SUPPORTING INFORMATION

Efficient and Simple Zinc–mediated Synthesis of 3–Amidoindoles

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General Information

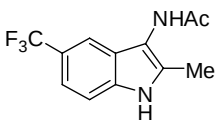
All reactions were carried out under argon atmosphere. Reactions were monitored by TLC analysis (pre-coated silica gel plates with fluorescent indicator UV_{254}, 0.2 mm) and visualized with 254 nm UV light or iodine. Chemicals were purchased from Aldrich, Fluka, Acros, AlfaAsar, Strem and unless otherwise noted were used without further purification. All compounds were characterized by ^{1}H NMR, ^{13}C NMR, GC-MS, HRMS and IR spectroscopy. ^{1}H spectra were recorded on Bruker AV 300 and AV 400 spectrometers. ^{13}C NMR and ^{19}F NMR spectra were recorded at 75.5 MHz and 282 MHz respectively. Chemical shifts are reported **only for major rotamer** (short signals on NMR scans belong to minor rotamer) in ppm relative to the center of solvent resonance. Melting points were determined on a digital SMP3 (Stuart). IR spectra were recorded on FT-IR ALPHA (Bruker) with Platinum-ATR (Bruker). EI (70 eV) mass spectra were recorded on MAT 95XP (Thermo ELECTRON CORPORATION). GC was performed on Agilent 6890 chromatograph with a 30 m HP5 column. HRMS was performed on MAT 95XP (EI) and Agilent 6210 Time-of-Flight LC/MS (ESI). GC-MS was performed on Agilent 5973 chromatograph Mass Selective Detector. All yields reported refer to isolated yields.

General procedure:

a) Conventioanl heating: In an Ace-pressure tube to a solution of alkyne derivative **2a – c** (1 mmol) and arylhydrazine derivative **1a – h** (1.5 mmol) in 1,2-dimethoxyethane or toluene (3 mL), zinc bromide or zinc chloride (3 mmol) was added under argon atmosphere. The pressure tube was fitted with a Teflon cap and heated at 110 °C for 20 h (TLC control). After removal of the solvent, the crude product **5 – 12** was purified by column chromatography and recrystallized using heptane with ethyl acetate, acetone or dichloromethane.

b) Microwave irradiation: A mixture of hydrazine **1** (1.5 mmol), propargylamide **2d – l** (1.0 mmol) and zinc bromide (1 – 3 mmol) in 1,2-dimethoxyethane (2 mL) was heated in reaction vial in CEM Discover microwave reactor cavity for 1 h at 100 – 130 °C. After removal of the solvent, the corresponding crude product **13 – 28** was purified by column chromatography using heptane/ethyl acetate.

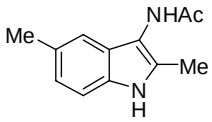
N-(2-Methyl-5-(trifluoromethyl)-1*H*-indol-3-yl)acetamide (5)



Yield: 182 mg (**71%**); white crystals; **Mp** 224 °C (from acetone/heptane); $\mathbf{R_f}$ = 0.55 (solvent ethyl acetate/ethanol 20:1); **^{1}H NMR** (300 MHz, Acetone-d_6): δ = 2.15 (s, 3H), 2.29 (s, 3H), 7.28 (dd, 1H, *J* ~ 1.6, 8.5 Hz), 7.38 (d, 1H, *J* ~ 8.5 Hz), 7.72 (s, 1H), 8.66 (s, 1H), 10.42 (s, 1H); **^{13}C NMR** (Acetone-d_6): δ = 11.2, 22.7, 111.6, 112.3, 115.7 (q, *J* = 4.5 Hz), 117.5 (q, *J* ~ 3.5 Hz), 121.0 (q, *J* = 31.3 Hz), 125.3, 126.4 (q, *J* = 271.1 Hz), 132.8, 136.1, 169.2; **GC-MS** (EI, 70 eV): *m/z* (%) 256 (52) [M^+]; **HRMS** (EI): Calc for $C_{12}H_{11}O_1N_2F_3$: 256.08180; found:

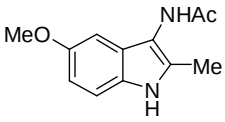
256.08201; **FTIR** (ATR, cm^{-1}): 3248, 3064, 2993, 2967, 2928, 2838, 2712, 1631, 1548, 1329, 1279, 1243, 1155, 1111, 1048, 1013, 893, 812, 697, 682, 657, 624, 599, 564, 535, 527.

N-(2,5-Dimethyl-1*H*-indol-3-yl)acetamide (6)



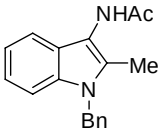
Yield: 121 mg (**60%**); yellow crystals; **Mp** 208 °C (from acetone/heptane); **R_f** = 0.47 (solvent ethyl acetate/ethanol 20:1); **^{1}H NMR** (300 MHz, DMSO-d_6): δ = 2.03 (s, 3H), 2.19 (s, 3H), 2.33 (s, 3H), 6.81 (dd, 1H, *J* = 1.5, 8.1 Hz), 7.04 (s, 1H), 7.11 (d, 1H, *J* = 8.2 Hz), 9.11 (s, 1H), 10.67 (s, 1H); **^{13}C NMR** (DMSO-d_6): δ = 11.3, 21.3, 22.7, 109.9, 110.3, 117.0, 121.7, 125.2, 126.6, 129.6, 132.0, 168.5; **GC-MS** (EI, 70 eV): *m/z* (%) 202 (55) [M^+]; **HRMS** (EI): Calc for $C_{12}H_{14}O_1N_2$: 202.11006; found: 202.10946; **FTIR** (ATR, cm^{-1}): 3230, 3208, 3066, 3026, 2976, 2917, 2860, 2781, 1623, 1549, 1461, 1424, 1369, 1315, 1294, 1247, 1133, 1023, 800, 794, 772, 753, 696, 677.

N-(5-Methoxy-2-methyl-1*H*-indol-3-yl)acetamide (8)



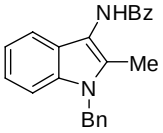
Yield: 105 mg (**48%**); white crystals; **Mp** 159 °C (from acetone/heptane); **R_f** = 0.5 (solvent ethyl acetate/ethanol 10:1); **^{1}H NMR** (300 MHz, Acetone-d_6): δ = 2.11 (s, 3H), 2.21 (s, 3H), 3.73 (s, 3H), 6.64 (dd, 1H, *J* = 2.4, 8.7 Hz), 6.86 (d, 1H, *J* = 2.5 Hz), 7.09 (d, 1H, *J* = 8.7 Hz), 8.52 (s, 1H), 9.84 (s, 1H); **^{13}C NMR** (Acetone-d_6): δ = 11.3, 22.7, 55.4, 99.8, 110.8, 111.2, 111.7, 126.4, 129.7, 131.2, 154.3, 169.1; **GC-MS** (EI, 70 eV): *m/z* (%) 218 (77) [M^+]; **HRMS** (EI): Calc for $C_{12}H_{14}O_2N_2$: 218.10498; found: 218.10530; **FTIR** (ATR, cm^{-1}): 3239, 3073, 2999, 2976, 2954, 2910, 2831, 1623, 1546, 1487, 1471, 1453, 1423, 1369, 1293, 1244, 1218, 1138, 1110, 1035, 839, 811, 767, 746, 691, 672.

N-(1-Benzyl-2-methyl-1*H*-indol-3-yl)acetamide (9)



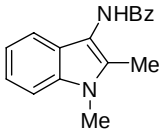
Yield: 128 mg (**46%**); white crystals; **Mp** 178 °C (from acetone/heptane); **R_f** = 0.34 (solvent ethyl acetate/heptane 2:1); **^{1}H NMR** (300 MHz, DMSO-d_6): δ = 2.06 (s, 3H), 2.19 (s, 3H), 5.39 (s, 2H), 7.01 (m, 4H), 7.27 (m, 4H), 7.38 (d, 1H, *J* = 7.7 Hz), 9.26 (s, 1H); **^{13}C NMR** (DMSO-d_6): δ = 10.0, 22.7, 45.8, 109.5, 110.9, 117.7, 118.8, 120.7, 124.3, 126.2 (2C), 127.1, 128.6 (2C), 131.0, 134.5, 138.4, 168.6; **MS** (EI): *m/z* (%) 278 (100) [M^+]; **HRMS pos.** (ESI): Calc for $[M+H]^+$, $C_{18}H_{19}N_2O$: 279.14919; found: 279.1495; **HRMS pos.** (ESI): Calc for $[M+Na]^+$, $C_{18}H_{18}N_2NaO$: 301.13113; found: 301.1316; **FTIR** (ATR, cm^{-1}): 3276, 3189, 3054, 3032, 2933, 2911, 1643, 1597, 1513, 1499, 1468, 1373, 1350, 1338, 1033, 732, 723, 698, 663.

N-(1-Benzyl-2-methyl-1*H*-indol-3-yl)benzamide (10)



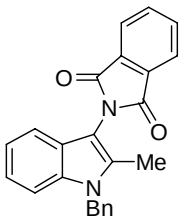
Yield: 300 mg (**88%**); white crystals; **Mp** from 169 °C (from acetone/heptane); **R_f** = 0.47 (solvent ethyl acetate/heptane 1:1); **^{1}H NMR** (300 MHz, $CDCl_3$): δ = 2.27 (s, 3H), 5.26 (s, 2H), 7.03 (m, 2H), 7.14 (m, 2H), 7.26 (m, 4H), 7.47 (m, 3H), 7.55 (m, 1H), 7.76 (s, 1H), 7.96 (m, 2H); **^{13}C NMR** ($CDCl_3$): δ = 10.2, 46.6, 109.3, 109.8, 117.3, 119.8, 121.4, 124.5, 126.0 (2C), 127.27 (2C), 127.29, 128.6 (2C), 128.7 (2C), 131.6, 132.2, 134.5, 135.1, 137.5, 166.8; **GC-MS** (EI): *m/z* (%) 340 (88) [M^+]; **HRMS** (EI): Calc for $C_{23}H_{20}O_1N_2$: 340.15701; found: 340.15746; **FTIR** (ATR, cm^{-1}): 3273, 3059, 3030, 2914, 1643, 1515, 1468, 1452, 1372, 1353, 1339, 1283, 1199, 1028, 736, 708, 692.

N-(1,2-Dimethyl-1*H*-indol-3-yl)benzamide (11)



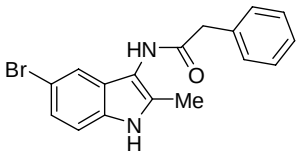
Yield: 161 mg (**61%**); white crystals; **Mp** 199 °C (from acetone/heptane); $\mathbf{R_f}$ = 0.49 (solvent ethyl acetate/heptane 2:1); **^{1}H NMR** (400 MHz, $CDCl_3$): δ = 2.34 (s, 3H), 3.65 (s, 3H), 7.09 (m, 1H), 7.18 (ddd, 1H, *J* ~ 1.1, 7.0, 8.2 Hz), 7.28 (d, 1H, *J* = 8.2 Hz), 7.28 (d, 1H, *J* = 7.8 Hz), 7.48 (m, 2H), 7.56 (m, 2H), 7.95 (m, 2H); **^{13}C NMR** ($CDCl_3$): δ = 10.2, 29.6, 108.88, 108.95, 117.0, 119.5, 121.1, 124.3, 127.3 (2C), 128.6 (2C), 131.6, 132.5, 134.6, 135.2, 166.9; **GC-MS** (EI): *m/z* (%) 264 (50) [M^+]; **HRMS** (EI): Calc for $C_{17}H_{16}O_1N_2$: 264.12571; found: 264.12547; **FTIR** (ATR, cm^{-1}): 3190, 3064, 3039, 2982, 2939, 2908, 2851, 1627, 1579, 1510, 1477, 1447, 1372, 1336, 1304, 1289, 1252, 1195, 919, 813, 743, 717, 696, 670.

2-(1-Benzyl-2-methyl-1*H*-indol-3-yl)isoindoline-1,3-dione (12)



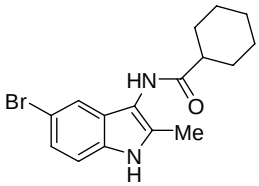
Yield: 201 mg **(55%)**; yellow crystals; **Mp** 229 °C (from acetone/heptane); $\mathbf{R_f}$ = 0.38 (solvent ethyl acetate/heptane 1:2); **^{1}H NMR** (300 MHz, $CDCl_3$): δ = 2.29 (s, 3H), 5.38 (s, 2H), 7.14 (m, 4H), 7.31 (m, 5H), 7.81 (ddd, 2H, *J* ~ 1.2, 5.1, 10.6 Hz), 7.99 (m, 2H); **^{13}C NMR** ($CDCl_3$): δ = 10.5, 46.9, 104.6, 109.7, 117.4, 120.4, 121.8, 123.6 (2C), 124.3, 126.0 (2C), 127.4, 128.9 (2C), 132.2 (2C), 134.2 (3C), 135.5, 137.0, 167.7 (2C); **GC-MS** (EI, 70 eV): *m/z* (%) 366 (100) [M^+]; **HRMS** (EI): Calc for $C_{24}H_{18}O_2N_2$: 366.13628; found: 366.13613; **FTIR** (ATR, cm^{-1}): 3088, 3061, 3034, 3004, 2921, 1720, 1708, 1465, 1454, 1442, 1388, 1356, 1344, 1308, 1109, 1083, 878, 749, 717, 691, 660.

N-(5-bromo-2-methyl-1*H*-indol-3-yl)-2-phenylacetamide (13)



Yield: 206 mg **(60%)**; white crystals; **Mp** 217 °C (from acetone/heptane); $\mathbf{R_f}$ = 0.46 (solvent ethyl acetate/heptane 2:1); **^{1}H NMR** (300 MHz, DMSO-d_6): δ = 2.20 (s, 3H), 3.65 (s, 2H), 7.09 (dd, 1H, *J* = 2.0, 8.5 Hz), 7.20 (d, 1H, *J* = 8.5 Hz), 7.25 (m, 1H), 7.36 (m, 5H), 9.48 (s, 1H), 11.11 (s, 1H); **^{13}C NMR** (DMSO-d_6): δ = 11.2, 42.4, 109.8, 111.0, 112.7, 119.6, 122.6, 126.5, 128.3 (2C), 129.0 (2C), 131.4, 132.2, 136.7, 169.6; **GC-MS** (EI, 70 eV): *m/z* (%) 342 (70) [M^+], 344 (69) [M^+]; **HRMS pos.** (ESI): Calc for $[M+H]^+$, $C_{17}H_{16}BrN_2O$: 343.0441 and 345.0422; found: 343.0441 and 345.0423; **HRMS pos.** (ESI): Calc for $[M+Na]^+$, $C_{17}H_{15}BrN_2NaO$: 365.026 and 367.0241; found: 365.0262 and 367.0248; **FTIR** (ATR, cm^{-1}): 3424, 3251, 3057, 3027, 2912, 1652, 1535, 1468, 1425, 1409, 1343, 1277, 1242, 1199, 979, 862, 800, 756, 734, 703, 649, 584, 576, 555, 524, 473, 420, 381.

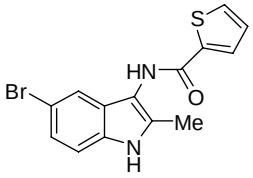
N-(5-Bromo-2-methyl-1*H*-indol-3-yl)cyclohexanecarboxamide (14)



Yield: 216 mg **(64%)**; white crystals; **Mp** 241 °C (from acetone/heptane); $\mathbf{R_f}$ = 0.54 (solvent ethyl acetate/heptane 2:1); **^{1}H NMR** (400 MHz, DMSO-d_6): δ = 1.26 (m, 3H), 1.45 (m, 2H), 1.65 (m, 1H), 1.81 (m, 4H), 2.20 (s, 3H), 2.37 (tt, 1H, *J* = 3.5, 11.5 Hz), 7.08 (dd, 1H, *J* = 2.0, 8.5 Hz), 7.19 (d, 1H, *J* = 8.5 Hz), 7.32 (d, 1H, *J* = 1.8 Hz), 9.04 (s, 1H), 11.05 (s, 1H); **^{13}C NMR** (DMSO-d_6): δ = 11.2, 25.4 (2C), 25.5, 29.6 (2C), 44.0, 109.9, 111.0, 112.6, 119.6, 122.5, 126.6, 131.3, 132.2, 174.8; **GC-MS** (EI, 70 eV): *m/z* (%) 334 (33.4) [M^+], 336 (34) [M^+]; **HRMS pos.** (ESI): Calc for $[M+H]^+$, $C_{16}H_{20}BrN_2O$: 335.0754 and 337.0735; found: 335.0754 and 337.0735; **HRMS pos.** (ESI): Calc for $[M+Na]^+$, $C_{16}H_{19}BrN_2NaO$: 357.0573 and 359.0554; found: 357.0573 and 359.0554; **FTIR**

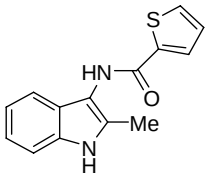
(ATR, cm^{-1}): 3377, 3174, 2928, 2851, 1665, 1489, 1474, 1450, 1430, 1315, 1295, 1262, 1248, 1196, 1044, 861, 795, 757, 644, 625, 560, 515, 431, 387.

N-(5-Bromo-2-methyl-1*H*-indol-3-yl)thiophene-2-carboxamide (15)



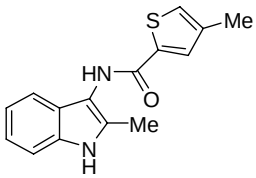
Yield: 198 mg **(59%)**; light yellow crystals; **Mp** 239 °C (dec.) (from acetone/heptane); $\mathbf{R_f}$ = 0.43 (solvent ethyl acetate/heptane 1:1); **^{1}H NMR** (400 MHz, DMSO-d_6): δ = 2.29 (s, 3H), 7.13 (dd, 1H, *J* = 1.8, 8.5 Hz), 7.22 (dd, 1H, *J* = 4.0, 4.6 Hz), 7.25 (d, 1H, *J* = 8.5 Hz), 7.43 (d, 1H, *J* = 1.4 Hz), 7.81 (d, 1H, *J* = 4.9 Hz), 8.02 (dd, 1H, *J* ~ 0.5, 3.2 Hz), 9.82 (s, 1H), 11.20 (s, 1H); **^{13}C NMR** (DMSO-d_6): δ = 11.4, 109.3, 111.2, 112.8, 119.7, 122.8, 126.6, 128.1, 128.8, 131.2, 132.2, 132.3, 139.9, 160.3; **GC-MS** (EI, 70 eV): *m/z* (%) 334 (90) [M^+], 336 (93) [M^+]; **HRMS pos.** (ESI): Calc for [M+H]$^+$, $C_{14}H_{12}BrN_2OS$: 334.9848 and 336.9828; found: 334.9846 and 336.9828; **HRMS pos.** (ESI): Calc for [M+Na]$^+$, $C_{14}H_{11}BrN_2NaOS$: 356.9668 and 358.9647; found: 356.967 and 358.9651; **FTIR** (ATR, cm^{-1}): 3329, 3098, 3075, 2920, 1649, 1597, 1514, 1467, 1447, 1336, 1287, 1207, 970, 867, 791, 762, 732, 718, 690, 644, 597, 542, 492, 450, 427.

N-(2-Methyl-1*H*-indol-3-yl)thiophene-2-carboxamide (16)



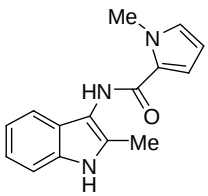
Yield: 154 mg **(60%)**; light yellow crystals; **Mp** 221 °C (dec.) (from acetone/heptane); $\mathbf{R_f}$ = 0.55 (solvent ethyl acetate/heptane 3:1); **^{1}H NMR** (400 MHz, Acetone-d_6): δ = 2.33 (s, 3H), 6.96 (m, 1H), 7.02 (m, 1H), 7.18 (dd, 1H, *J* = 3.8, 5.0 Hz), 7.26 (d, 1H, *J* = 8.0 Hz), 7.39 (d, 1H, *J* = 7.8 Hz), 7.71 (dd, 1H, *J* = 0.8, 5.0 Hz), 7.97 (dd, 1H, *J* = 0.7, 3.7 Hz), 9.06 (s, 1H), 10.02 (s, 1H); **^{13}C NMR** (Acetone-d_6): δ = 11.3, 110.6, 111.2, 117.9, 119.3, 121.2, 126.2, 128.3, 128.5, 130.9, 131.1, 134.8, 141.1, 161.0; **GC-MS** (EI, 70 eV): *m/z* (%) 256 (63) [M^+]; **HRMS pos.** (ESI): Calc for [M+H]$^+$, $C_{14}H_{13}N_2OS$: 257.07431; found: 257.07413; **HRMS pos.** (ESI): Calc for [M+Na]$^+$, $C_{14}H_{12}N_2NaOS$: 279.05625; found: 279.05619; **FTIR** (ATR, cm^{-1}): 3339, 3069, 2922, 1615, 1525, 1506, 1285, 1243, 739, 709, 666, 648, 603, 555, 538, 426.

4-Methyl-N-(2-methyl-1*H*-indol-3-yl)thiophene-2-carboxamide (17)



Yield: 160 mg **(59%)**; white crystals; **Mp** 246 °C (dec.) (from ethyl acetate/heptane); $\mathbf{R_f}$ = 0.59 (solvent ethyl acetate/heptane 3:1); **^{1}H NMR** (400 MHz, DMSO-d_6): δ = 2.27 (s, 6H), 6.94 (ddd, 1H, *J* ~ 1.0, 7.1, 8.1 Hz), 7.02 (ddd, 1H, *J* ~ 1.3, 7.1, 8.1 Hz), 7.28 (m, 2H), 7.38 (t, 1H, *J* = 1.1 Hz), 7.85 (d, 1H, *J* = 1.5 Hz), 9.70 (s, 1H), 10.94 (s, 1H); **^{13}C NMR** (DMSO-d_6): δ = 11.4, 15.5, 109.6, 110.7, 117.4, 118.5, 120.3, 125.1, 126.3, 130.3, 130.5, 133.7, 137.9, 139.8, 160.4; **GC-MS** (EI, 70 eV): *m/z* (%) 270 (78) [M^+]; **HRMS pos.** (ESI): Calc for [M+H]$^+$, $C_{15}H_{15}N_2OS$: 271.08996; found: 271.08955; **HRMS pos.** (ESI): Calc for [M+Na]$^+$, $C_{15}H_{14}N_2NaOS$: 293.0719; found: 293.07167; **FTIR** (ATR, cm^{-1}): 3333, 3063, 2916, 1615, 1550, 1516, 1459, 1422, 1285, 1243, 1221, 879, 866, 764, 738, 726, 651, 605, 588, 563, 543, 441, 426, 381.

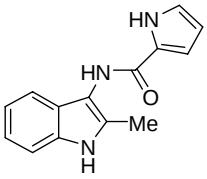
1-Methyl-N-(2-methyl-1*H*-indol-3-yl)-1*H*-pyrrole-2-carboxamide (18)



Yield: 167 mg **(66%)**; white crystals; **Mp** 230 °C (dec.) (from acetone/heptane); $\mathbf{R_f}$ = 0.58 (solvent ethyl acetate/heptane 3:1); **^{1}H NMR** (400 MHz, Acetone-d_6): δ = 2.31 (s, 3H), 3.94 (s, 3H), 6.09 (t, 1H, *J* = 3.2

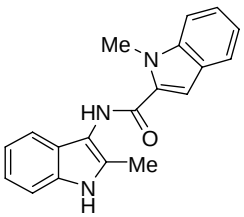
Hz), 6.88 (t, 1H, *J* = 2.1 Hz), 6.95 (ddd, 1H, *J* ~ 1.2, 7.2, 8.9 Hz), 7.00 (ddd, 1H, *J* ~ 1.4, 7.3, 9.3 Hz), 7.05 (br, 1H), 7.24 (ddd, 1H, *J* ~ 1.0, 1.7, 7.8 Hz), 7.38 (m, 1H), 8.57 (s, 1H), 9.95 (s, 1H); **^{13}C NMR** (Acetone-d_6): δ = 11.3, 36.4, 107.4, 111.0, 111.1, 112.9, 118.0, 119.2, 121.0, 126.5, 126.7, 128.2, 130.9, 134.8, 161.2; **GC-MS** (EI, 70 eV): *m/z* (%) 253 (93) [M^+]; **HRMS pos.** (ESI): Calc for [M+H]$^+$, $C_{15}H_{16}N_3O$: 254.12879; found: 254.12886; **HRMS pos.** (ESI): Calc for [M+Na]$^+$, $C_{15}H_{15}N_3NaO$: 276.11073; found: 276.1109; **FTIR** (ATR, cm^{-1}): 3353, 3205, 2916, 1634, 1531, 1460, 1316, 1247, 1059, 733, 694, 657, 618, 593, 550, 533, 489, 473, 436, 390.

