Electronic Supporting Information

$BF_3 \cdot OEt_2$ mediated metal-free one-pot sequential multiple annulation cascade (SMAC) synthesis of complex and diverse tetrahydroisoquinoline fused hybrid molecules

Anand H. Shinde, Vidyacharan Shinde and Duddu S. Sharada*

Indian Institute of Technology (IIT) Hyderabad, Kandi, Sangareddy, Telangana 502 285, India.

* Corresponding author. Tel: +91(40) 2301 7058; Fax: +91(40)2301 6032;
E-mail: sharada@iith.ac.in

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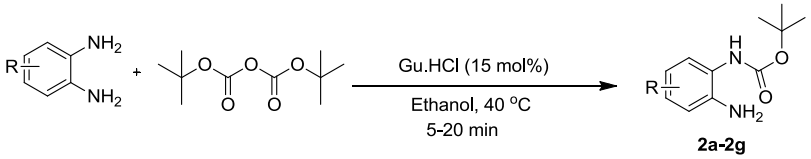
Experimental section

General information

In this section the preparations of all the compounds that have been made in the course have been discussed. For the experiments, all starting material and reagents are purchased from standard commercial sources or were prepared in laboratory. All the glassware were cleaned with soap water followed by acetone and dried in hot air oven at 100 ˚C for 2h. Solvents were distilled prior to use.

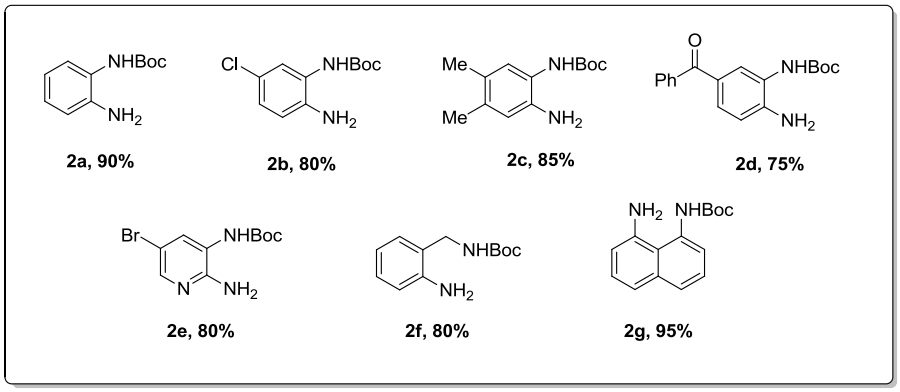
IR spectra were recorded on the Bruker Tensor 37 (FTIR) spectrophotometer. ^{1}H NMR spectra were recorded on Bruker Avance 400 (400 MHz) spectrometer at 295K in $CDCl_3$; chemical shifts value (δ ppm) and coupling constants (Hz) are reported in standard fashion with reference to either tetramethylsilane (TMS) (δ-H = 0.00 ppm) or $CHCl_3$ (δ-H = 7.26 ppm). ^{13}C NMR spectra were recorded on Bruker Avance 400 (100 MHz) spectrometer at 298K in $CDCl_3$; chemical shifts (δ ppm) are reported relative to $CHCl_3$ [(δ-C = 77.00 ppm) central line of triplet]. In ^{13}C NMR the nature of carbons (C, CH, CH_2, and CH_3) was determined by recording the DEPT- 135 spectra. In ^{1}H NMR, the following abbreviations were used throughout the experimental; s = singlet, d = doublet, t = triplet, q = quartet, qui = quintet, m = multiplet and br. s = broad singlet. The assignment of the signals was confirmed by ^{1}H, ^{13}C and DEPT spectra. Reactions were monitored by TLC on silica gel (254 mesh) using a combination of hexane and ethyl acetate as eluents.

General Procedure 1: Selective mono-boc-protection of o-phenylenediamines [1]



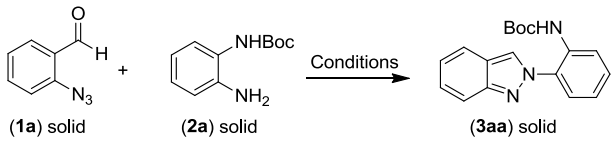
2a-2g

The compounds **2a-2g** was prepared by using reported literature procedure.[1] The diamine (1 mmol) was added to a stirred solution of GuHCl (15 mol %) and $(Boc)_2O$ (1.2 mmol) in EtOH (1 mL), stirred at 35–40 ^{o}C and monitored by TLC. After completion of the reaction the EtOH was evaporated. The reaction mixture was added water, extracted with ethyl acetate (2 X 10 mL). The combined organic extracts were washed with brine and dried with anhydrous Na_2SO_4, filtered and concentrated and then purified by silica gel column chromatography to afford the corresponding product **2**.



All Compounds **2a-2g** are already known in the literature.

Optimization conditions for the synthesis of 2*H*-indazole 3aa through SSMR strategy:[a]



(**1a**) solid (**2a**) solid (**3aa**) solid

Entry	Temperature (^{o}C)	Time (min)	Yield (%)[b]
1	40	60	0
2	60	60	20
3	90	60	40
4	100	50	42
5	**110**	**40**	**98**
6	120	40	95
7	140	20	80

[a] Reaction conditions: **1a** (0.5 mmol) and, **2a** (0.5 mmol), [b] Isolated yields after column chromatography.

Experimental procedure for the synthesis of 2*H*-indazole 3aa through SSMR strategy:

A mixture of *o*-azido aldehyde **1a** (0.5 mmol) and *tert*-butyl (2-aminophenyl)carbamate **2a** (0.5 mmol) was placed in a 10 mL round bottom flask and melted at 110 ºC for 40 min. The crude reaction mixture was washed with 5 mL of ethylacetate and hexane mixture (1:49 ratio) to yield the desired product **3aa** as a colorless solid.

Spectral data for the compound 3aa:

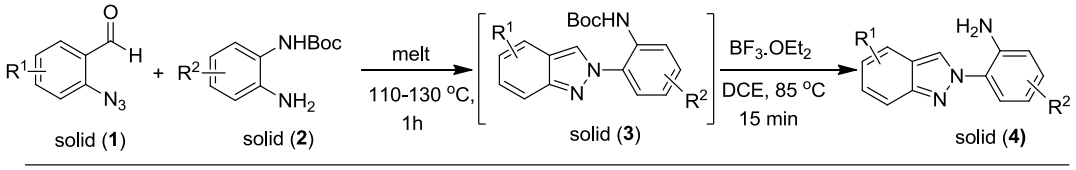
***Tert*-butyl (2-(2H-indazol-2-yl)phenyl)carbamate (3aa)**

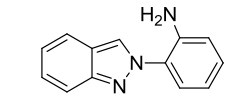
Colorless solid; 152 mg, 98% yield; mp 136 ^{o}C; IR (MIR-ATR, 4000-600 cm^{-1}): ν_{max} = 3284, 3064, 2977, 1723, 1598, 1235, 1152, 1050, 752 cm^{-1}; ^{1}H NMR ($CDCl_3$, 400 MHz): δ ppm = 1.48 (s, 9H), 7.10 - 7.21 (m, 2H), 7.35 - 7.47 (m, 3H), 7.70 - 7.88 (m, 2H), 8.27 (d, *J* = 0.98 Hz, 1H), 8.37 (d, *J* = 8.31 Hz, 1H), 9.42 (br s., 1H) ; ^{13}C NMR ($CDCl_3$, 100 MHz): δ ppm = 28.3, 80.6, 117.6, 120.5, 121.3, 122.0, 122.6, 122.7, 124.2, 127.2, 128.8, 129.3, 133.1, 149.9, 152.8; HR-MS (ESI+) *m/z* calculated for $C_{18}H_{20}N_3O_2^+$ [M + H$^+$]: 310.1550; found: 310.1564.

General procedure 2: Synthesis of 2*H*-indazole 4aa, 4ab, 4da, 4ca, 4ba, and 4ad through SSMR strategy:

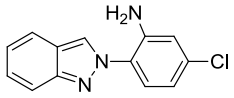
A mixture of *o*-azido aldehyde **1** (0.5 mmol) and *tert*-butyl (2-aminophenyl)carbamate **2** (0.5 mmol) was placed in a 10 mL round bottom flask and melted at 110 ºC for 1h. Then the formed solid compound **3** was dissolved in DCE (2 mL) and was added $BF_3{\cdot}OEt_2$ (0.5 mmol) and, heated at 85 ^{o}C for 15 min. Then the reaction mixture was quenched with sat. $NaHCO_3$ (1 mL) and extracted with ethyl acetate (2 X 20 mL). The combined organic extracts were washed with brine and dried with anhydrous Na_2SO_4. The crude extract was purified by filtration through a silica gel (100-200 mesh) column using hexane and ethyl acetate as eluents to furnish the desired products **4aa-4ad**.

Representative examples of amino-substituted 2*H*-indazole 4 through SSMR strategy:[a,b]

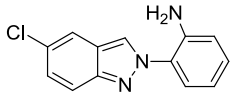




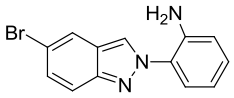
4aa, 95%



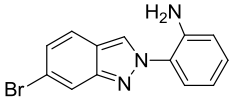
4ab, 95%



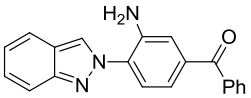
4da, 94%



4ca, 92%



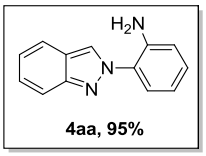
4ba, 93%



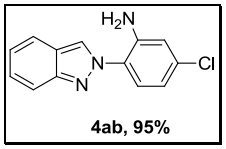
4ad, 90%

[a] Reaction conditions: **1** (0.5 mmol) and **2** (0.5 mmol), [b] Isolated yields after column chromatography.

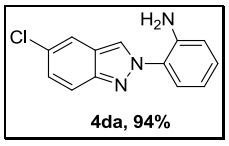
Spectral data for the compounds 4aa, 4ab, 4da, 4ca, 4ba, and 4ad :



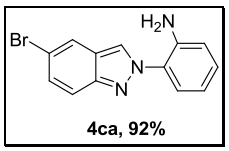
The compound **4aa** is already known in the literature. [2]



5-Chloro-2-(2H-indazol-2-yl)aniline (**4ab**)**:** Following the general procedure 2, **4ab** was isolated as a yellow solid; 116 mg, 95% yield; mp 96-98 °C; IR (MIR-ATR, 4000-600cm^{-1}): ν_{max} = 3452, 3335, 3202, 3124, 3060, 1619, 1582, 1499, 1460, 1426, 1385, 1350, 1304, 1263, 1199, 1151, 1099, 1042, 962, 864, 813, 788, 751, 731, 652cm^{-1}; ^{1}H NMR ($CDCl_3$, 400 MHz): δ ppm = 4.99 (br. s., 2H), 6.79 (d, *J* = 8.80 Hz, 1H), 7.12 - 7.21 (m, 2H), 7.31 - 7.42 (m, 2H), 7.77 (d, *J* = 8.80 Hz, 1H), 7.73 (d, *J* = 8.31 Hz, 1H), 8.19 (s, 1H); ^{13}C NMR ($CDCl_3$, 100 MHz): δ ppm = 117.5, 118.4, 120.4, 121.9, 122.2, 122.6, 123.6, 124.6, 126.8, 127.1, 129.2, 140.1, 149.63; HR-MS (ESI+) *m/z* calculated for $C_{18}H_{20}N_3O_2^+$ [M + H$^+$]: 244.0636; found: 244.0625.

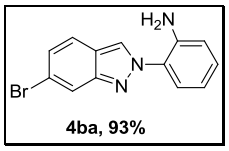


2-(5-Chloro-2H-indazol-2-yl)aniline (**4da**)**:** Following the general procedure 2, **4da** was isolated as a yellow solid; 114 mg, 94% yield; mp 114-116 °C; IR (MIR-ATR, 4000-600cm^{-1}): ν_{max} = 3447, 3343, 3200, 3127, 3060, 2105, 1616, 1552, 1510, 1462, 1392, 1356, 1317, 1285, 1261, 1224, 1194, 1158, 1099, 1048, 1027, 953, 810, 749, 615 cm^{-1}; ^{1}H NMR ($CDCl_3$, 400 MHz): δ ppm = 4.89 (br. s., 2H), 6.76 - 6.91 (m, 3H), 7.14 - 7.26 (m, 1H), 7.30 (dd, *J* = 7.8 and 1.5 Hz, 1H), 7.33 - 7.40 (m, 1H), 7.70 (d, *J* = 8.8 Hz, 1H), 8.17 (d, *J* = 1.0 Hz, 1H); ^{13}C NMR ($CDCl_3$, 100 MHz): δ ppm = 105.2, 116.4, 117.6, 118.1, 119.8, 122.2, 124.1, 124.7, 126.3, 129.6, 138.8, 141.3, 149.7; HR-MS (ESI+) *m/z* calculated for $C_{13}H_{11}ClN_3^+$ [M + H$^+$]: 244.0636; found: 244.0639



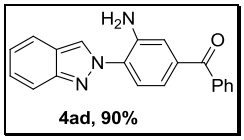
4ca, 92%

2-(5-Bromo-2H-indazol-2-yl)aniline (**4ca**)**:** Following the general procedure 2, **4ca** was isolated as a colorless solid; Yield: 132 mg (92%); mp 108-110 °C; IR (MIR-ATR, 4000-600cm^{-1}): ν_{max} = 3449, 3342, 3040, 1613, 1498, 1036, 799, 747, 674 cm^{-1}; ^{1}H NMR ($CDCl_3$, 400 MHz): δ ppm = 4.84 (br. s., 2H), 6.74 - 6.98 (m, 2H), 7.20 - 7.26 (m, 1H), 7.31 (dd, *J* = 8.1 and 1.2 Hz, 1H), 7.38 (dd, *J* = 9.3 and 1.9 Hz, 1H), 7.64 (d, *J* = 8.80 Hz, 1H), 7.89 (d, *J* = 1.5 Hz, 1H) 8.16 (d, *J* = 1.0 Hz, 1H); ^{13}C NMR ($CDCl_3$, 100 MHz): δ ppm = 115.7, 117.6, 118.2 119.3, 122.5, 123.0, 123.1, 124.9, 126.2, 129.7, 130.3, 141.3, 147.9; HR-MS (ESI+) *m/z* calculated for $C_{13}H_{11}BrN_3^+$ [M + H^+]: 288.0131; found: 288.0111.



4ba, 93%

2-(6-Bromo-2H-indazol-2-yl)aniline (**4ba**)**:** Following the general procedure 2, **4ba** was isolated as a colorless solid; Yield: 134 mg (93%); mp 132-134 °C; IR (MIR-ATR, 4000-600cm^{-1}): ν_{max} = 3454, 3339, 3126, 3064, 1617, 1033, 920, 807, 748 cm^{-1}; ^{1}H NMR ($CDCl_3$, 400 MHz): δ ppm = 4.84 (br. s., 2H), 6.79 - 6.90 (m, 2H), 7.18 - 7.26 (m, 2H), 7.30 (dd, *J* = 8.07 and 1.22 Hz, 1H), 7.60 (d, *J* = 8.80 Hz, 1H), 7.94 (d, *J* = 0.98 Hz, 1H), 8.10 - 8.26 (m, 1H); ^{13}C NMR ($CDCl_3$, 100 MHz): δ ppm = 117.6, 118.2, 119.9, 120.4, 120.8, 121.8, 124.2, 126.1, 126.2, 129.7, 141.3, 150.1; HR-MS (ESI+) *m/z* calculated for $C_{13}H_{11}BrN_3^+$ [M + H^+]: 288.0131; found: 288.0131.



4ad, 90%

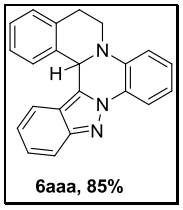
(3-Amino-4-(2H-indazol-2-yl)phenyl)(phenyl)methanone (**4ad**)**:** Following the general procedure 2, **4ad** was isolated as a colorless solid; Yield: 141 mg (90%); mp 166-168 °C; IR (MIR-ATR, 4000-600cm^{-1}): ν_{max} = 3457, 3355, 3057, 2124, 1652, 1609, 1516, 1439, 1384, 1321, 1258, 1198, 1136, 1076, 991, 949, 883, 853, 824, 788, 747, 709, 659 cm^{-1}; ^{1}H NMR ($CDCl_3$, 400

MHz): δ ppm = 5.25 (br. s., 2H), 7.15 (dd, *J* = 8.56, 6.60 Hz, 1H), 7.21 (dd, *J* = 8.07, 1.71 Hz, 1H), 7.30 - 7.39 (m, 2H), 7.42 - 7.53 (m, 3H), 7.56 - 7.63 (m, 1H), 7.71 - 7.79 (m, 2H), 7.81 - 7.86 (m, 2H), 8.29 (s, 1H); ^{13}C NMR ($CDCl_3$, 100 MHz): δ ppm = 117.6, 119.0, 119.7, 120.4, 121.9, 122.7, 123.6, 124.3, 127.2, 128.4, 128.9, 130.1, 132.6, 137.4, 138.1, 141.2, 149.7, 196.0; HR-MS (ESI+) *m/z* calculated for $C_{20}H_{16}N_3O^+$ [M + H^+]: 314.1288; found: 314.1287

General procedure 3: Synthesis of 2H-indazole fused tetrahydroisoquinolinoquinaxalines 6aaa-6daa and diazepinotetrahydroisoquinoline 7afa via SMAC:

A mixture of *o*-azido aldehyde **1** (0.2 mmol) and *tert*-butyl (2-aminophenyl)carbamate **2** (0.2 mmol) was placed in a 10 mL round bottom flask and melted at 110-145 ºC for 1h. Then the formed solid compound **3** was dissolved in DCE (2 mL) and was added $BF_3{\cdot}OEt_2$ (0.2 mmol) and, heated at 85 ºC for 15 min. After 15 min, was added 2-(2-bromoethyl)benzaldehyde (0.2 mmol) **5** in acetonitrile (2 mL) and again heated at 85 ºC for 1h. Then the reaction mixture was quenched with sat. $NaHCO_3$ (1mL) and extracted with ethyl acetate (2 X 20 mL). The combined organic extracts were washed with brine and dried with anhydrous Na_2SO_4. The crude extract was purified by filtration through a silica gel (100-200 mesh) column using hexane and ethyl acetate as eluents to yield the desired products **6aaa-6daa or 7afa**.

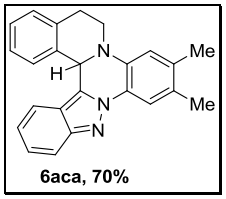
<u>Spectral data for the compounds 6aaa-6daa and 7afa</u> :



6aaa, 85%

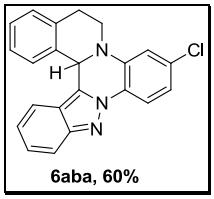
6,17*c*-Dihydro-5H-indazolo[2,3-a]isoquinolino[1,2-c]quinoxaline (6aaa): Following the general procedure 3, **6aaa** was isolated as a colorless solid; Yield: 55 mg (85%); mp 136-138 °C. IR (MIR-ATR, 4000-600cm^{-1}): ν_{max} = 3062, 2917, 1609, 1496, 1309, 926, 831, 741 cm^{-1}; ^{1}H NMR ($CDCl_3$, 400 MHz): δ ppm = 2.85 (dd, *J* = 16.6 and 4.4 Hz, 1H), 3.40 - 3.55 (m, 1H), 3.70 - 3.81 (m, 1H), 4.27 (dd, *J* = 14.2 and 5.4 Hz, 1H), 6.32 (s, 1H), 6.90 (t, *J* = 7.58 Hz, 1H), 6.95 - 7.06 (m, 3H), 7.07 - 7.24 (m, 3H), 7.33 - 7.40 (m, 1H), 7.67 (d, *J* = 8.3 Hz, 1H), 7.80 (d, *J* = 8.8 Hz, 1H), 8.12 (dd, *J* = 8.1 and 1.2 Hz, 1H); ^{13}C NMR ($CDCl_3$, 100 MHz): δ ppm = 24.2, 44.9, 56.1, 113.3, 117.7, 117.9, 119.1, 119.2, 120.6, 122.4, 126.3, 126.4, 126.5, 126.9, 127.0, 127.7,

128.1, 129.5, 133.9, 135.5, 136.7, 149.2; HR-MS (ESI+) *m/z* calculated for $C_{22}H_{18}N_3^+$ [M + H^+]: 324.1495; found: 324.1493



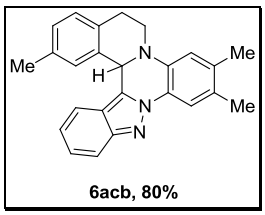
6aca, 70%

9,10-Dimethyl-6,17c-dihydro-5H-indazolo[2,3-a]isoquinolino[1,2-c]quinoxaline (6aca): Following the general procedure 3, **6aca** was isolated as a colorless solid; Yield: 49 mg (70%); mp 134 °C; IR (MIR-ATR, 4000-600cm^{-1}): ν_{max} = 3041, 2919, 1620, 1503, 1265, 1009, 877, 732, 635 cm^{-1}; ^{1}H NMR ($CDCl_3$, 400 MHz): δ ppm = 2.28 (s, 3H), 2.24 (s, 3H), 2.83 (dd, *J* = 16.9, 4.6 Hz, 1H), 3.42 - 3.57 (m, 1H), 3.72 (ddd, *J* = 14.3, 12.3, 5.1 Hz, 1H), 4.24 (dd, *J* = 14.4, 5.1 Hz, 1H), 6.26 (s, 1H), 6.83 (s, 1H), 6.91 - 7.02 (m, 2H), 7.06 - 7.21 (m, 3H), 7.32 - 7.43 (m, 1H), 7.66 (d, *J* = 8.3 Hz, 1H), 7.81 (d, *J* = 8.8 Hz, 1H), 7.91 (s, 1H); ^{13}C NMR ($CDCl_3$, 100 MHz): δ ppm = 18.8, 20.2, 24.1, 44.9, 56.1, 114.9, 117.5, 118.8, 119.1, 120.5, 122.1, 124.5, 126.3, 126. 5, 126.7, 126.9, 127.6, 127.6, 129.5, 133.9, 134.5, 135.4, 136.6, 149.0; HR-MS (ESI+) *m/z* calculated for $C_{24}H_{22}N_3^+$ [M + H^+]: 352.1808; found: 352.1802.



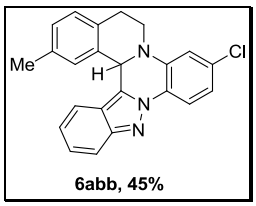
6aba, 60%

9-chloro-6,17c-dihydro-5H-indazolo[2,3-a]isoquinolino[1,2-c]quinoxaline (6aba): Following the general procedure 3, **6aba** was isolated as a colorless solid; Yield: 43 mg (60%); mp 152-154 °C. IR (MIR-ATR, 4000-600cm^{-1}): ν_{max} = 3055, 2924, 1660, 1604, 1491, 1231, 1128, 876, 742, 626 cm^{-1}; ^{1}H NMR ($CDCl_3$, 400 MHz): δ ppm = 2.85 (dd, *J* = 16.6 and 4.4 Hz, 1H), 3.38 - 3.50 (m, 1H), 3.74 (ddd, *J* = 14.4, 12.2 and 5.1 Hz, 1H), 4.20 (dd, *J* = 14.7 and 4.9 Hz, 1H), 6.28 (s, 1H), 6.86 - 6.96 (m, 2H), 6.96 - 7.04 (m, 1H),7.07 - 7.21 (m, 3H), 7.38 (ddd, *J* = 8.3, 7.3 and 0.98 Hz, 1H) , 7.65 (d, *J* = 8.3 Hz, 1H), 7.78 (d, *J* = 8.8 Hz, 1H), 8.12 (d, *J* = 2.5 Hz, 1H); ^{13}C NMR ($CDCl_3$, 100 MHz): δ ppm = 24.1, 45.1, 56.1, 114.3, 117.8, 118.0, 119.2, 120.6, 122.7, 124.2, 126.3, 126.5, 127.0, 127.2, 127.3, 127.7, 127.8, 129.5, 133.6, 135.2, 135.2, 149.4; HR-MS (ESI+) *m/z* calculated for $C_{22}H_{17}ClN_3^+$ [M + H^+]: 358.1106; found: 358.1101.



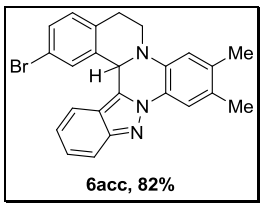
6acb, 80%

2,9,10-Trimethyl-6,17c-dihydro-5H-indazolo[2,3-a]isoquinolino[1,2-c]quinoxaline (6acb): Following the general procedure 3, **6acb** was isolated as a colorless solid; Yield: 58 mg (60%); mp 130 °C. IR (MIR-ATR, 4000-600cm^{-1}): ν_{max} = 3047, 2920, 1659, 1502, 1452, 1237, 1047, 818, 734, 698 cm^{-1}; ^{1}H NMR ($CDCl_3$, 400 MHz): δ ppm = 2.09 (s, 3H), 2.23 (s, 3H), 2.27 (s, 3H), 2.78 (dd, *J* = 16.6 and 4.9 Hz, 1H), 3.38 - 3.50 (m, 1H), 3.69 (ddd, *J* = 14.4, 12.2 and 5.1 Hz, 1H), 4.22 (dd, *J* = 14.2 and 4.9 Hz, 1H), 6.21 (s, 1H), 6.7 (s, 1H), 6.82 (s, 1H), 6.90 - 7.03 (m, 2H), 7.10 - 7.19 (m, 1H), 7.36 (ddd, *J* = 8.8, 6.6 and 1.2 Hz, 1H), 7.64 (d, *J* = 8.8 Hz, 1H), 7.80 (d, *J* = 8.8 Hz, 1H), 7.9 (s, 1H); ^{13}C NMR ($CDCl_3$, 100 MHz): δ ppm = 18.8, 20.2, 21.2, 23.9, 45.2, 56.1, 115.3, 117.2, 118.9, 119.2, 120.5, 122.5, 124.2, 126.9, 127.2, 128.6, 129.0, 129.4, 130.2, 130.7, 136.0, 137.0, 148.4; HR-MS (ESI+) *m/z* calculated for $C_{22}H_{23}N_3^+$ [M^+]: 366.1965; found:366.1950



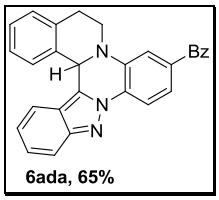
6abb, 45%

9-Chloro-2-methyl-6,17c-dihydro-5H-indazolo[2,3-a]isoquinolino[1,2-c]quinoxaline (6abb): Following the general procedure 3, **6abb** was isolated as a colorless solid; Yield: 34 mg (45%); mp 118 °C. IR (MIR-ATR, 4000-600cm^{-1}): ν_{max} = 3049, 2920, 2853, 1661, 1604, 1491, 1235, 872, 818, 732 cm^{-1}; ^{1}H NMR ($CDCl_3$, 400 MHz): δ ppm = 2.10 (s, 3H), 2.81 (dd, *J* = 16.6 and 4.4 Hz, 1H), 3.34 - 3.47 (m, 1H), 3.73 (ddd, *J* = 14.4, 12.2 and 5.1 Hz, 1H), 4.19 (dd, *J* = 14.4 and 4.6 Hz, 1H), 6.26 (s, 1H), 6.72 (s, 1H), 6.92 (d, *J* = 8.8 Hz, 1H), 6.94 - 7.03 (m, 2H), 7.11 - 7.21 (m, 2H), 7.39 (ddd, *J* = 8.8, 6.6 and 1.2 Hz, 1), 7.66 (d, *J* = 8.8 Hz, 1H), 7.79 (d, *J* = 9.3 Hz, 1H), 8.12 (d, *J* = 2.4 Hz, 1H); ^{13}C NMR ($CDCl_3$, 100 MHz): δ ppm = 21.2, 23.8, 45.2, 56.1, 114.3, 115.7, 117.7, 118.0, 119.2, 120.6, 121.8, 122.7, 124.1, 126.7, 127.0, 127.3, 127.7, 128.6, 129.4, 130.4, 134.9, 135.3, 136.2; HR-MS (ESI+) *m/z* calculated for $C_{23}H_{19}ClN_3^+$ [M + H^+]: 372.1262; found:372.1255.



