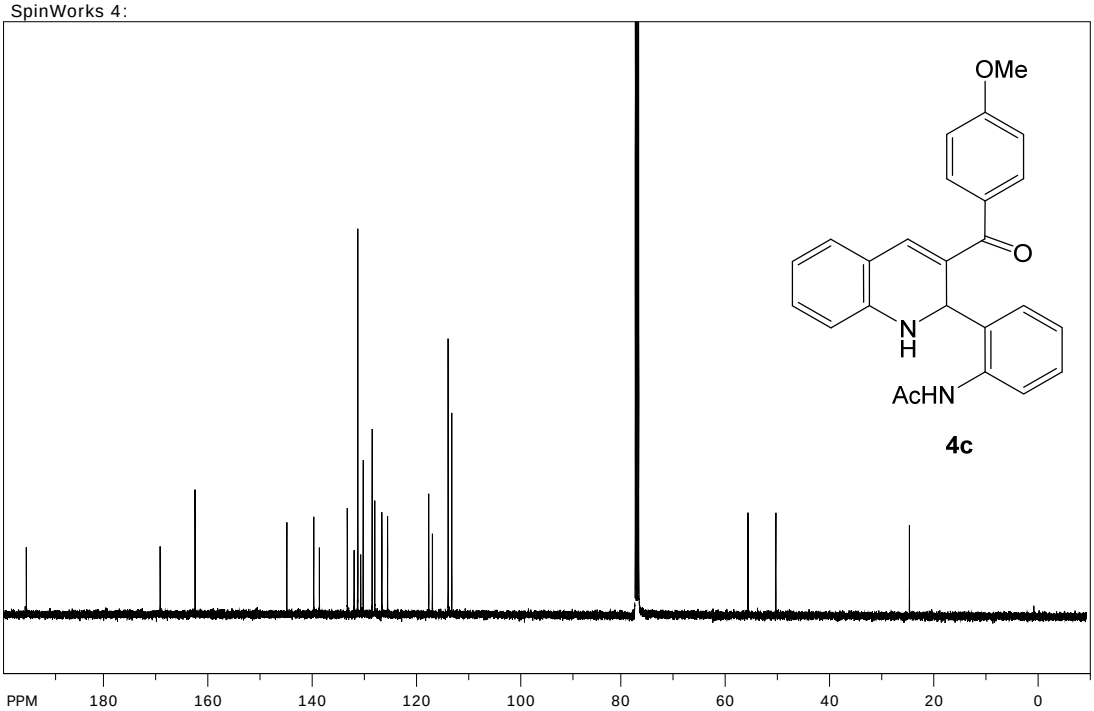
transmitter freq.: 400.132471 MHz
time domain size: 65536 points
width: 8012.82 Hz = 20.0254 ppm = 0.122266 Hz/pt
number of scans: 16

freq. of 0 ppm: 400.130009 MHz
processed size: 65536 complex points
LB: 0.000 GF: 0.0000
Hz/cm: 175.996 ppm/cm: 0.43984

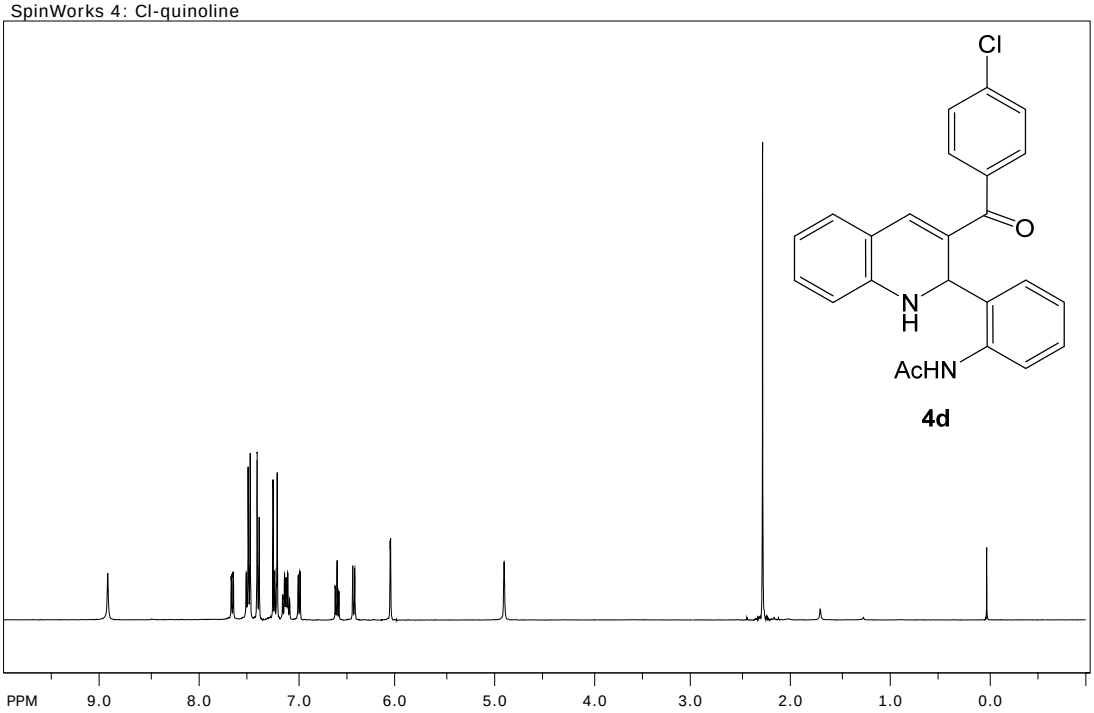
SpinWorks 4:



file: ...ihydroquinolines\OMe-DQ-13C\10\fid expt: <zgpg30>
transmitter freq.: 100.622829 MHz
time domain size: 65536 points
width: 24038.46 Hz = 238.8967 ppm = 0.366798 Hz/pt
number of scans: 8500

freq. of 0 ppm: 100.612753 MHz
processed size: 32768 complex points
LB: 0.000 GF: 0.0000
Hz/cm: 845.639 ppm/cm: 8.40404

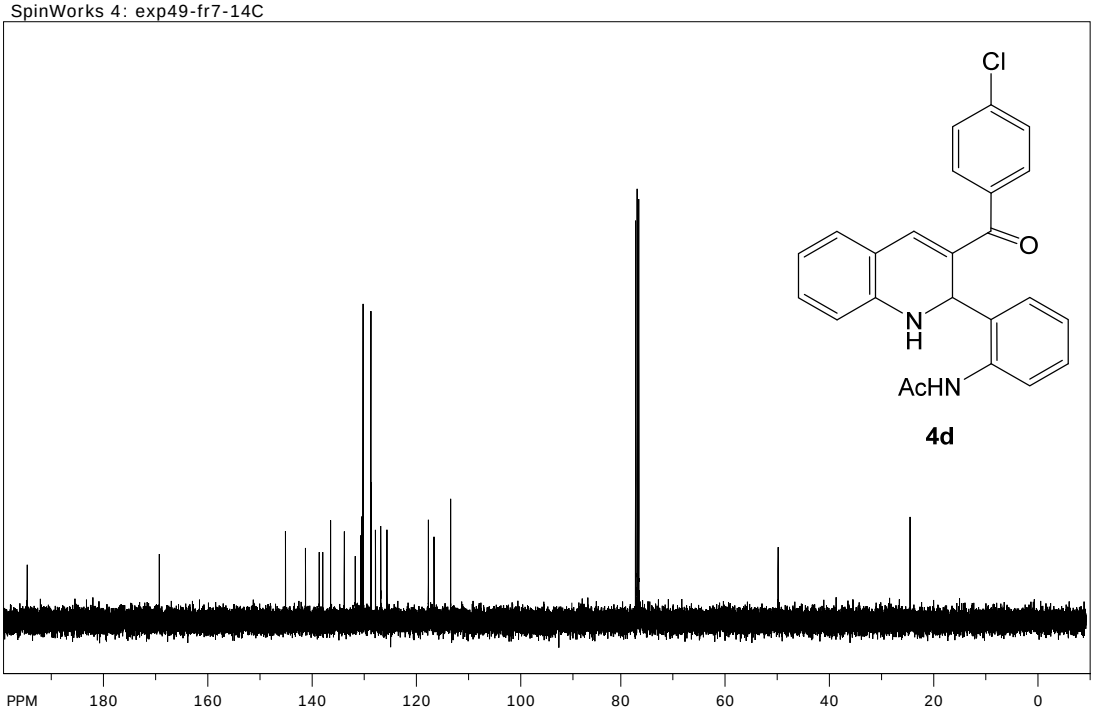
SpinWorks 4: Cl-quinoline



file: ...quinoline_20Feb2012\PROTON.fid\fid block# 1 expt: "s2pul"
transmitter freq.: 400.452035 MHz
time domain size: 44844 points
width: 6402.05 Hz = 15.9871 ppm = 0.142763 Hz/pt
number of scans: 8

freq. of 0 ppm: 400.449630 MHz
processed size: 65536 complex points
LB: 0.000 GF: 0.0000
Hz/cm: 176.342 ppm/cm: 0.44036

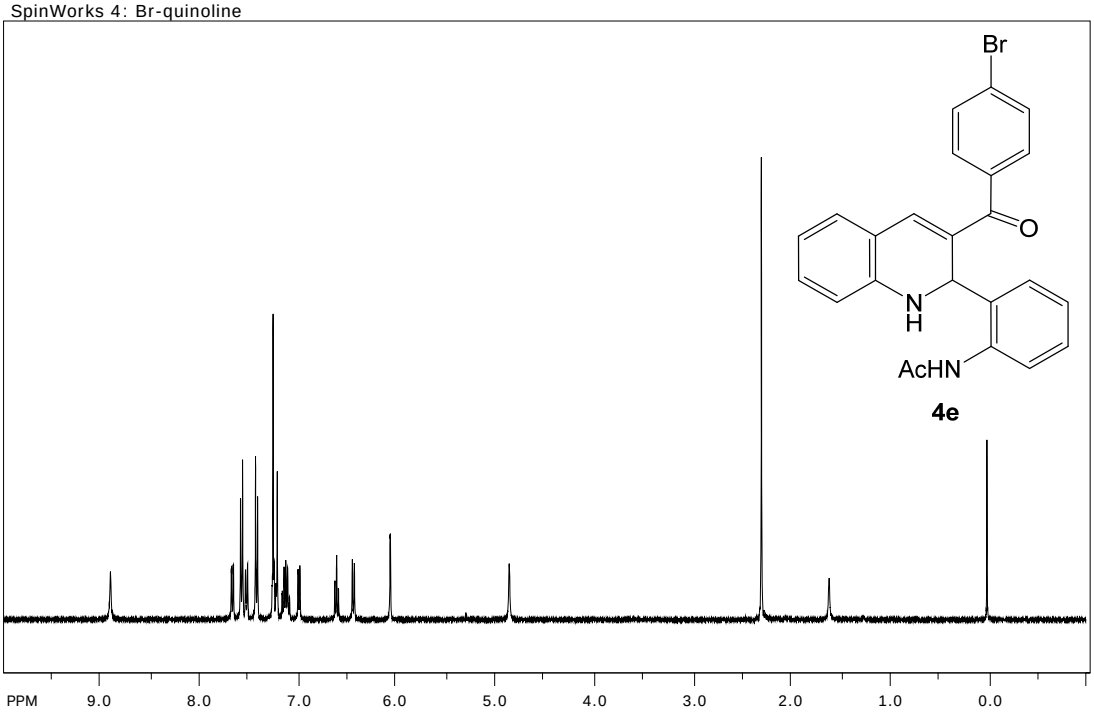
SpinWorks 4: exp49-fr7-14C



file: ...-DQ\exp49-fr7-14CCl\CARBON.fid\fid block# 1 expt: "s2pul"
transmitter freq.: 100.704192 MHz
time domain size: 65536 points
width: 25188.92 Hz = 250.1278 ppm = 0.384352 Hz/pt
number of scans: 256

freq. of 0 ppm: 100.693125 MHz
processed size: 65536 complex points
LB: 0.000 GF: 0.0000
Hz/cm: 845.628 ppm/cm: 8.39715

SpinWorks 4: Br-quinoline



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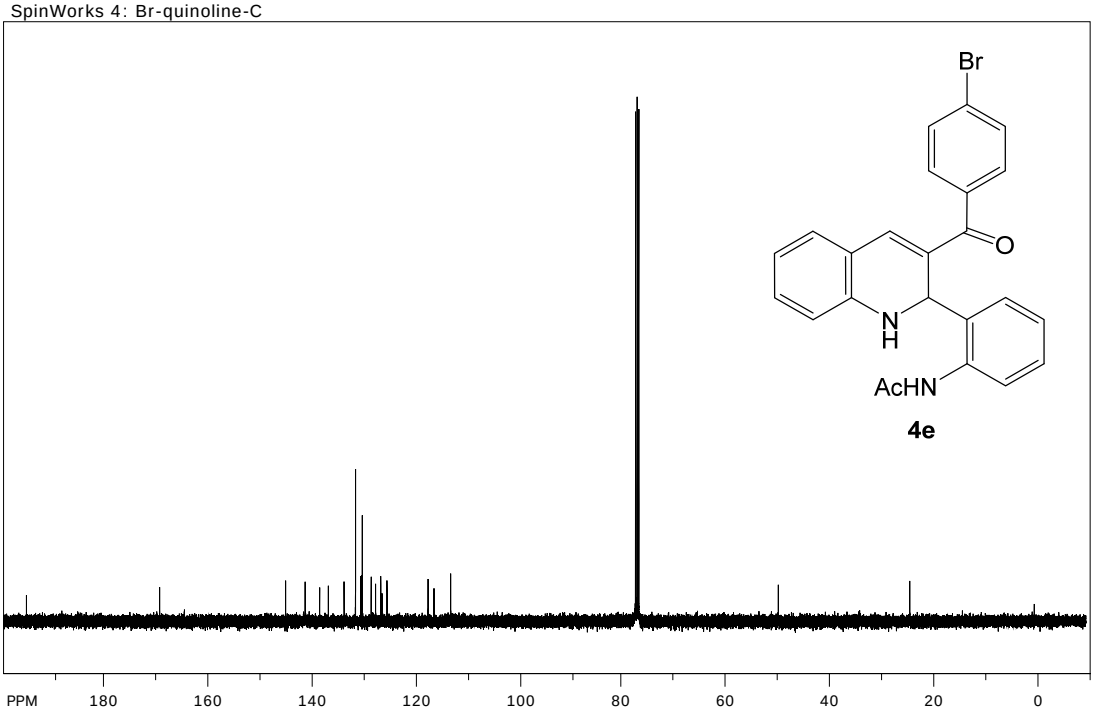
transmitter freq.: 400.452035 MHz
time domain size: 44844 points
width: 6402.05 Hz = 15.9871 ppm = 0.142763 Hz/pt
number of scans: 8

freq. of 0 ppm: 400.449630 MHz
processed size: 65536 complex points
LB: 0.000 GF: 0.0000
Hz/cm: 176.342 ppm/cm: 0.44036