N-(2-Methyl-1*H*-indol-3-yl)-1*H*-pyrrole-2-carboxamide (19)



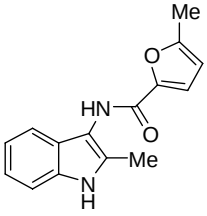
Yield: 110 mg **(46%)**; white crystals; **Mp** 201 °C (from acetone/heptane); **R_f** = 0.46 (solvent ethyl acetate/heptane 3:1); **^{1}H NMR** (400 MHz, Acetone-d_6): δ = 2.30 (s, 3H), 6.21 (br, 1H), 6.95 (m, 2H), 7.01 (m, 1H), 7.06 (br, 1H), 7.24 (d, 1H, *J* = 7.8 Hz), 7.38 (d, 1H, *J* = 7.8 Hz), 8.73 (s, 1H), 9.97 (s, 1H), 10.87 (s, 1H); **^{13}C NMR** (Acetone-d_6): δ = 11.3, 109.6, 110.4, 110.7, 111.1, 117.9, 119.2, 121.0, 122.0, 126.3, 127.2, 130.9, 134.8, 160.6; **GC-MS** (EI, 70 eV): *m/z* (%) 239 (36) [M^+]; **HRMS pos.** (ESI): Calc for [M+Na]$^+$, $C_{14}H_{13}N_3NaO$: 262.09508; found: 262.09534; **FTIR** (ATR, cm^{-1}): 3398, 3259, 3034, 1623, 1594, 1569, 1519, 1331, 1311, 1245, 1137, 741, 637, 598, 583, 539, 478, 442, 428, 386.

1-Methyl-N-(2-methyl-1*H*-indol-3-yl)-1*H*-indole-2-carboxamide (20)



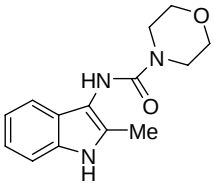
Yield: 191 mg **(63%)**; white crystals; **Mp** 264 °C (dec.) (from acetone/heptane); **R_f** = 0.61 (solvent ethyl acetate/heptane 3:1); **^{1}H NMR** (300 MHz, Acetone-d_6): δ = 2.39 (s, 3H), 4.10 (s, 3H), 6.98 (ddd, 1H, *J* ~ 1.4, 7.1, 8.9 Hz), 7.04 (ddd, 1H, *J* ~ 1.3, 7.1, 8.4 Hz), 7.13 (m, 1H), 7.31 (m, 2H), 7.37 (s, 1H), 7.45 (br d, 1H, *J* ~ 7.5 Hz), 7.52 (dd, 1H, *J* ~ 0.6, 8.4 Hz), 7.67 (d, 1H, *J* ~ 8.0 Hz), 9.07 (s, 1H), 10.07 (s, 1H); **^{13}C NMR** (Acetone-d_6): δ = 11.4, 31.4, 105.0, 110.7, 111.08, 111.13, 118.1, 119.3, 120.7, 121.2, 122.2, 124.2, 126.2, 126.9, 130.9, 133.2, 134.8, 139.6, 161.7; **GC-MS** (EI, 70 eV): *m/z* (%) 303 (100) [M^+]; **HRMS pos.** (ESI): Calc for [M+H]$^+$, $C_{19}H_{18}N_3O$: 304.14444; found: 304.14392; **HRMS pos.** (ESI): Calc for [M+Na]$^+$, $C_{19}H_{17}N_3NaO$: 326.12638; found: 326.12599; **FTIR** (ATR, cm^{-1}): 3365, 3231, 1655, 1514, 1458, 1245, 1226, 747, 730, 682, 658, 604, 576, 538, 508, 433, 384.

5-Methyl-N-(2-methyl-1*H*-indol-3-yl)furan-2-carboxamide (21)



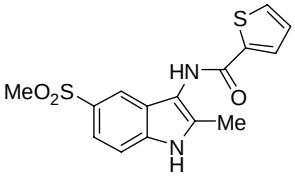
Yield: 130 mg **(51%)**; white crystals; **Mp** 225 °C (from acetone/heptane); **R_f** = 0.51 (solvent ethyl acetate/heptane 3:1); **^{1}H NMR** (400 MHz, DMSO-d_6): δ = 2.25 (s, 3H), 2.37 (s, 3H), 6.29 (dd, 1H, *J* = 0.8, 3.2 Hz), 6.93 (ddd, 1H, *J* ~ 1.0, 7.1, 8.1 Hz), 7.01 (ddd, 1H, *J* ~ 1.0, 7.1, 8.1 Hz), 7.18 (d, 1H, *J* = 3.3 Hz), 7.27 (m, 2H), 9.51 (s, 1H), 10.91 (s, 1H); **^{13}C NMR** (DMSO-d_6): δ = 11.3, 13.6, 108.2, 109.3, 110.7, 114.9, 117.4, 118.4, 120.3, 125.2, 130.4, 133.7, 146.5, 154.5, 157.1; **GC-MS** (EI, 70 eV): *m/z* (%) 254 (74) [M^+]; **HRMS pos.** (ESI): Calc for [M+Na]$^+$, $C_{15}H_{14}N_2NaO_2$: 277.09475; found: 277.09438; **FTIR** (ATR, cm^{-1}): 3381, 3238, 3130, 3053, 1651, 1546, 1504, 1430, 1284, 1021, 808, 745, 706, 661, 594, 562, 536, 434.

N-(2-Methyl-1*H*-indol-3-yl)morpholine-4-carboxamide (22)



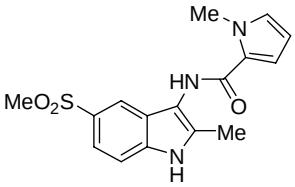
Yield: 150 mg **(58%)**; white crystals; **Mp** 240 °C (dec.) (from acetone/heptane); $\mathbf{R_f}$ = 0.55 (solvent ethyl acetate/ethanol 9:1); **^{1}H NMR** (300 MHz, Acetone-d_6): δ = 2.25 (s, 3H), 3.48 (m, 4H), 3.64 (m, 4H), 6.92 (ddd, 1H, *J* ~ 1.3, 7.2, 8.8 Hz), 6.97 (ddd, 1H, *J* ~ 1.4, 7.2, 9.2 Hz), 7.21 (m, 1H), 7.24 (s, 1H), 7.32 (m, 1H), 9.87 (s, 1H); **^{13}C NMR** (Acetone-d_6): δ = 10.9, 45.2 (2C), 66.9 (2C), 111.0, 112.1, 117.8, 118.9, 120.8, 126.9, 130.9, 134.7, 157.5; **HRMS pos.** (ESI): Calc for $[M+H]^+$, $C_{14}H_{18}N_3O_2$: 260.13935; found: 260.13927; **HRMS pos.** (ESI): Calc for $[M+Na]^+$, $C_{14}H_{17}N_3NaO_2$: 283.12427; found: 283.12403; **FTIR** (ATR, cm^{-1}): 3398, 3311, 3061, 2966, 2899, 2856, 1650, 1632, 1498, 1450, 1339, 1246, 1199, 1112, 997, 738, 652, 601, 565, 544, 436, 410, 385.

N-(2-Methyl-5-(methylsulfonyl)-1*H*-indol-3-yl)thiophene-2-carboxamide (23)



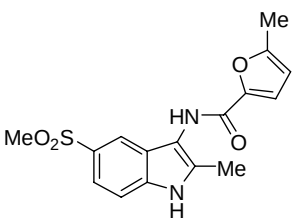
Yield: 180 mg (**54%**); white crystals; **Mp** from 259 °C (from acetone/heptane); $\mathbf{R_f}$ = 0.43 (solvent ethyl acetate/heptane 9:1); **^{1}H NMR** (300 MHz, DMSO-d_6): δ = 2.33 (s, 3H), 3.13 (s, 3H), 7.24 (dd, 1H, *J* = 3.7, 5.0 Hz), 7.50 (d, 1H, *J* = 8.6 Hz), 7.56 (dd, 1H, *J* = 1.8, 8.6 Hz), 7.84 (dd, 1H, *J* = 1.0, 5.0 Hz), 7.91 (d, 1H, *J* = 1.5 Hz), 8.05 (dd, 1H, *J* = 1.0, 3.7 Hz), 9.99 (s, 1H), 11.62 (s, 1H); **^{13}C NMR** (DMSO-d_6): δ = 11.6, 22.8, 44.6, 111.0, 111.5, 117.6, 118.8, 124.2, 128.1, 129.0, 131.0, 131.4, 133.4, 135.7, 139.7, 160.3; **GC-MS** (EI): *m/z* (%) 334 (100) $[M^+]$; **HRMS pos.** (ESI): Calc for $[M+H]^+$, $C_{15}H_{15}N_2O_3S_2$: 335.05186; found: 335.05224; **HRMS pos.** (ESI): Calc for $[M+Na]^+$, $C_{15}H_{14}N_2NaO_3S_2$: 357.0338; found: 357.03409; **FTIR** (ATR, cm^{-1}): 3351, 3196, 3093, 3000, 2933, 2917, 2854, 1619, 1592, 1533, 1313, 1283, 1160, 1134, 1114, 1058, 949, 782, 722, 710, 618, 561, 541, 499, 384.

1-Methyl-N-(2-methyl-5-(methylsulfonyl)-1*H*-indol-3-yl)-1*H*-pyrrole-2-carboxamide (24)



Yield: 172 mg (**52%**); light yellow crystals; **Mp** from 233 °C (dec.) (from acetone/heptane); $\mathbf{R_f}$ = 0.45 (solvent ethyl acetate/heptane 9:1); **^{1}H NMR** (300 MHz, Acetone-d_6): δ = 2.39 (s, 3H), 3.03 (s, 3H), 3.95 (s, 3H), 6.10 (dd, 1H, *J* = 2.6, 4.0 Hz), 6.91 (br t, 1H, *J* = 2.1 Hz), 7.07 (br d, 1H, *J* = 2.4 Hz), 7.48 (dd, 1H, *J* = 0.6, 8.6 Hz), 7.58 (dd, 1H, *J* = 1.7, 8.5 Hz), 8.02 (br d, 1H, *J* = 1.6 Hz), 8.82 (s, 1H), 10.58 (s, 1H); **^{13}C NMR** (Acetone-d_6): δ = 11.9, 36.9, 45.2, 107.8, 112.0, 112.0, 113.6, 119.0, 120.0, 126.2, 126.6, 128.9, 132.8, 134.4, 137.1, 161.5; **GC-MS** (EI): *m/z* (%) 331 (57) $[M^+]$; **HRMS pos.** (ESI): Calc for $[M+H]^+$, $C_{16}H_{18}N_3O_3S_1$: 332.10634; found: 332.1069; **HRMS pos.** (ESI): Calc for $[M+Na]^+$, $C_{16}H_{17}N_3NaO_3S_1$: 354.08828; found: 354.08886; **FTIR** (ATR, cm^{-1}): 3341, 3260, 3131, 2922, 1634, 1516, 1294, 1255, 1181, 1131, 1104, 1058, 952, 754, 738, 654, 609, 563, 543, 507, 494.

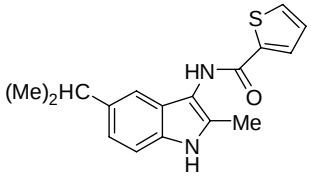
5-Methyl-N-(2-methyl-5-(methylsulfonyl)-1*H*-indol-3-yl)furan-2-carboxamide (25)



Yield: 173 mg (**52%**); white crystals; **Mp** from 263 °C (dec.) (from acetone/heptane); $\mathbf{R_f}$ = 0.44 (solvent ethyl acetate/heptane 9:1); **^{1}H NMR** (400 MHz, DMSO-d_6): δ = 2.30 (s, 3H), 2.39 (s, 3H), 3.11 (s, 3H), 6.32 (dd, 1H, *J* = 0.9, 3.3 Hz), 7.20 (d, 1H, *J* = 3.3 Hz), 7.48 (dd, 1H, *J* = 0.6, 8.4 Hz), 7.55 (dd, 1H, *J* = 1.5, 8.6 Hz), 7.88 (d, 1H, *J* = 1.7), 9.75 (s, 1H), 11.56 (s, 1H); **^{13}C NMR** (DMSO-d_6): δ = 11.6,

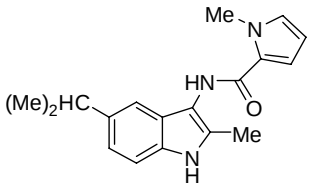
13.6, 44.6, 108.4, 110.7, 111.4, 115.4, 117.7, 118.7, 124.3, 130.9, 133.4, 135.7, 146.2, 154.8, 156.9; **GC-MS** (EI): *m/z* (%) 332 (86) [M^+]; **HRMS pos.** (ESI): Calc for [M+H]$^+$, $C_{16}H_{17}N_2O_4S_1$: 333.09035; found: 333.09104; **HRMS pos.** (ESI): Calc for [M+Na]$^+$, $C_{16}H_{16}N_2NaO_4S_1$: 355.0723; found: 355.07288; **FTIR** (ATR, cm^{-1}): 3367, 3282, 3203, 2997, 2918, 1628, 1549, 1507, 1319, 1285, 1138, 1117, 1057, 1017, 953, 796, 785, 754, 684, 600, 567, 541, 490, 424, 384.

N-(5-Isopropyl-2-methyl-1*H*-indol-3-yl)thiophene-2-carboxamide (26)



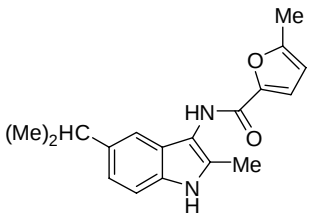
Yield: 185 mg (**62%**); white crystals; **Mp** 211 °C (dec.) (from acetone/heptane); **R$_f$** = 0.39 (solvent ethyl acetate/heptane 1:1); **^{1}H NMR** (400 MHz, Acetone-d$_6$): δ = 1.23 (d, 6H, *J* = 6.9 Hz), 2.32 (s, 3H), 2.93 (m, 1H), 6.94 (dd, 1H, *J* = 1.6, 8.3 Hz), 7.19 (d, 1H, *J* = 8.5 Hz), 7.19 (d, 1H, *J* = 1.1 Hz), 7.24 (s, 1H), 7.72 (dd, 1H, *J* = 0.9, 5.0 Hz), 7.98 (dd, 1H, *J* = 0.7, 3.6 Hz), 9.03 (s, 1H), 9.92 (s, 1H); **^{13}C NMR** (Acetone-d$_6$): δ = 11.4, 24.8 (2C), 34.7, 110.97, 111.03, 114.8, 120.2, 126.3, 128.3, 128.5, 130.9, 131.2, 133.4, 139.8, 141.4, 160.9; **GC-MS** (EI): *m/z* (%) 298 (70) [M^+]; **HRMS pos.** (ESI): Calc for [M+H]$^+$, $C_{17}H_{19}N_2O_1S_1$: 299.12126; found: 299.1218; **HRMS pos.** (ESI): Calc for [M+Na]$^+$, $C_{17}H_{18}N_2NaO_1S_1$: 321.10321; found: 321.10389; **FTIR** (ATR, cm^{-1}): 3369, 3308, 2953, 2919, 2861, 1612, 1600, 1524, 1494, 1458, 1288, 1249, 807, 714, 627, 566, 533, 499.

N-(5-Isopropyl-2-methyl-1*H*-indol-3-yl)-1-methyl-1*H*-pyrrole-2-carboxamide (27)



Yield: 159 mg (**54%**); white crystals; **Mp** 225 °C (dec.) (from acetone/heptane); **R$_f$** = 0.34 (solvent ethyl acetate/heptane 1:1); **^{1}H NMR** (400 MHz, Acetone-d$_6$): δ = 1.23 (d, 6H, *J* = 6.9 Hz), 2.30 (s, 3H), 2.93 (m, 1H), 3.94 (s, 3H), 6.09 (br t, 1H, *J* = 3.1 Hz), 6.88 (br t, 1H, *J* = 2.0 Hz), 6.93 (dd, 1H, *J* = 1.7, 8.3 Hz), 7.09 (br, 1H), 7.16 (d, 1H, *J* = 8.3 Hz), 7.23 (br, 1H), 8.53 (s, 1H), 9.83 (s, 1H); **^{13}C NMR** (Acetone-d$_6$): δ = 11.4, 24.8 (2C), 34.7, 36.4, 107.3, 110.86, 110.92, 112.8, 114.8, 120.0, 126.6, 128.8, 128.2, 131.1, 133.5, 139.6, 161.2; **GC-MS** (EI): *m/z* (%) 295 (100) [M^+]; **HRMS pos.** (ESI): Calc for [M+H]$^+$, $C_{18}H_{22}N_3O_1$: 296.17574; found: 296.17642; **HRMS pos.** (ESI): Calc for [M+Na]$^+$, $C_{18}H_{21}N_3NaO_1$: 318.15768; found: 318.15843; **FTIR** (ATR, cm^{-1}): 3357, 3245, 2957, 2923, 2867, 1639, 1532, 1499, 1452, 1407, 1319, 1251, 1099, 799, 739, 708, 672, 656, 607, 576, 542, 450.

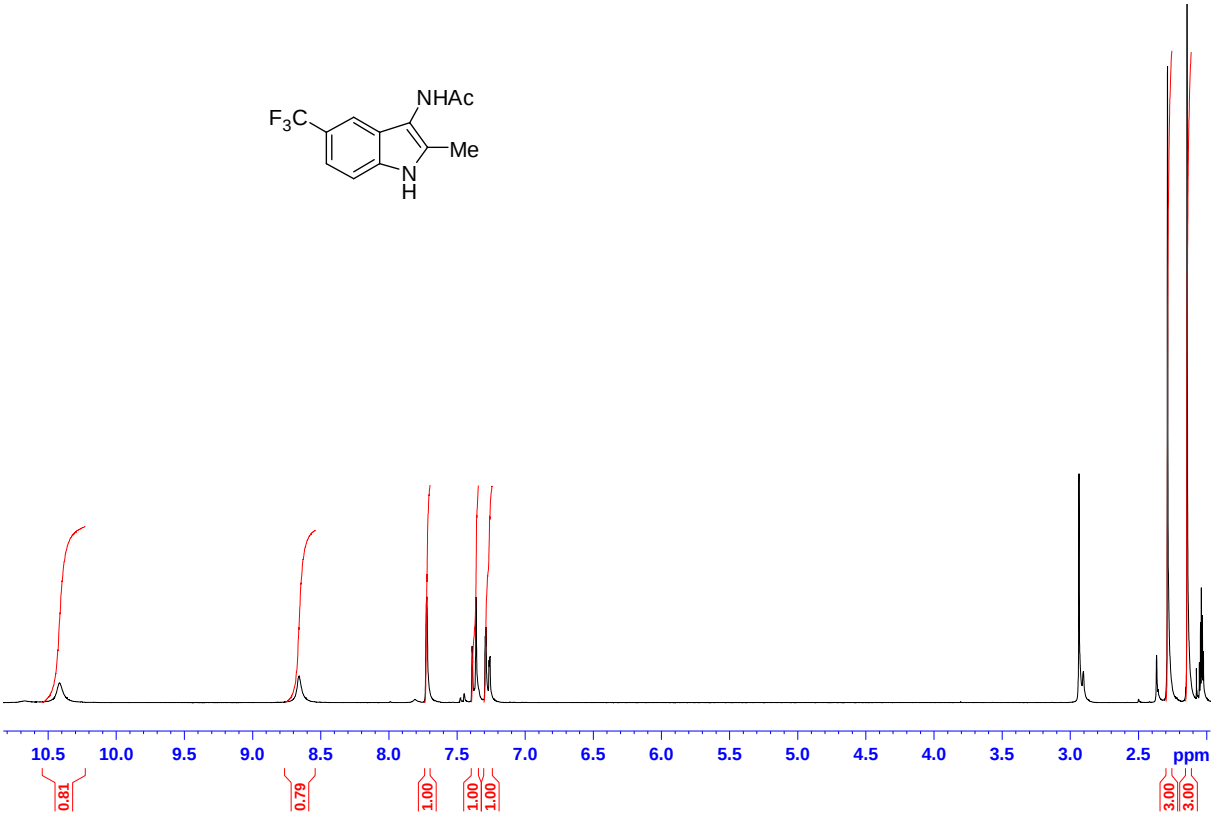
N-(5-Isopropyl-2-methyl-1*H*-indol-3-yl)-5-methylfuran-2-carboxamide (28)



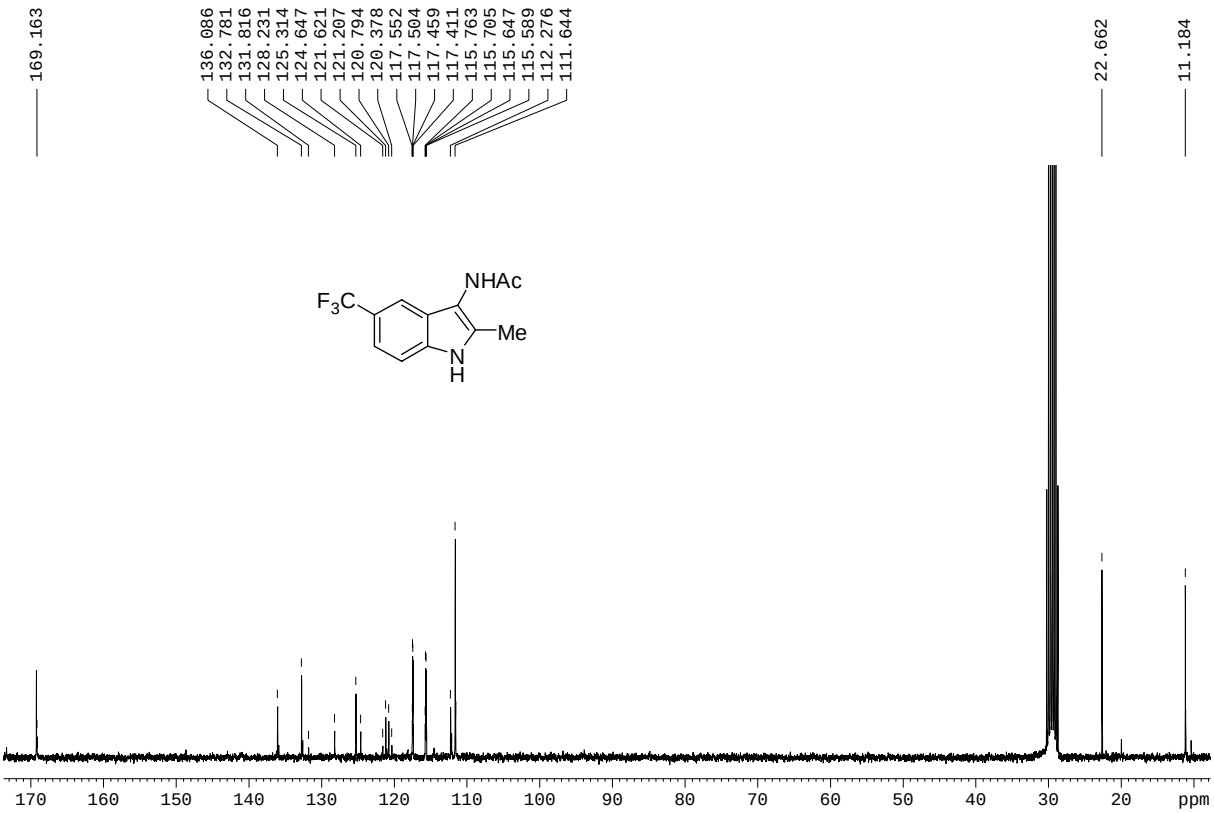
Yield: 181 mg (**61%**); white crystals; **Mp** 228 °C (dec.) (from acetone/heptane); **R$_f$** = 0.46 (solvent ethyl acetate/heptane 3:1); **^{1}H NMR** (300 MHz, Acetone-d$_6$): δ = 1.23 (d, 6H, *J* = 6.9 Hz), 2.30 (s, 3H), 2.37 (s, 3H), 2.93 (m, 1H), 6.24 (dd, 1H, *J* ~ 0.9, 3.3 Hz), 6.94 (dd, 1H, *J* = 1.7, 8.3 Hz), 7.06 (d, 1H, *J* = 3.3 Hz), 7.18 (d, 1H, *J* = 8.4 Hz), 7.23 (br, 1H), 8.80 (s, 1H), 9.92 (s, 1H); **^{13}C NMR** (Acetone-d$_6$): δ = 11.4, 13.4, 24.8 (2C), 34.7, 108.7, 110.0, 111.0, 114.8, 115.2, 120.1, 126.3, 131.1, 133.4, 139.7, 147.9, 155.0, 157.5; **GC-MS** (EI): *m/z* (%) 296 (95) [M^+]; **HRMS pos.** (ESI): Calc for [M+H]$^+$, $C_{18}H_{21}N_2O_2$: 297.15975; found: 297.16012; **HRMS pos.** (ESI): Calc for [M+Na]$^+$, $C_{18}H_{20}N_2NaO_2$: 319.1417; found: 319.14158; **FTIR** (ATR, cm^{-1}): 3358, 3253, 2951, 2920, 2887, 1643, 1604, 1544, 1477, 1456, 1287, 1271, 1209, 1023, 794, 752, 676, 631, 611, 563, 539, 501.