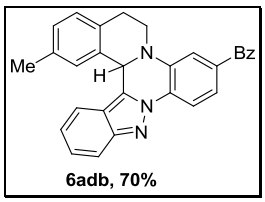
6acc, 82%

2-Bromo-9,10-dimethyl-6,17c-dihydro-5*H*-indazolo[2,3-a]isoquinolino[1,2-c]quinoxaline (6acc): Following the general procedure 3, **6acc** was isolated as a colorless solid; Yield: 71 mg (82%); mp 208-210 °C. IR (MIR-ATR, 4000-600cm^{-1}): ν_{max} = 2909, 1681, 1501, 1135, 1002, 877, 834, 743 cm^{-1}; ^{1}H NMR ($CDCl_3$, 400 MHz): δ ppm 2.17 - 2.30 (m, 6H), 2.77 (dd, *J* = 16.9 and 4.16 Hz, 1H), 3.33 - 3.47 (m, 1H), 3.61 - 3.74 (m, 1H), 4.23 (dd, *J* = 14.4 and 5.6 Hz, 1H), 6.19 (s, 1H), 6.79 (s, 1H), 6.96 (d, *J* = 8.3 Hz, 1H), 7.03 (s, 1H), 7.14 - 7.25 (m, 2H), 7.31 - 7.40 (m, 1H), 7.64 (d, *J* = 8.31 Hz, 1H), 7.79 (d, *J* = 8.8 Hz, 1H), 7.89 (s, 1H); ^{13}C NMR ($CDCl_3$, 100 MHz): δ ppm = 18.8, 20.2, 21.1, 23.5, 24.6, 44.7, 55.8, 75.9, 76.7, 77.0, 77.2, 77.3, 114.9, 117.6, 118.7, 118.8, 119.7, 120.5, 122.6, 126.1, 126.9, 128.0, 129.3, 130.7, 131.2, 132.2, 132.9, 134.1, 136.7, 137.6, 149.1; HR-MS (ESI+) *m/z* calculated for $C_{24}H_{21}BrN_3^+$ [M + H^+]: 430.0913; found:430.0909.



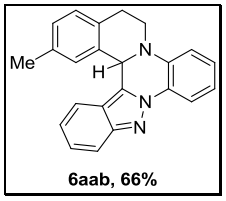
6ada, 65%

(6,17c-dihydro-5H-indazolo[2,3-a]isoquinolino[1,2-c]quinoxalin-9-yl)(phenyl)methanone (6ada): Following the general procedure 3, **6ada** was isolated as a colorless solid; Yield: 56 mg (82%); mp 138-140 °C. IR (MIR-ATR, 4000-600cm^{-1}): ν_{max} = 3059, 2955, 2923, 1655, 1598, 1272, 923, 832, 337 cm^{-1}; ^{1}H NMR ($CDCl_3$, 400 MHz): δ ppm 2.89 (dd, *J* = 17.1 and 4.4 Hz, 1H), 3.53 (ddd, *J* = 17.2, 11.9 and 6.1 Hz, 1H), 3.80 (ddd, *J* = 14.3, 12.3 and 5.1 Hz, 1H), 4.35 (dd, *J* = 14.4, 5.1 Hz, 1H), 6.39 (s, 1H), 6.93 - 7.05 (m, 2H), 7.12 - 7.25 (m, 4H), 7.34 - 7.43 (m, 1H), 7.45 - 7.53 (m, 2H), 7.54 - 7.63 (m, 2H), 7.70 (d, *J* = 8.8 Hz, 1H), 7.76 - 7.85 (m, 3H), 8.17 (d, *J* = 7.8 Hz, 1H); ^{13}C NMR ($CDCl_3$, 100 MHz): δ ppm = 24.2, 45.1, 56.1, 114.4, 117.2, 117.9, 119.3, 120.7, 122.2, 122.9, 126.2, 126.5, 127.6, 127.7, 127.9, 128.3, 129.3, 129.7, 130.0, 132.4, 133.7, 135.4, 136.7, 136.8, 137.7, 149.8, 196.0; HR-MS (ESI+) *m/z* calculated for $C_{29}H_{22}N_3O^+$ [M + H^+]: 428.1753; found:428.1745.



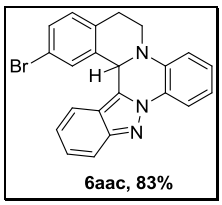
6adb, 70%

(2-methyl-6,17c-dihydro-5H-indazolo[2,3-a]isoquinolino[1,2-c]quinoxalin-9-yl)(phenyl)methanone (6adb): Following the general procedure 3, **6adb** was isolated as a colorless solid; Yield: 62 mg 70%); mp 150 °C. IR (MIR-ATR, 4000-600cm^{-1}): ν_{max} = 3062, 2924, 1658, 1598, 1266, 912, 837, 715 cm^{-1}; ^{1}H NMR ($CDCl_3$, 400 MHz): δ ppm = 2.11 (s, 3H), 2.84 (dd, *J* = 16.9 and 4.2 Hz, 1H), 3.48 (m, 1H), 3.77 (ddd, *J* = 14.3, 12.3 and 5.1 Hz, 1H), 4.33 (dd, *J* = 14.4 and 5.1 Hz, 1H), 6.35 (s, 1H), 6.76 (s, 1H), 7.01 (m, 2H), 7.21 (m, 2 H), 7.40 (ddd, *J* = 8.8, 6.8 and 1.0 Hz, 1H), 7.50 (m, 2H), 7.59 (m, 2H), 7.70 (d, *J* = 8.3 Hz, 1H), 7.80 (m, 3H), 8.17 (d, *J* = 8.3 Hz, 1H); ^{13}C NMR ($CDCl_3$, 100 MHz): δ ppm 21.2, 23.8, 45.2, 56.1, 76.7, 77.0, 77.2, 77.3, 114.4, 117.2, 117.8, 119.3, 120.8, 122.1, 122.9, 126.6, 127.6, 127.9, 128.3, 128.7, 129.4, 129.6, 130.0, 130.6, 132.4, 135.1, 136.2, 136.7, 136.8, 137.7, 149.8, 196.1; HR-MS (ESI+) *m/z* calculated for $C_{30}H_{24}N_3O^+$ [M + H$^+$]: 442.1914; found:142.1897.



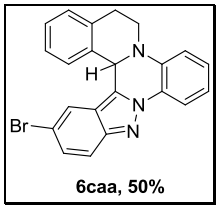
6aab, 66%

2-Methyl-6,17c-dihydro-5H-indazolo[2,3-a]isoquinolino[1,2-c]quinoxaline (6aab): Following the general procedure 3, **6aab** was isolated as a colorless solid; Yield: 45 mg 66%); mp 130 °C. IR (MIR-ATR, 4000-600cm^{-1}): ν_{max} = 3052, 2922, 2852, 1657, 1497, 1157, 1042, 820, 754 cm^{-1}; ^{1}H NMR ($CDCl_3$, 400 MHz): δ ppm = 2.00 - 2.17 (m, 3H), 2.80 (dd, *J* = 17.4 and 4.2 Hz, 1H), 3.37 - 3.50 (m, 1H), 3.72 (ddd, *J* = 14.2, 12.2 and 4.9 Hz, 1H), 4.24 (dd, *J* = 14.7, 4.9 Hz, 1H), 6.27 (s, 1H), 6.76 (s, 1H), 6.85 - 6.93 (m, 1H), 6.93 - 7.05 (m, 3 H), 7.13 - 7.23 (m, 2H), 7.37 (ddd, *J* = 8.8, 6.8 and 1.0 Hz, 1H), 7.66 (d, *J* = 8.3 Hz, 1H), 7.80 (d, *J* = 8.8 Hz, 1H), 8.11 (dd, *J* = 7.8 and 1.5 Hz, 1H); ^{13}C NMR ($CDCl_3$, 100 MHz): δ ppm = 21.2, 23.9, 45.0, 56.1, 76.7, 77.0, 77.3, 77.4, 113.3, 117.6, 117.9, 119.1, 119.2, 120.6, 122.3, 126.5, 126.8, 126.9, 127.1, 128.1, 128.5, 129.4, 130.7, 135.2, 136.0, 136.8, 149.3; HR-MS (ESI+) *m/z* calculated for $C_{23}H_{20}N_3^+$ [M + H$^+$]: 338.3652; found: 338.1615.



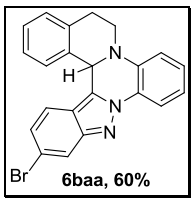
6aac, 83%

2-Bromo-6,17c-dihydro-5H-indazolo[2,3-a]isoquinolino[1,2-c]quinoxaline (6aac): Following the general procedure 3, **6aac** was isolated as a colorless solid; Yield: 67 mg (83%); mp 164-166 °C. IR (MIR-ATR, 4000-600cm^{-1}): ν_{max} = 3059, 2969, 2901, 1608, 1497, 1308, 923, 832, 741 cm^{-1}; ^{1}H NMR ($CDCl_3$, 400 MHz): δ ppm = 2.78 (d, *J* = 17.1 Hz, 1H), 3.30 - 3.47 (m, 1H), 3.59 - 3.78 (m, 1H), 4.24 (dd, *J* = 14.2 and 5.9 Hz, 1H), 6.24 (br. s., 1H), 6.85 - 7.03 (m, 3H), 7.13 - 7.31 (m, 3H), 7.32 - 7.43 (m, 1H), 7.65 (d, *J* = 8.3 Hz, 1H), 7.81 (d, *J* = 8.8 Hz, 1H), 8.13 (dd, *J* = 7.8 and 1.5 Hz, 1H); ^{13}C NMR ($CDCl_3$, 100 MHz): δ ppm = 23.6, 44.7, 55.7, 113.3, 117.8, 118.0, 118.8, 119.4, 119.8, 120.5, 122.8, 126.2, 126.5, 127.1, 128.2, 129.2, 130.8, 131.2, 132.8, 136.2, 137.6, 149.3; HR-MS (ESI+) *m/z* calculated for $C_{22}H_{17}BrN_3^+$ [M + H$^+$]: 102.0600; found: 402.0598.

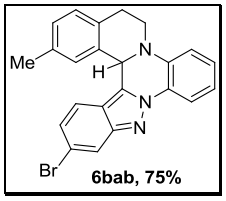


6caa, 50%

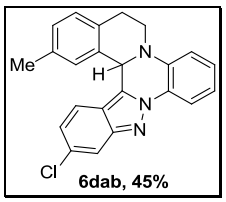
16-Bromo-6,17c-dihydro-5H-indazolo[2,3-a]isoquinolino[1,2-c]quinoxaline (6caa): Following the general procedure 3, **6caa** was isolated as a colorless solid; Yield: 40 mg 50%); mp 154 °C. IR (MIR-ATR, 4000-600cm^{-1}): ν_{max} = 3063, 2924, 2853, 1657, 1499, 1283, 1037, 938, 805, 735 cm^{-1}; ^{1}H NMR ($CDCl_3$, 400 MHz): δ ppm = 2.85 (dd, *J* =17.1 and 4.4 Hz, 1H), 3.46 (ddd, *J* = 17.1, 11.7 and 5.9 Hz, 1H), 3.73 (ddd, *J* = 14.2, 12.2 and 4.9 Hz, 1H), 4.24 (dd, *J* = 14.2 and 4.9 Hz, 1H), 6.23 (s, 1H), 6.85 - 6.95 (m, 2H), 6.99 - 7.07 (m, 2H), 7.08 - 7.13 (m, 1H), 7.14 - 7.24 (m, 2H), 7.41 (dd, *J* = 9.0 and 1.7 Hz, 1H), 7.67 (d, *J* = 9.3 Hz, 1H), 7.82 (d, *J* = 1.5 Hz, 1H), 8.08 (dd, *J* = 7.8 and 1.5 Hz, 1H); ^{13}C NMR ($CDCl_3$, 100 MHz): δ ppm = 24.3, 44.8, 44.9, 56.0, 113.5, 115.7, 118.0, 119.3, 119.4, 121.3, 121.7, 126.2, 126.5, 126.5, 127.8, 128.5, 129.6, 130.5, 133.8, 135.0, 136.8, 147.6; HR-MS (ESI+) *m/z* calculated for $C_{22}H_{16}BrN_3^+$ [M $^+$]: 401.0522; found: 401. 0490.



15-Bromo-6,17c-dihydro-5H-indazolo[2,3-a]isoquinolino[1,2-c]quinoxaline (6baa): Following the general procedure 3, **6baa** was isolated as a colorless solid; Yield: 48 mg 60%); mp 138 °C. IR (MIR-ATR, 4000-600cm^{-1}): ν_{max} = 3046, 1590, 1493, 1370, 1261, 1162, 1021, 821, 747, 691 cm^{-1}; ^{1}H NMR ($CDCl_3$, 400 MHz): δ ppm = 2.84 (dd, *J* = 17.1 and 4.4 Hz, 1H), 3.45 (ddd, *J* = 17.2, 11.9 and 6.1 Hz, 1H), 3.71 (ddd, *J* = 14.2, 12.2 and 4.9 Hz, 1H), 4.19 - 4.26 (m, 1H), 6.25 (s, 1H), 6.85 - 6.93 (m, 2H), 6.97 - 7.03 (m, 2H), 7.10 (d, *J* = 7.3 Hz, 1H), 7.16 (t, *J* = 7.3 Hz, 1H), 7.18 - 7.22 (m, 1H), 7.22 - 7.26 (m, 1H), 7.51 (d, *J* = 8.8 Hz, 1H), 7.96 (d, *J* = 1.0 Hz, 1H), 8.07 (dd, *J* = 8.3, 1.5 Hz, 1H); ^{13}C NMR ($CDCl_3$, 100 MHz): δ ppm = 24.3, 44.9, 56.0, 113.4, 118.0, 119.1, 119.3, 120.1, 120.6, 120.9, 126.1, 126.1, 126.2, 126.4, 127.5, 127.8, 128.5, 129.6, 133.9, 135.0, 136.7, 149.8; HR-MS (ESI+) *m/z* calculated for $C_{22}H_{16}BrN_3^+$ [M +]: 401.0523; found: 401.0548.

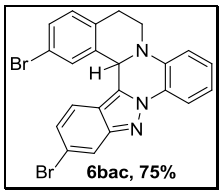


15-Bromo-2-methyl-6,17c-dihydro-5H-indazolo[2,3-a]isoquinolino[1,2-c]quinoxaline (6bab): Following the general procedure 3, **6bab** was isolated as a colorless solid; Yield: 62 mg 60%); mp 144 °C. IR (MIR-ATR, 4000-600cm^{-1}): ν_{max} = 3044, 2918, 2853, 1605, 1497, 1223, 1035, 927, 797, 736 cm^{-1}; ^{1}H NMR ($CDCl_3$, 400 MHz): δ ppm 2.11 (s, 3H), 2.80 (dd, *J* = 16.6 and 4.9 Hz, 1H), 3.34 - 3.47 (m, 1H), 3.68 (ddd, *J* = 14.2, 12.2 and 4.9 Hz, 1H), 4.21 (dd, *J* = 14.2 and 4.9 Hz, 1H), 6.21 (s, 1H), 6.68 (s, 1H), 6.85 - 6.92 (m, 1H), 6.93 - 7.03 (m, 3H), 7.16 - 7.28 (m, 2H), 7.52 (d, *J* = 8.8 Hz, 1H), 7.97 (d, *J* = 1.0 Hz, 1H), 8.07 (dd, *J* = 7.8 and 1.5 Hz, 1H); ^{13}C NMR ($CDCl_3$, 100 MHz): δ ppm = 21.2, 23.9, 45.0, 55.9, 113.4, 118.0, 119.1, 119.2, 120.0, 120.6, 120.9, 126.1, 126.2, 126.5, 127.6, 128.4, 128.6, 129.5, 130.7, 134.8, 136.1, 136.8, 149.8; HR-MS (ESI+) *m/z* calculated for $C_{23}H_{19}BrN_3^+$ [M + H$^+$]: 416.0757; found: 416.0753.



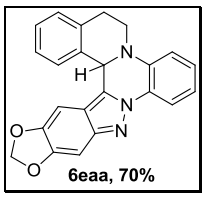
6dab, 45%

15-Chloro-2-methyl-6,17c-dihydro-5H-indazolo[2,3-a]isoquinolino[1,2-c]quinoxaline (6dab): Following the general procedure 3, **6dab** was isolated as a colorless solid; Yield: 33 mg 45%); mp 160-162 °C. IR (MIR-ATR, 4000-600cm^{-1}): ν_{max} = 3045, 2917, 2105, 1606, 1490, 1284, 1096, 948, 804, 731 cm^{-1}; ^{1}H NMR ($CDCl_3$, 400 MHz): δ ppm 2.10 (s, 3H), 2.78 (dd, *J* = 16.6 and 3.9 Hz, 1H), 3.32 - 3.45 (m, 1H), 3.66 (td, *J* = 13.1 and 4.6 Hz, 1H), 4.19 (dd, *J* = 14.2 and 5.9 Hz, 1H), 6.19 (s, 1H), 6.69 (s, 1H), 6.80 - 6.91 (m, 2H), 6.92 - 7.02 (m, 3H), 7.14 - 7.21 (m, 1H), 7.40 (s, 1H), 7.60 (d, *J* = 8.8 Hz, 1H), 8.05 (d, *J* = 7.8 Hz, 1H); ^{13}C NMR ($CDCl_3$, 100 MHz): δ ppm = 21.2, 23.9, 45.0, 56.0, 105.3, 113.4, 116.5, 117.8, 118.5, 119.2, 120.9, 126.3, 126.6, 127.6, 128.2, 128.6, 129.5, 130.8, 134.8, 136.1, 136.7, 139.0, 149.4; HR-MS (ESI+) *m/z* calculated for $C_{23}H_{19}N_3^+$ [M + H$^+$]: 372.1262; found:372.1265.

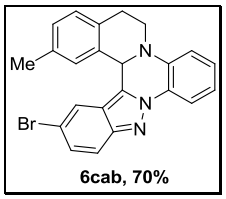


6bac, 75%

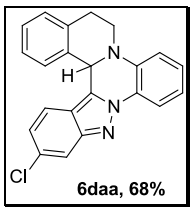
2,15-Dibromo-6,17c-dihydro-5H-indazolo[2,3-a]isoquinolino[1,2-c]quinoxaline (6bac): Following the general procedure 3, **6bac** was isolated as a colorless solid; Yield: 72 mg 75%); mp 204-206 °C. IR (MIR-ATR, 4000-600cm^{-1}): ν_{max} = 3063, 2960, 2923, 1605, 1482, 1263, 1035, 928, 795, 739 cm^{-1}; ^{1}H NMR ($CDCl_3$, 400 MHz): δ ppm 2.77 (dd, *J* = 17.1 and 4.4 Hz, 1H), 3.30 - 3.43 (m, 1H), 3.67 (ddd, *J* = 14.2, 12.2 and 4.9 Hz, 1H), 4.22 (dd, *J* = 14.2 and 5.4 Hz, 1H), 6.18 (s, 1H), 6.87 - 7.02 (m, 4H), 7.17 - 7.29 (m, 3H), 7.50 (d, *J* = 8.8 Hz, 1H), 7.95 - 8.00 (m, 1H), 8.08 (dd, *J* = 7.8 and 1.5 Hz, 1H); ^{13}C NMR ($CDCl_3$, 100 MHz): δ ppm = 23.7, 44.7, 55.6, 113.4, 118.1, 119.0, 119.6, 119.8, 120.1, 120.2, 121.1, 126.2, 126.5, 126.6, 128.5, 129.0, 131.0, 131.3, 132.8, 136.3, 137.2, 149.8; HR-MS (ESI+) *m/z* calculated for $C_{22}H_{16}{}^{79}Br^{81}BrO_3^+$ [M + H$^+$]: 481.9685; found:481.9679.



6,18c-Dihydro-5H-[1,3]dioxolo[4',5':5,6]indazolo[2,3-a]isoquinolino[1,2-c]quinoxaline (6eaa): Following the general procedure 3, **6eaa** was isolated as a colorless solid; Yield: 51 mg 70%); mp 138 °C. IR (MIR-ATR, 4000-600cm^{-1}): ν_{max} = 3057, 2902, 2860, 1654, 1504, 1470, 1197, 1030, 953, 834, 739 cm^{-1}; ^{1}H NMR ($CDCl_3$, 400 MHz): δ ppm 2.81 (dd, *J* = 16.9 and 4.2 Hz, 1H), 3.39 - 3.50 (m, 1H), 3.70 (ddd, *J* = 14.2, 12.2 and 4.9 Hz, 1H), 4.18 - 4.26 (m, 1H), 6.00 (s, 2H), 6.13 (s, 1H), 6.81 - 6.89 (m, 2H), 6.91 - 7.03 (m, 3H), 7.03 - 7.18 (m, 4H), 7.97 (dd, *J* = 7.8, 1.5 Hz, 1 H); ^{13}C NMR ($CDCl_3$, 100 MHz): δ ppm = 24.2, 45.0, 55.9, 93.9, 94.2, 101.1, 113.2, 115.9, 117.0, 119.1, 126.3, 126.4, 126.7, 126.7, 127.2, 127.6, 129.5, 133.9, 135.6, 135.9, 146.0, 146.9, 149.8; HR-MS (ESI+) *m/z* calculated for $C_{23}H_{18}N_3O_2^+$ [M + H$^+$]: 338.1394; found:338.1385.

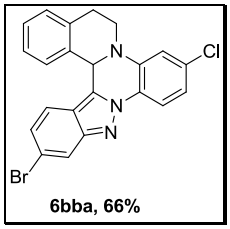


16-Bromo-2-methyl-6,17c-dihydro-5H-indazolo[2,3-a]isoquinolino[1,2-c]quinoxaline (6cab): Following the general procedure 3, **6cab** was isolated as a colorless solid; Yield: 58 mg 70%; mp 148 °C. IR (MIR-ATR, 4000-600cm^{-1}): ν_{max} = 3047, 2920, 2853, 1659, 1607, 1496, 1283, 1040, 939, 807, 737 cm^{-1}; ^{1}H NMR ($CDCl_3$, 400 MHz): δ ppm = 2.14 (s, 3H), 2.82 (dd, *J* = 16.6 and 4.4 Hz, 1H), 3.41 (ddd, *J* = 17.0, 11.6 and 6.1 Hz, 1H), 3.70 (ddd, *J* = 14.2, 12.2 and 4.9 Hz, 1H), 4.21 (dd, *J* = 14.2 and 4.9 Hz, 1H), 6.16 - 6.20 (s, 1H), 6.70 (s, 1H), 6.84 - 6.93 (m, 1H), 6.96 - 7.03 (m, 3H), 7.18 - 7.24 (m, 1H), 7.38 - 7.44 (m, 1H), 7.65 - 7.70 (m, 1H), 7.81 (d, *J* =1.0 Hz, 1H), 8.08 (dd, *J* = 7.8 and 1.5 Hz, 1H); ^{13}C NMR ($CDCl_3$, 100 MHz): δ ppm = 21.2, 24.0, 45.0, 55.9, 113.5, 115.6, 118.0, 119.2, 119.4, 120.8, 121.3, 121.6, 126.3, 126.6, 128.5, 128.6, 129.5, 130.5, 130.7, 134.6, 136.1, 137.0, 147.6; HR-MS (ESI+) *m/z* calculated for $C_{23}H_{19}BrN_3^+$ [M + H$^+$]: 416.0757; found: 416. 0739.



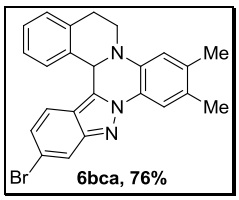
6daa, 68%

15-Chloro-6,17c-dihydro-5H-indazolo[2,3-a]isoquinolino[1,2-c]quinoxaline (6daa): Following the general procedure 3, **6daa** was isolated as a colorless solid; Yield: 48 mg 68%; mp 156 °C. IR (MIR-ATR, 4000-600cm^{-1}): ν_{max} = 3050, 2924, 2108, 1604, 1490, 1260, 1099, 943, 805, 731 cm^{-1}; ^{1}H NMR ($CDCl_3$, 400 MHz): δ ppm = 2.85 (dd, *J* = 16.9 and 4.2 Hz, 1H), 3.38 - 3.55 (m, 1H), 3.63 - 3.82 (m, 1H), 4.24 (dd, *J* = 13.9 and 4.6 Hz, 1H), 6.27 (s, 1H), 6.76 - 6.95 (m, 3H), 6.95 - 7.07 (m, 2H), 7.07 - 7.24 (m, 3H), 7.36 - 7.46 (m, 1H), 7.62 (d, *J* = 8.8 Hz, 1H), 7.96 - 8.14 (m, 1H); ^{13}C NMR ($CDCl_3$, 100 MHz): δ ppm = 24.3, 44.9, 56.0, 105.4, 113.4, 116.6, 117.9, 118.5, 119.3, 120.9, 126.2, 126.3, 126.4, 127.5, 127.8, 128.2, 129.6, 133.9, 135.1, 136.6, 139.1, 149.4; HR-MS (ESI+) *m/z* calculated for $C_{22}H_{16}ClN_3^+$ [M +]: 357.1019; found: 357.1019.

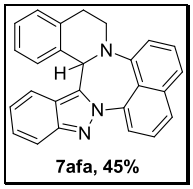


6bba, 66%

15-bromo-9-chloro-6,17c-dihydro-5H-indazolo[2,3-a]isoquinolino[1,2-c]quinoxaline (6bba): Following the general procedure 3, **6bba** was isolated as a colorless solid; Yield: 58 mg 66%); mp 204-206 °C. IR (MIR-ATR, 4000-600cm^{-1}): ν_{max} = 3049, 2950, 2860, 1625, 1265, 1070, 950, 810, 736 cm^{-1}; ^{1}H NMR ($CDCl_3$, 400 MHz): δ ppm = 2.86 (dd, *J* = 16.9, 4.2 Hz, 1H), 3.38 - 3.49 (m, 1H), 3.74 (ddd, *J* = 14.2, 12.2 and 4.9 Hz, 1H), 4.15 - 4.23 (m, 1H), 6.26 (s, 1H), 6.88 (d, *J* = 7.8 Hz, 1H), 6.93 (d, *J* = 8.8 Hz, 1H), 7.01 (t, *J* = 7.6 Hz, 1H), 7.10 - 7.21 (m, 2H), 7.21 - 7.28 (m, 3H), 7.52 (d, *J* = 9.8 Hz, 1H), 7.96 (d, *J* = 1.0 Hz, 1H), 8.09 (d, *J* = 2.4 Hz, 1H); ^{13}C NMR ($CDCl_3$, 100 MHz): δ ppm = 24.2, 45.0, 56.0, 114.5, 118.1, 119.1, 120.2, 120.6, 121.3, 124.4, 126.1, 126.5, 126.6, 126.7, 127.7, 128.0, 128.1, 129.6, 133.6, 134.7, 135.3, 148.7, 149.9; HR-MS (ESI+) *m/z* calculated for $C_{22}H_{16}BrClO_3^+$ [M + H$^+$]: 436.0211; found:436.0220.