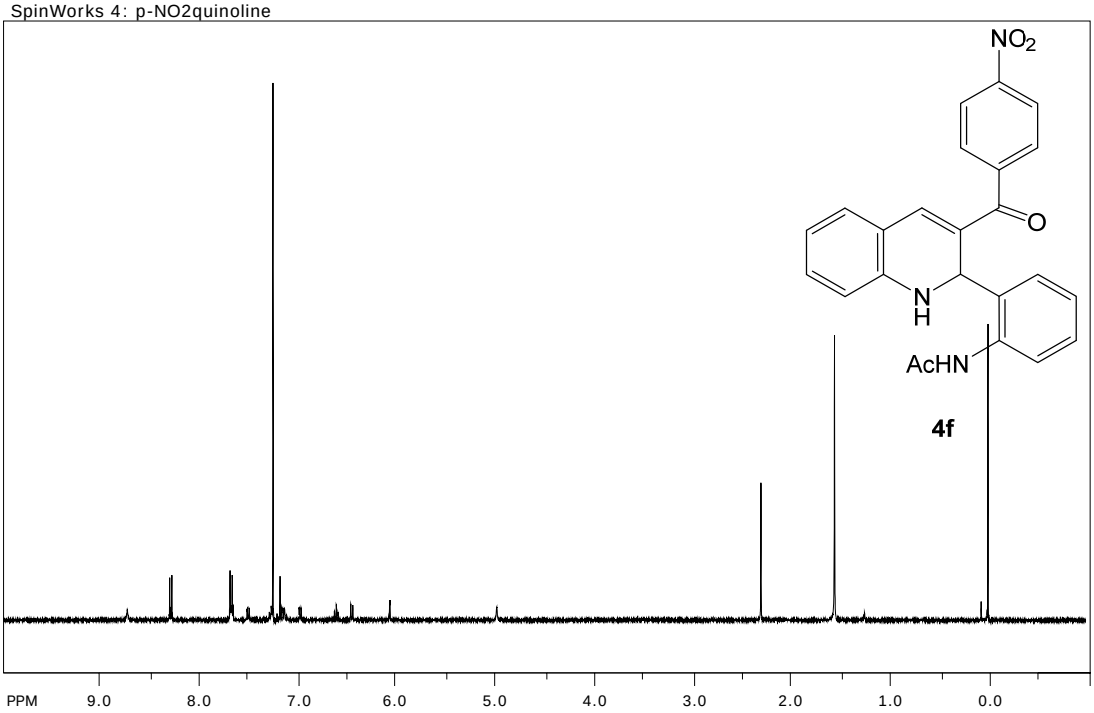
SpinWorks 4: Br-quinoline-C



file: ...h-DQ\Br-quinoline-C\CARBON.fid\fid block# 1 expt: "s2pul"
transmitter freq.: 100.704192 MHz
time domain size: 65536 points
width: 25188.92 Hz = 250.1278 ppm = 0.384352 Hz/pt
number of scans: 2000

freq. of 0 ppm: 100.693124 MHz
processed size: 65536 complex points
LB: 0.000 GF: 0.0000
Hz/cm: 845.628 ppm/cm: 8.39715

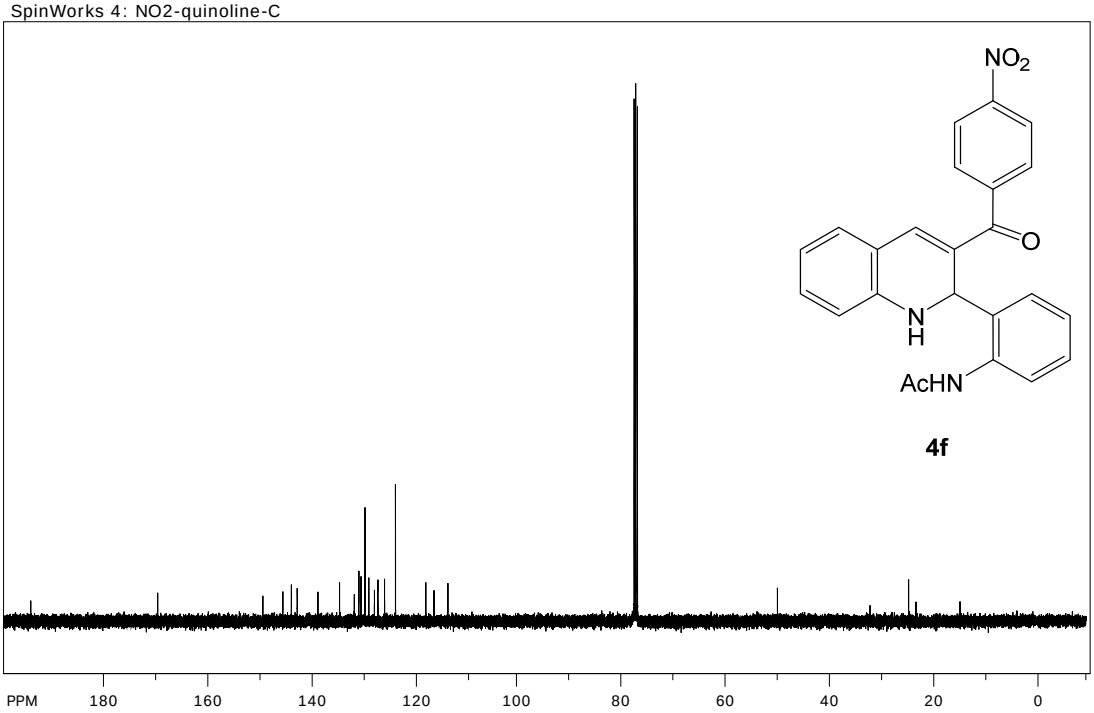
SpinWorks 4: p-NO2quinoline



file: ...quinoline_28Nov2011\PROTON.fid\fid block# 1 expt: "s2pul"
transmitter freq.: 400.452035 MHz
time domain size: 44844 points
width: 6402.05 Hz = 15.9871 ppm = 0.142763 Hz/pt
number of scans: 8

freq. of 0 ppm: 400.449632 MHz
processed size: 65536 complex points
LB: 0.000 GF: 0.0000
Hz/cm: 176.056 ppm/cm: 0.43964

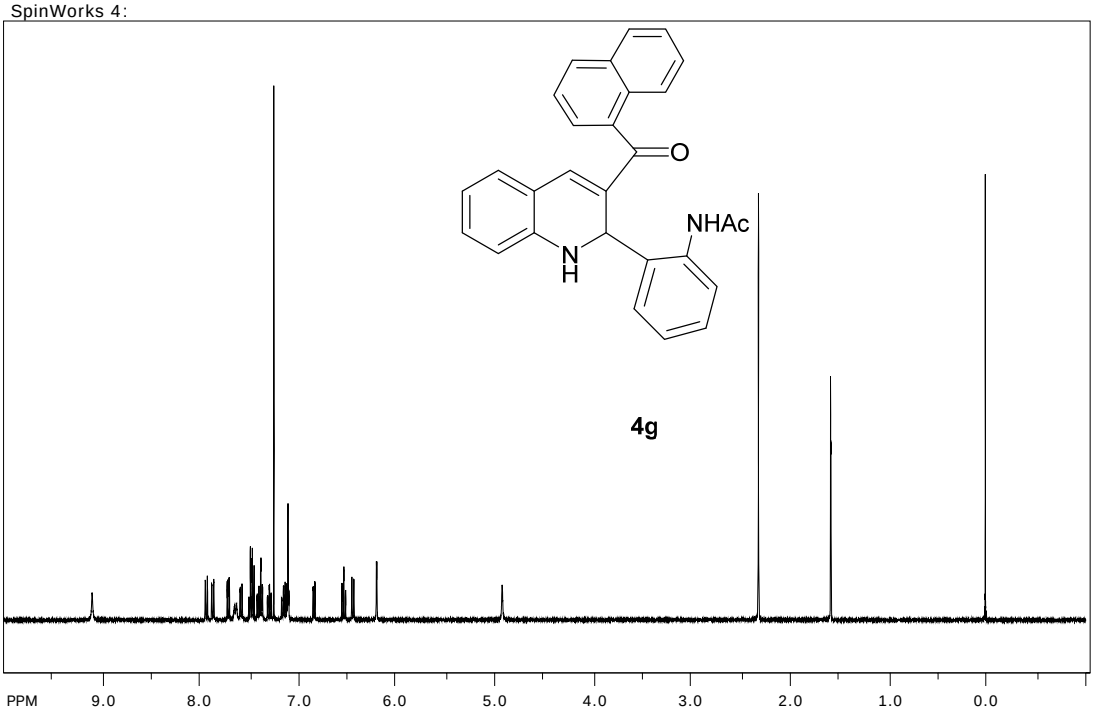
SpinWorks 4: NO2-quinoline-C



file: ...inoline-C_21Feb2012\CARBON.fid\fid block# 1 expt: "s2pul"
transmitter freq.: 100.704192 MHz
time domain size: 65536 points
width: 25188.92 Hz = 250.1278 ppm = 0.384352 Hz/pt
number of scans: 2000

freq. of 0 ppm: 100.693116 MHz
processed size: 65536 complex points
LB: 0.000 GF: 0.0000
Hz/cm: 845.628 ppm/cm: 8.39715

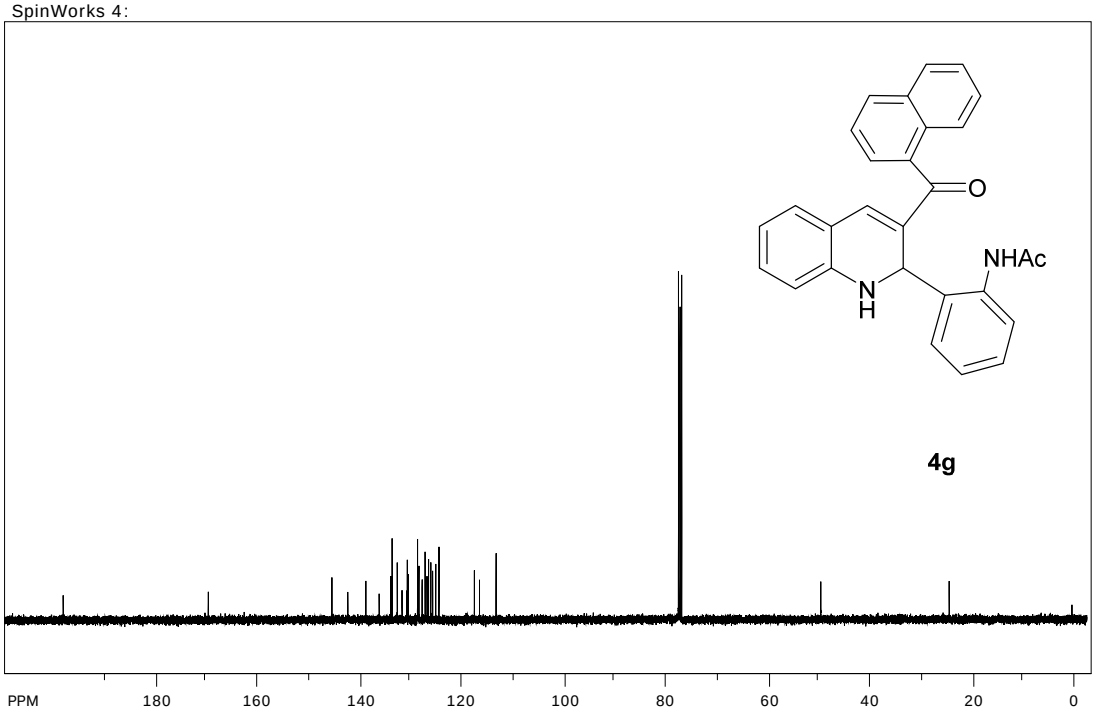
SpinWorks 4:



file: ...Users\健太\Desktop\Suzuki\nap\10\fid expt: <zg30>
transmitter freq.: 400.132471 MHz
time domain size: 65536 points
width: 8012.82 Hz = 20.0254 ppm = 0.122266 Hz/pt
number of scans: 8

freq. of 0 ppm: 400.130010 MHz
processed size: 65536 complex points
LB: 0.000 GF: 0.0000
Hz/cm: 176.711 ppm/cm: 0.44163

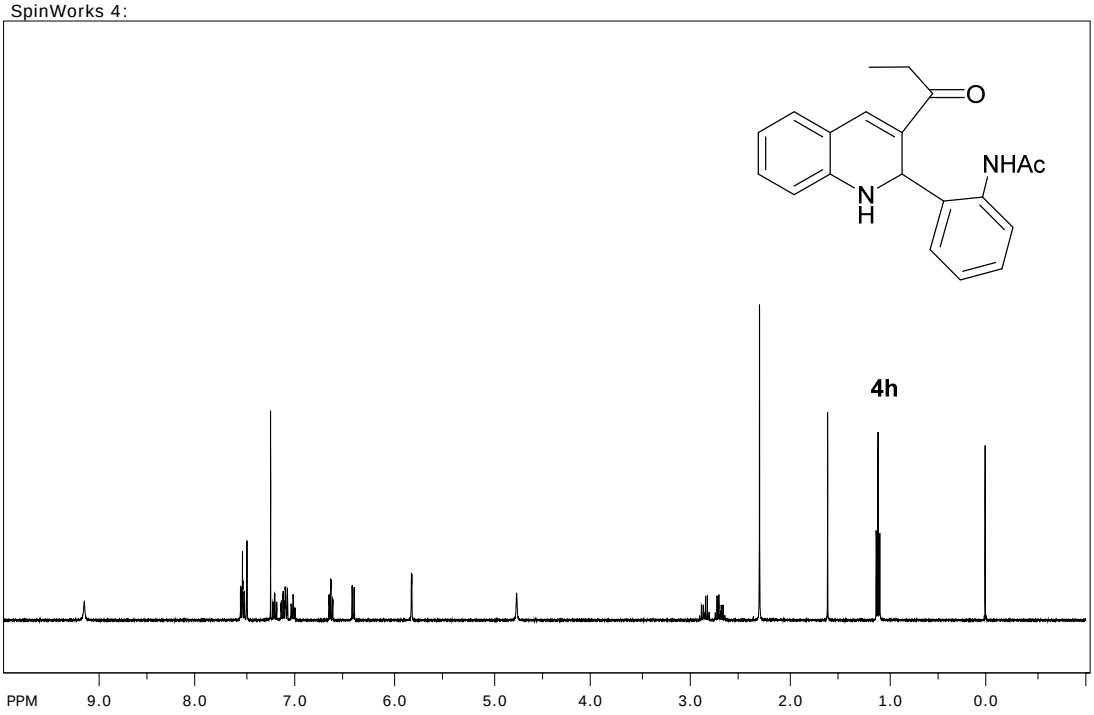
SpinWorks 4:



file: ...健太\Desktop\Suzuki\Napdq-13C\10\fid expt: <zgpg30>
transmitter freq.: 100.622829 MHz
time domain size: 65536 points
width: 24038.46 Hz = 238.8967 ppm = 0.366798 Hz/pt
number of scans: 450

freq. of 0 ppm: 100.612755 MHz
processed size: 32768 complex points
LB: 0.000 GF: 0.0000
Hz/cm: 856.370 ppm/cm: 8.51069