N-(2-Methyl-5-(trifluoromethyl)-1*H*-indol-3-yl)acetamide (5)

^{1}H NMR

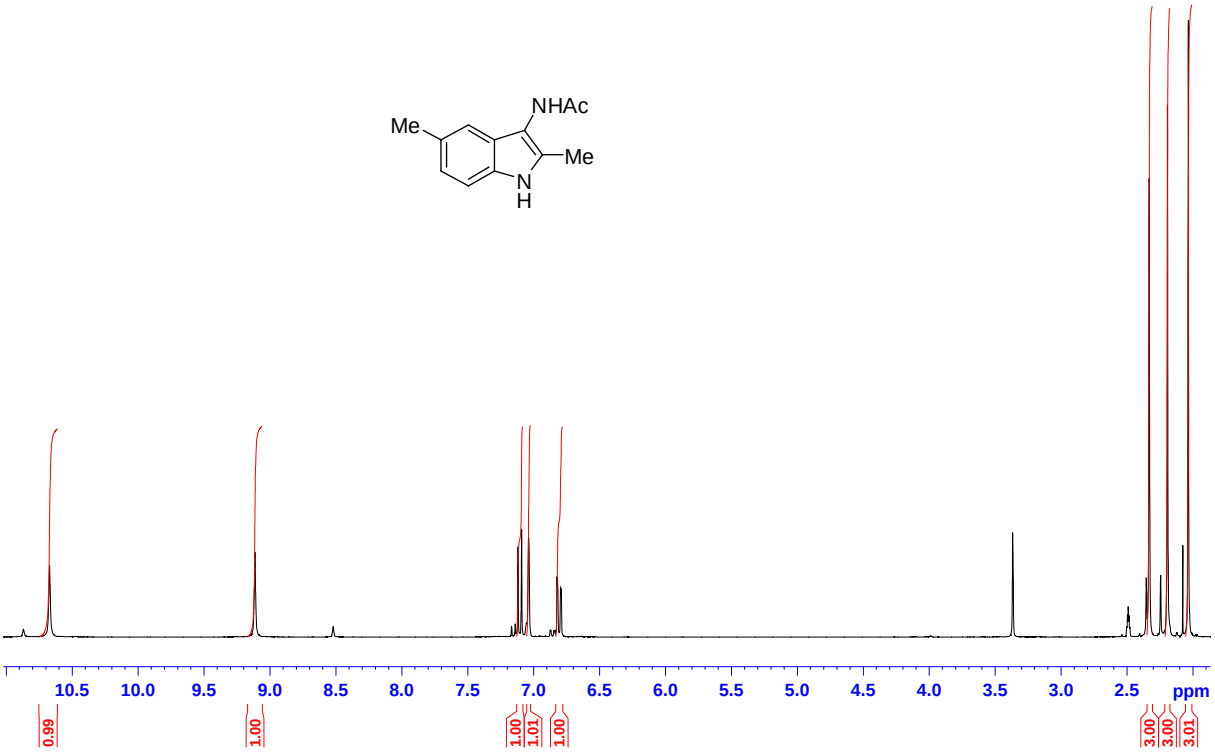


^{13}C NMR

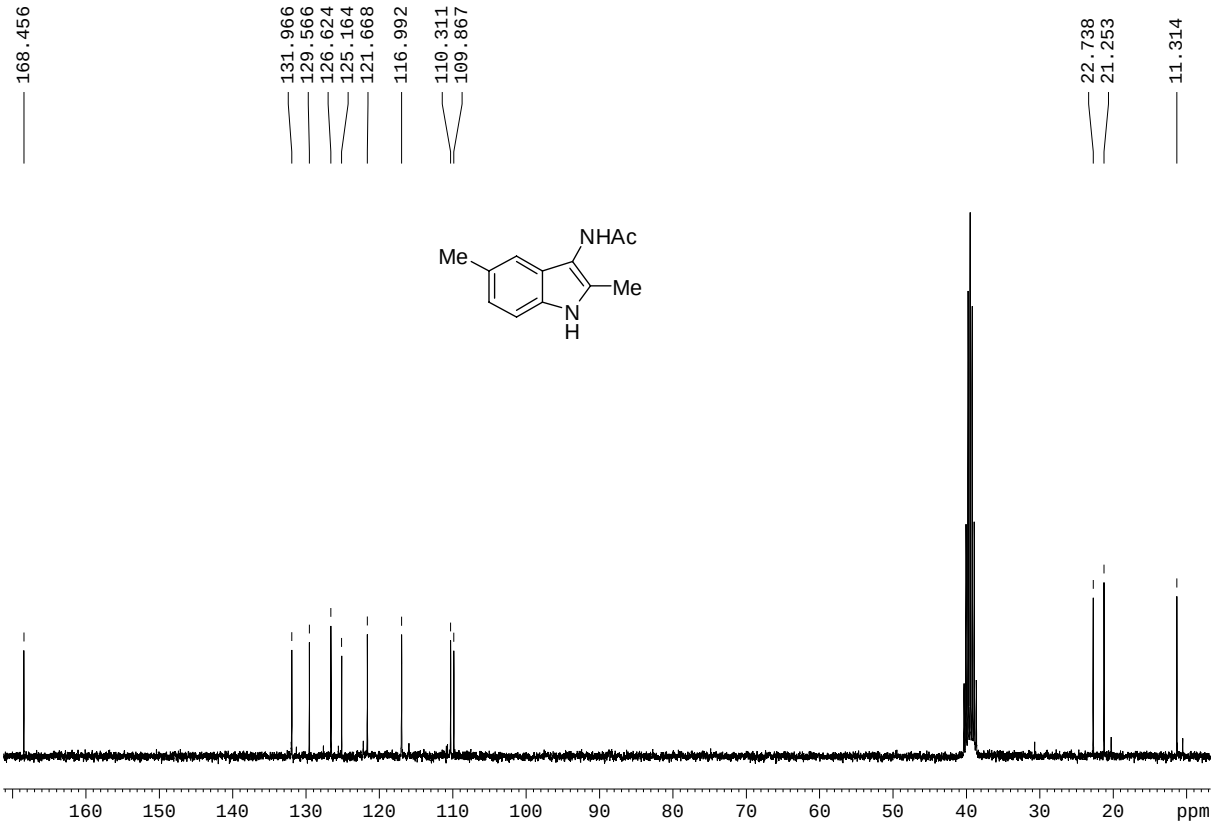


N-(2,5-Dimethyl-1H-indol-3-yl)acetamide (6)

^{1}H NMR

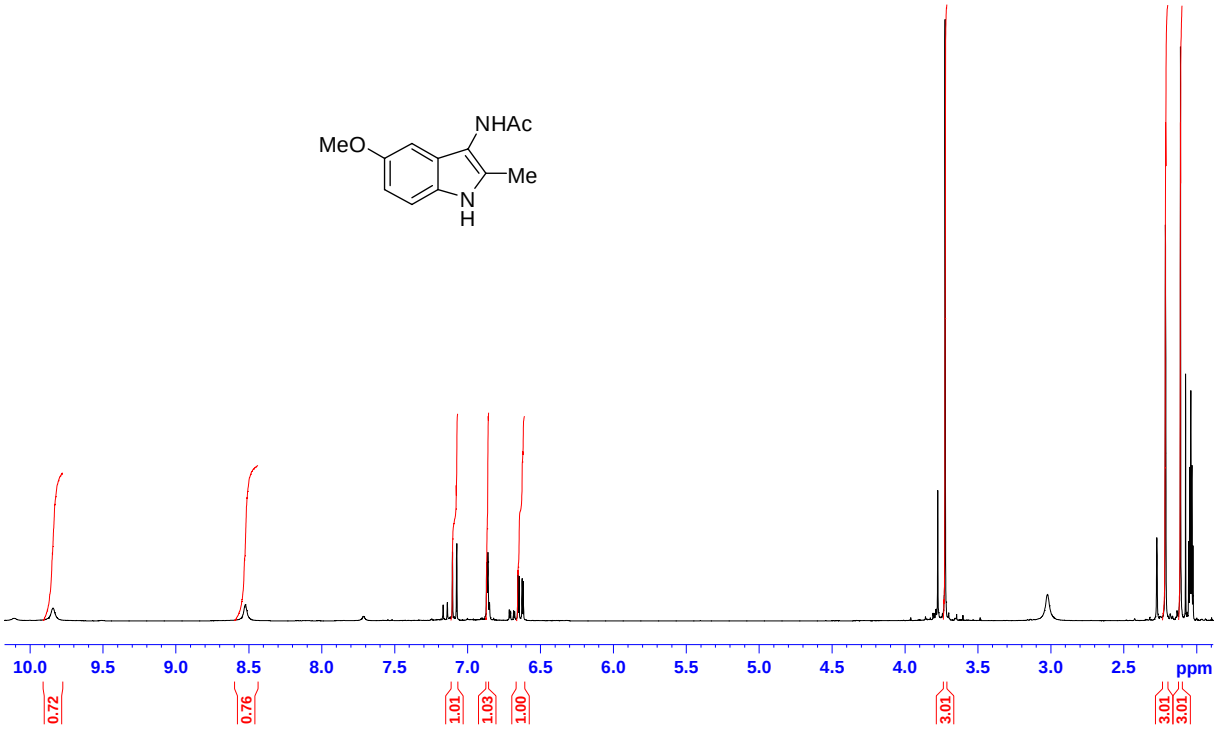


^{13}C NMR

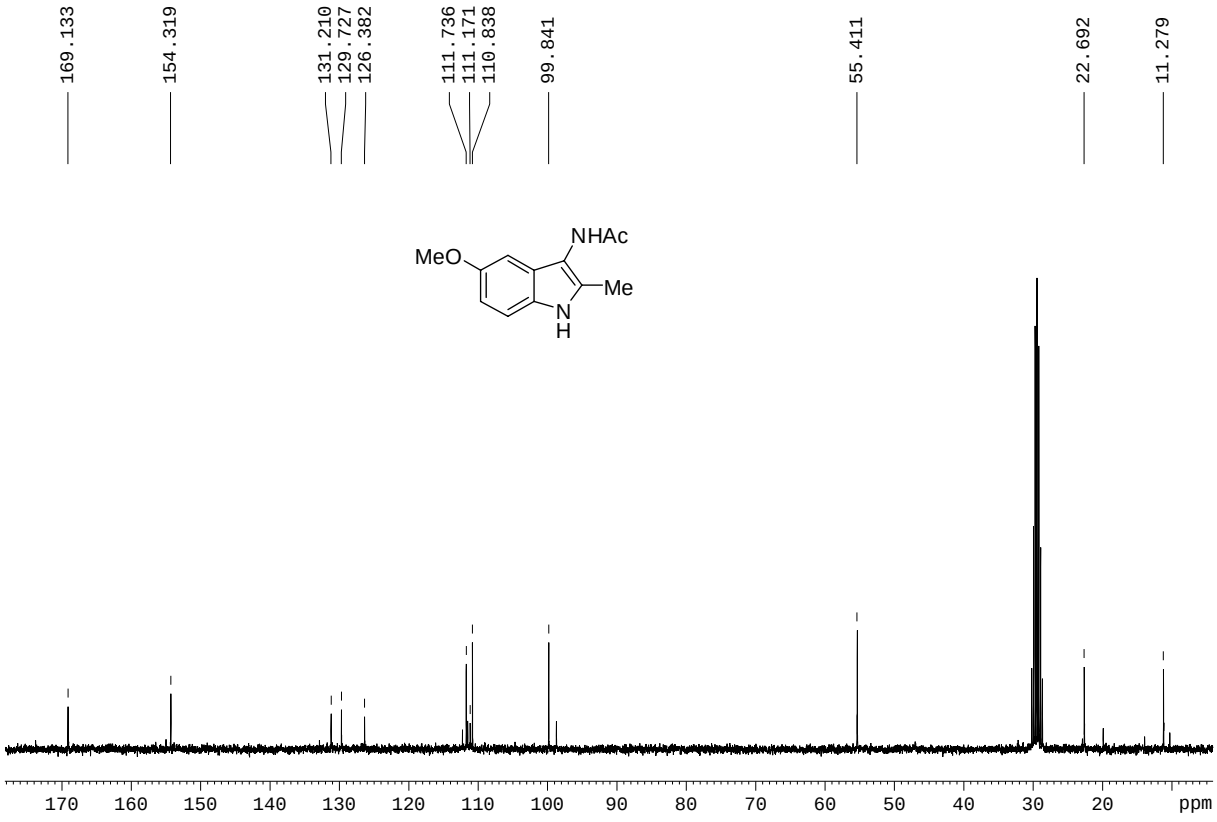


N-(5-Methoxy-2-methyl-1*H*-indol-3-yl)acetamide (8)

^{1}H NMR

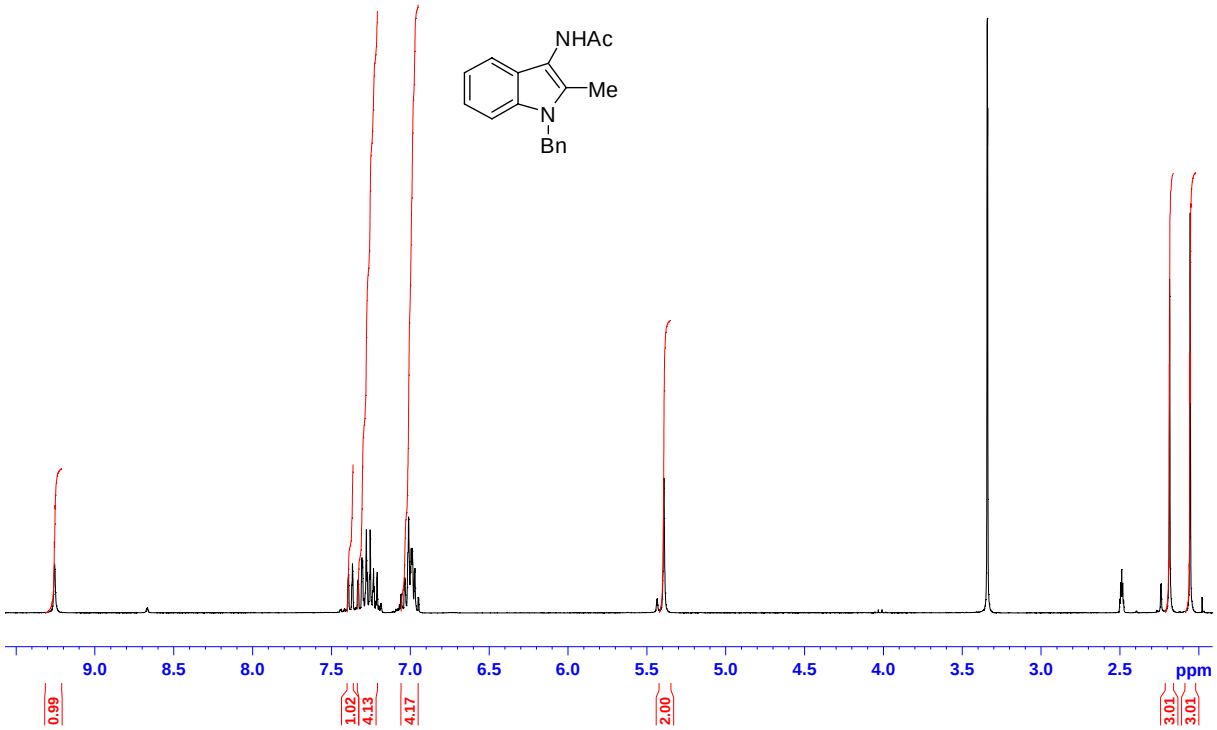


^{13}C NMR

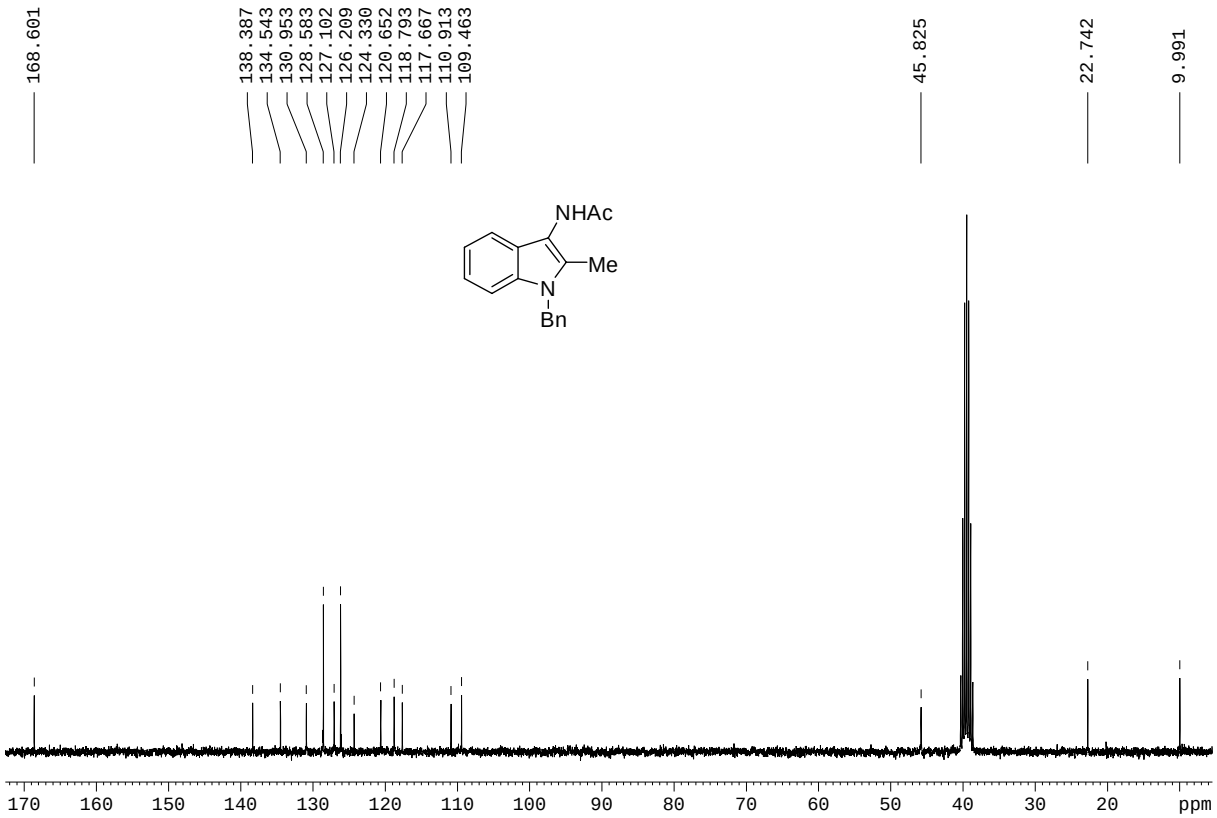


N-(1-Benzyl-2-methyl-1*H*-indol-3-yl)acetamide (9)

^{1}H NMR

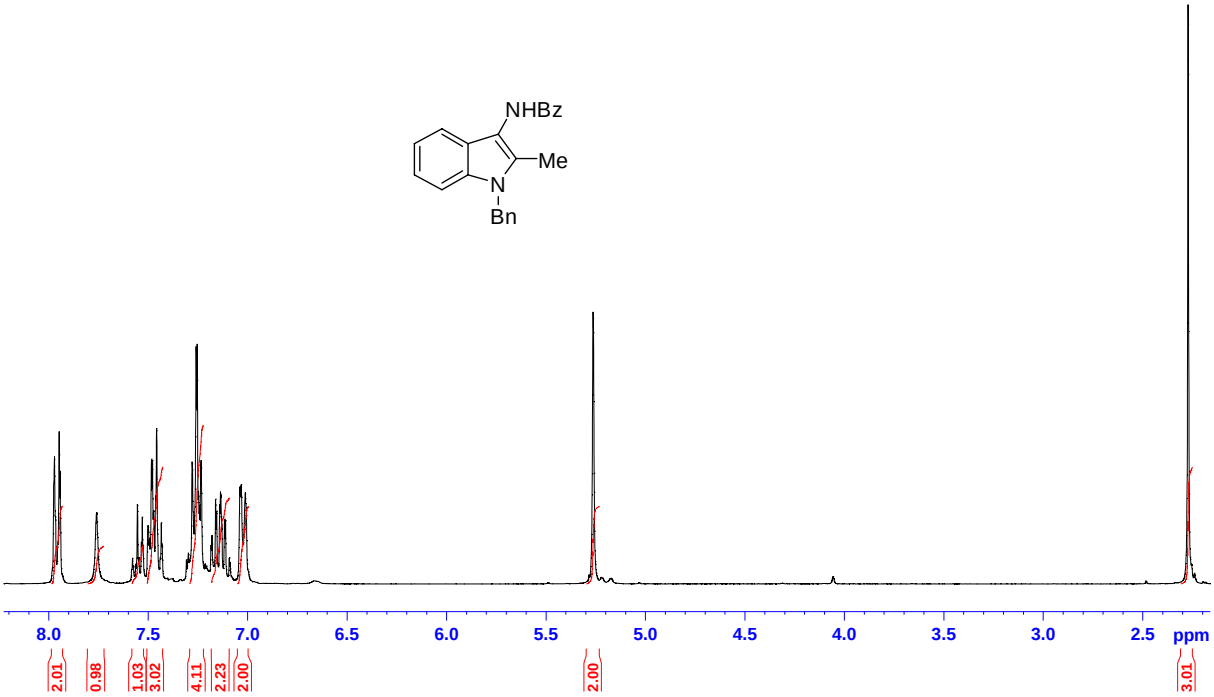


^{13}C NMR

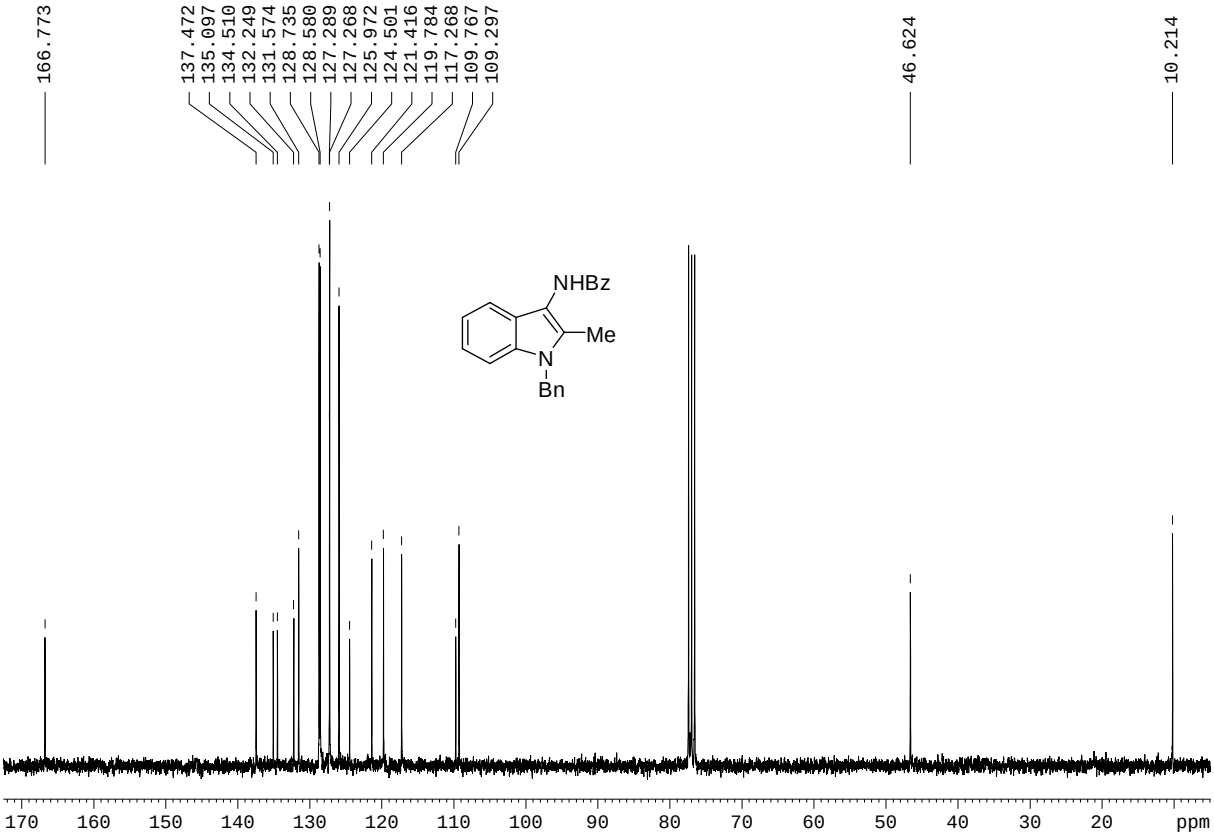


N-(1-Benzyl-2-methyl-1*H*-indol-3-yl)benzamide (10)