15-Bromo-9,10-dimethyl-6,17c-dihydro-5H-indazolo[2,3-a]isoquinolino[1,2-c]quinoxaline (6bca): Following the general procedure 3, **6bca** was isolated as a colorless solid; Yield: 65 mg 76%); mp 126-128 °C. IR (MIR-ATR, 4000-600cm^{-1}): ν_{max} = 3056, 2918, 2850, 1661, 1613, 1263, 1042, 923, 800. 734 cm^{-1}; ^{1}H NMR ($CDCl_3$, 400 MHz): δ ppm = 2.22 (s, 3H), 2.27 (s, 3H), 2.83 (dd, *J* = 17.1 and 4.4 Hz, 1H), 3.36 - 3.52 (m, 1H), 3.70 (ddd, *J* = 14.2, 12.2 and 4.9 Hz, 1H), 4.21 (dd, *J* = 14.4 and 4.6 Hz, 1H), 6.20 (s, 1H), 6.82 (s, 1H), 6.89 (d, *J* = 7.8 Hz, 1H), 6.99 (t, *J* = 7.3 Hz, 1H), 7.06 - 7.18 (m, 3H), 7.21 (dd, *J* = 8.8 and 1.5 Hz, 1H), 7.47 - 7.53 (m, 1H), 7.85 (s, 1H), 7.92 - 7.97 (m, 1H); ^{13}C NMR ($CDCl_3$, 100 MHz): δ ppm = 24.2, 45.0, 56.0, 114.5, 118.1, 119.1, 120.2, 120.6, 121.3, 124.4, 126.1, 126.5, 126.6, 126.7, 127.7, 128.0, 128.1, 129.6, 133.6, 134.7, 135.3, 148.7, 149.9; HR-MS (ESI+) *m/z* calculated for $C_{24}H_{19}BrN_3^+$ [M - H^+]: 428.0762; found: 428.0753.



17,18-dihydro-12cH-indazolo[3',2':3,4]naphtho[1',8':5,6,7][1,4]diazepino[2,1-a]isoquinoline (6afa): Following the general procedure 1, **6afa** was isolated as a colorless solid; Yield: 34 mg 45%); mp 140 °C. IR (MIR-ATR, 4000-600cm^{-1}): ν_{max} = 3049, 2923, 2856, 1658, 1497, 1358, 1041, 825, 750 cm^{-1}; ^{1}H NMR ($CDCl_3$, 400 MHz): *δ* ppm = 3.10 (dd, *J* = 6.6 and 4.6 Hz, 2H), 3.48 (dt, *J* = 10.6, 6.9 Hz, 1H), 3.56 - 3.80 (m, 1H), 6.65 - 6.71 (m, 1H), 6.93 (d, *J* = 7.3 Hz, 1H), 7.16 (ddd, *J* = 8.8, 6.4 and 1.0 Hz, 2H), 7.28 (s, 1H), 7.30 - 7.35 (m, 1H), 7.35 - 7.39 (m, 1H), 7.39 - 7.42 (m, 1H), 7.42 - 7.49 (m, 3H), 7.56 - 7.62 (m, 1H), 7.67 (d, *J* = 8.8 Hz, 1H), 7.85 (dd, *J* = 8.1 and 1.2 Hz, 1H), 8.22 (dd, *J* = 7.3 and 1.5 Hz, 1H); ^{13}C NMR ($CDCl_3$, 100 MHz): δ ppm = 29.7, 46.4, 56.9, 110.7, 117.6, 118.0, 119.6, 120.4, 120.5, 121.8, 122.6, 125.9, 126.4, 126.5, 127.1, 128.1, 128.3, 128.4, 129.0, 132.5, 136.9, 137.4, 137.4, 137.5, 148.1, 148.9; HR-MS (ESI+) *m/z* calculated for $C_{26}H_{20}N_3^+$ [M + H^+]: 374.1652; found: 374.1647.

X-ray crystal structure data for tetrahydroisoquinolinoquinaxaline 6acc: (CCDC 1443024)

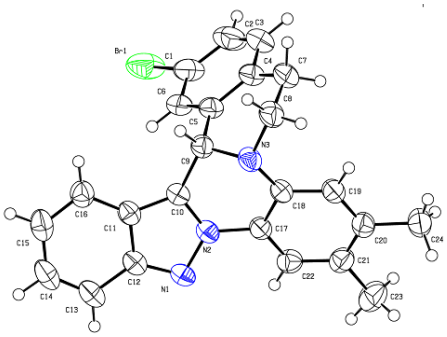
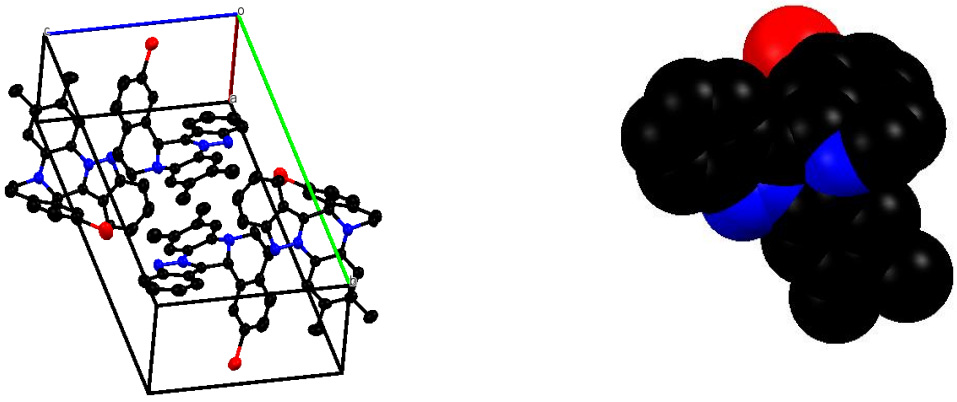


Figure 1: X-ray crystal structure of 6acc (CCDC 1443024)

Empirical formula	$C_{24}H_{20}N_3Br$
Formula weight	430.35
Temperature/K	298
Crystal system	monoclinic
Space group	$P2_1/n$
a/Å	10.1488(5)
b/Å	17.0478(4)
c/Å	12.0520(4)
α/°	90
β/°	113.032(5)
γ/°	90
Volume/Å^3	1918.97(15)
Z	4
ρ_{calc}g/cm^3	1.4895
μ/mm^{-1}	3.020
F(000)	879.4
Crystal size/mm^3	0.17 × 0.15 × 0.15
Radiation	Cu Kα (λ = 1.5418)
2Θ range for data collection/°	7.98 to 141.54
Index ranges	$-9 \le h \le 11$, $-20 \le k \le 15$, $-14 \le l \le 14$
Reflections collected	6456
Independent reflections	3237 [R_{int} = 0.0296, R_{sigma} = 0.0425]
Data/restraints/parameters	3237/0/256
Goodness-of-fit on F^2	1.049
Final R indexes [I>=2σ (I)]	R_1 = 0.0518, wR_2 = N/A
Final R indexes [all data]	R_1 = 0.0662, wR_2 = 0.1522
Largest diff. peak/hole / e Å^{-3}	0.70/-0.99



(a) **(b)**

Figure 2: a) Crystal packing diagram of 6acc with axial co-ordinates; b) Space-filling model of 6acc.

References:

1. F. Jahani, M. Tajbakhsh, H. Golchoubian and S. Khaksar, *Tetrahedron Lett.*, 2011, **52**, 1260.
2. S. Vidyacharan, A. Sagar, N. C. Chaitra and D. S. Sharada, *RSC Adv.*, 2014, **4**, 34232.

Copies of ^{1}H and ^{13}C NMR spectra of compounds 3a, 4ab-4ad, 6aaa-6afg and 7afg:

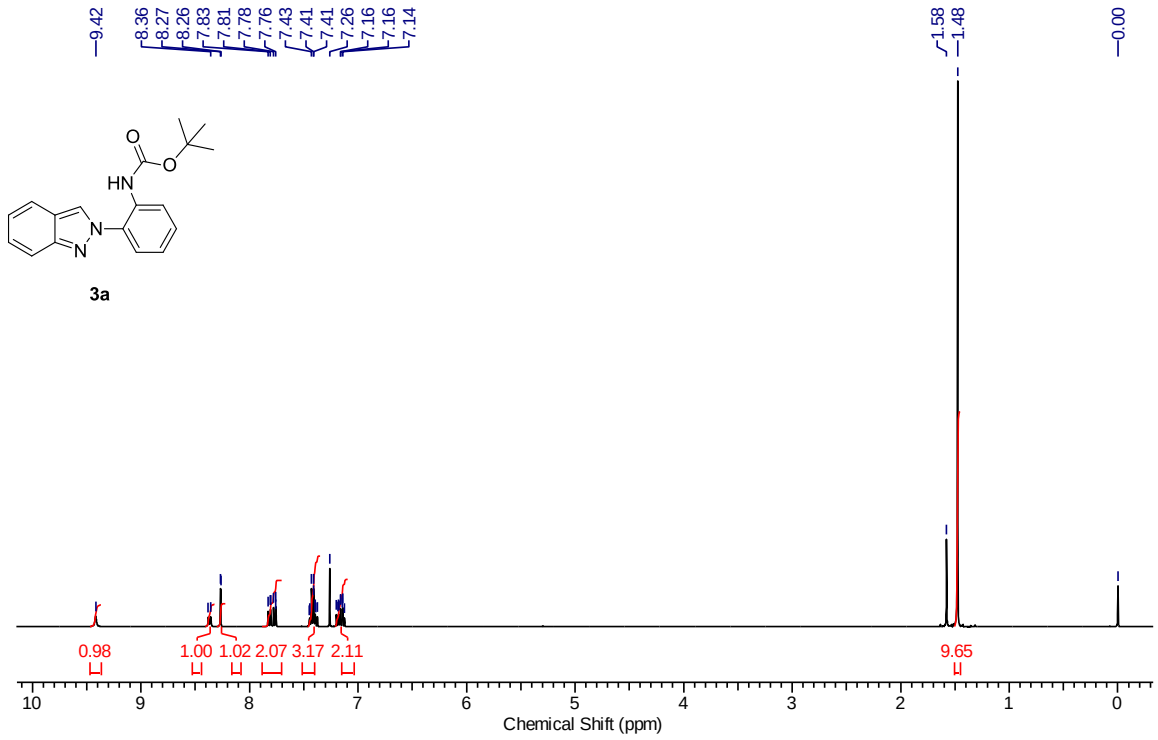


Figure 3. ^{1}H NMR (400 MHz) spectrum of compound **3a** in $CDCl_3$.

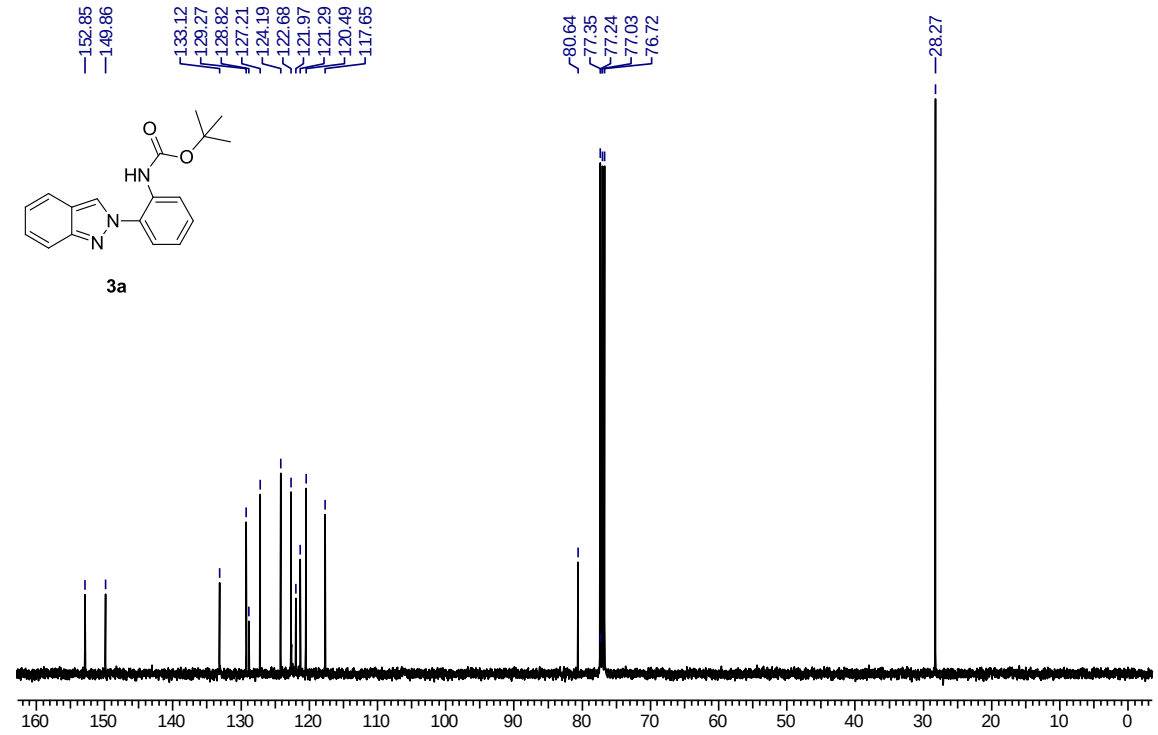


Figure 4. ^{13}C NMR (100 MHz) spectrum of compound **3a** in $CDCl_3$.

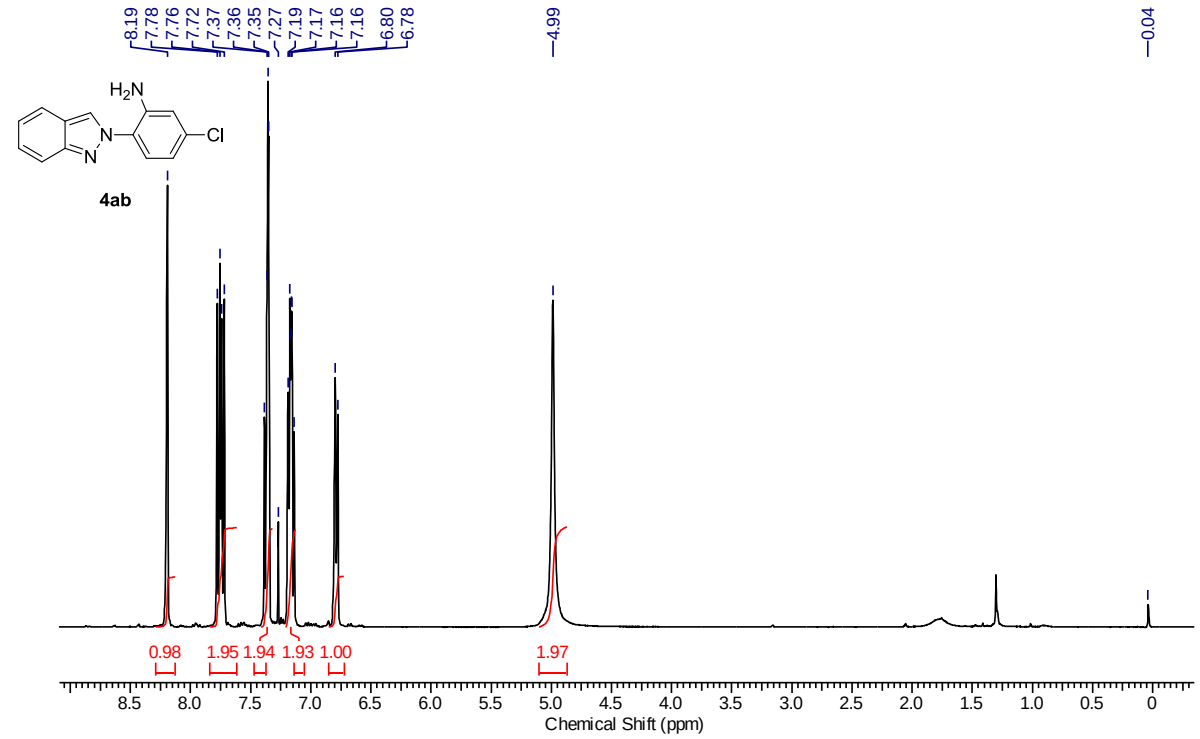


Figure 5. ^{1}H NMR (400 MHz) spectrum of compound **4ab** in $CDCl_3$.

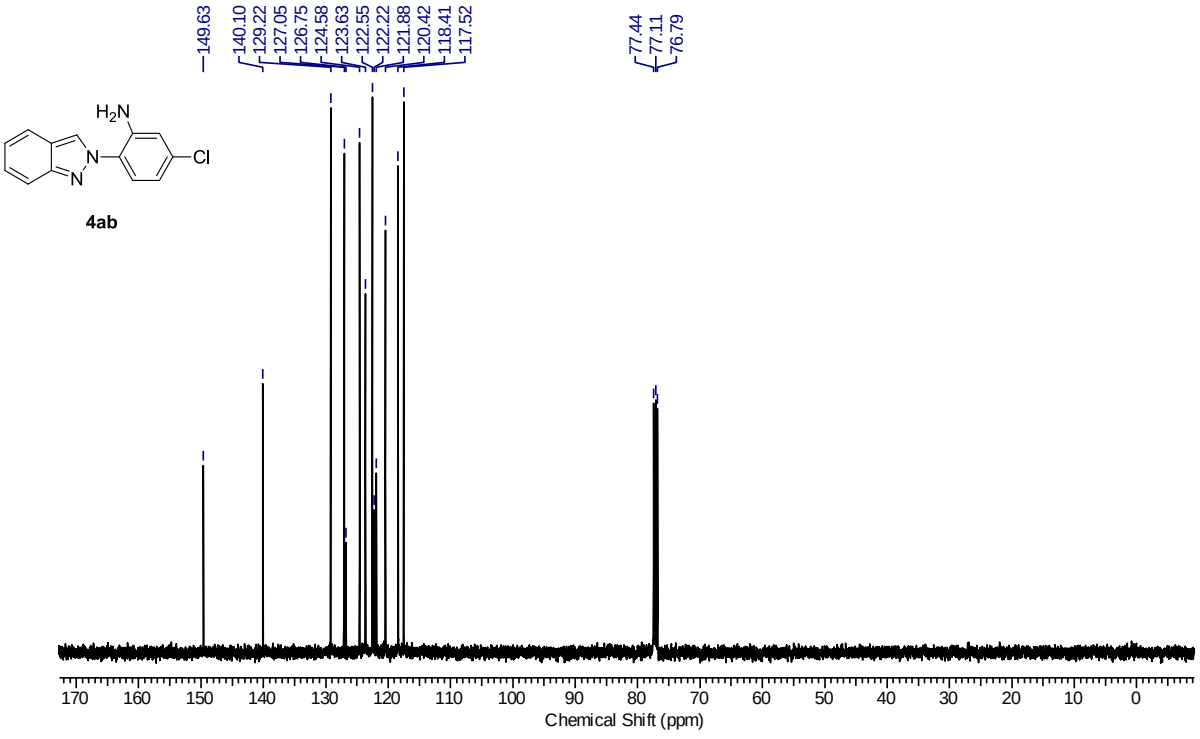


Figure 6. ^{13}C NMR (100 MHz) spectrum of compound **4ab** in $CDCl_3$.

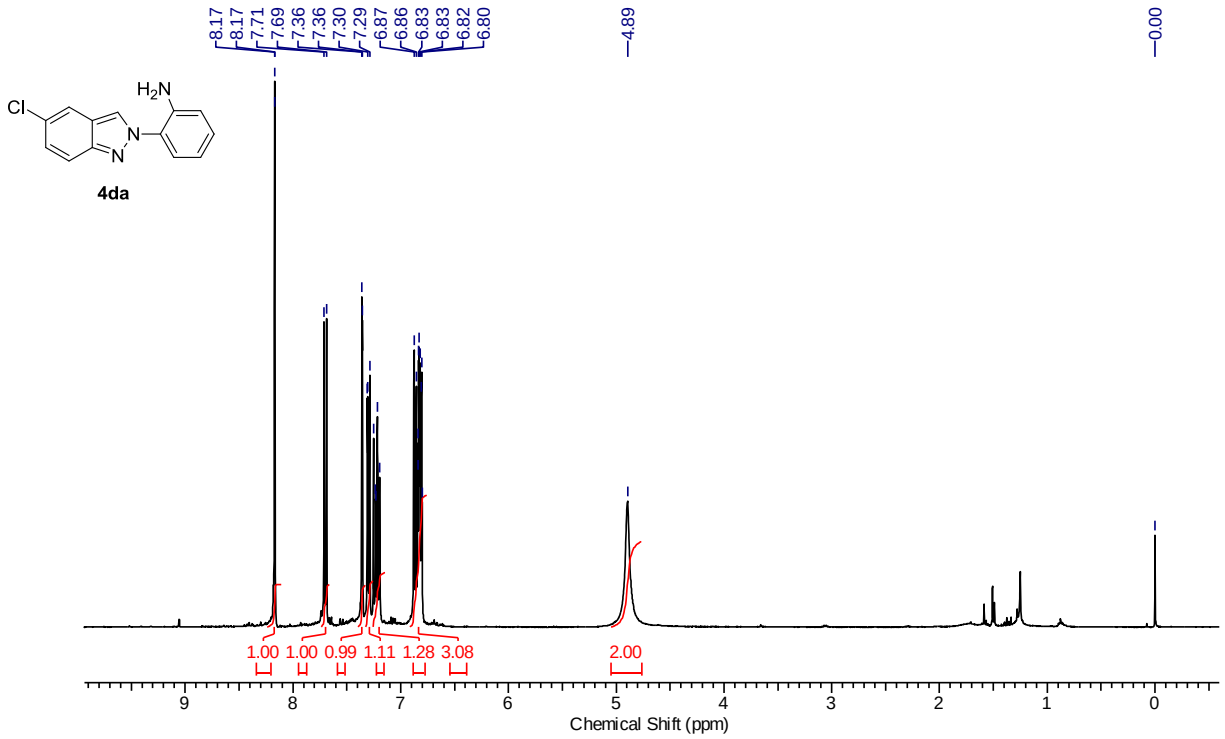


Figure 7. ^{1}H NMR (400 MHz) spectrum of compound **4da** in $CDCl_3$.

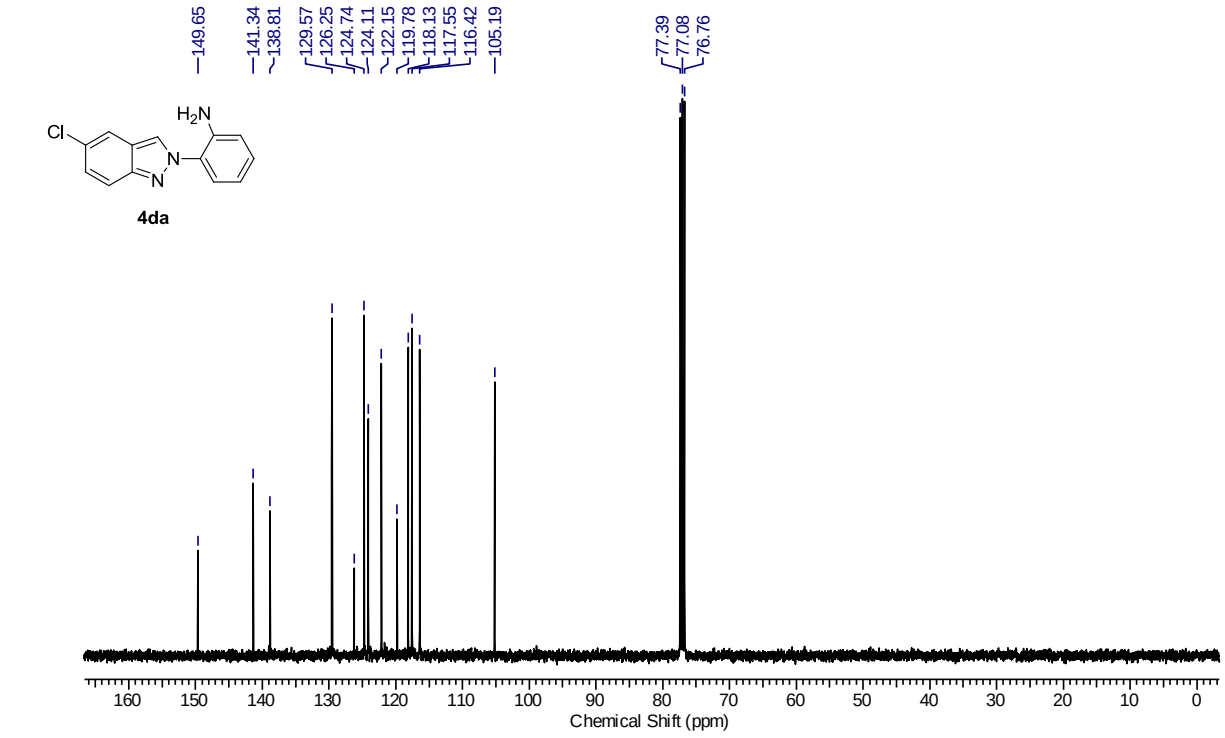


Figure 8. ^{13}C NMR (100 MHz) spectrum of compound **4da** in $CDCl_3$.

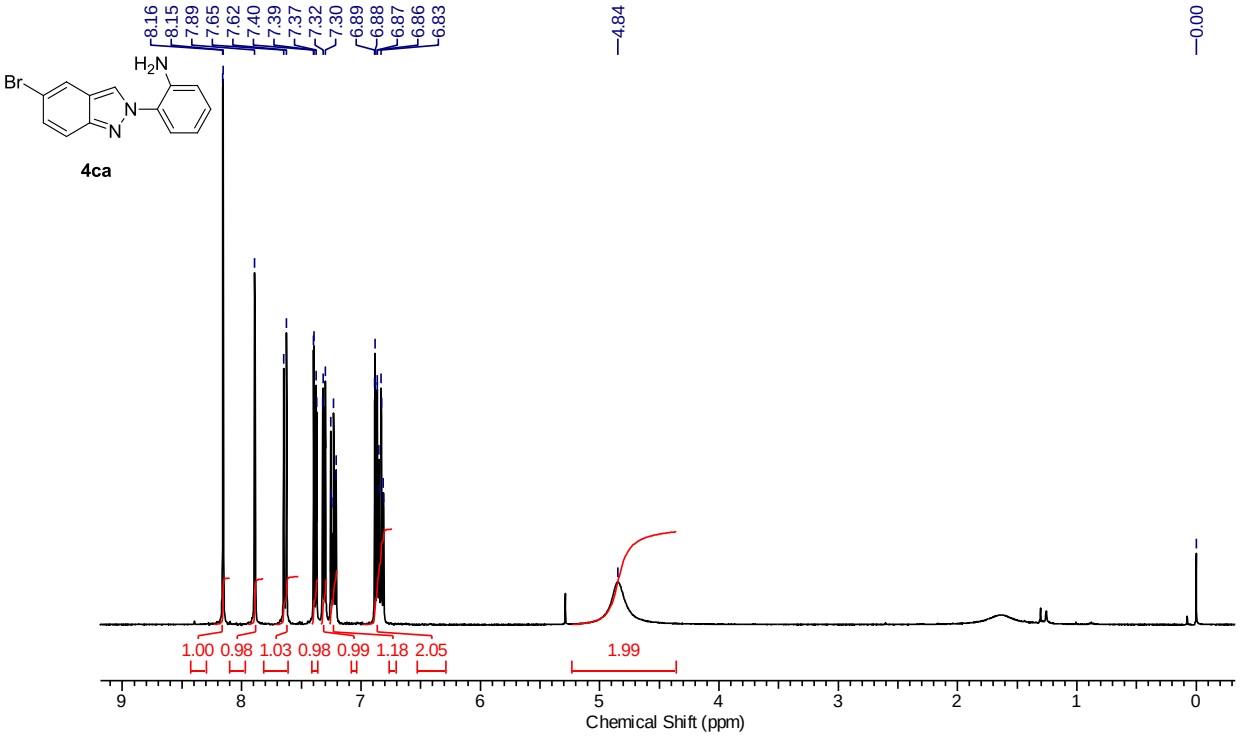


Figure 9. ^{1}H NMR (400 MHz) spectrum of compound **4ca** in $CDCl_3$.