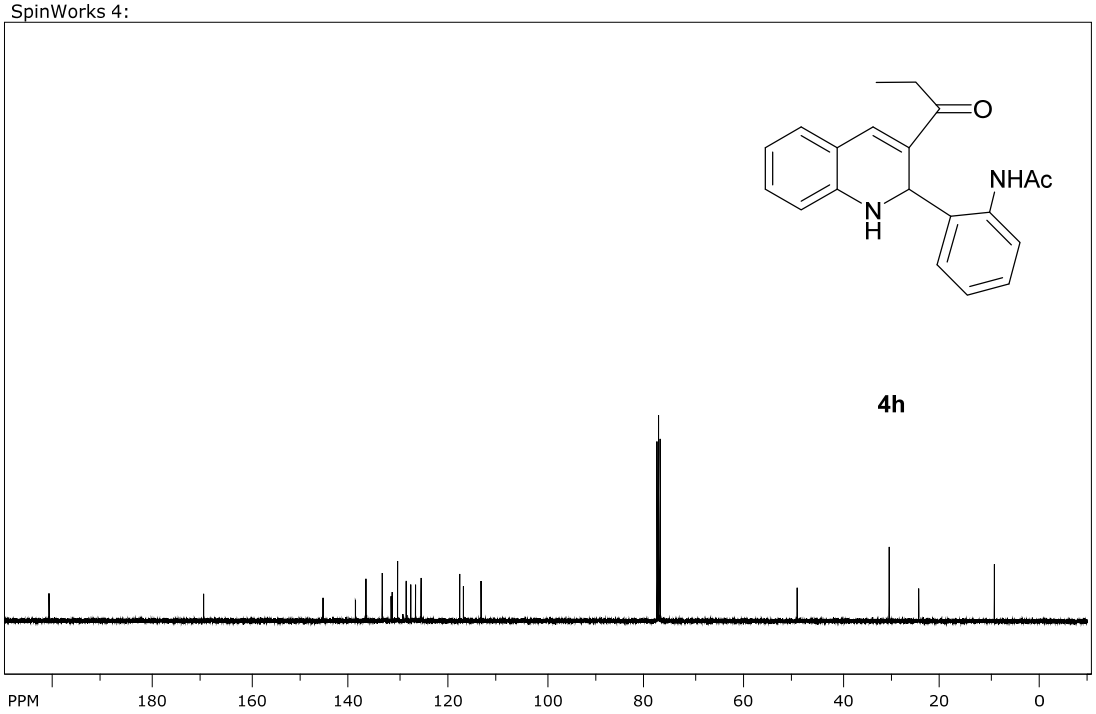
SpinWorks 4:



file: ...健太\Desktop\Suzuki\Et-DQ-pro\10\fid expt: <zg30>
transmitter freq.: 400.132471 MHz
time domain size: 65536 points
width: 8012.82 Hz = 20.0254 ppm = 0.122266 Hz/pt

freq. of 0 ppm: 400.130009 MHz
processed size: 65536 complex points
LB: 0.000 GF: 0.0000
Hz/cm: 175.996 ppm/cm: 0.43984

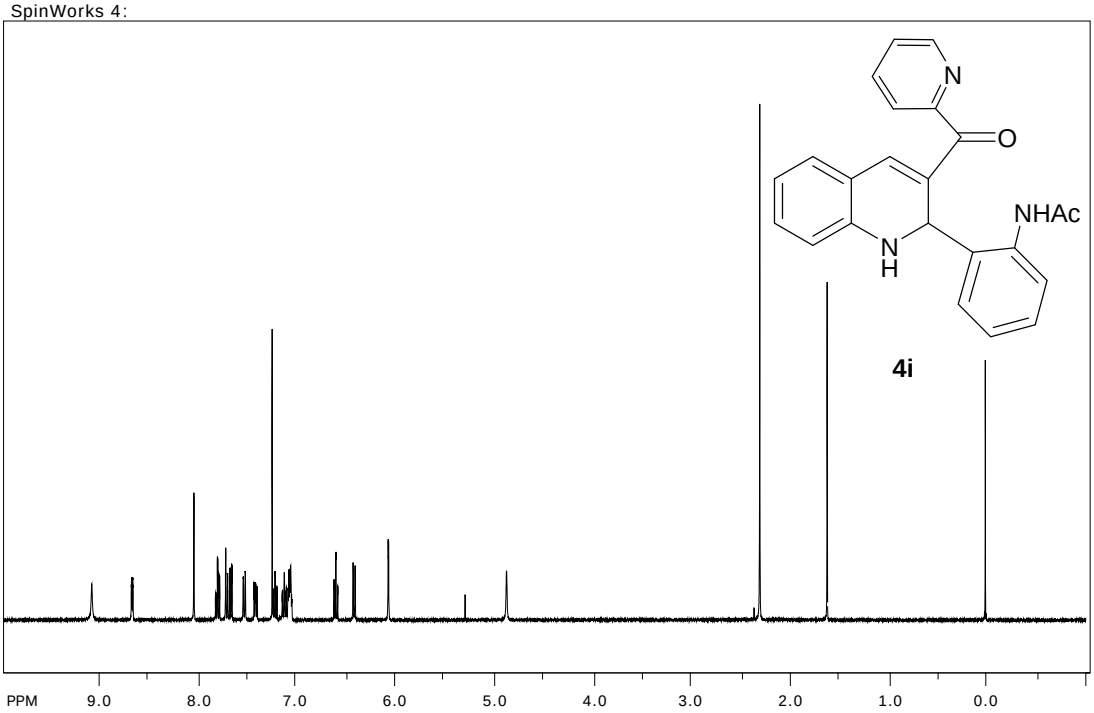
SpinWorks 4:



file: ...健太\Desktop\Suzuki\Et-DQ-13C\10\fid expt: <zgpg30>
transmitter freq.: 100.622829 MHz
time domain size: 65536 points
width: 24038.46 Hz = 238.8967 ppm = 0.366798 Hz/pt
number of scans: 512

freq. of 0 ppm: 100.612757 MHz
processed size: 32768 complex points
LB: 0.000 GF: 0.0000
Hz/cm: 886.418 ppm/cm: 8.80932

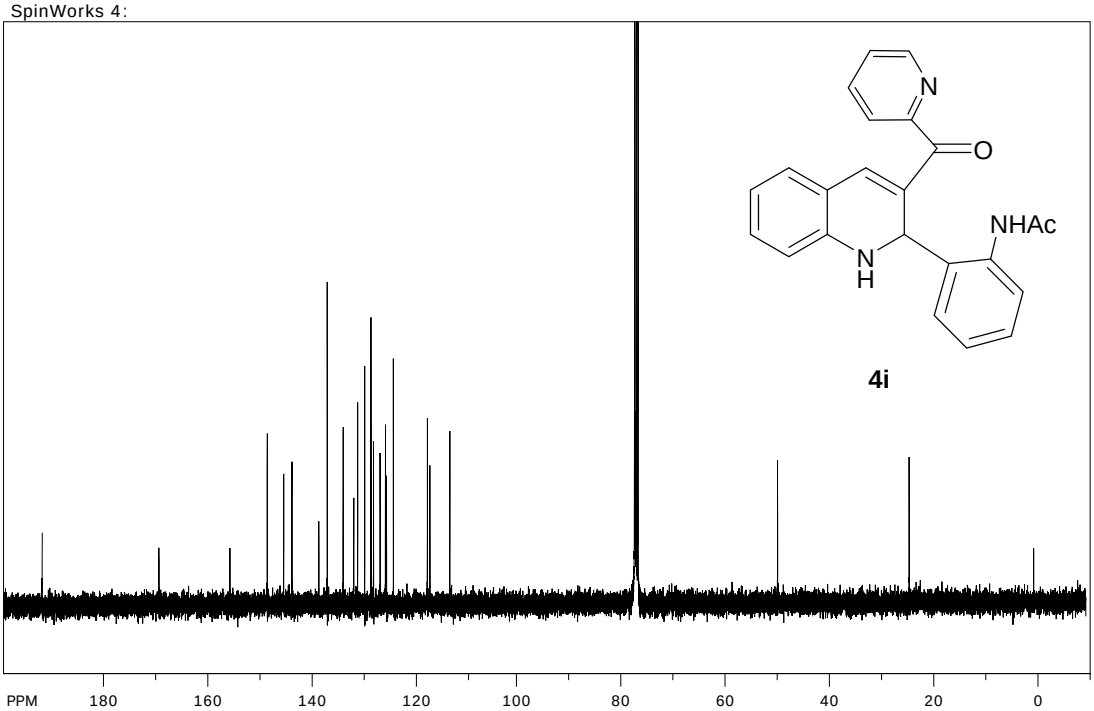
SpinWorks 4:



file: ...sers\健太\Desktop\Suzuki\pyri\10\fid expt: <zg30>
transmitter freq.: 400.132471 MHz
time domain size: 65536 points
width: 8012.82 Hz = 20.0254 ppm = 0.122266 Hz/pt
number of scans: 16

freq. of 0 ppm: 400.130010 MHz
processed size: 65536 complex points
LB: 0.000 GF: 0.0000
Hz/cm: 176.354 ppm/cm: 0.44074

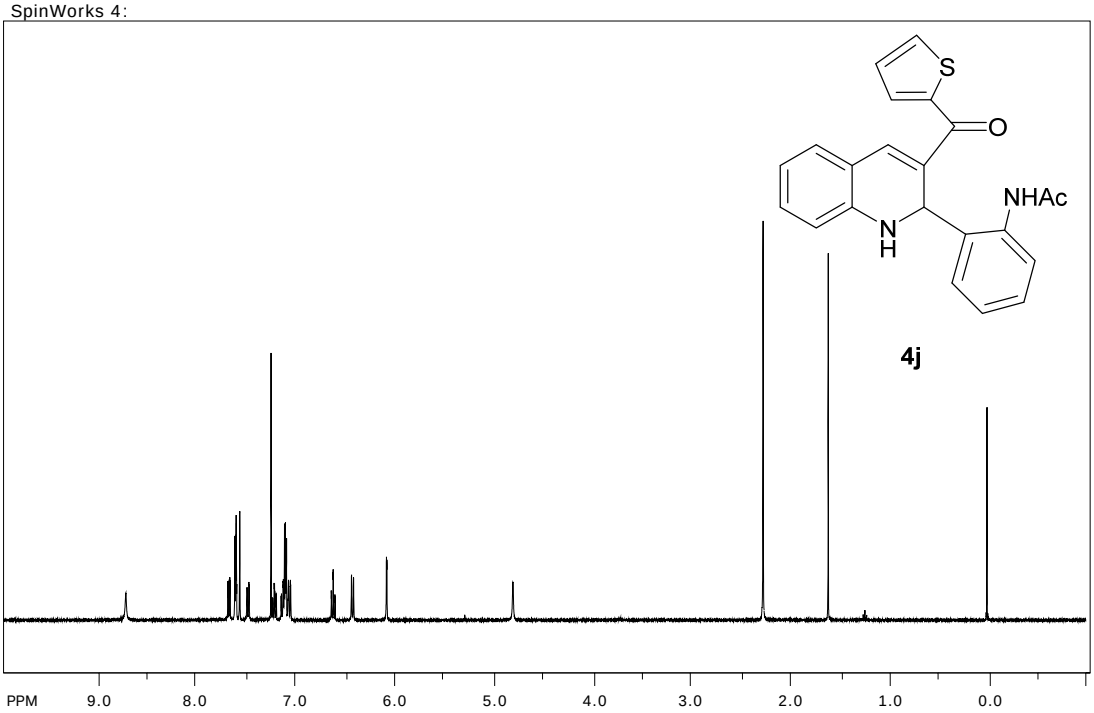
SpinWorks 4:



file: ...dihydroquinolines\py-dq-13C\10\fid expt: <zgpg30>
transmitter freq.: 100.622829 MHz
time domain size: 65536 points
width: 24038.46 Hz = 238.8967 ppm = 0.366798 Hz/pt
number of scans: 10000

freq. of 0 ppm: 100.612753 MHz
processed size: 32768 complex points
LB: 0.000 GF: 0.0000
Hz/cm: 844.566 ppm/cm: 8.39338

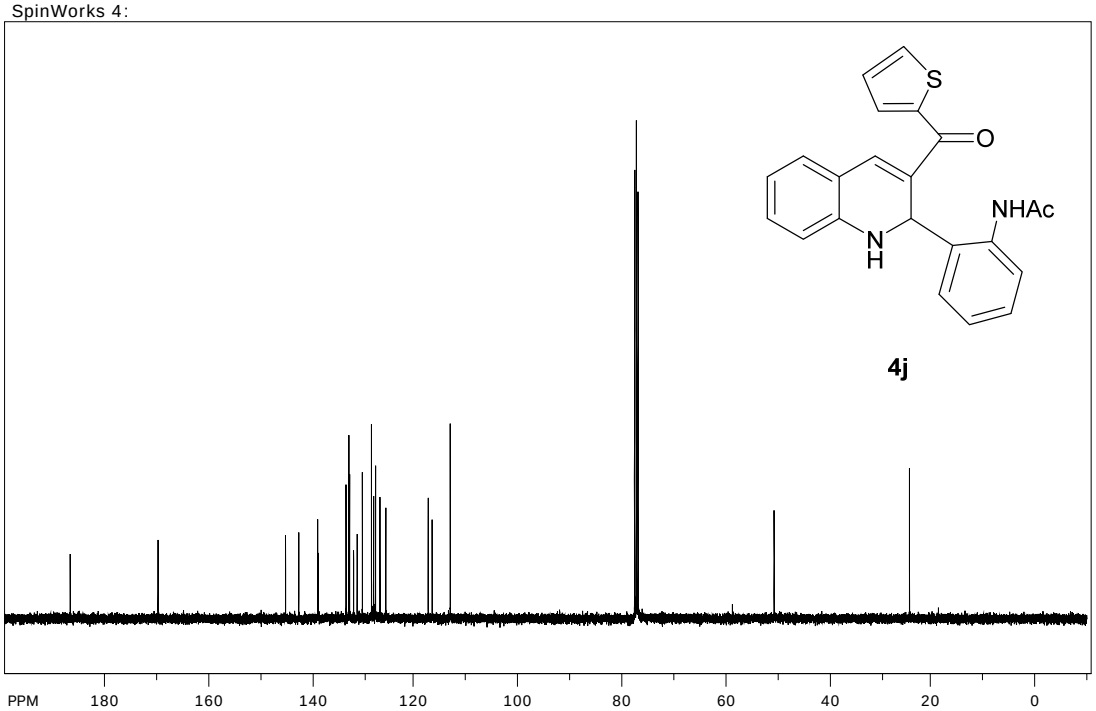
SpinWorks 4:



file: ...\Users\健太\Desktop\Suzuki\th\10\fid expt: <zg30>
transmitter freq.: 400.132471 MHz
time domain size: 65536 points
width: 8012.82 Hz = 20.0254 ppm = 0.122266 Hz/pt
number of scans: 8

freq. of 0 ppm: 400.130010 MHz
processed size: 65536 complex points
LB: 0.000 GF: 0.0000
Hz/cm: 175.638 ppm/cm: 0.43895