^{1}H NMR

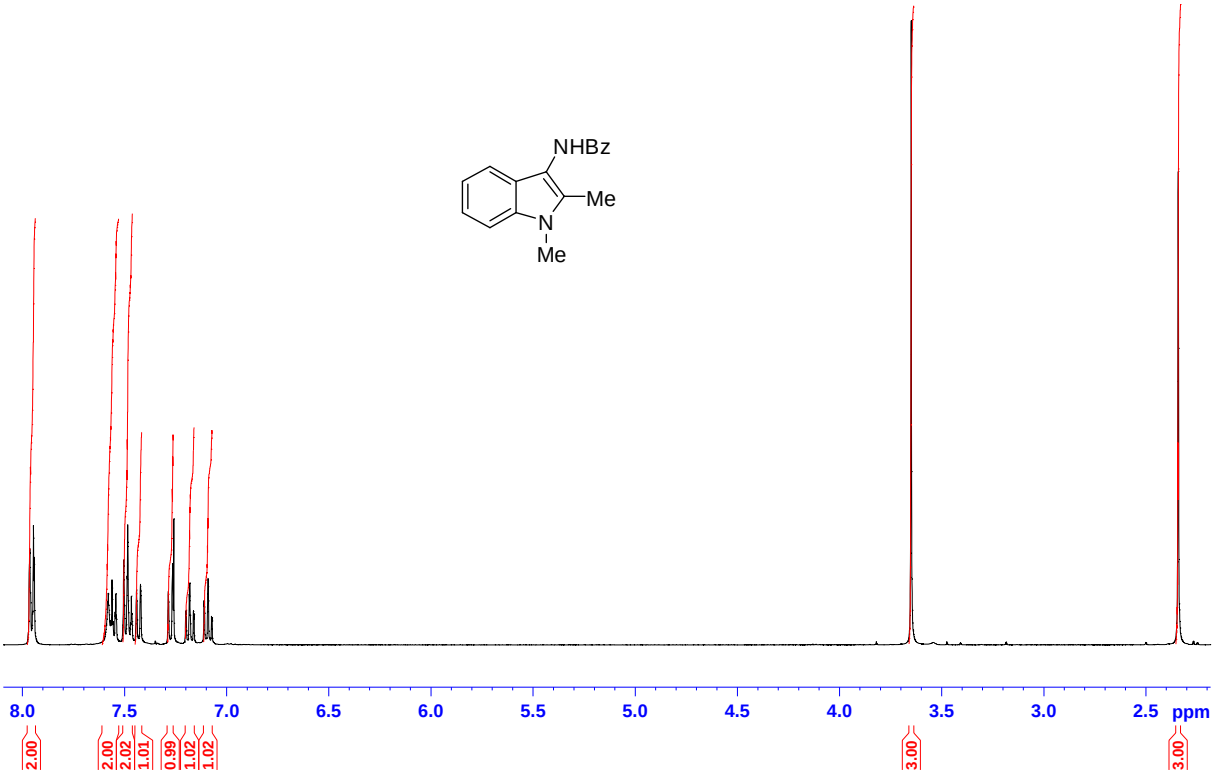


^{13}C NMR

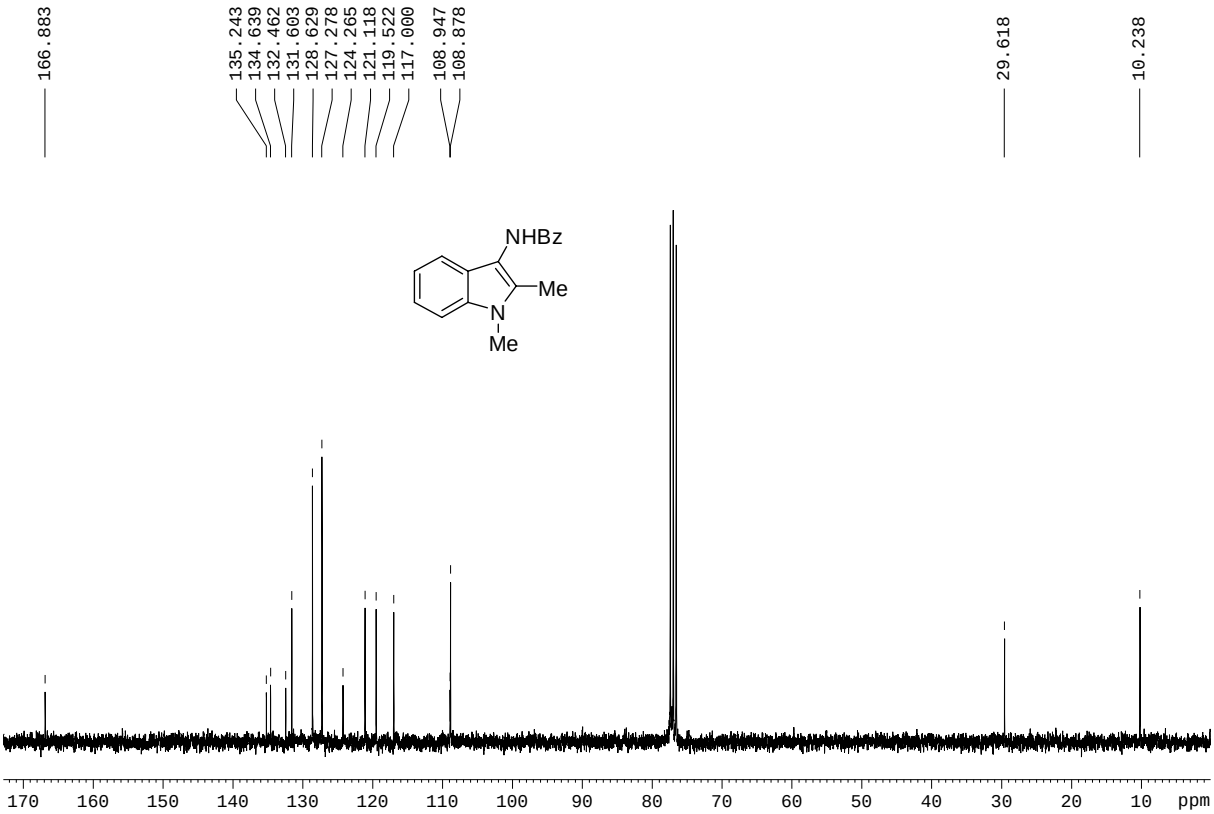


N-(1,2-Dimethyl-1*H*-indol-3-yl)benzamide (11)

^{1}H NMR

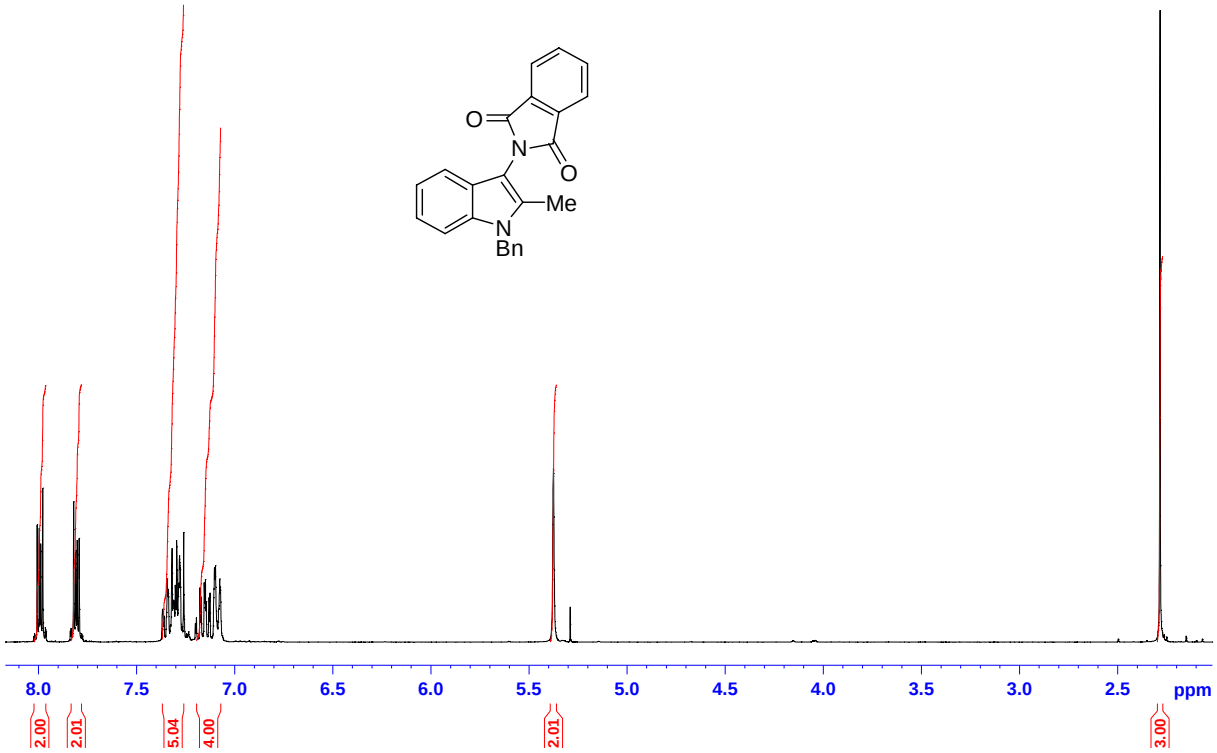


^{13}C NMR

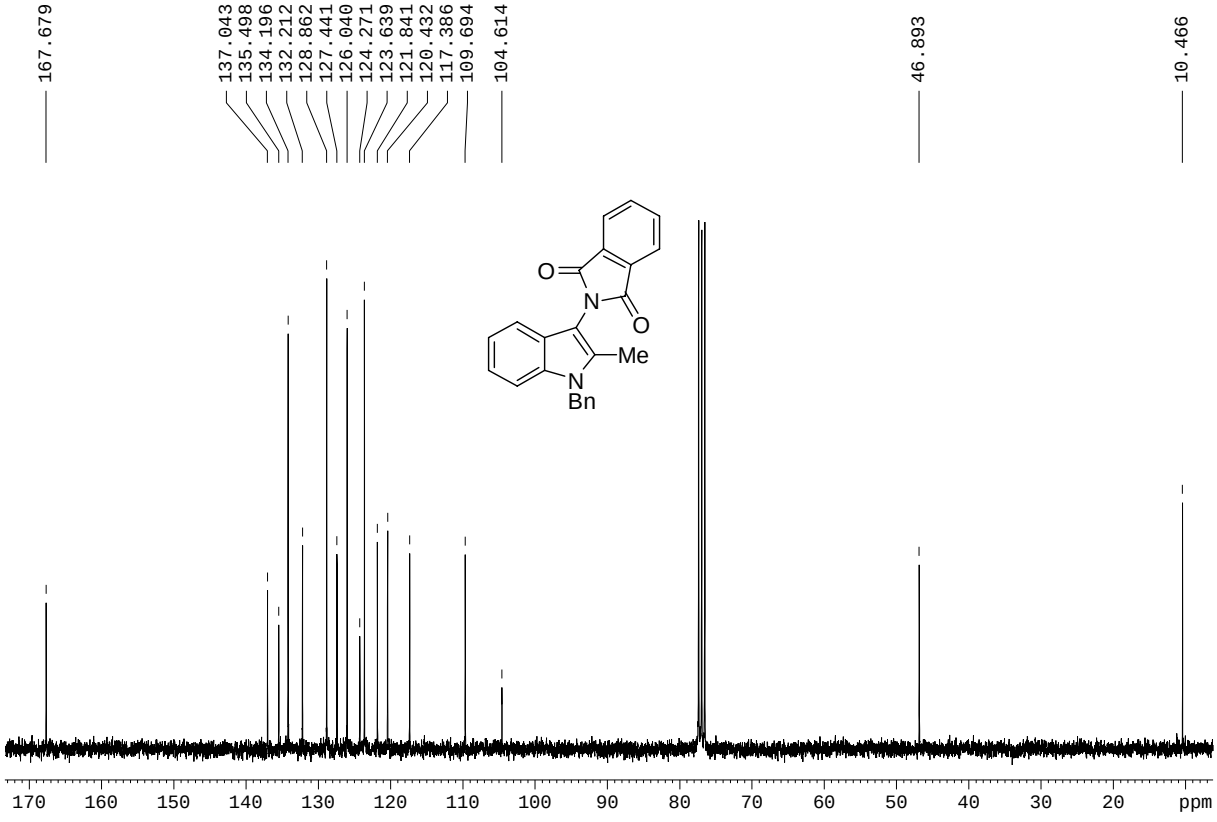


2-(1-Benzyl-2-methyl-1*H*-indol-3-yl)isoindoline-1,3-dione (12)

^{1}H NMR

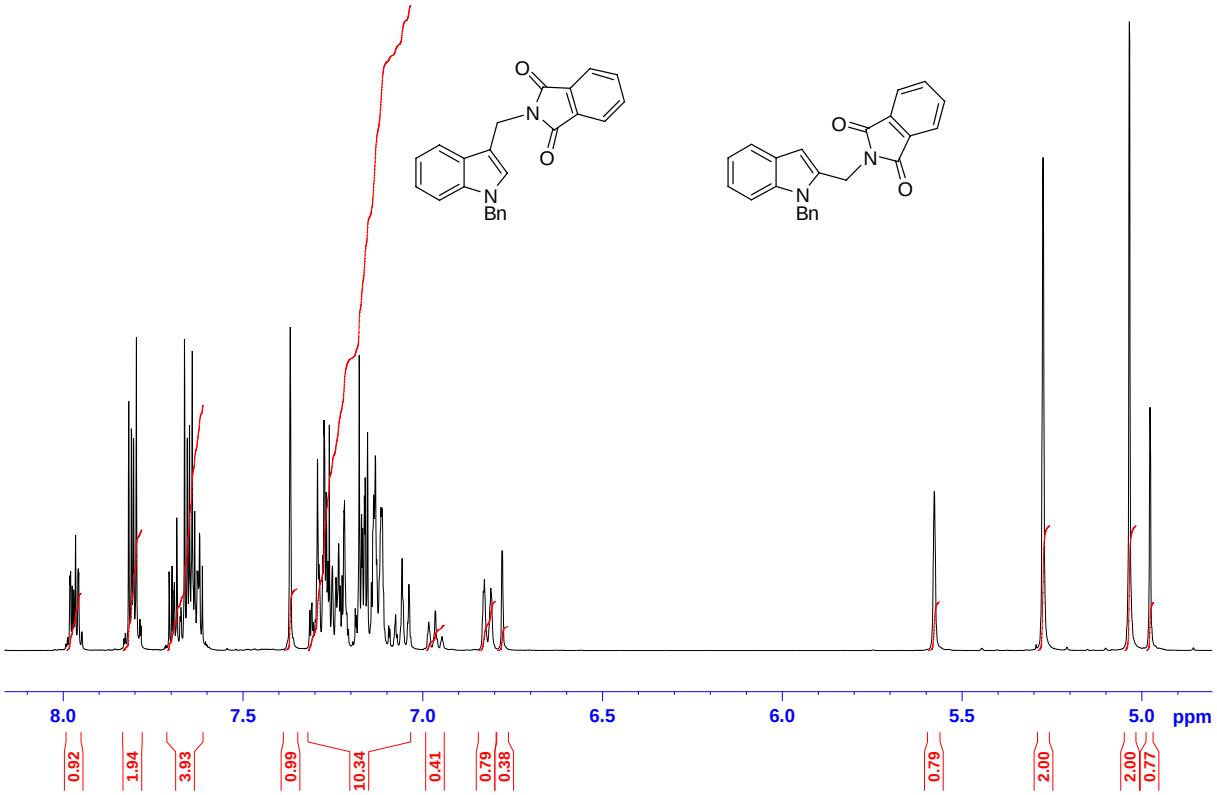


^{13}C NMR



Mixture of 2-((1-benzyl-1*H*-indol-2-yl)methyl)isoindoline-1,3-dione (12-1) and 2-((1-benzyl-1*H*-indol-3-yl)methyl)isoindoline-1,3-dione (12-2)

^{1}H NMR



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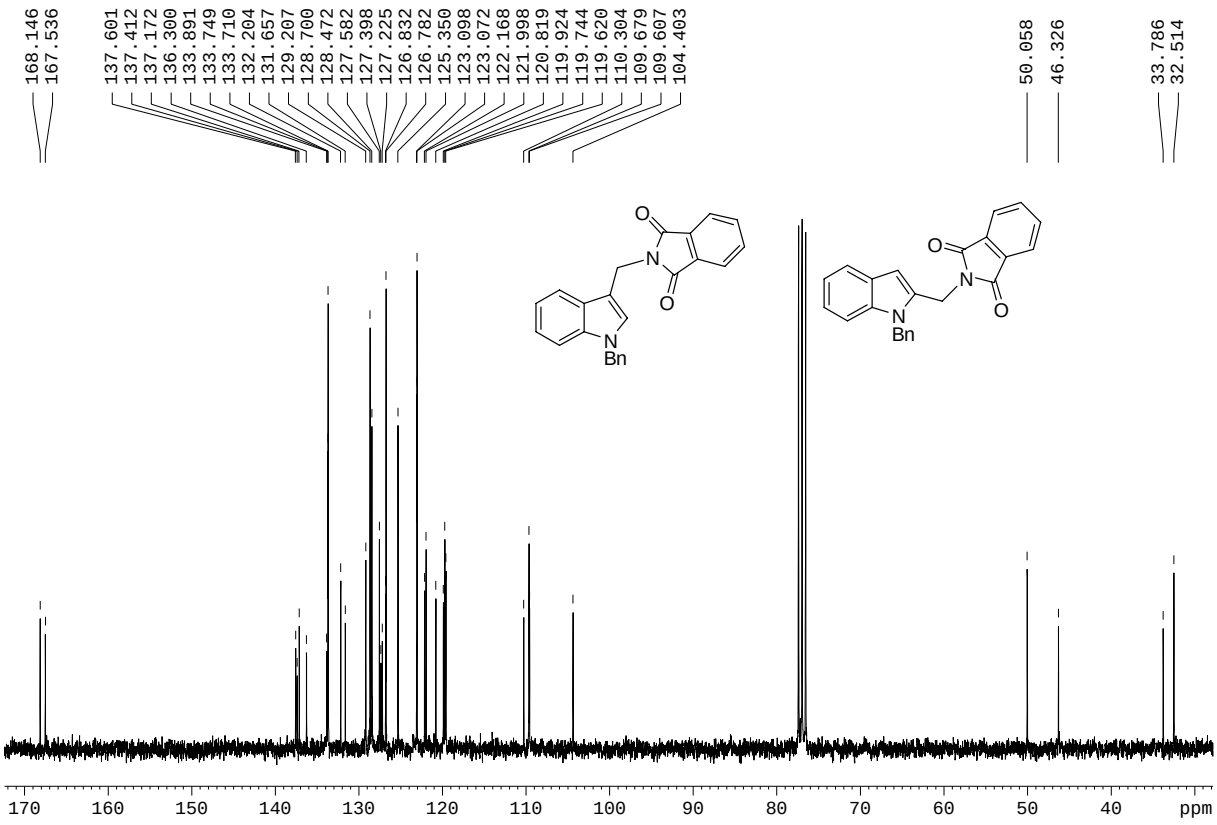
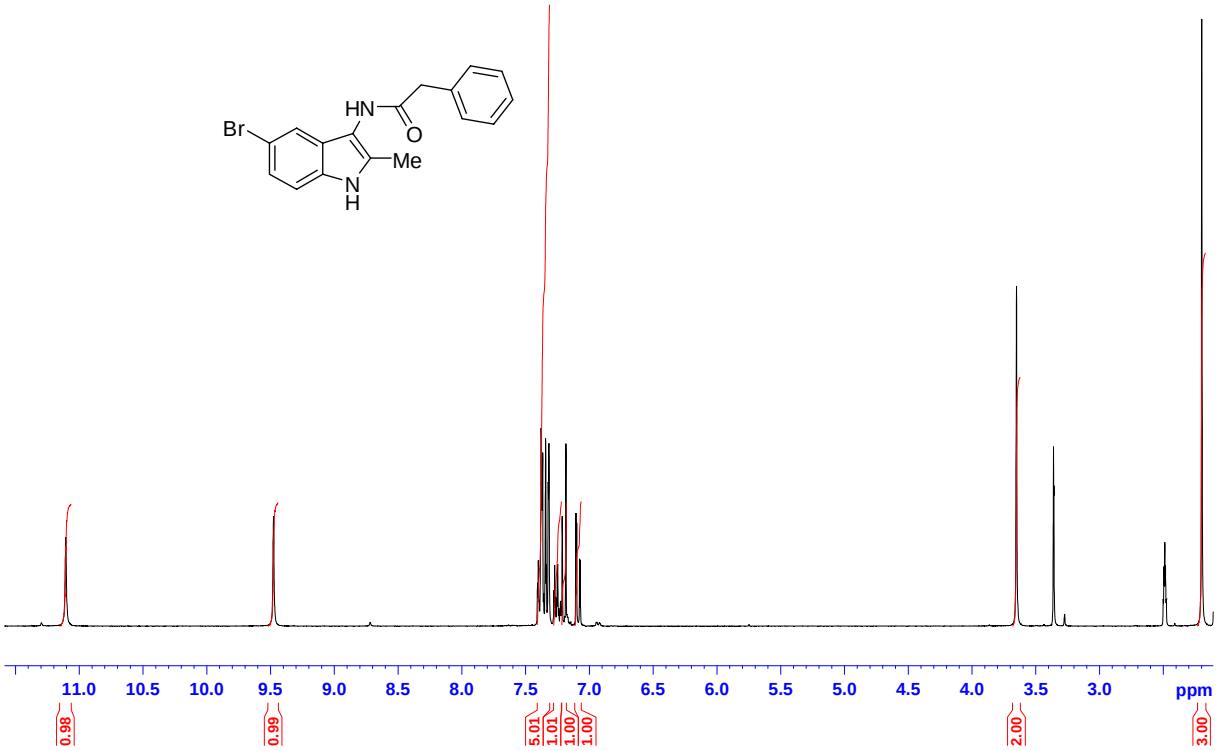
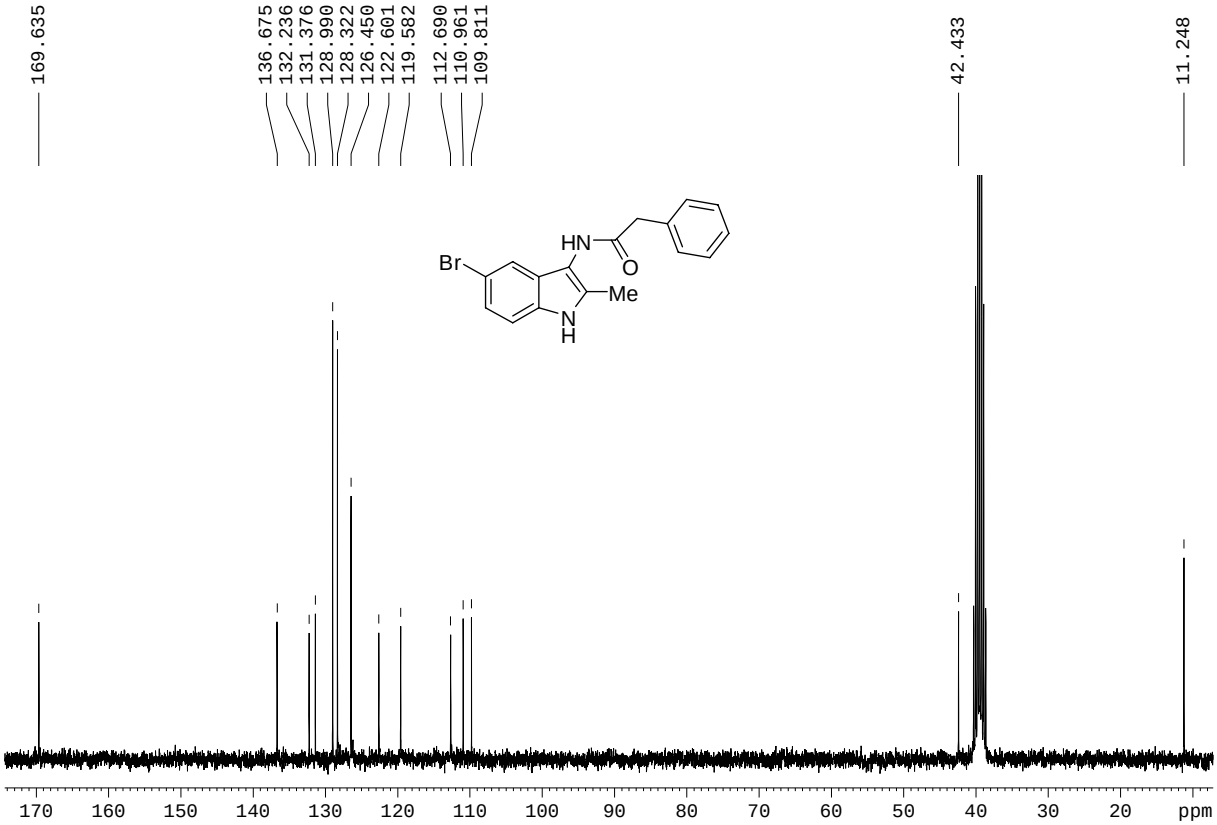