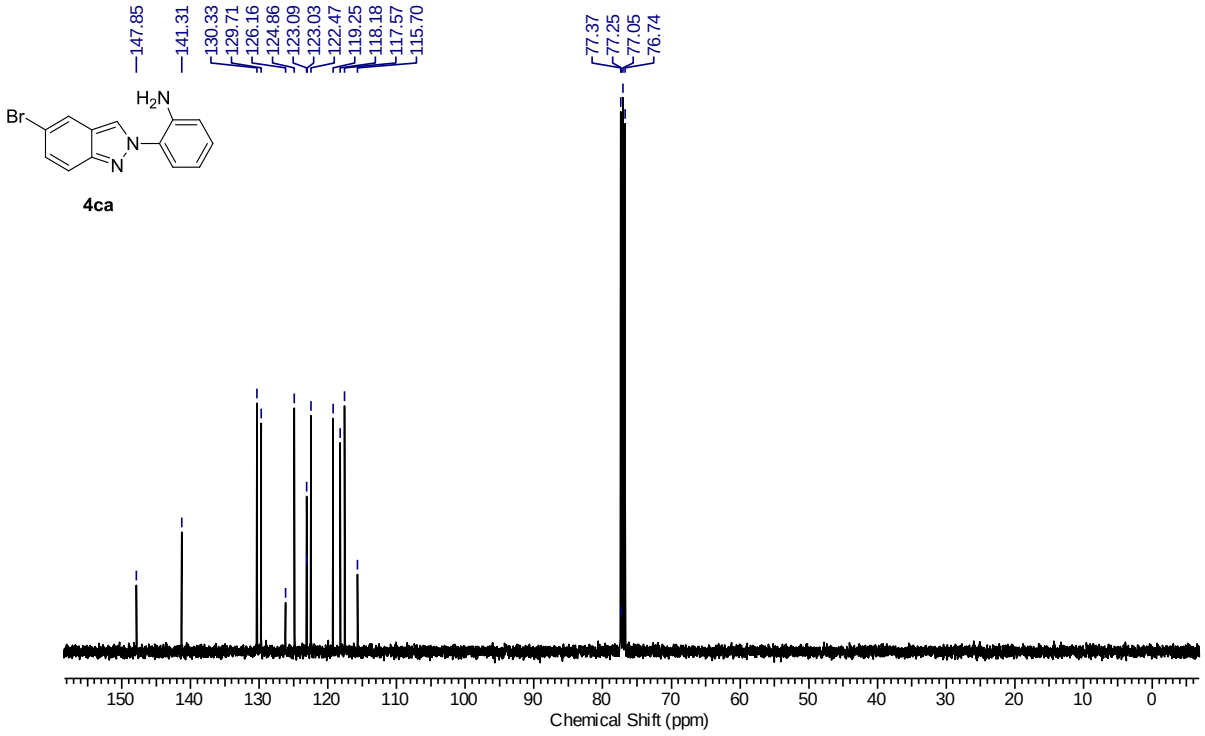


Figure 10. ^{13}C NMR (100 MHz) spectrum of compound **4ca** in $CDCl_3$.

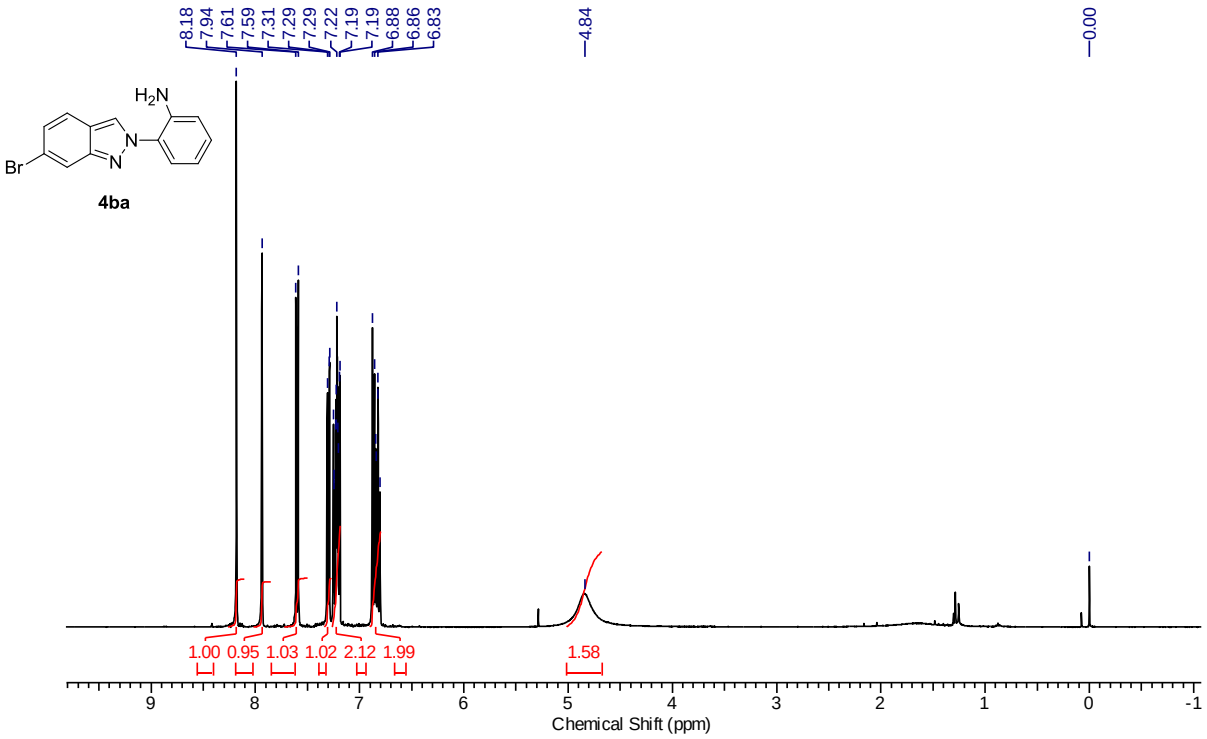


Figure 11. ^{1}H NMR (400 MHz) spectrum of compound **4ba** in $CDCl_3$.

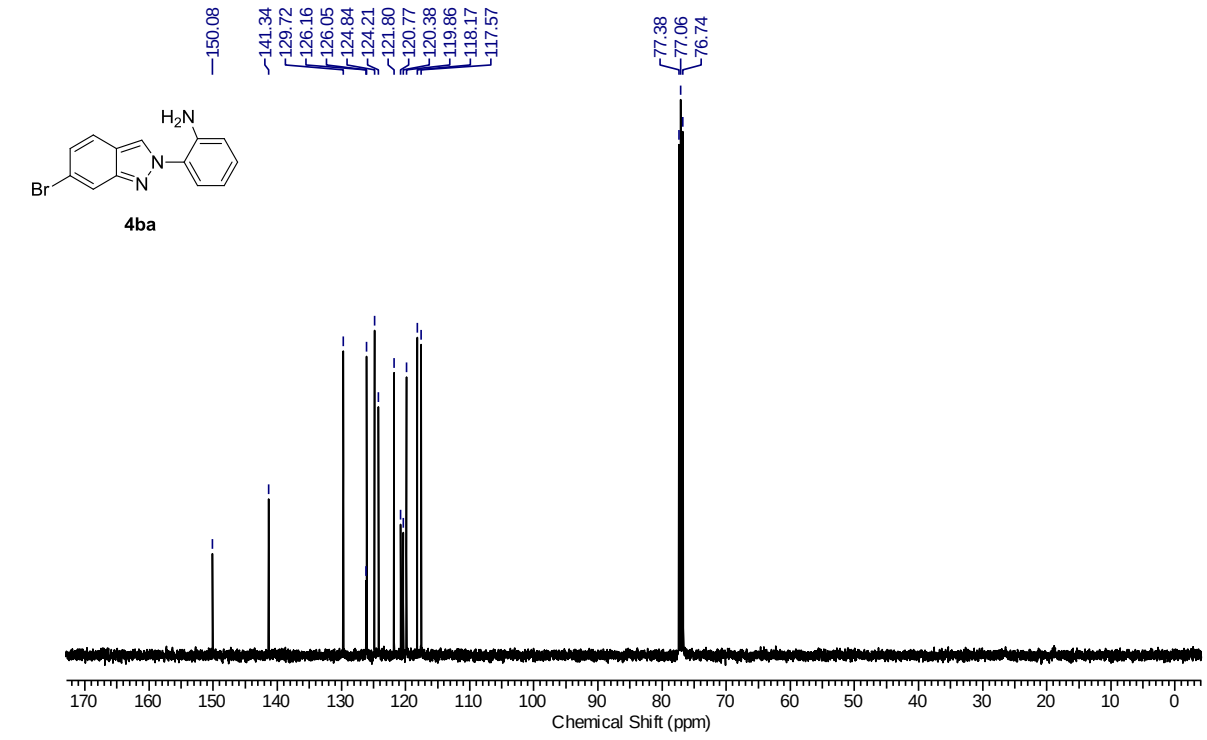


Figure 12. ^{13}C NMR (100 MHz) spectrum of compound **4ba** in $CDCl_3$.

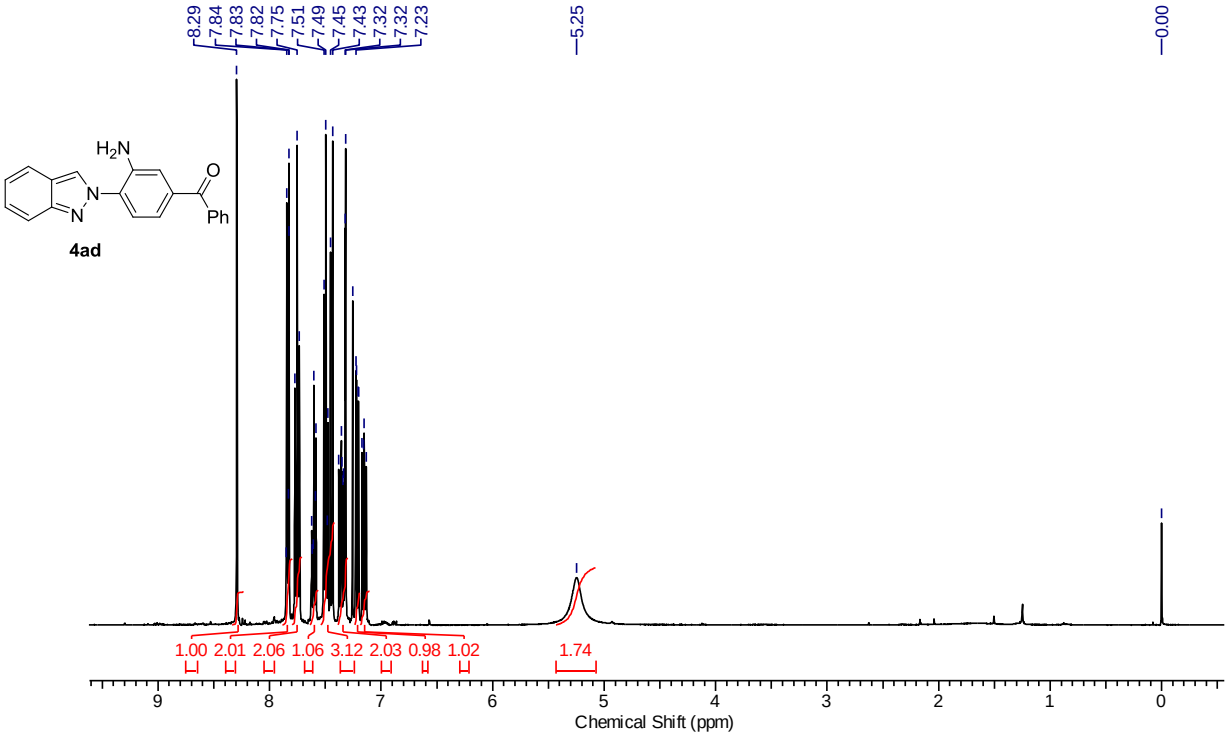


Figure 13. ^{1}H NMR (400 MHz) spectrum of compound **4ad** in $CDCl_3$.

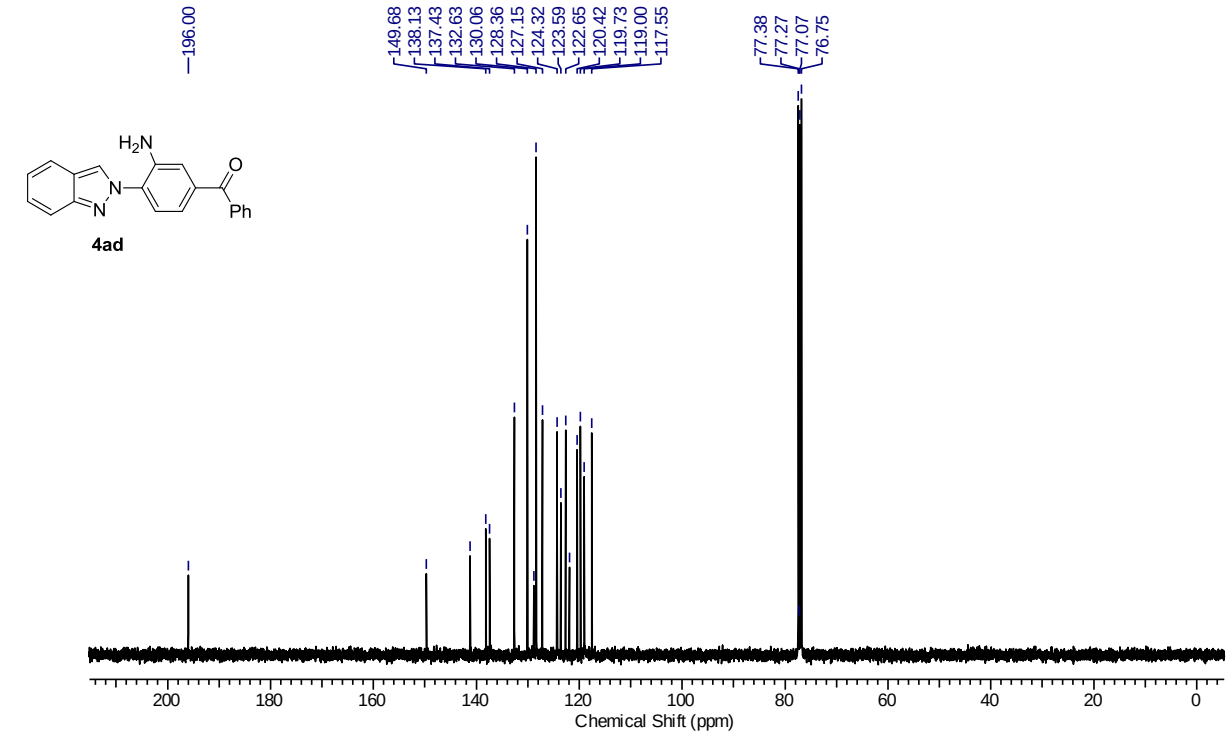


Figure 14. ^{13}C NMR (100 MHz) spectrum of compound **4ad** in $CDCl_3$.

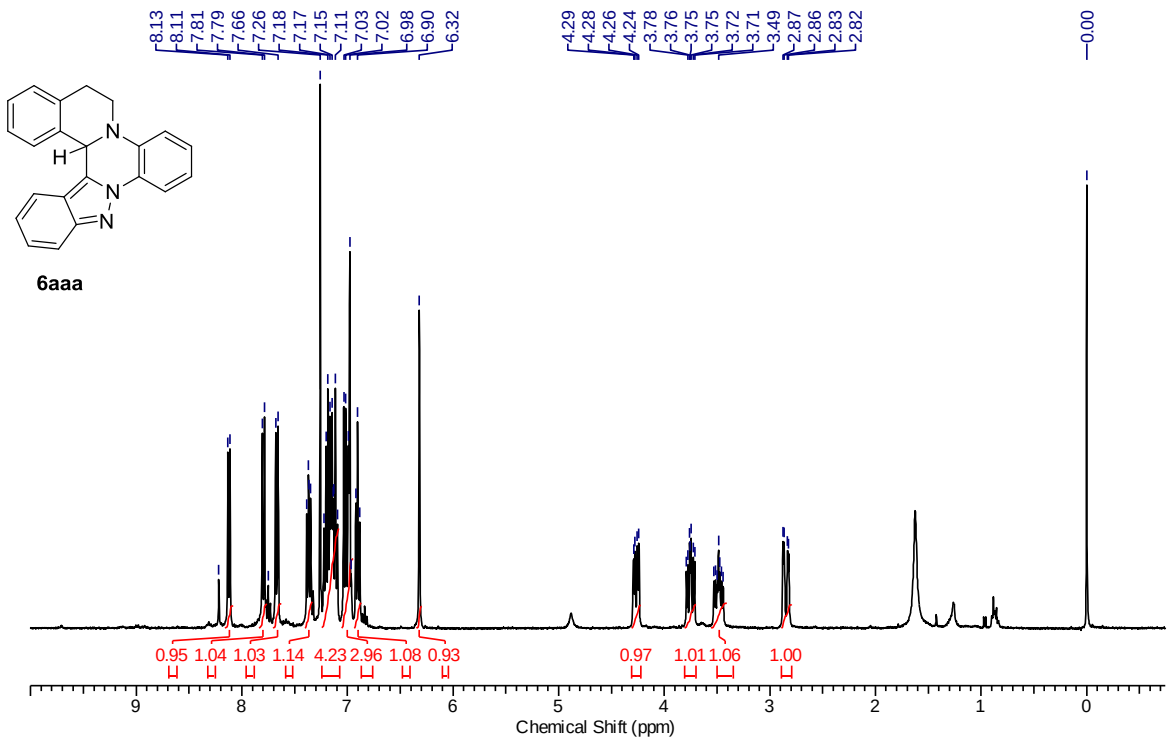


Figure 15. ^{1}H NMR (400 MHz) spectrum of compound **6aaa** in $CDCl_3$.

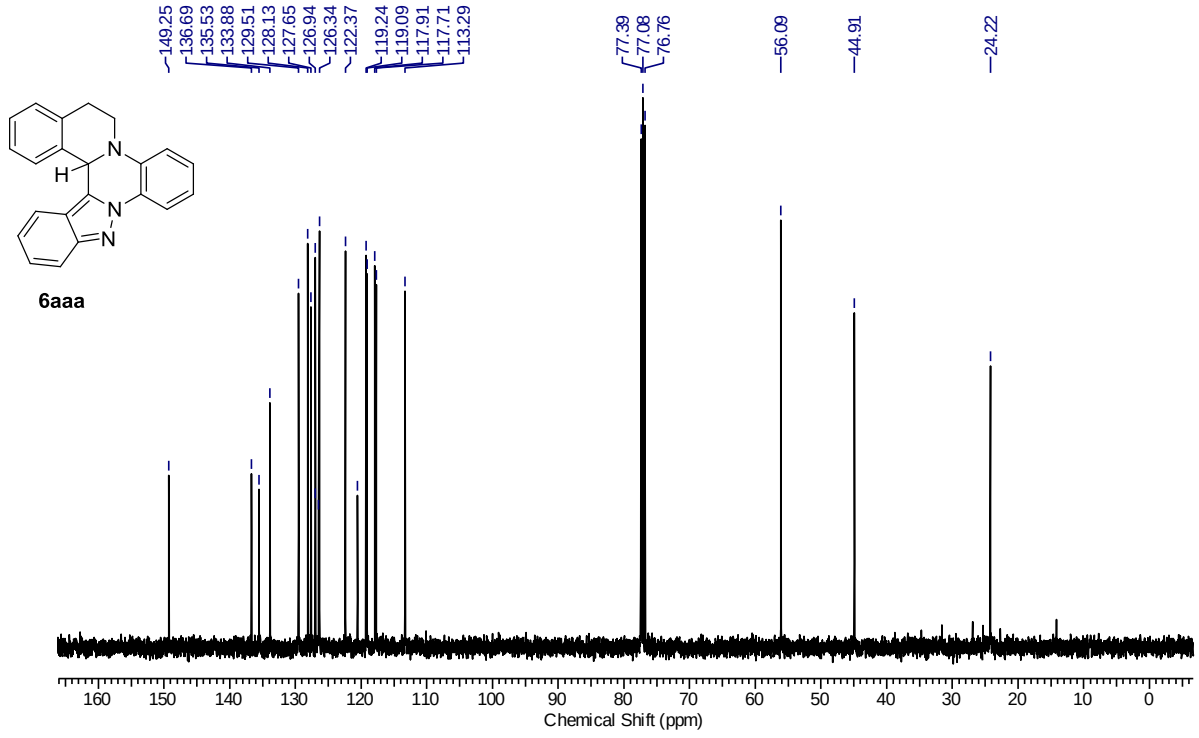


Figure 16. ^{13}C NMR (100 MHz) spectrum of compound **6aaa** in $CDCl_3$.

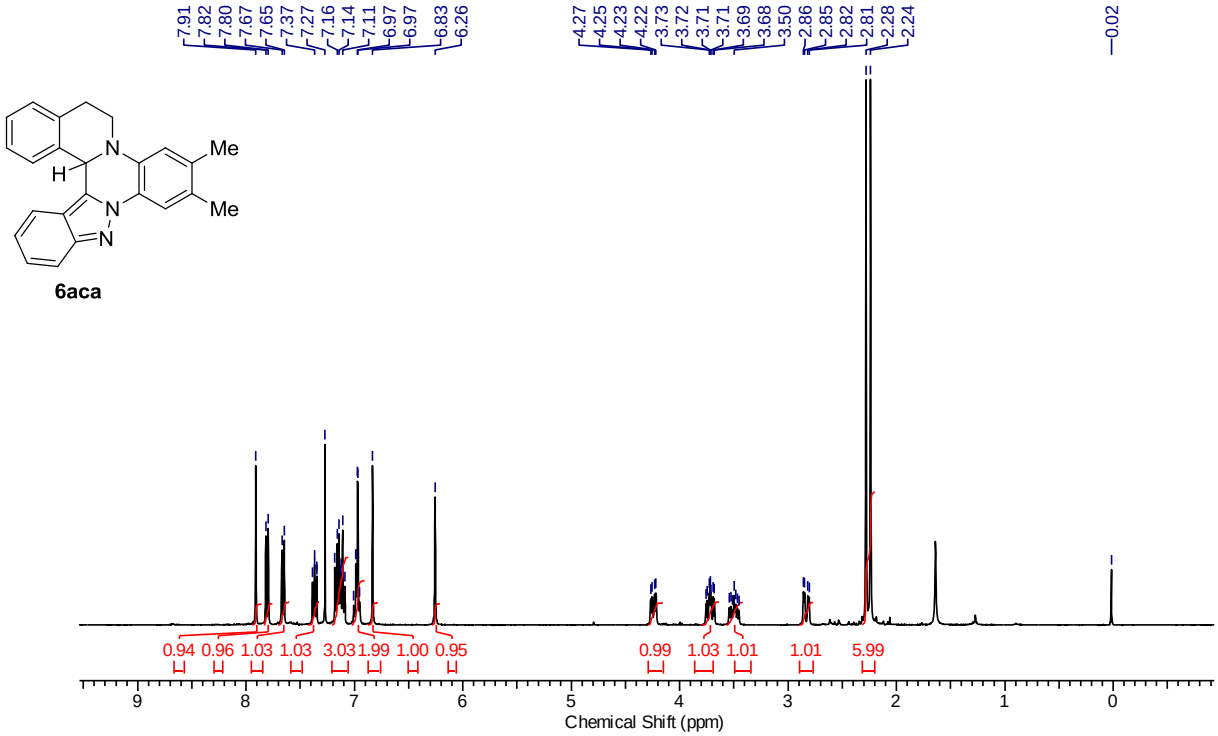


Figure 17. ^{1}H NMR (400 MHz) spectrum of compound **6aca** in $CDCl_3$.

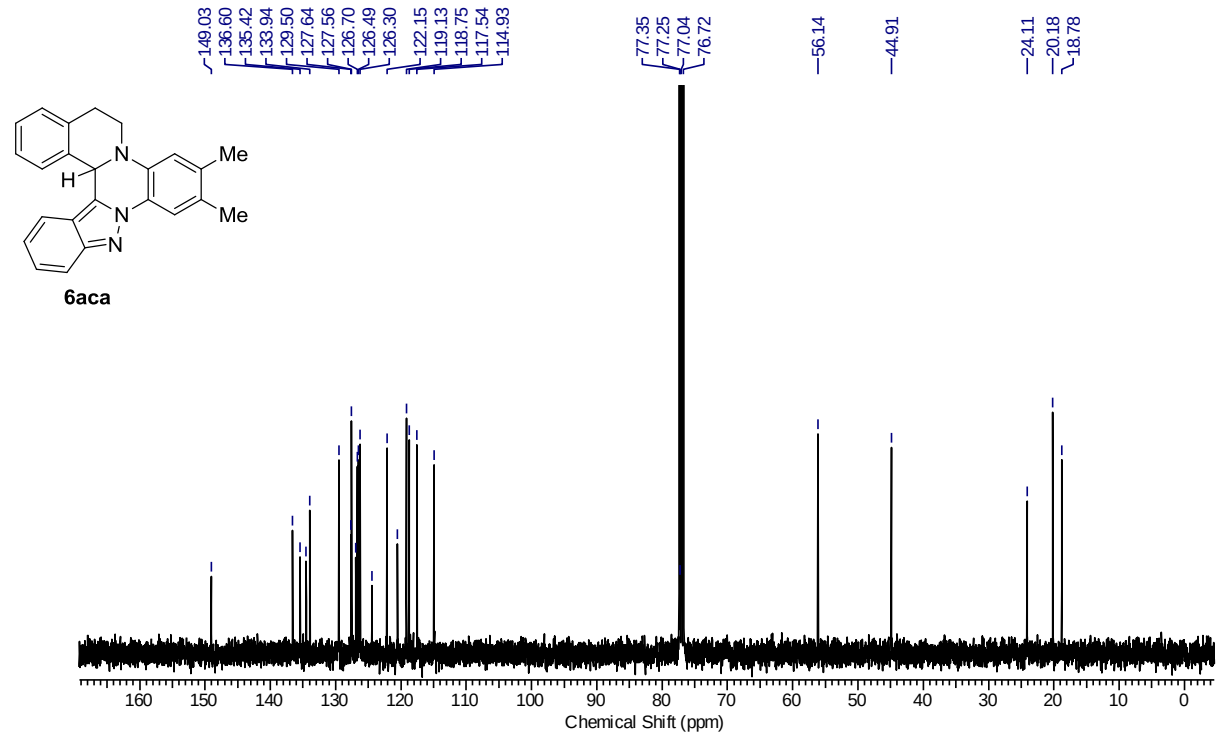


Figure 18. ^{13}C NMR (100 MHz) spectrum of compound **6aca** in $CDCl_3$.