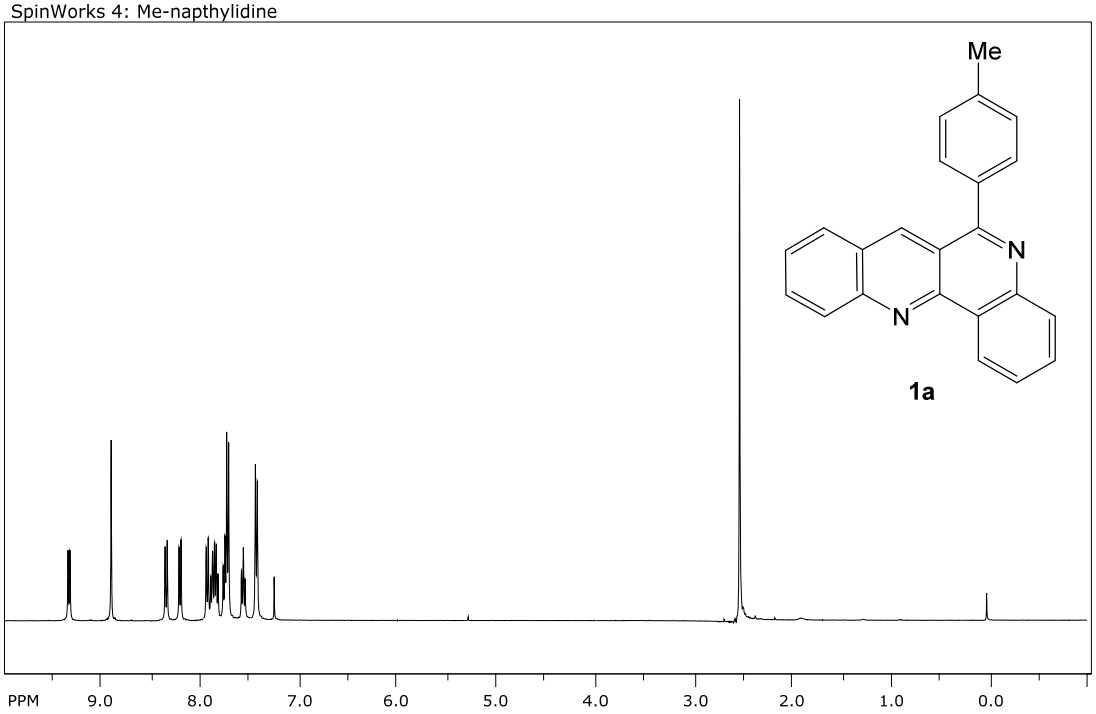
SpinWorks 4:



file: ...健太\Desktop\Suzuki\th-DQ-13C\19\fid expt: <zgpg30>
transmitter freq.: 100.622829 MHz
time domain size: 65536 points
width: 24038.46 Hz = 238.8967 ppm = 0.366798 Hz/pt
number of scans: 1024

freq. of 0 ppm: 100.612757 MHz
processed size: 32768 complex points
LB: 0.000 GF: 0.0000
Hz/cm: 845.639 ppm/cm: 8.40404

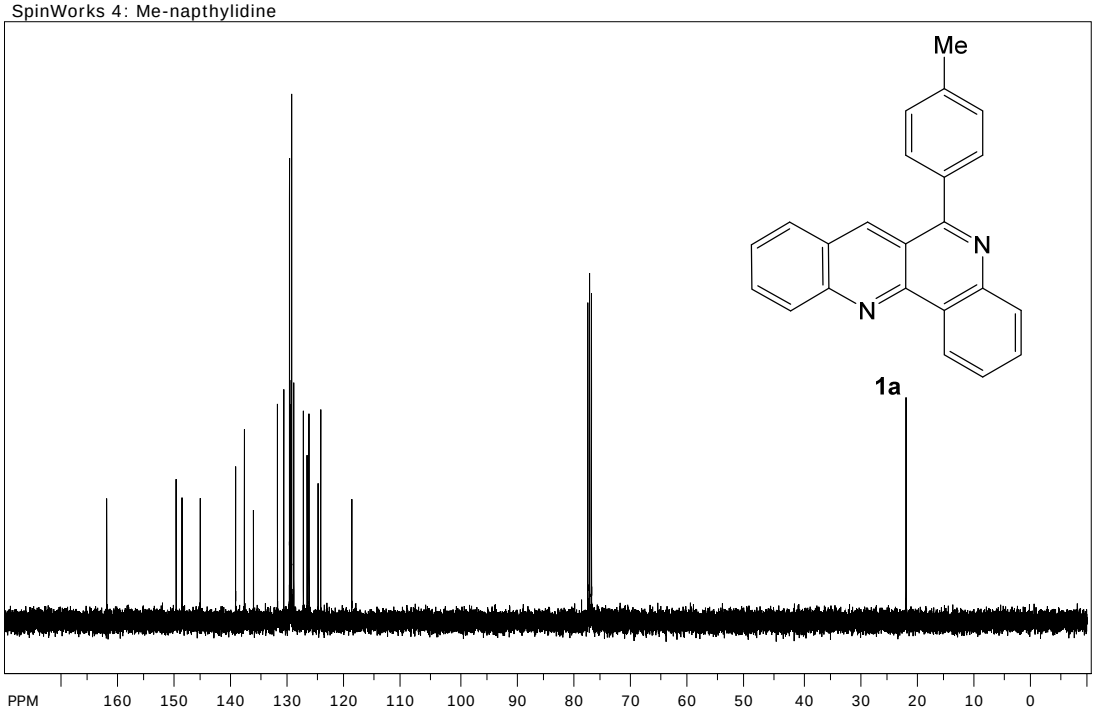
SpinWorks 4: Me-napthylidine



file: ...thylidine_20Feb2012\PROTON.fid\fid block# 1 expt: "s2pul"
transmitter freq.: 400.452035 MHz
time domain size: 44844 points
width: 6402.05 Hz = 15.9871 ppm = 0.142763 Hz/pt
number of scans: 8

freq. of 0 ppm: 400.449630 MHz
processed size: 65536 complex points
LB: 0.000 GF: 0.0000
Hz/cm: 176.342 ppm/cm: 0.44036

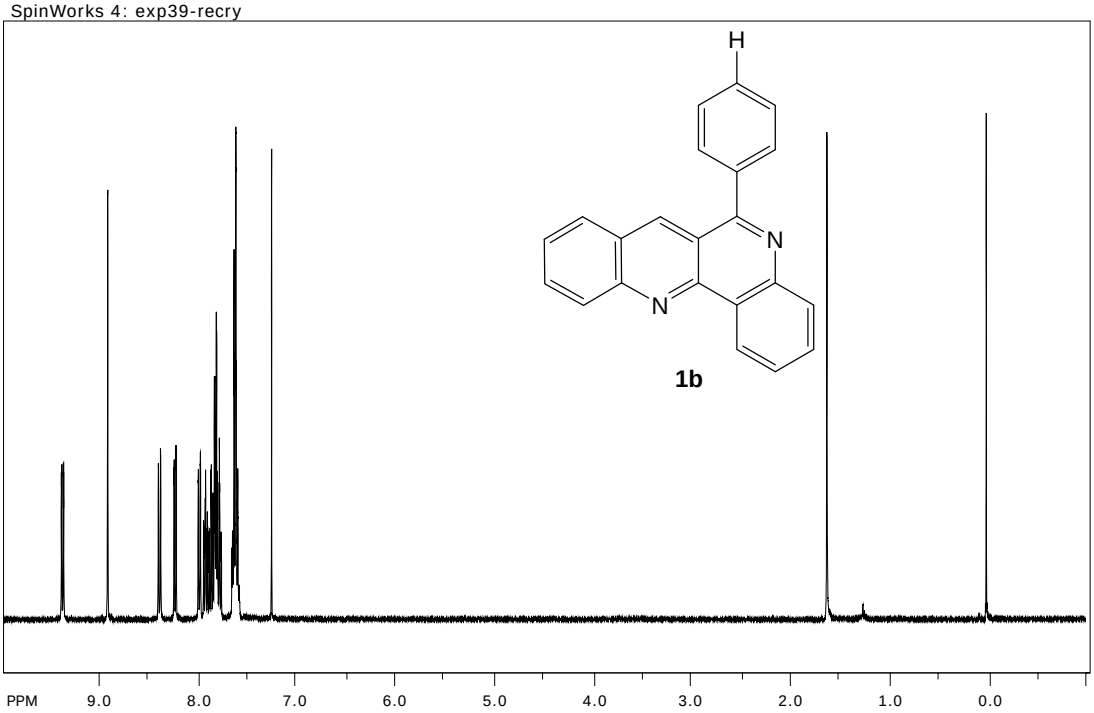
SpinWorks 4: Me-napthylidine



file: ...e\Me-napthylidine-C\CARBON.fid\fid block# 1 expt: "s2pul"
transmitter freq.: 100.704192 MHz
time domain size: 65536 points
width: 25188.92 Hz = 250.1278 ppm = 0.384352 Hz/pt
number of scans: 256

freq. of 0 ppm: 100.693128 MHz
processed size: 65536 complex points
LB: 0.000 GF: 0.0000
Hz/cm: 765.788 ppm/cm: 7.60433

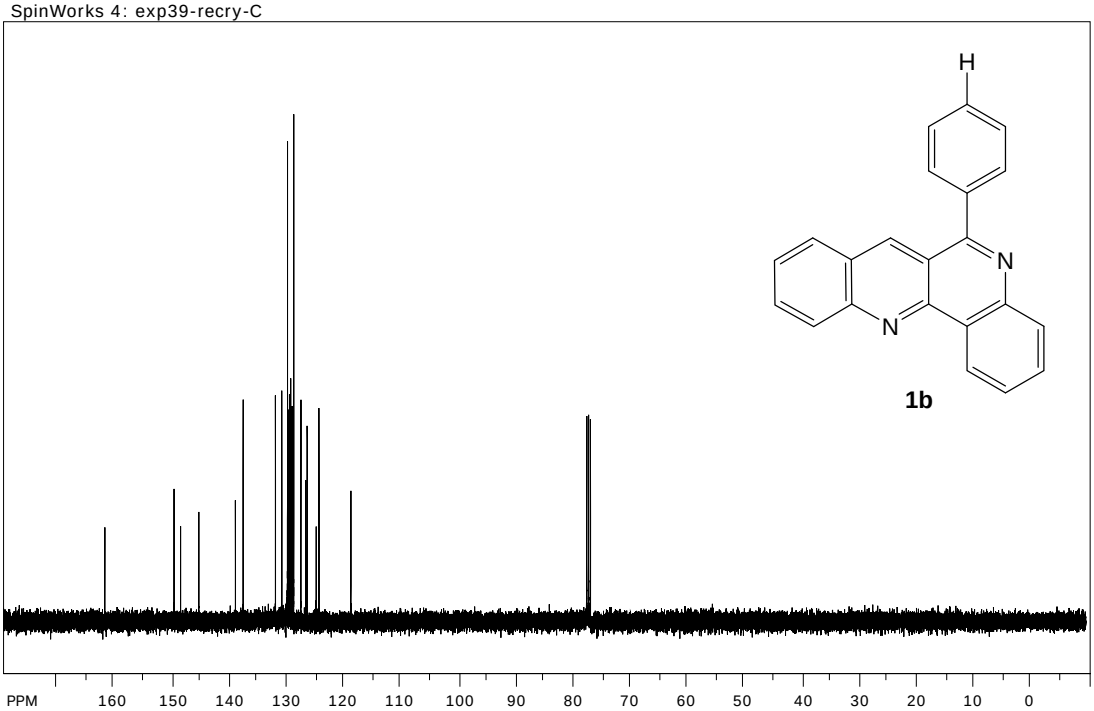
SpinWorks 4: exp39-recry



file: ...p39-recry_12Jul2011\PROTON.fid\fid block# 1 expt: "s2pul"
transmitter freq.: 400.452035 MHz
time domain size: 44844 points
width: 6402.05 Hz = 15.9871 ppm = 0.142763 Hz/pt
number of scans: 8

freq. of 0 ppm: 400.449631 MHz
processed size: 65536 complex points
LB: 0.000 GF: 0.0000
Hz/cm: 176.056 ppm/cm: 0.43964

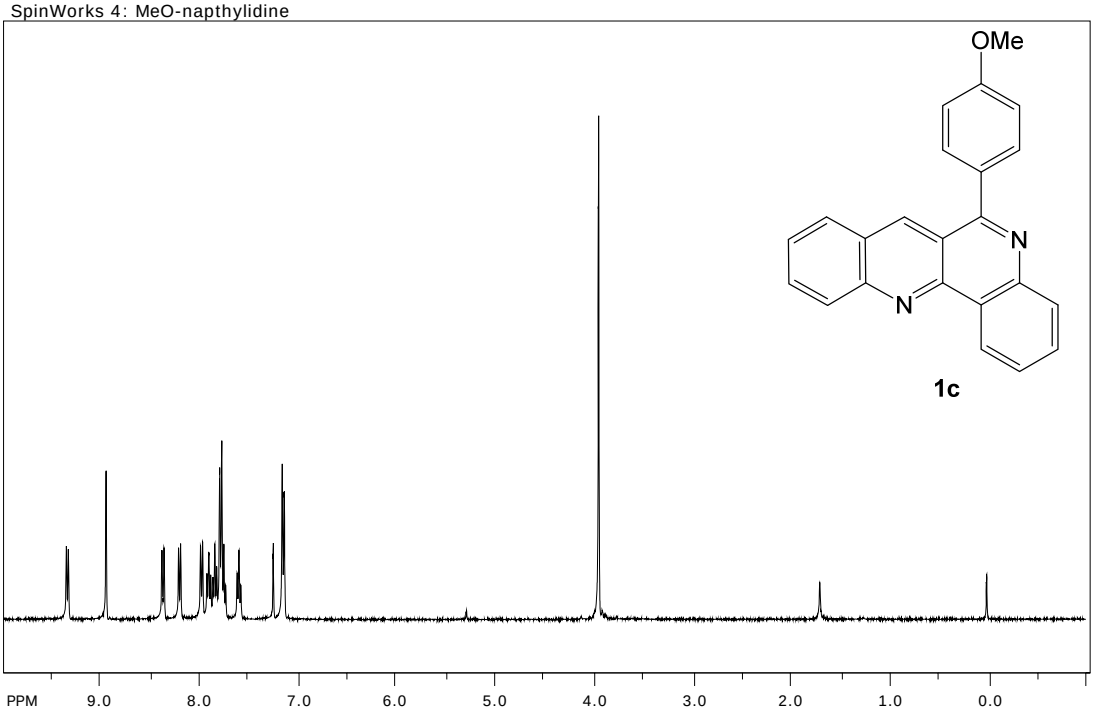
SpinWorks 4: exp39-recry-C



file: ...9-recry-C_12Jul2011\CARBON.fid\fid block# 1 expt: "s2pul"
transmitter freq.: 100.704192 MHz
time domain size: 65536 points
width: 25188.92 Hz = 250.1278 ppm = 0.384352 Hz/pt
number of scans: 128

freq. of 0 ppm: 100.693130 MHz
processed size: 65536 complex points
LB: 0.000 GF: 0.0000
Hz/cm: 763.539 ppm/cm: 7.58200

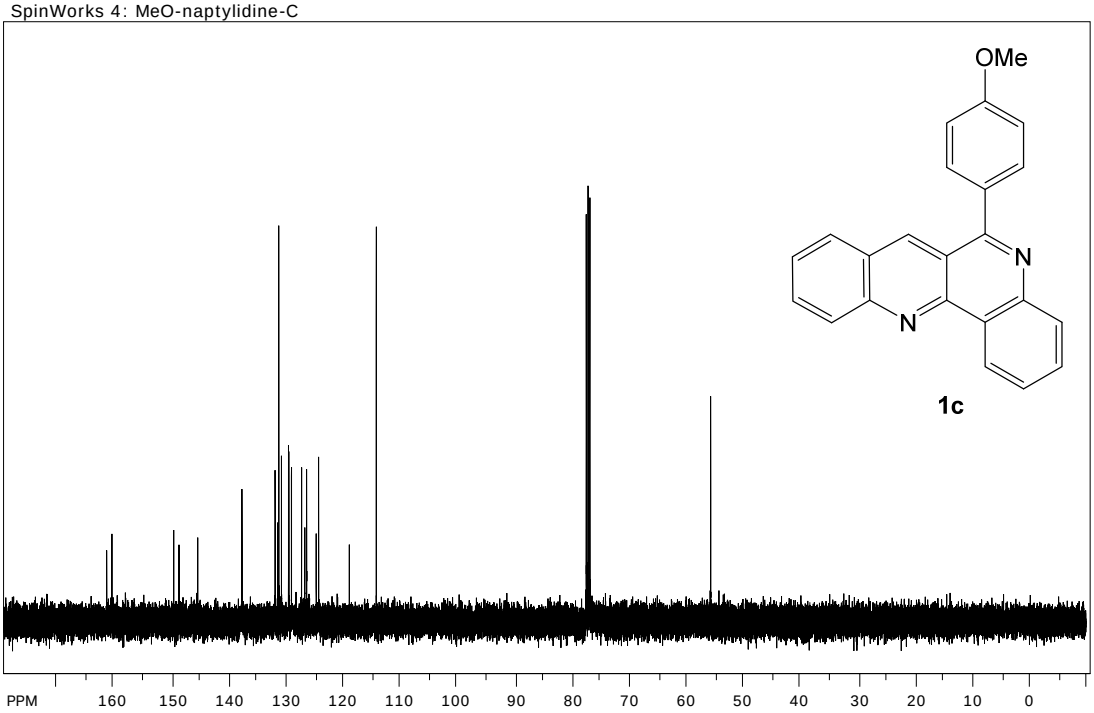
SpinWorks 4: MeO-napthylidine



file: ...20Feb2012_20Feb2012\PROTON.fid\fid block# 1 expt: "s2pul"
transmitter freq.: 400.452035 MHz
time domain size: 44844 points
width: 6402.05 Hz = 15.9871 ppm = 0.142763 Hz/pt
number of scans: 8

freq. of 0 ppm: 400.449629 MHz
processed size: 65536 complex points
LB: 0.000 GF: 0.0000
Hz/cm: 176.342 ppm/cm: 0.44036