N-(5-bromo-2-methyl-1*H*-indol-3-yl)-2-phenylacetamide (13)

^{1}H NMR

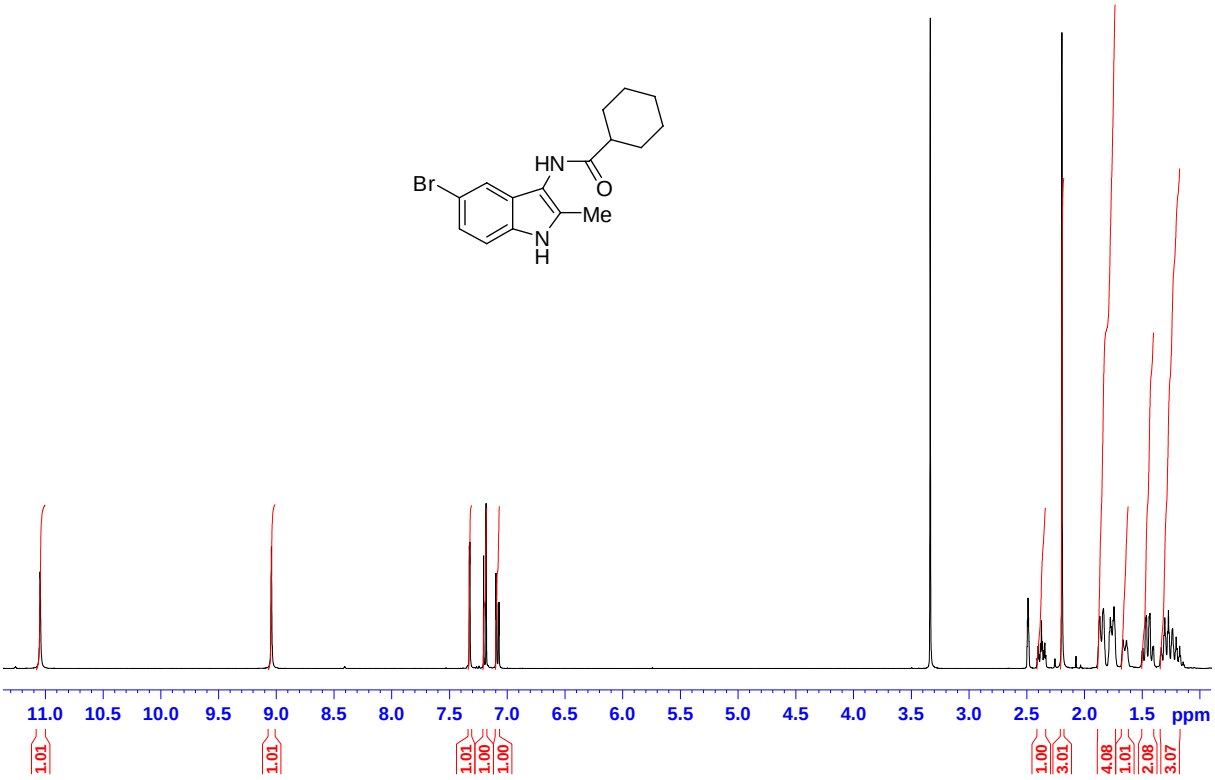


^{13}C NMR

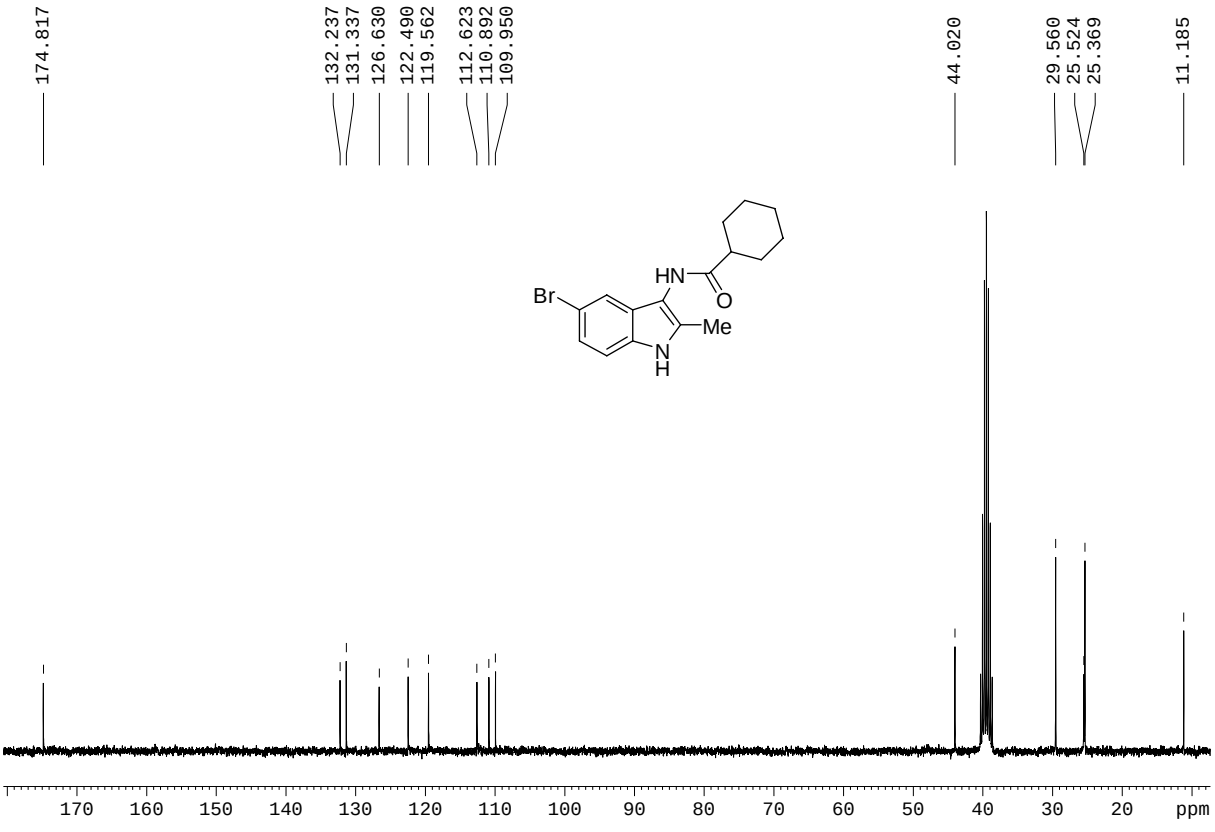


N-(5-Bromo-2-methyl-1*H*-indol-3-yl)cyclohexanecarboxamide (14)

^{1}H NMR

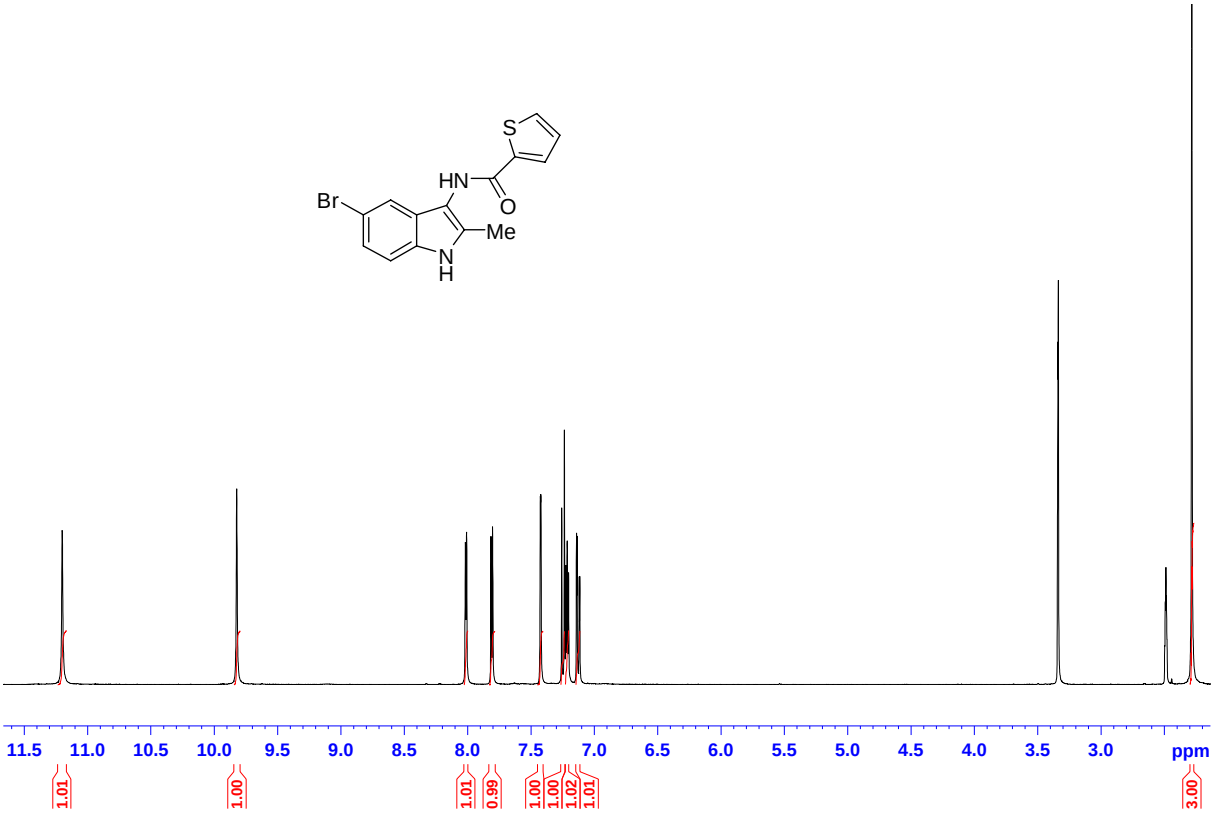


^{13}C NMR

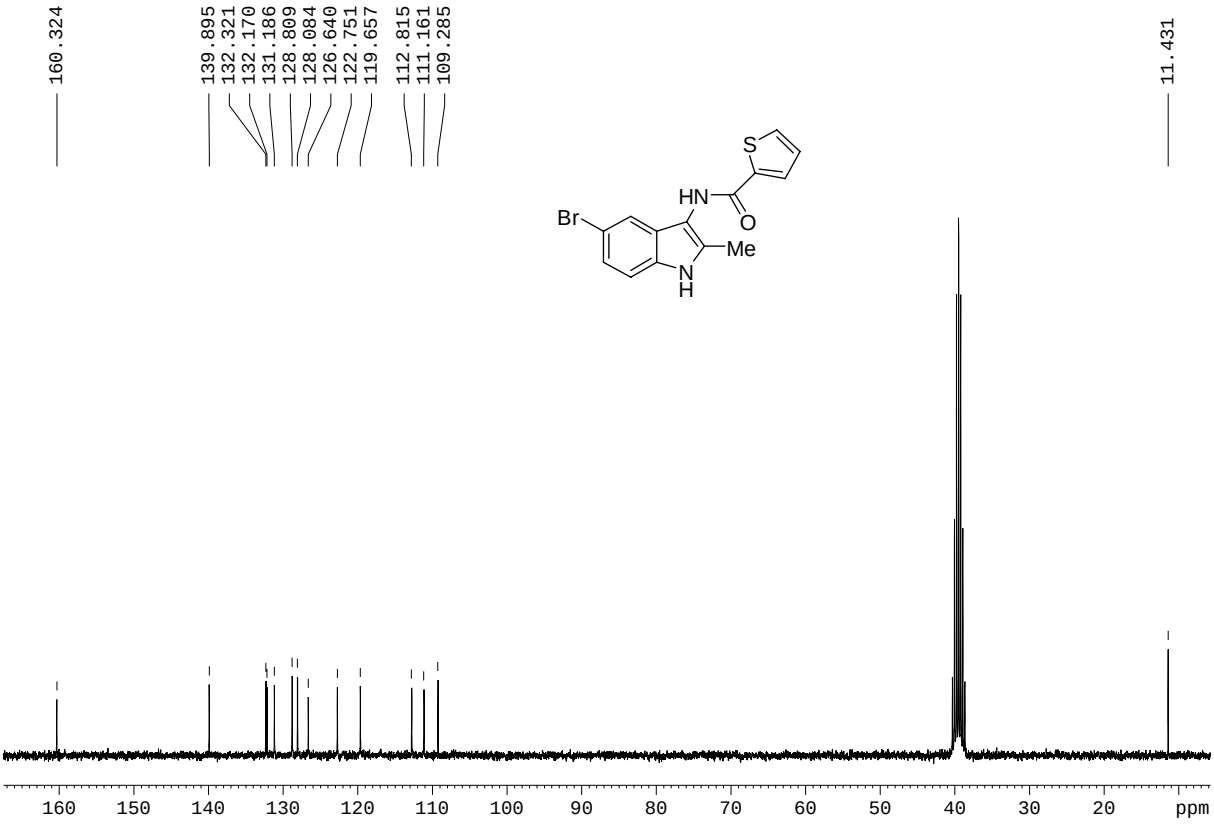


N-(5-Bromo-2-methyl-1*H*-indol-3-yl)thiophene-2-carboxamide (15)

^{1}H NMR

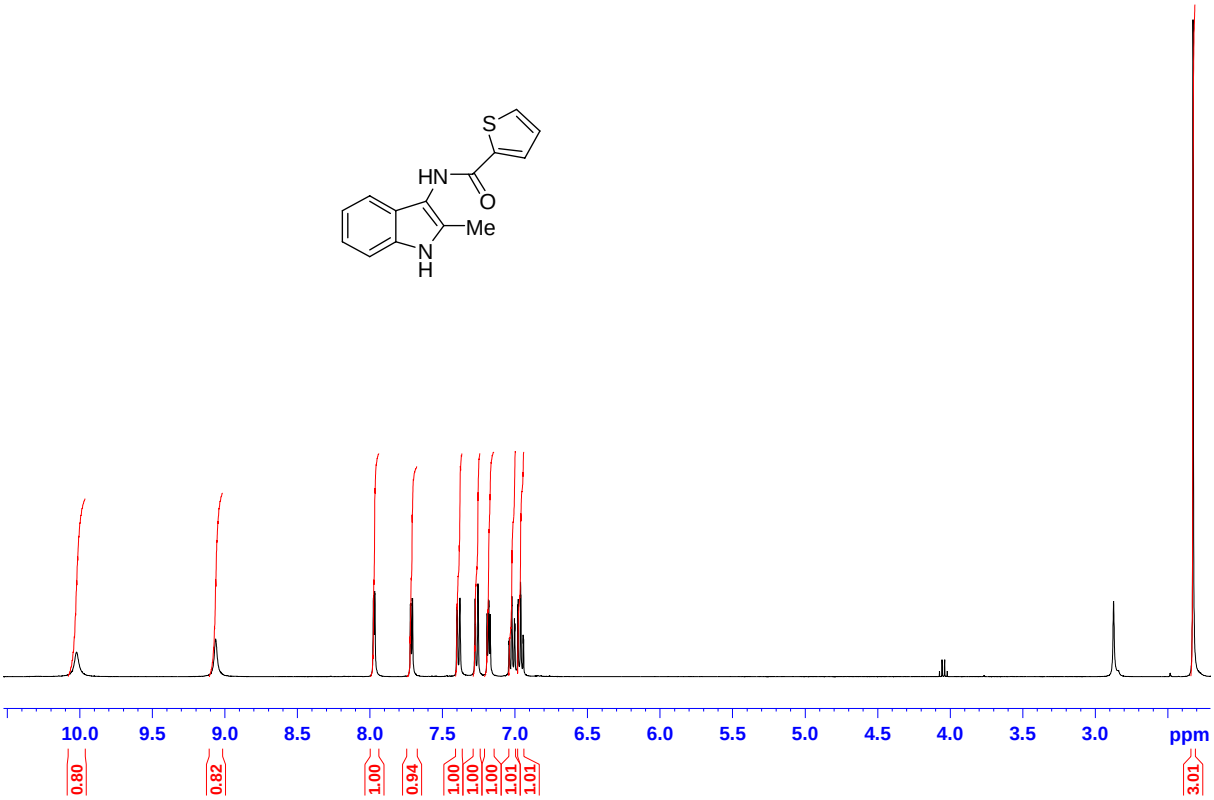


^{13}C NMR

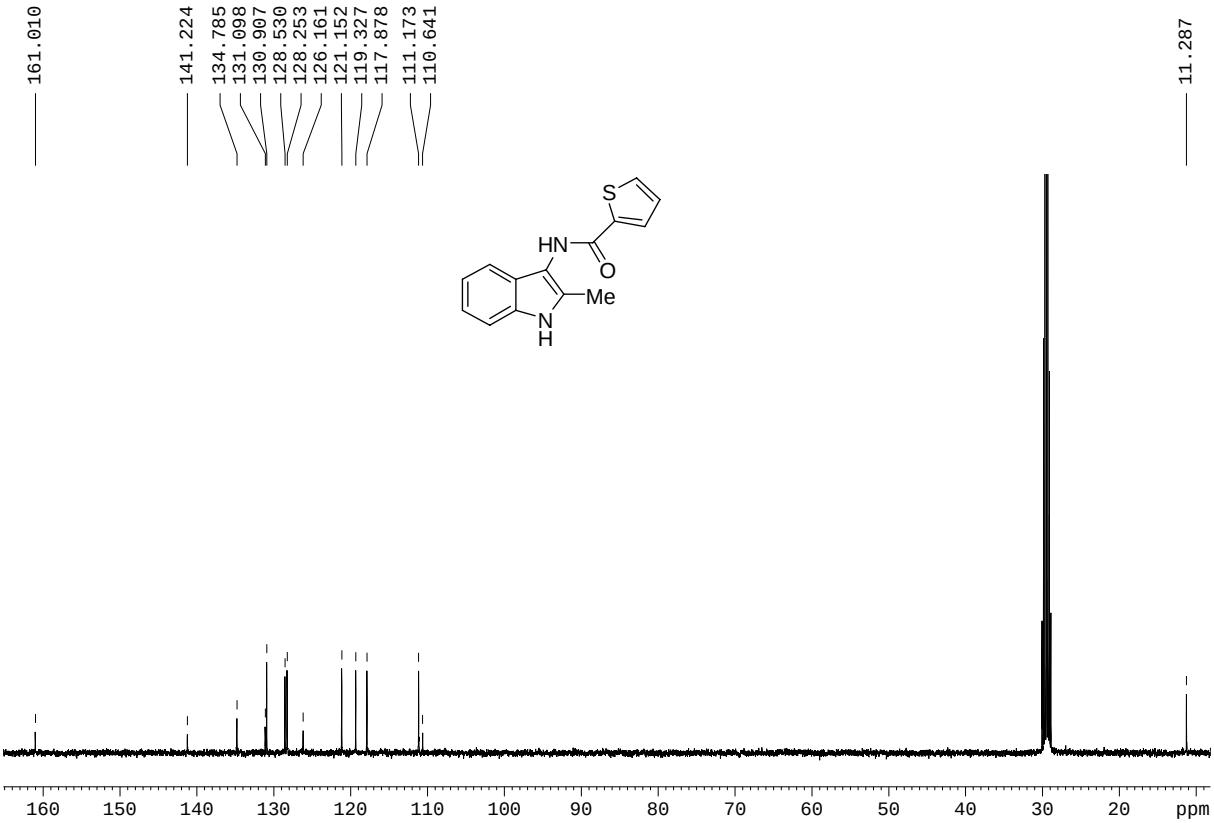


N-(2-Methyl-1*H*-indol-3-yl)thiophene-2-carboxamide (16)