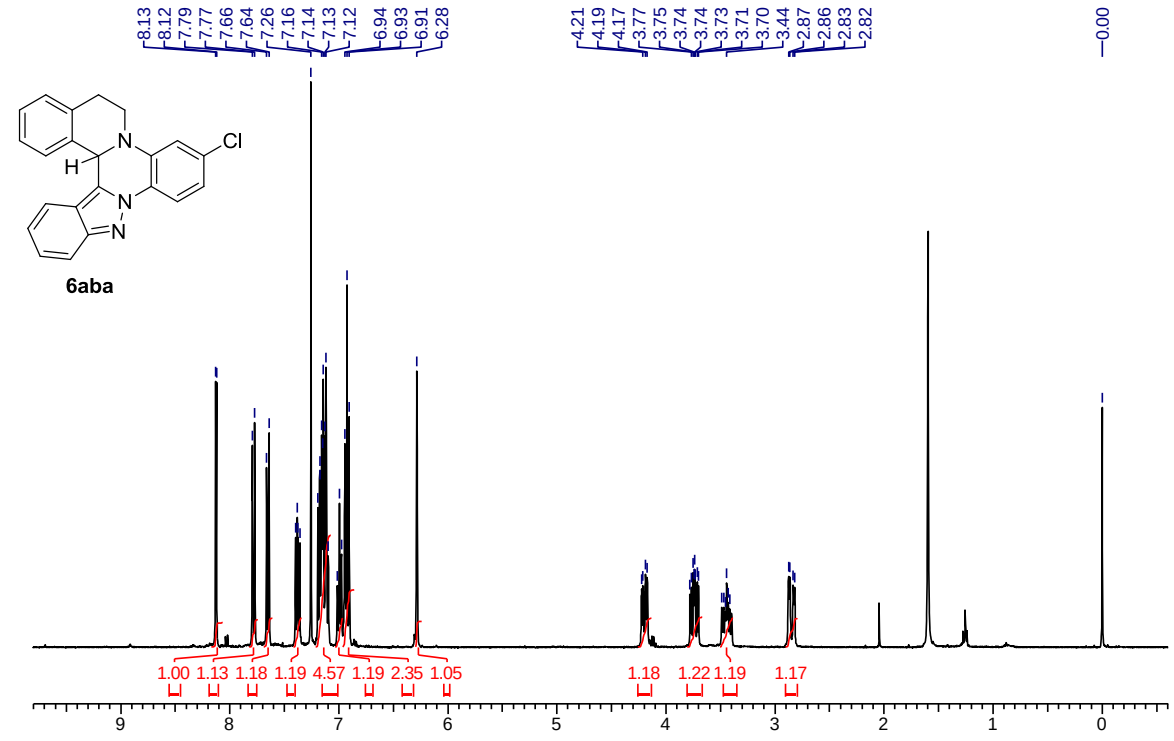


Figure 19. ^{1}H NMR (400 MHz) spectrum of compound **6aba** in $CDCl_3$.

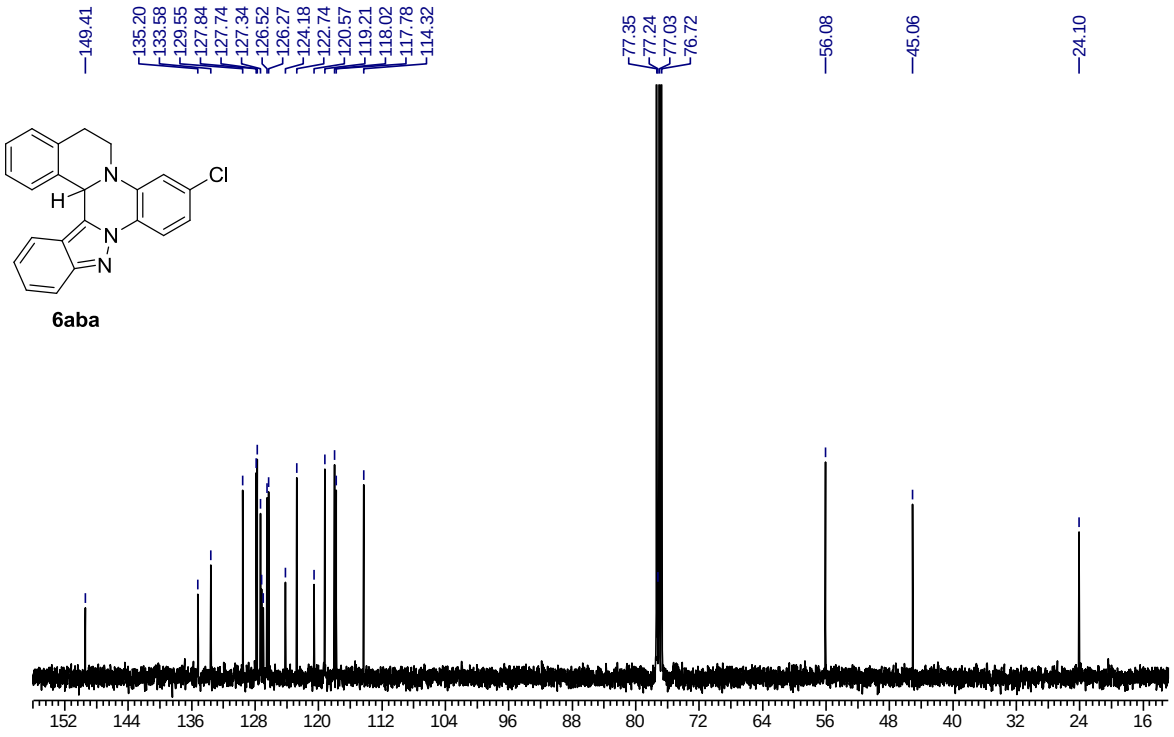


Figure 20. ^{13}C NMR (100 MHz) spectrum of compound **6aba** in $CDCl_3$.

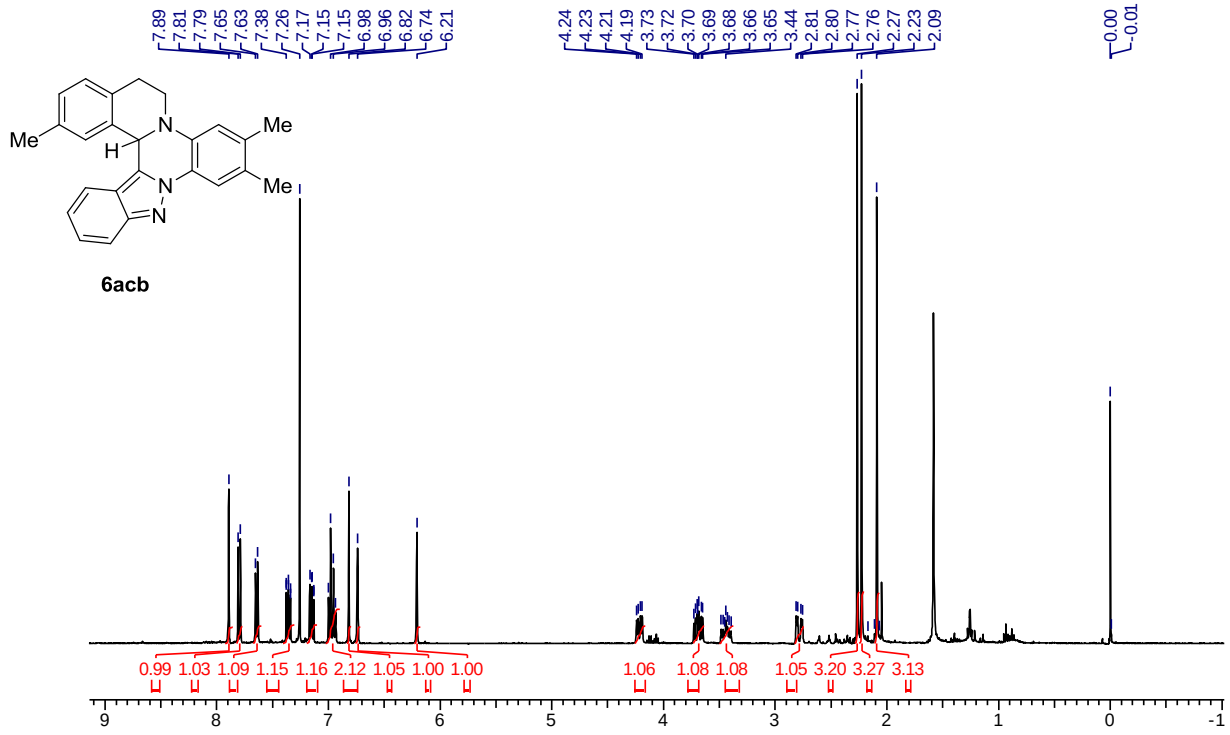


Figure 21. ^{1}H NMR (400 MHz) spectrum of compound **6acb** in $CDCl_3$.

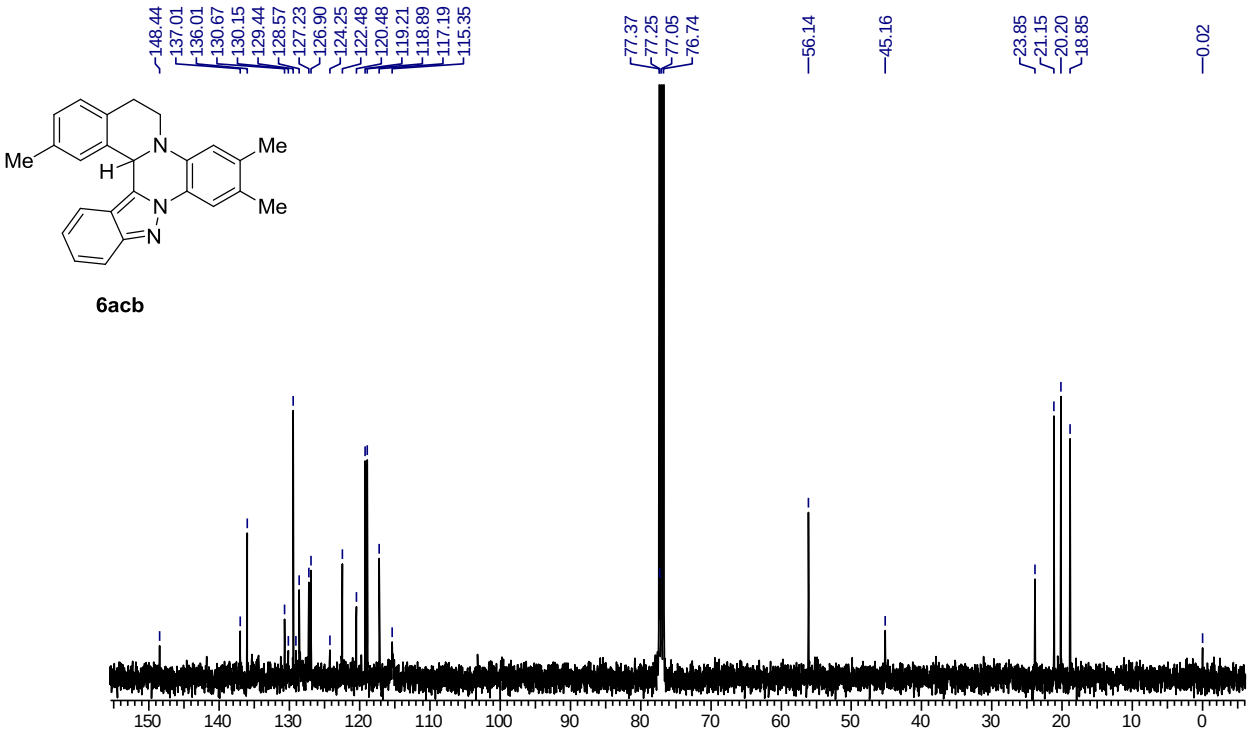


Figure 22. ^{13}C NMR (100 MHz) spectrum of compound **6acb** in $CDCl_3$.

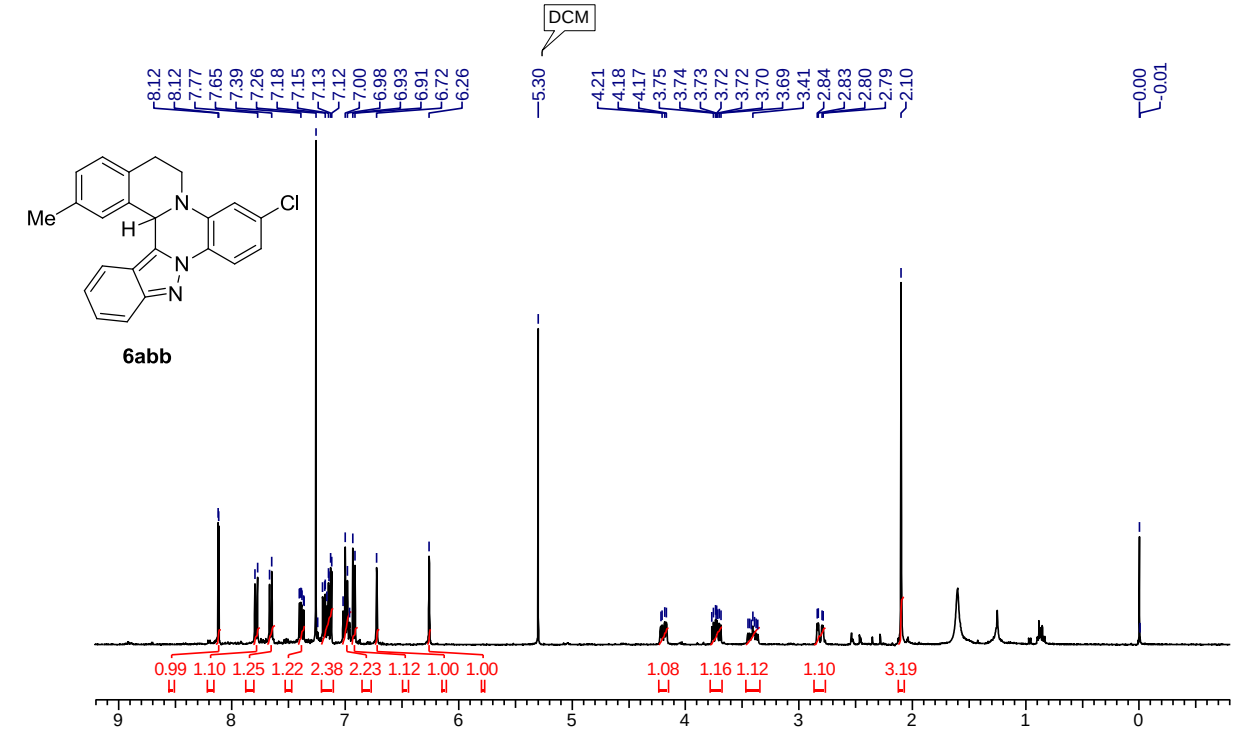


Figure 23. ^{1}H NMR (400 MHz) spectrum of compound **6abb** in $CDCl_3$.

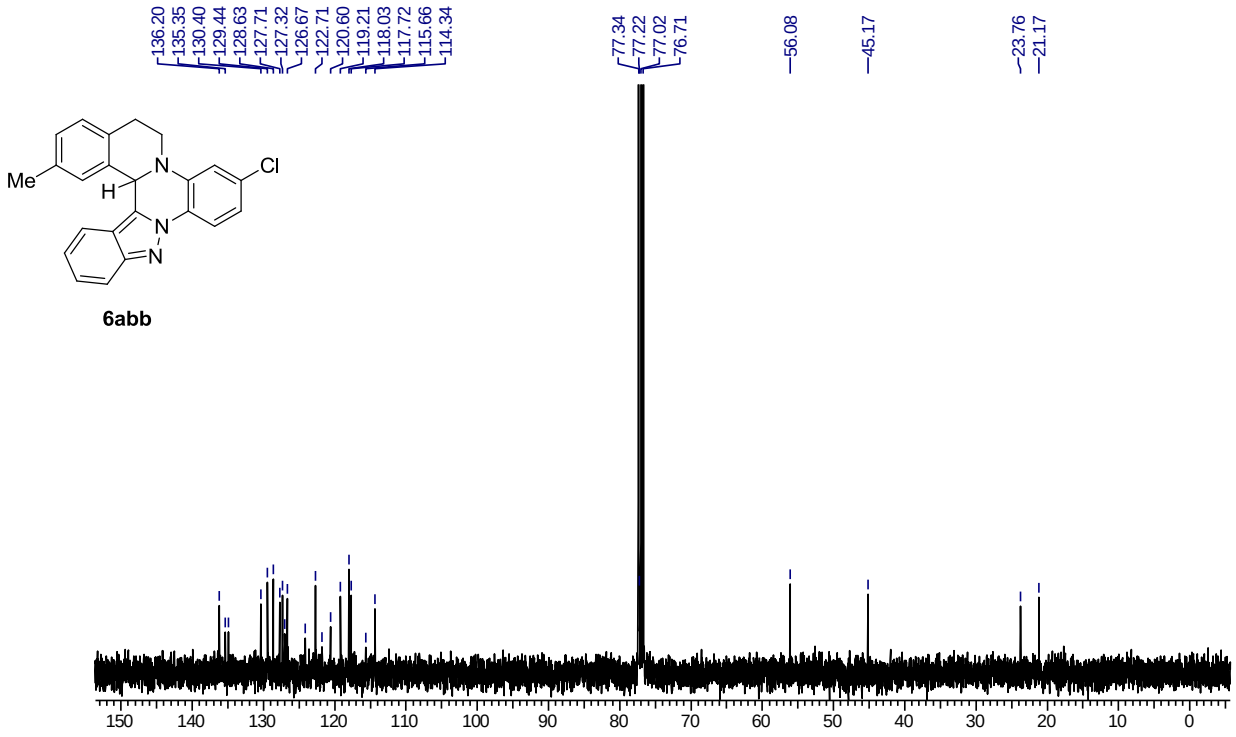


Figure 24. ^{13}C NMR (100 MHz) spectrum of compound **6abb** in $CDCl_3$.

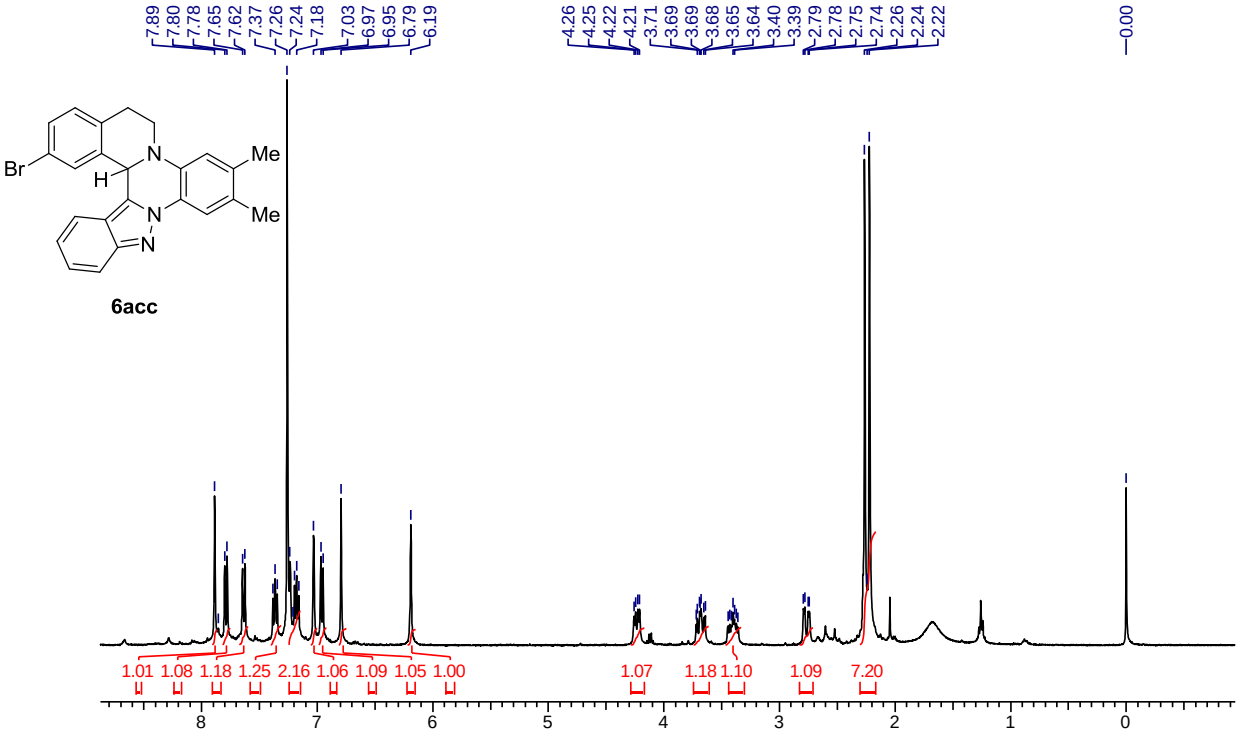


Figure 25. ^{1}H NMR (400 MHz) spectrum of compound **6acc** in $CDCl_3$.

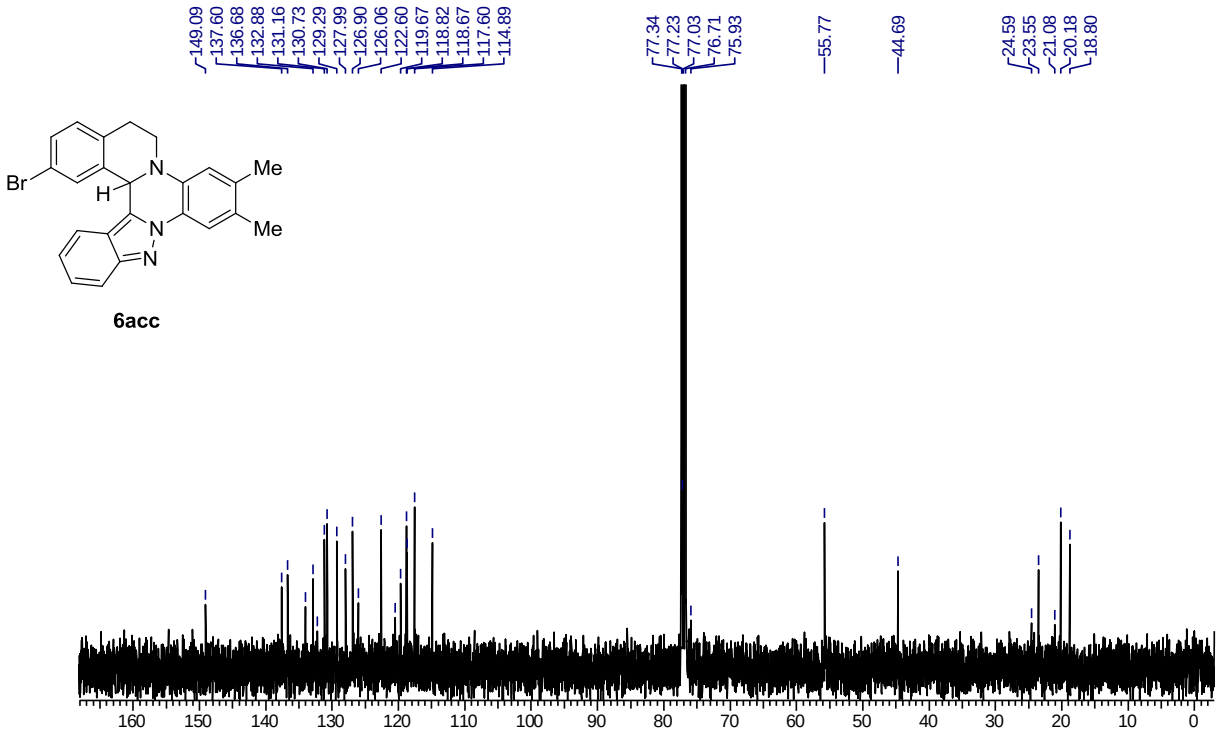


Figure 26. ^{13}C NMR (100 MHz) spectrum of compound **6acc** in $CDCl_3$.

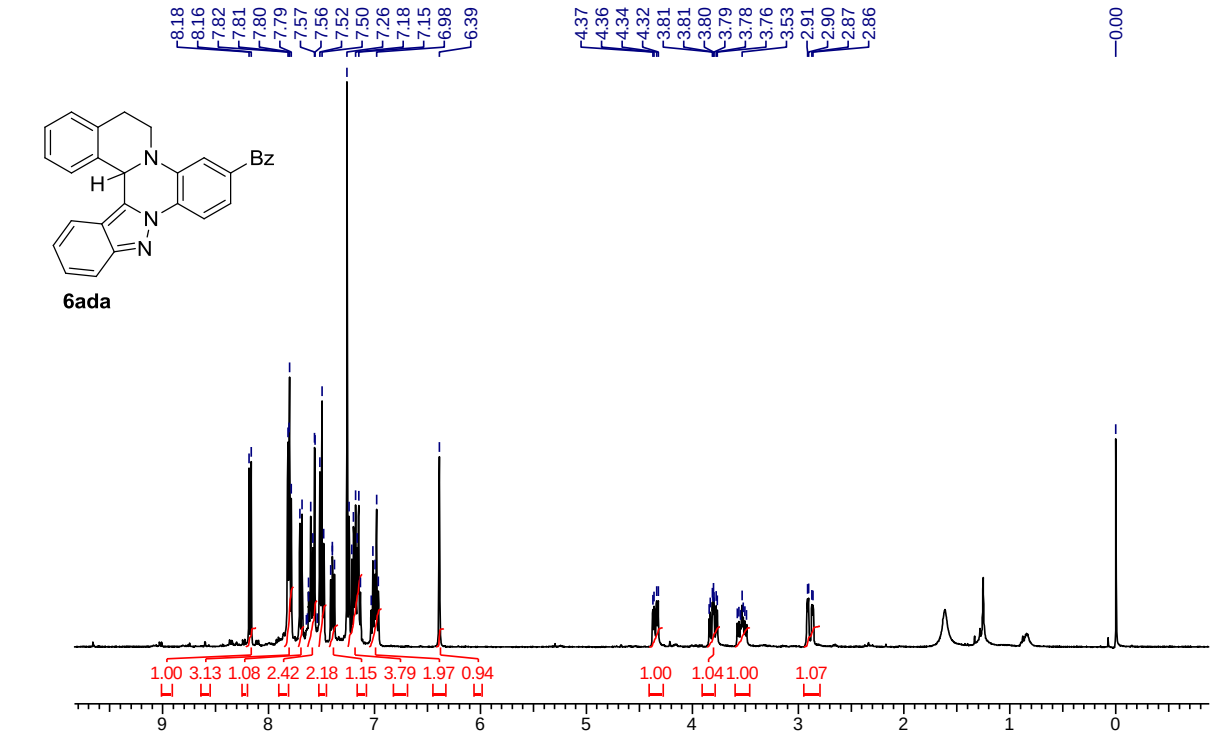


Figure 27. ^{1}H NMR (400 MHz) spectrum of compound **6ada** in $CDCl_3$.

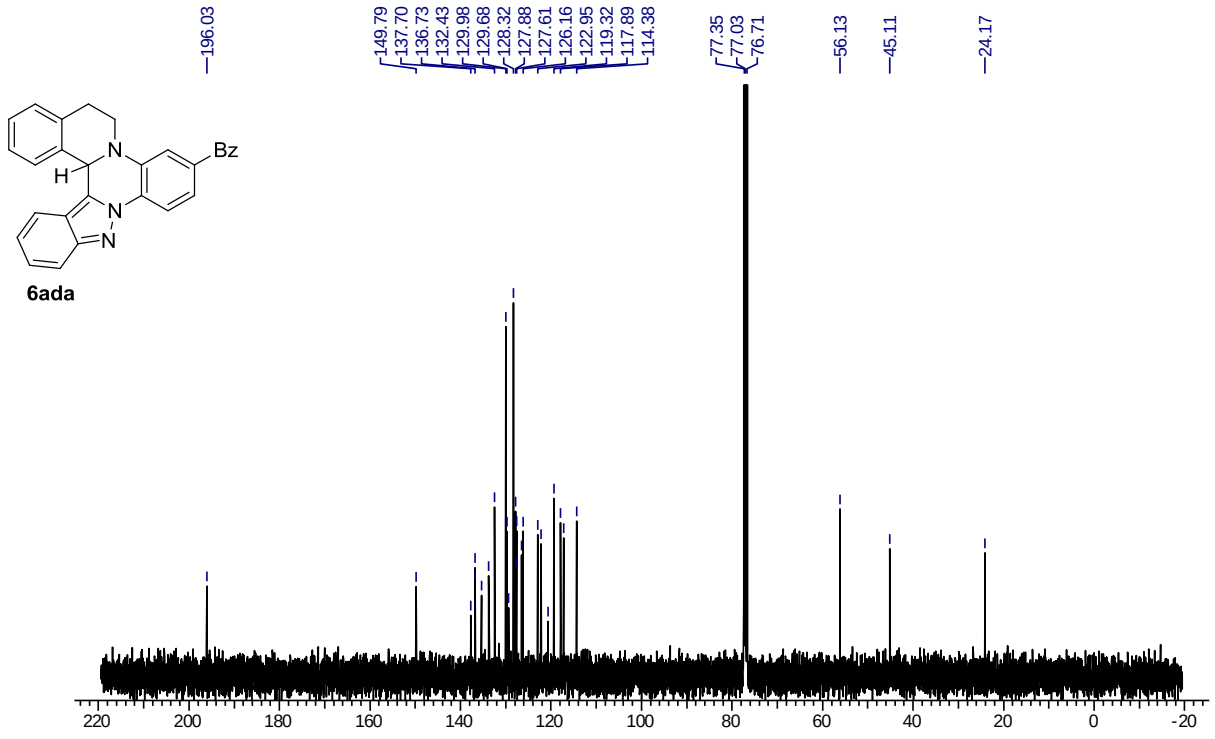


Figure 28. ^{13}C NMR (100 MHz) spectrum of compound **6ada** in $CDCl_3$.