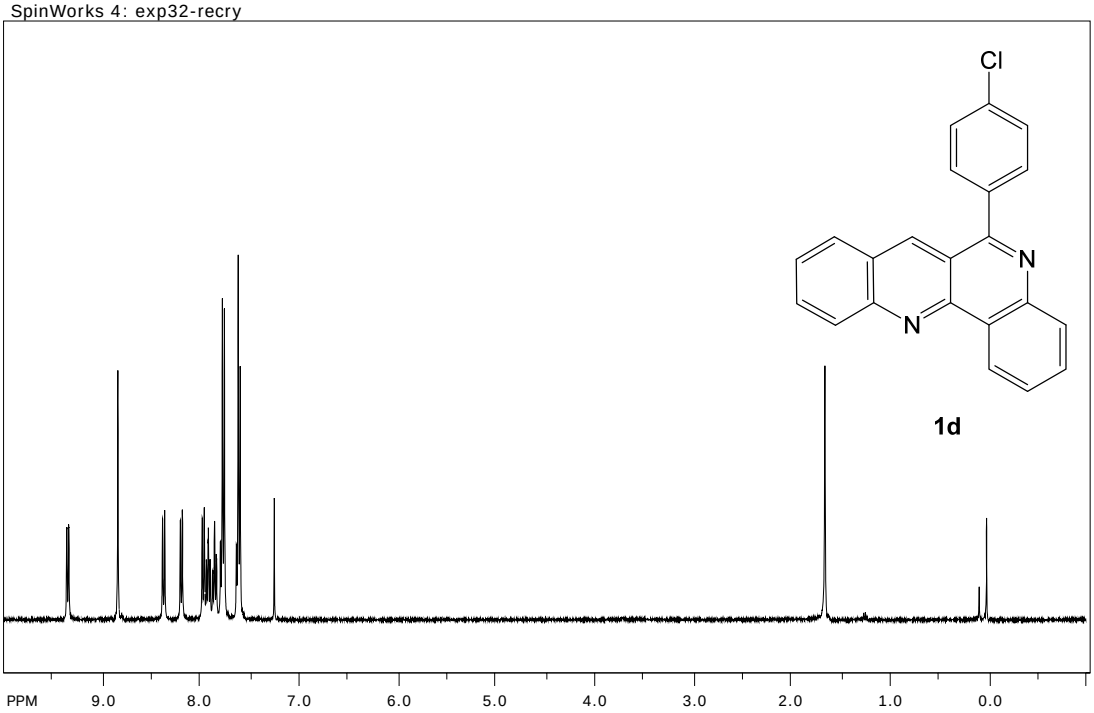
SpinWorks 4: MeO-naptylidine-C



file: ...ylidine-C_20Feb2012\CARBON.fid\fid block# 1 expt: "s2pul"
transmitter freq.: 100.704192 MHz
time domain size: 65536 points
width: 25188.92 Hz = 250.1278 ppm = 0.384352 Hz/pt
number of scans: 256

freq. of 0 ppm: 100.693125 MHz
processed size: 65536 complex points
LB: 0.000 GF: 0.0000
Hz/cm: 764.664 ppm/cm: 7.59316

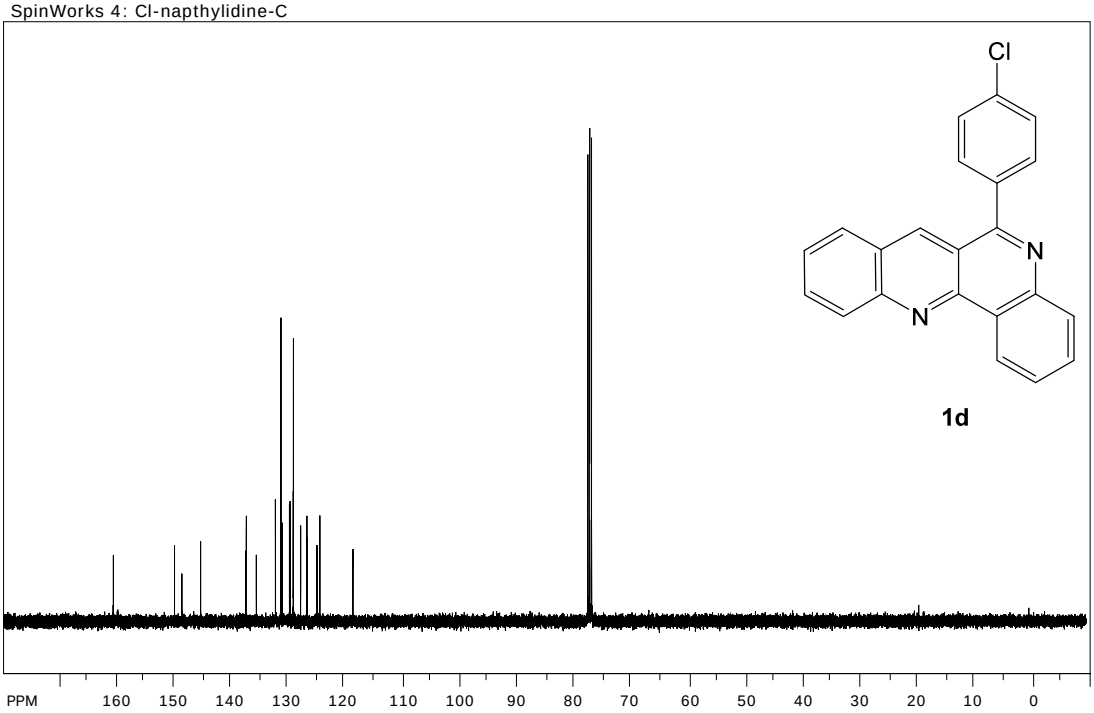
SpinWorks 4: exp32-recry



file: ...napthyridine\Cl-nap\PROTON.fid\fid block# 1 expt: "s2pul"
transmitter freq.: 400.452035 MHz
time domain size: 44844 points
width: 6402.05 Hz = 15.9871 ppm = 0.142763 Hz/pt
number of scans: 8

freq. of 0 ppm: 400.449631 MHz
processed size: 65536 complex points
LB: 0.000 GF: 0.0000
Hz/cm: 176.628 ppm/cm: 0.44107

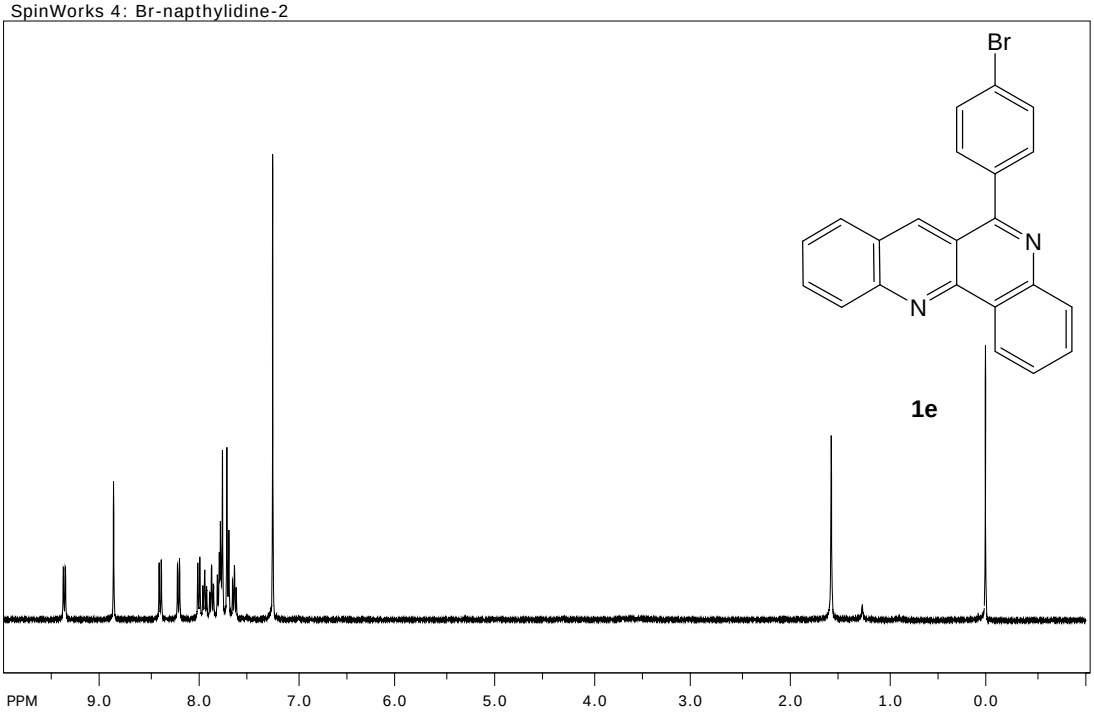
SpinWorks 4: Cl-napthylidine-C



file: ...ylidine-C_21Feb2012\CARBON.fid\fid block# 1 expt: "s2pul"
transmitter freq.: 100.704192 MHz
time domain size: 65536 points
width: 25188.92 Hz = 250.1278 ppm = 0.384352 Hz/pt
number of scans: 2000

freq. of 0 ppm: 100.693124 MHz
processed size: 65536 complex points
LB: 0.000 GF: 0.0000
Hz/cm: 764.664 ppm/cm: 7.59316

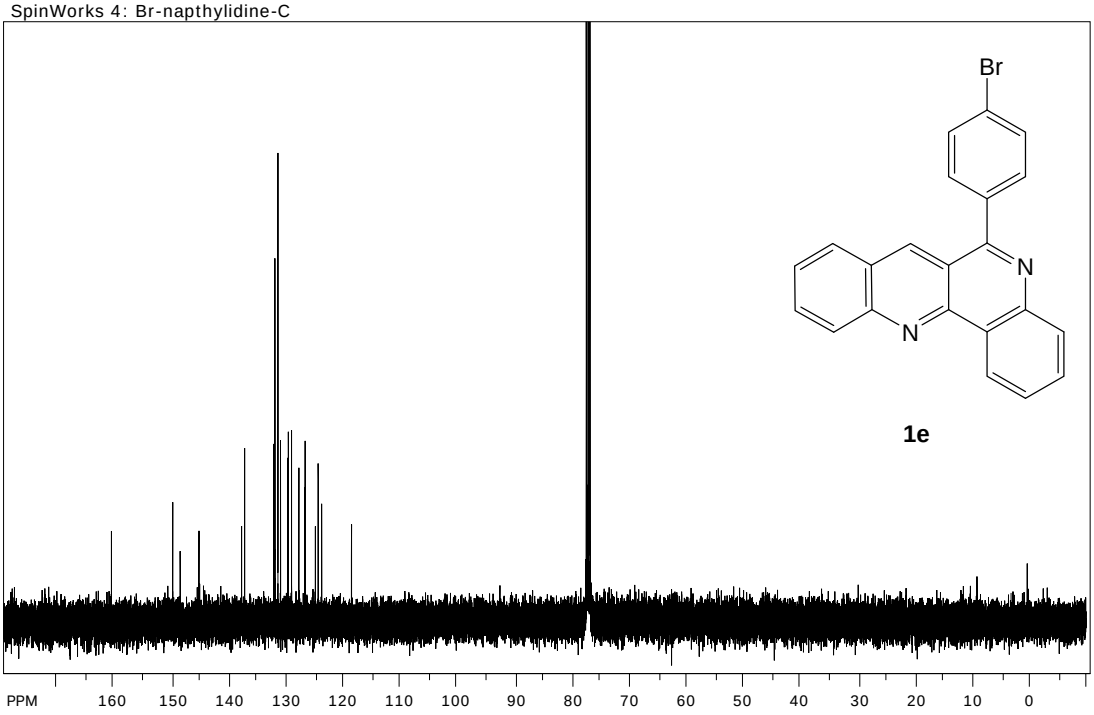
SpinWorks 4: Br-napthylidine-2



file: ...ylidine-2_20Feb2012\PROTON.fid\fid block# 1 expt: "s2pul"
transmitter freq.: 400.452035 MHz
time domain size: 44844 points
width: 6402.05 Hz = 15.9871 ppm = 0.142763 Hz/pt
number of scans: 32

freq. of 0 ppm: 400.449630 MHz
processed size: 65536 complex points
LB: 0.000 GF: 0.0000
Hz/cm: 176.628 ppm/cm: 0.44107

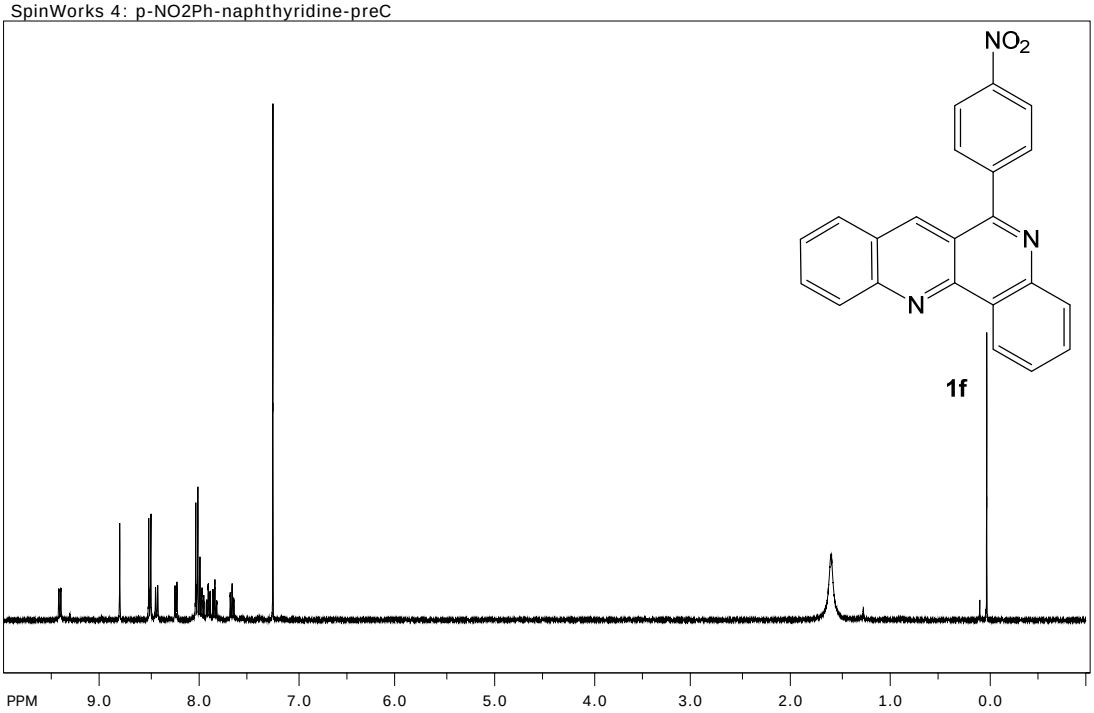
SpinWorks 4: Br-napthylidine-C



file: ...20Feb2012_20Feb2012\CARBON.fid\fid block# 1 expt: "s2pul"
transmitter freq.: 100.704192 MHz
time domain size: 65536 points
width: 25188.92 Hz = 250.1278 ppm = 0.384352 Hz/pt
number of scans: 5000

freq. of 0 ppm: 100.693123 MHz
processed size: 65536 complex points
LB: 0.000 GF: 0.0000
Hz/cm: 764.664 ppm/cm: 7.59316