^{1}H NMR

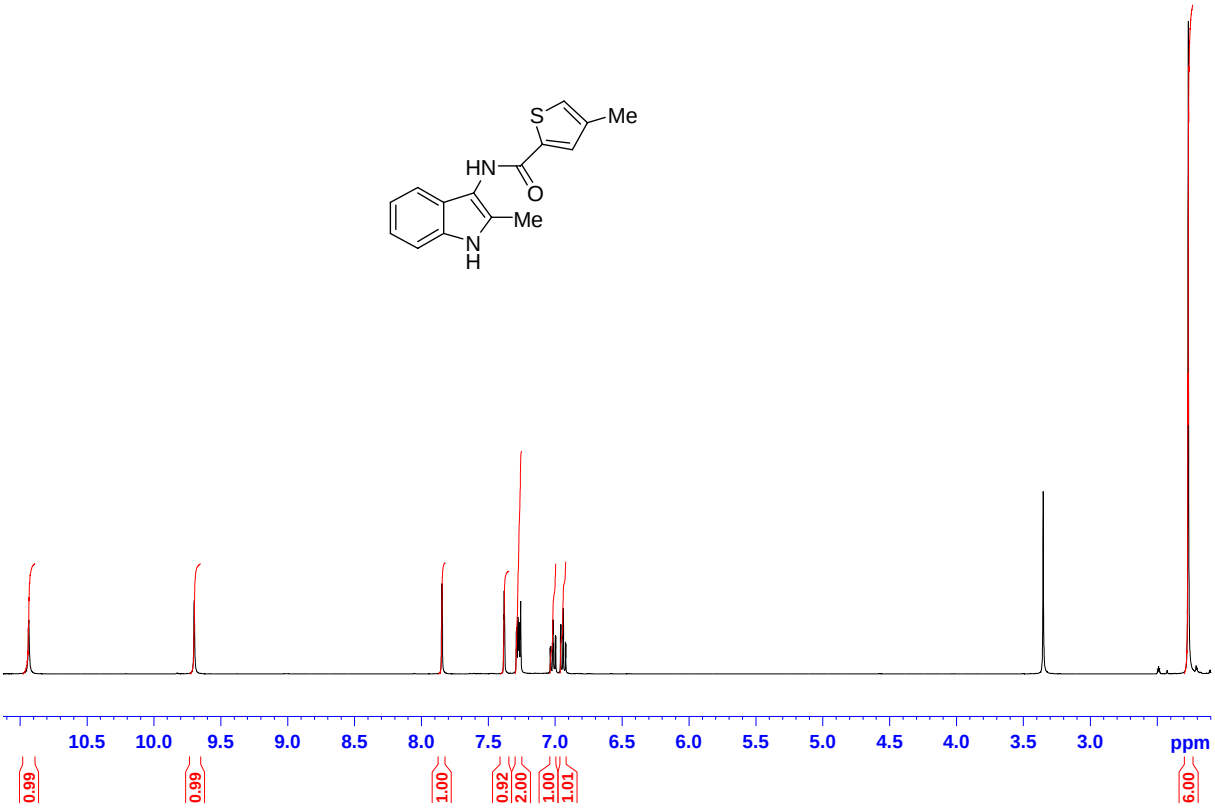


^{13}C NMR

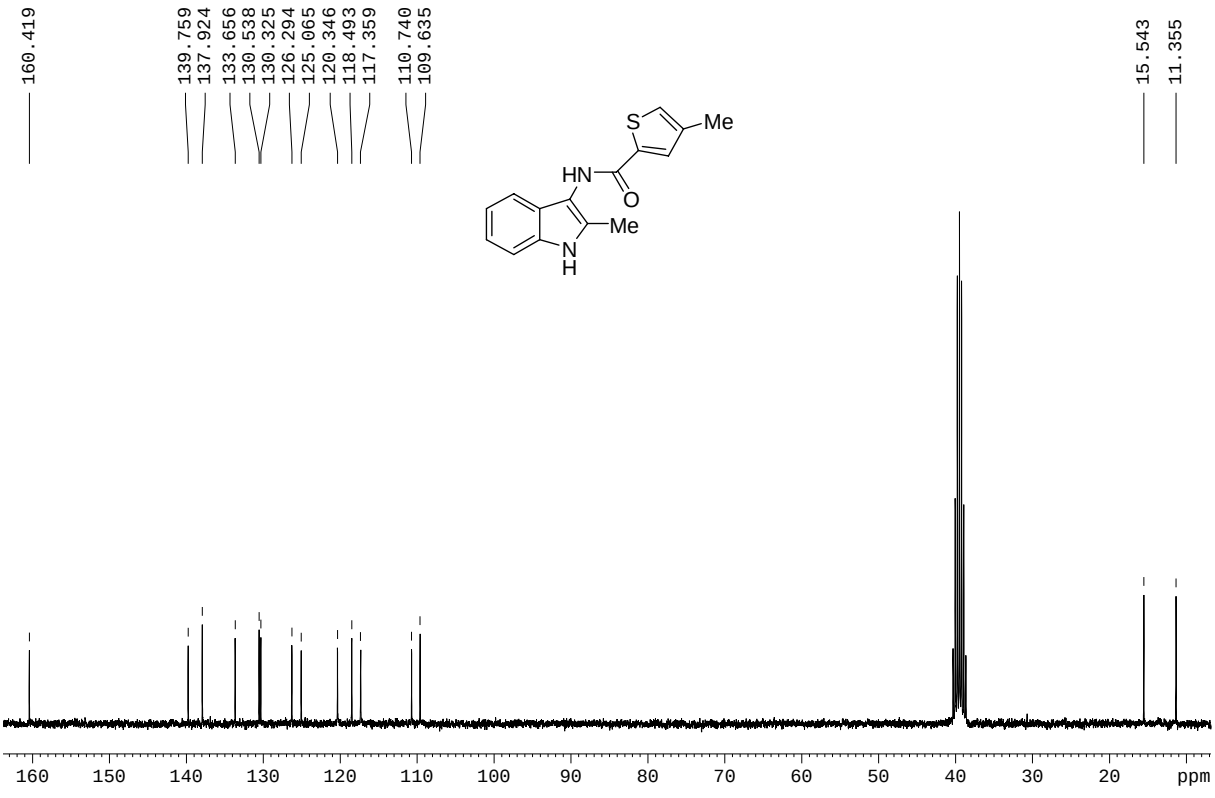


4-Methyl-N-(2-methyl-1*H*-indol-3-yl)thiophene-2-carboxamide (17)

^{1}H NMR

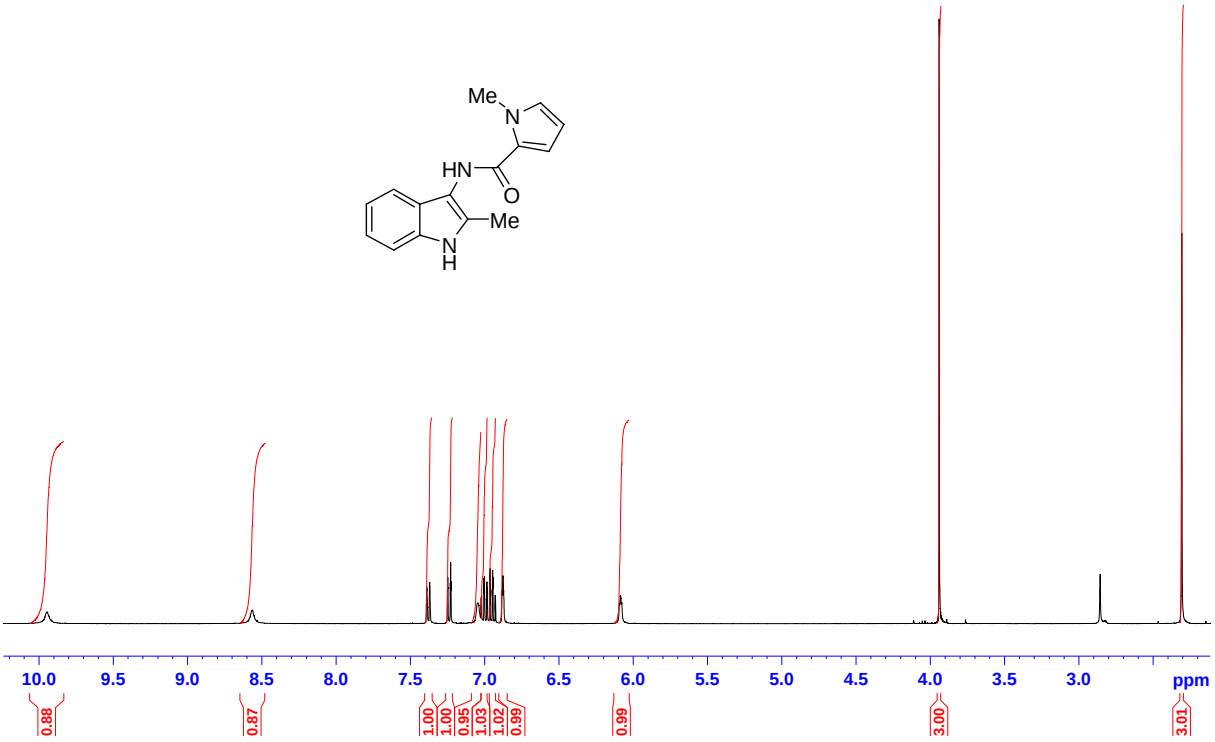


^{13}C NMR

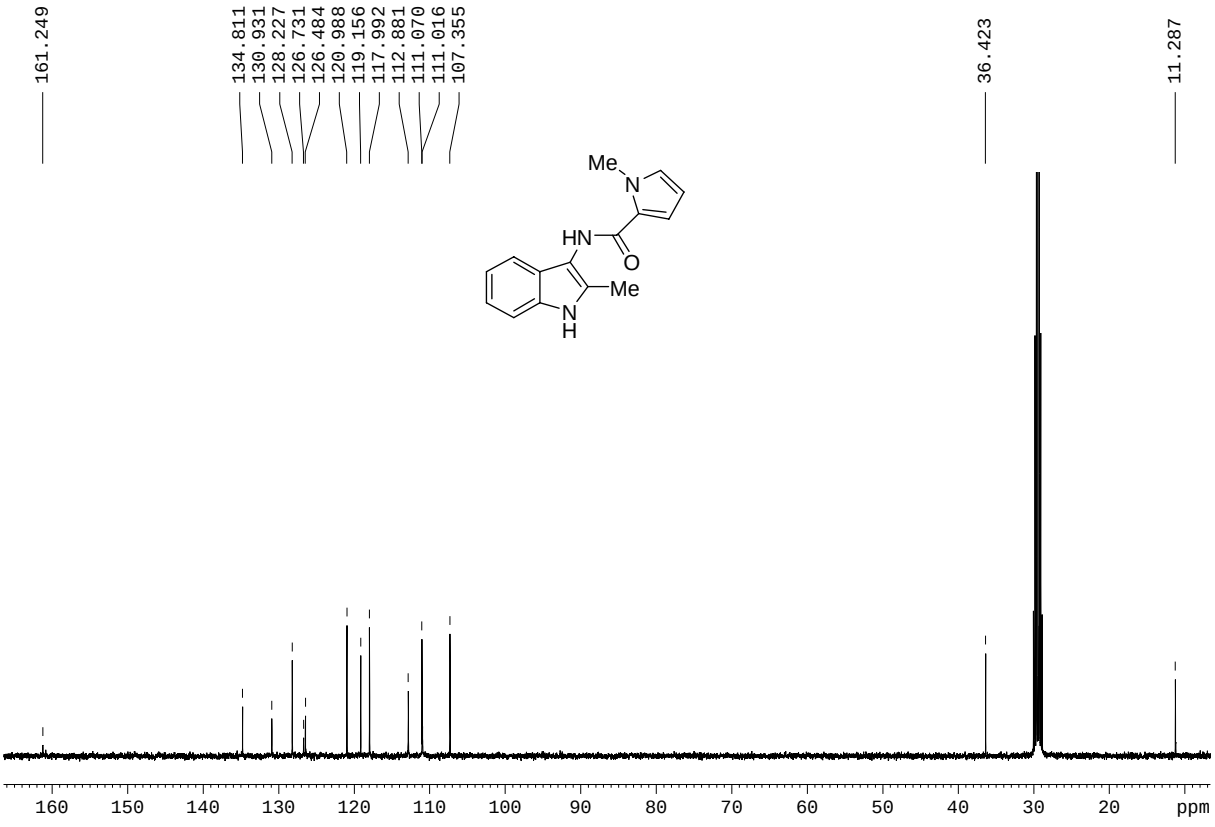


1-Methyl-N-(2-methyl-1*H*-indol-3-yl)-1*H*-pyrrole-2-carboxamide (18)

^{1}H NMR

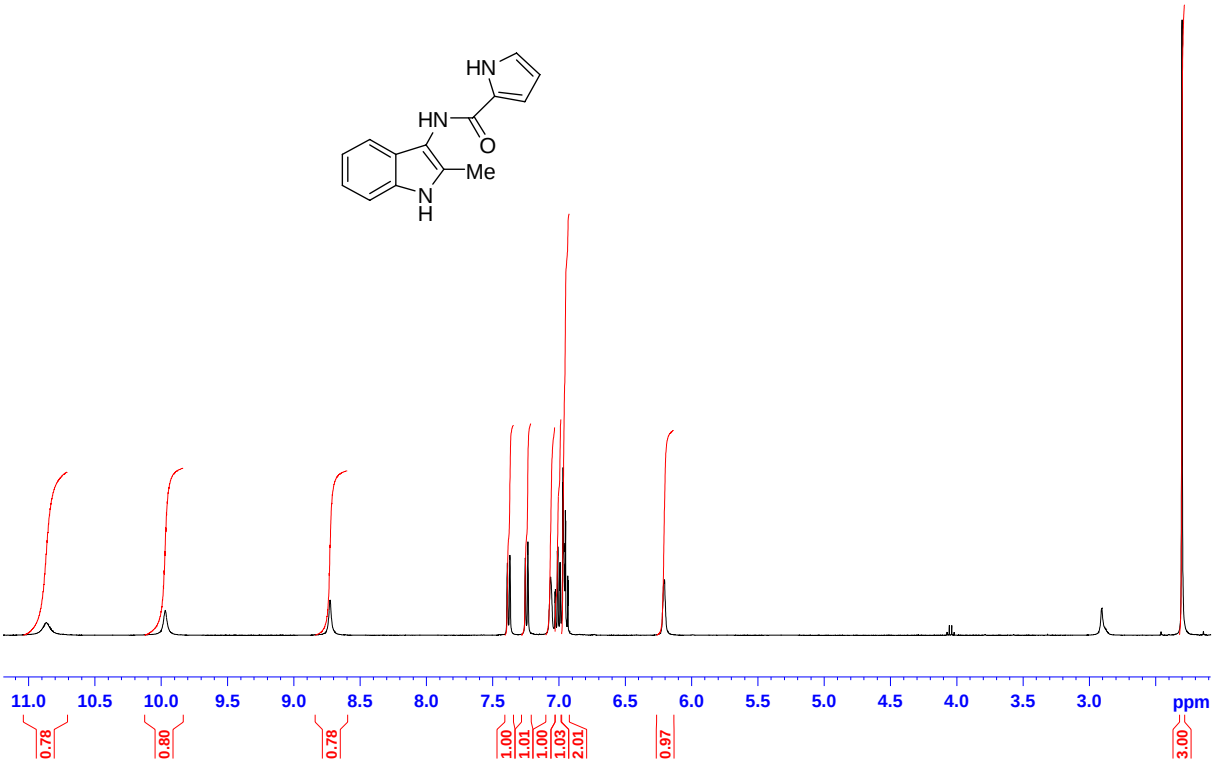


^{13}C NMR

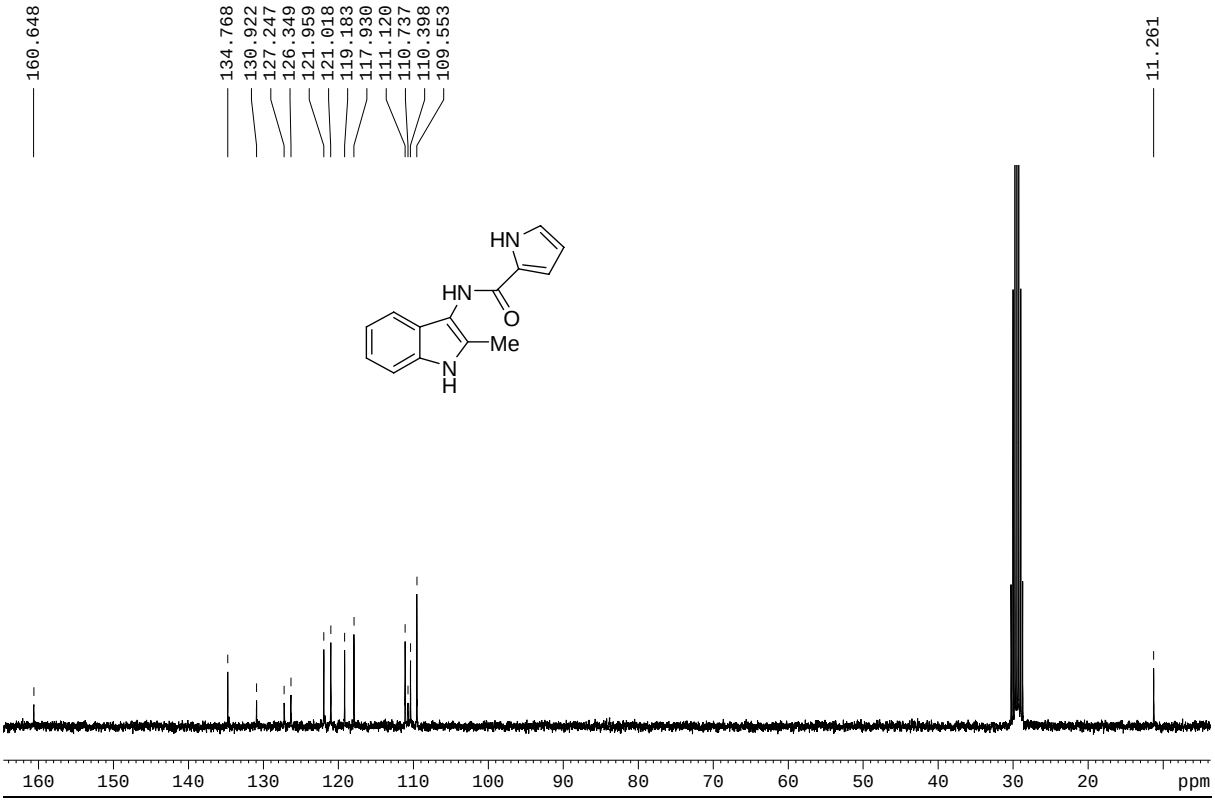


N-(2-Methyl-1*H*-indol-3-yl)-1*H*-pyrrole-2-carboxamide (19)

^{1}H NMR

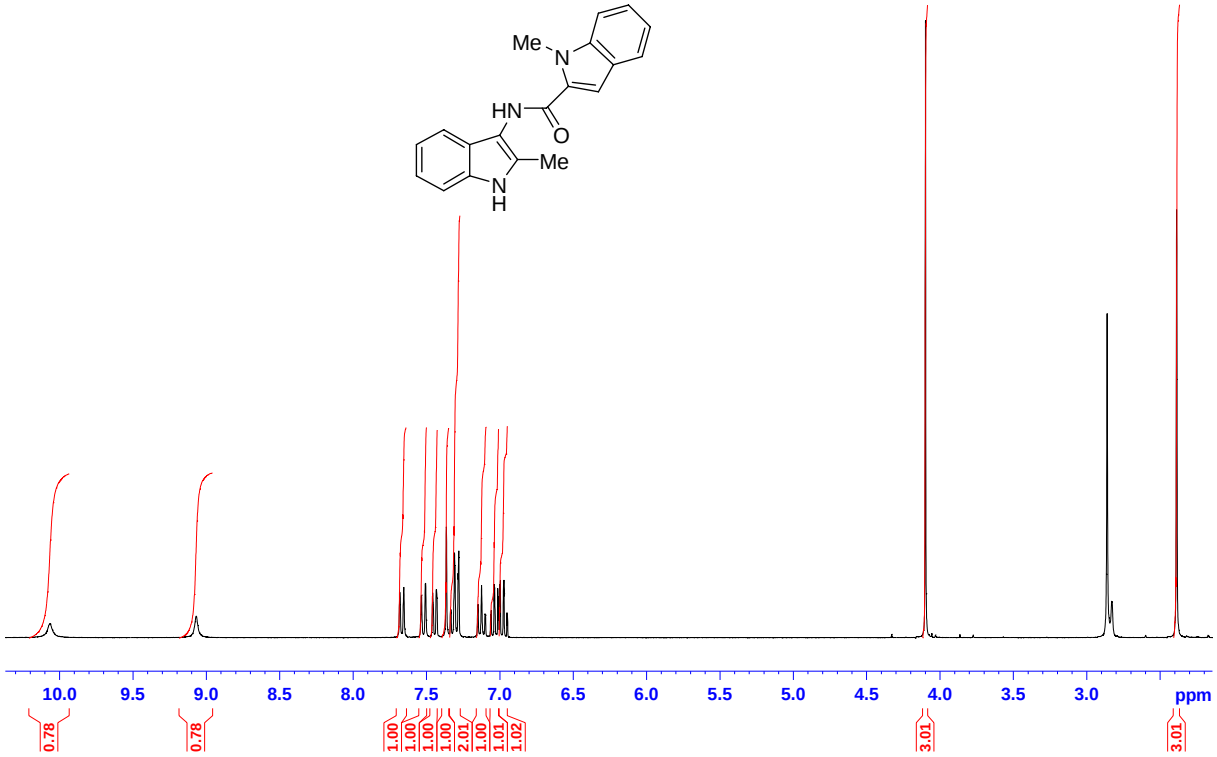


^{13}C NMR

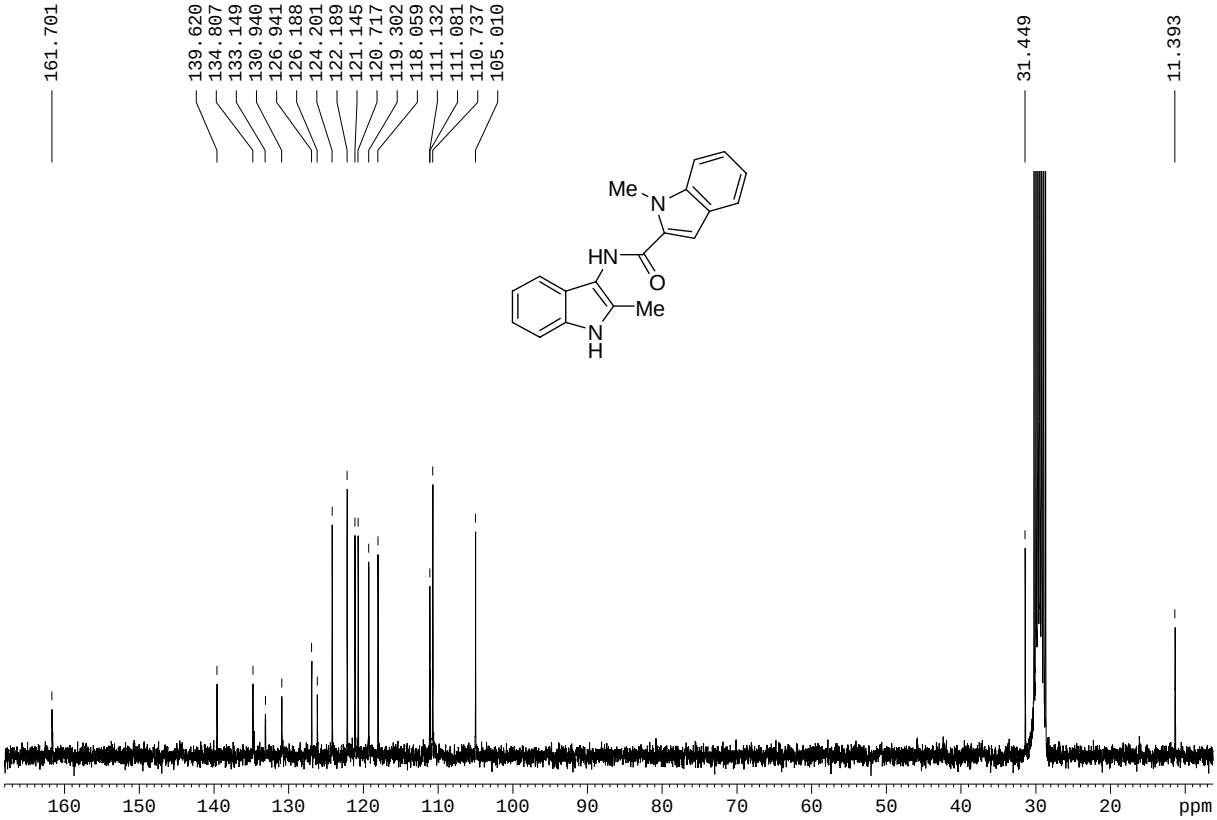


1-Methyl-N-(2-methyl-1*H*-indol-3-yl)-1*H*-indole-2-carboxamide (20)