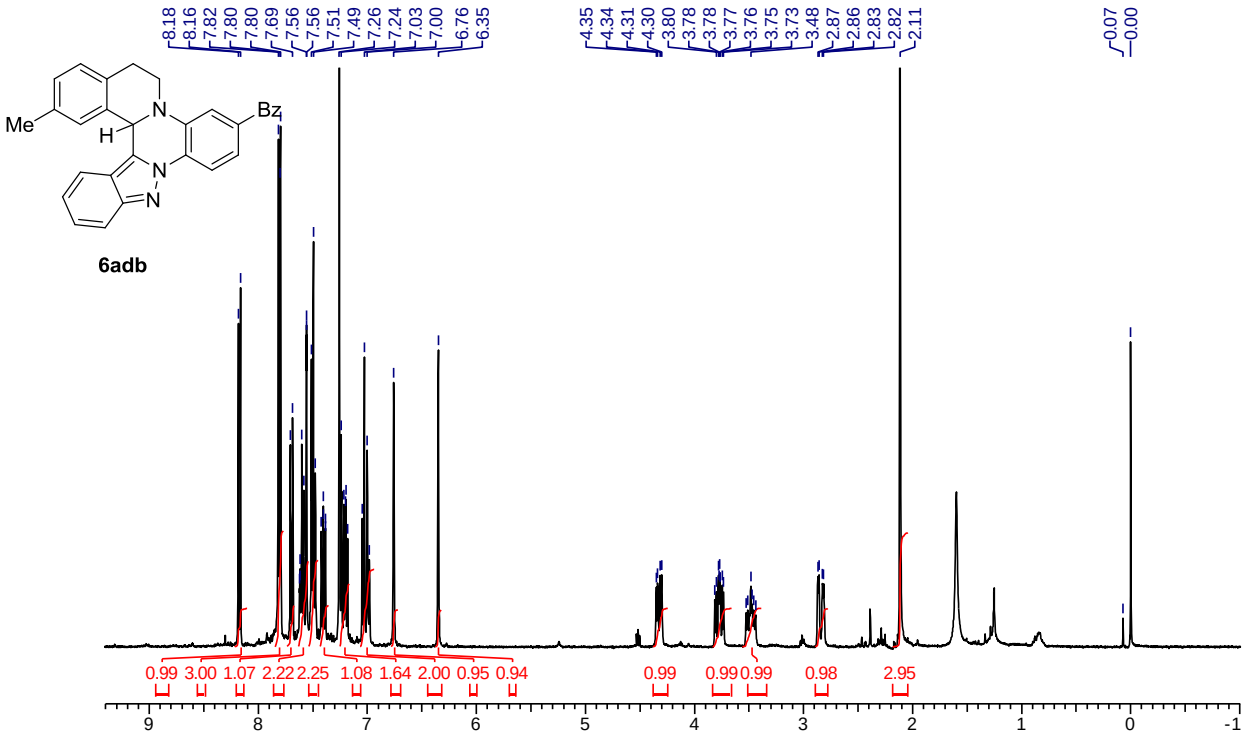


Figure 29. ^{1}H NMR (400 MHz) spectrum of compound **6adb** in $CDCl_3$.

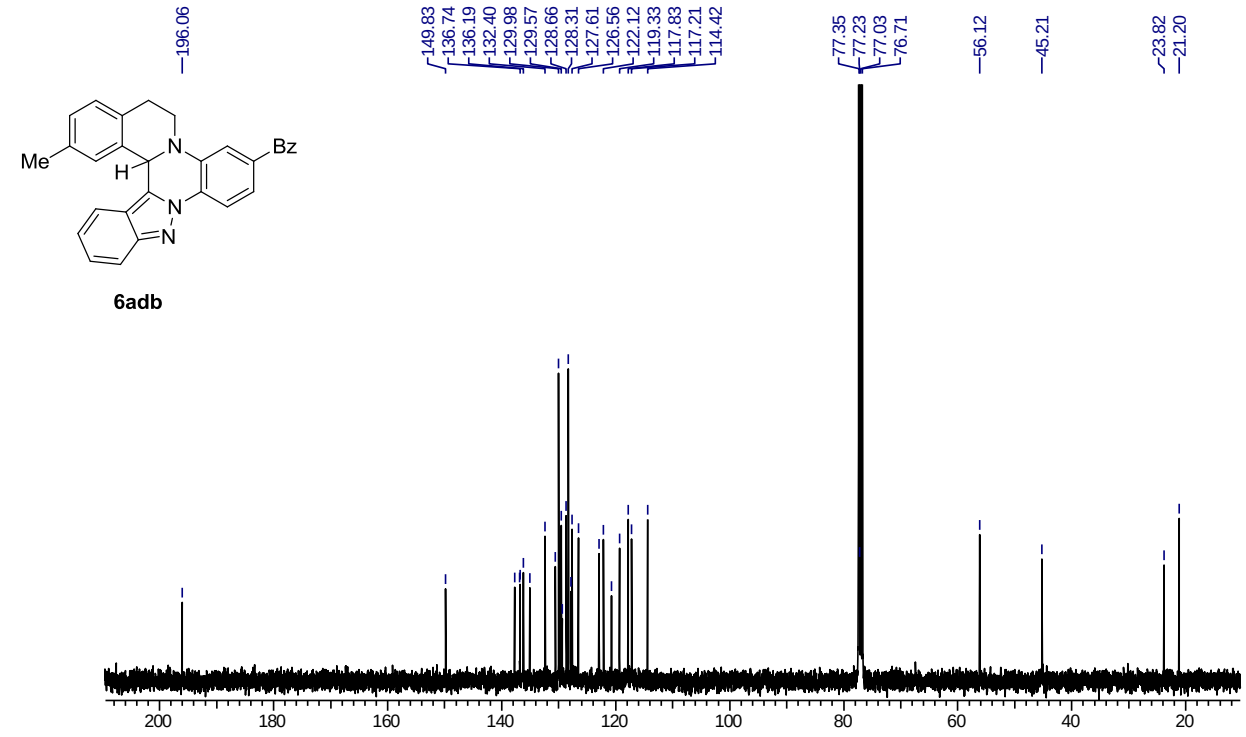


Figure 30. ^{13}C NMR (100 MHz) spectrum of compound **6adb** in $CDCl_3$.

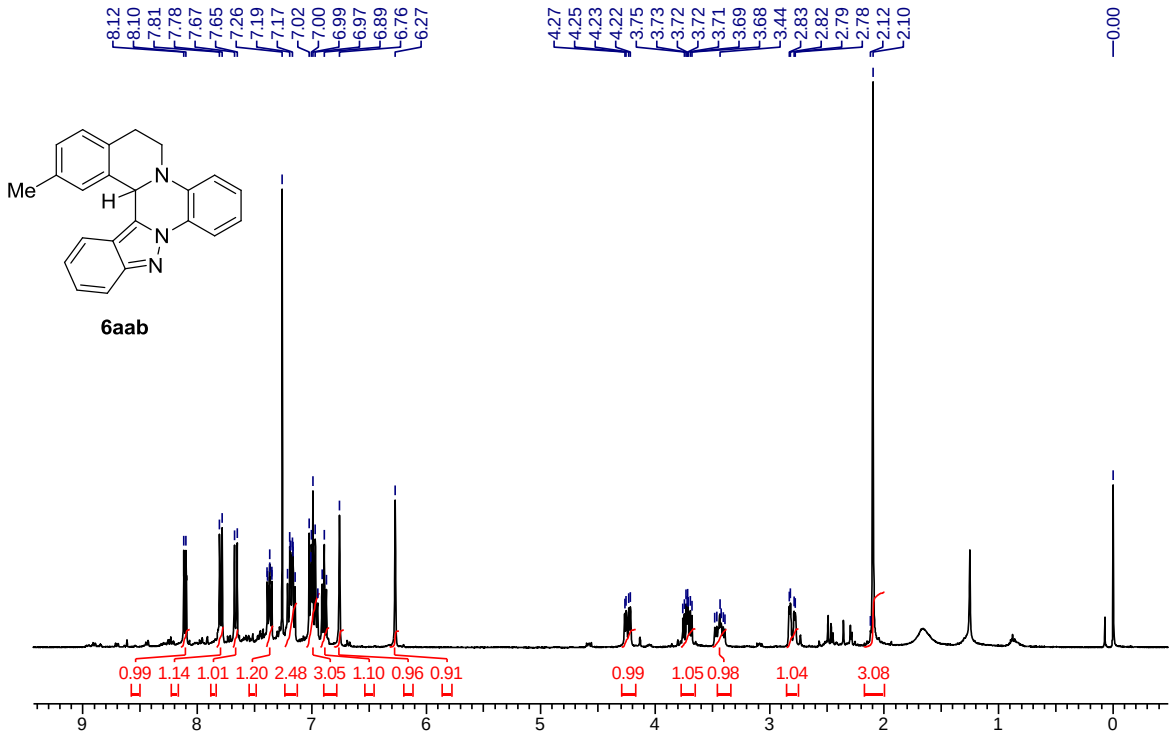


Figure 31. ^{1}H NMR (400 MHz) spectrum of compound **6aab** in $CDCl_3$.

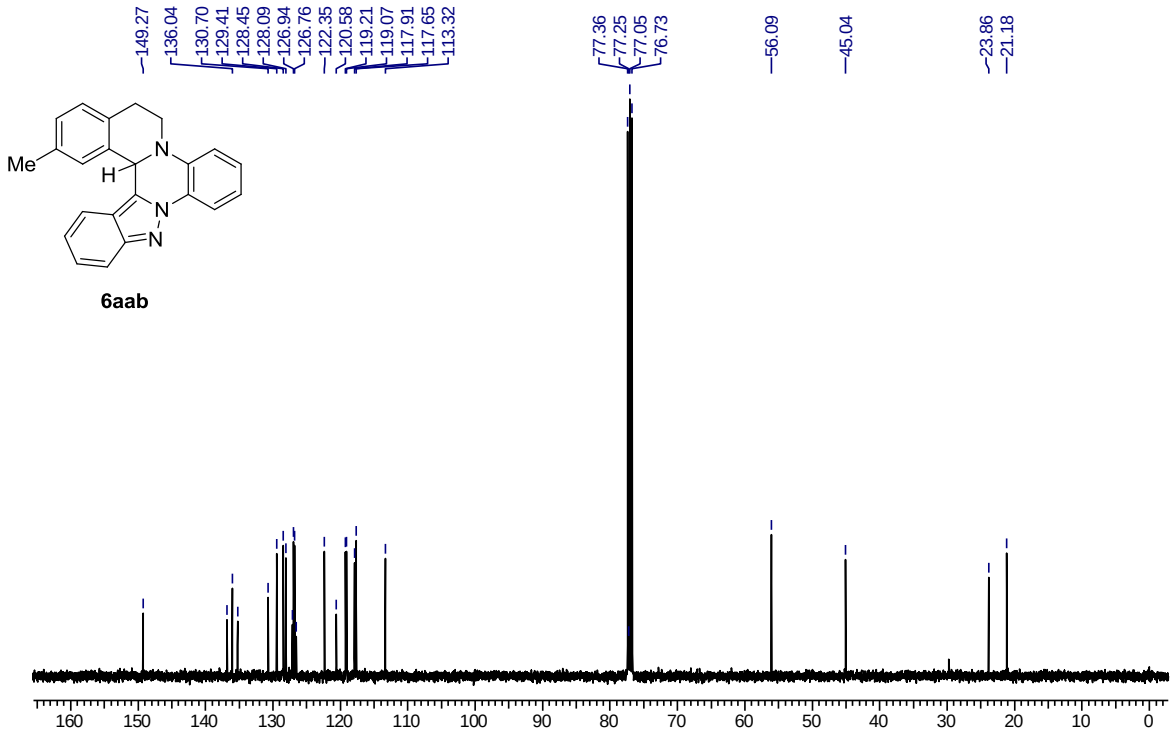


Figure 32. ^{13}C NMR (100 MHz) spectrum of compound **6aab** in $CDCl_3$.

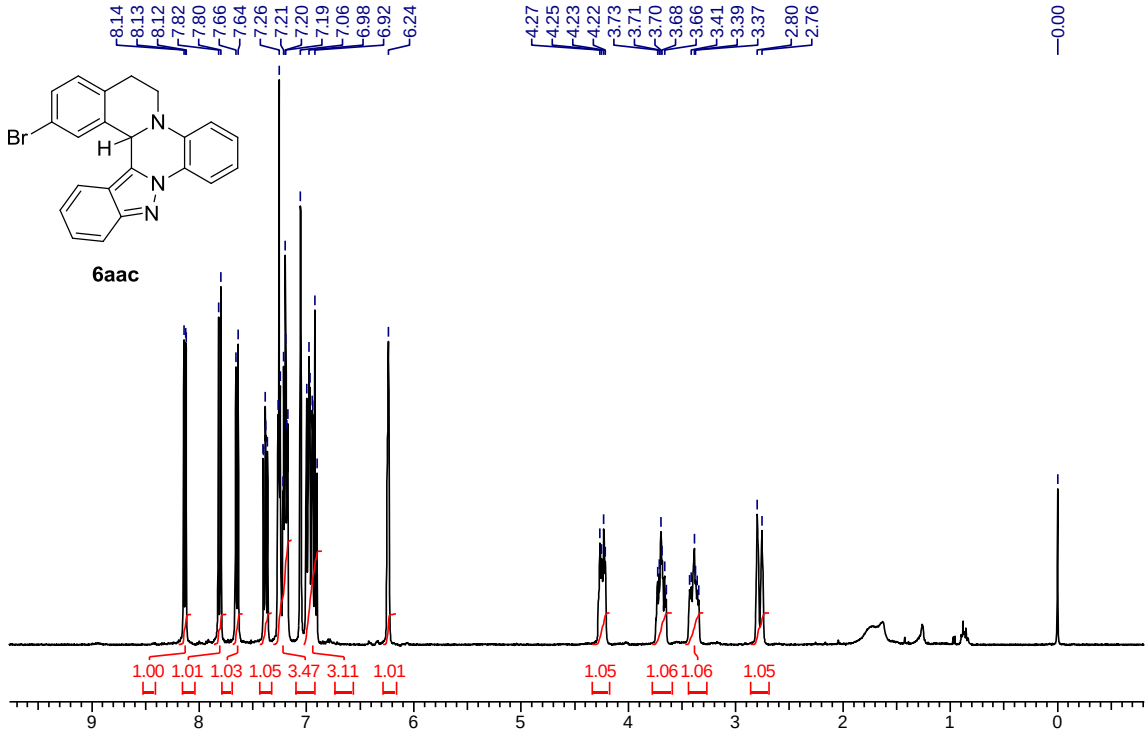


Figure 33. ^{1}H NMR (400 MHz) spectrum of compound **6aac** in $CDCl_3$.

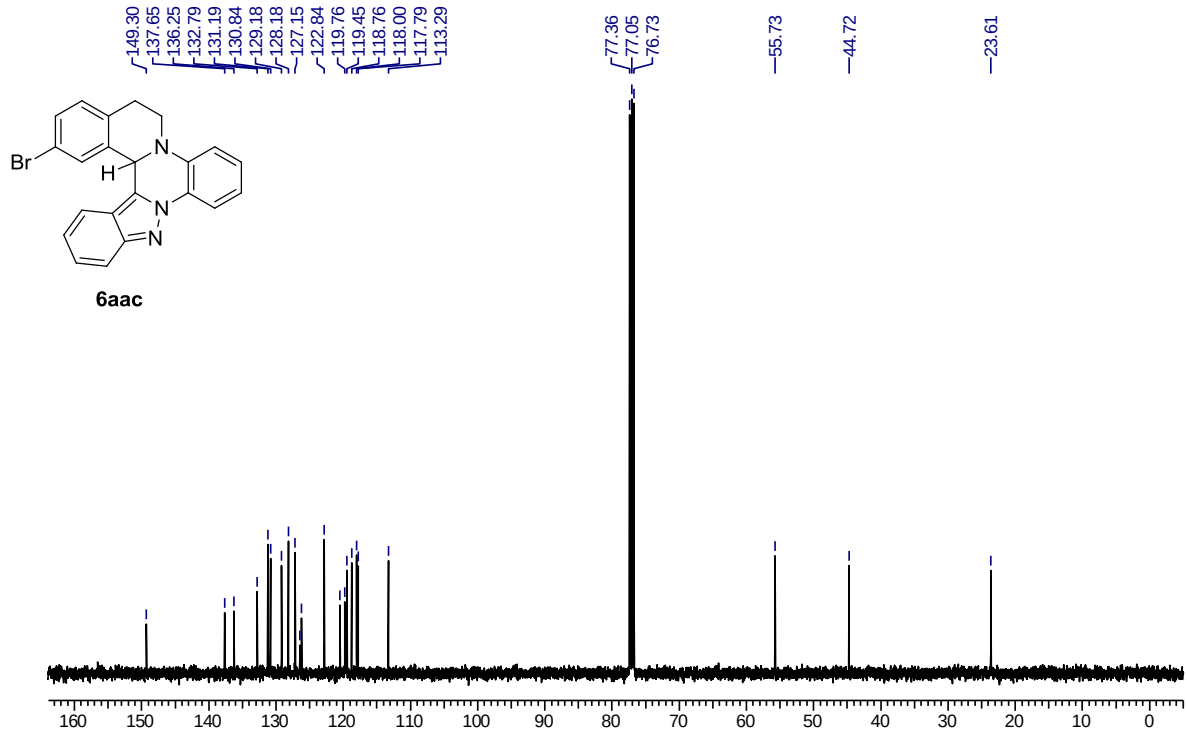


Figure 34. ^{13}C NMR (100 MHz) spectrum of compound **6aac** in $CDCl_3$.

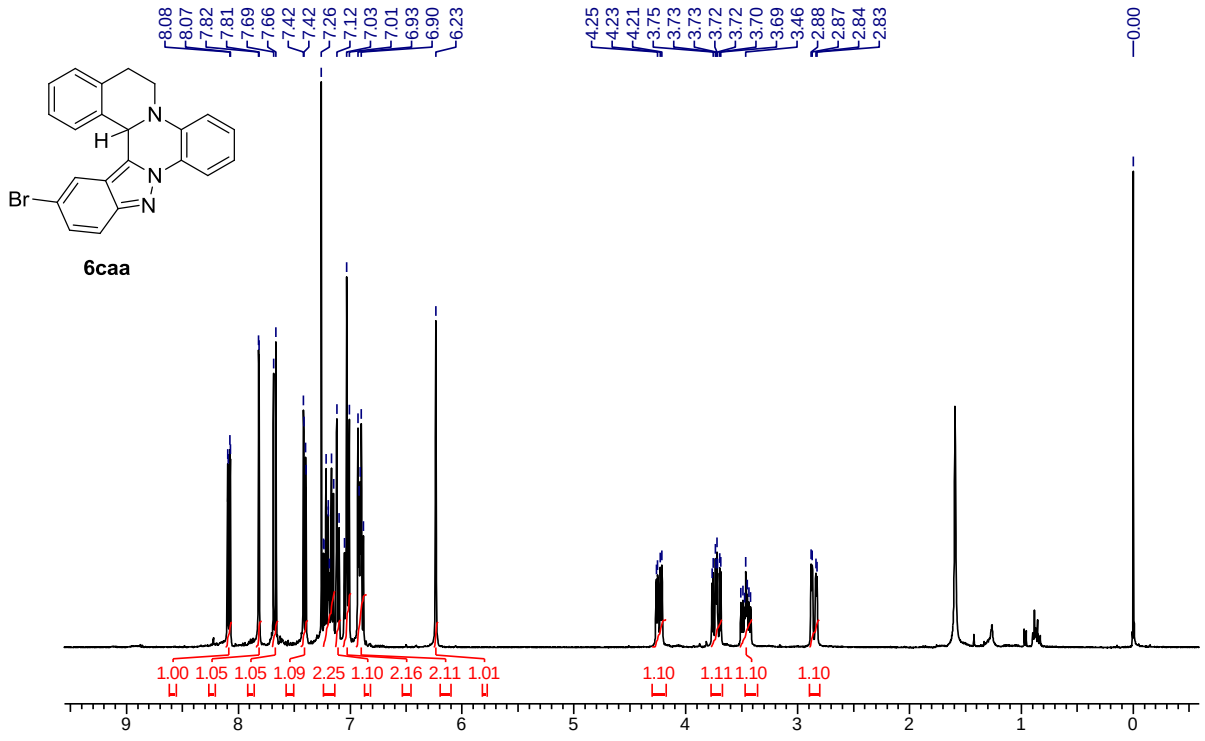


Figure 35. ^{1}H NMR (400 MHz) spectrum of compound **6caa** in $CDCl_3$.

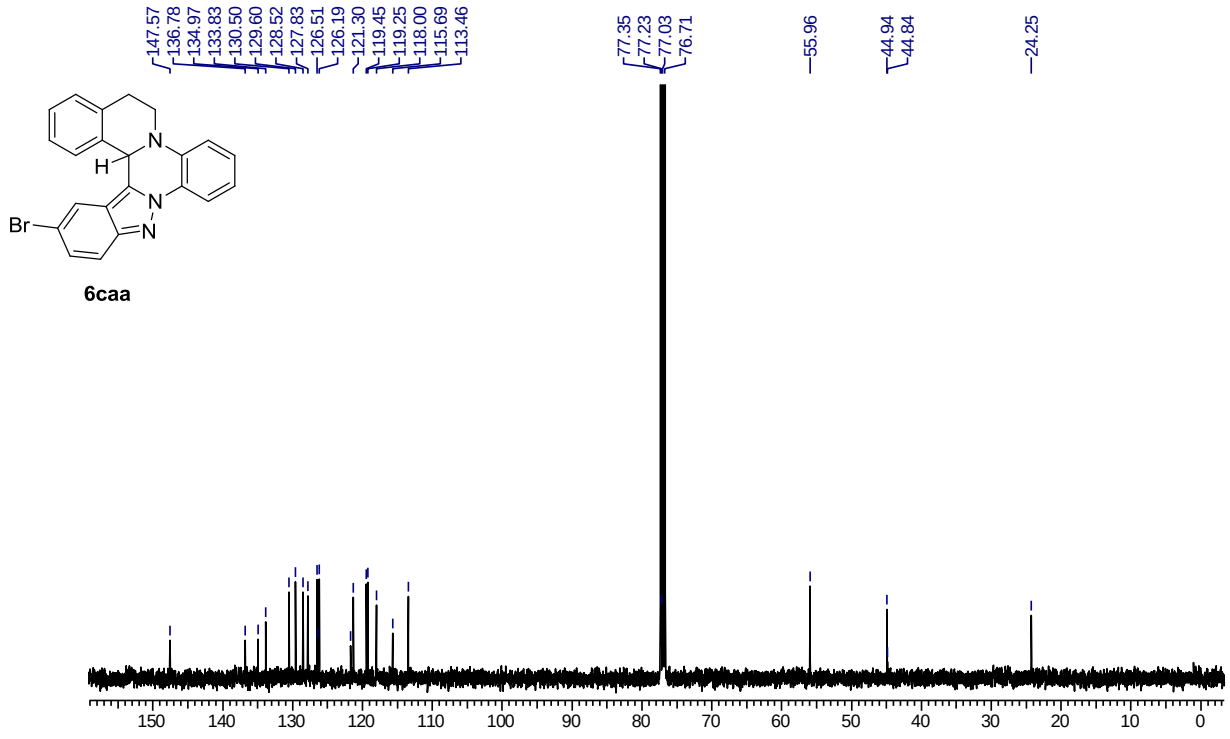


Figure 36. ^{13}C NMR (100 MHz) spectrum of compound **6caa** in $CDCl_3$.

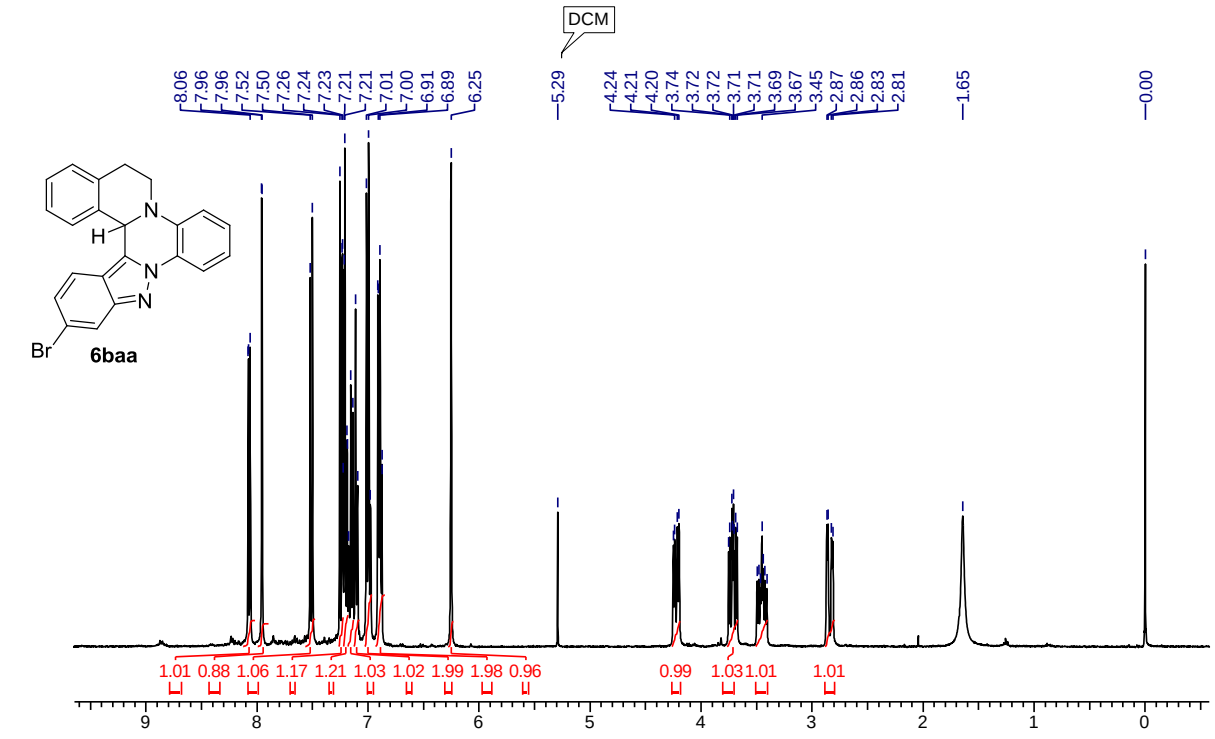


Figure 37. ^{1}H NMR (400 MHz) spectrum of compound **6baa** in $CDCl_3$.