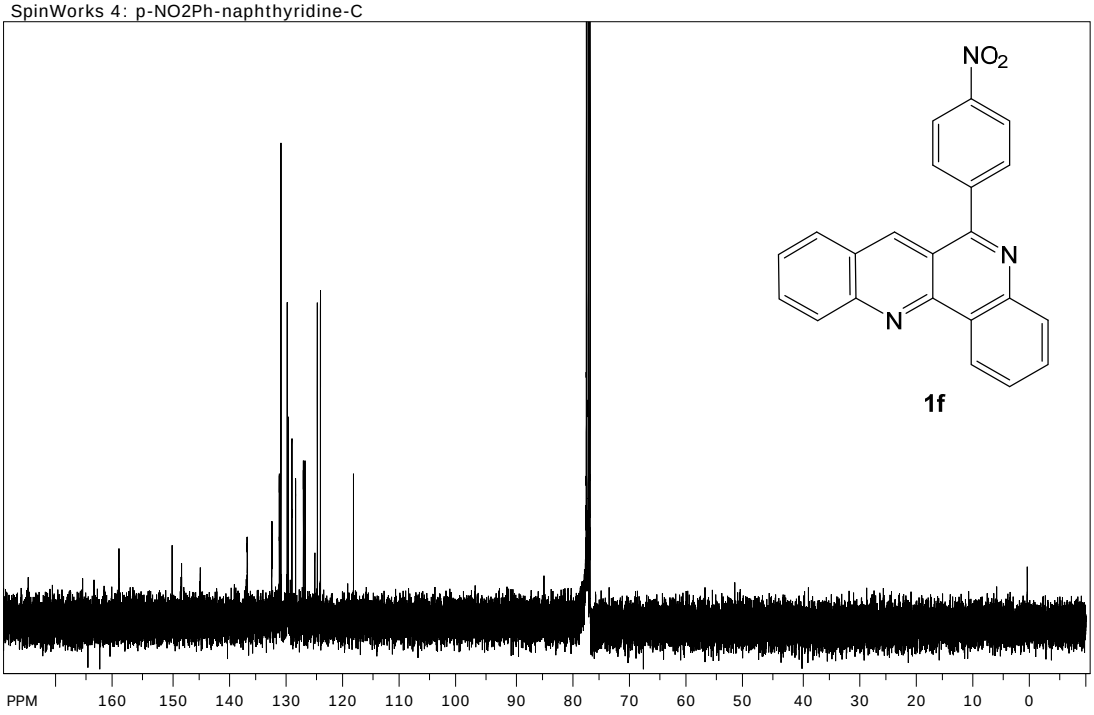
SpinWorks 4: p-NO2Ph-naphthyridine-preC



file: ...dine-preC_19Sep2013\PROTON.fid\fid block# 1 expt: "s2pul"
transmitter freq.: 400.452035 MHz
time domain size: 44844 points
width: 6402.05 Hz = 15.9871 ppm = 0.142763 Hz/pt
number of scans: 8

freq. of 0 ppm: 400.449631 MHz
processed size: 65536 complex points
LB: 0.000 GF: 0.0000
Hz/cm: 176.342 ppm/cm: 0.44036

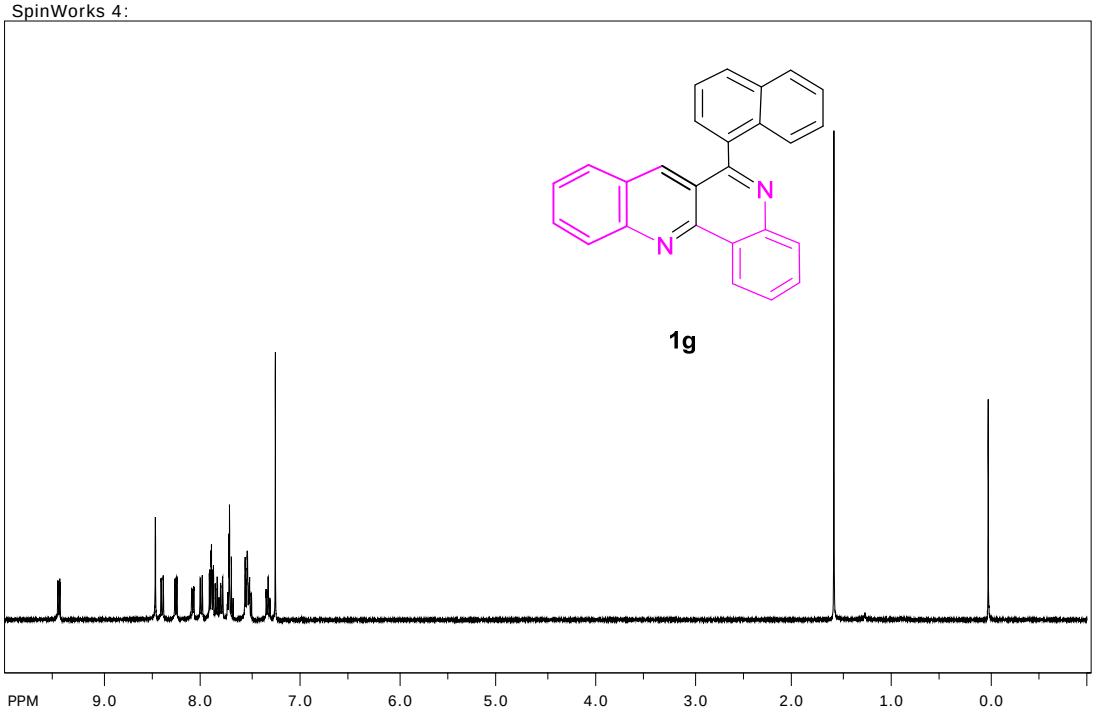
SpinWorks 4: p-NO2Ph-naphthyridine-C



file: ...yridine-C_19Sep2013\CARBON.fid\fid block# 1 expt: "s2pul"
transmitter freq.: 100.704192 MHz
time domain size: 65536 points
width: 25188.92 Hz = 250.1278 ppm = 0.384352 Hz/pt
number of scans: 15000

freq. of 0 ppm: 100.693121 MHz
processed size: 65536 complex points
LB: 0.000 GF: 0.0000
Hz/cm: 764.664 ppm/cm: 7.59316

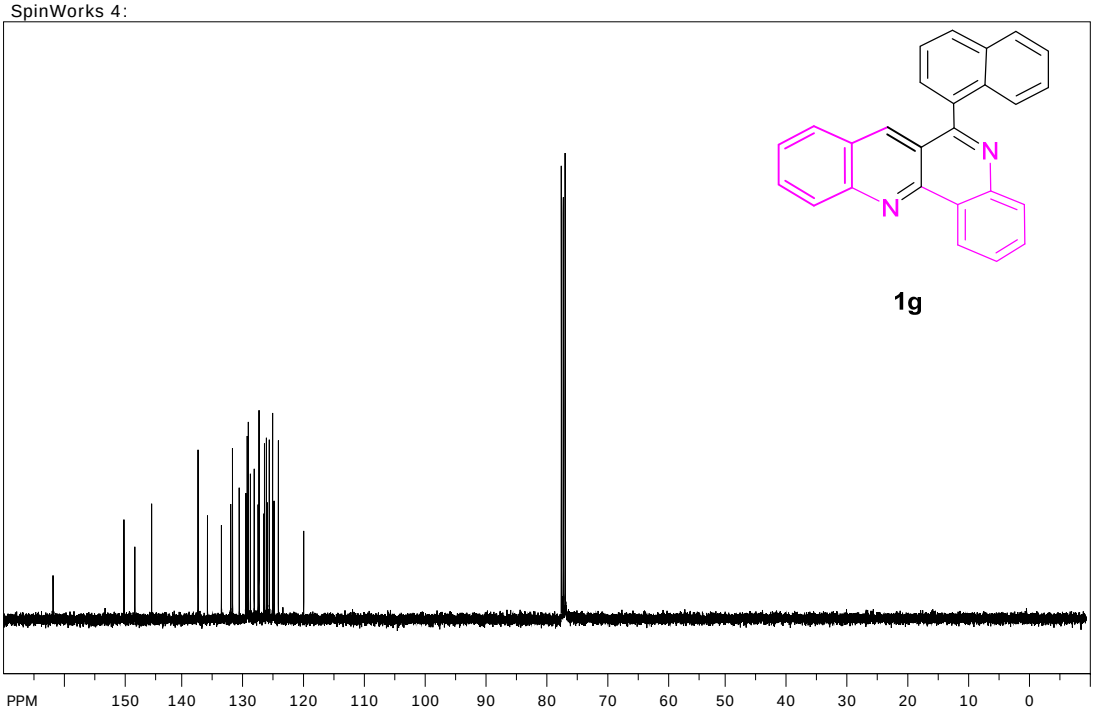
SpinWorks 4:



file: ...s\健太\Desktop\Suzuki\nap-nap\10\fid expt: <zg30>
transmitter freq.: 400.132471 MHz
time domain size: 65536 points
width: 8012.82 Hz = 20.0254 ppm = 0.122266 Hz/pt
number of scans: 8

freq. of 0 ppm: 400.130010 MHz
processed size: 65536 complex points
LB: 0.000 GF: 0.0000
Hz/cm: 176.354 ppm/cm: 0.44074

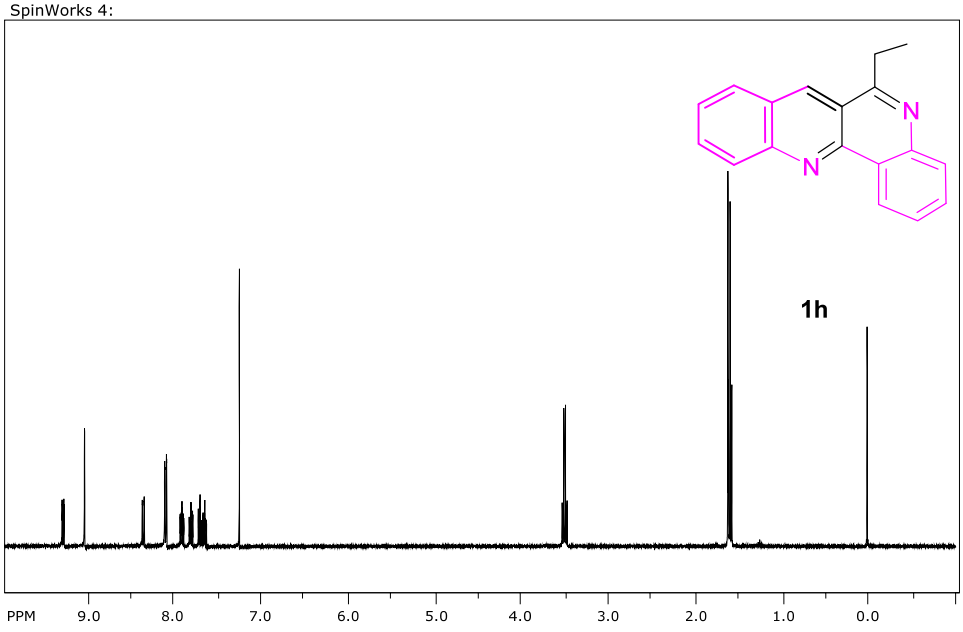
SpinWorks 4:



file: ...s\健太\Desktop\Suzuki\nap-nap\20\fid expt: <zgpg30>
transmitter freq.: 100.622829 MHz
time domain size: 65536 points
width: 24038.46 Hz = 238.8967 ppm = 0.366798 Hz/pt
number of scans: 512

freq. of 0 ppm: 100.612758 MHz
processed size: 32768 complex points
LB: 0.000 GF: 0.0000
Hz/cm: 724.373 ppm/cm: 7.19890

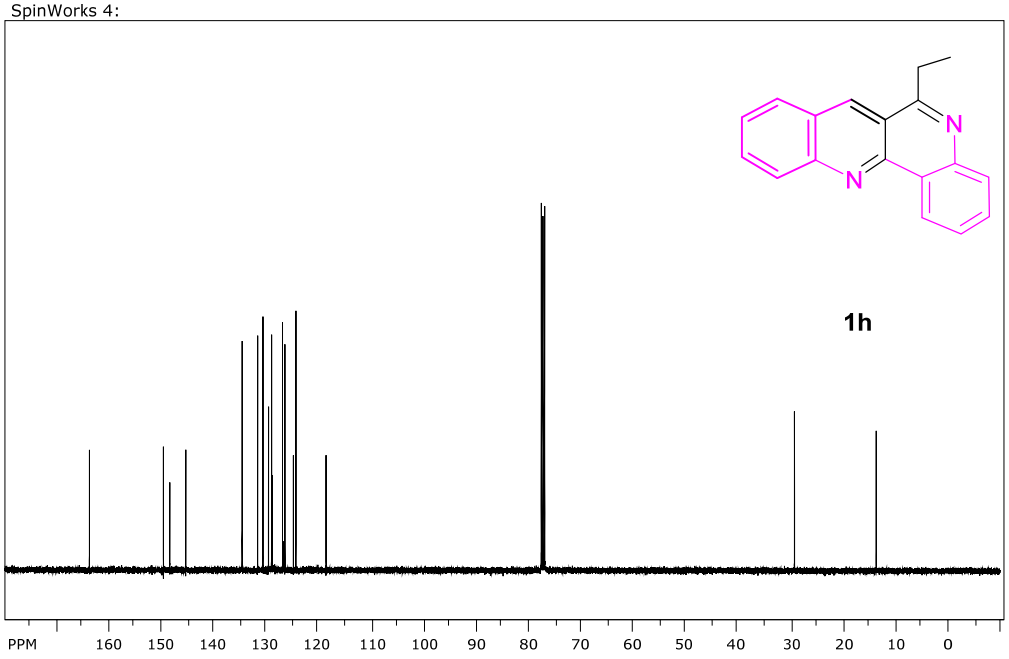
SpinWorks 4:



file: ...rs\健太\Desktop\Suzuki\hatena\10\fid expt: <zg30>
transmitter freq.: 400.132471 MHz
time domain size: 65536 points
width: 8012.82 Hz = 20.0254 ppm = 0.122266 Hz/pt
number of scans: 8

freq. of 0 ppm: 400.130009 MHz
processed size: 65536 complex points
LB: 0.000 GF: 0.0000
Hz/cm: 175.996 ppm/cm: 0.43984