^{1}H NMR

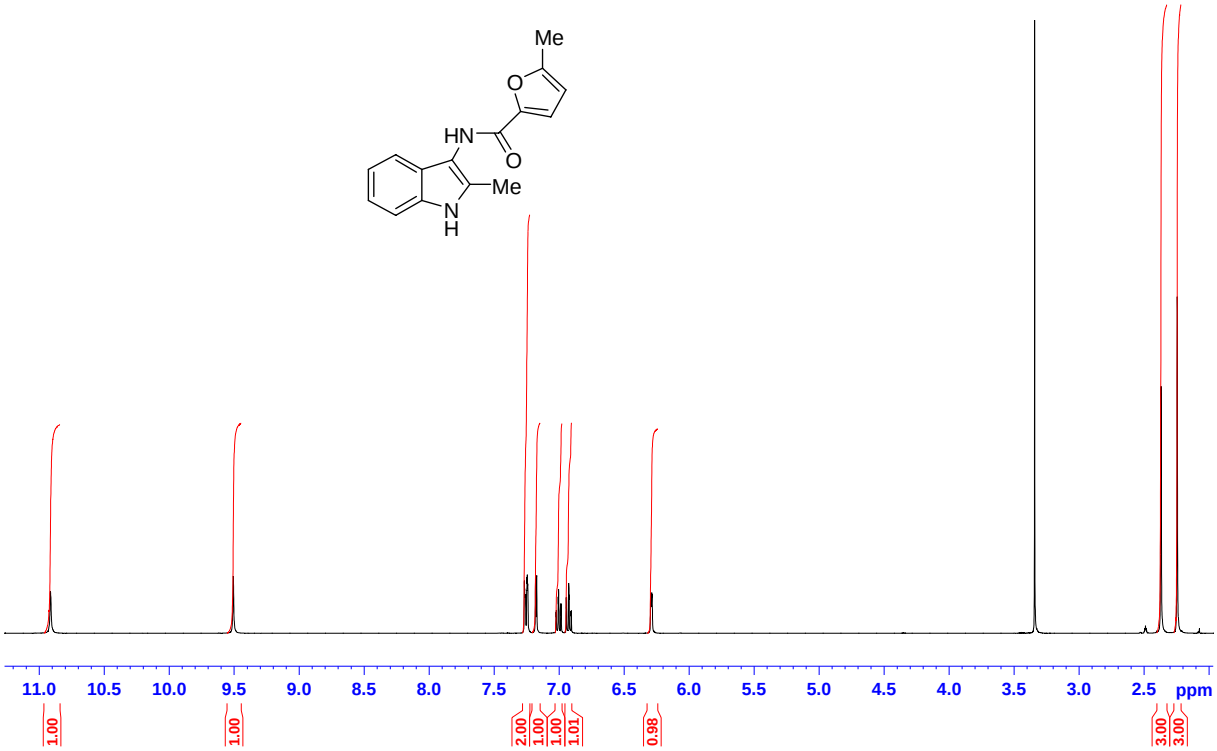


^{13}C NMR

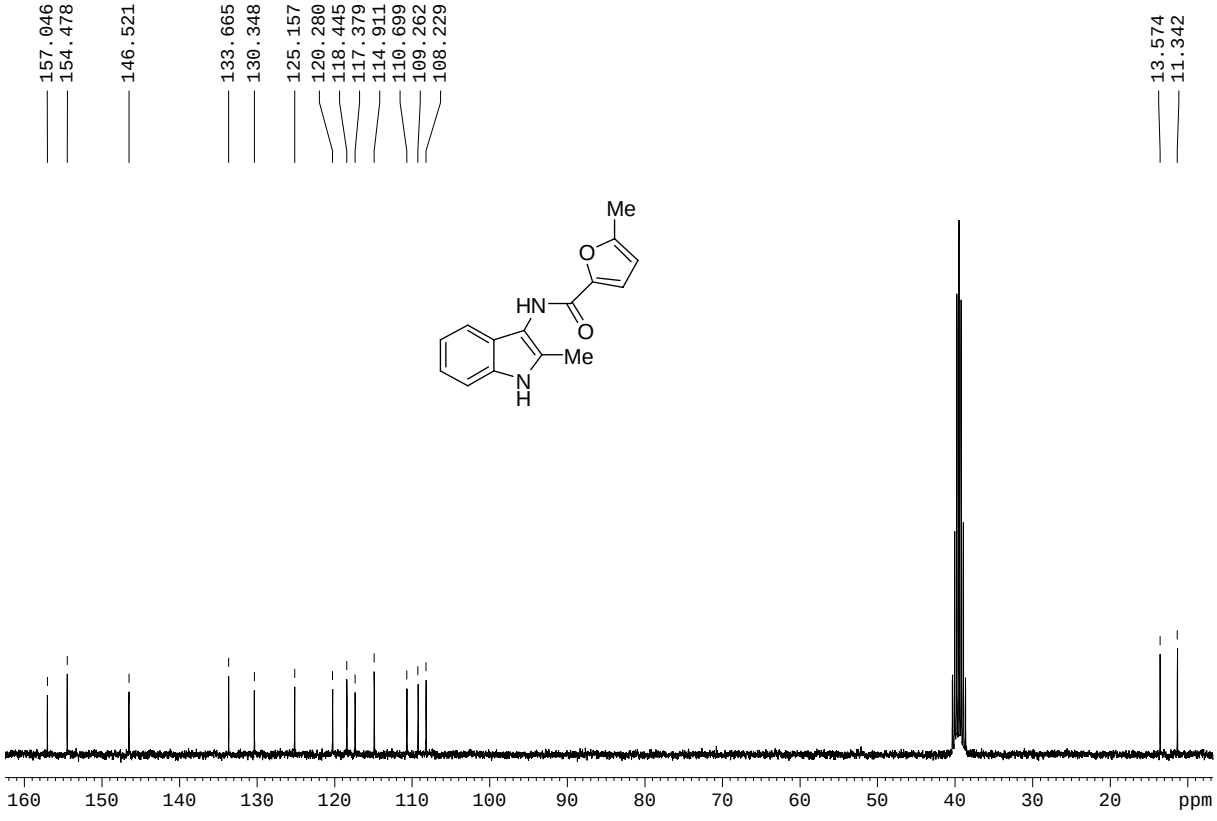


5-Methyl-N-(2-methyl-1*H*-indol-3-yl)furan-2-carboxamide (21)

^{1}H NMR

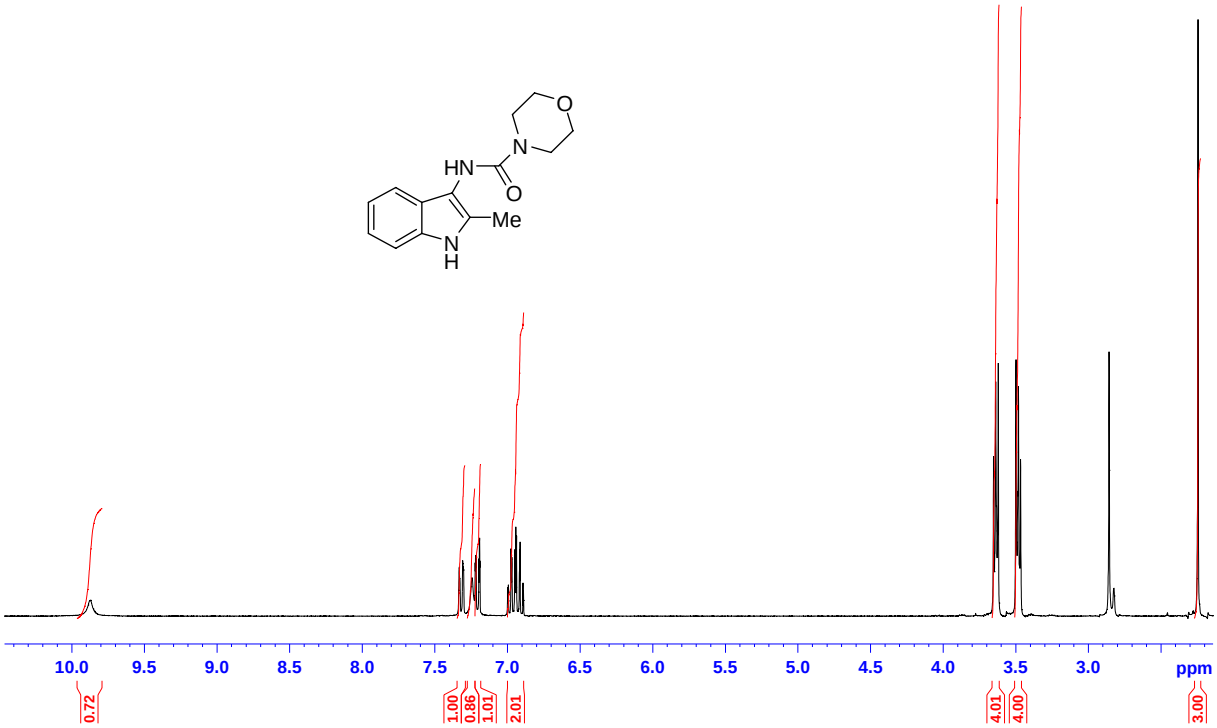


^{13}C NMR

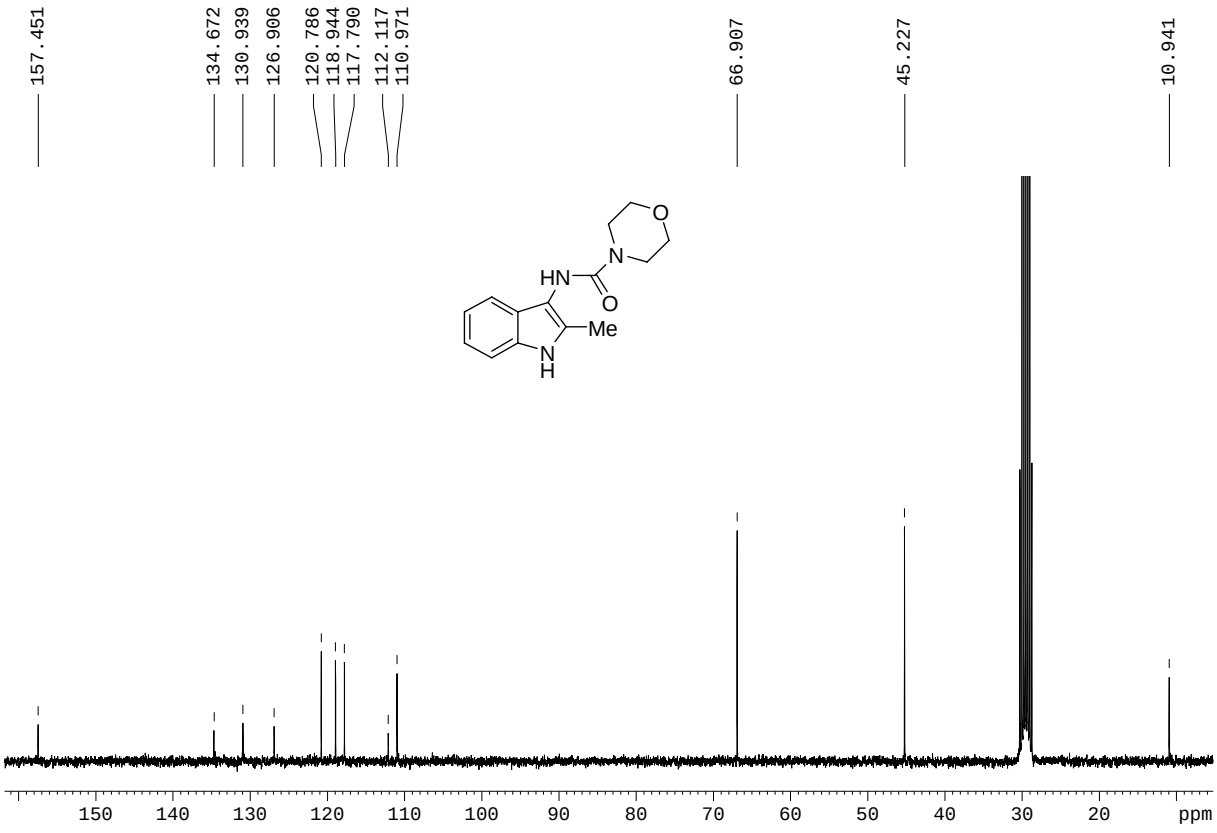


N-(2-Methyl-1*H*-indol-3-yl)morpholine-4-carboxamide (22)

^{1}H NMR

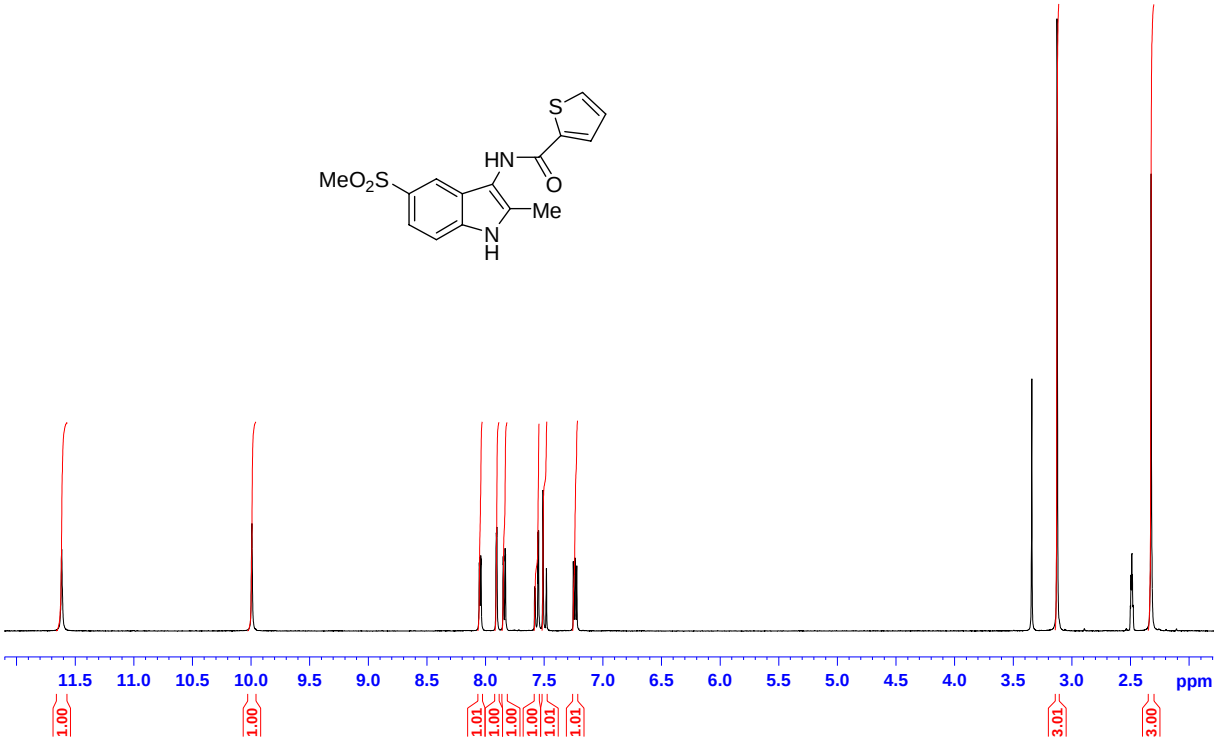


^{13}C NMR

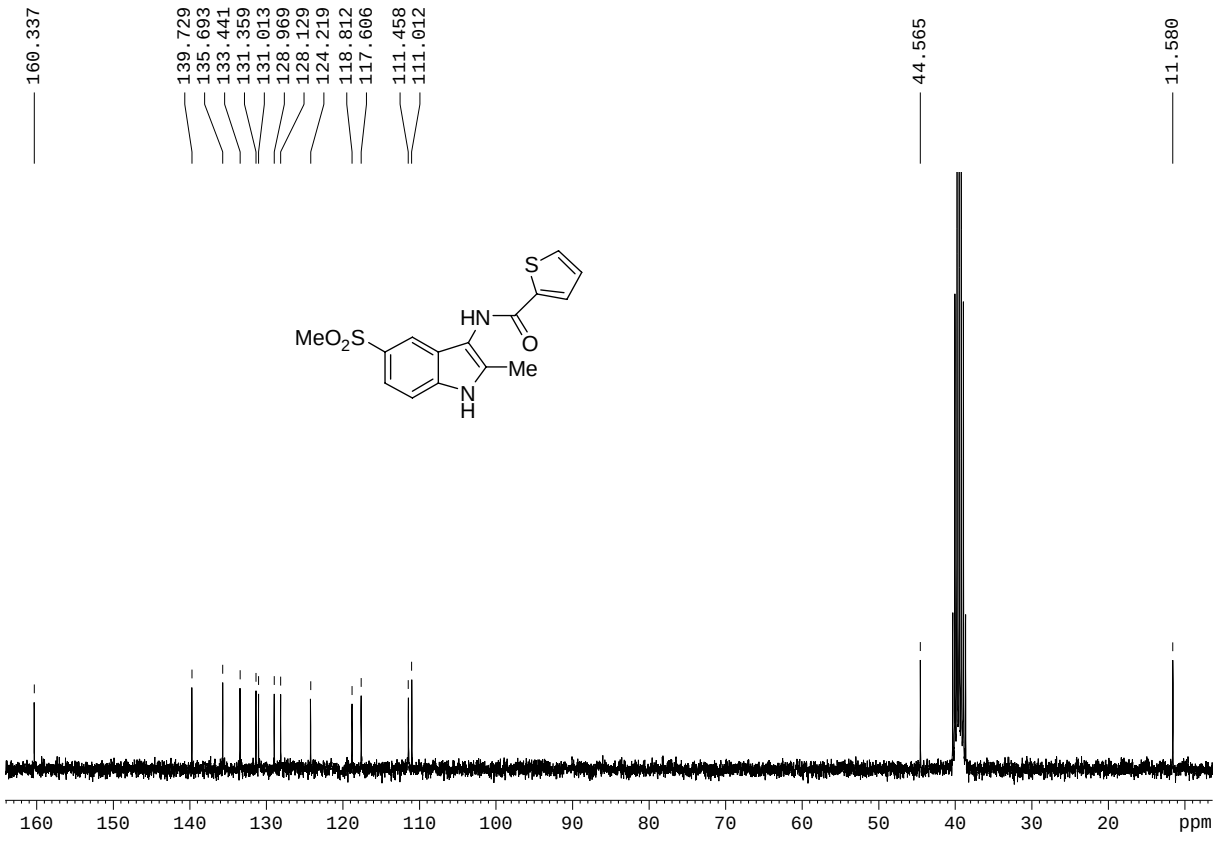


N-(2-Methyl-5-(methylsulfonyl)-1*H*-indol-3-yl)thiophene-2-carboxamide (23)

^{1}H NMR

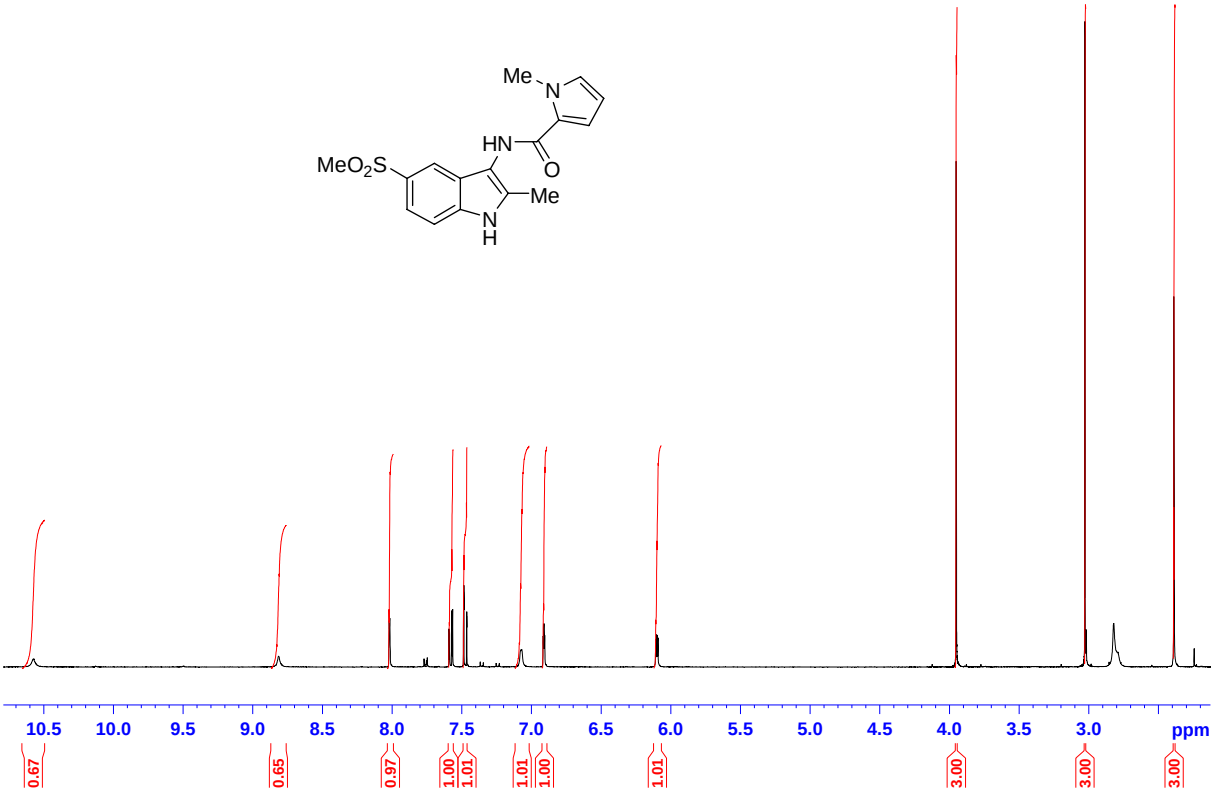


^{13}C NMR

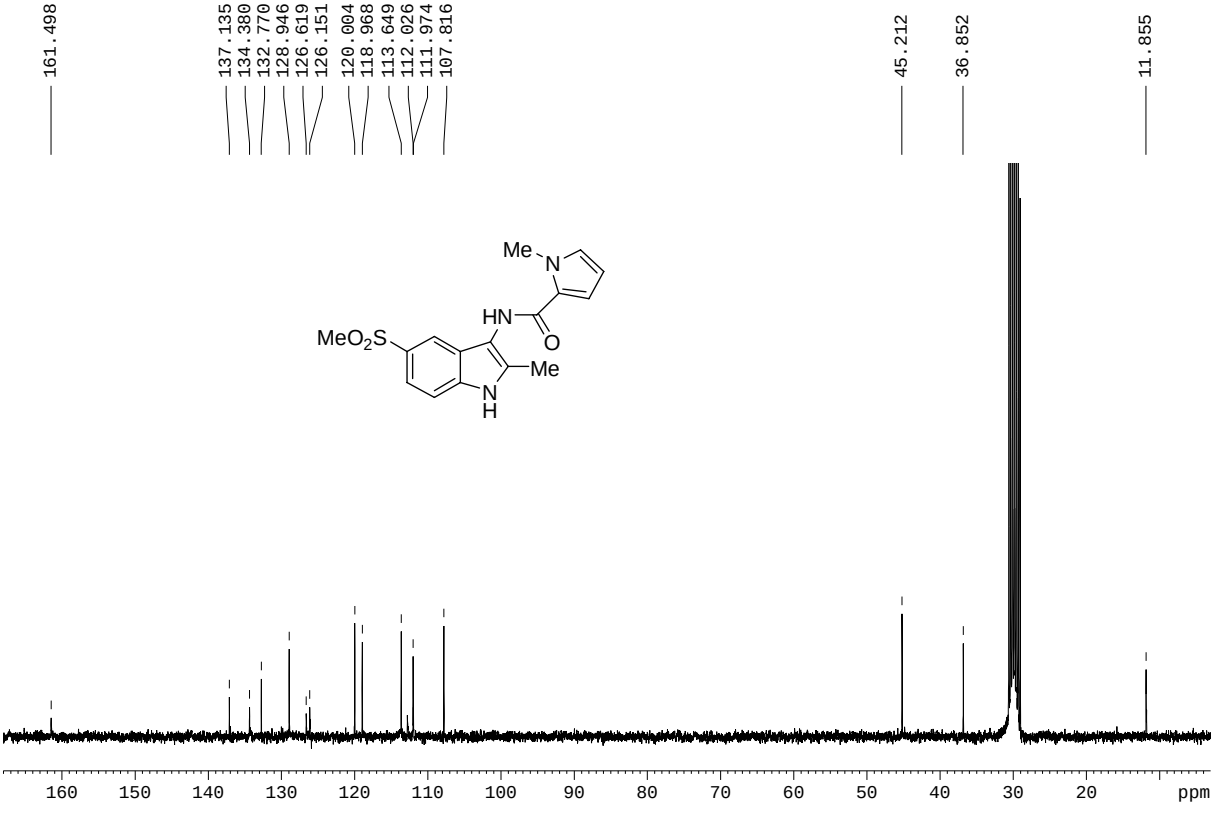


1-Methyl-N-(2-methyl-5-(methylsulfonyl)-1*H*-indol-3-yl)-1*H*-pyrrole-2-carboxamide (24)