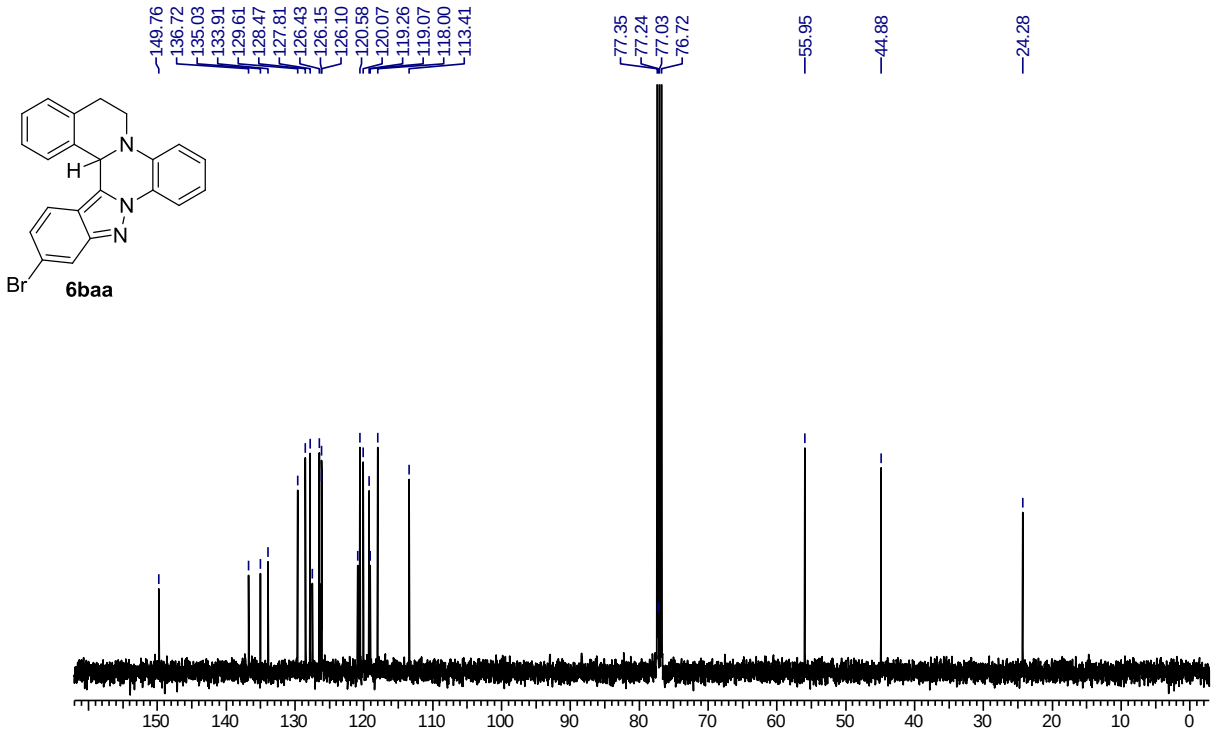


Figure 38. ^{13}C NMR (100 MHz) spectrum of compound **6baa** in $CDCl_3$.

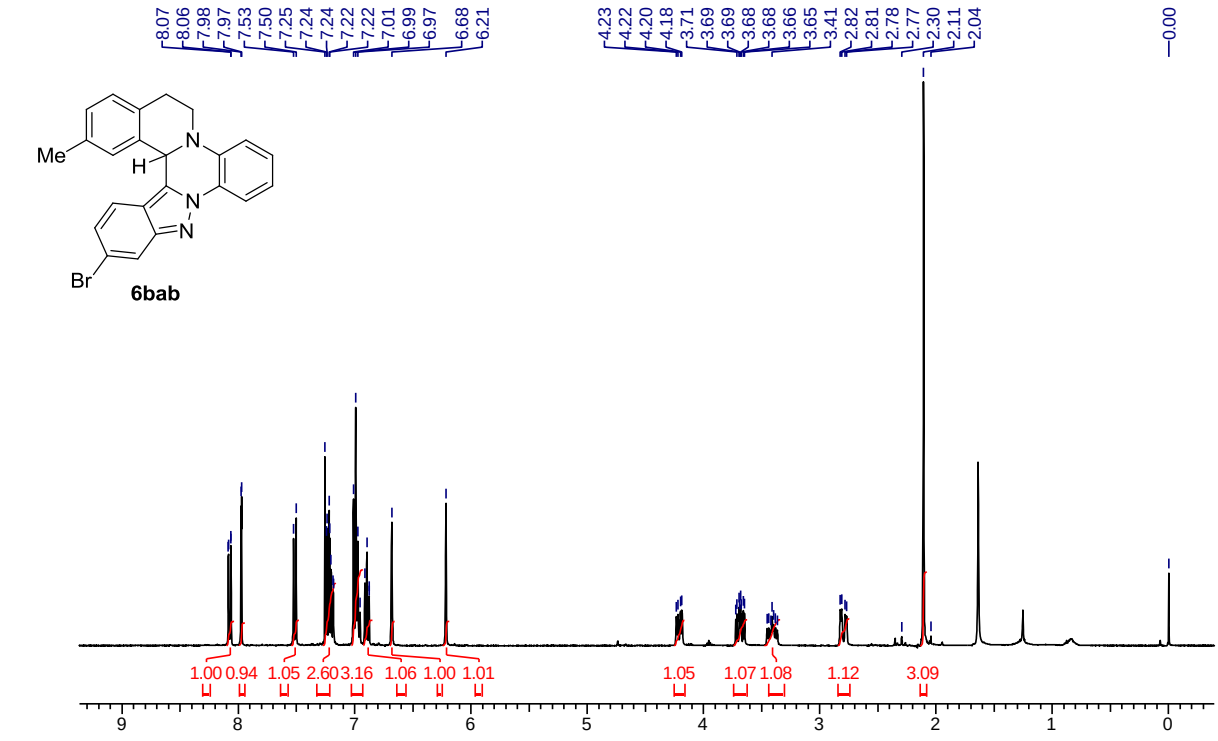


Figure 39. ^{1}H NMR (400 MHz) spectrum of compound **6bab** in $CDCl_3$

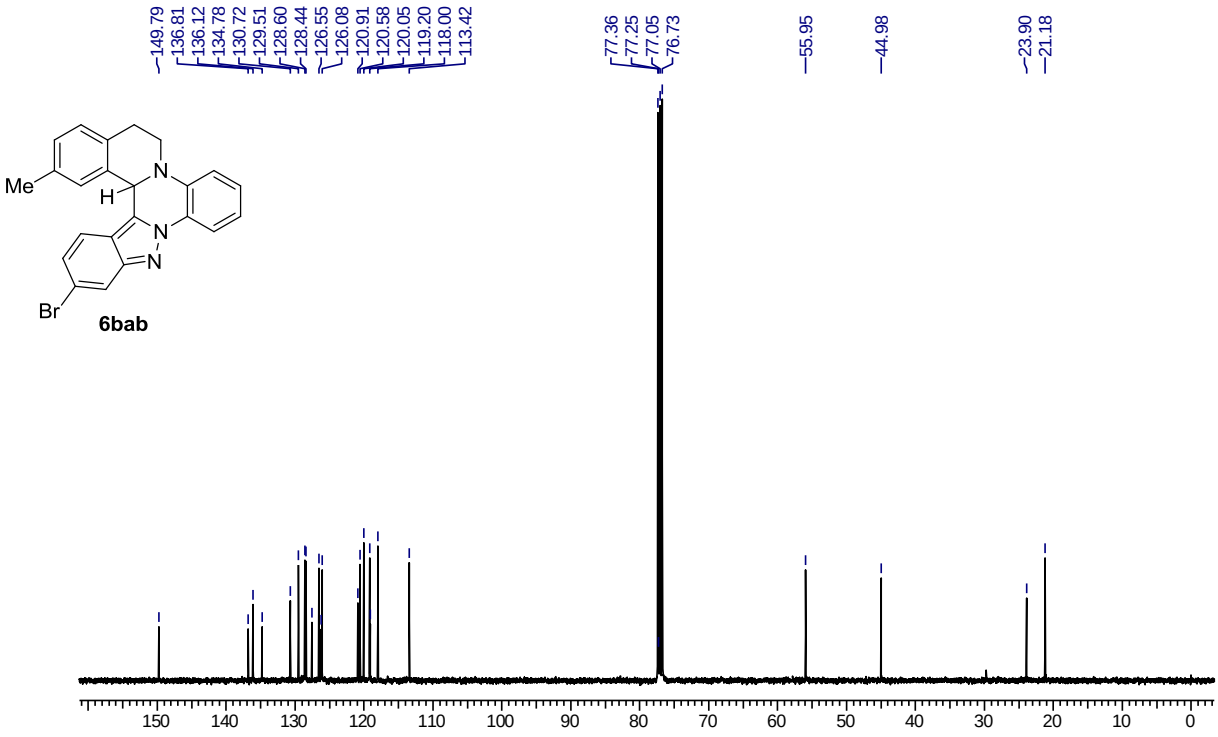


Figure 40. ^{13}C NMR (100 MHz) spectrum of compound **6bab** in $CDCl_3$.

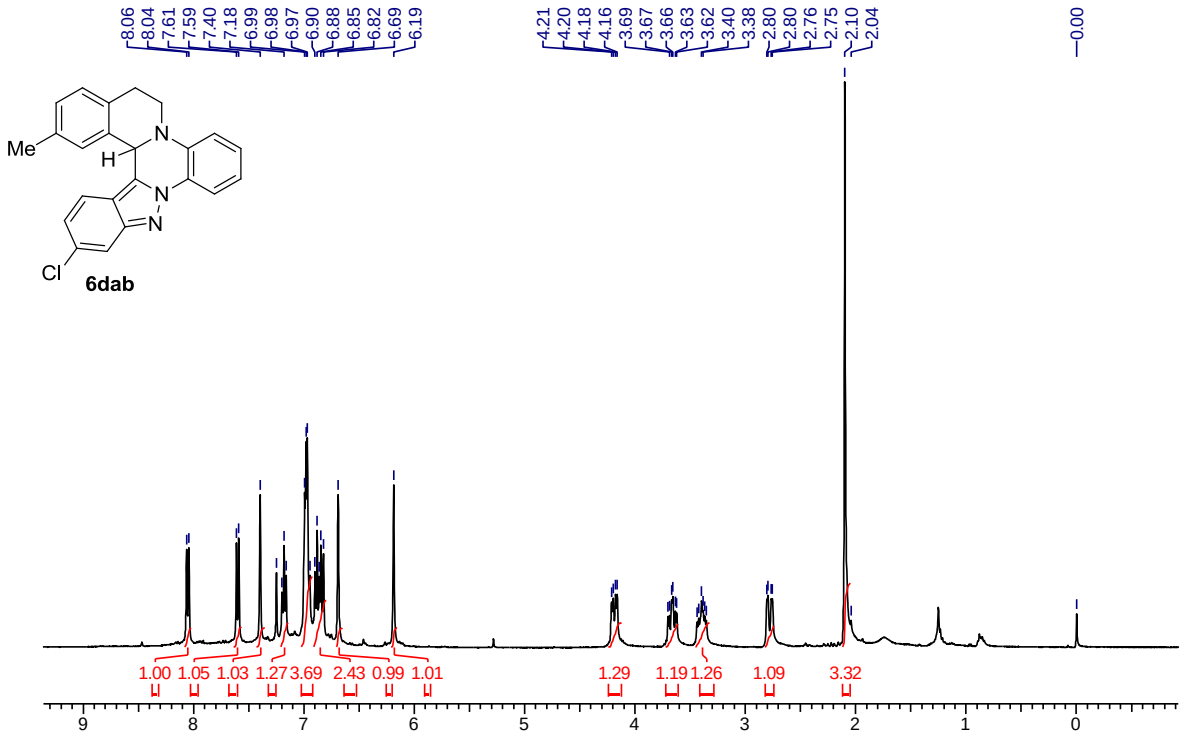


Figure 41. ^{1}H NMR (400 MHz) spectrum of compound **6dab** in $CDCl_3$

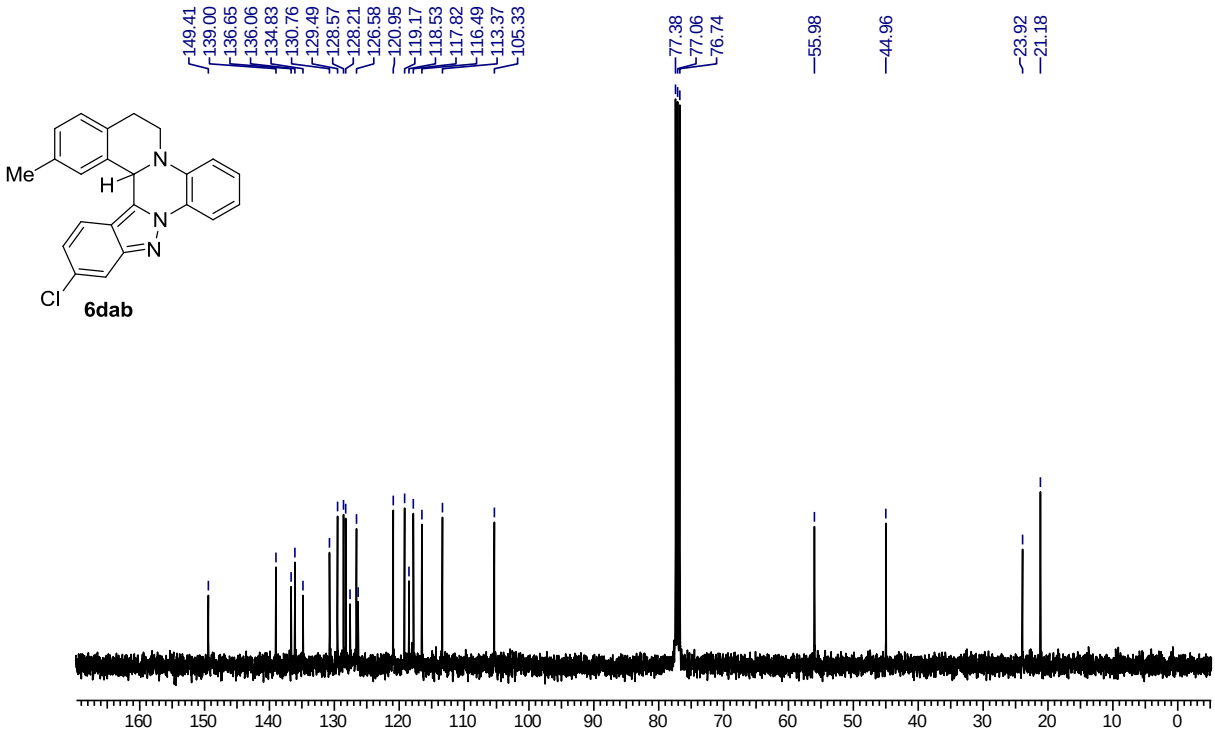


Figure 42. ^{13}C NMR (100 MHz) spectrum of compound **6dab** in $CDCl_3$.

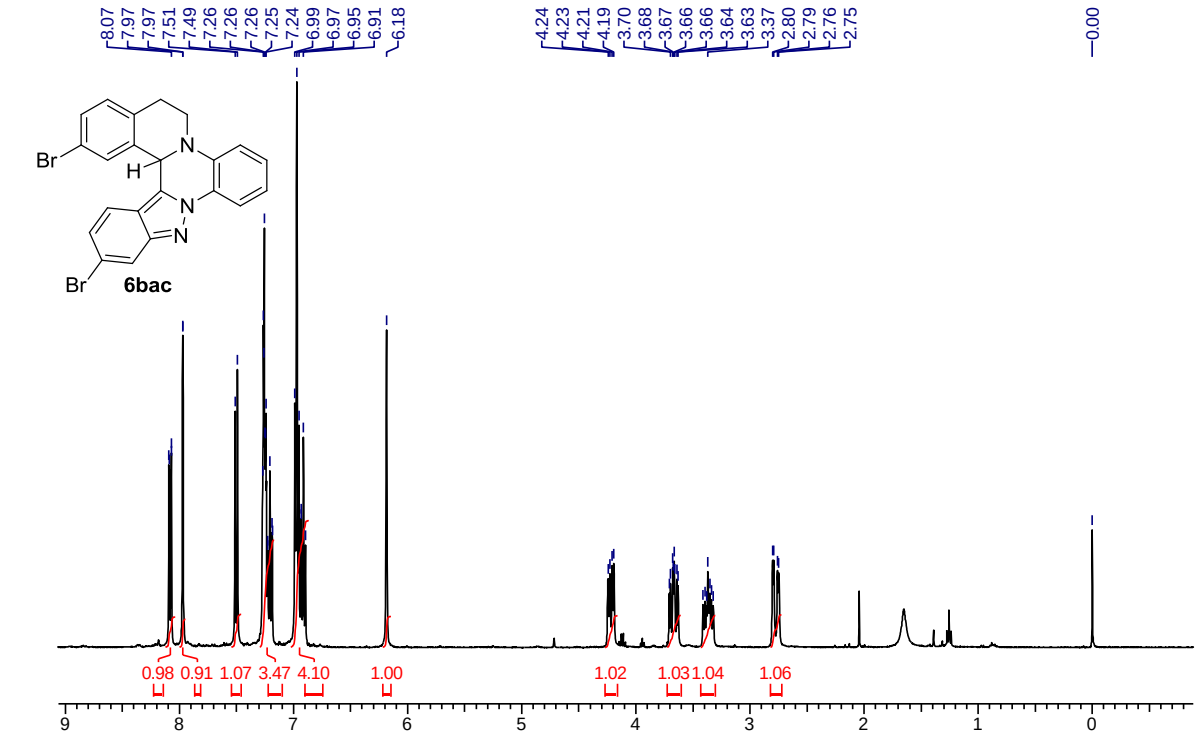


Figure 43. ^{1}H NMR (400 MHz) spectrum of compound **6bac** in $CDCl_3$

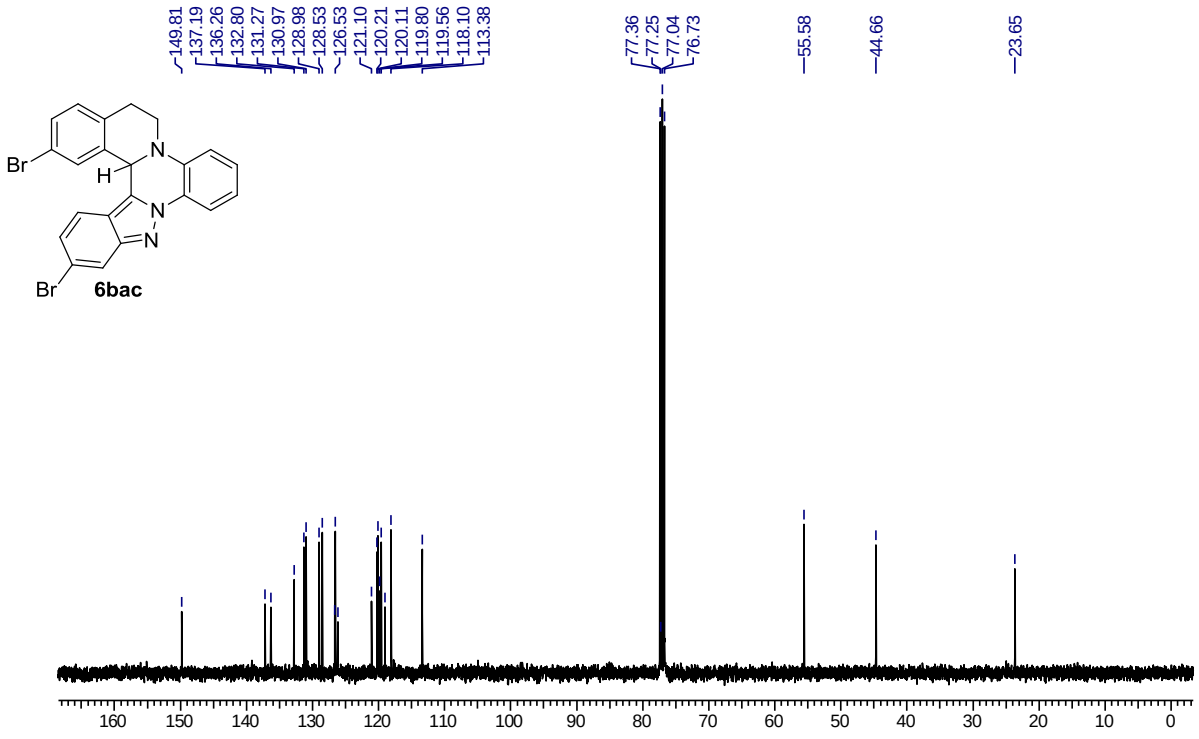


Figure 44. ^{13}C NMR (100 MHz) spectrum of compound **6bac** in $CDCl_3$.

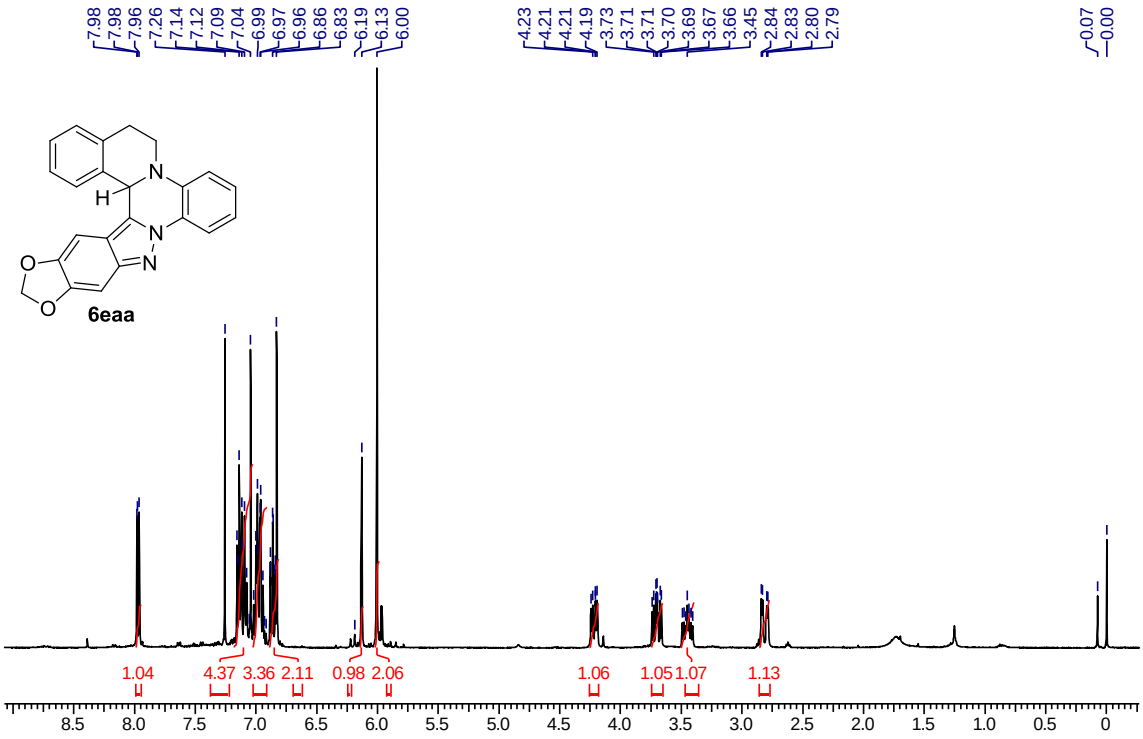


Figure 45. ^{1}H NMR (400 MHz) spectrum of compound **6eaa** in $CDCl_3$.

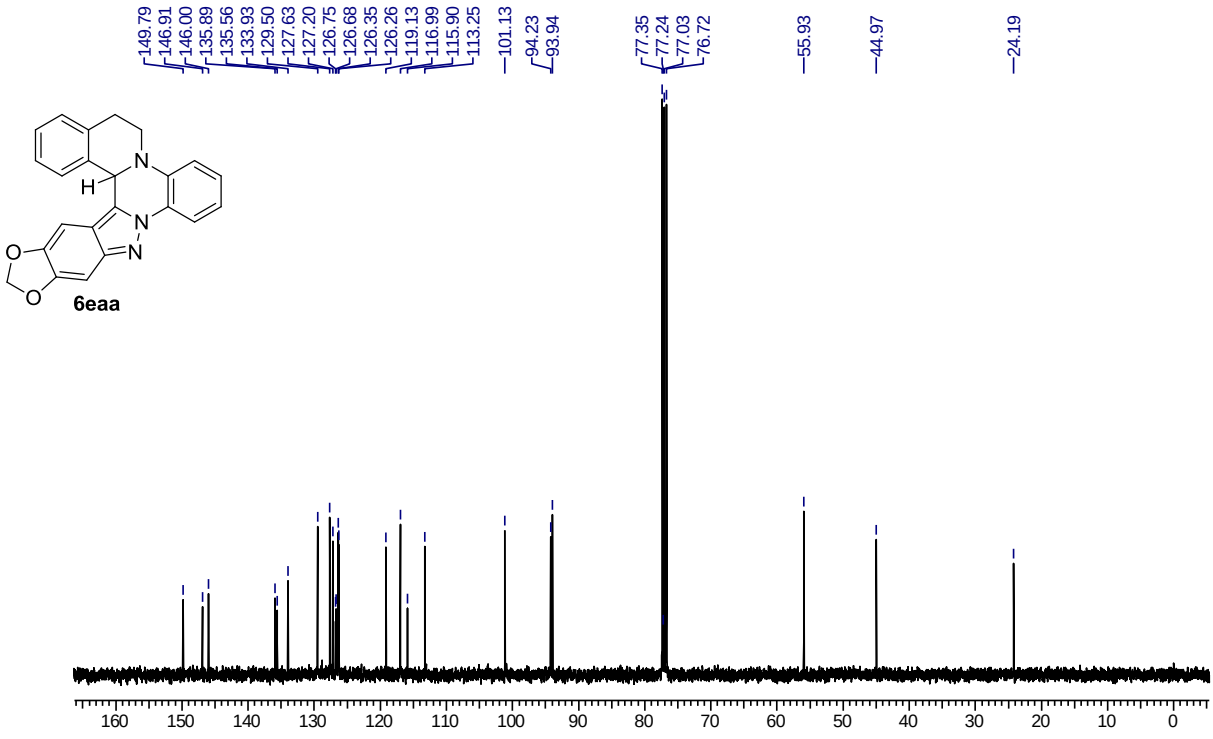


Figure 46. ^{13}C NMR (100 MHz) spectrum of compound **6eaa** in $CDCl_3$.