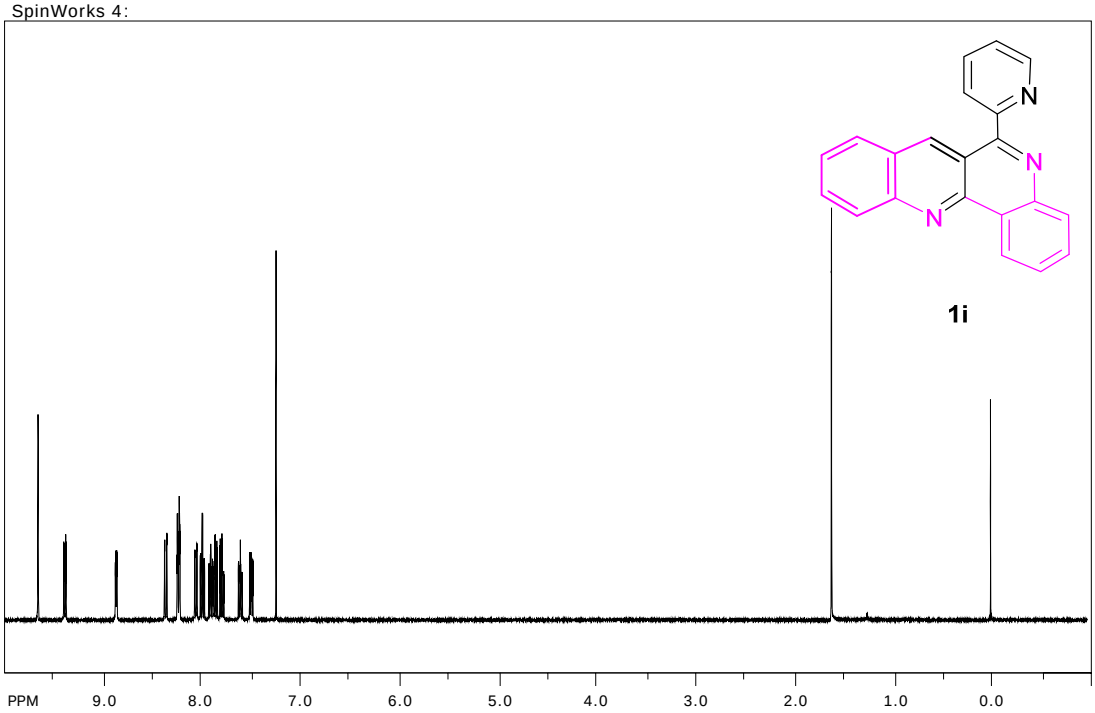
SpinWorks 4:



file: ...健太\Desktop\Suzuki\Et-DN-13C\10\fid expt: <zgpg30>
transmitter freq.: 100.622829 MHz
time domain size: 65536 points
width: 24038.46 Hz = 238.8967 ppm = 0.366798 Hz/pt
number of scans: 1024

freq. of 0 ppm: 100.612756 MHz
processed size: 32768 complex points
LB: 0.000 GF: 0.0000
Hz/cm: 766.226 ppm/cm: 7.61483

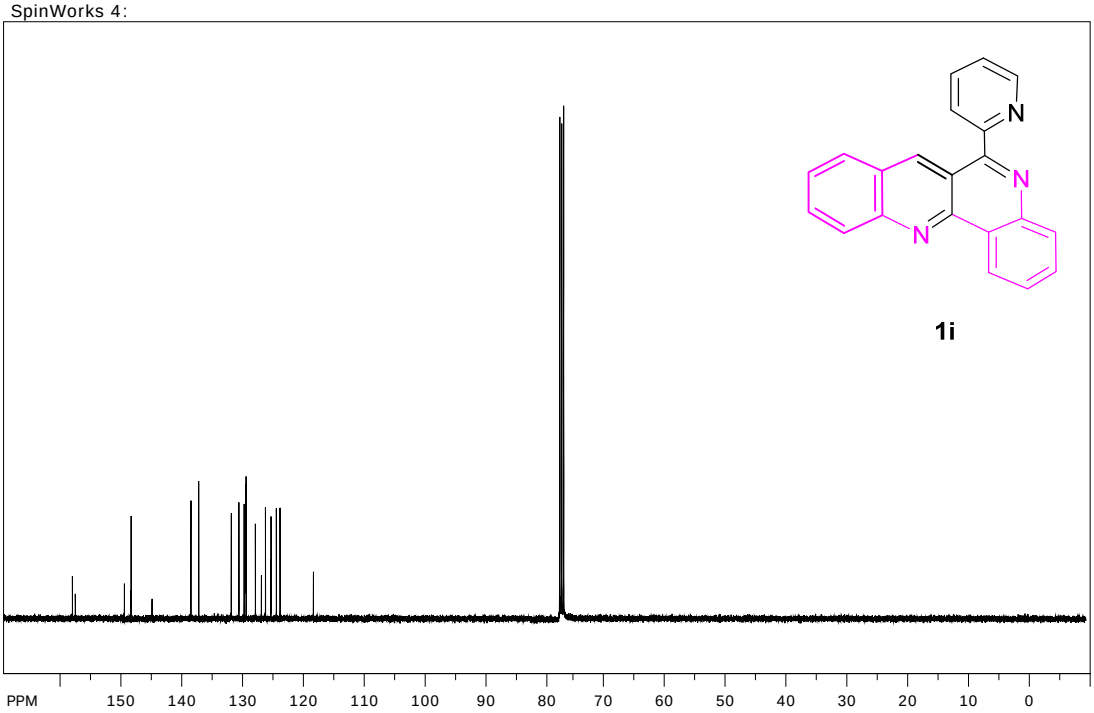
SpinWorks 4:



file: ...sers\健太\Desktop\Suzuki\Py-n\10\fid expt: <zg30>
transmitter freq.: 400.132471 MHz
time domain size: 65536 points
width: 8012.82 Hz = 20.0254 ppm = 0.122266 Hz/pt
number of scans: 8

freq. of 0 ppm: 400.130009 MHz
processed size: 65536 complex points
LB: 0.000 GF: 0.0000
Hz/cm: 175.996 ppm/cm: 0.43984

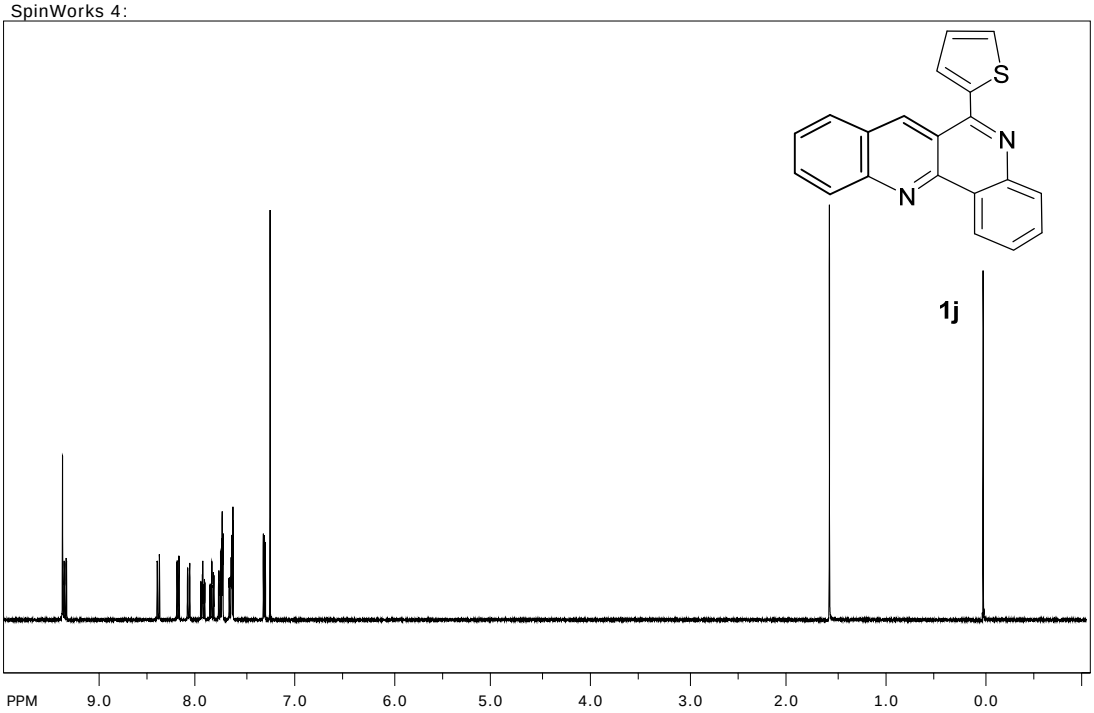
SpinWorks 4:



file: ...太\Desktop\Suzuki\py-Nap-13C\10\fid expt: <zgpg30>
transmitter freq.: 100.622829 MHz
time domain size: 65536 points
width: 24038.46 Hz = 238.8967 ppm = 0.366798 Hz/pt
number of scans: 2500

freq. of 0 ppm: 100.612754 MHz
processed size: 32768 complex points
LB: 0.000 GF: 0.0000
Hz/cm: 724.373 ppm/cm: 7.19890

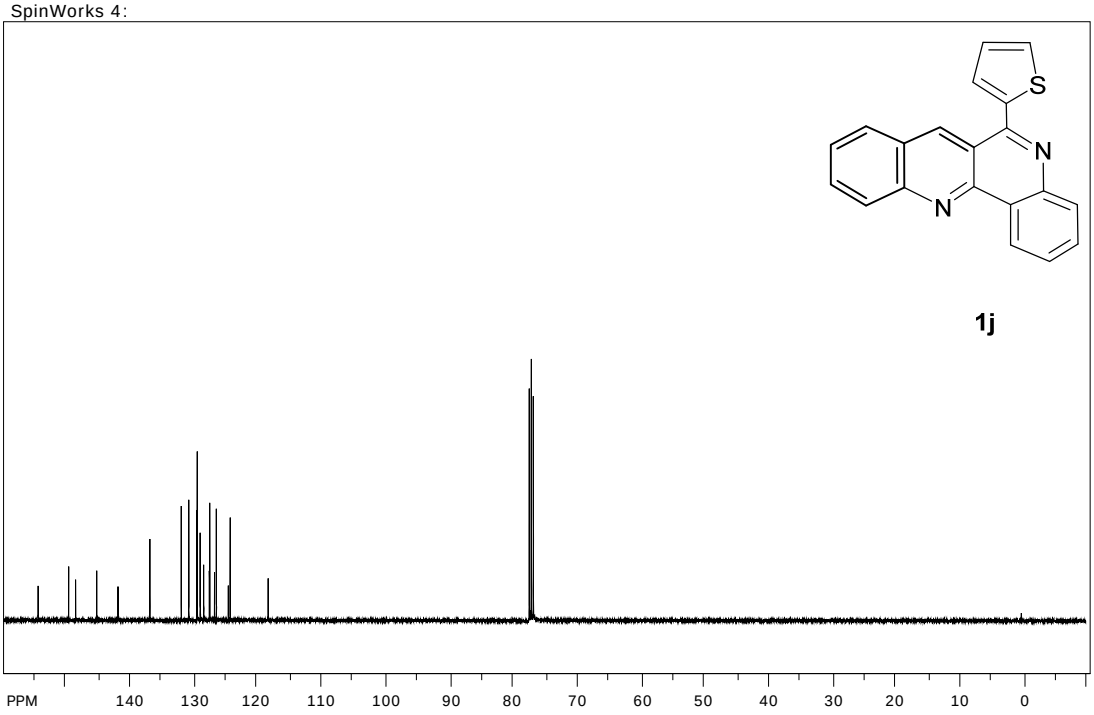
SpinWorks 4:



file: ...sktop\Suzuki\Thi-Nap-protom\10\fid expt: <zg30>
transmitter freq.: 400.132471 MHz
time domain size: 65536 points
width: 8012.82 Hz = 20.0254 ppm = 0.122266 Hz/pt
number of scans: 16

freq. of 0 ppm: 400.130009 MHz
processed size: 65536 complex points
LB: 0.000 GF: 0.0000
Hz/cm: 176.354 ppm/cm: 0.44074

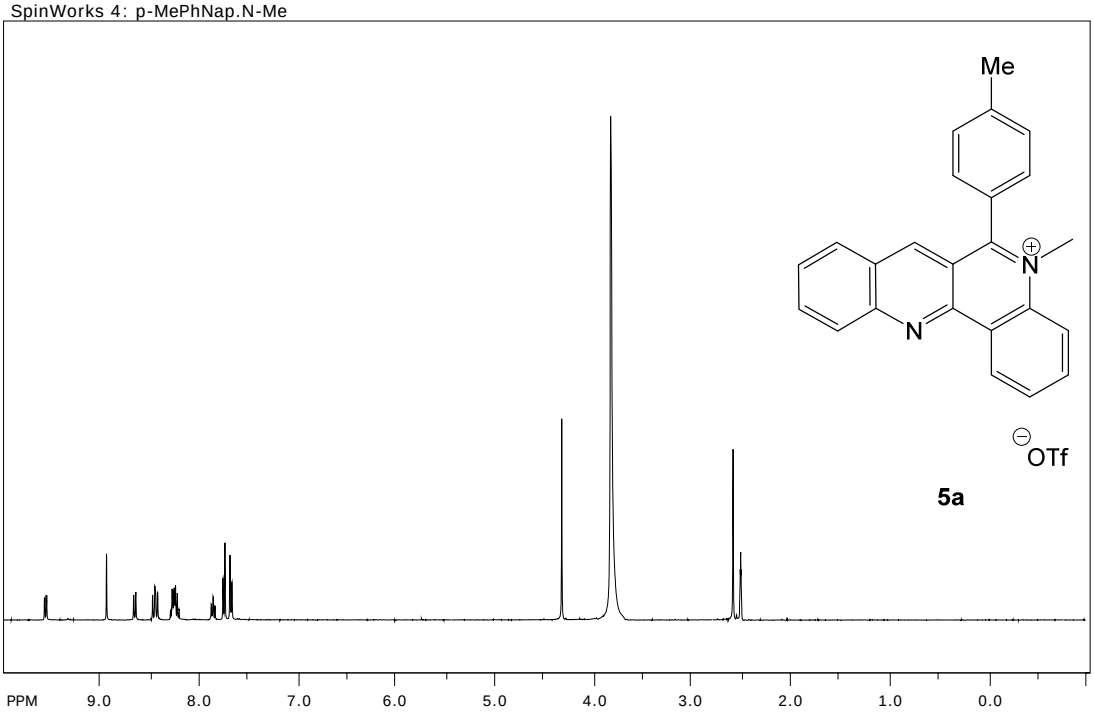
SpinWorks 4:



file: ...ktop\Suzuki\Thienyl-Nap-13C\10\fid expt: <zgpg30>
transmitter freq.: 100.622829 MHz
time domain size: 65536 points
width: 24038.46 Hz = 238.8967 ppm = 0.366798 Hz/pt
number of scans: 3000

freq. of 0 ppm: 100.612756 MHz
processed size: 32768 complex points
LB: 0.000 GF: 0.0000
Hz/cm: 684.667 ppm/cm: 6.80429