^{1}H NMR

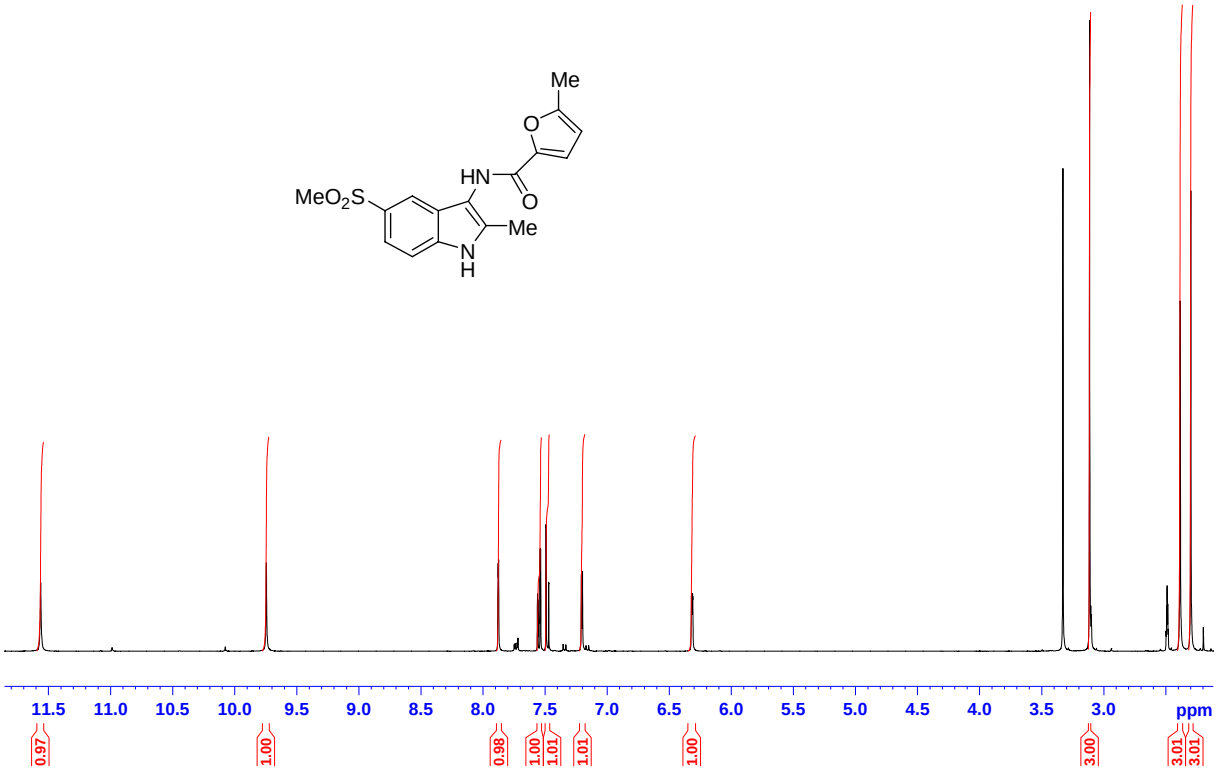


^{13}C NMR

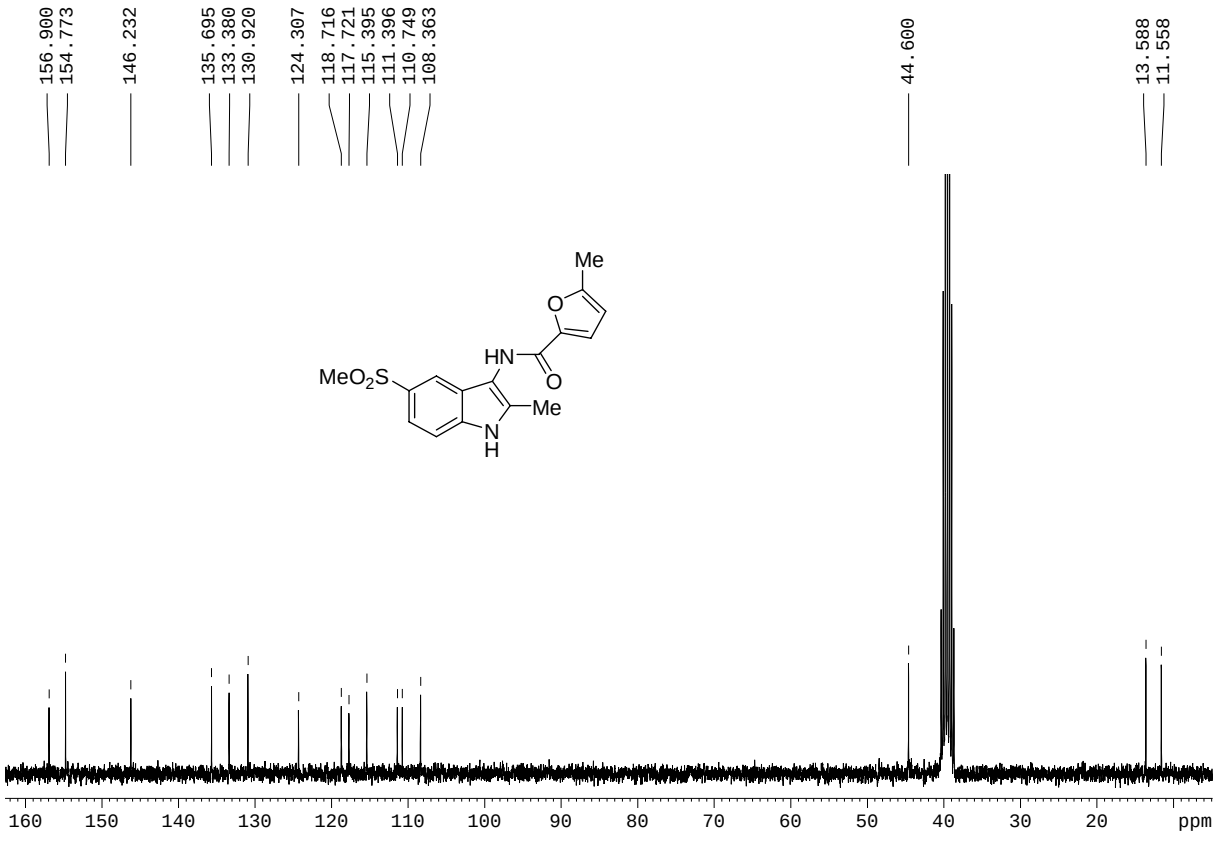


5-Methyl-N-(2-methyl-5-(methylsulfonyl)-1*H*-indol-3-yl)furan-2-carboxamide (25)

^{1}H NMR

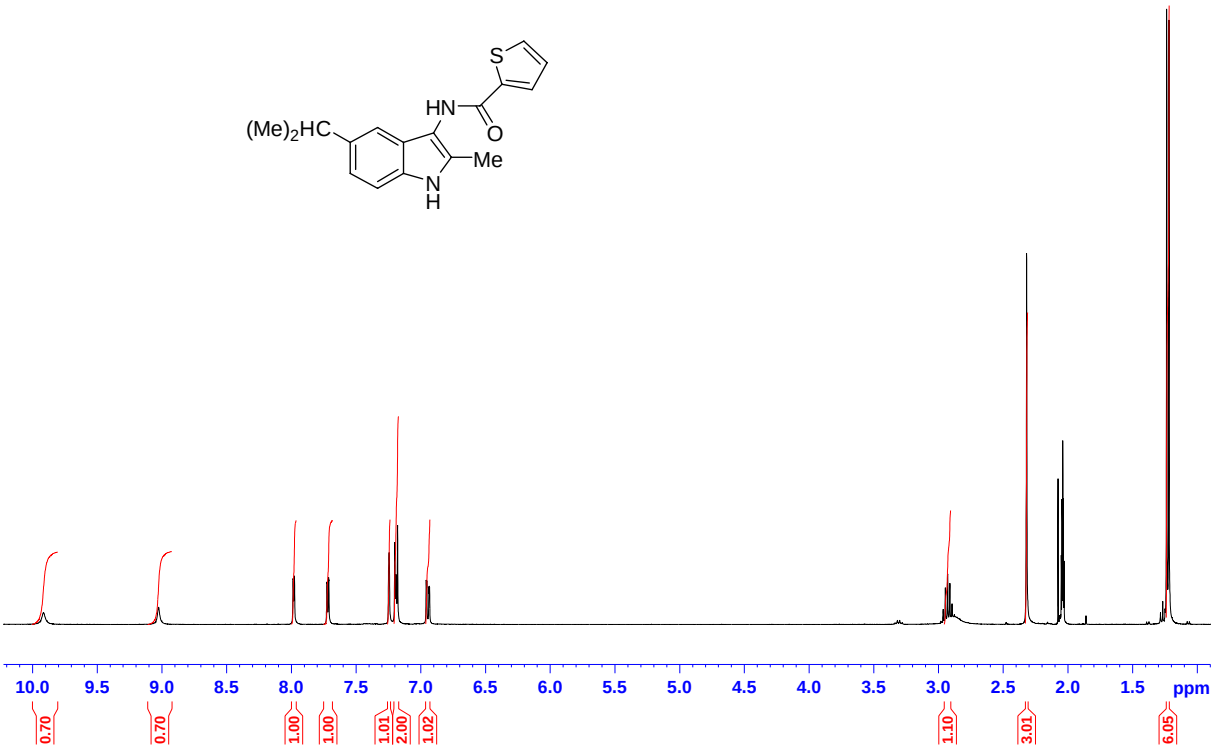


^{13}C NMR

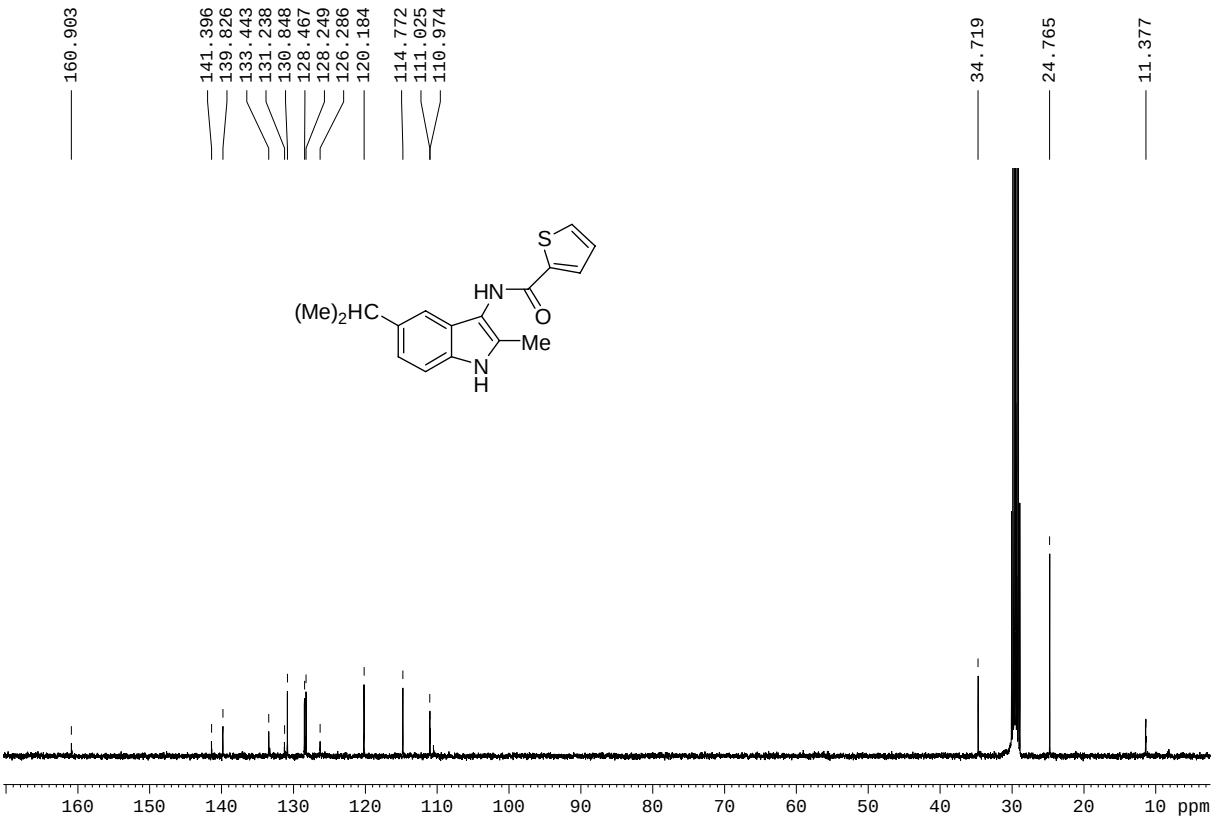


N-(5-Isopropyl-2-methyl-1*H*-indol-3-yl)thiophene-2-carboxamide (26)

^{1}H NMR

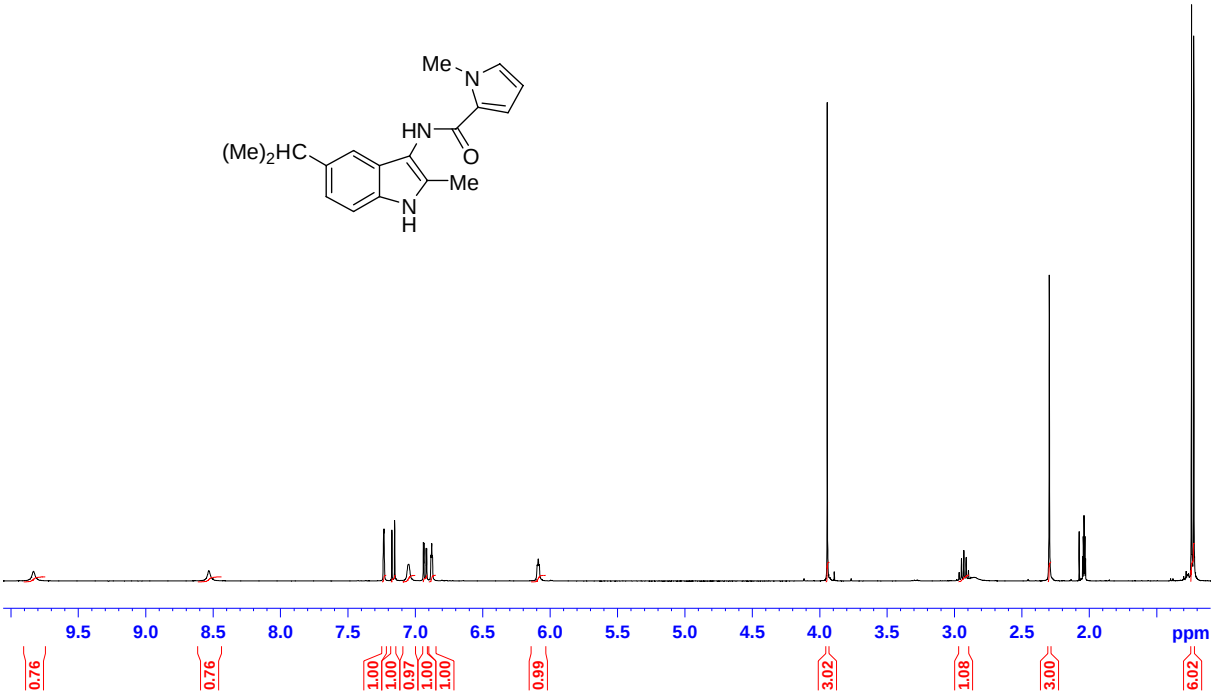


^{13}C NMR

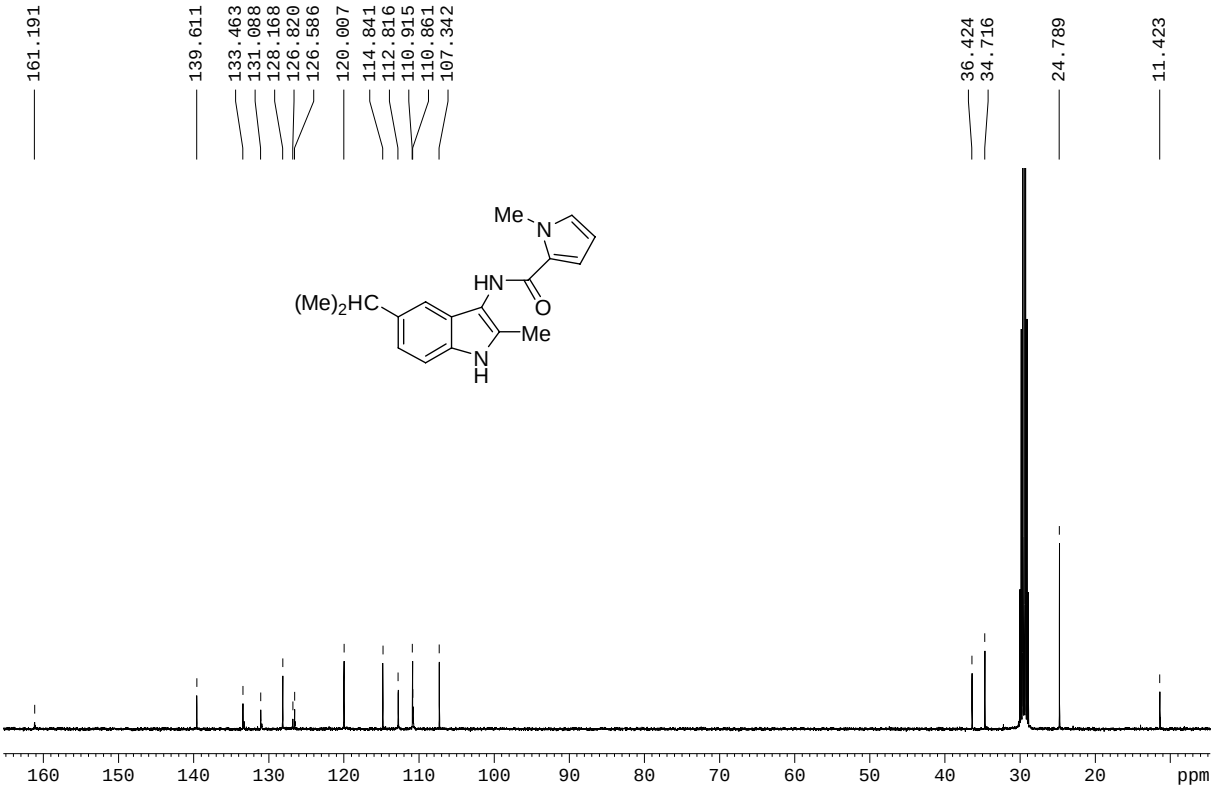


N-(5-Isopropyl-2-methyl-1*H*-indol-3-yl)-1-methyl-1*H*-pyrrole-2-carboxamide (27)

^{1}H NMR

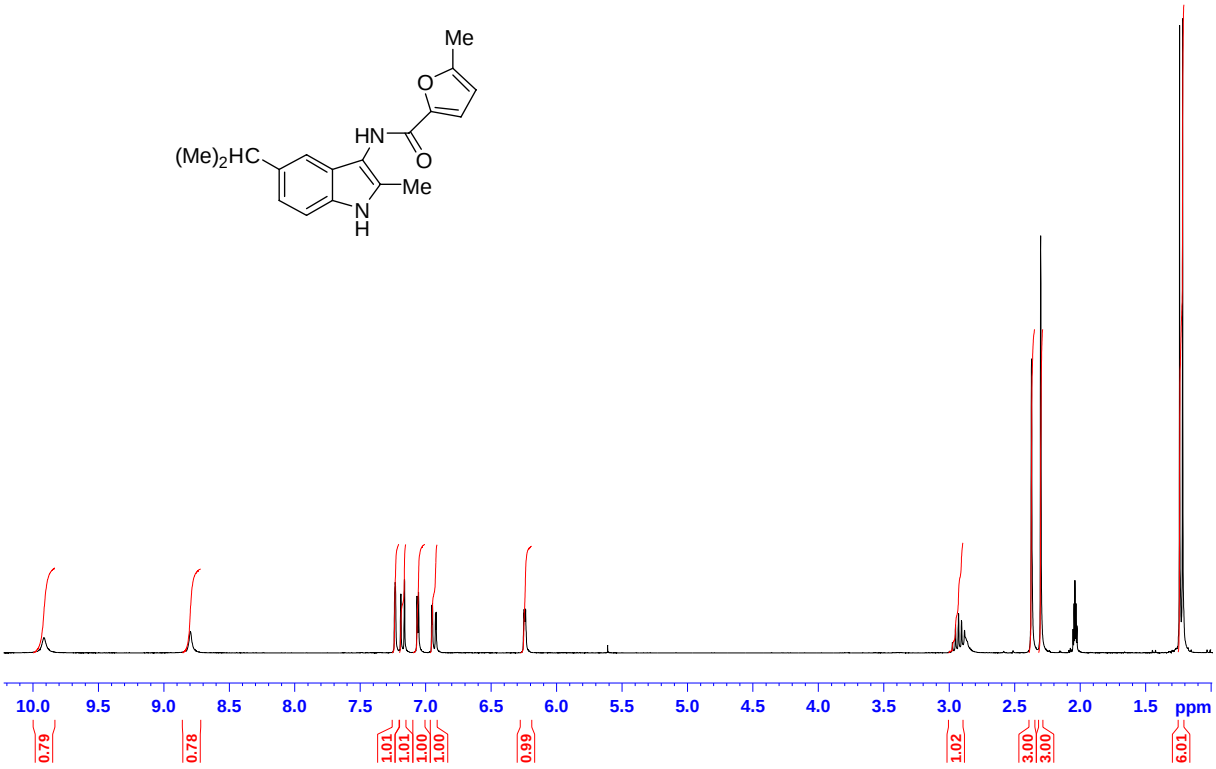


^{13}C NMR



N-(5-Isopropyl-2-methyl-1*H*-indol-3-yl)-5-methylfuran-2-carboxamide (28)

^{1}H NMR



^{13}C NMR