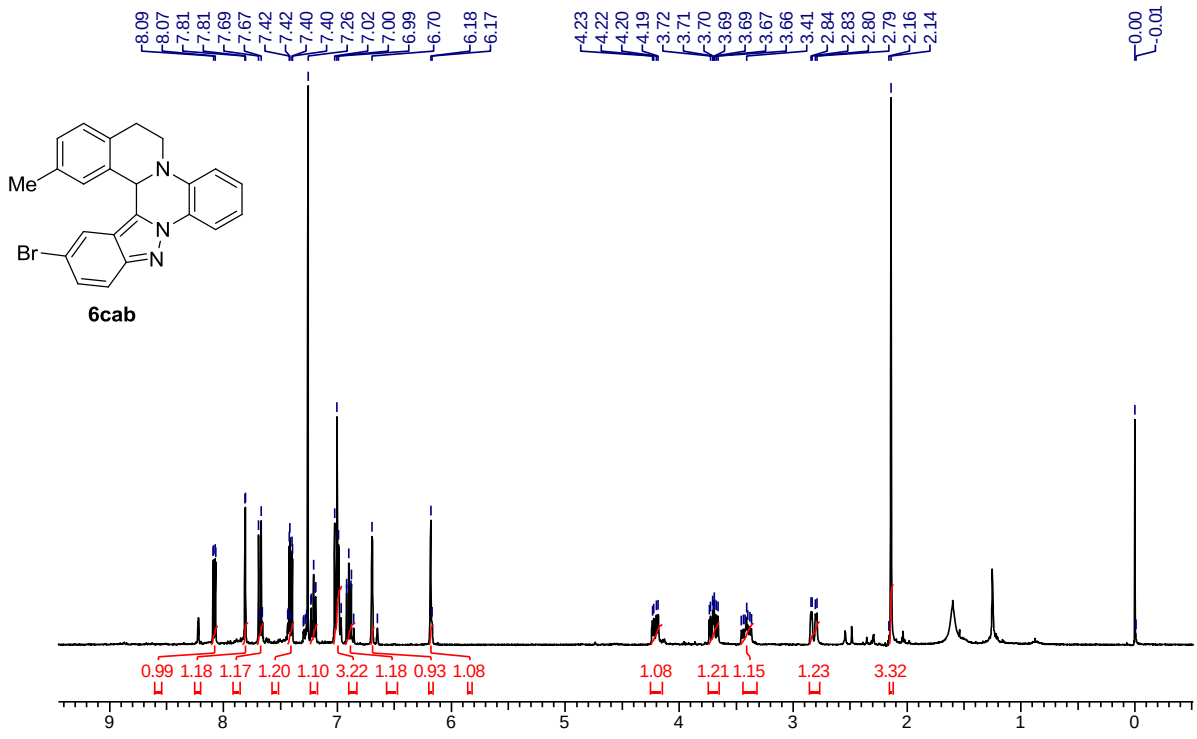


Figure 47. ^{1}H NMR (400 MHz) spectrum of compound **6cab** in $CDCl_3$.

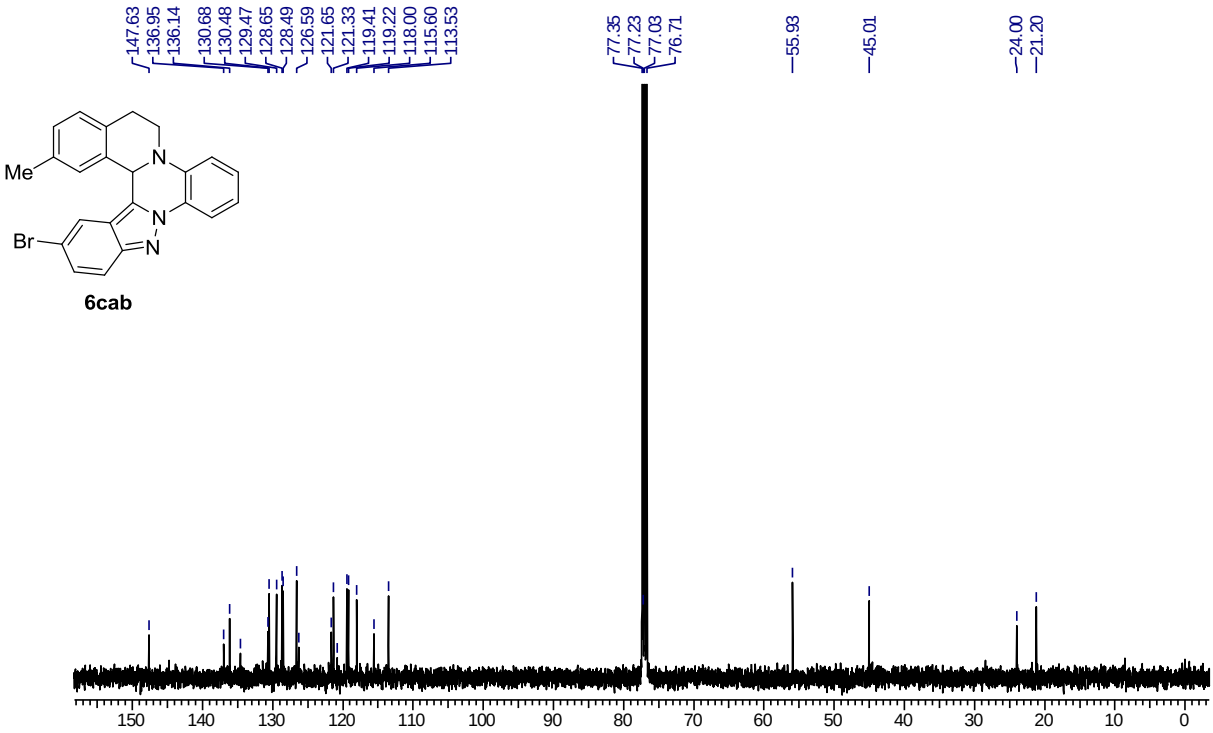


Figure 48. ^{13}C NMR (100 MHz) spectrum of compound **6cab** in $CDCl_3$.

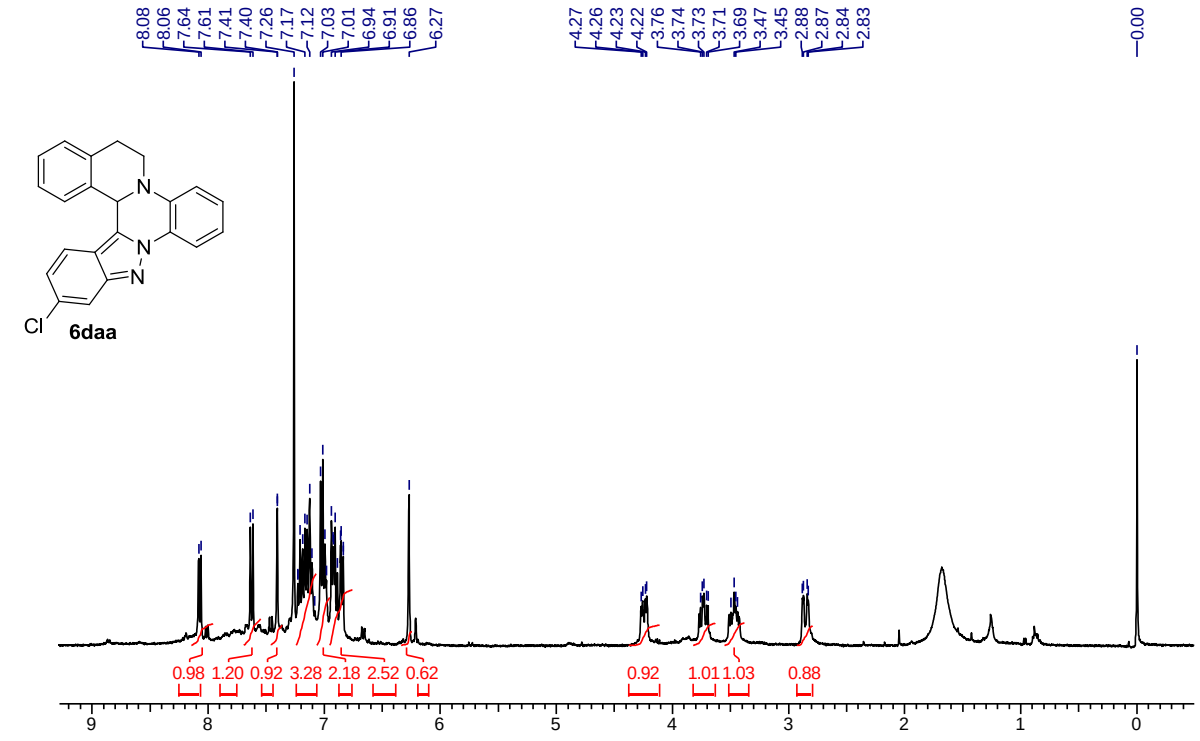


Figure 49. ^{1}H NMR (400 MHz) spectrum of compound **6daa** in $CDCl_3$.

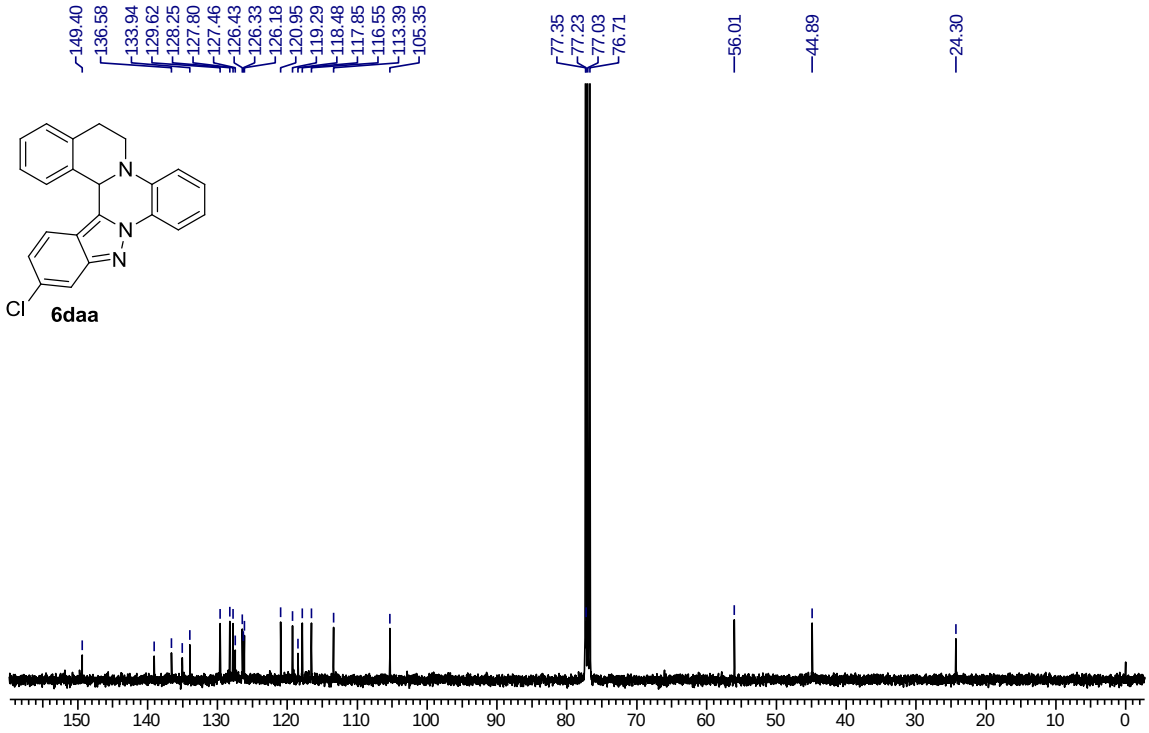


Figure 50. ^{13}C NMR (100 MHz) spectrum of compound **6daa** in $CDCl_3$.

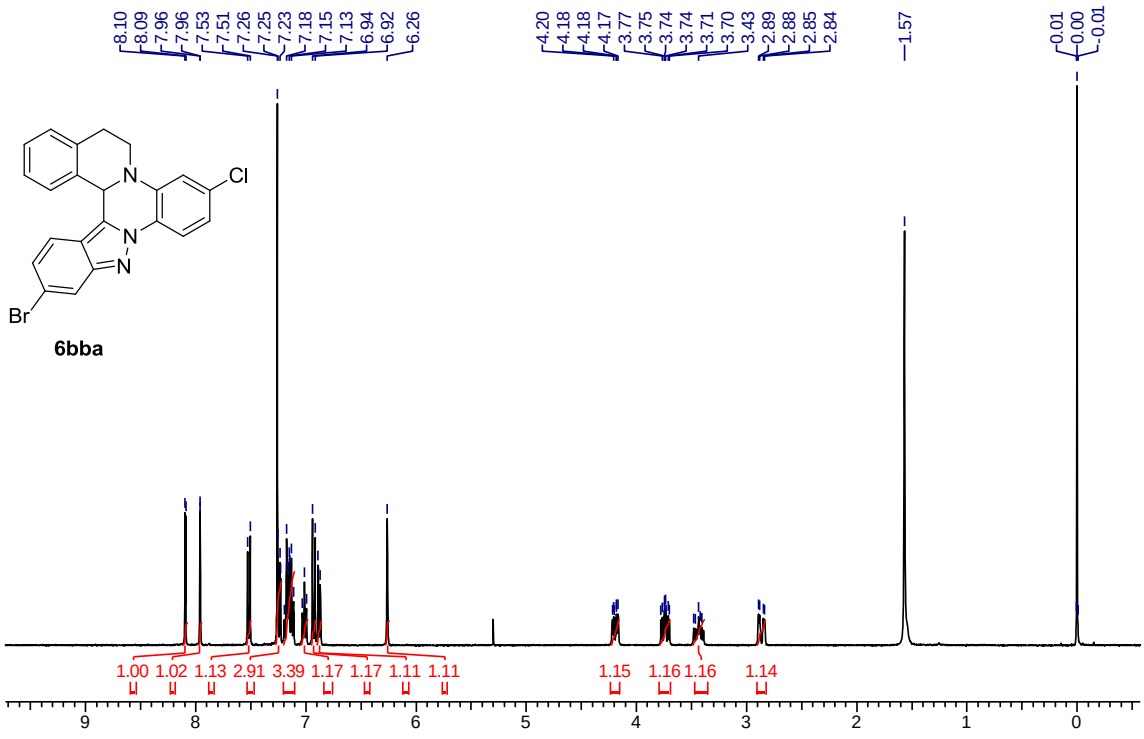


Figure 51. ^{1}H NMR (400 MHz) spectrum of compound **6bba** in $CDCl_3$.

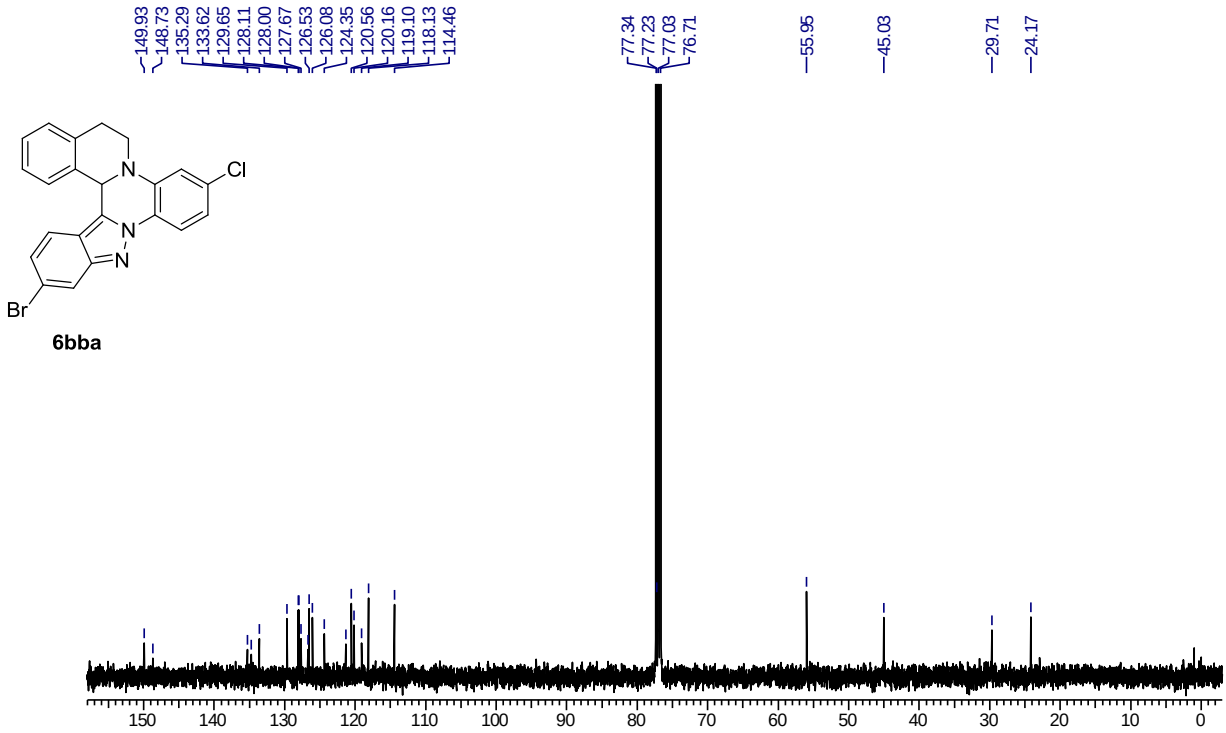


Figure 52. ^{13}C NMR (100 MHz) spectrum of compound **6bba** in $CDCl_3$.

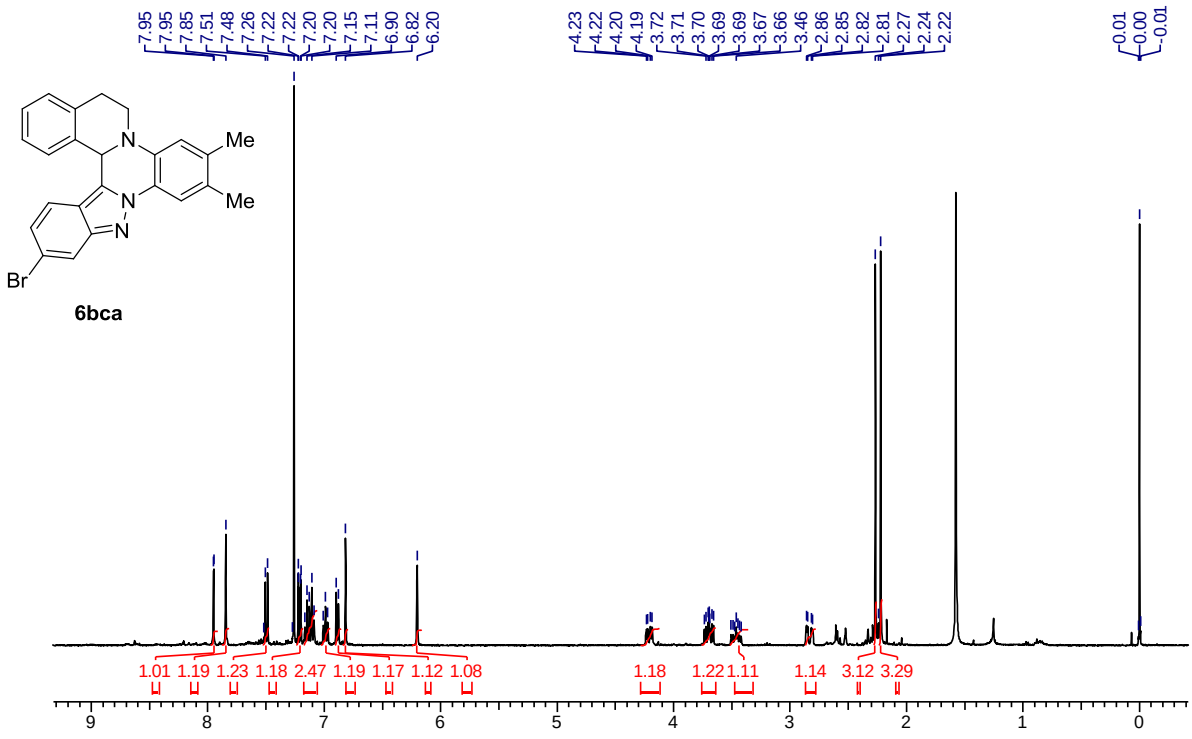


Figure 53. ^{1}H NMR (400 MHz) spectrum of compound **6bca** in $CDCl_3$.

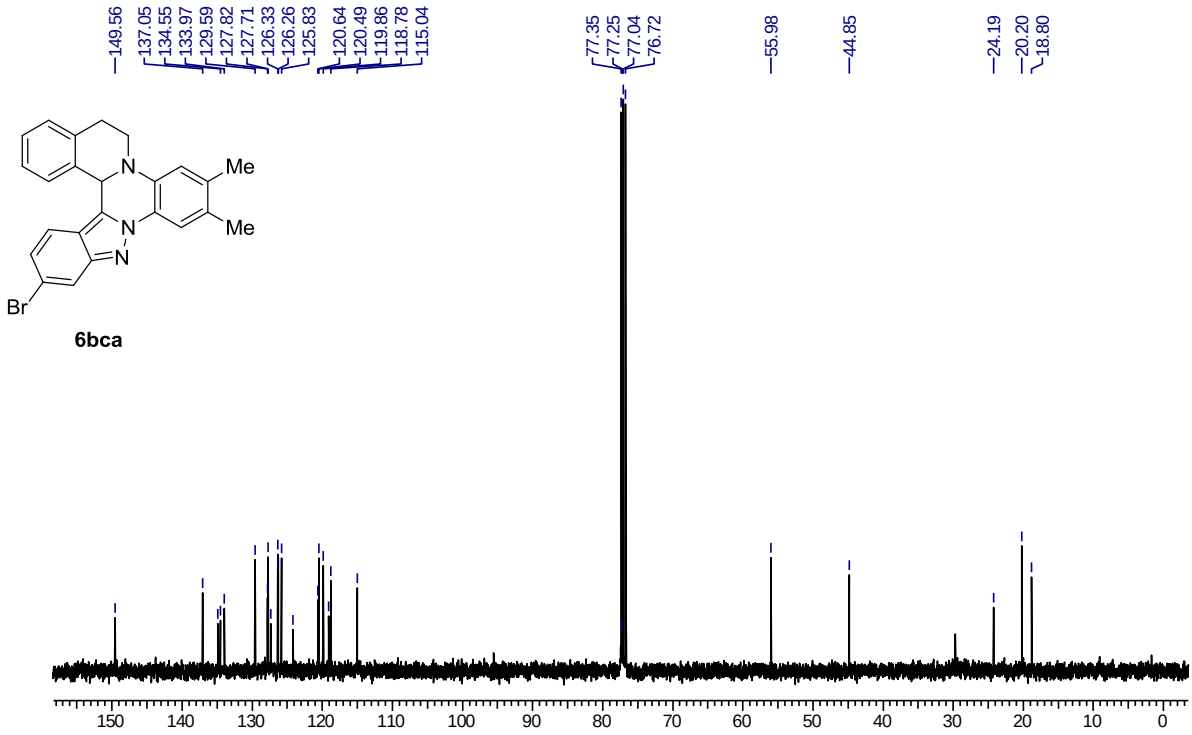


Figure 54. ^{13}C NMR (100 MHz) spectrum of compound **6bca** in $CDCl_3$.

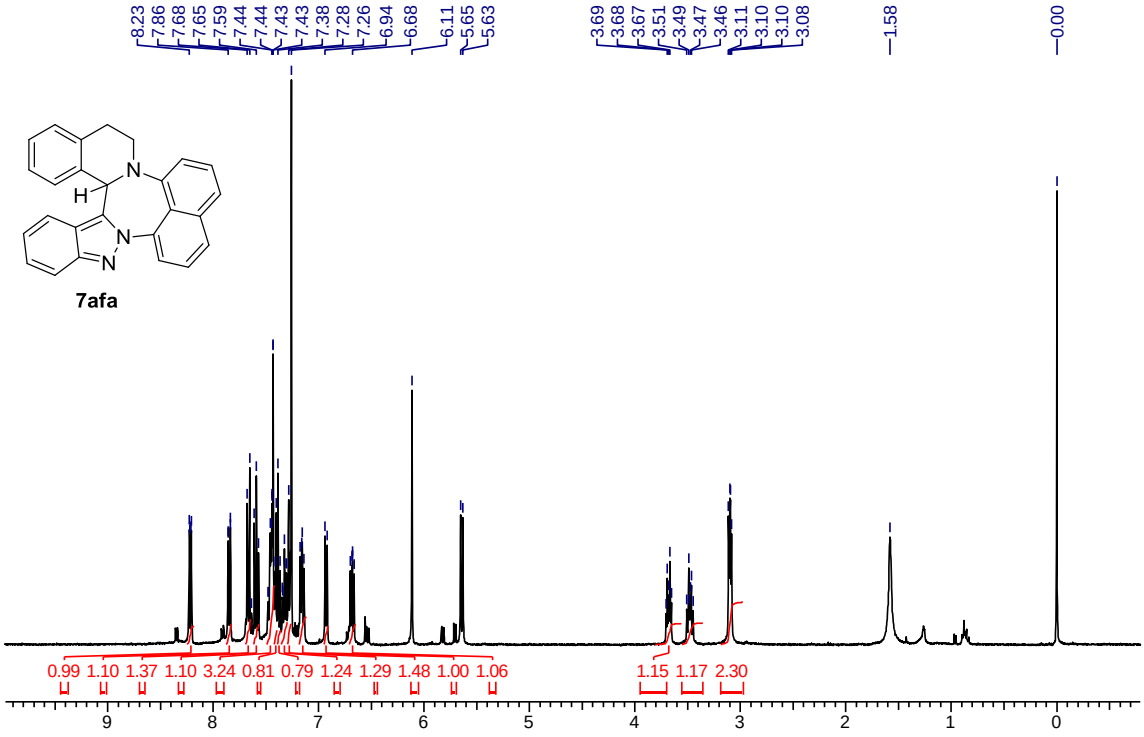


Figure 55. ^{1}H NMR (400 MHz) spectrum of compound **7afa** in $CDCl_3$.

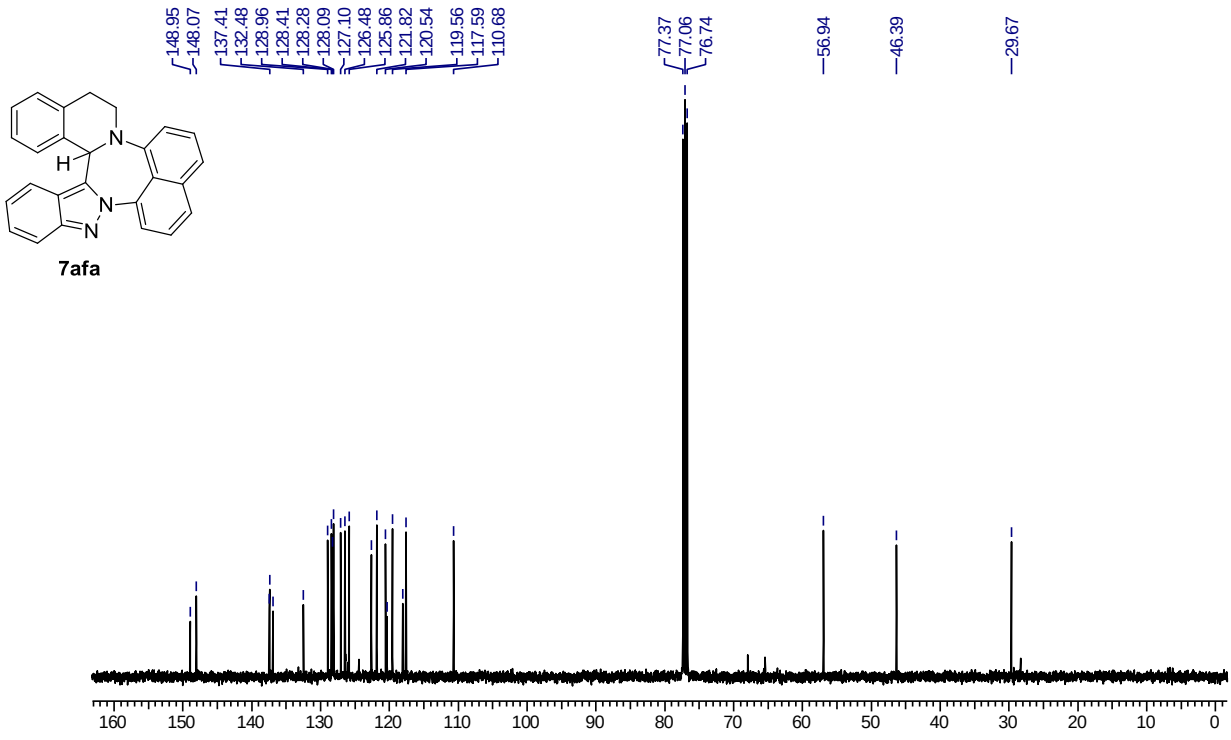


Figure 56. ^{13}C NMR (100 MHz) spectrum of compound **7afa** in $CDCl_3$.