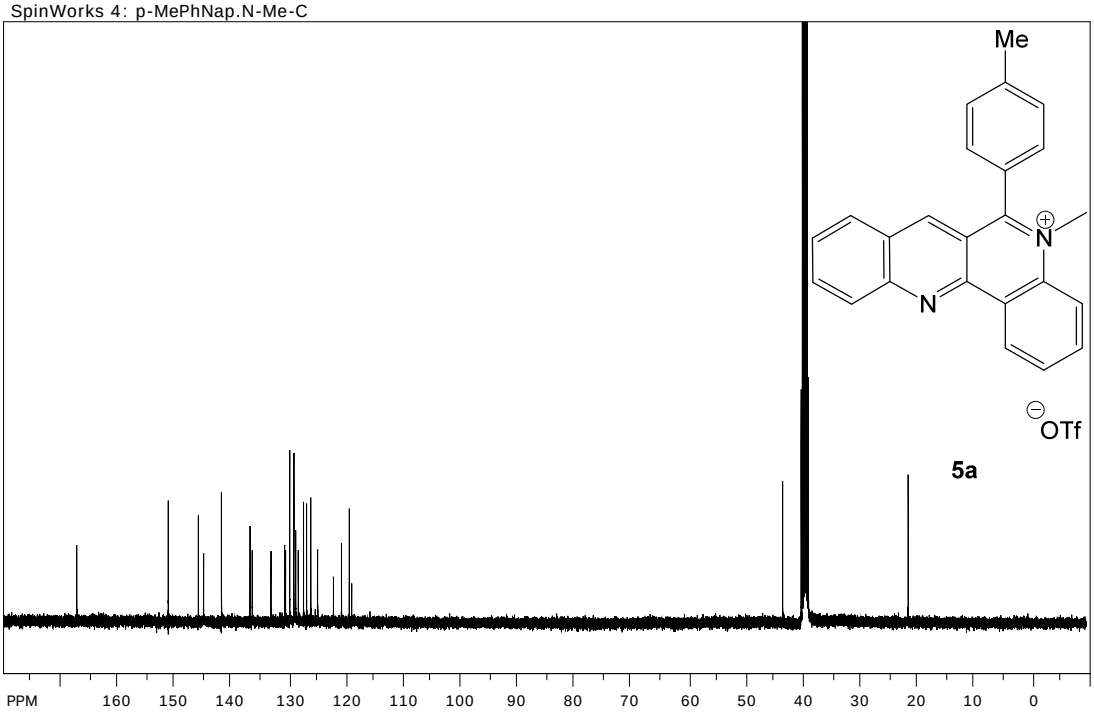
SpinWorks 4: p-MePhNap.N-Me



file: ...Me\p-MePhNap.N-Me_H\PROTON.fid\fid block# 1 expt: "s2pul"
transmitter freq.: 400.453937 MHz
time domain size: 44844 points
width: 6402.05 Hz = 15.9870 ppm = 0.142763 Hz/pt
number of scans: 8

freq. of 0 ppm: 400.451527 MHz
processed size: 65536 complex points
LB: 0.000 GF: 0.0000
Hz/cm: 176.342 ppm/cm: 0.44036

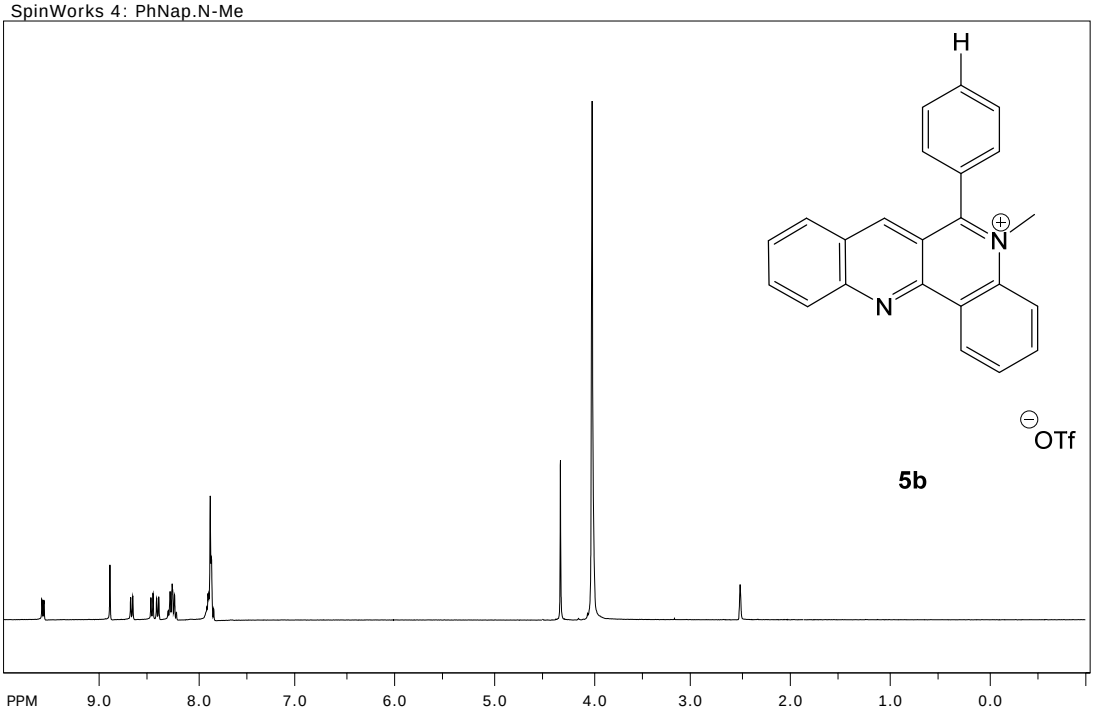
SpinWorks 4: p-MePhNap.N-Me-C



file: ...Me\p-MePhNap.N-Me-C\CARBON.fid\fid block# 1 expt: "s2pul"
transmitter freq.: 100.704671 MHz
time domain size: 65536 points
width: 25188.92 Hz = 250.1266 ppm = 0.384352 Hz/pt
number of scans: 20000

freq. of 0 ppm: 100.693658 MHz
processed size: 65536 complex points
LB: 0.000 GF: 0.0000
Hz/cm: 765.788 ppm/cm: 7.60430

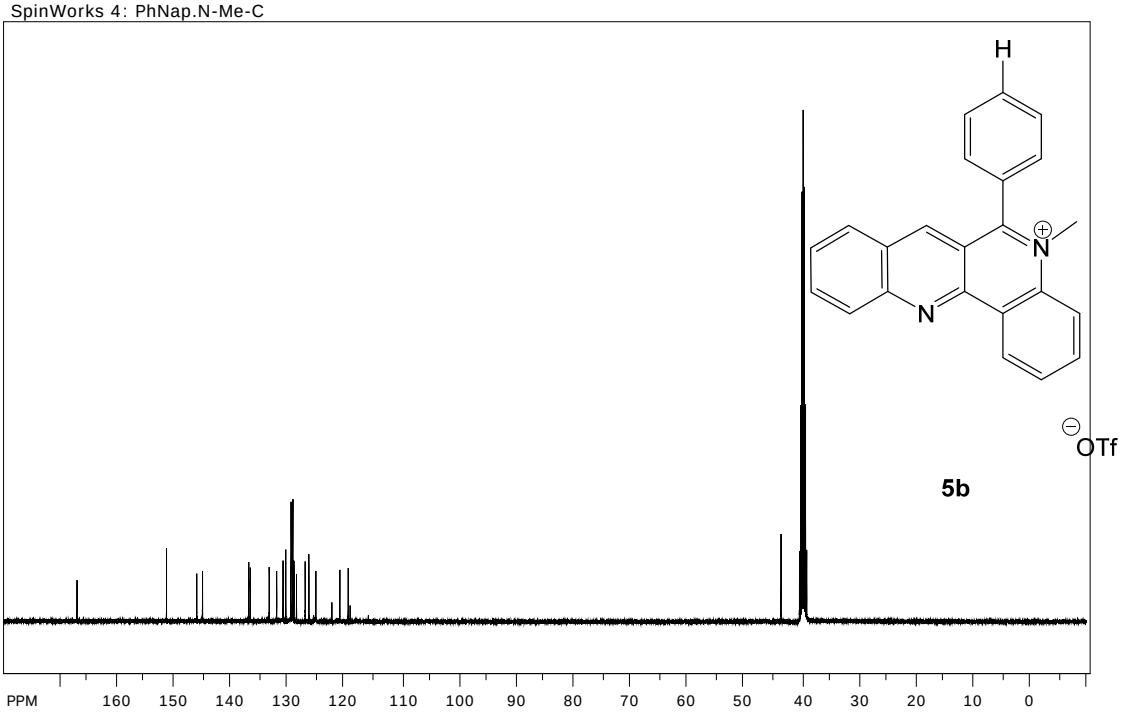
SpinWorks 4: PhNap.N-Me



file: ...p.N-Me\PhNap.N-Me_H\PROTON.fid\fid block# 1 expt: "s2pul"
transmitter freq.: 400.453937 MHz
time domain size: 44844 points
width: 6402.05 Hz = 15.9870 ppm = 0.142763 Hz/pt
number of scans: 8

freq. of 0 ppm: 400.451527 MHz
processed size: 65536 complex points
LB: 0.000 GF: 0.0000
Hz/cm: 176.056 ppm/cm: 0.43964

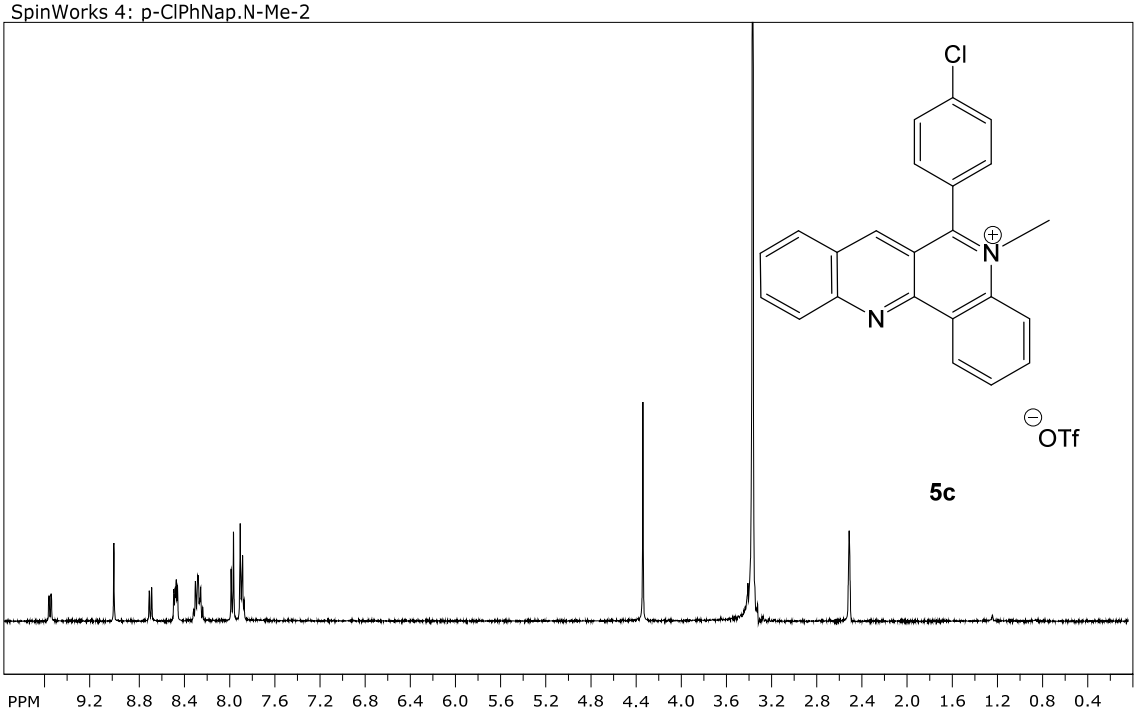
SpinWorks 4: PhNap.N-Me-C



file: ...p.N-Me\PhNap.N-Me-C\CARBON.fid\fid block# 1 expt: "s2pul"
transmitter freq.: 100.704671 MHz
time domain size: 65536 points
width: 25188.92 Hz = 250.1266 ppm = 0.384352 Hz/pt
number of scans: 15000

freq. of 0 ppm: 100.693658 MHz
processed size: 65536 complex points
LB: 0.000 GF: 0.0000
Hz/cm: 765.788 ppm/cm: 7.60430

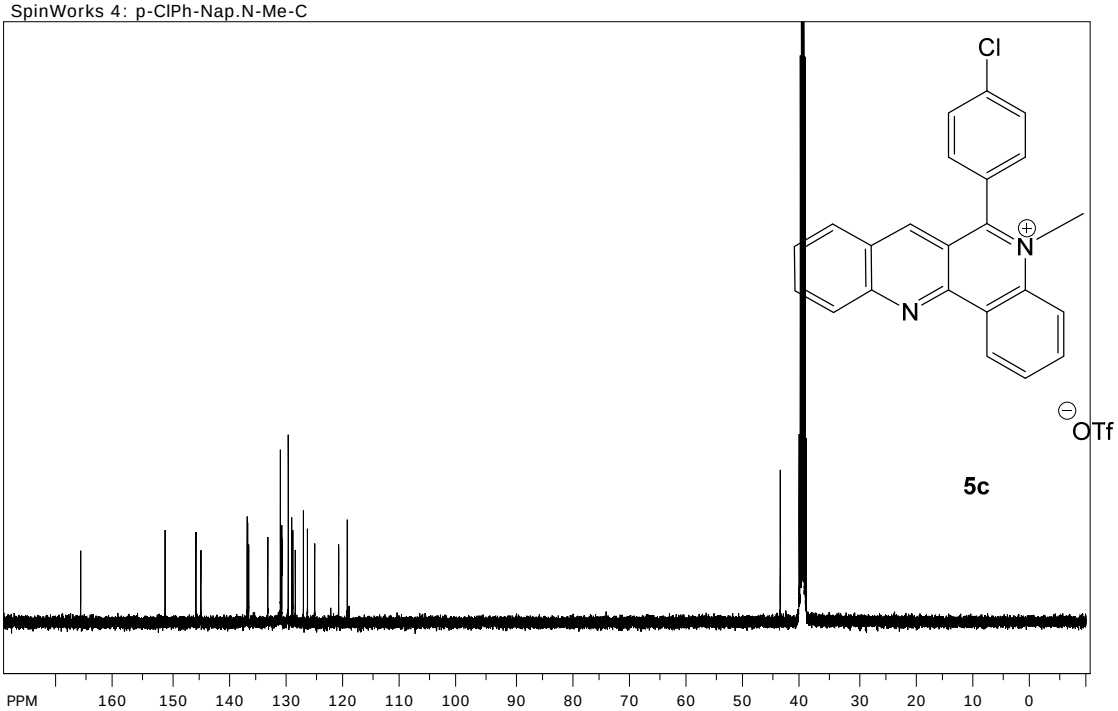
SpinWorks 4: p-ClPhNap.N-Me-2



file: ...Me\p-ClPhNap.N-Me-H\PROTON.fid\fid block# 1 expt: "s2pul"
transmitter freq.: 400.453937 MHz
time domain size: 44844 points
width: 6402.05 Hz = 15.9870 ppm = 0.142763 Hz/pt
number of scans: 8

freq. of 0 ppm: 400.451527 MHz
processed size: 65536 complex points
LB: 0.000 GF: 0.0000
Hz/cm: 159.765 ppm/cm: 0.39896

SpinWorks 4: p-ClPh-Nap.N-Me-C



file: ...e\p-ClPh-Nap.N-Me-C\CARBON.fid\fid block# 1 expt: "s2pul"
transmitter freq.: 100.704671 MHz
time domain size: 65536 points
width: 25188.92 Hz = 250.1266 ppm = 0.384352 Hz/pt
number of scans: 15000

freq. of 0 ppm: 100.693659 MHz
processed size: 65536 complex points
LB: 0.000 GF: 0.0000
Hz/cm: 764.664 ppm/cm: 7.59313